Amur Sleeper (*Perccottus glenii*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, November 2023
Revised, November 2023
Web Version, 6/18/2026

Organism Type: Fish
Overall Risk Assessment Category: High

Photo: Andshel. Licensed under CC BY-SA 3.0 DEED. Available: https://commons.wikimedia.org/wiki/File:%D0%A0%D0%BE%D1%82%D0%B0%D0%BD_%D0%B2_%D0%B0%D0%BA%D0%B2%D0%B0%D1%80%D0%B8%D1%83%D0%BC%D0%B5_%D1%84%D0%BE%D1%82%D0%BE2.JPG (November 2023).

1 Native Range and Status in the United States

Native Range

From Grabowska (2023):

"The Amur sleeper's natural range of distribution is situated in north-eastern China, the northern part of North Korea and in the Far East of Russia. It includes mainly the Amur River basin, i.e. tributaries like Zeya, Sunguri and Ussuri. In the north the natural range reaches the Uda River

(Reshetnikov, 2010) and the basin of the Tugur River and in the south the species is known from rivers of the Sea of Japan (Bogutskaya and Naseka, 2002 after Reshetnikov, 2001)."

Status in the United States

No records were found of *Perccottus glenii* in the wild or in trade in the United States.

Regulations

The U.S. Fish and Wildlife Service has listed *Perccottus glenii* as Injurious Wildlife under the Lacey Act (18 U.S.C 42).

Perccottus glenii is regulated in Alabama (ADCNR 2022), Kansas (KDWP 2023), Minnesota (MNDNR 2022), North Carolina (NCDEQ 2022), Ohio (ODNR 2022), and Texas (Texas Parks and Wildlife 2022). Please refer back to state agency regulatory documents for details on the regulations, including restrictions on activities involving this species. While effort was made to find all applicable regulations, this list may not be comprehensive. Notably, it does not include regulations that do not explicitly name this species or its genus or family, for example, when omitted from a list of authorized species with blanket regulation for all unnamed species.

Means of Introductions within the United States

No records of *Perccottus glenii* in the wild in the United States were found.

Remarks

This ERSS was previously published in September 2012 and September 2014. For the current version, revisions were completed to incorporate new information and conform to updated standards.

Other common names used for *P. glenii* include Chinese Sleeper and Rotan (Baker et al. 2023; Grabowska et al. 2023).

From Grabowska (2023):

"The specific epithet *glenii* is derived from the surname of the original collector, Glen, it may be misspelled as *glehni* or *glenhi*."

"The earlier records from Kazakhstan and Uzbekistan were based on misidentification of another related species *Micropercops cinctus* (Odontobutidae), because of similar appearance. Later ichthyological surveys in south-eastern Kazakhstan and Uzbekistan have failed to detect Amur sleeper (Mitrofanov et al., 1992; Reshetnikov, 2010)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2023):

Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Actinopterygii
Class Teleostei
Superorder Acanthopterygii
Order Perciformes
Suborder Gobioidei
Family Odontobutidae
Genus *Perccottus* Dybowski, 1877
Species *Perccottus glenii* Dybowski, 1877

According to Fricke et al. (2023), *Perccottus glenii* Dybowski 1877 is the current valid name for this species.

The following synonyms of *Perccottus glenii* from Fricke et al. (2023) were used to search for information for this report: *Perccottus glehni*, *Perccottus glenhi*.

Size, Weight, and Age Range

From Grabowska (2023):

"The Amur sleeper's life span is 7-10 years but in most populations studied, both in natural and non-native areas, individuals older than 4+ were not found (Bogutskaya and Naseka, 2002; Miller and Vasil'eva, 2003)."

"Amur sleeper is a small/medium fish up to 20-25 cm total length."

From Froese and Pauly (2023)

"Maturity: L_m 7.0, range 6 - 8 cm […] max. published weight: 250.00 g [Reshetnikov 2003]"

Environment

From Baker et al. (2023):

"*Perccottus glenii* inhabits stagnant muddy waters at depths of less than 10 m near coasts and vegetation (Pronin [and Bolonev] 2006; Grabowska et al. 2009; Golovanov and Ruchin 2011). This species can tolerate extreme temperatures. Individuals can tolerate freezing temperatures

and have been recorded to endure being frozen for up to 3 months by increasing the amino acid concentrations in their brains (Karanova 2009, 2018). *Perccottus glenii* also tolerates temperatures (as [sic] high as 35.8°C (Golovanov et al. 2013). It can withstand very low dissolved oxygen levels (~0.1 mg/L) (Reshetnikov 2003; Košco et al. 2008; Caleta et al. 2011; Grabowska et al. 2011; Yang et al. 2012). The optimal salinity range for this species is 0–6 ppt (Golovanov and Ruchin 2011)."

From Grabowska (2023):

"The Amur sleeper is a limnophilic species, inhabiting freshwater canals, gravel pits, natural and fish ponds. It lives in the littoral zone of these waterbodies. It prefers rather stagnant waters with dense aquatic vegetation and muddy substrate; in rivers it avoids the main current and is common in flood plains and oxbow lakes. It tolerates low oxygenation of water, so it can be found also in drying, shallow waterbodies."

