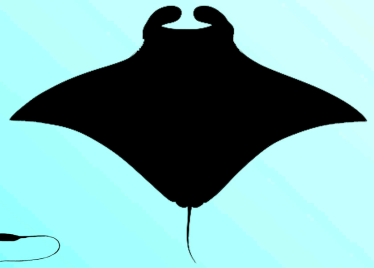
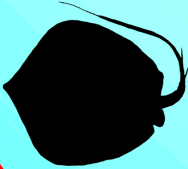
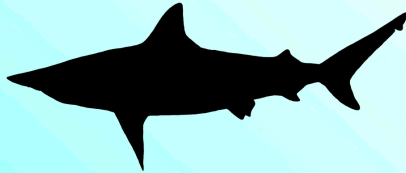
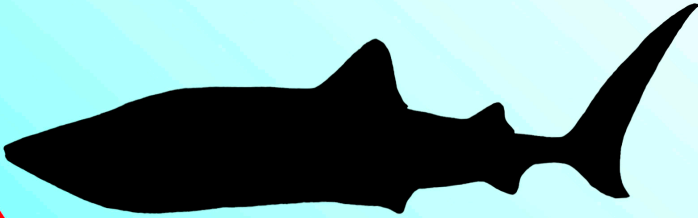




**Thailand National Plan of Action
for the Conservation and Management of Sharks
(NPOA-Sharks, Thailand : Plan 1, 2020-2024)**



NPOA-Sharks

Thailand National Plan of Action for the Conservation and Management of Sharks (NPOA-Sharks, Thailand: Plan 1, 2020-2024)



Department of Fisheries

Ministry of Agriculture and Cooperatives

Thailand

2021

**Thailand National Plan of Action
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Department of Fisheries

Ministry of Agriculture and Cooperatives, Thailand

Kaset Klang, Chatuchak, Bangkok 10900

Telephone No. : 662 5611589

E-mail : marine.bio.diverse@fisheries.go.th

Website : <https://www4.fisheries.go.th/local/index.php/main/welcome/marine>

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Foreword

Shark resources around the world have been in crisis and some species of sharks tend to be endangered or even extinct due to fishing pressure as well as their own biological characteristics which are the low birth rate owing to longtime embryonic development with a small amount of juvenile delivered and the late maturity. According to survey data from national and international organizations, it indicates that shark resources are risking to extinction, meanwhile the stakeholders have been concerned about the shark population status in the future. In this regard, the action plan for conserving and managing of sharks is urgently needed.

As one of the member countries of the United Nations Food and Agriculture Organization (FAO), Thailand ratified the Code of Conduct for Responsible Fisheries and manages fisheries under the Royal Ordinance on Fisheries, B.E. 2558 (2015) and its additional edition (No. 2), B.E. 2560 (2017), we recognize the significance of sustainable management of shark resources and stipulates that the Department of Fisheries (DoF) develops and implements the National Plan of Action for the Conservation and Management of Sharks (NPOA-Sharks) under framework of the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks). The objectives of this plan are to strengthen data collection and capacity building, as well as to rectify the negative perception towards shark catching in Thailand through enhancement of public awareness and education programs.

I wish to express my sincere gratitude to Thai NPOA-Sharks team for completing this plan which embodies stakeholders' opinions and interests in conserving and managing by-catch of sharks and rays. My appreciation is extended to whom devoted their times and effort to develop this plan. Finally, I thank all the staff of DoF, relevant agencies and private sectors for their supports and assistance.



(Mr. Amnuay Kongprom)

Director of Marine Fisheries Research and
Development Division

Executive Summary

The marine fisheries in Thailand are continuously growing as fishing gears and fishing methods evolve, and various types of fishing gears are allowed to operate on the same fishing ground. The results from Department of Fisheries of Thailand (DoF) landing survey and assessment of marine capture production in Thai waters revealed that overfishing is occurring in some marine species. In addition, new technologies have been used to improve catch efficiency of many fishing gears including trawls, purse seines, gill nets, long lines, etc., resulting in high catches of sharks. Although sharks are not the main fishery target for Thai fisherman, the survey data of DoF during 2002-2014 indicated that the number of sharks caught has continuously decreased in both the Gulf of Thailand and the Andaman Sea. Meanwhile, the current market demand for sharks and sharks products in many countries is increasing and leading to high numbers of sharks being caught.

Thailand, as a member of the United Nations Food and Agriculture Organization (FAO), supports the Code of Conduct for Responsible Fisheries (CCRF). The Royal Ordinance on Fisheries, B.E. 2558 emphasizes the sustainable management of fishery resources in Thailand, thereby ensuring both conservation and management of sharks. Understanding the status of sharks stocks in Thailand are difficult due to discontinuous or missing data sets.

The status of sharks resources around the world are in crisis and some sharks species are vulnerable to extinction due to (non) targeted fishing activities using a variety of fishing gears. Biologically, sharks are more susceptible to overharvesting because they have low birth rates, small litter sizes, and late sexual maturity. According to survey data from domestic and international organizations such as FAO, IUCN (International Union for Conservation of Nature), CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) and CMS (Convention on the Conservation of Migratory Species of Wild Animals), the status of sharks resources are at risk of extinction and stakeholders are concerned about the status of sharks populations in the future. In Thailand, there is no fisheries targeting to catch sharks directly. It was reported that sharks as by-catch in Thailand accounted only 0.72% of total catches. However, ray longline as a traditional fishing gear targeting rays had no longer used recently because declining of ray stocks when compared to the past.

DoF as the main organization managing sharks stocks in Thailand established Thailand National Plan of Action for the Conservation and Management of Sharks (NPOA-Sharks, Thailand) under framework of the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks), which its plan of actions will be implemented for five years (2020-2024). The outline of five key actions necessary to improve the management and conservation of sharks resources in Thai waters, are as follows:

Objective 1 Study and develop a database for information on biology, ecology, fisheries, and utilization of sharks in Thai waters

Objective 2 Systematically and regularly assess status and threats on sharks caused by fisheries and environment

Objective 3 Develop knowledge and enhance capability related to sharks management for relevant officers

Objective 4 Define conservation and management measures to regulate fishing activities and trade on sharks in consistent with international rules, regulations, and obligations

Objective 5 Establish and strengthen a network of stakeholders' engagement for management and conservation of sharks resources

With that objectives, DoF issued NPOA-Sharks of Thailand for conservation and management of sharks. Time series data of sharks resources in Thailand and guidelines for sharks resources management through national stakeholder consultation process to ensure sustainability conservation and management of sharks resources.

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Thailand National Plan of Action for the Conservation and Management of Sharks

1. Introduction

1.1 Background

Although sharks are not the main target of Thai fisheries, the improvement of catch efficiency and fishing gear practices has caused increasing in sharks catches by various types of fishing gears, including trawl, purse seine, gillnet, longline, etc. This group of fishes is classified as by-catch. However, they have been fully utilized for consumption and processing to be various products since there are market demands in many countries, leading to a continuous decline in sharks landings. The Fisheries Statistics of Thailand reported that 80% decline in landings from the highest catch of sharks and rays in 2003 (14,409 and 18,131 metric tons, respectively) to the lowest levels in 2011 (only 1,424 and 3,376 metric tons, respectively), in accordance with sharks landing trends around the world.

Many sharks species are migratory species or are reliant on multiple habitats and are often captured for their fins to make dried shark fins. Furthermore, sharks are more susceptible to overfishing because they have low birth rates due to longtime embryonic development, with a small litter sizes, and late maturity. Therefore, these species are highly at risk of extinction. Many countries concern about the continuous decline in sharks populations due to overfishing, which lead to insufficient numbers for recruitment. Stakeholders are worried that it may affect the sharks population in the future, ultimately leading to their extinction. Thus, FAO agreed to establish IPOA-Sharks in 1998, which was launched in 1999, and encouraged member States to establish their respective NPOA-Sharks to effectively conserve and manage sharks in their waters (FAO, 1999).

For Thailand, this involves not only compliance with the national law on the conservation of aquatic resources, but also complying with the international laws, various legal binding and non-legal binding international rules and regulations ratified and accessed, such as the United Nations Convention on the Law of the Sea, 1982, the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea dated December 10th, 1982 relating to the conservation and management of straddling and highly migratory fish stocks, the Port State Measures Agreement (PSMA), the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, CCRF, the Convention on Biological Diversity (CBD), CMS (1979) and CITES. Furthermore, Thailand is also a member of number of the regional fishery management organizations (RFMOs) supporting implementation of guidelines for sharks

management and encourage conservation and management measures for by-catch in their responsible area including the Indian Ocean Tuna Commission (IOTC), the Southern Indian Ocean Fisheries Agreement (SIOFA) and collaborating with the Western and Central Pacific Fisheries Commission (WCPFC) as a co-operating non-member country. At the same time, Thailand is concerned about this issue and prescribes the regulation to prohibition of fisheries or harming to some marine species such as the Ministry of Agriculture and Cooperatives notified “definitions for marine mammals and endangered or nearly extinction species that are prohibited to fish or bring up onboard fishing vessels” dated 7 April 2016 under the Royal Ordinance on Fisheries, B.E. 2558 (Fisheries Act, B.E. 2558), Whale shark (*Rhincodon typus*) was listed under appendix that was ranked at 4th under the list and declared as a preserved wildlife species in fish group under the Wildlife Preservation and Protection Act, B.E. 2562. Studies and monitoring of sharks resource status have continuously conducted on concordance with international practice for sharks conservation and management. In this connection, Thailand has established this NPOA-Sharks with objectives to effectively conserve and manage sharks resources and comply with the IPOA-Sharks.

1.2 Definition (as appeared in this document)

Sharks refer to all cartilaginous fishes (Class Chondrichthyes) including shark, ray and chimaera.

- Shark refer to cartilaginous fish with 5-7 pairs of gill openings on the lateral side of head.
- Ray refer to cartilaginous fish with 5-7 pairs of gill openings at the ventral side of head.
- Chimera refer to cartilaginous fish with a pair of gill opening on the lateral side of head.

1.3 Problems and limitations regarding sharks conservation and management in Thailand

Thailand have non specific shark fishing. Sharks are categorized as by-catch in from the Thai fishery sector, with very low levels, only 0.72 % of total marine catches. Nowadays, there is no specifically designed fishing gear to catch sharks, while in the past, only traditional fishing gear called “Rawai hook” or ray longline was used; the latter are not currently used because rays are no longer as abundant as in the past (Marine Fisheries Division, 1997). Current problems and limitations regarding sharks conservation and management in Thailand are as follows:

1.3.1 Problems and limitations of data

- Biological data such as species identification, size at first maturity, growth rate, abundance and distribution
- Fishery biological data such as fishing mortality, natural mortality, fishing effort and recruitment rate

- Status of sharks resources in Thai waters is unclear due to the lack of time series data collection.

- Fishery statistics data do not classify catch at species level of sharks. Therefore, it is not possible to assess clearly actual status of sharks resources.

- Quantity and value of domestic consumption, import and export of sharks products and related industries such as shark fins, leather goods, jewelry, souvenirs in various type, group and quality of imported and exported sharks products.

1.3.2 Problems and limitations of personnel

- Lack of fish taxonomists

- A limited number of government staff who is expert in sharks identification at the family or species level, and lack of staff gathering data for proper sharks resource management.

- Low level of involved stakeholders awareness and lack of cooperation among relevant government agencies due to lack of data integration and management of sharks resources of relevant government agencies and private sectors

1.3.3 Problems and limitations of budget

- Insufficient budget for sharks research and their monitoring

- Insufficient budget for sharks management schemes

1.3.4 Problems and limitations related to trade issues

- The global demand for sharks consumption and trade have induced marketing pressures (an important cause of sharks consumption), which increased until it affected sharks resources in Thailand.

1.3.5 Problems and limitations due to the obligations of the international fisheries management organizations

- Ineffective coordination and reporting of sharks landing data information in Thailand and that of highly migration or in the high seas

- National regulations and measures for fishery resources management are likely irrelevant with international obligations.

- Rules, regulations, or measures issued by RFMOs, responsible for fishery resource management in various regions in order to conserve sharks resources or reduce sharks catches by the fisheries, such as IOTC, WCPCF, etc., unenforceable fishing vessels of their respective non-member States, as well as discontinuous distribution of update information are cause of non compliance with vessels operation.

1.4 Goal

To ensure that Thailand has sharks conservation and management measures for sustainable utilization and the long-term socioeconomic development of sharks.

2. Objectives

2.1 Study and develop a database for information on biology, ecology, fisheries, and utilization of sharks in Thai waters

2.2 Systematically and regularly assess status and threats on sharks caused by fisheries and environment

2.3 Develop knowledge and enhance capability related to sharks management for relevant officers

2.4 Define conservation and management measures to regulate fishing activities and trade on sharks in consistent with international rules, regulations, and obligations

2.5 Establish and strengthen a network of stakeholders' engagement for management and conservation of sharks resources

3. Sharks resource status and fishery in Thai waters

3.1 Sharks found in Thai waters and adjacent waters

The survey and species list preparation of sharks in Thai waters was initiated in 1977 by Professor Supap Monkolprasit of the Faculty of Fisheries, Kasetsart University. As a result, publication in English version named “The Cartilaginous Fishes (Class Elasmobranchii) Found in Thai Waters and Adjacent Areas” was issued in 1984. As reported in this publication, there were 29 shark species of 7 families and 38 ray species of 6 families (Monkolprasit, 1984). Subsequently, new list of species was updated by the Department of Marine and Coastal Resources (DMCR) reported 50 shark species of 14 families and 56 ray species of 10 families (Natheewatthana and Chuenphan, 2002). Moreover, Krajangdara *et al.* (2006) revised the list of sharks to 59 species of 18 families, and Krajangdara (2014a, 2014b) revised the list of rays to 71 species of 11 families. These studies found the new record of 7 shark and 15 ray species in Thai waters during 2004-2014, and most of them were found in the Andaman Sea, Thailand.

DoF carried out sharks resource survey in Thai waters by a sampling method during 2011-2014, and reported 14 species out of 39 shark species belonging to 12 families were found in the Gulf of Thailand and 37 species were found in the Andaman Sea. They were mainly found in Ranong (33 species) and Phuket (16 species) whereas the smallest

number of species were found in Samutprakan Province (3 species). There were 3 shark species commonly found in all areas, i.e. two bamboo sharks (*Chiloscyllium punctatum* and *C. griseum*) and a Spottail shark (*Carcharhinus sorrah*). In addition, three new sharks were recorded the first time, i.e. Indonesian wobbegong (*Orectolobus leptolineatus*), Finback catshark (*Proscyllium magnificum*) and Ganges shark (*Glyphis* sp.) (Marine Fisheries Research and Development Bureau, 2014). For rays, a total of 16 species out of 41 species of 10 families were found in the Gulf of Thailand and 40 species in the Andaman Sea (Krajangdara *et al.*, 2014). Rays were found mainly in Ranong and Phuket, and the smallest number in Chumphon Province (35, 16 and 5 species, respectively). Rays under Family Dasyatidae were recorded in all areas, i.e. Sharpnose ray (*Dasyatis zugei*), Whitespotted whipray (*Himantura gerrardi*), Scaly whipray (*H. imbricata*), Dwarf whipray (*H. walga*) and Bluespotted maskray (*Neotrygon kuhlii*). In addition, nine newly recorded ray species were found, i.e. Broadnose wedgefish (*Rhynchobatus springeri*), Thailand pointed guitarfish (*Glaucostegus* cf. *granulatus*), Widenose guitarfish (*Rhinobatos obtusus*), Spotted guitarfish (*R. punctifer*), Pink whipray (*Himantura fai*), Black-spotted whipray (*H. toshi*), Round whip ray (*H. pastinacoides*), Speckled maskray (*Neotrygon* cf. *picta*) and Broad cowtail ray (*Pastinachus atrus*) (Krajangdara, 2014b). Under the list of sharks of Thailand and adjacent waters in 2017, There were a total of 160 including 76 shark species belonging to 21 families, 82 ray species of 16 families and 2 rat fish or chimera species of 1 family (Krajangdara, 2017). Scientific names of rays had been modified according to Last *et al.* (2016). Moreover, Krajangdara *et al.* (2019) updated new list of sharks in 2019, including a total of 183 species (86 shark species of 23 families, 92 ray species of 19 families and 5 chimera species of 2 families, see Figure 1, 2 and Appendix 1). This survey, it indicated that sharks are more abundant along the coastal area of Ranong Province than the other areas.

