

Orinoco Piranha (*Pygocentrus cariba*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, May 2012
Revised, September 2014, March 2018
Web Version, 10/31/2019



Photo: Passociable. Public domain. Available:
<https://commons.wikimedia.org/wiki/File:Pygocentruscariba.jpg>. (December 2017).

1 Native Range and Status in the United States

Native Range

From Fink (1993):

“This species is widely distributed in the Rio Orinoco basin lowlands, in Colombia and Venezuela; [...]”

Status in the United States

This species has not been reported as introduced or established in the United States. However, this species occurs in trade in the United States.

From AquaBid (2019):

“Up for sale is a group of 5 small sized Caribe (*Pygocentrus cariba*) wild collected from the Orinoco.”

“Final: \$74.99”

“Ended Jun 17 2018 – 12:10:04 PM”

“Location Boulder CO 80301 United States”

Possession or importation of fish of the genus *Pygocentrus*, 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 Administrative Code (2016):

“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 Arizona Administrative Code (2015):

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

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

“[...] All species of the genera *Pygocentrus*, *Pygopristis*, and *Serrasalmus*. Common name: piranha.”

From Arkansas Game and Fish Commission (2013):

“Certain fish species are banned within the state: it is unlawful to possess, import, or transport any [...] piranha in Arkansas.”

From California Department of Fish and Wildlife (2018):

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

From Colorado Parks and Wildlife (2017):

“These species and their viable eggs are detrimental to other fish and habitat in Colorado. Unless authorized in writing by CPW [Colorado Parks and Wildlife] for controlled and experimental purposes, it is illegal to export, import, transport, stock, sell or release: [...] piranha, [...]”

From State of Connecticut (2015):

“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 [...]”

From Florida Fish and Wildlife Conservation Commission (2018):

“Prohibited nonnative species are considered to be dangerous to the ecology and/or the health and welfare of the people of Florida. These species are not allowed to be personally possessed or used for commercial activities. Very limited exceptions may be made by permit from the Executive Director for research or for public exhibition by facilities that meet biosecurity criteria, although no exceptions are made for piranha and pirambeba; these two species are not allowed to be possessed by anyone at anytime [*sic*].”

From Georgia Department of Natural Resources (no date):

“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 (2018):

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

From Kentucky Administrative Regulations (2015):

“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 Department of Wildlife and Fisheries (2014):

“Illegal exotic fish possession of certain species, in this case piranhas, brings a \$400 to \$950 fine and up to 120 days in jail plus court costs.”

“An LDWF [Louisiana Department of Wildlife and Fisheries] issued permit for exotic fish of certain species is needed to possess piranhas.”

From Maine Department of Inland Fisheries and Wildlife (2018):

“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.”

“A person may not possess any species that has not been categorized.”

Pygocentrus cariba does not appear on Maine Department of Inland Fisheries and Wildlife’s Unrestricted Species List.

From Commonwealth of Massachusetts (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 Administrative Code (no date):

“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.”

“- Piranha and pirambebas Subfamily Serrasalminae ** *****”

“** - includes all the piranhas”

“***** - all species”

From Nevada Administrative Code (2011):

“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: [...]”

“(9) 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.

From Consolidated Laws of New York (2018):

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

From North Carolina Administrative Code (2013):

“It is unlawful to transport, purchase, possess, sell or stock in the public or private waters of North Carolina any live individuals of: (1) piranha, [...]”

From Oklahoma Administrative Code (2013):

“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., *Catoprion* spp., *Hydrocynus* spp., and *Salminus* spp.”

From South Carolina Code of Laws (2016):

“[...] A person may not possess, sell, offer for sale, import, bring, cause to be brought or imported into this State, 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 (2018):

“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 Virginia Department of Game and Inland Fisheries (2018):

“A special permit is required, and may be issued 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, [...]”

From Washington Department of Fish and Wildlife (2013):

“Unless authorized by rule by the Fish and Wildlife Commission, the department prohibits the importation/possession of certain deleterious or exotic species of animals from entering Washington State. These include, but or not limited to, fish (such as piranha), [...]”