From Froese and Pauly (2023):

"Occurs in lentic waters, lakes, ponds, backwaters and marshes with dense underwater vegetation and avoids river stretches with fast and even slow current [Kottelat and Freyhof 2007]. Prefers stagnant rivers and bogs [Reshetnikov 2003]. Can tolerate poorly oxygenated water and able to survive in dried out or completely frozen water bodies by digging itself into mud where it hibernates."

Climate

From Froese and Pauly (2023):

"Temperate; […] 54°N - 39°N, 106°E - 141°E"

From Grabowska (2023):

"Its present non-native distribution range covers the area between 44-63°N; 17-121°E" (Reshetnikov, 2010)."

Distribution Outside the United States

Native

From Grabowska (2023):

"The Amur sleeper's natural range of distribution is situated in north-eastern China, the northern part of North Korea and in the Far East of Russia. It includes mainly the Amur River basin, i.e. tributaries like Zeya, Sunguri and Ussuri. In the north the natural range reaches the Uda River (Reshetnikov, 2010) and the basin of the Tugur River and in the south the species is known from rivers of the Sea of Japan (Bogutskaya and Naseka, 2002 after Reshetnikov, 2001)."

Introduced
From Grabowska (2023):

"[…] the Amur sleeper has invaded many localities in Eurasia: Russia, Latvia, Lithuania, Estonia, Ukraine, Moldova, Mongolia, Poland, Hungary, Slovakia, Romania, Bulgaria, Serbia and Croatia. It has been recorded from the Gulf of Finland but not for the country itself Kudersky (1998) [sic]."

"The most northern record is from Plestsy Lake in Arkhangels province ([northwestern] Russia), while the most southern finding in western Eurasia is in Bulgaria. The most western record for this species is from the Kis-Balaton watershed (Hungary) (Antal et al., 2009)."

From Nehring and Steinhof (2015):

"During the period November 25 to December 13, 2014, a total of 28 specimens of *P. glenii* (juveniles and adults of the both [sic] sexes, TL range 30–145 mm) were caught in the Bücherlgraben stream [Bavaria, Germany]. Multiple age classes in the samples suggest that *P. glenii* is becoming established and is on its way to developing a permanent population in this section of the Danube watercourse."

According to Froese and Pauly (2026), *P. glenii* is also established outside its native range in Belarus and introduced to Italy with unknown establishment status.

Means of Introduction Outside the United States

From Baker et al. (2023):

"Percottus glenni was first introduced to Europe in 1912 when several fish that were kept in an aquarium were released to ponds near St. Petersburg, Russia (Grabowska et al. 2010)."

From Grabowska (2023):

"The first specimens were translocated from their natural distribution area, [i.e.,] the far east of Asia to Europe intentionally by a Russian naturalist and later by participants of Amur expeditions. The species is also known to be kept in aquaria (in Moscow in the 1950s it was available on a bird market) and was used as a live bait (Spanovskaya et al., 1964; Reshetnikov, 2004; 2010). Both were probably a source of uncontrolled local introductions by aquarists and anglers."

"The Amur sleeper has been accidentally introduced several times to many localities with stocking material of herbivorous cyprinids mainly *Cyprinus carpio*. It seems to be the most probable reason of its appearance in the Vistula and Danube river systems."

Short Description

From Baker et al. (2023):

"*Perccottus glenii* has a robust and streamlined body completely covered with scales. The body is dark and varies from greenish-olive to brownish-gray or dark green. It has irregular spots and blotches with numerous small pale yellow to blue-green flecks on the dorsal and lateral sides of the body. The belly is speckled. A dark streak runs from the tip of the snout towards the edge of the opercula and from the eye to the angle of the jaws (Miller and Vasil'eva 2003). The body depth at the pelvic origin is about 30% of its standard length. The mouth is large and the angle of the jaws is beneath the rear half of the eye, while the lower jaw is in advance of the upper jaw. The tip of the pectoral fin is below the origin of the second dorsal fin. The pelvic fins are relatively short, and less than ½ to ¾ of the length of the abdomen. The caudal fin is rounded. During the breeding season, males have darker coloration than the females, and have inflated areas on the head."

From Froese and Pauly (2023):

"Dorsal spines (total): 6 - 8; Dorsal soft rays (total): 9-11; Anal spines: 1-3; Anal soft rays: 7 - 10. Distinguished from other European freshwater species by the following characters: 2 dorsals with the first with 6-8 simple rays, and the second with 2-3 simple and 8-12 branched rays; no spines on first dorsal; no barbels; pelvics not fused into a disc; no lateral line canals; males during spawning period, develop a hump on nape and become black with bright green spots on body and unpaired fins (Kottelat and Freyhof 2007)."

Biology

From Froese and Pauly (2023):

"A voracious predatory fish (wide variety of invertebrates, tadpoles and fish) […] Spawns for the first time at 1-3 years and about 6.0 cm SL [standard length]. Spawns several potions [sic] of eggs in May to June at 15-20°C. Elongated eggs (3.8 x 1.3 mm) with sticky filaments usually deposited in one row close to water surface on underwater structures such as roots, leaves and others. Males guard the eggs and pelagic larvae [Kottelat and Freyhof 2007]."