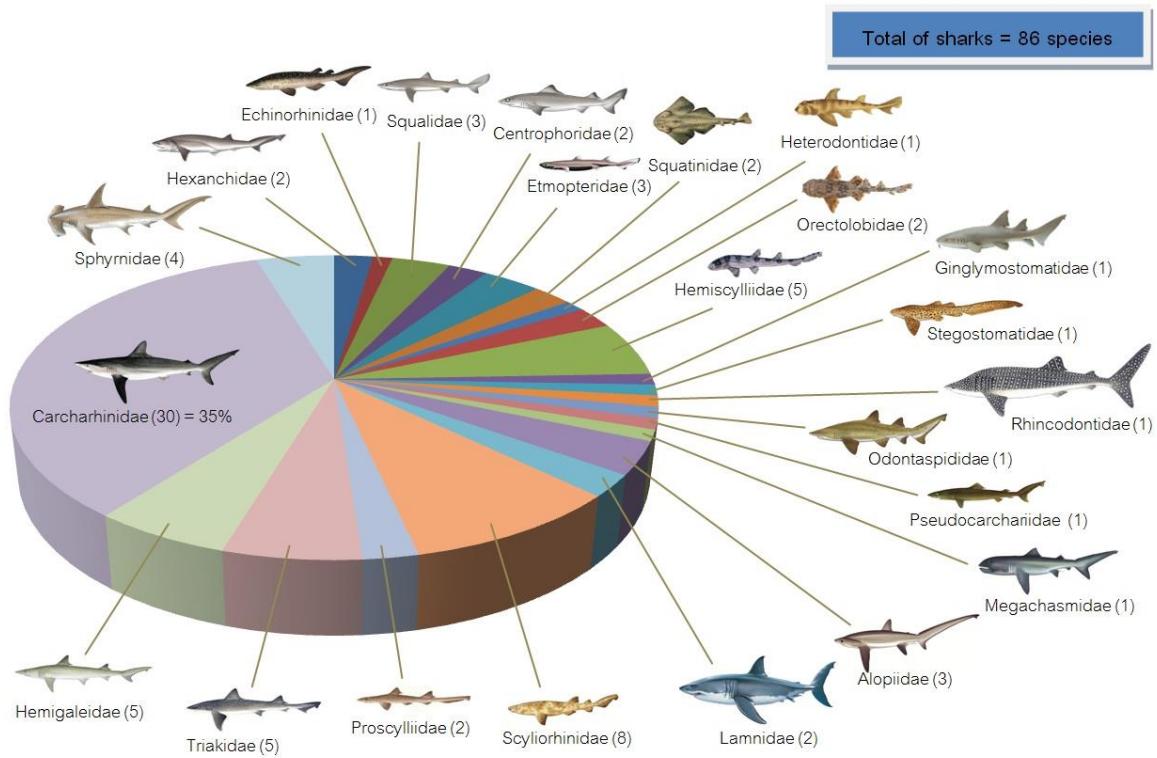


Figure 1 Sharks of Thailand and adjacent waters (Krajangdara *et al.* 2019)

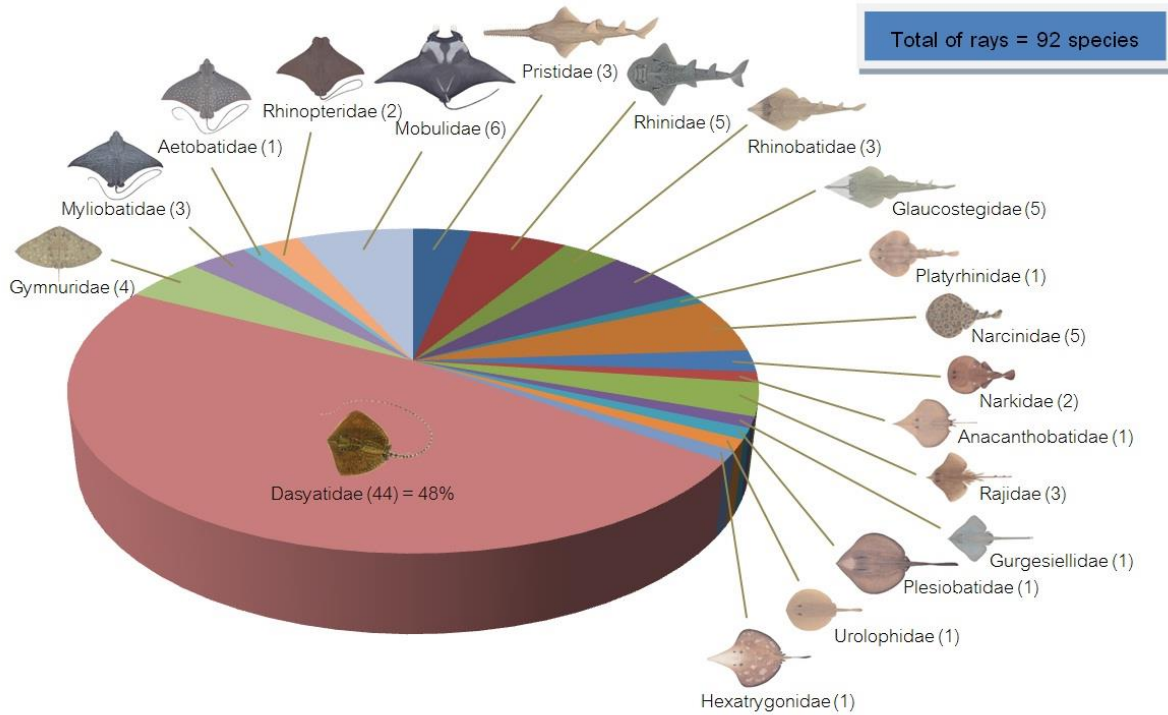


Figure 2 Rays of Thailand and adjacent waters (Krajangdara *et al.* 2019)

3.2 Fishing gears affect to sharks resources

DoF is the main agency responsible for fishery resource management. The Royal Ordinance on Fisheries, B.E. 2558 and its amendment in B.E. 2560 have been enforced by

prescribing all commercial fishing vessels who engage in commercial fishing shall obtain a commercial fishing license, that determine their respective coastal sea areas. The number of licensed commercial fishing vessels during 2016-2017 was 10,990 that were classified by fishing gear types as shown in Table 1.

Table 1 Number of commercial fishing vessels with fishing license issued during 2016-2017 classified by fishing gear types and fishing areas

Fishing gears	Gulf of Thailand	Andaman Sea	Total
Trawls	3,053	687	3,740
Otter board trawl (Fishes)	969	436	1,405
Otter board trawl (Shrimps)	691	38	729
Pair trawl	946	192	1,138
Beam trawl	447	21	468
Surrounding nets	895	316	1,211
Thai purse seine	629	266	895
Anchovy surrounding net	192	46	238
Neritic tuna purse seine	74	4	78
Encircling gill net	22	-	22
Encircling gill net	22	-	22
Gill and Entangling nets	782	10	792
Crab/Shrimp/Cuttlefish	213	-	213
Entangling nets			
Fish gill net	569	10	579
Lift nets	40	-	40
Anchovy lift net	16	-	16
Pomfret lift net	24	-	24
Cast/Falling nets	1,752	218	1,970
Anchovy cast/falling net	478	134	612
Squid cast/falling net	1,274	84	1,358
Push Net	140	-	140
Acetes push net	140	-	140
Traps	782	104	886
Fish trap	122	16	138
Crab trap	360	24	384
Octopus trap	208	-	208
Cuttlefish trap	92	64	156

Dredges	102	31	133
Baby clam dredge	68	-	68
Cockle dredge	14	-	14
Other dredges	20	-	20
Red frog crab dredge	-	31	31
Lines	79	17	96
Long line ≥ 100 m.	57	15	72
Hand line	22	2	24
Light luring vessels	1,316	644	1,960
Light luring vessels	1,316	664	1,960
Total vessels	8,963	2,027	10,990

Source: Fleet Control and Marine Fisheries Control Group, Fishing and Fleets Management Division (2016)

Remark: Commercial fishing vessel is fishing vessel ≥ 10 gross tonnage

According to national fisheries statistics of Thailand during 2002-2014, sharks catch from Thai waters was approximately 0.72% of the total catches, indicating very small proportion as compared to the total fish catches. Over 85% of sharks were caught by otter board trawl, which was the highest percentage of sharks caught in Thai marine fisheries, followed 11.33% from pair trawl and 3.50% from other fishing gears, such as longline, purse seine, Indo-Pacific mackerel gillnet, mackerel gillnet, etc. (Figure 3)

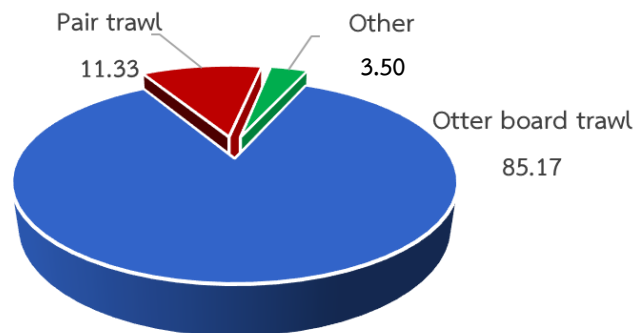


Figure 3 Percentage of sharks catch in Thai waters classified by fishing gears during 2002-2014

The analysis of sharks (shark and ray) catches from the Gulf of Thailand revealed that 83.65% of sharks were caught by otter board trawl, 12.63% from pair trawl and 3.72% from other fishing gears (Figure 4A). After classifying into groups, it was found that 83.75% of shark group was caught by otter board trawl, 12.75% from pair trawl and 3.50% from other fishing gears. For ray group, 83.59% was caught by otter board trawl, 12.54% from pair trawl and 3.87% from other fishing gears (Figure 4B).

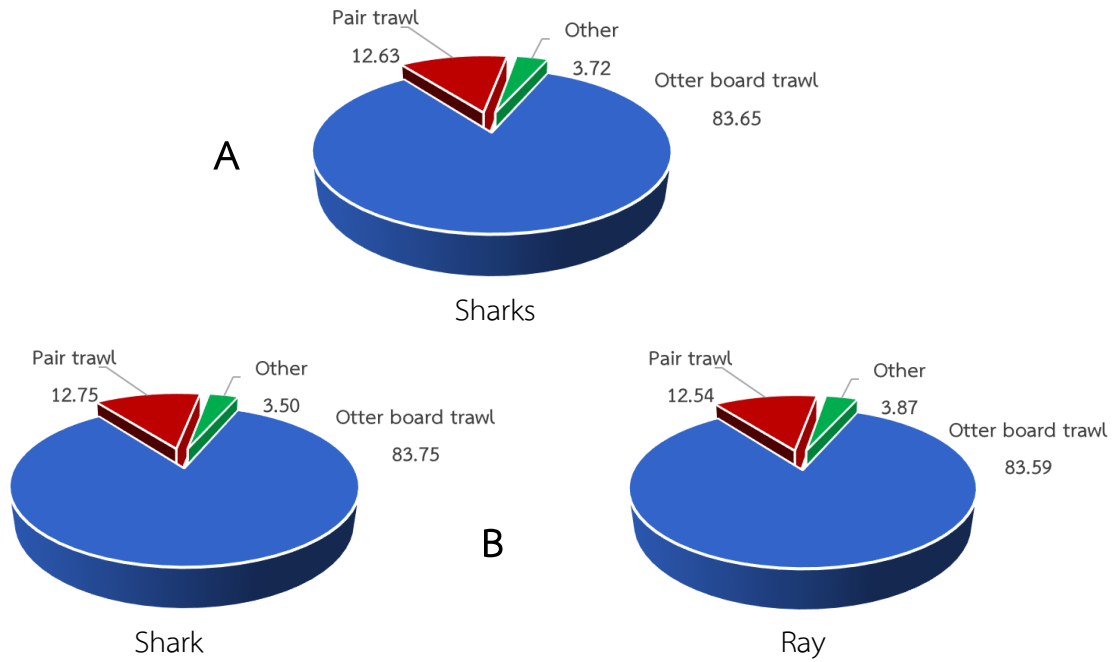


Figure 4 Percentage of sharks catch in the Gulf of Thailand by fishing gears during 2002-2014

The analysis of sharks catches from the Andaman Sea revealed that 87.61% of sharks were caught by otter board trawl, 9.26% from pair trawl and 3.13% from other fishing gears (Figure 5A). After classifying into groups, it was found that 88.94% of shark group was caught by otter board trawl, 9.63% from pair trawl and 1.43% from other fishing gears. For ray group, 86.75% was caught by otter board trawl, 9.02% from pair trawl and 4.23% from other fishing gears (Figure 5B).

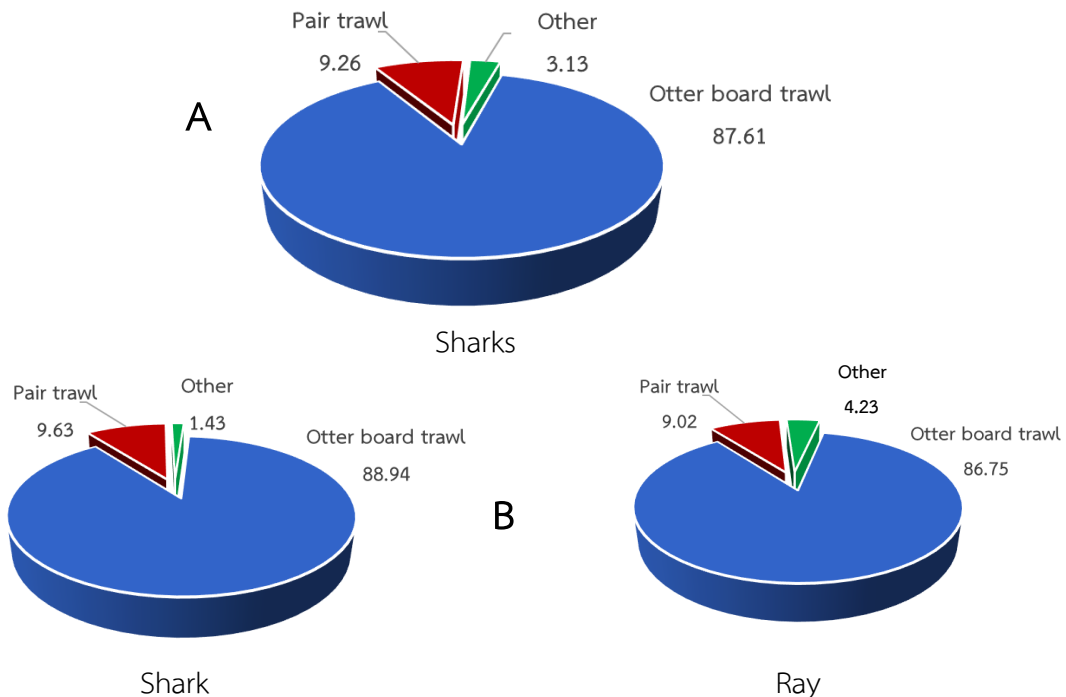


Figure 5 Percentage of sharks catch in the Andaman Sea by fishing gears during 2002-2014

Fishing grounds of otter board trawlers in the Gulf of Thailand are located from 10 to 45 meters along to the coastal line. Fishing ground in the eastern Gulf of Thailand are from Trat Province to Chonburi Province, and around Cha-am district of Phetchaburi Province in the upper Gulf of Thailand. In the central Gulf of Thailand, fishing grounds of otter board trawlers are located from Hua Hin district in Prachuap Khiri Khan Province to Lang Suan district in Chumphon Province, and expanding to Samui island and Phangan island in Surat Thani Province. In the lower Gulf of Thailand, fishing grounds of otter board trawlers are located from Khanom District in Nakhon Si Thammarat Province to Thepha District in Songkhla Province, and expanding to Pattani and Narathiwat Provinces. Intensive fishing activities are close to Thailand-Malaysia boundary for all year round. While fishing ground of otter board trawlers in the Andaman Sea scatter along the Andaman Sea coast line at water depth of 15-40 meters from Phayam island in Ranong Province, Phra Thong Island and Similan Island in Phang-Nga Province, south of Phuket Island, west of Lanta Yai island in Krabi Province, Tarutao and Adang islands in Satun Province. Generally, pair trawlers can fish all year round similar to that of otter board trawlers, its fishing ground is scatter throughout the Gulf of Thailand at water depth of 20-60 meters from islands in Trat Province to Chonburi Province, and expanding to Phetchaburi Province and Prachuap Khiri Khan Province, Mueang District to Lang Suan District in Chumphon Province, Samui island and Pha-ngan island in Surat Thani Province, expanding to Nakhon Si Thammarat, Songkhla and Pattani Provinces to border areas of Thailand-Malaysia. Fishing grounds of pair trawlers in the Andaman Sea are located along coastal line at water depth of 20-90 meters (Figure 6) (Marine Fisheries Research and Development Bureau, 2014).

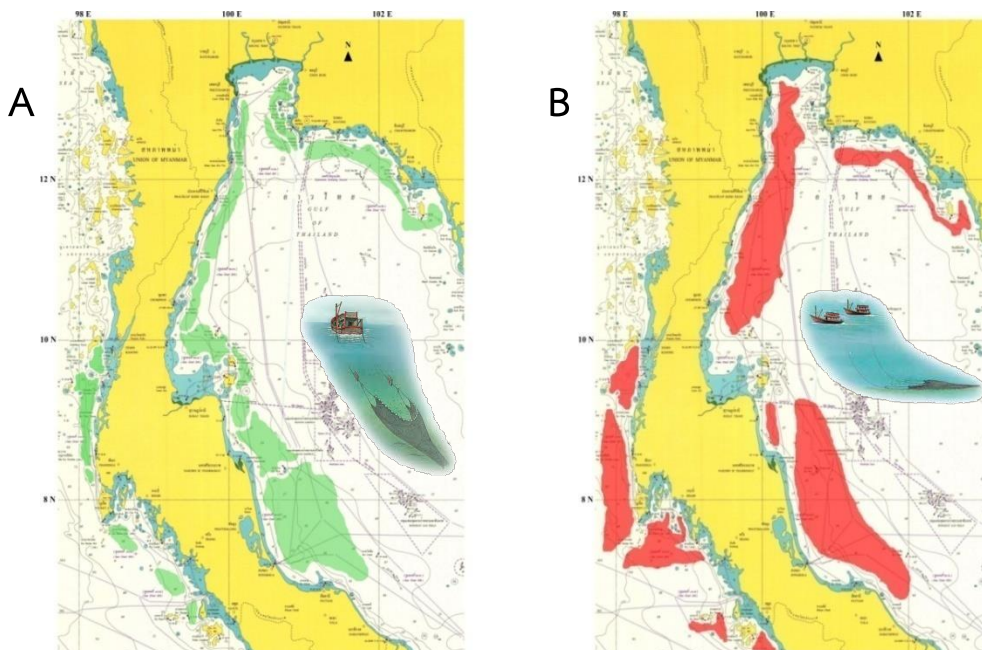


Figure 6 Fishing grounds of otter board trawlers (A) and pair trawlers (B) in Thai waters during 2011-2012

3.3 Sharks catch in Thai waters

3.3.1 Fishery statistics by sampling method survey

According to the data of sharks catches by fishing gear types during 2002-2014 (Department of Fisheries, 2004, 2005, 2006, 2008, 2009a, 2009b, 2010, 2012a, 2012b, 2013, 2014, 2015b, 2016b), which including otter board trawl, pair trawl, beam trawl, purse seine, Anchovy surrounding net, Mackerel gill net, Indo-Pacific mackerel gill net, push net, and bamboo strake trap, revealed that total catches of marine species from the Gulf of Thailand ranged between 861,143-1,719,415 metric tons/year, which included shark catches of 842-10,492 metric tons/year. The maximum shark catches were 10,492 metric tons in 2003 and continuously declined to the lowest catches of 842 metric tons in 2011 and then slightly increased from 2012-2014. Ray catches followed a similar trend. Ray catches ranged between 1,939-12,669 metric tons/year, with a maximum of 12,669 metric tons in 2003 and continuously declined to 1,939 metric tons in 2011 with slightly increased from 2012-2014 (Figure 7).

