

## *Pila scutata* (a snail, no common name)

### Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, May 2012

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Photo: Naturalis Biodiversity Center. Licensed under CC0 1.0 (public domain). Available: [https://commons.wikimedia.org/wiki/File:Naturalis\\_Biodiversity\\_Center\\_-\\_RMNH.MOL.157762\\_-\\_Pila\\_scutata\\_\(Mousson,\\_1848\)\\_-\\_Ampullariidae\\_-\\_Mollusc\\_shell.jpeg](https://commons.wikimedia.org/wiki/File:Naturalis_Biodiversity_Center_-_RMNH.MOL.157762_-_Pila_scutata_(Mousson,_1848)_-_Ampullariidae_-_Mollusc_shell.jpeg). (May 2018).

## 1 Native Range and Status in the United States

### Native Range

From Benson (2018):

“Indonesia, Malaysia, Myanmar [*sic*], Philippines, Cambodia, Laos, Vietnam, and Singapore (Low et al. 2013).”

From Sri-aroon and Richter (2012):

“This species is widely distributed throughout southeast Asia (Brandt 1974). It is present in Indonesia (Celebes, Jawa, Bali and Kalimantan), Andaman Island (India), Malaysia (West Malaysian States Malacca, Johore, Negri Sembilan, Selangor and Perak, and might be assumed to be present in Malaysian parts of Borneo), and is also known to be widely distributed in southern Thailand, but only locally in west and northern Thailand (Brandt 1974). Its presence in Indochina is doubtful (Brandt 1974).”

## **Status in the United States**

From Joshi et al. (2017):

“The Asian *Pila scutata* has been recorded from the islands of Maui, Molokai and Oahu (Cowie, 1995a), although it was not recorded on Maui and Molokai by Cowie et al. (2007) and Tran et al. (2008). It has since been confirmed as still present on Oahu (Cowie, Hayes, C. Tran & K. Matsukura, unpublished).”

“In the Pacific, it was [...] introduced to Guam (Smith, 1992) [...]”

Limited information is available on trade in *P. scutata* in the United States, but the initial introduction to Hawaii may have been as a food item (Joshi et al. 2017).

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

From Joshi et al. (2017):

“In the Pacific, *Pila scutata* was introduced without authorisation, either accidentally or deliberately as a food item to both Hawaii (first recorded 1966; Cowie, [1995]) and Guam (first recorded 1984; Smith, 1992), probably from the Philippines (Tran et al., [...] 2008).”

## **Remarks**

From Joshi et al. (2017):

“The true native range of *Pila scutata* is difficult to determine (Tan et al., 2013). In Singapore, it has declined drastically (Tan et al., 2013; Ng et al., 2014), but it used to be widespread and seemed to be strongly associated with anthropogenically disturbed habitats. It has been considered native in Singapore, with the first record in 1847 (not definitive) or 1885 (Low et al., 2013), but has also been recorded from Indonesia, Peninsular Malaysia, Myanmar, Borneo, Vietnam, Cambodia, Laos and the Philippines, and with doubt from Thailand and China (Low et al., 2013; Tan et al., 2013) and Taiwan (as *Pila leopoldvillensis*, see above). However, whether it occurred naturally in these countries or whether it became widespread as a widely introduced popular food item, is not clear (Tan et al., 2013).”

## 2 Biology and Ecology

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### Taxonomic Hierarchy and Taxonomic Standing

From MolluscaBase (2018):

“Animalia (Kingdom) > Mollusca (Phylum) > Gastropoda (Class) > Caenogastropoda (Subclass) > Architaenioglossa (Order) > Ampullarioidea (Superfamily) > Ampullariidae (Family) > Ampullariinae (Subfamily) > *Pila* (Genus) > *Pila scutata* (Species)”

“Status accepted”

From Benson (2018):

“Synonyms and Other Names: *Pila conica*”

Information searches for this ERSS were conducted using both the synonym, *Pila conica*, as well as the accepted scientific name, *Pila scutata*, as search terms.

### Size, Weight, and Age Range

From Tan et al. (2013):

“*Pila scutata* is relatively small for the genus, attaining shell height of about 50 mm although specimens seen are usually considerably smaller.”

### Environment

From Sri-aroon and Richter (2012):

“The species is found in calm freshwater habitats, such as paddy fields, ponds, klongs, pools and slow moving streams. [...] It is amphibious.”

