

Caspian Slender Shrimp (*Limnomysis benedeni*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, January 2023
Revised, February 2023
Web Version, 3/4/2025

Organism Type: Crustacean
Overall Risk Assessment Category: Uncertain



Photo: Strickling W. Licensed under CC BY-SA 4.0. Available:
[https://commons.wikimedia.org/wiki/File:Donau-Schwebegarnele_\(Limnomysis_benedeni\)_2019-06-09_Lingen-8879.jpg](https://commons.wikimedia.org/wiki/File:Donau-Schwebegarnele_(Limnomysis_benedeni)_2019-06-09_Lingen-8879.jpg) (January 2023).

1 Native Range and Status in the United States

Native Range

From Audzijontye et al. (2009):

“*Limnomysis benedeni* Czerniavsky, 1882 is a mysid crustacean native to the Ponto-Caspian (Black and Caspian Sea) rivers and estuaries, [...]”

“Native [to] estuaries in the Ponto-Caspian basin (Volga [Russia], Don [Russia], Dnieper [Ukraine], Dniester [Ukraine], Danube [Romania, Ukraine]) [...]”

Status in the United States

No records of *Limnomysis benedeni* in the wild in the United States were found.

No records of *Limnomysis benedeni* in trade in the United States were found.

Regulations

No species-specific regulations on possession or trade were found within the United States.

Means of Introductions within the United States

No records of *Limnomysis benedeni* in the wild in the United States were found.

Remarks

From Audzijontye et al. (2009):

“The species has not been found dispersing beyond the European continent so far, yet in risk assessments based on its ecological and dispersal characteristics it has been identified as likely to reach the Laurentian Great Lakes in North America (Ricciardi & Rasmussen, 1998).”

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2023):

Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Protostomia
Superphylum Ecdysozoa
Phylum Arthropoda
Subphylum Crustacea
Class Malacostraca
Subclass Eumalacostraca
Superorder Peracarida
Order Mysida
Family Mysidae
Genus *Limnomysis*
Species *Limnomysis benedeni*

According to Mees and Meland (2010), *Limnomysis benedeni* is the current valid name for this species.

Size, Weight, and Age Range

From Whittmann (2009):

“Body size of adults, measured as total length from the tip of the rostrum to the end of the telson, is typically in the range of 6-13 mm, in rare cases 5-15 mm.”

Environment

From Whittmann (2009):

“In most water bodies, *Limnomysis* is found in shallow (0.5-5 m) near-shore locations [...], unless disturbed by strong currents or wave motion (Kelleher et al. (1999) note a preference for still water, and Wittmann (1995) notes a maximum velocity tolerance of 0.5 m/s.”

“Most populations live in freshwater; however, mass occurrences were mainly observed in coastal and continental lakes with salinities of 0.5-5 PSU [...] (Wittmann, 1995, 2007). Only a few populations are known from habitats with salinity of 6-14 PSU (Bacescu, 1954; Komarova, 1991; Ovcarenko et al., 2006). A low tolerance for salinities above 10 PSU was found in the laboratory by Bacescu (1940). [...] Mass occurrences were only found at a pH of ≥ 7.7 (Wittmann, 2007). [...] A lower oxygen limit of 3.75 mg/L for the natural occurrence of *Limnomysis* in freshwater is comparatively high for freshwater invertebrates; [...] (Bacescu, 1940; Wittmann, 2007).”

Climate

From Palomares and Pauly (2023):

“Temperate”

From Reid and Orlova (2002):

“The Black Sea (~41–46°N) is located in southeast Europe in a semi-arid climate zone.”

“The Caspian Sea spans ~36–47°N and has arid to semiarid continental and Mediterranean climatic zones.”

Distribution Outside the United States

Native

From Audzijontye et al. (2009):

“*Limnomysis benedeni* Czerniavsky, 1882 is a mysid crustacean native to the Ponto-Caspian (Black and Caspian Sea) rivers and estuaries, [...].”

“Native [to] estuaries in the Ponto-Caspian basin (Volga [Russia], Don [Russia], Dnieper [Ukraine], Dniester [Ukraine], Danube [Romania, Ukraine]) [...].”

Introduced

From Whittmann (2009):

“Shortly before 1946, [*Limnomysis benedeni*] spread across continental Europe [...] and arrived in the coastal brackish waters of the Baltic and the North Sea. [...] The westward spread occurred mainly through multiple invasion waves along waterways of the southern corridor, from the Danube Delta [Ukraine, Romania], through the Main-Danube Channel [Germany], and in the River Rhine [Germany, France, Switzerland, Netherlands, Austria, Liechtenstein] down to the North Sea.”

