NON-DETRIMENT FINDINGS (NDF) FOR HAMMERHEAD SHARKS FROM INDONESIAN WATERS

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PREFACE

The convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between governments that aims to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species. Up to now, 184 parties have joined CITES voluntarily and agreed to be bound by the Convention. As a CITES party, Indonesia is committed to supporting and complying with the convention decisions, rules and resolutions related to the international trade of wild fauna and flora listed in the CITES Appendices.

In CITES CoP16 (Convention of the Parties) in 2013, three hammerhead sharks were added to Appendix II, including the scalloped hammerhead shark *Sphyrna lewini*, great hammerhead shark *Sphyrna mokarran* and smooth hammerhead shark *Sphyrna zygaena*. International trade of species listed in Appendix II must follow the recommendation of the Non-Detriment Findings (NDF) document prepared by the National Scientific Authority to justify 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 hammerhead sharks in Indonesian waters based on scientific data and information. The recommendations in the NDF are intended to be references for the Management Authority to establish management strategies for hammerhead sharks in Indonesia and emphasize three main aspects: sustainability, legality and traceability. BRIN developed this valuable document with collaboration and coordination with all stakeholders, such as the Ministry of Marine Affairs and Fisheries (MMAF), Non-Governmental Organizations and others. Hopefully, the collaboration will continue for the subsequent studies of other CITES Appendix II species.

Jakarta, October 2022
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National Research and Innovation Agency (BRIN)

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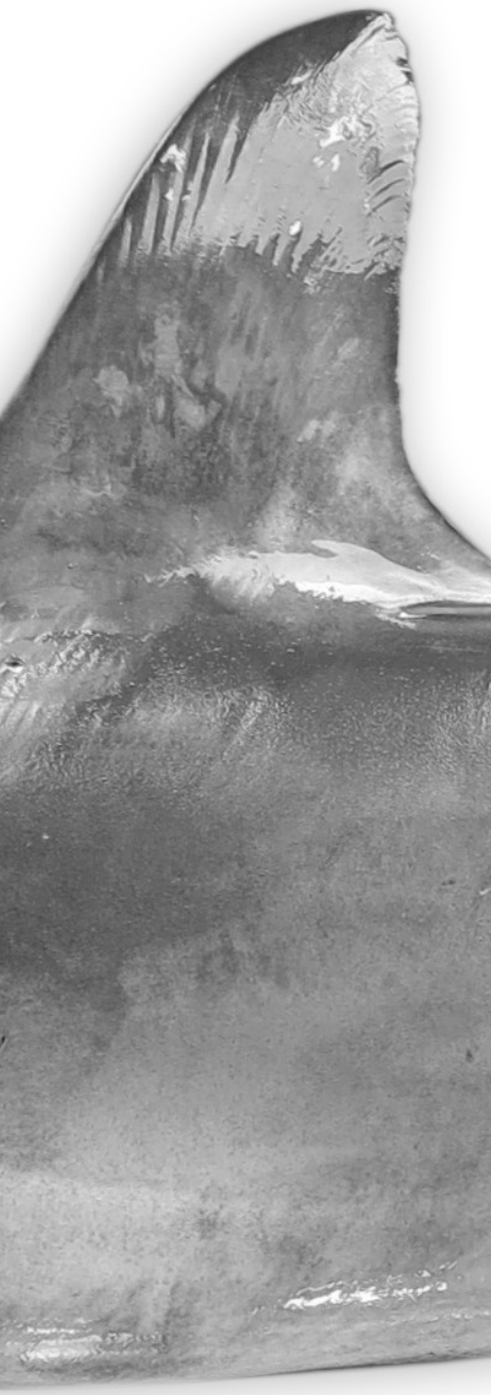

1. INTRODUCTION

1.1 Background

The convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is one of the international bodies controlling endangered biota trades. This convention regulates and restricts the international trade of numbers of wild biota by listing them in its Appendices I, II and III. All member countries must follow all CITES rules and ensure that their export of species listed in CITES appendices meets the CITES requirements. Indonesia has become a member of CITES since 1978. Hence Indonesia is subject to CITES rules regarding the international trade of biota listed in CITES Appendices.

CITES has listed sharks in Appendix II since 2003 by including two shark species. Several sharks were then listed later, including hammerhead sharks. Since 2014, three species of hammerheads have been firmly listed in CITES Appendix II based on the CITES CoP 16 in 2013 (CITES, 2021). The main reason for the listing was that those three hammerhead sharks (*Sphyrna lewini*, *S*. mokarran, and S. zygaena) had been caught in large numbers globally and their sustainability has become a global concern. The conservation status of the three species of hammerheads in the International Union for Conservation of Nature's Red List (IUCN Red List) categorized *S. zygaena* as vulnerable (VU), while *S. lewini* and *S. mokarran* were classified as critically endangered (CR) (Rigby et al., 2018a; Rigby et al., 2018b; Rigby et al., 2018c). Therefore since 2014, the export of those species by CITES member countries must fulfill all CITES requirements.

Indonesia has been the largest shark fishing country in the last decades, with an average production of 110,737 tons/year (Dent & Clark, 2015; Okes & Sant, 2019). The hammerhead sharks are the ones commonly caught in Indonesian waters, particularly in southern waters (part of the Indian Ocean), with the scalloped hammerhead (*S. lewini*) being the second most landed after the silky shark (*Carcharhinus falciformis*) (Simeon et al., 2019). That condition has led Indonesia to get increasing global attention for shark sustainabilities, especially for hammerhead sharks. As a CITES member country, Indonesia must guarantee that exploiting those three hammerhead shark species is not detrimental to the wild populations. Therefore, a Non-Detriment Finding (NDF) document is made to evaluate the harvest, stock status, and management measures for Indonesia's sustainable production of hammerhead sharks.

This NDF document contains several aspects of biology and vulnerability, fishery, utilization (socio-economic) of hammerhead sharks in Indonesian waters, and current management efforts. All these aspects become considerations for determining whether or not the export can be permitted. So far, no detailed stock assessment has been conducted on hammerhead sharks in Indonesia. The constraints lie in the data availability to represent the high diversity of sharks caught from too many fish landing sites in Indonesia. However, in recent years, agencies and organizations in Indonesia, such as the National Research and Innovation Agency/BRIN (formerly Indonesian Institute of Sciences/LIPI), the Ministry of Marine Affairs and Fisheries/MMAF and some NGOs have conducted data recording at main shark landing sites. Even though a formal stock assessment is still needed, combining all the best available resources gives a strong indication of whether the exploitation by Indonesian fishing fleets is detrimental to the wild populations of hammerhead sharks or not, which became the conclusion of this NDF. In addition, this NDF document also contains recommendations for the management authority to manage hammerhead shark fisheries in Indonesia.

1.2 Objectives

The Non-Detriment Finding (NDF) document for hammerhead sharks is an analysis document concerning Indonesia's population, utilization and management. The Indonesian Scientific Authority issued this NDF document as the basic policy for the Management Authority in determining the direction of sustainable management of CITES Appendix II shark fisheries in this country.

1.3 Scope

The Non-Detriment Finding (NDF) document for hammerhead sharks contains up-to-date information about the status of the hammerhead shark fisheries in Indonesia, providing information on biological aspects, fisheries, socio-economics, trades, and management options or recommendations based on the latest relevant data. The data presented in this document were taken from various literature, catch data, and research findings in Indonesia.

2.1 Sphyrna lewini (Griffith & Smith, 1834)

Figure 1. Scalloped hammerhead (*Sphyrna lewini*)

Photo: Simeon, 2019

Taxonomy

Class	Chondrichthyes	
Order	Carcharhiniformes	
Family	Sphyrnidae	
Genus	*Sphyrna*	
Species	*Sphyrna lewini* (Griffith & Smith, 1834)	
Local names	English	Scalloped hammerhead
	Indonesian	*Hiu martil*
	Local language	*Hiu bingkoh, hiu capil, hiu caping, yee rimbah*

Morphology

The scalloped hammerhead shark has a broad head, its width less than a third total length; the anterior margin of the head well arched, shallowly indented at the midline; the first dorsal fin is tall, moderately falcate; the second dorsal fin is short with long rear tip and weakly concave posterior margin; upper precaudal pit crescentic (White et al., 2006).

Life history characteristics

Age at maturity:	Indonesia: male 8.9 years; female 13.2 years (Drew et al., 2015) Australia: male 3-9 years (Harry et al., 2011) Gulf of Mexico: male 9-10 years; female 15 years (Stevens & Lyle, 1989)
Size at birth:	Indonesia: 32-53 cm TL (Chodrijah & Setyadji, 2015) Indonesia: 33-61 cm TL (LIPI unpublished data 2020) Indonesia: 39-57 cm TL (White et al., 2008) Australia: 45-55 cm TL (Stevens & Lyle, 1989; Baum et al., 2007)
Size at maturity:	Indonesia: male 165-190 cm TL; female 220-240 cm TL (White et al., 2006; White et al., 2008) Australia: male 135-161 cm TL; female 200 cm TL (Stevens & Lyle, 1989) Global: male 140-165 cm TL; female 212 cm TL (Compagno, 1984)
Maximum size:	Indonesia: 370-420 cm TL (White et al., 2006) Indonesia: male 240 cm TL; female 317 cm TL (White et al., 2008) Indonesia: 399 cm (Sentosa et al., 2016) Indonesia: 312 cm TL (Oktaviyani et al., 2019) Australia: male 301 cm TL; female 346 cm TL (Stevens & Lyle, 1989) Global: 370-420 cm TL (Compagno, 1984)
Maximum age:	Gulf of Mexico: male 22-30 years; female 35 years (Branstetter, 1987) Atlantic/Gulf of Mexico: male 26.6 years; female 38.5 years (Piercy et al., 2007) Australia: male 15 years; female 21 years (Harry et al., 2011)

Reproductive characteristics

Gestation period:	9-12 months (Branstetter, 1987; Stevens & Lyle, 1989)
Fecundity:	Indonesia: 14-41 pups (White et al., 2008) Indonesia: 16-38 pups (Chodrijah & Setyadji, 2015) Indonesia: 4-49 pups (LIPI unpublished data 2020) Australia: 13-23 pups (Steves & Lyle, 1989)
Population growth rate (r):	0.09 $year^{-1}$ (FAO's lowest productivity category (<0.14 $year^{-1}$)) (Chen & Yuan, 2006)

Growth coefficient (von Bertalanffy k):	West Pacific: male 0.22 year^{-1}; female 0.25 year^{-1} (Chen et al., 1990) Eastern Indian Ocean: male 0.075 year^{-1}; female 0.095 year^{-1} (Drew et al., 2015) Western Atlantic Ocean: 0.073 year^{-1}(Brenstetter, 1987) East Pacific: male 0.13 years^{-1}; female 0.15 years^{-1} (Tolentino & Mendoza, 2001) Northwest Atlantic: male 0.13 years^{-1}; female 0.09 years^{-1} (Piercy et al., 2007) Indonesia: 0.17 years^{-1} (Simeon et al., 2017)

Distribution

The scalloped hammerhead (*S. lewini*) is one of the most common shark species in Indonesian waters, which is distributed in all tropical and warm temperate waters (White et al., 2006; Fahmi & Dharmadi, 2013). Its distribution in Indonesia includes the Indian Ocean, Makassar Strait, Java Sea, South China Sea, and most of the waters around the islands of Sumatra, Kalimantan, Sulawesi, Moluccas, Nusa Tenggara and Papua (Fahmi & Dharmadi, 2013).

Genetic connectivity

The high diversity of the *S. lewini* populations in Indonesia showed that the scalloped hammerhead species had not experienced a genetic loss because of exploitation pressure. It was recorded that Indonesia has at least three significant subdivisions of genetic diversity and a stock population that recorded a similar genetic diversity to the Western Indian Ocean. On the contrary, a separate stock was observed for Aceh waters (FMA 572) and Eastern Indonesia (FMA 717). The restricted genetic sharing detected among the species obtained from Indonesia showed unique features among these populations. Therefore, a specific collaborative action across regions is needed to promote sustainable management and conservation purposes, both in Indonesia and at the regional scale in the Western Indian Ocean area (Hadi et al., 2020).

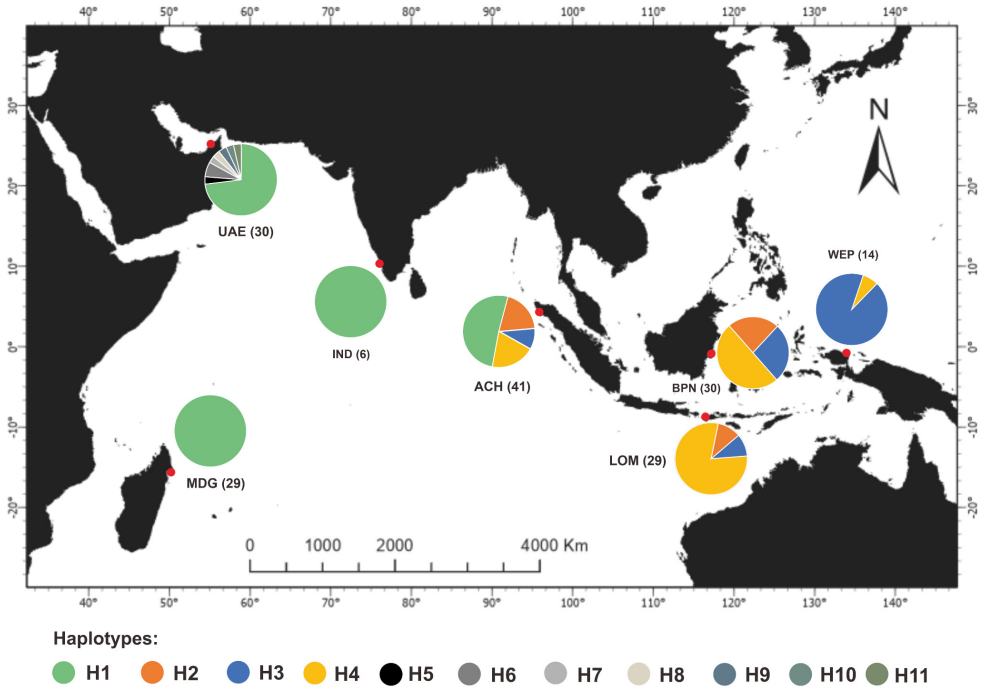

Figure 2. Distribution of the 11 haplotypes of the *S. lewini* population from Indonesia and the Western Indian Ocean at the regional scale (Hadi et al., 2020)

Habitat

Sphyrna lewini is a coastal and semi-oceanic pelagic shark. This species is often found on continental and insular shelves, from the surface and intertidal to at least 275 m depth (Compagno, 1984; White et al., 2006). Females move inshore for breeding and often use near-shore nurseries (Duncan et al., 2006). The nursery grounds of this species are in shallow coastal waters, with adults around mostly offshore (Compagno, 1984; Holland et al., 1993). The breeding season is reported throughout the year, with a peak season from October to November (White et al., 2008).

Pups of *S. lewini* tend to live in coastal areas close to the seafloor and are often found in high concentrations in summer in estuaries and bays (Clarke, 1971; Bass et al., 1975; Castro, 1983). Newborn pups and juveniles have been found gathering in coastal spawning grounds for two years before they moved to adult shark habitats (Holland et al., 1993). They have been observed to stick strictly to several core areas during the day (Holland et al., 1993) and often form large swarms (Stevens & Lyle, 1989).

