Chinese Ramshorn Snail (*Gyraulus chinensis*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, January 2025
Revised, April 2025
Web Version, 4/9/2026

Organism Type: Mollusk
Overall Risk Assessment Category: Uncertain

Photo: banyanya224. Licensed under CC BY-NC 4.0. Available: https://www.inaturalist.org/observations/183312143 (January 2025).

1 Native Range and Status in the United States

Native Range

From Köhler et al. (2012):

"The species is native to south and southeast Asia (Beran and Glöer 2006, AnimalBase 2011) from Iran to India, Korea, southern Japan, and New Guinea. This species is found in northern Viet Nam, and may have a more extensive range in China, and is also recorded from South

Korea (Kim at al. 2008). In Viet Nam it is known from Thai Nguyen and Bac Ninh provinces, the Chay River (Lao Cai and Yen Bai provinces), and the Gianh River in Quang Binh Province."

Status in the United States

From Donaldson et al. (2024):

"The invasive species *Gyraulus chinensis* is the only mollusk reported from the Matgue River [Guam] […]."

No records were found of *Gyraulus chinensis* in live trade in the United States.

Regulations

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

Means of Introductions within the United States

No information was found on means of introduction of *Gyraulus chinensis* to the United States.

Remarks

From Köhler et al. (2012):

"The full native and introduced ranges of the species requires confirmation."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From MolluscaBase editors (2025):

"Animalia (Kingdom) > Mollusca (Phylum) > Gastropoda (Class) > Heterobranchia (Subclass) > Euthyneura (Infraclass) > Tectipleura (Subterclass) > Hygrophila (Superorder) > Lymnaeoidea (Superfamily) > Planorbidae (Family) > Planorbinae (Subfamily) > Planorbini (Tribe) > *Gyraulus* (Genus) > *Gyraulus chinensis* (Species)"

According to MolluscaBase editors (2025), *Gyraulus chinensis* (Dunker, 1848) is the current valid name for this species.

Size, Weight, and Age Range

From Ohta et al. (2011):

"The snails have an adult shell diameter of c. 5 mm (Habe, 1990), a lifespan of about 6 months, […]."

Environment

From Glöer et al. (2014):

"[…] *Gyraulus chinensis*[…] is common in shallow water bodies such as ponds and river floodplains at altitudes up to 2,000 m […]."

Ohta et al. (2011) report the following water parameters (±SE) from Horonai Stream, southwestern Hokkaido, Japan, where *Gyraulus chinensis* was collected:

- Water temperature (°C): 11.6 (0.4)
- Current velocity (cm s^{-1}): 10.1 (1.2)
- Water depth (cm): 20.3 (1.3)
- Dissolved inorganic nitrogen (µg L^{-1}): 20 (5.1)
- Total phosphorous (µg L^{-1}): 1.0 (0.3)

The following source describes characteristics of snails of the genus *Gyraulus*.

From Ponder et al. (2024a):

"On water weeds, leaves, wood and stones, and similar substrates, in ephemeral and permanent waterholes, ponds, lakes, springs, billabongs, sphagnum bogs, swamps and sluggish streams and rivers."

Climate

From Toledo et al. (1998):

"The climate [of Albufera Natural Park in Spain, where *G. chinensis* is established] is typically mediterranean with mild winters (average temperature: 10.8ºC) and long warm rainless summers (average temperature: 25.5ºC)."

Distribution Outside the United States

Native

From Köhler et al. (2012):

"The species is native to south and southeast Asia (Beran and Glöer 2006, AnimalBase 2011) from Iran to India, Korea, southern Japan, and New Guinea. This species is found in northern Viet Nam, and may have a more extensive range in China, and is also recorded from South Korea (Kim at al. 2008). In Viet Nam it is known from Thai Nguyen and Bac Ninh provinces, the Chay River (Lao Cai and Yen Bai provinces), and the Gianh River in Quang Binh Province."

Introduced

From Saito et al. (2025):

"The earliest documented record in Europe is from Camargue, France, in 1973 (Brown et al., 1998). Subsequently, this snail is reported to have spread over a large area in Europe, and there are also records from Africa, Australia, Middle East (Israel), and Caribbean (Martinique) as an

alien species (Brown et al., 1998; Pointier, 2008; Appleton & Miranda, 2015; Mienis et al., 2015; Ponder et al., 2022)."

"Based on the collected 59 literature records and our survey, *Gyraulus chinensis* has been reported outdoors from Albania, Austria, France, Germany, Greece, Italy, Montenegro, the Netherlands, Portugal and Spain, and indoors from Austria, the Czech Republic, Ireland, Germany, the Netherlands, Norway, Sweden and the United Kingdom […] The south of Wonseradeel in the Netherlands was the northern limit of occurrence of *G. chinensis* in the outdoor environments."

"After the first outdoor record from France (1973), the species was also reported outdoors from Italy, Portugal and Spain by the 1980s. Findings in other European regions are more recent. In south-eastern Europe, the species was first reported outdoors from Greece in 2003, from Montenegro in 2013 and from Albania in 2018. In Central Europe, the oldest outdoor records are from the Netherlands (1976). In Austria and Germany, possible occurrences in the outdoor environments were reported already in 1993 and 1998, but reliable outdoor records come from 2001 and 2009."

