National Plan of Action (NPOA)

Conservation and Management of

Sharks and Rays

2016-2020

Ministry of Marine Affairs and Fisheries – Republic of Indonesia

NATIONAL PLAN OF ACTION (NPOA)
Conservation and Management of Sharks and Rays

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Acronyms

BalitbangKP	Badan Penelitian dan Pengembangan kelautan dan Perikanan (Marine and Fisheries Research and Development Agency, MMAF)
BPSDMKP	Badan Pengembangan Sumber Daya Manusia (Human Resource Development Agency, MMAF)
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CITES	Convention on International Trade in Endangered Species
DJPT	Direktorat Jendral Perikanan Tangkap (Directorate General of Capture Fisheries)
ERS	Ecologically Related Species
FAO	Food and Agriculture Organization
FMA	Fisheries Management Area
IOTC	Indian Ocean Tuna Commission
IPOA	International Plan of Action
IUCN	International Union for Conservation ofNature
KKHL	Konservasi dan Keanekaragaman Hayati Laut (Directorate of Conservation and Marine Biodiversity)
MMAF	Ministry of Marine Affairs and Fisheries
NPOA	National Plan of Action
PRL	Pengelolaan Ruang Laut (Directorate General of Marine Spatial Management, MMAF)
PSDKP	Direktorat Jendral Pengawasan Sumber Daya Kelautan dan Perikanan, KKP (Directorate General of Marine and Fisheries Resources Surveillance, MMAF)
RFMO	Regional Fisheries Management Organization
SDI	Direktorat Sumber Daya Ikan (Directorate of Fish Resources)
SEAFDEC	Southeast Asean Fisheries Development Centre
SIPI	Surat Ijin Penangkapan Ikan (Fishing Permit)
UN	United Nations
WCPFC	Western and Central Pacific Fisheries Commission
WCS	Wildlife Conservation Society
WG	Working Group
WWF	World Wildlife Fund for Nature

Foreword

Sharks and rays are part renewable resources. If sharks and rays are fished wisely and not exceeding the total allowable catch, these resources will be sustainable. Today's global utilization of sharks and rays have reached a concerning rate; the high demand of sharks and rays fins have led to signs of overexploitation in many countries, including Indonesia. From economic perspective, the high price of sharks fin and rays will give financial benefit to fisher communities and income to the country. However, fishing activities that exceed the rate of recovery and done in ways that are not environmentally friendly have become serious threats to the sustainability of sharks and rays in many countries, including Indonesia.

The characteristics of sharks and rays fisheries are unique; around 70% of sharks and rays production came from bycatch from various fishing gears such as handline, longline and gillnet, trawl, and purse seine. A specific fishing gear to catch sharks is sharks longline, while guitarfish is caught using liong bun net. Issues on shark finning in Indonesia arose earlier, however now all parts of the shark are utilized. Not only its fin, the meat, bone, skin and liver are also used for various products.

The concern over sharks and rays extinction and its declining population in many countries have raised international concern. In 2013, the Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES) has listed 5 (five) shark species and 2 (two) manta ray species in its Appendix II, which means that the international trade of those species must be controlled strictly according to CITES regulation.

Shark fishery is also related to tuna fishery. Almost inevitable to avoid sharks bycatch in tuna fisheries since they share the same habitat and food. Together with its stakeholders, many innovations have been done by Indonesian government to reduce shark bycatch in tuna fishery; several regulations related to capture fishery explicitly oblige boat owners to release pregnant and juvenile sharks if it is caught in their fishing activity.

Sharks and rays management efforts involve a number of stakeholders, not only by the Ministry of Marine Affairs and Fisheries (MMAF) but also related to local government and non governmental organizations. This National Plan of Action for Sharks and Rays is developed as the guidelines for various stakeholders in implementing sharks and rays management in Indonesia.

Jakarta, 2015
Director of Conservation and Marine Biodiversity

1. INTRODUCTION

1.1 Background

Based on the data released by the Food and Agriculture Organization (FAO), the total of Elasmobranchii fish in the world in 2008 reached 700,000 tons. From that figure, Indonesia, India, Spain, Taiwan and Mexico are five biggest shark producers in the world (Lack and Sant, 2011). Compare to other sharks and rays producer countries, Indonesia has bigger fishing area and therefore has high production rate.

Sharks and rays resources have become the main livelihood for some communities, particularly those who depends their lives on the species' fishery product – from fishermen, collector, seller, and processor of sharks and rays fishery in some regions. In the abovementioned fishery business, almost all parts of the caught fish are used by local fishermen. However, the main product that is processed locally and traded in its dried form to big cities in Indonesia is the fin. It is even exported to countries like Hongkong, Singapore, and Japan (Suzuki, 2002), while the meat is smoked or dried to be sold in local markets. Its skin, liver and jaws are also used for various purposes.

In the past few decades, the trend of shark fishing is increasing, from small scale longline fishery to commercial fishery targeting several high economic species such as dogfish sharks (Squalidae), shovelnose ray (Rhynchobatidae) and big sharks (Carcharhinidae, Lamnidae, Alopiidae and Sphyrnidae), both as target or bycatch. Several shark fin importers are willing to provide loan and capital to local fishermen in order to increase their shark catch.

Thus from socio economic perspective, shark is one of important fishery commodities for some communities and has significant impact to their livelihoods. Though shark is not the target of most fishing activities, it has become an important component of the catch. This condition slowly increases the level of exploitation of shark resources in Indonesian waters.

On the other hand, sharks as part of top predator and sits at the top of the food chain, are believed to have important role in protecting and managing the ecosystem balance. If its existence in the nature is threatened, it may change the nature of the community structure and disturb the ecosystem balance. Urged by uncontrolled exploitation of sharks and concerns on ecosystem balance, UN member countries through FAO in 1999 commended to establish an International Plan of Action (IPOA) on shark conservation and management. The IPOA mandates FAO member countries (including Indonesia) to develop a Workplan on Shark Management or a National Plan of Action (NPOA). Although the NPOA is voluntary, Indonesia is the world's biggest sharks and rays producer and therefore has big interest in implementing better sharks and rays management.

Indonesia has responded to the mandate by establishing an NPOA for Sharks and Rays Management in 2010 for a 5 year period which was ended in 2014. Rays was added in the NPOA since rays come from the same family as sharks and share similar high threats. The NPOA 2016 – 2020 is the continuation of Indonesia NPOA for Sharks and Rays 2010-2014, by taking into consideration the evaluation results of the 2010 – 2014 NPOA.

1.2 Objectives

The NPOA for Sharks and Rays Conservation and Management 2016-2010 document has the following objectives:

(1) As a reference for related parties to develop and implement sharks and rays conservation and management program;
(2) As an official document for the Government of Indonesia in implementing regional/international convention related to sharks and rays.
(3) As a sign of commitment of the Government of Indonesia on its ratified international commitments.

1.3 Scope

The NPOA for Sharks and Rays 2016 – 2010 is a reference for all parties to conserve and manage sharks and rays resources in Indonesia based on the main duty and function of each institution. Sharks and rays in this document refer to all species of sharks in general, manta ray, and large sawfish. Emphasize on manta ray and large sawfish is given since the two species are already protected by national regulation and therefore future management plan in required.

1.4 User

The NPOA for Sharks and Rays Conservation and Management 2016-2020 is intended for policy makers and made as a reference for central and local governments, marine and fisheries agencies, universities, research institutions, NGOs, and other parties that have interest and relevant duties and functions to manage sharks and rays resources sustainably.

2. CURRENT STATUS OF SHARKS AND RAYS MANAGEMENT

2.1 Bioiversity

Indonesian waters have high biodiversity of sharks and rays species. There are at least 221 species of sharks and rays found in Indonesian waters. However, current information shows that almost all sharks and rays of economic value are facing extinction.

Sharks and rays are members of cartilagenous fish from Chondrichtyes class. Most sharks and rays species known by public are from Elasmobranchii subclass. This subclass consists of two big groups – sharks and rays. Over 500 species of sharks are found around the world, from freshwater to the deep sea (Compagno, 2001; Compagno, et al., 2005).

The West Indo Pacific region is believed to be the world's center of cartilagenous fish (chondrichtyan) diversity (Compagno, 1984). It is estimated that there are around 245 species of Elasmobranchii fish in West Indo Pacific region, and around 41% of it are shark species (Compagno, 2002). Located in the region, Indonesian waters are also believed to have high diversity of sharks and rays.

Based on the study from various literatures and research up until 2010, at least 221 species of sharks and rays have been found in Indonesian waters, which consists of 117 shark species, 3 ghost shark species, and 101 ray species from 44 families (Fahmi, 2010; 2011; Allen & Erdman, 2012). From the 44 cartilagenous fish families, only around 26 shark species from 10 genus and 6 families have high economic value from its fin trade in national and international market. Sharks from Carcharhinidae, Lamnidae, Alopiidae and Sphyrnidae family are the ones commonly caught for its fins due to its big size. On the other hand, there are several shark-like ray species from Rhynchobatidae, Rhinobatidae, Rhinidae and Pristidae family are caught for its fins. Some even have relatively higher price in the market compared to shark fins.

International organization working on biota protection and conservation, the International Union for Conservation of Nature or IUCN, stated that sharks are one of the species with high level of threat. In Indonesia, one shark species is listed as Critically Endangered, 5 species are listed as Endangered, 23 species are Vulnerable, and 35 species are under Near Threatened category.

2.2 Production

Based on the 2012 Indonesia Capture Fishery Statistics Data, shark production from 2005 – 2011 does not show significant change. Shark production data in national fishery statistics is already divided into five groups, namely thresher sharks (*Alopias* spp., Alopiidae family), requiem sharks (consists of several species from *Carcharhinus* genus, Carcharhinidae family), mako sharks (*Isurus* spp. Lamnidae

family), hammerhead sharks (S*phyrna* spp., Sphyrnidae family), and dogfish sharks, which consists of several species from Squalidae family and Centrophoridae family (Squaliformes Order). Shark production data between 2005 until 2011 is available in the table below.

Table 1. National Shark Production from 2005 – 2011

NO	SHARK GROUP	PRODUCTION (TON)						
		2005	2006	2007	2008	2009	2010	2011
1	Silky sharks	12,971	25,530	29,687	26,000	28,378	26,454	23,934
2	Thresher sharks	13,274	14,474	13,767	9,385	8,210	12,890	18,240
3	Mako sharks	272	1,363	497	461	830	733	632
4	Hammerhead sharks	253	99	1,423	2,366	3,112	3,438	3,394
5	Dogfish sharks	16,536	14,472	12,066	5,413	5,302	2,585	4,014
6	Saw sharks	-	6	22	13	163	53	67
TOTAL		43,306	55,944	**57,462**	43,638	45,995	46,153	50,281

Capture Fishery Statistics in 2012 classified rays landing into five groups , which described rays production in the national fishery statistics. The five groups are blue-spotted ray/leopard whipray, butterfly ray, Javanese cownose ray, shovelnose ray, and shovelnose ray showed the tendency to decrease (Table 2).

