Non-Detriment Findings (NDF) for Mako Sharks from Indonesian Waters

National Research and Innovation Agency (BRIN)

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Non-Detriment Findings (NDF) for Mako Sharks from Indonesian Waters

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PREFACE

Indonesia has committed to supporting international conservation through its membership in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1978. CITES is the international agreement to ensure that international trade in wild flora and fauna does not threaten their sustainability in the wild. To date, CITES already has 183 parties and each party must comply with the convention decisions, rules, and resolutions related to the international trade of plant or animal species listed in the CITES Appendices.

In September 2019, the 18th Conference of the Parties (CoP18) of CITES-listed two mako shark species in CITES Appendix II, i.e., *Isurus oxyrinchus* and *I. paucus*. While Indonesia is a CITES member and the world's largest catcher and active exporter of elasmobranchs, Indonesia is required to provide the Non-Detriment Findings (NDF) document before conducting an international trade of species listed in Appendix II. The NDF document justifies that such export would not be detrimental to the species sustainability. In Indonesia, the mandate to develop NDF is given to the National Research and Innovation Agency/BRIN.

BRIN, through the Research Center for Oceanography (RCO), prepared the NDF document for mako sharks in Indonesian waters based on scientific data and information. The recommendation in the NDF are intended to be references for the Management Authority to establish management strategies for mako sharks in Indonesia and emphasizes three main aspects: sustainability, legality, and traceability. This valuable document was developed on the basis of collaboration and coordination with all stakeholders, such as the Ministry of Marine Affairs and Fisheries (MMAF), Non-Governmental Organizations, Associations and others. Hopefully, the collaboration will continue for the subsequent studies of other CITES Appendix II species.

Jakarta, July 2022
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION 1

1.1 Background

Indonesia ratified *the Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) in 1974. This agreement aims to control the trades of threatened species to maintain their sustainability in the wild. More than 35,000 species have been listed in the CITES Appendices, including Elasmobranchii (sharks and rays). This group has been listed since the 2000s due to the overexploitation issue driven by international demand for its fins.

As the third biggest exporting country for fin products worldwide which contributes 13% of the world's production (Clarke & Dent, 2015), Indonesia should contribute to the conservation of sharks and rays nationally and globally. Also, to ensure the population of endangered shark and ray species is sustained, Indonesia needs to manage its international trade in compliance with CITES provisions.

In September 2019, the 18th Conference of the Parties (CoP) of the CITES-listed two mako shark species in Appendix II. The main reason for the listing was the allegation that mako sharks' populations have been declining and will worsen if no international regulation is enforced. Indonesia asked for a reservation to include mako sharks in Appendix II until 26 May 2021; therefore, the CITES regulation of the international trade for this group was effectively applied from 27 May 2021.

The Indonesian capture fisheries statistical data shows that mako sharks contributed approximately 1.6% of national shark production from 2005 to 2016, much lower than other sharks (MMAF, 2017). This group has been traded in domestic and international markets in various products, such as dried fins, meats, teeth and skins. To continue the international trade of mako sharks, Indonesia should implement some procedures based on applicable provisions. One of the obligatory provisions before conducting the export of mako shark products is to provide a *Non-Detriment Finding* (NDF) document. The Indonesian scientific authority prepares the NDF document to advise whether such export will or will not be detrimental to that species' survival and monitor both the export permits and the species' actual exports.

This NDF document for mako sharks in Indonesian waters is made following a guideline developed by Oktaviyani et al. (2019). This guideline was adapted from Mundy & Taylor (2014) with several adjustments considering the complexity of Indonesian fisheries, with the main difference being the inclusion of the quantitative approach. Several stages or steps to develop an NDF document for sharks in Indonesian waters consist of preliminary consideration, assessment of biological, capture, trade, and management aspects, scoring, determination of NDF status and recommendations. In general, the information conveyed in this document could be a basis for developing a fisheries management strategy for mako sharks to attain sustainability in Indonesia.

1.2 Objectives

The NDF document of mako sharks reports the assessment conducted by the National Research and Innovation Agency/BRIN (formerly Indonesian Institute of Sciences LIPI). as the Scientific Authority of Indonesia. This document aims to assess trade's effect on the species' survival in the wild. Scientific recommendations in the NDF document can be used as a reference point for the Management Authority to establish sustainable management strategies for two species of mako sharks in Indonesia.

1.3 Scope

The NDF document for mako sharks includes the latest information on four main aspects: biology, fisheries (the information was predominantly from the eastern Indian Ocean), trades and current management actions in Indonesia. All data and information in this document are derived from various sources such as scientific publications, national statistics data, trade data recording, regulations and other documents related to mako sharks.

PRELIMINARY CONSIDERATIONS 2

The preliminary considerations assessed the information related to mako shark management at the national, regional and global level, species status in CITES, identification of species and its derived products, species' origin and the legality of utilization (Chapter 7). This stage is an initial assessment, and critical to know whether the NDF preparation could be followed up with the assessment.

Mako sharks, which are also known as mackerel sharks, belong to the family Lamnidae. This group consists of two species: the shortfin mako shark (*Isurus oxyrinchus*) and the longfin mako shark (*Isurus paucus*). Based on morphology, mako sharks could easily be distinguished from other shark groups because they have blade-like teeth, strong keels, and a large crescentic caudal fin. The difference between the two species is in the length of pectoral fins. However, the identification becomes more challenging when the shark is already in derivative products, such as processed fins, meats, skins and teeth.

Mako sharks belong to the oceanic sharks and are deemed to occur in all oceans (Rigby et al., 2019a), commonly caught in the USA, Chile, Spain and Indonesian waters, using pelagic longline, gillnet, purse seine and handline (FAO, 2019). Due to the limited data, there is still no information on whether the Indonesian stock shares with other countries. There is no multilateral management agreement, no stock assessment studies at the global, regional or national stock assessment studies, and no central management body specifies mako sharks' management in Indonesia. In 2010, the mako shark was mentioned in a resolution of *the Western and Central Pacific Fisheries Commission (*WCPFC) that all members must report their catch volume, fishing efforts of each fishing gear, and provide information on whether mako sharks are utilized or discarded.

The two mako shark species were listed in Appendix II CITES in 2019 and have a global status as Endangered in the Red List of IUCN (International Union for Conservation of Nature). Even though mako sharks are categorized as endangered species globally, the regional assessment for shortfin mako (*I. oxyrhynchus*) is Vulnerable in the Indian Ocean and Least Concerned in South Pacific (Rigby et al., 2019a). Indonesia may categorize the mako shark as the status mentioned above as this country is located between the Indian Ocean and the Pacific Ocean, but we refer to the global Endangered status as a precautionary approach.

In Indonesia, mako sharks are caught in artisanal and industrial fisheries as targets and by-catch. Before the listing on CITES Appendix II, there was no restriction on the catch and international trade for mako sharks. Even though Indonesia has some fishing and trade regulations for Appendix II species, no regulation is specific for mako sharks in trade and fisheries. Nevertheless, as a member of WCPFC, Indonesia is responsible for complying with all resolutions by providing catch reports, fishing efforts and utilization information.

Based on the availability of information on the biology, fishing pressure, trade and current management of mako sharks in Indonesia (Chapter 3-6), the NDF document for mako sharks in Indonesian waters can be assessed for further steps as described in Chapter 7.

BIOLOGICAL ASPECT 3

In general, sharks have common unique biological characteristics, such as slow growth, long lifespan, late to reach sexual maturity, and low fecundity (Coleman, 1996; Camhi et al., 1998; Stevens et al., 2000; Bonfil, 2002; Cavanagh et al., 2003). Therefore, sharks are more vulnerable to overfishing (Hoenig & Gruber, 1990). The biological aspects that are considered in the development of an NDF document consist of life history information (productive age, the median age at maturity, maximum age, maximum size, trophic level, and growth rate), reproduction (fecundity, mating season, and size at birth), population parameters (natural mortality rate, intrinsic rate of population, current stock size and abundance trend based on CPUE), distribution and habitat. Assessments of biological aspects for shortfin and longfin mako sharks are shown in Annex 2.

3.1 *Isurus oxyrinchus*

Figure 1. Shortfin mako shark (*Isurus oxyrinchus*)
Photo: LIPI, 2019

Biological Data

Taxonomy

Class	Chondrichthyes	
Order	Lamniformes	
Family	Lamnidae	
Genus	*Isurus*	
Species	*Isurus oxyrinchus*	
Local names	English	Shortfin mako
	Indonesian	*Hiu mako sirip pendek*
	Local language	*Hiu tenggiri, hiu buas, hiu anjing, hiu moro, hiu cakilan*

Morphology

The shortfin mako shark has an acutely pointed snout and a u-shaped mouth. Cusps of upper and lower anterior teeth are recurved lingually at bases but with tips reversed and curved labially. Teeth are large and blade-like. The underside of the snout and mouth are white in adults. Pectoral fins are considerably shorter than the head, relatively narrow-tipped in young and acutely pointed in adults. The origin of the anal fin is about under the mid base of the second dorsal fin. The upper body is blue or purple, and the underside is usually white. There is a pair of strong keels on the caudal peduncle, and the tail is crescent-shaped (Compagno, 2001; Ebert et al., 2013).

Life history characteristics

Age at maturity	Female 18 years and male 8 years in North Atlantic (Natanson et al., 2006) Female 19-21 years and male 7-9 years in New Zealand (Anonymous, 2009) Female 16 years and male 6 years in the western and central North Pacific Ocean (Semba et al., 2009) Female 19-21 years and 7-9 years for males (Bishop et al., 2006) Female 18 years and male 8 years in global (Ebert et al., 2013) Female 15 years and male 7 years in the south-west Indian Ocean (Groeneveld et al., 2014)

Size at maturity	Female 275-285 cm FL and male 180-185 cm FL in New Zealand (Francis & Dulvy, 2005) Female 275 cm FL and male 185 cm FL in North Atlantic (Natanson et al., 2006) Female 280 cm TL and male 195 cm TL in Indonesia (White et al., 2006) Female and Male 192 cm TL in Indonesian waters (Simeon et al., 2020) Female 212 cm TL and male 140-165 cm TL in global (Compagno, 1984) Female 298 cm TL in the western North Atlantic and female 273 cm TL in the Southern Hemisphere (Mollet et al., 2000) Female 278 cm TL and 210 cm TL for males in the Northwestern Pacific (Joung & Hsu, 2005). Female 256 cm TL and male 156 cm TL in the western and central North Pacific (Semba et al., 2011) Female 275-285 cm FL and male 180-185 cm FL in New Zealand (Anonymous, 2009) Female ≥280 cm TL and male ≥195 cm TL in Australia (Last & Stevens, 1994) Male 190 cm TL in the Mexican Pacific Ocean (Carreon-Zapiain et al. 2018)
Size at birth	70 cm TL (Mollet et al., 2000) 74 cm TL (Joung & Hsu, 2005) 70 cm TL in Indonesia (White et al., 2006) 90 cm TL (Groeneveld et al. 2014)
Maximum age	Female 32 years and male 29 years in the North Atlantic Ocean (Natanson et al., 2006) Female 28 years and male 29 years in New Zealand waters (Bishop et al., 2006) 31-41 years, theoretical age globally (Tsai et al., 2014) 26 years in south-eastern Pacific (Cerna & Licandeo, 2009)
Maximum size	Female 350 cm TL in Indian Ocean (Pratt & Casey, 1983) Female 366 cm TL in western North Atlantic (Ardizzone et al., 2006) Female 585 cm TL in Turkey (Kabasakal & Madalena, 2011) 400 cm TL in Indonesia (White et al., 2006) 445 cm TL (Weigmann, 2016) 310 cm TL in Indonesia (Simeon et al., 2020)

Trophic level	4.5 in Southern New England and Northwest Atlantic (Bowman et al., 2000)

Reproductive characteristics

Gestation period	15-18 months (White et al., 2006) 23-25 months (Joung & Hsu, 2005)
Fecundity	4-15 with a mean of 11, in the Northwestern Pacific (Joung & Hsu, 2005) 4-25 pups in Indonesia (White et al., 2006) 4-25 pups globally (Mollet et al., 2000)
Intrinsic population growth (r)	0.030 /year (Liu et al., 2021) 0.060 – 0.132 with a median 0.113, in the Indian Ocean (Semba et al., 2019)
Growth coefficient (k)	Female 0.090 and male 0.156 in North Pacific (Semba et al., 2009) 0.070 in California waters (Cailliet et al., 1983) Female 0.076 and male 0.087 in Southeast Pacific (Cerna & Licandeo, 2009) Female 0.074 and male 0.109 in northeast Coast and Gulf of Mexico (Natanson et al., 2006) Female 0.040 and male 0.049 in northwestern Pacific (Hsu, 2003) 0.050 in Mexico (Ribot-Carballal et al., 2005) 0.113 (Groeneveld et al., 2014) 0.123 (Liu et al., 2018) 0.06 in Indonesia (Simeon et al., 2020)
Natural mortality (M)	0.10 – 0.15 in New Zealand (Bishop et al., 2006)

Distribution

The shortfin mako is a cosmopolitan species. They are distributed worldwide in all temperate and tropical oceanic waters, close to inshore waters seasonally, mainly where the continental shelf is narrow (Compagno, 2001; Abascal et al., 2011; Ebert et al., 2013). The Indo-West Pacific subpopulation occurs from the western Indian Ocean to the eastern Pacific Ocean. It is found throughout Australian waters, and Indonesia waters, except for the Arafura Sea and Java Sea (Last & Stevens, 2009; MMAF, 2017). Geographic distribution of shortfin mako includes Western Indian Ocean (WIO), Eastern Indian Ocean (EIO), South-Western Pacific Ocean (SWP), North-Western Pacific Ocean (NWP), North-Eastern Pacific Ocean (NEP), South-Eastern Pacific Ocean (SEP), South-Western Atlantic Ocean (SWA), North-Western Atlantic Ocean (NWA), North-Eastern Atlantic Ocean (NEA), South Eastern Atlantic Ocean (SEA) (Weigmann, 2016).

