U.S. Fish & Wildlife Service

Ohrid Trout (*Salmo letnica*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2024
Revised, March 2025
Web Version, 12/18/2025

Organism Type: Fish
Overall Risk Assessment Category: Uncertain

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1 Native Range and Status in the United States

Native Range

From Crivelli (2006):

"It is restricted to Ohrid lake in Albania and the former Yugoslav Republic of Macedonia."

Status in the United States

From Fuller and Daniel (2025):

"The Ohrid trout was stocked in Parvin Lake, Big Creek Reservoir, and Turquoise Lake in **Colorado**, in 1969 (Courtenay and Hensley 1979; Wiltzius 1985; Courtenay et al. 1991), seven lakes in northern **Minnesota**, including Strawberry Lake, Chester Lake, and Big Trout Lake (MacCrimmon and Campbell 1969; Stroud 1969; Courtenay and Hensley [1979]; Radonski et al. 1984); an unspecified locality in **Montana** (Courtenay et al. 1991); Watauga Reservoir (= Ripshin Lake) (Courtenay and Hensley [1979]; Etnier and Starnes 1993) and South Holston Reservoir (Starnes, personal communication), **Tennessee**; and a few reservoirs in **Wyoming**, including Viva Naughton Reservoir on the Green River, lakes near Casper, and the North Platte River (MacCrimmon and Campbell 1969; Courtenay and Hensley 1979; Courtenay et al. 1991; Hubert 1994; Wyoming Game and Fish, Fish Division 1997)."

"Introductions into most of these states failed. Repeatedly stocked in Tennessee with no evidence of reproduction yet (Etnier and Starnes 1993). Courtenay and Hensley (1979) report that even though there has been no reproduction, spawning has been observed in Tennessee."

From Baxter and Stone (1995):

"The Pathfinder Reservoir [Wyoming] population is reproducing naturally."

No records of *Salmo letnica* in live trade in the United States were found.

Regulations

All species in the family *Salmonidae* are listed as injurious wildlife species by the U.S. Fish and Wildlife Service because of the risk that they carry certain pathogens harmful to other wildlife (USFWS 2025).

Additionally, all species in the family Salmonidae are regulated in Arizona (Arizona Game and Fish Commission 2022) and New Mexico (NMDGF 2023). 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

From Fuller and Daniel (2025):

"The Ohrid trout was brought into the United States by the U.S. Fish and Wildlife Service and shipped to a federal hatchery in Iowa and a state hatchery in Minnesota (Courtenay and Hensley 1979). In 1965, eggs from Yugoslavia were hatched in the United States; young fish were released into several small lakes in northern Minnesota in 1968 and 1969 (Stroud 1969). Ohrid

trout have been stocked in Tennessee since 1971 (Etnier and Starnes 1993). The species was first stocked in Colorado in 1969 (Wiltzius 1985)."

From Baxter and Stone (1995):

"[…] establishing a fishery […]"

Remarks

This ERSS was previously published in May 2018. Revisions were completed to incorporate new information and conform to updated standards.

From Crivelli (2006):

"Taxonomy needs to be confirmed using molecular data. There is also little information on abundance, trend and threats."

From Delling (2010):

"*Salmo letnica* is often subdivided into three or four subspecies (Stefanovic, 1948; Poljakov et al., 1958) and opinions on their relationship and distinctiveness towards each other and other Balkan *Salmo* species varies considerably (e.g., S. Karaman, 1957; M. Karaman 1966; Soric, 1990; Sušnik et al., 2007)."

From Fuller and Daniel (2025):

"The Ohrid trout faces extinction in its native lakes due to pollution, invasive species and overfishing. The warning comes from Balkan scientists who say even a proposed five-year commercial fishing ban won't be enough to save the species (Crivelli 2006)."

Salmo letnica has been intentionally stocked outside its native range within the United States by State fishery managers to achieve fishery management objectives. State fish and wildlife management agencies are responsible for balancing multiple fish and wildlife management objectives. The potential for a species to become invasive is now one important consideration when balancing multiple management objectives and advancing sound, science-based management of fish and wildlife and their habitat in the public interest.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2025):

Kingdom Animalia
  Subkingdom Bilateria
    Infrakingdom Deuterostomia
      Phylum Chordata
        Subphylum Vertebrata

Infraphylum Gnathostomata
Superclass Actinopterygii
Class Teleostei
Superorder Protacanthopterygii
Order Salmoniformes
Family Salmonidae
Subfamily Salmoninae
Genus Salmo
Species *Salmo letnica* (Karaman, 1924)

According to Fricke et al. (2025), *Salmo letnica* (Karaman 1924) is the current accepted name for this species.