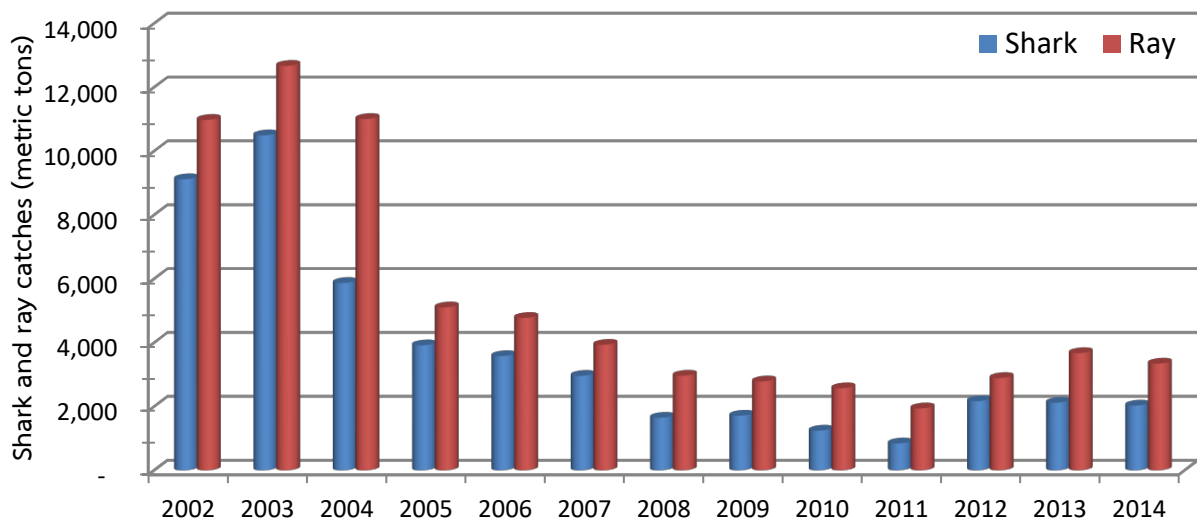


Figure 7 Production of sharks and rays from the Gulf of Thailand during 2002-2014

Source: Marine Fisheries statistics by random sampling

Regarding total catches of marine species from the Andaman Sea, it ranged from 301,884 to 801,695 metric tons/year, which included 156-4,779 metric tons/year of shark catches, while ray catches ranged from 400 to 7,748 metric tons/year. The highest shark catch was 4,779 metric tons in 2002 and it gradually decreased to 156 metric tons in 2014, while the highest ray catch was 7,748 metric tons in 2005 and it decreased the lowest of 400 metric tons in 2013. Shark and ray catches have continuously decreased in both the Andaman Sea and the Gulf of Thailand. Furthermore, this group represented relatively little of the total marine fisheries production from the Andaman Sea, in accordance with its from the Gulf of Thailand (Figure 8).

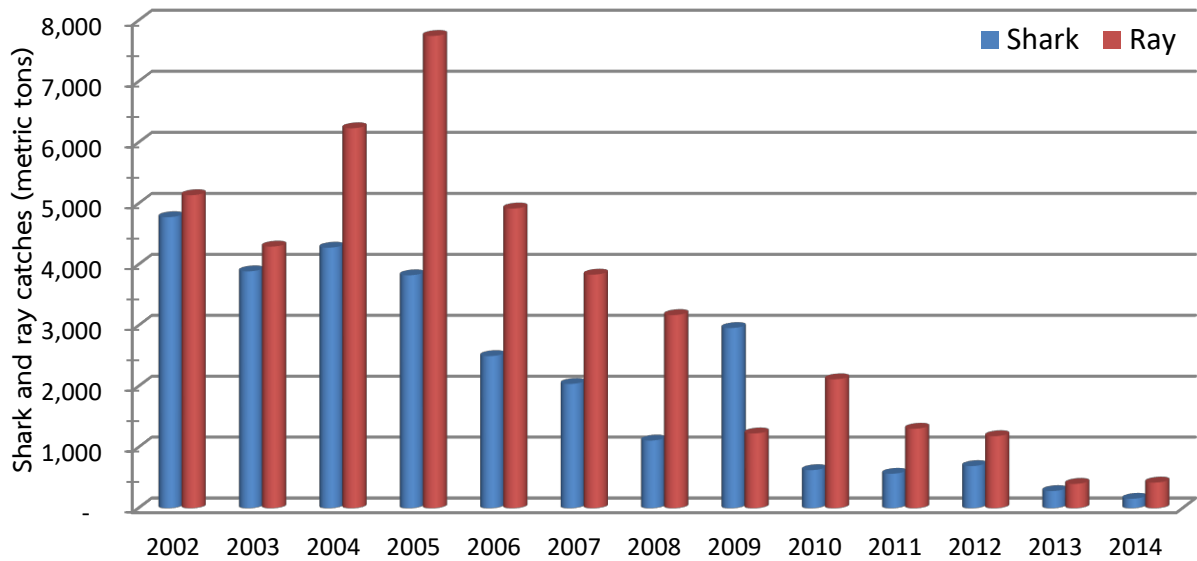


Figure 8 Production of sharks and rays from the Andaman Sea during 2002-2014

Source: Marine Fisheries statistics by random sampling

3.3.2 Resource survey by DoF

1) Fishery Research Vessel “Pramong” survey

The DoF joined a cooperative project with the Southeast Asian Fisheries Development Center (SEAFDEC) in 2004 with its objective to compile biological and fisheries data set of shark prior to the establishment of Thailand NPOA-Sharks. Since then, the biological and fisheries data were recollected in 2011 in order to identify stock status of shark in Thai waters. In the second survey, the data collection was also carried out in fishing ports and piers along sea coast of Thailand (Marine Fisheries Research and Development Bureau, 2014). The data collection on ray resources was done in 2013 under a collaboration project between DoF and FAO/BOBLME.

Marine Fisheries Research and Development Bureau (2014) reported results of the survey of sharks in Thai waters carried out by Fishery Research Vessels “Pramong” by using otter board trawl net during 2011-2012. Shark catch in the Gulf of Thailand and the Andaman Sea were 67.14 and 9.50 kg. with CPUE as 0.14 and 0.12 kg./hr, respectively. While ray catch of both areas were 33.95 and 71.63 kg. with CPUE as 0.07 and 0.87 kg./hr, respectively. In this survey, Brownbanded bambooshark (*Chiloscyllium punctatum*) was found in the Gulf of Thailand and the Andaman Sea, whereas the Zebra shark (*Stegostoma fasciatum*) was found in the Andaman Sea (Figure 9).

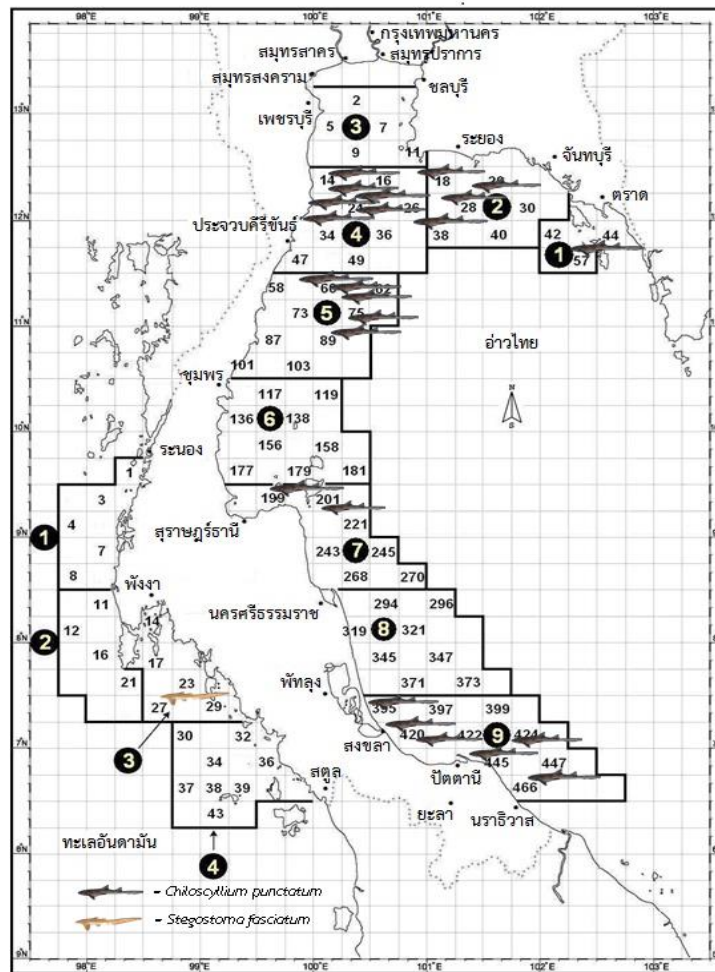


Figure 9 Survey stations during 2011-2012 illustrates shark distributions

2) Survey at fishing ports

The Marine Fisheries Research and Development Bureau (2014) reported the survey at fishing ports during 2011-2012, using catch data from otter board trawl and pair trawl in the Gulf of Thailand areas, and otter board trawl, pair trawl, purse seine and long line in the Andaman Sea areas. As a result of the Gulf of Thailand, proportions of sharks and rays catches as compared with its overall catch by otter board trawl and pair trawl were 0.07% and 0.13%, respectively (Table 2). This considers a small amount when compared to the total catch during that time period. The catch composition of economic fishes and trash fishes on average were 59.24% and 40.50%, respectively. Results also showed that productions of sharks and rays in early of 2012 were higher proportion than that of its productions in late of 2011. The highest proportion of shark catches were found in May 2012 (0.10%), followed by the production in March 2012 (0.08%). Regarding ray productions, its peak was found in March 2012 (0.23%), followed by May 2012 (0.22%). From this survey, it could be assumed that seasonality and fishing grounds influenced abundance and distribution of sharks in the Gulf of Thailand.

Table 2 Percentage of monthly catches in the Gulf of Thailand

Group	2011							2012					Average
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
Economic fishes	47.98	47.81	46.31	55.46	55.46	54.74	54.72	50.22	65.07	61.38	51.61	58.38	59.24
Trash fishes	51.92	52.05	53.57	44.40	44.57	45.13	45.10	49.57	34.72	38.31	48.17	41.30	40.56
Sharks	0.02	0.05	0.03	0.05	0.04	0.05	0.04	0.06	0.06	0.08	0.07	0.10	0.07
Rays	0.08	0.09	0.10	0.08	0.12	0.09	0.15	0.15	0.15	0.23	0.15	0.22	0.13
Total (metric tons)	3,929.2	4,485.7	6,495.0	5,579.7	6,272.8	7,140.0	4,334.7	4,083.2	4,361.3	3,208.5	2,937.4	2,848.8	3,387.7

In the Andaman Sea, sharks and rays were caught by four type of fishing gears i.e. otter board trawl, pair trawl, purse seine and long line. In that time, an average catch of sharks and rays were in 0.41% and 0.13% of the total catch, respectively (Table 3). This considers a small amount when compared to the total catch. Average catch composition of economic fishes and trash fishes were 61.28% and 38.19%, respectively. Results showed the proportions of shark catches in 2011 were higher than that of the catches in 2012. Highest proportion of shark catching were found in September 2011 (0.82%), followed by October 2011 (0.69%). It was clearly seen that highest catches of ray were found in both of April and May 2012 (0.24%), followed by January 2012 (0.17%). Monthly catches of ray in 2011 were ranged between 0.07-0.14%.

Table 3 Percentage of monthly catches in the Andaman Sea

Group	2011							2012					Average
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
Economic fishes	56.68	60.69	58.22	62.97	64.09	65.48	65.78	36.31	62.16	64.07	58.16	60.48	61.28
Trash fishes	43.00	38.90	41.22	36.14	35.15	34.01	33.72	63.08	37.47	35.68	41.32	39.02	38.19
Sharks	0.19	0.30	0.45	0.82	0.69	0.41	0.37	0.44	0.25	0.18	0.29	0.26	0.41
Rays	0.12	0.12	0.11	0.08	0.07	0.11	0.14	0.17	0.11	0.07	0.24	0.24	0.13
Total (metric tons)	2,486.0	3,724.5	3,120.2	3,886.0	4,856.9	4,120.3	3,667.8	1,162.9	2,993.1	3,084.5	3,246.2	3,530.2	39,878.6

4. Production of sharks from Thai-flags vessels overseas

Thailand is an operating long-distance fishing nation, and has offshore fisheries operating in many areas. During 2006-2007, however there were 15 out of 17 authorized fishing vessels actively operated in overseas.

According to the international procedure in high sea fisheries and the Thai Royal Ordinance in Fisheries, B.E. 2558, DoF has provided licensed observers on board fishing vessels for oversea fisheries (Department of fisheries, 2015a). Result from 15 fishing vessels operated in the Indian Ocean from July 2016 to June 2017 (11 otter board trawlers, 2 pair trawlers, 1 purse seiner with trap and 1 gill netter), sharks were found as by-catch with a total of 109.05 metric tons. Only gill netter that could not catch any sharks. By-catch of sharks by weight in otter board trawlers, pair trawlers and purse seiner averaged at 0.62, 1.09 and 0.06 metric tons/vessel or 1.17%, 1.01% and 0.86%, respectively. These catches were small proportion

when compared to their respective total catch (Table4). All of those fishing vessels have already returned to Thai waters.

Table 4 Catches of sharks by Thai fishing vessels operated in the Indian Ocean during 2016-2017

Quarter	species	Fishing Gear				Total
		otter board trawler	pair trawler	purse seiner with trap	gill netter	
		11 vessel	2 pair	1 vessel	1 vessel	
Round 1	Shark	3.55	1.73	-	-	5.29
	Angle shark (<i>Squatina</i> sp.)	0.57	-	-	-	0.57
	Ray	2.37	1.07	-	-	3.43
	Guitarfishes	0.89	0.34	-	-	1.23
	<i>Rhina ancylostoma</i>	-	0.18	-	-	0.18
Round 2 (1)	<i>Carcharhinus limbatus</i>		0.17	-	-	1.59
	<i>Carcharhinus melanopterus</i>	2.81	-	-	-	1.39
	<i>Sphyrna lewini</i>		-	-	-	-
	Shark	0.10	-	-	-	0.10
	Angle shark (<i>Squatina</i> sp.)	1.46	-	-	-	1.46
	Ray	0.35	0.30	-	-	0.65
	Guitarfishes	0.10	0.13	-	-	0.23
<i>Rhina ancylostoma</i>	0.04	-	-	-	0.04	
Round 2 (2)	<i>Carcharhinus limbatus</i>		-	-	-	10.73
	<i>Carcharhinus melanopterus</i>	10.73	5.02	-	-	5.02
	<i>Sphyrna lewini</i>		-	-	-	-
	Shark	0.30	-	-	-	0.30
	Angle shark (<i>Squatina</i> sp.)	3.44	0.70	-	-	4.15
	Ray	1.91	0.30	-	-	2.21
	Guitarfishes	0.15	0.28	-	-	0.43
<i>Rhina ancylostoma</i>	0.07	-	-	-	0.07	
Round 3	Shark	14.18	4.42	-	-	18.61
	Angle shark (<i>Squatina</i> sp.)	2.88	-	-	-	2.88
	Ray	5.26	0.36	-	-	5.62
	Guitarfishes	1.64	0.33	-	-	1.97
	<i>Rhina ancylostoma</i>	0.41	-	-	-	0.41
Round 4	Shark	22.04	10.32	0.75	-	33.12
	Angle shark (<i>Squatina</i> sp.)	0.85	-	-	-	0.85
	<i>Loxodon macrorhinus</i>	1.79	-	-	-	1.79
	Ray	3.22	0.36	0.02	-	3.60
	Guitarfishes	1.08	-	-	-	1.08
	Total of sharks (metric tons)	82.21	26.07	0.78		109.05
Total Catch (metric tons)		7,006.62	2,593.26	90.08	141.60	9,831.56
Average catch/months/vessel (metric tons)		53.08	108.05	7.51		
Average sharks/months/vessel		0.62	1.09	0.06		
Percentage of sharks/months/vessel		1.17	1.01	0.86		

Source: Oversea Fisheries and Transhipment Control Division, Department of fisheries, 2017

5. Stock assessment of shark resources in Thai waters

The assessment of shark resources in Thai waters was conducted by surplus production model method using CPUE (catch per unit effort) of sharks from otter board trawl, pair trawl, mackerel-gill net and purse seine during 2004-2014 from fisheries statistics by random sampling. Data was adjusted using the ICES method (Supongpan and Nitithamyong, 2001). Then CPUE was transformed to relative fishing effort for MSY (Maximum Sustainable Yield) calculation. Finally, the optimum catching level was calculated according to the Fox model (1970). As there is a high variation in catching data of rays in Thai waters, therefore assessment had been done only in shark groups with the following results.

5.1 Gulf of Thailand

The MSY of shark catches was 1,516 metric tons and their optimum fishing effort was $1,290 \times 10^3$ hours (Figure 10). Based on the data analysis that shark resources in the Gulf of Thailand, affected by catches and fishing effort, resulted in continuous reduction in catches to the minimum point at 468×10^3 hours in 2010. Although the fishing effort was higher in the following year, shark catch was the lowest level at 780 metric tons. This indicated that fisheries in the Gulf of Thailand has affected to shark resources, the direction trend of which was opposite to fishing effort.

