Pirapitinga (*Piaractus brachypomus*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, November 2023
Revised, December 2023
Web Version, 5/19/2026

Organism Type: Fish
Overall Risk Assessment Category: Uncertain

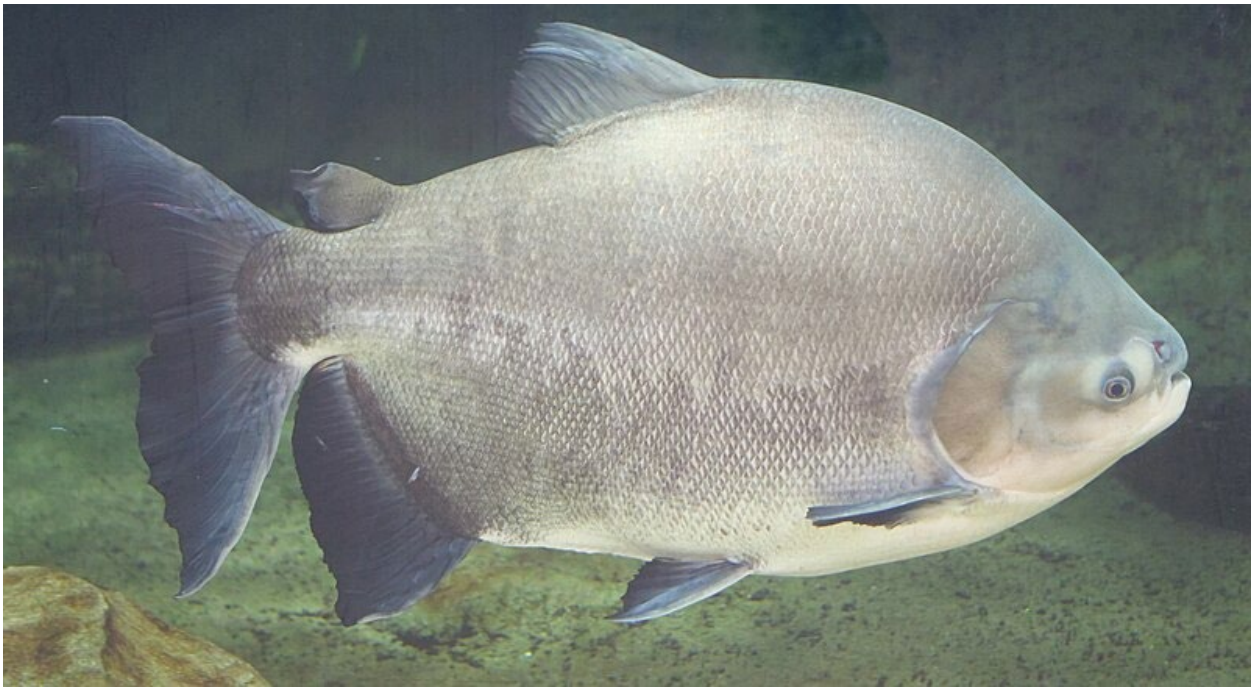

Photo: Kinori. Licensed under CC0 1.0 Universal Public Domain Dedication. Available: https://commons.wikimedia.org/wiki/File:Colossoma_macropomum_in_Sendai_Aquarium.jpg (November 2023).

1 Native Range and Status in the United States

Native Range

From Nico et al. (2023):

"Amazon River basin; Bolivia, Brazil, Colombia, Ecuador, and Peru"

Status in the United States

From Nico et al. (2023):

"Reported from 43 states; failed in all. Although some larger individuals have been captured, no instances of spawning or successful reproduction have been documented. Most reports are of single or few specimens."

According to Nico et al. (2023), nonindigenous occurrences of *Piaractus brachypomus* have been reported in the following States: Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, and Wisconsin.

From Nico et al. (2023):

"This species is a popular aquarium fish and is sold in most pet stores as juveniles. In warmer climates such as south Florida, it is also a popular pond fish."

Regulations

P. brachypomus is regulated under a scientific name synonym (*Colossoma brachypomum*, see Remarks) in Hawaii (HDOA 2019). It is regulated at the family level (Characidae) in New Mexico (NMDGF 2023). Please refer back to state agency regulatory documents for details on the regulations, including restrictions on activities involving this species. While effort was made to find all applicable regulations, this list may not be comprehensive. Notably, it does not include regulations that do not explicitly name this species or its genus or family, for example, when omitted from a list of authorized species with blanket regulation for all unnamed species.

Means of Introductions within the United States

From Nico et al. (2023):

"Most records likely represent aquarium releases, although some Florida and Georgia records may have resulted from fish farm escapes."

Remarks

This ERSS was previously published in August 2012. Revisions were completed to incorporate new information and conform to updated standards.

From Escobar L. et al. (2019):

"We also provide a re-description of *Piaractus brachypomus*, restricting its geographic distribution to the Amazon River basin. […] Results of all analyses consistently indicate that *Piaractus* from the Orinoco and Amazon Basins are different species."

From Nico et al. (2023):

*"*Common name: pirapitinga, red-bellied pacu
Synonyms and Other Names: *Colossoma bidens* (Spix and Agassiz 1829), *C. brachypomum* (Cuvier 1818), *Myletes paco* Humboldt 1821*; Cachama blanca*"

"*Colossoma bidens* and *C. brachypomum* are junior synonyms that have been widely used in the aquarium literature and in most past reports concerning fish introductions."