Table 2. National ray production in 2005 – 2011 period

NO	SPECIES	PRODUCTION (TON)						
		2005	2006	2007	2008	2009	2010	2011
1	Blue-spotted ray/leopard whipray	26,944	29,069	35,650	35,784	5,265	37,799	0,432
2	Butterfly ray	200	2,768	2,020	4,309	2,414	2,447	3,720
3	Javanese cownose ray	975	4,790	3,808	3,871	4,795	4,232	4,278
4	Shovelnose ray	120	12	2	-	223	189	293
5	Guitarfish	28,492	17,945	9,597	3,645	9,602	3,498	4,241
TOTAL		56,731	54,584	51,077	47,609	62,299	48,165	52,964

2.3 Fishing Ground

Sharks are caught in almost all areas in Indonesia. The vast area of Indonesian waters becomes one of the challenges in shark fishery management. In the efforts to have easier fishery management, the Government of Indonesia through Minister of Marine Affairs and Fisheries Regulation Number PER.18/MEN/2014 on Fisheries Management Area of the Republic of Indonesia has set Fisheries Management Units in Indonesia. The Ministerial Regulation divided Indonesia into 11 Fisheries

Management Areas (FMAs) from the waters in Malaka Strait to Arafura Sea (Figure 1). And thus shark fishery management is also divided according to the FMAs.

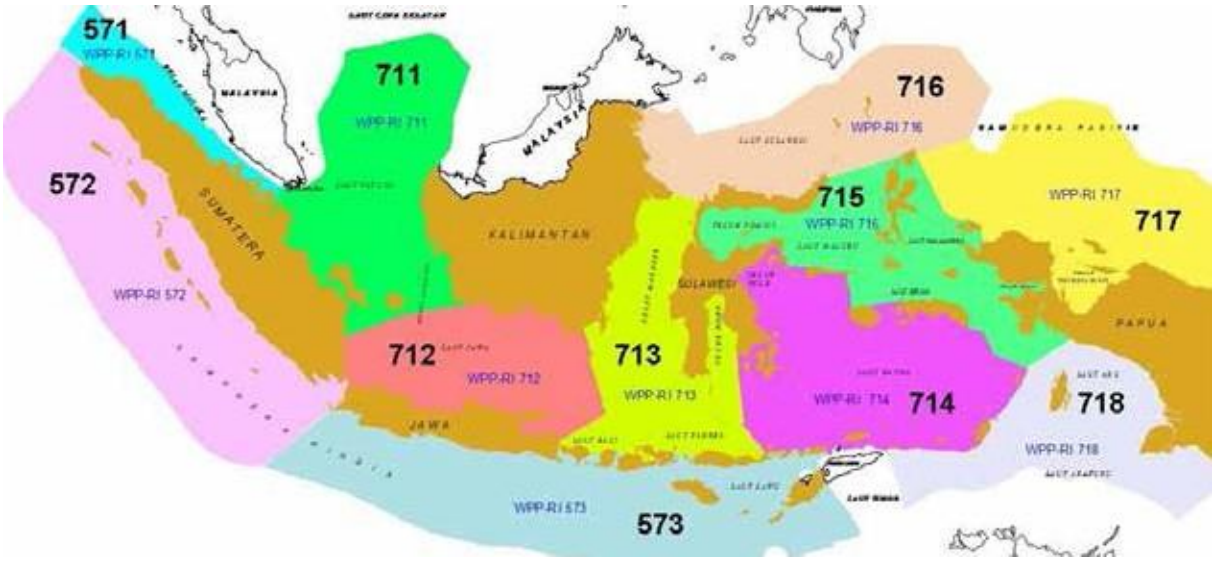


Figure 1. Fisheries Management Areas of the Republic of Indonesia

Determination of potential fishing area is usually based on the abundance of high economic value fish or the fish targeted by fishermen. Some areas in Indonesia have become the centers of important shark fishery production because it has become the landing sites for shark catch from within the FMA or as the collection site for the catch results from other areas. The potential areas for shark production in Indonesia includes the western part of Sumatera (FMA 572), southern part of Java, Bali, and Nusa Tenggara (FMA 573), Natuna Sea and Karimata Strait (FMA 711), Java Sea (FMA 712), and Arafura Sea (FMA 718), as served in the table below.

Table 3. Centers of Shark fishery production and its FMAs

NO	PRODUCTION CENTER	FISHING AREA
1	Sibolga, North Sumatera	FMA 572
2	Muara Baru, Jakarta	FMA 712, FMA 718, FMA 573
3	Muara Angke, Jakarta	FMA 712, FMA 713, FMA 711, FMA 573
4	Pelabuhanratu, West Java	FMA 573, FMA 572
5	Cilacap, Central Java	FMA 573
6	Prigi, East Java	FMA 573
7	Surabaya, East Java	FMA 712, FMA 713, FMA 573
8	Benoa, Bali	FMA 573, FMA 713, FMA 714
9	Tanjung Luar, West Nusa Tenggara	FMA 573

2.4 Fishing Gear

Sharks and rays are generally bycatch, there are no particular gears used to catch sharks and rays. In the national fishery statistics data, there are at least five fishing gears that can have sharks as bycatch, namely tuna longline, set bottom longline, set longline, drift longline, and drift gillnet. Since 1993 until 2003, the use of the five fishing gears tends to increase, but from 2003 to 2010 it tends to decrease. This may be caused by the decreasing catch, which could not cover the operational cost of fishing so the gears then modified or substituted.

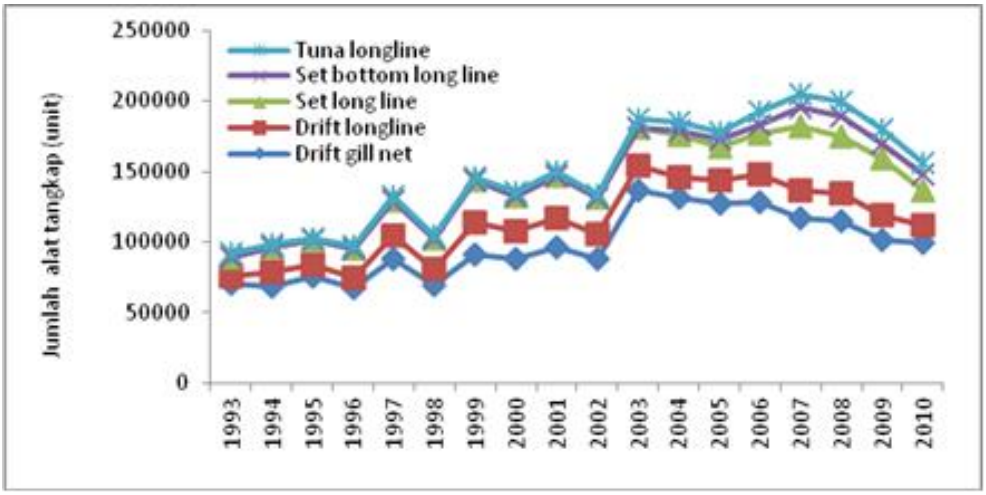


Figure 2. Development of fishing gear amount in 18 years (1993-2010)

2.5 Fishing Season

Shark fishing season in Indonesia is related to fishing time, which is related to fishing area and the amount of shark caught by the fishermen. Shark fishing is usually done all year long and not limited to any particular season. However, in certain months when fish catch increase, it is usually determined as shark fishing season. In some areas in Indonesia, shark fishing season has a certain pattern and this is usually related to the season pattern and weather condition in the area. The ideal shark fishing season is when the weather condition is good with calm wave and wind, so the fishermen can go farther and longer. An example is the Indian Ocean FMA (FMA 572 and 573) with shark fishing season between April to October. This is related to the season pattern and weather condition during that period when the sea is relatively calm and waves are relatively small and the fishermen can operate easily. On the contrary, from November to February the waters in the southern part of equator are highly influenced by the west season as indicated by high tide and strong winds that cause traditional fishermen with relatively small boats do not have the courage to operate.

2.6 Market

In Indonesia fishery export statistics, shark export commodity is divided into four product categories: dried fins, salted fins, frozen shark nei, and shark products (sharks fresh or chilled). The common product exported is the dried fins which include guitarfish and wedgefish/shovelnose ray (Rhyncobathidae and Rhinobatidae family) fins. In the fishery statistics data, only shark fins were specifically recorded, while other parts of the shark or ray body such as soft bone, sin, and gills are clustered together with other shark parts (shark fresh or chilled). Meanwhile, shark oil is put in the same category with other fish oil products and therefore very difficult to obtain the precise production number (Blaber, 2006)

The trade chain of sharks in Indonesia is relatively long and complex, from fishermen, collectors, processing units, exporters, and all the way to the importing countries. In Indonesia, trade chains in the collectors' level are the most complex. According to Zainudin (2011), the many levels of the collectors make it hard to develop a traceability system to know the origins of the caught sharks. Fish traceability system is very important in fishery management and trade system, since some buyer countries already apply and require a tracaebility document for all fish species entering their countries, such as the catch certificate which has been implemented by the European Union since 2010. However, by simplifying the trade chain at collectors' level, shark trade mechanism in Indonesia can be viewed as seen in Figure 3.

