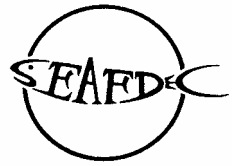
REPORT ON
THE STUDY ON SHARK PRODUCTION, UTILIZATION AND MANAGEMENT IN THE ASEAN REGION (2003-2004)

THE SECRETARIAT
SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER



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SEAFDEC Secretariat
20 March 2006

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EXECUTIVE SUMMARY

During the ASEAN-SEAFDEC Millennium Conference, Fish for the People, held in Bangkok in November 2001, the ASEAN member countries noted the external pressure put by the global community on the need to comprehensively address shark species management-related issues.

The “International Plan of Action for Conservation and Management of Sharks” or IPOA-Sharks was subsequently developed and endorsed by the member nations of COFI in October 1998, among them the ASEAN-SEAFDEC member countries.

The ASEAN member countries, which prevailing common position is that the management of commercial fisheries including those catching sharks should come under the purview of the FAO, have since 2001 taken several actions that will lead to the formulation of NPOA-Sharks.

They also recognized the need to carry-out the required actions suggested by the IPOA-Sharks through the initiation of an ad-hoc study supported by SEAFDEC that looked, from 2003 to 2004, into shark catches, biology, use, and trade in the region.

It was confirmed by this study that shark catches in the ASEAN region are mostly from small-scale fisheries. It is also a supplementary "cash" catch. The fishermen from small-scale fisheries make a living from the sharks and they do not practice "fining" since every parts of sharks are valuable and fully utilized.

Shark fins is only one of the by-product of the shark catches in ASEAN, although a very important one. Meat and many of the shark products are also used and sold by fishermen. Singapore was found to be an important place for the global trade of shark fin.

Another finding from the study is that shark dermal denticles for fin species identification can be used as the denticles have a specific shape at certain particular area for each species, although this method is not recommended to identify shark species from dried fin.

There is certainly a vast difference of capacity between ASEAN member countries, in terms of technical skills, manpower and financial resources, and they are therefore developing their NPOAs at different paces. Even so, all ASEAN countries have now initiated the development of their Shark Plan. Two countries, Malaysia and Thailand, are now entering the implementation phase while the others are going through their drafting, with stakeholder consultation and awareness building exercises. It is important to note that many ASEAN countries are strongly constrained by a lack of funds and limited manpower as they are many more urgent issues to address at the national level such as development and poverty alleviation.

The development and implementation of NPOA-Sharks will show that fisheries catching sharks, like all other fisheries, are appropriately utilizing marine resources and can be managed by the ASEAN governments in a sustainable manner.

CHAPTER 1 – BACKGROUND AND RATIONALE

1. 1 Introduction

The fisheries sector in Southeast Asia has long been facing problems and the countries in region are still struggling to ensure the sustainability of coastal and marine resources. Some of the most important issues are overcapacity in the fishing sector, the depletion of marine resources and serious environmental disruption. This underlying challenge is made more difficult for ASEAN countries to properly manage their fisheries for the reason that they are largely dominated by small-scale stakeholders who are using a wide array of gear and targeting a wide range of species (multi-gear multi-species fisheries). In line with the regional aim to establish sustainable regional fisheries in Southeast Asia, SEAFDEC has long been collaborating with its eleven member countries (consisting of the ten ASEAN member countries plus Japan) to implement various activities such as training and information dissemination to promote sustainable fisheries and adequate policy direction.

The starting point of recent initiatives undertaken by the Centre is often traced down to the ASEAN-SEAFDEC Millennium Conference, Fish for the People, held in Bangkok in November 2001, where the fishery related ministers and senior officials from the ASEAN member countries comprehensively discussed the sustainability of regional fisheries together with many of the relevant international and regional organizations. During the Conference, the ASEAN-SEAFDEC member countries recognized several environmental related issues, and among them was the problem of shark and sea-turtle by-catch. As such, they acknowledged the rising international concern that the reported increasing catches and trade of sharks around the world could potentially threaten shark populations. Although the ASEAN member countries never emphasized on the need for single species management approaches, as it is unpractical considering the characteristics of regional fisheries, they noted the external pressure put by the global community on the obligation of “burden of proof” and thus acknowledged the need to comprehensively address these species management-related issues, especially considering the lack of available information on their respective catch, utilization and trade in the region.

Around the world, sharks are mostly non-targeted catches and in some countries they may even be mostly or completely discarded by the fishers, while shark catch is largely both unregulated and unmonitored. As a result, information on shark catches and populations are not systematically collected and ecological characteristics of many of these species are still widely unknown. On the other hand, the market for shark products, particularly the important and increasing trade of shark fins, does not recognize the product value in term of species, but in terms of size, due to various usages for Chinese cuisine. This further constrains efficient collection of data on the shark trade by fisheries management and trade authorities, and further impedes with a clear understanding of the nature and range of shark fishing.

There is actually a large gap between fisheries catching sharks (no recognition- no data and information available) and markets trading shark products (greatly recognized and better known). The lack of data and information on the catch of shark is not specific to that group of fish and similar problems exist for most fishery resources in Southeast Asia. What make sharks a different case is the pressure put by CITES and the FAO IPOA-Sharks which request governments to collect data on these species and put up management measures when needed.

In 2001, there were already indications that the trade in sharks and shark products was vast in the region, and that in some cases it was increasing due to the high profitability of some shark products (such as fins, cartilage and liver oil). Increasing trade volumes could, potentially, indicate an increased of shark harvests in recent years in Southeast Asia as in many other regions of the world.

1.2 Regional constraints

Even though the Southeast Asian region has one of the richest elasmobranches diversity in the world with at least 136 species of sharks and rays (and Indonesia being the country with the richest biodiversity worldwide), the status of these resources and their fisheries is still largely unknown. There is a serious lack of available data on catch, landings and trade data as well as limited information on the biological parameters of many species and on their taxonomy, on one hand caused by the by-catch nature of shark fishing, and the other hand, due to the general weakness of the capacity to collect fishery data and information systems in the region. Although fishery statistics can be considered as one of the source of information, it should be recognized that collection of data and information by species can be beyond the mandate of fishery statistics, as far as single species fisheries do not exist.

There are however other factors in cause for this lack of understanding of shark populations in the region. To start with, although few Southeast Asian nations have the capacity to develop and conduct research activities on sharks, research work tended to be relatively of poor quality since countries in the region have to conduct many urgent priorities with limited financial resources. Often, these countries rely on external funding to ultimately conduct research activities on their fisheries. Such support has dwindling in recent years. Consequently, knowledge on shark biology by species, on the size and status of their stocks, on the real volume of their captures, and on their population dynamics is often insufficient and/or non-existent. This is a severe constraint if the fisheries related agency wish to start fisheries management including sharks. Furthermore, the few ambitious studies on sharks undertook in the past in the region have been seriously hampered by a general lack of information, and especially reference collection for the species, a lack of access to the regional management and information data systems, the near absence of a comprehensive regional identification guide to the shark species, and insufficient capacity of taxonomy on shark.

The absence of appropriate management system/measures at the national level is a cause for concern. Without an extensive program for research and management in place, risks of over-exploitation of shark fisheries will always exist and pose a serious threat to the population of sharks on the short and long-term, since little is known on the sustainable level of fishing pressure. Furthermore, repeatedly one has noticed that when there is a problem at the national level with data collection, development and implementation of a national plan for the management of sharks, there is often a similar management problem with other fishery sectors.

1.3 Conservation and Management related initiatives on international fora

The Convention on International Trade in Endangered Species (CITES) was intended to promote the conservation of wild animals and plants considered as endangered species. Once species are listed in Appendixes I, II or III of CITES, depending on the level of endangerment, the member countries of the Convention are obliged to take the required actions with respect to international trade. For example, if a species is listed in Appendix I, international trade of that species will be prohibited. Initially, CITES focused on rare species, mainly for terrestrial animal and plants. For such fauna and flora, the level of endangerment of a population can in most cases be easily evaluated through observation. However, due to the deterioration of the global environment, the numbers of species listed in the CITES appendixes has continually increased throughout the past decade, expanding to species that are harvested from the wild, including fisheries resources.

CITES has in fact played a pivotal role in the collection of biological and trade data for sharks. Resolution Conf. 9.17, adopted in November 1994, urged the Parties to submit to the Secretariat all available information concerning the trade and biological status of sharks and directed the Animals Committee to review such information, summarize the biological and trade status of sharks subject to international trade, and to prepare a discussion paper before the 10th

Conference of the Parties (COP 10). The Resolution also requested that the United National Food and Agriculture Organization (FAO) and other international fisheries management organizations establish programs to collect biological and trade data on shark species, and requested all nations utilizing and trading specimens of shark species to co-operate with FAO and other international fisheries management organizations.

At COP 10, further demand was put on the Parties to work in close collaboration with FAO and other international fisheries management organizations to effectively implement Resolution Conf. 9.17. Focus was put on improving methods to identify, record, and report landings of sharks, by species, would it be directed catch or by-catch. The Parties were also encouraged to initiate management of shark fisheries at the national level and to establish international and/or regional bodies to coordinate the management of shark fisheries throughout the geographic range of species, to ensure that international trade is not detrimental to the long-term survival of shark populations. The importance of improving statistics on trade in sharks and shark parts was also stressed-out.

The "International Plan of Action for Conservation and Management of Sharks" or IPOA-Sharks was subsequently developed and endorsed by the member nations of COFI in October 1998, among them the ASEAN-SEAFDEC member countries. It underlined the need for information on the catch, efforts, landings and trade, as well as on the biological characteristics of sharks and their identification, in order to develop proper management. It is important to note at this stage that the IPOA was not considered to be a full strategic plan for the world, but to rather prescribes a process whereby individual States or Regional Fisheries Management Organizations (RFMOs) identify lower level issues and then appropriately develop national (or regional) 'Shark Plans', called "National Plan of Action for Conservation and Management of Sharks" or NPOA-Sharks.

Besides pushing forward the IPOA-Sharks, CITES further acted in relation with sharks. The twelfth Conference of the Parties (CoP-12) the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), held in Santiago, Chile, in November 2002, agreed to include two shark species, whale sharks (*Rhincodon typus*) and busking sharks (*Cetorhimus maximus*) in CITES Appendix II. To do so required the support of two-thirds of Member Countries' votes, obtained after heated debates inside and outside the meeting. Several related controversial issues were raised during the meeting, especially concerning the identification of a competent agency for the management of aquatic commercial species and the criteria to be used to determine whether a species is endangered. As a consequence, member countries of CITES are obliged to take regulatory measures on the international trade of these shark species. In addition, related measures must also be taken on the management of fisheries that have the potential to by-catch these species.

Under the United Nations Law of the Sea, management responsibilities have been clearly mandated to national fisheries authorities with respect to the resources within Exclusive Economic Zones (EEZ) and relevant regional fisheries management bodies for transboundary and high sea fisheries resources. The prevailing ASEAN common position, however, is that the management of commercial fisheries, including shark fisheries, should come under the purview of the FAO. The FAO has advisory and promotional roles on fisheries management at the global level and on the Code of Conduct for Responsible Fisheries (CCRF). This ASEAN position was asserted at the 23rd Meeting of the ASEAN Ministers on Agriculture and Forestry (AMAF) in October 2001, with the recognition that CITES is not the most appropriate forum to manage fisheries.

Nonetheless, during the thirteenth Conference of the Parties (CoP-13) to CITES, which convened from 2-14 October 2004, in Bangkok, Thailand, another shark species was proposed for listing and, after much discussion, the very symbolical Great White Shark (*Carcharodon*

carcharias) was listed in Appendix II. More shark species might be proposed at forthcoming CoP-14, which will be held in June 2007 in the Netherlands.

1.4 Taking regional action

The ASEAN member countries having recognized these shark management problems both by endorsing the FAO IPOA-Shark and during the Millennium Conference, have since 2001, take several actions that would lead to the formulation of NPOAs-Sharks. During these five years, SEAFDEC as a regional fisheries management organization has provided a forum for the member countries to discuss and build a common stand on the issue of the management of sharks.

As a direct follow-up to the Millennium Conference, a Fish Trade and Environment Meeting was held in Bangkok in October 2002 during which the ASEAN-SEAFDEC member countries agreed and endorsed that the collection and analysis of data and information, combined with efforts to understand the status and trends of shark fisheries, are important bases for the development of appropriate fisheries management policy and actions. However, based on the recognition that shark fisheries in the region are generally small in terms of daily catch and by-catch, it was considered that the creation of a separate fisheries management policy for shark fisheries might not be useful. It was agreed that the member countries would incorporate shark management measures into their respective national fisheries management policies and framework.

The ASEAN-SEAFDEC member countries were therefore encouraged to further pursue and implement the regional common fisheries policy adopted at the Millennium Conference and develop and improve national fisheries management plans, while the required actions suggested by the IPOA-Sharks would be accommodated in practical terms by initiating ad-hoc study activities.

It was recognized that although the lack of financial resources may impinge upon the achievement of these activities, no fisheries management authorities amongst the ASEAN member countries should delay actions to understand and manage shark populations. Failure in conceiving timely and appropriate management actions would further aggravate the political atmosphere, as then seen from the debate at CoP-12.

1.5 The regional ad-hoc study on sharks

The first Regional Technical Consultation (RTC) on Sharks was organized in Vientiane, Lao PDR, in May 2003. It was attended by delegates from ASEAN-SEAFDEC member countries, together with representatives of SEAFDEC Departments. The Consultation was held back-to-back with the meeting of the ASEAN Sectoral Working Group on Fisheries (ASWGFi) so as to obtain immediate policy support on technical initiatives. This arrangement enabled ASEAN member countries to develop the required activities in a harmonized manner, for the interests of both technical staff and policy makers. The main purpose of the RTC was to provide a technical basis to initiate a new SEAFDEC project, the ad-hoc study on sharks.

The SEAFDEC project on sharks is under a Component of the Japanese Trust Fund program on Environment-Related Tasks in the Southeast Asian Region. The project's goal is to support the formulation of a regional policy and management mechanisms for fisheries catching sharks in Southeast Asia. The ASEAN-SEAFDEC member countries agreed that they would embark upon four main regional activities, starting upon 2003, under the project's framework:

1. A regional 1-year study on shark catch, local use and trade

It mostly consisted of a one-year study aimed at collecting essential regional baseline information on shark production, use and trade. The outcome of the study would then be discussed at another Regional Consultation Meeting on Shark Fisheries and used as the basis for the development of a regional policy on sharks and as a benchmark for future assessment of the status of shark resources. It would help in exploring mechanisms for future, more sustainable, data collection and support the management of shark populations. A critical element needed in order to understand on how to manage regional shark fisheries is to assess the current status of shark stocks. A one-year study certainly can't answer such information gap but in the longer term, based on the point of reference set by the study, trends in shark stocks can be evaluated through continuing national data collection. The results of the study are presented in Chapter 2 (Regional Synthesis) and in Appendix I (national Findings).

2. A survey on regional shark trade in Malaysia, Singapore and Thailand

The description of the regional utilization and trade of sharks is another important element to ensure a better understanding of shark fisheries. Beside the pledge of all ASEAN member countries to regularly provide information collected by their relevant national authorities on the shark trade, it was decided to undertake a regional trade survey in the main trading places for shark products in Southeast Asia, identified as Singapore, Thailand, and Malaysia, which would complement the information on local utilization and marketing of sharks observed at landing site level. The results of the survey are presented in Chapter 4 and in Appendix II.

3. A study on the identification of shark species based on dermal denticles

To support the identification of shark products on the markets, such as with fins, SEAFDEC initiated the development of species identification methods for the region, based on morphological characteristics of the dermal denticles on the skins of sharks. The results of the study are presented in Chapter 5 and in Appendix III.

4. The formulation of a NPOA-Sharks

As a follow up of previous activity, SEAFDEC and the member countries would thrive to develop NPOAs-Sharks. The development process of NPOAs is presented in Chapter 3. This is a long term commitment from SEAFDEC, as the Centre will continue to monitor and further assist ASEAN member countries in formulating and implementing their NPOA-Sharks after the completion of the project activities.

In July 2004, in Phuket, Thailand, the National Project Coordinators met together at the second Regional Technical Consultation in order to discuss the progress and findings of the study. This was a good occasion to analyze the many constraints and problems met in conducting the data collection, which are summarized in Chapter 2. It was also a starting point for discussion on how the formulate national shark plans in the region.

CHAPTER 2 – REGIONAL SYNTHESIS ON THE 1-YEAR STUDY ON SHARK CATCH, LOCAL USE AND TRADE

2.1 Methodology

With the support of SEAFDEC, eight ASEAN member countries agreed to collect baseline information in their selected landing sites. Lao PDR, a landlocked country, and Singapore, without any significant fishery, did not participate to the baseline study. All shark species (some information was also collected on rays but will not be presented in this regional synthesis) commonly caught and landed by fishers in each ASEAN member country was covered by the project. As the taxonomy and identification of sharks can be an important constraint to the collection of accurate data, SEAFDEC and the member countries developed national identification sheets and posters to support data collection on selected species.

2.1.1 Timeframe

The study was planned to start in August 2003, carried-out on a quarterly basis. However, only three countries were able to do so and the five other were delayed to next quarter, as shown in Table 1.