From Baker and Detloff (2023):

“Stocks taken from the Dnieper River in 1690 were used to stock the Kaunas Reservoir in Lithuania, and *L. benedeni* subsequently spread along the River Neman down to the Curonian Lagoon on the Baltic coast (Olenin and Leppäkoski 1999; Arbaciauskas 2002). From 1973 to present, this species has undergone vast range expansion throughout Asian and European waterways. In 1975, this species appeared in Lake Aral (Kazakhstan and Uzbekistan), possibly due to inadvertent stocking in the late 1950s and 1960s (Aladin et al. 2003). It was first found in 1977 in the Tisa River, Serbia and has since spread to the Sava and Zapadna Morava River basins (Zoric et al. 2020). The upper Danube River in Germany was reached in 1993 (Wittmann 1995), and in 1998 this species was found in the Main-Danube Canal. By 1998, *L. benedeni* had reached French waters of the middle Rhine River and the Rhine delta (Ketelaars et al. 1999; Wittmann and Ariani 2000). In 2003, this species was found for the first time in Poland, in the River Odra (Michels 2005). Further expansion from the Rhine led it to reach Switzerland (Wittmann 2007) and Belgium by 2005.”

From Semenchenko et al. (2007):

“The invasive Ponto-Caspian mysid *Limnomysis benedeni* Czerniavsky, 1882 has been recorded for the first time in August 2007 at three sites on the River Pripyat (the Belarusian part of the inland European central invasion corridor).”

“In the middle of the 20th century, *L. benedeni* was intentionally introduced into the Dnieper Reservoirs [Ukraine] and Balaton Lake [Hungary] [...] (Mordukhai-Boltovskoy 1969). This species also entered in the middle part of the Danube River on Serbian territory (Bogut et al. 2007) and the Rhine River (Bernauer and Jansen 2006).”

From Hanselmann et al. (2011):

“The mysid was found for the first time in the eastern part of Lake Constance [on the border of Germany, Switzerland, and Austria] in 2006, near the influx of the river Rhine in Austria (Fritz et al., 2006).”

Means of Introduction Outside the United States

From Whittmann (2009):

“Shortly before 1946, [*Limnomysis benedeni*] spread across continental Europe by both intentional (for fish feeding) and unintentional introductions [...] The westward spread occurred mainly through multiple invasion waves along waterways of the southern corridor, from the Danube Delta, through the Main-Danube Channel, and in the River Rhine down to the North Sea. Main vectors of expansion are ships (in cooling water filters or bilge or ballast water), with construction of navigation canals as the main associated factor. Overland transfers are evident but probably of minor importance. Considering that natural modes of overland transport are highly unlikely (Woynárovich, 1955), such transfers probably result from human activities such as inadvertent stocking with plants or commercially interesting animals, runoff from aquaria (aquarium trade), and quick overland transport of boats (Wittmann and Ariani, 2009).”

From Semenchenko et al. (2007):

“Most likely, this invasive mysid entered the River Pripyat basin [Belarus, Ukraine] from the Dnieper Reservoirs where it was intentionally introduced after 1960.”

“Intensive shipping along inland waterways via the Dniepr and Pripyat Rivers can most likely be considered as the main pathway of invasion of *L. benedeni* into the Prypyat River from the reservoirs in the Dniepr River, as indicated by records of this species in locations close to river ports.”

Short Description

From Whittmann (2009):

“These mysids are distinguished from other species of the family Mysidae by the following set of morphological characters: eyes normal, the cylindrical eyestalks are 1.4-2.3 times the length of the cornea. Antennal scale setose all around, with distinct, sexually dimorph apical segment, tip rounded with indistinct or weak ventral flexure in females, whereas more acute and with stronger flexure in males. Anterior margin of the carapace extends into a pair of lateral spine-like processes. Pleopods reduced to small setose plates in both sexes, except third and fourth pleopods in males. Third male pleopod fused to a two-segmented plate; fourth male pleopod with small, distinct endopod, exopod much longer but basally fused with the two-segmented sympod, exopod terminally of unique shape (occasionally with bifid tip). Telson short, stout and subtriangular with 14 spines along lateral margins; the short, rounded apical incision armed with 4-10 laminar processes (some additional information from Kelleher et al., 1999). The coloration is dark brown to translucent (R. Stubbington, Nottingham Trent University, Nottingham, UK, personal communication, 2011).”

Biology

From Whittmann (2009):

“In shallow habitats, the animals are usually solitary or found in small groups of weak cohesiveness. They tend to stay a few cm above the substrate or to rest directly on it. In the turbid waters of coastal lakes or in the dim deep waters of clear continental lakes (*Limnomysis* was found up to 33 m depth by Steinmann (2009)) they may form aggregations of hundreds or thousands of individuals. Aggregation densities have been observed over a wide distribution range in summer as well as in winter (KJ Wittman, Medical University of Vienna, Austria, personal communication, 2009). At night, *L. benedeni* shows a more scattered distribution, part of the population is found at the surface of the water column, and part lower down (i.e. there is some diel vertical [sic] migration). In coincidence with this, catches of drift nets exposed in rivers overnight are larger than in those exposed during the day (Wittmann et al., 1999).”

