



NOAA Technical Memorandum NMFS-SEFSC-686

## REPORT OF THE WORKSHOP ON SAWFISH CONSERVATION IN MOZAMBIQUE

BY

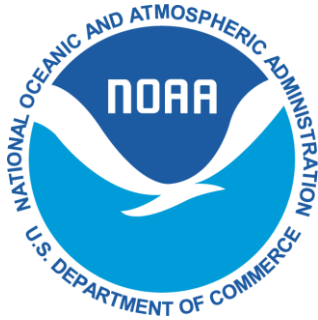
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## INTRODUCTION

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 27<sup>th</sup> and 28<sup>th</sup> 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 Investigação 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

<b>Agency</b>	<b>Abbreviation</b>
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

<b>Objective 1: Reduce interactions with fisheries; increase survival; improve reporting of sawfish</b>			
<b>Target</b>	<b>Action</b>	<b>Who, where?</b>	<b>Proposed time frame</b>
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

<p>Address bycatch and directed take by artisanal fishers (contd.)</p>	<p>Develop alternate livelihoods, e.g.:</p> <ul style="list-style-type: none"> <li>- Ecotourism lodges that provide income to locals that help protect the habitat – social responsibility</li> <li>- Recreational fishing - Specialize catch and release sawfish fishing programs?</li> <li>- Bee-keeping (already exists in some areas)</li> <li>- Smoke houses (smoking fish increases its value and increases ability to transport to markets further away)</li> <li>- Non-destructive aquaculture (e.g. bivalves grown on platforms, crab farming)</li> </ul>	<p>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</p>	<p>Ongoing</p>
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<b>Objective 2: Ensure protection of sawfish</b>			
<b>Target</b>	<b>Action</b>	<b>Who, where?</b>	<b>Time frame</b>
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.	ANAC is responsible authority and would work through IDPPE	After the development of sawfish legislation
	Some primary schools already provide education on conservation laws - Make certain sawfish are included	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.

<b>Objective 3: Regional plans to protect sawfish habitat</b>			
<b>Target</b>	<b>Action</b>	<b>Who, where?</b>	<b>Time frame</b>
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

<b>Objective 4: Awareness and compliance with CITES</b>			
<b>Target</b>	<b>Action</b>	<b>Who, where?</b>	<b>Time frame</b>
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

<b>Objective 5: Research to guide management</b>			
<b>Target</b>	<b>Action</b>	<b>Who, where?</b>	<b>Time frame</b>
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

<b>Objective 6: Effective communication and capacity building for sawfish conservation</b>			
<b>Target</b>	<b>Action</b>	<b>Who, where?</b>	<b>Time frame</b>
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

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

<b>Objective 8: Develop sawfish network of scientists, industry, NGOs, government representatives</b>			
<b>Target</b>	<b>Action</b>	<b>Who, where?</b>	<b>Time frame</b>
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

<b>Objective 9: Ensure funds are available</b>			
<b>Target</b>	<b>Action</b>	<b>Who, where?</b>	<b>Time frame</b>
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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## **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**

<b>Name</b>	<b>Affiliation</b>
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
Frazaio Omar	IIP, Sofala province
Pedro Pires	IIP, Maputo
Celso Inacio Sardinha	University of Eduardo Mondlane/ Maputo Natural History Museum
Antonio Siteo	IIP, Maputo
Dionisio Varela	IIP, Zambezia province
Francisco Zivane	IIP, Gaza province

# Appendix III: Presentation

## An Overview of Sawfish-Biology, Ecology and Conservation Status

**NOAA FISHERIES SERVICE**

**An Overview of Sawfish: Biology, Ecology and Conservation Status**

John K. Carlson  
Southeast Fisheries Science Center  
Panama City, FL USA

### Taxonomy

Five species

- more closely related to skates and rays than sharks
- rostrum important characteristic
- fin placement also distinguish species

### Biology

Large animals -rostrum makes up 1/3 of the body

### Habitat use and migration

Most species move between estuarine and marine environments

- Association with mangrove habitats with mud bottom
- Largetooth sawfish found more in freshwater
  - Lake Nicaragua and Zambezi River
- Dwarf sawfish also found up rivers in Australia
- Largetooth sawfish has been observed in isolated fresh water billabongs

### Habitat use and migration

- Larger individuals found offshore in deeper water, while smaller individuals are mostly found in shallow waters
- Larger juveniles demonstrated larger home ranges
- Acoustic tracking studies found individuals remained close to mangrove shorelines. Tide was found to be the main factor influencing movement on short time scales
- Juveniles prefer water less than 1 m deep, water temperature over 30° C, dissolved oxygen over 6mg L<sup>-1</sup>, and salinity between 18 and 30.

