

Regional Plan of Action for the Conservation and Management of Sharks for the Bay of Bengal

DRAFT



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Abbreviations

BOBLME	Bay of Bengal Large Marine Ecosystem Project
BOBP-IGO	Bay of Bengal Programme Intergovernmental Organisation
BRD	Bycatch Reduction Device
CCAMLR	Convention on the Conservation of Antarctic Living Resources
CCRF	FAO Code of Conduct for Responsible Fisheries
CCSBT	Commission the Conservation of Southern Bluefin Tuna
CITES	Convention on the International Trade in Endangered Species of Wild Fauna and Flora
CMFRI	Central Marine Fisheries Research Institute of India
CMS	Convention on Migratory Species
COFI	UN Committee on Fisheries
CTI	Coral Triangle Initiative
DFAR	Department of Fisheries and Aquatic Resources (Sri Lanka)
DoF	Division of Fisheries (Myanmar)
EEZ	Exclusive Economic Zone
FADs	Fish Attraction Devices
FAO	Food and Agriculture Organization of the United Nations
GPS	Global Positioning Satellite
IOTC	Indian Ocean Tuna Commission
IPOA	International Plan of Action
ITLOS	International Tribunal for the Law of the Sea
IUCN	International Union for the Conservation of Nature
IUU	Illegal, unreported and unregulated fishing
KPIs	Key Performance Indicators
MCS	Monitoring, Control and Surveillance
MFARD	Ministry of Fisheries and Aquatic Resources Development (Sri Lanka)
MFMD	Maldives Fisheries Management Department
MFRDMD	Marine Fishery Resources Development and Management Department
NARA	National Aquatic Resources Research and Development Agency (Sri Lanka)
NGO	Non-Governmental Organization
NPOA	National Plan of Action
RFMO	Regional Fisheries Management Organization
RPOA	Regional Plan of Action
SEAFDEC	Southeast Asian Fisheries Development Center
SLNPOA	IUU Sri Lanka National Plan of Action to Prevent, Deter and Eliminate IUU Fishing
SSME	Sulu-Sulawesi Marine Eco-region,
UNCLOS	United Nations Convention on the Law of the Sea
UNFSA	United Nations Fish Stocks Agreement
VMS	Vessel Monitoring System

Background

The Bay of Bengal lies between India and South-east Asia. The countries surrounding the Bay - Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka and Thailand - work together through the Bay of Bengal Large Marine Ecosystem (BOBLME) Project to improve the management of the Bay's environment and fisheries. One initiative involves the support of collaborative fisheries management approaches for key trans-boundary species. This is done by developing regional management plans and harmonizing and standardizing data collection. One of the key groups of species involved in this work are sharks (for the purposes of this document, the term "shark" is taken to include all species of sharks, skates, rays and chimaeras (Class *Chondrichthyes*)). Five of the world's top 14 shark fishing nations are BOBLME members (Indonesia, India, Malaysia, Thailand and Sri Lanka), with Indonesia and India being the biggest producers in the world.

It is recognised that catches and sizes of sharks are in decline throughout the world, leading to international concern over their sustainability. This is in the wake of increased commercial exploitation in recent decades (fuelled to a large extent by increased markets for shark fins), shark populations' vulnerability to overfishing and slow recovery rates, and limited scientific information. It is accepted that, unless strong management measures are taken soon, these key apex predators will become significantly overexploited - with dire consequences not only for shark populations and the societies that exploit them, but also for marine ecosystems as a whole.

In 1999, FAO adopted the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks) in accordance with its Code of Conduct for Responsible Fisheries (CCRF) (FAO, 1999). The objective of the IPOA is to improve the conservation and management of sharks and their long-term sustainable use in directed and non-directed fisheries. The IPOA applies to all countries in whose waters sharks are caught and, through the Committee on Fisheries (COFI) of the FAO, all member countries agreed to better manage shark populations in their exclusive economic zones (EEZs). Under this voluntary framework, countries are encouraged to assess their current shark populations, identify threats and provide management measures to sustainably manage them, paying special attention to vulnerable and threatened species. They are also encouraged to improve catch reporting, increase catch utilization, and enhance frameworks for broad stakeholder consultation.

Between 2012 and the present, BOBLME and the 8 member countries undertook a series of initiatives to manage sharks and to assist in developing National Plans of Action for Sharks (NPOAs). These included the following:

- Malaysia prepared a NPOA for sharks in 2006. In 2013 SEAFDEC, BOBLME and national and state Fisheries Departments in Malaysia delivered awareness-raising work, pilot training on improving catch data (which included identification training

and guides) and consultative workshops to review the 2006 NPoA. The latter led to the production of the revised NPoA (summarized in Appendix 1).

- Maldives used a BOBLME Project collaboration to (i) write its shark NPoA; (ii) conduct a study on social and economic impacts of its total shark ban; and (iii) institute a public SharkWatch program in 2014.
- Sri Lanka worked with BOBLME to develop a well-grounded consultative process which resulted in the completion of its NPoA in 2014. Implementation of this NPOA proceeded in 2015 with (i) the enactment of Shark Fisheries Management Regulations, including the protection of five scheduled species; (ii) improvements to logbooks and catch/by-catch data; and (iii) advice on alternatives to shark fishing being actively sought by fishers.
- Bangladesh received BOBLME assistance in 2013-2014 to survey shark fisheries and prepare its NPoA. The main species caught along the coast have now been catalogued, and several identification and awareness sessions have been held. Furthermore, information materials have been produced and disseminated.
- Indonesia had drafted a shark NPoA in 2007 which was published in 2010. A BOBLME Project in 2014 was used to design and implement a pilot program for improved shark catch data-gathering, a conservation awareness campaign, training to scientists on shark taxonomy; and stakeholder consultations to advise on the development and implementation of a revised shark NPoA.
- Myanmar had designated two shark reserves in the Myeik Archipelago in 2004, and a national ban was declared in 2008. A project supported assessment of shark and rays in the country in 2013-14 by FFI, including reviews of legislation and landings data. The study identified the major threats to shark populations, and provided recommendations for Myanmar to redraft its NPoA.
- Thailand received BOBLME funds in 2012 to hold consultations and improve data collection towards the production of its NPoA, which was drafted and presented in early 2015. The work also included capacity development in taxonomy, and specialized studies on heavy metal content in sharks.
- India already had bans on fishing for some species of shark and on the trade of some shark products. There has also been a significant stakeholder consultation process relating to the sustainability of shark fisheries in India. Research scientists from CMFRI have recently produced guidance on developing a NPoA for sharks in India. BOBLME supported studies of particular shark fisheries and trade, as well as consultations towards the production of its NPoA, through the BOBP-IGO (although reports are not yet available).

Because of the above work, from September 2014 to August 2015, complete or draft NPOAs for Sharks were therefore able to be provided by 6 countries (Bangladesh, Indonesia, Malaysia, Maldives, Sri Lanka and Thailand) while pre-NPOA documents describing how such NPOAs should be developed were provided by India and Myanmar. These documents were

developed in response to the situations and needs of each country and provide background on the state of knowledge of sharks and their fisheries in each country, and areas such as data collection and analysis, research, development of human capacity, implementation of management measures, monitoring, control and surveillance systems, communication and awareness initiatives and processes for international collaboration. The details contained in these documents are not repeated here although a summary is provided in Appendix 1.

This current document incorporates information from the above documents (and other appropriate information) into a draft Regional Plan of Action (RPOA) for Sharks for the Bay of Bengal. This Plan is intended to provide the basis for the harmonized, consistent and coordinated action of BOBLME countries in conserving and managing sharks throughout the region.

Developing a RPOA for this region is not a straightforward task because of the significant contrast that exists among the various BOBLME countries in how they utilize and manage sharks. That is, while 5 of the top shark harvesting nations in the world are BOBLME countries, there are complete shark protection policies in place in 2 of the other countries (the Maldives and Myanmar). The Maldives, in particular, has the key focus of its NPOA as supporting its no-shark-harvest policy. In addition, other countries in the region are also considering the merits of non-extractive uses of sharks to support the growing dive tourism industry.

Given these contrasts, developing (and getting agreement to) a meaningful RPOA that will realize significant improvements in shark populations throughout the region is a major challenge. And, whilst there are several areas of agreement among the NPOAs of all BOBLME countries (in terms of Data Needs, Research, International Collaboration, Monitoring Control and Surveillance, Communications and Capacity Development), there remain significant differences between countries in terms of the all-important Management Measures that each country is seeking to implement. As a result, this RPOA can not reflect ALL countries' priorities. It does, however, attempt to provide the best way forward for the region as a whole in how it may conserve and manage sharks sustainably.

Introduction

General Shark Biology and Ecology

Sharks, skates and rays are among the most primitive vertebrates in the world. They are predominantly oceanic with more than 1,000 species widely distributed throughout tropical, subtropical and temperate seas with a few species entering brackish and even freshwaters (Migdalsky *et al.* 1989).

Sharks are typically slow-growing, long-lived animals and, although their survival rate after birth is relatively high, they produce few young, have a relatively long gestation period and often do not reproduce every year. Most sharks also have delayed maturation with some species maturing at the age of 12-13 years. The low reproductive potential of sharks makes them highly susceptible to overexploitation and slow to recover from stock depletions (Castro *et al.* 1999).

Sharks are often the apex predators in marine ecosystems, making their depletion a particularly important issue for the health of such ecosystems. That is, because predatory sharks play an important role in ecosystem structure and function (Myers *et al.*, 2007), their large-scale decline may drive increases in prey abundances and have consequent cascading effects on the abundances of other organisms throughout the system (Morgan 2010). Indeed, an example of such an impact has been noted in some parts of Bangladesh, where shark catches and sizes have decreased, yet harvests of small-sized fish/shrimps are increasing.

Main Issues

The following is a summary of the main issues that concern the conservation and management of sharks in the Bay of Bengal. They come from the NPOAs obtained from the various BOBLME countries.

Fisheries for sharks in the region	The Bay of Bengal region is one of the most heavily fished regions in the world for sharks with over 30% of global landings being recorded there in 2008.
	This was led by Indonesia and India which rank the highest two countries in the world for shark landings (Sattar and Anderson 2011). Indonesia caught 13.3% of the global catch in 2008, India caught 9.0%, while Malaysia caught 2.9%, Thailand caught 2.8% and Sri Lanka caught 2.4%. The most recent annual catch figures for Indonesia and India (in 2013) were 52,268t and 46,471t respectively (DGCF, 2014, CMFRI, 2015).
	Whilst there is some targeted fishing for sharks in the region, they are mainly caught as bycatches from other fisheries or from fisheries that do not target any particular species. These catches can be very high and are often unregulated.
	The key methods involved are longline, gillnet, fish trawl and shrimp trawl. However, in some countries, sharks are mainly caught in artisanal fisheries which use drift gill nets, set nets, long lines and trammel nets to catch small sized animals.

Utilization & Trade	All parts of sharks are considered valuable commodities throughout the Bay of Bengal.
	Shark meat, fins, liver oil, skin, teeth and bones are all traded throughout a variety of local and international markets. However, there are reported to be declines in incomes and in the number of people engaged in the shark industry due to poor post-harvest handling practices and the high cost of producing shark oil.
	Worldwide it is estimated that up to 73 million sharks are killed each year to support the high global demand for shark fins alone (which mostly go through Hong Kong).
	Using the shark fin trade in Hong Kong as a source of information, Clarke <i>et al.</i> (2006) estimated that the total global catch of sharks may be between 3 and 5 times of that which is reported to FAO - suggesting that 66-80% of the total catch is unreported. CITES has concluded that such IUU fishing and trade is significantly contributing to unsustainable fishing for a number of shark species.
Status of shark stocks	Available catch data, landings records and anecdotal information indicate steeply declining catches of sharks throughout the region in recent decades, in addition to decreasing sizes of sharks, large captures of juveniles, and falling export earnings from shark products and trade.
	Further, whilst there are few comprehensive stock assessments or surveys of shark abundances throughout the region, those few indicate that stocks have fallen considerably and that catches and fishing effort are well beyond maximum sustainable limits.
	The current IUCN Red List of global assessments for sharks of relevance to BOBLME countries is provided below in Table 1. Many species on this list have no protective measures established in the region.

