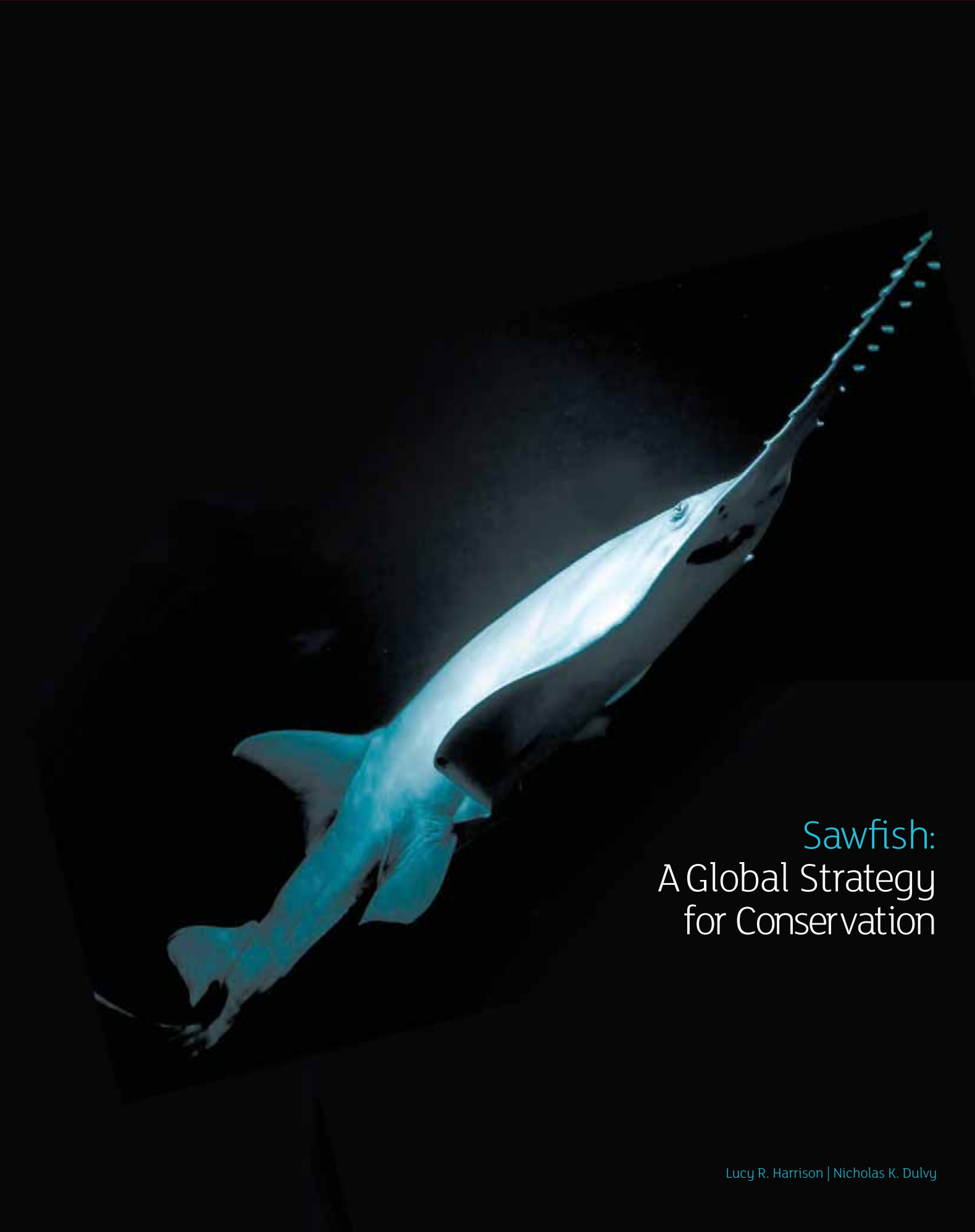

Sawfish: A Global Strategy for Conservation

Lucy R. Harrison | Nicholas K. Dulvy

A Call to Conserve Sawfishes

Simon Stuart
Chair of the IUCN Species
Survival Commission

Like many of the earth's natural resources, humankind has mistakenly viewed the ocean as having an infinite supply of reserves to satisfy our needs and wants. This has made the waters of our globe vulnerable to overexploitation and, as a consequence, many ocean species are now declining at an alarming and unsustainable rate. The sawfishes are one such group of species, and are now recognised as being among the most threatened marine species, facing a rapid descent to extinction if immediate action is not taken to address the severity of their plight.

The wonderful morphology of these species, with their long, highly distinctive tooth-nosed snout, makes them a truly striking and iconic image of our seas. Unfortunately, this unique feature has sadly been the cause of their own ruin, being both easily entangled in net and highly-prized for medicinal and cultural purposes and sold as curios for the tourist trade. Other threats to the sawfishes are common to many marine species and include overfishing and habitat destruction. As a result, sawfishes are now one of the most threatened families of marine species on the IUCN Red List of Threatened Species™.

Conservation must be built on sound knowledge and scientific research. The IUCN Species Survival Commission (SSC) is a science-based network of more than 8,000 volunteer experts from over 160 countries. SSC members are deployed in over 130 Specialist Groups, and it is one of these groups – the IUCN Shark Specialist Group – that has prioritised sawfishes for urgent conservation action and has ably led the way in designing a focused global strategy to provide the best possible scientific basis to secure the survival of these iconic species.

The SSC Conservation Action Plan series has been one of the world's most respected sources of information on species and their conservation needs. Since the mid-1980s, the SSC has published more than 60 Action Plans for some of the world's most charismatic species. Recently, the SSC has developed a new process better able to link science and management for the effective delivery of conservation action. The formerly known Action Plans are now known as Species Conservation Strategies.

This past decade has been characterised by our growing alarm of the state of the oceans. However, we are now in a position where we can move from describing the status to actually doing something about it. I have been witness to the careful and well-planned approach to the Global Sawfish Conservation Strategy and the network of expertise that has contributed to its evolution. This report is a crucial step on the path to conserving one of the most threatened families of marine fishes, the iconic sawfishes.

IUCN

IUCN, International Union for Conservation of Nature, helps the world find pragmatic solutions to our most pressing environment and development challenges.

IUCN's work focuses on valuing and conserving nature, ensuring effective and equitable governance of its use, and deploying nature-based solutions to global challenges in climate, food and development. IUCN supports scientific research, manages field projects all over the world, and brings governments, NGOs, the UN and companies together to develop policy, laws and best practice.

IUCN is the world's oldest and largest global environmental organization, with more than 1,200 government and NGO Members and almost 11,000 volunteer experts in some 160 countries. IUCN's work is supported by over 1,000 staff in 45 offices and hundreds of partners in public, NGO and private sectors around the world.

Further information: www.iucn.org

IUCN Species Programme

The IUCN Species Programme supports the activities of the IUCN Species Survival Commission and individual Specialist Groups, as well as implementing global species conservation initiatives. It is an integral part of the IUCN Secretariat and is managed from IUCN's international headquarters in Gland, Switzerland. The Species Programme includes a number of technical units covering Wildlife Trade, the Red List, Freshwater Biodiversity Assessments (all located in Cambridge, UK), and the Global Biodiversity Assessment Initiative (located in Washington DC, USA).

Further information: www.iucn.org/species

IUCN Species Survival Commission

The Species Survival Commission (SSC) is the largest of IUCN's six volunteer commissions with a global membership of 8,000 experts. SSC advises IUCN and its members on the wide range of technical and scientific aspects of species conservation and is dedicated to securing a future for biodiversity. SSC has significant input into the international agreements dealing with biodiversity conservation.

Further information: www.iucn.org/themes/ssc

IUCN Shark Specialist Group

In response to growing awareness and concern of the severe impact of fisheries on populations of sharks and their relatives around the world, the SSC established the IUCN Shark Specialist Group (SSG) in 1991; it is now one of the largest and most active specialist groups within the SSC. The SSG provides leadership for the conservation of threatened species and populations of all chondrichthyan fishes (sharks, skates, rays and chimaeras). It aims to promote the long-term conservation of the world's sharks and related species, effective management of their fisheries and habitats and, where necessary, the recovery of their populations.

Further information: www.iucnssg.org

ZSL

Founded in 1826, the Zoological Society of London (ZSL) is an international scientific, conservation and educational charity whose vision is a world where animals are valued, and their conservation assured. Their mission, to promote and achieve the worldwide conservation of animals and their habitats, is realised through groundbreaking science, active conservation projects in more than 50 countries and two Zoos, ZSL London Zoo and ZSL Whipsnade Zoo.

Further information: www.zsl.org

Background to Species Conservation Planning

IUCN Species Conservation Planning

In the past quarter century, the IUCN Species Survival Commission (IUCN SSC) has produced over 60 species Action Plans (Species Conservation Planning Task Force 2008). In 2006 the IUCN SSC established a Task Force to review lessons learned and create a new set of species conservation planning guidelines. The Task Force found that Action Plans, while good sources of biological data and scientific and conservation priorities, had limited conservation success. This shortfall was because: (1) species Action Plans were mostly compiled by highly resource-limited Specialist Groups without input from interest groups, and (2) there was unclear guidance on what species Action Plans should contain, hence (3) the target audience was rarely identified, (4) the link from knowledge to action was often unclear, and (5) progress and success went unmonitored.

As a result, the Species Conservation Planning Sub-Committee of the IUCN SSC was established in 2010 to implement a new approach to species conservation planning. This new approach emphasises the need to connect two main interest groups that embody knowledge and action: (1) the species experts in biology, ecology, conservation, policy, education and outreach, and (2) the key players who would implement the recommended actions, such as conservation managers, fisheries biologists, Non-Governmental Organisations (NGOs), and other education and outreach representatives. Involving both groups lends credibility and commitment to the process rather than creating a document in isolation. Conservation Strategies should include a status review of the species, or group of species, in question, leading to the development of a Vision, Goals and Objectives, but ending, ideally, with SMART (Specific, Measurable, Achievable, Realistic, and Time-bound) conservation actions. Each action (at least internally) should be assigned a contact person or organisation that will be responsible for its implementation or for finding someone to implement the action.

Species Conservation Planning in the Ocean

In the past, Species Conservation Strategies have been applied mainly to terrestrial species with narrow geographic ranges and where there is a substantial understanding of both the biology and potential conservation activities. In stark contrast, in marine ecosystems the scale of the challenge is vastly greater. Many threatened species are widely distributed spanning from freshwaters to estuaries, and across coastal seas and ocean basins. But also they are incredibly data-poor, with only tiny islands of data in an ocean of knowledge gaps. There is often no single country or organisation that can save species, as often happens in terrestrial conservation. Hence, a two-stage approach is needed. It is essential to develop a global overview of species conservation status and actions to then provide the foundation and motivation for the development of regional conservation strategies.

Now that the threat status of all known sharks, rays and chimaeras has been determined, the next step is to use this information to prioritise those species at most immediate risk of extinction for conservation planning. The IUCN Shark Specialist Group (SSG) identified the sawfishes (family: Pristidae) as requiring urgent attention.

The Global Sawfish Conservation Strategy provides a set of clear, global-scale priorities for research, education and conservation (Section 1), and a roadmap for the development of Regional Sawfish Conservation Strategies (Appendix 1). These Actions are based on the global status review of all sawfishes, including: taxonomy, historical and current status, threats, values, and conservation actions currently in place.

To develop the global recommendations for the conservation of sawfishes, the IUCN Shark Specialist Group held a workshop hosted by the Zoological Society London from 21–24 May 2012 with 29 participants from 10 countries. The workshop aims were threefold: to (1) review the global status of sawfishes; (2) reassess the global and regional Red List status of each sawfish species, and (3) create global-scale prioritised Actions for meaningful research, education, and conservation.

The second phase of this project will include both implementation of the Actions highlighted in this Global Sawfish Conservation Strategy and the creation of Regional Sawfish Conservation Strategies where necessary. The regional planning would more closely follow the model of species conservation planning as described by the Species Conservation Planning Sub-Committee (Species Conservation Planning Task Force 2008) and would be led by regional representatives. These Regional Sawfish Conservation Strategies would have a more direct focus on devising and implementing specific fisheries and conservation actions ‘on-the-ground’.

To support the implementation of the Global Sawfish Conservation Strategy a Sawfish page has been created on the IUCN Shark Specialist Group website (www.iucnssg.org/sawfish) where updates are provided on each Action as well as points of contact for each Action, where they exist.

Sawfish: A Global Strategy for Conservation
Lucy R. Harrison | Nicholas K. Dulvy

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Sawfish:
A Global Strategy for Conservation

Lucy R. Harrison | Nicholas K. Dulvy

Acknowledgements

The success of this project was made possible only through the commitment and unwavering efforts of many and we would like to thank them here. Our apologies and thanks to those that we have inadvertently missed.

Thank you, first of all, to Sarah Fowler and Mark Stanley Price for their guidance during the inception of this project.

The information documented in this report comes from an incredible number of people who participated at different stages of the project, including the Section authors (attributed accordingly) and the 153 members of the Sawfish Network and survey participants (Appendix 2). Without them our review would have been restricted to a fraction of the available literature and would have failed to illustrate the true narrative of the status of sawfishes globally.

The Global Sawfish Conservation Strategy Workshop was made possible only through the generous financial support of the following organisations: National Oceanic and Atmospheric Administration/National Marine Fisheries Service, the Save Our Seas Foundation, the Mohamed bin Zayed Species Conservation Fund, IUCN Species Survival Commission Sub-Committee for Species Conservation Planning, Environment Agency-Abu Dhabi, Chester Zoo, North West Group of Fauna and Flora International, Flying Shark, Global Ocean and the Dallas World Aquarium. Thanks also to Heather Koldewey and the Zoological Society of London for providing the workshop facility and thanks also to those participants who were in a position to partially or fully fund their attendance.

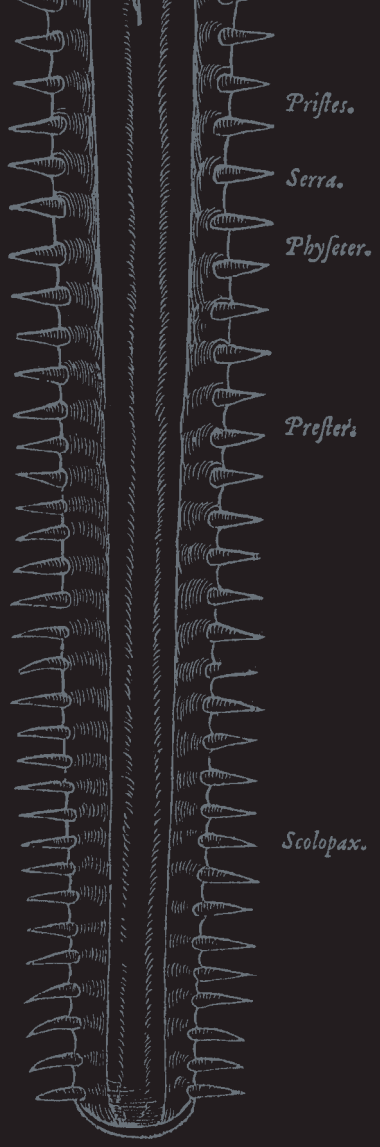
Special thanks are due to all those who attended the workshop; in particular due to their tolerance of the planning process and their knowledge, tenacity and energy right to the end (see Section 1).

We would also like to recognise Martin Clark for facilitating the workshop in an organised, energetic and professional manner, allowing us the time and space to coordinate other aspects of the workshop. Thanks go to those whose managed the logistics, especially Matthew Gollock and David Curnick from ZSL, and Romney McPhie and Lindsay Davidson. Thanks also to the members of the Sawfish Conservation Society and SSG interns: Heather Pettigrew, Megan Young, Joelle Prevost, and Jo Roche. Special thanks go to Lindsay Davidson for her mapping of the distributions of sawfishes, and management activities.

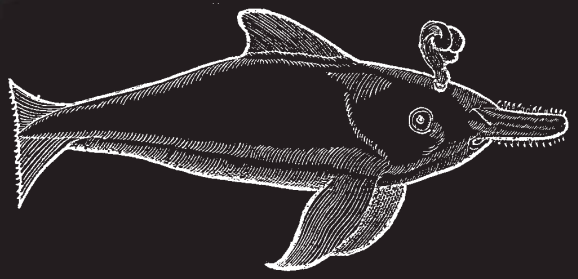
Our sincere thanks also to Claudio Campagna, Nicholas Pilcher, Yvonne Sadovy de Mitcheson and Bryan Wallace for their insightful reviews of an earlier draft.

A special thank you to all of those who have provided vital images for this report - they are acknowledged at the end of this report. A huge thanks also to Marc Dando who created the beautiful illustrations on pages 21, 25 and 26.

Finally, we thank the Department of Biological Sciences at Simon Fraser University for supporting the IUCN Shark Specialist Group since 2009.



Contents



Sawfish Summary

Large shark-like rays of shallow coastal warm waters

Sawfishes are very large shark-like rays that inhabit shallow coastal waters - less than 100m deep. They tolerate a wide range of salinities and can be found in freshwater, estuarine, and marine habitats. The Largetooth Sawfish (*Pristis pristis*), for example, penetrates far into major rivers and can be found in lakes in South America, Africa, and Southeast Asia.

There are five species of sawfish and some have been known to reach 7m in length. Sawfishes give birth to a few live young every two years after a gestation period of 4 - 5 months, and their large size at birth makes them incredibly vulnerable to capture.

Sawfishes have a large toothed rostrum, or saw, that can be up to one-quarter of its total body length. The rostrum is used to find, stun and capture prey, which includes fishes, shrimp, and other bottom-dwelling invertebrates.

Sawfish diversity varies considerably among ocean regions. Two species are present in the Atlantic, four in the Indo-West Pacific, and one species is present in the eastern Pacific. Only the Largetooth Sawfish is present in all oceans.

Culturally important

Sawfishes have been revered for millennia by societies along the tropical and subtropical coasts of the Atlantic and Indo-Pacific Oceans. They were first used on coins 5,000 years ago, and are still found on modern West Africa currency. Today, art, folklore, and mythology are almost all that is left to remind us of how widespread and abundant sawfishes once were.

Threats: easily entangled and habitat dependent

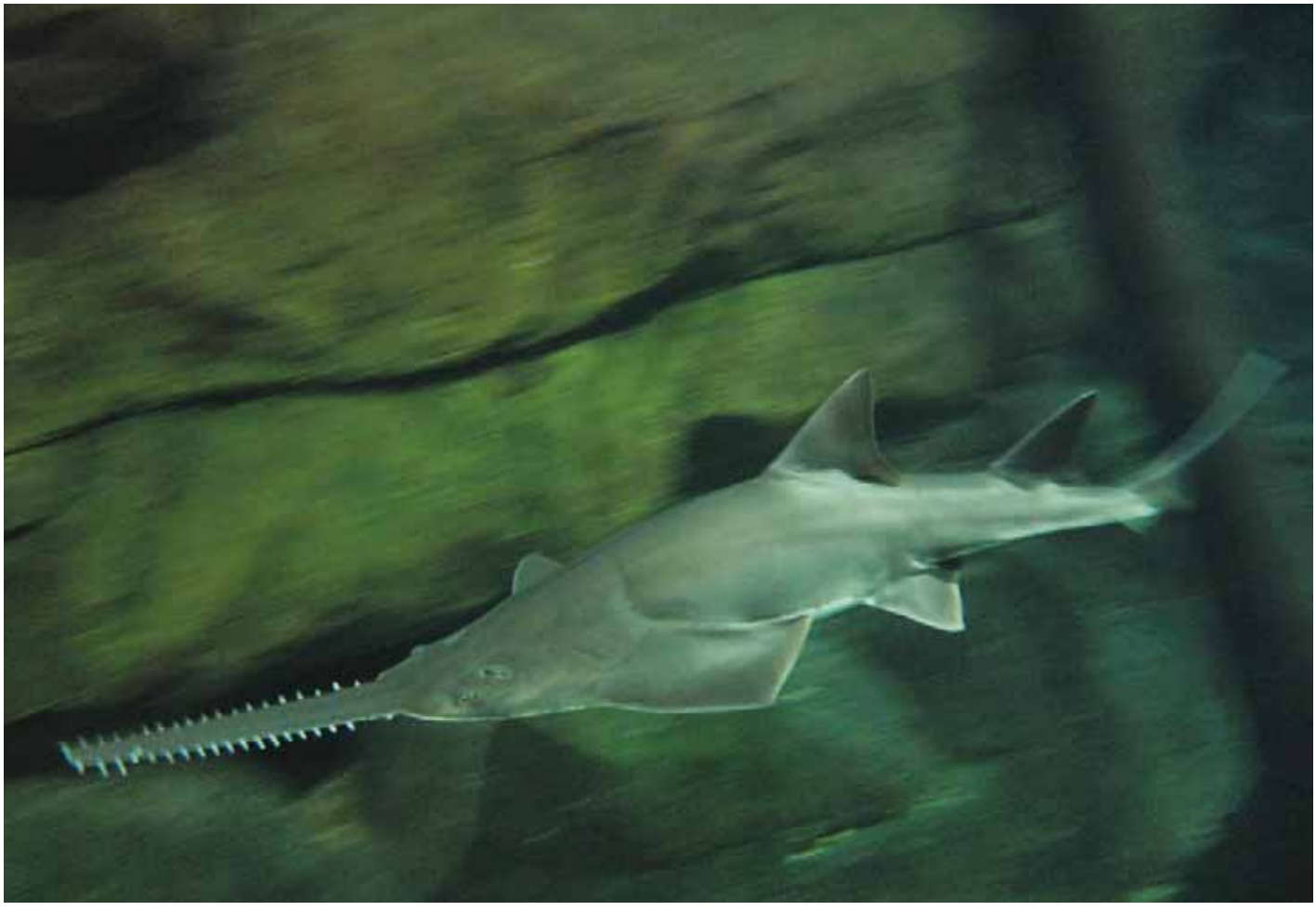
While their distinctive toothed rostra help sawfishes feed, it has been central to their downfall. Sawfish rostra are easily entangled in all types of fishing nets. Historically, fishermen have targeted sawfishes in some regions of the world for their meat.

Today, incidental capture, particularly in trawls and gillnets, is the primary threat to sawfishes. Captured sawfishes are retained primarily for their large, fins, and their rostra, both of which are highly valuable. Furthermore, sawfishes need healthy habitats, particularly mangroves, which are being removed at an alarming rate in many regions.

Formerly widespread and abundant

Sawfishes were once common throughout the tropical and subtropical waters of the Atlantic, Indian, and Pacific Oceans; they are thought to have been present in the waters of more than 90 countries. Over the past century, the populations of all five species have declined dramatically around the world, to the point where they can now only be reliably found in two remaining strongholds (where they are strictly protected): Florida, U.S. and Northern Australia

At regional scales there is considerable uncertainty in status because of poor scientific capacity as well as a paucity of scientific survey effort. Some local populations are thought to be already extinct, with most others on the brink of extinction.



Common name	Species name
Narrow Sawfish	*Anoxypristis cuspidata*
Dwarf Sawfish	*Pristis clavata*
Smalltooth Sawfish	*Pristis pectinata*
Green Sawfish	*Pristis zijsron*
Largetooth Sawfish	*Pristis pristis*

An exceptionally threatened family of fishes

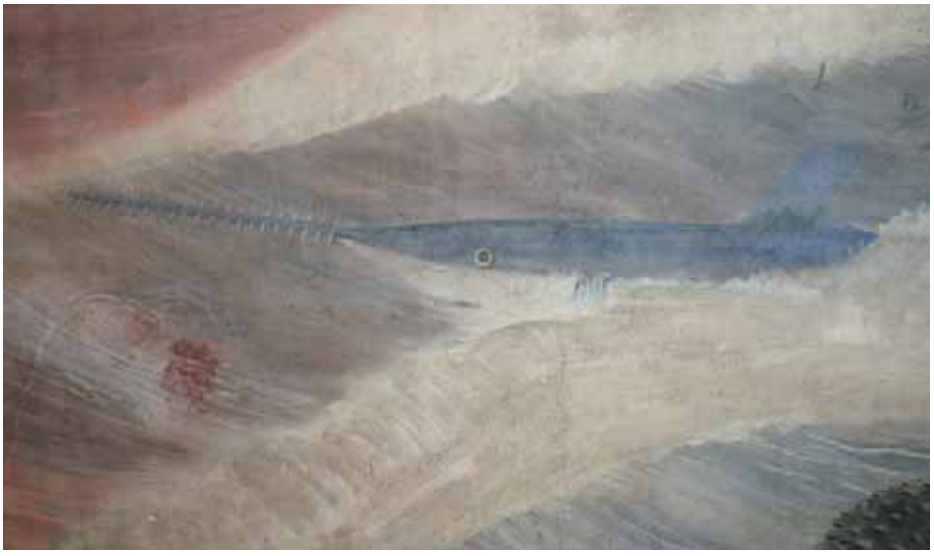
Given the dramatic declines experienced by all sawfish species and their much-reduced geographic range, sawfishes are among the most threatened family of marine fishes. Three species are assessed as Critically Endangered and two species listed as Endangered on the IUCN Red List of Threatened Species™.

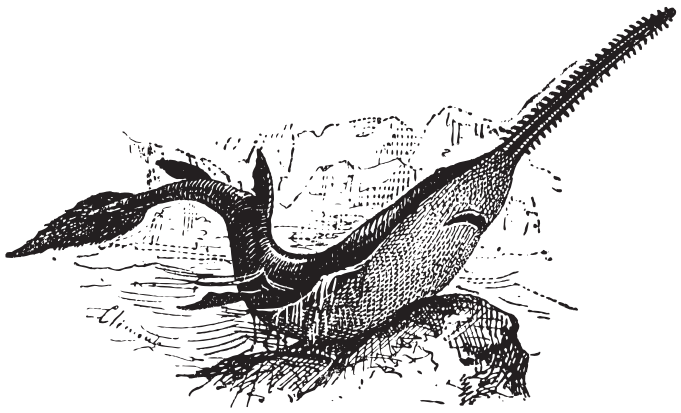
The previous (2006) assessment categorized all sawfishes as Critically Endangered. On the surface our reassessments could be interpreted as an improvement in status for the Narrow Sawfish (*Anoxypristis cuspidata*) and Green Sawfish (*P. zijsron*) since 2006. We caution, however, this is not a genuine improvement in their status. Our knowledge on the status of these species has improved over the intervening period and we now have a better understanding of their declines. Notwithstanding the non-genuine change in status, these species are still at great risk, especially so because their populations continue to decline unhalted.

Limited protections in place

International commercial trade of sawfishes is prohibited under Appendix I of the Convention on International Trade in Endangered Species (CITES) unless in exceptional circumstances. States that are Party to the Barcelona Convention (in the Mediterranean Sea) are required to "ensure that they provide maximum protection for and aid the recovery of" both Smalltooth (*P. pectinata*) and Largetooth Sawfish (listed on Annex II), although implementation is lacking. Nationally, sawfishes are protected to varying degrees, such as through prohibitions on take, in Australia, Bahrain, Bangladesh, Brazil, Guinea, India, Indonesia, Malaysia, Mexico, Nicaragua, Qatar, Senegal, South Africa, Spain, United Arab Emirates, and the United States.

These protections cover a small percentage of the range of sawfishes and are therefore not sufficient to ensure the species' recovery.





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

Goal A

Robust sawfish populations where threats are minimised and/or mitigated.

Goal B

Effective sawfish conservation and management achieved through capacity building, research, education, and outreach.

About this report

The conservation actions recommended in Section 1 are summarized in a way that someone from a particular constituency or region/country can look to their topic of focus to find what conservation actions they might be able to implement in their region or constituency.

We also hope that the findings and recommendations of this Global Sawfish Conservation Strategy will stimulate members of the Sawfish Network to champion and initiate Regional Sawfish Conservation Strategies.

While we have highlighted priority regions for research, fisheries, and outreach and education programmes, we caution that this document and network were created with a global overview, to serve as a precursor to the next stage - which is to develop regional capacity and more focused and tailored regional conservation action.

Next Steps

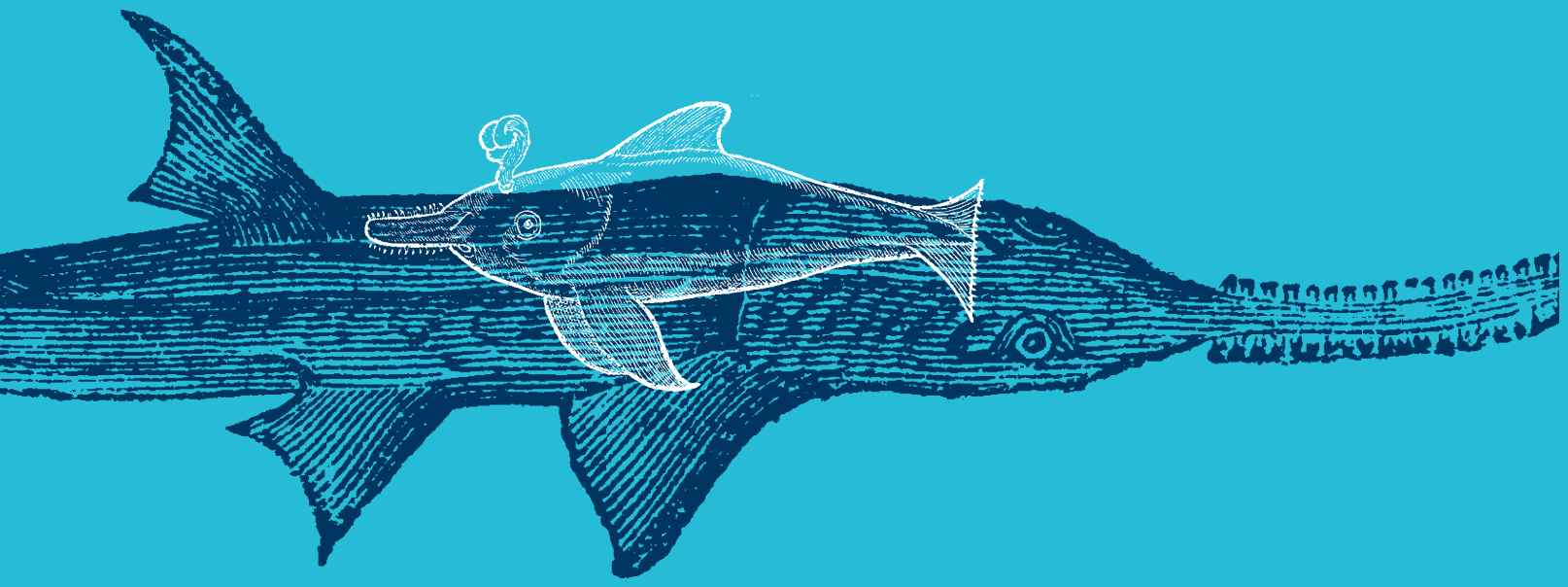
While priority regions for research, fisheries, and outreach and education programmes are highlighted here, this document and network were created with a global overview, to serve as a precursor to the next stage - which is to develop regional capacity and more focused and tailored regional conservation action. Please contact the IUCN Shark Specialist Group for support and additional information (iucnshark@gmail.com).

Join the Sawfish Network

The IUCN Shark Specialist Group has established the Sawfish Network to develop a sense of community and build capacity necessary to implement the recommended conservation actions. All individuals with capacity to help achieve the goals are welcome to join the Network (iucnshark@gmail.com).

Members of the Sawfish Network will receive the latest information on sawfishes and their conservation including: (1) actions that are being implemented, (2) projects that you can be part of, (3) funding opportunities, (4) communication materials, and (5) new publications and reports.

Global Sawfish Conservation Strategy



1| What can be done to improve the conservation status of sawfishes?

The following Vision, Goals, Objectives, and Actions (Figure 1) were developed by a small group of experts at the Sawfish Workshop held in May 2012. (For more information on how this was accomplished see inside front cover). Each Action has been assigned a point of contact (regularly updated) and this is available in the IUCN Shark Specialist Group's (SSG) Sawfish website (www.iucnssg.org/sawfish).

Please use these to direct your own conservation action, to inspire additional actions to conserve sawfishes in your country or region, and to help achieve the Vision for "a world where sawfishes are restored - through understanding, respect, and conservation - to robust populations within thriving aquatic ecosystems".

The SSG, through their role of coordinators of this Conservation Strategy, can provide assistance in this process by, amongst other things, assisting with proposal writing and engaging the Sawfish Network. Please ensure that you contact the IUCN Shark Specialist Group (iucnshark@gmail.com) to report your interest in an Action and your progress towards completing the Action.

A guide for individuals, NGOs, or range states who are interested in creating a Regional Sawfish Conservation Strategy is provided in Appendix 1. Please contact the SSG with your ideas, thoughts, and plans for this so that they can provide any necessary support (iucnshark@gmail.com).

Workshop participants

Front Row (L to R) Romney R. McPhie, Lindsay Davidson, Francesco Ferretti, Mika Diop, Patricia Charvet, Peter M. Kyne

Middle Row (L to R) Sarah L. Fowler, Cheri McCarty, Nicholas K. Dulvy, Bineesh Kinattum Kara, Paula Branshaw, Armelle Jung, Matthew T. McDavitt, Alec B. Moore, Katalin Csatadi

Back Row (L to R) Lucy R. Harrison, Sonja V. Fordham, George Burgess, Lyle Squire Jr., Vicente V. Faria, Rachel T. Graham, Colin A. Simpfendorfer, Mark R. Stanley Price, Matthew J. Gollock, John K. Carlson, Martin Clark

Not pictured: Monika Böhm, Heather J. Koldewey, Simon J. Pierce

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

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

Objective

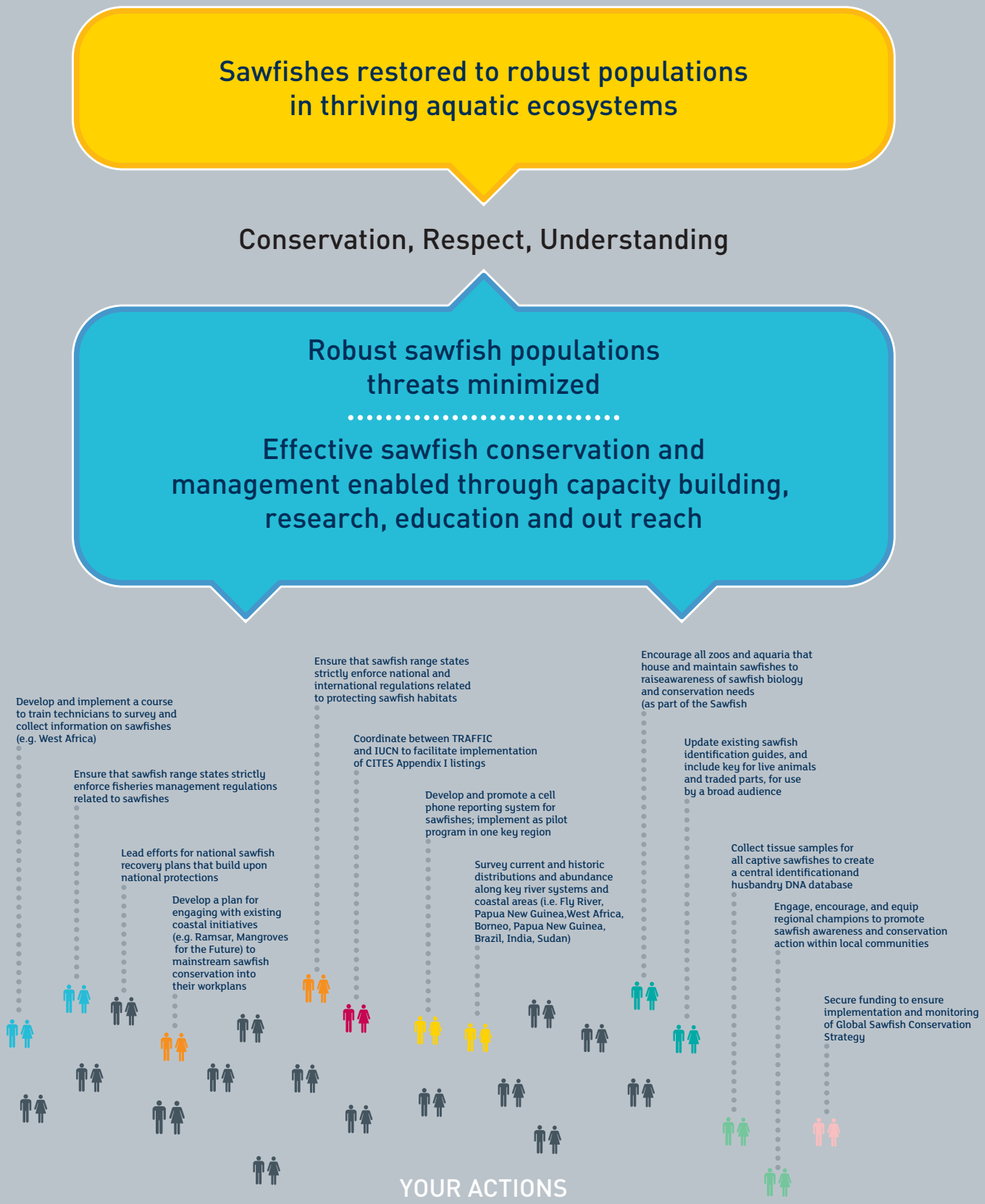
1. Fisheries Management: Interactions are minimised between fisheries and sawfishes, while maximising associated sawfish survival, catch reporting, and analysis of interactions
2. Species Protection: Ensure that sawfish range states have applied their strictest national wildlife protection legislation to all sawfish species, including a prohibition on targeted take, retention, and sale
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
4. Trade Limitation: Ensure awareness of and compliance with CITES Appendix I obligations and domestic trade regulations
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
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
8. Sawfish Network: Grow and mobilise 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
9. Fundraising: Ensure a continued stream of financial resources to ensure timely implementation of the actions included in this Global Sawfish Conservation Strategy

Figure 1:
An outline of the Global Sawfish Conservation Strategy



Goal A

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

Objective 1

FISHERIES MANAGEMENT	
Ensure interactions are minimized between fisheries and sawfishes, while maximising associated sawfish survival, catch reporting, and analysis of interactions	
Incidental catch in fishing gear is the principal threat to sawfishes. While more information on sawfish habits, take, and survival in fisheries is needed, there are a number of Actions that are already known to help minimise associated harm.	
Action	
1.1	Present recommendations from Global Sawfish Conservation Strategy to fisheries experts, government officials, fishing industry representatives, and conservation professionals at international meetings and regional workshops
1.2	Improve reporting of sawfishes in fishery logbooks, and validate associated data (i.e. Australia and the U.S.)
1.3	Develop and distribute a manual for best practice handling and safe release for sawfishes
1.4	Develop a fishing community outreach toolbox to support awareness-raising, including identification materials, handling/safe release, data collection guidance, and bycatch reduction; implement as a pilot program in a key region
1.5	Evaluate trawl fisheries to determine and promote most effective bycatch reduction methods and modifications for minimising sawfish bycatch mortality, particularly in areas where turtle/bycatch exclusion devices are not currently used (e.g. Southeast Asia)
1.6	In collaboration with fisheries agencies and industry representatives, develop a sawfish-safe or sawfish-aware fishery accreditation program as a pilot project in Australia with potential for duplication in the U.S. (and subsequently elsewhere)
1.7	Work with relevant management authorities and interest groups to establish sawfish protection zones (e.g. the Kimberley region of Australia)
1.8	Develop and implement a course to train technicians to survey and collect information on sawfishes (e.g. West Africa)
1.9	Establish an ongoing effort to increase and maintain U.S. government funding for implementation of the U.S. Smalltooth Sawfish Recovery Plan, particularly for bycatch reduction objectives, through encouragement of the National Marine Fisheries Service and the U.S. Congress, with a view to replication in other countries
1.10	Ensure that sawfish range states strictly enforce fisheries management regulations related to sawfishes
1.10.1	Assist in drafting and promoting the adoption of legislative text to enhance the legal basis for enforcing fisheries management regulations related to sawfishes and penalizing infractions
1.10.2	Understand the barriers to successful enforcement and encourage governments to make effective enforcement a high priority

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	
Until restored to thriving populations within thriving ecosystems, sawfishes require the strictest protection wherever they are found to ensure fisheries management and habitat protection agencies afford them the highest conservation attention. * Temporary, non-lethal retention as part of a well-controlled, peer-reviewed research program may be excepted	
Action	
2.1	Raise awareness of the need for sawfish protection at international and regional forums
2.2	Secure the addition of sawfishes as species covered by the CMS Memorandum of Understanding (MoU) for Migratory Sharks and its associated Conservation Plan
2.2.1	Draft, develop, and secure a range state proponent for a proposal to list all sawfishes under Appendices I and II of the Convention on Migratory Species for consideration at the next CMS CoP
2.2.2	Promote adoption of proposal to list sawfishes under CMS at the next CoP, including through CMS-specific fact sheets, outreach to key countries, active participation in the CMS CoP, and a sawfish-specific side event
2.3	Ensure effective national protection legislation and regulations specific to sawfishes
2.4	Lead efforts for national sawfish recovery plans that build upon national protections, incorporate directives for research, bycatch reduction, habitat conservation, enforcement, and include specific, measureable objectives and timelines
2.5	Ensure that sawfish range states strictly enforce national and international species protections
2.6.	Assist in drafting and promoting the adoption of new legislation for range states that do not yet provide legal protection for sawfishes (See Appendix 3 for priorities)
2.6.1	Assist in enhancing existing sawfish protection legislation with text that is stronger, more specific, and/or more comprehensive in terms of species covered, as needed (See Appendix 3 for priorities)
2.7	Assist in drafting and promoting the adoption of legislative text to enhance the legal basis for enforcing species protections and penalizing infractions
2.7.1	Understand the barriers to successful enforcement and encourage governments to make effective enforcement a high priority

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	
Sawfishes are often strongly associated with critical marine habitats, particularly mangrove forest, hence the protection of these habitats will complement fisheries management and species protection measures.	
Action	
3.1	Develop a plan for engaging with existing coastal initiatives (e.g. Ramsar, Mangroves for the Future) to mainstream sawfish conservation into their workplans
3.2	Promote regionally-specific, concerted efforts among a range of interest groups with the common goal of protecting key habitats, particularly mangroves
3.3	If sawfishes are listed under CMS, encourage prompt attention to conserve and restore critical sawfish habitats, as part of regional agreements
3.4	Ensure that sawfish range states strictly enforce national and international regulations related to protecting sawfish habitats
3.4.1	Assist in drafting and promoting the adoption of legislative text to enhance the legal basis for enforcing national and international regulations related to protecting sawfish habitats and penalizing infractions
3.4.2	Understand the barriers to successful enforcement and encourage governments to make effective enforcement a high priority

Objective 4

TRADE LIMITATION	
Ensure awareness of and compliance with CITES Appendix I obligations and domestic trade regulations	
Action	
4.1	Coordinate between TRAFFIC and IUCN to facilitate implementation of CITES Appendix I listings
4.2	If international trade in live sawfishes is allowed in the future under CITES through amendments to the Appendices, engage with range states
4.3	Update the CITES Wiki Identification Manual regarding the description of *Pristis microdon* (*P. pristis*)

Objective 5

STRATEGIC RESEARCH	
Ensure knowledge guides and underpins the development of operational fisheries management, species protection, and habitat conservation	
The above objectives may require additional research to tailor the Action to the local context. However, the lack of data should not preclude precautionary management.	
Action	
5.1	Consolidate and synthesize all available records to determine historic and core distributions of sawfish species, to assess and aid recovery and potential reestablishment throughout their historic range
5.1.1	Continue to compile photographs and measurements of all museum specimens with firm capture details with specific localities and encourage donation of sawfish rostra to recognised museums for study
5.1.2	Survey and document fishermen's historic knowledge through standardised questionnaire program in key communities
5.1.3	Archive photographs and articles detailing accounts of sawfish captures
5.1.4	Research and document fishery records of sawfish captures
5.2	Develop and promote a cell phone reporting system for sawfishes; implement as pilot program in one key region
5.3	Develop and secure funding for a student research program to build capacity for a range of sawfish related projects, and annually communicate results
5.4	Survey current and historic distributions and abundance along key river systems and coastal areas (i.e. Fly River, Papua New Guinea, West Africa, Borneo, Papua New Guinea, Brazil, India, Bangladesh, and Sudan)
5.5	Review trawl fisheries information and practices and perform a risk assessment for interactions with sawfishes (e.g. Southeast Asia)
5.6	Develop environmental DNA (eDNA) assays for the detection of sawfish species in freshwater, estuarine and marine habitats
5.7	Develop regional conservation and bycatch mitigation priorities
5.7.1	Identify priority areas, (for example, of historically low levels of fishing and good sawfish habitat) through mapping of environmental, fisheries and policy data with an aim to highlight priority areas for protection
5.7.2	Develop and launch a targeted campaign to identify and address global hotspots of sawfish bycatch, including pilot mitigation projects; potential hotspots include Sand Banks catfish trawling grounds off Brazil, shrimp trawling grounds in the U.S., Gulf of Mexico, Bay of Bengal, Papua New Guinea
5.8	Develop a standardised framework for traditional ecological knowledge survey; implement in Central America and other regions as appropriate
5.9	Expand investigation of the social and economic value of sawfishes and their parts in key, poorly-studied regions
5.10	Review existing knowledge of, and undertake research on, post-release mortality of sawfishes to inform improved handling and release protocols

Goal B

Effective sawfish conservation and management achieved through capacity building, research, education, and outreach.

