Giant Applesnail (*Pomacea maculata*)
Ecological Risk Screening Summary

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

Photo: A. J. Benson, U.S. Geological Survey.

1 Native Range and Status in the United States

Native Range

From CABI (2017):

"*P. maculata* has a wide native range in South America extending from the Rio de la Plata in Argentina and Uruguay, through Paraguay and northwards in Brazil through the Pantanal to north of Manaus in Amazonia, overlapping with the range of *P. canaliculata* in the south (Hayes et al., 2008, 2009a, b, 2012)."

Status in the United States

From CABI (2017):

"In the USA, *P. maculata* has been recorded from Alabama, Georgia, Florida, Louisiana, Mississippi, possibly North Carolina, South Carolina and Texas."

"In the USA, the US Department of Agriculture through its Plant Protection and Quarantine program prohibits interstate transport of *P. maculata* without a permit. Along with *P. canaliculata*, pro-active states (i.e. Texas, Florida, South Carolina) have put *P. maculata* on a list of prohibited species."

From Benson (2016):

"The first collection of this snail was in 1989 from two Palm Beach County, Florida locations. The earliest genetically confirmed specimen of *P. maculata* in Florida was collected from Lake Munson near Tallahassee, Florida collected in 2002 (Rawlings et al., 2007). At the time though, it was being referred to as *P. insularum*. Since then the Giant Applesnail has been recognized as present from much of Florida (D. Denson and L. Connor, pers. comm.). Outside of Florida, this snail has been found in Spring Hill Lake near Mobile, Alabama in 2003 (D. Shelton, pers. comm.); Alabaha River in Georgia in 2005 (B. Albanese, pers. comm.); American Canal and Mustang Bayou in Texas (Howells, 2001), and in 2006 in Verret Canal in Gretna, Louisiana and also Lajas Irrigation Canal in Puerto Rico (F. Grana, pers. comm.). More recently found in several locations in Mississippi in 2008 and 2009, South Carolina in 2010 and Arizona in 2011."

Means of Introductions in the United States

From CABI (2017):

"*P. maculata* in the southeastern USA was probably introduced via the aquarium trade (Karatayev et al., 2009; Martin et al., 2012). […] *P. maculata* does not perform well in an aquarium, however, and so pet owners will often release the illegally acquired snail 'back' into the environment without any awareness of the consequences."

From Rawlings (2007):

"[…] populations of *P. insularum* [*P. maculata*] were established in Texas by 1989, in Florida by the mid to late 1990s, and in Georgia by 2005, and this species continues to spread rapidly."

Remarks

From CABI (2017):

"Due to the confusion in species identification, the history of introduction of *P. maculata* remains somewhat uncertain as does its invasiveness and pest potential."

"Hayes et al. (2012) revised the taxonomy of *P. maculata* and *P. canaliculata*, redescribing both species and clearly distinguishing them morphologically. Hayes et al. (2012) reviewed many similar species and synonymized a number of them with either *P. maculata* or *P. canaliculata*. […] The name *Pomacea insularum* (anglicized in the USA as the "island applesnail") was formerly used as the valid name of *P. maculata* but is now a junior objective synonym of *P. maculata*, following the designation of a single specimen as both the neotype of *P. maculata* and lectotype of *P. insularum*; the same specimen was also designated as the neotype of *P. gigas*, thereby making this also a junior objective synonym of *P. maculata* (Hayes et al., 2012)."

"Prior to the work of Cowie et al. (2006), Rawlings et al. (2007), Hayes et al. (2008, 2009b, 2012) and Tran et al. (2008), the difficulty of distinguishing *P. canaliculata* from *P. maculata* meant that not only were their true ranges in South America not understood but also that the correct identities of ampullariids in Asia and other locations to which they have been introduced were not known. Thus, much of the literature published prior to these clarifications, especially in Asia, either confounded data from these two species (e.g. Cowie, 2002) or may have presented data from one species that in fact were derived from the other."