### Climate/Range

No information available.

### Distribution Outside the United States

Native

From Benson (2018):

“Indonesia, Malaysia, Myanmar [*sic*], Philippines, Cambodia, Laos, Vietnam, and Singapore (Low et al. 2013).”

From Sri-aroon and Richter (2012):

“This species is widely distributed throughout southeast Asia (Brandt 1974). It is present in Indonesia (Celebes, Jawa, Bali and Kalimantan), Andaman Island (India), Malaysia (West

Malayan States Malacca, Johore, Negri Sembilan, Selangor and Perak, and might be assumed to be present in Malaysian parts of Borneo), and is also known to be widely distributed in southern Thailand, but only locally in west and northern Thailand (Brandt 1974). Its presence in Indochina is doubtful (Brandt 1974).”

## Introduced

From Joshi et al. (2017):

“In the Pacific, it was [...] introduced to [...] Palau, where it was eradicated (Eldredge, 1994), and is probably the species identified as the African *Pila leopoldvillensis* in Taiwan [...]. It is widespread in Asia but its native range in Asia is not known definitively and it is possible that part of this wide Asian distribution results from introductions [...].”

## Means of Introduction Outside the United States

From Joshi et al. (2017):

“The main reasons for introduction of these species have included introduction as a human food resource, as a domestic aquarium snail, for biocontrol of other snails that act as vectors of the parasites causing schistosomiasis, and for control of aquatic weeds.”

“It was [...] introduced to Palau in 1984 or 1985, probably for the same purpose [as a food item], but was eradicated by 1987 (Eldredge, 1994).”

“The species identified in Taiwan as the African *Pila leopoldvillensis* is in fact probably Asian *Pila scutata* [...]. It was imported into Taiwan in 1975 for culture for food prior to the introduction of the South American *Pomacea canaliculata* (Wu & Lee, 2005), [...].”

## Short Description

From Tan et al. (2013):

“Shell colour is usually dark olive-green or brown with darker spiral bands, but this is often obscured by brownish stains on shells of living snails. The umbilicus of *Pila scutata* is obsolete, and unlike *Pomacea canaliculata*, there are no channels at its suture. Its operculum is solid and calcareous.”

## Biology

From Tan et al. (2013):

“*Pila scutata* appears to favour shady, sheltered places, often found among vegetation. The main diet of *Pila scutata* consists of vascular water plants, including partially decayed plant matter (Berry, 1963; Palmieri et al., 1979). The eggs are white, and are laid in clusters; each estimated to contain about a hundred or more eggs [...]. Egg clusters are deposited above the waterline, usually in depressions in the damp soil, and in sheltered spots under vegetation.”

From Sri-aroon and Richter (2012):

“It can aestivate and tolerates drying out.”

## Human Uses

From Joshi et al. (2017):

“The main reasons for introduction of these species have included introduction as a human food resource, as a domestic aquarium snail, for biocontrol of other snails that act as vectors of the parasites causing schistosomiasis, and for control of aquatic weeds.”

“The local apple snails [in the Philippines], *Pila scutata* and *Pila ampullacea*, can sometimes be found for sale at farmers’ markets. They are cooked and consumed as a special delicacy by local people.”

## Diseases

From Joshi et al. (2017):

“*Echinostoma ilocanum* was discovered in the Philippines at the beginning of the twentieth century. Bonne et al. (1953) found it infecting humans in Malaysia, with *Pila scutata* as one of the first intermediate hosts, among other snails.”

“Several *Pila* spp. (*P. scutata*, *P. gracilis*, *P. virescens* and *P. ampullacea*) have been found infected with *Angiostrongylus cantonensis* in Malaysia and Thailand (Harinasuta et al., 1965).”

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

## Threat to Humans

From Joshi et al. (2017):

“[Echinostomiasis] is a disease caused by infections by flukes of the family Echinostomatidae (echinostomes) via oral intake of undercooked infected snails and clams. Twenty species belonging to eight genera of this family are known to infect humans worldwide (Chai, 2009). The main clinical symptoms involve diarrhoea, abdominal pain, anaemia and eosinophilia (Mehlhorn, 2008). In cases with heavy loads of echinostomes mortality is caused by intestinal perforation or marked malnutrition and anaemia. *Echinostoma ilocanum* was discovered in the Philippines at the beginning of the twentieth century. Bonne et al. (1953) found it infecting humans in Malaysia, with *Pila scutata* as one of the first intermediate hosts, among other snails. Human infections with *E. ilocanum* were later reported in Indonesia, China, Thailand, India and Cambodia. The main cause of these infections was the consumption of raw or undercooked flesh of *Pila scutata* (Sohn et al., 2011).”

