

Presence and abundance of Largetooth Sawfish (*Pristis pristis*) in French Guiana and Suriname as perceived by local fishers



Rostrum of a Largetooth Sawfish (*Pristis pristis*)
Photo Credit: CRPMEM GUYANE

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Executive Summary

About This is the first baseline study of Sawfish in the Guianas. The WWF in its mission to promote the sustainability of fishing activities in the Guiana's shield has requested the production of this report by the French Guiana Regional Fisheries Committee (CRPM G). To do this work the CRPM G has selected to acquire data directly from the fishers who operate in French Guiana and Suriname. Guyana was excluded from this study seeing the complexity in understanding the levels in activity and having fruitful exchanges with entities in charge of fisheries management. In both French Guiana and Suriname, we conducted a baseline assessment between July 2017 and March 2018 using interviews with fishers from the various trawl and gillnet industries as the primary source of information on Sawfish distribution, recent catches, socio-economic value and cultural importance. Results show that Sawfish captures still occur in the Guianas though presence of large and small individuals has dramatically decreased over the past 30 years. It is evident that Sawfish bycatch occurred historically in shrimp trawl and gillnet gear and a few other gears. The last recorded and confirmed capture of a Largetooth Sawfish (*Pristis pristis*) in French Guiana occurred in 2016. Six Largetooth Sawfish rostra were identified and measured, with the oldest and biggest individual captured 50 years ago and the most recent sample coming from the 2016 capture. Fishing effort in the Guiana's shield is increasing at an alarming rate as neighbouring countries increase the length of gillnets used and fishing times to compensate for the reduction in yield of targeted fish resources. If international and regional entities do not act fast there will be serious consequences for both commercial and non-commercial marine species in the region.

To date little information is available to fishers to inform them of the conservation status of Sawfish, the methods for safe handling and release, or the importance of live release by crew following bycatch events.

With slow growth rates and taking up to several decades to reach sexual maturity, Sawfish are highly vulnerable to anthropogenic impacts, such as those caused by commercial fishing, consumption, trade, and climate change, to name a few. As a result, the International Union for the Conservation of Nature's (IUCN) Red List of Threatened Species classifies the Largetooth Sawfish (*Pristis pristis*) as "Critically Endangered" (IUCN, 2015).

Trawl and gillnet fisheries have long been recognized as having major impacts on both **species** of Sawfish. Although mortality as a direct result of bycatch in either trawls or gillnets is reported by fishers to be low, the removal of the rostrum is standard practice when disentangling Sawfish from fishing gear. While this practice is thought to be non-lethal by most fishers, the probability of post-release mortality of individuals without rostra is likely much greater than presumed.

Analyses conducted as part of this report identified northern Brazil and Venezuela as places where Sawfish baseline studies must be conducted. If in fact certain parts of Brazil can be identified as areas of continued higher abundance for Sawfish (adults or juveniles), these areas could be considered candidates for special planning aimed at restoring Sawfish populations.

In recent years, the EU has made important progress toward creating a more sustainable domestic and international fishing industry. Examples include the Common Fisheries Policy (CFP) reform and its international dimension and with its Illegal, Unreported and Unregulated (IUU) fishing regulations. In view of this, there is hope that the issues raised in this report will result in additional measures to address Sawfish bycatch through an international plan of action to prevent, deter and eliminate IUU Fishing.

Finally, it must be recognized here that any attempt to preserve marine species such as Sawfish, turtles or cetaceans in French Guiana through spatial planning or effort restrictions may be met with scepticism and resistance by local fishers. More importantly, attempts at conservation will be most challenged by the extremely high and persistent level of IUU fisheries operating in the area. If local, national and international pressure is not leveraged to bring attention and find solutions to the issue of IUU fisheries in the Guiana's shield region, Sawfish and other emblematic megafauna are destined to be nothing more than an old memory.

Recommended actions

- 1) Inform fishermen (formal and informal) of the protected status of Sawfish
- 2) Create a poster promoting the release of Sawfish when captured accidentally
 - a. Installation of the posters on boats
 - b. Explain the information to fishers through training courses to promote understanding
 - c. Include Sawfish and other megafauna information in fisher training courses
- 3) Integrate Sawfish area usage in future special planning work for the region (i.e., creation of a network of marine protected areas in the region).
- 4) Gain the support of IUCN's Shark Specialist Group to address a letter to countries of the Guianas on the importance of eliminating illegal fisheries (IUU) as per the threat this causes to all proposed management options aiming to conserve Sawfish and other marine megafauna in the Guianas shield eco-complex

Actions to tackle this issue, such as recommendation number 4, must be promoted by the secretariats of the relevant conventions, agreements, and guidelines to which the EU is associated. Failure to act could mean the EU's acceptance of certain imports makes it complicit in activities that could run counter to those agreements.

Recommended further research

Finally, in conducting this study key data gaps have been identified that need to be addressed in order to better understand the situation as per the status of Sawfish in the northern portion of South America. Recommended areas for further investigations that build upon the indicative information gathered in this study include:

- Extending interviews to Guyana and Para Brazil, and eventually Venezuela;
- Developing estimates of megafauna bycatch potentially associated with IUU fishing.

List of Acronyms

CFP	Common Fisheries Policy
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on Migratory Species
CRPMEM GUYANE	French Guiana Regional Fisheries Committee
DPMA	Directorate of Fisheries and Ocean Farming of France
EC	European Commission
EEZ	Exclusive Economic Zone
EMFF	European Maritime and Fisheries Fund
EU	European Union
FAO	Food and Agriculture Organisation (of the United Nations)
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unreported and Unregulated (fishing)
MSC	Marine Stewardship Council
NGO	Non-Governmental Organisation
NOAA	National Oceanic and Atmospheric Administration
TED	Turtle Excluder Device
TST	Tropical Shrimp Trawling
TTED	Trash (fish) and Turtle Excluder Device
VMS	Vessel Monitoring Systems
US	United States of America

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1. Introduction

Despite its circumtropical range and migratory nature, little is known about the distribution and abundance of Sawfish (Pristidae) populations outside of US and Australain waters (Leeney, 2016). In an attempt to address knowledge and information gaps for Sawfish of the Guiana's shield eco-complex, an area known for its vast and healthy mangrove and estuarian habitats, the WWF has contracted the CRPMEM GUYANE to conduct the first study on Sawfish in French Guiana and Suriname.

According to informal conversations with fishers, Sawfishes were formerly abundant along the Guiana's shield, but current data on Sawfish presence and distribution are lacking for most of the region. In its continued effort to better understand the impact of fishing activities on the marine resources of the Guiana's shield, the CRPMEM GUYANE proposed to conduct this study using Fishers Ecological Knowledge (FEK). Seeing the relative absence of abundance indices for fish catches in the Guianas shield and low levels of onboard observer coverage, the use of (FEK) can provide valuable baseline data. Interview data were gathered from Suriname and French Guiana fishermen on the past and current range of Sawfishes and causes of decline perceived amongst fishermen. This information contributes to a better understanding of the conservation status of this species group and provides the fishing sector a potential path towards recovery of these fishes. To bring awareness and to communicate the conservation need for Sawfishes, the CRPMEM GUYANE will work with designers to create a poster (in English, French and Portuguese) that will be printed and prepared for display on coastal fishing boats in French Guiana. Distribution of information and posters beyond French Guiana could be facilitated by WWF, which is present in all counties of the Guianas shield.

In situations where information is lacking, FEK can provide valuable data, which can be used to direct scientific studies. FEK can also provide insight into local attitudes towards species of interest such as Sawfishes. FEK data on the past and current range of Sawfishes within French Guiana and Suriname waters was collected using interviews. For French Guiana, both Tropical Shrimp Trawling (TST) and coastal artisanal gillnet captains participated in the interviews. For Suriname, we also include interviews with fish trawl captains, Seabob TST captains and Chinese seine fishers.

TST is a fishing method involving the towing of trawl nets through water to catch tropical shrimp. Fish, small and large, can also form an important part of the catch. In the absence of appropriate technical and management measures, TST fisheries can be highly indiscriminate, resulting in the capture of large quantities of marine fauna other than the targeted shrimp. This so-called 'bycatch' can be utilized, but is generally discarded, often dead or dying. The trawl gear used for TST (as opposed to mid-water trawling, for example) can also cause extensive damage to sensitive seabed habitats. Through Collaborative Fisheries Research (CFR), as described by Hartley et al. 2009, innovative gear modifications that reduce the bycatch of this type of fishing gear have been developed. Also, this fleet has been reduced to 10% of its original size over the last 20 years, opening the door for modifications in current and future spatial planning for trawl fisheries.

The success of recent strategies to reduce marine turtle and shark bycatch in the trawl fishery using the Turtle Excluder Device (TED) and Trash and Turtle Excluder Device (TTED)¹ have been a positive step forward for this fishery. In turn, this progressive and voluntary program promoting the use of selective fishing gear, made possible by the implementation of the CFR approach, has become another argument in favour of renewing the vessels and infrastructure of this fishery. Indeed, this fishery serves as an industry model in the region and is promoted as a sustainable activity. The TST fishery intends to pursue the Marine Stewardship Council's ecological certification scheme after consideration of shrimp stock assessment results.

¹ A TTED is a modified TED that has 5cm of bar spacing rather than 10cm. It has been shown to be more effective than the TED at reducing bycatch.

Unfortunately, the same principle of selectivity cannot be applied to Sawfish, whose rostrum may become entangled in the trawl webbing regardless of TED or TTED use. Sawfish are highly susceptible to bycatch by a large variety of fishing gears due to snagging of their toothed rostrum. Other fisheries in French Guiana may result in Sawfish bycatch, including the use of passive trawls (trawls not towed by fishing vessels) along the riverbanks of estuaries. This gear is locally called the chines barrier. The use of chines barriers is very limited in French Guiana as only nine of these gears are tolerated by the state in an effort to eliminate its use, which is considered by some to be a traditional fishing practice. However, in contrast with French Guiana, chines barriers are widely used in Suriname and Guyana. In fact, this gear can sometimes cover entire riverbanks, such as observed in the Nickery River located between Guyana and Suriname. The majority of interviews conducted during this study targeted gillnet fishers, although chines seine fishers were also interviewed.

The largest local fishery in French Guiana in terms of volume captured and unloaded is the artesian coastal gillnet fishery, with approximately 3000 tonnes of fish caught annually since 2006 (Nalovic Pers. Comm. 2018). Gillnets were composed of a variety of materials, mesh sizes and configurations (e.g. drifting vs. anchored) based on the fishers' preferences. There are 130 official boats (CRPM Guyane license) and another 70 unofficial boats² that practice gillnetting. Gillnets used by fishers from Brazil or Guyana yet working legally in French Guiana's fleet are identical to the gillnet configurations used in their home country, except that local nets are typically three to four times shorter in length relative to neighbouring French Guiana. More details on the different gillnets used can be found in other CRPMEM GUYANE reports that are available upon request.

We conclude this introduction by exposing the biggest fishery operating in French Guiana which inevitably poses the biggest threat to commercial fisheries resources and protected species: Illegal, Unreported and Unregulated (IUU) gillnet fisheries. It is estimated that at least 2/3 of the coastal gillnetting activity occurring in French Guiana is foreign IUU (IFREMER, 2012). IUU gillnet fisheries from neighbouring countries are a direct threat to initiatives aimed at the preservation of marine habitats and biological resources in French Guiana.

1.1. About this report

The objective of this report is to describe the results of this first baseline assessment of Sawfish historical presence in both French Guiana and Suriname. To this end we will report on the 80 interviews conducted in French Guiana and 49 conducted in Suriname to ascertain the history of the declining Sawfish abundance in the Guiana's shield as perceived by local fisher. so as to get an idea of when Sawfish stopped being abundant in this portion of the Guiana's shield.

Finally, after discussing the findings the report provides a set of next-step recommendations and provides overall conclusions.

2. Conservation urgency and fisheries

2.1. Current status of Sawfish populations

Sawfishes (family Pristidae) are currently among the most threatened fishes in the world, with declining numbers and reduced distributions worldwide (Wueringer et al., 2009; Faria et al., 2013). All Sawfish species are categorized as 'Critically Endangered' with decreasing populations by the International Union for Conservation of Nature (IUCN) (Simpfendorfer, 2013).

² Mainly professionals that have not yet entered the official system and no more than 10 boats operated by amerindian people considered sustenance fishing.

This alarming status is due to the combined effects of their habitat preferences, incidental catches in coastal fisheries, and habitat loss and deterioration (Dulvy et al., 2014). Unfortunately, Sawfish life history strategies are characterized by slow growth, late sexual maturity, and low fecundity, which corresponds to the species' low capacity for recovery after population depletion (Waters et al., 2014).

Only two species of Sawfish inhabit Atlantic waters: the Largetooth Sawfish (*Pristis pristis*) and the Smalltooth Sawfish (*P. pectinata*) (Faria et al., 2013). Adult Largetooth Sawfish in Australia inhabit marine and estuarine environments while corresponding juveniles of the same species occupy rivers and freshwater portions of estuaries (Whitty et al., 2009). It is assumed in this study that Largetooth Sawfish in the Guiana's have habitat use preferences similar to those of Largetooth Sawfish in Australia.

2.2. Threat from commercial fishing

Sawfish populations seem to have declined due to many factors including entanglement of their protruding toothed rostrum with gear, bycatch in commercial fisheries, retention of rostra as trophies by anglers or for illegal markets, and habitat degradation (e.g., Seitz and Poulakis, 2006; NMFS, 2009b). Indeed, the rostrum and demersal habits of Sawfishes species make them susceptible to capture in gillnets and demersal trawl nets (Leeney et al., 2014).