Objective 6

EDUCATION AND COMMUNICATION	
Increase societal awareness of, and interest in, sawfishes. Societal support for sawfish conservation is essential for government action.	
Action	
6.1	Compile and publish latest sawfish conservation research in a virtual issue of the journal *Aquatic Conservation*
6.2	Develop an educational campaign based on public service announcements, social media, local outreach to engage the public about the need for sawfish conservation
6.3	Regularly inform the public of sawfish related news through presentations, articles, press releases, and other media engagement
6.4	Engage recreational anglers and sport fishing organisations in cooperative efforts to coordinate education activities and improve reporting
6.5	Develop messages and curricula for educators based on current scientific information
6.5.1	Encourage all zoos and aquaria that house and maintain sawfishes to raise awareness of sawfish biology and conservation needs (as part of the Sawfish MoU; more detail in Objective 7)
6.5.2	Encourage and facilitate the use of this material in schools in the vicinity of sawfish habitat
6.6	Review and report on progress to Sawfish Network quarterly
6.7	Develop and circulate an 8-page document to communicate the Actions to a broader audience
6.7.1	Fundraise for the design, printing, and circulation of an 8-page sawfish actions document and translated into appropriate local languages
6.7.2	Design and communicate this report into an accessible format with images, figures, and Actions
6.7.3	Contact organisations based in key regions and request in-kind contributions of translation (e.g Arabic, Hindi, Urdu, Portuguese, French, Spanish, Mandarin)
6.7.4	Circulate through Sawfish Network, Regional NGOs, Governments, and IUCN Network
6.9	Update existing sawfish identification guides, and include key for live animals and traded parts, for use by a broad audience

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		
Action		
7.1	Develop an international Memorandum of Understanding within the public aquarium community that contains best practices guidelines for husbandry, transport, record keeping and the mandatory use of microchip technology on all captive sawfishes	
	7.1.1	Create best practices guidelines for husbandry, transport, and record keeping
	7.1.2	Encourage the use of microchip technology on all captive sawfishes (i.e. Australian ambassador agreement)
7.2	Collect tissue samples for all captive sawfishes to create a central identification and husbandry DNA database	
7.3	Continue development of captive breeding programs and increase exchange of information with the scientific community about the life history, physiology, and biology of captive sawfishes	

Objective 8

SAWFISH NETWORK		
Grow and mobilise 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 The Sawfish Network provides an important forum for sharing and propagating conservation knowledge and success.		
Action		
8.1	Maintain and grow the Sawfish Network	
	8.1.1	Create a sawfish webpage with links to related social media and educational sites
	8.1.2	Expand geographic coverage of Sawfish Network (e.g. Southeast Asia)
	8.1.3	Produce and distribute twice-yearly newsletters summarizing the activity of the Network
8.2	Engage, encourage, and equip regional champions to promote sawfish awareness and conservation action within local communities	
	8.2.1	Identify individuals or groups that can serve as leaders in their region
	8.2.2	Regional champions' suggested activities include: - Coordinate of outreach programs, highlighting cultural importance of sawfishes - Organise regional conservation planning and implementation workshops with interest groups - Share experience of best post-capture handling and release techniques of sawfishes - Collaboration with Marine Protected Areas management authorities to ensure effective sawfish conservation
8.3	Identify and develop opportunities for collaborative, resource-effective, research, and conservation programs (e.g. IUCN Specialist Groups, Non-Governmental Organisations with other aquatic vertebrates that share habitat and threats with sawfishes (e.g. dugongs and manatees, crocodilians, turtles, seahorses, and small cetaceans, other elasmobranchs)	

Objective 9

FUNDRAISING	
Ensure a continued stream of financial resources to ensure timely implementation of the Actions included in this Global Sawfish Conservation Strategy	
Action	
9.1	Secure funds to facilitate the implementation of and monitor the Global Sawfish Conservation Strategy
9.2	Maintain a list of funding sources and identify applicants for individual/groups of Actions
9.3	Identify and promote collaborations between members of the Sawfish Network and other interest groups and partners

Monitoring and Evaluation of Strategy Implementation

The SSG will carry out the following activities as funds allow:

- Communicate the plan to ensure that it is seen by those who will be involved in its implementation
- Develop, maintain, and keep in close contact with the Sawfish Network
- Maintain the Sawfish Page of the IUCN Shark Specialist Group website and ensure all documents are updated
- Monitor and evaluate implementation of the Global Sawfish Conservation Strategy
- Report regularly back to the Sawfish Network on progress and funding opportunities
- Provide assistance for professionals and organisations aiming to raise funds

Taxonomy, Biology and Cultural Value

2| Taxonomy: How many sawfish species are there?

Vicente V. Faria, Matthew T. McDavitt, Patricia Charvet, Tonya R. Wiley,
Colin A. Simpfendorfer, and Gavin J. P. Naylor

All extant sawfishes are included in the family Pristidae. Within the family, there are two genera: *Anoxypristis* and *Pristis* (Compagno and Cook 1995), which are readily distinguished from each other by three main characters. Rostral teeth are absent from the basal quarter of the rostra in *Anoxypristis* and present in *Pristis*. The rostral teeth of *Anoxypristis* adults are falcate with sharp margins, while those of *Pristis* adults are awl-like and have a flattened and grooved posterior margin. The nostrils of *Anoxypristis* are relatively narrow, but relatively broad in *Pristis*. Finally, *Anoxypristis* has a lunate-shaped caudal fin, while the lower lobe is relatively small or absent in *Pristis*.

The genus *Anoxypristis* includes the single species, *A. cuspidata* (Latham, 1794) (Narrow Sawfish). *Anoxypristis cuspidata* has an Indo-West Pacific distribution, with the exception of eastern Africa and the Red Sea (Faria *et al.* 2013). Populations of this species appear to be geographically substructured into at least four genetic haplotypes across its longitudinal distribution: northern Indian Ocean, Indonesia, New Guinea–Australia, and western Pacific (Faria *et al.* 2013).

The genus *Pristis* is composed of two species groups: the *P. pristis* group (commonly referred to as the 'largetooth'group) and the *P. pectinata* group (commonly referred to as the 'smalltooth'group) (Compagno and Cook 1995).

At least three characters readily distinguish these groups. First, the first dorsal fin is anterior to the origin of the pelvic fins in the largetooth group but above or posterior in the smalltooth group. Second, a lower lobe of the caudal fin is present at all growth stages in the largetooth group, while absent or only slightly developed in larger individuals of the smalltooth group. Finally, the rostrum in the largetooth group is, in general, relatively shorter and wider than in the smalltooth group.

The largetooth group consists of one species, *Pristis pristis* (Linnaeus, 1758) (Largetooth Sawfish) (Faria *et al.* 2013). Therefore, characters distinguishing this species from other *Pristis* species are those that distinguish it from the smalltooth group, mentioned above. *P. pristis* has a geographically-substructured circumtropical distribution, apparently with four genetic haplotypes populations: eastern Pacific, western Atlantic, eastern Atlantic, and Indo-West Pacific (Faria *et al.* 2013).

Previously some of these populations were considered to represent different species, but a recent molecular analysis of the mitochondrial NADH-2 gene has demonstrated that these alternate names are synonyms (Faria *et al.* 2013). Accordingly, the most commonly used junior synonyms of *P. pristis* are *P. perotteti* (Atlantic) and *P. microdon* (Indo-West Pacific). In addition, most of the literature citing *P. pristis* referred to species that do not actually exist in nature due to misinterpretations in the early literature (Faria *et al.* 2013).

The smalltooth group comprises three species: *P. clavata* Garman, 1906 (Dwarf Sawfish), *P. pectinata* Latham, 1794 (Smalltooth Sawfish), and *P. zijsron* Bleeker, 1851 (Green Sawfish) (Compagno and Cook 1995). *Pristis zijsron* can be distinguished from the other two species by several morphological characters. The origin of the dorsal fin is located above the centre of the base of the pelvic fin in *P. zijsron*, while in the other two species the origin of the first dorsal fin is located either opposite or slightly posterior to the origin of the pelvic fins. In *P. zijsron*, the rostral teeth are noticeably closer in the anterior region of the rostrum compared to the posterior region, a difference not seen in *P. clavata* or *P. pectinata*. *Pristis zijsron* has a widespread distribution in the Indo-West Pacific (Faria *et al.* 2013).

The remainder of the smalltooth group (*P. clavata* and *P. pectinata*) can be differentiated by the following characters. In *P. clavata*, the origin of the first dorsal fin is located slightly posterior to the origin of the pelvic fins, while in *P. pectinata* it is located opposite to the origin of the pelvic fins (Faria *et al.* 2013). Additionally, *P. clavata* has a shorter rostrum (up to 23% of the total length), relative to *P. pectinata* (up to 30% of the total length) (Faria *et al.* 2013). *Pristis*

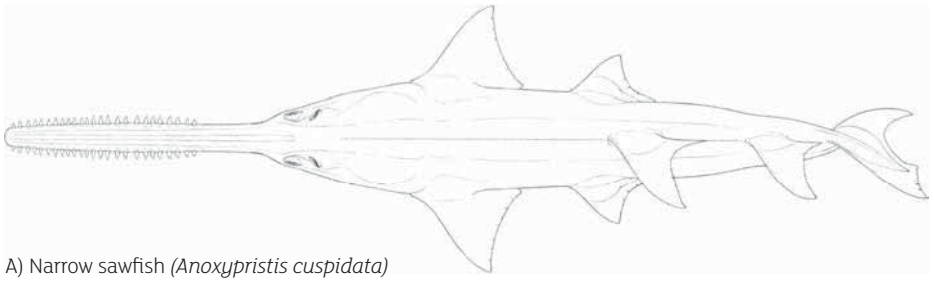
clavata has its current core population based in northern Australia, but historical records indicate the range of this species extended to tropical regions of Eastern Indian-Western Pacific oceans (Faria *et al.* 2013). *Pristis pectinata* has a tropical and subtropical Atlantic distribution. Evidence obtained from variation in the number of rostral teeth suggests geographical substructuring of *P. pectinata* into western and eastern Atlantic populations (Faria *et al.* 2013).

In summary, there are five valid extant sawfish species: *A. cuspidata*, *P. pristis*, *P. pectinata*, *P. clavata*, and *P. zijsron* (see Figure 2 and Table 1).

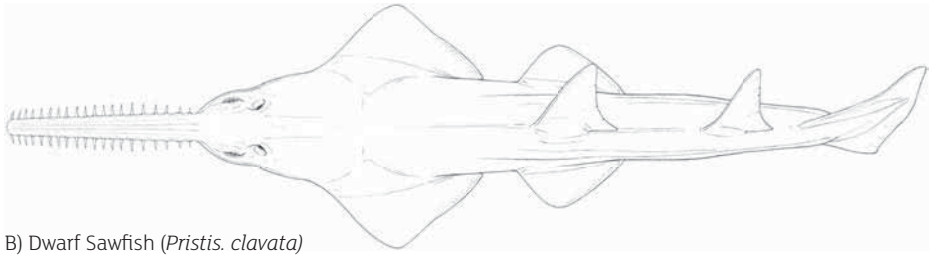
For clarity all species names throughout the document have been aligned to this most recent taxonomic nomenclature as described above, except where gaps in national legislation are highlighted that may leave sawfish species unprotected, as a result of the recent change in taxonomy. The original nomenclature is retained so that countries can be identified where the alignment of legislation with new taxonomic entities is required.

In accordance with IUCN guidelines a species common name is capitalised and the scientific name is provided in parentheses at the first use in a section and then common name is used in the subsequent text (IUCN Red List Unit 2009).

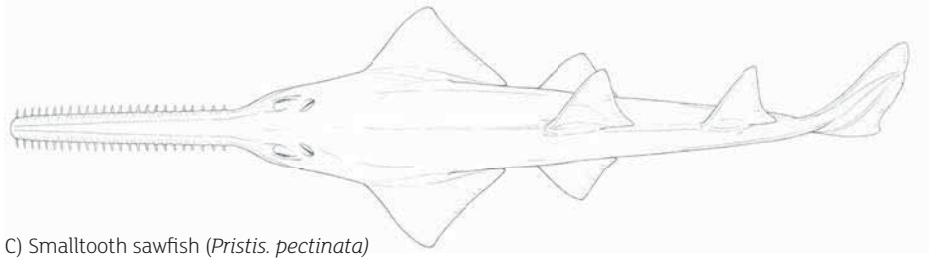
Figure 2
A dorsal illustration of all five sawfish species:



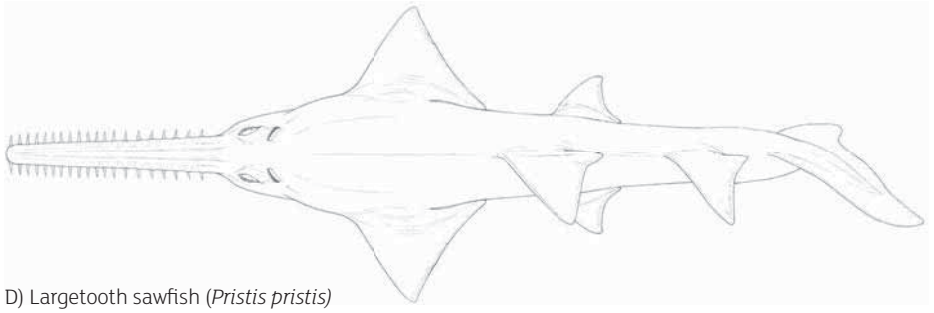
A) Narrow sawfish *(Anoxypristis cuspidata)*



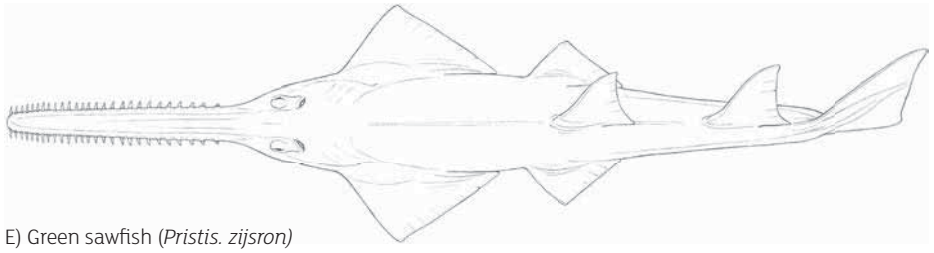
B) Dwarf Sawfish (*Pristis. clavata)*



C) Smalltooth sawfish (*Pristis. pectinata)*



D) Largetooth sawfish (*Pristis pristis)*



E) Green sawfish (*Pristis. zijsron)*

Table 1. List of previous sawfish species names (prior to Faria *et al.* 2013), widely accepted common names and valid species names

Previous species name	Valid species name in 2013	Common name
Anoxypristis cuspidata	*Anoxypristis cuspidata*	Narrow Sawfish
Pristis clavata	*Pristis clavata*	Dwarf Sawfish
Pristis pectinata	*Pristis pectinata*	Smalltooth Sawfish
Pristis zijsron	*Pristis zijsron*	Green Sawfish
Pristis pristis	*Pristis pristis*	Largetooth Sawfish
Pristis microdon	*Pristis pristis*	Largetooth Sawfish
Pristis perotteti	*Pristis pristis*	Largetooth Sawfish

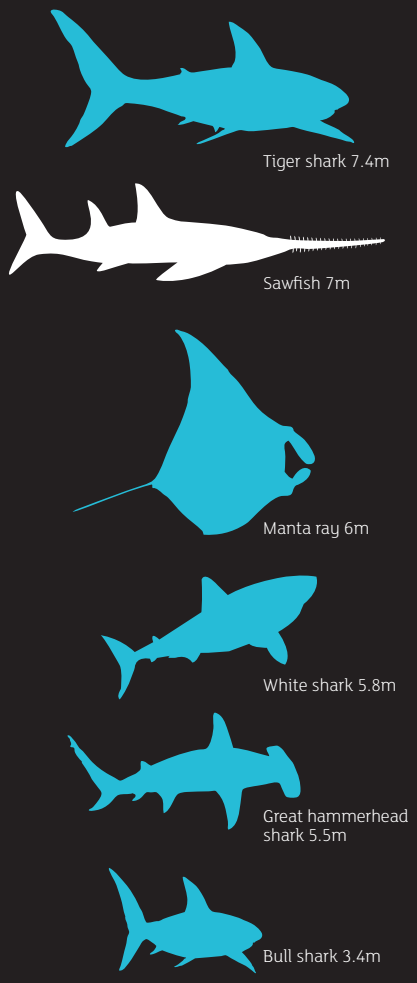
3| The Unusual Biology of Sawfishes

Colin A. Simpfendorfer, Kelcee Smith and John K. Carlson

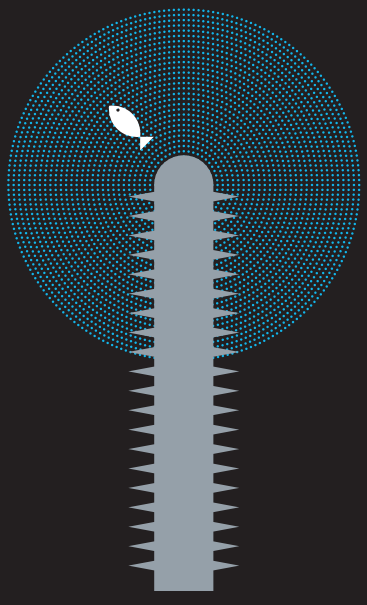
Sawfishes are a small and unusual family of shark-like rays found in coastal freshwaters and seas that grow to very large sizes. They are cartilaginous fishes of the Class Chondrichthyes (sharks, rays, and chimaeras), and are characterised by their large, flat, toothed rostrum. The rostrum makes up between 20% and 28% of the length of individual animals (Thorson 1973, Wiley *et al.* 2008), and plays an important role in prey detection and capture (Wueringer *et al.* 2012). Firstly, it contains extensive sensory organs that can detect the minute electrical signals from prey, helping them locate and capture their food. Secondly, it is used to 'club' fish - stunning or killing them before they are eaten.

Their abilities are so well refined that they can locate and target free-swimming fish in muddy water. Their ability to detect and stun prey in the three dimensions of the water column exceeds the abilities of other long-nosed relatives, such as shovelnose rays (Common Shovelnose Ray (*Glaucostegus typus*) and Eastern Shovelnose Ray (*Aptychotrema rostrata*) (Wueringer *et al.* 2012).

Sawfishes can potentially be visually or aurally confused for sawsharks (Family Pristiophoridae) or the Swordfish (*Xiphias gladius*). Sawsharks are also cartilaginous fish that have a long, toothed rostrum. There are three key distinctions between sawfishes and sawsharks. The gills of sawshark are on the side of the body above the pectoral fins, whereas sawfishes have gills on the underside of the body (as is the case for all skates and rays). Sawsharks live in much deeper waters than sawfishes, and they also have a pair of long barbels on the rostrum. Occasionally sawfishes are incorrectly referred to as Swordfish; which are teleost bony fishes that live in the open ocean and have a long narrow flat toothless bill (see Figure 3).



The rostrum contains extensive sensory organs that can detect the minute electrical signals from prey



It is used to 'club' fish - stunning or killing them before they are eaten

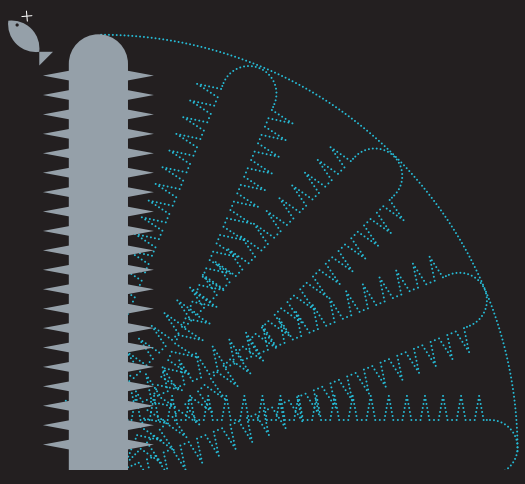
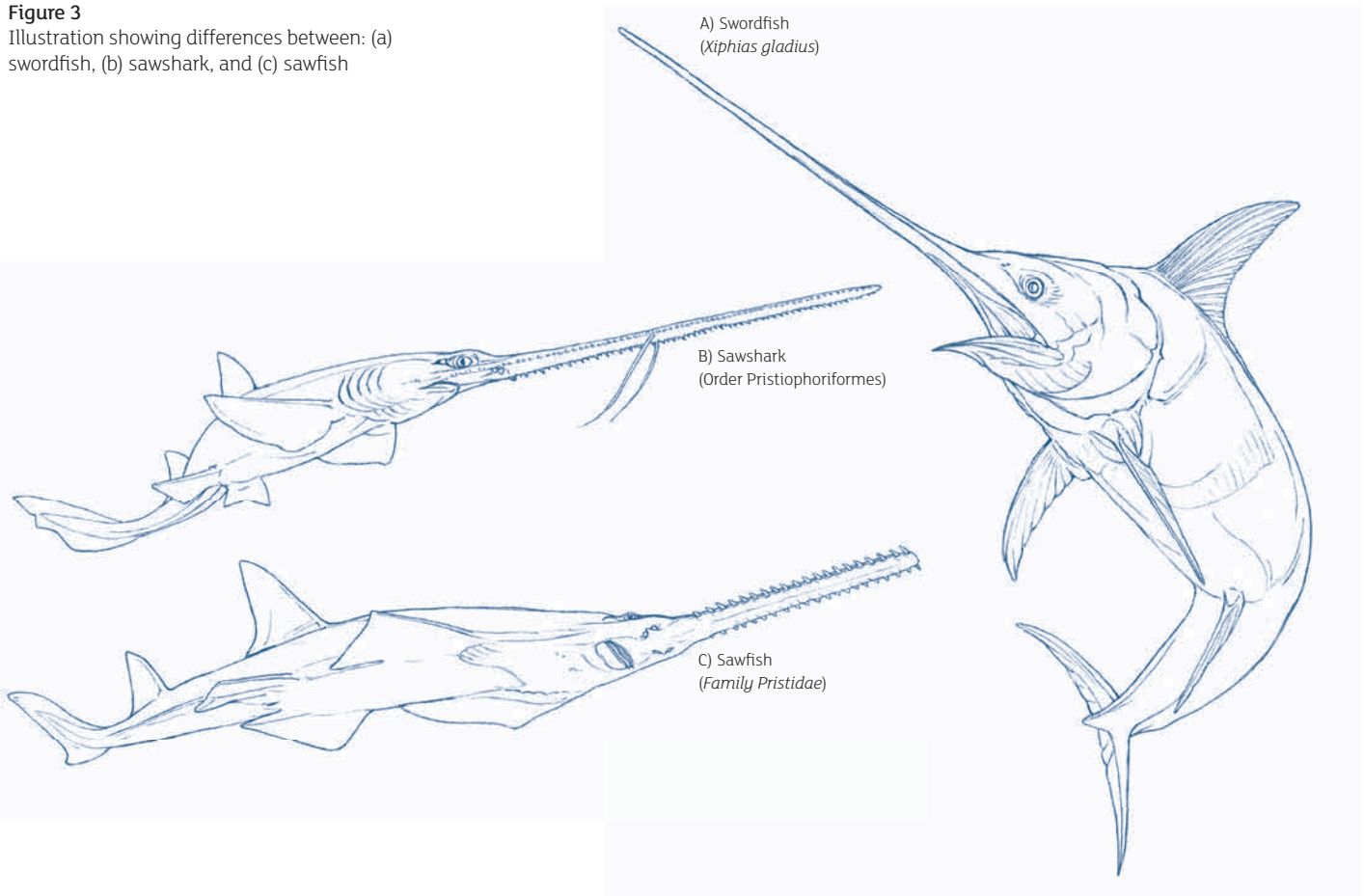
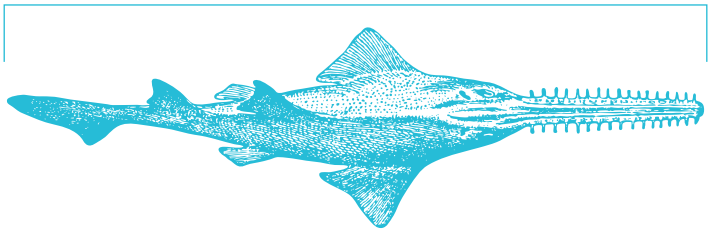


Figure 3
Illustration showing differences between: (a) swordfish, (b) sawshark, and (c) sawfish



Sawfish have been known to reach 7m in length



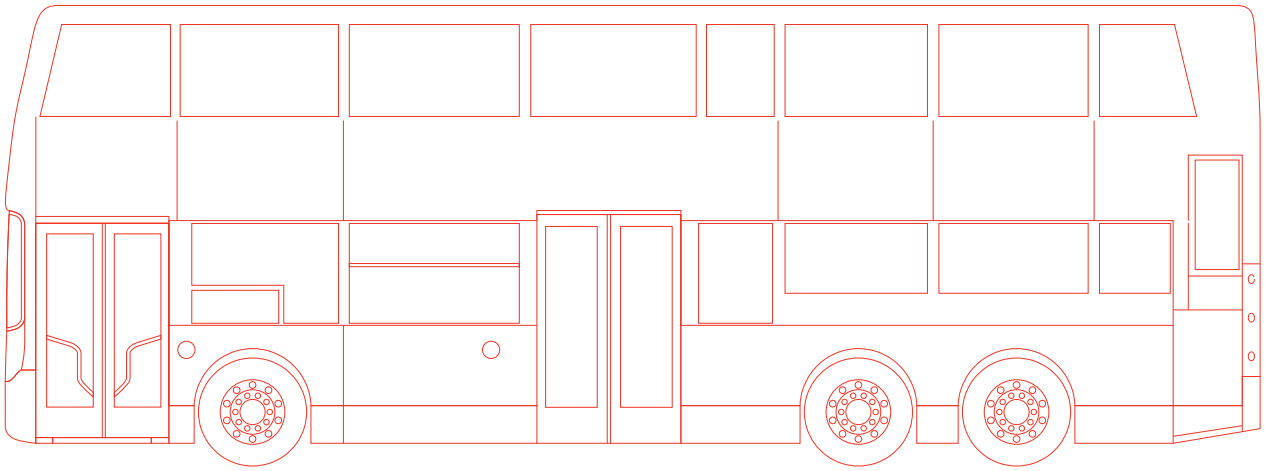


Figure 4.

Sawfishes are considered to be euryhaline (they can tolerate a wide range of salinities) and are generally found in rivers, lakes, estuaries, and marine waters shallower than 20 m (see Figure 4). The depth limit is shallow and these species are restricted to the nearshore waters of the continental shelves. The Largetooth Sawfish (*P. pristis*) has been found as deep as 122 m (J.K. Carlson pers. comm. 2013) and Smalltooth Sawfish has been found down to 88 m depth (Poulakis and Seitz 2004).

Young sawfishes prefer very shallow water, often being observed in depths of about 0.25 m to help them avoid predators (Whitty *et al.* 2009, Simpfendorfer *et al.* 2010). The shallow depth distribution and the use of freshwater and estuarine habitats may reduce the risk of predation, although Bull Sharks (Carcharhinus leucas), crocodiles, and alligators are known to prey on young sawfishes (Branstetter 1990, Thorburn *et al.* 2007).

The risk of predation is likely to decrease as juvenile sawfishes grow in length and mass, and they are found in more varied habitats and in deeper waters (Simpfendorfer *et al.* 2010, Wiley and Simpfendorfer 2010). Sawfishes feed on fishes, shrimp, and other bottom-dwelling invertebrates.

The rostrum makes up between 20% and 28% of the length of the animal

4| The Cultural Value of Sawfishes

Matthew T. McDavitt

Cultural values of threatened species are not typically a major component of conservation planning, but these values are critically important as they often underpin, motivate, and enable conservation action (McClenachan *et al.* 2012, Small 2012). First, the success of conservation efforts often hinges upon the perceived cultural or economic value that a particular species holds. For example, it is easier to foster public concern and political support for symbolic, charismatic, or valuable taxa, than for obscure ones (McClenachan *et al.* 2012). Such differences in cultural values may go some way to explain why there is a popular dolphin-safe tuna campaign, but no equivalent program to avoid shark bycatch in similar fisheries (Baird and Quastel 2011). Therefore, raising awareness of the cultural value of species can be a powerful tool with which to generate public concern for threatened species, which in turn can enhance the political mandate for conservation action.

Second, understanding the existing cultural significance of threatened species can help to craft culturally-appropriate management plans, and effective outreach activities to best engage and motivate communities to conserve. For example, interviews with native Hawaiians revealed that the Critically Endangered Hawaiian Monk Seal (*Monachus schauinslandi*) is associated with oral traditions and mythologies in some locations, while in other communities few cultural values exist for this species (Kittinger *et al.* 2011). Understanding place-specific cultural values and historical significance of species to different communities can help to shape conservation actions that have a high likelihood of success

Finally, the compilation of information about cultural uses and values can provide useful biological information, including the scope and impact of commercial or subsistence exploitation (Dulvy and Polunin 2004, Sáenz-Arroyo and Roberts 2005), population abundance compared to that found in the past (Sáenz-Arroyo *et al.* 2006), and biological features not previously known such as the existence of historical spawning locations, migrations, and ontogenetic changes (Ames 2004). One of the most important contributions of cultural information is that it can provide information on a species' historical and current range (Ames 2004, McClenachan and Cooper 2008, Guidetti and Micheli 2011).

For example, a diary written in 1726 describing a visit to Baja California included a drawing that depicted a native man carrying a 'fish' that bore a strong resemblance to the highly endangered porpoise, the Vaquita (*Phocoena sinus*), hence extending the current biological knowledge of the species' range and biological tolerances (Sáenz-Arroyo *et al.* 2005).

In West Africa, sawfishes are the principal symbol of judicial impartiality, among several coastal Congo peoples. It is not a blindfolded Lady Justice that symbolises justice as in the Western world, but the toothed rostrum of sawfishes. The quote "Sawfish Saw: [All that] went in front, I cut the same", describes the propensity of sawfish to smack their prey from the water column - seemingly without exception. This sawfish behaviour became, for these people, a model for a revered societal value. The symbolic sawfish rostrum is carried by the masked dancers who convey moral teachings among the coastal Congo, a reminder that justice must be fair, no matter what the accused person's status.

A masked dancer of the West African Woyo people called "Mampana", whose symbolism warns people not to gossip. The dancer holds a section of a *tchi tchiela tchi mbavu*, a sawfish rostrum, as a symbol that justice must be applied equally to all, just as the sawfish strikes every fish that comes before it's toothed rostrum. Cabinda, Angola Sawfishes have inspired a rich and robust cultural history - even surpassing that of sharks generally - probably

"The saw of the sawfish has killed the sawfish".

because they often inhabit the same shallow marine and riverine shorelines closest to human settlements. Additionally, people have had a natural fascination with the toothed rostrum of sawfishes, an intriguing and portable object. Such cultural value can be employed at the local level to foster awareness, concern, and ultimately, political and economic support for threatened sawfishes. While a comprehensive listing of the cultural importance of sawfishes in every range state is beyond the scope of this short account, examples of the diversity of cultural representation of sawfishes demonstrate the varied ways that such accounts could be employed to create a positive image for sawfishes, as well as supplying knowledge about these poorly-studied species.

Traditional cultures can also provide remarkable insights into the plight of species with which they interact. Recorded over a century ago, a proverb from the Duala people of Cameroon conveys surprising awareness of the vulnerabilities that threaten sawfishes. Symbolizing any single-minded obsession that leads to one's downfall or death, one Duala aphorism (a brief statement of a principle) reads: "The saw of the sawfish has killed the sawfish". As the Duala know the sawfish kills its prey using its saw, but this advantage has become its downfall, because the rostrum is easily entangled in fishing nets. The centrality of sawfishes to Duala culture is revealed by a proverb employed to teach listeners that news concerning dramatic events is rarely trustworthy: "Sawfish [caught] behind, news ahead [is incorrect]".

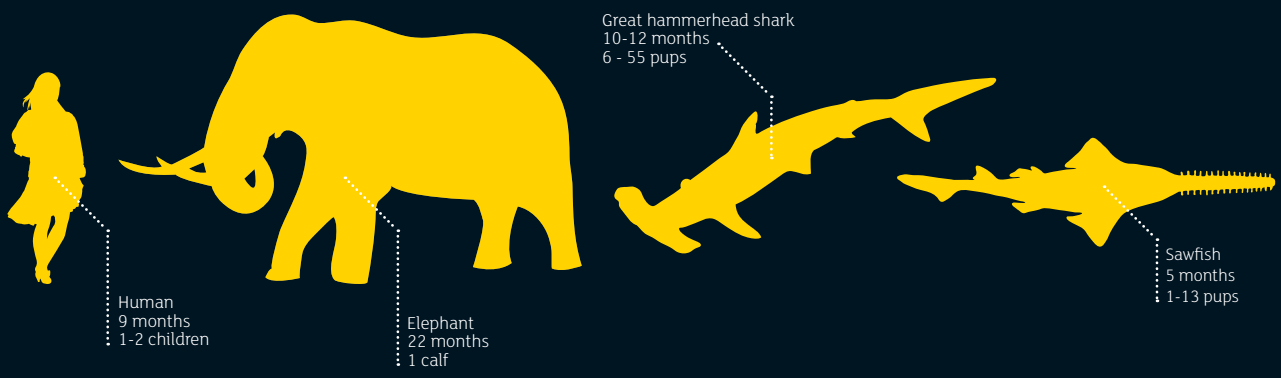
On the Atlantic coast of Panama, the Kuna people view sawfishes in a very positive light. According to traditional Kuna belief, sawfishes are special 'friends' of mankind, placed in the world by the creator to protect humanity physically, by patrolling the coasts and rivers, repelling dangerous beasts such as sharks, crocodiles, and whales. In addition, the powerful spirits of sawfishes may be called by shamans to help them battle the malevolent spirits of sickness that plague mankind. The Kuna attitude towards sawfishes, echoing Western notions about dolphins, provides a cultural 'personality' to sawfishes, sparking awareness and eliciting concern worldwide (M.T. McDavitt pers. obs.).

In Southeast Asia, sawfishes play an important role in the traditional account of the spread of Islam to Borneo. The first Muslim teacher to reach this island became known as "Sawfish-Rider" after he performed several miracles involving an immense sawfish to convince the local kingdom of the truth of his faith. Accounts and images of this story could form the core of a recommendation to raise awareness of sawfishes in Indonesia and Malaysia, demonstrating why individuals should care about the plight of dwindling sawfishes in the region.

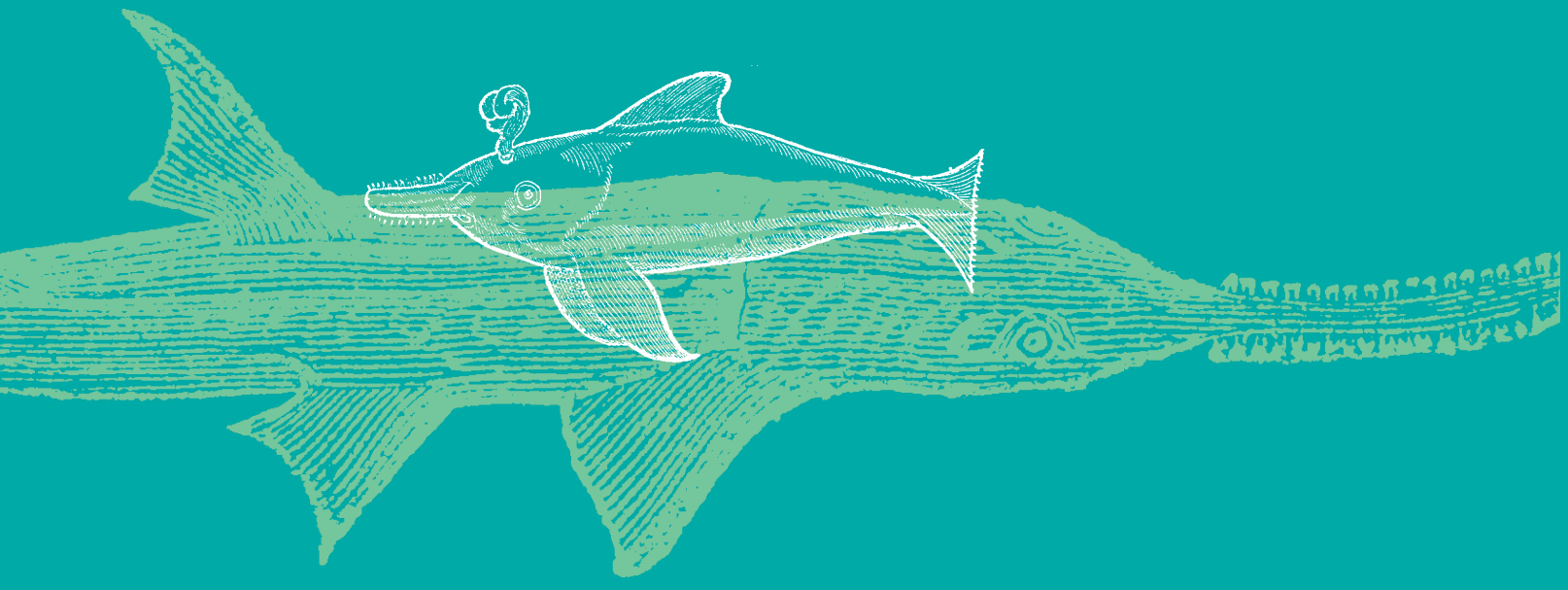
Cultural representation of sawfishes can also supply researchers with historical and modern range data. For example, abundant sawfish art and myth occurs among cultures along the Sepik River in Papua New Guinea, confirming that this system was formerly a stronghold for juvenile Largetooth Sawfish (*Pristis pristis*). Sawfish art, often incorporating actual rostra, and myth confirm that cultures familiar with sawfishes occur as far upstream as Kubkein.

Sawfishes are also important culturally in dozens of other societies throughout the tropical world. In several countries in West Africa, where sawfishes are associated with the authority of kings and the productivity of the rivers, these revered, supernaturally powerful fish appear on the West African CFA franc, both notes and coins. They have also been featured on postal stamps in South Africa, Viet Nam, Benin, and the Gambia.

The compilation of a species' cultural history can reveal some previously unknown facet of behaviour or biology, suggesting a new topic for scientific study, and continuing investigations into the historical and modern cultural significance of sawfishes could yield information important for conservation. Bringing awareness to the cultural significance of these species will enhance their charisma and increase conservation attention around the world.


Great hammerhead shark
10-12 months
6 - 55 pups
Human
9 months
1-2 children
Elephant
22 months
1 calf
Sawfish
5 months
1-13 pups

Red List Status and Geographic Distribution



Red List Status

It was essential to update the Red List Assessments of these species because of the revised taxonomic status of sawfishes and the substantial increase in available sawfish knowledge since the family was reassessed in 2006 (all species were originally assessed in 2000). Below is the new Red List Status for each species (and any associated subpopulations and the justification for this Red List Status. The justification is taken directly from the full Assessment which has more species-specific information, and can be found on the Red List website (www.iucnredlist.org).

5.1 Narrow Sawfish (*Anoxypristis cuspidata*)

Blanche R. D'Anastasi, Colin A. Simpfendorfer, Lynne van Herwerden (2013)

Status: Endangered A2cd

In 2006 this species was assessed as Critically Endangered. This downlisting is a non-genuine change (i.e. not a genuine improvement in status) because the declines occurred before the three-generation period to which the IUCN decline criteria are applied.

Justification: The Narrow Sawfish (*Anoxypristis cuspidata*) is an Indo-West Pacific species occurring from the northern Persian/Arabian Gulf to Australia and north to Japan. It is a bentho-pelagic species that occurs from inshore and estuarine areas to offshore habitats in depths of up to 100m.

This sawfish species has a relatively fast life history (growth, reproduction, generation length), reaching maturity early (2–3 yr) and having intrinsic rates of population increase >0.27 yr^{-1}, making it less susceptible to fishing pressure than other sawfish species. However, it does have the highest post-release mortality of all sawfish species. While the current population size and its historic abundance are unknown, it persists in most of its range states, but in substantially lower numbers than historically.

Like other sawfishes, the toothed rostrum and demersal occurrence makes Narrow Sawfish extremely susceptible to capture in gillnets and demersal trawl nets. The species has been affected by commercial net and trawl fisheries, which operate in inshore areas of its range, reductions in habitat quality, and coastal development, the impacts of which have cumulatively led to population decline. This species is listed on Appendix I of CITES, is protected in some range states as a no-take species, and is sheltered in some areas that are closed to fishing; but these actions alone will not be sufficient to ensure its survival in some regions. Ongoing fishing and development is likely to lead to future population declines.

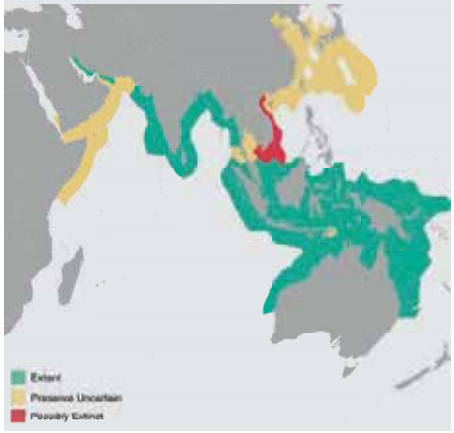
Despite a lack of quantitative data to support declines, current information indicates that Narrow Sawfish across its Indo-West Pacific range are considerably more rare than historically recorded. Declines of between 50 and 70% over three generation lengths (~18 years) are suspected and have primarily been attributed to ongoing capture in commercial net and trawl fisheries, with the Narrow Sawfish being particularly susceptible given it has poor post-release survival.

The previous assessment of this species was Critically Endangered. However, given the new information that has become available since the last assessment and the fact that the more dramatic declines have happened outside of the three generation period (~18 years), the species now meets the criteria for an Endangered listing (representing a non-genuine change in status based on new information available since the time of the last assessment).

Figure 5.
Range map of the Narrow Sawfish (*Anoxypristis cuspidata*).

Range is extended out to the edge of the EEZ (200 nautical miles) to make it more visable. In reality the actual sawfish range is limited to shallower than the 100 m bathymetry.

The presence of each sawfish species, as determined by expert consultation at a IUCN Sawfish workshop, follow the IUCN presence codes: Extant - the species is known or is presumed to presently occur in the area, Possible Extinct - the species did occur in this area but due to no recent sightings its occurrence is unknown, Possible Extinct - the species was formerly known, or was likely to occur in the area but is most likely now locally extinct.