“Angiostrongyliasis is caused by two species of nematodes of the genus *Angiostrongylus* (Secernentea, Metastrongyloidea). *Angiostrongylus cantonensis* causes eosinophilic meningitis

and meningoencephalitis, and the disease is sometimes referred to as neuroangiostrongyliasis, [...]”

“*Angiostrongylus cantonensis* was discovered by Chen (1935) in the pulmonary arteries and hearts of domestic rats in China, and therefore became known as the rat lungworm. [...] Humans acquire *A. cantonensis* by eating raw or undercooked intermediate or paratenic hosts that contain the infective third larval stage of the worm, or inadvertently by eating vegetables contaminated with infected snails. When infective larvae are ingested, they penetrate the intestinal wall and reach the circulatory system, and finally reach the brain where the third stage larvae develop to a sub-adult stage. These worms are not able to leave the brain and they generally die. The immune reaction causes inflammation, and the meninges and cerebral vessels are infiltrated with lymphocytes, plasma cells and eosinophils (Wang et al., 2008). Also, physical brain lesions, and even in the spinal cord, are caused especially by the movements of live worms (Chotmongkol & Sawanyawisuth, 2002; Cowie, [2013]). The larvae can also move to the eyes and cause ocular angiostrongyliasis, resulting in visual disturbance (Sawanyawisuth et al., 2006).”

“Several *Pila* spp. (*P. scutata*, *P. gracilis*, *P. virescens* and *P. ampullacea*) have been found infected with *A. cantonensis* in Malaysia and Thailand (Harinasuta et al., 1965). These species are used as a food resource and thus could cause human infection.”

### **3 Impacts of Introductions**

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From Cowie et al. (2009):

“[...] *Pila* spp. are local or minor crop pests (Cowie [2002], Levin et al. 2006) and recognized parasite vectors (Hollingsworth and Cowie 2006), [...]”

## 4 Global Distribution

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**Figure 1.** Known global distribution of *Pila scutata*. Map from GBIF Secretariat (2018). Points in Cuba were excluded from climate match analysis because they did not match any known distribution of *P. scutata* and were recorded under a synonym which may refer to another species. Points in China were excluded from the climate match analysis because the species presence in that country is doubtful (Joshi et al. 2017). No georeferenced occurrences were available for Myanmar, Laos, or Vietnam.

