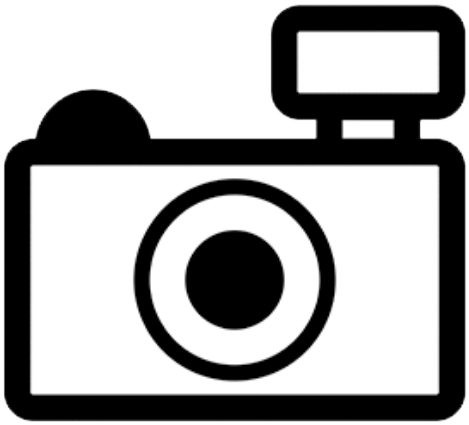
Tucunare Amarela (*Cichla kelberi*) (a fish)

Ecological Risk Screening Summary

U.S. Fish & Wildlife Service, July 2014
Revised, March 2019
Web Version, 8/15/2019



1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2019a):

"Known from the Rio Araguaia drainage and the lower Rio Tocantins drainage. […] Tucunaré amarela was listed from the Itaipu, Porto Primavera, Jupiá, Três Irmãos, Ilha Solteira, São Simão, Porto Colômbia, Volta Grande, Jaguara, Estreito, Promissão, Igaratá and Paraibuna dams in the Brazilian Paraná basin, the Funil and Ribeirão das Lajes dams in the Rio Paraíba do Sul drainage, the Xingó dam in the Rio São Francisco drainage, the Pacoti-Riachão dam near Fortaleza in Ceará, the Serra da Mesa dam in the Rio Tocantins drainage [Kullander and Ferreira 2006]."

Status in the United States

No wild populations of *Cichla kelberi* have been recorded in the United States. This species is for sale within the United States.

From Aqua-Imports (2019):

"Kelberi Peacock Bass (*Cichla kelberi*) […] $22.99-$29.99"

Means of Introductions in the United States

No wild populations of *Cichla kelberi* have been recorded in the United States.

Remarks

A previous version of this ERSS was published in 2014. Revisions were done to incorporate new information and to bring the document in line with current standards.

From Almeida-Ferreira et al. (2011):

"RAPD molecular marker research showed that there are two species (*Cichla kelberi* and *C. piquiti*) belonging to the genus *Cichla* in the rivers of the Paraná basin. Different morphotypes in the region may also be due to hybridization. Since exclusive SPAR molecular markers were obtained for *Cichla kelberi* and *C. piquiti* populations, the introduction of the two species in the region has been confirmed. Identification of the markers in specimens of the Paraná river basin confirmed hybridization between these exotic species."

Cichla kelberi was first described to science in 2006 (Fricke et al. 2019).

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From Fricke et al. (2019):

"**Current status:** Valid as *Cichla kelberi* Kullander & Ferreira 2006."

From Froese and Pauly (2019b):

"Animalia (Kingdom) > Chordata (Phylum) > Vertebrata (Subphylum) > Gnathostomata (Superclass) > […] Actinopterygii (Class) > Perciformes (Order) > Labroidei (Suborder) > Cichlidae (Family) > Cichlinae (Subfamily) > *Cichla* (Genus) > *Cichla kelberi* (Species)"

Size, Weight, and Age Range

From Froese and Pauly (2019a):

"Maturity: L_m 20.7 […]
Max length : 58.5 cm SL male/unsexed; [Freitas et al. 2017]; max. published weight: 4.9 kg [Freitas et al. 2017]"

Environment

From Froese and Pauly (2019a):

"Freshwater; benthopelagic."

Climate/Range

From Froese and Pauly (2019a):

"Tropical"

Distribution Outside the United States

Native

From Froese and Pauly (2019a):

"Known from the Rio Araguaia drainage and the lower Rio Tocantins drainage. […] Tucunaré amarela was listed from the Itaipu, Porto Primavera, Jupiá, Três Irmãos, Ilha Solteira, São Simão, Porto Colômbia, Volta Grande, Jaguara, Estreito, Promissão, Igaratá and Paraibuna dams in the Brazilian Paraná basin, the Funil and Ribeirão das Lajes dams in the Rio Paraíba do Sul drainage, the Xingó dam in the Rio São Francisco drainage, the Pacoti-Riachão dam near Fortaleza in Ceará, the Serra da Mesa dam in the Rio Tocantins drainage [Kullander and Ferreira 2006]."