"[…] most of these northern records [i.e., Netherlands, Austria, Germany] are from urban areas and even in the outdoor environments, it cannot be excluded that they inhabit water bodies affected by hot water discharge. Indeed, in the Lower Rhine, *G. chinensis* only occurs in water bodies with hot water discharge (van der Velde et al., 2002)."

From Brown et al. (1998):

"This is the first reported occurrence in Africa of *Gyraulus chinensis* (Dunker), a freshwater snail native to southern Asia, first collected in 1989 in a rice-growing area of Guinea Bissau, West Africa."

From Glöer et al. (2014):

"[…] *Gyraulus chinensis*, was anatomically identified and it is common in shallow water bodies such as ponds and river floodplains at altitudes up to 2,000 m [in Kyrgyzstan] […]"

"[…] its exact native and introduced ranges, including the origin of the populations from Kyrgyzstan, still require confirmation."

From Appleton and Miranda (2015):

"Recently the species has been collected in […] a swamp in Martinique, West Indies (Pointier 2008)."

From Outa et al. (2024):

"The present study shows that the snail is now established and has spread into aquatic ecosystems in South Africa."

From Ponder et al. (2024b):

“This Asian species is known from a single locality [in Australia] near Mt. Gambier in South Australia.”

Means of Introduction Outside the United States

From Saito et al. (2025):

“Although the specific mechanisms of introduction remain unclear, the most likely hypothesis is invasion via the aquarium trade.”

“[…] the European populations may have originated in the south-eastern part of the Eurasian continent, particularly on Kyushu Island, the Ryukyu Islands, Taiwan, and Hong Kong.”

“[…] there is no evidence to rule out other mechanisms of introduction and spread. In particular, due to the wide and dense distribution of *G. chinensis*, it is difficult to explain all dispersal in Europe by the aquarium trade alone. Other mechanisms such as release of contaminants by fisheries, transport by humans, external and internal transport by birds, and natural dispersal via water currents should be examined in further studies.”

From Brown (2013):

“[…] the present record [of *G. chinensis*] in eastern South Australia probably results from introduction through human agency.”

From Outa et al. (2024):

“According to Appleton and Miranda (2015), the first report of *G. chinensis* was in 1995 from a consignment of aquarium plants from Singapore that was intercepted by the Department of Plant and Quality Control in Kwazulu Natal. Until recently, records of the snail were from aquaria and artificial ponds (Appleton and Miranda, 2015, Griffiths et al., 2015).”

Short Description

From Appleton and Miranda (2015):

“[The shell of *G. chinensis*] is typically pale coloured with weak or no spiral sculpture and a rounded shoulder […]”

“Pigmentation of head, tentacles and mantle roof of conspicuous dark spots and blotches, flatness index of whorl [product of the whorl diameter from shoulder to the inside of the aperture and whorl height] between 1.9 and 4.0, prostate gland with fewer than 12 lobes, lobes of variable length and arrangement, preputium usually shorter than penis sheath […]”

Biology
From Ohta et al. (2011):

"[…] herbivorous snail […]"

The following source describes characteristics of snails of the genus *Gyraulus*.

From Ponder et al. (2024a):

"Feeds on detritus. Egg mass presumably a jelly strip containing small eggs. Development direct."

Human Uses
No information was found on human uses of *Gyraulus chinensis*.

Diseases
No information was found associating *Gyraulus chinensis* with any diseases listed by the World Organisation for Animal Health (2025).

From Outa et al. (2024):

"Although there is a paucity of data on parasite fauna of *G. chinensis*, the snail is known to transmit echinostomes in Asia and Europe (Lo, 1995, Toledo et al., 1998)."

"According to Lo (1995), *Echinostoma macrorchis* Ando & Ozaki, 1923 was the only digenean found from *G. chinensis* in Taiwan. Outside of its native range, *G. chinensis* was reported to transmit *Euparyphium albuferensis* Esteban, Toledo, Sanchez & Munoz-Antoli, 1997 in Spain (Toledo et al., 1998)."

From Appleton and Miranda (2015):

"In its native region, *G. chinensis* serves as the first intermediate host for several trematodes, including two which may infect people: the fasciolid *Fasciolopsis buski* (Lankaster, 1857) reported from Thailand by Manning and Ratanarat (1970) and the echinostome *Echinostoma macrorchis* Ando & Ozaki, 1923 reported by Lo (1995) and the World Health Organization (1995)."

Threat to Humans
From Appleton and Miranda (2015):

"In its native region, *G. chinensis* serves as the first intermediate host for several trematodes, including two which may infect people: the fasciolid *Fasciolopsis buski* (Lankaster, 1857) reported from Thailand by Manning and Ratanarat (1970) and the echinostome *Echinostoma macrorchis* Ando & Ozaki, 1923 reported by Lo (1995) and the World Health Organization (1995)."

From Mathison and Pritt (2022):

“Clinically, echinostomes may cause more severe disease than other intestinal trematodes due to physical damage to the intestinal epithelium caused by the presence of spines surrounding the oral sucker on adult worms. Symptoms include epigastric and abdominal pain, malaise, weight loss, anorexia, nausea, vomiting, and diarrhea. Pathologically, the intestinal epithelium shows mucosal ulceration and erosion, bleeding, and chronic gastritis. Echinostomes have been implicated in adenocarcinoma (Toledo and Esteban, 2016).”