Table 1. The timeframe of shark 1-year data collection by country

Country	1st August 2003 to 31stOctober 2003	1st November 2003 to 31st January 2004	1st February 2004 to 30th April 2004	1st May 2004 to 31st July 2004	1st August 2004 to 31stOctober 2004
Brunei	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
Cambodia		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Indonesia		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Malaysia	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
Myanmar		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
The Philippines	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
Thailand		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Vietnam		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter

2.1.2 Landing Sites

In order to keep the study within a practical scope, only a few landing sites were selected in each country. Each country selected a number of landing sites, according the project funding, using several criteria for their identification, as shown in Table 2.

The site selection concerned a fishing port, a small locality but not a wide geographic area such a district or province (e.g. Phuket port not Phuket Island).

Twenty-eight landing sites were selected in the region, as shown in Figure 1 and enumerated and named in Table 2.

Table 2. Selected landing sites

Criteria for the selection of landing sites	
1. It regularly shows the occurrence of shark capture with considerable volumes 2. It is representative of a main type of fishing boats/gears present in the country (coastal/commercial fisheries) 3. It is representative of a main coastal ecosystems (coastal, offshore, etc.) in the country 4. It is easily accessible through convenient ways of communication 5. It should be of manageable size, where the information collected would only concern local capacity. 6. It should have a functional public market or similar facilities for local fisheries catches	
Number and name of landing sites selected with project funding	
Brunei Darussalam	2 (Muara and Jerudong)
Cambodia	3 (Koh Sdach, Tomnop Rolok and Kampong Bay)
Indonesia	5 (Muara Baru, Palabuhan Ratu, Cilacap, Benoa Denpassar and Bitung)
Malaysia	6 (Hutan Melingtan, Kuantan, Mukah, Kota Kinabalu, Bintulu and Sandakan Baru)
Myanmar	3 (Sittwe, Myeik and Hine-Gyi)
Philippines	4 (San Jose, Coron, Appari and Mabua)
Thailand	3 (Songkhla, Phuket and Samut Prakarn)
Vietnam	2 (Vung Tu and Phan Thiet)

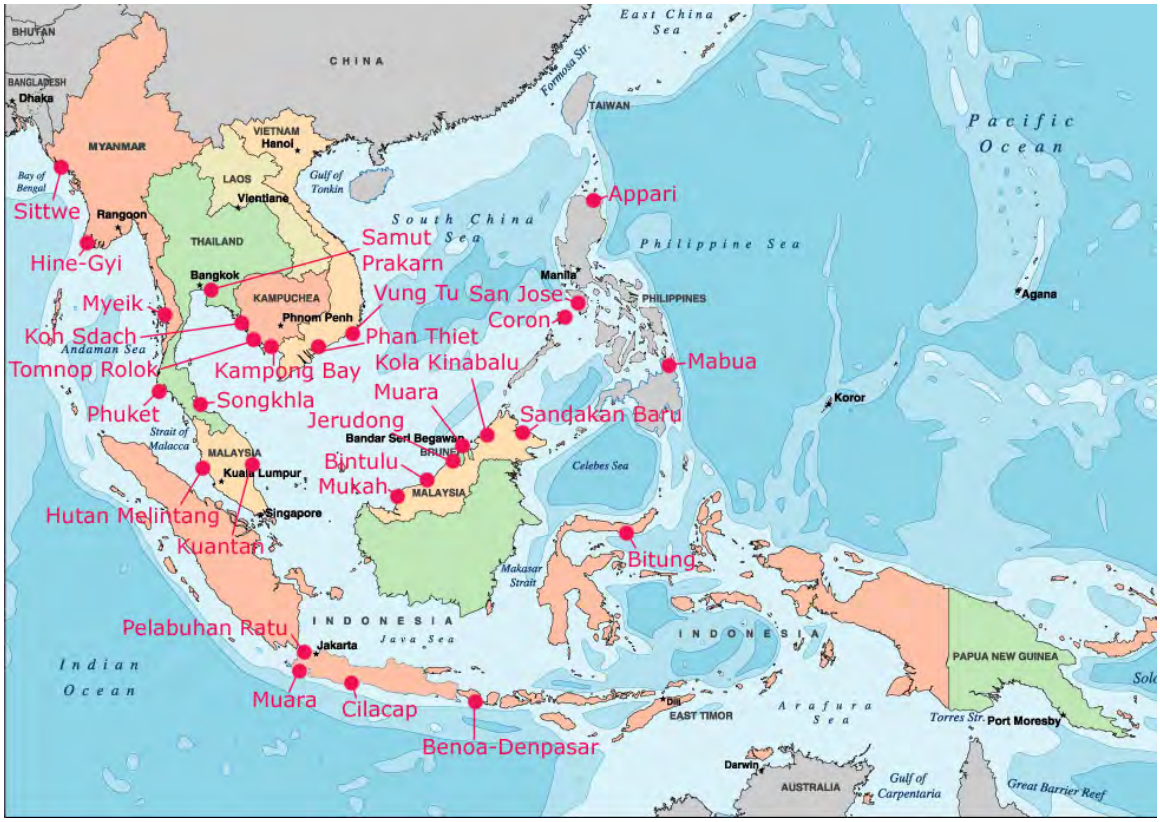


Figure 1. Selected landing sites for the 1-year data collection

2.1.3 Reporting mechanisms

While SEAFDEC Secretariat ensured the overall coordination of the project with the assistance of the members of the Working Group on the Regional Fisheries Policy (WGRFP), a National Project Coordinator (NPC) was designed for each country (Table 3). The NPC supervised and managed all required national activities and ensured regular communication with SEAFDEC. As the core for the research activity, a group of researchers was selected nationally. Directly based at the landing site level were the enumerators, qualified technical staff, working in collaboration with the researchers.

Table 3. Study's national coordinators

Country	Name (position)
Brunei Darussalam	Mr. Idris bin Haji Abdul Hamid (Head of Management and Conservation Section, Department of Fisheries) E-mail: idris_hamid@fisheries.gov.bn
Cambodia	Mr. Ing Try (Deputy Director, Department of Fisheries) E-mail: tmmp.cam@online.com.kh
Indonesia	Mr. Parlin Tambunan (Director for Fishery Resource Management) E-mail: dfrmdgf@indosat.net.id
Malaysia	Mr. Adbul Haris Helmi bin Ahmad Arshad (Research Officer, Fisheries Research Institute, Department of Fisheries) E-mail: haris_arshad@yahoo.com
Myanmar	Mr. Myint Pe (Assistant Director, Department of Fisheries) E-mail: myintpe@myanmar.com.mm
The Philippines	Mr. Noel C. Barut (Chief, Marine Research Division, National Fisheries Research and Development Institute, Bureau of Fisheries and Aquatic Resources) E-mail: noel_barut@hotmail.com
Thailand	Ms. Ratanawalee Phoonsawat (Fisheries Biologist, Department of Fisheries) E-mail: ratvaree@yahoo.com
Vietnam	Dr. Nguyen Long (Deputy Director, Research Institute for Marine Fisheries Ministry of Fisheries) E-mail: nlong@hn.vnn.vn

Shortly after data collection was completed for each quarter, the national coordinator was to gather and consolidate the results from the researchers/enumerators and prepare a progress report using a frame developed by SEAFDEC. After completion of the fourth quarter, they were to use these progress reports to develop and submit a final report (these are included in Appendix I). This mechanism is presented in Figure 2.

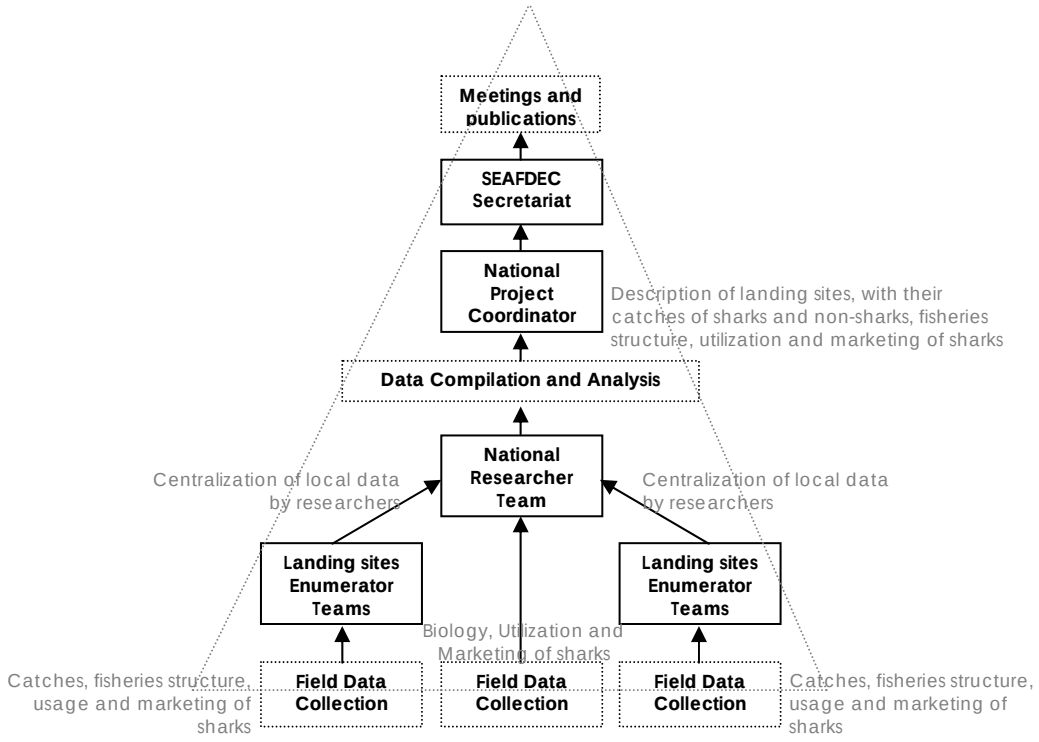


Figure 2. Reporting mechanism

2.1.4 Range of data collected

The data collected by each ASEAN Country on shark catch and on fisheries catching sharks at each selected landing site included:

1. General description of the fisheries (local socio-economic importance)
2. Landing data, mostly total catch of shark
3. Research on shark biology

The study relied on local enumerators, based at each landing sites for most (Table 4) who collected regular basic data and information in a time period for each quarter, complemented and supported by national researchers who visited the site a week per quarter (Table 5). The latter were strongly recommended to consult and cross-check information through discussion with the enumerators. An important part of the duty of the researchers was collecting specimens of sharks for biological studies. The most dominant species of sharks that are captured in national waters were selected first-hand for these studies (between 4 and 10 species according to the country) on length-frequency, sex ratio, and maturity stage.

Table 4. Data collection by enumerators

Timeframe	Daily basis, for 30 days per quarter.
Location	Each landing site individually.
Tasks	1. To collect the *total volume of shark and non-shark catches.* Shark catches should be very preferably collected by type of fishing gear while no distinction is necessary in term of species.
	2. To collect *descriptive information on the fisheries structure, and on the local usage and marketing of sharks.*

Table 5. Data collection by researchers

Timeframe	Daily basis, for 7 days per quarter (possibly shortly after completion of quarterly data collection by enumerators).
Location	Each landing site individually
Tasks	1. To provide a *general description of the landing site*, including description of the fishing boats, with their size, crews and gears, the fishing grounds, with their location and area, and the socio-economic characteristics of the shark fisheries.
	2. To collect data on the *shark biology*. This includes species composition, length frequency and sex and maturity
	3. To describe the *utilization and marketing of sharks*, how sharks are used, into which kind of product, from which fishing source and for which type of market destination. Some assessment of local prices of shark parts and products should also be carried-out.
	4. To *collect existing secondary information on shark utilization and trade* available in the government (e.g. Central Bureau of Statistics, Ministry of Trades, or others). Available data of at least the last 5-10 years should be collected.

2.1.5 Limitations

It is important to note at this stage that some of the submitted quarterly reports were sometime incomplete or containing inaccuracies which negatively affected their use and the making of this regional synthesis. The different starting time for the study, it was not planned to be so, as mentioned above further hindered the development of a regional picture of the shark fisheries and could have lead to inaccuracy and bias. It is therefore suggested to take the results presented in this Chapter with caution and to refer when needed to the national reports (Appendix I). The purpose of this Chapter is to compile both quantitative and qualitative data collected in the region in a simple manner in order to draw a gross yet simple picture of the situation in Southeast Asia.

Data was only available for 25 landing sites of the 28 selected one, distributed amongst 7 countries, since Brunei did not provide complete results for any of his 2 landing sites and Indonesia did not continue her data collection in Bintung (not accessible enough).

2.2 Results

2.2.1 Quantity of shark catch and its proportion to total fish catch

Total catch data recorded at the landing sites in each country is shown on Table 6, was measured in terms of body weight. Since most of shark catches can be landed in pieces rather than the whole body, the data can possibly be biased. In general, shark catch as relative to total catch in all eight countries is fairly low and this reflects the general by-catch nature of shark catch in Southeast Asia. Higher percentages, as reported in Brunei Darussalam, the Philippines and Indonesia, are mostly certainly to be related with very low sampling sizes and the fact the enumerators might have targeted fishing boat with lots of shark in the catch thus biasing the proportion. The percentages in these 3 cases are likely to be widely overestimated.

It is however quite clear that long lines are frequently associated with the by-catch of sharks, and that in these two countries, there exist some limited fisheries using long lines that target sharks. Indonesia and the Philippines are archipelagic in nature and have different target species than other more “continental” countries, as they are likely to catch more migratory species. They therefore use different fishing gear, which are more adapted for pelagic species, while not

having many trawlers. It might be worthwhile to explore the ecological difference of coastal and migratory species of shark, to see if this influence a higher rate of by-catch.

Countries with a bigger sampling size show more coherent results with typically less than 1% of catch of shark (in terms of bodyweight) when compared to total fish catch. In Malaysia and Thailand, trawlers were the main culprit in the by-catch of sharks but the proportion the shark catches as relative to total catches remained low.

Table 6. Total catch of shark and its proportion to total fish catch during the study

Country	Total sampling size of fish (in kg)	Total sampling size of shark (in kg)	Shark catch as relative to total catch (%)
Brunei Darussalam	**33,885**	4,309	**12.72***
Cambodia	25,481,010	149,803	0.59
Indonesia	**739,442**	101,471	**13.72***
Malaysia	19,214,035	131,819	0.69
Myanmar	25,978,057	51,792	0.20
Philippines	**113,696**	11,090	**9.75***
Thailand	15,596,568	38,097	0.24
Vietnam	30,056,961	119,098	0.40

**Likely to be insignificant due low sampling size and enumerators investigating fishing boat with lot of shark catches.*

2.2.2 Total weight composition of fishing gear catching shark

Total weight composition of fishing gear catching shark in each country, excluding Myanmar, is shown on the Figure 3 for the 1-year data collection.

Most of the shark catches in Brunei Darussalam were landed by gill-netters, while half of the sharks in Cambodia were also caught with the same gear. In Indonesia, the Philippines, and Vietnam, gill-netters also contributed significantly to shark catch, with namely 39.19%, 27.64%, and 28.42% respectively. Long-liners have contributed to the largest proportion of shark landings in Indonesia, the Philippines, and Vietnam, namely with 60.74%, 63.87%, and 65.57% respectively. Meanwhile, in Malaysia and Thailand, trawlers were found to be a fishing gear that significantly catch sharks, namely at 87.97% and 96.57% respectively. The significant shark catch landed by trawlers was also recorded in Cambodia, at 39.41% of the total shark catch by weight. A few sharks were reported to be caught by purse seiners in Myanmar and Thailand but other fishing gears were found to have no significant by-catch of shark in the Southeast Asian region.