"This confusion has meant that the common name most widely used in Asia, 'golden apple snail', or GAS (Joshi and Sebastian, 2006), in fact refers to two species, *P. canaliculata* and *P. maculata*. […] Similarly, the name 'channelled ['channeled' in the USA] apple snail' (or 'applesnail'), an anglicization of the specific epithet 'canaliculata', was originally applied to populations in the USA that were thought to be *P. canaliculata*, but turned out in fact to be *P. maculata* (Howells et al., 2006; Rawlings et al., 2007). […] However, when *P. insularum* was synonymized with *P. maculata* by Hayes et al. (2012), the common name 'island apple snail' became inappropriate. Subsequently, the common name 'giant apple snail' has been suggested for *P. maculata*, but this name suffers from the fact that many apple snail species are very large, as well as potentially fostering confusion with 'GAS' used to refer to 'golden apple snails' (traditionally *P. canaliculata* but now known to be a mixture of *P. canaliculata* and *P. maculata*) and the 'giant African snail' (*Lissachatina fulica*). […] Additional confusion has also arisen because some of these names have been used for more than one species of ampullariid; for instance, 'golden snail' and 'mystery snail' have been used primarily for orange/yellow varieties of both *P. canaliculata* and *P. diffusa* (the latter often misidentified as *P. bridgesii*), notably in the aquarium trade, in some cases without realizing that they are different species, or without being able to distinguish them, or simply misidentifying them (see Cowie et al., 2006). Consequently, the use of common names should be avoided to reduce confusion within this taxonomically difficult group (Hayes et al., 2009b)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From CABI (2017):

"Domain: Eukaryota
  Kingdom: Metazoa
    Phylum: Mollusca
      Class: Gastropoda
        Subclass: Caenogastropoda
          Order: Architaenioglossa

Superfamily: Ampullarioidea
Family: Ampullariidae
Genus: *Pomacea*
Species: *Pomacea maculata*"

Size, Weight, and Age Range

From CABI (2017):

"Adult *P. maculata* can reach up to 165 mm in shell height and weigh over 200g (Kyle et al., 2009; Hayes et al., 2012)."

"Anecdotal estimates suggest *P. maculata* can live for up to 8 years."

Environment

From CABI (2017):

"*P. maculata* occurs in shallow parts of slow-moving bodies of fresh water, close to riverbanks, at the edges of lakes and in ponds, in wetlands and irrigated wetland croplands and in drainage/irrigation ditches. It has been reported from estuaries (EFSA Panel on Plant Health, 2012) but its salinity tolerance probably prevents its extensive penetration into such brackish habitats (Ramakrishnan, 2007), although eggs remain viable when exposed to periodic inundations typical of a tidal regime and modest, albeit reduced, growth and survival occurs at moderate salinities (5 and 10‰) (Martin and Valentine, 2014). […] Ramakrishnan (2007) […] examined tolerance to environmental temperature (15.2-36.6°C), salinity (0-6.8‰) and pH (4.0-10.5). Ramakrishnan (2007) also showed that the maximum desiccation tolerance of *P. maculata* was loss of 58% of total corporeal plus extracorporeal water and that it is a moderate regulator of oxygen consumption when subjected to progressive hypoxia, maintaining a normal oxygen uptake rate down to a critical PO_2 of 80-120 Torr depending on temperature, and suggested that *P. maculata* would be most successful in oxygenated, flowing-water (but only slow-flowing) habitats."

Climate/Range

From CABI (2017):

"The most northern latitude at which *P. maculata* populations occur is the Ebro River delta in Spain (EFSA Panel on Plant Health, 2012; Horgan et al., 201[4]; Andre and Lopez, 2013), where it has been introduced. The southernmost latitude at which it occurs appears to be near Buenos Aires, Argentina (Hayes et al., 2012; Byers et al., 2013). Buenos Aires is one the coldest areas in the native range of the species, with average temperatures of 4-6 °C in the coldest months. In Houston, Texas, USA, where many populations of introduced *P. maculata* exist, temperatures can reach highs of 33 °C."

Distribution Outside the United States

Native

From CABI (2017):

"*P. maculata* has a wide native range in South America extending from the Rio de la Plata in Argentina and Uruguay, through Paraguay and northwards in Brazil through the Pantanal to north of Manaus in Amazonia, overlapping with the range of *P. canaliculata* in the south (Hayes et al., 2008, 2009a, b, 2012)."

