Streaked Prochilod (*Prochilodus lineatus*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2022
Revised, March 2022
Web Version, 4/10/2023

Organism Type: Fish
Overall Risk Assessment Category: Uncertain

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1 Native Range and Status in the United States

Native Range

From Castro and Vari (2004):

"*Prochilodus lineatus* is broadly distributed throughout the Rio Paraná-Río Paraguay basin in Argentina, Bolivia, Brazil, Paraguay, and Uruguay […]. We also have examined material of the species that originated in the independent Rio Paraíba do Sul system of the states of São Paulo and Rio de Janeiro, Brazil, and the rivers draining into northern portions of Lagoa dos Patos in the state of Rio Grande do Sul, Brazil. In addition to the localities from which specimens examined in this study originated, the species also occurs in the southern portions of the Lagoa dos Patos, Brazil (Roberto E. Reis, MCP, pers. comm., 2002), the Río Sali and Río Dule systems that drain into the Mar Chiquita basin of the state of Córdoba, Argentina (Sverlij et al., 1993:5, fig. 2) [figure in source material], and south of the mouth of the Río de La Plata in the Río

Salado and Laguna de Chascomús of Argentina (Sverlij et al., 1993:5, fig. 2) [figure in source material]."

Status in the United States

No records of *Prochilodus lineatus* in the wild in the United States were found. Although individuals were not in stock during this assessment, *P. lineatus* may be for sale in the United States. For example, the following record was found from a retailer based in Boca Raton, Florida.

From Predatory Fins (2022):

"Albino Prochilodus (Prochilodus Lineatus)"

"$175.00 SOLD OUT"

New Mexico Department of Game and Fish (2010) lists all species of Curimatidae, which includes *Prochilodus lineatus*, as part of Group I under the special permits program. Group I is "designated semi-domesticated animals and do not require an importation permit."

Means of Introductions in the United States

No introductions in the wild in the United States were found.

Remarks

According to Froese and Pauly (2022), other common names used in the United States include: Curimbata, Grumatá, Sabalo, and Tarpon Prochilodus.

In addition to the valid name *Prochilodus lineatus*, literature searches were also conducted for the synonym *P. scrofa* (Fricke et al. 2022).

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2022):

Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Actinopterygii
Class Teleostei
Superorder Ostariophysi
Order Characiformes
Family Curimatidae

Subfamily Prochilodontinae
Genus *Prochilodus*
Species *Prochilodus lineatus*

According to Fricke et al (2022), *Prochilodus lineatus* (Valenciennes 1837) is the current valid name for this species. It was originally described as *Paca lineatus* Valenciennes 1837.

Size, Weight, and Age Range

From Froese and Pauly (2022):

"Max length: 80.0 cm TL male/unsexed; [Zaniboni et al. 2004]; common length: 46.2 cm SL male/unsexed; [Castro and Vari 2003]; max. published weight: 7.2 kg [Machacek 2007]"

Environment

From Froese and Pauly (2022):

"Freshwater; benthopelagic; potamodromous [Riede 2004]"

Climate

From Froese and Pauly (2022):

"Subtropical; 2°S - 32°S"

Distribution Outside the United States

Native

From Castro and Vari (2004):

"*Prochilodus lineatus* is broadly distributed throughout the Rio Paraná-Río Paraguay basin in Argentina, Bolivia, Brazil, Paraguay, and Uruguay […]. We also have examined material of the species that originated in the independent Rio Paraíba do Sul system of the states of São Paulo and Rio de Janeiro, Brazil, and the rivers draining into northern portions of Lagoa dos Patos in the state of Rio Grande do Sul, Brazil. In addition to the localities from which specimens examined in this study originated, the species also occurs in the southern portions of the Lagoa dos Patos, Brazil (Roberto E. Reis, MCP, pers. comm., 2002), the Río Sali and Río Dule systems that drain into the Mar Chiquita basin of the state of Córdoba, Argentina (Sverlij et al., 1993:5, fig. 2) [figure in source material], and south of the mouth of the Río de La Plata in the Río Salado and Laguna de Chascomús of Argentina (Sverlij et al., 1993:5, fig. 2) [figure in source material]."

Introduced

From Endruweit (2014):

"Chaloupková et al (2010) reports *Prochilodus lineatus* in the Red River basin in Lang Son and Cao Bang Provinces, Vietnam, assumed to have escaped from aquaculture."