Introduced

From Espínola et al. (2010):

"The target species of the present study, the peacock-bass *Cichla kelberi* (Kullander and Ferreira 2006), was introduced into several Brazilian watersheds as well as into other world regions."

From Kovalenko et al. (2010a):

"Peacock bass was first observed in the Paraná River in 1985 and remained at a low density until recently."

From Froese and Pauly (2019a):

"Introduced in reservoirs in Rio Grande do Norte, Minas Gerais and Ceará (as *C. monoculus*, cited in Chellappa et al., 2003; as *C. ocellaris* cited in Fontenele, 1948,); [*sic*] in the Rio Paraíba do Sul (State of Rio de Janeiro); and, the Rio Paraná."

Means of Introduction Outside the United States

From Espínola et al. (2010):

"*Cichla kelberi* is appreciated in sport fishing because of its characteristics as a fighting fish (Winemiller 2001)."

Short Description

From Froese and Pauly (2019a):

"Diagnosis: Differs from its congeners by presence in adults of small light spots on pelvic and anal fins, and lower lobe of caudal fin. It is similar to *C. monoculus* and *C. pleiozona* in possessing three dark vertical bars on the side, presence of a pronounced occipital bar in large specimens, absence of black or ocellated markings laterally on head, and presence of irregular dark blotches on anterior abdominal side. Differs from *C. pleiozona* by less scales in a lateral row (76-83 vs. 84-93 in *pleiozona*) and typical absence of bar 4 [Kullander and Ferreira 2006]."

Biology

From Normando et al. (2009):

"Expansion of this genus in reservoirs is possibly due to their adaptability in lentic waters, piscivorous feeding habits (Novaes et al., 2004), multiple spawnings (Winemiller et al., 1997; Gomiero and Braga, 2004), parental care (Zaret, 1980), and plasticity in their resource allocation for growth and reproduction (Chellappa et al., 2003)."

Human Uses

From Espínola et al. (2010):

"*Cichla kelberi* is appreciated in sport fishing because of its characteristics as a fighting fish."

From Aqua-Imports (2019):

"Kelberi Peacock Bass (*Cichla kelberi*) […] $22.99-$29.99"

Diseases

No information on diseases of *Cichla kelberi* was found. **No OIE-reportable diseases (OIE 2019) were recorded for *Cichla kelberi*.**

Threat to Humans

From Froese and Pauly (2019a):

"Harmless"

3 Impacts of Introductions

From Pelicice and Agostinho (2009):

"To investigate the relationship between invasion and fish diversity, the present study followed a natural experiment in the Rosana Reservoir (Paraná River basin), where *Cichla kelberi* were introduced in 2004. We monitored fish assemblages associated with submerged macrophytes

between 2003 and 2007, using a 1 m^2 throw trap. In the years following the introduction, fish diversity dramatically changed. For example, in March 2007, mean fish density and richness were reduced by ca. 95 and 80%, respectively, and many small-sized species had vanished. One aspect was the gradual change of biodiversity, which unfolded at two times during each year: (1) impacts during summer/autumn periods, which coincided with large shoals of young *C. kelberi* in the patches; and (2) assemblage recovery during the spring. The sequence of extinction-colonization events, however, might not be able to maintain fish assemblages due to the decrease in recovery intensity each spring; assuming a constant decline rate in the coming years, we predict complete assemblage extinction by the summer of 2010. Results from this natural experiment provided evidence supporting the collapse of fish assemblages soon after the introduction of *C. kelberi*. Such rapid destruction (2 years) reveals an important homogenizing force behind this predator and stresses the need for control measures that prevent new transferences among South American basins."

From Kovalenko et al. (2010b):

"The non-native peacock bass (*Cichla kelberi*) is causing freshwater fish extinctions in the tropical regions around the world, but there are very few studies on its interaction with native species. This study, based on a mesocosm experiment, examined direct and indirect effects of a non-native peacock bass on the native prey in Paraná River, Brazil, and tested whether these effects were mitigated by aquatic vegetation. Feeding activity of most prey was unaffected by the presence of peacock bass. All prey were consumed in the absence of vegetation; whereas a marginally significant decrease in mortality was observed in the vegetated habitats. Overall, peacock bass had minor indirect effects on prey foraging, but very significant direct effects on prey survival. As aquatic plants provide very limited protection to native prey, vegetated habitats are unlikely to slow down the decline in biodiversity resulting from this invasive species and conservation measures may need to consider other ways to ensure survival of the source populations."