“Under conditions of bright light, it shows a generally phytophilic habit, preferring stands or spots of dense submerged vegetation, such as macrophytes, stonewort, roots of trees, and flooded terrestrial weeds (Bacescu, 1954; Dediu, 1[966]; Weish and Türkay, 1975; Wittmann, 1995; Wittmann et al., 1999; Gergs et al., 2008).”

From Baker and Detloff (2023):

“*Limnomysis benedeni* is primarily microphagous, with a diet consisting of phytoplankton, epilithon, detritus, and biofilms on macrophytes, while animal prey (chironomids, etc.) play a minor role (Dediu 1966; Wittmann and Ariani 2000; Gergs et al. 2008).”

“As in all mysid species, *L. benedeni* shows strictly sexual reproduction. [...] A single female with fertilized eggs may be sufficient for establishing an entirely new population (Wittmann 2009). Breeding females are found from March/April to October/November (Bacescu 1954), with an overwintering generation reproducing in spring/summer, followed by one or two summer generations reproducing in summer to autumn (Wittmann 1984, 2009) for a maximum of 5 generations per year.”

Human Uses

From Whittmann (2009):

“Starting in 1947 and culminating in the 1950-1960s, a great number of water bodies in the former Soviet Union were intentionally stocked with *L. benedeni* as part of fisheries management (Pauli, 1957; Zhuravel, 1959; Ioffe, 1968; Grigorovich et al., 2002).”

“Increasing aquarist use (Piepiorka and Walter, 2006) of *L. benedeni* as fish fodder and as ornamental ‘shrimp’ is accompanied (Wittmann and Ariani, 2009) by increasing numbers of Internet offers for its sale.”

Diseases

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

From Whittmann (2009):

“Austin and Alderman (1987) listed *L. benedeni* among the host species of burn spot disease, a bacterial shell disease found in cultured shellfish, particularly lobsters.”

Threat to Humans

No information was found on threats to humans from *Limnomysis benedeni*.

3 Impacts of Introductions

The following sources discuss both realized and potential impacts of *Limnomysis benedeni*, as well as impacts that cannot be definitively attributed to the species' introduction outside of its native range. Only realized impacts that can be attributed to *L. benedeni* were used to assess the History of Invasiveness (see section 4 below).

From Whittmann (2009):

“Olenin and Leppäkoski (1999) judged the non-native population of *Limnomysis* in the strongly eutrophic Curonian Lagoon on the Baltic coast to be a biomass dominant component of the nekto-benthic community with major significance in modifying sediment/habitat by pelletisation. For the same population, Olenin et al. (2007) assessed the effect by its invasion on habitats as weak (H1, i.e. alteration of habitat, but no reduction of spatial extent of a habitat). They classified the impact on ecosystem functioning as moderate (E2, i.e. weak modification of ecosystem performance and/or addition of a new, or reduction of existing, functional groups). Wittmann and Ariani (2000) found no marked effects at ecosystem level, following the invasion of *L. benedeni* into a backwater of River Danube in Vienna (Austria), whereas Gauer and Imesch (2008) did not exclude potential modifications of the food web in freshwaters of Switzerland.”

“From basic information on the abundance and distribution of *Limnomysis*, Olenin et al. (2007) assessed the effect of its invasion in the Curonian Lagoon as moderate (C2, i.e. decline in abundance and reduction of the distribution range of native species). [...] Bernauer and Jansen (2006) noted a loss of native macroinvertebrate species in the upper Rhine River in Germany after the appearance of a number of invasive macroinvertebrates, including *L. benedeni*.”

From Hanselmann et al. (2013):

“In consuming planktic algae and biofilm, *L. benedeni* surely changed the nutrient availability in the littoral of Lake Constance since their massive establishment. By consuming dreissenid biodeposited material (faeces and pseudofaeces), they are capturing energy which has been routed from the pelagia to the benthos (Gergs et al., 2009). Due to their swimming habit, they maybe recycling it back to pelagic foodwebs as it is described for pelagic mysids (Lindén & Kuosa, 2004), and therefor diversify the energy flow in the lake. [...] *L. benedeni* also competes

with other benthic species like snails, isopods and insects (Gergs et al., 2011). [...] In sum, *L. benedeni* has the potential to play an important role in the trophic relations in Lake Constance, and it seems necessary to further follow up and examine these processes.”

