Brown Ghost Knifefish (*Apteronotus leptorhynchus*)

Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, web verion – 4/2/2018

Photo: Erling Holm. Licensed under Creative Commons BY-NC-SA. Available: http://eol.org/data_objects/24187745.

1 Native Range and Status in the United States

Native Range

From Froese and Pauly (2014):

"South America: the Guianas, Brazil and Peru; rivers of Colombia and Venezuela, including the Catatumbo River."

Status in the United States

No records of *Apteronotus leptorhynchus* introductions in the United States were found.

Means of Introductions in the United States

No records of *Apteronotus leptorhynchus* introductions in the United States were found.

Remarks

No additional remarks.

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From ITIS (2014):

"Kingdom Animalia
Subkingdom Bilateria
Infrakingdom Deuterostomia
Phylum Chordata
Subphylum Vertebrata
Infraphylum Gnathostomata
Superclass Osteichthyes
Class Actinoptrygii
Subclass Neopterygii
Infraclass Teleostei
Superorder Ostariophysi
Order Gymnotiformes
Suborder Sternopygoidei
Family Apteronotidae
Genus *Apteronotus* Lacepède, 1800
Species *Apteronotus leptorhynchus* (Ellis in Eignmann, 1912)"

From Eschmeyer et al. (2017):

"*leptorhynchus*, *Sternarchus* Ellis [M. D.] in Eigenmann 1912:439 [Memoirs of the Carnegie Museum v. 5 (no. 1); […]] Amatuk, Guyana. Holotype: FMNH 53294 [ex CM 1762, not 1763a]. Paratypes: CAS 62333 [ex IU 12588] (1), FMNH 53295 (1) [? ex CM 1764a]. Type catalog: Henn 1928:71 […], Ibarra & Stewart 1987:81 […]. •Valid as *Apteronotus leptorhynchus* (Ellis 1912) -- (Ortega & Vari 1986:12 […], Mago-Leccia 1994:29 […], Galvis et al. 1997:104 […], Albert & Campos-da-Paz 1998:431 […], Albert 2001:110 […], de Santana 2003:8 […], Albert in Reis et al. 2003:498 […], de Santana & Crampton 2006:115 […], Triques 2007:85 […], de Santana et al. 2007:117 […], Triques 2011:300 […], de Santana & Cox Fernandes 2012:284 […], de Santana & Vari 2013:582 […], DoNascimiento 2016:534 […]). **Current status:** Valid as *Apteronotus leptorhynchus* (Ellis 1912). Apteronotidae."

Size, Weight, and Age Range

From Froese and Pauly (2014):

"Maturity: Lm 13.0, range 13 - ? cm.
Max length: 26.9 cm TL male/unsexed; [Albert 2003]"

Environment
From Froese and Pauly (2014):

"Freshwater; benthopelagic. […]; 24°C - 28°C [assumed to be recommended aquarium temperature range] [Baensch and Riehl 1991]"

Climate/Range
From Froese and Pauly (2014):

"Tropical; […]."

Distribution Outside the United States
Native
From Froese and Pauly (2014):

"South America: the Guianas, Brazil and Peru; rivers of Colombia and Venezuela, including the Catatumbo River."

Introduced
No records of *Apteronotus leptorhynchus* introductions were found.

Means of Introduction Outside the United States
No records of *Apteronotus leptorhynchus* introductions were found.

Short Description
From Froese and Pauly (2014):

"Dorsal fin reduced to a dorsal filament."

Biology
From Froese and Pauly (2014):

"Prefers fast flowing rivers [Galvis et al. 1997]. Forms loosely associated groups in rocky habitats or river banks [Kirschbaum 1995]. Nocturnal [Galvis et al. 1997]. Each individual fish possesses a unique spatiotemporal pattern of electric organ discharge (EOD) potentials distributed over the body surface [Rasnow et al. 1993]. Chirps and EOD frequency modulations are important elements of courtship behavior and are sensitive to testosterone levels [Dulka and Maler 1994, Møller 1995]. Seems to reach sexual maturity at 1 year of age, based on breeding experiments [Møller 1995]. Tuberous electro receptors are differentiated and functional in larvae at day 9; electric organ and electro receptors both present in the larvae at the time of first exogenous feeding [Kirschbaum 1995]."