From Fugi et al. (2008):

"In order to investigate trophic interactions, the diets of peacock bass (*Cichla kelberi*) and dogfish (*Galeocharax knerii*) were studied in the Corumbá Reservoir between 1997 and 2000. This dietary study was performed to assess the niche breadth of each species and to determine the degree of niche overlap during different phases of reservoir colonization. During Period I, peacock bass were absent or recorded only in low numbers; during Periods II and III, peacock bass reached high abundances in the reservoir. Interactions between the species were weak during period I, but, during Periods II and III, they were found to interact intensively. The diet overlap was highest during Period II. The niche breadth fluctuated for both species in the different phases. Greater niche breadth was observed for dogfish during periods of low peacock abundance (i.e., Period I), and the lowest niche breadth value was observed during Period II. During the same period, the peacock bass exhibited a wide foraging niche. During Period III, the dogfish showed an increase of its niche breadth, while for the peacock bass a simultaneous decrease in the niche breadth, caused by increasing rates of cannibalism, was recorded. These results show that the presence of peacock bass induces changes in the diet of dogfish, probably due to a restricted number of prey items."

4 Global Distribution

Figure 1. Known global distribution of *Cichla kelberi*. Locations in Brazil and Paraguay. Map from GBIF Secretariat (2019).

5 Distribution Within the United States

No wild populations of *Cichla kelberi* have been recorded in the United States.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Cichla kelberi* was low for most of the contiguous United States. There were some patches of high match along the Gulf of Mexico and into Florida, with medium match extending along the east coast up to about Kentucky. The Climate 6 score (Sanders et al. 2018; 16 climate variables; Euclidean distance) for the contiguous United States was 0.041, medium (scores greater than 0.005, but less than 0.103, are classified as medium). All States had low individual Climate 6 scores except for North Carolina and Texas, which had medium scores, and Alabama, Florida, Georgia, Louisiana, Mississippi, and South Carolina, which had high scores.