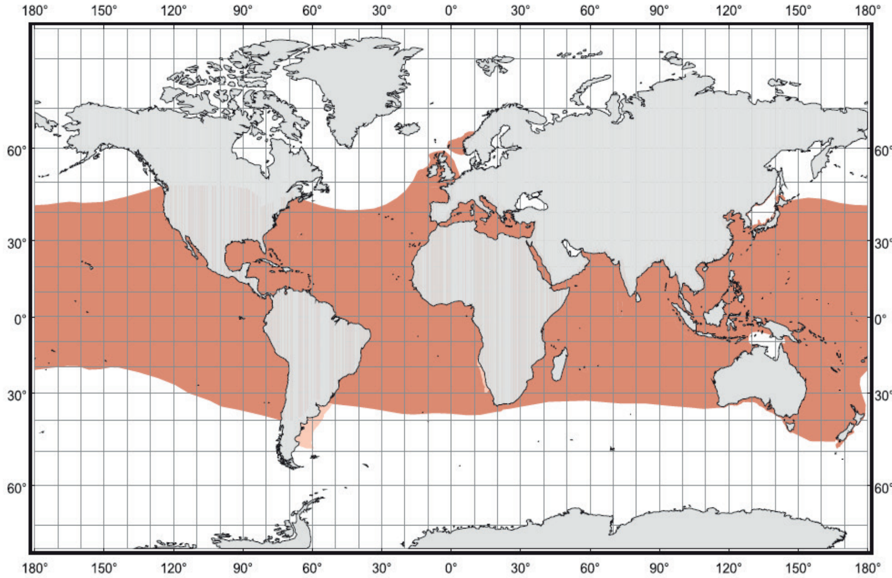

Figure 2. Distribution of the shortfin mako shark (Source: Compagno, 2001)

Habitat

The shortfin mako is a neritic, oceanic, epipelagic and mesopelagic species to depths of 888 m. It is a common, extremely active and highly migratory species with occasional inshore movements (Compagno, 2001; Abascal et al., 2011; Weigmann, 2016). However, shortfin mako is known to have habitat preference in pelagic habitats at depths of about 10 meters (Nasby-Lucas et al., 2019). Even though the shortfin mako has a wide range of swimming layers, their habitat preference is based on temperature, making them migrate from temperatures 11 to 31 °C, and are mostly found on the water with a temperature of 15-20 °C (Nasby-Lucas et al., 2019).

Conservation Status

The shortfin mako has been listed on the IUCN red list with different statuses based on regional waters. It was listed as an Endangered species globally (Rigby et al., 2019a). *Isurus oxyrinchus* has been listed in CITES Appendix II since 2019.

3.2 *Isurus paucus*

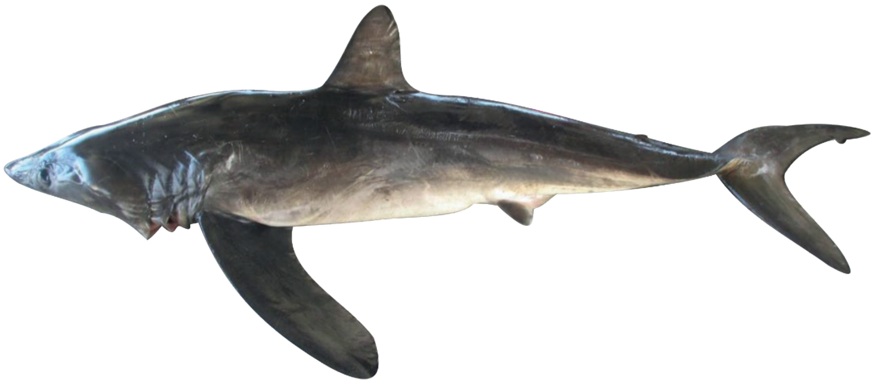

Figure 3. Longfin mako shark (*Isurus paucus*)
Photo: LIPI, 2019

Biological Data

Taxonomy

Class	Chondrichthyes	
Order	Lamniformes	
Family	Lamnidae	
Genus	*Isurus*	
Species	*Isurus paucus*	
Local names	English	Longfin mako
	Indonesian	*Hiu mako sirip panjang*
	Local language	*Hiu tenggiri, hiu buas, hiu anjing, hiu moro, hiu cakilan air*

Morphology

The snout is narrow to bluntly pointed, usually not acute. Cusps of upper and lower anterior teeth are straighter than the shortfin mako shark, with tips not reversed. Pectoral fins are about as long as the head, relatively broad-tipped in young and adults. The origin of the anal fin is about under the second dorsal fin insertion. The snout and mouth area are dusky (Compagno, 2001).

Life history characteristics

Age at maturity	unknown
Size at maturity	Female 230 cm TL and male 213 cm TL in northern Cuba (Ruiz-Abierno et al., 2021) Male 205-228 cm TL in Indonesia (White et al., 2006; White, 2007) Male 245 cm TL in the central Pacific and female 245 – 417 cm TL in the western North Atlantic (Compagno, 2001)

Size at birth	120 cm TL (Castro et al., 1999) 97 cm TL (Compagno, 2001)
Maximum age	unknown
Maximum size	417 cm TL (Compagno, 2001) 427 cm TL (Weigmann, 2016; Rigby et al., 2019b) 423 cm TL (Simeon et al., 2020)

Trophic level	4.5 in Northwest Atlantic (Bowman et al., 2000)

Reproductive characteristics

Gestation period	unknown
Fecundity	At least two pups (Compagno, 1984) 2 – 8 pups (Castro et al., 1999)
Intrinsic population growth (r)	unknown
Growth coefficient (k)	0.14 (Simeon et al., 2020)
Natural mortality (M)	0.20 (Simeon et al., 2020)

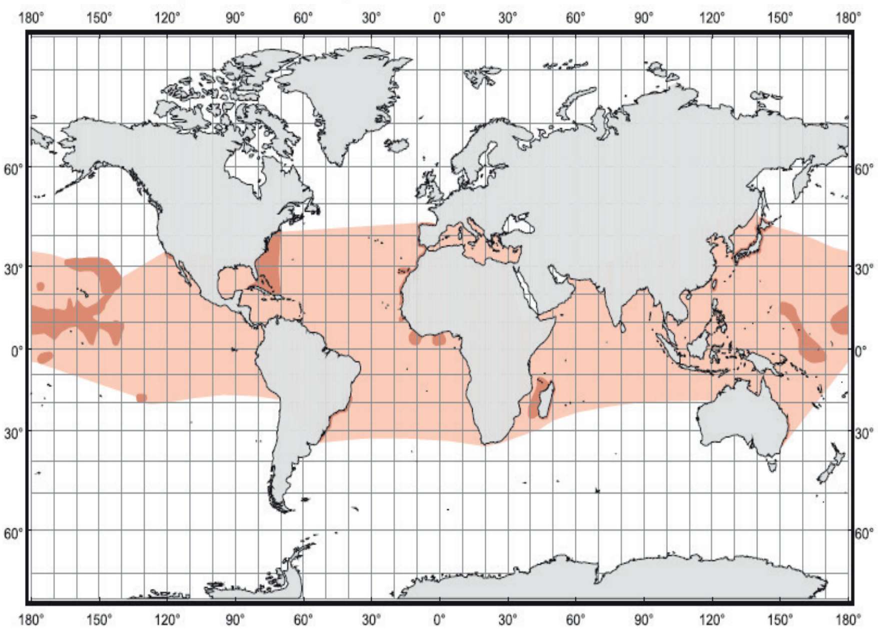

Figure 4. Distribution of the longfin mako shark
Source: Compagno, 2001

Distribution

The longfin mako shark is considered to occur in all oceans (Rigby et al., 2019b), apparently common in the western Atlantic and possibly in the Central Pacific but rare elsewhere (Compagno, 2001). Geographic distribution of longfin mako includes Western Indian Ocean (WIO), Eastern Indian Ocean (EIO), South-Western Pacific Ocean (SWP), North-Western Pacific Ocean (NWP), North-Eastern Pacific Ocean (NEP), South-Western Atlantic Ocean (SWA), North-Western Atlantic Ocean (NWA), North-Eastern Atlantic Ocean (NEA) (Weigmann, 2016).

Habitat

The longfin mako is an epipelagic, mesopelagic and bathypelagic species inhabiting Amorimetropical and warm temperate seas (Compagno, 2001; Rigby et al., 2019b). It is usually found in depths less than 760 meters, but it has been reported to get caught at 1300 m depth (Amorim et al., 1998; Weigmann, 2016).

Conservation Status

The longfin mako has been listed on the IUCN with different statuses based on regional waters. It was listed as an Endangered species globally (Rigby et al., 2019b). *Isurus paucus* has been listed in Appendix II CITES since 2019.

4.1 National Production

The Ministry of Marine Affairs and Fisheries (MMAF) regularly published the Indonesian Capture Fisheries Statistics Book, which was the only annual official statistics of fisheries capture production in Indonesia. From 2002 to 2014, the shark catch data were divided into five groups and nine groups during 2015-2016. The data was classified differently according to the genus, family or order. Mako sharks were listed separately at family level from 2002 to 2016.

According to Indonesian statistics, the annual mako shark production from 2005 to 2016 ranged from 272 to 1,110 tons and contributed between 0.6 and 3.1% of Indonesia's total shark production (MMAF, 2017). The average contribution of mako sharks was only 1.6% of total sharks and rays' production. Therefore, these species are considered to be rarely caught and landed. In general, the production of mako sharks fluctuated from the period of 2005-2019. Nevertheless, it showed an increasing trend from 2016 - 2019, up to 72%. The national catches kept increasing, with the highest volume recorded at 1,907 tons of mako sharks in 2019 (Figure 5).

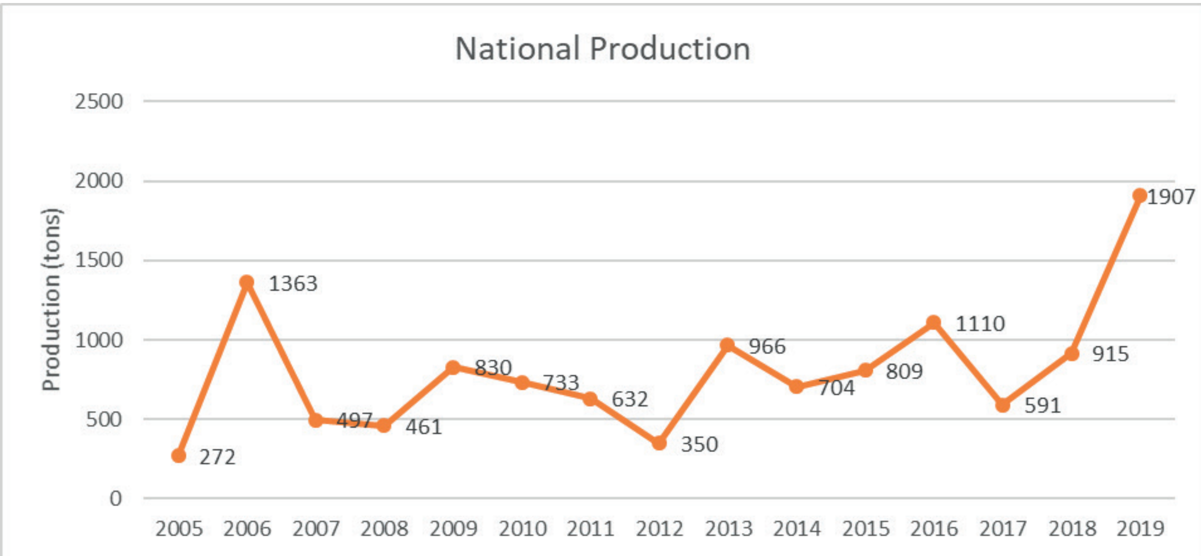

Figure 5. The annual total catch of mako sharks in Indonesia from 2005 to 2019
Source: MMAF, 2017

Currently, the national data of mako sharks available until 2016 were a combination of shortfin and longfin mako. Although it is quite easy to distinguish the two species, species-specific data recording is not a primary concern in Indonesia. After 2016, national statistics only present sharks as a group without separating them into families, which can be accessed at https://satudata.kkp.go.id/. On the other side, mako species recordings were conducted in each Fisheries Management Area (FMA) in Indonesia, yet the available data could not be accessed by the public, whereas it was needed to access some different portal data connected to the national data.

Despite the government's only official data, the Indonesian capture fisheries statistics were often considered not to reflect the actual catch due to some issues, such as double counting between the provincial and national levels, unrecorded data, misidentification, and human error in data input.

