

Memories of sawfish fisheries in a southwestern Atlantic estuary

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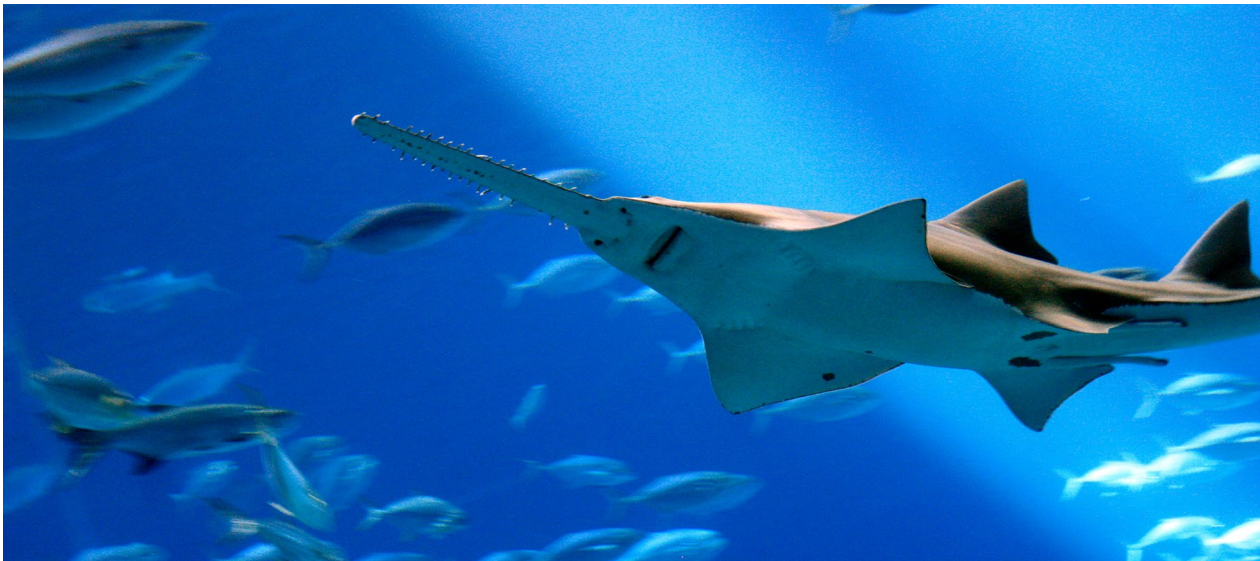
Abstract

An extinct sawfish fishery in mangroves of the Abrolhos Bank of eastern Brazil was investigated by interviewing four elderly and expert fishermen with local ecological knowledge of the area. Sawfish were usually caught with gill nets and longlines, as a secondary target of snooks (*Centropomidae*), Atlantic goliath grouper (*Epinephelus itajara*) and acoupa weakfish (*Cynoscion acoupa*) fisheries. Insights on the locally collapsed sawfish fisheries, traditional uses of the fish, and natural mortality events are given.

Introduction

Sawfishes (family Pristidae) are coastal elasmobranchs that share a unique anatomic feature: a large and elongated toothed rostrum. They represent one of the largest predators in shallow coastal waters and estuaries, yet only limited scientific data about them is available. Sawfishes are large, long-lived species and they were once widely distributed along the coastal waters of the Atlantic (Bigelow and Schroeder 1953). The species uses estuaries and rivers throughout its developmental stages. Now among the world's most threatened marine fishes (Wueringer et al. 2009; Dulvy et al. 2014), sawfishes suffer from anthropogenic impacts worldwide, mainly overfishing and coastal development (Seitz

and Poulakis 2006; Fernandez-Carvalho et al. 2014). The sawfishes of the western Atlantic – the large-tooth sawfish, *Pristis pristis*, and the smalltooth sawfish, *P. pectinata* – have been classified as “critically endangered” by the International Union for Conservation Nature for more than 10 years (Carlson et al. 2013; Kyne et al. 2013). Fishing for those species has been prohibited in Brazil since 2004. Today, sawfish populations have collapsed or become extinct over most of its historical range in the western Atlantic, including southern and southeastern Brazil (Fernandez-Carvalho et al. 2014). The smalltooth sawfish has not been observed or fished in Brazil for more than 10 years (Faria and Charvet-Almeida 2008). The only known viable population that still remains occurs in the northwestern Atlantic, off



Sawfish have a large and elongated toothed rostrum (image: Guy Incogneato - FlickrR)