"Three specimens […] of *Prochilodus lineatus* were obtained off a large basket with a jumble of wild caught fishes. The seller, a local Dai women, confirmed that these specimens were cast netted within the Nanlahe River subbasin, a left bank tributary to the Mekong in Xishuangbanna. She also confirmed that this was not the first time to catch this species which entails that there is a self-sustaining population of *Prochilodus lineatus* in the Mekong basin in China."

From Kalous et al. (2012):

"So far, known wild populations of *P. lineatus* have been recorded in China namely from Nandu River on the island of Hainan (Chan & Chen 2008) and also from Xi River in the Pearl River basin (Li, Li,Tan, Li. He, Luo, Lin & Su 2009)."

Means of Introduction Outside the United States

From Endruweit (2014):

"Chaloupková et al (2010) reports *Prochilodus lineatus* in the Red River basin in Lang Son and Cao Bang Provinces, Vietnam, assumed to have escaped from aquaculture."

From Kalous et al. (2012):

"According to DIAS (FAO 2010b), there is no information about the introduction of *P. lineatus* to Vietnam […] The introduction of curimbata to China in 1996 is mentioned in Ma, Bangxi, Yindong and Mingxue (2003) under the scientific name *Prochilodus scrofu*. Most likely, the Vietnamese stock is based on uncontrolled import from China for aquaculture purposes. Further, the Vietnamese name 'cá Trôi Tuòng Giang' means 'fish from Chinese river', which indicates the Chinese origin of the fish stock. According to a recent survey of the Vietnamese Research Institute for Aquaculture No.1, this fish is currently already being produced by local fish farmers in the provinces Vĩnh Phúc, Hà Tây and Bắc Ninh."

Short Description

From Endruweit (2014):

"Caudal fin hyaline; lateral line scales 40-50; circumpeduncular scales 17−21; lower, posterior area of flanks with horizontal zigzag lines; transverse scales to dorsal origin 7−10; and predorsal scales 14−20."

From Ota et al. (2018):

"Body deep; greatest body depth contained 2.2 to 3.3 and caudal peduncle depth 10.7 to 14.6 times in SL [standard length]; head length 2.7 to 4.3, predorsal distance 1.9 to 2.4 and caudal peduncle length 10.6 to 15.6 in SL; snout length 2.1 to 3.1, horizontal orbital diameter 3.3 to 6.6 and least interorbital width 1.7 to 2.1 in HL [head length]. Mouth terminal, with broad lips; upper lip with 95 teeth in the outer series, 13- 25 in the inner series, lower lip with 75 teeth in the outer series, 9-10 in the inner series, maxilla toothless. Lateral line complete, with 44-50 pored scales; transverse series above lateral line with 7-10 scale rows and below with 6-9 scale rows. Dorsal

fin with 12-13 [rays], pectoral fin with 14-19, pelvic fin with 8-9, anal fin with 10-12 and caudal fin with 19 rays (Castro, Vari, 2004b). Ground color silvery, darker dorsally. Dorsal fin pale grey; pelvic fin reddish-yellow; remaining fins dark-gray (Graça, Pavanelli, 2007)."

Biology

From Avigliano et al. (2017):

"Streaked prochilod reproductive cycle is correlated with the natural flood pulse regime (Neiff, 1999) with migrations upstream and spawning in open river waters coupled to the flooding periods as a mechanism of dispersion of eggs (Sverlij et al., 1993)."

From Kalous et al. (2012):

"It is a detritivorous fish that eats dead organic matter and especially periphyton (a complex mixture of algae, cyanobacteria, heterotrophic microbes and detritus that is attached to submerged surfaces)."

"As a consequence of their detritus feeding habits and their large populations, prochilods play a significant role in the energy flow of the tropical aquatic systems they inhabit (Winemiller 1996) and are functionally dominant in some aquatic ecosystems (Welcomme 1985; Flecker 1996)."

Human Uses

From Avigliano et al (2017):

"The streaked prochilod, *Prochilodus lineatus*, represents the most important fishery in the La Plata Basin (South America)."

From Kalous et al. (2012):

"*P. lineatus* makes up 40%,86% and 95% of the total commercial catch in the rivers Paraná, La Plata and Uruguay respectively"

"The freshwater characiform fish *Prochilodus lineatus* is a detritivorous species that has its native distribution area in South America but has been imported to China for aquaculture purposes. This is the first time that it is being reported in Vietnam, both from aquaculture and captured from a river channel. According to local authorities, the species is becoming increasingly important in local aquaculture and its spread can be expected."