From Forese and Pauly (2017):

"Eggs of about 3 mm diameter are deposited in crevices. Several days up to 2-3 weeks between batch spawnings. Larvae hatch after 4 days and start feeding on day 11."

Human Uses

Records of *Apteronotus leptorhynchus* in a Sydney pet shop (GBIF Secretariat 2015).

From Ilieş et al. (2014):

"This weakly electric fish is used as a major model system in behavioural neurobiology to study the neural control of the generation of electrocommunication signals and the electrosensory processing of such signals (Zupanc, 2002; Zupanc & Bullock, 2005)."

Diseases

No records of OIE reportable diseases found.

From Froese and Pauly (2014):

"Metacercaria Infection (Flatworms), Parasitic infestations (protozoa, worms, etc.)"

Threat to Humans

From Froese and Pauly (2014):

"Harmless"

3 Impacts of Introductions

No records of *Apteronotus leptorhynchus* introductions were found.

4 Global Distribution

Figure 1. Known global distribution of *Apteronotus leptorhynchus*. Map from Froese and Pauly (2014).

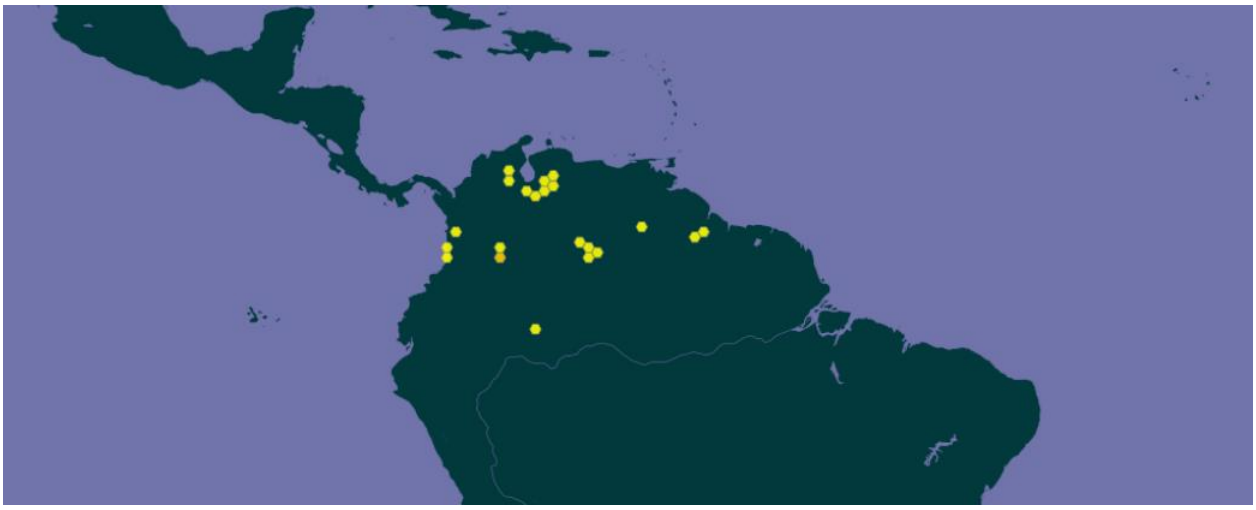

Figure 2. Known global distribution of *Apteronotus leptorhynchus*. Map from GBIF Secretariat (2015).

Point locations were given in Sydney, Australia; specimens were from a pet shop. Those locations were not used as source points for the climate matching. The locations in Sydney are not depicted in Figure 2.

5 Distribution Within the United States

No records of *Apteronotus leptorhynchus* introductions in the United States were found.

6 Climate Matching

Summary of Climate Matching Analysis

The climate match for *Apteronotus leptorhynchus* was medium for the southern tip of Florida and very low for the rest of the country. The Climate 6 score (Sanders et al. 2014; 16 climate variables; Euclidean distance) for the contiguous U.S. was 0.001, low, and no states had an individually high climate match.

