AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Ameiurus melas*
Common name	black bullhead
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species have been inroduced to a number of countries in Europe where it established
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Siluriformes (Catfishes) > Ictaluridae (North American freshwater
Native range	North America
Introduced range	Europe, South America
URL	https://www.fishbase.de/summary/Ameiurus-melas.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Welcomme, R. L. (Ed.). (1988). International introductions of inland aquatic species (Vol. 294). Food & Agriculture Org.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	for example Krogman, R. M., Fischer, J. R., Quist, M. C., Steuck, M. J., & Marron, M. M. (2011). Historical trends in ictalurid catfish commercial harvest in the upper Mississippi River. In American Fisheries Society Symposium (Vol. 77, pp. 000-000).	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congeners such as A. nebulosus (https://www.cabi.org/isc/datasheet/94468)	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Results of climmatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	Not yet recorded in wild in RA area	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Hitchicker, independent spread and also recreational purpose (e.g. Kutsokon, I., Kvach, Y., Dykyy, I., & Dzyziuk, N. (2018). The first report of the brown bullhead Ameiurus nebulosus (Le Sueur, 1819) in the Dniester River drainage, Ukraine. BioInvasions	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	No documented evidence	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	e.g. Cucherousset, J., Paillisson, J., Carpentier, A., & Chapman, L. J. (2007). Fish emigration from temporary wetlands during drought: the role of physiological tolerance. Fundamental and Applied Limnology-Archiv fur Hydrobiologie, 168(2), 169-178.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	For review - CABI, 2021. Ameiurus melas (bighead carp). https://www.cabi.org/isc/datasheet/94466 (accessed October 2021)	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evidence	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No documented evidence	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Reviewd in - CABI, 2021. Ameiurus melas (bighead carp). https://www.cabi.org/isc/datasheet/94466 (accessed October 2021)	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	Tha species is preadotr and the RA are is inhabited a large number of potential pray spacies	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Cucherousset, J., Paillisson, J., Carpentier, A., & Chapman, L. J. (2007). Fish emigration from temporary wetlands during drought: the role of physiological tolerance. Fundamental and Applied Limnology-Archiv fur Hydrobiologie, 168(2), 169-178.	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	CABI, 2021. Ameiurus melas (bighead carp). https://www.cabi.org/isc/datasheet/94466 (accessed October 2021)	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No documented evidence for negative effect on ecosystem services though this seems to be due to to lack of study	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Not such pests or infectious agents are known from the RA area	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Cvijanović, G., Lenhardt, M., Hegediš, A., Gačić, Z., & Jarić, I. Ameiurus melas (rafinesque)–pest or possibility. In eifac symposium on interactions between social, economic and ecological objectives of inland commercial and recreational	High

22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	https://www.fishbase.de/summary/Ameiurus-melas.html	Medium
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Not well documented, Usually reported from slowly moving rivers (Page, L.M. and B.M. Burr, 1991. A field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Company, Boston. 432 p. (Ref. 5723))	Low
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Indicated (CABI, 2021. Ameiurus melas (bighead carp). https://www.cabi.org/isc/datasheet/94466 (accessed October 2021) but not well documented	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Not well documented. However it is reported that the escaped individuals were source for established populations	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Reviewd in CABI, 2021. Ameiurus melas (bighead carp). https://www.cabi.org/isc/datasheet/94466 (accessed October	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	CABI, 2021. Ameiurus melas (bighead carp). https://www.cabi.org/isc/datasheet/94466 (accessed October 2021)	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	CABI, 2021. Ameiurus melas (bighead carp). https://www.cabi.org/isc/datasheet/94466 (accessed October	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Walter, R. P., Gnyra, E. S., Söderberg, L. I., & Heath, D. D. (2014). Rapid genetic identification of brown bullhead (Ameiurus nebulosus), black bullhead (Ameiurus melas) and their hybrids. Conservation Genetics Resources, 6(3), 507-509.	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Page, L.M. and B.M. Burr, 1991. A field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Company, Boston. 432 p.	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Page, L.M. and B.M. Burr, 1991. A field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Company, Boston. 432 p.	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Novomeská, A., & Kováč, V. (2009). Life-history traits of non-native black bullhead Ameiurus melas with comments on its invasive potential. Journal of Applied Ichthyology, 25(1), 79-84.	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Copp, G. H., Tarkan, A. S., Masson, G., Godard, M. J., Koščo, J., Kováč, V., ... & Blackwell, B. G. (2016). A review of growth and life-history traits of native and non-native European populations of black bullhead Ameiurus melas. Reviews in Fish Biology and Fisheries, 26(3), 441-469.	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Hitchhiker, natural increase of distribution, human mediated due to recreational purpose	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Western South Caucasian lowland (Colchis) is accessible through watercourses	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such evidnece exists.	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Not known from the close proximity, i.e. from the areas with direct connection via watercourse	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Due to active swimming abilities, Juveniles can easily dispese through water currents	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Species is not known as long distance migrant for reproduction. While no populations are known to close proximity of RA area, than no such expectation	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such acases are known	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Not well documented though expected	Low
43	7.09	Is dispersal of the taxon density dependent?	No	Not known, not documented	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not a documented vidence	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	Yes	temperature, dissolved oxygen, turbidity and salinity - Cucherousset, J., Paillisson, J., Carpentier, A., & Chapman, L. J. (2007). Fish emigration from temporary wetlands during drought: the role of physiological tolerance. Fundamental and Applied Limnology-Archiv fur Hydrobiologie, 168(2), 169-178.	High

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such a practice exists	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No such evidence exists	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Though not well documented	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No such species are present in the RA area	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Professional judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Professional judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Professional judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Professional judgement	Medium

Statistics	
Scores	
BRA	**33.0**
BRA Outcome	**-**
BRA+CCA	**39.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**11.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*6.0*
B. Biology/Ecology	**22.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*7.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*3.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**12**
Environmental	**12**
Species or population nuisance traits	**19**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.61**
BRA	**0.64**
CCA	**0.42**

Date and Time
04/05/2022 11:48:30

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Ameiurus melas*
Common name	black bullhead
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Economic benefits from Ameiurus spp. aquaculture occurred primarily within eastern Europe
Risk assessment area	South Caucasus
Taxonomy	Ameiurus melas (Rafinesque, 1820)
Native range	Native to Canada, USA and Mexico
Introduced range	Black bullhead have been introduced to Europe, South America and many states in the USA and
URL	https://www.fishbase.de/summary/ameiurus-melas.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	The black bullhead (Ameiurus melas; family Ictaluridae) is a scaleless fish found naturally in waters from southern Canada to Mexico, from the Rocky Mountains to the Western slopes of the Appalachians (Smith 1985). It has, however, been stocked in many areas outside of its natural range (Smith 1985).	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Black bullheads are not generally considered an important gamefish in Texas, though they are readily fished for by anglers in the Panhandle, and in far East Texas. A variety of baits may be used to catch them, but worms are usually the best. The largest specimen reported to date in Texas was 5.15 pounds.	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	In Europe A. melas forms dense stunted populations which makes it unpopular. Several countries report adverse ecological impact after introduction.	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	World Map of the Köppen-Geiger climate classification	Medium
5	2.02	What is the quality of the climate matching data?	Medium	World Map of the Köppen-Geiger climate classification	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No such fact has been detected	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species may be introduced by humans for aquacultural purposes.	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	There is no evidence at this stage that this species has been established around the SC region.	Medium
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	A. melas is known to have introduced to many European countries, but established self-sustaining populations have only been confirmed for the Belgium Province of Wallonie, and the Netherlands (Verreycken et al. 2010), Austria (Wiesner et al. 2010), Germany (Wolter and Röhr 2010), Czech Republic (Musil et al. 2008), England (Wheeler 1978; this study), France (Copp 1989; Cucherousset et al. 2008), Hungary (Bódis et al. 2012), Italy (Pedicillo et al. 2009), Poland (Nowak et al. 2010a, 2010b), Portugal (Gante and Santos 2002; Ribeiro et al. 2006), Romania (Wilhelm 1998; Gaviloaie and Falka 2006), Serbia (Cvijanović et al. 2005), Slovakia (Koščo et al. 2010) and Spain (Miranda et al. 2010; De Miguel et al. 2014), Switzerland (Wittenberg 2005) and	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	In natural waters, the introductions have resulted in many cases in economically profitable fisheries, although most introductions have failed or led to unwanted consequences in the form of reduced or collapsed native fish stocks (Turchini et al., 2008).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	According to cabi.org, the impact on aquaculture is assessed as positive.	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	In water bodies used by anglers, their perception of the angling value may be reduced by the species' presence (Aislabie et al. 2019). For instance a fishery in North London succumbed to this highly efficient invader, and the local angling club had lost one of	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Benthivorous fish in shallow, aquatic systems have been correlated with increased turbidity and declines in macrophyte production and wildlife use (Braig & Johnson 2003).	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	Yes	A. melas can cause a painful sting if pectoral spines puncture human flesh due to the small amounts of venom at theends of spine, which can cause pain for up to a week (Etnier and Starnes, 1993; Rose, 2006; Aislabie et al. 2019).	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Black bullheads tend to be found in high local abundance, their behaviour could therefore interfere with accompanying species and negatively affect the behaviour of native predators and prey (cabi.org).	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are meny endemic and threathened species in the SC region which would be affected by A. melas e.g. Salmo spp. Luciobarbus capito, Acipenser spp, etc.	High

17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species has been successfully established in some European countries and such a thing is expected in the Caucasus as well.	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	Investigation is needed to assess Ameiurus population trends and impacts, such as decline of reservoir water quality and food web structure alteration in some regions.	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Similar cases have already been reported in some countries (e.g. in UK) and the same is expected to happen in the SC region.	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Such data is not available for the SC region.	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	Such data is not available for the SC region.	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length is 66.0 cm TL male/unsexed, common length : 26.6 cm TL male/unsexed, max. published weight: 3.6 kg. This species is used for aquacultural purposes.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Inhabits pools, backwaters, and sluggish current over soft substrates in creeks and small to large rivers; impoundments, oxbows, and ponds.	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	A. melas has high potential impact on water quality. Ameiurus melas is related to the physic-chemical dimension of water quality. Changes in water transparency and increase of turbidity (Braig and Johnson, 2003).	Very high
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Such a fact is not known	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	The probability of this is high if the species is distributed in the region. The following species may be impacted: Salmo spp, Acipenser spp, Gobies, Luciobarbus capito, etc.	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	This species will be in competition with local fish e.g. in feeding.	Very high
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Maximum length of parental care in A. melas is 29 days.	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Currently this species is not occuring in the SC region.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Such a fact is not known.	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Such a fact is not known.	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Such a fact is not known.	Low
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	The females scoop out a small hole or depression in the lake floor and lay 2000 to 3800 eggs.	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Data deficient	Low
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species can be spread in the SC region by humans for aquacultural purposes.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	The probability of this is high.	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not has such means.	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	This species does not occurring in the SC region.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	This species does not occurring in the SC region.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species does not occurring in the SC region.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	This species does not occurring in the SC region.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	This species does not occurring in the SC region and at this stage it is impossible to determine.	Low
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Such data is not available	Low
8. Tolerance attributes					

44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	This species could not exist without water	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	A. melas has considerable tolerance to water pollution, turbidity, low oxygen concentration, elevated temperatures and a range of pH values.	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	The application of trapping and electric fishing to controlling black bullhead Ameiurus melas was relatively effective in a French lake as no compensatory responses were recorded. In contrast, compensatory responses were detected in A. melas populations elsewhere following mass removals.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species has spread by humans in many regions of the world.	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	A. melas is typicall freshwater species and not found in salt waters.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several potential predators distributed in the SC region which can controll A. melas population: Esox lucius, Sander lucioperca, Silurus glanis, Salmo spp, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	Medium

Statistics	
Scores	
BRA	**26.5**
BRA Outcome	**-**
BRA+CCA	**24.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**14.5**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*10.5*
B. Biology/Ecology	**12.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*7.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*-4.0*
8. Tolerance attributes	*0.0*
C. Climate change	**-2.0**
9. Climate change	*-2.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**7**
Environmental	**12**
Species or population nuisance traits	**7**

Thresholds	
BRA	-
BRA+CCA	-
Confidence	
BRA+CCA	0.69
BRA	0.71
CCA	0.50

Date and Time
02/05/2022 16:11:33

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Ameiurus melas*
Common name	black bullhead
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Introduced species in Europe
Risk assessment area	South Caucasus
Taxonomy	Ameiurus melas
Native range	Central eastern Nort America
Introduced range	Europe
URL	https://www.fishbase.se/summary/Ameiurus-melas.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Is used in aquaculture	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Has been transported live for improvement of fish stocks in Europe (Ribiero et al 2006)	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Yes, for example A. nebulosus	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	They are somehow similar. Out of 18 stations 4, 3 and 6 stations landed on values of 7, 8 and 9	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Quality is medium	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No. The species has never been spoted outside its captivity in RA area. There are no documented records of it.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture, recreational fisheries	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is present in Turkey and is likely to enter RA	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	It has been living in European cpuntries for more than a century "Ebro and Tagus drainages (Iberian Peninsula), most drainages of France, locally in Italy, the Netherlands and Germany; distribution could be wider" https://www.fishbase.se/summary/Ameiurus-	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Impacts native fish species by predation (Leunda et al 2008) and comperition with other predators (kreutzenberger et al 2008)	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	Markovic et al 2012 considered A. melas as species impacting serbian aquaculture	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	1) Affects water quality; 2) can be transmitting diseases; Holcik, 1991; Moyle and Light, 1996; Vitule et al., 2009	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No information is avalable about the socio-economic impact of the given species.	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous. Does not pose risks to human helth See: https://fishbase.mnhn.fr/summary/Ameiurus-melas.html	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Yes "Amongst the life history and ecological attributes that seem to characterize the success of the black bullhead as an invasive species are: high fecundity, parental care of the offspring, voracious and versatile feeding habits, habitat and water quality flexibility (withstanding water temperatures as high as 30° C, high turbidity, a wide range of pH and even hypoxia) and tolerance to pollution, as has been shown for many other invasive fish species in Mediterranean catchments (Alcaraz et al., 2005; Vila-Gispert et al., 2005; Ribeiro et al., 2008). These characteristics constitute a real rather than a potential threat for	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	does not parasite See: https://fishbase.mnhn.fr/summary/Ameiurus-melas.html	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	it can "withstanding water temperatures as high as 30° C, high turbidity, a wide range of pH and even hypoxia"https://www.ucm.es/data/cont/docs/568-2013-11-22-Leundaetal2008.pdf	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	it can "withstanding water temperatures as high as 30° C, high turbidity, a wide range of pH and even hypoxia"https://www.ucm.es/data/cont/docs/568-2013-11-22-Leundaetal2008.pdf	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	"In view of the continued reports of non-native range expansions by the species in Europe, it is highly likely that the distribution and impact to native communuties and ecosystem services of the species will increase."	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No information avalable.	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is likely. Even though, not studied, the risk is still there.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Yes: Max length : 66.0 cm TL male/unsexed; common length : 26.6 cm TL male/unsexed; max. published weight: 3.6 kg. See: https://fishbase.mnhn.fr/summary/Ameiurus-melas.html	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Inhabits pools, backwaters, and sluggish current over soft substrates in creeks and small to large rivers; impoundments, oxbows, and ponds. See:	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	"The black bullhead is a benthivorous fish inhabiting standing waters with soft bottom substrata (Keith & Allardi, 2001), and its activity is known to generate turbidity (Braig & Johnson, 2003). "http://brosse.sebastien.free.fr/2008_Kreutzenberger%20et%20al_J%20Fish%20Biol.pdf	Very high
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Yes.It is highly possible since their mating behaviour, which includes building the nest, guarding and airaing their eggs.	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Leunda et al 2008	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	" Taking into account black bullhead's voracity and aggressive behaviour, the diet similarity might lead to an unfavourable competition for the same food resources, subsequently, displacing native fishes to suboptimal food resources. Some effects of exotic ichthyophagous fishes, such as on competition and predation, are habitat-dependent and might be favoured by habitat degradation."https://www.ucm.es/data/cont/docs/568-2013-11-22-Leundaetal2008.pdf	Very high
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Both males and females guard and fan the nests	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No info avalable information. However, we can asume hat the probability of this is low due to the climatic conditions in RA.	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No. It is not documented and is unlikely.	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Their spawning habits are expressed on the following link: https://fishbase.mnhn.fr/summary/Ameiurus-melas.html	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. Can complete their life cycle without presence of another taxon.	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Females produce between 2,000 and 3,800 eggs.	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	1-3 years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Aquaculture	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	it is possible, since the aquaculture and recriational fisheries is very popular in the area, and stocking of non-native species is not well monitored.	Low
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Does not attach itself to hard substrata, this species do not have morphological traits that will allow them to do so.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. As far as we know this fish has not brought in the area as inseminated eggs. So it is not likely.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Is not documented but I assume it is possible.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	does not migrate	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. This type of dispersal is less likely.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	This species is not yet recorded so this question does not apply	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	no info	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No. It is not known.	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	tolerates a wide range of pH and even hypoxia	Very high

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	yes but it is costy and sometimes inefective	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	yes very tolerant to pollution (Leunda et al 2008)	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No information avalable	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies present in RA.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	it is a warmwater fish. with increasing temperatures, risks of establishment increases	Very high
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	With increased temperatures It can distribute to higher altitudes as well	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	They will be widely distributed and since their abundance the impacts on biodiversity will be higher	Very high
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Magnitude of potential impacts on ecosystem structure and function seems higher	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Magnitude of potential impacts on ecosystem services-socio-economic factors seems higher	Very high

Statistics	
Scores	
BRA	**35.0**
BRA Outcome	**-**
BRA+CCA	**47.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**19.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**16.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*7.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*-2.0*
8. Tolerance attributes	*2.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**14**
Environmental	**17**
Species or population nuisance traits	**18**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.81**
BRA	**0.80**
CCA	**0.92**

Date and Time
20/05/2022 15:33:04

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Anguilla anguilla*
Common name	European eel
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The first NNS risk scrining project for South-Caucasian fishes.
Risk assessment area	South Caucasus
Taxonomy	Animalia/Chordata/Actinopterygii/Anguilliformes/Anguillidae/Anguilla/A. anguilla
Native range	Europe
Introduced range	Caspian Sea basin
URL	

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Gousset, B. (1990). European eel (Anguilla anguilla L.) farming technologies in Europe and in Japan: Application of a comparative analysis. Aquaculture, 87(3-4), 209-235.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	The individuals are caught in the wild and then threated in captivity to artificially induce the maturation (Mordenti, O., Di Biase, A., Bastone, G., Sirri, R., Zaccaroni, A., & Parmeggiani, A. (2013). Controlled reproduction in the wild European eel (Anguilla anguilla): two populations compared. Aquaculture international,	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	Not known	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Climmatch algorithm - very similar	High
5	2.02	What is the quality of the climate matching data?	Medium	No exhaustive data distribution data is available	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili et al., 2021	Medium
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	It can be translocated by human dirctly or migrate through the chenelled system	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	No evidence of viable (established) populations in RA	Medium
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	No	No such an evidence exists	Medium
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Evans, D. W., & Matthews, M. A. (1999). Anguillicola crassus (Nematoda, Dracunculoidea); first documented record of this swimbladder parasite of eels in Ireland. Journal of Fish Biology, 55(3), 665-668.	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No such an evidence	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Expected but not documented evidence	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No such an evidence	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	No such an evidence exists	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	No such an evidence exist	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Species is not prasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	European eel need to migrate into the ocean for spowning. There is no evidence that it can adapt the migration through the Black-Caspian sea channales or spawn locally.	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	No such an evidence	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No any reason and not any evdence exists	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such potential parasite or pests is known from RA area	High
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	There are some eel-associated parasites/deseaze that is currently absent from the RA (Tesch, F. W., & Bartsch, P. (2003). The eel (p. 408). Oxford: Blackwell Science)	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Tesch, F. W., & Bartsch, P. (2003). The eel (p. 408). Oxford: Blackwell Science	Medium

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Eel is living in wide range of water velocity (Tesch, F. W., & Bartsch, P. (2003). The eel (p. 408). Oxford: Blackwell Science)	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No such an evidence	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No such information available	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Eel is predator and within the RA area there are a number of threatend species including fishes and invertebrates	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No such an evidence. Although it is competing food with Conger conger in thes native area, no similar species is known from the RA	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Deelder, C. 1970. Synopsis of biological data of the eel Anguilla anguilla (Linnaeus, 1758). FAO Fish. Synop., 80: 68.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	It needs to migrate to the atlantic for the spawning Tesch, F. W., & Bartsch, P. (2003). The eel (p. 408). Oxford: Blackwell Science.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No other taxa realted to Eel is known from RA area	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	Tesch, F. W., & Bartsch, P. (2003). The eel (p. 408). Oxford: Blackwell Science.	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	Yes	There must be a pathway for eel to migrate to the atlantic	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Tesch, F. W., & Bartsch, P. (2003). The eel (p. 408). Oxford: Blackwell Science.	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	>10	Tesch, F. W., & Bartsch, P. (2003). The eel (p. 408). Oxford: Blackwell Science.	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	It can spread by a human an also it can reach the Caspian sea basin through the Black-Caspian sea channel system	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	In the areas where Eel could be establish no such PA exists	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Tesch, F. W., & Bartsch, P. (2003). The eel (p. 408). Oxford: Blackwell Science.	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Based on the life history of Eel, this is impossible	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No documented evidence exists, nor expected	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Tesch, F. W., & Bartsch, P. (2003). The eel (p. 408). Oxford: Blackwell Science.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No evidence of this kind of dispersal	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Can be due to a human mediated release of new areas	High
43	7.09	Is dispersal of the taxon density dependent?	No	No such an evidence	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not an evidence that Eel can withstand conditions out of water	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No such an evidince exists	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such practice exists	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Not expected. Usually due to the species complex life cycle disturbance would hinder its distribution	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	The species is tollerant with wide range of water salinity represented its native range. However no reason to think about the even larger range of salinity level	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No such an information	High
C. Climate change					
9. Climate change					

50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	After climmatch modeling no significant change is expected	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	No significant change is expected in the establishment risk after climmatch scenario	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on personal judgment, expected climate change should not affect the eel dispersal	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	No change is expected	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	No change is expected	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No climate related change is expected	Medium

Statistics	
Scores	
BRA	**12.0**
BRA Outcome	**-**
BRA+CCA	**12.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**12.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*8.0*
B. Biology/Ecology	**0.0**
4. Undesirable (or persistence) traits	*2.0*
5. Resource exploitation	*5.0*
6. Reproduction	*-2.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**0.0**
9. Climate change	*0.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**11**
Environmental	**9**
Species or population nuisance traits	**-4**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.69**
BRA	**0.71**
CCA	**0.54**

Date and Time
04/05/2022 12:02:06

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Anguilla anguilla*
Common name	European eel
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Anguilla anguilla is a snake-like, catadromous fish. Eels have been important sources of food. At
Risk assessment area	South Caucasus
Taxonomy	Family - Anguillidae
Native range	Atlantic Ocean: Atlantic coast from Scandinavia to Morocco; Baltic, Black and Mediterranean Seas;
Introduced range	Continuous introductions to Asia and South and Central America
URL	https://www.fishbase.se/summary/Anguilla-anguilla.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Currently, the top three producing countries of farmed European eels are the Netherlands, Italy, and Denmark. Spain, Greece, Sweden and Germany are also centres of eel farming activity and smaller quantities are produced in several other European and North African countries (FAO 2021).	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Production of eels is based on wild catches of glass eels (elvers) used for further ongrowing (FAO 2021).	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	There is no evidence of the invasiveness of this species.	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Anguilla anguilla is naturally distributed in the SC region and enters in some rivers of Georgian Black Sea (Ninua et al. 2013; Kuljanishvili et al. 2020). Therefore, climatic conditions are	Very high
5	2.02	What is the quality of the climate matching data?	High	Anguilla anguilla is naturally distributed in the SC region and enters in some rivers of Georgian Black Sea (Ninua et al. 2013; Kuljanishvili et al. 2020). Therefore, climatic conditions are	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Anguilla anguilla is naturally distributed in the SC region and enters in some rivers of Georgian Black Sea (Ninua et al. 2013; Kuljanishvili et al. 2020).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	A. anguilla is naturally distributed in the SC region and enters in some rivers of Georgian Black Sea (Ninua et al. 2013; Kuljanishvili et al. 2020). This species can also be enter in the region through aquaculture.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	A. anguilla is naturally distributed in the SC region and enters in some rivers of Georgian Black Sea (Ninua et al. 2013; Kuljanishvili et al. 2020).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	No	No such facts have been recorded	Medium
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No such facts have been recorded	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No such facts have been recorded	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No such facts have been recorded	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No such facts have been recorded	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans	Medium
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	No such facts have been recorded	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	No such facts have been recorded	Medium
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species is naturally distributed in the SC region and climatic/environmental conditions are acceptable to it.	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	A. anguilla is native to the SC region. At the same time this species has very small population and such a fact is not expected.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	A. anguilla is native to the SC region. At the same time this species has very small population and such a fact is not expected.	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such fact has been observed.	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	No such fact has been observed.	Medium

22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Adult females can reach 133 cm in length with a total body weight of about 6 kg (Dekker et al., 1998) whereas males only reach 50 cm in length with a maximum weight of 0.3 kg. Eels are also extensively cultured in marine and brackish waters within a form of aquaculture known as valliculture. In these Mediterranean systems, mainly in Italy, in the north Adriatic, elvers of 15-35 g are stocked at the rate of 4-15 kg/ha. The elvers are mainly imported from France but also from Denmark, the Netherlands	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Inhabits all types of benthic habitats from streams to shores of large rivers and lakes. Naturally found only in water bodies connected to the sea (Kottelat and Freyhof, 2007).	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No such fact has been observed.	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No such fact has been observed.	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No such fact has been observed since A. anguilla has very small population in the SC region.	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No such fact has to be expected since A. anguilla has very small population in the SC region.	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No such fact has been observed.	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	A. anguilla migrates to the depths of the Sargasso Sea to spawn (Deelder, 1984; Rochard and Elie, 1994)	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	There is no data of hibridization of this species with native taxa.	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	According to Wiberg (1983) the karyological investigation revealed that in some of the specimens a heteromorphic chromosome pair was present. This heteromorphism appeared in both sexes of A. anguilla and in the hermaphrodite.	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	Yes	Young eels live in freshwater, where they stay for a period of 6-12 years for males and 9-18 years for females. As the eels become sexually mature they migrate to the sea, where they move to the spawning grounds in the Sargasso Sea. During migration the eels do not feed. Once in the Sargasso Sea the eels spawn in late winter and spring. Adult eels do not leave the Sargasso Sea but their progeny, the leaf-shaped larvae (leptocephali) are brought to the continental shelf of Europe by the Gulf Stream, a journey that takes 200-300 days (FAO 2021).	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	There is little information on their reproduction, but since European eels are closely related to Japanese eels, Anguilla japonica, similar breeding patterns might be assumed. Female A. japonica can lay from 2,000,000 to 10,000,000 eggs, but die soon after spawning (Deelder, 1970).	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	7	The lifespan of European eels is dependent on maturation time because once eels mature and spawn, they die. European eels can spawn as early as 7 years old (Dekker et al. 1998).	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	This species is naturally occuring in the SC region with very small population. Probably it can also spread by humans for aquaculture purposes.	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	There is a possibility of that. For instance in west Georgia there is Kolkheti National Park which is located in the natural area of A. anguilla.	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such fact has been observed.	Low
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such fact has been observed.	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No such fact has been observed.	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No such fact has been observed. This species is spawning in the Sargasso Sea.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has been observed.	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	No such fact has been observed.	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	No such fact has been observed.	Medium
8. Tolerance attributes					

44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been observed.	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Populations of the European eel (Anguilla anguilla) are declining rapidly and are now considered below safe biological limits. High pollution levels are one of the possible reasons for this decline (Guhl et al. 2014).	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No data. We think there is no need for that since A. anguilla has very small endangered populations in the world.	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Dam construction and other human activities has negative impacts on this species (IUCN 2018).	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Inhabits all types of benthic habitats from streams to shores of large rivers and lakes. Naturally found only in water bodies connected to the sea (Kottelat and Freyhof, 2007).	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are many potential predators in the SC region, e.g. birds, mammals, fish (Esox lucius, Silurus glanis etc). which can eat A. anguilla.	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Own judgement	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Own judgement	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Own judgement	High

Statistics	
Scores	
BRA	**1.0**
BRA Outcome	**-**
BRA+CCA	**-5.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**2.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*-2.0*
B. Biology/Ecology	**-1.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*0.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*-1.0*
C. Climate change	**-6.0**
9. Climate change	*-6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**6**
Environmental	**1**
Species or population nuisance traits	**-8**

Thresholds

BRA	-
BRA+CCA	-
Confidence	
BRA+CCA	0.69
BRA	0.69
CCA	0.63

Date and Time
02/05/2022 18:45:47

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Anguilla anguilla*
Common name	European eel
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Passing through the Volga-Baltic waterway, A. anguilla accidentally appeared in the Volga River,
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Anguilliformes (Eels and morays) > Anguillidae
Native range	Atlantic Ocean
Introduced range	The Caspian basin
URL	https://www.fishbase.se/summary/Anguilla-anguilla.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Juveniles of the eel are being cough and transported to different places for farming.	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Juveniles of the eel are being cough and transported to different places for farming.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Asian swamp eel (Reinert et al 2006).	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Very similar	High
5	2.02	What is the quality of the climate matching data?	High	High	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Since this species nesssessarily need to migrate to the atlantic basin for reproduction, the records of this species from RA are only accidental.	Low
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquaculture	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	It is likely, but there is no chance that this species could survive. there is no documented evidence that this organism is established in neigbouring river or lake or whatsoever.	Medium
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	No	The European eel has been recorded on the East coast and spreading south to Florida. Historical data stated the eel was found off the coast of California, but no populations were established due to an overall unfavorable habitat for the European eel. http://www.tsusinvasives.org/home/database/anguilla-	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	European eels present an ecological threat to the American eel (Anguilla rostrata), which is only found in North America. European eels have been recorded to carry a parasitic nematode, Anguillicola crassus, capable of causing severe damage to it's host. This parasite infects the swim bladder of the host resulting in acute inflammatory reactions such as fibrosis or fibrotic conglomerates, constriction of the intestine due to scar tissue, and complete rupture of the swim bladder in severe cases. This kind of damage can lead to unsuccessful migration, preventing spawning and death. With eel populations in decline, the spread of this nematode poses further risk to native American eel populations from exposure to infected European	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	it is not known	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Can transmit diseases and parasites	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	it is not known	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous See: https://fishbase.mnhn.fr/summary/Anguilla-anguilla.html	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	are considered threat to the American eel in North America	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite. See https://fishbase.mnhn.fr/summary/Anguilla-anguilla.html	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	Not adaptable to climatic and environmental conditions	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	it is not known	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	It is considered as harmless to humans https://fishbase.mnhn.fr/summary/Anguilla-anguilla.html	Very high

20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	yes it is likely	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Although not studied it is likely	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length : 122 cm TL male/unsexed; 133.0 cm TL; common length : 35.0 cm TL male/unsexed; common length :50 cm TL (female); max. published weight: 6.6 kg https://fishbase.mnhn.fr/summary/Anguilla-anguilla.html	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	It is catadromous species that migrates for reproduction for several thousands of kilometers and it is capable of sustaining itself in a range water velocity conditions	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Less likely	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Since this species is catadromous it can\t just maintain a population anywhere. It all depends wheather it has access to the marine waters	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Since this species eats almost all food it is possible that it will consume threatened or protected native taxa, however there is no information about it avalable	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	Not documented	Very high
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	"Eels resident in salt water grew on average in length 2.2 times faster than freshwater residents and increased in weight 5.3 times faster than freshwater residents. Previous findings of superior American eel growth rate in brackish water are thus extended to full-strength salt water. Freshwater residents took an estimated 2.4 times longer than saltwater residents to reach the silver eel stage." https://www.earth.sinica.edu.tw/content/people/EPMA/papers/Published%20PDF%20files/Fishery%202002-	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	This is a catadromous species that needs marine water for successful reproduction. Since there are no such conditions avalable in research area, this species can not produce viable	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No, it is not likley.	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. https://fishbase.mnhn.fr/summary/Anguilla-anguilla.html	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No https://fishbase.mnhn.fr/summary/Anguilla-anguilla.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	This species matures within 10-25years old and lays up to 5 million eggs, and after that it dies.	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	>10	10-25 years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Aquaculture	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	This vector is not that rapid that it will cause bringing it close to protected areas	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No https://fishbase.mnhn.fr/summary/Anguilla-anguilla.html	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No it is not possible.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No. due to its mating behaviour this is not possible	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No. not recorded.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Not possible.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	No.it is not documented.	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No.it is not documented.	High
8. Tolerance attributes					

44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No.it is not documented.	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	it is not tolerant	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	it can be	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No.it is not documented.	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	It can tolerate different salinity levels because, some live in freshwaters, and some in Brakish.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No.it is not documented.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	No change	Very high
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	No change	Very high
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	No change	Very high
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	No change	Very high
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No change	Very high

Statistics	
Scores	
BRA	**15.0**
BRA Outcome	**-**
BRA+CCA	**17.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**13.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*8.0*
B. Biology/Ecology	**2.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*5.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*-5.0*
8. Tolerance attributes	*-1.0*
C. Climate change	**2.0**
9. Climate change	*2.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**8**
Environmental	**9**
Species or population nuisance traits	**1**

Thresholds	
BRA	**-**

BRA+CCA	-
Confidence	
BRA+CCA	0.79
BRA	0.77
CCA	0.96

Date and Time
20/05/2022 16:06:05

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Carassius gibelio*
Common name	gibel carp
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	This is the most widespread invasive species in the region having a signficant although less
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Cyprinidae (Minnows or carps)
Native range	Northern Eurasia
Introduced range	Throughout the world
URL	https://www.fishbase.de/summary/Carassius-gibelio.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Rylková, K., Kalous, L., Bohlen, J., Lamatsch, D. K., & Petrtýl, M. (2013). Phylogeny and biogeographic history of the cyprinid fish genus Carassius (Teleostei: Cyprinidae) with focus on natural and anthropogenic arrivals in Europe. Aquaculture, 380, 13-20.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Personal observation and numerous own unpublished data.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Other congeners	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Climmatch comparision	Low
5	2.02	What is the quality of the climate matching data?	Low	Due to absence of extensive climate data for the region	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili, T., Epitashvili, G., Freyhof, J., Japoshvili, B., Kalous, L., Levin, B., ... & Mumladze, L. (2020). Checklist of the freshwater fishes of Armenia, Azerbaijan and Georgia. Journal of Applied Ichthyology, 36(4), 501-514.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Japoshvili, B., Mumladze, L., & Küçük, F. (2013). Invasive Carassius carp in Georgia: Current state of knowledge and future perspectives. Current Zoology, 59(6), 732-739.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kuljanishvili, T., Epitashvili, G., Freyhof, J., Japoshvili, B., Kalous, L., Levin, B., ... & Mumladze, L. (2020). Checklist of the freshwater fishes of Armenia, Azerbaijan and Georgia. Journal of Applied Ichthyology, 36(4), 501-514.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Kuljanishvili, T., Epitashvili, G., Freyhof, J., Japoshvili, B., Kalous, L., Levin, B., ... & Mumladze, L. (2020). Checklist of the freshwater fishes of Armenia, Azerbaijan and Georgia. Journal of Applied Ichthyology, 36(4), 501-514.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	e.g. Yalçın Özdilek, Ş., Partal, N., Jones, R.I., 2019. An invasive species, Carassius gibelio, alters the native fish community through trophic niche competition. Aquat. Sci. 81, 1–11. https://doi.org/10.1007/s00027-019-0623-6	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	No documented evidence	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	It can modify the ecosystem heavily (https://www.cabi.org/isc/datasheet/90562)	Very high
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Species is not harmful	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Gaygusuz, Ö., Tarkan, A.S., Gaygusuz, Ç.G., 2007. Changes in the fish community of the Ömerli Reservoir (Turkey) following the introduction of non-native gibel carp Carassius gibelio (Bloch, 1782) and other human impacts. Aquat. Invasions 2, 117–120. https://doi.org/10.3391/ai.2007.2.2.6	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are number of local endemic/threatened species caviar of which carassius carp can consume	Medium
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Nilsson, G.E., Renshaw, G.M.C., 2004. Hypoxic survival strategies in two fishes: extreme anoxia tolerance in the North European crucian carp and natural hypoxic preconditioning in a coral-reef shark. J. Exp. Biol. 207, 3131–3139. https://doi.org/10.1242/jeb.00979 De Boeck, G., Meeus, W., Coen, W. De, Blust, R., 2004. Tissue-specific Cu bioaccumulation patterns and differences in sensitivity to waterborne Cu in three freshwater fish: Rainbow trout (Oncorhynchus mykiss), common carp (Cyprinus carpio), and gibel carp (Carassius auratus gibelio). Aquat. Toxicol. 70, 179–188.	Very high

18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	Savini D, Occhipinti-Ambrogi A, Marchini A, Tricarico E, Gherardi F, Olenin S, Gollasch S, 2010. The top 27 animal alien species introduced into Europe for aquaculture and related activities. Journal of Applied Ichthyology [Alien species in aquaculture and fisheries. Proceedings of a conference Managing Alien Species for Sustainable Development of Aquaculture and Fisheries (MALIAF), University of Florence, Italy, 5-7 November 2008.], 26(s2):1-7. http://www.blackwell-synergy.com/loi/jai	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Through worthening water quality	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such a pests or enfectins are known	High
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Japoshvili, B., Mumladze, L., & Murvanidze, L. (2017). The population of Carassius gibelio (Bloch, 1782) and its parasites in Madatapa Lake (South Georgia). Iranian Journal of Fisheries Sciences, 16(2), 793-799.	Very high
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	Species is usually small to medium size (Kottelat, M., Freyhof, J., 2007. Handbook of European freshwater fishes. Imprimeria du Democrate SA, Dlemont. https://doi.org/10.1643/OT-08-098a.1)	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Uses a number of different water habitats	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Tarkan AS, Gaygusuz Ö, Gaygusuz ÇG, Saç G, Copp GH, 2012. Circumstantial evidence of gibel carp, Carassius gibelio, reproductive competition exerted on native fish species in a mesotrophic reservoir. Fisheries Management and Ecology, 19(2):167-177.	Very high
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	It can survive and reproduce even when there is only a few individuals because of reproductive strategy	Very high
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	It consumes the egges for instance of Atacus colchicus	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Paulovits, G., Tatrai, I., Matyas, K., Korponai, J., Kovats, N., 1998. Role of Prussian Carp (Carassius-Auratus Gibelio Bloch) in the Nutrient Cycle of the Kis-Balaton Reservoir. Int. Rev. Hydrobiol.	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No documented evidence	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	e.g. Kuljanishvili, T., Mumladze, L., Kalous, L., & Japoshvili, B. (2018). Fish species composition, sex ratio and growth parameters in Saghamo Lake (Southern Georgia). Biologia, 73(1),	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Freyhof J, Kottelat M, 2008. Carassius carassius. IUCN Red List of Threatened Species. http://www.iucnredlist.org	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	Paulovits, G., Tatrai, I., Matyas, K., Korponai, J., Kovats, N., 1998. Role of Prussian Carp (Carassius-Auratus Gibelio Bloch) in the Nutrient Cycle of the Kis-Balaton Reservoir. Int. Rev. Hydrobiol.	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Kottelat, M., Freyhof, J., 2007. Handbook of European freshwater fishes. Imprimeria du Democrate SA, Dlemont. https://doi.org/10.1643/OT-08-098a.1	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Kottelat, M., Freyhof, J., 2007. Handbook of European freshwater fishes. Imprimeria du Democrate SA, Dlemont. https://doi.org/10.1643/OT-08-098a.1	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	active dispersal, human mediated dispersal, also animal mediated dispersal is possible	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	It is already everywhere within the RA area	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Species is free sweemer with absence of such a capabilities	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	No documented evidence	Low
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	No documented evidence but highily expected	Low
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Species is not migrant at any stage (Kottelat, M., Freyhof, J., 2007. Handbook of European freshwater fishes. Imprimeria du Democrate SA, Dlemont. https://doi.org/10.1643/OT-08-098a.1)	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	Stresseed in the literature but not yet well documented	Low

42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Usually large number of propagule or adults are released	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	Yes	Species is very tolerant with drying or freezing water and can survive for month in such a conditions	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	Yes	e.g. Liasko, R., Koulish, A., Pogrebniak, A., Papiggioti, O., Taranenko, L., Leonardos, I., 2011. Influence of environmental parameters on growth pattern and population structure of Carassius auratus gibelio in Eastern Ukraine. Hydrobiologia 658, 317–328. https://doi.org/10.1007/s10750-010-0502-6	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No successful case exists	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No documented evidence	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documented evidence	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	Yes	Birds, some predatory fishes that are not very effective	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Not expected because the species is alreadu established in RA area	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Based on personal judgment establishment risks would increase	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on personal judgment dispersal risks would increase	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on personal judgment invirnmental impact would increase	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on personal judgment impact on ecosystems would increase	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on personal judgment impact on socio-economic and ecosystem services would increase	Low

Statistics	
Scores	
BRA	**44.0**
BRA Outcome	**-**
BRA+CCA	**54.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**20.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**24.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*7.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*4.0*
8. Tolerance attributes	*0.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*

Sectors affected	
Commercial	17
Environmental	17
Species or population nuisance traits	25

Thresholds	
BRA	-
BRA+CCA	-
Confidence	
BRA+CCA	0.76
BRA	0.79
CCA	0.58

Date and Time
04/05/2022 12:14:38

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Carassius gibelio*
Common name	gibel carp
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Carassius gibelio is one of the most widspread invasive species in many countries. This fish is also
Risk assessment area	South Caucasus
Taxonomy	Carassius gibelio (Bloch 1782)
Native range	Europe and Asia: usually considered as native from central Europe to Siberia
Introduced range	Introduced to European waters from eastern Asia. Clear and definite data on original distribution in
URL	https://www.fishbase.se/summary/Carassius-gibelio.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	C. gibelio have been introduced intentionally for the purposes of food production (U.S. Fish & Wildlife Service, 2012)	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Farmed crucian carp is entirely sold live or fresh. Drying and salting is only used for crucian carp caught from natural water bodies (rivers and lakes) by some traditional inland fishers (FAO	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	A major biological trait responsible for invasiveness in C. gibelio is its mode of reproduction. Invading populations are often triploid and composed of almost exclusively females that exhibit apomictic (gynogenetic) reproduction, using the sperm of other species to activate (but not fertilize) their own eggs (CABI 2019). This species has been reported as invasive in Alberta, Canada (Elgin et al., 2014; Ruppert et al., 2017) and in many countries of	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	C. gibelio has a wide range and therefore the SC region is somewhat in a suitable climatic zone.	Medium
5	2.02	What is the quality of the climate matching data?	Medium	C. gibelio has a wide range and therefore the SC region is somewhat in a suitable climatic zone.	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Carassius gibelio is widespread throughout South Caucasus Region and present in the ponds, lakes, rivers and reservoirs of the region (Japoshvili et al. 2013; Ninua et al. 2013; Kuljanishvili et	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	This fish is spread by both intentional by humans and unintentional by animals (birds, mammals, etc.)	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is widely distributed in the Caucasus region and surrounding.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	This species has been successfully established in many countries around the world (Japoshvili et al. 2013; Japoshvili et al. 2017; Yerli et al. 2014; Kuljanishvili et al. 2020; FAO 2021).	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	The species has negative impact on the local populations (Tarkan et al. 2012; Ruppert et al. 2017).	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	In aquaculture systems, C. gibelio is an unwelcome competitor with cultures of the major reared species. The occurrence of numerous populations of C. gibelio in fishponds causes considerable economic loss in the Czech Republic as there is no market for the species. Even when it can be sold, it reaches a considerably lower price (Lusková et al., 2010).	Very high
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	This species affect nutrient recycling and then primary productivity in aquatic ecosystems, either directly or indirectly	Very high
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	In Europe economic impact (on agriculture, animal production, forestry, human infrastructure, human health and human social life) caused by C. gibelio has been assessed and scored the highest impact points (Veer & Nentwig 2014).	Very high
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	No such fact has been revealed.	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Declines of toppredators/piscivorous fish such as native trout speciesand European catfish (S. glanis) and reduced compe-tition for food by the rest of the species may further favored the explosion of C. gibelio populations in Greece (Perdikaris et al.	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	In the SC region there are many protected and thretend species who are under pressure from this species, e.g. Luciobarbus capito, L. mursa, Acipencer spp, etc. (Ninua et al. 2013; Kuljanishvili et	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species has been successfully established in the region and consequently it has overcome all barriers.	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	C. gibelio has potential to cause economic and environmental damage by causing quantitative changes in community structure in becoming the dominant species and shifts in food chains, and by altering the physical and chemical properties of habitats	High

19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	A similar fact is likely to occur as this species interferes with the reproduction of local fish populations.	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	No such data available.	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	No such data available.	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	C. gibelio is a medium-sized cyprinid, and can growth up to 3 kilograms and a length of 45 centimetres. Therefore, it can released from captivity in the nature for angling.	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Inhabits a wide variety of still water bodies and lowland rivers, usually associated with submerged vegetation or regular flooding.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	The presence of C. gibelio in some habitats increased the biomass of planktonic algae, total and inorganic suspended solids, leading to decreased light intensity in the water and a lower biomass of benthic algae (Razlutskij et al. 2021).	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Successful adaptation and proliferation of Carassius gibelio is mainly attributed to its dual reproductive mode (allogynogenetic and gonochoristic), the opportunistic-omnivorous feeding habits and the ability to withstand and flourish in adverse ecological conditions. Accordingly, it exerts competitive, as well as destructive effects upon the indigenous fish species (sperm parasitism, antagonism for food, spawning grounds and spawning substrates) and therefore, efforts are needed to sustain a relative balance of the populations (Perdikaris et al. 2011).	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Such a fact has not been documented though it is to be expected	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Such a fact has not been documented though it is to be expected	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Relative density, duration of spawning, reproductive effort and gonado-somatic index of C. gibelio increased with some water quality variables and coincided with decreasing trends for natives (Tarkan et al. 2012).	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species is successfully breeding in the SC region (Japoshvili et al. 2013; Kuljanishvili et al. 2020).	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	C. gibelio are very similar to other members of the Carassius genus, Cyprinus carpio and hybrids of these species.	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	This species is characterized by asexual reproduction (Japoshvili et al. 2013; Yadrenkina 2020).	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Such a fact is not known	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Fecundity of this species is about 300 000 eggs (Ninua et al. 2013).	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	4	Sexually maturate at the age of 4 (Ninua et al. 2013).	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Carassius gibelio is widspread species in the throughout Caucasus region. This species is spreading both intentionally and accidentally by humans, birds, other animals and etc.	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	This species is occurring in the protected areas of the SC region for example in the Kolkheti National Park, west Georgia.	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Such a fact is not known	Low
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	This species can spread by birds and other organisms.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Not applicable	Such a fact is not known	Low
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species is not characterized by migration.	Medium
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	This species can spread by birds and other organisms in the SC region.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	A similar fact is likely to happen.	Medium
43	7.09	Is dispersal of the taxon density dependent?	Yes	C. gibelio by its high reproduction capacity by means of gynogenesis and tolerance to environmental changes, considered as asuccessfull invasive. It can become the dominant species in new habitat in a short time with the help of these attributes (Yerli	Medium
8. Tolerance attributes					

44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	Yes	C. gibelio has ability to withstand without water for several hours.	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Inhabits a wide variety of still water bodies and lowland rivers, usually associated with submerged vegetation or regular flooding. Can strongly tolerate low oxygen concentrations and pollution (Kottelat and Freyhof, 2007).	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	Data on this are not available.	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Climate, habitat and human disturbance were closely related to the life history, suggesting that C. gibelio will expand their distribution in response to future global environmental changes	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	This species is able to persist in low-salinity environments (<10 ppt) for long periods of time and at higher salinities for short time periods. When acutely shifted from fresh water to low-salinity conditions (5-15 ppt) the species is capable of survival for at least 72 h. However, acute transfer to salinities of20-25 ppt lead to 100% mortality (Schofield et al. 2006)	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	Yes	Esox lucius, Silurus glanis, Salmo labrax, etc. (Kuljanishvili et al. 2020).	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Own judgement	Low

Statistics	
Scores	
BRA	**52.0**
BRA Outcome	**-**
BRA+CCA	**64.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**24.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**28.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*7.0*
6. Reproduction	*5.0*
7. Dispersal mechanisms	*3.0*
8. Tolerance attributes	*4.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**21**
Environmental	**17**

Species or population nuisance traits	31

Thresholds	
BRA	-
BRA+CCA	-
Confidence	
BRA+CCA	0.72
BRA	0.73
CCA	0.58

Date and Time	
	03/05/2022 13:41:54

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Carassius gibelio*
Common name	gibel carp
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Prussian carp, Carassius gibelio (Bloch, 1782), has spread outside it's native range and has
Risk assessment area	South Caucasus
Taxonomy	Actinopterygii (ray-finned fishes) Cypriniformes (Carps) Cyprinidae (Minnows or carps) Cyprininae
Native range	Europe and Asia: usually considered as native from central Europe to Siberia or introduced to
Introduced range	At present, widely distributed and commonly stocked together with Cyprinus carpio which is
URL	https://www.fishbase.de/summary/Carassius-gibelio.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Carassius gibelio is considered as C. auratus complex, which means that species of C. auratus complex are very difficult to distinguish from each other in the wild. This group includes the most popular aquarium fish - goldfish (Rylkova et al 2013). Carassius gibelio itself is considered as a weed fish and it does not have economic benefits. Therefore it is not deliberately grown in fish farms or is subjected to substantial human selection. However, fish farming is mostly the case how this species is	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	The species was being introduced to some countries as a bait fish for other aquaculture fish (Lever 1996) however, this species is not harvested, sold or consumed nowadays.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Carassius auratus very closely related invasive species.	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	If we count that the native area of Carassius gibelio is Siberia/Asia then climatic conditions are different to those to S. Caucasian area, however, since we do not know what is exact native range of this species, confidence of this answer remains medium.	Medium
5	2.02	What is the quality of the climate matching data?	Low	The quality of the climate data is low since we do not know the exact native range of this species. This can affect the accuracy of the climate analysis.	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Following citations are the published records of this species apparance in RA area: Daraselia 1985; Japoshvili et al 2013; Japoshvili et al 2017; Kuljanishvili et a; 2018; Kuljanishvili et al	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Japoshvili et al 2013 proposed two vectors: unintentional introduction with Cyprinus carpio or spread by the birds, ornamental trade and natural dispersal are also the possible	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is established in almost every water body where it occurs (Japoshvili et al 2013; Japoshvili et al 2017; Kuljanishvili et al 2020)	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	It is known that this species have been naturalised in Europe since 19th century (See: Rylkova et al 2013).	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Carassius gibelio is recognized as one of the most successful invasive fish worldwide (Copp et al 2005; Gozlan et al 2010). It has negative impact on environment, in which it is introduced due to foraging behaviour and usual high abundances (Vetemaa et al 2005; Lusková et al 2010). Presence of Prussian carp populations increases turbidity (Crivelli, 1995) and leads to a change in the nutrient cycle (Paulovits et al., 1998). Additionally, Prussian carp affects native species including plants and animals in terms of grazing pressure and impacts on other fish by direct competition (Gaygusuz et al., 2007; Ribeiro and Leunda, 2012; Tarkan et al. 2012; Ruppert et al. 2017). As with other non-native species, Prussian carp may cause the introduction of uncommon parasites and diseases in newly invaded areas (Žitňan, 1974; Mahmoud et	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	There are no studies or assessments done in RA area regarding C. gibelo adverse impacts to aquaculture. However, based on other area assessments we can say thay it can negatively affect the productivity in the pond aquaculture, since its ability to change nutrient cycle, grazing pressure and competition.	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	Impacts all tyes of ecosystem services (in water). 1) Affects water quality (Crivelli, 1995; Richardson et al 1995); 2) can be transmitting diseases (Žitňan, 1974; Mahmoud et al 2009); 3)distrupts nutrient cycles in water (Paulovits et al 1998); 4) is not used in recreational fisheries.	Very high
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Does not have any known consequences on commercial or recreational fisheries or aquaculture.	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not known	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	C. gibelio can cause the decline of native fish in the environment due to it's invasive behaviour, which includes, competition, habitat quality changes, sperm parasitism (Deacon etal. 1964,	High

16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	This species is omnivorous. Is not characterised with parasitism and is not being a predator.	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	The species ability to tolerate degraded conditions in different environment makes this species invasive (Morgan 2007).	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	It can disrupt food-web structure via eating-out zooplankton (See Paulovits et al 1998)	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Can affect water quality, can be transmitting desases, disrupts nutrient cycles in water, and recreational fisheries are being impacted as this species is not local anglers favourite.	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	There is no information about endemic pests and infectious agents in the region	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Carassius gibelio might bring of uncommon parasites and diseases in newly invaded areas (Žitňan, 1974; Mahmoud et al 2009).	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	The fish grows up to 30cm (at least what is recorded) in the RA area (Japoshvili et al 2017). If held in captivity, it is more likely to be released into nature due to it's achieved size.	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Recently this fish has been found in flowing waters as well.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Several studies document it's foraging behaviour, leading the decrease of habitat quality and decline of native species	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	This species is known that can be reproducing by Parthenogenesis (Gui and Zhou, 2010).. Meaning that it can quickly reproduce even in low densities.	Very high
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	There is expectation that it can consume some threatened benthic invertebrates. However, local IUCN lists are not updated and it is difficult to say which local organisms it can affect. Secondly, C. gibelio is not a predatory fish, that means that it can not consume threatened fishes. Thus, answer will be NO, but with Medium confidence	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	It is known that the C. gibelio or its closely related taxa (C. carassius; C. auratus) impact the nutrient cycle and food resources availability for native organisms (Paulovits et al 1998; He et al 2017; He et al 2019; Jia et al 2019).	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	It is not known.	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	It has produced viable propagules.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	It might hybridize with Cyprinus carpio (Simkova et al 2015)	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	Yes it has ability to reproduce asexually as well, that has been documented using several studies.	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	C gibelio sometimes uses the sperm of other species of the same genus to trigger its clonal reproduction (Sperm dependent parthenogenesis). However, if there is not avalability of heterospecific sperm, they produce recombinant offspring of both sexes. Which indicates that they are not dependent on another taxon to complete its life cycle.	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Not recorded	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	Age at maturity is 3-4 years in central and eastern europe; 1-2 years in southern Europe (Kotellat & Freyhof, 2007).	Medium
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Unintentional releases with other fish species fry (e.g. C. carpio), accidental escapes from fish farms, intentional releases (by hobbysts).	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Like written above, C. gibelio appeares in flowing waters, making this species highly mobile for further dispersal. It has reached protected areas as well.	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	C. gibelio produces "sticky eggs that are attached to water plants or, submerged objects" (kottelat and Freyhof 2007). However, can it be transported by ships, hulls pilings, buoys? less likely.	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	Japoshvili et al. 2013 reported that the eggs of Carassius gibelio was believed to be introduced through birds in Georgia. However, it is less likely.	Low
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	There is no documentation of natural dispersal of this species larvae or juveniles	High

40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Not applicable	Does not migrate for reproduction	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	This species occurs in natural lakes, which serve as an important areas for water birds (e.i Javakheti upland lakes). Its eggs could be transported by birds, but less likely.	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	In some urban ponds, accidentally introduced C. gibelio reproduces and disperses very rapidly (one calendar year)	High
43	7.09	Is dispersal of the taxon density dependent?	No	Not documented	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No. can not withstand being out of water for more than one hour	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Tolerates low oxygen and eutrophic environments	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	There was documented case when C. auratus has been eradicated from the certain areas of the Vasse River via electrofishing and Gill nets (https://researchrepository.murdoch.edu.au/id/eprint/5948/1/Feral Goldfish.pdf). However, it is not known if it has been eridicated	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Several studies have revealed that C gibelio is very tolerant to environmental/human disturbance.	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	Carassius gibelio belongs to Stenohaline fishes, that can not tolerate wide variety of salinity. Study done for C. auratus showed that salinities higher than 8-10‰ affects its growth and food intake, results in muscle dehydratation and increase of cortisol	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	There is no such study done in RA area. Therefore, the answer has medium confidence.	Low
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypothised that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Increased temperatures will cause this species establish in higher altitudes	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It might favour by environmental changes (caused by climate change) that will increase resource availability, resulting their widespread.	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Population densities will increase making them on one hand impossible to eradicate and on the other hand, affecting native organisms due to competition, that does not leave much resources for native ones.	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	C. gibelio populations affect the environment in which it is invaded in many terms. Future increased temperatures will favour the dispersal and success of this species establishment which itself, affects native species that are of main concern for conservation. In addition, their foraging behaviour will definitely have impacts on ecosystem structure/function. for example, C. gibelio is known to be changing the nutrient cycle, and can be the reason of increased turbidity in the water body.	Very high
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	In the South Caucasus Area C. gibelio is already well established and distributed in almost all water bodies of different elevations (Kuljanishvili et al 2020). Under the predicted future climatic conditions, this species will disperse even wider, that will itself create the problem for native aquatic organisms and not only. The widespread and abundance of C. gibelio, which is quite adaptive and plastic to different environmental conditions, will increase its impact on ecosystem services and socio-economic factors. For example: water quality; transmission of diseases, disrupting nutrient cycles. It can also affect aquaculture and recreational	Very high

Statistics	
Scores	
BRA	**36.0**
BRA Outcome	**-**
BRA+CCA	**48.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**14.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*10.0*
B. Biology/Ecology	**22.0**
4. Undesirable (or persistence) traits	*10.0*
5. Resource exploitation	*2.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*2.0*

8. Tolerance attributes	*4.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**11**
Environmental	**12**
Species or population nuisance traits	**30**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.75**
BRA	**0.74**
CCA	**0.83**

Date and Time
20/05/2022 16:07:20

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Chelon auratus*
Common name	golden grey mullet
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species have been translocated to the Caspian Sea and have important economic value
Risk assessment area	South Caucasus
Taxonomy	https://www.fishbase.de/summary/Chelon-auratus.html
Native range	Mediterranean Sea
Introduced range	Caspian Sea
URL	https://www.fishbase.de/summary/Chelon-auratus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Crosetti, D. & Cataudella, S. (1995). The Mullets (pp. 253-268), In: C.E. Nash, A.J. Novotny (Eds.). World Anim. Sci.-Production of Aquatic Animals (fishes-C8). Elsevier Science, Amsterdam, Netherlands, 529 pp.;	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Ninua, N., Japoshvili, B., Bochorishvili, V., 2013. Fishes of Georgia. Tsignieri, Tbilisi.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Other congeners. CABI, 2022. Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Results of climatch algorithm	High
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	None	Human mediated translocation	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No documented evidence	Low
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evidence	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No documented evidence	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Species is harmless	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	No documented evidence	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Species is not parasite	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Guessed based on its ability to tolerate with varing level of salinity	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	No documented evidence	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No documented evidence	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No documented evidence	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	No documented evidence	Low

22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Species reared in mariculture for future release	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	No documented evidence	Low
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No documented evidence	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No documented evidence	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No documented evidence	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	No documented evidence	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Kottelat, M., Freyhof, J., 2007. Handbook of European freshwater fishes. Imprimeria du Democrate SA, Dlemont. https://doi.org/10.1643/OT-08-098a.1	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Species is established and reproducing in RA area	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Not a documentied evidence exists	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Species is sexualy reproducing (Kottelat, M., Freyhof, J., 2007. Handbook of European freshwater fishes. Imprimeria du Democrate SA, Dlemont. https://doi.org/10.1643/OT-08-098a.1)	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	It has independent life cycle	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Thausands of egges are produced by a single individual	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	Kesiktaş, M., Yemişken, E., Yildiz, T., & Eryilmaz, L. (2020). Age, growth and reproduction of the golden grey mullet, Chelon auratus (Risso, 1810) in the Golden Horn Estuary, Istanbul. Journal of the Marine Biological Association of the United Kingdom, 100(6), 989-995.	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Active dispersal, Human mediated translocation	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	No such areas in the Caspian Sea	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Not such fact is known. Furthermore, species morpholgy does not allow such behavior	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	Eggs are pelagic moving freely with water currents (Breder, C.M. and D.E. Rosen, 1966. Modes of reproduction in fishes. T.F.H. Publications, Neptune City, New Jersey. 941 p.)	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Juveniles are actively sweeming (Kottelat, M. and J. Freyhof, 2007. Handbook of European freshwater fishes. Publications Kottelat, Cornol and Freyhof, Berlin. 646 pp.)	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not such an evidence is known	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Not such an evidence exists	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Eggs or juveniles that reach large number can disperse independently	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not such evidence exists	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Salinity	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	Not known	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No such an evidence is known	High

48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	The species is living in marin and brackish waters and even occuring in lower reaches of rivers. Thus already tolerate large variety of salinity in its natural environment	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	In spite of some potential predators (Esox lucius, Sander lucioperca, Silurus glanis) no one is ever shown as an effective	Low
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgement	Low