In general, the different gear configurations used to exploit the resources of the Guianas are very similar if not identical among countries, for the simple reason that the targeted species are often the same in each country. The exceptions to this are the tuna fishery present only in Suriname and the Seabob shrimp fishery present in Guyana and Suriname, since these species are not targeted in French Guiana. Additionally, Suriname has an important fish trawling fleet.

2.3. Semi industrial and industrial fisheries of the Guianas

Amongst the semi-industrial and industrial fleets operating in the Guianas there are primarily two types of trawl gear used to target shrimp and finfish. There are also a variety of line fisheries and a trap fishery targeting red snapper.

2.3.1. Tropical shrimp trawling

Tropical shrimp trawling has been practiced in the Guianas since the 1950s. Even though there are different species of shrimp exploited, the techniques used generally remain the same. One exception is that in French Guiana twin trawls (two nets) are used, while in Suriname and Guyana double twin trawls (four nets) are utilized. Trawling may occur from coastal areas to the deep sea at 1000 m in depth depending on the target species. Even though Turtle Excluder Devices (TEDs) are mandatory in all three countries, this method of fishing is not considered to be selective. However, efforts to reduce bycatch in the region have shown promising results. Bycatch Reduction Devices (BRD's) have been implemented in the Seabob industry of Suriname (Meeremans et al. 2017) and the French Guiana marine shrimp industry now uses the TTED (Claro et al 2010).

2.3.2. Fish trawling

Fish trawling is conducted by stern trawlers using single trawls with headrope lengths (horizontal measurement of the opening of the mouth of the trawl) of 45 m with a variety of mesh sizes leading up to a tail bag composed of 8 cm stretched mesh. This activity is only known to occur in Suriname. The gear used by this fleet is not considered to be selective and the catch is multi-species.

2.3.3. Hook and line

Venezuelan fishermen have historically been known to be proficient in the use of hand lines, fishing the entire Guianas plateau for “Pargo”, otherwise known as Southern Red Snapper (*Genus, species*). Up to 15 hand lines can be used on one boat with an assortment of hook sizes. The hooks are attached to monofilament line and a weight (1.5 kg) used to bring the hooks to depths ranging from 30-60 m. This gear is considered selective since all the lines are regrouped close to the boat and catch is immediately brought to the boat.

2.3.4. Shark long-line

French Guiana has not issued any shark fishing licenses since 2007. However, it is possible that this practice is occurring in Suriname considering the high market value in Venezuela. Little is known about the species caught and the fishing strategy of this activity.

2.3.5. Tuna long-line

Tuna long-lining had been experimented with in the region in 2001. In 2016, there were 14 tuna long-line boats fishing from Suriname and 39 fishing in 2011. These boats generally fish outside of the Surinamese international waters. The Surinamese company processing the tuna catch has expressed their willingness to work with NGO's in Suriname to acquire an ecological label. The gear is described as having up to 10,000 hooks of varying sizes attached to gangions that are attached to a thick monofilament mainline. Radio beacons are used along the long-line to notify passing ships to the presence of the gear. The gear is typically set for nine hours before retrieval. This new fishing sector currently has 53 license in Suriname

2.3.6. Traps

Fish traps are used to target Southern Red Snapper in all three Guianas. These traps are baited with fish heads and set along the seafloor near or on rocks. They are generally connected to one another by ropes of various lengths. The dimensions and shape of the traps allow them to be easily stacked on the boat between fishing trips. The material that covers the steel frame was traditionally made of metal, but fishermen have replaced this material with plastic to increase the lifespan of the gear. Some interviewees believe that this gear could contribute to the decline of snapper populations since lost traps may continue fishing for long periods of time. This concern has been amplified by the new plastic design of this gear.

2.4. Coastal artisanal fisheries of the Guianas

There is a wide variety of gear used in artisanal fisheries. In this section a distinction is made between drifting and set gillnets and gear typically used in estuarine waters.

2.4.1. Drifting gillnets

Drift gillnets are used by the majority of boats in the Guianas. The length, height and mesh of the gillnets may vary depending on the boats capacity to hold gear and the target species. Larger gillnet boats fish at maximum depths of 20 m and use 180 or 200 mm stretched mesh to target large fish. The large mesh nets are made of either grey, green multifilament polyethylene (grey or green) or cabled polypropylene (white).

The length of these nets vary but are known to reach 5 km with depths ranging from 5 to 8 m. Nets drift with the current and must slide along the soft bottom to capture target species such as Gray Snapper (*Cynosion Acoupa*) and Yellow Catfish “Gillbaker” (*Sciades parkeri*). In French Guiana, all gillnets are limited to a maximum length of 2.5 km. The floats of these nets must be readjusted each time that the fishing depth changes. Nets are sometimes used in shallow waters 4-5 m in depth, which results in the gear covering the entire water column. Onboard observer studies in French Guiana have shown that soak times vary greatly among vessels. It was also noted that hydraulic winches used to

retrieve nets reduce the amount of work for the crew, which caused soak times to be reduced. Reducing soak times is an important factor that influences the quality of the product. In the warm waters of the Guianas, fish captured in the nets can spoil relatively quickly, affecting the overall quality and price of the product. It is also known that reducing soak times can also influence the catch rate of emblematic species and their mortality once captured.

2.4.2. Set or anchored seines

Often composed of clear multi or monofilament materials, seine nets are used in estuarine areas associated with river mouths. With anchors placed approximately every 25 to 50 m along the gear, these nets are not known to be longer than 500 m with depths of 4-5 m and sometimes covering the entire water column. The mesh sizes are small and vary between 60-50 mm (stretched) within the same net. Soak times generally last 6 to 12 hours depending on the fishing area, target species, and catch rate.

2.4.3. Chinese seines

In all three Guianas there are small boats operating in or near river mouths that use what is referred to as “Chinese seines”. These seines are modified static trawls that are deployed along shallow riverbanks near river mouths or estuaries. The nets are held open by long wooden poles driven into soft mud bottoms, allowing outward flowing tides carrying small fish such as Bangaméri (*Macrodon ancylodon*) or Dagoefisie (*Elops saurus*), Kubi (*Plagioscion squamosissimus*) and shrimps into the mouth of the trawl, which is typically 20 m wide. Shrimp species targeted are White Belly Shrimp (*Nematopalaemon schmitti*) and Seabob Shrimp (*Xiphopenaeus kroyeri*) with occasional captures of juvenile Brown Shrimp (*Farfantepenaeus subtilis*). Graduated mesh sizes are used throughout the trawl, from larger mesh sizes in the mouth of the net to reduce water resistance to decreasing mesh sizes sections terminating in a 1 or 2 cm mesh (stretched) tailbag. The plain Chinese seine using a single trawl net has gradually been replaced with the use of multiple Chinese seines. There can be up to six of these trawls in one assemblage. Chinese seines are banned in French Guiana but there is tolerance since only a few older locals use this technique. The “Yagi Yagi”, so named in Suriname and Guyana, is the only version of the Chinese seine that can be found in French Guiana, where it is called a “Chinese barrier”. The difference is that poles are added to guide fish towards the opening. It is a more difficult barrier to construct and therefore it is not commonly used.

2.4.4. Estuarine bottom long-lines or Cadel

Estuarine bottom long-lines or “Cadel” are used to compliment other fishing techniques. No boats are currently known to use this technique exclusively, but the extra catch helps contribute to the income of the fishing trip. Hook sizes are generally #7 or #8 and are tied to 30 or 40 cm nylon leaders set 1.3 m apart along a main line, comprising up to 2400 hooks. This gear may soak for up to 24 hrs since the primary catch consists of catfish and stingrays which stay alive for extended periods when hooked.

3. Methods

3.1. Ecological context of survey area

It is generally well accepted that the Guianas plateau marine eco-complex operates as a single ecological unit. The north Brazilian current runs all year from the Amazon river mouth towards Venezuela (Figure 1). The coastal waters of the Guianas flow along the continental shelf, which is part of the Amazon basin. Adjacent estuarine zones create optimal opportunities for growth and maintenance of various fish and shrimp species. An estuarine area is where freshwater mixes with seawater and is often referred to as coastal waters. These are some of the most productive ecosystems in nature because of the constant supply of nutrients from the land and marine currents. Mangroves are often an integral part of the estuarine areas in tropical zones. Estuaries have a functional relationship with fisheries, in terms of providing breeding and nursery areas for young fish

and shrimp (FAO, 2005). In the Guianas, the seabed in this zone and areas up to 30 m deep consist of mud and clay and contains an optimum amount of nutrients and microorganisms that form the basis of the food chain for fisheries stocks (Lowe-McConnell, 1987). Suriname has two areas with a high production of biomass (Master Plan for Fisheries Development of Suriname, 1980):

A) The tidal area - this area extends up to 30 m deep and is characterized by the presence of "brown" water due to the deposition of mud (Master Plan for Fisheries Development of Suriname 1980, H.A.C. 1989);

B) The area from 40 to 60 m deep - the so-called "green" water area that is rich in phytoplankton that forms the basis of the food chain there.

The production of nutrients is highest in the transition zone between the "brown" and "green" water (Smith, 1996). It is known that fish and shrimp, during their time spent in the estuarine area, migrate with the tide within the tidal area throughout the coastal mangroves and mud flats of the continental shelf (Dumas, 2006), suggesting the importance of the coastal mangrove intertidal zone to 30 m deep. Because of the habitat and the presence of nutrients, young fish and shrimp spend an important part of their life cycle in the estuarine zone, where they are able to grow to maturity and reproduce when they return to the deep sea.

There are two seasons that affect the tidal zone, the dry and rainy seasons. During the rainy season freshwater runoff from the Amazon and other rivers along the coast push saltwater away from the coast. Marine fauna that prefer to inhabit the limit between the salt and freshwater mix tend to move with this line, including coastal shrimp populations. During the dry season, freshwater runoff is reduced and saltwater moves closer to the coast sometimes reaching the river deltas. In June, waters with high chlorophyll concentration corresponding to waters rich in organic matter from the Amazon river runoff, extend further out from the coast than in September, which corresponds to the heart of the dry season when saltwater moves in closer to the coast.

3.2. Survey location and design

Interviews were conducted at a variety of coastal localities along the coast of French Guiana (Table 1A) and Suriname (Table 1B).

Table 1A Place of interviews in French Guiana. Table 1B Place of Interview in Suriname

Place of interview		
	Nb°	%
Crique docks	14	18%
CRPM office	11	14%
Dégrad des Cannes	2	3%
St Georges	7	9%
Sinnamary	5	6%
Iracoubo	6	8%
St. Laurent	9	11%
Awala-Yalimapo	7	9%
Galib	8	10%
Kourou	8	10%
Fish Market (MIR)	1	1%
Other	2	3%
total	80	

Place of interview		
	Nb°	%
Coronie	4	8%
Ramnan Docks	1	2%
Waterloo/Voorland	7	14%
Zeedijk	3	6%
Nickery	2	4%
Fisher home Nickery	5	10%
Waldeck Nickery	1	2%
Seadeg Nickery	1	2%
Coronie Totness	3	6%
Boskamp	4	8%
Nene Landing site PMB	5	10%
PMB Market	1	2%
Industrial Docks PMB	12	24%
total	49	

The locations called Crique, CRPM office, and the MIR are located in Cayenne, French Guiana. All interviews in this study were carried out by a CRPMEM GUYANE agent. In the Galibi area, a person appointed by the village captain accompanied the CRPMEM GUYANE agent conducting the survey.



Figure 1. Areas in French Guiana where interviews were conducted



Figure 2. Areas in Suriname where interviews were conducted

Fishers originating from a variety of locations were interviewed to represent the fishing sector including Suriname, Brazil and the capital of Guyana, Georgetown. Interviews were conducted either in French, English, or Portuguese or in the local Creole language.

Table 2A. Origin of French Guiana participants

Country of origin		
	Nb°	
French Guiana	19	24%
Suriname	13	16%
Guyana	26	33%
Brazil	17	21%
Other	5	6%
total	80	

Table 3B. Origin of Suriname participants

Country of origin		
	Nb°	
French Guiana	1	2%
Surinam	19	31%
Guyana	23	47%
Holland	4	8%
Other	2	4%
total	49	

In French Guiana, appointments were set up in advance according to the availability of each fisherman, or opportunistically if other fishers were available. An introduction of personnel was not necessary, as the interviewer was well known by the majority of fishers and industry members and was mandated to conduct the survey by the fisheries committee.

In Suriname, interviews were conducted without making appointments. It was agreed that the CRPMEM GUYANE agent in charge of this study would spend one week in Suriname in order to travel along the Surinamese coast accompanied by a Suriname Fisheries Department data collector who was familiar with the landing sites and fishers.

Prior to interviews in French Guiana and Suriname, it was explained that information would be collected in an anonymous fashion and that participants were not obligated to respond to a question that they did not feel comfortable with. All interviewees were reminded that there was no right or wrong answer. If the interviewee accepted participation, the interviewer collected basic data relating to the individual's age, job, number of years of experience in fisheries and (for fishers) the types of fishing gear used. At this stage in the survey the interviewees were shown a photograph of a Sawfish and asked if they recognized the fish. If the respondent could not identify the Sawfish the interview would end, while respondents positively identifying Sawfish were selected for full interviews following standardized data collection sheets (Appendix 1).

3.3. Limitations:

We recognize that local ecological knowledge (LEK) is not a substitute for ecologically sound surveys. However, this approach was the most financially and logistically feasible for the first Sawfish study in the Guianas, where baseline data on Sawfish is nonexistent. Information collected allow insight into elements reported by fishers which deserve more attention and research.