4.2 Mako Shark Fisheries

In general, mako sharks are caught in both industrial and artisanal fisheries. They are caught not only as targets but also as bycatch from various fishing gear operating offshore and on open seas. Based on the landing data from several provinces where sharks are caught as targets, mako sharks were landed less commonly than requiem sharks. Sharks, including mako sharks, are targeted by shark longlines, both drift and bottom longlines, with those from drift longlines being more common than those from bottom longlines. It is due to the natural behavior of pelagic sharks, which inhabit a swimming layer on the surface and the water column. Drift longlines have a branch rope with a depth of about 5-7 meters, while the bottom longlines can reach 80 m depth. Based on data from FMA 573, during 2016-2020, the catch of *I. oxyrinchus* from shark longlines constituted 3-54% of the annual total catch. From 2016-2019, the contributions of shark longlines ranged between 3-14% and in 2020, the contribution increased to 54%. Meanwhile, during 2016-2020, *I. paucus* were caught by shark longlines only in 2016 and 2017, contributing only 6 and 3% of the annual total catch. In 2018-2020, no *I. paucus* was caught by shark longlines. That is to say, mako sharks were more commonly caught as by-catch from other fishing gear than as targets from shark longlines. It is particularly true for *I. paucus*.

West Nusa Tenggara, East Java and Aceh are the three provinces where their fisheries target sharks, including mako sharks. Based on the actual landing data in Tanjung Luar (West Nusa Tenggara), from 2014 to 2020, an average of 173 individuals of the shortfin mako (*I. oxyrinchus*) were caught each year, which contributed only 2% of the total shark catch. On the other hand, the longfin mako (*I. paucus*) contributed only 0.05% of the total shark catch, namely about 32 individuals each year. In Muncar (East Java), only 37 individuals of mako sharks were recorded in 2018. It consisted of 25 individuals of shortfin mako and 12 longfin mako, corresponding to 1.18% and 0.56% of the total shark catch. Meanwhile, in 2019, 74 individuals were recorded, consisting of 54 individuals of shortfin mako and 20 longfin mako, which contributed 1.11% and 0.41% of the total catch that year (LIPI, unpublished, 2019). Meanwhile, in Aceh, only 33 individual shortfin mako sharks landed in the past three years (2017 to 2019).

In contrast, a more significant proportion of mako sharks were caught by various fishing gears targeting other fish (sharks are only by-catch). Some types of such fishing gears are described below.

1. Tuna Longline

Mako shark, particularly shortfin mako, is mostly caught by tuna longline from the industrial fishery, typically with large vessels with advanced mechanical and fish-finding navigation systems and high capital investment. The branch line design can vary but typically comprises the line, leader, and hook. The line is usually kept near the surface or at a specific depth range with regularly spaced branch lines between pairs of floats (Towers, 2015). Based on data in FMA 573 during 2016-2020, 27-58% of shortfin mako landed were caught by tuna longlines. Meanwhile, for longfin mako, tuna longlines contributed 20-51% of the annual catch (2017-2020). In 2016, no longfin mako was caught by tuna longlines.

2. Gillnet

Most gillnets catching sharks are drift gillnets. Drift gillnet is made from a large-meshed synthetic net with a line of float (corks) at the top and a series of weights (leads or concrete) at the bottom to maintain it vertically in midwater generally not far below the surface. It is normally set at dusk and hauled at dawn or in the morning. The drift gillnet deployed by fishermen targeting tuna or other large pelagic fish is commonly a few kilometers long with a height ranging from 18-30 m. Drift gillnet in Cilacap is only 38-40 m long and height of 18-20 m. The net material is nylon multifilament type d-21 with a mesh size of 5 inches. Floats are made of synthetic rubber type Y-15. There are six floats and four weights made from concrete weighing 0.5 kg each. Each piece of gillnet is equipped with two plastic buoys Ø 30 cm and a buoy line 6 m in length for keeping the position of the gillnet about 5-6 m below the sea surface (Novianto et al., 2016). During 2016-2019, gillnet contributed 30-47% of the annual total catch of shortfin mako and 11-72% of longfin mako in FMA 573. However, in 2020 the contributions of gillnet declined to 8 and 9% for shortfin and longfin.

3. Handline

Handline targets tuna. However, sharks are sometimes caught as well despite being in lower portions compared to tuna longlines and gillnet. In FMA 573 during 2016-2019, the proportion of shortfin mako catch from handline was less than 1%, while longfin mako was not caught at all by this fishing gear. However, in 2020, there was a substantial increase in the portion of mako sharks caught by handline, i.e., 11% for shortfin and 66% for longfin mako.

4. Other Gears

Other fishing gears sometimes catch mako sharks, although not regularly. Those gears include purse seine, beach seine, pole and line, and cast net. During 2016-2020, the proportion of shortfin mako caught by these gears ranged between 0-12% per year. Meanwhile, the proportion of longfin mako ranged between 0-7%.

Cilacap, Central Java, is an example of a fish landing port where mako sharks are caught using the above fishing gears as a by-catch. The landing data in Cilacap showed that the annual catch of shortfin mako during 2009-2020 ranged between 30-333 individuals with an average of 167 individuals. Meanwhile, in the same period, the annual catch of longfin mako ranged between 0-202 individuals and averaged to 50 individuals per year. Zero catch of longfin mako happened from 2009 to 2012.

4.3 Catch Selectivity

Mako sharks are caught of various sizes, from juvenile, sub-adult, and mature individuals. Different types of fishing gears catch different sizes. That information is presented in the table below:

Table 1. The mean length of captured mako sharks in Indonesian waters

Species	Average of Total Length (cm)	Fishing Gear	FMA*	Source
Isurus oxyrinchus	168,45	Shark longline	573	Simeon et al., 2020
	107 (PCL**)	Tuna Longline	573	Wujdi et al.2021
	190	Shark longline	573, 713	LIPI, unpublished 2019
	185,99	Shark longline	573	BRPL, unpublish 2020
Isurus paucus	312.70 (FL***)	Shark longline	573	Simeon et al., 2020
	190	Shark longline	573, 713	LIPI, unpublished 2019
	182,42(FL***)	Shark longline	573	BRPL, unpublish 2020

** Fisheries Management Area; ** Pre-caudal Length ***FL =Fork Length*

Shortfin mako sharks which were caught in Eastern Indian Ocean by tuna longline were dominated by juveniles and sub-adult individuals. The data records from 2015 to 2019 revealed that despite the increased length of captured sharks, they were still counted as immature fish (Figure 6). The size of the female shark was larger than the male, may be a sign of sexual dimorphism, a typical characteristic of shortfin mako sharks (Wudji et al., 2021).

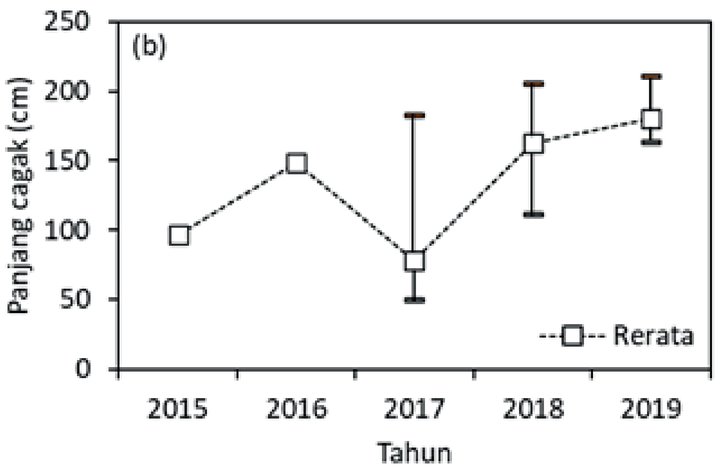

Figure 6. The Pre-Caudal Length trend from tuna fishery from 2015 to 2019
(y-axis = PCL in cm; x-axis = year)
Source: Wujdi et al., 2021

4.4 Level of Bycatch

Bycatch fishery are likely to affect the sustainability of mako shark population. Based on fishery data from the Eastern Indian Ocean (Indonesia FMA 573), the number of mako sharks as bycatch was relatively low compared to other species such as blue shark (*Prionace glauca*) (Loka Tuna Annual Report 2014-2016, unpublished data PIPP - MMAF data, 2021). From 2016 to 2020, *I. oxyrinchus* contributed at least 6% of sharks' annual production in the Eastern Indian Ocean, while *I. paucus* contributed 1.6% of sharks' annual production in the Eastern Indian Ocean (unpublished data PIPP - MMAF data, 2021).

Catch per Unit Effort (CPUE) of mako shark fishing from tuna fisheries in the Eastern Indian Ocean shows an increasing trend from 2015 to 2019, with the highest CPUE occurring in 2017. The average CPUE in this period was 0.06 individual/1000 hooks.

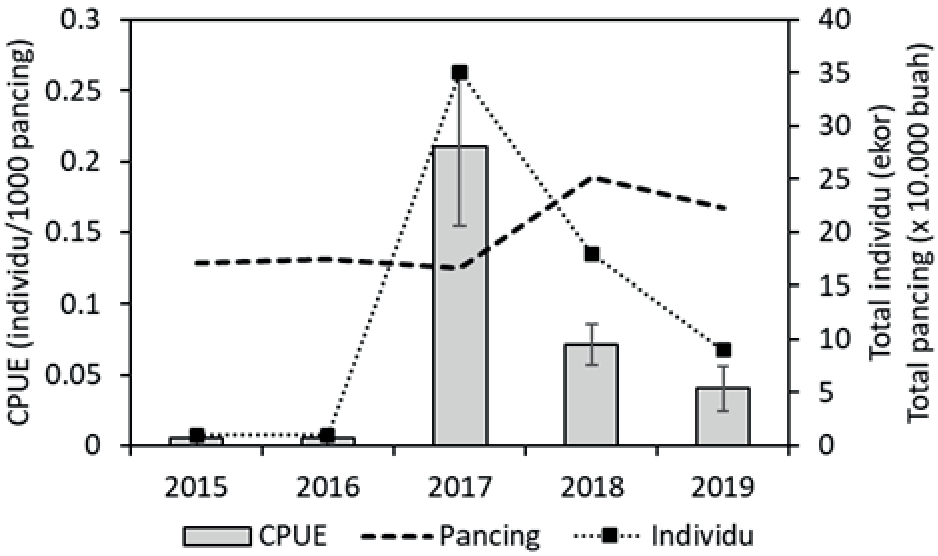

Figure 7. CPUE in tuna longline in the Eastern Indian Ocean
Source: Wujdi et al., 2021

4.5 Fishing Ground

Fishing grounds of mako sharks have been identified based on the data recording from 2004 to 2015. The Eastern Indian Ocean is a fishing ground that contributed more than 60% of Indonesia's mako production, which consisted of Southern Java, Southern Nusa Tenggara, Savu Sea, and Western Timor Sea (FMA 573) (Figure 8). Both areas are parts of the Eastern Indian Ocean with mako sharks mostly taken from tuna fisheries. Mako sharks were also caught from other fishing grounds in smaller proportions such as Malacca Strait and Andaman Sea (FMA 571), Makassar Sea, Bone Bay, Flores Sea (FMA 713), Tolo Bay and Banda Sea (FMA 714), Tomini Bay, Maluku Sea, Halmahera Sea, Seram Sea and Berau Bay (FMA 715) (Figure 9). Mako sharks were few times found in two of Indonesia's shallow waters, i.e., the Java Sea and the Arafura Sea. The occurrence is rare, probably because shallow water is not suitable for mako sharks.

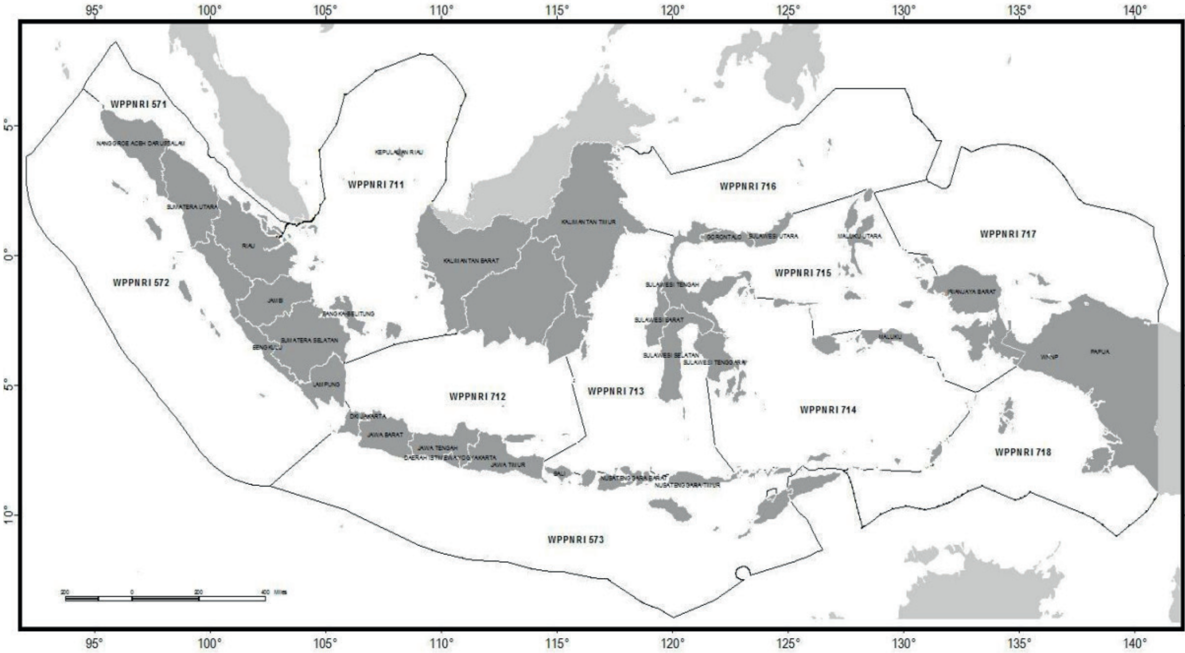

Figure 8. Fisheries management areas in Indonesia
(Source: Regulation of Minister of Marine Affairs and Fisheries Number 18 of 2014)

Based on tuna fishery logbooks, there was a change in the mako shark fishing ground within the Eastern Indian Ocean from 2015 to 2019. The latest mako shark fishing was detected at a higher latitude than in previous years. Nevertheless, It has not been clear whether the change in fishing grounds was due to the changes in shark distributions or stock depletion in the lower latitudes. It is because the information was obtained from the tuna fishery (fishery-dependent method), instead of the fishery-independent method (Wujdi et al., 2021). However, there is obvious evidence that the tuna fishery is closely related to mako shark catches (Figure 9).