From Fink (2013):

“[...] an invasion of mysids capable of trophic upgrading of dietary fatty acids might have positive effects on the fitness of planktivorous fish (Sargent et al., 1999). [...] *L. benedeni* is rich in PUFA [polyunsaturated fatty acids] and is thus a new and potentially high-quality resource for fish in ecosystems invaded by this mysid (Borcherding et al., 2007). [...] If invasive species provide a novel and high-quality (e.g. in terms of PUFA content) resource for the native predator species, ingestion of invasive organisms (such as *L. benedeni*) could yield considerably higher dietary quality in terms of essential PUFA for consumers compared with feeding on native (lower quality) prey taxa.”

4 History of Invasiveness

The History of Invasiveness for *Limnomysis benedeni* is classified as Data Deficient. This species' ability to invade new habitats outside of its native range and become abundant is well-documented and clear; however, information about negative impacts of this species' introduction is less straightforward. For example, Hanselmann et al. (2013) assume that this species altered the nutrient cycle when introduced to Lake Constance in Europe, but they suggest that further research is necessary to understand the process and potential impacts. There is also concern that this species may outcompete native macroinvertebrates where introduced, but evidence directly linking *L. benedeni* to this kind of deleterious effect was not available.

5 Global Distribution

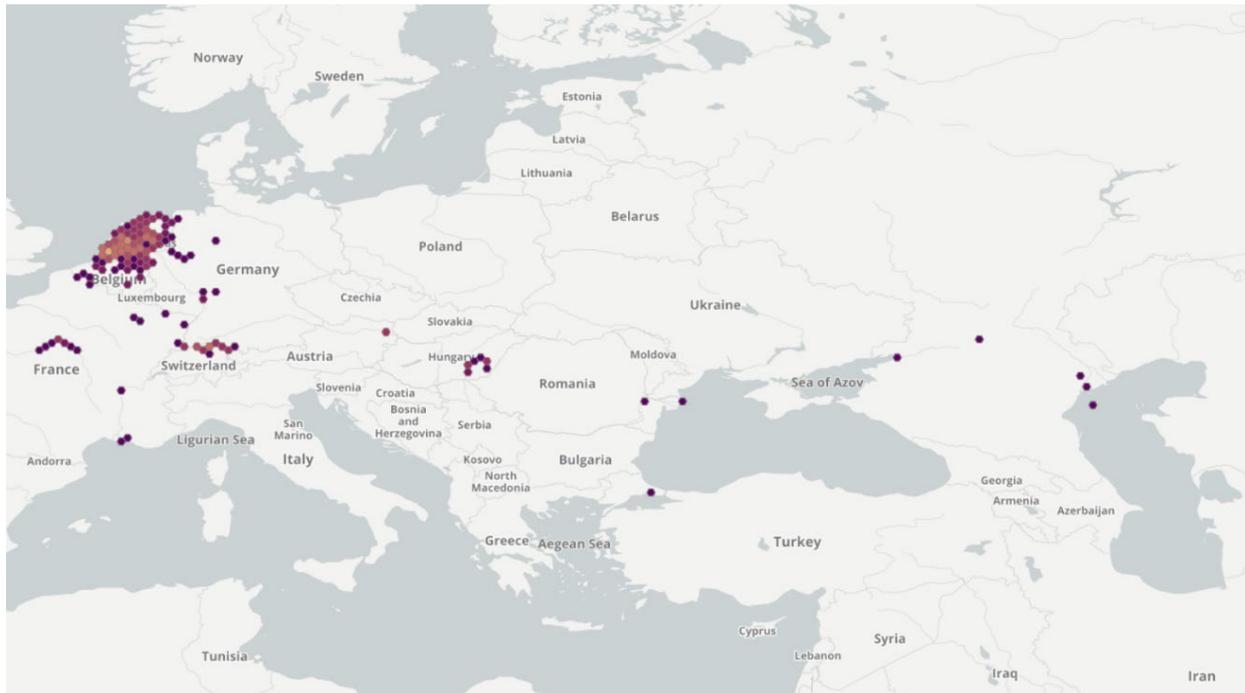


Figure 1. Reported global distribution of *Limnomysis benedeni*. Map from GBIF Secretariat (2023). Observations are reported from Austria, Belgium, France, Germany, Hungary, Netherlands, Romania, Russia, Switzerland, Turkey, and Ukraine. The high number of species occurrences in Belgium and The Netherlands is due to data availability and is not representative of the relative abundance of *L. benedeni* in those countries compared to other parts of the species' range.

Additional occurrences provided in Audzijonyte et al. (2009) for Austria, Croatia, Bulgaria, France, Germany, Hungary, Netherlands, Russia, Romania, Serbia, Slovakia, Turkey, and Ukraine were included in climate matching analysis.

6 Distribution Within the United States

No records of *Limnomysis benedeni* in the wild in the United States were found.