The following synonym of *Salmo letnica* from Fricke et al. (2025) was used to search for information for this report: *Trutta letnica*.

Size, Weight, and Age Range

From Froese and Pauly (2024):

"Maturity: L_m [length at maturity] 37.6, range 36 - 39.7 cm"

"Max length: 76.0 cm TL [total length] male/unsexed; [Crawford 1993]; max. published weight: 6.5 kg [International Game Fish Association 1991]"

Environment

From Froese and Pauly (2024):

"Freshwater; benthopelagic."

From Crivelli (2006):

"It lives at depths of 60–80 m within the lake [Ohrid Lake, Albania and Republic of North Macedonia]."

From Simonović et al. (2015):

"It seems that originally lacustrine Ohrid trout easily acclimatizes to stream-dwelling life style [sic], due to its plasticity."

Climate

From Froese and Pauly (2024):

"Temperate; 42°N - 40°N, 20°E - 21°E"

Distribution Outside the United States

Native

From Crivelli (2006):

"It is restricted to Ohrid lake in Albania and the former Yugoslav Republic of Macedonia."

Introduced

From Piria et al. (2017):

"Letnica trout (*Salmo letnica*, Salmonidae) was introduced to Serbia and Greece from Lake Ohrid. In Greece, it was introduced to the transboundary Prespa Lakes (Crivelli et al., 1997) in the 1950s […] Its current status within Greek territory is unknown (Barbieri et al., 2015); however, a single individual was caught again in 2011 in Great Prespa Lake (Koutseri, 2012). Introductions to Serbia began in 1953 and 1954, when fry (106 each year) were stocked (Janković & Raspopović, [1960]). Afterwards, fertilized roe was transferred to the new hatchery set on the Lake Vlasina reservoir […] Since the late 1960s, roe was reintroduced almost every year, since it seems that this species did not naturalize in the reservoir, despite its fast growth and great yield. It is not known whether this species hybridizes with the native brown trout, but from the regular roe imports over a long-term period, it appears that letnica trout were feral there and diminished after the cessation of reservoir stocking."

Means of Introduction Outside the United States

From Simonović et al. (2015):

"[…] [In Serbia] for commercial fishing purposes (Janković and Raspopović 1960)."

Short Description

From Fuller and Daniel (2025):

"Ohrid trout has a fusiform body with silvery coloration with numerous black spots, especially above the lateral line (dorsal region). The species has distinct red spots (when present) along the lateral line (Kottelat and Fr[e]yhof 2007). The trout has numerous spots on the caudal fin making it distinct from Brown trout (*Salmo trutta*)."

Biology

From Crivelli (2006):

"Spawning season is in January-February."

From Froese and Pauly (2024):

"Juveniles feed on zooplankton. Adults prey on zooplankton and fish, mainly *Alburnus scoranza*. Attains first sexual maturity at 5-6 years. Spawns in January-February in littoral and sublittoral areas [Kottelat and Freyhof 2007]."

Human Uses

From Crivelli (2006):

"This trout makes up the bulk of catches of salmonid in the Albanian waters of Ohrid lake."

From Froese and Pauly (2024):

"Fisheries: commercial; aquaculture: commercial; gamefish: yes"

Diseases

***Salmo letnica* has been documented as susceptible to *Gyrodactylus salaris*, a disease listed by the World Organisation for Animal Health (2025).**

According to Poelen et al. (2014), *S. letnica* is a host for the following parasites: *Eubothrium crassum*, *Goezia ascaroides*, *Gyrodactylus derjavinoides*, *G. salaris*, *G. thymalli*, *Metabronema canadense*, and *Raphidascaris acus*.

From Stojanovski et al. (1998):

"In the period from April, 1995 to March, 1996, 131 specimens of the Ohrid trout (*Salmo letnica*, Karaman) 1924 from the Macedonian part of Lake Ohrid were examined parasitologically. A total of 99 fishes (75.57%) were found to be infected. The presence of 6 parasite species [sic]: *Diclybothrium* sp., *Eubothrium crassum*, *Eubothrium salvelini*, *Cyathocephalus truncatus*, *Proteocephalus neglectus* and *Pomphorhynchus laevis*. The highest prevalence occurred with *Eubothrium crassum* (48.09%) and the lowest with *Pomphorhynchus laevis* (0.76%)."