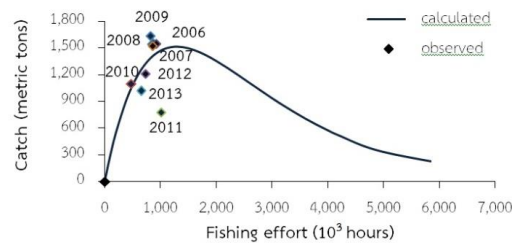


Figure 10 A shark catch curve from the Gulf of Thailand calculated by Fox model (1970)

5.2 Andaman Sea

The MSY for sharks was 347 metric tons and their optimum fishing effort was 336×10^3 hours (Figure 11). According to data analysis during 2004-2007, catch in 2004 was 970 metric tons, which was three times higher than MSY. It was observed that fishing effort decreased during 2004-2007, and shark catches declined to 110 metric tons in 2014. While fishing efforts were higher than their MSY in the following three years. As far as the catches of shark still decreased, these results could indicate that levels of shark catches in the Andaman Sea were over MSY.

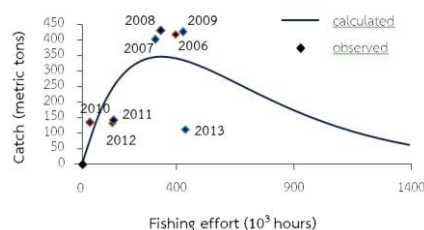


Figure 11 A shark catch curve from the Andaman Sea calculated by Fox model (1970)

6. Sharks utilization

There has been a long-time of believing that sharks meats are low quality and smell badly. Therefore, dishes from sharks were not commonly consumed whereas the consumptions were only among fishers' groups. At present where the total fish productions have been decreased, varieties of post-harvest have been developed resulting in the increased consumption of the sharks.

Shark species in Family Hemiscyllidae (bamboo sharks) and Carcharhinidae (blacktip sharks) are commonly found in local market. It was found that more than 95% of the shark was in a small size. The market price of these species at fishing ports are approximately 20-50 and 50-80 baht/kg, respectively. The price depends on freshness, size and species of sharks, that would be different in each area. The prices of smallest size (under 5 kg), small size (5-10 kg), medium size (over 10 kg) and big size shark (60-120 kg) are approximately 10-30, 30-50, 50-80 and 80-120 baht/kg, respectively. Prices of sharks (over 150 kg) will be determined through auction process by the wholesaler. However, prices of sharks in seafood markets could be 1.5-2.0 times higher than at of the prices at fishing ports (Marine Fisheries Research and Development Bureau, 2014).

Shark utilizations have normally the same pattern in many countries. There are mainly used for fresh consumption in families or restaurants. The rest of it will be processed for dried-shark fins (cutting the fins and drying under the sun), which will be used as materials for shark fins soup. The price of shark fins depends on its size of the shark, categorizing into 4 sizes, including over 80 kg, 50-80 kg, 20-50 kg and under 20 kg (150 baht/kg, 70-120 baht/kg, 50-70 baht/kg and 30-50 baht/kg, respectively). Shark meats are utilized in salty fish, sweetened fish and fish ball. Sharks' liver are extracted for fish liver-oil and cosmetic compound. Other parts are utilized as raw material for animal feeds. The middle size shark (1-10 kg.) may be stuffed and sold at the price of 150-2,000 baht each. Their teeth and jaws are also sold as souvenirs in seaside tourist areas, e.g. Phuket, Ranong and Chonburi Province, at the price of 20-1,000 baht for teeth and 150-3,000 baht for jaws (Marine Fisheries Research and Development Bureau, 2014).

Ray species in Family Dasyatidae and Myliobatidae are also commonly found in local market. Utilizations of rays (Krajangdara, *et al.*, 2014) are as follows:

1. Consumption in dried and salted fish. Most of these rays are small size, such as *Himantura imbricata*, *H. walga*, *Dasyatis zugei*, *D. akajei*, *Neotrygon kuhlii* and *Gymnura* spp., prices at the fishing port ranged from 15-65 baht/kg. Eventually, medium to large size rays were also found, such as *Dasyatis microps*, *Pastinachus* spp., *Aetobatus ocellatus* and

Rhinoptera spp., prices ranged from 20-100 baht/kg depending on the size and freshness. Especially, *Aetobatus ocellatus* and *Rhinoptera* spp. are usually grilled.

2. Processed shark fins of Whitespotted wedgefish (*Rhynchobatus australiae*) and guitarfishes (*Rhynchobatus*, *Rhinobatos* and *Glaucostegus* spp.). Rest of the bodies are salted or sent to fish meal factories at price of 10-70 baht/kg. The snout of guitarfishes are used for cooking and Chinese medicine compound as found in Ranong Province.

3. Jewelry and accessories are especially made from the thorny ridge on head of Bowmouth guitarfish or Shark ray (*Rhina ancylostoma*). Rest of the bodies are salted and sent to fish meal factories with the price of 45-110 baht/kg for body size over 25 kg and ranged from 10-40 baht/kg for size under 25 kg.

Remark: Bowmouth guitarfish and sawfishes are listed as a protected wildlife species in fish group under the Wildlife Preservation and Protection Act, B.E. 2562, therefore they can not be traded as in the past.

4. Ray leathers with thorny ridge or tubercles on the body disc, i.e. *Himantura gerradi*, *H. jenkinsii*, *Pastinachus* spp. and *H. uarnacoides*. Meats are sent to fish meal factories with price ranged from 15-100 baht/kg depending on body size. Auction is commonly used rather than selling it by weight. Rays of the bigger sizes, selling of rays such as *H. granulata* and *Taeniurops meyeri* are used in similar method but its price of whole body for these species are normally lower price.

5. Raw materials for fish meal from very small size and/or not fresh. These includes some species uncommon for consumption and utilization. Their factory prices are ranged from 5-10 baht/kg.

Sharks over 2 kg each in weight landed at the fishing ports around the Gulf of Thailand will be bought by middleman and sent to Mahachai fishing port in Samut Sakorn Province or to Mae Klong fishing port in Samut Songkhram Province. Sharks catches from the Andaman Sea landed in Phuket and Ranong Provinces will be sent to factories in Ranong Province, and subsequently sent to Mahachai market.

7. Type and volume of Trade (Export and Import) of sharks commodities

Fish Quarantine and Inspection Division of DoF has been assigned by Fish Quarantine and Inspection Centres to be responsible for setting up plans to monitor and control imports and exports of aquatic animals, particularly for sharks which have been imported and exported in various types. During 2008-2014, sharks commodities were exported and imported in forms of fresh, refrigerated, frozen, dried shark fins, smoked shark fins, shark fins in brine and ready-to-eat shark fins, etc. (Customs Department, 2014). During 2012-2014, Custom tariff requires export and import of sharks commodities including alive

and carcass of shark body in order to verify the species of sharks for the export/import. Details of the shark export/import are as follows:

7.1 Exports

7.1.1 Ground sharks (cha-lam-nu) and other sharks in fresh or chilled forms were exported to Australia, Iran, Greece, Algeria, Italy, Portugal, Spain, Singapore and Malaysia. Amounts of export ranged from 0.20-118.94 metric tons/year with value of 0.02-7.39 million baht/year. Most of these products were exported to Iran at the volume of 50.73 metric tons in 2010.

7.1.2 Dried or in brine and smoked shark fins were exported to 15 countries during 2008-2014 at the amount of 4.91-73.19 metric tons with the lowest export of 4.91 metric tons occurring in 2013. However, the export amount in 2014 increased to 73.19 metric tons. Hong Kong was the highest importer with average volume of 11.50 metric tons/year (10.56 million baht/year).

7.1.3 Canned shark fins (shark fins in vacuum container) were exported to 34 countries around the world during 2008-2014. Trend of this product was increasing continuously from 271.38 metric tons with value of 32.16 million baht in 2008 to 1,350.06 metric tons with value of 117.91 million baht in 2012. Myanmar was the highest importer, followed by South Africa, USA, Cambodia and Japan. Export amount of this product was the highest as compared with other products from all sharks products.

7.1.4 Ready-to-eat shark fins were exported to 49 countries around the world with an increasing trend during 2008-2011. Export amount increased from 4,444.98 metric tons in 2008 to 6,361.72 metric tons with value of 1,086.33 million baht in 2011. In following years later, this product was decreasing continuously until 2014 to 3,269.59 metric tons (509.89 million baht). Japan was the highest importer, followed by USSR, Austria and Taiwan.

7.1.5 Ground sharks and other sharks in frozen forms had amount of export from 172.86 metric tons (9.68 million baht) in 2008 increasing to 1,014.27 metric tons (50.49 million baht) in 2009. This type of products was exported to 16 countries. China was the highest importer during 2008-2014 with average amount of 503.81 metric tons/year (25.75 million baht/year), followed by Vietnam, Italy, South Korea, Singapore and Malaysia.

7.1.6 Alive ground sharks and other sharks (Aquarium fishes, unit: individual) as reported by the Customs Department for exporting to many countries, were exported to six countries in 2012. Total amount of the export was 36,934 individuals (to China 99.68 %). In the following year, the amount of export was 109,709 individuals exporting to 29 countries

with the most highest amount to Pakistan (54,000 individuals), followed by United Arab Emirates, USA and China (24,070, 12,132, and 1,698 individuals, respectively). In 2014, the exportation of this products increased to 35 countries, totally 978,240 individuals valuing at 11.90 million baht. The highest importing country was Taiwan (373,662 individuals), followed by Pakistan, China and United Arab Emirates (240,012, 180,345, and 180,310 individuals, respectively).

7.1.7 Tan leather of ground sharks and other sharks were exported to many countries as defined by the Customs Department. Export amount to three countries in 2013 was 12,894 individuals with value of 7.21 million baht, and later decreased to 9,262 individuals in 2014 but the value was high at 8.27 million baht.

7.2 Imports

7.2.1 Ground sharks and other sharks in fresh or chilled forms were imported at 0.18 metric tons only from Argentina in 2008. Import amounts occurred again from two countries in 2012 (0.30 metric tons), and three countries in 2013 (0.05 metric tons), and five countries in 2014 (16.07 metric tons, 0.37 million baht).

7.2.2 Dried or in brine and smoked shark fins were imported from 16 countries around the world during 2008-2010 at the amount of 33.06-66.07 metric tons. And its increasing trend was found from 65.54 metric tons in 2011 to 498.46 metric tons in 2014. The highest amount was imported from Malaysia, followed with Indonesia and Hong Kong. Import amount of this product was 8.3 times higher than export products during 2008-2014, but value of the import was only 1.3 times higher than the export. This showed that Thailand exported processed sharks as value added products.

7.2.3 Canned shark fins, Thailand had a few import amounts of this product from one to three countries each year. It was mainly imported from China in 2008, amounting 1.20 metric tons (019 million baht), and totally 2.58 metric tons in 2009 (1.68 and 0.90 metric tons from China and Japan, respectively). This increased more than two times. In the following year, the import amount was slightly lower. The import was higher in 2011, amounting 2.88 metric tons, from China and Canada. In 2014, the import was increased to 5.02 metric tons which all were only from China.

7.2.4 Ready-to-eat shark fins were imported from 11 countries in 2008, amounting 24.44 metric tons, and a high amount of 20.32 metric tons from South Korea. In 2010, importation was only from Japan with a decreasing amount to 2.06 metric tons. Import amounts increased slightly in 2011 and 2012 (24.40 and 26.52 metric tons, respectively). The countries that continually export these products to Thailand are South Korea and Japan.

7.2.5 Ground sharks and other sharks in frozen forms were imported from 20 countries around the world. Its trend of importation was fluctuated. Import amounts in 2008 2010, 2011, 2012, 2013, and 2014 were 217.64, 614.49, 889.42, 69.50, 345.11 and 400.98 metric tons, respectively. These products were mainly imported from Indonesia, China and Taiwan.

7.2.6 Alive ground sharks and other sharks (Aquarium fishes) were imported from Singapore (16 individuals) and Brazil (4 individuals) in 2012. There increased to 779 individuals importing from four countries and 3,991 individuals importing from nine countries in 2013 and 2014, respectively. Major exporting countries to Thailand included Brazil, Myanmar and Malaysia (1,826, 1,000 and 605 individuals, respectively). All of these sharks were imported only for aquarium purpose.

8. Law and measures related to sharks management

Although sharks are not targeted by fisheries of Thailand, by-catch of sharks occurred due to multi-type of fishing gears and methods. According to fisheries statistics, the catch amount of sharks has been continuously declining, and sharks extinction is therefore a concern. DoF and relevant agencies have established several measures to control fisheries and utilization of sharks resources by putting laws (and other relevant laws) and enforcement by competent authorities. Furthermore, international organizations have given priority to safeguard and establish several measures to conserve sharks resources for their sustainable use.

8.1 Law and measures related to sharks management in Thailand

Thailand has enforced a number of laws, which either directly or indirectly affect fisheries resource management and conservation with the objective of sustainable utilization of aquatic animal resources, including sharks resources. These concerned laws (Appendix 2) are as follows:

8.1.1 The Royal Ordinance on Fisheries, B.E. 2558 (Fisheries Act, B.E. 2558) and its amendment in B.E. 2560: DoF applied this Act from a principle law for all fisheries resources management (Fisheries Act B.E. 2490) until 2015, that was amended and revised to be Fisheries Act B.E. 2558. It complies with principles of international fisheries resources management and changing of fisheries situation in order to monitor, control and surveillance of Thai flagged fishing vessel activities in Thai waters and overseas. This aims to prevent IUU fishing and manage fisheries resources in accordance with maximum sustainable yield (Department of Fisheries, 2015a) by establishing guidelines for the conservation and management of fishery and aquatic animal resources in Thai waters for its sustainably utilization. With regard to conservation

of sharks, Ministry of Agriculture and Cooperatives notified “definitions for marine mammals and endangered or nearly extinction species that are prohibited to fish or bring up onboard fishing vessels” dated 7 April 2016. Under Article 66 of this Act, only Whale shark (*Rhincodon typus*) was listed as number 4 in the Annex of this notification. In addition, DoF, as a competent authority to sustain marine resources, developed Marine Fisheries Management Plan of Thailand 2009–2018, National Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (NPOA-IUU), 2015–2019, and the Fisheries Management Plan (FMP) 2015-2019.

8.1.2 The Wildlife Preservation and Protection Act, B.E. 2562: Whale shark, declared as preserved wildlife species in the fish group, and 12 ray species including 6 devilrays (Mobulidae; *Manta* and *Mobula* spp.), 4 sawfishes (Pristidae: *Anoxypristis cuspidata* and *Pristis* spp.), Bowmouth guitarfish (*Rhina ancylostoma*) and Giant freshwater stingray (*Urogymnus chaophraya* or original name is *Himantura chaophraya*) declared as protected wildlife species in the fish group.

8.1.3 National Park Act, B.E. 2504

8.1.4 Act on Ancient Monuments, Antiques, Objects of Art and National Museums, B.E. 2504

8.1.5 The Enhancement and Conservation of National Environmental Quality Act, B.E. 2535

8.1.6 Act on the Promotion of Marine and Coastal Resources Management, B.E. 2558

8.2 International obligations regarding conservation and management of sharks

Legal international fisheries obligations and instruments on conservation and management of sharks resources that Thailand shall comply or amend national legislation to be relevant (Appendix 3), are as follows:

8.2.1 The United Nations Convention on the Law of the Sea, 1982

8.2.2 Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea dated 10 December 1982

8.2.3 Port State Measures Agreement (PSMA)

8.2.4 Agreement to Promote Compliance with International Conservation and Management Measures for Fishing Vessels Operating in High Seas and Agreement on Definition of Flag State Responsibility on Fishing Vessels Operating in High Seas

8.2.5 Regional Fisheries Management Organization (RFMOs)

Thailand has been a party of several RFMOs, including IOTC and SIOFA, as well as a cooperating non-member of WCPFC. Additionally, Thailand has adopted other relevant non-legal international instruments, which require Thailand to apply accordingly. Such instruments are as follows:

1. The Code of Conduct for Responsible Fisheries (CCRF)
2. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
3. The Convention on Biological Diversity (CBD)
4. The Convention on the Conservation of Migratory Species of Wild Animals (CMS)
5. International Union for Conservation of Nature and Natural Resources (IUCN): this international organization has a mission to conserve biodiversity
6. Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat
7. Man and Biosphere Programme of United Nations Educational, Scientific and Cultural Organization (UNESCO) that certifies Ranong Biosphere Reserve covering 303 square kilometers (Mangrove Forest Research Center (Ranong), 2012)
8. ASEAN Declaration on Heritage Parks

9. Status of sharks

Many species of sharks worldwide are in crisis and tend to become extinct or endangered since they have been threatened by multi fishing gears, both unwanted or by-catch species, and being targeted species of some fisher groups.

9.1 Status of sharks according to IUCN Red List

IUCN defines status of animals called IUCN Red List, categorization of species that have still not extinct into seven status, namely critically endangered (CR), endangered (EN), vulnerable (VU), near threatened (NT), least concern (LC), data deficient (DD), and not evaluated (NE). Among all, the first three groups (CR, EN and VU) are called as threatened species considering most significant in terms of risk of extinction. IUCN (2017) conduct survey and assessment on status of sharks in waters worldwide. It was found that there are 11 shark and 14 ray species are CR species, 15 shark and 28 ray species are EN species, and 48 shark and 65 ray species are VU species (Table 5).