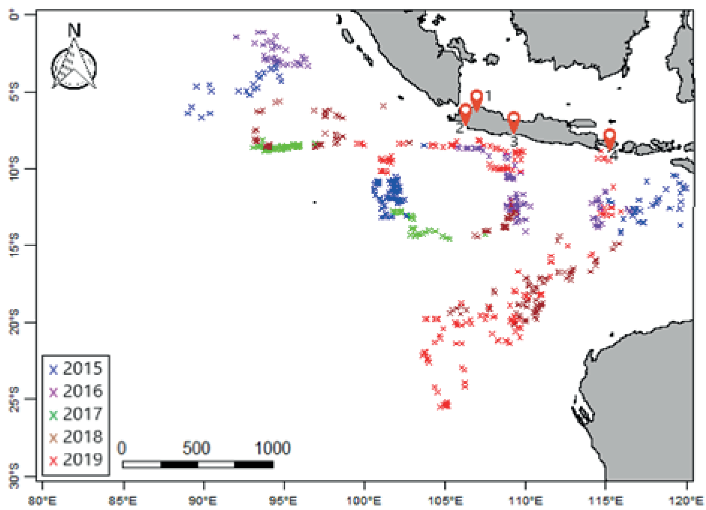

Figure 9. Mako sharks fishing ground in Eastern Indian Ocean generated from Indonesian tuna fishers
(Source Wujdi et al., 2021)

4.6 Fishing Pressure

As mentioned above, the shortfin mako shark (*I. oxyrinchus*) is mostly taken as bycatch from pelagic fisheries such as the ones targeting tuna, skipjack and mackerel tuna (Rigby et al., 2019a). The catch of mako sharks from longlines in the Indian Ocean decreased until 2004, then increased in subsequent years (Coelho et al., 2017). Referring to Brunet et al. (2018), it was known that more supporting data is still required to determine the management of mako shark populations in the Indian Ocean.

Information on the fishing pressure of mako shark fisheries in Indonesia can be assessed based on data collection from shark landings in Tanjung Luar that were used as a case study for a shark-targeting fishery (Simeon et al., 2020). According to the six-year data collection at Tanjung Luar, a total of 1,080 individuals of shortfin mako sharks were recorded, consisting of 62% females and 38% male individuals. The shortfin mako is a slow-growing fish with a growth coefficient (k) = 0.06. The exploitation rate of shortfin mako sharks landed in Tanjung Luar during 2014-2018 was estimated to be E = 0.56 but increased to 0.61 in 2019. By taking the reference point for utilization at 0.5, then the utilization of the shortfin mako sharks in the period between 2014 and 2019 indicates overexploitation. The average size of shortfin mako decreased slightly from 198 cm to 192 cm TL. On the contrary, in the tuna fishery, the average size of shortfin mako shark caught increased from juvenile to sub-adult. However, combining the catches from shark fishery and tuna fishery, it is revealed that immature individuals dominate. The proportion of immature sharks caught increased from 83% to 91%. This condition may indicate increasing fishing pressures, resulting in this shark species' overexploitation.

Table 2. Indicators of the stock of shortfin mako (*Isurus oxyrinchus*)

Stock indicators	2014-2018	2019	Trend
M	0,10	0,10	-
Z	0,23	0,26	Increasing
F	0,13	0,16	Increasing
E	0.56	0,61	Increasing
F/M	1,30	1,56	Increasing
Lc	169,61	168,45	Decreasing
Lmean	198,93	192,57	Decreasing
% Immature	83%	91%	Increasing

The fishing pressure for the shortfin mako shark in the first year of data collection has increased from 1.30 to 1.56. The ratio of immature individuals increased by 8%. The number of catches per trip also decreased from 2014 to 2019, this condition needs to be concerned.

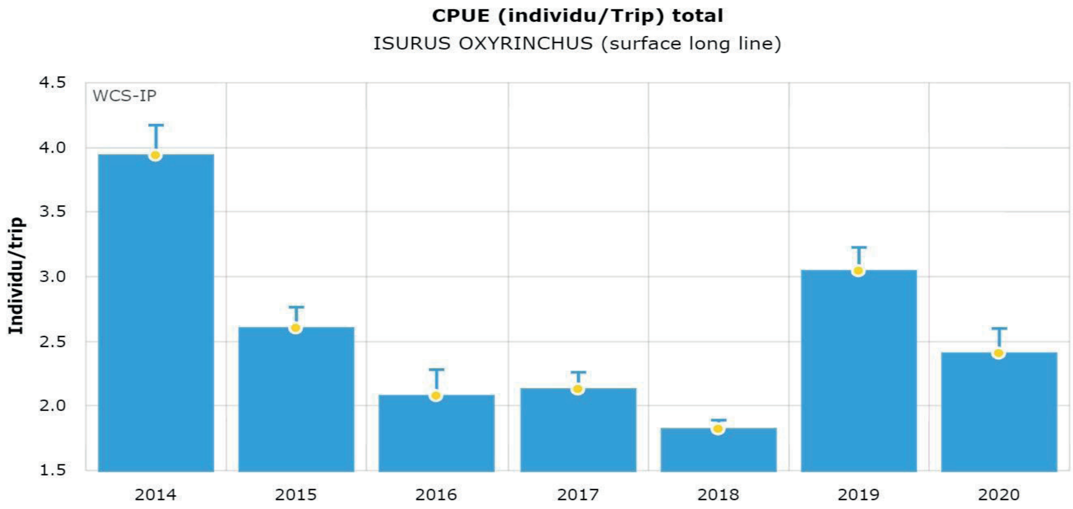

Figure 10. Catches (number of individuals) per trip of shortfin mako shark from shark longline

During the 2014-2019 data collection, it was recorded that 204 individuals of *I. paucus* species were caught with a composition of 61% female and 39% male. The catch of this mako shark from 2014-2019 fluctuated. In 2014-2016 it had decreased by up to 50%, while in 2017-2019, it increased.

The exploitation rate of *I. paucus* landed in Tanjung Luar during 2014-2018 is as high as E = 0.72, despite a slight decrease in 2019, E = 0.70. These values indicate the stock was overexploited. The mean length at first capture (Lc) increases from 185,6 cm to 312.70 cm. However, the percentage of immature sharks caught has increased by 1%, from 95% to 96%. It means that the sharks' size tends to increase in length, and fishing pressure decreases, resulting in a reduced rate of exploitation.

Table 3. Indicators of the stock of longfin mako (*Isurus paucus*)

Stock indicators	2014-2018	2019	Trend
M	0.20	0.20	-
Z	0.71	0.68	Decreasing
F	0.51	0.48	Decreasing
E	0.72	0.70	Decreasing
F/M	2.53	2.39	Decreasing
Lc	185.62	312.7048	Increasing
Lmean	214.98	227.5892	Increasing
% Immature	95%	96%	Increasing

Based on the length-frequency distribution of mako sharks (*I. paucus*) from the data collection, it is known that the average catch size has increased from year 0. Changes in catch size and shift in the length mode to the right can make the level of exploitation smaller, followed by a decrease in fishing pressure (F/M). The percentage of immature individuals caught in the years 2014-2018 and year 2019 does not significantly change so that the fishing pressure is still relatively high.

4.7 IUU Fishing Information

Even though shortfin and longfin mako are oceanic sharks and commonly found on the high seas, those species are also reported to get caught in coastal waters but less frequently compared to high seas. Gathering information on the exact location of mako shark fishing is a challenging task, as mako sharks are known as the secondary catch of many commercial fisheries. For example, there is a lack of data from some seas with closed boundaries with the Pacific Ocean, leading to unreported catches from the artisanal fishery in eastern Indonesia waters (Jaiteh et al., 2017). Moreover, many vessels likely catch sharks without fishing permits and they operate mainly in remote areas or small islands. Thus, the information has not been documented yet.

5.1 Products

Similar to the national production, the proportion of the mako shark products is smaller than requiem sharks or other coastal sharks, both for domestic and international markets. Those products consist of dried fin, fresh or frozen meat, dried skin, cartilage, teeth, and so on. The international market's highest demand is for dried fin (used as shark fin soup) and fresh or frozen meat (used as *Sashimi*). Clarke et al. (2013) described that the price of shortfin mako's meat reached USD 12 per kg in Europe. In fact, the meat price in Indonesia's domestic market is much cheaper, i.e., less than USD 2 per kg. On the other hand, the mako shark fin's price depends on its size, with the criterion based on its pectoral fin's size. At the local collector level, a set of fins of 40 cm long is priced at USD 60, while those over 40 cm is priced between USD 90 and 100. The selling price of mako fins tends to be similar to other shark fins' prices because these products are considered low quantity fins in the Indonesian market.

Table 4. Types, use and market for shark products

Products	Utilization	Main market
Fin	Food	Domestic and export
Meat	Food	Domestic
Skin	Food, fashion raw material	Domestic and export
Cartilage	Traditional medicine raw material, food supplement	Export
Teeth	Souvenir	Domestic and export
Guts	Animal feed	Domestic

Source: Muttaqin et al., 2018; Triyono et al., 2020

5.2 Domestic Trade

There is no time-series data on the domestic market for mako shark products. Trade records are only available for the export market. However, the MMAF's Coastal and Marine Resource Management Agency (B/LPSPL) recorded the volume of mako shark products sent to other regions through the recommendation letter. Unfortunately, it does not directly represent the actual mako shark product domestic trade and utilization, but only its domestic trade traffic.

During 2016-2019, it was recorded that the domestic market for specific mako shark products was not as much as other groups, both in terms of quantity of products and number of shipments. Some destinations are identified for domestic shipments such as Bali, Banten, Jakarta, Central Java, East Java, West Kalimantan, South Sulawesi, Southeast Sulawesi, North Sulawesi, and Yogyakarta. The products being shipped are skin, fins, cartilage, filet, and meat. The total volume of products shipped from 2016 to 2019 is shown in Figure 11 below.

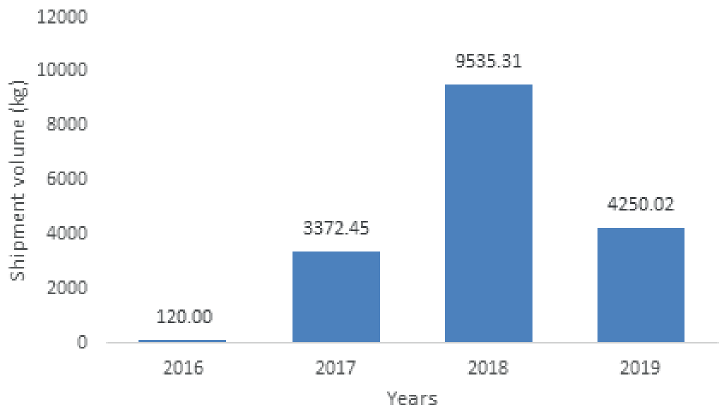

Figure 11. The national trade volume of mako sharks in a domestic market

Unfortunately, the available trade volume of the specific mako shark domestic market is not representing the actual domestic trade traffic. This can be seen from the fact that some of the B/LPSPL's recommendations consist of mixed species that may also include mako shark products. Therefore, the data collection system for domestic trade needs to be improved by recording species-specific products, especially for CITES commodities. Those data are required to support traceability for the domestic trade of shark products.

5.3 International Trade

Based on trade traffic data recorded by MMAF's Fisheries Quarantine, the export volume of mako shark products decreased by almost 35% from 2017 to 2018. In 2017, Indonesia exported 1.1 tonnes of mako shark products, decreasing to 0.8 tonnes in 2018. However, there are a few gaps between the MMAF's fisheries quarantine data and the data from MMAF's B/LPSPL recommendation letter that indicate the inaccuracy in the trade data recording. Both data are shown in Table 5.

Table 5. Data record of mako shark products based on two different sources of data

Years	Fisheries Quarantine data (kg)	B/LPSPL data (kg)	Gap (kg)
2016		558.41	-
2017	1,175.00	706.80	468.20
2018	808.12	1,119.74	-311.62
2019	184.10	2,480.11	-2,296.01

5.4 Trade Chain

The mako shark's business process involves fishers, local collectors, middlemen, exporters, and importers. Commonly, fishers sell their catch to local collectors in the form of fresh whole fish or fresh processed parts, depending on the region and fisheries business characteristics of each area. Local collectors will process the sharks into either semi-processed or processed products. Finally, the processed and semi-processed products will be sent to exporters or sold domestically. A simple trade chain for shark products is shown in Figure 12, while Figure 13 describes the trade chain based on the fisheries' scale.