Statistics	
Scores	
BRA	**14.0**
BRA Outcome	**-**
BRA+CCA	**20.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**6.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**8.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*2.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*1.0*
8. Tolerance attributes	*0.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**7**
Environmental	**4**
Species or population nuisance traits	**11**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.62**
BRA	**0.67**
CCA	**0.25**

Date and Time
04/05/2022 13:04:41

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Chelon auratus*
Common name	golden grey mullet
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	In some estuaries it is main target of both commercial fishery and recreational fishermen.
Risk assessment area	South Caucasus
Taxonomy	Chelon auratus (Risso, 1810)
Native range	Eastern Atlantic: Scotland to Cape Verde; in the Mediterranean and Black Sea. Also in coastal
Introduced range	It has been introduced into the Caspian Sea.
URL	https://www.fishbase.se/summary/1735

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	The species' potential for aquaculture is enhanced by its eurihalyne and eurithermal adaptability, allowing it to grow in a variety of ecosystems (Crosetti & Cataudella, 1995). Moreover, fry production is high in certain seasons, and their capture almost entirely supports seed supply for mullet aquaculture (Crosetti & Cataudella, 1995). Golden grey mullets are consumers of the low trophic layers and can therefore be used in most economic and efficient way by culturing them extensively (Crosetti & Cataudella,	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	The fish has a trade importance (Ninua et al. 2013).	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Data deficient	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	This species is naturally distributed in the SC region.	Very high
5	2.02	What is the quality of the climate matching data?	High	This species is naturally distributed in the SC region.	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is naturally distributed in the SC region and translocated in the Caspian Basin (Azerbaijan, Iran) (Kuljanishvili	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	This species is naturally distributed in the SC region. Also it was entered in the Caspian Sea basin via human, intentionally.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Chelon auratus is a common species and major commercial resource of Turkish waters (Kesiktas et al. 2020).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	C. auratus was introduced from the Black Sea to the Caspian Sea in Azerbaijan, Kazakhstan and Turkmenistan. It is established in all three countries.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	C. auratus has been introduced into the Caspian Sea where it has established populations but no negative impacts have been reported from this introduction. It has also been introduced in the Jordan River and Lake Kinneret but no adverse impacts have been recorded from these introductions.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Nu such fact has been reported	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Nu such fact has been reported	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Nu such fact has been reported	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	Nu such fact has been reported	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	A similar case is not expected because this species is naturally occurring in the SC region.	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species is naturally distributed in the SC region and environmental conditions are acceptable for it.	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	This species is naturally distributed in the SC region and therefore, such fact is not expected.	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	This species is naturally distributed in the SC region and therefore, such fact is not expected.	Very high
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficient	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Parasite fauna of the golden grey mullet Liza aurata (Risso, 1810) collected from Lower Kızılırmak Delta in Samsun, Turkey were investigated in the present study. A total of 10 parasite species were identified and they are; Trichodina puytoraci, Trichodina lepsii, Ligophorus mediterraneus, Ligophorus cephali, Microcotyle mugilis, Ascocotyle (Phagicola) longa, Haplosplanchnus pachysomus, Tylodelphys clavata, Neoechinorhyncus agilis and Ergasilus lizae. Overall infection prevalence was 100 %.	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Its maximum length is around 60 centimetres and weight around 1.5 kilograms, but commonly it is much smaller fish with average specimen having 30 centimetres in length.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Adults are neritic usually in schools, entering lagoons and lower estuaries; rarely entering freshwater.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No such fact has been described	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Not applicable	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No such fact has been detected	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No such fact has been described	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Data deficient	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species is naturally reproduces in the SC region.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No such fact has been described from the introduced range of the C. auratus.	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	The present study documents the occurrence of an intersex condition in a natural population of mullet Mugil cephalus (Dhanasekar et al. 2018).	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	This species does not have such requirements.	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Fecundity of C. auratus is 142 000 to 4 440 000 eggs (Ninua et al. 2013).	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	The fish reaches sexual maturity at the age of 3-4 (Ninua et al. 2013).	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	This species is disperse or dispersed within the SC region naturally and intentionally by humans.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Such a fact is to be expected. This species is already distributed within the protected areas of SC region, for instance in the Kolkheti National Park, west Georgia.	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not have such means.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	This fish is naturally reproduces and dispersed in the SC region.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This fish is naturally reproduces and dispersed in the SC region.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This fish is naturally reproduces in the SC region.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	Such a fact is not described though it is not ruled out.	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Own judgement	Medium
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Such a fact is not known.	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	It is tolerant of low oxygen levels and can ventilate water in contact with the air when conditions are hypoxic. This species lives in clear to turbid waters over sandy and muddy bottoms (Coad 2016).	High

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Not applicable	Data deficient	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	In some countries/regions this species has spread by humans	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Golden grey mullet is a neritic species, usually inshore, entering lagoons, ports and estuaries, but rarely moves into freshwater. Spawns in the Sea.	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several predators in the SC region which can controll the C. auratus: Esox lucius, Sander lucioperca, Silurus glanis, Salmo labrax, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	Medium

Statistics	
Scores	
BRA	**25.0**
BRA Outcome	**-**
BRA+CCA	**19.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**8.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**17.0**
4. Undesirable (or persistence) traits	*3.0*
5. Resource exploitation	*0.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*6.0*
8. Tolerance attributes	*5.0*
C. Climate change	**-6.0**
9. Climate change	*-6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**5**
Environmental	**-3**
Species or population nuisance traits	**22**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.76**
BRA	**0.80**
CCA	**0.50**

Date and Time

05/07/2021 17:23:09

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Chelon auratus*
Common name	golden grey mullet
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Chelon auratus and C. saliens are native to the Black Sea basin, and both species were
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Mugiliformes (Mullets) > Mugilidae
Native range	The Black Sea basin
Introduced range	The Caspian Sea basin
URL	https://fishbase.mnhn.fr/summary/Chelon-auratus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	This taxon has not been subject of substantial human selection, however it has comercial value and is being fisheries important.	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes. this species is very popular for market.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Chelon labrosus (Yankova 2016) or Chelon saliens (Medium risk) (Moghaddas et al 2021)	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Somehow similar	Medium
5	2.02	What is the quality of the climate matching data?	High	There are no climatic stations in climatch to make this analysis. However, according to Koppen-Geiger map the climate is somehow similar.	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	are distributed over the entire Caspian sea basin (Bogutskaya et al. 2013; Yusifov et al. 2017). are also found in the brackish and fresh waters of the Caspian Sea coast (Kuljannishvili et al 2021)	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquaculture	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	are distributed over the entire Caspian sea basin (Bogutskaya et al. 2013; Yusifov et al. 2017). are also found in the brackish and fresh waters of the Caspian Sea coast (Kuljannishvili et al 2021)	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	species formed self-sustaining populations (Ibrahimov and Mustafayev 2015)	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No adverse impacts to the wild comercial taxa ar known.	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No adverse impacts to aquaculture iare known.	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No adverse impacts to ecosystem are known, however, can be transmitting of parasites and deseases	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No adverse socio-economic impacts are known	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous https://fishbase.mnhn.fr/summary/Chelon-auratus.html	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	It is not known	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species can tolerate wide range of salinities and temeratures (Nita & Nenciu 2020)	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	No	The impact of G. aculeatus in Azerbaijan has not been documented	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No adverse impacts on ecosystem services in the RA area is known.	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No information avalable	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is possible.	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	This taxon is usually reared and then released in open waters (Maricultures)	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Yes. this specie is marine, which sometimes enters freshwaters	High

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Not documented	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Less likely. since the first attempt of introducing this species in caspian sea basin failed.	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	This species feed on small benthic organisms, detritus, and occasionally on insects and plankton	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	Less likely	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Not documented	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Yes. It has been considered as established species since 1930ies	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Not documented	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No https://fishbase.mnhn.fr/summary/Chelon-auratus.html	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. This tacon is not dependent on the presence of another taxon.	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Individual absolute ranges from 113 386 to 1.47 million eggs (Fazli et al 2008)	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	"Fifty percent of sexual maturity was at FL 26.0 cm. Mature gonads were present in 20% of fish at age 3, 63% at age 4, 88% at age 5, and 97% at age 6. " (Fazli et al 2008)	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture; recreational Fisheries;	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	It is possible however based on the spceies biological characters it will not establish in the protected areas. So the answer is no.	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No, The morohological traits of the species does not allow it to attach to the surfaces.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. This sort of dispersal is higly unlikely.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Yes it is possible, juveniles can spread independently	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No. it is reproducing in the sea	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. This is in my opinion not an option for dispersal.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	There is no information regarding how rapid is the stocking of this species in the RA area	Low
43	7.09	Is dispersal of the taxon density dependent?	No	Not documented	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not known. Not likely.	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	it can tolerate wide range of temperatures and salinities	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	Can not be eradicated. and it will not be, because it has fisheries value	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No. Not documented.	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	golden grey mullet fries can indeed tolerate a wide range of salinities (5‰-70‰),	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	no effective natural enemies exist in RA area	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High

51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Since this species are very much tolerant to wide range of temperatures their establishment wiill not decrease, it will stay the same	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	No change	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	No change	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	No change	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No change	Medium

Statistics	
Scores	
BRA	**14.0**
BRA Outcome	**-**
BRA+CCA	**16.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**7.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**7.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*0.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*3.0*
C. Climate change	**2.0**
9. Climate change	*2.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**6**
Environmental	**0**
Species or population nuisance traits	**13**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.70**
BRA	**0.71**
CCA	**0.63**

Date and Time
20/05/2022 16:11:28

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Chelon saliens*
Common name	leaping mullet
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species have been translocated to the Caspian Sea and have important economic value
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Mugiliformes (Mullets) > Mugilidae (Mullets)
Native range	Mediterranean Sea, Atlantic coast
Introduced range	Caspian Sea, USA
URL	https://www.fishbase.de/summary/Chelon-saliens.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Thomson, J.M., 1986. Mugilidae. p. 344-349. In J. Daget, J.-P. Gosse and D.F.E. Thys van den Audenaerde (eds.) Check-list of the freshwater fishes of Africa (CLOFFA). ISNB, Brussels, MRAC; Tervuren; and ORSTOM, Paris. Vol. 2.	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Thomson, J.M., 1986. Mugilidae. p. 344-349. In J. Daget, J.-P. Gosse and D.F.E. Thys van den Audenaerde (eds.) Check-list of the freshwater fishes of Africa (CLOFFA). ISNB, Brussels, MRAC; Tervuren; and ORSTOM, Paris. Vol. 2.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congenerics (CABI, 2022. Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.)	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Result of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32; Esmaeili, H. R., Teimori, A., Owfi, F., Abbasi, K., & Coad, B. W. (2014). Alien and invasive freshwater fish species in Iran: Diversity, environmental impacts and management. Iranian Journal of Ichthyology, 1(2), 62-72.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	None	Human mediated translocation	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32; Esmaeili, H. R., Teimori, A., Owfi, F., Abbasi, K., & Coad, B. W. (2014). Alien and invasive freshwater fish species in Iran: Diversity, environmental impacts and management. Iranian Journal of Ichthyology, 1(2), 62-72.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Esmaeili, H. R., Teimori, A., Owfi, F., Abbasi, K., & Coad, B. W. (2014). Alien and invasive freshwater fish species in Iran: Diversity, environmental impacts and management. Iranian Journal of Ichthyology, 1(2), 62-72.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No documented evidence	Low
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evidence	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No documented evidence	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not harmful species	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	No documented evidence	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Species is not parasite	Very high

17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	The species is adaptable to a range of water salinity, oxygen level and turbidity. Minos G, Katselis G, Kaspiris P, Ondris I. 1994. The differential increase of morphometrical characters during the growth of grey mullet, Liza ramada (Risso) and Liza saliens (Risso), in the Messolonghi – Etoliko lagoon. Bios (Macedonia, Greece), 2:149-154. https://www.researchgate.net/publication/236343487 The differential increase of the morphometrical characters during the growth of the grey mullets Liza ramada Risso and Liza saliens Risso in Messolongi-Etoliko lagoon; Minos, G. Kalselis, G. Kaspiris, P. Ondris, I. 1995. Comparison of the change in morphological pattern during the growth in length of the grey mullets Liza ramada and Liza saliens from western Greece. Fisheries Research	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	No documented evidence	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No documented evidence	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No documented evidence	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	e.g. Zorriehzahra, M. E. J., M. Ghasemi, M. Ghiasi, S.Haghighi Karsidani, G. Bovo, A. Nazari, M. Adel, V. Arizza, and K. Dhama. 2016. Isolation and confirmation of viral nervous necrosis (VNN) disease in golden grey mullet (Liza aurata) and leaping mullet (Liza saliens) in the Iranian waters of the Caspian Sea. Veterinary	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	No documented evidence.	Medium
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	No documented evidence	Low
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No such an evidence exist and not expected	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No such an evidence exist	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Species is plankton/detritus feeder and no threatened species within these organisms are known in the RA area	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	No documented evidence; Professional judgement	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No such an evidence is known	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Species is already established and reproducing in RA area	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Not such an evidence is known	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Species is sexually reproducing (Kottelat, M., Freyhof, J., 2007. Handbook of European freshwater fishes. Imprimeria du Democrate SA, Dlemont. https://doi.org/10.1643/OT-08-098a.1)	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such an evidnece is known	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Tousands of eggs are generated by a single individual per year	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Active dispersal, human mediated translocation	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	Species is found in Kolkheti National Park, Georgia. No other such PA is in RA area	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence is known. Species morphology and anataomy does not support such behavoir	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	Egges are pelagic and juveniles are sweeming freely (Breder, C.M. and D.E. Rosen, 1966. Modes of reproduction in fishes. T.F.H. Publications, Neptune City, New Jersey. 941 p.)	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Due to active swiming capabilities of juveniles	High

40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No such an evidence is known	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence are known	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Speices are producing large number of pelagic eggs and juveniles re swiming with large collonies	High
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence; Professional judgement	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such an evidence is known	Low
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Oxygen level, salinity, turbidity; Bekova, R., Prodanov, B, & Lambev, T (2019). Mullets and the impact of the environmental status of Burgas Bay on their populations. In International Scientific Conference "Kliment's Days (Vol. 104, pp. 62-69).	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No documented evidence; Professional judgement	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No such an evidence is knwon.	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	Species is using variable salinity environment in its natural habitats.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	In spite of a number of predators in RA area, no any of them are shown to be effective	Low
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	based on professional judgement	Low

Statistics	
Scores	
BRA	**14.0**
BRA Outcome	**-**
BRA+CCA	**20.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**6.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**8.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*2.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*1.0*
8. Tolerance attributes	*0.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*

8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**7**
Environmental	**4**
Species or population nuisance traits	**11**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.55**
BRA	**0.58**
CCA	**0.25**

Date and Time
04/05/2022 13:30:23

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Chelon saliens*
Common name	leaping mullet
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	The fish has a trade importance.
Risk assessment area	South Caucasus
Taxonomy	Chelon saliens (Risso, 1810)
Native range	Eastern Atlantic: Mediterranean Sea, the Black Sea, Sea of Azov and Atlantic coasts from Morocco
Introduced range	Introduced to Iran and is now naturally occurring in the Caspian Sea basin.
URL	https://www.fishbase.se/summary/Chelon-saliens

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Grey mullets are are important food fishes. The euryhalinity, eurythermality and their simpler diet, as well as the rapid growth of some species, have made them the object of aquaculture in many parts of the world, including the Mediterranean (Oren, 1981)	Medium
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Data deficient	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	Data deficient	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	This species is naturally distributed in the SC region.	Very high
5	2.02	What is the quality of the climate matching data?	High	This species is naturally distributed in the SC region (Ninua et al. 2013; Kuljanishvili et al. 2020).	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is naturally distributed in the SC region (Ninua et al. 2013; Kuljanishvili et al. 2020).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	This species is naturally distributed in the SC region, also it has been translocated in the Caspian Sea intentionally for aquacultural purposes.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is naturally distributed in the Caucasus region. C. saliens is also distributed in Turkey and introduced in Iran.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	C. saliens has been introduced into Israel, Iran, Azerbaijan, Kazakhstan, and Turkmenistan, where it has established populations. Now this fish naturally occurring in the Caspian Sea	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	C. saliens has been introduced into Israel, Iran, Azerbaijan, Kazakhstan, and Turkmenistan, where it has established populations. The introduction to Israel was for aquaculture. No negative impacts have been reported from these introductions.	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	C. saliens has been introduced into Israel, Iran, Azerbaijan, Kazakhstan, and Turkmenistan, where it has established populations. The introduction to Israel was for aquaculture. No negative impacts have been reported from these introductions.	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	No	C. saliens has been introduced into Israel, Iran, Azerbaijan, Kazakhstan, and Turkmenistan, where it has established populations. The introduction to Israel was for aquaculture. No negative impacts have been reported from these introductions.	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	C. saliens has been introduced into Israel, Iran, Azerbaijan, Kazakhstan, and Turkmenistan, where it has established populations. The introduction to Israel was for aquaculture. No negative impacts have been reported from these introductions.	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	No such fact has been detected.	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are several threathened and protected species in the SC region which may be affected by C. saliens (competition, eggs consumption, etc).	Medium
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species is naturally distributed in the Caucasus region and climatic conditions are acceptable for it.	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	This species is naturally distributed in the Caucasus region and such a case is not expected.	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	This species is naturally distributed in the Caucasus region and such a case is not expected.	Very high
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficient	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	Such a case is not expected.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length of C. saliens is 40.0 cm SL male/unsexed; common length: 30 cm, therefore this fish is good object for aquaculture.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Adults usually in schools inhabit coastal waters, sometimes in lagoons and estuaries.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No such fact has been described.	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Not applicable	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No such fact has been described.	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	The adults feed on worms, on snails, on crustaceans. The fray feed on detritus and on plankton (Ninua et al. 2013).	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	Data deficient	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species is naturally reproduces in the SC region.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No such fact has been described.	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	Tancioni et al. (2015) affirmed that the prevalence of natural hermaphroditism in mullets is non-existent or very low, some cases were previously reported for M. cephalus (Franks et al. 1998) and L. ramada (Bayhan & Acarli 2006). Thus, it is also possible that there is a general lack of information on this specific topic for migratory fish such as mullets, conversely to other more studied species (Bahamonde et al. 2013).	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	This species does not have such requirements.	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Fecundity of C. saliens is 500 000 to 2 100 000 eggs (Ninua et al. 2013).	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	It becomes sexually mature at the age of 3 (Ninua et al. 2013).	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	This fish is distributed in the region naturally and possibly by humans.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	C. saliens are found in protected areas of the SC region, such as Lake Paliastomi, in Kolkheti National Park, Georgia.	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This fish does not have such means.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	This species is naturally reproduces in the SC region (Ninua et al. 2013; Kuljanishvili et al. 2020).	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This species is naturally reproduces in the SC region (Ninua et al. 2013; Kuljanishvili et al. 2020).	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This species is naturally reproduces in the SC region (Ninua et al. 2013; Kuljanishvili et al. 2020).	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	There is no evidence of this, though it is possible.	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Own judgement	Medium
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been revealed.	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Data deficient	Low

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Own judgement	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species has expanded its range with the help of humans.	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	C. saliens is shoal sea fish, it's easily adapted to fresh and brackish waters (Ninua et al. 2013).	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several potential predators in the SC region which can controll the C. saliens populations: Esox lucius, Silurus glanis, Sander lucioperca, Salmo labrax, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	Medium

Statistics	
Scores	
BRA	**23.0**
BRA Outcome	**-**
BRA+CCA	**17.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**6.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**17.0**
4. Undesirable (or persistence) traits	*3.0*
5. Resource exploitation	*2.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*6.0*
8. Tolerance attributes	*3.0*
C. Climate change	**-6.0**
9. Climate change	*-6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**5**
Environmental	**-3**
Species or population nuisance traits	**20**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.73**
BRA	**0.76**
CCA	**0.50**

Date and Time

03/05/2022 14:17:07

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Chelon saliens*
Common name	leaping mullet
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Chelon auratus and C. saliens are native to the Black Sea basin, and both species were
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Mugiliformes (Mullets) > Mugilidae (Mullets)
Native range	The Black Sea basin
Introduced range	The Caspian Sea basin
URL	https://fishbase.mnhn.fr/summary/Chelon-saliens.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	This taxon has not been subject of substantial human selection, however it has comercial value and is being fisheries important.	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes, it is harvested in the wild and is likely to be sold in its live form.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Chelon labrosus (Yankova 2016)	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Somehow similar	Medium
5	2.02	What is the quality of the climate matching data?	Low	There are no climatic stations in climatch to make this analysis. However, according to Koppen-Geiger map the climate is somehow similar.	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Yes it is distributed alover Caspian Sea basin	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquaculture	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Are distributed over the entire Caspian sea basin (Bogutskaya et al. 2013; Yusifov et al. 2017). are also found in the brackish and fresh waters of the Caspian Sea coast (Kuljannishvili et al 2021)	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Species formed self-sustaining populations (Ibrahimov and Mustafayev 2015)	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No adverse impacts to the wild commercial taxa are known.	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No adverse impacts to aquaculture are known.	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No adverse impacts to ecosystem are known. Possible can be transmitting parasites or deseases	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No adverse socio-economic impacts are known	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous. https://fishbase.mnhn.fr/summary/Chelon-saliens.html	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	It is not known	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite https://fishbase.mnhn.fr/summary/Chelon-saliens.html	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species can tolerate wide range of salinities (Hotos &Vlahos 1998)	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	The impact of C. saliens in Azerbaijan has not been documented	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No adverse impacts on ecosystem services in the RA area is known.	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No information avalablle	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is possible.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	This taxon is usually reared and then released in open waters (Maricultures)	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Yes. this specie is marine, which sometimes enters freshwaters	High

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No. Not documented	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Less likely. since the first attempt of introducing this species in caspian sea basin failed.	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Adults are herbivorous feeding on algae and vegetal detritus while juveniles feed on zooplankton and then on bentic	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	Less likely	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No. Not documented	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Yes. It has been considered as established species since 1930ies	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No. Not documented	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No https://fishbase.mnhn.fr/summary/Chelon-saliens.html	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. this taxon is not dependent on the presence of another taxon to complete its life cycle	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	They mature at the age of 2 or 3 yo.	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	males 2 yo. females 3 y.o	Medium
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture; recreational Fisheries;	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	None of these.	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphological traits of this species does not allow it to attach on surgaces https://fishbase.mnhn.fr/summary/Chelon-saliens.html	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. It is not the way of the dispersal for this species	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	It is possible.Juveniles can themselfes disperse.	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No. Does not migrate	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. this is unlikely.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Commercial aquaculture seems to be rapid in this area	High
43	7.09	Is dispersal of the taxon density dependent?	No	No. No data.	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not known. Not likely.	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	It can tolerate wide range of temperatures and salinities	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	Can not be eradicated. and it will not be, because it has fisheries value	Very high
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No. Not documented.	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Tolerates salinities lower than 116 ppt	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	no effective natural enemies exist in RA area	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Medium

51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Since this species are very much tolerant to wide range of temperatures their establishment will not decrease, it will stay the same	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	No change	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	No change	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	No change	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No change	Medium

Statistics	
Scores	
BRA	**13.0**
BRA Outcome	**-**
BRA+CCA	**15.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**7.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**6.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*0.0*
6. Reproduction	*0.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*3.0*
C. Climate change	**2.0**
9. Climate change	*2.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**6**
Environmental	**0**
Species or population nuisance traits	**12**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.69**
BRA	**0.71**
CCA	**0.50**

Date and Time
20/05/2022 16:14:54

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Clarias gariepinus*
Common name	North African catfish
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	Species is absent from the RA Area howver can be found in neighbour country and is also a subject
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Siluriformes (Catfishes) > Clariidae (Airbreathing catfishes)
Native range	Africa, part of Asia Minor
Introduced range	Part of Europe, Asia and south America
URL	https://www.fishbase.de/summary/Clarias-gariepinus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Romanova, E. M., Lyubomirova, V. N., Romanov, V. V., Mukhitova, M. E., Shlenkina, T. M., Shadyeva, L. A., & Galushko, I. S. (2018). Biology of reproduction of catfish (CLARIAS GARIEPINUS, BURCHELL, 1822) in high-tech industrial aquaculture. Journal of fundamental and applied sciences, 10(5S), 1116-1129.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Okonkwo, C. O., Onyenweaku, E., & Uwujibha, J. O. Comparative Assessment of Nutrient Composition of Aquacultured and Wild Catfish (Clarias gariepinus) in Cross Rivers State Nigeria.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congeners	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	Results of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	CABI, 2021. Clarias gariepinus (North African catfish). https://www.cabi.org/isc/datasheet/88683 (accessed October	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquacultural and recreatinal purpose. It can also reach the South Caucasus naturally via transboundary rivers	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	It is known from neighbour country (Turkey) and can easily be imported in Georgia	Medium
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	CABI, 2021. Clarias gariepinus (North African catfish). https://www.cabi.org/isc/datasheet/88683 (accessed October	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Radhakrishnan, K. V., Lan, Z. J., Zhao, J., Qing, N., & Huang, X. L. (2011). Invasion of the African sharp-tooth catfish Clarias gariepinus (Burchell, 1822) in South China. Biological Invasions, 13(8), 1723-1727; Weyl, O. L. F., Daga, V. S., Ellender, B. R., & Vitule, J. R. S. (2016). A review of Clarias gariepinus invasions in Brazil and South Africa. Journal of fish biology, 89(1), 386-402.	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evidence	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	Radhakrishnan, K. V., Lan, Z. J., Zhao, J., Qing, N., & Huang, X. L. (2011). Invasion of the African sharp-tooth catfish Clarias gariepinus (Burchell, 1822) in South China. Biological Invasions, 13(8), 1723-1727. though Not well documented	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not well documented	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	Medium
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Not well documented though	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	Since the catfish are predator, it can consume a variety of freshwater fish and inverterbates in the RA area	Medium
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	CABI, 2021. Clarias gariepinus (North African catfish). https://www.cabi.org/isc/datasheet/88683 (accessed October 2021)	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	Expected, professional judgement	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Possible through reducing the economically important fish diversity and also through affecting the ecosystem structure (e.g. Radhakrishnan, K. V., Lan, Z. J., Zhao, J., Qing, N., & Huang, X. L. (2011). Invasion of the African sharp-tooth catfish Clarias gariepinus (Burchell, 1822) in South China. Biological Invasions, 13(8), 1723-1727.)	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Not expected based on professional judgement	Medium

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	e.g Akinsanya, B., & Otubanjo, O. A. (2006). Helminth Parasites of Clarias gariepinus (Clariidae) in Lekki Lagoon, Lagos, Nigeria. Revista de biología tropical, 54(1), 93-99; Oniye, S. J., Adebote, D. A., & Ayanda, O. I. (2004). Helminth parasites of Clarias gariepinus (Teugels) in Zaria, Nigeria. Journal of Aquatic Sciences,	Very high
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	https://www.fishbase.de/summary/Clarias-gariepinus.html	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	https://www.fishbase.de/summary/Clarias-gariepinus.html	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Expected but not well documented	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Not such an information	Low
	5. Resource exploitation				
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Polyphagous predator - https://www.fishbase.de/summary/Clarias-gariepinus.html	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	This includes native cat fish, however no RIP value have been calculated.	Low
	6. Reproduction				
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Haylor, G. S. (1989). The case for the African catfish, Clarias gariepinus Burchell, 1822, Clariidae: a comparison of the relative merits of Tilapiine fishes, especially Oreochromis niloticus (L.) and C. gariepinus Burchell, for African aquaculture. Aquaculture Research, 20(3), 279-285.	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Not cultured or released in the RA area untill yet	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Maneechot, N., Yano, C. F., Bertollo, L. A. C., Getlekha, N., Molina, W. F., Ditcharoen, S., ... & de Bello Cioffi, M. (2016). Genomic organization of repetitive DNAs highlights chromosomal evolution in the genus Clarias (Clariidae, Siluriformes). Molecular cytogenetics, 9(1), 1-10.	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No such an evidence. Species is sexual	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Not such an evidence is known. Species is polyphagous and no other particular species is needed for any stage of life cycle	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Haylor, G. S. (1989). The case for the African catfish, Clarias gariepinus Burchell, 1822, Clariidae: a comparison of the relative merits of Tilapiine fishes, especially Oreochromis niloticus (L.) and C. gariepinus Burchell, for African aquaculture. Aquaculture Research, 20(3), 279-285.	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Legendre, M., Teugels, G. G., Cauty, C., & Jalabert, B. (1992). A comparative study on morphology, growth rate and reproduction of Clarias gariepinus (Burchell, 1822), Heterobranchus longifilis Valenciennes, 1840, and their reciprocal hybrids (Pisces, Clariidae). Journal of Fish Biology, 40(1), 59-79; YALÇIN, Ş. Ö., Solak, K., & Akyurt, İ. (2001). Certain reproductive characteristics of the catfish (Clarias gariepinus Burchell, 1822) living in the River Asi, Turkey. Turkish Journal of Zoology, 25(4), 453-460.	High
	7. Dispersal mechanisms				
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Species is introduced intentionally for a aquacultural purpose as well as it can also spread by its own. Not a documented evidence for the RA area	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Professional judgement, not a documented evidnece	Low
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evdidence exists	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such an evidence exists	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Juveniles are active sweemers	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not such an evidence is known	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence is knwon	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Professional judgement, not a documented evidnece	Low
43	7.09	Is dispersal of the taxon density dependent?	No	No such case is known	Low
	8. Tolerance attributes				

44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	Yes	https://www.fishbase.de/summary/Clarias-gariepinus.html	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Oxygen, temperature, turbidity	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	Not known such cases	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Not such an evidence is known	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Britz, P. J., & Hecht, T. (1989). Effects of salinity on growth and survival of African sharptooth catfish (Clarias gariepinus) larvae. Journal of applied ichthyology, 5(4), 194-202.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies from the RA area is known	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	No enough information, professional judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	No enough information, professional judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	No enough information, professional judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	No enough information, professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	No enough information, professional judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	No enough information, professional judgement	Low

Statistics	
Scores	
BRA	**38.0**
BRA Outcome	**-**
BRA+CCA	**48.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**15.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*10.0*
B. Biology/Ecology	**23.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*7.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*5.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**12**
Environmental	**17**
Species or population nuisance traits	**23**

Thresholds	
BRA	**-**

BRA+CCA	-
Confidence	
BRA+CCA	0.60
BRA	0.62
CCA	0.38

Date and Time
04/05/2022 13:46:56

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Clarias gariepinus*
Common name	North African catfish
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	The African sharptooth catfish was introduced all over the world in the early 1980s for aquaculture
Risk assessment area	South Caucasus
Taxonomy	Clarias gariepinus (Burchell, 1822)
Native range	Africa: almost Pan-Africa, absent from Maghreb, the Upper and (most of the) Lower Guinea and the
Introduced range	Widely introduced to other parts of Africa, Europe and Asia.
URL	https://www.fishbase.se/summary/1934

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	C. garepinus was introduced all over the world in the early 1980s for aquaculture purposes.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	The price of catfish fingerlings remains high (USD 0.15-0.25 each in Cameroon) and most farmers prefer to collect wild seed when available.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	C. gariepinus has all the qualities of an aggressive and successful invasive species. Its high fecundity, flexible phenotype, rapid growth, wide habitat preferences, tolerance to extreme water conditions and the ability to subsist on a wide variety of prey can devastate indigenous fish and aquatic invertebrate populations	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	World Map of the Köppen-Geiger climate classification	Medium
5	2.02	What is the quality of the climate matching data?	Low	World Map of the Köppen-Geiger climate classification	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	Currently this species does not occurring in the SC region.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species can enter in the region only for aquacultural purposes.	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is distributed in the southern part of Turkey (Turan, 2016).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	This review of introductions, establishment, spread and impact of C. gariepinus in Brazil and outside of its native range in South Africa provides evidence that the species has been able to overcome all barriers to invasion in both countries (Weyl et al.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Clarias gariepinus has all the qualities of an aggressive and successful invasive species. Its high fecundity, flexible phenotype, rapid growth, wide habitat preferences, tolerance to extreme water conditions and the ability to subsist on a wide variety of prey can devastate indigenous fish and aquatic invertebrate populations (Bruton, 1986). It is because of these characteristics that countries such as India have imposed a ban on the introduction and culture of C. gariepinus (Dhawan and Kaur, 2001). Nevertheless, the effects of the illegal and indiscriminate introduction of this fish into India, as in other countries, have brought about potential ecological problems such as the loss of	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	C. gariepinus is one of the most suitable species for aquaculture in the world. (Hecht et al., 1995). It is a fast-growing species and probably has adverse impacts on aquaculture.	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	The most decisive economic parameter is the low selling price of C. gariepinus (2.20 EUR/kg whole fish), which affects the returns by ±70,463 EUR/year for every ten percent (0.22 EUR) price change. Among the variable costs, feed has by far the largest impact with a share of 61.4% (42.1% of total costs) (Pasch and	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Data deficient	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This fish does not pose a threat to humans	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Clarias gariepinus has all the qualities of an aggressive and successful invasive species. Its high fecundity, flexible phenotype, rapid growth, wide habitat preferences, tolerance to extreme water conditions and the ability to subsist on a wide variety of prey can devastate indigenous fish and aquatic invertebrate	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are several protected and threathened species in the SC region who may have been harmed by these fish: Acipenser spp, Salmo spp, Luciobarbus capito, etc.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	The probability of this is high	High

18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	The probability of this is high	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	The probability of this is high	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	There is a possibility of that	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	There is a possibility of that	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length is 170 cm TL male/unsexed; common length : 90.0 cm NG male/unsexed; max. published weight: 60.0 kg. This species is actively used in aquaculture.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Adults occur mainly in quiet waters, lakes and pools and prefer rather shallow and swampy areas with a soft muddy substrate and calmer water. They may also occur in fast flowing rivers and in	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Data deficient	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	The probability of this is high because C. garepinus is a predator fish.	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	The probability of this is high because C. garepinus is a predator fish.	Very high
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	The male guards the nest from predators, such as the clown loach (Chromobotia macracanthus) and yoyo loach (Botia lohachata), immediately following spawning. The female will return once the eggs have hatched and the male and female take part in protecting the fry until they are independent. The parental investment only extends to 24 hours following the hatching. By the third day, the fry are capable of swimming strongly and they	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	This species does not reproduces in the SC region	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Genetic introgression of native wild clariid catfish by escapees of hybrid catfish (C. gariepinus x C. macrocephalus) from fish farms have been reported in Thailand (Senanan et al. 2004).	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	This is the first histological evidence of intersex in a fish species inhabiting a South African water source (C. garepinus) (Barnhoorn et al. 2004).	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such data has been known	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	A modal size female produces about 50,000 eggs, but large females may produce over 150,000 eggs (Bruton 1979).	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	Not applicable	Data deficient	Low
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species may be spread by humans for aquacultural purposes.	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	The probability of this is high	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such means has been detected	Medium
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	This species is not distributed in the SC region.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	This species is not distributed in the SC region.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species is not distributed in the SC region.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	This species is not distributed in the SC region.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Data deficient	Low
8. Tolerance attributes					

44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	Yes	Clarias gariepinus, possesses a pair of suprabranchial chambers located in the dorsal-posterior part of the branchial cavity having extensions from the upper parts of the second and fourth gill arches, forming the arborescent organs. This structure is an air-breathing organ (ABO) and allows aerial breathing (AB).	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	Yes	The nature and structure of the respiratory organs of fish have a significant consequence on its ability to tolerate poor water condition. The gill of C. gariepinus is equipped with an air-breathing organ known as suprabranchial organ (Vandewalle and Chardon, 1991, Ahmed et al., 2008) while those of P. hypophthalmus do not have this organ but possesses a vascularized swim bladder (Browman and Kramer, 1985, Okomoda et al., 2017c). The efficiency of the air-breathing organ of the latter makes it more tolerant to anoxic water than the former	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Data deficient	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species has spread by humans in many regions of the world.	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Growth and survival of replicate batches of African catfish larvae were monitored in 0, 2.5, 5.0, 7.5 and 10 ppt salinity. No significant differences in mortality or growth rate were evident between 0 and 5 ppt salinity. It was concluded that 0–2.5 ppt is the optimal sclinity range for larval rearing and that short-term exposure to higher salinities (2.5–7.5 ppt) could be effective in the treatment of ectoparasitic diseases (Britz and Hecht 2007).	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several potential predators distributed in the SC region who can controll the C. garepinus populations: Esox lucius, Sander lucioperca, Silurus glanis, Salmo spp. etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Own judgement	Medium

Statistics	
Scores	
BRA	**45.0**
BRA Outcome	**-**
BRA+CCA	**55.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**22.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**23.0**
4. Undesirable (or persistence) traits	*10.0*
5. Resource exploitation	*7.0*
6. Reproduction	*5.0*
7. Dispersal mechanisms	*-4.0*
8. Tolerance attributes	*5.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*

7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**15**
Environmental	**17**
Species or population nuisance traits	**24**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.70**
BRA	**0.73**
CCA	**0.50**

Date and Time
03/05/2022 14:44:09

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Clarias gariepinus*
Common name	North African catfish
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Has been introduced as fisheries value fish in worldwide and has become invasive in many
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Siluriformes (Catfishes) > Clariidae
Native range	Africa: almost Pan-Africa, absent from Maghreb, the Upper and (most of the) Lower Guinea and the
Introduced range	Widely introduced to other parts of Africa, Europe and Asia
URL	https://www.fishbase.se/summary/1934

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Widely used for aquaculture	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes. has a comertial value and is being sold in its live form	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Clarias batrachus for example	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	out of 18 stations 8 are similar (at the threshold of 9 and 8) similar spots are alongside the kura river drainage and in abkhazian region	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Quality of climate matching data is medium	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No. not present.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture, recriational fisheries	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species occurs in Turkey and is considered invasive (Tarkan et al 2014)	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes. There are several countries where it has become invasive see: https://www.cabi.org/isc/datasheet/88683	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	The high level of niche overlap (92%) and strong competition for similar resources was exhibited by C. gariepinus. The adverse effects of African catfish on all fish and crustaceans in the reservoir were revealed by mixed trophic impact.'' (Khan et al	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No. no data	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	transmission of deseases	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No. no data	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous https://fishbase.mnhn.fr/summary/Clarias-gariepinus.html	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	It is possible	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	No. does not parasite.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	it can tolerate to wide range of environmental conditions however it can not tolerate cold waters	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	the ability to subsist on a wide variety of prey can devastate indigenous fish and aquatic invertebrate populations (Bruton, 1986). https://www.cabi.org/isc/datasheet/88683	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No info	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	It is likely	Very high
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	No info	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	It is likely. even though not documented I can assume it can be a host or vector for pests and infectious agents, that could be endemic in RA	High

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	very versatile to havitate use: they prefer quite waters but can occur in rapid rivers as well. ''Can leave the water at night using its strong pectoral fins and spines in search of land-based food or can move into the breeding areas through very shallow pathways ''https://www.fishbase.se/summary/1934	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	NO info	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Yes, if the conditions are good.	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	it is lilkely, however, no info	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	it is likely but has not been evaluated	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	yes https://fishbase.mnhn.fr/summary/Clarias-gariepinus.html	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	To survive, the average temp. of coolest month should be > 18°C. The region experiences quite cold winters, due to this reason it is less likely that it could produce viable propagules	Medium
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	It is but in the region there are no native clarias species.	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. it is not dependent on the presence of another taxon.	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	they spawn several times during the year	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	less than 1 years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Aquaculture	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	it is likely	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. does not have morphological caracters that will allow it to attach	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. Only juvenile.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	it is possible but less likely	Low
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	they might	Medium
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	no. I strongly believe that this is not the way their eggs can be distributed. And it was alos never documented.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	it has not been introduced yet	Low
43	7.09	Is dispersal of the taxon density dependent?	Yes	it is possible	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	Yes	Yes. it can be out of water for long periods thanks to its ability to breath from air	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	quite tolerant to wide water conditions and low oxigen concentrations	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Yes, however it is very costy and sometimes innefective	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	It is possible	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No. can not tolerate salinity fluctuations https://fishbase.mnhn.fr/summary/Clarias-gariepinus.html	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No. There are not.	Very high

C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Introduction risks increase	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	If temperatures will rise, it increases their establishment	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	more favorable habitats will be avalable for this species as well as recources	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Higher	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	No change	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No change	Low

Statistics	
Scores	
BRA	**38.0**
BRA Outcome	**-**
BRA+CCA	**46.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**15.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*10.0*
B. Biology/Ecology	**23.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*7.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*1.0*
8. Tolerance attributes	*4.0*
C. Climate change	**8.0**
9. Climate change	*8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**8**
Environmental	**13**
Species or population nuisance traits	**27**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.68**
BRA	**0.68**
CCA	**0.67**

Date and Time
20/05/2022 16:27:15

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Coregonus albula*
Common name	vendace
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species was subject of repeated introduction and had an important economic values
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids)
Native range	North-west Eurasia
Introduced range	NUmber of European Countries
URL	https://www.fishbase.de/summary/Coregonus-albula.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Japoshvili, B. (2012). Long-term assessment of a vendace (Coregonus albula L.) stock in Lake Paravani, South Georgia. Advances in Limnology, 63, 363-369.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Frys are imported for introduction purpose	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	There are other congeners also introduced in many areas	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	Climatch algorithm shows a low similarity to its native range	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to absence of extensive climate data for the RA	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	High
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Only human mediated dispersal is possible for the RA area	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	It is already in RA area	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	https://www.cabi.org/isc/datasheet/88207#toriskOfIntroduction	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No such an evidence	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No such an evidence	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No such an evidence	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No such an evidence	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	The species is not harmful	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	The species is zooplanktivorous and can have strong effect on plankton taxa Bøhn T; Amundsen PA, 1998. Effects of invading vendace (Coregonus albula L.) on species composition and body size in two zooplankton communities of the Pasvik River System, northern Norway. Journal of Plankton Research, 20(2):243-256.	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Vendace is not a parasite	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	No such an evidence. Usually requires very similar conditions to its native habitats	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	By affecting the local community Bøhn T; Amundsen PA, 1998. Effects of invading vendace (Coregonus albula L.) on species composition and body size in two zooplankton communities of the Pasvik River System, northern Norway. Journal of Plankton Research, 20(2):243-256. Amundsen PA; Siwertsson A; Primicerio R; Bøhn T, 2009. Long-term responses of zooplankton to invasion by a planktivorous fish in a subarctic watercourse. Freshwater Biology, 54(1):24-34. http://www.blackwell-synergy.com/loi/fwb	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No such an evidence	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such endemic pest or infectious agents are known for the RA area	Medium

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Although not yet such fact have been detected, species can bring pest or infectious agent absent in in RA area but common in vendace's native area	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	It is only kept in natural water bodies	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	The species is anadromous though no exact data is available on its ability to adapt different velocity levels	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Through the reduction of available food	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No such an evidence	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	THe fish is plancton feeder and no threatend plancton species are known from RA area	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Not the RIP values have been calculated, however, venadace is in dorect competition for food with native salmon and other cyprinids	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No such an evidence exists	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Kuljanishvili, T., Mumladze, L., Kalous, L., & Japoshvili, B. (2018). Fish species composition, sex ratio and growth parameters in Saghamo Lake (Southern Georgia). Biologia, 73(1), 93-100.	Medium
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No such an evidence	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No such an evidence exists	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Vendace does not require any other species for completion of life cycle	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Species is usually producing large amount of eggs after reaching the adult size (CABI, 2022. Coregounus albula. In: Invasive Species Compendium. Wallingford, UK: CAB International.	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Only human dependant translocation	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Yes, the species is released within the Javakheti protected areas	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such an evidence	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No such evidence exists for vendace	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No such evidence exists	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence is known	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Usually a large number of frys are released Japoshvili, B. (2012). Long-term assessment of a vendace (Coregonus albula L.) stock in Lake Paravani, South Georgia. Advances in Limnology, 63, 363-369.	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No such an evidence exists	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such ana evidence exists	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No such an evidence exists	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such an evidence exists	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Not expected based on professonal experience	High

48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No such an evidence	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies have been observed in RA area	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgment	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	Increase of temperature most probably decrease the risk of establishment	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Increase of temperature most probably decrease the risk of dispersal	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	Based on personal guess	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Based on personal guess	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Based on personal guess	Low

Statistics	
Scores	
BRA	**9.0**
BRA Outcome	**-**
BRA+CCA	**-1.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**7.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**2.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*2.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**-10.0**
9. Climate change	*-10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**3**
Environmental	**-1**
Species or population nuisance traits	**0**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.66**
BRA	**0.70**
CCA	**0.33**

Date and Time
14/05/2022 12:41:46

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Coregonus albula*
Common name	vendace
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	The species has a trade importance. It is included in Appendix III of the Bern Convention
Risk assessment area	South Caucasus
Taxonomy	Coregonus albula (Linnaeus 1758)
Native range	Europe: Baltic basin, lakes of upper Volga drainage (Seliger, Vseluga, Perejaslavskoe), some lakes
Introduced range	This fish frequently stocked in lakes and reservoirs in Germany and Poland. It has been introduced
URL	https://www.fishbase.in/summary/Coregonus-albula.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	This fish has a trade importance and frequently stocked in lakes and reservoirs in Germany and in Poland (Ninua et al. 2013).	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	The local populations of Coregonus lavaretus are commercially valuable in Georgia though the abundance is decreasing due to the unavailability of local hatcheries (Kuljanishvili et al. 2020).	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	In the Pasvik River System, northern Norway invasion and establishment of a dense vendace population in the upper locality had increased the predation pressure in the pelagic, resulting in a reduction of body size and a shift towards smaller species in the zooplankton community (Bohn & Amundsen 1998).	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Answer is based on Köppen–Geiger climate map.	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Answer is based on Köppen–Geiger climate map.	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species has been introduced in Georgia since 1930, in the Lakes Tabatskuri and Paravani. Two species were introduced to Lake Sevan in the 1920s: Coregonus ludoga from Lake Ladoga and Coregonus maraenoides from Lake Chudskoe (both in Northern European Russia). These two species naturalised and hybridised in the lake and an intermediate phenotype was subsequently described as a Coregonus lavaretus sevanicus by Dadikyan (1986) (Mailyan, 1957; Ninua et al. 2013; Kuljanishvili	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species intentionally spread within the south Caucasus region for aquacultural purposes (Kuljanishvili et al. 2020)	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Coregenus albula was first seen in the shared Aktas/Kartsakhi lake between Turkey and Georgia as an alien species (Yerli 2019)	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	This species has been established in many parts of the world, also in the SC region (Japoshvili et al. 2012; Ninua et al. 2013; Kuljanishvili et al. 2020).	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	In the Pasvik River System, northern Norway invasion and establishment of a dense vendace population in the upper locality had increased the predation pressure in the pelagic, resulting in a reduction of body size and a shift towards smaller species in the zooplankton community (Bohn & Amundsen 1998).	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Such data is not available	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Such data is not available	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Such data is not available	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	In the Pasvik River System, northern Norway invasion and establishment of a dense vendace population in the upper locality had increased the predation pressure in the pelagic, resulting in a reduction of body size and a shift towards smaller species in the zooplankton community (Bohn & Amundsen 1998).	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	C. albula is a predator fish and can eat protected or threatend native species in the Caucasus region such as Salmo caspius, Salmo ischchan, Cyprinus carpio etc.	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species is occurring in the South Caucasus region since 1920s and it seems that climatic and environmental conditions of the region is suitable for it.	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	On the example of Norway (Bohn & Amundsen 1998) we can assume that if its population increases this will lead to significant changes in the food web structure.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Own judgement	Medium

20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Such data is not available	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	Such data is not available	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length of C. albula is 48.0 cm, max. published weight: 1.0 kg (Muus and Dahlström 1968), therefore this species can released in nature from captivity.	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	C. albula is a lacustrine and marine species. At sea, forages close to coast (Kottelat and Freyhof 2007).	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Such data is not available	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	A recovery of C. albula from overfishing is possible because the biological features of this fish make it a highly resilient species (Sarvala et al. 2020).	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	C. albula is a predator fish and can eat protected or threatend native species in the Caucasus region such as Salmo caspius, Salmo ischchan, Cyprinus carpio etc.	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No such fact has been observed	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	Such data is not available	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species reproduces naturally in the South Caucasus region (Kuljanishvili et al. 2020).	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Hybridization between native Coregonus lavaretus and introduced C. albula were detected in Finland (Kahilainen et al. 2011).	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	The investigation of gonad development in the early life history stages of the whitefish Coregonus lavaretus baeri (Kessler) under experimental conditions revealed the phenomenon of mass hermaphroditism as response to high temperature influence (Bogdanova, 2004).	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such fact has been described	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	No such fact has been described	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	The species become sexually mature at the age of 3-4 (Ninua et al. 2013).	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species can disperse within the SC region intentionally by humans for aquacultural purposes.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	This species was found in the Aktaş/Kartsakhi Lake which is located on the border of Georgia-Turkey and Georgian side of the lake is part of the Javakheti Protected Areas.	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species has not such means	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such fact has been detected in the Caucasus region	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No such fact has been detected in the Caucasus region	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species has landlocked populations within the South Caucasus region and occuring in the several lakes such as: Paravani, Tabatskuri, Sevan and Kartsakhi. Therefore it is not	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has been detected	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Such data is not available.	Low
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Such data is not available.	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been detected.	High

45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	No	Low pH (pH 4.75 and 5.00) associated with 1.0-l.1 mg 1-1 Mn and 0.1 mg I -~ Fe did not reduce lmtching success and survival during the embryonic and early larval development in Coregonus albula population when the A1 concentration was low (0.1-0.2 mg 1 -~). However, when the A1 content was increased to 2.4 and 2.1 mg l -I at pH 4.75 and 5.00, respectively, mortality prior to hatch was high, no (pH 4.75) or very few embryos (pH 5.00) hatched, and no fish survived to the end of the experiment (DUIS	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Not applicable	Such data is not available	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Such data is not available	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	C. albula and C. lavaretus are species which, as adults, migrate into brackish water with salinities of 10 to 18 ”/oo or higher (Nellen, 1965)	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	In the Caucasus region there are distributed several species which should be considered as potential predators for C. albula. These species are S. ischchan, S. labrax, S. caspius, etc. according to Kuljanishvili et al. (2020)	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	C. albula has limited distribution range in the Caucasus region and future climatic conditions will lead to a deterioration of its living environment which represents the alpine lakes in the region. Water temperatures are expected to rise in these lakes, which will lead to a deterioration in the living conditions for these fish.	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	C. albula has limited distribution range in the Caucasus region and future climatic conditions will lead to a deterioration of its living environment which represents the alpine lakes in the region. Water temperatures are expected to rise in these lakes, which will lead to a deterioration in the living conditions for these fish.	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	C. albula has limited distribution range in the Caucasus region and future climatic conditions will lead to a deterioration of its living environment which represents the alpine lakes in the region. Water temperatures are expected to rise in these lakes, which will lead to a deterioration in the living conditions for these fish.	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	Own judgement	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Own judgement	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	High

Statistics	
Scores	
BRA	**19.5**
BRA Outcome	**-**
BRA+CCA	**7.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**9.5**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*4.5*
B. Biology/Ecology	**10.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*5.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*-4.0*
8. Tolerance attributes	*-1.0*
C. Climate change	**-12.0**
9. Climate change	*-12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**5**

Environmental	3
Species or population nuisance traits	2

Thresholds	
BRA	-
BRA+CCA	-
Confidence	
BRA+CCA	0.68
BRA	0.67
CCA	0.75

Date and Time
03/05/2022 16:08:20

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Coregonus albula*
Common name	vendace
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	It was introduced from the Volkhov hatchery at Lake Ladoga (Russia) to southern Georgia, in Lakes
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids) >
Native range	the Baltic Sea basin, lakes of the upper Volga River drainage, and also in some lakes of the White
Introduced range	Lakes of Javakheti Upland
URL	https://www.fishbase.se/summary/Coregonus-albula.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Has been a subject for stocking. This species were reproduced and transported from Russia to Georgia. and in Georgia, this species has been bred and stocked regularly during past century (Japoshvili et al 2012; Kuljanishvili et al 2018).	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Since the species is the commercially valuable, it is being harvested from the wild, and it can also be sold in its live form, for commercial purposes.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	Congeners of C. alba are not known to be serious pests	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	it is similar in high altitude areas. But in lowlands it is not.	Medium
5	2.02	What is the quality of the climate matching data?	High	out of 10 stations, 5 stations in mountainos areas have matched	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	It occurs in the lake Saghamo at least confirmed by catch (Kuljanishvili et al 2018).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Only quaculture	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Young individuals of the fish are being found in Saghamo lake. Documented by Kuljanishvili et al 2018	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	In the beginning, of C. albula introduction, local hatcheries were involved in artificial reproduction of C. albula and release of young fry into the lake (Japoshvili 2012). However, as of 2005, these hatcheries ceased operation and it was expected that C. albula populations would become extinct over time. However, twelve years later young individuals were found in Saghamo Lake, which is connected to Paravani Lake by the Paravani River. This meant that they had become naturalized in the area, although the population density was extremely low (Kuljanishvili et al. 2018).	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	There no adverse impacts documented in Georgia. However, one might assume that it could be altering the native food web via selective praying on zooplanktonic organisms (Savini et al 2010).	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No adverse impacts on aquaculture is known in Georgia.	Very high
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No adverse impacts on ecosystem is known in Georgia. Possible can be transmitting parasites or deseases	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No adverse socio-economic impacts is known in Georgia.	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Is not poisonous or pose other risks to human health	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	Impact of introduced C. albula on native taxa can only be alteration of native food webs (Savini et al 2010).	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	No.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	Coregonids are Coldwater fishes and they require cold environment. they can not adapt variable climatic environments.	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	May alter the food webs by selective praying on zooplankton	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No. No data. less likely	Very high
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	No information avalable	Medium

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is possible.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	it is usually released in the wild sine small fry.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	This species is anadromous, marine, or can form landlocked populations as well (Kottelat & Freyhof 2007).	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No. less likely, no documentation.	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	It usually spawns for the first time at the age of 2-5 years old. in case of overfishing it might not be able to have viable population in low densities.	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Not a predator, eats plankton only.	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	It is quite unlikely.	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No.No info.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	The conditions for maturation are available in the RA area	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	There are no native coregonids in RA area.	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No does not display asexual reproduction.	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Not dependent on another taxon to complete its life cycle	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Not known	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	From 2 to 5 years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Aquaculture	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	Stocking is not allowed in protected areas	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. does not attach to any surface.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Less likely.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	less likely.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No. does not migrate.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. not possible.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	As far as we know, no.	High
43	7.09	Is dispersal of the taxon density dependent?	No	It is not known	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No.can not withstand being out of water for long	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	This species requires specific conditions and are not tolerant to wide range of water quality conditions	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No, it can not be.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No data	High

48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	I guess it can tolerate sainity levels since it can be anadromous, freshwater or marine fish.	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No. Not documented	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	In terms of increased temperatures this species will be having troubles to survive in the wild	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Increased temperatures will cause stress in their populations making their populations weaker, therefore it won't be available to disperse	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	The environment for them will be unbearable and this species populations will decrease, making the impact lower.	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	If there is any, in future it will be lower.	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	The magnitude of future potential impact is low.	High

Statistics	
Scores	
BRA	**5.0**
BRA Outcome	**-**
BRA+CCA	**-3.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**5.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**0.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*0.0*
6. Reproduction	*0.0*
7. Dispersal mechanisms	*-5.0*
8. Tolerance attributes	*1.0*
C. Climate change	**-8.0**
9. Climate change	*-8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**2**
Environmental	**-3**
Species or population nuisance traits	**-1**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.78**
BRA	**0.78**
CCA	**0.79**

Date and Time
20/05/2022 16:35:23

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Coregonus sp.*
Common name	-
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	This taxa was introduced in sevan with probably other congeners. It is still there having important
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids)
Native range	North Russia
Introduced range	South Caucasus
URL	

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Dadikyan MG. 1964. Towards the Results of Intriduction of Coregonids (Coregonus lavaretus maraenoides Poljakow, C. lavaretus ludoga Poljakow) in the Lake Sevan. Proc Acad Sci Armenian SSR (in Russian) 17: 41–48	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Personal observation - harvested and imported in RA area as well as harvested and sold Within RA area	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Other coregonus species	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	Climatch shows no high similarity	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to absence of extensive local climate data in RA area	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili, T., Mumladze, L., Kalous, L., & Japoshvili, B. (2018). Fish species composition, sex ratio and growth parameters in Saghamo Lake (Southern Georgia). Biologia, 73(1), 93-100.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	None	Human mediated translocation	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	It is already in RA area Kuljanishvili, T., Mumladze, L., Kalous, L., & Japoshvili, B. (2018). Fish species composition, sex ratio and growth parameters in Saghamo Lake (Southern Georgia). Biologia, 73(1), 93-100.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	The taxon is already in Sevan lake for a long. But due to repeated releasing frys in the lake it is not known if it creates viable population in the lake. On the other hand The species was also released intho the Georgian lakes once and the did not survived Elanidze R. 1983. Ichthyofauna of the rivers and lakes of Georgia, Metsniereba (in Russian) Tbilisi, p. 320.	Low
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No such an evidence exits	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evidence exits	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No documented evidence exits	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence exits	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Is not harmful species	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	No documented evidence exits	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Species is not parasite exits	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	No documented evidence exits	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	No documented evidence exits	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Not expected based on personal judgment	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No documented evidence exits	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	No documented evidence exits	Low

22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	It is usually released into the natiral waterbodies	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Not a migratory species and no evidence of such a capabilities	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No documented evidence exits	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No documented evidence exits	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Since the species is plancton feeder, there is no such taxa protected or threatened in RA area	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	It can reach to high density and consume most of the planktonic resource	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No such an evidence exits	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Expected but not a documented evidence exists	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No such evidence exists	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	The species is sexually reproducing	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Not depends to any other taxon to complete its life cycle	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Usually produceing lareg number of eggs once reaching adult size	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	Kottelat M, Freyhof J. 2007. Handbook of European Freshwater Fishes. Kottelat, Cornol and Freyhof. Berlin, p. 646.	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	It can be dispersed with an active transloation by a human	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Yes, the species is introudeced in Javakheti protected areas	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence exists	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No documented evidence exists	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	No documented evidence exits	Low
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not a migrant speices	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence exists	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Large amount of frys are usually released periodically	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence exits	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such an evidence exists	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No documented evidence exits	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such a practice exists	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Not expected based on professional judgment	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documented evidence exits	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No an effective enemies have been observed in the RA area	High

C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Not expected based on personal experience	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	Based on professional judgment	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgment	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	Based on professional judgment	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Based on professional judgment	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Based on professional judgment	Low

Statistics	
Scores	
BRA	**8.0**
BRA Outcome	**-**
BRA+CCA	**0.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**6.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**2.0**
4. Undesirable (or persistence) traits	*2.0*
5. Resource exploitation	*2.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**-8.0**
9. Climate change	*-8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**2**
Environmental	**-2**
Species or population nuisance traits	**2**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.63**
BRA	**0.65**
CCA	**0.46**

Date and Time
14/05/2022 12:51:24

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Coregonus sp.*
Common name	-
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	C. lavaretus is important fish for trade. It has been stocked in waters of Europe, where it isn't
Risk assessment area	South Caucasus
Taxonomy	Coregonus lavaretus (Linnaeus 1758)
Native range	Europe: Native to Lake Bourget (France) and Geneva (Switzerland, France). Population of Lake
Introduced range	Has been stocked into many other places in Europe outside its native range. Introduced to Iran,
URL	https://www.fishbase.se/summary/Coregonus-lavaretus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	This species has been stocked into many places in Europe outside its native range for aquacultural purposes.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	In recent years in Lake Sevan, Armenia, the declining of whitefish is caused by high value of fishing pressure.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Population biology changes in native dimorphic whitefish Coregonus lavaretus were studied over a decade in the subarctic Pasvik watercourse, where large biotic changes occurred due to an invasion by vendace C. albula. Although initially recorded in the upstream part of the watercourse, where it is now the dominant pelagic species, the vendace subsequently also colonised the downstream area (Bohn & Amundsen 2004).	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Koppen - Geiger climate classification	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Koppen - Geiger climate classification	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is distributed in the SC region since 1920ies (Ninua et al. 2013; Kuljanishvili et al. 2020).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species already inhabits the region. It was introduced by human for aquacultural purposes	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	C. lavaretus was introduced in Iran (Coad, 1998).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Naturalised populations of C. lavaretus is occuring in the lakes of Armenia and Georgia (Ninua et al. 2013; Kuljanishvili et al. 2020)	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No such fact has been revealed	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No such fact has been revealed	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No such fact has been revealed	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No such fact has been revealed	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	This fish is a predator but no such fact has been revealed in the Caucasus region	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	This fish is a predator but no such fact has been revealed in the Caucasus region	Low
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species has inhabites the region for about 100 years	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	Such a fact is not expected because the population is small	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	This species will not affect ecosystem service in the SC region	Very high
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Such data is not available	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	Such data is not available	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	This species is common subject for fishery and aquaculture. Max length: 73.0 cm; max. published weight: 10.0 kg	Very high