Means of Introductions in the United States

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

Remarks

From Howells (1999):

“Restrictions of piranhas exist in many states largely due to concern about their aggressive natures and fears about released specimens establishing in U.S. waters. Cold tolerance studies in the laboratory that suggest possible over-winter survival in some American waters, and collections of piranhas [not this species] in the field, have served to reinforce these concerns.”

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2017):

“Kingdom Animalia
Phylum Chordata
Subphylum Vertebrata
Superclass Osteichthyes
Class Actinopterygii
Subclass Neopterygii
Infraclass Teleostei
Superorder Ostariophysi
Order Characiformes
Family Characidae
Genus *Pygocentrus*
Species *Pygocentrus cariba* (Humboldt in Humboldt and Valenciennes, 1821)”

From Eschmeyer et al. (2017):

“Current status: Valid as *Pygocentrus cariba* (Humboldt 1821). Serrasalminae.”

Size, Weight, and Age Range

From Froese and Pauly (2017):

“Max length : 27.9 cm TL male/unsexed; [Jégu 2003]; max. published weight: 560.00 g [IGFA 1994]”

Environment

From Froese and Pauly (2017):

“Freshwater; pelagic.”

From Seriously Fish (2018):

“Temperature: 20 – 28 °C

pH: 4.0 – 7.0

Hardness: 18 – 179 ppm [aquarium parameters]”

Climate/Range

From Froese and Pauly (2017):

“Tropical”

Distribution Outside the United States

Native

From Fink (1993):

“This species is widely distributed in the Rio Orinoco basin lowlands, in Colombia and Venezuela; [...]”

Introduced

This species has not been reported as introduced or established outside of its native range.

Means of Introduction Outside the United States

This species has not been reported as introduced or established outside of its native range.

Short Description

From Fink (1993):

“In larger juveniles and adults collected in the upper Rio Apure of Venezuela [...], dorsal and lateral parts of body from black humeral spot to anal-fin origin silvery grey. Abdomen from lateral spot to anal fin origin red or red-orange. Most of head grey, suffused with orange or red, especially posteriorly and ventrally. Eye silvery, with black pigment above and below iris. Lower jaw dark anteriorly, posteriorly the same red or orange as the abdomen. Pectoral and pelvic fins red to orange. Dorsal fin dark grayish-black. Adipose fin black proximally, often some hyaline area distally. Caudal fin dark grayish-black, with a pale subterminal band or posterior border. Anal fin black proximally in the area of small scales on the fin and with black pigment scattered along distal margin; otherwise, fin red or red-orange.”

Biology

From Nico and de Morales (1994):

“Piranhas (i.e., *Serrasalmus*, *Pygocentrus*, *Pristobrycon*, and *Pygopristis* species) exploit a broad range of food resources: arthropods, fishes and other vertebrates, fish fins and scales, carrion, seeds, fruits, leaves, and flowers (Goulding, 1980; Sazima and Machado, 1990; Nico, 1991). Small juvenile piranhas, <20 mm SL, feed mostly on aquatic insects and microcrustaceans. Juveniles of nearly all species then pass through a growth stage, typically between 20 and 80 mm SL, when fin eating becomes common to predominant (Sazima and Zamprogno, 1985; Nico and Taphorn, 1988; Winemiller, [1989]). Nearly all adult piranhas also take fins and scales but usually in relatively small quantities. [...] adults of the more carnivorous piranhas (*Pygocentrus* and most *Serrasalmus*) regularly bite out pieces of fish flesh or take whole or almost whole small fish (Goulding, 1980; Nico and Taphorn, 1988; Nico, 1991).”

From Guettero et al. (2009):

“In *P. cariba*, the percentage of immature males and females is highest in January, February, and March (near 100%). The percentage of mature males and females increases from April to June; in July, generally, all captured males and females are spent/spawned. Peaks in GSI [gonadosomatic index], along with changes in percentage frequency of mature and spent/spawned individuals, indicate that *P. cariba* spawns in July–August and has a reproductive peak in May– June.”