"Red-bellied pacu can be distinguished from piranhas primarily by dentition (single row of serrated incisor-like teeth in piranhas vs. two rows of molariform teeth in pacus). This species can be distinguished from tambaqui (*Colossoma macropomum*) by the adipose fin (rays present in *C. macropomum* vs. absent in *P. brachypomus*), dentition (triangular space between premaxillary tooth rows in *P. brachypomus* vs. no space in *C. macropomum*; teeth on maxillary bone in *P. brachypomus* vs. no teeth on maxillary in *C. macropomum*), and opercle shape (short and not semilunate, height/width ratio >2.0 in *P. brachypomus* vs. semilunate, h/w ratio ~1.5 in *C. macropomum*). *Piaractus brachypomus* can be distinguished from *P. mesopotamicus* and *P. orinoquensis* by the number of lateral line scales (84-100 in *P. brachypomus* vs. 107-128 and 72-89, respectively), scale rows above the lateral line (31-37 in *P. brachypomus* vs. 50-60 and 23-30, respectively), and scale rows below the lateral line (33-37 in *P. brachypomus* vs. 49-56 and 22-32, respectively) (Goulding and Carvalho 1982; Ruiz-Carus and Davis 2003, Escobar et al. 2019)."

From Kohler (2021)

"[…] it is very often confused by the media with piranhas."

From Froese and Pauly (2026):

"Further importations [to Malaysia] banned because of difficulty distinguishing juveniles from those of piranhas."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2023):

Kingdom Animalia
Phylum Chordata
Subphylum Vertebrata
Superclass Osteichthyes
Class Actinopterygii
Subclass Neopterygii
Infraclass Teleostei
Superorder Ostariophysi
Order Characiformes

Family Characidae
Genus *Piaractus* Eigenmann, 1903
Species *Piaractus brachypomus* (Cuvier, 1817)

According to Fricke et al. (2023), *Piaractus brachypomus* (Cuvier 1818) is the current valid name for this species.

The following synonyms of *P. brachypomus* from Fricke et al. (2023) were used to search for information for this report: *Colossoma brachypomum*, *Myletes bidens*, and *Myletes paco*.

Size, Weight, and Age Range

From Froese and Pauly (2026):

"Max length : 88.0 cm TL [total length]; [IGFA 2001]; max. published weight: 25.0 kg [Baensch and Riehl 1985]; max. reported age: 28 years [Loubens and Panfili 2001]"

From Nico et al. (2023):

"Size: 85 cm SL [standard length] and 20 kg."

Environment

From Froese and Pauly (2026):

"Freshwater; pelagic; pH range: 4.8 - 6.8; dH range: ? - 15. […] 23°C - 28°C [assumed to be recommended aquarium temperature; Baensch and Riehl 1985]"

From Escobar L. et al. (2019):

"*Piaractus brachypomus* occurs in white-water and clearwater tributaries and occasionally at the interface of white and black waters."

Climate

From Froese and Pauly (2026):

*"*Tropical; […] 23°N - 11°S"

Distribution Outside the United States

Native

From Nico et al. (2023):

"Amazon River basin; Bolivia, Brazil, Colombia, Ecuador, and Peru"

Introduced

From Correa et al. (2014):

“A major introduction of ‘Pacu’ [*P. brachypomus*] (along with seven other fish species) took place in the lower and middle Sepik-Ramu River Basin, northern Papua New Guinea (Oceania), between 1995 and 1997 […] *P. brachypomus* are successfully reproducing in this system.”

From An et al. (2013):

“Pirapatinga, also known as red-bellied pacu, is a cultured species that was accidentally released into the wild in the Mekong Delta. It has become more abundant in recent years. Several fishers have recorded low percentages of pirapatinga in their catches. One, who fishes for large fish (average about 400 grams) with large-mesh nets in the mainstream about 60 km from the sea, reported that the species accounted for 11.7 percent of the catch (FEVM, 2012).”

From Ng et al. (2018):

“Feral population often found in low dissolved oxygen and turbid waters in slow flowing rivers and wetlands [in Malaysia].”

From Froese and Pauly (2026):

“established, natural reproduction [in China] […] Since 1985, it has spread all over southern China's inland waters due to its rapid growth, high production and availability of feed.”

“Occurrence [in Argentina]: questionable”

From Ćaleta et al. (2011):

“Incidental finds of individual pirapitinga have also been recorded in Europe, in Spain (Leunda, 2010), Slovakia (Hensel, 2004) and Poland (Nowak *et al.*, 2008).”

“This is the first record of *P. brachypomus* in the open waters of Croatia and the Danube River, and the second such report in central Europe.”

“After these specimens were caught there were no data showing the continued existence of pirapitinga in the [sic] Croatia.”

From Cagauan (2007):

“A riverine species from South America introduced to the Philippines in the 1990s, it reproduces in ponds using artificial spawning.”

Tan et al. (2020) report multiple occurrences of *P. brachypomus* in Singapore but note: “This species is not known to breed in Singapore (Ng & Lim, [1997]).”

From Esmaeili et al. (2017):

"The presence of a South American fish, the red-bellied pacu, *Piaractus brachypomus* in Iran […] has been reported by Zarei and Rajabi-Maham (2017). […] *P. brachypomus* have not established self-sustaining populations due to the low frequency of individual introduction."

