Spike-topped Applesnail (*Pomacea diffusa*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2023
Revised, February 2023
Web Version, 4/2/2025

Organism Type: Mollusk
Overall Risk Assessment Category: Uncertain

Photo: H. Zell. Licensed under Creative Commons Attribution-Share Alike 3.0 Unported license. Available: https://nas.er.usgs.gov/queries/factsheet.aspx?SpeciesID=2662 (February 2023).

1 Native Range and Status in the United States

Native Range

From Benson (2025):

"Tropical and subtropical South America. The type locality is a lagoon in the city Santa Cruz, Bolivia; it is also native to Peru and the Amazon system of Brazil (Blume 1957)."

Status in the United States

From Benson (2025):

"*Pomacea diffusa* is established in Florida (Thompson 1984) and Hawaii (Cowie et al. 2017). It may also be established in Mobile, Alabama (Howells et al. 2006). In Puerto Rico, an applesnail identified as *Pomacea bridgesii* was collected as early as 1965. However, with the change of identification of introduced specimens collected globally (Cowie et al. 2017), it is most likely *P. diffusa* on the island."

Benson (2025) lists additional observations of *Pomacea diffusa* in Georgia and Illinois; establishment status for either observation was not reported.

From Fasulo (2021):

"*Pomacea diffusa* Blume, 1957, the spike-topped applesnail, […] was introduced into southern Florida, probably in the 1950s. This species has a lower tolerance for cold water than the Florida applesnail and is established in Broward, Miami-Dade, Monroe and Palm Beach counties. It is also present in parts of central and north-central Florida. Collections have been made in Alabama and Mississippi. (FFWCC 2006, USGS [2009])."

From Cowie and Hayes (2012):

"[…] and was reported in the wild in Hawaii (Cowie, 1995) but has declined and was not recorded in more recent surveys (Cowie et al, 2007)."

There is evidence of *Pomacea diffusa* being sold through online aquarium vendors (e.g., YourFishStore 2023).

From Cowie and Hayes (2012):

"It [*Pomacea diffusa*] is grown commercially on a large scale in Florida (Perera and Walls, 1996). The market has expanded since the discovery and development of bright yellow, orange and other colour variants of *P. diffusa* and to some degree other *Pomacea* species (Perera and Walls, 1996)."

Regulations

From Liu et al. (2017):

"[…] unlike its congeners, such as *P. canaliculata* and *P. maculata, P. diffusa* is the only Ampullariidae species permitted to be transported between states by the United States Department of Agriculture (Gaston 2006; Rawlings et al. 2007)."

Pomacea diffusa is regulated at the genus level (*Pomacea*) in Arizona (Arizona Game and Fish Commission 2022), Hawaii (HDOA 2019), Mississippi (MDAC 2022), Nevada (Nevada Board of Wildlife Commissioners 2022), North Carolina (North Carolina DEQ 2022), and Texas (TPWD 2022). Please refer back to state agency regulatory documents for details on the

regulations, including restrictions on activities involving this species. While effort was made to find all applicable regulations, this list may not be comprehensive. Notably, it does not include regulations that do not explicitly name this species or its genus or family, for example, when omitted from a list of authorized species with blanket regulation for all unnamed species.

Means of Introductions within the United States

From Benson (2025):

"Howells et al. (2006) summarized possible justifications for the existence of wild applesnail populations which include human food, aquarium and watergarden [sic] pets, research animals, weed control, and as hitchhikers on ornamental nursery plants. Applesnails have been in the pet trade for decades (Howells 2002). *Pomacea diffusa* has been found for sale in the aquarium pet trade in Florida (Morrison and Hay 2011) […]"

From Fasulo (2021):

"It [*P. diffusa*] is marketed as an aquarium species under the name 'golden applesnail.' However, commercial varieties have been bred for the aquarium trade, including the 'albino mystery snail.' These aquarium snails are sometimes dumped into isolated bodies of water and have been recovered as far north as Alachua County, Florida (Thompson 1984)."

Remarks

This ERSS was previously published in December 2017. Revisions were completed to incorporate new information and conform to updated standards.

From Benson (2025):

"Once considered as a subspecies, *P. bridgesii diffusa* (Blume 1957), it was elevated to a full species through genetic analysis (Hayes et al. 2008)."

From Darrigran et al. (2023):

"[…] concerning the identification and geographical range of both species we highlight that *P. bridgesii* is restricted to Bolivia and the western Amazon basin, whereas *Pomacea diffusa* Blume, 1957 is widely distributed through much of the Amazon basin and it is the one in the aquarium trade that is found around the world now (Cowie et al. 2017)."

