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Jason C. Seitz

ANAMAR Environmental Consulting, Inc., floridasawfish@gmail.com

John D. Waters

Aquatic Research & Conservation Society, Inc., johndenniswaters@gmail.com

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CLARIFYING THE RANGE OF THE ENDANGERED LARGETOOTH SAWFISH IN THE UNITED STATES

Jason C. Seitz^{1*} and John D. Waters²

¹ANAMAR Environmental Consulting, Inc., 2106 NW 67th Place, Suite 5, Gainesville, Florida 32653, USA; ²Aquatic Research & Conservation Society, Inc., 2915 Payne Avenue, Little Canada, Minnesota 55117, USA; *Corresponding author: floridasawfish@gmail.com

ABSTRACT: The United States population of the endangered Largetooth Sawfish (*Pristis pristis*) has a high probability of extinction. It is critical to identify areas with valid historical records as these areas may be important to the recovery of the species. The U.S. range is reported to extend as far east as Florida based on one vouchered specimen and 3 historical records from this state. Three of these reports presume a local capture location despite a lack of locality data. The vouchered specimen was presumed captured in southern Florida, but evidence suggests otherwise. Dried specimens observed in Florida were most likely imported to Florida from the Indo-Pacific region, or from the Caribbean, for the marine curio trade. A vouchered rostrum, purportedly from Louisiana, lacks locality data and it cannot reliably be assigned to this state. We believe that the range of the Largetooth Sawfish in the U.S. never extended farther east than Texas, which was likely the northern limit of its range in the western Atlantic Ocean. Future conservation efforts should be directed to areas in Texas rather than states to the east where the species likely never occurred.

KEY WORDS: Pristidae, *Pristis pristis*, conservation, endangered species, critical habitat

INTRODUCTION

Shark and ray populations in many areas of the world are declining due to modern fishing practices and enhanced incentives to target or retain these species, especially for the fin industry (Camhi et al. 1998, Clarke et al. 2006, Lack and Sant 2009). Sawfishes (Pristidae) are at particular risk as their fins are among the most valuable (McDavitt 2005) and because sawfishes and other coastal sharks and rays are vulnerable to habitat alterations and pollution (Seitz and Poulakis 2006, Dulvy et al. 2008, Dulvy et al. 2014). Bycatch mortality in net fisheries was the major reason for the decline in sawfishes worldwide (Stevens et al. 2000). Sawfishes were not part of a targeted fishery, except in the case of the historical Lake Nicaragua fishery (Thorson 1976, 1982), and therefore did not appear in fishery statistics. As a result, the reduction in sawfish populations went largely unnoticed or unaddressed by fisheries managers until recently. Although all 5 species of sawfishes are listed as endangered under the United States (U.S.) Endangered Species Act (ESA), the U.S. population of Largetooth Sawfish (*Pristis pristis*) is among those with the highest probability of extinction as demonstrated by Fernandez–Carvalho et al. (2013).

There is currently no known occupied habitat for Largetooth Sawfish in the U.S., possibly due to the lack of directed sampling efforts for this species. Any occupied habitat identified in the future could be designated as critical habitat following implementing regulations 50 CFR § 424.12, provision 5(f): “Critical habitat may be designated for those species listed as threatened or endangered but for which no critical habitat has been previously designated.” For this reason, it is crucial to identify areas with valid historical records of Largetooth Sawfish to be considered for conservation efforts as potential refugia and for the eventual recovery of the western Atlantic population across its historic range.