From Wanjari et al. (2023):

"In this study, *P. brachypomus* is reported for the first time from the Wainganga River at Kardha, Bhandara district, Maharashtra [India]. […] The probable reasons for the catch may be accidental entry into the river or there may be an established viable population. […] In 2011, the fish was reported in the Dimbhe Reservoir in Maharashtra and the Periyar River in Kerala, both of which are a part of the Western Ghats […]"

From Elias et al. (2018):

"We documented the first record of the non-native species *Piaractus brachypomus* (Characiformes: Serrasalmidae) in Lago Petén Itzá, Petén, Guatemala. […] There is currently no evidence that *P. brachypomus* has an established population in Lago Petén-Itzá (e.g., no records of breeding individuals in the lake) […]"

Roll et al. (2007) report that *P. brachypomus* was introduced to Israel in 1994 but is not established in the wild.

According to Kiruba-Sankar et al. (2021), *P. brachypomus* has been introduced to Andaman and Nicobar Islands, India, but is not established in the wild.

Additionally, Froese and Pauly (2026) report *Piaractus brachypomus* as introduced and probably not established in Ontario (Canada); as introduced and not established in Indonesia or Taiwan; and as introduced but status unknown in Cuba, Panama, and Myanmar.

Means of Introduction Outside the United States

From Froese and Pauly (2026):

"Imported [to Indonesia] for experimental aquaculture purposes, especially for consuming pineapple waste from canning factory."

From Correa et al. (2014):

"A major introduction of 'Pacu' (along with seven other fish species) took place in […] Papua New Guinea […] as part of a fish stock enhancement project coordinated and sponsored by the United Nations (Coates, 1997)."

From Ćaleta et al. (2011):

“The pirapitinga is often misidentified and sold as red piranha *Pygocentrus nattereri* (Kner, 1858). However, due to the large adult size, many aquarists intentionally release them into non-native waters when fish outgrow their aquarium. […] Unofficial information indicates that the high water levels of the Drava River [Central Europe] and its tributaries in spring 2010 lead [sic] to a flooding of fish-ponds (in Hungary) where pirapitinga were kept, thus sweeping them into the river course.”

Short Description

From Escobar L. et al. (2019):

“Body compressed, overall aspect of body ovoid, body deepest at vertical through pelvic-fin origin.”

“[…] 31–37 rows of scales above lateral line […] and 33 and 37 rows of scales below lateral line […]”

“Snout blunt and rounded. Mouth terminal to slightly upturned, with molariform teeth.”

“Body overall silver to dark grey, with dorsal region darker. […] Juveniles and young adults with strong orange tones on inferior part of the head, ventral and inferior region of flanks, making them quite similar in colouration to the red-bellied piranhas (*Pygocentrus* spp.). The orange intensity decreases in large adults.”

Biology

From Nico et al. (2023):

“Red-bellied pacu are mainly vegetarian and frugivorous, consuming fruits and nuts from a variety of floodplain forest trees during the flood season and are major seed dispersers (Anderson et al. 2009). Red-bellied pacu undergo seasonal spawning migrations, moving from marginal lagoons and ponds at the beginning of flood season and migrating upstream to spawn in headwaters. Larvae are transported downstream to floodplain forests and savannas, consuming plankton (Machado-Allison 1992).”

From Hintz (2012):

“During spawning, females scatter adhesive eggs; fertilization then occurs externally. Although parents abandon their eggs, pacu are brood hiders, minimizing the chances of the clutch being discovered by predators and scavengers. (Froese and Pauly, 2010; Innes, 1966)”

“Pacu are capable of intraspecific communication using an alarm chemical known as "Schrekstoff". If one fish is injured, this substance is discharged from the wound into the water, alerting nearby conspecifics and related species of possible danger. (Smith, 1992)”

“The dietary composition of red-bellied pacu (and a number of closely related species) shifts depending on the season. During the wet season, they rely heavily on seed predation from the newly dropped fruit of riparian trees and plants. Although red-bellied pacu are widely considered to be frugivores, they are actually omnivorous, also eating crustaceans and smaller fishes, especially in the dry season. As some of the largest fish in the Amazon, pacu require large amounts of food. They feed in multiple “bite events”, with each event containing a number of individual bites, which is similar to the feeding behavior observed in true piranhas. (Burkhart, et al., 2002; Fernandes, et al., 2004; Froese and Pauly, 2010; Hanke, et al., 2006)”

From Correa et al. (2014):

“Fish appear as a main food resource for the introduced population [in the Sepik River, Papua New Guinea]. Fish remains found among stomach and intestinal contents of *P. brachypomus* from the Sepik River included scales, fin rays, bones, and in few instances, visceral organs of other fishes. […] The nature of these fish remains suggests carrion feeding instead of predation of other fishes.”

“Whether introduced *P. brachypomus* perform an annual reproductive migration in the Sepik/Ramu River Basin remains to be evaluated.”

Human Uses

From Froese and Pauly (2026):

“Fisheries: minor commercial; aquaculture: commercial; aquarium: commercial”

From Ćaleta et al. (2011):

“It is very valued as an aquaculture species, and is considered to be one of the most significant and prized species in aquarium trade (Saint-Paul, 1992; Jégu, 2003).”

From Nico et al. (2023):

“It is a prized food fish in South America.”

Diseases

No information was found associating *Piaractus brachypomus* with any diseases listed by the World Organisation for Animal Health (2023).