Conservation Status

Sphyrna lewini has been listed in the International Union for Conservation of Nature and Natural Resources (IUCN) Red List as Critically Endangered (CR) and listed in CITES Appendix II.

2.2 Sphyrna mokarran (Rüppell, 1837)

Figure 3. Great hammerhead (*Sphyrna mokarran*)

Photo: Fahmi, 2019

Taxonomy

Class	Chondrichthyes	
Order	Carcharhiniformes	
Family	Sphyrnidae	
Genus	*Sphyrna*	
Species	*Sphyrna mokarran* (Rüppell, 1837)	
Local names	English	Great hammerhead
	Indonesian	*Hiu martil besar*
	Local language	*Hiu bingkoh, hiu capil, hiu caping, yee rimbah*

Morphology

The great hammerhead shark has a broad head, its width less than a third total length; the anterior margin of the head is nearly straight, shallowly indented at midline; the first dorsal fin is very tall, strongly falcate in adults; the second dorsal fin tall with short rear tip and strongly concave posterior margin; anal-fin base larger than second dorsal fin base; upper precaudal pit crescentic (White et al., 2006).

Life history characteristics

Age at maturity:	Australia: 8.3 years (Harry et al., 2011)
Size at birth:	Australia: 46.5-56.3 cm TL (Harry et al., 2011) Australia: 65 cm TL (Stevens & Lyle, 1989) Global 50-70 cm TL (Compagno, 1984)
Size at maturity:	Australia: 227.9 cm TL (Harry et al., 2011) Australia: male 225 cm TL; female 210 cm TL (Stevens & Lyle, 1989) Global: male 234-269 cm TL; female 250-300 cm TL (Compagno, 1984)
Maximum size:	Global: male 341 cm TL; female 482-549 cm TL (Compagno, 1984) Global: 610 cm TL (White et al., 2006) Australia: male 369.1 cm TL; female 439.1 cm TL (Harry et al., 2011)
Maximum age:	Indonesia : mix sex 35 years Australia: male 31.7 years; female 39.1 years (Harry et al., 2011)

Reproductive characteristics

Gestation period:	11 months (Stevens & Lyle, 1989)
Fecundity:	Global: 6-42 pups (Compagno, 1984) Australia: 15 pups (Stevens & Lyle, 1989)
Population growth rate (r):	unknown
Growth coefficient (von Bertalanffy k):	male 0.16 years-1; female 0.11 years-1 (Piercy et al., 2010) 0.19 years-1 (Simeon et al., 2017)

Distribution

Sphyrna mokarran is seldom found in Indonesian fisheries; only a few data records are available on this species' occurrence (Fahmi & Dharmadi, 2013). However, it is distributed in all warm tropical and subtropical waters (White et al., 2006).

Habitat

The great hammerhead shark is a coastal pelagic and tropical semi-oceanic species that are often found near the coast, offshore, over continental shelves, insular shelves, island terraces, coral atolls, and deep waters around islands at a depth of at least 80 m (Compagno, 1984; White et al., 2006). This species is considered solitary and rarely encountered in groups (Denham et al., 2007).

Conservation Status

Sphyrna mokarran is listed in the IUCN Red List as Critically Endangered (CR) and listed in CITES Appendix II.

2.3 Sphyrna zygaena (Linnaeus, 1758)

Figure 4. Smooth hammerhead (*Sphyrna zygaena*)

Photo: Fahmi, 2022

Taxonomy

Class	Chondrichthyes	
Order	Carcharhiniformes	
Family	Sphyrnidae	
Genus	*Sphyrna*	
Species	*Sphyrna zygaena* (Linnaeus, 1758)	
Local names	English	Smooth hammerhead
	Indonesian	*Hiu martil*
	Local language	*Hiu bingkoh, hiu capil, hiu caping, yee rimbah*

Morphology

The smooth hammerhead shark has a broad head, its width less than a third total length; the anterior margin of the head well arched, not indented at the midline; the first dorsal fin is tall, moderately falcate in adults; the second dorsal fin short with long rear tip and weakly concave posterior margin; anal fin and second dorsal fin base about equal in length; upper precaudal pit crescentic (White et al., 2006).

Life history characteristics

Age at maturity:	unknown
Pup size:	Global: 50-61 cm TL (Compagno, 1984) Global: 50 cm TL (Bester, 2011) Global: 50-60 cm TL (Ritte, 2001)
Size at maturity:	Australia: male 250-260 cm TL; female 265 cm TL (Stevens, 1984) Global: male 210.25 cm TL; female 270 cm TL (Bester, 2011)
Maximum size:	Global: 370-400 cm TL (Compagno, 1984) Global: 350 cm TL (White et al., 2006)
Maximum age:	Atlantic Ocean: male 21 years; female 18 years (Coelho et al., 2011)

Reproductive characteristics

Gestation period:	10-11 months (White et al., 2006)
Fecundity:	Global: 20-50 pups (White et al., 2006) Global: 20-40 pups (Bester, 2011) Global: 29-37 pups (Ritte, 2001)
Population growth rate (r):	Unknown

Growth coefficient (von Bertalanffy k):	unknown

Distribution

Sphyrna zygaena is rarely found in Indonesian waters (Fahmi & Dharmadi, 2013). They are distributed circumglobally in most temperate seas and ventured into some regions' tropical waters (White et al., 2006).

Habitat

Sphyrna zygaena is a coastal pelagic shark and semi-oceanic species often found over continental shelves to a depth of 200 m (Ebert, 2003). The nursery ground of this species is in shallow waters with a fine sand substrate to a depth of 10 m. Juvenile *S. zygaena* often gathers in a large groups of up to hundreds of individuals (Compagno, 1998).

Conservation Status

Sphyrna zygaena is listed in the IUCN Red List as Critically Endangered (CR) and listed in CITES Appendix II.

2.4 Eusphyra blochii (Gill, 1862)

Figure 5. Winghead hammerhead (*Eusphyra blochii*)

Photo: Krajangdara et al., 2022

Taxonomy

Class	Chondrichthyes	
Order	Carcharhiniformes	
Family	Sphyrnidae	
Genus	*Eusphyra*	
Species	*Eusphyra blochii*	
Local names	English	Winghead hammerhead (Cuvier, 1816)
	Indonesian	*Hiu martil*
	Local language	*Hiu bingkoh, hiu capil, hiu caping, cucut rong-geng*

Morphology

Head extremely broad, wing-shaped, its width about half TL. The midline of the head with a shallow indentation. The first dorsal fin is very tall and strongly falcate. Upper precaudal pit longitudinal, not crescentic (White et al., 2006).

Life history characteristics

Age at maturity:	5.5 years for males and females at 7.2 years (Stevens & Lyle, 1989; Smart et al., 2013)
Pup size:	32-42 cm (White et al., 2006) 45 cm TL (Stevens & Lyle, 1989)
Size at maturity:	86 cm TL (Last & Stevens, 2009) 108 cm TL for males and females at 120 cm TL (Stevens & Lyle, 1989; Smart et al., 2013)
Maximum size:	186 cm TL (Stevens & Lyle, 1989)
Maximum age:	21 years (Last & Stevens, 2009)

Reproductive characteristics

Gestation period:	8-11 months (Compagno, 1984; Stevens & Lyle, 1989)
Fecundity:	6-25 pups (mean 11 pups) (Compagno, 1984; Stevens & Lyle, 1989)
Population growth rate (r):	unknown
Growth coefficient (von Bertalanffy k):	unknown

Distribution

Eusphyra blochii is distributed in the Indo-West Pacific from the Arabian/ Persian Gulf through Asia to northern Australia and Papua New Guinea (Last & Stevens, 2009).

Habitat

The winghead shark occurs on the continental shelves and is mainly found in coastal nearshore waters (Smart & Simpfendorfer, 2016).

Conservation Status

Eusphyra blochii is listed in the IUCN Red List as Endangered (EN) and has not been listed in CITES Appendix.

3.1 Production

As the biggest shark fishing country in the world, the national data on fish production plays an important role in revealing the shark fishing pressure and the general conditions of shark fisheries. The four species of hammerhead were caught both in the shark-targeting fishery and as valuable bycatch from several fisheries across Indonesia. Hammerheads were also caught in various sizes depending on the fishing gear, the fishing ground, and the fishing season.

Data production for hammerhead sharks as a separate group in Indonesian fisheries statistics was recorded and published from 2005 to 2015 and contributed about 1.5% of the total national production. Referring to data from 2005 catches of hammerhead sharks increased sharply by up to 30 times for five years (2006 to 2010) but then declined in the following two years (2011-2013) by up to 50%. However, in 2016 a deterioration happened in national shark data. National fisheries production data only recorded all elasmobranch production in two big categories: shark and ray, without any group specification, including hammerhead sharks. The data are presented online at https://satudata.kkp.go.id/.

3.2 Fishing Ground and Fishing Season

Based on 2015 national statistics, the shark production data showed that the potential fishing areas for hammerhead sharks are the Indian Ocean (FMA 573 and FMA 572), the area from the Malacca Strait to the Karimata Strait (FMA 711), the Java Sea (FMA 712), and area from the Makassar Strait to the Flores Sea (FMA 713) (Figure 6). The highest hammerhead shark production was in the FMA 713, where these sharks were captured using surface and bottom longlines.

National production data in 2015 also showed a clear disparity between the western Indonesia waters (FMA's 572, 573, 711, 712, and 713) and eastern Indonesia waters (FMA's 714, 715, 716, and 717). The hammerhead shark production was dominated by western Indonesia waters, while eastern Indonesia waters show a lower production. It might be because most fish landing ports are located in western Indonesia. A gap in data recording intensity between the two areas may also be an influencing factor.

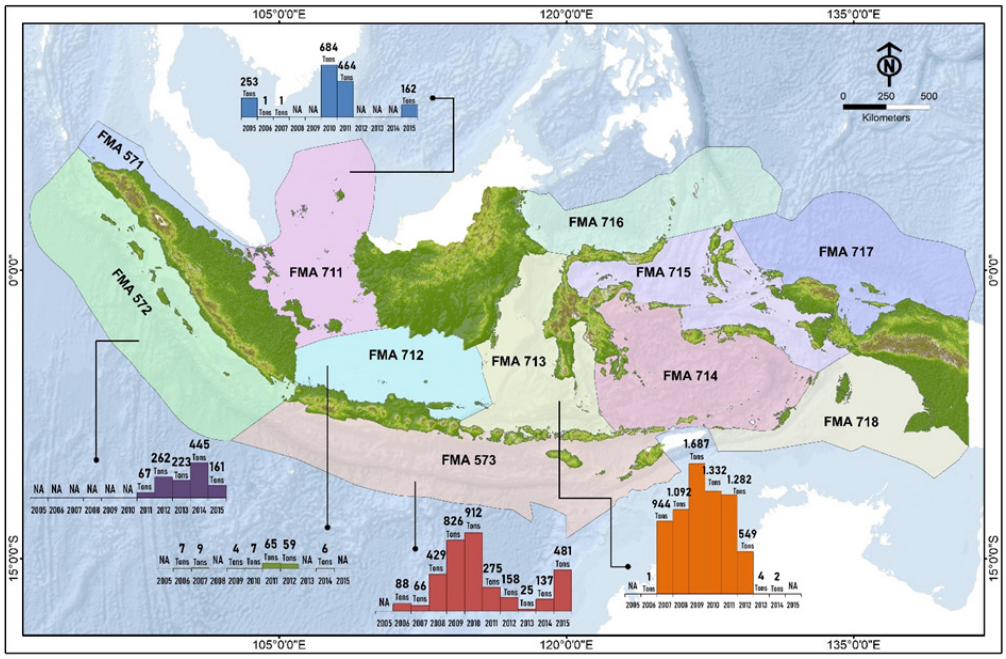

Figure 6. Fisheries management areas in Indonesia and the hammerhead production

(Source: MMAF, 2016)

Hammerhead shark fishing generally occurs all year round without seasonal patterns but shows higher catch volumes in certain months, indicating the fishing season. In the Indian Ocean, April to October and November to February are considered the shark fishing seasons.

In addition, there is information on the adult schooling migration of scalloped hammerhead sharks (*Sphyrna lewini*) in Indonesian waters. Large schooling of hammerhead sharks often occurs in the eastern Indian Ocean starting in September, with a diving point at Belongas Bay, Lombok Island. While from October to November, those schoolings appear in the Savu Sea and the Banda Sea. Those schooling locations have attracted tourists and are promoted by some dive centers. This information could better understand the hammerhead shark migration pattern in Indonesia.

Juveniles are known to occupy different habitats from adults. Juveniles are demersal, gregarious, and primarily found in coastal areas, estuaries, and embayments, while adults are mainly solitary and inhabit pelagic waters (Compagno, 1984; Clarke, 1971). Two critical habitats of juvenile *Sphyrna lewini* were identified in Sumbawa Island and the west coast of Aceh. Those areas are characterized by the muddy substrate on the river mouth to the coast (Simeon et al., 2018). Juvenile hammerhead sharks have relatively high metabolic rates and commensurately high daily food requirements (Lowe, 2001). Newborn pups and juveniles have been found gathering in coastal nursery grounds for two years before they moved to adult shark habitats (Holland et al., 1993).

Figure 7. Juvenile scalloped hammerhead caught in the coastal area, Lunyuk, West Nusa Tenggara

Photo: WCS-IP, 2018

3.3 Fishing Gear

In Indonesian waters, hammerhead sharks (*Sphyrna lewini*, *S. mokarran* and *S. zygaena*) are caught by either fishing lines or nets. Types of fishing gear used to catch these sharks are as follows:

a. Longline

Hammerhead sharks are caught as target and non-target. As a target, they are caught by both drift surface longline and set bottom longline. Those fishing gears have significant differences both in gear construction and the number of hooks. For example, drift surface longlines in Tanjung Luar can have 500 hooks, while a set bottom longline only has 80-120 hooks. The drift surface longline is operated on the surface with a depth of about 5-7 meters, while the set bottom longline is operated on the slope and bottom layers up to more than 80 meters depth.

There have been technological changes to increase fishing efficiency for the last decades. Re-measurement of fishing vessel size in Indonesia conducted in 2018 revealed these changes. Previously, the drift surface longline boats in Tanjung Luar were known to have the size of 18 GT. Re-measurement reveals that the drift surface longline boats are now about 20–26 GT. Previously, the bottom longline boats from Gili Maringkik had less than 10 GT tonnages. After re-measurement, it was known that the boats are 8-15 GT (Simeon et al., 2020).

Table 1. Summary of changes in the Indonesian shark fisheries, case study: Tanjung Luar

Decade	Number of Boats	Engine	Technology
The 1980s	<10 boats	manual diesel engine (no electronics)	No GPS
1990's	~100 boats	Electric-start diesel engine	Only a few boats had GPS
		Diesel engines up to 16 HP	
2000's	~60 boats	Accumulators for an electrician need	All boats with GPS
		Diesel engines up to 24 HP	
2018	~49 boats	No engines addition	GPS and solar panels.