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	This species has lacustrine forms and anadromous estuarine forms, rarely in full saltwater.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No such fact has been detected	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Data deficient	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	This species is a predator and can consume threatened or protected species, for instance Salmo ischchan/gegarkuni	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	This fish is a predator and might be a competitor for local species	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	Data deficient	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species is naturally reproduces in the region (Rubenian, 1997).	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Hybridization in the genus Coregonus is a common occurrence. There are facts that resident C. lavaretus was hybridised with C. albula or C. peled, but the fact that the transported whitefish were hybridized to native species does not exist.	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	A single hermaphrodite specimen of Coregonus lavaretus was caught mid-January in Loch Lomond, Scotland (Scott 1975).	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such fact has been described	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Fecundity of C. lavaretus is up to 54 000 eggs (Ninua et al. 2013).	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	The males were sexually mature at the age of 1+, while most females were mature at the age of 2+. (Szczepkowski et al. 2010).	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species may spread in the region by artificially from hatchery	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	C. lavaretus is already inhabited in the Lake Tabatskuri, Georgia, which is protected area.	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Own judgement	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such fact has been detected	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No such fact has been detected	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No such behavior has been detected	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has been detected	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Own judgement	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	This species inhabit lakes, enter rivers, prefer sandy-stony cold water which is rich in oxygen (Ninua et al. 2013)	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	There is no need for this as this species is not considered harmful	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species was spread by humans in regions where it was not inhabited.	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	C. lavaretus has lacustrine and anadromous estuarine forms, rarely in full saltwater forms.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	Yes	There are several predators in the Caucasus region which can controll the C. lavaretus population: Salmo spp, Squalius spp,	High
C. Climate change					

9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Such risks are likely to be reduced as climate change adversely affects the alpine lakes (Sevan, Paravani, Tabatskuri, etc) in the region where the species currently inhabits.	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	Such risks are likely to be reduced as climate change adversely affects the alpine lakes (Sevan, Paravani, Tabatskuri, etc) in the region where the species currently inhabits.	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Such risks are likely to be reduced as climate change adversely affects the alpine lakes (Sevan, Paravani, Tabatskuri, etc) in the region where the species currently inhabits.	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	Own judgement	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Own judgement	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	High

Statistics	
Scores	
BRA	**18.0**
BRA Outcome	**-**
BRA+CCA	**6.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**7.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**11.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*7.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*-4.0*
8. Tolerance attributes	*1.0*
C. Climate change	**-12.0**
9. Climate change	*-12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**2**
Environmental	**2**
Species or population nuisance traits	**4**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.68**
BRA	**0.68**
CCA	**0.63**

Date and Time
03/05/2022 16:24:37

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Coregonus sp.*
Common name	-
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Following the recommendations of Prof. Derzhavin, commercially valuable species such as
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids) >
Native range	Russian Lakes
Introduced range	South Caucasian Lakes
URL	

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Following the recommendations of Prof. Derzhavin, commercially valuable species such as Coregonus sp. and C. ludoga from Ladoga Lake, and C. maraenoides from Chudskoe Lake were introduced to Sevan Lake in Armenia from 1924-1927, to support fish production (Barach, 1940; Dadikyan, 1964). During these three years, these coregonids were transported in the form of fertilized eggs from the Volkhov Hatchery in Russia, and already in 1927, fish farms around the lake could reproduce whitefishes and release them in the lake (Dadikyan, 1964). According to Elanidze (1983) in 1930, C. ludoga was introduced from the Volkhov hatchery at Ladoga Lake to Tabatskuri Lake in Georgia. For some reason, however, the species was not recorded for the	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Since the species is the commercially valuable, it is being harvested from the wild, and it can also be sold in its live form, for commercial purposes.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Not known	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	it is similar in high altitude areas. But in lowlands it is not.	Very high
5	2.02	What is the quality of the climate matching data?	High	out of 10 stations, 5 stations in mountainos areas have matched	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Occurs in Lake Sevan (Kuljanishvili et al 2020)	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquaculture	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Occurs in Lake Sevan (Kuljanishvili et al 2020)	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Following the recommendations of Prof. Derzhavin, commercially valuable species such as Coregonus sp. and C. ludoga from Ladoga Lake, and C. maraenoides from Chudskoe Lake were introduced to Sevan Lake in Armenia from 1924-1927, to support fish production (Barach, 1940; Dadikyan, 1964). During these three years, these coregonids were transported in the form of fertilized eggs from the Volkhov Hatchery in Russia, and already in 1927, fish farms around the lake could reproduce whitefishes and release them in the lake (Dadikyan, 1964). Later on these species were interbred (Mailyan, 1957) and a hybrid form arose as a new subspecies C. lavaretus sevanicus (Dadikyan, 1986).	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	Not known	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No advarse impact on aquaculture	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	NO adverse impacts on ecosystem services, however can be transmitting deseases and parasites	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No socio-economic impacts	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Harmless.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Impact of introduced witefish on native taxa can only be alteration of native food webs (Savini et al 2010).	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	No. does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	Coregonids are Coldwater fishes and they require cold environment. they can not adapt variable climatic environments.	Very high

18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	May alter the food webs by selective praying on zooplankton	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No information available	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No information available	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is possible.	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Iit is usually released in the wild since small fry.	Medium
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	This is a lacustrine species.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No. Not documented	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	It usually spawns for the first time at the age of 3-6 years old. in case of overfishing it might not be able to have viable population in low densities.	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Not a predator, eats plankton only.	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	It is unlikely	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No.No info.	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	The conditions for maturation are available in the RA area	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	There are no native coregonids in RA area.	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No does not display asexual reproduction.	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. it is not dependent on the presesence of another taxon to complet its life cycle.	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Not known	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	4	From 3-5 (Kottelat & Freyhof, 2007)	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Aquaculture	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	Stocking is not allowed in protected areas	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Can not attach to anything. does not have that morphological traits that will allow them to attach. Thanks	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. less likely.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No. no data.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No does not migrate	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No, it is not possible.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	As far as we know, no.	High
43	7.09	Is dispersal of the taxon density dependent?	No	No. Not likely	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No. It is not documented	High

45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	This species requires specific conditions and are not tolerant to wide range of water quality conditions	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No, it can not be.	Very high
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No, not documented	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No. Cann not tolerate.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No. there are not.	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	In terms of increased temperatures this species will be having troubles to survive in the wild	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Increased temperatures will cause stress in their populations making their populations weaker, therefore it won't be available to disperse	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	The environment for them will be unbearable and this species populations will decrease, making the impact lower.	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	If there is any, in future it will be lower.	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	the magnitude of future potential impact is low.	High

Statistics	
Scores	
BRA	**1.0**
BRA Outcome	**-**
BRA+CCA	**-7.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**6.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*1.0*
B. Biology/Ecology	**-5.0**
4. Undesirable (or persistence) traits	*3.0*
5. Resource exploitation	*0.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*-5.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**-8.0**
9. Climate change	*-8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**2**
Environmental	**-3**
Species or population nuisance traits	**-5**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.80**
BRA	**0.81**

CCA	0.75

Date and Time
20/05/2022 16:40:04

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Ctenopharyngodon idella*
Common name	grass carp
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	Continuous introduction into South Caucasus region. Not yet estableshed population form the RA
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Xenocyprididae (East Asian minnows)
Native range	China
Introduced range	Worldwide
URL	https://www.fishbase.de/summary/Ctenopharyngodon-idella.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Shireman JV; Smith CR, 1983. Synopsis of biological data on the grass carp, Ctenopharyngodon idella (Cuvier and Valenciennes, 1844). FAO Fisheries Synopsis, No. 135:iv + 86pp.; [distribution restricted.].	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Cudmore, B. M. N. E., & Mandrak, N. E. (2004). Biological synopsis of grass carp (Ctenopharyngodon idella). Canadian manuscript report of fisheries and Aquatic Sciences, 2705(7), 1-44.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No other taxa within the genus is known as invasive	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	Results of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	High
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Acuacultural purpose	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	No well presented distribution of established populations	Low
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Shireman JV; Smith CR, 1983. Synopsis of biological data on the grass carp, Ctenopharyngodon idella (Cuvier and Valenciennes, 1844). FAO Fisheries Synopsis, No. 135:iv + 86pp.; [distribution restricted.].	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Petr T, 2000. Interactions between fish and aquatic macrophytes in inland waters a review. FAO Fisheries Technical Paper, No. 396:185 pp. Shireman JV; Smith CR, 1983. Synopsis of biological data on the grass carp, Ctenopharyngodon idella (Cuvier and Valenciennes, 1844). FAO Fisheries Synopsis, No. 135:iv + 86pp.; [distribution restricted.].	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	CABI, 2021. Ctenopharyngodon idella (grass carp). https://www.cabi.org/isc/datasheet/16772 (accessed November	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	CABI, 2021. Ctenopharyngodon idella (grass carp). https://www.cabi.org/isc/datasheet/16772 (accessed November	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	CABI, 2021. Ctenopharyngodon idella (grass carp). https://www.cabi.org/isc/datasheet/16772 (accessed November	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Petr T, 2000. Interactions between fish and aquatic macrophytes in inland waters a review. FAO Fisheries Technical Paper, No. 396:185 pp. Shireman JV; Smith CR, 1983. Synopsis of biological data on the grass carp, Ctenopharyngodon idella (Cuvier and Valenciennes, 1844). FAO Fisheries Synopsis, No. 135:iv + 86pp.; [distribution restricted.].	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Not a parasite species	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Shireman JV; Smith CR, 1983. Synopsis of biological data on the grass carp, Ctenopharyngodon idella (Cuvier and Valenciennes, 1844). FAO Fisheries Synopsis, No. 135:iv + 86pp.; [distribution restricted.].	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	Shireman JV; Smith CR, 1983. Synopsis of biological data on the grass carp, Ctenopharyngodon idella (Cuvier and Valenciennes, 1844). FAO Fisheries Synopsis, No. 135:iv + 86pp.; [distribution restricted.].	Medium

19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Usually positive effects are reported on ecosystems and ecosystem services (CABI, 2021. Ctenopharyngodon idella (grass carp). https://www.cabi.org/isc/datasheet/16772 (accessed November 2021))	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Based on professional judgement	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Based on professional judgement	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Cudmore, B. M. N. E., & Mandrak, N. E. (2004). Biological synopsis of grass carp (Ctenopharyngodon idella). Canadian manuscript report of fisheries and Aquatic Sciences, 2705(7), 1-44.	Low
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	CABI, 2021. Ctenopharyngodon idella (grass carp). https://www.cabi.org/isc/datasheet/16772 (accessed November 2021)	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No documented evidence exist	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Based on professional judgement	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Based on professional judgement	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Shireman, J.V. and C.R. Smith, 1983. Synopsis of biological data on the grass carp, Ctenopharyngodon idella (Cuvier and Valenciennes, 1884). FAO Fish. Synop. No.135, 86 p	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No such fact is known and not expected in RA area based professional experience	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Shireman, J.V. and C.R. Smith, 1983. Synopsis of biological data on the grass carp, Ctenopharyngodon idella (Cuvier and Valenciennes, 1884). FAO Fish. Synop. No.135, 86 p	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Not such a dependancy is ever observed	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	More than milion eggs a year (Cudmore, B. M. N. E., & Mandrak, N. E. (2004). Biological synopsis of grass carp (Ctenopharyngodon idella). Canadian manuscript report of fisheries and Aquatic Sciences, 2705(7), 1-44.)	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	5	years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species is and can only spread via aquacultural purpose in RA area. This is supposed based on own experience	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	This includes Colkheti national park and surroundings	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such fact is ever observed	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	Pelagic egges are drifting along the river	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	CABI, 2021. Ctenopharyngodon idella (grass carp). https://www.cabi.org/isc/datasheet/16772 (accessed November 2021)	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not migrant species (Cudmore, B. M. N. E., & Mandrak, N. E. (2004). Biological synopsis of grass carp (Ctenopharyngodon idella). Canadian manuscript report of fisheries and Aquatic Sciences, 2705(7), 1-44.)	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No, Such fact is not known	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	The inroduction usually happans with lare amount of juveniles	High
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence exist	Low
8. Tolerance attributes					

44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No documented evidence exist	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	CABI, 2021. Ctenopharyngodon idella (grass carp). https://www.cabi.org/isc/datasheet/16772 (accessed November 2021)	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No documented evidence exist	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No documented evidence exist	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Frimodt, C., 1995. Multilingual illustrated guide to the world's commercial warmwater fish. Fishing News Books, Osney Mead, Oxford, England. 215 p.	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Not an effective enemies have been observed in RA area	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Solely based on professinal experience	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgement	Low

Statistics	
Scores	
BRA	**18.0**
BRA Outcome	**-**
BRA+CCA	**28.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**8.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*6.0*
B. Biology/Ecology	**10.0**
4. Undesirable (or persistence) traits	*5.0*
5. Resource exploitation	*2.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*1.0*
8. Tolerance attributes	*3.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**10**
Environmental	**6**
Species or population nuisance traits	**14**

Thresholds	
BRA	**-**

BRA+CCA	-
Confidence	
BRA+CCA	0.63
BRA	0.67
CCA	0.25

Date and Time
14/05/2022 15:12:07

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Ctenopharyngodon idella*
Common name	grass carp
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Grass carp is cultivated in China for food, but was introduced in Europe and the United States for
Risk assessment area	South Caucasus
Taxonomy	Ctenopharyngodon idella (Valenciennes, 1844)
Native range	Asia: Eastern China and Russia in eastern Siberia, Amur River system.
Introduced range	Widely transported around the world. Introduced in Europe and the United States for aquatic weed
URL	https://www.fishbase.se/summary/Ctenopharyngodon-idella.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	It is cultivated in China for food, but was introduced in Europe and the United States for aquatic weed control, becoming the species of fish with the largest reported production in aquaculture globally, over five million tonnes per year.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	At present artificial propagation is the major supply of seed for the culture of grass carp, although natural seeds are still available in some rivers of China. Seed collected from the wild is mainly used for maintaining the genetic quality of the broodstock.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Grass Carp has been globally introduced to waterways for purposes of controlling invasive macrophytes, but is also perceived as an invasive species when populations cause unwanted impacts to native macrophytes (Wittmann et al. 2014).	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	World Map of the Köppen-Geiger climate classification	Medium
5	2.02	What is the quality of the climate matching data?	Medium	World Map of the Köppen-Geiger climate classification.	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is inhabits in Jandari, Lisi, Kumisi lakes and other lakes and reservoirs in Georgia as well as in the SC region (Ninua et al. 2013; Own unpublished data).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species is enter in the SC region by humans for aquacultural purposes.	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	The grass carp was first introduced outside its native area for aquaculture and aquatic management purposes after 1945 and in Turkey after 1972 (Kırkağaç 2011). This species is also distributed in the natural and artificial lakes and reservoirs in the SC region.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	As a result of intensive introduction and accidental releases, the European and central Asian areas of the USSR now have naturally reproducing grass carp populations in the Amudar'ya, Syrdar'ya, Terek, Volga and Kuban Rivers and in the Karakum Canal (Nikol'sky and Ahiev, 1974).	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	The exotic grass carp has been used for almost a half a century in the United States as a bi- ological agent to control and manage aquatic plants. This long-lived generalist herbivore consumes large amounts of vegetation and can considerably alter habitat and impact aquatic communities (Dibble & Kovalenko 2009).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Data deficient	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Data deficient	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	The socio-economic study concludes that, in addition to the significant ecological threat that is posed by the presence of grass carp in the Great Lakes, there would also be economic, social and cultural ripple effects (Hayder 2019).	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose threat to humans	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	In Tashkent C. idella, resulted in declines in local species through superior growth and fecundity (Rosenthal, 1976).	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are several protected and threatened species which would be impacted by C. idella, e.g. Luciobarbus capito, L. mursa, Cyprinus carpio, etc.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species has inhabited in the SC region for several decades however, it cannot reproduce naturally.	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	C. idella has significantly altered the food web and trophic structure of aquatic systems in USA by inducing changes in plant, invertebrate, and fish communities (NAS Database). No such fact has been observed in the Caucasus region yet.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Such a fact has not been observed	Medium

20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No research has been conducted in this direction	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	No research has been conducted in this direction	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	C. idella is a large, herbivorous, freshwater fish species. Max length : 150 cm TL male/unsexed; common length : 10.7 cm SL male/unsexed; max. published weight: 45.0 kg. It is important fish for trade and widely used throughout the world.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Adults occur in lakes, ponds, pools and backwaters of large rivers, preferring large, slow-flowing or standing water bodies with vegetation.	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Detrimental changes in water quality parameters (in-crease in nitrite, nitrate, phosphate concentrations) follow-ing vegetation control by grass carp were reported in moststudies that evaluated water quality (Table 5; Shireman andSmith 1983, Kirkagac and	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No such fact has been documented	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No such fact has been documented. In general, C. idella feed on higher aquatic plants and submerged grasses; takes also detritus, insects and other invertebrates (Frimodt, 1995).	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	C. idella as an exotic species for the SC region should be competitor to native species	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No research has been conducted in this direction	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	This species does not reproduces naturally in the SC region	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Such fact is not known	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Such fact is not known	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Such fact is not known	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Fecundity reachs up to 82 000 eggs (Ninua et al. 2013).	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	4	Sexually maturate from the age of 4 (Ninua et al. 2013).	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species can only be spread within the SC region by humans.	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	There is a possibility of that.	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not have such means	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	This species does not reproduces or spreads in the SC region.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	This species does not reproduces or spreads in the SC region.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species does not reproduces in the SC region.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has been detected.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been described	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Adults occur in lakes, ponds, pools and backwaters of large rivers, preferring large, slow-flowing or standing water bodies with vegetation. Tolerant of a wide range of temperatures from 0° to 38°C, and salinities to as much as 10 ppt and oxygen levels down	Very high

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Not applicable	Data deficient	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species is mostly spread by humans.	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	C. idella is tolerant of a wide range of temperatures from 0° to 38°C, and salinities to as much as 10 ppt.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several predators distributed in the SC region which can controll the C. idella populations: eg. Esox lucius, Sander lucioperca, Silurus glanis, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	Medium

Statistics	
Scores	
BRA	**20.5**
BRA Outcome	**-**
BRA+CCA	**14.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**12.5**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*7.5*
B. Biology/Ecology	**8.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*2.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*-4.0*
8. Tolerance attributes	*5.0*
C. Climate change	**-6.0**
9. Climate change	*-6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**8**
Environmental	**-1**
Species or population nuisance traits	**10**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.69**
BRA	**0.71**
CCA	**0.50**

Date and Time

03/05/2022 17:12:18

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Ctenopharyngodon idella*
Common name	grass carp
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Has been introduced for aqaculture worldwide
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Xenocyprididae
Native range	Esatern China and Russia
Introduced range	Worldwide
URL	https://www.fishbase.se/summary/Ctenopharyngodon-idella.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	It has been grown in aquaculture facilities more than 20 generations	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes. Taxon is harvested in wild and is sold in its live form	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Yes. for example Hypophthalmichthys nobilis and H. molitrix	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	The climate is more or less similar out of 19 stations, 15 match at value 9 (out of 10).	Very high
5	2.02	What is the quality of the climate matching data?	Medium	Climatch data is medium since there are not much station on the RA area	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is released in ponds and rivers in RA area	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture, recreational fisheries	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is released in ponds and rivers in RA area	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes in some places of suitable climate.	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Negative impact inculde the shaping of zooplanctonic comunities and predation pressure (competiton) on other planktonivorous species (Spataru & Gophen 1985	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	it is not known, but possibly the competition with native planktonivorous fish can affect the aquaculture (Spataru & Gophen 1985)	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	affects native fish fauna via shaping the zooplanktonic organisms	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not known	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	They have ability to fine filter the water and also they grow very fast and can form dence populations, they are versatile in terms of feeding and this can often lead to habitat alterations amd disruption of food webs and nutrient cycles in new invaded ecosystems (Milstein et al. 1988; Cooke et al. 2009; Gozlan et al. 2010; Ma et al. 2010; Rosemberg et al. 2010. Such changes as zooplankton and phytoplancton exploatation, shaping the fish communities can affect native fishes populations that are sharing	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	No. does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	is tolerant of a wide range of temperatures from 0° to 38°C, and salinities to as much as 10 ppt and oxygen levels down to 0.5 ppm however, due to cold winters it is not reproducing in RA area	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	They have ability to fine filter the water and also they grow very fast and can form dence populations, they are versatile in terms of feeding and this can often lead to habitat alterations and disruption of food webs and nutrient cycles in new invaded ecosystems (Milstein et al. 1988; Cooke et al. 2009; Gozlan et al. 2010; Ma et al. 2010; Rosemberg et al. 2010.	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	it is possible, however, it should be mentioned that they are not known to be independently reproducting in RA	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	Possible, but not documented	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	it is possible. However, it is not documented.	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	yes https://fishbase.mnhn.fr/summary/Ctenopharyngodon-idella.html	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	No https://fishbase.mnhn.fr/summary/Ctenopharyngodon-idella.html	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	They have ability to fine filter the water and also they grow very fast and can form dence populations, they are versatile in terms of feeding and this can often lead to habitat alterations and disruption of food webs and nutrient cycles in new invaded ecosystems (Milstein et al. 1988; Cooke et al. 2009; Gozlan et al. 2010; Ma et al. 2010; Rosemberg et al. 2010)	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	depending on the water and weather conditions	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Not known	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	It is possible	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No dos not exhibit parental care	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No. climate is not suitable	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No. Can not hibridize with native taxa. Own assumption.	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. https://fishbase.mnhn.fr/summary/Ctenopharyngodon-idella.html	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	can produce 1.5 million eggs per season	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	5	5-6 years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture and recreational fisheries	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Yes. it is used for aqauculture and recriational fisheries which allows them to be brought to these places	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. it does not have.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. Because does not reproduce in RA	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	They do not produce viable gametes and therfore can be distributed by larvae, or juveniles.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Do not reproduce therefore, does not migrate.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Yes it seems very rapid	Very high
43	7.09	Is dispersal of the taxon density dependent?	Yes	it is possible	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No indormation	Low
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	"Tolerant of a wide range of temperatures from 0° to 38°C, and salinities to as much as 10 ppt and oxygen levels down to 0.5 ppm." https://www.fishbase.se/summary/Ctenopharyngodon-idella.html	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	it is possible	Medium

47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information, probably not	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No. https://fishbase.mnhn.fr/summary/Ctenopharyngodon-idella.html	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No. No effective natural enemies present in RA area	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	if the temperatures increase, it will make their populations able to reproduce indipendently, therefore the risk of their potential impact is increasingDispersal might increase	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It could be higher. Because it is known that they create dance populations when they reproduce in new environments and creating problems for the native species	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	The magnitude of future potential impact on ecosysytem structure and function is increasing	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	No change	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No change	Medium

Statistics	
Scores	
BRA	**23.5**
BRA Outcome	**-**
BRA+CCA	**31.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**16.5**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*10.5*
B. Biology/Ecology	**7.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*2.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**8.0**
9. Climate change	*8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**13**
Environmental	**9**
Species or population nuisance traits	**15**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.77**
BRA	**0.78**
CCA	**0.71**

Date and Time
20/05/2022 16:43:40

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gambusia holbrooki*
Common name	eastern mosquitofish
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species have been introduced in Georgia and later on introduced/spread over the South
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cyprinodontiformes (Rivulines, killifishes and live bearers)
Native range	North America
Introduced range	Worldwide
URL	https://www.fishbase.de/summary/Gambusia-holbrooki.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	No such information is available	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	No such fact is known	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congener	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Result of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	CABI, 2021. Gambusoa holbrooki (eastern mosquitofish). https://www.cabi.org/isc/datasheet/82089 (accessed November 2021)	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Human mediated translocation for mosquito control.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	e.g. Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Hurlbert, S. H., Zedler, J., & Fairbanks, D. (1972). Ecosystem alteration by mosquitofish (Gambusia affinis) predation. Science, 175(4022), 639-641.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documended evidence	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	Hurlbert, S. H., Zedler, J., & Fairbanks, D. (1972). Ecosystem alteration by mosquitofish (Gambusia affinis) predation. Science, 175(4022), 639-641.	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Hurlbert, S. H., Zedler, J., & Fairbanks, D. (1972). Ecosystem alteration by mosquitofish (Gambusia affinis) predation. Science, 175(4022), 639-641.	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	By predation of egges (Myers, G. S. (1965). Gambusia, the fish destroyer. Tropical Fish Hobbyist, 13(5), 31-32.)	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are number of threatend or species in the RA area that can be altered by the species	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Pyke, G. H. (2005). A review of the biology of Gambusia affinis and G. holbrooki. Reviews in Fish Biology and Fisheries, 15(4), 339-365.	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	Hurlbert, S. H., Zedler, J., & Fairbanks, D. (1972). Ecosystem alteration by mosquitofish (Gambusia affinis) predation. Science, 175(4022), 639-641.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Hurlbert, S. H., Zedler, J., & Fairbanks, D. (1972). Ecosystem alteration by mosquitofish (Gambusia affinis) predation. Science, 175(4022), 639-641.	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Not known, and not expected based on personal experience	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Davis, J. R., & Huffman, D. G. (1977). A comparison of the helminth parasites of Gambusia affinis and Gambusia geiseri (Osteichthyes: Poeciliidae) from the upper San Marcos River. The Southwestern Naturalist, 359-366.; Tobler, M., & Schlupp, I. (2008). Influence of black spot disease on shoaling behaviour in female western mosquitofish, Gambusia affinis (Poeciliidae, Teleostei). Environmental Biology of Fishes, 81(1), 29-34.	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	It is generally a small bodied species	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Pyke, G. H. (2005). A review of the biology of Gambusia affinis and G. holbrooki. Reviews in Fish Biology and Fisheries, 15(4), 339-365.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Hurlbert, S. H., Zedler, J., & Fairbanks, D. (1972). Ecosystem alteration by mosquitofish (Gambusia affinis) predation. Science, 175(4022), 639-641.	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	No documented evidence, professional judgement	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	At the egg/larval stage	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Hurlbert, S. H., Zedler, J., & Fairbanks, D. (1972). Ecosystem alteration by mosquitofish (Gambusia affinis) predation. Science, 175(4022), 639-641.	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Pyke, G. H. (2005). A review of the biology of Gambusia affinis and G. holbrooki. Reviews in Fish Biology and Fisheries, 15(4), 339-365.	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	The species is surviving for many decades in the RA area	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No such fact is known or expected	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Pyke, G. H. (2005). A review of the biology of Gambusia affinis and G. holbrooki. Reviews in Fish Biology and Fisheries, 15(4),	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	It can complete its life cycle without any fishes	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Page, L.M. and B.M. Burr, 1991. A field guide to freshwater fishes of North America north of Mexico. Houghton Mifflin Company, Boston.	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	Week	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Unintentional translocation	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	It is alreapdy widespread in several parts of RA area	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence is known	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No documented evidence exists	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	The species can easily disperse through water currents naturally at the juvenile stage	Low
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Species does not require migration for ther eproduction	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact is known	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Due to large population density, the inintentional translocation or dispersal through water current can be very intensive	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	No such fact is knwon	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Usually daiyng quickly out of water	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Low oxygen, high temperature, turbidity	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No successful cases	High

47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Not known, no documented eveidence exists	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Alcaraz, C., & García-Berthou, E. (2007). Life history variation of invasive mosquitofish (Gambusia holbrooki) along a salinity gradient. Biological Conservation, 139(1-2), 83-92.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Not known effective natural enemies from the RA area	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Professional judgement. The species is already in RA area with no new introduction events	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Professional judgement. Expected to increase since the species prefers warm waters in RA area	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Professional judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Professional judgement. I expect to increase its realized area as well as density thus would have largerimpact	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Professional judgement. I expect to increase its realized area as well as density thus would have largerimpact	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Professional judgement. I expect to increase its realized area as well as density thus would have largerimpact	Medium

Statistics	
Scores	
BRA	**34.0**
BRA Outcome	**-**
BRA+CCA	**44.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**15.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**19.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*7.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*3.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**11**
Environmental	**17**
Species or population nuisance traits	**19**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.70**
BRA	**0.72**
CCA	**0.54**

Date and Time
16/05/2022 11:39:50

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gambusia holbrooki*
Common name	eastern mosquitofish
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	G. holbrooki is one of the widspread species. Its distribution was facilitated by human mostly for
Risk assessment area	South Caucasus
Taxonomy	Gambusia holbrooki Girard 1859
Native range	The native habitat of mosquitofish is the lowland ponds, lakes and streams of southern USA
Introduced range	Introduced worldwide in tropical and subtropical countries. North America: Atlantic and Gulf Slope
URL	https://www.fishbase.se/summary/4521

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	G. holbrooki is small sized fish and is not an interesting object for aquaculture.	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	G. holbrooki is small sized fish and is not an interesting object for aquaculture.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Gambusia holbrooki is a remarkably successful invader of freshwater systems worldwide, with the capacity to detrimentally impact native fishes both directly (e.g. competition, predation, agonistic interactions) and indirectly (e.g. triggering trophic cascades) (Macdonald et al. 2012).	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Köppen–Geiger climate classification system	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Köppen–Geiger climate classification system	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is widely distributed in the SC region (Ninua et al. 2013; Kuljanishvili et al. 2020; Epitashvili et al. 2020).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species has spread in the Caucasus region intentionaly by humans (Ninua et al. 2013).	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is widely distributed in Iran, Turkey and surrounding of the South Caucasus region (Patimar et al. 2011; Kurtul and Musa, 2020).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	This species has become naturalised in the most countries and regions outside of its native range.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Because of their aggressive and predatory behavior, mosquitofish may negatively affect populations of small fish through predation and competition (Myers 1967; Courtenay and Meffe, 1989).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	There is no data however it is expected to have an impact	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	Pest fish including G. holbrooki may affect markets (e.g., changes in prices), and non-market attributes (e.g., changes in ecosystem services) (Rowe et al. 2008).	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Alien pest fish are likely to affect people's way of life due to impacts on recreational fishing and commercial fishing industries. Some of the measurable likely impacts include impacts on recreational opportunities and impacts on employment (Rowe et	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Since their introduction into Australia in 1925 for the purpose of mosquito control, gambusia have become widespread in NSW, especially modified waterways, and are considered to be a contributing factor to the decline of frogs (threatened or otherwise) as well as other native species such as freshwater fishes and macro-invertebrates.	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are several threatened and protected species in the SC region which are likely to be under pressure from this species (Ninua et al. 2013, Kuljanishvili et al. 2020).	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species has been successfully established in the SC region which means that it has crossed these barriers.	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	Gambusia predation decreased markedly the overall abundance of zooplankton. Large crustaceans (Anostraca and Calanoida) were rapidly eliminated, while Cyclopoida and Cladocera peaked in March before in turn disappearing in the later stages of the hydroperiod. These results are congruent with the theory supporting the influence of both predation and competition as major interacting forces shaping freshwater communities	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	G. holbrooki may affect markets (e.g., changes in prices), and non-market attributes (e.g., changes in ecosystem services) (Rowe et al. 2008).	Medium

20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	No research has been conducted in this regard	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	No research has been conducted in this regard	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	This fish is small sized and therefore is an uninteresting species for aquaculture	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Adult mosquitofish specimens occur in standing to slow-flowing water, mostly in vegetated ponds and lakes, backwaters and quiet pools of steams (Page & Burr 1991)	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Degradation of the quality of water and natural habitat are a threat to this invasive species -- from the Atlantic coast in North America -- which competes against and moves local species away (Cano-Rocabayera et al. 2019).	Very high
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Not applicable	No research has been conducted in this regard	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Not applicable	Such data is not available	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Not applicable	No research has been conducted in this regard however, this species is likely to be a serious competitor to local fish.	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No research has been conducted in this regard	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species breeds in the South Caucasus region (Kuljanishvili et al. 2020).	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Such fact has not been detected yet	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Such fact has not been detected yet	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No research has been conducted in this regard	Low
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	G. holbrooki matures at 4-6 weeks; 3 generations can be produced in one year. Gestation lasts 3-4 weeks. Brood may reach up to 354 young, but is generally around 40-60 (Riehl and Baensch, 1991; Kottelat and Freyhof, 2007).	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	G. holbrooki matures at 4-6 weeks (Kottelat and Freyhof, 2007).	Medium
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Currently this species spreading within the SC by itself/or other animals (birds) (own observation).	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	G. holbrooki is distributed within the protected areas of the SC region, for instance in the Kolkheti National Park, Western Georgia (Own data).	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Such a fact is not described	Medium
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	This species should be propagated within the SC region with the help of other animals (birds, reptilies, etc.) (Own observation)	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This species should be propagated within the SC region with the help of other animals (birds, reptilies, etc.) or move by water between waterbodies (Own observation)	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species lives permanently in specific reservoirs and does not migrate.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	This species should be propagated within the SC region with the help of other animals (birds, reptilies, etc.)	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Probably yes	Low
43	7.09	Is dispersal of the taxon density dependent?	Yes	Probably yes	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Such a fact is not described	Medium

45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	Yes	This study showed that G. holbrooki off drainage of Domat Al-Jandal Lake, KSA can tolerate abrupt changes in salinity, temperature and pH changes. The LC50 of salinity was 16 ‰. LC50 of lower and upper temperature on G. holbrooki were 3.5 and 36.5 0C when transferred abruptly from 22 0C. The LC50 of pH in acidity and alkalinity range were 3.5 and 11.5 respectively. From this study, it can be concluded that G. holbrooki can be used under different conditions of 15 ‰ salinity, range of pH from 4 to 11 and range of temperature from 4 to 35 0C for controlling mosquito if transferred abruptly without acclimatization (EL-Borav	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	Attempts have been made to eradicate G. holbrooki from water bodies using the fish poison rotenone. Most native fish are killed by a rotenone concentration of 0.5 ppm but Gambusia can survive this concentration without mortality (Pyke, 2005). Impacts on native fishes and other native fauna have been mitigated by releasing potassium permanganate downstream of the rotenone release point in flowing waterways. Gambusia is more tolerant of the organo-phosphorus pesticide Dursban™ than several native fishes (Pyke, 2005). These observations mean that chemical control methods are highly likely to affect native fish and other aquatic biota well before useful levels of gambusia mortality can	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	The inappropriate spread of Gambusia by humans for the purpose of mosquito control remains a problem in spite of repeated cautionary advice over the past 20 years (Arthington and Lloyd,	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	The broad salinity tolerance of mosquitofish allows them to colonise environments, such as salt lakes, estuaries, near coastal marine environments (Lloyd, 1987). The salinity LD50 for mosquitofish is more than 58g/L and they can tolerate direct transfers to salinity differences of up to seawater (35 g/L) with few mortalities (Chervinski, 1983).	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	Yes	There are meny predators which can eat G. holbrooki in the SC region (fish, reptilies, birds etc.)	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own observation	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Own observation	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own observation	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Own osbervation	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Own observation	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Own osbervation	Low

Statistics	
Scores	
BRA	**31.5**
BRA Outcome	**-**
BRA+CCA	**37.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**14.5**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*13.5*
B. Biology/Ecology	**17.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*0.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*5.0*
8. Tolerance attributes	*5.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**

4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**11**
Environmental	**7**
Species or population nuisance traits	**24**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.60**
BRA	**0.64**
CCA	**0.25**

Date and Time
03/05/2022 18:03:42

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gambusia holbrooki*
Common name	eastern mosquitofish
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	was introduced into Georgia from Italy in 1925 by Dr. Rukhadze as a biological pest control agent
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cyprinodontiformes (Rivulines, killifishes and live bearers) >
Native range	Gambusia holbrooki is native of North America
Introduced range	Armenia, Azerbaijan, Georgia
URL	https://fishbase.mnhn.fr/summary/Gambusia-holbrooki.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	This species has no ornamental value, however it is rarely kept indoors by hobbists	Medium
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	No. this species does not have a comercial value	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Gambusia affinis	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	It is somehow similar. Especially similar in the Kura river basin	Medium
5	2.02	What is the quality of the climate matching data?	High	Good	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	st has been introduced and released in natural water bodies of SC countries since 1920s	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Biological control	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Currently, this species is distributed widely and is considered invasive in the SC (Kuljanishvili et al., 2020)	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	yes. not only naturalized but also invasive.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	It was said that this species exsistance had negative effect on native biodiversity (Kottelat & Freyhof 2007).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	Yes, this could be due to competition with the planktonivourous fishes	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Can be transmitting diseases, and not used for recreational fisheries	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	This species is difficult to eradicate and it was predicted that it could be the major challange for fisheries an environmental managers (https://docs.niwa.co.nz/library/public/RoweReviewofimpacts2008.	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	It was said that this species existence had negative effect on native biodiversity (Kottelat & Freyhof 2007).	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	it may survive low oxigen environments via taking the oxygen fromm upper levels (kottelat & Freyhof 2007)	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	It may exploit food resources for native species	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	It can transmit parasites and pathogens, is not used for recreational fisheries.	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No information	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is possible	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	This is small bodied organism	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	It prefers slow-flowing or standing environments	Medium

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Yes, this could be due to competition with the planktonivourous fishes	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Reproduces from 3-4 month 3-4 times a year. Wthin one year 3 generations can be born (Kttelat & Freyhof 2007)	Very high
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	it is likely to consume the eggs of threatened or protected native taxa	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	It is possible	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	These are livebearer species that rproducs from 3-4 month 3-4 times a year. Wthin one year 3 generations can be born (Kttelat & Freyhof 2007) they can give birth up to 60 fish	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Yes. It has been considered as established species since 1930ies	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. reproduces sexually See: https://www.fishbase.in/summary/Gambusia-holbrocki.html	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.in/summary/Gambusia-holbrocki.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Reproduces from 3-4 month 3-4 times a year. Wthin one year 3 generations can be born (Kttelat & Freyhof 2007)	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	3-4 months	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Biological control, self-dispersal	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Yes. This is possible since the accidental or deliberate releases that are common in RA	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Yes. This is possible since the accidental or deliberate releases that are common in RA	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	this species do not lie egss	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Yes it is possible	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Does not migrate	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	Introduction for biological control is not happening anymore, however it still spreads itself	Medium
43	7.09	Is dispersal of the taxon density dependent?	Yes	Yes (Cote et al 2010)	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information	Low
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Salinity (Chervinsky 19853), temperature (Uliano et al 2010; Meffe et al 1995), oxygen (Kottelat & Freyhof 2007)	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	It can be removed from streams however, it is difficult and costly to remove them from lakes and reservoirs	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Can tollerate pollution caused by humans	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	They can tolerate high salinity levels (Chervinsky 1983)	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	Yes	There are fish like Perch, Pike, Catfish.. But There is no information about their effectivness	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High

51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Increased temperatures will cause this species establish in higher altitudes	Very high
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It might favour by environmental changes (caused by climate change) that will increase resource availability, resulting their widespread.	Very high
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Population densities will increase making them on one hand impossible to eradicate and on the other hand, affecting native organisms due to competition, that does not leave much resources for native ones.	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Future increased temperatures will favour the dispersal and success of this species establishment which itself, affects native species that are of main concern for conservation.	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	The magnitude of future potential impact on ecosystem services will not change	Medium

Statistics	
Scores	
BRA	**38.0**
BRA Outcome	**-**
BRA+CCA	**48.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**19.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**19.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*7.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*3.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**13**
Environmental	**16**
Species or population nuisance traits	**22**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.79**
BRA	**0.79**
CCA	**0.75**

Date and Time
21/05/2022 14:03:32

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gasterosteus aculeatus*
Common name	three-spined stickleback
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	G. aculeatus has invided Caspian Sea and is widespread already there. It is translocated species
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Perciformes/Gasterosteoidei (Sticklebacks) > Gasterosteidae
Native range	Curcum arctic temperate regions
Introduced range	Caspian Sea
URL	https://www.fishbase.de/summary/Gasterosteus-aculeatus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	Not such fact is known	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	For the aquarium purpose. Not a documented evidence	Low
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	Not other congeneric or invasive races are known	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	based on Climatch results	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low resolution of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	It spreads with help of human (direct translocation) and alos via the chennel system	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Already in the RA area Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Roch, S., von Ammon, L., Geist, J., & Brinker, A. (2018). Foraging habits of invasive three-spined sticklebacks (Gasterosteus aculeatus)–impacts on fisheries yield in Upper Lake Constance. Fisheries Research, 204, 172-180.	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	Roch, S., von Ammon, L., Geist, J., & Brinker, A. (2018). Foraging habits of invasive three-spined sticklebacks (Gasterosteus aculeatus)–impacts on fisheries yield in Upper Lake Constance. Fisheries Research, 204, 172-180.	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	Candolin, U. (2019). The threespine stickleback (Gasterosteus aculeatus) as a modifier of ecological disturbances. Evolutionary Ecology Research.	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Roch, S., von Ammon, L., Geist, J., & Brinker, A. (2018). Foraging habits of invasive three-spined sticklebacks (Gasterosteus aculeatus)–impacts on fisheries yield in Upper Lake Constance. Fisheries Research, 204, 172-180.	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a poisonous or risky species for human health	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Roch, S., von Ammon, L., Geist, J., & Brinker, A. (2018). Foraging habits of invasive three-spined sticklebacks (Gasterosteus aculeatus)–impacts on fisheries yield in Upper Lake Constance. Fisheries Research, 204, 172-180.	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Species is not parasite	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	It is capable to survive in fresh, brackish and marine waters	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	Candolin, U. (2019). The threespine stickleback (Gasterosteus aculeatus) as a modifier of ecological disturbances. Evolutionary Ecology Research.; Roch, S., von Ammon, L., Geist, J., & Brinker, A. (2018). Foraging habits of invasive three-spined sticklebacks (Gasterosteus aculeatus)–impacts on fisheries yield in Upper Lake Constance. Fisheries Research, 204, 172-180.	Medium

19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Candolin, U. (2019). The threespine stickleback (Gasterosteus aculeatus) as a modifier of ecological disturbances. Evolutionary Ecology Research.; Roch, S., von Ammon, L., Geist, J., & Brinker, A. (2018). Foraging habits of invasive three-spined sticklebacks (Gasterosteus aculeatus)–impacts on fisheries yield in Upper Lake Constance. Fisheries Research, 204, 172-180.	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No documented evidence eixsts	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	The species can be host of many parasites and infectious agents absent from the RA area in the past. e.g. hrelfall, W. (1968). A mass die-off of three-spined sticklebacks (Gasterosteus aculeatus L.) caused by parasites. Canadian Journal of Zoology, 46(1), 105-106. Chappell, L. H. (1969). The parasites of the three-spined stickleback Gasterosteus aculeatus L. from a Yorkshire pond. I. Seasonal variation of parasite fauna. Journal of Fish Biology, 1(2),	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	https://www.fishbase.de/summary/Gasterosteus-aculeatus.html	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	The species is known from many different water bodies including lotinc and lentic systems	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No documented evidence exists	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	No documented evidence. Based on professional judgement	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Species is predatory and thus can consume anything in freshwater while at juvenile stage	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Thogh no documented evidence exists.	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Pinder, A.C., 2001. Keys to larval and juvenile stages of coarse fishes from fresh waters in the British Isles. Freshwater Biological Association. The Ferry House, Far Sawrey, Ambleside, Cumbria, UK. Scientific Publication No. 60. 136 p.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	It is already reproducing in RA area for decades	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No documented evidence eixsts	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	The species is reproducing sexually	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No documented evidence eixsts	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Usually up to 400 eggs annualy	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable habitats nearby)?	>1	Human mediated translocation and direct migration through chanal system. Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	The species is already known from the Kolkheti national park along the Black Sea	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such fact is known	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No documented evidence eixsts	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Highily expected but not documented evidence	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No documented evidence exists	Low
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No documented evidence eixsts	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	The species can reach alrge number of freshwater bodies thorugh water currents in RA Area	Low

43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence exists	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No documented evidence eixsts	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No documented evidence eixsts	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such practice exists	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Candolin, U. (2019). The threespine stickleback (Gasterosteus aculeatus) as a modifier of ecological disturbances. Evolutionary Ecology Research.	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documented evidence eixsts	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No documented evidence eixsts	Low
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Professional judgement - not expected	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Professional judgement - not expected	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Professional judgement - not expected	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Professional judgement - not expected	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Professional judgement - not expected	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Professional judgement - not expected	Low

Statistics	
Scores	
BRA	**38.0**
BRA Outcome	**-**
BRA+CCA	**38.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**20.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**18.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*7.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*2.0*
C. Climate change	**0.0**
9. Climate change	*0.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**19**
Environmental	**10**
Species or population nuisance traits	**14**

Thresholds	
BRA	-
BRA+CCA	-
Confidence	
BRA+CCA	0.60
BRA	0.62
CCA	0.42

Date and Time
16/05/2022 12:05:04

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gasterosteus aculeatus*
Common name	three-spined stickleback
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Gasterosteus aculeatus is a fish native to most inland and coastal waters north of 30°N. It has long
Risk assessment area	South Caucasus
Taxonomy	Gasterosteus aculeatus Linnaeus 1758
Native range	Circumarctic and temperate regions: Extending south to the Black Sea, southern Italy, Iberian
Introduced range	According to Miller and Hubbs (1969), the threespine stickleback was introduced into the Mohave
URL	https://www.fishbase.de/summary/Gasterosteus-aculeatus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Three-spined stickleback is easy to find in nature and easy to keep in aquaria.	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	This fish is small sized (8-9 cm) and dos not have a trade importance.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	A massive increase in the pelagic population of non-endemic three-spined sticklebacks, Gasterosteus aculeatus L. in Lake Constance has coincided with drastic declines in fishery yields. This study assesses the possible direct and indirect impact of the mass occurrence on native fish species in the lake (Roch et al. 2018).	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	G. aculeatus is naturally distributed in the Caucasus region	Very high
5	2.02	What is the quality of the climate matching data?	High	G. aculeatus is naturally distributed in the Caucasus region	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	G. aculeatus is naturally distributed in the Caucasus region	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	G. aculeatus is naturally spreads within the Caucasus region	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	There are two sticklebacks (Gasterosteus aculeatus, an exotic, and Pungitius platygaster, a native) and one native pipefish (Syngnathus caspius), the natives found in the Caspian Sea basin and the exotic in that basin and adjacent basins (Coad 2015).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Gasterosteus aculeatus, an exotic species found in the Caspian Sea basin, Iran (Coad 2015).	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	A massive increase in the pelagic population of non-endemic three-spined sticklebacks, Gasterosteus aculeatus L. in Lake Constance has coincided with drastic declines in fishery yields. This study assesses the possible direct and indirect impact of the mass occurrence on native fish species in the lake (Roch et al. 2018).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	A massive increase in the pelagic population of non-endemic three-spined sticklebacks, Gasterosteus aculeatus L. in Lake Constance has coincided with drastic declines in fishery yields (Roch et al.	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Data deficient	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Data deficient	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	In absence of larval prey, sticklebacks were shown to feed predominantly on Daphnia in the field, indicating a strong interspecific food competition with whitefish (Roch et al. 2018)	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	G. aculeatus can eat Sturgeon (Acipenser spp) and other threathened/protected species eggs.	Medium
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species is naturally occuring in the SC region (Kuljanishvili et al. 2020)	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	This species is naturally occuring in the SC region (Kuljanishvili et al. 2020) and therefore a similar fact is not to be expected.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	This species is naturally occuring in the SC region (Kuljanishvili et al. 2020) and no such fact has been observed at this stage.	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficient	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	Data deficient	Low

22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	This species is small sized and does not has a trade importance (Ninua et al. 2013).	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	In freshwater, adults prefer to live in small stream but may occur in a variety of habitats including lakes and large rivers.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	In 2015, nearly 180 million artificially hatched whitefish derived from wild offspring were released into Lake Constance (IBKF, 2016), resulting in an estimated biomass input of over a ton within a short time period. This easy, nutrient and energy rich food source in the oligotrophic water might facilitate the stickleback development, which permits the species to fully exploit the pelagic habitat and simultaneously reduce recruitment	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Own judgement	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	The probability of this is high, because the G. aculeatus is a predator fish and can eat threatened or protected species larvaes/eggs (e.g. Sturgeons, Colchic barb - *Capoeta sieboldii*,	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	In case of lake Constanca study shows that in absence of larval prey, sticklebacks were shown to feed predominantly on Daphnia in the field, indicating a strong interspecific food competition with whitefish - *Coregonus lavaretus* (Roch et al. 2018).	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	This species displays elaborate breeding behavior (defending a territory, building a nest, taking care of the eggs and fry)	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species is naturally reproduces in the region (Ninua et al. 2013; Kuljanishvili et al. 2020).	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Not applicable	Data deficient	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	Sticklebacks were raised from syngamy through sexual maturity in untreated water and in three target concentrations of sodium perchlorate-treated water. Perchlorate was found to interfere with the expression of nuptial coloration, courtship behavior, and normal sexual development. Genetic testing revealed that some females were masculinized to the extent that they produced both sperm and eggs, and histological analysis showed that these individuals had intersexual gonads (ovotestes) containing both oocytes and cells undergoing spermatogenesis (Bernhardt et al.	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Data deficient	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Fecundity of G. aculeatus is 60-400 eggs (Ninua et al. 2013).	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	The fish becomes sexually mature at the age of 14-18 months (Ninua et al. 2013).	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species may be spread unintentionally by humans	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	There is a possibility of that	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such fact has been described	Medium
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	This species naturally reproduces in the region (Ninua et al. 2013).	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This species naturally reproduces in the region (Ninua et al. 2013).	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This species naturally reproduces in the region (Ninua et al. 2013).	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	There is a possibility of that	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Yes	Own judgement	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been detected	High

45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	Yes	Adults occur in fresh waters, estuaries and coastal seas. Anadromous, with numerous non-anadromous populations in brackish or pure freshwater, rarely in marine waters. In the sea, confined to coastal waters. In freshwater, adults prefer to live in small stream but may occur in a variety of habitats including lakes and large rivers. Inhabit shallow vegetated areas, usually over	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Own judgement	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species may be spread by humans	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Anadromous, with numerous non-anadromous populations of G. aculeatus in brackish or pure freshwater, rarely in marine waters. In the sea, confined to coastal waters.	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are meny species which can controll G. aculeatus population in the region (Esox lucius, Squalius spp, Sander lucioperca, Perca fluviatilis, etc.)	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	Medium

Statistics	
Scores	
BRA	**38.0**
BRA Outcome	**-**
BRA+CCA	**44.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**13.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*10.0*
B. Biology/Ecology	**25.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*7.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*5.0*
8. Tolerance attributes	*3.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**8**
Environmental	**9**
Species or population nuisance traits	**29**

Thresholds	
BRA	**-**
BRA+CCA	**-**

Confidence	
BRA+CCA	**0.66**
BRA	**0.68**
CCA	**0.50**

Date and Time
05/05/2022 16:57:43

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gasterosteus aculeatus*
Common name	three-spined stickleback
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Gasterosteus aculeatus is native to the Black Sea basin. The building of the Volga-Don canal
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Perciformes/Gasterosteoidei () > Gasterosteidae
Native range	The Black Sea basin
Introduced range	The Caspian Sea basin
URL	https://www.fishbase.in/summary/Gasterosteus-aculeatus.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	The taxon is not the subject of domestication, however it is used as aquarium fish or laboratory animal	Medium
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	It does not have much fisheries value, however it is harvested sometimes for aquariums by local hobbysts or can be harvested for public aquariums. Also, is occasionally taken commercially in Scandinavia and processed into fishmeal and oil	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No information avalable	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	It is somehow similar.	High
5	2.02	What is the quality of the climate matching data?	Low	5. There are no climatic stations in climatch to make this analysis. However, according to Koppen-Geiger map the climate is somehow similar.	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	The building of the Volga-Don canal opened a way for this species to disperse into the Caspian Sea basin (Bogutskaya et al. 2013) and it is now widely distributed throughout the Azerbaijani coast of the Caspian Sea and into the river mouths (Ibrahimov & Mustafayev, 2015). The fish enter the rivers during reproduction (Yusifov et al. 2017).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Self-spreading	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	It is found around the shorelines of the Caspian Sea in Azerbaijan	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes. The taxon has established viable populations.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	It is known that G. aculeatus introduction has been affecting the fishery yields. It has been shown that the species is predating on some native fish larvae such as Rutilus rutilus, Perca fluviatilis and Coregonus lavaretus (Roch et al 2018a). It was also reported that G. aculeatus is in food competition with native whitefish species since it is also feeding on Daphnia (Roch et al 2018a).	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	Roch et al 2018b provided the evidence that G. aculeatus is the reason of the disruption of an entire existing food web and that it has substantially altered existing fish communities, wich had the severe consequences for fishery yields.	Very high
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	can be transmitting diseases; is not used in recreational fisheries.	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	this species had severe consequences for fishery yields in Lake Constance (Roch et al 2018a;b)	Very high
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	It is harmless	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	In Lake Constance it was shown that G. aculeatus introduction has influenced the growth and abundance of native pelagic whitefish (Roch et al 2018b)	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Can tolerate hypoxia because they have ability to decrease metabolic rates during hypoxia (Regan et al 2017). Besides, G. aculeatus inhabit a range of environments with variable salinity and thermal stability and in addition since this species has both, marine and freshwater populations and are known to have invaded freshwater habitats by marine populations some time ago following the recession of the Pleistocene glaciers, they are quite adaptable to the novel conditions and are very much cold tolerant	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	The impact of G. aculeatus in Azerbaijan has not been documented, however according to the research from other countries of similar climate it is quite likely	High

19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	May decrease fishery yields	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Nothing is known about this	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is possible	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	This species is a small sized animal	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	This species present themselves as anadromous, inhabitting different water environments: marine, coastal, riverine and even lakes.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	does not reduce the habitat quality for natives	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Not known	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	It can be predator of native pelagic fish larvae. Also can be in competition with them for food	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Eats, worms, small crustaceans, larvae and adult aquatic insects, drowned aerial insects, fish larvae and small fishes	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Males build nests and they guard and ventilate the eggs and young.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Yes and it has been successfully reproducing since its introduction	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No See: https://www.fishbase.de/summary/Gasterosteus-aculeatus.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	"Anadromous forms usually die of exhaustion after spawning cycle. Freshwater individuals are able to complete several cycles within one year or sometimes over several years " https://www.fishbase.in/summary/Gasterosteus-aculeatus.html	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	1 year	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Self spreading	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	It is possible	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. does not have morphological caracters that will allow it to attach	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. Because eggs are being deposited in the nests which are guarded by the parent unless hatched.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No. This is less likely	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	It is anadromous species which migrates in the freshwaters for reproduction	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	No information about it	Low
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	can tolerate different ranges of salinity and oxigen	High

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No. This is less likely.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information avalable	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	This species do well on higher salinity levels (Metzger et al 2016)	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No. No effective natural enemies present in RA area	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Since this species has high termal tolerance, the risks of its establishment might increase	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	No informatio. probably no change	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	No change	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	No change	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No change	Medium

Statistics	
Scores	
BRA	**37.0**
BRA Outcome	**-**
BRA+CCA	**41.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**19.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**18.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*7.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*3.0*
C. Climate change	**4.0**
9. Climate change	*4.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**15**
Environmental	**12**
Species or population nuisance traits	**17**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.75**
BRA	**0.78**
CCA	**0.58**

Date and Time
21/05/2022 14:07:30

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gobio artvinicus*
Common name	Artvin gudgeon
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	This species is reported from the east South Caucasus area as an introduced species.
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Gobionidae (Gudgeons)
Native range	South-eastern Black Sea basin
Introduced range	Kura River basin
URL	https://www.fishbase.de/summary/Gobio-artvinicus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	Low economic value, not used in aquaculture/captivity	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	Not an ornamental fish and not any economic value	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congeners are known to be invasive	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Results of climatch	Low
5	2.02	What is the quality of the climate matching data?	Low	Low quality of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	None	Human mediated translocation	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No documented evidence. Guessed	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evidence. Guessed	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No documented evidence. Guessed	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence. Guessed	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	No documented evidence. Guessed	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	No documented evidence. Guessed	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	No documented evidence. Guessed	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	No documented evidence. Guessed	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	No documented evidence. Guessed	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No documented evidence. Guessed	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No endemic pests or infectious agents are known from the RA area	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	No documented evidence. Guessed	Medium

22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	Species is not kept in captivity	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	No documented evidence. Guessed	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No documented evidence. Guessed	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No documented evidence. Guessed	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No documented evidence. Guessed	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	No documented evidence. Guessed	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No documented evidence. Guessed	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No documented evidence. Guessed	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	No documented evidence. Guessed	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No documented evidence. Guessed	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	No documented evidence. Guessed	Low
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Years	Low
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Human mediated translocation	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Already in RA area (Kuljanishvili et al., 2021)	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No documented evidence. Guessed	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No documented evidence. Guessed	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	No documented evidence. Guessed	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No documented evidence. Guessed	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No documented evidence. Guessed	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	In that case starting point is located in RA area from which other parts of the RA area are accessible through the river system. No documented evidence. Guessed	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence. Guessed	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No documented evidence. Guessed	Low
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No documented evidence. Guessed	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such a practice exists	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No documented evidence. Guessed	Medium

48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documented evidence. Guessed	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No documented evidence. Guessed	Low
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgment	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgment	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgment	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Based on professional judgment	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Based on professional judgment	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Based on professional judgment	Low

Statistics	
Scores	
BRA	**7.0**
BRA Outcome	**-**
BRA+CCA	**7.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**2.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**5.0**
4. Undesirable (or persistence) traits	*2.0*
5. Resource exploitation	*2.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**0.0**
9. Climate change	*0.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**0**
Environmental	**1**
Species or population nuisance traits	**8**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.52**
BRA	**0.56**
CCA	**0.25**

Date and Time
16/05/2022 12:25:26

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gobio artvinicus*
Common name	Artvin gudgeon
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Gobio artvinicus is a small sized species of gudgeon, distributed in Turkey and Georgia. This
Risk assessment area	South Caucasus
Taxonomy	Gobio artvinicus Turan, Japoshvili, Aksu & Bektaş 2016
Native range	Aralık and Çifteköpru streams, tributaries of the lower part of Çoruh River, Black Sea basin in
Introduced range	According to Kuljanishvili et al. (2020) Gobio artvinicus is translocated within the South Caucasus
URL	https://www.fishbase.se/summary/Gobio-artvinicus.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	Gobio artvinicus is a newly discribed small sized species. It has not commercial value.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	Gobio artvinicus is a newly discribed small sized fish and has not commercial value.	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	Although the species was translocated to the Caucasus region, no such fact has been discribed yet	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	This species is naturally distributed in the Caucasus region (Kuljanishvili et al. 2020).	Very high
5	2.02	What is the quality of the climate matching data?	High	This species is naturally distributed in the Caucasus region (Kuljanishvili et al. 2020).	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is naturally distributed in the Caucasus region (Kuljanishvili et al. 2020)	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	This species is distributed in the region naturally and also accidentally spread by humans through translocations	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is naturally distributed in Çoruh River, Black Sea basin in Turkey (Turan et al. 2016).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	This species was spread in eastern part of the Caucasus region (Caspian Basin) and it appears to have viable populations here.	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No such fact has been discribed	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No such fact has been discribed	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No such fact has been detected	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No such fact has been detected	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	No such fact has been detected	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There is a possibility of that. In the Caucasus region there are distributed several threatened and protected species such as sturgeons, Salmo spp, etc.	Medium
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	G. artvinicus is naturally distributed in the SC and the climatic conditions of the region are acceptable to it.	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	Such a case is not expected	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Such a case is not expected	Very high
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Such a case is not expected	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	Such a case is not expected	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	G. artvinicus is small sized (up to 10 cm) fish and does not have commercial value	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	G artvinicus occurs in streams with swift and warm flowing water, and cobbled and pebbled bottoms	Medium

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	This can happen if the population of this species increases	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Not applicable	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No such fact has been detected	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	There is a possibility of that	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	Data deficient	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species is naturally reproduces in the SC region	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	There is a possibility of that. There are closed relative species distributed in the Caucasus Region such as G. caucasicus and Romanogobio macropterus which may hybridized with G.	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No such fact has been described	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such fact has been described	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Data deficient	Low
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Data deficient	Medium
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	This species is distributed in the region naturally and also accidentally spread by humans through translocations	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	There is a probability of that	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Own judgement	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	This species is naturally reproduces and spreading in the region	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This species is naturally reproduces and spreading in the region	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This species is naturally reproduces and spreading in the region	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	Own judgement	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Yes	Own judgement	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been detected	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Own judgement	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Own judgement	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Own judgement	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	This fish is typical freshwater species and does not occurring in the brackish or salinity water	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are meny predator species which can controll the populations of G. artvinicus: e.g. Esox lucius, Squalius spp, Salmo spp, Sander lucioperca, Perca fluviatilis, etc.	Very high
C. Climate change					
9. Climate change					

50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	High

Statistics	
Scores	
BRA	**14.0**
BRA Outcome	**-**
BRA+CCA	**14.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**2.0**
1. Domestication/Cultivation	*-2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**12.0**
4. Undesirable (or persistence) traits	*3.0*
5. Resource exploitation	*2.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*6.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**0.0**
9. Climate change	*0.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**0**
Environmental	**0**
Species or population nuisance traits	**18**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.62**
BRA	**0.63**
CCA	**0.54**