Threat to Humans

From Froese and Pauly (2024):

"Harmless"

3 Impacts of Introductions

The following quotations detail **potential, anecdotal,** or **highly generalized** information on impacts of introduction from *Salmo letnica*.

From Perdikaris et al. (2010):

"The Pestani trout *Salmo letnica* has been introduced into Lake Prespes (Crivelli *et al.* 1997). This species is a desirable target for anglers; however, the main problem is the risk of hybridization with the native Prespa trout *Salmo peristericus* Karaman, 1938."

From Zenetos et al. (2009):

"[…] the introduction of *Salmo trutta* and *Salmo letnica* to Greek freshwaters (where different *Salmo* species exist) has resulted in harmful hybridizations that may prove detrimental to the native trout species in the long term (Crivelli *et al.*, 1997; Economou *et al.*, [2007])."

All species in the family *Salmonidae* are listed as injurious wildlife species by the U.S. Fish and Wildlife Service (USFWS 2025) and are regulated in Arizona (Arizona Game and Fish Commission 2022) and New Mexico (NMDGF 2023). See section 1.

4 History of Invasiveness

The History of Invasiveness for *Salmo letnica* is classified as Data Deficient. This species has become established in Pathfinder Reservoir in Wyoming, outside its native distribution within Lake Ohrid, on the border of Albania and North Macedonia. There have been numerous failed introductions in other regions. Multiple authors propose that the introduction of *Salmo letnica* poses a significant risk to native trout populations through hybridization, but this potential impact has not been convincingly documented.

5 Global Distribution

Figure 1. Reported global distribution of *Salmo letnica*. Map from GBIF Secretariat (2023). Observations are reported from Albania, North Macedonia, Serbia, and the United States. Occurrences in Serbia and Tennessee represent stocking-dependent populations rather than self-sustaining ones and were not used to select source points for the climate matching analysis. Aside from Pathfinder Reservoir, Wyoming, occurrences in Minnesota and the western United States are not known to represent established populations and were not used to select source points for climate matching.