	<p>A key species is whale sharks (<i>Rhincodon typus</i>) which have been on the IUCN's Red List since 1990 and are classified as 'vulnerable to extinction'. They are also the 1st shark species listed under the Convention on Migratory Species (CMS) and listed in CITES' Appendix II (Irvine and Keesing 2005; Norman and Catlin 2007). Whale sharks are considered a 'flagship' or 'iconic' species indicating healthy oceanic conditions, and conservation efforts focussing on their international protection have become a high priority for many stakeholders and governments. Whale sharks are already protected in 4 of the 8 BOBLME countries (Maldives, India, Thailand and Malaysia) and it is suggested that they also need to be declared protected by Bangladesh, Sri Lanka, Myanmar and Indonesia.</p>
Shark bans in the region	<p>In contrast to the harvestable usage of sharks in the region, a 1992 study in the Maldives demonstrated that a live reef shark was worth much more than a dead shark, with shark watching by tourist divers generating US\$ 2.3 million per year compared to US\$ 0.7 million generated from shark exports. A ban on all shark fishing within Maldivian waters was therefore implemented in 2010 and compliance with that policy forms the major thrust of the country's NPOA. Furthermore, there has been a ban on shark fishing in Myanmar since 2008. Other governments are also beginning to recognize that sharks can be more valuable to a society alive as an economic driver for ecotourism.</p>
	<p>On the other hand, sharks sometimes attack fishermen and swimmers, making their complete protection and conservation, in some instances, quite controversial.</p>
Knowledge, research and capacity	<p>Despite some very useful recent work by SEAFDEC and others in the production of taxonomic guides and posters, there is relatively little information on shark taxonomy in the region - hindering shark identifications in many areas of the region.</p>
	<p>This lack of information, combined with complex transboundary jurisdictional issues, pose significant challenges for assessing, managing and conserving sharks in the region (Dulvy <i>et al.</i> 2008). The precautionary approach to management and conservation is therefore particularly warranted.</p>

	Developing and adopting suitable measures for the conservation and management of sharks in the region is not only hindered by a lack of scientific information but also by: a lack of adequately trained personnel in the region, poor stakeholder awareness, communication, monitoring, control and surveillance, and a general shortage of funding available to apply to such shortfalls.
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Table 1 - The current IUCN Red List of global assessments for sharks of relevance to the Bay of Bengal:

English name	Scientific name	Status
Silvertip shark	<i>Carcharhinus albimarginatus</i>	Near Threatened
Bignose shark	<i>Carcharhinus altimus</i>	Data deficient
Spinner shark	<i>Carcharhinus brevipinna</i>	Near threatened
Silky shark	<i>Carcharhinus falciformis</i>	Near threatened
Galapagos shark	<i>Carcharhinus galapagensis</i>	Near threatened
Blacktip shark	<i>Carcharhinus limbatus</i>	Near threatened
Oceanic white tip shark	<i>Carcharhinus longimanus</i>	Vulnerable
Australian black tip shark	<i>Carcharhinus tilstoni</i>	Least concern
Tiger shark	<i>Galeocerdo cuvier</i>	Near threatened
Blue shark	<i>Prionace glauca</i>	Near threatened
Whale-shark	<i>Rhincodon typus</i>	Vulnerable
Pelagic thresher shark	<i>Alopias pelagicus</i>	Vulnerable
Big eye thresher shark	<i>Alopias superciliosus</i>	Vulnerable
Common thresher shark	<i>Alopias vulpinus</i>	Vulnerable
Crocodile shark	<i>Pseudocarcharias kamoharai</i>	Near threatened
Scalloped hammerhead shark	<i>Sphyrna lewini</i>	Endangered
Great hammerhead shark	<i>Sphyrna mokarran</i>	Endangered
Smooth hammerhead shark	<i>Sphyrna zygaena</i>	Vulnerable
Spotted eagle ray	<i>Aetobatus narinari</i>	Near threatened

Ornate eagle ray	<i>Aetomylaeus vespertilio</i>	Endangered
Manta ray	<i>Manta birostris</i>	Near threatened
Mobula ray	<i>Mobula tarapacana</i>	Data deficient
Smooth tail mobula	<i>Mobula thurstoni</i>	Near threatened

It is the light of the above issues that one begins to address how to conserve and manage sharks throughout the Bay of Bengal. The remainder of this RPOA details the various steps (in approximate chronological order) that should be taken to achieve this overarching goal. These steps begin with improving the scientific information available to manage sharks, the actual management measures needed, the compliance operations required to enforce such measures, the communication and capacity building needs of the region and the international collaborations required. Finally, this RPOA describes the steps needed to implement and review the success (or otherwise) of this Plan and provides a table of actions, performance indicators, responsible agencies and timelines which, if adhered to, should result in significant improvements in shark populations and their sustainable use throughout the region.

Data Needs

Good scientific data underpins good fisheries management and all BOBLME countries note the significant lack of scientific information available concerning sharks in the region. In order to begin to conserve and manage sharks in the region, this lack of data needs to be addressed at the earliest opportunity.

Fishery Information	Basic catch and effort data concerning sharks (at a species-specific and size-specific level) are required from industrial and artisanal vessels and at landing sites on an ongoing basis. This should include data on targeted catches, incidental bycatches and discards and be gathered by scientifically trained staff.
	Surveys should also be done to obtain information about fleets, vessels, gear, the technology and instrumentation used, and spatial and temporal patterns in fishing.
	In addition, logbooks for recording shark catches, bycatches and discards should be issued to larger fishing vessels (say over 10m) for mandatory reporting. Furthermore, a methodology should be developed and implemented to obtain data from smaller boats for which logbooks are not practical.
Fishery-	Although relatively costly, fishery-independent research surveys and

independent surveys	observer programmes should be done where and when appropriate to provide information on shark stocks, size and age structures, relative abundances, life history information and reproductive rates of commercially important and protected species, as well as to identify critical shark habitats
Trade data needs	Regular monitoring should occur of imports, exports, trade chains and the utilization of various shark products.
Data from non-fishery stakeholders	Develop and implement “citizen science” programs involving divers to provide information for the assessment of reef-associated sharks.
Develop a coordinated information base	All the above data collection systems need to be standardized throughout the region, consistently adopted by all countries and linked using common databases.
	All data so collected should be continually shared and summarized using appropriate web-based technologies to provide relevant institutions throughout the region with timely information on harvests, yields, weights, size-structures and products.

Research Needs

All BOBLME countries identified a variety of research priorities needed to enhance the information and tools available to manage sharks. At a regional level these are:

Biological and Ecological studies	Extensive taxonomic work to provide accurate descriptions of shark species to use in developing outputs such as field guides, posters and websites that can be used to train staff and fishermen in data collection.
	Conduct research to determine the size at sexual maturity for key species and therefore inform the setting of minimum size limits.
	Conduct research to obtain information on critical habitats, including breeding and nursery grounds (particularly for vulnerable species), in which to focus spatial and temporal closures to fishing and associated compliance activities.
	Develop and use genetic identification techniques to identify products and derivatives of protected species for use in compliance operations. An example concerns the recent use of genetic information in a criminal case in India concerning illegally caught whale shark flesh.
Stock	Review all current stock assessments of sharks in the region and, where

assessments and Risk assessments	possible, conduct/update assessments for key species. In so doing, make use of the latest techniques for stock assessments of data-poor fisheries (e.g. Punt <i>et al.</i> 2011).
	Undertake formal risk assessments of proposed management actions against the sustainability of shark populations.
Gear Research	Promote and strengthen research on gear modifications to mitigate the capture of protected species, bycatch and discard mortality.
Utilization	Research needs to be done to improve the utilization, value-adding and quality of shark products so as to maximize the use of the sharks caught, and minimize wastage and discards. This may include better ways to extract shark liver oil, dry/smoke/pack shark products, treat and utilise flesh, hides, fins, teeth (as jewellery products), develop more pharmaceuticals from sharks, etc.
Socio-economic research	Undertake targeted socio-economic studies of shark fisheries and their participants, including comparisons of the economic utilization of sharks with non-consumptive uses such as dive tourism.

Management Measures

These are the most important elements of this RPOA because they are the actual tools that can conserve and/or manage sharks and their fisheries in the region. They come from a consideration of the measures provided in the individual NPOAs but are designed to be applied throughout the entire Bay of Bengal.

Harvest Bans	Throughout the region, there should be bans on the harvesting of whale sharks (<i>Rhincodon typus</i>), Thresher sharks (<i>Alopias pelagicus</i> , <i>A. superciliosus</i> and <i>A. vulpinus</i>), the Oceanic whitetip shark (<i>Carcharhinus longimanus</i>), Hammerhead sharks (<i>Sphyrna lewini</i> , <i>S. mokarran</i> , <i>S. zygaena</i>), Silky shark (<i>Carcharhinus falciformis</i>), Blacktip shark (<i>C. limbatus</i>), Tiger shark (<i>Galeocerdo cuvier</i>) as well as all species of saw fishes (<i>Anoxypristis cuspidata</i> , <i>Pristis microdon</i> , <i>P. pectinata</i> and <i>P. zijsron</i>), the Spotted eagle ray <i>Aetobatus narinari</i> , the skate/shovelnose ray (<i>Rhina ancylostoma</i>), all species of Butterfly rays (<i>Gymnura micrura</i> and <i>G. poecilura</i>), all species of Electric rays (<i>Narcine brunnea</i> , <i>N. timlei</i> and <i>Narke dipterygia</i>) and Manta rays (<i>Manta birostris</i>).
	Total fishing bans for all sharks should be enforced in all Marine Protected Areas.

	Introduce spatial and/or temporal closures for all fishing gears that catch sharks at locations and times identified as important for shark breeding, nursery grounds and critical habitats for protected species.
Recovery Programs	Establish focused recovery programs for particularly important declined species including the possible use of breeding programs.
Size/weight limits, protection for breeders	There should be a minimum weight limit for the harvesting of all sharks of 5 kg except for dogfishes (<i>Mustelus kanekonis</i>) and milk sharks (<i>Rhizoprionodon acutus</i>). The minimum weight for Eagle rays, Devil rays and Manta rays should be 4 kg;
	The harvesting of all berried female sharks (gravid, having eggs or young foetuses) should be banned.
Control live finning	Live finning (discarding carcasses into the water) of any shark should be prohibited - all sharks should be landed with fins attached.
	If sharks are not landed intact, then fin-to-carcass ratios should not exceed 5% of dressed weight (or 2% of whole weight). Further, the ratio of dried fins to body trunk (wet weight) on board any boat should not exceed 12 kg dry fins: 1,000 kg wet weight body/trunk
Restrictions on fishing methods	The use of explosives, poisons, pollutants, electric shock, pair trawling and push nets to capture sharks should be banned.
	To minimize shark discards, appropriate bycatch reduction devices and fishing practices should be implemented. For example, the minimum depth for setting longlines could be set at or below 60m.
	Set standards for boats used for ecotourism that minimize their impacts on shark stocks.
Manage fishing effort	Fishing effort (in terms of numbers of vessels, operators, fishing gears, etc.) should be reduced to reflect the size and sustainability of the shark stocks harvested.
	Where fishing effort is to be reduced, consider the use of gear buy-back schemes, compensations to traders for the shark products in their possession, and a Shark Trust Fund to raise money for alternative livelihood training programmes – as used in the Maldives.
Control trade	The export or import of any CITES-listed sharks should be banned.
Amend regulatory frameworks	Transboundary shark management agreements for shared stocks should be established and adhered to (e.g. for Total Allowable Catches, spatial and temporal closures, size limits, etc.).
	Where appropriate, and if they do not already, national fisheries laws should incorporate the management of freshwater sharks.

Compliance, Monitoring, Control and Surveillance

After adopting any management measure, proper monitoring, control and surveillance (MCS) should be implemented to ensure enforcement of the measure. Yet, it is noted that MCS activities throughout the region are minimal – mostly due to a shortage of on-water and onshore resources and expertise. The steps that should be taken to rectify such issues are:

Review current practices	Detail and review current MCS processes throughout the region.
Training	Recruit, train and properly outfit MCS Officers in each country so that they can effectively monitor compliance with all current and future management measures. This will include training in: shark identification and measuring, the relevant legislation and regulations, enforcement techniques, etc.
Implementation of compliance programs	Once trained, implement programs to ensure active enforcement of management measures at sea, at landing sites and in markets. Also include a focus on the selling of products from protected species.
	Establish an efficient Vessel Monitoring System for large vessels and observer programs, strengthen port inspection schemes, and encourage informants to give information on unlawful fishing activities.
	Implement data- and intelligence-sharing systems throughout and among jurisdictions in the region in order to optimize MCS operations.

Communication and Capacity Development

All BOBLME countries noted a need to improve the general community's awareness of shark conservation issues. They also noted a need to increase the level of expertise of fishers, scientists, managers, policy staff and MCS officers. In particular:

Building general awareness about shark issues	Awareness and education campaigns throughout the general community should focus on balancing the conservation needs for vulnerable shark populations with the sustainable use of sharks and their valuable products. These campaigns should include educating school children, and the establishment of shark information centres and shark museums - that can also be used to house research laboratories and taxonomic collections.
	Encourage ecotourism for sharks as a way to assist in building awareness about shark conservation issues.

	Develop and build expertise and professional capacity for fishers, traders, officials, extension agents and NGOs. These should focus on the status, role and importance of the conservation and management of sharks, their vulnerability to fishing pressure and their key role in marine ecosystems.
Specific capacity building	There is a particular need to encourage more young scientists to study sharks, undertake training courses and participate in conferences, seminars, workshops and mentoring by senior scientists.
	Educate fishers in the need to return juvenile sharks back to the sea alive.
	Educate fishers in the importance of accurate species- and size-specific data recording – as a pre-cursor to logbook data collection programs.
	Educate fishers in relevant legislation, management measures, reporting requirements and penalties for non-compliance.
	Shark identification keys, guides and posters that have been developed need to be appropriately disseminated and officers and fishers need to be trained in their use.
Communication among agencies	Improve communication among different agencies responsible for fisheries management and shark conservation within and between all jurisdictions in the region.