From Hintz (2012):

“Commensal/Parasitic Species
Anacanthorus penilabiatus (Monogenea: Dactylogyridae)
Mymarothecium viatorum (Monogenea: Dactylogyridae)
Dadaytrema oxycephala (Trematoda: Cladorchiidae)”

In addition, Poelen et al. (2014) list the following parasites for this species: *Anacanthorus spatulatus*, *Denticauda quadrangulata*, *Echinorhynchus jucundus*, *Klossinemella iheringi*, *Microrchis megacotyle*, *Monhysterides iheringi*, *Pseudoparabaris parabaris*, *Rondonia rondoni*, *Spectatus spectatus*, and *Travassosinia dilatata.*

Threat to Humans

From Froese (2026):

"Possesses powerful dentition that can cause serious bites [Robins et al. 1991]."

"Traumatogenic"

From Correa et al. (2014):

"Interestingly, *P. brachypomus* is now called "ball cutter" among the local villagers purportedly due to few reported cases in which fishermen have been bitten in their testicles while wading in the water."

3 Impacts of Introductions

From Correa et al. (2014):

"'Pacu' from native populations rarely feed on aquatic plants (Goulding, 1980; Knab-Vispo et al., 2003), but leaves and stems of such plants represented a large proportion of the diet of 'Pacu' from the Sepik [Papua New Guinea]. These findings support local people's claims that *P. brachypomus* are consuming aquatic vegetation causing declines in native floodplain fish populations (Gehrke et al., 2011). Although the mechanism is unclear, it is possible that consumption of aquatic macrophytes reduces habitat for aquatic invertebrates resulting in lower food availability for native floodplain fishes."

"Interestingly, *P. brachypomus* is now called "ball cutter" among the local villagers purportedly due to few reported cases in which fishermen have been bitten in their testicles while wading in the water."

From Nico et al. (2023):

"The impacts of this species are currently unknown, as no studies have been done to determine how it has affected ecosystems in the invaded range. The absence of data does not equate to lack of effects. It does, however, mean that research is required to evaluate effects before conclusions can be made."

Piaractus brachypomus is regulated in Hawaii (HDOA 2019) and New Mexico (NMDGF 2023). See section 1.

4 History of Invasiveness

The History of Invasiveness for *Piaractus brachypomus* is classified as Data Deficient. There are records of introduction into countries around the world. Cases of successful establishment of introduced populations have been rare. Where established in Papua New Guinea, *P. brachypomus* may be causing declines in native fish populations and occasional injuries to humans, but there is limited evidence available to evaluate the reliability of these impacts.

5 Global Distribution

Figure 1. Reported global distribution of *Piaractus brachypomus*. Map from GBIF Secretariat (2023). Observations are reported from North and South America, Southeastern Asia, Europe, and Africa. The points in North America, Europe, Africa, India, Bangladesh, Thailand, Myanmar, Singapore, Indonesia, and South America outside the Amazon River Basin are not known to represent established populations and were not used to select source locations for the climate matching analysis.

No georeferenced observations of established *P. brachypomus* populations in China were found to use as source points for the climate matching analysis.

6 Distribution Within the United States

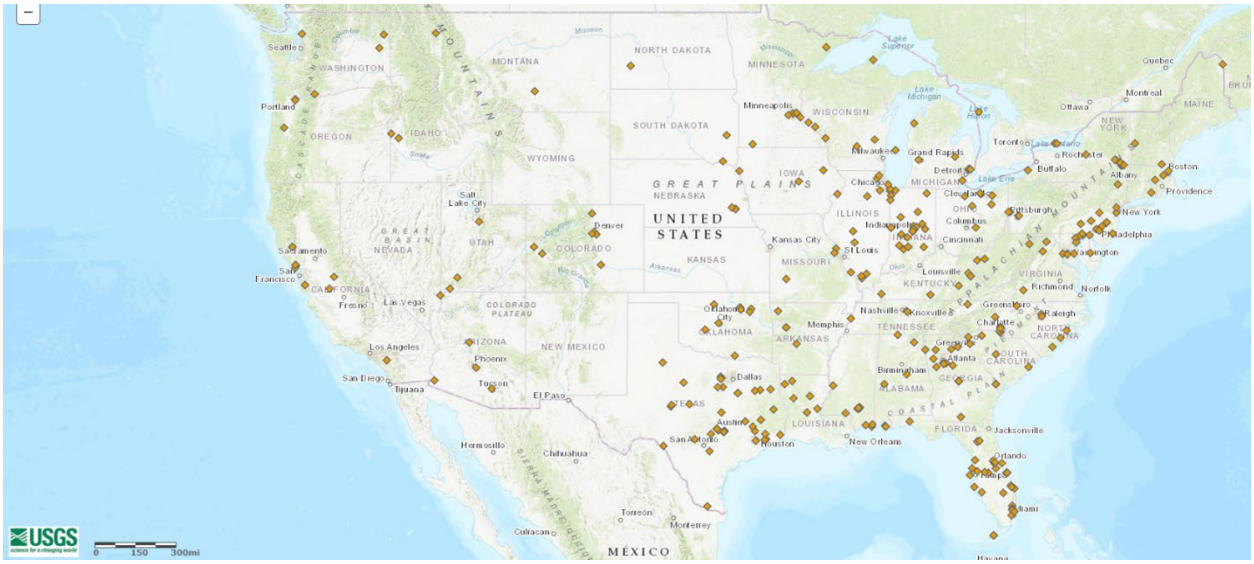

Figure 2. Reported observations of *Piaractus brachypomus* in the contiguous United States. Map adapted from Nico et al. (2023). Observations are reported mostly in the eastern United States although there are scattered observations country wide. None of the points represent an established population; they were not used to select source points for the climate matching analysis.

