

The South American Sailfin Armored Catfish, *Liposarcus multiradiatus* (Hancock), a New Exotic Established in Puerto Rican Fresh Waters

LUCY BUNKLEY-WILLIAMS,¹ ERNEST H. WILLIAMS, JR.,¹ CRAIG G. LILYSTROM,²
IRIS CORUJO-FLORES,² ALFONSO J. ZERBI,³ CATHERINE ALIAUME,³
AND TIMOTHY N. CHURCHILL⁴

¹Caribbean Aquatic Animal Health Project, Department of Marine Sciences,
University of Puerto Rico, P.O. Box 908, Lajas, Puerto Rico 00667-0980

²Scientific Investigation Section, Department of Natural Resources, San Juan, Puerto Rico 00906-5887

³Tarpon-Snook Project, North Carolina State University,

Fisheries Research Laboratory, Mayagüez, Puerto Rico 00681-3665

⁴Department of Zoology, North Carolina State University,

Raleigh, North Carolina 27695-7617

ABSTRACT. – The South American sailfin armored catfish, *Liposarcus multiradiatus* (Hancock) is reported for the first time from Puerto Rican fresh waters. This exotic fish from Venezuela was probably introduced by aquarium hobbyist releases and has become established since 1990 in at least eight rivers and two reservoirs. This fish is edible, its eggs are valued as caviar, and its young may be sold as aquarium fish. Unfortunately, its burrowing behavior and capacity for overpopulation are detrimental to reservoir fishes. At least 20 endangered brown pelicans have choked to death attempting to swallow this fish. Increased availability of this exotic as an aquarium fish and habitat modifications may have facilitated this invasion in Puerto Rico. The spread of this alien species should be monitored closely and future introductions must be avoided.

RESUMEN. – El bagre armado o corroncho de América del Sur, *Liposarcus multiradiatus* (Hancock), es reportado por primera vez en cuerpos de agua dulce en Puerto Rico. Esta especie exótica de Venezuela fue probablemente introducida por aficionados de acuarios, y se han establecido desde el 1990 en por lo menos ocho ríos y dos embalses. El pez es comestible, sus huevos son valorados como caviar y los juveniles pueden ser vendidos como peces de acuario. Desafortunadamente, su comportamiento de enterrarse y su capacidad para sobrepoblar son perjudiciales para otros peces en las represas. Por lo menos 20 pelicanos pardos, en peligro de extinción, han muerto ahogados tratando de ingerir este pez. El incremento en la disponibilidad de los bagres armados como peces de acuario y modificaciones en los hábitats pueden haber facilitado su invasión en Puerto Rico. La dispersión de esta especie introducida debe ser seguida de cerca y futuras introducciones deben ser evitadas.

INTRODUCTION

The freshwater fish fauna of Puerto Rico is largely composed of exotic species introduced from the southeastern USA, Africa, and South America (Erdman, 1984). Most of these exotics were purposely introduced to improve sport fishing opportunities, since the native fish fauna was limited to mountain mullet, American eel, and a few gobies (Erdman, 1972, 1984). These introductions were made in a more naive time when many of the dangers and responsibilities involved in such actions

were not appreciated (Kohler and Courtenay, 1986). The results of these uncontrolled experiments have ranged from very beneficial, in the case of the largemouth bass, *Micropterus salmoides* (Lacepède), (Centrarchidae); to very detrimental, in the case of the Mozambique tilapia, *Tilapia mossambica* (Peters), (Cichlidae). Further introductions should only occur after careful scientific evaluation. Unfortunately, a new exotic has recently, probably accidentally, become established in Puerto Rico without the benefit of evaluation.

Suckermouth armored catfishes (Lori-

cariidae) occur in a variety of freshwater habitats in South and Central America. They are characterized by bony plates covering the body, a pair of subterminal barbels, sucking lips, usually a spine in front of the adipose fin, and a flat-bottom body shape (Page and Burr, 1991). They occur from sea level to 3000 m and often survive in conditions that exclude other fishes. A number of species have become popular as algae-controlling aquarium fishes and are shipped and sold around the world.

