

Status Review of the Largetooth Sawfish

(Pristis perotteti)



National Marine Fisheries Service

National Oceanic and Atmospheric Administration

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BACKGROUND

This status review summarizes the biological information gathered for an Endangered Species Act (ESA) assessment of the status of the largemouth sawfish (*Pristis perotteti*). Species are added to a Species of Concern list as a notification to the public that the National Marine Fisheries Service (NMFS) has concerns about a species or population which may lead to listing under the ESA. The purpose of this list is to facilitate and encourage outside voluntary conservation efforts that act to prevent species from an ESA listing. It is the policy of NMFS to highlight these species before they are listed so that Federal and state agencies, Native American tribes, and the private sector are aware of unlisted species that could benefit from proactive conservation efforts. The following text explains the chronological history of the status of the species starting with its listing as candidate species. The largemouth sawfish was listed as a candidate species by the NMFS on June 11, 1991 (56 FR 26797), along with the smalltooth sawfish (*Pristis pectinata*). Both species were removed from the candidates list on July, 14 1997 (62 FR 37560), but were subsequently added to the revised list published on June 23, 1999 (64 FR 33466).

On November 30, 1999, the Center for Marine Conservation (currently called Ocean Conservancy) petitioned NMFS to list North American populations of largemouth and smalltooth sawfish as endangered under the ESA. While the smalltooth sawfish began a formal status review (56 FR 12959) on March 10, 2000, NMFS determined that the petitioner did not present substantial evidence that the petitioned action may be warranted for the largemouth sawfish. The largemouth sawfish was, however, maintained on the candidate species list and later transferred to

NMFS' Species of Concern list. The largemouth sawfish was transferred to NMFS' Species of Concern list on April 15, 2004 (69 FR 19975).

On April 21, 2009, WildEarth Guardians petitioned the Secretary of Commerce to list largemouth sawfish as endangered or threatened throughout its range and to designate critical habitat for this species. The petitioners also requested that NMFS reconsider our previous March 10, 2000, negative finding on listing a North American Population. This petition further requested that the March 10, 2000, negative finding be re-examined and reversed.

On July 29, 2009, NMFS published a positive 90- day finding (74 FR 37671) in the *Federal Register* announcing the petition presented substantial scientific or commercial information indicating the petitioned action may be warranted for listing the species. NMFS announced the initiation of a status review of the species and requested information to inform its decision on whether to propose the species for ESA listing.

To conduct a comprehensive review of the status of the species, we reviewed all conservation action efforts ongoing or proposed for the species, gathered all known records of and data on largemouth sawfish by contacting fishery managers, museums and other research collectors in the United States and in foreign countries within the species' historic range. This status review contains the best scientific and commercial information available on largemouth sawfish.

The status review is being used to inform our decision on whether we should propose listing the species under the ESA. A species can be listed as endangered or threatened under the ESA. The

ESA defines an endangered species as “any species which is in danger of extinction throughout all or a significant portion of its range” (ESA Section 3(6)). A threatened species is defined as “any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range” (ESA Section 3(19)). Section 4(a)(1) of the ESA states that the Secretary shall determine whether any species is threatened or endangered because of any of the following factors: (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. Section 4(b)(1)(A) of the ESA requires that NMFS make listing determinations solely on the basis of the best scientific and commercial data available, after conducting a review of the status of the species and after taking into account those efforts, if any, being made by any state or foreign nation, or any political subdivision of a state or foreign nation, to protect such species, whether by predator control, protection of habitat and food supply, or other conservation practices, within any area under its jurisdiction, or on the high seas.

LIFE HISTORY AND BIOLOGY

TAXONOMY AND DISTINCTIVE CHARACTERISTICS

All sawfishes belong to the Order Pristiformes, Family Pristidae, and one of two Genera (*Pristis* and *Anoxypristis*), and are classified as rays (Superorder Batoidea). Sawfishes are distinguished from other rays by their long snout (rostrum) with teeth on either side. Using molecular phylogeny (mitochondrial and nuclear gene analysis) paired with morphological characters, Faria (2007) distinguished seven extant species in the Pristidae family. Sawfishes are classified into

three morphological groups based on rostrum characteristics: largetooth, smalltooth, and knifetooth (Garman, 1913). Three species are currently classified in the largetooth “group,” namely *P. perotteti*, *P. microdon*, and *P. pristis*, though difficulties associated with taxonomic identification are known (Faria, 2007; Wiley et al., 2008, Wueringer et al., 2009). The genus *Pristis* is taxonomically chaotic with uncertainty regarding the number of valid species (Campagno & Cook, 1995).

Pristis perotteti has been referred to by other names throughout its range. For instance, it has been called *P. antiquorum* (as cited in Bigelow and Schroeder 1953), *P. zephyreus* (Beebe and Tee-Van, 1941), *P. pristis* (McEachran and Fechhelm, 1998), or *P. microdon* (Garman, 1913; Fowler, 1941; Chirichigno and Cornejo, 2001; Vakily et al., 2002). Some authors consider the eastern Pacific populations to be part of the species *P. microdon* (Garman, 1913; Fowler, 1941; Chirichigno and Cornejo, 2001) while others consider the eastern Pacific populations to be *P. perotteti* (Jordan and Evermann, 1896; refs. in Beebe and Tee-Van, 1941; Compagno and Cook, 1995; Camhi et al., 1998; Cook et al., 2005). There appears to be no morphological character to distinguish *P. perotteti* and *P. microdon*, and species are generally classified based upon location (i.e., *P. perotteti* occurs in the Atlantic, while *P. microdon* is in the Indo-Pacific), however there is some evidence that tooth counts may differ (Wueringer et al., 2009). The conserved morphology of sawfishes makes identification difficult in some cases; most species are distinguished by the number of teeth on, and size of, the rostrum, placement of the first dorsal fin in relation to the pectoral fins, and shape of the lower lobe of the caudal fin. However, Faria 2007, used both mitochondrial and nuclear genes to investigate the population structure for all (Pristidae) species. The results from the studies indicate that the largetooth

species *P. microdon* and *P. perotteti* are separate species based on their mitochondrial deoxyribonucleic acid sequencing data and based on their differences in external morphological characters (e.g. rostrum length and eye horizontal length). Based on the available taxonomic information on *P. perotteti* we have determined the species range is the eastern and western Atlantic Ocean. The rostral tooth count per side for *P. perotteti* ranges from 14 to 22, and the space between the two most posterior teeth is between 4.5 and 8.5% of rostrum standard length (Faria 2007). The origin of the first dorsal fin is forward of the pelvic fin origin, and the lower lobe of the caudal fin is distinct at all maturity stages. The largest known specimen was a 700 cm total length (TL) female captured in northern Brazilian waters (Almeida 1999). The only other sawfish species that overlaps in range with *P. perotteti* is the smalltooth sawfish, *P. pectinata*. These species are differentiated by the number of teeth on the rostrum [24-32 in *P. pectinata*, 22-29 in U.S. Wiley et al., 2008)], and the rostrum length of *P. pectinata* is shorter in relation to its body length.

RANGE AND HABITAT USE

Largetooth sawfish are generally restricted to shallow (< 33 feet or 10 m) coastal, estuarine, and fresh waters, although they have been found at depths of up to 400 ft (122 m) in Lake Nicaragua. Largetooth sawfish are often found in brackish water near river mouths and large bays, preferring partially enclosed waters, lying in deeper holes and on bottoms of mud or muddy sand (Bigelow and Schroeder, 1953). This species, like the smalltooth sawfish, is highly mangrove-associated (Burgess et al., 2009). While it is thought that they spend most of their time on the bottom, they are commonly observed swimming near the surface in the wild and in aquaria (Cook et al., 2005). Largetooth sawfish move across salinity gradients freely and appear to have

more physiological tolerance of freshwater than smalltooth sawfish (Bigelow and Schroeder, 1953; Dahl, 1971; Thorson, 1974; 1976a; all as cited in Thorson, 1982a).

Though their habitats once overlapped in the northern Gulf of Mexico, the largetooth sawfish historically had a more southerly range than the smalltooth sawfish, with what appears to be a more narrow seasonal migration pattern. Mature largetooth sawfish seasonally ventured into waters as far north as U.S. waters of the Gulf of Mexico, while the smalltooth occurred as far north as New York. The range of the largetooth sawfish was most likely historically limited by seasonal water temperatures (Burgess et al., 2009).

PREDATION AND DISEASE

Pristis sp. have been documented within the stomach of a dolphin near Bermuda (Bigelow and Schroeder, 1953), in the stomach of a bull shark (*C. leucas*) in Australia (Thorburn et al., 2004), and a juvenile smalltooth sawfish was captured with fresh bite marks from what appears to be a bull shark (pers. comm from Tonya Wiley to Shelley Norton, 2009). Scientific data does not exist on diseases that may affect the largetooth sawfish.

AGE AND GROWTH

There have been no rigorous scientific examinations of the age and growth of the largetooth sawfish, though Thorson (1982a) study of the Lake Nicaragua population estimated size at birth to be 75 cm and an early juvenile growth rate of 35-40 cm/year. Thorson (1982a) also estimated, age of maturity to be 10 years and size at maturity 300 cm. Preliminary vertebral growth ring

analysis has extrapolated largemouth sawfish (*P. microdon*) lifespan to an estimated maximum age of 51 years (Peeverell 2006).

REPRODUCTIVE BIOLOGY

The reproductive method of sawfishes is most likely lecithotrophic viviparity; ova are internally fertilized, developing embryos receive nourishment from an external yolk sac, and the pups are born live after the yolk sac is absorbed. The only known reproductive study of largemouth sawfish was from Lake Nicaragua in the 1970s (Thorson, 1976a). This study found that litter size ranged from one to 13 pups, with an average of 7.3 pups per cycle. The gestation period was approximately five months, with a biennial reproductive cycle. After a five-month gestation period, young are born between October and December (Oetinger, 1978). Thorson (1976a) also found that both ovaries appeared to be functional, though the left seemed to be larger and carry more ova. Parturition occurred in October and November and size at birth was between 28.7 and 31.5 in (73 and 80 cm) TL. Thorson (1976a) reported that the smallest gravid female was 120 in (305 cm) TL, and based on this and other observations, reported the size at maturity is estimated to be around 118 in (300 cm) TL. The life history of largemouth sawfish, like most elasmobranchs, is characterized by slow growth, late maturity, and low fecundity, which generally contributes to a low intrinsic rate of increase.