## 5 Distribution Within the United States

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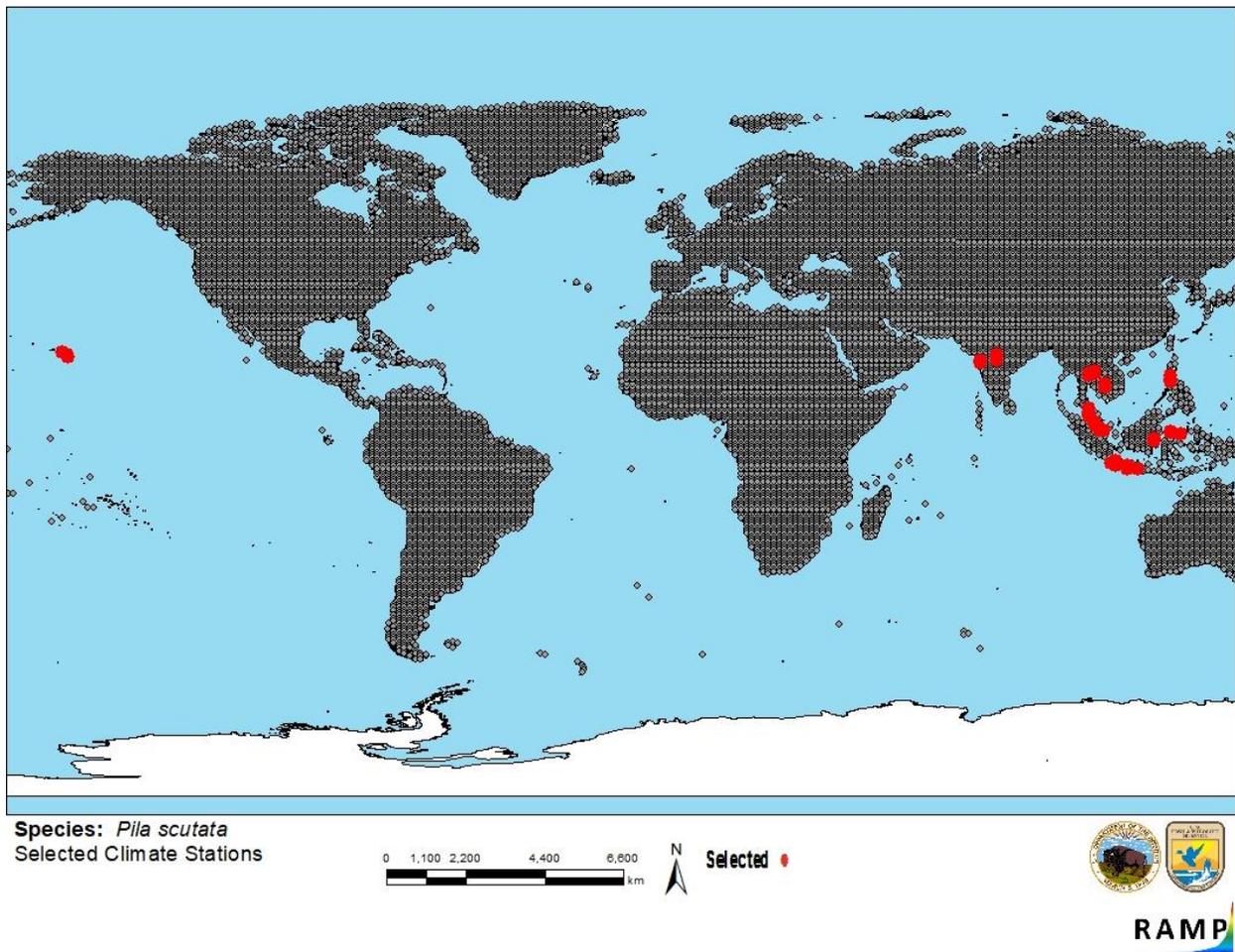


**Figure 2.** Known distribution of *Pila scutata* in the United States. Map from Benson (2018). The only confirmed established population is in Oahu (Joshi et al. 2017), so all other locations were excluded from the climate matching analysis.

