A REVIEW OF THE STATUS OF SHARK FISHERIES AND SHARK CONSERVATION IN INDONESIA

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PREFACE

Sharks have become a valuable fisheries commodity in the past decade, as a result of the high demand for shark fins on the international market. FAO data indicate that Indonesia is the world's largest shark producer, contributing around 12.3% of total world production. Almost all parts of a shark have economic value and contribute to the livelihoods of fishers, traders and exporters. Shark products include the flesh, cartilage, skin, teeth, jawbone, stomach contents, liver and fins. Shark flesh can be cooked in all kinds of ways: barbequed, smoked, salted, served as steaks and made into a special soup. Shark flesh can also be roasted with spices or made into jerky, fish balls and fish crackers. So it is no surprise that almost everyone in Indonesia depends on fish resources, including elasmobranchs (sharks and rays).

In several areas of Indonesia, shark is the main livelihood source for local communities. However, this is no reason to overfish sharks. Although shark resources are renewable, if we do not exploit these resources wisely and prudently, they could become endangered.

The prudent exploitation of shark resources, which takes into account the biological characteristics of sharks, such as slow growth, long lifespan, late maturity, and low fecundity. Characteristics like these make sharks very vulnerable to overfishing. Exploitation of sharks in Indonesian waters is multi-species and multi-gear.

Fish conservation programs are not only about protection, but also focus on maintaining sustainable exploitation of these fish resources. The measures taken include allocating marine areas as conservation zones, limiting the size of fish that can be taken, and other measures to maintain the sustainability of these resources and prevent them from becoming endangered species. The best management option for shark fisheries is to adopt a resource management strategy based on the principles of sustainable development. The greatest

challenge for Indonesia's shark fisheries is designing a sustainable shark fisheries management model that can ensure the survival of these marine resources so they can be enjoyed by future generations.

This book, "A Review of the Status of Shark Fisheries and Shark Conservation in Indonesia", contains data and information about the management and exploitation of sharks. This book has been published to provide information, offer scientific and intellectual inspiration, and as a reference for all, including policy makers, on conservation-based exploitation of shark resources that is of benefit to the Indonesian people.

Jakarta, 2013

Director General of Marine, Coastal and Small Islands

Dr. Sudirman Saad, M.HUM

FOREWORD

There are no fewer than 116 species of shark recorded living in Indonesian waters. Intense pressure on and exploitation of sharks has brought them to the edge of extinction. One of the main causes of this is the high economic value of shark fins, coupled with the soaring demand for shark fins on the international market.

In response to this, the Indonesian government, through the Ministry of Marine Affairs and Fisheries, decided to introduce shark protection and conservation measures. Sharks are at the top of the tropical marine food chain. This means that a decline in the shark population would cause an imbalance in lower levels of the tropical ecosystem. Overfishing of shark could cause problems, because unlike other fish, most sharks have low fecundity.

It is not easy to respond to the challenge of designing a sustainable shark management plan. Good cooperation among stakeholders is crucial to ensuring that shark conservation does not harm fishers who have long depended on shark fishing for their survival. Raising awareness about the importance of shark conservation should reduce the number of shark taken both as bycatch and target catch. As an example, the Raja Ampat district government responded in a positive way to shark conservation by issuing Regional Regulation 9/2012, which bans the capture of sharks, rays and other fish species in the marine waters of Raja Ampat district. This is a concrete demonstration of the district's commitment to protecting endangered fish species.

Publication of this book, "A Review of the Status of Shark Fisheries and Shark Conservation in Indonesia" aims to provide readers information and a reference, as well as add to the bare minimum of available data and research on sharks and rays.

With the completion of this book, we would like to express our sincere gratitude to Dr. Toni Ruchimat (Director of Fish Resources), Fahmi (shark

researcher from the Indonesian Institute of Sciences), Dharmadi (shark researcher from Marine and Fisheries Research and Development Agency), Umi Chodriyah (contributor from the Marine Fisheries Research Institute), Tenny Apriliani (contributor from Fisheries Social and Economic Research Centre), Prof. Dr. Suharsono (researcher from the Indonesian Institute of Sciences), Iman Mustofa Zainuddin and Sudarsono from WWF-Indonesia, and all those who directly and indirectly contributed to the completion of this book.

Jakarta, 2013

Director of Area and Fish Species Conservation

Agus Dermawan

SUMMARY

Indonesia is home to a large number of shark species: at least 116 shark species from 25 families are found in Indonesian waters. But current conditions indicate that almost all shark species of economic value are endangered. This situation is of international concern, in particular for conservation activists. The International Union for Conservation of Nature (IUCN) has established several criteria for the conservation status of animal species, based on their vulnerability to extinction, in the form of a Red List. One species of shark found in Indonesia is categorised as critically endangered, five as endangered, 23 as vulnerable, and 35 as near threatened. Sharks are typically at the top of the marine food chain, and play a key role in maintaining and regulating the balance of the ecosystem. Therefore, any threats in nature that could change the natural order in the structure of communities would disrupt the balance of an ecosystem.

In recent decades, sharks have become a valuable fisheries commodity, as international demand for shark fins has grown. In general, sharks are caught in Indonesian waters as bycatch using a variety of fishing gear, including longlines, drift nets and gill nets. Exploitation of this commodity in Indonesia has been on the increase since the 1980s. Shark catch data show a significant upward trend between 1975 and 2011. Shark catch volumes reached a peak in 2000, before showing a fluctuating, yet downward trend. One indicator of the decrease in shark populations is catch per unit effort (CPUE), which reflects the real level of exploitation of fishery resources. In Indonesia, the shark fisheries region with the most potential is the Indian Ocean. In general, sharks are caught all year round, although there are peak months for catches of this commodity in Indonesian waters

The types of gear used and fishing grounds largely determine the composition of species and volumes of shark caught. Also, the composition of catches changes depending on the season. The use of non-selective fishing gear in coastal and shallow waters where juvenile sharks are found will gradually affect the adult population and hinder the process of recruitment in the wild. A decrease in shark production volumes in Indonesia became apparent for several

shark species that are commonly taken, such as Alopiidae and Carcharhinidae, between 2005 and 2007. In the same period, there was shift in fishing grounds, away from south Java and west Sumatera to the Natuna Sea and east Indonesia. Shark fishers have also witnessed indications of a decrease in shark stocks in the wild in several regions, in the increasing number of days and distances they have to go to catch sharks.

Sharks are a main source of livelihood for people across Indonesia. Because the shark marketing chain tends to be long and complex, it is difficult to develop a tracking system to trace the origins of sharks that are caught. An appropriate way of simplifying the marketing chain therefore needs to be developed. When implementing shark fisheries management in Indonesia, stakeholders need to pay particular attention to the importance of sharks to many fishers. To save shark populations in the wild, the government needs to adopt conservation management strategies and limit the capture of sharks, for example by limiting the species and size of individuals caught, regulating and limiting fishing gear, limiting catch volumes and fishing methods, and prohibiting fishing in certain areas and at certain times. As well as establishing regulations and laws on sustainable fisheries management, other measures, such as habitat protection, developing data and information, institutional strengthening, and public awareness raising are the key to achieving sustainable shark fisheries.

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I. INTRODUCTION

1.1 Background

Sharks and rays (*Elasmobranchii*) are one of the world's most important fishery commodities. Food and Agriculture Organization (FAO) data indicate that the world's total production of elasmobranchs in 1994 was 731,000 tons. The countries of Asia contributed 60% of this total catch. Four countries in Asia: Indonesia, India, Japan and Pakistan, contribute around 75% of the total catch of sharks and rays in Asia (Bonfil, 2002).

These fishery commodities, and the shark fin trade in particular, are important to Indonesia as the largest country in Southeast Asia. There has been a significant upward trend in capture fisheries production of shark and ray in Indonesia in the last two decades, and Indonesia is the world's largest producer of shark and ray, with an estimated catch of more than 100,000 tons each year.

The high market price of shark fin has encouraged shark fishing and threatens the sustainability of the stock in the wild (Daley *et al*., 2002). In terms of their biology, sharks in general have slow growth, live long, mature late, and have low fecundity (Coleman, 1996; Camhi *et al*., 1998; Stevens *et al*., 2000; Bonfil, 2002; Cavanagh *et al*., 2003). This means that sharks are endangered due to overfishing (Hoenig & Gruber, 1990). If over-exploited, sharks are at higher risk of extinction than other fish groups. Thus, shark populations can only be protected by controlling shark fisheries to avoid depleting their stocks (Camhi *et al*., 1998; Musick, 2003; Cortes, 2000). Several areas across Asia have been shown to be over-exploited. The South China Sea and several areas in Indonesia have an index of relative production (IRP) for elsamobranchs of more than 10, which means that they are fully exploited, or over-exploited (Bonfil, 2002).

Shark fisheries in Indonesia have been operating since the 1970s, when shark was a bycatch of tuna fisheries. Shark fishing began to take off and become more popular when the price of shark fin on the world market increased in 1988; shark became a target for capture fisheries – particularly artisanal fisheries – at fish landing centres across Indonesia (Anung & Widodo, 2002). In general, artisanal fisheries in Indonesia are located in remote coastal villages. In artisanal fisheries, nearly all parts of the sharks caught are used by local fishers, except for the fins, which are the main product. These are processed locally and sold dried in cities across Indonesia, and then exported to countries such as Hongkong, Singapore and Japan (Suzuki, 2002). The flesh is smoked or dried for sale on the local market, as are the skin, liver and jawbone, for various uses.

Sharks have become the main source of income in certain communities, especially among those whose livelihood depends on these fishery products, including fishers, collectors, sellers and processors of the produce of shark fisheries in places where sharks are the target catch. One example is local traders in Indramayu, West Java, who used to trade only in salted shark meat, but since 1986 have been collecting and selling shark fins (Suzuki, 2002). In the past few decades, there has been an expansion in shark fishing, from small-scale longline fishing to commercial fishing that target several high-value species such as dogfish shark (Squalidae), wedgefishes (Rhynchobatidae) and large species of shark (Carcharhinidae, Lamnidae, Alopiidae and Sphyrnidae), either as the target catch or as bycatch. Several shark fin exporters have even been willing to offer loans and capital to local fishers to increase their shark catches. This means that in socio-economic terms, shark fishery commodities are among the most important for some communities. While shark fisheries have had a positive impact on their welfare, unfortunately these communities no longer perceive

shark as incidental catch, but as desirable bycatch. Although most fisheries do not specifically target shark, this commodity is an important part of their catch. This has led to a gradual increase in the level of exploitation of shark resources in Indonesian waters.

Shark fisheries in Indonesia are currently in the international spotlight because Indonesia has is the world's largest producer of shark. Current growth of shark fisheries in Indonesia is believed to exceed its production capacity, as local fishers find it increasingly difficult to catch shark. They are having to venture further afield to do so, their catches are dwindling, and the sharks they catch are getting smaller and smaller. These are indications of declining shark stocks and a growing threat to the sustainability of shark resources in Indonesia. This problem is exacerbated by the absence of an effective national shark fisheries management strategy. The lack of public awareness of the connection between the biological characteristics of sharks and their vulnerability to the threat of extinction means that there is little concern for the conservation status of shark resources in this country. As an example, whale shark, which is one of the world's largest fish, has had protected status since 2003, when it was first included in CITES Appendix II and categorised as vulnerable on the IUCN red list (Cavanagh *et al*., 2003). Meanwhile, as of the end of 2011, the majority of Indonesian people still had very little concern for this species of fish. Whale sharks were still being caught in fishers' nets and not reported; beached whale sharks were not getting a positive response from the authorities, but being used by local people; and shops were still selling dried whale shark fins, to be used in medicines and shark fin soup. The situation is very different in neighbouring Malaysia, which now protects six species of shark, including whale shark, under fisheries regulations that protect endangered species. These regulations prohibit

the capture, disturbance, killing and trade in protected species without written permission from the Malaysian Directorate General of Fisheries (Ali *et al*., 2004). The same is true in other countries like Australia, which provides full protection to whale sharks and requires fishers to immediately release any whale sharks that they capture unintentionally if they wish to avoid punishment (Daley, *et al*., 2002).

