

# Ghost Ramshorn (*Biomphalaria havanensis*)

## Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2023

Revised, May 2023

Web Version, 5/2/2024

Organism Type: Mollusk

Overall Risk Assessment Category: Uncertain



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<https://www.inaturalist.org/observations/34225867> (February 2023).

## 1 Native Range and Status in the United States

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### Native Range

From NatureServe (2023):

“This species is widely distributed in the West Indies and Central America (Thompson, 1999). In North America, it is distributed in parts of Florida, Louisiana and Texas; Arizona, and Mexico (Burch, 1989). It is also known from Cuba but only from Havana (Pointier et al., 2005). Burch (1989) also cites Puerto Rico.”

From Cordeiro and Perez (2011):

“Native: Anguilla; Antigua and Barbuda; Barbados; Belize; Costa Rica; Cuba; Dominica; Dominican Republic; El Salvador; Grenada; Guadeloupe; Guatemala; Honduras; Jamaica; Martinique; Mexico; Montserrat; Nicaragua; Panama; Puerto Rico; Saint Kitts and Nevis; Saint Lucia; United States (Arizona, Florida, Louisiana, Texas); Venezuela, Bolivarian Republic of; Virgin Islands, British”

## **Status in the United States**

From Benson et al. (2023):

“Native Range: The southern United States in southern Florida, central and southern Louisiana, and much of Texas (Malek 1969) and Arizona; [...] Puerto Rico [...] (Burch and Tottenham 1980).”

“Established in South Carolina.”

Benson et al. (2023) also report nonindigenous occurrences of *B. havanensis* in Idaho (Upper Snake-Rock watershed) and Mississippi.

From NatureServe (2023):

“Common in ditches and ponds in southeast Florida from Brevard and Okeechobee Cos. south to Monroe Co., Florida (Thompson, 1999). An introduced population was discovered in South Carolina Pond at Charles Towne Landing State Park in Charlestown (Dillon and Stewart, 2003). Dillon et al. ([2007]) report a specimen lot at the Georgia Museum of Natural History from McIntosh Co., but this occurrence has not been confirmed.”

No records of *Biomphalaria havanensis* in trade in the United States were found.

## **Regulations**

Arkansas (Arkansas Game and Fish Commission 2022) prohibits this species from being imported for aquaculture or for private stocking purposes.

While effort was made to find all applicable regulations, this list may not be comprehensive.

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

From Benson et al. (2023):

“Dillon and Dutra-Clarke (1992) assumed that *Biomphalaria havanensis* are being introduced as hitchhikers on aquatic plants or with stocked fishes. Several aquaculture facilities have known populations of the snail (Rosser et al. 2016, Griffin et al. 2018).”

## Remarks

From Dillon (2019):

“Back in the early 1990s Dr. Emile Malek confirmed that our Charleston [South Carolina] population was specifically identical to populations widespread in Florida, Texas, and Louisiana. But for years there was no consensus regarding the identity of any *Biomphalaria* population anywhere in the USA – some authorities referring them all to *B. havanensis* (Pfeiffer 1839), other authorities preferring *B. obstructa* (Morelet 1849). The underlying problem has been a general uncertainty regarding the identity of the *havanensis* type population in Cuba (Paraense & Deslandes 1958, Yong et al. 1997). The more recent genetic and morphological studies of Yong et al. (2001) and DeJong et al. (2001) have, however, firmed up the identity of *B. havanensis* in Cuba and convincingly demonstrated a match of our U.S. populations to it.”

“The taxonomic history of the genus to which *havanensis* has been assigned is a long and complicated one, including the nomina *Taphius*, *Australorbis*, and *Tropicorbis*.”

## 2 Biology and Ecology

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### Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2023):

Kingdom Animalia  
Subkingdom Bilateria  
Infrakingdom Protostomia  
Superphylum Lophozoa  
Phylum Mollusca  
Class Gastropoda  
Order Basommatophora  
Family Planorbidae  
Genus *Biomphalaria*  
Species *Biomphalaria havanensis* (Pfeiffer, 1839)

According to MolluscaBase (2024), *Biomphalaria havanensis* is the accepted scientific name for this species.

Two scientific name synonyms for *B. havanensis* have been used in the literature in the last 50 years and were included in information searches for this report: *B. temascalensis* and *Tropicorbis havanensis*.

### Size, Weight, and Age Range

From Pan American Health Organization (1968):

“The shell grows to about 13 mm in diameter and 3.5 mm in width, with about 5 whorls, increasing moderately in diameter”

From Benson et al. (2023):

“Large specimens are 9-11 mm in diameter and 2.4-2.7 mm in height (Yong et al. 1997).”

## Environment

From Cordeiro and Perez (2011):

“This species occurs in freshwater river systems and lakes and shows tolerance to a broad range of habitats including commercial channel catfish ponds, (Yost *et al.* 2009) [...]”