5.2 Dwarf Sawfish (*Pristis clavata*)

Peter M. Kyne, Cassie Rigby,
Colin A. Simpfendorfer (2013a)

Status: Endangered A2cd

In 2006 this species was assessed as Critically Endangered. This downlisting is a non-genuine change (i.e. not a genuine improvement in status) because the declines occurred prior to the three-generation period to which the IUCN decline criteria are applied.

Justification: The Dwarf Sawfish (*Pristis clavata*) is possibly now restricted to tropical waters of northern Australia. Historically, it apparently occurred more widely in the Indian Ocean region and Southeast Asia, but there are very few verifiable records from outside of Australia and therefore a great deal of uncertainty regarding its true historical distribution. There have been no confirmed records outside of Australia since the 1800s, although it may still persist in other parts of the Indo-West Pacific. Within Australia, its status on the northeastern coast of Queensland is uncertain with no confirmed records, either recent or historic; its confirmed range is from western Cape York, Queensland, to the northern Pilbara region of Western Australia.

It may therefore now have the smallest known distribution of any sawfish species. This is a shallow water coastal and estuarine sawfish occurring on sand and mud flats, with a close association to those adjacent to mangroves. Although it penetrates upstream into rivers it does not regularly occur in freshwater reaches. It reaches at least 318cm TL but its life history is poorly known. Demographic models demonstrate that population productivity is low. Like other sawfishes, the toothed rostrum and demersal occurrence makes Dwarf Sawfish extremely susceptible to capture in gillnets and demersal trawl nets. Historically, the species has been affected by commercial net and trawl fisheries which operate in inshore areas of its range, the cumulative impacts of which have led to the population decline of this and other sawfish species. The restricted inshore occurrence of Dwarf Sawfish makes it particularly susceptible to capture in commercial gillnet fisheries and observer data has shown that mortality associated with such capture is close to 50% despite a ban on retention

Despite uncertainty regarding the extent of the species' wider historical range, it can be considered 'possibly extinct' outside of Australia with the disappearance of the species probably occurring outside of the last three generation period (pre-1960s; considering that there are no confirmed records since the 1800s).

All sawfish species that occur in Australian waters have undergone significant, albeit largely unquantified, declines, although the current population size and historical abundance of Dwarf Sawfish is unknown. While specific management measures are now in place in Australia, including full species protection, education of fishers about safe release practices, and fishery-specific management, threats are ongoing and there is no information to suggest that the population is recovering from previous declines. Declines of 50 - 80% are inferred from capture in continuing commercial fisheries, with the Dwarf Sawfish particularly susceptible given its restricted inshore occurrence and relatively limited global range; it is therefore assessed as Endangered.

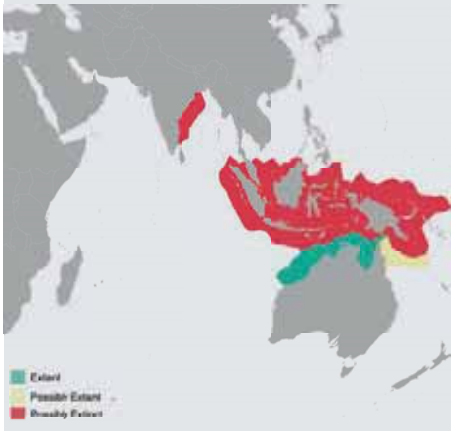
Some remote regions of northern Australia do however have little commercial fishing activities with some relatively small inshore areas closed to commercial fishing. This may provide localised refugia for Dwarf Sawfish (an area where conditions have enabled the species to survive after extinction in surrounding areas), but until such time that viable populations can be verified, it is assumed that the species is continuing to decline, given that threats are ongoing.

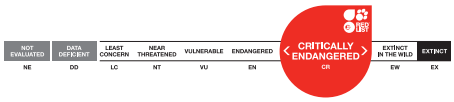
The previous assessment for this species was Critically Endangered. However, given the new information that has become available since that last assessment and the fact that the more dramatic declines have happened outside of the three generation period (~49 years), the species now meets the criteria for an Endangered listing (representing a non-genuine change in status based on new information available since the time of the last assessment).

Figure 6.
Range map the Dwarf Sawfish *(Pristis clavata)*.

Range is extended out to the edge of the EEZ (200 nautical miles) to make it more visable. In reality the actual sawfish range is limited to shallower than the 100 m bathymetry.

The presence of each sawfish species, as determined by expert consultation at a IUCN Sawfish workshop, follow the IUCN presence codes: Extant - the species is known or is presumed to presently occur in the area, Presence Uncertain - the species did occur in this area but due to no recent sightings its occurrence is unknown, Possible Extinct - the species was formerly known, or was likely to occur in the area but is most likely now locally extinct.





5.3 Smalltooth Sawfish (*Pristis pectinata*) Global

John K. Carlson, Tonya R. Wiley, Kelcee Smith (2013b)

Status: Critically Endangered A2cd

Justification: The Smalltooth Sawfish (*Pristis pectinata*) has been wholly or nearly eliminated from large areas of its former range in the Atlantic Ocean by fishing (trawl and inshore netting) and habitat modification. Negative records from scientific surveys, anecdotal fisher observations, and fish landings data over its historic range infer a population reduction of ≥95% over a period of three generations (i.e. 1962 to present). The remaining populations are now small, and fragmented. The species can only be reliably encountered in the Bahamas (where suitable habitat is available) and the United States (Georgia south to Louisiana). It is rare but present in Honduras, Belize, Cuba, Sierra Leone, and possibly Guinea-Bissau and Mauritania. Threats to Smalltooth Sawfish still exist today in areas where sawfishes are unprotected and habitat modification (mangrove removal) and inshore netting still occurs.

Smalltooth Sawfish Western Atlantic Subpopulation

Tonya R. Wiley, John K. Carlson, Kelcee Smith (2013)

Status: Critically Endangered A2cd

Justification: The Smalltooth Sawfish (*Pristis pectinata*) has been wholly or nearly eliminated from large areas of its former range in the Western Atlantic Ocean by fishing (trawl and inshore netting) and habitat modification. Negative records from scientific surveys, anecdotal fisher observations, and fish landings data over its historic range infer a population reduction ≥95% over a period of three generations (i.e. 1962 to present). While the population found in the United States appears to have stabilised with some evidence of increase, information from other areas is lacking. The remaining populations are inferred to be small and fragmented based on the lack of records. The species can only be reliably encountered in the Bahamas (where suitable habitat is available) and the United States (Georgia south to Louisiana). It is rare but present in Honduras, Belize, and Cuba. While historic threats to Smalltooth Sawfish have been reduced in places like the U.S., threats still exist today from areas where sawfishes are unprotected and habitat modification and inshore netting still occurs.

Smalltooth Sawfish Eastern Atlantic Subpopulation

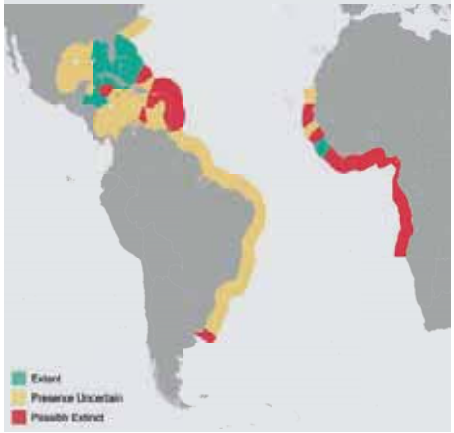
John K. Carlson, Tonya R. Wiley, Kelcee Smith (2013c)

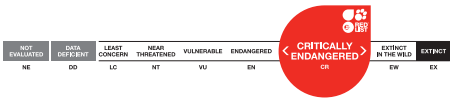
Status: Critically Endangered A2cd

Justification: The Smalltooth Sawfish (*Pristis pectinata*) were once a common component of the marine fauna of the Eastern Atlantic but now have been nearly eliminated primarily by fishing (trawl and inshore netting). The lack of records infers a population reduction of ≥80% over a period of three generations (i.e. 1962 to present) based on a reduction in extent of occurrence (EOO). There has been only one confirmed record for the region in the last 10 years (Sierra Leone in 2003) and it is not known if the population is recovering. There are unconfirmed records (*Pristis* sp.) from only two other countries (Guinea-Bissau in 2011, and Mauritania 2010). It is likely that areas around Guinea-Bissau represent the last areas where sawfishes can be found in western Africa. Threats to Smalltooth Sawfish are ongoing from inshore netting and habitat modification (mangrove removal).

Figure 7.
Range map of the Smalltooth Sawfish *(Pristis pectinata)*.

Range is extended out to the edge of the EEZ (200 nautical miles) to make it more visable. In reality the actual sawfish range is limited to shallower than the 100 m bathymetry. The presence of each sawfish species, as determined by expert consultation at a IUCN Sawfish workshop, follow the IUCN presence codes: Extant - the species is known or is presumed to presently occur in the area, Presence Uncertain - the species did occur in this area but due to no recent sightings its occurrence is unknown, Possible Extinct - the species was formerly known, or was likely to occur in the area but is most likely now locally extinct.





5.4 Largetooth Sawfish (*Pristis pristis*) Global

Peter M. Kyne, John K. Carlson, Kelcee Smith (2013b)

Status: Critically Endangered A2cd

Justification: The Largetooth Sawfish (*Pristis pristis*) formerly had a widespread tropical distribution, consisting of four subpopulations (Eastern Atlantic, Western Atlantic, Indo-West Pacific and Eastern Pacific). A recent taxonomic review has shown that *P. perotteti* (Atlantic) and *P. microdon* (Indo-West Pacific) are synonymous with *P. pristis* and this Red List assessment replaces the previous (2006) assessments for those species. The Largetooth Sawfish is a large (greater than 6.5m TL) euryhaline species, with juveniles occurring in freshwater systems and adults in marine and estuarine environments (although in Lake Nicaragua, individuals spent much, if not all, of their lives in freshwater).

All subpopulations have undergone significant population declines and the species is now apparently extinct in many former range states. In most others, recent records are rare (for example there have been very few records in the Eastern Atlantic in the last decade). In the Western Atlantic, current records indicate that Largetooth Sawfish can only be regularly encountered today in the Amazon River basin, the Rio Colorado-Rio San Juan area in Nicaragua, and possibly some remote areas of French Guiana, Suriname, and Guyana. In the Indo-West Pacific, northern Australia represents a globally important remaining population centre. Overall, a population reduction based on a reduction in extent of occurrence (EOO) of ≥80% over a period of three generations (i.e. 1960s to present) is inferred. Despite protection in some range states (e.g. Australia, India, Brazil, United States, Mexico; it is possibly extinct in the latter two range states), threats are ongoing and the species is assessed globally as Critically Endangered.

Largetooth Sawfish Western Atlantic Subpopulation

Authors: John Carlson and Kelcee Smith (2013a)

Status: Critically Endangered A2cd

Justification: Western Atlantic Largetooth Sawfish (*Pristis pristis*) were once found from Uruguay to the United States and commonly found from Brazil to Mexico. They have been nearly eliminated primarily by fishing (trawl and inshore netting) throughout their range inferring a population reduction based on a reduction in extent of occurrence (EOO) of ≥80% over a period of three generations (i.e. 1961 to present). Despite protections in Brazil, Nicaragua, Mexico, and the United States (it is possibly extinct in the latter two range states), the species is still subject to threats region-wide from gillnets used in rivers, river mouths, estuaries, and nearshore waters, and trawling. Coastal development and the loss of mangroves also contributed to the decline and will slow any potential recovery of the species. Current records indicate that Largetooth Sawfish can only be regularly encountered today in the Amazon River basin, the Rio Colorado-Rio San Juan area in Nicaragua, and possibly some remote areas of French Guiana, Suriname, and Guyana. Declines and continuing threats result in a Critically Endangered assessment for this subpopulation.

Largetooth Sawfish Eastern Atlantic Subpopulation

Authors: John K. Carlson and Kelcee Smith (2013b)

Status: Critically Endangered A2cd

Justification: Eastern Atlantic Largetooth Sawfish (*Pristis pristis*) were once commonly found from Angola to Mauritania but now have been nearly eliminated primarily by fishing (trawl and inshore netting). The lack of recent records infers a population reduction based on a reduction in extent of occurrence (EOO) of ≥80% over a period of three generations (i.e. 1961 to present). There are recent unconfirmed records (*Pristis* spp.) from only two countries (Guinea-Bissau in 2011, Mauritania in 2010) and there have been few individual records of Largetooth Sawfish in the last decade (three reported in Guinea-Bissau in 2003, 2004 and 2005, and one in Sierra Leone in 2003) and in general, few captures over the last three generations. The region has been subject to intense trawl fisheries in offshore waters from international fleets since at least the 1950s, combined with intense fishing pressure due to rapid coastal population growth and the rise in artisanal fisheries throughout the region. Declines and continuing threats result in a Critically Endangered assessment for this subpopulation.

Largetooth Sawfish Indo-West Pacific Subpopulation

Peter M. Kyne, John K. Carlson and Kelcee Smith (2013c)

Status: Critically Endangered A2cd

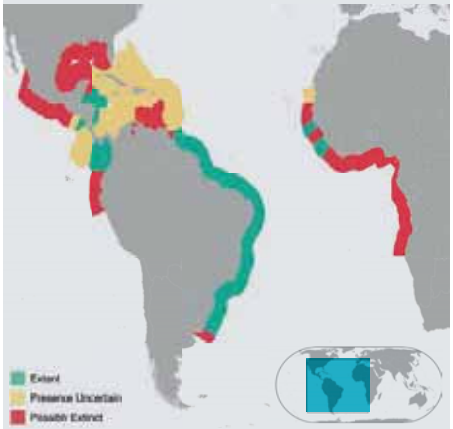
Justification: Indo-West Pacific Largetooth Sawfish (*Pristis pristis*) were once widespread from parts of the Western Indian Ocean, through India, the Bay of Bengal, and Southeast Asia to New Guinea and northern Australia. Large-scale population declines and extirpations have occurred across the species' former range, and

Figure 8.
Range maps of the Largetooth Sawfish (*Pristis pristis*).

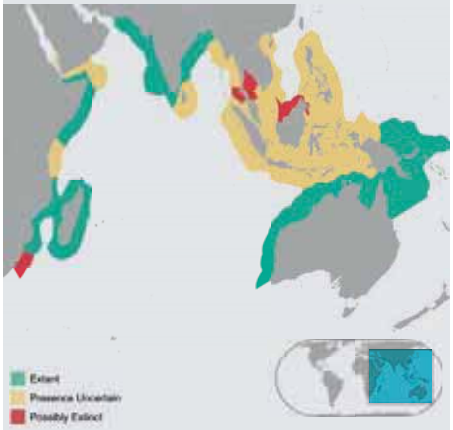
(A) Western and Eastern Atlantic Subpopulations, and (B) Indo-West Pacific and Eastern Pacific Subpopulations. Range is extended out to the edge of the EEZ (200 nautical miles) to make it more visable.

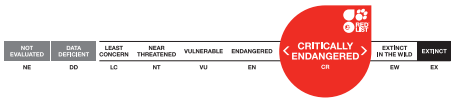
In reality the actual sawfish range is limited to shallower than the 100 m bathymetry. The presence of each sawfish species, as determined by expert consultation at a IUCN Sawfish workshop, follow the IUCN presence codes: Extant - the species is known or is presumed to presently occur in the area, Presence Uncertain - the species did occur in this area but due to no recent sightings its occurrence is unknown, Possible Extinct - the species was formerly known, or was likely to occur in the area but is most likely now locally extinct.

Map A



Map B





while there is uncertainty regarding its status in parts of the region, Australia now likely comprises a high proportion of the regional subpopulation (indeed, the global population of the species). Recent records from elsewhere in the Indo-West Pacific are now extremely rare; in places the species was once described as "common" or "abundant".

All sawfishes have also undergone significant, albeit largely unquantified, declines in Australia, and although protection and management is in place in Australia, there is no evidence to suggest population recovery. Regionally, a population reduction of ≥80% is inferred based on a reduction in extent of occurrence (EOO) over a period of three generations (i.e. 1969 to present). The subpopulation is considered to be Critically Endangered given declines and continuing threats; much of the species' former Indo-West Pacific range, with the exception of northern Australia, is subject to intense human pressure, particularly through generally unregulated and unmanaged fisheries, and habitat loss and degradation in critical sawfish habitats.

Largetooth Sawfish Eastern Pacific Subpopulation

John K. Carlson, Kelcee Smith and Peter M. Kyne (2013a)

Status: Critically Endangered A2cd

Justification: Eastern Pacific Largetooth Sawfish (*Pristis pristis*) were formerly present from Peru to Mexico but are now found only in Columbia, Nicaragua, and Panama (few records) inferring a population reduction based on a reduction in extent of occurrence (EOO) of ≥80% over a period of three generations (i.e., 1961 to present). Threats are ongoing for Eastern Pacific Largetooth Sawfish, from longline fisheries targeting sharks and inshore netting. Furthermore, there has also been a substantial decline in mangroves which are critical habitat for sawfish. Declines and continuing threats result in a Critically Endangered assessment for this subpopulation.

5.5 Green Sawfish (*Pristis zijsron*)

Colin A. Simpfendorfer (2013)

Status: Critically Endangered A2cd

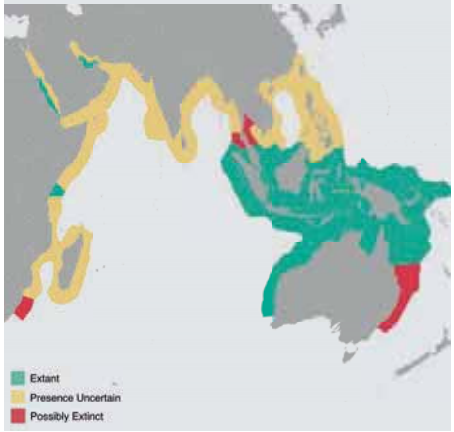
Justification: The Green Sawfish (*Pristis zijsron*) is probably the largest of the sawfish species, reaching lengths in excess of 7m, although currently lengths greater than 6m are rare. Historically, it occurred widely in the Indo-West Pacific from southern Africa to Australia and Taiwan, including the Red Sea, Persian (Arabian) Gulf, and some of the Indian Ocean islands.

The Green Sawfish is a coastal species, with the young occurring in shallow nearshore waters, while the adults are more common offshore in waters to >70m. Its life history is poorly known, with data from the Gulf of Carpentaria (northern Australia) indicating that it has low intrinsic rates of population increase, making its resilience to fishing pressure low and its recovery from depletion slow. While the current population size and historic abundance is unknown, it is suspected as having declined in all of its range states. In Australian waters, its range has been well documented to have contracted significantly.

Like all sawfishes, the toothed rostrum and demersal occurrence makes Green Sawfish extremely susceptible to capture in gillnets and demersal trawl nets. Historically, the population has been negatively affected by commercial net and trawl fisheries which operate in inshore areas throughout most of its range, the cumulative impacts of which have led to population declines. This species is now protected by no-take status in some range states (e.g. Australia, Bahrain, India), is listed on Appendix I of CITES, and is protected by some areas that are closed to fishing; but these actions alone will not be sufficient to ensure its survival in most regions. Despite a lack of quantitative data to support declines, available information indicates that populations of Green Sawfish are considerably rarer than historically across its entire range. Australia has some of the last remaining viable populations of Green Sawfish in the world, albeit at significantly reduced levels. Declines in the population are suspected to exceed 80% over three generation lengths (~44 yr), and it is possible that there has been localised extinction in a number of range states due to intensive fishing, reducing its extent of occurrence, and supporting its listing as Critically Endangered.

Figure 9. Range map the Green Sawfish (*Pristis zijsron*).

Range is extended out to the edge of the EEZ (200 nautical miles) to make it more visable. In reality the actual sawfish range is limited to shallower than the 100 m bathymetry. The presence of each sawfish species, as determined by expert consultation at a IUCN Sawfish workshop, follow the IUCN presence codes: Extant - the species is known or is presumed to presently occur in the area, Presence Uncertain - the species did occur in this area but due to no recent sightings its occurrence is unknown, Possible Extinct - the species was formerly known, or was likely to occur in the area but is most likely now locally extinct.



6 | How was this information compiled?

Status Review

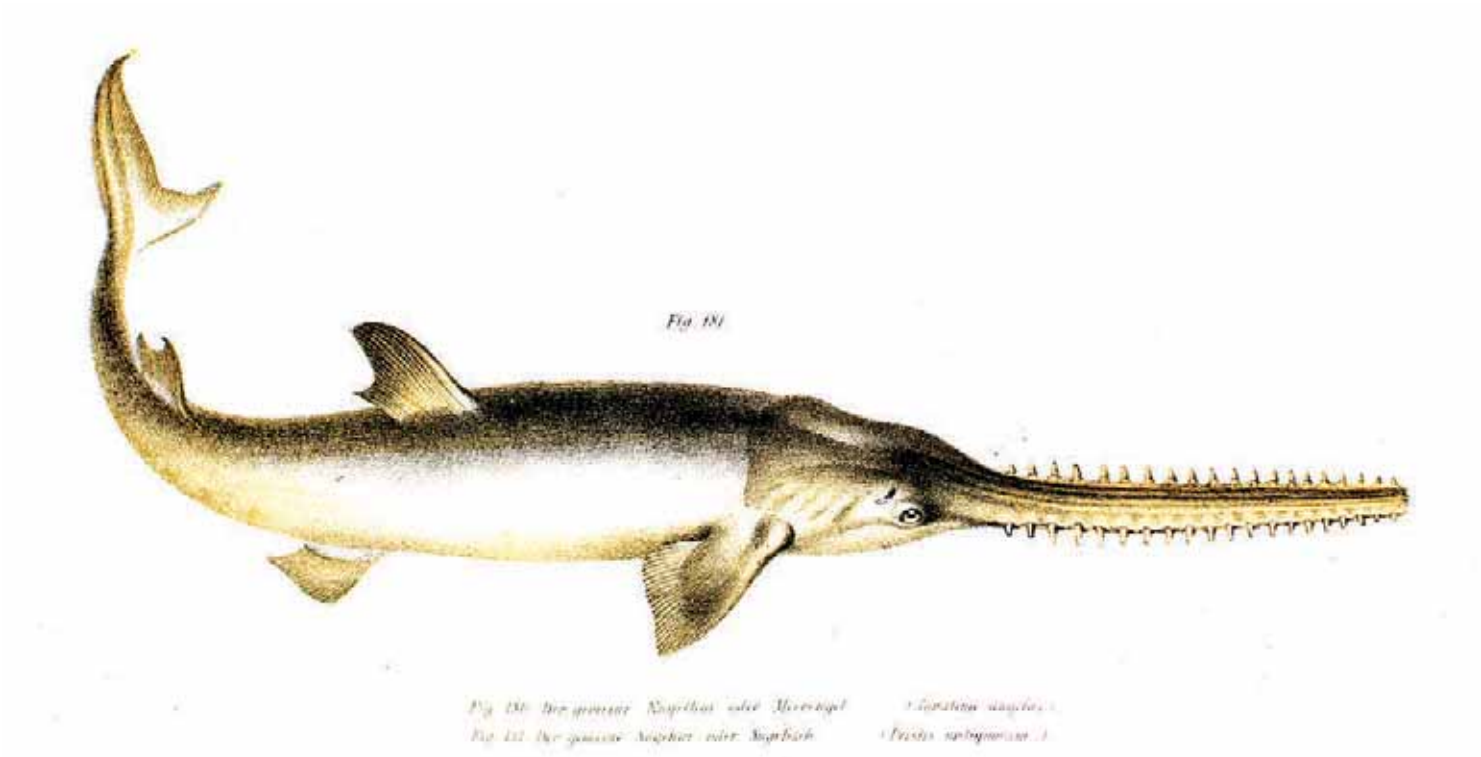
This Status Review was developed through two activities. First, all available peer-reviewed and grey literature on sawfishes was compiled and synthesized, as well as anecdotal information. Sawfish encounter records were also gathered from a number of databases: the International Sawfish Encounter Database (page 79), a NOAA/NFMS database, museum archives, and Fishbase (Froese and Pauly 2012). Further details on how this information was compiled can be found in Appendix 4. This yielded 8,530 records (with both a country and year) spanning 92 countries and more than two centuries since the earliest record in 1782. These records have not been verified for accuracy and may include duplicates; however, these data can be used to depict the current level of knowledge of sawfishes at this time and can provide a conservative estimate of species distribution (McKelvey *et al.* 2008).

Second, an online survey was developed to enable respondants to provide informal and unpublished knowledge on sawfishes across all range states (a country that has jurisdiction over the ecosystem that a species inhabits. See Appendix 5 for the structure of the survey). This enabled respondents to provide their knowledge of sawfishes in their region, including: recent and historic distribution, past and present threats, fisheries (e.g. bycatch, targeted), cultural values, and any management or conservation policies that are in place. Respondents were also given the opportunity to suggest other key contacts.

In addition to circulating this survey through a number of outlets (170+ SSG members; IUCN Shark Specialist Group website, Facebook page, and Twitter account; and science blogs), fisheries managers, scientists, NGOs and SCUBA diving organisations in range states were targeted where no representation from other avenues of inquiry had been received. Given the overall objective of involving as many interest groups as possible in the process of data collection and report creation, and notwithstanding the limited time and resources available, the literature reviewed and contacts made are fit for the current purpose. Through these efforts, submissions were received from members of 36 range states and their names are included in Appendix 2.

***Note to reader**

Sawfishes are often discussed as a family group rather than by individual species. Indeed it makes sense to consider them in aggregate because all species have broadly similar life histories, ecological, and distributional attributes and face similarly indiscriminate threats. Therefore, the narrative of this report is laid out by theme or by region, and in a number of cases sawfishes are treated as a group rather than providing detail on individual species, except where species-specific information was available.



Species Mapping

Lindsay N. K. Davidson

Sawfish distribution maps were created based on a combination of data sources including encounter databases, museum archives, literature searches, and expert judgement. Before expert consultation, maps for the five species were created using two databases: International Sawfish Encounter Database (Page 77) and data from the National Marine Fisheries Service. This data was based on sightings from between 1782 and 2011 and had 8,530 records. These data included taxonomic nomenclature of eleven sawfish species, which were reconciled with current taxonomic names.

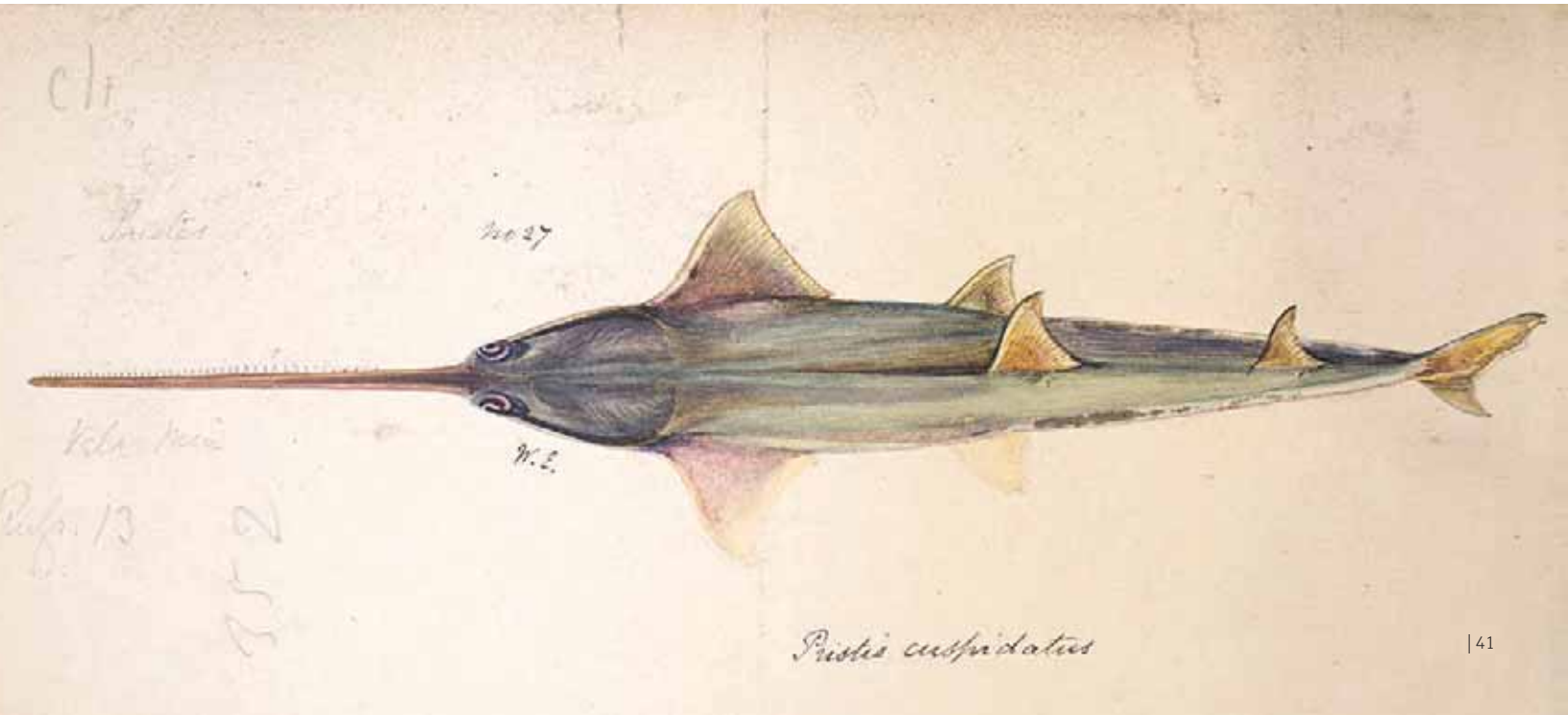
Expert opinion on the distribution of each sawfish species was collated at the Sawfish Workshop. Each map was presented to the group, and the presence status for each species was discussed. Four presence codes were used: Extant (the species is known, or thought very likely to occur presently in the area), Probably Extant (a species presence is considered probable, either based on extrapolations of known records, or realistic inferences), Presence Uncertain (the species was formerly known or thought very likely to occur in the area but it is no longer known whether it still occurs), and Possibly Extinct (the species was formerly known or thought very likely to occur in the area but it is most likely now extinct from the area).

The historical range of a species is defined as the sum of all portions of the range regardless of presence code. Based on the ecology of sawfishes, it was assumed that the sawfish depth range was no deeper than 100m and that the geographic range area calculations are therefore bounded by the 100m depth contour and summarised as the area occupied by each presence code expressed as a proportion of the total (historic area). For visualization purposes, the resulting maps were drawn out to extent of Exclusive Economic Zone (EEZ; 200 nautical miles from the coastline). Therefore, these maps are an overestimation of the range area. Some countries have EEZs connected to offshore islands. These areas were 'clipped' or removed from a species range. Consequently, islands such as Fernando de Noronha off Brazil, Lord Howe Island off New South Wales in Australia, and San Antonio off Equatorial Guinea, were removed from the range maps.

Species richness maps

Species richness maps were created using a hexagonal grid of cell size 23,322 km^2 covering the range of all sawfish species (mapped to the EEZ scale). The four presence codes for each species were counted within each cell. Historic species richness was determined by the count of species present per cell, regardless of current presence code).

8,530 records (with both a country and year) spanning 92 countries and more than two centuries.



7 | Geographical Distribution and Status

Summary

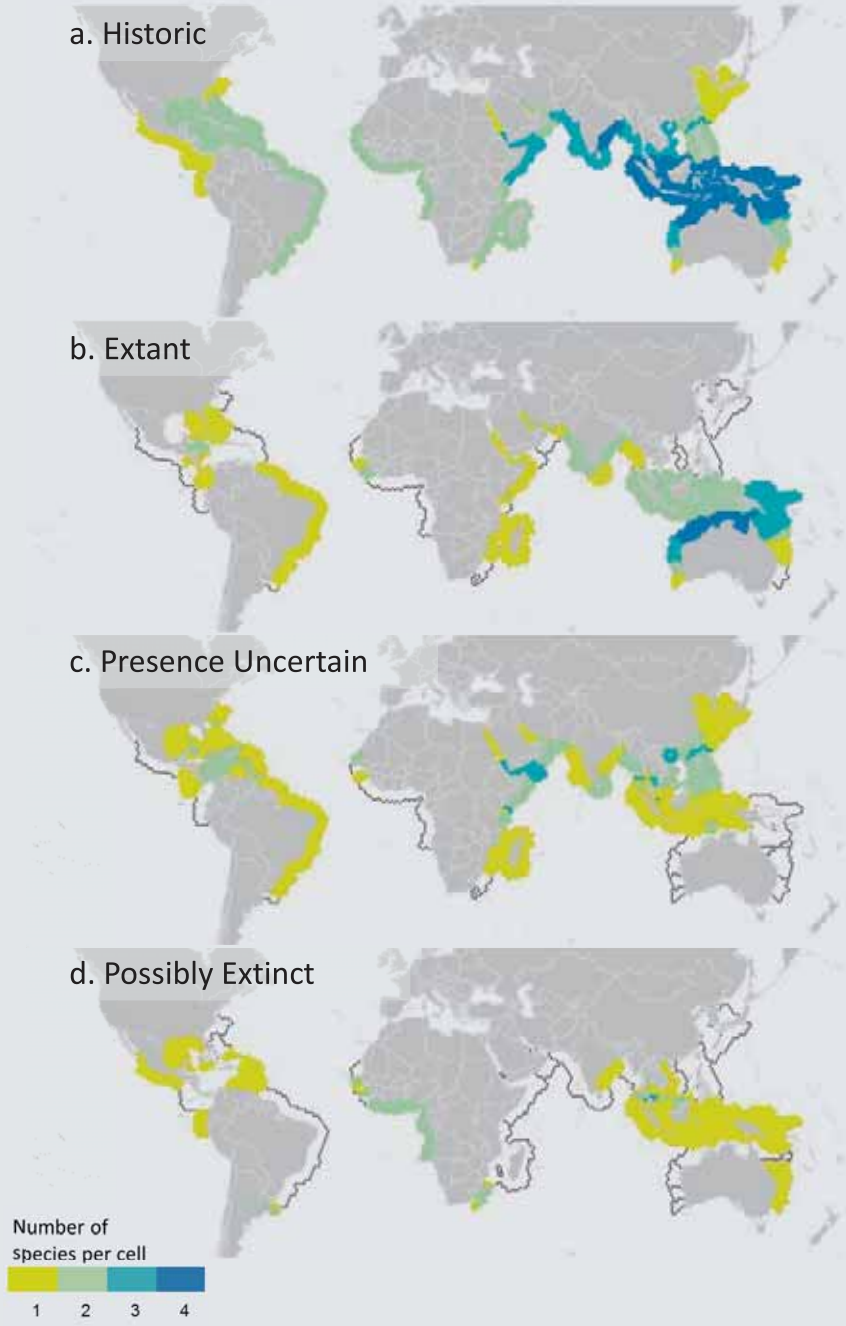
Historically, sawfishes have been documented throughout the tropical and subtropical waters of the Atlantic, Indian, and Pacific Oceans. In the Atlantic, they were found on the west and east coastlines, from North Carolina to central South America, and from the Mediterranean Sea to South Africa, respectively. In the Indian Ocean, their distributions extend up the eastern coast of Africa to the Red Sea and the Gulf, through much of the Indo-Pacific (encompassing northern Australia), and to southern China. In the Pacific, it is unclear whether they were found on the oceanic islands of the Pacific plate, but there are records from the west coast of Central and South America. Their historical and present-day range is shown in Figure 10A and B, and locations where the presence of sawfishes is uncertain are shown in Figure 10C.

The descriptions of population status are separated into four regions: (7.1) Western Atlantic, (7.2) Eastern Atlantic, (7.3) Indo-West Pacific, and (7.4) Eastern Pacific Ocean. Within these four regions we provide detail on the following areas: (7.1) United States, Caribbean and Central American coastal seas, Southwest Atlantic Ocean; (7.2) Mediterranean Sea, Eastern Central and Southeast Atlantic Ocean; (7.3) Western Indian Ocean, Red Sea, the Gulf, Northern Indian Ocean, Eastern Indian and Western Central Pacific Ocean, Australia; and (7.4) Eastern Pacific Ocean. The current understanding of the contemporary distribution of sawfishes is limited, and ultimately comprehensive surveys of suitable habitats will be required to validate this information.

The historical range of sawfishes has been much reduced to the point where only two centres of sawfish abundance remain - Florida, U.S. and northern Australia. Outside of both locations, populations of all five sawfish species have declined dramatically over the past half-century to the point were they are only rarely encountered now. Historically, sawfishes have been recorded from at least 92 countries since the late-1700s. Most recently, in the past three decades, sawfishes have been recorded from only just over half (n = 44) of the original range states (Appendix 4). Since 1980 there have been records from 33 countries and from only 24 countries since 1990. However, there have been almost no targeted surveys for these species throughout much of their geographic distribution.

Atlantic: Both the Largetooth Sawfish (*Pristis pristis*) and Smalltooth Sawfish (*P. pectinata*) are present in the Atlantic Ocean; however, targeted survey effort is required to determine their true status and distribution throughout most

Figure 10. Global sawfish species richness, the expected number of sawfish species that are found within the ~23,322 km2 hexagon grid. Note that some areas have artificially inflated richness values due to the hexagons showing overlapping range edges, whereas in reality there is a strong possibility that at a finer scale the species ranges do not cross. Richness map show: (A) historical species richness including all presence codes, (B) present day sawfish richness based on the Extant range portions only, (C) Presence Uncertain range portions only, locates sawfish richness that have high uncertainty and where further work is needed to identify if sawfish species are still present and (D) present day with only the Possibly extinct portions of ranges shown.



of this region. The Western Atlantic retains one of the last strongholds for one sawfish species. The Largetooth Sawfish is now thought to be regionally extinct, but a small slowly-increasing population of Smalltooth Sawfish remains in Florida, United States. In the Caribbean and Central American coastal seas, both species are still present but their species distributions do not overlap consistently; sawfishes have been found in the Bahamas, Cuba, and Nicaragua, and to a lesser extent in Belize and Panama.
In the Southwest Atlantic Ocean, the Smalltooth Sawfish appears to be regionally extinct, while Brazil is the only remaining range state for Largetooth Sawfishes. In the Eastern Atlantic, the historic presence of breeding sawfish populations in the Mediterranean Sea remains uncertain. However, it appears that both the Largetooth Sawfish and Smalltooth Sawfish remain in the Eastern Central and Southeast Atlantic Ocean, although the species identity of recent captures is unknown and large areas of the region remain unsurveyed (11 out of 18 countries).

Indo-West Pacific: Very little targeted work on sawfishes has been undertaken in this region. With the exception of Australia, scientific capacity is extremely limited; consequently there is greater uncertainty in the status of sawfishes there. Historically, four species were present in this region: Largetooth (*P. pristis*), Green (*P. zijsron*), Dwarf (*P. clavata*), and Narrow (*Anoxypristis cuspidata*) Sawfishes.

In the Western Indian Ocean, the Largetooth and Green Sawfishes have been identified as being present historically. Both species are now extinct from South Africa, Mauritius, Reunion Island and the Seychelles. Largetooth Sawfish is still present in Madagascar, but surveys are required to confirm their continued presence in Mozambique, Tanzania, Kenya, and Somalia. There is little species-specific information available in the Red Sea, however sawfishes are still present in Sudan but may be extinct from Saudi Arabia, Yemen, Djibouti, and Eritrea (surveys are required to confirm their status). Both the Green and Narrow Sawfishes are still present throughout the Gulf region, though there is little scientific capacity to identify recent captures. Although this region is adjacent to areas where Largetooth and Dwarf Sawfishes have been found, these species have not been identified in the Gulf, perhaps indicating that the habitats or conditions are not suitable for these species.

The Northern Indian Ocean is one of three regions inhabited by four sawfish species: Green, Largetooth, Dwarf, and Narrow Sawfish. Although once common, sawfishes are now considered rare throughout the region, but are still occasionally caught in artisanal and commercial fisheries.

Notwithstanding the paucity of the data from the Eastern Indian and Western Central Pacific Ocean the Green, Largetooth, Dwarf, and Narrow Sawfish appear to have experienced considerable population declines. There have only ever been a handful of records of the Dwarf Sawfish and since that there have been none in the past 100 years, it is most probably extinct from this region. The Green and Narrow Sawfish are both probably extinct in many areas of their former range. Largetooth Sawfish populations are severely depleted but still present in the region. Australia represents the only remaining global stronghold for the Narrow, Largetooth, and Dwarf Sawfishes. The Green Sawfish has experienced a large reduction in range size in recent decades due to overfishing.

Eastern Pacific Ocean: Only the Largetooth Sawfish is present and it was formerly distributed from Mazatlán, Mexico in the north, down to Peru. The current status of this species is poorly understood; it appears to only remain in a small part of its former range, populations are still in decline.

7.1 Western Atlantic

7.1.1 United States

John K. Carlson and Shelley Norton

Two sawfish species have been found in waters of the United States: the Smalltooth Sawfish (*Pristis pectinata*) and the Largetooth Sawfish (*P. pristis*). While historic captures of the Smalltooth Sawfish from within the United States range from Texas to New York, over the past century its range has contracted significantly and this species is now restricted to parts of southern Florida. The Largetooth Sawfish was found at much lower densities than the Smalltooth Sawfish, from Texas to Florida; however, it is now thought to be extinct.

The range of the Smalltooth Sawfish (Texas to New York) is likely to have been limited in the north by water temperatures and the availability of appropriate coastal habitat. Most records of this species from areas north of Florida occurred during spring and summer periods when inshore waters were warmer, and since most records were of larger individuals they likely represent seasonal migrants from a historic Florida core population rather than being members of a continuous, even-density population (Bigelow and Schroeder 1953)

The northernmost U.S. record of Smalltooth Sawfish is based upon a specimen from New York taken in July 1782 (Schopf 1788). There have been no reports of Smalltooth Sawfish in New Jersey, Maryland, or Virginia since 1928 (Hildebrand and Schroeder 1928). The only records of Smalltooth Sawfish from this area are only from the late 1800s and early 1900s (NMFS 2009).

There are multiple reports of sawfishes in North Carolina from the late 1800s and early 1900s, however some are repeats of earlier reports (NMFS 2009). However, since 1915 there have been only three published records of captures in North Carolina: one in 1937 (Fowler 1945), one in 1963 (Schwartz 1984), and a recent report from 1999 (Schwartz 2003). Records from South Carolina and Georgia are sparse with the last reported capture in 1958 and in 2002, respectively (NMFS 2009).

Further south in the Gulf of Mexico Large Marine Ecosystem, Smalltooth Sawfish historically occurred throughout the Gulf of Mexico from Texas to Florida. Numerous records of Smalltooth Sawfish exist from the ichthyological literature with many reporting that Smalltooth Sawfish was "frequently taken" and "plentiful" (Baughman 1943). Smalltooth Sawfish was regarded as "abundant" in Texas (Bigelow and Schroeder 1953) and as recently as the late 1950s sawfishes were characterised as being "not uncommon" in Alabama waters (Boschung 1957). Some reports indicate Smalltooth Sawfish was first recorded in the lower Mississippi River about 750 km upstream as far as the Red River, Arkansas (Rafinesque 1820) [Editorial note: We wonder whether it is more likely that this is a record of a Largetooth Sawfish, which is has greater preference and tolerance for freshwater]. However, records of Smalltooth Sawfish in the northern and western Gulf of Mexico have become rare in the last 30 years (NMFS 2009).

Since 1971, there have been only three published or museum reports of Smalltooth Sawfish captured from this region (NMFS 2009). Recent studies using data provided by the public encounters with Smalltooth Sawfish have yielded only a handful of records since 1990 (Wiley and Simpfendorfer 2010).

Numerous records of Smalltooth Sawfish exist from the ichthyological literature with many reporting that Smalltooth Sawfish was "frequently taken", "plentiful", and "abundant".

In Florida, although no longer common, Smalltooth Sawfish were once characteristic and prominent elements of inshore fish communities (NMFS 2009). For example, the Indian River Lagoon on the east coast of Florida was an area of former abundance. Evermann and Bean (1898) noted the Smalltooth Sawfish was "an abundant species," with a single commercial fisher having captured 300 Smalltooth Sawfish in a single fishing season. However, an extensive multi-year scientific study of the Indian River Lagoon system between 1975 and 1978 did not capture any sawfishes (Snelson and Williams 1981).