From Ahmed et al. (2020):

"It should be noted that all records of *P. bridgesii* from India, and indeed the world, as an introduced species, likely refer to *P. diffusa*, which was originally considered a subspecies of *P. bridgesii*, but has since been elevated to species. Additionally, *P. diffusa* has a much wider distribution, through much of the Amazon basin, as compared to *P. bridgesii*, which is restricted in range to Bolivia, and the western Amazon basin."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From MolluscaBase (2025):

"Animalia (Kingdom) > Mollusca (Phylum) > Gastropoda (Class) > Caenogastropoda (Subclass) > Architaenioglossa (Order) > Ampullarioidea (Superfamily) > Ampullariidae (Family) > Pomaceinae (Subfamily) > *Pomacea* (Genus) > *Pomacea diffusa* (Species)"

According to MolluscaBase (2025), *Pomacea diffusa* Blume, 1957 is the current valid name for this species.

Size, Weight, and Age Range

From Benson et al. (2025):

"**Size:** Up to 60 mm height (Thompson 1984); generally 42 mm height, 33 mm width (Blume 1957); average 38 mm height (Pain 1960)."

"The life span is several years."

Environment

From Benson (2025):

"Freshwater rivers, streams, ponds, and wetlands."

From Perera and Epa (2008):

"Water temperature, pH, dissolved oxygen (DO), conductivity, biological oxygen demand (BOD;), total suspended solids (TSS), soil organic matter (SOM), and water level of theri [*sic*] environment ranged from 26.8 °C – 32.8 °C, 6.3 - 7.3 [pH], 1.1 - 1.8 mg/1 [DO], 280.0 - 516.6 µS/cm [conductivity], 0.5 - 1.0 mg/1 [BOD], 0.03 - 0.07 mg/1 [TSS], 5.9 - 14.1% [SOM] and 29.4 cm - 46.8 cm [water level], respectively in the snail habitats."

Climate

From Fasulo (2021):

"This species has a lower tolerance for cold water than the Florida applesnail [*Pomacea paludosa*] […]"

From Benson (2025):

"Tropical and subtropical […]"

Distribution Outside the United States

Native

From Benson (2025):

"Tropical and subtropical South America. The type locality is a lagoon in the city Santa Cruz, Bolivia; it is also native to Peru and the Amazon system of Brazil (Blume 1957)."

Introduced

Cowie and Hayes (2012) lists *Pomacea diffusa* as introduced in Australia, Brazil (States of Rio de Janeiro, Pará, and Pernambuco), Colombia, French Guiana, New Zealand, Panama, Sri Lanka, and Venezuela.

From Mohammed (2014):

"These exotics [in Trinidad and Tobago] include a wide range of taxa such as the […]; the apple snail, *Pomacea diffusa*, in Trinidad (Mohammed and Rutherford 2012) and in Tobago (Rutherford and Mohammed 2013); […]"

"Several monitoring events over the last five years throughout Tobago's drainages revealed three aquatic invasive species to be established at one site in southwestern Tobago [including] *Pomacea diffusa* […]"

From Collier et al. (2011):

"We report the discovery of a single specimen of a live apple snail *Pomacea diffusa* Blume 1957 (Ampullariidae: Prosobranchia), from the Waikato River, Hamilton city, central North Island, New Zealand."

From Ahmed et al. (2020):

"Amongst the non-native apple snails, only a single species, *Pomacea diffusa* Blume, 1957, has been recorded from the country [India] thus far, from the states of Odisha and West Bengal in Eastern India, and Maharashtra in Western India."

"The present report of a feral population from the city of Mumbai, in the Mumbai suburban district, is the first record of the species from the Mumbai region."

Appleton and Miranda (2015) report *Pomacea diffusa* as introduced but not invasive in South Africa and that it was originally reported as *P. bridgesi*.

Darrigran et al. (2023) list *Pomacea diffusa* as introduced in Ecuador near the Huapuno River, Pastaza.

Means of Introduction Outside the United States

From Benson (2025):

"Applesnails have been in the pet trade for decades (Howells 2002). *Pomacea diffusa* has been found for sale in the aquarium pet trade […] as well as in Singapore, a major source of exports around the world (Ng et al. 2016)."

From Mohammed (2014):

"These exotics include a wide range of taxa such as the […]; the apple snail, *Pomacea diffusa*, in Trinidad (Mohammed and Rutherford 2012) and in Tobago (Rutherford and Mohammed 2013); […]. The invasive snails arrived via the aquatic ornamental pet trade, presumably with aquatic plants and, as in the case of *Pomacea diffusa*, as intentional purchases as pets (pers. obs.)."

From Perera and Epa (2008):

"Golden apple snail, *Pomacea diffusa* has been introduced to Sri Lanka by ornamental fish industry in 1980s. They became popular among ornamental fish hobbyists due to their varying colors, mainly the brownish red, brown and bright golden yellow and their scavenging feeding habit. However, later they became a burden to the aquarists when they were overpopulated and the ultimate result was to release them into natural environment."

Short Description

From Benson (2025):

"A large globose conic shape, 6 whorls, shell color varies from yellowish to dark olive-brown color, radial stripes, more pronounced spire than other *Pomacea* species (Blume 1957; Pain 1960). Egg color of applesnails are often used to help identify the species. For *P. diffusa*, they are a tan to salmon color (Rawlings et al 2007)."

