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INTRODUCTION

Sawfishes (Pristidae) are amongst the most endangered of all families of elasmobranchs (sharks and rays; Dulvy et al. 2014). A recent conservation strategy released by the International Union for the Conservation of Nature (IUCN) (Harrison and Dulvy 2014) highlighted the urgent need for baseline data on sawfishes throughout much of their historical range. In particular, sawfishes formerly inhabited both the west and east coasts of the African continent, but are now thought to be extinct throughout much of this range. All five species are classified as highly threatened with extinction according to IUCN Red List criteria and all species are listed on the US Endangered Species Act (ESA). International commercial trade in sawfish has been banned through the listing of all species on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Recent studies in West Africa have suggested that sawfishes are now rare in areas of known historical abundance, including the Gambia River and Guinea-Bissau (Leeney and Poncelet 2013; Leeney and Downing 2015). At least two species of sawfish, the largetooth sawfish (*Pristis pristis*) and the green sawfish (*P. zijsron*) formerly inhabited the western Indo-Pacific Ocean (Pierce 2014). The last record of a sawfish in South African waters occurred in 1999 on the KwaZulu-Natal coast, and sawfishes are now considered to be extinct in South Africa (Everett et al. 2015), but a baseline study conducted in 2014 indicated that sawfish populations are likely still present in Mozambique (Leeney in rev.). Mozambique thus has the unique opportunity to protect some of the last remaining populations of sawfishes anywhere in mainland Africa.

The IUCN Global Sawfish Strategy, published in 2014, provides a set of clear, global-scale priorities for research, education and conservation of sawfishes and a roadmap for the development of Regional Sawfish Conservation Strategies (Harrison and Dulvy 2014). These actions were based on information within the global status review of all sawfishes, including taxonomy, historical and current status, threats, values, and any conservation actions currently in place. Although species conservation requires planning at the international levels, almost all directly effective conservation activities are conducted under the authority of national or local governments. It is therefore essential that the Global Sawfish Strategy is translated into action plans which can be implemented nationally or regionally. National conservation strategies for sawfishes should be based on the Global Sawfish Conservation Strategy to ensure that there is a coordinated global approach to implementation.

A workshop was held in Maputo, Mozambique on the 27th and 28th of August 2015, with the primary aim of introducing the Global Sawfish Conservation Strategy to government representatives, alongside data from a recent study which showed that sawfish populations are present in Mozambican waters, and facilitating discussion on the activities needed in Mozambique to better protect sawfish populations. The workshop also aimed to provide training in the identification of potential sawfish parts in trade (e.g. fins, rostra) and provide safe release guidelines for fishers. The workshop also discussed broadly the shark and ray monitoring activities already taking place in Mozambique in an effort to provide some basic training in shark identification. Finally, future activities were identified that can build capacity for the monitoring and sustainable management of shark and ray fisheries in Mozambique.

WORKSHOP OUTLINE

The workshop was structured according to recommendations provided by the IUCN Global Sawfish Conservation Strategy (Harrison and Dulvy 2014). After an introduction to sawfish biology and ecology globally, with some insight into the research being conducted on *P. pectinata* in Florida (Appendix III), presentations were made on the current state of knowledge in Africa (Appendix IV), and then specifically in Mozambique, based on a baseline study conducted in 2014 (Leeney in rev., Appendix V). Following from this introduction, there was a presentation on safe release handling guidelines (Appendix VI), and a presentation on some ongoing research on elasmobranchs in northern Mozambique by researchers at the University of Lurio. The potential for developing shark and ray monitoring program in Mozambique was then discussed (Appendix VII). On the second day of the workshop, participants were first provided with training in the identification of the fins of CITES-listed sharks (Appendix VIII). Following this, the vision of the Global Sawfish Conservation Strategy was introduced to the workshop participants (Appendix IX).

Vision: a world where sawfishes are restored - through understanding, respect, and conservation - to robust populations within thriving aquatic ecosystems.

This vision is directly applicable at a national level in Mozambique. The two over-arching goals of the Global Strategy, and each of the objectives nested within these goals, were then introduced. Once each objective was introduced and explained, participants were asked to develop between one and three national targets. The targets should describe what needs to be done to meet each objective and should focus on addressing the previously identified threats and constraints.

Goal A: Robust sawfish populations where threats are minimized through improved fisheries management, strategic research, species and habitat protection, and trade limitation.

Objective 1: Fisheries Management: Interactions are minimized between fisheries and sawfishes, while maximising associated sawfish survival, catch reporting, and analysis of interactions.
Objective 2: Species Protection: Ensure that sawfish range states have applied their strictest national wildlife protection legislation to all sawfish species, including a prohibition on targeted take, retention, and sale.
Objective 3: Habitat Conservation: Ensure development by range states of regional plans/agreements to harmonize and strengthen national efforts to identify, restore, and protect critical sawfish habitats.
Objective 4: Trade Limitation: Ensure awareness of and compliance with CITES Appendix I obligations and domestic trade regulations.
Objective 5: Strategic Research: Knowledge guides and underpins the development of operational fisheries management, species protection, and habitat conservation.

Goal B: Effective sawfish conservation and management enabled through capacity building, outreach, and fundraising.

Objective 6: Education and Communication: Increase societal awareness of, and interest in, sawfishes.
Objective 7: Responsible Husbandry: Ensure that captive sawfishes are handled, studied, displayed, and (where legal) transported according to the highest standards with a view to contributing to their recovery.
Objective 8: Sawfish Network: Grow and mobilize a coordinated, global group of engaged scientists, conservationists, fishers, aquarists, educators, government officials, and experts to play leadership roles in implementation of the Global Sawfish Conservation Strategy.
Objective 9: Fundraising: Ensure a continued stream of financial resources to ensure timely implementation of the actions included in this Global Sawfish Conservation Strategy.

WORKSHOP OUTPUTS

1. Monitoring of sharks and rays in Mozambican fisheries

A number of existing protocols and methods for monitoring shark and ray landings in both industrial and artisanal fisheries were presented to the workshop participants (Appendix V). A discussion session followed, in order to ascertain whether monitoring activities for sharks and rays are currently conducted by Instituto Nacional de Investigacao Pesceira (IIP) and how these activities might be improved or expanded through support from partner organizations.
It was noted that for all fisheries monitored by IIP, all species landed are required to be recorded. However, staff involved in collecting data on landings of artisanal fishers noted that sharks can be landed without their fins, which causes problems for identification. They also reported that some artisanal fishers believe that landing sharks is illegal, and may therefore hide shark carcasses from IIP staff.

Current status of monitoring of elasmobranchs in Mozambican fisheries
Although Mozambique has the highest recorded elasmobranch diversity in the southwestern Indian Ocean region (73 shark species and 35 ray species; reviewed by Kiszka et al. 2009), research on elasmobranchs in Mozambique has been limited and information on targeted and incidental captures of elasmobranchs in Mozambique's fisheries is scarce. There is a licensed demersal gill net fishery for deep water squalids and many industrial and artisanal fisheries catch elasmobranchs incidentally, particularly the shrimp trawler fleet (Kiszka and van der Elst 2015). National legislation has required the use of Bycatch Reduction Devices (BRD) in trawl fisheries since 2005 but this is currently not enforced (S. Fennessy pers. comm.). In addition, some artisanal fishers specifically target sharks using gill nets (Leeney in rev.) and other, ephemeral targeted fisheries for elasmobranchs may occur from time to time (Pierce et al. 2008), but the monitoring of such activities is difficult as authorities may not even be aware that such fisheries are taking place.
Sharks and rays landed by all artisanal and industrial fisheries are theoretically recorded by Instituto Nacional de Investigação Pesceira (IIP; the National Institute for Fisheries Research) staff. However, data collection does not occur at a broad spatial scale and not all chondrichthyans observed may be identified to species level. Workshop participants also noted that artisanal fishers may hide the sharks they have landed from IIP staff or may have already finned them, making identification difficult.

Recommendations for improving monitoring protocols for Mozambican fisheries
South Africa has produced a guide to aid in the identification of shark trunks (i.e. sharks landed without their fins). It may be useful to translate this guide into Portuguese and provide some training to IIP staff in its use, to improve the landings data collected for artisanal fisheries. Workshop participants expressed enthusiasm for training on shark and ray identification, and the provision of hard copy materials (i.e. identification guides or smart phone apps) to assist observers in identification, as means of ensuring that more detailed data are collected in the future by observers.

2. (a) Identification of threats to sawfishes in Mozambique

Threat: Artisanal fisheries.
Comments: Gill nets, trawls, longlines are all used by artisanal and subsistence fishers and all likely pose some threat to sawfishes, with gill nets being of greatest concern (Leeney 2015).

Threat: Industrial fishing
Comments: Both the bycatch of sawfishes and the presence of ghost nets are likely to impact sawfish populations. Whilst artisanal fishers, the majority (but not all) of whom tend to operate near the coast or within rivers, are more likely to encounter juvenile sawfishes, industrial fishing vessels operate offshore and thus are more likely to encounter sub-adult and adult sawfishes.

Threat: Habitat loss.
Comments: Mangrove loss is happening country-wide (although it may not be occurring at such serious levels as in other African nations – S. Nazerali and S. Bandeira pers. comm.). Gold mining in the Rio Save (Sofala province) may be causing erosion or otherwise negatively impacting freshwater and coastal environments (e.g., mercury poisoning).
Other human impacts on possible sawfish habitats include mangrove deforestation for cooking wood, charcoal production, construction of houses and boats and salt extraction; coastal development for aquaculture, and inland deforestation which may cause increased sedimentation in rivers.

Threat: Pollution
Comments: Plastic pollution is a threat to all marine wildlife off the Mozambican coast, as it is elsewhere. Oil exploration activities are taking place in northern Mozambican waters; the oil drilled in Mozambique is also refined there and thus there is an associated risks of oil spills. Fertilisation of farmland crops may also lead to run-off into freshwater environments.

Threat: Climate change
Comments: The changes that climate change will bring to Mozambique may include more extreme weather events such as flooding during the cyclone season, which in turn may cause loss of key sawfish habitats such as mangroves.

2. (b) Identification of constraints to implementing actions for the recovery and protection of sawfishes

Constraint: Lack of funding and resources
Comments: Currently there are limited or no resources specifically designated for sawfish conservation work at the level of government institutions.

Constraint: Availability of appropriately qualified personnel
Appropriately trained and qualified personnel, with local knowledge and an understanding of the legal framework, will be needed to monitor sawfishes and to implement and enforce relevant laws.