Figure 3. Reported observations of *Piaractus brachypomus* in Hawaii. Map from Nico et al. (2023). Observation is reported on the island of Oahu. This observation does not represent an established population and was not used to select source points for the climate matching analysis.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Piaractus brachypomus* was low for most of the contiguous United States. Southern Florida was the only area with a high climate match. Medium matches were recorded along the Gulf Coast and Southern Atlantic Coast. The overall Climate 6 score (Sanders et al. 2023; 16 climate variables; Euclidean distance) for the contiguous United States was 0.016, indicating that Yes, there is establishment concern for this species. The Climate 6 score is calculated as: (count of target points with scores ≥ 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 *Piaractus brachypomus* (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.

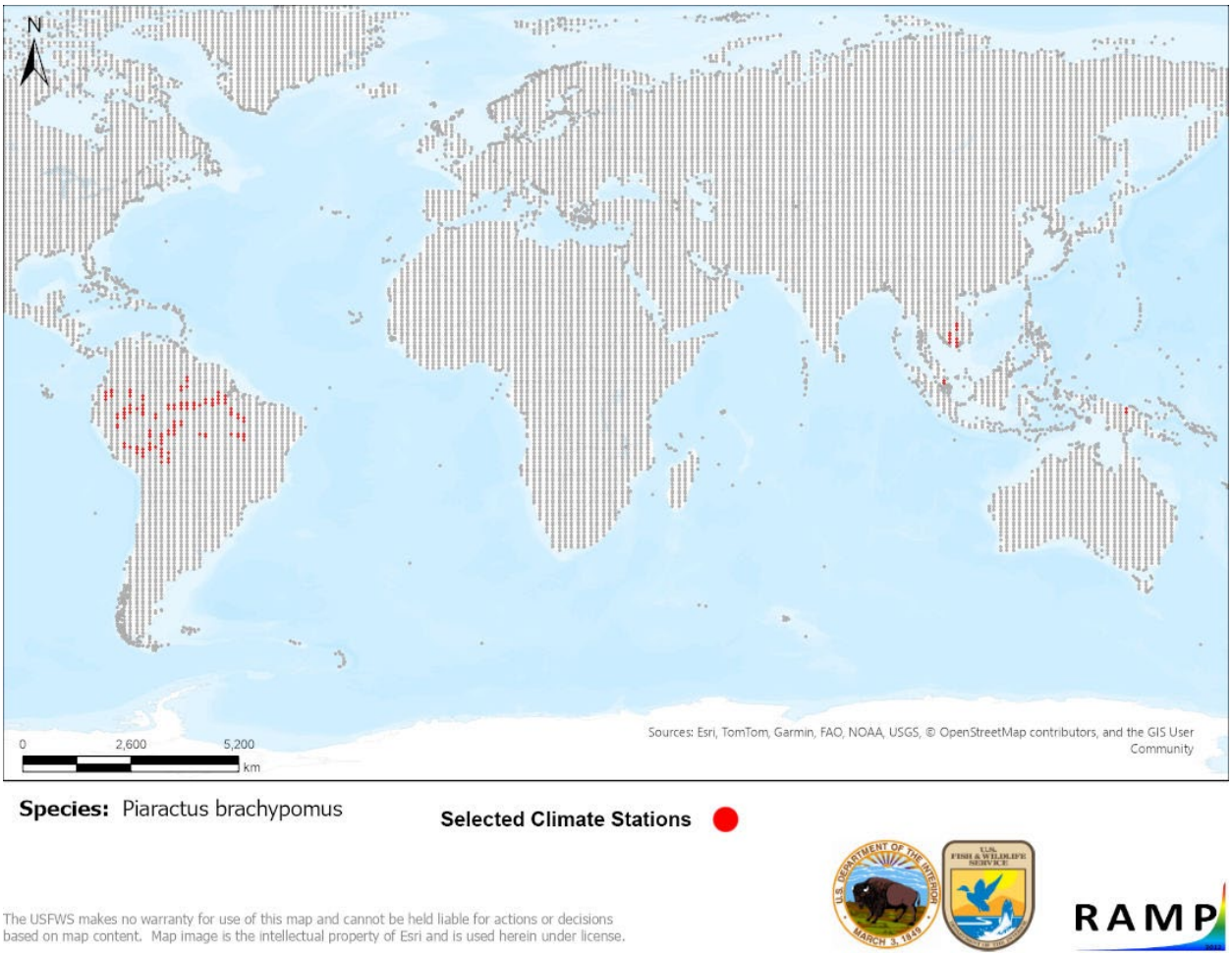

Figure 4. RAMP (Sanders et al. 2023) source map showing weather stations in a majority of the world selected as source locations (red; Bolivia, Brazil, Cambodia, Colombia, Ecuador, Malaysia, Papua New Guinea, Peru, Vietnam) and non-source locations (gray) for *Piaractus brachypomus* climate matching. 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.