Date and Time
05/05/2022 18:16:52

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gobio artvinicus*
Common name	Artvin gudgeon
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Kuljanishvili et al. 2020 described that G. artvinicus in the Kura-Aras River basin is alien.
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Gobionidae (Gudgeons)
Native range	Black Sea basin, the lower Choruh River
Introduced range	Kura-Aras River system
URL	https://fishbase.mnhn.fr/summary/68289

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	This is a newly described species and it has not been subject of domestication.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	This taxon is not harvested from the wild. However it can be a contaminant of other trade important fish parcels, this is possibly the way how it got to the Kura-Aras river system (Kuljanishvili et	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Gobio gobio is considered as invasive species for insance in Italy, reducing the native Gobio benacensis (Bianco & Ketmaier 2005)	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	The climate is somehow similar	High
5	2.02	What is the quality of the climate matching data?	Low	There are no climatic stations in climatch to make this analysis. However, according to Koppen-Geiger map the climate is somehow similar.	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Yes it has been found in Kura-Aras system in Turkey, east Georgia, Armenia and Azerbaijan (Kaya et al 2020; Kuljanishvili et	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquaculture	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Currently, this species is widely distributed in the Kura-Aras system (Kuljanishvili et al 2021)	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes (Kuljanishvili et al 2021)	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	Nothing is known yet, however one might assume there is some impact to wild stocks in terms of competition	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No. No effective natural enemies present in RA area	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No known adverse impacts to ecosystem services. Possible can be transmitting parasites or deseases	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No known adverse socio-economic impacts	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	They might be in competition for food and resources with the native gobionid fishes.	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Not applicable	This species is newly discovered and there is no information about its biology.	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	Most likely it will not disrupt food-web structure	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Not likely	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	No information avalable	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is likely	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	It is a small sized fish 10 cm max SL	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	It inhabits in fast flowing rivers. Species of its genera are known to be adapting in different habitats (Turan et al 2016)	High

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	It is not documented. However it is less likely	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	There is no documented evidence that theyy can maintain a viable populations when present in low densities but the fact that they are so widespread in Kura Aras system, indicates that they can.	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No information avalable	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	it is less likely	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No. information avalabe	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Yes. The climate is quite similar	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	It is likely	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.de/summary/Gobio-artvinicus.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	The species reproduction biology is not known, however as its relatives spawn several times a year it can be possible	Low
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	possibly 1	Low
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Auqculture	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	Not this vectors. But it might disperce in the protected areas from neigbouring areas	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Yes. it is possible.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Does not migrate	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	NO information avalable	Low
43	7.09	Is dispersal of the taxon density dependent?	No	Not documented	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	It is not documented, however we know that this species is a rheophilic which means that it prefers fast flowing and clean water.	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	It is very widespread and it will be impossible	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	less likely	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Not applicable	No information avalable	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No. No effective natural enemies present in RA area	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High

51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	It was discovered in warm flowing watres which makes us think that this species might benefit from the climate change	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	If their populations will favour from warming temperatures their dispersal might increase	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	competition with other rheophilic species will increase since their populations will increase.	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	I assume there won't be much change	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Impact on ecosystem services and impact on socio-economic factors can be increased. If this species will contribute to the decline of native fish species	Medium

Statistics	
Scores	
BRA	**5.0**
BRA Outcome	**-**
BRA+CCA	**15.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**3.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**2.0**
4. Undesirable (or persistence) traits	*3.0*
5. Resource exploitation	*0.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**2**
Environmental	**2**
Species or population nuisance traits	**12**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.63**
BRA	**0.64**
CCA	**0.54**

Date and Time
21/05/2022 14:09:46

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gymnocephalus cernua*
Common name	ruffe
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	This species is known to cause a significant changes in the introduced areas. In the RA area it was
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Perciformes/Percoidei (Perchs) > Percidae (Perches)
Native range	Caspian Sea, Black Sea, Baltic Sea basins but not in the South Caucasus
Introduced range	Widely in Europe and USA
URL	https://www.fishbase.de/summary/Gymnocephalus-cernua.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	Not an ornamental species and not an economic importance	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Maitland, P.S. and R.N. Campbell, 1992. Freshwater fishes of the British Isles. HarperCollins Publishers, London.368 p. ; Gutsch, M., Hoffman, J. A review of Ruffe (Gymnocephalus cernua) life history in its native versus non-native range. Rev Fish Biol Fisheries 26, 213–233 (2016). https://doi.org/10.1007/s11160-016-9422-5	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No other congener or races are known as invasive	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Result of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Epitashvili, G., Geiger, M.F., Astrin, J.J., Herder, F., Japoshvili, B., Mumladze, L., 2020. Towards retrieving the Promethean treasure: a first molecular assessment of the freshwater fish diversity of Georgia. Biodivers. Data J. e57862.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Human mediated dispersal	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Epitashvili, G., Geiger, M.F., Astrin, J.J., Herder, F., Japoshvili, B., Mumladze, L., 2020. Towards retrieving the Promethean treasure: a first molecular assessment of the freshwater fish diversity of Georgia. Biodivers. Data J. e57862.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Gutsch, M., Hoffman, J. A review of Ruffe (Gymnocephalus cernua) life history in its native versus non-native range. Rev Fish Biol Fisheries 26, 213–233 (2016).	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Rosch R. & Schmid W. 1996: Ruffe (Gymnocephalus cernuus L.,) newly introduced into Lake Costance: preliminary data on population biology and possible effects on whitefish (Coregonus lavaretus L.). Ann. Zool. Fennici 33: 467–471.; Lorenzoni, M., Pace, R., Pedicillo, G., Viali, P., & Carosi, A. (2009). Growth, catches and reproductive biology of ruffe Gymnocephalus cernuus in Lake Piediluco (Umbria, Italy). Folia Zoologica, 58(4), 420.	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	Rosch R. & Schmid W. 1996: Ruffe (Gymnocephalus cernuus L.,) newly introduced into Lake Costance: preliminary data on population biology and possible effects on whitefish (Coregonus lavaretus L.). Ann. Zool. Fennici 33: 467–471.	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Not well documented evidence. Professional guess (affecting the economically important fish populations)	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Not well documented evidences	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	It competes to at least a native Perca fluviatilis. Leigh, P. (1998). Benefits and costs of the ruffe control program for the Great Lakes fishery. Journal of Great Lakes Research, 24(2), 351-360.	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	Wide variety of food includes juvenile fishes, egs and invererbates (CABI, 2022. Gymnocephalus cernuus. In: Invasive Species Compendium. Wallingford, UK: CAB International.	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Gutsch, M., Hoffman, J. A review of Ruffe (Gymnocephalus cernua) life history in its native versus non-native range. Rev Fish Biol Fisheries 26, 213–233 (2016). https://doi.org/10.1007/s11160-016-9422-5	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	No documented evidence	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	By cometing/predation to economically valued species	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Not a documented evidence exists	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	No documented evidence exists	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	Generally small bodied species	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Gutsch, M., Hoffman, J. A review of Ruffe (Gymnocephalus cernua) life history in its native versus non-native range. Rev Fish Biol Fisheries 26, 213–233 (2016).	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Gutsch, M., Hoffman, J. A review of Ruffe (Gymnocephalus cernua) life history in its native versus non-native range. Rev Fish Biol Fisheries 26, 213–233 (2016). https://doi.org/10.1007/s11160-016-9422-5	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No documented evidence exists	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	It is a predator (Bergman, E. (1988). Foraging abilities and niche breadths of two percids, Perca fluviatilis and Gymnocephalus cernua, under different environmental conditions. The Journal of Animal Ecology, 443-453.)	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Competing with other predators (Bergman, E. (1988). Foraging abilities and niche breadths of two percids, Perca fluviatilis and Gymnocephalus cernua, under different environmental conditions. The Journal of Animal Ecology, 443-453.)	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Not ever observed	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	No documented evidence exists though it have been recently cought in wild	Medium
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Not known, and not expected	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Known as sexually reproducing species	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Species can complete its life cycle independently	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	(CABI, 2022. Gymnocephalus cernuus. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.)	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	Years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Natural dispersal, Human mediated dispersal	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Already detected nearby to Protected areas of Black Sea Coast with RA area	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such fact is observed	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Not a documented evidence exists	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Through water currents with RA area	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not a migrant species and not such an evidence have ever been described from other areas	Medium
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Not expected based on professional judgement	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Due to large number of eggs/juveniles	High
43	7.09	Is dispersal of the taxon density dependent?	No	No information, though not expected	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information thoug not expected	Low
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Phisical and chemical composition; Gutsch, M., Hoffman, J. A review of Ruffe (Gymnocephalus cernua) life history in its native versus non-native range. Rev Fish Biol Fisheries 26, 213–233 (2016). https://doi.org/10.1007/s11160-016-9422-5	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No documented evidence exists	Low

47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No documented evidence exists	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documented evidence exists.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Not known, not expected	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgement	Low

Statistics	
Scores	
BRA	**34.0**
BRA Outcome	**-**
BRA+CCA	**46.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**19.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**15.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*7.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*0.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**18**
Environmental	**16**
Species or population nuisance traits	**16**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.58**
BRA	**0.62**
CCA	**0.25**

Date and Time
16/05/2022 12:54:13

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gymnocephalus cernua*
Common name	ruffe
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	The Eurasian ruffe (Gymnocephalus cernua), is a freshwater fish found in temperate regions of
Risk assessment area	South Caucasus
Taxonomy	Gymnocephalus cernua (Linnaeus 1758)
Native range	Europe: Caspian, Black, Baltic and North Sea basins; Great Britain; north to about 69° N in
Introduced range	It has been introduced to parts of Western Europe (France, northern Italy) and Greece, as well as
URL	https://www.fishbase.se/summary/gymnocephalus-cernua.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	Although the ruffe once was a popular fish for consumption and its flesh described as delicious and healthy, it has disappeared almost entirely from central, northern and western European food culture. It is no longer sought after in the market.	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Although the ruffe once was a popular fish for consumption and its flesh described as delicious and healthy, it has disappeared almost entirely from central, northern and western European food culture. It is no longer sought after in the market. However, it has survived to some extent as human food in Finland, Estonia, Belarus and Russia. In Finland, it seems to be the roe that still attracts some consumers, especially within restaurants serving the New Nordic Cuisine. In Estonia, it is sold dried and salted as snacks. In Russia, some people still make ukha, the typical clear	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No toehr congenerics or subspecies as invasive is known	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Koppen - Geiger climate classification (This species is naturally distributed in the Caucasus region)	High
5	2.02	What is the quality of the climate matching data?	High	Koppen - Geiger climate classification (This species is naturally distributed in the Caucasus region)	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is naturally distributed in the Caucasus region. First record from Georgia was confirmed by Epitashvili et al. (2020)	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Probably this species spreads within the region by humans unintentionally and by animals (birds, etc.)	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Confirmed record of Gymnocephalus cernua (Linnaeus, 1758) (Perciformes: Percidae) as a new exotic species for Turkey (Çiçek et al. 2021)	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	The ruffe has already invaded Lake Superior and GARP modeling predicts it will find suitable habitat almost everywhere in all five Great lakes.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	The ruffe has affected fish populations in other areas where introduced. In Scotland, native perch populations declined, and in Russia whitefish numbers have declined because of egg predation by ruffe (McLean 1993)	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	G. cernua is the second most costly invasive aquatic taxon in the world (Haubrock et al. 2022).	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Given that G. cernua is the second most costly invasive aquatic taxon in the world it should have a serious impact on ecosystem	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	When ruffe first invaded Lake Superior, it was thought that this species could generate a considerable cost for recreational fishing, particularly by causing a decline in yellow perch (Perca flavescens) populations (Leigh 1998). Under a moderate scenario of spread and impact, it was predicted that ruffe could generate costs in excess of $500 million by 2050 (Leigh 1998). However, these concerns have yet to be confirmed as the extent of ruffe's contribution to declines in native fish populations remains undecided (Czypinksi et al. 2007). Ruffe abundance appeared to remain stable or decline annually in Lake Superior as late as 2001-2005 (Czypinski et al. 2007, Gorman et al. 2010).	Very high
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	The ruffe has affected fish populations in other areas where introduced. In Scotland, native perch populations declined, and in Russia whitefish numbers have declined because of egg predation by ruffe (McLean 1993).	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are meny threatened and protected species in the Caucasus region which may be influenced by Ruffe: Luciobarbus capito, L. mursa, Salmo spp, Rutilus spp, etc.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species naturally inhabits the region and environmental conditions are acceptable to it.	Very high

18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	Such a case is expected if this species is widespread in the region.	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Such a case is expected if this species is widespread in the region.	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	No research has been conducted in this direction.	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	No research has been conducted in this direction.	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length of Ruffe is 25.0 cm TL male/unsexed; common length : 12.0 cm TL male/unsexed; max. published weight: 400.00 g, so this species can be used in aquaculture.	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Inhabits eutrophic lakes, lowland and piedmont rivers. Most abundant in estuaries of large rivers, brackish lakes with salinities up to 10-12 ppt and reservoirs. In general, its abundance increases with increased eutrophication. Reported to prefer still or slow-flowing water with soft bottom and without vegetation and deep water with deposits of sand and gravel.	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Data deficient	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Ruffe is a predator/omnivor species and can consume threatened or protected species in the region: L. mursa, L. capito, Salmo spp, Acipenser spp, etc.	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Ruffe is a predator/omnivor species and may be competitor for native species in terms of food and nutrient extraction.	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Data deficient	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	It seems that this species is naturally reproduces in the region	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Such fact is not detected in the SC region. Natural hybridization between ruffe and perch has been recorded in the past. Regan (1911) cites a 1907 reference for perch and ruffe hybrids in the Danube, noting that "these hybrids are not fertile per se, but are quite fertile with either parent!" (see also Holcik and Hensel 1974). So far there is no evidence that ruffe have been	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Data deficient	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Own judgement	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	The ruffe has the capacity to reproduce at an extremely high rate. A ruffe usually matures in two to three years, but a ruffe that lives in warmer waters has the ability to reproduce in the first year of life. A single female has the potential to lay from 130,000 to 200,000 eggs annually.	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	A ruffe usually matures in two to three years, but a ruffe that lives in warmer waters has the ability to reproduce in the first year of life.	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	This species can be spread within the SC region naturally and artificially by humans.	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	There is a probability of that exist	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	The ruffe was probably introduced in US via ship ballast water discharged from a vessel arriving from a Eurasian port.	Medium
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	This species should breed naturally in the region	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This species should breed naturally in the region	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Data deficient	Low
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	There is a probability of that exist	Medium

42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	There is a probability of that exist	Medium
43	7.09	Is dispersal of the taxon density dependent?	Yes	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been described	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	Yes	Adult Ruffe has characteristics that allow them to adapt to a range of environments, including rapid maturation, relatively long life and large size (allowing them to reproduce many times in large batches), batch spawning, genotype and phenotype (having plasticity in their genetic expression), tolerance to a wide range of water quality (Gutsch & Hoffman 2016).	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Ever since the ruffe was introduced into the Great Lakes system, scientists and fishery managers have been searching for the right way to get rid of them. In the beginning, the main method of control was to increase the Walleye and Northern Pike populations, because they are natural predators of the ruffe. Other methods that have been considered are poison and chemical control. If a large school of ruffe is found, they can be poisoned. If some survive, however, they will rapidly reproduce. Chemicals can be targeted to act on specific species of fish. The chemical lampricide TFM kills ruffe, but leaves other fish unharmed.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	The ruffe was probably introduced in US via ship ballast water discharged from a vessel arriving from a Eurasian port.	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Ruffe tolerate a wide range of salinity (0–12 ppt) (Lind 1977).	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	Esox lucius is a natural predators of the ruffe and distributed in the South Caucasus region. There are also other species which can controll ruffes population: Birds, Snakes, Otters, Sander lucioperca, Silurus glanis, Squalius spp, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Such fact has been detected in East Georgia, where Ruffe was cateched by anglers in Taribana reservoir.	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Such fact has been detected in East Georgia, where Ruffe was cateched by anglers in Taribana reservoir.	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Own judgement	Medium

Statistics	
Scores	
BRA	**46.0**
BRA Outcome	**-**
BRA+CCA	**58.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**20.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**26.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*7.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*5.0*
8. Tolerance attributes	*3.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*

2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**19**
Environmental	**16**
Species or population nuisance traits	**28**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.64**
BRA	**0.64**
CCA	**0.58**

Date and Time
16/05/2022 12:55:12

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Gymnocephalus cernua*
Common name	ruffe
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Ruffe, Gymnocephalus cernua (Linnaeus, 1758), has caused substantial ecological damage in North
Risk assessment area	South Caucasus
Taxonomy	Actinopterygii (ray-finned fishes) Perciformes (Perch-likes) Percidae (Perches) Percinae
Native range	Basin of Northen Black Sea and Sea of Azo: Dneistr, South Bug, Dniepr, Don and Kuban drinages.
Introduced range	Has established populations in Lakes in Italy, England, Scotland, Wales, Germany, Austria,
URL	https://www.fishbase.de/summary/Gymnocephalus-cernua.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	This species is not a subject of domestication	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Used to be an object of commercial fishing around coastal regions of Baltic sea (Gutsch & Hoffman); In South-eastern England it has been introduced as live bait which has lead to it's successful establishment (Copp et al, 2005).	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Perca fluviatilis and Sander lucioperca are is also known as an introduced species	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Similar. According to Climatch application its 9 out of 10	Very high
5	2.02	What is the quality of the climate matching data?	High	Quality of climate matching data is high	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Yes. It has been found in the rivers of north-weast Georgia (pers. comm. G. Epitashvili)	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Recreational fisheries, aquaculture, ornamental trade, natural dispersal.	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	The RA is a neighbouring area of G. cernua native range	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Introduced and have become established (even inavasive) in France; Northern Italy, northern Great Britain, the Great Lakes; North America (Kottelat & Freyhof, 2007), Germany, Austria, Switzerland and Norway (Gutsch & Hoffman, 2016)	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	It was suggested that in introduced lakes G. cernua was affecting the native Coregonid species, However it is not well documented (Copp. et al 2005).	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	Since the exsistance of G. cernua in new environment is affecting native organisms throught competition, we can assume it will affect the aquaculture	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	provisioning - can affect production of food (trade important coregonids); cultural - can affect recreational fisheries.	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	G. cernua is oppressing native Perca fluviatilis populations which are the main resource for the lakes fishermen (Lorenzoni et al	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	G. cernua is oppressing native Perca fluviatilis and Coregonid fish populations.	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Not parasite, however, can be predating on young of the year or small native fishes.	Low
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Ruffe can tolerate to very low temperature conditions. it is also very tolerant to in waters ranging from oligotrophic to eutrophic. Thanks to advance lateral line and sensori organs it can easily coordinate in turbid waters.	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	It can affect native organisms through competition for food due to niche overlap; consume fish eggs, and can prey on young- of-the-year fish or small fishes.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Can affect production of food (aquaculture); cultural - can affect recreational fisheries.	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No information	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	No information	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	It is a small body sized organism (12 cm).	High

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	it prefers still slow-flowing rivers, estuaries, brackish lakes.	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Can feed in low light, in deep and oligotrophic conditions. can alter population dynamics of prey (benthic invertebrates and zooplankton prey), competes with fishes	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	In North America, Ruffe was introduced to the Laurentian Great Lakes in the 1980s via ballast water releases, establishing populations in both US and Canadian waters of Lake Superior, Lake Michigan, MI, and Lake Huron, MI. Propagule pressure (i.e., the abundance and frequency of Ruffe introduced) on the Great Lakes has been low (Kolar and Lodge 2001); genetic evidence suggests there was a single founding population from the Elbe River drainage region, Germany (Stepien et al. 2005)" (See	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	There is no updated res list assessments for RA countries. However, we can assume that G. cernua can affect endangered benthic invertebrates and fish fry.	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Neogobius melanostomus has a RIP score of 2.83. therefore, I assume that G. cernua can be the sequester for food resources, because this two species were almost at the same rate invading	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Early maturity could be caused by a response to high mortality rates at the population level (Lind 1977) or to warmer water at a physiological level (Fedorova and Vetkasov 1974; Craig 1987).	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	RA conditions are favourable for maturation and reproduction of G. cernua	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction https://www.fishbase.de/summary/4474	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No See" https://www.fishbase.de/summary/4474	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	sexual maturity occurs at 1-3 y.o. during season they spawn multiple times. Especially in non-native range. for instance "In Lake Glubokoe in the Moscow region of Russia, Ruffe spawned up to three batches in a two-month period (Koshelev 1963)."	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	1-3.	Medium
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Recreational fisheries, aquaculture, local hobbyists (international releases for curiosities), natural dispersal.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	appearing of G. cernua in flowing waters will bring it to the protected areas.	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No morphological structure that would allow to attach to different surfaces.	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No. Less likely	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Does not migrate for reproduction	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	We do not really know the exact time of it's appearance in the region therefore it is difficult to answer this question.	Low
43	7.09	Is dispersal of the taxon density dependent?	No	Not documented	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	G. cernua exhibits plasticity with regard to chemical, physical, biological, and habitat requirements (See Gutsch & Hoffman, 2016)	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	"In dealing with invasive species, eradication is obviously the favoured strategy and several studies have demonstrated its success. However, success has been limited to small, isolated biotopes, on a local scale and in the early stages of invasion (Z a v a l e t a et al. 2001). Fishery experts concur that eradication of the ruffe is not possible (B u s i a h n 1996), as the species is capable of rapid population increase and range expansion (See	Low

47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Can tolerate eutrophication	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	Can tolerate salinities up to 10-12%.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No information avalable	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Yes. Increase	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	So far this species was detected only in northwester Georgia but it is predicted that it will spread widely.	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Can affect native fish species with competition for food and resources	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	It probably will have no change in ecosystem structure of function	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	aquaculture and recriational fisheries can be affected	High

Statistics	
Scores	
BRA	**38.0**
BRA Outcome	**-**
BRA+CCA	**48.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**22.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**16.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*7.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*4.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**18**
Environmental	**15**
Species or population nuisance traits	**19**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.67**
BRA	**0.67**
CCA	**0.67**

Date and Time
21/05/2022 14:11:34

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Hemiculter leucisculus*
Common name	sharpbelly
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	It is a pest fish with no economic value
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Xenocyprididae (East Asian minnows)
Native range	East Asia
Introduced range	Asia, Middle Aast
URL	https://www.fishbase.de/summary/Hemiculter-leucisculus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	This is not a fish with any economic or ornamental value	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	No such fact is known	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No other congeners or races within species is known as invasive	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Dong, X., Ju, T., Grenouillet, G., Laffaille, P., Lek, S., & Liu, J. (2020). Spatial pattern and determinants of global invasion risk of an invasive species, sharpbelly Hemiculter leucisculus (Basilesky, 1855). Science of The Total Environment, 711, 134661.	High
5	2.02	What is the quality of the climate matching data?	Medium	Due to low accuracy of local climate data	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Esmaeili, H. R., & Gholamifard, A. (2011). Short communication Range extension and translocation for Hemiculter leucisculus (Basilewsky, 1855)(Cyprinidae) in western and northwestern Iran. J. Appl. Ichthyol, 27, 1394-1395; Dong, X., Ju, T., Grenouillet, G., Laffaille, P., Lek, S., & Liu, J. (2020). Spatial pattern and determinants of global invasion risk of an invasive species, sharpbelly Hemiculter leucisculus (Basilesky, 1855). Science of	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Accidental translocation	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Mustafayev, N. J., Ibrahimov, S. R., & Levin, B. A. (2015). Korean sharpbelly Hemiculter leucisculus (Basilewsky, 1855)(Cypriniformes, Cyprinidae) is a new species of Azerbaijan fauna. Russian journal of biological invasions, 6(4), 252-259.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Esmaeili, H. R., & Gholamifard, A. (2011). Short communication Range extension and translocation for Hemiculter leucisculus (Basilewsky, 1855)(Cyprinidae) in western and northwestern Iran. J. Appl. Ichthyol, 27, 1394-1395.; Dong, X., Ju, T., Grenouillet, G., Laffaille, P., Lek, S., & Liu, J. (2020). Spatial pattern and determinants of global invasion risk of an invasive species, sharpbelly Hemiculter leucisculus (Basilesky, 1855). Science of	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	CABI, 2021. Hemiculter leucisculus (common sawbelly). https://www.cabi.org/isc/datasheet/110574 (accessed septemebr 2021)	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	CABI, 2021. Hemiculter leucisculus (common sawbelly). https://www.cabi.org/isc/datasheet/110574 (accessed septemebr 2021)	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	CABI, 2021. Hemiculter leucisculus (common sawbelly). https://www.cabi.org/isc/datasheet/110574 (accessed septemebr 2021)	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	CABI, 2021. Hemiculter leucisculus (common sawbelly). https://www.cabi.org/isc/datasheet/110574 (accessed septemebr 2021)	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	Yes	Sattari, M., Mokhayer, B., Khara, H., Nezami, S., & Shafii, S. (2007). Occurrence and intensity of parasites in some bonyfish species of Anzali wetland from the southwest of the Caspian Sea. Bulletin of the European Association of Fish Pathologists, 27(2),	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Rosenthal, H., 1976. Implications of transplantations to aquaculture and ecosystems, in: FAO Technical Conference on Aquaculture. Kyoto, Japan, pp. 1–19.	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Not a prasite species	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	CABI, 2021. Hemiculter leucisculus (common sawbelly). https://www.cabi.org/isc/datasheet/110574 (accessed septemebr 2021)	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	CABI, 2021. Hemiculter leucisculus (common sawbelly). https://www.cabi.org/isc/datasheet/110574 (accessed septemebr 2021)	Medium

19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	CABI, 2021. Hemiculter leucisculus (common sawbelly). https://www.cabi.org/isc/datasheet/110574 (accessed septemebr 2021)	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Not known and not expected	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Sattari, M., Mokhayer, B., Khara, H., Nezami, S., & Shafii, S. (2007). Occurrence and intensity of parasites in some bonyfish species of Anzali wetland from the southwest of the Caspian Sea. Bulletin of the European Association of Fish Pathologists, 27(2),	Very high
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	Since no species is kept in captivity this is not expected	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Usually is living in stagnant waters although have been frequently reported form flowing waters	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Sattari, M., Mokhayer, B., Khara, H., Nezami, S., & Shafii, S. (2007). Occurrence and intensity of parasites in some bonyfish species of Anzali wetland from the southwest of the Caspian Sea. Bulletin of the European Association of Fish Pathologists, 27(2),	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Usually population develops from a small batch of individuals in an invided areas	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	CABI, 2021. Hemiculter leucisculus (common sawbelly). https://www.cabi.org/isc/datasheet/110574 (accessed septemebr 2021)	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	CABI, 2021. Hemiculter leucisculus (common sawbelly). https://www.cabi.org/isc/datasheet/110574 (accessed septemebr 2021)	Very high
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Not well documented	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	N.J. Mustafayev, S.R. Ibrahimov, B.A. Levin Korean sharpbelly Hemiculter leucisculus (Basilewsky, 1855) (Cypriniformes, Cyprinidae) is a new species of Azerbaijan fauna Russ. J. Biol. Invasions., 6 (2015), pp. 252-259, 10.1134/S2075111715040049	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Not documented evidence and not expected	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Species is tyoical sexually reproducing	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Can complete life cycle independently	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Hundreeds of thousands of egges a year	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Natural dispersal and as a hitchhiker pest	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Due to large number of propagules with active swiming abbilities and with the help of water current	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such fact have ever been detected. Biology also does not suppert such behavior	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No documented evidence exists	Low
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Not a documented evidence exists, though expected	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Dispersal is not depends on the density - no such fact is known	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence exists	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Due to a large number of juveniles produced by an individual	High
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence exists	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No documented evidence exists	Medium

45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	It is tolerant to various polution source, temperature etc. CABI, 2021. Hemiculter leucisculus (common sawbelly). https://www.cabi.org/isc/datasheet/110574 (accessed septemebr 2021)	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No documented evidence exists	Very high
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No documented evidence exists	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documented evidence exists	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective predator is known from the RA area. Based on professional judgement	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgement	Medium

Statistics	
Scores	
BRA	**35.0**
BRA Outcome	**-**
BRA+CCA	**45.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**17.0**
1. Domestication/Cultivation	*-2.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**18.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*7.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*0.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**16**
Environmental	**17**
Species or population nuisance traits	**16**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.70**
BRA	**0.72**

CCA	0.54

Date and Time
16/05/2022 12:49:39

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Hemiculter leucisculus*
Common name	sharpbelly
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Hemiculter leucisculus, an invasive species, has expanded its range throughout much of Asia and
Risk assessment area	South Caucasus
Taxonomy	Hemiculter leucisculus (Basilewsky, 1855)
Native range	The native range of H. leucisculus is East Asia: from Far East Russia and Mongolia in the north,
Introduced range	H. leucisculus was unintentionally introduced into the Aral Sea Basin, Central Asia. It is currently
URL	https://www.fishbase.se/summary/4755

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	The species is common in large streams and reservoirs in Hong Kong but not favored as a table fish because the flesh is unpalatable and very bony. Therefore, H. leucisculus has not	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	The species is common in large streams and reservoirs in Hong Kong but not favored as a table fish because the flesh is unpalatable and very bony (fishbase.org).	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	H. leucisculus as an invasive species has become established in several countries, including Iran, Afghanistan, and the former Soviet Union, where it has displaced local species.	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	World Map of the Köppen-Geiger climate classification	Medium
5	2.02	What is the quality of the climate matching data?	Medium	World Map of the Köppen-Geiger climate classification	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Hemiculter leucisculus is fast expanding its range into the southern Caspian Sea basin in Iran (Zareian, Esmaeili, Zamanian Nejad, & Vatandoust, 2015) and was recently recorded from Azerbaijan by Mustafayev, Ibrahimov, and Levin (2015). This species is also found in the Alazani River, Georgia by G.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	This species may be spread by humans accidentally and also it can grows its range by itself (this fish found in the Alazani river which means that it came from Mingachevir Reservoir). Nowadays, Korean sharpbelly H. leucisculus is a common naturalized species that is widely distributed throughout Azerbaijan. Probably, it penetrated into freshwaters of Azerbaijan from the water bodies of neighboring countries, where this species was detected previously as an invasive one, or it settled here owing to the accidental appearance during the introduction of other species of water organisms to Azerbaijan (Mustafayev et al.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	H. leucisculus was first reported from Central Asia in the Amu Darya Basin in 1958, and in the Syr Darya Basin in 1961. In Iran, it was first found in the Anzali Lagoon (Holcík and Razavi, 1992) where it was probably introduced with Asian carp in 1967.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	H. leucisculus is a common naturalized species that is widely distributed throughout Azerbaijan (Mustafayev et al. 2015). H. leucisculus was unintentionally introduced into the Aral Sea Basin, Central Asia. It is currently widespread in the plains of the region up to foothills, and in the drainages of the Amu Darya, Syr Darya, Zarafshan, Qashqadarya, and Tedzhen rivers. In Iran it was reported from the Caspian Sea (Safid River, Aras River, Golestan Province) and Tigris basins. It is thought to be widespread in Iran, although this may be the native fish the Danube bleak (Chalcalburnus chalcoides), which is very similar.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	It has become established as an exotic species in several countries, including Iran, Afghanistan, and the former Soviet Union, where it has displaced local species.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	H. leucisculus is considered as a pest in fish farms where it competes with juveniles of commercial species.	Very high
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Data deficient	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Data deficient	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	H. leucisculus has become established as an exotic species in several countries, including Iran, Afghanistan, and the former Soviet Union, where it has displaced local species.	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are several protected and threatened species in the SC region which may have been affected by H. leucisculus e.g. Salmo spp, Acipencer spp, Luciobarbus capito, L. mursa, etc.	Very high

17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	H. leucisculus has been successfully established in Azerbaijan which means that climatic conditions in the SC region is acceptable for this species.	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	The probability of this is very high because this species is a predator.	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	There is a probability of that.	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficient	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	As most fish species, the sharpbelly harbours several species of parasites. One of them is Paradiplozoon hemiculteri, a monogenean living on the gills.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length of H. leucisculus is 23.0 cm, therefore this species can be kept in an aquarium or pond and then released into the wild.	Medium
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	H. leucisculus is found in rivers, lakes, reservoirs, canals, and marshes. It keeps to the water surface in stagnant waters.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	H. leucisculus as an benthivorous fish may affect the water quality by inducing sediment disturbance and resuspension, resulting in reduced water transparency and increased nutrient release from the sediment (Yu et al. 2021).	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	The probability of this is high but there is no evidence yet	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	The probability of this is high but there is no evidence yet	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	Data deficient	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	H. leucisculus is a common naturalized species that is widely distributed throughout Azerbaijan (Mustafayev et al. 2015).	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Data deficient	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Data deficient	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such fact has been described.	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	The average fecundities of H. leucisculus is about 19978.6 eggs (Mousavi-Sabet et al. 2019).	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	(Mousavi-Sabet et al. 2019)	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable habitats nearby)?	>1	Probably, it penetrated into freshwaters of Azerbaijan from the water bodies of neighboring countries, where this species was detected previously as an invasive one, or it settled here owing to the accidental appearance during the introduction of other species of water organisms to Azerbaijan (Mustafayev et al. 2015).	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	The probability of this is high but there is no evidence yet	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not have similar means	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	H. leucisculus is a common naturalized species that is widely distributed throughout Azerbaijan (Mustafayev et al. 2015). It seems that this species is naturally reproduces in the SC region.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	H. leucisculus is a common naturalized species that is widely distributed throughout Azerbaijan (Mustafayev et al. 2015). It seems that this species is naturally reproduces in the SC region.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	H. leucisculus is a common naturalized species that is widely distributed throughout Azerbaijan (Mustafayev et al. 2015). It seems that this species is regularly migrates within the water bodies of the SC region for reproduction.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	There is a possibility of this but we have no evidence yet	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Own judgement	Medium

43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been recorded	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	This species is highly tolerant of water pollution (Coad, 2014)	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	The average biomass of unwanted fishes like Carassius aurat us, Hemiculter leucisculus, Alburnus alburnus and Pseudoras bora parva of the first and second treatments in comparison to control showed a reduction of 94, 88.9, 62.4 and 56.82 percent, respectively by Esox lucius (Khaval et al. 2010).	Very high
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species has been spread by humans in many countries.	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	Data deficient	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There is several predators which can controll the populations of H. leucisculus, e.g.: Esox lucius, Silurus glanis, Salmo spp, Squalius spp, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Own judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Own judgement	Low

Statistics	
Scores	
BRA	**34.5**
BRA Outcome	**-**
BRA+CCA	**44.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**9.5**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*7.5*
B. Biology/Ecology	**25.0**
4. Undesirable (or persistence) traits	*10.0*
5. Resource exploitation	*7.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*6.0*
8. Tolerance attributes	*0.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**9**

Environmental	13
Species or population nuisance traits	28

Thresholds	
BRA	-
BRA+CCA	-
Confidence	
BRA+CCA	0.69
BRA	0.72
CCA	0.42

Date and Time
05/05/2022 19:37:04

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Hemiculter leuciscułus*
Common name	sharpbelly
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	The species appeared on the Iranian shores of the Caspian Sea in the 1990s as an accidental
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Xenocyprididae
Native range	Southeastern Asia and the Amur River basin
Introduced range	Armenia, Azerbaijan, Georgia
URL	https://www.fishbase.se/summary/4755

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	The taxon hasn't been subject of domestication	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	The taxon is not harvested in the wild however it is often accidentally sold together with other aquaculture important fishes (Coad & Abdoli 1993)	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	The species doesn't have invasive races variatieshowever it is from the same family as most worldwide introduced Chinese carps	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	The climate is very similar	Very high
5	2.02	What is the quality of the climate matching data?	High	The quality of climate matching is high	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	It was recorded in Azerbaijan for the first time in 2012 (Mustafayev et al., 2015), but the exact time of its introduction and the vectors or pathways are still unknown. Most probably it entered from the neighboring areas, where it was already introduced (Mustafayev et al., 2015). H. leuciscus was also recently discovered in Armenia, in the Arpa River by (Pipoyan & Arakelyan, 2021). The first introduction date and pathway of this species' introduction in Armenia is unknown, but it probably penetrated from neighboring areas. The species is currently well established in the Caspian Sea basin and Kuljanishvili et al. (2020) and it is assumed that it will soon penetrate the Black Sea	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture and self spread	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is recorded from Azerbaijan Armenia and probably exist in Georgia	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes, for example in Iran and Iraq	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	It has not documented, however we might assume that since it is with competition of native alburnus species(Coad and Hussain 2013) it might have adverse impact on commercial taxa	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	It has not been documented however we may assume that since this species feeds on fish eggs and young (Holčík and Razavi, 1992)can have adverse impact to aquaculture	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Can be transmitting deseases	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	There is no information	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	It is not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Since this species is known to grow more rapidly and have higher fecundity in introduced habitats than in native habitats (Esmaeili et al., 2010; Zareian et al., 2015) we may assume that this tax on can smother one or more native taxa	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This fish is very adaptive to variable and environmental conditions and this allows it to breed and established in areas outside their native range (Martin et al 2010).This fish can with stand heavily modified water conditions and is very tolerant to water pollution	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	These fish has the ability to easily modify their food habit as the conditions change (Holčík and Razavi, 1992) therefore it can give us idea that this species actually can disrupt food web structure	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Can be transmitting diseases and can affect recreational fisheries	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	Yes but there is no information about it	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is possible	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	This fish can achieve maximum of 18 centimetres total length	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	This base inhabits large streams and reservoirs (Radkhah et al 2013) however it is not known is this specie is capable of sustaining itself in a range of water velocity conditions	Low
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No information available	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Yes. That is what contributed in its successful spread	Very high
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Yes.It is possible that this species will consume threatened or protected native taxa larvae or eggs	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No info	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	This fish has ability to have higher fecundity in a newly invaded environments (Esmaeili et al., 2010; Zareian et al., 2015). however it's does not exhibit parental care	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	No information availableNo information available	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No See: https://www.fishbase.se/summary/4755	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	It can spawn 16 times during the season and the potential annual fecundity was something around 200,000 oocytes over the whole spawning season (Wang et al 2014). high annual fecundity is likely to be one of the factors of successful invasion of this fish in a new environment (Wang et al 2014).	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Maturity occurs over one year (Mousavi-Sabet et al 2019)	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture and self spread	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Yes	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Yes. It is possoible	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Does not migrate for reproduction	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	We do not know about it	Low
43	7.09	Is dispersal of the taxon density dependent?	No	No information about it	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Polution and salinity	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No. This is less likely.	High

47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Can tolerate polluted environments	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No information	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No. No effective natural enemies present in RA area	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Increased temperatures will cause this species establish in higher altitudes	Very high
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It might favour by environmental changes (caused by climate change) that will increase resource availability, resulting their widespread.	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Population densities will increase making them on one hand impossible to eradicate and on the other hand, affecting native organisms due to competition, that does not leave much resources for native ones.	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Difficult to judge	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Under the predicted future climatic conditions, this species will disperse even wider, that will itself create the problem for native aquatic organisms.The widespread and abundance of this fish which is quite adaptive and plastic to different environmental conditions, will increase its impact on ecosystem services and socio-economic factors. For example: transmission of diseasesIt can also affect aquaculture and recreational fisheries	High

Statistics	
Scores	
BRA	**32.0**
BRA Outcome	**-**
BRA+CCA	**42.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**14.0**
1. Domestication/Cultivation	*-2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**18.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*5.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*4.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**12**
Environmental	**14**
Species or population nuisance traits	**20**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.74**
BRA	**0.73**
CCA	**0.79**

Date and Time
21/05/2022 14:15:42

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Hypophthalmichthys molitrix*
Common name	silver carp
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	Is regularly stocked in South Caucasus
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Xenocyprididae (East Asian minnows)
Native range	China
Introduced range	Europe and Middle East, USA
URL	https://www.fishbase.de/summary/Hypophthalmichthys-molitrix.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	CABI, 2021. Hypophphalmichthys molitrix (Silver carp). https://www.cabi.org/isc/datasheet/79036 (accessed septemebr 2021)	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Not a documented evidnece however based on personal data the species is captured in wild and sold in it native areas	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Other congeners	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Based on Climatch algorythm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Have been detected in eDNA in wild (Beridze et al. 2022)	Medium
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquacltural purpose	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	The species can be found in many areas with RA area (Beridze et al 2022)	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	CABI, 2021. Hypophphalmichthys molitrix (Silver carp). https://www.cabi.org/isc/datasheet/79036 (accessed septemebr 2021)	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	CABI, 2021. Hypophphalmichthys molitrix (Silver carp). https://www.cabi.org/isc/datasheet/79036 (accessed septemebr 2021)	Low
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evidences exists	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	CABI, 2021. Hypophphalmichthys molitrix (Silver carp). https://www.cabi.org/isc/datasheet/79036 (accessed septemebr 2021)	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	CABI, 2021. Hypophphalmichthys molitrix (Silver carp). https://www.cabi.org/isc/datasheet/79036 (accessed septemebr 2021)	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not harmful species	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	CABI, 2021. Hypophphalmichthys molitrix (Silver carp). https://www.cabi.org/isc/datasheet/79036 (accessed septemebr 2021)	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Not a parasite species	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	No documented evidences exists	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	CABI, 2021. Hypophphalmichthys molitrix (Silver carp). https://www.cabi.org/isc/datasheet/79036 (accessed septemebr 2021)	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No documented evidences exists from other areas	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Not such pest/parasites are known from the RA area	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	This is expected though not documented	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Growing over 1 m in length	High

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Lotic systems or slowly moving water bodies only	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Not known, not a documented evidence exists.	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Stuck JG, Porreca AP, Wahl DH, Colombo RE (2015) Contrasting population demographic of invasive silver carp between an impounded and free-flowing river. North American Journal of Fisheries Management 35: 114–122, http://dx.doi.org/10.1080/0275 5947.2014.986343	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No documented evidence exists	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Based on professional judgement though no documented evidences exists	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Not reported yet	Medium
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No such case is knwon	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Not a documented evidence exists	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	It completes its life cycle without any other species	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Half a milion of eggs per year - Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	5	years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Species is intentionally introduced to water bodies for recreational prurposes while its suveniles can also unintentionaly be spread as a hitchicker	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Along the Black Sea Within RA area there is great chance for thsi species to occure in PA using the intentionally or through water currents	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such fact has ever been observed	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	Eggs need to drift before hutching - Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No such an evidence exists	Low
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence is known	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	The eggs can be spread with large quantity through water currents	High
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence exists	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No documented evidence exists	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No documented evidence exists	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No documented evidence exist	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Not expected, no documented evidence exist	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documented evidence exist	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Based on professional judgement	High
C. Climate change					
9. Climate change					

50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgement	Low

Statistics	
Scores	
BRA	**24.0**
BRA Outcome	**-**
BRA+CCA	**34.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**19.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**5.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*2.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*2.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**16**
Environmental	**10**
Species or population nuisance traits	**12**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.58**
BRA	**0.62**
CCA	**0.25**

Date and Time
16/05/2022 13:17:19

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Hypophthalmichthys molitrix*
Common name	silver carp
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	H. molitrix has long been cultivated in China. By weight, more silver carp are produced worldwide
Risk assessment area	South Caucasus
Taxonomy	Hypophthalmichthys molitrix (Valenciennes, 1844)
Native range	Asia: Native to most major Pacific dainages of East Asia from Amur to Xi Jiang, China and Hanoi,
Introduced range	Introduced around the world for aquaculture and control of algal blooms. The species has also been
URL	https://www.fishbase.in/summary/274

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	This fish is one of among 3 or 4 species of cyprinids whose world production in aquaculture exceeds 1 million tons per year.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Own data	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Several countries report adverse ecological impact after introduction of H. molitrix.	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	World Map of the Köppen-Geiger climate classification	Medium
5	2.02	What is the quality of the climate matching data?	Medium	World Map of the Köppen-Geiger climate classification	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	It was introduced in Georgia from China and now it is distributed in Jandari, Kumisi, Lisi lakes and in other places (Ninua et al.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species enters the region by human intentionally for aquacultural purposes.	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is already occuring in the SC region. As for the neighbouring regions, H. molitrix introduced to Iran from China in 1992.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Data deficient	Medium
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	In the USA native fishes are likely already being impacted by reduced phytoplankton available for feeding in areas where silver carp are found.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Such a fact is not known	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Such a fact is not known	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	The Commercial Fishing Industry depends heavily on the health and ecological state of the Great Lakes, USA. The total value of the Commercial Fisheries in the Great Lakes during 2011 was over $33 million dollars. The presence of Asian carp would have multiple impacts, including: Increased costs and decreased revenues for commercial harvesters. Small prey fish of commercially fished species would be impacted through direct consumption by Asian carp. Increased competition for food resources with young and mature native species. This decrease in revenue would in turn reduce the level of gross profits and	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Planktivorous Silver Carp Hypophthalmichthys molitrix and Bighead Carp H. nobilis have successfully invaded much of the Upper Mississippi River System and its tributaries during the last 30 years. During the initial years of the invasion, concurrent declines in the body condition and the catch per unit effort (CPUE) of planktivorous Gizzard Shad Dorosoma cepedianum and Bigmouth Buffalo Ictiobus cyprinellus were attributed to competition with Asian carp (Pendleton et al. 2017).	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are several threathened and protected species in the SC region which may have been under pressure of H. molitrix, e.g. Luciobarbus capito, L. mursa, Salmo spp, Acipenser spp, etc.	Medium
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Own judgement	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	H. molitrix threaten to invade the Great Lakes and disrupt aquatic food webs and fisheries in USA (Zhang et al. 2011). This is expected to happen in the SC region.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	It is not expected that this will happen	Medium

20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	It is difficult to assess this because relevant studies have not been conducted	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	Whether bigheaded carps act as carriers and/or hosts for exotic and native parasitic and infectious diseases is largely unknown. The prevalence of infectious diseases in bigheaded carps is also largely unknown.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	H. molitrix is widely used in aquaculture. Its max length is 120 cm. Common length : 18.0 cm, max. published weight: 50.0 kg	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Found in their natural range in rivers with marked water-level fluctuations and overwinters in middle and lower stretches, swimming just beneath the surface. They feed in shallow (0.5-1.0 m deep) and warm (over 21°C) backwaters, lakes and flooded areas with slow current on phytoplankton and zooplankton.	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Data deficient	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	H. molitrix is plankton-feeding species and consumption of protected species by it has not been recorded in the SC region.	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	This species is a competitor to local species	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	Data deficient	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	This species does not breed in the region	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Such a fact is not known	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Such a fact is not known	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Own judgement	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Fecundity of H. molitrix is 500000-600000 eggs (Ninua et al. 2013).	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	5	H. molitrix sexually maturates at the age of 5-6 (Ninua et al. 2013).	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species is spread by humans in the SC region (Ninua et al. 2013).	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	There is a probability of this	Low
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not have such means.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	This species does not reproduces in the SC region.	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	This species does not reproduces in the SC region.	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species does not reproduces in the SC region.	Medium
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has been detected	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Yes	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been described	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Found in their natural range in rivers with marked water-level fluctuations and overwinters in middle and lower stretches, swimming just beneath the surface (fishbase.org).	Low

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Own judgement	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species is spread by humans for aquacultural purposes	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	H. molitrix can tolerate salinities up to 12 ppt and low dissolved oxygen (3mg/L).	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several predators distributed in the SC region which can controll the H. molitrix populations, e.g. Esox lucius, Silurus glanis, Squalius spp, Sander lucioperca, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	Medium

Statistics	
Scores	
BRA	**20.5**
BRA Outcome	**-**
BRA+CCA	**18.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**12.5**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*7.5*
B. Biology/Ecology	**8.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*2.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*3.0*
C. Climate change	**-2.0**
9. Climate change	*-2.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**8**
Environmental	**3**
Species or population nuisance traits	**10**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.60**
BRA	**0.61**
CCA	**0.50**

Date and Time

05/05/2022 19:51:22

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Hypophthalmichthys molitrix*
Common name	silver carp
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Has been introduced worldwide for Aquaculture and algae control
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Xenocyprididae
Native range	East China and Russia
Introduced range	South Caucasus (Arm, Azr Geo)
URL	https://www.fishbase.se/summary/Ctenopharyngodon-idella.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	It has beeen grown in aquaculture facilities more than 20 generations	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes. Taxon is harvested in wild and is sold in its live form	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	for example Hypophthalmichthys nobilis and Ctenopharyngodon idella	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	The climate is more or less similar out of 19 stations, 15 match at value 9 (out of 10).	High
5	2.02	What is the quality of the climate matching data?	Medium	Climatch data is medium since there are not much station on the RA area	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is released in ponds and rivers in RA area	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture, recreational fisheries	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is released in ponds and rivers in RA area	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes. has become naturalised for example in Taiwan (Thang 1960).	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	negative impact inculde the shaping of zooplanctonic comunities and predation pressure (competiton) on other planktonivorous species (Spataru & Gophen 1985)	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	it is not known, but possibly the competition with native planktonivorous fish can affect the aquaculture (Spataru & Gophen 1985)	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	affects native fish fauna via shaping the zooplanktonic organisms	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	It is not known	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	They have ability to fine filter the water and also they grow very fast and can form dence populations, they are versatile in terms of feeding and this can often lead to habitat alterations amd disruption of food webs and nutrient cycles in new invaded ecosystems (Milstein et al. 1988; Cooke et al. 2009; Gozlan et al. 2010; Ma et al. 2010; Rosemberg et al. 2010. Such changes as zooplankton and phytoplancton exploatation, shaping the fish communities can affect native fishes populations that are sharing	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	yes foe example, in India and Bangladesh	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	They have ability to fine filter the water and also they grow very fast and can form dence populations, they are versatile in terms of feeding and this can often lead to habitat alterations amd disruption of food webs and nutrient cycles in new invaded ecosystems (Milstein et al. 1988; Cooke et al. 2009; Gozlan et al. 2010; Ma et al. 2010; Rosemberg et al. 2010.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	it is possible, however, it should be mentioned that they are not known to be independently reproducting in RA	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	Possible, but not documented	Medium

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	it is possible. However, it is not documented.	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	yes	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	in their natural habitat they migrate upstreams for reproduction.	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	They have ability to fine filter the water and also they grow very fast and can form dence populations, they are versatile in terms of feeding and this can often lead to habitat alterations and disruption of food webs and nutrient cycles in new invaded ecosystems (Milstein et al. 1988; Cooke et al. 2009; Gozlan et al. 2010; Ma et al. 2010; Rosemberg et al. 2010)	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	depending on the water and weather conditions	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	It is not known	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Yes it is possible	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No information available	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	As far as it is known, No.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.de/summary/Hypophthalmichthys-molitrix.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	females lay 500 000 eggs in one or seveal seasons depending on conditions	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	4	4-5 years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture and recreational fisheries	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Yes. it is possible	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. Because does not reproduce in RA	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	They do not produce viable gametes and therfore can be distributed by larvae, or juveniles.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Do notreproduce therefore, does not migrate.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Yes, It seems to be rapid	Very high
43	7.09	Is dispersal of the taxon density dependent?	Yes	Yes, it is possible.	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information	Low
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	"Tolerant of a wide range of temperatures from 0° to 38°C, and salinities to as much as 10 ppt and oxygen levels down to 0.5 ppm."https://www.fishbase.se/summary/Ctenopharyngodon-idella.html	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	yes it can be	Medium

47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information. probably not.	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	no, iT can maximum tolerate salinity levels up to 7%o.	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No. No effective natural enemies present in RA area	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	if the temperatures increase, it will make their populations able to reproduce indipendently, therefore the risk of their potential impact is increasing	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Dispersal might increase	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	It could be higher. Because it is known that they create dance populations when they reproduce in new environments and creating problems for the native species	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	The magnitude of future potential impact on ecosysytem structure and function is increasing	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No Change	High

Statistics	
Scores	
BRA	**24.0**
BRA Outcome	**-**
BRA+CCA	**34.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**16.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*10.0*
B. Biology/Ecology	**8.0**
4. Undesirable (or persistence) traits	*10.0*
5. Resource exploitation	*2.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**11**
Environmental	**12**
Species or population nuisance traits	**16**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.78**
BRA	**0.78**
CCA	**0.79**

Date and Time
21/05/2022 14:19:36

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Hypophthalmichthys nobilis*
Common name	bighead carp
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	Is regularly stocked in South Caucasus
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Xenocyprididae (East Asian minnows)
Native range	China
Introduced range	Worldwide
URL	

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	e.g. Tave, D. (1993). Growth of triploid and diploid bighead carp, Hypophthalmichthys nobilis. Journal of Applied Aquaculture, 2(2), 13-26.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	The Species is usually harvested and sold in its live form in native areas as well as from aquaculture	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congeners	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Result climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	Not such an evidence exist	Medium
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquacultural purpose	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	No such an evidence exists	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	CABI, 2021. Hypophphalmichthys nobilis (Bighead carp). https://www.cabi.org/isc/datasheet/92426 (accessed septemebr 2021); Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	No documented evdience, only expected	Low
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evdience exist	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	No documented evdience exist, only expected	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Welcomme, R.L., 1988. International introductions of inland aquatic species. FAO Fish. Tech. Pap. 294. 318 p.	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	No documented evdience exist	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Not a parasite species	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Based on its invasion history - CABI, 2021. Hypophphalmichthys nobilis (Bighead carp). https://www.cabi.org/isc/datasheet/92426 (accessed septemebr 2021)	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	No documented evdience exist	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Not expected - CABI, 2021. Hypophphalmichthys nobilis (Bighead carp). https://www.cabi.org/isc/datasheet/92426 (accessed septemebr 2021)	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Not expected and no documented evdience exist	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Expected but no documented evdience exist	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Not expected - CABI, 2021. Hypophphalmichthys nobilis (Bighead carp). https://www.cabi.org/isc/datasheet/92426 (accessed septemebr 2021)	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No documented evdience exist	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Not expected	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Based on professional judgement, no repsective evidence exists	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Not expected	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Usually reproducing sexually	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Species can complete its lifecycle without any other species	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	5	Years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Species is intentionally introduced to water bodies for recreational prurposes while its suveniles can also unintentionaly be spread as a hitchicker	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Because of large number of eggs/juveniles produced that are able to cover lareg distace through water curretns	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence exists	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Eggs are free floating and juveniles also drifting through water currents	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No such an evidence exists	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence exists	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Due to a large number of eggs produced that are freely floating through water cuurents	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No relevant information is available	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not expected and no such an evidence exists	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such an evidence exists	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No such an evidence exists	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No such an evidence exists	Low

C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgement	Medium

Statistics	
Scores	
BRA	**28.0**
BRA Outcome	**-**
BRA+CCA	**38.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**18.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**10.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*2.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*2.0*
8. Tolerance attributes	*3.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**15**
Environmental	**9**
Species or population nuisance traits	**17**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.63**
BRA	**0.64**
CCA	**0.50**

Date and Time
16/05/2022 13:24:54

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Hypophthalmichthys nobilis*
Common name	bighead carp
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	H. nobilis has long been cultivated in the world. This species is a good object for pond fishery. It
Risk assessment area	South Caucasus
Taxonomy	Hypophthalmichthys nobilis (Richardson, 1845)
Native range	It is a native freshwater fish in China, with a broad distribution from the drainage areas of the
Introduced range	Though it has been introduced into many other countries (mainly Asia and Eastern Europe), very
URL	https://www.fishbase.se/summary/275

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	This species has a trade importance and considered as good object for pond fishery (Ninua et al. 2013).	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	The broodstock used for artificial propagation is usually raised in captivity with seed from the wild or from breeding stations, where good natural stock are maintained.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Several countries report adverse ecological impact after introduction of H. nobilis. This fish is considered as serious invasive species in the USA.	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	World Map of the Köppen-Geiger climate classification	Medium
5	2.02	What is the quality of the climate matching data?	Medium	World Map of the Köppen-Geiger climate classification	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Own data	Medium
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species is enters in the SC region by humans for aquacultural purposes	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is acclimatized in the neighbouring countries of the SC region (Iran, Turkey).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	As noted by Jennings (1988), there is a lack of specific information on longevity and mortality of naturalized or indigenous populations of Bighead Carp in USA (Kolar et al. 2005).	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	USGS-NAS (2005) reports that, "Because bighead carp are planktivorous and attain a large size, Laird and Page (1996) suggested these carp have the potential to deplete zooplankton populations. A decline in the availability of plankton can lead to reductions in populations of native species that rely on plankton for food, including all larval fishes, some adult fishes, and native	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	The spread of this species adversely affects commercial fishery in parts of the Mississippi River Basin, USA (Maher 2005).	Very high
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Data deficient	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Hypophthalmichthys nobilis has a high potential socio-economic impact in the Great Lakes, USA.	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Because bighead carp are planktivorous and attain a large size, Laird and Page (1996) suggested these carp have the potential to deplete zooplankton populations. As Laird and Page pointed out, a decline in the availability of plankton can lead to reductions in populations of native species that rely on plankton for food.	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are several protected and threathened species in the SC region which may be affected by this species: e.g. Cyprinus carpio, Luciobarbus capito, etc.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	This species does not reproduces in the SC region.	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	There is such a risk.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Such a risk is unlikely	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficient	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Bighead carp are often infected with bacterial and parasitic diseases (Kolar et al. 2005).	High

22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length is 146 cm SL male/unsexed; common length : 60.0 cm TL male/unsexed; max. published weight: 40.0 kg. Therefore this fish is good object for fishery.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	In its natural environment, it occurs in rivers with marked water-level fluctuations, overwinters in middle and lower stretches.	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Adult bighead, silver, and hybrid carp are invavsive species of fish that spread quickly once they are established in a water body. These carp damage habitat and reduce water-quality for native fish.	Very high
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	The minimum numbers of bighead and silver carp required to maintain a viable population in the Great Lakes.	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No such fact has been detected.	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	There is a probability of that.	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	Data deficient	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	This species does not reproduces in the Caucasus region.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Data deficient	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	Bighead and silver carps are successfully maturing and spawning in the Missouri River some reproductive abnormalities such as intersex, atresia, and sterility were observed.	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such data available	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	This fish sexually matures at the age of 4-7 and fecundity is about 500 000 eggs.	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	4	This fish sexually matures at the age of 4-7 (Ninua et al. 2013).	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species can only disperse within the SC region by humans.	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	There is a probability of that.	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not has such means	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	This species does not reproduces in the SC region.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	This species does not reproduces in the SC region.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species does not reproduces in the SC region.	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has been detected	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Yes	Own judgement	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been described.	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Soft water has been said to cause the bursting of Bighead carp eggs and thus has been suggested as a factor that would limit the spread of this species (Chapman and Deters 2009).	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	The toxicity of many chemicals to bighead, grass, and silver carps has been examined (13 chemicals, 34 studies for bighead carp; 75 chemicals, 233 studies for grass carp; 21 chemicals, 83 studies for silver carp; Pesticide Action Network 2005). Rotenone and antimycin are the only registered piscicides available to potentially control Asian carps in the United States without considerable additional expense.	Very high
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	In meny countries this species is spread with human help.	High

48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	In aquaculture, adults can survive brackish water (up to 7 ppt) when released into estuaries and coastal lakes.	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	Yes	There are several predators in the SC region which can controll the H. nobilis populations: Esox lucius, Silurus glanis, Squalius	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	Medium

Statistics	
Scores	
BRA	**25.5**
BRA Outcome	**-**
BRA+CCA	**19.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**18.5**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*13.5*
B. Biology/Ecology	**7.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*2.0*
6. Reproduction	*0.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*1.0*
C. Climate change	**-6.0**
9. Climate change	*-6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**11**
Environmental	**4**
Species or population nuisance traits	**7**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.65**
BRA	**0.66**
CCA	**0.50**

Date and Time
10/05/2022 17:35:01

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Hypophthalmichthys nobilis*
Common name	bighead carp
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Introduced for aquaculture and algae control
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Xenocyprididae
Native range	Asia. China
Introduced range	Worldwide
URL	https://www.fishbase.se/summary/Hypophthalmichthys-nobilis.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	It has been grown in aquaculture facilities more than 20 generations	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes. Taxon is harvested in wild and is sold in its live form	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	for example Hypophthalmichthys moltrix and Ctenopharyngodon Idella	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	The climate is more or less similar out of 19 stations, 15 match at value 9 (out of 10).	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Climatch data is medium since there are not much station on the RA area	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is released in ponds and rivers in RA area	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture, recreational fisheries	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is released in ponds and rivers in RA area	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes. has become naturalised for example in Taiwan (Thang 1960).	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	negative impact inculde the shaping of zooplanctonic comunities and predation pressure (competiton) on other planktonivorous species (Spataru & Gophen 1985)	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	It is not known, but possibly the competition with native planktonivorous fish can affect the aquaculture	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	affects native fish fauna via shaping the zooplanktonic organisms	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	it is not known	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Chinese carps have ability to fine filter the water and also they grow very fast and can form dence populations, they are versatile in terms of feeding and this can often lead to habitat alterations amd disruption of food webs and nutrient cycles in new invaded ecosystems (Milstein et al. 1988; Cooke et al. 2009; Gozlan et al. 2010; Ma et al. 2010; Rosemberg et al. 2010. Such changes as zooplankton and phytoplancton exploatation, shaping the fish communities can affect native fishes populations that are sharing the same niche.	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Yes for example, in India and Bangladesh	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	They have ability to fine filter the water and also they grow very fast and can form dence populations, they are versatile in terms of feeding and this can often lead to habitat alterations and disruption of food webs and nutrient cycles in new invaded ecosystems (Milstein et al. 1988; Cooke et al. 2009; Gozlan et al. 2010; Ma et al. 2010; Rosemberg et al. 2010.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	It is possible, however, it should be mentioned that they are not known to be independently reproducting in RA	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	Possible, but not documented	Medium