Biology

From Benson (2025):

"In general, applesnails feed primarily on plants. In addition, it has been shown that *P. diffusa* readily feed on carcasses of dead aquatic animals (Aditya and Raut 2001). All snails in the genus *Pomacea* possess both lungs and gills and the sexes are separate (Mackie and Claudi 2010). The female lays a clutch of 200-600 eggs (each egg 3 mm in diameter) above the water surface on emergent plants or other hard substrate such as rock or concrete (Mackie and Claudi 2010). The eggs hatch and the young snails fall into the water."

From Ahmed et al. (2020):

"*P. diffusa* largely feeds on decaying organic matter, and algae, ignoring living plant tissue, and is therefore not considered a threat to aquatic plants, or cultivated crops such as rice (Morrison 2010; Wong et al. 2010, in Collier et. al 2011) […]"

Human Uses

From Benson (2025):

"Applesnails have been in the pet trade for decades (Howells 2002). *Pomacea diffusa* has been found for sale in the aquarium pet trade in Florida (Morrison and Hay 2011) as well as in Singapore, a major source of exports around the world (Ng et al. 2016)."

From Cowie and Hayes (2012):

"*Pomacea diffusa* has also been sold for food in Belgium, as 'sea snails' (Thiengo, S. C., pers. comm.)."

From Collier et al. (2011):

"*P. diffusa* is widely available in New Zealand pet stores, specialist aquarium stores and via the internet."

Diseases

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

From Damborenea et al. (2017):

"In Brasil, Dias et al. (2006, 2008, 2010) studied the ciliates adhering to the shell surface of two species of *Pomacea* and Gorni & Alves (2006) studied the oligochaetes inhabiting the umbilicus of *Pomacea bridgesii* (probably correctly identified as *P. diffusa*; R.H. Cowie, pers. comm.). Four species of leeches in the family Glossiphoniidae have been recorded in the umbilicus of *P. canaliculata* and occasionally in the mantle cavity (Damborenea & Gullo, 1996), and in the mantle cavity, foot and on the shell of *P. diffusa* (De-Carli et al., 2014)."

Threat to Humans

No information was found on threats to humans from *Pomacea diffusa*.

3 Impacts of Introductions

Information regarding documented impacts of *Pomacea diffusa* introductions was not found. The information below covers potential impacts or laboratory investigations of potential impact mechanisms.

From Benson (2025):

"The impacts of some species of applesnails, such as *P. canaliculata*, as an agricultural pest are well known (Joshi et al 2017). However, in a study by Howells (2002) he found *P. diffusa* (known as *P. bridgesii* at the time of his study) rejected rice sprouts and preferred periphyton-

covered rocks. He concluded that wild populations of *P. diffusa* may not be a significant threat to macrophytes and crops in the United States. In a laboratory study by Morrison and Hay (2011), they found *P. diffusa* avoided most plants offered to them preferring animal tissue instead. Therefore, although the impact on plants may be minimal. However, *P. diffusa* could have other impacts by competing with other organisms for their preferred foods."

From Collier et al. (2011):

"[…] in the United States *P. diffusa* is generally regarded as innocuous (Rawlings *et al*. 2007). Because it feeds mostly on decaying vegetation or algae, *P. diffusa* is not considered an agricultural pest or a problem for macrophytes like *P. canaliculata* or *P. insularum* which can feed voraciously on live plant material high in nitrogen (Morrison 2010; Wong *et al*. 2010). However, potential direct and indirect effects on natural habitats are unclear, and *P. diffus*a may compete for food with native scavengers such as crayfish, shrimps and some fish species (Rawlings *et al*. 2007). In addition, laboratory trials indicate feeding on eggs of other freshwater snails (Aditya & Raut 2002), suggesting potential for an impact on native biodiversity."

The importation, possession, or trade of *Pomacea diffusa* is regulated by the following U.S. states (see section 1): Arizona (Arizona Game and Fish Commission 2022), Hawaii (HDOA 2019), Mississippi (MDAC 2022), Nevada (Nevada Board of Wildlife Commissioners 2022), North Carolina (North Carolina DEQ 2022), and Texas (TPWD 2022).

4 History of Invasiveness

The History of Invasiveness for *Pomacea diffusa* is classified as Data Deficient. There are records of introduction and established nonnative populations. However, the full understanding of the species' nonnative distribution may be limited due the history of being considered a subspecies of *P. bridgesii* and having most introductions recorded under that name. The information available on this species' impact on native species and habitat describes potential impacts and not documented impacts.

5 Global Distribution

Figure 1. Reported global distribution of *Pomacea diffusa*. Map from GBIF Secretariat (2022). Observations are reported from the United States, Mexico, Trinidad and Tobago, Brazil, South Africa, Hong Kong, Taiwan, Sri Lanka, and Australia. Reported locations in Mexico, Taiwan, Hong Kong, and United States (North Carolina) do not represent established populations of *P. diffusa* and were therefore excluded from the climate matching analysis. There was no additional literature to support these occurrences as representing established populations.