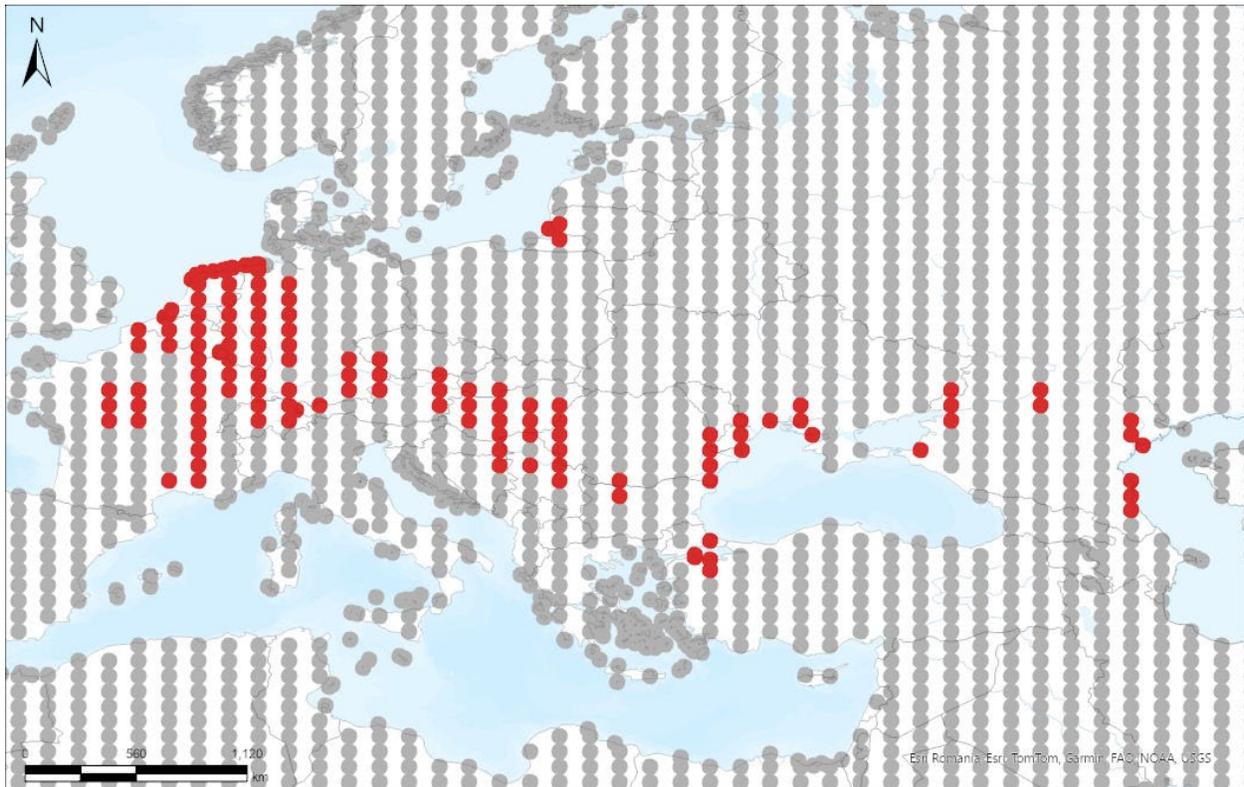
7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Limnomysis benedeni* to the contiguous United States was high around the Great Lakes and Northeast, including the Appalachian Range. Other small areas of high match were scattered through the Great Plains, Great Basin, and Western Mountains. Areas of low match were found along the Gulf Coast and throughout Florida, in the Desert Southwest, the northern Pacific Coast, and the Sierra Nevada. Medium matches were found in most other areas. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for

the contiguous United States was 0.787, 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 *Limnomysis benedeni* (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.



