

# Florida Applesnail (*Pomacea paludosa*)

## Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, web version – 3/30/2018

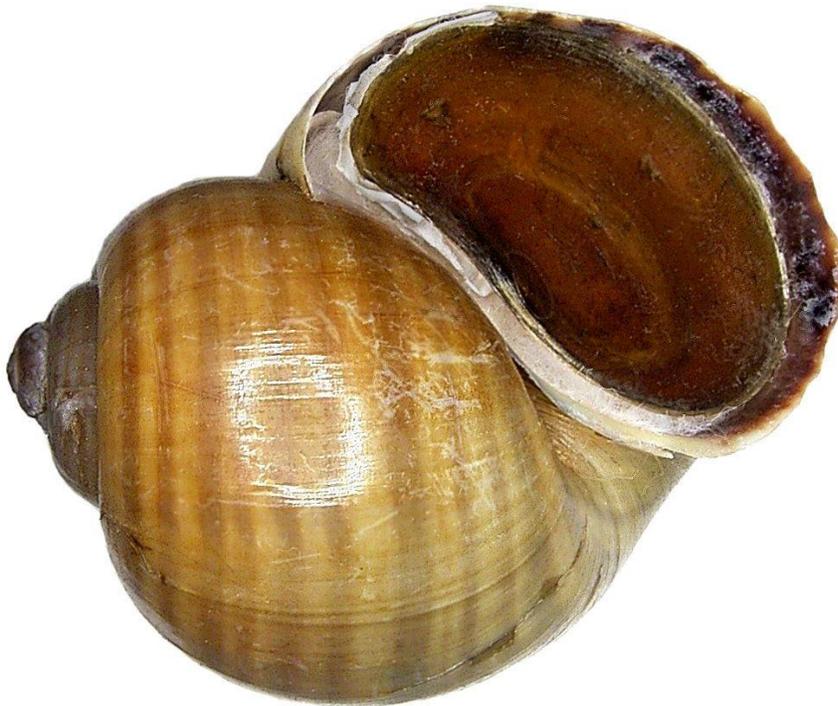


Photo: U. Schmidt. Used under CC BY-SA. Available: [http://eol.org/data\\_objects/24969974](http://eol.org/data_objects/24969974). (March 2017).

## 1 Native Range and Status in the United States

---

### Native Range

From Benson (2016):

“Central and southern Florida (Thompson 1984); Cuba; Hispanola (Dundee 1974).”

From Cordeiro and Perez (2011):

“This species is found in the Florida peninsula, westward to the Suwannee and Choctawhatchee rivers, and in Cuba, Bolivia, Peru southward to the Paraguay river and into southeastern Brazil (Perera and Walls 1996, Ghesquiere 2007).”

## **Status in the United States**

From Benson (2016):

“It has limited northern distribution in Florida. Collections have been made in Georgia, Oahu, Hawaii (Devick 1991), Louisiana, and Oklahoma (Dundee 1974).”

From Dillon et al. (2006):

“Our recent surveys have not confirmed the occurrence of *P. paludosa* in the Altamaha or in any other Georgia Atlantic drainage. The single South Carolina population of which we are aware, on Spring Island near Beaufort, seems to result from an artificial introduction.”

From NatureServe (2015):

“[...] is introduced in Covington Co., Alabama.”

From Karatayev et al. (2009):

“Several species of freshwater exotic gastropods have been reported from Texas waterbodies, some of which have established populations and some that survived for a short period of time and then disappeared. Species that failed to survive or for which there is no recent confirmation of an established population include: Florida applesnail (*Pomacea paludosa*) [...]”

From Cowie (1998):

“Whether established [in Hawaii] unknown”

From Williams et al. (2001):

“Some *P. paludosa* may have been introduced into Puerto Rican fresh waters, but we have not been able to confirm this. As a result of our efforts, importation of this species has been banned to prevent the establishment of a second applesnail in Puerto Rico (DNER, in press).”

## **Means of Introductions in the United States**

From Cowie (1998):

“Probably introduced [to Hawaii] via the aquarium trade”

From Williams et al. (2001):

“Several years ago, distributors supplying *P[omacea] cumingii* to local [Puerto Rican] aquarium fish retailers substituted the Florida applesnail, *P. paludosa*.”