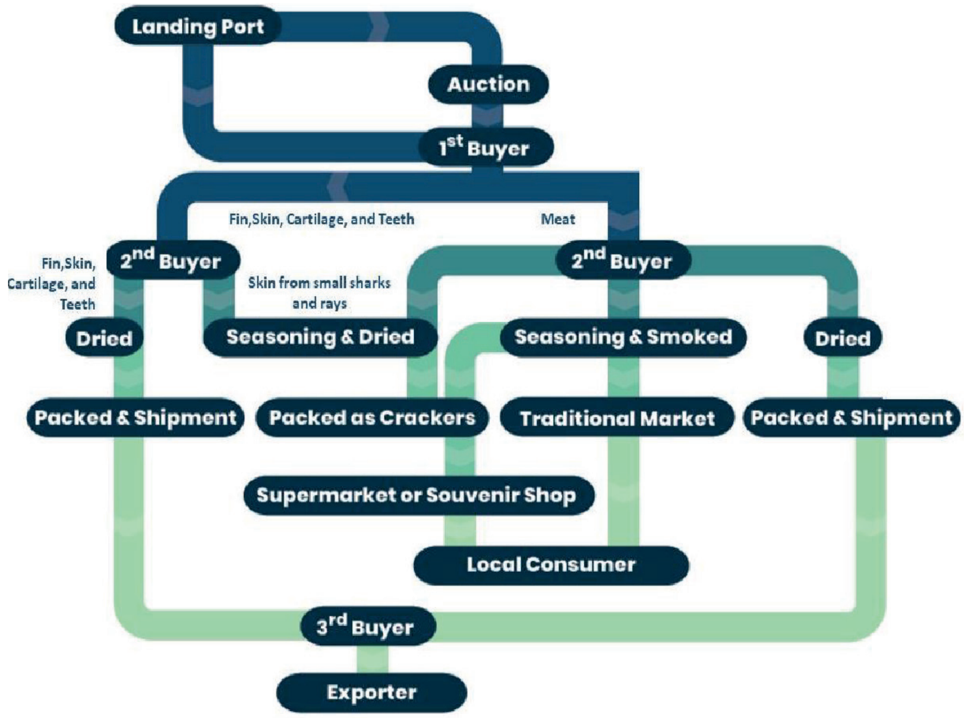

Figure 12. A simple trade chain for shark's products
Source: Muttaqin et al., 2018

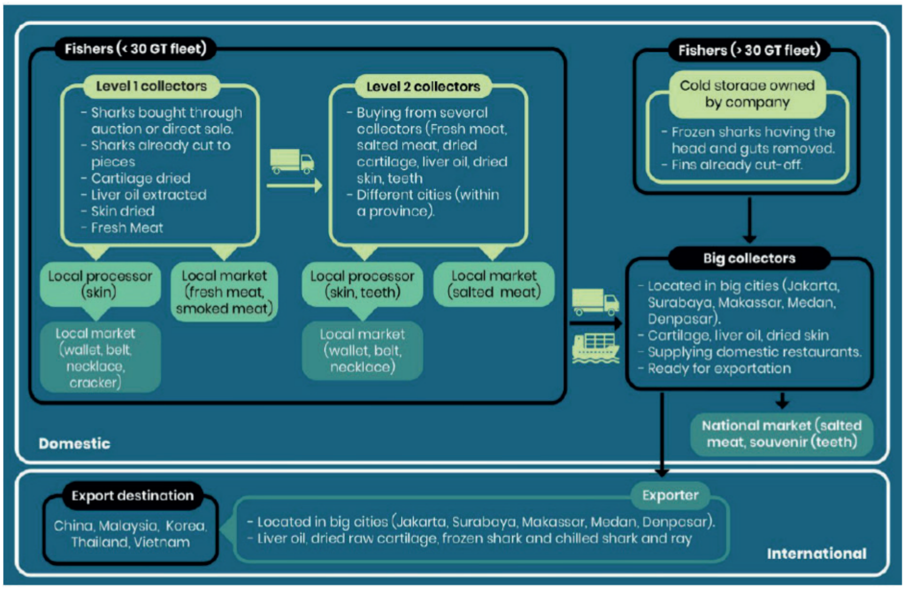

Figure 13. The trade chain is based on a fisheries scale
Source: Muttaqin et al., 2018

5.5 Illegal International Trade Information

There is no official information about illegal international trade. However, it is believed that unreported exports of shark products from Indonesia still occur.

6.1 NPOA Shark Implementation

The Indonesian government has developed the National Plan of Action (NPOA) to conserve and manage sharks and rays in Indonesia for the period 2010-2014 and 2016-2020, while the next phase (2020-2024) is still in the finalization process. This NPOA adopted and implemented the International Plan of Action (IPOA) for sharks in 1999. Nine strategies on the NPOA for sharks and rays 2016-2020 are as follows: (1) Development and implementation of national regulations to support sustainable shark and ray management; (2) Review of shark and ray fisheries status at national, regional, and international levels; (3) Strengthening of shark and ray fisheries data and information; (4) Development of shark and ray research; (5) Strengthening of conservation efforts for endangered sharks and rays; (6) Strengthening of management steps; (7) Awareness-raising on sharks and rays; (8) Institutional empowerment; and (9) Human resource capacity building.

6.2 Traceability Mechanism

The proper traceability system is needed to identify the chain or route of fishery products from being caught, landed, sold, processed, collected and marketed. However, it is quite challenging to implement this traceability system due to the complexity of the trade chain for shark products in Indonesia. The Indonesian government, through the MMAF, has already established legal regulations to support the traceability system. However, the regulation had not been well implemented yet due to the complexity of the shark trade in Indonesia.

Ideally, every fishing vessel must have a permit to catch sharks listed in appendix CITES and fill a logbook as a catch monitoring system. After the fish is landed, it should be complemented by a Catch Recording Certificate and Certificate of Fish Origin. The sellers or middlemen (person or legal entity) are also required to have a permit to utilize protected species and/or species listed in the CITES Appendix. Meanwhile, at the processor level, they must have a permit and Processing Eligibility Letter. When the specimens (products or live fish) will be transported to another region or country, they must be accompanied by a domestic fish transport permit (SAJI-DN) for domestic or CITES export permit (SAJI-LN) for international transport. Those documents also become a basis or reference for the government to monitor the realization of quotas.

There are additional documents for international trade, such as a letter of approval from the Ministry of Trade and Health Certificate for Fish and Fish Products from the Fish Quarantine and Inspection Agency of MMAF, an export approval document from customs, and an export permit notification document from the Ministry of Trade. Nevertheless, Indonesia still needs to develop supporting tools to apply the traceability system for better mechanisms and thorough implementations, from fishing to marketing processes in local markets, to international market chains. Currently, the implementation of the traceability mechanism in Indonesia is still based on the product origin information stated in either SAJI-DN or SAJI-LN published by the MMAF. Every local trader and/or exporter has an obligation to provide the product origin information such as fishing ground and fishing gear in those permit documents.

6.3 Data and Information Recording

The system for data recording at the landing sites for sharks has changed several times. From 2002 to 2014, sharks were grouped into five groups, namely thresher sharks (*Alopias* spp., Family Alopiidae), requiem sharks (consisting of several species from the Genus *Carcharhinus*, Family Carcharhinidae), mako sharks (*Isurus* spp., Family Lamnidae), hammerhead sharks (*Sphyrna* spp., Family Sphyrnidae), and dog sharks, which consist of several species from the Squalidae and Centrophoridae families (Order Squaliformes). Subsequently, in 2015, several groups were added, namely tiger shark (*Galeocerdo cuvier*), blue shark (*Prionace glauca*), oceanic whitetip shark (*Carcharhinus longimanus*), and other shark groups, so that there were nine groups. However, the recording is still based on groups, either genus, family, or even order. Not all are recorded at the species level (except for the oceanic whitetip, tiger, and blue shark). This system changed again in 2017 when it was decided to aggregate all shark species to only the "shark" group. Indeed this is not an improvement to the data recording system but rather a setback.

Meanwhile, the recording system of trade data uses HS Code, which is also very general, following the type of product being traded, for example, shark fins, fresh fillets, and frozen fillets, without including the species name. Thus, it is necessary to improve the data and information recording system when the product is landed and traded at the domestic or export level.

6.4 Fishing Regulations

While mako sharks are caught in pelagic fisheries and shark-targeting fisheries, there are no specific fishing regulations for mako sharks in Indonesia. Most of the regulations generally apply to all capture fisheries, not specific to sharks and rays. However, such regulations are also relevant and can be implemented for shark and ray fisheries, namely:

1. **Minister of Marine Affairs and Fisheries Regulation No. 14 of 2011 on Capture Fisheries Business**

   The regulation stipulates every fishing vessel operating both in the Indonesian FMA and high seas to have a fishing permit.

2. **Minister of Marine Affairs and Fisheries Regulation No. 12 of 2012 on Capture Fisheries Business on The High Seas**

   The regulation requires that every fishing vessel operating on the high seas and gaining bycatch (ecologically related to the tuna fisheries) must take conservation action.

3. **Minister of Marine Affairs and Fisheries Regulation No. 1 of 2013 on the Monitoring of Fishing Vessels and Fish-Transporting Vessels**

The regulation states that every fishing vessel over 30 GT must place a fishing observer to monitor, measure, record, and report fishing activities. Monitoring aims to obtain objective and accurate data on fishing and fish transfer activities directly on fishing vessels and carrier vessels, particularly in preventing Illegal, Unreported, and Unregulated (IUU) Fishing.

An observer works on a fishing vessel that uses purse seine and longline operating on the high seas. This regulation is relevant since these vessels also catch mako sharks on the high sea. The observer also works on a vessel that uses fishing rods, ring nets, lift nets, gillnets, seine nets, and trawls operating in Indonesian waters, and fish transporting vessels operating in Indonesian waters and on the high seas. Unfortunately, the compliance of fishing vessels to place observers on the vessels is still deficient.

4. **Minister of Marine Affairs and Fisheries Regulation No. 48 of 2014 on Fishing Log Books**

The regulation amended the previous Minister of Marine Affairs and Fisheries Regulation No. PER.18 / MEN / 2010 on fishing logbooks, which was considered less effective in the implementation. This regulation requires every fishing vessel over 5 GT, licensed, Indonesian-flagged, and operating in Indonesian territorial waters, to have a logbook, fill it out, and hand it over to the chief of fishing harbor. Various breakthroughs have been made to improve the compliance of fishing vessels in filling in and reporting the fishing logbooks, one of which is the use of e-logbook. So the captains can fill the logbooks using an application.

5. **Minister of Marine Affairs and Fisheries Regulation No. 58 of 2020 on Capture Fisheries Business**

The regulation explains that conservation action is mandatory for every fishing vessel operating in the RFMO-managed area that gains shark bycatch that is ecologically related to the tuna fisheries.

6. **Minister of Marine Affairs and Fisheries Regulation No. 22 of 2021 on Fisheries Management Plan and Fisheries Management Governance**

The regulation explains fisheries management plans (FMP) in each fisheries management area (FMA) in Indonesia, including economically important fishery resources, endangered and protected species, CITES-listed species, and endemic species.

6.5 Trade Regulations

Like fishing regulations, Indonesia also does not have any specific regulations for mako shark products. The regulations are relatively general for all species listed in Appendix II CITES or protected species.

1. **Minister of Marine Affairs and Fisheries Regulation No. 61 of 2018 on the Utilization of Protected Fish Species and/or Fish Species Listed in the CITES Appendix**

   The ministerial regulation was revised through the Minister of Marine Affairs and Fisheries Regulation Number 44 of 2019 concerning the Amendment to the Minister of Marine Affairs and Fisheries Regulation No. 61 of 2018. The regulation stipulates the procedures for using protected fish species and the species listed in the CITES Appendix. The utilization under this regulation includes six components: research and development, breeding, trade, aquaria, exchange and maintenance for pleasure. The regulation stipulates that every person or legal entity is required to have a permit to utilize protected species and/or species listed in the CITES Appendix. The permit granted is then regulated for use by a quota mechanism (catch and export quota) to ensure the utilization does not detriment the population.

2. **Regulation of the Director-General of Marine Space Management Number 13 of 2018 concerning Procedures for the Issuance of Shark and Ray Trading Recommendations**

   The regulation specifies that the authorized officers will check every shark and ray product traded between provinces or exported. The information gathered includes shark and ray species, product name, product volume, product origin (landing and city), and destination. The regulation has been implemented since 2015 and shows increasing compliance from related stakeholders. The monitoring mechanism is done to ensure the traceability of the products traded domestically and internationally.

3. **Standard Operating Procedure (SOP) for Domestic and International Trade of CITES Appendix Listed Fish Species**

   Indonesia regulates the procedures for sharks and rays trading through the issuance of several permits, namely the Utilization Permit of Fish Species (SIPJI) for domestic trade and the Transport Permit of Fish Species (SAJI) for domestic and international trade. SIPJI permit for domestic trade is valid for five years. Traders can obtain SAJI permits if they have SIPJI permits and SAJI permits can only be used for one shipment within six months.

6.6 Conservation Regulations

Indonesia has regulations on the conservation of fish resources through government regulation number 60 of 2007. Although they do not specifically explain the conservation of mako sharks, these regulations stipulate conservation to protect all fish species, including mako sharks. This conservation is carried out to protect endangered fish species, maintain fish species diversity, maintain ecosystem balance and stability, and sustainable use of fish resources. The criteria for protected fish species in this regulation include fish species that are endangered, rare, endemic, those whose populations have drastically decreased in nature, and/or those with a low level of reproductive ability.

