

Spike-topped Applesnail (*Pomacea diffusa*)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, November 2016

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1 Native Range and Status in the United States

Native Range

From Rawlings et al. (2007):

“The type locality of *Pomacea diffusa* is in the city of Santa Cruz, Bolivia, although the species is widespread throughout the Amazon Basin.”

Status in the United States

From Fasulo (2011):

“*Pomacea diffusa* Blume, 1957, the spike-topped applesnail, is a Brazilian species that was introduced into southern Florida, probably in the 1950s. This species [. . .] 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 Rawlings et al. (2007):

“Howells et al. [2006] reported its establishment in Mobile, Alabama in 2003.”

From Cowie and Hayes (2012):

“*Pomacea diffusa* [...] was reported in the wild in Hawaii (Cowie, 1995) but has declined and was not recorded in more recent surveys (Cowie et al, 2007).”

Means of Introductions in the United States

From Fasulo (2011):

“It 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

From GBIF (2016):

“SYNONYMS

Pomacea bridgesii subsp. *diffusa* Blume, 1957”

From Rawlings et al. (2007):

“*Pomacea diffusa* was originally described as a subspecies of *Pomacea bridgesii*. Pain [1960] argued that *P. bridgesii bridgesii* was a larger form with a restricted range, with the smaller *P. bridgesii diffusa* being the common form throughout the Amazon Basin (Brazil, Peru, Bolivia). Cowie and Thiengo [2003] suggested that the latter might deserve full species status, and the two taxa have been confirmed as distinct species by genetic analyses [[Cowie et al. 2006], K.A. Hayes, R.C. Joshi, S.C. Thiengo and R.H. Cowie, in prep.]”

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From CABI (2016):

“Domain: Eukaryota

Kingdom: Metazoa

Phylum: Mollusca

Class: Gastropoda

Subclass: Caenogastropoda
Order: Architaenioglossa
Superfamily: Ampullarioidea
Family: Ampullariidae
Genus: *Pomacea*
Species: *Pomacea diffusa*”

Size, Weight, and Age Range

From Queensland Museum (2016):

“The shell may be 40-70mm high and 40-50mm wide [...]”

Environment

From Mackie and Claudi (2010):

“*Pomacea* inhabits rivers, springs, ponds, ditches, wetlands (mostly marshes, rarely swamps), and similar freshwater environments with low flow and large standing crops of aquatic macrophytes, especially rice and taro of which many species are voracious consumers. [...] Formerly known as *Pomacea bridgesii*, this apple snail’s habitat preferences are much like those in the *Pomacea canaliculata* complex and also prefers lentic habitats (i.e., standing water) that may have alternating periods of drought and high rainfall. Like all pomaceans, the possession of both lungs and gills reflects an adaptation to low dissolved oxygen conditions that are often present in swamps and shallow water due to decay of organic materials like dead vegetation and high temperatures.”

Climate/Range

From Fasulo (2011):

“This species has a lower tolerance for cold water than the Florida applesnail [...].”

From Mackie and Claudi (2010):

“In aquaria, the life span appears to be temperature dependent; at higher temperatures they live shorter, but grow, reproduce, and move faster; at 20-21°C, they live for three years or more; at 25°C or above, the life span is shorter, about two years (Perrera and Halls, 1996).”

Distribution Outside the United States

Native

From Rawlings et al. (2007):

“The type locality of *Pomacea diffusa* is in the city of Santa Cruz, Bolivia, although the species is widespread throughout the Amazon Basin.”

Introduced

From Hayes et al. (2008):

“*Pomacea diffusa* was found outside the Americas in Australia and Sri Lanka.”

From Queensland Museum (2016):

“In December 2006, a significant population of the Spike-top Apple Snail was discovered in a waterway on the north side of Brisbane [Australia].”

From Rawlings et al. (2007):

“[...] Cuba [...]”

Means of Introduction Outside the United States

From Vázquez Perera and Valderrama (2010):

“Introductions that have been directly linked with human activities are generally associated with the pet trade for aquariums [Perera and Walls 1996]. Several species of freshwater snails are commonly sold to aquarists. These include *Marisa cornuarietis* and *Pomacea diffusa*, the latter being the most commonly traded ampullariid [Hayes 2009].”

