Japanese mystery snail (*Cipangopaludina japonica*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, web version – 03/21/2018

Photo: Author unknown. Licensed under Pubic Domain.

1 Native Range and Status in the United States

Native Range

From Kipp et al. (2016):

"*Cipangopaludina japonica* is native to mesotrophic and eutrophic lakes in Japan (Jokinen 1992). Native to Japan, Taiwan, and Korea."

Status in the United States

From Kipp et al. (2016):

"Mid-Atlantic Region: Concord River, Massachusetts.
Great Lakes: Japanese mystery snails was found for the first time in Lake Erie in the 1940s (Mills et al. 1993, Wolfert and Hiltunen 1968). There are also some specimens of this species from Green Bay, Lake Michigan from some time before 1968 (Wolfert and Hiltunen 1968)."

"Established in US. This species is considered established in Lake Erie and reported from Lake Michigan."

From NatureServe (2016):

"This species was recently collected in Wisconsin for the first time at six sites in the Namekagon River in the St. Croix River drainage (Bury et al., 2007). It was recently collected in Indiana for the first time in the northern third of the state in the White, Tippecanoe, and St. Josephs drainages (Pyron et al., 2008)."

From Dillon et al. (2006):

"Although native to southeast Asia, *Bellamya* [*Cipangopaludina*] *japonica* (and the closely-related *B. chinensis*) were first introduced to North America in the late 1890s and have now spread throughout the United States, especially in New England and the Midwest (Cordeiro 2002). Our earliest Pennsylvania record is a 1962 lot in the USNM from Lake Warren, our earliest Virginia record is a 1976 collection from a fish pond in Montgomery County, and our earliest South Carolina record is a 1995 report from Jonesville Reservoir in Union County (Anon. 1995). As of the 2013 version of this website, *Bellamya japonica* is widespread in large hydroelectic impoundments throughout the Carolinas, including High Rock/Tuckertown Reservoir and Lakes Norman, Wylie, Bowen, Greenwood, Marion, Moultrie, and Hartwell. FWGNA incidence rank I-4."

Means of Introductions in the United States

From Kipp et al. (2016):

"Imported to West Coast into Asian food market about 1892. Deliberate release to the Great Lakes where it was intentionally stocked as food for the channel catfish, Ictalurus punctatus in Lake Erie in the 1940s (Mills et al. 1993, Wolfert and Hiltunen 1968)."

From Kipp et al. (2012):

"Mystery snails (*Cipangopaludina* spp.) have been popular aquarium species in the U.S., and their role in the aquarium/ornamental market is often invoked as the primary explanation of these species' widespread dispersal (Cordiero 2002, Havel 2011, Karatayev et al. 2009, Mackie 2000, Mills et al. 1993). *Cipangopaludina* spp. have also had presence in live food markets, particularly in Asian markets of the Western U.S. (Mackie 2000)."

From Dillon et al. (2006):

"An anecdote relayed to me by North Carolina Fish and Game officials in 2005, involving fishermen of Laotian descent harvesting *B. japonica* from High Rock Reservoir by night, suggests that the rapid spread of *Bellamya* through the Carolinas in recent years may have been promoted by artificial "seeding.""

""Water gardening" has, however, become a popular hobby throughout much of the US. The retail stores that have developed to supply hobbyists with pond liners, pumps, goldfish and ornamental lilies also commonly stock "mystery snails" or "trap-door snails" to clarify the water. These are almost always *Bellamya*. So it is also certainly possible that most of the recent introductions in this country are simply excess snails casually dumped by water gardeners."

Remarks

From Kipp et al. (2016):

"Taxonomy of the introduced populations of Oriental mystery snails is confusing and there are many different scientific names in use. There has also been debate regarding whether or not *C. chinensis malleata* and *C. japonica* in North America are synonymous and simply different phenotypes of the same species. This database considers the two as separate species. Smith (2000) argues that *Cipangopaludina* is a subgenus of *Bellamya*; however, because most North American literature does not use the genus *Bellamya* to refer to these introduced snails, oriental mystery snails discussed here are referred to by *Cipangopaludina*."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2016):

"Taxonomic Status:
Current Standing: valid"

"Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Protostomia
Superphylum Lophozoa
Phylum Mollusca
Class Gastropoda
Subclass Prosobranchia
Order Architaenioglossa
Family Viviparidae
Genus *Cipangopaludina*
Species *Cipangopaludina japonica* (von Martens, 1861)"

Size, Weight, and Age Range

From Kipp et al. (2016):

"Size: can reach 50 mm. In Lake Erie, adults range from 30–65 mm high and 22–46 mm wide; females are slightly larger than males when mature (Wolfert and Hiltunen 1968)."