From Seriously Fish (2018):

“Has been recorded from major river channels, smaller tributaries, and floodplain lakes, many of which comprise acidic, mineral-poor blackwater environments with brownish, tannin-stained water, although it has been observed to inhabit clear waters as well.”

“Many of its habitats lie within the Venezuelan and Colombian llanos, a vast, highly biodiverse system of tropical savannah grasslands, seasonally-flooded plains and forests covering an area measuring almost 600,000 square kilometers. There are well-defined annual weather patterns with distinct wet and dry seasons and year-round high temperatures.”

Human Uses

From Froese and Pauly (2017):

“Gamefish: yes”

From Seriously Fish (2018):

“Suitable only for public installations or the very largest private aquaria with an aquarium measuring 240 * 90 * 60 cm or equivalent the minimum requirement for a group.”

This species occurs in trade in the United States.

From AquaBid (2019):

“Up for sale is a group of 5 small sized Caribe (*Pygocentrus cariba*) wild collected from the Orinoco.”

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Diseases

Poelen et al. (2014) lists the following parasites of *Pygocentrus cariba*: *Corallobothrium giganteum*, *Ligictaluridus mirabilis*, *Leptorhynchoides thecatus*, and *Corallobothrium fimbriatum* (Strona et al. 2013).

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

Threat to Humans

From Froese and Pauly (2017):

“Traumatogenic”

“Has powerful dentition that can inflict serious bites [Robins et al. 1991].”

3 Impacts of Introductions

This species has not been reported as introduced or established outside of its native range.

The following states have prohibitions or restrictions against importation or possession of piranhas, including *Pygocentrus cariba*: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Kentucky, Louisiana, Maine, Massachusetts, Mississippi,

Nevada, New Mexico, New York, North Carolina, Oklahoma, South Carolina, Texas, Virginia, and Washington.

