

White Piranha (*Serrasalmus brandtii*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, April 2012

Revised, July 2018 and August 2019

Web Version, 8/21/2019



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http://eol.org/data_objects/26104603. (July 2018).

1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2018):

“South America: São Francisco River basin in Brazil.”

Santos and Caramaschi (2011) report *S. brandtii* from the Santo Antônio River, located within Paraguaçu River basin in eastern Brazil, where it is presumably also native.

From Seriously Fish (2018):

“Possibly restricted to the rio São Francisco watershed in eastern Brazil, where it has been recorded throughout the system including major tributaries including the rios das Velhas, Grande, and Urucuia. It may also occur in the rio Itapicuru which is located south of the São Francisco but is not connected to it.”

Status in the United States

This species has not been reported as introduced or established in the wild in the United States. This species has a history of trade in the United States, for example:

From AquaScape Online (2018):

“Brandtii Piranha 6" (*Serrasalmus Brandtii*) [*sic*] [...] This item is currently out of stock”

“*S. Brandtii* [*sic*] is only found in a geographically very limited range, which commercial traders visit rarely. Because of this, this species is a rare sight in home aquariums, and the prices for this fish are usually very high.”

Possession or importation of fish of the genus *Serrasalmus*, or fish known as “piranha” in general, is banned or regulated in many States. Every effort has been made to list all applicable State laws and regulations pertaining to this species, but this list may not be comprehensive.

From Alabama Department of Conservation and Natural Resources (2019):

“No person, firm, corporation, partnership, or association shall possess, sell, offer for sale, import, bring, release or cause to be brought or imported into the State of Alabama any of the following live fish or animals: [...] Any Piranha or any fish of the genera *Serrasalmus*, *Pristobrycon*, *Pygocentrus*, *Catorprion*, or *Pygopristus*; [...]”

From Alaska State Legislature (2019):

“Except as provided in (b) - (d) of this section, no person may import any live fish into the state for purposes of stocking or rearing in the waters of the state.

(b) Live oysters native to and originating from the Pacific Coast of North America may be imported [...]

(c) Ornamental fish not raised for human consumption or sport fishing purposes may be imported into the state, but may not be reared in or released into the waters of the state. Fish wastes and waste water from ornamental fish may not be released directly into the waters of the state.

(d) Weathervane scallops originating from wild stocks or cultured stocks in the Southeastern Alaska and Yakutat Areas may be imported for aquaculture purposes and may be released only into the waters of the Southeastern Alaska and Yakutat Areas under a stock transport permit required by this chapter [...]

From Arizona Office of the Secretary of State (2013):

““Restricted live wildlife” means wildlife that cannot be imported, exported, or possessed without a special license or lawful exemption.”

“Fish listed below are considered restricted live wildlife [...]

Piranha, all species of the genera *Serrasalmus*, *Serrasalmo*, *Phygoctrus*, *Teddyella*, *Rooseveltiella*, and *Pygopristis* [...]

From Arkansas Game and Fish Commission (2019):

“It is unlawful to import, transport, or possess any species commonly known as [...] piranha [...]

“EXCEPTION: These species may be possessed for display and educational purposes by written permit approved by the Commission.”

From California Department of Fish and Wildlife (2019):

“All species of piranha are on California’s list of restricted animals and cannot be imported, transported, or possessed without a permit.”

From Colorado Secretary of State (2019):

“For the following aquatic species or viable gametes thereof, because of the potential for a detrimental affect [*sic*] on existing fish and their habitat in Colorado, and except as enumerated in these regulations, or as authorized in writing by the Division of Wildlife for management purposes only; the release or the importation, transportation, stocking, sale, acquisition or possession for release is prohibited. Persons who have proof of possession issued prior to January 1,1978 or who obtain prior approval from the Division of Wildlife may possess the following species:

a. Piranha: including members of the genera *Serrasalmus*, *Roosevelthiella*, and *Pygocentrus*.”

From Connecticut Secretary of State (2016):

“The importation or possession of piranha of the subfamily: Serrasalminae, genera *Serrasalmus*, *Serrasalmo*, *Pygocentrus*, *Teddyella*, *Rooseveltiella* and *Pygopristus*, [...] is prohibited except that the Commissioner may at his discretion issue permits for the importation and possession, when it is in the public interest, for public display purposes, of specimens of piranha [...]”

Serrasalmus brandtii is listed on Florida’s Prohibited Nonnative Species List (FFWCC 2019).