Leeney & Poncelet (2013) discussed in detail caveats associated with using interviews to collect data. These include interviewees withholding information if they fear repercussions for any interactions they report with the species of interest, or if they disagree with perceived or stated conservation goals (Silver & Campbell, 2005). In this study we were fortunate that the interviewer and author was considered 'local' by interviewees in French Guiana, which tends to reduce feelings of mistrust or fear (e.g. Leeney and Poncelet, 2013). It is also possible that some interviewees unknowingly withheld information due to memory loss or inaccuracy recalling events that could have occurred decades before, diminishing the quality of collected data. In Suriname the situation was different since

personnel conducting the study were not native to Suriname. To overcome this, a locally known and well-respected fisheries department data collector was recruited to facilitate the interviews in an attempt to offset potential feelings of mistrust.

Fortunately, elected officials in French Guiana are appointed by members of local fisheries to determine the conservation goals of the CRPMEM GUYANE. The conservation goals are therefore in line with the industries primary interests. The CRPMEM GUYANE understands that the future of the fisheries sector is dependent on its own ability to guarantee the sustainability of the fisheries operating in French Guiana’s EEZ.

In French Guiana, fishers have historically worked jointly with the CRPMEM GUYANE and NGOs, thus they are accustomed to agents’ solicitations for receiving information and providing it. Furthermore, a supportive working relationship between industry and the CRPMEM GUYANE has been fostered through fisher participation in onboard observer work by CRPMEM GUYANE.

4. Results for French Guiana

Results are presented in two separate sections, one for French Guiana and the other for Suriname. The data gathered and presented are similar in content to what has been seen in other studies. Going forward it is important to remember that fishers did not always respond to every question and that sometimes fishers provided more than one answer to the same question.

In the Results section we first expose the results from the interviews conducted in French Guiana. The results from the work conducted in Suriname are exposed in a separate section since we recognize that beyond the environmental similarities between the two countries there are very significant differences in the way fishing is conducted in terms of effort and enforcement capacities. These differences are both historic and recent. In the Discussions section we compare and contrast the findings between French Guiana and Suriname and provide informed recommendations for sawfish conservation specific to each country.

4.1. What fishing gears did interviewees in French Guiana focus their activity on.

In French Guiana, interviewees were from the artisanal, semi-industrial and industrial sectors. All interviewees where asked which gear they associated with their past and current fishing activities.

Table 4. Type of gear the interviewees associate themselves with

Type of gear used by Interviewees		
	Nb°	%
Shrimp trawls	23	29%
Drifting gill nets	68	85%
Set gill nets	22	28%
Cadel	4	5%
Chinese' Barrier	2	3%
total	119	

We point out here that some interviewees indicated that they were involved currently or historically with more than one fishing activity. This explains why the total for the Nb° column (119) exceeds the 80 persons interviewed. To illustrate this point, we report that while 80 persons where interviewed, 52 respondents had declared working in only one fishery, 22 indicated having worked in two fisheries, four had worked in three fisheries and one respondent had worked in five fisheries. Ten Venezuelan

Southern Red Snapper (*Lutjanus purpures*) handline boat captains who operate in French Guiana were also interviewed. Since none had reported capturing a sawfish, these interviews are not included in the 80 reported on in this section.

4.2. Age of interviewees in French Guiana and fishing experience

The youngest interviewee was 19 years old and the oldest was 79 years of age, with most age groups well represented (Table 5). Data for ages were binned by categories spanning 10 years. Data were also collected on the number of years interviewees have been operating in a particular fishery (by gear type) (Table 6).

Table 5. Age of interviewees

Age of interviewees		
	Nb°	%
< 21	1	1%
22-31	9	11%
32-41	14	18%
42-51	10	13%
52-61	26	33%
62-71	17	21%
> 72	3	4%
total	80	

Table 6. Interviewees experience in fishing

Years in fishing		
	Nb°	%
1 to 7	12	15%
8 to 12	11	14%
13 to 22	13	16%
23 to 32	17	21%
33 to 42	18	23%
43 and up	9	11%
total	80	

4.3. Countries fished by French Guiana Interviewees

As many interviewees originated from outside of French Guiana, participants were asked in which other countries' waters had they fishes in their lifetime.

Table 7. Interviewees in French Guiana have fished in which countries?

Having fished in these countries		
	Nb°	%
Guyana	22	28%
Sur	14	18%
Bra	11	14%
Guyane	59	74%
Maronie Estuary	22	28%
total	128	

We recognise that the Maronie estuary is not a country per say but for the people of Kalin'ia decent interviewed in this study (Nb°= 22), this area is hard to split into the two separate entities, Suriname and French Guiana. Fishers from the villages of Galibi and Awala-Yalimapo always indicated that they fished the Maroni estuary as a unit, thus data collected and are reported here reflect this perception. One would expect that 100% of the fishers interviewed would have considered that they fish in French Guiana but as explained above the people from the Maroni estuary consider the estuary as a functional unit.

4.4. Having seen a Sawfish in French Guiana or not and number of individuals seen?

Fishers were asked if they had ever seen Sawfish and how many had they seen.

Table 8. Were Sawfish recognized in French Guiana?

Do you recognize this fish ?		
	Nb°	%
Yes	59	76%
Yes but never seen	2	4%
No	19	24%
total	80	

76% of participants have seen at least one Sawfish in their lifetime while 24% had never seen one. 4% knew of Sawfish but had never seen one.

Table 9. How many Sawfish have participants seen in French Guiana?

Nb of Sawfish seen		
	Nb°	%
1	6	10%
2	6	10%
3 to 4	5	9%
5 to 9	4	7%
10 to 14	6	10%
15 to 19	6	10%
20 to 29	6	10%
30 to 99	13	22%
100 +	7	12%
total	59	

36% had seen a Sawfish between 1 and 10 times, 20% had seen them between 10 and 19 times and 6% had seen them between 20 and 29 times. 20% of individuals had seen them more than 30 times.

4.5. When was the last time participants had seen a Sawfish?

59 interviewees were asked when was the last time they had seen a Sawfish in French Guiana. If they did not know the exact year interviewers proposed a range of dates to approximate their response. If interviewees had not seen one in French Guiana they were asked where they had seen a Sawfish.

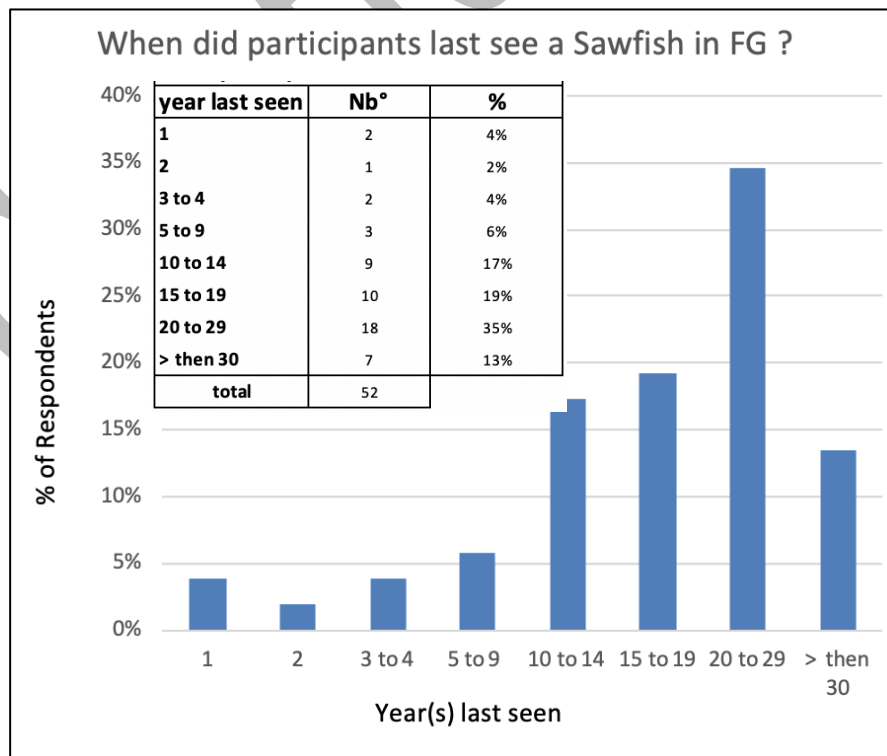


Figure 3. When did participants last see Sawfish in French Guiana?

17% responded “more than 10 and less than 15 years ago” (category 10 to 14), 19% responded “more than 15 and less than 20 years ago”, 35% responded “between 20 and 29 years ago”, 13% responded “more than 30 years ago”. These four categories regrouped represents 85% of responses leaving 15% of respondents having seen a sawfish within the past 10 years. In this study we could only report one confirmed sighting in 2016 (sample 1 in Appendix 2 with measurements in Appendix 3 under sample ID TN1).

Table 10. Where outside of French Guiana did participants last see Sawfish

Seen elsewhere		
	Nb°	%
Brazil	5	8.3%
Suriname	1	1.7%
Venezuela	1	1.7%
Guyana	1	1.7%
total	8	

Four fishers indicated that they had seen Sawfish in Brazil prior to coming to work in French Guiana. The 4 fishers had been in French Guiana no more than 6 years and had seen Sawfish in Amapa and Marajao regions of Brazil in 2000, 2004, 2007 and 2010. The high number of positive and recently reported sightings (non-confirmed) from fishers having recently captured Sawfish in Brazil is noteworthy and will be further explored in the discussion section of this report. Suriname, Guyana and Venezuela all had been mentioned once by four separate fishermen.

Bringing our focus back to French Guiana, another way of determining which decade Sawfish were no longer abundant was to compare the years of experience actually fishing that correlated to reported sightings.

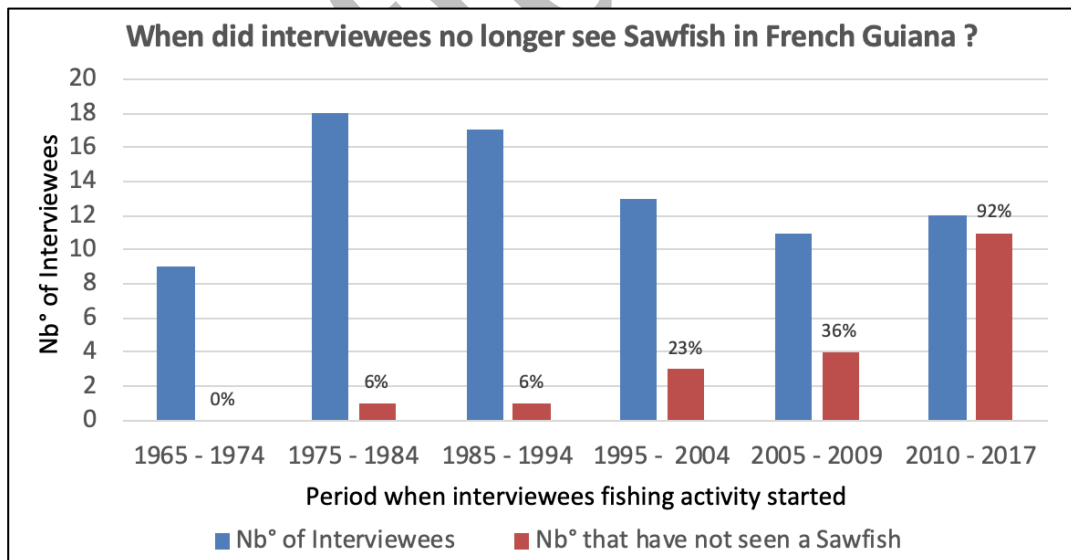


Figure 4. Correlation between experience in fishing and having seen a Sawfish in French Guiana

Using this method we can see that 92% of interviewees with fishing experience starting in 2010 have not seen a sawfish. None of the interviewees with experience starting between 1965-1974 had not seen a sawfish (i.e., they all saw Sawfish). We clearly see that there is an adverse relationship between

years of experience fishing and the reporting of having seen a Sawfish, whereby the fishers with the most experience rarely report not having seen Sawfish.

4.6. Direct mortality from bycatch of Sawfish in French Guiana.

59 Interviewees were asked if the Sawfish they last saw in their fishing gear was alive in the gear.

Table 11. Mortality from fishing gear in French Guiana

Was it alive or dead ?		
	Nb°	%
Alive	42	71%
Dead	17	29%
total	59	

71% responded 'Yes', while 29% responded 'No'. This question raised concerns and is therefore addressed in the discussion section of the report. Eight participants reported that they had cut off the rostra of live Sawfish.

59 interviewees were asked to describe which gear they were using when they most recently captured a Sawfish.

Table 12. In what gear were most recently observed Sawfish captured in French Guiana

Last Sawfish caught in :		
	Nb°	%
Trawl	13	22%
Drift gillnet	37	64%
Set gillnet	7	12%
Cadel	1	2%
Chinese seine	1	2%
total	59	

Sawfish had been most recently caught in drifting gillnets (64%), trawls (22%) set gillnets (12%) Cadel (estuarian longlines) (2%) and in the 'Chinese' seine (2%). These results seem to correlate with the number of interviewees operating with each different fishing gear, but more importantly it confirms that Sawfish are susceptible to bycatch in many different gears.

To have a better idea of the historical importance of Sawfish bycatch by different fishing gears we compared the number of Sawfish caught in recent decades by the three most prevalently used fishing gears in the French Guiana portion of this study.