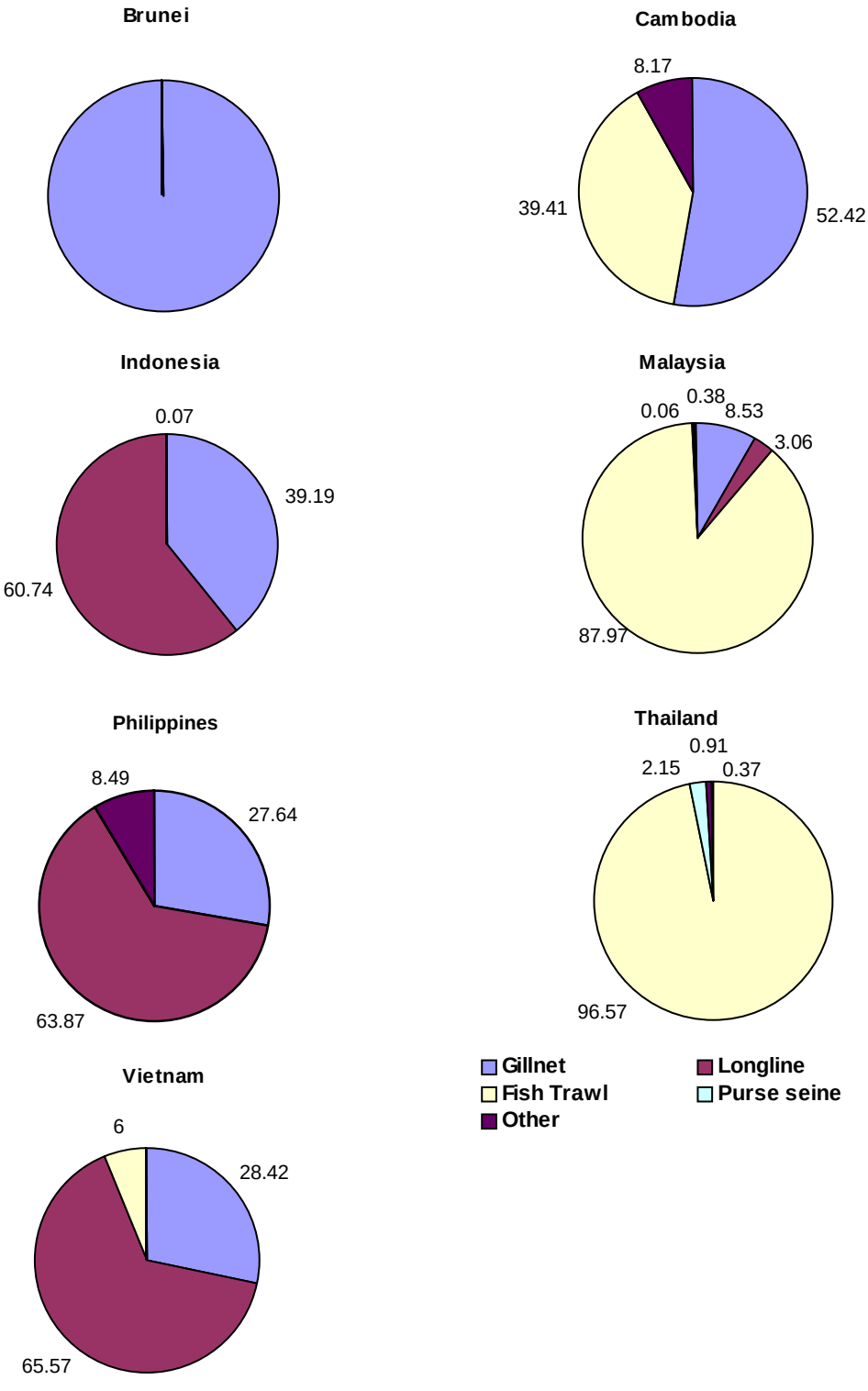


Figure 2. Weight Composition of Fishing Gear Catching Shark (in %) in each country during the 1-year data collection

2.2.3 Species composition and biology of dominant species captured

From the sampling conducted during the study period, there are around 69 species found (Table 7) in the Southeast Asian region. Nevertheless, only around 10 species were dominantly found in each country, as shown in table 8. The study shows that most of the sharks studied for biological parameters were juveniles, but this might be biased by the fact that most researchers couldn't afford to purchase larger sharks from fishermen, thus getting only smaller size specimens.

Table 7. List of Shark Species found in the ASEAN Region

Shark Species	Found in
1. *Alopias pelagicus*	INA, PHP, VIET
2. *Alopias superciliosus*	PHP, THA
3. *Alopias vulpinus*	THA
4. *Alopias sp.*	MAS
5. *Atelomycterus marmoratus*	CAM, MAS, MYM
6. *Carcharhinus albimarginatus*	INA, NYM, PHP
7. *Carcharhinus altimus*	PHP, THA
8. *Carcharhinus amblyrhynchoides*	MAS, MYM, THA
9. *Carcharhinus amblyrhynchos*	INA, MAS, THA
10. *Carcharhinus amboinensis*	MYM, PHP, THA
11. *Carcharhinus borneensis*	MAS, MYM
12. *Carcharhinus brachyurus*	
13. *Carcharhinus brevipinna*	INA, MAS, MYM
14. *Carcharhinus cautus*	INA
15. *Carcharhinus dussumieri*	CAM, INA, MAS, MYM, THA
16. *Carcharhinus falciformis*	INA, MYM
17. *Carcharhinus fitzroyensis*	INA
18. *Carcharhinus galapagensis*	MYM
19. *Carcharhinus leucas*	CAM, MAS, MYM, PHP, THA
20. *Carcharhinus limbatus*	CAM, INA, MAS, MYM, PHP
21. *Carcharhinus longimanus*	INA
22. *Carcharhinus melanopterus*	CAM, INA, MAS, MYM, THA

Shark Species	Found in
23. *Carcharhinus plumbeus*	INA, MAS, MYM
24. *Carcharhinus sealei*	MAS, MYM
25. *Carcharhinus sorrah*	CAM, INA, MAS, MYM, THA, VIET
26. *Cetroscymnus crepidater*	INA
27. *Chaenagaleus microstoma*	
28. *Chiloscyllium griseum*	CAM, MAS, MYM, THA, VIET
29. *Chiloscyllium hasselti*	MAS, THA
30. *Chiloscyllium indicum*	MAS, THA
31. *Chiloscyllium plagiosum*	MAS, THA, VIET
32. *Chiloscyllium punctatum*	CAM, MAS, MYM, PHP, THA
33. *Eugomphodus taurus*	PHP
34. *Eusphyra blochii*	MYM
35. *Galeocerdo cuvier*	INA, MAS, MYM, PHP
36. *Glyphis gangeticus*	MYM
37. *Halaelurus buergeri*	VIET
38. *Halaelurus canescens*	MYM
39. *Hemigaleus microstoma*	MAS, MYM
40. *Hemipristis elongatus*	INA, MAS, MYM, THA
41. *Heptranchia perlo*	INA, VIET
42. *Heterodontus zebra*	MAS, VIET
43. *Hexanchus gresius*	PHP
44. *Isurus oxyrinchus*	INA
45. *Lamiopsis temmincki*	MAS
46. *Loxodon macrorhinus*	MAS, MYM
47. *Mustelus griseues*	VIET
48. *Mustelus manazo*	INA
49. *Mustelus sp.*	MAS, INA
50. *Mustelus sp.B*	THA
51. *Negaprion acutidens*	PHP

Shark Species	Found in
52. *Nebrius ferrugineus*	PHP
53. *Orectulobus ornatu*	PHP
54. *Prionace glauca*	INA
55 *Pseudo komoharai*	INA
56 *Rhiconodon typus*	CAM
57 *Rhina ancylostoma*	MYM, PHP
58 *Rhinubatus sp.*	PHP
59 *Rhizoprionodon acutus*	MAS, MYM, PHP, THA
60*Rhizoprionodon oligolix*	MAS, MYM
61*Rhyncobatus djiddensis*	PHP
62 *Scoliodon laticaudas*	MAS, MYM

Shark Species	Found in
63 *Sphyrna lewini*	INA, MAS, MYM, PHP, THA, VIET
64 *Sphyrna Mokarran*	CAM, MAS, MYM
65 *Squaliformis sp*	PHP
66 *Squalus megalops*	INA, PHP
67 *Squalus sp.*	MYM
68 *Stegostoma fasciatum*	CAM, INA, MAS, MYM, VIET
69 *Triaenodon obesus*	MAS, MYM, PHP, THA

Note: CAM = Cambodia; INA = Indonesia; MAS = Malaysia; MYM = Myanmar; PHP = Philippines; THA = Thailand; VIET = Vietnam

Table 8. The ten dominant species in the specific composition of shark catch in each country

Country/ Species	Percentage (%)		Total length (cm)		Average Weight (kg)	Average maturity stage *
	Number	Weight	Mean	Range		
INDONESIA						
1. Carcharhinus falciformis	33.71	31.78	122.89	-	26.63	Immature
2. Carcharhinus almbiyrhynchos	16.85	13.25	130.4	-	22.21	-
3. Prionace glauca	8.99	14.56	206.13	-	45.75	-
4. Alopias pelagicus	5.62	14.00	258.78	-	70.40	-
5. Carcharhinus longimanus	5.62	3.38	108.12	-	31.08	-
6. Carcharhinus sorrah	4.49	0.37	74.5	-	2.33	Immature
7. Sphyrna lewini	4.49	14.00	133.95	-	88.00	Immature
8. Squalus megalops	4.49	0.31	64.6	-	1.93	-
9. Carcharhinus brevpinna	4.49	4.08	111.73	-	25.65	Mature
10. Mustelus sp.	3.37	0.67	108.67	-	5.58	Mature
Others	7.87	3.60	-	-		-
MALAYSIA						
1. Scoliodon laticaudus	27.74	3.58	38.47	26.6-51.5	0.46	Mature
2. Chiloscyllium punctatum	26.76	21.75	65.37	26.7-98	1.70	Immature
3. Carcharhinus sorrah	7.97	16.66	84.37	37.8-150	3.67	Immature
4. Chiloscyllium hasselti	7.63	6.02	59.20	38.3-82.6	1.12	-
5. Carcharhinus sealei	7.29	3.55	55.11	31.5-85	1.07	Immature
6. Sphyrna lewini	5.48	10.66	58.9	46.4-89.4	4.20	Immature
7. Rhizaprionodon acutus	3.63	2.2	68.70	36-95	1.40	Immature
8. Carcharhinus amblyrhyncoides	2.61	14.72	91.1	90.2-100	11.51	Immature
9. Hemigaleus microstoma	2.34	1.96	62.72	38.3-90.4	1.63	Mature
10. Carcharhinus griseum	1.74	0.89	62.56	44.6-80	1.13	-
Others	6.81	18.01	-			-

PHILIPPINES						
1. Triaenodon obesus	43.11	33.83	-	***75-167***	5.07	-
2. Squalus megalops	27.27	7.56	-	40-105	1.79	-
3 Rhinabatus sp.	10.41	2.36	-	70-93	1.46	-
4. Chiloscyllium punctatum	7.48	4.16	-	89-121	3.59	-
5. Rhyncobatus djiddensi	2.20	6.77	-	120-210	19.87	-
6. Carcharhinus limbatus	1.91	3.41	-	140-220	11.54	-
7. Negaprion acutidens	1.91	1.41	-	120-187	4.77	-
8. Alopias pelagicus	1.76	14.15	-	273-320	51.92	-
9. Galeocerdo cuvier	0.88	17.26	-	200-290	126.67	-
10. Carcharhinus albimarginatus	0.73	2.61	-	210-240	23.00	-
Others	2.34	6.48				
THAILAND						
1. Chiloscyllium punctatum	50.44	21.87	63.37	16.4-98	1.30	Immature
2. Chiloscyllium plagiosum	14.78	3.65	60.21	33-93	1.04	-
3 Chiloscyllium griseum	5.89	2.37	63.16	38.8-80	1.19	-
4. Carcharhinus sorrah	5.78	8.21	85.18	40.135	3.21	Immature
5. Sphyrna lewini	5.33	6.08	83.53	26-180	3.53	Immature
6. Carcharhinus melanopterus	3.78	3.53	88.22	35.5-124	3.47	Immature
7. Carcharhinus leucas	1.67	2.17	101.15	62-185	3.93	-
8. Atelomycterus marmoratus	1.67	0.26	57.23	47-69	0.46	-
9. Carcharhinus amblyrhyncos	1.33	5.6	79.79	76-95	3.53	-
10.Alopias vulpinis	1.11	15.46	252	130-322	46.67	-
Others	8.22	30.8	-	-	-	-
VIETNAM						
1. Carcharhinus sorrah	66.10	55.13	115.38	93-130	3.34	Immature
2. Chiloscyllium griseum	20.22	19.31	67.82	43-107	1.60	-
3. Chiloscyllium plagiosum	4.68	1.72	52.97	32.5-78	0.60	-
4. Atelomycterus marmoratus	3.00	0.29	36.96	27.2-59	0.21	-
5. Stegostoma fasciatum	2.62	1.68	52.95	35-88	0.66	Immature
6. Heterodontus zebra	0.94	1.88	69	59-81	3.78	Mature
7. Halaelurus buergeri	0.75	0.30	58	50-62	0.65	-
8. Sphyrna lewini	0.56	0.47	61	59-69	3.03	Immature
9. Alopias pelagicus	0.37	10.62	59	59-59	15	-
10. Carcharhinus brachyurus	0.19	0.06	78	78	2.47	-
Others	0.57	8.54	-	-	-	-

** Maturity stage was compared to standardized maturity length (see box below)*

Standardized matured length for some common species

Determining the maturity stage of sharks on the field is difficult exercise. The following matured lengths can help observations by providing standardized maturity stage related to the length of the shark species mentioned as the Commercial sharks of Malaysia and Brunei Darussalam. This matured length of shark species is very useful to determine the maturity stages of the sharks at the landing sites.

Species name	Local name	Sex	Matured length (cm)
Eusphyrna blochii	Wing head shark	♂	108
		♀	120
Spyhrna lewini	Scalloped hammer head shark	♂	140-160
		♀	200
Heterodontus zebra	Zebra horn shark	♂	64-84
Galeocerdo cuvieri	Tiger shark	♂	300
		♀	330
Stegostoma fasciatum	Zebra shark	♂	147-183
		♀	169-171
Carcharhinus amblyrhynchoides	Graceful sharks	♂♀	110-115
Carcharhinus brevipinna	Spinner shark		Varies between region
Carcharhinus falciformis	Silky shark	♂♀	200-210
Carcharhinus galapagensis	Galapagos shark	♂	210-230
Carcharhinus limbatus	Common blacktip shark	♂	135-180
		♀	120-190
Carcharhinus malcloti	Hard nose shark	♂♀	70-75
Carcharhinus melanopterus	Black tip reef shark	♂♀	95-110
Carcharhinus plumbeus	Common black tip shark	♂	130-180
		♀	145-185
Carcharhinus sealei	Black spot shark	♂♀	70-80
Carcharhinus sorrah	Spot tail shark	♂♀	90-95
Loxodon macrorhinus	Slit eye shark	♂♀	60-80
Rhizoprionodon acutus	Milk shark	♂♀	75
Rhizoprionodon digolinx	Grey sharp nose shark	♂♀	35-40
Scoliodon laticaudus	Spade nose shark	♂	24-36
		♀	33-35
Triaenodon obesus	White tip reef shark	♂♀	105
Chaenogaleus macrostoma	Hook tooth shark	♂	68-97
Hemipristis elongatus	Fossil shark	♂	110
		♀	120
Hemigaleus microstoma	Weasel shark	♂	60
		♀	65
Chiloscyllium puntatum	Grey carpet shark	♂	68-76
Musteus mosis	Arabian smooth hound	♂	63-67

In the case of Cambodia, there are only 9 species of shark found during the study period namely, *Stegostoma fasciatum, Chiloscyllium punctatum, Chiloscyllium griseum, Atelomycterus marmoratus, Sphyrna mokarran, Carcharhinus leucas, Carcharhinus dussumieri, Carcharhinus melanopterus, and Rhicondon typus.* Unfortunately, no species composition of catch neither biological data could be reported. Meanwhile, in Myanmar, the lack of knowledge on taxonomy causing serious problems in shark identification, while the vast majority of sharks were landed already cut into pieces, adding to the difficulty for local enumerators to identify the species.

Several species can be found in many countries in the region, even among the dominant species, such as *Chiloscyllium punctatum* that is widely reported by Malaysia, the Philippines and Thailand.

2.2.5 Other biological aspects

Besides biological parameters such as length and weight that has been collected during the study, other important biological aspects have been recorded such as sex ratio and the maturity level of the shark caught. Results are however very disparate from country to country and impossible to summarize regionally.

In Cambodia, biological parameters were only observed for a few shark specimens, due to lack of experience at local level. The maturity stage was only observed for female sharks and it was found that some sharks were mostly caught immature, such as from the species of *Chiloscyllium griseum* and *carcharhinus melanopterus*.

Malaysia recorded juvenile & sub adult stage catches of several species (*C. sorrah, C. sealei, C. dussumieri, C. limbatus and C. amblyrhynchoides)*. In Thailand and Vietnam, juvenile sharks were reported the most but this is probably due to the difficulty to have access to big size sharks for biological study (they are simply too expensive) whereas in Vietnam there were difficulties in carrying out biological studies as most sharks were landed in a dried form.

2.3 Shark Utilization and Marketing

The utilization and market destination of shark product for most species can be summarized in the region as represented in Figure 3 and summarized in Table 8. Almost all participating countries reported that shark catch was fully utilized and that there was nearly no discard for any part of the body. Fining is thus a complete alien concept in the region. In fact, in some countries like Myanmar, the locals even directly consumed certain internal organs of shark. Under certain circumstances, Vietnam reported that during a rainy weather, only the shark fins were processed while the meat was discarded as it couldn't be dried properly. Shark meat is in fact popular food throughout the region although not in every community. Value added process also take place for certain species and products as summarize in Table 9. It is important to note that even a small daily shark catch by a fishing unit provides substantial economic return to the fishing household, shark fins being preserved and processed backyard until sold.

Although almost all countries have clearly reported that sharks are both sold on local and export markets, it is nonetheless clear that certain shark products are highly marketable and either sold to an urban elite through expensive restaurants or exported to countries ready to pay a premium prices for these. For instance, the Philippines report that while almost all shark parts are sold at the local market (e.g. meat, smaller fins), larger shark fins are exclusively for sale at the international market.