### Habitat use and migration

- Information on sawfish movements is being collected using archival satellite tags and acoustic telemetry

### Habitat use and migration

- More information is still needed especially on use patterns and migration of adults
- Despite historical records of large seasonal movements, archival satellite tag data indicates limited migrations

### Age and Growth

Sawfish were originally assumed to be long lived and grow slow

New studies using actual measurements of observed tag and recapture

Fitting growth models to tag recapture data, length frequency or estimates of size at age

Growth parameters:

- P. pristis*: Theoretical maximum size= 638 cm TL, Slowest growth, Growth rate of 12 cm within the 1<sup>st</sup> year and 17 cm by the 5<sup>th</sup> year.
- A. cuspidatus*: Theoretical maximum size= 377 cm TL, Fastest growth
- P. cilirostris*: Theoretical maximum size= 508 cm TL
- P. ziziprus*: Theoretical maximum size= 482 cm TL
- P. pacificus*: Theoretical maximum size= 48 cm TL, Growth = 20 cm per month during first year of life

### Reproduction

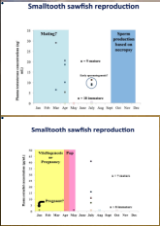
Data is highly variable (data anecdotal)

- 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



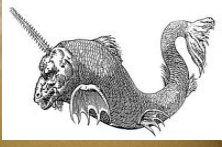
### Non-invasive sampling

Smalltooth sawfish reproduction




Our data supports a seasonal, biennial cycle in which males produce sperm in Fall, and store sperm and mate during Spring when females undergo follicular development. Oviposition 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

None of the 19<sup>th</sup> century smalltooth sawfish were common throughout the Gulf of Mexico and southern United States



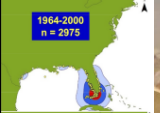
1782-2000  
n = 3435

From Burgess et al. (2011)


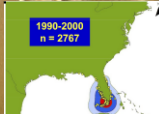


The sawfish was one of the most common and most abundant fish caught in the Gulf of Mexico and the southern United States. It was a valuable source of food and was also used for its teeth. The sawfish was also used for its skin, which was used for making shoes and other goods. The sawfish was also used for its oil, which was used for making soap and other goods.

300 records from the Indian River Lagoon  
"an abundant species, permanently resident in the Indian River"  
(Overman and Bean, 1937)

1964-2000  
n = 2975



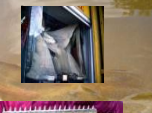





1990-2000  
n = 2767

### Where have the Sawfish gone??


Fishing Mortality

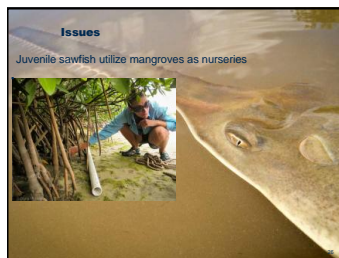
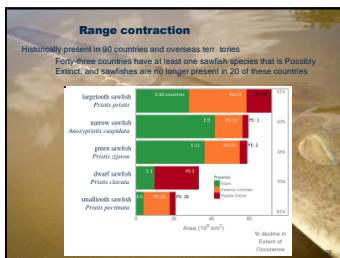
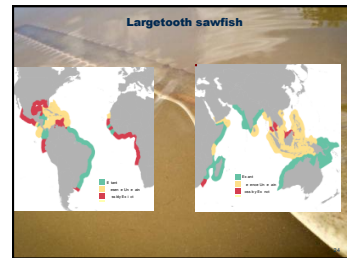
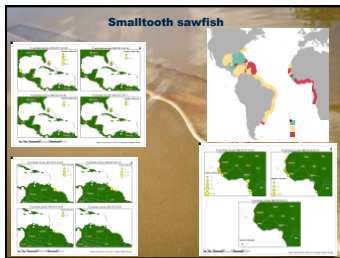
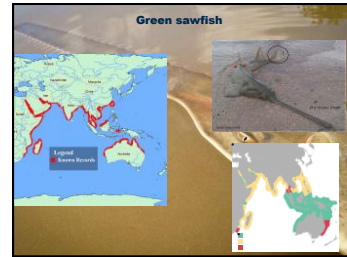
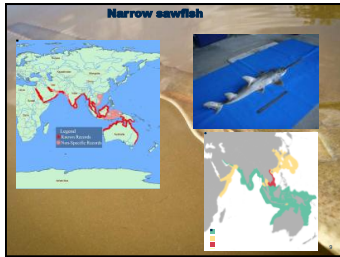
Habitat Loss