No georeferenced observations were found for portions of the reported native range of *Pomacea diffusa* in Bolivia and Peru, or for portions of the reported introduced range in Colombia and Venezuela.

Ahmed et al. (2020) report *P. diffusa* from several localities throughout India. These observations were used in the climate matching analysis.

Figure 2. Additional known distribution of *Pomacea diffusa* in India. Blue, red, and green dots indicate known observations of *P. diffusa* in India. The green dot represents a captive population and was not used in the climate matching analysis. Map from Ahmed et al. (2020), licensed under CC-BY-NC-ND.

6 Distribution Within the United States

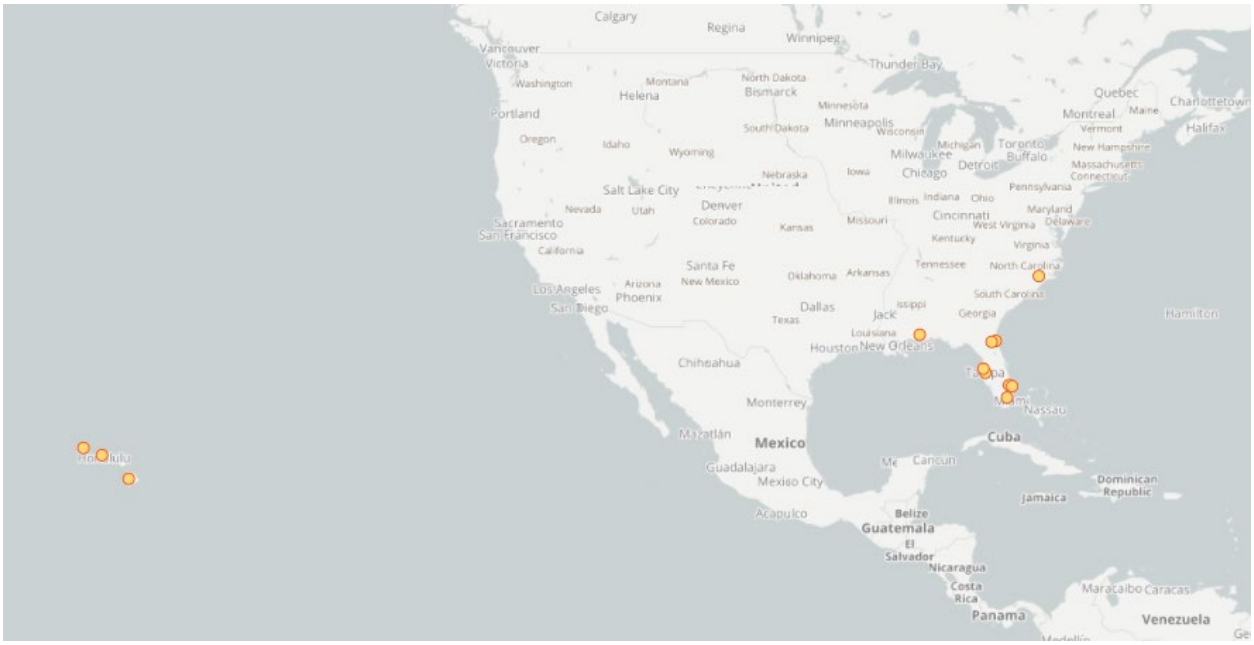

Figure 3. Reported distribution of *Pomacea diffusa* in the United States. Map from GBIF-US (2023). Observations are reported from Alabama, Florida, North Carolina, and Hawaii. Reported location in North Carolina does not represent an established population and therefore was excluded from the climate matching analysis.

7 Climate Matching

Summary of Climate Matching Analysis

The climate matching analysis for *Pomacea diffusa* to the contiguous United States found areas of high match in the southern United States along the Gulf and Southern Atlantic coasts. Most of Florida also had a high match. The Southwest and areas of the Appalachian and Mid-Atlantic regions also had a high climate match. Much of the Northeast, Northern Plains, and areas to the west had low matches. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.323, 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 *Pomacea diffusa* (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.