Table 13. When were the most recently caught Sawfish captured by drifting gillnets

Recent Sawfish in drifting gillnets		
Years ago	Nb° caught	%
1	2	3%
2	1	2%
3 to 4	2	3%
5 to 9	2	3%
10 to 14	4	7%
15 to 19	6	10%
20 to 29	11	19%
> 30	3	5%
total	31	

The majority of the responses from the gillnet fishermen indicated that Sawfish bycatch had occurred more than 15 years ago. However, bycatch by gillnets was reported recently, indicating that gillnet bycatch of Sawfish, though rare, still occurs in French Guiana.

Table 14. When were the most recently caught Sawfish captured by trawls

Recent Sawfish in shrimp trawls		
Years ago	Nb° caught	%
1 to 9	0	0%
10 to 14	2	3%
15 to 19	2	3%
20 to 29	6	10%
> 30	2	3%
total	12	

The most recent 10 years had no incidences reported by the participants of this study. It should be noted here that the fleet of shrimp trawlers has been greatly reduced in the last 20 years, decreases from 80 active boats to 17 in 2017. Having interviewed 12 active captains representing a large proportion of this fleet, information regarding Sawfish captures was very likely to be shared amongst the remaining shrimp boat captains.

Table 15. When were the most recently caught Sawfish captured by set gillnets

Recent Sawfish in set gillnets		
Years ago	Nb° caught	%
0 to 9	1	2%
10 to 14	3	5%
15 to 19	1	2%
20 to 29	1	2%
> 30	1	2%
total	7	

During the most recent 10 years, one capture was reported by participants while six other participants reported catching a Sawfish in a set gillnet more than 10 years ago.

For the single Cadel user and the single 'Chinese' seine fisher interviewed in this study, bycatch of Sawfish was reported to have occurred over 30 years ago and 15 to 19 years ago, respectively.

4.7. Locality of sightings in French Guiana

In accordance with IUCN recommended practices for Critically Endangered species we will not report on the exact localities where Sawfish have been captured most frequently. It can be said however that

based on the results of this study, Sawfish were captured along the entire coast of French Guiana from areas as deep as 30 meters, according to shrimp boat captains, and as shallow as 50 cm of water according to indigenous populations. River mouths and zones inside of estuaries were reported as being areas where both large and small individuals could be captured, while large animals were exclusively reported from offshore areas. A map showing the approximate locations of areas where interviewees say they captured Sawfish more recently can be found in Appendix 4.

4.8. Last locality of most recent sightings in French Guiana

The most recently confirmed capture in French Guiana occurred in 2016, the rostra from this animal measured 113 cm, indicating that bycatch of large animals still occurs in French Guiana. One fisher using set gillnets in the Larivot river indicated that he had caught a small individual (75 cm) in 2012. One fisher from the French side of the Maronie estuary stated that he has captured a small individual (1.1 m) in the Coswine river in 2013. Another fisher stated that he had captured a small individual (45 cm) near the Mana river mouth opening in August of 2016. The Larivot, Coswin and Mana sightings are not considered confirmed, only the Cayenne 2016 sighting is confirmed.

The confirmed Sawfish capture from 2016 in Cayenne had marks from netting on its rostrum (Appendix 5) and netting incorporated inside the hard flesh of the rostrum. The material from this net is not typically found in French Guiana, Suriname or Guyana; it comes exclusively from Brazilian gillnet fisheries, and fishers questioned about this rostrum presumed that the animal had migrated to French Guiana from Brazil. We will further explore these implications in the discussion section of this report.

4.9. Size of animals most recently captured

59 interviewees were asked “What was the size of the Sawfish they had last seen?”. When an interviewee indicated that he had seen more than one Sawfish in his lifetime, the interviewee was asked to think about only the most recent capture.

Table 16. The size of the most recently captured Sawfish

Size of last Sawfish seen		
	Nb°	%
40 to 79	5	10%
80 to 100	4	8%
100 to 150	6	12%
151 to 200	5	10%
201 to 300	7	14%
301 to 500	9	18%
500 to 600	7	14%
600 <	12	24%
total	55	

Respondents had seen a variety of sizes ranging from as small as 40 cm to individuals as large as 7 m. A few individuals did not report the full length of the animal but rather the rostra length (n=2) with reported approximate measurements of 1.3 m and 6 ft. Two other interviewees separately reported that the Sawfish weighed 800 kg.

4.10. Where do Sawfishes prefer to live

59 Interviewees were asked if they knew where Sawfishes preferred to live, whether they preferred a certain depth or a certain type of benthos.

Table 17. Perception of where Sawfish prefer to live

Where do Sawfish prefer to live ?		
	Nb°	%
Sand	18	35%
Don't know	11	22%
Mud/sand	8	16%
Shallow	6	12%
Deep waters	4	8%
Rock bottom	3	6%
Mud	3	6%
Around wood	2	4%
Near rivers	2	4%
Everywhere	2	4%
total	59	

The vast majority of interviewees (34%) answered that Sawfish preferred to live on sand with another 15% saying that they preferred to live between the sand and the mud. Only 6% indicated that Sawfish live in or on the mud.

4.11. Do Sawfish still exist in French Guiana waters?

59 interviewees were asked if they thought that Sawfish still existed in French Guiana. They were then asked if they thought there were more or less Sawfishes in French Guianas' waters than previously.

Table 18. Participants perception of whether or not Sawfish still exist?

Do Sawfish still existe ?		
	Nb°	%
Yes	16	30%
Yes but very rare	13	25%
They must exist	4	8%
No	17	32%
Don't know	3	6%
total	53	

30% responded that sawfish still exist while 32% responded that they thought Sawfish no longer existed. Another 25% responded that Sawfish must exist but are very rare and 6% indicated that they did not know.

Table 19. Participants perception of whether Sawfish are more or less abundant today?

Are Sawfish more or less abundant today ?		
	Nb°	%
Less	48	89%
More	5	9%
Don't know	1	2%
total	54	

89% of respondents stated that Sawfish are less abundant, which is a clear indication that interviewees generally thought that there were less Sawfish in French Guiana now than in the past. Only five participants (9%) believed that there were more Sawfish. Of these five participants, four (80%) believed that there were more sawfish because people don't target Sawfish, and one believed that the Sawfish had moved to live further offshore.

4.12. What contributed to the observed decrease in Sawfish abundance in French Guiana?

To obtain information about the perception of fishers on the reasons that Sawfish had decreased in French Guiana, 59 interviewees were asked if they had any ideas as to what contributed to the population decline. Some gave multiple reasons. Interviewees who had previously stated that Sawfish had increased were also asked the question.

What factors contribute to the decrease in French Guiana Sawfish abundance

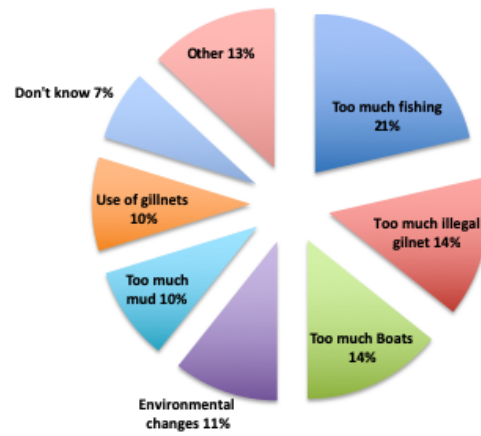


Figure 5. Participants perception of what factors contributed to the decrease Sawfish abundance

21% responded “too much fishing”, 14% responded “too much illegal gillnetting”, 14% responded “too much boats” and 10% simply stated that gillnets were the cause for the decrease in Sawfishes. In summary, many fishermen thought that fishing was the major cause for Sawfish decrease in French Guiana. In contrast, 11% responded that changes in the environment were the major cause for Sawfish declines, and 10% of respondents stated that “too much mud” in the river mouths and coastal zones caused the Sawfish to go elsewhere. 7% responded that they did not know why sawfish had disappeared and 13% stated that other factors caused the decrease as described below.

Other factors contributing to the decrease in French Guiana Sawfish abundance

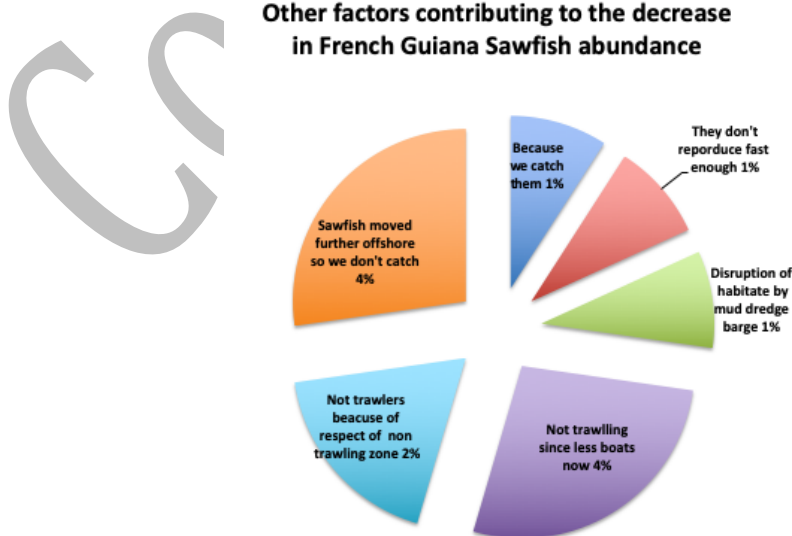


Figure 6. Participants perception of what ‘other’ factors contribute to the observed decrease Sawfish abundance

Fewer respondents gave specific reasons or factors contributing to decreases in Sawfish. Factors included slow rates of reproduction (2%) or the disruption of areas where reproduction occurs by mud dredge (2%). Some shrimp boats captains said that they believed it was not due to shrimp trawling, since there are few shrimp boats today when compared with 30 or 20 years ago. Some also added that since 2007, shrimp boats have fished further offshore than in the past since they must respect the non-trawling zones of less than 30 m depth (Appendix 6). 2007 corresponds to the year that all shrimp boats operating in French Guiana were equipped with mandatory vessel monitoring systems (VMS), which corroborates this observation made by shrimp boat captains.

4.13. Support and ideas for Sawfish conservation in French Guiana

59 Interviewees were asked if they were supportive of Sawfish conservation in French Guiana.

Table 20. Willingness to support Sawfish conservation in French Guiana

Would you support Sawfish conservation ?		
	Nb°	%
Yes	43	83%
No	4	8%
Don't think anything	5	10%
Total	52	

83% responded 'Yes' versus 8% who stated 'No' regarding their support of Sawfish conservation. 10% stated not having an opinion on Sawfish conservation. Seven persons interviewed chose not to respond to the question at all.

43 interviewees that were supportive of conservation efforts were asked if they had any ideas as to how they could go about protecting Sawfish in the wild. Some participants gave multiple answers.

Table 21. Participants ideas on how to protect Sawfish in French Guiana

Do you have any ideas on how to protect Sawfish?		
	Nb°	%
No	20	34%
Release alive	13	22%
Stop illegale fishing	9	16%
Protect zone where they stay	9	16%
Impossible	6	10%
I would not change anything	1	2%
Total	58	

34% responded that they had no ideas on how to protect Sawfish in French Guiana. 22% responded that Sawfish could/should be released alive. 16% responded that stopping illegal fishing activities would be the best way to protect Sawfishes. Another 16% responded that zones where these fishes stay should be protected. Finally, 11% responded that it would be impossible to conserve Sawfish. Interviewees that stated that Sawfish could/should be released alive were further asked how they managed/handled Sawfish to release them alive. This information was gathered to better advise fishers on the safest possible handling techniques for Sawfish captured in French Guiana.

4.14. Cultural importance of Sawfish in French Guiana

To better understand the level of importance given by the French Guiana fishing community to Sawfish, 59 interviewees were asked if they considered Sawfish to be important or not. Based on the responses (Table 26) 34 interviewees were asked why Sawfish were important (Table 27) while 16 interviewees were asked why Sawfish were not important (Table 28).

Table 22. Were Sawfish considered important to participants

Were sawfish important to you?		
	Nb°	%
Yes	34	63%
No	16	30%
Don't think anything	4	7%
total	54	

63% responded "Yes" vs. 30% who responded "No" to whether or not Sawfish were important. 7% responded that they didn't think anything about Sawfish importance. Five interviewees did not respond to the question.

Table 23. Reasons why Sawfish were considered important in French Guiana

Why are they important ?		
	Nb°	%
Unique species	11	20%
Has a role to play	10	18%
For the kids	6	11%
However they are a nuisance	5	9%
Sell nose	8	15%
Good to eat it	15	27%
total	55	

20% responded that Sawfish were important because they were good to eat, this corresponds mainly to Brazilian and Galibi Indians interviewees. 18% responded that Sawfish were a unique species with another 19% responding that Sawfish had a role to play in the food chain. 11% responded specifically that having Sawfish around would be important for the children to see and know. 9% stated that although they were supportive of Sawfish conservation, they considered Sawfish to be a nuisance.

Table 24. Reasons why Sawfish were not considered important in French Guiana

Why are they not important ?		
	Nb°	%
Don't eat	6	32%
Too much work to want ot help.	5	26%
Don't target	3	16%
Don't like it	3	16%
Prefer to sell meat and teeth to brazilians	2	11%
total	19	

Interestingly, in contrast with those that were supportive of Sawfish conservation because they are good to eat, 32% (16 interviewees) did not consider Sawfish to be important and stated specifically that they don't eat Sawfish. 26% responded that Sawfish where too much work and therefore they did not want to help Sawfish. 16% responded that they don't think Sawfish are important because they do not target them. 16% responded that they simply do not like Sawfish. 11% responded that they prefer to be allowed to sell Sawfish meet and teeth to the Brazilian market.