From Baker et al. (2023):

"Its average fecundity ranges [sic] 7,766–9,149 eggs per female, which increases with increasing size (Grabowska et al. 2011). *Perccottus glenii* is an aggressive nest guarder and tends the fertilized eggs until hatch (Bogutskaya and Naseka 2002). […] Individual growth rates are higher in the Vistula River than in its native range (Grabowska et al. 2011). Life history characteristics such as short max[imum] body length and reproductive strategies (e.g., early maturation, multiple spawning events, extended breeding season, and parental care) are attributed to *P. glenii* being one of the most successful non-native invaders in Europe (Grabowska and Przybylski 2015; Natase [et al.] 2019)."

From Grabowska (2023):

“It usually co-occurs with gibel carp (*Carassius gibelio*), crucian carp (*Carassius carassius*) and mud loach (*Misgurnus fossilis*).”

Human Uses

From Grabowska (2023):

“The Amur sleeper does not have any human uses, economic value and social benefits, apart from use as bait (see Reshetnikov, 2001).”

“The species is also known to be kept in aquaria (in Moscow in the 1950s it was available on a bird market) […]”

Diseases

No information was found associating *Perccottus glenii* with any diseases listed by the World Organisation for Animal Health (2023).

From Baker et al. (2023):

“*Perccottus glenii* is a host to some parasites. Data suggests that parasites *Myxidium rimskykorsakowi*, *Henneguya alexeevi, Nippotaenia mogurndae*, *Goussia obstinata*, *Amurotaenia percotti*, and *Gyrodactylus perccotti* were introduced to new regions with *P. glenii* as a vector (Sokolov et al. 2014; Kvach et al. 2016); these parasites infect fishes in the Odontobutidae family. Notably, *G. percotti* is unable to survive on non-gobiid hosts longer than 24 hours and therefore is unlikely to represent a threat to non-gobiid fishes in non-native ranges (Ondracková 2016). *Perccottus glenii* specimens released from aquariums are often infected with parasites common in aquaria (Sokolov 2018). It is known to host the copepod *Neoergasilus japonicus,* which is currently found in the Great Lakes (Kvach et al. 2020). This species also is a host to the diplomonad *Spironucleus salmonis* (Denikina et al. 2019), which can cause systemic spironucleosis in wild salmon and has been linked to significant aquacultural damage (Jorgensen and Sterud 2006; Williams et al. 2011) [sic] However, none of these events have been directly linked to *Perccottus glenii*. A full list of parasites in non-native *Perccottus glenii* populations can be located in Sokolov and Reshetnikov (2020).”

According to Poelen et al. (2014), *Perccottus glenii* can harbor the following parasites in addition to those listed above: *Ancyrocephalus*, *Diplostomum chromatophorum*, *Duplaccessorius andinus*, *Echinochasmus milvi*, *Gyrodactylus glehnii, Gyrodactylus perccotti*, *Ophiotaenia europaea*, *Opisthorchis sinensis* (Chinese Liver Fluke), *Philometroides moraveci*, and *Triaenophorus nodulosus.*

Threat to Humans

From Baker et al. (2023):

"*Perccottus glenii* is a host to the liver fluke, which is a parasite that infects humans (Mastitsky et al. 2010), but there are no reports suggesting that *Perccottus glenii* is responsible for liver fluke infection in humans."

From NOBANIS (2019):

"Predation on small-sized individuals of commercial fish species may result in significant decreases in commercial efficiency of fish ponds (cf. Reshetnikov & Schliewen 2013)."

3 Impacts of Introductions

From Baker et al. (2023):

"As a trophic competitor and a predator, *Perccottus glenii* has been implicated in the population declines of historically abundant native species such as *Umbra krameri*, *Carassius carassius*, and *Leucaspius delineatus* (Košco et al. 2003). In laboratory experiments, *Perccottus glenii* reduced the foraging efficiency of *Umbra krameri* through aggressive interactions, resulting in a feeding rate one third of that found in the control (Grabowska et al. 2019). Habitats with high numbers of *Perccottus glenii* were associated with lower fish species richness and diversity. *Perccottus glenii* can potentially compete with native species that utilize similar microhabitats and food resources (Košco et al. 2003). *Perccottus glenii*'s piscivory and high food competition resulted in a monospecific community in a Latvian marsh (Kutsokon et al. 2021)."

From Froese and Pauly (2023):

"A voracious predatory fish (wide variety of invertebrates, tadpoles and fish) constituting a most serious threat to aquatic fauna wherever it occurs. In small water bodies; known to extirpate almost all other fish species and amphibian larvae."

From Reshetnikov (2003):

"[…] species richness of invertebrates and vertebrates (fishes and amphibians) is significantly lower in waterbodies [in Moscow Province, Russia] occupied by *P. glenii* in comparison with other waterbodies."