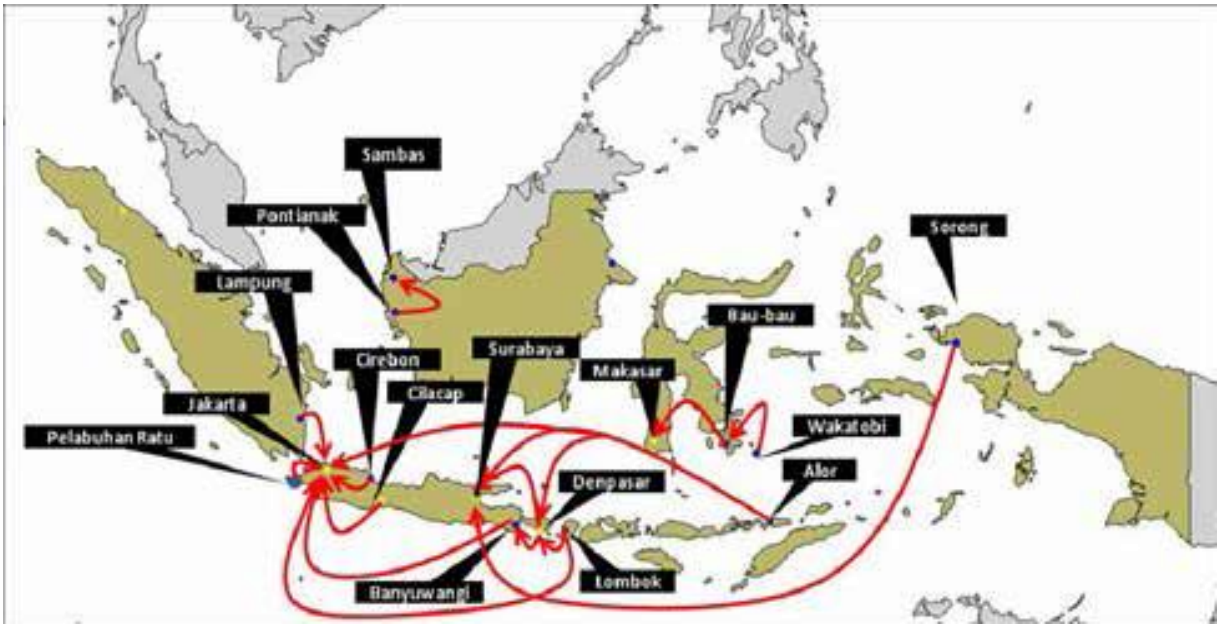
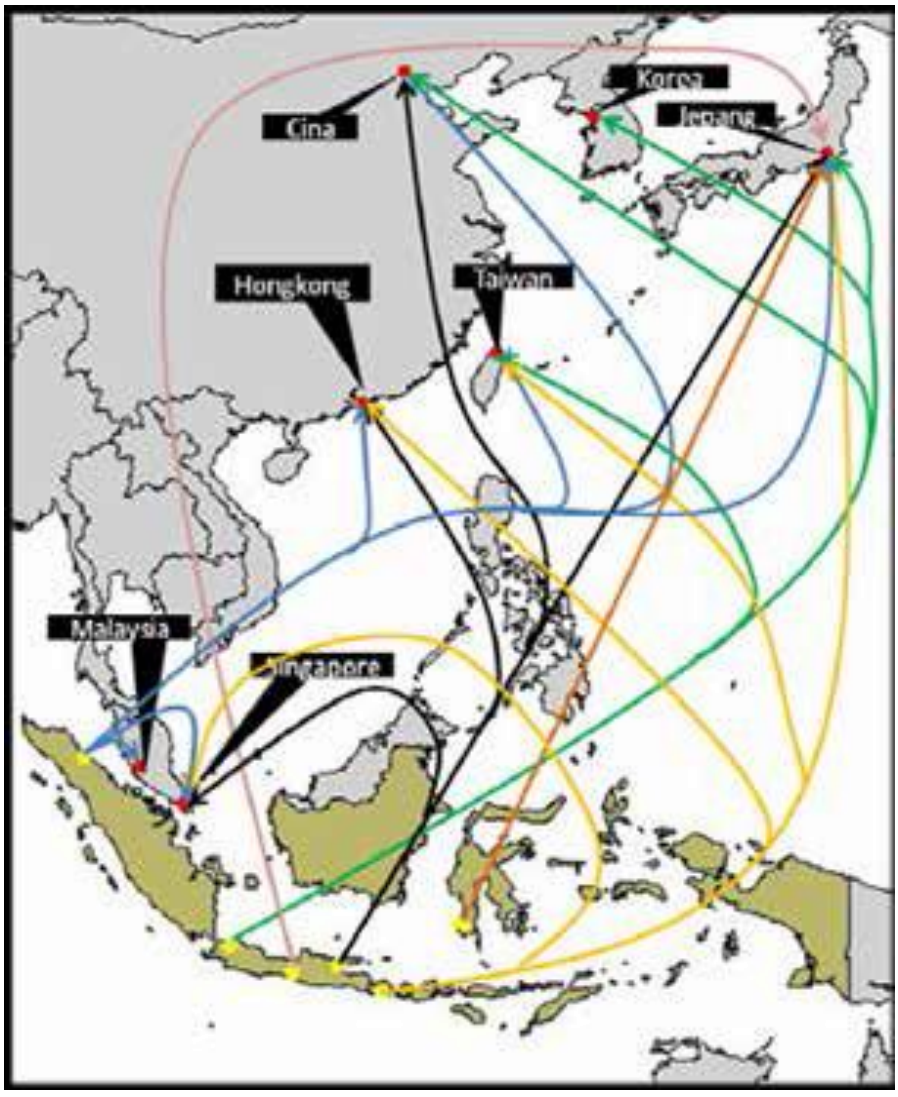


Figure 3. The flow of shark product in domestic trade in Indonesia (Zainudin, 2011)

Sharks and rays products are exported through several international airports such as Jakarta, Surabaya, Denpasar and Medan. For shark products from Cilacap, it is usually exported via Jakarta and a small amount

is exported to Japan using marine transportation. Shark product from Lombok (Tanjung Luar) is exported via Surabaya and Jakarta. The main destination countries for Indonesia shark product export are Japan, China, Taiwan, and Hongkong, besides South Korea, Singapore, and Malaysia (Figure 4). The main airports could be the base to control and monitor Indonesia's shark product export at the exit gates in order to support shark fishery management in Indonesia. While shark product produced by fishing boats in several areas in Indonesia are not only for export but also to fulfill the demands from domestic consumers, such as those landed in Juwana, Pati, Rembang, Pontianak, Wakatobi, and several other places (Zainudin, 2011).

Figure 4. International trade flow of shark product (Zainudin, 2011)



2.7 Post Harvesting of Shark

Different from the issue spreading in the international world about shark fishery, almost all parts of the shark's body are utilized, providing economic benefit and helping the lives of fishermen communities, traders, and exporters. Shark product consists of meat, soft bone, skin, teeth, jaw, innards, liver and fin. The fresh shark fins are marketed locally, which are then processed into various dining menu such as

roasted, smoked, *pindang* (preserved with salt without drying), steak, or specially prepared soup. Shark meat can also be processed into *abon* (shredded meat that has been boiled and fried), *dendeng* (jerked meat), smoked, and made as materials for meatballs, *otak-otak* (seafood snack steamed in banana leaves), and fish crackers.

The products from shark commodity besides the fins and soft bones are generally used only for local consumption or marketed in national level, though some are also marketed abroad. Fins and soft bones that are marketed abroad generally go through several phases.

Generally, the fishermen sell all of their catch to the collector (whole body). Collectors will then sort the shark body parts and then sell it according to the market needs. Shark meat is usually sold directly to consumers or to processing companies to be processed into various food products. Fins, bones, and teeth were usually sent to bigger collectors which act as the exporter of shark fins, teeth, and bones. While the skin and other body parts were usually collected by home industries to be made as skin crackers, crafts, or cattle feed.

Dried shark meat (salted) besides being sold in the local market, it also sent to big cities such as Jakarta, Bandung, Surabaya, Semarang, or even exported to neighboring countries such as Bangladesh and Srilangka. Dried soft bones are exported to various countries with Japan as the main destination. Shark's soft bones are used as the materials for adhesive, cosmetics, and raw materials for pharmacy which is believed by the Japanese as medicine for cancer. Collectors could not yet process the soft bones into final product. So far it is only exported as raw materials (only dried).

Shark skins from blue shark species, *Prionace glauca*, can be used as the materials for crackers; while the skin from other shark species after it is tanned could be made for leather industry, such as bags, wallets, or shoes. Shark teeth can be processed into accessories such as necklaces, bracelets, earrings, rings, buttons, etc. The intestines could be processed into raw materials for insulin, and this organ also produces protease enzyme that is broadly used in food and non food industry.

Sharks' liver can produce oil, particularly from dogfish sharks (Squalidae and Centrophoridae family). The oil from dogfish sharks can be utilized for lubricants in factories and raw materials for medicines, and consmetics since it contains vitamin A and D. Other than that, shark liver oil from Centrophorus genus could be used as an airplane fuel and lubricants in cold areas. Laboratory analysis showed that the content of non saturated fatty acid of dogfish sharks was 3.7%, while the composition of non saturated fatty acid in dogfish shark's liver oil consists of Omega-3 Octadecanoate, Linolenate, Octadecatetraenoate, Eicosatetraenoate, and Eicosapentaenoate (EPA) (Damongilala, 2008). The fins are

the most valuable part of the body. Shark fins are generaly used for soup and considered a prestigious menu in seafood restaurants in Indonesia's big cities such as Jakarta, Semarang, and Surabaya with the price of up to IDR 500,000 per portion.

2.8 Socio Economic Aspect of Shark Fishery

From socio-economic point of view, shark fishery provides economic benefits to direct business actors such as the fishermen and the processors. Besides providing new opportunities for processing or crafts (e.g. ray and shark leather) industries, shark exploitation also provide the opportunity for complimentary businesses, such as marketing and export. Various work opportunities that are currently developing along with the development of shark fishery among others are fishermen, fishing gear providers, retailers, collectors, and exporters.

The result of shark fishery socio economic study analysis conducted in 2004-2005 in several areas in Indonesia showed that shark production gives significant contribution to fishermen's income, both that are targeting sharks as their main catch and those getting it through bycatch. The main income received by fishermen usually depends on the profit and loss sharing system that is commonly practiced in some shark production locations, though there are some that apply salary system. Some examples are boat crews from Tanjung Luar (West Nusa Tenggara), Sungai Liat (South Kalimantan), and Sungai Kakap (West Kalimantan) each year receive IDR 20.8 million, IDR 24.1 million, and IDR 8.5 million. While the crew that catch sharks from bycatch in Kedonganan (Bali) and Batang (Central Java) each has IDR 27.7 million and IDR 22.4 million per year (Review on Shark Fishery Status and Its Conservation Efforts in Indonesia, 2013).

Based on the economic analysis, it can be concluded that shark commodity has given significant contribution to fishermen's income, both that are targeting sharks as their main catch and those getting it through bycatch. The importance of shark commodity for some fishermen related to shark fishery needs to be a special note for the stakeholders in applying the management measures for shark resource in Indonesia. With international pressure to save sharks population in nature, the government of Indonesia is requested to apply conservation efforts and limits shark catch within its jurisdiction area. Therefore, the government needs to further analyze the level of implications of regulations that will limit or tighten shark fishing activities to the fishermen directly involved with the commodity. In addition, there needs to be an alternative source of income other than shark fishery without changing too much of the work pattern and culture of the fishermen should the limitation or stricter fishery management is applied in all FMAs in Indonesia.

2.9 International/National Regulation on Sharks and Rays

2.9.1 International Regulation

2.9.1.1 Indian Ocean Tuna Commission (IOTC)

Indonesia ratified IOTC convention through Presidential Regulation Number 9/2007 on the approval of the Agreement for Establishment of the Indian Ocean Tuna Commission. Since its establishment, IOTC has established resolutions related to shark fishery through Resolution Number 05/2005 on the protection of sharks caught in association with fishery management, and Resolution Number 12/2009 on the protection of thresher sharks (Alopiidae family) in IOTC management area. IOTC stipulations on shark fishery are:

- All Contracting Parties must report their shark catch, including the historical catch;
- All fishing vessels are not allowed to store on their vessels, transport from/to other vessels or land shark fins catch that are against Resolution 05/2005;
- All countries must release the live sharks caught from fishing activities, particularly juvenile and pregnant female;
- All countries must conduct research on selective fishing gears.

In IOTC Resolution 12/2009 on The Conservation of Thresher shark (Family Alopiidae) Caught in Association with Fisheries in The IOTC Area of Competence, the stipulations are as follows:

- All vessels are prohibited from detaining on board, transport from/to other vessel, land, store, sell or offer to sell any parts or the whole body of all thresher shark species from Alopiidae family except for scientific observation.
- All vessels must immediately release thresher shark caught without harming it.
- All vessels must record and report thresher sharks that are accidentally caught and released.
- In fishing recreation and sport, thresher shark caught must be released alive and must be equipped with animal release equipments.
- If possible, CPCs conducts research on *Alopias* spp. species within IOTC convention area to identify the fostering area.
- Scientific observers are allowed to collect biological sample of dead thresher sharks as part of the activities approved by Scientific Committee.
- All Contracting Parties must report their shark catch to IOTC Secretariat.