"Females live up to 8 years […]"

Environment

From Kipp et al. (2016):

"Lives in freshwater rivers and lakes."

"It sometimes undergoes mortality events in marshes around Sandusky Bay in hot periods when waters dry up (Wolfert and Hiltunen 1968). In general in North America, the Japanese mystery snail has been found inhabiting waters of pH 6.3–7.3, calcium concentration of 11 ppm, sodium concentration of 16 ppm and conductivity of 62–194 μmhos/cm (Jokinen 1992)."

Climate/Range

From Kipp et al. (2016):

"The Japanese mystery snail in Sandusky Bay, Lake Erie, survives in conditions where surface water temperatures may reach 30ºC, bottom water temperatures can reach 16–24ºC, water is 4 m deep or less, there is high turbidity, the substrate is mud, and aquatic vegetation is sparse (Wolfert and Hiltunen 1968)."

Distribution Outside the United States

Native

From Kipp et al. (2016):

"*Cipangopaludina japonica* is native to mesotrophic and eutrophic lakes in Japan (Jokinen 1992). Native to Japan, Taiwan, and Korea."

Introduced

The only known introductions of *Cipangopaludina japonica* outside of its native range occur in the U.S.

Means of Introduction Outside the United States

The only known introductions of *Cipangopaludina japonica* outside of its native range occur in the U.S.

Short Description

From Kipp et al. (2016):

"The genus *Cipangopaludina* can be identified by its relatively large globose shells and concentrically marked opercula (Burch 1980). *Cipangopaludina japonica* exhibits a shell with 7–8 whorls, a very narrow umbilicus, and a spire that is produced at an angle of 50–55º (Jokinen 1992). Adult shells display fine carinae, while those of juveniles are covered in hairs on the periostracum where the carinae are located as well as around 8 striae/mm between the carinae in the middle of each whorl (Smith 2000). Individuals are light colored as juveniles and dark brown as adults (Wolfert and Hiltunen 1968)."

"The shell of *C. japonica* grows allometrically, the height increasing faster than the width, and does so at an increased rate in comparison with *C. chinensis*, so the adult shell is more elongate than that of the latter species (Jokinen 1982). The radula also may differ between *C. japonica* and *C. chinensis*, but there is so much variation even within one species that it is not a good diagnostic characteristic (Smith 2000). However, in one North American population, *C. japonica* adults had five small cusps on either side of the large central cusp and nine cusps on the marginal tooth (Jokinen 1982)."

Biology

From Kipp et al. (2016):

"In Japan, this species is commonly found in rice paddy fields on soil amongst higher plants (Kurihara and Kadowaki 1988)."

"The Japanese mystery snail is known to feed on detritus and sludge, both of which contain a myriad of different types of bacteria (Kurihara and Kadowaki 1988)."

"This species is viviparous (Wolfert and Hiltunen 1968), giving birth to crawling young. Females live up to 8 years and are able to carry 10–120 young (Jokinen 1992). Young are generally born after water temperature rises to 15ºC or more (Jokinen 1992)."

Human Uses

From Kipp et al. (2012):

"Research in Japanese rice paddies suggested that the feeding activity of *C. japonica*, a common rice paddy dweller and consumer of bacteria, could be used to assimilate excess sewage from wastewater treatments if the sewage were applied as compost (Kurihara and Kadowaki 1988). However, utilizing *C. japonicus* in such a way could pose a danger to consumers of the snail, including humans, due to the potential accumulation of heavy metals and other toxic substances (Kurihara and Kadowaki 1988)."

Diseases

No records of OIE reportable diseases were found.

From Kipp et al. (2016):

"The Japanese mystery snail is a host to *Angiostrongylus cantonensis* larvae in Taiwan, a species associated with eosinophilic meningitis (Lin and Chen 1980). It is also host to many other parasites in Asia, some of which may infect humans."