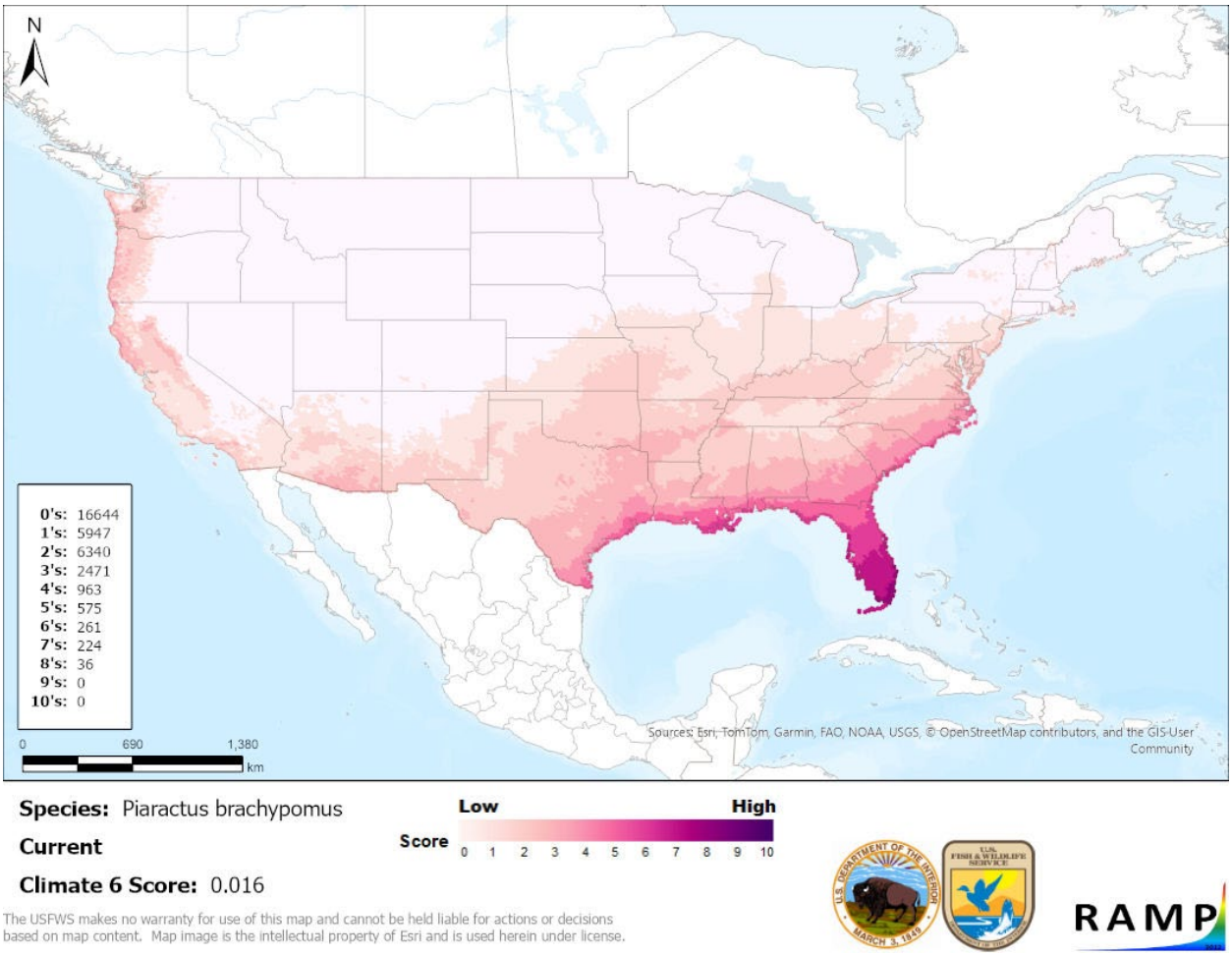

Figure 5. Map of RAMP (Sanders et al. 2023) climate matches for *Piaractus brachypomus* in the contiguous United States based on source locations reported by GBIF Secretariat (2023). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

8 Certainty of Assessment

The Certainty of Assessment for *Piaractus brachypomus* is classified as Low. There is reliable data showing the biology and ecology of this species. However, georeferenced observations were not found to represent the full introduced range of the species, which could affect the climate match in parts of the United States. There are records showing introductions and established populations, but establishment status was difficult to assess for some locations. Information on impacts of introduction comes from anecdotal observations.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Piaractus brachypomus, Pirapitinga, is a fish that is native to Amazon River Basin in South America. This species is common in the aquarium and aquaculture industries globally. *P. brachypomus* can reach large sizes up to 88 cm and 25kgs. It is commonly misidentified as piranha when sold. It is mostly vegetarian and frugivorous in its native range but a dietary shift toward piscivory and insectivory has been observed in part of its introduced range. There are observations of this species in the United States but there have been no known established populations. The History of Invasiveness for *Piaractus brachypomus* is classified as Data Deficient. *P. brachypomus* has been reported anecdotally to have impacts on native fish populations and to be responsible for human injuries, but more evidence is needed to support these anecdotal observations. This species is regulated in New Mexico under the current scientific name and in Hawaii under a synonymous scientific name. The climate matching analysis for the contiguous United States indicated there is establishment concern for this species, particularly in southern Florida. Most of the contiguous United States had a low match with this tropical species. The Certainty of Assessment for this ERSS is classified as Low due to information on impacts of introductions coming from anecdotal sources and gaps in georeferenced observations. The Overall Risk Assessment Category for *Piaractus brachypomus* 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: Traumatogenic**
- **Overall Risk Assessment Category: Uncertain**

10 Literature Cited

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in section 11.

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Appendix

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).