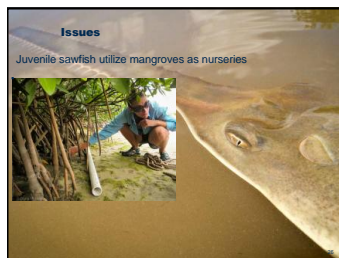
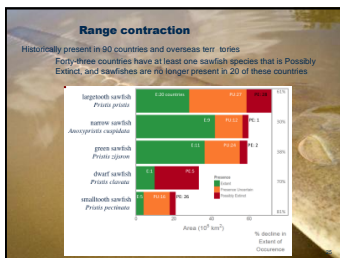
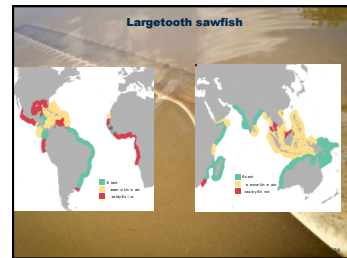
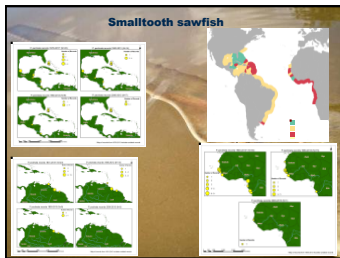
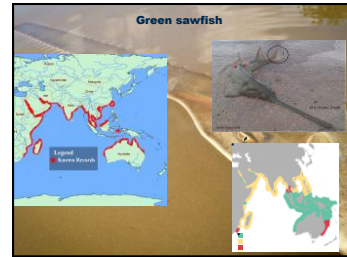
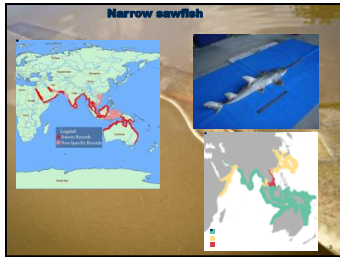
International Union for Conservation of Nature convened the Global Sawfish Conservation Strategy Workshop at the Zoological Society of London, UK on 21-24 May 2012

- 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





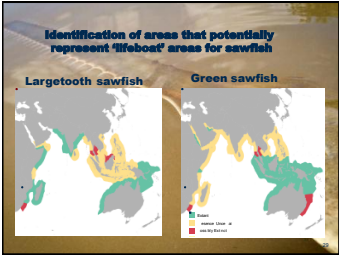




Several nations have recognized the urgent need for conservation action for sawfishes

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

**What sawfish conservation progress has been made?**

Public awareness of the plight of sawfishes  
 Education to fishermen (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

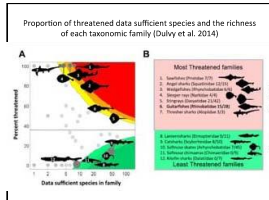


**Introduction**


- Atlantic: Large-tooth sawfish (*Pristis pristis*) and small-tooth 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




**Threats to sawfishes (globally):**



- Fin trade
- Habitat loss
- Conto trade
- Frequent net entanglements

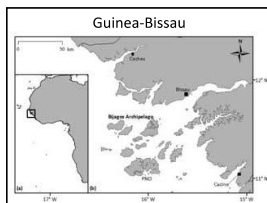
**Cultural importance**

- 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





**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

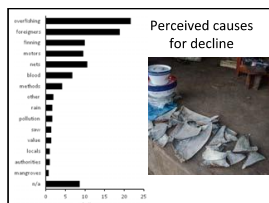


**Results**

- 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




**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 – *catore*
- Sawfish headresses/masks



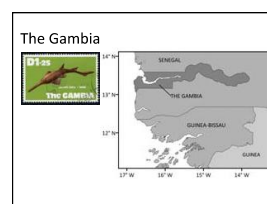
**Recent sightings**

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**

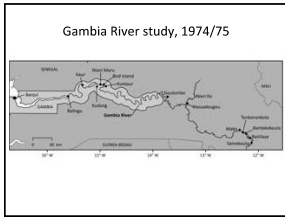
- Sawfishes are probably still present in Bissau-Guinean waters
- Important to the Bijago culture – this significance could be used to support conservation & management actions
- Nets, increased fishing pressure, finning may have contributed to decline
- Immediate action required to find & protect habitats
- 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



**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. . . . [It 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...'*