From Benson et al. (2023):

“*Biomphalaria havanensis* shows tolerance to a broad range of freshwater habitats and a certain degree of habitat modification (urbanization) (Vázquez Perera et al. 2010, IUCN 2019).”

## Climate

From Palomares and Pauly (2022):

“Subtropical”

## Distribution Outside the United States

### Native

Part of the native range for this species is within the United States, see section 1 for a complete description of the native range.

From NatureServe (2023):

“This species is widely distributed in the West Indies and Central America (Thompson, 1999). In North America, [...] and Mexico (Burch, 1989). It is also known from Cuba but only from Havana (Pointier et al., 2005). Burch (1989) also cites Puerto Rico.”

From Cordeiro and Perez (2011):

“Native: Anguilla; Antigua and Barbuda; Barbados; Belize; Costa Rica; Cuba; Dominica; Dominican Republic; El Salvador; Grenada; Guadeloupe; Guatemala; Honduras; Jamaica; Martinique; Mexico; Montserrat; Nicaragua; Panama; [...] Saint Kitts and Nevis; Saint Lucia; [...] Venezuela, Bolivarian Republic of; Virgin Islands, British”

### Introduced

No records were found of introduction of *Biomphalaria havanensis* in the wild outside the United States.

## Means of Introduction Outside the United States

No records were found of introduction of *Biomphalaria havanensis* in the wild outside the United States.

## Short Description

From Benson et al. (2023):

“*Biomphalaria havanensis* snails have a discoidal shape (resembling a disk) and flattened spire (Burch and Tottenham 1980). The shell is a grayish-white in color and transparent when fresh (Thompson 1999). The shell is sculptured with irregular growth striations, with adults having 5 whorls (Burch and Tottenham 1980, Thompson 1999).”

## Biology

From Benson et al. (2023):

“*Biomphalaria havanensis* is a hermaphroditic, pulmonate (lunged) aquatic snail found on all continents (Thompson 1999, Yong et al 2001). [...] Populations have been observed to occur with floating vegetation (e.g., duckweed, *Lemna*) and filamentous green algae mats (*Cladophora* and *Pithophora*; Dillon and Dutra-Clarke 1992, Dillon and colleagues 2019).”

## Human Uses

No records of *Biomphalaria havanensis* in trade were found.

## Diseases

**No information was found associating *Biomphalaria havanensis* with any diseases listed by the World Organisation of Animal Health (2023).**

From Benson et al. (2023):

“Multiple laboratory studies have identified *Biomphalaria havanensis* as a moderately suitable (Brooks 1953, McQuay 1953, Rosser et al. 2016) to suitable (Cram and Files 1946, Yong et al. 2009) intermediate host for the trematode, *Bolbophorus damnificus*. This trematode causes significant economic losses in channel catfish (*Ictalurus punctatus*) aquaculture in the southeastern USA (Rosser et al [sic] 2016, Griffin et al. 2018).”

From Stunkard (1946):

“The human schistosomes, in different parts of the world, employ a great variety of snail hosts, members of a half dozen genera, distributed among three different families and two distinct zoological orders. Related species of snails are numerous in the continental United States and the possible establishment of schistosomiasis in North America is more than an academic postulate. Indeed, Cram, Jones, and Wright (1945) have already shown that *Tropicorbis havanensis* [i.e., *Biomphalaria havanensis*], a snail of the Southern United States, may transmit *S[chistosoma] mansoni*, the causative agent of human schistosomiasis in South America and the West Indies.”

## Threat to Humans

From Rosser et al. (2016):

“The digenetic trematode *Bolbophorus damnificus* [for which *B. havanensis* is an intermediate host] is a significant hindrance to the production of farm-raised catfish in the southeastern USA. Severe infections with *Bolbophorus damnificus* can result in death, but the real damage lies in mild to moderate infections, which can go unnoticed by producers. Research has shown even mild infections can inhibit production to the point of operating at a net loss.”

*B. havanensis* may be able to serve as a host for a parasite causing human schistosomiasis (Stunkard 1946; see Diseases).

## 3 Impacts of Introductions

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No information available on impacts of reported introductions.

Arkansas prohibits import of this species for commercial aquaculture or private stocking purposes (Arkansas Game and Fish Commission 2022).

## 4 History of Invasiveness

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The History of Invasiveness for *Biomphalaria havanensis* is classified as Data Deficient. There are records of nonnative introductions of *B. havanensis* and at least one introduction resulted in an established population in South Carolina. However, no information is available on direct impacts of introduction of this species in South Carolina or elsewhere outside the native range. Additionally, no evidence was found of trade involving this species.