Threat to Humans

From Kipp et al. (2016):

"The Japanese mystery snail is a host to *Angiostrongylus cantonensis* larvae in Taiwan, a species associated with eosinophilic meningitis (Lin and Chen 1980). It is also host to many other parasites in Asia, some of which may infect humans."

From Kipp et al. (2012):

"The extent of this species' role as a host to parasites in the Great Lakes is unknown."

3 Impacts of Introductions

From Kipp et al. (2016):

"This species has been caught in very large numbers by fishermen in Sandusky Bay, Lake Erie; in fact, two tons have sometimes been caught in one seine haul (Wolfert and Hiltunen 1968). Fishermen in this region often consider it a nuisance (Wolfert and Hiltunen 1968)."

"In the Boston area, the Japanese mystery snail has been found to be a regular host to the common native parasite *Aspidogaster conchicola*, which is a first time record in North America for a gastropod acting as host to this species (Michelson 1970). Negative interactions with native gastropods are also possible."

From Kipp et al. (2012):

"Reports of *C. chinensis* clogging water intakes have emerged, suggesting that closely related *C. japonica* may also be capable of damaging infrastructure, particularly given the high densities which have been encountered by fishermen in the past (Wolfert and Hiltunen 1968)."

4 Global Distribution

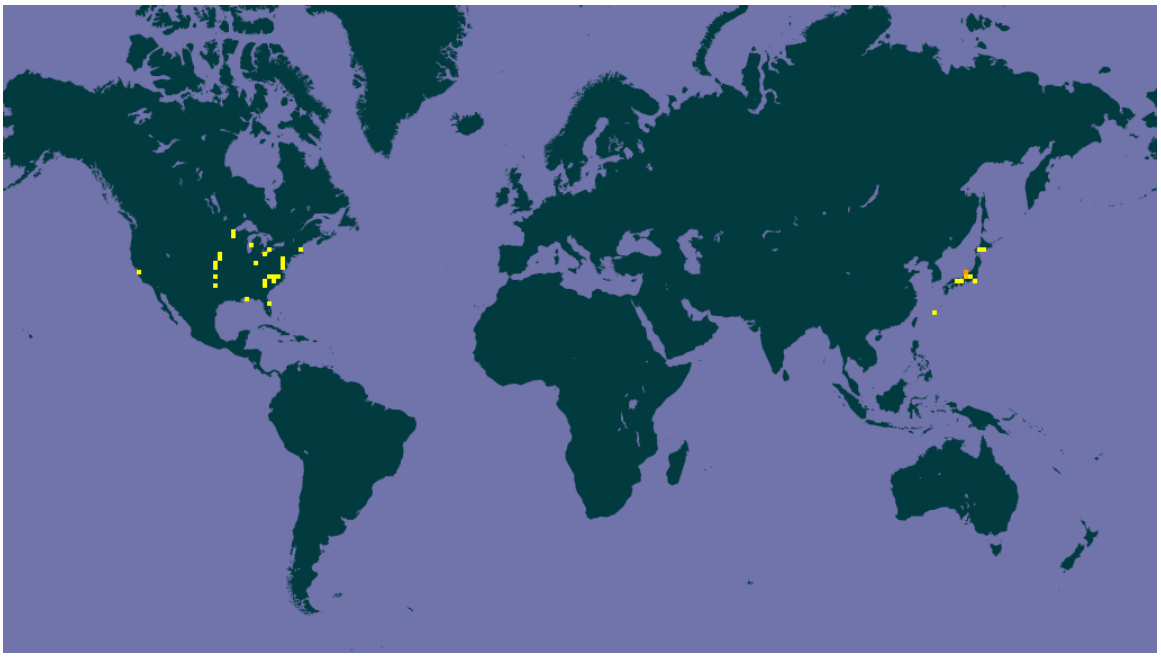

Figure 1. Known global distribution of *Cipangopaludina japonica*. Map from GBIF Secretariat (2016).