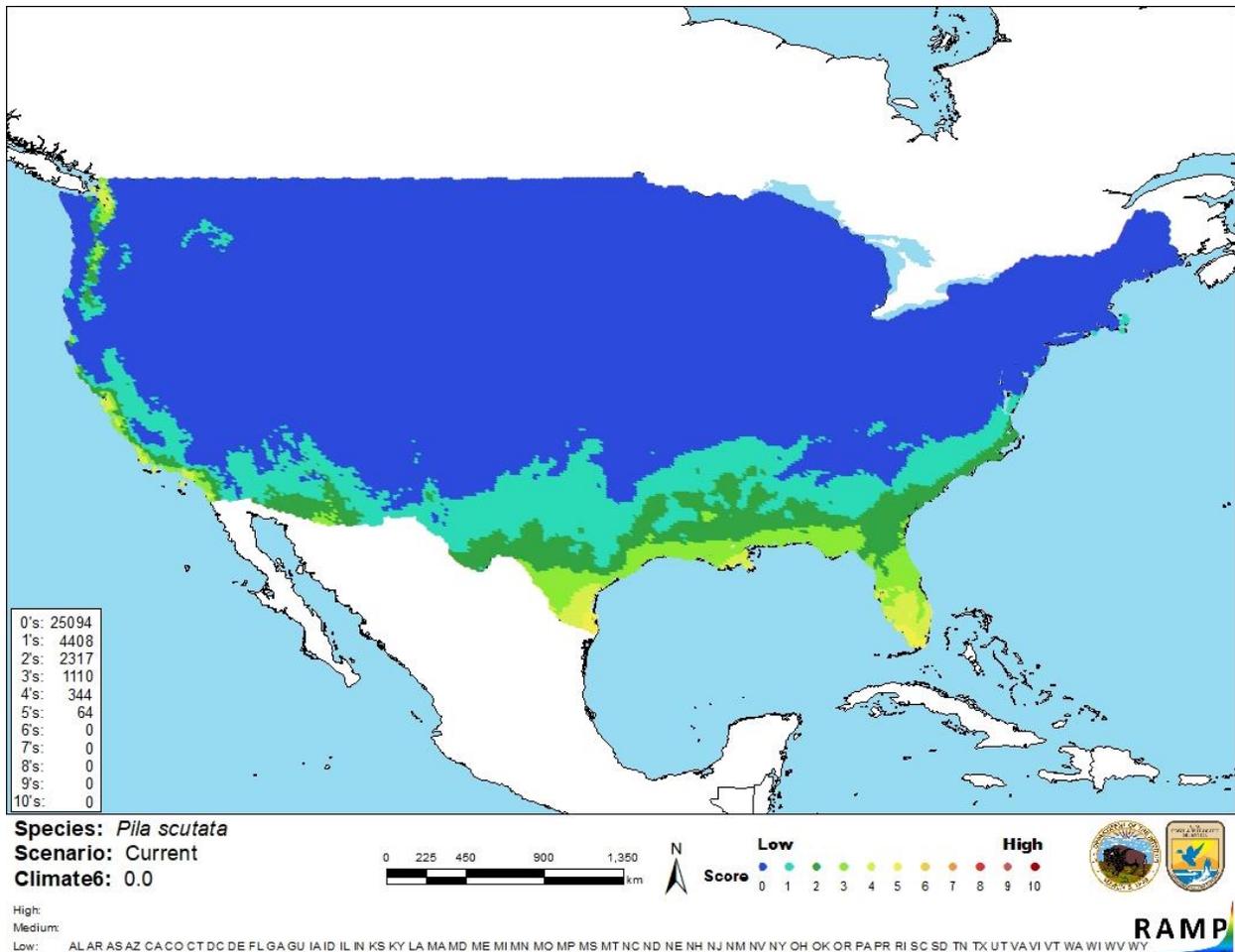
## 6 Climate Matching

### Summary of Climate Matching Analysis

The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.000, which is a low climate match. The range for a low climate match is between 0.000 and 0.005, inclusive. Medium climate matches occurred in the vicinity of Seattle, Washington, along the central and southern coast of California, in southern Texas, in southeastern Louisiana, and in southern Florida. The remainder of the contiguous United States showed low climate match.



**Figure 3.** RAMP (Sanders et al. 2018) source map showing weather stations selected as source locations (red; Hawaii, India, Thailand, Cambodia, Malaysia, Singapore, Indonesia, Philippines) and non-source locations (gray) for *Pila scutata* climate matching. Source locations from GBIF Secretariat (2018).



**Figure 4.** Map of RAMP (Sanders et al. 2018) climate matches for *Pila scutata* in the contiguous United States based on source locations reported by GBIF Secretariat (2018). 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
$0.000 < X < 0.005$	Low
$0.005 < X < 0.103$	Medium
$\geq 0.103$	High

## 7 Certainty of Assessment

There is adequate information available about the biology of *Pila scutata*; however, information on impacts of introductions is lacking. This species has been documented as established outside of its native range. No credible information about specific negative impacts of introductions of *Pila scutata* is available. The native range of this species is also uncertain. Certainty of this assessment is low.

## 8 Risk Assessment

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### Summary of Risk to the Contiguous United States

*Pila scutata* is an amphibious freshwater snail native to Southeast Asia, although the exact extent of its native range is uncertain. This species has been introduced outside of its native range due to its use as a food source, a domestic aquarium snail, for biocontrol of other snails that act as vectors of the parasites causing schistosomiasis, and for control of aquatic weeds. It is established in Hawaii on the island of Oahu but has not been reported from the continental United States. The genus *Pila* is reportedly a vector of human parasites and a minor crop pest, but there is no information specific to *Pila scutata* causing disease or crop damage. Further, there is no information available on impacts of its introduction to ecosystems. *P. scutata* has a low climate match with the contiguous United States. Further information is needed to determine what impacts, if any, this species has where introduced. Certainty of this assessment is therefore low, and the overall risk assessment category is Uncertain.

### Assessment Elements

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

## 9 References

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**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

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**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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