## 5 Global Distribution

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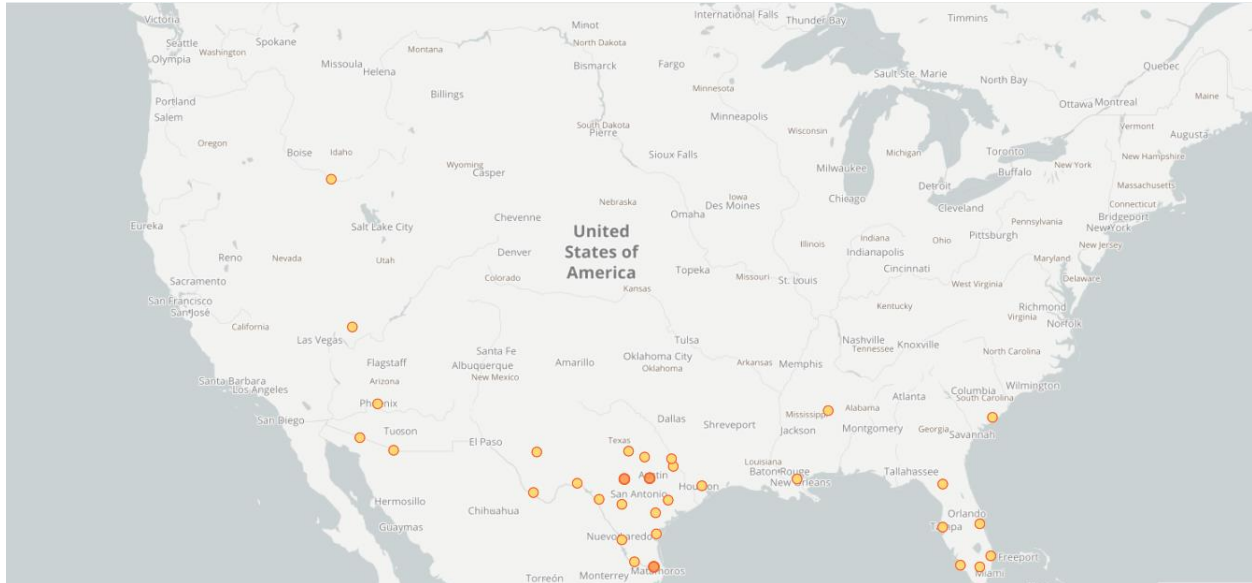


**Figure 1.** Reported global distribution of *Biomphalaria havanensis*. Map from GBIF Secretariat (2023). Observations are reported from the contiguous United States (Florida, South Carolina, Mississippi, Louisiana, Texas, Arizona, Nevada, and Idaho), Mexico, Puerto Rico, Cuba, Haiti, Trinidad and Tobago, and Venezuela. Occurrences reported in Idaho, Mississippi, Nevada, and Trinidad are not known to represent established populations and were not used as source points in the climate matching analysis.

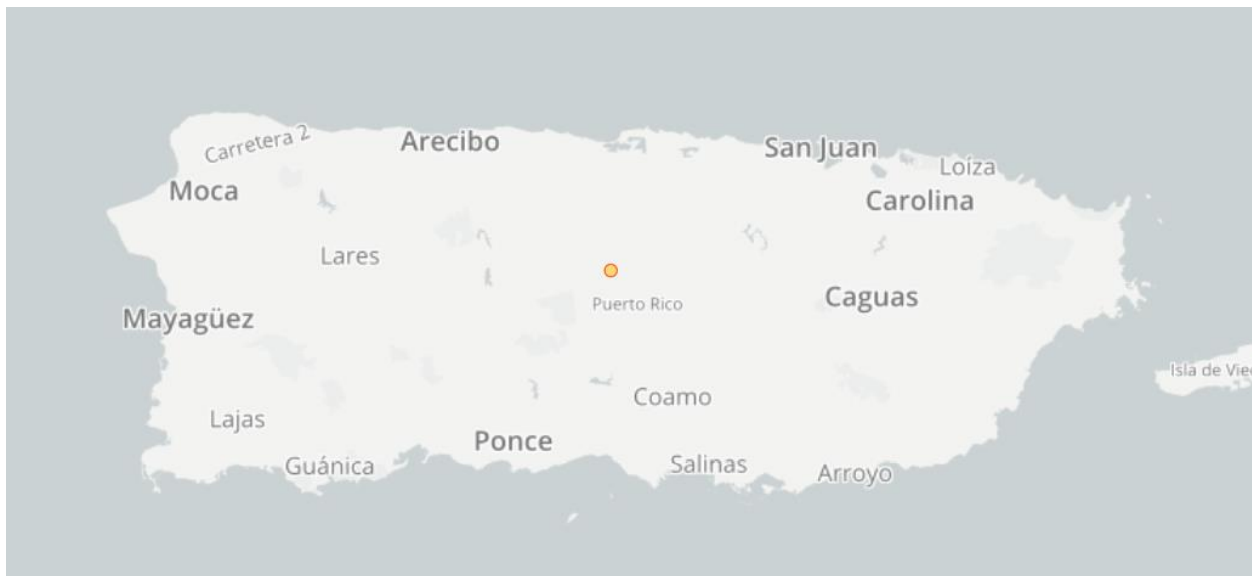
Additional source points were added to the climate matching analysis for Lesser Antillean islands reported by Cordeiro and Perez (2011) as part of the native range of *B. havanensis*: Anguilla, Antigua and Barbuda, Barbados, British Virgin Islands, Dominica, Grenada, Guadeloupe, Martinique, Montserrat, St. Kitts and Nevis, St. Lucia.