5 Distribution Within the United States

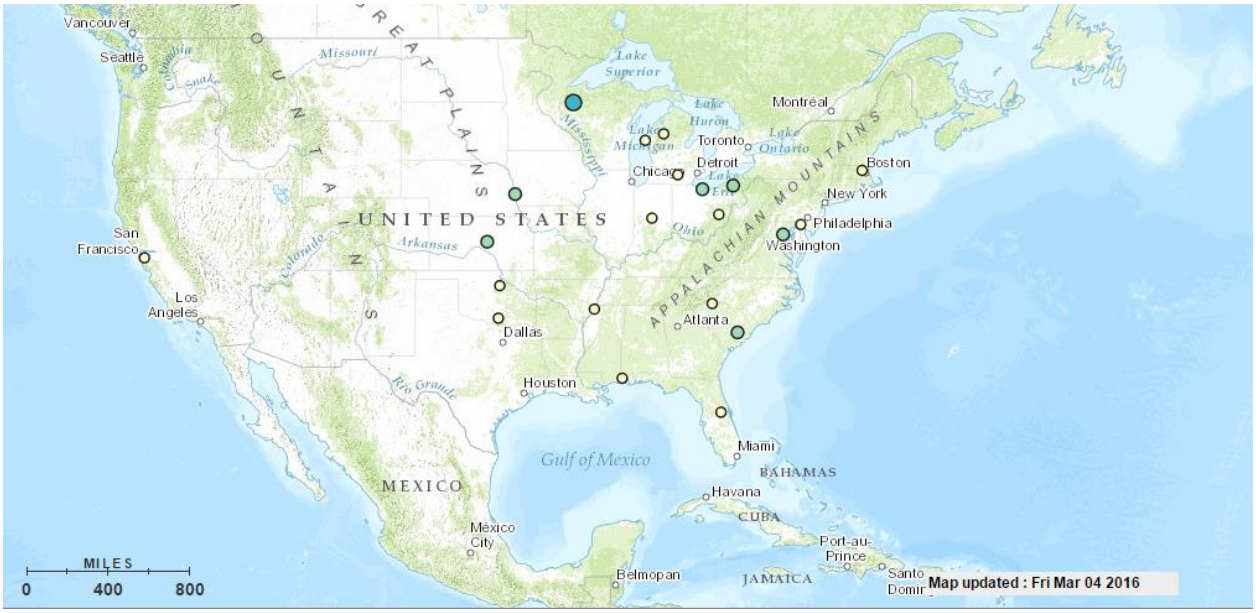

Figure 2. Distribution of *Cipangopaludina japonica* in the United States. Map from Kipp et al. (2016).

A map of counties in Mid-Atlantic States with known reports of *Cipangopaludina japonica* is available in Dillon et al. (2006).

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Cipangopaludina japonica* was high for the eastern half of the country and parts of California. It was low in parts of the Pacific Northwest and western Great Plains. It was medium everywhere else. The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous U.S. was 0.690, high. The following states had individually high climate scores: Alabama, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, Washington D.C., West Virginia, Wisconsin, and Wyoming.