Constraint: Lack of communication and coordination amongst government agencies

Constraint: No current legislation regarding sawfishes
Sawfishes are not currently part of the National List of Protected Species in Mozambique and there are no specified catch limits within fisheries.

Constraint: Lack of enforcement capacity
There is insufficient staff (and possibly a lack of appropriately-trained staff) to enforce the requirements for fishing permits and, if legislation regarding sawfishes were to be introduced, to ensure that this legislation was being implemented.

Constraint: Limited access to internet and social media amongst some fisheries staff
This may limit their ability to connect with other researchers, report catches, ask questions and use of online resources.

Constraint: Misunderstandings or lack of information regarding existing laws related to protected species and fisheries
Some fishers believe that catching sawfishes or sharks in general is illegal. Better communication is required between on-the-ground fisheries staff and communities regarding existing legislation.

3. Recommendations for future efforts to conserve sawfishes in Mozambique

For each of the Global Objectives, national Targets– steps that describe what needs to be done to meet an Objective - were identified. These Targets bring national relevance to the Global Objectives. For each of these Targets, participants then made suggestions regarding possible activities – 'Actions' - which would be undertaken to meet each Target. Following this session, we revisited the list of suggested Actions and identified when, where and by whom each action would be undertaken. Where possible, we assessed the resources required to realize each Action, whether those resources were available, and whether the proposed Action was in fact locally feasible.
The results of this discussion session are presented in the following tables, with each set of suggested activities, with the proposed associated actors and timeframes, grouped under the relevant Global Objective. A list of agencies relevant to these activities and their abbreviations is found in Table 1.

Table 1. List of Agencies and Abbreviations

Agency	**Abbreviation**
National Administration of Fisheries	ADNAP
National Administration of Conservation of Areas	ANAC
Blue Ventures	BV
Fishers' Community Cooperative	CCP
Institute for the Development of Small-scale Fisheries	IDPPE
Indian Ocean Tuna Commission	IOTC
Instituto Nacional de Investigacao Pesceira	IIP
Ministry of the Earth, Environment and Rural Development	MITADER
Marine Megafauna Foundation	MMF
Protect Africa's Sawfishes	P.A.S
World Wildlife Fund-CARE	WWF-CARE

Objective 1: Reduce interactions with fisheries; increase survival; improve reporting of sawfish			
Target	**Action**	**Who, where?**	**Proposed time frame**
Address bycatch in industrial trawl fisheries	Develop Sawfish excluder device 'SED'?	Research will likely be undertaken by parties potentially conducting experiments to determine if this is feasible (e.g. Australia or USA). Commercial fishing gear experiments have been discussed with biologists in USA but no research has yet been implemented.	n/a
	Implement shark and ray bycatch monitoring program in industrial trawl fisheries and collect data on sawfish catches	IIP already has a monitoring program in place, but the scope of the program and training for observers needs to be improved. There is the possible involvement by P.A.S. and training by Regional Fishery Management Organizations (e.g. IOTC)	2016
Address bycatch and directed take by artisanal fishers	Training and sensitisation of fishers regarding need to protect sawfishes and release any sawfish captured	IIP/ IDPPE/ ADNAP is to work with Presidents of CCPs to sensitize and educate fishers (IIP will review report and advise ADNAP. Each group will advise the next group within the chain of command)	2016-2017
		Increase public announcements (e.g. radio) of the need to protect/ release sawfishes	2016
	Identification of critical habitats (nursery areas, feeding areas etc.) to focus fisheries management in those areas	This will necessarily be one of the focuses of future research on sawfish in Mozambique (likely conducted by P.A.S.)	Ongoing
	Change artisanal gears used; gill net buyback Prohibit use of nets/ close certain areas to fishing	These are complex actions that will require considerable community sensitisation and a community consultation phase. P.A.S. plan to undertake such activities once key sawfish habitats have been identified	2016-2017

Address bycatch and directed take by artisanal fishers (contd.)	Develop alternate livelihoods, e.g.: - Ecotourism lodges that provide income to locals that help protect the habitat – social responsibility - Recreational fishing - Specialize catch and release sawfish fishing programs? - Bee-keeping (already exists in some areas) - Smoke houses (smoking fish increases its value and increases ability to transport to markets further away) - Non-destructive aquaculture (e.g. bivalves grown on platforms, crab farming)	This is a complex action that will take place in the future. Probably the responsibility of whatever research and development group (NGO/ researchers) is working in each specific sawfish habitat, in collaboration with appropriate government institutions. Potential partners: P.A.S., WWF-CARE, MMF	Ongoing

Objective 2: Ensure protection of sawfish			
Target	**Action**	**Who, where?**	**Time frame**
Encourage government to impose regulations	Provide government with local data on sawfishes (and recommendations regarding appropriate legislation/ management activities)	Data have been provided to government via P.A.S.'s final report and this workshop report. There is a current restructuring of agriculture and fisheries institutions and the decision of which institution that will take the lead on developing sawfish conservation is to be determined. The development of a law would probably go through Ministry of Sea, Inland waters and Fisheries.	Information transfer: completed. Development of legislation: 2016?
	The insertion of sawfishes into existing National List of Protected Species *	Ministry of Fisheries/ MITADER/ ADNAP	2016-2017
	Training of government staff to ensure any future laws are implemented	The Ministry of Fisheries will be responsible but implementation is through the National Fisheries Inspection Department.	After the development of sawfish legislation
Increase awareness amongst communities of sawfishes and of laws relating to sawfishes	Sensitise fishing communities about new law regarding sawfishes. Some primary schools already provide education on conservation laws - Make certain sawfish are included	ANAC is responsible authority and would work through IDPPE	After the development of sawfish legislation
		P.A.S. will be developing a community education and sensitisation program in areas where sawfish populations are identified	2016-2017

* ANAC - National Administration of Conservation of Areas – is currently considering adding whale sharks and manta rays to a list of protected species which includes dugongs and sea turtles. There may therefore be the possibility of also adding sawfishes.

Objective 3: Regional plans to protect sawfish habitat			
Target	**Action**	**Who, where?**	**Time frame**
Identify habitats where sawfishes are present	Research to identify areas where sawfishes are present: - Interview surveys have already been completed by P.A.S. - Catch monitoring by IIP, in collaboration with P.A.S. - Sampling of habitats (planned for 2016)	P.A.S., in collaboration with IIP. University of Lurio is working with IIP to monitor sharks and rays in Cabo Delgado, using a smart phone application which will link in with IIP database	Ongoing
	Research to identify threats to those habitats	P.A.S., in collaboration with IIP	Ongoing
Develop plans to protect habitats	Pass information on the distribution of sawfishes, and key habitats in Mozambique, to relevant government authorities and provide recommendations for how best to protect these habitats	P.A.S. will provide all information collected on sawfish habitats to ANAC, IIP and ADNAP.	Ongoing
	Encourage monitoring of habitats in areas where none exists: - Public posters to encourage reporting of sawfish catches - Sensitisation of fishers through CCPs	P.A.S., in collaboration with field staff from IIP and IDPPE. Sensitization of communities for reporting sawfish catches ADNAP → IDPPE	Ongoing
	Sensitize high levels of IIP and central government (via P.A.S. baseline report on sawfishes and future meetings/ workshops) and encourage higher-level managers to provide training in monitoring techniques for local staff in regions where sawfish populations are present	P.A.S. will collaborate with IIP to communicate results and provide recommendations to appropriate government institutions	From 2016
	Community-based management may be appropriate in remote areas. This would be effected through consultation with community leaders, focus groups, training and education programs	P.A.S. may employ these techniques in identified sawfish habitats	Ongoing
	If sawfishes are confirmed to be present in an area where management plans already exist, integrate sawfishes into those plans	ADNAP in collaboration with local district authorities and NGOs will be responsible for adding sawfish to any existing habitat management plans, this is a function of the habitat. E.g. Primeiras and Segundas Protected Area: WWF-CARE and local authorities.	To be determined

Objective 4: Awareness and compliance with CITES			
Target	**Action**	**Who, where?**	**Time frame**
Improve government awareness of CITES legislation and its implications, at top tier level	Workshops for top tier level government staff	Workshops should be organised by local government CITES staff. MITADER is currently responsible for CITES but this could change in the future. Workshops would be relevant to MITADER, IIP and Customs staff	Immediate
	Production and dissemination of information materials (identification guides for products from CITES-listed species) to Fisheries and Customs staff at all levels, but particularly those dealing directly with fish landings and exports	CITES. This report provides initial information on sawfishes as CITES-listed species	Immediate
Ensure dissemination of information on CITES legislation throughout government organizations to all levels	Guarantee all individuals in the information dissemination process are properly trained	CITES/ MITADER	2016
	Identify all government personnel for whom information on CITES regulations is pertinent	CITES/ MITADER	2016
Improve communication between the public and government, to improve public awareness and understanding of CITES	Identify all public sectors for whom information on CITES regulations is pertinent	CITES/ MITADER	2016
	Include information on CITES-listed species and CITES regulations in community environmental education programs	MITADER should oversee this but will work with ANAC, CCPs Ministry of Education. Possibly also universities/ NGOs	Immediate

Objective 5: Research to guide management			
Target	**Action**	**Who, where?**	**Time frame**
Research data on sawfish populations in Mozambique	Identify key habitats e.g. nursery areas, through interviews (completed 2014) followed by sampling (scientific fishing) and tagging	Baseline data has been collected (Leeney 2015) P.A.S. in collaboration with IIP, IDPPE	2016-2017
	Encourage communities to report catches. Sensitize top tier persons within regional government offices (IIP and IDPPE) and communities, and ensure information is disseminated throughout the communities	P.A.S. will work with and take actions through CCPs. CCPs represent local fishers and information will likely be accepted more if coming from like-minded individuals	2016 onwards
	Develop smart phone app to collect additional data	University of Lurio and BV in collaboration with IIP are already working in Cabo Delgado. Can this be expanded to other provinces?	2016 onwards
Research data on the socio-economic importance of sawfishes to fishing communities	Carry out interview surveys to assess the socio-economic value of sawfishes, in communities adjacent to confirmed sawfish habitats	P.A.S. in collaboration with IIP, IDPPE	2016-2017
Data on constraints to management and conservation of sawfishes	Collection of observational data during sampling and socio-economic surveys in communities adjacent to sawfish habitats. Interviews with CCP presidents, local IDPPE and IIP staff to assess their perceptions of the likely challenges facing sawfish conservation in their area	P.A.S. in collaboration with IIP, IDPPE	2016-2017

Objective 6: Effective communication and capacity building for sawfish conservation			
Target	**Action**	**Who, where?**	**Time frame**
Popularize sawfish	Use local media – updates on sawfish research and sawfish-related activities in newspapers and on local radio stations	P.A.S. in collaboration with IIP, IDPPE, CCPs, MMF	2016
	Create short education film where sawfish are present, interviewing fishers and discussing sawfish to increase public awareness	P.A.S.	2016
	Book/ other educational materials to be distributed to schools, CCPs and community members in key sawfish areas.	P.A.S.	2016
Incorporate sawfishes into environmental education programs at elementary schools	Create educational materials on sawfishes. Train local teachers and MMF staff to use these materials	P.A.S. in collaboration with MMF	2016

Objective 7: Responsible husbandry
This objective is not relevant to Mozambique, since there are no aquaria in the country.