Table 5 Status of sharks according to IUCN Red List in 2017

Status	Shark	Ray	Chimaera
CR	11	14	0
EN	15	28	0
VU	48	65	0
NT	67	62	3
LC	115	114	12
DD	209	256	22
Total	465	539	37

Source: IUCN (2017). <https://cmsdata.iucn.org/downloads/factsheetspdf>, 1 June 2017

9.2 Sharks species listed under CITES Appendices

Presently, marine resources, including sharks, have been diversely utilized, both in terms of methods and species utilization. Demand for such resources has been increasing due to the growing global population. Therefore, protection of aquatic animals from extinction, maintaining biodiversity, and sustainably using aquatic animals from nature, have been given as a priority by a number of countries worldwide. Listing aquatic animals under CITES Appendices is used as a way to conserve aquatic animal resources. According to the result of the 17th meeting of the Conference of the Parties to the CITES (CITES CoP17) held in South Africa in September 2016, there was a number of shark and ray species proposed to be listed under CITES Appendix II, including Silky shark (*Carcharhinus falciformis*), three species of thresher sharks (*Alopias* spp.) and devilrays (*Mobula* spp.). These species are rare and only recorded as oceanic species with very little amount of catch in Thailand. All sharks species listed under CITES Appendices from 2000 -2017 are presented in Table 6 (CITES, 2017).

Regarding to CITES-CoP18 at Geneva, Switzerland in August 2019, proposals to list mako sharks (*Isurus* spp.), Bowmouth guitarfish (*Rhina ancylostoma*), wedgefishes (*Rhynchobatus* spp.) and guitarfishes (*Rhinobatos* and *Glaucostegus* spp.) was made for consideration. As a result, the approval was made for listing these species under CITES Appendix II (Krajangdara *et al.*2019)

Table 6 Sharks species listed under CITES Appendices from 2000-2017

CLASS ELASMOBRANCHII (SHARKS)	Appendices I	Appendices II	Appendices III
CARCHARHINIFORMES			
Carcharhinidae : Requiem sharks		<i>Carcharhinus falciformis</i> (entry into effect delayed by 12 months, i.e. until 4 October 2017)	
		<i>Carcharhinus longimanus</i>	
Sphyrnidae : Hammerhead sharks		<i>Sphyrna lewini</i>	
		<i>Sphyrna mokarran</i>	
		<i>Sphyrna zygaena</i>	
LAMNIFORMES			
Alopiidae : Thresher sharks		<i>Alopias</i> spp. (entry into effect delayed by 12 months, i.e. until 4 October 2017)	
Cetorhinidae : Basking sharks		<i>Cetorhinus maximus</i>	
Lamnidae : Mackerel sharks		<i>Carcharodon carcharias</i>	
		<i>Lamna nasus</i>	
MYLIOBATIFORMES			
Myliobatidae : Eagle and mobulid rays		<i>Manta</i> spp.	
		<i>Mobula</i> spp.	
Potamotrygonidae : Freshwater stingrays			<i>Paratrygon aiereba</i> (Colombia)
			<i>Potamotrygon</i> spp. (population of Brazil) (Brazil)
			<i>Potamotrygon constellata</i> (Colombia)
			<i>Potamotrygon magdalenae</i> (Colombia)
			<i>Potamotrygon motoro</i> (Colombia)
			<i>Potamotrygon orbignyi</i> (Colombia)
			<i>Potamotrygon schroederi</i> (Colombia)
			<i>Potamotrygon scobina</i> (Colombia)
<i>Potamotrygon yepesi</i> (Colombia)			
ORECTOLOBIFORMES			
Rhincodontidae : Whale sharks		<i>Rhincodon typus</i>	
PRISTIFORMES			
Pristidae : Sawfishes	<i>Pristidae</i> spp.		

Source: CITES (2017). <https://www.cites.org/eng/app/appendices.php>, 15 June 2017

9.3 Status of sharks in Thai waters

9.3.1 Status of sharks in Thai waters according to IUCN Red List

According to the IUCN Red List of threatened species in 2019 (Krajangdara *et al.*, 2019), many species of sharks in Thai waters are categorized in this groups (i.e., CR, EN, VU), including 25 shark and 41 ray species in Thai waters. Among them, 11 ray species are considered as CR, i.e. 2 sawfishes (*Pristis* spp.). which have not been found in Thai waters for a long time, 8 guitarfishes and Java stingaree (*Urolophus javanicus*), its appearance was reported once only in 1982 in the Andaman Sea. Under the groups of EN, there are totally 17 species, namely Whale shark (*Rhincodon typus*), Zebra shark (*Stegostoma fasciatum*), 2 mako sharks (*Isurus* spp.), Whitecheek shark (*Carcharhinus dussumieri*), Winghead shark (*Eusphyra blochii*), 2 hammerhead sharks (*Sphyrna lewini* and *S. mokarran*), Narrow sawfish

(*Anoxypristis cuspidata*), 6 species in Dasyatidae, namely Roughback whipray (*Fluvitrygon kittipongi*), Marbled whipray (*F. oxyrhynchus*), White-edge whipray (*F. signifer*), Mekong stingray (*Hemistrygon laosensis*), Roughnose cowtail ray (*Pastinachus solocirostris*), Giant freshwater stingray (*Urogymnus chaophraya* or *Himantura chaophraya*) and 2 eagle rays (*Aetomylaeus maculatus* and *A. vesperilio*). Regarding the groups of VU, there are totally 17 and 21 species of sharks and rays, respectively (Table 7).

Table 7 Vulnerable species of sharks in Thai waters based on IUCN Red List in 2019

Sharks			Rays		
Thai name	English name	Scientific name	Thai name	English name	Scientific name
chalam nang fa	Ocellated angelsharks	<i>Squatina turgocellatoides</i> Chen, 1963	kraben fai fa chut nam tan	Shorttip numbfish	<i>Narcine brevirostris</i> Bessednov, 1966
chalam sai	Sandtiger shark	<i>Carcharias taurus</i> Rafinesque, 1810	kraben fai fa lang riap	Finless sleeper ray	<i>Temera hardwickii</i> Grey, 1831
chalam hang yao	Pelagic thresher	<i>Alpias pelagicus</i> Nakamura, 1935	kraben phisuea hang lai	Zonetail butterfly ray	<i>Gymnura zonura</i> (Bleeker, 1852)
chalam hang yao na nu	Bigeye thresher	<i>A. superciliosus</i> (Lowe, 1841)	kraben pak mae nam	Estuary stingray	<i>Hemistrygon fluviorum</i> (Ogilby, 1908)
chalam hang yao	Thresher shark	<i>A. vulpinus</i> (Bonnaterre, 1788)	kraben lai suea dao	Leopard whipray	<i>Himantura leoparda</i> Manjaji - Matsumoto & Last, 2008
chalam khi sao	Tawny nurse shark	<i>Nebrius ferrugineus</i> (Lesson, 1831)	kraben lai suea lek	Coach whipray	<i>H. uarnak</i> (Gmelin, 1789)
chalam nu	Hooktooth shark	<i>Chaenogaleus macrostoma</i> (Bleeker, 1852)	kraben lai suea yai	Honeycomb whipray	<i>H. undulata</i> (Bleeker, 1852)
chalam nu	Sicklefin weasel shark	<i>Hemigaleus microstoma</i> Bleeker, 1852	kraben malaeng wan	Whitespotted whipray	<i>Maculabatis gerrardi</i> (Gray, 1851)
chalam nu	Snaggletooth shark	<i>Hemipristis elongata</i> (Klunzinger, 1871)	kraben bua	Round whipray	<i>M. pastinacoides</i> (Bleeker, 1852)
chalam hu khao	Silvertip shark	<i>Carcharhinus albimarginatus</i> (Rüppell, 1837)	kraben lai dok mai	Pink whipray	<i>Pateobatis fai</i> (Jordan & Seale, 1906)
chalam thao	Silky shark	<i>C. falcoformis</i> (Müller & Henle, 1839)	kraben thong hang nam	Jenkin's whipray	<i>P. jenkinsii</i> (Annandale, 1909)
chalam khrip yao	Oceanic whitetip shark	<i>C. longimatus</i> (Poey, 1861)	kraben chamuk khao	Whitenose whipray	<i>P. uarnacoides</i> (Bleeker, 1852)
chalam thao	Dusky shark	<i>C. obscurus</i> (LeSueur, 1818)	kraben tok kra	Blotched stingray	<i>Taeniuraps meyeri</i> (Müller & Henle, 1841)
chalam kradong sung	Sandbar shark	<i>C. plumbeus</i> (Nardo, 1827)	kraben bai khanun	Porcupine whipray	<i>Urogymnus asperrimus</i> (Bloch & Schneider, 1801)
chalam nu	Indonesian whaler shark	<i>C. tjtjot</i> (Bleeker, 1852)	kraben chut khao	Mangrove whipray	<i>U. granulatus</i> (Macleay, 1883)
chalam khrip khong	Sharptooth lemon shark	<i>Negaprion acutidens</i> (Rüppell, 1837)	kraben nok bang	Banded eagle ray	<i>Aetomylaeus nichofii</i> (Bloch & Schneider, 1801)
chalam hua khon san	Smooth hammerhead	<i>Sphyrna zygaena</i> (Linnaeus, 1758)	kraben nok	Spotted eagle ray	<i>Aetobatus ocellatus</i> (Kuhl, 1823)
			kraben chamuk wua	Javan cownose ray	<i>Rhinoptera javanica</i> Müller & Henle, 1841
			kraben rahu naeo pakaram	Reef manta ray	<i>Mobula alfredi</i> (Kieff, 1868)
			kraben rahu yak	Giant manta ray	<i>M. birostris</i> (Walbaum, 1792)
			kraben rahu khrip laem	Chilean devilray	<i>M. tarapacana</i> (Philippi, 1892)

9.3.2 Status of sharks species listed under CITES Appendices in Thailand

According to the meeting results of CITES CoP18 (Krajangdara *et al.*, 2019), 33 species of sharks found in Thai waters are listed under CITES Appendices, including 11 shark species namely Whale shark, Silky shark, Oceanic whitetip shark, 3 hammerhead sharks (*Sphyrna* spp.), 3 thresher sharks, 2 mako sharks (Figure 12), and 19 ray species namely 6 devilrays (Mobulidae), 13 guitarfishes (Rhinidae, Rhinobatidae and Glaucostegidae) under CITES Appendix II, while 3 sawfishes (Pristidae) under CITES Appendix I (Figure 13).

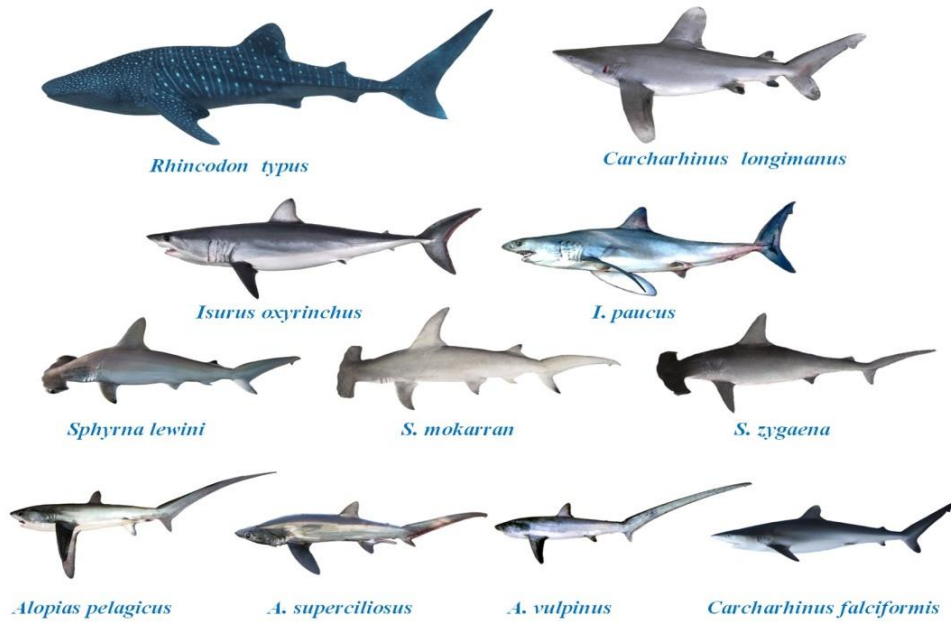


Figure 12 Sharks of Thailand listed under CITES Appendix II



Figure 13 Rays of Thailand listed under CITES Appendix I and II

9.3.3 Status of sharks in Thailand with Legal Implications

Currently, only Whale shark is legally protected by the Notification of the Ministry of Agriculture and Cooperatives on definitions of marine mammals and endangered species prohibited for fishing or taking onboard fishing vessels issued on 7 April 2016 and as preserved wildlife species in fish group under the Wildlife Preservation and Protection Act, B.E. 2562. It includes 12 ray species listed as protected wildlife species in the fish group, i.e. 6 devilrays (Mobulidae), 4 sawfishes (Pristidae), Bowmouth guitarfish and giant freshwater stingray (Krajangdara *et al.*, 2019).

DMCR categorizes endangered marine species into three groups, namely 1) marine endangered species defined under a framework of DMCR, 2) marine threatened species listed under Office of Natural Resources and Environmental Policy and Planning (ONEP) and international organizations, 3) marine endemic species as the first record of the world. Objectives of these actions with regard to sharks are as follows:

1) Preserved and protected wildlife species in fish group under the Wildlife Preservation and Protection Act, B.E. 2562, i.e. Whale shark, sawfishes, Bowmouth guitarfish, Giant freshwater stingray and devilrays.

2) Species to be proposed as protected wildlife species in fish group under the Wildlife Preservation and Protection Act, B.E. 2562, i.e. hammerhead sharks, Zebra shark, and other sharks.

3) Species with the first record of the world, i.e. Magnificent catshark

10. Management and conservation of sharks in Thailand

Thai marine fisheries have continuously developed, particularly fishing gears and methods have developed over time. Various fishing gears have been used in the same areas. According to marine stock assessment in Thai waters, it was found that several species have been already overcapacity (overfishing). Moreover, problem also included illegal fishing in prohibited areas. These issues cause complexity and difficulties in managing marine resources of Thailand whereby the concern is not only the sustainable use but also the compliance with international laws and regulations, such as the Charter of the United Nations, CCRF, CBD, the United Nations Agreement Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, international trades related to CITES, sea turtle conservation and sharks resources management. Therefore, Thailand shall carry out the following activities:

10.1 Scientific research

10.1.1 Taxonomy study and establishment of gene bank of sharks because DoF is responsible for issuing an export certificate for aquatic animals. However, most of exported sharks are mainly in processed products in forms of meat, fins, skin or others. These products are difficult to identify at species level of the raw materials. Thus, it is necessary to have a direction for implementation, for example, species identification method using DNA barcoding and establishment of sharks gene bank which will be used as a database for verifying and comparing the genetic code.

10.1.2 Study on biology and stock assessment of sharks for sustainable utilization

10.1.3 Sharks aquaculture for conservation or aquarium promotion

10.1.4 Explore of population and distribution areas of sharks from coastal areas and beyond

10.2 Management of information on sharks

10.2.1 Monitor and verify information on sharks from private fishing ports and fishery research vessels of DoF annually or every 3 years

10.2.2 Record and collect information for stock assessment as follows:

1) Fish Marketing Organization to record data of sharks landed into family or species levels (if it is applicable, as a more accurate stock assessment can be conducted by using time series catch data of concerned species).

2) Develop a website with users friendly environment where divers or ordinary people who spot sharks while diving, travelling or shopping at local markets can notify/send information to information center for comprehensive data compilation.

11. Work Plan of activities under NPOA-Sharks of Thailand

Based on the context of the Fisheries Act, B.E. 2558 and its amendment in B.E. 2560 with regard to conservation of aquatic animal resources, particularly endangered species, DoF as the leading authority for drafting NPOA-Sharks in order to obtain views from stakeholders prior to submission of the result to the National Fisheries Committee.

As far as the NPOA-Sharks is still not enforced by laws, clarity on sharks resources management has therefore no concrete results. Nevertheless, DoF has carried out a number of relevant activities to support the NPOA-Sharks implementation as follows:

11.1 Compilation of scientific data of sharks from capture during 2004-2016

11.2 Monitoring and determination of status of fisheries resources on annual basis by fishery research vessels four trips per year

11.3 Organization of trainings on sharks species identification for officers of Marine Fisheries Research and Development Division who conducted field surveys in 2011, 2013 and 2015.

11.4 Development of public awareness materials related to sharks resources conservation, including posters and plastic sheets of pictures of sharks found in Thai waters which were disseminated in 2004, plastic sheet of pictures of rays found in Thai waters and adjacent waters disseminated in 2013, posters on knowledge of sharks of Thai waters listed under CITES Appendix disseminated in 2014, and a publication of Cartilaginous Fishes (Sharks,

Rays, and Chimaeras) found in Thai Waters and the Adjacent Areas disseminated in 2017, and Guidebook to Cartilaginous Fishes of Thailand and Adjacent Waters disseminated in 2019.

11.5 Organization of activities to promote shark conservation, such as nursing and releasing bamboo sharks and blacktip reef shark to nature, in cooperation with other government sectors and private agencies.