The core range of Smalltooth Sawfish (in Florida state or U.S. waters generally) is now restricted to the south and southwest portions of Florida from approximately Charlotte Harbor through the Dry Tortugas.

It is likely that the U.S. population is currently less than 5% of its pre-fishing population size, based on the contraction of the range, and other evidence of population decline (Simpfendorfer 2002). However, within its current much-reduced range, sightings data indicates that the population has stablized (Carlson *et al.* 2007) with the potential for some increasing expansion of its core range (NMFS 2010) and increased abundance within protected areas (Carlson and Osborne 2012) and there is still a resident reproducing population in south Florida (Seitz and Poulakis 2002, Poulakis and Seitz 2004, Wiley and Simpfendorfer 2010).

While they were never abundant, the Largetooth Sawfish historically occurred in the United States primarily only within the Gulf of Mexico Large Marine Ecosystem, from Texas to Florida (Burgess and Curtis 2003). Sawfish encounters have been reported throughout the entire Gulf of Mexico from the early part of the last century, but the morphological similarities between the Smalltooth Sawfish and Largetooth Sawfish limits the confidence in the ability of the layperson to distinguish between both species in many of these records. Notwithstanding this caveat, 40 confirmed records have been identified from U.S. waters, with 33 in Texas alone (Burgess *et al.* 2009).

In Texas, Largetooth Sawfish records decreased from northeast Texas to the Texas-Mexico border and were primarily found in three regions: Padre Island-Laguna Madre, Corpus Christi-Port Aransas, and Galveston-Freeport (Burgess *et al.* 2009). The distribution of these records could be an artifact of either or both of higher fishing effort or perhaps because Largetooth Sawfish are associated with the higher freshwater outflow in northern Texas.

Records of Largetooth Sawfish in the Galveston-Freeport, Texas area were primarily from shallow inshore areas from 1929 - 1957, though duplication of records may be a possibility (Baughman 1943). Ten Largetooth Sawfish were encountered in the Corpus Christi-Aransas region from 1917 - 1961 (Burgess *et al.* 2009). Only two records of Largetooth Sawfish recorded in the Padre Island-Laguna Madre area from between about 1925 and 1947, the latter of which came from a shrimp trawl.

The majority of the remaining Gulf of Mexico records of Largetooth Sawfish come from Florida. One Largetooth Sawfish was reported from Louisiana between 1916 - 1919. Two Largetooth Sawfish reported in Florida were recorded from Key West (1941), and another from Port Salerno (c. 1943 - 1952) which is on the east (Atlantic) coast of Florida, making it the only reported

The meat was salted and dried and sold in Guatemala or Mexico and the fins were sold to the Chinese traders.

Largetooth Sawfish from outside of the Gulf of Mexico in the U.S. (Burgess *et al.* 2009). A specimen from south Florida was collected by the American Museum of Natural History in 1910 and the final record for Largetooth Sawfish was from the Tampa Bay area in 1953 (Springer and Woodburn 1960).

All Largetooth Sawfish found in U.S. waters were large (>4.3 m) and primarily encountered during periods of warm water (May - October), which would indicate that Largetooth Sawfish was a seasonal visitor to waters of the U.S. from Mexico.

There is very high confidence that Largetooth Sawfish is now regionally extinct from U.S. waters. Of the total of 40 records, the last confirmed record of Largetooth Sawfish in U.S. waters was from Port Aransas, Texas on 24 June 1961. The last records for other Gulf of Mexico states were reported in Florida in 1941 and Louisiana in 1917 (Burgess *et al.* 2009).

7.1.2 Caribbean and Central American coastal seas

Rachel T. Graham

The presence of two sawfish species is confirmed in the Caribbean and Central American coastal seas: the Smalltooth Sawfish (*Pristis pectinata*) (Simpfendorfer 2005)and the Largetooth Sawfish (*P. pristis*) (Thorson 1982a,b). Sawfishes were once widespread throughout the coastal areas of the north, western, and central Caribbean and Gulf of Mexico, but it is likely that both species are now regionally extinct in many parts of the Caribbean and Central America, with the possibility of small populations remaining in the Bahamas, Cuba, Nicaragua, and to a lesser extent in Belize and Panama. Most information on populations of sawfishes in the region is based on historical records complemented with fisher interviews conducted by scientists between 2006 and 2012.

Historical accounts suggest a broad distribution of both Largetooth Sawfish and Smalltooth Sawfish, at both juvenile and adult life stages, throughout the western and southern Caribbean, including Mexico and the Central American Isthmus (Carranza 1959, Thorson *et al.* 1966, Thorson 1982a,b). Most information on sawfishes in Central America comes from studies conducted by Thomas Thorson and colleagues during the 1970s and 1980s (Thorson *et al.* 1966, Thorson 1973, 1982a,b). Fishers interviewed in the western Caribbean's Mexico, Belize, Guatemala and Honduras specifically identified overfishing and the proliferation of nets in the 1970s as the primary cause for the demise of sawfishes (Graham 2012).

Recent records of captures or sightings are extremely rare throughout the Caribbean and Central American coastal seas. Here they will be discussed from north to south from Barbados, the Bahamas, Cuba, Mexico, and down Mesoamerica (the Central American Isthmus that spans Belize, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, and Panama).

No sawfishes have been recorded recently in Barbados (H. Oxenford pers. comm. 2011). Although considered rare overall in the Bahamas (B. Franks pers. comm. 2011), the Smalltooth Sawfish is relatively common on at least one island - Andros Island (D. Grubbs pers. comm. 2013) and may have been historically distributed throughout the Bahamas. Recent captures include: (1) in the mangrove lagoon of Abaco Island around 2002 (D. Claridge pers. comm. 2011), (2) in a mangrove creek in Eleuthera in 2002 (E. Brooks pers. comm. 2011), and (3) they transiently occur in the well-monitored Bimini Lagoon, including captures as recent as 2009 (B. Franks pers. comm. 2011) and 2012 (G. Johnson pers. comm. to Dean Grubbs 2012). Substantial numbers are considered to persist on the west side of Andros due to the amount of available suitable habitat and low anthropogenic pressure (E. Brooks pers. comm. 2011). Two sawfish were tagged in satellite transmitters on the west side of Andros in 2010 (D. Grubbs pers. comm. 2013). Fishing guides in this region report that adult Smalltooth Sawfish are common in this region (D. Grubbs pers. comm. 2013). Very few reports of small juvenile Smalltooth Sawfish exist in the Bahamas, however, one record of a Smalltooth Sawfish under 150 cm TL in Andros provides anecdotal evidence that pupping may take place in this region (C. Bethel pers. comm. to D. Grubbs 2012).

In Cuba, literature reviews and interviews with fishers conducted by Fabian Pina-Amargos, who is currently compiling historical and contemporary information on sawfishes in Cuba (F. Pina-Armargos pers. comm. 2012), suggest the presence of a single species, Smalltooth Sawfish. Historically, the pattern of captures

in longline, net, and hook and line fisheries suggest low abundance with broad distribution throughout Cuba's territorial seas. Patriarch fishers interviewed noted that sawfishes were most abundant near the Old Bahamas Canal until the late 1980s. The status of sawfish populations at that site is no longer known, because the fishery is not now allowed to operate in that zone and there are few records compiled from the Bahamian fishing fleet that can be related to that site. Thirteen records of captures between 1960 and late 1990s were compiled from Cayo Paredón Grande (Ciego de Ávila) (1990s), Cayo Romano (Camagüey); Puerto Padre (Tunas) and Guamá (Pinar del Río) (1990s); Cayo Sevilla (Camagüey) (1960s); Sancti Spíritus (1960s) and the river mouth of Río la Mula y Magdalena-Cotobelo (Santiago de Cuba) (1960s) (F. Pina-Amargos pers. comm. 2012). In the past decade, sawfishes have been observed or captured for meat and trophies off southern Cuba's Punta Frances on the Isla de la Juventud, in the Canal de Cayo Blanco, Guayabal and the Río la Mula y Magdalena-Cotobelo (F. Pina-Amargos pers. comm. 2012).

There are few historical records of, or publications on, sawfishes in Caribbean Mexico (Méndez-Loeza *et al.* 2012), although both Largetooth Sawfish and Smalltooth Sawfish are confirmed as having been distributed throughout Mexico's Gulf of Mexico and Caribbean coastlines (Castro-Aquirre 1999). Questionnaires carried out by Juan Carlos Pérez-Jiménez (pers. comm. 2012) with fishers and fisheries cooperative managers (n = 64, all men) along Mexico's Gulf of Mexico coast between 2010 and 2012 revealed that sawfishes, although not identified to species, were abundant in trawls conducted along the lagoons and coasts of the states of Tabasco, Campeche, and Yucatán (Méndez-Loeza *et al.* 2012).

Although sawfishes were bycatch of a traditional shark and ray longline fishery, nets and spears were cited as the primary fishing gears used for the targeted capture of sawfishes (Méndez-Loeza *et al.* 2012). The largest captures of Smalltooth Sawfish were documented by Carranza (1959) in the Laguna de Términos, Campeche, prior to the 1970s. Patriarch fishers over 40 years old fishing that site had not recorded a sawfish in over 30 years (prior to 1980) (Méndez-Loeza *et al.* 2012). The only record of seasonal abundance comes from fishers interviewed in Quintana Roo, Mexico, who noted higher abundances in the turbid waters of Holbox's Yalahao Lagoon in June and July. The most recent sighting of a sawfish comes from 1997 when a mature Largetooth Sawfish weighing 800 kg was captured along the NE coast of Quintana Roo (Burgess *et al.* 2009).

The earliest historical records of sawfishes in Mesoamerica come from the ancient Maya who buried their dead with sawfish 'teeth' in Tikal (now in Guatemala) during the late classic period (600 - 900 CE) (Moholy-Nagy 1998) (Moholy-Nagy 1998). Historically, sawfishes were abundant in Belize until the late 1980s and were fished although they were considered to yield poor quality meat and fins (Thompson 1944, Dres 1964). The other countries sharing the Mesoamerican Barrier Reef (Mexico, Guatemala, Honduras) have not yielded sawfish captures or sightings for either species over the past 15 - 25 years (from 1985 - 1995), based on broad outreach efforts through local and regional fisher networks, coastal shark fieldwork and 173 interviews conducted with fishers and coastal inhabitants in all four countries from 2006 - 2010 (R.T. Graham unpublished data.

In Belize, the last refuge for the Smalltooth Sawfish is thought to exist in the northern Corazol Bay and its string of shallow coastal lagoons. This is based on claims by Guatemalan fishers that three sawfishes were captured in that area in 2009 (Z. Walker pers. comm. 2011), and a fly fishing guide from San Pedro noted seeing two sawfishes in the sandy flats of Savannah Caye behind Ambergris Caye as recently as 2011. None of these sightings were photographed and could not be confirmed. A country-wide survey conducted in 2011 and 2012 using longlines and in-water SCUBA fish census transects did not find any sawfishes (R.T. Graham (unpublished data).

According to interviewees in Belize (n = 145; 21 women, 124 men), both sawfish species broadly overlapped in habitat use, although the Largetooth Sawfish was primarily confined to the south, an area with numerous estuaries. Juvenile and adult Smalltooth Sawfish were distributed along the country's coastal sandy flats, along the

Lake Nicaragua's sawfish: a recent warning from history
Alec B. Moore

Lake Nicaragua is the largest lake in Central America. It is connected directly to the Caribbean Sea by the San Juan River, which forms the border with Costa Rica. Research in the 1960s showed that sawfishes occurred in exceptionally high abundance here.

In 1970, a targeted, intensive fishery for both Largetooth Sawfish (*Pristis pristis*) and Bull Sharks (*Carcharhinus leucas*) was started. At first, catches were huge - up to 2,000 sawfishes were caught a month - with meat, skins, and fins being exported.

Within just two years there was evidence of a sharp reduction in catches, but the intensive fishery continued despite warnings from fisheries managers, and by 1975 up to 100,000 sawfishes had been landed (Thorson 1982b). As Thomas B. Thorson predicted, by the early 1980s the fishery had completely collapsed - at which point the government placed a ban on catching them.

In 1998, around two decades after the ban, sawfish researcher Matthew McDavitt visited the lake with local researchers to assess the status of the sawfish population (McDavitt 2002). All indications, from both longline surveys and interviews with fishermen, were that the population had never recovered to former abundance. Yet a handful of sawfishes were being caught every year.

The case of Lake Nicaragua's sawfishes serves not only as a bleak reminder of the vulnerability of sawfishes, but remains one of the clearest examples of the sensitivity of many elasmobranch species to unrestrained fisheries exploitation.

Until the addition of sawfish fins to the sharkfin trade (i.e. up into the 1980s), they were a common sight in the shallow water along the beach down the coast. There used to be a lot of them in Cane Creek and boys would try to chop off their saws with machetes just for play. However, as of 2008, heavy commercial fishing targeting sharks and sawfish for their fins (for export) has decimated their numbers.

mud bottom habitats of the Victoria Channel and in shallow coastal lagoons. Although sawfishes were usually captured incidentally in nets and shrimp trawlers, there are accounts of fishers targeting the species with harpoons between the 1950s and 1980 (R.T. Graham unpublished data). The meat was salted and dried and sold in Guatemala or Mexico and the fins were sold to the Chinese traders (Graham 2012). Across the border from Southern Belize in Guatemala, Lago Izabal was a known nursery ground for the Largetooth Sawfish and several other species of elasmobranchs (Thorson *et al.* 1966). Although juvenile and adult sawfishes were abundant prior to the 1980s in the embayment near the opening of Izabal and in the Sarstoon River that separates Guatemala and Belize, none have been captured there in over 25 years (R.T. Graham unpublished data).

In Honduras, patriarch fishers interviewed (n = 15; 14 men, 1 woman; 21 - 94 years of age) in the island of Utila and the coastal town of la Ceiba recount captures of Largetooth Sawfish over 25 years ago from the nearby estuaries of the Motagua and Chamelecon Rivers and of Smalltooth Sawfish captures in the sandy flats near Utila's mangroves. Sawfishes are still thought by fishers to persist along the less inhabited and remote Mosquito Coast and its numerous coastal lagoons (R.T. Graham unpublished data)

Historically, sawfishes were abundant along Nicaragua's east coast prior to 1980. Bycatch of sawfishes in the targeted shark fishery for fins led to dramatic declines both coastally and in the freshwater Lake Nicaragua (Thorson 1982b). In the extensive Pearl Lagoon system facing Nicaragua's eastern shores, both species occurred as juveniles and large adults based on the existence of trophy rostra and as recalled by Bill McCoy (B. McCoy pers. comm. 2012).

In the 1970s, fishers working the Pearl Lagoon frequently caught juvenile sawfishes in cast nets in the mud flats near the mangroves, yet released them (B. McCoy pers. comm. 2012). Furthermore a dictionary of Nicaragua's Rama language published in 2009 details an account of the disappearance of sawfishes in this region. Quotations reveal the long-term impact that targeted exploitation for shark fins had on local elasmobranch populations, virtually eradicating them from the area (Grinevald and Assadi 2009):

In Nicaragua's Pearl Lagoon, the last sawfish was captured in 2008 with none observed or landed since (B. McCoy pers. comm. 2012, K. Stevens pers. comm. 2013). Yet Largetooth Sawfish are reportedly still captured, albeit rarely, in Lake Nicaragua and in the Rio San Juan River, which forms a natural border between Nicaragua and Costa Rica (M.T. McDavitt pers. comm. 2011). When captured in Nicaragua, the meat is sold in the local markets in Managua or near Lake Nicaragua (R. Rojas pers. comm. 2011) and there is a local market for the rostrum (K. Stevens pers. comm. 2013). Anecdotal evidence shows that people are unaware of the global scarcity of this species and that there is no motivation or incentive to protect it (K. Stevens pers. comm. 2013).

Although sawfishes are historically recorded in the cultural tradition of Panama's Caribbean-facing Kuna Indians there are no documented records of either sawfish species. Few studies exist of the fishes of Panama's remote and challenging Darien region, which could still host a remnant population of sawfishes based on habitat suitability, low anthropogenic disturbance and the existence of nearby records of sawfish captures and sightings in neighboring Colombia.

7.1.3 Southwest Atlantic Ocean

Patricia Charvet and Vicente V. Faria

Two sawfish species occur (or used to occur) in the Southwest Atlantic Ocean: the Largetooth Sawfish (*Pristis pristis*) and the Smalltooth Sawfish (*P. pectinata*). In this section the historic and current status of sawfishes are discussed in two regions: northern South America and eastern South America.

Northern South America

Northern South America comprises of the Atlantic coast of Colombia, and the coasts of Venezuela, Guyana, Suriname, and French Guiana. There are no recent records of sawfishes in this region and all known records for this area are historical, and even these records are scarce (especially from Guyana, Suriname, and French Guiana). Therefore, historic and present-day occurrence in the area may be underreported and highly uncertain.

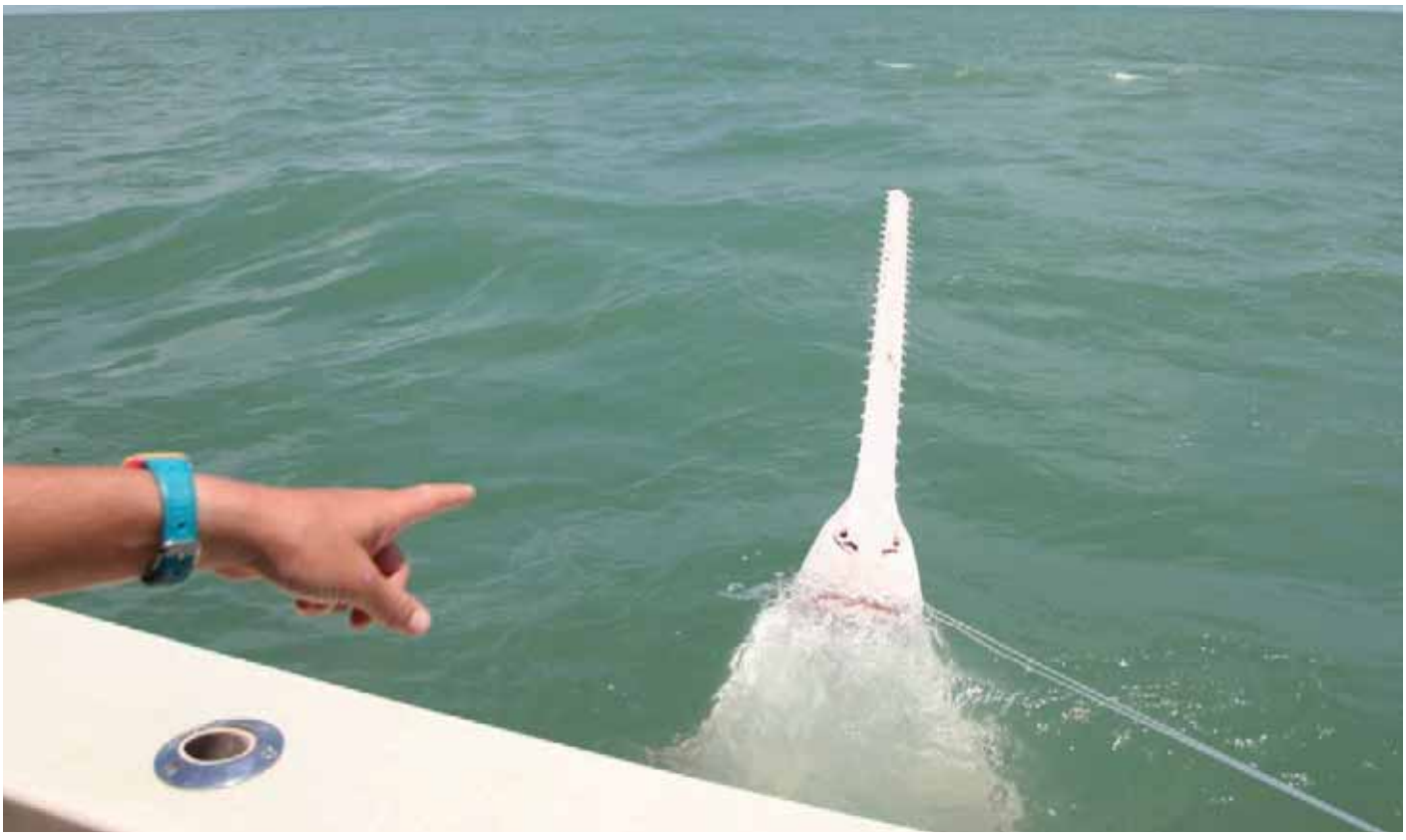
There are no recent records of sawfishes in Atlantic Colombia, and most accounts that do exist lack photographic evidence and collection specimens. A Smalltooth Sawfish rostrum has been identified from Colombia and the Atlantic locality inferred because of the confirmed distribution of this species (Faria *et al.* 2013) and it has been cited from the Atrato River (Eigenmann 1920, 1922 as cited in Bigelow and Schroeder 1953) and possibly from the Magdalena River estuary (Miles 1945, 1947). There are relatively more records for the Largetooth Sawfish. It has been recorded from the coast of Atlantic Colombia (Franky & Rodríguez 1976 as cited in Mejía and Acero 2002) and also from swamps and marshes (Grijalba-Bendeck *et al.* 2009) and in rivers (Eigenmann 1922 as cited in Bigelow and Schroeder 1953, Miles 1947 as cited in Grijalba-Bendeck *et al.* 2009). Additionally, a 1 ton sawfish (measuring 6 m TL) was caught in a tournament in Barranquilla in 1967 (Martínez 1978 as cited in Grijalba-Bendeck *et al.* 2009).

Both Largetooth Sawfish and Smalltooth Sawfish were apparently common along coastal Venezuela. For instance, sawfishes have been considered abundant in Lake Maracaibo, the Gulf of Venezuela, Gulf of Paria, and south of the Trinidad Island (Cervigón 1966). The earliest recorded sawfishes occurred as early as the 1940s, based on a report of several rostra of both species left by fishermen on a beach in Sinamaica, Gulf of Venezuela (Schultz 1949). However, it now seems that sawfishes are locally extinct. The last published record of a sawfish capture in Venezuela was 1962 (Cervigón 1966) and the last capture in Venezuela may have been in the 1990s or early 2000s, most likely in the Gulf of Venezuela and the Orinoco River delta (R. Tavares unpublished data).

Museum specimens document the historical presence of both Smalltooth Sawfish and Largetooth Sawfish in Guyana, Suriname, and French Guiana. However, almost no additional literature information is available, and therefore, population abundance and trends in these countries remains unknown.

Several specimens of embryos (collected in 1958; Faria *et al.* 2013) and rostra (Faria *et al.* 2013) document the presence of Smalltooth Sawfish in Guyana. This species was also documented in a species list for the country (Bigelow and Schroeder 1953), but no additional information on locality or capture date was provided. The presence of the Largetooth Sawfish in Guyana is dubious as rostral identity could not be confirmed (Faria *et al.* 2013) or identity was questioned (Hargreaves 1904 as cited in Bigelow and Schroeder 1953, Faria *et al.* 2013).

Smalltooth Sawfish have been documented in Suriname based on the rostrum of one specimen caught at Tygerbank in September 1963 (Faria



et al. 2013). Historically, the Largetooth Sawfish was thought to have penetrated into at least two river systems: the Suriname and the Marowijne (Mol *et al.* 2012), three specimens document Largetooth Sawfish in Suriname (Faria *et al.* 2013) and their presence was also indicated on a species list (Fowler 1910, 1919 as cited in Bigelow and Schroeder 1953).

In French Guiana two isolated rostra document the presence of Smalltooth Sawfish: one from Cayenne and another without any further locality data (Faria *et al.* 2013). Insight into the abundance of this species is given in Puyo (1936 as cited in Bigelow and Schroeder 1953): "many small ones [Smalltooth Sawfish] are caught by fishermen along the coast of French Guiana". Smalltooth Sawfish are also included in an updated species list for the region though this doesn't imply that presence has been confirmed (Le Bail *et al.* 2012). Largetooth Sawfish has been documented in French Guiana by the isolated rostrum of a specimen collected in the Maroni River c. 1830 (Faria *et al.* 2013). Further evidence of this species in the country is based on a capture in the Cayenne River in 1929 (Puyo 1949). Finally, there are anecdotal accounts of sawfish sightings and catches from the main river estuaries of French Guiana (Oyapock, Approuague, Mahury, Kourou, Sinnamary, Mana, and Maroni) (P. Charvet unpublished data).

Eastern South America

Eastern South America comprises Brazil, Uruguay, and Argentina. The Smalltooth Sawfish used to occur in Brazil, Uruguay, and Argentina, but is no longer present. Largetooth Sawfish is now only present in northern Brazil.

Interviews with fishermen in the northern region of Brazil (over 1,000 structured interviews at landing sites over 16 years) and landing observation data (year-round direct landing observations, various fishing gear) indicate that sawfish populations are very likely to have been declining since at least the late 1980s (Charvet-Almeida 1999, 2002, P. Charvet unpublished data).

The Largetooth Sawfish was once distributed from northern Brazil to as far south as São Paulo State. However, it is now only present in coastal and riverine waters of four States: Amapá, Pará, Maranhão, and the non-coastal State of Amazonas where all size classes have been found: (a) isolated rostra traded in Pará and Amapá States (Charvet-Almeida 2002), (b) a 1.6 m TL female caught in the Amazon River, near Manaus, Amazonas (Santos and Val 1998), and (c) a 7 m TL female captured in Maranhão (Almeida 1999, Nunes *et al.* 2005). Some riverine records include localities more than a 2,000 km distant from the coast. No Smalltooth Sawfish records have been confirmed in more than a decade despite efforts to monitor rostrum trade in Belém and other landing sites (State of Pará) (P. Charvet unpublished data). Historical records are scattered throughout the coast (Faria and Charvet-Almeida 2008) and the last records for Brazil are isolated rostra being traded in Belém (State of Pará) in the 1960s and 1970s (Thorson 1974).

The Smalltooth Sawfish has been recorded in Uruguay based on local species checklists and field guides (Nion *et al.* 2002, Meneses and Paesch 2003), but there are no more direct, primary records available.

In Argentina, the first record of the Smalltooth Sawfish was published by Lahille (1906), and subsequently included in a checklist of cartilaginous fishes of Argentina (Lahille 1921). This first record of Smalltooth Sawfish in Argentinean waters refers to two specimens of 1.8 and 2 m TL captured in Mar del Plata (Menni and Stehmann 2000). Three sawfish rostra are held in the Museo Argentino de Ciencias Naturales Bernardino Rivadavia: two are described as being obtained off the Argentinean coast, but this cannot be confirmed (G.E. Chiaramonte pers. comm. 2012). The third rostrum likely corresponds to a Smalltooth Sawfish that was described as being collected off Argentina and taken to the museum (H.P. Castello pers. comm. as cited in Menni and Stehmann 2000). The most recent and very likely last record of sawfishes off Argentinean waters corresponds to a report of a *Pristis* sp. close to the surface observed during research cruise in 1971 (Walter Herwig cruise 1971). This was considered the second of two records in nearly a century and sawfishes (*Pristis* sp.) are therefore assumed to be rare in this region (Menni *et al.* 2010).

7.2 Eastern Atlantic

7.2.1 Mediterranean Sea

Francesco Ferretti

The Largetooth Sawfish (*Pristis pristis*) and the Smalltooth Sawfish (*P. pectinata*) have been previously included in a number of historical and recent regional faunal lists of the Mediterranean Sea (Tortonese 1956, Whitehead *et al.* 1984, Serena 2005). Yet the nature of the presence of sawfishes in this Sea is uncertain (Whitehead *et al.* 1984, Bilecenoğlua and Taşkavaka 1999). There are a few museum exhibits of uncertain provenance, and there have not been any recent captures or sightings from the area in the last 54 years. Consequently, both species have been regarded as occasional vagrant visitors entering the Mediterranean from the Atlantic Ocean or Red Sea. The available museum materials were regarded as possible acquisitions from curio markets selling material of non-Mediterranean origin.

There are at least 83 published records of sawfishes, and seven unpublished museum exhibits or personal observations that suggest the presence of *Pristis* spp. in the Mediterranean. Forty-six percent of these records were repeated observations already described in earlier original publications. Of the 21 museum exhibits, 10 were misidentifications, nine of which pointed to Indo-Pacific Ocean species such as the Green Sawfish (*P. zijsron*) and the Narrow Sawfish (*Anoxypristis cuspidata*).

Here, an overview of the available information on sawfishes recorded in the Mediterranean is provided, including accounts from antiquity (items belonging to or remaining from ancient times, as monuments, relics, or customs), the Middle Ages, and recent accounts from the modern scientific era. Sawfishes were occasionally mentioned in antiquity around 2400 - 1800 years ago, but these accounts lack quantitative, taxonomic and geographic detail, and in some cases, included obvious exaggeration (Diaper and Jones 1722, Bostock and Riley 1855, Romero 2012). Sawfishes were also included in medieval bestiaries, though these descriptions were essentially religious and mythological (White 2002).

There are records of sawfishes from scientific species catalogues from many areas of the Mediterranean in the 18th and 19th centuries. The earliest records of sawfishes in the Mediterranean come from southern Italy in 1573 (Robertis 1853), Malta (Forskål 1755) and southern France where in 1777, it was reported that small Smalltooth Sawfish could be taken from the coasts of Provence (Duhamel du Monceau 1777); Du Monceau personally preserved one of those juvenile sawfishes at home. Thirty years later, the French ichthyologist Risso echoed Duhamel Du Monceau's observations adding that the last individual taken from the beaches of Nice (Provence) was a specimen of 1.5 m in length later identified by the local ichthyologist M. Audiberti (Risso 1810).

Numerous records pertaining to four species have been documented from seven Mediterranean countries since the 19th century. Fifty-eight percent of these records (30 publications) were of the Largetooth Sawfish (*P. pristis*, including two identified as *P. microdon*, and two as *P. perotteti*), 25% of the Smalltooth Sawfish, and 17% were referring to unspecified sawfishes (*Pristis* spp.). These records come mainly from western Mediterranean coasts, including France and Italy. Catch records were reported from eastern Languedoc, Provence, the Gulf of Naples, and the Adriatic Sea (Duhamel du Monceau 1777, Risso 1810, Robertis 1853, Šoljan 1948, Granier 1964). There are two accounts of the Smalltooth Sawfish from the eastern Mediterranean from the first half of the 20th century. Both were relatively recent (20th century), far away from the closest western records, and pertained to Smalltooth Sawfish, a species that might be easily confused with Green Sawfish, which unlike the Smalltooth Sawfish occured in the Red Sea (Simpfendorfer 2013) connected to the Mediterranean through the Suez Canal since 1867.

While there is evidence that sawfishes might have occurred in the Mediterranean, the conservation significance of this information requires further investigation. While some have argued that there were breeding populations of Smalltooth and Largetooth Sawfish, others point out that average sea surface temperature of Mediterranean is considerably colder than that observed within the distribution of sawfishes mapped from anthropological and cultural histories (M. McDavitt unpublished data) making breeding populations unlikely.

This latter interpretation does not exclude the possibility that these species occurred in the Mediterranean as vagrants since they are known to occasionally roam far from their normal ranges (Chidlow 2007). No matter how these results are interpreted, no sawfish of either species have been recorded in the region for the past 54 years because of the declines in the species in the Eastern Central and Southeast Atlantic region (see Section 7.2.2) and intense fisheries in the Mediterranean (Airoldi and Beck 2007, Saidi and Bradaï 2009, Coll *et al.* 2010).

Sawfishes were also included in medieval bestiaries, though these descriptions were essentially religious and mythological.

First documented record of sawfish in the Mediterranean?
Francesco Ferretti

The oldest rostrum of a Mediterranean sawfish is displayed in the Sanctuary of Carmine Maggiore in Napoli. This is a relic of a supposedly 'miraculous event' that occurred in 1573 when a cargo vessel sailing from Napoli to Sicily was hit by a strong storm, and almost sunk off Messina (in the southern Tyrrhenian Sea; Collenuccio *et al.* 1591, Robertis 1853). The story tells that in the struggle to save the ship, the crew started to pray to the Virgin of Carmine for help. Eventually the storm eased, and the ship stopped taking on water, which allowed the seamen to save the vessel. Later they discovered that a large sawfish was stuck in a large gash of the keel preventing the water from entering the boat.

The crew did not know that it was a sawfish, but as a sign of devotion brought the unknown fish to shore and gave the rostrum, and a model of the galleon, to the Church of Carmine Maggiore - which then preserved and displayed the rostrum in a shrine. Three hundred years later, in 1853 the rostrum was brought to the attention of a local naturalist, O. G. Costa, Professor of Zoology and member of the Italian Royal Academy of Science, who identified the species as the Largetooth Sawfish (*Pristis pristis*).

Costa gave a detailed account of the rostrum morphometrics, estimating that the fish must have been about 3 m long (Robertis 1853). In his report he remarked that sawfishes were rare in the Mediterranean, possibly entering from the Atlantic to reproduce in calmer and more suitable waters for spawning and nursing. He added that sawfishes usually observed in the Mediterranean were not of notable dimensions, reporting two sawfishes that he had seen in the fish market of Trieste that were about 80 cm each, and two in a local market of about 50 kg each (Robertis 1853 Shrine to the 1573 sawfish rostrum preserved in the Sanctuary of Carmine Maggiore, Napoli.

7.2.2 Eastern Central and Southeast Atlantic Ocean

Natascia Tamburello, Mika Diop and Justine Dossa

The African nations of the Eastern Central and Southeast Atlantic seaboard possess some of the most extensive mangrove and estuarine ecosystems on the continent, providing large expanses of potential sawfish habitat (Ballouard *et al.* 2006b, UNEP 2007, Burgess *et al.* 2009). Sawfishes were once common in this region; however, conventional data sources have yielded scant information on the diversity, distribution, and abundance of sawfishes in this region (Ballouard *et al.* 2006a). In the absence of official records, the knowledge of the status of sawfishes in this region has been constructed primarily from interviews with fisher people, historical reports, and surveys of rostra in museum and private collections (Ballouard *et al.* 2006b, Robillard and Séret 2006).

Verified records of sawfishes from the Eastern Central and Southeast Atlantic Ocean are sparse; however there are many historic records when compared to other regions. In most states in the Eastern Central and Southeast Atlantic Ocean, extending from Mauritania to Angola, the last observations of sawfishes date back to the early 1960s (Appendix 4). A survey of the literature yielded historical mentions of sawfishes from Senegal (1841 - 1902), Gambia (1885 - 1909), Guinea-Bissau (1912), Guinea (1900 - 1964), Sierra Leone (date unknown), Liberia (1927), Côte d'Ivoire (1881 - 1923), Ghana (1947 - 1964), Togo (1963 - 1964), Benin (1963 - 1964), Nigeria (1963 - 1964), Cameroon (1907 - 1964), Gabon (1963 - 1964), the Democratic Republic of the Congo (1886 - 1964), Angola (1949 - 1964), and Namibia (1900 - 1974) (Burgess *et al.* 2009, Appendix 4). However, records originating from the Global Biodiversity Information Facility (GBIF) database remain unverified and should be interpreted with caution. The most detailed historical information comes from extensive surveys conducted jointly by the Sub Regional Fisheries Commission (SRFC), the Fondation Internationale du Banc d'Arguin (FIBA) and the Noé Conservation organisation between 2005 and 2006 in Mauritania, Senegal, Gambia, Guinea, Guinea-Bissau, and Sierra Leone (Ballouard *et al.* 2006b).

Sawfishes were once considered to be common in these states and were reportedly caught in great numbers as recently as the 1930s (Svensson 1933, Ballouard *et al.* 2006a). Although never specifically targeted, sawfishes were captured on an infrequent but regular basis primarily at the mouths of rivers and occasionally at sea. Fishermen report hauling in one to two specimens per net and, in some instances, up to ten could be captured simultaneously (Svensson 1933, Ballouard *et al.* 2006b, 2006a, Robillard and Séret 2006, N. Downing pers. comm. 2009). Captures were more common in certain regions, especially near Tidra in Mauritania, between Casamance in Senegal and Kamsar in Guinea, and in Sierra Leone, most likely owing to the presence of numerous estuaries and rivers, including the Gambia River, Rio Cacine, Rio Gebe, Rio Mansoa, and Little Scarcies (Svensson 1933, Ballouard *et al.* 2006b). While sawfishes were considered common, according to many fishermen they have not been abundant for at least a generation (approximately 30 years), and one dedicated shark fisherman recently interviewed in Sierra Leone reports capturing only 35 specimens throughout his career (Svensson 1933, Ballouard *et al.* 2006a).

Because local fishermen make no distinction between sawfish species, the abundance and distributions of individual species is estimated solely from surveys of rostra in museum and private collections (Ballouard *et al.* 2006b). It seems that two sawfish species were historically present in the Eastern Central and Southeast Atlantic Ocean: the Largetooth Sawfish (*Pristis pristis*) and the Smalltooth Sawfish (*P. pectinata*) (Compagno and Last 1999, Ballouard *et al.* 2006b, Burgess *et al.* 2009, Appendix 4). The Narrow Sawfish (*Anoxypristis cuspidata*) has been noted, however, this is very probably a misidentification (Compagno and Last 1999, Ballouard *et al.* 2006b, Burgess *et al.* 2009, Appendix 4). The most recent information indicates that Largetooth Sawfish and Smalltooth Sawfish are extant in the region and most likely share the same habitats. The rostra of Smalltooth Sawfish consistently outnumbered those of Largetooth Sawfish roughly threefold, suggesting Smalltooth Sawfish was the most commonly encountered species (Ballouard *et al.* 2006b, 2006c, Robillard and Séret 2006). While it cannot

be ruled out that Smalltooth Sawfish may be the more favoured rostrum, this is unlikely.

Size distributions of sawfishes in the Eastern Central and Southeast Atlantic Ocean appear to have shifted over time, with one fisherman in Guinea-Bissau recalling that "in the 1990s, there were [sawfishes] of all sizes…now, we catch only little ones" (Ballouard *et al.* 2006c). French oceanographer Anita Conti described the capture of sawfishes weighing in excess of one tonne (t) during scientific expeditions to the region in the 1940s, whereas recent records cite a maximum published weight of 350 kg for Smalltooth Sawfish and 600 kg for Largetooth Sawfish (Stehmann 1981, Conti 1993 as cited in Diop and Dossa 2011). Surveys of sawfishes in the Gambia River carried out in the 1930s documented frequent catches of smaller individuals measuring 76 to 96 cm, while records of museum specimens collected across the Eastern Central and Southeast Atlantic Ocean in the 1950s report overall size distributions of 158 to 463 cm for Smalltooth Sawfish and 89 to 700 cm for Largetooth Sawfish. Specimens captured in the last decade occupy the lower end of this size spectrum, measuring between 100 and 400 cm (Svensson 1933, Ballouard *et al.* 2006c, Robillard and Séret 2006).

In Guinea-Bissau, fishermen report that sawfishes could be captured year-round, with captures peaking in May close to the coastline at the onset of the wet season. This corresponds to the reproductive period when females enter rivers to give birth and thereby are more vulnerable to capture (Ballouard *et al.* 2006a, 2006c). Young sawfishes were reported to reside in upstream mangrove habitats while larger neonates (50 - 70 cm) occurred farther downstream towards the end of the dry season (Ballouard *et al.* 2006a, 2006c). Juveniles have also been observed in recent years, including six juveniles (1 m TL) captured illegally in 2006 within a protected area of the Bijagos archipelago in Guinea-Bissau (Ballouard *et al.* 2006c).

Sawfishes are now rare across the region (Diop and Dossa 2011). The 1970s saw the first signs of decline coinciding with the arrival of migrant fishers from outlying states, the transition from traditional fishing techniques towards the use of nylon monofilament nets and longlines, and the growing demand for shark fin products (Ballouard *et al.* 2006b, 2006c, Robillard and Séret 2006). Sawfishes first disappeared from northern Senegal, with declines propagating southwards along the coast (Ballouard *et al.* 2006b).

Although sawfishes are a common sight in Senegalese wallets, where their image graces the surface of local coins and banknotes, the animals themselves have not been seen in northern Senegal since the 1970s and in southern Senegal since 1992 (Ballouard *et al.* 2006b, Robillard and Séret 2006). However, in 2010, a solitary specimen captured in Mauritanian waters was landed in Saint-Louis, Senegal, with one local witness confirming it to be the first sawfish he had seen in 35 years (Diop and Dossa 2010). The last observation in Gambia dates to 1995, and in Guinea to 1999, although anecdotal accounts describe captures in Dobiré as recently as 2005 (Ballouard *et al.* 2006b). Captures occurred infrequently in Sierra Leone from the 1960s through the mid-2000s, with the most recent records occurring at the mouth of the Great Scarcies River in 2006 (Ballouard *et al.* 2006b, 2006a), and off of the Freetown Peninsula in 2012 (E. Henderson pers. comm. 2013). Interviews with fishers in Liberia suggest that sawfishes, locally known as 'dahoo', are still present in national waters but are not at all common. Several captures have been reported by fishermen based in Robertsport, including one specimen of unspecified length observed in August 2012 and another measuring 1.5 m landed in October 2012 (T. Dodman pers. comm. 2013). There are also a handful of observations from Pointe Noire in the Democratic Republic of Congo in 2003 (Appendix 4). However, following seven months of interview-based investigations carried out by Noé Conservation from Mauritania through Sierra Leone, Guinea-Bissau was determined to be the only state where the present existence of sawfishes could be confirmed (Ballouard *et al.* 2006c, Leeney 2013).

Potential importance of the Lake Piso area, Liberia for sawfishes
Tim Dodman

Lake Piso is a large brackish coastal lagoon in western Liberia near the town of Robertsport, with an area of around 11,000 ha and a maximum depth of 4-5 m. The most important economic activity is fishing. There is a sizeable fishing port for sea-going boats on Lake Piso at Fanti Town, northeast of Robertsport. Canoe - and shore-based fishing also occurs, with canoes kept along the beach, some using sieve nets of small mesh size and seine nets.

Informal discussions with conservation volunteers and fishermen in February 2013 revealed that a range of fish species are caught, with seasonal fluctuations, including sawfishes (described clearly by two people using the word 'chainsaw'). Conservation volunteers reported a sawfish caught by fishermen several years ago on a beach east of Robertsport, and more recent catches at sea during the rainy season (June and July) of small ones less than 1 m in length and larger fish over 2 m; the meat was considered "very sweet".

Two fishermen based at Robertsport reported catches in August and October 2012, one of about 1.5 m long. One described sawfish as sometimes following a boat, speculating an attraction to the smell of engine oil. The local name is apparently "dahoo". Some 40 km west, sawfish have been reported caught by fishermen based at Sulima, in Sierra Leone, at the mouth of the Moa River.

There are local conservation branches of Farmers Associated to Conserve the Environment (FACE) around Lake Piso and a local fisheries office, whilst the Piso Conservation Forum (PCF) includes fisheries monitoring volunteers. Awareness about the endangered status of sawfishes was very low. There is definitely scope for an awareness campaign and conservation action in the Lake Piso area, involving FACE and PCF, though it is first important to verify these informal findings.

The symbolic usage of sawfishes in proverbs and judicial symbolism has been reported in coastal peoples from Angola northwards into the Congo and Gabon (M.T. McDavitt pers. comm. 2012). Of these nations, Guinea-Bissau demonstrates the strongest cultural ties to sawfishes, which represent a totemic animal among indigenous peoples of the Bijagos archipelago and suggests their long-standing presence and continued existence in national waters (Ballouard *et al.* 2006c). Fishermen report that sawfishes were more common there before the mid-1980s, and captures continued to occur on an infrequent but regular basis after 1990. The most recent records are from 2011 and cite two specimens captured far upstream the Geba River near Mato de Cão (Ballouard *et al.* 2006b, 2006c, Jung *et al.* 2011). Although sawfishes appear to be present along the entire coast of Guinea-Bissau, they are most likely to be encountered in the vicinity of the Mansoa and Cacine rivers, around the island of Jeta, and in the Orango National Park and the João Vieira and Poilão Marine National Park within the Bijagos archipelago (Ballouard *et al.* 2006b, Jung *et al.* 2011). The persistence of sawfishes in this area has been attributed to the presence of well-preserved estuarine and mangrove habitats, the establishment of protected areas, and navigational constraints that preclude access by large industrial vessels (Ballouard *et al.* 2006c). Despite the verified existence of this residual population, the scarcity of sawfish captures emphasises their continuing vulnerability (Ballouard *et al.* 2006c).