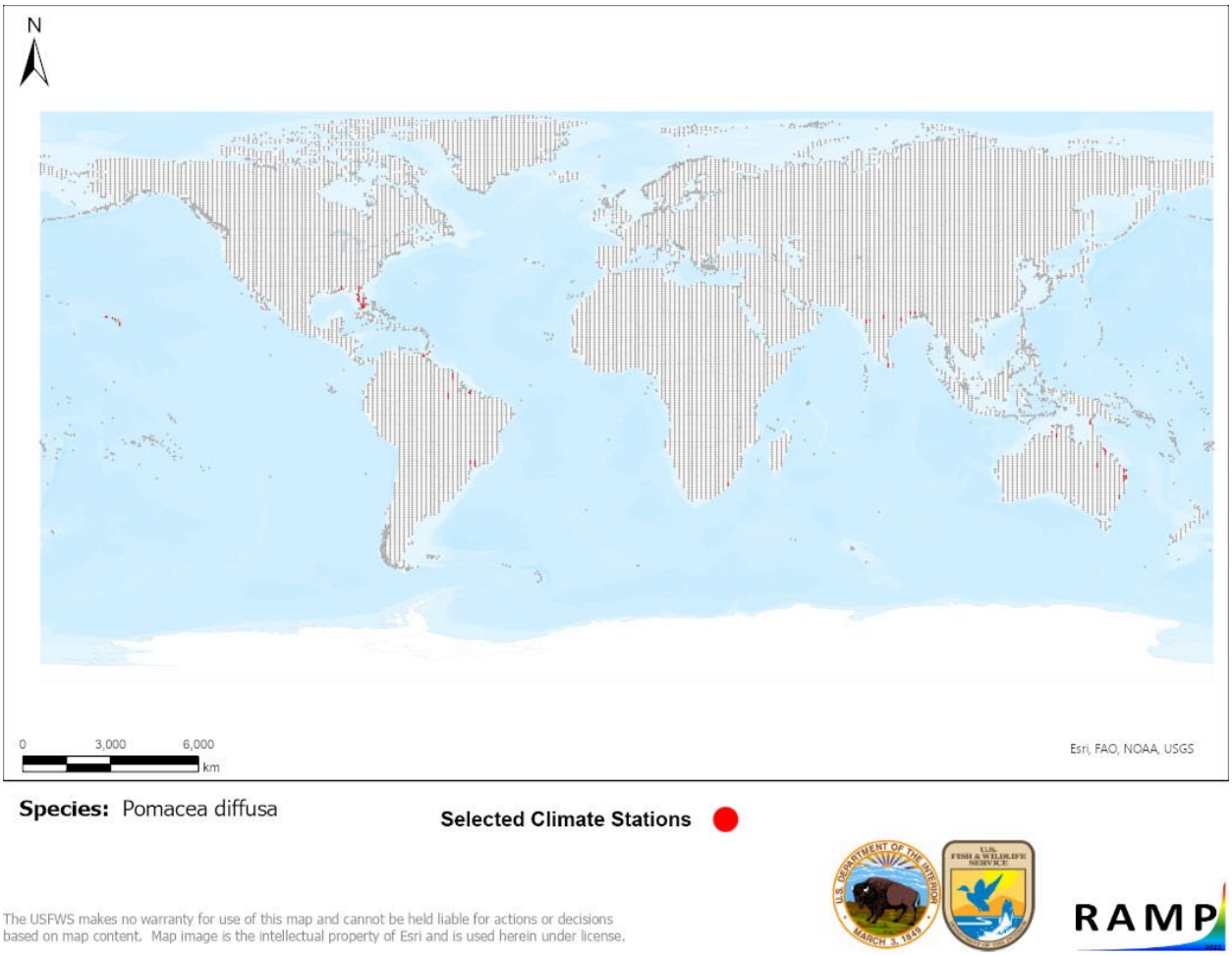

Figure 4. RAMP (Sanders et al. 2023) source map showing weather stations in the Americas, Africa, Asia, and Australia selected as source locations (red; United States, Trinidad and Tobago, Brazil, South Africa, Sri Lanka, India, and Australia and non-source locations (gray) for *Pomacea diffusa* climate matching. Source locations from GBIF Secretariat (2022) and Ahmed et al. (2020). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

