Pearl Eartheater (*Geophagus brasiliensis*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, April 2011
Revised, September 2018
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Photo: R. S. Dantas. Licensed under CC BY-NC 3.0. Available: https://www.fishbase.de/photos/ThumbnailsSummary.php?Genus=Geophagus&Species=brasiliensis#. (September 2018).

1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2018):

"South America: Coastal drainages of eastern and southern Brazil and Uruguay."

From Nico (2018):

“Tropical America. Widely distributed in rivers along the Atlantic Coast of Brazil from Bahia State to mouth of Río de la Plata, Argentina (Axelrod 1993), including Rio São Francisco (Britski et al. 1984).”

Status in the United States

From Nico (2018):

“Reported from Florida.”

“The first *Geophagus* to enter the aquarium trade, this species has been widely available and bred commercially in Florida (Loiselle [1980]).”

This species is in trade in the U.S.

From Imperial Tropicals (2015):

“*Geophagus Brasiliansis* [*sic*] "Pearl Cichlid" […] $ 9.99”

Means of Introductions in the United States

From Nico (2018):

“Probable fish-farm escape.”

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 Acanthopterygii
Order Perciformes
Suborder Labroidei
Family Cichlidae
Genus *Geophagus*
Species *Geophagus brasiliensis* (Quoy and Gaimard, 1824)”

From Fricke et al. (2018):

"Current status: Valid as *Geophagus brasiliensis* (Quoy & Gaimard 1824). Cichlidae: Cichlinae."

Size, Weight, and Age Range

From Froese and Pauly (2018):

"Maturity: Lm 9.1 range ? - ? cm
Max length : 28.0 cm TL male/unsexed; [Kullander 2003]; common length : 9.0 cm TL male/unsexed; [Hugg 1996]"

From CABI (2018):

"Published literature suggests that the maximum size is approximately 250 mm for males and markedly smaller for females. However, a male specimen of over 350 mm total length was collected in south-western Australia (Beatty et al., 2013). While fish may reach these sizes, both males and females are typically much smaller measuring up to 100 mm in length (Britski et al., 1984; Froese and Pauly, 2014; USGS NAS, 2014)."

Environment

From Froese and Pauly (2018):

"Freshwater; brackish; benthopelagic; pH range: 6.5 - 7.0; dH range: 5 - 10; potamodromous [Riede 2004]. […] 20°C - 23°C [Riehl and Baensch 1991; assumed to be recommended aquarium temperature range]"

From de Graaf and Coutts (2010):

"*Geophagus brasiliensis* is known to occur in brackish water (14 PPT; Mazzoni & Iglesias-Rios 2002) and it may be expected that this species would tolerate elevated levels of salinity."

From CABI (2018):

"Of particular note is that the species is highly tolerant of temperature and salinity variability and may survive in the low temperatures of temperate latitudes (i.e. down to 10°C) and salinities from fresh to seawater."

Climate/Range

From Froese and Pauly (2018):

"Tropical […]"

Distribution Outside the United States

Native

From Froese and Pauly (2018):

"South America: Coastal drainages of eastern and southern Brazil and Uruguay."

From Nico (2018):

"Tropical America. Widely distributed in rivers along the Atlantic Coast of Brazil from Bahia State to mouth of Río de la Plata, Argentina (Axelrod 1993), including Rio São Francisco (Britski et al. 1984)."

Introduced

From Beatty et al. (2013):

"Native to the coastal drainages of eastern and southern Brazil and Uruguay, the pearl cichlid (also known as the pearl eartheater) *Geophagus brasiliensis* (Quoy & Gaimard, 1824) is a popular aquarium species and has been introduced into natural systems of the USA, Taiwan, Philippines and Australia (Axelrod 1993; Fuller et al. 1999; Liang et al. 2006; Fishbase 2012). Sightings of *G. brasiliensis* in a wild aquatic system in Western Australia were first reported to the authors from Bennett Brook (a major tributary of the Swan River, […]) in February 2006. The species was not recorded in a previous survey of the catchment in 1998 (Bamford et al. 1998). In 2011, *G. brasiliensis* was also reported in irrigations lakes on the Vines Golf Course (Ellen Brook), another major tributary of the Swan River (C. Bird, Department of Fisheries, Government Western Australia, pers. comm.)."