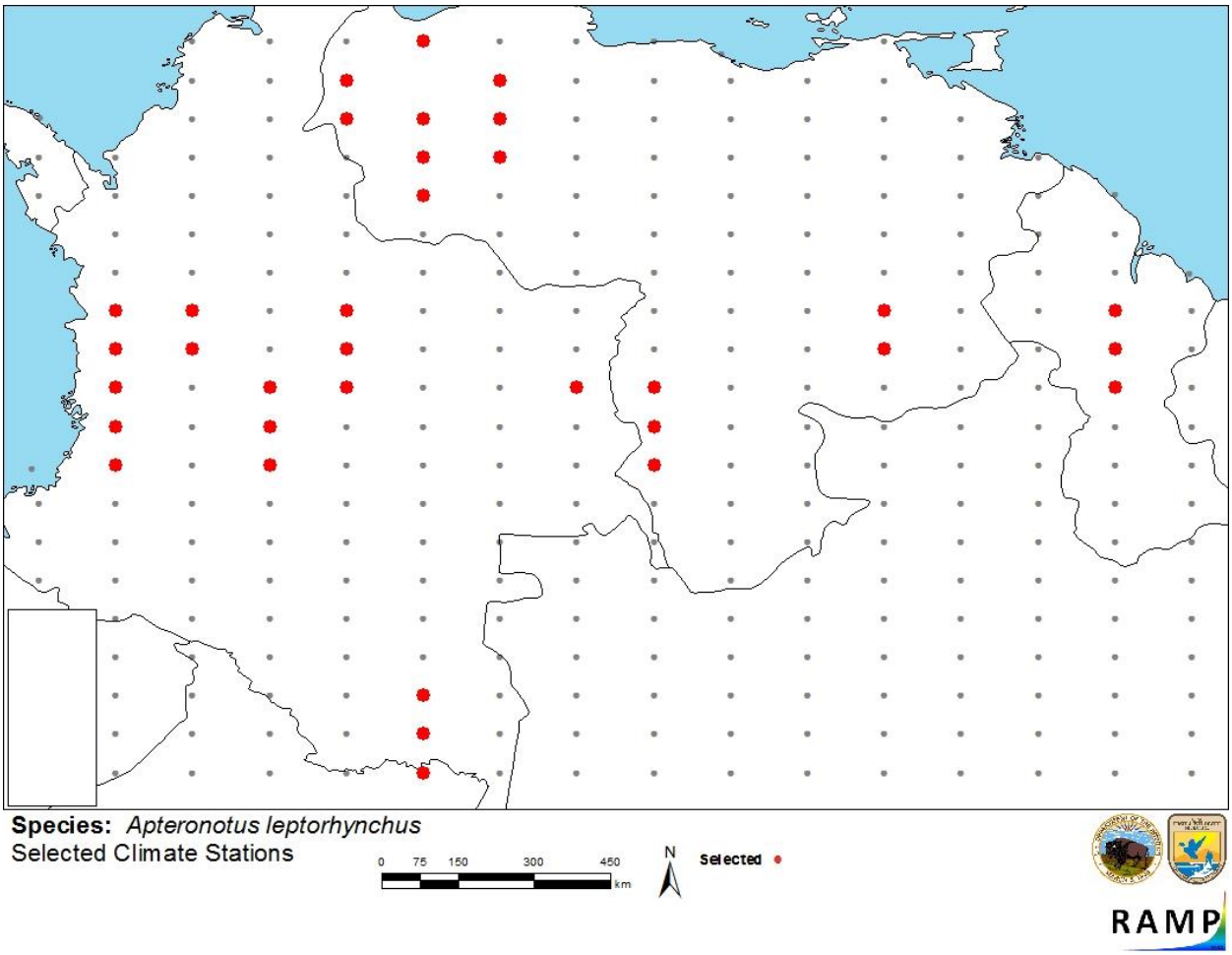

Figure 3. RAMP (Sanders et al. 2014) source map showing weather stations in Colombia, Venezuela, Guyana, and Peru selected as source locations (red) and non-source locations (grey) for *Apteronotus leptorhynchus* climate matching. Source locations from Froese and Pauly (2014) and GBIF Secretariat (2015).