Source: Simeon et al., 2020

As bycatch, hammerhead sharks are caught by various fishing gear in Indonesia, including:

b. Drift gillnet

Drift gillnets are usually carried by vessels of industrial vessels with a size greater than 30 GT. Considering their schooling behavior, hammerhead sharks are also often caught as bycatch by drift gillnets.

c. Set gillnet

Set gillnets are fishing gears operated by artisanal up to semi-industrial fishers. Artisanal fisheries using gillnets usually use a vessel smaller than 10 GT. These vessels generally operate in shallow waters with muddy substrates. Gillnets from these vessels usually catch juvenile hammerheads, as those juveniles often swim in groups in the estuary, river mouth and coastal waters.

d. Purse Seine

Sharks caught by purse seines are generally bycatch. Sharks are usually found near aggregating pelagic fishes. Sharks caught by this fishing gear are generally large, as they also prey on sizable pelagic fishes.

e. Seine net

Hammerhead sharks are often caught by seine nets such as mini trawls, locally known as *dogol, cantrang* or *payang*. The hammerhead sharks caught by the seine nets are found in the Malacca Strait (FMA 711) and the Java Sea (FMA 712). The sharks caught are small to medium size, as this fishing gear is operated in shallow waters with muddy substrates. Shallow waters are habitats for juveniles and small to medium sharks.

3.4 Stock assessment by fisheries approach

One way to assess the population condition of sharks is through stock assessment. With high accuracy, much information is needed to perform a stock assessment, including sex and length-frequency data. The national fisheries data could not be used for stock assessment analysis as it emphasizes production volume without length data. However, the current case study on the length and frequency of landed fish can be used to perform a stock assessment of sharks in Indonesia. One of the study cases was conducted in Tanjung Luar Coastal Fishing Port - West Nusa Tenggara Province, where landing monitoring has been conducted since 2014. The Tanjung Luar Coastal fishing port data focused on targeted shark fishery fished in the Eastern Indian Ocean.

The stock assessment analysis has been done using length-based analysis for scalloped hammerhead species, the dominant species in the hammerhead group. Based on this analysis, the fishing pressure showed that the exploitation rate (E) of scalloped hammerheads decreased after the CITES listing in 2014. However, the exploitation rate is still over-exploited (>0.5). After the decrease in 2015, E ranged between 0.45-0.64, with a slightly increasing trend each year. Until 2021, the exploitation rate was still lower than in 2014 but higher than the threshold of 0.5. It should be decreased. However, the estimated mean length at first capture (Lc) fluctuated during 2014-2021. With the same fishing gear used in Tanjung Luar over this period, a constant Lc value is expected. The fluctuating Lc indicates some uncertainty in its value whic h might bias the estimate of E (see Table 2). Unfortunately, the generated E value did not represent the national stock assessment. Due to the lack of data and landing monitoring activity across Indonesia, some places were known to be the blind spots of shark fisheries, including hammerhead sharks.

The percentage of immature individuals generally decreased in Tanjung Luar fishing port because the community agreed to conduct some management efforts, such as critical habitat protection of hammerhead juveniles. However, it needs to be a concern that there were also possibilities of unmanaged and unrecorded juveniles caught across Indonesia.

Table 2. *Sphyrna lewini* stock assessment with the length-based approach in Tanjung Luar Fishing Port

Parameters	2014	2015	2016	2017	2018	2019	2020	2021
M	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Z	0.66	0.37	0.40	0.42	0.47	0.59	0.56	0.53
F	0.46	0.17	0.20	0.22	0.27	0.39	0.36	0.33
E	0.70	0.45	0.51	0.52	0.58	0.66	0.64	0.62
F/M	2.28	0.83	1.02	1.09	1.36	1.96	1.78	1.65
Lc (cm TL)	196.70	165.24	168.47	154.61	169.94	177.68	194.97	159.42
Lm (cm TL)	180.73	180.73	180.73	180.73	180.73	180.73	180.73	180.73
%immature	43%	34%	51%	43%	35%	37%	49%	38%
N (ind)	688	325	803	609	802	806	529	605

Source: Simeon et al., unpublished data

3.5 Catch Per Unit Effort (CPUE)

Catch abundance can indicate the condition of fish populations in a particular area. Similar to the stock assessment for determining the exploitation rate, the complete national data to calculate catch per unit effort (CPUE) is unavailable.

Due to the data system being changed since 2016, production data at the species level needed to be traced or accessed in the different data resources, i.e., PIPP (Fishing Port Information Center). In PIPP, the shark catch record was quite limited. The hammerhead catch data was only available from FMA 573. The information was obtained from the multi fisheries, which consisted of shark-targeting fishery and non-targeting fishery in the Southern water of Java, Bali, and Nusa Tenggara. Based on PIPP data, the CPUE shows an increasing trend in the last five years (Figure 8).

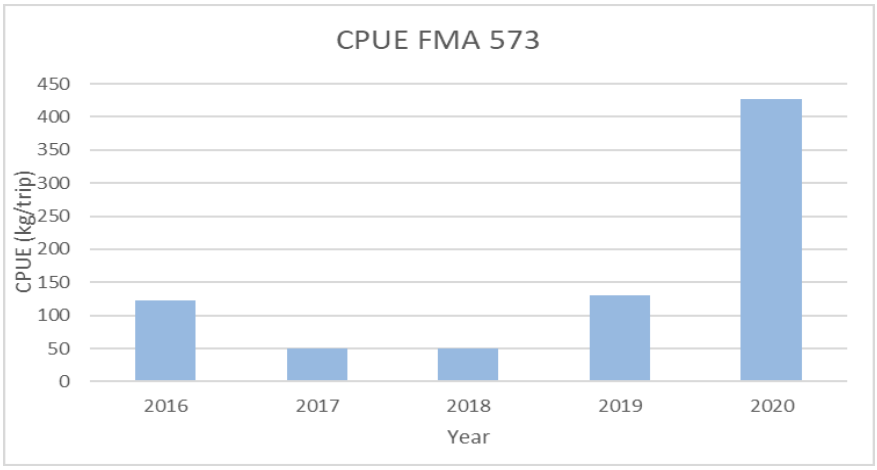

Figure 8. CPUE hammerheads in FMA 573

Source: MMAF Fishing Port Information Center, 2021

In contrast, based on the data from the shark-targeting fishery in Tanjung Luar, the CPUE of *Sphyrna lewini* peaked in 2016. However, it continually decreased from 2016 to 2021, so the value in 2021 was lower than in 2014. Considering the decrease of CPUE on targeted fishery and the increase in general fishing, then for this time, it is hard to infer the trend of population abundance of this shark in FMA 573.

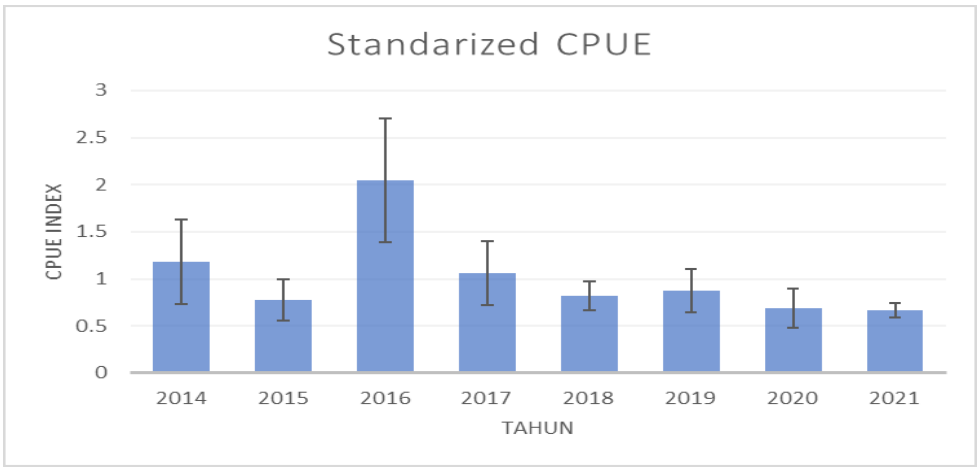

Figure 9. CPUE *Sphyrna lewini* targeted shark fisheries in Tanjung Luar West Nusa Tenggara

Source: Simeon et al., unpublished data

Based on the updated information above, there are several points of concern related to the implementation of recommendations in the NDF document in 2018, as follows:

Management Measure	Mandatory implementation
Production data	The NDF 2018 recommended the production data should be recorded at the species level instead of the group level. However, the recent national fisheries statistics show degraded quality data by reporting all shark species as a group.
Exploitation rate	The fishing mortality rate decreased from 0.36 to 0.33 on a targeted fishery hotspot, but non-targeted fisheries need to be considered in future monitoring.
Immature catch	The percentage of immature catches in the strictly managed sites decreased, but many unmanaged and unrecorded sites across Indonesia still caught and landed immature hammerheads.
CPUE	The CPUE in general fisheries in FMA 573 increased but declined in the target shark fishery. It showed a possibility of high fishing pressure in the non-target fishery.

4.1 Social-economics

In some regions, many people depend on shark fisheries, such as fishers (sharks are caught as targets or bycatch), collectors, middlemen, product processors, and shark product exporters. According to Fahmi & Dharmadi (2013), shark fishing in Indonesia has been increasingly incentivized by the high price of shark fins in the international market since the 1980s. Consequently, many fishers changed their target catch to sharks. Some areas are known to be shark landing centers (either target or bycatch) in Indonesia, such as Tanjung Luar, Muncar, Cilacap, Aceh, Sibolga, Palabuhanratu, Indramayu, and Muara Baru. Indirectly, the local community got a positive impact from shark fisheries, as sharks became the primary source of income and protein or consumption for daily needs. Nevertheless, the CITES Appendix II listing did not affect the local utilization of hammerhead sharks.

4.2 Shark products

Hammerhead sharks are utilized as fresh, frozen, dried, and smoked meat for consumption, fins for shark fin soup, skin for leather products, and livers for oil (Compagno, 1984). In Indonesia, different body parts are used for various purposes. The meat is commonly processed into salted, steamed, or grilled meat (mainly for domestic consumption) and frozen meat (for export). Meanwhile, shark fins are mostly dried entirely or prepared (peel) as the main export product. Shark fins have the highest economic value among these products and have become the main ingredient for Chinese luxury soup meals. Besides, other body parts such as teeth are utilized as souvenirs, livers for oil, dried skin for food or fashion material, cartilage for medical needs and food supplements. Examples of hammerhead shark products are shown in the figures below.

Figure 10. The dried fin of great hammerhead shark (*Sphyrna mokarran*: left) and scalloped hammerhead shark (*S. lewini*; right)

Photo: Oktaviyani, 2019

Figure 11. The dried fin of smooth hammerhead (*S. zygaena*; left) and winghead hammerhead shark (*Eusphyra blochii*; right)

Photo: Simeon, 2022

Figure 12. Processed dried fins of hammerhead sharks

Photo: Oktaviyani, 2019

Figure 13. Products of frozen and fresh hammerhead sharks

Photo: Simeon, 2022

According to Muttaqin et al. (2018), other shark species were utilized the same way as hammerhead sharks. Those products are marketed both domestically and internationally. The price of shark products varied depending on the type of products, species, and location. Effendi et al. (2018) described the price of shark products traded in Balikpapan from IDR 300,000 to 1,200,000/kg for dried fins (depending on fin size and species), IDR 8,000–18,000 for meat (depending on the level of the freshness), IDR 50,000–75,000/sheet for shark's skin, IDR 700,000–5,000,000/individual for live sharks (depending on size and species). While the price for souvenirs from the shark's teeth was IDR 100,000/piece, and head bone/jaws were IDR 1,500,000–3,000,000/piece (Esteria et al., 2019). Those prices will increase along with the level of business actors in the trading chain.

4.3 Trade

International trade

According to Dent & Clarke (2015), Indonesia is the third-largest shark exporter in quantity and the sixth-largest in value. However, specific data for each species' products is not known. From 2014 to 2018, all hammerhead shark products were banned from export. Thus, no export data were recorded. The Indonesian government considered banning the export because many management efforts needed to be made or improved before conducting international trade, starting from improving data collection, traceability, law enforcement, and socialization. Hammerhead sharks were the first shark group in Indonesian waters regulated and controlled under CITES provisions.

Indonesia exports various products of sharks, such as fins (frozen, dried, prepared or preserved forms), frozen meat, whole-body (frozen), headless-finless, headless, and finless (frozen), living specimens, skin, cartilage, and others. Before the export ban regulation was implemented, those products were regularly exported, including hammerhead sharks. However, those shark products were not specified in detail. The export volume of shark fins from Indonesia from 2000–2011 is shown in Figure 14.

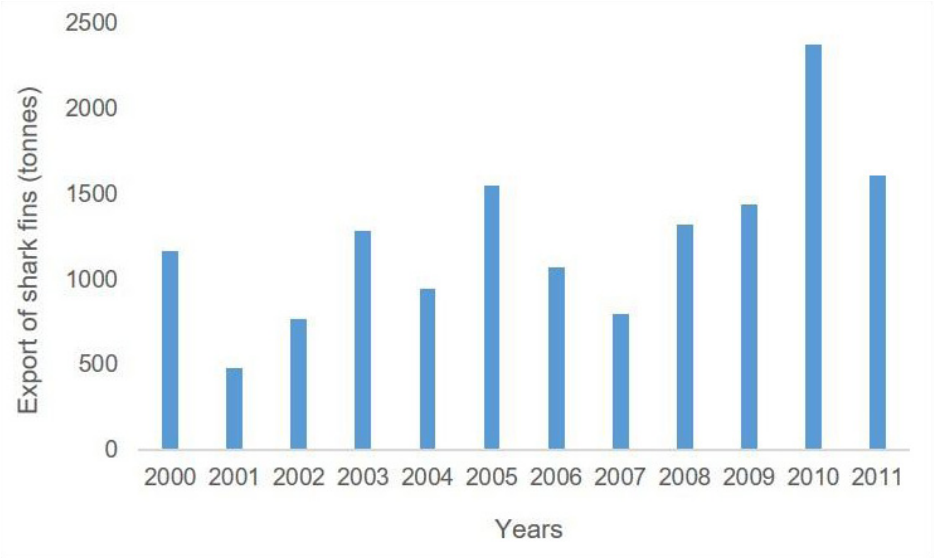

Figure 14. The export volume of shark fins from Indonesia in 2000-2011

Source: Dent & Clarke, 2015

Figure 14 indicates that Indonesia's total export of shark fin products fluctuated from 2000 to 2011. Annual export volumes were recorded between 479 and 2,378 tons per year (Dent & Clarke, 2015). Booth et al. (2018) suggested that shark fins only contributed 10% of the total export volume of shark products, while the remainder (90%) were other non-fin frozen and chilled sharks. It means that the total export for non-fin commodities was nine times shark fin export volumes then.

From 2016, all shark and ray products must be checked by officers from the MMAF technical unit (Regional Office for Marine and Coastal Resources Management) before being traded domestically and internationally. This procedure is implemented to ascertain the condition and information of the products, including the type of product, number, and species name. During the inspection, they often found hammerhead shark products mixed with non-CITES-listed species. Local collectors rarely separate products per species, except for certain species with high market prices. They combine various species and only separate them by product types, such as skin, dried fins, meat, and others.

Since 2020, Indonesia has developed a catch and export quota for hammerhead sharks. The export quota was only made for fin products and the total export decreased from 2020 to 2021 (Figure 15). The export volume in 2020 was 24,036.12 kg and 15,802.86 kg in 2021.