Simpfendorfer (2000) estimated that largemouth sawfish in Lake Nicaragua had an intrinsic rate of increase (r) of 0.05 to 0.07 per year, with a population doubling time (t_{x2}) of 10.3 to 13.6 years. Intrinsic rates of increase below 0.1 are considered low, making species particularly vulnerable to population decline (Musick et al., 2000). The results indicated that if effective

conservation measures are put in place for the species and its habitats, recovery to levels with little risk of extinction will take a few decades. Since Thorson (1973) hypothesized that many Lake Nicaraguan sawfish may live their whole lives in the lake and Faria (2007) reported that the Lake Nicaraguan sawfish may be a separate stock, the life history parameters estimated by Simpfendorfer (2000) may be unique to that subpopulation or stock.

DIET AND FEEDING

No published information is available quantitatively describing the diet of largemouth sawfish. Bigelow and Schroeder (1953) reported that in general, sawfish subsist on the most abundant small schooling fishes in the area, such as mullets and small clupeids. There is also some evidence of sawfish feeding on crustaceans and other small benthic organisms (Bigelow and Schroeder, 1953). In these cases, the rostrum may be used to stir up the bottom sediments to locate prey, and in the case of fish predation, the rostrum may be used to stun or wound the fish in a slashing movement.

DISTRIBUTION AND ABUNDANCE

Largemouth sawfish historically inhabited warm temperate to tropical marine waters in the Atlantic, Caribbean, and depending on the taxonomic classification, eastern Pacific (Fig. 1). In the western Atlantic *P. perotteti* occurred from the Caribbean and Gulf of Mexico south through Brazil, and in the United States, largemouth sawfish were reported in the Gulf of Mexico mainly along the Texas coast and east into Florida waters (Burgess and Curtis, 2003; Burgess et al., 2009), (Fig. 2). Burgess et al. (2009), also state that based on the evidence, the species rarely

occurred in Florida waters and that nearly all records of largemouth sawfish encountered in U.S. waters were limited to the Texas coast.

In the eastern Atlantic, largemouth sawfish historically occurred from Spain through Angola. In the eastern Pacific, the historic range was from Mazatlan, Mexico to Guayaquil, Ecuador (Cook et al., 2005) or possibly Tumbes, Peru (Chirichigno and Cornejo, 2001). While the central eastern Pacific Ocean is considered by some to be part of its range, Faria (2007) used molecular phylogeny to infer that *P. perotteti* has only historically inhabited the Atlantic Ocean.

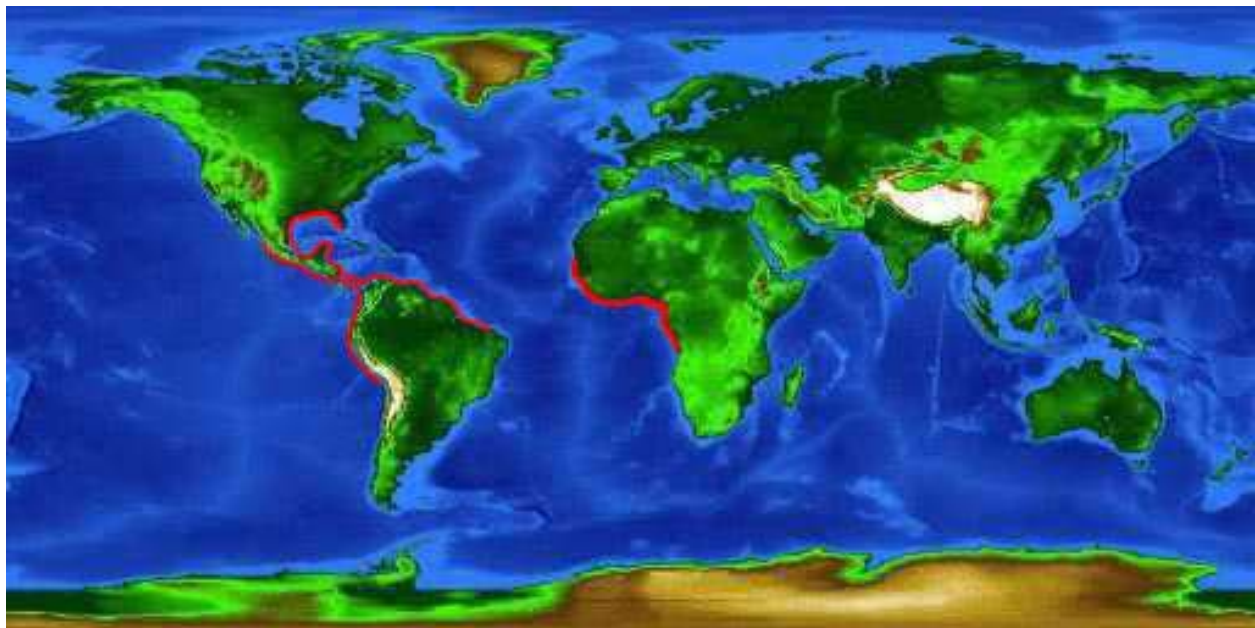


Figure 1. World-wide historical distribution map for the largemouth sawfish. (Florida Museum of Natural History, 2010)¹

In the present day, largemouth sawfish are thought to primarily occur in freshwater habitats in Central and South America, and Africa. In Atlantic drainages, largemouth sawfish have been

¹ <http://www.flmnh.ufl.edu/fish/Gallery/Descript/LTSawfish/LTSawfish.html>

found in freshwater at least 833 miles (1,340 km) from the ocean in the Amazon River system (Manacapuru, Brazil), as well as in Lake Nicaragua and the San Juan River; the Rio Coco, on the border of Nicaragua and Honduras; Rio Patuca, Honduras; Lago de Izabal, Rio Motagua, and Rio Dulce, Guatemala; the Belize River, Belize; Mexican streams that flow into the Gulf of Mexico; Las Lagunas Del Tortuguero, Rio Parismina, Rio Pacuare, and Rio Matina, Costa Rica; Rio San Juan and the Magdalena River, Colombia; the Falm River in Mali and Senegal; the Saloum River, Senegal; coastal rivers in Gambia; and the Geba River, Guinea-Bissau (Thorson, 1974; 1982b; Castro-Augiree, 1978 as cited in Thorson, 1982b; Compagno and Cook, 1995; C. Scharpf and M. McDavitt, pers. comm., as cited in Cook et al., 2005). In the eastern Pacific the species has been reported in freshwater in the Tuyra, Culebra, Tilapa, Chucunaque, Bayeno, and Rio Sambu Rivers, and at the Balboa and Miraflores locks in the Panama Canal, Panama; Rio San Juan, Colombia; and in the Rio Goascoran, along the border of El Salvador and Honduras (Fowler, 1936; 1941; Beebe and Tee-Van, 1941; Bigelow and Schroeder, 1953; Thorson et al., 1966a; Dahl, 1971; Thorson, 1974; 1976; 1982a; 1982b, 1987; Compagno and Cook, 1995; all as cited in Cook et al., 2005).

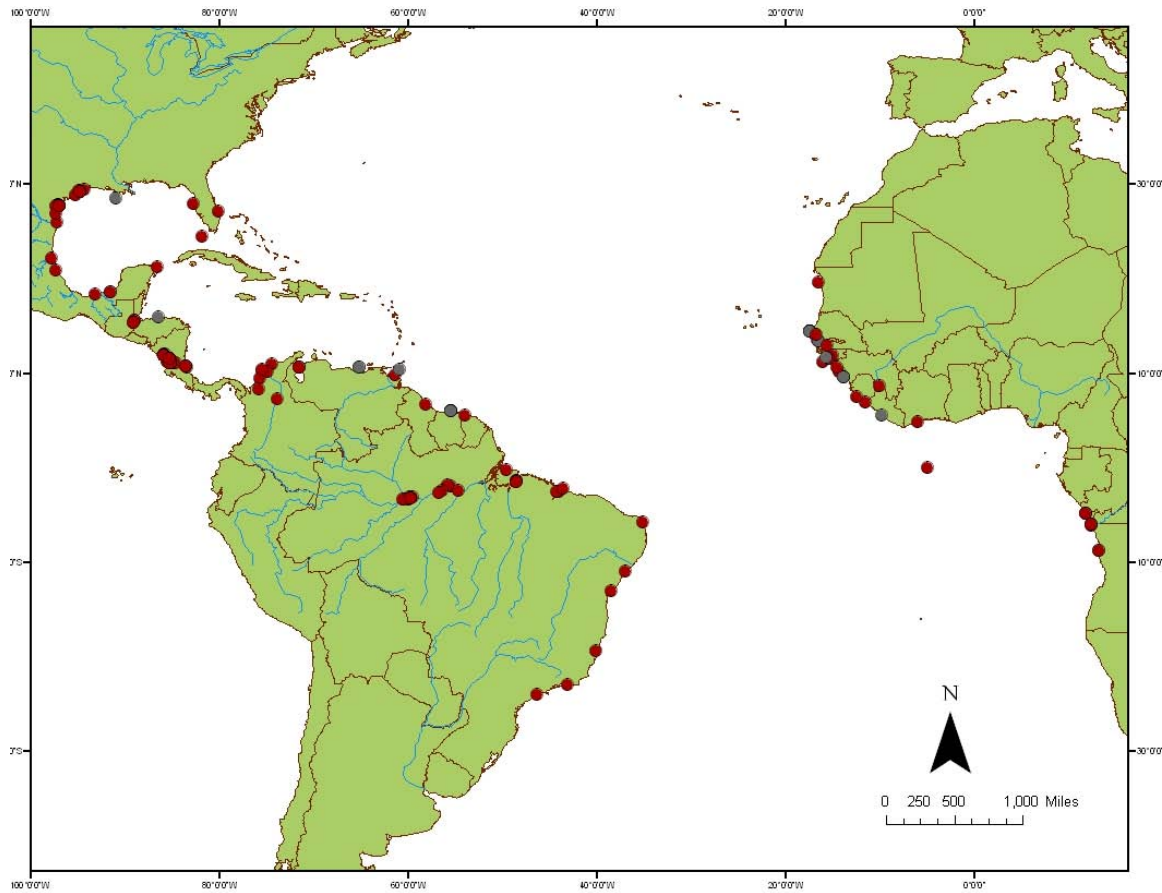


Figure 2. Historical records of largemouth sawfish, *Pristis perotteti*. Red dots represent records for which location information was available and grey dots have only general location data. Some records are questionable (Burgess et al., 2009).