"[…] in a pond with a low species richness of macroinvertebrates, many of the species that were not observed in the faunal surveys were actually detected in intestines of rotan […]. In some other fishless waterbodies, these species of invertebrates were easily observed."

"When analysing the spatial distribution of *P. glenii* and amphibian populations, I found a significant negative relationship bewteen [sic] fish presence and the breeding success of two newt species (*T*[*riturus*] *cristatus*, *T. vulgaris*) as well as three frog species (*R*[*ana*] *arvalis*, *R. lessonae*, *R. temporaria*) […]."

The U.S. Fish and Wildlife Service has listed *Perccottus glenii* as Injurious Wildlife under the Lacey Act (18 U.S.C 42). *Perccottus glenii* is also regulated in Alabama (ADCNR 2022), Kansas (KDWP 2023), Minnesota (MNDNR 2022), North Carolina (NCDEQ 2022), Ohio (ODNR 2022), and Texas (Texas Parks and Wildlife 2022). See section 1.

4 History of Invasiveness

The History of Invasiveness for *Perccottus glenii* is classified as High. This species is established throughout much of Eastern Europe and Southwestern Russia. Negative impacts of introduction have been documented in the wild. Through predation and competition, *Perccottus glenii* has led to reductions in native species abundance and species richness.

5 Global Distribution

Figure 1. Reported global distribution of *Perccottus glenii*. Map from GBIF Secretariat (2023). Observations are reported from Belarus, Bulgaria, China, Czechia, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Romania, Russia, Serbia, Slovakia, and Ukraine. The observation near Lake Baikal is a human observation of a live tank specimen and does not represent an established population; it was not used to select source points for the climate matching analysis. The observations in Czechia, Finland, Germany, and Kyrgyzstan also do not represent an established population and were not used to select source points for the climate match.

Additional occurrences in eastern Asia were available from Reshetnikov (2010) for the climate matching analysis. No georeferenced occurrences were found for established populations in Croatia.

6 Distribution Within the United States

No records of *Perccottus glenii* in the wild in the United States were found.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Perccottus glenii* to the contiguous United States was mostly medium to high. The area of highest climate match was centered on the Great Lakes region, extending into the Northern Plains, Appalachian Range, and northern New England. There were also areas of high match in the Rocky Mountains. Low climate matches for *Perccottus glenii* were found along the length of the Pacific Coast and as far east as the Cascade Range, Sierra Nevada, and Sonoran Desert. Other areas of low match included the Florida peninsula and the central Gulf Coast. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.672, indicating that Yes, there is establishment concern for this species. The Climate 6 score is calculated as: (count of target points with scores ≥ 6)/(count of all target points). Establishment concern is warranted for Climate 6 scores greater than or equal to 0.002 based on an analysis of the establishment success of 356 nonnative aquatic species introduced to the United States (USFWS 2024).

Projected climate matches in the contiguous United States under future climate scenarios are available for *Perccottus glenii* (see Appendix). These projected climate matches are provided as additional context for the reader; future climate scenarios are not factored into the Overall Risk Assessment Category.