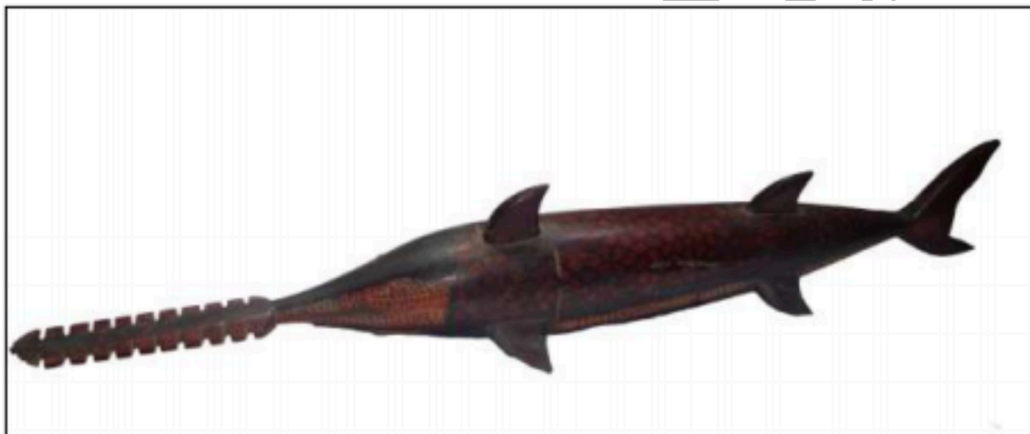
4.15. Local legends or myths about Sawfish in French Guiana

59 Interviewees were asked if they knew of any local legends or myths associated with Sawfish.

Table 25. Participants reports on Sawfish myths or legends in French Guiana

Any Sawfish legends or myths ?		
	Nb°	%
Yes	5	9%
No	50	91%
total	55	

94% of respondents answered that they did not know of any local legends or myths about Sawfish. An Amerindian chief from the village of Awala-Yalimapo did say that many years ago his people would go hunt for Sawfish with spears in shallow waters. The fish would be brought to shore and shared with all in the village who would typically salt the fish or smoke it for longer conservation. This fish was considered a specialty food typically associated with New Year's celebrations in the Galibi Culture. A sawfish shaped bench carved out of a single piece of wood by Palikur Indians, another Amerindian tribe of French Guiana was found on the internet (picture 1). One of the older Creole fishermen who replied "No" to the question stated that when he was child a friend of his had been injured across the chest by a Sawfish while swimming at the Montjolie beach.



Picture 1. Palikur Indian shamanistic bench in the shape of a sawfish carved into a single piece of wood (photo credit: Pauline Laval)

4.16. Local names for Sawfish in French Guiana

Sawfish have different names within different communities present in French Guiana. Sawfish are called Espadron with an 'r' by the Creole population. This name resembles 'Espadon' or the French word for Swordfish. Sawfish are called Kalali by the Kalina Amerindians. People that come from or are descendent of Guyanese (from Guyana) persons call the Sawfish a Comb Shark.

4.17. Records of Sawfish rostra in French Guiana

During interviews, fishers were asked if they knew where we could see a Sawfish rostra. Standard measurements were taken from the rostra of six Largetooth Sawfish. Each rostrum was assigned a specific number and measurements were collected in accordance with the protocol provided by Dr. Ruth Leeney. In the future these measurements will permit us to assign an approximate animal size for each rostra. The pictures of the rostra are presented in Appendix 2 and the data from the measurements are presented in Appendix 3. Two fishers produced pictures of Large tooth Sawfish rostra (Appendix 7), one of which came from a gillnet operation in an unknown location, while the second one was from a shrimp boat in Suriname in 1976 and fishing in approximately 30-40 m depth.

4.18. IFREMER's knowledge on Sawfish in French Guiana

L'Institut Francaise pour l'Exploitation de la Mer (IFREMER) has never encountered a single Sawfish in either their trawl surveys or their more recent gillnet surveys.

5. Results for Suriname

Data were gathered and are presented for Suriname in the same format as the French Guiana results. It is important to remember that fishers in Suriname did not always respond to every question, and that sometimes fishers provided more than one answer to the same question. Indeed, when gathering the data, the agent who originally comes from French Guiana was not perceived as a local in Suriname. This made insisting on responses for each question important but more difficult than in French Guiana, where the fishers were familiar with the agent. In many cases, so as to not intimidate the interviewees in Suriname the data was collected orally during the interview and then the data was transcribed onto the data collection sheet once the interview was finished.

5.1. What fishing gears did interviews in Suriname focus their activity on.

As was the case in French Guiana, interviewees represented the artisanal, semi-industrial and industrial sectors of Suriname. A few persons in Suriname who were interviewed were not fishers but had intimate and historic knowledge of local fish catches and included boat owners (X) and fisheries observers (2). All interviewees were asked with which gear, they associated their past and current fishing activity.

Table 26. Type of gear the interviewees associate themselves with

Type of gear used by interviewees		
	Nb°	%
Shrimp trawls	4	9%
Sea bob trawls	7	15%
Fish trawls	8	17%
Drifting gill nets	28	60%
Set gillnets	5	11%
Handlines	2	4%
Cadell	7	15%
Chinese' seine	12	26%
Total	73	

Some interviewees indicated that they were involved currently or historically with more than one fishing activity, accounting for total Nb° (73) that exceeds the 49 persons interviewed in Suriname.

5.2. Age of interviewees in Suriname and fishing experience

The youngest interviewee in Suriname was 20 years old (questionnaire 30) and the oldest was 91 years of age. Data for age were binned in categories spanning 10 years. Data were also collected on the number of years interviewees have been operating in a particular fishery (i.e. gear type) (table 21).

Table 27. Age of interviewees

Age of interviewees		
	Nb°	%
< 21	1	2%
22-31	3	6%
32-41	7	14%
42-51	13	27%
52-61	14	29%
62-71	7	14%
> 72	4	8%
total	49	

Table 28. Interviewees experience in fishing

Years in fishing		
	Nb°	%
1 to 7	4	6%
8 to 12	3	6%
13 to 22	14	29%
23 to 32	17	35%
33 to 42	8	14%
43 and up	3	6%
total	49	

5.3. Countries fished by interviewees in Suriname

As interviewees in Suriname could have originated from outside of Suriname, participants were asked in which other countries' waters had they fishes in their lifetime.

Table 29. Interviewees in Suriname have fished in which countries?

Having fished in these countries		
	Nb°	%
Guyana	15	32%
Suriname	46	94%
Guyane	4	8%
total	65	

94% responded that The vast majority of fishers had focussed their fishing career in Suriname. The 6% that therefore did not report having fished in Suriname where the two fisheries inspectors that had been interviewed. 32% reported that they had also fished in Guyana. Only 8% responded that they had fished in Guyane (French Guiana).

5.4. Having seen a Sawfish in Suriname or not and number of individuals seen?

49 Interviewees were asked if they had ever seen Sawfish and how many had they seen.

Table 30. Were Sawfish recognized in Suriname?

Do you recognize this fish ?		
	Nb°	%
Yes	31	63%
Yes but never seen	3	6%
No	15	31%
total	49	

63% responded that they have seen at least one Sawfish in their lifetime while 31% responded that they had never seen one. 6 % knew of Sawfish but had never seen one.

Table 31. How many Sawfish have participants seen in Suriname?

Nb of Sawfish seen		
	Nb°	%
1	11	38%
2	5	17%
3 to 4	3	10%
5 to 9	4	14%
10 to 14	3	10%
15 to 19	0	0%
20 to 29	0	0%
30 to 99	3	10%
100 +	2	7%
total	31	

38% Responded having seen a Sawfish 1 time. Only 5 interviewees reported having seen more than 14 Sawfish in their lifetime.

5.5. When was the last time participants had seen a Sawfish?

31 Interviewees were asked when the last time was they had seen a Sawfish in Suriname. If they did not know the exact year interviewees were proposed a range of dates to approximate their response. If Interviewees had not seen one in Suriname they were asked where they had seen a Sawfish.

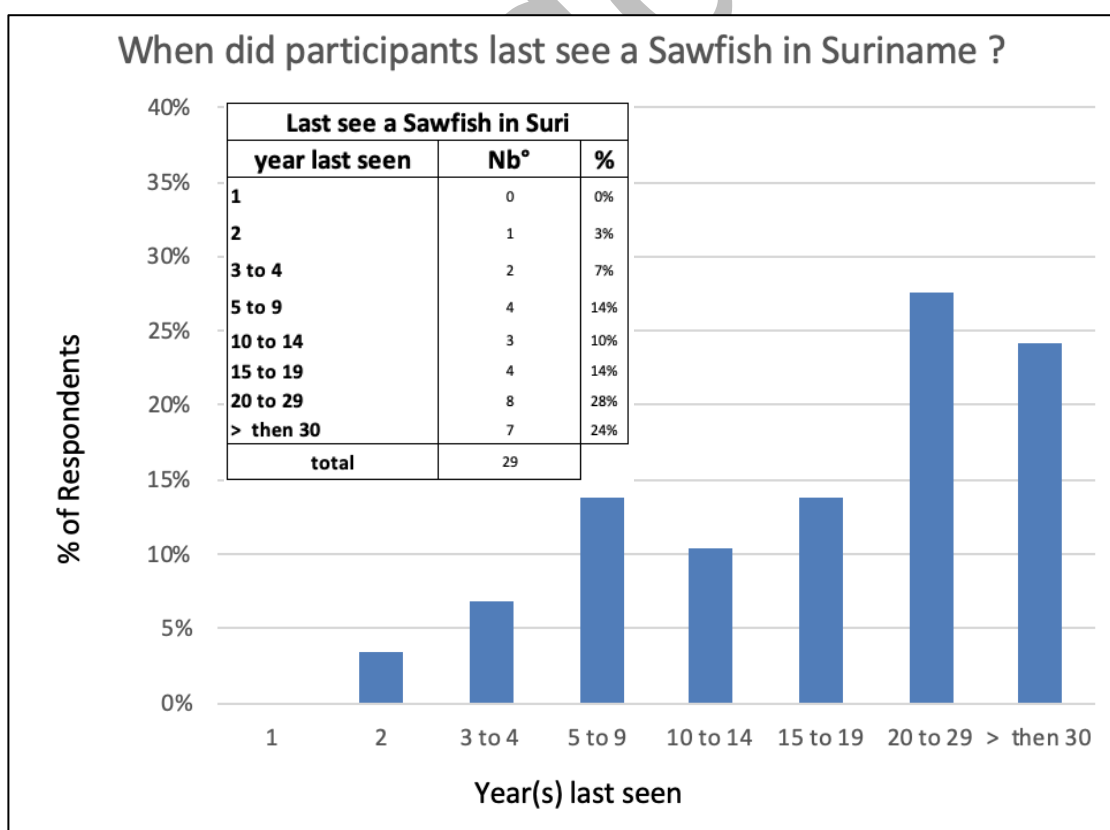


Figure 7. When did participants last see Sawfish in Suriname?

10% responded “more than 10 and less than 15 years ago” (category 10 to 14), 14% responded “more than 15 and less than 20 years ago”, 28% responded “between 20 and 29 years ago”, 24% responded “more than 30 years ago”. These four categories regrouped represents 85% of responses leaving 15% of respondents having seen a sawfish within the past 10 years. In this study in Suriname we could not report on any confirmed sighting.

Table 32. Where outside of Suriname did participants last see Sawfish

Seen elsewhere		
	Nb°	%
Guyana	1	2.0%
Venezuela	1	2.0%
total	2	

Two fishers had indicated that they had seen Sawfish outside of Suriname, one in Guyana and the other in Venezuela.

Bringing our focus back to Suriname, another way of determining in which decade Sawfish were no longer abundant was to compare the years of experience of fishers actually fishing that correlated to reported sightings.