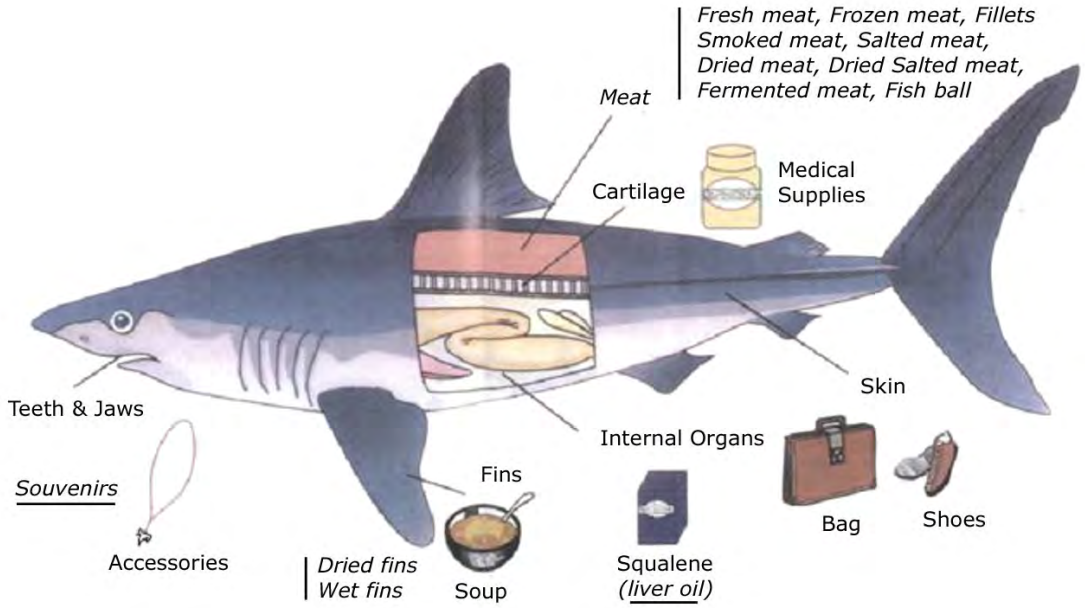


Figure 3. Utilization of shark in Southeast Asia
(figure courtesy of the Global Guardian Trust, Japan).

Table 9. Summary of Utilization of shark products in the Southeast Asian Region

Part	Product type after processing	Market Destination
Meat	Fresh meat, frozen meat, smoked meat, salted meat, dried mead, dried salted meat, fermented meat (pindang), fish ball	Mostly local market
Fin	Dried fin, wetfin flesh	Mainly export market (at least for the larger ones)
Bones	Dried cartilaginous bone (Chinese medicine)	Mainly export market
Liver	Liver oil extracted by heating	Mainly export market
Jaw	Dried jaw (souvenir)	Mostly local market
Teeth	Dried teeth (souvenir)	Mostly local market
Skin	Dried and fried or making leather product	Mainly export market

Complete information on shark utilization and marketing in the region is summarized in Table 10.

Table 10. Species, Part, Usage and market destination of shark fisheries (for all national landing sites and quarters reported)

Country	Species	Part	Usage Locally consumed (C), Discarded (D), Traded (T), Processed (Type of processing)	Market Destination
Cambodia	*S. fasciatum*	-	-	-
	C. punctatum, C. griseum, C. melanopterus	Whole and fins	Locally consumed and traded	Local and City markets
	A. marmoratus, S. mokarran, C. leucas, C. dussunieri	Whole	Locally consumed	Local and City markets
	Rhinconodon typus	whole	-	-
Indonesia	*C. amblyrynchos, C. melanopterus, C. brevipinna, C. cautus, C. fitroyensis*	Meat, stomach, skin	Dry salted, head and stomach are used in feeding aquaculture, dried cartilage	Local market
	C. plumbeus, A. superciliosus, A. pelagicus, I. Oxyrinchus, P. galuca, G. cuiver, S. lewini	Meats, fin Tomach, skin	Dry salted, dried fins, head and stomach are used in feeding aquaculture, dried cartilage	Local market, dried find exported to Taiwan, Hong Kong, China and Japan
	S. megalops	Meat, liver, stomach, skin	Dry salted, dried fins, head and stomach are used in feeding aquaculture, dried cartilage, liver oil	Local market
Malaysia	*C. sorrah, C. punctatum, R. acutus, C. sealei, H. microstoma, C. dussumieri*	whole	C, T, fresh whole shark, shark fin, frozen shark meat, salted meat, shark bone, shark skin, fish ball	Local Markets, Singapore, Hong Kong, Taiwan, China
	C. hasselti,	Whole	C, T	Local Markets, Hong Kong, Taiwan China
	S. lewini, C. griseum, S. fascianatum	Whole	C, T, fresh whole shark, shark fin, salted meat, shark bone, shark skin	Local Markets, Singapore, Hong Kong
	C. leucas	Whole	C, T, wetfin Flesh	Local Markets, Singapore
	S. laticaudus	Whole	C, T, shark fin, salted meat, fish ball	Local Markets, Hong Kong, Taiwan, China
	L. macrorhinus	Whole	C, T, fresh whole sharks, shark fin, frozen, shark meat, & fish ball	Local Markets, Singapore
	S. mokarran	Whole	C, T, fresh whole shark, shark fin, salted meat	Local Markets
	G. cuvier	Whole	C, T, fresh whole shark	Local Markets, Singapore
	T. obesus	Whole	C, T	Local market, Hong Kong, China
	C. indicum	Whole	C, T	Local Market, Singapore
	C. amblyrhynchoides	Whole	C, T, frozen shark meat, fish ball	Local Market
Myanmar	Shark (no species identification)	All part are valuable	Fresh meat, dried meat, internal organ such intestine and liver are also locally consumption, dried fins and skins are used for trading, shark cartilage processed as medical and foods products	Most of shark product are exported to China, jaws are exported to Thailand

Philippines	*C. punctatum, T. obesus, E. taurus, N. acutidens*	Meat	Traded	Local Market
	S. megalops	Meat	Traded	Local Market
		Liver	Extract liver oil (cooked process)	Local Market
	R. acutus, R. djiddensis, Rhinobatos sp, A. pelagicus, Isurus oxyrinchus, S. lewini, C. falciformes, C. dussumieri, C. melanopterus	Meat	Mainly locally consumed and traded	Local Market
		fins	Traded	Local Market
	C. amboinensis, C. leucas	Meat	Locally consumed	Local Market
		Fins	Traded	Local Market
		Jaws	Traded	Local Market
Thailand	*C. punctatum, C. plagiosum, C. sorrah, C. dussumieri, A. marmoratus, C. amblyrhynchos, C. melanopterus, C. griseum, C.indicum S. lewini, C. amblyrhynchoides, T. obesus, R. acutus, C. hasselti, A. vulpinus, C. altimus, C. leucas, H. elongates, S. fascinatum, C. amboinensis, Mustellus sp.B A. superciliosus*	Whole	Mainly locally consumed and traded	Local Market in Thailand
Vietnam	*A. pelagicus, C. brachyurus, C. falciformes, C. sorrah, M. griseues, S. fasciatum, H. zebra, H. perlo, C. plagiosum, H. buergeri, A. marmoratus, and S. lewini*	All part (Meat, fins, bone, skin, liver)	Shark oil (extracted liver by heat), dried meat (depend on the weather), frozen meat, gut and stomach are discarded	Fresh and dried meat is sold locally, skin, bone or liver oil marketed in China

According to the 1-year data collection of shark, market process varies from one country to another country, in Malaysia, sharks products generally will be sold directly to traders. Meanwhile, in Vietnam sharks products will be landed or sold to a middleman before being sold to next buyers and in Indonesia sharks products will undergo an auction process before reaching the traders. Meanwhile in other countries, the shark market can be combined among the mentioned market patterns.

In general pattern of shark trade, as reported during the study, can be synthesized as represented in Figure 4.

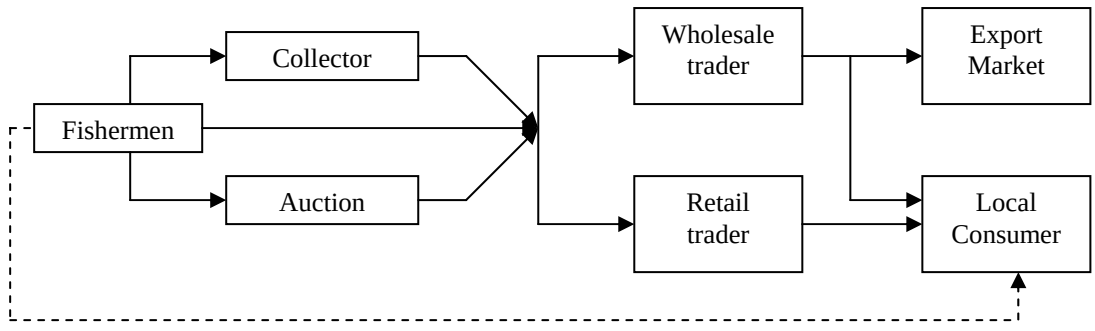


Figure 4. General pattern of shark trade in Southeast Asia

2.4 Problems and Constraint during the Regional Study

Many limitations have been observed during the course of the study, and certainly many lessons have been learnt through conducting these ad-hoc activities. Many areas for improvement were also identified. In some countries, it was found that when external assistance will be available, comprehensive data collection on shark resources can be continued in the future. In the context of the study itself, serious flaws and lack of training resulted in constraints in obtaining quality data and information. The reports submitted by the member countries show a wide range of variety, especially in terms of quality, reflecting the very different available human and financial capacity of the respective ASEAN countries.

In conducting the regional study, it was noted that the following common constraints were encountered by most of the participating countries:

- Insufficient knowledge and experience in data collection for sharks particularly on conducting biological research including taxonomy and determination of maturity;
- Limited financial support which hindered optimal data collection;
- Limited cooperation with fishers and landing site owners in data and specimen collection; and
- Access to samples of large-size sharks as they are usually cut into smaller parts due to limited fish hold capacity of fishing vessels, or landed headless, finless, gutted or dried.

The participating countries made several suggestions for possible improvement of data collection in the future:

- Regular cross checking of the collected information with relevant secondary information when available
- Preparation of elaborated guidelines for data and information collection on sharks
- Training for researchers on shark taxonomy and identification of maturity stages;
- Development of methods for estimation of the actual size (weight and length) of sharks as often landed already separated in parts;
- Need for technical cooperation on species identification of sharks by observation of denticles;
- Possible expansion of shark trade study into other member countries; and
- Future activities focus on streamlining routine and non-routine data collection methodologies to ensure their sustainability.

The problems and constraints faced by the member countries during the regional ad-hoc study on sharks are summarized for the region in Table 11. The Table also highlights means to resolve these issues, as suggested by the national project coordinators during the second Regional Technical Consultation on Sharks.

Table 11. Problems and constraints faced during study and suggestions of member countries

Country	Problems & Constraint	Suggestions for future action
1. Catch & Biological Data	- Sharks non-targeted species: by- catch or incidental catch	- Develop rapid appraisal methods or tools for shark identification such as species identification based on fin/dermal denticles
	- Sharks landed in different places at various time (depend on season or climate), landing schedule not consistent	- Keep record of fisher's landing schedule - Study shark behaviour and distribution to find out the fishing ground & spawning season of shark and hinder the catch of immature shark - Need lasting research activities to know the seasonal fluctuation of shark catches - Need to expand study areas beyond the project sites to cover all sites where sharks might be potentially landed
	- Shark landed incomplete (headless, finless or gutted), already cut into pieces, or in dried forms (such as dried meats, skins and bones) resulting in difficulties to determine their actual length, weight and maturity stage	- Study to determine the whole weight of sharks that are landed with missing body parts: develop conversion factors to get the whole weight of the fish based on the weight of some parts - Develop standardized method to determine maturity stage - Need research on board: collect biological data when fishers are processing sharks
	- Not enough samples for certain species due to high demand (most of them sold directly to middlemen) while big size sharks are expensive to purchase for biological study, resulting in that the only small sized sharks are available for biological study (normally immature stage)	- Take photo for huge specimens then refer to expert for validation - More fund should be allocated for future research, covering this kind of purchase for biological studies
	- No cooperation from fishermen, owners & skippers in providing sample/data (misunderstanding on the purpose of the study)	- Need of interpersonal dialogue with all level of stakeholders, awareness building on the purpose of NPOA-Sharks, and organization of national stakeholder workshops - Work closely and strengthen cooperation with the fishers, owners and skippers - Cooperation with the other national resource survey projects as well as other local projects for getting more scientific information on shark

	- Inadequate capacity for both researchers and enumerators in species and biological identification	- Provide technical or on-site training courses on data collection (biological/ taxonomy identification) - Provide appropriate formats or guidelines for data collection and analysis on shark biology. - Produce field guides for shark identification
	- Lack of existing biological data, e.g. species, spawning season, maturity size, distribution and abundance	- Data collection must be carried-out continually, both using the national system and ad-hoc studies, to provide sufficient baseline information on the status of sharks
2. Utilization and marketing data	- No cooperation from fish merchants, middlemen, sellers , traders and processors in providing data	- Same suggestions as with the problem mentioned above with no cooperation from fishermen, owners & skippers - Be friendly with small traders and assure them of the confidentiality of the data collected (e.g. do not take their name and address)
	- Lack of information on existing shark marketing channels as traded shark is normally not reported to the relevant local authority	- Cooperate with other resource survey to include collected data on shark
	- Shark products are traded in different markets (possibly exported) resulting in the difficulty to gather trade data. In addition, normally shark are traded in a large number of small operations, as it is an irregular by-catch (difficult to report)	- Expand surveys in all local markets and cooperate with traders and custom agencies - Interview middlemen for getting data and information
3. Secondary information and other statistical data	- Normally, structure of national statistical data collection do not include sharks and if it does, there is no break down by species (except in Indonesia, which started having specific information in 2002)	- Reorganize data collection and data processing methods to include sharks - set up suitable data collection and data processing format - Train all levels of people with responsibility in data collection and processing, especially enumerators - Facilitate shark research and fishery monitoring at national and regional levels and encourage the sharing of data - Ensure uniform approaches at the national and regional level for shared stocks - Catches of shark should be broken down by species and include information on location and date of catch - Shark by-catch, either retained or discarded should be recorded
	- Only little research has been done dealing with sharks and it is difficult to trace down. Inconsistency in compilation of data/information. Some data only exist as hard copies available at local offices.	- Conduct survey or inquires possible data sources, maybe through national network and contacts - Conduct national workshops on sharks and invite researchers, line agencies, NGOs, and especially local people who use/trade shark resources.

4. Other	- The guidelines provided for the SEAFDEC study were not always easy to understand. For some, this shark study is the first experience in collecting shark data, thus only 1-year data collection is not enough to get accurate data and experience	- Provide a regional suitable format of data entry - Provide training to produce quality reports as well as other relevant important things
	- Limited financial support and fund	- More fund should be provided for a comprehensive study
	- Shark, in developing countries, normally is a less priority issue when considering national issues, even within fisheries	
	- Need to produce NPOA-Sharks	- Need financial and expertise support from SEAFDEC and other organizations

CHAPTER 3 – THE CURRENT PROGRESS OF THE DEVELOPMENT OF NPOAS-SHARKS IN THE REGION

Along a series of regional meetings in the last three years, particularly during the ASEAN-SEAFDEC Preparatory Meeting on Issues Related to Fish Trade and Environment held in March 2004 in Hat Yai, Thailand, the Member Countries progressively adopted a common position on how to manage shark resources. This resulted in the commitment by all members to establish their respective National Plan of Action on Sharks (NPOA-Sharks) in line with the FAO International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks). The ASEAN member countries stressed out that fisheries catching sharks, like all other fisheries, are appropriate fisheries to utilize marine resources and can be managed by the ASEAN governments in a sustainable manner, through the establishment of the NPOA-Sharks within their management framework.

During this Preparatory Meeting, it was agreed that these NPOA should be supported with the best scientific evidence available under the framework of a comprehensive sectoral fisheries management. In other words, management measures for sharks would be integrated into the existing management framework for national fisheries, which will be strengthened, not taken separately. Each NPOA-Sharks, outlining data collection & analysis, supporting research, awareness & capacity building, and monitoring, could help clarifying the actions required for such integration.

It was recognized that great efforts would be required in order to continuously monitor shark resources, but this indeed would form the basis for appropriate fisheries management programs. FAO goes beyond monitoring in its advices for developing NPOAs. It prescribes that states should cover the following aspects: shark fisheries descriptions, species identification, stock identification and stock structure, and fishery monitoring. Yet, in conducting their national study with the support of SEAFDEC, the Member Countries faced several serious constraints, as highlighted above, which will need to be overtaken in the future. This can probably only be done with external assistance.

During the 2nd Regional Technical Consultation on Sharks, the Member Countries requested SEAFDEC to provide a basic frame and additional guidelines to the FAO IOPA to support the formulation of NPOA-Sharks that would take place in 2005. This frame is presented in the box below.

Suggested Content of a NPOA-Sharks in the Southeast Asian context

1. **Preamble**
   - 1.1. The Preamble would state the main national policy and position for the sustainable exploitation of shark species.
   - 1.2. It would also emphasize on linkages with the existing overall fisheries management framework, as follow:
     - The existing overall fisheries management framework
     - The Resolution and Plan of Action adopted at the ASEAN/ SEAFDEC Millennium Conference
     - The regional guidelines of the Code of Conduct for Responsible Fisheries
     - Pursue international cooperation through FAO and regional fisheries management organizations.
   - 1.3. The Preamble would eventually also include a brief review of national shark fisheries, possibly based on the initiatives undertaken under ASEAN-SEAFDEC mechanisms.

2. Objective

"The objective of NPOA-Shark in ASEAN region is to take appropriate actions for the improvement of data collection on shark fisheries that will ultimately support the conservation and management of sharks and their long term sustainable use under the comprehensive national fisheries management policy, plan, and program."

3. National Plan of Action for Shark

As the first priority is to improve data and information collection on shark fisheries, this key section would cover all the four components described below, clearly stating the strategies for achieving the above mentioned objective.