Nearly all records of Largetooth Sawfish from the U.S. have been from the coast of Texas (Fernandez–Carvalho et al. 2013). Baughman (1943) stated that the species reproduced in Texas waters based on captures of gravid females by Texas shrimp trawlers. He considered Port Arthur, TX (on the eastern border of Texas) to be the eastern extent of the species’ range in the U.S. Similarly, Bigelow and Schroeder (1953), Walls (1975), and Thorson (1976) all considered the Texas–Louisiana border to be the eastern extent of its U.S. range. However, many other early authors considered Florida to be part of the range (e.g., Briggs 1958, Duarte–Bello 1959, Robins and Ray 1986), and this idea has been perpetuated by more recent regional fish guides (e.g., McEachran and Fechhelm 1998, McEachran and de Carvalho 2002, Kells and Carpenter 2011). This opinion eventually became viewed as fact by some researchers such as Fernandez–Carvalho et al. (2013), Last et al. (2016), and Snyder and Burgess (2016). Work by del Monte–Luna et al. (2009, p. 510) went so far as to describe the species as being “once common and even plentiful in Florida waters,” erroneously citing Bigelow and Schroeder (1953) as their source. Recent regulatory documents by the U.S. National Marine Fisheries Service (NMFS) have also included Florida as part of the species’ historical range (NMFS 2011, NMFS 2014). The goal of this paper is to identify the easternmost extent of reliable historical records of the Largetooth Sawfish in the U.S. to inform future conservation and recovery efforts.

MATERIALS AND METHODS

We searched public and private collections and databases, including the International Sawfish Encounter Database (ISED) at the University of Florida, for reports or specimens from the U.S. east of Texas (Table 1). Institutional abbreviations follow Sabaj (2016). We also searched all available data



FIGURE 1. Map of Largetooth Sawfish records and specimens discussed in this paper. Location names on map refer to specimens purported from southern Florida (Monroe County), and elsewhere in Florida (Key West, Salerno, and Clearwater Beach). One specimen was purported from Louisiana.

(e.g., primary and secondary literature, unpublished reports, unpublished data) for evidence to corroborate or repudiate the stated localities of these specimens.

RESULTS AND DISCUSSION

Our search revealed one vouchered specimen and 3 records of Largetooth Sawfish purported from Florida waters, and one vouchered specimen purported from Louisiana waters. A dried rostrum vouchered at the University of Iowa Museum of Natural History (formerly State University of Iowa) (SUI) was reported by Fernandez–Carvalho et al. (2013) to be from Louisiana. The Florida records consisted of a dried rostrum vouchered at the American Museum of Natural History (AMNH), a dried rostrum observed in Key West (reported by S. Springer in Boughman 1943), a dried rostrum observed in Salerno (reported by S. Springer in Bigelow and Schroeder 1953), and a dried whole specimen seen on display in Clearwater Beach (Springer and Woodburn 1960) (Figure 1).

Marine curio trade in Florida

To put the purported Florida records into perspective, it is important to understand how the marine curio trade functioned, including its connection to international markets. Sawfish rostra have been popular in the marine curio trade in the U.S. for over a century (Norman and Fraser 1938, Migdalski 1960, Hoover 2008). Florida has had a thriving trade in marine curios, including shells and shark and ray parts, since at least the late 1800s. For example, an advertisement from March 16, 1895, for 25 cm sawfish “saws” for \$0.21 each was included in a list of marine curios for sale from one dealer in St. Augustine, FL (Kirke B. Mathes 1895). An article in the same magazine described how Smalltooth Sawfish (*P. pectinata*) rostra were sold to tourists along the Indian River Lagoon, FL in the late 1800s: “At the landings, or wharves as the steamers pass up and down in Indian River, and other points on the coast, natives offer the saws for sale, and these are from 5 inches to 4 feet long.” (Bright 1895, p. 26). The

senior author has seen sawfish rostra from the Indo–Pacific region, including the Largetooth Sawfish, among the inventory of marine curio shops in Florida in recent decades up until, and even beyond 2007, when all sawfish species were added to the Convention on International Trade in Endangered Species (CITES) (13 September 2007). Marine shells, the mainstay of the curio trade in Florida, have been routinely imported from the Indo–Pacific region (Darlene’s Shells 2008, Atlantic Coral Enterprise 2010, North Florida Shells 2016). A major importer (now deceased) of natural history items located in Titusville, FL had imported at least 20 Largetooth Sawfish rostra measuring to at least 136 cm from Chittagong, Bangladesh, in early 2007 prior to the species being added to CITES. In addition, this importer received large numbers of sawfish rostra into Florida from the Philippines through the late 1990s. These rostra, which included the Largetooth Sawfish, were typically sold wholesale to shell and curio shops in Florida and elsewhere in the U.S. for retail sale.