11.6 Cooperation with international organizations, i.e. FAO, CITES, IOTC, BOBLME Project, and SEAFDEC, by regularly sending officers to attend meetings on consultations and specifying guidelines of sharks conservation at the regional level

As the Fisheries Act B.E. 2558 has come into force since December 2015 and under its Articles 64, 65 and 66, DoF has carry out several activities to support the responsibilities in accordance with the laws, as well as to manage and conserve sharks resources in Thailand. In this connection, DoF has established a working group to finalize the first and final draft of the NPOA-Sharks of Thailand to comply with the IPOA-Sharks. Study on advantages and disadvantages from NPOA-Sharks of other countries will also be considered in preparatory process of the draft. Key elements of the NPOA-Sharks of Thailand preparation are as follows:

- 1) Study and develop a database for information on biology, ecology, fisheries, and utilization of sharks in Thai waters
- 2) Systematically and regularly assess status and threats on sharks caused by fisheries and environment
- 3) Develop knowledge and enhance capability related to sharks management for relevant officers
- 4) Define conservation and management measures to regulate fishing activities and trade on sharks in consistent with international rules, regulations, and obligations
- 5) Establish and strengthen a network of stakeholders' engagement for management and conservation of sharks resources

Details of activities under the five key elements of the plan of actions presented in Table 8 are as follows:

- 1) Study and develop a database of information on biology, ecology, fisheries, and utilization of sharks in Thai waters
 - Collect sharks data by recording name at family or species level, by fishery research vessels and fishing vessels who landed their catches at fishing ports
 - Explore sharks living in marine national parks, conservation areas of aquatic animals, rivers, areas of connected ecosystem and inactive concession areas of offshore drilling rig

- Study on sharks biology, ecosystem, and fisheries
 - Collect sharks samples for museums
 - Collect information of export and import sharks by recording names at family or species level
 - Study and collect DNA samples of sharks species found in Thai waters, and from their products
 - Study on sharks utilization
 - Develop a database system of sharks
- 2) Systematically and regularly assess status and threats on sharks caused by fisheries and environment
- Assess sharks stock status in Thai waters
 - Assess threats caused by fisheries and tourism
 - Study on impacts of threats from environment on sharks
- 3) Develop knowledge and enhance capability related to sharks management for relevant officers
- Train officers and staff of relevant government agencies and private sectors on sharks species identification at fishing ports
 - Train on knowledge of species identification of sharks parts or their products
 - Prepare a field guide on sharks identification
 - Organize a scientific conference on sharks
- 4) Define conservation and management measures to regulate fishing activities and trade on sharks in consistent with international rules, regulations, and obligations
- Define sharks species that will be prohibited for catching/occupancy in accordance with international obligations as ratified by Thailand
 - Define conservation measures for sharks resources, as well as conduct study on impacts from such measures
 - Develop traceability system for sharks and their products
 - Define marketing measures for sharks utilization
- 5) Establish and strengthen a network of stakeholders' engagement for management and conservation of sharks resources
- Establish a network between government agencies by using online social media
 - Establish a network between government and private sectors by using online social media

- Attend international meetings relating to sharks
- Review and update NPOA-Sharks of Thailand
- Conduct study and research on sharks breeding
- Restock sharks from breeding programs to nature
- 9 7 8 Publicize activities of sharks restocking in cooperation with relevant

agencies

- Develop public awareness materials related to sharks conservation
- Organize exhibitions on sharks conservation

Table 8 NPOA-Sharks of Thailand, a 5-year plan (2020-2024)**Objective 1:** Study and develop a database for information on biology, ecology, fisheries, and utilization of sharks in Thai waters

Activities	Time frame					Responsible agencies	Budget	Target	Index
	Phase 1			Phase 2			(million baht)		
	2020	2021	2022	2023	2024				
1. Collect sharks data by recording name at family or species level, by fishery research vessels and fishing vessels who landed their catches at fishing ports	←				→	Leading agencies: DoF Supportive agencies: FMO, SEAFDEC, Univ, NFAT, and SSFO	22.6	For sharks resources assessment	Sharks information into family or species level
2. Explore sharks living in marine national parks, conservation areas of aquatic animals, rivers, areas of connected ecosystem and inactive concession areas of offshore drilling rig	←				→	Leading agencies: DNP, DoF, DMCR Supportive agencies: PTT and Univ	15.0	To promote marine ecotourism	Sharks species information in study areas
3. Study on sharks biology, ecosystem and fisheries	←				→	Leading agencies: DoF Supportive agencies: DMCR, DNP and Univ	5.0	To define measures and assess the status of sharks resources	Technical paper on sharks
4. Collect sharks samples for museums	←				→	Leading agencies: NSM, DoF Supportive agencies: DMCR, DNP and Univ	5.0	To be references for sharks specimens	Sharks specimens collection in museums
5. Collect information of export and import sharks by recording names at family or species level	←				→	Leading agencies: DoF Supportive agencies: TCD	1.0	To assess the situation of sharks trade	Import and export sharks data into family or species level
6. Study and collect DNA samples of sharks species found in Thai waters, and from their products	←				→	Leading agencies: DoF, NSTDA Supportive agencies: DNP, DMCR, Univ and TMT	5.0	Gene bank for references of sharks species	Collection of sharks DNA barcoding samples
7. Study on sharks utilization	↔				↔	Leading agencies: DoF Supportive agencies: NFAT	0.4	To fully utilize of sharks	Report on sharks utilization
8. Develop a database system of sharks					↔	Leading agencies: DoF Supportive agencies: Univ, DMCR, DNP and NFAT	20.0	Database system on sharks	Sharks database

Objective 2: Systematically and regularly assess status and threats on sharks caused by fisheries and environment

Activities	Time frame					Responsible agencies	Budget	Target	Index
	2020	2021	2022	2023	2024		(million baht)		
1. Assess sharks stock status in Thai waters					↔	Leading agencies: SEAFDEC, DoF Supportive agencies: FMO, DMCR, Univ and ONEP	2.0	To define threatened or endangered species	Report on sharks status assessment
2. Assess threats caused by fisheries and tourism				↔		Leading agencies: DoF Supportive agencies: DMCR, DNP, TAT, ONEP, PRD, Univ and PAO	4.0	To define the causes of reduction in sharks numbers	Report of threat assessment of sharks
3. Study on impacts of threats from environment on sharks	↔					Leading agencies: DoF, DMCR Supportive agencies: PCD, DIW, ONEP, TAT, PAO, Univ and TMT	10.0	Guidelines for protection of sharks from environment impacts	Information of environmental quality in areas of sharks

Objective 3: Develop knowledge and enhance capability related to sharks management for relevant officers

Activities	Time frame					Responsible agencies	Budget (million baht)	Target	Index
	2020	2021	2022	2023	2024				
1. Train officers and staff of relevant government agencies and private sectors on sharks species identification at fishing ports		↔		↔		Leading agencies: DoF Supportive agencies: DMCR, FMO, NSM, DNP, Univ and NFAT	1.0	Training relevant offices on sharks identification	100 trained officers
2. Train on knowledge of species identification of sharks parts or their products		↔		↔		Leading agencies: DoF Supportive agencies: DMCR, FMO, NSM, DNP, Univ and NFAT	1.0	Training relevant offices on sharks part identification	100 trained officers
3. Prepare a field guide on sharks identification	↔					Leading agencies: DoF Supportive agencies: Univ	2.0	To publish field guide on sharks identification	3,000 copies of a field guide on sharks identification
4. Organize a scientific conference on sharks		←————→				Leading agencies: DoF and Univ Supportive agencies: DMCR, DNP, NSTDA and ONEP	4.0	To exchange related scientific knowledge on sharks	Organize scientific conference once a year

Objective 4: Define conservation and management measures to regulate fishing activities and trade on sharks in consistent with international rules, regulations, and obligations

Activities	Time frame					Responsible agencies	Budget	Target	Index
	2020	2021	2022	2023	2024		(million baht)		
1. Define sharks species that will be prohibited for catching/occupancy in accordance with international obligations as ratified by Thailand						Leading agencies: DoF, DMCR Supportive agencies: DNP, ONEP, FMO, PAO, NFAT and SSFO	1.0	To protect sharks species based on international obligations committed by Thailand	A number of protected sharks species
2. Define conservation measures for sharks resources, as well as conduct study on impacts from such measures						Leading agencies: DoF, DMCR Supportive agencies: DNP, ONEP and NFAT	1.0	Existence of sharks in Thai waters	Measures for sharks conservation
3. Develop traceability system for sharks and their products						Leading agencies: DoF Supportive agencies: NFAT and Univ	10.0	To be able to trace the source of sharks	Traceability system for sharks
4. Define marketing measures for sharks utilization						Leading agencies: DoF, DMCR Supportive agencies: NFAT	1.0	To reduce the use of sharks	Marketing measures

Objective 5: Establish and strengthen a network of stakeholders' engagement for management and conservation of sharks resources

Activities	Time frame					Responsible agencies	Budget (million baht)	Target	Index
	2020	2021	2022	2023	2024				
1.Establish a network between government agencies by using online social media	←	→				Leading agencies: DoF, DMCR Supportive agencies: DNP, PAO and Univ	1.0	To integrate the information access between government agencies	100 members
2.Establish a network between government and private sectors by using online social media		←	→			Leading agencies: DoF, DMCR Supportive agencies: NFAT and SSFO	2.0	To integrate the information access between government and private sectors	100 members
3.Attend international meetings relating to sharks	←	→				Leading agencies: DoF Supportive agencies: DMCR, DNP	1.0	To exchange sharks information at international level	Attend a meeting once a year
4.Review and update NPOA-Sharks of Thailand				↔		Leading agencies: DoF Supportive agencies: DMCR, DNP, SEAFDEC, NFAT and Univ	2.0	To review and update NPOA-Sharks of Thailand, Plan 1	A draft of NPOA-Sharks, Plan 2
5.Conduct study and research on sharks breeding	←	→				Leading agencies: DoF, DMCR Supportive agencies: DNP, RTN and Univ	5.0	Sharks species that can be bred in captivity	Technical paper on sharks breeding
6.Restock sharks from breeding programs to nature	←	→				Leading agencies: DoF, DMCR Supportive agencies: DNP, RTN and Univ	2.0	To increase sharks in nature	At least 50 sharks released to the nature per year

Objective 5: (Cont)

7.Publicize activities of sharks restocking in cooperation with relevant agencies						Leading agencies: DoF, DMCR Supportive agencies: DNP, PRD, RTN and Univ	2.0	To build awareness on sharks conservation	One event of releasing sharks to the nature per year	
8.Develop public awareness materials related to sharks conservation						Leading agencies: DoF, DMCR Supportive agencies: DNP and Univ	2.0	To build awareness on sharks conservation	At least three channels of public relations (Line, Facebook, Website)	
9.Organize exhibitions on sharks conservation						Leading agencies: DoF, DMCR Supportive agencies: DNP, PRD, RTN and Univ	2.0	To build awareness on sharks conservation	At least one exhibition	
							Total budget for 5 objectives 130 million baht			

List of responsible agencies:

DIW = Department of Industrial Works

DoF = Department of Fisheries

DMCR = Department of Marine and Coastal Resources

DNP = Department of National Parks, Wildlife and Plant Conservation

FMO = Fish Marketing Organization

NFAT = National Fisheries Association of Thailand

NSM = National Science Museum

NSTDA = National Science and Technology Development Agency

ONEP = Office of Natural Resources and Environmental Policy and Planning

PAO = Provincial Administrative Organization

PCD = Pollution Control Department

PRD = Government Public Relations Department

PTT = Petroleum Authority of Thailand

RTN = Royal Thai Navy

SEAFDEC = Southeast Asian Fisheries Development Center

SSFO = Small scale fisheries organization

TAT = Tourism Authority of Thailand

TCD = Thai Customs Department

TMT = Manta Trust (Thailand)

Univ = University

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Appendix

Appendix 1

Appendix table 1 Species list of cartilaginous fishes found in Thai waters and the adjacent areas in 2019

1) Subclass Elasmobranchii : sharks and rays

Order	Family	No.	Thai name	English name	Scientific name	Status	Source	IUCN Redlist
Shark 8 order , Organize the list according to Last et al., 2016 (Shark of the World)								
1) Hexanchiformes	1) Hexanchidae	1	Chalam pak jing jok	Sharpnose sevengill shark	<i>Heptanchias perlo</i> (Bonnaterre, 1788)	+	RS/FP	NT
		2	Chalam ngeak hok chong	Bigeye sixgill shark	<i>Hexanchus nakamurai</i> Teng, 1962	+	RS	DD
2) Echinorhiniformes	2) Echinorhinidae	3	Chalam nam	Bramble shark	<i>Echinorhinus brucus</i> (Bonnaterre, 1788)	-	FP	DD
3) Squaliformes	3) Squalidae	4	Chalam lang nam	Indonesian shotnout dogfish	<i>Squalus hemipinnis</i> White, Last & Yearley, 2007	+	RS/FP	NT
		5	Chalam lang nam	Shortnose spurdog	<i>S. megalops</i> (Macleay, 1881)	+	RS/FP	DD
		6	Chalam lang nam	Spiny dogfish	<i>Squalus</i> sp.	-	RS/FP	NE
	4) Centrophoridae	7	Chalam gulper	Gulper shark	<i>Centrophorus granulosus</i> (Bloch and Schneider, 1801)	+	RS	DD
		8	Chalam gulper khrip lek	Smallfin Gulper shark	<i>C. cf. maluccensis</i> Bleeker, 1860	+	RS	NE
	5) Etmopteridae	9	Chalam thong dam	Southern lanternshark	<i>Etmopterus granulosus</i> (Gunther, 1880)	+	RS	LC
		10	Chalam thong dam	Smooth lanternshark	<i>E. cf. pusillus</i> (Lowe, 1839)	+	RS	NE
		11	Chalam thong dam	Sculptured lanternshark	<i>E. Sculptus</i> Ebert , Compagno & De Vries, 2011 1839	-	RS	LC
4) Squatiniformes	6) Squatinidae	12	Chalam nang fa	Angelshark	<i>Squatina</i> sp.	-	RS	NE
		13	Chalam nang fa	Ocellated angelshark	<i>S. tergocollataoides</i> Chen, 1963	-	FP	VU
5) Heterodontiformes	7) Heterodontidae	14	Chalam na wua lai	Zebra bullhead shark	<i>Heterodontus zebra</i> (Gray, 1831)	+	RS/FP	LC
6) Lamniformes	8) Odontaspidae	15	Chalam sai	Sandtiger shark	<i>Carcharias taurus</i> Rafinesque, 1810	-	RS	VU
	9) Pseudocarchariidae	16	Chalam cho ra khe	Crocodile shark	<i>Pseudocarcharias kamoharui</i> (Matsubara, 1936)	-	RS	LC
	10) Megachasmidae	17	Chalam pak kwang	Megamouth shark	<i>Megachasma pelagios</i> Taylor, Compagno & Struhsaker,	-	RS	LC
	11) Alopiidae	18	Chalam hang yao	Pelagic thresher	<i>Alopias pelagicus</i> Nakamura, 1935	+	RS/FP	VU
		19	Chalam hang yao na nu	Bigeye thresher	<i>A. superolius</i> (Lowe, 1841)	+	RS/FP	VU
		20	Chalam hang yao	Thresher shark	<i>A. vulpinus</i> (Bonnaterre, 1788)	-	RS/FP	VU
	12) Lamnidae	21	Chalam pak ma	Shortfin mako	<i>Isurus paucus</i> Rafinesque, 1810	-	RS/FP	EN
		22	Chalam pak mom	Longfin mako	<i>I. paucus</i> Guitart, 1966	-	RS/FP	EN
7) Orectolobiformes	13) Orectolobidae	23	Chalam kob yipun	Japanese wobbegong	<i>Orectolobus cf. japonicus</i> Regan, 1906	+	FP	NE
		24	Chalam pak nuat	False cobbler wobbegong	<i>O. leptolineatus</i> Last, Pogonoski & White, 2010	+	RS/FP	NE
	14) Hemisylliidae	25	Chalam kob	Grey bamboo shark	<i>Chiloscyllium griseum</i> Muller & Henle, 1838	++	RS/FP	NT
		26	Chalam kob	Indonesian bamboo shark	<i>C. hasseltii</i> Bleeker, 1852	++	FP	NT
		27	Chalam kob lai	Slender bamboo shark	<i>C. indicum</i> (Gmelin, 1789)	+	FP	NT
		28	Chalam kob lai suea nam	Whitespotted bamboo shark	<i>C. plagiatum</i> (Bennett, 1830)	+	FP	NT
		29	Chalam kob	Brownbanded bamboo shark	<i>C. punctatum</i> Muller & Henle, 1838	+++	RS/FP/OT	NT
	15) Ginglymostomatidae	30	Chalam chi sao	Tawny nurse shark	<i>Nebrius ferrugineus</i> (Lesson, 1831)	+	FP/OT	VU
	16) Stegostomatidae	31	Chalam suea dao	Zebra shark	<i>Stegostoma fasciatum</i> (Hermann, 1783)	+	RS/FP/OT	EN
	17) Rhincodontidae	32	Chalam whale	Whale shark	<i>Rhincodon typus</i> Smith, 1828	+	OT	EN
8) Carchariformes	18) Squalioididae	33	Chalam mao hua yao	Longhead catshark	<i>Apristurus longicephalus</i> Nakaya, 1875	+	RS	LC
		34	Chalam kob lai hin on	Coral catshark	<i>Atelomyxterus marmoratus</i> (Bennett, 1830)	+	RS/FP	NT
		35	Chalam khrae	Bristly catshark	<i>Bythaelurus hispidus</i> (Alcock, 1891)	-	RS	DD
		36	Chalam khrae	Mud catshark	<i>B. lutanus</i> (Springer & D' Aubrey, 1972)	+	RS	DD
		37	Chalam phong lom	Australian reticulated swellshark	<i>Cephaloscyllium cf. hicosellum</i> White & Ebert, 2008	-	RS	NE
		38	Chalam thong pong	Indian swellshark	<i>C. sitoi</i> (Talwar, 1974)	-	RS	DD
		39	Chalam thong pong	Speckled swellshark	<i>C. cf. speculum</i> Last, Secret & White, 2008	+	RS	NE
		40	Chalam kob chut dam	Blackspeckled catshark	<i>Haloaelurus buergeri</i> (Muller & Henle , 1838)	+	RS/FP	DD
	19) Proscylliidae	41	Chalam mao hang thaep	Pygmy ribbontail catshark	<i>Endacnis radcliffei</i> smith, 1913	-	RS	LC
		42	Chalam mao chut	Magnificent catshark	<i>Proscyllium magnificum</i> Last & Vongspanich, 2004	+	RS/FP	NE
	20) Triakidae	43	Chalam ma	Magalore houndshark	<i>Iago cf. magalorensis</i> (Cubelio Remya & Kurup, 2011)	+	RS	NE
		44	Chalam ma ta to	Bigeye houndshark	<i>I. omanensis</i> (Norman , 1939)	+	RS	LC
		45	Chalam ma	Starspotted smoothhound	<i>Mustelus manazo</i> Bleeker , 1854	-	RS	DD
		46	Chalam ma	Arabian smoothhound	<i>M. mosis</i> Hemprich & Ehrenberg , 1899	+	RS/FP	DD
		47	Chalam ma chut khao	Whitespotted gummy shark	<i>M. cf. stevensi</i> White & Last , 2008	+	FP	NE
	21) Hemigaleidae	48	Chalam nu	Hooktooth shark	<i>Chaenogaleus macrostoma</i> (Bleeker , 1852)	+	RS/FP	VU
		49	Chalam nu	Sicklefin weasel shark	<i>Hemigaleus microstoma</i> (Bleeker , 1852)	+	RS/FP	VU
		50	Chalam nu	Snaggletooth shark	<i>Hemipristis elongata</i> (Kunzinger , 1871)	+	RS/FP	VU
		51	Chalam nu	Slender weasel shark	<i>Paragaleus randalli</i> Compagno, Krupp & Carpenter, 1996	+	FP	NT
		52	Chalam nu	Straighttooth weasel shark	<i>P. tengi</i> (Chen, 1963)	+	FP	DD
	22) Carcharhinidae	53	Chalam hoo khao	Silvertip shark	<i>Carcharhinus albimarginatus</i> (Ruppell, 1837)	+	FP/OT	VU
		54	Chalam chamuk to	Bignose shark	<i>C. altimus</i> (Springer , 1950)	+	RS/FP	DD
		55	Chalam hoo dam	Graceful shark	<i>C. amblyrhynchoides</i> (Whitley , 1834)	++	FP	NT
		56	Chalam khrip dam yai	Gray reef shark	<i>C. amblyrhynchus</i> (Bleeker , 1856)	+	FP/OT	NT
		57	Chalam ta lek	Pigeye shark	<i>C. ombainensis</i> (Muller & Henle, 1839)	+	FP	DD
		58	Chalam khrip dang	Bronze whaler	<i>C. brachyurus</i> (Gunther, 1870)	+	FP	NT
		59	Chalam hoo dam	Spinner shark	<i>C. brevipinna</i> (Muller & Henle, 1839)	++	RS/FP	NT
		60	Chalam nu	Whiteshark shark	<i>C. dussumieri</i> (Muller & Henle, 1839)	++	RS/FP	EN
		61	Chalam thao	Silky shark	<i>C. falcatrimis</i> (Muller & Henle, 1839)	+	RS/FP	VU
		62	Chalam hua bat	Bull shark	<i>C. leucas</i> (Muller & Henle, 1839)	+	FP/OT	NT
		63	Chalam hoo dam lek	Blacktip shark	<i>C. limbatus</i> (Muller & Henle, 1839)	+	FP	NT
		64	Chalam khrip yao	Oceanic whitetip shark	<i>C. longimanus</i> (Poey , 1861)	+	RS/FP	VU
		65	Chalam chamuk khaoeng	Hardnose shark	<i>C. macroti</i> (Muller & Henle, 1839)	+	RS/FP	NT