## Remarks

From Dillon et al. (2006):

“Systematic relationships within the Ampullariidae have been the object of much research in recent years (Cowie et al. 2006). At the species level, however, *Pomacea paludosa* has remained taxonomically stable.”

## 2 Biology and Ecology

---

### Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2016):

“Kingdom Animalia  
Subkingdom Bilateria  
Infrakingdom Protostomia  
Superphylum Lophozoa  
Phylum Mollusca  
Class Gastropoda  
Subclass Prosobranchia  
Order Architaenioglossa  
Family Ampullariidae  
Genus *Pomacea*  
Species *Pomacea paludosa* (Say, 1829)”

“Taxonomic Status: valid”

### Size, Weight, and Age Range

From Benson (2016):

“60 mm in length and width (Burch 1982)”

From Dillon et al. (2006):

“Maturity is reached at about 30-40 mm, a size which typically requires a year to achieve (Kushlan 1975). Adult snails can live for several years, reproducing iteroparously (life cycle G of Dillon 2000: 158).”

## **Environment**

From Benson (2012):

“Amphibious, but can survive dry seasons (Burch 1982).”

From Cordeiro and Perez (2011):

“This species is found in swamps and artificial lakes as well as the warm waters of rivers, lakes, ponds and roadside ditches (Perera and Walls 1996, Ghesquiere 2007). It is found in creeks in Cuba and slow flowing or stagnant waters in Florida (Freshwater Mollusk Conservation Society 2004). [...] can tolerate relatively acidic water conditions (Perera and Walls 1996).”

## **Climate/Range**

From Benson (2016):

“Tropical species.”

From Howells et al. (2006):

“Inability to tolerate extremely low temperatures has been reported for [...] *Pomacea paludosa* (Freiburg and Hazelwood 1977) [...]”

## **Distribution Outside the United States**

### **Native**

From Benson (2016):

“[...] Cuba; Hispanola (Dundee 1974).”

From Cordeiro and Perez (2011):

“[...] Cuba, Bolivia, Peru southward to the Paraguay river and into southeastern Brazil (Perera and Walls 1996, Ghesquiere 2007).”

### **Introduced**

From NatureServe (2015):

“Introduced extensively into Pacific Islands and southeast Asia (Thompson, 1999).”

From Cowie and Hayes (2012):

“Other species recorded as introduced are based on misidentifications, e.g., [...] *P[omacea] paludosa* in Asia [...]”

## Means of Introduction Outside the United States

No information available. Introductions outside of the United States are unconfirmed.

## Short Description

From Benson (2016):

“This species is the largest freshwater gastropod in North America (Burch 1982). It is globose in shape, body whorls are wide, spire is depressed, and the aperture is narrowly oval (Burch 1982). They are brown in color and have a striped pattern.”

## Biology

From Cordeiro and Perez (2011):

“This species is amphibious and is a critical food source for the endangered Snail Kite (*Rostrhamus sociabilis*) (Freshwater Mollusk Conservation Society 2004). The eggs are white and are laid on emerging stems of vegetation in clutches of 10-80 eggs, roughly 3-6 mm in diameter (Ghesquiere 2007). Young begin to appear after two weeks and due to their large size when born, they are less sensitive to habitat desiccation (Ghesquiere 2007). It is also a voracious eater [...]”

From Dillon et al. (2006):

“*P. paludosa* is primarily a consumer of aquatic macrophytes (Sharfstein & Steinman 2001). The snails are able to enfold a pocket of air in their mantle cavity, much like a pulmonate, by which they float on the surface of rich, calm waters, grazing on macrophytic vegetation of any sort tender enough for their jaws and radula to penetrate (Dillon 2000:97-99).”

“Sexes are separate. Research with the better-known *P. canaliculata* suggests that sex determination may be oligogenic (Yusa [2004], 2006 [...]).”

“During dry periods the adults burrow and aestivate, while their egg masses are protected by calcareous shells on the reeds and cat-tails above.”

## Human Uses

From Cordeiro and Perez (2011):

“This species is edible and is consumed in several local areas (Perera and Walls 1996).”

From Howells et al. (2006):

“Limited numbers of *P. paludosa* have been offered for sale in Asian food markets in Texas.”