Objective 8: Develop sawfish network of scientists, industry, NGOs, government representatives			
Target	**Action**	**Who, where?**	**Time frame**
Creation of a database of all stakeholders involved in sawfish or mangrove research	To be determined (does TRAFFIC/ WWF/ IIP have existing list?)	To be determined	Immediate
Improve communication amongst stakeholders	Generate an email list or facebook page to facilitate reporting of sawfish catches, provision of information to on-the-ground teams and sharing updates on sawfish research and activities in Mozambique	This activity is already underway but local players in Mozambique need to be encouraged to use these avenues of communication. However, there is a lack of access to social media/ internet in remote areas. P.A.S. will encourage local stakeholders to use these channels of communication, where possible	Ongoing

Objective 9: Ensure funds are available			
Target	**Action**	**Who, where?**	**Time frame**
Identify possible funders and apply for funding	e.g. Mozambique Biofund - funds multiple projects most practical applications	P.A.S. in collaboration with local actors	Ongoing
Increase public awareness of the plight of sawfish especially to individuals that have philanthropic institutions	Communicate with media regarding ongoing sawfish work and future needs	P.A.S.	
Develop a National Sawfish Conservation Fund	Fund could potentially be developed with donations from petroleum companies, game fishing companies, mining companies etc. and could be used to determine if their activities impact sawfish/ sawfish habitats	Mozambican government. This may not be immediately feasible as it will depend on the pressure imposed by the Mozambican government on potential developers to contribute to such a fund	Ongoing

NEXT STEPS

This report provides a series of recommendations for potential activities that can be undertaken by the Mozambican government, research institutions and non-governmental organizations to improve the status of sawfishes in Mozambique. Certainly, not all of these activities will be feasible, and a final strategy should be developed through further consultation with government and stakeholders. It is hoped that the process to develop a National Sawfish Conservation Strategy will move forward in 2016 and that the various governmental partners will take pride in developing and implementing the first formal National Sawfish Conservation Strategy for any African nation.

Continued engagement by the workshop participants, their institutions and the other governmental organizations dealing with fisheries and conservation in Mozambique will greatly advance post-workshop efforts and help with implementing the recommendations drawn up during this meeting.

Future fieldwork in other western Indian Ocean countries (e.g. Tanzania, Madagascar, Kenya) is needed to investigate whether additional sawfish populations exist in the region. This could lead to a regional approach to sawfish conservation and the development of a Regional Sawfish Conservation Strategy for the western Indian Ocean, in the same vein as the development of the Sub-Regional Plan of Action for the Conservation and Management of Sharks by West African countries (Diop and Dossa 2011).

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Section 7.3.1, pg. 56.

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APPENDICES

Appendix I: Workshop agenda

Day 1 – Thursday, 27th August 2015

08:30 – 08:45 Welcome and introduction
08:45 – 09:45 Introduction to sawfishes – biology, ecology, conservation status, threats (Dr. John Carlson, NOAA Fisheries, USA)
09:30 – 10:30 Sawfish conservation efforts in other parts of the world (Dr. Ruth Leeney, Protect Africa's Sawfishes)
10:30 – 11:00 Coffee break
11:00 – 12:00 Sawfishes in Mozambique – a summary of the findings of baseline data collection (Dr. Ruth Leeney)
12:00 – 12:30 Sawfish handling and release techniques (Dr. John Carlson, NOAA Fisheries, USA)
12:30 – 13:00 Questions
13:00 – 14:00 Lunch break
14:00 – 14:30 The Primeiras and Segundas management plan (Sean Nazerali, consultant for WWF)
14:30 - 15:30 Developing a shark and ray monitoring system for Mozambique (Dr. John Carlson, Dr. Ruth Leeney and João Paulo Macuio)
15:30 – 16:00 Coffee break
16:00 - 17:00 Discussion on developing a shark and ray monitoring system for Mozambique

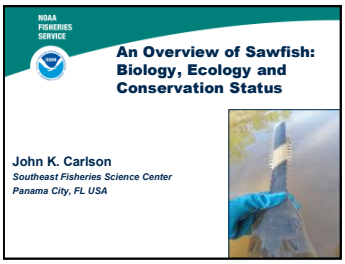
Day 2 - 28th August 2015

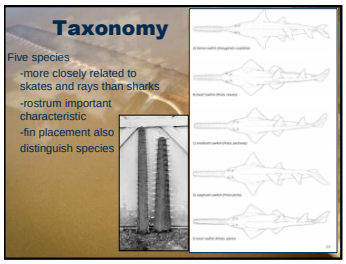
08:30 – 09:00 Introduction/ review of yesterday's topics
09:00 – 10:00 Training presentation: Identifying CITES-listed sharks and rays (Debra Abercrombie, Abercrombie and Fish/ Pew Charitable Trusts)
10:00 – 10:30 Coffee break
10:30 – 11:00 Introduction to the IUCN's Global Sawfish Conservation Strategy (Dr. Ruth Leeney)
11:00 - 12:30 Discussion groups – Making the Global Sawfish Conservation Strategy relevant in Mozambique
12:30 – 13:30 Lunch break
13:30 – 16:00 Continue discussion groups and developing a set of recommendations for the development of a National Sawfish Conservation Strategy
16:00 – 16:30 Coffee break
16:30 – 17:30 Conclusions – discussion of recommendations for the development of a National Sawfish Conservation Strategy

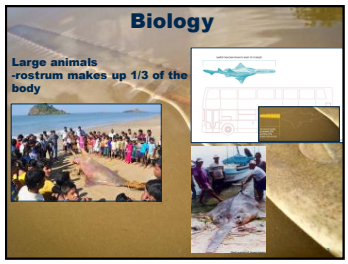
Appendix II: List of attendees

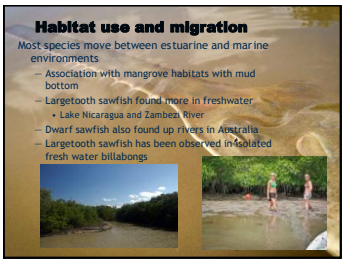
Name	Affiliation
Debra Abercrombie	Abercrombie and Fish (consultancy)
Carlota Amoda	IIP, Zambezia province
Salomao Bandeira	University of Eduardo Mondlane
Alice Costa Pires	TRAFFIC
John Carlson	NOAA Fisheries Service
Antonio Felix Coyo	IIP, Maputo
Stela Fernando	IIP, Maputo
Sergio Jose	IIP, Cabo Delgado province
Ruth Leeney	Protect Africa's Sawfishes
Gary Lowman	US Embassy
João Paolo Macuio	University of Lurio
Adriano Manjato	IIP, Maputo
Ricardina Matasse	PNAB-ANAC
Rui Muitombene	IIP, Maputo
Sean Nazerali	Independent consultant
Emildo Notisso	IIP, Inhambane province
Frazao Omar	IIP, Sofala province
Pedro Pires	IIP, Maputo
Celso Inacio Sardinha	University of Eduardo Mondlane/ Maputo Natural History Museum
Antonio Sitoe	IIP, Maputo
Dionisio Varela	IIP, Zambezia province
Francisco Zivane	IIP, Gaza province

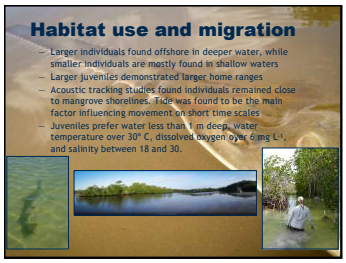
Appendix III: Presentation
An Overview of Sawfish-Biology, Ecology and Conservation Status

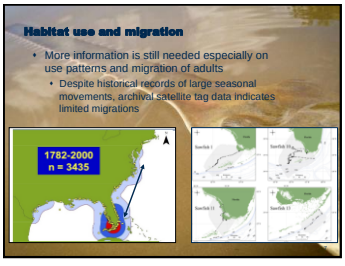


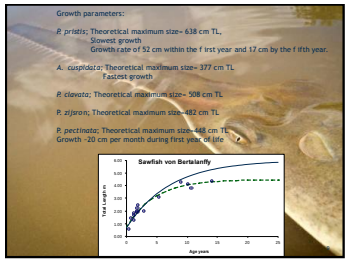


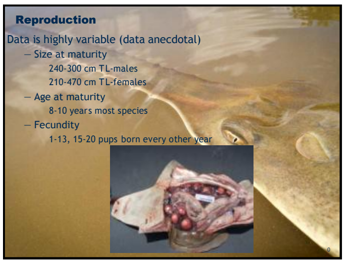


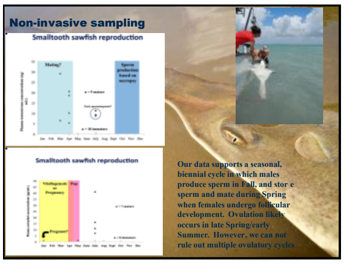


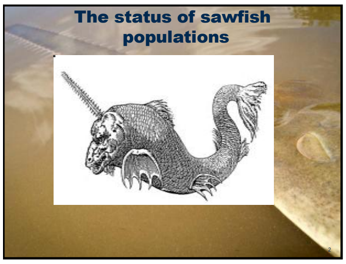


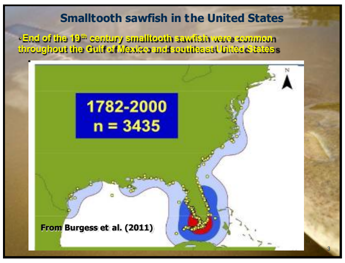


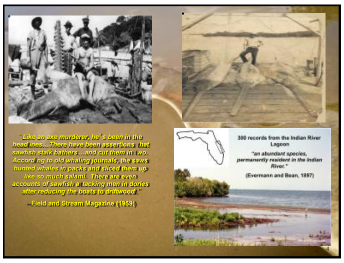


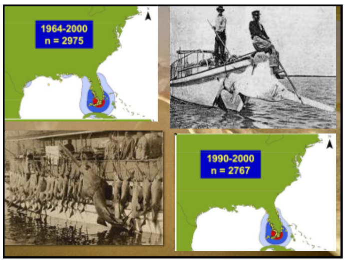

Reproduction
Data is highly variable (data anecdotal)
– Size at maturity
240-300 cm TL-males
210-470 cm TL-females
– Age at maturity
8-10 years most species
– Fecundity
1-13, 15-20 pups born every other year