2.9.1.1 Commission for the Conservation of Southern Bluefin Tuna (CCSBT)

CCSBT in 2011 implemented the Recommendation to Mitigate the Impact on Ecologically Related Species (ERS) of Fishing for Southern Bluefin Tuna that regulates the followings:

- All member countries must implement IPOA for Sharks, IPOA for Seabirds, and FAO for Sea Turtles;
- All member countries must comply with binding regulations or recommendations on the

protection of ecological related species applied by IOTC and WCPFC;

- All member countries must collect and report ERS catch data and report actions taken to address ERS.

Indonesia ratified IOTC convention through Presidential Regulation Number 109/2007 on the Convention for The Conservation of Southern Bluefin Tuna.

2.9.1.2 Western and Central Pacific Fisheries Commission (WCPFC)

West and Central Pacific countries and countries that catch fish around the region has agreed on the Convention on the Conservation and Management of Highly Migratory fish Stocks in the Western and Central Pacific Ocean signed on September 5, 2000 in Honolulu, USA. However, the convention is effective on June 19, 2004. On September 2013, Indonesia ratified its full membership for WPCFC convention.

The commission stipulates the following:

- All countries must implement IPOA for sharks and update the implementation of National Plan of Action for Sharks and submit it in its annual report to WCPFC;
- All member countries must report in its annual report the catch of blue shark (*Prionace glauca*), silky shark (*Carcharhinus falciformis*), oceanic whitetip shark (*Carcharhinus longimanus*), mako sharks (*Isurus* spp.) and thresher sharks (*Alopias* spp.), including the catch that are kept and disposed, and research and development activities conducted to reduce shark catch.

2.9.1.3 Inter American Tropical Tuna Commission (IATCC)

Inter American Tropical Tuna Commission (IATTC) is an international commission responsible for the conservation and management of tuna and other marine resources in the Eastern Pacific Ocean which was established in May 31, 1994 and consist of members from Belize, Canada, China, Colombia, Costa Rica, Ecuador, Elsavador, European Union, France, Guatemala, Japan, Kiribati, Korea, Mexico, Nicaragua, Panama, Peru, Chinese Taipei, United States, Vanuatu, and Venezuela. In June 2013, Indonesia joined IATTC with Bolivia, Honduras and Liberia as a non-cooperating member.

In 2005, IATTC issued resolution No. C-05-05 on Resolution on the Conservation of Sharks Caught in Association with Fisheries in the Eastern Pacific Ocean. The provisions in this resolution among others are:

- All parties are obligated to implement a national plan of action for conservation and management of sharks stock, in accordance with the FAO International Plan of Action (IPOA) for the Conservation and Management of Sharks.
- All parties must undertake necessary measures to require their fishermen to fully utilize their retained shark catches.

2.9.1.4 Convention on International Trade in Endangered Species (CITES)

CITES or international trade convention for species of wild flora and fauna, is an international agreement adopted since 1975. The Government of Indonesia has ratified the convention through Government Regulation No. 43/1978. As a member of CITES, Indonesia is obliged to follow and support CITES decisions. In CITES, there are three lists called Appendices as follow:

- Appendix I, consist of the list of species and protect all wild flora and fauna species that are threatened with extinction and are or may be affected by all forms of trade.
- Appendix II, are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation.
- Appendix III, are wildlife flora and fauna species that are protected in one particular country inside their habitat. Appendix III gives an option for CITES Parties to list the species in Appendix II or Appendix I.

IATTC Resolution Content Related to Sharks and Rays

Each Party and co-operating non-party, co-operating fishing entity or regional economic integration organization (collectively "CPCs") should establish and implement a national plan of action for conservation and management of shark stocks, inaccordance with the FAO International Plan of Action for the Conservation and Management of Sharks.

In 2006, the IATTC, incooperation with scientists of CPCs and, if possible, the Western and Central Pacific Fisheries Commission, shall provide preliminary advice on the stock status of key shark species and propose are search plan for a comprehensive assessment of these stocks.

CPCs shall take the measures necessary to require that their fishers fully utilize any retained catches of sharks. Full utilization is defined as retention by the fishing vessel of all parts of the shark excepting head, guts, and skins, to the point of first landing.

CPCs shall require their vessels to have on board fins that total no more than 5% of the weight of sharks onboard, up to the first point of landing. CPCs that currently do not require fins and carcasses to be off loaded together at the point of first landing shall take the necessary measures to ensure compliance with the 5% ratio through certification, monitoring by an observer, or other appropriate measures. CPCs shall take the measures necessary to require that their fishers fully utilize any retained catches of sharks. Full utilization is defined as retention by the fishing vessel of all parts of the shark excepting head, guts, and skins, to the point of first landing.

The ratio of fin-to-body weight of sharks described in paragraph 4 shall be reviewed by the Working Group on Stock Assessment and reported back to the Commission in 2006 for revision, if necessary.

Fishing vessels are prohibited from retaining on board, transshipping, landing or trading in any fins harvested in contravention of this Resolution.

In fisheries for tunas and tuna-like species that are not directed at sharks, CPCs shall encourage the

release of live sharks ,especially juveniles, to the extent practicable, that are caught incidentally and are not used for food and/or subsistence.

CPCs shall, where possible, undertake research to identify ways to make fishing gears more selective.

CPCs are encouraged, where possible, to conduct research to identify shark nursery areas.

The Commission shall consider appropriate assistance to developing CPCs for the collection of data on shark catches.

Each CPC shall annually report data for catches, effort by gear type, landing and trade of sharks by species, where possible, inaccordance with IATTC reporting procedures, including available historical data. CPCs shall send to the IATTC Secretariat, by May 1, at the latest, a comprehensive annual report of the implementation of this Resolution during the previous year.

Table 4. List of Shark species listed in CITES Appendix

NO	SCIENTIFIC NAME	COMMON NAME	APPENDIX	YEAR
1.	*Rhincodon typus*	Whale sharks	II	2003
2.	*Cetorhinus maximus*	Basking sharks	II	2003
3.	*Carcharhodon carcharias*	Great white sharks	II	2005
4.	*Pristidae* spp.	Sawfish	I	2007
5.	*Carcharhinus longimanus*	Whitetip sharks, Silvertip sharks, Whitetip whaler	II	2013
6.	*Sphyrna lewini*	Hammerhead sharks	II	2013
7.	*Sphyrna mokarran*	Hammerhead sharks	II	2013
8.	*Sphyrna zygaena*	Hammerhead sharks	II	2013
9.	*Lamna nasus*	Mackerel sharks* * not found in indonesia	II	2013
10.	*Manta* spp.	Manta ray	II	2013

2.9.2 National

Law Number 31/2004 on Fisheries as amended by Law Number 45/2009, Article 7 Paragraph (1) stated that in order to manage fish resources, Minister sets a minimum size or weight of fish that can be caught in marine conservation areas and also regulates protected fish species. The points of these arrangements are one of the management instruments that can be done to ensure the existence, availability and sustainable utilization of fish resources, including sharks.

Legislations and its subsidiary legal products which directly and indirectly related to fish resources conservation efforts (protection, preservation and sustainable utilization), including sharks and rays, among others are:

2.9.2.1 Government Regulation Number 7/1999

Government Regulation No. 7 year 1999 on Preservation of Wild Flora and Fauna is an implementing regulationof Law Number 5/1990 on Conservation of Natural Resources and its Ecosystem. The protected wild flora and fauna are listed in the appendix of this regulation, and one species of ray included in the list is *Pristis microdon* or commonly known as sawfish. Most people thought this ray (sawfish) is a shark due to its similar feature to shark. One of the differences between sharks and rays is the position of the gills where shark's gill is located at the side of the head while ray's is located at the bottom of the head.

2.9.2.2 Ministerial Regulation of Marine Affairs and Fisheries Number 12/2012

Ministerial Regulation of Marine Affairs and Fisheries Regulation Number 12/2012 regulates the provisions of ~~fishing business in the open sea~~ capture fishery enterprises on the high seas. Several articles in this ministerial regulation related to shark resources management are:

- Article 39 stated that "all fishing vessels that fish in the sea and get bycatch that are ecologically related species to tuna fisheries such as sharks, seabirds, sea turtles, marine mammals including whale and thresher shark must undertake conservation measures."
- Article 40 outlined the conditions of shark bycatch that is ecologically related to tuna fisheries must not be a juvenile or pregnant female and should be landed in whole.
- Article 43 further describes the status of bycatch species that are ecologically related to tuna fisheries such as thresher shark that must be released alive. In addition, it also stipulates the sanctions for fishing vessels that catch, transport, land, store and/or trade thresher sharks from Alopiidae family, either whole or in parts.

2.9.2.3 Ministerial Regulation of Marine Affairs and Fisheries Number 57/PERMEN-KP/2014

Ministerial Regulation of Marine Affairs and Fisheries Number 57/PERMEN-KP/2014 is the amendment of Ministerial Regulation No. 26/2013 that regulates capture fisheries business within Fisheries Management Areas (FMAs) in Indonesia. Article 73 stated the obligations concerning conservation measures and fish resource management as follows:

- All fishing vessels with fishing licence (SIPI) in Indonesia's FMAs must take conservation measures towards particular species that are ecologically related to tuna, as determined by the Regional Fisheries Management Organization;
- Particular species as referred in paragraph (1) are as follows:
  a. Bycatch fish such as thresher shark, sea turtle and sea mammals including whales; or
  b. Non-fish that are caught incidentally (incidental catch) such as seabirds.
- Conservation measures for bycatch fish as referred in Paragraph (2) letter (a) are:
  a. The obligation to release the live fish.

b. Handle and/or clean the caught fish that are dead and land it as a whole.
c. Record the caught fish species that are dead and report it to the Director General through the Head of Port Base as stated in SIPI.

- Conservation measures for non-fish incidental catch as referred in Paragraph (2) letter (b) are:
  a. Release the non-fish species that are caught alive
  b. Record the caught non-fish species that are dead and report it to the Director General through the Head of Port Base as stated in SIPI

- Fishing vessel that violates the provisions as referred in Paragraph (3) and (4) will be given administrative sanctions in form of SIPI revocation.

2.9.2.4 Ministerial Regulation of Marine Affairs and Fisheries Number PER.18/MEN/2010

Ministerial Regulation of Marine Affairs and Fisheries Number PER.18/MEN/2010on Fishing Log Book requires all fishing vessels that have Fishing Licence (SIPI) to fill the fishing log book. This logbook contains data on fishing gears, fishing operation and catch report. With this regulation, each catch including sharks and rays must be reported to the related parties.

2.9.2.5 Ministerial Regulation of Marine Affairs and Fisheries Number 1/Permen-Kp/2013

Ministerial Regulation of Marine Affairs and Fisheries Regulation Number 1/Permen-Kp/2013 stipulates the provisions on the monitoring of fishing vessels and fish transport vessels. This regulation stated that all fishing vessels above 30 GT (gross tonnage) and fish transport vessels operating in Indonesia's FMA are required to have an observer. One of the tasks of the observer is to monitor and record the bycatch species that are ecologically related to tuna fishery, shrimp-trawl fishery and fish-trawl fishery.