Cordeiro and Perez (2011) and NatureServe (2023) also indicate that this species is widespread throughout Central America. However, no georeferenced occurrences were available for parts of the native range in Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, or Panama. Additionally, no georeferenced occurrences were available for Jamaica or Venezuela, also reported to be part of the native range (Cordeiro and Perez 2011).

## 6 Distribution Within the United States



**Figure 2.** Reported distribution of *Biomphalaria havanensis* in the United States. Map from GBIF-US (2023). Observations are reported from Idaho, Florida, South Carolina, Louisiana, Texas, Arizona, and Mississippi. Observations reported in Idaho, Mississippi, and Nevada are not known to represent established populations and were not used as source points in the climate matching analysis.



**Figure 3.** Reported distribution of *Biomphalaria havanensis* in Puerto Rico. Map from GBIF-US (2023).



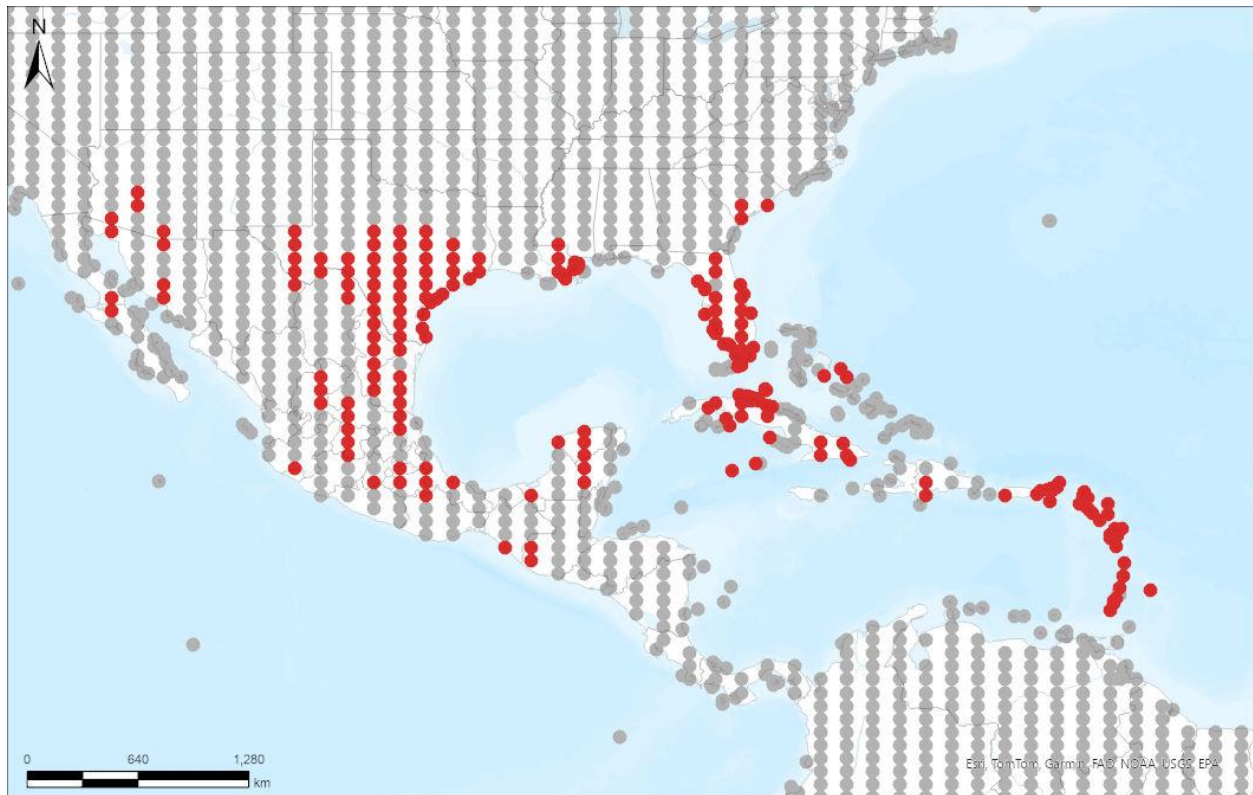
## 7 Climate Matching

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### Summary of Climate Matching Analysis

The climate match for *Biomphalaria havanensis* in the contiguous United States was high along the southern Atlantic and Gulf coasts, throughout much of Texas, and in the Southwest, including the native and established range of the species in Florida, Louisiana, Texas, Arizona, and South Carolina. Medium to high matches extended from the areas listed above into southern New Jersey and Kentucky, on either side of the Appalachian Range, and into the Southern Plains and central California. The climate match was lower in the northern parts of the country, with the lowest scores occurring along the northwest Pacific coast and in parts of the Rocky Mountains. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.522, indicating that Yes, there is establishment concern for this species outside its native range. The Climate 6 score is calculated as: (count of target points with scores  $\geq 6$ )/(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 *Biomphalaria havanensis* (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.