“In the 1950s and 1960s, use of native *P. paludosa* and other imported, exotic ampullariids in the aquarium trade increased dramatically. In time, as *Pomacea* replaced viviparid gastropods, the name “mystery snail” was retained by tropical fish dealers, exacerbating the confusion associated

with terminology. *P. paludosa* and species in the *P. canaliculata* complex aggressively consumed aquarium plants and often failed to eat algae. Thus, these snails soon fell out of favor.”

## Diseases

From Wallace and Rosen (1969):

“Mollusks from the volcanic islands of Oahu, Hawaii; Tahiti, Society Islands; and Rarotonga, Cook Islands; and from the coral atoll of Majuro, Marshall Islands, were studied in an attempt to determine which species might serve as intermediate hosts of the rat lung worm, *Angiostrongylus cantonensis*[*Parastrongylus cantonensis*]. [...] At least five species of aquatic and amphibious snails, of five families, were examined from the island of Oahu, but only one species, the pilid snail, *Pomacea paludosa*, was found infected with *A. cantonensis*.”

From Howells et al. (2006):

“Although *P. canaliculata* and other Ampullariidae can carry *Angiostrongylus cantonensis* (rat lungworm) (Halwart 1994), none of the *P. canaliculata* complex populations in the US have been reported as carriers thus far. [...] although most biologists working with *Pomacea* in the US believe that local snail populations do not host the parasite, very few individual specimens or populations have actually been examined for the infection. Ampullariidae can also host a varied array of other parasites as well, but again, few US populations have ever been examined regarding associated parasites. Therefore, there is a necessity for a parasitological study of introduced *Pomacea* in the US [...]”

## Threat to Humans

From Hollingsworth and Cowie (2006):

“Apple snails (Ampullariidae) are intermediate hosts of parasites causing at least three diseases in humans: cercarial dermatitis ("swimmer's itch") caused by trematode cercariae, intestinal problems caused by flukes in the genus *Echinostoma*, and eosinophilic meningitis caused by the nematode *Angiostrongylus cantonensis*.”

## 3 Impacts of Introductions

---

From Benson (2016):

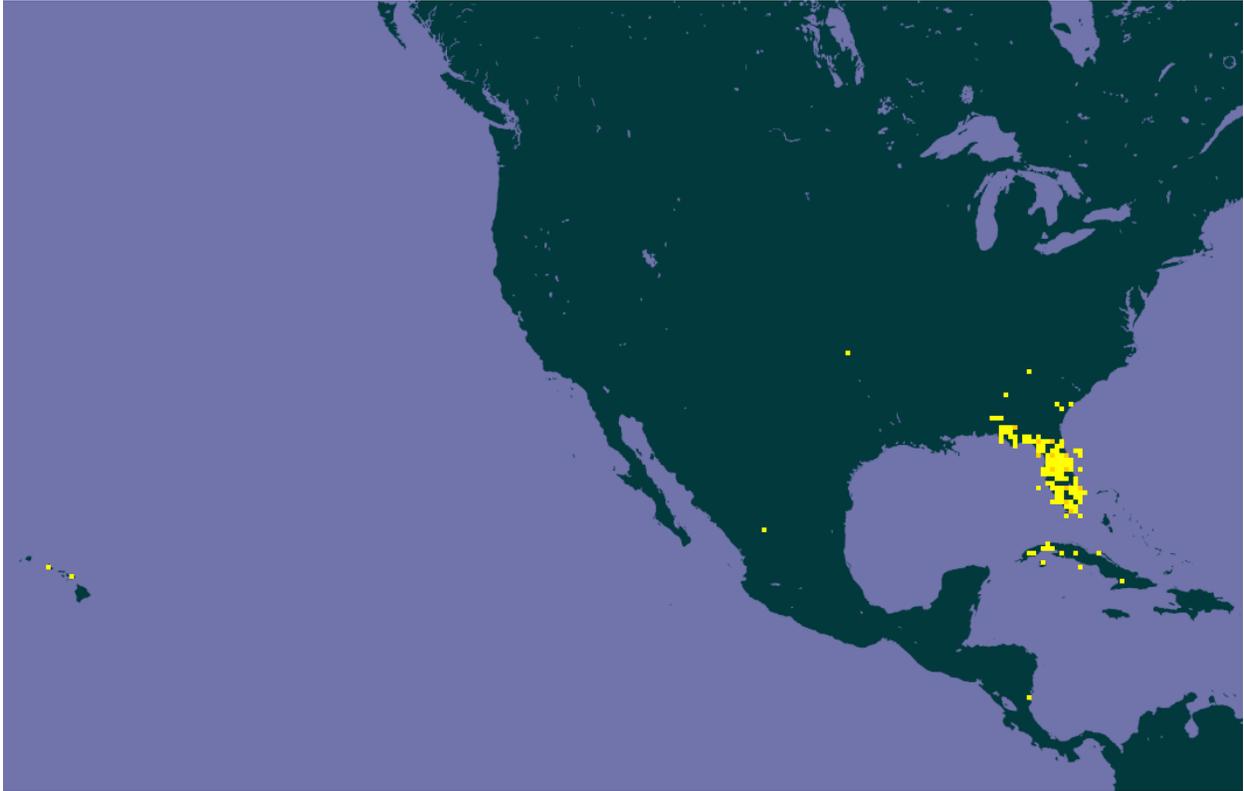
“Unknown”