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	it is possible. However, it is not documented.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	yes See: https://www.fishbase.se/summary/Hypophthalmichthys-nobilis.html	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	No information avalable	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	They have ability to fine filter the water and also they grow very fast and can form dence populations, they are versatile in terms of feeding and this can often lead to habitat alterations and disruption of food webs and nutrient cycles in new invaded ecosystems (Milstein et al. 1988; Cooke et al. 2009; Gozlan et al. 2010; Ma et al. 2010; Rosemberg et al. 2010)	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	depending on the water and weather conditions	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Not known	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Yes, it is possible	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No doe not exhibit parental care. See: https://www.fishbase.se/summary/Hypophthalmichthys-nobilis.html	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No. climate is not suitable	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	they can be triploids usually for fisheries production	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.se/summary/Hypophthalmichthys-nobilis.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	yes, produces up to 100 000 eggs per season	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	5	5-6 years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture and recreational fisheries	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Yes. it is possible	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. Because does not reproduce in RA	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	They do not produce viable gametes and therfore can be distributed by larvae, or juveniles.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Do not reproduce therefore, does not migrate.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Yes, It seems to be rapid	High
43	7.09	Is dispersal of the taxon density dependent?	Yes	Yes, it is possible	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information about it	Low

45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	No	Forages in shallow (0.5-1.5 m deep) and warm (over 24°C) backwaters, lakes and flooded areas with slow current. Feeds on zooplankton throughout its life under natural conditions (Ref. 120904). Breeds in very deep, very turbid and warm water above 18°C (usually 22-30°C), with high current (1.1-1.9 m/s) and high oxygen concentrations. Stocked to large rivers and almost all still water bodies as lakes and ponds. In aquaculture, adults can survive brackish water (up to 7 ppt) when released into estuaries and coastal lakes''	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Yes it can be	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information, probably not	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No, iT can maximum tolerate salinity levels up to 7%o.	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No.No effective natural enemies present in RA area	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	if the temperatures increase, it will make their populations able to reproduce indipendently, therefore the risk of their potential impact is increasing	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It could be higher. Because it is known that they create dance populations when they reproduce in new environments and creating problems for the native species	Very high
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	The magnitude of future potential impact on ecosysytem structure and function is increasing	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	No change	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	NO change	High

Statistics	
Scores	
BRA	**27.0**
BRA Outcome	**-**
BRA+CCA	**35.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**20.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**7.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*2.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*-4.0*
C. Climate change	**8.0**
9. Climate change	*8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**15**
Environmental	**10**
Species or population nuisance traits	**15**

Thresholds

BRA	-
BRA+CCA	-
Confidence	
BRA+CCA	0.75
BRA	0.74
CCA	0.83

Date and Time
21/05/2022 14:23:56

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Ictalurus punctatus*
Common name	channel catfish
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species was introduced to the RA area in the past. Most probably not yet established, but could
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Siluriformes (Catfishes) > Ictaluridae (North American freshwater
Native range	North America
Introduced range	Worldwide sporadicaly
URL	https://www.fishbase.de/summary/Ictalurus-punctatus.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Welcomme RL, 1988. International introductions of inland aquatic species. FAO Fisheries Technical Paper, No. 294:x + 318 pp	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	The species is introduced more than 30 countries and in many cases captured in wild. Actually the species is actively aquaculterd though the wild catch and selling its life forms is still a usuall	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	Not known other congeneres or a specific race as invasive	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Results of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Invasive Species Compendium, Datasheet report for Ictalurus punctatus (channel catfish) https://www.cabi.org/isc/datasheetreport/79127	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	None	Human mediated translocation	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Invasive Species Compendium, Datasheet report for Ictalurus punctatus (channel catfish) https://www.cabi.org/isc/datasheetreport/79127	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Haubrock, P. J., Azzini, M., Balzani, P., Inghilesi, A. F., & Tricarico, E. (2020). When alien catfish meet—Resource overlap between the North American Ictalurus punctatus and immature European Silurus glanis in the Arno River (Italy). Ecology of Freshwater Fish, 29(1), 4-17.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	Although the species is an oportunistic predator, no hard evidences exists on its adverse impact on wild stock	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	CABI, 2022. Ictalurus punctatus. In: Invasive Species Compendium. Wallingford, UK: CAB International.	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	CABI, 2022. Ictalurus punctatus. In: Invasive Species Compendium. Wallingford, UK: CAB International.	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not reported	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	It possesses toxic difence mechanisms but not the negative effect on human is reported	Medium
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	The species at least partly competes at least with native Silurus glanis for food (Haubrock, P. J., Azzini, M., Balzani, P., Inghilesi, A. F., & Tricarico, E. (2020). When alien catfish meet—Resource overlap between the North American Ictalurus punctatus and immature European Silurus glanis in the Arno River (Italy). Ecology of Freshwater Fish, 29(1), 4-17).	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	Since it is active predator, any other fishes in the RA area can be smoothered	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Based on the widespread distribution of the species, its adaptability of diverse environmental conditions can be deduced	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	Not documented evidence exist	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Is expected due to its predatory lifestyle	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Not expected	High
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	e.g. Geng, Y., Wang, K., Chen, D., Huang, X., He, M., & Yin, Z. (2010). Stenotrophomonas maltophilia, an emerging opportunist pathogen for cultured channel catfish, Ictalurus punctatus, in China. Aquaculture, 308(3-4), 132-135.	High

22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	It is also kept for recreational purpose and can reach the size unsuitable for a small bodyed water reserviors	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	As the species can live in a diverse types of waterbodies	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No such an effect is documented	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No such an evidence exists	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Th species is predator and consums wide variety of freshwater animals	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	E.g. Silurus glanis	Very high
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	The species exhibit parental care behavior	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No documented evidence	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	(Arias, C. R., Cai, W., Peatman, E., & Bullard, S. A. (2012). Catfish hybrid Ictalurus punctatus× I. furcatus exhibits higher resistance to columnaris disease than the parental species. Diseases of aquatic organisms, 100(1), 77-81.)	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Not such an evidence is known	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Species does not depend on any particular taxa	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Usually produces thousands of eggs annually	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	Years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	By human mediated translocations as well as direct dispersal using channel system	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Colchis national park	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such fact is sknown	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such an evidence exists	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Expected though no documented evidence exist	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not a migrant species	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Not expected and not observed	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	Not expected	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence exists	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not a documented evidence exists	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No relevan research reports are available	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such a practice is known	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Not expected and no documented evidence	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No evidence that it tolerates more variable level than presented in tis native areas	Low

49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	There is no effective natural enemy in RA area	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgment	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgment	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgment	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Species is not currently established in the region. If it will establish in the future, given the changing climate conditions, the effect on biodiversity/ecological integrity is expected	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Species is not currently established in the region. If it will establish in the future, given the changing climate conditions, the effect on biodiversity/ecological integrity is expected	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Species is not currently established in the region. If it will establish in the future, given the changing climate conditions, the effect on biodiversity/ecological integrity is expected	Low

Statistics	
Scores	
BRA	**26.0**
BRA Outcome	**-**
BRA+CCA	**32.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**12.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*10.0*
B. Biology/Ecology	**14.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*7.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**10**
Environmental	**15**
Species or population nuisance traits	**9**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.59**
BRA	**0.62**
CCA	**0.38**

Date and Time
16/05/2022 14:13:10

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Ictalurus punctatus*
Common name	channel catfish
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Interest in channel catfish began when the United States Fish and Fisheries Commission began
Risk assessment area	South Caucasus
Taxonomy	Ictalurus punctatus (Rafinesque 1818)
Native range	North America: St. Lawrence-Great Lakes, Hudson Bay (Red River drainage), and Missouri-
Introduced range	Introduced throughout most of US. Channel catfish have been introduced into Europe, Russian
URL	https://www.fishbase.in/summary/ictalurus-punctatus.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Commercial aquaculture was first considered to be economically practical in the late 1950s. Catfish farming developed rapidly during the 1960s and 1970s as improvements in pond management, disease identification and control, and prepared feeds were developed and adopted by farmers. The commercial industry developed in the southern United States within the original range of the species. At least 90 percent of the farmed fish are produced in the Mississippi River Valley region.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Catfish are the most consumed native freshwater fish in the US (NASS 2006). Although commercial aquaculture produces most catfish consumed (NASS 2006), free living populations of channel catfish (Ictalurus punctatus) still provide important sport and commercial fisheries throughout the US.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	I. punctatus recorded as invasive species in 28 cauntries and iselands. The North American channel catfish Ictalurus punctatus has been introduced to several locations in Europe but has received little or no scientific study despite its invasive attributes, including prolific reproduction, tolerance to a wide range of conditions, opportunistic feeding, at least partial 'predator release', and some evidence of environmental impacts (e.g. disease transmission) (Haubrock et al. 2021).	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Koppen - Geiger climate classification	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Koppen - Geiger climate classification	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No such fact has been detected	Low
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species may be spread by humans intentionally.	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	There appears to be some disagreement regarding the presence of the channel catfish in Turkey; Cildir (2001) reported that its introduction into Lake Egirdir was unsuccessful. However, it is listed as being present in a report listing its use in aquaculture and stocking operations (Olenin et al., 2008) and in reservoir systems (Innal and Erk'akan, 2006; Innal, 2012).	Low
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	The channel catfish, Ictalurus punctatus, is an invasive alien species introduced from North America. We investigated the present status of the fish in Japan and found that it is widely distributed in the Abukuma, Tone, and Yahagi River systems, as well as in Lake Shimokotori (Katano et al. 2010).	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	In the metric "Relative Impact Potential" (RIP), the functional response (FR) of a non-native species can be compared with that of a native analogue and combined with the species abundance to predict its environmental impact. Here, using the River Guaraguaçu (Brazil) as a case study, this methodology was implemented to identify the impacts of the non-native channel catfish Ictalurus punctatus (Rafinesque) compared with a native species Rhamdia quelen (Quoy & Gaimard) towards small prey fish. Both species exhibited Type II FRs, but handling times were lower for I. punctatus, resulting in a greater maximum feeding rate in this species. Consequently, an RIP > 1 was found, indicating that I. punctatus represents a superior impact to prey compared with its native analogue. These results demonstrate that I. punctatus is a potential threat to small endangered fish	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	This species has been introduced to at least 11 countries but the ecological and economic impacts of this nonnative species are fairly unknown throughout most of its introduced range	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	No	This species has been introduced to at least 11 countries but the ecological and economic impacts of this nonnative species are fairly unknown throughout most of its introduced range	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	This species has been introduced to at least 11 countries but the ecological and economic impacts of this nonnative species are fairly unknown throughout most of its introduced range	Low
B. Biology/Ecology					

4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Invasive channel catfish exerted heavy predation on P. clarkii and P. parva in Japan opposed to available native prey (Endo et al. 2015)	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are meny threatened and protected species in the Caucasus region which can be hunted by this species (Salmo spp, Acipencer spp, Luciobarbus capito, etc.)	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Own judgement	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	Introduced channel catfish can exert a major negative effect on populations of native and endangered species, and commercial fisheries, through competition for food, habitat or through predation (cabi.org).	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	A similar fact is to be expected because I. punctatus is an aggressive predator and can have a negative impact on local fish	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficient	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	Data deficient	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length: 132 cm TL male/unsexed; common length: 57.0 cm SL male/unsexed; max. published weight: 26.3 kg.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Inhabits lakes and deep pools and runs over sand or rocks in small to large rivers. Adults occur in rivers and streams and prefer clean, well oxygenated water, but also in ponds and reservoirs.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Studies in this regard are not known it is expected, however, that habitat quality will be affected by its distribution.	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	With an optimum water temperature range between 24 and 30 °C, channel catfish possesses the demonstrated ability to establish self-sustaining populations outside its native range, both when translocated within North America and introduced elsewhere.	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	This species is predator and can consume as threathened and protected species in the Caucasus Region, such as Salmo spp, Acipencer spp, Luciobarbus capito, etc.	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	This species is predator and will be a serious competitor for local species	Very high
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Behavioral observations have suggested that Channel Catfish spawn as monogamous pairs and that males alone provide subsequent care to the resulting embryos and fry (Tatarenkov et	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	So far this species cannot reproduce in the region	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Data deficient	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Data deficient	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Data deficient	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Channel catfish requires cool water and short day lengths during the winter months for proper egg development; an egg mass can contain up to 20,000 eggs. Sexual maturity is reached at 2-3	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	Sexual maturity in Channel catfish is reached at 2-3 years.	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species may spread as a result of escaping from the fish farms	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	The probability of this is high (own judgement)	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not have such means	Medium
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	This species does not reproduces in the region	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	This species does not reproduces in the region	High

40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species does not reproduces in the region	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Such fact has not been detected yet	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been detected	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Inhabits lakes and deep pools and runs over sand or rocks in small to large rivers. Adults occur in rivers and streams and prefer clean, well oxygenated water, but also in ponds and reservoirs.	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	Data deficient	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This fish is spread mainly from the fish farms	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Channel catfish fry were more resistant to saltiness than hybrid catfish and blue catfish ($P< 0.0001$) at 6.0 ppt for swim-up fry (Abass & Dunham 2017).	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	Channel catfish has a limited number of natural predators, which include pikeperches Sander spp. (Scott and Crossman 1973; Hanchin et al. 2002), cormorants Phalacrocorax spp., herons Ardea spp., pelicans Pelecanus spp. and otters (Lutra lutra). Younger (smaller) channel catfish are particularly susceptible to avian predators (Glahn and Dorr 2002; Wywialowski 1999). However, despite its strongly piscivorous diet, the northern pike Esox lucius is not likely to take ictalurid catfishes. In the Caucasus region only Otter and Sander lucioperca can be considered as potential natural enemies of I. punctatus.	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Own judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Own judgement	Low

Statistics	
Scores	
BRA	**28.0**
BRA Outcome	**-**
BRA+CCA	**40.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**10.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*6.0*
B. Biology/Ecology	**18.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*7.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*-4.0*
8. Tolerance attributes	*5.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**

1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**9**
Environmental	**13**
Species or population nuisance traits	**19**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.59**
BRA	**0.63**
CCA	**0.25**

Date and Time	
10/05/2022 19:07:02	

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Ictalurus punctatus*
Common name	channel catfish
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Aquaculture species
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Siluriformes (Catfish) > Ictaluridae
Native range	North America
Introduced range	Worldwide
URL	https://www.fishbase.se/summary/Ictalurus-punctatus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Yes. Comercially valuable fish. https://www.fishbase.de/summary/275	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes. Taxon is harvested in wild and is sold in its live form	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No does not have invasive races	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Similar, out of20 stations, 15 matches at the value of 9	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Medium	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No evidence.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquaculture	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Yes. Established in neigbouring areas	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Cultured worldwide, it has been introduced in more than 32 countries including Italy, Brazil, China, Japan and Russia for aquaculture and recreational fisheries. It has been introduced for aquaculture and recreational fisheries to over 32 countries, and widely throughout the USA, and has established itself in most waters to which it has been introduced.	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	it can threaten the wild stocks through predation, hybridization, and competition.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	Channel catfish in the James River estuary in Virginia were reported to prey on blue crab (Callinectes sapidus) and white perch (Morone americana) and are known to eat the spawn of many other commercial sport and fishery species, including Atlantic shad (Alosa sapidissima), blueback herring (A. aestivalis), alewife (A. pseudoharengus) (Menzel, 1945). McGovern and Olney (1988) found M. americana eggs and M. saxatilis eggs and larvae in gut contents of juvenile channel catfish from the Pamunkey River in Virginia.	Very high
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Transmit deseases	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Channel catfish in the James River estuary in Virginia were reported to prey on blue crab (Callinectes sapidus) and white perch (Morone americana) and are known to eat the spawn of many other commercial sport and fishery species, including Atlantic shad (Alosa sapidissima), blueback herring (A. aestivalis), alewife (A. pseudoharengus) (Menzel, 1945). McGovern and Olney (1988) found M. americana eggs and M. saxatilis eggs and larvae in gut contents of juvenile channel catfish from the Pamunkey River in Virginia.	Very high
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	threatenes vulnerable and endangered species such as Rana chiricahuensis (Chiricahua leopard frog) and Gila cypha and others https://www.cabi.org/isc/datasheet/79127#tothreatenedSpecies	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	It was documented that this species was breeding independently in Georgia (Goradze et al 2012)	High

18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	Larval stages feed on midge larvae and pupae. Channel catfish smaller than 102 mm total length (TL) feed primarily on insects; while those larger than 102 mm TL continue to feed on aquatic insects, they also begin to feed on large species of mayflies and caddis flies. Larger fish tend to feed on terrestrial insects, seeds (from elm and cottonwood trees), crayfish, aquatic insect nymphs, snakes, birds, spiders and plant matter https://www.cabi.org/isc/datasheet/79127#tothreatenedSpecies	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Transmit diseases	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	No information	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	No info	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Yes. See: https://www.fishbase.se/summary/Ictalurus-punctatus.html	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Juveniles prefer depths of 50-70 cm while adults go for the deepest water possible (Holland and Peters, 1992); both juveniles and adults prefer areas of slow to moderate currents e.g. less than 60 cm/sec (Holland and Peters, 1992). McMahon and Terrell (1982) however report that current velocities of less than 15 cm/sec are preferred in deep ponds and backwaters and optimal turbidity levels of below 100 ppm.	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No expectation based on professional judgement	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	It is possible	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	It is possible however there is no information about it	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Yes it is possoble	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	males guard the nests	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	"In some trial water bodies, the natural breeding of channel catfishes were observed, proving the existence of independent (self-breeding) population" (Goradze et al 2012)	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	The channel catfish hybridizes with the threatened Yaqui catfish (Ictalurus pricei) in Mexico (Sublette et al., 1990; Kelsch and Jensen, 1997) while in New Mexico, it hybridizes with the native headwater catfish (I. lupus) (Kelsch and Hendricks, 1990). https://www.cabi.org/isc/datasheet/79127#tothreatenedSpecies	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.se/summary/Ictalurus-punctatus.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	can produce 20,000 eggs	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	2-3 years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Aquaculture	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	It is likely	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No. Less likely	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Does not migrate for reproduction	Very high

41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	Not rapid	Very high
43	7.09	Is dispersal of the taxon density dependent?	Yes	It is possible	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	temperature, dissolved oxygen https://www.cabi.org/isc/datasheet/79127#tothreatenedSpecies	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	it is possible but it is very costy and sometimes ineffective	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information avalable	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documentation	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No. No effective natural enemies present in RA area	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Increase	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Increase	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Higher	Very high
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	HIgher	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	higher	High

Statistics	
Scores	
BRA	**33.0**
BRA Outcome	**-**
BRA+CCA	**45.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**20.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**13.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*7.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**

9. Climate change	*6*
Sectors affected	
Commercial	**17**
Environmental	**15**
Species or population nuisance traits	**14**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.75**
BRA	**0.74**
CCA	**0.79**

Date and Time
22/05/2022 21:59:41

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Lepomis gibbosus*
Common name	pumpkinseed
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species extensively used for different purpose in EU and introduced/established in many
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Centrarchiformes (Basses) > Centrarchidae (Sunfishes)
Native range	USA
Introduced range	Parts of Europe, Middle east
URL	https://www.fishbase.de/summary/Lepomis-gibbosus.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	CABI, 2021. Lepomis gibbosus (pumpkinseed). https://www.cabi.org/isc/datasheet/77080 (accessed November 2021)	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	The species is a subject of recreationa fisheries and they are captured in wild and transported to new areas	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congeners	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Results of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of lcal climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	CABI, 2021. Lepomis gibbosus (pumpkinseed). https://www.cabi.org/isc/datasheet/77080 (accessed November 2021)	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquacluture, recreation	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Esteblished in neighbour country (Turkey) - Ağdamar, S., Tarkan, A. S., Keskin, E., Top, N., Doğaç, E., Baysal, Ö., & Emiroğlu, Ö. (2015). The role of environmental factors and genetic diversity on colonization success of a non-native fish, Lepomis gibbosus from western part of Turkey. Biochemical Systematics and Ecology, 58,	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	CABI, 2021. Lepomis gibbosus (pumpkinseed). https://www.cabi.org/isc/datasheet/77080 (accessed November 2021)	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No documented evidence exist	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evidence exist	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No documented evidence exist	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence exist	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Since the species can reach high density and is oportunistic feeder	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	It can consume ;variety of foods including fish eggs and juveniles thus predate on many different threatend taxa	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Is considered warmwater species while is established in northern European countries	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	Expected but not documented	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Possible due to its lifestyle and agressive spread, however not well documented elsewhere	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Not expected	High
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It hosts a number of parasatises/deaseaze that are absent in the region	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	Small bodied species	High

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Avoids fast flowing rivers	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No documented evidence exists	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No documented evidence exists	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	e.g. García-Berthou E; Moreno-Amich R, 2000. Food of introduced pumpkinseed sunfish: ontogenetic diet shift and seasonal variation. Journal of Fish Biology, 57(1):29-40.	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Because species can develop dense populations	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Gross, M.R. and R.C. Sargent, 1985. The evolution of male and female parental care in fishes. Am. Zool. 25(3):807-822.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Expected but not documented evidence	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	CABI, 2021. Lepomis gibbosus (pumpkinseed). https://www.cabi.org/isc/datasheet/77080 (accessed November 2021)	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Species is reproducing sexually (https://www.fishbase.se/)	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such fact is known. It can complete its lifecycle independently	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Only few thousand eggs per year	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Intentional introduction for recreational fisheries, unintentioal introduction as a hitchicker	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Colchis national park along the Black Sea is the most easily attainable	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such beavoir is known	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Not expected	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Juveniles can spread via water currents easily (Copp GH; Cellot B, 1988. Drift of embryonic and larval fishes, especially lepomis gibbosus (L.) in the upper Rhône river. J. Freshwat. Ecol, 4:419-423.)	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No such an vidence is known	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Not expected and not observed	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Less expected because the absence of direct water connection between RA area and the surroundings, however, human mediated introduction with large quantity is possible	Low
43	7.09	Is dispersal of the taxon density dependent?	No	No such fact is known	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact is known	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Salinity and temperature	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No effective eradication evidence exists	Very high
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Almeida D; Almodóvar A; Nicola GG; Elvira B, 2009. Feeding tactics and body condition of two introduced populations of pumpkinseed Lepomis gibbosus: taking advantages of human disturbances? Ecology of Freshwater Fish, 18(1):15-23. http://www.blackwell-synergy.com/loi/eff	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documented evidence exists	Medium

49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Based on professional judgement although no documented evidence exists	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgement	Low

Statistics	
Scores	
BRA	**28.0**
BRA Outcome	**-**
BRA+CCA	**38.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**7.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**21.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*7.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*4.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**8**
Environmental	**12**
Species or population nuisance traits	**22**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.67**
BRA	**0.69**
CCA	**0.54**

Date and Time
16/05/2022 14:29:28

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Lepomis gibbosus*
Common name	pumpkinseed
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	In Europe, the pumpkinseed is considered an invasive species. They were introduced to European
Risk assessment area	South Caucasus
Taxonomy	Lepomis gibbosus (Linnaeus, 1758)
Native range	North America: New Brunswick in Canada south to Savannah River in Georgia, USA; Great Lakes,
Introduced range	Introduced to Europe from North America in the late 1800s (Maes, 1898), L. gibbosus is now
URL	https://www.fishbase.se/summary/Lepomis-gibbosus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	The Pumpkinseed was introduced to Europe in the 1880s for use in outdoor ponds and as aquarium fish (Hanel, 2011, CABI, 2018).	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	The pathways by which the L. gibbosus reached Norway are not known. Pumpkinseed is not commonly sold in aquarium shops in Oslo, but the species is occasionally imported by special order. Pet shop owners in Oslo have mentioned the Czech Republic as the most likely origin of the fish (Sterud and Jørgensen 2006).	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	This species is invasive in Netherlands (Van Kleef et al., 2008), Portugal, Romania, Spain, UK (CABI, 2018), and potentially invasive in Germany (Nehring et al, 2015), Austria (NOBANIS, 2011), Belgium (Anseeuw et al., 2011) and Poland (Grabowska et al, 2010; NOBANIS, 2011). It seems to be able to form established populations in almost all countries in Europe	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	World Map of the Köppen-Geiger climate classification	Medium
5	2.02	What is the quality of the climate matching data?	Medium	World Map of the Köppen-Geiger climate classification	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	Currently this species does not occurring in the SC region.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species may be introduced into the region by humans	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Lepomis gibbosus is now established in at least 28 countries of Europe and in Turkey the species' spread has been especially rapid between 2001 and 2006, with its distribution including the following areas: Kemer Reservoir, Akçay river catchment and inland waters of the Aegean and Anatolian regions (Ozcan 2007).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	L. gibbosus is now established in a minimum of 28 countries in Europe and Asia Minor (Copp and Fox, 2007), with a population reported for Brazil and possibly also Chile.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	The impact of L. gibbosus in Europe remains poorly assessed. The species has been reported to prey on fish eggs (García de Jalón et al., 1993; García-Berthou and Moreno-Amich, 2000a) as well as an endemic mollusc subspecies (García-Berthou and Moreno-Amich, 2000a), and it has been said to contribute to the decline of some indigenous fish species (Godinho and Ferreira, 1998). However, the only known study to document impacts of L. gibbosus on biodiversity comes from the Netherlands (van Kleef et	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Data deficient	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	No	There are no studies regarding the current economic costs but if thinking about the efforts to avoid loss of native species and loss of ecosystem services this cost may only grow in the future.	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	L. gibbosus has long been considered a pest (Künstler, 1908; Roule 1928, 1935), but there is no documented evidence of the species having an adverse effect other than public perception.	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Such a fact is not known	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	L. gibbosus is an effective competitor of native fish due to plasticity of diet, parental care behaviour which enhances reproductive success, and aggressive behaviour which can affect native species' foraging success, reproduction and microhabitat	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are meny threathened and protected species in the SC region who would be affected by L. gibbosus if this species spreads in the region e.g. Salmo spp; Acipenser spp, Capoeta spp, Huso huso, Luciobarbus capito, etc.	Very high

17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	L. gibbosus can tolerate a wide range of climatic conditions. It is established in all biogeographic areas (Fox et al, 2007): Continental area, Mediterranean area, Atlantic area, Black Sea area, Pannonian area, Alpine area, Macaronesian area and Steppic Area. It could establish in Boreal area, where population where recorded in Lithuania (Elvira, 2001) and Sweden (http://www.smp.se/kronoberg/solabborre-i-asnen-vacker-oro/).	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	The probability of this is very high.	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	The probability of this is high.	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Data deficient	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	Data deficient	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length is 40.0 cm TL male/unsexed; common length : 9.9 cm TL male/unsexed; max. published weight: 630.00 g. Therefore, this species has commercial value.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Inhabits vegetated lakes and ponds, as well as quiet pools of creeks and small rivers.	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	The pumpkinseed affects the quality of the water, increasing the levels of chlorophyll and turbidity and the concentrations of nitrogen and phosphorus.	Very high
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Not applicable	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	If this species spreads within the SC region the probability of this is very high.	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	L. gibbosus will be competitor to native species.	Very high
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	L. gibbosus is an effective competitor of native fish due to plasticity of diet, parental care behaviour which enhances reproductive success.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	At this stage this species is not distributed in the SC region.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	There is no evidence of possibility of hybridisation with native species but hybridisation within species of the same family occurs, making more difficult to distinguish between species (Misra and Holdsworth, 1972).	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Data deficient	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such fact has been described	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	This species produces up to 1000 eggs.	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	Pumpkinseeds usually reach sexual maturity at age 2.	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species can be spread by humans for aquacultural/recreational purposes.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	The probability of this is high.	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such fact has been described.	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Currently this species is not found in the region.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	Currently this species is not found in the region.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Currently this species is not found in the region.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Currently this species is not found in the region.	Very high

42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been described.	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	High tolerance of L. gobbosus would allow species to adapt in response to changes in biotic and abiotic conditions and to survive control methods as for instance: removing exemplars, draining the pond.	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Currently there is little experience with pumpkinseed control. However, options to be explored include: decreasing depth of colonized waters by filling them with soil allowing them to occasionally dry up, introducing native competitors and predators and the use of biodegradable piscicides (Kleef et al. 2008).	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species has spread to many countries with the help of humans.	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	In Europe L. gibbosus avoids swift waters and occurs in estuaries with a salinity up to 18.2 ppt.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several potential predators distributed in the Caucasus region which can control L. gibbosus populations, e.g. Esox lucius, Sander lucioperca, Perca fluviatilis, Silurus glanis, Salmo spp, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Own judgement	Medium

Statistics	
Scores	
BRA	**25.5**
BRA Outcome	**-**
BRA+CCA	**37.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**11.5**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*7.5*
B. Biology/Ecology	**14.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*7.0*
6. Reproduction	*0.0*
7. Dispersal mechanisms	*-4.0*
8. Tolerance attributes	*3.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*

C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**11**
Environmental	**13**
Species or population nuisance traits	**15**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.71**
BRA	**0.74**
CCA	**0.50**

Date and Time
10/05/2022 19:16:55

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Lepomis gibbosus*
Common name	pumpkinseed
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Widly introduced in Europe and Asia
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Centrarchiformes (Basses) > Centrarchidae
Native range	The eastern North America
Introduced range	Europe and Asia Minor
URL	http://fishbase.org/summary/Lepomis-gibbosus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	It has been kept in aquariums	Medium
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes, this was the way how it got to Europe. They brought it as a sportfishishing or ornamental object	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Yes. for example Lepomis macrochirus	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Climate is somehow similar. From 18 stations, 3, 4 and 9 are above the threshold 7, 8 and 9 respectively	Medium
5	2.02	What is the quality of the climate matching data?	Medium	The climatch data is medium	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No evidence	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture (contaminant),Recreational fisheries, pet trade.	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species exsist in Turkey and it is likely to appiar in the RA in the near future	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes. It has been established in Europe.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	It has been demonstrated that this species interacts with native species in terms of feeding, since this species is an opportunistic omnivor (Rezsu & Specziar 2006) and feeds on any avalable food resource (Copp et al 2017).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	It has impact on pond aquaculture (Copp et al 2017)	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	can transmit diseases and not used for recriational fisheries	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	This subject is not well studied	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	It is likely	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species is considered as warm water fish, however the fact that it has been established into countries with cold climate such as Canada, Norway or Switzerland, we may say that it is adaptable	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	studies have documented that L. gibbosus and native fishes devide (Parrtition) food resources so we can not really say that they disrupt (Fobert et al 2011).	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	it can transmit deseases and affect the recreational fisheries	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	no information avalable	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	it is likely	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	it is a small bodied fish, common length 10 cm, however individuals can reach 40 cm.	Medium
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	avoids rapid waters and prefers standig waters	High

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No information	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Yes it is likely	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	No information avalable	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No. Less likely	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	it is known that males build and guard nests which contributes to its successful reproduction	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	It is possible, however, there is no information avalable	Medium
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See:http://fishbase.org/summary/Lepomis-gibbosus.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	can produce up to 7000 eggs	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	2-5 years	Medium
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture (contaminant), recreational fisheries, pet trade, local hobbysts	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Yes it is likely	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	it is possible	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Does not migrate for reproduction	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	It has not been recorded into RA yet so this question is not applicable in this case	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No information	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	temperatures and salinities	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Yes, however it is costy and sometimes inefectibve	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Yes. it is possible	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Yes. it is possible	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No No effective natural enemies present in RA area	Very high
C. Climate change					
9. Climate change					

50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native species (Hellmann et al 2008). In additon studies have shown that this species establishment increases with increasing temperatures	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	yes (Zieba et al 2020)	Very high
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	If Commercial and recreational activities will increase, it increases the chances of its occurance	Very high
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Population densities will increase making them on one hand impossible to eradicate and on the other hand, affecting native organisms due to competition, that does not leave much resources for native ones.	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	NO change	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	It will be more difficult to eradicate and economic losses will be nonreversable	High

Statistics	
Scores	
BRA	**36.0**
BRA Outcome	**-**
BRA+CCA	**46.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**19.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**17.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*5.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*5.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**15**
Environmental	**13**
Species or population nuisance traits	**21**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.75**
BRA	**0.74**
CCA	**0.83**

Date and Time
21/05/2022 14:46:55

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Micropterus salmoides*
Common name	largemouth bass
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species is known as worldwide invasive though important game fish. Not yet reported from RA
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Centrarchiformes (Basses) > Centrarchidae (Sunfishes)
Native range	Nort America
Introduced range	Worldwide
URL	https://www.fishbase.de/summary/Micropterus-salmoides.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	e.g. Bai, J., & Li, S. (2018). Development of largemouth bass (Micropterus salmoides) culture. Aquaculture in China: Success Stories and Modern Trends, 421-429.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	CABI, 2022. Micropterus salmoides. In: Invasive Species Compendium. Wallingford, UK: CAB International.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congeneres, subspecies	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Result of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	Species is not detected in RA area	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Recreation, aquacultural, biocontrol purpose (CABI, 2022. Micropterus salmoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.)	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	CABI, 2022. Micropterus salmoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	CABI, 2022. Micropterus salmoides. In: Invasive Species Compendium. Wallingford, UK: CAB International.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Summarised in CABI, 2022. Micropterus salmoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.; Pereira, F. W., & Vitule, J. R. S. (2019). The largemouth bass Micropterus salmoides (Lacepède, 1802): impacts of a powerful freshwater fish predator outside of its native range. Reviews in Fish Biology and Fisheries, 29(3), 639-652.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	CABI, 2022. Micropterus salmoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.; Pereira, F. W., & Vitule, J. R. S. (2019). The largemouth bass Micropterus salmoides (Lacepède, 1802): impacts of a powerful freshwater fish predator outside of its native range. Reviews in Fish Biology and Fisheries, 29(3), 639-652.	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Not quantified	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not quantified ever	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	Yes	Large specimens can cause phisical damage to human by a sharp spines	Low
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	CABI, 2022. Micropterus salmoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	The species is generally carnovorous praying anything including fishes. CABI, 2022. Micropterus salmoides. In: Invasive Species Compendium. Wallingford, UK: CAB International.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Mulhollem, J. J., Suski, C. D., & Wahl, D. H. (2015). Response of largemouth bass (Micropterus salmoides) from different thermal environments to increased water temperature. Fish physiology and biochemistry, 41(4), 833-842; Glover, D. C., DeVries, D. R., & Wright, R. A. (2012). Effects of temperature, salinity and body size on routine metabolism of coastal largemouth bass Micropterus salmoides. Journal of Fish Biology, 81(5), 1463-1478.	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	Although not a documented evidence, this is expected based on professional judgement	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Although not a documented evidence, this is expected based on professional judgement	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Although not a documented evidence, this is expected based on professional judgement	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Although not a documented evidence, this is expected based on professional judgement	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Species can reach alrge size while it can be used in captivity	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	CABI, 2022. Micropterus salmoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No such case is documented	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No documented evidence exist	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Species is agresive predator (CABI, 2022. Micropterus salmoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.)	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Many speices in RA area are using the same ecological niche	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Cooke, S. J., Philipp, D. P., & Weatherhead, P. J. (2002). Parental care patterns and energetics of smallmouth bass (Micropterus dolomieu) and largemouth bass (Micropterus salmoides) monitored with activity transmitters. Canadian Journal of Zoology,	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No documented evidence exist	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Morizot, D. C., Calhoun, S. W., Clepper, L. L., Schmidt, M. E., Williamson, J. H., & Carmichael, G. J. (1991). Multispecies hybridization among native and introduced centrarchid basses in central Texas. Transactions of the American Fisheries Society, 120(3), 283-289. Also a review at CABI, 2021. Micropterus salmoides (Large-mouth bass). https://www.cabi.org/isc/datasheet/74846 (accessed October	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No such an evidece exist	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	The species can complete its lifecycel without any other particular species	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Only few to many thousands of eggs yearly (CABI, 2022. Micropterus salmoides. In: Invasive Species Compendium. Wallingford, UK: CAB International. www.cabi.org/isc.)	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Intentional, anintetntional as well as independently	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Colchis national park is vulnerable to the invasion of the species	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such a behavoir have observed	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such an evidence exists	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Juveniles are dispersing through water currents	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not a migrant species	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence is known from other areas	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Based on professional guess due to high fecundity capabilities	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	Not expected	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not a documented evidence exist	Medium

45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No documented evidnece exists	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	Not a successful case is known	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Not expected and no evidence exists	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documented evidence exists	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Based on professional experiance no effective natural enemies exist in RA area	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgement	Low

Statistics	
Scores	
BRA	**33.0**
BRA Outcome	**-**
BRA+CCA	**39.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**15.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*10.0*
B. Biology/Ecology	**18.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*7.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**16**
Environmental	**12**
Species or population nuisance traits	**15**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.62**
BRA	**0.67**

CCA	**0.25**

Date and Time
16/05/2022 14:49:32

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Micropterus salmoides*
Common name	largemouth bass
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	The species is exploited heavily for angling in its native range, and was spread primarily for
Risk assessment area	South Caucasus
Taxonomy	Micropterus salmoides (Lacepède, 1802)
Native range	North America: St. Lawrence - Great Lakes, and Mississippi River basins from southern Quebec to
Introduced range	M. salmoides has been introduced outside of its native range in North America to other areas of
URL	https://www.fishbase.de/summary/3385

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Largemouth bass is native to North America. The species has been introduced widely as a game fish and is now cosmopolitan. It was introduced into Taiwan (China) in the mid 1970s, and following successful artificial propagation in 1983 was introduced into Guangdong in mainland China. This species is now distributed throughout the country and has become a major freshwater product in Chinese aquaculture.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Largemouth bass fishing in Florida is an important source of revenue, contributing $632 million per year to the economy of Florida (U.S. Department of Interior et al. 2006).	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Its establishment, once introduced, was likely assisted by its aggressive feeding strategy, which has caused considerable declines in native prey fishes, where introduced (Scott and Crossman, 1973; Welcomme, 1988).	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	World Map of the Köppen-Geiger climate classification	Medium
5	2.02	What is the quality of the climate matching data?	Medium	World Map of the Köppen-Geiger climate classification	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	This species is not currently found in the Caucasus region.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species may have entered in the region by human for aquacultural purposes.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Micropterus salmoides have been recorded as introduced into Iran and Iraq including the Tigris-Euphrates.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	The largemouth bass has been introduced into many other regions and countries due to its popularity as a sport fish. It causes the decline, displacement or extinctions of species in its new habitat through predation and competition, for example in Namibia. They are also an invasive species in the Canadian province of New Brunswick, and are on the watch list across much of the far	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	M. salmoides has been introduced outside of its native range in North America to other areas of North America, South America, Europe, Asia and Pacific islands (i.e. Fiji, Hawaii). The species is exploited heavily for angling in its native range, and was spread primarily for recreational angling opportunities and secondarily for aquaculture. Its establishment, once introduced, was likely assisted by its aggressive feeding strategy, which has caused considerable declines in native prey fishes, where introduced (Scott and Crossman, 1973; Welcomme, 1988).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	No such study has been conducted	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	No such study has been conducted	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	No such study has been conducted	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Introduced bass usually affect populations of small native fishes through predation, sometimes resulting in the decline or extinction of such species (Minckley 1973, in Fuller, 1999). Studies have shown that largemouth bass are capable of displacing native species, even predatory species such as northern	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are several protected and threatened species in the SC region which would be affected by M. salmoides: e.g. Salmo spp, Acipenser spp, Luciobarbus capito, etc.	Very high

17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	M. salmoides has been introduced outside of its native range in North America to other areas of North America, South America, Europe, Asia and Pacific islands (i.e. Fiji, Hawaii). Its establishment, once introduced, was likely assisted by its aggressive feeding strategy, which has caused considerable declines in native prey fishes, where introduced (Scott and Crossman, 1973; Welcomme, 1988). It seems that this species has adapted to new environmental conditions and it is expected that it will be successfully established in the Caucasus region if it	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	The probability of this is quite high if this species is distributed in the region.	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	The probability of this is high if this species distributed in the region.	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficient	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	Data deficient	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length is 97.0 cm TL male/unsexed; common length : 40.0 cm TL male/unsexed; max. published weight: 10.1 kg. This species is a active subject for aquaculture.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Inhabit lakes, ponds, swamps, and backwaters and pools of creeks, and small to large rivers. Usually found over mud or sand and common in impoundments. They prefer quiet, clear water and	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	No similar study has been conducted	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	No similar study has been conducted	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	M. salmoides is a predator fish and the probability of that is very high. Potential prays includes threathened and protected species e.g.: Acipenser spp, Salmo spp, etc.	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	M. salmoides is a predator fish and the probability of that is very high.	Very high
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Male largemouth bass care for their offspring from fertilization until the offspring disperse after becoming capable of avoiding predators.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Currently this species does not occurring in the SC region.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Such a fact is not known	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	The study details the severity of intersex in a population of largemouth bass near a major metropolitan area, which represents an important contribution to the understanding of fish reproductive ecology in ecosystems with a history of environmental disturbance and recovery such as the Illinois River	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such fact has been described.	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	One female can produce anywhere from 3,000-45,000 offspring at once but the average is 4,000.	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Largemouth bass usually reach sexual maturity and begin spawning when they are about a year old.	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species can be spread by artificial introduction by humans into the SC region.	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	If the species spreads in the region, it is likely that it will penetrate protected areas as well.	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not has such means.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Currently, this species is not common in the region.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	Currently, this species is not common in the region.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Currently, this species is not common in the region.	Very high

41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Currently, this species is not common in the region.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been described.	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Largemouth bass are more tolerant of low dissolved oxygen and pH than are smallmouth bass (Scott and Crossman 1973; Lasenby and Kerr 2000).	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Options for M. dolomieu control include biological control, chemical control, environmental manipulation, and physical removal (Loppnow et al. 2013).	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species has spread by humans in many regions of the world.	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Largemouth bass are generally found in low salinity environments < 5 ppt, but have also been shown to be tolerant of salinities up to 12 ppt (Peer et al., 2006).	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several potential predators distributed in the SC region which can controll the M. salmoides populations: Esox lucius, Sander lucioperca, Silurus glanis, Salmo spp, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Own judgement	Medium

Statistics	
Scores	
BRA	**38.5**
BRA Outcome	**-**
BRA+CCA	**50.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**17.5**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*13.5*
B. Biology/Ecology	**21.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*7.0*
6. Reproduction	*6.0*
7. Dispersal mechanisms	*-4.0*
8. Tolerance attributes	*3.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*

C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**14**
Environmental	**16**
Species or population nuisance traits	**22**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.73**
BRA	**0.76**
CCA	**0.50**

Date and Time
13/05/2022 13:01:39

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Micropterus salmoides*
Common name	largemouth bass
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Introduced worldwide for angling and aquaculture
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Centrarchiformes (Basses) > Centrarchidae
Native range	North America: St. Lawrence - Great Lakes, and Mississippi River basins from southern Quebec to
Introduced range	has been introduced outside of its native range in North America to other areas of North America,
URL	https://www.fishbase.se/summary/Micropterus-salmoides.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	It can be farmed in aquaponic systems and fish farms	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes. Taxon is harvested in wild and is sold in its live form	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	for example Micropterus dolomieu	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Very similar. out of 19 stations 15 are similar at the value of 9	High
5	2.02	What is the quality of the climate matching data?	Low	quality is low	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No evidence	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Recreational fisheries, aquaculture	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Iran	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	has become naturalised in several countries see the list: https://www.cabi.org/isc/datasheet/74846	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	reduction of pray species	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No adverse impacts to aquaculture are known.	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	transmission of deseases	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	NOt assessed	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	can cause the reduction of abundance of prey taxa and compete with natives for resources	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	does not parasite	Very high

17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	M. salmoides prefers warm freshwater habitats within lakes, ponds, rivers and streams. Temperatures from 26.6-27.7°C were preferred during a field study in Ontario, Canada (Scott and Crossman, 1973). The species has wide habitat tolerances that allow it to colonize many temperate and sub-tropical freshwaters. However, the species may tolerate ice-cover for up to six months in its native range, suggesting that ice cover within the introduced range may not hinder dispersal success providing that suitably warm temperatures (>15.6°C) exist during spawning season. Within its native range the species frequents relatively shallow waters and is seldom captured from depths greater then 7 m (Scott and Crossman, 1973). Coincident with its introduction for sport and aquaculture, it may inhabit artificial waterbodies (e.g., irrigation ditches; canals) that possess suitably warm water for spawning (>15.6°C; Scott and Crossman, 1973). Survival within ice-covered lakes is possible assuming sufficient dissolved oxygen (> 1.5 mg/L). Relatively clear waters are preferred due to the species' method of visual predation, although the species is known from certain turbid systems where it presumably relies on scent and vibration to obtain prey items. Aquatic vegetation (both emergent and submergent) is usually necessary, as are mud, sand or gravel substrates that provide spawning habitat. The species preferentially occupies the nearshore (littoral) area of lakes due to the abundance of aquatic vegetation and warm temperatures. Feeding is reduced at water temperatures below 10°C, or may cease entirely during winter and spawning periods (Scott and	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	it is likely	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	transmission of dieseases	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	No info	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is possible	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	yes. See: https://www.fishbase.se/summary/Micropterus-salmoides.html	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	No information avalable	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No information avalable	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	yes. Most likely	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	it is possible	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No information available	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	parental care	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	It is likely	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.se/summary/Micropterus-salmoides.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	A nest may produce between 751-11,457 fry, averaging 5000-7000 individuals https://www.cabi.org/isc/datasheet/74846#tohabitat	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	1 year	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Recreational fisheries, Aquaculture	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	it is possible	High

37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	yes. it could be possible	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	does not migrate	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	no. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	it is not yet introduced	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	No information avalable	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	no	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Can not tolerate low oxygen environment and is very sensitive to temperature and to human-produced chemicals.	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	yes but it is costy and sometimes ineffective	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	no information avalable	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documentation	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	no. No effective natural enemies present in RA area	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	increases	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	increases	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	increases	Very high
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	higher	Very high
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	higher	Very high
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	higher	High

Statistics	
Scores	
BRA	**22.0**
BRA Outcome	**-**
BRA+CCA	**34.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**11.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*6.0*
B. Biology/Ecology	**11.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*5.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*-4.0*
C. Climate change	**12.0**
9. Climate change	*12.0*

Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**11**
Environmental	**12**
Species or population nuisance traits	**14**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.76**
BRA	**0.74**
CCA	**0.92**

Date and Time
21/05/2022 14:52:44

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Mugil cephalus*
Common name	flathead grey mullet
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species have been translocated to the Caspian Sea and have important economic value for the
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Mugiliformes (Mullets) > Mugilidae (Mullets)
Native range	Cosmopolitan
Introduced range	Caspian Sea
URL	https://www.fishbase.de/summary/Mugil-cephalus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	Not spawning in captivity (within RA area). Yelghi, S., Shirangi, S. A., Ghorbani, R., & Khoshbavar Rostami, H. A. (2012). Annual cycle of ovarian development and sex hormones of grey mullet (Mugil cephalus) in captivity. Iranian Journal of Fisheries Sciences, 11(3), 693-703.	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yelghi, S., Shirangi, S. A., Ghorbani, R., & Khoshbavar Rostami, H. A. (2012). Annual cycle of ovarian development and sex hormones of grey mullet (Mugil cephalus) in captivity. Iranian Journal of Fisheries Sciences, 11(3), 693-703.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No other species within this genus or different races as invasive are known	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Result of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	Bogutskaya N, Kijashko P, Naseka AM, Orlova MI. 2013. Identification keys for fish and invertebrates of the Caspian Sea. Vol. 1. Fish and molluscs, Tovarishestvo Naucnikh Izdanii KMK. (In Russian) Moscow, p. 443.	Low
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Human mediated translocation	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Species is historically known from Black Sea coastline while it have been trayed to introduced in Caspian Sea	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	VAZIRZADEH, A., & EZHDEHAKOSHPOUR, A. (2015). The effects of different hormonal treatments on the oocyte maturation in wild grey mullet (Mugil cephalus) collected from the Iranian coastal waters of the Oman Sea. Iranian journal of Ichthyology, 1(1), 17-	Low
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	Not a documented evidence is available	Low
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Not evaluated, and in general is generally poorly understood	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Not known, understudied	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not known however less possible	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	The species is harmless	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	Not such a species are within RA area	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	The species is not parasite nor predator (not ocnsider the plancton feedenig behavior)	Low
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	M cephalus is known to adopt a wide variety of environmental conditions. Albaret, J - J., 2003. Mugilidae. p. 601-611 In C. Lévêque, D. Paugy and G.G. Teugels (eds.) Faune des poissons d'eaux douce et saumâtres de l'Afrique de l'Ouest, Tome 2. Coll. Faune et Flore tropicales 40. Musée Royal de l'Afrique Centrale, Tervuren, Belgique, Museum National d'Histoire Naturalle, Paris, France and Institut de Recherche pour le Développement, Paris,	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	No documented evidence exist	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Not expected. Generally this species have important economic value and introduced area it is also thought to bring additional economic benefit within RA area	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No documented evidence for that and not expected	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Although no documented evidence exists, it can bring such a new pest/parasite in new areas	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	No documented evidence exist though species can grow as large as 100 cm that might triger to make them release aquacultural captivity	Low
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	https://www.fishbase.de/summary/Mugil-cephalus.html	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No documented evidence exists	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Although no documented evidence exist we suppose that species is not able to maintain population in low density	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Based on professional judgment	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	In spite the fact that species is mostly feedeing in marine environment, the species can compete to other species while populations are usually large	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No such behaviour is characteristic for that species	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Yousefian, M., Ghanei, M., Pourgolam, R. and Rostami, H. H. 2009. Gonad Development and Hormonal Induction in Artificial Propagation of Grey Mullet, Mugil Cephalus L., Research Journal of Fisheries and Hydrobiology, 4(2), 35-40.	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Not such an evidence exists	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	the species is reproducing sexually	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Species is independent from any other species duirng its lifecycle	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	https://www.fishbase.de/summary/Mugil-cephalus.html	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	Years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Human mediated translocation	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	There is not such a protected areas in in the RA area	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Speices is not capable for such a behavior	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Naturally it is nearly impossible to attain the RA area	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Yelghi, S., Shirangi, S. A., Ghorbani, R., & Khoshbavar Rostami, H. A. (2012). Annual cycle of ovarian development and sex hormones of grey mullet (Mugil cephalus) in captivity. Iranian Journal of Fisheries Sciences, 11(3), 693-703.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not expected, no documented evidence exists	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has ever been recorded	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Translocation is usually happens with large amount of propagules	High
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence exists	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not expected and no documented evidence exists	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Oxygen concentration, Salinity, temperature, turbidity	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No documented evidence exists	Low

47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Not expected	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	Not expected based on professinal judgment	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Not an effective natural enemies are there based on professional experience	Low
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgement	Low

Statistics	
Scores	
BRA	**6.0**
BRA Outcome	**-**
BRA+CCA	**14.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**2.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**4.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*2.0*
6. Reproduction	*0.0*
7. Dispersal mechanisms	*-2.0*
8. Tolerance attributes	*0.0*
C. Climate change	**8.0**
9. Climate change	*8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**4**
Environmental	**4**
Species or population nuisance traits	**7**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.51**
BRA	**0.54**
CCA	**0.25**

Date and Time
16/05/2022 16:35:29

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Mugil cephalus*
Common name	flathead grey mullet
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Mugil cephalus is an important food fish species in the mullet family Mugilidae.
Risk assessment area	South Caucasus
Taxonomy	Mugil cephalus Linnaeus, 1758
Native range	Cosmopolitan in coastal waters of the tropical, subtropical and temperate zones of all seas. Eastern
Introduced range	This species was first introduced to be cultured with carp in Israel in 1957. Also introduced into
URL	https://www.fishbase.se/summary/Mugil-cephalus.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Flathead grey mullet is a very important aquaculture species in Egypt, where its farming has been traditional in the hosha system in the delta region for centuries. Since the early 1960s, flathead grey mullet has also been cultured in semi-intensive ponds with tilapia and carps in Egypt. In the Russian Federation mullet aquaculture has been practised in the Black Sea and Caspian Sea regions since 1930. This species was first introduced to be	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Trials on the artificial propagation of flathead grey mullet have been carried out, but most of the commercial aquaculture production of flathead grey mullet still depends on fry collected from the wild, which is cheaper.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	The impacts of this species are currently unknown, as no studies have been done to determine how it has affected ecosystems in the invaded range. The absence of data does not equate to lack of effects. It does, however, mean that research is required to evaluate effects before conclusions can be made.	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	This species is naturally distributed in the SC region.	Very high
5	2.02	What is the quality of the climate matching data?	High	This species is naturally distributed in the SC region.	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is naturally distributed in the SC region.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species is naturally distributed and enters in the SC region.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is naturally distributed in the SC region and also in the neighbouring countries (Russia, Turkey, Iran).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	M. cephalus successfully established in the Caspian Sea basin where it hit from the Black Sea basin via the Don Canal or by accidentally, as a result of aquacultural activities (Kuljanishvili et	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No such study has been conducted	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No such study has been conducted	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No such study has been conducted	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No such study has been conducted	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	There is a probability of that because M. cephalus is a competitor fish to native taxa.	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There is a probability of that because M. cephalus is a common fish in the SC region and it is expected to compete with local threathened/protected species.	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	M. cephalus is naturally distributed in the SC region.	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	M. cephalus is naturally distributed in the SC region and there is no such risk.	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	M. cephalus is naturally distributed in the SC region and there is no such risk.	Very high
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficient	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	Data deficient	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Average length of M. cephalus is 75 cm, weight 5-6 kg, sometimes 12 kg (Ninua et al. 2013). Because of these properties, this fish is widely used in aquaculture.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Adults are found in coastal waters, often entering estuaries and rivers, sometimes far-up-river, lagoons and hypersaline environments. They are usually in schools over sand or mud	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No such fact has been detected	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Not applicable	No such study has been conducted	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No such fact has been documented	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	As a native species to the Caucasus region, M. cephalus should be competitive to other native species in feeding.	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Once eggs are laid, adult striped mullet do not provide any further parental care (Texas Parks 2005).	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	M. cephalus is naturally reproduces in the SC region.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No such study has been conducted	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	The present study documents the occurrence of an intersex condition in a natural population of mullet Mugil cephalus (Dhanasekar et al. 2018).	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	This species does not have such requirements.	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Fecundity of M. cephalus is 2-8 million eggs (Ninua et al. 2013).	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	This fish sexually mature at 3 to 4 years.	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species is naturally disperse within the SC region.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	M. cephalus is distributed in the protected areas of the SC region, for instance in the Kolkheti National Park, western Georgia.	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This fish does not have such means.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	This species is naturally reproduces in the SC region.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This species is naturally reproduces in the SC region.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This species is naturally reproduces in the SC region.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	There is no data about this but such case is to be expected.	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Yes	Own judgement	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	This fish cannot exist without water.	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Data deficient	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Data deficient	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Humans contributed to the spread of this species	Very high

48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	M. cephalus is sea shoal fish, it's easily adopted to the changeability of salt (Ninua et al. 2013).	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several predators distributed in the SC region which can controll the M. cephalus population: Esox lucius, Sander lucioperca, Silurus glanis, Salmo labrax, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	Medium

Statistics	
Scores	
BRA	**22.0**
BRA Outcome	**-**
BRA+CCA	**18.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**5.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**17.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*2.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*5.0*
8. Tolerance attributes	*3.0*
C. Climate change	**-4.0**
9. Climate change	*-4.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**2**
Environmental	**-1**
Species or population nuisance traits	**19**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.74**
BRA	**0.77**
CCA	**0.50**

Date and Time
13/05/2022 13:11:56

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Mugil cephalus*
Common name	flathead grey mullet
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Comercial fisheries importance
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Mugiliformes (Mullets) > Mugilidae
Native range	Cosmopolitan in coastal waters of the tropical, subtropical and temperate zones of all seas. Eastern
Introduced range	Caspian Sea
URL	https://www.fishbase.se/summary/Mugil-cephalus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	It has comercial value	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes. Taxon is harvested in wild and is sold in its live form	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Chelon labrosus (Yankova 2016) or Chelon saliens (Medium risk) (Moghaddas et al 2021)	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Somehow similar	High
5	2.02	What is the quality of the climate matching data?	Medium	Medium	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	It was brought together with Chelon auratus and C. saliens, from the Black Sea and released into the Caspian Sea for acclimatization in 1930-34. Unlike Chelon auratus and C. saluens, M. cephalus could not adapt to local environmental conditions in the Caspian Sea and disappeared (Bogutskaya et al. 2013).	Medium
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquaculture	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	Probably not.	Low
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Reported as invasive in USA, Iran and Thailand https://www.gbif.org/species/8189568	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No adverse impacts to the wild commercial taxa are known.	Low
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No adverse impacts to aquaculture are known.	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No adverse impacts to ecosystem are known	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No adverse socio-economic impacts are known	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	It is not known	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species can tolerate wide ranges of salinities	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	Not documented	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	transmit deseases	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	no info	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	No info	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Yes. See: https://www.fishbase.se/summary/Mugil-cephalus.html	High

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Yes. this specie is marine, which sometimes enters freshwaters	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No information avalable	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Less likely, since all the attempts to breed this species in caspian sea failed,	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	They are mainly diurnal, feeding on detritus, micro-algae and benthic organisms (Ref. 56548, 74902, 74760). Juveniles feed on zooplankton until about 3.0 cm SL (Ref. 59043).	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No. Less likely	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No. Does not exhibit parental care See: https://www.fishbase.se/summary/Mugil-cephalus.html	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No. climate is not suitable	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.se/summary/Mugil-cephalus.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	0.5–2.0 million eggs per female	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	3-4 years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Aquaculture	Low
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	less likely	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. See: https://www.fishbase.se/summary/Mugil-cephalus.html	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	Does not migrate for reproduction	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No. Can not be dispersed by other ananimals	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	NO information avalable	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	No data	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	No information avalable	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No. This is less likely.	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	it can tolerate wide range of temperatures and salinities	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No information avalable	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information avalable	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documentation	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No.No effective natural enemies present in RA area	Very high
C. Climate change					
9. Climate change					

50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	It might increase	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Might increase	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	No change	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	NO change	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No change	Medium

Statistics	
Scores	
BRA	**6.0**
BRA Outcome	**-**
BRA+CCA	**12.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**6.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**0.0**
4. Undesirable (or persistence) traits	*5.0*
5. Resource exploitation	*0.0*
6. Reproduction	*0.0*
7. Dispersal mechanisms	*-5.0*
8. Tolerance attributes	*0.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**3**
Environmental	**0**
Species or population nuisance traits	**9**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.66**
BRA	**0.68**
CCA	**0.50**

Date and Time
21/05/2022 14:56:22

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Mylopharyngodon piceus*
Common name	black carp
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	This species is widely introduced in EU and USA for a number of reasons. It was also introduced in
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Xenocyprididae (East Asian minnows)
Native range	East Asia
Introduced range	West Eurasia
URL	https://www.fishbase.de/summary/Mylopharyngodon-piceus.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	This species usually is harvested for domestic purposes but in most case with other chinse carps accidentally and then transported and sold as such	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	Although there are other chinse carps known "for famous domestic fishes", no other congeners or races as invasive is known	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Result of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	CABI, 2022. Mylopharyngodon piceus (Black carp). https://www.cabi.org/isc/datasheet/73511 (accessed October	High
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	For biocontrol and aquaculture	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	Not reported in wild or nearby	Medium
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	CABI, 2022. Mylopharyngodon piceus (Black carp). https://www.cabi.org/isc/datasheet/73511 (accessed October	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Rothbard S, Rubinshtein I, Shelton WL, 1996. The Black Carp, Mylopharyngodon piceus, as a Biocontrol of Freshwater Molluscs, YAFIT Laboratory, Fish Breeding Center, Israel, University of Oklahoma.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Usually it considered as bearing positive efefct on aquaculture (CABI, 2022. Mylopharyngodon piceus (Black carp). https://www.cabi.org/isc/datasheet/73511 (accessed October	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	Nico LG, 2011. Mylopharyngodon piceus. USGS Nonindigenous Aquatic Species Database. Gainesville, Florida, USA: USGS. http://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=573	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not reported although expected	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species for human health	Medium
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Rothbard S, Rubinshtein I, Shelton WL, 1996. The Black Carp, Mylopharyngodon piceus, as a Biocontrol of Freshwater Molluscs, YAFIT Laboratory, Fish Breeding Center, Israel, University of Oklahoma.	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	The species is preadator. And a large number of inverterbates - in particular molluscs and foshes can be decline due to this species. CABI, 2022. Mylopharyngodon piceus (Black carp). https://www.cabi.org/isc/datasheet/73511 (accessed October 2022). However, Currently not a threatened species are known from RA area that might be altered from this fish	Low
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	No enough information is available	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	CABI, 2022. Mylopharyngodon piceus (Black carp). https://www.cabi.org/isc/datasheet/73511 (accessed October 2022)	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	based on the examples of elsewhere (CABI, 2022. Mylopharyngodon piceus (Black carp). https://www.cabi.org/isc/datasheet/73511 (accessed October	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Not expected due to absence of endemic parasite/pathogens for RA area	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	CABI, 2022. Mylopharyngodon piceus (Black carp). https://www.cabi.org/isc/datasheet/73511 (accessed October 2022)	Very high
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	The species can reach large size enough to be unsuitable for smal water reserviors	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	The species is basically attached to a lentic systems but moves for reproduction to upstreams (Nico, L.G., J.D. Williams and H.L. Jelks, 2005. Black carp: biological synopsis and risk assessment of an introduced fish. American Fisheries Society, Bethesda, Maryland, USA. 337 p)	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No enough data is available	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No documented evidence exists	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	It is strong predator hunting diverse prey	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	This can be mostly other predator on bentic feeder fishes	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No such behavior is known	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Not expected based on professional judgement	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Species is usually sexually reproducing	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such requirement is known for this species	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Hundreeds of thousands of eggs are produced annually	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	6	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Intentional introduction and unintentional introduction along with other chinise carps	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Colcheti national park along the Black Sea	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such a behavoir is recorded for this speices	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Eggs are usually transported by a water currents downstream (Nico, L.G., J.D. Williams and H.L. Jelks, 2005. Black carp: biological synopsis and risk assessment of an introduced fish. American Fisheries Society, Bethesda, Maryland, USA. 337 p)	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not expected due to absence of intensive transboundary river system with countries where the species is established	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact is ever observed	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	Not large number of individuals are introduced for aquacultural puropse, neithe hitchickers are usually dense. However this have never been studied	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence exists	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No documented evidence exists	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No evidence exists that species tolerates wider variation of enivornmental conditions than presented in its natural distribution area	Medium