The taxonomy of the approximately 450 species in this family is incomplete (Page and Burr, 1991). Some species used commercially have not been scientifically described. Three species of suckermouth catfish exotics have become established in Florida, Nevada, and Texas in the continental USA, but have only been identified to genus (*Hypostomus* spp.) (Courtenay et al., 1986). The only previous record of this family from Puerto Rico was a 1.8 kg, 51.2 cm, plecostomus, *Hypostomus plecostomus* (L.) [Robins et al. (1991) calls this species the "suckermouth catfish," but this is confusing because they also call the family Loricariidae "suckermouth catfishes" and undescribed members of the genus *Hypostomus* are also referred to as "suckermouth catfishes."], from Dos Bocas Lake (Corujo-Flores et al., 1985—unpubl. report). This record was possibly a misidentification of the species discussed in the present paper. Unfortunately this specimen was lost.

One species of loricariid, guacharote, *Hypostomus guacharote* Cuvier and Valenciennes, was described from "Porto Rico" (Cuvier and Valenciennes, 1840; Jordan and Evermann, 1896; Jordan et al., 1930). This was apparently an error in locality, as we can find no other indication that these fishes have previously occurred in Puerto Rico. Suckermouth armored catfish were not mentioned in the most recent list of freshwater exotic fishes in Puerto Rico (Erdman, 1984).

The sailfin armored catfish, *Liposarcus multiradiatus* (Hancock) [until recently *Pterygoplichthys multiradiatus* (Hancock)], has also been called the radiated ptero (Page and Burr, 1991) and the sailfin catfish (Robins et al., 1991). This fish is native to Ven-

euela (Weber, 1991), although various authors have erroneously noted it from Bolivia, Brazil, Guyana, Paraguay and Peru. It is similar to suckermouth catfishes (*Hypostomus* spp.), but has a larger dorsal fin with one spine and 10–12 soft rays, a granular edge on the snout, and a last dorsal ray which is connected at the base to the following bony plate by a small membrane. The sailfin armored catfish grows to a length of 70 cm (Page and Burr, 1991). It has become an established exotic in Broward, Dade, Hillsborough and Palm Beach Counties in Florida and on the island of Oahu, Hawaii (Ludlow and Walsh, 1991; Page and Burr, 1991; Robins et al., 1991).

MATERIALS AND METHODS

Sailfin armored catfish data were collected largely incidental to other studies. Fishes were collected by hand, seines, gill nets, hook and line, and electrofishing boat. Specimens were deposited in the Fish Collection of the University of Puerto Rico at Mayaguez (UPRM), and in the Ichthyology Collection, Systematics Laboratory, NOAA/NMFS, National Museum of Natural History. Examinations for parasites followed standard techniques.

RESULTS AND DISCUSSION

Many specimens of sailfin armored catfish have been collected in eight rivers and two reservoirs in Puerto Rico (Table 1, Fig. 1). Three were examined for parasites and disease by LBW but none was found. Two catfish were gravid females. Two specimens were deposited in museums (UPRM No. 3781, USNM No. 325580).

The presence of gravid females and young individuals suggests that reproduction is occurring. We conclude from the number of specimens collected, and the reports of many catches of probably the same species by numerous sport and commercial fishermen in Puerto Rico, that the sailfin armored catfish has become established (Fig. 1).

This fish is being commercially reared for the aquarium fish trade in at least one farm in Puerto Rico, and a small-scale seine fishery exists in the streams around San Juan (M. McGee, pers. comm.) (Table 1).

TABLE 1. Specimens of Sailfin Armored Catfish, *Liposarcus multiradiatus*, collected in Puerto Rico.