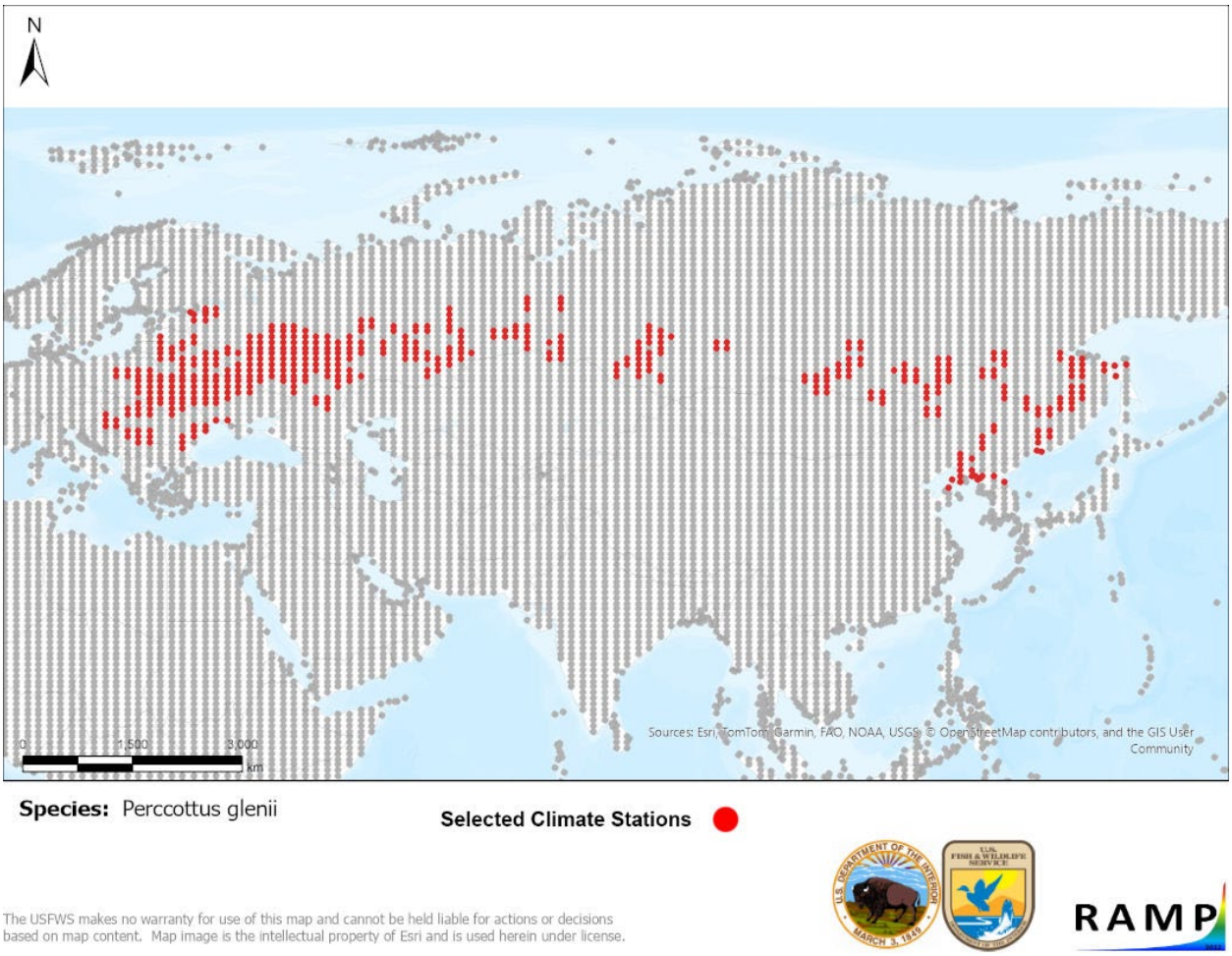

Figure 2. RAMP (Sanders et al. 2023) source map showing weather stations in Eurasia selected as source locations (red; Belarus, Bulgaria, China, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Mongolia, North Korea, Poland, Romania, Russia, Serbia, Slovakia, Ukraine) and non-source locations (gray) for *Perccottus glenii* climate matching. Source locations from GBIF Secretariat (2023) with additional locations from Reshetnikov (2010). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