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No documented evidence exists	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No documented evidence exists	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documented evidence exists	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No documented evidence exists	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgment	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgment	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgment	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgment	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgment	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgment	Low

Statistics	
Scores	
BRA	**24.0**
BRA Outcome	**-**
BRA+CCA	**34.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**14.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*10.0*
B. Biology/Ecology	**10.0**
4. Undesirable (or persistence) traits	*5.0*
5. Resource exploitation	*7.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*1.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**12**
Environmental	**16**
Species or population nuisance traits	**10**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.59**
BRA	**0.63**
CCA	**0.25**

Date and Time
16/05/2022 17:05:32

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Mylopharyngodon piceus*
Common name	black carp
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	It is widely cultivated for food and Chinese medicine. In China, black carp are the most highly
Risk assessment area	South Caucasus
Taxonomy	Mylopharyngodon piceus (Richardson, 1846).
Native range	Asia: Amur river basin to southern China. Reported from Vietnam. Native stocks in Russia have
Introduced range	Persists only in Europe by stocking or accidental releases. It was first brought into the USA in the
URL	https://www.fishbase.in/summary/Mylopharyngodon-piceus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Black carp, together with bighead carp, silver carp, and grass carp, make up the culturally important "four famous domestic fishes" used in polyculture in China for over a thousand years.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Captures indicate that black carp in the wild are much fewer in number than grass carp, silver carp, or bighead carp. Louisiana commercial fish-ers and fish market operators who are famil-iar with black carp report that the species has been taken consistently from the vicinity of the Red–Atchafalaya River system since the early 1990s (Nico & Jelks, 2011).	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	The presence of black carp within this enormous river system means that this highly invasive species has the accessibility to a vast range of bodies of water covering the majority of the Midwestern United States, so could establish populations in a	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	World Map of the Köppen-Geiger climate classification.	Medium
5	2.02	What is the quality of the climate matching data?	Low	World Map of the Köppen-Geiger climate classification.	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No such fact has been documented.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species enters the region by humans intentionally.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	In October 2000, a fish with body weight of 7500g and total lenght of 970mm was caught by a beach seine near Bandar Anzali coastal waters in the southern Caspian Sea, then in March 2001, a similar fish with 4800g weight and 800mm total lenght was caught by another beach seine in this area for the second time. These specimens were distinguished a commercial cyprinid species, Black carp (Abbasi 2003).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Froese and Pauly (2019) report that M. piceus is established outside its native range in Armenia, Bulgaria, Mexico, Vietnam, Turkmenistan, Uzbekistan, Romania, Japan, and Cuba, and probably established in Serbia and Montenegro (Skadar Lake) and	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	"There is high potential that the black carp would negatively impact native aquatic communities by feeding on, and reducing, populations of native mussels and snails, many of which are considered endangered or threatened (Nico et al. 2005).	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No such study has been conducted	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No such study has been conducted	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No such study has been conducted	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	In the taxons introduction range such a fact is to be expected. Black carp presumed to negatively impact native aquatic communities by feeding on, and reducing, populations of native	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are meny threatened and protected species in the SC region (Acipenser spp, Salmo spp, Luciobarbus capito, etc) and such a fact is to be expected.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species is already exist in Armenia and presumably it has the ability to adapt to the local climate.	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	This is likely to happen if the species is widespread in the region.	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	This is likely to happen if the species is widespread in the region.	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficient	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	M. piceus are hosts to parasites, flukes, bacterial and viral diseases. It could possibly transfer these to other fish species. It serves as intermediate host for human parasites (e.g. schistosoma), or parasites relevant to fish culture, such as the yellow and white grubs in channel catfish and stripe bass farming.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	It is widely cultivated for food and Chinese medicine. One of the largest cyprinids in the world, the black carp can reach up to 1.9 m in length and 109 kg in weight.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Adults inhabit large lowland rivers and lakes, preferably with clear water and high oxygen concentrations.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Reduced populations of mussels caused by black carp predation could result in degraded water quality, reduced recreational harvest of fish, and decreased mussel shell revenue.	Very high
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Data deficient	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	This is likely to happen if the species is widespread in the region.	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	This is likely to happen if the species is widespread in the region.	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Because black carp produce semipelagic eggs and spawn in open rivers, it can be concluded that they do not tend their eggs and that there is no parental care (Nico and Williams 1996).	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No such fact has been detected	Medium
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Such a fact is not known	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Such a fact is not known	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Such a fact is not known	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Average fecundity is about 600 000 eggs.	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	7	Black carp mature at the age of 7 to 9 years in subtropics (e.g. Egypt) which is 3 to 5 years earlier than in China.	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Most likely this species will be spread by humans.	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	This is likely if the species is widespread in the region.	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not have such means.	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Currently this species does not reproduces in the SC region.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	Currently this species does not reproduces in the SC region.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Currently this species does not reproduces in the SC region.	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Currently this species does not reproduces in the SC region and such a fact did not detected.	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been described.	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Not applicable	Data deficient	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Not applicable	Data deficient	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species has spread by humans in many regions.	High

48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	M. piceus is freshwater fish and does not occurs in brackish or marine waters.	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several potential predators distributed in the Caucasus region which can controll the M. piceus populations: Esox lucius, Sander lucioperca, Silurus glanis, Salmo spp, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own judgement	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Own judgement	Medium

Statistics	
Scores	
BRA	**22.0**
BRA Outcome	**-**
BRA+CCA	**34.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**10.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*6.0*
B. Biology/Ecology	**12.0**
4. Undesirable (or persistence) traits	*10.0*
5. Resource exploitation	*7.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*-4.0*
8. Tolerance attributes	*0.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**9**
Environmental	**13**
Species or population nuisance traits	**13**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.67**
BRA	**0.67**
CCA	**0.67**

Date and Time
13/05/2022 13:16:07

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Mylopharyngodon piceus*
Common name	black carp
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Introduced for aquaculture worldwide
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Xenocyprididae
Native range	he Amur River basin to southern China
Introduced range	Worldwide
URL	http://fishbase.org/summary/Mylopharyngodon-piceus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	It has been grown in aquaculture facilities more than 20 generations	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes. Taxon is harvested in wild and is sold in its live form	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	For example Hypophthalmichthys nobilis, H molotrix and Ctenopharyngodon Idella	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	The climate is more or less similar out of 19 stations, 15 match at value 9 (out of 10).	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Climatch data is medium since there are not much station on the RA area	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	It was reported as an acclimatized species by (Pipoyan and Tigranyan, 1998 2002), but without giving any details of the species distribution in the wild (Levin and Rubenyan, 2010). Later, Pipoyan (2012) reported that this species was distributed in the Metsamor River drainage; however, due to discontinuation of artificial reproduction, it disappeared from the inland waters of Armenia (Pipoyan, 2012). Unless there is new evidence of this species being caught in the wild in Armenia, we believe that this species should be taken off the list of non-native species of	Medium
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquaculture	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	It is possible that it would enter the RA again in near future	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes it has become naturalized outside its native area	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Negative impact include the predation on mollusc species. Larvae feeds on zooplankton, ostracods and some aquatic insects. therefore it might be in competiton with wildstocks and comercial	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	Negative impact include the predation on mollusc species. Larvae feeds on zooplankton, ostracods and some aquatic insects. therefore it might be in competiton with wildstocks and comercial	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No information avalable	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No information avalable	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Since this species is mainly consuming molluscs many native freshwater mussels (order Unionoida) and snails in North America are already critically endaingered (Lysne et al. 2008; Haag 2009; Burkhead 2012), the presence of Black Carp in USA rivers and streams is recognised as a major concern (Nico et al. 2005).	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	No it is not much adaptable in terms of climtic and other environmental confitions. Thus their potential persistenec if it has invaded is less.	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	It is possible	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No it is less likely	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	Possible, but not documented	Medium

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is possible. However, it is not documented.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Yes. See: http://fishbase.org/summary/Mylopharyngodon-piceus.html	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Undertake upriver migration and spawns in open waters. Deposit pelagic or semipelagic eggs which hatch while drifting downstream. Larvae settle into floodplain lakes and channels with	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	they grow very fast and can form dence populations, they are versatile in terms of feeding and this can often lead to habitat alterations and disruption of food webs and nutrient cycles in new invaded ecosystems (Milstein et al. 1988; Cooke et al. 2009; Gozlan et al. 2010; Ma et al. 2010; Rosemberg et al. 2010)	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	depending on the water and weather conditions	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	It is possible, but not known	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	It is possible howerver not doccumented	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Not known	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No. climate is different.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: http://fishbase.org/summary/Mylopharyngodon-piceus.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Yes See: http://fishbase.org/summary/Mylopharyngodon-piceus.html	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	7	6-11 years for male, and for females even later,	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Aquaculture	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Yes it is possible	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. Because does not reproduce in RA	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	They do not produce viable gametes and therfore can be distributed by larvae, or juveniles.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Do not reproduce therefore, does not migrate.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	Not rapid	Very high
43	7.09	Is dispersal of the taxon density dependent?	Yes	It is possible	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No info	Low
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No it is not tolerant of a wide range of water quality conditions.	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	It is possible	Very high
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information. probably not.	Low

48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No information avalable	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No information avalable	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypothesized that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	It is possible to increase, however it needs more documentation	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Can increase, but difficult to assume now.	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	It could be higher	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	No change	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No change	Low

Statistics	
Scores	
BRA	**20.0**
BRA Outcome	**-**
BRA+CCA	**28.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**14.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*10.0*
B. Biology/Ecology	**6.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*7.0*
6. Reproduction	*-1.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*-4.0*
C. Climate change	**8.0**
9. Climate change	*8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**11**
Environmental	**10**
Species or population nuisance traits	**8**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.72**
BRA	**0.76**
CCA	**0.42**

Date and Time
21/05/2022 15:04:43

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Oncorhynchus kisutch*
Common name	coho salmon
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species was introduced in Azerbaijan in the past and released in tho Caspian sea. Is an
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids)
Native range	Atlantic
Introduced range	Europe and Former USSR regions
URL	https://www.fishbase.de/summary/Oncorhynchus-kisutch.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Fleming, I. A., & Gross, M. R. (1993). Breeding success of hatchery and wild coho salmon (Oncorhynchus kisutch) in competition. Ecological applications, 3(2), 230-245.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	Not expected because salmonids are usually sold as life forms from the aquculture	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congeners	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Results of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No documented evidence	Medium
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquacultural purpose	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	No records are available	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Many areas in US and Europe are reported form various literature	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	Data deficient, no such an evidence exists	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Not reported and not expected	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Not reported and not expected	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not reported and not expected	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	Not expected, based on professional judgement	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Although species is predator, it mainly consumes the aquatic insects from which no threatened species are known from RA area	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	Not enough data is available, howver salmonids are generally less adaptable to variable climate	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	Based on professional judgement	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Based on professional judgement	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Based on professional judgement	High
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Based on professional judgement	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Based on professional judgement	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Living in a waters of wide ranging velocities	Very high

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Based on professional judgement	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Based on professional judgement	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Based on professional judgement	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Can compete to native salmonids, supposed based on professional judgement	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Page, L.M. and B.M. Burr, 2011. A field guide to freshwater fishes of North America north of Mexico. Boston : Houghton Mifflin Harcourt, 663p.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Not documented evidence exists	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Not documented evidence exists	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Page, L.M. and B.M. Burr, 2011. A field guide to freshwater fishes of North America north of Mexico. Boston : Houghton Mifflin Harcourt, 663p.	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Page, L.M. and B.M. Burr, 2011. A field guide to freshwater fishes of North America north of Mexico. Boston : Houghton Mifflin Harcourt, 663p.	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Page, L.M. and B.M. Burr, 2011. A field guide to freshwater fishes of North America north of Mexico. Boston : Houghton Mifflin Harcourt, 663p.	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	year	Medium
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Intentional introduction, based on professional judgement	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	The species is basically expected to inhabit river parts that are not within such a protected areas in RA area	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Page, L.M. and B.M. Burr, 2011. A field guide to freshwater fishes of North America north of Mexico. Boston : Houghton Mifflin Harcourt, 663p.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Not expected, based on professional judgment	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This includes the escaped juveniles from captivity	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not expected since no species have recorded from the RA area in wild	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has ever been reported	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Based on professional judgement	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	No such ebservation exists. Page, L.M. and B.M. Burr, 2011. A field guide to freshwater fishes of North America north of Mexico. Boston : Houghton Mifflin Harcourt, 663p.	Very high
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not a documented evidence exists, but salmonids are generally less tolerant out of water environment	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	-	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Based on professional judgement	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Based on professional judgement	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	It naturally lives in marin and freshwaters (Page, L.M. and B.M. Burr, 2011. A field guide to freshwater fishes of North America north of Mexico. Boston : Houghton Mifflin Harcourt, 663p.)	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Not an effective natural enemy exists in RA area	High
C. Climate change					
9. Climate change					

50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Based on professional judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Based on professional judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Based on professional judgement	Medium

Statistics	
Scores	
BRA	**4.0**
BRA Outcome	**-**
BRA+CCA	**8.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**4.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**0.0**
4. Undesirable (or persistence) traits	*2.0*
5. Resource exploitation	*2.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*-2.0*
8. Tolerance attributes	*-4.0*
C. Climate change	**4.0**
9. Climate change	*4.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**2**
Environmental	**0**
Species or population nuisance traits	**7**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.68**
BRA	**0.71**
CCA	**0.46**

Date and Time
16/05/2022 17:24:33

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Oncorhynchus kisutch*
Common name	coho salmon
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	In North America, coho salmon is a game fish in fresh and salt water from July to December,
Risk assessment area	South Caucasus
Taxonomy	Oncorhynchus kisutch (Walbaum, 1792)
Native range	North Pacific: distributed from the Anadyr River in Russia south towards Hokkaido, Japan, and from
Introduced range	Introduced into northern rivers of France; in 1973 and 1974, 50,000 yearlings escaped into the
URL	https://www.fishbase.se/summary/245

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	The coho salmon stocks presently used in aquaculture were derived from government hatchery programmes in the United States of America and Canada, but most countries now rely on local sources. Self-sustaining stocks have been reported in the Great Lakes of America and in Chile, where they are a major species in a rapidly expanding aquaculture industry.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Self-sustaining stocks of O. kisutch have been reported in the Great Lakes of America and in Chile, where they are a major species in a rapidly expanding aquaculture industry.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Within this genus, one of the most widespread and invasive species is O. mykiss. O. mykiss is listed as one of the world's 100 worst invasive species by the ISSG (2021).	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	WORLD MAP OF THE KÖPPEN-GEIGER CLIMATE CLASSIFICATION	Medium
5	2.02	What is the quality of the climate matching data?	Medium	WORLD MAP OF THE KÖPPEN-GEIGER CLIMATE CLASSIFICATION	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No such fact has been detected	Medium
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species enters in the region for aquaculture purposes	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Oncorhynchus kisutch introduced to Iran and probably established in the wild.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	No	Coho salmon, which are native to the coastal area of the North Pacific Basin, have been introduced into many areas of North America, Asia, Europe and Latin America, although most attempts to establish naturalized populations have been unsuccessful.	Medium
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Coho salmon compete with native lake trout Salvelinus namaycush (Page and Laird 1993). Fausch and White (1986) found that coho salmon may compete with brook trout S. fontinalis and brown trout Salmo trutta for food and space in the Great Lakes if resources become scarce. Coho have an advantage over brook and brown trout because of an earlier emergence and a larger size at emergence (Fausch and White 1986).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Such a fact is not known	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Such a fact is not known	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Such a fact is not known	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Own judgement	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are several protected and threatened species in the region which will be potential prey for O. kisutch, such as Sturgeons, Luciobarbus capito, Salmo gegarkuni, Salmo labrax, etc.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Own judgement	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	O. kisutch is a predator fish and can disrupt food web structure in the freshwater ecosystems of the Caucasus region.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	If the species is distributed in the region, this is expected to happen	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficient	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	If the species is distributed in the region, this is expected to happen	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length of O. kisutch is 108 cm; max. published weight: 15.2 kg, therefore this species has commercial value. The coho salmon stocks presently used in aquaculture were derived from government hatchery programmes in the United States of America and Canada, but most countries now rely on local sources.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	The fish occur in the ocean or in lakes; adults return to the rivers where they were born. The young fish emerge in springtime and they usually live in fresh water for 1-2 years (sometimes up to 4 years; later they migrate at night to freshwater lakes or to the sea.	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Not applicable	Data deficient	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Not applicable	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	O. kisutch is a predator species and can eat native protected species in the SC region such as L. capito, Salmo spp, Acipencer	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Own judgement	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	Data deficient	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Such fact has not been detected yet	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Data deficient	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Data deficient	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	Yes	O. kisutch is a anadromous species and spawns in the rivers where they were born. Therefore fast flowing and oxygen rich waters are crucial for their reproduction.	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	In the wild, coho salmon usually mature during their third year of life, including 4–6 months in incubation, 15 months rearing in freshwater, and 18 months of ocean residence. Mature fish return to their rivers of origin during late summer and autumn. Spawning occurs between November and January. Female coho produce 2	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	In the wild, coho salmon usually mature during their third year of life.	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species may be disperse within the region by human through translocation	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	There is a probability of this.	Low
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not have such means	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	This species does not inhabit the region	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	This species does not inhabit the region	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species does not inhabit the region	Medium
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has been detected	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	Own judgement	Medium
43	7.09	Is dispersal of the taxon density dependent?	Yes	Such a fact is not known	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Such a fact is not known	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No studies have been conducted in this direction	Medium

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	No studies have been conducted in this direction	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species is distributed through humans	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	The fish occur in the ocean or in lakes; adults return to the rivers where they were born. The young fish emerge in springtime and they usually live in fresh water for 1-2 years, later they migrate at night to freshwater lakes or to the sea.	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several potential predators in the Caucasus region which can controll the populations of O. kisutch: Salmo spp, Squalius spp, Sander lucioperca, otters, birds, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Own judgement	Medium

Statistics	
Scores	
BRA	**15.0**
BRA Outcome	**-**
BRA+CCA	**17.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**5.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*1.0*
B. Biology/Ecology	**10.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*7.0*
6. Reproduction	*-3.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*1.0*
C. Climate change	**2.0**
9. Climate change	*2.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**6**
Environmental	**8**
Species or population nuisance traits	**4**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.60**
BRA	**0.61**
CCA	**0.50**

Date and Time
13/05/2022 14:06:24

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Oncorhynchus kisutch*
Common name	coho salmon
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	This species was transported from Kamchatka in Russia to Azerbaijan in 1977-83, to the Chaykend
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids) >
Native range	northern Pacific Ocean.
Introduced range	Caspian Sea basin
URL	https://www.fishbase.se/summary/Oncorhynchus-kisutch.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Has been farmed in marine environments	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	This kind is traded as fresh fish, dried or salted, smoked, canned, preserved and frozen (Ref. 9988)	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Examples: golden trout, brook trout, brown trout (Knapp 1996)	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Climate is somehow similar	High
5	2.02	What is the quality of the climate matching data?	Medium	Medium	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	This species was transported from Kamchatka in Russia to Azerbaijan in 1977-83, to the Chaykend fish hatchery in the form of fertilized eggs. After incubation, the hatched fries were released into the Caspian Sea (Musayev et al. 2004). However, there is no data on the results of the acclimatization of this fish and no	Low
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquaculture	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	No evidence	Medium
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	In Great lakes for example	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Through a meta-analysis of existing data, we show a reduction in survival or abundance of Atlantic salmon; sea trout; and pink, chum, and coho salmon in association with increased production of farmed salmon. https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.0060033	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No data	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No, However it can transmit diseases,	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not known	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Coho salmon farming was correlating to the mortality of native salmonid species https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.0060033	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Coho salmon can tolerate temperatures ranging from 5 to 25 degrees celsius (Brett 1952). Later studies show that it can tolerate temperatures up to 29.5, and this findings were important to assess the potential ecological consecuenses of this species if entered environments, that are caracterised with temperatures above their normal tolerance limit (Chen et al 2015).	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	There is no information avalable	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Can transmit deseases	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	It is likely. However no information avalable about it	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is likely. However no information avalable about it	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Yes. See: https://www.fishbase.se/summary/Oncorhynchus-kisutch.html	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	It is migratory species that can sustain itself in a range of water velocity conditions	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No data	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No information avalaible	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	It is likely	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No information	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Female salmon construct and defend nests, whereas male salmon provide no parental care	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No. climate is not suitable	Medium
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Yes it is possible	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.se/summary/Oncorhynchus-kisutch.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	It can produce 2400-2800 eggs	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	4	4 years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Aquaculture	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	Less likely	Low
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	yes. it could be possible	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Does not migrate for reproduction	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	Not rapid	High
43	7.09	Is dispersal of the taxon density dependent?	No	No info	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Can not tolerate low oxygen environment and is very sensitive to temperature and to human-produced chemicals.	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	It can be	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information avalable	High

48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No information avalable	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies present in RA area	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	Since this species can not tolerate high temperatures, risks of establishment posed by taxon likely decreaase	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Decrease	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	Lower	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	No change	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No change	High

Statistics	
Scores	
BRA	**14.5**
BRA Outcome	**-**
BRA+CCA	**10.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**8.5**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*4.5*
B. Biology/Ecology	**6.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*5.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*-4.0*
C. Climate change	**-4.0**
9. Climate change	*-4.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**6**
Environmental	**4**
Species or population nuisance traits	**1**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.64**
BRA	**0.65**
CCA	**0.54**

Date and Time
21/05/2022 15:13:14

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Oncorhynchus mykiss*
Common name	rainbow trout
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	Thsi economically important species were widely introduced in the RA area
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids)
Native range	North Atlantic
Introduced range	Worldwide
URL	https://www.fishbase.de/summary/Oncorhynchus-mykiss.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	e.g. Wysocki, L. E., Davidson III, J. W., Smith, M. E., Frankel, A. S., Ellison, W. T., Mazik, P. M., ... & Bebak, J. (2007). Effects of aquaculture production noise on hearing, growth, and disease resistance of rainbow trout Oncorhynchus mykiss. Aquaculture, 272(1-4), 687-697.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Definitely in the past. However, currently the species can be cultured in the farms or collected within the introduced range	Low
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Other trouts	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Resluts of climatch algorithm	Low
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Human mediated translocation for aquacultural and recreational purpose	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	No	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Medium
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Behnke RJ, 2002. Trout and Salmon of North America. New York, USA: The Free Press, 359 pp	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evidence, and not expected	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No documented evidence	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Species is harmles	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	No documented evidence, professional judgement but also Behnke RJ, 2002. Trout and Salmon of North America. New York, USA: The Free Press, 359 pp	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Not a parasite species	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	Based on professional judgement	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	No documented evidence exists	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No documented evidence elsewhere	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Based on professional judgement	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	E.g. Buchmann, K., Bresciani, J., 1997. Parasitic infections in pond-reared rainbow trout Oncorhynchus mykiss in Denmark. Diseases of Aquatic Organisms, 28(2), 125-138. doi: 10.3354/dao028125; Skov, J., Mehrdana, F., Marana, M. H., Bahlool, Q. Z. M., Jaafar, R. M., Sindberg, D., Jensen, H. M., Kania, P. W., Buchmann, K., 2014. Parasite infections of rainbow trout (Oncorhynchus mykiss) from Danish mariculture. Aquaculture, 434, 486-492. doi:	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	This can not be a reson of release. Usually they are intended to be released in wild	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Mountain rivers as well as marin waters for anadromous populations are known for the species	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No documented evidence exist	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Based on professional judgement.	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Some invertebrates, or even fishes	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Native salmonids	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Page, L.M. and B.M. Burr, 2011. A field guide to freshwater fishes of North America north of Mexico. Boston : Houghton Mifflin Harcourt, 663p.	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No documented evidence exist. There are unpulished own data about the escape of O. mykiss from aquaculture with no cases of juveniles born in the wild.	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Young, W. P., Ostberg, C. O., Keim, P., & Thorgaard, G. H. (2001). Genetic characterization of hybridization and introgression between anadromous rainbow trout (Oncorhynchus mykiss irideus) and coastal cutthroat trout (O. clarki clarki). Molecular	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No documented evidence of asexuality	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such an evidence exists	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Several thousands of eggs per year	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Popular species for aquaculture and recreational fisheris. If established at single point it can disperse naturally as well	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Colchis natural park along the Black Sea coast	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence, nor fish biology morphology support this behavior	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Not known from neighbouring areas in the wild	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Juveniles are migrating	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Although there are anadrmous populations known for O. mykiss in its native range there are no such populations in the neghboring seash of RA area	Low
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence exists	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Given the large amount of aqucultural units in RA area	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence exist	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such an evidence, although the salmonids generally can not cope with out of water conditions	High

45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Based on professional judgement.	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Based on professional judgement, no documented evidence.	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Based on professional judgement	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No documented evidence	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Not known anu effective natural enemy from the RA area (based on professinal judgement)	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	Based on professional judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Based on professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Based on professional judgement	Low

Statistics	
Scores	
BRA	**15.0**
BRA Outcome	**-**
BRA+CCA	**15.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**8.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**7.0**
4. Undesirable (or persistence) traits	*2.0*
5. Resource exploitation	*7.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*-4.0*
C. Climate change	**0.0**
9. Climate change	*0.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**11**
Environmental	**6**
Species or population nuisance traits	**3**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.63**
BRA	**0.67**

CCA	0.33

Date and Time
16/05/2022 20:26:08

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Oncorhynchus mykiss*
Common name	rainbow trout
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	O. mykiss is one of the widspread species in the world and is widely used in aquaculture
Risk assessment area	South Caucasus
Taxonomy	Oncorhynchus mykiss (Walbaum 1792)
Native range	Pacific Slope from Kuskokwim River drainage in Alaska to Otay River drainage in California, USA
Introduced range	Widely introduced and established in Canada and USA, including Arctic, Atlantic, Great Lakes,
URL	https://www.fishbase.se/summary/oncorhynchus-mykiss.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	This fish is important for pond fishery (Ninua et al. 2013)	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	This species is one of the commercial fish and actively used for both aquacultural and recreational fishing.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	It has been widely introduced around the word for fisheries and aquaculture. It is an effective competitor which can displace native trout species when introduced into new environments. Several countries report adverse ecological impact after	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Köppen–Geiger climate classification system	Medium
5	2.02	What is the quality of the climate matching data?	#N/A	No data	Low
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species often escapes from fish farms and occurs in many rivers and lakes of the SC region (Ninua et al. 2013). For instance in Georgia O. mykiss often seen in rivers where fish farms are	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species entered in the SC region intentionaly by humans for aquaculture.	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Rainbow trout (Oncorhynchus mykiss) has become by far the most frequently farmed freshwater fish species in Turkey, whereas very little is known about its establishment and invasiveness potential (Yoğurtçuoğlu et al. 2021).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Introductions of rainbow trout in European waters have been encouraged for many years and intentional releases still occur. Our study demonstrated that, in some cases, O. mykiss can constitute self-sustaining, stable populations, able to survive over a long time period and to colonise areas that naturally lack other salmonids. The ability to create naturally reproducing populations may represent a local threat to the rich biological diversity of the	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	In the experiment, to test whether rainbow trout is a vector of the pathogenic freshwater mold Saprolegnia diclina (Oomycetes), eggs of Engystomops petersi were placed with infected and uninfected rainbow trout. There was a high mortality rate in the embryos of E. petersi exposed to trout infected with S. diclina. This represents the first evidence that rainbow trout may have a direct negative effect on Neotropical amphibian populations, and thus should be considered a threat. Management programs should be implemented to eradicate trout from Andean rivers, especially in areas with high number of endangered amphibians (Martín-	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No data	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	No	Several invasives have provided positive recreation and tourism opportunities, especially in the area of fishing. These include large mouth bass (Micropterus salmoides), brown trout (Salmo trutta) and rainbow trout (Oncorhynchus mykiss) (Charles and Dukes	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Several invasives have provided positive recreation and tourism opportunities, especially in the area of fishing. These include large mouth bass (Micropterus salmoides), brown trout (Salmo trutta) and rainbow trout (Oncorhynchus mykiss) (Charles and Dukes	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	This fish is predator and can affect on native taxa	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	This fish is predator and can eat threatened or protected taxas in the SC region such as Sturgeons, trouts, etc.	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species has been found in the region for a long time and it seems that the climatic and environmental conditions here are acceptable to it.	Medium

18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	O. mykiss is an predator fish and can disrupt food web structure in the region because it can eat local small sized species. Also this species is competitor to native trout populations (e.g. Salmo caspius, S. ciscaucasicus, S. labrax, S. rizeensis) and consequently negatively affects mountain river ecosystems. Such a fact is known from other regions as well (Juncos et al. 2011).	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	A similar study has not yet been conducted, although it may have some impact.	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	No data	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	No data	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	This fish has been widely introduced around the word for fisheries and aquaculture. The rearing of captive rainbow trout for fish farming and stock enhancement programmes mimics the life history of wild Oncorhynchus mykiss and utilises both freshwater and sea water environments as appropriate. Because of the efficiencies of farm husbandry practices, the farming process accelerates the life cycle to 1 year or less in freshwater (smolts typically 40g to 120g) and harvesting is done after 10 to 20 months of growth in sea cages at between 2 and 6kg in body	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	This species inhabit clear, cold headwaters, creeks, small to large rivers, lakes, and intertidal areas (Page and Burr 2011)	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	A similar study has not yet been conducted	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Not applicable	No data	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	This species is predator and can eat meny native species in the SC region, including threathened and protected species.	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	O. mykiss is competitor species for native taxa	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	No data	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No such case has been confirmed yet	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Hybridization between native and non-native species has serious biological consequences, but our understanding of how dispersal and selection interact to influence invasive hybridization is limited. Here, we document the spread of genetic introgression between a native (Oncorhynchus clarkii) and invasive (Oncorhynchus mykiss) trout, and identify the mechanisms influencing genetic admixture (Kovach et al. 2015).	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No data	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Such data is not available	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	The fish becomes sexually mature at the age of 3-4, Fecundity - 500-2500 eggs (Ninua et al. 2013).	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	The fish becomes sexually mature at the age of 3-4 (Ninua et al. 2013).	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species may spread accidentally as a result of escaping from fish farms.	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	This species has wide range in the SC region and probably distributed in he protected areas or nearby.	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This fish does not have such means	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	It is believed that this species can not reproduce naturally in the Caucasus region.	Low
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	This species can not reproduce naturally in the Caucasus region	Low
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This species has migratory form which is living in the Black Sea and enters in the rivers of western Georgia (Own data)	High

41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has been revealed	Low
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	No data	Low
43	7.09	Is dispersal of the taxon density dependent?	No	No data	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	This fish inhabits clear, oxygen rich cold waters, creeks, small to large rivers, lakes, and intertidal areas (Page and Burr 2011)	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	No	Water temperature was an important factor in trout distribution in the two pools of Southern California. During 1–11 August 1994, water temperatures in pool 1 ranged from 21·5) C at the bottom (4·1 m) to 28·9) C at the surface. After 5 August, trout were no longer found in this pool, suggesting that trout had moved out of the high temperature water or died (Matthews and Berg 1997).	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	A similar study has not yet been conducted	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species is spread from fishing farms as a result of floods or other factors.	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Anadromous forms are living in the coastal streams (Page and Burr 1991).	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	Yes	There are several predators which can eat O. mykiss: birds, reptilies, fish (Esox lucius, Squalius spp, Salmo spp, etc).	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Own observation	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Own observation	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own observation	Low

Statistics	
Scores	
BRA	**19.0**
BRA Outcome	**-**
BRA+CCA	**17.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**5.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*0.0*
B. Biology/Ecology	**14.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*7.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*-2.0*
8. Tolerance attributes	*1.0*
C. Climate change	**-2.0**
9. Climate change	*-2.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*

8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**2**
Environmental	**8**
Species or population nuisance traits	**9**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.57**
BRA	**0.61**
CCA	**0.25**

Date and Time
13/05/2022 14:28:27

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Oncorhynchus mykiss*
Common name	rainbow trout
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Recriational fisheries favourite object
Risk assessment area	South Caucasus
Taxonomy	Salmoniformes (Salmons) Salmonidae (Salmonids) Salmoninae
Native range	native to the North America from Pacific basin to northern Mexico, also native from Kamchatka to
Introduced range	Canada and USA, including Arctic, Atlantic, Great Lakes, Mississippi River, and Rio Grande basins,
URL	https://www.fishbase.de/summary/Oncorhynchus-mykiss.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	O. mykiss is a trade important fish that spawns easy, fast growing and quite adaptable to different environments. it easily adapts to an artificial diet. can be bread in aquaculture facilities as well as natural water bodies such as lakes. the production of O. mykiss has drasticallygrown since 1950s (More at: http://www.fao.org/fishery/culturedspecies/Oncorhynchus_mykiss/en).	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Artificially spawned O. mykiss can be sold as fertilized eggs of fry.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Examples: golden trout, brook trout, brown trout (Knapp 1996).	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	After running Climatch between the native range and South Caucasian countries the software calculates most parts as similar climate, however the maximum similarity is 7 out of 10.	Medium
5	2.02	What is the quality of the climate matching data?	Medium	The data is of medium quality.	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Besides intentional releases from amateur fishermen, O. mykiss is being stocked in the lakes of high altitude areas.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Recreational fisheries, aquaculture, natural dispersal.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This fish is distributed all over RA.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	In some places this species have become naturalised (for example Quebec Canada Thibault 2010).	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Can hybridize with native trouts and compete for resources and spawning rounds.	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No adverse impacts on aquaculture is known.	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Can be transmitting the diseases and disrupt nutrient cycle.	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No dramatic changes are known.	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Is not poisonous and does not pose risk to human health.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Introduced trout are affecting the distribution of a wide range of native aquatic species including native fishes, amphibians, zooplankton, and benthic macroinvertebrates in terms of predation, competition.	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	It can be stocked in rivers and lakes which are rich with oxygen. It may not survive in the places where temperatures are higher than 25 degrees Celsius and low oxygen.	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	It can shape native fish community as well as amphibians, zooplankton and benthic macroinvertebrates.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Less likely.	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such information available.	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Likely, yes.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Yes. See: https://www.fishbase.de/summary/Oncorhynchus-mykiss.html	High

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	It can persist in both, standing and flowing rivers and lakes and the anadromous behaviour of the fish facilitates it's dispersal upstreams.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No information avalable	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Most likely no.	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Can affect endangered benthic invertebrates and fish fry.	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Possibly, yes.	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Not known https://www.fishbase.de/summary/Oncorhynchus-mykiss.html	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Not likely.	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Yes. for instance with cutthroat trout (Oncorhynchus clarkii)	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.de/summary/Oncorhynchus-mykiss.html	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Spawning happens from November until May in the Northern hemisphere and from August to November on the Southern hemisphere with female producing 700 to 4000 eggs.	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	Males mature generally at 2 years and females at 3.	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Stocking in natural waters, Accidental escapes from fish farms, intentional releases (by hobbyists).	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Active stocking and releases plus the species ability to overcome different velocities brings in close proximities to protected areas in RA.	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Natural dispersal can not occur as eggs because, this species struggles to spawn independently in RA.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Juveniles of O. mykiss can be released into waters by fishermen, and it is mostly the reason of it's dispersal in the RA.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This is an anadromous species. Even though it can migrate, it is still not documented that this species can spawn themselves in RA. For this reason, the confidence level of this answer is Low.	Low
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	All the above mentioned vectors have rapid character. However it should be mentioned that, even though there is a hight propagule pressure, their populations are not established in wild. For this reason the answer will have low confidence.	Low
43	7.09	Is dispersal of the taxon density dependent?	No	Since this species are not reproducing themselves and they are object for recreational fisheries their population density is always regulated. They are not likely to reach such densities that would cause their further dispersal.	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Can not tolerate low oxygen environment and is very sensitive to temperature and to human-produced chemicals.	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Via rotenone in streams (Lintermans & Raadik 2001) and gill nets from lakes (Knapp & Matthews 1998).	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Very sensitive species and can not tolerate human disturbance.	Very high

48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Life cycle of rainbow trout may be presented in two forms: the anadromous phenotype, with a growth phase in saltwater, or the freshwater resident phenotype. The anadromous phenotype, however can still into freshwaters, increasing the species' capacity to disperse (Thibault et al 2010).	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies present in RA area	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	In terms of increased temperatures this species will be having troubles to survive in the wild.	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Increased temperatures will cause stress in O. mykiss populations making their populations weaker.	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	The environment for them will be unbearable and this species populations will decrease.	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	The magnitude of future potential impact is low.	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	The magnitude of future potential impact is low.	Medium

Statistics	
Scores	
BRA	**26.5**
BRA Outcome	**-**
BRA+CCA	**18.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**13.5**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*7.5*
B. Biology/Ecology	**13.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*7.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*2.0*
8. Tolerance attributes	*-1.0*
C. Climate change	**-8.0**
9. Climate change	*-8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**8**
Environmental	**6**
Species or population nuisance traits	**10**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.68**
BRA	**0.70**
CCA	**0.46**

Date and Time
21/05/2022 15:17:21

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Oreochromis niloticus*
Common name	Nile tilapia
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	the species is invasive in many countries and it was already documented in RA area once, also in
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cichliformes (Cichlids, convict blennies) > Cichlidae (Cichlids)
Native range	Africa, Nile basin
Introduced range	South and Noth America, European and Asian countries
URL	https://www.fishbase.de/summary/Oreochromis-niloticus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Amal, M. N. A., & Zamri-Saad, M. (2011). Streptococcosis in tilapia (Oreochromis niloticus): a review. Pertanika Journal of Tropical Agricultural Science, 34(2), 195-206	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Is sold as ornamental and reared in captivity (Trewavas, E., 1983. Tilapiine fishes of the genera Sarotherodon, Oreochromis and Danakilia. British Mus. Nat. Hist., London, UK. 583 p. (Ref. 2))	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Global Invasive Species Database (2021) Species profile: Oreochromis. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=813 on 08-11-2021.	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	Results of Climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	No good enough climate data exists for a RA	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili, T., Epitashvili, G., Japoshvili, B., Patoka, J., & Kalous, L. (2021, April). Finding of nile tilapia Oreochromis niloticus (Cichliformes: Cichlidae) in Georgia, the South Caucasus. In IOP Conference Series: Earth and Environmental Science (Vol. 744, No. 1, p. 012036). IOP Publishing.	Low
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Intentional introduction - Global Invasive Species Database (2021) Species profile: Oreochromis. Downloaded from http://www.iucngisd.org/gisd/species.php?sc=813 on 08-11-2021.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kuljanishvili, T., Epitashvili, G., Japoshvili, B., Patoka, J., & Kalous, L. (2021, April). Finding of nile tilapia Oreochromis niloticus (Cichliformes: Cichlidae) in Georgia, the South Caucasus. In IOP Conference Series: Earth and Environmental Science (Vol. 744, No. 1, p. 012036). IOP Publishing.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	CABI, 2022. Oreochromis niloticus. In: Invasive Species Compendium. Wallingford, UK: CAB International.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Gu, D. E., Ma, G. M., Zhu, Y. J., Xu, M., Luo, D., Li, Y. Y., ... & Hu, Y. C. (2015). The impacts of invasive Nile tilapia (Oreochromis niloticus) on the fisheries in the main rivers of Guangdong Province, China. Biochemical Systematics and Ecology, 59, 1-7.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No published data	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	Deines, A. M. (2013). Environmental change and tradeoffs in freshwater ecosystem services: Nile Tilapia (Oreochromis niloticus) introduction to the Kafue River, Zambia. University of	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Deines, A. M. (2013). Environmental change and tradeoffs in freshwater ecosystem services: Nile Tilapia (Oreochromis niloticus) introduction to the Kafue River, Zambia. University of	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	No such an evidence	Low
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Gu, D. E., Ma, G. M., Zhu, Y. J., Xu, M., Luo, D., Li, Y. Y., ... & Hu, Y. C. (2015). The impacts of invasive Nile tilapia (Oreochromis niloticus) on the fisheries in the main rivers of Guangdong Province, China. Biochemical Systematics and Ecology, 59, 1-7; Nico, L.G., Schofield, P.J., and Neilson, M.E., 2021, Oreochromis niloticus (Linnaeus, 1758): U.S. Geological Survey, Nonindigenous Aquatic Species Database, Gainesville, FL, https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=468, Revision Date: 1/8/2020, Peer Review Date: 12/18/2013, Access Date: 11/8/2021	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	The species is not parasite	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Due to its widespread itroduction	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	No respective study is known however the species is actively involving in the local ecosystem food web that most probably also introduce changes	Low

19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Deines, Marion E. Wittmann, Jillian M. Deines & David M. Lodge (2016) Tradeoffs among Ecosystem Services Associated with Global Tilapia Introductions, Reviews in Fisheries Science & Aquaculture, 24:2, 178-191	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such research exists	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Dong, H. T., Nguyen, V. V., Le, H. D., Sangsuriya, P., Jitrakorn, S., Saksmerprome, V., ... & Rodkhum, C. (2015). Naturally concurrent infections of bacterial and viral pathogens in disease outbreaks in cultured Nile tilapia (Oreochromis niloticus) farms. Aquaculture, 448, 427-435.	Very high
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Trewavas, E., 1983. Tilapiine fishes of the genera Sarotherodon, Oreochromis and Danakilia. British Mus. Nat. Hist., London, UK.	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Trewavas, E., 1983. Tilapiine fishes of the genera Sarotherodon, Oreochromis and Danakilia. British Mus. Nat. Hist., London, UK. 583 p.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No such an evidence	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No respective study is available	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=468	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Expected but no specific research has been done	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Peterson, M. S., Slack, W. T., Brown-Peterson, N. J., & McDonald, J. L. (2004). Reproduction in nonnative environments: establishment of Nile tilapia, Oreochromis niloticus, in coastal Mississippi watersheds. Copeia, 2004(4), 842-849.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Expected but not yet documented	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Nico, L.G.; P.J. Schofield; M.E. Neilson (2019). "Oreochromis niloticus (Linnaeus, 1758)". U.S. Geological Survey, Nonindigenous Aquatic Species Database	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Trewavas, E., 1983. Tilapiine fishes of the genera Sarotherodon, Oreochromis and Danakilia. British Mus. Nat. Hist., London, UK.	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Not such an evidence exists.	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Trewavas, E., 1983. Tilapiine fishes of the genera Sarotherodon, Oreochromis and Danakilia. British Mus. Nat. Hist., London, UK.	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	Noakes, D.G.L. and E.K. Balon, 1982. Life histories of tilapias: an evolutionary perspective. p. 61-82. In R.S.V. Pullin and R.H. Lowe-McConnell (eds.) The biology and culture of tilapias. ICLARM Conf. Proc. 7.	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Only human mediated dispersal is possible in RA	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Coclhis national park along the Black Sea is the most vulnerable for invasion	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	There is no such an evidence exist	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such an evidence exist	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Juveniles can be released intentionally/unintentionally	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not amigration typically occures in the nile talipia populations	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence exist	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Expected based on professional judgement	Low
43	7.09	Is dispersal of the taxon density dependent?	No	Not such an evidence exists and this is even less relevant for the RA area	High
8. Tolerance attributes					

44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such an evidence exists	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Kammerer, B. D. (2009). Short-term mechanisms of seawater acclimation in tilapia (Oreochromis mossambicus). University of California, Davis.	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such an evidence exists	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No such an evdience exist	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Kammerer, B. D. (2009). Short-term mechanisms of seawater acclimation in tilapia (Oreochromis mossambicus). University of California, Davis.	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Not known based on professional judgement	Low
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Not expected based on professional judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Under climate change scenario where increse of temperature is expected, the establishment/distribution risks of tilapia is also expected that most probably will increase the impact on local ecosystems	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Under climate change scenario where increse of temperature is expected, the establishment/distribution risks of tilapia is also expected that most probably will increase the impact on local ecosystems	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Under climate change scenario where increse of temperature is expected, the establishment/distribution risks of tilapia is also expected that most probably will increase the impact on local ecosystem services	Low

Statistics	
Scores	
BRA	**38.0**
BRA Outcome	**-**
BRA+CCA	**44.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**19.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**19.0**
4. Undesirable (or persistence) traits	*7.0*
5. Resource exploitation	*7.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*3.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**15**
Environmental	**16**
Species or population nuisance traits	**16**

Thresholds	
BRA	**-**

BRA+CCA	-
Confidence	
BRA+CCA	0.57
BRA	0.61
CCA	0.25

Date and Time
16/05/2022 21:08:42

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Oreochromis niloticus*
Common name	Nile tilapia
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	The culture of Nile tilapia (Oreochromis niloticus) can be traced to ancient Egyptian times as
Risk assessment area	South Caucasus
Taxonomy	Oreochromis niloticus (Linnaeus, 1758)
Native range	Africa: naturally occurring in coastal rivers of Israel, Nile basin (including lake Albert, Edward and
Introduced range	Nile tilapia were introduced to developing countries and cultured on a subsistence level to meet
URL	https://www.fishbase.se/summary/oreochromis-niloticus.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	The Nile tilapia, Oreochromis niloticus, is widely distributed in the world for aquacultural purposes. For instance, this fish is the main species farmed in Brazil, predominantly in net cages within freshwater reservoirs (Roriz et al., 2017).	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Nile tilapia has been extensively propagated locally by farmers and anglers for recreational and sport fishing into small- and medium-sized reservoirs, often circumventing permitting	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Nile tilapia is well-suited for aquaculture because of its wide range of trophic and ecological adaptations, and its adaptive life history characteristics that enable it to occupy many different tropical and sub-tropical freshwater niches (Trewavas, 1983). These attributes have inherently predisposed it to be a successful invasive species, with established feral populations in most tropical and sub-tropical environments in which it has either been cultured or has otherwise gained access to.	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	Climate analysis did not confirm the environmental suitability for the Nile tilapia in Georgia, the risk of this species establishment still exists. For example, Nile tilapia was not considered to be established in temperate environments in the US, since it was believed that the species could not survive the winter. However, the study done by Grammer et al. [15] proved its successful establishment in temperate Mississippi (Southeastern Mississippi, the Pascagoula River) (Kuljanishvili et al. 2021).	High
5	2.02	What is the quality of the climate matching data?	Low	Kuljanishvili et al. 2021	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	In the summer of 2019, a tilapia (Oreochromis sp.) fish appeared in local anglers caught in a small village Mshvidobani (Lagodekhi region) in Eastern Georgia (Kuljanishvili et al. 2021).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species enters in the region for aquacultural purposes.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Nile tilapia was found in Turkey by Mert & Cicek, which was supposed to be its maximum northern distribution in the Mediterranean area. Authors, however, emphasized that the confirmation of this species establishment was needed. Later, Nile tilapia was included in the checklist of the freshwater fishes of	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Study done by Grammer et al. proved successful establishment of Nile tilapia in temperate Mississippi (Southeastern Mississippi, the Pascagoula River). Although the extended temperatures range for Nile tilapia is 8-42°C, it was found to be well adapting to the outflows of the aquaculture farms, where water is warmer (so-called thermal refugia), which then could have led to survival and establishment of Nile tilapia in temperate regions in the USA	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Several countries report adverse ecological impact after introduction of nile tilapia.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	The introduction of Nile tilapia did not increase the total catch-per-unit-of-effort (CPUE), the number of fishers actively fishing or their per capita income. Conversely, a significant reduction in the CPUE of other commercially important species was observed after the introduction of Nile tilapia in the reservoir. Although other factors cannot be rule out as possible explanations of the observed changes in the reservoir fisheries, the results are consistent with the hypothesis that these changes may have been caused, at least partially, by the introduction of the Nile tilapia	Very high
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	This review (1) provides a new estimate of the global scale of tilapia introduction and the reported occurrence of impacts to ecosystem services; (2) assesses whether reported changes to ecosystem services differ among species, regions and type of ecological effect reported; and (3) determine how perceptions of tilapia introduction are related to the reported occurrence of ecological effects and/or the contribution of tilapia to countries’	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Data deficient	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					

14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	It is possible that this will happen if the species enters the new region.	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	The chances of this happening are quite high if this species spreads in the region	Medium
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	The probability of this is low though it can happen	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	There is a possibility of that. The study conducted in the Gulf of Mexico showd that proliferation of nile tilapia will have important detrimental effects on the structure of native food webs in shallow, structured coastal habitat (Martin et al. 2010).	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	There is a possibility of that	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficient	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	Data deficient	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Nile tilapia is one of the most widely cultured species in aquaculture and stock enhancements (FAO).	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Occurs in a wide variety of freshwater habitats like rivers, lakes, sewage canals and irrigation channels.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	No research has been conducted in this direction, however it is expected that this will happen in some places.	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	The chances of this happening are quite high if this species spreads in the region	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	The chances of this happening are quite high if this species spreads in the region	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Parental care is a well-developed reproductive behaviour in the family Cichlidae, the family to which the tilapias belong. While all the members of the three genera modify a portion of the substratum in which eggs are laid and fertilized, only the eggs of the genus Tilapia hatch in the nest.	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Currently this species does not reproduces in the Caucasus region	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	The Nile tilapia Oreochromis niloticus has been introduced throughout Africa outside its native range for aquaculture purposes. Hybridisation between escaped O. niloticus and native Oreochromis species is of concern due to potential negative effects on wild genetic resources for conservation, aquaculture and capture fisheries. We document the 2008–2010 extent of O. niloticus established in the Kafue River, Zambia, test for hybridisation with two native species, O. andersonii and O. macrochir, using eight microsatellite loci, and evaluate losses in	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Data deficient	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such a study has been conducted	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Nile tilapia are maternal mouthbrooders. A female lays her eggs in a simple nest prepared by the male, the male fertilizes the eggs and then the female picks the eggs up and incubates them in her mouth. Even after eggs hatch, fry will remain in the mother's mouth. Once the fry are free-swimming they will return to her mouth for protection. Females can produce several hundred to	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Sexual maturity in Nile tilapia reached at 3-6 months depending on temperature, reaching about 30 g.	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species enters in the region for aquacultural purposes.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Nile tilapia caught in a small village Mshvidobani (Lagodekhi region) in Eastern Georgia which is close from the Lagodekhi Protected Areas.	Medium

37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Such fact has not been detected	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Such fact has not been detected yet.	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	Such fact has not been detected yet.	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Such fact has not been detected.	Medium
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Such fact has not been detected yet.	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	Not applicable	Data deficient	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Such fact has not been detected.	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Occurs in a wide variety of freshwater habitats like rivers, lakes, sewage canals and irrigation channels. Does not do well in pure salt water, but is able to survive in brackish water.	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Among the seven (7) methods in use for the control of tilapia populations in aquaculture the following techniques may be appropriate and could be applied as soon as possible in controlling the Mozambique tilapia in the natural bodies of water in Nauru. (1) periodic harvesting of fry and fingerlings including the parents; (2) biological control; and (3) eradication of tilapia using organic toxicants and/or other chemicals.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	An example of this is the tilapia found in the Lagodekhi region, Georgia, which spread from an artificial lake.	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Nile tilapia is able to survive in brackish water (Lamboj 2004).	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several predators which can controll Nile tilapia in the Caucasus region: Esox lucius, Silurus glanis, Squalius spp, Salmo spp, birds, Snakes, Otters etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	In the view of global climate change the probability of species establishment and spreading is increasing as the fish enter the open waters of the Caucasus region (Kuljanishvili et al. 2021).	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	In the view of global climate change the probability of species establishment and spreading is increasing as the fish enter the open waters of the Caucasus region (Kuljanishvili et al. 2021).	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	In the view of global climate change the probability of species establishment and spreading is increasing as the fish enter the open waters of the Caucasus region (Kuljanishvili et al. 2021).	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	In the view of global climate change the probability of species establishment and spreading is increasing as the fish enter the open waters of the Caucasus region as well as its impact on local biodiversity will be high.	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	In the view of global climate change the probability of species establishment and spreading is increasing as the fish enter the open waters of the Caucasus region as well as its impact on local biodiversity and ecosystem structure will be high.	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	In the view of global climate change the probability of species establishment and spreading is increasing as the fish enter the open waters of the Caucasus region as well as its impact on local biodiversity and ecosystem services will be high.	Medium

Statistics	
Scores	
BRA	**36.0**
BRA Outcome	**-**
BRA+CCA	**48.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**19.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**17.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*7.0*

6. Reproduction	*3.0*
7. Dispersal mechanisms	*-4.0*
8. Tolerance attributes	*3.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**14**
Environmental	**17**
Species or population nuisance traits	**19**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.63**
BRA	**0.65**
CCA	**0.50**

Date and Time
13/05/2022 14:46:49

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Oreochromis niloticus*
Common name	Nile tilapia
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Has been recorded from East Georgian Rivers
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cichliformes (Cichlids, convict blennies) > Cichlidae (Cichlids) >
Native range	Africa, The Nile basin
Introduced range	East Georgia
URL	https://www.fishbase.de/summary/Oreochromis-niloticus.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	"The culture of Nile tilapia (Oreochromis niloticus) can be traced to ancient Egyptian times as depicted on bas-relief from an Egyptian tomb dating back over 4000 years, which showed the fish held in ornamental ponds. While significant worldwide distribution of tilapias, primarily Oreochromis mossambicus, occurred during the 1940s and 1950s, distribution of the more desirable Nile tilapia occurred during the 1960s up to the 1980s" http://www.fao.org/fishery/culturedspecies/Oreochromis_niloticus/en#tcNA003F	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	This is fisheries important species that can be harvested in the wild, ca be sold or used in its live form.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	For instance, Blue tilapia	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	Not much similar	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Quality of Climatch is medium	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	It has been found in the rivers of eastern Georgia	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Aquaculture	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Yes, in Turkey for instance (Mert & Cicek 2010).	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Has been become naturalised for instance in India https://india.mongabay.com/2020/10/commentary-tilapia-how-an-invasive-fish-came-to-dominate-our-ecology-food-and-psyche/. their populations are known to exsit at least in 114 countries (Deines 2016) and at least 55% of all countries report established tilapia populations outside aquaculture (Deines 2016)	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Tilapias can very easily compete the native species by feeding on their resources. ''increasing tilapia production may cause a decrease in populations of harvestable native species, a decrease in habitat, or recreational and cultural ecosystem services linked to the native species harmed by tilapia (Canonico et al., 2005)''	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	Tilapia have also been implicated in harm to other fisheries such as milkfish aquaculture in Nauru (Ranoemihardjo, 1981), and cyprinid harvests in India (Sugunan, 2000; Sugunan, 1995)''	Very high
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Water quality; transmitting diseases.	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Results also illustrate that increasing research efforts leads to increasingly ambivalent perspectives about the net socioeconomic value of tilapia introductions, as undesirable ecological impacts become as apparent as the socioeconomic benefits of tilapia production. In some cases, perspectives are regionally determined. There is not, nor is there likely ever to be, a global consensus on the socioeconomic merits of tilapia introduction. Rather, we recommend that decisions be informed by comparisons of the regional and local economic benefits to the regional and local ecological costs now and in the future. While the ecological effects may be similar over much of the introduced range of tilapia, as results demonstrate, there is no reason to expect uniform socioeconomic benefits. The work of managers, decision and policy makers, and other stakeholders is therefore made all the more relevant in the careful consideration of local context in decisions about tilapia introductions. And there will be ample	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	It is possible	High

16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	it can adapt to different salinities and temperatures	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	No	species of the genus Tilapia are typically macrophyte feeders while Oreochromis are typically microphagous (Beveridge and Baird, 2000). As a result, Tilapia have previously been used to control aquatic weeds (Hauser et al., 1977), suggesting these species may impact plant habitats relatively frequently.	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	More than 80% of published ecological research on tilapia reports changes in ecosystem services (Deines 2016)	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	Tilapia provided a reservoir which maintained or propagated the incidence of an existing pathogen or parasite (Deines 2016)	High
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Tilapia can bea vector for nonindigenous pathogens or parasites (Deines 2016)	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length is 60cm	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Occurs in a wide variety of freshwater habitats like rivers, lakes, sewage canals and irrigation channels	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Reductions in other ecosystem services caused by tilapia are associated with the loss of aquatic plants and the habitats they provide to native species (Crutchfield, 1995), as well as undesirable biotic and abiotic changes associated with eutrophication (Figueredo and Giani, 2005).	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Absolutely. The parental care is the one of the traits that allow them to be successful invaders	Very high
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No. less lkely	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	It is possible. However, the impact does not seem to be high	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	They are mouth breaders	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	The strict winter conditions will not allow this species to produce viable gametes. However, It is known that this species has become established in temperate MIssisippi. in the outflow of fishery farms, where the temperatures were higher during winter.	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Yes this species can hybridise with native taxa in Africa	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.de/summary/Oreochromis-niloticus.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Several yearly spawnings every 30 days. Females incubate eggs inside their mouths (approximately for a week) overall it can be 200 eggs	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	3-6 months	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture, Self-spreading	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	It is possible.	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Yes. it is possible.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Does not migrate	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high

42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Yes they seem to be rapid	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No (Osofero et al 2009)	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Can not tolerate temperature changes, or high salinities	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	NO	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information avalable	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	They can not tolerate high salinities	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No information avalable	Low
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Increased temperatures will cause this species establishment in RA	Very high
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Population densities will increase making them on one hand impossible to eradicate and on the other hand, affecting native organisms due to competition, that does not leave much resources for native ones.	Very high
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Difficult to judge	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Higher	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Under the predicted future climatic conditions, this species will disperse even wider, that will itself create the problem for native aquatic organisms.The widespread and abundance of this fish which is quite adaptive and plastic to different environmental conditions, will increase its impact on ecosystem services and	Medium

Statistics	
Scores	
BRA	**24.0**
BRA Outcome	**-**
BRA+CCA	**34.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**12.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*7.0*
B. Biology/Ecology	**12.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*2.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*

Sectors affected	
Commercial	12
Environmental	7
Species or population nuisance traits	19

Thresholds	
BRA	-
BRA+CCA	-
Confidence	
BRA+CCA	0.76
BRA	0.77
CCA	0.71

Date and Time
21/05/2022 15:21:23

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Perca fluviatilis*
Common name	Eurasian perch
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	This is locally translocated, predatory species from west to the east South Caucasus. Now it is
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Perciformes/Percoidei (Perchs) > Percidae (Perches)
Native range	Europe
Introduced range	Worldwide
URL	https://www.fishbase.de/summary/Perca-fluviatilis.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Douxfils, J., Mandiki, S. N. M., Marotte, G., Wang, N., Silvestre, F., Milla, S., ... & Kestemont, P. (2011). Does domestication process affect stress response in juvenile Eurasian perch Perca fluviatilis?. Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology, 159(1), 92-99.	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	e.g. Rundberg, H. (1977). Trends in harvests of pikeperch (Stizostedion lucioperca), eurasian perch (Perca fluviatilis), and northern pike (Esox lucius) and associated environmental changes in lakes Mälaren and Hjälmaren, 1914–74. Journal of the Fisheries Board of Canada, 34(10), 1720-1724.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No other congeners or specific race is known as invasive	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Result of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	e.g. Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Human mediated dispersal for recreational fisheires	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	E.g. Morgan, D. L., Hambleton, S. J., Gill, H. S., & Beatty, S. J. (2002). Distribution, biology and likely impacts of the introduced redfin perch (Perca fluviatilis)(Percidae) in Western Australia. Marine and Freshwater Research, 53(8), 1211-1221.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	Not documented evidence exist	Low
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	e.g. Closs, G. P., Ludgate, B., & Goldsmith, R. J. (2001, May). Controlling European perch (Perca fluviatilis): lessons from an experimental removal. In Proceedings of the workshop: Managing invasive freshwater fish in New Zealand (pp. 10-12).	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No documented evidence exist	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence exist	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	No documented evidence exist	Low
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	e.g. No documented evidence exist	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	Species is predator and thus can affect a number of fish and inverebrates in RA area	Low
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Morgan, D. L., Hambleton, S. J., Gill, H. S., & Beatty, S. J. (2002). Distribution, biology and likely impacts of the introduced redfin perch (Perca fluviatilis)(Percidae) in Western Australia. Marine and Freshwater Research, 53(8), 1211-1221.	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	No documented evidence exist	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No documented evidence exist	Low