Species: *Limnomysis benedeni*

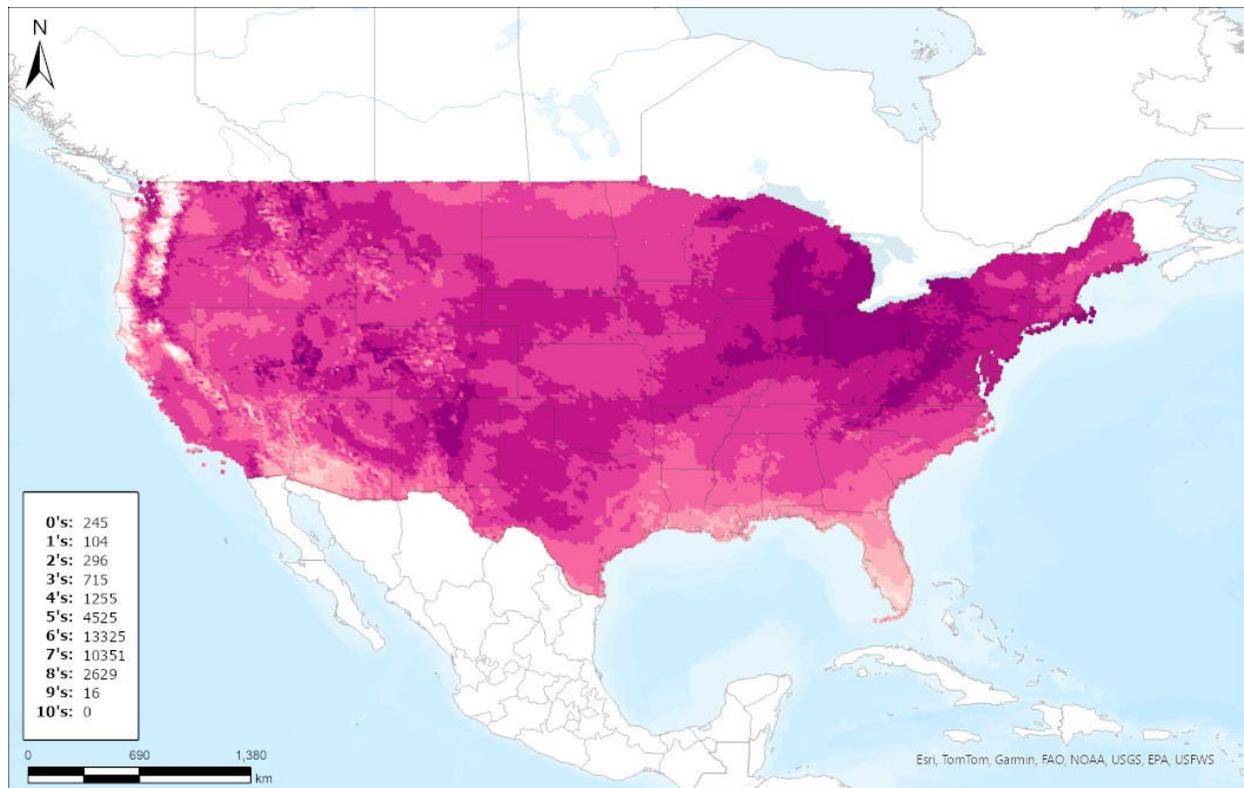
Selected Climate Stations ●



RAMP

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Figure 2. RAMP (Sanders et al. 2023) source map showing weather stations in Europe selected as source locations (red; Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, France, Germany, Hungary, Lithuania, Netherlands, Moldova, Romania, Slovakia, Serbia, Switzerland, Turkey, Ukraine) and non-source locations (gray) for *Limnomysis benedeni* climate matching. Source locations from GBIF Secretariat (2023) and Audzijonyte et al. (2009). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.



Species: *Limnomysis benedeni*

Current

Climate 6 Score: 0.787



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Figure 3. Map of RAMP (Sanders et al. 2023) climate matches for *Limnomysis benedeni* in the contiguous United States based on source locations reported by GBIF Secretariat (2023) and Audzijonyte et al. (2009). 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 *Limnomysis benedeni* is classified as Low. There is ample information available about the species distribution and biology. There is conflicting and scarce evidence as to whether this species has had a negative impact where introduced. Further information is necessary to adequately assess the risk *L. benedeni* poses to the contiguous United States.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Limnomysis benedeni, the Caspian Slender Shrimp, is a crustacean that is native to Eastern Europe and the Ponto-Caspian region. It has become widespread in Europe through two main pathways: migration to new basins through manmade canals, and intentional stocking to improve food availability in fisheries. *Limnomysis benedeni* has been demonstrated to be a carrier of burn

spot disease, a shell disease in crustaceans, but no information was found on the potential impacts to aquaculture or threats to humans. The History of Invasiveness for *Limnomysis benedeni* is classified as Data Deficient due to limited and conflicting evidence of what negative impacts, if any, this species is having on ecosystems, native species, and nutrient cycles where introduced. The climate matching analysis for the contiguous United States indicates establishment concern for this species. Areas of high match were found around the Great Lakes, Northeast, and in patches out to the Western Mountains. The Certainty of Assessment for this ERSS is classified as Low. The Overall Risk Assessment Category for *Limnomysis benedeni* 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: No additional remarks.**
- **Overall Risk Assessment Category: Uncertain**