International Collaborations

Because of the mobile nature of sharks and their extensive geographical ranges, the sustainability of shark fisheries is recognised as an international as well as a regional and national challenge. This requires significant collaboration to occur among jurisdictions that have responsibilities for shark conservation and management.

Transboundary agreements among Countries	Most of the exploited shark species in the Bay of Bengal are transboundary and are being exploited by several BOBLME countries. Hence, there is a significant need for appropriate joint transboundary management, stock assessments, cooperative research and compliance in order to effectively manage sharks throughout the region.
	There is a need to develop and adopt regional and/or bilateral fishery management agreements throughout the region for all management measures, especially for species protection bans, size limits, spatial and temporal closures, Total Allowable Catches, fishing effort reductions, etc.
	Various international and regional organizations, bodies, agreement and

	treaties are relevant to managing shark stocks. For the Bay of Bengal, relevant frameworks that should be considered when implementing NPOAs and this RPOA include those contained in: the United Nations Convention on the Law of the Sea (UNCLOS), the International Tribunal for the Law of the Sea (ITLOS), the FAO Code of Conduct for Responsible Fisheries (CCRF), the International Plan of Action for the Conservation and management of Sharks (IPOA-Sharks), the Convention on Migratory Species (CMS), the Convention on International Trade in Endangered Species (CITES), the International Union for Conservation of Nature (IUCN), the UN Fish Stocks Agreement (UNFSA), the Convention on the Conservation of Antarctic Living Resources (CCAMLR), the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and the Indian Ocean Tuna Commission (IOTC).
Enhance relationships with external agencies	There is a need for all BOBLME countries to engage in active membership, participation and dialogues with the above agencies as well as with the Southeast Asian Fisheries Development Center (SEAFDEC), the Coral Triangle Initiative (CTI), Sulu-Sulawesi Marine Eco-region (SSME), the Bay of Bengal Large Marine Ecosystem project (BOBLME), the PEW Environment Group, TRAFFIC and other relevant NGOs.

Implementation and Review

Strategic planning for the implementation of a Plan of Action is almost as important as the Plan itself because without proper implementation, the chief goals of a plan can be compromised. The following steps should be adopted to facilitate the implementation of this RPOA:

Oversight Council	Establish an Oversight Council consisting of representatives from all BOBLME countries, the fishing industry and other appropriate agencies to oversee the implementation and review of this RPOA and ensure ongoing coordination among, and consultation with, all stakeholders.
	The Oversight Council should undertake continual monitoring of issues, stocks, size-structures and markets to assess the success (or otherwise) of the management measures in the RPOA.
	The Council should undertake an assessment of the RPOA and its measures every year and hold a full, formal review every 4 years. The latter should also include expert review by individual(s) independent of BOBLME countries.
	An appropriate forum to establish such a Council and see to the implementation and review of this RPOA would be the BOBLME Strategic

	Action Programme.
Roll-out of the RPOA	The day-to-day actions to be taken as the RPOA is implemented should be simple, easy-to-understand, realistic and achievable. A step-by-step, logical approach using the approximate order provided in the Table of Actions (below) should be used in moving towards the full implementation of the RPOA.
	Ensure that the RPOA remains a living document that can be updated following the above periodic reviews or as new measures and initiatives are developed, endorsed and incorporated.
International assistance	Seek international assistance and resources to enhance the region's capacity to implement the RPOA and develop systems for the efficient and rapid transfer of such resources to researchers, MCS officers, managers and policy makers throughout the region.

Table of Actions

The following table describes the objectives, actions, performance indicators, responsible agencies and timelines for the implementation of this RPOA.

Objective	Broad Actions	Specific Actions	Performance Indicator	Responsibility	Timeframe
Data to improve the information that underpins shark management and conservation	Basic data collection	Routine catch and effort data collection programs from vessels and at landing sites.	Routine data collection programs implemented	National governments	3 years
		Surveys of fleets, vessels, gear, the technology and instrumentation used, and spatial and temporal patterns in fishing.	Surveys implemented and repeated every 3 years	National governments	3 years
		Monitoring imports, exports, trade chains and the utilization of shark products.	Routine monitoring implemented	IOTC, National governments	3 years
		Logbooks for recording shark catches, bycatches and discards for larger fishing vessels (over 10m)	Logbooks designed and distributed and data-flow established	SEAFDEC, IOTC, National governments	3 years
		Develop and implement a method to obtain data from smaller boats for which logbooks are not practical.	Method developed and implemented	SEAFDEC, National governments	3 years
	Data standardization and sharing	Standardization of data collection systems and databases throughout the region.	Systems and databases standardized	IOTC, National governments and BOBLME	3 years
		Appropriate web-based technologies to provide institutions with timely information	Reporting systems developed and implemented	BOBLME	3 years
	Additional data collection	Develop and implement “citizen science” programs involving divers for the assessment of reef-associated sharks.	Programs developed and implemented	SEAFDEC, National governments, external experts	4 years
		Fishery-independent research surveys and observer programmes.	Surveys implemented as required	National governments, external experts	4 years

Objective	Broad Actions	Specific Actions	Performance Indicator	Responsibility	Timeframe
Research priorities needed to improve the tools available to manage sharks	Biological and ecological studies	Taxonomy to provide accurate descriptions of sharks for various outputs such as field guides, posters and websites for training.	Taxonomic work completed and outputs produced	National governments, external experts, university sector	2 years
		Determine the size at sexual maturity for key species to inform minimum size limits.	Research completed and fed into management processes	National governments, external experts, university sector	2 years
		Research to identify critical habitats (including breeding and nursery grounds).	Research completed and fed into management processes	National governments, external experts, university sector	4 years
		Develop genetic techniques to identify products from protected species for compliance operations.	Research completed and fed into compliance programs	National governments, external experts, university sector	3 years
	Stock assessments and risk assessments	Review, conduct and/or update stock assessments for key species.	Stock assessments completed	National governments, external experts, university sector	4 years
		Risk assessments of proposed management actions.	Risk assessments completed	National governments, external experts, university sector	Ongoing
	Research on the utilization of sharks	Research to improve the utilization, value-adding and quality of shark products	Research completed and fed to industry	National governments, external experts, university sector	3 years
	Gear Research	Research on gear modifications to mitigate	Research completed and	National	4 years

	the capture of protected species, bycatch and discard mortality.	fed into management processes	governments, external experts, university sector	
Socio-economic research	Socio-economic studies of shark fisheries and their participants for extractive and non-consumptive uses (such as dive tourism)	Research completed and fed into management processes	National governments, external experts, university sector	3 years

Objective	Broad Actions	Specific Actions	Performance Indicator	Responsibility	Timeframe
Management measures to conserve and manage sharks and their fisheries.	Harvest bans	Bans on the harvesting of whale-sharks (<i>Rhincodon typus</i>), Thresher sharks (<i>Alopias pelagicus</i> , <i>A. superciliosus</i> and <i>A. vulpinus</i>), the Oceanic whitetip shark (<i>Carcharhinus longimanus</i>), Hammerhead sharks (<i>Sphyrna lewini</i> , <i>S. mokarran</i> , <i>S. zygaena</i>), Silky shark (<i>Carcharhinus falciformis</i>), Blacktip shark (<i>C. limbatus</i>), Tiger shark (<i>Galeocerdo cuvier</i>) as well as all species of saw fishes (<i>Anoxypristis cuspidata</i> , <i>Pristis microdon</i> , <i>P. pectinata</i> and <i>P. zijsron</i>), the Spotted eagle ray <i>Aetobatus narinari</i> , the skate/shovelnose ray (<i>Rhina ancylostoma</i>), all species of Butterfly rays (<i>Gymnura micrura</i> and <i>G. poecilura</i>), all species of Electric rays (<i>Narcine brunnea</i> , <i>N. timlei</i> and <i>Narke dipterygia</i>) and Manta rays (<i>Manta birostris</i>).	Species-specific harvest bans legislated and implemented	IOTC, National governments	1 year
		Total fishing bans for all sharks in all Marine Protected Areas.	Bans legislated and implemented	IOTC, National governments	1 year
		Ban the harvesting of all berried female sharks (gravid, having eggs or young foetuses).	Bans legislated and implemented	IOTC, National governments	1 year
		Ban the export or import of any CITES-listed	Bans legislated and	IOTC, National	1 year

	sharks.	implemented	governments	
Size/Weight limits	Minimum weight limit for the harvesting of all sharks of 5 kg except for dogfishes (<i>Mustelus kanekonis</i>) and milk sharks (<i>Rhizoprionodon acutus</i>).	Limits set, legislated and implemented	IOTC, National governments	1 year
	Minimum weight limit for Eagle rays, Devil rays and Manta rays of 4 kg.	Limits set, legislated and implemented	IOTC, National governments	1 year
Restrictions on fishing practices	Ban on live finning (discarding carcasses into the water) of any shark.	Ban legislated and implemented	IOTC, National governments	1 year
	If sharks are not landed intact, then fin-to-carcass ratios should not exceed 5% of dressed weight (or 2% of whole weight). And the ratio of dried fins to body trunk (wet weight) on board should not exceed 12 kg dry fins: 1,000 kg wet weight body/trunk.	Regulations legislated and implemented	IOTC, National governments	1 year
	Ban on the use of explosives, poisons, pollutants, electric shock, pair trawling and push nets for catching sharks	Bans legislated and implemented	IOTC, National governments	1 year
	Appropriate bycatch reduction devices and fishing practices to reduce discards should be implemented.	Regulations legislated and implemented	National governments, IOTC, SEAFDEC, external experts	2 years
	Set standards for boats used for ecotourism that minimize their impacts on shark stocks.	Standards developed and implemented	National governments	2 years
Closures to fishing	Spatial and/or temporal closures at locations and times identified as important for shark breeding, nursery grounds and critical habitats for protected species.	Closures legislated and implemented	IOTC, National governments	4 years
Fishing effort restrictions	Reduce fishing effort (numbers of vessels, operators, fishing gears, etc.) to reflect the size and sustainability of the shark stocks harvested.	Fishing effort reduced	IOTC, National governments	4 years

	Where fishing effort is reduced, consider gear buy-back schemes, compensations to traders and a Shark Trust Fund for alternative livelihood training.	Schemes and Trust established	IOTC, National governments, BOBLME	4 years
Recovery programs	Establish focused recovery programs for particularly important declined species including breeding programs.	Recovery programs implemented	IOTC, National governments, BOBLME	4 years
Legislations and agreements	Establish transboundary shark management agreements for shared stocks.	Agreements implemented	IOTC, National governments, BOBLME	2 years
	Ensure national fisheries laws incorporate the management of freshwater sharks.	Laws amended if necessary	National governments	1 year

Objective	Broad Actions	Specific Actions	Performance Indicator	Responsibility	Timeframe
Improve Compliance, Monitoring, Control and Surveillance	Review current practices	Detail and review current MCS processes throughout the region.	Review completed	National governments, IOTC, BOBLME	1 year
	Training of MCS officers	Recruit, train and properly outfit MCS Officers	Training completed	National governments, IOTC, BOBLME	2 years
	Implementation of compliance programs	Implement programs to ensure active enforcement of management measures at sea, at landing sites and in markets.	Compliance programs implemented	National governments, IOTC, BOBLME	2 years
		Establish Vessel Monitoring Systems and observer programs, strengthen port inspection schemes and intelligence-gathering.	Systems and programs implemented	National governments, IOTC, BOBLME	2 years
		Implement data- and intelligence-sharing systems throughout the region.	Data- and intelligence-sharing systems implemented	National governments, IOTC, BOBLME	3 years

Objective	Broad Actions	Specific Actions	Performance Indicator	Responsibility	Timeframe
Improve communication, the general community's awareness of shark issues and increase expertise levels.	Building general awareness about shark issues	Develop and implement awareness and education campaigns throughout the general community.	Campaigns implemented	National governments, BOBLME	2 years
		Encourage ecotourism for sharks to build awareness about shark conservation issues.	Ecotourism increases	National governments, BOBLME	2 years
		Develop expertise and professional capacity for fishers, traders, officials, extension agents and NGOs.	Expertise and capacity increased	National governments, IOTC, BOBLME	3 years
	Specific capacity building	Encourage more young scientists to study sharks, undertake training courses and participate in conferences, seminars, workshops and mentoring by senior scientists.	Numbers and expertise of scientists increased	National governments, external experts, SEAFDEC, BOBLME	3 years
		Develop and/or provide easy-to-use shark identification keys, guides and posters.	Keys developed and disseminated	SEAFDEC, National governments, external experts, BOBLME	1 year
		Educate fishers in: the need to release juvenile sharks, the importance of accurate data recording, relevant legislation, management measures, reporting requirements and penalties.	Fishers educated	SEAFDEC, National governments, external experts, BOBLME	2 years
	Communication among agencies	Improve communication among agencies responsible for fisheries management and shark conservation in the region.	Communication processes established	National governments, IOTC, BOBLME	1 year