2.9.2.6 Ministerial Decree of Marine Affairs and Fisheries Number 18/KEPMEN-KP/2013

The Ministerial Decree of Marine Affairs and Fisheries Number 18/KEPMEN-KP/2013 determined the full protection status of whale shark (*Rhincodon typus*). According to this ministerial decree, whale shark is determined as a fully protected fish species and the extractive use of this species and its parts is prohibited by law.

2.9.2.7 Ministerial Decree Marine Affairs and Fisheries Number 4/KEPMEN-KP/2014

The Ministerial Decree of Marine Affairs and Fisheries Number 14/KEPMEN-KP/2014 concerning the full protection status of Manta rays (*Manta* spp.). Manta rays consist of two species, namely *Manta birostris* and *Manta alfredi* and both determined as fully protected fish species. With this ministerial decree, the catching or trading of Manta rays parts and its derivatives is prohibited. The manta rays are highly traded

in international market particularly for its gills and skins. Violations of these provisions shall be sentenced according to law.

From economic point of view, Manta ray has the potential to be utilized and developed for marine tourism. Manta ray has become one of attractive diving objects. Indonesian waters such as Bali, East Kalimantan, Komodo and Raja Ampat have become world destinations for Manta rays diving tourism. The determination of this fully protected status is expected to ensure the sustainable source of income for local community.

2.9.2.8 Ministerial Regulation of Marine Affairs and Fisheries Number 59/PERMEN-KP/2014

The Ministerial Regulation of Marine Affairs and Fisheries Number 59/PERMEN-KP/2014 concerning the export ban of all parts of oceanic white tip sharks (*Carcharhinus longimanus*) and hammeredhead sharks (*Sphyrna* spp.) from Indonesia. The listing of Oceanic white tip sharks and hammeredhead sharks in CITES Appendix II in 2013 indicated that the global population of these species have been seriously threatened, which mostly caused by high demand in international trade.

In order to anticipate the extinction threats of Oceanic whitetip sharks and hammerhead sharks in Indonesian waters and to prepare the implementation of CITES provisions toward the two shark species, the international trading is temporarily banned and the resources status will be further evaluated. Based on this consideration, if the evaluation result showed that the sustainable utilization of these species can be possibly done, the export of these species will be reopened. Over the enactment of this ministerial regulation, fishing for domestic use is still allowed.

2.10 Challenges

In this NPOA document, the challenge is defined as a gap between the existing conditions with the necessary conditions (expected). The necessary condition is a management objective that includes the management at the national level and the implementation of regional provisions or international ratified provisions.

Some of the challenges related to sharks and rays that have been identified are:

2.10.1 Regulation

Law enforcement in grassroots level is proved to be ineffective. Other than the insufficient level of supervision in the field due to the extent of the Indonesian territorial waters, the lack of carrying capacity, the lack of infrastructure and human resources are still the main constraints for the implementation of

shark fishery management on the field.

Moreover, low respect toward law enforcement, lack of motivation and information, and deviation in implementing the regulation on the ground become an obstacle in achieving sustainable management of sharks and rays. Furthermore, the “sharks finning” is one of the issues that have become an international concern. The practice of finning is not just considered as cruel but also a waste of resourcesbecause only part of the fins are utilized while other parts thrown into the sea or discarded. It requires a special regulation with clear sanctions to stop the practice of sharks and rays finning.

The characteristic of shark fishery also creates difficulties in implementing the regulation. The challenge encountered in the field showed that in general, sharks were caught in weak condition or even already dead by the time of removal of the fishing rod or net that was installed by the fishermen on the previous day. Another consideration from the fishermen is that if they discard the sharks that have been caught, it will reduce their earnings. Therefore, the implementation of the regulation should be followed with intensive and continuous awareness program for shark fishermen communities on the protection of several shark species including those in vulnerable to extinction category.

2.10.2 Capacity for Data Collection

Until recently, there are about 120 shark species that have been identified (Fahmi & Kathleen Tan, 2013a; 2013b; 2014; Fahmi & White, 2015) and 101 species of rays found in Indonesian waters. It is a big challenge to prepare the human resources that is capable to identify the sharks and rays in Indonesia. Currently, the provisions of CITES have regulated to the level of genus/species and it will be difficult to effectively implement the convention provision on the ground if the current human resources do not have the ability to identify to these levels.

Particular for sharks and rays, the international trade is commonly done in form of dry fins and thus it is difficult to identify a species. Considering that the provision of convention regulates up to species level, the mechanism of species identification needs to be developed and should be started at the time the sharks is landed until the specimen is ready for export.

2.10.3 Data Accuracy

According to the statistical data of fisheries, catches of sharks have been classified into five groups of thresher shark (family Alopiidae), dusky shark (family Carcharhinidae), mako sharks (family Lamnidae), hammerhead sharks (family Sphyrnidae); and a group of dogfish sharks and greeneye spurdog (family Squalidae and Centrophidae). The classification of this data collection is already applied in large-scale

fishing ports, but it has not been optimally implemented for small-scale fishing port and thus it needs to be strengthened. Another concern is the lack of public awareness from community to land their catch in the existing fisheries ports. Hence, there is likely a bias between the data in the fishing port with the existing data of fishing catch.

2.10.4 Socio Economic Condition of Community

It is generally known that the economic condition of fishermen in Indonesia is always at the bottom layer. Low education level and economic capability makes them difficult to change their livelihood as fishermen which have been done in generations. Generally, the fishermen used small size boat/ship and do fishing in the coastal waters where sharks and rays that caught were small and have not reached the age of maturity. Usually, most of them were sold to meet their daily needs and no part of the shark was discarded.

The other fishermen group is quite advanced because they generally use a large-sized fleet so they can fish in areas that are relatively far from the coast. The issue of shark finning generally occurs in this group of fishermen. Sharks were not the targets of catch, however due to the common fishing area, many sharks caught as bycatch. The high market demand and the exports price of shark fins have driven the fishers to take shark fins that were caught and discard the other parts with low commercial value.

Considering the abovementioned structure of fishers, a different regulation between the small-scale and the large-scale fishers is required. The shark fishing policy should not have a big impact to the small-scale fishers.

2.10.5 Bycatch

Currently, the information on sharks and rays resources is limited and the models of sustainable management related to shark fishery have yet to be well-formulated. Moreover, small sharks generally live in the coastal area where most of the traditional fishermen are fishing. Though shark is not the target of fishing, small-size sharks (immature) are often caught as bycatch.

Therefore, it requires specific actions to reduce the number of bycatch for small sharks though impossible to be eliminated completely. One of the possible options is to establish conservation area in some parts of the coastal area which have been identified as spawning ground and nursery ground of sharks. With this establishment, it is expected that some of the sharks could reach maturity age to keep the rate of shark recruitment in their natural habitat.

The studies on nursery ground and spawning ground are limited and need to be mapped, and should be followed up as an effective conservation action on the field level.

2.10.6 Research

Studies on sharks and rays carried out by research institutions are still limited. The main challenges are low interest from the researchers as well as budget constraint.

The lack of information could lead to policies taken in shark fishery management is unsupported by sufficient scientific database. On the other hand, some shark species are migratory species. Thus to determine its potential population, a study requires to be done on a regional basis in accordance with the species' range state.

3. EVALUATION OF NPOA IMPLEMENTATION IN 2010-2014

The 2010-2014 sharks and rays NPOA has ended on October 2014. During that period, there were many improvements shown by Indonesian Government regarding sharks and rays management. The complete matrix of activities on that period is available in Table 5. The summary of achievements is as follows:

1. **Status of national shark fishery**. In 2013, Ministry of Marine Affairs and Fisheries published a book, titled "Review on National Shark Fisheries Status," to provide one national data reference on shark fishery. Several important information contained in the book were on national shark production development, shark product export development, fishing gears resulting shark bycatch, as well as a list of endangered shark species.
2. **Protection of endangered sharks and rays.** As a commitment to protect endangered sharks and rays, Government has included whale shark (*Rhincodon typus*) in the protection list, which means the fishing and trading of this species in Indonesian waters is prohibited. Similar action was also taken by the government for manta ray. The Ministry of Marine Affairs and Fisheries stated two spesies of manta rays as fully protected.
3. **Biological research of sharks and rays.** Biological researches on sharks and rays have been conducted in several fish landing sites and should be continued in order to monitor its development. Information obtained from this study could be the basis for government in setting the policies regarding shark management in Indonesia.
4. **Strenghtening inventory.** The current data divided shark production into 5 (five) families; silky shark, thresher shark, hammerhead shark, dogfish shark and shortfin mako. For species enlisted in CITES appendix, inventory efforts at species level has been done by placing enumerators. These enumerators were placed in main sharks landing, and the activity is still on going.
5. **Sustainable management.** To maintain sharks and rays sustainability, shark fishery management has been included in fishing permit regulation. Since 2014, a plan for fishing quota has been initiated for sharks enlisted in Appendix II CITES. A technical guideline to differentiate shark fins listen in CITES Appendix and the technical guide to differentiate the gills of manta ray gills from other rays have been produced. In addition, the guidelines were trained to surveillance officers in the field.

Table 5. Evaluation Matrix of Sharks and Rays NPOA Implementation in 2010-2014

PROGRAM	ACTIVITIES CONDUCTED	RECOMMENDATION
1. Revisit the status of sharks and rays fisheries in Indonesia	(1) Development of "Shark Fishery Status in Indonesia" book which is a compilation of data and information from various sources: P4KSI, Dit. KKJI, P2O-LIPI and WWF Indonesia	The sharks and rays fisheries status to be updated at least every two years
2. Development of data collection method and process	(2) Data collection process has comply with the existing guides and regulations	Should be continued in the next NPOA implementation
3. Development of sharks and rays research	(3) 2008-2011/P4KSI-ACIAR; Shark Fishery in Tanjung Luar, East Lombok (4) 2010/BPPL; the biology and fishery of shark in Indian Ocean at Southern Java;and (5) 2012/BPPL; the biology and fishery of shark in Java Sea.	Should be continued in the next NPOA implementation
4. Improvement of management steps	(6) 2012; Shark enumerator placement in Tanjung Luar Port and Labuan Batu (NTB) and Kupang (NTT) (7) 2013; Identification of sharks landed in South Java Coast and Lampung by LPSPL Serang (8) 2012; MMAF Regulation No.12/2012 on Offshore Fisheries, Article 39 – Article 44 on obligation to land sharks in whole condition (excluding juvenile and pregnant sharks) and to release thresher sharks in live condition. (9) 2013; MMAF Decree No.26/2013 on Capture Fisheries Business in Indonesia's Fishery Management Areas, which prohibit thresher shark capture.	Should be continued in the next NPOA
5. Protection of biodiversity, habitat, and the function and structure of ecosystem	(10) 2012; Workshop to update Sharks and Rays NPOA implementation status (11) 2013; MMAF Research centre and P2O-LIPI published a pocket book of endangerend shark species (12) 2013; Whale shark (*Rhincodon typus*) is protected through MMAF Decree No. 18 Kep./MEN-KP/2013; (13) 2013; Together with MMAF Research Centre, P2O-LIPI, Fisheries Resources Directorate and WWF jointly published "SHARK FISHERIES STATUS IN INDONESIA" (14) 2013; Raja Ampat district Waters is stated as no take zone for sharks and rays, which is stipulated by local government regulation; (15) 2013; Waters of Manggarai Barat, East Nusa Tenggara Province is stated as shark and manta ray Protection zone, which is stipulated by local government regulation	Should be continued in the next NPOA