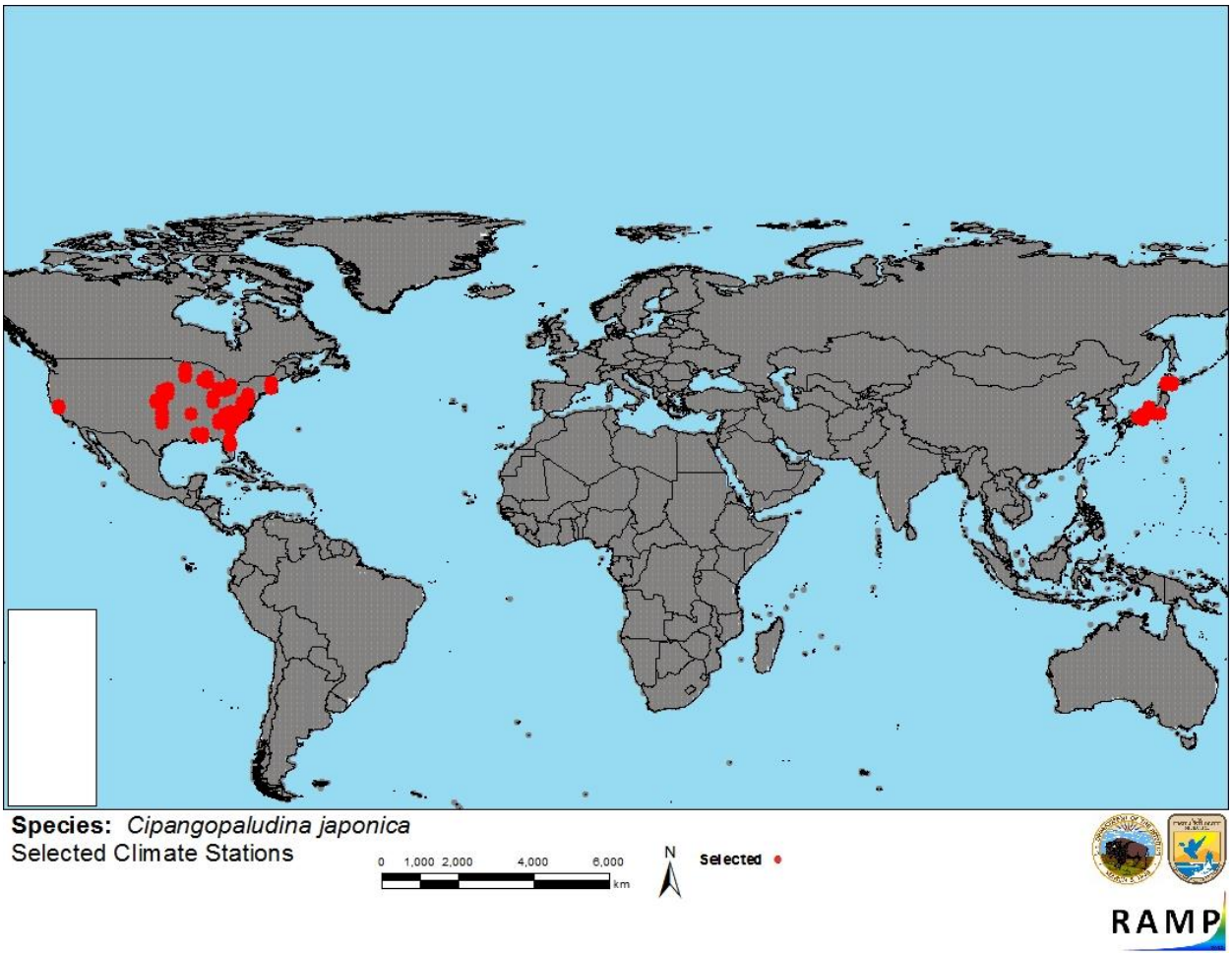

Figure 3. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (grey) for *Cipangopaludina japonica* climate matching. Source locations from Dillon et al. (2006), GBIF Secretariat (2016), and Kipp et al. (2016).