4 Global Distribution

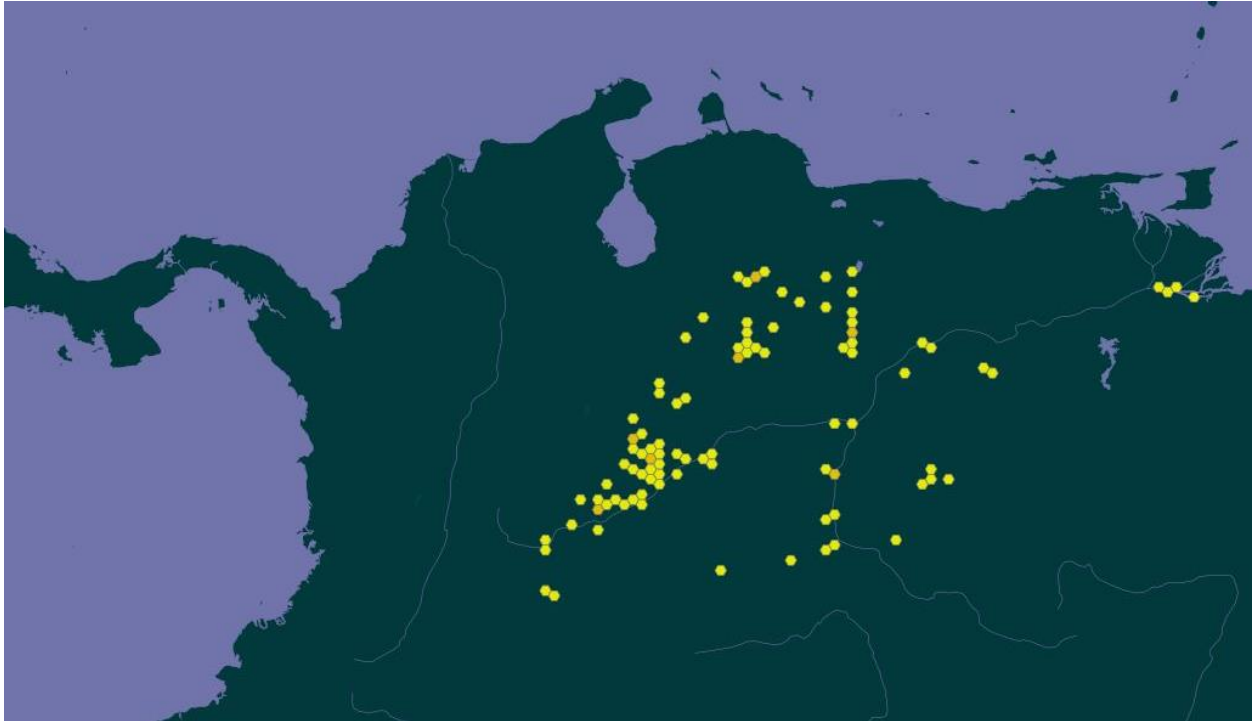


Figure 1. Known global distribution of *Pygocentrus cariba*, reported from Colombia and Venezuela. Map from GBIF Secretariat (2018). Points in Peru and southern Colombia were excluded as outliers from this map and from climate match analysis because they are outside of the documented range of this species.

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 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous United States was 0.001, which is a low climate match. (Scores between 0.000 and 0.005, inclusive, are classified as low.) The climate match was low across the entire contiguous United States, except for southern Florida, the southern tip of Louisiana, and small areas along the Texas Gulf Coast, which had a medium climate match. The climate match was slightly higher, although still low, along most of the coast from North Carolina to Texas. Florida had a medium climate score; all other states had a low score.