Concern for the conservation status of endangered sharks in Indonesia has started to grow following enormous international pressure and demand that Indonesia participate in programs to protect endangered species. Many international environmental and conservation organisations are monitoring shark fisheries in this country, and Indonesia has even come under pressure to manage its shark fisheries properly or face a ban on export of its fisheries products. However, there are insufficient catch data and information about the potential biodiversity, biology and level of shark exploitation in Indonesia to form a rational basis for a sustainable shark fisheries management strategy. Seki *et al*. (1998) and Stevens *et al*. (2000) state that basic biological information about elasmobranchs (sharks and rays), such as species identification, size composition, size at maturity, and reproduction, is essential to the management of shark resources and the management of shark fisheries.

1.2 Purpose and scope of this book

As a step towards adopting sustainable shark fisheries management in Indonesia, the Indonesian government, under the coordination of the Ministry of Marine Affairs and Fisheries, and in coordination with other government agencies, research institutes, NGOs, and universities, has produced a set of basic guidelines, which make up this book, ‘A Review of the Status of Shark Fisheries

and Shark Conservation in Indonesia'. This book contains basic information about the status of shark fisheries in Indonesia, from available catch data to research findings, species diversity, and socio-economic aspects related to shark resources in this country. The data presented in this book are sourced from a range of literature, catch data, and findings of research conducted in Indonesia in the past 20 years. These data were collected by national and local government, research institutes in Indonesia and overseas, universities and NGOs.

II. SHARK MANAGEMENT AND CONSERVATION

Like fish species in general, sharks are a renewable resource that can be exploited sustainably. However, sharks are also vulnerable to the threat of extinction. Sharks are highly vulnerable to over-exploitation because they have slow growth, late maturity (decades for some species of shark), and low fecundity. Yet exploitation of sharks in Indonesian waters continues without any sustainable fisheries regulation or management.

The lack of understanding and awareness about shark conservation among fishing communities in particular, and the Indonesian public in general, is evident from the continued widespread illegal, unregulated and unreported fishing. Finning – taking shark to remove their fins before dumping their carcasses back into the sea – is still practiced in Indonesia. In addition, many juveniles and pups continue to be taken by various kinds of fishing gear used in Indonesia. In fact, "baby shark" is a popular choice at some seafood restaurants in Indonesia. Sooner or later, this will lead to a depletion of the shark population in the wild, and Indonesian fishers are already beginning to see this, as the volume and the size of the shark they catch are getting smaller. Despite years of

international concern about the depletion of shark populations, as indicated by growing evidence that several shark species are endangered, the shark population continues to decline due to an absence of effective fisheries management.

Fisheries management is an integrated process that involves collecting and analysing information, planning, consultation, decision-making, allocating resources, design and implementation, and law enforcement. Fisheries management thus aims to ensure optimal exploitation of fisheries resources while taking into account and maintaining the conservation of these resources and environments. In principle, fisheries management aims to regulate the intensity of fishing in order to obtain the optimal catch (Widodo, 2000). Also, according to Purwanto (2003), fisheries management aims to set catch levels that are sustainable in the long term in two ways: control of fishing and control of fishing effort.

1.1 Endangered and Vulnerable Sharks

Sharks play an important role in coral reef ecosystems and other habitats because they are top of the marine food chain, and are vital to maintaining the balance of marine ecosystems. For this reason, steps need to be taken to ensure their continued survival in the wild. The survival of shark in the wild has been under threat since growth in coastal fisheries since the 1950s started to put pressure on coastal environments. Commercial fisheries that target shark as desirable bycatch have been growing since the mid 1980s, in response to high demand for shark fin, meat and cartilage. Today, almost all species of shark that have economic value face the threat of extinction.

The International Union for Conservation of Nature (IUCN) has devised several criteria for the conservation status of biota based on their level of

vulnerability to extinction, in the form of a red list that is published online (www.iucn.org). The conservation status of biota is determined based on population status and the threat of human activity on the species. Around 181 of the world's shark species are on the IUCN Red List, including several species that have suffered such drastic population decreases that their survival is threatened. Six species of elasmobranch (one shark species and five species of ray) are categorised as critically endangered; 12 species (five shark and seven ray species) are listed as endangered; 50 species (23 shark and 27 ray) are listed as vulnerable; and 46 species (35 shark and 11 ray) are categorised as near threatened. These risk categories can be defined, in brief, as follows (Fahmi & Dharmadi, 2005):

Extinct (EX)

A species is extinct when there is no reasonable doubt that the last individual has died. A species is presumed extinct when exhaustive and extensive surveys in known or expected habitat have failed to record an individual.

Extinct in the wild (EW)

A species is extinct in the wild when surveys have failed to record an individual in the wild, but the species is known to exist in captivity or in protected locations, such as nature reserves, wildlife reserves, fisheries reserves, or other protected locations.

Critically endangered (CR)

A species is critically endangered when it is confirmed to be close to extinction in the wild.

Endangered (EN)

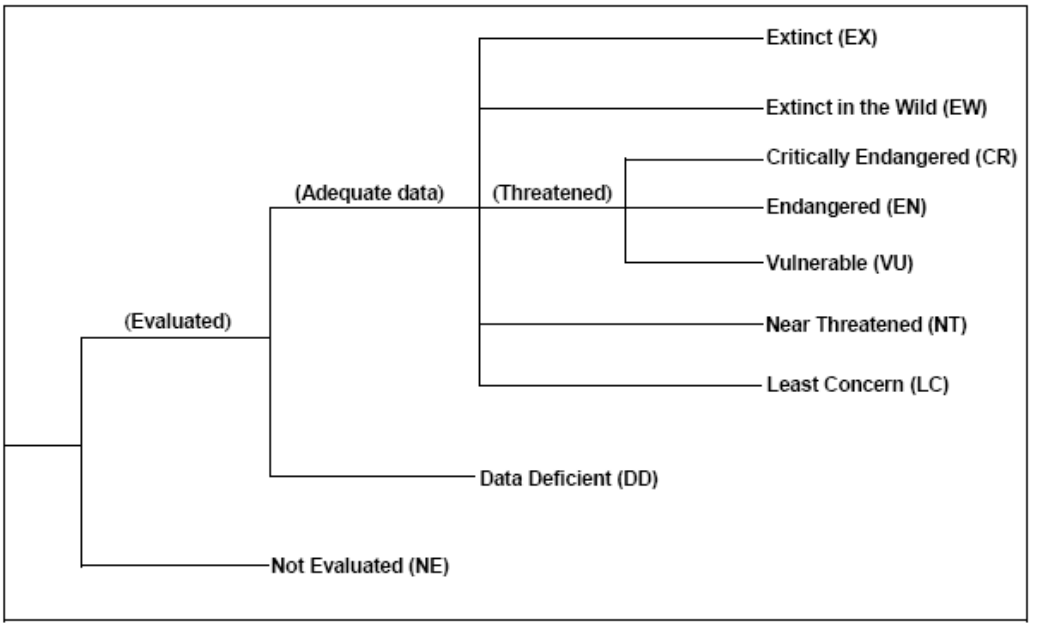
A species is endangered when it is confirmed to be at very high risk of extinction in the wild.

Vulnerable (VU)

A species is vulnerable when it considered to be at high risk of extinction in the wild.

Near threatened, (NT)

A species is near threatened when its survival is considered to be at risk in the future if nothing is done to manage this species.



Most shark species that are at risk of extinction are species that are endemic, have a limited range, have a specific habitat, and are over-exploited.

Following are the species of shark in Indonesia that are listed as endangered and vulnerable (IUCN Version 3.2):

Table 2.1 Sharks species categorised at risk of extinction on the IUCN Red List

No	Common Name	Scientific Name	Family	Status
1	Pondicherry Shark	*Carcharhinus hemiodon*	Carcharhinidae	Critically Endangered
2	Borneo Shark	*Carcharhinus borneensis*	Carcharhinidae	Endangered
3	Speartooth Shark	*Glyphis glyphis*	Carcharhinidae	Endangered
4	Borneo Broadfin Shark	*Lamiopsis tephrodes*	Carcharhinidae	Endangered
5	Scalloped Hammerhead	*Sphyrna lewini*	Sphyrnidae	Endangered
6	Great Hammerhead	*Sphyrna mokarran*	Sphyrnidae	Endangered
7	Pelagic Thresher Shark	*Alopias pelagicus*	Alopiidae	Vulnerable
8	Bigeye Thresher Shark	*Alopias superciliosus*	Alopiidae	Vulnerable
9	Oceanic Whitetip Shark	*Carcharhinus longimanus*	Carcharhinidae	Vulnerable
10	Dusky Shark	*Carcharhinus obscurus*	Carcharhinidae	Vulnerable
11	Sandbar Shark	*Carcharhinus plumbeus*	Carcharhinidae	Vulnerable
12	Sharptooth Lemon Shark	*Negaprion acutidens*	Carcharhinidae	Vulnerable

13	Lowfin Gulper Shark	*Centrophorus lusitanicus*	Centrophoridae	Vulnerable
14	Leafscale Gulper Shark	*Centrophorus squamosus*	Centrophoridae	Vulnerable
15	Tawny Nurse Shark	*Nebrius ferrugineus*	Ginglymostomatidae	Vulnerable
16	Hooktooth Shark	*Chaenogaleus macrostoma*	Hemigaleidae	Vulnerable
17	Sicklefin Weasel Shark	*Hemigaleus microstoma*	Hemigaleidae	Vulnerable
18	Snaggletooth Shark	*Hemipristis elongata*	Hemigaleidae	Vulnerable
19	Papuan Epaulette Shark	*Hemiscyllium hallstromii*	Hemiscyllidae	Vulnerable
20	Hooded Carpetshark	*Hemiscyllium strahani*	Hemiscyllidae	Vulnerable
21	Shortfin Mako	*Isurus oxyrhynchus*	Lamnidae	Vulnerable
22	Longfin Mako	*Isurus paucus*	Lamnidae	Vulnerable
23	Grey Nurse Shark	*Carcharhias taurus*	Odontaspididae	Vulnerable
24	Sandtiger Shark	*Odontaspis ferox*	Odontaspididae	Vulnerable
25	Whale Shark	*Rhincodon typus*	Rhincodontidae	Vulnerable
26	Bali Catshark	*Atelomycterus baliensis*	Scyliorhinidae	Vulnerable
27	Smooth Hammerhead	*Sphyrna zygaena*	Sphyrnidae	Vulnerable
28	Indonesian Greeneye Spurdog	*Squalus montalbani*	Squalidae	Vulnerable
29	Zebra Shark	*Stegostoma fasciatum*	Stegostomatidae	Vulnerable

One shark species categorised as critically endangered is *Carcharhinus hemiodon*, which is a medium-sized shark that inhabits coastal and shallow waters in the West Indo Pacific region, but has not been observed since 1979. It very likely that the decline in the population of this shark species was due to coastal fisheries activity putting it at very high risk of extinction. In Indonesia, this shark species was observed in the Java Sea in the 1900s but since then there have been no recorded sightings in this area. Most of the shark species listed as endangered are species that have a limited range and habitat, such as *Carcharhinus borneensis, Glyphis glyphis* and *Lamiopsis tephrodes*. In Indonesia, these three shark species are found only the coastal waters of Kalimantan. Overexploitation is the likely cause of the decline in the populations of these three species, which are considered at risk of extinction if no action is taken. The smooth hammerhead shark (*Sphyrna lewini*) is a species that inhabits coastal to semi-oceanic waters, and is widely distributed in the world's warm waters. However, overexploitation of juveniles and adults of this species has led to a drastic decline in its populations in the wild. Decreases of as much as 50% to 90% in the past 30 years have even been recorded in some locations (Baum *et al*., 2007).