6.7 Local Government Regulations

Several local government regulations were issued to manage and protect sharks and rays in their jurisdictions. However, the regulations are mostly general (apply to all species) and include only e coastal areas. These include:

1. Government Regulation of Raja Ampat Regency Number 9 of 2012 that prohibits the fishing of sharks, manta rays, and certain types of fish in the waters of Raja Ampat, Papua Province.
2. Government Instruction of West Manggarai Regency Number DKPP/1309/VII/2013 concerning the prohibition of fishing for sharks, manta rays, napoleon wrasse, and other marine biotas in West Manggarai waters, East Nusa Tenggara Province.
3. Governor Instruction of DKI Jakarta Number 78 of 2014 stipulates the prohibition of consuming sharks and manta rays and their derivative products for officials and employees of the DKI Jakarta government.
4. Governor Regulation of South Sumatra Number 27 of 2015 concerning the prohibition of consuming, capturing, and trading sharks, manta rays, and/or their derivative products.
5. Governor Decree of West Nusa Tenggara Province Number 55 of 2020 concerning management action plan of shark and ray fisheries in West Nusa Tenggara Province from 2020-2025.
6. Bupati Regulation of Kaur of Bengkulu Province Number 104 of 2018 concerning control of fishing for sharks in the waters of Kaur Regency

6.8 Habitat Protection

Through the MMAF, the Indonesian government designated the Marine Protected Areas (MPA) in 2019 that covers 23.14 million hectares, most of which are in coastal areas. The coastal area is a critical habitat for many marine biotas for nurturing, spawning, and foraging, including sharks and rays. This policy aims to maintain the wealth of marine biological resources and coastal ecosystems and reduce habitat destruction due to destructive fishing practices and other coastal areas' activities.

6.9 Capacity Building, Information Dissemination, and Awareness Program

The Indonesian government also needs to regularly disseminate the decisions and results of the convention to relevant stakeholders. Therefore, in September 2019, the MMAF, as the management authority for the Class of Pisces, held a meeting to disseminate and formulate follow-up plans for the results of the 18th CoP of CITES. The planned follow-up to the proposed listing includes three aspects:

a. Protection aspect: preparing MMAF Decrees for fully/limited habitat protection, juveniles, and broodstocks; and a decree for the export ban.

b. Conservation aspect: consisting of restocking of populations to the natural habitat, habitat rehabilitation, technical assistance/training in data collection and species recognition, awareness-raising or information dissemination of legislation to the public, preparation of Non-Detriment Findings (NDF) document, and recording of traceability, improvement of shark and ray logbook and landing recording.

c. Utilization aspect: covering the preparation of catch and export quotas, data collection of business actors, data collection of shark and ray warehouse business actors, guidance for business actors, licensing facilitation for business actors, and preparing recommendations for zero export quotas by BRIN.

Table 6. Evaluate management at the level of national, regional and global

Availability of national, regional, and global management			
No	**Information**	**Description/comments**	**Source of Information**
1	Main catching countries	USA, Chile, Spain, Indonesia	FAO, 2019
2	Global main gear types and catching units	Pelagic longline, gillnet, purse seine, handline	FAO, 2019
3	Global conservation status	IUCN Status *Isurus oxyrinchus* and *I. paucus* Globally: Endangered (2019)	Rigby et al., 2019a Rigby et al., 2019b
4	Multilateral management agreements	CITES Appendix II	
5	National stock assessments	Due to the lack of data, a stock assessment is currently not carried out	
6	Regional stock assessments	*Isurus oxyrinchus*: Population trend data are available from four sources: (1) stock assess-ments in the north Atlantic and south Atlantic (ICCAT 2017); (2) stock assessment in the north Pacific (ISC 2018); (3) standardized catch per-unit-effort (CPUE) in the south Pacific (Francis et al. 2014); and (4) a prelimi-nary stock assessment in the Indian Ocean (Brunel et al. 2018). *Isurus paucus*: Population trend data are missing from the South Atlantic, Indian, and Pacific Oceans, which account for approximately 80% of the species' range (Rigby et al., 2019b).	Rigby et al., 2019a Rigby et al., 2019b
7	Global stock assessments	There is no data available on the absolute global population size of the Shortfin Mako and the Longfin Mako	Rigby et al., 2019a Rigby et al., 2019b

8	Main management bodies	Western and Central Pacific Fisheries Commission (WCPFC) Ecologically Related Species Working Group. CITES	
9	Cooperative management arrangements	Member of WCPFC has an obligation to provide estimates of the numbers of non-target fish species taken in the tuna longline fishery as part of its contribution to the Ecologically Related Species	Conservation and Management Measure 2010-07, WCPFC
10	Non-membership of Regional Fisheries Body (RFB)	None	
11	Fishery types	Indonesia: artisanal and industrial fisheries, both as target or bycatch	
12	National or regional management units	Management of shortfin mako in the western and central Pacific Ocean is the responsibility of the Western and Central Pacific Fisheries Commission (WCPFC) Indonesia has developed several national regulations by incorporating RFMO resolutions and other conservation and management strategies.	
13	Reported national catch(es) data, shark fishing trends and their trade value	The Ministry of Marine Affairs and Fisheries (MMAF) regularly published the Indonesian Capture Fisheries Statistics Book until 2016, since 2017 it was published by :: SATU DATA :: (kkp.go.id).	
14	Harvest or trades from other countries	Limited information from several countries	
15	Catch data from other countries	Limited information from several countries	

Table 7. Assessment parameters of preliminary consideration

Preliminary considerations					
No	**Criteria**	**Yes**	**No**	**Information**	**Source of Information**
Information on the specimen status in the CITES					
16	Listed in CITES Appendix II?	Yes		Mako sharks have been listed in CITES Appendix II since 2019 at CoP 18.	
Information on specimen origin					
17	Collected from the Indonesian management area? Explain the habitat location and distribution!	Yes		The Eastern Indian Ocean is a fishing ground that contributed more than 60% of Indonesia’s mako production, which consisted of Southern Java, Southern Nusa Tenggara, Sawu Sea, and Western of Timor Sea (FMA 573). Both areas are parts of the Eastern Indian Ocean with mako sharks are mostly taken from tuna fisheries. Mako sharks are also derived from other fishing grounds in smaller proportions such as Malacca Strait and Andaman Sea (FMA 571), Makassar Sea, Bone Bay, Flores Sea (FMA 713), Tolo Bay and Banda Sea (FMA 714), Tomini Bay, Maluku Sea, Halmahera Sea, Seram Sea and Berau Bay (FMA 715). Mako sharks were few times found in two of Indonesia’s shallow waters, i.e., the Java Sea and the Arafura Sea. The occurrence is rare, probably because shallow water is not suitable for mako sharks.	
18	Information on the stock limits and shared stock in several countries?		NA		
19	Which other countries fish this shared stock? Fishing the shared stock needs further coordination with the relevant countries.		NA		
20	Regional Fisheries Management Organization (RFMO) that managed this shared stock?		No		

Identification of species and their derivative products					
21	Are the species easy to identify and/or distinguished from other species based on their morphology?	Yes		Based on morphology, mako sharks could easily be distinguished from other shark groups because they have blade-like teeth, strong keels, and a large crescentic caudal fin. The difference between the two species is in the length of pectoral fins.	
22	Derived products that are used and traded? Please explain!	Yes		Fins (main product), meat, skins, cartilages, teeth. The recording system of trade data uses HS Code, which is also very general following the type of product being traded, for example, shark fins, fresh fillets and frozen fillets, without including the species name.	
23	Could the derived products be identified both visually and genetically?		No	Detached fins can be identified to genus level using the FAO shark fin guide or the isharkfin software or http://www.fao.org/ipoasharks/tools/software/isharkfin/en/) Carcass could be identified using identification book by Abercrombie and Jabado (2021) The visual identification becomes more challenging when the shark is already in derivative products, such as processed fins, meats, skins and teeth. Determination of species for derivative products can be done with a molecular genetic approach, but it takes time and high cost.	Abercrombie DL, Jabado RW. 2021. CITES Sharks and Rays - Implementing and Enforcing Listings: Volume II - Processed Carcass ID. Ministry of Marine Affairs and Fisheries (Indonesia), Cefas (UK).

Specimen legality					
24	Does the state fully protect the species?		No	Not protected under Indonesian regulations. All fishing vessels operating in RFMO management areas and catching sharks as bycatch are prohibited from catching juveniles and pregnant sharks. They have to release and report it in the logbook.	
25	Listed as a species whose export is prohibited?		No		
26	Regulated under a multilateral agreement?		No		
27	Sourced from illegal fishing activities? (contrary to fishing regulations in Indonesia)		No		
28	Taken from a no-take marine protected area?		No		
29	Taken in contravention of RFMO regulations?		No		
30	Could the NDF document be continued? Explain your reason or justification!	Yes		Based on the availability of information related to biology, fishing pressure, trade and current management of mako sharks in Indonesia, the NDF document for mako sharks in Indonesian waters can be assessed for further steps.	

Table 8. Assessment parameters of biological aspect for shortfin mako shark (*I. oxyrinchus*)

BIOLOGICAL ASPECT					
No	**Parameters**	**Category**	**Indicator**	**Value**	**Reference**
31	**Productive age**				
	When a species is productive for mating and breeding.	Low - 1	>20 years	2	Semba et al., 2009 Bishop et al., 2006 Ebert et al., 2013 Groeneveld et al., 2014
		Medium - 2	10-20 years		
		High– 3	<10 years		
32	**Median age at maturity**				
	The age at which 50% of a cohort is mature.	Low - 1	< 5 years	3	LIPI, WCS, BRPL, WWF & Mobula Project, unpublished data Semba et al., 2009 Bishop et al., 2006 Ebert et al., 2013 Groeneveld et al., 2014
		Medium - 2	5-15 years		
		High– 3	> 15 years		

33	**Median size at maturity**				
	Size at which 50% of a cohort reaches maturity.				
	* Large-sized sharks	Low– 1	< 200 cm (total length)	2	LIPI, WCS, BRPL, WWF & Mobula Project, unpublished data Compagno, 1984 Last & Stevens, 1994 Mollet et al., 2000 Joung & Hsu, 2005 Francis & Dulvy, 2005 White et al., 2006 Natanson et al., 2006 Semba et al., 2011 Carreon-Zapiain et al. 2018
		Medium - 2	200-400 cm (total length)		
		High - 3	> 400 cm (total length)		
34	**Maximum Age**				
	Longevity in an unfished population.				
	* Large-sized sharks	Low– 1	< 20 years	2	Natanson et al., 2006 Bishop et al., 2006 Cerna & Licandeo, 2009 Tsai et al., 2014
		Medium - 2	20-35 years		
		High - 3	> 35 years		

35	**Maximum size**				
	The large-sized sharks have the higher the vulnerability because it takes longer to reach maturity.				
	* Large-sized sharks	Low– 1	< 300 cm (total length)	2	LIPI, WCS, BRPL, WWF & Mobula Project, un-published data Pratt & Casey, 1983 Ardizzone et al., 2006 White et al., 2006 Kabasakal & Madalena, 2011 Weigmann, 2016 Simeon et al., 2020
		Medium - 2	300-500 cm (total length)		
		High - 3	> 500 cm (total length)		
36	**Trophic level**				
	The trophic level of a shark species is a measure of its position within ecosystem.	Low– 1	Low	3	Bowman et al., 2000
		Medium - 2	Medium/Mesopredator		
		High - 3	High/Top predator		
37	**Growth coefficient**				
	In the von Bertalanffy growth model, the growth rate coefficient (k) indicates the time taken by an individual to attain its maximum or asymptotic length.	Low– 1	>0.5	3	Cailliet et al., 1983 Hsu, 2003 Natanson et al., 2006 Cerna & Licandeo, 2009 Groeneveld et al., 2014 Liu et al., 2018 Simeon et al., 2020
		Medium - 2	0.1-0.5		
		High - 3	<0.1		

38	**Fecundity**				
	The fecundity of elasmobranch species is often determined by simply counting the number of eggs and embryos within the uterus of viviparous species (Conrath, 2005).	Low– 1	> 21 pups/eggs	2	Mollet et al., 2000 Joung & Hsu, 2005 White et al., 2006
		Medium - 2	11 - 20 pups/eggs		
		High - 3	1 - 10 pups/eggs		
39	**Mating season**				
	Maturity in sharks is determined by either observation of the reproductive tract organs or secondary sex structures or by noting the presence or absence of reproductive products within the reproductive tract (Conrath, 2005).	Low– 1	throughout the year	3	Unknown
		Medium - 2	certain seasons		
		High - 3	uncertain or unknown		
40	**Size at birth**				
	The large size at birth will increase survivorship of young. Meanwhile, the small size has the high risk of predation by large predators.				
	* Large-sized sharks	Low– 1	> 80 cm	2	Mollet et al., 2000 Joung & Hsu, 2005 White et al., 2006
		Medium - 2	50-80 cm		
		High - 3	< 50 cm		
41	**Natural mortality rate**				
	Natural mortality rate (M) indicates reduction in total stock due to competition, disease, predation, etc.	Low– 1	> 0.4	3	Bishop et al., 2006
		Medium - 2	0.17-0.4		
		High - 3	< 0.17		
42	**Intrinsic rate of population increase (r)**				
	Low rates of population increase, higher vulnerability.	Low– 1	> 0.35	3	Semba et al., 2019 Liu et al., 2021 LIPI, WCS, BRPL, WWF & Mobula Project, unpublished data
		Medium - 2	0.15-0.35		
		High - 3	<0.15		

	Current stock size				
43	This parameter is known after assessing stock size, trend and distribution against the baseline data	Low– 1	>50% of baseline abundance	3	unknown
		Medium - 2	25-50% of baseline abundance		
		High - 3	<25% of baseline abundance		
	Population trend				
44	- This parameter takes into account the population size trend and the current stock abundance that is subject of the NDF. - Area of distribution is frequently to be one of the signs of population decline. - Density may be measured by catch per unit effort (CPUE); if the "hotspots" are decreasing, this usually indicates a declining population (Mundy-Taylor et al., 2014).	Low– 1	- Population trend is stable; or - Population trend is declining less than 30% in three months; or - Population trend is increasing; or - The area of distribution is stable or increasing.	2	CPUE in tuna bycatch decreased in last 3 years since 2017 to 2019 (Wudji et al.2021) CPUE in shark fisher decreased since 2014 (data-ikan.org)
		Medium - 2	- Population trend is declining 30-60% in three years; or - The distribution area is fragmented or decreased.		
		High - 3	- Declining population trend is above 60% in three years; or - The distribution area is restricted and fragmented, and "hot spots" are no longer present.		