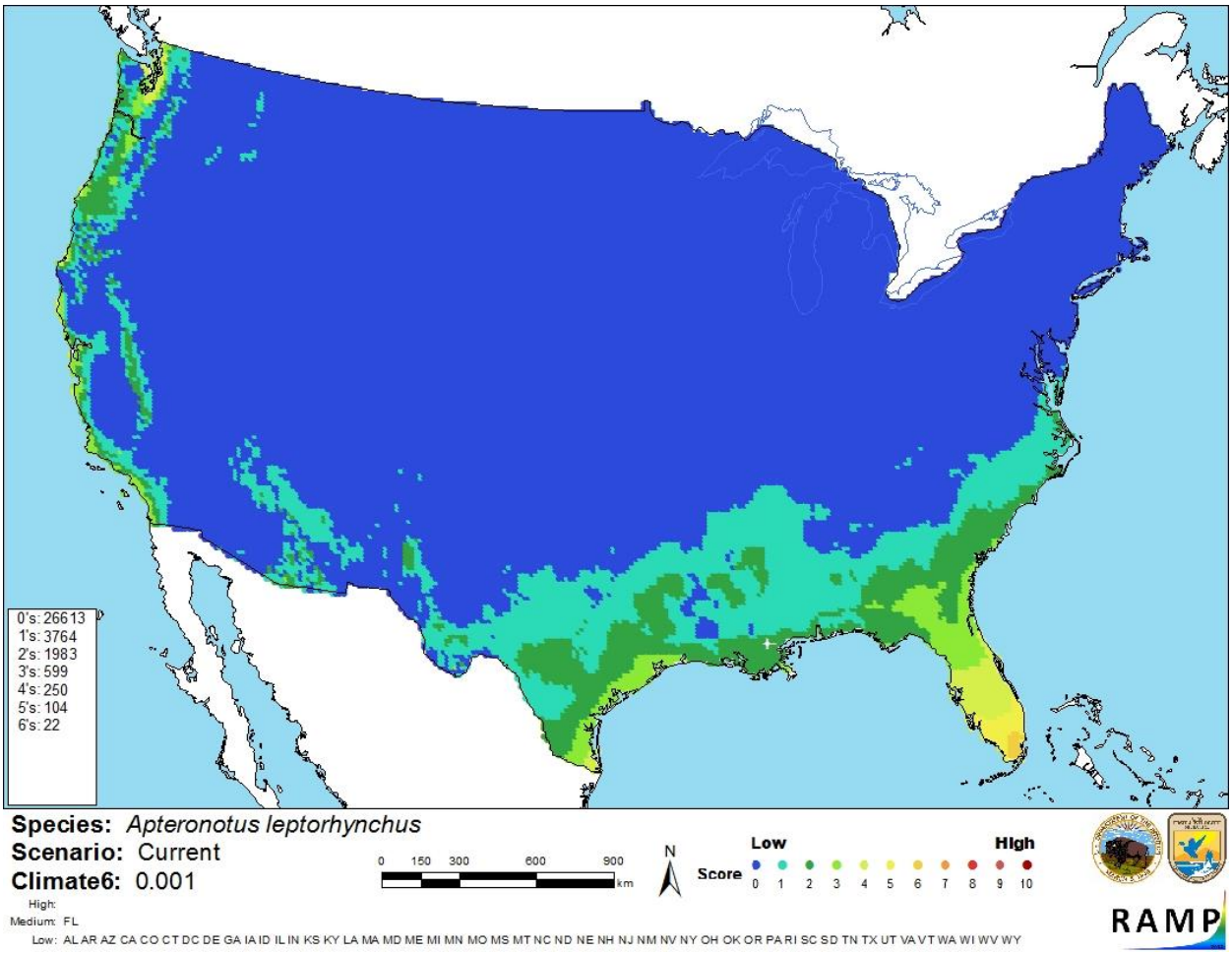

Figure 4. Map of RAMP (Sanders et al. 2014) climate matches for *Apteronotus leptorhynchus* in the contiguous United States based on source locations reported by Froese and Pauly (2014) and GBIF Secretariat (2015). 0 = Lowest match, 10 = Highest match.