Objective	Broad Actions	Specific Actions	Performance Indicator	Responsibility	Timeframe
Enhancing collaboration among	Develop and implement	Establish joint transboundary management, stock assessments, cooperative research and	Joint arrangements established	National governments,	1 year

jurisdictions.	transboundary agreements among Countries	compliance throughout the region. Develop and adopt regional and/or bilateral fishery management agreements for all regional management measures.	Agreements legislated and implemented	IOTC, BOBLME National governments, IOTC, BOBLME	1 year
	Enhance relationships with external agencies	Engage in active membership, participation and dialogues with all appropriate international agencies external to countries.	Participation increased	National governments, IOTC, BOBLME	1 year

Objective	Broad Actions	Specific Actions	Performance Indicator	Responsibility	Timeframe
Implementation and review of the RPOA.	Oversight Council	Establish an Oversight Council of representatives from BOBLME countries, the fishing industry and other appropriate agencies to oversee the RPOA.	Oversight Council established	National governments, BOBLME	Immediate
		Ongoing monitoring of issues, stocks, size-structures and markets by the Council.	Monitoring systems established	Oversight Council	Ongoing
		Assess the RPOA and its measures every year, with a full, formal review every 4 years. The latter should include independent expert review.	Assessments and reviews completed	Oversight Council, Independent expert(s)	Yearly with full review every 4 years
	Roll-out of the RPOA	Ensure day-to-day actions are simple, easy-to-understand, realistic and achievable.	Day-to-day activities are implemented	National governments, BOBLME, Oversight Council	Ongoing
		Ensure that the RPOA remains a living document that can be updated as appropriate.	RPOA updated appropriately	National governments, BOBLME, Oversight Council	Ongoing
	International assistance	Seek and appropriately disperse international assistance and resources.	Adequate assistance received	National governments, BOBLME, Oversight Council	Ongoing

Appendix 1 - Summary of BOBLME countries' National Plans of Action

Bangladesh

The NPOA Sharks for Bangladesh is a comprehensive document whose main strength is its provision of specific measures for the conservation and management of sharks in Bangladesh waters. It also provides a very useful regional perspective. Basically it notes that the volume and sizes of harvested sharks (and export earnings from shark products) have been decreasing for some time and calls for regulatory measures to improve shark conservation and management in Bangladesh waters, and also more broadly throughout the Bay of Bengal. The following is a summary.

Background and history

- Sharks have been harvested and traded in Bangladesh for many years with only a few species actually targeted by commercial artisanal fisheries (who are allowed to fish to 40m depth). The majority of sharks are caught as bycatch – mainly in the hilsa and Indian salmon fisheries, with a small number caught as bycatch by industrial fish trawlers (who are allowed to fish beyond 40m depth).
- Mostly small-sized sharks and rays are caught by the artisanal fishery with drift gill nets, set bag nets, long lines and trammel nets;
- The various locations of shark catches throughout Bangladesh waters are provided and it is noted that harvesting increases in October-December each year, peaks during January-March, and gradually decreases in April-June with lowest catches occurring during July-September;
- Shark meat is not significantly important economically in Bangladesh, but mainly eaten by people in coastal regions, and shark meal is used for poultry feed. But fins, skins and oil are significant export commodities – although export earnings from shark products have been decreasing since 1999-2000;
- There is no comprehensive study or report on the status of sharks in Bangladesh and little information on their taxonomy - hindering their identification in the field;
- The NPOA also summarizes the legislative and regulatory frameworks available in Bangladesh to manage sharks as well as the various regional and international agreements and instruments.

Main issues

- Declining catches, decreasing sizes of sharks and falling export earnings from shark products;
- As shark catches and sizes are decreasing, harvests of small-sized fish/shrimps are increasing, suggesting ecosystem changes are occurring due to the removal of the top predators;
- A lack of scientific data on targeted catches and bycatches;
- A need for better MCS and enforcement of current and future management measures;
- The need for significant awareness and education campaigns and capacity building; and

- The need to prepare a Shark Assessment Report that:
 - Identifies fishers who target sharks and those who catch sharks as a bycatch;
 - Monitor and assess catches from these two groups separately;
 - Provide harvest trends, catch and yield in terms of weight and value;
 - Estimate directed and non-directed fishing effort;
 - Conduct stock assessments for key species;
 - Detail existing management measures including the control of access to fishing grounds, technical measures (including by-catch reduction measures, sanctuaries, closed seasons, etc.);
 - Detail monitoring, control and surveillance (MCS) processes; and
 - Assesses the effectiveness of management measures and provide recommendations for their modification.

Current management measures

- In 2000, Bangladesh established a 698 km² Marine Reserve at Middle Ground and South Patches in the Bay of Bengal. Two Marine Parks have been established at St. Martin Island and in the Sundarban mangrove forest;
- Monofilament net (locally called *Current jal*) is banned and the minimum mesh-size in gillnets is 60 mm;
- The Forestry Act currently restricts harvesting of any sharks in and around the Sundarbans; and
- The Wildlife (Conservation & Protection) Act 2012 declared 25 species of sharks as protected animals.

Proposed new management measures

(this is the most important elements of any Action Plan for Sharks (ie. the actual management measures aimed to conserve and/or manage sharks)

- Live finning (discarding carcasses into the water) of any elasmobranch to be prohibited - all sharks are to be landed with fins attached;
- Ensure that fin-to-carcass ratios do not exceed 5% of dressed weight (or 2% of whole weight). Further, the ratio of dried fins to body trunk (wet weight) ratio on board any boat should never exceed 12 kg dry fins: 1,000 kg wet weight body/trunk;
- Ban the harvesting of all berried female sharks (gravid, having eggs or young fetuses) - irrespective of size, area and season, and require their immediate release alive;
- To be in harmony with other Bay of Bengal countries (Maldives, India, Thailand and Malaysia), the harvesting of whale-sharks (*Rhincodon typus*) is to be banned;
- Further, the harvesting of Silky shark (*Carcharhinus falciformis*), Black shark (*C. limbatus*), Tiger shark (*Galeocerdo cuvier*) and *Aetobatus narinari* is also proposed to be banned as is the harvesting of all species of saw fishes (*Anoxypristis cuspidata*, *Pristis microdon*, *P. pectinata* and *P. zijsron*), the skate/shovelnose ray (*Rhina ancylostoma*), all species of Butterfly rays (*Gymnura micrura* and *G. poecilura*) and all species of Electric rays (*Narcine brunnea*, *N. timlei* and *Narke dipterygia*);

- There should be a minimum size limit for harvesting all sharks of 5 kg except for dogfishes (*Mustelus kanekonis*) and milk sharks (*Rhizoprionodon acutus*). The minimum size for Eagle rays/Devil rays/Manta should be 4 kg; and
- Total fishing bans including for all sharks is to be strictly enforced in all MPAs.
- After updating the legislation, proper monitoring, control and surveillance (MCS) should be implemented to ensure compliance.

Data collection

- A review is required of any available stock assessments or other studies of sharks;
- Standardize recording of species-specific catch data of sharks and increase reporting of discard mortality.

Research

- Promote and strengthen research into gear modifications aimed at mitigating elasmobranch bycatch and discard mortality.
- Initiate research to improve the utilization of shark products (eg. extraction of shark liver oil, drying, value added products using meat, hide and fins, jewellery products, etc.).

International collaboration

- Ensure active membership and dialogue with CITES, Convention on Migratory Species (CMS), IUCN, PEW Environment Group, TRAFFIC, RFMOs and other relevant international groups. Also promote and support the advice of the CMS Scientific Council and the CITES Animals Committee with respect to shark management.
- Because most of the exploited shark species are transboundary, and are being exploited by several BOBLME countries, there is a need for appropriate transboundary management of the shark fishery resources in the entire Bay of Bengal (ie the current initiative to develop an RPOA).
- Adopt bilateral fishery management agreements (eg. for total allowable catches, etc) for shared stocks.

Communication and capacity building

- Develop and build capacity through awareness raising training to fishers, traders, fishery officials, extension agents of government departments and NGOs and the general public on the status, role and importance of conservation and management of sharks, their vulnerability to fishing pressure, their role in the marine ecosystem, the need to return young and juveniles back to the sea, the importance of species-specific catch data recording and accurate identification, the creation of identification keys and training of stakeholders in their use, increased stakeholder awareness of the pertinent legislation and management measures, reporting requirements and penalties.
- Improve communication among different agencies responsible for fishery management and species conservation;
- adopt a participatory approach with the involvement of all stakeholders - as broadly as practical;

- make management plans as realistic and achievable as possible, including the use of a step-by-step approach towards their full implementation; and
- ensure that the NPOA-Shark remains a living document that can be updated as new measures are developed and endorsed.

Implementation

- Seek international assistance and resources to enhance Bangladesh's capacity to implement the NPOA-Shark;
- Identify, declare and enforce no shark fishing areas/seasons/periods and minimum mesh sizes of marine set bag nets;
- Monitor designated areas, seasons, mesh sizes of nets, encounters with protected sharks; and
- Continually assess impacts on shark populations and provide ongoing recommendations to changes in management.

Indonesia

The NPOA Sharks for Indonesia is a relatively brief plan that, like some of the others, generally focusses on the early requirements of any Plan of Action for Sharks – the need to improve data on catches, bycatches, socio-economic and scientific information about the sharks and fisheries involved – especially in areas such as taxonomy, training, capacity development and education programs. The following is a summary.

Background and history

- Over 200 species of shark and rays are in Indonesian waters, most of which are landed;
- Most catches are from fisheries that do not specifically target sharks but are bycatches from other fisheries or from fisheries that do not target any particular species;
- The key methods involved are longline, gillnet, fish trawl and shrimp trawl;
- All parts of the sharks caught are utilized (fins, meat, liver for oil, skin and skeleton);
- Landings occur throughout all of Indonesia; and
- Catches are in decline.

Main issues

- Better taxonomy to improve the identification of the many species;
- Improving the accuracy of data on catch and effort;
- Obtaining socio-economic information on the fishery and its participants;
- The high market demand for shark products, especially fins; and
- The significant capture of small sharks.

Key actions to address issues

- Review the status of fisheries for sharks and rays in Indonesia;
- Improve and standardize data collection processes, develop databases, and share data for shark fisheries throughout Indonesia and also regionally;
- Adopt similar approaches for shark management throughout the country and regionally;
- Assess social responsibilities of the economic utilization of sharks compared to non-consumptive use;
- Record data on all sharks caught as bycatch – whether landed or discarded;
- Begin the use of observer, monitoring and fishery independent surveys where appropriate;
- Develop a field guide and posters to improve identifications; and
- Better education of fishers, observers, researchers and fisheries officers, particularly in terms of shark identification.

Improving management measures

- Regular monitoring of shark resources, trade chains and the utilization of products;
- Set management objectives based on research; and
- Implement management measures as appropriate

Proposed new management measures

- Rationalizing fishing effort with the availability of shark resources;
- Identifying and protected particular species and habitats;
- Defining and protecting particular spawning areas;
- Establishing recovery programs for declined populations; and
- Banning the trade of sharks less than 60cm (5kg).

Research

- Develop and implement surveys of biodiversity, shark distributions, life cycles and habitats;
- Assess the feasibility of the Ecosystem Approach to manage sharks in Indonesia;
- Develop and implement surveys of the fisheries that catch sharks including information about fleets, vessels, gear, the technology and instrumentation used, spatial and temporal patterns in fishing and the bycatch discarded;
- Examine the socio-economic characteristics of the utilization of shark products; and
- Develop information about particular characteristics for protected species.

Education and outreach

- An information Centre;
- Education programs to increase the public's awareness and understanding of shark management; and
- Develop ecotourism that incorporates shark awareness.

Institutional arrangements

- Facilitation of information sharing and joint training among stakeholder groups;
- Establish effective communication and consultation mechanisms among all stakeholders; and
- Implement shared shark management with neighboring countries as well as regionally under the relevant regional and international arrangements (this includes involvement in this current initiative to develop an RPOA Sharks for BOBLME).

Implementation

- Formal implementation of the NPOA throughout Indonesia;
- Evaluate its implementation via progress reports every year; with
- Formal evaluation and assessment of actions every 5 years.

Malaysia

The latest Malaysian NPOA-Sharks was prepared in 2014 and is the 2nd version of the plan, the first being done in 2006 - making Malaysia one of the first countries in the world to produce such an NPOA. The document is a very polished one that builds on the previous version.

Like most of the NPOAs Sharks for the Bay of Bengal region, the Malaysian NPOA concentrates on actions to improve monitoring, research, identifications of sharks, training, awareness programs and data-sharing processes, with relatively less on specific management measures to conserve sharks. The following is a summary.