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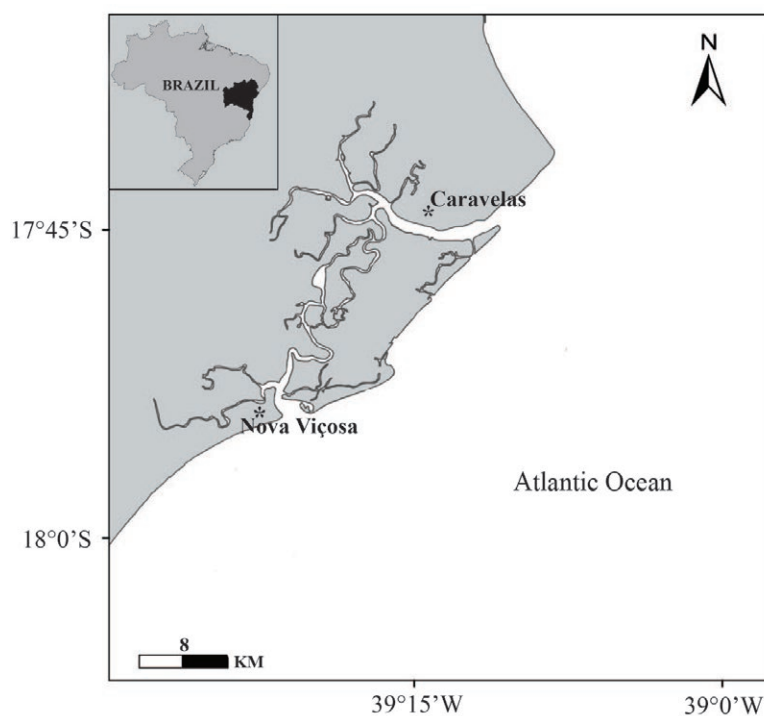
Florida in the United States (Carlson and Simpfendorfer 2014). The highest abundance of largemouth sawfish in the Atlantic was confirmed in the Amazon estuary in northern Brazil. (Fernandez-Carvalho et al. 2014). Recently, Giglio et al. (2015) verified that largemouth sawfishes were last caught 10 years ago on the Abrolhos Bank off of eastern Brazil. In a nearby estuary the species was considered extinct according to traditional fishermen (Reis-Filho et al. 2016).

Sawfishes are generally caught by commercial gill net fisheries (Simpfendorfer 2000) and on a smaller scale by line and longline fishers (Seitz and Poulakis 2006). In Brazil, there is little information about sawfish fisheries, especially where it has either collapsed or become extinct. Under such conditions, an alternative approach to overcoming constraints imposed by limited historical data is to tap into the memories of fishers (Venkatachalam et al. 2010; Leeney and Poncelet 2013). Fishers' local ecological knowledge (LEK) was suggested as a priority research for gathering information about sawfishes, especially in areas where they are rare or possibly extinct (Dulvy et al. 2014). In recent years, studies using fishers' LEK have been conducted to investigate the historical ecology of sawfishes (e.g. Leeney and Poncelet 2013; Giglio et al. 2015; Leeney 2015; Leeney and Downing 2015)

Here, we report on the LEK of elderly fishers about the characteristics of sawfish fisheries and two reported causes of natural mortality on the estuaries of the Abrolhos Bank off of eastern Brazil. Sawfishes were caught until approximately 20 years ago.

Methodology

This study was conducted in the Caravelas-Nova Viçosa estuarine complex (CNEC) located on the Abrolhos Bank, the most biodiverse reef complex of the South Atlantic (Leão et al. 2003). Fishing in the CNEC is mainly small-scale or subsistence, multi-specific and represents an important economic activity for local communities (Santos and Brannstrom 2015). In 2009, a marine protected area (MPA) was designated under a self-governing (community-based) regime, namely the Cassurubá Extractive Reserve.



Location of the Caravelas-Nova Viçosa estuarine complex, eastern Brazil

The community reserve covers a representative portion of CNEC and adjacent coastal areas.

Between 2009 and 2010, after 102 interviews with local artisanal fishers and fruitful discussions about sawfish natural history, we met four elderly fishers who were identified by their peers as having caught the largest number of sawfish, hence also likely the most knowledgeable about our taxa of interest. All four are estuarine fishers who spend their lives in the mangroves of the CNEC. In the past, fishing in the region was primarily a subsistence activity carried out by riverine communities using gill nets, hook-and-line, and longline from small dug-out canoes. However, since the 1980s, the advent of motorboats has led to increasing fishing activity throughout the CNEC, allowing artisanal fishing to expand both spatially and temporally.

Interviews with open questions were performed individually in fishers' households. Our aim was to gather information about fishing gear used to catch sawfish, fishing sites, quantity and number of individuals caught, uses for the sawfishes, and causes of natural mortality.

Results

The age of our informants ranged between 55 and 81 years and their experience ranged between 40 and 60 years. Fishing gear commonly used to catch

Table 1. Summary data of interviews with expert sawfish fishermen on Caravelas-Nova Viçosa estuarine complex, eastern Brazil.