Num-ber	Size (TL, cm)	Geographic location	Map #	Method	Date	Status
1	51.2	Dos Bocas Lake	F	net	21 Jul 1983	Accidental? ¹
many ²	11-31	Loiza Reservoir	J	nets	1990-present	Established
3000	0-38	Sabana Grande Fish Farm	D	in earthen ponds ³	1991-present	Commercial
many	25-40	Bayamon River	H	large seines	1991-present	Established
many	to 42	Rio Piedras (River)	I	large seines	1991-present	Established
few	—	upper Loiza River	K	nets	Aug 1990	Established
many	to 50	Rio Loco near Guanica	E	net	Sep 1992	Established
50	25-40	Loiza Reservoir	J	net	1991-1992	Established
few	12-37	Guanajibo River, Sabana Grande	c	net	1992	Established
12 ⁴	32.0	Guanajibo River, Hormigueros	B	grabbing	13 Mar 1992	Established
1	3.5	Guanajibo River above mouth	A	8 m seine	20 Aug 1992	Established
	>40	lower Loiza River	M	choked pelicans	Ott 1992	Established
	>40	Gurabo River	L	choked pelicans	Ott 1992	Established
10	34-52	Dorado Shrimp Farm	G	in aquaria ⁵	Feb 1993	Transferred
28	23-39	Rio Grande de Loiza (River)	M	shocking boat ⁶	19 Feb 1993	Established

¹Corujo-Flores et al., 1985—unpublished report.

²Very abundant, but only 7 specimens measured.

³Culture for aquarium fish trade.

⁴Only 2 specimens examined by TNC.

⁵Originally collected from the Loiza Reservoir by Shrimp Farm personnel, but transferred to a new area.

⁶Total shocking time was only 10 minutes.

NOTE ADDED IN PROOF: On April 25, 1994 specimens were collected in Lake Luchetti, near Yauco.

We do not believe that culture efforts were directly responsible for the introduction, but sales without instruction or restriction to local pet stores have probably made the sailfin armored catfish more available to the public. [Recent prices for sailfin armored catfish in Mayaguez pet shops were \$1.49 to \$1.99 each.] We suspect that multiple introductions were caused by aquarium hobbyists discarding their pets without understanding the consequences of their actions. The fish is available in pet shops throughout the island.

The unusual appearance of adult sailfin armored catfish, lack of local knowledge concerning this fish, and ease of capture may entice people to collect specimens and make transfers such as the one from the Loiza Reservoir to the Dorado Shrimp Farm (Table 1). These transfers may have also expanded the geographic range of the introductions. This fish is unfortunately well suited to survive transfers by the public. It seems resistant to handling stresses and can survive completely out of the water (aerial respiration) for several hours without harm.

Surveys of the Loiza Reservoir from August 1989 through July 1990 did not yield armored catfish; however, the species is now abundant in this reservoir. Our general impression, based on records and rumors, is that the sailfin armored catfish first became established in Puerto Rico in early 1990.

One immediate consequence of this introduction has been the deaths of locally endangered, brown pelicans, *Pelecanus occidentalis* (Pelecanidae), in the lower part of the Loiza River (Fig. 1J) and in the Gurabo River (Fig. 1L) (Table 1). Twenty mortalities have been reported to us, but we suspect many more have occurred and continue to occur. These birds strangled with sailfin armored catfish lodged in their throats. This bird has suffered other unexplained die-offs (Williams et al., 1992), and its population has declined in Puerto Rico in the last few years (J. Collazo, pers. comm.).

The sailfin armored catfish has a few positive economic aspects: 1) edible flesh; 2) fresh roe for caviar; 3) small individuals have commercial value as an aquarium fish.