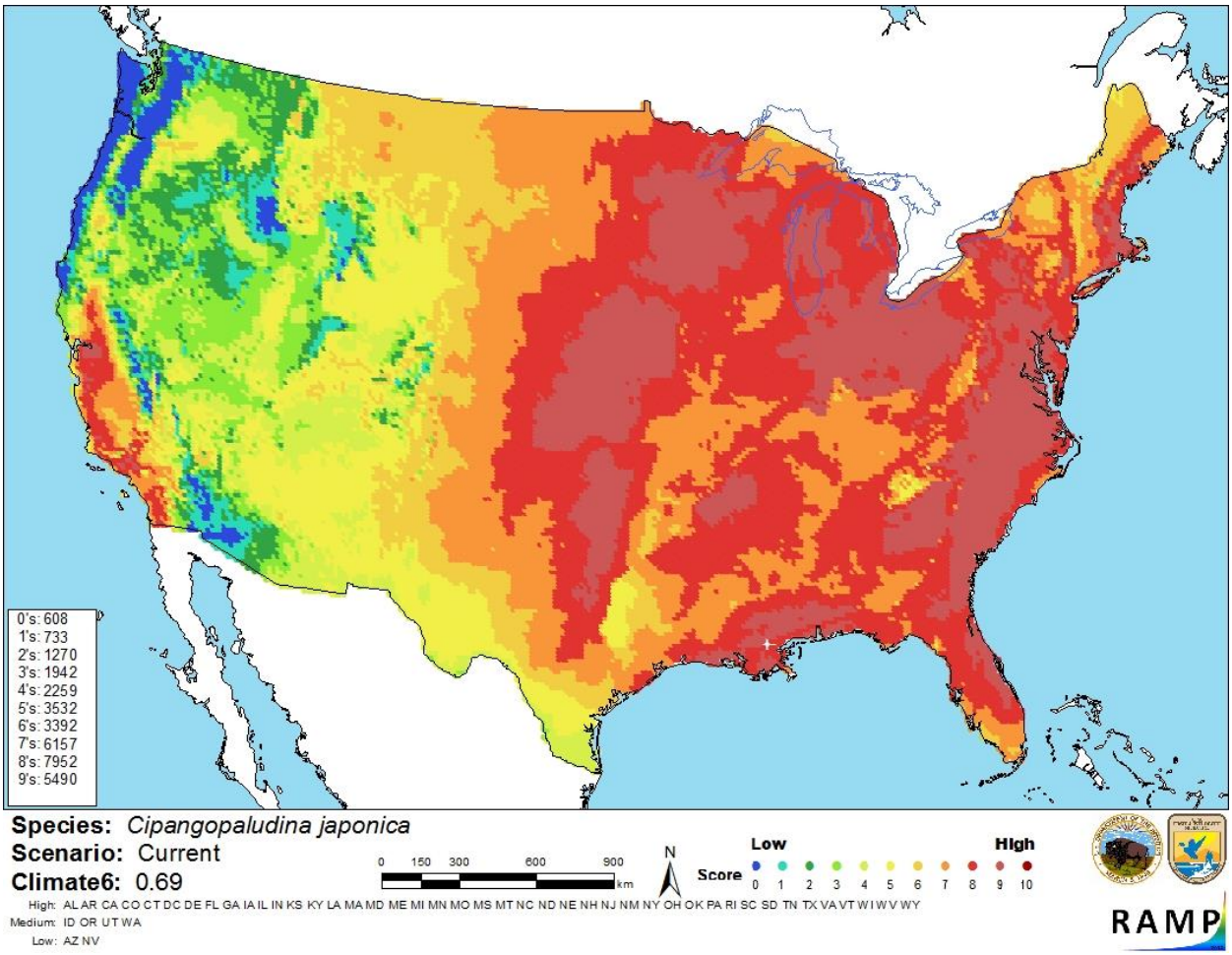

Figure 5. Map of RAMP (Sanders et al. 2014) climate matches for *Cipangopaludina japonica* in the contiguous United States based on source locations reported by Dillon et al. (2006), GBIF Secretariat (2016), and Kipp et al. (2016). 0 = Lowest match, 10 = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: Proportion of (Sum of Climate Scores 6-10) / (Sum of total Climate Scores)	Climate Match Category
$0.000 \leq X \leq 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

7 Certainty of Assessment

The certainty of assessment is medium. There is more than adequate information available about the biology and ecology of *Cipangopaludina japonica*. The history of invasiveness of this species is uncertain because there are not any documented impacts of invasion from reputable sources.

8 Risk Assessment

Summary of Risk to the Contiguous United States

The history of invasiveness of *Cipangopaludina japonica* is not documented. There are no well documented impacts of *C. japonica*, however, it is widespread in the United States. The climate match is high. This is not unexpected as this species is already present in many of the areas with the highest climate matches. The certainty of assessment is medium. The overall risk assessment category is uncertain. There is a likelihood that this species could spread further within the United States.

Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): Medium**
- **Remarks/Important additional information** No additional remarks.
- **Overall Risk Assessment Category: Uncertain**

9 References

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

Dillon, R. T., Jr., B. T. Watson, T. W. Stewart, and W. K. Reeves. 2006. The freshwater gastropods of North America. Available: http://www.fwgna.org/species/viviparidae/b_japonica.html. (March 2016).

GBIF Secretariat. 2016. GBIF backbone taxonomy: *Cipangopaludina japonica* (Martens, 1861). Global Biodiversity Information Facility, Copenhagen. Available: http://www.gbif.org/species/2292566. (March 2016).

ITIS (Integrated Taxonomic Information System). 2016. *Cipangopaludina japonica* (von Martens, 1861). Integrated Taxonomic Information System, Reston, Virginia. Available: http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=70332. (March 2016).