3.1. Monitoring (core component)
- Improve fisheries statistics (keywords: routine and non-routine mechanisms, indicators)
- Ultimately, assess status and trends of shark stocks and ensure continuous monitoring

3.2. Data collection and analysis
- Review shark fisheries
- Cooperate with industry
- Gather ecological information on shark species
- Understand shark utilization and trade
- Understand socio-economic importance of shark fisheries

3.3. Research
- Develop taxonomy
- Facilitate and encourage research on little known shark species;
- Promote research activities to maximize utilization of sharks
- Asses threat to shark populations, determine and protect critical habitats

3.4. Building of human capacity
- Train those concerned with identification of shark species;
- Promote effective utilization of shark catches;
- Build awareness on shark resource management among stakeholders and public;

4. Priorities

The actions to be undertaken are presented in order with priorities and possibly schedule, clearly stating how the country's first focus is on the improvement of data collection to understand national shark fisheries. Later on, focus could be shifted to more management and conservation type of actions, as judged necessary by the Member Country.

5. Cooperation with International and Regional Fisheries Management Organizations

The role and support that regional and international organizations such as SEAFDEC and FAO, as well as donors, could provide would be specified.

It is certain that there is a vast difference of capacity between ASEAN member countries in developing their NPOA, in terms of technical skills, manpower and financial resources. This has resulted in some countries going much faster than the others in the development of their Shark Plan. The approaches adopted from country to country have also widely differed and one will find great differences among the draft NPOA developed in Southeast Asia.

As of October 2005, when the member countries met at the ASEAN-SEAFDEC Preparatory Meeting on Environmental Related Tasks in Southeast Asia: Sharks and Sea cucumbers, in Bangkok, Thailand, only Malaysia and Thailand had already completed their NPOA-Sharks. Meanwhile, Brunei Darussalam, Cambodia, Indonesia, Myanmar, the Philippines and Vietnam were in a drafting stage, pending for critical input, and in some cases external support, as well as consultation with national stakeholders. In case of Myanmar, it was reported that some existing

national fisheries management schemes actually already existed to conserve sharks such as closed season and fisheries conservation area. Myanmar however reported that there was still a lot of work needed in order for them to complete the process of drafting their NPOA.

The complete progress of development NPOA by country as informed during the Preparatory Meeting on Environmental Related Tasks in Southeast Asia: Sharks and Sea cucumbers, can be summarized as follows:

3.1 The current progress of NPOA-Sharks development in Brunei Darussalam

No information has been provided by Brunei Darussalam, beside the fact they are currently drafting their NPOA-Sharks.

3.2 The current progress of NPOA-Sharks development in Cambodia

The fisheries law, recently reformed, is under the process of adoption, requiring the mobilization of a large part of the capacity of the Department of Fisheries. The limited manpower issue, coupled with a lack of national scientific information of sharks and habitats and of funding for activities, had greatly hindered Cambodia in developing their NPOA-Sharks. Nevertheless, compilation of relevant data and information related to sharks has been done, under SEAFDEC support, and serious efforts have been put to initiate a drafting process of a NPOA for the country.

The current drafting process in however further hindered pending because of the difficulty found by its undertaker to find partners and experienced people who can collaborate in the formulation of the NPOA. Also, sharks are definitively not a priority issue for Cambodia, where urgent and direly required efforts and funding are rather put into the process of development and poverty alleviation. These combined problems have resulted in serious difficulty to get a supporting budget, as SEAFDEC study has been terminated, to develop and formulate an effective NPOA, as this is unfortunately a costly process.

3.3 The current progress of NPOA-Sharks development in Indonesia

The Indonesian NPOA-Sharks is still being developed. Efforts were initiated in January 2005 when the Directorate of Fish Resources conducted a National Workshop for its formulation in collaboration with the Research Centre for Capture Fisheries. The workshop resulted in the drafting of a detailed outline of the Indonesian NPOA-Sharks to be.

The formulation of the plan then started with the reviewing of the shark status in Indonesia notably through using the results obtained from the SEAFDEC supported activities. Review exercises included reorganizing data collection methods, data processing, and the inclusion of biological, economical and social aspects.

Along this formulation process, many problems were observed. Among others, there were serious weaknesses in the shark data collection system and a lack attention paid on shark resources as sharks are not considered as primary food source neither as having a relatively good economical value. Another problem was that fishery statistics recorder in the past did not have any break down into species due to poor taxonomical knowledge of local enumerators. This changed in 2002 but this made understanding shark status and trends difficult.

3.4 The current progress of NPOA-Sharks development in Malaysia

Malaysia is one of the ASEAN-SEAFDEC member countries that have already completely the drafting of their NPOA-Sharks. The complete draft NPOA can be downloaded (*http:///www.mfrdmd.org.my*). Currently, they are getting input from the stakeholders through

national consultative workshops involving representatives from fishers, fisheries association, NGOs, entrepreneurs, and fishery managers from most states in Malaysia.

Briefing and explaining to public, fishers and other stakeholders on the importance to manage shark resources was done through national consultative workshops, exhibitions, talks, seminar, and media messages (radio and television). However, this is a source of problems as it requires important funding and manpower, and a lot of time, in order to build public awareness at the national level.

Practically, much has to be learned from the Malaysian experience, which stand as a beacon for other Southeast Asian countries in promptly and seriously developing their shark plan. The process was started by gathering information on status of sharks and rays from various sources such as a special research program initiated in 1999-2004, nation wide surveys, partly with SEAFDEC support, literature review, analysis of fisheries statistic, and use of others available sources of information. Once this information review was completed, Malaysia appointed a group of appropriate people as members of a committee to draft the NPOA.

This committee proceeded with the determination of a format for the NPOA and on deciding which key element will be used. For this purpose, they analyzed the suggested formats prepared by FAO, SEAFDEC Secretariat as well as existing NPOAs from other countries. Based on this, the drafting proper was initiated. This draft was then presented to a special committee, namely the Planning and Implementation Committee chaired by the Director -General of Fisheries Malaysia. The Committee made several suggestions and comments and the NPOA was subsequently amended before being openly distributed for comments through internet. The last step is to organize the “road-shows” or workshops to gather feedbacks from stakeholders in the different Malay states. Based on recommendations and suggestions from the stakeholders, the NPOA will be finalized and adopted in 2006.

3.5 The current progress of NPOA-Sharks development in Myanmar

The most important objective under consideration by the Department of Fisheries at present relates to the development and management of marine fishery resources to increase production. In order to achieve the balance between fishing efforts, sustainability of resources exploitation, and environmental conservation, various programmes were implemented. Yet, none of them explicitly address the need for the monitoring and management of shark resources. This is understandable given the nature of tropical multi-species fisheries, as in Myanmar, where management is best achieved for fish population as a whole. It would be impossible to focus on individual resource, or specific mono-species stocks of fish. Furthermore, sharks and rays have never been featured conspicuously in the landings of marine capture fisheries, either in terms of volume or value.

There is still a need for a comprehensive understanding of the biology and ecology of sharks and rays especially in areas pertaining to their population dynamics, critical habitat requirements during their life cycle and conservation needs. These are crucial factors for the successful management of sharks and rays resources. The absence of such comprehensive studies hinders the formulation of a management plan.

The Department of Fisheries is now in the process of drafting their NPOA, although this will be an expensive and time consuming activity. The objectives of their Shark Plan will be as follow:

- To ensure sustainable use of sharks and rays;
- To assess threats to shark and rays population and to provide special attention to the threatened stocks;
- To minimize unutilized incidental catches, waste and discards from sharks and rays catches;

- To encourage full use of dead sharks;
- To facilitate the identification and reporting of species-specific biological and trade data;
- To facilitate improved species-specific catch and landings data and monitoring of sharks and rays catches; and
- To improve and develop a framework for establishing research, management and educational initiatives of sharks and rays.

3.6 The current progress of NPOA-Sharks development in the Philippines

The Philippines has not started drafting their NPOA-Shark as they want first to comprehensively review all existing information and data available on sharks. However, some practical steps that will be used for the development of a NPOA have been identified as follows:

- Determine available sources of data and information on shark;
- Gather and review all available information from above sources;
- Draft the outline of the NPOA-Sharks including detailed content;
- Conduct a stakeholder dialogue/consultation where the detailed outline and process are presented, amended and eventually agreed;
- Raise the level of awareness to all sector of the community through the preparation of awareness building materials and the implementation of an information campaign. Practically, this will involve additional public consultations, seminars and other means of public communication like using TV and radio advertisements, flyers, billboards, and if deemed possible, through comics to reach children as well;
- Involve all stakeholders in the preparation of the NPOA-Sharks proper so that a sense of ownership is built;
- Prepare policy and regulations on the conservation and management of sharks
- Monitor the implementation of the NPOA-Sharks with the involvement of all stakeholders. In general, stakeholders would take an active part in the implementation of the provisions of the NPOA-Sharks.

3.7 The current progress of NPOA-Sharks development in Thailand

Thailand is another country in the region that already drafted their NPOA-Sharks. The process of development for the plan lied on try to answer the fundamental question: “What are the problems related to sharks in Thailand?”

Answers offered a clear linkage with the issue of the status of shark resources, in turn highlighting problems in shark management, which then lead to a second question – “How to solve these problems?”

Answering this resulted in identifying objectives and determined a scope by the development of the NPOA. On this basis, Thailand then set up an Action Plan to prepare her Shark Plan and later on went through a consultative process before completing the draft NPOA.

3.8 The current progress of NPOA-Sharks development in Vietnam

Vietnam is in the drafting process of their NPOA-Sharks. During this development, several problems arise such as the lack of data and information as few shark studies and surveys were carried out in the past beside the SEAFDEC supported study. As it is, statistical data on the catch of shark on a species basis by gear type is insufficient to understand the status of the resources. The drafting process was also pending the organization of conferences on the management and utilization of sharks. Both the drafting and these conferences are requiring funds which are currently insufficient.

This has resulted that, so far, the NPOA-Sharks development process has not been completed and couldn't be approved by the government. Nevertheless, Vietnam is confidant that the drafting process of their NPOA-Sharks could be finalized in 2006 with the organization of the national conference on the management and utilization of sharks, if proper sources of funding are identified.

The development and implementation of the NPOA is carried-out according to the following practical themes:

- The fishery statistical data system will be strengthened;
- Shark species will considered on a species basis within the system in order to give a robust basis for the management and conservation of shark resources;
- Awareness building for all stakeholders on how to sustainable utilize shark resources using various methods such as pamphlets, posters, and training;
- Surveys and studies to assess shark resources in Vietnam will be conducted to provide the necessary baseline information on shark resources to ensure proper management and conservation measures can be undertaken;
- Proper management measures applied such as: fishing licenses, investigation at sea, strict control of the fishing fleet that target sharks (long line for shark);
- Fishery extension promoted to support fishers to store, process and utilize properly shark catches in order to achieve a higher economic efficiency;
- Collaboration with FAO must be strengthened, while collaboration must be maintained with SEAFDEC for information exchange in the region.

CHAPTER 4 - TRADE IN SHARK PRODUCTS IN MALAYSIA, SINGAPORE AND THAILAND

4.1 Introduction

This study is one of three related investigations, undertaken under the ASEAN-SEAFDEC project on sharks, designed to document shark catches and trade in the region. This component of the study characterizes the trade in shark products while parallel studies will explore the status and trends of shark fisheries and the utilization of shark products in Southeast Asia.

In concert, these studies are intended to serve as an essential basis for developing appropriate fisheries management policies and actions, and thereby promote national and regional responsibility for marine resource management issues. Documenting and strengthening data collection and monitoring systems for shark fisheries and shark product trade in this way will facilitate implementation of national programs which underpin international policies articulated by FAO such as the Code of Conduct for Responsible Fisheries and the International Plan of Action for Sharks. Effective national management of shark resource issues is the most reliable means of ensuring sustainable harvests while supporting the local communities and industries which depend on shark products.

Although trade in shark products occurs throughout Southeast Asia, it was agreed that the scope of this study would encompass Malaysia, Singapore and Thailand in this initial stage, and that based on the results presented here, trade studies may been extended to other ASEAN countries in the future. The rationale for focusing this study on Malaysia, Singapore and Thailand was that the regional trade in shark fins, which is the most valuable of all shark-derived products, was believed to be concentrated in these three countries. In order to complement the parallel study of shark utilization, the range of products included in the present study was not limited to shark fins although the bulk of available information was expected to pertain to this product.

This report, the result of a survey undertaken by Shelley Clarke and SEADFEC MFRD in late 2003, first presents an introduction to the trade in shark products which highlights the variety of useful goods derived from sharks. The remainder of the report is organized around four research questions intended to elucidate key features of the shark trade in Southeast Asia:

- **Product Sources**: What contribution do regional shark resources make to local and world shark production figures and how is excess regional demand met?
- **Trade Volume**: What is the volume of regional trade in shark products and its context in the global trade?
- **Product Disposition**: What quantities of various shark products are consumed within, as opposed to being transshipped through, the region and what factors influence regional demand?
- **Trade Characteristics**: How do the features and trends of the shark product trade differ by country and as a region from other world markets?

A combination of existing literature, statistical trade and production records, and field surveys involving trader interviews was used to address each of these research questions. Compilation and analysis was undertaken during the period September through November 2003 and thus represents the situation at that time. As is often the case with trade analyses, data sources may be incomplete or otherwise unreliable due to the protection of confidential business information as well as other factors. This report attempts to provide the most accurate description of the trade based on available information, acknowledging shortcomings of the data wherever applicable. Cases of data interpretation and presentation of quantitative information are clearly distinguished and objectively interpreted.

The complete results of this study can be found in Appendix 2.

4.2 Summary of findings

The first limitations in tracing product trade within the ASEAN region is that all national trade statistics only available for two types of shark products – meat and fins.

A quick review of FAO figures in its FISHSTAT's Commodities Trade and Production Database suggest that large quantities of shark products are not originating in Malaysia and Thailand (no production figures between 1997-2001), but other evidences (Capture Production Database figures) however indicates that this may not be the case. Based on capture figures for 2001, there is an estimated production of approximately 10,000 mt and 8,500 mt per annum of shark meat production, and 500 mt and 175 mt, respectively of wet shark fins for Malaysia and Thailand respectively. At the same time (1997-2001), figures for Singapore show no production of shark meat but 100-500 mt per annum for shark fins. However, when considering that Singapore's reported capture production for sharks is less than 100 mt per annum, Singapore's production of shark fin most likely refers to production of processed fins from imported raw product.

Obviously, sharks sold in Southeast Asia are also imported from outside the region, and in this regard Singapore is a key regional trading hub, receiving meat and fins from a large number of countries. Malaysia's external sources for shark meat and fins are more limited to its close neighbors (Indonesia and Singapore), while Thailand is more likely to obtain shark fins from Hong Kong and China and shark meat from North America. Figure 4 represents the trade of shark meat and fins from the major suppliers to Malaysia, Singapore and Thailand.

In turn, shark meat and fins are traded, within the region, but especially exported toward China, as represented in Figure 5.

Table 12 sums up the reported trade volumes in terms of imports, while Table 13 does so for the exports.

FAO and national trade statistics highlights the importance of Singapore as an entreport for trade in shark products. Singapore dominated reported ASEAN imports (87-90%) and exports (92-99%) of shark meat although these quantities are only a very small portion of global trade volumes (2-3%). However, in terms of shark fins, Singapore not only dominated reported ASEAN imports (60-80%) and exports (45-65%) of shark fins but these quantities were also a significant portion of global trade volumes (7-17%), highlighting her importance as an international hub for the trade of fins.