Non-invasive sampling
Smalltooth sawfish reproduction
Smalltooth sawfish reproduction
Our data supports a seasonal, biennial cycle in which males produce sperm in Fall, and stor e sperm and mate during Spring when females undergo follicular development. Ovulation likely occurs in late Spring/early Summer. However, we can not rule out multiple ovulatory cycles

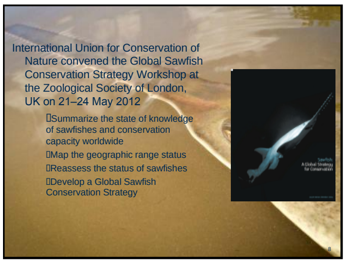

The status of sawfish populations

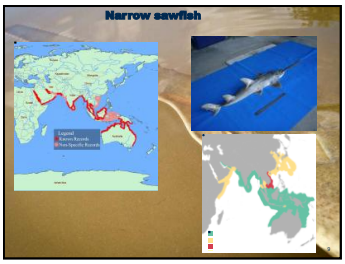

Smalltooth sawfish in the United States
End of the 19th century smalltooth sawfish were common throughout the Gulf of Mexico and southeast United States
1782-2000
n = 3435
From Burgess et al. (2011)


"Like an axe murderer, he's been in the head ines…There have been assertions hat sawfish stalk bathers…and cut them in wo. Accord ng to old whaling journals, the saws hunted whales in packs and sliced them up like so much salami. There are even accounts of sawfish a tacking men in dories after reducing the boats to driftwood."
-Field and Stream Magazine (1959)
300 records from the Indian River Lagoon
"an abundant species, permanently resident in the Indian River."
(Evermann and Bean, 1897)

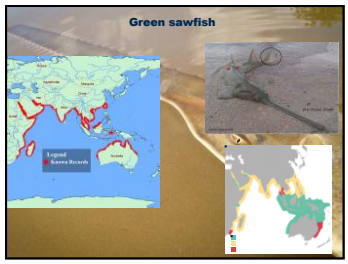

1964-2000
n = 2975
1990-2000
n = 2767

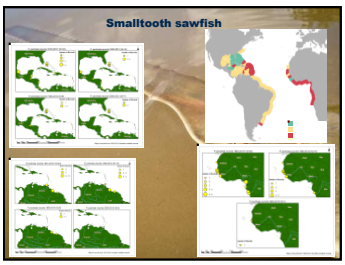

Where have the Sawfish gone??
Habitat Loss
Fishing Mortality


International Union for Conservation of Nature convened the Global Sawfish Conservation Strategy Workshop at the Zoological Society of London, UK on 21–24 May 2012
Summarize the state of knowledge of sawfishes and conservation capacity worldwide
Map the geographic range status
Reassess the status of sawfishes
Develop a Global Sawfish Conservation Strategy
Sawfish
A Global Strategy for Conservation

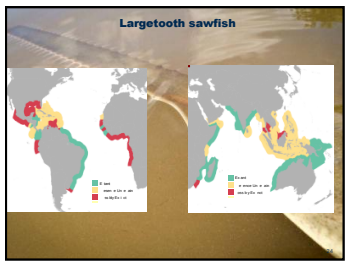

Narrow sawfish

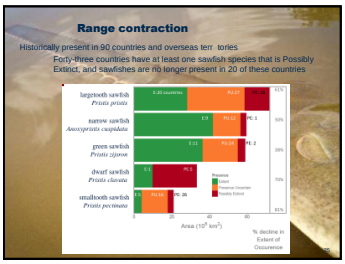

Dwarf sawfish
Range now restricted to Australia
Kimberly terr tory and Pilbara
region (western Australia) may
be the last significant
remaining areas


Green sawfish


Smalltooth sawfish

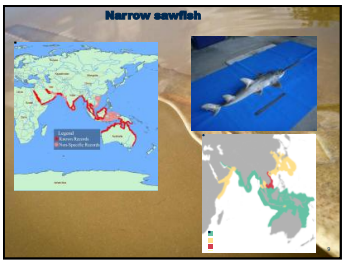

Largetooth sawfish


Largetooth sawfish


Range contraction
Historically present in 90 countries and overseas terr tories
Forty-three countries have at least one sawfish species that is Possibly
Extinct, and sawfishes are no longer present in 20 of these countries
largetooth sawfish
Pristis pristis
narrow sawfish
Anoxypristis cuspidata
green sawfish
Pristis zijsron
dwarf sawfish
Pristis clavata
smalltooth sawfish
Pristis pectinata
Area (10³ km²)
% decline in
Extent of
Occurrence


Issues
Juvenile sawfish utilize mangroves as nurseries


At least 20% of the area of mangrove forests has
been lost in the past two decades, losses that
exceed those for tropical rain forests and coral
reefs (Valiela et al., 2001)
Adequate protection of remaining areas will be
essential


Narrow sawfish


Dwarf sawfish
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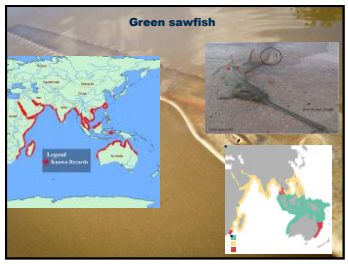
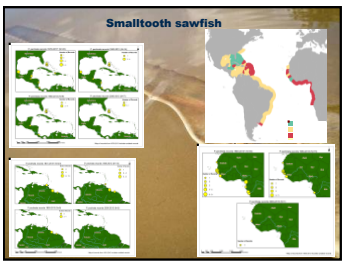
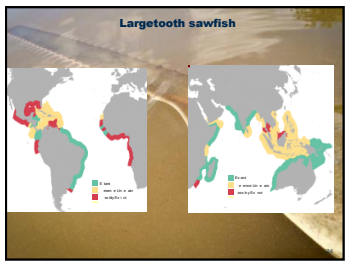
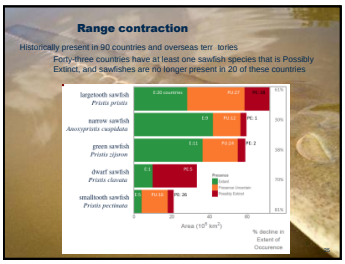

Green sawfish


Smalltooth sawfish


Largetooth sawfish


Largetooth sawfish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Area (10³ km²)
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Issues
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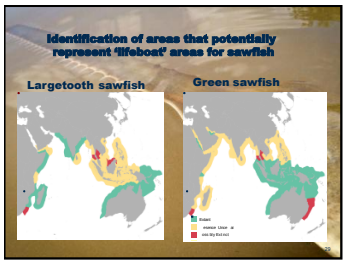
At least 20% of the area of mangrove forests has
been lost in the past two decades, losses that
exceed those for tropical rain forests and coral
reefs (Valiela et al., 2001)
Adequate protection of remaining areas will be
essential


Several nations have recognized the urgent need for conservation action for sawfishes
International commercial trade in sawfish has been banned through the listing of all species on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
Sawfishes were listed on Appendix I under the Convention on Migratory Species (CMS) Appendices in 2014


Identification of areas that potentially represent 'lifeboat' areas for sawfish
Largetooth sawfish
Green sawfish


What sawfish conservation progress has been made?
Public awareness of the plight of sawfishes
Education to fisherman (safe release guidelines)
Recovery is most likely to occur under a coordinated conservation-planning regime that shares the lessons learned, particularly from regions where declines have been stemmed to areas of priority need

Appendix IV: Presentation
Sawfishes in Africa – the race against extinction

Sawfishes in Africa – the race against extinction

Ruth H. Leeney
Protect Africa's Sawfishes

Introduction

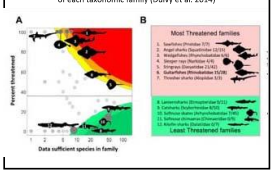
- Atlantic: Largetooth sawfish (*Pristis pristis*) and smalltooth sawfish (*P. pectinata*)
- Indo-Pacific: *P. pristis*, *P. zijsron*, *P. clavata*, *Anoxypristis cuspidata*
- Dramatic decline in sawfishes throughout Africa
- Likely extinct throughout much of their historical range

Broader decline....

- 1014 chondrichthyan species
- 25% of all sharks & rays threatened with extinction
- Larger species inhabiting shallower/ coastal waters are most at risk
- Sawfishes, guitarfishes, other batoids

- Dulvy et al. 2014. Extinction risk and conservation of the world's sharks and rays

Proportion of threatened data sufficient species and the richness of each taxonomic family (Dulvy et al. 2014)



Threats to sawfishes (globally):

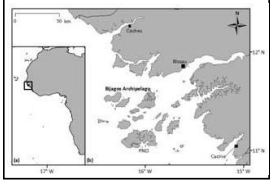
Cultural importance

- West Africa – sawfishes have long been important
- Symbol of strength, power, protect house & inhabitants
- Cultural significance should be integral to conservation/ management actions

Fishers' Ecological Knowledge of sawfishes in Guinea-Bissau

Fishers Ecological Knowledge (FEK) – valuable baseline data, insights into local attitudes & culture

Guinea-Bissau



Methods

- Training of interviewers
- Discussion & development of questionnaire

- Initial day of questionnaires; feedback
- Further 4 days of interviews in Orango National Park; 2-3 days in North & South; 2 days in Bissau
- Some focal interviews with village chiefs

- Type of net(s) used
- Recognise image of sawfish?
- Local name for sawfish
- Ever seen a sawfish, dead or alive? If yes, when most recently?
- Where sawfish were seen
- Noticed a change in sawfish numbers?
- What might be the cause of this change?
- Local cultural beliefs/ practices relating to sawfish?
- Describe any ceremonies?
- Age of interviewee

Results

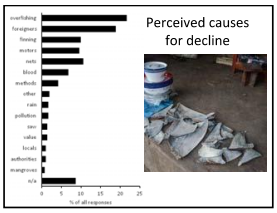
- 274 interviews
→~6.6% of Bissau-Guinean artisanal fishing community

- 15% of respondents could not identify a sawfish from the image, or had heard of them but never seen one
- Of these 41 individuals, 76% were aged 39 or younger
- 19-22 (born in 1990s): 83% had never seen or could not identify a sawfish
- 23-32 (born in 1980s): 45%
- 33-42 (born in 1970s): 14%