Several shark species are also listed in the appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which regulates trade in endangered species. In the past few years, shark species have been high on the agenda for discussion at the CITES Conference of the Parties (CoP), at which several countries have proposed including several shark species in the appendices in order to tighten up regulation of their international trade. At the CITES CoP held on 3-14 March 2013 in Bangkok, five shark species were included in CITES Appendix II, four of which are found, and taken

by fishers, in Indonesia (*Sphyrna lewini, S. zygaena, S. mokarran,* and *Carcharhinus longimanus*).

2.2 Examples of protected and vulnerable shark species

International concern about the risk of extinction of the world's shark resources is growing day by day. This risk of extinction is the consequence of international trade in shark fin and environmentally unfriendly fishing practices. The international conservation agency IUCN has published a list of shark species that are at risk of extinction. Several of these species are found in Indonesian waters. The IUCN Red List is a warning to governments that own these resources to take more effective conservation measures. The following section provides information and a brief description of each of the shark species found in Indonesia that are on the IUCN Red List.

2.2.1 *Rhincodon typus* (Smith, 1828)

Figure 2-1. Whale shark, *Rhincodon typus* (Photo: White *et al*., 2006b)

Rhincodon typus (whale shark), known in Indonesian as *hiu paus, hiu geger lintang, hiu bodoh,* or *hiu tutul*, is a cosmopolitan tropical and warm temperate species and is the world's largest living chondrichthyan, with an estimated length of up to 18 m. Because of its large size, it moves relatively slowly in the water. These sharks are usually solitary, but have been sighted in small groups. Because of its large size, this species is instantly recognisable.

Whale shark also have thick, dark grey skin with yellow or yellowish white stripes and spots. Along the dorsal sides are prominent ridges, and it has a broad, flattened head with a large, terminal mouth.

Range and estimated population

Whale sharks are found in all tropical and warm temperate seas except the Mediterranean. In Indonesia, there have been recorded sightings of whale sharks in almost all Indonesian waters, from the Indian Ocean, South China Sea, Java Sea and Pacific Ocean to Makassar Strait, Sulawesi Sea, Flores Sea, Sawu Sea, Banda Sea and Arafura Sea. Whale sharks are highly migratory, and are known to inhabit both deep and shallow coastal waters. They migrate in search of suitable spawning grounds and also in search of food. Exact data and information on the status of the whale shark population in Indonesia are not known, but it is thought to be decreasing.

Threats to populations

Whale sharks are not generally targeted by whale fishers in Indonesia. In fact, in some fishing communities, such as the Bajo, capture of this species is taboo (Stacey *et al*., 2012). Indonesian fishers typically capture whale sharks unintentionally, but it is a target species for fishers in Lamalera (Barnes, 2005; Mustika, 2006). Whale sharks also frequently get caught in shallow waters when searching for food, which can lead to mortality as a result of beaching or, on occasion, being trapped in fishing nets set by fishers in shallow waters. The large number of deaths and beachings of whale sharks in Indonesia contribute to some extent to the decrease in the population in the wild, especially since this shark

species take a very long time to reach maturity and reproduce. Hunting of whale shark for its fins and flesh had depleted its population in the wild.

Uses

The main use of whale sharks is as a tourist attraction, because they are generally affable to fishers, divers and tourists. In several locations in Indonesia, such as Cenderawasih Bay and Probolinggo, whale sharks are used to attract domestic and international tourists. Also, whale shark fins are traded on the international market, while their flesh is consumed locally.

Conservation status

The IUCN conducted the first evaluation of the conservation status of whale shark in 1990, when its status was 'indeterminate'. In 1994, its status had changed to 'data deficient', and in 2000, it was designated a vulnerable species.

At the CITES CoP-12, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) listed whale sharks in Appendix II, which means that globally, whale sharks are not at risk of extinction, but may become extinct if unregulated trade in this species continues.

In 2013, Indonesia declared whale shark a protected fish species by way of Decree of the Minister of Marine Affairs and Fisheries No. 18/MEN-KP/2013. Measures to manage whale shark resources in Indonesia should continue, and include developing models of non-extractive use, such as ecotourism, in order that this resource can continue to be of economic benefit to the general public.

2.2.2 *Alopias pelagicus* (Nakamura, 1935)

Figure 2-2 *Alopias pelagicus* (Photo: White *et al*., 2006b)

Alopias pelagicus (Pelagic Thresher Shark), known in Indonesian as *hiu monyet* or *hiu tikus*, is oceanic from the surface to 152 m deep (White *et al.*, 2006b). Its long caudal fin is a distinguishing feature of this shark species of the Alopiidae family. The eye shape, position of dorsal fin, and colour of *A. pelagius* are characteristics that differentiate the pelagic thresher shark from other species of *Alopias*.

Range and estimated population

Thresher sharks are found all over the Indo Pacific region, from the Indian Ocean to Australia, and from the western part of the north Pacific to the western part of the south Pacific, central Pacific, and eastern Pacific (Compagno, 2001). In Indonesia, observations of this species have been recorded in the Indian Ocean, from west Sumatera to south Nusa Tenggara, the South China Sea, Pacific Ocean, Makassar Strait, Sulawesi Sea, Banda Sea and Arafura Sea. *A. pelagicus* is frequently caught as bycatch in tuna nets and by purse seiners operating offshore in the Indian Ocean. The estimated population in the wild is not determined because thresher sharks are highly migratory. Accurate data on size and reproduction are not available, although catch figures for this species are available at local and national level.

Threats to populations

Alopias pelagicus is generally bycatch in tuna and commercial pelagic fisheries. Nationally, in a period of ten years (2002-2011), there has been a drastic reduction in catch figures for this species. The factors contributing to this population decrease include a reduction in the number of fishing vessels and a likely reduction in population numbers.

The estimated size of *A. pelagicus* landed at fish landing centres varies depending on the type of fishing gear used. Based on the results of surveys conducted at fish landing centres in Bali, Lombok and Cilacap between 2001 and 2007, the estimated total length of *A. pelagicus* caught by fishers was between 130 cm and 320 cm, but in general ranged from 230 cm to 250 cm. Results of the most recent survey in Lombok (2012), recorded estimated total lengths of between 130 cm and 280, with an average length of around 230 cm.

Alopias pelagicus is known to attain a length of 365 cm. Males mature at around 240 cm and females at around 260 cm (White *et al*., 2006b), which means that in general the thresher sharks caught by fishers in the Indian Ocean are juveniles and adults.

Uses

Like other shark species, almost all parts of *Alopias pelagicus* are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and

cosmetics, is generally dried and then exported to several countries. The skin is also used in the craft industry and made into snack foods.

Trade volume

In Indonesian fisheries statistics, *Alopias pelagicus* is generally grouped with other species of the *Alopias* family because of their morphological similarities, under the name *hiu tikus*. Its long caudal fin is the distinguishing feature that differentiates this shark species from others. However, in the shark fin trade, it is difficult to differentiate its fins from those of other species. This affects the recording of the volume of trade in shark fins in Indonesia: although national figures for the trade in shark, including shark fin and flesh, are available, they are overall figures for all shark species. National and local and export trade figures per species are still not available.

Conservation status

The downward trend in the production volume of *A. pelagicus* in the past decade, and in the capture of juveniles, suggest that the survival of the populations of this shark species in the wild is at risk. In 2012, Indonesia adopted ITOC resolution 10/12 to prohibit the capture of shark of the *Alopiidae* family. Implementation of these measures has begun with the mounting of billboards calling for an end to the capture of these sharks.

At the national level, article 43 of the Regulation of the Minister of Marine Affairs and Fisheries No. PER.12/MEN/2012 on Offshore Capture Fisheries requires the captains of all vessels to release any thresher sharks that they catch and prohibits all trade in this species.

2.2.3 *Alopias superciliosus* (Lowe, 1841)

Figure 2-3. *Alopias superciliosus* (Photo: White *et al*., 2006b)

Alopias superciliosus or Bigeye Thresher Shark, known in Indonesian as *hiu lutung* or *hiu pahitan*, is an oceanic shark species found from close inshore to the open water, from the surface to a depth of 600 m (White *et al*., 2006b). Its large caudal fin is a distinguishing feature of shark species of the Alopiidae family. Its large eyes and grooves on each side of its nape are characteristics that differentiate this species from other species of *Alopias.*

Range and estimated population

This species is found almost everywhere in tropical and warm, sub-tropical seas, from the west Atlantic Ocean and Indian Ocean to the eastern Pacific (Compagno, 2001). In Indonesia, observations of this species have been recorded in the Indian Ocean, Pacific Ocean, Makassar Strait, Sulawesi Sea and Banda Sea. Unlike *A. pelagicus*, *A. superciliosus* are captured in relatively few numbers, as bycatch in the tuna fisheries and purse seiners operating offshore in the Indian Ocean. Due to its highly migratory nature and the lack of accurate size and reproduction data, no estimate of the population in the wild is available. Local production volume data for this species are available, such as in Cilacap and Palabuhanratu, but the figures appear to fluctuate and cannot indicate any upward or downward trend in production volume.

Threats to the population

Alopias superciliosus is a bycatch of the commercial tuna and pelagic fisheries, but relatively few are actually caught. The average catch for *A. superciliosus* in Cilacap is between 0.1 and 1.0 tons per month. Catch data for this species have fluctuated over the past decade, making it difficult to assess the level of risk to the population of this species in Indonesia.

The size of *A. pelagicus* landed at fish landing centres varies depending on the type of fishing gear used. Based on the results of surveys conducted at fish landing centres in Bali, Lombok and Cilicap between 2001 and 2007, the estimated total length of *A. superciliosus* caught by fishers was between 150 cm and 380 cm, but in general ranged from 280 cm to 330 cm. Results of the most recent survey in Lombok (2012), recorded estimated total lengths of between 130 cm and 280, with an average length of around 230 cm.

A. superciliosus is known to attain a length of 461 cm. Males mature at around 276 cm and females at around 341 cm (White *et al*., 2006b), which means that in general the thresher sharks caught by fishers in the Indian Ocean are juveniles and adults.

Uses

Like other shark species, almost all parts of *Alopias superciliosus* are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in

medicines and cosmetics, is generally dried and then exported to several countries. The skin is also used in the craft industry or made into snack foods.

Trade volume

In Indonesian fisheries statistics, *Alopias superciliosus* is generally grouped with other species of the *Alopias* family because of their morphological similarities, under the name *hiu tikus*. Its long caudal fin is the distinguishing feature that differentiates this shark species from others. However, in the shark fin trade, it is difficult to differentiate its fins from those of other species. This affects the recording of the volume of trade in shark fins in Indonesia: although national figures for the trade in shark, including shark fin and flesh, are available, they are overall figures for all shark species. National and local and export trade figures per species are still not available.

Conservation status

While globally, this species is categorised as vulnerable due to the decrease in populations in several locations worldwide, including in the Atlantic, the IUCN lists it as endangered (Amorim *et al*., 2009).

At the national level, article 43 of the Regulation of the Minister of Marine Affairs and Fisheries No. PER.12/MEN/2012 on Offshore Capture Fisheries requires the captains of all vessels to release any bigeye thresher sharks that they catch and prohibits all trade in this species.