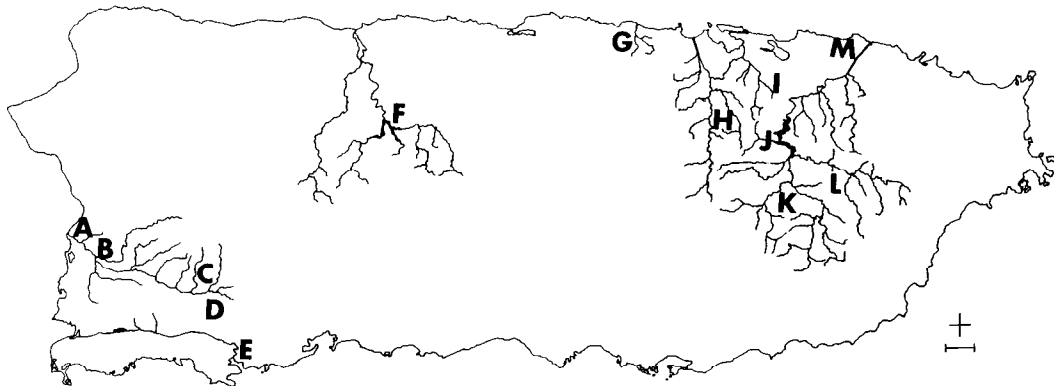


FIG. 1. Map indicating localities and waterways where sailfin armored catfish, *Liposarcus multiradiatus* (Hancock), have been collected in Puerto Rico: (A) Guanajibo River above mouth, (B) Guanajibo River, Hormigueros, (C) Guanajibo River, Sabana Grande, (D) Sabana Grande Fish Farm, (E) Río Loco near Guánica, (F) Dos Bocas Lake, (G) Dorado Shrimp Farm, (H) Bayamón River, (I) Río Piedras (River), (J) Loiza Reservoir, (K) upper Loiza River, (L) Gurabo River brown pelican kill, (M) Río Grande de Loiza (River). Letters in order from West to East (left to right) and correspond to the "Map #" column in Table 1. Cross (in lower right) = 18°00'N, 36°45'W, Scale Bar = 5 km.

They eat snails (M. McGee, pers. comm.), and could be of use in controlling snails that serve as hosts for the digeneans causing bilharzia. Devick (1991) suggests that modest numbers of armored catfishes may be beneficial for the maintenance of ecosystem quality in deteriorated or disturbed streams.

McGee (pers. comm.) found peacock bass (also called the peacock cichlid), *Cichla ocellaris* Bloch and Schneider (Cichlidae) controlled sailfin armored catfish in Puerto Rican ponds, but Devick (pers. comm.) found no control in Hawaiian reservoirs. Large-mouth bass consumed small armored catfish in aquaria, but provided no control in Hawaiian reservoirs (Devick, 1988). These predators seem unlikely to control the problem in Puerto Rican reservoirs. We found no evidence of effective predators, parasites, or diseases to control sailfin armored catfish. Eradication measures in Hawaii have been ineffective, with populations quickly returning to pretreatment sizes (Devick, 1989b, pers. comm.). Eradication from Puerto Rico is very unlikely (Devick, pers. comm.).

Devick (1989a, 1991) reported 4 genera (*Pterygoplichthys*, *Hypostomus*, *Ancistrus*, *Corydoras*) and 5 species of armored catfishes (families Loricariidae and Callichthyidae)

established in Hawaiian fresh waters, and a fifth genus (*Pekoltia*) possibly established. These fishes have only been introduced recently and they were not mentioned in a 1984 summary of known Hawaiian exotic fishes (Maciolek, 1984). The sudden and unexpected "explosion" of armored catfishes in Hawaii may now be beginning in Puerto Rico. Posters, pamphlets, and TV commercials supported by Sport Fish Restoration Funds; and a program for returning unwanted fishes to pet stores and the Humane Society, have been effective in stopping new aquarium-fish introductions in Hawaii (Devick, 1988, 1989b, pers. comm.). A ban on the sale of other species of armored catfishes in Puerto Rico may also be prudent. The sailfin armored catfish should be sufficient to serve the needs of local aquarists. The establishment of multiple armored catfish species, as occurred in Hawaii, should be avoided.

Acknowledgments. —We thank Drs. Walter R. Courtenay, Jr., Florida Atlantic University, William S. Devick, State of Hawaii, Donald S. Erdman, Portland, Oregon, Christopher C. Kohler and Brooks M. Burr, Southern Illinois University for reviewing the manuscript. Specimens of sailfin armored catfish were deposited in museum

collections by Drs. Bruce B. Collette, Systematic Laboratory, NOAA / NMFS, National Museum of Natural History, and Dannie A. Hensley, Department of Marine Sciences Vertebrate Collection, University of Puerto Rico. Some occurrence records, biological information, and background information concerning these fish was provided by Drs. Dallas E. Alston, William S. Devick, Donald S. Erdman, Dannie Hensley, Luis Nieves, Department of Biology, University of Puerto Rico at Humacao, and Michael V. McGee. Some information concerning brown pelicans was provided by Dr. Jaime A. Collazo, Cooperative Fishery and Wildlife Research Unit, North Carolina State University and Raul Colon, Department of Natural Resources. This work was supported by the Commonwealth of Puerto Rico Department of Natural Resources and Wallop-Breaux Sport Fish Restoration Funds, project Nos. F-16, 28, 30 and 33.