Vouchered specimen purported from southern Florida

American Museum of Natural History specimen AMNH–11 was cited in a recent status review by Fernandez–Carvalho et al. (2013) to indicate that the historical presence of this species included Florida (Monroe County). A query of the AMNH online database shows AMNH–11, a dried rostrum, as having been collected during January 1910 in southern Florida by scientist John T. Nichols. The field number has the prefix “TEKLA,” an alternate spelling referring to a cruise from Miami through the Florida Keys to the southwestern coast of Florida during

January–March 1910 using the vessel *Tecla* (AMNH 1922). The locality is written on the specimen label as “Probably Southern Florida.” The label also applies the term “probably” to the name of the expedition as well as the date of capture. These aspects of the label suggest that the provenance of the specimen is not certain.

TABLE 1. List of public and private collections and databases reviewed for Largetooth Sawfish material or encounter information from the United States east of Texas. See Sabaj (2016) for the full institutional names.

Name of institution or individual	Number of Largetooth Sawfish specimens or encounters	Number of Largetooth Sawfish purported from the Gulf of Mexico or U.S. waters, associated information
ALMNH	1	0
AMNH	8	n = 1: AMNH-11, rostrum, ‘Probably Jan.-Feb. 1910’, ‘Probably Southern Florida’, ‘Probably “Tekla” Expedition’
ANSP	2	n = 1, ANSP-17388, rostrum, prior to 1878, Gulf of Mexico
ASUMZ	0	0
AUM	0	0
BMNH	25	0
CAS	0	0
CUMV	1	0
FMNH	21	n = 1: FMNH-83732, rostrum, no date, Gulf of Mexico
FLMNH	2 (not including uncatalogued rostra)	0
GCRL	0	0
GMNH	0	0
INHS	0	0
INPA	3	0
ISED (currently held at FLMNH)	3	n = 3, NSED-04109 = SUI-17512 (see SUI below); NSED-04150 = rostrum observed in Key West, Florida, as reported by S. Springer in Baughman (1943) (see text); NSED-05115 = AMNH-11 (see AMNH above)
LSUMZ	0	0
MCZ	5	0
MNHNC	7	0
MRAC	7	0
NLU	0	0
RMNH	20	0
SUI	1	n = 1: SUI-17512, presumed to be a rostrum, no date, no location (presumed by some authors to be from Louisiana [see text])
TCWC	0	0
TNHC	0	0
TU	0	0
UCM	1	0
USNM	33	0
UT	0	0
UTEP	0	0
ZMB	16	0
J.C. Seitz (private collection)	11	n = 2: JCSPP270103, rostrum, no date, Texas; JCPP241009, rostrum, 1925–1930, Brownsville, Texas
J.C. Seitz (private database of sawfish encounters)	3	n = 2: JCS-894, rostrum, 1948, Texas; JCS-XXX, photo and reporter interview, 4 Sep 1938, Galveston, Texas
J.J. Hoover (private collection)	2	0
M.T. McDavitt (private collection)	19	0



FIGURE 1. Photographs taken in the late 1930s. A. Chester Thompson, proprietor of a marine curio shop in Key West, Florida, holding a Largetooth Sawfish rostrum in one hand and a taxidermied juvenile Smalltooth Sawfish in the other. B. Two unidentified people, perhaps tourists, holding a Largetooth Sawfish rostrum and a Green Turtle carapace in front of Chester Thompson's marine curio shop that he operated until 1943. From Windhorn and Langley (1973) used by permission of T. Corcoran, Dredgers Lane, LLC.

The reason for the uncertainty is likely due to a lack of provenance information for the specimen at the time the label was written. Since the specimen was originally identified as a Smalltooth Sawfish, a species that was certainly collected during the *Tecla* expedition (Nichols 1917), AMNH-11 was assumed to have originated from this expedition (R. Arrindell, AMNH, pers. comm.). AMNH-11 was later re-determined by scientist Guido Dingerkus as *P. perotteti* (= *P. pristis* [see Faria et al. 2013]).