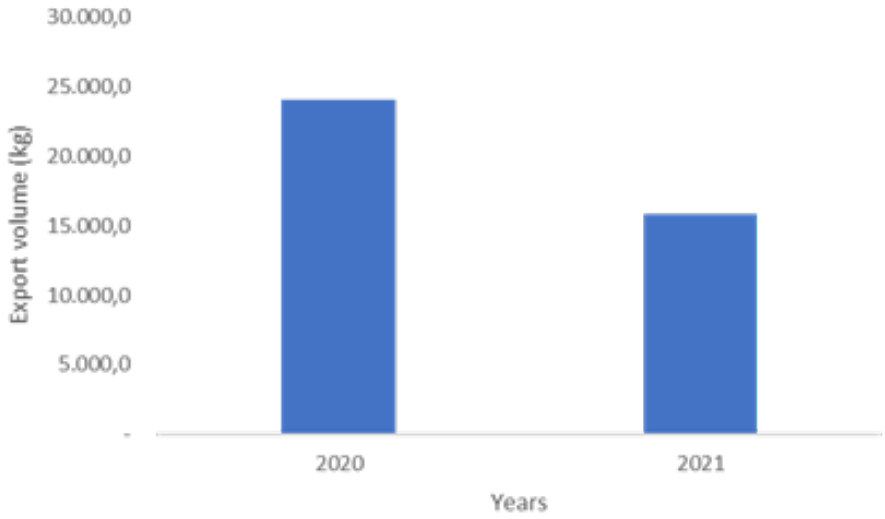

Figure 15. The export volume of hammerhead shark fins from Indonesia in 2020-2021

Source: CITES Trade Database and MMAF unpublished data

Identifying shark species that have been turned into specific product forms are challenging. Commonly, identification based on morphology can only be made when the whole body is still complete. Even though it can be done through DNA analysis, the costs are high and will undoubtedly burden the exporters. Therefore, a sound traceability system must be built, so each individual has a clear identity. The information can be traced from fishing activity to processing or has become a specific product in the importing country.

Domestic Trade

Information on Indonesia's domestic shark production and trade is minimal. Currently, there are no well-established monitoring systems to know the magnitude of the domestic trade, both specific data at the species level and shark commodities in general (Muttaqin et al., 2018). However, it is believed that shark products' domestic trade is not as high as for export. The most significant demand from local communities is for meat, with products sold in frozen, partially prepared (e.g., dried, salted, steamed and grilled); or cooked and processed such as meatballs, fish cake, fish floss

and jerky (Muttaqin et al., 2018; Oktaviyani et al., 2019). People in some regions, such as Java, Lombok, Aceh, North Sumatra and East Kalimantan, regularly consume shark meat (Efendi et al., 2019; Muttaqin et al., 2018; Oktaviyani et al., 2019). Meanwhile, the demand for shark fins only comes from Chinese restaurants that provide shark fin soup (Esteria et al., 2019). Skins are commonly processed into crackers or leather for fashion materials. They are often used to manufacture wallets, bags, belts, bracelets, buckles, and shoes (Muttaqin et al., 2018), as well as teeth and jaws for souvenirs, commonly sold in Bali (Esteria et al., 2019).

Unfortunately, the actual total production of national consumption is still not known. Detailed information is usually available at specific locations based on a study case. Efendi et al. (2019) estimated the total weight of sharks used for local consumption in Balikpapan in the form of smoked and salted meat to be about 2 tons per year.

4.4 Trade Chain

The trade chain of shark products, including hammerhead sharks in Indonesia, is generally long and complicated, starting from the fishers, local collectors (sometimes different depending on the type of product), local traders, intermediaries, processors, and prominent collectors, until exporters to importing countries. Shark products are usually sent to big cities in Indonesia, where shark exporters are located, such as Jakarta, Surabaya, Medan, Manado, Makassar, and Denpasar. Most shark products for export from other cities or small islands were sent to those cities by local collectors. Shark exporters sent their products abroad by air or sea transportation to importing countries. In 2021, hammerhead shark products were exported to Singapore, Hong Kong SAR and China (MMAF unpublished data, 2022).

Based on the above information, there are several things of concern when compared to the NDF document in 2018:

Management Measure	Mandatory implementation
Trade	International trade was banned from 2014 to 2018 after hammerhead sharks were listed in CITES appendix II. In the years after, the Indonesia government started to initiate CITES implementation by registered shark traders and established technical guidance for shark trading. The recommendation listed in the 2018 and 2020 NDF was to construct an integrated data system on trade to minimize the data gap among government technical units. However, the integrated data system still needs improvement, considering some gaps between implementing the catch and trade quotas. Labeling is required to trace sharks since caught, landed, and being traded.

5. CURRENT MANAGEMENT EFFORTS

5.1 NPOA Shark Implementation

To adopt and implement the International Plan of Action (IPOA) for sharks and rays in 1999, the Government of Indonesia developed a National Plan of Action (NPOA) for the conservation and management of sharks and rays in Indonesia for the period 2010-2014 and 2016-2020, meanwhile for the next phase (2020-2024) the NPOA is still on finalization process. The NPOA for shark and rays 2016-2020 has nine main strategies, namely:

(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.

In general, the Indonesian government has made significant progress in managing sharks and rays in Indonesia in the past five years, according to the nine strategies in the NPOA. Most strategies have been achieved through collaborative programs with all parties managing sharks and rays in Indonesia. The most implemented programs for the Conservation and Management of Sharks and Rays in 2018-2021 improved data on sharks and rays by placing enumerators on main landings sites and observers on tuna fishing boats. The data improvement was carried out to strengthen research on biology and fisheries, such as identifying critical habitats and estimating population status in several areas. In addition, other implemented priority programs were supporting the protection of endangered species of sharks and rays, as well as campaign and awareness programs for all stakeholders. Concerning strengthening institutions and increasing human capacity, the ministry has facilitated forming working groups on shark and ray conservation at national and provincial levels. Nevertheless, some of the

expected outputs from the NPOA strategies are not fully implemented, such as updating the review of the status of shark and ray fisheries in Indonesia and strengthening management measures related to law enforcement and compliance with the fishing regulations.

5.2 Traceability Mechanism

The MMAF, a representative Indonesian government, has already established legal regulations to support the traceability system. However, the regulation has not yet been well implemented due to the shark trade's complexity in Indonesia. Ideally, every fishing vessel that catches sharks listed in appendix CITES must have a permit and then fill out a logbook as a catch monitoring system. Then, a Catch Recording Certificate and Certificate of Fish Origin must be made after the fish is landed. The sellers or middlemen (persons or legal entities) are also required to have a permit to utilize protected species and/or species listed in the CITES Appendix. The processor level must have a permit and Processing Eligibility Letter. Transport Permit is issued when the specimens (products or live fish) will be transported to another region or country, which is 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 to monitor the realization of quotas by the government.

For international trade, there are additional documents that have to be completed, such as a letter of approval and an export permit notification document from the Ministry of Trade, a Health Certificate for Fish and Fish Products from the Fish Quarantine and Inspection Agency of MMAF as well as an export approval document from customs. Nevertheless, Indonesia still needs to develop supporting tools of a traceability system for better mechanisms and comprehensive 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 issued by the MMAF.

5.3 Data Collection and Trade System

The recording system of the production data 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. Even though most sharks were not recorded at the species level (except for the oceanic whitetip, tiger, and blue shark), the data recording in 2016 was the most comprehensive national fisheries statistics ever made. In contrast, the recording system suffered a setback when the Ministry of Marine Affairs and Fisheries decided to aggregate all shark species into only the "shark" group in 2017. This change was due to the ministry's implementation of one data policy.

On the other hand, the trade data of shark and ray products are recorded using a Health Certificate (HS) Code system. However, the current HS code system categorizes shark and ray products in general terms based on the type of product being traded, such as shark fins, fresh fillets, and frozen fillets, without separating them into species names or groups of species. Therefore, it is necessary to improve the data and information recording system when the product is landed and traded at both domestic and export levels.

5.4 Fishing Regulation

1) Minister of Marine Affairs and Fisheries Regulation No. 04 of 2010 on Procedures for Utilizing Fish Types and Fish Genetic

This regulation requires taking fish and genetic samples of fish types regulated by CITES to be done with quota.

2) Minister of Marine Affairs and Fisheries Regulation No. 14 of 2011 on Capture Fisheries Business

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

3) Minister of Marine Affairs and Fisheries Regulation No. 12 of 2012 on Capture Fisheries Business on the High Seas

The regulation requires every fishing vessel operating on the high seas and gaining bycatch (ecologically related to the tuna fisheries) to take conservation actions. The conservation actions include not catching juvenile and pregnant sharks, landing captured sharks (non-juvenile and non-pregnant) as a whole with all fins intact and reporting each

captured shark to the chief of the relevant fishing port according to the SIPI (fishing permit) in the fishing logbook.

4) Minister of Marine Affairs and Fisheries Regulation No. 48 of 2014 on Fishing Log Book.

The regulation amended the previous Minister of Marine Affairs and Fisheries Regulation No. 18 of 2010 on fishing logbooks. 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 the fishing harbor. The e-logbook is developed as one improvement strategy for increasing fishing vessels' compliance in filling in and reporting the fishing logbooks.

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

This regulation requires every fishing vessel operating in the RFMO-managed area and gaining bycatch (ecologically related to the tuna fisheries) to take conservation actions. The conservation actions are the same as the Ministerial Regulation No. 12 of 2012.

6) Minister of Marine Affairs and Fisheries Decision No. 21 of 2021 on Quota for Utilizing of Species Listed in Appendix II CITES

The regulation stipulates a quota for utilizing species listed in Appendix II CITES, which includes species name, amount, size, unit and province. This regulation was valid until 31 December 2021.

7) 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, and CITES-listed and endemic species.

8) **Minister of Marine Affairs and Fisheries Decision No. 12 of 2022 on Quota for Utilizing of Limited Protection Species according to National Provisions and Species Listed in Appendix II CITES**

The regulation stipulates a quota for utilizing limited protection species based on national provisions or regulations and species listed in Appendix II CITES, which includes species name, amount, size, unit and province. This regulation is valid until 31 December 2022.

5.5 Trade Regulations

1) **Minister of Marine Affairs and Fisheries Regulation No. 59 of 2014 on Export Banning for Oceanic Whitetip Shark and Hammerhead Sharks from Indonesia**

The regulation prohibits exporting oceanic whitetip and hammerhead sharks and their derivative products from Indonesia. The regulation was valid until November 2015.

2) **Minister of Marine Affairs and Fisheries Regulation No. 5 of 2018 on Export Banning for Oceanic Whitetip Shark and Hammerhead Sharks from Indonesia**

The regulation prohibits exporting oceanic whitetip and hammerhead sharks and their derivative products from Indonesia. The regulation was valid until 31 December 2018.

3) **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 regulation was revised through the Minister of Marine Affairs and Fisheries Regulation No. 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 those listed in the CITES Appendix. Every person or legal entity must have a permit to utilize protected species and/or species listed in the CITES Appendix through a quota mechanism (catch and export quota). This quota mechanism is implemented to ensure the utilization does not detriment the population.

4) **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 for export. The information gathered includes shark and ray species, product name, volume, origin (landing and city), and destination. The regulation was implemented in 2015 and showed increasing compliance from related stakeholders. The monitoring mechanism ensures the traceability of the products traded domestically and internationally.

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

Indonesia regulates procedures for the trade of sharks and rays through the issuance of several permits, such as 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.

5.6 Critical Habitat Protection

It is generally understood that coral reefs, seagrass beds and mangrove forests are critical habitats for various types of fish as nursery, spawning, feeding, mating and foraging areas. Indonesia successfully established around 23.14 million hectares of Marine Protected Areas (MPA) to protect those areas and conserve the coastal ecosystem's biodiversity in 2019. In addition, some local governments issued regulations to manage critical habitats in their jurisdictions. For instance, there is a Governor Decree of West Nusa Tenggara Province Number 55 of 2020 concerning the management action plan for shark and ray fisheries in West Nusa Tenggara Province from 2020 to 2025, including protection of critical habitats and fishing efforts limitation. There is also a Decree of the Minister of Marine Affairs and Fisheries Number 76 of 2020 on the Coastal Conservation Area and Small Islands of Aceh Jaya and surrounding areas in Aceh Province.

5.7 Local Government Regulations

Local governments issued several regulations to manage and protect sharks and rays in their jurisdictions. However, those regulations are primarily generic and apply to all species, as follows:

1. Government Regulation of Raja Ampat Regency Number 9 of 2012 prohibits the fishing for 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 prohibits 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 prohibits consuming, capturing, and trading sharks, manta rays, and/or their derivative products.

5. District Regulation of Kaur Regency of Bengkulu Province Number 104 of 2018 concerning control of fishing for sharks in the waters of Kaur Regency.

6. District Regulation of Berau Regency Number 16 of 2019 concerning protecting sharks (whale shark, nurse shark, grey reef shark and white tip reef shark), manta rays, certain species and coral reefs.

7. Governor Decree of West Nusa Tenggara Province Number 55 of 2020 concerning the management action plan of shark and ray fisheries in West Nusa Tenggara Province from 2020-2025.

5.8 Awareness Programs and Supervision

As a response to shark listing in CITES Appendix II, the Ministry of Marine Affairs and Fisheries, as the authorized party in fisheries management, is responsible for providing information on the management of those listed sharks to relevant stakeholders such as fishers, traders, quarantine officers, supervision officers and relevant regional governments. In 2013, public consultation activities were conducted involving fishers in several locations (i.e., Aceh, Sibolga, Tanjung Luar and Jakarta) on the provisions of CITES concerning the international trade of sharks listed in CITES appendix II and the issue of look-alike species. The same year, socialization activities aimed explicitly at exporters were conducted in Surabaya – East Java.

Other locations, such as North Sumatra, West Nusa Tenggara, Sulawesi and Jakarta, were covered in 2014. Furthermore, as a follow-up to the 17th CITES CoP, awareness program and public consultation sessions on the development of shark and ray management policies were held in 2017 in Aceh, Jakarta, Cilacap, Banyuwangi, Surabaya, Denpasar, Lombok, Pontianak, Makassar and Sorong.

Based on the information above, several concerns arise when recalling the NDF documents in 2018:

Management Measure	Mandatory implementation
Regulation	The management authority has conducted many regulations related to CITES implementation and awareness program activities for stakeholders. Most recommendations listed in the 2018 NDF have been implemented primarily regarding limiting the number of catches through the quota system, protecting some critical habitat areas, and controlling the trade mechanisms for CITES-listed species. Nevertheless, the recommendation on size limitation for captured hammerhead sharks has not been well implemented. Juveniles and subadult sharks are still often caught and landed at many landing sites in this country.