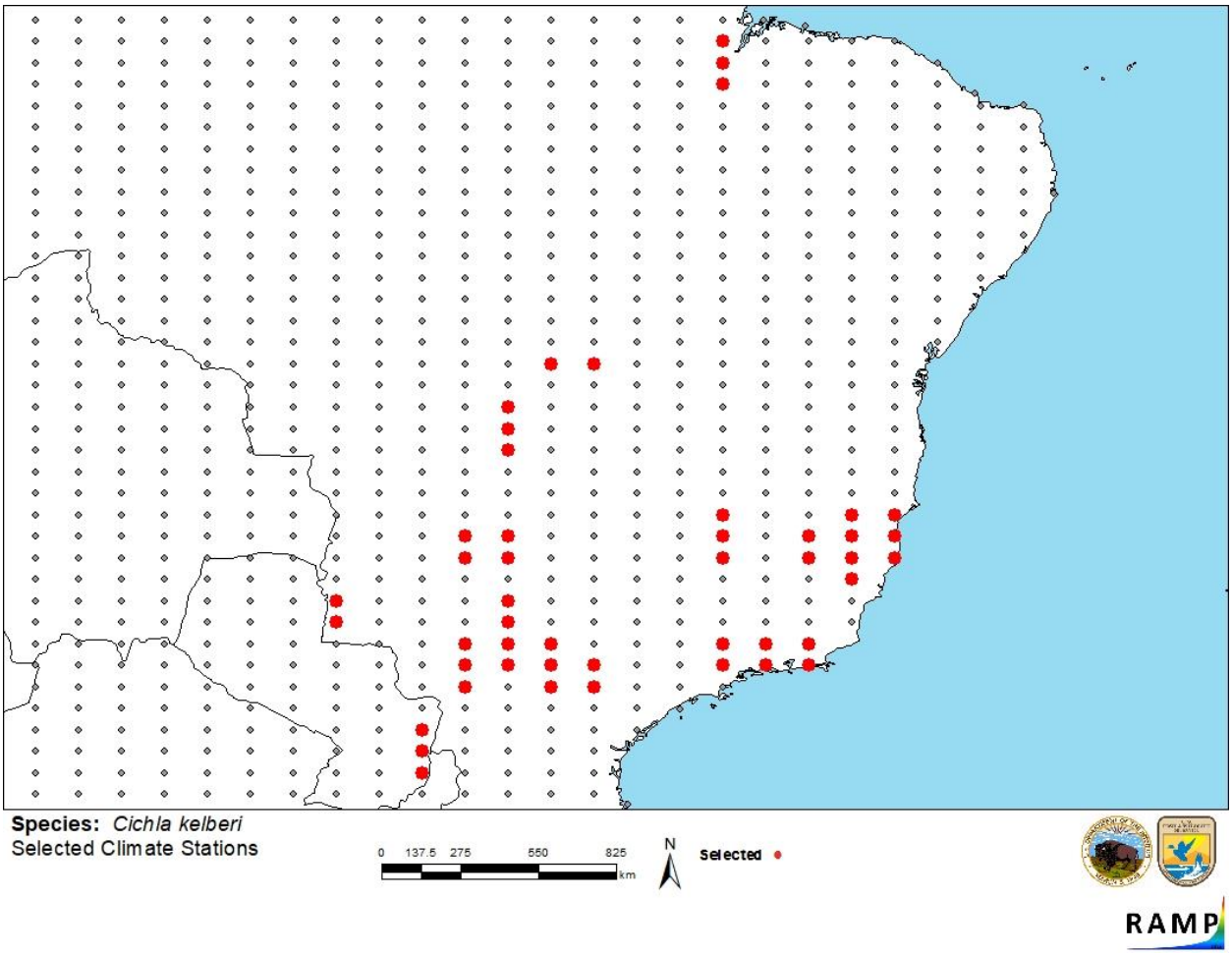


Figure 2. RAMP (Sanders et al. 2018) source map showing weather stations in Brazil and Paraguay selected as source locations (red) and non-source locations (gray) for *Cichla kelberi* climate matching. Source locations from GBIF Secretariat (2019). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