Today, younger generations of West Africa know of sawfishes only from the money in their pocket or through stories or, in some cases, not at all (Ballouard *et al.* 2006a, 2006c). When asked about the current reputation of this once infamous species, one elderly fisherman laments: "Dégémayéré, pis espada, O kank! - There aren't any. It's been over 10 years since anyone's caught this fish. There are even those who don't recognise it, and children born here 25 years ago…will say 'What is it?'" (Ballouard *et al.* 2006c).

It is likely that sawfishes no longer exist in Mauritania, Senegal, Gambia, and Guinea but are still present in Guinea-Bissau and, to a lesser extent, Sierra Leone and Liberia. However, little current information is available in the remaining Eastern Central and Southeast Atlantic Ocean states, including: Cote d'Ivoire, Ghana, Togo, Benin, Nigeria, Cameroon, Equatorial Guinea, Gabon, the Democratic Republic of The Congo, Angola, and Namibia. Of these remaining states, Nigeria is perhaps the most likely to still support a population of sawfishes as it possesses the largest network of estuaries and mangroves on the continent, particularly in the vicinity of the Ologbo Game Reserve, the Bonny Estuary, and the Rey Estuary (UNEP 2007).

If present trends persist, the species once considered by the people of this region as a fearsome emblem of strength and courage, a symbol of prosperity and productivity, an artistic motif, a protective amulet, and a totemic entity, may soon disappear into obscurity (Robillard and Séret 2006).

"Dégémayéré, pis espada, O kank! - There aren't any. It's been over 10 years since anyone's caught this fish. There are even those who don't recognise it, and children born here 25 years ago…will say "What is it?".

A Russian Perspective on Sawfishes in West Africa: Conversations with the Late Ichthyologist Feodor Litvinov

Nicholas K. Dulvy

During the West African Red List Assessment Workshop in Dakar, Senegal (2006), the Russian ichthyologist Dr Feodor Litvinov recounted his experiences while working for several years during the mid-1970s to the early 1980s on the Russian trawl ships conducting research surveys in the shelf seas off West Africa.

Although present for numerous trawl hauls over numerous surveys Dr Litvinov had never witnessed the capture of a sawfish during these surveys, suggesting by this time that sawfishes had already been overfished. He did recall seeing rather imposing sawfish rostra on display while dining in the homes of the ship's captain and senior scientists back in Russia. Dr Litvinov described the rostra as, "being as wide as a man's chest" and measuring 1.8 to 2.4 m long, guessing they may have come from adult Largetooth Sawfish (*Pristis pristis*) larger than 5 m in length caught in West African cruises in the 1950s and 1960s.

7.3 Indo-West Pacific

Dried rostra were regularly displayed for sale as curios in mainland Tanzania and Zanzibar in the 1990s.

7.3.1 Western Indian Ocean

Simon J. Pierce

Historical records show that sawfishes were native to southern Africa (South Africa and Mozambique), East Africa (Tanzania, Kenya and Somalia), and the Western Indian Ocean islands (Madagascar, Mauritius, Reunion, and the Seychelles). Two species, Largetooth Sawfish (*Pristis pristis*) and Green Sawfish (*P. zijsron*), are present in the region (Faria *et al.* 2013) and their historic distributions extend along the eastern African mainland, from South Africa north to Somalia, penetrating as far inland as Zimbabwe in large rivers (Compagno *et al.* 2006b, Faria *et al.* 2013). Largetooth Sawfish have also been recorded from Madagascar (Taniuchi *et al.* 2003), Reunion (Letourneur *et al.* 2004) and the Seychelles (Nevill *et al.* 2007), while Green Sawfish has been reported from Mauritius (Compagno *et al.* 2006a) and Reunion (Wallace 1967). There are no confirmed records of Green Sawfish from Madagascar or the Seychelles. A variety of synonyms have been used in the area and specific identity is generally difficult to establish from older published records. The records from the Mascarene Archipelago (Mauritius, Reunion) and the Seychelles are unverified and are likely to result from traded specimens sourced from Madagascar (B. Seret pers. comm.)Sawfishes were previously common along the KwaZulu-Natal (KZN) coast of South Africa (Smith and Heemstra 2003), with the St. Lucia estuary system regarded as a particularly important habitat and breeding area (Wallace 1967, Compagno *et al.* 2006b, 2006a).

Over 100 sawfishes were caught during research surveys of Lake St. Lucia between 1967 and 1970, with the majority being released alive (S. Dudley pers. comm. 2012). Sawfish catches from 1969 - 1970 were identified as Green Sawfish (B. Everett pers. comm. 2012). Extreme and prolonged drought conditions coupled with increased agricultural and industrial extraction of water from the system led to reduced flow and prolonged closure of the estuary mouth which is likely to have affected reproductive output and juvenile survival (Compagno *et al.* 2006b, 2006a, Dudley and Simpfendorfer 2006, B. Everett pers. comm. 2012). Largetooth Sawfish has been recorded in South African catches but due to challenges in species identification there are uncertainties regarding their correct identification as either Largetooth Sawfish or Green Sawfish, or regarding their previous levels of abundance. Bather protection nets targeting sharks along the southern KZN coast provide an index of decline, with 86 sawfishes caught between 1964 and 2012 (S. Dudley pers. comm. 2012). Of these, 30 were caught during the 1980s, three during the 1990s, and none have been captured since (G. Cliff pers. comm. 2012). The last recorded capture of any sawfishes (not identified to species level) in KZN was in 1999 and the genus is now considered to be locally extinct in South Africa (S. Dudley pers. comm. 2012, B. Everett pers. comm. 2012)

Interviews with residents and surveys of curio markets in Mozambique suggest sawfishes are at very best rare in the south of the country (Maputo, Gaza and Inhambane provinces) (R.T. Graham pers. comm. 2009, S. Pierce unpublished data), although sawfishes were reported as a bycatch of artisanal fisheries at Inhaca Island near Maputo (Kiszka 2012, J. Kiszka pers. comm. 2012). Largetooth Sawfish were once common in the Zambezi River in Mozambique (Wallace 1967), although no contemporary sightings have been documented. There have been recent sightings of sawfishes (no detail available on species) in the Quirimbas Archipelago in the north of the country (A. Costa pers. comm. 2012). Surveys of the larger river systems and fisher interviews are necessary to confirm the persistence of sawfishes outside the Quirimbas area, where they are likely to still be present.

Dried rostra were regularly displayed for sale as curios in mainland Tanzania and Zanzibar in the 1990s (Barnett 1997). Interviews of long-time fishers from Unguja Island (Zanzibar) found that sawfishes were regularly caught earlier in these fisher's careers, lasting up to 40 years, though by the time of interview they were thought to be very rare or locally extinct (Schaeffer 2004). However, recent catches (date unknown) have been made in artisanal fisheries from Zanzibar (Kiszka 2012, J. Kiszka pers. comm. 2012). There are historical records of Largetooth Sawfish from Kenya (Okeyo 1998) and Green Sawfish is also likely to be native to the country based on its confirmed presence in South Africa and Somalia but no recent sightings have been documented from Kenya. Surveys are required in Tanzania and Kenya to confirm their continued persistence.

Sawfishes (probably referring to Green Sawfish) have been listed as a major commercial species within coastal waters of Somalia (Musse and Mahamud 1999), and both Largetooth Sawfish and Green Sawfish are caught as bycatch of shark gill-netting activities (Heileman and Scott 2009). No focused surveys on the population status on sawfishes in Somalia have taken place, and so their status in the country is uncertain

Healthy populations of Largetooth Sawfish were present in several western Madagascan rivers in 2001 based on focused field surveys in the Betsiboka River and fisher interviews (Taniuchi *et al.* 2003). Sawfishes were taken in coastal shark fisheries in northwestern Madagascar, where fishers reported that they were once commonly caught but had become rare as a consequence of intensive netting across estuaries (Cooke 1997). The introduction of Tilapia (*Oreochromis* spp.) into Lake Kinkony, a freshwater lake connected to the sea in northwestern Madagascar, resulted in the disappearance of weed beds and subsequent displacement of fish fauna including sawfishes (Therezian 1976 as cited in Ardill 1982). Sawfishes were reported to have been previously common in catches by artisanal fishers along the mangrove-fringed coast of western Madagascar, but are now considered extremely rare throughout the area (Manach *et al.* 2011). Although sawfishes still comprised an important component of fin fisheries in Toliara in southern Madagascar during the 1990s (Cooke 1997), a survey of rostra in tourist shops in Morondava in southwestern Madagascar found that all sawfishes had been captured between 1989 and 1998 in the region and no recent reports of catches have been made (F. Humber pers. comm. 2012). There has been little dedicated survey effort in the country, but it seems that at least the Largetooth Sawfish remains.

There have been no recent reports of sawfish catches or reported landings in the Seychelles in the last decade (D. Rowat pers. comm. 2012). There have been no sawfishes captured by small-scale fisheries or observed by divers from Reunion since at least the early 1990s (Letourneur *et al.* 2004, Frick *et al.* 2009, Y. Letourneur pers. comm. 2012, E. Tessier pers. comm. 2012).

Any records from these Western Indian Ocean Islands are likely to have resulted from traded specimens sourced from Madagascar and it is unlikely that sawfishes were ever present.

Sawfish rostra for sale in Tanzania
Nicholas K. Dulvy

In 1993, I saw four 1.2 to 1.8 m long sawfish rostra for sale resting against fences behind the stalls of marine mollusc traders in Dar-es-Salaam fish market. The traders claimed these sawfishes (and the molluscs) were captured in the Mafia Island and Songo Songo Island group. This region was comprehensively surveyed by The Society for Environmental Exploration Frontier expeditionary projects, including the Frontier - Tanzania Mafia Island and Songo Songo projects. These projects were located adjacent to the largest river delta in eastern Africa (Rufiji River), and project staff and expeditionary volunteers did not find sawfishes in extensive fisheries catch surveys and market surveys in early 1990s.

Along with Will Darwall, I was scientific officer on this Mafia Island project coordinating underwater diver surveys and comprehensive landings and fish catch surveys and we never saw or heard of a sawfish landing throughout southeast Mafia Island. Will Darwall subsequently witnessed the butchering of a large sawfish on the main fish landing beach of Songo Songo (Will Darwall pers. comm. 2013). This sawfish rostra was 1.1 m in length which suggests that the total length was close to 4.5 m total length. Colin Simpfendorfer has confirmed the identification of this specimen as Largetooth Sawfish (*Pristis pristis*). The Rufiji Delta was extensively trawled for tropical prawns, little is known of the bycatch of this fishery. Recent work in Northern Tanzania suggests two species are still present. It appears that two species occur in Ungwana Bay and the lower reaches of the Tana River but the identification of these species needs to be confirmed (Samoilys *et al.* 2011).

The introduction of Tilapia into Lake Kinkony [Madagascar]...resulted in the disappearance of weed beds and subsequent displacement of fish fauna including sawfishes.

7.3.2 Red Sea

Julia L.Y. Spaet and Igbal S. Elhassan

Historically, two sawfish species were present in the Red Sea: Narrow Sawfish (*Anoxypristis cuspidata*) and Green Sawfish (*Pristis zijsron*). Most available information from the region comes from interviews with coastal fishermen, which indicates that sawfish abundance has decreased severely throughout the Red Sea and Gulf of Aden. There are some recent records suggesting that sawfishes are persisting in parts of the region, however species-specific identification is scarce to confidently determine their current status.

Information on sawfishes in many Red Sea countries, as for most elasmobranchs, is extremely limited (Spaet *et al.* 2012). Sawfishes have long been exploited for their fins in the region; the earliest evidence for the use of sawfish fins in the shark fin trade comes from the beginning of the 19th century (Mountnorris 1809). In Yemen, the Mehri people (living just outside of the Red Sea) state that sawfishes have been gone from their waters for decades (Sima 2009), and in Djibouti, during interactions with local fishers in January each year since 2005, no sawfishes were seen in their catches (D. Rowat pers. comm. 2012). There are confirmed records of sawfishes in the northern Red Sea based on three rostra obtained by local researchers a decade ago, that were identified in the headquarters of the Ministry of Agriculture and Water/Marine Fisheries Department in Yanbu, Saudi Arabia, and two preserved specimens that are on display at the Marine Museum in Hurghada, Egypt (Bonfil 2002). Sawfish bycatch in trawl fishing operations has been reported from Eritrea (A.H. Gebrihiwet pers. comm. 2012), although species-specific information or catch rates have not been reported.

Between 2011 and 2013 interviews were conducted to investigate the historic status of elasmobranchs in Saudi Arabia, spanning almost the entire east coast of the Red Sea (J. Spaet unpublished data). Fifty-five male fishermen were interviewed in three geographical areas along the Red Sea coast (Yanbu and Dibba (10), Thuwal and Jeddah (35), and Jizan and Farasan islands (10)). Three-quarters (n = 41) of interviewees reported that sawfishes had disappeared over the past twenty years, however the remaining 25% (n = 14) reported drastic declines but knew of at least one person who had seen one or more sawfishes in the past seven years. Those that had caught sawfishes mentioned significant size reductions in sawfishes caught prior to 1992 compared to those caught recently. All of the 55 fishermen interviewed had caught or sighted at least one individual sawfish in the thirty years from 1960 to 1990, but none could provide species-specific details. All sightings and catches were reported exclusively from the Jizan/Farasan area (southern Saudi Arabia) with the last sighting by one of the interviewees six years ago.

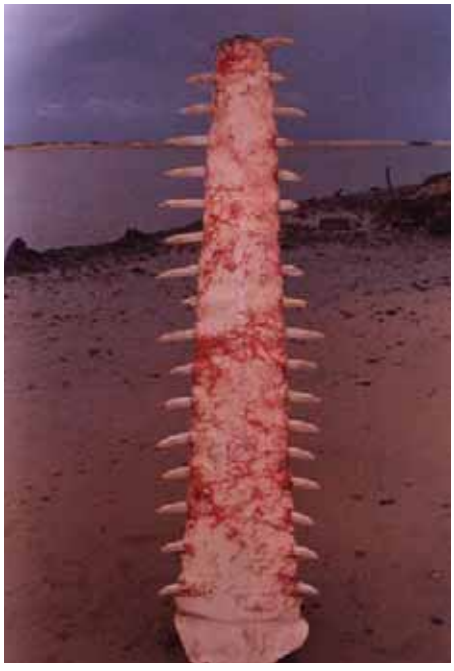
Interviewees also stated that the southern Saudi Arabian fish market in Jizan used to sell sawfish rostra in high quantities until 1990, but since then they have been a rarity. The major threat for sawfishes in Saudi Arabia appears to be the gillnet fishery. The majority of interviewed Saudi fishermen (89%) claim that sawfishes are exclusively caught as bycatch although interestingly, 11% mentioned that they used to be targeted for their rostra.

Baited remote underwater video surveys for chondrichthyans have also been conducted in Saudi Arabia (400 hours between 2010 and 2013) and Sudan (60 hours in 2013). These surveys covered various habitat types (including seagrass and sand, depths of 1 - 200 m). Surveys in Saudi Arabia spanned the entire coastline (57 different locations), while those in Sudan focused on waters off Port Sudan (eight locations). None of these surveys have yielded any record of sawfishes (J. Spaet unpublished data).

In 2007, a series of sawfish-focused interviews were conducted along the coast of Eritrea, Sudan (for two months), and Yemen (for one month) by Dawit Tesfamacheal (pers. comm. 2012) who found that the fishermen in the Red Sea mentioned that sawfishes had experienced dramatic declines over the last 60 years. In all interviews, the older fishermen said they used to catch sawfishes but the younger fishermen had never seen one (D. Tesfamacheal pers. comm. 2012).

Since March 2011, a questionnaire has been employed to collect information on sightings or captures of sawfishes in Sudan (I. Elhassan unpublished data). The questionnaire included

the earliest evidence for the use of sawfish fins in the shark fin trade comes from the beginning of the 19th century.



53 fishermen from the Sudanese coast, 15 fish traders at Port Sudan fish market and an owner of a tourism agency. Based on information gathered, sawfishes still exist in this region, and were reported to have been most common in shallow embayments and areas associated with mangrove stands and sea grass habitats particularly in August and September. All the fishermen reported that sawfishes have become very rare in the past 20 years.

Fishermen from the northern coast of Sudan reported that newborn and juvenile sawfishes were common in Marsa Darur north of Port Sudan 20 years ago and prior to the construction of Oseif port in 1994, sawfishes were common on Marsa Oseif (S.M. Ali pers. comm. 2002). Newborn and juvenile sawfishes were also common in Marsa Ausheri, a mangrove area south of Port Sudan. Green Sawfish have been caught rarely but with some regularity in the past ten years. They have been identified from both rostra and whole adults (Elhassan 2002). A juvenile Green Sawfish was caught in Maras Heidub on the south coast by gillnet from a shallow muddy area in September 1999. An adult Green Sawfish was confiscated by the Marine Fisheries Administration, from a Yemini shark fishing boat in August 2000 poaching in Sudanese waters, and two were found in December 2000. They were caught from Trinkitat, Talla Talla Sagir and Seven Isles south of Port Sudan. The largest was a female of 3.5 m long, and was carrying large ova. Three rostra were displayed for sale by fishermen in the Port Sudan fish market during 2001.

Recent reports from the southern coast were from Agitai (a juvenile in 2007), Agig Bay, Elkalifia (two female sawfishes caught in May 2009) and Takrinyay lagoon (one sawfish in November 2011). The most recent capture of sawfishes from the southern coast was a female Green Sawfish with six pups caught in December 2012 from Trinkitat as bycatch in the prawn fishery. In 2007, a large sawfish was confiscated from a poaching Yemeni boat apprehended in Marsa Osief in the northern coast; the rostrum was bought by a fin trader from Port Sudan. The last record of a sawfish from Dongunab Bay, 125 km north of Port Sudan, was in 1999.

In addition to fishing, other threats in the region include the construction of coastal roads along the southern coast of Sudan, without bridges to allow the passage of water, which subsequently prevents seasonal streams from reaching the coast. This is believed to have altered sawfish habitat (Captain Halim pers. comm. 2012). Harvesting of mangrove trees by local people and grazing by camels in mangrove habitats has also degraded sawfish habitat, as has coastal construction and port development.

Experiences of sawfishes in Sudan's Red Sea Region

Steven T. Kessel and Nigel E. Hussey

In 2012, while tagging manta rays we took the opportunity to question local fishermen along the Red Sea coast of Sudan about the presence and trade of sawfishes. All stated that sawfishes, from small to large, were present in the shallow coastal lagoons and nearshore waters. However, none could precisely remember the last time they had seen or caught one, when pressed the best estimates were three to four years ago. They said that sawfishes are rare, and whenever they are caught they are retained due to the "very high" price obtained at market for the rostrum.

Sudan is a party to CITES and the fishermen were aware that sawfish rostrum trade is illegal, thus is all conducted on the black market. When a fisherman has a sawfish rostrum he travels to Port Sudan to sell it. Tourists from Europe, the Americas, Russia, and Egyptian traders purchase the rostrums from the fishermen via curio stands. They are taken to a "quiet and private" location to make a deal directly with the fisherman.

They claimed not to know the going price for rostrum, though may have withheld this information from fear of prosecution, but they explained that when the fishermen return from Port Sudan after selling a rostrum they "have a big smile on their face and lots of new expensive things with them".

7.3.3 The Gulf*

Alec B.M. Moore

Two species of sawfishes, Green Sawfish (*Pristis zijsron*) and Narrow Sawfish (*Anoxypristis cuspidata*), have confirmed records from the Gulf. There are no such records for Largetooth Sawfish (*P. pristis*) or Dwarf Sawfish (*P. clavata*), although the known ranges of these species are adjacent to the Gulf region (Faria *et al.* 2013, A.B.M. Moore unpublished data).

The Gulf appears to present ideal habitat for sawfishes, with an average depth of just 35 m, extensive seagrass beds, and a major estuary. Yet a clear understanding of diversity, distribution and abundance is made difficult by a general lack of scientific data on Gulf elasmobranchs (Moore 2012). Local museums are generally poorly resourced and difficult to access. Rostra are scattered widely, often in private homes and without collection details. Valuable whole museum specimens are badly deteriorating, or have even been lost as a result of war (S.M. Ali pers. comm. 2012). The lack of distribution and abundance data from conventional sources therefore requires alternative approaches, such as use of historical works and archaeological literature.

The historic presence of sawfishes in the Gulf is known from the presence of vertebral centra in archaeological deposits of fish remains. Sawfish centra are distinctive in shape and easily distinguished from those of other elasmobranchs (M. Beech pers. comm. 2012, M.T. McDavitt pers. comm. 2012). Records of centra in archaeological deposits point towards a widespread distribution of sawfishes in the Gulf, extending from the 'Ubaid (5th to 4th millenium BCE) to the late Islamic period (c. 16th to 18th century CE), and along the entire southern and western Gulf from Kuwait to the United Arab Emirates (Beech 2004, Uerpmann and Uerpmann 2005). At some sites, sawfish centra were described as "common" (Beech *et al.* 2001). At a late Islamic site, near Abu Dhabi, centra of 'Chondrichthyes' (poorly preserved and not identifiable further) - along with many clearly identifiable as from sawfishes - almost entirely dominated fish remains, strongly suggesting specialised exploitation focusing on these species (Beech 2004). These data suggest that sawfishes were not rare, but instead they were common (or even abundant) enough to be routinely exploited for human consumption.

Evidence for the former abundance of sawfishes also appears in the classical literature of the region. In the 13th century, the Persian geographer Zakariya' al-Qazwini wrote that small sawfishes (one to two yards [0.9 - 1.8 m] long) were "numerous" in two locations: G'ennaba (presumably Bandar-e Ganaveh, in present-day Iran) where green-coloured sawfishes were caught; and Basrah (Iraq) where sawfishes appeared seasonally in the river (M.T. McDavitt pers. comm. 2012).

In the 1800s, evidence suggests that sawfishes were common, and that large specimens were present. Pearl divers blindly grubbing on the seabed of the eastern Gulf for extended periods considered the risk from sharks "...as nothing when compared to the danger they encountered from the saw fish (*Pristis*, Latham). Many of the divers said they had seen people cut absolutely in two by these fearful monsters" (Whitelock 1836). A well-travelled naval surveyor described Gulf sawfishes as "...far larger...than in any other part of the world where I have met with them... the [rostrum] is six feet [1.83 m] in length" (Wellsted 1838). Sawfishes, along with five local names (Persian: Meesharee, Shamsheeree; Arabic: El-Meesharee, Aboo-seif, Seiyaf), were also listed in an administrative report of Gulf fish resources (MacIvor 1881).

The limited data available indicates that sawfishes were abundant in at least some locations up until the middle of the 20th century. Sawfishes (along with sharks) were common enough to support a targeted fishery and temporary fishing camps for several months on Sir Abu Nu'ayr island in the eastern Gulf, north of Abu Dhabi (Anonymous 1920). Writing of Bahrain's Hawar Islands (between 1926 to 1957), a British diplomat noted "...sawfish were very numerous. The shore near the villages was littered with [their] beaks, some of them three or four feet [0.9 - 1.2 m] long, with, on each side of the central bone, a row of hard, very sharp points" (Belgrave 1960). "Relatively common" sawfishes were also reported to be a hazard to fishermen in Dubai Creek prior to its deepening by dredging (Anon 1998), i.e. before around 1960 (Joyce 2003). An undated (probably mid-20th century) and presumably local photograph in the Bahrain National Museum shows two *Pristis zijsron* landed on a beach; one of which is estimated by the author to be in excess of 6 m TL near the maximum known for any sawfish species (A.B.Moore pers. obs. 2002).

By between 1974 - 1978 the occurrence of sawfishes was described as "occasional", based on extensive trawling around Bahrain (Herdson 1981). A world authority on the Indo-Pacific Ocean fishes considered *Pristis* "rare" in the Gulf during active fish collection in Kuwait and Bahrain from the late 1970s to the mid 1980s (J.E. Randall pers. comm. 2007). A large number of published and unpublished fish surveys using a variety of methods throughout the Gulf from the 1980s onwards do not report the conspicuous sawfish, even though most of these recorded other demersal elasmobranchs, such as guitarfishes (A.B.M. Moore unpublished data). Instances of individual sawfish in the past 20 or so years have been an unusual and noteworthy event, such as Green Sawfish records off Abu Dhabi in 1989 (Brown 1990), Saudi Arabia in the early 1990s (F.A. Krupp pers. comm. 2007), and Kuwait in 2000 (Bishop 2003).

Recent reports of sawfishes are rare, and requests for information to the wider community (Moore 2009), have resulted in little

** The name of this water body remains contentious. 'Persian Gulf' (or variants of it) is a name that dates back more than 1000 years. However, the name used by Arab states on the Arabian peninsular side is 'Arabian Gulf'. Fourteen historical variants of the name are known. On a regional level, the name 'Inner Gulf' of the ROPME Sea has been accepted by the ROPME Council. All riparian states have accepted this name. Here 'Gulf' is used (as is the case in several preceding scientific texts) hoping that the omission of geographic descriptors will be less offensive to some parties than use of the 'wrong' one would be (for a good summary of the naming disputes with key references and legal decisions, see http://en.wikipedia.org/wiki/Persian_Gulf_naming_dispute). (Sheppard et al. 2010)*

Records of centra in archaeological deposits point towards a widespread distribution of sawfishes in the Gulf... [and that] they were common (or even abundant) enough to be routinely exploited for human consumption.

or no information. Occasional substantiated records have occurred, for example, the capture and release of a c. 4 m TL Green Sawfish from northern Qatar around 2006 or 2007 (R. Peirce pers. comm. 2009). Surveys that enumerated approximately 6,000 individual elasmobranchs in Gulf fish markets from 2008 - 2012 did not record any sawfishes (Moore *et al.* 2012, A.B.M. unpublished data). In contrast, reported total annual landings of sawfishes from Iran's three provinces with Gulf coastlines for 2002 - 2009 range from 5 - 35 tonnes (t), with an exceptionally high 141 t in 2010 from Hormozgan, which also has a Gulf of Oman coast (Anonymous 2005). Given the apparent rarity of sawfishes elsewhere in the Gulf, the veracity of these data requires verification.

The available data suggest that Green Sawfish is the most commonly encountered sawfish species in the Gulf, and there are reliable records from several Gulf states. Large adults have been recorded from the north-western (Bishop 2003) and south-eastern Gulf (Brown 1990). Sex is not usually recorded, but large (and likely mature) males of >4 m TL are known from Abu Dhabi (Brown 1990) and off Qatar (A.B.M. Moore unpublished data), and mature females have been recorded off Abu Dhabi, U.A.E., and Bahrain (A.B.M. Moore unpublished data). Young Green Sawfish of <1 m TL (as figured in Randall 1995) and juveniles of approximately 1.4 - 1.6 m TL have been collected from Bahrain and probably also Iran (Blegvad 1944).

Records of Narrow Sawfish are confined to the Iranian coast; it is not known whether this distribution is related to few data or environmental influences. Gulf records exist of individuals that are neonate, juvenile, and around the size at maturity (Blegvad 1944, Faria *et al.* 2013). A 30 kg specimen was reported from the Gulf's easternmost boundary (Vossoughi and Vosoughi 1999), near the much deeper Gulf of Oman; there are no records of large Narrow Sawfish from within the main body of the Gulf.

Temporal distribution is poorly understood from the limited records available. As the Gulf is shallow with highly variable water temperature, seasonal elasmobranch migrations are likely (Moore 2012). One report from Kuwait noted that sawfishes appeared in summer months (Clayton and Pilcher 1983), although young Narrow Sawfish have been trawled in winter in the northern Gulf in January and February (Blegvad 1944).

Historical data strongly suggest that sawfishes in the Gulf were widespread, not rare, and in some cases abundant. Records include neonate and juveniles (Green Sawfish and Narrow Sawfish) and large adults (Green Sawfish). Sawfishes appear to become less common from around the 1960s or 1970s, and were rare by the 1980s. Captures still occur very occasionally, although inadequate data collection on elasmobranchs in the region severely compromises effective monitoring of sawfishes. In summary, the available data shows a severe reduction of abundance of sawfishes from pre-20th century levels.

7.3.4 Northern Indian Ocean

K.K. Bineesh, Alec B.M. Moore and Peter M. Kyne

This Section describes the distribution and status of sawfishes occurring in the northern Indian Ocean between Myanmar and Pakistan, encompassing the eastern Arabian Sea and Bay of Bengal adjacent to Pakistan, India, Sri Lanka, Bangladesh, and Myanmar. Four species are known to have historically occurred in this region: Green Sawfish (*Pristis zijsron*), Largetooth Sawfish (*P. pristis*), Dwarf Sawfish (*P. clavata*), and Narrow Sawfish (*Anoxypristis cuspidata*). Three of these species are widely distributed in the region, but the Dwarf Sawfish is only known outside of Australia from a handful of confirmed historic records (from 1880s - early 1900s) including one from Kolkatta (Calcutta) on India's Bay of Bengal coast (Faria 2007). There are no recent confirmed records of Dwarf Sawfish from the region, although a possible Dwarf Sawfish (poor photographs preclude accurate identification) landed at a port on the Musandam Peninsula of eastern Arabia (possibly Khasab, Oman; photographs posted 26 January 2006) could have been caught in the easternmost region of the Gulf, the Gulf of Oman, or even the northwestern Arabian Sea (A.B.M. Moore unpublished data).

Elasmobranchs are increasingly and heavily exploited in this region, and declines in large elasmobranchs have been widely reported (Raje and Joshi 2003, Hoq *et al.* 2011). Historical reports and records indicate that sawfishes were once abundant in the region until around the 1980s, but more recent evidence summarised below suggests significant reductions in abundance. While species-specific information is lacking, all species appear to now be rare (with the possible exception of Narrow Sawfish; see below). Sawfishes are protected only in India under the Indian Wildlife (Protection) Act, threats continue with little effective management.

In Pakistan, Green Sawfish were historically described as "fairly common" along parts of the coast (Day 1878 as cited in Marichamy 1969), and sawfishes continued to be considered as "quite common" until at least the mid-1980s (Bianchi 1985). National fisheries statistics for Pakistan report sawfish catch landings in 1982 of around 1800 t from the coastal states of Balochistan and Sindh. These catch landings declined to 0.9 t in 2003, with no further official catch since then (M. Moazzam Khan pers. comm. 2011). Sawfishes were once sufficiently common that the rostrums were used as fence posts in coastal Pakistani towns (M. Moazzam Khan pers. comm. 2011), but recent records of sawfish are sparse. A Largetooth Sawfish was recorded in Gwadar (western Balochistan) in 2009 (A. Rahim

pers. comm. 2012), but such reports are now rare. Indeed, the General Director of the Karachi Fisheries Department commented that the last time he saw a sawfish in the Arabian Sea was in 1984 (Ebrahim 2010).

In India, "the great potentialities of fishing for elasmobranchs" on the east coast were highlighted in the 1970s (James, 1973); "the common skates include…the saw-fishes of the genus *Pristis*", and "[the sawfishes] are abundant in the southern region but good grounds are indicated in the north also" (James 1973, Devadoss 1978). Large sawfish (3–6 m) were routinely reported in trawl catches across a range of depth strata off India's eastern coast (Nagabhushanam 1966). Sawfishes have been highly valued in the Indian region for their good quality flesh and high liver oil yields (Misra 1969). India has also traditionally been a regional hub in the shark fin trade, collecting fins from around the Western Indian Ocean (e.g. Red Sea, the Gulf, Indian subcontinent), and shipping these to the main markets of Singapore and Hong Kong (M.T. McDavitt pers. comm. 2012). Early publications recognised the higher value of sawfish fins: "the best are procured from the saw-fish, the fins of which sell for more than double the price of those obtained from the other species of shark" (Anonymous 1847).

Surveys with fishers in Raigad District (Maharashtra state) of India, where sawfishes were commonly historically captured, indicate a drastic decline in the sawfish fishery from 1985 - 1990, with only occasional catches now (R. Raut pers. comm. 2012). In the Mandapam area (Tamil Nadu state), sawfishes were heavily fished for oil and meat and drastic declines were observed in landings after 1970 (N.G.K. Pillai pers. comm. 2012). Sawfishes were common in trawl bycatch in the Gulf of Mannar when fishing commenced in around 1970, but are rarely seen now and some fishers believe that they are locally extinct (Lobo 2006). Recent scientific reports support the perceived rarity of sawfishes in southern India (Joel and Ebenezer 1999, Manojkumar *et al.* 2002). But even until recently sawfishes were still considered to be commercially important in India (Raje and Joshi 2003). Observer data on Indian catch landings of Narrow Sawfish between 1989 and 2011 have been consistently less than 5 t per year, however, there was a peak catch of more than 25 t from Okha, Gujarat on the Arabian Sea coast in 2009 (K.K. Bineesh unpublished data). This is despite the species being protected in India in 2001 and hence any landings after that date were technically illegal catches.

In Sri Lanka, there is little information available on the status of sawfishes. While they were noted as being "relatively common" in the mid-1900s, by 1994 there were "no reports on the west coast for nearly 40 years" (Anonymous 1994) and a fisheries identification guide for Sri Lanka noted that sawfishes were "not abundant" (De Bruin *et al.* 1994).

In the Bay of Bengal in the early 1900s, sawfishes in general were reported to "abound" and individual species were considered to be either "very common" or "common" in the estuaries and mouths of the Ganges and Brahmaputra Rivers (Annandale 1909). In the early 1960s, sawfish rostra were "all over the beach" of Cox's Bazaar (Bangladesh, Bay of Bengal) (Anonymous 2010). While sawfishes are still caught by fishers in the Bay of Bengal, there is information to suggest that numbers have declined significantly (S.M.A. Rashid pers. comm. 2012). The Narrow Sawfish is reportedly now "rarely found" in Bangladeshi waters of the Bay of Bengal (Hoq *et al.* 2011), although three specimens were collected from Chittagong in 2006 (Roy *et al.* 2007).

Sawfish in Bangladesh
By Heather Koldewey

I have just returned from Bangladesh (29 November 2011) where I was working in the Sundarbans on a new fisheries project. While visiting a fish market, in Boiddomari, Chandpai Range I came across a market trader selling vertebrae of what turned out to be from sawfishes. He was carving off one vertebrae and stringing it on a waistband. The waistbands are worn by the buyer to ward off rheumatism. Each centra cost 20 Taka (US $0.26) and I counted about 130 vertebral on each of the spina chords. He had 10 vertebrae in total and said he bought 20 - 30 every 2 - 3 months from Chittagong and travelled around selling them in various markets. The 'juice' from the flesh is also used for vitamin A and D as a treatment, but he doesn't deal in oil.

Sawfishes were once sufficiently common that the rostrums were used as fence posts in coastal Pakistani towns.

7.3.5 Eastern Indian and Western Central Pacific Ocean

Peter M. Kyne and Colin A. Simpfendorfer

This Section describes the distribution and status of sawfishes occurring in the Eastern Indian and Western Cerntral Pacific Ocean west to Myanmar, and thus encompassing Southeast Asia. The region west of Myanmar (Northern Indian Ocean) is covered in Section 7.3.4 while Australia, specifically, is covered in Section 7.3.6. This Section covers four sawfish species within a region of intense human pressure, particularly through unregulated and unmanaged fisheries, and habitat loss and degradation in critical sawfish habitats, particularly freshwater and estuaries: Green Sawfish (*Pristis zijsron*), Largetooth Sawfish (*P. pristis*), Dwarf Sawfish (*P. clavata*), and Narrow Sawfish (*Anoxypristis cuspidata*). Information on the occurrence and status of sawfishes within many parts of the region is scarce, but what information that is available points to considerable population declines and localised extinctions. Given the level of fishing pressure in many parts of Southeast Asia, the outlook for sawfishes within this region is bleak with sawfishes apparently severely depleted or possibly extinct throughout much of this region.

Localised depletions and extinctions of sawfishes have been reported or inferred from across their Eastern Indian-Western Pacific range, but there is a high degree of uncertainty regarding sawfish status and occurrence in this region. It is unknown if viable populations exist anywhere outside of Australia, though it is possible that the island of New Guinea may represent another regionally significant area, at least for Largetooth Sawfish and there is a clear need to determine sawfish status there. During some eleven years of market surveys (over 160 visits to 11 market sites) in various parts of Indonesia only two individual sawfish (both Largetooth Sawfish) were recorded which were caught in the Arafura/Banda Sea region (W. White pers. comm. 2012).

Demersal elasmobranchs are intensively targeted in Indonesia (Blaber *et al.* 2009), and this extremely low occurrence (out of some 60,000 chondrichthyans examined) is indicative of severely deleted populations in Indonesia. In fact, it is thought that sawfishes are extinct from large areas of Indonesia. Despite the presence of sawfish rostra in houses near fishing ports, local Indonesian fishermen indicate that they have not seen sawfishes for more than 20 or 30 years (W. White pers. comm. 2012). In Sabah (Malaysian Borneo), fishers and villagers reported sawfishes as abundant in the 1970s and declining sharply in the 1980s, with very limited catches since that time (Manjaji 2002). Datasets from as early as 1963 - 1972 showed the considerable decline in batoids (species of the Order Rajiformes) in the Gulf of Thailand (Pauly 1979), which included the virtual disappearance of sawfishes (Pauly 1988). Declines in demersal fishes in the Thai Andaman Sea were also documented (Pauly 1979) and these likely included sawfishes. In contrast, historic accounts indicated that sawfishes were formerly "common" and caught in "considerable numbers" in Thailand, including in rivers (Smith 1945). Note that a record from New Zealand (Faria *et al.* 2013) is in all likelihood a case of confused geographic locations; sawfishes do not occur in New Zealand.

The status of the Dwarf Sawfish outside of Australia is uncertain, with only a handful of confirmed historic records (from the 1800s - early 1900s) from scattered Indo-West Pacific locations, including: Papua New Guinea (specimen held in the Nationaal Natuurhistorisch Museum - Naturalis, Leiden, collected in 1828) and Indonesian Borneo (Zoologisches Museum der Humboldt Universität Berlin, Germany, collected in 1894). The lack of records over a period of >100 years suggests that the species may now be restricted to Australia only (see Section 7.3.4 for a note on a possible Dwarf Sawfish landed on the Arabian Peninsula

The exact regional range of the Largetooth Sawfish, which occupies both coastal and riverine habitats, is uncertain. Historically, this species may have been found throughout Southeast Asia, westwards to India and the Western Indian Ocean. It has been confirmed from several major river systems of Papua New Guinea, Indonesia and Malaysia (including Borneo), Cambodia, Viet Nam, and the Philippines (Roberts 1978, Tan and Lim 1998, Compagno *et al.* 2005, Stevens *et al.* 2005). Their use of freshwater systems in a region characterised by numerous river delta megacities has meant that habitat loss, habitat modification and pollution due to human developments are much greater threats to this species than to other sawfishes.

While a general lack of information makes it difficult to ascertain its current status, all populations are probably severely depleted. It has previously been described as common in the middle reaches and large tributaries of the Fly River (Roberts 1978) but its status there requires a reappraisal. More recently, the 'demise' of the species has been reported in Lake Sentani, New Guinea as a result of the change from traditional fishing methods to the use of gill nets (Polhemus *et al.* 2004)

Despite the presence of sawfish rostra in houses near fishing ports, local Indonesian fishermen indicate that they have not seen sawfishes for more than 20 or 30 years.

although these authors provide no further detail of this. Within the Cambodian Mekong system, numbers of Largetooth Sawfish have reportedly decreased considerably. Historically, they were regularly seen as far upstream as Khoné Falls, and in other areas of the Mekong (Tonlé Sap and Great Lake), none have been seen for "several decades" (Rainboth 1996). Populations in Borneo are thought to be seriously depleted (Last *et al.* 2010), with the last known record from the Kinabatangan River in 1996 (B.M. Manjaji-Matsumoto pers. comm. 2012). Largetooth Sawfish were considered common in the Philippines by Herre (1953) but none were recorded in more recent surveys and it is thought that the population "has greatly declined in the Philippines" (Compagno *et al.* 2005).

The Green Sawfish formerly occurred throughout Southeast Asia with a range encompassing New Guinea, Indonesia north to southern China and westwards to India (as well as Australia and southern Africa) (Last and Stevens 2009). Despite material attributed to collection in Fiji, no sawfishes have been confirmed from those waters (Duffy *et al.* 2011). The Green Sawfish is generally found in inshore coastal waters although it has been recorded offshore in Australian waters (Stevens *et al.* 2005) so it may also occur in deeper waters elsewhere in its range. There are no records from recent surveys in Indonesia (W. White pers. comm. 2012) or the Philippines (Compagno *et al.* 2005). There are a handful of recent records from Borneo (Malaysia), but it may be extinct throughout a large part of its Southeast Asian range (Last *et al.* 2010).

The Narrow Sawfish is the widest-ranging of the Indo-Pacific sawfish and is found in coastal waters of New Guinea, the Indonesian Archipelago, Southeast Asia, and the China Seas northwards to Japan, as well as Australia, the Bay of Bengal, the Indian subcontinent, and westwards to at least the Arabian Sea and the Gulf (Last and Stevens 2009, M.T. McDavitt, A.B.M. Moore and V.V. Faria pers. comm. 2012). Its occurrence in the Philippines is uncertain with no records in recent surveys (Compagno *et al.* 2005). There is very little specific information available on this marine-brackish species from outside of Australian waters and it is possibly extinct in some parts of its former range (Last *et al.* 2010). It was previously (1992) considered common in shark fishing catches from the Arafura Sea, Indonesia (Monk *et al.* 1997), but the lack of sawfishes in more recent Indonesian market surveys (W. White pers. comm. 2012) suggests severe depletion.

Sawfishes in Sabah and Sarawak
Rachel Cavanagh and Scott Mycock

In 1996 the SSG was awarded a grant from the UK Government's Darwin Initiative, to fund a collaborative study (led by Sarah Fowler) with the Sabah Fisheries Department (including Project Officer Mabel Manjaji), WWF Malaysia, and Universiti Malaysia Sabah. Undertaken during 1996 - 1998, the study was the first detailed investigation of the biodiversity, distribution and conservation needs of elasmobranchs in Sabah. The project comprised a combination of regular visits to fish markets, river surveys (mainly the Kinabatangan River), fishing trawler surveys, and visits to river and coastal kampungs (villages) to interview villagers. Cameras and fish tanks (to preserve any captured fish) were left at a number of locations inland from the river mouth. Occasional visits were also made to Sarawak. Despite these efforts, and collecting anecdotal information from those in possession of rostra, we only recorded one sawfish capture - that of a Largetooth Sawfish (*Pristis pristis*).

The former Director of the Department of Fisheries, Sabah, recalled that sawfishes had been caught regularly by trawlers close to Kota Kinabalu, Sabah, during the 1950s, but our fish market surveys failed to record any. When questioning local fishers about sawfishes, the majority said they hadn't caught any for years. However, in June 1996, a fisherman in Sukau (a kampung on the Kinabatangan River, Sabah) caught a Largetooth Sawfish. We have a photograph taken with a disposable camera by the local teacher. To the best of our knowledge, this was the only sawfish captured during the project, although several villagers kindly donated rostra from fish caught some time ago. Traditionally in this region, rostra are nailed over doorways to keep ghosts out of houses, and wrapped in cloth and hung over cradles to stop babies crying. In 1998, we came across two large Largetooth Sawfish rostra in the house of a Filipino family on Pulau Denawan (an island in the South China Sea, Sabah). These sawfishes had been caught only six months previously - encouragement that they were still to be found. The same year, a photograph of a 6 m sawfish was found in a Chinese medicine shop in Kuching - this goliath fish was trawled up two years previously off the Sarawak coast. Its fins and flesh fetched high prices and the rostrum was considered priceless.