From Georgia Department of Natural Resources (2019):

“The animals listed below are examples of the exotic species regulated under Georgia Law. [...] The exotic species listed below, except where otherwise noted, may not be held as pets in Georgia. [...] Piranha; all species”

From Hawaii Department of Agriculture (2019):

“For example, the following are prohibited from entry or possession by private individuals in the State. [...] *Piranhas*”

From Idaho Office of the Administrative Rules Coordinator (2019):

“No person may possess, cultivate, import, ship, or transport any invasive species [...] into or through the state of Idaho following the effective date of this rule, unless the person possessing, importing, shipping or transporting has obtained a permit under Section 103, or unless otherwise exempt by this rule, as set forth in Section 104.”

“INVASIVE SPECIES – FISH. [...]

05. Piranhas, *Serrasalmus* spp., *Rosseveltiella* spp., *Pygocentrus* spp. [...]

From Illinois Department of Natural Resources (2015):

“For the purposes of Section 20-90 of the Fish and Aquatic Life Code [515 ILCS 5/20-90], the Aquatic Life Approved Species List is established. The following aquatic life categories will be considered approved for aquaculture, transportation, stocking, importation and/or possession in the State of Illinois.”

Serrasalmus brandtii does not appear on the Aquatic Life Approved Species List for Illinois.

From Kentucky General Assembly (2019):

“The live aquatic organisms established in subsections (1) through (7) of this section shall not be imported, bought, sold, or possessed in aquaria:

(1) Subfamily Serrasalminae - piranha, piraya, pirae, or tiger characins; [...]

From Louisiana State Legislature (2019):

“No person shall have in possession or sell in this state [Louisiana] a piranha or Rio Grande Cichlid; except that, piranha may be possessed and displayed at the Aquarium of the Americas, Audubon Institute, New Orleans, as authorized by a special permit issued by the department, under conditions the department deems necessary to prevent their introduction into waters of the state.”

From Maine Department of Inland Fisheries and Wildlife (2019):

“Unrestricted List [...] (no permit needed): Maine law allows the Department to maintain a list of species of fish and wildlife, including tropical fish and invertebrates, which do not require an importation, exhibition, or possession permit, and may be traded by commercial pet shops.”

Serrasalmus brandtii does not appear on the Maine Department of Inland Fisheries and Wildlife’s Unrestricted List.

From Massachusetts Division of Fisheries and Wildlife (2014):

“All aquarium trade fish may be kept without a permit except species categorically non-exempt pursuant to 321 CMR 9.01(3), and except that the following species are prohibited without a permit: [...]

(b) Piranha (*Pygocentrus* spp. and *Serrasalmus* spp.)”

From Mississippi Secretary of State (2019):

“All species of the following animals and plants have been determined to be detrimental to the State's native resources and further sales or distribution are prohibited in Mississippi. No person shall import, sell, possess, transport, release or cause to be released into the waters of the state any of the following aquatic species or hybrids thereof. However, species listed as prohibited may be allowed under a permitting process where environmental impact has been assessed.”

“[The list includes all piranhas and all species of] Subfamily Serrasalminae”

From State of Nevada (2016):

“Except as otherwise provided in this section and NAC [Nevada Administrative Code] 504.486, the importation, transportation or possession of the following species of live wildlife or hybrids thereof, including viable embryos or gametes, is prohibited: [...]

Piranhas..... All species in the genera *Serrasalmus*, *Serrasalmo*, *Pygocentrus*, *Teddyella*, *Rooseveltiella* and *Pygopristis*”

From New Mexico Department of Game and Fish (2010):

“Species importation list group IV may be for live non-domesticated animals that are considered dangerous, invasive, undesirable, state or federal listed threatened, endangered, a furbearer or any other species of concern as identified by the director. The importation of these species are prohibited for the general public but may be allowed for, scientific study, department approved restoration and recovery plans, zoological display, temporary events/entertainment, use as service animal or by a qualified expert.”

All piranha and pacu (Family Characidae) are listed in Group IV of the Director’s Species Importation List for New Mexico.

From New York State Senate (2019):

“No person shall import, export, own, possess, acquire or dispose of live piranha fish (*Serrasalmus*, *Rooseveltiella* or *Pyrocentrus [sic]*), grass carp (*Ctenopharyngodon idella*) or hybrid grass carp within the state without a license or permit issued at the discretion of the department for scientific, biological or exhibition purposes.”

From North Carolina Office of Administrative Hearings (2019):

“It shall be unlawful to transport, purchase, possess, sell, or stock in the public or private waters of North Carolina any live individuals of [...] piranha; [...]”

From Oklahoma Secretary of State (2019):

“Until such time as is necessary for the Department of Wildlife Conservation to obtain adequate information for the determination of other harmful or potentially harmful exotic species, the importation into the State and/or the possession of the following exotic fish or their eggs is prohibited: [...]