From Howells et al. (2006):

“Although present in Gantt Lake in Alabama for over 40 years, no significant impacts appear to have been reported. Other than possible minor introductions short distances outside its natural range in Florida and Georgia, this species has failed to become established at other sites in the continental US, and no impacts of failed introductions have been documented.”

## 4 Global Distribution

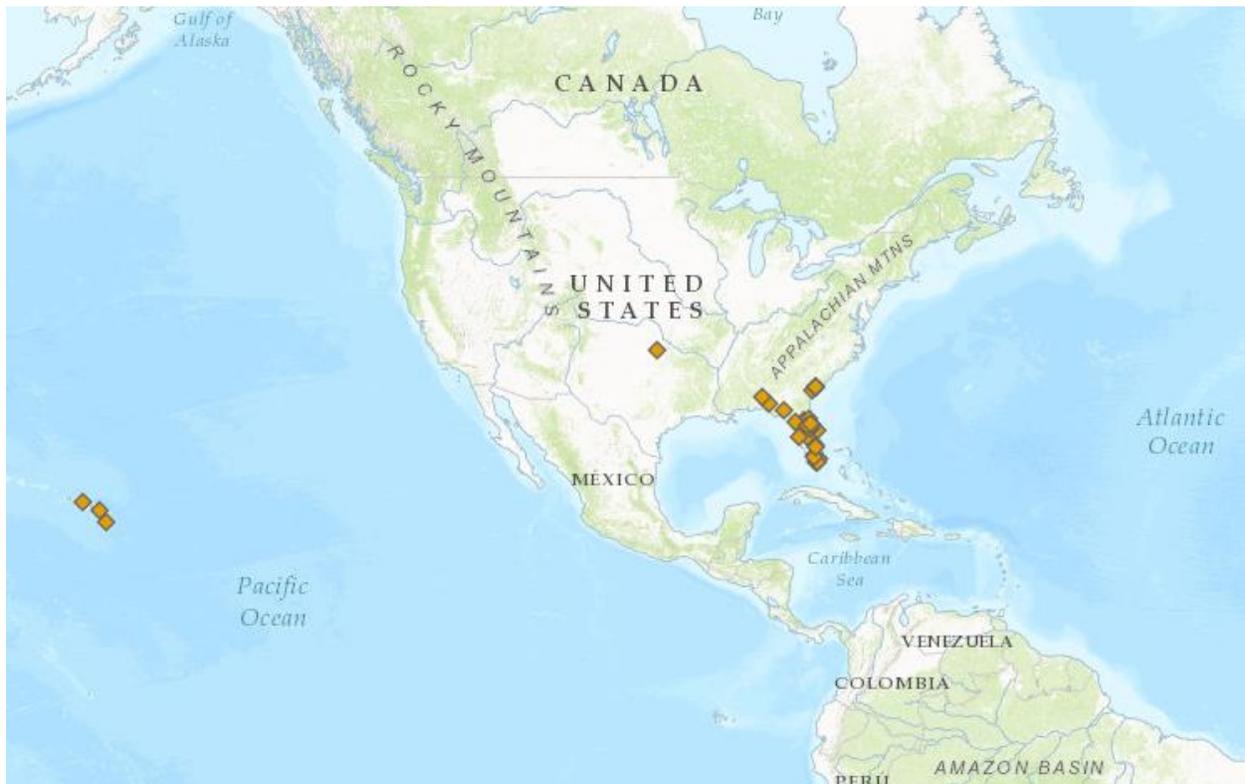
---



**Figure 1.** Known global established locations of *Pomacea paludosa*. Map from GBIF (2016). Records in the