From de Graaf and Coutts (2010):

"[…] introductions of *G. brasiliensis* have been reported in Taiwan, USA, Philippines (www.fishbase.org) and the Tweed River, New South Wales, Australia."

Means of Introduction Outside the United States

From de Graaf and Coutts (2010):

"Recently a new feral species (ornamental escape), the South American Pearl Cichlid (*Geophagus brasiliensis*) […], was recorded in Bennett Brook […], a tributary of the Swan River [Australia]."

Short Description

From CABI (2018):

"The background colour of *G. brasiliensis* is often silvery light brown though significant dissimilarities in body colour and patterning are observed depending on locality. The background colouration may be dominated by varying shades of blue, green or yellow. *G. brasiliensis* has one dark spot on its mid-flank, located towards its tail and may also display several vertical black

bands with many small iridescent powder blue spots on sides. These spots are more noticeable when removed from the water. The species often has red highlights on the fins, principally the dorsal and caudal fins."

"Variations are observed in body shape of populations of *G. brasiliensis* depending on the type of environment inhabited. For example, specimens from lotic environments are often more elongate than those from lentic habitats. Dominant males often develop a nuchal hump, a bump or bulge on the forehead."

Biology

From Wimberger (1991):

"*G. brasiliensis*, the substrate-spawner, is found in southern Brazil, Paraguay and northern Argentina. A mated pair spawns on a cleaned, generally elevated surface where the eggs adhere. The female guards and constantly fans the eggs which hatch in approximately five days. Fry begin feeding exogenously when 3 to 4 mm long."

From CABI (2018):

"*G. brasiliensis* is a habitat generalist and will thrive in habitats with varying levels of water movement (lentic and lotic), turbidity and substrates. It thrives in anthropogenically modified habitats such as irrigation canals in subtropical Florida (USGS NAS, 2014), small lotic habitats in urban areas (Beatty et al., 2013) and ornamental ponds (McKay, 1989)."

"In its native range in south eastern Brazil, *G. brasiliensis* occurs in coastal drainages and the lower reaches of rivers. Some populations inhabit coastal lagoons with permanent or temporary connections to the ocean (Mazzoni and Iglesias-Rios, 2002; Garcia et al., 2003)."

"*G. brasiliensis* is a generalised omnivore with the natural diet composed of detritus, plant material, algae, aquatic invertebrates (particularly Chironomid larvae, Ostracoda and Cladocera) and fish including fish eggs (Sabino and Castro, 1990; Marcos et al., 2004; Arcifa and Meschiatti, 1993; Bastos et al., 2011; Beatty et al., 2013; Nunes et al., 2014)."

Human Uses

From Froese and Pauly (2018):

"Quite popular with aquarists."

"Aquarium: commercial"

This species is in trade in the U.S.

From Imperial Tropicals (2015):

"*Geophagus Brasiliansis* [*sic*] "Pearl Cichlid" […] $ 9.99"

Diseases

From Froese and Pauly (2018):

"Cosmoxynema Infestation, Parasitic infestations (protozoa, worms, etc.)
Procamallanus Infection 17, Parasitic infestations (protozoa, worms, etc.)"

Poelen et al. (2014) list *Neoechinorhynchus paraguayense* and *Gyrodactylus geophagensis* as parasites of *Geophagus brasiliensis* (Smithsonian Institution, no date).

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

Threat to Humans

From Froese and Pauly (2018):

"Harmless"

3 Impacts of Introductions

From de Graaf and Coutts (2010):

"Based on the results of this study it is highly unlikely that without effective management action, the feral *G. brasiliensis* will be confined to Bennett Brook. *Geophagus brasiliensis* is likely to spread throughout the interconnected watercourses of the upper Swan catchment. It is, however, unclear whether *G. brasiliensis* would be able leave the Swan system and to migrate along the coast and invade other river systems in southwestern WA. The spread of *G. brasiliensis* may pose a threat to aquatic biodiversity for several reasons. In the first place, the relatively large *G. brasiliensis* is territorial and aggressive towards conspecifics and other fish species especially during the breeding season. Secondly, *G. brasiliensis* is an omnivore (de Moraes et al. 2004; […], de Graaf unpublished data) and will compete with most native fish species for the same food resources (Morgan et al. 1998)."