THE UNITED STATES

Though reported in the United States, it appears that the largemouth sawfish was never abundant, with approximately 39 confirmed records (33 in Texas) from 1910 through 1961, (Table 1, Fig 3) and no confirmed sightings in the years since. A 1963, newspaper article reported a shrimp trawler off the coast of Texas taking a “broadbill sawfish” likely refers to a largemouth sawfish (Burgess et al., 2009). One specimen from was reported from the 1916-1919 period, and four individuals from Florida were noted between 1910 and 1960 (Fig. 2, Table 1). The capture

location and sawfish species “presumably from Alabama” was catalogued at the University of Alabama but could not be verified (Burgess et al., 2009). Two of the largetooth sawfish reported in Florida were identified by Stewart Springer by rostral tooth counts: one from Key West (1941) and another from Port Salerno (circa 1943-1952) (S. Springer, Shark Industries Inc). Port Salerno is on the east coast of Florida making this capture the only reported largetooth sawfish outside of the Gulf of Mexico in the U.S. Another specimen from south Florida was collected by the American Museum of Natural History in 1910. The final record for *P. perotteti* in Florida was in the Springer and Woodburn (1960) study of Tampa Bay fishes. The dried specimen was on display at the Sea-Orama in Clearwater Beach, but the identification was not verified, and the size of the specimen was much smaller than any other individual captured in U.S. waters. With this exception, all largetooth sawfish captured in the U.S. were 4.3 m or larger.

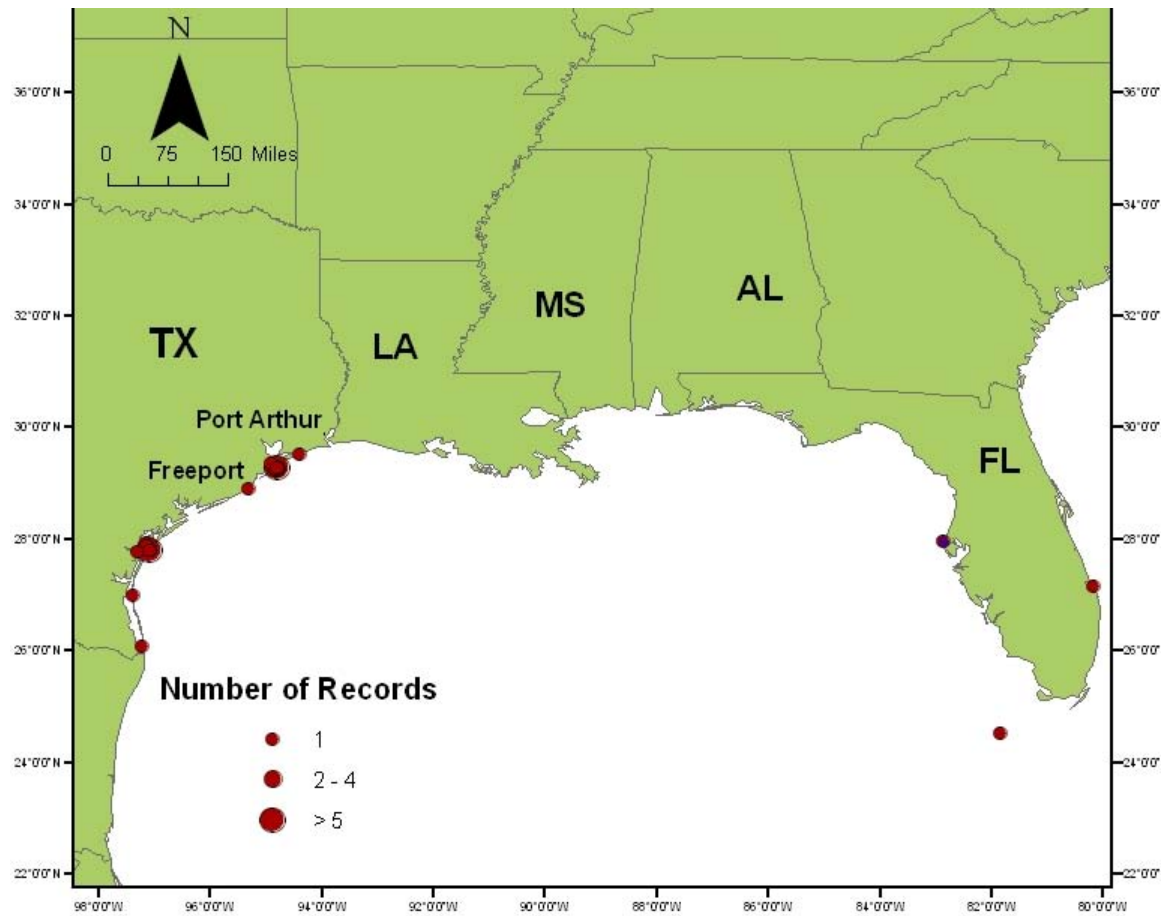


Figure 3. *Pristis perotteti* records from the United States, excluding Louisiana (Burgess et al., 2009).

TABLE 1. Regional and temporal distribution of U.S. *Pristis perotteti* records. Records lacking state data are listed under “Gulf of Mexico.” Florida 1960 record is questionable.

Region					
Year	TX	LA	FL	Gulf of Mexico	Total
1878				1	1
1910			1		1
1917	1				1
1918		1			1
1925	1				1
1929	1				1
1935	1				1
1938	3				3
1940	5				5
1941			1		1
1942	8				8
1943	6				6
1947	2				2
1948	1				1
1951	1				1
1957	1				1
1960			1		1
1961	1				1
1943-1953			1		1
Unreported	1			1	2
Total	33	1	4	2	40

Although the first confirmed record of a U.S. largemouth sawfish was from “the Gulf of Mexico” in 1878, they were likely present prior to this time period. Sawfish encounters were reported in the entire Gulf of Mexico in the early literature, but the similarities between the smalltooth and largemouth sawfishes limited the ability to discriminate. Because of this, there are no conclusive data available for largemouth sawfish abundance before fishing and other anthropogenic pressures

began to affect their distribution. Recreational fishers in Texas began targeting prize fishes, including large elasmobranchs such as sawfishes, in the 1930's. Photographs taken of these catches were favored in the print media, allowing Burgess *et al.* (2009), to identify 33 largemouth sawfish in Texas.

In Texas, largemouth sawfish were primarily found in three regions: Padre Island-Laguna Madre, Corpus Christi-Port Aransas, and Galveston-Freeport (Table 2). Most were caught from 1929-1957, though some records may have been duplicated (Baughman, 1943). Ten largemouth sawfish were encountered in the Corpus Christi-Port Aransas region, from 1917-1961, though again duplication of records is possible. The highest number of records is from the northeast Texas coast (Galveston) and the lowest number from near the Texas-Mexico border (Padre Island), corresponding to historic freshwater inflow pattern of the region (Longley 1994). That is, sighting frequency is positively correlated with higher freshwater flow discharge. While it is likely that the freshwater affinity of this species, especially in comparison to the smallmouth sawfish, attracted the largemouth sawfish to these high outflow areas, these numbers may also be an artifact of higher fishing effort or likelihood of reporting in that area.

TABLE 2. Temporal distribution by County of Texas records of *Pristis perotteti* (for records with county information noted).

Year	Aransas	Brazoria	Cameron	Galveston	Kleberg/Kennedy	Nueces
1917						1
1925			1			
1929				1		
1935						1
1938				2		1
1940	1			3		
1942		1		7		
1943	1			3		2
1947					1	1
1948						
1951				1		
1957				1		
1961						1
Total	2	1	1	18	1	7

Captures of largemouth sawfish in Texas, were primarily in shallow inshore waters and the majority (65%) of those captures noted were taken from fisheries using rod and reel gears (Fig. 4). Additionally, shrimp nets (reported as shrimp seines, shrimp net, and shrimp trawls) are the gear type associated with approximately (25%) of all captures. The Padre Island-Laguna Madre area only produced two sawfish around 1925 and 1947, the latter of which came from a shrimp trawl. Where size data could be determined, all largemouth sawfish caught in Texas were greater than 4.88 m TL (Burgess et al., 2009).

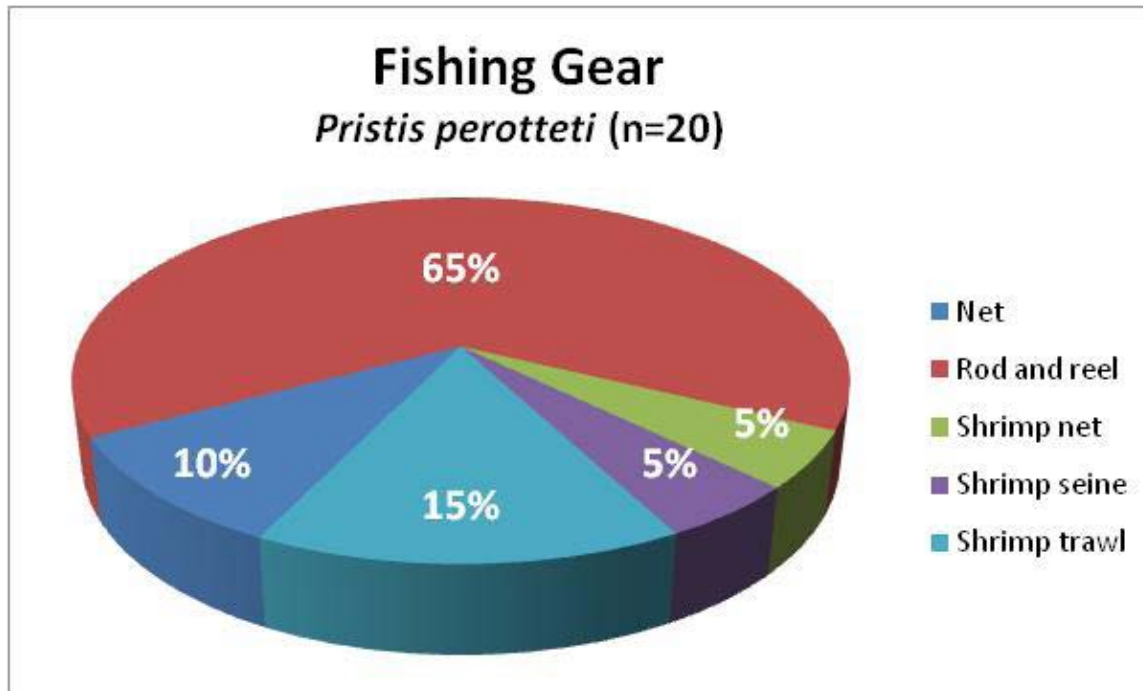


Figure 4. Fishing gear associated with *Pristis perotteti* captures in Texas.