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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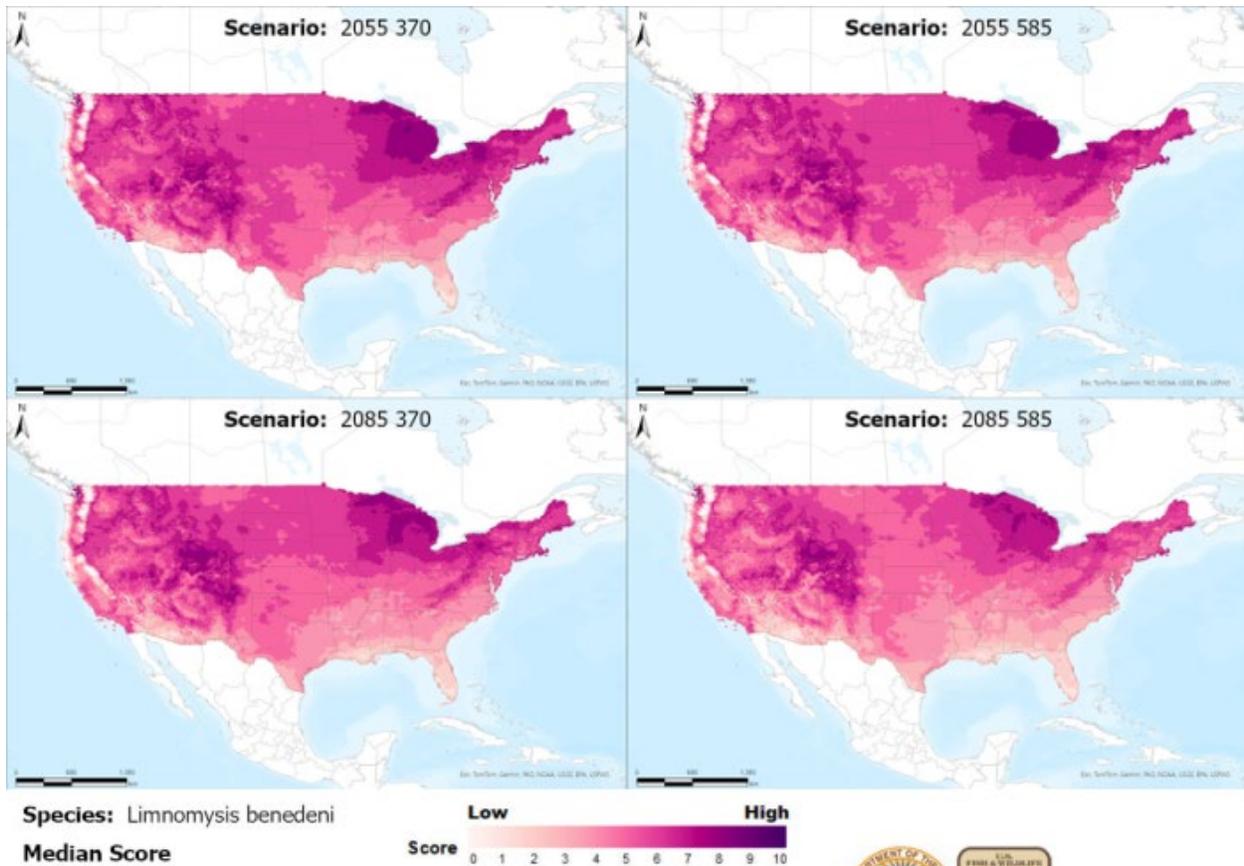
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Appendix

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 Audzijonyte et al. (2009).

Under the future climate scenarios (figure A1), no regions of the contiguous United States were projected to have a high climate match for *Limnomysis benedeni*. Areas of medium-high match were projected to occur in the Great Lakes and in patches in the Colorado Plateau, particularly under time step 2055. Areas of low climate match were projected to occur in the Gulf Coast, Northern Pacific Coast, and Southern Florida regions. The areas of low match expanded between time steps 2055 and 2085. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.173 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.694 (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 (0.787, 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 one or more time step and climate scenarios, areas within the Colorado Plateau 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 Appalachian Range, California, Colorado Plateau, Great Lakes, Gulf Coast, Mid-Atlantic, Southeast, Southern Atlantic Coast, Southern Plains, and Southwest saw a large decrease in the climate match relative to current conditions. Additionally, areas within the Great Basin, Northeast, Northern Pacific Coast, Northern Plains, 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).



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Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Limnomysis benedeni* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023) and Audzijonyte et al. (2009). 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.