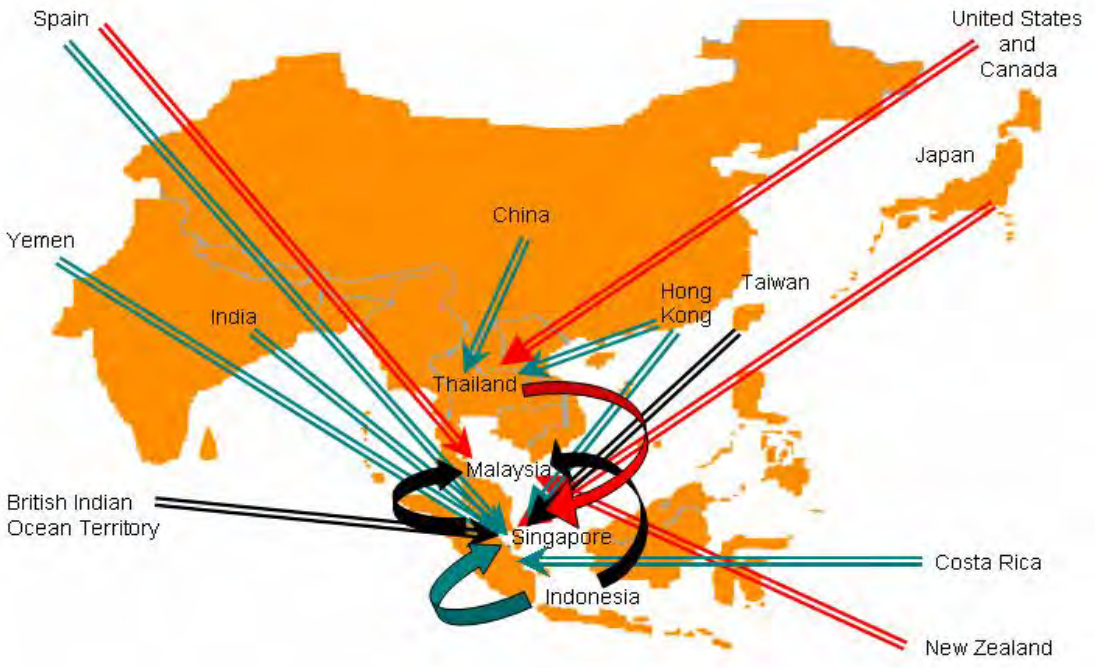


Figure 5. Major suppliers of shark meat and fins to Malaysia, Singapore and Thailand

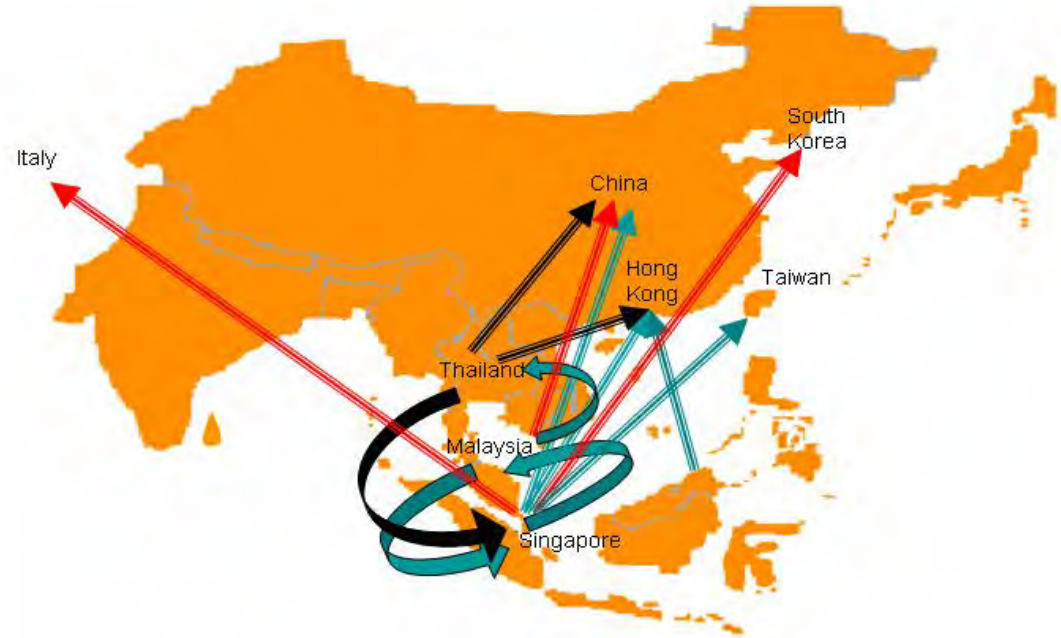


Figure 6. Major export destinations for shark meat and fins from Malaysia, Singapore and Thailand

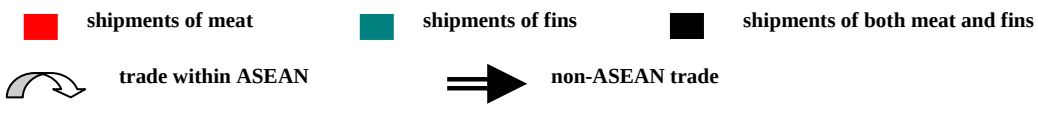


Table 12. Trade Volumes – Imports (mt)

Country	Product Form	1997	1998	1999	2000	2001	2002
Malaysia	Meat, Fresh & Frozen	28	66	23	21	16	12
	Fins, Dried, Salted & Prepared	122	87	101	56	65	37
Singapore	Meat, Fresh & Frozen	1,386	1,516	1,467	1,550	1,901	1,659
	Fins, Dried & Prepared	1,207	643	948	936	682	992
Thailand	Meat, Fresh	0	0	0	0	0	0
	Meat, Frozen	316	114	187	210	166	164
	Fins, Dried	83	42	98	66	81	60

Table 13. Trade Volumes – Exports (mt)

Country	Product Form	1997	1998	1999	2000	2001	2002
Malaysia	Meat, Fresh & Frozen	32	162	32	12	7	25
	Fins, Dried, Salted & Prepared	31	29	50	15	7	9
Singapore	Meat, Fresh & Frozen	1,516	1,455	1,860	1,670	1,416	974
	Fins, Dried & Prepared	599	417	622	653	492	707
Thailand	Meat, Fresh & Frozen	<1	0	95	0	113	111
	Meat, Dried	78	139	39	71	61	34

Table 14 shows the respective importance of Malaysia, Singapore and Thailand in the global trade of shark fins.

Table 14. Percentage of global trade in shark fins through Malaysia, Singapore and Thailand

Country	1997	1998	1999	2000	2001	2002
Malaysia	2	1	2	1	1	1
Singapore	17	7	10	9	8	12
Thailand	2	2	1	1	2	1

Throughout the survey, a series of observations and interviews were carried out with shark fin traders in Malaysia, Singapore and Thailand. First, prices were found to be relatively consistent between markets with dried loose fin needles in 'nests' commanding US$150-250/kg, small (<10cm) whole fins at US$200-400/kg (dried) or US$40-100/kg (wet), and small loose fin needles (wet) at US$3-40/kg (as subject to mixing with artificial fins).

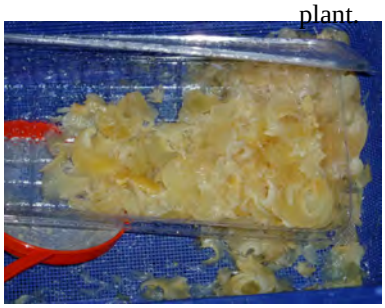
It was found it was not possible to obtain extensive, reliable information regarding the species used in the shark fin trade due to the apparent absence of a standardized nomenclature within the various trade communities. As market categories are based on the length and thickness of fin needles, shark fins are grouped into categories producing differing grades of fin needles, and thus the number and identity of species in each category is of little practical business interest.

Some attitudes and outlooks of interviewed traders were common in all three countries with the majority believing that the supply of shark fin was steady, and that shark meat was nearly always fully utilized in the source country even though shark skin, cartilage and liver oil markets were underdeveloped. They also concurred that the Southeast Asian market is specializing in lower grade fins because the China market commands the top quality products. They raised the concern that the supply of shark fin was becoming increasingly controlled by Mainland China buyers. Most were relatively untroubled by shark conservation campaigns, although traders working in areas which have been targeted by environmental groups (specifically Singapore and Bangkok) displayed a heightened sensitivity to information gathering activities.

Dried low grade loose fin needles shaped to resemble whole fins and marketed as fin 'nests' or 'baskets'.

Typical packaging of shark fins in the Bangkok market.

Small processed fins in wet form from a Singapore processing plant.



The most expensive dried processed shark fins observed in the Bangkok market (20,000 Baht (500 US$) per bag).

They were also key differences in the attitudes and outlooks of interviewed traders in the three countries. In Malaysia for example, there appeared to be a growing acceptance of real and artificial shark fin mixtures. In Singapore, traders demonstrated the highest awareness of CITES and shark management issues. In Thailand, the market may be more closely tied to China than other ASEAN countries.

In conclusion, the survey concludes that domestic production levels of shark meat and fins appear to be under-reported, especially in Malaysia and Thailand. This may be the result of statistical systems which do not differentiate shark products from other fish resources and/or do not count unprocessed shark products such as fresh or frozen meat as production.

In terms of imports, Singapore is the largest at 1,000-2000 mt of shark meat and 600-1,500 mt of shark fins per annum followed by Thailand with 110-320 mt of shark meat and 100-200 mt of shark fins per annum and Malaysia, the lowest with 10-70 mt shark meat and 50-125 mt shark fins per annum. The fresh and frozen shark meat trade in Malaysia, Singapore and Thailand comprises nearly all of the reported ASEAN imports. However, when compared to global totals, ASEAN's fresh and frozen shark meat trade figures are consistently less than 10%. In contrast, Singapore appears to be a major shark fin trading center handling between 7-17% of global trade volumes. Malaysia and Thailand appear to be minor players in the international shark fin trade (2% or less of global trade volumes)

Singapore was found to be a consolidation hub for shark products from Southeast Asia before onward shipment to markets primarily located in East Asia. In addition to relying on Singapore as a transshipment center, Malaysia and Thailand also export shark products directly to Hong Kong and Mainland China.

From the interviews, traders were generally in agreement on the importance of a healthy economy to their trade, the growing influence of Mainland Chinese consumers and overseas

operatives on the market, and the full utilization of shark fins and meat in source fisheries while differing views on CITES and the future of shark fisheries management were expressed, and individual traders adopted more or less proactive approaches to participating in debates that will shape these issues in the future.

The study recommended that improvement should be made to the reporting systems for shark commodity production figures by ASEAN countries, possibly through linking shark landings/catch and commodity production statistical systems. This would help to overcome the unaccountable discrepancies between catch and production data.

Given that from 1997 onwards, shark fins trade figures for Singapore were not available in FAO statistics, although they are still available from Singapore's national statistics publication, it was also recommended that Singapore's shark fins trade figures should be included in FAO statistics in order to facilitate accurate global shark fin trade monitoring.

CHAPTER 5 –MICROSCOPIC OBSERVATION ON DERMAL DENTICLES OF SHARK FINS

5.1 Introduction

As another component of the SEAFDEC project on sharks, SEAFDEC MFRDMD undertook a study on the dermal denticles of shark fins, as a tool to identify the shark species when only having access to a wet fin.

Looking at the external surface of a shark, it is apparent that the skin is covered with an investiture of scales. In elasmobranchs these flat, non-overlapping unit are called placoid scales. Because the scales are individual tooth-like appendages embedded in the skin, they are aptly called dermal denticles. Teleost fishes, reptiles, and birds have scales that differ from those of elasmobranchs by developing as folds of the skin. Scales of shark are tiny as compared to those of teleosts. Shark denticles are very distinctive, and are often used to help identify species.

Denticles are small (mostly less than 2mm long) and tooth like structure, with the enameloid-covered exposed crowns and dentine bases rooted the skin (Figure 7). They vary greatly in form and size and can develop into enlarge specialized derivatives such as fin spines on the dorsal fins of various sharks and the first, Jurassic rays, rostral teeth in sawsharks and sawfishes, clasper spines, the sting of stingray and their relatives, and enlarged thorns of bucklers on the dorsal surfaces of many rays and the bramble shark (*Echinorhinus brucus*). Denticles of neoselachians are periodically replaced by being shed and having new denticle erupting through the skin, but some denticle derivatives such as fin spines, the rostral teeth of sawfish, and some thorns and bucklers grow by periodic addition of dentine to their proximal ends and peripheries.

Typically dermal denticles consist of (i) a basal plate embedded in the dermis (ii) a pedicel that arises from the base and forms a neck connecting with the crown, and (iii) exposed outer portion, the crown.

Study conducted outside the region using scales extracted from frozen and dried fin concluded that dermal denticles possess species-specific characters, which is useful in the identification of species of shark fins. Other studies on scales characteristics of 35 benthic and sedentary shark species have showed that scale crown shapes vary from true plate-like crown with longitudinal ridge to uniquely shape scales with spine-like or cross-hatched crowns. For plate-like denticles, the crown shapes range from circular and semicircular to lanceolate or rhomboidal. The result also showed the variation of denticles shape, at different parts on the body.

One of the important issues in stock assessment of sharks is to estimate the amount of landing and trading by species. At present however, the landing of each species has not been recorded and usually data are obtain only from trading amount of shark fin. Since the issue of “look alike” in shark fin trade will effect the trade of unlisted species, an effort were taken to establish a method to identify shark species from shark fins. These include scanning electron microscope observation of denticles and characteristic of morphological of shark fin.

The objectives of this study are to:

- Observe dermal denticles of shark fins using compound microscope in order to establish a method for identification of shark species from their fins.
- Produce a publication on dermal denticles of sharks fin commonly found in local markets.
- Act as basic for identification of shark species from dried or wet shark fin available in the market.

5.2 Materials and Methods

A total of 63 sharks and a ray samples from 19 species were bought from Bintulu, Mukah and Kuching in Sarawak (East Malaysia) and also from Kuantan, Pahang in Peninsular Malaysia. Every shark sample was recorded by species, sex, body weight and total length. However, detail information on sex, total length and body weight of a few species such as *Carcharhinus leucas*, *C. amblyrhynchos*, *C. sorrah*, *Stegostoma fasciatum*, *Scoliodon laticaudus* and *Chiloscyllium hasselti* were not available since these samples were already cut into pieces by fishermen.

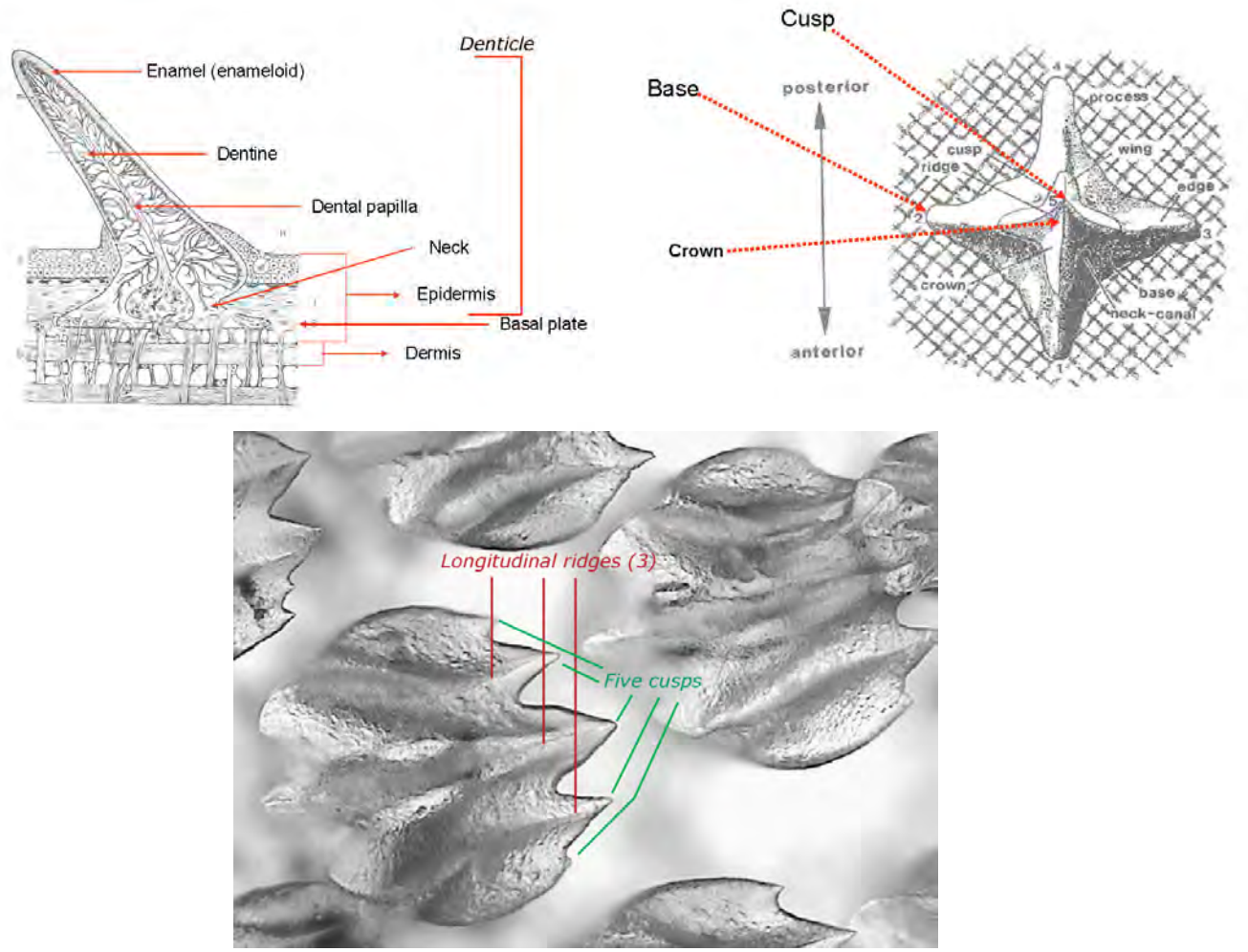


Figure 7. Shark dermal denticles

Skin samples measured 2cm x 1cm were cut from 3 different parts of each shark sample namely 1st dorsal fin, pectoral fin and lower lobe of caudal fin except for *Chiloscyllium plagiosum*, *Chiloscyllium indicum* and *Chiloscyllium hasselti* where only 1st dorsal fin and pectoral fin were used. All meat attached to the skin was carefully removed using dissecting knife. The skin was then cut into two sections measured 1cm x 1cm each and washes carefully using distilled water. One of the samples was kept as wet in refrigerator and another one, sun dried for about two hours.

The shape of dermal denticles was than observed under Compound microscope (Model Olympus CX31), which is connected to Sony color video digital camera (Model SSC-DC 58AP) and screen monitor (Model Syn. Master 955 FF). Images of dermal denticles of dorsal, pectoral and lower lobe of caudal fin for every species, different sex and total length were later stored for further documentation.

5.3 Results and Conclusion

The shapes of wet and dried dermal denticles of fins from various shark species are as shown in Appendix 3.

The result of this study shows that every shark species has its own distinctive dermal denticles shape at certain particular area. The shapes of these dermal denticles of shark fins could be used as a mean to identify shark species if the fins still fresh. However the shape of denticles collected from dried fins of the same species look significantly different compared to the fresh specimens. Posterior part of denticles from dried fins were fractured and broken during the handling and sun dried processes. Based on this study it can be concluded that this method is not recommended to identify shark species from dried shark fin and that other alternative such as DNA technique should be envisaged for these cases.