45	**Geographic distribution**				
	Restricted distribution, higher vulnerability	Low– 1	Widespread	2	Compagno, 2001 Abascal et al., 2011 Ebert et al., 2013
		Medium - 2	Regional		
		High - 3	Restricted		
46	**Habitat**				
	Specific habitat, higher vulnerability. It means, if the habitat is degraded, it will has a direct impact on a species.	Low– 1	Not Specific	3	Compagno, 2001 Abascal et al., 2011 Ebert et al., 2013 Nasby-Lucas et al., 2019
		Medium - 2	Moderate		
		High - 3	Specific		

Summary for biological aspect:
1.00 – 1.67 = Low vulnerability
1,68 – 2.33 = Medium vulnerability
2,34 – 3.00 = High vulnerability and/ or unknown
Notes:
Average value for biological aspect is 2.50 or is categorized in high vulnerability (for shortfin mako shark)

Table 9. Assessment parameters of biological aspect for longfin mako shark (*I. paucus*)

BIOLOGICAL ASPECT					
No	**Parameters**	**Category**	**Indicator**	**Value**	**Reference**
31	**Productive age**				
	When a species productive for mating and breeding.	Low - 1	>20 years	3	unknown
		Medium - 2	10-20 years		
		High– 3	<10 years		
32	**Median age at maturity**				
	The age at which 50% of a cohort is mature.	Low - 1	< 5 years	3	unknown
		Medium - 2	5-15 years		
		High– 3	> 15 years		
33	**Median size at maturity**				
	Size at which 50% of a cohort reaches maturity.				
	* Large-sized sharks	Low– 1	< 200 cm (total length)	2	LIPI, WCS, BRPL, WWF & Mobula Project, unpublished data Compagno, 2001 White et al., 2006 White, 2007 Ruiz-Abierno et al., 2021
		Medium - 2	200-400 cm (total length)		
		High - 3	> 400 cm (total length)		

34	**Maximum Age**				
	Longevity in an unfished population.				
	* Large-sized sharks	Low– 1	< 20 years	3	unknown
		Medium - 2	20-35 years		
		High - 3	> 35 years		
35	**Maximum size**				
	The large-sized sharks have a higher vulnerability because it takes longer to reach maturity.				
	* Large-sized sharks	Low– 1	< 300 cm (total length)	2	Compagno, 2001 Weigmann, 2016 Rigby et al., 2019a Simeon et al., 2020
		Medium - 2	300-500 cm (total length)		
		High - 3	> 500 cm (total length)		
36	**Trophic level**				
	The trophic level of a shark species is a measure of its position within the ecosystem.	Low– 1	Low	3	Bowman et al., 2000
		Medium - 2	Medium/Mesopredator		
		High - 3	High/Top predator		
37	**Growth coefficient**				
	In the von Bertalanffy growth model, the growth rate coefficient (k) indicates the time taken by an individual to attain its maximum or asymptotic length.	Low– 1	>0.5	3	unknown
		Medium - 2	0.1-0.5		
		High - 3	<0.1		

38	**Fecundity**				
	The fecundity of elasmobranch species is often determined by simply counting the number of eggs and embryos within the uterus of viviparous species (Conrath, 2005).	Low– 1	> 21 pups/eggs	3	Compagno, 1984 Castro et el., 1999
		Medium - 2	11 - 20 pups/eggs		
		High - 3	1 - 10 pups/eggs		
39	**Mating season**				
	Maturity in sharks is determined by either observation of the reproductive tract organs or secondary sex structures or by noting the presence or absence of reproductive products within the reproductive tract (Conrath, 2005).	Low– 1	throughout the year	3	Unknown
		Medium - 2	certain seasons		
		High - 3	uncertain or unknown		
40	**Size at birth**				
	The large size at birth will increase survivorship of young. Meanwhile, the small size has the high risk of predation by large predators.				
	* Large-sized sharks	Low– 1	> 80 cm	1	Castro et al., 1999 Compagno, 2001
		Medium - 2	50-80 cm		
		High - 3	< 50 cm		
41	**Natural mortality rate**				
	Natural mortality rate (M) indicates reduction in total stock due to competition, disease, predation, etc.	Low– 1	> 0.4	3	unknown
		Medium - 2	0.17-0.4		
		High - 3	< 0.17		

	Intrinsic rate of population increase (r)				
42	Low rates of population increase, higher vulnerability.	Low– 1	> 0.35	3	unknown
		Medium - 2	0.15-0.35		
		High - 3	<0.15		
	Current stock size				
43	This parameter is known after assessing stock size, trend and distribution against the baseline data	Low– 1	>50% of baseline abundance	3	unknown
		Medium - 2	25-50% of baseline abundance		
		High - 3	<25% of baseline abundance		
	Population trend				
44	- This parameter takes into account the population size trend and the current stock abundance that is subject of the NDF. - Area of distribution is frequently to be one of the signs of population decline. - Density may be measured by catch per unit effort (CPUE); if the "hotspots" are decreasing, this usually indicates a declining population (Mundy-Taylor et al., 2014).	Low– 1	- Population trend is stable; or - Population trend is declining less than 30% in three months; or - Population trend is increasing; or - The area of distribution is stable or increasing.	3	unknown
		Medium - 2	- Population trend is declining 30-60% in three years; or - The distribution area is fragmented or decreased.		
		High - 3	- Declining population trend is above 60% in three years; or - The distribution area is restricted and fragmented, and "hot spots" are no longer present.		

	Geographic distribution				
45	Restricted distribution, higher vulnerability	Low– 1	Widespread	2	Compagno, 2001 Rigby et al., 2019a Weigmann, 2016
		Medium - 2	Regional		
		High - 3	Restricted		
	Habitat				
46	Specific habitat, higher vulnerability. It means, if the habitat is degraded, it will has a direct impact on a species.	Low– 1	Not Specific	3	Compagno, 2001 Rigby et al., 2019a Weigmann, 2016
		Medium - 2	Moderate		
		High - 3	Specific		

	Summary for biological aspect:
	1.00 – 1.67 = Low vulnerability
	1,68 – 2.33 = Medium vulnerability
	2,34 – 3.00 = High vulnerability and/ or unknown
	Notes: **Average value for biological aspect is 2.69 or is categorized in high vulnerability (for longfin mako shark)**

Table 10. Assessment parameters of fishing pressure aspect

FISHING ASPECT					
No	**Parameters**	**Category**	**Indicator**	**Value**	**Reference**
47	**National production data at species level**				
	National production data at level species is needed to determine population trends in nature.	Low - 1	Data at the species level is available nationally	2	MMAF, 2017 :: SATU DATA :: (kkp.go.id)
		Medium - 2	Partially (available at group level)		
		High - 3	No data		
48	**National production data for each FMA (Fisheries Management Area)**				
	Fisheries management plans in Indonesia are based on FMA, so national production data for each FMA is crucial.	Low - 1	Available and nationally	2	MMAF, 2017 :: SATU DATA :: (kkp.go.id)
		Medium - 2	Partially (only available in some FMAs)		
		High - 3	No data		
49	**Variation of fishing gear**				
	Sharks are caught by various fishing gears and usually depend on the type of habitat.	Low - 1	One type of fishing gear	3	Annual reports from Technical Implementation Unit of MMAF
		Medium - 2	Two types of fishing gear		
		High - 3	More than two types of fishing gear		
50	**Catch selectivity**				
	The fishing gear, which has a high selectivity, will provide opportunities for recruitment because it caught a bigger size or adult individual.	Low - 1	Selective against the size	2	Juvenile and subadult was caught in longline (Wudji et al.2021); and gillnet (unpublished data,MMAF 2021)
		Medium - 2	Moderate		
		High - 3	Not selective		

51	**Level of by-catch**				
	How big is the shark as a by-catch seen from the national production data (in weight unit)	Low - 1	Low (low catch volume/0-10%)	1	Compared with other shark annual catch (unpublish data PIPP - MMAF data, 2021)
		Medium - 2	Medium (medium catch volume/10-20%)		
		High - 3	High (high catch volume /30-40%)		
52	**Fishing ground**				
	The larger the fishing ground, the more the capture intensity is spread out, and the vulnerability becomes low, and vice versa	Low - 1	Large (oceanic – the fishing ground under RFMO jurisdiction)	1	Rigby et al., 2019a
		Medium - 2	Regional (coastal)		
		High - 3	Limited (only at certain location)		
53	**Sex ratio**				
	The equal of shark sex ratio supports the recruitment process. This value is obtained from on chi-square test.	Low - 1	Equal	2	Wujdi et al.2021
		Medium - 2	Not equal		
		High - 3	No data		
54	**Fishing season (in a year)**				
	The fishing season is usually different, related to the weather conditions at each fishing ground.	Low - 1	<3 months	3	Caught all the year without any fishing season
		Medium - 2	3-6 months		
		High - 3	>6 months		

55	**Fishing mortality**				
	Fishing mortality (F) is the mortality rate caused by fishing activities (targeted and secondary catch) and declines in the proportion of the total stock.	Low - 1	< 0.5 (less than 0.5)	3	*I.oxyrhynchus* 1.56 in 2019 and *I.paucus* 1.67 in 2019 (Simeon et al.2020)
		Medium - 2	0.5-1 (between 0.5 and 1)		
		High - 3	>1* (more than 1 and compared to natural mortality value/M)		
56	**Exploitation rate**				
	Exploitation rate (E) is the ratio between the fishing mortality rate (F) and the total mortality rate (Z), where Z = F + natural mortality (M).	Low - 1	< 0.5 (less than 0.5)	3	*I.oxyrhynchus* 0.55 in 2019 and *I.paucus* 0.62 in 2019 (Simeon et al.2020)
		Medium - 2	0.5 (E equals 0.5)		
		High - 3	> 0.5 (more than 0.5)		

57	**IUU fishing information**				
	Illegal, unreported and unregulated (IUU). Illegal fishing takes place where vessels operate in violation of the fishing laws of a RFMO or a coastal State. Unreported fishing is unreported or misreported to relevant authorities, in contravention of applicable laws and regulations. Unregulated fishing generally refers to fishing by vessels without nationality, or flagged to a State not Party to the RFMO governing the species or fishing area.	Low - 1	- Catch data is well-documented; - The trading chain is transparent; - The total catch, domestic trade and total export are expected to be balanced; and - Relevant control instruments have been appropriately arranged.	2	xx
		Medium - 2	- Catch data is not well-documented; - The trading chain is difficult to trace; - There is an issue of unbalanced between total catch, domestic trade and total export; and - Only a few relevant control tools have been arranged.		
		Tinggi - 3	- No catch data; - The trading chain is not transparent; - The total catch, domestic trade and total export are expected to be unbalanced; and - Relevant control tools have not been appropriately arranged.		

	Summary for fishing pressure aspect:
	1.00 – 1.67 = Low vulnerability
	1,68 – 2.33 = Medium vulnerability
	2,34 – 3.00 = High vulnerability and/ or unknown
	Notes:
	Average value for fishing pressure aspect is 2.18 or is categorized in medium vulnerability

Table 11. Assessment parameters of trade aspect

TRADE ASPECT					
No	**Parameters**	**Category**	**Indicator**	**Value**	**Reference**
58	**Volumes of foreign market shipment for shark meat and non-fin products**				
	The sharks in this parameter are those caught in Indonesian waters, not from the outside or re-export products.	Low - 1	< 40% of the total production	3	No data recorded
		Medium - 2	40-60% of the total production		
		High - 3	> 60% of the total production		
59	**Trend of foreign market shipment volume for shark meat and non-fin products**				
	Trend of foreign market shipment volume for shark meat and non-fin products.	Low - 1	Stable or increasing <20% in the last decade	3	No data recorded
		Medium - 2	Increasing 20-40% in the last decade		
		High - 3	Increasing more than 40% in the last decade, or no data		

60	**Volumes of foreign market shipment for shark fins**				
	The sharks in this parameter are those caught in Indonesian waters, not from the outside or re-export products.	Low - 1	< 40% of the total production	3	see page 25
		Medium - 2	40-60% of the total production		
		High - 3	> 60% of the total production		
61	**Trend of foreign market shipment volume for shark fins**				
	Trend of foreign market shipment volume for shark fins and derivative products	Low - 1	Stable or increasing <20% in the last decade	3	see page 25
		Medium - 2	Increasing 20-40% in the last decade		
		High - 3	Increasing more than 40% in the last decade, or no data		
62	**Recording of trade data**				
	Recording of information on species, volume, and commodities of products traded	Low - 1	Trade data is recorded entirely (recorded for each species and in all regions)	2	The recording system of trade data uses HS Code, which is also very general following the type of product being traded, for example, shark fins, fresh fillets and frozen fillets, without including the species name.
		Medium - 2	Partially (recorded in group level or only recorded in a few regions)		
		High - 3	No data		
63	**Illegal International Trade**				
	International shipping or trade of shark products does not appropriate with legal documents.	Low - 1	In accordance with export documents	3	Unknown
		Medium - 2	Partially		
		High - 3	No data and/or low data accuracy		