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

7 Certainty of Assessment

The certainty of assessment is low. There was a lack of information available about A*pteronotus leptorhynchus*. No records of introduction were found for *A. leptorhynchus*. There is minimal indication that this species may be present in the aquarium trade but not enough information was available to aid in the assessment.

8 Risk Assessment

Summary of Risk to the Contiguous United States

The history of invasiveness is uncertain. There were no records of introductions of *Apteronotus leptorhynchus* but it could not be determined if that was more likely due to a lack of introductions or a general lack of information. This species may be present in the aquarium trade but there was not enough information available to determine the length of time or at what volume it has been in trade. The climate match is low; only the southern tip of Florida has a medium match. The certainty of assessment is low due to a general lack of information. 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**
- **Remarks/Important additional information** No additional remarks.
- **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.

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. (February 2017).

Froese, R., and D. Pauly, editors. 2014. *Apteronotus leptorhynchus* (Ellis, 1912). FishBase. Available: http://www.fishbase.org/summary/Apteronotus-leptorhynchus.html. (March 2014).

GBIF Secretariat. 2015. GBIF backbone taxonomy: *Apteronotus leptorhynchus* (Ellis, 1912). Global Biodiversity Information Facility, Copenhagen. Available: http://www.gbif.org/species/2401870. (December 2015).

Google Inc. 2011. Google Earth (Version 7.0.3.8542) [Software]. Available: http://www.google.com/intl/en/earth/index.html. (March 2014).

Ilieş, I., I. M. Traniello, R. F. Sîrbulescu, and G. K. H. Zupanc. 2014. Determination of relative age using growth increments of scales as a minimally invasive method in the tropical freshwater *Apteronotus leptorhynchus*. Journal of Fish Biology 84(5):1312–1325.

ITIS (Integrated Taxonomic Information System). 2014. *Apteronotus leptorhynchus* (Ellis in Eigenmann, 1912). Integrated Taxonomic Information System, Reston, Virginia. Available: http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=640246. (March 2014).

Sanders, S., C. Castiglione, and M. Hoff. 2014. Risk assessment mapping program: RAMP. 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.

Albert, J. S. 2001. Species diversity and phylogenetic systematics of American knifefishes (Gymnotiformes, Teleostei). University of Michigan, Museum of Zoology, Miscellaneous Publications Number 190.

Albert, J. S. 2003. Apteronotidae (Ghost knifefishes). Pages 497–502 *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.

Albert, J. S., and R. Campos-da-Paz. 1998. Phylogenetic systematics of Gymnotiformes with diagnoses of 58 clades: a review of available data. Pages 419–446 *in* L. R. Malabarba, R. E. Reis, R. P. Vari, Z. M. S. de Lucena, and C. A. S. Lucena, editors. Phylogeny and classification of Neotropical fishes. Edipucrs, Porto Alegre, Brazil.

Baensch, H. A., and R. Riehl. 1991. Aquarien atlas. Bd. 3. Melle: Mergus, Verlag für Natur-und Heimtierkunde, Germany.

de Santana, C. D. 2003. *Apteronotus caudimaculosus* n. sp. (Gymnotiformes: Apteronotidae), a sexually dimorphic black ghost knifefish from the Pantanal, western Brazil, with a note on the monophyly of the *A. albifrons* species complex. Zootaxa 252:1–11.

de Santana, C. D., and C. Cox Fernandes. 2012. A new species of sexually dimorphic electric knifefish from the Amazon Basin, Brazil (Gymnotiformes: Apteronotidae). Copeia 2012(2):283–292.

de Santana, C. D., and W. G. R. Crampton. 2006. Redescription of the ghost knifefish *Apteronotus spurrellii* from trans-Andean Colombia (Gymnotiformes: Apteronotidae). Ichthyological Exploration of Freshwaters 17(2):115–120.

de Santana, C. D., J. A. Maldonado-Ocampo, and W. G. R. Crampton. 2007. *Apteronotus galvisi*, a new species of electric ghost knifefish from the Río Meta basin, Colombia (Gymnotiformes: Apteronotidae). Ichthyological Exploration of Freshwaters 18(2):117–124.

de Santana, C. D., and R. P. Vari. 2013. Brown ghost electric fishes of the *Apteronotus leptorhynchus* species-group (Ostariophysi, Gymnotiformes); monophyly, major clades, and revision. Journal of the Linnaean Society 168:564–596.