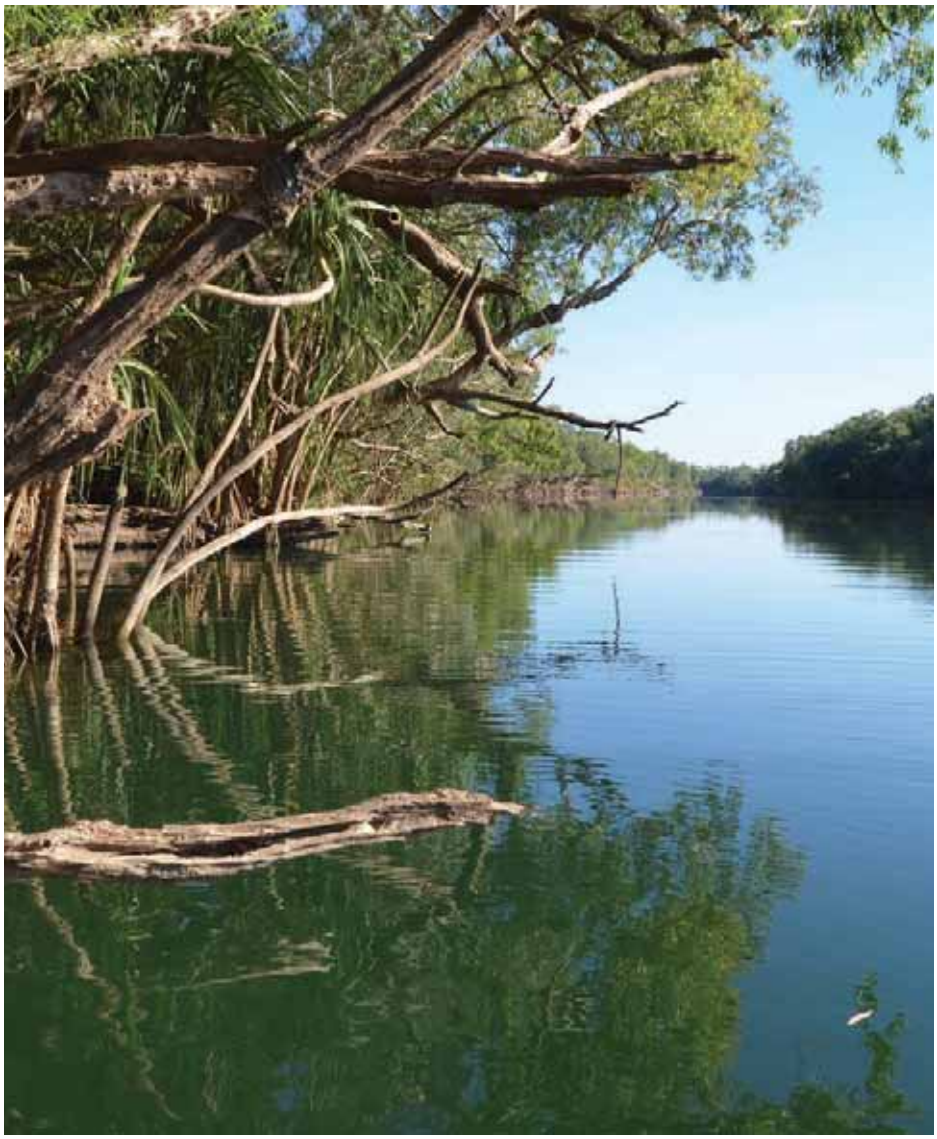
7.3.6 Australia

Peter M. Kyne, Colin A. Simpfendorfer, Blanche R. D'Anastasi and Nicole M. Phillips

This Section deals with the status of sawfishes in Australian waters only; the status of species in the wider Eastern Indian and Western Central Pacific region is described in Section 7.3.5. Within Australia, sawfishes are largely restricted to northern tropical waters. One species has a wide global distribution (Largetooth Sawfish, *Pristis pristis*), two species have wide Indo-West Pacific distributions (Green Sawfish, *P. zijsron*; Narrow Sawfish, *Anoxypristis cuspidata*), while one may now be restricted to Australian waters (Dwarf Sawfish, *P. clavata*) (Last and Stevens 2009). All sawfishes have undergone significant, albeit largely unquantified, declines in Australia due to capture in fisheries and habitat modification. However, Australia is one of a limited number of global strongholds for sawfishes and in places represents some of the last viable populations in the Indo-West Pacific (Stevens *et al.* 2005, DSEWPaC 2011). Relatively more information is available on sawfishes in Australia than most other parts of the Indo-Pacific, although current population sizes and historical abundances are unknown.

Species-specific data with which to accurately ascertain the status of Australian sawfishes is generally lacking and the evidence for decline and range contraction is largely anecdotal. Genetic data show that all sawfishes in Australia have very low to moderate levels of genetic diversity (D'Anastasi 2010, Phillips *et al.* 2011). It is unclear whether this is due to human impacts, or is naturally occurring. Nonetheless, populations with low levels of genetic diversity are at risk of negative effects associated with losses in genetic diversity if populations decline (Frankham 2003, Phillips *et al.* 2011). Data from the Queensland Shark Control Program, which operates bather protection fishing gear along the Queensland east coast, shows a clear decline in sawfish catch (individual species were not distinguished) over a 30-year period from the 1960s, and the complete disappearance of sawfishes in southern regions of Queensland (Stevens *et al.* 2005). All *Pristis* species are now rare along the Australian east coast (the area in which human population pressure is greatest) where they have undergone a considerable range contraction, in particular Green Sawfish. While specific management measures are now in place in Australia, threats are ongoing and likely are continuing to affect populations.

The Dwarf Sawfish has the narrowest distribution of any Australian sawfish, occurring from the northern Pilbara coast of Western Australia to western Cape York, Queensland. It may also have historically occurred on the northeast



coast of Queensland as far south as Cairns, but there are no verified records, either recent or historic, to confirm this (DSEWPaC 2011, S. Peverell pers. comm. 2010). There are also no recent records from outside of Australian waters, with only a handful of confirmed historic records (from the 1800s - early 1900s) from scattered Indo-West Pacific locations (see Section 7.3.4 for a note on a possible Dwarf Sawfish landed on the Arabian Peninsula). This is primarily a coastal and estuarine species, although it also penetrates upstream into river estuaries but not into freshwater.

Genetic data indicate low to moderate levels of genetic diversity, with very low diversity in the Gulf of Carpentaria population. Populations in Western Australia, the north coast of the Northern Territory, and the Gulf of Carpentaria are distinct genetic stocks (Phillips *et al.* 2011, Phillips 2012). The Dwarf Sawfish is rare in the Northern Territory and the Gulf of Carpentaria, while its status on the northeast Queensland coast is uncertain (Peverell 2005, Last and Stevens 2009, DSEWPaC 2011, Phillips *et al.* 2011). Hence, the western part of its range in the Kimberley and northern Pilbara regions of Western Australia represent a globally significant area for the Dwarf Sawfish (Morgan *et al.* 2011

The Largetooth Sawfish is unique amongst sawfishes in having marine and freshwater stages to its life cycle. In Australia, juveniles spend 4 - 5 years in the freshwater reaches of tropical rivers before migrating to coastal and marine environments (Thorburn *et al.* 2007). Genetic data indicate this species has moderate levels of genetic diversity and male-biased dispersal in Australian waters (Phillips *et al.* 2011, Phillips 2012). Females have strong reproductive philopatry (returning to sites previously used for reproduction), with maternal population structuring between Western Australia and the Gulf of Carpentaria, with the northern coast of the Northern Territory and the Queensland east coast populations also potentially forming distinct maternal populations (Phillips *et al.* 2011). In contrast, males disperse between at least Western Australia, the Northern Territory and the Gulf of Carpentaria (Phillips 2012). Most information on the species comes from its early life stages, with the occurrence and distribution of adults being poorly understood. The Fitzroy River in the Kimberley region of Western Australia, the Daly and Victoria Rivers in the Northern Territory, and the rivers of western Cape York in Queensland are particularly important for this species (Peverell 2005, Morgan *et al.* 2011, P. Kyne unpublished data). Other river systems across northern Australia may also be important, but

Inshore areas and river mouths, including Princess Charlotte Bay on the Queensland east coast, are important sites for juveniles and pregnant females.

surveys in some remote systems are lacking. Its status (occurrence and extent of the population) on the east coast of Queensland is unknown. There is a single record of the species outside of the tropics, from marine waters off Cape Naturaliste, southwest Australia (Stevens *et al.* 2005, Chidlow 2007). The Australian population of Largetooth Sawfish likely comprises a high proportion of the global population and these waters represent a globally significant area for the species (Stevens *et al.* 2005).

The Green Sawfish formerly had the widest Australian distribution of any sawfish, occurring across the tropical waters of northern Australia, as well as into temperate waters along the west and east coasts (Last and Stevens 2009). The Kimberley and Pilbara regions of Western Australia represent a globally significant area for the Green Sawfish (Morgan *et al.* 2011), but little information is available on its occurrence along the west coast south of the Pilbara, where it possibly occurs south to Perth (there is also a single historical record off Glenelg, South Australia) (Last and Stevens 2009). This species has undergone a major range contraction on the east coast. Historically, it was recorded south to the central New South Wales coast but it has now been declared "Presumed Extinct" in that state (very high confidence), with the last museum record occurring in 1972 (NSWFSC 2006). It persists south of Cairns in low abundance in isolated patches of central Queensland coastline where it is occasionally caught by fishers (Harry *et al.* 2011). Across its range, including the Gulf of Carpentaria (Peverell 2005), abundance is low relative to other sawfishes. In Australia, this species is found in inshore coastal waters including estuaries, river mouths and off sandy and muddy beaches, and occasionally offshore to a depth of 70 m (Stevens *et al.* 2005). Genetic data indicate low to moderate levels of genetic diversity, with the lowest genetic diversity in the Gulf of Carpentaria. Populations in Western Australia and the Gulf of Carpentaria are distinct genetic stocks, with the remnant east coast population potentially also forming a distinct stock (Phillips *et al.* 2011, Phillips 2012).

The Narrow Sawfish is distributed across northern Australia from the Pilbara coast of Western Australia to the central Queensland coast and is the most abundant Australian pristid in the Gulf of Carpentaria (Peverell 2005), on the Queensland east coast (Harry *et al.* 2011), and probably elsewhere. It is a bentho-pelagic, marine-brackish species, occupying inshore and coastal waters to 40 m depth (Peverell 2005, Last and Stevens 2009). Inshore areas and river mouths, including Princess Charlotte Bay on the Queensland east coast, are important sites for juveniles and pregnant females. Genetic data indicate extremely low to moderate genetic diversity across its Australian range, with extremely low diversity on the east coast of Queensland (D'Anastasi 2010). Populations in Western Australia and the Queensland east coast form distinct genetic stocks, with the Gulf of Carpentaria likely forming a distinct stock (based on two mitochondrial DNA markers) (D'Anastasi 2010, Green 2013). Australia is likely to be the remaining global stronghold for this species (Peverell 2005).

7.4 Eastern Pacific Ocean

Peter M. Kyne, Matthew T. McDavitt and Rachel T. Graham

This Section covers the Eastern Pacific Ocean region from which only one species is known - the Largetooth Sawfish (*Pristis pristis*). Reports of Smalltooth Sawfish (*P. pectinata*) from the Eastern Pacific are erroneous. The Largetooth Sawfish has had a somewhat confused taxonomic history in the region, with several names being used for it, including *P. zephyreus*, *P. microdon*, and *P. perotteti*. The Eastern Pacific population of the Largetooth Sawfish can be considered ecologically distinct because of the large geographic separation from the Indo-West Pacific population. The status of the species in the region is poorly understood, but it has disappeared from a large part of its former range, and it can be considered of critical conservation concern here.

The historic range of the Largetooth Sawfish in the Eastern Pacific was limited by cooler water currents to the north and south, the California and Humboldt Currents, respectively (V.V. Faria pers. comm. 2012). The historic range was thought to occur from Mazatlán, Mexico in the north down to Peru (Chirichigno and Cornejo 2001, Cook and Compagno 2005, Faria *et al.* 2013). Other references (i.e. Amezcua Linares 2009) suggest that it occurred south from Topolobampo (some 440 km further north than Mazatlán), highlighting the uncertainty over its historic range. The occurrence of Largetooth Sawfish in Peru may have represented seasonal migration from the species' core range in Central America. A continuous historic range between Mexico and Peru would have also included Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, and Colombia. Largetooth Sawfish were historically reported from a number of freshwater systems in the Eastern Pacific (as summarised in the original Red List Assessment; Cook and Compagno 2005).

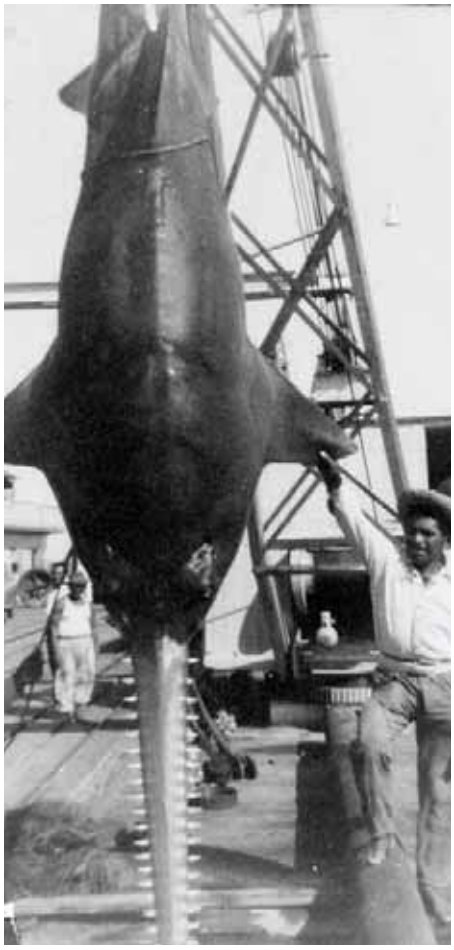
Culturally, there is little evidence of sawfish use on the Pacific coasts of the Americas, except for: (1) incorporation of huge Largetooth Sawfish rostra into dance masks by the Huave and Zapotec Indians of Tehuantepec Province, Oaxaca, Mexico", (2) archaeological remains of usage of rostra, vertebral centra and rostral teeth, and cultural depiction of sawfishes by the Cocle people (c. 150 BCE to 700 CE) of Panama, (3) usage and depiction of sawfishes among the Wounaan and Embera Indians of the Rio Chucunaque (and related systems), Darien Province, Panama, and (4) occasional decades-old fishing captures of huge Largetooth Sawfish adults at locations in north Peru (i.e. Punta Sal and Talara). This small amount of cultural and historical information highlights a lack of available information from the region.

Interestingly, despite the fact that the Aztecs had trade and tribute networks on both the Atlantic and Pacific coasts supplying valuable shells, pearls, and corals which were employed in jewelry and ritual, all of the sawfish remains that have been recorded (dozens of sawfish rostra were interred beneath the Aztec Great Temple in Mexico City) are Smalltooth Sawfish, and thus are of Atlantic origin. Furthermore, the two Aztec 'place names' employing the Aztec name for sawfishes (Tanzipac or 'Place of Sawfish'; Sipaki'apan or Sawfish River) are in Veracruz, on the Mexican Atlantic coast (i.e. in the Tamiahua Lagoon) (M.T. McDavitt unpublished data).

Based on fisher interviews of recent but unconfirmed sightings, Costa Rica's Osa Peninsula, which encompasses the Corcovado National Park's Rio Sirena and the Térraba-Sierpe Wetland is thought to host a remnant population of sawfishes (I. Zanella pers. comm. 2011). However, in the contiguous Golfo Dulce (Costa Rica), seven patriarch artisanal fishers engaged in hook and line and net fishing were interviewed in the coastal towns of Puerto Jimenez and Golfito in 2004 and reported that they had not seen a sawfish in decades (R.T. Graham unpublished data).

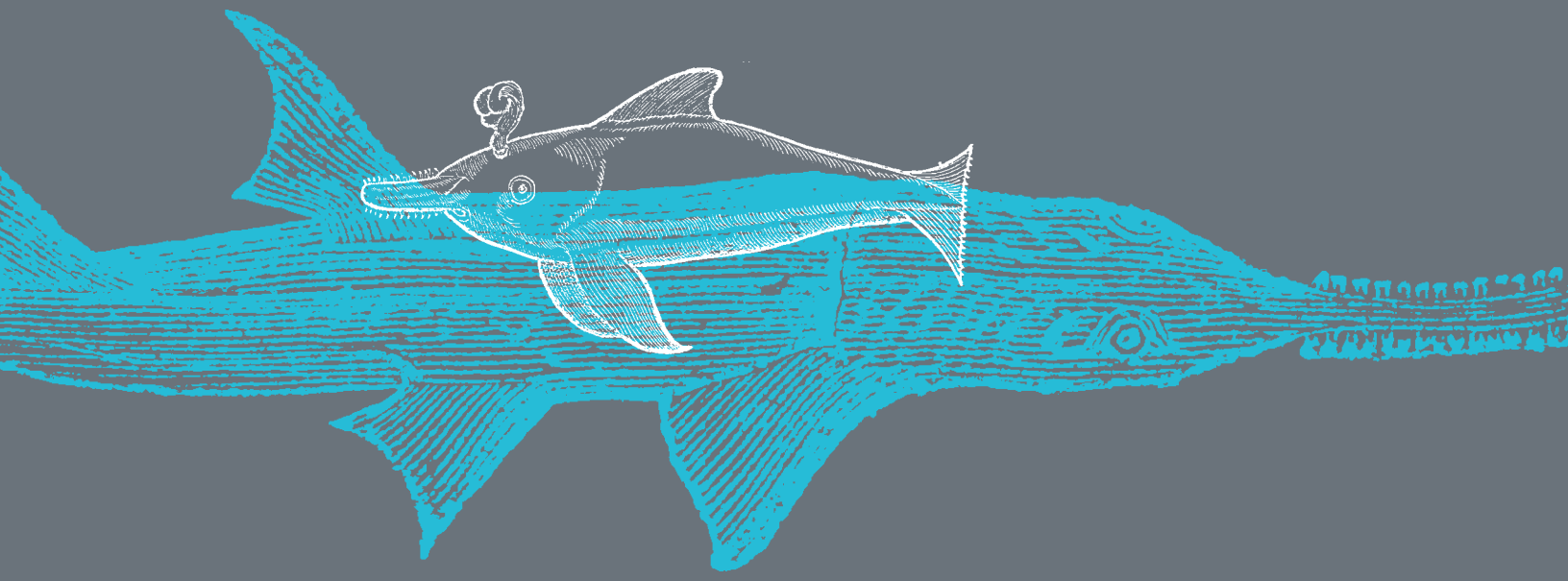
Largetooth Sawfish existed in Panama's Pacific-draining man-made Lake Bayano in 1982 (Montoya and Thorson 1982), but there are no recent records from that site or other parts of Panama or nearby Colombia, based on a broad request for information to SSG Members, NGOs, and Sawfish Network Members on species occurrence sent out by the SSG in 2011–2012. The species may now possibly be extinct in several countries such as Mexico, Guatemala, Ecuador, and Peru; there are no confirmed records in many parts of the region for the past decade. This represents a significant contraction in the species' extent of occurrence in the Eastern Pacific. There may possibly be a major nursery area in the Darien/Rio Chucunaque system (Panama), from which adults moved out north to Mexico and south to Peru (M.T. McDavitt unpublished data). There are poorly-studied parts of the region with suitable sawfish habitat (e.g. the Darien), suggesting that targeted surveys are required to locate any remnant populations.

In the Eastern Pacific, Largetooth Sawfish were caught by gillnets, longlines, and trawl nets and its meat was used for human consumption fresh, frozen, or salted (McEachran 1995), or for ornamental purposes (Amezcua Linares, 2009). In Mexico, the catch of sawfishes is now prohibited (DOF 2007), but threats (e.g. artisanal net fishing, shark longlining, and substantial mangrove loss) are ongoing throughout the species' historical range in the Eastern Pacific, so any remnant populations are likely still in decline.



The historic range of the Largetooth Sawfish in the Eastern Pacific was limited by cooler water currents to the north and south, the California and Humboldt Currents, respectively. The historic range was thought to occur from Mazatlán, Mexico in the north down to Peru.

Threats and Management



8 | Threats to Sawfishes

The greatest impact over the past 50 years has been bycatch resulting from the widespread availability of cheap, non-perishable monofilament nets, and the increased coverage and intensity of fishing activity due to widespread use of outboard engines in commercial, recreational, and artisanal fisheries.

8.1 Fisheries

Colin A. Simpfendorfer

Sawfishes have historically been the target of directed fisheries throughout their range including in the Caribbean and Central America (Belize, Mexico, Nicaragua), the Red Sea (Saudi Arabia), the Gulf (U.A.E.), and elsewhere (Anonymous 1920, Thorson 1982b, Grinevald and Assadi 2009, Méndez-Loeza *et al.* 2012, R.T. Graham unpublished data, J. Spaet unpublished data). These targeted fisheries focused on sawfish meat for food and income, and were practiced mainly by local subsistence fishermen. More commonly, however, sawfishes have been retained as bycatch of fisheries targeted at other species because of the value of their fins, rostrum and meat (Charvet-Almeida 2002, Peverell 2005, Simpfendorfer 2005). Today, the major threat to sawfishes is incidental capture, particularly by net fisheries.

While targeted fisheries have been important in the demise of sawfishes, the greatest impact over the past 50 years has been bycatch resulting from the widespread availability of cheap, non-perishable monofilament nets, and the increased coverage and intensity of fishing activity due to widespread use of outboard engines in commercial, recreational, and artisanal fisheries. The threat from fishing remains throughout most of the range states of sawfishes and continues to place pressure on the reduced populations. Sawfishes are particularly susceptible to nets because their large toothed rostrum becomes easily entangled (Simpfendorfer 2000). A wide range of net types have been reported as capturing sawfishes, including: gillnets, driftnets, trammel nets, and trawls (Brewer *et al.* 2006, NMFS 2010). Longlines, handlines, and dynamite fishing have also been highlighted as current threats but these would have a much smaller influence than nets (NMFS 2009).

If appropriate care is taken, sawfishes of the genus *Pristis* caught in nets can survive the capture process (Thorson 1982a, Whitty *et al.* 2009, Simpfendorfer *et al.* 2010). However, the value of sawfish products, and the damage to gear that result from capture, often mean that animals are retained for sale or killed to save damage to the fishing gear. Unlike other sawfishes, the Narrow Sawfish (*Anoxypristis cuspidata*) is less resilient to capture and handling, and has low levels of survival in commercial fishing operations even if handled carefully (S. Peverell pers. comm. 2013, L. Squire Jr. pers. comm. 2013). Handling guidelines for fishers have been developed in the U.S. (http://goo.gl/6UEMMW) and Australia (http://goo.gl/l9zW2i) to improve the survival of sawfish when they are captured.

There are four reasons why the scale of the threat to sawfishes due to nets is largest in developing countries: (1) , the use of gill and entanglement nets is widespread, (2) any incidental catch is retained because of the economic value fins in the fin trade (Mazumdar 1940, Nyingi 2007, 2008), rostra in the curio souvenir trade (Charvet-Almeida 2002, Musick and McMillan 2002, Nyingi 2007, 2008), and other products including meat, skin, and eggs (Charvet-Almeida 2002), (3) coastal human population densities are high and the population growth and immigration rates are high, increasing the pressure on all marine resources for subsistence food and income, and (4) a lack of fisheries monitoring, management, controls or enforcement.

Recreational fisheries have previously resulted in the widespread killing of sawfishes, such as recreational harpooning in Florida (Heilner 1917) and angling in Texas (Caldwell 1990). There is some indication that recreational fisheries may still pose a threat to sawfishes, particularly in Australia and the U.S. Despite both of these countries having strict regulations for recreational fisheries that prohibit retention, and require live release of sawfishes, recreational fishers do at times kill sawfishes. For example, reports of sawfish encounters in Florida include a small number where the animal was killed (Wiley and Simpfendorfer 2010). Given the remoteness of areas where sawfishes are often encountered by recreational fishers, and the low level of enforcement, education of fishers is critical to ensuring the threat from recreational fishing remains low.

8.2 Habitat degradation and loss

Peter M. Kyne and Alec Moore

All species of sawfish occupy shallow nearshore coastal and estuarine waters, and in some cases, rivers, lakes, and floodplain waterholes. An individual may have a reliance on a variety of habitat types throughout its life, such as the euryhaline Largetooth Sawfish (*Pristis pristis*), which, at least in the Indo-West Pacific, spends 4 - 5 years in freshwater habitats before migrating to coastal and marine waters (Thorburn *et al.* 2007). Smalltooth Sawfish (*P. pectinata*) and Dwarf Sawfish (*P. clavata*) also use river environments, although they do not penetrate into freshwater reaches. Nearshore, estuarine, river, and freshwater habitats provide nursery areas for sawfishes, with adults occurring more broadly including into offshore marine waters. A reliance on a diversity of habitats therefore makes sawfishes susceptible to a wide variety of anthropogenic impacts on their habitats, from land-based activities in catchments which may affect freshwater environments, to coastal and marine habitat degradation and loss. It remains unclear what proportion of suitable sawfish habitat has been historically lost or degraded.

Many species, especially the juvenile stages, show preferences for very shallow water. Dwarf

Sawfish were shown to generally occupy shallow depths of 0–2 m (Stevens *et al.* 2008), juvenile Smalltooth Sawfish use very shallow mud and sand banks (Simpfendorfer *et al.* 2010), juvenile Largetooth Sawfish use shallow river water of just tens of cm deep in northern Australia (Whitty *et al.* 2009), and Green Sawfish (*P. zijsron*) have also been shown to consistently occupy shallow water (<1.5 m deep) (Peverell and Pillans 2004, Stevens *et al.* 2008). Furthermore, within a landscape of available habitat, individual sawfish may show a high level of restricted site fidelity. For example, Dwarf Sawfish rested in inundated mangrove forests on high tides and moved out onto the subtidal mudflats at low tide, often returning to within 100 m of previous high-tide resting sites (Stevens *et al.* 2008).

In many parts of the historic and current distribution of sawfishes, increasing human populations, industrialization, and development is placing intense pressure on coastal zone habitat extent and quality (Jennings *et al.* 2008, Knip *et al.* 2010). The degree to which habitat loss and degradation has contributed to sawfish population declines is unknown. However,

continuing coastal and catchment development and habitat degradation has the ability to limit sawfish population recovery.

Coastal and catchment development (industrial, agricultural, residential, and tourism) can result in the direct permanent loss of habitat, for example through dredging and infill activities (including land reclamation), but may also cause indirect affects through changes to productivity and prey availability. Habitat can become

Dams, barrages, impoundments (a confined body of water, such as a reservoir), and other river modifications not only alter flows and cause the build-up of silt, but also restrict migration and movement patterns.

fragmented and connectivity between suitable habitat can be lost. An example is the scale and rate of loss of shallow habitat in the Gulf, where mega-developments such as the Palm and the World have resulted in massive amounts of dredging and loss of intertidal and shallow subtidal areas. Even placing these high-profile developments aside, the routine and largely unregulated loss of intertidal habitat is on a huge-scale. For example, the tiny island nation of Bahrain - formerly known to have exceptional sawfish abundance - increased its land area by 11% between 1963 and 2007, resulting in the permanent loss of 91 km^2 of shallow waters and the degradation through dredging of a further several hundred kilometres of subtidal seabed to provide infill (Sheppard *et al.* 2010).

Several species of sawfish have a demonstrated affinity with mangrove forests, such as Smalltooth Sawfish, Dwarf Sawfish, and Green Sawfish. Mangroves have been widely degraded in recent decades, with an estimated average 35% loss (by continent) in the last two decades of the 20th century (Valiela *et al.* 2001). Losses have been high in several areas of historical sawfish abundance, such as West Africa, India, Brazil and many countries of Southeast Asia (Valiela *et al.* 2001) and the southeast United States. Mangrove loss is continuing and is predicted to worsen with sea level rise (Sandilyan and Kathiresan 2012).

Changes in hydrological regimes as a result of land-based activities have the potential to impact upon sawfish habitat, in particular for the Largetooth Sawfish. Dams, barrages, impoundments (a confined body of water, such as a reservoir), and other river modifications not only alter flows and cause the build-up of silt, but also restrict migration and movement patterns, thus reducing or effectively eliminating available habitat. Barriers can also concentrate predator density immediately downstream of the structure, leading to higher predation pressure, for example below Camballin Barrage on the Fitzroy River of northern Australia (Morgan *et al.* 2005). The damming of the Ord River in northern Australia, a river occupied by Largetooth Sawfish, has altered the upstream movement of fish species (Doupé *et al.* 2005) and dam development projects throughout the tropical world are likely to represent one of the most significant barriers to Largetooth Sawfish population recovery. For example, Southeast Asian nations are developing considerable numbers of large-scale dams, which will severely impact fish movement (however, this may be somewhat irrelevant for Largetooth Sawfish given the intense and unregulated nature of Asian fisheries; while many dams are slated for the Mekong River and tributaries, this species may be long gone from that river; Rainboth 1996).

In Iraq and Iran, human modifications to the Tigris-Euphrates-Karun system have significantly altered the ecology of the northwestern Gulf, and the impending development of vast

hydro-electric schemes far upstream in Turkey, Iraq, and Iran, has the potential for further serious impacts, such as significant reduction in river discharge and the permanent removal of seasonal flooding (Al-Yamani *et al.* 2007). In northern Australia, there is the potential for increased freshwater extraction from tropical rivers as agriculture and the mining industry continue to expand, which may reduce habitat availability.

Chemical pollution or contamination as a result of agricultural activities, development, and onshore and offshore mining operations is of potential concern for sawfishes. Point source pollution from agriculture and industry can introduce compounds toxic to elasmobranchs and their prey. Pesticide contamination has been suggested to alter endocrine and immune function in a freshwater occurring elasmobranch (Gelsleichter *et al.* 2006). Mining activities can potentially introduce heavy metal pollutants and radioactive isotopes into sawfish habitat, and while mining poses a number of contamination risks, modern management approaches are able to mitigate many of these (Brereton *et al.* 2009), although these approaches may not be applied in developing nations. Some examples of mining affects on sawfish habitats include

the elevated levels of heavy metals in the Finniss River of northern Australia from the rehabilitated Rum Jungle mine site (Brereton *et al.* 2009), and the suspected affects on the Largetooth Sawfish population of cyanide spills from mining operations in the Fly River system of Papua New Guinea (Compagno and Cook 2005).

A new emerging large-scale threat is the development of ocean-connecting canals through prime sawfish habitat. The most recent proposed development is of an Inter-Oceanic Nicaragua Canal, similar to the Panama Canal (Hammick 2013, Watts 2013). The proposed route is through the San Juan River and Lake Nicaragua. These habitats previously harboured one of the largest and best known freshwater sawfish populations and offer an important conservation and restoration opportunity (Thorson 1976, 1982b).

The protection, and where necessary, restoration of critical sawfish habitat will be an important consideration in the recovery of sawfish populations. This is a major challenge where development in the coastal zone and within river systems is ensuing, often with little environmental regard. Designating and managing critical habitat for the Smalltooth Sawfish in the U.S. is a positive move (Norton *et al.* 2012). Northern Australia represents one of the few remaining strongholds for the other four sawfish species, and it also represents a remaining stronghold for their habitat, a result of the relatively low (although expanding) level of mining, the dispersed nature of agricultural activities, and low population densities. Future development in places like northern Australia will need to be mindful of sawfish habitat as well as river-estuary-coastal connections.

8.3 Sawfish products and trade

Matthew T. McDavitt

Humans have long exploited sawfishes as a source of valued commercial products throughout their range. Today, the most prominent products derived from sawfishes, ranked in order of probable threat to remaining populations are: fins, traditional medicines, artificial cockfighting spurs, curios, meat, liver oil, leather, and aquarium animals.

The threatened status of sawfishes combined with the continued appearance of high-value sawfish products in markets worldwide is a troubling key challenge. Such trade should continue to be managed nationally and internationally to halt decline and facilitate recovery efforts. The scale of public and political support for conserving threatened fauna often correlates with the perceived economic or cultural value of the species or groups of species (McClenachan *et al.* 2012). Hence, the economic value of sawfishes could be employed to inspire awareness, political support, and ultimately conservation measures to assist in the restoration of sawfish populations and their habitats.

Global historical and modern trade in sawfishes and their parts remains poorly documented, primarily because sawfishes are often taken as an incidental catch rather than by targeted fishing. As a result, sawfishes are often unrecorded in official fishery statistics (Seitz and Poulakis 2006). Detailed statistics on the scale of sawfish exploitation and trade is rarely available. However, literature and anecdotal records often provide important trade details.

Fin trade

Some of the earliest Western references to the Chinese shark fin trade confirm that sawfishes have long been targeted as a high-value species. The shark-like rays generally, including the Sawfishes (Pristidae), Wedgefishes (Rhynchobatidae), and Shark-ray (Rhinidae), are all high-value in the trade. For instance, two centuries ago a traveler discovered a mysterious pile of sawfish rostra on an island off Eritrea (Red Sea), the remains of shark fin exploitation (Mountnorris 1809):

"We had seen a large heap of the saw-fish's saws in one of the vales;...They kill the fish for the fins, which is a large article of export to India: it finds a market in China with those of the shark, where they are used...to give a glutinous richness to the soups."

A new emerging large-scale threat is the development of ocean-connecting canals through prime sawfish habitat. The most recent proposed development is of an Inter-Oceanic Nicaragua Canal, similar to the Panama Canal.

From the mid 1970s until today, sawfish rostral teeth have been the preferred material used to manufacture artificial 'spurs' for cockfighting in Peru.

A century later, dozens of sawfish rostra were found scattered at shark finning camps along the estuaries of Kenya, confirming long-term exploitation for this purpose in East Africa (Hebley 1929, Jackson 1969). Similarly, an early report from Lake Maracaibo, Venezuela stated that a Chinese company was catching and exporting some product derived from the abundant sawfishes from the lake (Totten 1911), almost certainly a reference to the shark fin trade. While pricing information for sawfish fins in the fin trade is hard to come by, recently it was reported that a Kenyan fisherman could retire after catching just one sawfish, due to the high value of its fins (up to U.S. $3,896 per set) and rostrum (up to U.S. $1,450) (Nyingi 2007, 2008).

In the Americas, sawfishes were commonly caught in the Big Pine Key shark fishery of the 1920s in the Florida Keys (Viele 1996). A worker at this shark camp stated that sawfish fins attained the highest value in the Asian trade (Young and Mazet 1933). The lucrative market for fins was a primary motivation for the catastrophic targeted fishery in Lake Nicaragua, which virtually eliminated sawfishes from this Central American lake within a five-year period of the initiation of the fishery (Davies 1976, Thorson 1982b). Regarding Southeast Asia, Neill (1973) remarks that the Chinese "value [sawfish] fins above those of sharks as a soup ingredient," a factor which encourages Indonesian fishermen to capture them.

The exploitation of sawfishes for the fin trade is ongoing; over the past few years, websites of Madagascan, Chinese, Indonesian, and Australian shark fin dealers have appeared selling both *Pristis* sp. and Narrow Sawfish (*Anoxypristis cuspidata*) fins (M.T. McDavitt pers. obs.). Highly-prized in the shark fin trade, the near-elimination of sawfishes from much of their former range has elicited melancholic recollections from nostalgic connoisseurs: "Generally speaking, *Pristis* is best. However, this species has become very rare now. Its four centimetre-thick fin meat walls, and toothpick-thick fin needles can perhaps only be seen now in dreams" (Anonymous n.d.).

Green Sawfish (*Pristis zijsron*) fins advertised for sale on the website of a Chinese shark fin dealer with five locations in different parts of China. The modern trade in fins is very poorly documented and as a result these shark-like rays have received little attention in fin-trade analyses, despite their high value fins (Clarke *et al.* 2004, 2006 a,b).

Cockfighting Spurs

From the mid 1970s until today, sawfish rostral teeth have been the preferred material used to manufacture artificial 'spurs' for cockfighting in Peru (Cogorno Ventura 2001). The rostral teeth are obtained mostly from Brazil, Ecuador, Panama, as well as various Caribbean countries. Sawfish rostral teeth became favored over other natural spur materials (such as deer & bull horn, hawksbill sea turtle shell, sea lion teeth, mammal bones, and stingray spines), after systematic testing revealed that sawfish teeth were more durable, and have a sufficiently porous surface to cause greater body damage to the opponent, a harmful quality termed ponzoñosa 'poisonous' (Cogorno Ventura 2001).

Now, there is growing concern among practitioners because sawfish rostra are becoming more difficult to obtain, and teeth on the market are now of lower quality and more expensive. Currently, several Peruvian websites offer both finished spurs and raw sawfish rostral teeth for the Peruvian, Ecuadoran, and international markets. Prices for finished spurs range from U.S. $80 to $220 per pair (representing half of one tooth). If all teeth on a sawfish were usable, this would mean that each rostrum would be valued at between U.S. $1,120 and $13,200, depending on the tooth count (assuming 28 low, 60 high). While it is clear that sawfish tooth spurs are favored in Peruvian-style cockfighting, it remains unclear whether other countries also employ this natural material to produce their spurs. The extent of this trade remains unknown

Traditional Medicine

While the cultural history of sawfishes remains poorly documented, use of sawfish parts as traditional medicine is known from nine countries (Mexico, Brazil, Kenya, Eritrea, Yemen, Iran, India, Bangladesh, and China). One of the main medicinal uses has been the use of dried

and powdered rostra as treatments for respiratory ailments, including in Brazil and Mexico (Barajas Casso-Lopez 1951, Cifuentes Lemus *et al.* 1993, Charvet-Almeida 2002, McDavitt and Charvet-Almeida 2004). Sawfish liver oil has been used for similar purposes in Eritrea (Nyingi 2007), and as a cure for vision problems in Yemen by the Mehri people (Sima 2009). In Bangladesh, it has been observed that sawfish vertebral centra are employed to treat rheumatism, with each centrum selling for 20 Taka (US $0.27; Box 5). In India, a recent newspaper article describes a traditional medicine vendor selling "powdered sawfish snout to relieve pain" (Watson 2004). In Iran, sawfish ova are employed medicinally along the southern coasts of Iran as a treatment for rheumatism (Nurbakhsh 1995).

In modern times, three sawfish products are listed as 'materia medica' in Traditional Chinese Medicine: sawfish liver, ova, and bile (Anonymous 1983, Han and Xu 1992). The bile is used to remove phlegm and diminish inflammation from fall injuries, rheumatoid arthritis, and cholecystitis (Anonymous 1983). Sawfish bile is used to cure scabies and skin ulcers, sawfish ova are used to combat diarrhea, and liver oil is used to treat lung and stomach problems (Anonymous 1983). *There is no scientific evidence to support the perceived medicinal value of sawfishes.*

Curios

Sawfish rostrums have long been favorite marine curios in Western society and globally. Before online auctions became prevalent, sawfish rostra were usually sold locally as tourist curios, through biological supply companies, antique stores, or in shell shops (McDavitt 1996). Now, sawfish rostra are primarily sold via internet auctions, such as through eBay, and Sotheby's and Christie's. Longer rostra are favoured and there is a correlation between the average price paid for rostra and the total length. All five sawfish species have been observed in trade (McDavitt and Charvet-Almeida 2004).

Meat

Sawfishes have been exploited as food on a small scale throughout their range (Bigelow and Schroeder 1953). While use of sawfishes for meat has historically been opportunistic and localised, there are examples where sawfishes have been targeted for food. The clearest example of intentional capture of sawfishes for food occurred in Lake Nicaragua (Thorson 1976, 1982b). Starting in 1970, the Nicaraguan government encouraged the development of a targeted fishery to exploit the abundant sawfishes and shark resources in the lake. The meat appeared in local markets and was exported throughout Central America, the Caribbean, and even the United States (Thorson 1982b). Within five years, a handful of artisanal fishermen caught an estimated 60,000 to 100,000 sawfishes from the lake, causing a precipitous decline in the sawfish population (Thorson 1976).

There are indications that sawfishes may be opportunistically targeted in other areas. For instance, in preparing the traditional Burmese recipe "shark baked with a tomato and citrus juice sauce," the recipe "particularly recommended using sawfish" (Davidson 2003) and in Thailand the flesh of sawfishes was preferred to that of sharks (Smith 1945) and was regularly taken in inshore fisheries for human consumption (Compagno 1999).

Liver Oil

Sawfishes have been exploited periodically for their liver oil which is rich in vitamin A. Day (1889) observed a factory in Calicut, India that processed shark livers into medicinal oil. Similarly, in the late 1800s, sawfishes were targeted for their liver oil in Madagascar (Pollen and Van Dam 1874). In the Big Pine Key shark fishery off the Florida Keys in the 1920s, the liver oil of sawfishes was considered the highest quality based on its vitamin content (Viele 1996). This use, however, largely declined as synthetic vitamin A became widely available after the

Sales of Sawfish Rostra on eBay

Matthew T. McDavitt

Given their intriguing shape, sawfish rostra have been valued curios in many human societies. In the Western world, prior to the advent of the internet, such sales largely occurred at auction houses, curio shops, and antique stores. Now such sales are more common online. A year-long survey of the sale of sawfish parts on eBay (www.eBay.com) between February 2004—2005, for instance, estimated that approximately 210 rostra were sold over this auction site annually, for a total value of U.S. $25,000, with around one-third (31 of 84 sales) of the sales constituting (illegal) international trade. The average price of rostra sold over eBay during 2004 was U.S. $119, with prices varying predictably with length. The highest price paid for a single rostrum during the study period was U.S. $1,242 (McDavitt and Charvet-Almeida 2004).

In 2006, the Ocean Conservancy contacted eBay to encourage them to ban sales of Smalltooth Sawfish (*Pristis pectinata*) parts, particularly because of their endangered status under the U.S. Endangered Species Act. In line with its general policy regarding prohibited items, eBay eventually agreed to allow interested parties to report infringing listings, and to remove listings that violate applicable wildlife laws or its general eBay policies (NMFS 2000, Anonymous 2006, MSNBC 2006).

eBay places the onus of preventing illegal listings on sellers, who are directed to follow all applicable laws. eBay claims that policing its site for illegal items is impossible because over six million new listings appear on the online auction site daily. As a result, this 'ban' has had little actual impact on the appearance and sale of sawfish parts on eBay. During the 2004 eBay study, an average of five rostra were available on the eBay system sale weekly. Nearly eight years later, on 26 October 2012, the author located 10 sawfish rostra currently available on eBay. On 1 March 2012 a rostrum, apparently from Smalltooth Sawfish, and stated to be "mid-century" (i.e. not antique under wildlife law) sold for U.S. $315. Because eBay now hides bidder name and profile information, it remains unknown whether this sale was interstate or international. Since eBay was alerted to these conservation concerns in 2006, it has become easier to illegally sell sawfish parts through this service.

Second World War. Sawfish liver oil is used as a medicine for respiratory problems in Eritrea (Peretti n.d.), and was consumed to treat vision problems in Yemen (Sima 2009).

Leather

Sawfishes have been exploited for leather intermittently throughout their range. Sawfishes commonly caught in the Big Pine Key shark fishery during the 1920s were a valued source for leather given the quality of their skin and the great surface area of the animal (Young and Mazet 1933, Viele 1996). Subsequently, a shark leather industry-pricing guide from 1960 lists sawfish leather at half the value of other sharks, apparently due to inferior leather quality (Anonymous 1960). However, the popularity of shark leather (used primarily for cowboy boots) has been declining since the 1980s, and currently shark leather production in America has fallen off dramatically (Rose 1996).

Aquarium Trade

Sawfishes have long been prized as exhibit animals in public aquaria (McDavitt 1996). Their bizarre appearance and enormous size make them favorite displays among aquarium patrons, and a number have survived for decades in captive conditions.