6 Distribution Within the United States

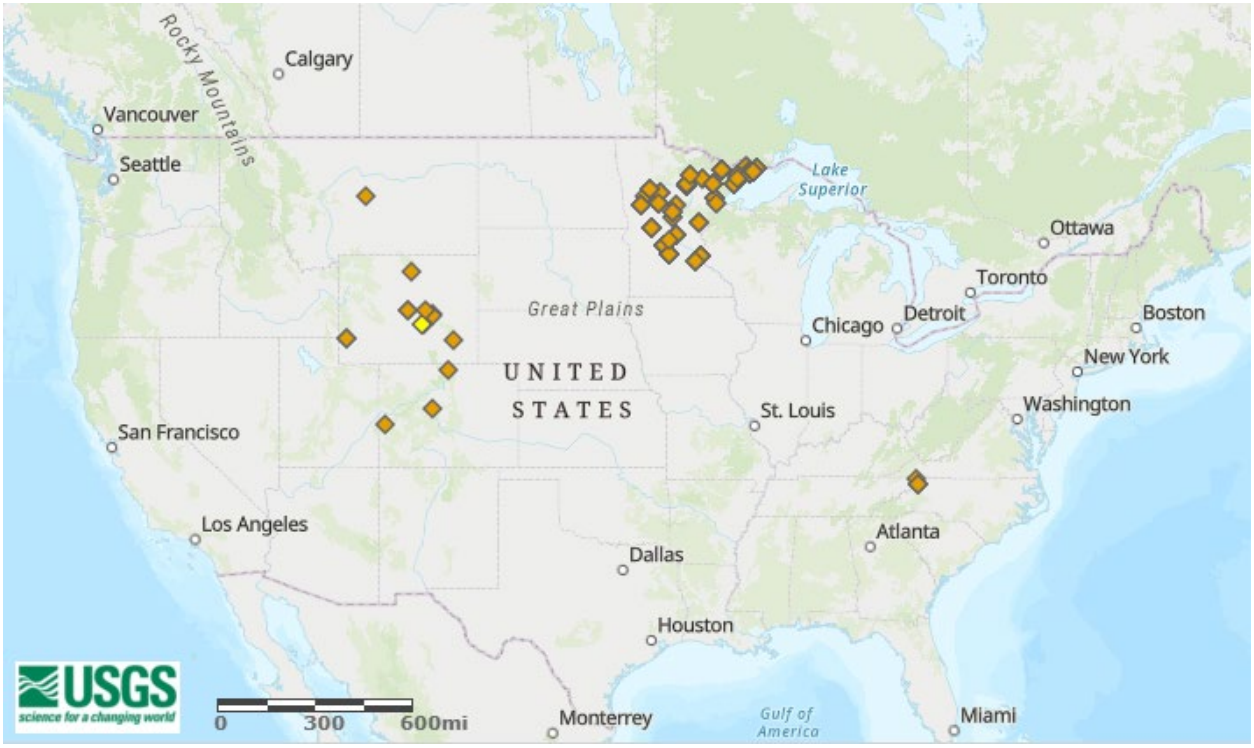

Figure 2. Reported distribution of *Salmo letnica* in the United States. Map from Fuller and Daniel (2025). Observations are reported from Colorado, Minnesota, Montana, Tennessee, and Wyoming. Yellow points represent established nonnative populations and orange points represent other reported nonnative occurrences. Only established populations were used to select source locations for the climate matching analysis.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Salmo letnica* to the contiguous United States was highest around its current established location in Wyoming, although high climate matches were also found in the northwestern Great Plains, Great Basin, and Western Mountains. Areas of low climate match were observed along the Northern Pacific Coast, in the Sonoran Desert, in parts of the Rocky Mountains, along the Gulf Coast, and in southern Florida. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.360, 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 *Salmo letnica* (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.