3 Impacts of Introductions

Although there are records of introductions for *Gyraulus chinensis* outside of its native range, the impacts of these introductions are unknown. The following are potential impacts of introductions discussed in the literature.

From Saito et al. (2025):

“[…] despite its global distribution, little is known about the nature of *G. chinensis* as an invasive species. At least in its native range, the snail serves as an intermediate host for parasites that are harmful to human health (Lo, 1995; Toledo et al., 1998). Although *G. chinensis* was a part of the community that has replaced native fauna in the Arno River in Italy (Haubrock et al., 2021), its direct impact has not been considered. Given its widespread invasion in Europe, *G. chinensis* may pose an existing and/or potential threat to snails of the same genus and family, which include endangered species (IUCN, 2022).”

“[…] the consequences of *G. chinensis* invasion have hardly been assessed and documented so far.”

4 History of Invasiveness

The History of Invasiveness for *Gyraulus chinensis* is classified as Data Deficient. Multiple introductions of this species have been documented in the scientific literature on at least three continents. However, information documenting negative impacts, or lack thereof, from introductions of *G. chinensis* was not available. This species is not known to be in trade intentionally.

5 Global Distribution

Figure 1. Reported global distribution of *Gyraulus chinensis*. Map from GBIF Secretariat (2023). Observations are reported from Japan, Spain, Sweden, Martinique, China, Italy, Albania, Czechia, France, India, Austria, South Korea, North Korea, Australia, Norway, and Germany. Points in Sweden and Norway represent collections from indoor environments and were excluded from the climate matching analysis. Points in Germany, Austria, and Czechia were also excluded because of uncertainty over whether they represented water bodies under natural climatic conditions (Saito et al. 2025). Points in eastern Australia, Christmas Island, Guadeloupe, and Martinique were excluded because population establishment could not be confirmed at those locations.

No georeferenced occurrences were available representing the distribution of *G. chinensis* in Guam, Guinea Bissau, or across much of its native range in Asia.

Additional georeferenced occurrences were available from Glöer et al. (2014; Kyrgyzstan) and Outa et al. (2024; South Africa) and were used in the climate matching analysis.

6 Distribution Within the United States

Figure 2. Approximate location of the Matgue River in Guam, from which *Gyraulus chinensis* has been reported. Adapted from map by Alexrk2. Licensed under Creative Commons BY-SA 3.0. Available: https://commons.wikimedia.org/wiki/File:USA_Guam_location_map.svg (April 2026). This location was not used to select source points for the climate matching analysis due to lack of information about establishment status or precise location of occurrence.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Gyraulus chinensis* was medium to high across nearly all of the contiguous United States. The highest climate matches were found in the Rocky Mountains, Great Basin, southern Midwest, and southeast Atlantic coast. The climate match was low along the northern Pacific coast and in the Cascade and Sierra Nevada ranges. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.838, 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 *Gyraulus chinensis* (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.