Sawfishes have commanded high prices in the aquarium trade; a sawfish in the Vancouver Aquarium in 1986 was valued at U.S. $10,000 (Harper 1986) and juvenile Largetooth Sawfishes (*P. pristis*) imported from "freshwater Indonesia" by one Canadian dealer in the late 1990s were priced at U.S. $5,000 per animal (Biotope Imports pers. comm. 1999). Another estimate from 2000 reported that sawfishes were then worth approximately U.S. $1,000 per foot (NMFS 2000). One Australian exporter has been regularly selling sawfishes to public aquaria worldwide for nearly a decade. Green Sawfish and Largetooth Sawfish sold for U.S. $5,400 per metre, and Dwarf Sawfish (*P. clavata*) sold for U.S. $5,700 per metre (L. Squire Jr. pers. comm. 2005).

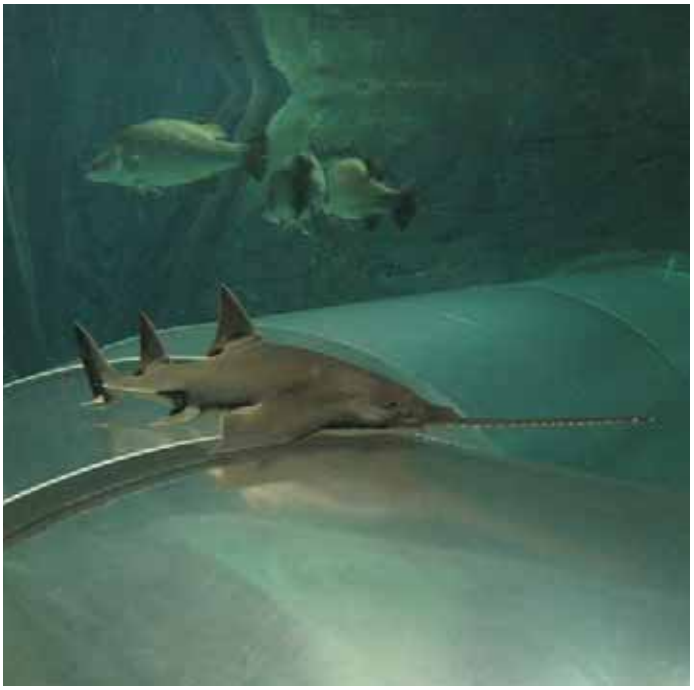
Prior to the listing of sawfishes on Appendices I and II of Convention on the International Trade of Endangered Species of Wild Fauna and Flora (CITES) in 2007, juvenile Largetooth Sawfish, usually less than 1 m TL, were supplied to the international market by exporters in the Jambi province of Sumatra, Indonesia (Ng and Tan 1997). Even though this was a targeted fishery, the volume was apparently low because the animals themselves are scarce, with reported annual estimates under 20 animals per year (Tan and Lim 1998). However, anecdotal evidence shows that "...sawfish have not been seen in the ornamental trade in this region since the 2000s", however demand still exists (H.H. Tan pers. comm. 2012).

The removal of sawfishes from the wild for display in aquaria has been considered by some to be a significant threat to sawfish populations. However, the implementation of the CITES listings has reduced the potential threat of the unsustainable capture of sawfishes from the wild for use in aquaria. Eight live specimens of Largetooth Sawfish (*P. pristis*; traded under *P. microdon*; then listed on Appendix II of CITES; see Section 9) were traded from Australia to France (n = 2) and the U.S. (n = 6) since 2007 (Appendix 6). This trade was carried out in accordance with CITES regulations and on the basis of a Non Detriment Finding (NDF) (DSEWPaC 2007). International commercial trade is now strictly restricted

(see Section 9 for more details).

There are 72 sawfishes from four species currently held in aquaria (S. White pers. comm. 2012; details of each facility and the number of sawfishes that they hold are shown in Appendix 7). It was thought for some time that it would be difficult to breed sawfishes in captivity, however, on 12 April 2012, two male and two female Smalltooth Sawfish (*P. pectinata*) pups were born to one female at the Atlantis, Paradise Island Resort (Bahamas) and were still alive at the time of press (December 2013). This may lead to captive breeding opportunities, which will in turn reduce the pressure on wild populations as a source of sawfishes for aquaria.

Generally speaking, *Pristis* is best. However, this species has become very rare now. Its four centimetre-thick fin meat walls, and toothpick-thick fin needles can perhaps only be seen now in dreams.



8.4 Future threats

Colin A. Simpfendorfer

The threats that sawfish currently face - most notably fishing and habitat modification - are likely to persist into the future due to rising human populations in coastal areas and their need for food and energy. In northern Australia, where some of the healthiest populations of some sawfish species persist, the development of new agricultural ventures may see a number of important rivers for Largetooth Sawfish (*Pristis pristis*) dammed and water quality degraded. In addition, water extraction from rivers or aquifers may reduce water levels in important riverine habitats.

Throughout their range, the development of tidal power generating facilities in coastal areas, especially in regions with larger tides, may increase threats by restricting access to important habitats or by physically harming sawfish. The growth of offshore windfarms (and potentially wave and tidal energy) will also see the rapid increase in high voltage undersea cables, the potential of which to affect elasmobranches has been studied to a limited degree (Gill and Kimber 2005).

There is also evidence that climate change could potentially impact sawfishes. Largetooth Sawfish, Dwarf Sawfish (*P. clavata*), Green Sawfish (*P. zijsron*), and Narrow Sawfish (*Anoxypristis cuspidata*) were all assessed as having "moderate overall vulnerability" to climate change, based on calculations of exposure, sensitivity and adaptive capacity (Chin *et al.* 2010). Further work needs to be undertaken to fully understand the potential impact of future changes in climate and ocean conditions on sawfishes.

With sawfish populations in most parts of their range now at very low levels, there are also potential future threats from the effects of small population size. This includes reductions in population health, genetic bottlenecks, inbreeding depression, and genetic drift. While little is known about the genetic health of sawfish populations, there is evidence that the population reduction experienced by Smalltooth Sawfish (*P. pectinata*) in Florida waters during the 20th century has not lead to dramatic genetic effects (Chapman *et al.* 2011). However, the population reductions in other parts of the range of sawfishes are likely to be much greater, and future management will need to consider the potential for negative genetic effects.

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9 | Sawfish Conservation Policies

Sonja V. Fordham

Effective recovery of sawfishes depends on enforceable policies at multiple levels to prevent intentional killing, minimise bycatch mortality, control trade, and conserve critical habitats. Most of the sawfish-specific protective policies in-place to-date focus on take and trade of these species. Sawfishes may also be benefitting from broader measures to reduce fishing effort and mitigate bycatch, yet these can be exceptionally difficult to quantify.

As described in Section 8.3, fins are valued at up to several thousand dollars per set in the Asian soupfin trade, and rostra can sell for upwards of U.S. $1,400 each in the curio trade. This high value provides significant incentive for fishermen to kill sawfish for their parts that might otherwise survive capture.

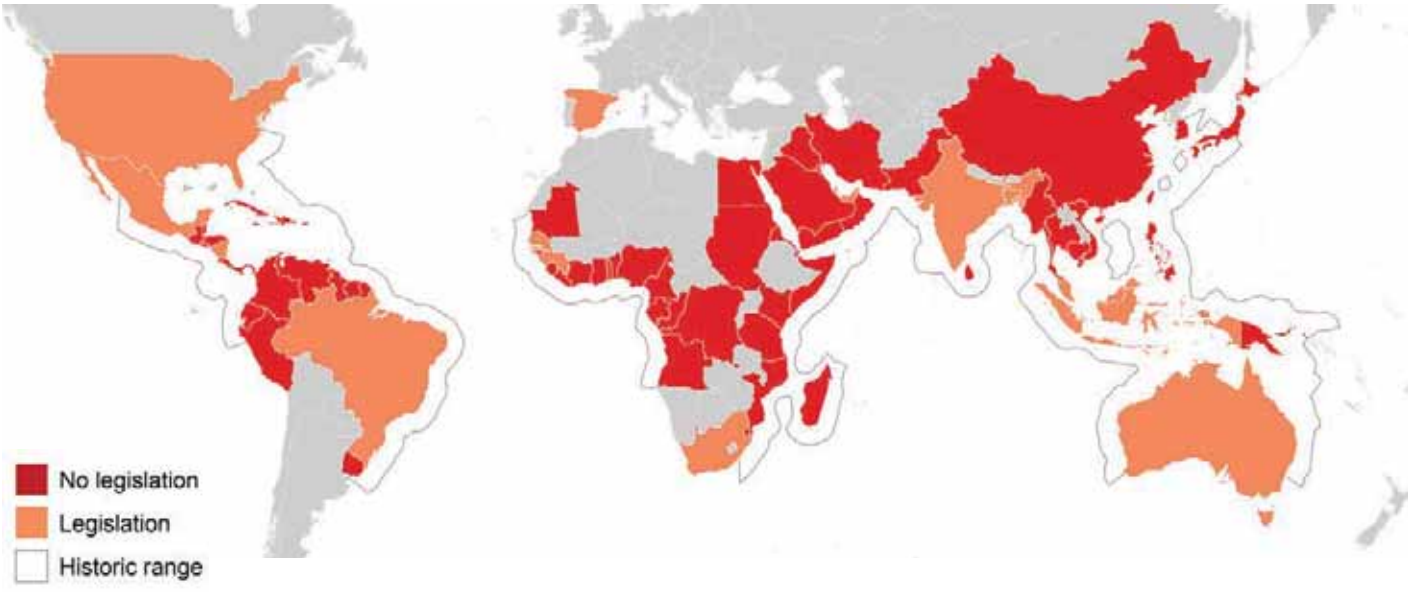
National legal safeguards for sawfishes vary widely among countries. The U.S. offers its strongest legal protection from all harm for both Largetooth Sawfish (*Pristis pristis*) and Smalltooth Sawfish (*P. pectinata*) along with bycatch mitigation and critical habitat conservation measures for Smalltooth Sawfish. Australia provides almost as much, although requirements vary across species and regions, and in some cases could benefit from strengthening and harmonization. Most other range states, on the other hand, provide little or no specific protection (see Appendix 8 for details of specific policies and Figure 11 for location of protections). Of the 92 sawfish range states, sawfish-specific protections exist to some degree in 16 of them (Australia, Bahrain, Bangladesh, Brazil, Guinea, India, Indonesia, Malaysia, Mexico, Nicaragua, Qatar, Senegal, South Africa, Spain, United Arab Emirates, and the U.S.; Appendix 8). Enforcement and the specificity and scope of most of these laws, however, are generally poor. Although there are also a number of countries that have banned some or all forms of shark fishing or established large marine protected areas (Ward-Paige *et al.* 2012), these measures vary in terms of exceptions and enforcement (Davidson 2012, Dulvy 2013), and therefore the implications for sawfishes are unclear.

In 2010 Smalltooth Sawfish and Largetooth Sawfish were added to Annex II of the Barcelona Convention Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean; States that are Party to the Convention are required to "ensure that they provide maximum protection for and aid the recovery of" these species. Subsequently, the General Fisheries Commission for the Mediterranean (GFCM) adopted measures in 2012 to confer protection from fishing activities on these Annex II species. However, implementation of these measures are lacking.

International trade of sawfish specimens and parts is regulated globally through the Convention on the International Trade of Endangered Species of Wild Fauna and Flora (CITES). In 2007, six of the seven species of sawfish (as valid then) were listed on CITES Appendix I, which amounts essentially to a ban on international commercial trade, based on a proposal from the United States and Kenya. Australia, however, asserted that their populations of *Pristis microdon* (now recognised as Largetooth Sawfish, *P. pristis*) were robust and secured trade controls for this species through listing on Appendix II (rather than Appendix I as proposed), "for the exclusive purpose of allowing international trade in live animals to appropriate and acceptable aquaria for primarily conservation purposes" (CITES 2007). In 2011, as part of the required process for ensuring sustainable international trade in CITES Appendix II listed species, the Australian government reported that it could not be certain that sawfish exports were not detrimental to species recovery, and ended the trade. A subsequent Australian proposal to uplist *Pristis microdon* to CITES Appendix I was adopted by consensus by the Parties in March 2013, thereby completing a global ban on commercial international trade in all sawfishes. Although ending the inconsistencies in CITES rules for sawfishes closes loopholes in global trade policy, full implementation of the Appendix I listing remains a critical challenge. Sawfish fins can be disguised in shipments of shark fins and assistance in building the capacity to monitor such trade is still needed in many range states.

Of the 92 sawfish range states, sawfish-specific protections exist to some degree in 16 of them. Enforcement and the specificity and scope of most of these laws, however, are generally poor.

Figure 11. Map indicating location of sawfish-specific country-based conservation policies



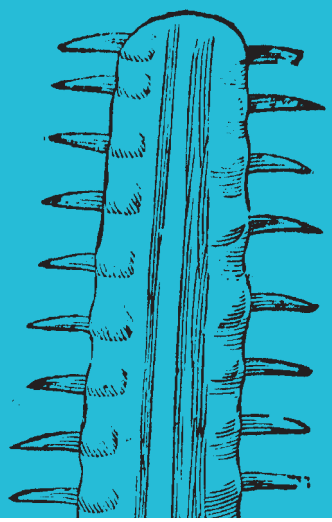
International Sawfish Encounter Database
George H. Burgess

The International Sawfish Encounter Database (ISED), formerly the National Sawfish Encounter Database (NSED), is a compendium of data records that attempts to record all known encounters with sawfishes throughout the world. The Database, at time of writing, currently documents 6,952 encounters representing 10,611 individual sawfishes. The oldest encounter documented record is from 1782.

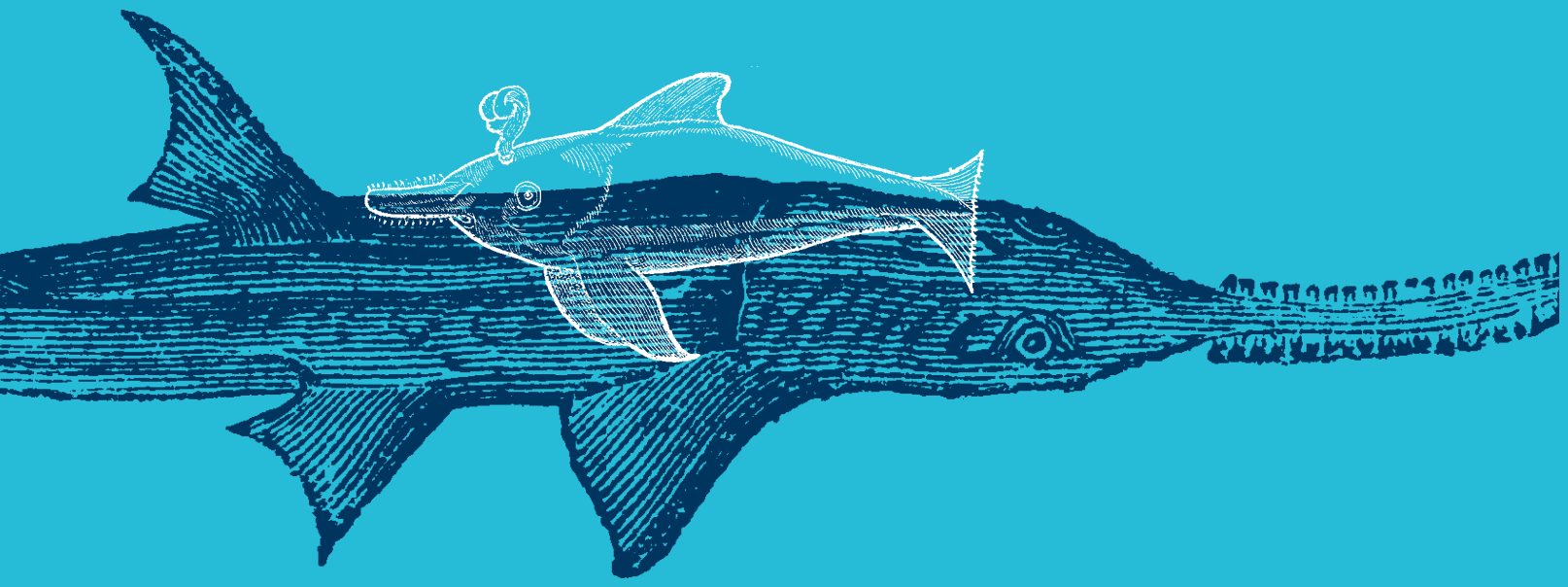
The NSED originated at Mote Marine Laboratory in 2000 where it was maintained by Tonya Wiley and Colin Simpfendorfer. It was later transferred to the Florida Program for Shark Research (FPSR) at the Florida Museum of Natural History, University of Florida under the care of George H. Burgess. Since transfer, the Database has grown four-fold in size with the integration of the original Mote database and five other independently-derived sawfish databases: one from the FPSR, two from the Florida Fish and Wildlife Conservation Commission (Gregg Poulakis), and two databases from private sawfish aficionados, Matthew McDavitt and Jason Seitz. In addition, sawfish records from observers and researchers of the U.S. National Marine Fisheries Service (John Carlson, Shelley Norton) are routinely forwarded to the Database. As a result, all existing information regarding U.S. sawfishes is now held in one place.

As the global threat to sawfishes became more apparent, especially with the species ranges that do not honor geopolitical boundaries and the need for multinational management, it became clear that documentation of non-U.S. records is increasingly important. A decision was made to broaden the scope of the project and the name was changed to International Sawfish Encounter Database (ISED) to reflect the more inclusive nature of the database. We are actively attempting to bring our non-U.S. records up to the level of inclusivity we have achieved for the U.S.

The data from ISED sawfish encounter reports, and that data-mined from museum specimens and published records are entered into the Database and used for a variety of scientific purposes. This information assists in the evaluation of species' abundance, habitat, and range, both before anthropogenic influences began the decline process and after - the current situation worldwide. The data provide coarse-scale evaluators of historical changes in population sizes and their dynamics, and offer insight into historical and current habitat preferences. This type of information is vital for the recovery of sawfish populations, and greatly assists in conservation efforts. We endeavor to carefully document the identification of the species involved through photographs and drawings and hope to develop a marking-specific portfolio of individuals similar to ongoing efforts focusing on marine mammals and Whale Sharks. We seek and encourage scientists, conservationists, and the general public to report any encounter - historical or recent - as well as literature or museum records to the ISED. For links to ISED reporting forms (online, phone or mail submission), please visit www.flmnh.ufl.edu/fish/sharks/sawfish/sawfishencounters.html.



Conclusion and next steps



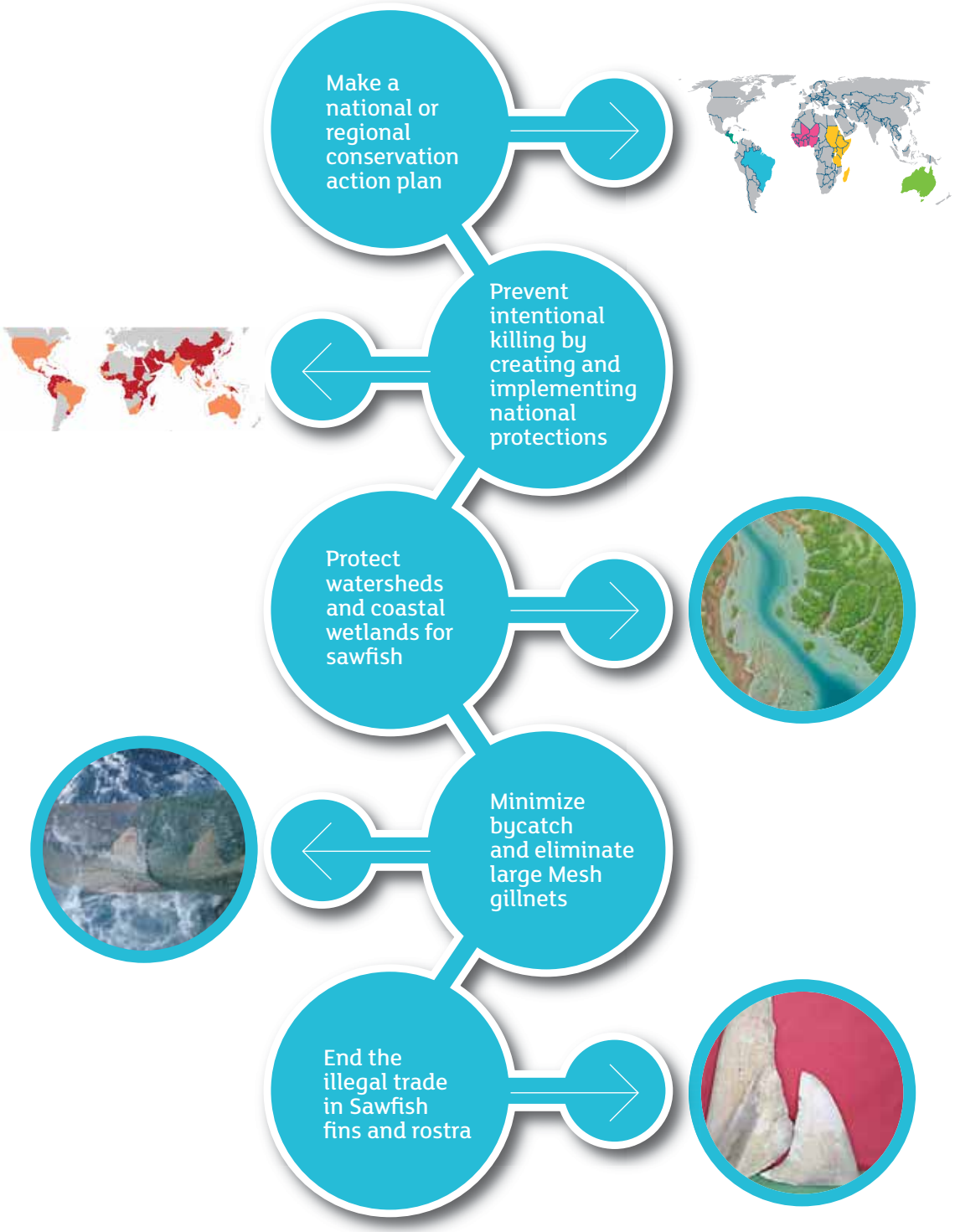
10 | Conclusion and next steps

As we have seen in the U.S., stablising sawfish populations is possible with the implementation of well-enforced conservation interventions and education programs. Although there is a lot of work to be done to bring other countries up to the protection quality of the U.S. and Australia, successful sawfish conservation is possible.
This Global Sawfish Conservation Strategy, the guidelines for creating regionally-focused Conservation Strategies and the expertise contained within the Sawfish Network community are all incredibly useful tools and resources that will guide and stimulate the work that is required to improve the conservation status of sawfishes.

Next Steps
While priority regions for research, fisheries, and outreach and education programmes are highlighted here, this document and network were created with a global overview, to serve as a precursor to the next stage - which is to develop regional capacity and more focused and tailored regional Conservation Strategies.

Please contact the IUCN Shark Specialist Group for support and additional information at (iucnshark@gmail.com).

Stepping Stones to Sawfish conservation success



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Glossary & Acronyms

Action Plan	See Conservation Strategy
Anecdotal	Casual observations or indications rather than those derived from rigorous scientific sampling.
Anthropogenic	Caused or produced by humans
Artisanal fisheries	Small-scale traditional fisheries involving fishing households (as opposed to commercial companies) which input a relatively small amount of capital and energy, and catch fish mainly for local consumption (some catch may be exported).
Barcelona Convention	Barcelona Convention Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean
Barrage	An artificial obstruction, such as a dam or irrigation channel, built in a watercourse to increase its depth or to divert its flow.
Bather protection nets	An active fishing method utilising nets or baited drumlines to remove sharks from the local area for the purpose of bather protection. Employed in Australia and in South Africa.
BCE	Before Common Era
Bentho-pelagic	Living and feeding near the bottom as well as in midwater or near the surface. Feeding on benthic as well as free swimming organisms.
Bycatch	The part of a catch taken incidentally in addition to the target species. In a broad context, this includes all non-targeted catch.
CE	Common Era
Centra	The main part or body of a spinal vertebra.
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora. An international conservation agreement which aims to ensure that international trade in specimens of wild fauna and flora does not threaten the survival of species.
CITES Appendix I	Lists species that are the most endangered among CITES-listed animals and plants. They are threatened with extinction and CITES prohibits international trade in specimens of these species except when the purpose of the import is not commercial, for instance for scientific research. In these exceptional cases, trade may take place provided it is authorised by the granting of both an import permit and an export permit (or re-export certificate). Article VII of the Convention provides for a number of exemptions to this general prohibition.
CITES Appendix II	Lists species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled. It also includes so-called "look-alike species", i.e. species of which the specimens in trade look like those of species listed for conservation reasons. International trade in specimens of Appendix-II species may be authorised by the granting of an export permit or re-export certificate. No import permit is necessary for these species under CITES (although a permit is needed in some countries that have taken stricter measures than CITES requires). Permits or certificates should only be granted if the relevant authorities are satisfied that certain conditions are met, above all that trade will not be detrimental to the survival of the species in the wild.
CITES CoP	Conference of the Parties. Approximately very 3 years, parties to CITES (government representatives from participating countries) meet to discuss a variety of issues. At each CoP, CITES parties discuss and vote on proposals to amend the Appendices. Two thirds of the parties present and voting must vote in favour of a proposal for it to be accepted.
CMS	The Convention on the Conservation of Migratory Species of Wild Animals. An international conservation agreement that recognises the need for countries to cooperate in the conservation of animals that migrate across national boundaries, if an effective response to threats operating throughout a species' range is to be made.

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CMS CoP	The Conference of the Parties is the CMS' principal decision-making body. It meets every three years.
Conservation Strategy	A document that assesses the conservation status of species and their habitats, and outlines conservation priorities (previously called an Action Plan).
Curio	A decorative object considered novel, rare, or bizarre.
Demersal	Occurring or living near or the bottom of the ocean.
Dispersal	The act or process of moving away from a location.
Distribution	The natural geographic range of an organism.
Diversity	Number of species (though also see genetic diversity)
Euryhaline	Capable of tolerating a wide range of salinities.
Extant presently in the area	The species is known, or thought very likely to occur
Extent of occurrence (EOO)	Area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy.
Extinction	Biological extinction is the complete disappearance of a species from an area; local extinction: the loss of the last individual of a particular species from a particular region or area.
Falcate	Curved and tapering to a point; sickle-shaped
FIBA	Fondation Internationale du Banc d'Arguin
FPSR	Florida Program for Shark Research
GBIF	Global Biodiversity Information Facility www.gbif.org
Genetic diversity	Genetic variation between and within species, which is measured by determining the proportion of polymorphic loci across the genome, or by the number of heterozygous individuals in a population.
Gestation	The process of carrying or being carried in the womb. between fertilisation and birth.
GFCM	General Fisheries Commission for the Mediterranean
Gillnet	A type of fishing net designed to entangle fish by the gills.
Incidental catch/capture	When catch of a non-targeted species is retained.
ISED	International Sawfish Encounter Database
IUCN	International Union for Conservation of Nature. A union of sovereign States, government agencies and non-governmental organisations.
IUCN Red List Assessment	A measure of the risk of extinction or conservation status of a species.
IUCN Red List of Threatened Species™	The world's most comprehensive inventory of the global conservation status of a species.
IUCN Species Programme	The IUCN Global Species Programme produces, maintains and manages The IUCN Red List of Threatened Species ™. It implements global species conservation initiatives, including Red List Biodiversity Assessment projects to assess the status of species for the IUCN Red List.
IUCN SSC Species Conservation Planning Sub-Committee	Its purpose is to disseminate the philosophy, methodologies and processes for effective species planning deriving from Strategic Planning for Species Conservation principally across the SSC's 120 Specialist Groups, but also with the aim of establishing a bench mark of good practice for conserving species to cope with the vast diversity of species needing planning and the multitude of conditions under which these species exist.

Life cycle	The series of changes in the growth and development of an organism from its beginning as an independent life form to its mature state in which offspring are produced.
Longline fishing	A fishing method using short lines bearing hooks attached at regular intervals to a longer main line. Longlines can be laid on the bottom (demersal) or suspended (pelagic) horizontally at a predetermined depth with the assistance of surface floats. Oceanic longlines may be as long as 150 km with several thousand hooks.
Megacity	A city with over 10 million inhabitants.
Migrant	An animal that moves from one region to another.
Monofilament	A single strand of untwisted synthetic fiber, such as nylon, used especially for fishing line.
MoU	Memorandum of Understanding; a document describing a bilateral or multilateral agreement between two or more than two parties
Non-detriment finding	A determination by a CITES member that the trade in a species is sustainable and that the specimens have been collected legally.
NGO	Non-governmental organisation; legally constituted organisations created by natural or legal people that operate independently from any form of government.
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NSED	National Sawfish Encounter Database
Ova	A mature female reproductive cell, that can divide to give rise to an embryo usually only after fertilization by a male cell.
Overexploitation	Overfishing of a renewable resource to the point where the deaths exceed the replacement rate.
Population	A group of individuals of a species living in a particular area. (This is defined by IUCN (2001) as the total number of mature individuals of the taxon, with subpopulations defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less).
Post-release mortality	Survival of a specimen after being removed from a hook or net and returned to the sea.
Possibly Extinct	The species was formerly known or thought very likely to occur in the area but it is most likely now extinct from the area.
Presence Uncertain	The species was formerly known or thought very likely to occur in the area but its no longer known whether it still occurs.
Probably Extant	A species presence is considered probable, either based on extrapolations of known records or realistic inferences.
Provenance	The records or documents authenticating such an object or the history of its ownership.
Ramsar	The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
Range	The geographical area within which that species naturally occurs.
Range state	Any nation that exercises jurisdiction over any part of a range which a particular species occurs in.
Rostrum	The toothed beak-like or snout-like projection of a sawfish (plural rostra).
SRFC	Sub Regional Fisheries Commission
SSC commissions of IUCN	Species Survival Commission, one of six volunteer
Action Plan	See Conservation Strategy
SSG	IUCN SSC Shark Specialist Group

Stock	A population or group of populations subject to actual or potential use, and which occupy a well defined geographical range independent of other populations of the same species. Usually regarded as an entity for fisheries management and assessment.
Subpopulation	Geographically or otherwise distinct groups in a population between which there is little exchange.
Subsistence fishery	A fishery where the fish landed are shared and consumed by the families and kin of the fishers instead of being sold on to the next larger market.
Synonym	A scientific name of an organism or of a taxonomic group that has been superseded by another name at the same rank.
Threatened	At risk from a particular threat
TL	Total length: a standard morphometric measurement for sharks and some batoids, from the tip of the rostrum to the end of the upper lobe of the caudal fin.
Totemic	An animal, plant, or natural object serving among certain tribal or traditional peoples as the emblem of a clan or family and sometimes revered as its founder, ancestor, or guardian.
TRAFFIC	A wildlife trade monitoring network; an international organisation dedicated to ensuring that trade in wild plants and animals is not a threat to the conservation of nature.
Transect monitored.	A line along which a particular scientific measurement is
Trawling (trawl netting)	A fishing method utilising a towed net consisting of a cone or funnel shaped net body, closed by a codend and extended at the openings by wings. Can be used on the bottom (demersal trawl) or in midwater (pelagic trawl).
Unsustainable resources.	Upsetting the ecological balance by depleting natural
Vagrant normal range.	When an individual animal appears well outside of its
Viable (populations)	Populations with positive population growth rate (due to a either or a combination of immigration or births).
ZSL	Zoological Society of London

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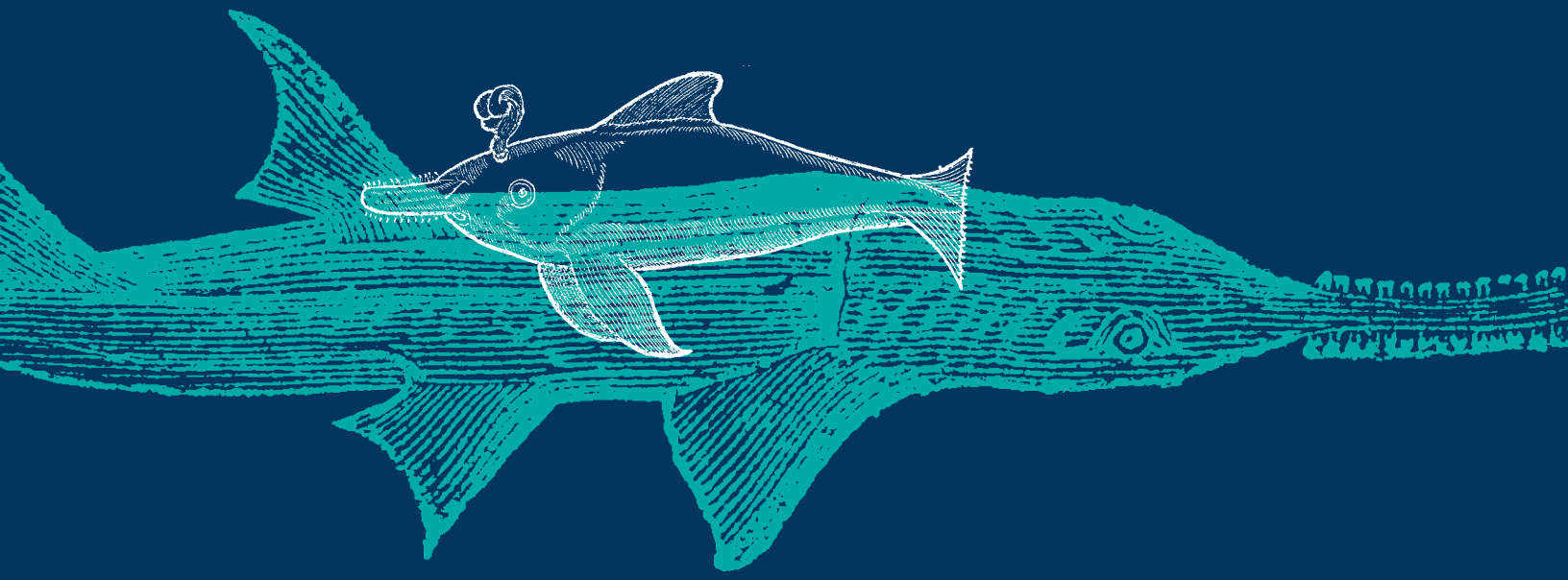

Appendix 1:

Workshop Guidelines for Regional and National Sawfish Conservation Strategies

Although species conservation requires planning at the international or range-wide levels, almost all directly effective conservation activities are conducted under the authority of national or local governments. Sawfish species' geographic ranges overlap areas administered by multiple authorities so it is essential that the global Sawfish Conservation Plan is eventually translated into action plans which can be implemented nationally or regionally. Basing these plans on the global conservation plan should ensure that national plans complement it and each other, and facilitate a coordinated approach to implementation. This section of the report outlines how regional, national or local action plans can be developed using the global plan as a basis.

***Timescale:** The global conservation plan has a horizon of eight years, to fit with the United Nations Convention on Biological Diversity Strategic Plan for Biodiversity and the 2020 timeline for the Aichi targets (www.cbd.int/sp/). This plan falls under and will help deliver target 6 of Strategic Goal B **(Reduce the direct pressures on biodiversity and promote sustainable use)** and This means that although the vision and goals are longer-term, the objectives (or at least their associated targets) are judged to be achievable in this timescale and all actions are to be completed by then. National action plans will normally follow the same timescale.

Process

The process for drawing up a national (or regional) action plan should involve broad-based participation, using the global conservation plan as a template, firstly to:

1. Outline the Status of sawfish conservation in the area

The global status review, with the associated Red List Assessments, should serve as a starting point. There may be an opportunity to refine the information with local detail, in particular on local protection mechanisms, etc. It will often be useful to look regionally even if drawing up a national plan, to show the importance of the State for the conservation of the species as a whole and to highlight areas where trans-national cooperation is required.

Then, to review the global conservation plan towards formulating your national plan:

2. Share the Vision for sawfish conservation

It should not be necessary to formulate a national vision separate from that given in the global plan. You may however want to briefly discuss how this vision translates into the national setting to ensure that the overall vision is 'owned' by participants locally. There may be elements of particular national importance, for example as relates to habitat or cultural significance etc

*The IUCN Handbook describes the vision as "An inspirational and short statement that outlines the future state for the species; the desired range and abundance for the species, its ecological role, and its relationship with humans". The vision is a description of the world as we would like to see it. It is aspirational as well as inspirational, long term, and in our sphere of interest but not of direct control.

[1]It draws from Chapter 9 of Strategic Planning for Species Conservation: A Handbook, IUCN Species Survival Commission ('IUCN Handbook' see Resources section) and the process participants went through in London to draft the Global Plan above.

3. Review the Goals of the global Plan

As with the vision, the two goals of the global plan should also serve as a basis for national plans. You should however consider (and unpack) what such goals mean locally, and discuss what they mean for a national plan. Again, some aspects may be more applicable locally than others. This will be important for the next stages as you outline local targets and actions. Your local actions should help fulfil these goals and the overall vision for sawfish conservation.

*From the IUCN Handbook: **Goals are** "The vision defined in operational terms, to capture in greater detail what needs to be done and where … written using operational terms [but] have the same range-wide and long-term temporal scale as the vision". Note: the goals are also long-term and aspirational but start to 'un-pack' the vision into areas that can be progressed.

They bridge our sphere of interest with our sphere of influence.

4. Check the global Objectives

The overall objectives of the global plan should address the key obstacles to sawfish conservation and be sufficiently broad that they can be adopted for use at the national level without adjustment. However, some of the global objectives may not be relevant nationally; you should therefore discuss their applicability nationally and set out a national interpretation where needed. You might also identify a new objective you feel is appropriate nationally. First, however, consider if this could be better framed as a particular national sub-objective (or 'target' - see below) underneath one of the objectives in the global plan. Note that the objectives in the global plan describe progress we want to see over the next eight years.

*From the IUCN Handbook: **Objectives** "Outline how the Vision and Goals will be turned into reality."
Each "relates to a logically related set of threats and constraints". If the vision and goals describe 'why' we are doing this work, the objectives describe 'what' we will seek to achieve. They are shorter-term (see 'timescale' below) and are within our sphere of influence. I.e. we should, through our actions, stand a reasonable chance of achieving them. Objective targets should be **SMART (**see below).

Most of your time will be spent on agreeing the particular targets (or sub-objectives) and actions needed nationally to deliver the plan:

5. Consider the Threats to, and Constraints on, sawfish conservation nationally

Threats might include local fishing practices and/or trade or degradation of habitat in the area. Constraints might include a lack of political will or few resources for example. These can be brainstormed and clustered under relevant global objectives. This will help to formulate the specific national targets and actions needed to deal with them.

*Threats and constraints are those factors or forces preventing our goals being met, consideration of which helps formulate objectives, targets and actions. The IUCN Handbook describes a threat as "a factor which causes either a substantial decline in the numbers of individuals of that species, or a substantial contraction of the species' geographic range. Proximate threats are immediate causes of population decline .... e.g., habitat loss, over-harvest. Drivers or ultimate threats are root causes of proximate threats, and are almost always anthropogenic (e.g. human population growth). Constraints are those factors which contribute to or compound the threats. For example, lack of political will or resources. Note that not all threats (human population growth or climate change, for example) are within our remit, or resources, to address; in these cases, ask what could be achieved that would at least help to mitigate such threats or minimise their negative impact.

6. Set national objective Targets

Having reviewed the global objectives and targets above, you can now identify those that need work nationally in order to meet them; and what if any additional targets you should set in order to deal with particular local threats and constraints.

Targets, and ideally objectives, should be SMART (see below): what concretely are you going to try to achieve nationally, over the period of the plan, in order to contribute to the global objectives and hence our shared vision for sawfish conservation? Targets should focus on addressing the threats and constraints identified earlier. The starting point again is those presented in the global strategy but sub-objectives which are not relevant may be skipped over. There may be additions you need to make to deal with local threats or constraints but before adding lots more objectives, consider if in fact you can describe the actions you need to take under those already there.

* Objective Targets are described as "measurable steps that describe what needs to be accomplished to meet an objective". They help determine what actions are needed and to group actions into logically related clusters. Such targets are needed when the objective itself is too broad or not SMART:

- ✔ Specific: It is clear what you are seeking to achieve by when (see the 'photograph test' below).
- ✔ Measurable: You will know when it's achieved, and be able to report progress.
- ✔ Achievable: You will be able to take the necessary steps with the resources available and considering the threats and constraints you will face
- ✔ Relevant (or Realistic): Meeting this target will contribute to the objective and goals.
- ✔ Timed: All targets should be for completion within the next few years, remembering that the objectives in the global plan have been set for eight years.

All Targets should be SMART!

7. Agree a set of Actions

This is the most important step but one that can't be effectively completed until it is clear what we are trying to achieve (the objectives and national targets) and why (the goals and vision). Start by reviewing the global actions and identifying those which need to be implemented locally. In these cases agree the specific step that needs to be taken by who, when, and with what resources. There again may be global actions which are not priorities locally. Similarly, if you have identified additional national objectives and targets you should detail the actions you will take to meet each of them.

- Actions are (the only thing) within our sphere of control. We may need others to act but in such cases we should identify who will get them to act, how, and when. (This is one reason for having representatives from different sectors involved in drawing up the plan - see 'participation' below.)
- Actions may include, for example, research, publications, field conservation, education, media-work, outreach to others, advocacy, and so on. Where resources are not available, seeking to secure additional resources may be a necessary action in its own right.
- For each action, identify: who will take it, when, and the associated resources needed.

8. Finalise and circulate the Plan

If the plan is developed through a workshop as suggested below, working groups can be asked to draft elements of the plan as the workshop progresses. Key elements of the plan should be recorded on flipcharts as you go but you will also need a note-taker to ensure that all necessary points have been recorded. Following the workshop, a draft plan should be collated and circulated to participants with a deadline for additions and corrections. Please contact and stay in touch with the Shark Specialist Group throughout the process for advice and guidance.

The final plan should be circulated to participants and the relevant audience (identification of the appropriate audience could form an Action).

- Format: National plans should be drawn up to follow a similar format to the global conservation action plan. Particular attention should be paid to adding relevant objective targets (which should be SMART) and the actions needed under these and other targets detailing who and when, and the resources necessary.

9. Implement, Monitor and Evaluate National Workshops

As the plan will need to be implemented by a number of people and organisations, it is important that it is developed collaboratively. No one person will have the necessary knowledge, expertise or perspective to develop a plan on their own and developing it together also helps to ensure joint ownership.

Participants

Participants in a national workshop should be those most likely to be involved in implementing the national action plan, be that through habitat protection or population management, capacity development, research, policy development, fundraising, or other means. This will include representatives from national and local authorities, NGOs, researchers and others able to make a practical contribution to the development and implementation of the plan. At least one participant of the London workshop will need to be present as best placed to explain the global conservation plan.

If covering more than one country, the number of participants from each will be constrained by the need to keep discussions manageable, as well as by limited space and resources; this means that participants need to be chosen carefully to ensure all countries are covered and participants can represent a variety of perspectives.

It is difficult to ensure full participation by groups of more than about forty people. It may also be appropriate to allow a number of people, for example students, to attend the workshop as observers, to follow the discussion but not to participate in decision-making.