2.2.4 *Isurus oxyrinchus* (Rafinesque, 1810)

Figure 2-4. *Isurus oxyrinchus* (Photo: Fahmi)

Isurus oxyrinchus or shortfin mako, known in Indonesian as *hiu mako*, is an epipelagic and oceanic species, found from the surface to a depth of 650 m (Last *et al.*, 2010). Its sharply pointed snout, small eyes and keel on its caudal fin are distinguishing features of sharks of the Isurus family.

Range and estimated population

Mako sharks are found almost everywhere in tropical and warm, sub-tropical seas (Compagno, 2001). In Indonesia, observations of this species have been recorded in the Indian Ocean, from west Sumatera to south Nusa Tenggara, South China Sea, Makassar Strait, Banda Sea and the west Pacific. *Isurus oxyrinchus* is frequently caught as bycatch in tuna longline fisheries and as bycatch or target catch by shark longline fisheries operating offshore in the Indian Ocean. Due to its highly migratory nature and the lack of accurate size and reproduction data, no estimate of the population in the wild is available. Local and national Production volume data for this species are available in Indonesian fisheries statistics, as discussed in Chapter 5.

Threats to the population

Isurus oxyrinchus is generally captured as bycatch in commercial tuna and pelagic fisheries. In general, the catch data for this species fluctuate, although an upward trend has been observed over a period of eight years (2004-2011). The average monthly catch for *I. oxyrinchus* in Java sea is relatively low, ranging from 0.2 tons to 0.8 tons in Cilacap and from 0.05 tons to 0.4 tons in Palabuhanratu. The figures from these two locations do not indicate a significant decrease in catch.

Based on the results of surveys conducted at fish landing centres in Bali, Lombok and Cilicap between 2001 and 2007, the estimated total length of *I. oxyrinchus* caught by fishers was between 130 cm and 250 cm, but in general ranged from 180 cm to 210 cm. Results of the most recent survey in Lombok (2012), recorded estimated total lengths of between 130 cm and 280 cm. *I. oxyrinchus* is known to attain a length of 400 cm. Males mature at around 185-195 cm and females at 250-280 cm (Last *et al*., 2010), which means that in general the mako sharks caught by fishers in the Indian Ocean are juveniles and adults.

The fluctuation in the catch data for *I. oxyrinchus* in the past eight years and the fact that most of the individuals captured are adults, suggests that the population of mako sharks in the wild is relatively stable. However, the practice of finning – capturing shark just to remove their fins before dumping their carcasses back into the sea – needs to be monitored because production volume data for this practice have never been recorded. Monitoring and awareness raising for fisher communities and commercial fisheries is needed to put a stop to this illegal practice.

Uses

Like other shark species, almost all parts of *I. oxyrinchus* are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and cosmetics, is generally dried and then exported to several countries. The skin is also used in the craft industry or made into snack foods.

Trade volume

In Indonesian fisheries statistics, *I. oxyrinchus* is generally grouped with the other species of the *Isurus* family (*I. paucus*) because of their morphological similarities, under the name *hiu mako*. Its sharply pointed snout and keel on its caudal fin are distinguishing features that differentiate mako sharks from other shark species. However, in the shark fin trade, it is difficult to differentiate its fins from those of other species. Also, in the commercial pelagic fisheries, sharks are not landed whole, but with their heads and fins removed, making it difficult to differentiate the flesh of maro sharks from that of sailfish and marlin when frozen. This affects the recording of the volume of trade in shark fins in Indonesia: although national figures for the trade in shark, including shark fin and flesh, are available, they are overall figures for all shark species. Specific national and local and export trade figures for *I. oxyrinchus* are still not available.

2.2.5 *Sphyrna lewini* (Griffith & Smith, 1834)

Figure 2-5 *Sphyrna lewini* (Photo: White *et al.*, 2006b)

Sphyrna lewini (Scalloped hammerhead shark) has several local names, including *hiu martil, hiu caping, hiu topeng, hiu bingkoh* and *mungsing capil*. Scalloped hammerheads are a coastal pelagic and semi oceanic species, commonly found in continental shelves, insular shelves, and nearby deep water, from the surface and intertidal zone to 275 m depth (Compagno in prep. in Baum *et al.*, 2007). Nursery grounds are found in shallow inshore waters, while the adults are found offshore (Compagno, 1984, Lessa *et al.*, 1998). The pups of this species tend to stay in coastal zones, near the bottom, occurring at high concentrations during summer in estuaries and bays (Bass *et al.*, 1975, Castro, 1983). Neonates and juveniles are known to shoal in confined coastal pupping areas for up to two years before moving out to adult habitat (Holland *et al.*, 1993). Neonates and juveniles seek protection, particularly in diurnal core areas (Holland *et al.*, 1993) and often form large groups (Stevens and Lyle, 1989).

Range and estimated population

S. lewini is one of the most common fish species found in Indonesia. It is found almost everywhere in tropical waters. In Indonesia, its range covers the Indian Ocean, Sunda Strait, Java Sea, South China Sea, and the waters around

Sumatera, Kalimantan, Sulawesi, Maluku and Papua. Its population is likely decreasing due to unsustainable fishing activity. Scalloped hammerheads often get caught by longlines or drift nets, either as bycatch or target catch, and many juveniles are caught by fishers using Danish purse seine and drift nets close to shore.

Threats to the population

The estimated total length of scalloped hammerheads landed at fish landing centres is between 50 cm and 310 cm. Males mature and are ready to reproduce at around 165-175 cm, and females at 220-230 cm. Survey results indicate that more than half of the scalloped hammerheads landed in the period 2001-2006 were juveniles. This is threat to the population of this species because the more juveniles are captured, the less likely these sharks are to reproduce.

Juveniles are typically caught in waters close to shore, while larger individuals are caught by tuna nets, longlines and shark nets operating offshore in deeper waters. Although *S. lewini* is relatively fecund compared to other sharks (with litters of 12-38 pups), its high catch frequency has caused the population in the wild to dwindle, as indicated by the diminishing number of juvenile and adult scalloped hammerheads landed at fish landing centres in Indonesia.

Over-exploitation of this shark species occurs not only in Indonesia, but the world over, wherever scalloped hammerheads are found. At the CITES CoP-16 in March 2013, *Sphyrna* spp. was included in CITES Appendix II, which means trade in these sharks is regulated and special regulations apply.

Uses

Almost all parts of this shark are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and cosmetics, is generally dried and then exported to several countries.

Trade volume

The most important commodity from scalloped hammerheads is their fins. Although at first glance the dried fins of *S. lewini* resemble those of other species of shark fin, the fins of sharks from the Marga family can be differentiated from those of other shark families, even in dried form. However, only the properly trained eye can identify this shark species by fin alone. Although national figures for the trade in shark, including shark fin and flesh, are available, they are overall figures for all shark species. In Indonesia, specific production volume data for scalloped hammerheads are still not available.

2.2.6 *Sphyrna mokarran* (Ruppel, 1837)

Figure 2-6. *Sphyrna mokarran* (Photo: White *et al.*, 2006b)

Sphyrna mokarran (Great hammerhead shark) has several local names, including *hiu martil*, *hiu caping*, *hiu topeng*, *hiu bingkoh* and *mungsing capil*. Great hammerheads are a large coastal pelagic and semi oceanic species, commonly found close inshore and offshore, in continental shelves, insular shelves, coral atolls, nearby deep water, from the surface to 80 m depth (Denham *et al*., 2007). A solitary animal, this shark is seldom seen in groups. (Denham *et al*., 2007).

Range and estimated population

During a 2001-2006 survey, very few individuals were recorded. Landings of this great hammerheads were reported at Tanjungluar in Lombok, Benoa and Kedonganan in Bali, and Palabuhanratu, Muara Angke and Muara Baru in Jakarta. *S. mokarran* is commonly a bycatch of offshore tuna longline and drift net fisheries in the south (Indian Ocean) and in the east of Indonesia.

Threats to the population

The estimated total length of great hammerheads landed at fish landing centres is between 150 cm and 250 cm. *S. mokarran* can attain a length of 610 cm. Males mature and are ready to produce at around 234-269 cm and females at around 250-300 cm. This means that, although seldom captured or observed in Indonesian waters, those that are landed are juveniles, which could threaten the population in the wild if the unregulated capture of great hammerheads is allowed to continue. This could be exacerbated by the possibility that fishers capturing large specimens simply remove their fins and dump their carcasses back into the sea.

Uses

Almost all parts of this shark are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and cosmetics, is generally dried and then exported to several countries.

Trade volume

The most important commodity from shark of the Marga family is their fins. Although at first glance the dried fins of *S. mokarran* resemble those of other species of shark fin, the fins of sharks from the Marga family can be differentiated from those of other shark families, even in dried form. This family have elongated triangular fins with sharp tips. However, only the properly trained eye can identify this shark species by fin alone. In Indonesia, specific production volume data for great hammerheads are still not available, because although national figures for the trade in shark, including shark fin and flesh, are available, they are overall figures for all shark species.

Conservation status

Over-exploitation of great hammerheads almost everywhere it is found threatens the survival of this species. At the CITES CoP-16 in March 2013, *Sphyrna* spp. was included in CITES Appendix II, which means trade in these sharks is regulated and special regulations apply.

2.2.7 *Sphyrna zygaena* (Linnaeus, 1758)

Figure 2-7. *Sphyrna zygaena* (Photo: White *et al*., 2006b)

Sphyrna zygaena (Smooth hammerhead shark) has several local names, including *hiu martil, hiu caping, hiu topeng, hiu bingkoh* and *mungsing capil*. Smooth hammerheads are a coastal pelagic and semi oceanic species, commonly found in continental shelves to 200 m depth (Ebert, 2003). This species is also found in fresh water, in the Indian River, Florida, USA, and the Rio de la Plata estuary in Uruguay (Casper *et al*., 2005). Nursery grounds are found in shallow waters with fine sand substrate to 10 m depth. Juvenile smooth hammerheads commonly gather in large groups, sometimes consisting of hundreds of individuals (Compagno, 1998). This species has sometimes been confused with *S. lewini* in the tropics and these two species are probably misidentified with each other in some areas.

Range and estimated population

Smooth hammerheads are seldom found in Indonesian waters. During a 2001-2006 survey, very few individuals were recorded at fish landing centres in south Indonesia, such as Cilacap, Palabuhanratu, and Tanjungluar in Lombok. This species is sometimes caught by shark or tuna longlines. In Indonesia, it is thought to be found in the Indian Ocean and nearby waters. Due to a lack of data, its population is very difficult to estimate.

Threats to the population

S. zygaena can attain a length of 350 cm. Males mature at 250 cm and females at around 265 cm. Surveys have recorded landings of specimens between 130 cm and 280 cm, which means that most smooth hammerheads captured are juveniles. Although caught only in small numbers, gradually the population will diminish as there is less opportunity to reproduce because they are caught before being able to reproduce. The practice of finning – removing the fins and dumping the carcasses into the sea – means that population data are not accurate, because the number of individuals captured by fishers cannot be verified.

Uses

Almost all parts of this shark are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and cosmetics, is generally dried and then exported to several countries.

Trade volume

The most important commodity from shark of the Marga family is their fins. Although at first glance the dried fins of *S. zygaena* resemble those of other species of shark fin, the fins of sharks from the Marga family can be differentiated from those of other shark families, even in dried form. This family have elongated triangular fins with sharp tips. However, only the properly

trained eye can identify this shark species by fin alone. Although national figures for the trade in shark, including shark fin and flesh, are available, they are overall figures for all shark species. In Indonesia, specific production volume data for smooth hammerheads are still not available

Conservation status

Over-exploitation of great hammerheads almost everywhere it is found threatens the survival of this species. At the CITES CoP-16 in March 2013, *Sphyrna* spp. was included in CITES Appendix II, which means trade in these sharks is regulated and special regulations apply.