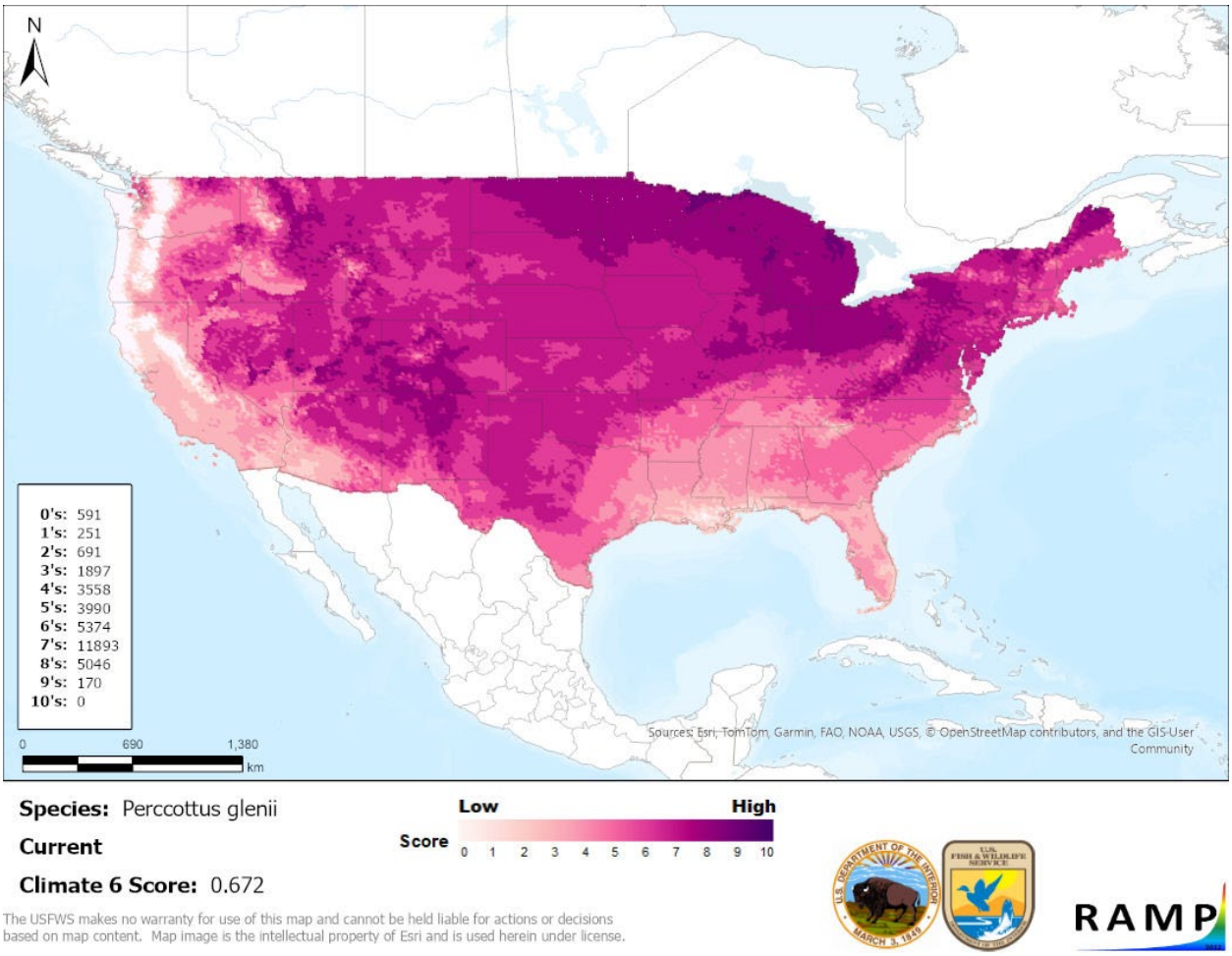

Figure 3. Map of RAMP (Sanders et al. 2023) climate matches for *Perccottus glenii* in the contiguous United States based on source locations reported by GBIF Secretariat (2023) with additional locations from Reshetnikov (2010). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Perccottus glenii* is classified as High. There is ample evidence of nonnative established populations. Negative impacts of introduction have been well documented. The species' biology, ecology, and distribution are also well documented, lending confidence to the climate matching analysis.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Perccottus glenii, the Amur Sleeper, is a fish species native to the Amur River Basin and surrounding areas in China, North Korea, and Russia. It is a hardy species capable of tolerating low dissolved oxygen content and a large temperature range, including freezing conditions. *Perccottus glenii* is used as a bait fish and may be kept in aquaria. *P. glenii* is listed as an injurious wildlife species in the United States under the Lacey Act and several U.S. states have

regulations regarding the species. The History of Invasiveness for *Perccottus glenii* is classified as High due to successful establishment of many nonnative populations and documented negative impacts of introduction. Nonnative populations of this species have been associated with declines in invertebrate and vertebrate species richness and abundance. The climate matching analysis for the contiguous United States indicates establishment concern for this species. The climate match for *Perccottus glenii* was medium to high throughout the contiguous United States except for areas of low match west of the Rocky Mountains, along the Gulf Coast, and in peninsular Florida. The area of highest climate match was the Great Lakes Basin. The Certainty of Assessment for this ERSS is classified as High due to ample evidence of nonnative establishment and documentation of negative impacts of introduction. The Overall Risk Assessment Category for *Perccottus glenii* in the contiguous United States is High.

Assessment Elements

- **History of Invasiveness (see Section 4): High**
- **Establishment Concern (see Section 7): Yes**
- **Certainty of Assessment (see Section 8): High**
- **Remarks, Important additional information: None**
- **Overall Risk Assessment Category: High**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in section 11.

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11 Literature Cited in Quoted Material

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

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Appendix

Summary of Future Climate Matching Analysis

Future climate projections represent two Shared Socioeconomic Pathways (SSP) developed by the Intergovernmental Panel on Climate Change (IPCC 2021): SSP5, in which emissions triple by the end of the century; and SSP3, in which emissions double by the end of the century. Future climate matches were based on source locations reported by GBIF Secretariat (2023) and Reshetnikov (2010).

Under the future climate scenarios (figure A1), no regions of the contiguous United States were projected to have a consistently high climate match for *Perccottus glenii*, although there were significant areas of high match in the Great Lakes and Western Mountain regions under most scenarios. Areas of low climate match were projected to occur in California, the Gulf Coast, Northern Pacific Coast, Southern Atlantic Coast, and Southern Florida regions. Areas of low climate match expanded north along the Atlantic Coast and east into the Great Basin going from SSP3 to SSP5 and from the 2055 time step to the 2085 time step. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.143 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.584 (model: MPI-ESM1-2-HR, SSP5, 2055). All future scenario Climate 6 scores were above the Establishment Concern threshold, indicating that Yes, there is establishment concern for this species under future scenarios. The Climate 6 score for the current climate match (0.672, figure 3) falls above the range of scores for future projections. The time step and climate scenario with the most change relative to current conditions was SSP5, 2085, the most extreme climate change scenario. Under all time step and climate scenarios only minor or no increases in the climate match relative to the current match were observed. Primarily under the SSP5, 2085 scenario, areas within the Appalachian Range, Colorado Plateau, Great Basin, Great Lakes, Gulf Coast, Mid-Atlantic, Northeast, Northern Plains, Southeast, Southern Atlantic Coast, Southern Plains, and Southwest saw a large decrease in the climate match relative to current conditions. Additionally, areas within California, Southern Florida, and the Western Mountains saw a moderate decrease in the climate match relative to current conditions under one or more scenarios. The magnitude and extent of decreased climate match appeared much greater at the 2085 time step than at the 2055 time step. Additional very small areas of large or moderate change may be visible on the maps (figure A3).