The AMNH-11 rostrum originated from a much larger specimen (122 cm standard rostrum length [SRL], equating to approximately 560 cm total length [TL] based on Whitty et al. [2013] and modified using length data in Leeney and Downing [2015]) than any of the sawfish at AMNH listed from southern Florida by Nichols (1917). The TL of the AMNH-11 specimen is over 7 times the length of the only 2 sawfish specimens (66 and 76 cm TL) reported from the 1910 *Tecla* expedition by Nichols (1917). Since AMNH-11 was originally identified as a Smalltooth Sawfish, it would seemingly have been included in this list if it had been taken during this expedition.

Additionally, a search of the AMNH online database showed a large gap in catalog numbers between AMNH-11 and the only other *Tecla* expedition sawfish specimen (AMNH-2540, the 66 cm TL specimen) in this database. The remaining 429 fish lots from the *Tecla* expedition were given catalog numbers in numerical order with few or no gaps in the sequence (AMNH 2016). Thus, there is no evidence to support the notion that specimen AMNH-11 was

collected in Florida during the 1910 *Tecla* expedition.

The low catalog number for AMNH-11 suggests it likely was cataloged prior to the addition of the *Tecla* expedition specimens because at least 6 sawfish rostra lacking locality data were donated to AMNH prior to 1910 (AMNH 1903, AMNH 1909). Thus, we suggest that AMNH-11 was donated to the museum and originated from the marine curio trade.

Record purported from Key West, FL

The record from Key West, FL was based on a dried rostrum observed by self-trained scientist Stewart Springer and reported as a personal communication by Baughman (1943) and Bigelow and Schroeder (1953). Springer is quoted by Baughman (1943) as having spoken with the owner of the rostrum, "Chester Thompson". Interestingly, a Chester T. Thompson was a proprietor of a marine curio shop in Key West that operated until 1943 (Windhorn and Langley 1973). Photographs in Windhorn and Langley (1973), taken in the late 1930s, indicate that sawfish rostra, including Largetooth Sawfish, and whole taxidermy sawfishes, were specialties of the shop (Figures 2A and 2B). Springer described Mr. Thompson as "the man who collected the saw" (Baughman 1943, p. 46). This choice of words, instead of characterizing Mr. Thompson as the man who caught the sawfish, suggests that the fish was not landed locally. The Chester Thompson that Springer spoke with was most likely the same man who owned the marine curio shop in Key West. A link between the specimen and the marine curio trade was also suggested by Snelson and Williams (1981) and we believe the addi-

tional information presented here documents this link and casts doubt that the rostrum was collected in Florida.

Record purported from Salerno, FL

The record from Salerno, FL was based on a dried rostrum observed by Stewart Springer in a fish house there and reported as *P. perotteti* by Bigelow and Schroeder (1953). This record lacked capture locality documentation, and the place of capture was only assumed to have been the vicinity of Salerno (S. Springer pers. comm. in Snelson and Williams 1981). This record was rejected by Snelson and Williams (1981) as originating from Florida in their treatment of the elasmobranchs of the Indian River Lagoon, and they suggested that the rostrum had been imported to Florida for the marine curio trade. We agree with Snelson and Williams (1981) that the rostrum likely originated from the marine curio trade.

Record purported from Clearwater Beach, FL

The record from Clearwater Beach, FL was based on a small, dried, whole specimen on display at the Sea—Orama, an exhibit of fish mounts at a marina. The specimen lacked capture locality documentation but was assumed to have originated locally as reported by Springer and Woodburn (1960) in their treatment of the fishes of Tampa Bay. We suggest that this specimen was imported to Florida for the marine curio trade as whole taxidermy sawfishes were known from this source (see Record purported from Key West, FL section above).

The dried specimens observed in Florida at Key West, Salerno, and Clearwater Beach were most likely imported from the Indo—Pacific region for the marine curio trade or were shipped to Florida along with live Green Turtles (*Chelonia mydas*) from the Caribbean prior to their protection under the ESA (July 28, 1978) (Parsons 1962, Rebel 1974). Green Turtles appear with rostra of Largetooth Sawfish in Figure 2B, whose western Atlantic range is centered south of the U.S. (Bigelow and Schroeder 1953, Bonfil et al. 2017). Entanglement nets were often used to capture these turtles (Ingle and Smith 1949, Rebel 1974), and sawfish might have occasionally been caught as bycatch, as the same type of net was used in the sawfish fishery of Lake Nicaragua (Davies 1976, Thorson 1976).