2.2.8 *Carcharhinus longimanus* (Poey, 1961)

Figure 2-8. *Carcharhinus longimanus* (Photo: White *et al.*, 2006b)

Carcharhinus longimanus (Oceanic whitetip shark) is known locally as *hiu koboy*. It is the only true pelagic species of the genus *Carcharhinus*, and is found far off shore in open waters at up to more than 200 m depth, in continental shelves, and around islands in open waters. Oceanic whitetip sharks are pelagic and highly migratory throughout the tropics, and frequently caught as bycatch in

the tuna and swordfish fisheries. This shark prefers temperatures of above 20°C (range of 18-28°C) (Baum *et al*, 2006). The critical habitat of this species is not known, but in tropical regions of the Pacific Ocean, gestating females and juveniles have been found geographically concentrated between 20°N to the equator, and 170°E to 140°W, and its nursery grounds are found well off shore (Seki *et al*., 1998). Its distinctive rounded, white-tipped fins differentiate this shark species from others.

Oceanic whitetips are highly trophic predators in open waters, and its main prey is teleost and cephalopoda (Compagno, 1984). Based on its prey, Cortés (1999) reckoned this species to have a trophic rating of 4.2 (with 5.0 as maximum). This shark species is easily distinguished from others in the genus *Carcharhinus* by its enlarged, rounded, white-tipped first dorsal fin, broad, white-tipped pectoral fin (Abercrombie and Chapman, 2012).

Range and estimated population

This is a widespread shark, ranging across entire oceans in warm tropical and subtropical waters. In Indonesia, observations have been recorded in the Indian Ocean, west of Sumatera to south Nusa Tenggara. Its population is not known because fishers rarely land this species. A 2001-2006 survey conducted in the waters south of Java, Lombok and Bali found that few *C. longimanus* were landed either as bycatch of tuna fisheries or as target catch of shark longline fisheries in Lombok.

Threats to the population

The estimated total length of oceanic whitetips landed at fish landing centres is between 70 cm and 180 cm, but this species can attain a length of 300

cm. Males mature and are ready to produce at 234-269 cm and females at around 180-200 cm. In general, specimens landed are juveniles, which could threaten the population in the wild if their unregulated capture is allowed to continue, because there will be less opportunity for this species to reproduce. During a 2001-2006 survey very few adult specimens of *C. longimanus* were recorded. Surveys at Cilicap and Palabuhanratu fish landing centres found that this species accounted for a maximum of around 1% of all shark caught in these two locations. Also, production volumes at Cilicap and Palabuhanratu tend to fluctuate every year. There are two possible explanations for this: first, it may be that artisanal fishers in south Indonesia capture juveniles because they are limited by their fishing gear and vessels. The second possibility is that larger, adult oceanic whitetips that are captured are not landed, but finned and their carcasses thrown back into the sea. Adult specimens are commonly caught in east Indonesia, from Lombok in West Nusa Tenggara to the Leti Islands in Southeast Maluku. The size of sharks can be estimated from the size of its fins, and the shark fins found at fin collectors in east Indonesia indicate that most of the oceanic whitetips landed by fishers in this region are adults.

Uses

Almost all parts of this shark are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and cosmetics, is generally dried and then exported to several countries.

Trade volume

The fins of *C. longimanus* are very easily identified from their rounded apex, which are quite unlike the fins of any other shark species. This makes it easier to monitor the trade in these fins than in the fins of other species. However, in Indonesia, specific production volume data for oceanic whitetips are still not available, because although national figures for the trade in shark, including shark fin and flesh, are available, they are overall figures for all shark species.

Conservation status

Over-exploitation of this shark species almost everywhere it is found threatens the survival of this species. At the CITES CoP-16 in March 2013, the majority of member states agreed to include *Sphyrna* spp. in the CITES Appendix II, which means trade in these sharks is limited and CITES regulations apply

2.2.9 *Carcharhinus obscurus* (Lesueur, 1818)

Figure 2-9. *Carcharhinus obscurus* (Photo: White *et al.*, 2006b)

Carcharhinus obscurus (Dusky shark) is known locally as *hiu merak bulu* and *hiu lanjaman*. Dusky sharks are found in insular shelves and continental shelves, from the surf zone to oceanic waters, from the surface to 400 m depth

(White *et al.,* 2006b). This large, aggressive shark is potentially harmful to humans if approached.

Range and estimated population

The Dusky Shark has a cosmopolitan distribution in tropical and warm sub-tropical seas, from the Pacific and Atlantic to the Mediterranean Sea. In Indonesia, observations have been recorded in the Indian Ocean, from west Sumatera to Nusa Tenggara. This shark species is commonly captures by surface longlines, as bycatch in tuna fisheries and as target catch in shark longline fisheries in Nusa Tenggara.

Based on the decreasing number and size of individuals of this species caught, its population in Indonesia is thought to be declining. A 2001-2006 survey at Tanjungluar fish landing centre, Lombok, the length of *Carcharhinus obscurus* landed by fishers ranged between 205 cm and 289 cm. However, surveys at the same location throughout 2012, indicated a decrease in estimated length to 130-227 cm.

Threats to the population

Carcharhinus obscurus can attain 400 cm length. Males mature at around 280-300 cm and females at around 257-300 cm. Catch data for this species in Tanjungluar, Lombok, in 2012, indicate that the specimens caught are juveniles. This could threaten the population in the wild because there will be less opportunity for this species to reproduce. Although relatively few dusky sharks are caught, persistent overfishing and the small size of the individuals landed indicate that the population of this species in the wild is at risk, and sustainable management of this species is necessary.

Uses

Like other shark species of the family *Carcharhinus*, almost all parts of this shark are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and cosmetics, is generally dried and then exported to several countries.

Trade volume

In fisheries and trade statistics, *Carcharhinus obscurus* is generally grouped with other species of the *Carcharhinus* family because of their general morphological similarities, under the name *hiu lanjaman*. It is also known in the trade as *hiu super* or *hiu merak bulu* (Lombok). Catch data and trade data for this species is very difficult to ascertain because only the trained eye can differentiate this shark species from others. Also, that much of the catch is fins only makes the process of identification even more difficult. Although national figures for the trade in shark, including shark fin and flesh, are available, they are overall figures for all shark species. Specific trade figures for *C. obscurus* are still not available.

2.2.10 *Carcharhinus plumbeus* (Nardo, 1827)

Figure 2-10. *Carcharhinus plumbeus* (Photo: Fahmi)

Carcharhinus plumbeus (*Sandbar shark*) is known locally as *hiu super* (super shark) for its large dorsal fin. This large species is commonly occurs over insular and continental shelves, and adjacent deep water, from surf zone to a depth of 280 m (White *et al.*, 2006b). Its tall, broad fins put *Carcharhinus plumbeus* in the category of super shark, which has high economic value in the shark fin trade.

Range and estimated population

This large coastal species is widespread in tropical and warm subtropical waters around the world. In Indonesia, observations have been recorded in the Indian Ocean, from west Sumatera to south Nusa Tenggara. Large individuals are sometimes caught on longlines or in tuna drift nets. Juveniles and pups are sometimes caught in drift nets or on hook and line close to shore. The exact population is not known because there are no specific catch data available for this species

Threats to the population

The size of *Carcharhinus plumbeus* landed at fish landing centres varies depending on the type of fishing gear used. A 2001-2006 survey conducted at several fish landing centres in Bali, Lombok and Cilacap indicates that sandbar sharks caught by fishers range from 92 cm to 200 cm in length. This species can attain 280 cm length and matures at around 140-180 cm. Census data from Tanjungluar fish landing centre in Lombok in 2012 indicate that the length of *C. plumbeus* landed by fishers ranged between 240 cm and 270 cm. These figures suggest that in general, sandbar sharks caught by shark fishers in Tanjungluar are adult specimens. Having its nursery grounds in coastal waters is a particular threat to the development of juveniles in coastal waters that are the fishing grounds on the south coasts of Java, Bali and Nusa Tenggara. Further research is therefore needed to identify the nursery grounds of *C. plumbeus* in Indonesia, so that they can be managed sustainably to mitigate the threat to the development and growth of juvenile sandbar sharks.

Uses

Like other shark species of the family *Carcharhinus*, almost all parts of *C. plumbeus* are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and cosmetics, is generally dried and then exported to several countries.

Trade volume

Carcharhinus plembeus is generally grouped with other species of the *Carcharhinus* family because of their general morphological similarities. In trade statistics it is categorised as *hiu super* (super shark), along with several other shark species. In some regions this shark species is also categorised under *hiu lanjaman* or *hiu polos* (plain shark), making it quite difficult to ascertain catch and trade data for sandbar sharks. Likewise, specific local and national trade volume and export figures for *C. plumbeus* are still not available.

2.2.11 *Carcharhinus falciformis* (Müller & Henle, 1839)

Figure 2-11. *Carcharhinus falciformis* (Photo: Fahmi)

Carcharhinus falciformis (*Silky shark*) is known locally as *hiu lanjaman*. A medium-sized, oceanic and pelagic species, but most abundant offshore close to land masses, usually near the surface but also down to depths of 500 m (White *et al.*, 2006b).

Range and estimated population

This species is circumglobal in tropical waters. In Indonesia, it has been recorded in the Indian Ocean, from west Sumatera to south Nusa Tenggara, the South China Sea, Makassar Strait, and Banda Sea. Juveniles are sometimes found in shallow waters such as the Java Sea. This species is commonly taken by

longlines or tuna drift nets, and other pelagic fisheries. Juveniles and pups are sometimes captured by drift nets or hook and line close to the shore. The exact population is not known because there are no specific catch data available for this species, but it very likely decreasing due to overfishing at all sizes.

Threats to the population

Carcharhinus falciformis or silky shark (*hiu lanjaman*) is the shark species most commonly taken, both as bycatch and main catch in longline and drift net fisheries operating offshore. A 2001-2006 survey conducted at several fish landing centres in Bali, Lombok and Cilacap indicates that *C. falciformis* caught by fishers ranged from 62 cm to 254 cm in length. It attains at least 350 cm length, but typically to 250 cm. Males mature at 183-204 cm and females at 216-223 cm (White *et al.*, 2006b). These figures indicate that most of the individuals taken are juveniles. This is a threat to the population of this species, because the more juveniles are captured, the less opportunity these sharks have to reproduce. Juveniles are commonly taken by fishing gear operating in waters close to shore, while larger specimens are caught by tuna nets, long lines or shark nets operating offshore. There are concerns that the population of *C. falciformis* will decline further if management policy is not introduced to regulate the capture of this species. Also, the growing practice of finning is a serious threat to the survival of this shark species in Indonesian and adjacent waters.

Uses

In general, almost all parts of this shark are used. The fins are the most sought after body part due to their high economic value, especially for large fins.

The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and cosmetics, is generally dried and then exported to several countries.

Trade volume

Silky sharks are both bycatch and target catch for fishers. Shark fishers are typically able to differentiate between this and other species of the *Carcharhinus* family; and fishers in Cilacap use *hiu lanjaman* only for this species. However, in national fisheries and trade statistics, *C. falciformis* is grouped with other species of the *Carcharhinus* family, so specific national and local trade and export figures for this species are still not available.

2.2.12 *Carcharhinus leucas* (Müller & Henle, 1839)

Figure 2-12. *Carcharhinus leucas* (Photo: White *et al.*, 2006b)

Carcharhinus leucas (Bull shark) has several local names, including *hiu buas, hiu bekem* and *hiu lembu*. A large species of shark that is very tolerant to variations in salinity, and is able to exist in estuarine waters and penetrate large, freshwater rivers. It is one of the most dangerous sharks and there have been

many reports of shark attacks involving this species. Its short, rounded snout is its main distinguishing feature, along with its triangular upper teeth.