“Piranha group: *Serrasalmus* spp., *Pygocentrus* spp., *Rooseveltiella* spp., *Catopirion* spp., *Hydrocynus* spp., and *Salminus* spp.”

From South Carolina Legislature (2019):

“A person may not possess, sell, offer for sale, import, bring, cause to be brought or imported into this State [South Carolina], or release in this State the following species at any stage of its life cycle: [...] piranha (all members of *Serrasalmus*, *Rooseveltiella*, and *Pygocentrus* genera) [...]”

From Texas Parks and Wildlife (2019):

“The organisms listed here are legally classified as exotic, harmful, or potentially harmful. No person may possess or place them into water of this state except as authorized by the department.”

“Piranhas, Family Characidae

All species of genera *Catoprion*, *Pristobrycon*, *Pygocentrus*, *Pygopristis*, and *Serrasalmus*”

From Utah Office of Administrative Rules (2019):

“All species of fish listed in Subsections (2) through (30) are classified as prohibited for collection, importation and possession [...]”

(22) Piranha, (*Serrasalmus*, All species) family Characidae.”

From Virginia Department of Game and Inland Fisheries (2019):

“A special permit is required, and may be is- sued [*sic*] by the Department, if consistent with the Department’s fish and wildlife management program, to import, possess, or sell the following non-native (exotic) amphibians, fish, mollusks, aquatic invertebrates, and reptiles: [...] piranhas [...]”

Means of Introduction into the United States

This species has not been reported as introduced or established in the wild in the United States.

Remarks

From Seriously Fish (2018):

“This species is also known as ‘green piranha’ or ‘Brandt’s pirambeba’, the latter a general vernacular term for *Serrasalmus* species which may have been first applied to *S. brandtii*.”

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2018):

“Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Actinopterygii
Class Teleostei
Superorder Ostariophysi
Order Characiformes
Family Characidae
Genus *Serrasalmus*
Species *Serrasalmus brandtii* Lütken, 1875”

From Fricke et al. (2019):

“**Current status:** Valid as *Serrasalmus brandtii* Lütken 1875. Serrasalmidae.”

Size, Weight, and Age Range

From Santos et al. (2009):

“*Serrasalmus brandtii* is commonly known as “pirambeba” or “white piranha” (Jegú 2003), and can reach a total length of 31 cm and weight of 700 g (Braga 1975).”

From Honorato-Sampaio et al. (2009):

“Adult females of *S. brandtii* from the Juramento Reservoir (mean \pm s.d. 15.14 \pm 1.80 cm L_s, 108.30 \pm 42.50 g) were significantly longer and heavier than males (14.36 \pm 2.11 cm L_s, 94.25 \pm 39.60 g) (Mann–Whitney U-test, P < 0.05) [...]”

Environment

From Froese and Pauly (2018):

“Freshwater; benthopelagic.”

Climate/Range

From Froese and Pauly (2018):

“Tropical”

Distribution Outside the United States

Native

From Froese and Pauly (2018):

“South America: São Francisco River basin in Brazil.”

Santos and Caramaschi (2011) report *S. brandtii* from the Santo Antônio River, located within Paraguaçu River basin in eastern Brazil, where it is presumably also native.

From Seriously Fish (2018):

“Possibly restricted to the rio São Francisco watershed in eastern Brazil, where it has been recorded throughout the system including major tributaries including the rios das Velhas, Grande, and Urucua. It may also occur in the rio Itapicuru which is located south of the São Francisco but is not connected to it.”

Introduced

From Trindade and Jucá-Chagas (2008):

“Among the different exotic fish species found in the Barragem de Pedra Reservoir, the species *Serrasalmus brandtii* (Lütken, 1875) and *Pygocentrus piraya* (Cuvier, 1819) were accidentally introduced into the reservoir about 10 years ago [...]”

From Sales et al. (2018):

“[...] at least three other species from the neighbouring São Francisco River (*Serrasalmus brandtii*, *Moenkhausia costae*, and *Leporinus taeniatus*) were introduced into the JRB [Jequitinhonha river basin, eastern Brazil] (Andrade-Neto 2010) [...]”

From Seriously Fish (2018):

“An introduced population inhabits the Pedra do Cavalo reservoir on the rio Paraguaçu, Bahia state.”

Means of Introduction Outside the United States

From Trindade and Jucá-Chagas (2008):

“[...] probable rupture of private tanks in marginal areas during floods.”

From Sales et al. (2018):

“[...] hypothesis of anthropogenic introduction [...]”