6. RECOMMENDATIONS

Indonesia has developed its national plan of action (NPOA) for sharks and rays since 2010. In a recent NPOA document, there are at least seven management targets, such as integrating the management efforts among stakeholders, controlling the utilization of the CITES appendix-listed species, data improvement, protecting critical habitats, bycatch mitigation, improving awareness programs, and identifying alternative livelihood. As one of the management targets, maintaining sustainable use to reduce the threat of species extinction from the international trade of CITES appendix-listed species, including hammerhead sharks, is essential. Therefore, based on the data and information presented in the previous sections of this document, the Management Authority needs to take the following steps:

Improving catch data recording

Ideally, each CITES-listed shark species caught and landed must be recorded entirely, including the size, sex, fishing location, and other related information, to monitor the implementation of CITES regulation and complete the data for catch per unit effort (CPUE) analysis. However, on several occasions, some potential problems are encountered in collecting the data, such as a large number of fish landings, limited personnel, and limited access to the source of data. Recently, hammerhead sharks have been caught with various fishing gear and boats without restriction. Consequently, not all fish landings or fishing boats have such data to be recorded for their captured sharks.

The national catch database for CITES-listed species, including the hammerhead sharks, must be realized to monitor the implementation of the catch quota as one of the requirements in the CITES regulation. The management authority can assign a bureau or a national body to act as a data center for the catch record. To anticipate a large number of fish landings and limited personnel, the management authority should select and determine several major fish landings to be official sites for the CITES-listed species landing. Each selected landing site may represent each province or Fisheries Management Area (FMA) in Indonesia. In contrast, any CITES-listed species that are landed outside the selected locations can be considered illegal. At least one professional enumerator for data collection should be assigned at each landing site. The data should be compiled based on the province or FMA and updated at least quarterly to identify the traceability and monitoring of the implementation of quota management. The government may collaborate with other stakeholders, such as research institutions and NGOs, to achieve this goal.

Assessment of the hammerhead shark population is also needed to improve the data collection in capture fisheries. The data from this assessment will serve as an important input for better policymaking. In addition, hammerhead sharks perform a regional migration and cross national boundaries. This type of shark migration needs to be treated with a population study at the regional level so that fishing quota regulation can also be imposed regionally.

Controlling the over-exploitation rate through a permitting mechanism

Demands for hammerhead shark products in the international markets, especially for fins, are high. Therefore, It is necessary to regulate a mechanism in the utilization of the hammerhead shark following the CITES provisions. Only registered fishers or boats are permitted to catch hammerhead sharks to maintain the traceability and sustainability of the CITES-listed species. Fishers are also expected to report the fishing grounds, species, and numbers of sharks and rays (can be in logbooks) so that this becomes supporting information in identifying shark and ray fishing activities. Thus, all hammerhead landings will be controlled and well-recorded. This mechanism can be followed by a labeling system for each individual in compliance with the quota restriction.

Indonesia currently has a trade mechanism for exporting CITES-listed species by registering exporters and businessmen who are allowed to deal with CITES-listed shark products. This step should be continued by registering the middlemen and traders for domestic trade. The middlemen and domestic traders should connect both to registered fishers or boats and registered exporters to maintain the traceability of the CITES products.

One obstacle in controlling the exploitation rate is the difficulty in species identification of shark products. In order to anticipate this problem, the labeling system should be attached not only when the shark lands but also to each product's derivatives. This mechanism will separate the CITES and non-CITES products in the market chain and minimize the possibility of misidentification, mislabeling, and smuggling of the CITES-listed products. Nevertheless, good identification skills for shark products are still essential to control the shark trade and issuing permits for inter-state (interprovincial) and international trade. Therefore, some improvements are needed for the guidance to identify CITES-listed shark products with an emphasis on the fin characteristics, not only for the dorsal fin identification. For better identification, the guidance should also provide detailed forms of the processed fins (from fresh until the final skinless fins). Finally, regular training for shark product identification to field officers should be provided and regularly maintained to improve their capabilities to distinguish the CITES-listed shark products.

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, separated from other non-CITES species, and registered since the sharks are first landed at the landing site (all fins are still intact) until they are processed and then collected by middlemen until being exported. The ideal market system for CITES species products is registering each individual with a unique barcode. This barcode number will identify the CITES product until the export level. 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.

Limiting the number of catches through the catch quota system

The catch quota is the maximum number of fish that can be caught without jeopardizing their viability. Knowing the biological aspects of the hammerhead sharks is important to determine the catch quota, together with the availability of data and information about the population status.

Recently, determining the catch quota for the hammerhead sharks is based on reducing the total catch from previous annual catch data to 90% as the easiest option to control the fishing rate. When an estimate of population size is available, then the catch quota should be based on that information. Given the limited data available (only the national fisheries statistic data), the catch quota can only be given as a national quota. Ideally, the catch quota should be divided proportionally based on the contribution of each fishing area. Therefore, the national fisheries statistics should provide the catch data based on the catch origin area or the FMA, not the landing area (provincial data). On the other hand, the fact that most sharks are caught as bycatch will also make it difficult to enforce the catch quota.

The current implementation of the allocation of the catch quota is based on the proportion of total catch per province. Provinces with large landing sites, close to the main hub of trade and industry, usually have the highest landing data. Consequently, they will get a larger proportion of the catch quota even though the sharks are not taken from those areas. This situation can bias the information of the fishing origin if the traceability system is not well implemented. Therefore, the labeling mechanism from the first place where the shark landed is essential to determine the quota allocation.

Another element that should be considered in implementing the CITES regulation is the mechanism and effectiveness of supervision in the field. The implementation of a determined catch quota will be vague if there is no strict control, no optimal documentation and supervision, and no traceability system due to a lack of information about the origin of fishery products. At present, the control of the quota implementation is based on the export permit published by the MMAF. Thus, the total catch of the CITES-listed species, including local and domestic use, is unknown and may exceed the catch quota limit. Therefore, labeling each CITES-listed species once landed will control the catch quota given by the management authority.

Regulations on size limitation for captured sharks

The scientific authority determines the annual catch quota with size limitations. Only adult hammerhead sharks with a total length of more than 2.5 m are allowed for trade. Restricting the size of hammerhead sharks that are allowed to be caught is one of the important instruments in maintaining the sustainability of shark resources. The captured hammerhead sharks should ideally be adult-size, assuming they already have the opportunity to reproduce to maintain their sustainability before being caught. Until today, many hammerhead sharks caught and landed in Indonesia were still in juvenile and sub-adult stages or immature conditions. This condition becomes a significant concern for their sustainability and compliance with CITES provisions.

In order to minimize the capture of immature hammerhead sharks, it is necessary to improve the fishing gear selectivity, install a shark excluder device for non-targeted shark fishing gear, and manage the fishing area. In addition, it is also important to improve the knowledge and awareness of fishing communities to act appropriately when small-size sharks are caught in their fishing gear by releasing them back to the sea and not utilizing them.

Trade restrictions based on specific criteria

Shark and ray derivative products are diverse. For certain products, e.g., dried or wet fins, it is necessary to limit the minimum allowable size for trade domestically and internationally. Through this restriction, fishers will only catch individuals of a larger size. The minimum size of the product can be adjusted to the length at first maturity (Lm) of a shark species so that fishing and trading can be interconnected. Restriction of the minimum size of shark and ray derivative products must be a common concern, given the large number of traded small-sized fins, or in other words, the fishing of juveniles is still widely practiced.

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.

Protection of critical habitat (mating and nursery grounds)

Another instrument that can be implemented to preserve the hammerhead shark population is protecting some of their critical habitats (mating and nursing habitats). As the redaction of the regulation is being processed and there is a good commitment by the Indonesian government, there is an optimism that critical habitats for the hammerhead sharks can be designated as conservation areas in the near future. The constraint that may be faced in developing these conservation areas is the limited data and information about the location of mating and nursery grounds of those species. Hence there is a need to conduct more research related to addressing this issue. Identification of potential nursery areas for hammerhead sharks may be made through community-based information. Local fishers generally know where they can find immature sharks in their fishing area. Persuasive approaches and good communications with local fishers are significant points to getting that information.

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

Finally, all stakeholders must appropriately implement existing regulations regarding the protection and utilization of sharks in general or for hammerhead sharks. 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.

7. CLOSING

Considering the available data and the condition of shark fisheries in Indonesia within the last decade, the NDF analysis following the NDF guidance for Elasmobranch species (see Annexes) and the existing and ongoing management measures that the government has taken. As a scientific authority of Indonesia, the National Research and Innovation Agency (BRIN) found that the population of hammerhead sharks in Indonesian waters has not faced a severe threat if appropriately managed. Therefore, a positive NDF can be issued with certain conditions. The management authority should fulfill all the recommendations mentioned in Chapter 6 before implementing the international trade for hammerhead shark products.

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CITES Non-Detriment Findings (NDF) Worksheet for Hammerhead Sharks in Indonesia

<table>
<tr><th colspan="4">Worksheet for Step 1</th></tr>
<tr><th colspan="4">Question 1.1 (a)

Is the specimen subject to CITES controls?

(How did you identify the species?)</th></tr>
<tr><td colspan="4">See pages 64–65 of Annex 1 for additional Guidance Notes on completing this Worksheet.</td></tr>
<tr><td>Species Name</td><td>Product Form</td><td>CITES Appendix</td><td>Source of Identification</td></tr>
<tr><td>Sphyrna lewini

Sphyrna mokarran

Sphyrna zygaena

Eusphyra blochii</td><td>Whole fish/fins/carcass</td><td>II

*Eusphyra blochii being proposed to appendix II in CoP19 CITES in 2022</td><td>The specimen was identified to the species level based on White et al. (2006) and Ebert et al. (2020). Meanwhile, the carcass was identified by Jabado & Abercrombie (2021). Fin identified by Marshal & Barone (2011)</td></tr>
<tr><td colspan="4"><u>NEXT STEPS</u></td></tr>
<tr><td rowspan="3">In view of the above, is the specimen subject to CITES controls?

Consult ‘Decision and Next Steps’ guidance in Annex 1</td><td>YES</td><td colspan="2">GO TO Question 1.1 (b)</td></tr>
<tr><td>NOT CERTAIN</td><td colspan="2">Describe concerns in more detail below, and GO TO Question 1.1 (b)</td></tr>
<tr><td>NO</td><td colspan="2">NDF is not required</td></tr>
<tr><td>Concerns and uncertainties:</td><td colspan="3">Look-alike species and has an overlap habitat.

Some derivates products of hammerhead shark (fillets, skin and cartilage) cannot be identified at the species level</td></tr>
</table>

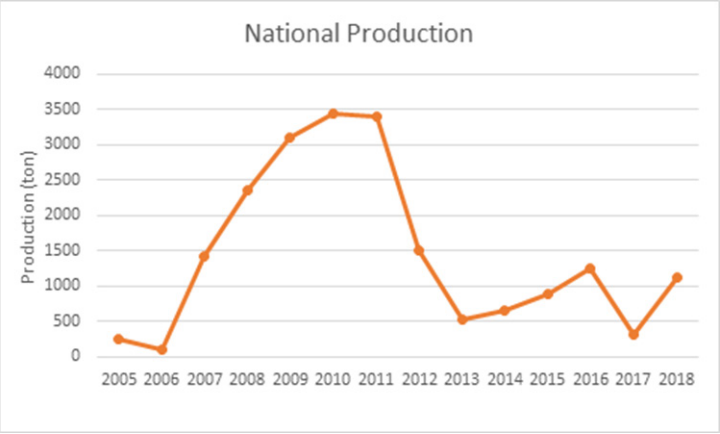
Worksheet for Step 1 (continued)		
Question 1.1 (b) **From which stock will the specimen be taken/was the specimen taken?** **(Can origin and stock be confidently identified)**		
See pages 66–67 of **Annex 1** for additional Guidance Notes on completing this Worksheet**.**		
	Description/comments	**Sources of information**
Ocean basin	Pacific Ocean, Indo-Pacific, Indian Ocean, Atlantic Ocean	Rigby et al., 2019a Rigby et al., 2019b Rigby et al., 2019c Smart & Simpfendorfer, 2016
Stock location/ distribution/ boundaries (attach a map)	Indo-Pacific	
Is this a shared stock (i.e. occurring in more than one EEZ[1] and/or the high seas)?	Not certain, probably yes	
If the stock occurs in more than one EEZ, which other Parties share this stock?	Not known	
If high seas stock, which other Parties shark this stock?	Not known	
Which, if any, RFB[2](s) cover(s) the range of this stock?	Indonesia is parties to IOTC, WCPFC, and CCSBT	
Are all Parties listed above (which fish or share the stock concerned) members of the relevant RFBs?	No	
Are there geographical management gaps?	Not certain	
How reliable is the information on origin?	Reliable	
NEXT STEPS		
Is information on origin sufficiently detailed for Question 1.2 to be answered?		**YES**
Consult "Decision and Next Steps" guidance in **Annex 1**. **(Apply this answer at end of Question 1.2)**		**NO**

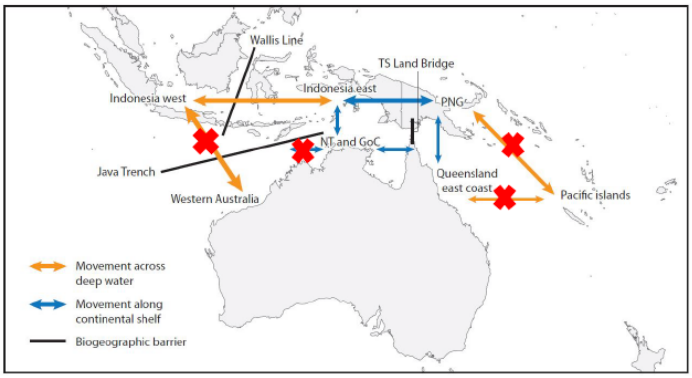
1 Exclusive Economic Zone
2 Regional Fisheries Body

Worksheet for Step 1 (continued)		
Question 1.2 **Was (will) the specimen (be) legally obtained and is export allowed?**		
See pages 67–68 of **Annex 1** for additional Guidance Notes on completing this Worksheet**.**		
Is the species:	**Description/comments**	**Sources of information**
Protected under wildlife legislation, a regional biodiversity Agreement, or (for a CMS[3] Party) listed in CMS Appendix 1?	No	CMS website (http://www.cms.int/en/page/appendix-i-ii-cms)
Sourced from illegal fishing activities (e.g. in contravention of finning regulations, or where a TAC[4] is zero or exceeded)?	Not sure, but shark finning still happens in Eastern Indonesia from artisanal fisheries	Jaiteh et al., 2016
Taken from a no-take marine protected area or during a closed season?	No	
Taken in contravention of RFB recommendations, if any?	No	
Listed as a species whose export is prohibited?	No	
Of concern for any other reason?	No	
NEXT STEPS		
In view of the above and the final section of the Worksheet for Question 1.1(b), was the specimen legally acquired and can exports be permitted? Consult "Decision and Next Steps" guidance in **Annex 1.**	**YES**	**GO TO Question 1.3**
	SOME DOUBT	Describe concerns in more detail below, and **GO TO Question 1.3**
	NO	Export cannot be permitted, **NDF is not required**
Concerns and uncertainties:	Indonesia's stock status and species-specific trade data are particularly available.	