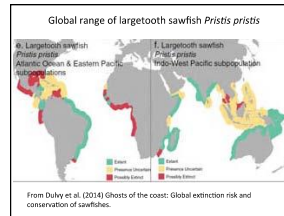


- Some findings:**
- 44 *P. pristis* caught at Niani Maru in 1975
  - Rostrum length, n rostral teeth, (total length) collected from 64 individuals
  - Total length of juveniles (n=16) ranged between 83 cm and 92.4 cm
  - Sawfishes were caught infrequently as far upriver as Baitfalls
  - Two adult females 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



# 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

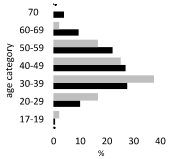
- 201 interviews completed at 38 sites
- All male interviewees
- Artisanal fishers (n=157), industrial and semi-industrial fishers (n=24), fish traders and processors (n=6), IIP monitoring staff (n=11), sport fishing operators (2); (no ans: n=1)

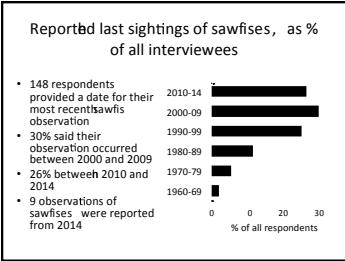
Local names for sawfishes

Region	Local names
Maputo	Mbilu; salipanga
Gaza province	None
Inhambane province	Salipanga/ saropanga
Sofala province	Sarrapanga
Zambezia province	Piilu/ billu; cachão/ cação
Nampula province	Piilu/ mpiilu/ mbitu; salipanga
Cabo Delgado province	Mbiru/ mpiiru; papapanga/ papopanga; nziruê; nsungu/ papa nsungi

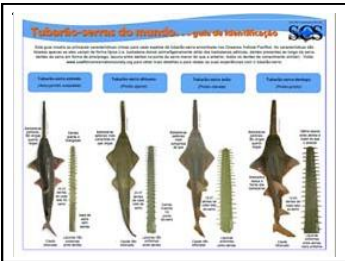
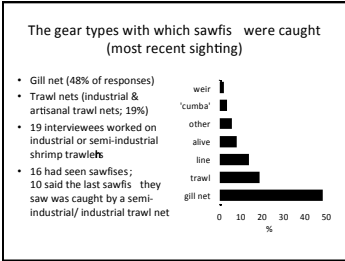
Summary of results: Interviews 2014

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



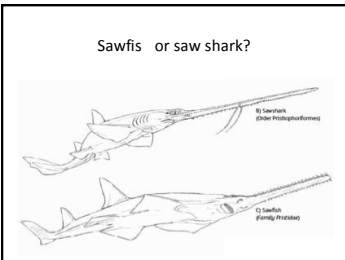


- The most recent reports of sawfish catches were last week, provided by two fishermen, both of whom were interviewed in mid-June (2014).
- Two sites were identified where recent catches of sawfish (in 2014) were reported to occur. At both sites, the fishermen interviewed were able to show the interview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



### Monitoring sawfishes in trawler fisheries

- Saw sharks (image below) are sometimes caught in trawler 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.



### Conclusions (1)

- First systematic study on the distribution, exploitation and status of sawfishes in Mozambique
- Sawfishes still encountered by both industrial and artisanal fisheries
- 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 large both 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. Acúrgio Luis Anselmo Eduardo Avene Osvaldo Chetate Alice Inacio Enrico Pereira Mórias Daniel Mualeque Afonso Munduze Rui Mutombene Martinho Padeira José Vilanculo and Francisco Zivane

**IDPPE:** Ernesto Polosse

**MMF:** Libby Bowles Andrea Marshall Simon Pierce Clare Prebble

**E tãmbem:**

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

Peter Bechtel Fern Breslaw John Carlson Alice Costa Eleanor Fox Ruth Higgins Prof. Amildo Naitai Sean Nazeralli Larry Routledge Elizabeth Stephenson Yara Tibrica Simon Wearne Jeff Whitty

Work in Guinea-Bissau was funded by Noé Conservation.

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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](http://www.facebook.com/ProtectAfricasSawfishes)



## Appendix VI: Presentation

### Sawfish handling and release techniques

NOAA Service Announcement




### Sawfish handling and release techniques

John K. Carlson  
 Southeast Fisheries Science Center  
 Panama City Laboratory  
 Panama City, FL USA

NOAA FISHERIES SERVICE

NOAA FISHERIES SERVICE



### Sawfish are very susceptible to captures in a variety of fishing gears

The rostrum of sawfish has been entangled in:

- Gillnets
- Longlines
- Trawls
- Fishing line
- Dock lines



NOAA FISHERIES SERVICE




### Sawfish Protection

In USA and Australia, sawfish are extremely protected.