The last confirmed record of *P. perotteti* in U.S. waters was from Port Aransas, Texas on June 24, 1961, though an animal caught in a shrimp trawl in 1963 that was called a “broadbill sawfish” in a newspaper article was likely a largemouth. The last records for other Gulf of Mexico states include Florida in 1941 and Louisiana in 1917. No records of largemouth sawfish were found from Mississippi, and, as stated previously, the one Alabama specimen could not be verified. The decline of the species in its apparent extreme northern range seems to mimic that of its congener, *P. pectinata* (Burgess and Curtis, 2003; NMFS, 2009b). In both cases increasing fishing mortality and habitat disruption were major factors that eventually led to the contraction of the species’ range and abundance. The last confirmed report of the largemouth sawfish in their northern range (U.S.) was in 1961.

All largetooth sawfish found in U.S. waters were large (>4.3 m) and were primarily encountered during periods of warm water (May-October) (Fig. 5). Data on month of capture only exists for 10 records. As such, historical records suggest that adults of this species mainly utilized Texas waters in the summer. Occasional sightings were reported in Florida. The frequency of reporting of this species seemed to be equal to that of the smalltooth sawfish in Texas waters prior to their declines (Bigelow and Schroeder, 1953; Burgess et al., 2009).

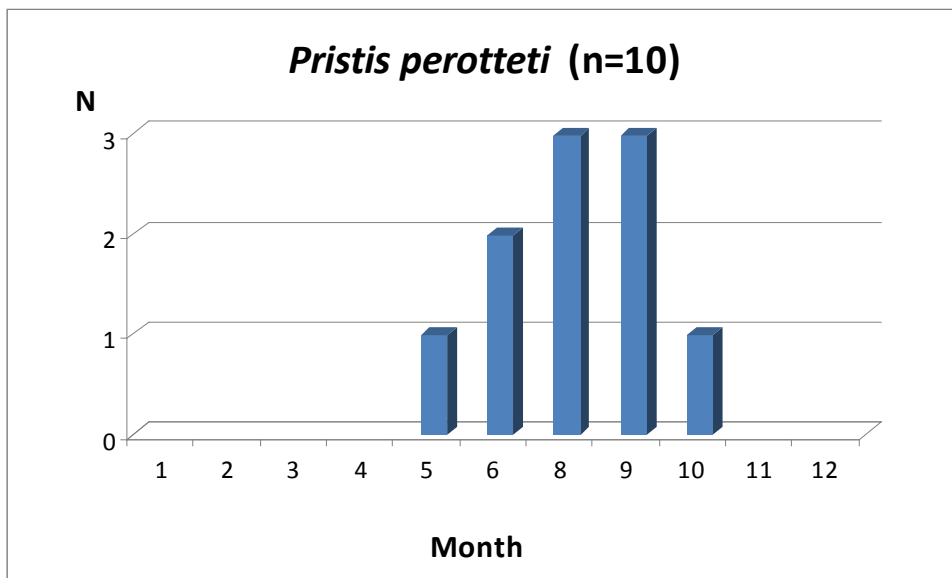


Figure 5. Seasonal distribution of *Pristis perotteti* in the Gulf of Mexico.

THE CARIBBEAN, CENTRAL AMERICA, AND NORTHERN SOUTH AMERICA

Only 33 confirmed records of *P. perotteti* exist for this region outside of Costa Rica and Nicaragua (Table 3, Burgess et al., 2009). The lack of data likely stems from several factors, including confusion with identification with smalltooth sawfish and the lack of scientific surveys and popular reports during the time of highest abundance. In total, 5 largetooth sawfish records were from Mexico, 5 from Guatemala, 1 from Honduras, 483 from Nicaragua, 37 from Costa

Rica, 7 from Colombia, 6 from Venezuela, 1 from Guyana, 5 from Suriname, 1 from French Guiana, and 1 from Trinidad (Fig. 6). Length data were not available for most of these specimens.

TABLE 3. Temporal distribution of records of *Pristis perotteti* from the circum-Caribbean and northern South American region. Records listed under “Caribbean” are only known from the “Caribbean Sea,” but the country is unavailable. All records listed as Pre-xxxx were located in sources from that specific year but the actual date the record occurred is unknown but must have occurred prior to the date on the source document.

YEAR	COUNTRY												
	MEXICO	GUATEMALA	HONDURAS	NICARAGUA	COSTA RICA	COLOMBIA	VENEZUELA	TRINIDAD	GUYANA	SURINAME	GUYANE OR FRENCH GUIANA	BRAZIL	CARIBBEAN
1830										1	1		
1856										1			
1865												3	
1873												1	
1877				1									
1878										1		1	
1894							1						
1900							1						
1903							2						
1909													
1913												1	
1929												1	
1942				1									
1943				3									
1946		2											
1947		3											
1951													
1955												1	
1960				2	1								
1962							1			1			
1964												1	
1965												1	
1966												1	
1967												1	
1968				71									

TABLE 3. (CONT.) Temporal distribution of records of *Pristis perotteti* from the circum-Caribbean and northern South American region. Records listed under “Caribbean” are only known from the “Caribbean Sea,” but the country is unavailable.

YEAR	COUNTRY												
	MEXICO	GUATEMALA	HONDURAS	NICARAGUA	COSTA RICA	COLOMBIA	VENEZUELA	TRINIDAD	GUYANA	SURINAME	GUYANE OR FRENCH GUIANA	BRAZIL	CARIBBEAN
1969				1									
1971												1	
1978												1	
1980				9									
1985				1									
1991				1									
1997	1												
1998				4								1	
1999												48	
2000												40	
2002												2	
2009												1	
PRE- 1934												1	
PRE-1940								1					
PER-1945						3							
PRE-1962	1												
PRE-1964						2							
1966-1977				384	34								
PRE-1974												3	
PRE-1976						1							
PRE-1978	3												
1983-1986												1	
PRE-1985						1							
PRE-1998												1	
YEAR N/A			1	5	2		1		1	1		27	4
TOTAL	5	5	1	483	37	7	6	1	1	5	1	139	4

Of the known Mexican largemouth sawfish, four were from the southwestern Gulf of Mexico (Tamaulipas, Veracruz, Tabasco, and Campeche), while one was captured at the northeastern tip of the Yucatan Peninsula (Quintana Roo). The mature (5.4 m TL, 800 kg) Yucatan individual was captured in 1997, which is the northern-most record in recent history. It appears that the last records in the Mexican Gulf of Mexico were prior to 1978, and Caribbean records are very sparse.

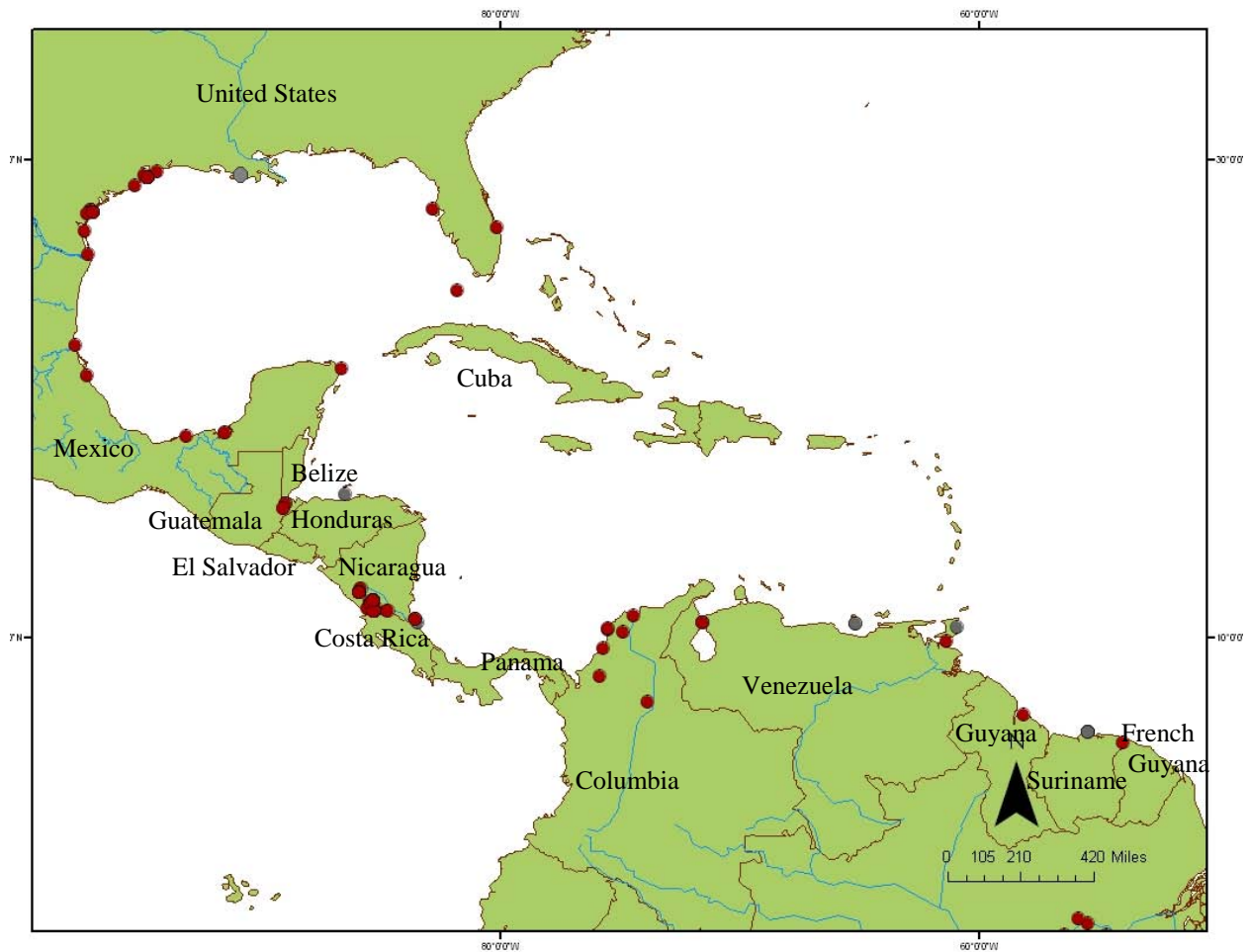


Figure 6. Locations of *Pristis perotteti* in the United States, Central America, and northern South America.

No encounters could be substantiated in Belize (Burgess et al., 2009). All five Guatemalan largemouth sawfish were from a survey of Lake Izabal in 1946-1947, and sawfishes were reported to be important inland fishes (Saunders et al., 1950). Though reported by Thorson et al., (1966a; 1966b) to be common throughout the area, a claim which was mirrored by local fishers at the time, there are no recent reports of encounters with sawfishes in Guatemala. The lone largemouth sawfish reported from Honduras was acquired from that country, but the true origin of the rostrum and the date of capture could not be confirmed.