3 Convention on Migratory Species
4 Total Allowable Catch

Worksheet for Step 1 (continued)		
Question 1.3 **What does the available management information tell us?**		
See pages 69 and Table A of **Annex 1** for additional Guidance Notes on completing this Worksheet**.**		
Part 1. Global-level information		
	Description/comments	**Sources of information**
Reported global catch	*S. lewini*: 135 tonnes (average global annual catch 2011-2020). *S. mokarran*: 26 tonnes (average global catch for 2013-2015), only years for which data is reported over the last five years. *S. zygaena*: 280 tonnes (average global annual catch 2011-2015).	FAO, 2022
Species distribution	Sphyrnidae contents of two genera, *Sphyrna* and *Eusphyra.* Species which found in Indonesia : 1. *Sphyrna lewini* :a circumglobal distribution 2. *Sphyrna mokarran* : worldwide throughout tropical and warm temperate seas 3. *Sphyrna zygaena* : temperate seas and in some regions, it is present in tropical seas 4. *Eusphyra blochi*i : Indo-West Pacific from the Arabian/ Persian Gulf through south Asia to northern Australia and Papua New Guinea	Ebert et al. 2021 Last and Stevens 2009 Rigby et al., 2019a Rigby et al., 2019b Rigby et al., 2019c.
Known stocks/ populations	During this 10-year period there was a 61.7% decline in CPUE of hammerheads (*Sphyrna* spp.) in Indian Ocean	Rigby et al., 2019a
Main catching countries	Guinea-Bissau, US	FAO 2022
Main gear types by which the species is taken	See section 3.3	
Global conservation status	Critically Endangered (CR) for *Sphyrna lewini, S. mokarran* and Vulnerable (VU) for *S. zygaena* Endangered (EN) for *Eusphyra blochii*	Rigby et al., 2019a Rigby et al., 2019b Rigby et al., 2019c Smart & Simpfendorfer, 2016
Multilateral Environmental Agreements	CMS Appendix II CITES Appendix II	

Part 2. Stock/context-specific information		
Stock assessments	Not available	
Main management bodies	Not available	
Cooperative management arrangements	Not available	
Non-membership of RFBs	Not available	
Nature of harvest	Targeted and by-catch	
Fishery types	The Scalloped Hammerhead is caught globally as a target and bycatch in commercial and small-scale pelagic longline, purse seine, and gillnet fisheries. Most of the catch is taken as bycatch of industrial pelagic fleets in offshore and high-seas waters	Camhi et al. 2008
Management units	Not available	
Products in trade	Fins Meat/Fillet Skin Cartilage vertebrate	Muttaqin et al., 2018 Dharmadi and Prasetyo, 2019 Oktaviyani et al., 2019
Part 3. Data and data sharing		
Reported national catch(es)	Production for hammerhead sharks 	MMAF, 2019

Are catch and/or trade data available from other States fishing this stock?	 Previously there was some hypotheses about hammerhead share stock between Indonesia and Australia, but the hypotheses was renewed that the massive movement was not happen.	Heupel et al., 2020
Reported catches by other States		
Catch trends and values	Decreasing significantly in the last decade in many countries, including Indonesia	MMAF, 2016 FAO, 2022
Have RFBs and/or other States fishing this stock been consulted during or contributed data during this process?	No	

https://www.fao.org/fishery/en/aqspecies/2028

MMAF, 2019 https://satudata.kkp.go.id/MMAF

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NEXT STEPS

The information collated in the above worksheets can now be passed to the Scientific Authority, so that the NDF process can begin with Step 2

Worksheet for Step 2		
Question 2.1 **What is the level of intrinsic biological vulnerability of the species?**		
• **See pages 73–75 of Annex 1 for additional Guidance Notes on completing this Worksheet.** • **In the Worksheet below, circle the level of vulnerability associated with each Intrinsic Biological Factor. Default indicator/metric figures for listed shark and ray species are provided in Annex 4 (pages 111-131). These may be inserted here, but they are derived from international standardised data and may not reflect local stock characteristics. Wherever possible, verified local data on stocks should be utilised.**		
Intrinsic biological factors *(see page 73 of the Guidance Notes)*	**Level of vulnerability** *(circle or highlight as appropriate)*	**Indicator/metric** *(see page 73 of the Guidance Notes)*
a) Median age at maturity	Low	
	Medium	See Section 2.1
	High	
	Unknown	
b) Median size at maturity	Low	
	Medium	See Section 2.1 (males)
	High	See Section 2.1 (females)
	Unknown	
c) Maximum age/longevity in an unfished population	Low	
	Medium	
	High	See Section 2.1
	Unknown	
d) Maximum size	Low	
	Medium	
	High	See Section 2.1
	Unknown	
e) Natural Mortality rate (M)	Low	
	Medium	See Section 3.4
	High	
	Unknown	

f) Maximum annual pup production (per mature female)	**Low**	See Section 2.1
	Medium	
	High	
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	See Section 2.1
	Unknown	
h) Geographic distribution of stock	**Low**	Ocean basin, unrestricted, limited fragmentation
	Medium	
	High	
	Unknown	
i) Current stock size relative to historic abundance	Low	
	Medium	
	High	
	Unknown	No data at the species level
j) Behavioral factors	Low	
	Medium	
	High	Schooling, coastal waters as a nursery ground and feeding ground, frequent juvenile captures from the coastal waters.
	Unknown	
k) Trophic level	Low	
	Medium	
	High	4.1 (Froese & Pauly, 2022)
	Unknown	

SUMMARY for Question 2.1 Intrinsic biological vulnerability of species Provide an assessment of the overall intrinsic biological vulnerability of the species (tick appropriate box below). Explain how these conclusions were reached and the main information sources used.			
High	Medium	Low	Unknown
Biological data for *S. lewini* is still limited in Indonesian waters. However, from available data and information, it is considered to have high vulnerability in Indonesia. The primary consideration is its behavior, low fecundity, late maturity, and slow growth.			
NEXT STEPS • Go to **Section 2.2**			

Sphyna mokarran

Worksheet for Step 2		
Question 2.1 **What is the level of intrinsic biological vulnerability of the species?**		
• See pages 73–75 of **Annex 1** for additional Guidance Notes on completing this Worksheet**.** • In the Worksheet below, circle **the level of vulnerability** associated with each **Intrinsic Biological Factor**. Default indicator/metric figures for listed shark and ray species are provided in **Annex 4** (pages 111-131). These may be inserted here, but they are derived from international standardised data and may not reflect local stock characteristics. Wherever possible, verified local data on stocks should be utilised.		
Intrinsic biological factors *(see page 73 of the Guidance Notes)*	**Level of vulnerability** *(circle or highlight as appropriate)*	**Indicator/metric** *(see page 73 of the Guidance Notes)*
a) Median age at maturity	Low	
	Medium	See Section 2.2
	High	
	Unknown	
b) Median size at maturity	Low	
	Medium	
	High	See Section 2.2
	Unknown	
c) Maximum age/longevity in an unfished population	Low	
	Medium	
	High	See Section 2.2
	Unknown	

d) Maximum size	Low	
	Medium	
	High	See Section 2.2
	Unknown	
e) Natural Mortality rate (M)	Low	
	Medium	
	High	
	Unknown	Limited information
f) Maximum annual pup production (per mature female)	**Low**	See Section 2.2
	Medium	
	High	
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	
	Unknown	Limited information
h) Geographic distribution of stock	**Low**	Ocean basin, unrestricted, limited fragmentation
	Medium	
	High	
	Unknown	
i) Current stock size relative to historic abundance	Low	
	Medium	
	High	
	Unknown	No data at the species level
j) Behavioral factors	Low	
	Medium	
	High	Schooling, coastal waters as a nursery ground and feeding ground, frequent juvenile captures from the coastal waters.
	Unknown	

k) Trophic level	Low	
	Medium	
	High	4.3 (Froese & Pauly, 2021)
	Unknown	

SUMMARY for Question 2.1 **Intrinsic biological vulnerability of species** Provide an assessment of the overall intrinsic biological vulnerability of the species (tick appropriate box below). Explain how these conclusions were reached and the main information sources used.			
High	Medium	Low	Unknown
Biological data for *S. mokarran* is still limited in Indonesian waters. However, from available data and information, it is considered to have high vulnerability in Indonesia. The primary consideration is its behavior, low fecundity, late maturity, and slow growth			
NEXT STEPS • Go to **Section 2.2**			

Sphyrna zygaena

Worksheet for Step 2		
Question 2.1 **What is the level of intrinsic biological vulnerability of the species?**		
• See pages 73–75 of **Annex 1** for additional Guidance Notes on completing this Worksheet. • In the Worksheet below, circle **the level of vulnerability** associated with each **Intrinsic Biological Factor**. Default indicator/metric figures for listed shark and ray species are provided in **Annex 4** (pages 111-131). These may be inserted here, but they are derived from international standardised data and may not reflect local stock characteristics. Wherever possible, verified local data on stocks should be utilised.		
Intrinsic biological factors *(see page 73 of the Guidance Notes)*	**Level of vulnerability** *(circle or highlight as appropriate)*	**Indicator/metric** *(see page 73 of the Guidance Notes)*
a) Median age at maturity	Low	
	Medium	
	High	
	Unknown	Limited information

b) Median size at maturity	Low	
	Medium	
	High	See Section 2.3
	Unknown	
c) Maximum age/longevity in an unfished population	Low	
	Medium	See Section 2.3
	High	
	Unknown	
d) Maximum size	Low	
	Medium	
	High	See Section 2.3
	Unknown	
e) Natural Mortality rate (M)	Low	
	Medium	
	High	
	Unknown	Limited information
f) Maximum annual pup production (per mature female)	**Low**	See Section 2.3
	Medium	
	High	
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	
	Unknown	Limited information
h) Geographic distribution of stock	Low	
	Medium	
	Low	Ocean basin, unrestricted, limited fragmentation
	Unknown	
i) Current stock size relative to historic abundance	Low	
	Medium	
	High	
	Unknown	No data at the species level

j) Behavioral factors	Low	
	Medium	
	High	Schooling, coastal waters as a nursery ground and feeding ground, frequent juvenile captures from the coastal waters.
	Unknown	
k) Trophic level	Low	
	Medium	
	High	4.9 (Froese & Pauly, 2022)
	Unknown	

SUMMARY for Question 2.1

Intrinsic biological vulnerability of species

Provide an assessment of the overall intrinsic biological vulnerability of the species (tick appropriate box below). Explain how these conclusions were reached and the main information sources used.

High	Medium	Low	Unknown

Limited studies and lack of data on *S. zygaena* in Indonesian waters. However, it is estimated to have a similar biological characteristics as others hammerhead and then considered to have high vulnerability in Indonesia. The primary consideration is its behavior, low fecundity, late maturity, and slow growth.

NEXT STEPS

- Go to **Section 2.2**

Worksheet for Step 2		
Question 2.1 **What is the level of intrinsic biological vulnerability of the species?**		
• See pages 73–75 of **Annex 1** for additional Guidance Notes on completing this Worksheet**.** • In the Worksheet below, circle **the level of vulnerability** associated with each **Intrinsic Biological Factor**. Default indicator/metric figures for listed shark and ray species are provided in **Annex 4** (pages 111-131). These may be inserted here, but they are derived from international standardised data and may not reflect local stock characteristics. Wherever possible, verified local data on stocks should be utilised.		
Intrinsic biological factors *(see page 73 of the Guidance Notes)*	**Level of vulnerability** *(circle or highlight as appropriate)*	**Indicator/metric** *(see page 73 of the Guidance Notes)*
a) Median age at maturity	Low	
	Medium	See Section 2.4
	High	
	Unknown	
b) Median size at maturity	Low	
	Medium	See Section 2.4
	High	
	Unknown	
c) Maximum age/longevity in an unfished population	Low	
	Medium	See Section 2.4
	High	
	Unknown	
d) Maximum size	Low	
	Medium	See Section 2.4
	High	
	Unknown	
e) Natural Mortality rate (M)	Low	
	Medium	
	High	
	Unknown	Limited information

f) Maximum annual pup production (per mature female)	**Low**	See Section 2.4
	Medium	
	High	
	Unknown	
g) Intrinsic rate of population increase (r)	Low	
	Medium	
	High	
	Unknown	Limited information
h) Geographic distribution of stock	Low	
	Medium	Regional; partially restricted; relatively fragmented
	High	
	Unknown	
i) Current stock size relative to historic abundance	Low	
	Medium	
	High	
	Unknown	No data at the species level
j) Behavioral factors	Low	
	Medium	
	High	Schooling, coastal waters as a nursery ground and feeding ground, frequent juvenile captures from the coastal waters.
	Unknown	
k) Trophic level	Low	
	Medium	
	High	4.2 (Froese & Pauly, 2022)
	Unknown	

SUMMARY for Question 2.1 Intrinsic biological vulnerability of species Provide an assessment of the overall intrinsic biological vulnerability of the species (tick appropriate box below). Explain how these conclusions were reached and the main information sources used.			
High	**Medium**	Low	Unknown
Limited studies and lack of data on *E. blochii* in Indonesian waters. However, it is estimated to have a similar biological characteristics as others hammerhead and then considered to have high vulnerability in Indonesia. The primary consideration is its behavior, low fecundity, late maturity, and slow growth.			
NEXT STEPS • Go to **Section 2.2**			

Worksheet for Step 2 (continued) Question 2.2 What is the severity and geographic extent of the conservation concern?		
• See pages 76–80 of **Annex 1** for additional Guidance Notes on completing this Worksheet**.** • Based on existing stock assessments or conservation status assessments, evaluate the severity and geographic extent/scope of conservation concern, including reasons for the conclusions drawn and information on sources used. • In the Worksheet below, circle the **level of severity/scope of concern** associated with each **Factor** using the descriptions in the indicator column in **Table B** in the Guidance Notes (**Annex 1**). In the column entitled Indicator in the Worksheet below, note briefly the reason for this assessment of level of severity/ scope of concern. Further explanation (including information on sources used) can be provided in the boxes entitled '*Comments*'.		
Conservation concern factors *(see page 78 of the Guidance Notes)*	**Level of severity/scope of concern** *(circle as appropriate)*	**Indicator/metric** *(see page 78 of the Guidance Notes)*
Conservation or stock assessment status	Low	
	Medium	
	High	Rigby et al., 2019a Rigby et al., 2019b Rigby et al., 2019c Smart & Simpfendorfer, 2016
	Unknown	
	Comments: Formal stock assessment for these species has not been done yet from Indonesian waters. IUCN Red List category has been applied to this species	

Population trend	Low	
	Medium	
	High	
	Unknown	No stock/population data
	Comments: There is no population trend data for these species from Indonesian waters. However, for Tanjung Luar case (FMA 573) shows the population trend of *S. lewini* has a significant increase in 2016. However, it continually decreased in 2016 to 2021, such that the value in 2021 was lower than 2014.	
Geographic extent/scope of conservation concern	Low	
	Medium	Identified threats (juvenile fishing) affect the national stock of the species
	High	
	Unknown	
	Comments: Percentage of immature catches in the sites which strictly managed were decreased, but many unmanaged and unrecorded sites across Indonesia caught and landed immature hammerheads.	

SUMMARY for Question 2.2

Severity and geographic extent of the conservation concern

Provide an assessment of the overall severity and geographic extent of the conservation concern for this species or stock (tick appropriate box below). Explain how these conclusions were reached and the main information sources used.

High	**Medium**	Low	Unknown

Rigby, C.L., Dulvy, N.K., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. (2019a). *Sphyrna lewini*. *The IUCN Red List of Threatened Species* 2019: e.T39385A2918526. Accessed on 01 July 2022.

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Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. (2019c). *Sphyrna zygaena*. *The IUCN Red List of Threatened Species* 2019: e.T39388A2921825. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T39388A2921825.en. Accessed on 01 July 2022.