Federal law in United States requires no harm to sawfish and must be released from all fishing gear.

Safe release guidelines were developed to follow these laws.

NOAA FISHERIES SERVICE




### Fishing lines and longlines

Make Every Effort to Remove Gear:  
 If can be done safely, untangle line from the animals' saw.

Cut gear tangled around the saw by cutting along the length of the saw.

Hooked animals:  
 If the hook cannot be removed, cut the line as close to the hook as possible.  
 If hooked internally, DO NOT attempt to remove the hook cut the line as close to the animal as possible.

NOAA FISHERIES SERVICE




### Trawl nets and gillnets


It is advisable to keep the sawfish out of your boat and if you can bring the sawfish in a safe location

When towing a sawfish to a more practical release site, ensure you secure it by the rostrum to avoid head shaking and tail slapping

Once the sawfish is beached, untangle the tail and mid-section of the animal from the mesh before the rostrum



NOAA FISHERIES SERVICE




### Trawl nets and gillnets

Always stand in front of or behind the rostrum when attempting to free the sawfish from the mesh.

If beaching the net is not possible, as in the case of a creek set net, use a sharp knife to cut the mesh.

Secure the rostrum. It is very dangerous



NOAA FISHERIES SERVICE



### Post release

Keep nets in the immediate area out of the water for as long as possible



NOAA FISHERIES SERVICE



### Importance of releasing sawfish

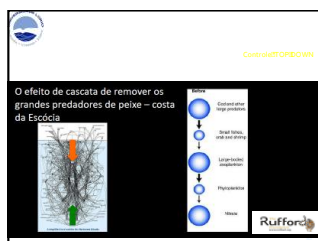
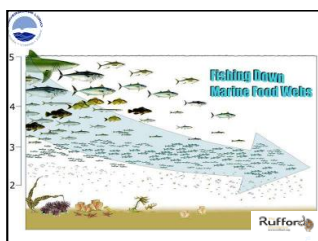
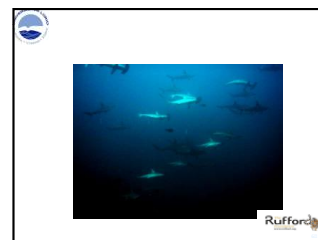
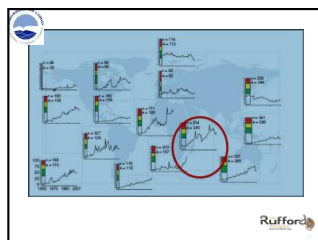
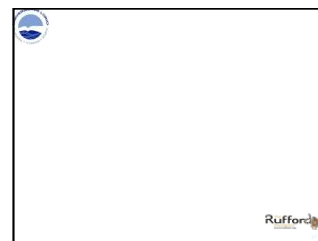
Sawfish are not protected in Mozambique.

Opportunity to save one of the last remaining populations in East Africa.

Protect for future generations.

## 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 manejo de tubarões, e interagir com as comunidades



### Objectivos do Projecto

- (iii) produzir um vídeo em Swahili/Português 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 processados




### 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



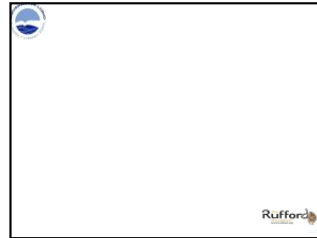
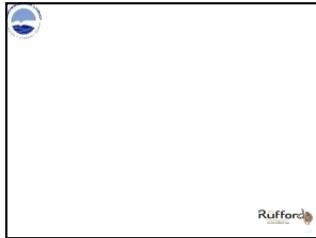
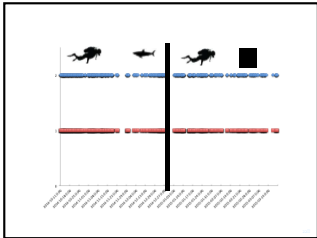
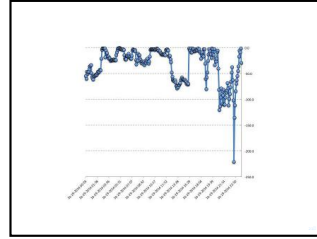
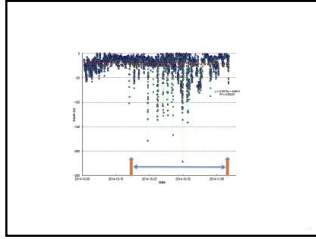
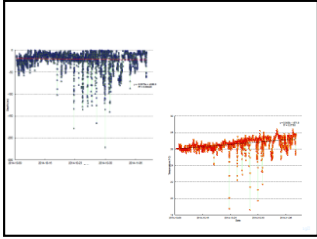