**Species:** *Biomphalaria havanensis*

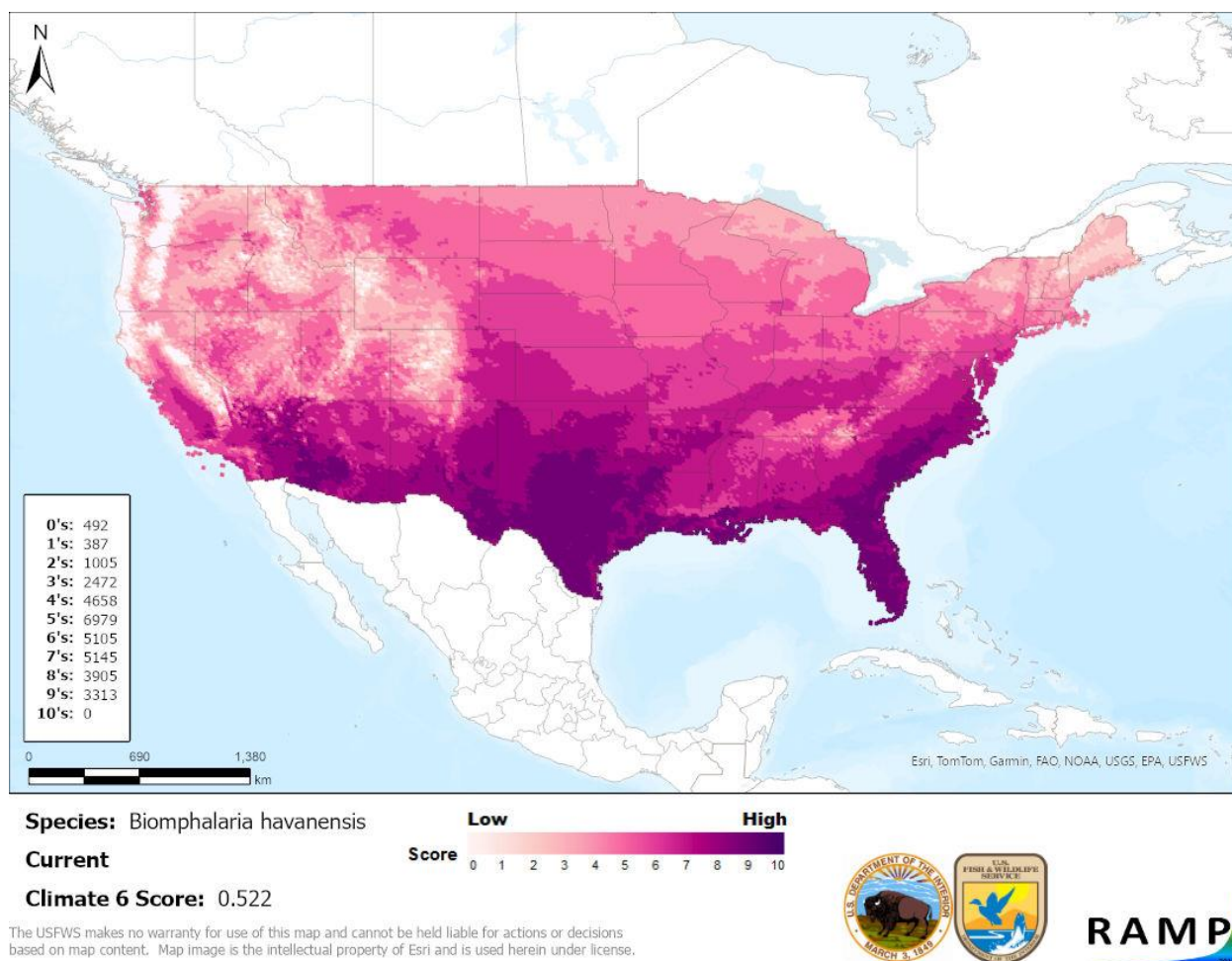
**Selected Climate Stations** ●



**RAMP**

The USFWS makes no warranty for use of this map and cannot be held liable for actions or decisions based on map content. Map image is the intellectual property of Esri and is used herein under license.