Short Description

From Queensland Museum (2016):

“The Spike-top Apple Snail’s most obvious features are ‘square shoulders’ at the tops of the whorls, a very large, oval aperture and a deep umbilicus. It has a high, somewhat pointed spire which gives rise to the common name term ‘spike-top’. Mature apple snails can grow as large as a golf ball or sometimes larger. [...] colour varies from yellow to greenish brown, some forms having dark spiral bands. The yellow form was originally bred in Florida, U.S.A. and these variations are often referred to in the aquarium trade as ‘mystery snails’.”

Biology

From Mackie and Claudi (2010):

“The spiketop applesnail is dioecious and somewhat sexually dimorphic. The shell opening of the male tends to be larger and rounder than females, due to the penial complex. The penial complex lies to the right of the mantle in front of the gills; females lack the penial complex (Perrera and Hall, 1996). Females deposit pale pink to reddish eggs above the water surface on vegetation or hard surfaces like rocks [. . .]. The eggs, 2.20-3.5 mm (0.5-0.9 inch) diameter, are closely attached to each other and average 200 to 600 eggs to a clutch. The average size of a clutch is 3.8 cm (1.5 inches). Eggs hatch out after two to three weeks but high temperature causes earlier hatching.”

From Fasulo (2011):

“They feed mostly on decaying vegetation.”

From Rawlings et al. (2007):

“[...] a study [...] concluded that it feeds primarily on aufwuchs, not macrophytes [Howells 2002]. [...] a conflicting study reports that, in addition to macrophytes, it will feed readily on animal carcasses, live worms, and the eggs of planorbid snails [Aditya and Raut 2001].”

Human Uses

From Queensland Museum (2016):

“Apple Snails (*Pomacea* spp.) are freshwater snails commonly sold in the aquarium trade for the purpose of keeping aquarium glass clean of algae.”

From Cowie and Hayes (2012):

“It is grown commercially on a large scale in Florida (Perera and Walls, 1996). [...] *Pomacea diffusa* has also been sold for food in Belgium, as ‘sea snails’ (Thiengo, S. C., pers. comm.).”

Diseases

No information available.

Threat to Humans

No information available.

3 Impacts of Introductions

From Rawlings et al. (2007):

“*Pomacea diffusa* has generally been assumed also to pose little threat in the U.S. and it is the only apple snail for which interstate transport is permitted. This lack of concern may be unwarranted. The U.S. Department of Agriculture considered it (as *P. bridgesii*) to be innocuous [Gaston 2006], presumably based on a study that concluded that it feeds primarily on aufwuchs, not macrophytes [Howells 2002]. The potential effects of *Pomacea diffusa* in natural habitats are unknown, but a conflicting study reports that, in addition to macrophytes, it will feed readily on animal carcasses, live worms, and the eggs of planorbid snails [Aditya and Raut 2001]. It may therefore have direct effects on both aquatic vegetation and native snails and compete for food with native scavengers such as crayfish, shrimp, and fish.”

From Morrison and Hay (2011):

“Consumption and growth was minimal for *P. diffusa* on all macrophytes. [...] Regarding *Pomacea diffusa*, our findings differ from those of Aditya and Raut (2001), whose snails

“devoured completely” both macrophyte species offered (*Eichhornia crassipes* and *Cabomba* sp.). They also reported that *P. diffusa* preferred animal to plant tissue, consuming live worms, mollusk eggs, and dead animals. In our study, *Utricularia* sp. was consumed by 31% of the *P. diffusa*, but all other macrophytes were almost completely avoided. Howells (2002), however, found similar results to ours, with none of the 18 macrophytes offered to the snails consumed except for “slight nibble on leaf tips” of *Cabomba caroliniana*. [...] We wonder if strains of *P. diffusa* differ in food preferences (see Sotka and Hay 2002 for a marine example) or whether Aditya and Raut (2001) may have used a hybrid between *P. diffusa* and another *Pomacea* species. Nonetheless, even though our results suggest that *P. diffusa* would have a minimal direct impact on macrophytes, consumption of epiphytes and or invertebrate eggs could lead to indirect ecosystem impacts.”

4 Global Distribution



Figure 1. Known global established locations of *Pomacea diffusa*, recorded in Australia, the United States, and South America. Map from GBIF (2016).