Background and history

- At least 63 species of sharks are found in Malaysian waters and 84 species of rays.
- Sharks are not specifically targeted by fishers but are caught together with other commercially important species.
- Sharks are fully utilized in Malaysia, shark meat is widely eaten and processed throughout the country, fins are dried and consumed or exported, as are liver oil, skins, teeth, bones, etc.
- Summarized landings and product information on sharks are summarized over time, highlighting the growth of shark fins for exports;
- The section on the status of Shark resources provides lists of species caught but does not provide any assessment of status, making it difficult to determine if any species are in decline.

Review of the 2006 version of the NPOA

- The actions of the first version of the NPOA were mainly focused on biological information on sharks and related habitats, socio-economic information about fishers and traders, utilization, marketing and trade information, and coordinating research and expertise on sharks and management measures.
- The review found that for actions associated with strengthening data collection on shark biology and their habitats, no direct or specific work was taken but other, more opportunistic or tangential work was done that assisted with the objectives.
- For data collection on socio-economics and trade, and for developing better value-added products, no specific action was taken.
- In contrast, for many of the capacity building, research co-ordination and awareness-raising work, several actions were done in terms of training courses, seminar attendances, 2 multi-national surveys and public awareness/educational activities.
- For the all-important actions concerning effective management measures, progress was made via certain enforcement actions, the protection of whale sharks and sawfishes, and the creation of anti-trawling artificial reefs.
- The review concluded that all actions from the 2006 plan are still relevant and were consequently included in the 2014 NPOA.

Developing the new NPOA

- Adopted similar objectives as those in the 2006 plan and cover:
 - the need to ensure the future sustainability of stocks by gathering better information about shark biology, catches, landings, uses and shark habitats and so inform risk assessments;
 - identify and attend to particularly vulnerable or threatened species;
 - improve consultation mechanisms and data-sharing systems; and
 - maximize the use of the sharks caught, including minimizing waste and discards.
- A shortcoming of the 2006 plan was noted to be a lack of specific benchmarks to measure. In light of this, the new NPOA includes Key Performance Indicators (KPIs) to enable better performance evaluation.

Current management measures

- Whale sharks and all sawfishes are protected under legislation;
- There is protection of breeding and nursery grounds of sharks associated with large, anti-trawling artificial reefs (120 new sites were implemented between 2006 and 2014);
- Fishing activities are not allowed in more than 50 MPAs;
- A zoning system for fishing fleets is established to protect nursery areas (not necessarily shark nursery areas) and to avoid conflict among fishers; Traditional fishing was extended from 5 nm to 8 nm from the coastline in 2014 and commercial trawlers and purse seiners were prohibited to operate within 8 nm from the coastline;
- The use of explosives, poisons, pollutants, electric shock, pair trawling and push nets are all banned. The locally known 'pukat pari', a drift net with a mesh size of more than 25.4 cm (10 inches), which was once used to catch large sized sharks has been banned since 1990;
- Shark finning (where carcasses are discarded) is prohibited; and
- Malaysia does not allow the export or import of any CITES-listed sharks, manta rays or sawfishes.

Proposed new management measures

- State fisheries laws incorporate the management of freshwater sharks;
- Genetic bar-coding be used to identify products and derivatives of species listed under CITES;
- Awareness programs on sharks concerning finning and the bycatch of protected and endangered species be intensified;
- New conditions on fishing licences are to ensure that no discards of finned sharks occurs and they should be retained and landed whole.
- Improving data collection:
 - A project to record sharks at the species level at landing sites will be expanded throughout the country;
 - A book on the identification of sharks species was published in 2013 and more training courses and workshops will be conducted to build capacity for identifying species; and

- Research projects aimed at addressing data deficiencies in biology, socio-economics and trade will be implemented.
- Rectifying negative perceptions about sharks. There exists significant negative perceptions concerning the catching and utilization of sharks and it is proposed to highlight facts about the full utilization of sharks by Malaysia. This will be done through public awareness programs, consultations with stakeholders and the general public.
- Intensifying capacity building:
 - To encourage more young scientists to do research on sharks, Malaysia intends to run training courses and encourage participation in conferences, seminars, workshops and mentoring by senior scientists; and
 - Stakeholders also need to know at least the basic biology and ecology of sharks to help them understand the importance of sustainable exploitation and conservation of sharks.

Research

- Continuous and intensified research, data mining and data sharing should be coordinated among institutions and countries to enhance knowledge on sharks for their effective and efficient management.
- An efficient mechanism is needed to facilitate faster transfer of research funds - especially from international donors.

International collaboration

- The plan noted that the conservation, management and long term sustainable use of sharks needs to be pursued under international and regional frameworks and agencies such as the Food and Agriculture Organization (FAO), Southeast Asian Fisheries Development Center (SEAFDEC), Coral Triangle Initiative (CTI), Sulu-Sulawesi Marine Eco-region (SSME) and Bay of Bengal Large Marine Ecosystem (BOBLME) - including the current RPOA initiative.

Monitoring and Review

- It was noted that regular monitoring of the implementation of the 2006 NPOA was insufficient, making it difficult to assess its performance. In the light of this, it is proposed that over the time frame of this new NPOA, regular monitoring will be conducted by a Technical Committee, which will report the progress of the implementation of the Plan to the National Steering Committee. A full review is expected to be conducted at the end of 2018.

Maldives

The Maldives NPOA Sharks is quite different from other NPOAs in the Bay of Bengal because of the Maldives' simpler management initiative regarding sharks – their complete protection from fishing. That is, because of the shark ban in the Maldives, their quite polished, succinct NPOA uses the IPOA Sharks as a guide to focus their plan to address their most pressing need: the implementation and observation of the total shark ban. The following is a summary.

Background and history

- Describes global trends in shark fisheries, their catches, developing markets, overfishing and stock collapses. It then summarizes international efforts to conserve and manage shark stocks, culminating in the development of the IPOA Sharks and the need for NPOAs.
- Shark fishing in the Maldives is centuries-old and evolved from traditional to a more export-oriented commercial fishery but, compared to the tuna fishery, remained quite minor.
- The fishery increased significantly in the 1970's and 80's as exports of shark products increased, initially focused on liver oil. A small multi-hook handline (vertical longline) fishery developed for the deepwater gulper shark to meet demand. By the end of the 1980s, there were longline and handline fisheries for oceanic sharks, gillnetting, handlining and longlining for reef sharks and multihook handlining for deepwater sharks. Gradually, the main product exported changed from shark liver oil to fins.
- Targeted fishing pressure led to the collapse of the gulper shark fishery in the early 1990's and very significant declines in the catches of other species throughout the 2000's. Fishing vessels involved in shark fishing reduced by 60%.
- The economic importance of sharks to the Maldives was not only for their harvest but also its importance to the major dive tourism industry of the country. Reef sharks such as the white tip shark, black tip reef shark, grey reef shark, tawny nurse shark, silvertip shark, variegated shark, hammerhead sharks and whale sharks are frequently watched by tourists.
- The annual revenue from shark watching through dive tourism was estimated to be USD 2.3 million per year compared to the estimated annual contribution from shark fisheries of USD 1.7 million. It was estimated that a single shark left alone in its environment could generate an estimated USD 3300 per year from tourism compared to the same shark killed for its fins and meat only generating about USD 32.
- In recognition of the importance of dive tourism, 15 prominent dive sites were declared as MPAs in June of 1995. Of these, nine sites were prominent shark watching sites. Also in the same year, whale sharks, a major charismatic species, was declared a marine protected species. In 1998, to conserve the reef sharks for the tourism sector, a 10 year moratorium on reef shark fishing was declared in seven of the central atolls which were notable tourism areas.
- Oceanic sharks such as the silky shark (*Carcharhinus falciformis*) also have an economic and ecological significance to pole and line tuna fishermen. Pole and line

tuna fishermen believe that tunas follow the silky sharks and catching these sharks reduces the availability of tuna. This led to shark fishing being banned during the daytime in tuna fishing grounds, around FADs and around two seamounts known to be tuna aggregating sites.

- In February, 2009, the government banned shark fishing from all atolls of the Maldives and announced a ban on all types of shark fishing (including from the EEZ) to occur one year later in March 2010.
- However, artisanal shark fishing was a prominent livelihood in some islands of the Maldives and, to minimize the impact of the ban, the government introduced a gear buy-back scheme for shark fishing gear, compensations to traders for the shark products in their possession at the time of the ban, and began a Shark Trust Fund to raise money for alternative livelihood training programmes.
- Incidental catches of sharks still occur as a bycatch - mainly from the offshore tuna longline fishery so there is a need for the Maldives to manage this incidental catch.
- Describes the fisheries management frameworks and administrative responsibilities in the Maldives, the role of the Ministry of Fisheries and Agriculture and other government departments including the Ministries of Tourism, Economic Development, Environment and Energy, the Environment Protection Authority, Defense and Police. It also outlines the relevant key legislations and regulations.

Objective for the NPOA

- Despite a complete ban on targeted shark fisheries, management and stringent monitoring of offshore shark bycatch is still required so this NPOA-Sharks was developed to address these concerns.
- The Maldives took the overarching goal of the IPOA-Sharks “to ensure the conservation and management of sharks for their long-term sustainable use” and altered it to create a specific main objective for its NPOA: *“to ensure the implementation and observation of the total shark ban”*;
- It is therefore a 4-year plan to strengthen current management measures and propose further actions that are necessary for sustainable non-extractive utilization of the Maldives’ shark resources.

Status of shark stocks

- 36 species of sharks have been recorded in Maldivian waters, half of which have been sighted for the first time in the last 10 years.
- Little emphasis has been placed on the collection of data from shark fisheries in the Maldives as the main data collection has focused on tuna fishing). Shark catch data from oceanic and reef shark fisheries were grouped together into a ‘Reef Fish’ category of the Basic Fisheries Statistics published annually.
- Nevertheless, through information from resource users, historical information, export data and a consideration of their biology, it was deduced that shark stocks were in significant decline in the Maldives – especially (and most obviously) the collapsed gulper shark fishery. There was also great concern for the significant depletion of other, reef associated sharks.

Current management measures

- The above-mentioned ban on fishing, extracting, capturing and harming any shark species from the entire EEZ of the Maldives effective from March 2010;
- Prohibited exports of products from rays and skates;
- Ban on fishing, extracting, capturing and harming any rays and skates from the Maldives effective from June 2014;
- Oceanic White tip sharks are not to be retained and to be released unharmed, to the extent practicable;
- To minimize shark bycatch in the tuna longline fishery, a regulation has set the minimum depth for the mainline to be deployed at or below 60m;
- Dead shark bycatch is to be brought onboard and landed with fins attached and reported to a fisheries enforcement officer or a fisheries observer (however, because of a lack of onboard surveillance, dead sharks are likely to be discarded at sea);
- For tuna longlining from 100nm outwards, licenses have to be obtained from the Ministry of Fisheries and Agriculture; and
- There is a newly introduced quota system for tuna longlining vessels.

Proposed new management measures

(these come complete with associated timelines and responsible agencies)

- Socio-economic impact mitigation of the ban
 - Carry out a socio-economic study of the impact of the ban on shark fishermen and, based on the results, undertake a formal analysis of alternative activities and options, and conduct livelihood diversification programmes for former shark fishermen; and
 - Devise a plan to strengthen the existing Shark Trust Fund and ensure support from the tourism sector to raise funding for livelihood diversification programmes and to raise awareness among the public and resource users on shark conservation and the need for management.
- Data Collection and Handling
 - Adopt a mechanism to validate shark bycatch data from commercial longliners in the EEZ before leaving Maldivian waters through an observer programme;
 - Develop or adapt a shark species identification guide in English and the local language and make sure that all user groups get a copy;
 - Train and assign fisheries observers, for the commercial longliners, tuna handlining and pole and line vessels, to collect species-specific bycatch data on sharks, and to monitor discards in non-directed shark fisheries;
 - Analyze data on imports and exports for shark products; and
 - Carry out regular shark taxonomy training for fishermen, Coastguard and Customs Services.
- Research and Development
 - Carry out annual assessments to evaluate the effectiveness of shark management and conservation measures on reef-associated shark species;
 - Promote citizen science in assessing reef-associated sharks;
 - Disseminate the findings of the assessments through workshops and seminars to relevant stakeholders; and

- Evaluate methodologies and initiate research, where possible, to assess the impact of shark management and conservation measures on ecosystem structure and function.
- Education and Raising Awareness
 - Design and introduce educational materials aimed at all stakeholders including the general public, the tourism and tuna industries, to raise awareness about the vulnerability of targeted species and their role in marine ecosystems, current threats, status and management decisions;
 - Raise awareness among relevant stakeholders about the rationale for the use of shark bycatch data;
 - Develop awareness among resource users on (a) penalties and provisions in the Fisheries act, (b) fisheries regulations and the rationale and need for the shark ban and (c) reporting mechanisms on illegal activities;
 - Improve coordination, consultation and monitoring of the ban;
 - Identify human resource capacity gaps in research and management divisions of government departments, and identify other capacity needs for the effective implementation of the NPOA;
 - Develop a regular consultation mechanism to seek advice from resource users, officials from the tuna and tourism industries, and the Maldives National Defence Force on the implementation of the NPOA-Sharks;
 - Actively promote the implementation of the NPOA-Sharks;
 - Legislate required actions against the trade, import and export of shark products;
 - Develop protocols whereby data can be shared between relevant stakeholders, (link to Wetlands Conservation and Coral Reef Monitoring for Adaptation to Climate Change protocols); and
 - Review on regular basis, the effectiveness of the shark ban and the implementation of the NPOA-Sharks.