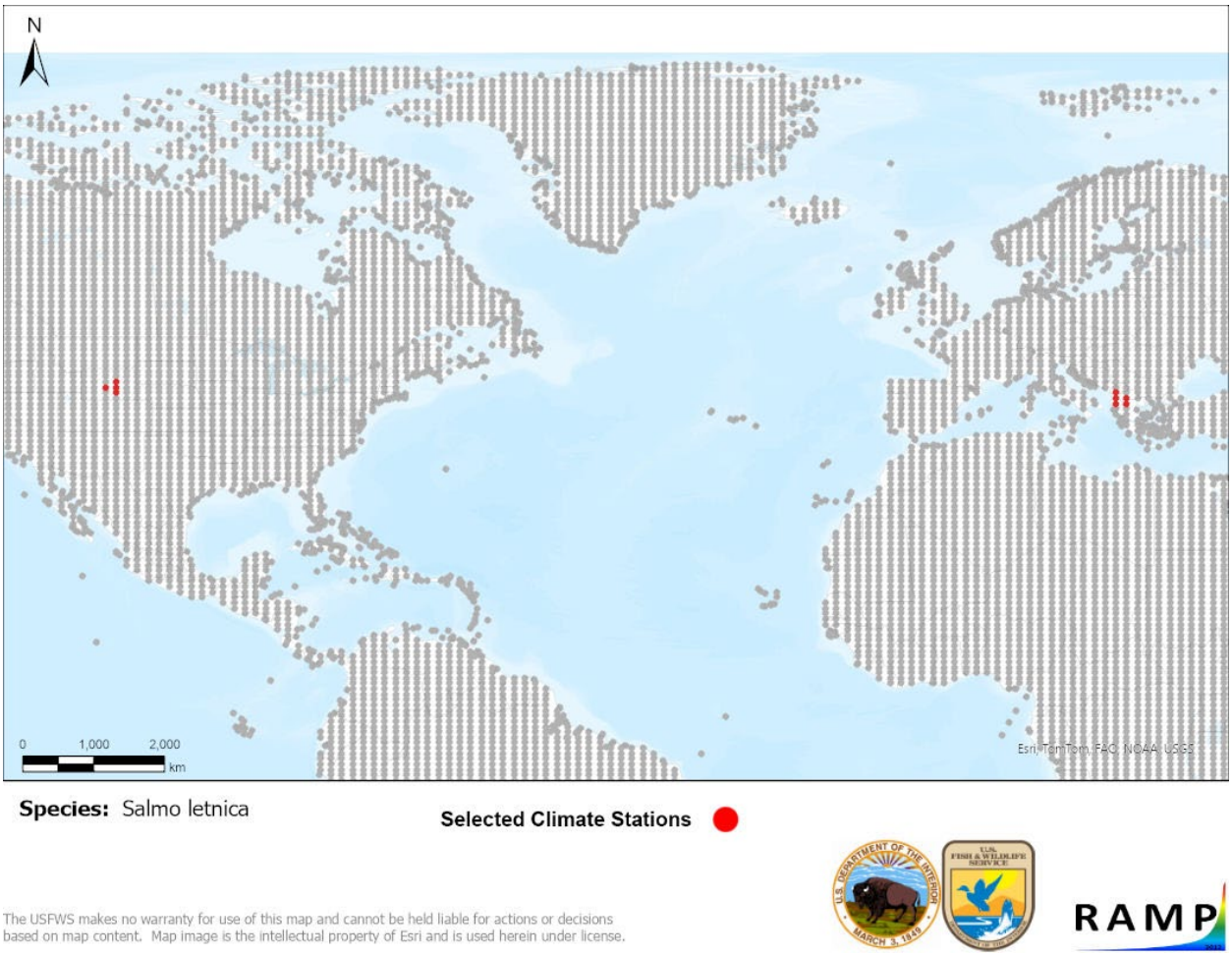

Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations throughout the world selected as source locations (red; Albania, Greece, North Macedonia, and United States) and non-source locations (gray) for *Salmo letnica* climate matching. Source locations from GBIF Secretariat (2023). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