5 Distribution Within the United States

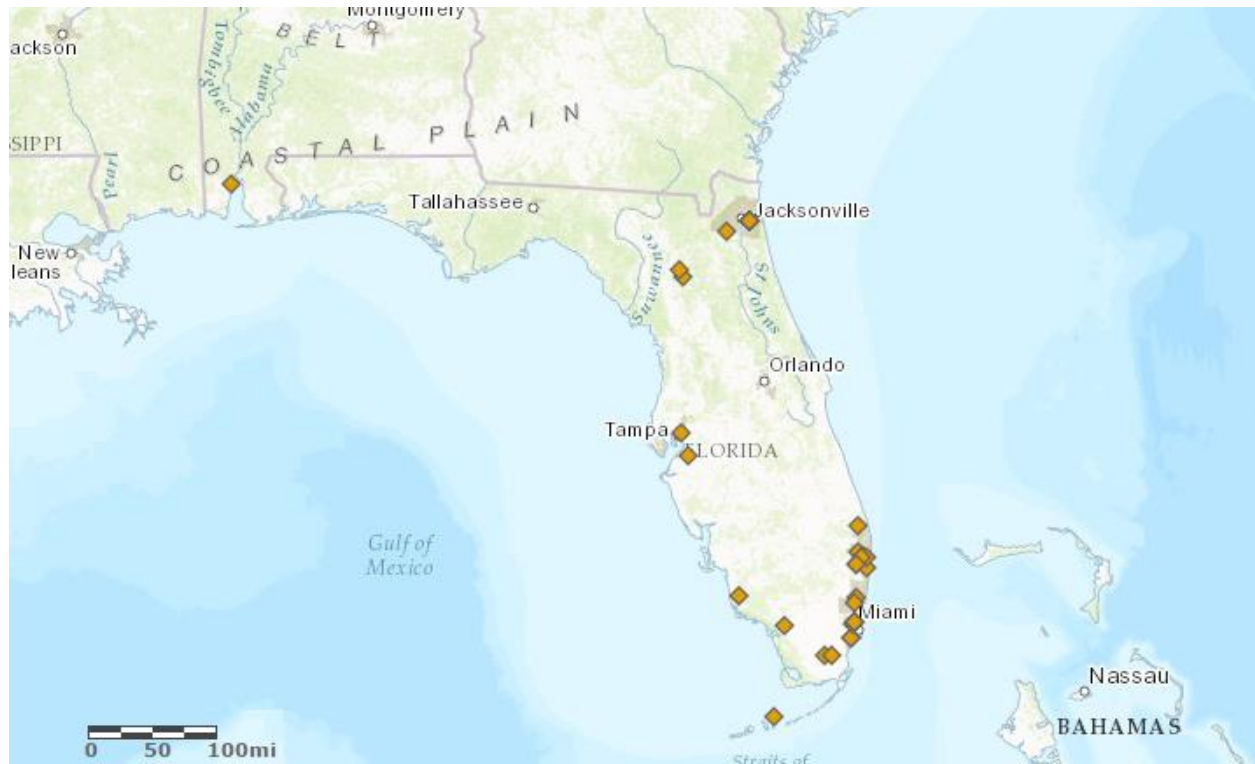


Figure 2. Known established locations of *Pomacea diffusa* in the United States. Map from USGS (2016).

6 Climate Matching

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean Distance) was high in Florida, Georgia, southern Texas, and along the Gulf Coast. The climate match was medium across the remainder of the southern U.S. and low in the northern U.S. Climate 6 proportion indicated that the contiguous U.S. has a high climate match. The range of proportions indicating a high climate match is 0.103-1.000; the Climate 6 proportion of *Pomacea diffusa* is 0.116.