Short Description

From Seriously Fish (2018):

“Adult individuals are uniformly golden-bronze with some reflective scales on the flanks. The caudal-fin is dark at the base, and the dorsal, adipose, anal, and caudal fins have dark margins with the remainder often reddish or yellowish. The upper head profile is distinctly concave above the eye. Juveniles possess dark spots on the body, the fins are mostly hyaline, and the head profile is less concave.”

Biology

From Honorato-Sampaio et al. (2009):

“In the Juramento Reservoir, south-eastern Brazil, the white piranha *Serrasalmus brandtii* showed a prolonged reproductive season, with evidence for multiple spawning and a reproductive peak associated with seasonal rains.”

“In general, during the breeding season, piranhas build nests and spawn multiple batches of eggs on a site prepared for egg attachment (mostly floating plant roots); one or both parents provide care for offspring (Leão, 1996).”

“*Serrasalmus brandtii* is the most abundant species in the Juramento Reservoir (16°46 S; 43°39 W), representing 22% of catches in an experimental fishery (Silva et al., 2006).”

From Trindade and Jucá-Chagas (2008):

“Comparison of the frequencies of occurrence of food items (%) determined by the analysis of stomach content revealed fish (Teleostei), scales and shrimp (*Macrobrachium amazonicum*) as the most frequent items in *S. brandtii* [...]”

“In the present study, *S. brandtii* showed a greater feeding plasticity than *P[ygocentrus] piraya*, with even the presence of Ephemeroptera, Odonata, Coleoptera, Mollusca and other invertebrates being observed in some stomachs analyzed.”

Human Uses

From Seriously Fish (2018):

“It appears infrequently in the aquarium trade but its name is sometimes misapplied to the distantly related *Pygopristis denticulata*.”

From AquaScape Online (2018):

“*S. Brandtii* [*sic*] is only found in a geographically very limited range, which commercial traders visit rarely. Because of this, this species is a rare sight in home aquariums, and the prices for this fish are usually very high.”

Diseases

No OIE-reportable diseases (OIE 2019) have been documented for this species.

From Froese and Pauly (2018):

“Procamallanus Infection 10, Parasitic infestations (protozoa, worms, etc.)”

From Moravec et al. (2008):

“The cystidicolid nematode *Cystidicoloides fischeri* (Travassos, Artigas and Pereira, 1928) is redescribed from specimens collected from the stomach of the San Francisco piranha, *Pygocentrus piraya* (Cuvier), and the white piranha, *Serrasalmus brandtii* (Lütken) (both Characidae, Characiformes) (new host records), from the Três Marias Reservoir, Upper São Francisco River, Minas Gerais state, Brazil.”

From Thatcher et al. (2008):

“*Gamidactylus piranhus* sp. nov. (Copepoda, Vaigamidae) from the nasal fossae of “San Francisco piranha”, *Pygocentrus piraya* (Cuvier, 1819) and “White piranha” *Serrasalmus brandtii* (Lütken, 1875) is described.”

From Santos et al. (2007):

“*Brasergasilus bifurcatus* sp. nov. (Copepoda, Ergasilidae, Abergasilinae) is described. Specimens of the new species were collected from the gills and nasal fossae of the serrasalmid fishes, known as “piranhas”, *Pygocentrus piraya* (Cuvier, 1819) and “pirambebas”, *Serrasalmus brandtii* (Lütken, 1875).”

From Santos et al. (2009):

“Santos (2008) found [...] *Philometra* sp. in *S. brandtii*., [sic] [...] as well as *Hysterothylacium* sp., *Goezia*. [sic] sp. and *Capillostrongyloides* sp. from these carnivorous hosts.”

“A total of 59 specimens (27 in *P[ygocentrus] piraya*, 30 in *S. brandtii* and two in *C[ichla] kelberi*) of nematode larvae found in the three hosts were identified as third stage (L₃) *Spiroxys* sp.; prevalence was higher in *S. brandtii* [...]”

“*Spiroxys* sp. was significantly more prevalent and abundant in smaller specimens of *S. brandtii*. This can be explained by the piscivorous-insectivorous feeding habit of juvenile “pirambebas”, as reported by Pompeu & Godinho (2003), including the intermediate host species of this nematode among the various arthropods eaten.”

Threat to Humans

From Froese and Pauly (2018):

“Harmless”

3 Impacts of Introductions

No information available.