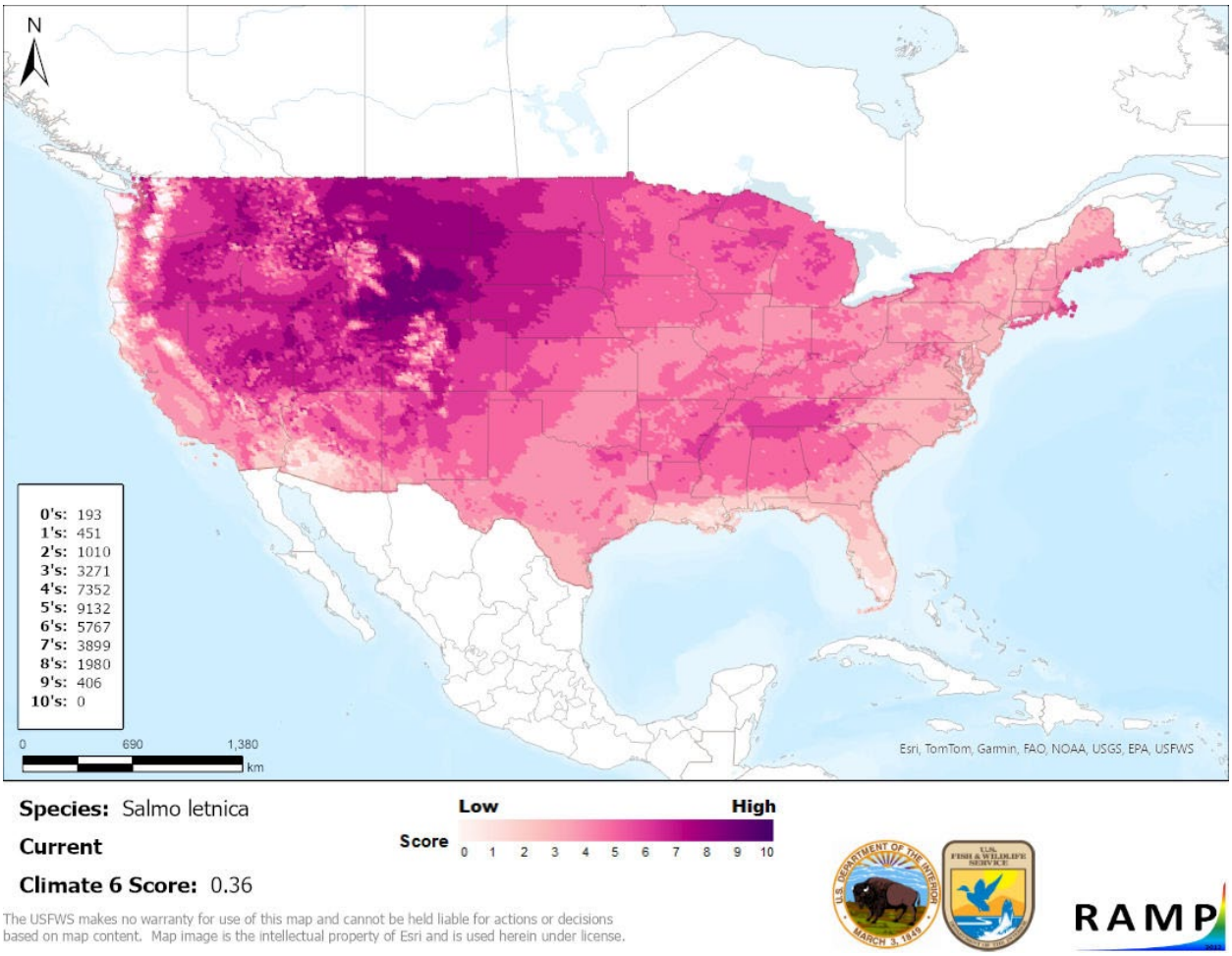

Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Salmo letnica* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Salmo letnica* is classified as Low. There is information available on the biology, ecology, and distribution of the species. However, there is no information on whether *Salmo letnica* introductions have resulted in negative impacts to ecosystems, human health, or economies.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Salmo letnica, Ohrid trout, is a fish that is native to Lake Ohrid, on the border of Albania and North Macedonia in southeastern Europe. Overfishing, pollution, and the introduction of invasive species have severely impacted populations in its native range. *Salmo letnica* has been introduced to Greece, Serbia, and several locations in the United States in attempts to establish fisheries for the species, but only the introduction to Pathfinder Reservoir in Wyoming appears

to have resulted in an established population. Along with all species in the family Salmonidae, *Salmo letnica* is listed as an injurious wildlife species by the U.S. Fish and Wildlife Service due to pathogen transmission risk. It is also regulated along with other salmonids in two U.S. States. The History of Invasiveness for *Salmo letnica* is classified as Data Deficient because there is no clear, convincing, and reliable documentation on impacts or lack of impacts of introduction of *Salmo letnica*. The climate matching analysis for the contiguous United States indicates establishment concern for this species; there were high climate matches across much of the interior western United States. The Certainty of Assessment for this ERSS is classified as Low due to the lack of information on impacts of introduction of this species. The Overall Risk Assessment Category for *Salmo letnica* in the contiguous United States is Uncertain.

Assessment Elements

- **History of Invasiveness (see Section 4): Data Deficient**
- **Establishment Concern (see Section 7): Yes**
- **Certainty of Assessment (see Section 8): Low**
- **Remarks, Important additional information: Susceptible to *Gyrodactylus salaris*, a disease listed by the World Organisation for Animal Health.**
- **Overall Risk Assessment Category: Uncertain**

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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).

Under the future climate scenarios (figure A1), there were limited areas of high climate match for *Salmo letnica* in the Colorado Plateau, Great Basin, and Western Mountains. Most of the contiguous United States ranged from low to medium climate match across all scenarios. Areas of particularly low climate match were projected to occur in the Gulf Coast, Northern Pacific Coast, Southern Atlantic Coast, and Southern Florida regions. The inland Southeast showed a medium to high climate match particularly under the 2055 time step but that area was projected to be smaller by the 2085 time step. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.072 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.376 (model: MPI-ESM1-2-HR, SSP3, 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 (0.360, figure 4) 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 one or more time step and climate scenarios, areas within the Mid-Atlantic, Northeast, Southwest, and Western Mountains saw a moderate increase in the climate match relative to current conditions. No large increases were observed regardless of time step and climate scenarios. Under one or more time step and climate scenarios, areas within the Colorado Plateau, Great Basin, Northern Plains, Southern Plains, and Southwest saw a large decrease in the climate match relative to current conditions. Additionally, areas within the Appalachian Range, California, Great Lakes, Gulf Coast, Mid-Atlantic, Southeast, Southern Atlantic Coast, and Western Mountains saw a moderate decrease in the climate match relative to current conditions. Additional, very small areas of large or moderate change may be visible on the maps (figure A3). The magnitude of change was greatest at the 2085 time step, particularly under SSP5.