Appendix table 1 (Cont)

Order	Family	No.	Thai name	English name	Scientific name	Status	Source	IUCN RedList
		66	Chalam hu dam	Blacktip reef shark	<i>C. melonopterus</i> (Quoy & Gaimard, 1824)	++	FP/OT	NT
		67	Chalam thao	Dusky shark	<i>C. obscurus</i> (LeSueur, 1818)	+	FP	VU
		68	Chalam kradong sung	Sandbar shark	<i>C. plumbeus</i> (Nardo, 1827)	-	RS/FP	VU
		69	Chalam nu	Blackspot shark	<i>C. sealei</i> (Pietschmann, 1913)	+	RS/FP	NT
		70	Chalam hu dam	Spottail shark	<i>C. sarrah</i> (Muller & Henle, 1839)	+++	RS/FP/OT	NT
		71	Chalam nu	Indonesian whaler shark	<i>C. tjutjot</i> (Bleeker, 1852)	+	RS/FP	VU
		72	Chalam suea	Tiger shark	<i>Galeocerdo cuvier</i> (Peron & LeSueur, 1822)	+	RS/FP/OT	NT
		73	Chalam mae nam	Ganges shark	<i>Glyphis cf. gangeticus</i> (Muller & Henle, 1839)	+	FP	NE
		74	Chalam mae nam	Borneo broadfin shark	<i>Lamiopsis tephrodes</i> (Fowler, 1905)	-	RS	NE
		75	Chalam ta chik	Sliteye shark	<i>Loxodon macrorhinus</i> Muller & Henle, 1839	+	RS/FP	LC
		76	Chalam khrip khong	Sharptooth lemon shark	<i>Negaprion acutidens</i> (Ruppel, 1837)	+	FP	VU
		77	Chalam si nam ngoen	Blue shark	<i>Prionace glauca</i> (Linnaeus, 1758)	+	RS	NT
		78	Chalam nu hua laem	Milk shark	<i>Rhizoprionodon acutus</i> (Ruppel, 1837)	+	RS/FP	LC
		79	Chalam nu hua laem	Grey sharpnose shark	<i>R. ologolinx</i> Springer, 1964	+	RS/FP	LC
		80	Chalam nu hua laem	Spadenose shark	<i>Scoliodon laticaudus</i> Muller & Henle, 1838	+	RS/FP	NT
		81	Chalam nu hua laem	New spadenose shark	<i>S. macrorhynchus</i> (Bleeker, 1852)	+	FP	NE
		82	Chalam khrip khao	Whitetip reef shark	<i>Triaenodon obesus</i> (Ruppel, 1837)	+	RS/FP/OT	NT
	23) Sphymidae	83	Chalam hua khon yao	Winghead shark	<i>Eusphya blochii</i> (Cuvier, 1816)	-	FP	EN
		84	Chalam hua khon si nam	Scalloped hammerhead	<i>Sphyrna lewini</i> (Griffith & Smith, 1834)	+	RS/FP/OT	EN
		85	Chalam hua khon yai	Great hammerhead	<i>S. mokarran</i> (Ruppel, 1837)	+	RS/FP	EN
		86	Chalam hua khon san	Smooth hammerhead	<i>S. zygaena</i> (Linnaeus, 1758)	-	FP	VU
Rays 4 order, Organize the list according to Last et al., 2016 (Rays of the World)								
1) Rhinopristiformes	1) Pristidae	1	Chanak pak laem	Narrow sawfish	<i>Anaxyrpis cuspidata</i> (Latham, 1794)	-	RS/FP	EN
		2	Chanak yak	Large-tooth sawfish	<i>Pristis pristis</i> (Linnaeus, 1758)	-	RS/FP	CR
		3	Chanak khiao	Green sawfish	<i>P. zjirson</i> (Bleeker, 1851)	-	RS/FP	CR
	2) Rhinidae	4	Ronin	Shark ray	<i>Rhina ancylostoma</i> (Bloch and Schneider, 1801)	++	FP	CR
		5	Ronan chut khao	Bottlenose wedgefish	<i>Rhynchobatus australiae</i> (Whitley, 1939)	++	RS/FP	CR
		6	Ronan chut khao	Smoothnose wedgefish	<i>R. laevis</i> (Bloch and Schneider, 1801)	+	RS/FP	CR
		7	Ronan chut khao	Eyebrow wedgefish	<i>R. palpebratus</i> Compagno & Last, 2008	-	FP	NT
		8	Ronan chut khao lai	Broadnose wedgefish	<i>R. springeri</i> Compagno & Last, 2010	+	FP	CR
	3) Rhinobatidae	9	Ronan hua sai chut khao	Bengal guitarfish	<i>Rhinobatos annandalei</i> Norman, 1926	+	RS/FP	DD
		10	Ronan hua sai	Borneo guitarfish	<i>R. borneensis</i> Last, Secret & Naylor, 2016	+	RS/FP	NE
		11	Ronan hua sai	Ranong guitarfish	<i>R. ranongensis</i> Last, Secret & Naylor, 2019	++	RS/FP	NE
	4) Glaucostegidae	12	Ronan med	Sharpnose guitarfish	<i>Glaucostegus granulatus</i> (Cuvier, 1829)	-	FP	CR
		13	Ronan hua sai yak	Thailand pointed guitarfish	<i>G. cf. granulatus</i> (Cuvier, 1829)	+	FP	NE
		14	Ronan chamuk kwang	Widenose guitarfish	<i>G. obtusus</i> (Muller & Henle, 1841)	+	FP	CR
		15	Ronan hua jing jok	Clubnose guitarfish	<i>G. thouin</i> (Anonymous, 1798)	-	FP	CR
		16	Ronan hua sai yak	Giant guitarfish	<i>G. typus</i> (Bennett, 1830)	-	FP	CR
	5) Platyrhinidae	17	Ronan hua klom	Indian fanray	<i>Platyrhina psomadakisi</i> White & Last, 2016	+	RS	NE
2) Topeoideiformes	6) Narcinidae	18	Kraben fai fa india	Indian blind numfish	<i>Benthobatis moresbyi</i> Alcock, 1898	+	RS	LC
		19	Kraben fai fa chut nam tar	Shortlip numfish	<i>Narcine breviliabata</i> Bessednov, 1966	+	FP	VU
		20	Kraben fai fa chut khem	Smallspot numfish	<i>N. maculata</i> (Shaw, 1804)	+	RS/FP	DD
		21	Kraben fai fa chut lek	Tonkin numfish	<i>N. prodorsalis</i> Bessednov, 1966	+	FP	DD
		22	Kraben fai fa si nam tan	Brown numfish	<i>N. timlei</i> (Bloch and Schneider, 1801)	+	FP	DD
	7) Narkeidae	23	Kraben fai fa hang chut	Spot-tail sleeper ray	<i>Narke dipterygia</i> (Bloch and Schneider, 1801)	+	FP	DD
		24	Kraben fai fa lang riap	Finless sleeper ray	<i>Temera hardwickii</i> (Gray, 1831)	+	RS/FP	VU
3) Rajiformes	8) Rajidae	25	Kraben lang nam chut	Borneo sand skate	<i>Okamejei cairae</i> Last, Fahmi & Naylor, 2010	-	RS	NE
		26	Kraben lang nam chut lue	Holland skate	<i>O. hollandi</i> (Jordan & Richardson, 1909)	-	RS	DD
		27	Kraben lang nam chut	Indian ring skate	<i>Orbiraja powelli</i> (Alcock, 1898)	+	RS/FP	DD
	9) Gurgesiellidae	28	Kraben lang nam andaman	Andaman pygmy skate	<i>Cruniraja andamanica</i> (Lloyd, 1909)	+	RS	DD
	10) Anacanthobatidae	29	Kraben kha yao	Andaman legskate	<i>Sinobatis andamaensis</i> Last & Bussarawit, 2016	-	RS	NE
4) Myliobatiformes	11) Hexatrygonidae	30	Kraben nguak hok chong	Singill stingray	<i>Hexatrygon bickelli</i> Heemstra & Smith, 1890	+	RS	LC
	12) Gymnuridae	31	Kraben phisuea yipun	Japanese butterfly ray	<i>Gymnuro japonica</i> (Temminck & Schlegel, 1850)	++	RS/FP	DD
		32	Kraben phisuea phueak	Smooth butterfly ray	<i>G. cf. micrura</i> (Bloch and Schneider, 1801)	-	RS/FP	NE
		33	Kraben phisuea hang yao	Longtail butterfly ray	<i>G. poecilura</i> (Shaw, 1804)	-	RS/FP	NT
		34	Kraben phisuea hang lai	Zonetail butterfly ray	<i>G. zonura</i> (Bleeker, 1852)	+	FP	VU
	13) Dasyatidae	35	Kraben hang san	Smooth stingray	<i>Bathytoshia brevicaudata</i> (Hutton, 1875)	-	RS/FP	LC
		36	Kraben hang nam	Brown stingray	<i>B. lata</i> (German, 1880)	+	FP	LC
		37	Kraben tukkata	Dwarf whipray	<i>Brevitrygon heterura</i> (Bleeker, 1852)	+++	RS/FP	NE
		38	Krabang	Bengal whipray	<i>B. imbricata</i> (Bloch and Schneider, 1801)	+++	RS/FP	DD
		39	Krabang	Scaly whipray	<i>B. cf. imbricata</i> (Bloch and Schneider, 1801)	+++	RS/FP	NE
		40	Kraben mae klong	Roughback whipray	<i>Fluvitrygon kittipongi</i> Vidhayanon & Robert, 2005	+	-	EN
		41	Kraben nam chuet	Marbled whipray	<i>F. oxyrhynchus</i> (Sauvage, 1878)	+	-	EN
		42	Kraben nam chuet khao	White-edge whipray	<i>F. signifer</i> (Compagno & Robert, 1982)	+	-	EN
		43	Kraben hang wai	Red stingray	<i>Hemitrygon akajei</i> (Muller & Henle, 1841)	++	RS/FP	NT
		44	Kraben hang wai	Bennett's stingray	<i>H. bennetti</i> (Muller & Henle, 1841)	+	RS/FP	DD
		45	Kraben pak mae nam	Estuary stingray	<i>H. fluviurum</i> Ogilby, 1908	+	FP	VU
		46	Kraben lao	Mekong stingray	<i>H. laosensis</i> Robert & Kamasuta, 1987	-	-	EN
		47	Kraben hin	Oriental black stingray	<i>H. navarrae</i> (Steindachner, 1892)	+	FP	DD
		48	Kraben khrae dam	Dwarf black stingray	<i>H. parvovirga</i> Last & White, 2008	+	FP	DD

Appendix table 1 (Cont)

Order	Family	No.	Thai name	English name	Scientific name	Status	Source	IUCN Redlist	
		49	Kraben lai suea dao	Leopard whipray	<i>Himantura leoparda</i> Manjaji-Matsumoto & Last,	+	FP	VU	
		50	Kraben lai suea lek	Coach whipray	<i>H. uarnak</i> (Gmelin, 1789)	++	RS/FP	VU	
		51	Kraben lai suea yai	Honeycomb whipray	<i>H. undulata</i> (Bleeker, 1852)	++	RS/FP	VU	
		52	Kraben chut dam	Blackspotted whipray	<i>Maculabatis astra</i> (Last, manjaji-Matsumoto &	+	FP	LC	
		53	Kraben malang wan	Whitespotted whipray	<i>M. gerrardi</i> (Grey, 1851)	+++	RS/FP	VU	
		54	Kraben malang wan	Sharpnose whipray	<i>M. macrura</i> (Bleeker, 1852)	+	FP	NE	
		55	Kraben bua	Round whipray	<i>M. pastinacoides</i> (Bleeker, 1852)	+	FP	VU	
		56	Kraben ta lek	Smalleye stingray	<i>Megatygon microps</i> (Annandale, 1908)	+	FP	DD	
		57	Kraben chamuk to	Bluespotted maskray	<i>Neotrygon caeruleopunctata</i> Last, White & Secret,	++	RS/FP	NE	
		58	Kraben chamuk to	Kuhl's maskray	<i>N. kuhlii</i> Muller & Henle, 1841	+++	RS/FP	DD	
		59	Kraben chamuk to	Oriental bluespotted	<i>N. orientalis</i> Last, White & Secret, 2016	++	RS/FP	NE	
		60	Kraben phrik thai	Speckled maskray	<i>N. cf. picta</i> Last & White, 2008	+	-	NE	
		61	Kraben chamuk to si nam	Mahogany maskray	<i>N. variidens</i> (German, 1885)	+	RS/FP	NE	
		62	Kraben thong hang bai	Broad cowtail ray	<i>Pastinachus ater</i> (Macleay, 1883)	+	FP	LC	
		63	Kraben thong hang khaep	Narrow cowtail ray	<i>P. gracilicaudus</i> Last, manjaji-Matsumoto, 2010	+	FP	NE	
		64	Kraben thong	Roughnose cowtail ray	<i>P. solocastrois</i> Last, manjaji & yearsley, 2005	+	-	EN	
		65	Kraben thong chamuk klet	Starynose cowtail ray	<i>P. stellurostris</i> Last, Fahmi & Naylor, 2010	+	-	NE	
		66	Kraben bua	Bleeker's whipray	<i>Pateobatis bleekeri</i> (Blyth, 1860)	++	RS/FP	NE	
		67	Kraben lai dok mai	Pink whipray	<i>P. fai</i> (Jordan & Seale, 1906)	+	FP	VU	
		68	Kraben thong hang nam	Jenkin's whipray	<i>P. jenkinsi</i> (Annandale, 1909)	++	RS/FP	VU	
		69	Kraben chamuk khao	Whitenose whipray	<i>P. uamocoides</i> (Bleeker, 1852)	+	FP	VU	
		70	Kraben dam	Pelagic stingray	<i>Pteroplatytrygon violacea</i> (Bonaparte, 1832)	+	RS	LC	
		71	Kraben thong	Bluespotted fantail ray	<i>Taeniura lymma</i> (Forsskal, 1775)	+	RS/FP/OT	NT	
		72	Kraben tok kra	Blotched stingray	<i>Taeniuraps meyeri</i> (Muller & Henle, 1841)	+	RS/FP/OT	VU	
		73	Kraben pak laem	Indonesian sharpnose ray	<i>Telatygon bioso</i> Last, White & Naylor, 2016	+++	RS/FP	NE	
		74	Kraben pak laem	Pale-edge sharpnose ray	<i>T. zuger</i> (Muller & Henle, 1841)	+++	RS/FP	NT	
		75	Kraben bai khanun	Porcupine whipray	<i>Urogymnus asperrimus</i> (Bloch & Schneider, 1801)	+	RS/FP	VU	
		76	Kraben chao phra ya	Giant freshwater stingray	<i>U. chaophraya</i> (Monkolprasit and Robert, 1990)	++	FP	EN	
		77	Kraben chut khao	Mangrove whipray	<i>U. granulatus</i> (Macleay, 1883)	+	FP	VU	
		78	Kraben bua	Songkhla lake whipray	<i>U. aff. lobistoma</i> (Manjaji-Matsumoto & Last, 2006)	++	-	NE	
14)	Plesiobatidae	79	Kraben nam luek	Giant stingray	<i>Plesiobatis daviesi</i> (Wallace, 1967)	+	RS/FP	LC	
15)	Urolophidae	80	Kraben ja va nam luek	Java stingaree	<i>Urolophus javanicus</i> (Martens, 1864)	-	RS	CR	
16)	Myliobatidae	81	Kraben nok chut khao	Mottles eagle ray	<i>Aetomylaeus maculatus</i> (Gray, 1834)	+	RS/FP	EN	
		82	Kraben nok bang	Banded eagle ray	<i>A. nichofii</i> (Bloch & Schneider, 1801)	+	RS/FP	VU	
		83	Kraben nok rang kra sae	Ornate eagle ray	<i>A. vespertilio</i> (Bleeker, 1852)	+	RS/FP	EN	
17)	Aetobatidae	84	Kraben nok	Spotted eagle ray	<i>Aetobatus ocellatus</i> (Kuhl, 1823)	++	RS/FP	VU	
18)	Rhinopterae	85	Kraben chamuk wua	Javan cownose ray	<i>Rhinoptera javanica</i> Muller & Henle, 1841	+	FP	VU	
		86	Kraben chamuk wua hang	Shorttail cownose ray	<i>R. jayakari</i> Boulenger, 1895	+	FP	NE	
19)	Mobulidae	87	Kraben rahu naeo	Reef manta ray	<i>Mobula alfredi</i> (Krefft, 1868)	+	OT	VU	
		88	Kraben rahu yak	Giant manta ray	<i>M. birostris</i> (Walbaum, 1792)	+	OT	VU	
		89	Kraben rahu khrip san	Kuhl's devilray	<i>M. kuhlii</i> Muller & Henle, 1841	+	FP	DD	
		90	Kraben rahu hang nam	Giant devilray	<i>M. mobular</i> (Bonnaterre, 1788)	+	RS/FP	NT	
		91	Kraben rahu khrip laem	Chilean devilray	<i>M. tarapacana</i> (Philippi, 1892)	-	OT	VU	
		92	Kraben rahu	Bentfin devilray	<i>M. thurstoni</i> (Lloyd, 1908)	+	FP	NT	
2) Subclass Holocephali : ratfishes , rabbit fishes , elephant fishes , chimaeras , ghost sharks									
Order	Family	No.	Thai name	English name	Scientific name	Status	Source	IUCN Red list	
1)	Chimeriformes	1) Chimeridae	1	Pla nu nam yao	Longspine chimaera	<i>Chimaera aff. macrospina</i> Diddier, Last & White ,	+	RS	NE
			2	Chi me ra si ngoen	Silver Chimera	<i>Chimaera cf. phantasma</i> Jordan & Snyder, 1900	-	RS	NE
			3	Pla kra tai khrip lon	African Chimera	<i>Hydrolagus africanus</i> (Gilchrist, 1922)	+	RS	DD
			4	Chalam pee	Ghost shark	<i>Hydrolagus sp.</i>	-	RS	NE
		2) Rhinochimeridae	5	Pla nu chamuk yao	Sicklefin Chimera	<i>Neohariotta pinnata</i> (Schnakenbeck, 1931)	+	RS	DD