The importation, possession, or trade of the piranha *Serrasalmus brandtii* is prohibited or restricted in the following states: Alabama (Alabama Department of Conservation and Natural Resources 2019), Alaska (Alaska State Legislature 2019), Arizona (Arizona Office of the Secretary of State 2013), Arkansas (Arkansas Game and Fish Commission 2019), California (California Department of Fish and Wildlife 2019), Colorado (Colorado Secretary of State 2019), Connecticut (Connecticut Secretary of State 2016), Florida (FFWCC 2019), Georgia (Georgia Department of Natural Resources 2019), Hawaii (Hawaii Department of Agriculture 2019), Idaho (Idaho Office of the Administrative Rules Coordinator 2019), Illinois (Illinois Department of Natural Resources 2015), Kentucky (Kentucky General Assembly 2019), Louisiana (Louisiana State Legislature 2019), Maine (Maine Department of Inland Fisheries and Wildlife 2019), Massachusetts (Massachusetts Division of Fisheries and Wildlife 2014), Mississippi (Mississippi Secretary of State 2019), Nevada (State of Nevada 2016), New Mexico (New Mexico Department of Game and Fish 2010), New York (New York State Senate 2019), North Carolina (North Carolina Office of Administrative Hearings 2019), Oklahoma (Oklahoma Secretary of State 2019), South Carolina (South Carolina Legislature 2019), Texas (Texas Parks and Wildlife 2019), Utah (Utah Office of Administrative Rules 2019), and Virginia (Virginia Department of Game and Inland Fisheries 2019).

4 Global Distribution

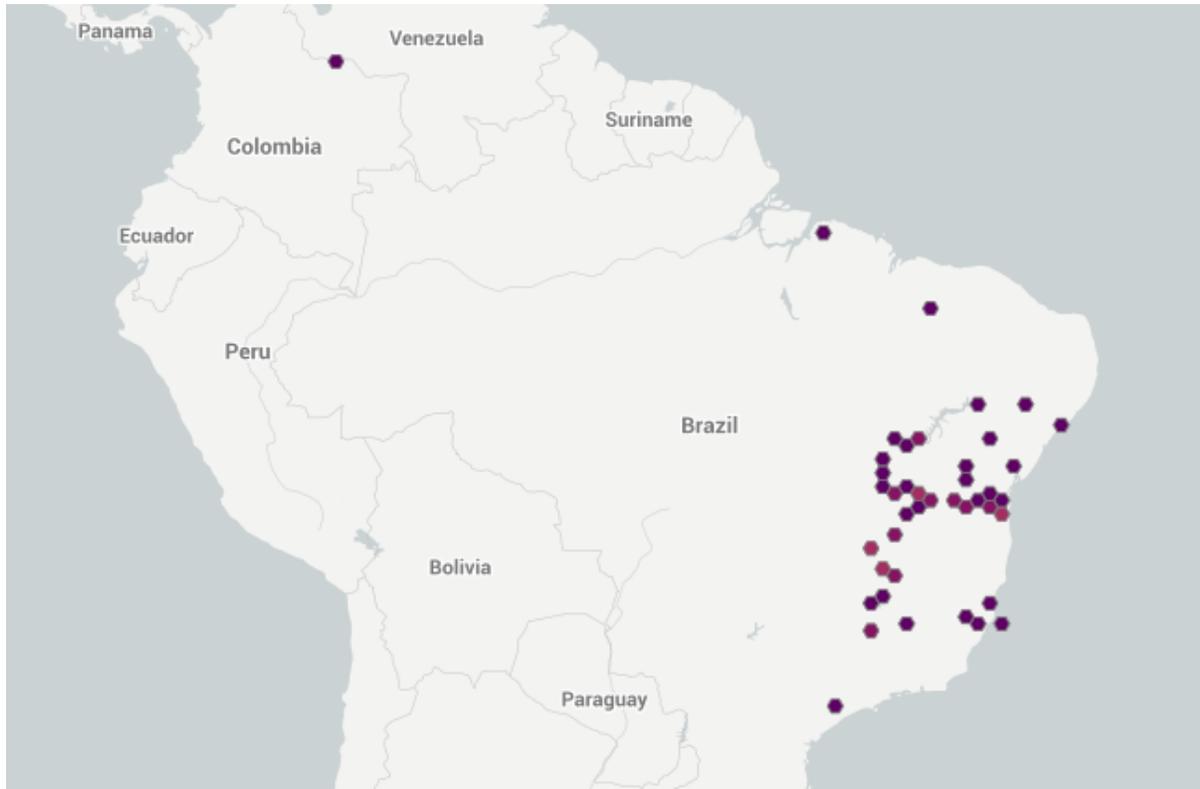


Figure 1. Reported global distribution of *Serrasalmus brandtii*, reported from South America. Map from GBIF Secretariat (2017). The location in Colombia was excluded from the climate matching analysis because it does not represent a known established population. The two northernmost locations and the southernmost location in Brazil were excluded from the climate matching analysis because of coordinate imprecision noted in GBIF Secretariat (2017). The locations reported in the Doce River basin (coastal southeastern Brazil) and on the Itapicuru River (east-central Brazil) were excluded from the climate matching analysis because there are no known established populations within these basins.