Most recent observations & catches

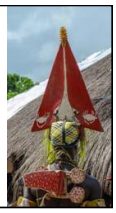
- **Orango National park**: 1980s (53%)
  Only a single respondent claimed to have seen a sawfish after 2000.
- **Bissau**: many did not recognize the sawfish or had never seen one
- **North**: 1980s (31%) or 1990s (24%)
  Only 16% claimed to have seen a sawfish since 2000.
- **South**: majority of respondents placed last sighting in the 1980s or 1990s
  but 30% of respondents (n=25) claimed to have seen a sawfish since 2000, and 10 of these respondents said their last sighting occurred in 2010 or later

Perceived causes for decline



Cultural importance

- Sawfish are only culturally important on the Bijagos; in other areas, they are simply a source of food
- Important part of ceremonies – *fanado*
- Traditional dish – *catoré*
- Sawfish headdresses/ masks



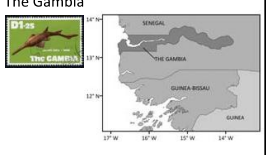
Recent sightings

Ten respondents in the south claimed to have seen a sawfish in 2010 or more recently, of which nine provided details of the area where they last saw or used to see this species

Conclusions

- Sawfishes are probably still present in Bissau-Guinean waters
- Important to the Bijago culture – this significance could be used to support conservation & management actions
- Nets, increased fishing pressure, finning may have contributed to decline
- Immediate action required to find & protect habitats
- Collaboration with fishing communities will be essential but likely not sufficient
- Conservation of sawfishes will also contribute to the conservation of a unique West African culture

The Gambia



A Swedish study (Svensson, 1933) carried out in the 1930s suggested that sawfishes were plentiful in Gambian waters:

'This sawfish is common in the river at all seasons. . . . [I]t was [also] caught in remarkably great numbers, just at the mouths of creeks. It is known by the natives in all parts of the river in the Gambia.'

'The obtained specimens range from 760 to 960 mm in total length. The native fishermen state that small specimens, about 200 mm. in length, were often seen in the dry season. . . . Budgett (1899a) obtained specimens 9 feet (about 2740 mm.) in length in the Gambia river at Niani Maru...'

Gambia River study, 1974/75

Some findings:

- 44 *P. pristis* caught at Niani Maru in 1975
- Rostrum length, n rostral teeth, (total length) collected from 64 individuals
- Total length of juveniles (n=16) ranged between 83 cm and 92.4 cm
- Sawfishes were caught infrequently as far upriver as Baitilaye
- Two adult females caught: 5.6 m (Niani Maru); 5.1 m with 15 pups (Kartong)

Interviews in The Gambia, 2014

- 30 interviews, 13 sites
- Local names for sawfish: *Bio*, *biga*, *sang*, *djasan*, *dakonang*, *anyande*, *ngalo*….
- 6 had never seen a sawfish
- 42% had last seen sawfish ~20 years ago
- 8 had seen sawfish in last 5 years
- Primary perceived cause of decline - increased use of nets

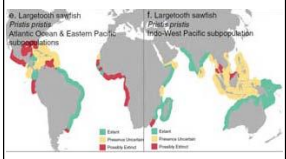
Conclusions

- The Gambia River was a key habitat for freshwater sawfish
- The species is likely extinct now in this region
- Probably due to multiple causes including commercial demersal trawl fisheries in Gambia estuary, dedicated shark fisheries in 1960s, transition from traditional gear to longlines & monofilament, shark fin industry
- 'Shifting baseline' over 40 years

West Africa

- Sawfishes are on Senegal's national list of protected species – all fishing and sale of sawfishes prohibited in EEZ
- Sawfishes are protected in Guinean waters
- Research is ongoing in Sierra Leone, The Gambia, Senegal and Guinea-Bissau

Global range of largetooth sawfish *Pristis pristis*



From Dulvy et al. (2014) Ghosts of the coast: Global extinction risk and conservation of sawfishes.

Global range of green sawfish *Pristis zijsron*

Appendix V: Presentation
Sawfish in Mozambique 2014-a baseline assessment

Sawfish in Mozambique 2014

- a baseline assessment

Are endangered sawfish still present in Mozambique?
- A baseline study

- At least two species of sawfish, the largetooth sawfish (*Pristis pristis*) and the green sawfish (*P. zijsron*) formerly inhabited the western Indo-Pacific Ocean

Do sawfish *Pristis* spp. represent South Africa's first local extirpation of marine elasmobranchs in the modern era?

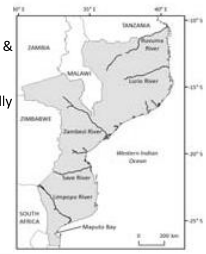
Historical records of sawfishes

- Livingstone (1858-1864) *'in the mouth of the river many sawfish are found…. The saw is from a foot to eighteen inches long. We never heard of anyone being wounded by this fish, nor, though it goes many hundreds of miles up the river in fresh water, could we learn that it was eaten by the people'*
- Wallace (1967) - specimen of *Pristis microdon '8 ft 4 in in length was captured in the Zambesi River approximately 60 miles from the sea, where the species appears to be common'*

Research & sensitisation in 2014

- Interviews in collaboration with IIP
- Training of IIP staff in data collection on sawfishes
- Sawfish rostra
- Sawfish monitoring kits
- Posters – encouraging reporting of sawfish catches

Focus on probable & known historical habitats for sawfishes, especially river mouths



Interview questions

- Village, age, profession, years experience
- Type of fishing gear
- Recognise sawfish image →
- When was the last time?
- Where did you see it?
- Decline? Reasons?
- Uses of sawfish
- Do you have a sawfish rostrum?

Results

- 201 interviews completed at 38 sites
- All male interviewees
- Artisanal fishers (n=157), industrial and semi-industrial fishers (n=24), fish traders and processors (n=6), IIP monitoring staff (n=11), sport fishing operators (2); (no ans: n=1)

Local names for sawfishes

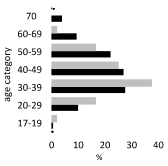
Region	Local names
Maputo	Mbilu; salipanga
Gaza province	None
Inhambane province	Salpanga/ saropanga
Sofala province	Sarrapanga
Zambezia province	Piilu/ biilu; cachão/ cação
Nampula province	Piilu/ mpiilu/ mbilu; salipanga
Cabo Delgado province	Mbiru/ mpiru; papapanga/ papopanga; nzirué; nsungi/ papa nsungi

Summary of results: Interviews 2014

- 76% of interviewees (n 151) had seen a sawfish at least once
- 50 interviewees had never seen a sawfish

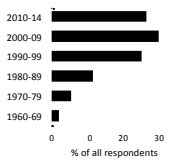
→ Included individuals of almos all age categories (black bars)

- Proportions of individuals who had not seen a sawfish (grey bars) were greater in the three youngest age categories (17-39 years old)



Reported last sightings of sawfishes, as % of all interviewees

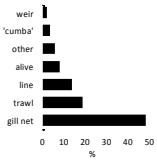
- 148 respondents provided a date for their most recent sawfish observation
- 30% said their observation occurred between 2000 and 2009
- 26% between 2010 and 2014
- 9 observations of sawfishes were reported from 2014

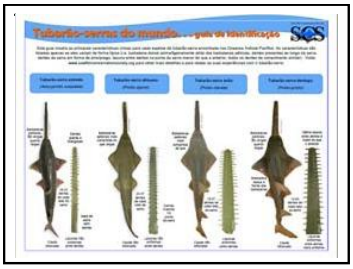


- The most recent reports of sawfish catches were last week, provided by two fishermen, both of whom were interviewed in mid-June (2014).
- Two sites were identified where recent catches of sawfish (in 2014) were reported to occur. At both sites, the fishermen interviewed were able to show the interview team rostral from sawfish they had caught.

The gear types with which sawfish were caught (most recent sighting)

- Gill net (48% of responses)
- Trawl nets (industrial & artisanal trawl nets; 19%)
- 19 interviewees worked on industrial or semi-industrial shrimp trawlers
- 16 had seen sawfishes; 10 said the last sawfish they saw was caught by a semi-industrial/ industrial trawl net





Identifying sawfish species from rostra

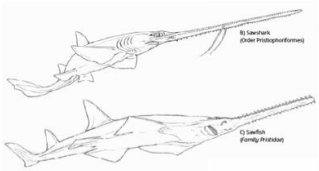
Largetooth sawfish
Pristis pristis

Green sawfish
Pristis zijsron

Monitoring sawfishes in trawl fisheries

- Saw sharks (image below) are sometimes caught in trawl fisheries in Mozambique
- These should not be confused with sawfishes!
- Saw sharks only grow up to 2 m in length, and are true sharks with gill slits on the sides of their bodies. Sawfishes are more closely related to rays, and have gill slits on the ventral surface of their bodies

Sawfish or saw shark?



Conclusions (1)

- First systematic study on the distribution, exploitation and status of sawfishes in Mozambique
- Sawfishes still encountered by both industrial and artisanal fishers
- 26% of interviewees had seen or caught a sawfish between 2010 and 2014

→ Compare with Guinea-Bissau only 12% of respondents reported sightings of sawfishes between 2005 & 2012

→ This suggests that sawfishes are more commonly encountered in Mozambique

Conclusions (2)

- Observations/ catches in all coastal provinces
- Presence of largetooth sawfish rostra alongside reports of recent captures supports the idea that sawfishes are still present in Mozambique
- Sawfishes provide source of food, as well as saleable commodities – primarily fin but also the flesh – for fishing communities
- Gill nets & trawl nets catch sawfishes
- Other possible threats – mangrove deforestation, shark fin industry, other?

Conclusions (3)

- More work urgently needed in Mozambique
  - Locate remaining sawfish habitats (sampling)
  - Assess local threats
  - Work with communities to protect sawfishes
  - Work with government to create legislation
- Research on local sawfish biology & ecology
- How will we conserve sawfishes in Mozambican waters?

→ Challenges include IUU fishing, lack of reporting, lack of internal capacity for monitoring or enforcement; alternative livelihoods may be necessary for fishers

Muito obrigada!