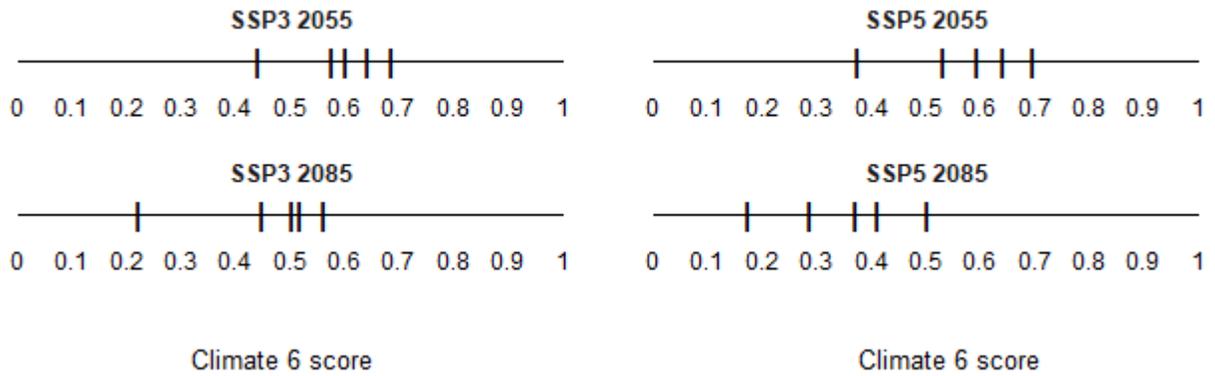


Figure A2. Comparison of projected future Climate 6 scores for *Limnomysis benedeni* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018;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

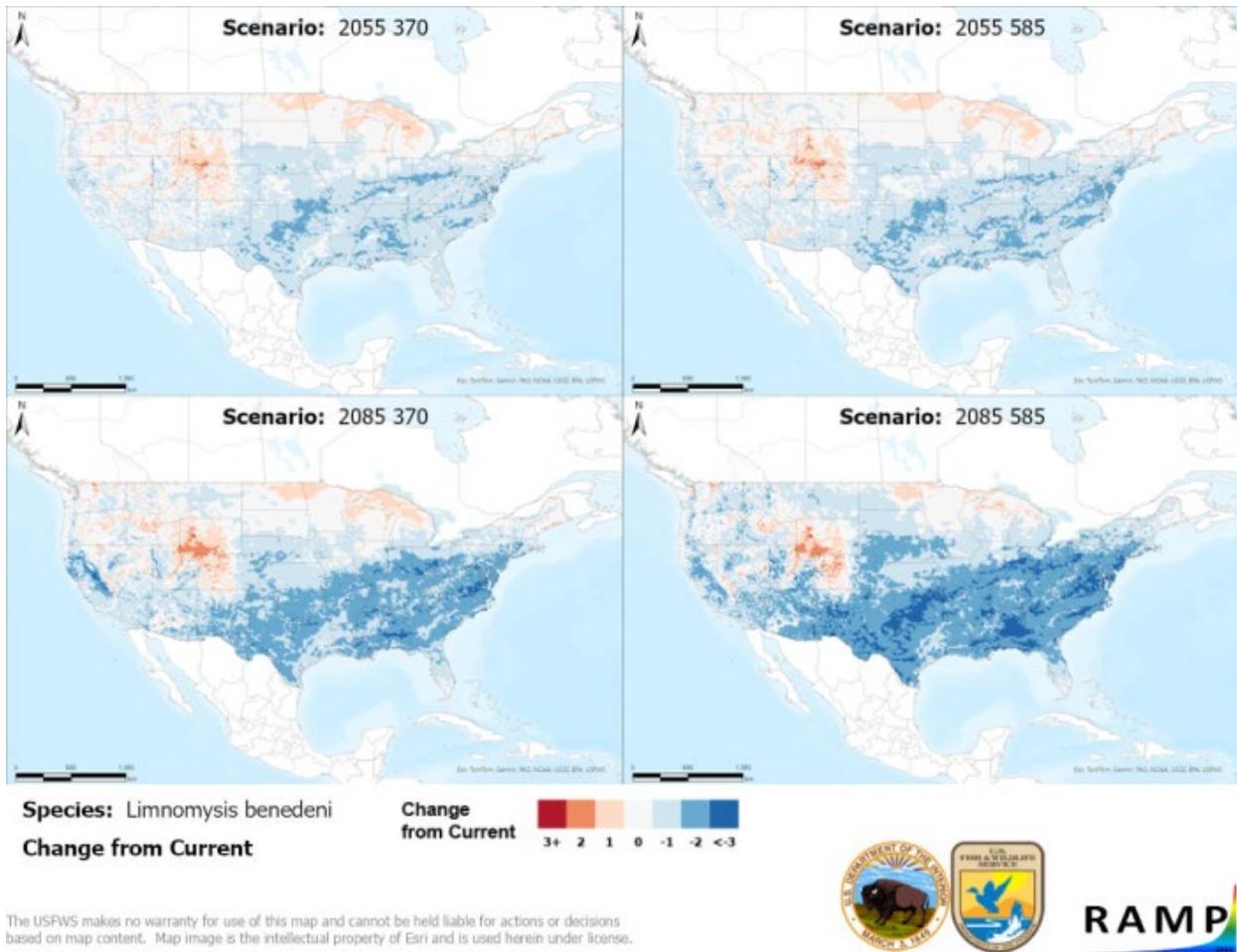


Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 3) and the median target point score for future climate scenarios (figure A1) for *Limnomysis benedeni* based on source locations reported by GBIF Secretariat (2023) and Audzijonyte et al. (2009). 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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