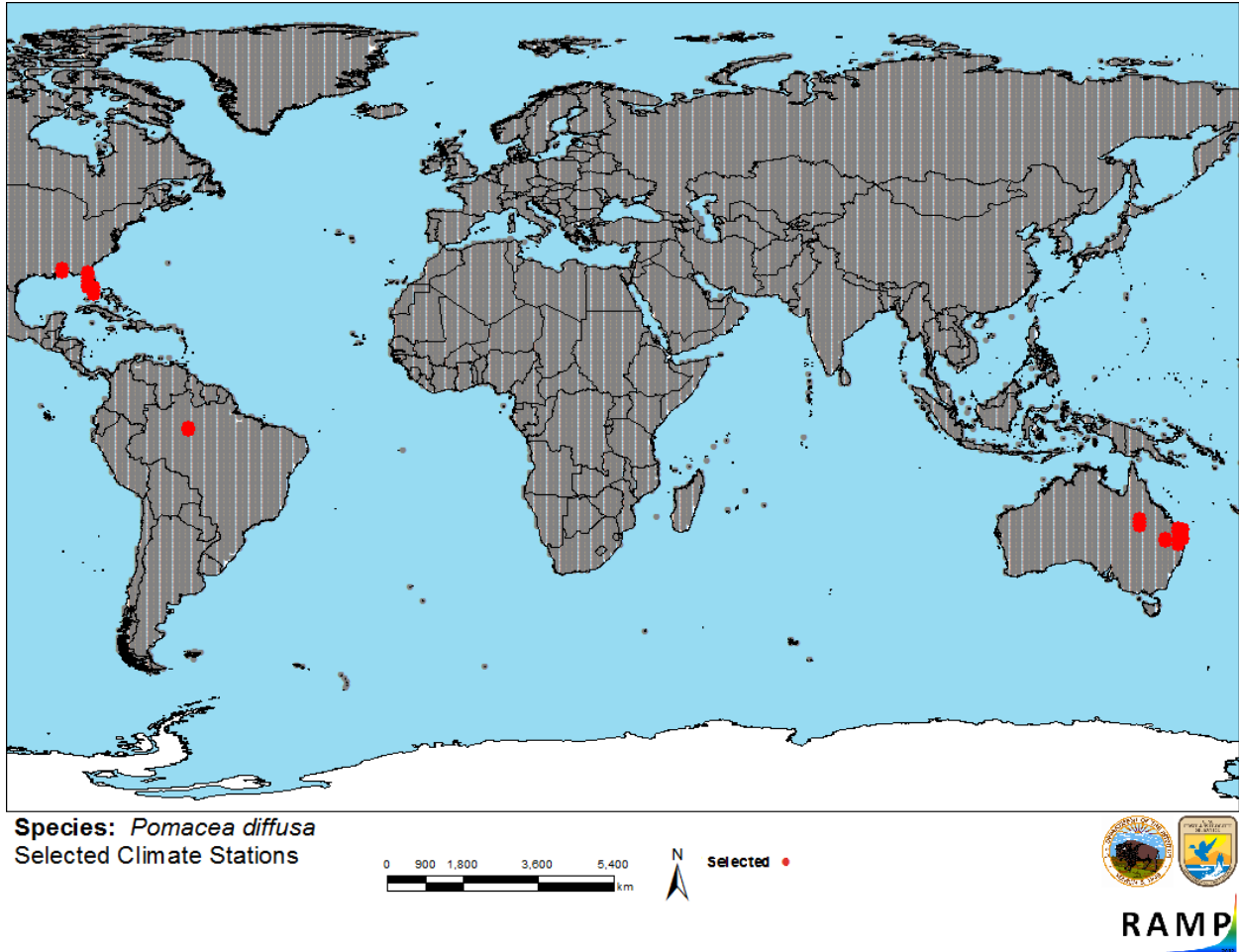


Figure 3. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *Pomacea diffusa* climate matching. Source locations from GBIF (2016).