Smart, J.J. & Simpfendorfer, C. 2016. Eusphyra blochii. The IUCN Red List of Threatened Species 2016: e.T41810A68623209. http://dx.doi.org/10.2305/ IUCN.UK.20161.RLTS.T41810A68623209.e

NEXT STEPS

- Go to **Step 3**

Worksheet for Step 3

Question 3.1

What is the severity of trade pressure on the stock of species concerned?

- See pages 81–84 of **Annex 1** for additional Guidance Notes on completing this Worksheet**.**
- In the Worksheet below, circle the **level of severity** associated with each trade pressure **Factor** using the descriptions in the Indicator column in **Table C** in the Guidance Notes (**Annex 1**). In the column entitled **Indicator/metric** in the Worksheet below, note briefly the reason for this assessment of level of trade pressure severity. Consider **all products in both domestic and international trade.**
- For each Factor, circle the **level of confidence** associated with each assessment of trade pressure severity. This involves an assessment of the **quality of the information** used to evaluate the severity of trade pressure on the stock of the species concerned.
- In the box entitled '*Reasoning*', provide reasons to justify the evaluation of severity of trade pressure and assessment of confidence level (i.e. quality of information used). Here, comments/information should also be provided on:
  - the sources of information used to evaluate severity of trade pressure;
  - whether a precautionary approach was taken to the evaluation of trade pressure severity (e.g. due to a lack of robust trade information to inform the evaluation);
  - whether the evaluation of trade pressure was adjusted (i.e. severity increased to a higher level) to take into account high intrinsic biological vulnerability/conservation concern assessed in **Step 2**;
  - whether information is particularly lacking and, if so, how this data availability may be improved (see also **Section 6.1** of the Guidance Notes in **Annex 1** for further advice).

Factor *(see page 84 of the Guidance Notes)*	**Level of severity of trade pressure** *(highlight or circle as appropriate)*	**Indicator/metric** *(see page 84 of the Guidance Notes)*
a) Magnitude of legal trade	Low	
	Medium	Multiple uses in commercial trade, market demand is stable
	High	
	Unknown	
	Level of confidence *(circle as appropriate)* Low **Medium** High	

Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of trade pressure been increased in light of the assessment in Step 2?)

Multiple-use in commercial trade (domestic market demands meat products, such as fresh, salted, smoked meat as well as skins for crackers; meanwhile, fins, cartilage and meat are exported to Asian countries).

In general, for one product, collectors or traders mixed all hammerhead species, they do not separate each product at the species level. So, if it is already in derivative products, such as fillet or cartilage, it will be challenging to identify.

b) Magnitude of illegal trade	Low	
	Medium	Moderate documentation of international trade, trade chain is long and complicated, some concern about substation for look-alike species.
	High	
	Unknown	
	Level of confidence *(circle as appropriate)*	
	Low **Medium** High	

Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of trade pressure been increased in light of the assessment in Step 2?)

From 2013 to 2018, all hammerhead shark products were banned from exporting, but the fishers still caught it. No specific trade data for hammerhead shark, even for domestic or export. The traceability mechanism improved since 2016, which shark and ray products that will be traded domestically and internationally must be checked by officers from the MMAF technical unit (Regional Office for Marine and Coastal Resources Management) to ascertain the condition and information of the products, including the type of product, number, and species name. During the inspection, they often found hammerhead shark products mixed with others not listed in CITES Appendix. Local collectors rarely separate products per species, except for certain species with high market prices. They combine various species, only separated by product types, such as skin, dried fins, meat, and others. Identifying derivative products of hammerhead is still the biggest challenge for staff on recording trade data. So far, data of volume and trade in the domestic market is still lacking, both for hammerhead or elasmobranch in general.

NEXT STEPS

- Add notes in the Worksheet for **Section 6.1** on improvements in trade data availability/monitoring required to evaluate trade pressure under **Section 3.1**.
- GO TO **Section 3.2** to evaluate fishing pressures.

Worksheet for Step 3

Question 3.2

What is the severity of fishing pressure on the stock of species concerned?

- See pages 85–90 of **Annex 1** for additional Guidance Notes on completing this Worksheet**.**
- In the Worksheet below, circle the **level of severity** associated with each fishing pressure **Factor** using the descriptions in the Indicator column in **Table D** in the Guidance Notes (**Annex 1**). In the column entitled **Indicator/metric** in the Worksheet below, note briefly the reason for this assessment of level of fishing pressure severity. Consider **all fishing methods and gears that** interact with the shark stock concerned.
- For each Factor, circle the **level of confidence** associated with each assessment of fishing pressure severity. This involves an assessment of the **quality of the information** used to evaluate the severity of fishing pressure on the stock of the species concerned.
- In the box entitled '*Reasoning*', provide reasons to justify the evaluation of severity of fishing pressure and assessment of confidence level (i.e. quality of information used). Here, comments/information should also be provided on:
  - the sources of information used to evaluate severity of fishing pressure;
  - whether a precautionary approach was taken to the evaluation of fishing pressure severity (e.g. due to a lack of robust information to inform the evaluation);
  - whether the evaluation of fishing pressure was adjusted (i.e. severity increased to a higher level) to take into account high intrinsic biological vulnerability/conservation concern assessed in **Step 2**;
  - whether information is particularly lacking and, if so, how this data availability may be improved (see also **Section 6.1** of the Guidance Notes in **Annex 1** for further advice).

Factor *(see page 89 of the Guidance Notes)*	**Level of severity of fishing pressure** *(highlight or circle as appropriate)*	**Indicator/metric** *(see page 89 of the Guidance Notes)*
a) Fishing mortality (retained catch)	Low	
	Medium	Medium proportion of stock removed by all fishing activities (targeted and by-catch).
	High	
	Unknown	
	Level of confidence *(circle as appropriate)* Low **Medium** High	

Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of fishing pressure been increased in light of the assessment in Step 2?)

Hammerhead are caught as target or by-catch. Fishers who targeted hammerhead use a longline, meanwhile, other fishing gears catch hammerhead as by-catch, such as a drift gillnet, set gillnet, purse seine and seine net (See section 3.3).

b) Discard mortality	Low	
	Medium	Moderate proportion of total catch is thrown back.
	High	
	Unknown	
	Level of confidence *(circle as appropriate)* Low **Medium** High	
Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of fishing pressure been increased in light of the assessment in Step 2?) So far, there is no information about discard of the species if caught. These species is either consumed or traded, both domestically or internationally. However, Jaiteh et al. (2016) reported that the finning activities still happened in Eastern Indonesia. Despite only mentioning shark fisheries, it probably includes hammerhead.		
c) Size/age/sex selectivity	Low	
	Medium	Fisheries moderately selective for any size-age classes for female and male.
	High	
	Unknown	
	Level of confidence *(circle as appropriate* Low Medium **High**	
Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of fishing pressure been increased in light of the assessment in Step 2?) Fishers who targeted hammerhead used a longline, which has a medium-sized hooks. So, mostly they caught sub-adult or adult hammerhead. However, juvenile or immature individual are also caught by other fishing gears as by-catch (See Section 3.4).		

d) Magnitude of illegal, un-reported and unregulated (IUU) fishing	Low	
	Medium	.
	High	
	Unknown	No information
	Level of confidence *(circle as appropriate)* Low **Medium** High	

Reasoning (e.g. has this assessment involved the exercise of precaution, and/or has severity of fishing pressure been increased in light of the assessment in Step 2?)

There is no information on IUU fishing of this species

NEXT STEPS

- Add notes in the Worksheet for **Section 6.1** on improvements in fisheries data availability/monitoring required to evaluate fishing pressure under **Section 3.2**.
- GO TO **Section 4** to evaluate the extent to which existing management measures are effective in mitigating the risks/pressures/concerns identified in **Steps 2 and 3**.

Worksheet for Step 4		
Preliminary stage **Compile information on existing management measures**		
In the table below, provide a list of existing generic and species-specific management measures in place for the stock or population of the species concerned. Consider measures implemented at the **(sub-) national, regional and international level** (i.e. including any measures implemented by relevant RFBs). Include a brief description of each measure, the sources of information used and any other comments if appropriate. A table of commonly used generic and species-specific fisheries management measures is provided in **Annex 5** (page 132). It is **advisable to consult Annex 5 prior to completing the Worksheets in this section, in conjunction with context-specific fisheries management advice.**		
Existing management measures *(see Annex 5 for examples)*	**Is the measure generic or species-specific?**	**Descriptions/comments/sources of information**
(SUB-)NATIONAL		
NPOA for the Conservation and Management of Sharks. **See Section 5**	General	It was issued in 2010 by the Directorate General of Capture Fisheries, MMAF. NPOA extended up to now.
Minister of Marine Affairs and Fisheries Regulation No. 14 of 2011 on Capture Fisheries Business. **See Section 5**	General	The regulation stipulates every fishing vessel operating in the Indonesian FMA and high seas to have a fishing permit.
Minister of Marine Affairs and Fisheries Regulation No. 12 of 2012 on Capture Fisheries Business on the High Seas **See Section 5**	General	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.
Minister of Marine Affairs and Fisheries Regulation No. 48 of 2014 on the Fishing Logbook **See Section 5**	General	The regulation amended the previous Minister of Marine Affairs and Fisheries Regulation No. 18 of 2010 on fishing logbooks. 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. The e-logbook is developed as one improvement strategy for increasing fishing vessels' compliance in filling in and reporting the fishing logbooks.

Minister of Marine Affairs and Fisheries Regulation No. 58 of 2020 on the Capture Fisheries Business **See Section 5**	General	This ministerial regulation explains that conservation action is mandatory for every fishing vessel operating in the RFMO-managed area that gains bycatch, including sharks. The conservation actions include not catching juvenile and pregnant sharks, landing whole sharks caught (non-juvenile and non-pregnant) and reporting the sharks caught to the chief of the relevant fishing port according to the SIPI in the fishing logbook.
Minister of Marine Affairs and Fisheries Regulation No. 22 of 2021 on the Fisheries Management Plan and Fisheries Management Governance **See Section 5**	General	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.
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. **See Section 5**	General	The regulation was revised through the Minister of Marine Affairs and Fisheries Regulation No. 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. Every person or legal entity must 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.
Regulation of the Director-General of Marine Space Management Number 13 of 2018 concerning Procedures for the Issuance of Shark and Ray Trading Recommendations. **See Section 5**	General	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, volume, origin (landing and city), and destination. The regulation was implemented in 2015 and showed increasing compliance from related stakeholders. The monitoring mechanism ensures the traceability of the products traded domestically and internationally.
Standard Operating Procedure (SOP) for Domestic and International Trade of CITES Appendix-Listed Fish Species **See Section 5**	General	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.

Governor of Raja Ampat, Indonesia Regency Regulation No 9 of 2012. **See Section 5**	General	Prohibits the fishing for sharks, manta rays, and certain types of fish in the waters of Raja Ampat, Papua Province.
Government Instruction of West Manggarai Regency Number DKPP/1309/ VII/2013 **See Section 5**	General	Prohibits fishing for sharks, manta rays, napoleon wrasse, and other marine biotas in West Manggarai waters, East Nusa Tenggara Province.
Governor Instruction of DKI Jakarta Number 78 of 2014 **See Section 5**	General	Prohibition of consuming sharks and manta rays and their derivative products for officials and employees of the DKI Jakarta government.
Governor Regulation of South Sumatra Number 27 of 2015 **See Section 5**	General	Prohibits consuming, capturing, and trading sharks, manta rays, and/or their derivative products
Bupati Regulation of Kaur of Bengkulu Province Number 104 of 2018 **See Section 5**	General	Control of fishing for sharks in the waters of Kaur Regency.
Local Regulation of Berau Regency Number 16 of 2019 **See Section 5**	General	Protecting sharks (whale shark, nurse shark, grey reef shark and white tip reef shark), manta rays, certain species and coral reef.
Governor Decree of West Nusa Tenggara Province Number 55 of 2020 **See Section 5**	General	Management action plan of shark and ray fisheries in West Nusa Tenggara Province from 2020-2025.
REGIONAL/INTERNATIONAL		
- CITES: Inclusion of the species in CITES Appendix II effective date 14/09/2014 (Species-specific) - CMS: listed in Appendix II of CMS		
NEXT STEPS • GO TO **Question 4.1(a).**		

Worksheet for Step 4 (continued)
Question 4.1(a) **Are existing management measures appropriately designed and implemented to mitigate the pressures affecting the stock/population of the species concerned?**
• See pages 91–92 of **Annex 1** for additional Guidance Notes on completing this Worksheet**.** • Firstly assess whether **appropriately designed** management measures are in place to mitigate the pressures affecting the stock/population of the species concerned: o From the '**Preliminary stage**' Worksheet above, transfer information on existing management measures into the Worksheet below, alongside the relevant fishing and trade pressure Factor(s) the measures(s) can help to mitigate (as evaluated in **Step 3**). o Use the information in the table of commonly used generic and species-specific fisheries management measures in **Annex 5** to determine which pressures the existing management measures in place can help to address/mitigate. • Next, assess whether the existing management measures in place are being **implemented**: o In the column entitled "Relevant Monitoring, Control and Surveillance (MCS) measure(s)", include information on existing MCS measures that are relevant to the implementation of the existing management measures identified. **Annex 5** provides information on MCS measures that can help to secure compliance with commonly used fisheries management measures. o Second, based on the explanations provided in the column in the Worksheet below entitled "Overall assessment of compliance regime", make a judgement as to whether the existing management measure(s) identified is/are being implemented (i.e. adequately enforced/complied with). o NOTE: in some circumstances where the fishing/trade pressure severity was assessed as "Low" for any of the Factors in **Step 3**, mitigation may not be required (see also the Guidance Notes for Question 4(a) in **Annex 1**). In such cases, "Not applicable" can be noted under the "Existing management measure(s)" and "Relevant MCS measure(s)" columns in the Worksheet (for that trade/fishing pressure Factor). o Provide reasons to justify the assessments made in this Worksheet in the box entitled "Reasoning/comments", including any sources used. o Where certain management measures are being implemented but others are not, this information can also be included under "Reasoning/comments". Also note down any considerations, issues or shortcomings relating to any of the management measures identified that will need to be kept in mind when completing the Worksheet for **Question 4.1(b)** below

Factor	Existing management measure(s)	Relevant monitoring, control and surveillance (MSC) measure(s)	Overall assessment of compliance regime *(tick as appropriate)*	
TRADE PRESSSURE				
a) Magnitude of legal trade	**Shark traders have mandatory registered, and all trade need permit called ESAJI DN for domestic trade and ESAJI LN for export trade**	**Online digital database of Ministry of Marine Affairs and Fisheries (ESAJI DN and ESAJI LN)**	Unknown (no information on compliance)	
			Poor (limited relevant compliance measures in place)	
			Moderate (some relevant compliance measures in place)	√
			Good (comprehensive relevant compliance measures in place)	
	Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?) The system was established in 2020, some adjustment for the implementation need to be improved.			
b) Magnitude of illegal trade	**Procedure Utilization of Protected Fish Species and/or Listed in the CITES Appendices by ESAJI DN and ESAJI LN**	**Trade data recorded by Fish Quarantine and Coastal and Marine Research Agency of Ministry of Marine Affairs and Fisheries**	Unknown (no information on compliance)	
			Poor (limited relevant compliance measures in place)	
			Moderate (some relevant compliance measures in place)	√
			Good (comprehensive relevant compliance measures in place)	
	Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?) Hong Kong Customs 9 November 2020 seized about 1.9 tonnes of suspected scheduled dried shark fins of endangered species from Indonesia with an estimated market value of about $1.45 million from a container at the Kwai Chung Customhouse Cargo Examination Compound (Hong Kong Customs seizes suspected scheduled dried shark fins (with photo) (info.gov.hk)			

<table>
<tr><td colspan="5">FISHING PRESSSURE</td></tr>
<tr><td rowspan="5">a) Fishing mortality (retained catch)</td><td rowspan="4">Fishing regulation

MPA</td><td rowspan="4">- Fishing permit
- Logbook
- Monitor of the fishing vessel
- Prohibition to catch sharks and rays in several area</td><td>Unknown (no information on compliance)</td><td></td></tr>
<tr><td>Poor (limited relevant compliance measures in place)</td><td></td></tr>
<tr><td>Moderate (some relevant compliance measures in place)</td><td>√</td></tr>
<tr><td>Good (comprehensive relevant compliance measures in place)</td><td></td></tr>
<tr><td colspan="4">Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?)