Appalachian Mountains, U.S.; Alberta, Canada; Mexico; and Nicaragua were excluded from climate matching because they lie outside the described range of *P. paludosa* (see Native Range, Status in the United States, and Distribution Outside the United States, above).

## 5 Distribution Within the United States

---



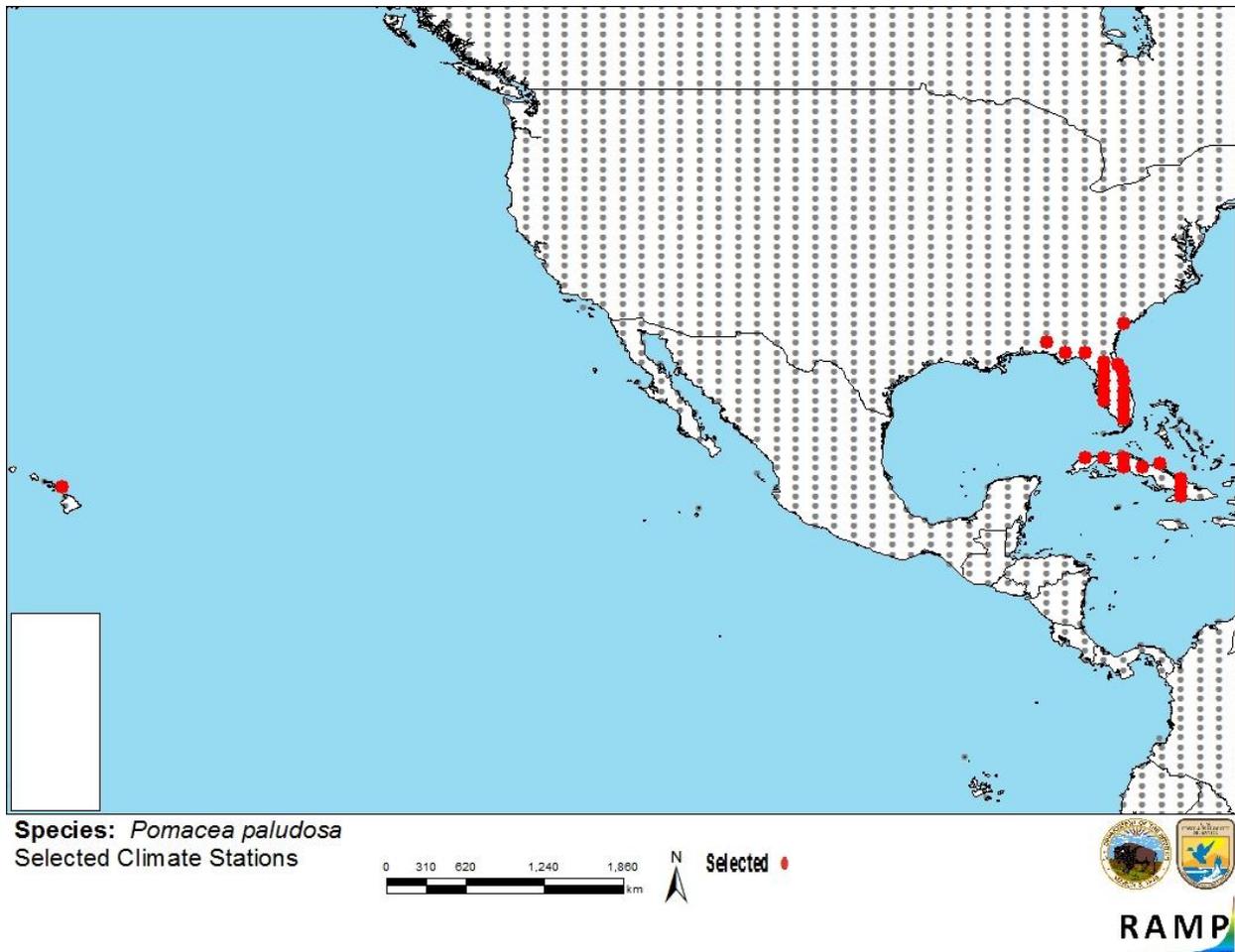
**Figure 2.** Known U.S. established locations of *Pomacea paludosa*. Map from Benson (2016). Record in Oklahoma was excluded from climate matching because the establishment status of *P. paludosa* is unknown for this location.