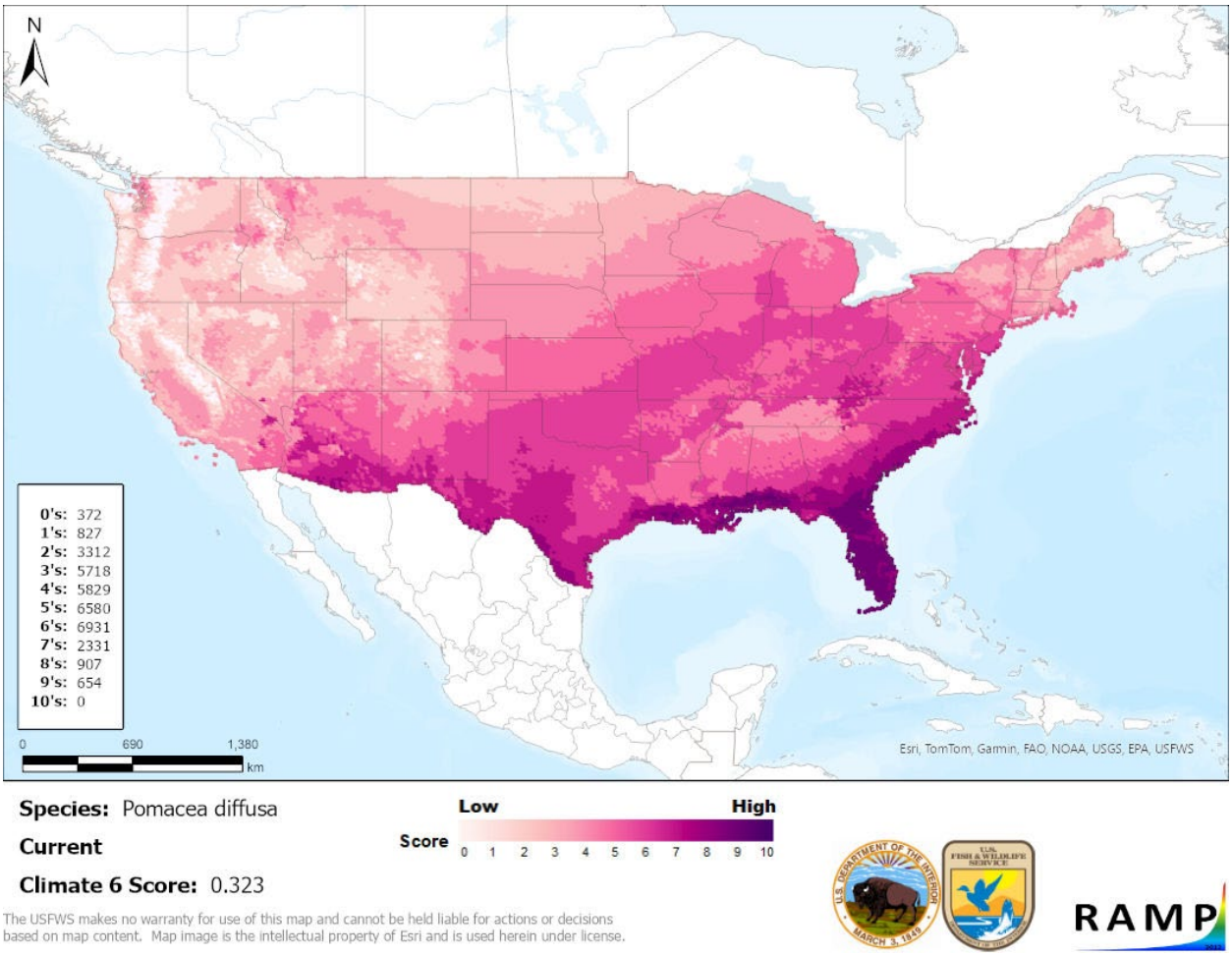

Figure 5. Map of RAMP (Sanders et al. 2023) climate matches for *Pomacea diffusa* in the contiguous United States based on source locations reported by GBIF Secretariat (2022) and Ahmed et al. (2020). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The full understanding of the introduced distribution of *Pomacea diffusa* is uncertain due to the elevation of *P. diffusa* to full species status from its former status as a subspecies of *P. bridgesii*. This taxonomic reorganization also affects information regarding impact of introductions and trade history. Therefore, the Certainty of Assessment for *Pomacea diffusa* is classified as Low.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Pomacea diffusa, Spike-topped Applesnail, is a mollusk that is native to tropical and subtropical South America. *P. diffusa* is found in freshwater rivers, streams, ponds, and wetlands. It has a low tolerance to colder water but can live for several years under appropriate conditions. These applesnails are sold as both aquarium pets globally and as a food source in several countries. *P. diffusa* is often misidentified and sold in the aquarium market under the name *P. bridgesii* due

to the historic taxonomic relationship between the species. *Pomacea diffusa* is regulated in six U.S. states. It has been introduced and established populations in the United States, Africa, Asia, and Australia. Mechanisms for potential impacts from introductions have been investigated in the laboratory but no information on documented impacts was found. The History of Invasiveness for *Pomacea diffusa* is classified as Data Deficient. The climate matching analysis for the contiguous United States indicates establishment concern. Areas of high match were found in the southern United States, primarily along the Gulf and Southern Atlantic Coasts. More northern areas and much of the west had low climate matches. The Certainty of Assessment for this ERSS is classified as Low due to the taxonomic history of *P. diffusa* being considered a subspecies of *P. bridgesii* and much of the historic information being reported under that name. The Overall Risk Assessment Category for *Pomacea diffusa* 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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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 (2022) and Ahmed et al. (2020).

Under the future climate scenarios (figure A1), on average, high climate match for *Pomacea diffusa* was projected to occur in the Southern Atlantic Coast and Southern Florida regions of the contiguous United States. Areas of low climate match were projected to occur in the Great Basin, Northern Pacific Coast, and Western Mountain regions. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.257 (model: MPI-ESM1-2-HR, SSP5, 2085) to a high of 0.459 (model: MRI-ESM2-0, SSP5, 2085). 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 (0.323, figure 5) falls within 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 Appalachian Range, Colorado Plateau, Great Basin, Great Lakes, Mid-Atlantic, Northeast, Northern Pacific Coast, Northern Plains, 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, Gulf Coast, Southeast, Southern Atlantic Coast, Southern Florida, and Southwest saw a moderate decrease in the climate match relative to current conditions. No large decreases were observed regardless of time step and climate scenarios. Additional, very small areas of large or moderate change may be visible on the maps (figure A3).