	Summary for trade aspect:
	1.00 – 1.67 = Low vulnerability
	1,68 – 2.33 = Medium vulnerability
	2,34 – 3.00 = High vulnerability and/ or unknown
	Notes:
	Average value for trade aspect is 2.83 or is categorized in high vulnerability

Table 12. Assessment parameters of management aspect

MANAGEMENT ASPECT					
No	**Parameters**	**Category**	**Indicator**	**Value**	**Reference**
64	**Traceability of traded commodities**				
	International trade in CITES-listed species must be traceable, starting from fishing to export.	Low– 1	The system/mechanism is available and complete	2	Indonesian government has developed several stipulations and regulations in the fishing and trade activities. However, Indonesia still needs to develop other tools so that the traceability system is better and well implemented, from fishing to marketing on a local to an international scale.
		Medium– 2	The system/mechanism is avalaible but incomplete and does not yet cover nation-ally		
		High - 3	No system/mechanism of traceability		
65	**Implementation of traceability mechanism**				
	This parameter assesses whether or not the traceability mechanism is implemented	Low - 1	Implemented nationally	2	The traceability mechanism is not implemented nationally.
		Medium - 2	Implemented, but not nationally		
		High - 3	Not yet implemented		

66	**NPOA of Sharks**				
	This parameter assesses whether or not the NPOA is available as a reference for all parties involved in developing and implementing shark and ray conservation and management programs.	Low - 1	The NPOA of Shark is available, legalized, and is updated periodically	1	The Indonesian government has developed the National Plan of Action (NPOA) to conserve and manage sharks and rays in Indonesia for 2010-2014 and 2016-2020, while the next period is still in preparation.
		Medium - 2	The NPOA of Shark is available, but not yet legalized		
		High - 3	No NPOA of Shark		
67	**Implementation of NPOA – Sharks**				
	This parameter assesses whether or not the NPOA of sharks is implemented	Low - 1	All the action plans already implemented	2	Mostly the action plans were already implemented and were supported by many stakeholders. Based on the evaluation by MMAF, 2020
		Medium - 2	Not all the action plans implemented		
		High - 3	Not yet implemented		
68	**Recording data and information**				
	This parameter assesses whether or not data has been well-documented and how complete the information recorded, whether it covers up to the species level and represents all the main landing sites.	Low - 1	Data has been recorded at the species level and covered all main landing sites or available data covered at least 90% of the main landing site	2	see page 13 and 18
		Medium - 2	1. Data has been recorded at the species level, but does not cover all the main landing sites (25-90%); or 2. Data covered all main landing sites, but still recorded at the genus/group level		
		High - 3	Data availability is less than 25%		

69	**Regulations of species protection**				
	This parameter assesses whether or not there is protection regulation (full or limited protection by size, time, place and life cycle) for endangered sharks.	Low - 1	Regulations of species protection are available	3	No specific protection regulations for mako sharks in Indonesia.
		Medium - 2	-		
		High - 3	No regulations of species protection		
70	**Implementation of species protection regulations**				
	This parameter assesses whether or not regulations of species protection are implemented.	Low - 1	Implemented (note: supervision and law enforcement applied)	3	None
		Medium - 2	Implemented, but partially		
		High - 3	Not yet implemented		
71	**Place/location limitations**				
	This parameter assesses whether or not there are regulations that managed the location in which fishers are allowed or not to catch sharks.	Low - 1	Regulations of location shark fishing limitations are available	3	No regulations of the place or location limitation.
		Medium - 2	Regulations of location sharks fishing limitation are available but do not yet cover nationally		
		High - 3	No regulation		
72	**Implementation of location limitation regulations**				
	This parameter assesses whether or not regulations of the location sharks fishing limitation are implemented	Low - 1	Implemented nationally	3	None
		Medium - 2	Implemented, not nationally		
		High - 3	Not yet implemented		
73	**Minimum size restriction**				
	This parameter assesses whether or not there are regulations of the shark minimum size restriction.	Low - 1	Regulations of shark minimum size restriction are available	2	see page 31
		Medium - 2	Regulations of shark minimum size restriction are available, not covered nationally		
		High - 3	No regulations		

74	**Implementation of minimum size restriction regulations**				
	This parameter assesses whether or not regulations to limit the size of sharks allowable for catch are implemented	Low - 1	Implemented nationally	3	None
		Medium - 2	Implemented, but not nationally		
		High - 3	Not yet implemented		
75	**Time limitation**				
	This parameter assesses whether or not there are regulations of sharks fishing time limitation. (Note:* if the species has the data related to mating seasons)	Low - 1	Regulations of sharks fishing time limitation are available	3	No regulations of sharks fishing time limitation
		Medium - 2	Regulations sharks fishing time limitation are available, not covered nationally		
		High - 3	No regulations		
76	**Implementation of time limitation regulations**				
	This parameter assesses whether or not regulations of sharks fishing time limitation are implemented	Low - 1	Implemented nationally	3	None
		Medium - 2	Implemented, but not nationally		
		High - 3	Not yet implemented		
77	**Intact shark landing regulation**				
	This parameter assesses whether or not there is intact shark landing regulation.	Low - 1	Intact shark landing regulation is available	3	No intact shark landing regulation
		Medium - 2	Intact shark landing regulation is available but does not cover nationally		
		High – 3	No regulation		

78	**Implementation of intact shark landing regulation**				
	This parameter assesses whether or not intact shark landing regulation is implemented.	Low - 1	Implemented nationally	3	None
		Medium - 2	Implemented, but not nationally		
		High - 3	Not yet implemented		
79	**Utilization regulations**				
	This parameter assesses whether or not there are licensing regulations of shark utilization (trade, aquaria, cultivation, exchanging, fishing, and research).	Low - 1	Regulations are available and complete	2	The utilization regulations are relatively general for all species listed in Appendix II CITES or protected species: 1. Minister of Marine Affairs and Fisheries Regulation No. 61 of 2018 on the Utilization of Protected Fish Species and/or Fish Species Listed in the CITES Appendix 2. Regulation of the Director-General of Marine Space Management Number 13 of 2018 concerning Procedures for the Issuance of Shark and Ray Trading Recommendations
		Medium - 2	Regulations are available, but not complete		
		High - 3	No regulation		
80	**Implementation of utilization regulations**				
	This parameter assesses whether or not regulations of shark utilization are implemented	Low - 1	Implemented nationally	2	The utilization regulations have not been implemented nationally.
		Medium - 2	Implemented, but not nationally		
		High - 3	Not yet implemented		

81	**Dissemination of regulations**				
	This parameter assesses whether or not there is the dissemination of existing regulations, and whether the information of dissemination was conveyed to all stakeholders in the shark business process.	Low - 1	All the existing regulations have been disseminated nationally to relevant stakeholders (Note: explain for each stakeholder in the shark business process)	2	Indonesian government have not regularly disseminated the decisions and results of the convention to relevant stakeholders
		Medium - 2	Not all the existing regulations have been disseminated nationally		
		High - 3	No dissemination		
82	**Supervision of the implemented regulations**				
	This parameter assesses whether or not there are supervisions of the implemented regulation and whether the supervision was held in all locations.	Low - 1	Supervision of the implemented regulations is available and nationally	2	Supervision or regulations of have not implemented nationally
		Medium - 2	Supervision was held only at specific locations or for particular regulations		
		High - 3	No supervision		
83	**Law enforcement**				
	This parameter assesses whether or not there is law enforcement against violations of shark utilization.	Low - 1	Law enforcement has been conducted for all cases	1	Law enforcement is applied for all cases.
		Medium - 2	Law enforcement was only conducted in some cases		
		High - 3	No law enforcement		

Summary for management aspect:
1.00 – 1.67 = Low vulnerability
1,68 – 2.33 = Medium vulnerability
2,34 – 3.00 = High vulnerability and/ or unknown
Notes: **Average value for management aspect is 2.35 or is categorized in high vulnerability**

Scoring Method

The NDF document was assessed using a scoring method for more straightforward status determination and decision making. Each parameter for each aspect was summed up and averaged. The value was then weighted according to a predetermined percentage for each aspect, viz. biological aspect, 20%; fishing, 30%; trade, 20%; and management, 30%. The value for the shortfin and longfin mako sharks are shown in the table below.

Table 13. The score value for shortfin mako shark (*Isurus oxyrinchus*)

Aspects	Average values	Rating weight	Values
Biology	2.50	0,2	0,50
Fishery	2.18	0,3	0,65
Trade	2.83	0,2	0,57
Management	2.35	0,3	0,71
			2,43

Table 14. The score value for longfin mako shark (*Isurus paucus*)

Aspects	Average values	Rating weight	Values
Biology	2.69	0,2	0,54
Fishery	2.18	0,3	0,65
Trade	2.83	0,2	0,57
Management	2.35	0,3	0,71
			2,47

The status or final decision of the NDF document is obtained through the scoring method. Therefore, the criteria for NDF mako sharks (*Isurus* spp.) is negative or a high vulnerability category. The recommendations are described in Chapter 8.

Since the final decision of mako sharks NDF is negative, any effort to exploit the mako shark will allegedly endanger the sustainability of their population in the wild. This NDF will be reviewed in the next one or two years. Several recommendations are proposed for the sustainable management of mako sharks as follows:

Improving the implementation of NPOA

Many programs and activities should be conducted to achieve the goals of NPOA and involve various stakeholders in a participatory approach. The NPOA implementation was expected to enhance the conservation effort and ensure the improvement of shark populations, including mako sharks. However, NPOA had not been supported and established by a strong legal baseline, making its implementation challenging to support by the collaborative partnership.

Improving catch data recording by covering more landing sites and detailing taxon identity

The catch data must be recorded at each landing site or at least at priority locations that represent mako shark data from Indonesia waters. The data must be recorded up to species level, no longer at the group or family level, especially for the CITES-listed species. The robust data is critical to support the monitoring, evaluation, and assessment of the mako shark population in Indonesia waters.

Including the mako shark in the conservation priority list on Fisheries Management Plans

Several species of sharks and rays have become conservation priorities because of their conservation status on the IUCN Red List and their listing in CITES Appendix 2, one of which is the mako sharks. Meanwhile, regulation for species protection is only enforced nationally for a few shark and ray species. Mako sharks are often caught in multi-gear fisheries. Thus, the management authority should include them in the conservation priority species in the Fisheries Management Plan (FMP) for Fisheries Management Areas (FMA). Some FMAs are known to be the range of occurrence of mako sharks, such as FMA 572, 573, 716, and 717. This effort will maintain sustainability and reduce the catch mortality rate and the level of exploitation of these species.

Strengthening management through regulation

Several regulations related to fishing and trade should be developed to maintain the sustainability of the mako shark population in the waters. These regulations can aim at releasing juveniles and pregnant sharks that are still alive, limiting the catch through a quota system, obliging fishers to catch and land the whole body, and controlling the catch through regulations on the fishing season, fishing location, or catch on only limited size range. On the other hand, regulations related to trade can be the form of restrictions through export quotas and size restrictions on specific products.

Implementing all regulations related to fisheries, trade, and management of mako sharks

In general, existing regulations regarding the protection and utilization of sharks in general or for mako sharks must be appropriately implemented. Up to the present, the government has made some management tools for both local and national levels. This implementation should be supported by supervision and law enforcement to increase compliance from all stakeholders involved in the shark business process.

Capacity Building

The Indonesian government needs to increase the capacity of technical unit staff in order to strengthen the management system through regular and measurable training. The capacity building will not only be needed for the trade verifiers but also for port enumerators and onboard observers. Capacities that are needed include identification skills for mako sharks both whole body and/or derivative products, and the skill of management implementation such as using software usages such as traceability system, e-logbook system, and online fishing port information system.

Improvements to the collection system of trade data

Data recording for trade monitoring needs to be improved by completing detailed information to enhance the traceability aspect of a product. Ideally, every product of CITES-listed sharks should be identifiable and registered from the first landed, processed, and then collected by middlemen until exported.

Information on the catch locality, size and fishing gear should be attached to each individual if the CITES product is subject to export through the barcode system. The government needs to develop a data recording system and trade monitoring that can be implemented and tracked at all levels. In addition, the data recording format for this CITES product should be synchronized among different Technical Implementation Units (UPT) in the MMAF, the Fish Quarantine and Inspection Agency, and Customs.

Improvements to the Health Certificate (HS) Code to detail the information on species and product types

The existing HS Code for shark and ray products only classifies the products into dried fins, bones, skin, and frozen meat, without regard for species. Information on species identity is required, especially for the CITES-listed species, to reveal how many of those species are utilized as export commodities. It is recommended that the HS Code should be updated and specify the species or group name for the CITES-listed products. Therefore, information on the export of those species can be known more accurately as the types of derivative products.

CLOSING REMARK 9

Based on the assessments that considered four main aspects of the condition of mako sharks in Indonesia in the last decade, BRIN (National Research and Innovation Agency) found that the mako shark population in Indonesian waters is facing severe threats if not appropriately managed. Therefore, a negative NDF result is given. It is not impossible to change the NDF into positive in the future if all recommendations, as explained in Chapter 8, are implemented. Currently, the international trade in mako sharks and their derivative products is not recommended until the Management Authority ensures the reduction of mako shark mortality and improves the measurable management. This NDF will be reviewed in the next few years to evaluate the progress of implementations of all aspects of fisheries and the trade of mako sharks that reduced the threat to their populations.

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Non-Detriment Findings (NDF) for Mako Sharks from Indonesian Waters

National Research and Innovation Agency (BRIN)

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