## 6 Climate Matching

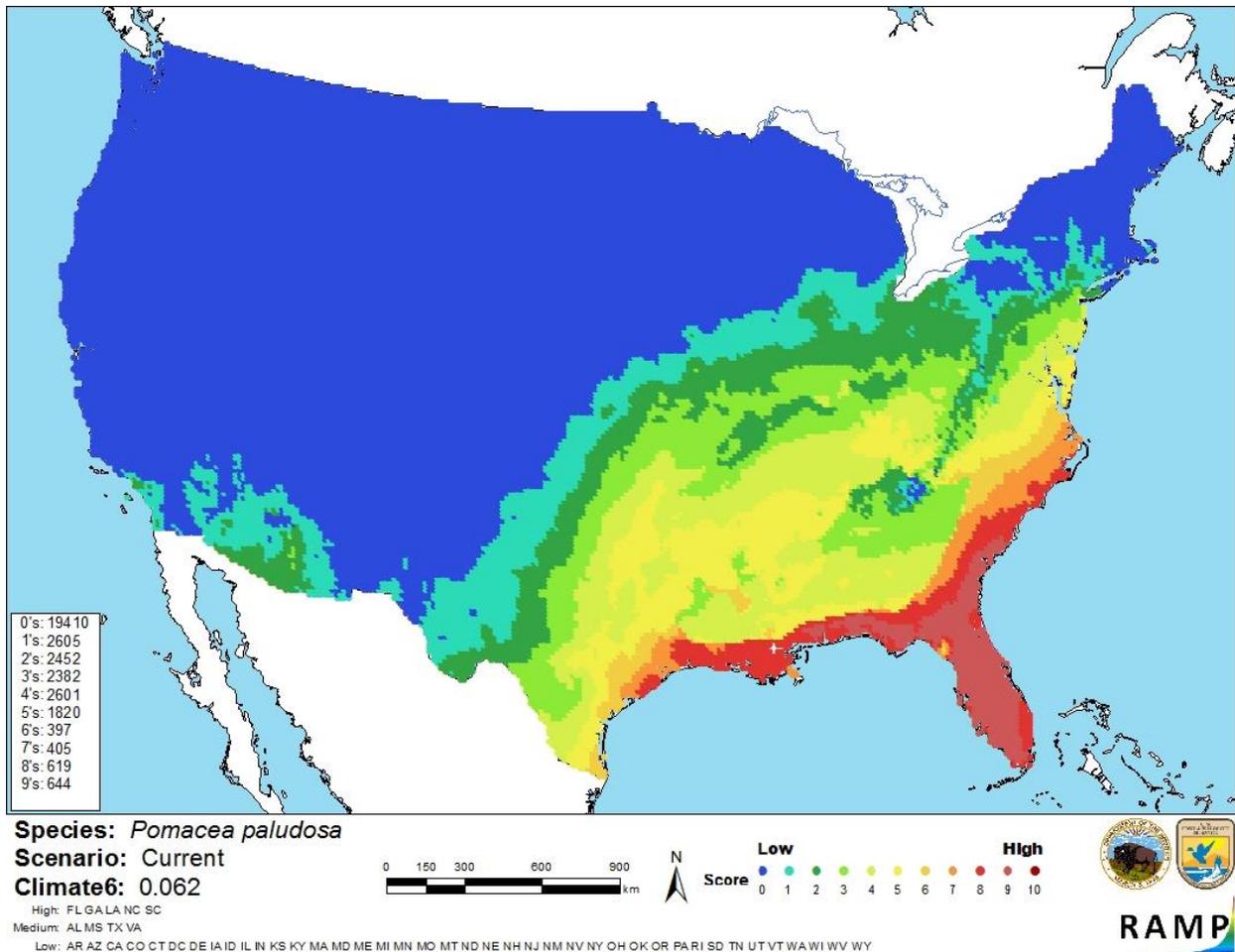
---

### Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean Distance) was high in Florida, west along the Gulf of Mexico coast to eastern Texas, and north along the Atlantic coast through South Carolina. Most of the remainder of the Southeast showed a medium match; the climate match was low across the remainder of the contiguous U.S. Climate 6 proportion indicated that the contiguous U.S. has a medium climate match overall. Proportions between 0.005 and 0.103 indicate a medium climate match; the Climate 6 proportion of *Pomacea paludosa* was 0.062.