APPENDIX 1

NATIONAL REPORTS OF THE AD-HOC STUDY ON SHARKS

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STUDY ON DATA AND INFORMATION COLLECTION ON SHARK FISHERIES IN CAMBODIA

Pich Sereywath[1]

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1. GENERAL OVERVIEW

Marine fisheries are very important both for the national economy and for improving local livelihoods in the coastal areas. Further, marine fisheries resources play a very important role to contribute to national food security after the production of inland fisheries. Even though, this such richness was constantly declined from day to day due to lack of proper national data and information collection system, poor management and research activities. Therefore, as the Department of Fisheries has no qualitative and quantitative data and scientific information, it cannot set up any action plan for protecting marine aquatic resources such as sharks, rays and skates, and their habitat.

Prior to 2004, many species, typically sharks, the Department of Fisheries (DoF), Cambodia has been considering sharks as non-target species and usually caught by accident with several gears such long-line fishing, gill nets (fish and crab net), and trawlers. In general, the sizes of the sharks caught are small, but in big amount in the wet season and they occur in various habitats from open oceans to brackish water such as inshore estuaries and sometime some were also found in freshwater (SEADEC, 2004).

Although, landing and national catch data have not been recorded on sharks, but fins and fresh shark meat have been formally consumed as food in coastal areas as well as in the city. In addition, there are about 3-5 sharks, including rays exported to Thailand as either fins or whole body. However it is known that dried shark fins are imported to Cambodia from neighboring countries such as China, Vietnam, Taiwan, etc. They are used in Cambodian restaurants for important ceremonies and parties. Further more, small sharks (juveniles) was mixed with other low value fisheries product (waste or trash) and used for aquaculture and animal purpose either in locally, or areas far from coastal area (Try *et al.*, 2004). However, the figure of Rays were recorded in the national statistic data by the Department of Fisheries, but its number collected seemed not to cover all effort. So far, there have no study in detail related to Sharks and Rays, but there were some report by Tana (1996, 1999) and then by Jensen & Try (2002) which reported that there were approximately 23 species of sharks and 22 species of rays found in Cambodia waters. Of 23, some are become rare in the nature and some are endangered species. Due to lack of research activities it has caused Cambodia under an adequate situation in management and conservation its marine aquatic resources, especially any species of sharks and rays species that become rare and endanger, and as well as other marine mammals.

Even though, Cambodia tries its best either in collaboration with conservation organization or convention of fauna and flora. In fact, Cambodia today is both one of signatory parties of CITES and one of a members of FAO.

Other appropriate effort, the fisheries law of the Kingdom of Cambodia mentioned that any fishing activities relating to endangered species as listed in the endangered species list were strictly banned. Of those one shark species, namely whale shark (*Rhincodon typus*), is included and also appeared on the poster named Marine Endangered Species in Cambodia (see in figure 1).

[1] Fisheries Officer at the Department of Fisheries, Cambodia

More importantly, the DoF has made efforts to designate to select landing sites and set up team works (provincial fisheries officers and researchers) for shark fisheries study, to collect catch data and information and biological observation. Through sharing cost of both parties, in which SEAFDEC, technical and financial support was provided for Cambodia to enable to run its one-year study program on data and information collection on shark fisheries in Cambodia. This study plays a role as a collaborative study program between the Department of Fisheries of the Ministry of Agriculture, Forestry and Fisheries Cambodia and the South East Asia Fisheries Development Center. All information and catch are the result of overall interviews of enumerators with landing site owners and fishermen, including existing data and information in each provincial fisheries office.

2. STUDY AREAS

Three selected landing sites from three coastal areas, in which one namely Kampong Bay in Kampot province, one named Tomnob Rolork in Sihanoukville and one called Koh Sdach in Koh Kong province were chosen as targeted sites and they were used to collect catch and biological data and information, consumption and its marketing status in Cambodia as well as other countries involved in shark fisheries. These three sites were designated for conducting this research and data collection were described in following details and shown in reference map in figure 2.

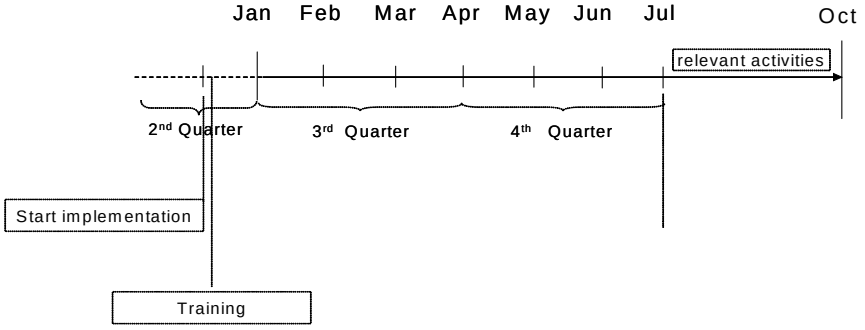
Kampong Bay, located in Kampot province has 340 fishing boats ranging from small to middle scale gear. Shark landings in this area are mainly as by-catch, caught with trawls from 33 hp boats, gillnets and hook and line. These sharks are kept for family consumption, or to be dried. Large sharks are sold to fish merchants for extra income. The survey found that there is one specific gear designed for taking sharks, shark gillnet. This implies that there is a sustenance or commercial shark fishery, however no further information was found on this.

Tomnob Rolork, is the largest landing port in coastal areas which located in Sihanoukville municipality. 80 % of families who are living in this area are fishermen and it has about 957 fishing boats, with trawl, purse seine, gillnet, long-line and traps operating either in Sihanoukville water or other location nearby. Sharks are usually caught in this area as accidental by-catch as well, by trawls, gillnets, and hooklines.

Koh Sdach, Koh Kong Province has 300 local fishing boats. With fishing gear ranging from small scale hook and line, gillnet, and traps. To commercial scale trawl nets. Sharks are caught in this area by trawl, gillnet and hookline. There are about 45 fishing vessels applying trawl nets in this area. Sharks are generally not a target species, caught accidentally by 4-5 fishing gears, longline, gillnets, traps and trawlers. There are two kinds of boats, long-tailed with engine capacity of 11-13 Hp and trawling boats with an engine capacity of 33-200Hp.

3. TIMEFRAME OF THE STUDY

The time frame of study on shark fisheries in Cambodia is shown on the following diagram:



Activities of the study were completely ended and the finding of this study has been sent to SEAFDEC secretariat. Other study, however, activities regarding sharks fisheries hopefully will continue based on the finding of first-year study and four years study plan.

4. DESCRIPTION OF BOATS AND GEARS FOR CATCHING SHARK

Sharks, generally, are not targeted specie, which mostly caught by accident by several fishing gears. In facts, there are main four to five fishing gears, namely long line fishing, gillnets (fish and crab net), Grouper traps, and trawlers. Two kinds of boats are the majorities, namely long-tailed boats with engine capacity of 11-13Hp and trawling boats with engine capacity of 33 to 200 Hp, which allow operating in fishing ground with water dept from 20 m to up).

A. Long-tailed boat:

The length of boat is generally from 11 to 15 m, width is about 3 m, its loading capacity is about one ton, and engine power is usually 13Hp. It is one of small scale fishing boat in Cambodia. Formally, two types of fishing gears have applied on the boat per month for fishing, Mackerel gill net, crab gill net and shrimp gill net. In general, a period of one month, the duration of applying Mackerel gill net on boat is about 15 days and shrimp gill net 15 days, in case of fishermen who are skill at using of these two gears, while fishermen who are skill at using of crab net and shrimp gill net they spent 15 days for crab net and 15 days for shrimp net. In habit, one trip of fishing, they took time about 12 hours and there are at least two or three people on boat for operating their fishing. Among of these gears, only crab net caught in big amount of sharks and rays by accident.

B. Crab gill net (called in Khmer Mong Kdam):

Normally, the length of one line of crab net (so-called Mouy PHÉ in Khmer) is approximately at least 1,000 m and one boat from five to six PHÉ have applied on for one-trip operation. Formally, one trip of their fishing is four to five days and sometime depends on weather condition. From fishermen experience, generally, during a period of one month they crab net can use from ten to 15 days and other 15 days they use shrimp gill net. The crab net is one kind of gears that can catch by accident in a big amount of sharks and rays per time if compared to shrimp gill net, hook long and line, small trawling and grouper trap. Big amount of sharks and rays, which mostly accidentally caught by this gear is in the rainy season and vice versa in the dry season. However, in average, they can monthly catch about 30 kg of sharks and 20 to 30 kg of rays.

C. Shrimp gill net (called in Khmer Mong Bang Kea):

This gear particularly designed for catching shrimp and applied on long-tailed boat. The length of one line of shrimp gill net (one PHÉ) is nearly to 1,000 m. Generally, they use from five to six lines of shrimp gill nets per boat per trip. Target species of this gear is shrimp, but it also accidentally caught in small amount of sharks with small size. The operation of this gear spent about 15 hour per trip per day, which caught one to two kg of shrimp and about ten kg of other fishes (excluded sharks) per trip in the dry season and from 10 to 20 kg of shrimp and 6 to 10 kg of multi-fish species (excluded sharks) in the rainy season.

D. Mackerel gill net (called in Khmer Mong Trey Kamong):

It is used to catch mackerel species. In Cambodia, usually this gill net can catch one kind of mackerel and round scads species, namely short mackerel and which comprises more than 80-90 % of the total catch. Mackerel fishing is prohibited every year from 15 January to 31 March because this is the spawning period for mackerel. In Cambodia, one fisherman has at

least two fishing gears, so they can change to another fishery during the closed season. Scomberomorus boat/gill net (called in Khmer Touk Beka or Mong Trey Beka).This gill net is widely distributed in Sihanoukville and Koh Kong province. One fishing boat has from 1 to 10 km of net depending on the size of the boat. For boats with engines from 10 to 90 HP, gill nets with a height of 9 m are used, whereas boats with engines bigger than 90 HP, use nets with a height of 18 m. On the bottom the gill nets are anchored or weighted and they are used to catch various pelagic fish species. The main fish species caught by this gill net are Scomberomorus, scads and shark.

E. Hook and line:

One line of hook and line there are about 3,000 hooks, this gear was operated only during in a period of moon, it is mean that it operated 6 month a year. Totally, Sharks caught by this hook and line was 30 to 50 kg per day.

F. Single trawling boat: were issued a license

According to interviewing with captain and worker of joint venture vessel (only single trawling boat), there are at least big five-transferred vessels (may be call landing vessel in Khmer called Touk Sang and in Thai, Chhut) have been loading marine product on ocean. These five Chhut, after loading will go back to Thailand, where is good price for them. In general, Chhut's Owner, somebody who is Owner of single trawling boat was licensed to do exploitation in Cambodia water by (mixed-commission) under Koh Kong provincial authorities.

5. OBJECTIVE OF THE STUDY

Based on an one-year study initiative on Shark Fisheries, done with the support of SEAFDEC, Cambodia has been studying relevant issues relating to sharks-catch, consumption, and biological data collection. This regional support was aimed for Cambodia to run the first one-year study program on sharks, which started in January last year, which will provide a basis for longer term activities in the future. Along line with this project, importance was given to the management and conservation together with awareness building, notably through the production of some awareness materials such the poster and some descriptive documentation.

In order to have an access to the initiative, the Department of Fisheries of Cambodia sets up 6 objectives to enable to support this one-year study program on shark fisheries in Cambodia as well as in the region. Those objectives are:

1. Collect data and information related to sharks, typically on catch and biological data of sharks captured in Cambodian waters.
2. List and rank the types of fishing gear used in shark fisheries.
3. Identify sharks and rays species.
4. Collect information on consumption and marketing of sharks
5. Collect information from authorities concerning import and export of sharks and sharks products.
6. Develop the National Plan of Action of Sharks Conservation and Management (NPOA-SHARKS).

6. METHODS OF THE STUDY

Three enumerators of which one for each landing site was selected for collecting catch data and information from fishermen and landing site owner and also gather relevant information around landing site. On the other hand, in order to push this study to receive a good result, three researchers which nominated by the Department of Fisheries, have an obligation to assist

enumerators in part of technical support and their biological study on maturity development stage of some species of sharks.

Tools for data and information collection are followed the format sheet and technical guidance designed by SEAFDEC and FAO for supporting this study program. For data catch and information collection were conducted in each selected landing site in every month of the quarter based on the real situation. In this case, enumerators conducted their work for 15 days per month on data catch collection from landing sites and fishermen, while biological data was conducted sampling by researchers about 2 to 3 days a month.

7. FINDING OF THE STUDY

7.1 Encountered Evidences

In 1973, one whale shark with 600-800 weight was fired by soldier in the Koh Kapi, Koh Kong Province, and then on 12 October 1998, another whale shark with 8oo-1000kg weight was accidentally caught by Scomberomorus gillnet (Beka gillnet in Khmer) in Koh Kong province water (see in figure 3)

While, in 1999, a rare giant freshwater stingray named (*Himantura chaophraya*) with a total weight of about 18 kg was caught by fishermen in Prey Veng province. While in December 2002, the fishermen in Prey Veng province again caught another freshwater stingray of the same species at Peam Chhor by bottom trawl (Khmer name: Yang Kav). This fish had a total length of 4.2 m, diameter 2.1 m and weight 180 kg (see in figure 4).

7.2 Shark's Landing Data

The catch indicated here is only a part of effort that has been collected by enumerators in each selected landing sites with targeted fishermen, the owners of landing sites and fish merchant. The way was collected is relied on the real situation and factors in individual sites. It, therefore, is clear that this figure was not taken from the annual national statistic record. On the other hand, the details of number of boats, families living around landing sites, and catch collection shown from table1 to table5 of Appendix i.

7.3 Sharks and Ray species found

Through the study period, 9 species of sharks and 8 species of rays found in the Cambodia water (see in table6 of Appendix i). Of 9 sharks, several species were abundantly appeared in the production and preferably consumed in the whole country, particularly in the local market, while several rays species were also similar case like sharks as well. However, the number of those recently seems to be declined this because of increasing fishing effort with improper methods while the trends of resources are critically declining. Table below preliminarily shown sharks and rays species encountered in Cambodia.

7.4 Sharks Consumption and its Market

So far, not many people known about the taste of sharks, shark soup and steamed shark, but recently market demand for Sharks and rays in Cambodia is the one of popular marine products from users, due to last several years this preference have been occurred in the coastline areas and this preference is dominating to non-coastal areas, especially in the city and tourist sites (see in figure 5 & 6). Currently, due to high demand caused the price of fresh sharks goes increasingly which is varying from 8,000 to 16,000 riels per kilogram, while its fin is more expensive is about 40,000 to 60,000 riels.

Generally, Sharks were used in both fresh (for shark soup) and processed product. Locally, Sharks and rays were processed to be dried product for only country supply, and the dried sharks were only processed while the numbers of sharks were abundant with cheaper price. The cost of such processing product was about 15,000 Riels, was about US$3.80.

Furthermore, dried-meat sharks and dried fins were imported from Viet Nam, China, Thailand and other countries. Dried-shark meat (about 2.5-3 $US per kilogram) and small-dried fin were flown from Viet Nam into Cambodia, but its price was cheaper than the price of processed sharks in the country, and whereas, a big-dried shark fin was imported from the other countries (see in figure 7, 8 & 9). However, the exact number and price of shark products have imported into the country were neither recorded nor clearly known.

The fish sellers or middle man separately collect sharks and rays from the fishermen for selling at the local market, restaurants or bring to other areas in the country (Fig. 3). The shark fin is more expensive than the other parts; usually they cut the fins off before they sell them in the local markets (see in figure 10 & 11).

7.5 Biological Study

Few shark species, namely grey bamboo shark (*Chiloscyllium griseum*), Blacktip reef shark (*Carchrhinus melanopterus*), Brownded bambooshark (*Chiloscyllium punctatum*) and Coral catshark (*Atelomycterus marmoratus*) were conducted a sampling, but only female was identified their maturity stage development, while male was not did so, because from starting point of the study and now there has been no clear guideline was informed yet even few consultations were done.

Resulting from biological study found that the gonad development of Grey bamboo shark, Browned bamboo shark, and Coral catch shark were round-year, but development of their maturity stage is different, according to location.

Grey bamboo sharks: it was plenty in Sihanoukville and Koh Kong water and fewer amounts in Kampot water. However, based on quarterly sampling in each site, it was identified that among 100 % of female sampled 70 % was in expecting stage, 20 % was in mature stage and 10 % was in juveniles.

Coral catch shark: This species basically appeared in big amount in Kampot water that mostly caught in rocky areas, but it was also rarely found in Sihanoukville water and never in Koh Kong. From the biological view indicated that in Sihanoukville among 100 % of female sampled 80 % was in expecting stage and 20 % was in mature stage, while in Kampot among 100 % of female sampled about 30 % was in expecting stage and around 70 % was in mature stage. Table 8 & 9 in appendix ii below indicated the input and result of biological field study.

Blacktip reef shark was found in big amount in Sihanoukville water, less in Koh Kong water and never found in Kampot water. Generally, its numerous numbers appeared in Sihanoukville water, but mostly in small size (juvenile). From the point of biological study, only one big female was found and through checking for her gonad development indicated there had 6 babies inside her belly, it is mean that she was in stage 6.