Introduced

From CABI (2017):

"**Country**	[…]	**Origin**	**First Reported**	[…]	**References**
Cambodia		Introduced	1995		Cowie, 2002; Hayes et al., 2008; Cowie, 1995
Israel		Introduced	2008		Roll et al., 2008
Japan		Introduced	2008/2013		Matsukura et al., 2008; Matsukura et al., 2013
[…]					
Korea, Republic of		Introduced	2008		Hayes et al., 2008; Matsukura et al., 2013
-Peninsular Malaysia		Introduced	2008		Hayes et al., 2008
Philippines		Introduced	2013		Matsukura et al., 2013
Singapore		Introduced	2008		Hayes et al., 2008
Thailand		Introduced	1990		Keawjam & Upatham, 1990; Hayes et al., 2008
Vietnam		Introduced	2008		Hayes et al., 2008
[…]					
Spain		Introduced	2009		Andre & Lopez, 2013; Horgan et al., 201[4]; MMAMRM (Ministerio de Medio Ambiente y Medio Rural y Marino), 2011"

Means of Introduction Outside the United States

From CABI (2017):

"The primary pathways of intentional introduction by people have been the aquaculture industry and the aquarium trade (Cowie, 2002; Cowie and Hayes, 2012). The former has probably been the main source of the invasion of *P. maculata* in Asia […]"

"Eggs or hatchlings can be accidentally introduced to new locations as *P. maculata* females will lay clutches on any hard surface, including boats (EFSA Panel on Plant Health, 2012). If the clutch stays out of the water, it can develop over a period of two weeks or so and then hatch into a different body of water on the next boat trip, perhaps after the boat has travelled great distances on a trailer, as reported for zebra mussels by Britton and McMahon (2005). It is possible that snails (especially small juveniles or hatchlings) or their eggs may also be transported on wetland plants or propagules used for outplanting, as suggested for *P. canaliculata* (Cowie, 2002; Levin et al., 2006)."

Short Description

From CABI (2017):

"The adult shell is globose, thick, occasionally malleate (predominantly in Brazilian specimens) but generally smooth (sometimes with faint axial growth lines) and ~35 to >165 mm in shell height. The shell coils dextrally – that is, when viewed with the apex uppermost the aperture is on the right side of the shell. […] The shell is yellowish brown or yellow–green to greenish brown or dark chestnut, sometimes with reddish to green–brown or dark brown spiral bands of variable number and thickness. The shell has five or six whorls on average, increasing rapidly in size, with a deep suture between the whorls. The shoulder of the whorls is angulate. The shell spire is generally low but variable. The aperture is large and generally ovoid, and the inside lip of the shell is pale yellow to reddish orange."

"The operculum (the trap-door like structure attached to the upper part of the animal's foot and used to close the shell aperture when the animal withdraws into the shell) is dark brown; it is horny (corneous) in texture and somewhat flexible, and is uniformly concave in females, but concave at the centre and becoming convex toward the margins in males."

"The foot is oval with a squarish anterior edge. The tentacles are long and tapering, highly extensible and with large but short eye stalks at their outer bases. The snout is short, squarish and with lateral, anterior tips elaborated into long tapering labial palps. The neck is modified on the left into a long, extensible siphon. The mantle cavity is deep and broad, occupying a third to half of the body whorl. In males the penis sheath is visible just behind the mantle edge above the right tentacle. The lung occupies most of the left side of the mantle and the gill is situated in the mantle roof, anterior to the lung and just posterior to the base of the siphon."

Biology

From GISD (2016):

"Apple snails readily consume vascular plants in contrast to periphyton resources commonly associated with aquatic snails (Burlakova et al. 2008, Qiu & Kwong 2009, as cited in [Burks] et al. 2010). The island apple snail is likely to pose the greatest threat to native submersed macrophytes, which generally have a lower cellulose and lignin content and a higher protein content, and are easier to access by snails (Burlakova et al. 2009)."

From Benson (2016):

"The sexes are separate and fertilization is internal (Andrews, 1964). Bright pink egg masses are laid on emergent vegetation or manmade structures above the water. They are held in place when the secreted mucous dries (Andrews, 1964). Individual eggs are very small, approximately 1-2 millimeter in diameter. An egg mass may contain over 2000 eggs (Barnes et al., 2008)."

From CABI (2017):

"In Texas, with a warm temperate climate, females tend to start laying clutches near the end of spring or start of summer and continue throughout summer and the warmer months of autumn. Seasonal patterns have not been studied in the native range of *P. maculata*. No study has yet documented the potential or limitations for reproduction in the species but anecdotal observations suggest that mature female snails can lay one clutch every 7-10 days, with clutch size ranging widely but averaging over a thousand eggs per clutch (Barnes et al., 2008; Burks et al., 2010). Their reproductive capacity certainly exceeds that reported for other *Pomacea* species (Cowie, 2002). Viable clutches usually take 10-14 days to hatch (Barnes et al., 2008; Horn et al., 2008). […] Immersion of the eggs, especially for extensive periods, reduces hatching success."