Possible Agenda

The workshop should follow the logic of the planning process outlined above.[2]

Topic & Time needed	Notes
Welcome 10 mins	Opening remarks from e.g. the host of the meeting
Introductions 30 mins	Participants should have a chance to introduce themselves briefly Run through the objectives of the workshop, for example: To summarise the status of sawfishes globally and nationally

Examples of agendas for national workshops on other species can be downloaded at http://intranet.iucn.org/webfiles/doc/SSC/SCS/Ch9_ntl_wkshp_agenda_cheetwd_BOT.pdf and http://intranet.iucn.org/webfiles/doc/SSC/SCS/Ch9_ntl_wkshp_agenda_AWCB_VIE.pdf

[3] **Rough timings only. See below under 'Suggestions' for further guidance in constructing an agenda**

– To review the global Sawfish Conservation Strategy and Agree a national Action Plan

Go through the agenda. Check if time is needed for any other items Agree 'ground rules' for the meeting, for example:

– respecting diversity of expertise and experience
– ensuring all get a chance to contribute
– 'Chatham house rules' (i.e. that although people can report on the meeting generally, individual opinions are off the record
– Starting on time and presenters to stick to allotted times
– Check participants' expectations of the meeting and outline yours.
– Go through logistical arrangements: arrangements for lunch, per-diems etc

Global Status Review - 20 mins

– Presentation from a participant in the London workshop
– Time for questions and discussion if possible but most input will come in subsequent sessions

National &/or Regional Status 1-2 hours

– Use global status report and Red List Assessments as basis
– Possible presentations from experts present on latest findings (NB: ensure all speakers are briefed on expectations before the meeting)
– If covering more than one country can break into groups as necessary and report back in plenary
– Discuss and identify the key points that should inform the planning (including threats and constraints and what has worked or not previously)

Introduction to Planning - 15 mins

– Introduce the planning framework and how it will be completed
– Use the points above as a guide
– Make sure people are comfortable with the terminology
– Stress that the task is to see how the global plan can be implemented nationally, not to re-write the global plan
– You can use a large wall space to display elements of your plan as it is developed. Place the existing Vision at the top, the Goals underneath, then Objectives. Under each Objective you can later use cards to show national targets and underneath each of them the lists of actions you will include

Vision 20 mins

– Present the global Vision and ask participants, in small groups or plenary, to discuss what this means for the local context
– Record key points from the discussion and make sure they are reflected later as you develop your plan

Goals 30 mins

– As for the Vision, present the global Goals and discuss what they mean for national work. Record key points
– (You might have two groups, each looking at a different goal)

Objectives & Targets 2 hours

– Present the global Objectives. Show how they contribute to achieving each Goal
– Talk through the Global targets where they exist
– Check that the objectives are relevant nationally (you can come back to this later)
– Working groups can look at each objective you will work on to:
    - **brainstorm the threats and constraints preventing the objective from being met locally (and, if helpful, the further causes of each)**
    - **discuss your capacity, strengths, and weaknesses to address these issues**
    - **identify any opportunities for making progress**
    - **formulate one to three national Targets for the objective**
    - **check the targets are SMART**
– Groups should report back in plenary. Together, check that each groups' proposed targets complement the global plan and each other; are SMART, deal with the major threats and constraints, and as necessary refine and then agree your national targets.

Actions 2-4 hours

– Go back into groups (probably the same groups that looked at Objectives and Targets)
    - **For each target, identify the steps needed to achieve it**
    - **Identify who will do what when and what resources are needed; this should be recorded on a chart**
    - **Identify if the needed resources are available or would need to be secured, and where from**
    - **Step back for a 'reality check': is what you are suggesting feasible with the capacity available or that you might reasonably secure**
    - **Look at how the proposed actions support or could be supported by actions taken elsewhere under the global Plan**
    - **If necessary, prioritise the actions, and associated targets, in light of capacity, need and opportunity**
– If there is time, groups can report back and discuss in plenary. Otherwise, each group should at least report on progress and identify any key conclusions they have reached or impact their work might have for the work of the other groups

Conclusions 30 mins

– Closing remarks
– Go back to the objectives you set for the workshop; were they achieved?
– You can ask each participant in turn for any last words reflecting on the meeting and the work ahead
– If there are outstanding issues, decide how and by who they will be taken forwards
– be clear on next steps: writing up a draft plan from the workshop and circulating that for input and the associated deadlines
– Don't forget to thank participants, presenters and others who helped with the workshop

Suggestions

- A one-and-a-half or two-day workshop is suggested. The timings however can be adjusted if only one day is available. If this is the case, most of the time should be spent on looking at national threats and constraints and then on actions after a brief introduction to the global plan.
- Don't forget to build in time for breaks! These are not included above so you can plan for workshops of different durations and with additional agenda items etc. A morning and afternoon break of thirty minutes each and a long lunch break allows people to recharge their batteries, gives flexibility if a session overruns, and time for people to have necessary side conversations or to work in small groups on outstanding tasks.
- An experienced workshop facilitator who has no other role in the meeting can help with the agenda, keep people to time and ensure the desired outcome is reached. This allows others to focus on the content. You should work with the facilitator before and during the meeting to make sure your objectives are met.
- Particularly with a large number of people, it will be more productive to break people into working groups to deal with particular aspects of the plan with plenary introductions, report-backs and conclusions. Split people according to their interest or specialism and ensure each group understands their task, how long they have, and the format in which you need them to deliver their work.
- It may be interesting and useful to include additional presentations in the agenda to share recent scientific findings or

experiences of particular conservation tools for example. This can be of particular relevance when looking both at the status of sawfish conservation nationally and when thinking about options for actions that can be included in the plan. Ideally however, not too much of the workshop should be in a lecture format; the overall approach should rather be one of collaborative working, with participants bringing their specialist knowledge and experience to the group work.

- If people have not worked with each other before, a social event the evening before the workshop gives people a chance to get to know each other before they have to work together.
- **Equipment needed:**

✔ Copies of the global conservation plan
✔ Copies of the agenda
✔ Flipcharts and pens, sticky tape etc.
✔ Small cards, or 'post-it notes' for brainstorming threats, or actions, etc which can then be collated on the wall, clustered, and reviewed
✔ If possible, a projector to allow laptop presentations and also to help groups of participants to work together on the text of Target statements and Actions for example
✔ It can also help participants to have copies of presentations that others will be making

Resources

This document which includes:

- A Status Review, summarizing the biology and conservation status of sawfish species (http://www.iucnssg.org/index.php/sawfish);
- The rationale for associated Red List Assessments (full versions will be available here http://www.iucnredlist.org/search)
- The global Sawfish Conservation Strategy outlining the global Vision, Goals, Objectives and Actions and on which national plans should build.

Also available:

- Strategic Planning for Species Conservation: A Handbook, published by the IUCN Species Survival Commission. This part of the report builds on Ch.9 of the Handbook which includes much more detailed information on the process of conservation planning. The information here and in this report should however give you enough for a national workshop.
- Strategic Planning for Species Conservation: An Overview, a summary of the document above.

People

- Please contact the IUCN Shark Specialist Group (iucnshark@gmail.com) and Mark Stanley-Price of the IUCN Species Conservation Planning Sub-Committee (mark.stanleyprice@zoo.ox.ac.uk) for help and support. You are also welcome to contact Martin Clark, an independent consultant, who facilitated the London workshop and drafted this section of the report martin_clark.1@virgin.net

Final words: Some planning tips

- **Does your plan tell a story?** The plan should suggest a narrative: Is it clear how you will use the resources you have available to take a set of actions which will achieve your targets? Do your actions complement the work elsewhere in order to stand a good chance of achieving the local and global objectives within eight years? Do our objectives deal adequately with the threats and constraints we face and if these objectives are met, will we together progress towards our global goals and our shared vision for the future of sawfish conservation?
- **The photograph test:** A quick - and fun - way of testing an objective or target is to ask if you could take a photograph of it being achieved; i.e. we can imagine a picture of habitats being restored, fishermen using new techniques, or a minister signing a decree for example; these are all good objectives. It is hard however to know what a picture of 'political will' would look like; which suggests some more work is needed to agree what achieving this means in reality.
- **Do a few things well:** There is a temptation to add lots of objectives, targets and related actions. Always have your capacity and resources in mind; (we always overestimate capacity in a workshop; what will your commitments look like when you're back at your desk with the other demands on you!). Thinking about the threats might help set priorities: which have the greatest impact? Which are most feasibly addressed? What needs to be done first? Also look for synergies; what can you do that supports - and is supported by - the actions from the global plan being taken by others elsewhere?
- **Changing a changing world:** All plans are a 'work in progress'. Keep your plans under review and change them as needed to exploit opportunities or address changing situations. See 'monitoring and evaluation' above.

http://data.iucn.org/dbtw-wpd/edocs/2008-047.pdf
http://cmsdata.iucn.org/downloads/scsoverview_1_12_2008_2.pdf

Appendix 2:
List of contributors

Sawfish Network Members and other colleagues that have provided data included in this report.
We ask forgiveness for any names that may have been inadvertently omitted or misspelled.

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Appendix 3:
Species-specific protections: A prioritised list of sawfish range states

At the IUCN Global Sawfish Conservation Strategy Workshop in 2012, experts from around the world collaborated to develop an initial prioritisation of needed actions with respect to national protective regulations. Needed actions were divided into three broad categories based on whether the main concern with range state rules was that: (1) they didn't exist, (2) they didn't cover all relevant species in a specific manner, or (3) were not being sufficiently enforced. After range states were assigned to one of these three categories, they were given a priority of I or II based on a combination of factors, including: (1) sense of urgency in terms of extinction risk, (2) relative degree of adequacy of existing regulations, (3) importance of range state to regional population, (4) level of government interest, (5) chances for success, and (6) IUCN Shark Specialist Group (SSG) regional capacity and contacts. Minor adjustments were made after the workshop based on new information. The SSG plans further

Necessary Improvements	Priority I	Priority II
Species-specific national legal protection	Surinam French Guiana Guiana Cuba Colombia Panama Mozambique Tanzania The Gambia * Guinea Bissau Sierra Leone Guinea* Madagascar Papua New Guinea Venezuela Bangladesh Myanmar Cambodia Pakistan Iran Ecuador	Dominican Republic Haiti Uruguay Peru Costa Rica El Salvador Belize Sri Lanka Nigeria Philippines Cote D'Ivoire Guatemala Gabon China Viet Nam Argentina Taiwan Democratic Republic Congo
More comprehensive and/ or species-specific national protection	Bahamas Indonesia Australia ** Honduras Nicaragua Malaysia Kenya	
Significantly improved enforcement of legal protections / more resources for enforcement	Brazil India UAE Qatar Bahrain Senegal* Mauritania*	Mexico USA

*It is not known for certain whether or not sawfish still exist in these waters.
** Some laws and/or species require more improvements than others.

Appendix 4:
Development of a database of sawfish records

We developed this dataset in order to produce preliminary species maps for subsequent editing by workshop participants. Sawfish records were combined from a number of sources including databases maintained by the International Sawfish Encounter Database (see Box on Page 77) and the National Marine Fisheries Service (J. Carlson unpublished data) and supplemented by museum archives, searches of ISI Web of Science and Fishbase. A unique code was assigned to each record to indicate the original source of the record. The records in the database have not been verified for accuracy, however we assumed the data can be used to depict our current level of knowledge of sawfishes at this time. We do caution however, that such anecdotal data are known to provide overinflated presence range estimates that need to be corroborated using expert opinion, surveys of Traditional Ecological Knowledge, museum visits, and dedicated ecological and fisheries surveys (McKelvey et al 2008). Notwithstanding this important caveat, we used these records to visualize the geographic distribution of sawfishes throughout the world. Furthermore, duplicate records were not removed because one single record of a species was enough to score its presence, likewise for multiple individuals in a catch.

Once data from these different sources were combined (N = 8530) it was necessary to standardize nomenclature, geographic locations, and calendar dates. Where this could not be done we deleted the record. These steps are detailed below. Where necessary (all original information for the record has also been retained):

1. The species name was 'translated' to both the seven or five species taxonomic descriptions in recent usage.
2. The location information was updated to the current accepted country name and we allocated a country for those records that only had a site name.
3. The date for each record varied tremendously by source. Therefore the date format for all records was verified and aligned.
4. Each date was then converted into a year. If the year of the record consisted of a year range then the midpoint was used. If it was 'pre-X' then the year X was used, for example: early 1980s = 1982, late 1980s = 1988, and 1920s = 1925 (midpoint).
5. Some records had no year (or year could not be confirmed), no country or no country and no year. These records were not included in the database.
6. Duplicate records and records with multiple sawfishes were retained as such - because we were interested specifically in presence or absence, not abundance at this stage.

Record name	Seven Species Taxonomic Description	Five Species Taxonomic Description
A_cuspidata	*A_cuspidata*	*A cuspidata*
A_cuspidatus	*A_cuspidata*	*A_cuspidata*
P_antiquorum	*P_microdon*	*P_pristis*
P_clavata	*P_clavata*	*P_clavata*
P_cuspidatus	*A_cuspidata*	*A_cuspidata*
P_microdon	*P_microdon*	*P_pristis*
P_pectinata	*P_pectinata*	*P_pectinata*
P_perotteti	*P_perotteti*	*P_pristis*
P_pristis	*P_pristis*	*P_pristis*
P_zephyreus	*P_zephyreus*	*P_pristis*
P_zijsron	*P_zijsron*	*P_zijsron*
Pristidae, Pristis, Pristis sp., Pristis spp.	*Pristis sp.*	*Pristis sp*

Sawfish distribution maps

1. The database was converted into a spreadsheet structured by year, country, presence (1), or absence (0). Subsequent years following a last confirmed sighting were marked as absent. Years previous to the last confirmed sighting were considered present extending back to the first date in the database.
2. We created maps of the historic and current distribution range. The historic range map for each of the five sawfish species was presented to participants at the Sawfish Workshop.
3. Experts at the workshop provided additional records, information and comments, and countries were added or deleted based on the knowledge of this geographically-diverse group of experts. Expert opinion was considered more accurate than the sightings databases as sightings can be misnomers, incorrectly identified, or contain other errors. Documentary references in support of species presence or absence were supplied by the experts.
4. The process was repeated for the current (2012) distribution of the five sawfish species. In this instance experts were able to give more fine-scale detail by indicating that a sawfish was present in particular sections of a country's Exclusive Economic Zone.
5. The distribution maps, as shown in this report, are the result of expert opinion, and the above-mentioned database.

Appendix 5:
Structure of Sawfish Status Review online survey

Sawfishes are arguably the most imperilled fishes in the world and the whole family has been classified as Critically Endangered by the IUCN Shark Specialist Group. We welcome and greatly appreciate any information that you can provide on the conservation, ecology, protection or management of sawfishes to inform our status review.

Please be as descriptive as possible - dates, locations, supporting materials and detailed descriptions are all welcome!

Name (First, Last)

Email

Phone Number (please include country code)

Would you like to be added to the Sawfish Network mailing list? *

◯ Yes ◯ No

Interest in Your Sawfishes

What is your area or field of sawfish knowledge - conservation, fisheries, protection or ecology? Do you work on a local, regional or global scale? Which countries do you work in? We are also looking to find representatives from countries where sawfishes are present. Please provide details.

Suggestions of Sawfish Contacts

We would like the Sawfish Network to be as broad as possible. Please list names and contact details of anyone else that could contribute.

Sawfish Status Review

Here we provide a number of boxes in which you can give details of your Sawfish knowledge. Any detail that you provide, however large or small, will be useful to us especially if you can provide a date! Information on where sawfishes were not found is also very important!

Recent Distribution of Sawfishes

Do you know of any recent sawfish sightings? Are there surveys that might have caught sawfishes if they were still present? Have anglers reported any sawfish catches? Have there been any newspaper articles on sawfishes being caught? Do you have any information or idea of the population size in your region?

Historical Distribution of Sawfishes

Do you have any knowledge of historical sightings of sawfishes? Is there indigenous or traditional knowledge that indicates that sawfishes used to be present?

Past and Present Threats to Sawfishes

What activities are sawfishes threatened by in your area of interest?
Has the threat to sawfishes changed over time?

Fisheries Impacts on Sawfishes

Are sawfishes caught by fisheries in your region? Are they targeted or bycatch? Is this bycatch used? Do you have any knowledge on numbers caught per year?

Value of Sawfishes

Do you have any information on the use and value of sawfishes? Are they used for cultural, social, economic or ecological purposes?

Do you have any other comments or information on the status of sawfishes?

Email relevant sawfish documents

Please provide any relevant sawfish documents - photos, pdfs, word and excel documents.

Appendix 6:

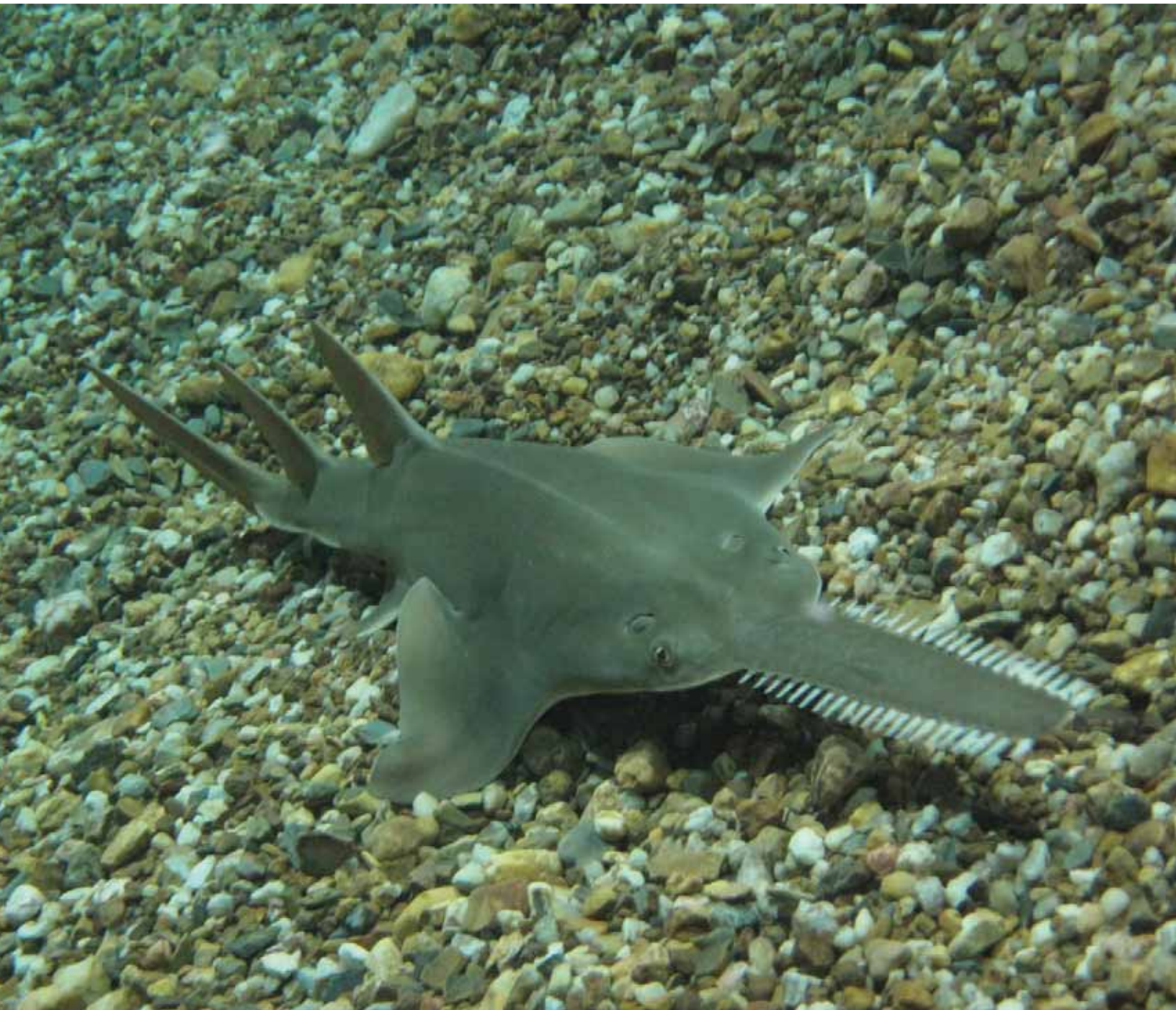
International trade of sawfishes and sawfish parts as reported to CITES between 2007 and 2011. It is not often clear what the unit of export or import is. Information is retained as reported by CITES. Pre-convention specimens are those collected prior to the 2007 CITES listing of sawfishes. Records that describe the same trade event (an import and an export) have been noted as so.

Year	Species name	Exporter	Importer	Country of Origin	Export quantity	Export Unit	Specimen description	Export Purpose	Source of specimen	Import quantity	Import Unit	Description of specimen	Import Purpose	Source of the specimen	Export/Import Event
2007	*Pristis microdon*	Australia	France		2		live	Educational	Taken from the wild	2		live	Educational	Taken from the wild	1
2007	*Pristis microdon*	Australia	USA							4		live	Zoos	Taken from the wild	2
2007	*Pristis microdon*	Australia	USA		4		live	Educational	Taken from the wild						2
2008	*Pristis pectinata*	Switzerland	France	Unknown	1		bodies	Circuses or travelling exhibitions	Pre-convention specimens	1		bodies	Circuses and travelling exhibitions	Pre-convention specimens	3
2008	*Pristis pectinata*	France	Switzerland	Unknown	1		bodies	Circuses or travelling exhibitions	Pre-convention specimens	1		bodies	Circuses or travelling exhibitions	Pre-convention specimens	3
2008	*Pristis pectinata*	Portugal	Brazil	Unknown	1		teeth	Educational	Pre-convention specimens						4
2008	*Pristis zijsron*	Australia	USA	Papua New Guinea						1		bodies	Personal	Taken from the wild	5
2008	*Pristis zijsron*	Australia	USA	Papua New Guinea	1		bones	Personal	Pre-convention specimens						5
2008	*Pristis microdon*	Australia	USA							2		live	Zoos	Taken from the wild	6
2008	*Pristis microdon*	Australia	USA		2		live	Circuses or travelling exhibitions	Taken from the wild						6
2008	*Pristis microdon*	United Kingdom	USA	Unknown						1		bones	Personal	Confiscated or seized specimens	7
2009	*Pristidae* spp.	Germany	Russian Federation	Unknown	1		skin pieces	Circuses or travelling exhibitions	Pre-convention specimens						8
2009	*Pristidae* spp.	Germany	USA	Unknown	1		carvings	Circuses or travelling exhibitions	Pre-convention specimens	1		carvings	Circuses or travelling exhibitions	Pre-convention specimens	9
2009	*Pristidae* spp.	Russian Federation	Germany	Unknown	1		derivatives	Circuses or travelling exhibitions	Pre-convention specimens						10
2009	*Pristidae* spp.	Unknown	Germany							2		trophies		Confiscated or seized specimens	11
2009	*Pristis* spp.	Netherlands	Switzerland	Unknown	1		teeth	Commercial trade	Pre-convention specimens						12
2009	*Pristis clavata*	Australia	USA							100	Mg	ears	Scientific	Taken from the wild	13
2009	*Pristis zijsron*	Australia	France		1		bones	Commercial trade	Pre-convention specimens						14

2009	*Pristis zijsron*	Australia	USA		1		bones	Circuses or travelling exhibitions	Pre-convention specimens	1		bones	Circuses or travelling exhibitions	Pre-convention specimens	15
2009	*Pristis zijsron*	Australia	USA							100	mg	ears	Scientific	Taken from the wild	16
2009	*Pristis microdon*	Australia	USA							100	mg	ears	Scientific	Taken from the wild	17
2009	*Pristis microdon*	France	USA	Madagascar	4		tusks	Commercial trade	Pre-convention specimens						18
2010	*Pristidae* spp.	Russian Federation	Germany	Unknown						1		skin pieces	Circuses or travelling exhibitions	Pre-convention specimens	19
2010	*Pristidae* spp.	USA	Germany	Unknown						1		carvings	Circuses or travelling exhibitions	Pre-convention specimens	20
2010	*Pristidae* spp.	USA	Germany	Unknown	1		leather products (l)	Circuses or travelling exhibitions	Pre-convention specimens						20
2010	*Pristis* spp.	France	Australia	Venezuela	1		bone pieces	Personal	Pre-convention specimens						21
2010	*Pristis* spp.	France	Australia	Venezuela	2		bones	Personal	Pre-convention specimens						22
2010	*Pristis* spp.	France	New Zealand	Unknown	1		bones	Personal	Pre-convention specimens						23
2010	*Pristis* spp.	France	Russian Federation	Unknown	1		carvings	Circuses or travelling exhibitions	Pre-convention specimens						24
2010	*Pristis* spp.	Netherlands	Switzerland	Unknown	1		teeth	Commercial trade	Pre-convention specimens						25
2010	*Pristis* spp.	Russian Federation	France							1		carvings	Circuses or travelling exhibitions	Pre-convention specimens	26
2010	*Pristis pectinata*	South Africa	Australia		1		bones	Educational	Taken from the wild						27
2010	*Pristis zijsron*	USA	Australia	Australia	1		bones	Circuses or travelling exhibitions	Pre-convention specimens						28
2011	*Pristidae* spp.	Norway	Somalia		1		bodies		Confiscated or seized						29
2011	*Pristis* spp.	China	Germany	Unknown						1		teeth	Commercial trade	Pre-convention specimens	30
2011	*Pristis* spp.	USA	Germany	Australia						1		teeth	Personal	Pre-convention specimens	31
2011	*Pristis pectinata*	USA	Kuwait	Australia	1		carvings	Commercial trade	Confiscated or seized						32
2011	*Pristis pectinata*	USA	Russia	Unknown	1		derivatives	Personal	Confiscated or seized						33
2011	*Pristis pristis*	USA	Germany	Australia	1		bodies	Personal	Taken from the wild						34
2011	*Pristis microdon*	Germany	Australia		1		live	Zoos	Taken from the wild						35

Appendix 7:
Aquarium reports of sawfishes in their collection by species

				Smalltooth Sawfish (*P. pectinata*)		Largetooth Sawfish (*P. pristis*)		Green Sawfish (*P. zijsron*)		Dwarf Sawfish (*P. clavata*)		
Aquarium Name	**City**	**State/ Province/ Territory**	**Country**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Total**
Reef HQ Aquarium	Townsville	Queensland	Australia				1					1
Melbourne Aquarium	Melbourne	Victoria	Australia			1	2					3
Territory Wildlife Park	Palmerston	Northern Territory	Australia			1	1					2
Underwaterworld Sunshine Coast	Mooloolaba	Queensland	Australia				1					1
Sydney Aquarium	Sydney	Victoria	Australia			3	1					4
Atlantis Resort at Paradise Island (Kerzner)	Nassau	New Providence	Bahamas	3	5							8
Qingdao Aquarium	Qingdoa	Shangdong	China			1	2					3
Ocean Park	Hong Kong		China			1	1					2
Aquarium La Rochelle	La Rochelle		France			1						1
Océanopolis	Brest		France				1					1
Sea Life Oberhausen	Oberhausen		Germany			1						1
Acquario di Genova	Genoa		Italy					1	1			2
Epson Shinagawa Aqua Stadium	Tokyo		Japan						1	1	1	3
COEX AQUARIUM	Seoul		South Korea				1					1
L'Oceanogràfic (Grupo Parques Reunidos)	Valencia		Spain					1	1			2
Universeum Ab	Gothenburg		Sweden				1					1
The Deep	Hull		UK					1	1			1
Adventure Aquarium	Camden	New Jersey	USA						1			1
Dallas World Aquarium	Dallas	Texas	USA			2	1					3
Georgia Aquarium	Atlanta	Georgia	USA			4	1	1				6
John G. Shedd Aquarium	Chicago	Illinois	USA						1			1
Landry's Downtown Aquarium	Denver	Colorado	USA			1	1					3
Landry's Downtown Aquarium	Houston	Texas	USA			1	1					2
Long Beach Aquarium of the Pacific	Long Beach	California	USA				1					1
National Aquarium in Baltimore	Baltimore	Maryland	USA			2						2
Ripley's Aquarium in Myrtle Beach	Myrtle Beach	South Carolina	USA	1	1	1		1				4
Ripley's Aquarium of the Smokies	Gatlinburg	Tennessee	USA	1		1	1		1			4
Shark Reef at Mandalay Bay	Las Vegas	Nevada	USA					2	1			3
Underwater Adventures @ Mall of America	Bloomington	Minnesota	USA					1	1			2
Sea World of Florida	Orlando	Florida	USA	1	1							2
Totals				**6**	**7**	**20**	**17**	**10**	**10**	**1**	**1**	**72**



Appendix 8:

International or country-based protection legislation for sawfishes. Only the legislation pertaining specifically to sawfishes have been retained; general shark reguations have not been included here. The details included here are largely unedited notes provided to us by the Sawfish Network.

Australia	EPBC Act Listed species, currently including *Pristis clavata*, *Pristis microdon* and *Pristis zijsron*	Environmental Protection and Biodiversity Conservation Act (1999) (Commonwealth)	Under the Environmental Protection and Biodiversity Conservation Act (1999) (Commonwealth) (EPBC Act), a register of listed threatened species is maintained. In 2012, three species of *Pristis* (*P. zijsron*, *P. microdon* and *P. clavata*) were on the list as Vulnerable. It is illegal to take an action (to kill, injure, take, trade, keep, move or to undertake projects, developments, activities, fisheries or variations to one of these things) that has, is likely to or will have a significant impact on listed species, unless there is an approval, accreditation or exemption in place. If an action has, will or is likely to have a significant impact on a listed species of sawfish, the action must be referred to the Commonwealth Environment Minister to decide if the action will be assessed or approved. All Commonwealth, State and Territory fisheries that interact with EPBC listed species are legally required to report all interactions in fishery log books. All Commonwealth, State and Territory fisheries that export are required to undergo a stategic assessment and obtain accreditation as a Wildlife Trade Operation under the EPBC Act and may have conditions imposed upon them to improve sustainability as part of the accreditation process.
Australia	EPBC Act Listed species including *Pristis clavata*, *Pristis microdon* and *Pristis zijsron*	Fisheries Managment Act (Commonwealth) 1991	Under the Fisheries Management Act (1991) (Commonwealth) (FMA Commonwealth) all Commonwealth fisheries have accrediation as Wildlife Trade Operations.
Australia (Northern Territory)	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*.	Territory Parks and Wildlife Conservation Act (2000) (NT)	Under the Territory Parks and Wildlife Conservation Act (2000) (NT), *P. clavata*, *P. microdon* and *P. zijsron* are listed as Vulnerable. It is illegal to take or interfere with a species that is listed as Vulnerable unless the person has authorisation. *Anoxypristis cuspidata* is not protected under this legislation.
Australia (Western Australia)	*Pristis zijsron*	Wildlife Conservation Act (1950) (WA)	Under the Wildlife Conservation Act (1950) (WA), *P. zijsron* is listed in Schedule 1 - Fauna that is rare or is likely to become extinct and are protected under the Act. It is an offence to take fauna while protected under the Act.
Australia	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*, *Anoxypristis cuspidata*	Fisheries Act (1994) (Qld) and the Fisheries Regulations 2008	Under the Fisheries Act (1994) (Qld), *Pristis clavata*, *Pristis microdon*, *Pristis zijsron* and *Anoxypristis cuspidata* are all listed as no take. The taking and possessing of no take species is prohibited. If accidentally caught, these species must be immediately returned to the water. All Queensland fisheries that export have accredited plans of management for the management of interactions with MNES, under the EPBC Act in place. In 2009, spatial closures of the Bizant, Normanby and Kennedy Rivers, which flow into Princess Charlotte bay, were put in place to improve the sustainability of sawfish and northern river shark populations.
Australia (Northern Territory)	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*	NT Fisheries Act (1988) & NT Fisheries Regulations	The NT Fisheries Act (1988) adheres to classifications set out in the Territory Parks and Wildlife Conservation Act (2000) (NT) and certain fish are not to be taken including sawfish of the genus *Pristis*. A person shall not take, whether as by-catch or otherwise, protected species under the Act. In recreational fisheries all sawfish are protected and must not be taken. In commercial fisheries, *P. zijsron*, *P. microdon* and *P. clavata* are protected. *Anoxypristis cuspidata* is not protected under this legislation.
Australia (Western Australia)	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*, *Anoxypristis cuspidata*	Fish Resources Management Act (1994) (WA)	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron* and *Anoxypristis cuspidata* are listed as 'Totally Protected' which means that a person must not take, have in the person's possession, sell or purchase, consign, or bring into the State or into WA waters, any totally protected fish.
Australia	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*, *Anoxypristis cuspidata*	East Coast Inshore Fin Fishery	Under the EPBC Act, conditions were placed on this fishery as part of the process of accreditation as a Wildlife Trade Operation for export purposes. Monitoring arrangements are in place to assess changes in the number of interactions with sawfish. Reporting and monitoring of sawfish interactions in areas where fisheries overlap with important areas of habitat are in place.
Australia	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*, *Anoxypristis cuspidata*	East Coast Otter Trawl Fishery	Under the EPBC Act, conditions were placed on this fishery as part of the process of accreditation as a Wildlife Trade Operation for export purposes, however none of these appear to pertain directly to sawfish.
Australia	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*, *Anoxypristis cuspidata*	Gulf of Carpentaria Developmental Fin Fish Trawl Fishery	Under the EPBC Act, conditions were placed on this fishery as part of the process of accreditation as a Wildlife Trade Operation for export purposes, however none of these appear to pertain directly to sawfish. There are a limited number of interactions with sawfish in this fishery.
Australia	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*, *Anoxypristis cuspidata*	Gulf of Carpentaria Inshore Fin Fishery	Under the EPBC Act, conditions were placed on this fishery as part of the process of accreditation as a Wildlife Trade Operation for export purposes. The two main conditions include that the retention of sawfish was prohibited in 2009 by listing all sawfish species as no-take; and sawfish were required to be reported in log books since 2006. Sawfish other than narrow sawfish are considered as being at a high risk in this fishery.
Australia (Western Australia)	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*, *Anoxypristis cuspidata*	Western Australian Pilbarra Fish Trawl Interim Managed Fishery	Under the EPBC Act, conditions were placed on this fishery as part of the process of accreditation as a Wildlife Trade Operation for export purposes. Since May 2008, no elasmobranches can be retained in this fishery. Due to the high level of take of cetaceans in this fishery, as well as other protected species, ongoing risk assessment, monitoring, surveillance and gear modification to reduce interactions is occurring. *Pristis zijsron* and *Anoxypristis cuspidata* are at high risk in this fishery.
Australia (Northern Territory)	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*, *Anoxypristis cuspidata*	Northern Territory Offshore Net and Line Fishery	Under the EPBC Act, conditions were placed on this fishery as part of the process of accreditation as a Wildlife Trade Operation for export purposes. This fishery has a no-take policy for the three *Pristis* spp. Log book reporting of all sawfish interactions is required for *Pristis* spp. and is implied as being required for *Anoxypristis cuspidata*. The voluntary Offshore Net and Line Fishery Code of Practice lists all sawfish, including *Anoxypristis cuspidata* as no-take species.
Australia (Northern Territory)	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*, *Anoxypristis cuspidata*	Northern Territory Offshore Net and Line Fishery	Offshore Net and Line Fishery Code of Practice. Prepared by the Northern Territory Seafood Council, Fisheries Research and Development Corporation and the Northern Territory Government.
Australia (Northern Territory)	*Pristis clavata*, *Pristis microdon*, *Pristis zijsron*, *Anoxypristis cuspidata*	Barrumundi Fishery	This fishery has a no-take policy for the three *Pristis* species. Log book reporting of all sawfish interactions is required for *Pristis* species and is implied as being required for *Anoxypristis cuspidata*. The voluntary Barrumundi Fishery Code of Practice lists all sawfish, including *Anoxypristis cuspidata* as no-take species.
Bahrain	*Pristis zijsron*	Order (1) under the Public Commission for the Protection of Marine Resources, Environment and Wildlife	Prohibits all and any targeted fishing for *Pristis zijsron* in Bahraini waters. Fishermen are required to: - Return any bycatch specimens, - Report landings/captures referencing date and location.
Bangladesh	*P. microdon*	Listed as a protected animal in Schedule 1 by Bangladesh Wildlife (conservation and security).	
Brazil	*Pristis perotteti*, *Pristis pectinata*	Statute: Instrução Normativa no. 5, de 21 de Maio de 2004, Ministério do Meio Ambiente [Ministry of the Environment]	Protection Level: Anexo I [highest lvl]
Guinea	All species	Unknown	In all waters of EEZ

India	*A. cuspidata*, *P. microdon*, *P. zijsron*	The Wildlife (Protection) Act, 1972 (53 of 1972), Dec. 2001, by notification: S.O. 1197(E)	Sawfishes are categorized as schedule I of animal of Wildlife protection act 1972 of India. - highest protected status, Protection Level: Schedule I [highest lvl], Agency: Ministry of Environment & Forests
Indonesia	*Pristis microdon*	SK Mentan No. 716/KPTS/ Um/10/1980	Regulation from the Ministry of Farming to prohibit the catch of *Pristis microdon*.
Indonesia	"Pritis sp. Pari Sentani, Hiu Sentani (semua jenis dari genus Pritis)" [Sentani Ray, Sentani Shark, all species of the genus *Pristis*]	Peraturan Pemerintah Republik Indonesia Nomor 7 Tahun 1999 Tentang Pengawetan Jenis Tumbuhan dan Satwa [Government Regulation of the Republic of Indonesia, Number 7 Year 1999, Concerning the Conservation of Plant and Animal Species]	
Malaysia	All species	Fisheries (Control of Endangered Species of Fish) regulation 1999	All *Pristidae* is protected as endangered species under Fisheries (Control of Endangered Species of Fish) regulation 1999. "No person shall fish or, disturb, harass, catch, kill, take, posses, sell, buy, export or transport except with the written permission from the Director General of Fisheries Malaysia. Any person who contravenes the regulations is committing a offence and can be fined not exceeding RM 20,000 (US6,060) or a term of imprisonment not exceeding two years or both
Mexico	*Pristis* spp.	NOM-029-CFSP-2006	The NOM-029-CFSP-2006 prohibits the capture.
Nicaragua	*Pristis pectinata* (in Lake Nicaragua only), *Pristis perotteti* (in Lake Nicaragua only)	RESOLUCIÓN MINISTERIAL N° 54 - 02 (2002)	Agency: MINISTERIO DEL AMBIENTE Y LOS RECURSOS NATURALES MARENA, Reenacts : RESOLUCIÓN MINISTERIAL N° 007 - 99 (1999)
Qatar	Green sawfish	No information available	In March the Qatar government issued a decree giving total protection to the *Pristis zijsron* in Qatari waters. This legislation was proposed by SCS following the two expeditions to Qatar in 2009.
Senegal	All species	National list of protected species.	Fishing and sale of sawfishes is prohibited in all waters of EEZ.
South Africa	Species present in South Africa	Marine Living Resources Act	Since 1974 spearing of sawfish was prohibited in KwaZulu-Natal and subsequently in 1997 all exploitation, handling or possession of sawfish was prohibited under the Marine Living Resources Act
Spain	*Pristis pristis*, *P. pectinata*	List of Wild Species under Special Protection Regime	Cannot be killed, but no management plans have to be put in place
United Arab Emirates	Sawfish (not species-specific)	Ministry of Environment and Water decrees 542 (2008) and 216 (2011)	Ministerial decrees with respect to shark fishing in UAE waters specify that fishing for sawfish is banned year-round.
USA	*Pristis pectinata*	Lacey Act of 1981 (16 U.S.C. 3371-3378)	The Lacey Act makes it a federal crime to import, export or engage in interstate transport of any fish or wildlife taken in violation of state law - may deter interstate transport of illegally posessed *Pristis pectinata*.
USA	*Pristis perotteti*	Lacey Act of 1981 (16 U.S.C. 3371-3378)	The Lacey Act makes it a federal crime to import, export or engage in interstate transport of any fish or wildlife taken in violation of state law - may deter interstate transport of illegally posessed *Pristis perotteti*.
USA	*Pristis pectinata*	Endangered Species Act of 1973 (16 U.S.C. 1531-1543)	The ESA provides for the conservation of plant and animal species federally listed as threatened or endangered - illegal to take (harrass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct), import or export (from the United States), sell or offer for sale (in interstate or foreign commerce) *Pristis pectinata*. The US designated critical habitat and published a recovery plan in 2009. Listed as Endangered in 2003.
USA	*Pristis perotteti*	Endangered Species Act of 1973 (16 U.S.C. 1531-1543)	The ESA provides for the conservation of plant and animal species federally listed as threatened or endangered - illegal to take (harrass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct), import or export (from the United States), sell or offer for sale (in interstate or foreign commerce) *Pristis perotteti*. Listed as Endangered in 2011.
USA (Florida)	*Pristis pectinata*	Section 370.027 (2)(f) of Florida statutes	Protected species in Florida waters (within 3 nautical miles from shore on East coast and 9 nautical miles from Gulf coast). No person is allowed to harvest, possess, land, purchase, sell or exchange *Pristis pectinata* or any part of this species. Also denies requests for exempted permits to collect this species from Florida waters for public display.
USA (Florida)	*Pristis perotteti*	Section 370.027 (2)(f) of Florida statutes	Protected species in Florida waters (within 3 nautical miles from shore on East coast and 9 nautical miles from Gulf coast). No person is allowed to harvest, possess, land, purchase, sell or exchange *Pristis perotteti* or any part of this species. Also denies requests for exempted permits to collect this species from Florida waters for public display.
USA (Louisiana)	*Pristis pectinata*	Title 56 of Louisiana Revised Statues	*Pristis pectinata* is protected as prohibited species in Louisiana waters (within 3 nm).
USA (Louisiana)	*Pristis perotteti*	Title 56 of Louisiana Revised Statues	*Pristis perotteti* is protected as prohibited species in Louisiana waters (within 3 nm).
USA (Alabama)	*Pristis pectinata*	Regulation 220-3-.30 (2004-MR-3)	Prohibits the commercial and recreational take of *Pristis pectinata*.
USA (Alabama)	*Pristis perotteti*	Regulation 220-3-.30 (2004-MR-3)	Prohibits the commercial and recreational take of *Pristis perotteti*.
USA (Texas)	*Pristis pectinata*	Parks and Wildlife Code Chapter 68	Texas Parks and Wildlife Division has listed *Pristis pectinata* as endangered. It is illegal to "possess, take, or transport" listed species without required permits.
USA (Texas)	*Pristis perotteti*	Parks and Wildlife Code Chapter 68	Texas Parks and Wildlife Division has listed *Pristis* perrotteti as endangered. It is illegal to "possess, take, or transport" listed species without required permits.

Appendix 9:
Personal Communications

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Sawfishes once roamed the coastal waters of more than 90 tropical nations, searching for food and capturing prey with their large toothed saws. Because of their gigantic size and fantastical appearance they were important cultural symbols in many coastal communities.

The rapid growth of human populations combined with rapid advances in fishing technology, particularly of trawls and nylon nets, has driven steep declines worldwide over the past century. This problem was compounded by the international trade in high-value sawfish products precipitated by rising affluence. Sawfishes have been eliminated, almost unnoticed, through their range, to the point where known healthy populations exist in only two places in the world – northern Australia and Florida, U.S.

We have taken the first steps toward securing a safe future for these iconic fishes. This report lays out a roadmap for sawfish conservation based on a comprehensive assessment of their status. We can save sawfishes only with your help. We provide actions for aquariums, conservationists, fisheries scientists, managers, donors, policymakers, and science communicators.

"Nowhere in the world can you get a better or more up to date summary of the status of sawfishes; this document is superb!"

Dr. Claudio Campagna

Co-Chair, IUCN SSC Marine Conservation Sub-Committee

Conservation Zoologist, Wildlife Conservation Society

"Natural biology and conservation come together nicely in this comprehensive report, which provides guidance on protection measures and a look at the history and biology of an incredibly amazing group of sharks. Simply amazing".

Dr. Nicolas Pilcher
Co-Chair IUCN SSC Marine Turtle Specialist Group
Technical Advisor, CMS-UNEP
Dugong MoU

"Timely, practical and comprehensive, an excellent one-stop publication on all there is to know about the fascinating sawfishes and how to make sure we don't lose them".

Dr. Yvonne Sadovy de Mitcheson

Co-Chair of the IUCN SSC Grouper and Wrasse Specialist Group

Co-Chair of the IUCN SSC Marine Conservation Sub-Committee

Swire Institute of Marine Science, University of Hong Kong

"Clearly this group of incredible animals need our help! The IUCN Shark Specialist Group and the Sawfish Network have assembled a very impressive resource that will guide the way to a better future for sawfishes".

Dr. Bryan Wallace

Regional Co–Vice Chair, Eastern Pacific Region and Red List Focal Point, IUCN SSC Marine Turtle Specialist Group

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Adjunct Assistant Professor, Division of Marine Science and Conservation, Duke University

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صندوق محمد بن زايد للمحافظة على الكائنات الحية

The Mohamed bin Zayed SPECIES CONSERVATION FUND