**Figure 3.** RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *Pomacea paludosa* climate matching. Source locations from GBIF (2016) and Benson (2016).



**Figure 4.** Map of RAMP (Sanders et al. 2014) climate matches for *Pomacea paludosa* in the contiguous United States based on source locations reported by GBIF (2016) and Benson (2016). 0= Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

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
$0.000 \leq X < 0.005$	Low
$0.005 < X < 0.103$	Medium
$\geq 0.103$	High

## 7 Certainty of Assessment

Peer-reviewed literature on the biology, ecology, and distribution of *Pomacea paludosa* is available, but the literature is limited in regards to information on impacts of invasion. There is some disagreement among sources over what constitutes the native range of the species. More information on this species is needed to strengthen the certainty of this assessment. The certainty of this assessment is low.

## 8 Risk Assessment

---

### Summary of Risk to the Contiguous United States

*Pomacea paludosa* is the only species of applesnail native to the United States. Its native range in the U.S. is restricted to Florida, but it has become established in South Carolina and Alabama, with additional collections made in Hawaii and other southern states. *P. paludosa* has a medium climate match with the United States. Although the species has been documented as introduced outside of its native range, it is unclear what impact, if any, it is having on the ecosystems where it has been introduced. Overall risk assessment category for this species is uncertain.

### Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): Medium**
- **Certainty of Assessment (Sec. 7): Medium**
- **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.**

- Benson, A. 2016. *Pomacea paludosa*. USGS Nonindigenous Aquatic Species Database, Gainesville, Florida. Available: <https://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=98>. (November 2016).
- Cordeiro, J., and K. Perez. 2011. *Pomacea paludosa*. The IUCN Red List of Threatened Species 2011. Available: <http://www.iucnredlist.org/details/189339/0>. (November 2016).
- Cowie, R. H. 1998. Patterns of introduction of non-indigenous non-marine snails and slugs in the Hawaiian Islands. *Biodiversity and Conservation* 7:349-368.
- Cowie, R. H., and K. A. Hayes. 2012. Apple snails. Pages 207-217, plates 18.1-18.4 in R. A. Francis, editor. *A handbook of global freshwater invasive species*. Earthscan, London.
- Dillon, R. T., Jr., B. T. Watson, T. W. Stewart, and W. K. Reeves. 2006. Species account: *Pomacea paludosa* (Say 1829). *Freshwater Gastropods of North America*. Available: [http://www.fwgna.org/species/ampullariidae/p\\_paludosa.html](http://www.fwgna.org/species/ampullariidae/p_paludosa.html). (August 2016).
- GBIF (Global Biodiversity Information Facility). 2016. GBIF backbone taxonomy: *Pomacea paludosa* Say, 1839. Global Biodiversity Information Facility, Copenhagen. Available: <http://www.gbif.org/species/2292584>. (November 2016).
- Hollingsworth, R. G., and R. H. Cowie. 2006. Apple snails as disease vectors. Pages 121-132 in R. C. Joshi, and L. S. Sebastian, editors. *Global advances in ecology and management of golden apple snails*. Philippine Rice Research Institute, Muñoz, Nueva Ecija, Philippines.

Howells, R. G., L. E. Burlakova, A. Y. Karatayev, R. K. Marfurt, and R. L. Burks. 2006. Native and introduced *Ampullariidae* in North America: history, status, and ecology. Pages 73-112 in R. C. Joshi, and L. S. Sebastian, editors. Global advances in the ecology and management of golden apple snails. Philippine Rice Research Institute, Muñoz, Nueva Ecija, Philippines.