"Age or size at first reproduction has not been studied in *P. maculata* but based on anecdotal evidence, juvenile *P. maculata* mature and can start producing very small egg clutches at 9-12 months old."

"Burlakova et al. (2010) best described the invasive populations of *P. maculata* in a study conducted in southeastern Texas. In permanent habitats, such as ponds and lakes, they observed low densities (fewer than two snails per square meter), stable populations, and the same size structure through the year. […] In contrast, ephemeral agricultural habitats contained extremely high densities (>130 snails per square meter), and furthermore, snail size and numbers varied through time, both peaking in autumn."

Human Uses

From CABI (2017):

"The impetus to introduce the snails [to Asia] was their perceived potential to provide an alternate, cheaper human food source as well as a gourmet product for export. […] A large market did not develop in Asia for introduced apple snails, primarily *P. canaliculata* but probably also including *P. maculata*. With the global need to find alternate protein sources, the culinary industries of various countries might explore further the use of apple snails as a local delicacy or ethnic cuisine. However, there is a risk of further spread of the snails, and consequent negative impacts, associated with such efforts."

"For professional researchers, because of the anatomical, physiological and behavioural adaptations of apple snails, the group in general provides a powerful model for addressing a number of ecological and evolutionary questions (Hayes et al., 2009b)."

"Sometimes intentionally but frequently accidentally (due to taxonomic confusion and difficulty of identification), vendors might sell *P. maculata* as an aquarium snail for cleaning algae off aquarium walls. However, due to the snails' preference for macrophytes over algae as a food resource, this species has limited application in the aquarium trade."

"Apple snails, though not *P. maculata* specifically, have been suggested for control of weeds in wetland rice (e.g. Wada, 2006)."

Diseases

From Teem et al. (2013):

"This species can serve as a host for the rat lungworm, *Angiostrongylus cantonensis* [Chen 1935], a parasite that can cause disease in people who consume infected mollusks."

From Dodd et al. (2016):

"Avian vacuolar myelinopathy (AVM) is a neurologic disease causing recurrent mortality of Bald Eagles (*Haliaeetus leucocephalus*) and American Coots (*Fulica americana*) at reservoirs and small impoundments in the southern US. […] Previous studies link the disease to an uncharacterized toxin produced by a recently described cyanobacterium, *Aetokthonos hydrillicola* gen. et sp. nov. that grows epiphytically on submerged aquatic vegetation (SAV). The toxin accumulates, likely in the gastrointestinal tract of waterbirds that consume SAV, and birds of prey are exposed when feeding on the moribund waterbirds. *Aetokthonos hydrillicola* has been identified in all reservoirs where AVM deaths have occurred and was identified growing abundantly on an exotic SAV hydrilla (*Hydrilla verticillata*) in Lake Tohopekaliga (Toho) in central Florida. Toho supports a breeding population of a federally endangered raptor, the Florida Snail Kite (*Rostrhamus sociabilis*) and a dense infestation of an exotic herbivorous aquatic snail, the island applesnail (*Pomacea maculata*), a primary source of food for resident Snail Kites. We investigated the potential for transmission in a new food chain and, in laboratory feeding trials, confirmed that the AVM toxin was present in the hydrilla/*A. hydrillicola* matrix collected from Toho. Additionally, laboratory birds that were fed apple snails feeding on hydrilla/*A. hydrillicola* material from a confirmed AVM site displayed clinical signs (3/5), and all five developed brain lesions unique to AVM. This documentation of AVM toxin in central Florida and the demonstration of AVM toxin transfer through invertebrates indicate a significant risk to the already diminished population of endangered Snail Kites."

No OIE-reportable diseases have been documented for this species.

Threat to Humans

From Teem et al. (2013):

"This mollusk serves as an intermediate host of the rat lungworm parasite (*Angiostrongylus cantonensis*), which can cause eosinophilic meningitis in humans who consume infected mollusks. A PCR-based detection assay was used to test nonindigenous apple snails for the rat lungworm parasite in Louisiana, Texas, Mississippi, and Florida. Only apple snails obtained from the New Orleans, Louisiana, area tested positive for the parasite. These results provide the first evidence that *Angiostrongylus cantonensis* does occur in nonindigenous apple snails in the southeastern United States."

From CABI (2017):

“It can directly affect two aquatic crops: taro (*Colocasia esculenta*) and rice (*Oryza sativa*), but probably others.”