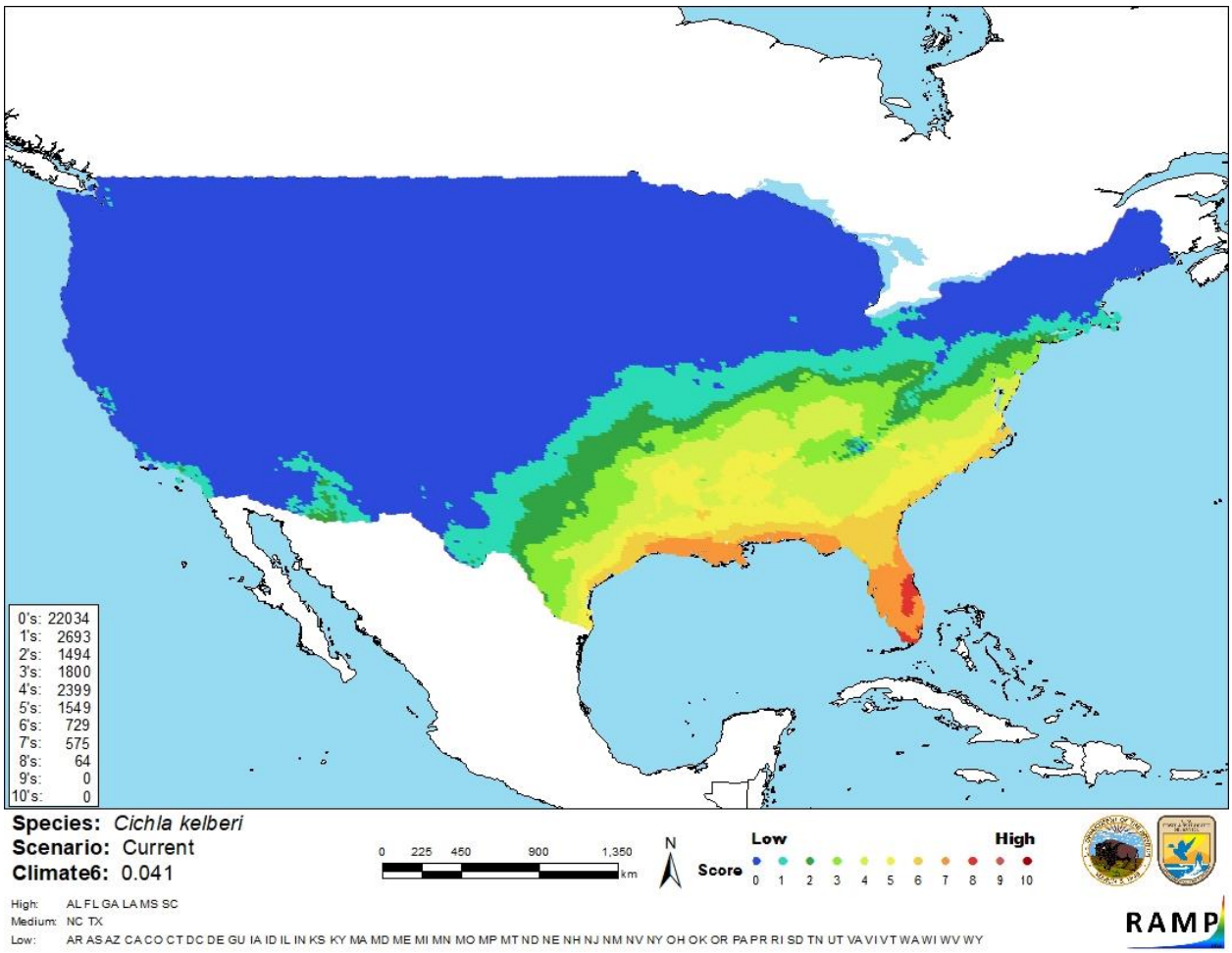


Figure 3. Map of RAMP (Sanders et al. 2018) climate matches for *Cichla kelberi* in the contiguous United States based on source locations reported by GBIF Secretariat (2019). Counts of climate match scores are tabulated on the left. 0 = Lowest match, 10 = Highest match.

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

Information on the impacts of introduction for this species are fairly well documented in peer-reviewed literature. However, this species has only been introduced in locations close to its native range. Information on the actual extent of the introduced range is also limited. For these reasons the certainty of assessment is medium.

8 Risk Assessment

Summary of Risk to the Contiguous United States

Cichla kelberi is a freshwater tropical fish native to an isolated region of Brazil. *Cichla kelberi* is a piscivorous generalist. This species negatively impacts native species through predation and competition; it has been implicated in the extirpation of small prey fish in its introduced range. The history of invasiveness for this species is high. The introduced range of this species appears to be mostly limited to reservoirs in non-native areas of Brazil and Paraguay, where it has been introduced for recreational angling. Impacts include significant reductions in native fish populations and alterations in foraging of native species. Climate match with the United States is medium with all states having an individually low climate scores except for North Carolina and Texas, which had a medium score, and Alabama, Florida, Georgia, Louisiana, Mississippi, and South Carolina, which had a high score. The certainty of assessment is medium. The overall risk assessment category for *Cichla kelberi* is high.

Assessment Elements

- **History of Invasiveness (Sec. 3): High**
- **Climate Match (Sec. 6): Medium**
- **Certainty of Assessment (Sec. 7): Medium**
- **Remarks/Important additional information: No additional remarks.**
- **Overall Risk Assessment Category: High**

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.

Almeida-Ferreira, G. C., A. V. Oliveira, A. J. Prioli, and S. M. A. P. Prioli. 2011. SPAR genetic analysis of two invasive species of *Cichla* (Tucunaré) (Perciformes: Cichlidae) in the Paraná river basin. Acta Scientiarum - Biological Sciences 33(1):79–85.

Aqua-Imports. 2019. Kelberi Peacock Bass (*Cichla kelberi*). Available: https://www.aqua-imports.com/shop/product/kelberi-peacock-bass-cichla-kelberi/. (August 2019).

Espínola, L. A., C. V. Minte-Vera, and H. F. Júlio Jr. 2010. Invasibility of reservoirs in the Paraná Basin, Brazil, to *Cichla kelberi* Kullander and Ferreira. Biological Invasions 12(6):1873–1888.

Fricke, R., W. N. Eschmeyer, and R. van der Laan, editors. 2019. Catalog of fishes: genera, species, references. Available: http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp. (March 2019).