Table 5. Continuation

PROGRAM	ACTIVITIES CONDUCTED	RECCOMMENDATION
5. continuation	(16) 2013; public consultation to initiate endangered shark protection in Sibolga (North Sumatra), Banda Aceh, Jakarta, Surabaya (East Java), Tanjung Luar (NTB). (17) 2013; Dissemination of information on international trade of sharks listed in CITES appendix in Sibolga, Aceh, Jakarta, NTB, Surabaya, Makassar (KKJI), Pekalongan and Lampung (LPSPL Serang), NTT (BPSPL Bali) (18) 2013; Coordination meeting (2 times) to formulate catch quota/shark export; (19) 2014; Manta ray (*Manta birostris* and *Manta alfredi*) are protected by MMAF decree No. Kep.04/Men-KP/2014 (20) 2014; Development of "Shark Fisheries NDF" for 4 shark species: hammerhead (*Sphyrna lewini*, *S.mokarran* and *S. zygaena*) and oceanic whitetip shark (*Carcharhinus longimanus*); (21) 2014; Development of CITES Appendix II Shark Fin identification pocket book	Should be continued in the next NPOA Agar dilanjutkan pada periode NPOA berikutnya
6. Raising awareness on sharks and rays	(22) 2014; A lecture on "biological aspect and level of shark utilization and threat in Indonesia" also took place, along with public consultation on shark and manta ray protection plan and CITES regulation information dissemination on international trade of sharks listed in CITES Appendix II,. Venue: Sibolga, Aceh, Tanjung Luar, Surabaya, NTT, Makassar, Lampung and Pekalongan (23) 2014; The study on Utilization of Whale Shark Tourism Attraction in Probolinggo, East Java (24) 2013; directorate of area and fish species conservation facilitated inter echelon I coordination meeting in MMAF and related institutions on Indonesia's position on COP CITES regarding the proposal of several shark species listing in Appendix II	Should be continued in the next NPOA

4. NATIONAL PLAN OF ACTION FOR SHARKS AND RAYS CONSERVATION

4.1 Conservation and Management Objective

The general objectives of "NPOA for Sharks and Rays Conservation and Management" 2016-2020 period among others are to improve the protection of endangered sharks and rays as well as to promote sustainable shark utilization. The main objectives of NPOA Shark and Ray 2016-2020 are:

a. Preparing national regulation on sharks and rays management,
b. Implementation of international regulation regarding sharks and rays management,
c. Improving data accuracy of sharks and rays catch,
d. Protection/management of endangered sharks and rays utilization,
e. Improving research on sharks and rays, and,
f. Improving stakeholders'understanding on sharks and rays management.

4.2 Conservation and Management Strategy

In order to achieve those objectives, the 2016-2020 Sharks and Rays Conservation and Management NPOA has developed 9 (nine) primary strategies, the summary of those strategies are:

(1) Develop and implement national regulation to support sustainable sharks and rays management

The main target of this strategy is the establishment of primary regulation regarding management and conservation of sharks and rays, along with its implementation. The umbrella regulation is NPOA of sharks and rays and other regulations which support the sustainable management of sharks and rays fisheries.

With the establishment of primary regulation, sharks and rays management could be done in a sustainable manner, considering that management for sharks and rays also involved several related sectors.

(2) Conduct sharks and rays fisheries status review at national, regional and international level

In 2014, Indonesia has finished sharks and rays fisheries status book which is a compilation of various research sources and fisheries statistics. This book is the main reference for management of sharks and rays in Indonesia, thus requires updates.

Indonesia is a member of RFMO and CITES, this could be a strategy to conduct review on sharks and rays

regulation related to RFMO policy (SEAFDEC, IOTC, CCSBT, WCPFC, etc.) and CITES, particularly those related to international trade of sharks and rays.

(3) Strengthening data and information on sharks and rays fisheries

Sharks and rays fisheries data is still the biggest challenge. Therefore, the strengthening of information of these data is one of the main strategies in this NPOA. The main target of the data should be indicated by easy access of sharks and rays fisheries data through MMAF official website.

In addition, data quality of some species should be improved and available at species level through standardized sharks and rays inventory format which is connected to database system, especially in landing sites.

(4) Sharks and Rays research development

Research development on sharks and rays needs to be conducted in Indonesia, considering sharks and rays fisheries have long history and involved both traditional and subsistent fishers. Therefore, the research should address challenges regarding biological, management, and socio economic aspects that support the government in developing sharks and rays management policy.

(5) Strengthening protection efforts of endangered shark and ray

Indonesia has high diversity of sharks and rays. Different species has different status of population, utilization and threat, and thus require different management steps. For endangered shark and ray species, conservation steps are required. These steps include protection status/utilization regulation and important habitat protection (spawning ground and nursery ground).

(6) Improving management steps.

Based on the acquired data, both from research or inventory, the next step is to improve management. This improvement should be conducted in main centers of sharks and rays utilization, both for controlling and management purposes.

(7) Increase awareness on sharks and rays

Conservation in post reform era is a common thing done by the government at central and local level. Due to decentralization of conservation area management, many local governments realize the importance of natural resource conservation and provide rooms for conservation in their marine spatial planning.

Species conservation, especially sharks and rays is relatively new and did not get good response partially due to the myth that sharks prey on human and the lack of knowledge of the importance of shark as top

predator which is important to sea ecosystem balance. Therefore an awareness program needs to be applied especially regarding the management and conservation of sharks and rays in community level up to local government level.

(8) Institutional empowerment

Sharks and rays management involved several sector both at national and local level and therefore requires communication media that can enhance management coordination process. The initial working group of shark and ray was formed based on the list of sectors and partners in 2010-2014 sharks and rays NPOA. The upcoming 2016-2020 NPOA is expected to be institutionalized by the sharks and rays management working group, thus can support the government in setting-up the policy direction and evaluating management effectiveness.

(9) Improvement of human resources capacity

The last strategy is the improvement of human resources capacity, especially those who conduct inventory and the controlling of sharks and rays utilization. The target is for them to be able to identify/recognize protected/regulated shark and ray species of which utilization is regulated by RFMO/conventions. This is required to obtain good quality data and to have a sustainbale and effective sharks and rays management.

4.3 Matrix of NPOA for sharks and rays Conservation

4.4 4.5 No 4.6	Strategy / Program		Activity		Indicator	Coordinator	Year				
							2016	2017	2018	2019	2020
1	Collating the Regulations to Support Sustainable Management of Sharks and Rays										
	1.1	Preparing legal framework for NPOA of Sharks and Rays	1.1.1	Facilitating the NPOA discussion and legislation process for sharks and rays legal framework	Ministerial Decree (MMAF) regulating the NPOA sharks and rays	(Dit.KKJI-Ditjen KP3K), Ditjen PT; BalitbangKP; BKIPM, BPSDMKP, NGO, Agency of Marine Affairs and Fisheries (DinasKP), Universities	x				
	1.2	Preparing additional regulations for sustainable management of sharks and rays	1.2.1	Focus Group Discussion, public consultation, sharks and rays management workshop	Report and recommendation regarding sharks and rays management	(Dit.KKJI-Ditjen KP3K), Ditjen PT; BalitbangKP; BKIPM, BPSDMKP, NGO, Agency of Marine Affairs and Fisheries (DinasKP), Universities	x	x			
2	Reviewing the sharks and rays fisheries status in national, regional and international level										
	2.1	Assessing the sharks and rays fisheries status in Indonesia	2.1.1	Scientist meeting /workshop to update the sharks and rays fisheries status in Indonesia	National data regarding the sharks and rays fisheries status	Dit.SDI, Ditjen PT; BalitbangKP; BKIPM, BPSDMKP, NGO, Agency of Marine Affairs and Fisheries (DinasKP)	x	x	x	x	x

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No	Strategy / Program		Activity		Indicator	Coordinator	Year				
							2016	2017	2018	2019	2020
2	2.2	Assessing the sharks and rays fisheries management status related to regional policies/RFMO (SEAFDEC, IOTC, CCSBT, WCPFC, etc.)	2.2.1	Updating the sharks and rays regional resolution	Dissemination of the report of regional resolution to related institutions	(Dit.SDI-Ditjen P.Tangkap), BalitbangKP; Ditjen KP3K	x	x	x	x	x
			2.2.2	Implementing the regional fisheries resolution in national level	Report(s) of the implementation of sharks and rays regional resolution	(Dit.SDI-Ditjen P.Tangkap), BalitbangKP; Ditjen KP3K	x	x	x	x	x
			2.2.3	Collating national annual report about the regional fisheries resolution	Annual report regarding the implementation of sharks and rays regional resolution	(Dit.SDI-Ditjen P.Tangkap), BalitbangKP; Ditjen KP3K; NGO	x	x	x	x	x
	2.3	Implementing the CITES related to international trade of sharks and rays	2.3.1	Implementing the CITES in sharks and rays management	Report(s) regarding the implementation of CITES related to sharks and rays management	(Dit.KKJI-Ditjen KP3K), Ditjen PT; BalitbangKP, PUSKARI, Ditjen PSDKP	x	x	x	x	x
			2.3.2	Facilitating the meetings in preparation for convention implementation	Meeting reports	(Dit.KKJI-Ditjen KP3K), Ditjen PT, BalitbangKP, NGO	x	x	x	x	x
			2.3.3	Reporting the convention result to CITES Secretariat	CITES implementation meeting reports related to sharks and rays	(Dit.KKJI-Ditjen KP3K), Ditjen PT, BalitbangKP, PUSKARI, Ditjen P2SDKP; NGO	x	x	x	x	x

No	Strategy / Program		Activity		Indicator	Coordinator	Year				
							2016	2017	2018	2019	2020
3	Strengthening the Data and Fisheries Information Related to Sharks and Rays										
	3.1	Strengthening the database and sharks and rays fisheries information system	3.1.1	Conducting data compilation of sharks and rays fisheries national data	Data compilation of sharks and rays fisheries national data	(Dit.KKJI-Ditjen KP3K), Ditjen PT, BalitbangKP, PUSKARI	x	x	x	x	x
			3.1.2	Collating national fisheries database of sharks and rays	National sharks and rays fisheries database	(Dit.KKJI-Ditjen KP3K), Ditjen PT, BalitbangKP, PUSKARI	x				
	3.2	Optimizing the sharks and rays production/capture data from the primary landing sites	3.2.1	Integrating the sharks and rays data collection format	National standard format of sharks and rays registration	(Dit. SDI_Ditjen P.Tangkap), Ditjen KP3K, BaitbangKP, LIPI	x				
			3.2.2	Collating the sharks and rays introduction guidance	Sharks and rays introduction guidance book	(Dit.KKJI_Ditjen KP3K), BalitbangKP, Ditjen PT, Universities	x				
			3.2.3	Recruiting and assigning the enumerator staff	Report(s) of data collection	(Dit.SDI-Ditjen P.Tangkap), Ditjen KP3K, BalitbangKP, LIPI	x	x	x	x	x
			3.2.4	Collecting the data related to sharks and rays (level: genus/species) in primary landing sites	Report(s) of data collection	(Dit.SDI-Ditjen P.Tangkap), Ditjen KP3K, BalitbangKP, LIPI	x	x	x	x	x