### As ferramentas


Telemetria de satélite







**Objectivo 2**  
Localização, artes e sazonalidade da pesca de Tubarões e raias



**Objectivo 2 (cont.)**  
Envio de fotografias




**Objectivo 3**





**Objectivo 2 (cont.)**  
Educação ambiental



<https://www.facebook.com/raisatubaroes>



**Objectivo 4**  
Disseminação dos Resultados



UNIVERSIDADE LÚRIO  
FACULDADE DE CIÊNCIAS NATURAIS

Thank you  
**Rufforo**  
www.rufforo.org

Obrigado



## Appendix VIII: Presentation

### Field identification of shark fins for law enforcement and trade monitoring



Field identification of shark fins for law enforcement and trade monitoring

Debra L. Abercrombie (M.S.)  
Demian D. Chapman (Ph.D.)

STONY BROOK UNIVERSITY The Safina Center at Stony Brook University

### Shark life-history

Sharks are generally considered to be K-selected species with relatively slow reproductive rate

- long lived (low natural mortality)
- grow slowly
- mature late in life
- reproduce infrequently
- long gestation periods
- produce few offspring

Vulnerable to over-exploitation and recover slowly once depleted

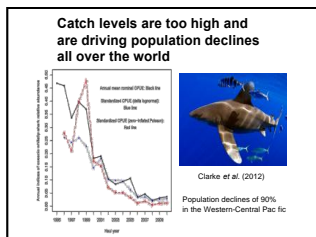
### Tens of millions of sharks caught annually

Global estimates of shark catches using trade records from commercial markets

Global catches, exploitation rates, and rebuilding options for sharks

Beals Warren<sup>1</sup>, Ronald Davis<sup>1</sup>, Luu Kien<sup>2</sup>, Christine A. Ward<sup>3</sup>, Dennis Chapman<sup>1</sup>, Michael B. Hoffner<sup>1</sup>, Steven T. Koenig<sup>1</sup>, Samuel H. Gruber<sup>1</sup>

### Catch levels are too high and are driving population declines all over the world



Clarke et al. (2012)

Population declines of 90% in the Western-Central Pac fic




- a lipped hammerhead  
*Sphyrna tiburo*
- xanotic whitetip  
*Isurus paucus*
- ebacagle  
*Isurus paucus*

um et al. (2003) Science, Hayes et al. (2009) North American Journal of Fisheries Management, Dudley & Tipler (2006) Marine & Freshwater Research

um & Myers (2005) Ecology Letters, Walsh & Clarke (2011) NOAA Report

mpiana et al. (2006) Sharks of the Open Oceans & Domingo (2010) ICCAT

Bangkok, Thailand, 2013 (CoP16)-  
Five species of sharks (two mantas) were listed on Appendix II of CITES

September 2014-implementation of the CITES listed shark species

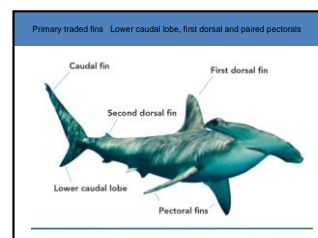


### Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

- Voluntary, international agreement signed by 180 countries ("Parties").
- Goal is to "... ensure that international trade in specimens of wild animals and plants does not threaten their survival."
- CITES works through mandatory permits/certificate requirements for exports of species listed (Appendices I and II) that prove trade is not threatening their survival.

### Primary traded fins

Lower caudal lobe, first dorsal and paired pectorals





**Shark fin visual ID project**

~ 2,000 fins  
~ 45 species

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

**Identifying Shark Fins:**  
Oceanic Whitetip, Porbeagle and Hammerheads

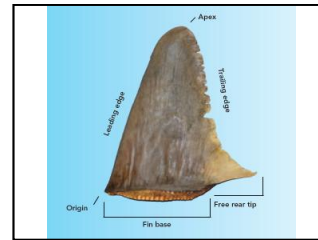
Field-based visual identification of fins from the new CITES-listed Sharks

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](http://www.sharkfind.org)

Sharkfin Identifier App (iTunes)  
<https://itunes.apple.com/au/app/id1022227156>



**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)

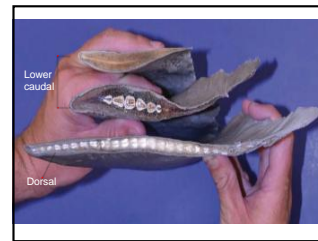
**Step 1: Find first dorsal fin**

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.