From Souza et al. (2017):

"As an alternative to mitigate these effects, restocking programmes are used in Brazilian rivers as a strategy for the conservation of several endangered species (Agostinho et al. 2007), which include *P. lineatus*."

Diseases

No records of OIE-reportable diseases (OIE 2022) were found for *Prochilodus lineatus.*

From Valladão et al. (2014):

"This is the first report of *T.* [*Trichodina*] *heterodentata* in *P. lineatus* that is responsible for an acute disease that culminates in larval mortality."

According to Poelen et al. (2014), *Prochilodus lineatus* hosts the following parasite: *Kritskyia* spp., *Neoechinorhynchus australis*, *Neoechinorhynchus curemai*, *Protorhinoxenus* spp., *Rhinoxenus* spp., *Saccocoelioides nanii*, *Sanguinicola argentinensis*, *Spinitectus asperus*, *Spinitectus jamundensis*, *Tereancistrum curimba*, *Tereancistrum toksonum*, *Valipora campylancristrota*.

Threat to Humans

From Froese and Pauly (2022):

"Harmless"

3 Impacts of Introductions

There are records of introductions for *Prochilodus lineatus*. However, there are no documented impacts of introduction. The following refers to potential impacts of introductions.

From Kalous et al. (2012):

"Keeping in mind the high biomass production in the rivers of its native distribution area, a successful establishment of *P. lineatus* into Vietnamese fresh waters may exert serious impacts on the local ecosystems."

"The ability of curimbata to gain a shortcut in the food chain is regarded as a serious ecological effect. It can be expected that in the case of high abundance of this fish, the amount of detritivorous insect larvae that serve as one of the most important foods for a variety of riverine fishe [sic] will decrease. Additionally, intercontinental translocations bear a high risk of the introduction of alien diseases and parasites. Therefore, we consider *P. lineatus* as potentially dangerous for the native ichthyofauna in Vietnam."

4 History of Invasiveness

Prochilodus lineatus has been introduced from its native range in South America to locations in Vietnam and China where it is reared as an aquaculture species. Established wild populations have been recorded in both countries, with some sources positing these populations originated from aquaculture escapees. Despite known introductions of *P. lineatus*, no information on the impacts of introductions was found during this assessment; only potential impacts were discussed in the literature. The History of Invasiveness category for this species is therefore classified as Data Deficient.

5 Global Distribution

Figure 1. Known global distribution of *Prochilodus lineatus*. Observations are reported from Argentina, Brazil, Bolivia, Paraguay, Uruguay, Peru, Venezuela, and China. Map from GBIF Secretariat (2022). Occurrences in Argentina, northwestern Brazil, Peru, and Venezuela were not found to represent established populations of *P. lineatus* and were excluded from the climate matching analysis.

In addition to georeferenced occurrences from GBIF Secretariat (2022), a georeferenced collection of *Prochilodus lineatus* in Vietnam was given in Kalous et al. (2012).

No georeferenced observations were available representing the population reported on the island of Hainan (China; Kalous et al. 2012).

6 Distribution Within the United States

No records of *Prochilodus lineatus* in trade or in the wild in the United States were found.

7 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Prochilodus lineatus* with the contiguous United States was variable with high matches found in the Southeast from Texas to New Jersey, particularly in coastal areas. Additionally, smaller areas of high match occurred in southern Arizona and in an area stretching from central Texas to southwestern Missouri. Much of the central and eastern regions from Arizona to Minnesota, and eastward to New England had a medium climate match. Low matches were generally found throughout most western States and in the extreme Northeast. The overall Climate 6 score (Sanders et al. 2021; 16 climate variables; Euclidean distance) for the contiguous United States was 0.415, High (scores greater than 0.103, inclusive, are classified as high). Over half the States had high individual Climate 6 scores. Colorado, Iowa, Massachusetts, Nebraska, and Wisconsin had medium individual scores. California, Idaho, Maine, Minnesota, Montana,

Nevada, New Hampshire, North Dakota, Oregon, Rhode Island, South Dakota, Utah, Vermont, Washington, and Wyoming had low individual scores.