"Future research should focus on a) the reproductive biology to determine size-at-maturity, breeding period and its potential ability to reproduce in the Swan River, and b) the diet of *G. brasiliensis* to determine the potential impact on native fish through competition and/or predation. The results of this preliminary study clearly suggest that ongoing control efforts are required in order to limit/prevent the invasion of the species into the Swan catchment."

From CABI (2018):

"*G. brasiliensis* may burrow/modify the substrate during nest preparation when breeding therefore disrupting the habitat of other organisms (Loiselle, 1980)."

"There are no data outlining potential impacts of *G. brasiliensis* on aquatic biodiversity. While empirical research clearly outlining impacts is lacking, it is possible to infer potential impacts based on the biology and ecology of the species. Both de Graaf and Coutts (2010) and Beatty et al. (2013) discussed the potential impacts of *G. brasiliensis* based on their research."

"*G. brasiliensis* is territorial and aggressive towards conspecifics and sympatric fishes especially when breeding (Loiselle, 1980). Furthermore, *G. brasiliensis* grows larger than all but one of the endemic freshwater fish in south-western Australia and thus would likely have a competitive advantage based on size (Beatty et al., 2013). The levels of agonistic behaviour and territoriality exhibited by *G. brasiliensis* when reproducing and when not reproducing, have not been quantified and are worthy of further research (Beatty et al., 2013)."

"*G. brasiliensis* is omnivorous which contrasts with the carnivorous diets of endemic freshwater fishes of south western Australia (Morgan et al., 1998). While the diets of *G. brasiliensis* and other freshwater fish may thus appear different, *G. brasiliensis* will also readily consume aquatic and terrestrial invertebrates that are the foundation of the diet of the native species. Also, Beatty et al. (2013) proposed that an omnivorous diet would allow *G. brasiliensis* to occupy a broader range of ecosystems and potentially result in impacts on the structure and function of the aquatic ecosystems that may be difficult to predict due to the potential de-coupling of trophic cascades."

"Direct predation of sympatric fish may also occur, particularly as noted previously, *G. brasiliensis* grows larger than all but one of the local species in south western Australia. Fishes were found to be a small component of the diet of *G. brasiliensis* by Beatty et al. (2013), however were a much larger component of the diet of the species examinated by de Graaf and Coutts (2010); although the latter data was based on a small sample size."

4 Global Distribution

Figure 1. Known global distribution of *Geophagus brasiliensis*, reported from South America, East Asia, and Australia. Map from GBIF Secretariat (2018). Points in the Amazon River basin were excluded from climate matching because they occur outside the documented range of this species. This species' presence in Hong Kong has not been documented by other sources, but the records from there appeared legitimate and therefore were not excluded.

5 Distribution Within the United States

No map is available for this species' distribution within 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 U.S. was 0.059, which is a medium climate match. A Climate 6 score of between 0.005 and 0.103 indicates a medium climate match. The climate match was highest in the Southeast: Florida, Georgia, Louisiana, North Carolina, South Carolina, and Texas had high climate matches. Alabama and Mississippi had a medium climate match. The climate match was low in the rest of the contiguous United States.