IIP: Dr. Paula Santana Afonso Sr. Acurcio Luis Anselmo Eduardo Avene Osvaldo Chacate Alice Inaçio Eurico Pereira Morias Daniel Mualeque Afonso Munduze Rui Mutombene Martinho Padeira José Vilanculo and Francisco Zivane

IDPPE: Ernesto Poiosse

MMF: Libby Bowles Andrea Marshall Simon Pierce Clare Prebble

E tambem:

Cremildo Armando Simon Chitsenga and Abu Junior (WWF-CARE); Valdemiro Muhala (UEM Quelimane) Prof. Almeida Guissamulo (UEM) Karen Allen (EWT) Nick Dulvy (IUCN SSG) David Obura (CORDIO)

Peter Bechtel Fern Breslaw John Carlson Alice Costa Eleanor Fox Ruth Higgins Prof. Anildo Naftal Sean Nazerali Larry Routledge Elizabeth Stephenson Yara Tibirica Simon Wearne Jeff Whitty

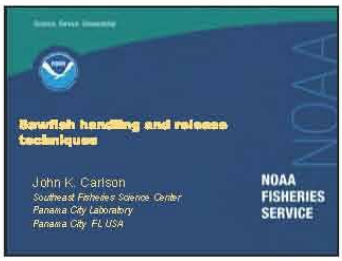
Work in Guinea-Bissau was funded by Noé Conservation.

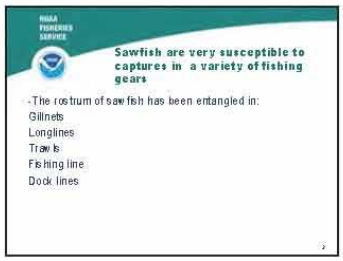
Work in The Gambia (2014) was funded by the Mohammed Bin Zayed Species Conservation Fund.

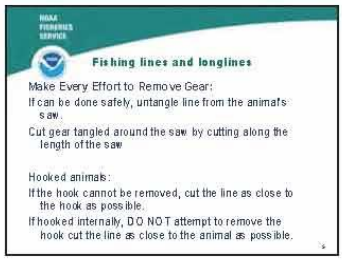
Research in Mozambique was funded by the New England Aquarium's Marine Conservation Action Fund, the Rufford Foundation and the Shark Foundation and is supported by the Marine Megafauna Foundation.

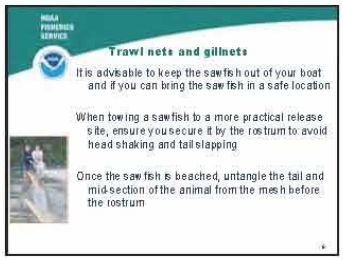
www.facebook.com/ProtectAfricasSawfishes

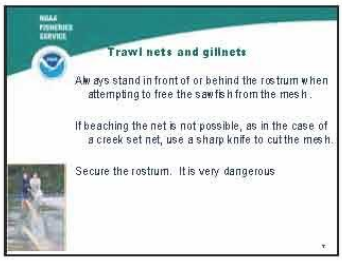
Appendix VI: Presentation
Sawfish handling and release techniques

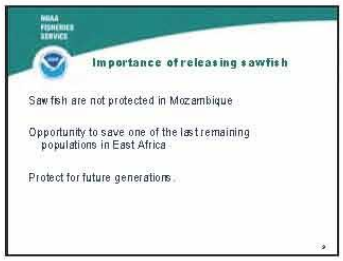




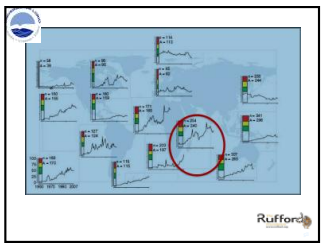


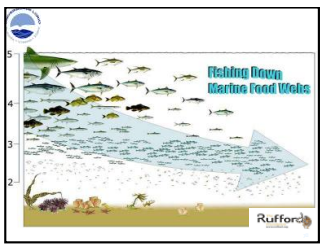


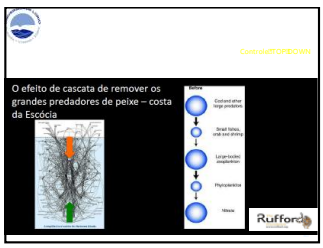




Appendix VII: Presentation
Conservação e gestão de tubarões cinzentos de recife, no Oceano Índico ocidental (WIO), através de acções colaborativas entre comunidade científica e as comunidades locais







Conservação e gestão de tubarões cinzentos de recife, no Oceano Índico ocidental (WIO), através de acções colaborativas entre comunidade científica e as comunidades locais

Objectivos do Projecto

(i) Conhecer os padrões de movimento e residência dos tubarões cinzentos no local chamado Neptunes através de telemetria acústica passiva

(ii) Capacitar um estudante moçambicano em telemetria acústica e maneio de tubarões, e interagir com as comunidades

Objectivos do Projecto

(iii) produzir um vídeo em Swahili/Portugês sobre o valor económico e ecológico destas espécies de peixes ameaçadas de extinção

(iv) Realização dum workshop regional para discutir as estratégias de conservação dos tubarões

As ferramentas

Telemetria acústica

Telemetria acústica

- Monitores no fundo colocados em posições chave ao longo de recifes Exteriores e interiores
- Transmissores acústicos colocados nos animais de Estudo
- Cobertura 24hrs/dia, 365 dias/ano até 20 anos

Técnica de Pesca - Pesca "Polyball"

- Uma linha é posta à deriva – com uma profundidade máxima de 30m
- Fio de metal de alta resistência com um anzol circular de 19/0 iscado
- Os tubarões são puxados para o barco e process[illegible]

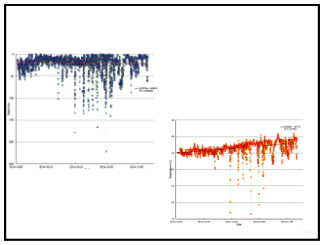
Posicionamento da estação acústica

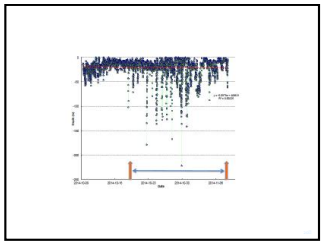
Amarrações:

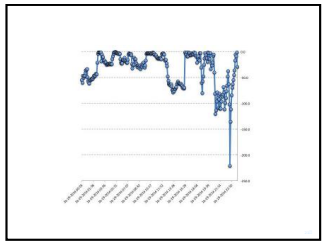
- Ancoras são postas no substracto
- Com cadeias metálicas
- E boias de arrasto de alta resistencia mantêm a estação de pé

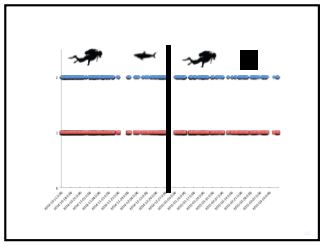
As ferramentas

Telemetria de satélite







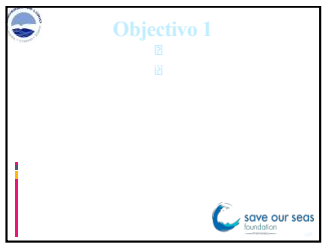



Rufford


Rufford


save our seas
foundation


Local de actividades
Google earth
save our seas
foundation


Objectivo 1
save our seas
foundation

Objectivo 2

Localização, artes e sazonalidade da pesca de Tubarões e raias

save our seas foundation

Objectivo 2 (cont.)

Envio de fotografias

save our seas foundation

Objectivo 3

save our seas foundation

Objectivo 3(cont.)

Educação ambiental

https://www.facebook.com/raiastubaroes

save our seas foundation

Objectivo 4

Disseminação dos Resultados

save our seas foundation

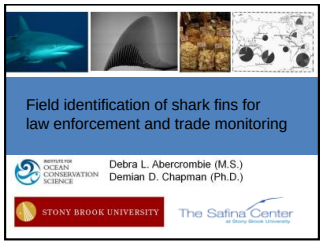
UNIVERSIDADE LÚRIO
FACULDADE DE CIÊNCIAS NATURAIS

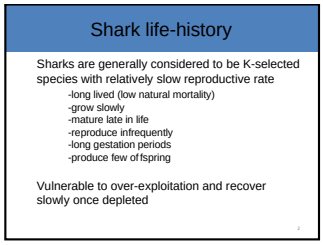
The Rufford Foundation
www.rufford.org

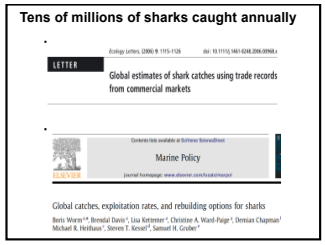
Obrigado

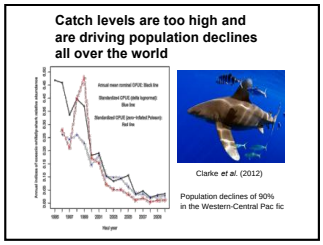
save our seas foundation
10th anniversary

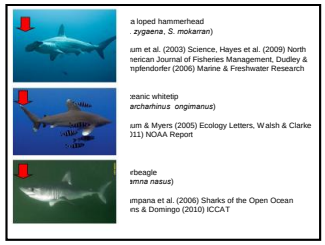
Appendix VIII: Presentation
Field identification of shark fins for law enforcement and trade monitoring

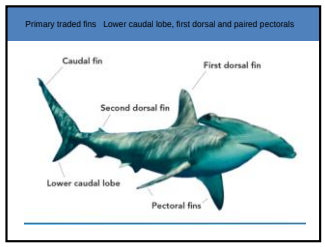


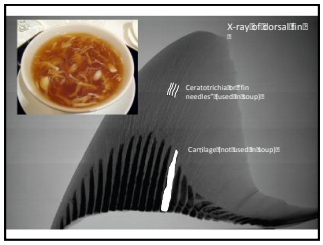


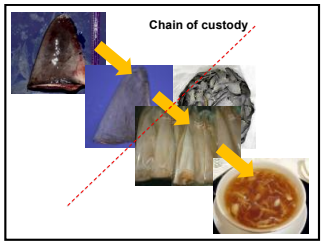












Vulnerable to overexploitation, some more than others

Need for species-specific landings and trade data to assess shark population status

Need to enforce landings and trade restrictions on particular species, such as those prohibited by RFMOs or listed on CITES

How can shark fins be identified to species?