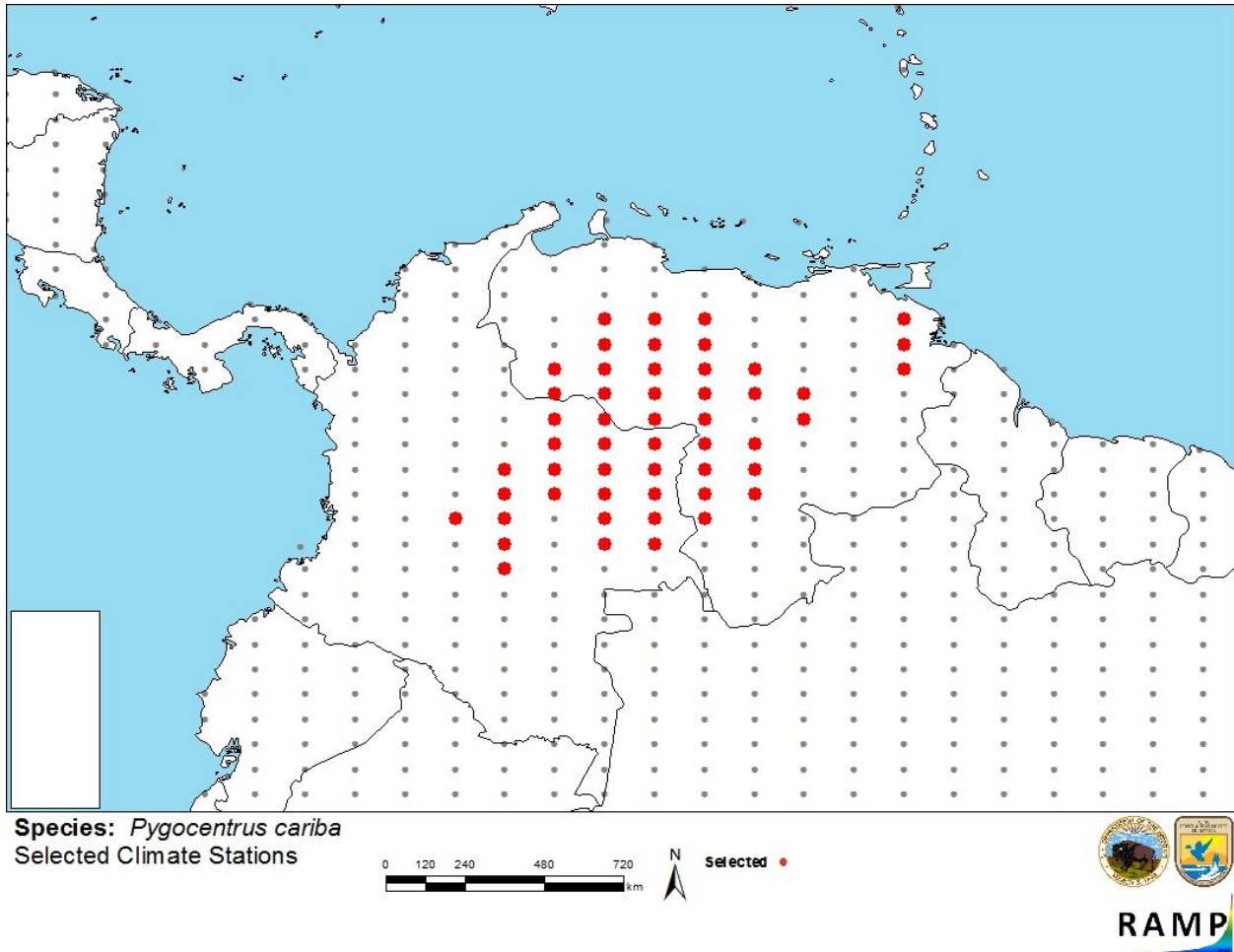


Figure 2. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red; Venezuela, Columbia) and non-source locations (gray) for *Pygocentrus cariba* climate matching. Source locations from GBIF Secretariat (2018).