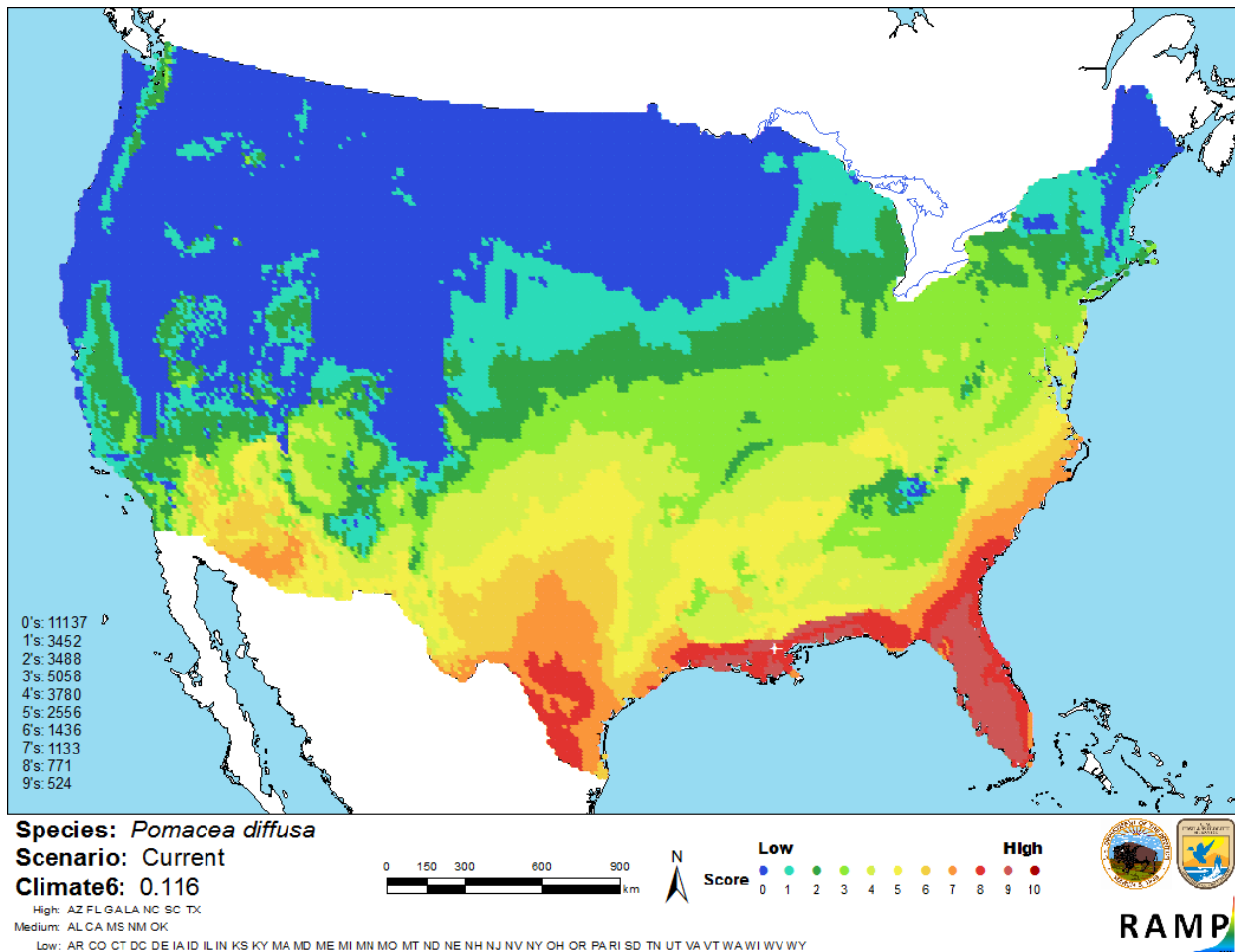


Figure 4. Map of RAMP (Sanders et al. 2014) climate matches for *Pomacea diffusa* in the contiguous United States based on source locations reported by GBIF (2016). 0 = Lowest match, 10 = Highest match. Climate match scores are tabulated on the left.

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
$0.000 < X < 0.005$	Low
$0.005 < X < 0.103$	Medium
≥ 0.103	High

7 Certainty of Assessment

Information is available on the biology and distribution of *Pomacea diffusa*, but multiple authors have expressed uncertainty about the impacts of introduction of this species. Certainty of this assessment is low.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Pomacea diffusa is a snail species native to the Amazon Basin that has become established in Florida and Alabama, as well as Australia and Sri Lanka, primarily through the aquarium trade. In the U.S., interstate transport of the species is allowed because the species is not considered as much of a threat as other species of *Pomacea*. However, uncertainty about the components of the diet of *P. diffusa* has led multiple authors to reject the assumption that *P. diffusa* is harmless to native species. Climate match to the contiguous U.S. is high. Overall risk posed by this species is uncertain.

Assessment Elements

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

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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.

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