Remarks:

Status:	+++	= dominant
	++	= normal
	+	= rare
	-	= only recorded
Source:	FP	= Fishing port
	OT	= Observation & Tourism
	RS	= Research Survey

Appendix 2

Laws and Management measures for sharks in Thailand

Thailand has several fisheries laws which directly and indirectly affect to sharks conservation by virtue of the Fisheries Act, B.E. 2490; Royal Ordinance on Fisheries, B.E.2558; Marine Fisheries Management Plan of Thailand; National Policy for Marine Fisheries Management 2015–2019; Wildlife Preservation and Protection Act, B.E. 256 2 ; National Park Act, B.E. 25 0 4; Enhancement and Conservation of the National Environmental Quality Act, B.E. 2535; Act on Promotion of Marine and Coastal Resources Management, B.E. 2558; and other legislations related to fisheries. Details of these legislations are as follows:

The Fisheries Act, B.E. 2490 was a major legislation of DoF until 2015. Regulations and Notifications of the Ministry of Agriculture and Cooperatives related to fisheries that issued under the Fisheries Act, B.E. 2490 are as follows:

1) Ministerial notification dated 20 July 1972 on prohibiting the use of trawl net and push net by motorized vessels to protect sharks by prohibiting the use of trawls and push nets in the area within 3,000 meters from shoreline in order to allow marine aquatic animals living in coastal areas will not be caught from these type of fishing gears.

2) Ministerial regulation dated 17 September 1996 on implementation procedure to limit the number of trawlers and push-netters, considering that such fishing gears can significantly catch large number of sharks. Therefore, this regulation limits the number of fishing gears to control fishing efforts exceeding level of fisheries productivities.

3) Ministerial notification dated 24 September 1999 on prohibiting the use of specific types of fishing gear to operate during the determined spawning and breeding seasons in the areas of Prachuap Khiri Khan, Chumphon, and Surat Thani Provinces, also prohibiting the use of these fishing gears from 1 February to 15 May.

4) Ministerial notification dated 24 October 2008 on prohibiting the use of specific types of fishing gear to operate during the determined spawning and breeding seasons in the areas of Phuket, Phangha, Krabi, Trang Provinces, also prohibiting the use of these fishing gears from 1 April to 30 June.

5) Ministerial notification on prohibiting the use of trawl net and push net with motorized vessels in specific fishing areas of 10 provinces, including Krabi Province (dated 9 October 2007), Prachuab Khiri Khan Province (dated 9 October 2007), Trang Province (dated 9 October 2007), Rayong Province (dated 3 January 2008), Narathiwat Province (dated 3 January 2008), Pattani Province (dated 3 January 2008), Satun Province (dated 29 January 2009), Nakorn si thamrat Province (dated 17 July 2009), Chumphon Province (dated 11 April 2011) and Chantaburi Province (dated 11 December 2012), by prohibiting the use of trawl net and push net in the areas within 5,400 meters of shoreline.

6) Ministerial notification dated 13 August 2013 on prohibiting the use of specific types of fishing gear from 1 June to 31 July in some fishing areas of Prachuap Khiri Khan, Phetchaburi, Samut Songkhram, Samut Sakhon, Bangkok, Samut Prakan, Chachoengsao and Chonburi Provinces.

The Royal Ordinance on Fisheries, B.E. 2558 (Fisheries Act, B.E. 2558) is a major legislation in the present time, including the Royal Ordinance on Fisheries issued in 2015 and its amendment issued in 2017, which extremely realize importance for sustainable management of aquatic resources. It was used as a basis to prepare Marine Fisheries Management Plan of Thailand: A National Policy for Marine Fisheries Management 2015–2019. This management plan provides guidelines to resolve problems facing presently. It also provides details on management measures and implementation for replacing the open access scheme to limited access to limit the level of fishing efforts in accordance with the Maximum Sustainable Yield (MSY) of fisheries productions. This management plan has a close link with the National Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported, and Unregulated Fishing (NPOA-IUU), 2015 (Department of Fisheries, 2015a, 2016a), including:

1) Defining that all fishing vessels shall be the fishing license holders, and develop electronic fishing license system for all vessels operating in Thai waters to ensure all fishing vessels are registered and licensed.

2) Strengthen coordination across Department of Fisheries, Department of Marine and Coastal Resources, Custom Department, Royal Thai Navy, Marine Police Division, Marine Department, Provincial Administration Department, Ministry of Labor and Thailand Maritime

Enforcement Coordinating Centre (Thai-MECC) through a MOUs for information exchange, enforcement authorization, prosecution, and penalty.

3) Establishment of Port in-Port out control center for commercial fishing vessels size 30 GT and over, effectively to control in all areas.

4) Defining that commercial fishing vessels size 30 GT and over shall install onboard Vessel Monitoring System (VMS)

5) Defining that commercial fishing vessels shall use fishing logbook for recording their catch

6) Developing onboard observer program based on a risk assessment for fishing vessels and transshipment vessels operating beyond Thai waters.

7) Foreign vessels who transship catches in Thailand shall comply with the national Port State Measure.

8) Controlling import and export of goods shall comply with international trade agreement under CITES and the Wildlife Preservation and Protection Act.

9) Enhancing capacity through the use of application system developed for improving and strengthening traceability system.

10) Increasing the total areas of Marine Protected Area

11) Improving fisheries data collection system and fisheries information dissemination in order to effectively monitor implementation of Marine Fisheries Management Plan.

Regarding Whale shark, Ministerial notification was issued to prohibit whale shark fishery dated 28 March 2000 under the Fisheries Act, B.E. 2490 was revoked. Afterwards, Ministerial notification on definition of marine mammals and endangered species to be prohibited for fishing or taking onboard fishing vessels dated 7 April 2016 was issued by virtual of the Fisheries Act, B.E. 2558.

The National Park Act, B.E. 2504 indirectly protects sharks habitats in national parks and connected coastal areas by prohibiting all fishing activities. Currently, there are 22 marine national parks in the Gulf of Thailand and the Andaman Sea covering the areas of 6,166.93 km², namely Khao Laem Ya–Mu Ko Samed National Park, Mu Ko Chumphon National Park, Mu Ko Ang Thong National Park, Tarutao National Park, Mu Ko Lanta National

Park, Had Nopparat Tara–Mu Ko Phi Phi National Park, Had Chao Mai National Park, AoPhang Nga National Park, Mu Ko Similans National Park, and Mu Koh Ranong National Park.

The Act on Ancient Monuments, Antiques Objects of Art and National Museums, B.E. 2504 relates to marine archaeology protected areas which indirectly protects sharks habitats in those areas.

The Wildlife Preservation and Protection Act, B.E. 2562 is the major legislation enforced by DNP and DoF (for aquatic animals), which aims to protect wildlife species, including species listed under CITES appendices and other relevant legislations, as follows:

1) Ministerial regulation on protecting some wildlife species, namely 4 sawfishes (Pristidae), Bowmouth guitarfish, Giant freshwater stringray and 6 devilrays (Mobulidae, except *Mobula tarapacana*) became to enforce since 1 September 2018. Subsequently, Whale shark was declared as wildlife preserved fish as revised under the Appendix of Wildlife Preservation and Protection Act, B.E. 2562 dated 29 May 2019.

2) Natural Resources and Environment Ministerial Notification on definitions of wild animals and carcasses of wild animals prohibited for import and export, dated 25 February 2011, and listing of wild animals as Appendix, dated 18 November 2010, in order to implement the national legislations in accordance with CITES listed species.

3) Department of Fisheries regulation on application and certification of species not listed under CITES appendices dated 29 September 2004 was issued in relevance with the Wildlife Preservation and Protection Act, B.E. 2562 and CITES in order to control trades of aquatic animals listed in CITES appendices.

The Enhancement and Conservation of the National Environment Quality Act, B.E. 2535: indirectly protects sharks habitats in specified environmental protection areas for a certain period of time. There are Natural Resources and Environment Ministerial Notifications and Orders to protect 6 areas covering 12,190.21 km² in total.

The Act on Promotion of Marine Coastal Resources Management, B.E. 2558: indirectly protects sharks habitats and prohibits to hurt sharks. This Act is directly controlled by DMCR.

Appendix 3

International Commitment related to sharks conservation and management

Legal binding on international fisheries commitments and instruments related to sharks conservation and management that Thailand has to conduct or revise or issue national legislations to be consistent with, are as follows:

1. The United Nations Convention on the Law of the Sea, 1982 aims to establish conservation measure, fisheries resources management and other utilization from the sea extensively under legislation of exclusive economic zones and high seas. Furthermore, to specify coordinate obligation of the coastal state and another state in order to conserve and utilize aquatic species which highly migrate such as Sixgill shark (*Hexanchus griseus*), Basking shark (*Cetorhinus maximus*), Thresher sharks (Alopiidae), Whale shark (*Rhinocodon typus*), Requiem sharks (Carcharhinidae), Hammerhead sharks (Sphyrnidae) and Mako sharks (Lamnidae). Thailand submitted ratification on 15 May 2011 and become into force on 14 June 2011.

2. The Port State Measures Agreement to eliminate Illegal, unreported and unregulated fishing aims to prevent marine resources and their products form Illegal, fishing to international fish market that landed or transhipped their catches as Illegal, unreported and unregulated ports considering harmful for sharks, particularly to endangered species. Therefore, Port State Measures Agreement has benefits on sharks resources conservation. Thus, Thailand submitted to accession on 10 May 2016.

3. The Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas. The objective of this Agreement can be achieved through specifying flag states' responsibility in respect of fishing vessels entitled to operating on the high seas. Such States should operate essential measure in order to certify vessels entitled to fly its flag unrelated with other activity of fishing vessels affecting to marine resources conservation and management measures in high seas.

4. The Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982. This agreement relates to the conservation and management of straddling fish stocks and highly migratory fish stocks. The

objectives of the agreement are to ensure the long-term conservation and sustainable use of straddling fish stocks and highly migratory fish stocks. In addition, it aims to establish collaborative responsibility for State under the regional fisheries management organization in order to conservation and management of straddling fish stocks and highly migratory fish stocks.

Furthermore, this Agreement established obligation of States parties to decrease target species from fishing, including sharks and other associated species especially endangered species, as well as to reduce pollution and waste through precautionary approach for preventing and managing on basis of ecosystem applying to those who operate in High Seas and territorial waters of coastal States. Hence, Thailand submitted to accession on 27 May 2017.

5. Regional Fisheries Management Organization

Thailand is a member of several regional fisheries organizations such as IOTC and SIOFA that complies with the specified conservation and management measures in their respective areas, including Sharks Conservation and Management Measures in IOTC area, for example by-catch measures, sharks fishery, report requirements, data collection and research work.

Moreover, there are a number of non-legal binding instruments and other related international instruments. Thailand therefore shall cooperate and implement resource management measures in consistent with such measures. It includes:

1. The Code of Conduct for responsible fisheries (CCRF). This code aims to set principles and standards applicable for responsible fishing activities in order to promote conservation, management and development of all fisheries. It also defines principles in accordance with the relevant regulations to support the objectives of this code. In this connection, the IPOA-Sharks is an instrument under this code.

2. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international treaty to establish principles for international trade in specimen's species of endangered wild animals and plants has to be authorized through a licensing system. Such species are covered in the CITES listed in their appendices where by Appendix I includes species that prohibits for trade; Appendix II includes species that permit

for trade under control in order to avoid inconsistent use with survival in wildlife; and Appendix III includes species that are protected by one member country but requesting other CITES parties to collaborate with an appropriate import permit and a certificate of origin from the State of the member country who has listed the species. Thailand became a member of CITES since 21 January 1983.

3. The Convention on Biological Diversity (CBD) is a convention for promoting conservation of biodiversity to ensure sustainable use of biological ecosystem, fair and equitable sharing of benefits from resources utilization. In addition, Committee of the Convention approved suggestions on sharks conservation and their sustainable use, especially large pelagic shark. Thailand became a member of the Convention on 29 January 2004.

4. The Convention on the Conservation of Migratory Species (CMS), 1979 aims to conserve migratory species within their migratory ranges and/or in out of state jurisdiction to avoid any migratory species becoming endangered. In 2010, Memorandum of Understanding on the conservation of migratory sharks have been adopted in September 2012. Regarding the Appendix of the MOU that announcement in 2018, it was found that shark species listed in Appendix I include Whale shark (*Rhincodon typus*), Great white shark (*Carcharodon carcharias*), Basking shark (*Cetorhinus maximus*), Angelshark (*Squatina squatina*), common guitarfish (*Rhinobatos rhinobatos*), sawfishes (Pristidae) and devilrays (Mobulidae). Shark species in the Appendix II include Whale shark (*Rhincodon typus*), Great white shark (*Carcharodon carcharias*), Mako sharks (*Isurus* spp.), Porbeagle shark (*Lamna nasus*), Basking shark (*Cetorhinus maximus*), Thresher sharks (*Alopias* spp.), Silky sharks (*Carcharhinus falciformis* and *C. obscurus*), Blue shark (*Prionace glauca*), Hammerhead sharks (*Sphyrna lewini* and *S. mokarran*), Spiny dogfish shark (*Squalus acanthias*), Angelshark (*Squatina squatina*), common guitarfish (*Rhinobatos rhinobatos*), Whitespotted guitarfish (*Rhynchobatus australiae*), sawfishes (Pristidae) and devilrays (Mobulidae).

5. The International Union for Conservation of Nature (IUCN) is an international organization who has a mission on conservation of biodiversity by establishing Sharks Specialist Group (SSG) responsible to promote long-term sharks conservation. The SSG

evaluated sharks status and threats of sharks species. SSG also provided IUCN Red List to indicate status of the extinction risk of wild animal species.

6. Ramsar Convention or Convention on Wetlands is the intergovernmental treaty that provide a framework for conservation and wise use of wetland and their resources. The Convention was adopted in the Iranian city of Ramsar on 2 February 1971. For this reason, nine wetlands in Thailand have been designated as Ramsar sites. These wetlands cover a total area of 3,768.52 km² (Office of Natural Resources and Environmental Policy and Planning, 2014).

7. The United Nations Education, Scientific and Cultural Organization (UNESCO). Biosphere Reserve in Ranong was established by UNESCO covering a total area of 303 km² (Mangrove Forest Research Center (Ranong), 2012).

8. ASEAN Declaration on Heritage Parks. Two sites of marine and coastal protected areas in Thailand have been designated as ASEAN Heritage Parks including Tarutao National Marine Park and Ao Phang-Nga-Mu Ko Surin-Mu Ko Similan National Park, covering a total area of 1,361.80 km² (Department of National Park, 2014).



Marine Fisheries Research and Development Division

Department of Fisheries

Ministry of Agriculture and Cooperatives