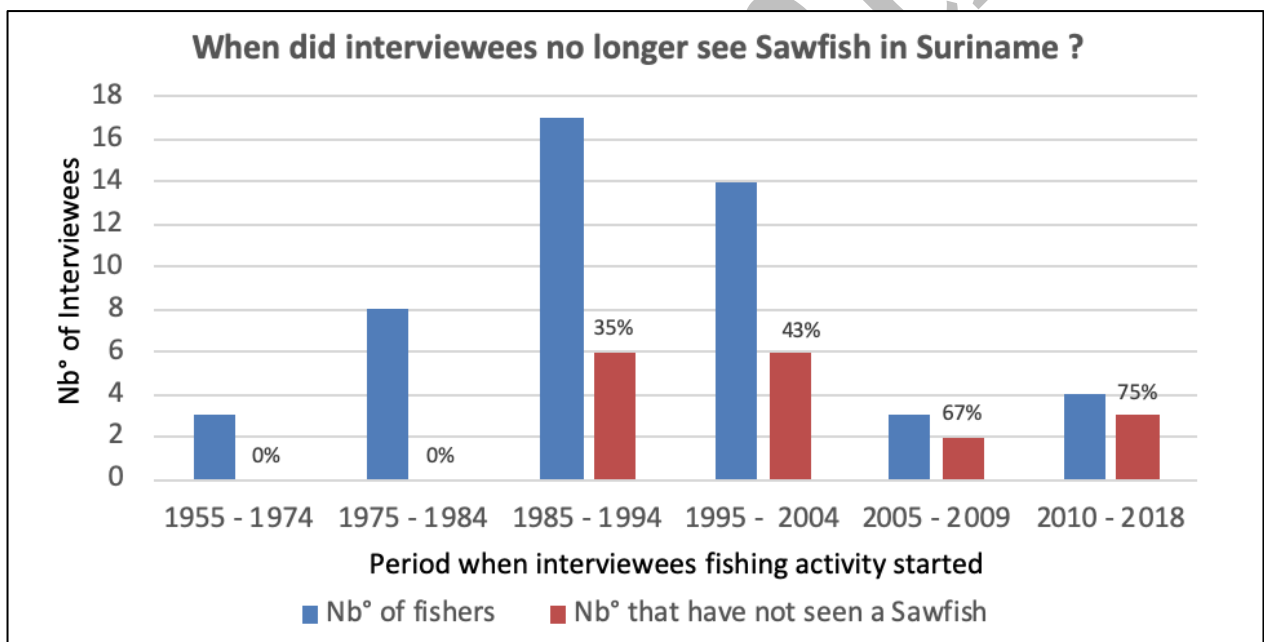


Figure 8. Correlation between experience in fishing and having seen a Sawfish in Suriname

Using this method we can see that 75 % of interviewees with fishing experience starting in 2010 have not seen a sawfish. None of the interviewees with experience starting between 1965-1984 had not seen a sawfish (i.e. they all saw Sawfish). In Suriname we clearly see that there is also an adverse relationship between years of experience fishing and the reporting of having seen a Sawfish, whereby the fishers with the most experience rarely report not having seen Sawfish.

5.6. Direct mortality from bycatch of Sawfish in Suriname.

31 Interviewees were asked if the Sawfish they last saw in their fishing gear was alive in the gear.

Table 33. Mortality from fishing gear in Suriname

Was it alive or dead ?		
	Nb°	%
Alive	22	71%
Dead	9	29%
total	31	

71 % responded 'Yes', while 29% responded 'No'. This question seemed to raise concerns and is therefore addressed in the discussion section of the report. One participants reported that they had cut off the rostra of live Sawfish while 3 reported cutting off the rostra of dead Sawfish.

31 interviewees were asked to describe which gear they were using when they most recently captured a Sawfish.

Table 34. In what gear where most recently observed Sawfish captured in Suriname

Last Sawfish caught in :		
	Nb°	%
Trawl	7	24%
Drift gilnet	19	66%
set gillnet	0	0%
Cadel	1	3%
Chinese' Seine	3	10%
total	30	

Sawfish had been most recently caught in drifting gillnets (66%), trawls (24%), Cadel (estuarian longlines) (3%) and in the 'Chinese' seine (10%). These results seem to correlate with the number of interviewees operating with each different fishing gear but more importantly for Suriname it confirms that Sawfish are susceptible to bycatch in many different gears.

To have a better idea of the historical importance of Sawfish bycatch by different fishing gears we compared the number of Sawfish caught in recent decades by the three most prevalently used fishing gears in the Suriname portion of this study.

Table 35. When where the most recently caught Sawfish captured by drifting gillnets

Recent Sawfish in drifting gillnets		
Years ago	Nb° caught	%
2	1	3%
3 to 4	0	0%
5 to 9	2	7%
10 to 14	2	7%
15 to 19	1	3%
20 to 29	6	20%
> 30	5	17%
total	17	

The majority of the responses from the gillnet fishermen indicated that Sawfish bycatch had occurred more than 15 years ago. However bycatch by gillnets was reported recently indicating that gillnet bycatch of sawfish, though rare, still occurs in Suriname.

Table 36. When were the most recently caught Sawfish captured by trawls

Recent Sawfish in trawls (shrimp and fish)		
Years ago	Nb° caught	%
3 to 4	1	3%
5 to 9	2	7%
10 to 14	1	3%
15 to 19	0	0%
20 to 29	3	10%
30 <	0	0%
total	7	

The most recent 10 years did have bycatch incidences of Sawfish by trawls as reported by the interviewees of this study. It should be noted here that the results indicate that sawfish bycatch had occurred in all the trawling segments (marine shrimp, Seabob and fish trawls).

Table 37. When were the most recently caught Sawfish captured by drifting gillnets

Recent Sawfish in drifting gillnets		
Years ago	Nb° caught	%
2	1	3%
3 to 4	0	0%
5 to 9	2	7%
10 to 14	2	7%
15 to 19	1	3%
20 to 29	6	20%
> 30	5	17%
total	17	

During the most recent 10 years three captures was reported by the participants while fourteen other participants reported catching a Sawfish in drifting gillnets more than 10 years ago.

For the single Cadel user and the 3 'Chinese' seine fishers interviewed in this study, bycatch of sawfish was reported to have occurred over 30 years ago and 15 to 19 years ago respectively.

5.7. Locality of sighting in Suriname

Sawfish in Suriname were captured along the entire coasts of Suriname from areas as deep at 30 meters, according to shrimp boats captains and as shallow as 50cm of water according to indigenous populations. River mouths and zones inside of estuaries were reported as being areas where both large and small individuals could be captured, while large animals were exclusively reported from offshore areas. A map showing the approximate locations of areas where interviewees say they captured Sawfish more recently can be found in Appendix 8.

5.8. Last locality of most recent sightings in Suriname

The most recently reported capture (non-confirmed) in Suriname occurred to 2016. The animal is reported to having been 1m long and captured in 1.2m water depth, however the location was not reported. One bycatch event of a Sawfish measuring 4.5m was reported to have occurred in 2015 at 31 meters depth in a gillnet straight offshore of the Coppename river. The same year a 2m sawfish was reported to have been captured at 32m of depth straight offshore of the Maronie river by a fish trawler. Other than these 3 reports there are 2 reports of sawfish capture that date to 2013. One of

a Sawfish that measured 'no more than 1 meter in length' occurred in a 'Chinese' seine located in the Coppename river mouth and the other of a 5m long Sawfish captured at 'Saramaca Points' at about 35m in depth straight offshore of the Coppename river.

There was no confirmed Sawfish capture reported in this study.

5.9. Size of animals most recently captured in Suriname

31 interviewees were asked 'What was the size of the Sawfish they had last seen?'. When an interviewee indicated that he had seen more than one Sawfish in his lifetime, the interviewee was asked to think about only the most recent capture.

Table 38. The size of the most recently captured Sawfish in Suriname

Size of last Sawfish seen		
	Nb°	%
80 to 100	4	16%
100 to 150	6	24%
151 to 200	4	16%
201 to 300	4	16%
301 to 500	6	24%
500 to 600	3	12%
total	27	

Respondents had seen a variety of sizes ranging from as small as 40cm to individuals as large as 6 m. A few individuals (n=4) did not report the length of the Sawfish they had seen.

5.10. Where do Sawfishes prefer to live in Suriname

31 Interviewees were asked if they knew where Sawfishes preferred to live, whether they preferred a certain depth or a certain type of benthos.

Table 39. Perception of where Sawfish prefer to live in Suriname

Where do Sawfish prefer to live ?		
	Nb°	%
Sand	6	23%
Don't know	5	19%
Mud/sand	2	8%
Shallow	1	4%
Deep waters	1	4%
Rock bottom	1	4%
Mud	3	12%
Around wood	1	4%
Near rivers	1	4%
Shell bottom	4	15%
Everywhere	1	4%
total	26	

23% responded that sand, 15% responded that shell bottoms and 12% responded that mud bottoms were preferred by Sawfish. 19% reported not knowing where Sawfish preferred to stay.

5.11. Do Sawfish still exist in Suriname waters?

31 interviewees were asked if they thought that Sawfish still existed in Suriname. They were then asked if they thought there were more or less Sawfishes in Suriname's waters than previously.

Table 40. Participants perception of whether or not Sawfish still exist?

Do Sawfish still existe ?		
	Nb°	%
Yes	15	54%
Yes but very rare	5	18%
They must exist	2	7%
No	3	11%
Don't know	4	14%
total	29	

54 % responded that sawfish still exist while only 11% responded that they thought Sawfish no longer existed. Another 7% responded that Sawfish must exist but are very rare and 14% indicated that they did not know.

Table 41. Participants perception of whether Sawfish are more or less abundant today?

Are Sawfish more or less abundant today ?		
	Nb°	%
Less	20	87%
More	0	0%
Don't know	3	13%
total	23	

87% of respondents stated that Sawfish are less abundant' which is a clear indication that interviewees generally thought that there were less Sawfish in Suriname now than in the past. No respondents believed that there were more Sawfish.

5.12. What contributed to the observed decrease in Sawfish abundance in Suriname?

To obtain information about the perception of fishers on the reasons that Sawfish had decreased in Suriname, 31 interviewees were asked if they had any ideas as to what contributed to the population decline in Sawfishes (Figure 9). Some gave multiple reasons.

What factors contribute to the decrease in Suriname Sawfish abundance

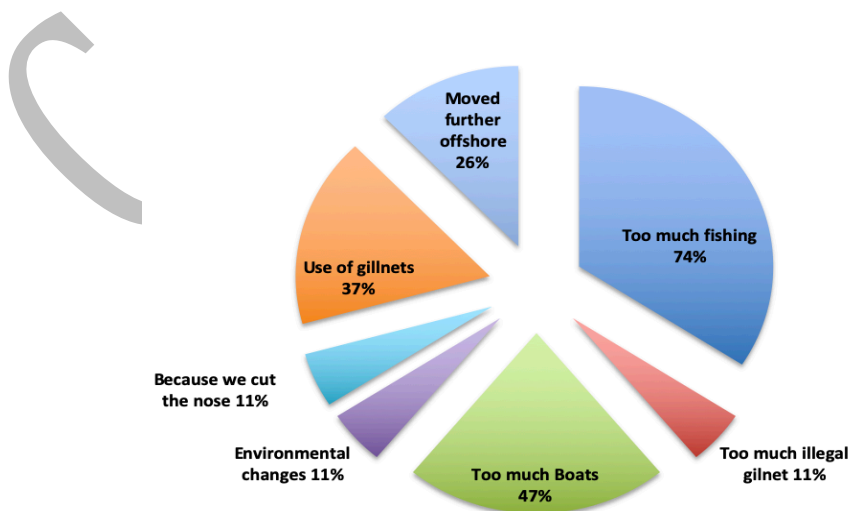


Figure 9. Participants perception of what factors contributed to the decrease Sawfish abundance

74% responded “too much fishing”, 11% responded “too much illegal gillnetting”, 47% responded ‘too much boats’ and 37% simply stated that gillnets were the cause for the decrease in Sawfishes. In summary many fishermen thought that fishing was the major cause for Sawfish decrease in Suriname. 26% responded that Sawfish had simply moved further offshore. In contrast, 11% responded that changes in the environment was the major cause for sawfish decrease. 11% stated that “because we cut off the nose” was the factor causing the decrease in abundance.

5.13. Support and ideas for Sawfish conservation in Suriname

31 Interviewees were asked if they were supportive of Sawfish conservation in Suriname.

Table 42. Willingness to support Sawfish conservation in Suriname

Would you support Sawfish conservation ?		
	Nb°	%
Yes	14	74%
No	2	11%
Don't think anything	3	16%
No Answer	6	32%
total	25	

74% responded ‘Yes’ versus 11% who stated ‘No’ regarding their support of Sawfish conservation. 16% stated not having an opinion on Sawfish conservation. 6 persons interviewed chose not to respond to the question at all.

14 interviewees that were supportive of conservation efforts were asked if they had any ideas as to how they could go about protecting Sawfish in the wild. Some participants gave multiple answers.

Table 43. Participants ideas on how to protect Sawfish in Suriname

Do you have any ideas on how to protect Sawfish?		
	Nb°	%
No	5	26%
Release alive	8	42%
Stop Illegale fishing	0	0%
Protect zone where they stay	3	16%
Stop so much fishing	3	16%
total	19	

26% responded that they had no ideas on how to protect Sawfish in Suriname. 42% responded that Sawfish could/should be released alive. Another 16% responded that zones where these fishes stay should be protected. Finally, 16% responded that you would have to ‘stop so much fishing’ for Sawfish conservation.

5.14. Cultural importance of Sawfish in Suriname

To better understand the level of importance given by the Suriname fishing community to Sawfish, 31 interviewees were asked if they considered Sawfish to be important or not. Based on the responses (Table 44) 15 interviewees were asked why Sawfish were important (Table 45) while 10 interviewees were asked why Sawfish were not important (Table 46).

Table 44. Where Sawfish considered important to participants

Were Sawfish important to you?		
	Nb°	%
Yes	15	56%
No	10	37%
Don't think anything	2	7%
total	27	

63% responded 'Yes' vs 30% who responded 'No' to whether or not Sawfish were important. 7% responded that they didn't think anything about Sawfish importance. Two interviewees did not respond to the question at all.

Table 45. Reasons why Sawfish were considered important in Suriname

Why are Sawfish important ?		
	Nb°	%
Unique species	5	21%
Has a role to play	2	8%
For the kids	2	8%
However they are a nusense	0	0%
Sell nose	0	0%
Good to eat it	6	25%
Part of nature	4	17%
Because they are rare	2	8%
Nice to look at	3	13%
total	24	

25% responded that Sawfish were important because they were good to eat. 21% responded that Sawfish were a unique species, 17% responded that they were part of nature, with another 8% responding that Sawfish had a role to play in the food chain. 13% responded stated that Sawfish where nice to look, 8% responded specifically that having Sawfish around would be important for the children to see and know and 8% because they were rare.