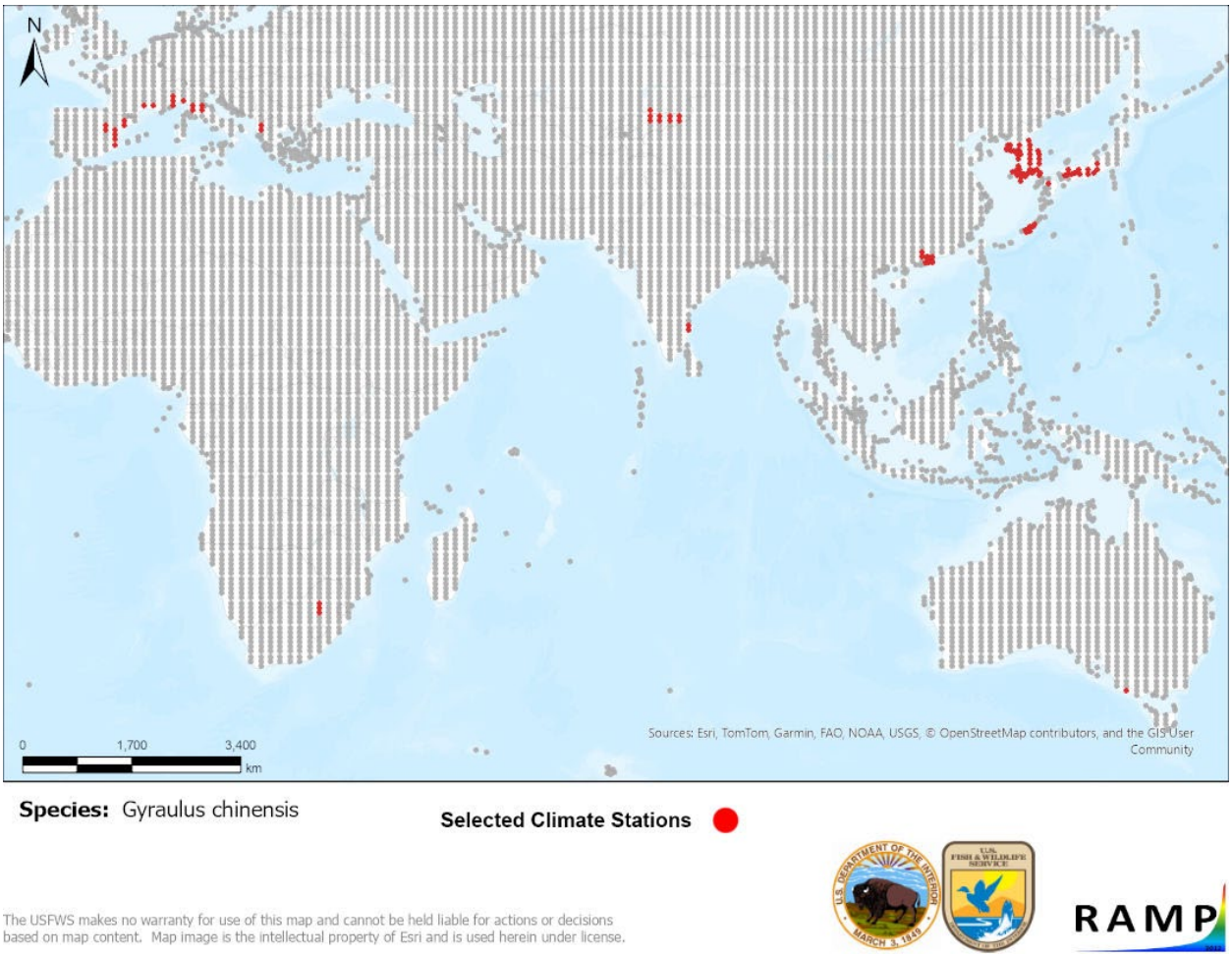

Figure 3. RAMP (Sanders et al. 2023) source map showing weather stations throughout the world selected as source locations (red; Albania, Australia, China, Democratic People's Republic of Korea, France, Hong Kong, India, Italy, Japan, Macao, Republic of Korea, South Africa, and Spain) and non-source locations (gray) for *Gyraulus chinensis* climate matching. Source locations from GBIF Secretariat (2023), Glöer et al. (2014), and Outa et al. (2024). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