International collaboration

- Actively participate in the management and research of shark species by relevant RFMOs (including the current initiative to develop a RPOA-Sharks for the bay of Bengal);
- Actively participate in other international projects and forums on the conservation and management of sharks;
- Actively participate in meeting the obligations of CITES
- Utilize international agreements and promote the IPOA-Sharks, undertake cooperative research, stock assessments, and participate in initiatives to conserve transboundary, highly migratory and straddling shark stocks
- Disseminate shark bycatch assessments regularly to relevant RFMOs
- Seek international assistance in capacity strengthening for the effective implementation of the NPOA-Sharks

Monitoring and Review

- It is the responsibility of the Maldives Fisheries Management Department (MFMD) to undertake annual reviews on the progress of the NPOA-Sharks and provide recommendations for its effective coordination and implementation; and
- The implementation of each management measure in this NPOA-Sharks would be an output of the NPOA-Sharks. The success of their implementation will be evaluated based on the extent to which these outputs have been achieved. However, the main determining outcome of the NPOA-Sharks will be the restoration of depleted shark stocks to sustainable levels.

Sri Lanka

The Sri Lankan NPOA is a very clear, logical and well-constructed document that provides an excellent explanation of the background, history and current status of shark fishing in Sri Lanka, current and future measures for the conservation and management of sharks and a clear, prioritized list of actions for the implementation of measures, complete with responsibilities and timelines. It adheres to FAO's IPOA and FAO's guidelines on how to develop an NPOA and provides an excellent template for other countries and regions to follow when developing NPOAs-Sharks. The following is a summary.

Background and history

- Outlines the purpose of the document and the international agreements that led to its development.
- Approx. 60 shark species belonging to 5 orders and 17 families have been reported in landings in Sri Lanka;
- Sharks have been exploited for the past 40 – 50 years by offshore fishing vessels using long-lines. At present long-lines are operated at very small levels with the majority of sharks landed as bycatch from the offshore tuna long-line fishery and the gillnet fishery. A targeted spiny dogfish fishery and a skate and ray fishery also occur. A targeted thresher shark fishery existed until the capture of thresher sharks was prohibited in 2012. The NPOA provides significant detail about the history and status of each of these fisheries.
- Sri Lanka has experienced a steep decline in shark production since 1999.
- Sharks that are caught are generally not discarded. They are used both for local consumption of fresh and dried meat and extraction of fins, liver oil, skin, jaws and teeth for export.
- Eco-tourism activities are rapidly expanding in Sri Lanka. Whales, dolphins, flying fish, turtles, manta rays and whale sharks can be seen a few miles off Mirissa in the south coast and have become a strong lure for tourists. At present more than 10 companies are operating whale watching tours from the Mirissa harbour from November to April.

Legal and administrative processes

The NPOA describes the legal and administrative fisheries framework, legislations, responsible agencies, current and proposed regulations and associated penalties in Sri Lanka, noting that the Fisheries and Aquatic Resources Act, No. 2 of 1996 and the Fisheries (Regulation of Foreign Fishing Boats) Act, No. 59 of 1979 are the main instruments used to manage sharks in Sri Lanka. Both are administered by the Department of Fisheries and Aquatic Resources.

Vision

The vision is “The effective conservation and management of sharks to ensure their optimal, long-term, sustainable use for the benefit of all Sri Lankans of both present and future generations” and the following objectives are to achieve this vision:

- Ensure that shark catches from directed and non-directed fisheries are sustainable;
- Assess threats to shark populations, determine and protect critical habitats and implement harvesting strategies consistent with the principles of biological sustainability and rational long-term economic use;
- Identify and provide special attention in particular, to vulnerable or threatened shark stocks;
- Contribute to the protection of biodiversity and ecosystem structure and function;
- Improve and develop frameworks for establishing and coordinating effective consultation involving all stakeholders in research, management and educational initiatives within and between States;
- Minimize unutilized incidental catches of sharks;
- Minimize waste and discards from shark catches in accordance with the Code of Conduct for Responsible Fisheries (for example, requiring the retention of sharks from which fins are removed);
- Encourage full use of dead sharks;
- Facilitate improved species-specific catch and landings data and monitoring of shark catches; and
- Facilitate the identification and reporting of species-specific biological and trade data.

Key Issues

Through various stakeholder consultation workshops, key issues concerning the conservation and management of sharks were identified and prioritized through a risk assessment process.

- Ecological issues were:
 - Declining catches of the major shark species;
 - Catches of the prohibited species (thresher sharks) by fishing gear targeting other species;
 - Destruction of corals and skate grounds due to use of harmful gear such as trammel nets and bottom set gill nets (this was ranked as a high priority); and
 - Movements of boats used for ecotourism causing disturbances to whale sharks.
- Socioeconomic issues were:
 - Loss of employment of fishers engaged in directed coastal thresher shark fishing due to the ban (ranked as a high priority);
 - Negative impacts of the thresher shark ban on the production of, and trade in, dried fish affecting those involved in those activities;
 - Loss of income to fin traders due to the decline in demand for shark fins in the international market and the ban on thresher shark;
 - Decline in the number of people engaged in the shark oil industry due to the high cost of production;
 - Decline of incomes from fishing and dry fish production; and
 - Poor post-harvest handling that reduces the value of shark products.
- Governance issues included various institutional issues (legal frameworks; compliance issues; data and reporting about catch, discards, landing, effort and

trade; life history information about sharks and related habitats; and research capacity) and consultation mechanisms.

Current management measures

- Ban on the practice of shark finning (slicing off fins of sharks caught) onboard fishing vessels and discarding the carcasses at sea. There is also a required 5% fin-to-body weight ratio for sharks on board vessels; and
- Prohibit the capture of thresher sharks; and
- Sri Lanka also has a number of marine parks and sanctuaries which provide some protection to coastal sharks.

New initiatives

The NPOA developed indicators, benchmarks and performance measures for the high priority objectives and, in the most important part of the NPOA, provides a Table that, for each priority area, provides a list of tasks to be done within the 4 years of the Plan, the agency responsible, the relative priority assigned to it and the timeframe in which it is to be achieved. In summary, to achieve:

- Improvement in data acquisition and reporting (for catch, effort, discards, landings and trade), the tasks are:
 - Develop a shark identification guide, handouts and posters;
 - Expand the ongoing data collection scheme to cover coastal sharks;
 - Design logbooks for reporting shark catches and issue to fishing boats;
 - Develop and implement a methodology to obtain data from small boats for which logbooks are not mandatory;
 - Enforce Fish Catch Data Collection Regulations to ensure that fishing vessels of 32 feet and over provide required data;
 - Implement an observer programme;
 - Update export/import trade data in terms of quantity and value by product type and form; and
 - Conduct a socio-economic survey to assess the number of fishers and traders engaged in shark fishing and trade.
- Strengthening of data acquisition on biology and habitats, the tasks are:
 - Conduct research surveys and observer programmes to compile information on stock structure, abundance, life history and reproduction rates of commercially important species and protected species, and identify critical shark habitats and threats to those habitats;
- Effective conservation and management, the tasks are:
 - Make regulations for controlling the international trade of CITES listed shark species;
 - Monitor catches/conduct further studies on endangered and threatened species listed under CITES;
 - Introduce spatial and/or temporal closures at localities identified based on the above improved data;
 - Set standards for boats used for ecotourism;

- Prepare whale-shark guidelines to help regulate interactions with them;
- Introduce by-catch reduction devices (BRD) for protected shark species such as thresher sharks;
- Introduce techniques for the live release of prohibited shark species incidentally caught in fishing gear;
- Review the existing regulatory framework to assess whether the current management arrangements for sharks are enforceable and consistent with the ecologically sustainable use of sharks in terms of the objectives and actions of the NPOA and introduce amendments accordingly;
- Make regulations for the protection of whale shark which is of importance for ecotourism;
- Establish closed areas where concentrations of threatened or vulnerable species e.g. thresher sharks are located either at certain times of year or permitting the use of gear that does not take by-catch of these species;
- Improved consultation, the tasks are:
 - Develop and establish a council consisting of representatives from universities, NARA, DFAR, MFARD, IUCN, Sri Lanka Fisheries Federation and Fishing Industry for effective coordination among, and consultation with, all stakeholders (management, research, industry, trade, etc.);
- Strengthening Enforcement/Compliance, the tasks are:
 - Enhance implementation of the Sri Lanka National Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (SLNPOA – IUU) by, among others, establishing an efficient VMS and an observer programme, strengthening the port inspection scheme, and encouraging informants to give information on unlawful fishing activities;
- Measures to address socioeconomic issues, the tasks are:
 - Direct fishers affected by the Prohibition of Catching Thresher Shark Regulations to alternative livelihood programmes or alternative income generating activities;
 - Implement programmes to improve the quality of products (meat, skin, oil, cartilage etc.);
- Capacity building, the tasks are:
 - Provide researchers with opportunities through national, regional and international training to build their capabilities on shark fisheries;
- Improved communication and awareness, the tasks are:
 - Develop and implement a comprehensive education and awareness-building strategy comprising different media and materials and targeting different stakeholders as follows:
 - For fishers: the importance and need for conservation and management of shark resources;
 - For all stakeholders: the current regulations concerning conservation and management of sharks;
 - For officers of DFAR, Sri Lanka Customs, Navy and Coast Guard, Ceylon Fishery Harbours Corporation and boat operators: the identification of different shark species;

- For boat operators: the importance of shark catch data for management of shark fisheries and recording catch data in logbooks with GPS positions;
- For boat operators, fishers, fish collectors and traders: post-harvest technology for quality improvement of shark products;
- For boat owners and operators: Whale Shark Guidelines;
- For all stakeholders: highlighting the main elements and recommendations of this NPOA.

International collaboration

The NPOA notes the importance of international cooperation for the implementation of any NPOA for sharks because the same shark stock often occurs within the EEZs of several countries.

- Establish cooperative research, stock assessments, conservation and management initiatives for trans-boundary, straddling, highly migratory and high-seas shark stocks and promote the current initiative to develop a RPOA – Sharks for the bay of Bengal;
- Promptly analyse data and publish results in a timely manner, in an understandable format, and make the reports available for peer review, and
- Seek international assistance and resources to enhance national capacities to further develop and implement the NPOA – Sharks.

Implementation, monitoring and evaluation

- A coordinating committee comprising representatives of the respective organizations under the Chair of the Director General of the DFAR is to be established to review the progress of this NPOA and, where necessary, to make adjustments to improve its effectiveness. It will meet every six months
- Sri Lanka's NPOA – Sharks is intended to have an initial duration of four years (2014 - 2017) and focus on establishing the capacity, systems and databases required for the ongoing conservation and management of sharks, while managing fishing effort on the targeted and non-targeted shark fisheries.
- Upon the conclusion of the first 4 year period, the overall progress and the impacts of implementation will be evaluated against the Plan's goals, objectives and performance indicators with a view to revising the NPOA – Sharks.
- Several actions of the NPOA have already been initiated including:
 - The provision of training for shark data collection and species identification;
 - The development of educational and awareness materials on sharks (posters, leaflets and identification sheets);
 - Awareness building among stakeholders
 - Upgrading databases to enable the incorporation of more information on shark landings with regard to species, quantity and value of landings, size composition, fishing areas, fishing methods etc; and
 - Eliminating or at least minimizing IOTC non-compliance issues.

Thailand

The Thai NPOA-Sharks summarizes the current situation with respect to shark conservation and management in Thailand, which basically concerns the protection of whale sharks.

A useful table summarizing the NPOA is provided that contains activities, target groups, timelines and responsible agencies under the objectives of better data collection, research needs, human resources development, information sharing and studies on the full utilization of landed sharks.

Like many of the NPOAs Sharks for the Bay of Bengal region, the Thai NPOA concentrates on the above actions to improve monitoring, research, shark identifications, training, awareness programs and data-sharing processes, with relatively less on specific future management measures to conserve sharks. The following is a summary.