**Figure 4.** RAMP (Sanders et al. 2023) source map showing weather stations in the North and South America selected as source locations (red; United States [Florida, South Carolina, Mississippi, Louisiana, Texas, Arizona, Puerto Rico, U.S. Virgin Islands], Mexico, Guatemala, Cuba, Dominican Republic, Anguilla, Antigua and Barbuda, Barbados, British Virgin Islands, Dominica, Grenada, Guadeloupe, Martinique, Montserrat, St. Kitts and Nevis, St. Lucia) and non-source locations (gray) for *Biomphalaria havanensis* climate matching. Source locations from GBIF Secretariat (2023). 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 *Biomphalaria havanensis* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). 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 Certainty of Assessment for *Biomphalaria havanensis* is classified as Low. There is information available on the biology, ecology, and distribution of *B. havanensis*. However, there was no information available on impacts of introduction to help determine the risk this species poses in the contiguous United States beyond its native range.

## 9 Risk Assessment

### Summary of Risk to the Contiguous United States

*Biomphalaria havanensis*, Ghost Ramshorn, is a snail native to the southern United States, Mexico, Central America, and the Caribbean. This freshwater snail can tolerate a broad range of habitats from lakes and rivers to catfish ponds. *Biomphalaria havanensis* is thought to be transported unintentionally via hitchhiking on aquatic plants or stocked fish. It can serve as a host of the trematode parasite *Bolbophorus damnificus*, which is known to contribute to mortality

in channel catfish aquaculture, and it may also be capable of harboring a parasite responsible for human schistosomiasis. However, the impacts of introduction of *B. havanensis* outside the native range remain unknown. Arkansas is the only State that regulates this species, prohibiting importation for aquaculture and private pond stocking. The History of Invasiveness for *Biomphalaria havanensis* is classified as Data Deficient due to the lack of information regarding actual impacts of introductions. The climate matching analysis for the contiguous United States indicates establishment concern for this species outside its native range. The highest climate matches were found along the southern boundary of the contiguous United States, including areas both within and outside the native range. The Certainty of Assessment for this species is classified as Low due to lack of information on impacts of introductions. The Overall Risk Assessment Category for *Biomphalaria havanensis* 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:** Potential host for multiple harmful parasites
- **Overall Risk Assessment Category: Uncertain**

## 10 Literature Cited

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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 11.**

Arkansas Game and Fish Commission. 2022. Certain exotic species prohibited. Arkansas Game and Fish Commission Code Book 26.13.

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## 11 Literature Cited in Quoted Material

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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.**

Brooks CP. 1953. A comparative study of *Schistosoma mansoni* in *Tropicorbis havanensis* and *Australorbis glabratus*. The Journal of Parasitology 39(2):159–165.

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Cram EB, Files VS. 1946. Laboratory studies on the snail host of *Schistosoma mansoni*. The American Journal of Tropical Medicine and Hygiene 1:715–720.

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Dillon RT Jr and colleagues. 2019. The freshwater gastropods of North America volume 1: Atlantic drainages, Georgia through Pennsylvania. Available: [http://www.fwgna.org/species/planorbidae/b\\_obstructa.html](http://www.fwgna.org/species/planorbidae/b_obstructa.html). [Source did not provide full citation for this reference.]

Dillon RT Jr, Dutra-Clarke AVC. 1992. *Biomphalaria* in South Carolina. Malacological Review 25:129–130.