DoNascimiento, C. 2016. Lista de los peces de agua dulce de Venezuela: una actualización? Pages 521–553 *in* L. F. del Moral-Flores, A. J. Ramírez-Villalobos, and J. A. Martínez-Pérez, ediotrs. Colecciones ictiológicas de Latinoamérica. Facultad de Estudios Superiores Iztacala, México. Colecciones ictiológicas de Latinoamérica.

Dulka, J. G., and L. Maler. 1994. Testosterone modulates female chirping behavior in the weakly electric fish, *Apteronotus leptorhynchus*. Journal of Comparative Physiology 174A:331–343.

Eigenmann, C. H. 1912. The freshwater fishes of British Guiana, including a study of the ecological grouping of species, and the relation of the fauna of the plateau to that of the lowlands. Memoirs of the Carnegie Museum 5(1):1–578.

Galvis, G., J. I. Mojica, and M. Camargo. 1997. Peces del Catatumbo. Asociación Cravo Norte, Santafé de Bogotá, D.C.

Henn, A. W. 1928. List of types of fishes in the collection of the Carnegie Museum on September 1, 1928. Annals of the Carnegie Museum 19(4):51–99.

Ibarra, M., and D. J. Stewart. 1987. Catalogue of type specimens of recent fishes in Field Museum of Natural History. Fieldiana Zoology (New Series) 35:1–112.

Kirschbaum, F. 1995. Vergleichende Daten zur Fortpflanzungsbiologie von drei Messerfisch-Arten (Gymnotiformes). Pages 91–114 *in* H. Greven, and R. Riehl, editors. Fortpflanzungsbiologie der Aquarienfische. Birgit Schmettkamp Verlag, Bornheim, Germany.

Mago-Leccia, F. 1994. Electric fishes of the continental waters of America. Caracas, Fundacion para el Desarrollo de las Ciencias Fisicas, Matematicas y Naturales. (Spanish summary.)

Møller, P. R. 1995. Electric fishes: history and behavior. Chapman and Hall, London.

Ortega, H., and R. P. Vari. 1986. Annotated checklist of the freshwater fishes of Peru. Smithsonian Contributions to Zoology 437.

Rasnow, B., C. Assad, and J. M. Bower. 1993. Phase and amplitude maps of the electric organ discharge of the weakly electric fish, *Apteronotus leptorhynchus*. Journal of Comparative Physiology 172A:481–491.

Reis, R. E., S. O. Kullander, and C. J. Ferraris, Jr., editors. 2003. Check list of the freshwater fishes of South and Central America. CLOFFSCA. EDIPUCRS, Porto Alegre, Brazil.

Triques, M. L. 2007. *Parapteronotus bonapartii* (Castelnau), considerado sinônimo sênior de *Parapteronotus hasemani* (Ellis) (Teleostei, Apteronotidae). Revista Brasileira de Zoologia 24(1):84–86.

Triques, M. L. 2011. *Apteronotus acidops*, new species of long snouted electric fish (Teleostei: Gymnotiformes: Apteronotidae) from the upper rio Paraná basin in Brazil, with a key to the apteronotid species from the area. Vertebrate Zoology 61(3):299–306.

Zupanc, G. K. H. 2002. From oscillators to modulators: behavioral and neural control of modulations of the electric organ discharge in the gymnotiform fish, *Apteronotus leptorhynchus*. Journal of Physiology 96:459–472.

Zupanc, G. K. H., and T. H. Bullock. 2005. Electrogenesis to electroreception: an overview. Pages 5–46 *in* T. H. Bullock, C. D. Hopkins, A. N. Popper, and R. R. Fay, editors. Electroreception. Springer, New York.