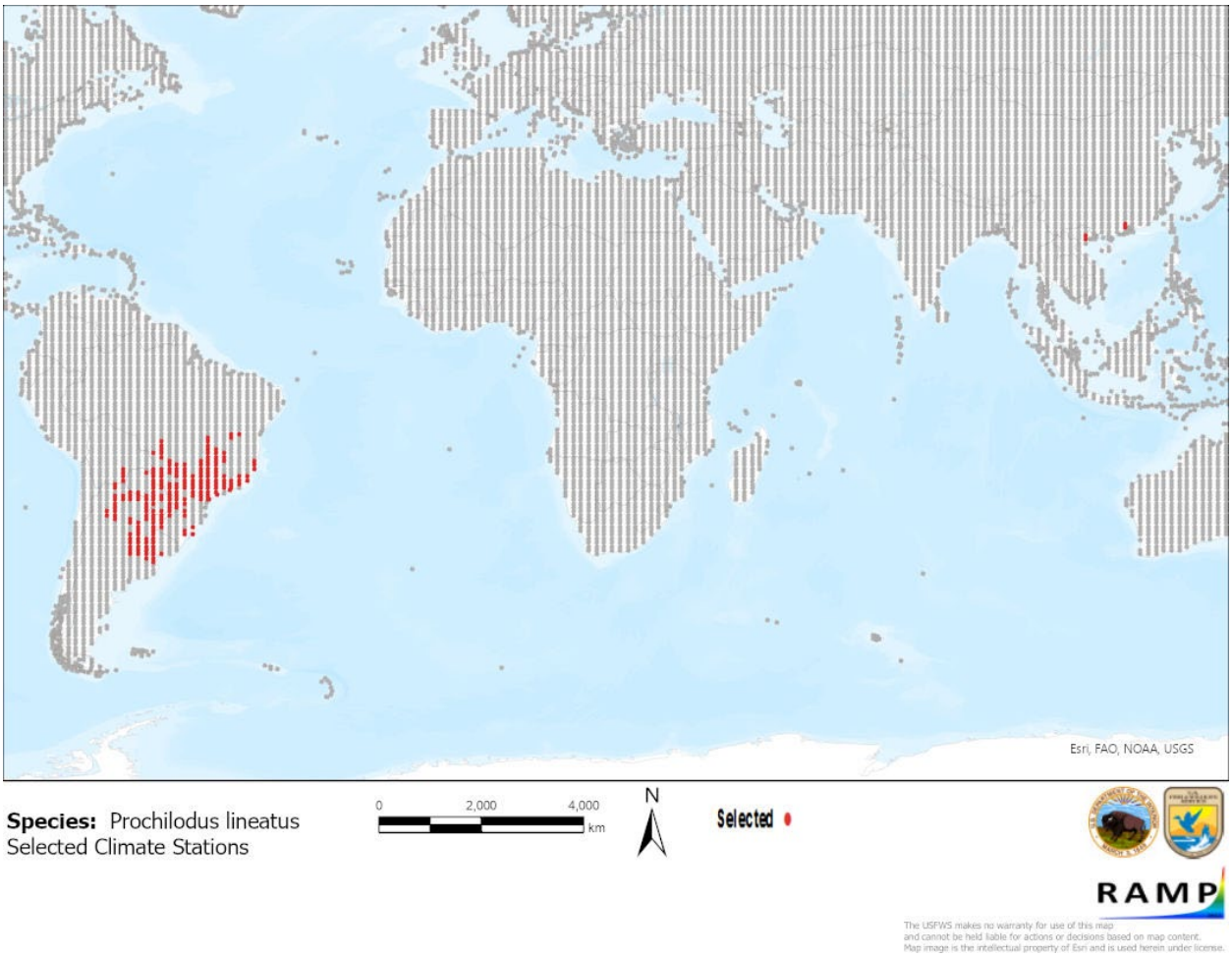

Figure 2. RAMP (Sanders et al. 2021) source map of the world showing weather stations in South America and Asia selected as source locations (red; Argentina, Brazil, Bolivia, Paraguay, Uruguay, Peru, Venezuela, Vietnam, and China) and non-source locations (gray) for *Prochilodus lineatus* climate matching. Source locations from GBIF Secretariat (2022). Selected source locations are within 100 km of one or more species occurrences, and do not necessarily represent the locations of occurrences themselves.