(Page 3 of guide)

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

START

Fin is generally uniform in color

YES → Go to Step 3 on Page 4

NO

Distinct white or black markings on fin apex, free rear tip or trailing edge

Markings are black → STOP

Markings are white → STOP

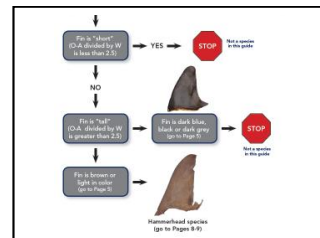
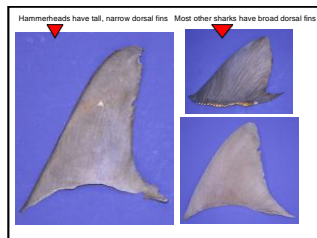
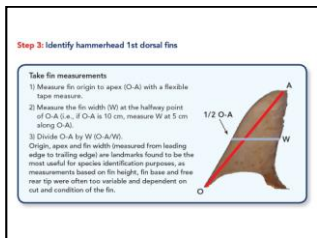
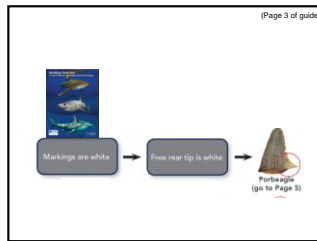
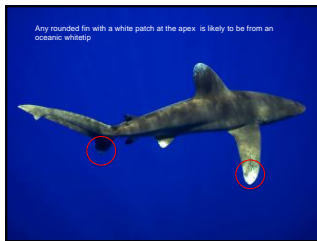
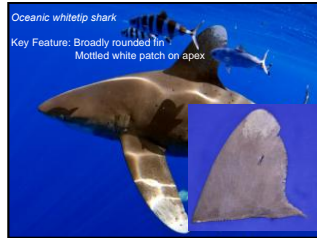
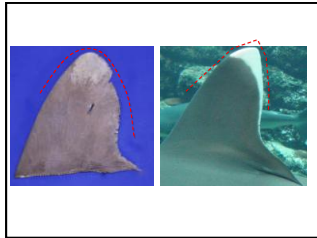
A STOP in the flowchart below indicates that the fin is not from a species covered in this guide. Additional information regarding identification of these shark species was omitted to keep this guide as concise and easy to use in the field as possible.

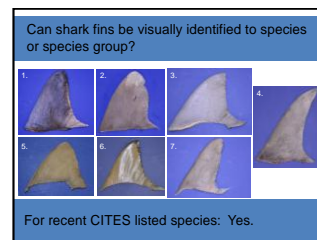
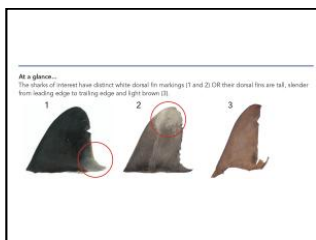
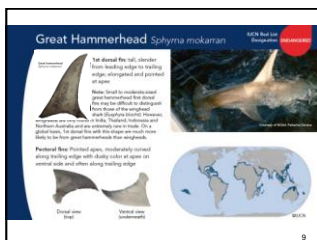
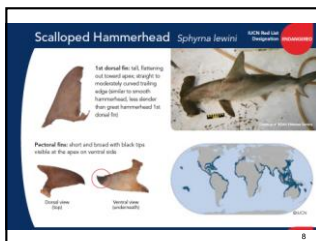
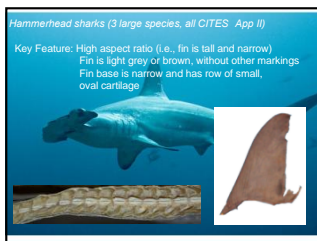
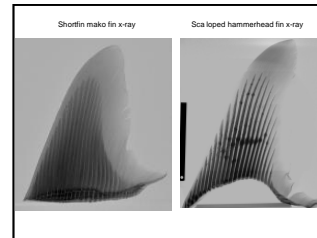
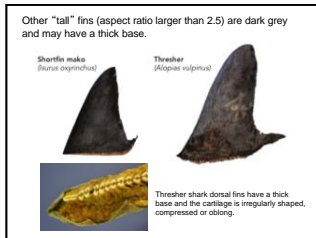
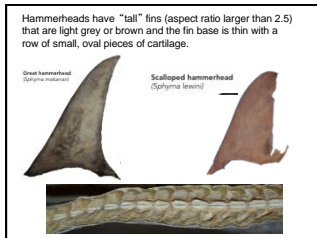
(Page 3 of guide)