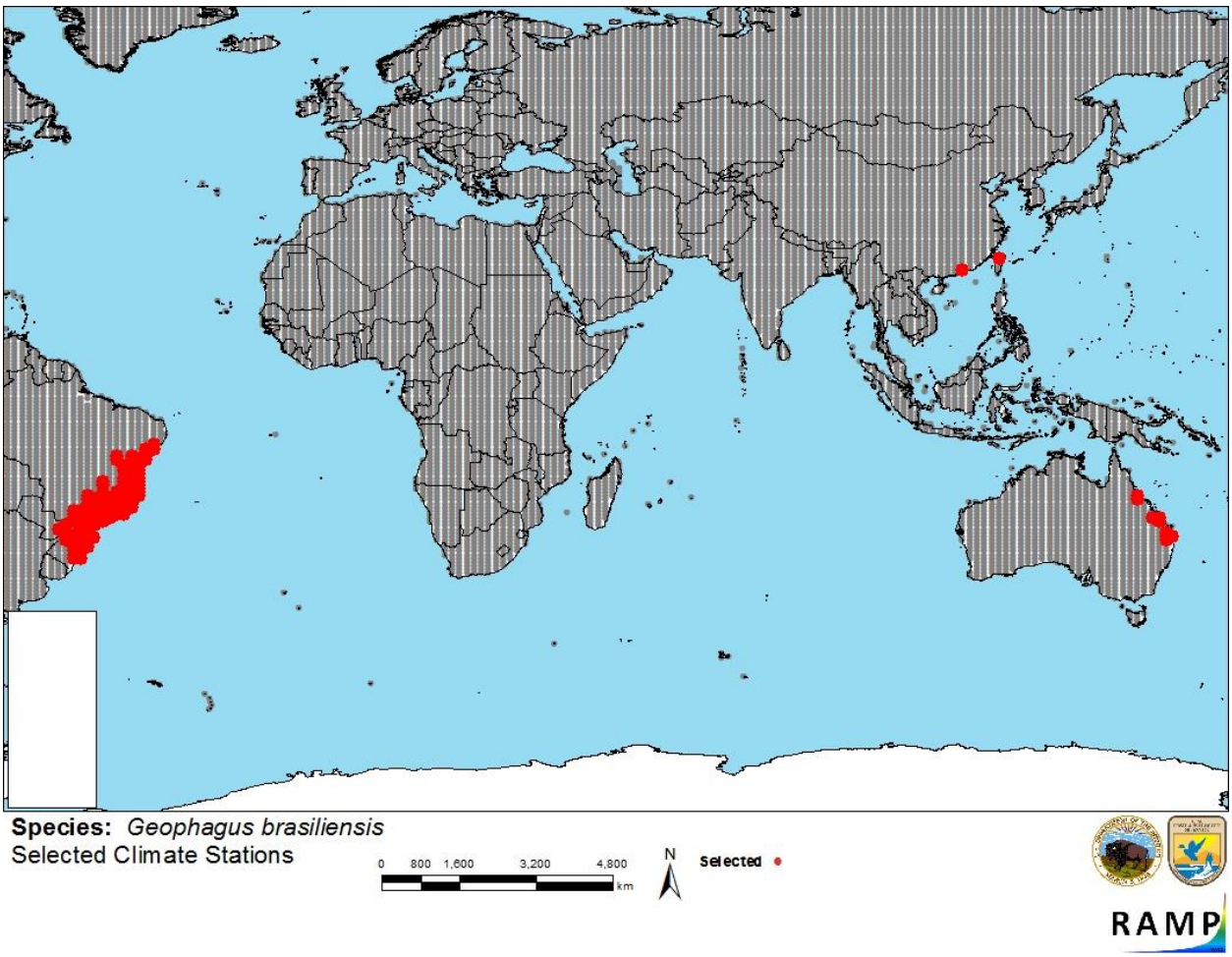

Figure 2. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red; Brazil, China, Taiwan, Australia) and non-source locations (gray) for *Geophagus brasiliensis* climate matching. Source locations from GBIF Secretariat (2018).