Under the future climate scenarios (figure A1), no region of the contiguous United States was projected to have a consistently high climate match for *Piaractus brachypomus*, although Southern Florida had a mostly high match at the 2055 time step. Most of the contiguous United States was projected to have a low climate match under all future scenarios. The Climate 6 scores for the individual future scenario models (figure A2) ranged from a low of 0.012 (model: GFDL-ESM4, SSP3, 2085) to a high of 0.022 (model: IPSL-CM6A-LR, SSP5, 2055). 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 (0.016, figure 5) falls within 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. Under one or more time step and climate scenarios, areas within the Appalachian Range, California, Great Lakes, Mid-Atlantic, Northeast, Northern Pacific Coast, Southeast, Southern Plains, Southwest, and Western Mountains saw a moderate increase in the climate match relative to current conditions. These areas of moderate increase were more widespread under SSP5 than under SSP3 and also more widespread at the 2085 time step than at the 2055 time step. No large increases were observed regardless of time step and climate scenarios. At the 2085 time step, areas within Southern Florida saw a moderate decrease in the climate match relative to current conditions. No large decreases were observed regardless of time step and climate scenarios. Additional very small areas of large or moderate change may be visible on the maps (figure A3).

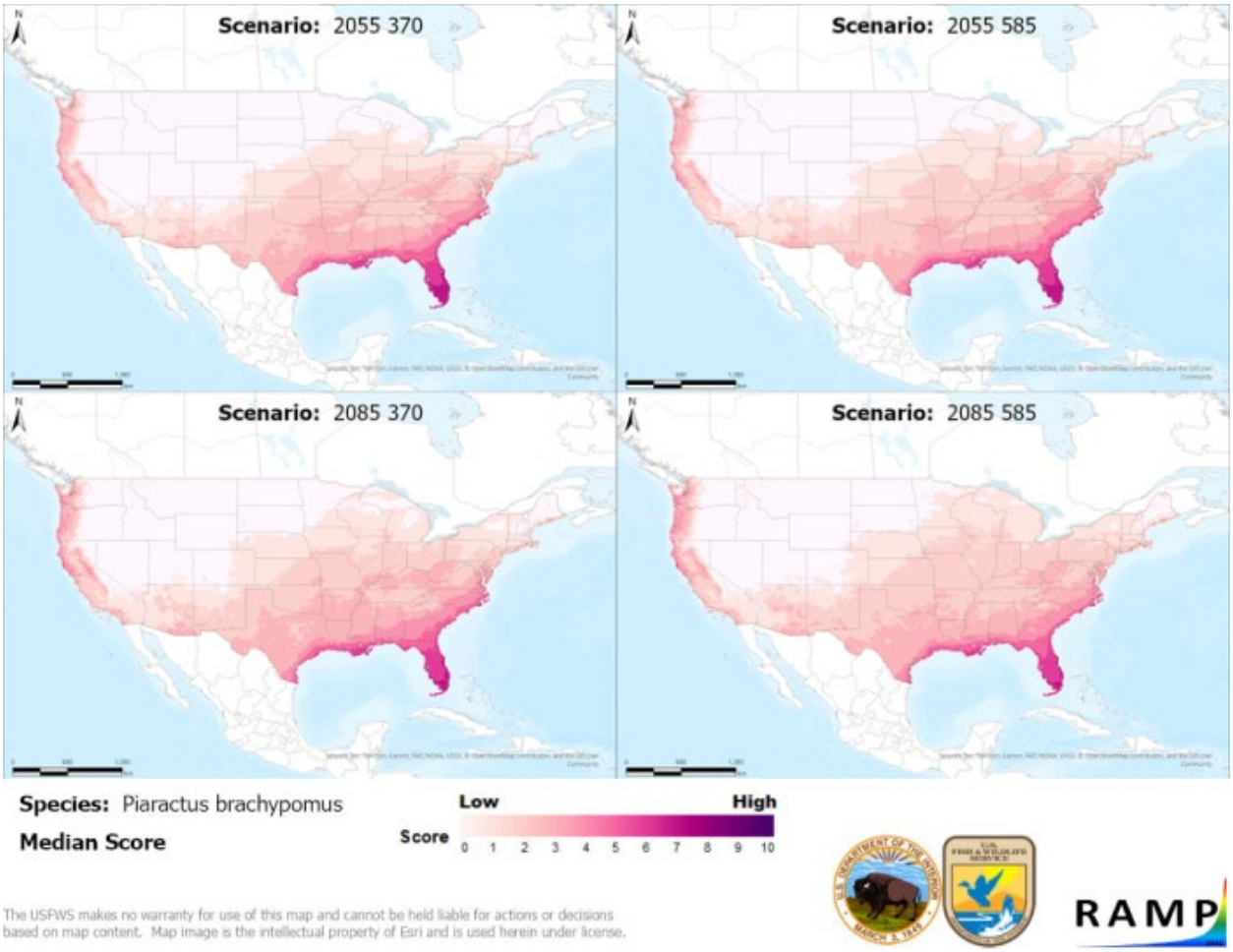

Figure A1. Maps of median RAMP (Sanders et al. 2023) climate matches projected under potential future climate conditions using five global climate models for *Piaractus brachypomus* in the contiguous United States. Climate matching is based on source locations reported by GBIF Secretariat (2023). Shared 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.