Markings are white

Apex is white → Large, mottled white patch; fin is very loosely mounted → Oceanic whitetip (go to Page 5)

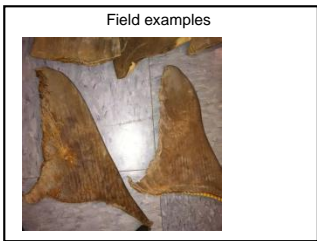
Apex is pointed with cartilage on trailing edge → STOP












**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
  - Anakfin
  - Lower caudal lobes

### Pectoral fins

### Retail Market random sampling (Chapman Lab)

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

73% of trade made up of approx. 18 species

Species
Blue
Silky
Bull
Oceanic whitetip*
Dusky or Galapagos
Copper
Splinner
Blacktip
Blacktip reef
Shortfin mako
Tiger
Scalloped hammerhead*
Smooth hammerhead*
Great hammerhead*
Thresher species
Sabine
Ray or chimaera species
Other**

### VIRAL IDENTIFICATION OF FIVE FALLOUS COHES ELABORATED IN THE NORTHWEST ATLANTIC OCEAN

BY  
 JEREMY A. BROWN  
 BRADLEY T. DODD  
 JOHN E. CARLSON

U.S. DEPARTMENT OF COMMERCE  
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
 NATIONAL MARINE FISHERIES SERVICE  
 National Fisheries Institute Center  
 Beaufort, NC 28516  
 252-751-8200  
 www.nmfs.gov

### THANK YOU...

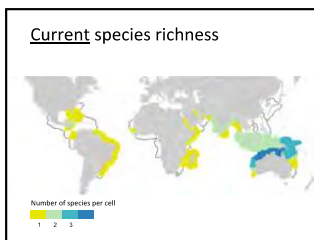
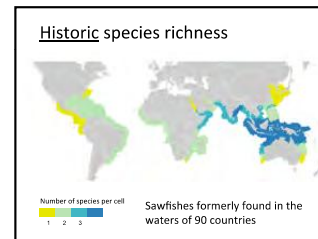
Stan Shea  
 Sebastian Hernandez  
 Lisa Natanson  
 Sabine Wintner  
 John Carlson  
 Simon Gulak  
 Clinton Duffy  
 Jamie Hutt  
 Doug Adams  
 Kevin Feldheim  
 Jasmine Valentín  
 Andrew Fields  
 Fiji Depart of Fisheries

**Funding Sources:**  
 The Pew Charitable Trusts  
 National Marine Fisheries Service  
 The Field Museum of Natural History  
 The Safina Center (Story Brook, NY)  
 The Roe Foundation



## Appendix IX: Presentation The IUCN Global Sawfish Conservation Strategy

The IUCN Global Sawfish Conservation Strategy

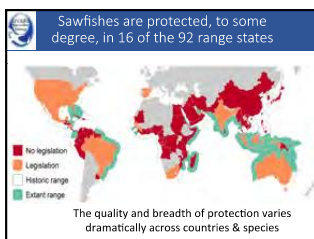


How many countries have lost all sawfishes?

**20** ?

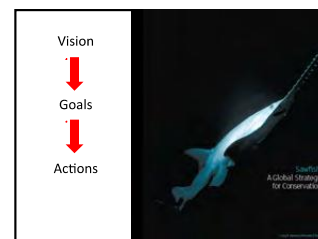
How many countries have lost one sawfish?

**43** ?



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:**

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

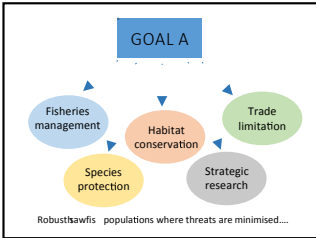


**Threats & Constraints**

- **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?

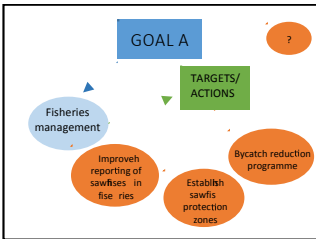
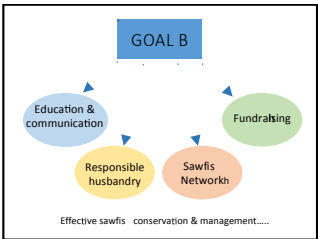
**GOAL A:** Robust sawfish populations where threats are minimised through improved fisheries management, strategic research, species & habitat protection & trade limitation

1. Fisheries management interactions minimised between fisheries & 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 efforts 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



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

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, fisheries 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.



## 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 ✗

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!