Kipp, R. M., A. J. Benson, J. Larson, and A. Fusaro. 2012. *Cipangopaludina japonica*. U.S. Geological Survey, Nonindigenous Aquatic Species Database, Gainesville, Florida, and NOAA Great Lakes Aquatic Nonindigenous Species Information System, Ann Arbor, Michigan. Available: https://nas.er.usgs.gov/queries/greatlakes/FactSheet.aspx?SpeciesID=1046&Potential=N&Type=0&HUCNumber=DGreatLakes. (March 2016).

Kipp, R. M., A. J. Benson, J. Larson, and A. Fusaro. 2016. *Cipangopaludina japonica* (von Martens, 1861). U.S. Geological Survey, Nonindigenous Aquatic Species Database, Gainesville, Florida. Available: http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=1046. (March 2016)

NatureServe. 2016. NatureServe Explorer: an online encyclopedia of life, version 7.1. NatureServe, Arlington, Virginia. Available: http://explorer.natureserve.org. (March 2016).

Sanders, S., C. Castiglione, and M. Hoff. 2014. Risk assessment mapping program: RAMP. U.S. Fish and Wildlife Service.

10 References Quoted But Not Accessed

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.

Anon. 1995. Exotic aquatics show up in South Carolina. South Carolina Wildlife, July-August.

Burch, J. B. 1980. A guide to the fresh water snails of the Philippines. Malacological Review 13(1-2):121–144.

Bury, J. A., B. E. Sietman, and B. N. Karns. 2007. Distribution of the non-native viviparid snails, *Bellamya chinensis* and V*iviparus georgianus*, in Minnesota and the first record of *Bellamya japonica* from Wisconsin. Journal of Freshwater Ecology 22(4):697–703.

Cordeiro, J. R. 2002. Proliferation of the Chinese mystery snail, *Cipangopaludina chinensis malleata* (Reeve, 1863) throughout Connecticut. *In* R. T. Dillon, editor. Program and Abstracts of the 68th Meeting of the American Malacological Society, Charleston, South Carolina.

Havel, J. E. 2011. Survival of the exotic Chinese mystery snail (*Cipangopaludina chinensis malleata*) during air exposure and implications for overland dispersal by boats. Hydrobiologia.

Jokinen, E. H. 1982. *Cipangopaludina chinensis* (Gastropoda: Viviparidae) in North America, review and update. Nautilus 96(3):89–95.

Jokinen, E. H 1992. The freshwater snails (Mollusca: Gastropoda) of New York State. The University of the State of New York, The State Education Department, The New York State Museum, Albany.

Karatayev, A. Y., L. E. Burlakova, V. A. Karatayev, and D. K. Padilla. 2009. Introduction, distribution, spread, and impacts of exotic freshwater gastropods in Texas. Hydrobiologia 619:181–194.

Kurihara, Y., and K. I. Kadowaki. 1988. Effect of different ecological conditions on the mud snail *Cipangopaludina japonica* in submerged paddy soil. Biology and Fertility of Soils 6(4):292–297.

Lin, C. Y., and S. N. Chen. 1980. Epidemiologic studies of angiostrongyliasis in north Taiwan. Medical Journal of Osaka University 31(1-2):7–12.

Mackie, G. L. 2000. Introduction of molluscs through the import for live food. Pages 305–313 *in* R. Claudi, and J. H. Leach, editors. Nonindigenous freshwater organisms: vectors, biology and impacts. CRC Press, Boca Raton, Florida.

Michelson, E. H. 1970. *Aspidogaster conchicola* from fresh water gastropods in the USA. Journal of Parasitology 56(4):709–712.

Mills, E. L., J. H. Leach, J. T. Carlton, and C. L. Secor. 1993. Exotic species in the Great Lakes: a history of biotic crises and anthropogenic introductions. Journal of Great Lakes Research 19(1):1–54.

Pyron, M., J. Beaugly, E. Martin, and M. Spielman. 2008. Conservation of the freshwater gastropods of Indiana: historic and current distributions. American Malacological Bulletin 26:137–151.

Smith, D. G. 2000. Notes on the taxonomy of introduced *Bellamya* (Gastropoda: Viviparidae) species in northeastern North America. Nautilus 114(2):31–37.

Wolfert, D. R., and J. K. Hiltunen. 1968. Distribution and abundance of the Japanese snail *Viviparus japonicus*, and associated macrobenthos in Sandusky Bay, Ohio. Ohio Journal of Science 68(1):32–40.