Background

- In Thailand, sharks and rays are caught by a few fishing gears in quite low numbers, accounting for less than 0.5% of total fish catch.
- They are not considered target species but are regarded as by-catch.
- Otter trawlers catch the most (85.66% of total shark catch) and pair trawlers catch 11.71%. The fishing season for these methods is all year round. The other fishing gears (that catch far fewer sharks) include purse seiners, longliners and gill netters.
- There are 39 species in 12 families of sharks found in Thailand, 14 species in the Gulf of Thailand and 37 species in the Andaman Sea. The most common are Bamboo shark (*Chiloscyllium punctatum* and *C. griseum*) and Spot-tail shark (*Carcharhinus sorrah*).
- There are 41 species of rays in 10 families, 16 species found in the Gulf of Thailand and 40 species in the Andaman Sea. The most common are Sharpnose stingray (*Dasyatis zugei*), Whitespotted whipray (*Himantura gerrardi*), Scaly whipray (*H. imbricata*), Dwarf whipray (*H. walga*) and Bluespotted stingray (*Neotrygon kuhlii*).
- The most common sharks sold are Bamboo and Blacktip sharks with their prices at landing varying between 20-80 Baht/kilogram depending on size and freshness.
- Many products come from sharks and rays in Thailand including: flesh for consumption, dried shark fin, marinated dried meat, salted and smoked fish and fish balls, shark liver for oil and beauty products, fish meal for use in shrimp aquaculture, teeth and jaws sold in souvenir shops and as jewellery, leather products from the skin and the taxidermy of stuffed sharks.
- Exports and imports of shark products from (and into) Thailand include: fresh, refrigerated and frozen dogfish, dried shark fin or shark fin in salted water or smoked, canned shark fin and instant shark fin soup.

Main Issues

- Catches of sharks in Thailand have decreased markedly over the past decade. In 2003, catches of sharks and rays was a record 14,409 and 18,131 metric tons

respectively, but in 2014 there were only 1,424 and 3,376 metric tons caught – a decrease of 80% during the past decade.

- This decline is of great concern and is blamed on fishing animals with a biology that is characterized by low reproduction, slow growth, advanced ages of maturity, long gestation periods and low fecundity.
- Results from Surplus Production Modelling using catch data and standardized fishing effort showed that the maximum sustainable yield of sharks in the Gulf of Thailand is 2,018 metric tons with a fishing effort of 960×10^3 hours and, for the Andaman Sea is 864 tons per year with a fishing effort of 185×10^3 hours.
- Catches have long since surpassed these maximum sustainable yields.

Current management measures

- There are several laws in Thailand that have direct and indirect effects on shark conservation and management. Of particular relevance to the NPOA are those concerning the protection of whale sharks (*Rhincodon typus*) and include:
 - The Wildlife Preservation and Protection Act (1992)
 - Ministerial Order on determining protected wildlife species (2003)
 - The Natural Resources and Environment Ministerial Notification on determining wild animals and wild animal remains prohibited for import or export (2011) and
 - The Fisheries Department Rule on application and certification of species not listed in CITES (2004).
- At present, therefore, management measures for sharks in Thailand almost solely involve the prohibition of whale shark fishing.
- In addition, however, four more shark and one ray species were requested to be listed in the CITES Appendix, the Oceanic whitetip shark (*Carcharhinus longimanus*), Hammerhead shark (*Sphyrna lewini*, *S. mokarran*, *S. zygaena*), and Manta ray (*Manta* spp.), which became effective on 14 September 2014.
- There are a host of spatial and temporal closures, marine reserves and restrictions on particular methods which, whilst not specifically focused on the protection of sharks, should lead to significant decreases in catches. These include:
 - no trawl areas inside 3,000 meters,
 - seasonal bay closures in the Gulf of Thailand and Andaman Sea
 - and 22 marine national parks covering an area of 6,166.93 km².
- There are also certain shark conservation activities, including the breeding and release of Bamboo sharks and blacktip sharks coordinated by Department of Fisheries and other public and private agencies.

Research

There are several data collection activities underway in Thailand including:

- The monitoring of sharks and rays to family or species level conducted at landing ports and private piers by the Fish Marketing Organisation; and
- Annual monitoring of fishery resources using a survey vessel by the Department of Fisheries.

Proposed new work includes:

- Determining data collection and analyses for sharks concerning their biology, fishery and usage from primary and secondary sources. These include:
 - Biological data on species, size at maturity, distribution and abundance, etc.
 - Fishery data on catches, effort, fishing grounds, etc.
 - Utilization data on the types, quantity and value of products, throughout the whole production chain including marketing channels.
- Research on toxic contamination in shark meat for consumption.
- Taxonomic work and DNA data collection to enable export certification.
- Aquaculture development for conservation and trade.
- Creating a website for divers and the public to report sightings of sharks and rays during diving, travelling and/or around local markets.
- Research by government with fishers and NGOs to develop fishing methods and gears that selectively catch target species and exclude sharks.

Communication and Capacity Building

Workshops are currently conducted on the identification of sharks and rays for field data collectors/officers. Furthermore, publications and materials on shark and ray conservation, such as posters and plastic slates are prepared:

It is proposed to expand this by the following initiatives:

- To train officers both inside and outside the Department of Fisheries (ie. from Marine Fisheries Research and Development Bureau, Bureau of Fisheries Administration and Management, Fishery Technological Development Division, Fish Inspection and Quality Control Division) and others.
- To produce a handbook for field identification.
- Exchange information and brainstorm with stakeholders both inside and outside Thailand.
- To organize academic seminars / workshops / exchange for a.
- To produce materials for distribution to raise awareness and understanding for better cooperation in shark conservation efforts.

International collaboration

- Cooperate with international organizations, i.e. FAO, CITES, BOBLME, IOTC, and SEAFDEC by regularly participating in meetings to discuss and develop regional conservation guidelines for sharks and rays.
- The government sector should promote international collaborations on research regarding selective fishing gears and responsible fisheries by gathering information, disseminating the results, and transferring technology to fishermen.

Myanmar

Whilst Myanmar has not formally provided an approved NPOA for Sharks, the document entitled “Guide to the Development of Myanmar’s National Plan of Action for the Conservation and Management of Sharks” by DoF/BOBLME/FFI (2015) provides a platform from which an NPOA should be able to be developed in the near future. The document describes the history and background to shark fishing and trade in Myanmar, current measures to manage shark exploitation and supplies a description of how an NPOA Sharks for Myanmar could be developed and implemented.

Background and history

- It is estimated that there may be 58 sharks and 71 ray species in Myanmar waters, with 24 sharks and 14 rays actually caught and consumed.
- The most commonly caught species is the spadenose shark, *Scoliodon laticaudus*, (64% of the catch), followed by scalloped hammerhead shark, *Sphyrna lewini* and grey bamboo shark, *Chiloscyllium griseum*. For rays, the most commonly caught species was the dwarf whiptail, *Himantura walga*, (95% of the catch), followed by whitenose whiptail, *Himantura uarnacoides*.
- Before 2008 (when a shark fishing ban was introduced - see below), fishers report using pelagic longlines varying from 200-1000 hooks/line and up to 3km long to target ‘big-sized sharks’.
- Since the ban on shark fishing, most fishers have switched to gillnetting other species with some longlining, bottom trawling, grouper trapping, drift netting and gill netting also occurring. Fishers state that sharks are caught accidentally as bycatch with most being juveniles, although all sizes of rays are hooked.
- Most targeted shark fishing is conducted by fishers using longlines out of Myeik using hooks designed specifically for sharks.
- In some locations, dynamite is used as an indirect form of targeting sharks by luring them to an area that has been recently bombed as they became attracted to the dead fish. The sharks are then caught using hook and line.
- Rays are caught in similar ways to sharks using drift or stationary nets, but also by fish and shrimp trawlers as by-catch. For larger species of rays, longlines are used. In Ayeyarwady fishers have started targeting manta and mobula rays using 18 inch mesh size gillnets.
- Sharks and rays caught in Myanmar are utilised in a variety of ways including: as fresh, dried and salted meat, dried shark fins, gill rakers and skin. Small-sized sharks and rays caught as by-catch are consumed by crews and their families, while those catching larger sharks process them at sea to avoid detection before offloading them at unknown markets. Traders indicate that dried ray skin and fins are being sent to China through Thailand. The skin of some ray species are valued as quality leather and shark’s teeth and jaws are used for the curio trade. The fins of shark and gill rakers of manta and mobula rays are highly valued as gourmet food and Chinese medicine.
- Several scientific surveys and other studies have provided information on the past and current status of shark populations:
 - Surveys by the research vessel Dr Fridtjof Nansen found a 50% decrease in both shark and ray catches.

- A PhD study between 2006 and 2010 showed a marked decrease in landings of sharks (by 49%) and rays (by 48%).
- However, catch data gathered by Department of Fisheries officers from select landing sites in each district indicate a slight increase in landings.
- Socio-economic surveys done in 2014 of two island communities revealed that over 50% of household heads reported a decline in shark and ray catch trends over the past 5 years.
- In 2013 dive tourism interviews reported a decline in shark sightings during dives. Further, tourists returning from dives noticed the rarity of sharks in the area.

Current management measures

- There is a reported nationwide ban on shark fishing dating back to 2008. This was a declaration by the Department of Fisheries calling an end to shark fishing.
- With respect to the IUCN status for sharks in Myanmar, two are listed as Critically Endangered (*Glyphis gangeticus* and *Glyphis siamensis*) and two as Endangered (*Sphyrna lewini* and *Sphyrna mokarran*). A further nine sharks are listed as Vulnerable and 21 Near Threatened. For rays, two species are listed as Critically Endangered (*Pristis pectinata* and *Pristis pristis*, both sawfishes) and five species as Endangered (*Aetobatus flagellum*, *Aetomylaeus maculatus*, *Aetomylaeus vespertilio*, *Anoxypristis cuspidata* and *Pastinachus solocirostris*); with 18 listed as Vulnerable and nine Near Threatened.
- With regards to CITES regulations, one shark is listed in Appendix I (*Rhincodon typus*) and three in Appendix II (*Sphyrna lewini*, *Sphyrna mokarran* and *Sphyrna zygaena*). For rays there are three in Appendix I (*Anoxypristis cuspidata*, *Pristis pectinata* and *Pristis pristis*) and one in Appendix II (*Manta birostris*).
- In Myanmar two other pieces of legislation specifically target the conservation/management of sharks:
 - *Notification 2/2001* which prohibits the capture and sale of Whale shark (*Rhincodon typus*); and
 - *Notification 2/2004* which outlines the creation of two shark reserves within the Myeik Archipelago in which targeting of sharks is prohibited (not including rays).

Main Issues

- Although several laws have been put in place in Myanmar that deal with shark conservation, the actual application of these laws and the management of fisheries related to sharks has been minimal.
- It particular, there is a need to clarify the existence of, and relative compliance with, the reported 2008 shark ban.
- There is also some doubt concerning the effectiveness of the 2 shark reserves established in the Myeik Archipelago (see below).

- Further, given the 2008 shark ban, there is also a question as to the need for the above reserves.
- The Myanmar Marine Fisheries Law 1990 regulates fishing effort by quotas and seasonally but does not include specific regulations for shark fisheries.
- Important information for fisheries management such as landings data and the status of shark resources is minimal - following the 2008 ban, catch data is no longer collected, compromising the ability to track and monitor shark catches.
- There is a lack of understanding of the biodiversity, biology and ecology of sharks and rays in Myanmar - especially their population dynamics, critical habitat requirements and conservation needs.
- Lack of information on critical habitats including breeding and nursery grounds in which to focus compliance activities.
- No requirements regarding the catch-and-release of by-catch.
- Lack of enforcement in applying the law due to an absence of resources for the Division of Fisheries (DoF) to undertake on-water patrols including boat inspections.

Developing the NPOA Sharks

It is proposed that the overall goal of Myanmar's National Plan of Action for Sharks is:

- to ensure the conservation and management of sharks and rays and their sustainable use.

This is to be done via the following series of objectives:

- ensure sustainable use of sharks and rays;
- assess threats to populations of sharks and rays and provide special attention to threatened stocks of sharks and rays;
- minimize unutilized incidental catches of sharks and rays;
- minimize waste and discards from catches of sharks and rays;
- encourage the full use of dead sharks;
- facilitate the identification and reporting of species-specific biological and trade data;
- facilitate the collection of improved species-specific catch and landings data; and
- develop a framework for establishing research, management and educational initiatives concerning sharks and rays.

Data Collection

The NPOA Sharks for Myanmar requires:

- Assessments of the resource status of sharks should be done on a continuous basis using:
 - data collected by DoF staff trained in shark taxonomy (see capacity development below) who would collect catch data at landing sites and/or markets on the species landed, including sizes and abundances, landing site data, etc.; and

- fishery independent scientific survey data.
- Specific monitoring of whale shark populations should also been undertaken through collaboration with dive operators, in which tourist photos showing distinct patterning or scarring can be uploaded to websites such as EcoOcean for use in mark-recapture analysis.
- There is a need for multinational surveys targeted on deep-water and oceanic species.
- Detailed information on marketing and trading routes by accessing traders and middle men in Myanmar and in places like Ranong and Thailand; and marketing routes from landing sites to Yangon and across international borders.
- Socio-economic surveys coupled with assessments specific to sharks need to be done on a regular basis in order to monitor the socio-economic importance of sharks, the demographic profile of shark fishers and systems in places which process shark products.