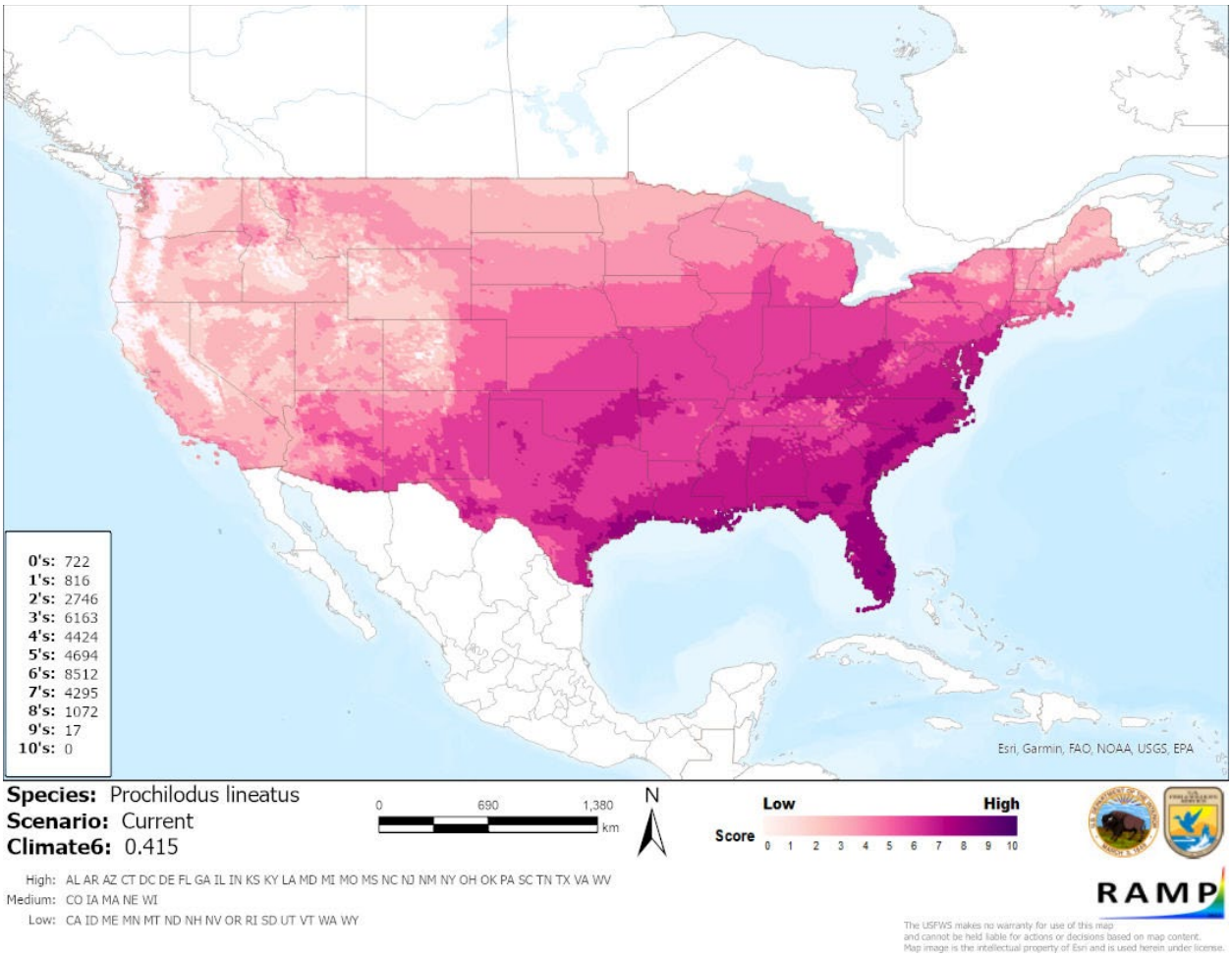

Figure 3. Map of RAMP (Sanders et al. 2021) climate matches for *Prochilodus lineatus* in the contiguous United States based on source locations reported by GBIF Secretariat (2022). Counts of climate match scores are tabulated on the left. 0/Pale Pink = Lowest match, 10/Dark Purple = Highest match.

The High, Medium, and Low Climate match Categories are based on the following table:

Climate 6: (Count of target points with climate scores 6-10)/ (Count of all target points)	Overall Climate Match Category
0.000≤X≤0.005	Low
0.005<X<0.103	Medium
≥0.103	High

8 Certainty of Assessment

Quality information is available about the biology and distribution of *Prochilodus lineatus*. This species has been reported as introduced and established outside of its native range to Vietnam and China. Despite this, no information is available on impacts of introductions for this species.