The vast majority of *P. perotteti* records from Costa Rica (34 of 37) and Nicaragua (397 of 483) stem from Thorson's (1982a; 1982b) years of work on the Lake Nicaragua-Rio San Juan system. Bussing (2002) indicated that this species was known to inhabit the Rio Tempisque and tributaries of the San Juan basin in Costa Rica. Three recent occurrences were found in internet searches, one being a 200 lb specimen caught recreationally (Burgess et al., 2009). The San Juan River originates at Lake Nicaragua and runs along the Nicaragua-Costa Rica border until it reaches the Caribbean slightly south of the Nicaraguan border therefore movement between the countries was likely. Sawfish were noted in Nicaragua as early as 1529 by a Spanish chronicler (Gill and Bransford 1877), but by 1981, Thorson (1982a) was unable to locate a single live specimen. This species was also reported in Nicaragua by Meek (1907), Regan (1908), Marden (1944), Bigelow and Schroeder (1953), Hagberg (1968), and Baez (1980a; 1980b). There are no known Nicaraguan records of the largemouth sawfish outside of the Lake Nicaragua-Rio San Juan-Rio Colorado system (Burgess et al., 2009). A commercial fishery for the largemouth sawfish that began in earnest around 1970 quickly decimated the Lake Nicaragua population (Thorson 1982a). Low-level sustenance fishing for this species was common before this time,

but the Nicaraguan government helped to establish a processing plant in 1970, which processed and sold the meat, fins, and rostra in an efficient manner. In the 1970's, an American supermarket chain (A&P) produced advertisements in their Ohio, Pennsylvania, and Illinois chains which included "Fish Features" listing "Sierra Steaks" using the Spanish name for sawfish: *pez sierra* as a fresh fish available in their stores (The Times Recorder, 1975). Thorson (1982a) documented that within a decade the commercial largemouth sawfish fishery had removed the species from shallow water habitats within Lake Nicaragua. The species was relegated to deep water "pockets," remaining in Lake Nicaragua. Commercial fishing for largemouth sawfish in Lake Nicaragua was banned in 2006, but the species is still caught incidentally by fishers netting for other species (McDavitt, 2002). A Lake Nicaraguan fisherman reported that he encounters a few sawfish annually, nowadays (McDavitt, 2002).

The Magdalena River estuary was the primary source for largemouth sawfish encounters in Colombia from the 1940's (Miles, 1945), while other records originated from the Bahia de Cartagena and Isla de Salamanca (both marine), and Rio Sinu (freshwater) from the 1960's through the 1980's (Dahl, 1964; 1971; Frank and Rodriguez, 1976; Alvarez and Blanco 1985). Scientists in the country reported that there have been no sightings of this species in Colombia for about 10 years (Burgess et al., 2009). According to Fabio Gomez (Departamento de Biología Pontificia Universidad Javerina, Bogota 2009 pers. comm.): "*After evaluating my databases I see and confirm with concern what we have been discussing in the Coordinating Committee of the Action Plan for the Conservation of Sharks, Rays and Chimeras: there have been no sightings of Pristis perotteti in the last 10 years (or more) in the south Colombian Caribbean (south side of Río Magdalena to Cabo Tiburón, border with Panama).*"

Though thought to have once been abundant in some areas of Venezuela (Cervignon 1966a; 1966b), the last of the four confirmed records of *P. perotteti* from that country was from 1962. The single records from Guyana, French Guiana, and Trinidad appear to be from the late 1800's and early 1900's. Of the five Suriname accounts, the latest was collected in 1962.

BRAZIL

The largemouth sawfish was assessed as critically endangered in Brazil by Charvet-Almeida and Faria (2008). A total of 139 reports are available for this species (Fig 7, Table 4), some from as recently as 2009. Most of the records for which location is known originated in the state of Amazonas (12), which encompasses the middle section of the Amazon River basin along with the confluence of the Rio Negro and Rio Solimoes (in the state of Manaus). The other known locations are from the states of Rio Grande do Norte, Sergipe, Bahia, Espirito Santo, Rio de Janeiro, and Sao Paulo (1 record each), Para (7 records), and Maranhao (3 records). Para contains the estuary and lower reaches of the Amazon River, and Maranhao is just southeast of Para. Anecdotal reports from fishers indicate that they are also caught in Amapa, which is the northernmost state in Brazil (Charvet-Almeida and Faria 2008).

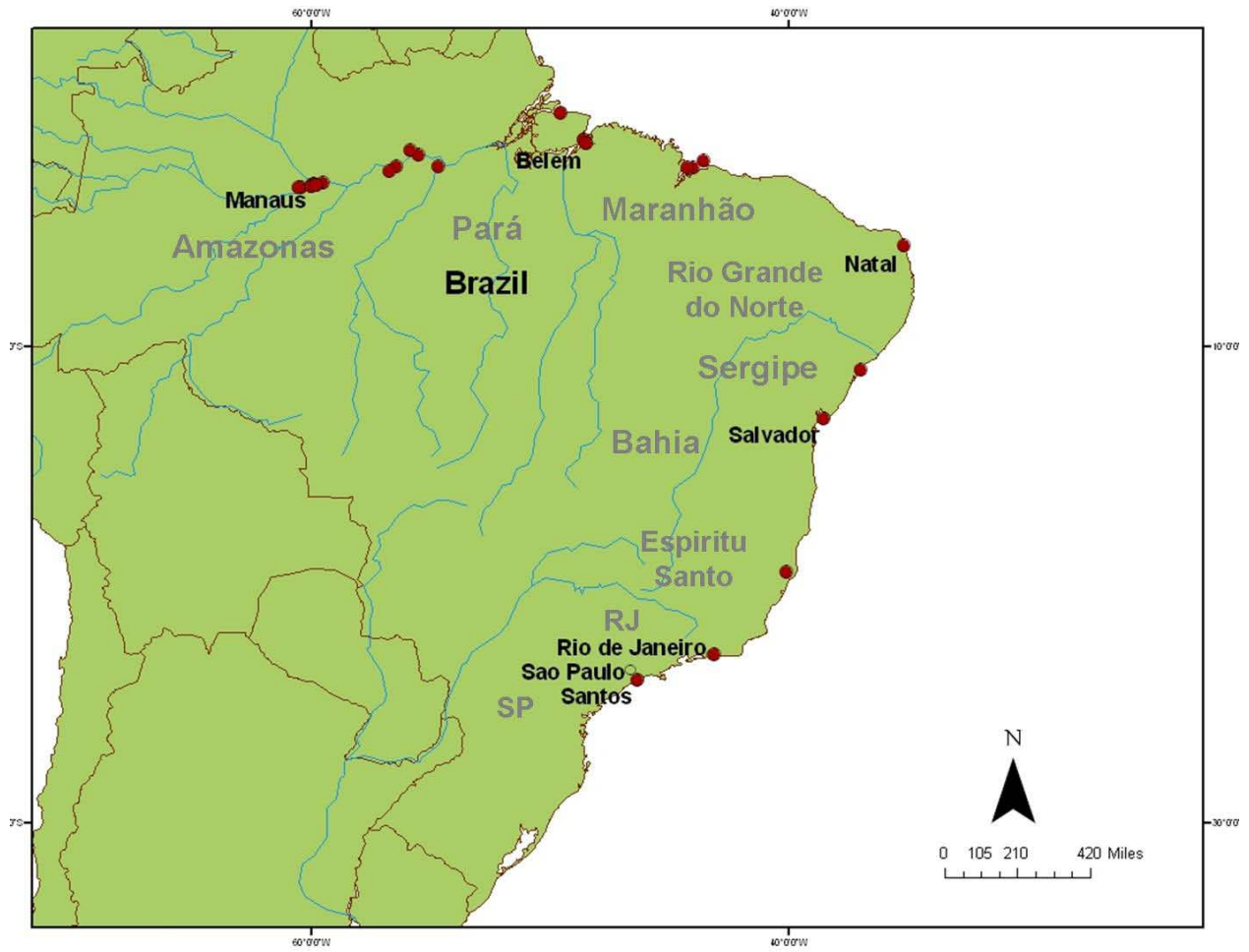


Figure 7. Records of *Pristis perotteti* in Brazil.

Table 4. Temporal and geographical distribution of records of *Pristis perotteti*. Records for which the state was unavailable are listed under “Unknown State.” Records noted as “Pre-xxxx” are from sources dated that year but the actual date of the sighting is sometime prior to the source date.

YEAR	PARÁ	AMAZONAS	MARANHÃO	RIO GRANDE DO NORTE	SERGIPE	BAHIA	ESPIRITO SANTO	RIO DE JANEIRO	SÃO PAULO	UNKNOWN STATE	TOTAL
1865	2						1				3
1873	1										1
1878	1										1
1913				1							1
1929										1	1
1955		1									1
1964		1									1
1965		1									1
1966		1									1
1967		1									1
1971		1									1
1978										1	1
1998			1								1
1999										48	48
2000										40	40
2002	2										2
2009			1								1
PRE-1934		1									1
PRE-1974		3									3
1983-1986			1								1
PRE-1998	1										1
YEAR N/A		2			1	1		1	1	21	31
TOTAL	7	12	3	1	1	1	1	1	1	111	139

The Amazon River basin and adjacent waters are traditionally the most abundant known range of largetooth sawfish in Brazil (Bates 1964; Marlier 1967; Furneau 1969). However, scientific collection and fisheries data for this region are very limited, both historically and recently. Sawfishes are captured as bycatch in artisanal and commercial fisheries in northern Brazil (Charvet-Almeida 2002). McDavitt (email to Shelley Norton, 2010) notes there is anecdotal evidence that *P. perotteti* is being targeted in Brazil for the lucrative Chinese shark fin trade. A recent popular guide in China to dried seafood products supplies descriptions of a dozen or so popular shark fin categories. Based on photographs and descriptions, the category *huang jiao* (literally: “yellow-glue”) comes from *Pristis*-genus sawfishes, the trade name deriving from its beige color and the especially copious gelatine it produces when cooked. This Chinese dried seafood book gives the current sources for *huang jiao* fin, noting that the supply from Brazil is favored nowadays due to its comparatively large size:

The Yellow Glue fin is produced on the Pacific coasts such as in Indonesia and the Philippines in Asia, and Brazil in South America. In particular, those from the later [nation, Brazil] are especially large and plentiful. [translated from Chinese]

The Brazilian sawfishes, which are almost exclusively of the largetooth species, are presumably large and abundant, compared to those captured in other localities, due to the fact that sawfishes have not yet been extirpated in Brazilian waters to the extent as elsewhere.