Genetic techniques

DNA barcodes available for sharks

FISH-BOL

Species-specific PCR tests published for sharks

Sandbar/dusky (Pank et al. 2001)
Blue/shortfin mako/longfin mako/porbeagle/dusky/silky (Shivji et al. 2002)
Great white (Chapman et al. 2003)
Great hammerhead/scalloped hammerhead/smooth hammerhead (Abercrombie et al. 2005)

Identification of Shark Species Composition and Proportion in the Hong Kong Shark Fin Market Based on Molecular Genetics and Trade Records

Chinese traders can visually ID fins to species

Identification of Shark Species Composition and Proportion in the Hong Kong Shark Fin Market Based on Molecular Genetics and Trade Records

Conservation Biology Volume 20, No. 1, 201–211

DOI: 10.1111/j.1523-1739.2006.00247.x

Liu qiu
流球

oceanic whitetip (*C. longimanus*)

Chun chi
春翅

smooth and scalloped hammerhead (*Sphyrna zygaena* and *S. lewini*)

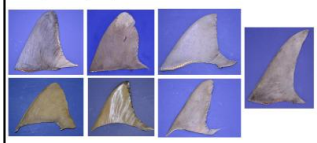
Gu pian
骨片

great hammerhead (*S. mokarran*)

Time and costs are obstacles to routine genetic testing of shark fins.

Solution: ID in the field and/or more targeted DNA testing.

Can shark fins be visually identified to species or species group?



Shark fin visual ID project

Goal: Develop a tool to help users rapidly pick out fins from CITES listed species

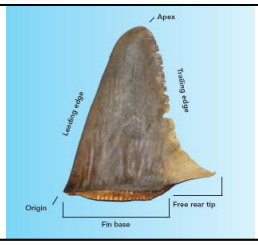
Field-based visual identification of fins from the new CITES-listed iSharks

First dorsal fin; simple format

Establish probable cause to hold fin or shipments that do not have proper permits based on visual ID

www.sharkfind.org

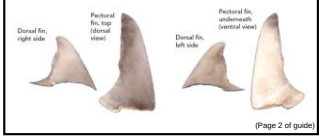
Sharkfin identifier App (iTunes)
https://itunes.apple.com/app/id9322 2756



Step 1: Find first dorsal fin

Is the fin the same color on both sides?

Yes…….Possible dorsal fin
No…….Pectoral fin

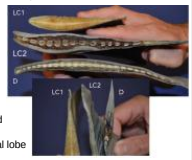


(Page 2 of guide)

Step 1: Find first dorsal fin

Is there a row of continuous row of cartilage along the base, with each piece touching the adjacent one.

Yes…….
= Dorsal fin
(there will also likely be an intact free rear tip)

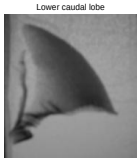


No…….
Few, large, widely spaced, irregular shaped pieces of cartilage or none at all=Lower caudal lobe

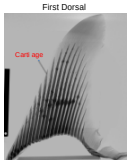
(Page 2 of guide)

If you are still not sure the lower caudal has very little (if any) cartilage when viewed under x-ray , while the dorsal fins of the CITES species contain a significant amount.

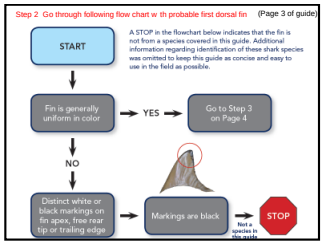
Lower caudal lobe



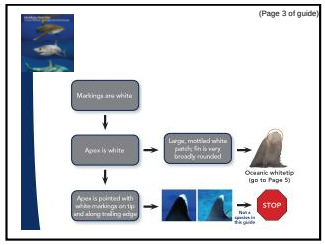
First Dorsal

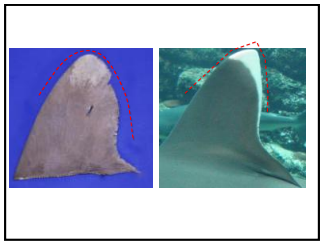


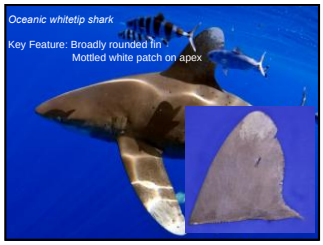
Step 2 Go through following flow chart w th probable first dorsal fin (Page 3 of guide)



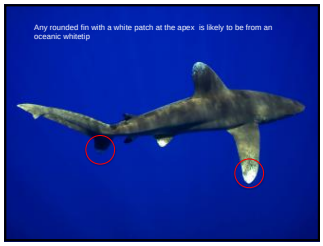
(Page 3 of guide)

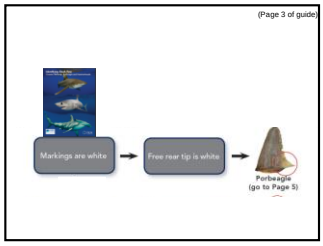


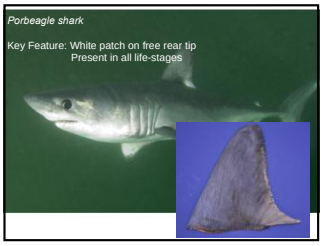


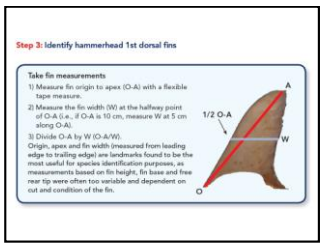

Oceanic whitetip shark
Key Feature: Broadly rounded fin
Mottled white patch on apex

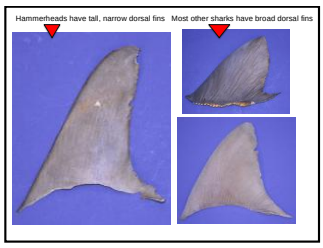

Oceanic Whitetip Carcharhinus longimanus

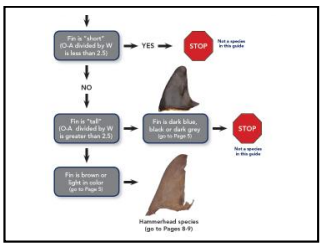

Any rounded fin with a white patch at the apex is likely to be from an oceanic whitetip


(Page 3 of guide)
Markings are white
Free rear tip is white
Porbeagle
(go to Page 5)

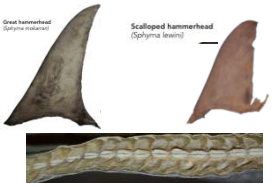

Porbeagle shark
Key Feature: White patch on free rear tip
Present in all life-stages


Step 3: Identify hammerhead 1st dorsal fins
Take fin measurements
1) Measure fin origin to apex (O-A) with a flexible tape measure.
2) Measure the fin width (W) at the halfway point of O-A (i.e., if O-A is 10 cm, measure W at 5 cm along O-A).
3) Divide O-A by W (O-A/W).
Origin, apex and fin width (measured from leading edge to trailing edge) are landmarks found to be the most useful for species identification purposes, as measurements based on fin height, fin base and free rear tip were often too variable and dependent on cut and condition of the fin.
1/2 O-A
A
W
O


Hammerheads have tall, narrow dorsal fins
Most other sharks have broad dorsal fins

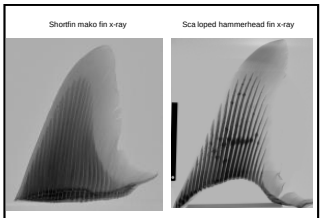

Fin is "short" (O-A divided by W is less than 2.5)
YES
STOP
NO
Fin is "tall" (O-A divided by W is greater than 2.5)
Fin is dark blue, black or dark grey (go to Page 9)
STOP
Fin is brown or light in color (go to Page 9)
Hammerhead species (go to Pages 8-9)

Hammerheads have "tall" fins (aspect ratio larger than 2.5) that are light grey or brown and the fin base is thin with a row of small, oval pieces of cartilage.



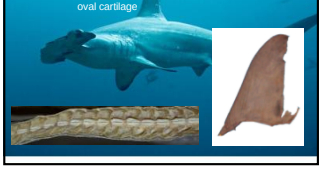
Other "tall" fins (aspect ratio larger than 2.5) are dark grey and may have a thick base.

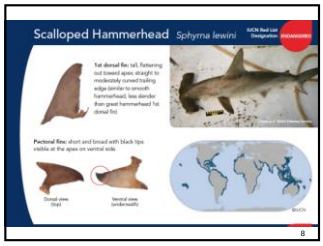
Thresher shark dorsal fins have a thick base and the cartilage is irregularly shaped, compressed or oblong.

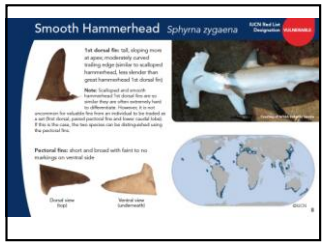


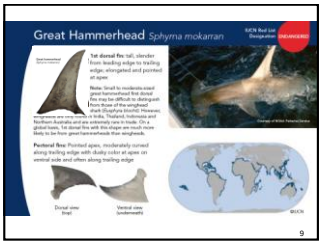
Hammerhead sharks (3 large species, all CITES App II)

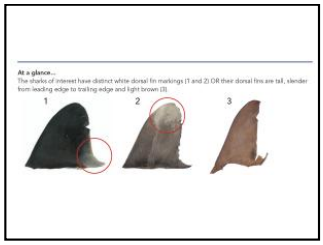
Key Feature: High aspect ratio (i.e., fin is tall and narrow)
Fin is light grey or brown, without other markings
Fin base is narrow and has row of small, oval cartilage.









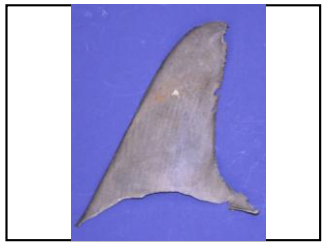


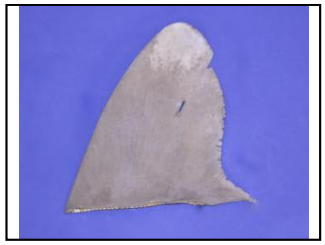
Can shark fins be visually identified to species or species group?

For recent CITES listed species: Yes.





Field examples

How can we regulate the trade?

(1) Monitor the species composition

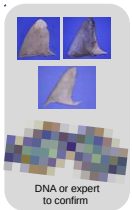
(2) Regulate trade of certain species

CITES listings are a start

Identify suspected oceanic whitetip, porbeagle or hammerhead species visually using fin morphology

Do a DNA test to confirm (if required)

Border control can visually identify fins that may be from CITES species



DNA or expert to confirm

Next Steps

- Expand and update the guide: Conduct morphological analyses/genetic testing that can be used to rapidly ID the 5 recently listed species
  - Pectoral fin
  - Anal fin
  - Lower caudal lobes

Next Steps

- Expand and update the guide: Conduct morphological analyses/genetic testing that can be used to rapidly ID the 5 recently listed species
  - Pectoral fin
  - Anal fin
  - Lower caudal lobes

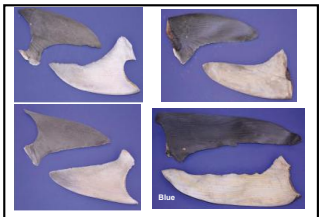
Pectoral fins

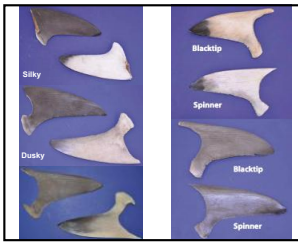
Retail Market random sampling (Chapman Lab)

Currently our best estimate of he % of each species coming into Hong Hong.