Research

- Improve and develop knowledge on the taxonomy, biology and ecology of elasmobranch resources in collaboration with SEAFDEC/MFRDMD to assist with the determination of stock status.
- Creation of a national collection of sharks and rays.
- Identification of natural habitats for breeding and nursery grounds of sharks and rays for conservation and protection.

Communication and capacity building

- Courses are required to ensure all DoF officers who work at landing sites and checkpoints have received training like the shark identification training conducted by SEAFDEC/MFRDMD in 2014/2015.
- Participate in seminars, meetings and courses related to elasmobranchs at national, regional and international levels.
- Although many fishers and traders are aware of the ban on shark fishing and do not target them, they still keep and sell sharks as bycatch, many of which are juveniles. This indicates a need for the DoF and NGO partners to implement an awareness campaign educating people on why sharks are protected, why fisheries need to be sustainable as a whole and the basic elements of marine conservation.

Future Management Measures

- All current management measures require a review or strategies developed to ensure that they are not just paper plans but lead to real improvements in stocks.
- The 2008 nationwide ban on shark fishing needs to be strengthened into a more formal legal document such as a notification. Importantly this document also needs to address the issue of bycatch and catches of immature sharks.

- The marine reserves in Myanmar underwent an analysis which found them to be underperforming but, most importantly, redundant given the nationwide ban (i.e. whether inside or outside the reserve, fishers cannot target sharks). The review proposed two possible actions:
 - Cancellation of *Notification 2/2004*: given there is a country-wide ban on fishing of sharks anyway, the premise for the reserves is now redundant; and/or
 - Identify core zones in the reserves and establish them as full MPAs: given the extent of the reserves and lack of resources to monitor such large areas, the identification of key areas of biodiversity within the reserves could be designated as no-take zones in which all fishing is banned. This would include shark breeding and nursery grounds and could reduce the number of juvenile sharks caught as by-catch.
- Steps are underway to develop the co-management of marine resources with local communities to ensure suitable use. Such efforts could lead to more sustainable fisheries in general and lead to enhanced environmental awareness and responsibility, particularly for the conservation of sharks.
- Active enforcement at sea, landing sites and markets is needed, with a focus on illegal targeting of sharks at sea and selling of protected shark species.
- Finally, any future NPOA requires adequate monitoring and evaluation of its implementation and the provision of regular progress reports.

National/International/Regional cooperation

- Stronger inter-governmental cooperation between the DoF and Myanmar's Navy is needed to monitor fishing vessels at sea and their catch.
- Cooperation is needed with Thailand, in which many of Myanmar's sharks are sold. Although shark fishing and trade is legal in Thailand, agreements need to be made between the two countries in terms of what markets in Thailand can buy from Myanmar fishers.
- Although Myanmar has banned foreign fishing vessels from operating in its waters since April 2014, there is still concern that Illegal, Unregulated and Unreported (IUU) fishing activities by foreign fleets will undermine the impacts of a NPOA Sharks.
- Myanmar should continue its cooperation with countries and programs involved with FAO (e.g. the BOBLME Strategic Action Program) and regional fisheries management organizations (e.g. SEAFDEC).

India

Whilst India has not formally provided an approved NPOA Sharks, the very comprehensive and polished document entitled “Guidance on National Plan of Action for Sharks in India” by CMFRI (2015) provides an excellent point from which an NPOA should be able to be developed in the near future. The document describes the history and background to shark fishing and trade in India, vulnerability aspects of the species involved, current measures to manage shark exploitation and supplies a detailed description of how an Indian NPOA Sharks should look, operate and be implemented.

Background and History

- India is the second most important shark fishing nation in the world (behind Indonesia), contributing around 9% of the world catch.
- Targeted shark fishing in India began to match increasing demand.
- This led to a shift from an artisanal coastal fishery towards an oceanic fishery employing drift gillnets and hooks & lines operated from mechanised craft.
- The gross value of sharks landed in the Indian maritime states in 2010 was 278 crores (or approx. 42 million USD). Shark fins are a significant export commodity (in 2011 approx 195 t were exported at a value of around USD 15 million) and are sent to Hong Kong, China and Singapore.
- 160 species of sharks are known to occur in India’s commercial fishing zone. Of these, 88 species are true sharks, 53 are rays and 19 are skates. Of these, 18 species are predominant in the fishery and 27 are commonly caught along the coast.
- Carcharhinidae formed 84.6% of the true sharks landed during 2007-2013. Out of about 31 species of requiem sharks, at least 21 species are regularly fished. Shark landings along the north-west coast of the country are dominated by the milk sharks *Rhizoprionodon oligolinx* and *R. acutus* and the spade-nose shark *Scoliodon laticaudus*. Landings along the southwest and south-east coast are dominated by requiem sharks of the genus *Carcharhinus*. Landings of thresher and mackerel sharks and the oceanic white tip shark *Carcharhinus longimanus* has been increasing in recent years, with increased operations in oceanic waters.
- Utilisation of sharks in India is mostly in the form of shark meat, with a good domestic market for fresh meat in the coastal states and in dried form in the southern states. Shark products and by-products include dried shark fins, fin rays, shark cartilage, shark liver oil and shark skin. Shark fins and rays are used for shark fin soup in south-east Asian countries. Shark skin is used for manufacturing leather products. Shark cartilage is marketed in capsule or tablet form in the pharmaceutical industry, particularly “Chondroitin”, to treat arthritis. Shark liver oils are used in medicines, cosmetics and lubricants. Shark teeth and jaws are sold as artefacts.
- On- board “shark finning” is not practiced in India.

Current management measures:

- In 2001 India included four species of sharks, two species of rays, one species of guitar fish and three species of sawfishes under Schedule I of the Indian Wildlife (Protection) Act, 1972. Exploitation and trade of these species have been banned and declared as punishable offences.
- In 2013, India prohibited the removal of shark fins on board a vessel in the sea, and advocates landing of the whole shark.
- India then supported trade regulations on species listed under CITES Appendix II in 2014.
- In February 2015, India prohibited the export and import of shark fins in India.
- India is a signatory party to IOTC Resolution 13/06/2013 which states that Oceanic whitetips are not to be retained and are to be released unharmed, to the extent practicable, when caught in association to IOTC regulated fisheries.
- Following the inclusion of five species of sharks and two species of manta rays in Appendix II of CITES in September 2014, steps have been initiated to consider conservatory measures for fishing and trade of four of the five shark species (oceanic white tip reef shark *Carcharhinus longimanus* and the hammer-head sharks *Sphyrna lewini*, *S. mokarran* and *S. zygaena*) and both the manta rays which are currently being commercially exploited from Indian waters.
- It was also decided that trade regulations would be effected by introducing a “minimum fin size” for legal export, subject to the “no finning” policy of the Government.
- The below table is Table 12 from CMFRI (2015) and describes the compliance status in India for implemented shark management measures.

Management Measure	Compliance Status	Remarks
Protection of 10 species under Schedule 1 of the Indian WPA, 1972 since 2001	Complied	No intentional fishery; however, incidental catches may occur.
IOTC resolution (2013) promoting release of oceanic whitetip caught in IOTC regulated fisheries	Compliance status not known	Fishery status in Indian waters is being studied
Prohibition of on-board finning of sharks vide MoEF (Wildlife Division) policy (2013)	Complied	Finning of sharks on board is not practised by Indian fishermen and sharks caught are landed whole.
Regulation of trade of fins and gill plates of sharks and manta rays listed under CITES Appendix II (2014)	Complied	Shark fin trade in India is being regulated. The available molecular tools to identify shark species from processed fins will be of use in regulating shark fin trade of CITES listed species till such time NDF studies are completed.
Prohibition of shark fin export and import by the Department of Commerce, Ministry of Commerce (2015)	Complied but needs re-consideration	Shark fin trade in India is being regulated. Since Indian fishermen do not practise onboard shark finning, complete prohibition of trade in shark fins may be re-evaluated and restricted to prohibition of trade in protected and listed species.

Main issues

- An initial rise in shark catches along the coast, followed by a subsequent and consistent decline in catches and catch rates in the last decade has raised serious concerns over shark resources and the long-term viability of the shark fishery in India.
- Falling trends in the contribution of sharks to total marine fish landings of India as well as the proportion of true sharks in total shark landings together indicate that, despite the extension of fishing grounds, the exploitation of oceanic waters and increases in the diversity of sharks caught, the catch is stagnating. Landings of several high-value carcharhinid sharks have also notably dwindled at some of the major fish landing centres like Chennai in recent years.
- The distribution of Indian sharks classified under IUCN categories indicates that 24% of the species in Indian waters are “Near Threatened”, 26% are “Vulnerable”, 24% are “Data Deficient”, 9% as “Not Evaluated” and 3% as “Critically Endangered”.
- Most of the sharks landed along the Indian coast, particularly the commercially important carcharhinid sharks, are in the length range below the size at maturity.
- Taxonomic issues need to be resolved before effective management can be achieved.
- Available catch and effort data for sharks and shark-like fishes are inadequate in most fisheries.
- Biological parameters of growth and reproduction have been estimated for some species, but other fundamental data such as fishing effort and species/sex/length/age composition of the catch required for stock assessment are not available for most species.
- The conservation status of most species is not known, particularly throughout the region. There is also a large gap in knowledge with respect to Biological Reference Points (BRP) and limit points for exploitation of even species that are of common occurrence in the fishery.
- Many species of sharks have low stock recruitment due to late sexual maturity and low fecundity and exhibit complex spatial structures (size and sex related aggregation; and seasonal breeding migrations).
- Widespread multispecies fisheries take a variety of species, all with different potential for sustainable use.
- There is a general lack of knowledge about critical habitats for most of the species.
- There is little coordination to collect information on trans-boundary species due to lack of responsibility for these stocks, particularly in international waters.

Developing the NPOA Sharks

CMFRI (2015) describe a model and way forward for developing and implementing an NPOA Sharks for India which should have, as its starting and core objective:

- to ensure conservation and management of sharks and their long-term sustainable use through active stakeholder support and participation.

Several overarching points are made with regard to developing the NPOA:

- The term 'shark' should be taken to include sharks, skates and rays.
- The Government of India and all maritime states have to participate in shark management with support from research institutions, stakeholders and NGOs.
- Management and conservation strategies should aim to keep fishing mortality for each stock within sustainable levels by applying a precautionary approach. Standing stock biomass estimates and potential yield estimates have to be revalidated for all shark species in Indian waters and limit points have to be set for sustainable exploitation.
- Management and conservation objectives and strategies should recognize that shark catches are a traditional and important source of food, employment and income. Such catches should be managed on a sustainable basis to provide a continued source of food, employment and income to local communities. Where management is directed towards ban on fishing of certain species, strategies should be evolved to develop alternate source of livelihood for artisanal fishermen who are directly impacted by a loss of income due to the ban.

Databases

- Strengthen databases on:
 - the fishery biology of sharks,
 - stock abundance,
 - utilization,
 - market channels & trade, and
 - socio-economics of stakeholder groups.

Research

- Undertake coordinated, need-specific research and development on shark fishery assessment & management,
- Do repeatable shark resource surveys,
- develop identification guides,
- develop a shark museum,
- do the science needed to inform risk assessments,
- research to reduce shark by-catch,
- shark taxonomy & biology for the validation of conservation status,
- research to inform Minimum Size Limits,
- assess ecosystem impacts,
- Develop and use molecular identification techniques to regulate trade in protected species. An example concerns the recent use of genetic information in a 2008 a criminal case concerning illegally caught whale shark flesh.

Education and Outreach

- Initiate focused education/awareness programs towards capacity building for efficient participatory management

Institutional arrangements

- Improve coordination and consultation between management, research and stakeholder groups

Improving management measures

- Review and assess existing conservation and management measures
- Implement improved strategies, noting that future management measures will need to account for spatio-temporal distributions of exploited shark populations. That is, targeted species or those that dominate in the commercial fishery will have to be managed differently from stocks which are of moderate or rare occurrence and are more prevalent in deeper or oceanic waters. From the frequency of occurrence of sharks in different gears along the Indian coast, it is clear that:
 - pelagic longlines and gill nets (drift and bottom set) require management strategies to restrict the capture of undersized and threatened or vulnerable species.
 - whilst trawl nets, which are currently exploiting smaller species of least concern like *Rhizoprionodon spp.* and the near threatened species *Scoliodon laticaudus*, will need to consider fishing zones and cod-end mesh sizes.

Implementation and review

- The Indian NPOA Sharks should be developed to effectively implement all the above; and
- Review the impact of this implementation on:
 - the status of shark stocks and fishery in Indian waters particularly for protected/endangered species,
 - trade in shark & shark by-products,
 - implications on stakeholders and
 - the status of transboundary stocks and regional assessments of shark populations

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