Further information is needed to adequately assess the risk posed by introductions of *P. lineatus*. The certainty of assessment is Low.

9 Risk Assessment

Summary of Risk to the Contiguous United States

Prochilodus lineatus is a freshwater fish native to parts of southern South America which has been introduced to Vietnam and China. This species is an important commercially harvested fish in its native range and is a popular aquaculture species in both its native and introduced ranges. Established populations have been reported from both Vietnam and China with sources suggesting these populations originated from aquaculture escapees. *P. lineatus* may be in trade in the United States. No information regarding documented impacts from introduction were found. The history of invasiveness is classified as Data Deficient. This species had a high overall climate match with the contiguous United States, with most areas of locally high match in the Southeast. The certainty of assessment for *P. lineatus* is Low mainly due to the lack of information regarding impacts of introductions. The overall risk assessment category is Uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 4): Data Deficient**
- **Overall Climate Match Category (Sec. 7): High**
- **Certainty of Assessment (Sec. 8): Low**
- **Remarks/Important additional information: No additional remarks.**
- **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.

Avigliano E, Pisonero J, Domanico A, Sanchez S, Volpedo A. 2017. Migration and brackish environment use of *Prochilodus lineatus* (Characiformes: Prochilodontidae) inferred by Sr:Ca ratio transects of otolith. Neotropical Ichthyology 15(3):e170055.

Castro RMC, Vari RP. 2004. Detritivores of the South American fish family Prochilodontidae (Teleostei:Ostariophysi:Characiformes): a phylogenetic and revisionary study. Washington: Smithsonian Books.

Endruweit M. 2014. Four new records of fish species (Cypriniformes: Nemacheilidae, Balitoridae; Characiformes: Prochilodontidae) and corrections of two misidentified fish species (Tetraodontiformes: Tetraodontidae; Beloniformes: Belonidae) in Yunnan, China. Zoological Research 35:51–58.

Fricke R, Eschmeyer WN, van der Laan R, editors. 2022. Eschmeyer's catalog of fishes: genera, species, references. California Academy of Science. Available: http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp (March 2022).

Froese R, Pauly D, editors. 2022. *Prochilodus lineatus* (Valenciennes, 1837). FishBase. Available: https://www.fishbase.in/summary/Prochilodus-lineatus.html (February 2022).

GBIF Secretariat. 2022. GBIF backbone taxonomy: *Prochilodus lineatus* (Valenciennes, 1837). Copenhagen: Global Biodiversity Information Facility. Available: https://doi.org/10.15468/dl.muygbv (March 2022).

[ITIS] Integrated Taxonomic Information System. 2022. *Prochilodus lineatus* (Valenciennes, 1836). Reston, Virginia: Integrated Taxonomic Information System. Available: https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=641604#null/ (February 2022).

Kalous L, Bui AT, Petrtýl M, Bohlen J, Chaloupková P. 2012. The South American freshwater fish *Prochilodus lineatus* (Actinopterygii: Characiformes: Prochilodontidae): new species in Vietnamese aquaculture. Aquaculture Research 43(6):955–958.

New Mexico Department of Game and Fish. 2010. Director's species importation list. Santa Fe: New Mexico Department of Game and Fish. Available: http://www.wildlife.state.nm.us/download/enforcement/importation/information/Directors-Species-Importation-List-08_03_2010.pdf (November 2020).

[OIE] World Organisation for Animal Health. 2022. Animal diseases. Available: https://www.oie.int/en/what-we-do/animal-health-and-welfare/animal-diseases/ (January 2022).

Ota R, Deprá G, Graça W, Pavanelli C. 2018. Peixes da planície de inundação do alto rio Paraná e áreas adjacentes: Revised, annotated and updated. Neotropical Ichthyology 16(2):e170094. DOI: 10.1590/1982-0224-20170094.

Poelen JH, Simons JD, Mungall CJ. 2014. Global Biotic Interactions: an open infrastructure to share and analyze species-interaction datasets. Ecological Informatics 24:148–159.

Predatory Fins. 2022. Albino Prochilodus (*Prochilodus Lineatus*). Available: https://www.predatoryfins.com/products/albino-prochilodus-lineatus (March 2022).