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# Appendix

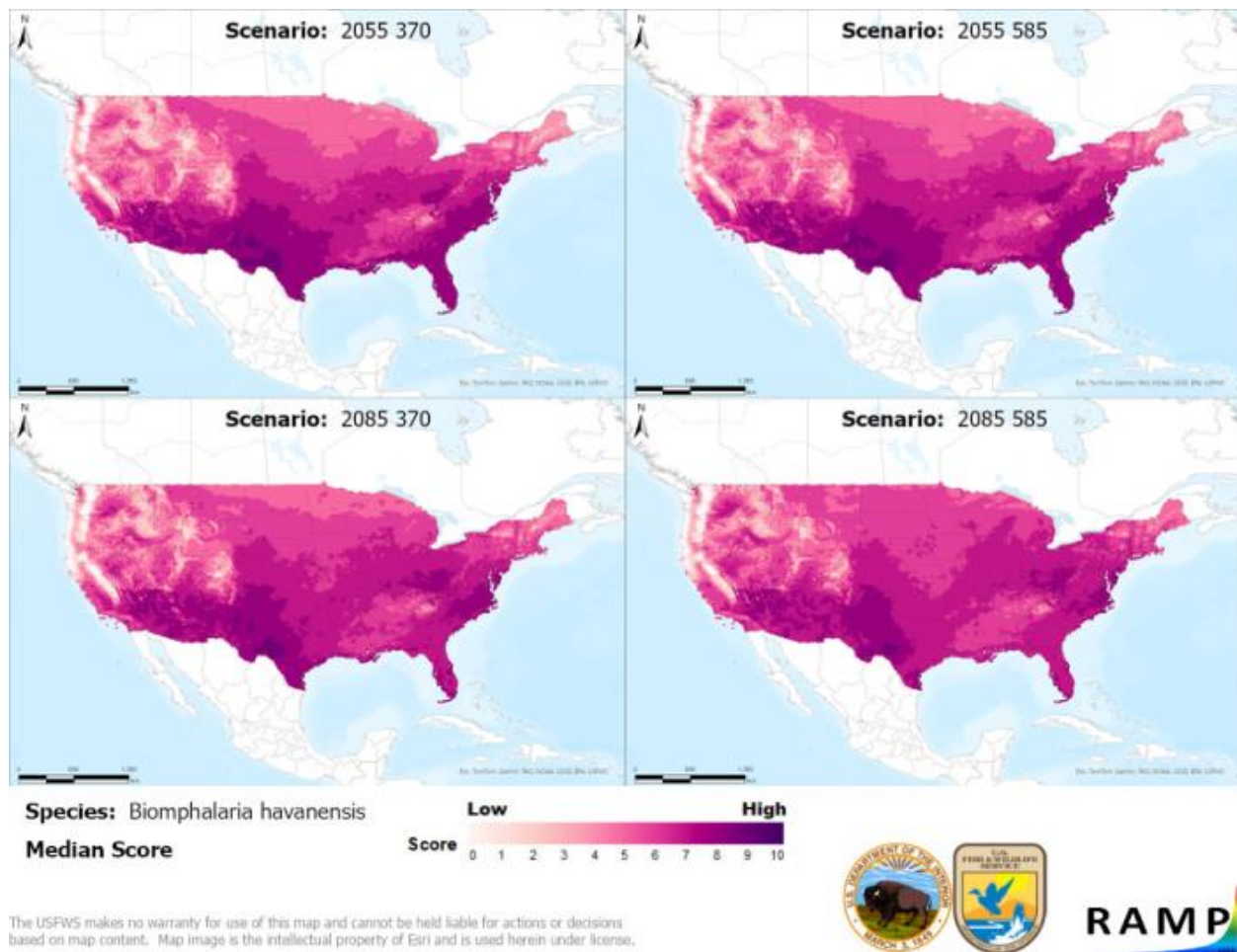
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## Summary of Future Climate Matching Analysis

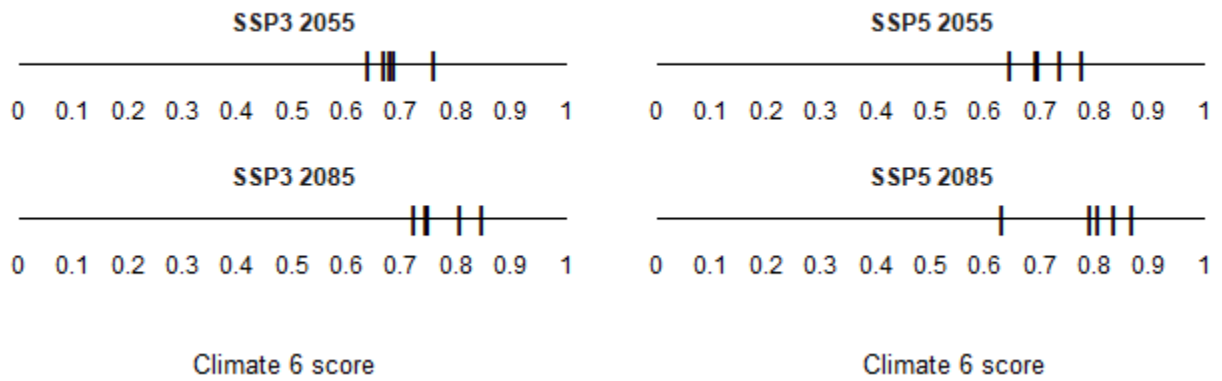
Future climate projections represent two Shared Socioeconomic Pathways (SSP) developed by the Intergovernmental Panel on Climate Change (IPCC 2021): SSP5, in which emissions triple by the end of the century; and SSP3, in which emissions double by the end of the century. Future climate matches were based on source locations reported by GBIF Secretariat (2023) and Cordeiro and Perez (2011).

Under the future climate scenarios (figure A1), on average, high climate match for *Biomphalaria havanensis* was projected to occur in the Mid-Atlantic, Southern Atlantic Coast, Southern Florida, Gulf Coast, Southern Plains, and Southwest regions of the contiguous United States. Areas of low climate match were projected to occur in the Northern Pacific Coast region primarily, with additional areas of low match scattered through the Western mountains, Colorado Plateau, and New England. Particularly in the eastern and central United States, areas of higher climate match shifted slightly northward with time and from SSP3 to SSP5. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.629 (model: MPI-ESM1-2-HR, SSP5, 2085) to a high of 0.864 (model: UKESM1-0-LL, 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 (0.522, figure 5) falls below 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 (figure A3). Under one or more time step and climate scenarios, areas within the Colorado Plateau, Great Basin, Great Lakes, and Northeast saw a large increase in the climate match relative to current conditions. Additionally, areas within the Appalachian Range, Mid-Atlantic, Northern Plains, Southern Plains, Southwest, and Western Mountains saw a moderate increase in the climate match relative to current conditions. Under one or more time step and climate scenarios, areas within the Gulf Coast region saw a large decrease in the climate match relative to current conditions. Additionally, areas within California, the Southeast more generally, the Southern Plains, and Southwest saw a moderate decrease in the climate match relative to current conditions. Additional, very small areas of large or moderate change may be visible on the maps (figure A3). Moderate to large changes were much more common at the 2085 time step than at the 2055 time step, and changes were also more extreme under SSP5 than under SSP3.