73% of trade made up of approx. 18 species

Species
Blue
Silky
Bull
Oceanic whitetip*
Dusky or Galapagos
Copper
Spinner
Blacktip
Blacktip reef
Shorfin mako
Tiger
Scalloped hammerhead*
Smooth hammerhead*
Great hammerhead*
Thresher species
Salmon
Ray or chimera species
Other**





VISUAL IDENTIFICATION OF FINS FROM COMMON ELASMOBRANCHS IN THE NORTHWEST ATLANTIC OCEAN

BY

DEBRA L. ABERCROMBIE
DEMIAN D. CHAPMAN
SAMUEL M. GULAK
AND
JOHN K. CARLSON

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

THANK YOU…

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Sebastian Hernandez
Lisa Natanson
Sabine Wintner
John Carlson
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Fiji Depart of Fisheries

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The Field Museum of Natural History
The Safina Center (Stony Brook, NY)
The Roe Foundation

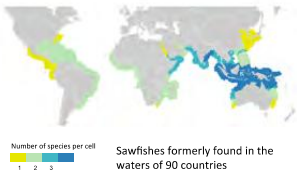
Appendix IX: Presentation
The IUCN Global Sawfish Conservation Strategy

The IUCN Global Sawfish Conservation Strategy

5 species of sawfishes

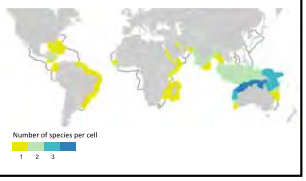
- Critically Endangered
  - *Pristis pristis* (tubarão-serra dentuço)
  - *Pristis pectinata* (tubarão-serra candú)
  - *Pristis zijsron* (tubarão-serra africano)
- Endangered
  - *Pristis clavata* (tubarão-serra anão)
  - *Anoxypristis cuspidata* (tubarão-serra estreita)

Historic species richness



Sawfishes formerly found in the waters of 90 countries

Current species richness



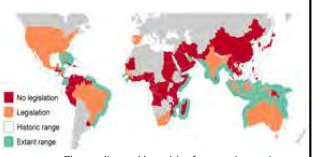
How many countries have lost all sawfishes?

20 ?

How many countries have lost one sawfish?

43 ?

Sawfishes are protected, to some degree, in 16 of the 92 range states



The quality and breadth of protection varies dramatically across countries & species

Status of sawfishes in western Indian Ocean

- South Africa extinct
- Mozambique present!
- Tanzania, Kenya possibly present; recent assessments suggest sawfish are occasionally caught
- Madagascar – at least one species present

Vision

↓

Goals

↓

Actions

Vision:

A world where sawfishes are restored, through understanding, respect and conservation, to robust populations within thriving aquatic ecosystems

→ What does this mean for Mozambique?

Goals

GOAL A

Robust sawfish populations where threats are minimised through improved fisheries management, strategic research, species and habitat protection, and trade limitation

GOAL B

Effective sawfish conservation and management enabled through capacity building, outreach and fundraising

Global Objectives

(Progress we want to see between now and 2020)

Threats & Constraints

- Threats factor causing decrease in number of individuals, or contraction of geographic range

→ e.g. habitat loss, overfishing, pollution, human population growth…

- Constraints factors which contribute to threats, or make dealing with threats difficult

→ e.g. lack of resources, lack of trained personnel, lack of political will…

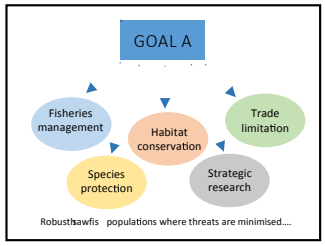
- It's not possible to address some of the threats to sawfishes (e.g. climate change)

→ What can help to minimise the effect of these threats?

GOAL A: Robust sawfish populations where threats are minimised through improved fisheries management, strategic research, species & habitat protection & trade limitation

OBJECTIVES

1. Fisheries management interactions minimised between fishers & sawfishes; sawfish survival, catch reporting & analysis of interactions maximised
2. Species protection ensure that each country applies its strictest national legislation for wildlife protection to all sawfish species, including prohibition on take, retention & sale
3. Habitat conservation strengthen national effots to identify, restore & protect critical sawfish habitats through legislation, management plans etc.
4. Trade limitation awareness of & compliance with CITES Appendix I obligations
5. Strategic Research knowledge will guide development of fisheries management, species protection & habitat conservation

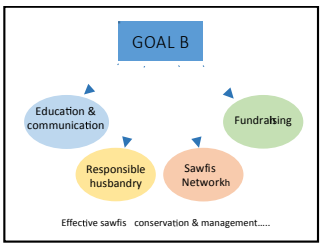


Robust sawfish populations where threats are minimised….

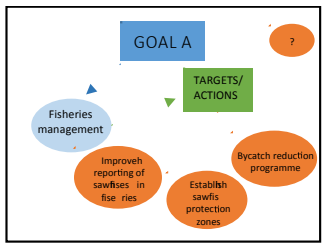
GOAL B: Effective sawfish conservation and management enabled through capacity building, outreach & fundraising

OBJECTIVES

6. Education & communication Increase public awareness of & interest in sawfishes
7. Responsible husbandry Ensure that captive sawfishes are handled, studied & displayed according to the highest standards
8. Sawfish Network Develop coordinated group of scientists, conservationists, fishers, educators, government staff & experts to lead the implementation of the Global Sawfish Conservation Strategy
9. Fundraising Ensure a continued stream of financial resources to ensure that the conservation strategy actions are implemented, and soon.



Effective sawfish conservation & management……



Task 1: National Targets

Objective 1: Ensure interactions are minimised between fisheries & sawfishes, while maximising associated sawfish survival, catch reporting & analysis of interactions

- What are the Threats & Constraints preventing this objective from being met locally
- Mozambique's capacity, strengths & weaknesses for addressing these Threats & Constraints
- Opportunities for making progress

→Create 1 to 3 National Targets for this Objective

- steps that describe what needs to be done to meet an objective
- should focus on addressing Threats & Constraints

The photograph test

Can you take a photo of your Objective or Target being achieved?

→Restoring habitats ✓

→Minister for Fisheries signing legislation to protect sawfishes ✓

→Create political will X

Objective 2: Ensure that countries have applied their strictest national wildlife protection laws to all sawfish species, including a prohibition on targeted take, retention & sale

- What are the Threats & Constraints preventing this objective from being met locally
- Mozambique's capacity, strengths & weaknesses for addressing these Threats & Constraints
- Opportunities for making progress

→Create 1 to 3 National Targets for this Objective

- steps that describe what needs to be done to meet an objective
- should focus on addressing Threats & Constraints

Objective 3: Ensure development of regional plans to strengthen national efforts to identify, restore & protect critical sawfish habitats

- What are the Threats & Constraints preventing this objective from being met locally
- Mozambique's capacity, strengths & weaknesses for addressing these Threats & Constraints
- Opportunities for making progress

→Create 1 to 3 National Targets for this Objective

- steps that describe what needs to be done to meet an objective
- should focus on addressing Threats & Constraints

Objective 4: Awareness of & compliance with CITES Appendix I obligations & domestic trade laws

- What are the Threats & Constraints preventing this objective from being met locally
- Mozambique's capacity, strengths & weaknesses for addressing these Threats & Constraints
- Opportunities for making progress

→Create 1 to 3 National Targets for this Objective

- steps that describe what needs to be done to meet an objective
- should focus on addressing Threats & Constraints

Objective 5: Ensure that knowledge guides the development of fisheries management, species protection & habitat conservation

- What are the Threats & Constraints preventing this objective from being met locally
- Mozambique's capacity, strengths & weaknesses for addressing these Threats & Constraints
- Opportunities for making progress

→Create 1 to 3 National Targets for this Objective

- steps that describe what needs to be done to meet an objective
- should focus on addressing Threats & Constraints

Objective 6: Increase public awareness of and interest in sawfishes

- What are the Threats & Constraints preventing this objective from being met locally
- Mozambique's capacity, strengths & weaknesses for addressing these Threats & Constraints
- Opportunities for making progress

→Create 1 to 3 National Targets for this Objective

- steps that describe what needs to be done to meet an objective
- should focus on addressing Threats & Constraints

Objective 7: Responsible husbandry (captive sawfishes)

Objective 8: Develop network of scientists, conservationists, fishers, educators, government officials & experts to lead implementation of the Global Sawfish Strategy & to share knowledge & advice

- What are the Threats & Constraints preventing this objective from being met locally
- Mozambique's capacity, strengths & weaknesses for addressing these Threats & Constraints
- Opportunities for making progress

→Create 1 to 3 National Targets for this Objective

- steps that describe what needs to be done to meet an objective
- should focus on addressing Threats & Constraints

Objective 9: Ensure a continued stream of financial resources for timely implementation of the actions in the Global Sawfish Conservation Strategy

- What are the Threats & Constraints preventing this objective from being met locally
- Mozambique's capacity, strengths & weaknesses for addressing these Threats & Constraints
- Opportunities for making progress

→Create 1 to 3 National Targets for this Objective

- steps that describe what needs to be done to meet an objective
- should focus on addressing Threats & Constraints

Task 2: Steps needed to achieve National Targets

Now we know WHAT we want to achieve (objectives & national targets) and WHY (the goals and vision)

→We can discuss what ACTIONS can be taken in Mozambique

This is the most important step!

Actions

For each Target

- Identify WHO will do WHAT, WHEN
- What resources are needed
- Are these resources available? If not, where can they be sourced?
- Reality check – is what you are proposing feasible with the available or possible capacity?
- Prioritise Actions / Targets taking into account the capacity, need & opportunity

Finalised list of recommendations for Actions we can take in Mozambique to develop a National Sawfish Conservation Strategy

Conclusions

- Did we achieve our workshop objectives?
- Last words?
- Next steps for moving forward with a National Sawfish Conservation Plan

- Thank you all for your contribution!