5 Distribution within the United States

This species has not been reported as introduced or established in the United States.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2018; 16 climate variables; Euclidean Distance) for *Serrasalmus brandtii* was medium in peninsular Florida, coastal Texas (especially southern Texas), southeastern Arizona, and coastal southern California. The rest of the contiguous United States had low climate match. The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean Distance) for the contiguous United States was 0.001. This score is classified as a low overall climate match (scores between 0.000 and 0.005, inclusive, are classified as low). Individually, Florida had a medium Climate 6 score while all other States had low scores.

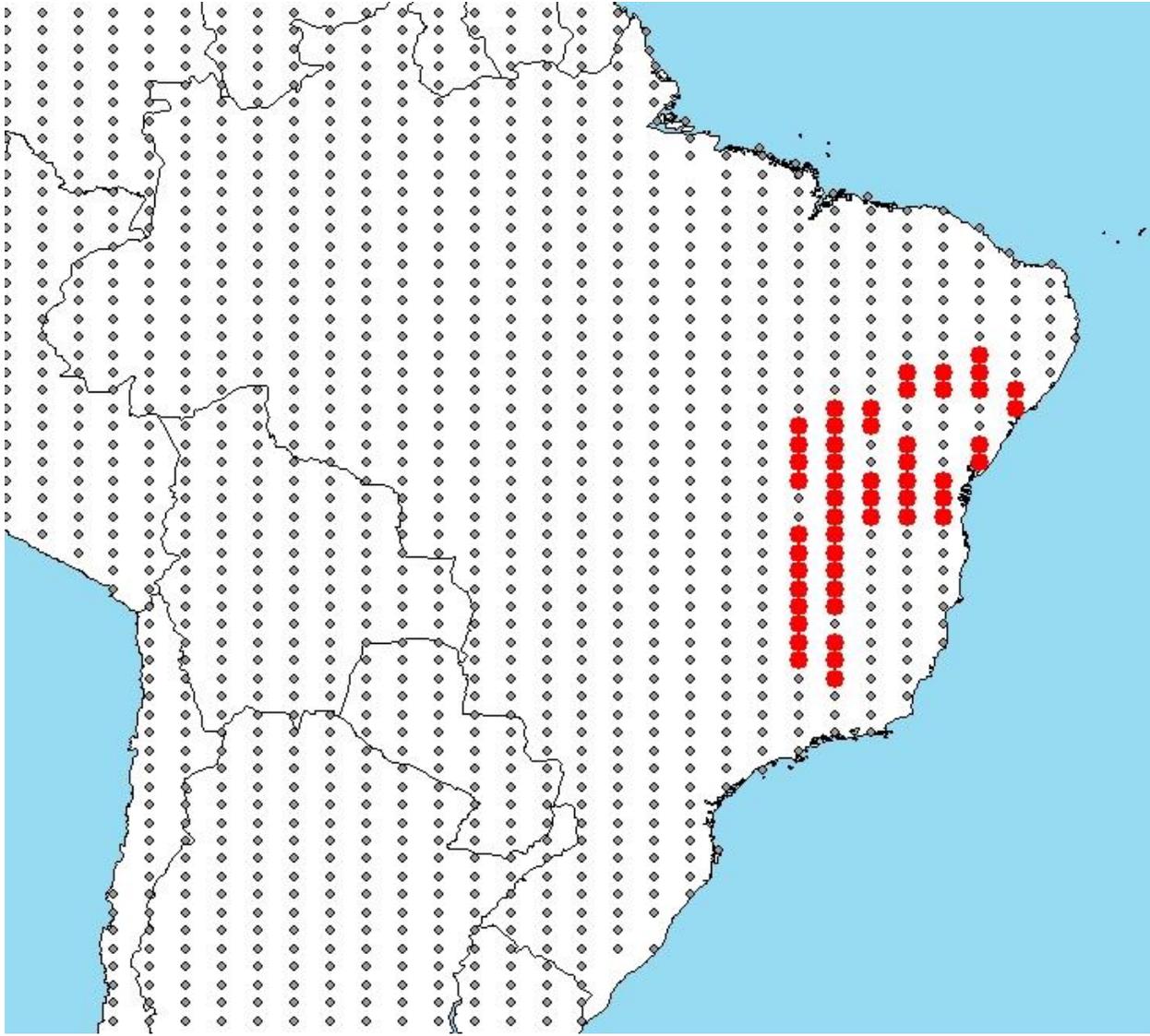


Figure 2. RAMP (Sanders et al. 2018) source map showing weather stations in Brazil and surrounding countries selected as source locations (red; Brazil) and non-source locations (gray) for *S. brandtii* climate matching. Source locations from GBIF Secretariat (2017).