Lack of modern verified records from Florida

In addition to the doubtful dried specimens observed in Florida at Key West, Salerno, and Clearwater Beach, there is no conclusive evidence of Largetooth Sawfish having occurred in Florida in recent years. A recent query of the ISED resulted in 2,025 sawfish records from Florida waters where the species was verified by photographic evidence, including 472 sawfish recorded by researchers who were targeting them. None were identified morphologically or genetically as Largetooth Sawfish (Chapman et al. 2011, Poulakis et al. 2011); all have been the Smalltooth Sawfish. Likewise, private collections visited by the senior author from 1999 to

date resulted in no valid records of Largetooth Sawfish from Florida (Table 1).

Specimen purported from Louisiana

Specimen SUI—17512 at the University of Iowa’s Museum of Natural History was stated by Fernandez—Carvalho et al. (2013) to have been captured in Louisiana waters in 1917 or 1918 and to measure 488 cm TL. These authors cited SUI—17512 as evidence of Largetooth Sawfish having historically occurred in Louisiana waters. In contrast to this statement, Baughman (1943) stated that none had been reported from Louisiana.

According to the current collections manager, SUI—17512 is thought to be the 96.5 cm rostrum from a Largetooth Sawfish affixed to a 503 cm TL cast replica of the fish it was taken from, although its identity could not be confirmed as it lacked a specimen label (C. Opitz, pers. comm., Museum of Natural History, SUI). SUI—17512 lacks locality data and a date of collection, being catalogued simply as “Saw of Saw—fish Deposited by C. C. Nutting” (C. Opitz pers. comm.). During an 1888 presentation by Nutting, who was at that time a professor at Iowa State University, he mentioned a sawfish captured in the Gulf of Mexico (Nutting 1888). Thus, SUI—17512 may have been captured during the early period of Nutting’s tenure, which was 1886–1927 (Taylor 1943). Alternatively, it is possible that SUI—17512 was obtained from SUI alumnus and ex—curator of the Louisiana State Museum (LSM) Alfred M. Bailey (curator from 1 July 1916–1 September 1919) and Professor Homer R. Dill of the LSM through Bailey (C. Opitz pers. comm.). This would help explain how Fernandez—Carvalho et al. (2013) made a connection between SUI—17512 and Louisiana as well as the date of capture these authors assigned to it (1917 or 1918). However, if this is the case, then there are other possibilities as to where the specimen may have been collected. Three large sawfish were reported captured during Bailey’s tenure at LSM: one from the Gulf of Mexico, one from Barataria Bay (southeastern Louisiana), and one caught in a shrimp trawl net in an unspecified area of the Gulf of Mexico (LSM 1918, Bailey 1919). The sawfish captured by trawl was kept and the rostrum was likely added to the LSM collection. The trawler catch had a reported TL of 488 cm (Bailey 1919) and is close in size to the mounted specimen at SUI. Thus, SUI—17512 may have been collected at an unrecorded locality in the Gulf of Mexico or from Barataria Bay.

CONCLUSIONS

There is no reliable evidence of historical or current resident, breeding, or core populations of Largetooth Sawfish in the U.S. east of Texas. Along with the lack of reliable evidence of records east of Texas in the past, there remains a lack of recent occurrences in Florida waters. None of the hundreds of sawfish documented in recent research samplings and thousands of sawfish encounters photographed by fishers in Florida have been attributed to this species.

Thus, we believe that the range of the Largetooth Sawfish in the U.S. never extended farther east than Texas, which was likely the northern limit of its range in the western Atlantic Ocean. We recommend focusing future Largetooth Sawfish

conservation efforts (e.g., environmental DNA sampling) in Texas where reproduction may have historically occurred and where recovery may occur.

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