LITERATURE CITED

- Courtenay, W. R., Jr., D. A. Hensley, J. N. Taylor, and J. A. McCann. 1986. Distribution of exotic fishes in North America. Chapter 18. *In* C. H. Hocutt and E. O. Wiley (eds.), *The zoogeography of North American freshwater fishes*, pp. 675-698. John Wiley & Sons, New York, New York. 866 pp.
- Cuvier, G., and A. Valenciennes. 1840. *Histoire naturelle des poissons*, Vol. 15.
- Devick, W. S. 1988. Disturbances and fluctuations in the Wahiawa Reservoir ecosystem. Wallop-Breaux Funds, Sport Fish Restoration Project, Project No. F-14-R-12, Job 4, Study I: 48 pp.
- Devick, W. S. 1989a. Armored catfish appear in Hawaiian fresh waters. *Introduced Fish Section Newsletter*, American Fisheries Society 9(1):2-4.
- . 1989b. Disturbances and fluctuations in the Wahiawa Reservoir ecosystem. Wallop-Breaux Funds, Sport Fish Restoration Project, F-14-R-13, Job 4, Study I: 30 pp.
- . 1991. Patterns of introductions of aquatic organisms to Hawaiian freshwater habitats. *In* W. S. Devick (ed.), *New directions in research, management, and conservation of Hawaiian freshwater stream ecosystems*, pp. 189-213. Proceedings of the 1990 Symposium on Freshwater Stream Biology and Fisheries Management, December 1991. Division of Aquatic Resources, Department of Land and Natural Resources, State of Hawaii, Honolulu. 318 pp.
- Erdman, D. S. 1972. The inland game fishes of Puerto Rico. Commonwealth of Puerto Rico Department of Agriculture, Federal Aid Project F-1-20, Job 7, 2nd ed., Vol. IV, Number 2, San Juan. 96 pp.
- . 1984. Exotic fishes in Puerto Rico. Chapter 8. *In* W. R. Courtenay, Jr. and J. R. Stauffer, Jr. (eds.), *Distribution, biology, and management of exotic fishes*, pp. 162-176. John Hopkins University Press, Baltimore, Maryland. 430 pp.
- Jordan, D. S., and B. W. Evermann. 1896. The fishes of north and middle America, *Bull. U.S. Nat. Mus.* 47.
- . B. W. Evermann, and H. W. Clark. 1930. Check list of the fishes and fishlike vertebrates of north and middle America north of the northern boundary of Venezuela and Colombia. U.S. Department of Commerce, Bureau of Fisheries, Appendix X to the Report of the U.S. Commissioner of Fisheries for 1928, Bureau of Fisheries Document 1055, Washington, DC. 670 pp.
- Kohler, C. C., and W. R. Courtenay, Jr. 1986. American Fisheries Society position on introductions of aquatic species. *Fisheries* 11(2):39-42.
- Ludlow, M. E., and S. J. Walsh. 1991. Occurrence of a South American armored catfish in the Hillsborough River, Florida. *Florida Scientist* 54:48-50.
- Maciulek, J. A. 1984. Exotic fishes in Hawaii and other islands of Oceania, Chapter 7. *In* W. R. Courtenay, Jr. and J. R. Stauffer, Jr. (eds.), *Distribution, biology, and management of exotic fishes*, pp. 131-161. John Hopkins University Press, Baltimore, Maryland. 430 pp.
- Page, L. M., and B. M. Burr. 1991. A field guide to freshwater fishes of North America north of Mexico. Peterson Field Guide Series, Houghton Mifflin Company, Boston, Massachusetts. 432 pp.
- Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1991. Common and scientific names of fishes from the United States and Canada. American Fisheries Society Special Publication No. 20. 183 pp.
- Weber, C. 1991. Nouveaux taxa clans *Pterygoplichthys* sensu lato (Pisces, Siluriformes, Loricariidae). *Revue suisse Zool.* 98:637-643.
- Williams, E. H., Jr., L. Bunkley-Williams, and Ivan Lopez-Irizarry. 1992. Die-off of brown pelicans in Puerto Rico and the United States Virgin Islands. *American Birds* 46:1106-1108.