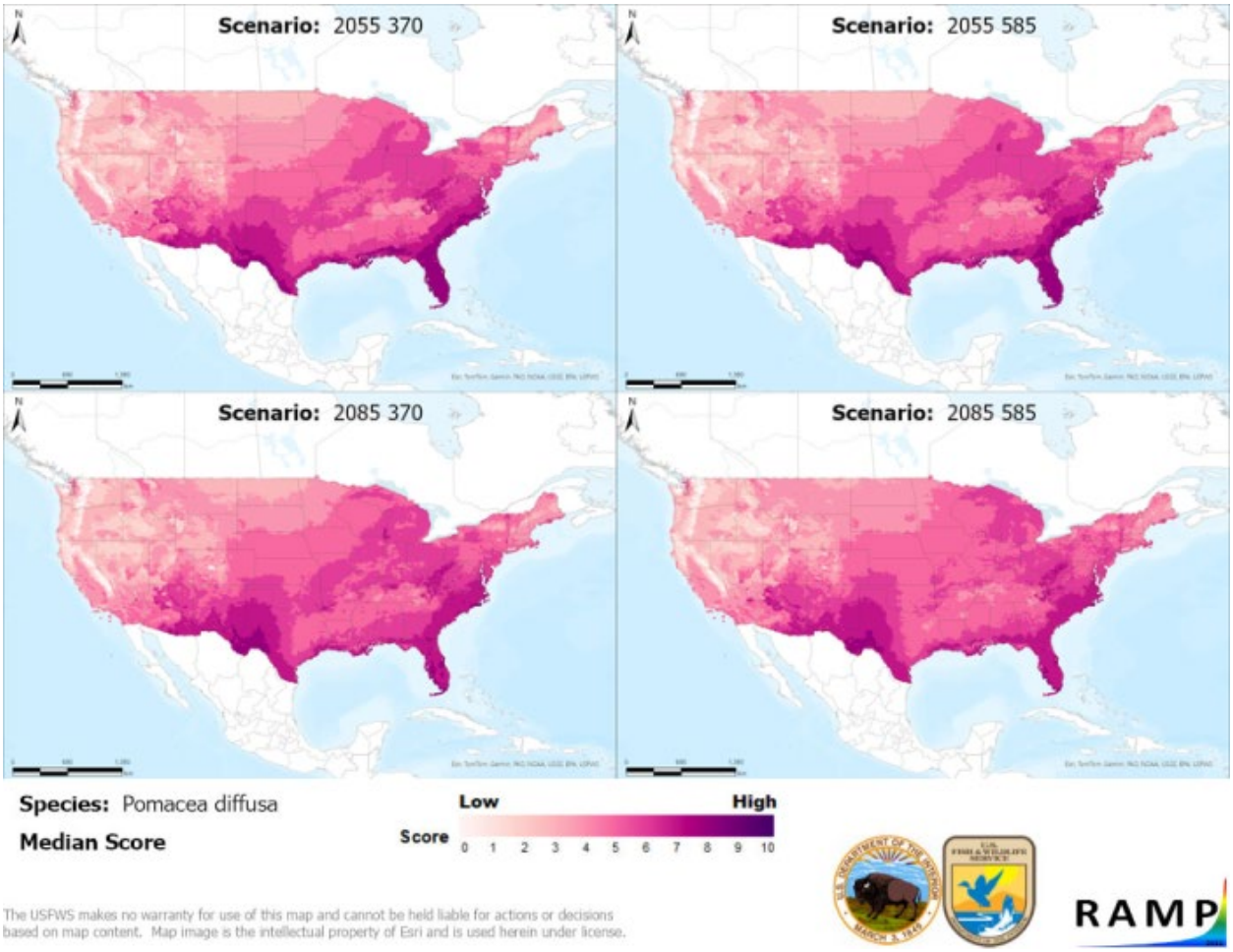

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Pomacea diffusa* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2022) and Ahmed et al. (2020). 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.