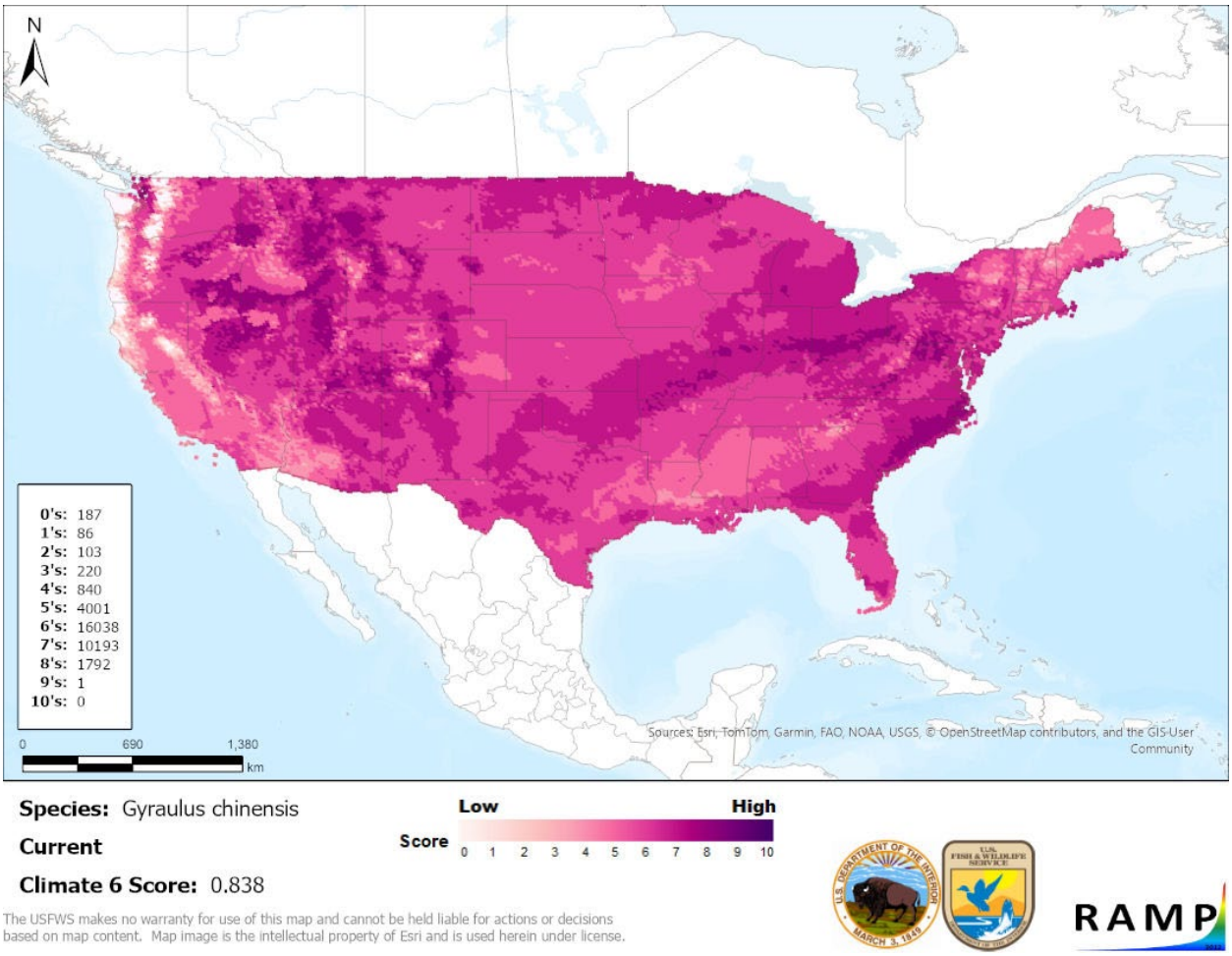

Figure 4. Map of RAMP (Sanders et al. 2023) climate matches for *Gyraulus chinensis* in the contiguous United States based on source locations reported by GBIF Secretariat (2023), Glöer et al. (2014), and Outa et al. (2024). Counts of climate match scores are tabulated on the left. 0/Pale Pink=Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Gyraulus chinensis* is classified as Low. There is some information available regarding the distribution and ecology of *Gyraulus chinensis*. However, occurrence data from the native range is sparse and establishment status is unclear for several portions of the introduced range. Information regarding the impacts of these introduced populations was only speculative; no clear and reliable documentation of impacts or lack of impacts was found.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Gyraulus chinensis, Chinese Ramshorn Snail, is an aquatic snail that is native to south and southeast Asia. This species is an herbivore that inhabits small freshwater ponds and streams. *G. chinensis* has multiple documented introductions in Europe, where it may occur in the wild or

in indoor environments such as greenhouses. It has also been reported from Africa, Australia, and Guam. The likely pathway of introduction of *G. chinensis* is the aquarium plant trade. The History of Invasiveness for *Gyraulus chinensis* is classified as Data Deficient because although multiple introductions of this species have been reported globally, there is no information available on impacts of its introduction or lack thereof. The climate matching analysis for the contiguous United States indicates establishment concern for this species. The climate match was medium to high across most of the contiguous United States, but low along the West Coast. The Certainty of Assessment for this ERSS is classified as Low due to gaps in species occurrence data and a lack of clear, convincing, and reliable research on impacts of this species' introduction. The Overall Risk Assessment Category for *Gyraulus chinensis* 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: Host to parasites that can infect humans.**
- **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.

Appleton CC, Miranda NA. 2015. Two Asian freshwater snails newly introduced into South Africa and an analysis of alien species reported to date. African Invertebrates 56:1–7.

Brown DS. 2013. Freshwater snails of the genus *Gyraulus* (Planorbidae) in Australia: taxa of the mainland. Molluscan Research 21:17–107.

Brown DS, Gracio MA, Meier-Brook C. 1998. The Asian freshwater snail *Gyraulus chinensis* (Dunker, 1848) (Planorbidae) in West Africa and Europe. Journal of African Zoology 112:203–213.

Donaldson TJ, Kottermair M, Mesa TN. 2024. Natural resource condition assessment: War in the Pacific National Historical Park. Science Report NPS/SR—2024/150. Fort Collins, Colorado: National Park Service. Available: https://doi.org/10.36967/2303627 (January 2025).

GBIF Secretariat. 2023. GBIF backbone taxonomy: *Gyraulus chinensis*. Copenhagen: Global Biodiversity Information Facility. Available: https://www.gbif.org/species/4562197 (April 2025).

Glöer P, Boeters HD, Pesic V. 2014. Freshwater molluscs of Kyrgyzstan with description of one new genus and species (Mollusca: Gastropoda). Folia Malacologica 22(2):73–81.

Köhler F, Do V, Madhyastha A. 2012. *Gyraulus chinensis*. The IUCN Red List of Threatened Species 2012. Available: https://www.iucnredlist.org/species/155805/736420 (January 2025).

Mathison BA, Pritt BS. 2022. Parasites of the gastrointestinal tract. Pages 136–203 in Rezaei N, editor. Encyclopedia of infection and immunity. Amsterdam: Elsevier.

MolluscaBase editors. 2025. *Gyraulus chinensis* (Dunker, 1848). World Register of Marine Species. Available: https://www.marinespecies.org/aphia.php?p=taxdetails&id=742049 (January 2025).

Ohta T, Miyake YO, Hiura T. 2011. Light intensity regulates growth and reproduction of a snail grazer (*Gyraulus chinensis*) through changes in the quality and biomass of stream periphyton. Freshwater Biology 56:2260–2271.

Outa JO, Bhika P, Avenant-Oldewage A. 2024. Gastropod invasions in anthropogenically impacted impoundments in South Africa: tracing their origins and exploring field evidence of parasite spillback and amplification. International Journal for Parasitology 54(6):279–301.

Ponder WF, Hallan A, Shea ME, Clark SA, Richards K, Klunzinger MW, Kessner V. 2024a. Gyraulus (Charpentier, 1837). Australian freshwater molluscs. Revision 2B. Available: https://keys.lucidcentral.org/keys/v3/freshwater_molluscs/ (January 2025).

Ponder WF, Hallan A, Shea ME, Clark SA, Richards K, Klunzinger MW, Kessner V. 2024b. *Gyraulus chinensis* (Dunker, 1848). Australian freshwater molluscs. Revision 2B. Available: https://keys.lucidcentral.org/keys/v3/freshwater_molluscs/ (January 2025).

Saito T, Šlachtová E, Nováková M, Horsáková V, Ye B, Beran L, Horsák M. 2025. Invasion history of *Gyraulus chinensis* (Gastropoda: Planorbidae) in Europe: a molecular and literature-based approach. Hydrobiologia 852:1359–1371.