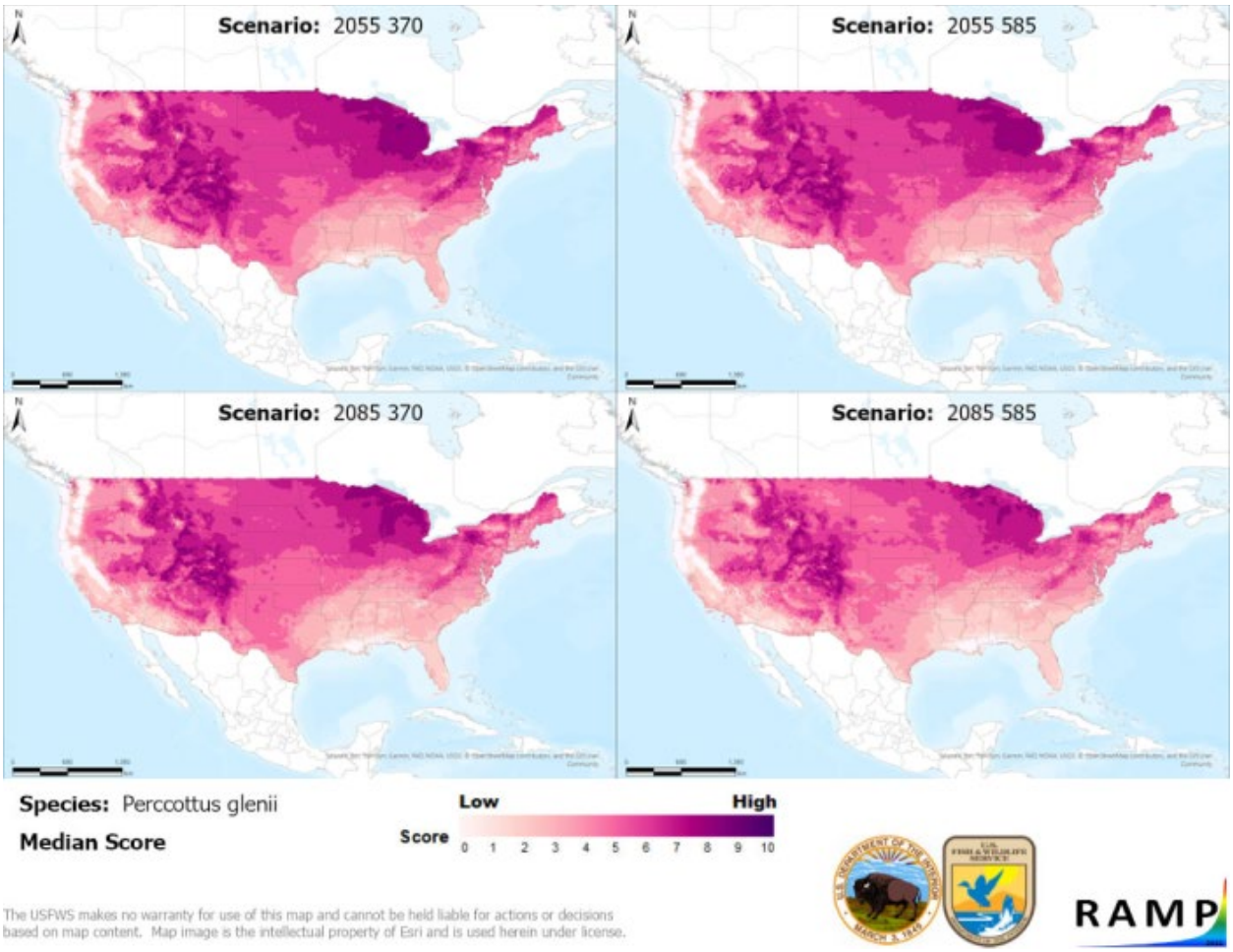

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Perccottus glenii* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023) and Reshetnikov (2010). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

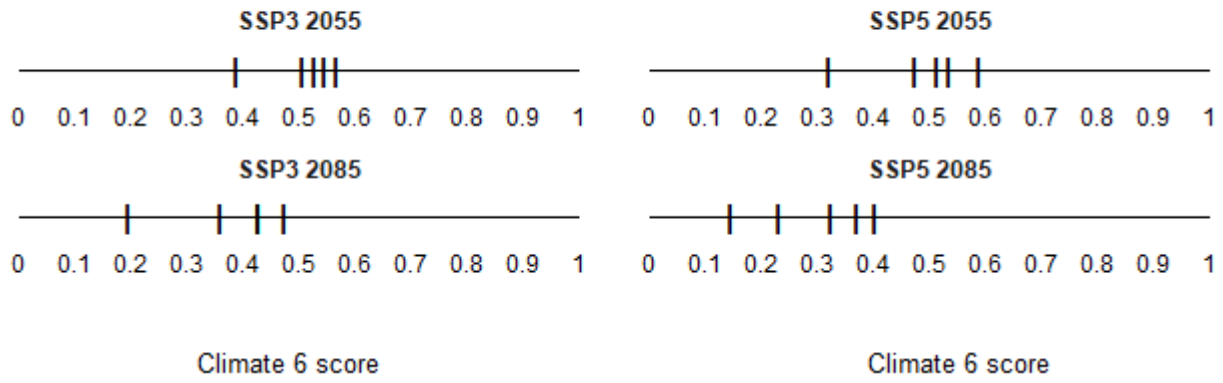

Figure A2. Comparison of projected future Climate 6 scores for *Perccottus glenii* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global climate models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0.