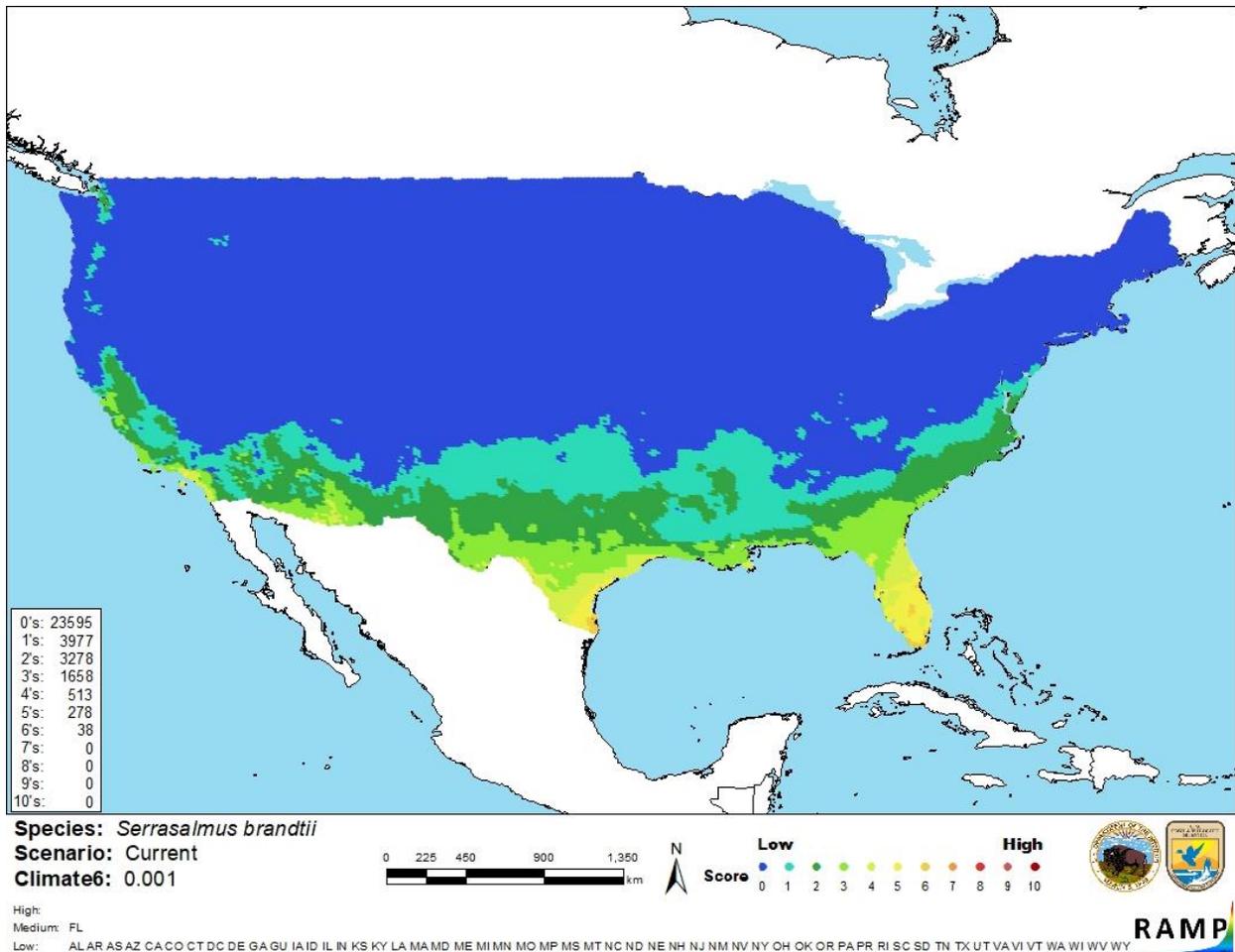


Figure 3. Map of RAMP (Sanders et al. 2018) climate matches for *S. brandtii* in the contiguous United States based on source locations reported by GBIF Secretariat (2017). 0=Lowest match, 10=Highest match.

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

7 Certainty of Assessment

Information is available on the biology and ecology of *Serrasalmus brandtii*. There is some uncertainty about the extent of the native range of *S. brandtii*, and information about introductions of *S. brandtii* is difficult to find. Locations of introduction do not appear to be consistently or fully documented. No information is available on impacts of introduction, at least in the English language literature. The certainty of assessment for *Serrasalmus brandtii* is low.