Sanders S, Castiglione C, Hoff M. 2023. Risk Assessment Mapping Program: RAMP. Version 5.0. U.S. Fish and Wildlife Service.

Toledo R, Muñoz-Antolí C, Pérez M, Esteban JG. 1998. Larval trematode infections in freshwater gastropods from the Albufera Natural Park in Spain. Journal of Helminthology 72:79–82.

[USFWS] U.S. Fish and Wildlife Service. 2024. Standard operating procedure: how to prepare an "Ecological Risk Screening Summary." Version 3. Available: https://www.fws.gov/media/standard-operating-procedures-how-prepare-ecological-risk-screening-summary-2024 (December 2024).

World Organisation for Animal Health. 2025. Animal diseases. Paris: World Organisation for Animal Health. Available: https://www.woah.org/en/what-we-do/animal-health-and-welfare/animal-diseases/ (January 2025).

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.

AnimalBase. 2011. Species summary for *Gyraulus chinensis*. Available: http://www.animalbase.unigoettingen.de/zooweb/servlet/AnimalBase/home/species?id=2084.

Beran L, Glöer P. 2006. *Gyraulus chinensis* (Dunker, 1848) – a new greenhouse species for the Czech Republic (Gastropoda: Planorbidae). Malacologica Bohemoslovaca Online 5:25–28.

Griffiths C, Day J, Picker M. 2015. Freshwater life: a field guide to the plants and animals of southern Africa. Cape Town, South Africa: Penguin Random House.

Habe T. 1990. Inventory of nonmarine aquatic snail in Japan (2). Hitachiobi 55:3–9. Japan: Tokyo Snail Club. (In Japanese.)

Haubrock PJ, Pilotto F, Innocenti G, Cianfanelli S, Haase P. 2021. Two centuries for an almost complete community turnover from native to non-native species in a riverine ecosystem. Global Change Biology 27:606–623.

IUCN. 2022. The IUCN Red List of Threatened Species. Version 2022-1. Available: https://www.iucnredlist.org.

Kim DW, Park JC, Ryu JK. 2008. An investigation of flora and fauna in upper streams and lower streams of weirs with and without a fish-way in Haman Stream. Environmental Engineering Research 13(3):147–154.

Lo CT. 1995. *Echinostoma macrorchis*: life history, population dynamics of intramolluscan stages, and the first and second intermediate hosts. Journal of Parasitology 81:569–576.

Manning GS, Ratanarat C. 1970. *Fasciolopsis buski* (Lankaster, 1857) in Thailand. American Journal of Tropical Medicine and Hygiene 19:613–619.

Mienis HK, Vaisman S, Rittner O. 2015. Finds of *Gyraulus chinensis* (Dunker, 1848) (Mollusca, Gastropoda, Planorbidae) in Israel. Triton 31:9–11.

Pointier J-P. 2008. Guide to the freshwater molluscs of the Lesser Antilles. Hackenheim, Germany: ConchBooks.

Ponder WF, Hallan A, Shea M, Clark SA, Richards K, Klunzinger MW, Kessner V. 2022. Australian freshwater molluscs. Revision 1A. Available: https://keys.lucidcentral.org/keys/ v3/freshwater_molluscs/.

Toledo R, Esteban JG. 2016. An update on human echinostomiasis. Transactions of the Royal Society of Tropical Medicine and Hygiene 110:37–45.

van der Velde G, Nagelkerken I, Rajagopal S, de Vaate AB. 2002. Invasions by alien species in inland freshwater bodies in Western Europe: the Rhine Delta. Pages 360–372 in Leppäkoski E, Gollasch S, Olenin S, editors. Invasive aquatic species of Europe. Distribution, impacts and management. Dordrecht, the Netherlands: Springer.

World Health Organization. 1995. Control of foodborne trematode infections. WHO Technical Report Series 849. Geneva, Switzerland: World Health Organization.

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), Glöer et al. (2014), and Outa et al. (2024).

Under the future climate scenarios (figure A1), there were scattered areas of high climate match for *Gyraulus chinensis* in the Great Basin, Great Lakes, and Western Mountain regions. Areas of low climate match were projected to occur in the Northern Pacific Coast region and along the Sierra Nevada range. Areas of high match generally shrank in size from SSP3 to SSP5 and from time step 2055 to 2085. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.302 (model: UKESM1-0-LL, SSP5, 2085) to a high of 0.724 (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 (0.838, 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. At time step 2085, especially, areas within the Great Lakes 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 the SSP5, 2085 scenario, areas within the Colorado Plateau, Great Basin, and Northern Plains 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, Northeast, Southeast, Southern Atlantic Coast, Southern Florida, Southern Plains, Southwest, and Western Mountains saw a moderate decrease in the climate match relative to current conditions under multiple scenarios. Additional very small areas of large or moderate change may be visible on the maps (figure A3).