Range and estimated population

The Bull Shark has a worldwide distribution in tropical and warm subtropical waters. In Indonesia observations of juveniles have been recorded in almost all regions. Adults are commonly found in the Indian Ocean, South China Sea and Banda Sea. Large adults are sometimes taken by longlines, either as bycatch or target catch, and juveniles are sometimes taken by drift nets operating in shallow waters close to shore or in river estuaries. The exact population is not determined because specific catch data for this species is not available, but catch data at Cilicap fish landing centre does differentiate between this species and other shark species in its fisheries data. Bull sharks account for only around 1% of the total shark catch landed at this location.

Hreats to the population

Carcharhinus leucas or bull shark is the only species of shark that can enter fresh water, such as large rivers, in search of prey. This makes it more vulnerable to the impacts of human activity in coastal and estuarine areas, such as fishing, water pollution and land conversion. The greatest threat to this shark species is at the juvenile stage, when bull sharks are commonly found in estuarine and coastal waters. The relatively high intensity of fisheries and other anthropogenic impacts in these areas will gradually threaten the growth and development of its population in the wild.

Uses

As with other shark species, in general, almost all parts of this shark are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and cosmetics, is generally dried and then exported to several countries. The skin is also used in the craft industry and made into snack foods.

Trade volume

National and local trade and export figures for *Carcharhinus leucas* are not known because shark trade data are not disaggregated by species, but by size and quality of fin. For this reason, national and local trade and export volume figures are not available for *C.leucas*. However, at some fish landing centres, such as Cilacap and Palabuhanratu, specific production and economic value data are available for this species. Overall, the shark fishery production value trends follow production trends. High shark production volume in a given year is typically accompanied by high production value for this commodity in Indonesian fisheries statistics.

2.2.13 *Galeocerdo cuvier* (Peron & Lesueur, 1822)

Figure 2-13. *Galeocerdo cuvier* (Photo: White *et al.*, 2006b)

Galeocerdo cuvier (Tiger shark), known locally as *hiu macan*, is a large shark species that occurs close inshore to the continental shelf, in tropical and subtropical regions, from the surface to a depth of 150 m. An omnivorous species, tiger sharks feed on a wide variety of prey including dolphins and turtles, and even scraps in the water. This species of shark is potentially dangerous to humans but is not normally aggressive (White *et al.*, 2006b).

Range and estimated population

Circumglobal in all tropical and warm subtropical seas. Observations have been recorded in almost all Indonesian waters, but it commonly occurs in the Indian Ocean, from west Sumatera to Nusa Tenggara, the South China Sea, Makassar Strait and Banda Sea. Tiger sharks are sometimes taken by longlines, bottom gill nets and trawl nets, both as bycatch and target catch. The exact population is not known because there are no specific catch data available for this shark species.

Threats to the population

Catch data for 2001-2006 indicate that specimens landed were between 79 cm and 314 cm in length, but were typically in the 180-250 cm range. This

means that most of the tiger sharks landed were juveniles. Although a relatively small number of *G. cuvier* were caught or landed, the high intensity of capture in Indonesian waters, coupled with the widespread practice of finning (removing the fins from large specimens and dumping their carcasses in the sea), means that more individuals were caught than were reported. Therefore, although the survival of this species is considered not threatened, measures should be taken to ensure that management of tiger shark fisheries remains sustainable.

Uses

As with other shark species in the *Carcharhinidae* family, in general, almost all parts of *G. cuvier* are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and cosmetics, is generally dried and then exported to several countries.

Trade volume

Galeocerdo cuvier is easily identified from its skin, which is grey with black stripes, like a tiger. However, if separated from its body, its fins are quite difficult to identify except to the trained eye. As a result, accurate catch data and trade data based on the volume of trade in tiger shark fins are not known, and specific national and export trade volume figures for *G. cuvier* are not yet available. However, at some fish landing centres, such as Cilicap and

Palabuhanratu, production and economic value data for this species of shark are available.

2.2.14 *Prionace glauca* (Linnaeus, 1758)

Figure 2-14. *Prionace glauca* (Photo: Last *et al.*, 2010)

Prionace glauca (Blue shark) has several local names, including *hiu karet, hiu biru* and *hiu selendang*. This species is oceanic and occurs in tropical and warm subtropical regions, from the surface to 800 m depth. This shark species is migratory and is commonly found in groups from the surface to a depth of more than 150 m. It elongated body with the first dorsal fin positioned in the middle makes this shark easy to identify. Litters are 4-135 pups (but typically 15-30), born annually or every second year after a 9-12 pregnancy. Its diet consists primarily of small pelagic fishes and cephalopods, but also demersal fishes, small sharks and seabirds. Although potentially dangerous to humans, it often timid when approached. (Compagno, 2001).

Blue sharks are typically taken on longlines, as target catch in shark longline fisheries, and as bycatch on tuna longlines. They are also caught by tuna drift nets and purse seine. Although typically caught and recorded separately in local fisheries statistics, such as in Cilacap and Palabuhanratu, its exact population is not known. This species accounts for 3-15% of all sharks caught in south Java. Surveys of the number of sharks landed in Cilacap (2006-2011) and

Palabuhanratu (2003-2008) indicate a downward trend in the blue shark catch in south Java waters.

Range and estimated population

Blue sharks are the world's most wide-ranging of sharks, occurring from the east Atlantic to west Pacific. In Indonesia, blue sharks are commonly found in the Indian Ocean, from west Sumatera to south Nusa Tenggara, and occasionally in the South China Sea and Banda Sea.

Threats to the population

Prionace glauca can attain a total length of 383 cm. Males and females mature at 210-220 cm length. Survey data for 2001-2006 indicate that blue sharks landed by fishers in Indonesia are between 200 cm and 300 cm long. Most specimens taken are adults, sometimes even pregnant females. With litters typically containing 15-30 pups, there are concerns that the population in the wild will dwindle in the future as a result of fishing pressure on this species. Therefore sustainable management of the use of this species is necessary.

Uses

Like other species of Carcharhinidae, in general, almost all parts of this shark are used. The fins are the most sought after body part due to their high economic value, especially for large fins. The fins are typically served up in restaurant dishes as costly shark fin soup, or exported overseas. The flesh is salted or smoked, mainly for local consumption, with only a small portion destined for export. The cartilage, which has a high economic value as an ingredient in medicines and cosmetics, is generally dried and then exported to

several countries. The skin is also used in the craft industry and made into snack foods.

Trade volume

In national fisheries statistics, data for blue sharks are not disaggregated, so no local or export trade data for *P. glauca* are available at the national level. However, at some fish landing centres, such as Cilacap and Palabuhanratu, production and economic value data for this shark species are available. Overall, the shark fishery production value trends follow production trends. High shark production volume in a given year is typically accompanied by high production value for this commodity in Indonesian fisheries statistics.

2.3 Regulations and Legislation concerning the Management and Conservation of Shark Resources

In Indonesia, Law 31/2004 on fisheries defines fisheries management as all initiatives, including integrated processes, in information collection, analysis, planning, consultation, decision making, allocation of fish resources, implementation, and enforcement of fisheries legislation, carried out by government or another authority with the aim of achieving sustainable productivity of marine biota resources and agreed objectives. Pertinent to this broad definition of fisheries management is the aim to ensure optimal use of fisheries resources, with due regard for the conservation of resources and their environments. The steps involved in fisheries management include collection of baseline data, including biological, technological, economic and social data, relevant to fisheries. These data are then presented in the form of information

that can be used to make decisions. In reality, in shark management and conservation in Indonesia, fishing bans or regulations to protect particular shark species cannot be made without due regard for the ecological, social, economic and cultural aspects of fishing communities in Indonesia. A more appropriate approach to the use of shark resources in Indonesia is through sustainable management of shark fisheries regulated in a realistic and feasible fisheries management action plan

Support for shark fisheries management comes not only from within Indonesia, but also from the international community. There are several international and regional initiatives to promote or focus concern on management and conservation of shark populations, both inshore and offshore. Several countries provide national protection for one or more threatened species, under provisions in fisheries and wildlife legislation. Many shark species that are found offshore have a wide range and are migratory, not limited by national boundaries or particular jurisdictions. For this reason, with regard to migratory species that have a broad range, disputes can arise between neighbouring countries regarding the use of shark fishery resources. Conflict can arise if one country gives a protected status to a species that is not protected by a neighbouring country, and may even still be fully exploited by that country. So, countries need to be bound by joint agreements on managing shark species that migrate and cross marine borders as shared stock.

2.3.1 International Conventions and Legislation

Under international legislation, the mandate for Indonesia to adopt specific shark fisheries management is perfectly clear. The United Nations Convention on the Law of the Sea (UNCLOS, 1982), which was ratified by the

Indonesian government via Law 17/1985 (concerning the ratification of UNCLOS 1982), calls on all states to cooperate in the following areas:

1) Conserving living resources in the deep sea;
2) Developing measures to protect and restore populations of harvested marine at levels which can produce the maximum sustainable yield (MSY)
3) Taking into consideration the effects on species associated with or dependent upon harvested species with a view to maintaining balance in food chains and avoiding population depletion or extinction of species associated with these harvested species.

UNCLOS also identifies several highly migratory shark species, such as the bluntnose sixgill shark *(Hexanchus griseus,* Hexanchidae), whale shark (*Rhincodon typus,* Rhincodontidae), and several species of shark from the Carcharhinidae, Sphyrnidae and Lamnidae families. These species are also recorded as occurring in Indonesian waters. To respond to this resolution from UNCLOS, the United Nations Fish Stocks Agreement (UNFSA) adopts management initiatives for these migratory shark species (Lack & Sant, (2006). Furthermore, Lack & Sant (2006) explain that to support management of highly migratory sharks, UNFSA calls on each UNFSA member state to individually and collectively, through cooperative regional fisheries management organisations (RFMOs), apply a precautionary approach to the management of these sharks species, including target and non-target species, in which the level of precaution is agreed beforehand. When the status of a target or non-target species is the management focus, monitoring of the species should be intensified in order to determine the effectiveness of management and conservation

measures. This includes developing, collecting and implementing research programs to identify the impacts of catching non-target species.

The 1985 Code of Conduct for Responsible Fisheries (FAO CCRF) provides detailed guidelines for implementing the provisions of the UNFSA. Specific to shark management are the provisions to minimise the waste and discard of shark fisheries. The FAO CCRF provides specific provisions on procedures for ensuring the sustainability of shark fisheries, whether as target or bycatch, through the International Plan of Action for the Management and Conservation of Sharks. This plan requires each member state to adopt this action plan on a national scale by developing a national plan of action for the management and conservation of sharks. However, the level of compliance of Indonesian fisheries management with FAO CCRF, in particular with Article 7 on fisheries management, remains low, at less than 30% (Pitcher, *et al*., 2008). In terms of current Indonesian legislation, there are no provisions that specifically regulate shark fisheries, although there are instruments and references available that could be used to develop ecosystem-based shark management.

International regulations relevant to shark fisheries include:

1. IOTC (Indian Ocean Tuna Commission)

Since its establishment, this organisation has issued two resolutions related to shark fisheries: Resolution 05/2005 concerning the conservation of sharks caught in association with fisheries managed by IOTC; and Resolution 12/09 on the conservation of thresher sharks (Family Alopiidae) caught in association with fisheries in the IOTC area of competence. These IOTC provisions concerning shark fisheries are:

- Contracting parties shall report data for catches of shark, including historical data;
- Fishing vessels are prohibited from retaining on board, transhipping, or landing any fins harvested in contravention with Resolution 05/05;
- CPCs shall release live sharks, especially juveniles and pregnant sharks;
- CPCs shall undertake research to make fishing gear more selective.