Both *P. perotteti* and *P. pectinata* are found in this region, and presumably both are caught and sold. No quantification of the number of captured or sold sawfishes is currently available,

though Charvet-Almeida and Faria (2008) reported that as many as 1500 small and medium rostra and 180 large rostra were sold each year in Para alone. Most records of largetooth sawfish in the Amazon River (Amazonia) predate 1974, though a more recent encounter in the 1990's was reported by Almeida (1999) from Manaus. Known lengths ranged from 1.5 to 2.5 m TL.

The two most recent largetooth encounters in Brazil were from Maranhao, one caught by a fisher in 1998 and another in 2009. The latter was a gravid female estimated to be 7 m TL (Burgess et al., 2009). Earlier reports of largetooth sawfish in Maranhao were mostly from the 1980's and 90's (Lessa, 1986; Martins-Juras et al., 1987; Stride and Batista, 1992; Menni and Lessa, 1998; and Lessa et al., 1999). Sawfish are likely caught incidentally by shark fishers in this state and landed for their saws (Almeida et al., 2006).

Records of largetooth sawfish in each of the states south of Maranhao are limited to one each, and the dates of capture are largely unknown, though most appear to be from the nineteenth century. An archeological site in Sao Paulo yielded tooled *P. perotteti* rostral teeth, though whether they came from locally caught animals, or were traded from the north is unknown. Charvet-Almeida and Faria (2008) concluded that largetooth sawfish were most likely extinct in most of the states south of Maranhao.

WEST COAST OF AFRICA

Historic records indicate that largetooth sawfish were once relatively common in the coastal estuaries of West Africa. Verified records exist from Senegal (1841-1902), Gambia (1885-1909), Guinea-Bissau (1912), Republic of Guinea (1965), Sierra Leone (date unknown), Liberia

(1927), Cote d'Ivoire (1881-1923), Congo (1951-1958), Democratic Republic of the Congo (1951-1959), and Angola (1951) (Fig. 8, Table 5). Most records, however, lacked species identification and locality data and may have been confused taxonomically with other species. Unpublished notes from a 1950's survey detail 12 *P. perotteti* from Mauritania, Senegal, Guinea, Cote d'Ivoire, and Nigeria, ranging in size from 89-700 cm TL (Burgess et al., 2009).

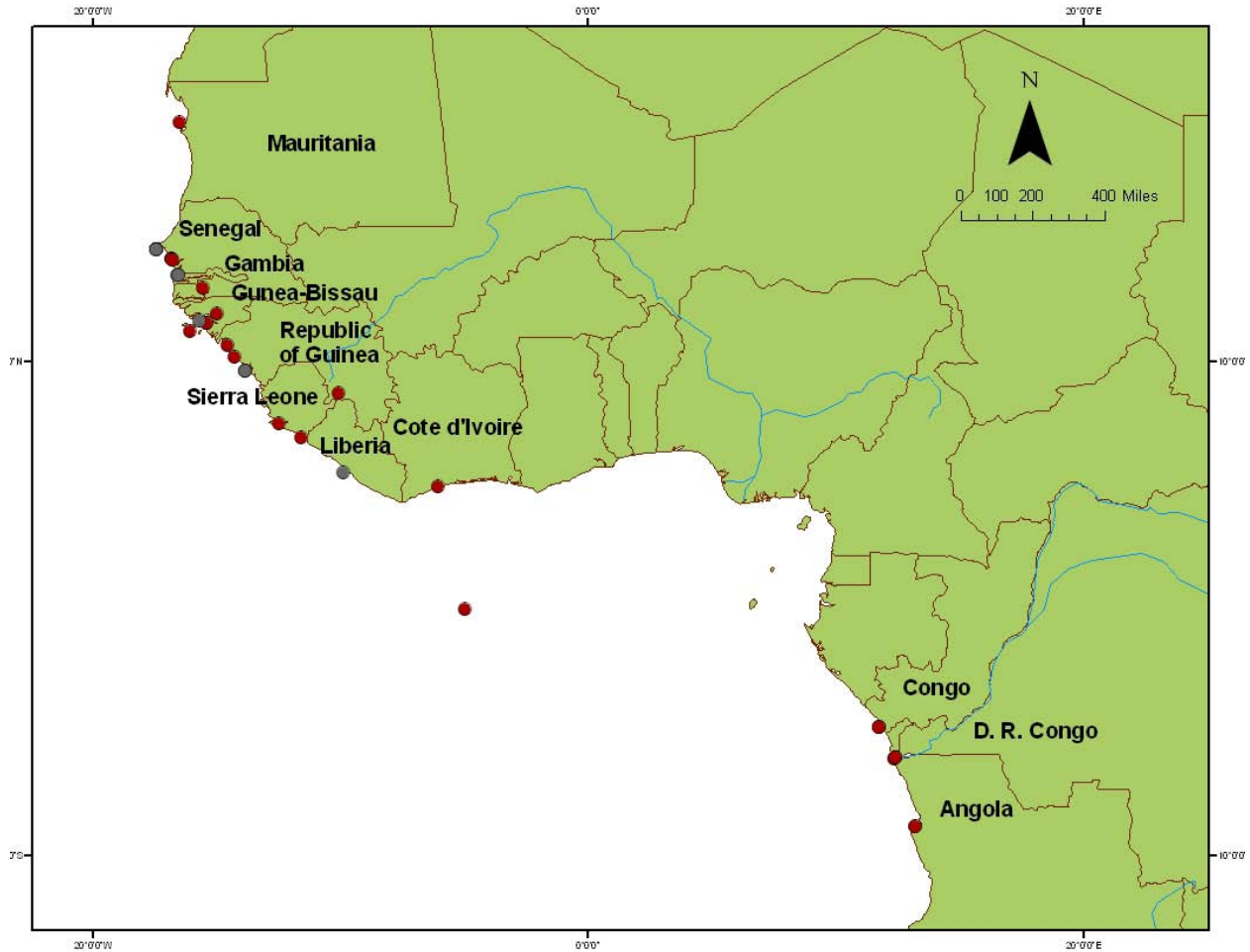


Figure 8. Historical locations of *Pristis perotteti* in western Africa. Red dots represent records for which specific location is available, and grey dots represent general location (i.e., country). The offshore dot is a questionable museum record.

A more recent status review by Ballouard et al., (2006) reported that sawfishes, including the largetooth sawfish, were once common from Mauritania to the Republic of Guinea but are now rarely captured or encountered. According to this report, the range of sawfishes has decreased to the Bissagos Archipelago (Guinea Bissau). The most recent sawfish encounters outside Guinea Bissau were in the 1990's in Mauritania, Senegal, Gambia, and the Republic of Guinea. The most recent documented *P. perotteti* capture was from 2005 in Nord de Caravela (Guinea Bissau), along with anecdotal accounts from fishers of captures off of two islands in the same area (Burgess et al., 2009).

TABLE 5. Temporal distribution and geographical distribution of records of *Pristis perotteti* from Africa. Records for which the country was not available are listed under “Africa.” Records noted as “Pre-xxxx” are from sources dated that year but the actual date of the sighting is sometime prior the source date.

YEAR	MAURITANIA	SENEGAL	SENEGAMBIA	GAMBIA	GUINEA-BISSAU	REPUBLIC OF GUINEA	SIERRA LEONE	LIBERIA	CÔTE D'IVOIRE	DEMOCRATIC REPUBLIC OF THE CONGO	ANGOLA	AFRICA	TOTAL
1881									1				1
1882			2										2
1902									1				1
1927								1					1
1951										3	1		4
1958										3			3
1959										1			1
1965						2							2
1980's	1	1			1	1							4
1980					1								1
1983					3	1							4
1989						1							1
1990		1											1
2003					2		1						3
2004					2								2
2005					1								1
PRE-1909				1									1
PRE-1930									1			2	3
PRE-2005		1		1	1								3
YEAR													
N/A		8		1	2	1	1			1	1		15
TOTAL	1	11	2	3	13	6	2	1	3	8	2	2	54

EVALUATION AND SUMMARY

DESTRUCTION, MODIFICATION, OR CURTAILMENT OF HABITAT OR RANGE

Historic accounts of the largemouth sawfish (*P. perotteti*) indicate the species was found in tropical marine waters of the Gulf of Mexico (GOM) from its northern most extent of its range in the U.S. (in the summer) following the Mexican coastline down into Central America, the Caribbean, South America, to the southernmost extent of its range in West Africa. The species range also includes the fresh waters of Lake Nicaragua. Review of current literature, museum collection specimens and anecdotal information on the historic and current distribution of the species indicates the species historically occurred commonly from Texas southward into Mexico, Central America, the Caribbean, South American, to the southernmost extent of its range in West Africa. Information on the current distribution of the species indicates the range has contracted to the Atlantic coast of Central America, South America (primarily Brazil), and West Africa. Although no time-series abundance data exists to quantify the extent of the decline of the species throughout its range, we believe that with the substantial number of commercial and recreational fisheries fishing along our U.S. coast, with the uniqueness of the fishes morphology, and because the media and internet sites are easily accessible to the public we believe that largemouth sawfish encounters would be noteworthy and reported. Additionally, outreach efforts along the GOM coast in the U.S. for the smallmouth sawfish, which includes printed brochures and signage in local bait shops, marinas, and boat ramps on where and how to report sawfish encounters, should increase the likelihood of reporting a largemouth sawfish encounter. Access to media and internet sites for reporting largemouth encounters outside the U.S. is more likely uncommon in some of the remote areas along the coasts of Mexico, Central America, Amazonian region of Brazil, and South Africa. Thorson (1973) tagging study of the largemouth sawfish is the only non-anecdotal

evidence that documents the abundance of the largemouth sawfish outside the U.S. Thorson tagged over 300 sawfish between the years of 1966-1970, in the Lake Nicaraguan-Rio San Juan system. As stated earlier in this document, reports of largemouth sawfish captures are rare now throughout most of the species historic range. The Amazonian region of Brazil appears to harbor a population of largemouth sawfish today. Based on the extreme contraction of the species range, the abundance of the largemouth sawfish is at an extremely low level from relative historic levels.

Coastal habitat loss throughout the species historic range is a contributing factor to the species decline. Coastal habitats in the southern United States, Gulf of Mexico region, have experienced and continue to experience losses due to urbanization. Wetland losses in the Gulf of Mexico region of the U.S. averages annual net losses of 60,000 acres of coastal and freshwater habitats from 1998 to 2004 (Stedman and Dahl, 2008). Although wetland restoration activities are ongoing in this region of the U.S., the losses outweigh the gains, significantly (Stedman and Dahl, 2008). These losses have been attributed to commercial and residential development, port construction (dredging, blasting, and filling activities) construction of water control structures, modification to freshwater inflows (Rio Grande River in Texas), and gas and oil related activities. Riverine systems throughout the species historical range have been altered or dammed. NOAA's Restoration Center is involved in ongoing coastal restoration activities throughout the GOM to restore coastal habitats. In 2010, NOAA will fund coastal restoration activities in Texas and Louisiana using appropriations from The American Recovery and Investment Act of 2009. In spite of ongoing efforts to restore coastal habitats, coastal habitat losses will continue to occur.