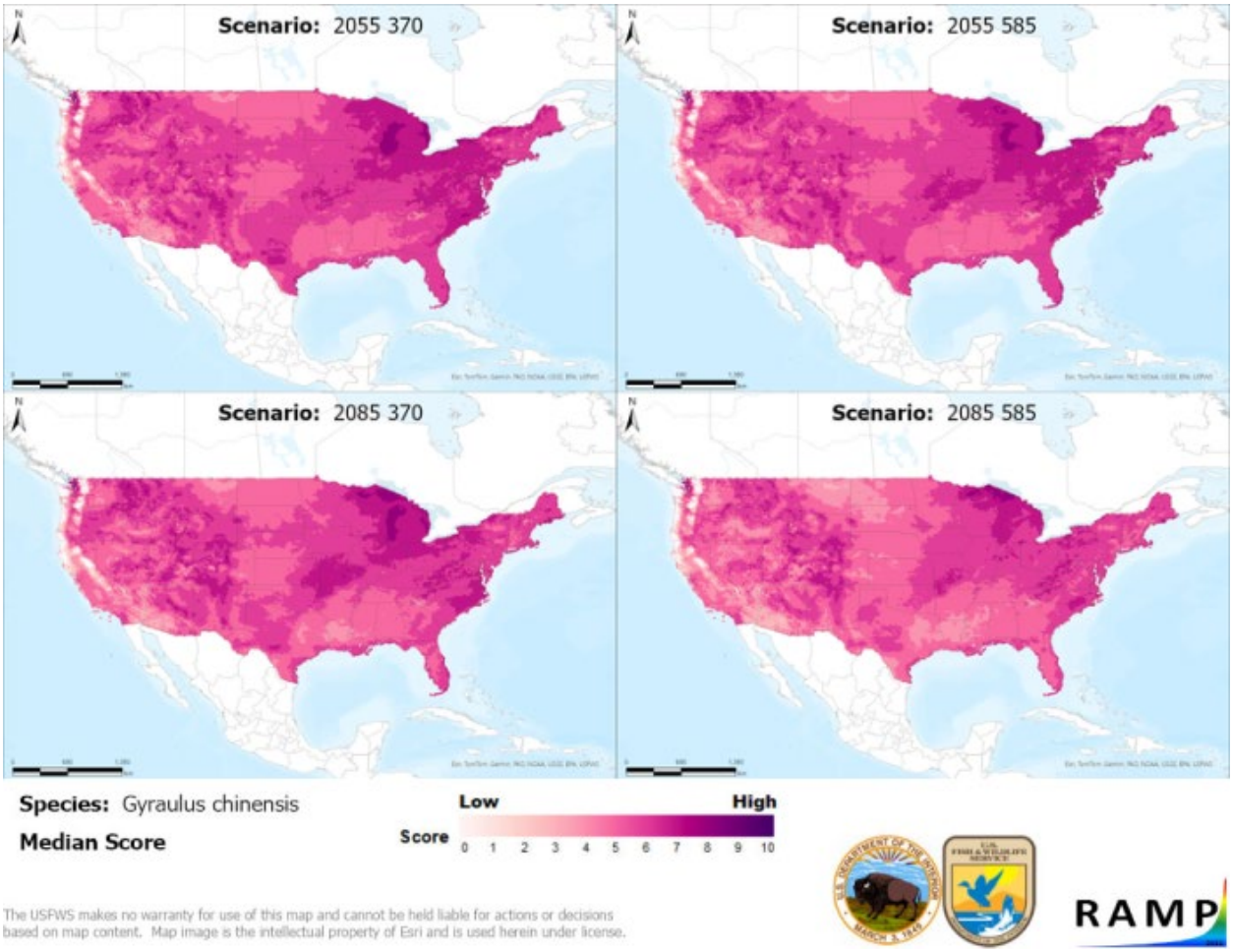

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Gyraulus chinensis* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023), Glöer et al. (2014), and Outa et al. (2024). 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.

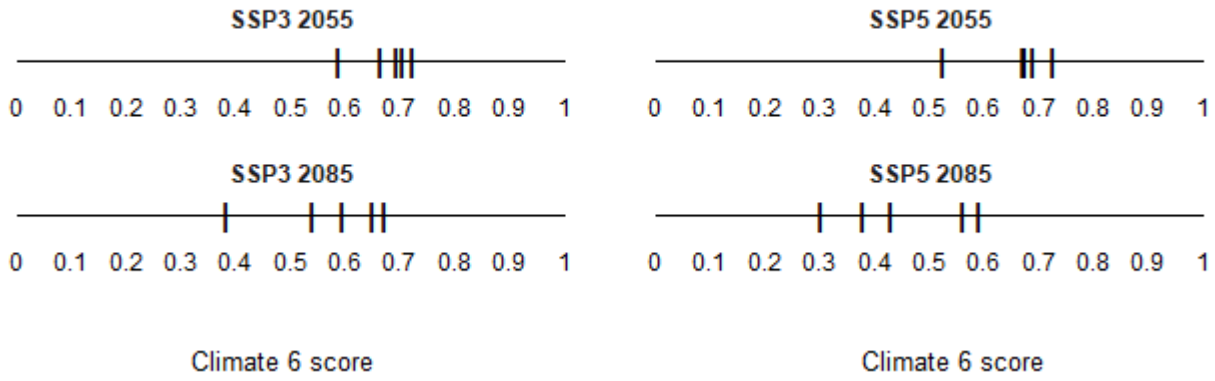

Figure A2. Comparison of projected future Climate 6 scores for *Gyraulus chinensis* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018;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