Table 46. Reasons why Sawfish were not considered important in Suriname

Why are they not important ?		
	Nb°	%
Don't eat	4	40%
Dont target	1	10%
total	5	

Interestingly in contrast with those that were supportive of Sawfish conservation because they are good to eat, 40% (4 of the 10 interviewees) did not consider Sawfish to be important and stated specifically that they don't eat Sawfish. 10% responded that they don't think Sawfish are important because they do not target them. 50% of the 10 interviewees who had been asked this question did not respond.

5.15. Local legends or myths about Sawfish in Suriname

31 Interviewees were asked if they knew of any local legends or myths associated with Sawfish.

Table 47. Participants reports on Sawfish myths or legends in Suriname

Any Sawfish legends or myths ?		
	Nb°	%
Yes	9	45%
No	11	55%
total	20	

55% of respondents answered that they did not know of any local legends or myths about Sawfish. The explanations that were given can be separated into two categories, one that concerns the idea that having ocean decorations in the home such as Sawfish Rostra on the wall or seashells is considered by some fisherfolk as bad muck. The other information that some interviewees considered to be a myth about sawfish is that they were very dangerous and could 'cut you in two'. One interviewee who was of Kalin'ia decent stated that in his tradition 'eating Sawfish makes you strong and you don't get fat',

5.16. Local names for Sawfish in Suriname

People that come from or are descendent of Guyanese (from Guyana) persons call the Sawfish a comb shark. The Dutch word for saw is 'Zaag' which was sometimes helpful in describing the Sawfish to interviewees who had never seen a Sawfish. Finally, the people of Kalinia decent meet in Suriname confirmed that the Sawfish was called the Kalali.

5.17. Records of Sawfish rostra in Suriname

During interviews, fishers were asked if they knew where we could see a Sawfish rostra. None were found in Suriname. This is largely due to the limited amount of time that we were working on the ground in Suriname. Also, many people had stated that Dutch tourists had purchased a lot of the Sawfish rostra that could be found in the shops years ago.

5.18. LVV's Department of Fisheries knowledge on Sawfish in Suriname

The Fisheries Department of Suriname has never encountered a single Sawfish in either their surveys.

6. Discussion

This study is the first of its kind in French Guiana or Suriname. Both French Guiana and Suriname were sampled in accordance with the project proposed by the CRPMEM GUYANE to the WWF. A total of 80 and 49 interviews took place with willing participants and data was analysed to acquire a better understanding of Sawfish's historical and present abundance in both Suriname and Guiana's waters respectively. This method is a cost-effective and quick way for the public to contribute to research for rare species (Scott et al. 1995)

In French Guiana we benefit from working with fishers who are typically not opposed to sharing information with scientist or managers of the CRPMEM GUYANE. Since the CRPMEM GUYANE's mission is to help the fishing sector adapt to evolutions in fishing regulations, management and the resource they exploit, the relations or interactions that occur between the CRPMEM GUYANE, boat owners and fishers remains positive. We therefore believe that the results of the French Guiana study are particularly accurate since fishers working with the fisheries committee have no reason to lie though some individuals (2) were clearly not willing to provide accurate information.

We can consider that the Surinamese portion of this work to be less representative than the French Guiana Survey for two main reasons, In Suriname we were able to conduct 49 total interviews in comparison to the 80 conducted in French Guiana which represents 39% less interviews. Adding to

this the fact that Suriname had at least 425 fishing license (350 coastal fishing license, 20 Seabob License, 35 marine shrimp boat license, and 20 fish trawler license) at the time vs 137 license for French Guiana (120 coastal fishing license and 17 shrimp boat license) + 70 Informal boats there is a much better sample size and representation in French Guiana with 38.6% coverage vs Suriname with 11.5% coverage. This being said we do feel that the information gathered in Suriname does reflect the reality since many of the results and trends from the data gathered in French Guiana closely resembles the results and trends from Suriname.

The results of this study indicate that Largetooth Sawfish were historically captured by all fishing gears used by local people and that the levels of interactions which were frequent still 30 to 20 years ago have largely decreased since. This result concurs with the results of faunal surveys from the 1890's that indicated that healthy populations of Sawfishes could be found across the western Atlantic in areas such as Brazil, Nicaragua, and the USA though most of these populations had declined by the mid-1980s (Faria et al. 2013).

Over the most recent decade interactions with Sawfish have occurred in the drifting gillnet industry in French Guiana and Suriname. Interactions with trawl fisheries have not been reported in the recent decade in French Guiana but have been reported in Suriname. Going back to the only confirmed 2016 Sawfish capture from this study, it is interesting to note that the particular rostrum has gillnet marking and pieces of gillnet incorporated inside the flesh (Appendix 5). The material that this netting is made off was, until very recently only available in Brazil. This may indicate that this animal was originally from Brazil. Further, within the gillnet fishery, 92% of newcomers with less than 7 years of experience have never seen a Sawfish in French Guiana waters while 4 of the 7 newcomers who were originally from Brazil stated that prior to coming to French Guiana they had seen Sawfish in Brazilian waters. In Suriname we reported that 67% (2 of 3) of interviewees who started fishing between 2005 and 2009 and 75% of interviewees (3 of 4) who started fishing in 2010 and 2018 had never seen sawfish. This is different than the results from French Guiana with 36% (4 of 11) of interviewees who started fishing in 2005-2009 and 92% (11 of 12) who started in 2010-2018 that had never seen Sawfish respectively. Though the prevalence is different, which may be due to low numbers of interviewees from those time periods in Suriname, the trend of decreased sightings is similar in both French Guiana and Suriname. For the Brazilian fishers who stated having seen sawfish in Brazil prior to coming to French Guiana three of these fishers stated that they caught the Sawfish in the Amapa region in 2004, 2005 and 2010.

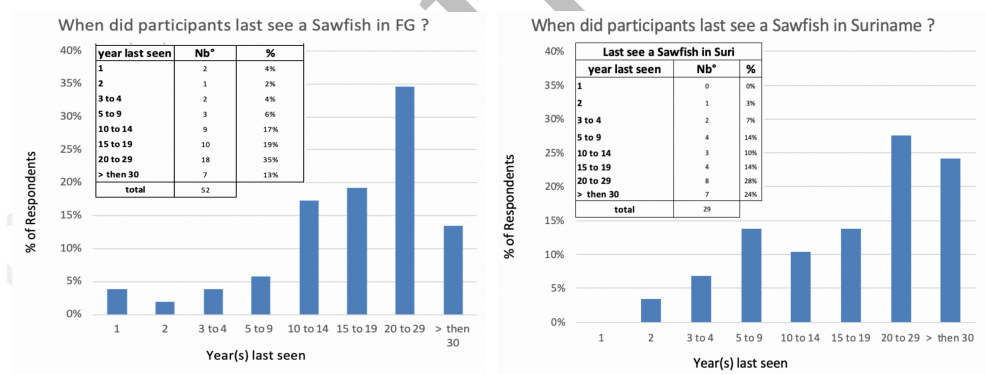
A 2016 study by Reis-Filho et al. explains that traditional fishers of the north-eastern coast of Brazilian currently continue to report the occasional presence of the Sawfish. This same study makes the point of explaining that Sawfish may persist in some large estuaries where the typology is more complex since this would heighten resilience to anthropogenic threats (Reis-Filho et al. 2016). In light of this and seeing that the estuaries in French Guiana or Suriname are not as vast and complex in their typology as the ones described in the Reis-Filho et al 2016 study it is likely that Sawfish in French Guiana and Suriname may not have benefited from shelter from anthropogenic threats from fisheries bycatch for example. It is generally well accepted that predator distribution for species such as Sawfish may be affected by salinity fluctuations and prey abundance. It is difficult to know how these factors come into play in the Guianas seeing that data is lacking on species presence under different regimes of salinity and prey abundance for a long enough time period. It is even more difficult to determine this for Sawfish, which have not been studied as extensively as Sawfish in the Florida everglades and Australia for example.

Moving over to the more offshore component of this study, the shrimp trawl industry in French Guiana has not reported a capture of Sawfish in the recent decade. The shrimp trawling industry in French Guiana has also undergone changes in the past 20 years, including 90% decreases in its activity. It has also had to adapt to evolutions in fishing management by, for example, having to use VMS since

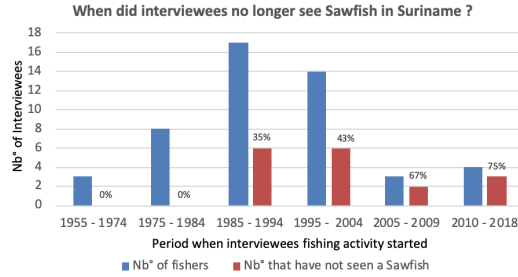
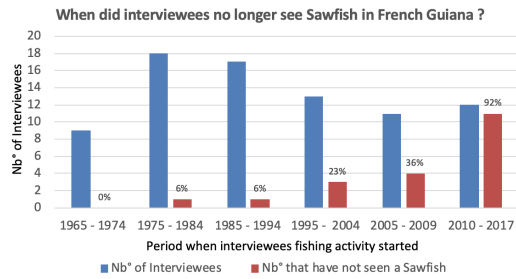
2007. The use of VMS guarantees that trawlers do not fish inside the 30m non-trawling zone (Appendix 6) which as a result is deemed to be non-trawled since 2007. The absence of trawling in this area and the reduced fishing effort may partially or largely explain why shrimp trawlers operating in French Guiana have reported zero Sawfish bycatch incidences over the last decade. This non-voluntary fishing area restriction may be a positive thing for Sawfishes though it would be very difficult to determine with certainty how this phenomenon impacted Sawfish abundance without a well-designed and vast ecological survey. In Suriname which has a much larger continental shelf, trawlers for shrimp and fish have reported Sawfish bycatch over the most recent decade. This could be seen as a positive thing for Sawfish of the region however trawl fishing effort in Suriname has continued to increase over the past decade which may counter the benefits to the Sawfish of the Guianas procured by the reduction of effort seen in French Guiana.

It is worth noting that having stand-alone laws to protect species such as Sawfish if not effectively enforced does not in itself guaranty conservation; especially in a place like the different EEZs of the Guianas (except for French Guiana) where fishing practices susceptible of causing Sawfish bycatch to remain largely unchecked. This point is critical and must be highlighted here if Sawfish are ever to have a chance of reestablishing themselves in the Guianas, indeed IUU fisheries must once and for all be stopped. Until illegal fisheries are eradicated it will be very difficult if not impossible to convince fishers or their representatives that conservation of Sawfish along with other megafauna is a priority that needs to be addressed locally. Fishers interviewed are clearly aware that the levels of fishing effort in the region are increasing and indicate that it is too high for the marine resources, in general, to regenerate themselves. Whether it comes from IUU fishing, such as reported by interviewees in French Guiana or from too much legally authorized fishing, such as reported by interviewees in Suriname (74%), fishing effort seems to be an issue that needs to be addressed quickly and with efficiency.

When comparing the main results for the question ‘When did participants last see a Sawfish in French Guiana and Suriname?’ (below) we can see that both countries report a very drastic decrease in Sawfish sightings over the past 30 years with very few sightings in recent years.



The same negative trend is observed with the results from the question ‘When did interviewees no longer see Sawfish in French Guiana and Suriname?’. Indeed, regular Sawfish sightings were still occurring in French Guiana 35-25 years ago since only 6% of interviews who started fishing in that time period had not seen sawfish compared to 35% of interviewees who had not seen a sawfish in Suriname in the same timeframe.



This seems to indicate that sawfish presence may have begun to decline in Suriname before French Guiana. It is possible that the apparition and wide of the use of gillnets which started in Suriname in 1970-1975 before being widely used in French Guiana could explain this delay of 10 years in decline observed in French Guiana in comparison to Suriname. Further, in the 60s and 70s shrimp trawling was already occurring in the Guianas with a fleet of 120 vessels which was based out of French Guiana's Larivot fishing port and operating along the entire coast of the Guianas from Brazil (Para) to Guyana. Though shrimp trawling was extensive it typically occurs at depths of 20m or deeper leaving the coastal zones of 20m and less with little anthropogenic pressure from commercial fishing at the time.

It is therefore possible that Sawfish were, to a certain level able to co-exist with the shrimp fishery though we cannot measure with certainty the impact of this activity on Sawfish. Adding to the shrimping activity the vast use of gillnets along the entire coast of the Guianas shield in waters going from only 1 meter in depth to 20 meters has caused all potential habitat of sawfish to be partially occupied by fishing gear and activities.

Concerning the potential impact of climate change on the abundance of Sawfish in French Guiana and Suriname, very little information was found that could be help inform this idea locally. The same can be said about the impact of pollution from river runoffs o resulting from extensive agriculture which is continuously developing in and around the Amazon river basin or from gold mining. Also, it is very difficult to know how the 'new' phenomenon of Sargassum is impacting the Sawfish or the availability of Sawfish prey in the Guianas. It has been reported by fishers that Sargassum and its deposits along the coast both on the beaches and along the continental shelf are impacting marine life. No studies to date have described the potential impact of Sargassum in the marine habitat in the Guianas shield. Even if the Sargasum was not the cause of the decline of Sawfish, it may impact potential recovery plans for the species.

In the end the Sawfish sightings have since become a rare event in French Guiana and Suriname. Based on the results of the work conducted in French Guiana and Suriname, two sets of recommendations are listed below as inherent differences in fisheries and their management occurring in French Guiana and Suriname make it difficult to provide the same recommendations.