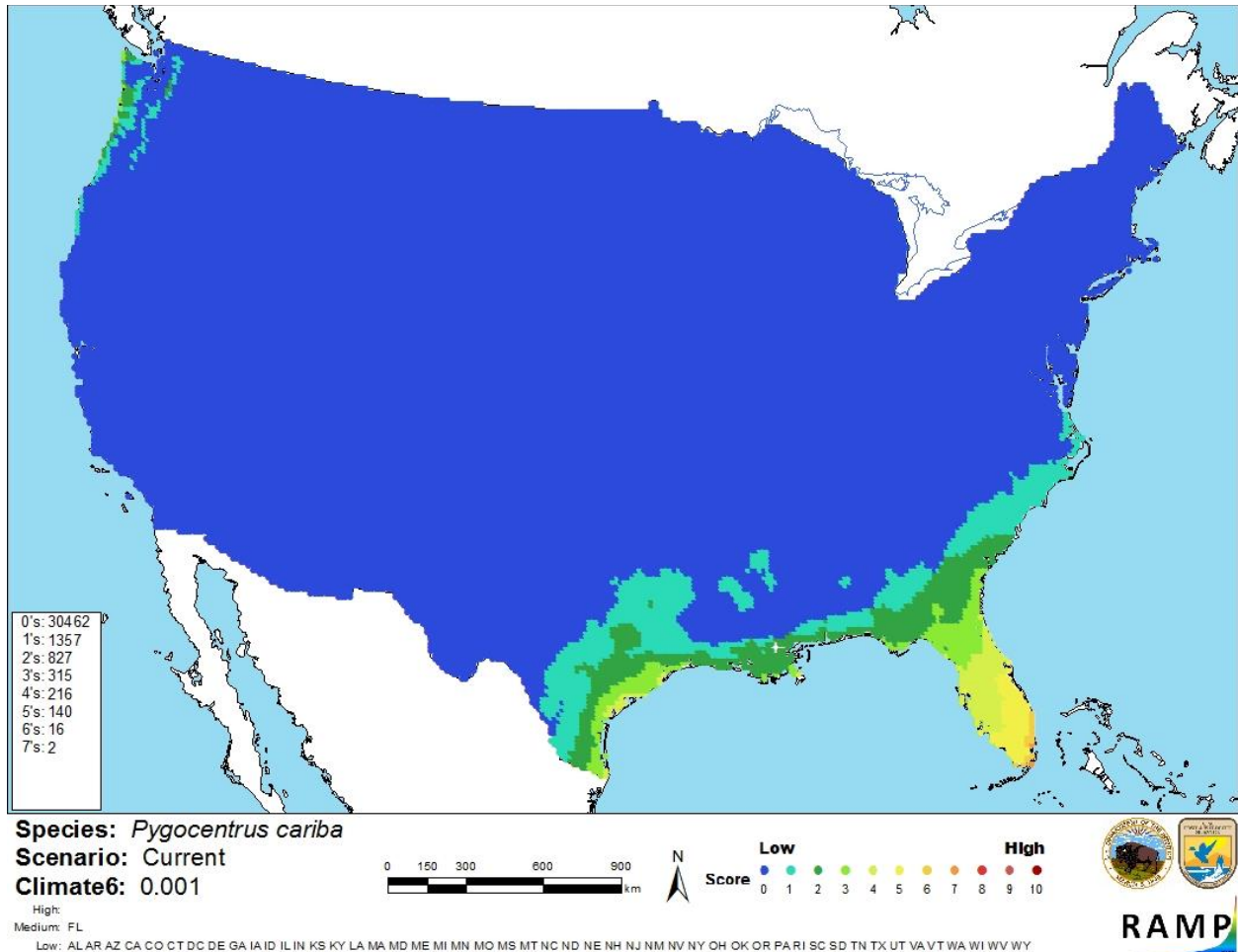


Figure 3. Map of RAMP (Sanders et al. 2014) climate matches for *Pygocentrus cariba* in the contiguous United States based on source locations reported by GBIF Secretariat (2018). 0=Lowest match, 10=Highest match.

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

7 Certainty of Assessment

There is somewhat limited information available on *Pygocentrus cariba*. This species has never been reported as introduced or established outside of its native range, so there are no impacts of introductions of this species documented. Further information is needed to adequately assess the risk this species poses to the contiguous United States. Certainty of this assessment is low.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Pygocentrus cariba, Orinoco piranha, is a fish native to Colombia and Venezuela. This species has not been reported as introduced or established outside of its native range. Due to concerns about the risk *Pygocentrus* sp. and other piranha genera pose to the environment and human safety if introduced to United States waters, many states ban or strictly regulate the possession of piranhas. History of invasiveness is uncertain. *P. cariba* has a low climate match with the contiguous United States. The only state with a medium climate score was Florida. Because this species has never been documented as introduced outside of its native range, further information is needed to adequately assess the risk this species poses. Certainty of assessment is low. The overall risk assessment category is Uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3): Uncertain**
- **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 Administrative Code. 2016. 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.

AquaBid. 2019. Caribe (*Pygocentrus cariba*) small – 5 fish. Available: https://www.aquabid.com/cgi-bin/auction/closed.cgi?view_archive_item&fwcharacins1529255404. (October 2019).

Arizona Administrative Code. 2015. Article 4. Live Wildlife. Arizona Administrative Code, Game and Fish Commission, Sections R12-4-401 and R12-4-406.

Arkansas Game and Fish Commission. 2013. Arkansas aquatic nuisance species management plan. Arkansas Game and Fish Commission, Little Rock, Arkansas. Available: https://www.anstaskforce.gov/State%20Plans/Final_Arkansas_ANS_Mgmt_Plan_July_2013.pdf. (March 2018).

California Department of Fish and Wildlife. 2018. California's Invaders: Piranha. State of California. Available: <https://www.wildlife.ca.gov/Conservation/Invasives/Species/Characidae>. (March 2018).