ITIS (Integrated Taxonomic Information System). 2016. *Pomacea paludosa* (Say, 1829). Integrated Taxonomic Information System, Reston, Virginia. Available: [https://www.itis.gov/servlet/SingleRpt/SingleRpt?search\\_topic=TSN&search\\_value=70343#null](https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=70343#null). (November 2016).

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.

NatureServe. 2015. *Pomacea paludosa*. NatureServe Explorer. Available: <http://explorer.natureserve.org/>. (November 2016).

Sanders, S., C. Castiglione, and M. Hoff. 2014. Risk Assessment Mapping Program: RAMP. U.S. Fish and Wildlife Service.

Wallace, G. D., and L. Rosen. 1969. Studies on eosinophilic meningitis. V. Molluscan hosts of *Angiostrongylus cantonensis* on Pacific Islands. *American Journal of Tropical Medicine and Hygiene* 18(2):206-216.

Williams, E. H., Jr., L. Bunkley-Williams, C. G. Lilyestrom, and E. A. R. Ortiz-Corps. 2001. A review of recent introductions of aquatic invertebrates in Puerto Rico and implications for the management of nonindigenous species. *Caribbean Journal of Science* 37(3-4):246-251.

## 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.**

Burch, J. B. 1982. North American freshwater snails. *Walkerana* 1(4):217-365.

Cowie, R. H., K. A. Hayes, and S. C. Thiengo. 2006. What are apple snails? Confused taxonomy and some preliminary resolution. Pages 3-23 in R. C. Joshi, and L. S. Sebastian, editors. Global advances in ecology and management of golden apple snails. Philippine Rice Research Institute, Nueva Ecija, Philippines.

Devick, W. S. 1991. Disturbances and fluctuations in the Wahiawa Reservoir ecosystem. Project No. F-14-R-15, Job 4 Study I. Division of Aquatic Resources, Hawaii Department of Land and Natural Resources, Honolulu, Hawaii.

- Dillon, R. T., Jr. 2000. The ecology of freshwater molluscs. Cambridge University Press, Cambridge, England.
- DNER. In press. Fishery regulations of the Commonwealth of Puerto Rico. Department of Natural and Environmental Resources, Puerta de Tierra, San Juan, Puerto Rico.
- Dundee, D. S. 1974. Catalog of introduced mollusks of eastern North America (north of Mexico). *Sterkiana* 55:1-37.
- Freshwater Mollusk Conservation Society. 2004. Showing your shells. In K. E. Perez, S. A. Clark, and C. Lydeard, editors. A primer to freshwater gastropod identification. University of Alabama, Tuscaloosa, Alabama.
- Freiberg, M. W., and D. H. Hazelwood. 1977. Oxygen consumption of two amphibious snails: *Pomacea paludosa* and *Marisa cornuarietis* (Prosobranchia: Ampullariidae). *Malacologia* 16:541-548.
- Ghesquiere, S. 2007. Apple snails. Available: <http://www.applesnail.net>. (November 2016).
- Halwart, M. 1994. The golden apple snail *Pomacea canaliculata* in Asian rice-farming systems: present impact and future threat. *International Journal of Pest Management* 40(2):199-206.
- Kushlan, J. 1975. Population changes of the apple snail, *Pomacea paludosa*, in the southern Everglades. *Nautilus* 89:21-23.
- Perera, G., and J. G. Walls. 1996. Apple snails in the aquarium. T.F.H Publications, Neptune City, New Jersey.
- Sharfstein, B., and A. D. Steinman. 2001. Growth and survival of the Florida apple snail (*Pomacea paludosa*) fed three naturally occurring macrophyte assemblages. *Journal of the North American Benthological Society* 20:84-95.
- Thompson, F. G. 1984. The freshwater snails of Florida: a manual for identification. University of Florida Press, Gainesville, Florida.
- Thompson, F. G. 1999. An identification manual for the freshwater snails of Florida. *Walkerana* 10(23):1-96.
- Yusa, Y. 2004. Brood sex ratio in the apple snail *Pomacea canaliculata* is determined genetically and not by environmental factors. *Journal of Molluscan Studies* 70:269-275.
- Yusa, Y. 2006. Genetics of sex-ratio variation inferred from parent-offspring regressions and sib correlations in the apple snail *Pomacea canaliculata*. *Heredity* 96:100-105.