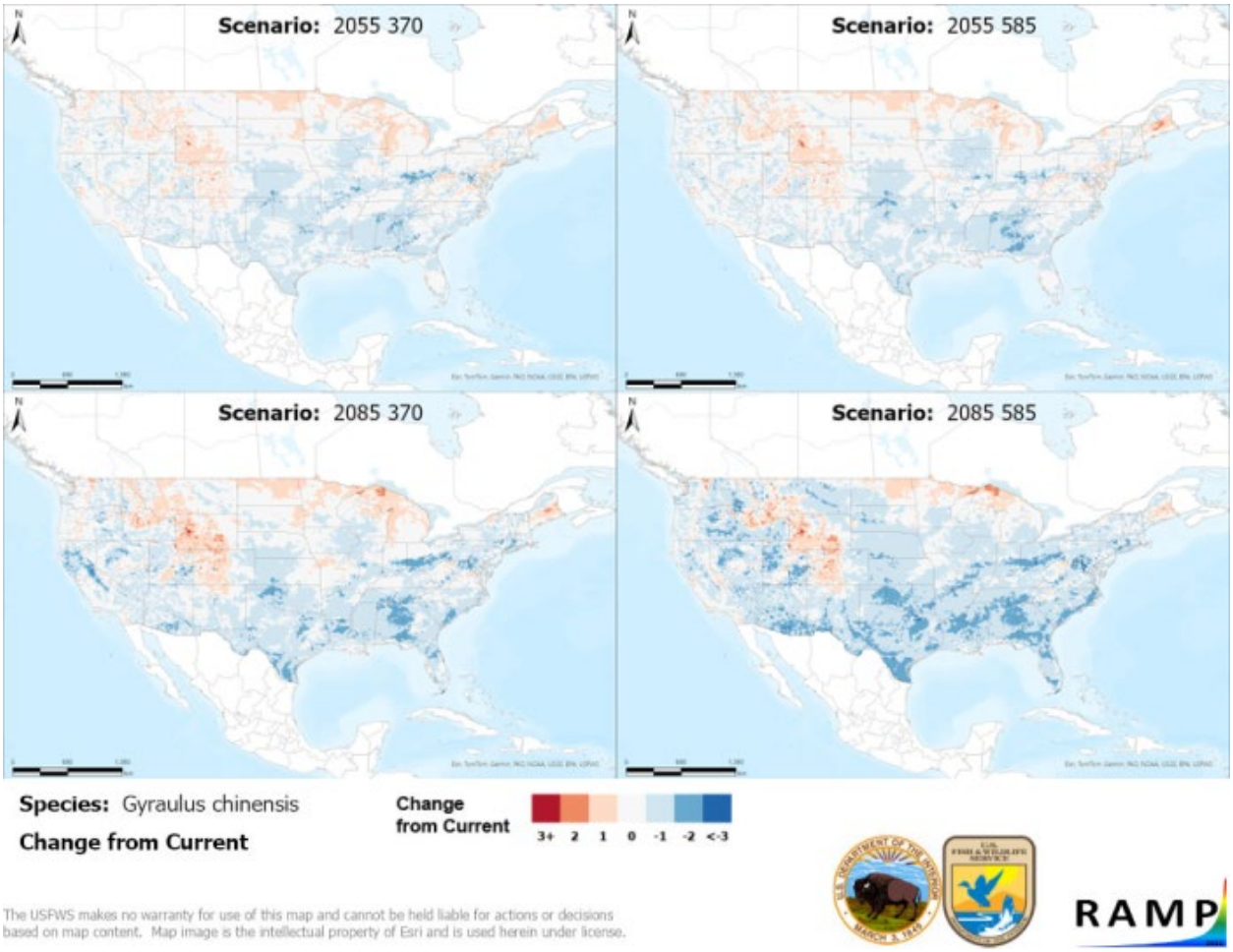

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 4) and the median target point score for future climate scenarios (figure A1) for *Gyraulus chinensis* based on source locations reported by GBIF Secretariat (2023), Glöer et al. (2014), and Outa et al. (2024). 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.

Literature Cited

GBIF Secretariat. 2023. GBIF backbone taxonomy: Gyraulus chinensis. Copenhagen: Global Biodiversity Information Facility. Available: https://www.gbif.org/species/4562197 (April 2025).

Glöer P, Boeters HD, Pesic V. 2014. Freshwater molluscs of Kyrgyzstan with description of one new genus and species (Mollusca: Gastropoda). Folia Malacologica 22(2):73–81.

[IPCC] Intergovernmental Panel on Climate Change. 2021. Climate change 2021: the physical science basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

Karger DN, Conrad O, Böhner J, Kawohl T, Kreft H, Soria-Auza RW, Zimmermann NE, Linder HP, Kessler M. 2018. Data from: Climatologies at high resolution for the earth's land surface areas. EnviDat. Available: https://doi.org/10.16904/envidat.228.v2.1.

Karger DN, Conrad O, Böhner J, Kawohl T, Kreft H, Soria-Auza RW, Zimmermann NE, Linder P, Kessler M. 2017. Climatologies at high resolution for the Earth land surface areas. Scientific Data 4:170122.

Outa JO, Bhika P, Avenant-Oldewage A. 2024. Gastropod invasions in anthropogenically impacted impoundments in South Africa: tracing their origins and exploring field evidence of parasite spillback and amplification. International Journal for Parasitology 54(6):279–301.

Sanders S, Castiglione C, Hoff M. 2023. Risk Assessment Mapping Program: RAMP. Version 5.0. U.S. Fish and Wildlife Service.