8 Risk Assessment

Summary of Risk to the Contiguous United States

White Piranha (*Serrasalmus brandtii*) is native to the São Francisco River basin in eastern Brazil. It is also found in several adjacent river basins, but it is not clear in every case whether the species is native to those basins or was introduced. *S. brandtii* has been introduced to multiple reservoirs outside its native range, although no impacts of introduction have been documented to date. Piranhas, such as *S. brandtii*, are prohibited from possession or trade in numerous U.S. States. Climate match to the contiguous United States is low overall, with medium matches occurring in portions of Florida, Texas, Arizona, and California. Due to lack of information of impacts of introduction, the certainty of assessment is low. The overall risk assessment category for *Serrasalmus brandtii* 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

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

Alabama Department of Conservation and Natural Resources. 2019. Restrictions on possession, sale, importation and/or release of certain animals and fish. Alabama Department of Conservation and Natural Resources Administrative Code, Chapter 220-2-.26.

Alaska State Legislature. 2019. Prohibitions on importation and release of live fish. Alaska Administrative Code, Title 5, Chapter 41, Section 70.

- AquaScape Online. 2018. Brandtii Piranha 6" (*Serrasalmus Brandtii*). Available: <https://www.aquascapeonline.com/products/brandtii-piranha-6in-serrasalmus-brandtii.html>. (July 2018).
- Arizona Office of the Secretary of State. 2013. Live wildlife. Arizona Administrative Code, Game and Fish Commission, Title 12, Chapter 4, Article 4.
- Arkansas Game and Fish Commission. 2019. Certain exotic species prohibited. Arkansas Game and Fish Commission Code of Regulations 26.13.
- California Department of Fish and Wildlife. 2019. California's invaders: Piranha. Habitat Conservation Planning Branch, California Department of Fish and Wildlife, Sacramento, California. Available: <https://www.wildlife.ca.gov/Conservation/Invasives/Species/Characidae>. (August 2019).
- Colorado Secretary of State. 2019. Prohibited species. Code of Colorado Regulations, Chapter 00, Article VIII #008.
- Connecticut Secretary of State. 2016. Importation, transportation or liberation of live fish or live fish eggs. Regulations of Connecticut State Agencies, Section 26-55-1.
- FWCC (Florida Fish and Wildlife Conservation Commission). 2019. Prohibited nonnative species list. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. Available: <https://myfwc.com/wildlifehabitats/nonnatives/prohibited-species-list/>. (August 2019).
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- Georgia Department of Natural Resources. 2019. Wild animals/exotics. Georgia Department of Natural Resources Law Enforcement Division, Social Circle, Georgia. Available: <http://gadnrle.org/exotics>. (August 2019).

- Hawaii Department of Agriculture. 2019. Animal guidelines. Hawaii Department of Agriculture, Plant Industry Division, Honolulu, Hawaii. Available: <http://hdoa.hawaii.gov/pi/pq/import-program/animal-guidelines/>. (August 2019).
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- Idaho Office of the Administrative Rules Coordinator. 2019. Rules governing invasive species. Idaho Administrative Code 02.06.09.
- Illinois Department of Natural Resources. 2015. Aquatic life approved species list. Illinois Department of Natural Resources, Springfield, Illinois. Available: https://www.ifishillinois.org/programs/aquaculture/aquatic_approved_species.pdf. (August 2019).
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- Kentucky General Assembly. 2019. Importation, possession, and prohibited aquatic species. Kentucky Administrative Regulations, Tourism, Arts, and Heritage Division, Department of Fish and Wildlife Resources, 301 KAR 1:122.
- Louisiana State Legislature. 2019. Exotic fish; importation, sale, and possession of certain exotic species prohibited; permit required; penalty. Louisiana Revised Statutes, Title 56, Section 319.
- Maine Department of Inland Fisheries and Wildlife. 2019. Fish and wildlife in captivity. Maine Department of Inland Fisheries and Wildlife, Augusta, Maine. Available: <https://www.maine.gov/ifw/fish-wildlife/captivity.html>. (August 2019).
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- Mississippi Secretary of State. 2019. Guidelines for aquaculture activities. Mississippi Administrative Code, Title 2, Part 1, Subpart 4, Chapter 11. Regulatory and Enforcement Division, Office of the Mississippi Secretary of State, Jackson, Mississippi.

- Moravec, F., M. D. Santos, and M. C. Brasil-Sato. 2008. Redescription of *Cystidicoloides fischeri* based on specimens from piranhas in Brazil, and erection of a new genus (Nematoda: Cystidicolidae). *Journal of Parasitology* 94(4):889–897.
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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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