3 Impacts of Introductions

From Cattau et al. (2010):

“Despite acknowledging that exotic species can exhibit tremendous influence over native populations, few case studies have clearly demonstrated the effects of exotic prey species on native predators. We examined the effects of the recently introduced island apple snail (*Pomacea insularum*) on the foraging behavior and energetics of the endangered snail kite (*Rostrhamus sociabilis plumbeus*) in Florida. […] When foraging for *P. insularum*, snail kites dropped a greater proportion of snails, and they experienced increased handling times and decreased consumption rates; however, kites foraging for *P. insularum* also spent a smaller proportion of the day in flight. Estimates of net daily energy balances between kites feeding on *P. insularum* versus [native] *P. paludosa* were comparable for adults, but juveniles experienced energetic deficiencies when feeding on the exotic snail. Due to this discrepancy, we hypothesize that wetlands invaded by *P. insularum*, such as Lake Tohopekaliga, may function as ecological traps for the snail kite in Florida by attracting breeding adults but simultaneously depressing juvenile survival.”

From Monette et al. (2016):

“This study examined the differences between adult life-stage native *Pomacea paludosa* (Florida Applesnail) and adult non-native *Pomacea maculata* (Giant Applesnail) grazing behavior and rates on *Vallisneria americana* (Tapegrass), a plant of restoration importance, to assess the potential ecological impact. […] The observed grazing behavior of adult life-stage specimens of the 2 species differed substantially, with Florida Applesnail grazing along blade edges and Giant Applesnail completely cutting off blades from their bases. These results also show that Giant Applesnail consumed and removed more Tapegrass biomass at a faster rate than the native Florida Applesnail. The introduction of Giant Applesnail, with its greater herbivory and total biomass damage rates over the native apple snail and behavior that removes leaf blades, may shift competitive interactions in Tapegrass communities under pressure from non-native plant invaders such as *Hydrilla verticillata* (Waterthyme).”

From Posch et al. (2013):

“The Florida apple snail, *Pomacea paludosa* (Say, 1829), is the only native *Pomacea* species in North America. Due to alterations in wetland hydrologic conditions, populations have been declining for several years (Darby, Bennetts & Percival, 2008). This reduction has had a negative impact on the federally endangered snail kite, *Rostrhamus sociabilis*, which feed predominately on apple snails (Stevens et al., 2002). […] In July 2011, 10 *P. maculata* egg clutches were collected from a drainage canal in Indian River County, Florida and 30 native snail egg clutches were collected from the Fort Drum Wildlife Management Area, Florida. Eggs from both species were allowed to hatch naturally in the laboratory, and hatching occurred within 1–2 weeks of collection. […] Snails were randomly selected and stocked into one of five treatment ratios with four replicates each: 30 natives (30N:0E), 30 exotics (0N:30E), 15 natives:15 exotics (15N:15E), 24 natives:6 exotics (24N:6E), or 6 natives:24 exotics (6N:24E). […] Increased presence of *P. maculata* resulted in lower growth rates in native [*P. paludosa*] snails, especially in treatments where exotic snails were dominant. Suppressed growth has also been recorded when juvenile native snails were stocked with adult *P. maculata* at varying densities (Conner et al., 2008). These results suggest that native snails may be susceptible to interspecific competition with the exotics, as has been demonstrated before with other snail species (Riley, Dybdahl & Hall, 2008). It is thought that enhanced feeding rates and higher conversion efficiencies may give the exotic *Pomacea* snails a competitive edge (Morrison & Hay, 2011). In our study, it is unknown whether or not the exotic snails consumed a greater proportion of the food. However, there is currently no evidence that *P. maculata* is displacing *P. paludosa* through resource competition (Pomacea Project, Inc., 2013)."

From CABI (2017):

"The snails' herbivory is the main factor affecting habitats and the increasing spread of *P. maculata* populations, such as their invasion of the Florida Everglades, causes concern. Whilst quantitative consumption data remain uncollected from the field, various laboratory studies indicate that *P. maculata* acts as a generalist herbivore, and quickly consumes available resources. When given the opportunity, it can indiscriminately eliminate aquatic macrophytes by consuming them at a relatively rapid rate. On a small scale, the effects may not provoke action, but populations with higher densities would magnify this pattern and increase the ecological impact. In a study of *P. canaliculata* (the identification is probably correct), Laos Carlsson et al. ([2004]) found that apple snail herbivory contributed to a shift in alternative stable states of a lake from a clear to a turbid condition. However, no studies on how *P. maculata* might alter ecosystem processes, particularly nutrient cycling, have been conducted. Nonetheless *P. maculata* may also be able to cause such an impact, which might be expected given the larger size of the species relative to *P. canaliculata* and other invertebrates."