- Colorado Parks and Wildlife. 2017. Colorado fishing. Colorado Parks and Wildlife, Denver, Colorado. Available: <http://cpw.state.co.us/Fishing/Brochure>. (March 2018).
- Commonwealth of Massachusetts. 2014. Exemption list. Massachusetts General Law Chapter 131, Division of Fisheries and Wildlife, 321 CMR 9.00.
- Consolidated Laws of New York. 2018. Importation, possession and sale of fish without license or permit; prohibitions. Laws of New York, Environmental Conservation Law, 11-1703 (6).
- Eschmeyer, W. N., R. Fricke, and R. van der Laan, editors. 2017. Catalog of fishes: genera, species, references. Available: <http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>. (December 2017).
- Florida Fish and Wildlife Conservation Commission. 2018. Prohibited species list. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. Available: <http://myfwc.com/wildlifehabitats/nonnatives/regulations/prohibited/>. (March 2018).
- Froese, R., and D. Pauly, editors. 2017. *Pygocentrus cariba* (Humboldt, 1821). FishBase. Available: <http://www.fishbase.org/summary/Pygocentrus-cariba.html>. (December 2017).
- GBIF Secretariat. 2017. GBIF backbone taxonomy: *Pygocentrus cariba*, Humboldt, 1821. Global Biodiversity Information Facility, Copenhagen. Available: <https://www.gbif.org/species/2352463>. (December 2017).
- Georgia Department of Natural Resources. No date. Wild Animals/Exotics. Georgia Department of Natural Resources Law Enforcement Division, Social Circle, Georgia. Available: <http://gadnrle.org/exotics>. (March 2018).
- Guerrero, H. Y., E. Cardillo, G. Poleo, and D. Marcano. 2009. Reproductive biology of freshwater fishes from the Venezuelan floodplains. *Fish Physiology and Biochemistry* 35(1):189-196.
- Hawaii Department of Agriculture. 2018. Animal guidelines. State of Hawaii, Hawaii Department of Agriculture, Plant Industry Division, Honolulu, Hawaii. Available: <http://hdoa.hawaii.gov/pi/pq/import-program/animal-guidelines/>. (March 2018).
- Howells, R. G. 1999. Guide to identification of harmful and potentially harmful fishes, shellfishes, and aquatic plants prohibited in Texas. Texas Parks and Wildlife Department, Inland Fisheries Division, Austin, Texas.
- Idaho Department of Fish and Game. 2013. Ask Fish and Game: Can you have piranhas in a fish tank in Idaho as pets? Idaho Department of Fish and Game, Boise, Idaho. Available: <https://idfg.idaho.gov/question/can-you-have-piranhas-fish-tank-idaho-pets>. (March 2018).

- ITIS (Integrated Taxonomic Information System). 2017. *Pygocentrus cariba* (Humboldt, 1821). Integrated Taxonomic Information System, Reston, Virginia. Available: https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=639907#null. (December 2017).
- Kentucky Administrative Regulations. 2015. 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 Department of Wildlife and Fisheries. 2014. Jefferson man cited for illegal possession of piranhas. Louisiana Department of Wildlife and Fisheries, Baton Rouge, Louisiana. Available: <http://www.wlf.louisiana.gov/news/38457>. (March 2018).
- Maine Department of Inland Fisheries and Wildlife. 2018. Fish and wildlife in captivity. State of Maine, Maine Department of Inland Fisheries and Wildlife, Augusta, Maine. Available: <https://www.maine.gov/ifw/fish-wildlife/captivity.html>. (March 2018).
- Mississippi Administrative Code. No date. Title 2: Agriculture and Commerce, Part 1: Rules of the Mississippi Department of Agriculture and Commerce, Subpart 4: Bureau of Regulatory Services. Chapter 11- Guidelines for aquaculture activities.
- Nevada Administrative Code. 2011. Restrictions on importation, transportation and possession of certain species. NAC 503.110.
- New Mexico Department of Game and Fish. 2010. Director's species importation list. New Mexico Department of Game and Fish, Law Enforcement Division, Special Use Permits Program. Available: http://www.wildlife.state.nm.us/download/enforcement/importation/information/Directors-Species-Importation-List-08_03_2010.pdf. (March 2018).
- Nico, L. G., and M. de Morales. 1994. Nutrient content of piranha (Characidae, Serrasalminae) prey items. *Copeia* 1994(2):524-528.
- North Carolina Administrative Code. 2013. Possession of certain fishes. 15A NCAC 10C .0211.
- OIE (World Organisation for Animal Health). 2019. OIE-listed diseases, infections and infestations in force in 2019. World Organisation for Animal Health, Paris. Available: <http://www.oie.int/animal-health-in-the-world/oie-listed-diseases-2019/>. (August 2019).
- Oklahoma Administrative Code. 2013. List of restricted exotic species. Oklahoma Administrative Code 800:20-1-2.
- Poelen, J. H., J. D. Simons, and C. J. Mungall. 2014. Global Biotic Interactions: an open infrastructure to share and analyze species-interaction datasets. *Ecological Informatics* 24:148-159.