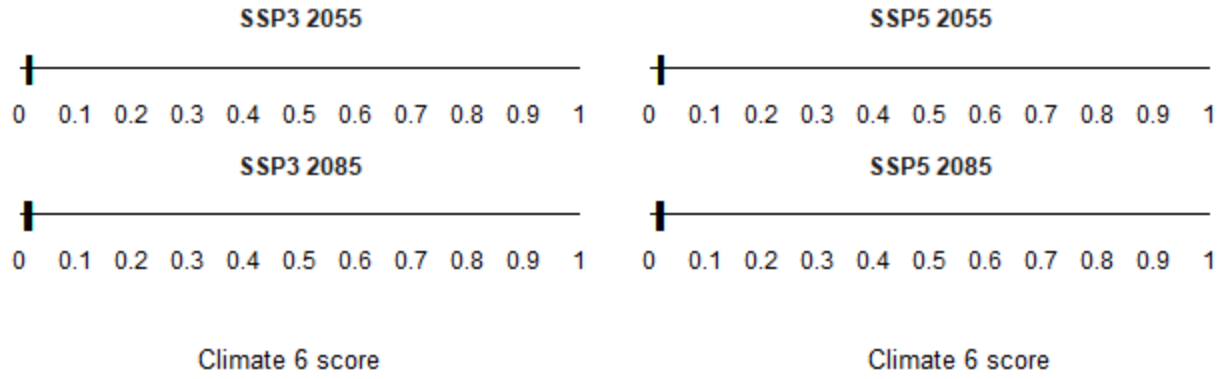

Figure A2. Comparison of projected future Climate 6 scores for *Piaractus brachypomus* in the contiguous United States for each of five global climate models under four combinations of Shared Socioeconomic Pathway (SSP) and time step. SSPs used (from left to right): SSP3, SSP5 (Karger et al. 2017, 2018; 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.

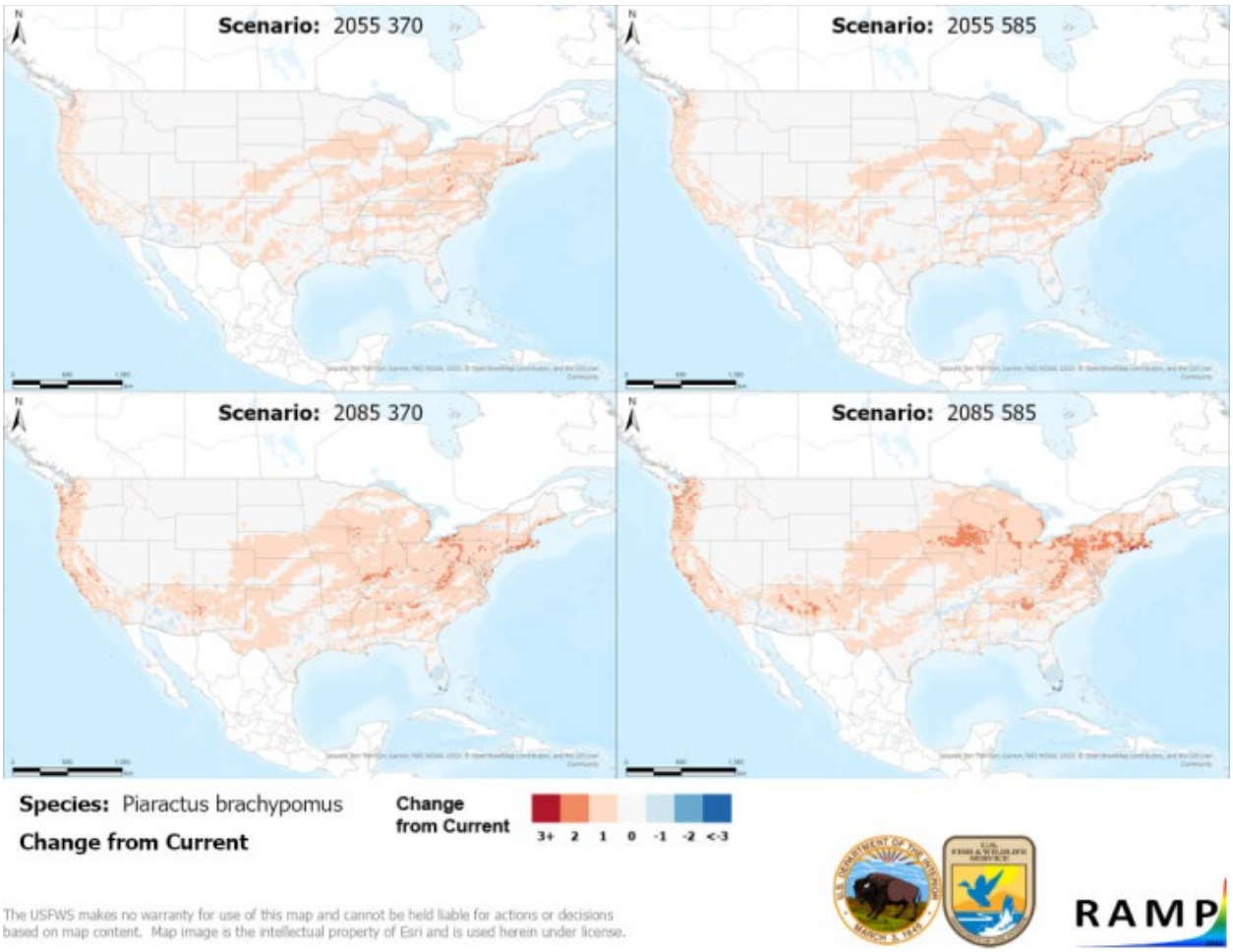

Figure A3. RAMP (Sanders et al. 2023) maps of the contiguous United States showing the difference between the current climate match target point score (figure 5) and the median target point score for future climate scenarios (figure A1) for *Piaractus brachypomus* based on source locations reported by GBIF Secretariat (2023). 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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