7. Recommendations for French Guiana and Suriname

French Guiana Recommendations

- 1) Inform fishermen (formal and informal) of the protected status of Sawfish
- 2) Create a pamphlet promoting the release of Sawfish when captured accidentally
 - a. Providing these pamphlets to the captains and crew of the fishing boats
 - b. Going through the information with the fishers to make sure they understand it
- 3) Integrate Sawfish area usage in future spatial planning work for the region including the creation of a web of marine protected areas in collaboration with the fishing industry.

- 4) Get the support of IUCN's Shark specialist group to address a letter to countries of the Guianas on the importance of eliminating illegal fisheries (IUU) as per the threat this causes to all proposed management options aiming to conserve Sawfish and other species in the Guianas shield eco-complex.

Actions to tackle this issue, such as recommendation number 4, must be promoted by the secretariats of the relevant conventions, agreements, and guidelines to which the EU is associated. Failure to act could mean the EU's acceptance of certain imports make it complicit in activities that could run counter to those agreements.

Suriname Recommendations

- 1) Limit fishing effort
 - a. Limit the number of fishing license of different segments of gillnetting and trawling fleets.
 - b. Inspect the length of gillnets being used
 - c. Continue to promote the installation of VMS on the coastal fishing fleet.
- 2) Conduct complementary interviews with more fishers and different fleets in Surinam.
- 3) Inform fishermen (formal and informal) of the protected status of Sawfish
- 4) Disseminate the pamphlet created in French Guiana promoting the release of Sawfish
 - a. Providing these pamphlets to the captains and crew of the fishing boats
 - b. Going through the information with the fishers to make sure they understand it
- 5) Integrate Sawfish area usage in future spatial planning work in Suriname.
- 6) Ban the use of the pin-sein used to close off large portions of the coast at high tide and even rivers.

Recommended further research for the region

Finally, in conducting this study a number of key data gaps have been identified that need to be addressed in order to better understand the situation as per the status of Sawfish in the northern portion of South America. Recommended areas for further study that build upon the indicative information gathered in this work could be to:

- Extend the interviews to Guyana, Oyapocke (fishing town on the Brazilian side of Oyapock river) eventually to the Amapa region of Brazil and eventually Venezuela, political situation permitting.
- Develop estimates of mega fauna bycatch and therefore fishing effort potentially associated with IUU fishing.
- Develop studies to better understand the impact of pollution and or Sargassum on local fauna and habitats.
-

8. Conclusions

This study confirms that Largetooth Sawfish are still present and captured as bycatch in French Guiana and Suriname. Sawfish conservation is dependent on being able to control fishing effort in time and space so as to reduce the bycatch impact. To this affect Sawfish and its worldwide status as critically endangered could be an additional argument to entice the eradication of illegal, unreported, and unregulated (IUU) fishing activities in both French Guiana and Suriname. In fact, IFREMER in 2012 estimated that 2/3rd of the fishing effort occurring in French Guiana's coastal habitat is attributed to illegal foreign flagged vessels. Other than destabilizing the local economies, the practitioners of these

illegitimate activities no regards for the delimitation of natural reserves and are therefore a threat to any potential conservation strategy that could be developed in the Guianas.

Unfortunately, seeing the current level of foreign IUU fishing occurring in French Guiana, it is not possible, at this stage, to imagine that fishers or their representatives would be willing to negotiate other forms of Sawfish bycatch mitigation techniques such as the limitation of fishing zones even though many are favorable to Sawfish conservation as this report shows. In the meantime the CRPMEM GUYANE, in accordance with the terms of reference of this project and in association with the WWF will contribute to Sawfish conservation in French Guiana and Surinam by designing a pamphlet that describes the conservation status and associated local laws as well as propose safe and effective handling techniques to release bycaught Sawfish. This pamphlet will be distributed, explained and installed by the CRPMEM GUYANE onboard coastal gillnet boats operating in French Guiana, with versions edited in the different languages of fishers of the Guiana's shield

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Appendix 1. Pictures shown to survey participants to see if they recognized the animal



Appendix 2 – Pictures of the 6 rostras identified and measured during the study.



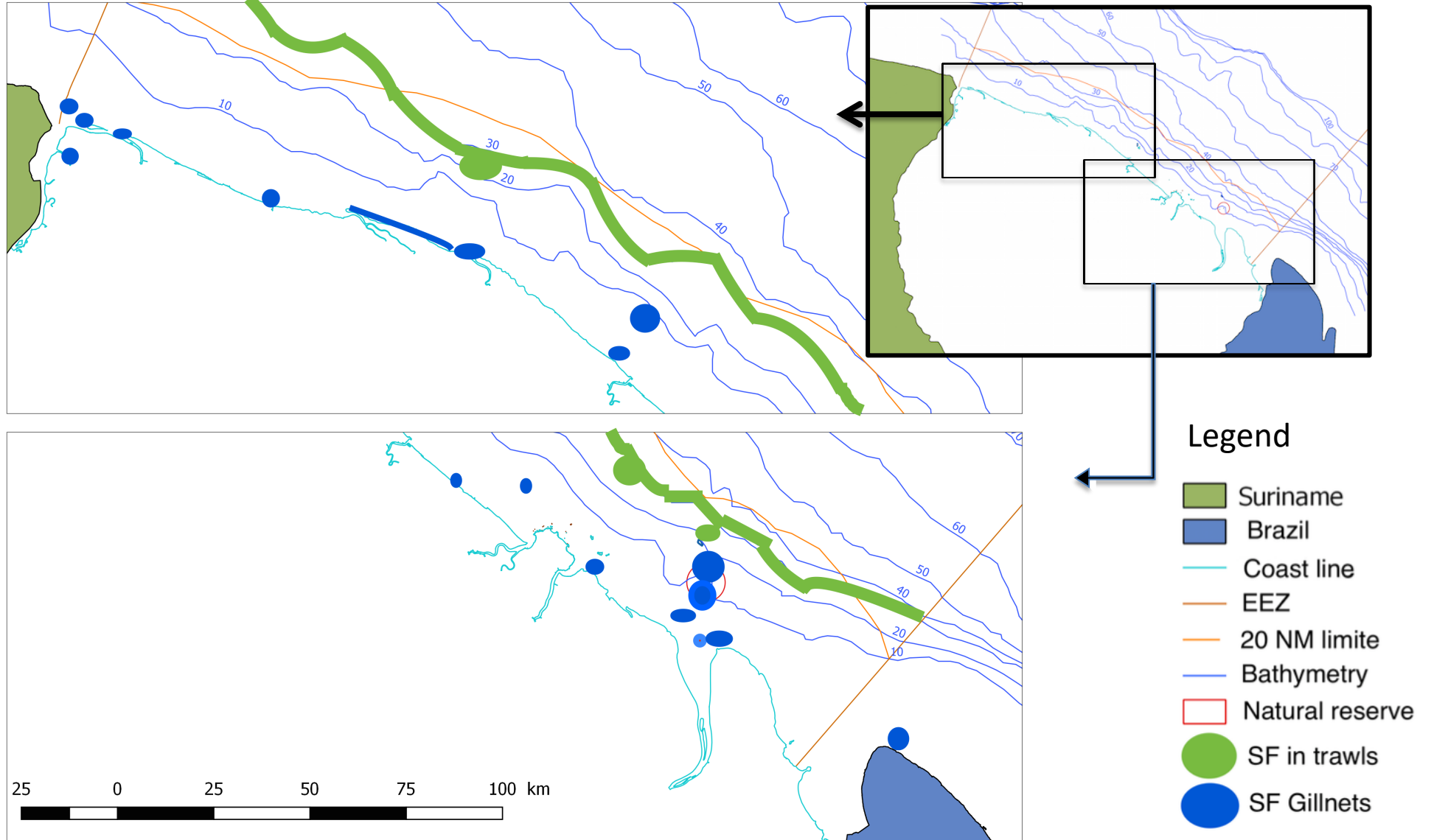
Appendix 3.

Table 48. Sawfish rostra measurements

Sampler	TN	TN & VA	TN & VA	TN & VA	TN & VA	TN & VA
Source	Anonymous	Vaudé work	Vandé work	Venkatapen home	Hotel Marina	Francois Abchee home
Date	25-Sep-17	25-Sep	25-Sep	27-Sep-17	27-Sep-17	27-Sep-17
Sampling tool	Tape Measure™	TM	TM	Tape measure	TM	TM
ID	TN01	TN02	TN03	TN04	TN05	TN06
L	17	17	19	18	20	17
R	17	17	18	18	19	18
TRL	113	128.5	114	114.5	116	132
SRL	110	122	112.2	111.5	113	130
SRW	23.5	26.5	24	23.5	26	28.5
TW	11	10	10	9.2	9.4	10
Ld	4.7	5.6	4.2	4.5	4	6
Ld-1	5	6	4	4.4	4.2	6
Rd	4.3	5.2	4	4.7	4	6.5
Rd-1	4.5	4.9	4.3	4.2	4.2	6
Lp	5.3	6.6	5.4	6.7	5.9	7.5
Rp	6.2	7	7.5	6.5	6	7
Tooth LP	7	5.4	5	4	4	5.5
Tooth LD	7	3.3	5	3.8	3.5	6.5
Origin	Off shore of Sinnamary Waiting on GPS position	Bourda Beach	Eric Hansen (FG)	Between PK10 buoy & devils island	? Waiting on feedback (FG)	Between Sinnamary et Iracoubo
Capture date	2016	> de 50ans	?	10-14 years ago	?	between 1990-1995
TL	NA	NA	NA	NA	?	?
Sex	NA	NA	NA	NA	?	?
L Grooves (f/p)	16f with groves	17		18f	12f/8p	18 full groves
Notes	Missing Ld tooth N1, In tissue one can see netting (blue)				Missing Rd Tooth	Missing 1 row of teeth from bottom

Appendix 4.

Figure 10. Map of the French Guiana EEZ showing where shrimp and gillnet fishers say they captures Sawfish (SF)



Appendix 5. Pictures of netting incorporated in the flesh or Largetooth Sawfish



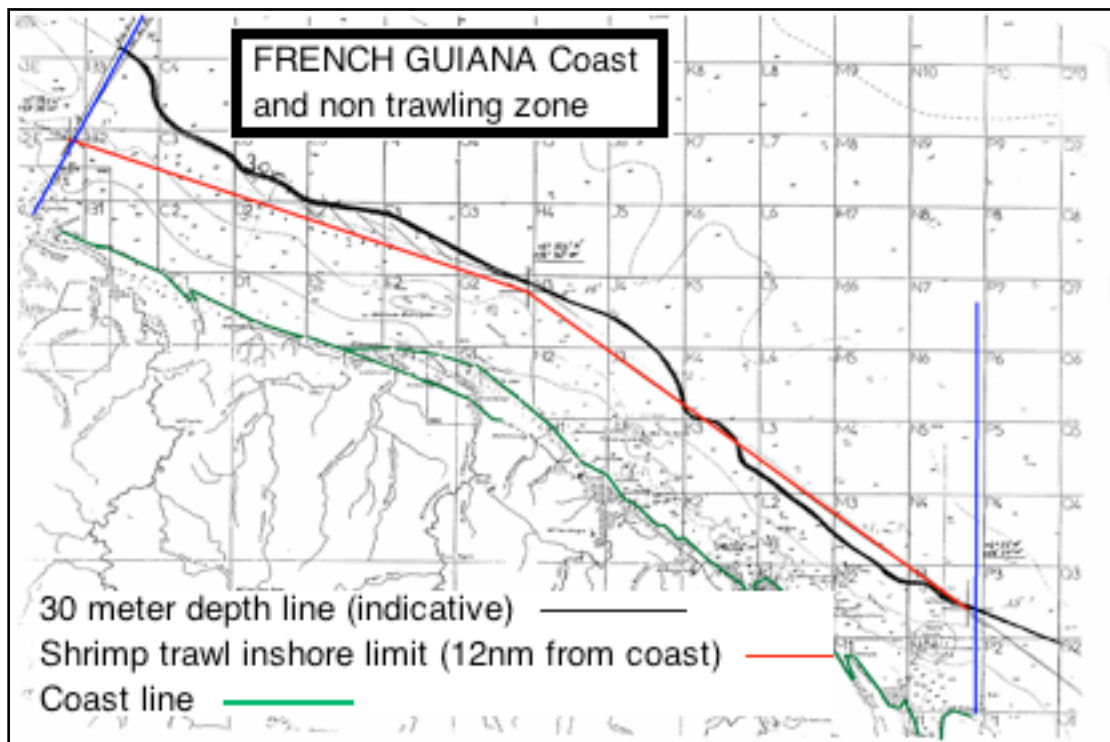
Here we see the mesh marks on the rostra



Here we see that gillnet pieces are incorporated inside the rostra tissue. This type of blue nylon is not available in Guyana, Suriname or French Guiana. Fishers from Brazil were asked to identify the material and they reported that this material is common in Brazil hence the theory that this animal came to French Guiana from Brazil.

Appendix 6.

Figure 11. The 30 meter non trawling zone in French Guiana.



The red line on this map represents the official non trawling area whereas the black line is the approximate 30 m bathymetry line. The green line is the coast line.

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Appendix 7. Fisher photos of rostra.



In the 1st picture you can see the animal in the water. This animal was captured in a gillnet and the rostra was cut off. In the 2nd picture we just see the fisher exposing the rostra of a Sawfish that was captured in 1976 in Suriname during brown shrimp fishing operations occurring at approximately 30-40m in depth and in front of the city of Paramaribo.

Continued

Appendix 8

Figure 12. Map of the Suriname EEZ showing where trawler (fish and shrimp), gillnet and chinese sein fishers say they captures Sawfish (SF)