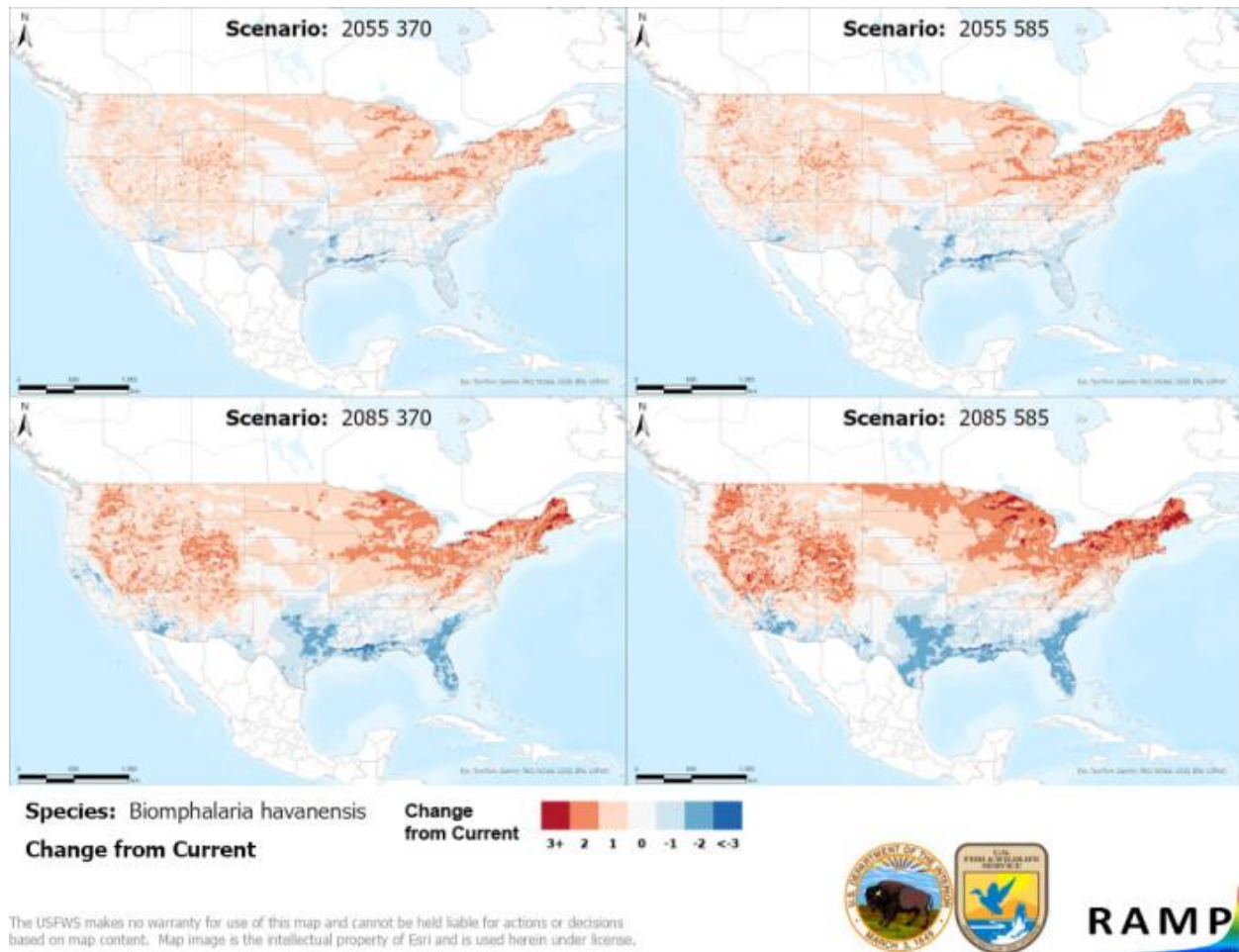




**Figure A1.** Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Biomphalaria havanensis* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023) and Cordeiro and Perez (2011). 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 *Biomphalaria havanensis* 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 4) and the median target point score for future climate scenarios (figure A1) for *Biomphalaria havanensis* based on source locations reported by GBIF Secretariat (2023) and Cordeiro and Perez (2011). 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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