20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No documented evidence exist	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	No documented evidence exist. Furthermore, the species is translocated and hosting parasites or infections that are not new for the RA area	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Expected based on professional judgement though no documented evidence exist	Low
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Usually lives in lotic systems or slow mooving water	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No such an evidence exist	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No documented evidence exist	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	It can consume juveniles of any other species including threatened fishes	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No documented evidence exist	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No sucha behavior is registered	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Species is currently a common one in many water bodies in East Georgia. Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Kahilainen KK; Teacher AGF; Kahkonen K; Vinni M; Lehtonen H; Merila J, 2010. First record of natural hybridization and intogression between pikeperch (Sander lucioperca) and perch (Perca fluviatilis). Ann. Zool. Fenn, 48:39-44.	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	The species is sexually reproducing	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such dependancy is ever recorded	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Craig, J. F. (2008). Percid fishes: systematics, ecology and exploitation. John Wiley & Sons.	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Human mediated translocation for recreational or aquacultural purpose, but also independently	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	In the areas where such protectead areas are established, species is native	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence is available	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Not expected	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	The larval perch usualy dispersing actively through currents. E.g. Craig, J. F. (2008). Percid fishes: systematics, ecology and exploitation. John Wiley & Sons.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not expected based on professional judgment	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence exists	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	No documented evidence exist	Low
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence exist	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such an evidence exists	Medium

45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No documented evidence exists	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No documented evidence exists	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No such fact have been reported	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No such an evidnece exists	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Based on professional judgement	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Based on professional judgement	Low

Statistics	
Scores	
BRA	**17.0**
BRA Outcome	**-**
BRA+CCA	**23.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**9.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*6.0*
B. Biology/Ecology	**8.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*5.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*-2.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**9**
Environmental	**9**
Species or population nuisance traits	**7**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.52**
BRA	**0.55**

CCA	0.33

Date and Time
16/05/2022 21:32:03

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Perca fluviatilis*
Common name	Eurasian perch
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	The Eurasian perch Perca fluviatilis is an important fish species in both commercial and
Risk assessment area	South Caucasus
Taxonomy	Perca fluviatilis Linnaeus, 1758
Native range	Eurasia: throughout Europe to northernmost extremity of Scandinavia, except Iberian Peninsula,
Introduced range	Widely introduced. Several countries report adverse ecological impact after introduction.
URL	https://www.fishbase.se/summary/perca-fluviatilis.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	The farming of percids (Eurasian perch Perca fluviatilis, pikeperch Sander lucioperca) has progressively become a diversification path of European inland aquaculture in the past 25 years. This required the domestication of wild or pseudowild (coming from polyculture ponds) populations (Fontaine and Teletchea 2019).	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	For instance total farmed perch production in 2005 was 315 tonnes (FAO 2007 stats).	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Several countries have reported adverse ecological impacts after the introduction of P. fluviatilis (Froese and Pauly, 2011). One such example is in the Murray-Darling Basin, South Australia, where it is considered a threat to native fish species.	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	P. fluviatilis is naturally distributed in the South Caucasus Region (Kuljanishvili et al. 2020; Epitashvili et al. 2020) and actively translocated within the region by fishermans. Therefore climatic conditions for this species within the region is more or less	Very high
5	2.02	What is the quality of the climate matching data?	High	Köppen-Geiger climate classification map	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	P. fluviatilis is naturally distributed in the South Caucasus Region (Kuljanishvili et al. 2020; Epitashvili et al. 2020) and actively translocated within the region by fishermans.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	P. fluviatilis is actively translocated within the Caucasus Region by fishermans	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	There are three species, Perca fluviatilis, Sander lucioperca and S. marinus, found naturally in the Caspian Sea basin of Iran (Coad 2016)	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	There is a long history of intentional introductions of this species for sustenance and sport fishing. Many of those introductions have resulted in established wild populations.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	One such example is in the Murray-Darling Basin, South Australia, where P. fluviatilis considered as threat to native fish species.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No data	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	P. fluviatilis has negative impact on the local biodiversity and therefore ecosystem services. Example of this are Tbilisi Reservoir where P. fluviatilis was released by fishermans and currently this fish become dominant species in the reservoir. This has a negative impact on recreational fishing as other species are currently less available because of this species (Own observation).	Very high
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Perca fluviatilis has the potential for moderate socio-economic impact if introduced to the Great Lakes. P. fluviatilis may prey on native species and trout, negatively affecting recreational fisheries. Within a 72-hour period, P. fluviatilis eliminated 20,000 newly released rainbow trout fry from a reservoir in south-western Australia (NSW DPI 2012).	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	P. fluviatilis is a predator species and harms local species.	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	P. fluviatilis is a predator species and harms local threarened and protected species in the Caucasus region such as Salmo spp; Acipenser spp, Luciobarbus capito, etc (Own observation).	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	P. fluviatilis is naturally distributed in the South Caucasus Region (Kuljanishvili et al. 2020; Epitashvili et al. 2020) and actively translocated within the region by fishermans. Therefore climatic conditions for this species within the region is more or less	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	Such example is in the Murray-Darling Basin, South Australia, where P. fluviatilis considered as threat to native fish species. Such a fact is already noticeable in the Tbilisi Reservoir (Own	Very high

19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	P. fluviatilis has negative impact on the local biodiversity and therefore ecosystem services. Example of this are Tbilisi Reservoir where P. fluviatilis was translocated and released by fishermans and currently this fish become dominant species in the reservoir. This has a negative impact on recreational fishing as other species are currently less available because of this species (Own	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Data deficiencies	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	Data deficiencies	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Maximum length of P. fluviatilis is 60 cm, weight 5 kg. Therefore this species is one of the main object to aquaculture.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Inhabits a very wide range of habitats from estuarine lagoons, lakes of all types to medium-sized streams. Feeding larvae occur in open water.	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Not applicable	Data deficiencies	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	In the Tbilisi reservoir P. fluviatilis were released in low numbers and it was able to reproduced itself and today it is one of the most numerous species in this reservoir.	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	This species is predator and can consume local endemic species such as Salmo spp, Acipenser spp and etc. (Own observation).	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	This fish is a predator and competitor species for native taxa within its introduced/translocated ranges of the South Caucasus Region.	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	Data deficiencies	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species naturally breeds in the Southern Caucasus Region (Ninua et al. 2013; Kuljanishvili et al. 2020)	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	A case of natural hybridization between pikeperch (Sander lucioperca) and perch (Perca fluviatilis) was confirmed in Finland based on the intermediate morphological, anatomical and genetic characteristics of the hybrid. Micro satellite analyses ruled out the possibility that the focal individual was of either pure species, and indicated it was a S. lucioperca backcross (Kahilainen et al. 2011).	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	Yes	Chevey (1922) recorded a specimen of P. fluviatilis which had undergone a sex reversal from male to female (Jellyman 1976).	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such a study has been conducted	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Fecundity of P. fluviatilis varies from 12000 to 900 000 eggs (Ninua et al. 2013)	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	The species becomes mature at the age of 2-3 years.	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	This species is distributed naturally and artificially through translocation in the Caucasus region.	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	P. fluviatilis is naturally distributed within the protected areas in the Caucasus region (e.g. Kolkheti National Park; Kobuleti Managed Reserve etc.) and may spread to other protected areas that are not in its natural range.	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not has such means.	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	This species naturally reproduces in the SC region (Ninua et al. 2013; Kuljanishvili et al. 2020).	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This species naturally reproduces in the SC region (Ninua et al. 2013; Kuljanishvili et al. 2020).	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This species reproduces naturally within the Caucasus region (Kuljanishvili et al. 2020).	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	This species is mostly distributed by humans in the region although it is expected that various animals will also disperse its	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Sometimes this species is kept on fish farms and then released to a new location.	Medium
43	7.09	Is dispersal of the taxon density dependent?	Yes	Own judgement	Medium
8. Tolerance attributes					

44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact is known	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	P. fluviatilis inhabits a very wide range of habitats from estuarine lagoons, lakes of all types to medium-sized streams. Feeding larvae occur in open water.	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	Perch are particularly susceptible to the epizootic haematopoietic necrosisvirus (EHN) (Bucke et al. 1979). However, this virus is unlikely to prove usefulin the control of perch (Closs et al. 2001).	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Often this species is spread by humans	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Inhabits a very wide range of habitats from estuarine lagoons, lakes of all types to medium-sized streams. Feeding larvae occur in open water.	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several predators in the SC region which can eat this fish : Salmo spp; Esox lucius, Silurus glanis, Sander lucioperca, etc (Kuljanishvili et al. 2020).	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	This species has potential to increase its range within the Caucasus region.	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	This species has potential to increase its range within the Caucasus region.	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	This species has potential to increase its range within the Caucasus region.	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own judgement	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Own judgement	Medium

Statistics	
Scores	
BRA	**51.0**
BRA Outcome	**-**
BRA+CCA	**63.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**19.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**32.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*7.0*
6. Reproduction	*5.0*
7. Dispersal mechanisms	*7.0*
8. Tolerance attributes	*5.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**16**
Environmental	**16**
Species or population nuisance traits	**35**

Thresholds

BRA	-
BRA+CCA	-
Confidence	
BRA+CCA	0.74
BRA	0.76
CCA	0.54

Date and Time
13/05/2022 14:54:56

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Perca fluviatilis*
Common name	Eurasian perch
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Translocated from the west Georgia to the east.
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Perciformes/Percoidei () > Percidae (Perches) >
Native range	The Black Sea basin
Introduced range	The Kura River Basin
URL	https://fishbase.mnhn.fr/summary/Perca-fluviatilis.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	It has fisheries value	Medium
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes. It has value for commercial, aquaculture and recreational fisheries	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Ruffe Gymnocephalus cernua	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	It is somehow similar	Medium
5	2.02	What is the quality of the climate matching data?	Low	There are no climatic stations in climatch to make this analysis. However, according to Koppen-Geiger map the climate is somehow similar.	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	It is commonly distributed in many eastern Georgian water bodies such as the Algeti and Tbilisi Reservoirs, Bareti, Bazaleti, Lisi, Turtle, and other lakes	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Fisheries; Recreational fisheries	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	It is commonly distributed in many eastern Georgian water bodies such as the Algeti and Tbilisi Reservoirs, Bareti, Bazaleti, Lisi, Turtle, and other lakes	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes it has become naturalized outside its native area	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	It is not known but we may assume that it has great impact since its diet, that consumes any avalable pray.	Low
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	It is not known but we may assume that it has great impact since its diet, that consumes any avalable pray.	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Can affect production of food (trade important coregonids); can be transmissing deseases.	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not knonw	Medium
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	No information avalable	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Inhabits a very wide range of habitats from estuarine lagoons, lakes of all types to medium-sized streams.	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	Not documented	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No adverse impacts on ecosystem services havebeen documented	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	Yes it is possible	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is possible	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Yes. See: https://fishbase.mnhn.fr/summary/Perca-fluviatilis.html	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Inhabits a very wide range of habitats from estuarine lagoons, lakes of all types to medium-sized streams.	Very high

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No info	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Yes. could be possible	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	Not known	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Does not exhibit parental care See: https://fishbase.mnhn.fr/summary/Perca-fluviatilis.html	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Yes, Climate is quite similar.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	NO	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://fishbase.mnhn.fr/summary/Perca-fluviatilis.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Yes See: https://fishbase.mnhn.fr/summary/Perca-fluviatilis.html	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	males at 1-2; Females at 2-4.	Medium
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture; Recriational fisheries	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Yesm it is possible	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	No. can not be distributed as eggs.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	Does not migrate for reproduction	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	No. Can not be dispersed by other ananimals	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No data	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No data	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Temperatures; salinities	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Yes it is possible	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No data	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Yes	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies present in RA area	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high

51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Increase	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Increase	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Higher	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Higher	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	no change	Low

Statistics	
Scores	
BRA	**28.0**
BRA Outcome	**-**
BRA+CCA	**38.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**12.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*6.0*
B. Biology/Ecology	**16.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*5.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*2.0*
8. Tolerance attributes	*1.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**7**
Environmental	**14**
Species or population nuisance traits	**22**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.73**
BRA	**0.74**
CCA	**0.63**

Date and Time
21/05/2022 15:27:42

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Pseudorasbora parva*
Common name	topmouth gudgeon
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	This species is already widespread in the whole South Caucasus and is considered one of the most
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Cypriniformes (Carps) > Gobionidae (Gudgeons)
Native range	Asia
Introduced range	Eurasia
URL	https://www.fishbase.de/summary/Pseudorasbora-parva.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	Not a species with any aquacultural, recreational or ather importance	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	No such fact has ever been reported	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No such taxa is known	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	Result of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low resolution of RA climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Human mediated and natural dispersal	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	e.g. Gozlan, R. E., St-Hilaire, S., Feist, S. W., Martin, P., & Kent, M. L. (2005). Disease threat to European fish. Nature, 435(7045), 1046-1046.	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	e.g. Gozlan, R. E., St-Hilaire, S., Feist, S. W., Martin, P., & Kent, M. L. (2005). Disease threat to European fish. Nature, 435(7045), 1046-1046.	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Have a strong effect on ecosystems however not well evaluated the impact on services	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Species is harmless	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	Can parasite on any fish eggs	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Although not well documented, its widespread invasion indicates the ability of the species to adopt the variable environment.	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	Britton, J. R., Davies, G. D., & Harrod, C. (2010). Trophic interactions and consequent impacts of the invasive fish Pseudorasbora parva in a native aquatic foodweb: a field investigation in the UK. Biological Invasions, 12(6), 1533-1542.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	High

20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such an expectation exists	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	This is small bodied species not exceeds 15 cm in length	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Occures in all kind of stagnant and flowing waterbodies	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	No documented evidence exists	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	Very high
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	The species is reproducing sexually	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such dependancy have ever been observed	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	9	Month	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable habitats nearby)?	>1	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence exists	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No documented evidence exists	Low
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence exists	Medium

42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Gozlan, R. E., Andreou, D., Asaeda, T., Beyer, K., Bouhadad, R., Burnard, D., ... & Robert Britton, J. (2010). Pan-continental invasion of Pseudorasbora parva: towards a better understanding of freshwater fish invasions. Fish and Fisheries, 11(4), 315-340.	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No such an evidence exists	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Own unpublished data	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Oxygen, turbidity, wastewaters, temperature etc.	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Britton, J. R., Davies, G. D., & Brazier, M. (2010). Towards the successful control of the invasive Pseudorasbora parva in the UK. Biological Invasions, 12(1), 125-131.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	No documented evidence exists, based on professional judgement	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	Own unpublished data. It usually can not tollerate marine or even brackish waters.	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Based on professional judgement	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Its already in all drainages of RA ara	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Established populations everywhere in RA area	Very high
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Very high
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Due to adding effect of different threats, based on professional judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgement	Medium

Statistics	
Scores	
BRA	**41.0**
BRA Outcome	**-**
BRA+CCA	**47.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**18.0**
1. Domestication/Cultivation	*-2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**23.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*7.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*2.0*
8. Tolerance attributes	*2.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	

Commercial	17
Environmental	17
Species or population nuisance traits	18

Thresholds	
BRA	-
BRA+CCA	-
Confidence	
BRA+CCA	0.80
BRA	0.81
CCA	0.75

Date and Time
16/05/2022 21:38:48

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Pseudorasbora parva*
Common name	topmouth gudgeon
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Native range of Pseudorasbora parva is Asia: Amur to Zhujiang [Pearl River] drainages in Siberia,
Risk assessment area	South Caucasus
Taxonomy	Pseudorasbora parva (Temminck & Schlegel 1846)
Native range	Asia: Amur to Zhujiang [Pearl River] drainages in Siberia, Korea and China
Introduced range	Introduced to various areas in Europe and Asia
URL	https://www.fishbase.se/summary/4691

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	This fish is a weed, harms other species and is not used in aquaculture	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	This fish is caught randomly while fishing for other species. It has low quality meat and is less used for food.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	P. parva is considered as one of the most invasive species in Europe (FAO 1988, Britton et al. 2009).	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	In some areas of the Caucasus region, like the native range of this species, the climatic conditions are more or less similar (Climate Change in the South Caucasus (2012); Tishchenko et al. 2019).	High
5	2.02	What is the quality of the climate matching data?	Medium	Köppen-Geiger climate classification map	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This fish is widely distributed in the SC region (own data, Ninua et al. 2013; Epitashvili et al. 2020; Kuljanishvili et al. 2020).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	This species is translocated within the region by anglers or other persons unintentional but probably animals also can transport the eggs of P. parva (Karabanov et al. 2013).	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is widely spread around the Caucasus region	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	This species has viable populations around the Caucasus region (Ninua et al. 2013; Karabanov et al. 2013; Pipoyan and Arakelyan 2015; Kuljanishvili et al. 2020).	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	P. parva is considered to be a major threat to native fish communities and listed as an invasive alien species of European Union concern (Spikmans et al. 2020).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	P. parva is known as the spreader of the parasite - Sphaerothecum destruens which became known for causing mortality in salmonid fishes in aquaculture (Spikmans et al. 2020).	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	The study in Czech Republic described harmful competitive effect of huge populations of P. parva and its surprising economic consequences (Musil et al. 2015).	Very high
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	The study in Czech Republic described harmful competitive effect of huge populations of P. parva and its surprising economic consequences (Musil et al. 2015).	Very high
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Such a fact is not known	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	This species is invasive in the Caucasus region and reduces the spread and reproduction of local fish (Kuljanishvili et al. 2020).	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	P. parva as an invasive species eats eggs of local fish and prevents their reproduction.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species has long been established in the SC region and accordingly, the local environmental conditions were acceptable to it.	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	No research has been conducted in this regard although a similar fact is likely to have occurred in many reservoirs of the SC region where local fish populations have been depleted by P. parva	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	No research has been conducted in this regard however, a similar fact probably occurred in many reservoirs where local species were declining which in turn affects angling or other ecosystem services in the SC region.	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No research has been conducted in this regard.	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	No research has been conducted in this regard.	Low

22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	Max length of this species is 12.5 cm TL (Verreycken et al. 2011)	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	P. parva found in a wide variety of habitats, most abundantly in well vegetated small channels, ponds and small lakes (Kottelat and Freyhof, 2007).	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	No research has been conducted in this regard although it is expected that P. parva has a negative impact on habitat quality (Own judgement).	Very high
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	No research has been conducted in this regard.	Very high
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	No research has been conducted in this regard however, the probability of this is very high.	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	This fish is a competitor to local species.	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	No data	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species is naturally reproduces in the SC region (Kuljanishvili et al. 2020).	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Such a fact is not known.	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Such a fact is not known.	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Such a fact is not known.	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Females spawn 3-4 times in a season (Kottelat and Freyhof, 2007; Ninua et al. 2013).	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	The species sexually maturate at the age of 2 (Ninua et al. 2013).	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	This species may disperse within the SC region by itself, other animals or by humans unintentionally.	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	This species is distributed in the protected areas of the SC region (own data).	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such fact is known.	Medium
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	No such fact is known however, P. parva can be spread by animals (e.g. birds).	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This species is naturally reproduces in the region and accordingly, both juvenile and adult individuals are found here.	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This species is actively spawns in the South Caucasus region	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	No such fact is described however, P. parva can be spread by animals (e.g. birds) within the SC region.	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	There is a possibility of that.	High
43	7.09	Is dispersal of the taxon density dependent?	Yes	Populations of this species are growing rapidly in many countries which in turn leads to the expansion of its range.	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been revealed	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	P. parva demonstrates great adaptability and tolerance of poor habitat quality (Gozlan et al. 2002; Beyer et al. 2007).	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	This species is one of the most widespread invasive fish in the Europe, Caucasus and etc. There is no method by which this species could be removed from the environment.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species has become widespread due to human activities.	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	This fish is typical freshwater species and does not occure in the sea or estuaries	High

49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several species in the Caucasus region which can eat P. parva: Silurus glanis, Esox lucius, Squalius spp, Sander lucioperca, etc. see checklist of the South Caucasian freshwater fish (Kuljanishvili et al. 2020).	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	The area of this species is constantly growing in the Caucasus region.	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	The area of this species is constantly growing in the Caucasus	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	The area of this species is constantly growing in the Caucasus	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Potential impacts on the local biodiversity caused by P. parva will be increased in the future.	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Potential impacts on the local biodiversity caused by P. parva will be increased in the future.	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Future potential impacts on the ecosystem services/socio economic development caused by P. parva is unclear for the Caucasus region.	Medium

Statistics	
Scores	
BRA	**47.0**
BRA Outcome	**-**
BRA+CCA	**57.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**22.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**25.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*7.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*7.0*
8. Tolerance attributes	*2.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**17**
Environmental	**17**
Species or population nuisance traits	**28**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.77**
BRA	**0.78**
CCA	**0.75**

Date and Time
13/05/2022 17:16:59

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Pseudorasbora parva*
Common name	topmouth gudgeon
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Stone moroko, Pseudorasbora parva (Temminck & Schlegel, 1846), has been distributed outside
Risk assessment area	South Caucasus
Taxonomy	Actinopterygii (ray-finned fishes) Cypriniformes (Carps) Cyprinidae (Minnows or carps) Gobioninae
Native range	Asia: Amur to Zhujiang [Pearl River] drainages in Siberia, Korea and China
Introduced range	Introduced to various areas in Europe and Asia.
URL	https://www.fishbase.de/summary/Pseudorasbora-parva.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	No trade value	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	It is not harvested or sold deliberately, however it is often the contaminant of aquaculture parcels, can be transported in live	Low
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	Other species of genus Pseudorasbora are harmless	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	According to the Koppen-Geiger climate classification system Source (Amur basin, Korea, central and southern Japan, northern and central China and Taiwan) and Target area (Southern Caucasus) climates are not quite similar.	High
5	2.02	What is the quality of the climate matching data?	High	I run climatch and the all the lowland areas are matching (8 out of 10) and only one mountanous area is 7,	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	P. parva is widely distributed in the RA area (Elanidze 1983; Pipoyan 2012; Ninua et al. 2013; Pipoyan & Kh.Arakelyan 2015; Karabanov et al. 2013; Pipoyan 2012; Ninua et al. 2013;	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	aquaculture, recreational fishing, ornamental fish trade and natural dispersal.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	P. parva is already established throughout the RA area (Kuljanishvili et al, 2020)	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Introduction of P. parva (sexual maturity occurs when they are 1yo) in the territory of Georgia and Armenia was introduced in 1960s (Elanidze 1983; Pipoyan 2012; Ninua et al. 2013; Pipoyan & Kh.Arakelyan 2015), almost 6 decades this species exist, they naturalize and established their populations.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	When established, P. parva creates dense populations, that increases the competition with native species for resources (Britton et al, 2007). It can be a host of a novel fish pathogen to Europe Sphaerothecum destruens (Gozlan et al. 2005).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	It can affect the pond aquaculture trough the competition for the resources and pathogen transfer.	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	1) can affect pond aquaculture food production; 2)can transmit diseases; 3) does not have recrieational value	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No information avalable	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	In an introduced area P. parva quickly becomes dominant species and competes with native species for resources (Britton 2010). It is also known to be feeding on other native species eggs or larvae (Pinder et al 2005)	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	P. parva has been found in a transboundary lake (Lake Kartsakhi) between Georgia and Turkey, which is around 2000 m a.s.l. (Kuljanishvili et al, 2020)	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	in a pond where P. parva was invaded they conducted Stable isotope analysis and found out = apparent trophic position shift for several fishes (See: Britton et al 2010)	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	impacts recreational fisheries can affect pond aquaculture	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	No information about endemic pests and infectious agents in the region.	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	P. parva is healthy host of a novel fish pathogen to Europe Sphaerothecum destruens (Gozlan et al. 2005).	High

22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	This is a small sized fish max length 12.5 cm.	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	This species is fast-running water dwelling.	Medium
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Can be the reason of decreasing some native fish populations	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	phenotype plasticity, fast growth, early maturity, fecundity, reproductive behaviour and resistance to pathogens makes this species able to have sustainable populations even at low densities.	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	During the IUCN Red List assessment of Southern Caucasian native species, a few native species have been identified to be alerted by P. parva. It may consume their eggs or larvae.	Medium
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	They conducted the Stable Isotopic Analysis on the species in a pond where P. was introduced and they found out significantly depressed somatic growth in R. rutilus, in comparison to the P. parva free pond (Britton et al 2010).	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	P. parva exhibits parental care (Gozlan et al 2010)	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Yes. Established in RA since 1960s.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	In introduced range can hybridize with sun bleak Leucaspius delineatus, which is throughout most part of Europe. In Native range natural cross-hybridization happened due to shared resources between species P. parva and P. pumila (an endangered species for of Japan), and caused extirpation of P. pumila in some places (Gozlan et al. 2005).	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.de/summary/Pseudorasbora-parva.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	In introduced areas it can spawn eve earlier than in native range. They are quite plastic about duration and timing of their reproduction, which makes them such successful invaders (Gozlan	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	1 YO	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Contaminant of the Aquaculture goods; Intentional translocations by locals as a bait or curiosity	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	This species is already spread in areas that are protected	Very high
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Although it does not have adaptation of morphological structure that facilitates its attachment to some surfaces, P. parva can spawn on different substrate: rocks, the surfaces of shells, plants and some artificial materials (plastic pipes), thus dispersal via eggs attached to the boats is likely (Pinder and Gozlan 2003)	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	"Eggs laid on floating macrophytes or even the flat surfaces of boats could enable dispersal through connected waterbodies (Pinder and Gozlan 2003)''	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Yes. it is possible.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species do not migrate for spawning	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	possible with some mollusc species	Low
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	In introduced areas it disperses rapidly (one calendar year).	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No data	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No data	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	are plastic to withstand different environmental conditions	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	In some lakes of UK they applied rotenon, de-watering and desinfection, which turned out to be ducessful for eradication P. parva (Britton et al 2008).	High

47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Yes. Does not mind environmental or human disturbance	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	P. parva can not tolerance brackish waters. Estuaries are more of barriers for it's dispersal (Scott et al 2007)	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies present in RA area	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	In terms of increased temperatures, the climate of the RA will become more similar to its native area, and P. parva will definitely benefit by this change	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	They already are distributed everywhere. Increased temperatures might allow them to spread to upper altitudes.	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	This species will reach higher densities and it will affect native fish species in terms of competition, distribution of pathogens.	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	It can affect native organisms and cause their decrease.	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	It can affect recreational fisheries (since this specie is considered as weed within locals); and it can affect pond aquaculture production.	High

Statistics	
Scores	
BRA	**32.0**
BRA Outcome	**-**
BRA+CCA	**44.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**5.0**
1. Domestication/Cultivation	*-2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*5.0*
B. Biology/Ecology	**27.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*7.0*
6. Reproduction	*5.0*
7. Dispersal mechanisms	*4.0*
8. Tolerance attributes	*2.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**7**
Environmental	**15**
Species or population nuisance traits	**27**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.75**
BRA	**0.76**
CCA	**0.63**

Date and Time
21/05/2022 15:09:13

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Rhinogobius lindbergi*
Common name	Lin's goby
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	Newly introduced species in the RA area
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Gobiiformes (Gobies) > Gobiidae (Gobies)
Native range	Amur River
Introduced range	Asia
URL	https://www.fishbase.de/summary/Rhinogobius-lindbergi.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	Species does not have any economic or ornamental value	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	No documented evidence though the species does not have any economic or ornamental values thus no reason behind	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congeners	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	Result of climatch algorithm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of clocal limate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Japoshvili B, Lipinskaya T, Gajduchenko H, Sinchuk A, Bikashvili A, Mumladze L. 2020. First DNA-based records of new alien freshwater species in the Republic of Georgia. Acta Zool Bulgar 72: 545–551; Epitashvili G, Geiger MF, Astrin JJ, Herder F, Japoshvili B, Mumladze L. 2020. Towards retrieving the Promethean treasure: a first molecular assessment of the freshwater fish diversity of Georgia. Biodivers Data J 8: e57862.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Human mediated translocation; natural dispersal	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Sadeghi R, Esmaeili HR, Zarei F, Esmaeili A, Abbasi K. 2019. The taxonomic status of an introduced freshwater goby of the genus Rhinogobius to Iran (Teleostei: Gobiidae). Zool Middle East 65: 51–58.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Sadeghi R, Esmaeili HR, Zarei F, Esmaeili A, Abbasi K. 2019. The taxonomic status of an introduced freshwater goby of the genus Rhinogobius to Iran (Teleostei: Gobiidae). Zool Middle East 65: 51–58; Japoshvili B, Lipinskaya T, Gajduchenko H, Sinchuk A, Bikashvili A, Mumladze L. 2020. First DNA-based records of new alien freshwater species in the Republic of Georgia. Acta Zool Bulgar 72: 545–551	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No documented evidence	Low
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evidence	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No documented evidence	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	No documented evidence exists	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Species is not parasite nor pronounced predator	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	No documented evidence exists	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	No documented evidence exists	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	No documented evidence exists	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such an endmeic pests/infectious deseazes are known from the RA area	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Expected but no documented evidence exists	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	Small bodied fish generally not exceeds 10 cm in length	Low
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Although no documented evidence exists	Low
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No documented evidence exists	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Based on professional judgment but no documented evidence exists	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Some inverterbates although not documented evidences exists	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Similar species of the same family	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Guarding eggs and nest	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Already recorded in a number of areas in the RA area Kuljanishvili et al., 2021 and own unpublished data	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No documented evidence exists	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No such an evidence exists	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such an evidence exists	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	No such an evidence exists	Low
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Human mediated unintentional translocation, natural dispersal	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Colchis national park along the Black Sea	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence exists	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such an evidence exists	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Naturally occuring in part of the RA area most probably already dispersng through water currenets	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No documented evidence eixsts	Low
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence exists	Low
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Due to interconnectivity the species can be spread actively within the Ra area	Low
43	7.09	Is dispersal of the taxon density dependent?	No	No such an evidence exists	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such an evidence exists	Low
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No such an evidence exists	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such an evidence exists	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No documented evidence	Low

48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No such an evidence exists	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No such an evidence exists	Low
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgement	Low

Statistics	
Scores	
BRA	**16.0**
BRA Outcome	**-**
BRA+CCA	**26.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**4.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**12.0**
4. Undesirable (or persistence) traits	*5.0*
5. Resource exploitation	*7.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**5**
Environmental	**12**
Species or population nuisance traits	**14**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.46**
BRA	**0.49**
CCA	**0.25**

Date and Time
16/05/2022 21:56:59

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Rhinogobius lindbergi*
Common name	Lin's goby
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Rhinogobius lindbergi is described species from Amur and Ussuri rivers, Russia (Eagderi et al.
Risk assessment area	South Caucasus
Taxonomy	Rhinogobius lindbergi Berg 1933
Native range	Amur and Ussuri river basins, far eastern part of Russia
Introduced range	Introduced in freshwater systems of Mongolia (Neely et al. 2008), Kazakhstan (Kopylets &
URL	https://www.fishbase.in/summary/Rhinogobius-lindbergi.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	There are no data on the cultivation of this species because it is a very small fish and has no economical or recreational importance.	Medium
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	This species is a very small sized fish and has no economical or recreational importance.	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	This fish is occurring in Iran, North-eastern Anatolia and South Caucasus region and considered as invasive species for the above mentioned regions (biodiversity-georgia.net).	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Köppen-Geiger climate classification map.	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Köppen-Geiger climate classification map.	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	R. lindbergi found in some reservoirs of the SC region (Japoshvili et al. 2020; Kuljanishvili et al. 2020; Epitashvili et al. 2020).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Rhinogobius lindbergi spread unintentionally in the southern Caucasus region as well as throughout its area of invasion.	Medium
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is occuring in Iran (Eagderi et al. 2018).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	R. lindbergi has stable/viable populations in Iran (Eagderi et al. 2018).	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	There are some warnings with regard to the potential effect of R. lindbergi on the native fish fauna (Neely et al. 2008)	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	No data	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No data	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Not applicable	No data	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Such a fact is not known.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	There are some warnings with regard to the potential effect of R. lindbergi on the native fish fauna but still no published evidence exists about its negative impact (Japoshvili et al. 2020)	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are many threatened and protected species in the SC region which are likely to be under the influence of R. lindbergi: e.g. Salmo spp; Acipenser spp; Luciobarbus capito, etc. (Kuljanishvili et al. 2020; Epitashvili et al. 2020).	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	It seems that this species has a high ability to adapt new environmental conditions because it has been successfully established in the Caucasus region.	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	Still no published evidence exists about its negative impact on the food web structure in ecosystems	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	No research has been conducted in this direction.	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No data	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	No data	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	R. lindbergi is small sized fish. Economic value of this species is not evaluated.	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	R. lindbergi is distributed in rivers and lakes of the Caucasus region and can live in both standing and flowing waters.	High

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	R. lindbergi should be considered as new invasive species for the Caucasus region and adverse negative impacts on the local habitats and ecosystems are expected.	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	No research has been conducted in this direction.	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Such data is not available right now	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Not applicable	No research has been conducted in this direction.	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	No research has been conducted in this direction.	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Not applicable	Most likely this species is breeding in the region but currently we have no evidence.	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No such fact has been detected	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No research has been conducted in this direction.	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Such a fact is not known.	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	No data	Low
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	No data	Medium
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Unintentional distribution by humans	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	This species found in the Chachuna Managed Reserve, eastern Georgia (Own unpublished data).	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No data	Medium
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	The eggs of this species may be spread by animals but there is no evidence.	Low
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No such data available	Low
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species is small sized and does not migrate in the long distances.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such data available for this time	Low
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Own observation	Low
43	7.09	Is dispersal of the taxon density dependent?	Yes	No data	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Such a fact is not known.	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Data deficient	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Data deficient	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Data deficient	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	This fish is a typical freshwater species	Medium
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several taxas which should be considered as natural predators for R. lindbergi. This taxons are birds (kingfisher, herons, gulls, etc.), fish (Squalius spp; Perca fluviatilis, Silurus glanis, etc.) reptilies and etc.	High
C. Climate change					
9. Climate change					

50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	The Rhinogobius species, considered invasive in the Caspian Sea basin, seems to be now widespread also in the Caspian part of the study area (Japoshvili et al., 2020) and is expected to enter the Black Sea basin soon (Kuljanishvili et al. 2020)	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	The Rhinogobius species, considered invasive in the Caspian Sea basin, seems to be now widespread also in the Caspian part of the study area (Japoshvili et al., 2020) and is expected to enter the Black Sea basin soon (Kuljanishvili et al. 2020)	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	The Rhinogobius species, considered invasive in the Caspian Sea basin, seems to be now widespread also in the Caspian part of the study area (Japoshvili et al., 2020) and is expected to enter the Black Sea basin soon (Kuljanishvili et al. 2020)	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own observation	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Own observation	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Own observation	Medium

Statistics	
Scores	
BRA	**17.5**
BRA Outcome	**-**
BRA+CCA	**27.5**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**8.5**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*7.5*
B. Biology/Ecology	**9.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*5.0*
6. Reproduction	*0.0*
7. Dispersal mechanisms	*-2.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**7**
Environmental	**13**
Species or population nuisance traits	**11**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.52**
BRA	**0.51**
CCA	**0.63**

Date and Time
13/05/2022 17:59:37

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Rhinogobius lindbergi*
Common name	Lin's goby
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Most probabbly accidentally introduced through aquaculture
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Gobiiformes (Gobies) > Oxudercidae
Native range	The Amur River drainage
Introduced range	The Caspian Sea basin
URL	https://fishbase.mnhn.fr/summary/Rhinogobius-lindbergi.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	No trade value	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	It is not harvested or sold	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Rhinogobius giurinus and R. cliffordpopei (Actinopterygii, Gobiidae) in a plateau lake, southwestern China, However there is not assessment done if they are invasive (Guo et al 2016).	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Somehow similar	Medium
5	2.02	What is the quality of the climate matching data?	Medium	There are no climatic stations in climatch to make this analysis. However, according to Koppen-Geiger map the climate is somehow similar.	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	today the species is distributed only in the eastern part of Georgia and Azerbaijan	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture; Natural dispersal	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	today the species is distributed only in the eastern part of Georgia and Azerbaijan	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes it has become naturalized outside its native area	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	Not known	Low
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Not known	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Not known	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not known	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	No information avalableNo information avalable	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	No. does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	It is not known	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	Less likely	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No adverse impacts on ecosystem services in the RA area is known	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Noinformation avalable	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	No information avalable	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	Does not achive big sizes	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	No information avalable	Medium

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No information avalable	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Yes. as it has already established in RA after 'accidental' introduction	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Can pray on native fish larvae	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	in introduced environment they can change their reporoductive biology Guo et al 2013	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Yes Climate is quite similar.	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://fishbase.mnhn.fr/summary/Rhinogobius-lindbergi.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	No information available	Low
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	1	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture; natural spread	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	It is possible	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	Yes	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	Yes. it is possible	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Yes. it is possible	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Does not migrate	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Yes they seem to be rapid	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	No information avalable	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No	Low
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No info	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No. This is less likely.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information avalable	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No info	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies present in RA area	Low
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high

51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Since this species is originally from the Amur River drainage, where the temperatures are higher than in RA under the predicted climatic conditions risk of establishment will increase	Very high
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It will distribute more widely	Very high
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Since their number will increase it will increase potential impact on biodiversity	Very high
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Higher	Very high
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Higher	Very high

Statistics	
Scores	
BRA	**16.0**
BRA Outcome	**-**
BRA+CCA	**28.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**4.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**12.0**
4. Undesirable (or persistence) traits	*3.0*
5. Resource exploitation	*5.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*4.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**12.0**
9. Climate change	*12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**5**
Environmental	**10**
Species or population nuisance traits	**18**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.65**
BRA	**0.61**
CCA	**1.00**

Date and Time
22/05/2022 15:41:17

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Salmo ischchan*
Common name	Sevan trout
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species is endemic to Sevan lake in Armenia. However it was introduced to several
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids)
Native range	Sevan Lake
Introduced range	South Caucasus
URL	https://www.fishbase.de/summary/Salmo-ischchan.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Musayev MA, Quliyev ZM, Rehimov DB, et al. 2004. Vertebrates, volume III. In: Musayev MA, ed. The AnimalWorld ofAzerbaijan: Elm (in Azeri) Baku. 3–316.; Elanidze R. 1983. Ichthyofauna of the rivers and lakes of Georgia, Metsniereba (in Russian) Tbilisi,	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Supposed though not a recent documented evidence	Low
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congeneric S. trutta	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Low	Results of climatch algorithm	Low
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Human mediated dispersal for aquacultural purpose	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32; Bogdanowicz, W., Rutkowski, R., Gabrielyan, B. K., Ryspaev, A., Asatryan, A. N., Mkrtchyan, J. A., & Bujalska, B. M. (2017). Fish introductions in the former Soviet Union: The Sevan trout (Salmo ischchan)—80 years later. PloS one, 12(7), e0180605.	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No relevan information exists	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No documented evidence	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No documented evidence	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not harmful speceis	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Native salmonids	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Species is not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	Not known	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	No relevan information available	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No relevant information	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such pest/infectious agents are known	Low

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	No	Less likely because of the species is a local endemic within the RA area	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	It can grow as large as 1 m	Low
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Species can cope with standing and flowing waters	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Not expected	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No such an evidence exists	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Some invertebrate larvas (e.g. threatened dragonflies)	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Only based on professional judgement, it is expected to consume the same food used by a native river salmon	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Lavrovsky VV. On trout husbandry management in the U.S.S.R. First and Second Group Fellowship Study Tours on Inland Fisheries Research, Management and Fish Culture in the Union of Soviet Socialist Republics, 15 July–15 August 1965 and 31 May–2 July 1966, Lectures. Repository FAO/UNDP(TA) 2547. Rome: Food and Agriculture Organization of the United Nations; 1968. http://www.fao.org/docrep/005/77678e/77678E04.htm. Accessed 10 April 2016.	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32; Bogdanowicz, W., Rutkowski, R., Gabrielyan, B. K., Ryspaev, A., Asatryan, A. N., Mkrtchyan, J. A., & Bujalska, B. M. (2017). Fish introductions in the former Soviet Union: The Sevan trout (Salmo ischchan)—80 years later. PloS one, 12(7), e0180605.	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Not well documented	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No evidence of asexual reproduction	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Completes its life cycle without any other species	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Several thousands only. Lavrovsky VV. On trout husbandry management in the U.S.S.R. First and Second Group Fellowship Study Tours on Inland Fisheries Research, Management and Fish Culture in the Union of Soviet Socialist Republics, 15 July–15 August 1965 and 31 May–2 July 1966, Lectures. Repository FAO/UNDP(TA) 2547. Rome: Food and Agriculture Organization of the United Nations; 1968. http://www.fao.org/docrep/005/77678e/77678E04.htm. Accessed	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Human mediated transocation, natiral dispersal	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Such teritories are in Javakheti highland and along the Black Sea coast. The later is most probably unsuitable area while the former can be a suitable for the species	Low
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence exists	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Not expected because its native area is landlocked	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	No documented evidence	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	The species is soawing in lakes	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Not expected, not recorded	Very high

42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be rapid?	Yes	For a aquaculture purpose, milions of frys/eggs are released usually Lavrovsky VV. On trout husbandry management in the U.S.S.R. First and Second Group Fellowship Study Tours on Inland Fisheries Research, Management and Fish Culture in the Union of Soviet Socialist Republics, 15 July–15 August 1965 and 31 May–2 July 1966, Lectures. Repository FAO/UNDP(TA) 2547. Rome: Food and Agriculture Organization of the United Nations; 1968. http://www.fao.org/docrep/005/77678e/77678E04.htm. Accessed 10 April 2016.	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No documented evidence	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Professional judgement	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Professional judgement	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such a case is known	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Professional judgement. Its abundance declained in the native area most probably due to human disturbance	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	In the areas of its introduction where established populations exist (e.g. Issyk kul) there are different salinity level compared to Svan lake	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No such natural enemies are known	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Based on professional judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Based on professional judgement	Low

Statistics	
Scores	
BRA	**20.0**
BRA Outcome	**-**
BRA+CCA	**20.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**7.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**13.0**
4. Undesirable (or persistence) traits	*2.0*
5. Resource exploitation	*7.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*1.0*
C. Climate change	**0.0**
9. Climate change	*0.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*

7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**6**
Environmental	**6**
Species or population nuisance traits	**12**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.53**
BRA	**0.56**
CCA	**0.25**

Date and Time
16/05/2022 22:29:52

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Salmo ischchan*
Common name	Sevan trout
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	The trouts of the Salmo ischchan complex are endemic to Lake Sevan (Armenia). Four "forms" of
Risk assessment area	South Caucasus
Taxonomy	Salmo ischchan subsp. gegarkuni Kessler, 1877
Native range	Lake Sevan
Introduced range	Georgia, Azerbaijan
URL	https://www.fishbase.se/summary/4792

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	At present, 17-18 tonnes of commercial fish are produced in Armenia, the bulk of which is the golden trout—Salmo ischchan.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Poaching takes a substantial blame for the reduction in the stocks of Sevan trout. It has become so serious that it threatens the very existence of the species (Savvaitova and Petr).	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No such fact has been detected yet	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	S. gegarkuni is naturally distributed in Lake Sevan which is one of the main reservoir in the South Caucasus Region.	Very high
5	2.02	What is the quality of the climate matching data?	High	Climatic conditions in some regions of the South Caucasus are similar to lake Sevan, for instance in Javakheti region, Southern	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This fish is naturally distributed in Lake Sevan Armenia and also found in artificial reservoir "Tbilisi Sea" in Georgia (own data).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species is translocated within the SC region by human intentionally.	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This fish is already exist in the SC region.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	No	This species has been translocated to other regions of the South Caucasus however, viable populations could not be formed there (Kuljanishvili et al. 2020).	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	Such facts has not been detected yet	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Such facts has not been detected yet	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Such facts has not been detected yet	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Such facts has not been detected yet	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	Such facts has not been detected yet	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Such facts has not been detected yet	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Climatic conditions in some regions of the South Caucasus are similar to lake Sevan, for instance in Javakheti region, Southern Georgia	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	Such facts has not been detected yet	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Due to the scarcity of species such a fact is not expected	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	Data Deficiencies	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Data Deficiencies	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length of S. ischchan is 104 cm TL, max. published weight: 17.0 kg (Berg, 1962), therefore this species is being actively released from captivity.	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	This fish can live in both standing and flowing waters.	Very high

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Such fact is not known	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	This fish is critically endangered and largely or completely dependent on artificial reproduction and stocking (Kuljanishvili et al. 2020).	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	S. gegarkuni is a predator fish and can eat threatened or protected native species in the SC region.	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	S. gegarkuni is a predator fish and can be as a competitor for native taxa.	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	No data	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	The adult specimens of S. gegarkuni spawn in the lake Sevan proper at a depth range of 0.5 to 3 m, over fine gravel. Two spawning stocks are known: one spawns in the northwestern corner of the lake from the beginning of November till the end of December; the other spawns at the southeastern corner, from the middle or the end of January till the end of March.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Such fact has not been detected	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Such fact has not been described	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	Yes	The adult specimens of S. gegarkuni spawn in the lake Sevan proper at a depth range of 0.5 to 3 m, over fine gravel. Two spawning stocks are known: one spawns in the northwestern corner of the lake from the beginning of November till the end of December; the other spawns at the southeastern corner, from the middle or the end of January till the end of March.	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Data deficiency	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	Data deficiency	Low
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species can be dispersed only by restocking.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	Currently this species is not found in protected areas of the SC region.	Low
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This fish does not has such means.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	This taxon spreads within the region only by human	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	This taxon spreads within the region only by human	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This species migrates from Lake Sevan to its tributaries for reproduction.	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has been described yet	Low
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Data deficiencies	Low
43	7.09	Is dispersal of the taxon density dependent?	No	No data	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	This species cannot live without water and dies quickly	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	This species as well as meny other species from this genus is sensitive to water quality	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	Currently there is no need for that.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Data deficient	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	This fish is typical freshwater species.	High

49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are some species in the SC region which can eat S. ischchan: e.g. Esox lucius, Salmo spp and etc (Ninua et al. 2013; Kuljanishvili et al. 2020).	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Global warming will cause a change in the level of Lake Sevan which will negatively affect this species (Own judgement)	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	Global warming will cause a change in the level of Lake Sevan which will negatively affect this species (Own judgement)	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Global warming will cause a change in the level of Lake Sevan which will negatively affect this species (Own judgement)	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	Global warming will cause a change in the level of Lake Sevan which will negatively affect this species (Own judgement)	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Global warming will cause a change in the level of Lake Sevan which will negatively affect this species (Own judgement)	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Global warming will cause a change in the level of Lake Sevan which will negatively affect this species (Own judgement)	High

Statistics	
Scores	
BRA	**5.0**
BRA Outcome	**-**
BRA+CCA	**-7.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**1.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*-2.0*
B. Biology/Ecology	**4.0**
4. Undesirable (or persistence) traits	*5.0*
5. Resource exploitation	*7.0*
6. Reproduction	*-2.0*
7. Dispersal mechanisms	*-2.0*
8. Tolerance attributes	*-4.0*
C. Climate change	**-12.0**
9. Climate change	*-12.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**3**
Environmental	**1**
Species or population nuisance traits	**-9**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.70**
BRA	**0.70**
CCA	**0.75**

Date and Time
13/05/2022 18:10:26

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Salmo ischchan*
Common name	Sevan trout
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	This species was introduced into Georgia in the 1930s, first to Tabatskuri Lake in 1930-35, then in
Risk assessment area	South Caucasus
Taxonomy	This species was introduced into Georgia in the 1930s, first to Tabatskuri Lake in 1930-35, then in
Native range	Armenia (Sevan Lake)
Introduced range	Azerbaija, Georgia.
URL	https://fishbase.mnhn.fr/summary/Salmo-ischchan.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	S. gegarkui has been commercial species and it has been bred in Armenia more than 20 generations	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Since the species is the commercially valuable, it is being harvested from the wild, and it can also be sold in its live form, for commercial purposes.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Salmonid fishes are widly introduced throughout the world due to their commercial value. Some salmonid species are considered as invasive, for instance Salmo salar	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	The number of climtic stations are not sufficient for climatch analysis. However according to Koppen Geiger climate map they are similar	High
5	2.02	What is the quality of the climate matching data?	High	I would say it is high	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species was introduced into Georgia in the 1930s, first to Tabatskuri Lake in 1930-35, then in Paravani Lake in 1970, and in Tbilisi Reservoir around the 1980s. It was released into the Azerbaijani reservoirs and lakes in the 1970s (e.g., Maralgel Lake in 1977) for aquaculture (Elanidze, 1983; Musayev et al., 2004; Kuljanishvili et al., 2020)	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture, recriational fisheries.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species presents in Tbilisi Reservoir, and possibly also in mountain lakes of the Kalbajar region of Azerbaijan. However, nobody has confirmed if this species is truly S. gegarkuni	Medium
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	It is believed that this species has been naturalised in Georgian and Azerbaijani water bodies, however there is only records from fishermen, it needs scientific proof	Medium
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Yusifov et al., 2017 reported that after the introduction of S. gegarkuni (named as S. ischchan) in the Kalbajar region, the native trout species populations decreased in abundance to the point where they were included on the Red List of Endangered Species in Azerbaijan.	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	Yusifov et al., 2017 reported that after the introduction of S. gegarkuni (named as S. ischchan) in the Kalbajar region, the native trout species populations decreased in abundance to the point where they were included on the Red List of Endangered Species in Azerbaijan.	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	It can only be transmitting parasites and deseases, however the introductions are not rapid and this information needs evidence.	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	In Azerbaijan it might have affected commercial fishing on native trouts, but it is not documented.	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	It is possible that it might be in competition with native Salmo caspius. and Actually Yusifov et al., 2017 reported that after the introduction of S. gegarkuni (named as S. ischchan) in the Kalbajar region, the native trout species populations decreased in abundance to the point where they were included on the Red List of Endangered Species in Azerbaijan.	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	This are very sensitive species and can not tolerate variable environmental condidtions.	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	It is possible, however it is not documented.	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No adverse impacts on ecosystem services havebeen documented	High

20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	It is possible. however there is no evidence	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is possible. however there is no evidence	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Yes. See: https://fishbase.mnhn.fr/summary/Salmo-ischchan.html	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	This species can sustain in a range of water velocity conditions	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Has not been documented	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Adults might consume small fish of native species	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No information about it	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Does not exhibit parental care See: https://fishbase.mnhn.fr/summary/Salmo-ischchan.html	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Yes. since the conditions are avalable. However, more research is needed to proove this point.	Medium
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	It is possible however it needs evidence	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://fishbase.mnhn.fr/summary/Salmo-ischchan.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Fecundity can be something between 1300-7460 (Bogdanowicz et al 2017)	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	adults spawn around 3-4 age	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture, Recriational fisheries	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	It is possible	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	It is possible	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Does not migrate for reproduction	Medium
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No.Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	No information avalable	High
43	7.09	Is dispersal of the taxon density dependent?	No	No information about it	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Can not tolerate low oxygen environment and is very sensitive to temperature and to human-produced chemicals.	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	It can be no documented evidence tho	Medium

47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Very sensitive species and can not tolerate human disturbance.	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No information avalable	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies present in RA area	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	In terms of increased temperatures this species will be having troubles to survive in the wild	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Increased temperatures will cause stress in their populations making their populations weaker.	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	The environment for them will be unbearable and this species populations will decrease, reducing the impact on biodiversity	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	The magnitude of future potential impact is low.	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	The magnitude of future potential impact is low.	High

Statistics	
Scores	
BRA	**25.0**
BRA Outcome	**-**
BRA+CCA	**17.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**20.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**5.0**
4. Undesirable (or persistence) traits	*5.0*
5. Resource exploitation	*5.0*
6. Reproduction	*0.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*-4.0*
C. Climate change	**-8.0**
9. Climate change	*-8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**12**
Environmental	**7**
Species or population nuisance traits	**2**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.69**
BRA	**0.68**
CCA	**0.75**

Date and Time
22/05/2022 15:44:31

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Salmo trutta*
Common name	brown trout
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species was introduced in the South Caucasus region and still is considered as having
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids)
Native range	North Atlantic basin
Introduced range	Many european Countries
URL	https://www.fishbase.de/summary/Salmo-trutta.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Krieg, F., Quillet, E., & Chevassus, B. (1992). Brown trout, Salmo trutta L.: a new species for intensive marine aquaculture. Aquaculture Research, 23(5), 557-566.	Medium
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Not well documented, but mostly farmed individuals/propagules are distributed	Low
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Other salmonids	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Results of climatch algorithm	Low
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of lcal climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Human mediated dispersal	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Not documented evidence exists	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	The species is a predator mostly consuming arthropod larvae. Thus there are number of species that can be destroied by this species such as larvae of Gomphidae	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	Not known	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	If established it may reduce native trout	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	no such parasites/infectious agents are known	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Species can attain large enough size to make it easy to keep in captivity. Although in most cases large specimens are used for commercial purposes	Low

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	No documented evidence	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Invertebrates	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	For a native trout	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	The female display provisional parental care on egges and can also change the age-at-maturity in response to environmental conditions - Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No documented evidence	Medium
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Expected, not well documented	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	no such an evidence exists	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No such an evidence exists	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Recreational and aqucultural purpose	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Colchis protected areas along the Black Sea	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence exists	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Not expected	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Species is anadromous	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	Low
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence exists	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Can be released intentionally or unintentioally with large quantity	Very high
43	7.09	Is dispersal of the taxon density dependent?	No	No evidence for that	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not expected as with other salmonids	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	Not a documented evdience	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Ryan, C. 2014. "Salmo trutta" (On-line), Animal Diversity Web. Accessed November 12, 2021 at https://animaldiversity.org/accounts/Salmo_trutta/	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	No such an evidence exists	High

49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Not known any species that can act as an effective natural enemy	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Not enough information, based on professional judgment	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgment	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgment	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgment	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgment	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgment	Medium

Statistics	
Scores	
BRA	**34.0**
BRA Outcome	**-**
BRA+CCA	**40.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**20.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**14.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*5.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*2.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**17**
Environmental	**17**
Species or population nuisance traits	**11**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.58**
BRA	**0.61**
CCA	**0.38**

Date and Time
16/05/2022 22:44:30

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Salmo trutta*
Common name	brown trout
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	Brown trout have been widely introduced into suitable environments around the world, including
Risk assessment area	South Caucasus
Taxonomy	Salmo trutta Linnaeus 1758
Native range	Europe and Asia: Atlantic, North, White and Baltic Sea basins, from Spain to Chosha Bay (Russia).
Introduced range	Brown trout have been widely introduced into suitable environments around the world, including
URL	https://www.fishbase.se/summary/Salmo-trutta.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	According to FAO aquaculture production statistics (which amalgamate the production of all morphs of Salmo trutta under the statistical category of 'sea trout'), the main producers (>100 tonnes/year) of Salmo trutta in sea water or freshwater in 2010 were the Russian Federation (80 percent of the global total, almost all in freshwater), Italy, Romania, France, the United Kingdom, Germany, Denmark and Bosnia and Herzegovina	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Sea trout are almost exclusively produced in intensive monoculture systems. The only variations are linked to broodstock supply (wild or farmed) and the age at which the product is sold (eggs, swim-up fry, fingerlings, pan-size fish). Seed supply is an important component of sea trout culture because an important part of the production output is sold as eggs, fry or fingerlings. Broodstock may be domesticated (originating from cultured fish)	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	In North America Brown trout is considered as invasive in many places as it can out-compete local species like brook trout (Salvelinus fontinalis).	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Köppen-Geiger climate classification map	High
5	2.02	What is the quality of the climate matching data?	High	Köppen-Geiger climate classification map	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	European brown trout is found in some rivers of the Caspian and the Black Sea basins (Ninua et al. 20218).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species enters the region for aquaculture purposes	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	Data deficient	Low
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Introduced brown trout have established self-sustaining, wild populations in many introduced countries.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Brown trout have had serious negative impacts on upland native fish species in some of the countries where they have been introduced, particularly Australia.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Data deficient	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Acoording to cabi.org: Impact Summary of S. trutta: Impact on Fisheries / aquaculture - Positive; impact on Tourism - Positive	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Acoording to cabi.org: Impact Summary of S. trutta: Impact on Fisheries / aquaculture - Positive; impact on Tourism - Positive	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Brown trout Salmo trutta were introduced to New Zealand in 1867. Successful establishment was broadly predictable in terms both of the characteristics of brown trout and of the receiving community. There is evidence of impacts of brown trout on the abundance of some native fish and invertebrates, and brown trout have been responsible for the local extinction and fragmentation of certain species (Townsend 1996).	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are meny protected and threatened species in the SC region which can be hunted by S. trutta: Salmo labrax, Salmo caspius, Salmo ischchan, Acipenser spp, etc.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Own judgement	High

18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	This is to be expected. For instance in New Zealand Brown trout may profoundly affect the functioning of stream communities, reducing the abundance of grazing invertebrates and altering their grazing behaviour so that algal biomass increases. A trophic cascade was predictable on the basis of the attributes of the invader and of the stream community. Brown trout seem to have been responsible for the evolution among invertebrates of novel anti-predator behaviours with far-reaching community	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	This is to be expected if the species is distributed in the region.	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	This is to be expected if the species is distributed in the region.	Medium
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Data deficient	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Max length of S. trutta is 140 cm SL male/unsexed; common length : 72.0 cm TL male/unsexed; max. published weight: 50.0 kg. Therefore, S. trutta is one of the most widely used species in	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	S. trutta found in streams, ponds, rivers and lakes (Scott & Scott, 1988). Individuals spend 1 to 5 years in fresh water and 6 months to 5 years in salt water.	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Data deficient	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	S. trutta is a predator fish and probability of this is high if the species is distributed in the SC region. Local threatened/protected species such as Salmo spp, Acipenser spp, Luciobarbus capito, etc. will be in danger.	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	S. trutta is a predator fish and probability of this is high if the species is distributed in the SC region.	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	The fact that brown trout eggs can be cannibalised by peripheral individuals just after spawning suggests that dominant males would benefit from protecting their offspring by keeping cannibals away from the nest (Tentelier et al. 2011).	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Such a fact is not documented	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Hybrids between native white-spotted charr Salvelinus leucomaenis and non-native brown trout Salmo trutta were identified in streams of Hokkaido, Japan, using both appearance and genetic characters. The DNA analyses indicated that the specimens were hybrids between female S. leucomaenis and male S. trutta. Occurrence of such hybrids implies increased mating opportunities between these species in wild streams (Kitano et al.	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Data deficient	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	Yes	Lacustrine populations of S. trutta undertake migration to tributaries and lake outlets to spawn, rarely spawning on stone, wave-washed lake shores. Spawns in rivers and streams with swift current, usually characterized by downward movement of water	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Juveniles mature in 3-4 years and each female produces about 10.000 eggs.	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	S. trutta mature in 3-4 years (Hart, 1973).	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	This species may be distributed in the region through translocation.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	There is a possibility of that if the species distributed in the region.	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not have a similar means	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such fact has been documented	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No such fact has been documented	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	No such fact has been documented	Medium

41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has been documented	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Data deficient	Low
43	7.09	Is dispersal of the taxon density dependent?	No	Data deficient	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been detected	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	Yes	Found in streams, ponds, rivers and lakes. Individuals spend 1 to 5 years in fresh water and 6 months to 5 years in salt water. Juveniles mature in 3-4 years. Lacustrine populations undertake migration to tributaries and lake outlets to spawn, rarely spawning on stone, wave-washed lake shores. Spawns in rivers and streams with swift current, usually characterized by downward movement of water intro gravel. Spawning takes place normally more than one time. They prefer cold, well-oxygenated upland waters although their tolerance limits are lower than those of rainbow trout and favors large streams in the mountainous areas with adequate cover in the form of submerged rocks, undercut banks,	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	No research has been conducted in this direction.	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	In meny countries and areas this species distribuited through humans	High
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	S. trutta individuals spend 1 to 5 years in fresh water and 6 months to 5 years in salt water.	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several predators in the SC region which can controll the populations of S. trutta, e.g. Salmo spp, Squalius spp, Esox lucius, Sander lucioperca, etc.	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	The entry of this species into the region depends on the human	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	The establishment of this species into the region will probably growth	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	The disperse of this species in the South Caucasus depends on the human and further development of the aquaculture in the region.	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Own judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Own judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	Low

Statistics	
Scores	
BRA	**35.0**
BRA Outcome	**-**
BRA+CCA	**39.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**19.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**16.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*7.0*
6. Reproduction	*0.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*3.0*
C. Climate change	**4.0**
9. Climate change	*4.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*