Sanders S, Castiglione C, Hoff M. 2021. Risk Assessment Mapping Program: RAMP. Version 4.0. U.S. Fish and Wildlife Service.

Souza FPD, Castro PLD, Goes ESDR, Ribeiro RP, Santos SCAD, Lima ECSD, Murari PJF, Lopera-Barrero NM. 2018. Genetic variability of *Prochilodus lineatus* in artificial and semi-natural reproduction. Italian Journal of Animal Science 17(2):321–25.

Valladão GMR, Gallani SU, De Pádua SB, Martins ML, Pilarski F. 2014. *Trichodina heterodentata* (Ciliophora) infestation on *Prochilodus lineatus* larvae: a host–parasite relationship study. Parasitology 141(5):662–669. (Abstract only.)

11 Literature Cited in Quoted Material

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.

Agostinho AA, Gomes LC, Pelicice FM. 2007. Ecology and management of fishing resources in Brazil reservoirs. Maringá, Brazil: Eduem.

Castro RMC, Vari RP. 2003. Prochilodontidae (Fannel mouth characiforms). Pages 65–70 in Reis RE, Kullander SO, Ferraris CJ Jr, editors. Checklist of the freshwater fishes of South and Central America. Porto Alegre, Brazil: EDIPUCRS.

Chaloupková P, Banout J, Kalous L, Petrtýl M, Poláková DM, Le TL, Bui TA, Nguyen QD, Nguyen QT, Nguyen TLA. 2010. Support of freshwater fish farming in mountain areas (Vietnam). Prague: Ministry of Agriculture of the Czech Republic.

Chan BPL, Chen X. 2008. Species diversity and distribution of freshwater fishes at Mt. Yinggeling, Hainan Island, China. Biodiversity Science 16:44–52.

FAO. 2010b. Database on introductions of aquatic species. Available: http://www.fao.org/fishery/introsp/search/en (February 2010). [Accessed by original author.]

Flecker AS. 1996. Ecosystem engineering by a dominant detritivore in a diverse tropical stream. Ecology 77:1845–1854.

Graça WJ, Pavanelli CS. 2007. Peixes da planície de inundação do alto rio Paraná e áreas adjacentes. Maringá, Brazil: Eduem.

Le TB, Mai DY, Nguyen HL. 2009. Preliminary impacts assessment of alien aquatic species on biodiversity as well as invasion [sic] of native fishes in aquaculture and some management measures. ILEC Conference. [Source material did not provide complete citation.]

Li J, Li X, Tan X, Li Y, He M, Luo J, Lin J, Su S. 2009. Species diversity of fish community of Provincial Xijiang River Rare Fishes Natural Reserve in Zhaoqing City, Guangdong Province. Journal of Lake Science 21:556–562.

Ma X, Bangxi X, Yindong W, Mingxue W. 2003. Intentionally introduced and transferred fishes in China's inland waters. Asian Fisheries Science 16:279–290.

Machacek H, editor. 2007. World records freshwater fishing. Available: www.fishing-worldrecords.com (November 2007). [Accessed by original author.]

Neiff JJ. 1999. El régimen de pulsos en ríos y grandes humedales de Sudamérica. Pages 90–150 in Malvárez AI, editor. Tópicos sobre humedales subtropicales y templados Sudamérica. Montevideo, Uruguay: UNESCO.

Riede K. 2004. Global register of migratory species - from global to regional scales. Bonn, Germany: Federal Agency for Nature Conservation. Final Report of the R&D-Projekt 808 05 081.

Sverlij SB, Espinach Ros A, Ortí G. 1993. Synopsis de los datos biológicos del Sabalo *Prochilodus lineatus* (Valenciennes, 1847). Rome: Food and Agriculture Organization of the United Nations. Sinopsis sobre la Pesca 154.

Welcomme RL. 1985. River fisheries. Rome: FAO. Technical Paper 262

Winemiller KO. 1996. Factors driving spatial and temporal variation in aquatic floodplain food webs. Pages 298–312 in Polis GP, Winemiller, KO, editors. Food webs: integration of patterns and dynamics. New York: Chapman and Hall.

Zaniboni E, Meurer S, Shibatta OA, Nuñer ADO. 2004. Catálogo ilustrado de peixes do alto Rio Uruguai. Brazil: Universidade Federal de Santa Catarina.