No	Strategy / Program		Activity		Indicator	Coordinator	Year				
							2016	2017	2018	2019	2020
4	Research Development of Sharks and Rays										
	4.1	Strengthening the research program related to biological and ecological aspects	4.1.1	Researching sharks and rays diversity	Research report	P4KSI-BalitbangKP, Universities, LIPI, NGO	x	x	x	x	x
			4.1.2	Researching the life cycle of sharks and rays (CITES, IUCN, and high economic value)	Research report	P4KSI-BalitbangKP, Universities, LIPI, NGO	x	x			
			4.1.3	Researching the primary habitat of sharks and rays (spawning, nursery, migration path)	Research report	P4KSI-BalitbangKP, Universities, LIPI, NGO	x	x			
	4.2	Strengthening the research program related to fisheries management aspect	4.2.1	Assessing the stock in nature and population captured	Stock assessment report	P4KSI-BalitbangKP, Komnaskajiskan, LIPI, Universities, Ditjen PT	x	x			
			4.2.2	Assessing the environmental-friendly fishing gear	Stock assessment report	Dit.Kapal API-Ditjen PT, Universities; NGO	x	x			
			4.2.3	Assessing the labeling and DNA barcoding methods as a result of catch product and sharks and rays processed product	Labelling assessment report	P4KSI-BalitbangKP, Dit.KKJI, BalitbangKP, Universities	x	x			

No	Strategy / Program		Activity		Indicator	Coordinator	Year				
							2016	2017	2018	2019	2020
4	4.3	Strengthening the social–economic research program	4.3.1	Assessing the trade chain of sharks and rays product	Assessment report	Dit. Perdagangan LN-Ditjen P2HP, BalitbangKP, Ditjen KP3K, Universities, NGO	x	x			
			4.3.2	Assessing the processed product of sharks and rays	Assessment report	Dit. Perdagangan LN-Ditjen P2HP, BalitbangKP, Universities	x	x			
			4.3.3	Assessing the condition of sharks and rays fisherman's	Assessment report	Pusat Riset Sosek-BalitbangKP, Universities, NGO	x	x			
			4.3.4	Assessing the alternatives livelihood	Assessment report	Pusat Riset Sosek, BalitbangKP, Universities, NGO	x	x			
5	Conservation of Natural Biodiversity, Habitat, Function and Ecosystem Structure										
	5.1	Conservation of threatened sharks and rays species	5.1.1	Identifying the threatened sharks and rays species	National data of threatened sharks and rays species	Dit.KKJI, Ditjen KP3K, BalitbangKP; Ditjen Perikanan Tangkap; LIPI	x	x	x		
			5.1.2	Facilitating to collate the regulation in conservation status of threatened sharks and rays species	Implementation report and/or Ministerial Decree regarding the protected sharks and rays	Dit.KKJI-Ditjen KP3K, BalitbangKP, Ditjen Perikanan Tangkap, LIPI	x	x			
			5.1.3	Socializing the regulation and awareness regarding the sharks and rays conservation program	Socialization report	Pusdatin-SekjenKP, Ditjen KP3K, BalitbangKP, Ditjen Perikanan Tangkap	x	x	x	x	x

5

No	Strategy / Program		Activity		Indicator	Coordinator	Year				
							2016	2017	2018	2019	2020
5	5.1	Conservation of threatened sharks and rays species	5.1.4	Collating the conservation action plan regarding the protected sharks and rays	Final document of conservation action plan of the protected sharks and rays	Dit.KKJI-Ditjen KP3K, Ditjen Perikanan Tangkap, BalitbangKP, LIPI	x				
	5.2	Determination and conservation of the main habitat for sharks and rays	5.2.1	Initiating the primary habitat conservation of sharks and rays as conservation zone	Assessment result report	P4KSI-BalitbangKP, Ditjen Perikanan Tangkap, Ditjen KP3K, LIPI	x	x			
6	Strengthening Management Stages										
	6.1	Monitoring and evaluation of data collection process	6.1.1	Monitoring and evaluating the result of data collection	Result report of monitoring and evaluation	P4KSI-BalitbangKP, Ditjen Perikanan Tangkap, Ditjen KP3K, LIPI	x	x	x	x	x
			6.1.2	Verifying the information from data collection sites (capture, processed products, and trade)	Verification report	P4KSI-BalitbangKP, Ditjen Perikanan Tangkap, Ditjen KP3K, LIPI	x	x	x	x	x
	6.2	Rationalization of utilization control and capture with the resource status	6.2.1	Implementing the policy regarding the fishing gear type, fishing ground, the size of the catch, number of boat, allowed species to catch	Selected-policy report regarding the rationalization of sharks fishing	Dit. Kapal API, Ditjen PT, BalitbangKP, Universities, NGO, Dinas KP	x	x			
			6.2.2	Registering the traders and exporters of sharks and rays	Report about the number of traders and exporters of sharks and rays	Dit.KKJI-Ditjen KP3K, Ditjen Perikanan Tangkap, Ditjen P2HP	x				

No	Strategy / Program		Activity		Indicator	Coordinator	Year				
							2016	2017	2018	2019	2020
6	6.2	Rationalization of utilization control and capture with the resource status	6.2.3	Implementing the licensing program regarding the sharks and rays circulation and trade (CITES Appendices)	Report on the number of traders and circulation realization	Dit.KKJI-Ditjen KP3K, BKIPM, P2SDKP, Ditjen P2HP	x	x	x	x	x
			6.2.4	Determining the catching quota and trade	Discussion report regarding the catching quota	P4KSI-BalitbangKP, Ditjen Perikanan Tangkap, Ditjen KP3K, Universities, Komnaskajiskan	x	x	x	x	x
			6.2.5	Implementing the sharks and rays management surveillance policy	Sharks and rays trade data (traffic circulation)	PUSKARI-BKIPMKP, Ditjen KP3K, Ditjen P2SDKP	x	x	x	x	x
7	Public Awareness about Sharks and Rays										
	7.1	Development of public awareness regarding the management and conservation program	7.1.1	Preparing the publication and socialization materials	Print out publication and socialization materials	Dit.KKJI-Ditjen KP3K, PUSDATIN-SekjenKP	x				
			7.1.2	Disseminating socialization materials and public awareness	Disseminated socialization materials	Dit.KKJI-Ditjen KP3K, Ditjen Perikanan Tangkap, NGO, Dinas KP	x	x			
			7.1.3	Implementing the socialization to the public	Socialization report	Dit.KKJI-Ditjen KP3K, Ditjen Perikanan Tangkap, BalitbangKP, NGO	x	x	x	x	x

No	Strategy / Program		Activity		Indicator	Coordinator	Year				
							2016	2017	2018	2019	2020
8	Institutional Capacity Development/Institutional Empowerment										
	8.1	Establishment of Task Force (POKJA)	8.1.1	Establishing and legislating the NPOA Task Force	Letter of Decree (Sharks and Rays Task Force) – It can be Ministerial Decree or Director General Decree	Dit.KKJI-Ditjen.KP3K, Ditjen Perikanan Tangkap, BalitbangKP, Biro Hukum-SekjenKP	x				
			8.1.2	Regular meeting of Task Force	Regular meeting report of Task Force	Dit.KKJI-Ditjen.KP3K, Ditjen Perikanan Tangkap, BalitbangKP, BPSDMKP, Ditjen P2SDKP, BKIPM, Universities	x		x		x
			8.1.3	Task Force Coordination Meeting	Coordination meeting report of Task Force	Dit.KKJI-Ditjen.KP3K, Ditjen Perikanan Tangkap, BalitbangKP, BPSDMKP, Ditjen P2SDKP, BKIPM, Universities	x		x		x
			8.1.4	Comparative Study and Task Force Cross Visit	Cross visit and comparative study report	Dit.KKJI-Ditjen.KP3K, Ditjen Perikanan Tangkap, BalitbangKP, BPSDMKP, Ditjen P2SDKP, BKIPM, Universities		x		x	

No	Strategy / Program		Activity		Indicator	Coordinator	Year				
							2016	2017	2018	2019	2020
9	Human Resources Capacity Development										
	9.1	Training Program	9.1.1	Identifying the type of training	Data regarding the need/type of training	Puslat-BPSDMKP, Ditjen KP3K, BalitbangKP, Ditjen Perikanan Tangkap, PUSKARI, Ditjen P2SDKP	x				
			9.1.2	Preparing the syllabus and training module	Syllabus and training module	Puslat-BPSDMKP, BalitbangKP, Universities, Ditjen KP3K, NGO	x	x			
			9.1.3	Training implementation	Training report	Puslat-BPSDMKP, BalitbangKP, Ditjen KP3K, Ditjen PT, LIPI, Universities		x	x		

5. IMPLEMENTATION MECHANISM

Implementation mechanism of the 2016-2010 sharks and rays NPOA is the responsibility of cross-institutions and cross-sectors at national and local level. The responsibility of role and function is embedded in each institution or sector according to their role and responsibility as stated in the 2016-2010 sharks and rays NPOA management, while communication and coordination mechanism of sharks and rays management is conducted through sharks and rays management working group.

5.1 Sharks and rays management working group

Sharks and rays management working group members consist of government and non-government elements as well as experts and related stakeholders which function to develop/implement sharks and rays management plan in Indonesia.

Member of sharks and rays working group are:

- Marine and Fisheries Research and Development Agency (Balitbang KP) of MMAF (Marine and Fisheries Research Center/Puslitbangkan, BBPSEKP)
- Directorate General of Capture Fisheries (Directorates of Fish Resources, KAPAL API, PP, Fish Capture Business Development)
- Marine and Fishery Resources Surveillance of MMAF/PSDKP (Marine Resources, Fishery Resources)
- Directorate General of Marine Spatial Management/DJPRL (Directorate of Conservation and Marine Biobiodiversity/KKHL)
- Secretariat General (Data and Information Center of MMAF)
- Human Resources Development Agency of MMAF/BPSDM (Training Center, Extension Center)
- Fisheries Product Processing and Marketing /P2HP (Directorates of Product Processing, Domestic Marketing, and Foreign Marketing)
- Indonesian Institute of Sciences/LIPI (P2O, P2B)
- National Commission on Fish Resources Study (KOMNASKAJISKAN)
- Fish Quarantine, Quality Control, and Fishery Product Safety Agency of MMAF (BKIPM)
- NGOs (WWF, WCS, CI)
- UNIVERSITIES
- ASSOCIATIONS

The main tasks of the working group are:

- Coordinate the implementation, monitoring and regular evaluation against the programs planned in shark and ray management plan
- Formulate policy recommendation for better and sustainable sharks and rays management
- Develop annual progress report on sharks and rays implementation plan

- Develop a 5 (five) year report on the implementation of sharks and rays management

Coordination of sharks and rays management plan implementation requires a coordinator. Therefore, the coordinator of this working group is the head of echelon II of the working group member and appointed by working group meeting.