The status of habitats in Mexico, Nicaragua, Brazil, and West Africa is not well known, but continued development and human population increase is likely. Ruiz-Luna et al (2008) acknowledge that deforestation of mangrove forests in Mexico has occurred from logging practices, construction of harbors, tourism, and aquaculture activities. In addition to deforestation, Ruiz-Luna et al (2008), also acknowledge the changes in the hydrological systems occurred with opening of the artificial canal in Cuautla, Nayarit. Valiela et al. (2001) showed that the area of mangrove habitat in Brazil decreased by more than half (25,000 to 13,400km²) from 1983-1997, with similar trends in Guinea-Bissau (4760 to 2484km²) from 1953-1995. The areas with the most rapid mangrove declines in the Americas included Venezuela, Mexico, Panama, the United States, and Brazil, while Senegal, Gambia, Sierra Leone, and Guinea-Bissau showed the largest declines in western Africa. World-wide mangrove habitat loss was estimated to be 35% from 1980-2000 (Valiela et al., 2001). There are unconfirmed reports of dam building activities on Rio San Juan (Nicaragua) system, which could affect the movements of existing largetooth sawfish in that region. Habitat modification, including mangrove forest removal, is also likely in northern Brazil (Compagno et al., 2006). These threats cannot be directly related to the decline of the largetooth sawfish, but habitat loss is a known factor contributing to the decline of many freshwater and marine species, including the endangered U.S. distinct population of smalltooth sawfish.

OVERUTILIZATION FOR COMMERCIAL, RECREATIONAL, SCIENTIFIC, OR
EDUCATIONAL PURPOSES

COMMERCIAL FISHERIES

Sawfishes are very vulnerable to most fishing gears, and were historically caught by gillnets, trawls, seines, and lines (Compagno et al., 2006). Most targeted catches of largemouth sawfish in Texas in the 1930's were from recreational hook and line, but they were also caught incidentally by shrimp trawls and seines (Burgess et al., 2009). The Lake Nicaragua commercial fishery for largemouth sawfish consisted mostly of gillnet boats (Thorson 1982a), and the commercial small coastal shark fishery in Brazil mainly utilizes gillnets and some handlines (Charvet-Almeida 2002).

Today the main threat to the largemouth sawfish is most likely from bycatch mortality, though sawfishes may be targeted opportunistically in some areas (Brazil) when the occasion arises. The current scarcity of sawfish may inhibit targeted fisheries that might occur in spite of international bans. However, if caught as bycatch in Brazil they are most likely retained because of the value of their products, as the rostra, teeth, and fins can fetch upwards of \$1,000 US (Charvet-Almeida, pers. com).

RECREATIONAL FISHERIES

Historically, recreational hook and line fishers targeted large elasmobranchs, including sawfishes, as trophies in Texas (Burgess et al., 2009). Elsewhere in the U.S., abundance was likely never high enough for recreational fishers to encounter this species, much less target it. Because of its current distribution, which is mostly in developing nations, the largemouth sawfish

is unlikely to be encountered by recreational fishers, with possible rare exceptions of tourists in these areas. There is no current information on the use of sawfish species for subsistence fishing, though it was noted in Brazil that the meat was often sold in local fish markets, while the other products (rostra, fins) were sold internationally (Charvet-Almeida, 2002).

COMMERCIAL TRADE

There is very little information available about the trade of sawfish products in general, especially the largetooth sawfish. Largetooth sawfish were listed under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2007, which prohibits the commercial trade of largetooth sawfish parts (see Regulatory Mechanisms section below). In 2006, eBay banned the sale of smalltooth sawfish on their online auction site; however the ban was not established for all sawfish species. A survey by McDavitt and Charvet-Almeida (2004) of sawfish rostra on eBay (before the ban) found that large rostra could fetch over \$1,000 (US). An informal web search in November 2009 turned up several sawfish rostra for sale online, some listed as “largetooth” along with sites selling cockfighting spurs made from South American sawfish teeth to international buyers. It is apparent that largetooth and smalltooth sawfishes are still landed and sold illegally in northern Brazil (Charvet-Almeida pers. comm., 2009). Most likely the meat is consumed locally, while the fins and rostra are sold at market. It was previously observed that sawfish rostra from small individuals were sold to tourists, while damaged or cut rostra were used for local folk medicine (McDavitt and Charvet-Almeida, 2004). The larger rostra were sold in international cockfighting markets, as the rostral teeth were used as spurs. The larger rostra were also purchased by Asian shark fin buyers, most likely for medicine or curios. The proportion of

largetooth sawfish in these markets is unknown, though as many as 180 large *Pristis sp. rostra* were sold at a single market in northern Brazil per year in the early 2000's (McDavitt and Charvet-Almeida, 2004). With little enforcement of regional and international laws, the practice of landing sawfishes may continue in Brazil, though the extent of any international trade since the CITES listing is unknown. No confirmed reports of largetooth sawfish in aquaria exist currently. No seizures of largetooth sawfish in international trade have occurred since its CITES listing [email from Sharon Lynn (USFWS) to Shelley Norton (NMFS) on November 16, 2009].

SCIENTIFIC USE

The only published studies on life history and movements of the largetooth sawfish were conducted by Thorson in the 1970's-1980 in Costa Rica and Nicaragua (Thorson, 1970; 1973; 1974; 1976a; 1976b; 1978; 1982a; 1982b; 1987; Thorson et al., 1966a; 1966b). While many live largetooth sawfish were tagged by Thorson in this time period, it seems that most of the biological data were obtained from dead specimens that were purchased from commercial fishers. Most areas where the largetooth sawfish now occurs suffer from lack of biological sampling due to logistical difficulties and most likely low funding of research. However, there is some scientific information being collected by researchers in Brazil, mostly from fish markets, where sawfishes are illegally landed and sold.

COMPETITION, PREDATION, OR DISEASE

While there is potential for competition with the smalltooth sawfish due to their overlap in range and habitat types, there is no data to support this and differences in patterns of habitat use and salinity tolerance may adequately partition the niches of these species. Thorson (1970)

speculated that the Lake Nicaragua population may have also competed with the bull shark, *Carcharhinus leucas*, as both were quite prevalent (Thorson, 1970), however both species have since declined to the point of near extirpation. *Pristis sp.* have been documented within the stomach of a dolphin near Bermuda (Bigelow and Schroeder, 1953), in the stomach of a bull shark (*C. leucas*) in Australia (Thorburn et al., 2004), and a juvenile smalltooth sawfish was captured with fresh bite marks from what appears to be a bull shark (pers. comm from Tonya Wiley to Shelley Norton, 2009). The International Union for Conservation of Nature (IUCN) Red List for the largetooth sawfish (*P. perotteti*), also states that crocodiles prey on the species (<http://www.iucnredlist.org/>). Scientific data does not exist on diseases that may affect the largetooth sawfish but we do have a report of a *P. pectinata* that was found dead during a red tide event on the west coast of Florida (National Sawfish Encounter Database, 2009). Red tide may be a manmade factor that could also affect the largetooth sawfish.

EXISTING REGULATORY MECHANISMS

Though not currently found in U.S. waters, existing regulations and measures put in place to protect the smalltooth sawfish could also benefit the largetooth sawfish, should it return into the northern most extent of its range in North America. Protective measures (i.e. take prohibitions) covering the largetooth sawfish *Pristis perotteti* are protected internationally under Appendix I of CITES, making trade of parts illegal. Additional federal, state, and national laws in the United States, Nicaragua, and Brazil are designed to limit the harvest and sale of largetooth sawfish locally and internationally. Regional sawfish abundance within their current range is depleted so targeted fisheries are unlikely; however those caught as bycatch are probably kept due to their value. The status of largetooth sawfish protection in western Africa is unknown. Trade of

sawfish parts may be ongoing in Nicaragua and Brazil in spite of the CITES listing and national laws due to lack of enforcement.

Existing laws in place for the smalltooth sawfish could also benefit the largetooth sawfish if its range expands into the U.S. The U.S. distinct population segment (DPS) of smalltooth sawfish (*Pristis pectinata*) was listed as endangered on April 1, 2003. Both the smalltooth and largetooth sawfish are susceptible to similar threats (e.g. bycatch in various fisheries and habitat loss). The Smalltooth Sawfish Recovery Plan was finalized in 2009. The Smalltooth Sawfish Recovery Plan lays out specific guidelines for federal and state agencies to follow. Among the recovery plan's objectives are to minimize harm caused by human interactions and to protect and restore habitats. Since both species are susceptible to similar threats, implementation of the Smalltooth Sawfish Recovery Plan will provide conservation benefits for the largetooth sawfish if it returns to U.S. waters (NMFS, 2009a).

In response to the listing of U.S. DPS of smalltooth sawfish, Texas implemented a ban on harvest of largetooth sawfish because of the possibility of misidentification. The trading of any largetooth sawfish parts is banned by state laws in both Florida and Louisiana. Additionally, Florida and Texas do not allow gillnet fishing in state waters less than 9 miles from shore) and Alabama restricts gillnet fishing within less than 3.5 miles from shore.

The Nicaraguan government officially banned commercial fishing for largetooth sawfish in Lake Nicaragua in 2006. The Brazilian Environment Ministry listed *P. perotteti* in Appendix I of the "Instrucao Normativa numero 05," meaning that the species is considered endangered and

therefore cannot be landed or sold. Enforcement of these regulations in Brazil is difficult due to the length of the coastline, extensive internal waterways, and need for more efficient tools.

There is little known about existing laws and enforcement in western Africa, though Guinea-Bissau has created six official Protected Areas, which were established in 2005 (UNEP, 2008). Among these areas are several island chains and deltas with intertidal muddy sand banks and mangroves, which are ideal sawfish habitat.

OTHER NATURAL OR MANMADE FACTORS AFFECTING ITS CONTINUED EXISTENCE

Largetooth sawfish have slow growth rates, late maturity, a long life span, and low fecundity rates. The largetooth sawfish is a k-selected species, with an intrinsic rate of population increase below 1.0 (Simpfendorfer, 2000). K-selected animals are usually successful at maintaining relatively small, persistent population sizes in relatively constant environments. Conversely, they are not able to respond rapidly to additional sources of mortality, such as overexploitation and habitat degradation. Because of this, the risk of extinction remains high without effective conservation plans put into place.