3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**11**
Environmental	**12**
Species or population nuisance traits	**19**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.64**
BRA	**0.68**
CCA	**0.25**

Date and Time
13/05/2022 18:12:22

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Salmo trutta*
Common name	brown trout
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Aquaculture important species introduced worldwide
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids) >
Native range	Europe and Asia: Atlantic, North, White and Baltic Sea basins, from Spain to Chosha Bay
Introduced range	Widly introduced
URL	https://www.fishbase.de/summary/Salmo-trutta.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Sea trout is probably the first species of fish for which artificial reproduction was performed. This probably occurred in Germany around 1739 and the first sea trout hatchery was established in 1841 in the UK. The technique of artificial fertilization was optimized in the 1850s. Since then, sea trout has been produced extensively in Europe and introduced to all continents as a sport fish http://www.fao.org/fishery/culturedspecies/Salmo_trutta/en#tcNA	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Artificially spawned sea trout can be sold as fertilized eggs of fry.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Examples: golden trout, brook trout, brown trout (Knapp 1996)	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	The climate is somehow similar	Medium
5	2.02	What is the quality of the climate matching data?	Low	Quality of clilmate matching data is low	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Recorded from Armenian freshwaters	High
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture, intentional releases by local fishermnen	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	It is already found in Armenia and has been introduced in Georgia in the past	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes. For example North America	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	They usually sellected native prey for example in Trinity River (California).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	They have been praying on aquaculture important fish	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Can be transmitting the diseases	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	It is not known	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	introduced brown trout may negatively affect populations of native fishes in 39 areas where they have been introduced (Townsend, 1996; McHugh & Budy, 2006; Belk 40 et al., 2016; Hoxmeier & Dieterman, 2016)	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Found in streams, ponds, rivers and lakes (Ref. 5951). Individuals spend 1 to 5 years in fresh water and 6 months to 5 years in salt water (Ref. 51442).	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	It can shape native fish community as well as amphibians, zooplankton and benthic macroinvertebrates.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	can be transmitting deseases	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such information available.	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Likely, yes.	Low

22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Can grow up to 70 cm	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	It can persist in both, standing and flowing rivers and lakes and the anadromous behaviour of the fish facilitates it's dispersal upstreams.	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No information avalable	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Probably no	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Can affect endangered benthic invertebrates and fish fry.	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Possibly yes	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Does not exhibit parental care See: https://www.fishbase.de/summary/Salmo-trutta.html	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	Kuljanishvili et al 2021 proposed that there are no conditions for this species to produce viable gametes	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	It is possible	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.de/summary/Salmo-trutta.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Can spawn 2-3 times during season	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	2-3 years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture, Recreational fisheries, Self Dispersal	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	it can reach there via self-spreaading	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Yes. it is possible.	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	It is possible, however, it is not documented	Medium
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	It could be, however not documented	Medium
43	7.09	Is dispersal of the taxon density dependent?	Yes	SInce this species is very territorial, it could be that they will further spread as population density increases	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Can not tolerate low oxygen environment and is very sensitive to temperature and to human-produced chemicals.	Medium
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No. This is less likely.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information avalable	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Found in streams, ponds, rivers and lakes (Ref. 5951). Individuals spend 1 to 5 years in fresh water and 6 months to 5 years in salt water (Ref. 51442).	High

49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies present in RA area	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	In terms of increased temperatures this species will be having troubles to survive in the wild	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Increased temperatures will cause stress in O. mykiss populations making their populations weaker.	High
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	The environment for them will be unbearable and this species populations will decrease.	High
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	the magnitude of future potential impact is low.	High
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	the magnitude of future potential impact is low.	High

Statistics	
Scores	
BRA	**39.0**
BRA Outcome	**-**
BRA+CCA	**31.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**20.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**19.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*7.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*3.0*
8. Tolerance attributes	*1.0*
C. Climate change	**-8.0**
9. Climate change	*-8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**13**
Environmental	**7**
Species or population nuisance traits	**16**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.69**
BRA	**0.68**
CCA	**0.75**

Date and Time
22/05/2022 15:47:39

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Salvelinus fontinalis*
Common name	brook trout
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	Widely introduced out of its natural margins. Not yet introduced in the South Caucasus but
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids)
Native range	Nort America
Introduced range	South America, Europe and Asia
URL	https://www.fishbase.de/summary/Salvelinus-fontinalis.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	CABI, 2021. Salvelinus fontinalis (Brook trout). https://www.cabi.org/isc/datasheet/65325 (accessed November 2021)	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	The species was extensively harvested and sold in its live forms in the past, but no information on recent harvesting and use is	Low
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Congeneres	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Results of climatch algoriyhm	Medium
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	CABI, 2021. Salvelinus fontinalis (Brook trout). https://www.cabi.org/isc/datasheet/65325 (accessed November 2021)	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquacultural and recreational purpose	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	CABI, 2021. Salvelinus fontinalis (Brook trout). https://www.cabi.org/isc/datasheet/65325 (accessed November 2021)	High
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	CABI, 2021. Salvelinus fontinalis (Brook trout). https://www.cabi.org/isc/datasheet/65325 (accessed November 2021)	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No documented evidence	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No such an evidence exists	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No such an evidence is exists	High
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No such an evidence is exists	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	No	It is reported that the species is outcompeted by a native river salmon (CABI, 2021. Salvelinus fontinalis (Brook trout). https://www.cabi.org/isc/datasheet/65325 (accessed November 2021))	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Not a parasite species	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	No relevan information is available	Medium
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	Not expected	Medium
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Not expected based on professional judgement	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such parasite/infectious agent is known from the RA area	High
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	CABI, 2021. Salvelinus fontinalis (Brook trout). https://www.cabi.org/isc/datasheet/65325 (accessed November 2021)	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Needs mountain rivers (medium to fast flowing). Hoever Mountain lakes are also invided CABI, 2021. Salvelinus fontinalis (Brook trout). https://www.cabi.org/isc/datasheet/65325 (accessed November 2021)	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Not expected	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Not expected, no relevant data	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Some aquatic invertebrates	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Native salmon	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Muus BJ, Dahlström P, 1981. [English title not available]. (Sötvattensfisk och fiske i Europa.) Sötvattensfisk och fiske i Europa. Stockholm: PA Norstedt & Söners förlag	Medium
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No such an evidence exists	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	CABI, 2021. Salvelinus fontinalis (Brook trout). https://www.cabi.org/isc/datasheet/65325 (accessed November 2021); Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Sexually reproducing species	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Does not depend on any other species to complete life cycle	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Maximum several thousand of egges are reported (CABI, 2021. Salvelinus fontinalis (Brook trout). https://www.cabi.org/isc/datasheet/65325 (accessed November 2021))	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	year	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Recreational and aquacultural purpose, can escape from captivity	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Colchis national park along the Black Sea	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such a behavior is ever recorded	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such an evidence exists	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Juveniles are usually transported with water currents for long distance	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Not occuring in neghboring seas	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence exists	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Human meidated dispersal can be rapid depneding on the release intensity.	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	No such an evidence is known	High
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	As other salmonids this species can not cope with out of water environment	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	No such an evidnece exists	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No such an evidence exists	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Not expected based on professional judgment	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	Not expected since in its natural environment th variability of salinity level is very large	High

49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effectiv enatural enemies are known from the RA area	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional guess	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	Based on professional guess	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Based on professional guess	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Based on professional guess	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Based on professional guess	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional guess	Low

Statistics	
Scores	
BRA	**17.0**
BRA Outcome	**-**
BRA+CCA	**17.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**7.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**10.0**
4. Undesirable (or persistence) traits	*2.0*
5. Resource exploitation	*7.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*0.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**0.0**
9. Climate change	*0.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**8**
Environmental	**6**
Species or population nuisance traits	**7**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.70**
BRA	**0.76**
CCA	**0.25**

Date and Time
16/05/2022 23:08:38

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Salvelinus fontinalis*
Common name	brook trout
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	S. fontinalis were intentionally introduced for aquaculture, sport fisheries and for food production
Risk assessment area	South Caucasus
Taxonomy	Salvelinus fontinalis (Mitchill, 1814)
Native range	North America: native to most of eastern Canada from Newfoundland and Labrador to western side
Introduced range	Introduced widely in North America and temperate regions of other continents. Acclimatization
URL	https://www.fishbase.se/summary/Salvelinus-fontinalis.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	S. fontinalis were intentionally introduced for aquaculture, sport fisheries and for food production beginning in the late nineteenth century throughout many temperate regions of the world. In Europe, S. fontinalis was originally considered an attractive species, especially for sports fisheries, and it has been extensively stocked in natural waters. Brook trout are commercially raised in large numbers for food production, being sold for human consumption in both fresh and smoked forms.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	In Yellowstone National Park, anglers may take an unlimited number of non-native brook trout in some drainages.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Introductions of S. fontinalis began in the nineteenth century (Welcomme, 1988), to more than 40 countries in temperate areas on all continents, including the southern hemisphere (Welcomme, 1992). S. fontinalis is considered a poor to moderate invader, and this is reflected in its mean fish invasiveness (FISK) score for the United Kingdom (13.5), i.e. the 'medium risk' (of being invasive) category (Copp et al., 2009). Potential impacts include predation on various species of amphibians, zooplankton and other invertebrates as well as increases in primary productivity (Adams et al., 2002; Dunham et al., 2004).	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	World Map of the Köppen-Geiger climate classification	Medium
5	2.02	What is the quality of the climate matching data?	Medium	World Map of the Köppen-Geiger climate classification	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No such fact has been detected	High
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	This species may be entered in the SC region intentionally for aquacultural purposes.	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Salvelinus fontinalis was introduced in Iran and known to compete with native fish for resources in the Tigris-Euphrates basin.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	S. fontinalis becoming established in most of Northern Europe (NOBANIS, 2006), with populations believed to be established in high altitude lakes of Corsica, Italy, the Czech Republic and southern Germany.	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Studies from North America on the effects of introductions of S. fontinalis into waters where it is not native have shown impacts such as decline of native salmonid species. Species that have been replaced or negatively impacted include strains of cutthroat trout (Oncorhynchus clarki), golden trout (O. aguabonita), and bull trout (S. confluentus).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Data deficient	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem services?	Yes	Some predominantly freshwater species that are also found in marine environments have been included in our assessment. While they have a high impact in the freshwater environment, most of these species are not invasive in marine waters and thus were excluded from the proposed European inventory of alien species that have a high impact on the ecosystem services and biodiversity of the marine environment. These species include the mysid Hemimysis anomala, and the fishes Oncorhynchus mykiss	Very high
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	Data deficient	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	In France, brown trout habitat, growth and apparent survival were hardly affected by brook trout (Blanchet et al. 2007).	High

16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	There are several protected and threatened species in the SC region (Salmo labrax, S. caspius, S. gegarkuni, etc) which turns out to be under the influence of S. fontinalis if this species will be distributed in the region.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	The species is expected to adapt to local environmental conditions.	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	It is expected that this will happen.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Own judgement	Low
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Data deficient	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	It is expected that this will happen.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	This species is widely used in aquaculture. It has maximal length 86.0 cm SL male/unsexed; common length : 26.4 cm TL male/unsexed; max. published weight: 8.0 kg.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	The brook trout inhabits large and small lakes, rivers, streams, creeks, and spring ponds. They prefer clear waters of high purity and a narrow pH range and are sensitive to poor oxygenation, pollution, and changes in pH caused by environmental effects	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No research has been conducted in this direction	High
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	S. fontinalis is a predator fish and it is expected that it will eat protected/threathened species in the SC region, e.g. Salmo spp, Acipenser spp, etc.	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	S. fontinalis is a predator fish and it is expected that this will happen.	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	In brook trout populations there is a growing body of evidence linking female preference for large males with greater survival of eggs in fish where males make a significant parental investment. In these cases male parental care leads to a greater hatching success of eggs due to the ability of large males to defend eggs from predators (Blanchfield 1998).	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	No such fact has been detected.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	The impact of introductions of S. fontinalis are relatively well documented. For instance, in Canada S. fontinalis is known to hybridise with threatened native S. confluentus.	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Data deficient	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	Yes	Brook trout are very specific when it comes to habitat, they require cold, clean, well-oxygenated water and even a seemingly minor change in these conditions can result in the loss of brook trout populations (LaConte, 1997).	High
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	In S. fontinalis the numbers of eggs varies between 90 and 4,800 eggs.	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	S. fontinalis reach sexual maturity after two to four years.	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	It is likely that this species will spread within the region intentionally by humans.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	There is a probability of this.	Medium
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not has such means.	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	This species does not reproduces in the SC region.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	This species does not reproduces in the SC region.	Very high

40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	This species does not reproduces in the SC region.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such fact has been detected.	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	Own judgement	Medium
43	7.09	Is dispersal of the taxon density dependent?	Yes	Evidence of density-dependence in the periphery, consequently, may not be the result of local negative feedback, but rather is the result of a density-regulated source of immigrants. Under such a mechanism, when population size in the core habitat is low, population growth rates the following year are high. This results in an increased number of potential immigrants to the periphery and an increase in peripheral growth rates. High densities in the core then result in elevated growth rates in and dispersal to the	Very high
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	This species does not exist without water.	Very high
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	Yes	Within their first year, most brook trout reared in aerated water could withstand oxygen concentrations down to 1.9 mg.O2/1. The 50% tolerance level was 1.75 mg.O2/1. Most fish died at 1.5 mg.O2/1. Acclimation to low (but not lethal) oxygen levels occurred; for a drop of 1.0 mg.O2/1. in environmental oxygen concentration, the tolerance level decreased by approximately 0.09 mg.O2/1. and resistance times at given lethal levels increased up to five-fold. By acclimations trout could exist at	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	As established populations are difficult and costly to control, further introductions or stocking with S. fontinalis should be avoided. The only effective method of fish eradication is the application of rotenone, a pesticide that is also toxic to non-target	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	This species has spread by humans in many regions.	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	The brook trout inhabits large and small lakes, rivers, streams, creeks, and spring ponds. Semianadromous or sea-run brook trout, commonly called "salters", ranged from southern New Jersey, north throughout the Canadian maritime provinces, and west to Hudson Bay. Salters may spend up to three months at sea feeding on crustaceans, fish, and marine worms in the spring, not straying more than a few miles from the river mouth.	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are several potential predators in the SC region which can controll the S. fontinalis populations: Esox lucius, Salmo spp, Sander lucioperca, etc.	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Low
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Own judgement	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	Own judgement	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Own judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	Medium

Statistics	
Scores	
BRA	**33.0**
BRA Outcome	**-**
BRA+CCA	**29.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**18.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*0.0*
3. Invasive elsewhere	*14.0*
B. Biology/Ecology	**15.0**
4. Undesirable (or persistence) traits	*8.0*

5. Resource exploitation	*7.0*
6. Reproduction	*0.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*3.0*
C. Climate change	**-4.0**
9. Climate change	*-4.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**9**
Environmental	**10**
Species or population nuisance traits	**11**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.70**
BRA	**0.76**
CCA	**0.29**

Date and Time
13/05/2022 18:34:08

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Salvelinus fontinalis*
Common name	brook trout
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Has been introduced for aquaculture, sportfishing
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Salmoniformes (Salmons) > Salmonidae (Salmonids)
Native range	Eastern Canada
Introduced range	more than 40 countries in temperate areas on all continents
URL	https://www.fishbase.se/summary/Salvelinus-fontinalis.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	yes comercially valuable fish	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Yes. Taxon is harvested in wild and is sold in its live form	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	yes. Has invasive races	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	14 out of 19 stations are similar with the values of 7,8, and 9	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Medium	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	No	No evidence.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture, sportfishing	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	yes. Turkey	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes it has become naturalized outside its native area	High
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	list of threatened taxa can be found on https://www.cabi.org/isc/datasheet/65325	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Not assessed	Low
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	transmission of deseases	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not known	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	list of threatened taxa can be found on https://www.cabi.org/isc/datasheet/65325	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	No	Very sensitive species does not tolerate wider range of climatic or environmental conditions	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	No	No documented evidence	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	diseases	Very high
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No info	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	it is likely	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	yes. See: https://www.fishbase.se/summary/Salvelinus-fontinalis.html	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	yes. It is likely	High

24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	No information avalable	Very high
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Yes. it is possible	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	It is possible	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	No. unlikely	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	No	Does not exhibit parental care See: https://www.fishbase.se/summary/Salvelinus-fontinalis.html	High
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	No	less likely	Low
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	Medium
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.se/summary/Salvelinus-fontinalis.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	can produce up tp 5000 eggs	Medium
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	2-4 years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	aquaculture or recreational fisheries	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	it is possible	Low
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Yes. it is possible.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	it is possible	Medium
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Not applicable	not yet recorded in the wild.	Medium
43	7.09	Is dispersal of the taxon density dependent?	Yes	They are territorial animals, therefore dispersal is density	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	no. do not tolerate wide range of water quality conditions	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Yes but it is costy and sometimes inefective	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	It is possible	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies present in RA area	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	increases.	High

51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	Decrease	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	They might be forced to dispers in higher altitudes where temperatures will be low	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	No change	Low
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	no change	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	no change	Low

Statistics	
Scores	
BRA	**21.0**
BRA Outcome	**-**
BRA+CCA	**23.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**11.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*6.0*
B. Biology/Ecology	**10.0**
4. Undesirable (or persistence) traits	*4.0*
5. Resource exploitation	*5.0*
6. Reproduction	*0.0*
7. Dispersal mechanisms	*2.0*
8. Tolerance attributes	*-1.0*
C. Climate change	**2.0**
9. Climate change	*2.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**9**
Environmental	**6**
Species or population nuisance traits	**11**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.70**
BRA	**0.74**
CCA	**0.38**

Date and Time
22/05/2022 15:51:45

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Sander lucioperca*
Common name	pikeperch
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species is naturally occurs in the Black-Caspian Sea basins, howver was not known from Arax
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Perciformes/Percoidei (Perchs) > Percidae (Perches)
Native range	Europe
Introduced range	Worldwide
URL	https://www.fishbase.de/summary/Sander-lucioperca.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	e.g. Zakęś, Z. (2007). Out-of-season spawning of cultured pikeperch [Sander lucioperca (L.)]. Aquaculture Research, 38(13), 1419-1427.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Personal observation	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	Not known	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	Medium	Results of climatch algorithm	Low
5	2.02	What is the quality of the climate matching data?	Low	Due to low accuracy of local climate data	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	e.g. Berg S, 2012. Zander Sander lucioperca (Linnaeus, 1758). (Sandart Sander lucioperca (Linnaeus, 1758).) In: Atlas over Danske ferskvandsfisk [ed. by Carl, H. \Møller, P. R.]. Copenhagen, Denmark: Natural History Museum of Denmark, University of Copenhagen, 585-599.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Recreational purpose, Natural dispersal	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	Kuljanishvili, T., Mumladze, L., Japoshvili, B., Mustafayev, N., Ibrahimov, S., Patoka, J., ... & Kalous, L. (2021). The first unified inventory of non-native fishes of the South Caucasian countries, Armenia, Azerbaijan, and Georgia. Knowledge & Management of Aquatic Ecosystems, (422), 32.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	https://www.cabi.org/isc/datasheet/65338#F361ADBE-F16F-40BB-967C-72193652783C	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	Koed A; Jepsen N; Aarestrup K; Nielsen C, 2002. Initial mortality of radiotagged Atlantic salmon (Salmo salar L.) smolts following release downstream of a hydropower station. Hydrobiologia, 483:31-37.; Crivelli AJ, 1995. Are fish introductions a threat to endemic freshwater fishes in the northern Mediterranean region? Biological Conservation, 72:311-319.	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	Koed A; Jepsen N; Aarestrup K; Nielsen C, 2002. Initial mortality of radiotagged Atlantic salmon (Salmo salar L.) smolts following release downstream of a hydropower station. Hydrobiologia, 483:31-37.; Crivelli AJ, 1995. Are fish introductions a threat to endemic freshwater fishes in the northern Mediterranean region? Biological Conservation, 72:311-319.	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	No documented evidence	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No documented evidence	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Sepecies is harmless	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Because of predatory lifestile	Medium
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	The species is strong predator consuming apropriately sized fishes and invertebrates of any kind	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Occures wide range of environmental conditions however not well doccumented the extrem environmental conditions	Low
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	Due to preadoty lifestile e.g. Schulze, T., U. Baade, H. Dörner, R. Eckmann, S.S. Haertel-Borer, F. Hölker and T. Mehner 2006. Response of the residental piscivorous fish community to introduction of a new predator type in a mesotrophic lake. Canadian Journal of Fisheries and Aquatic Science	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No documented evidence	Low

20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No documented evidence	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	No documented evidence	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	Can be as large as 1 m	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Usually lives in standing or slowly moving rivers	Low
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Most probaly no because of predatory foraging behavior	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Not known	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	Fishes (such as for instance Cuciobarbus capito, ro Salmo caspius)	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	e.g. Esox lucius	Very high
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Kottelat, M. and J. Freyhof, 2007. Handbook of European freshwater fishes. Publications Kottelat, Cornol and Freyhof, Berlin.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	It was recorded naturally with 10 years of a laps of time. Pipoyan SKH, Tigranyan EA. 2002. Modern fish fauna of Armenia. J Ichthyol (in Russian) 42: 601–604.; Pipoyan SKH. 2012. Ichthyofauna of Armenia: stages of formation and current state, Palmarium Academic Publishing (In Rissian), p. 538.	Medium
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	Kahilainen KK; Teacher AGF; Kahkonen K; Vinni M; Lehtonen H; Merila J, 2010. First record of natural hybridization and intogression between pikeperch (Sander lucioperca) and perch (Perca fluviatilis). Ann. Zool. Fenn, 48:39-44. Müller T; Taller J; Kolics S; Kovács B; Urbányi B; Specziár A, 2010. First record of natural hybridization between pikeperch Sander lucioperca and Volga pikeperch S. volgensis. J. Appl. Ichthyol. 26:481-484.	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Reproducing sexually	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Is independ during the completing its lifecycle	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Kottelat, M. and J. Freyhof, 2007. Handbook of European freshwater fishes. Publications Kottelat, Cornol and Freyhof, Berlin.	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	3	Years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Due to its value as a recreational fishery, it is supposed to be activle translocated. It can also dispers on its own	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	No such PAs in the respective RA area	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such behavior is known	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No such an evidence exists	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	Juvenalis can spread through water currents	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	Since the species are known from nearby regions, it can migrate in the Aras basin for spowning. Kottelat, M. and J. Freyhof, 2007. Handbook of European freshwater fishes. Publications Kottelat, Cornol and Freyhof, Berlin.	Medium
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No such an evidence is knwon	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Based on professional judgement	Low
43	7.09	Is dispersal of the taxon density dependent?	No	Not known	Low
8. Tolerance attributes					

44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Not known though not expected	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	No	Not well documented	Low
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No documented cases exists	Low
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Based on professional judgement	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	No	Based on professional judgement	Low
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Based on professional judgement	Low
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	professional judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Based on professional judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgement	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Based on professional judgement	Low

Statistics	
Scores	
BRA	**30.0**
BRA Outcome	**-**
BRA+CCA	**38.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**14.0**
1. Domestication/Cultivation	*2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*10.0*
B. Biology/Ecology	**16.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*7.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*1.0*
8. Tolerance attributes	*-2.0*
C. Climate change	**8.0**
9. Climate change	*8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**15**
Environmental	**10**
Species or population nuisance traits	**17**

Thresholds	
BRA	**-**

BRA+CCA	-
Confidence	
BRA+CCA	0.58
BRA	0.60
CCA	0.42

Date and Time
16/05/2022 23:17:06

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Sander lucioperca*
Common name	pikeperch
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	The fish has wide distribution in the world. It is a trade important species.
Risk assessment area	South Caucasus
Taxonomy	Sander lucioperca (Linnaeus 1758)
Native range	Europe and Asia: Caspian, Baltic, Black and Aral Sea basins; Elbe (North Sea basin) and Maritza
Introduced range	Introduced widely in Europe and other regions of the world
URL	https://www.fishbase.se/summary/sander-lucioperca.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	Currently, the main producing countries of S. lucioperca are the Czech Republic, Denmark, Hungary, Romania, Tunisia and Ukraine. In addition to the other countries shown on the FAO map, pike-perch are also grown in the Netherlands and Poland.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	Cultivating and maintaining broodstocks in RAS frees this type of pike-perch production from the necessity of catching spawners in the wild.	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	As S. lucioperca is an obligate piscivore as an adult, this species will predate on native and non-native fish species where	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	This species is naturally distributed in the South Caucasus region and translocated within the region by fishermans. Therefore, natural conditions for this species between native and introduced ranges is more or less similar	Very high
5	2.02	What is the quality of the climate matching data?	High	Köppen-Geiger climate classification map	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	This species is naturally distributed in the South Caucasus region (Kuljanishvili et al. 2020).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	This species is spread naturally within the SC region and also by humans.	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	These species is distributed in the Caucasus region and surrounding (Turkey, Iran, Russia, etc)	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Pikeperch is found naturalised as an alien species in a large number of countries in Europe (Lever 1996), including the UK, Denmark, Italy, Turkey, France and Holland (Perez-Bote & Roso,	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	As S. lucioperca is an obligate piscivore as an adult, this species will predate on native and non-native fish species where introduced.	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	S. lucioperca can also potentially cause the collapse of a fishery by removing many of the young fish not allowing them to grow and spawn.	High
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	Data deficient	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	There is insufficient information available to determine how Sander lucioperca would impact socio-economics in the Great Lakes region, USA. S. lucioperca is a top predator of brown trout, perch and salmonids, and as such could impact commercial fisheries for these species. It is not known to what extent S. lucioperca could affect these fisheries, but many think that it could benefit North American fisheries due to its popularity as an	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans	High
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Schulze et al. (2006) noted that when S. lucioperca was introduced into a German lake, there was a shift in perch (Perca fluviatilis) habitat usage from the pelagic zones of the lake towards the littoral zone in response to the competition from the pikeperch. They also stated there was an increase in predation on juvenile perch by both pikeperch and pike (Esox Lucius) leading to a decrease in the abundance of large perch	Very high
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	S. lucioperca is a predator fish and can eat threatened and protected species in the South Caucasus region such as Luciobarbus capito, Salmo spp, Acipencer spp, etc.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species is naturally distributed in the SC region and therefore environmental conditions of the region is suitable for it.	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	As a predator, S. lucioperca can disrupt food web structure in such ecosystems where it was not naturally distributed.	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	As a predator, S. lucioperca can affect on local ecosystem services such as recreational/commercial fishing (This is manifested in the reduction of local species).	High

20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	Data deficient	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	S. lucioperca is a vector of fish diseases and parasites which can be transmitted to native and farmed fish.	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	This species generally attains lengths of 50-70 cm and body weights (BW) of 2-5 kg but a maximum length of 130 cm and weights of 12-18 kg have been reported.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	Adults inhabit large, turbid rivers and eutrophic lakes, brackish coastal lakes and estuaries.	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	In the South Caucasus this is not expected as S. lucioperca is a native species.	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	No	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	S. lucioperca is a predator fish and can eat threatened and protected species in the South Caucasus region	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	S. lucioperca is a predator fish and can other species distributed in the SC region.	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Data deficient	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species is naturally reproduces in the SC region	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	A case of natural hybridization between pikeperch (Sander lucioperca) and perch (Perca fluviatilis) was confirmed based on the intermediate morphological, anatomical and genetic characteristics of the hybrid (Kahilainen et al. 2011).	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No data	Medium
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Such a fact is not known.	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	Fecundity varies from 13 000 to 1000000 eggs (Ninua et al. 2013).	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	2	The species become mature at the age of 2-4 (Ninua et al. 2013).	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	This species is spread naturally in the SC region and possibly by humans (translocation)	Medium
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	This species is distributed in the protected areas of the SC region, for instance in Kolkheti National Park in Georgia.	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	Such a fact is not known	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	This species is naturally distributed in the SC region and other animals may move its eggs from one place to another.	Medium
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This species is naturally dispersed within the region	High
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This species is naturally reproduces within the region	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	Probably yes (Data deficient)	Medium
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	No data	Low
43	7.09	Is dispersal of the taxon density dependent?	Yes	No research has been conducted in this direction although its prevalence may depend on population density.	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	Such fact has not detect	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	S. lucioperca inhabits rivers, lakes, reservoirs, moderately running waters and brackish coastal waters with salinities of ca. 12 ppt (Larsen and Berg, 2006) or more. It thrives in turbid, moderately eutrophic waters with high oxygen content	Very high

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	As established populations are difficult and costly to control, further introductions or stocking should be avoided.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	Data deficient	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	S. lucioperca inhabits rivers, lakes, reservoirs, moderately running waters and brackish coastal waters with salinities of ca. 12 ppt	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	Yes	There are several predator species which can eat S. lucioperca in the Caucasus region: Esox lucius, Silurus glanis, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Decrease	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Translocation by humans	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Lower	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Lower	Own judgement	Medium

Statistics	
Scores	
BRA	**50.0**
BRA Outcome	**-**
BRA+CCA	**42.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**24.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**26.0**
4. Undesirable (or persistence) traits	*8.0*
5. Resource exploitation	*7.0*
6. Reproduction	*4.0*
7. Dispersal mechanisms	*6.0*
8. Tolerance attributes	*1.0*
C. Climate change	**-8.0**
9. Climate change	*-8.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**16**
Environmental	**8**
Species or population nuisance traits	**22**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.68**
BRA	**0.70**
CCA	**0.50**

Date and Time
13/05/2022 18:43:43

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Sander lucioperca*
Common name	pikeperch
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Sander lucioperca is native to the Black and Caspian Sea basins. This species was not recorded in
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Perciformes/Percoidei () > Percidae (Perches) > Luciopercinae
Native range	The Black and Caspian Sea basins
Introduced range	Aras River basin
URL	https://www.fishbase.de/summary/Sander-lucioperca.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	Yes	It is possible to produce this fish in aquaculture facilities	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	Yes	This species has importance as it is eatable and tasty. They are sold in its life forms.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	For example P. fluviatilis	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	The climatic conditions are similar	Very high
5	2.02	What is the quality of the climate matching data?	Medium	The quality of climate matching is low since there are no much stations in Armenia	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	It has been caught in the Aras River at the Agarak-Megri district (Pipoyan & Tigranyan, 2002; Pipoyan, 2012), and was also recorded by Levin and Rubenyan (2010) in the Aras River. Though not officially reported, the repeated findings indicate the existence of established populations in Armenia	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Aquaculture, Recriation.	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	It has been caught in the Aras River at the Agarak-Megri district (Pipoyan & Tigranyan, 2002; Pipoyan, 2012), and was also recorded by Levin and Rubenyan (2010) in the Aras River. Though not officially reported, the repeated findings indicate the existence of established populations in Armenia	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its	Yes	Yes it has become naturalized outside its native area	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	In Turkey it is known that it caused the extension of three endemics fish species (Crivelli 1995).	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	Yes	In France it caused the decline of sand smelt (Atherina boyeri) populations (Kiener 1968), In England it was main reason for waning of Cyprinids populations (Kell 1985; Manchester et al. 2000). because of this, S. lucioperca is considered as an invasive species (Fickling and Lee 1983).	Very high
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	Yes	It can be transmissing deseases	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	Yes	there is definetely adverse socio-economic impact, however this is not assessed https://nas.er.usgs.gov/queries/greatlakes/FactSheet.aspx?SpeciesID=65&Potential=Y&Type=2&HUCNumber=DGreatLakes	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not poisonous	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	It is possible and it had happened that it caused extripaton of some native taxa for example in Britain, Turkey	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Does not parasite	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Can tolerate high temperatures up to 25 C Swirplies et al 2019, It can tolerate turbidity and eutrophication (Kottelat & Freyhof 2007) and salinity brackish and freshwaters (Kottelat & Freyhof 2007)	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	In great lakes, this species has become the top predator and it is known that has forgagin behaviour in the area https://nas.er.usgs.gov/queries/greatlakes/FactSheet.aspx?SpeciesID=65&Potential=Y&Type=2&HUCNumber=DGreatLakes	Very high
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	Can affect aquaculture production, and be transmitting deseaases and parasites	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Yes	Can be, however it is not documented	High

21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Can be, however it is not documented	High
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	Yes	This taxon can achive very large sizes An individual weighing 19 kg was reportedly caught in 1959 in Starnberger, Bavaria, Germany (Peter Admicka, pers. Comm. E-mail: peter.adamicka@oeaw.ac.at)	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	It can live in ponds, estuaries or rivers (Kottelat & Freyhof 2007)	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Yes it has become naturalized outside its native area	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Yes (Poulet et al 2009)	High
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	Yes	In great lakes, this species has become the top predator and it is known that has forgagin behaviour in the area and consumes protected or threatened native fishes https://nas.er.usgs.gov/queries/greatlakes/FactSheet.aspx?SpeciesID=65&Potential=Y&Type=2&HUCNumber=DGreatLakes	Very high
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	This taxon is known to expose foraging behaviour that might reduce food avalability to other piscivorous species in the area through competition, however there is no information id it can sequester nutrients minerals trace elements	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Males defend their nests and fans the eggs (Kottelat & Freyhof 2007)	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	the conditions for maturation and reproduction are avalable in the RA area	High
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	Yes	It has been hybridising with native S. volgensis (Manchester & Bullock 2000)	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. Does not display asexual reproduction	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	Yes	The relative fecundity varies from the minimum of 48 to the maximum of 467 eggs per 1 g of the female (Erm 1961; Gaygalas & Gyarulaytis 1974). On average, it is between 150 and 400 eggs.	High
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	4	4 years	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Aquaculture, ecriational fisheries, Self-dispersad	Very high
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	it is possible	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No. can not be distributed as eggs.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	It is possible	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This fish migrates for reproduction	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Yes all these vectors seem to be rapid	High
43	7.09	Is dispersal of the taxon density dependent?	Yes	Sice these species are territorial one might assume their dispersal is denisty dependent	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	turbidity, euthrophication, sallinity	Medium

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No. This is less likely.	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No information	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Yes (KrystynaDemska-Zakęś et al 2021)	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies present in RA area	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native	Very high
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Increased temperatures do not seem to be an obstacle for this species survival. In addition increased temperatures will cause this species establish in higher altitudes	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	With increased propagule pressure and resource avalability the risks of their dispersal are increasing	Very high
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Population densities will increase making them on one hand impossible to eradicate and on the other hand, affecting native organisms due to competition, that does not leave much resources for native ones.	Very high
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	No change	Difficult to assume	Low
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Under the predicted future climatic conditions, this species will disperse even wider, that will itself create the problem for native aquatic organisms.The widespread and abundance of this fish which is quite adaptive and plastic to different environmental conditions, will increase its impact on ecosystem services and socio-economic factors. For example: transmission of diseases, foraging behaviour and species adaptability It can also affect aquaculture and recreational fisheries	Very high

Statistics	
Scores	
BRA	**49.0**
BRA Outcome	**-**
BRA+CCA	**59.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**24.0**
1. Domestication/Cultivation	*4.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*18.0*
B. Biology/Ecology	**25.0**
4. Undesirable (or persistence) traits	*9.0*
5. Resource exploitation	*7.0*
6. Reproduction	*3.0*
7. Dispersal mechanisms	*3.0*
8. Tolerance attributes	*3.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**21**
Environmental	**14**
Species or population nuisance traits	**29**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.81**
BRA	**0.81**

CCA	0.83

Date and Time
22/05/2022 15:54:15

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Syngnathus abaster*
Common name	black-striped pipefish
Assessor	Bella Japoshvili
Risk screening context	
Reason and socio-economic benefits	The species is has some recreational value and due to this reason is translocated from its native
Risk assessment area	South Caucasus
Taxonomy	Actinopteri (ray-finned fishes) > Syngnathiformes (Pipefishes and seahorses) > Syngnathidae
Native range	Mediterranean basin
Introduced range	Caspian Sea basin
URL	https://www.fishbase.de/summary/Syngnathus-abaster.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	Species is not cultured for aquacultural purpose nor as ornamental fish.	Very high
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	Less possible and such case have not yet recorded	Very high
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No other invasive race or congenerics have ever reported	High
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Kuljanishvili, T., Patoka, J., Bohatá, L., Rylková, K., Japoshvili, B., & Kalous, L. (2021). Evaluation of the potential establishment of black-striped pipefish transferred by cultural drivers. Inland	Medium
5	2.02	What is the quality of the climate matching data?	Medium	Kuljanishvili, T., Patoka, J., Bohatá, L., Rylková, K., Japoshvili, B., & Kalous, L. (2021). Evaluation of the potential establishment of black-striped pipefish transferred by cultural drivers. Inland	Medium
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	Kuljanishvili, T., Patoka, J., Bohatá, L., Rylková, K., Japoshvili, B., & Kalous, L. (2021). Evaluation of the potential establishment of black-striped pipefish transferred by cultural drivers. Inland	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	One	Translocation for recreational purpose	High
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	No	Kuljanishvili, T., Patoka, J., Bohatá, L., Rylková, K., Japoshvili, B., & Kalous, L. (2021). Evaluation of the potential establishment of black-striped pipefish transferred by cultural drivers. Inland Waters, 1-8.	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Kuljanishvili, T., Patoka, J., Bohatá, L., Rylková, K., Japoshvili, B., & Kalous, L. (2021). Evaluation of the potential establishment of black-striped pipefish transferred by cultural drivers. Inland	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	Not reported such an effect	Very high
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Not ever recorded such an effect	Very high
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Not ever recorded such an effect	Very high
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Not ever recorded such an effect	Very high
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	Not a harmful species	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	Based on professional judgement, it can reach to much density so that can suppress some other fishes though no documented evidence exists	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	Not a parasitic nor predator species	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	Can survive and reproduce in marin, brackish and freshwaters.	Very high
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA	Yes	Possible though not a documented evidence	Low
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	Professional judgement	Medium
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	No	No such a pests/infectious agents are known	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Professional judgement	Medium
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	Small bodied species	Very high

23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	Lives in lentic systems	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	Professional judgement, no documented evidence. It can reach high density and can produce large amount of excetion product	Low
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	Professional judgement, no documented evidence	Medium
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Professional judgement, no documented evidence (consumes only zooplankton - Didenko, A., Kruzhylina, S., & Gurbyk, A. (2018). Feeding patterns of the black-striped pipefish Syngnathus abaster in an invaded freshwater habitat. Environmental Biology of Fishes, 101(6), 917-931.)	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	Didenko, A., Kruzhylina, S., & Gurbyk, A. (2018). Feeding patterns of the black-striped pipefish Syngnathus abaster in an invaded freshwater habitat. Environmental Biology of Fishes,	Low
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	Herald, E. S. (1959). From pipefish to seahorse – a study of phylogenetic relationships. Proceedings of the Californian Academy of Sciences 29, 465–473	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	Kuljanishvili, T., Patoka, J., Bohatá, L., Rylková, K., Japoshvili, B., & Kalous, L. (2021). Evaluation of the potential establishment of black-striped pipefish transferred by cultural drivers. Inland	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Not expected, no such an evidence is known	Very high
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Sexully reproducing species	High
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	It can complete its lifecycle independently	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Kottelat, M., & Freyhof, J. (2007). Handbook of European freshwater fishes. Publications Kottelat.	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Years	High
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	One	Recreational purpose, indpendently through watercurrent	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	No	No PAs in the respective areas of RA area	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No such an evidence is known	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	Nos such an evidence is known	High
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	It natiurally spreading. e.g Didenko, A., Kruzhylina, S., & Gurbyk, A. (2018). Feeding patterns of the black-striped pipefish Syngnathus abaster in an invaded freshwater habitat. Environmental Biology of Fishes, 101(6), 917-931.	Medium
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	No	Less possible based on professional epxerience	High
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	Nos such an evidence is known	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	Based on professional judgemnet	Medium
43	7.09	Is dispersal of the taxon density dependent?	No	Based on professional judgemnet, no documented evidence	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	Yes	Based on professional judgemnet	Medium
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	Based on professional judgemnet	Very high
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	No	No documented evidence	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	No such an evidence exists	Low
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	Based on professional judgemnet	Very high

49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	Based on professional judgemnet	Medium
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgemnet	High
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgemnet	High
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	Based on professional judgemnet	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Based on professional judgemnet	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Based on professional judgemnet	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	Higher	Based on professional judgemnet	Medium

Statistics	
Scores	
BRA	**13.0**
BRA Outcome	**-**
BRA+CCA	**19.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**1.0**
1. Domestication/Cultivation	*-2.0*
2. Climate, distribution and introduction risk	*1.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**12.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*2.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*-3.0*
8. Tolerance attributes	*5.0*
C. Climate change	**6.0**
9. Climate change	*6.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**2**
Environmental	**6**
Species or population nuisance traits	**12**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.72**
BRA	**0.74**
CCA	**0.58**

Date and Time
16/05/2022 23:26:47

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Syngnathus abaster*
Common name	black-striped pipefish
Assessor	Giorgi Epitashvili
Risk screening context	
Reason and socio-economic benefits	The black-striped pipefish is a species of fish in the family Syngnathidae. Syngnathids are
Risk assessment area	South Caucasus
Taxonomy	Syngnathus abaster Risso 1827
Native range	S. abaster found in the eastern Atlantic from the southern Gulf of Biscay to Gibraltar, also in the
Introduced range	As the introduced species it is mentioned in the Caspian Sea and fresh waters of its basin.
URL	https://www.fishbase.se/summary/Syngnathus-abaster.html

			Response	Justification (references and/or other information)	Confidence
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	This species does not have commercial value	Medium
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	This species does not have commercial value	Medium
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	Yes	Although the invasiveness of S. abaster was doubted by MacIsaac et al. (2015), the species is considered likely to establish in the Great Lakes, and S. abaster is expected to expand its range and successfully take over new areas because of its ability to osmoregulate, which allows it to quickly adapt to salinity changes (Snyder et al. 2015). In a new environment, the pipefish may negatively affect the native ecosystem by feeding on zooplanktonic communities, mainly copepods, but it can also affect native fish species by predating their larvae (Didenko et al.	Very high
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	S. abaster is naturally distributed in the western parto of the SC region and has been translocated in the Caspian basin. (World Map of the Köppen-Geiger climate classification)	Very high
5	2.02	What is the quality of the climate matching data?	High	World Map of the Köppen-Geiger climate classification	Very high
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	The black-striped pipefish is normally found in coastal waters of the Mediterranean, Black, and Azov seas. Recently this species found in the Tbilisi Reservoir, East Georgia (Kuljanishvili et al.	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	This species is distributed in the region naturally and by humans.	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	This species is naturally distributed in the SC region and surrounding countries (Kuljanishvili et al. 2020).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	We confirmed the existence and successful establishment of black-striped pipefish in the Tbilisi Reservoir. S. abaster has lived and been reproducing in the reservoir for at least 4 decades (Kuljanishvili et al. 2021).	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	Yes	In a new environment, the pipefish may negatively affect the native ecosystem by feeding on zooplanktonic communities, mainly copepods, but it can also affect native fish species by predating their larvae (Didenko et al. 2018; Kuljanishvili et al.	High
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	Data deficient	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Data deficient	Low
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	Data deficient	Low
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	This species does not pose a threat to humans	Medium
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	In a new environment, the pipefish may negatively affect the native ecosystem by feeding on zooplanktonic communities, mainly copepods, but it can also affect native fish species by predating their larvae (Didenko et al. 2018).	High
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	Yes	In a new environment, the pipefish may negatively affect the native ecosystem by feeding on zooplanktonic communities, mainly copepods, but it can also affect native fish species by predating their larvae (Didenko et al. 2018).	High
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species is naturally distributed in the SC region (Ninua et al. 2013; Kuljanishvili et al. 2020).	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	Yes	In a new environment, the pipefish may negatively affect the native ecosystem by feeding on zooplanktonic communities, mainly copepods, but it can also affect native fish species by predating their larvae (Didenko et al. 2018).	High
19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	Yes	No research has been conducted in this direction.	Medium

20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	No research has been conducted in this direction.	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Not applicable	No research has been conducted in this direction.	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	S. abaster is small sized fish and does not have commercial value	High
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	No	The black-striped pipefish is found in coastal waters and in the lower reaches of rivers in the Caspian, Black and Mediterranean Sea basins, living in relatively shallow waters around seaweed and sea grass, and is also found in brackish waters	Very high
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	Yes	No research has been conducted in this direction.	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Not applicable	Data deficient	Low
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	No such fact has been described	Low
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	Yes	In a new environment, the pipefish may negatively affect the native ecosystem by feeding on zooplanktonic communities, mainly copepods, but it can also affect native fish species by predating their larvae (Didenko et al. 2018).	High
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Not applicable	Data deficient	Low
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	This species is naturally reproduces in the SC region.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	Such a fact is not described.	Low
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	Such a fact is not known.	Low
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	Such a fact is not known.	Medium
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	Females lay 10-60 eggs into a brood pouch on ventral surface of tail of males.	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Own judgement	Medium
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	This species disperses within the region naturally and by other organisms (birds, etc). Also unintentional translocation has been noted in case of the Tbilisi Reservoir (Kuljanishvili et al. 2021).	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	The probability of this is quite high	High
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	This species does not have such means	High
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	Yes	This species is naturally spreads in the SC region.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	Yes	This species is naturally spreads in the SC region.	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	This species is naturally reproduces in the SC region.	Very high
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	Yes	The probability of this is quite high.	High
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	Yes	Own judgement	Medium
43	7.09	Is dispersal of the taxon density dependent?	Yes	Own judgement	Low
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No such fact has been described	High
45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being considered.]	Yes	Black-striped pipefish is an euryhaline species of fish that can tolerate significant fluctuations in salinity, live in both fresh and salty water. Pipefish live among vegetation in shallow waters of the Mediterranean, the Black, Azov and Caspian seas, enter rivers and lakes associated with them.	High

46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Of the four chemical piscicides registered for use in the United States, antimycin A and rotenone are considered general piscicides, but no studies have been found about their effects on S. abaster (GLMRIS 2012)	High
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	Yes	Introductions of S. abaster into new areas were mostly due to self-spreading (Kuderskii 1971) but also to human-mediated activities such as river regulation, fish stocking (Slynko et al. 2011, Didenko et al. 2018, Marenkov 2018), and ballast water transport (Lavoie et al. 1999).	Very high
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	S.abaster living in relatively shallow waters around seaweed and sea grass, and is also found in brackish waters.	Very high
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA area?	Yes	There are meny predator species in the SC region which can controll the S. abaster population: Sander lucioperca, Perca fluviatilis, Salmo spp, Squalius spp, etc.	Very high
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	Increase	Own judgement	Medium
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	Higher	Own judgement	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Higher	Own judgement	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	Own judgement	Medium

Statistics	
Scores	
BRA	**27.0**
BRA Outcome	**-**
BRA+CCA	**37.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**8.0**
1. Domestication/Cultivation	*0.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*6.0*
B. Biology/Ecology	**19.0**
4. Undesirable (or persistence) traits	*6.0*
5. Resource exploitation	*2.0*
6. Reproduction	*1.0*
7. Dispersal mechanisms	*7.0*
8. Tolerance attributes	*3.0*
C. Climate change	**10.0**
9. Climate change	*10.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**7**
Environmental	**8**
Species or population nuisance traits	**27**

Thresholds	
BRA	**-**
BRA+CCA	**-**
Confidence	
BRA+CCA	**0.66**

BRA	**0.68**
CCA	**0.50**

Date and Time
13/05/2022 18:54:13

AS-ISK v2

Taxon and Assessor details	
Category	Fishes and Lampreys (freshwater)
Taxon name	*Syngnathus abaster*
Common name	black-striped pipefish
Assessor	Tatia Kuljanishvili
Risk screening context	
Reason and socio-economic benefits	Has been observed in a freshwater reservoir of the middle Kura River basin.
Risk assessment area	South Caucasus
Taxonomy	Syngnathiformes Syngnathidae Syngnathinae
Native range	Mediterranean, Black and Azov seas.
Introduced range	The Kura River Basin
URL	https://www.fishbase.de/summary/Syngnathus-abaster.html

			Response	**Justification (references and/or other information)**	**Confidence**
A. Biogeography/Historical					
1. Domestication/Cultivation					
1	1.01	Has the taxon been the subject of domestication (or cultivation) for at least 20 generations?	No	Has not been subject of domestication or human selection.	High
2	1.02	Is the taxon harvested in the wild and likely to be sold or used in its live form?	No	This species does not have trade importance.	High
3	1.03	Does the taxon have invasive races, varieties, sub-taxa or congeners?	No	No. However the taxon has been object of discussion if it is invasive itself or not, for example in freshwaters reservoirs of Ukraine, and Great Lakes.	Medium
2. Climate, distribution and introduction risk					
4	2.01	How similar are the climatic conditions of the Risk Assessment (RA) area and the taxon's native range?	High	Yes it is somehow similar.	High
5	2.02	What is the quality of the climate matching data?	Medium	Native area versus Kura River basin before Mingachevir reservoir shows climate similarity of 7-8 (out of 10) in east Georgia and west Azerbaijan however, whole Armenian territory is 4-5.	High
6	2.03	Is the taxon already present outside of captivity in the RA area?	Yes	S. abaster is normally found in coastal waters of the Mediterranean, Black and Azov Seas; however, it has expanded its range upstream in the Danube, Dniester, Dnieper, Don and Volga rivers (Berg, 1949; Svetovidov, 1964; Kottelat & Freyhof, 2007). Recently, this species has also become an invader of freshwater reservoirs (Kiryukhina, 2013a; 2013b; Tereshchenko et al., 2016; Didenko et al., 2018; Marenkov, 2018).	Very high
7	2.04	How many potential vectors could the taxon use to enter in the RA area?	>1	Self-spreading, fish stocking, ballast water transport, opening channels to interconnect river basins (for example Volga-Don	Very high
8	2.05	Is the taxon currently found in close proximity to, and likely to enter into, the RA area in the near future (e.g. unintentional and intentional introductions)?	Yes	We found S. abaster in the freshwater reservoir in the middle Kura River basin (Kuljanishvili et al 2020: in review).	Very high
3. Invasive elsewhere					
9	3.01	Has the taxon become naturalised (established viable populations) outside its native range?	Yes	Yes. Abovementioned articles (Q6) demonstrated that this species is naturalised outside its native range. We found naturalised population as well (our own data).	Very high
10	3.02	In the taxon's introduced range, are there known adverse impacts to wild stocks or commercial taxa?	No	No information avalable	Medium
11	3.03	In the taxon's introduced range, are there known adverse impacts to aquaculture?	No	No information avalable	Medium
12	3.04	In the taxon's introduced range, are there known adverse impacts to ecosystem	No	Could be transmitting new diseases, otherwise does not have adverse impacts to ecosystem services.	Medium
13	3.05	In the taxon's introduced range, are there known adverse socio-economic impacts?	No	No socio-economic impacts are known.	High
B. Biology/Ecology					
4. Undesirable (or persistence) traits					
14	4.01	Is it likely that the taxon will be poisonous or pose other risks to human health?	No	S. abaster is harmless fish.	Very high
15	4.02	Is it likely that the taxon will smother one or more native taxa (that are not threatened or protected)?	Yes	It may impact native ecosystem through shaping zooplanktonic communities by feeding its activity, which is mainly focused on copepods but can also affect native fish species (including threatened species) due to predation of their larvae (Didenko et	Low
16	4.03	Are there any threatened or protected taxa that the non-native taxon would parasitise in the RA area?	No	No. S. abaster does not parasite.	Very high
17	4.04	Is the taxon adaptable in terms of climatic and other environmental conditions, thus enhancing its potential persistence if it has invaded or could invade the RA area?	Yes	This species is of Ponto-Caspian origin (is distributed in coasts of Mediterranean Sea as well). modern Ponto-Caspian fauna includes the species, that lived in the Thethys Sea and the marine ancestry has contributed to their ability to easily adapt to different salinity fluctuations and has resulted in Ponto-Caspian species invasiveness. Ponto-Caspian aquatic species are well known invaders into North America due to their abilities to tolerate different environmental conditions and salinities (Reid & Orlova,	High
18	4.05	Is the taxon likely to disrupt food-web structure/function in aquatic ecosystems if it has invaded or is likely to invade the RA area?	No	It may impact native ecosystem through shaping zooplanktonic communities by feeding its activity, which is mainly focused on copepods but can also affect native fish species due to predation of their larvae (Didenko et al. 2018). However it is not documented if S. abaster can cause disruption of food-web structure in aquatic ecosystem.	Medium

19	4.06	Is the taxon likely to exert adverse impacts on ecosystem services in the RA area?	No	No.	High
20	4.07	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are endemic in the RA	Not applicable	Nothing is known about this.	Low
21	4.08	Is it likely that the taxon will host, and/or act as a vector for, recognised pests and infectious agents that are absent from (novel to) the RA area?	Yes	Can be. However, no research has been conducted.	Low
22	4.09	Is it likely that the taxon will achieve a body size that will make it more likely to be released from captivity?	No	This species are very small body sized, in terms of their form, which is like a needle or a tube. It can not reach such sizes that could cause them to be released from captivity.	Very high
23	4.10	Is the taxon capable of sustaining itself in a range of water velocity conditions (e.g. versatile in habitat use)?	Yes	This species native range is coastal and brackish waters of the Mediterranean, Black and Azov Seas, and they are invading freshwater (standing waters) reservoirs in Ukraine and Georgia, which means that they can sustain different ranges of velocity	High
24	4.11	Is it likely that the taxon's mode of existence (e.g. excretion of by-products) or behaviours (e.g. feeding) will reduce habitat quality for native taxa?	No	Less likely.	Medium
25	4.12	Is the taxon likely to maintain a viable population even when present in low densities (or persisting in adverse conditions by way of a dormant form)?	Yes	The perfect example would be the study that we conducted (Kuljanishvili et al 2020 in review). Few individuals of S. abaster were translocated from the Black Sea basin to Tbilisi freshwater reservoir, which locals call 'Tbilisi Sea'. Due to reservoirs 'marine' name, local hobbyists assumed that, if the pipefish can live in the Black Sea, why would not it live in 'Tbilisi Sea'. They transported few individuals of pipefish from the Black Sea into the reservoir, and 20 years after we found S. abaster naturalised in the area.	Very high
5. Resource exploitation					
26	5.01	Is the taxon likely to consume threatened or protected native taxa in the RA area?	No	Less likely.	High
27	5.02	Is the taxon likely to sequester food resources (including nutrients) to the detriment of native taxa in the RA area?	No	Less likely.	Medium
6. Reproduction					
28	6.01	Is the taxon likely to exhibit parental care and/or to reduce age-at-maturity in response to environmental conditions?	Yes	They are characterised with 'Male pregnancy' which means taking care of the inseminated eggs unless the larvae develops to fry and then they hatch.	Very high
29	6.02	Is the taxon likely to produce viable gametes or propagules (in the RA area)?	Yes	during our field works we have found a few juvenile individuals.	Very high
30	6.03	Is the taxon likely to hybridise naturally with native taxa?	No	No information available	High
31	6.04	Is the taxon likely to be hermaphroditic or to display asexual reproduction?	No	No. Does not display asexual reproduction	Very high
32	6.05	Is the taxon dependent on the presence of another taxon (or specific habitat features) to complete its life cycle?	No	No. See: https://www.fishbase.de/summary/Syngnathus-abaster.html	Very high
33	6.06	Is the taxon known (or likely) to produce a large number of propagules or offspring within a short time span (e.g. < 1 year)?	No	They only have very limited number of propagules, only around 40 eggs can be developed in their sacks, per spawning.	Very high
34	6.07	How many time units (days, months, years) does the taxon require to reach the age-at-first-reproduction?	1	Spawns at 1 year.	Very high
7. Dispersal mechanisms					
35	7.01	How many potential internal vectors/pathways could the taxon use to disperse within the RA area (with suitable	>1	Intentional release, natural dispersal.	High
36	7.02	Will any of these vectors/pathways bring the taxon in close proximity to one or more protected areas (e.g. MCZ, MPA, SSSI)?	Yes	Difficult to answer. Possibly, yes.	Low
37	7.03	Does the taxon have a means of actively attaching itself to hard substrata (e.g. ship hulls, pilings, buoys) such that it enhances the likelihood of dispersal?	No	No. Morphologically this species does not have a means of actively attaching itself to hard substrata	Very high
38	7.04	Is natural dispersal of the taxon likely to occur as eggs (for animals) or as propagules (for plants: seeds, spores) in the RA area?	No	No, they are born as young individuals. They can not be dispersed as eggs whatsoever.	Very high
39	7.05	Is natural dispersal of the taxon likely to occur as larvae/juveniles (for animals) or as fragments/seedlings (for plants) in the RA area?	No	No. No documented evidence	Very high
40	7.06	Are older life stages of the taxon likely to migrate in the RA area for reproduction?	Yes	Migration is possible during winter. However, due to obstacles (dams), it is less likely.	Low
41	7.07	Are propagules or eggs of the taxon likely to be dispersed in the RA area by other animals?	No	No. Can not be dispersed by other ananimals	Very high
42	7.08	Is dispersal of the taxon along any of the vectors/pathways mentioned in the previous seven questions (35–41; i.e. both unintentional or intentional) likely to be	No	No information avalable	High
43	7.09	Is dispersal of the taxon density dependent?	No	Not documented.	Medium
8. Tolerance attributes					
44	8.01	Is the taxon able to withstand being out of water for extended periods (e.g. minimum of one or more hours) at some stage of its life cycle?	No	No information avalable	Very high

45	8.02	Is the taxon tolerant of a wide range of water quality conditions relevant to that taxon? [In the Justification field, indicate the relevant water quality variable(s) being	Yes	S. abaster can tolerate a wide range of salinities: freshwater, brackish and marine water conditions (Dawson 1984; Kottelat and Freyhof 2007).	High
46	8.03	Can the taxon be controlled or eradicated in the wild with chemical, biological, or other agents/means?	Yes	Possibly yes.	Medium
47	8.04	Is the taxon likely to tolerate or benefit from environmental/human disturbance?	No	We found this species in Tbilisi Reservoir shorelines, with developed vegetation, where people do not visit.	Medium
48	8.05	Is the taxon able to tolerate salinity levels that are higher or lower than those found in its usual environment?	Yes	S. abaster is a euryhaline species that can tolerate a wide range of salinities: freshwater, brackish and marine water conditions (Dawson 1984; Kottelat and Freyhof 2007).	High
49	8.06	Are there effective natural enemies (predators) of the taxon present in the RA	No	No effective natural enemies present in RA area	High
C. Climate change					
9. Climate change					
50	9.01	Under the predicted future climatic conditions, are the risks of entry into the RA area posed by the taxon likely to increase, decrease or not change?	No change	It was hypotheses that climate change might alert the mechanisms of transportation and introduction of non-native species. Commercial and recreational activities will increase, that itself increases the propagule pressure levels of non-native species (Hellmann et al 2008). However, since, this species are not connected commercial or recreational fisheries, I would assume that in future, their spread will mostly be caused as self-spread, rather than altered mechanism of transportation caused	Medium
51	9.02	Under the predicted future climatic conditions, are the risks of establishment posed by the taxon likely to increase, decrease or not change?	Decrease	Warming temperatures can be intolerable for this species, which can lead to the decrease of their establishment.	Low
52	9.03	Under the predicted future climatic conditions, are the risks of dispersal within the RA area posed by the taxon likely to increase, decrease or not change?	No change	I would assume that in future, their spread will mostly be caused as self-spread, rather than altered mechanism of transportation caused by climate change.	Low
53	9.04	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on biodiversity and/or ecological integrity/status?	No change	No change or even lower.	Medium
54	9.05	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem structure and/or function?	Lower	Possibly lower.	Medium
55	9.06	Under the predicted future climatic conditions, what is the likely magnitude of future potential impacts on ecosystem services/socio-economic factors?	No change	No change.	Medium

Statistics	
Scores	
BRA	**9.0**
BRA Outcome	**-**
BRA+CCA	**5.0**
BRA+CCA Outcome	**-**
Score partition	
A. Biogeography/Historical	**2.0**
1. Domestication/Cultivation	*-2.0*
2. Climate, distribution and introduction risk	*2.0*
3. Invasive elsewhere	*2.0*
B. Biology/Ecology	**7.0**
4. Undesirable (or persistence) traits	*5.0*
5. Resource exploitation	*0.0*
6. Reproduction	*2.0*
7. Dispersal mechanisms	*-1.0*
8. Tolerance attributes	*1.0*
C. Climate change	**-4.0**
9. Climate change	*-4.0*
Answered Questions	
Total	***55***
A. Biogeography/Historical	**13**
1. Domestication/Cultivation	*3*
2. Climate, distribution and introduction risk	*5*
3. Invasive elsewhere	*5*
B. Biology/Ecology	**36**
4. Undesirable (or persistence) traits	*12*
5. Resource exploitation	*2*
6. Reproduction	*7*
7. Dispersal mechanisms	*9*
8. Tolerance attributes	*6*
C. Climate change	**6**
9. Climate change	*6*
Sectors affected	
Commercial	**2**
Environmental	**-1**
Species or population nuisance traits	**8**

Thresholds	
BRA	**-**

BRA+CCA	-
Confidence	
BRA+CCA	0.71
BRA	0.74
CCA	0.42

Date and Time
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