4 Global Distribution

Figure 1. Known global established locations of *Pomacea maculata*. Map from GBIF (2016). Points in northeastern Brazil and Venezuela do not represent known established locations (see Distribution Outside the United States), so they were not included in climate matching.

5 Distribution Within the United States

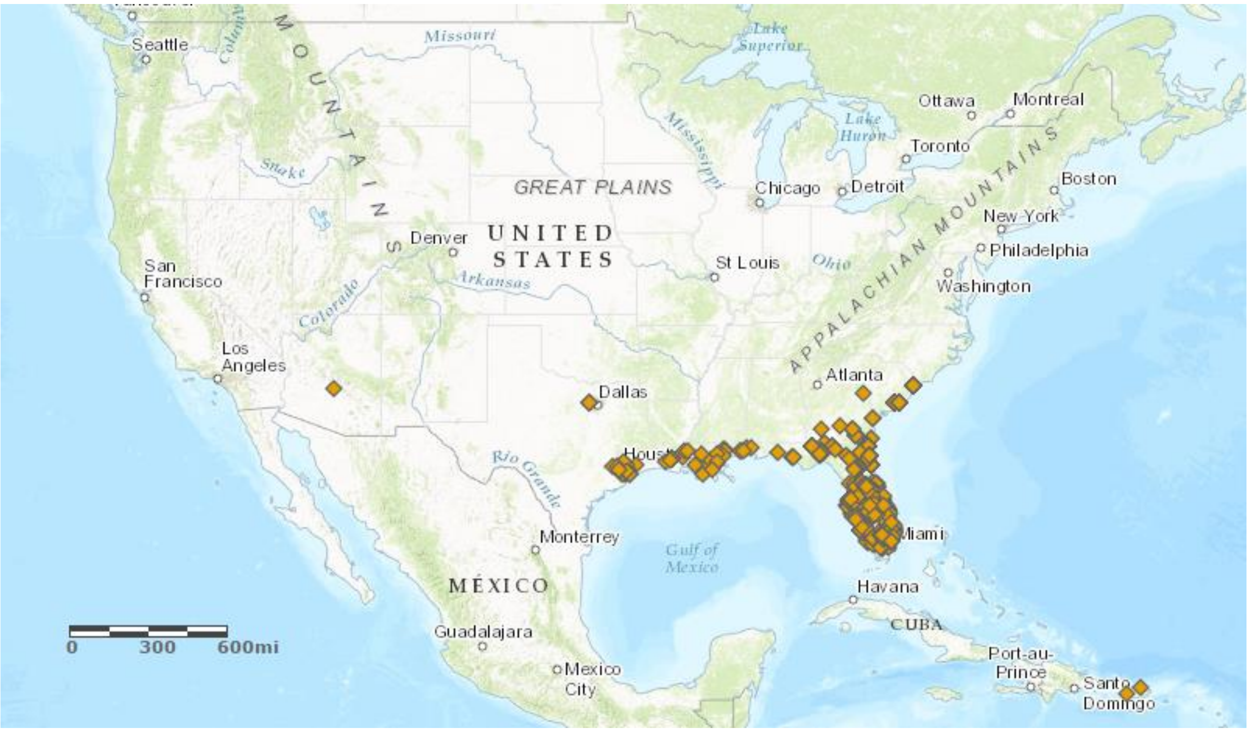

Figure 2. Known established locations of *Pomacea maculata* in the United States. Map from Benson (2016).

6 Climate Matching

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean Distance) was medium to high throughout much of the southern and southwestern United States, with particularly high matches in Florida, Texas, and Arizona. The climate match was low in New England, the north-central U.S., and the West (apart from the Southwest and southern California). Climate 6 proportion indicated that the contiguous U.S. has a high climate match. Proportions greater than or equal to 0.103 indicate a high climate match; the Climate 6 proportion of *Pomacea maculata* is 0.195.