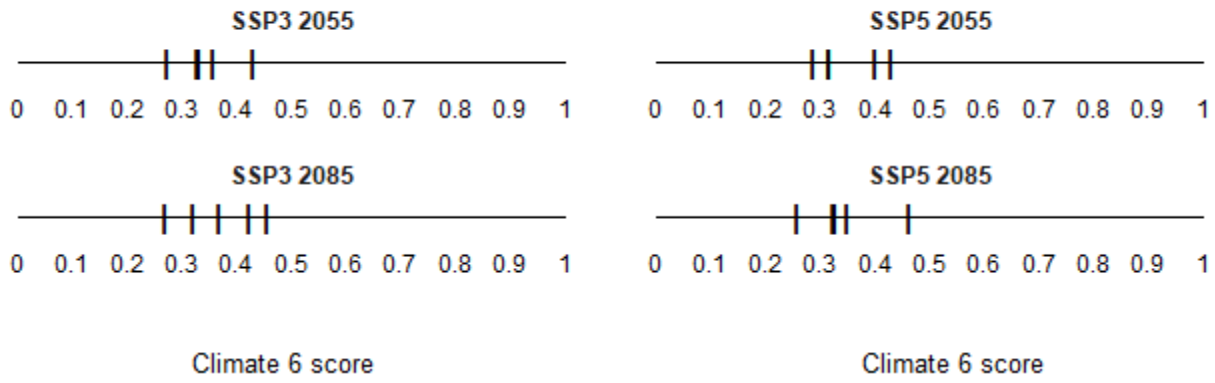

Figure A2. Comparison of projected future Climate 6 scores for *Pomacea diffusa* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; IPCC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

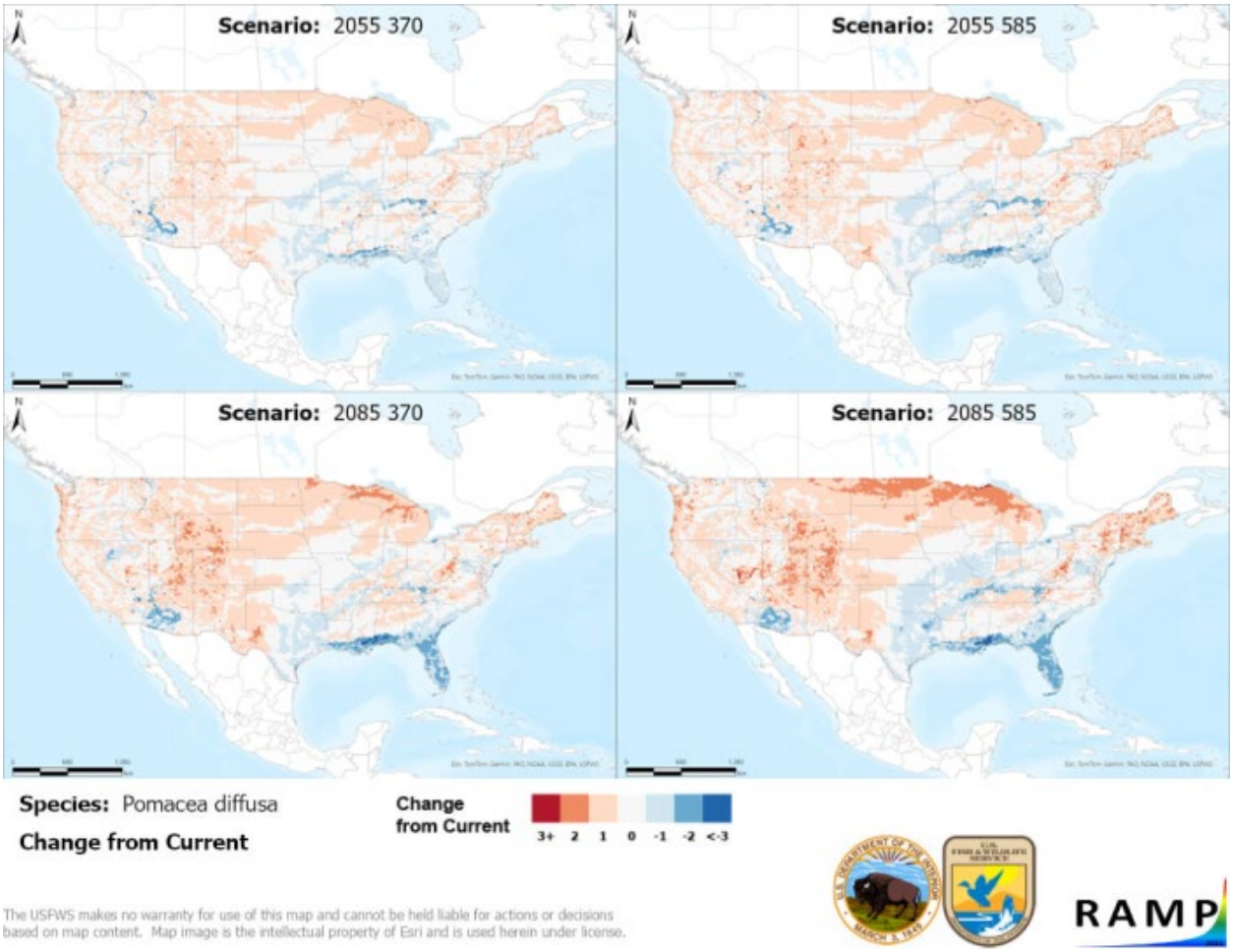

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 5) and the median target point score for future climate scenarios (figure A1) for *Pomacea diffusa* based on source locations reported by GBIF Secretariat (2022) and Ahmed et al. (2020). 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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