5.2 Working group regular meeting

Annual working group meeting is conducted to update progress of implementation. This meeting is facilitated by Echelon II Unit which becomes the coordinator of working group.

5.3 Funding

The source of fund for NPOA implementation is national budget (APBN) which is embedded in ministries/institution or other source of funding that is not against the prevailing laws and regulations. For an easier funding, the implementation of main actions is adjusted with the task and function of Echelon II unit in ministries/institution.

5.4 Reporting

An annual progress report on sharks and rays management implementation should be developed by working group members under the working group coordinator.

5.5 Evaluation

Sharks and rays management plan is valid for 5 (five) years from 2016-2020 and during that period is open for evaluation. Evaluation is conducted on program and activities with the objective to improve sharks and rays management effectiveness and to response to issues and challenges regarding its management in Indonesia.

6.CONCLUSION

The development of Sharks and Rays National Plan of Action is one of Indonesia's commitments to conserve sharks and rays resource in Indonesian waters. This is also a commitment toward IPOA-shark implementation, RFMOs resolution implementation and CITES convention regulation regarding international shark trade in appendix II CITES.

This action plan could be updated along with the development of issues and challenges in managing sharks and rays.

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Appendix 1. Endangered sharks in Indonesia

1. *Rhincodon typus* Smith, 1828

Figure 5. *Rhincodon typus* (Photo credit: White *et al*., 2006)

Rhincodon typus (whale shark) or also known with its local name *hiu paus, hiu geger lintang, hiu bodoh* or *hiu tutul*, is a cosmopolitan species that lived in tropical or warm waters. This is the largest shark in the world and could reach 18 m long. This shark is solitary though it could be found in small schools. Whale shark is very easy to recognize due to its size. In addition to that, the dark gray thick skin has stripes and pale yellow spots. Due to it size, this shark is relatively slow. There are prominent ridges along its sides. The head is wide and flat with big mouth positioned at the front.

2. *Alopias pelagicus* Nakamura, 1935

Figure 6. *Alopias pelagicus* (Photo credit: White *et al*., 2006)

Alopias pelagicus (Pelagic Thresher Shark) or also known by the local name *hiu monyet* or *hiu tikus*. It is an oceanic shark that lives down to 152 m (White et al., 2006). The long fin tail is a characteristic of Alopiidae genus. The eye shape, dorsal fin position and color of *A. pelagicus* are special features that differentiate it from other Alopias.

3. *Alopias superciliosus* (Lowe, 1841)

Figure 7. *Alopias superciliosus*
(Photo credit: White *et al*., 2006)

Alopias superciliosus (Bigeye Thresher Shark) also known as *hiu lutung* or *hiu pahitan*, is oceanic shark that lives from shallow coastal waters to open sea, ranging from surface level to 600 m deep (White *et al*., 2006). The long tail fin is the characteristics of Alopiidae. The big eye and deep groove on the top of its head differs this species from other Alopias.

4. *Isurus oxyrinchus* Rafinesque, 1810

Figure 8. *Isurus oxyrinchus* (Photo credit: Fahmi)

Isurus oxyrinchus (Shortfin mako) or *hiu mako* is epipelagic and oceanic shark that lives on sea surface level down to 650 m deep (Last *et al*., 2010). The sharp snout, small eyes and keel at the base of its tail are characteristics of Lamnidae family.

5. *Sphyrna lewini* (Griffith & Smith, 1894)

Figure 9. *Sphyrna lewini* (Photo credit: White *et al*., 2006)

Sphyrna lewini (Scalloped hammerhead shark) has several local names such as *hiu martil*, *hiu caping, hiu topeng, hiu bingkoh, mungsing capil*. This shark is coastal pelagic and semi oceanic that often found on continental shelf, island shelf and the surrounding deep waters between intertidal and surface down to 275 m (Compagno in prep. in Baum *et al*., 2007). Nursery ground for this species is shallow water along coastal area while adult species is found in open sea (Compagno, 1984, Lessa *et al*., 1998). The juvenile has the tendency to live in coastal area, near to the bottom and often found in high concentration during summer in estuaries and bays (Bass *et al*., 1975, Castro, 1983). Juveniles of this species must be protected, especially in several core zones at day time (Holland *et al*., 1993) and often formed large schools (Stevens and Lyle, 1989).

6. *Sphyrna mokarran* (Ruppel, 1837)

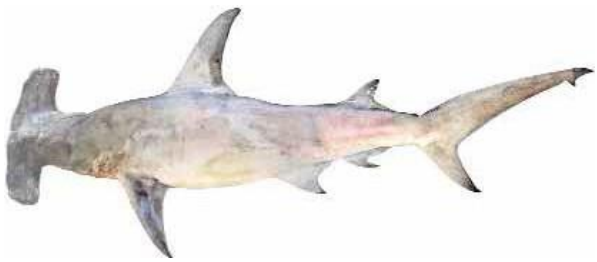

Figure 10. *Sphyrna mokarran* (Photo credit: White *et al*., 2006)

Sphyrna mokarran (Great hammerhead shark) also known with the local name; *hiu martil, hiu caping, hiu topeng, hiu bingkoh, munsing capil*. Hammer head shark is great coastal pelagic and semioceanic tropical species which often found in coastal area and offshore, continent shelf, islands, atolls and deep waters around the island with the depth ranging from surface level to 80 m (Denham *et al*., 2007). This shark is considered as solitary species, and thus rarely met in large number (Denham *et al*., 2007).

7. *Sphyrna zygaena* (Linnaeus, 1758)

Figure 11. *Sphyrna zygaena* (Photo credit: White *et al*., 2006)

Sphyrna zygaena (Smooth hammerhead shark) also known with the local name *hiu martil, hiu caping, hiu topeng, hiu bingkoh or mungsing capil*. This hammerhead shark is coastal pelagic shark and also semioceanic species which often found in continental shelf down to 200 m deep (Ebert, 2003). This species has also found in fresh waters of Indian River, Florida, USA and estuaries of Rio de la Plata in Uruguay (Casper *et al*., 2005) Nursery ground of this species is shallow waters with fine sand substrate down to 10 m deep. Juvenile of *S.zygaena* are often found in large schools that may consist of hundreds of individuals (Compagno, 1998). Due to its similar appearance with *S.lewini*, this shark is sometimes wrongly identified in some areas.

8. *Carcharhinus longimanus* (Poey, 1861)

Figure 12. *Carcharhinus longimanus* (Photo credit: White *et al*., 2006)

Carcharhinus longimanus (Oceanic whitetip shark) is known by the local name *hiu koboi*. This species is considered as true pelagic shark of *Carcharhinus* Genus and found far at open sea down to 200 m deep, continental shelf, or islands offshore. Oceanic whitetip shark is pelagic shark species with high migration level along tropics, and often found as bycatch in tuna and swordfish fisheries. This shark is predator at high trophic level in open waters and targeting leleost and cephalopoda as its main prey (Backus, 1956). Oceanic whitetip shark can be easily identified through its white rounded tip first dorsal fin and wide white tipped pectoral fin (Abercrombie and Chapman, 2012).

9. *Carcharhinus obscurus* (Lesueur, 1818)

Figure 13. *Carcharhinus obscures* (Photo credit: White *et al*., 2006)

Carcharhinus obscures (Dusky shark) is known by the local name *hiu merak bulu* or *hiu lanjaman*, lives in islands waters and continental shelf, from near the coastal to open sea at surface level and down to 400 m deep (White *et al*., 2006). This shark is classified as big sharks and tends to be aggressive, thus potentially dangerous to human.

10. *Carcharhinus plumbeus* (Nardo, 1827)

Figure 14. *Carcharhinus plumbeus* (Photo credit: Fahmi)

Carcharhinus plumbeus (Sandbar shark) or known by the local name *hiu super* due to its big dorsal fin. This big shark commonly found in island waters, continental shelf and Deep Ocean border (drop). It lives from tidal area to 280 m deep (White *et al*., 2006). The dorsal fin is high and wide, hence it is classified as super class shark with high market value in shark's fin trade.

11. *Carcharhinus falciformis* (Müller & Henle, 1839)

Figure 15. *Carcharhinus falciformis* (Photo credit: Fahmi)

Carcharhinus falciformis (Silky shark) is better known by the local name *hiu lanjaman*. This is an oceanic and pelagic medium size shark, commonly found in open sea near land and near to surface level, even though it can be found in 500 m deep (White *et al*., 2006).

12. *Carcharhinus leucas* (Müller & Henle 1839)

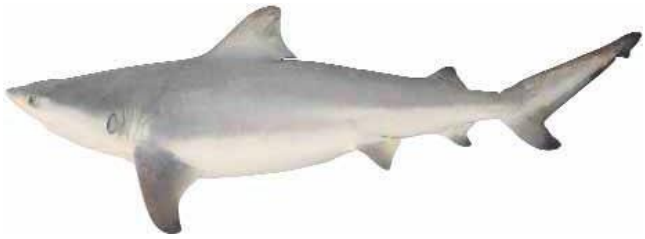

Figure 16. *Carcharhinus leucas* (Photo credit: White *et al*., 2006)

Carcharhinus leucas (Bullshark) is known by the local name *hiu buas*, *hiu bekem* or *hiu lembu*. This is a big sized shark and known for its tolerance to various salinity conditions, thus it can enter brackish water and even sometimes to wide fresh water river. This shark is one of the most dangerous species and caused many reports on shark attack. The short and rounded snout is the main characteristic of this species, in addition to the line of wide triangle upper teeth.

13. *Galeocerdo cuvier* (Péron & Lesueur, 1822)

Figure 17. *Galeocerdo cuvier* (Photo credit: White *et al*., 2006)

Galeocerdo cuvier (Tigershark) or known by its local name *hiu macan* is large size shark that is common in coastal rivers to continental shelf both in tropics and subtropics ranging from surface level down to 150 m deep. This shark is omnivore and diets on small sea creature to larger one such as dolphins and turtles, and sometimes consume on garbage thrown in the ocean. This species is potentially dangerous to human, however not usually aggressive (White *et al*., 2006).

14. *Prionace glauca* (Linnaeus, 1758)

Figure 18. *Prionace glauca* (Photo credit: Last *et al*., 2010)

Prionace glauca (Blue shark) has several local names, such as *hiu karet, hiu biru, hiu selendang*. This large shark is oceanic shark commonly found in tropics or warm subtropics, swimming in surface level down to 800 m deep. This shark migrates and often found in schools at surface level down to 150 m deep. The elongated body with the first dorsal fin positioned in the middle of its body made this shark is easilty to be recognized. The number of cub born is between 4-135 cubs (though commonly it is between 15-30 cubs) per year or every two years with pregnancy period of 9-12 months. Main diet consists of small pelagic fish, squids, demersal fish, small shark and sea birds. Even though this shark is potentially dangerous to human, it is often scared and swam away if being approach by human (Compagno, 2001). *Prionace glauca* is usually caught by gill net and purse seine. Even if this shark is commonly caught and recorded in local fisheries statistics such as in Cilacap and Pelabuhan Ratu, the population in nature is uncertain. This shark contributes to 3-15% of shark catch in southern java waters. Based on landing inventory in Cilacap (2006-2011) and Pelabuhan Ratu (2003-2008), the trend for blue shark catch is declining in southern java waters.


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