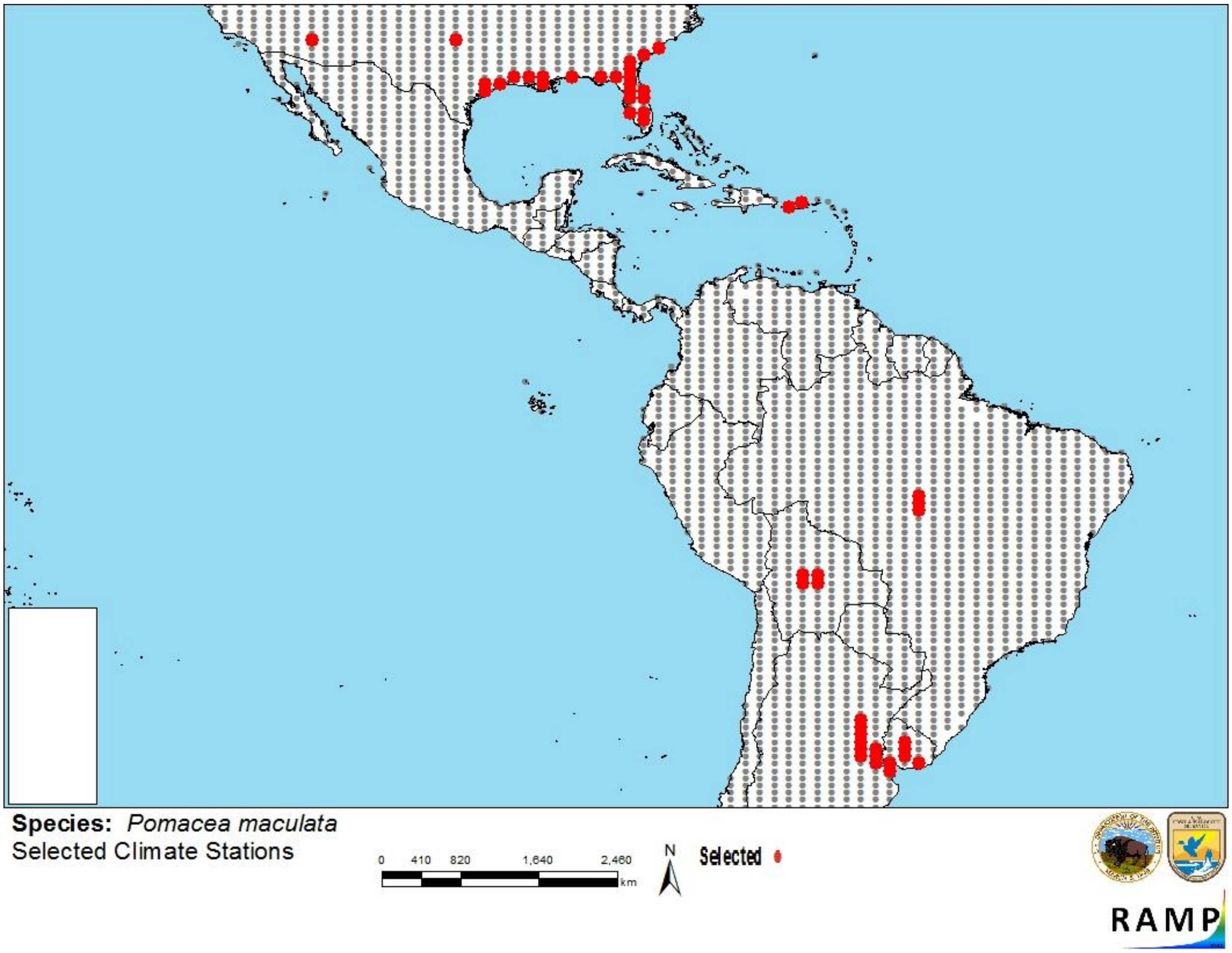

Figure 3. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *Pomacea maculata* climate matching. Source locations from GBIF (2016) and Benson (2016).