Age	No. years of experience	Fishing gear used	No. of individuals caught	Largest individual caught (kg)	Use of saw
55	40	gill net, hook-and-line	15	180	souvenir
66	51	gill net	10	100	souvenir
69	40	gill net, longline	40	220	souvenir
81	60	longline	60	300	medicinal (asthma cure) charm to prevent bad luck

sawfish were gill nets, longlines and hook-and-lines. Fishers caught up to 60 individuals during their lifetime, including juveniles weighing less than 10 kg. The largest sawfish weighed 300 kg (Table 1). The sawfish rostrum was traded as a souvenir and for medicinal or religious purposes. Sawfish were caught as a secondary target species of fisheries aimed at acoupa weakfish (*Cynoscion acoupa*), cubera snapper (*Lutjanus cyanopterus*), snooks (*Centropomus* spp.) and Atlantic goliath grouper (*Epinephelus itajara*). No specific sawfish fishery ground was reported, but our informants acknowledged that sawfish were caught throughout the CNEC, and juveniles were caught in very shallow waters (< 1 meter depth).

In the CNEC, fishing was done from small rowing canoes. Catches of large sawfishes were challenging because they are powerful enough to drag a small canoe. To avoid being dragged, fishers cooperated using up to four canoes to tow large individual sawfish. The meat was divided among participants. Informant No. 4 mentioned an episode involving a large individual:

“When I verified that a large sawfish, of more than 300 kg was caught on the longline, I felt a tug that dragged the canoe for dozens of meters. I had to request help from other fishers with canoes to tire the fish and take it to the landing port.”

All informants agreed that the toothed rostrum is the main cause of sawfish entanglement in gill nets and longlines. According informant No. 3:

“They get entangled several times in gill nets by their saw, and cannot get out. Their saw is their ‘Achilles’ heel’, which causes species disappearance

due to entanglement and the impossibility to escape. I witnessed a fish that got entangled in a fishing line and even without biting the hook, it was captured because it was overly entangled in the line.”

The elderly fisher (No. 4) witnessed individuals’ death from natural causes in mangroves:

“I found a sawfish that was about three meters in length, dead in red mangrove trees [*Rizophora mangle*] because the saw was trapped in the roots of trees. Other fish and two juveniles were trapped in the mud when the tide receded.”

Discussion

In many coastal communities, memories of elderly fishers are an important, if not the only available, source of information about extinct fisheries. This knowledge is vanishing fast as subsequent generations of fishers progressively shift their environmental baselines to the already degraded conditions that they experienced in their youth (Pauly 1995; Sáenz-Arroyo et al. 2005). Sawfishes were a relatively common fishery resource in the CNEC until the 1980s when it disappeared for over 10 years. Fishers mentioned overfishing by gill nets as the main cause of sawfish fishery collapse in the region (Giglio et al. 2015). In addition, it was verified that a longline is a commonly used gear for catching sawfishes in the CNEC and may have exerted a fishing pressure that contributed to the species’ collapse.

Our informants acknowledged that sawfishes entangle easily in gill nets, because of their elongate blade-like, toothed rostrum. Fishers using

hook-and-line and longline methods also observed entanglement. In the CNEC, fishers mentioned that sawfishes, when caught using longlines, can become entangled several times, and thus, lines are a worrisome source of mortality to sawfishes (Seitz and Poulakis 2006), and their unique morphology makes them exceptionally vulnerable to fishing.

Our most elderly informants described two cases of what they believe were natural mortality events among sawfishes. Both sawfishes died at low tide. A large individual had its rostrum trapped in mangrove roots, and was badly damaged. Adults are sought in various coastal habitats from shallow estuarine areas to >100 m depths (Poulakis and Seitz 2004; Carlson et al. 2013), a strategy that possibly increases feeding success (Poulakis et al. 2011). However, this large individual entangled its rostrum between mangrove roots, possibly during a feeding incursion. On the other hand, it is not possible to confirm that entanglement was the cause of the sawfish's death because the individual was found already dead. It may have died before becoming entangled in the mangrove roots.

Death of small juveniles was also observed occasionally. Frequently, juvenile sawfishes were observed in shallow waters (<1 m depth), probably avoiding predators (Witthy et al. 2009; Poulakis et al. 2011). Several fish species were observed by fishers in mud puddles in a long plain called "Rio do largo", including juvenile sawfishes. Fishes become trapped in these pools for about five hours, which under conditions of intense heat and extremely low oxygen levels can cause death. Seitz and Poulakis (2004) reported a substantial decrease in water temperature owing to the passage of multiple cold fronts as another possible cause of natural deaths in Florida.

The occurrence of sawfishes in the CNEC was frequent until 1980; however, its abundance decreased rapidly due to the increase in fishing activity. Currently, the sawfish fishery in the region is considered to be extinct (Giglio et al. 2015). Urgent efforts are required to avoid the extinction of the last sawfish populations in northern Brazil. The creation of MPAs to reduce fishing effort and protect key habitats is a critical management action needed to avoid the extinction of this iconic fish.

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