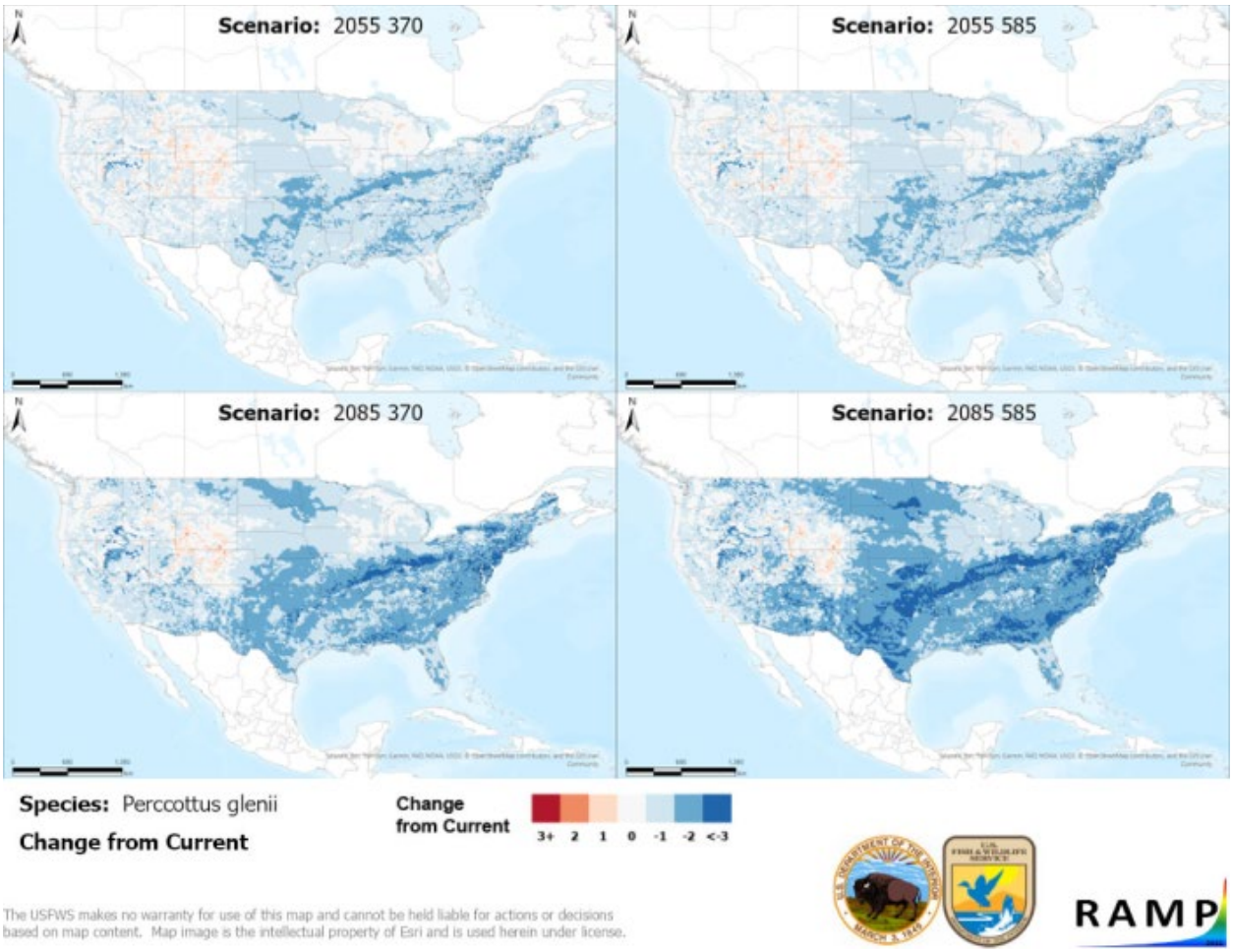

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 3) and the median target point score for future climate scenarios (figure A1) for *Perccottus glenii* based on source locations reported by GBIF Secretariat (2023) and Reshetnikov (2010). Shared Socioeconomic Pathways (SSPs) used (from left to right): SSP3, SSP5 (IPCC 2021). Time steps: 2055 (top row) and 2085 (bottom row). Climate source data from CHELSA (Karger et al. 2017, 2018); global models used: GFDL-ESM4, UKESM1-0-LL, MPI-ESM1-2-HR, IPSL-CM6A-LR, and MRI-ESM2-0. Shades of blue indicate a lower target point score under future scenarios than under current conditions. Shades of red indicate a higher target point score under future scenarios than under current conditions. Darker shades indicate greater change.

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