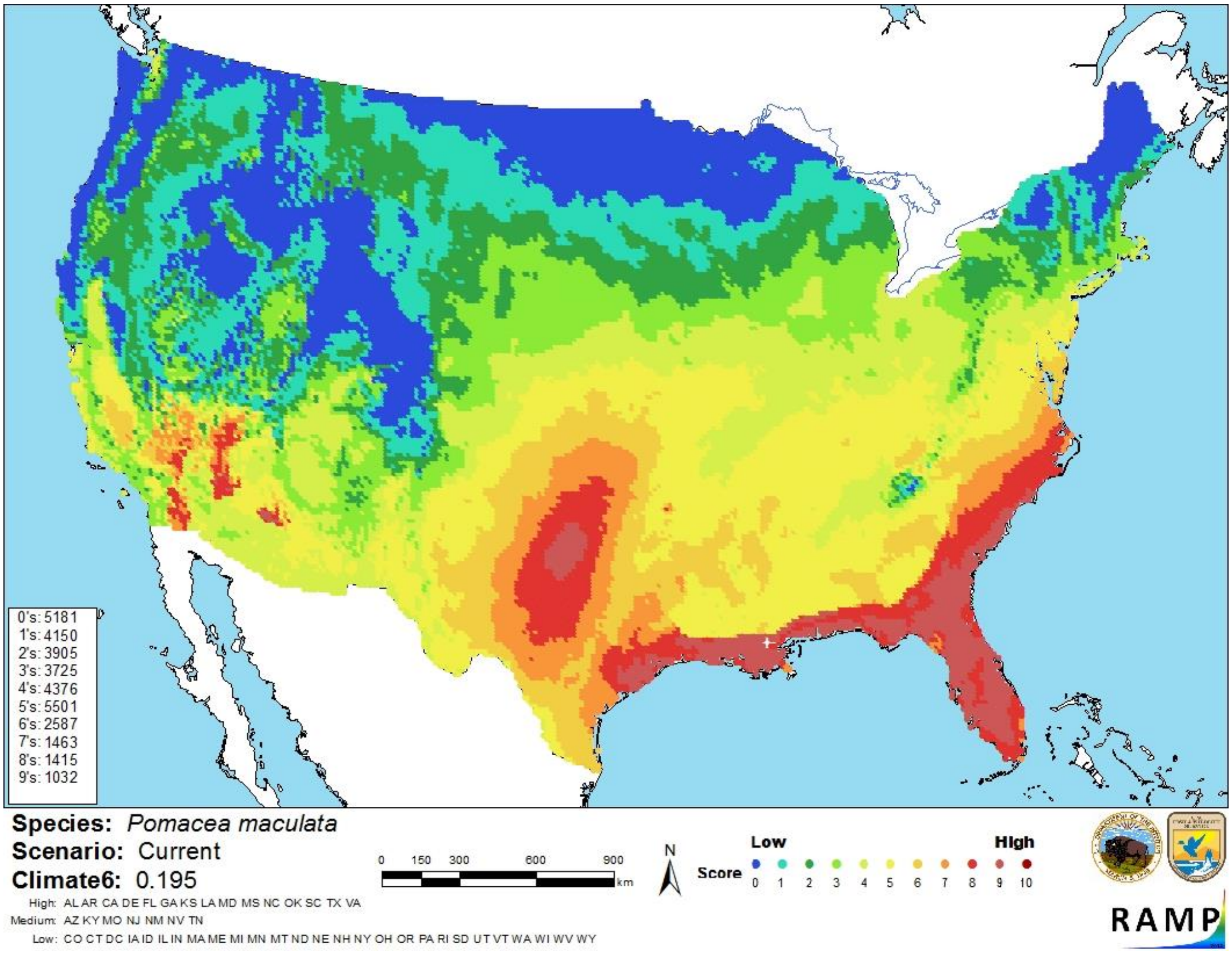

Figure 4. Map of RAMP (Sanders et al. 2014) climate matches for *Pomacea maculata* in the contiguous United States based on source locations reported by GBIF (2016) and Benson (2016). 0= Lowest match, 10=Highest match. Counts of climate match scores are tabulated on the left.

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≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

7 Certainty of Assessment

Information on the biology, distribution, and impacts of *P. maculata* is readily available. Negative impacts from introductions of this species are documented in the scientific literature, and additional negative impacts are inferred due to impacts from closely related *Pomacea* species. Some uncertainty in the literature exists due to difficulty distinguishing *P. maculata* from *P. canaliculata.* Certainty of this assessment is medium.

8 Risk Assessment

Summary of Risk to the Contiguous United States

P. maculata is a freshwater snail native to South America that is used in the aquarium and aquaculture trades. Its introduction has been documented in at least seven southern U. S. states. This species has a high climate match with the United States, especially in the south. Some confusion exists between *P. maculata* and *P. canaliculata*, another highly invasive applesnail species. Despite this, *P. maculata* has well-documented ecological impacts, such as negatively affecting the feeding success of the endangered snail kite in Florida and depressing the growth of a native congener. Overall risk posed by this species is high.

Assessment Elements

- **History of Invasiveness (Sec. 3): High**
- **Climate Match (Sec. 6): High**
- **Certainty of Assessment (Sec. 7): Medium**
- **Overall Risk Assessment Category: High**

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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