Red tide is caused by an increase of toxin, naturally occurring microscopic blooms of plankton are coastal phenomena caused by environmental conditions, which promote explosive growth. Factors that are especially favorable include warm surface temperatures, high nutrient content, low salinity, and calm seas. Rain followed by sunny weather in the summer months is often associated with red tide blooms. We do not have specific information on red tide effects to largetooth sawfish but we do have a report of a smalltooth sawfish that was found dead along the

west coast of Florida, during a red tide event (National Sawfish Encounter Database, 2009). Red tide could affect largemouth sawfish.

SUMMARY

This report summarizes the best available scientific and commercial data available for an Endangered Species Act (ESA) assessment of the status of the largemouth sawfish (*Pristis perotteti*). The available data suggest that *P. perotteti* has tropical distribution in the eastern and western Atlantic Ocean and has always been rare at latitudes higher than 12°N and 12°S. Most encounter records in the western Atlantic have been concentrated in tropical rivers and lakes of Nicaragua, Costa Rica, and Brazil. Waters of the United States (primarily Texas) were historically on the northern fringe of the species range. It is clear that range contraction has occurred and populations have declined dramatically. No records of *P. perotteti* exist in U.S. waters since the 1960's, suggesting the United States is no longer part of the range of the species. A similar range contraction is apparent at the southern extreme of the species historical range. The species has not been reported from southern Brazil for almost a century.

The process for determining whether a species should be listed includes conducting a status review and taking into account conservation efforts being made for the species, based solely upon the best available scientific and commercial information. NMFS must then determine whether the species is endangered or threatened because of any of these factors specified in section 4 (a)(1) of the ESA:

1. The present or threatened destruction, modification, or curtailment of its habitat or range;

2. Overutilization for commercial, recreational, scientific, or educational purposes;
3. Disease or predation;
4. Inadequacy of existing regulatory mechanisms; or
5. Other natural or manmade factors affecting the continued existence of the species.

For the first ESA listing factor, habitat alterations considered in our status review that potentially affect largemouth sawfish include: commercial and residential development, port construction (dredging, blasting, and filling activities) construction of water control structures, modification to freshwater inflows, and gas and oil related activities. Largemouth sawfish, like all sawfish species, are vulnerable to a host of habitat impacts because they use rivers, estuaries, bays, and the ocean at various points of their life.

Based on a review of current literature, museum collection specimens, and anecdotal information on the historic and current distribution of the species, the species historically occurred commonly from Texas southward into Mexico, Central America, the Caribbean, South America in the western Atlantic, and in West Africa. Information on the current distribution of the species indicates the range has contracted to the Atlantic coast of Central America, South America (primarily Brazil), and West Africa. No confirmed reports have been documented in the U.S. since 1961. Northern Brazil appears to host the largest remaining numbers of largemouth sawfish, given the persistence of trade in parts. It is unclear what effects ongoing Amazonian deforestation has on largemouth sawfish, but they are likely serious given the enormous changes in terrestrial ecosystems.

For the second listing factor, largemouth sawfish have historically been caught as bycatch in various fishing gears (rod and reel, shrimp nets, and gill nets). The only large-scale directed fishery was located in Lake Nicaragua prior to the 1980's. No other large-scale directed fisheries are known for the species. The Lake Nicaraguan fishery collapsed, presumably when the sawfish population also collapsed. Largemouth sawfish, like all sawfish species, are highly susceptible to entanglement in fishing gears because their toothed-rostrum makes it difficult to avoid entanglement in almost all types of mesh nets. The saw becomes entangled in the net and fishers often harm the animal (remove their saw or kill them) when removing them from their nets. In the U.S., most records come from recreational fishing, and large sawfish were also kept as trophies. A directed fishery and incidental capture in other commercial and recreational fisheries are the most likely cause of the species range contraction and presumed current low population. Unfortunately, no quantitative data of fishery impacts exist. NMFS believes that any largemouth sawfish parts that are in international or domestic trade are likely from retained bycatch in other commercial or subsistence fisheries.

Monte-Luna et al. (2009) used the model of Roberts and Solow (2003), to try to determine the extinction risk for *P. pectinata* based on intervals between successive sighting dates. Monte-Luna et al. suggest that, statistically, the species could only be confidently declared as absent from Virginia to New York, where it has historically been only an exceptional visitor. However, the authors argues that their analysis cast doubt on the “regional extinction” (no individuals have been left alive) of those species outside the Florida Keys and the Everglades National Park in U.S. waters. We could apply the Roberts and Solow (2003) model to the largemouth sawfish sightings data and statistically estimate with some level of confidence whether or not the species

can be confidently extirpated from U.S. waters, where it was historically a seasonal visitor. Unfortunately, the model does not take into account important biological information (e.g. population increase rates) that limits the conclusions that can be drawn from the results.

There is very little information available about the trade of sawfish products in general, especially the largemouth sawfish. Largemouth sawfish were listed under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2007, which prohibits the commercial trade of largemouth sawfish parts (see Regulatory Mechanisms section below). Sawfish parts are sold on internet sites such as eBay, sawfish teeth are being used as cockfighting spurs, and sawfish parts are still being consumed in Asian countries, likely for shark fin soup and Chinese medicine. Based on the best available information on trade of sawfish parts, commercial trade is a threat for the species.

The third listing factor is disease and predation. Based on the best available information, predation from sharks, dolphins, and crocodiles may pose a threat for the species.

The fourth ESA listing factor examines the adequacy of existing regulatory mechanisms in protecting the species. As a wide-ranging species, largemouth sawfish are subject to Federal (U.S. and foreign), state and provincial, and inter-jurisdictional laws, regulations, and policies. Very few laws or policies specifically protect largemouth sawfish. For example, largemouth sawfish are not a protected species under the Federal Magnuson-Stevens Act, which was first enacted in 1976, after the species last reported occurrence in the U.S. As stated previously, largemouth sawfish are protected internationally under Appendix I of CITES, making trade of parts illegal.

Additional state, and national laws in the United States, Nicaragua, and Brazil are designed to limit the harvest and sale of largemouth sawfish locally and internationally. Regional sawfish abundance within their current range is depleted so targeted fisheries are unlikely; however those caught as bycatch are probably kept due to their value. The status of largemouth sawfish protection in western Africa is unknown. Trade of sawfish parts may be ongoing in Nicaragua and Brazil in spite of the CITES listing and national laws due to lack of enforcement. Due to the lack of enforcement of the existing laws in place for the species, we believe that existing laws and regulations are inadequate to protect the largemouth sawfish.

Under the final ESA listing factor, we considered the natural or manmade factors that may threaten the species. Largemouth sawfish have slow growth rates, late maturity, a long life span, and low fecundity rates. They are not able to respond rapidly to additional sources of mortality, such as overexploitation and habitat degradation. Because of this, the risk of extinction remains high without effective conservation plans put into place. As part of our analysis on potential manmade factors that may threaten the species we considered the potential effects that global climate change may have on the species. Based on the limited information on the precise location of the largemouth sawfish documented, the lack of specific information on the habitats in those areas, and the lack of information on seasonal migration patterns, we cannot determine the effects from global climate change on the species.

As a requirement of the ESA, current conservation efforts underway to protect and recover largemouth sawfish must be evaluated under the Policy for Evaluation of Conservation Efforts (PECE). This policy is designed to determine whether any conservation efforts that have been

recently adopted or implemented, but not yet proven to be successful, will result in recovering the species to the point at which listing is not warranted or contribute to forming a basis for listing a species as threatened rather than endangered (68 FR 15101). The PECE policy established two basic criteria: (1) the certainty that the conservation efforts will be implemented and (2) the certainty that the efforts will be effective. We determined that no current conservation efforts are underway to protect and recover the largemouth sawfish, other than the fishery and trade controls previously discussed.

In summary, the largemouth sawfish (*Pristis perotteti*) faces ongoing threats from habitat alteration, bycatch, trade, and the inadequacy of existing regulatory mechanisms to address and reduce habitat alterations, bycatch, and trade. The species range has constricted so that it has not been seen in the northern most extent of its range in the U.S. since 1961. A similar range constriction is apparent at the southern extreme of the species historical range. The species has not been reported from southern Brazil for almost at century. All of the threats attributed to the species decline are ongoing, except for the directed largemouth sawfish fishery in Lake Nicaragua. The Lake Nicaraguan fishery collapsed presumably when the sawfish population collapsed. These ongoing threats exist throughout the species current range (Central and South America and West Africa) and existing regulatory mechanisms in place are insufficient to protect the species from further decline.

LISTING SPECIES UNDER THE ENDANGERED SPECIES ACT

We are responsible for determining whether the largemouth sawfish (*Pristis perotteti*) are threatened or endangered under the ESA (16 U.S.C. 1531 et seq.). To be considered for listing

under the ESA, a group of organisms must constitute a “species,” which is defined in section 3 of the ESA to include “any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature.” On February 7, 1996, the Services adopted a policy describing what constitutes a DPS of a taxonomic species (61 FR 4722; February 7, 1996). The joint DPS policy identified three elements that must be considered when making DPS listing determinations: (1) the discreteness of the population segment in relation to the remainder of the species (or subspecies) to which it belongs; (2) the significance of the population segment to the remainder of the species (or subspecies) to which it belongs; and (3) the population segment's conservation status in relation to the ESA's standards for listing. Section 3 of the ESA defines an endangered species as “any species which is in danger of extinction throughout all or a significant portion of its range” and a threatened species as one “which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” The statute requires us to determine whether any species is endangered or threatened due to any of the following five factors: (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence (section 4(a)(1)(A)(E)). Section 4(b)(1)(A) of the ESA requires us to make listing determinations based solely on the best scientific and commercial data available after conducting a review of the status of the species and after taking into account efforts being made to protect the species. Accordingly, we have followed a stepwise approach in making our listing determination for the largemouth sawfish. As the first of three steps, we determined that our review would be at the species level of largemouth sawfish *P.*

perotteti. Based on the available taxonomic information on largetooth sawfish, its range is the eastern and western Atlantic Ocean. We then reviewed the status of the species and the threats to its status using the five-factor analysis described above. Finally, we assessed efforts being made to protect the species, determining if these efforts are adequate to mitigate existing threats. We evaluated all conservation efforts using the criteria outlined in the Policy for Evaluating Conservation Efforts (PECE; 68 FR 15100; March 28, 2003). Based on our review of the best scientific data and information on the species, the species is in danger of extinction throughout all of its range and should be listed as endangered.

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