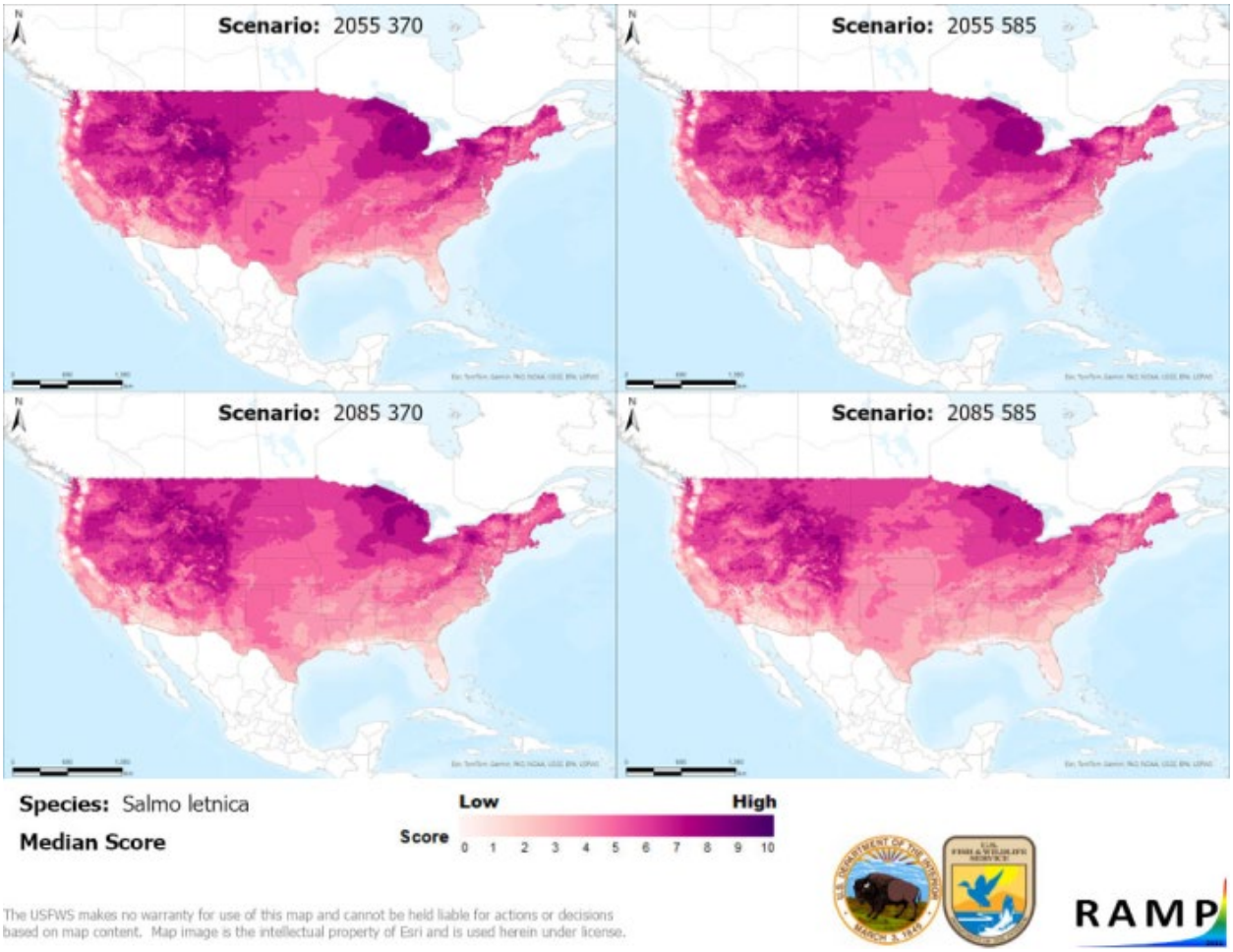

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Salmo letnica* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023). Shared Socioeconomic 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.

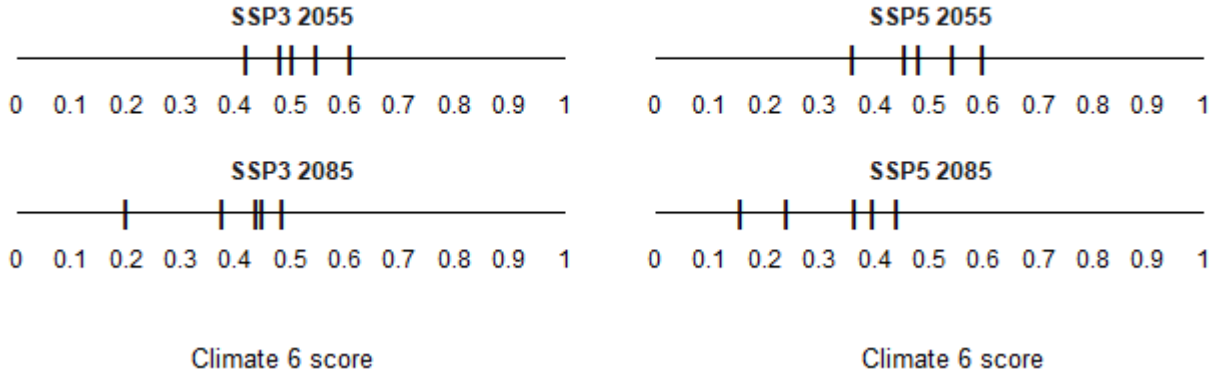

Figure A2. Comparison of projected future Climate 6 scores for *Salmo letnica* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC 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.