These fisheries management measures have not complied yet and are not specific for hammerhead sharks generally across Indonesia, only particular places implement shark fishing control effort yet need more improvement.

MPA special for hammerhead has been established in Aceh Jaya, and live release initiate to be conducted.</td></tr>
<tr><td rowspan="5">b) Discard mortality</td><td rowspan="4"></td><td rowspan="4"></td><td>Unknown (no information on compliance)</td><td>√</td></tr>
<tr><td>Poor (limited relevant compliance measures in place)</td><td></td></tr>
<tr><td>Moderate (some relevant compliance measures in place)</td><td></td></tr>
<tr><td>Good (comprehensive relevant compliance measures in place)</td><td></td></tr>
<tr><td colspan="4">Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?)

So far, there is no regulation for whole body landing. Those species are either consumed or traded, both domestically or internationally. However, Jaiteh et al. (2016) reported that finning activities still happened in Eastern Indonesia. Although they only mentioned shark fisheries, however it probably includes hammerhead sharks.</td></tr>
</table>

c) Size/age/sex selectivity	**West Nusa Tenggara Governor Regulation no 55/2020 about shark fisheries action plan**	**Landing monitoring**	Unknown (no information on compliance)	
			Poor (limited relevant compliance measures in place)	√
			Moderate (some relevant compliance measures in place)	
			Good (comprehensive relevant compliance measures in place)	
	Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?) Management measures regarding size limits are lacking, only conducted in West Nusa Tenggara province. However, fishers, who targeted hammerhead sharks used a longline, which has a medium-sized hook. So, mostly they caught sub-adult or adult hammerhead. On the other hand, the juvenile or immature individual is also caught by other fishing gears as by-catch (See Section 3).			
d) Magnitude of IUU fishing	**Marine patrolling** **Placement a monitor in fishing vessel**	**Marine patrolling** **Placement a monitor in fishing vessel**	Unknown (no information on compliance)	
			Poor (limited relevant compliance measures in place)	
			Moderate (some relevant compliance measures in place)	
			Good (comprehensive relevant compliance measures in place)	√
	Reasoning/comments (e.g. Are management measures being implemented to varying degrees? Which compliance measures are lacking?) There is no report of IUU fishing for these species due to the species is not recorded as fully protected species.			
NEXT STEPS • Go to Question 4.1(b)				

Worksheet for Step 4 (continued)	
Question 4.1(b) **Are existing management measures effective (or likely to be effective) in mitigating the pressures affecting the stock/population of the species concerned?**	
• See pages 93–94 of **Annex 1** for additional Guidance Notes on completing this Worksheet. • From the **Worksheet for Question 4.1(a)** above, transfer information on existing management measures currently in place into the column in the table below entitled "Existing management measure(s)", alongside the relevant fishing/trade pressure Factor. • NOTE as above for **Question 4.1(a)**: in some circumstances where the fishing/trade pressure severity was assessed as "Low" for any of the Factors in **Step 3**, mitigation may not be required (see also the Guidance Notes for **Question 4(b)** in **Annex 1**). In such cases, "Not applicable" can be noted under the "Existing management measure(s)" and "Relevant MCS measure(s)" columns in the Worksheet (for that trade/fishing pressure Factor). • In the relevant columns in the table below, for each management measure indicate with a tick in the appropriate box whether: • 1. Data are collected and analysed to inform management decisions? • 2. Management is consistent with expert advice? • Based on the responses to these questions, make a judgement as to whether the management measures(s) identified is/are effective/likely to be effective. Provide reasons to justify this assessment. For example, is effectiveness being compromised by poor design of the management measures or by their inadequate implementation (see responses in the Worksheet for **Question 4.1(a)** above)? Include information on any sources used in the box entitled "Reasoning/ comments". • Note that for each fishing/trade pressure identified, there may be more than one management measure currently in place aimed at mitigating the pressure. When assessing whether the management of a particular fishing/trade pressure is effective/likely to be effective, the aim should be to consider the combined effect of all relevant measures in mitigating the pressure identified.	

Factor	Existing management measure(s)	Are relevant data collected and analysed to inform management decisions? (e.g. landings, effort, fisheries independent data) *Tick as appropriate*		Is management consistent with expert advice? *(tick as appropriate)*	
TRADE PRESSSURE					
a) Magnitude of legal trade		No data OR data are of poor quality OR data are not analysed (adequately) to inform management		No expert advice on management identified	
		Limited relevant data are collected AND analysed to inform management		Not consistent	
	All products recorded by Procedure Utilization of Protected Fish Species and/or Listed in the CITES Appendices by ESAJI DN dan ESAJI LN	Some relevant data are collected AND analysed to inform management	√	Expert advice partially implemented	√
		Comprehensive data collected AND analysed to inform management		Consistent	
	Management measure(s) effective/likely to be effective? (circle as appropriate) Yes Partially No Insufficient information				
	Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?) The trade data has been recorded but is not yet species-specific. The traceability system must be improved, starting from landing port to the importing country (even if it is already derivative products). Many information should be collected in detail, such as catch data, fishing activity information, trade volume, and so on. Need improvement on HS code and need traceable labeling from landing site to export gate.				

TRADE PRESSSURE					
b) Magnitude of illegal trade		No data OR data are of poor quality OR data are not analysed (adequately) to inform management		No expert advice on management identified	
		Limited relevant data are collected AND analysed to inform management		Not consistent	
	Procedure Utilization of Protected Fish Species and/or Listed in the CITES Appendices **Procedure for the Issurance of Sharks and Rays Trading Recommendation**	Some relevant data are collected AND analysed to inform management	√	Expert advice partially implemented	√
		Comprehensive data collected AND analysed to inform management		Consistent	
	Management measure(s) effective/likely to be effective? (circle as appropriate) Yes Partially No Insufficient information				
	Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?) For supporting traceability mechanisms, it should be supported by a strict monitoring system in the exit points, both seaports and airports.				

FISHING PRESSSURE					
a) Fishing mortality (retained catch)		No data OR data are of poor quality OR data are not analysed (adequately) to inform management		No expert advice on management identified	
		Limited relevant data are collected AND analysed to inform management		Not consistent	
	Fishing regulation **MPA**	Some relevant data are collected AND analysed to inform management	√	Expert advice partially implemented	√
		Comprehensive data collected AND analysed to inform management		Consistent	
	Management measure(s) effective/likely to be effective? (circle as appropriate) Yes Partially No Insufficient information				
	Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?) The other regulation could be implemented to decrease fishing mortality of hammerhead sharks.				

FISHING PRESSSURE					
b) Discard mortality		No data OR data are of poor quality OR data are not analysed (adequately) to inform management		No expert advice on management identified	
		Limited relevant data are collected AND analysed to inform management		Not consistent	√
		Some relevant data are collected AND analysed to inform management	√	Expert advice partially implemented	
		Comprehensive data collected AND analysed to inform management		Consistent	
	Management measure(s) effective/likely to be effective? (circle as appropriate) Yes Partially No Insufficient information				
	Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?) No measure is in place to reduce discard mortality, such as regulation on whole-body landing in all or specific landing sites.				

FISHING PRESSSURE					
c) Size/age/sex selectivity		No data OR data are of poor quality OR data are not analysed (adequately) to inform management		No expert advice on management identified	
		Limited relevant data are collected AND analysed to inform management		Not consistent	√
		Some relevant data are collected AND analysed to inform management	√	Expert advice partially implemented	
		Comprehensive data collected AND analysed to inform management		Consistent	
	Management measure(s) effective/likely to be effective? (circle as appropriate) Yes Partially No Insufficient information				
	Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?) Lack of measures is in place to manage fishing of juvenile hammerheads in Indonesia. One critical habitat for hammerheads has been established but needs to be improved to strengthen the conservation action. However, data related to this measure has been collected.				

d) Magnitude of IUU fishing		No data OR data are of poor quality OR data are not analysed (adequately) to inform management		No expert advice on management identified	
	Marine patrolling **Placement a monitor in fishing vessel**	Limited relevant data are collected AND analysed to inform management	√	Not consistent	
		Some relevant data are collected AND analysed to inform management		Expert advice partially implemented	√
		Comprehensive data collected AND analysed to inform management		Consistent	
	Management measure(s) effective/likely to be effective? (circle as appropriate) Yes Partially No Insufficient information				
	Reasoning/comments (e.g. Is effectiveness compromised by poor design and/or implementation, or is a greater diversity or amount of management required? What data are required to better inform and evaluate management decisions? How is management inconsistent with expert advice?) There is no information on IUU fishing of those species in Indonesian waters				

NEXT STEPS

- Add notes in the Worksheet for **Section 6.1** on improvements in data availability/monitoring required to evaluate the effectiveness/likely effectiveness of management under **Question 4.1(b**).
- Add notes in the Worksheet for **Section 6.2** on improvements in management (including compliance systems) required to more fully mitigate the pressures impacting the stock/population of the shark species concerned.
- Go to **Step 5**

Worksheet for Step 5

Question 5.1

Based on the outcomes of the previous steps, is it possible to make a positive NDF (with or without associated conditions) or is a negative NDF required?

- See pages 95–97 of **Annex 1** for additional Guidance Notes on completing this Worksheet**.**
- Transfer all results from **Steps 2–4** to the Table below by circling the appropriate descriptors.
    - From the **Worksheets for Questions 2.1 and 2.2** above, transfer the **level of vulnerability** and **level of severity/scope of conservation concern** into the Worksheet below.
    - From the **Worksheets for Questions 3.1 and 3.2** above, transfer the **level of severity** for each trade and fishing pressure Factor into the second column in the Worksheet below and the **level of confidence** associated with each evaluation of severity into the third column in the Worksheet below.
    - Based on the information contained in the **Worksheets for Questions 4.1(a) and 4.1(b),** state in the Worksheet below whether the **existing management measures are effective/likely to be effective** at mitigating each of the pressures identified (taking into account whether they are **appropriately designed** and **being implemented**), or whether there is insufficient information to make such an assessment.
- Based on the information generated and evaluations made in the previous **Steps**, the Scientific Authority now has to decide whether to make a positive NDF for the export (with or without mandatory conditions), or a negative NDF. A decision tree to assist in this decision-making process is provided in the Guidance Notes in **Annex 1**.
- The final decision regarding the NDF should be indicated in the relevant box at the end of this Worksheet. Under "Reasoning/comments" include justification for the decision made and describe any **mandatory conditions** (for a positive NDF) and/or **recommendations as to further measures** (e.g. improvements in monitoring and/or management required – relevant for both positive and negative NDF).

Step 2: Intrinsic biological vulnerability and conservation concern

Intrinsic biological vulnerability (Question 2.1)	**High**	Medium	Low	Unknown
Conservation concern (Question 2.2)	**High**	Medium	Low	Unknown

Step 3: Pressures on species			**Step 4: Existing management measures**
Pressure	**Level of severity (Questions 3.1 and 3.2)**	**Level of confidence (Questions 3.1 and 3.2)**	**Are the management measures effective* at addressing the concerns/pressures/impacts identified? (Question 4.1b)** **Taking into account the evaluation of management appropriateness and implementation under Question 4.1a*

Trade pressures			
a) Magnitude of legal trade	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient Information **Not applicable
a) Magnitude of illegal trade	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient Information **Not applicable
** Only to be used where the trade pressure severity was assessed as "Low" for any of the Factors in **Step 3** and a judgement is made that the impacts on the shark stock/population concerned are so low that mitigation is not required.			
Fishing pressures			
a) Fishing mortality (retained catch)	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient Information **Not applicable

b) Discard mortality	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient Information **Not applicable
c) Size/age/sex selectivity of fishing	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient Information **Not applicable
d) Magnitude of IUU fishing	High Medium Low Unknown	High Medium Low	Yes Partially No Insufficient Information **Not applicable

** Only to be used where the fishing pressure severity was assessed as "Low" for any of the Factors in **Step 3** and a judgement is made that the impacts on the shark stock/population concerned are so low that mitigation is not required.

A) Can a positive NDF be made?	**YES** – *go to B*	**NO** – *go to **Step 6** and list recommendations for measures to improve monitoring/management under Reasoning/comments below*
B) Are there any mandatory conditions to the positive NDF?	**YES -** *list under Reasoning/ comments below and go to C*	**NO** – *go to C*

C) Are there any other further recommendations? *(e.g. for improvements to monitoring/ management)*	**YES** - *go to **Step 6** and list recommendations for measures to improve monitoring/management under Reasoning/comments below*	**NO**
Reasoning/comments (include justification for decision made and information on mandatory conditions and/ or further recommendations)		

NEXT STEPS

- OPTION 1: If improvements in monitoring or management are required (whether in the case of a **positive or negative NDF**) go to **Step 6**
- OPTION 2: If no improvements in monitoring or management are required, make a **positive NDF** and stipulate any **mandatory conditions**, if appropriate, to the Management Authority and any other relevant bodies.

Worksheet for Step 6

Further measures

Section 6.1

Improvement in monitoring or information required

In the space below, authorities are encouraged to list the improvements in monitoring or information that are required to address cases where:

(i) The severity of trade/fishing pressures has been assessed as unknown.

(ii) The level of confidence in the evaluation of trade/fishing pressures is low.

(iii) There is insufficient information on the effectiveness of management.

(iv)

Recommendations should be made in **consultation with the national fisheries management agency** and should be as **specific as possible** to address any gaps/shortcomings identified with **clearly defined objectives**. Time-frames for implementation should be specified where possible, including with regard to the review of progress on implementation.

See pages 98-99 of **Annex 1** for additional Guidance Notes on completing this Worksheet.

See section 6

Section 6.2 Improvement in management is required
In the space below, authorities are encouraged to list the improvements in management that are required to address cases where management has been assessed as partially effective or ineffective at addressing any of the concerns/pressures/impacts identified, particularly where a fishing or trade pressure is assessed as medium or high (confidence levels: low, medium or high). As noted above for **Section 6.1**, recommendations should be made in **consultation with the national fisheries management agency** and should be as **specific as possible** to address any gaps/shortcomings identified with **clearly defined objectives**. Time-frames for implementation should be specified where possible, including with regard to the review of progress on implementation. See page 100 of **Annex 1** for additional Guidance Notes on completing this Worksheet.
See Section 6

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