The provisions in IOTC Resolution on the conservation of thresher sharks (Family Alopiidae) caught in association with fisheries in the IOTC area of competence, are as follows:

- Fishing vessels are prohibited from retaining on board, transhipping, landing, storing or selling or offering for sale any whole or part carcass of thresher shark of all the species of the family Alopiidae, except for the purpose of scientific observation.
- All vessels must release unharmed all thresher sharks caught.
- All vessels must record and report incidental catches as well as live releases of thresher sharks.
- Thresher sharks caught by recreational and sport fishers must be released alive, and both recreational and sport fishers shall be equipped with instruments suitable to release the sharks alive.
- CPCs shall, where possible, undertake research on sharks of the species *Alopias* spp., in the IOTC convention area in order to identify their nursery grounds.
- Scientific observers shall be allowed to collect biological samples from thresher sharks that are dead, as part of the research project approved by the IOTC Scientific Committee, on the approval of the member states.

- The Contracting Parties shall submit catch data for sharks to the IOTC Secretariat.

To follow up on these provisions, in 2011, the Directorate General of Capture Fisheries issued a ban on the capture of three species of shark of the family Alopiidae (*Alopias pelagicus*, *A. superciliosus* and *A. vulpinus*) in Indonesian waters. However, this ban has not been effective. In reality, most sharks that are caught are in a weak condition or dead by the time fishers raise lines or nets that they laid the day before. Another consideration for fishers is that if they release sharks that they have caught, their incomes will suffer. Therefore, implementation of this ban must be accompanied by intensive and regular dissemination programs to raise the awareness of shark fishers about the conservation of shark species, including those that are categorised as endangered. At the very least, if any of these protected species of shark are caught by fishers, their size, sex, and geographical location of capture must be recorded.

2. CCSBT (Commission for the Conservation of Southern Bluefin Tuna*)*

The CCSBT has issued the Recommendation to mitigate the impact on ecologically related species (ERS) of fishing for Southern Bluefin Tuna, which provides as follows:

- Each member nation must implement the IPOAs for the conservation and management of sharks, seabirds and sea turtles;
- Members with comply with all current binding and recommendatory measures aimed at the protection of ecologically related species adopted by the IOTC and WCPFC;

- All member states will collect and report data on ecologically related species to the Extended Commission and/or its subsidiary bodies

3. WCPFC (Western and Central Pacific Fisheries Commission)

The provisions issued by this commission include:

- All nations must implement the IPOA for the Conservation and Management of Sharks and a National Plan of Action for the Conservation and Management of Sharks, and submit these in annual reports to the WCPFC;
- All nations must provide annual reports on catches of blue shark (*Prionace glauca*), silky shark (*Carcharhinus falciformis*), oceanic whitetip shark (*Charcharhinus longimanus*), mako shark (*Isurus* spp.) and thresher shark (*Alopias* spp.), including catches that are retained and discarded, as well as carry out research and development to reduce the capture of sharks.

2.3.2. National Provisions and Legislation

Indonesia has no specific regulations on the management of shark fisheries, although steps in this direction are being taken. A positive response must be made to the growing international concern about shark fisheries in Indonesia, because shark resources not only have an important role in aqua ecosystems, but also have a significant role as a source of income for people living in some parts of Indonesia.

One measure that has been taken is to draft a National Plan of Action for the Management of Sharks and Rays, which was issued in 2004 by the Directorate General of Capture Fisheries at the Directorate of Fish Resources.

This management plan was drafted based on the International Plan Of Action (IPOA) for the Conservation and Management of Sharks , which was issued by the FAO Fisheries Committee in 1999. Although voluntary, all countries that harvest sharks and rays are encouraged to adopt this IPOA by developing research on sharks and rays and implementing a National Plan of Action (NPOA). The goal of this action plan is have specific per species capture data, collated landing data, and improved monitoring and management of shark and ray fisheries. The IPOA is also an important international collaboration for collection of data and management of straddling areas, shared stocks, and stocks of oceanic shark and ray and other highly migratory species.

Indonesia's National Plan of Action for the Conservation and Management of Sharks and Rays covers key areas related to the conservation and management of sharks and rays at the national level. It discusses biodiversity, range, shark and ray fisheries, uses, and management measures that need to be taken by government and other stakeholders at the national and local level. Coordination at the regional level is also needed to implement the NPOA effectively. Implementation of the action plan for management of sharks published in 2010 has been fraught with difficulties, one of which is the different priorities of the directorates that are responsible for implementing this NPOA. Also, the collection of data on shark fisheries disaggregated by species is difficult, because so few people are trained to able to identify the various species, so many landing centres need to be monitored, and so many sharks landed are only part carcasses, making them difficult to identify. In addition, because many shark catches are not recorded at official fish landing centres, it is difficult to obtain sufficiently accurate data. To address these problems, comprehensive and more closely coordinated planning involving all the relevant authorities is

needed, because these data are the raw material for drafting a shark fisheries management policy in Indonesia.

Indonesia's NPOA for the Conservation and Management of Sharks and Rays contains several priority action programs , including:

- Reviewing the condition of shark and ray fisheries in Indonesia;
- Designing data collection methods and processes;
- Developing research on sharks and rays;
- Improving management initiatives by raising awareness about shark and ray fisheries, strengthening institutions, and carrying out monitoring and evaluation.

When carrying out these activities there needs to be coordination among relevant government agencies, including the Directorate of Fish Resources, Directorate General of Capture Fisheries; Directorate of Fish Habitats and Species, Directorate General of Marine, Coastal and Small Island Areas; Data and Information Systems Centre; Education and Training Centre, Marine and Fisheries Human Resource Development Agency; Marine and Fisheries Research and Development Agency; the Indonesian Institute of Sciences and other relevant institutions, including universities, Ministry of Forestry, international NGOs (WWF, CI, WCS, MSC) and fisheries associations.

Although Indonesia's NPOA for Conservation and Management of Sharks and Rays has been finalised and approved as a fisheries management action plan in Indonesia since 2008, this NPOA has no legal power, so no concrete action has been taken to manage shark fisheries in Indonesia. However, local governments do appear to be starting to respond in a positive way to the management of shark fisheries.

The Raja Ampat district government in Papua province has issued Regional Regulation 9/2012 which prohibits "the capture of sharks, rays and other fish species in Raja Ampat waters". Article 18 of Law 32/2004 on regional governments explicitly states that regional governments have the authority to undertake resource management measures, including conservation. While this commitment of Raja Ampat district government should be applauded, it does not mean that there should be blanket ban on catching sharks in Indonesia.

With so many organisations involved in the management of sharks, communication to make decisions on everything to do with shark management is not always effective, for example, when deciding on the status and condition of sharks in Indonesia at the annual CITES conference. In principle, Indonesia has an institutional instrument for the management of fisheries in general (Forum Koordinasi Pengelolaan Pemanfaatan Sumberdaya Ikan or FKPPS). FKPPS is a coordination forum for fisheries management in a particular fisheries management area, each of which is required to prepare a fisheries management plan. These plans are used as reference making shark management plans in Indonesia (SDI, 2011). In general, Indonesia has more than sufficient fisheries management regulatory and policy instruments to make shark fisheries management instruments, including international conventions that have been ratified by Indonesia as well as national legislation.

2.4 Provisions on the Protection of Shark Resources

Although Indonesia has no specific regulations on the conservation of sharks, it does have several regulations on the conservation of endangered species, so that they do not become extinct and continue to provide sustainable benefits to people and their environment.

Article 7 clause (1) of Law 31/2004 on Fisheries as amended by Law 45/2009 states that in the context of the management of fish resources, the Minister defines the minimum size or weight for fish species that are allowed to be taken; marine conservation areas; and protected fish species. These points are one management instrument that could be used to ensure the survival, availability and sustainable use of fish resources, including sharks.

Other derivative regulations and legal products that are directly or indirectly related to conservation (protection, preservation and sustainable use) of fish resources, including sharks, include:

1) Government Regulation 7/1999 on preservation of flora and fauna, which is a derivative of Law 5/1990 on conservation of biota and their ecosystems, which is a national regulation that establishes the conservation status of endangered species. The appendix to this government regulation contains lists of protected species of flora and fauna, one of which is *Pristis microdon*, a species of ray also known as the largetooth sawfish. In Indonesian it is called *hiu gergaji* (literally 'saw shark') because it is commonly believed to look like a shark. One of the differences between sharks and rays is in the position of their gills: sharks have gills on the sides of their heads, while rays have them on the underside of their heads.
2) Government Regulation 60/2007 on conservation of fish resources is an instrument for the protection, conservation and use of fish resources, including ecosystems, species and genetics, to ensure their existence, availability and sustainability by maintaining and improve the quality and biodiversity of fish resources. This means that conservation and protection of all fish resources, including sharks, is needed to obtain sustainable benefits for current and future generations. This government regulation

provides a strong legal basis for the management of endangered fish species, including shark species. Conservation of fish resources can be implemented at the ecosystem, species and genetic level.

3) Regulation of the Ministry of Marine Affairs and Fisheries 3/2010 concerning Procedure for Designating Protected Status to Fish Species is a derivative of Government Regulation 60/2007 concerning Conservation of Fish Resources. Regulation of the Ministry of Marine Affairs and Fisheries 3/2010 recognised two types of protection: full protection and limited protection. Limited protection is divided into three sub-types: protection limited by size, protection limited by location, and protection limited by time. One legal product that has been established based on this ministerial regulation is Decree of the Minister of Marine Affairs and Fisheries 18/MEN-KP/2013 concerning Establishment of the Protected Status of Whale Sharks (*Rhynocodontypus*), which has full protection.
4) Regulation of the Minister of Marine Affairs and Fisheries 2/2009 concerning Procedures for Establishing Aquatic Conservation Areas. Marine conservation areas are established for two purposes: (a) to protect and conserve fish resources and critical aquatic ecosystem types to ensure the sustainability of their ecological function; (b) to use fish resources and their ecosystems, as well as environmental services sustainably; (c) to preserve local knowledge about fish resources management in and/or around aquatic conservation areas; and (d) to improve the welfare of communities living in and around aquatic conservation areas. This ministerial regulation could be used as an instrument for protecting shark spawning grounds and nursery grounds, when sharks are in vulnerable phases of their life cycle. Currently there are no conservation areas

specifically to protect critical habitats of sharks in Indonesia. Data and information about these shark spawning grounds and nursery grounds is crucial to the future sustainability of shark resources. As of the end of 2012, the Ministry of Marine Affairs and Fisheries had designated 11,089,181 hectares of marine and coastal areas as conservation areas.

5) Regulation of the Minister of Marine Affairs and Fisheries 4/2010 concerning Procedures for the Exploitation of Fish Species and Fish Genetics focuses on the procedures for exploiting protected fish species and species of fish whose international trade is regulated by the CITES convention. This regulation establishes, among others, the procedures for exploiting wild and farmed fish species, the licensing mechanism, catch quotas, and the administrative sanctions for breaching these.
6) Presidential Decree 39/1980 concerning the Eradication of Trawlers from Indonesian Waters. Trawlers are not selective fishing gear, as almost all fish species of all sizes are taken during fishing operations, including species of shark. This decree to eradicate trawlers is an example of an appropriate policy to maintain the sustainability of fish resources, including sharks and other fish species.
7) To ensure the sustainability of fish resource and avoid conflict, Presidential Decree 85/1982 on the use of shrimp trawlers in the Kai, Tanimbar, Aru, Irian Jaya waters and the Arafura sea, from 130° E to the east. This decree could be used to reduce the capture of sharks and rays as trawler bycatch, in particular the capture of *Urolophus kaianus*, which commonly occurs in Kai waters.