Sanders, S., C. Castiglione, and M. H. Hoff. 2014. Risk Assessment Mapping Program: RAMP. U.S. Fish and Wildlife Service.

Seriously Fish. 2018. *Pygocentrus cariba* (Humboldt, 1821). Available: <http://www.seriouslyfish.com/species/pygocentrus-cariba/>. (March 2018).

South Carolina Code of Laws. 2016. Importing, possessing, or selling certain fish unlawful; special permits for research; Department to issue rules and regulations; penalties. South Carolina Code of Laws, section 50-13-1630.

State of Connecticut. 2015. Importation, transportation or liberation of live fish or live fish eggs. Regulations of Connecticut State Agencies, Section 26-55-1.

Texas Parks and Wildlife. No date. Invasive, prohibited and exotic species. Texas Parks and Wildlife, Austin, Texas. Available: https://tpwd.texas.gov/huntwild/wild/species/exotic/prohibited_aquatic.phtml. (March 2018).

Virginia Department of Game and Inland Fisheries. 2018. Nongame fish, reptile, amphibian and aquatic invertebrate regulations. Virginia Department of Game and Inland Fisheries, Henrico, Virginia. Available: <https://www.dgif.virginia.gov/fishing/regulations/nongame/>. (March 2018).

Washington Department of Fish and Wildlife. 2013. WDFW Help. Is it legal to own or possess exotic wildlife in Washington? Washington Department of Fish and Wildlife, Olympia, Washington. Available: <https://wdfw.wa.gov/help/questions/150/Is+it+legal+to+own+or+possess+exotic+wildlife+in+Washington%3F>. (March 2018).

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.

Goulding, M. 1980. The fishes and the forest: explorations in Amazonian natural history. University of California Press, Los Angeles.

International Game Fish Association (IGFA). 1994. World record game fishes, 1994. International Game Fish Association, Pompano Beach, Florida.

Jégu, M. 2003. Serrasalminae (Pacus and piranhas). Pages 182-196 in R. E. Reis, S. O. Kullander and C. J. Ferraris, Jr., editors. Checklist of the freshwater fishes of South and Central America. EDIPUCRS, Porto Alegre, Brazil.

- Nico, L. G. 1991. Trophic ecology of piranhas (Characidae: Serrasalminae) from savanna and forest regions in the Orinoco River basin of Venezuela. Doctoral dissertation, University of Florida, Gainesville.
- Nico, L. G. and D. C. Taphorn. 1988. Food habits of piranhas in the low Llanos of Venezuela. *Biotropica* 20:311-321.
- Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea and W. B. Scott. 1991. World fishes important to North Americans. Exclusive of species from the continental waters of the United States and Canada. American Fisheries Society Special Publication 21.
- Sazima, I., and D. F. A. Machado. 1990. Underwater observations of piranhas in western Brazil. *Environmental Biology of Fishes* 28:17-31.
- Sazima, I., and D. C. Zamprogno. 1985. Use of water hyacinths as shelter, foraging place, and transport by young piranhas, *Serrasalmus spilopleura*. *Environmental Biology of Fishes* 12:237-240.
- Strona, G., M. Lourdes, D. Palomares, N. Bailly, P. Galli, and K. D. Lafferty. 2013. Host range, host ecology, and distribution of more than 11800 fish parasite species. *Ecology* 94:544.
- Winemiller, K. O. 1989. Ontogenetic diet shifts and resource partitioning among piscivorous fishes in the Venezuelan Llanos. *Environmental Biology of Fishes* 26:177-199.