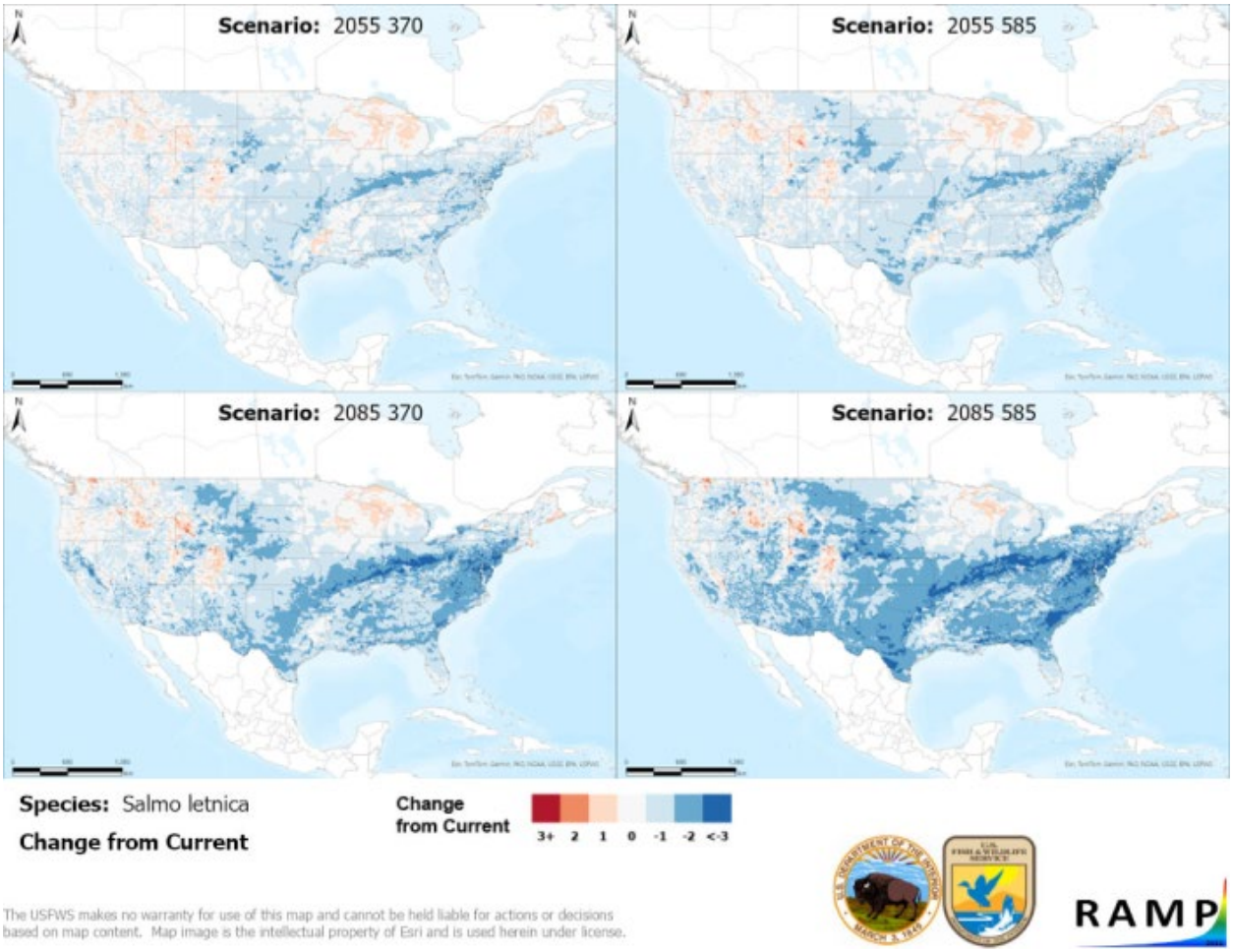

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Salmo letnica* based on source locations reported by GBIF Secretariat (2023). 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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