8) Regulation of the Minister of Marine Affairs and Fisheries 12/2012 concerning Offshore Capture Fisheries. Several articles in this ministerial regulation are relevant to the management of shark resources, including:
   a. Article 39, which states that "all fishing vessels operating in seas that take bycatch of ecologically related species in tuna fisheries, including sharks, seabirds, turtles, marine mammals including whales, and sharks, are required to take conservation action".
   b. Article 40, which also contains provisions regulating bycatch of ecologically related shark species in tuna fisheries. Fishers must not take juvenile or pregnant sharks, and all sharks taken must be landed whole, and
   c. Article 43, which provides more detail about the status of bycatch of ecologically related species in tuna fisheries, such as thresher sharks, which must be released alive into the wild. It is also provides the sanctions for fishing vessels that catch, tranship, land, store and/or sell thresher sharks of the family Alopiidae, either whole carcasses or parts.

The world's regional fisheries management organisations (RMFOs) have warned that the principles of sustainable fisheries also apply to offshore fisheries. The government, through the scientific authority (currently the Indonesian Institute of Sciences), and in partnership with other stakeholders, is expected to be able to create a database of endangered shark species, including their estimated populations in the wild. For the management of endangered shark species, state intervention is a must. This management could take the form of setting export quotas at a level that allow populations in the wild to recover.

2.5 Shark Fisheries Management

The management of shark fisheries requires a common understanding and cooperation between the relevant institutions, fishing communities, environmental organisations and fisheries. The involvement of national and international NGOs in drafting management measures and making regulations and their legal bases will contribute to the creation of sustainable shark fisheries management.

Sustainable shark fisheries as defined by Rahardjo (2007) involve adopting several criteria:

1. Limiting the species and size of fish that can be caught
2. Regulating the gauge of fishing nets or gear
3. Limiting catch volume
4. Regulating fishing gear
5. Setting catch quotas
6. Regulating fishing methods
7. Closing fishing grounds and limiting fishing seasons

Fisheries management options developed by Merta *et al.* (2003) include:

1) Size limitation
2) Vessel and gear limitation
3) Sanctuary zones
4) Increased monitoring, control and surveillance (MCS)
5) Setting total allowable catch (TAC)

Taking into account the biological characteristics of sharks and rays (*Elasmobranchi*), which in general have relatively low fecundity and late sexual maturity, as well as their economic value to local communities, a sustainable management approach is the recommended option, where conservation is done

to main stocks while allowing their sustainable use. Taking into consideration the various management approaches outlined above, there are several options that could be adopted in the sustainable management of shark fisheries in Indonesia, including:

1. Prohibiting finning

   One issue of international concern that has affected the world's shark fisheries, including in Indonesia, is finning. This practice, which involves removing a shark's fins while still alive and dumping its carcass back into the sea, has attracted a great deal of international attention, for its cruelty and waste of resources. Prohibiting finning is something that Indonesia must do if it wants to use shark resources sustainably, and win international approval.

   A strategic decision for Indonesia is to introduce national regulations that require all shark fishing vessels or fishing vessels that take sharks as bycatch to bring their catch whole to fish landing centres. This regulation would not only improve national shark fisheries data, but also allow shark carcasses that in the past have been dumped into the sea to be processed into economically valuable fisheries products.

   A regulation requiring that sharks be landed whole could also reduce the number of sharks caught by fishers, due to the limited cargo capacity of fishing vessels. If the fins of a shark account for only 3% of its total weight, then 97% of its potential is dumped back into the sea. This regulation would also facilitate surveillance of shark fisheries.

2. Species and size limitation

   Surveys conducted since 2001 indicate the number of juvenile sharks landed or caught by fishers. The capture of sharks that are sexually

immature, will, in the long term threaten the survival of these fish resources. Article 7 clause 1 letter q of Law 31/2004 on fisheries as amended by Law 45/2009 clearly states minimum allowable size of fish caught.

Juvenile sharks are commonly found in coastal waters, which are typically the fishing grounds for intensive artisanal fisheries. Stricter policies are needed to regulate the use of fish resources in coastal waters, with due regard for the value of these resources to local communities. In addition, the types of fishing gear used by fishers are not very selective, which means that many juveniles are taken as bycatch.

3. Regulating the gauge of fishing nets or gear

Of the various types of net used to catch shark and nets that capture shark species as bycatch, only liongbun nets are of a gauge that is sufficiently selective; all other types of net are small gauge and therefore non-selective. The aim of regulating the gauge of nets and gear is to allow small individuals (juveniles) from the available stock to go free, and requiring the use of large gear and large bait aims to ensure that the sharks caught are adults.

One challenge that needs to be addressed is how to reduce the bycatch of juveniles in coastal waters, when many of these species, such as sharks, are actually desirable bycatch because they have a high economic value.

4. Limiting catch volumes

Limiting allowable catch can be justified by the downward trend in shark production volumes and the decrease in catch per unit effort. Shark capture volumes are also affected by market demand and price: the higher the demand the more intensive the fishing, and vice versa, including for sharks.

Limiting allowable catch is a complex issue, because most sharks are caught as bycatch, and as long as people continue to fish, sharks will continue to be caught. Building the knowledge and awareness of fishers about the importance of releasing juveniles and pregnant fish species is crucial to the sustainability of fish resources, which will in turn will make a positive contribution to the sustainable livelihoods of fishing communities. However, in theory, limiting allowable catch is necessary to avoid overfishing.

Given Indonesia's current economic situation and the low level of welfare of fishing communities, the best option for limiting allowable catch is to cap the number of fishing vessels operating. This means, that for the time being, the government should not issue any new licences for fishing vessels, in particular those whose bycatch includes species of shark.

5. Setting quotas

The aim of introducing quotas is to limit the intensity of exploitation so that the volume of fish resources caught does not exceed their sustainability potential. These quotas are set based on the potential of the resource, so quotas may differ from one area to another, because their potentials and level of exploitation are different. Giving that fishing pressure is the main cause of the decline in a population of a species, including sharks, to set quotas, adequate data are needed to be able to calculate its sustainability potential.

In the case of sharks, setting quotas may not be too difficult, because most sharks are caught as bycatch. One option is to set export quotas and a minimum size for fins that can be traded on the international market.

Without export quotas for shark fin, the capture of sharks will continue to be driven by market demand: the higher the demand, the more sharks will be caught. Controlling exploitation through market mechanisms is believed to be an effective way to reduce the level of exploitation. Limiting the size of shark fins that can be traded on the international market is one option for controlling the exploitation of sharks as juvenile sharks caught by fishers will released back into the water because they are too small to be traded on the international market.

6. Protecting spawning grounds and nursery grounds

Coastal waters are spawning grounds and nursery grounds for several species of fish, but they are also areas of high fishing pressure, which means that many juveniles are caught by fishers. From the conservation perspective, the taking of sexually immature fish will, in the long term, endanger the survival of these species, and will result in reduced catch volumes and incomes for fishing communities.

Fishers who operate in coastal waters are typically artisanal fishers who use a variety of non-selective fishing gear. Thus it is a difficult decision for the government to tightly control fishing in these areas, because of the significant impact it would have on fishing communities, which are typically poor. That aside, the government is obliged to ensure that fish resources do not become extinct and continue to benefit local communities in the long term.

One option is to find a balance between the interests of the communities that exploit fisheries potentials in coastal areas and the need to protect parts of these coastal areas as fish spawning grounds and nursery grounds. To do

this would require the support of research data on coastal locations that are the spawning grounds and nursery grounds for shark species. These locations would be declared conservation zones, giving sharks more of an opportunity to grow and reproduce, while fishing communities are still able to exploit resources in other coastal areas.

7. Protecting Endangered Sharks

The International Union for Conservation of Nature (IUCN) has published a list of shark species that are endangered globally, some of which are found in Indonesian waters. These endangered shark species need to have national protection to stop them becoming extinct. The process for conferring protected status to endangered aquatic species, including sharks, has been established by the Ministry of Marine Affairs and Fisheries by way of Regulation of the Minister of Marine Affairs and Fisheries 3/2010 concerning the Procedure for Conferring Protected Status to Fish Species.

As explained in the previous section, protected status for fish species may be full or limited. Limited protection is a new initiative in the context of fish conservation that takes into account both the interests of the local communities and conservation needs in the context of maintaining the sustainability of resources. One shark species that is now protected is the whale shark (*Rhincodontypus*). Despite being fully protected, opportunities to use this species still exist, by developing non-extractive uses, such as ecotourism.

Comprehensive shark fisheries management in Indonesia is an urgent matter. National shark management action could be undertaken in stages, or at least

through pilot projects, as a first step to implementing a shark fisheries management plan. The locations for this pilot project should be selected from locations that make a significant contribution to shark production, as reflected in national fisheries statistics. There should be at least one pilot project in Sumatera, one in Java and on in Nusa Tenggara, as initial monitoring points. The location in Sumatera could one of the larger shark landing centres in Aceh or Sibolga; in Central Java, the location could be Cilacap Ocean Fishing Port; in Nusa Tenggara, Tanjungluar fish landing centre in East Lombok; and for the Indo Pacific region, Bitung Fishing Port.

Properly integrated and coordinated shark fisheries management should be able to resolve the problems of Indonesia's shark fisheries, without anyone losing out. The awareness and willingness to change for the better is the key achieving this.

3. CONCLUSION

The main issue concerning shark fisheries is finning. This is an international issue that could potentially have enormous implications for fisheries management in Indonesia. Shark fisheries are a major source of income for fishing communities in Indonesia, which is the world's largest shark producer. Yet, crucially, uncontrolled shark fishing will threaten certain species of shark with extinction. So, prudent management is required. The issues related to shark fisheries are sensitive, and are related to the management of economically valuable fish resources, such as tuna, because many sharks are caught as bycatch in tuna fisheries. Sharks are also a desirable bycatch, because they fetch a good price, especially their fins.

Law enforcement has proved to be an ineffective way of enforcing regulations and legislation at grassroots level. As well as a relatively low level of surveillance, due to the massive expanse of Indonesia's marine territory, lack of supporting data, infrastructure, and human resources are constraints to the implementation of shark fisheries management on the ground. Lack of respect for law enforcement, lack of motivation and information, and irregularities in the field are additional constraints. To address these issues, in the context of implementing sustainable shark fisheries management, the following steps need to be taken:

1. To strengthen supporting data for sustainable shark fisheries management support from various quarters is needed to improve scientific research on shark resources, reproductive biology, population dynamics, and shark stocks in Indonesia. Research on the socio-economic aspects and alternative livelihoods for those involved in shark fisheries is also a must. This research

could be carried out in collaboration with relevant government agencies, NGOs, and shark conservation activists.

2. Recording of shark catch data should be by species. This means developing the skills of human resources in identifying shark species through training, which should be done regularly and in stages in all regions of Indonesia. This human resource development should target not only fisheries personnel at fish landing centres, but also enumerators and observers working in the field and on fishing vessels;
3. Taking into consideration the biological characteristics of sharks, which have low fecundity and mature late, it is necessary to have fairly tight regulations on their extraction, while taking into account economic value of shark fisheries to local communities. Adopting conservation principles in the management of shark fisheries is a must because will improve Indonesia's image in the eyes of the international community as well as ensure the sustainability of shark resources;
4. Given the expanse of its marine territory and the large number of fish landing centres across Indonesia, the National Plan Of Action for the Management and Conservation of Sharks published by the Directorate General of Capture Fisheries in 2010, should be rolled out in continuous stages;
5. There needs to be commitment from government agencies and stakeholders responsible for the coordination, monitoring and implementation of management measures, in the form of sustainable budgeting and program mechanisms;
6. Periodic and transparent evaluation of each management step.

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