Froese, R., and D. Pauly, editors. 2019a. *Cichla kelberi*, Kullander and Ferreira, 2006. FishBase. Available: https://www.fishbase.de/summary/Cichla-kelberi.html. (March 2019).

Froese, R., and D. Pauly. 2019b. *Chichla kelberi*. *In* World Register of Marine Species. http://www.marinespecies.org/aphia.php?p=taxdetails&id=1008929. (March 2019).

Fugi, R., K. D. Luz-Agostinho, and A. A. Agostinho. 2008. Trophic interaction between an introduced (peacock bass) and a native (dogfish) piscivorous fish in a Neotropical impounded river. Hydrobiologia 607(1):143–150.

GBIF Secretariat. 2019. GBIF backbone taxonomy: *Cichla kelberi*, Kullander and Ferreira, 2006. Global Biodiversity Information Facility, Copenhagen. Available: https://www.gbif.org/species/5208140. (March 2019).

Kovalenko, K. E., E. D. Dibble, A. A. Agostinho, and F. M. Pelicice. 2010a. Recognition of nonnative peacock bass, *Cichla kelberi* by native prey: testing the naiveté hypothesis. Biological Invasions 12:3071–3080.

Kovalenko, K. E., E. D. Dibble, A. A. Agostinho, G. Cantanhêde, and R. Fugi. 2010b. Direct and indirect effects of an introduced piscivore, *Cichla kelberi* and their medication by aquatic plants. Hydrobiologia 638:245–253.

Normando, F. T., F. P. Arantes, R. K. Luz, R. G. Thome, E. Rizzo, Y. Sato, and N. Bazzoli. 2009. Reproduction and fecundity of tucunaré, *Cichla kelberi* (Perciformes: Cichlidae), an exotic species in Três Marias Reservoir, Southeastern Brazil. Journal of Applied Ichthology 25:299–305.

OIE (World Organisation for Animal Health). 2019. OIE-listed diseases, infections and infestations in force in 2019. Available: http://www.oie.int/animal-health-in-the-world/oie-listed-diseases-2019/. (March 2019).

Pelicice, F. M., and A. A. Agostinho. 2009. Fish fauna destruction after the introduction of a non-native predator (*Cichla kelberi*) in a Neotropical reservoir. Biological Invasions 11:1789–1801.

Sanders, S., C. Castiglione, and M. Hoff. 2018. Risk assessment mapping program: RAMP, version 3.1. U.S. Fish and Wildlife Service.

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.

Chellappa, S., M. R. Câmara, N. T. Chellappa, M. C. M. Beveridge, and F. A. Huntingford. 2003. Reproductive ecology of a neotropical cichlid fish, *Cichla monoculus* (Osteichthyes: Cichlidae). Brazilian Journal of Biology 63:17–26.

Fontenele. 1948. [Source material did not give full citation for this reference.]

Freitas, T. M. S., G. M. Dutra, and G. N. Salvador. 2017. Length-weight relationships of 18 fish species from Paraíba do Sul basin, Minas Gerais, Brazilian Journal of Applied Ichthyology 33:652–654.

Gomiero, L. M., and F. M. S. Braga. 2004. Reproduction of species of genus *Cichla* in a reservoir in Southeastern Brazil. Brazilian Journal of Biology 64:613–624.

Kullander, S. O., and E. J. G. Ferreira. 2006. A review of the South American cichlid genus *Cichla*, with descriptions of nine new species. Ichthyological Exploration of Freshwater 17(4):289–398.

Novaes, J. L. C., E. P. Carmaschi, and K. O. Winemiller. 2004. Feeding of *Cichla monoculus* Spix, 1829 (Teleostei: Cichlidae) during and after reservoir formation in the Tocantins River, Central Brazil. Acta Limnologica Brasiliensia 16:41–49.

Winemiller, K. O., D. C. Taphorn, and A. Barbarino-Duque. 1997. Ecology of *Cichla* (Cichlidae) in two blackwater rivers of Southern Venezuela. Copeia 1997(4):690–696.

Winemiller, K. O. 2001. Ecology of peacock cichlids (*Cichla* spp.) in Venezuela. J. Aquaric Aquat. Sci. 9:93–112.

Zaret, M. T. 1980. Life history and growth relationships of *Cichla ocellaris*, a predatory South American cichlid. Biotropica 12:144–157.