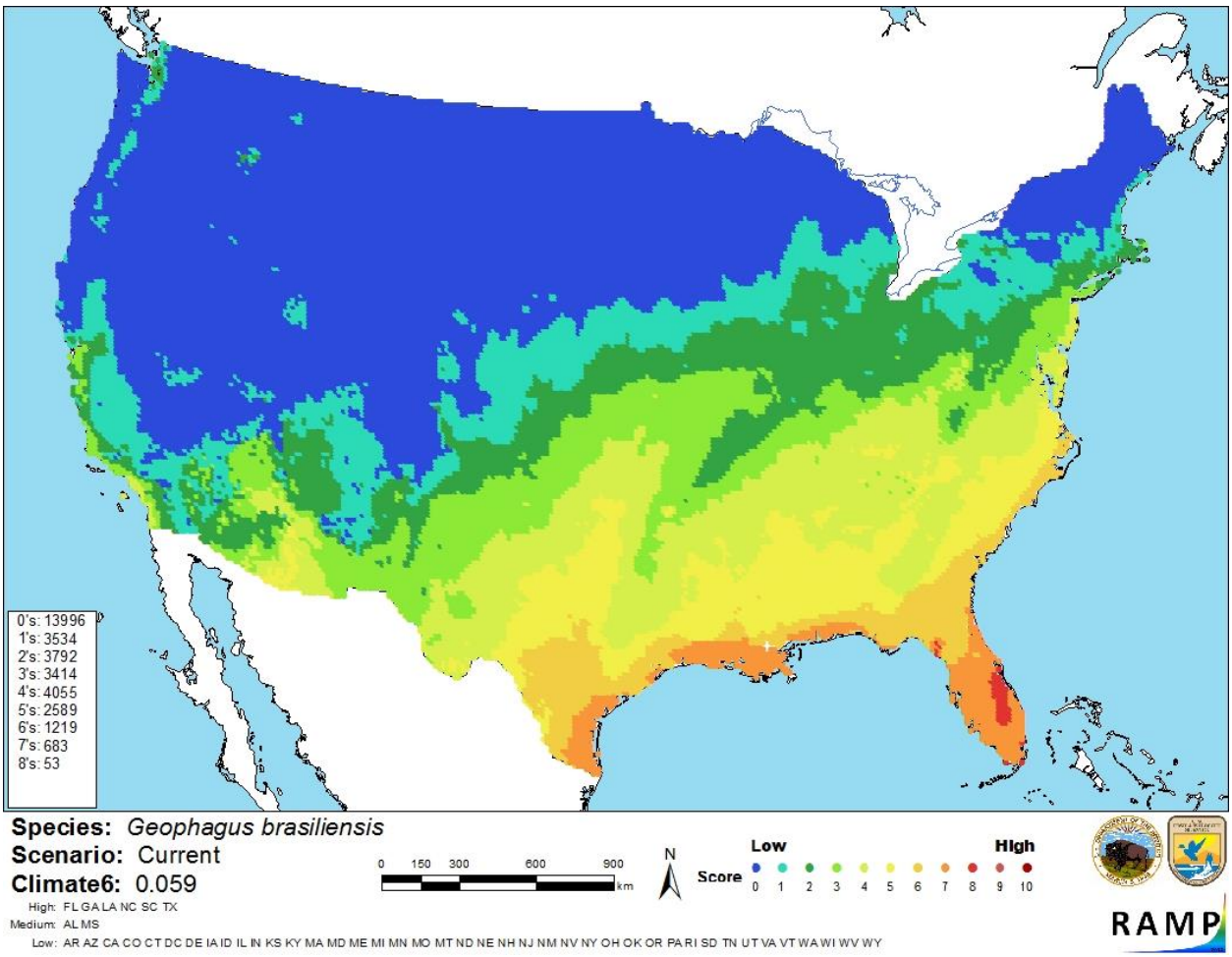

Figure 3. Map of RAMP (Sanders et al. 2014) climate matches for *Geophagus brasiliensis* in the contiguous United States based on source locations reported by GBIF Secretariat (2018). Counts of climate match scores are tabulated on the left. Counts of climate match scores are tabulated on the left. 0=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

The "High", "Medium", and "Low" climate match categories are based on the following table:

Climate 6: Proportion of (Sum of Climate Scores 6-10) / (Sum of total Climate Scores)	Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

7 Certainty of Assessment

There is adequate information available about the biology, ecology, and distribution of *Geophagus brasiliensis*. This species has been reported as established outside of its native range, and the pathway of these introductions is known. There is no research currently available documenting negative impacts that *G. brasiliensis* is having in the ecosystems where it has been

introduced. Further information is needed to assess the risk this species poses to the contiguous U.S., so the certainty of this assessment is low.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Geophagus brasiliensis, the Pearl Eartheater, is a cichlid species native to southeast Brazil and Uruguay. This species is popular in the aquarium trade and is bred commercially and in trade in the United States. It has been reported as introduced to Florida, probably as the result of an aquaculture escape, but no negative impacts of its introduction have been documented. The climate match of *G. brasiliensis* with the contiguous U.S. is medium overall, but medium to high in the Southeast. Outside of the U.S., it has been reported as introduced in Australia, Taiwan, and the Philippines. While no negative impacts of this species' introduction have been documented, there is concern that it may displace native fish species with aggressive territorial behavior, disturb substrate during spawning, and compete with native species for food resources. Further research into these potential negative impacts is needed to assess the risk this species poses with any certainty, so the certainty of this assessment is low. The overall risk assessment category is uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3): None Documented**
- **Climate Match (Sec. 6): Medium**
- **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.

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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.

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