8. PUBLICATION PREPARATION

A Poster, namely Sharks and rays species found in Cambodia was finalized in drafting. Before printing out it was edited by Mr. Ing Try[2], Prof. Katch R. Jensen[3] and Mr. Ahmad Ali[4]. On the

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poster, there were nine species of sharks and eight species of rays included (see in figure 12). However, these species were just a finding of a one-year study program on shark fisheries in Cambodia. Respectively, more species will be appeared if the continuation of such activities will be also considered to be extended.

9. ESTABLISHMENT OF NPOA-SHARKS

Regarding this duties, some clarifications related to formulation of National Plan of Action on Sharks Fisheries used to inform to SEADEC via quarter report. Event that the going-on process of NPOA-SHARKS development is underway, but it is only forming within the DoF itself there has no any involvement from outsider.

In order to get a good NPOA-SHARKS and avoid any conflict in the future, DoF tried to seek fund to support this activity trough conducting consultative workshops among its skill institution, line agencies and other stakeholders. Even though, this effort has not come up with yet and due to this caused the step of finalization of NPOA-SHARKS seem not to be developed award.

10. CONCLUSION AND SUGGESTION

In order to get more qualitative and quantitative sources relating to shark fisheries in Cambodia as well as in the region, more researches need to be carried out to be able to identify status of shark fisheries and their habitats (feeding ground and spawning) in Cambodia that might be provided a completed information to enable to formulate a proper NPOA-Shark or guideline, in terms of good Management and Conservation of Sharks in Cambodia as well as regionally.

With this context, the Department of Fisheries of Cambodia suggest to SEAFDEC to continue its Collaborative Study Program, namely Data and Information Collection on Shark Fisheries, which would be an indicator to other purpose in terms of management manner in regional level.

Apart from this, Cambodia also suggest to SEAFDEC to support to finalize a formulating a National Plan of Action on Shark Management and Conservation. If do so, this will provide more useful to Cambodia to enable to complete the NPOA-SHARKS with considerable accountability and transparency consensus among its skill institutions, line agencies and other stakeholders.

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[4] SEAFDEC Marine Fisheries Resources Development and Management Department, Terengganue, Malaysia

Table 1. Number of boats and families in three selected landing sites

Landing Site	Number of Boats	Number of Families	Number of person	Fishermen Families	
Tomnob Rolork	1129	2150	9376		
				Family member	Fishing Labor
				???	???
Kampong Bay	340	934	8080	389	
				Family member	Fishing Labor
				1145	1131
Koh Sdach	196	800	3873	80% are fishermen families	
				Family member	Fishing Labor
				80% of	

Table 2. Catch in Kg (boats), Kampong Bay, Kampot Province

Catch in kg					Number of Boat Operation per quarter
Quarter	Gear	Average catch in Kampong Bay			
		Shark	Ray	Non-shark	
1st (January)	Trawl net	560	1400	105000	70
	Fish net	0	0	0	0
	Shrimp net	80	40	2200	20
	Hook line	50	90	360	2
	Crab Net	1200	3000	15000	60
	other	187	561	56100	187
Sub-total		**2077**	**5091**	**178660**	
2nd	Trawl net	7161	22596	4373386.5	70
	Fish net	45	5215.5	1670587.5	10-60
	Shrimp net	379.5	1883.4	317201.55	20
	Hook line	90	292.5	990	3
	Crab Net	2322	900	260280	60
	Beka net	121.5	266.4	53049.9	2
Sub-total		**10119**	**31153.8**	**6675495.45**	
3rd	Trawl net	3254.25	15737.9	187054.2	70
	Fish net	1498.2	7308.9	72077.1	58-72
	Shrimp net	0	0	0	0
	Hook line	0	0	0	0
	Crab Net	1377	9297	64305	60
Sub-total		**6129.45**	**32343.8**	**323436.3**	
4th	Trawl net	5130	20520	202464	70-80
	Fish net	1410	8460	63732	60-70
	Shrimp net	0	0	0	0
	Hook line	0	0	0	0
	Crab Net	682.5	18375	152565	60
Sub-total		**7222.5**	**47355**	**418761**	
Total Catch		**25548**	**115944**	**7596352.75**	

Table 3. Catch in Kg (boats), Tomnob Rolork, Sihanoukville

Catch in kg					Number of Boat Operation per quarter
Quarter	Gear	Average catch in Tom Nob Rolork			
		Shark	Ray	Non-shark	
1st (January)	Trawl net	2940	26460	205800	147
	Fish net	150	200	3000	10
	Shrimp net	0	0	0	0
	Hook line	720	1440	7200	24
	Crab Net	4040	6060	35350	101
	Beka Net	900	1260	1080	18
	other	4050	5670	891000	810
Sub-total		**12800**	**41090**	**1143430**	

2nd	Trawl net	6480	37440	4568400	180
	Fish net	1702	0	110078	23
	Shrimp net	0	0	0	0
	Hook line	1080	288	23076	18
	Crab Net	747	3780	17856	18
	Beka Net	864	1488	14424	24
	Trap	500	0	5000	25
Sub-total		**11373**	**42996**	**4738834**	
3rd	Trawl net	3744	18810	1487646	180
	Fish net	3570	220.5	49659	23
	Shrimp net	0	0	0	0
	Hook line	2160	0	139770	24
	Crab Net	2152.8	11250	59022	18
	Beka Net	11109	0	446667.13	23
	other	0	0	0	0
Sub-total		**22735.8**	**30280.5**	**2182764.13**	
4th	Trawl net	2880	17100	1207620	180
	Fish net	2160	300	21240	23
	Shrimp net	0	0	0	0
	Hook line	0	0	0	0
	Crab Net	6210	15210	68490	18
	other	0	0		0
Sub-total		**11250**	**32610**	**1297350**	
Total Catch		**58158.8**	**146977**	**9362378.13**	

Table 4. Catch in Kg (boats), Koh Sdach, Koh Kong Province

Catch in kg					**Number of Boat Operation per month**
Quarter	**Gear**	**Average catch in Koh Sdach**			
		Shark	**Ray**	**Non-shark**	
1st	Trawl net	150	1400	15000	10
	Fish net	0	0	0	0
	Shrimp net	250	150	6000	50
	Hook line	1650	1320	385000	110
	Crab Net	12600	5600	9800	70
	other	600	1000	90000	200
Sub-total		**15250**	**9470**	**505800**	
2nd	Trawl net	850	960	256000	5
	Fish net	0	0	0	0
	Shrimp net	0	0	0	0
	Hook line	2100	2350	7100	15-20
	Crab Net	0	0	0	0
	Joint venture	20250	71550	4320000	45
Sub-total		**23200**	**74860**	**4583100**	
3rd	Trawl net	393	673.2	30198.8	5
	Fish net	2538	4164	36921	30
	Shrimp net	852	2068	25668	40-50
	Hook line	100	640	0	4
	Crab Net	5388	8958	47208	60
	Joint venture	5100	33000	1200000	20
Sub-total		**14371**	**49503.2**	**1339995.8**	
4th	Trawl net	110	552.5	5542.5	5
	Fish net	4425	2662.5	377175	30
	Shrimp net	440	1920	19066.66	40-50
	Hook line	0	2490	0	4
	Crab Net	3200	7620	46600	60
	Joint venture	5100	33000	1200000	20
Sub-total		**13275**	**48245**	**1648384.16**	
Total Catch		**66096**	**182078**	**8077279.96**	

Table 5. Catch in Kg in three selected landing site

Catch in Kg				
Landing Site	**Quarter**	**Shark**	**Ray**	**Non-Shark**
Tom Nob Rolork	1st	957	0	92428
	2nd	1812	1555	147579
	3rd	149.9	324.7	49044.4
	4th	888	2519	111796
	Sub-total	**3806.9**	**4398.7**	**400847.4**
Kampong Bay	1st	93	0	2994.5
	2nd	254.6	732.4	145112
	3rd	964	3388	92617.5
	4th	164.2	338.4	53054.3
	Sub-total	**1475.8**	**4458.8**	**293778.3**
Koh Sdach	1st	1330	0	311500
	2nd	11066.6	11462.4	324001
	3rd	1342.4	5732.7	178601.9
	4th	240	2408	26646
	Sub-total	**13979**	**19603.1**	**840748.9**
	Total Catch 3rd Quarter	**19261.7**	**28460.6**	**1535374.6**

Table 6. Sharks and Rays species found in the period of study

	Scientific Name	**English Name**	**Khmer Name**
	Sharks		
1	*Stegostoma fasciatum*	Zebra shark	Kla
2	*Chiloscyllium punctatum*	Brownded bambooshark	Chhout
3	*Chiloscyllium griseum*	Grey bamboo shark	Chhout or king kork
4	*Atelomycterus marmoratus*	Coral catshark	Tok Kae
5	*Sphyrna mokarran*	Great hummerhead shark	EK
6	*Carchrhinus leucas*	bull shark	Ka Mab
7	*Carchrhinus dussumieri*	Whitecheek shark	Sor
8	*Carchrhinus melanopterus*	Blacktip reef shark	Pruy Khmao
9	*Rhiconodon typus*	Whale shark	Trey Banun Kingkork
	Rays		
1	*Rhynchobatus sp.*	Unknown	Trouch
2	*Taentiura lymma*	Blue-spotted fantail ray	Khean
3	*Dasyatis kulii*	Bluespotted maskray	Kror Loat
4	*Himantura gerrardi*	Whitespotted whipray	Sach Ouch
5	*Himantura imbricata*	Sealy whipray	Moann
6	*Himantura sp.*	Unknown	Spoann
7	*Mobula japanica*	Spinetail mobula	Leak or Ses
8	*Aetobatus narinari*	Eagle ray	Ork or Chroeung

Table 7. Summary for consumption and marketing of sharks

Species	Part	Shark Source		Abundance at landing site[1]	Locally consumed (***C***), Discarded (***D***), Traded (***T***), Processed (***type of processing***)	Local price per kg [2] (Riel)	Market destination
		Type of fishing boat	Type of fishing gear				
SHARKS							
1. *Stegostoma fasciatum*	NA	1	d	+	NA	NA	NA
2. *Chiloscyllium punctatum*	wh & fin	1 & 2	a, c & d	+++	c	6-1000 4-50000	local & city
3. *Chiloscyllium griseum*	wh & fin	1 & 2	a, b, c, & d	+++	c	6-1000 4-50000	local & city
4. *Atelomycterus marmoratus*	wh	1	a & c	++	c	2-4000	local & city
5. *Sphyrna mokarran*	wh	2	1	+	c	NA	NA
6. *Carcharhinus leucas*	wh	1 & 2	a, d & e	++	c & T	5000- 12000	local, city & out
7. *Carcharhinus dussumieri*	wh	1 & 2	1	+	c	NA	
8. *Carcharhinus melanopterus*	wh & fin	1, 2 & 3	a, d & e	+++	c & T	5000- 12000	local, city & out
9. *Rhiconodon typus*	wh	NA	f	+	NA	NA	NA
RAYS							
1. *Rhynchobatus sp.*	Meat & fin	1	d	+	c & T	- 1- 20000 - NA	local & out
2. *Taentiura lymma*	wh	1 & 2	d & e	+++*	c	8-15000	local & city
3. *Dasyatis kulii*	wh	1 & 2	a, d & e	+++*	c & T	8-15000	local & out
4. *Himantura gerrardi*	meat & wh	1 & 2	d & e	+++**	c & T	8-15000	local & out
5. *Himantura imbricata*	wh	1 & 2	a, c, & d	+++*	c	2-3000	local & city
6. *Himantura sp.*	wh	1 & 2	d & e	+++*	c	3-5000	local & city
7. *Mobula japanica*	wh	1 & 2	f	+	NA	NA	local & city
8. *Aetobatus narinari*	meat	1 & 2	f	+	c	NA	local & city

Remarks:
Abundance: rarely (+), relatively common (++), abundant to plentiful (+++)
Abundance +++: * in Sihanoukville and Koh Kong waters; ** only in Kampot water
Currency is in Riel (exchange rate is 1USD = 4000 R)
Boats: 1 = Trawling Boat; 2 = long-tailed boat; 3 = Beka Boat
Gears: a = Crab net; b = trap; c = Shrimp net; d = trawl net; e = hook & f= gill net
Part: wh= whole body

Table 8. Sharks species composition for biological observe

Quarter	species	SHV			KAM			KK		
		Total sampled	Sp. Observed (2days)	% of total sampled catch	Total sampled	Sp. Observed (2days)	% of total sampled catch	Total sampled	Sp. Observed (2days)	% of total sampled catch
1st	*Carchrhinus melanopterus**	30	1	50	NA	0	NA	6.3	1	100
	Chiloscyllium griseum	3.8	1	30	NA	0	NA	NA	0	NA
2nd	*Carchrhinus melanopterus**	20.8	2	50	NA	0	NA	3.35	1	20
	Chiloscyllium griseum	6.5	2	10	4.92	2	30	2.9	2	20
	*Atelomycterus marmoratus**	NA	0	NA	2.04	2	5	NA	0	NA
3rd	*Chiloscyllium griseum*	15.6	2	30	NA	0	NA	14.1	2	50
4th	*Chiloscyllium griseum*	23.5	1	40	14.3	1	NA	17	1	NA
	*Atelomycterus marmoratus**	3.5	1	3.5	5	1	4.16	0	1	NA

NA - Total catch was not known due to these sharks bought from fish merchant and they already iced one day before conducting biological sampling

Table 9. Sampled species for biological observe

Landing Site	Quarter	Species	Mean length (cm)	Sex		Maturity (% in each category of maturity)
				% Male	% Female	
Tomnob Rolork	1st	Carchrhinus melanopterus*	120	0	100	100 in st.6
		Chiloscyllium griseum	40.35	50	50	100 in st.3 (F)
	2nd	Carchrhinus melanopterus*	78.66	0	100	**
		Chiloscyllium griseum	85.5	30	70	100M in st1, 70F in st.2 & 30F in st.3
	3rd	Chiloscyllium griseum	66.91	0	100	80 expecting & 20 mature
	4th	Chiloscyllium griseum	51.17	0	100	70 expecting, 20 mature & 10 Juvenile
		*Atelomycterus marmoratus**	52.62	0	100	80 expecting & 20 mature
Kampong Bay	1st	*Carchrhinus melanopterus**	NA			
		Chiloscyllium griseum				
		*Atelomycterus marmoratus**				
	2nd	*Chiloscyllium griseum*	67.83	20	80	100M in st.4 & 100F in st.5
		*Atelomycterus marmoratus**	47.25	50	50	**
	3rd	*Chiloscyllium griseum*	NA			
		*Atelomycterus marmoratus**				
	4th	*Chiloscyllium griseum*	55.65	0	100	80 expecting & 20 mature
		*Atelomycterus marmoratus**	50.43	0	100	70 expecting & 30 mature
Koh Sdach	1st	*Chiloscyllium griseum*	50.35	0	100	30 in st.3 & 70 in st.3
	2nd	*Chiloscyllium griseum*	67.5	0	100	100F in st.4*
		*Carchrhinus melanopterus**	56.22	0	100	**
	3rd	*Chiloscyllium griseum*	72.33	30**	70	100F expecting
	4th	*Chiloscyllium griseum*	74.53	0	100	80 expecting & 20 mature

** Not for Male shark

NA-No sample for Analyse

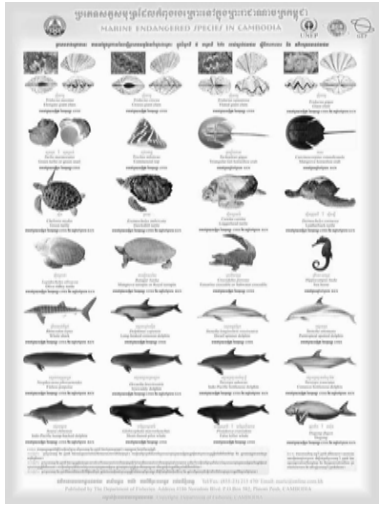

Figure 1. Marine Endangered species in Cambodia

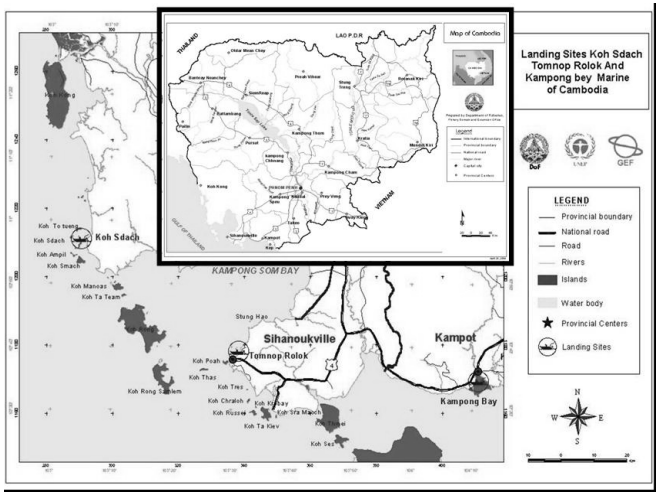

Figure 2. Map showing Map of Cambodia and selected landing site

Figure 3. Whale shark caught in a Scomberomorus gill net (Khmer name *Mong Trey Bek*a) about 4 km from the beach on the outer side of Koh Kong island in 1973 (Photo: Koh Kong Fisheries Office).

Figure 4. Freshwater stingray (*Himantura chaophraya*) caught by bottom trawl (Khmer name: *Yang Kav*) at Peam Chhor, Prey Veng Province, in late 2002 (Photo: Nicolaas van Zalinge)

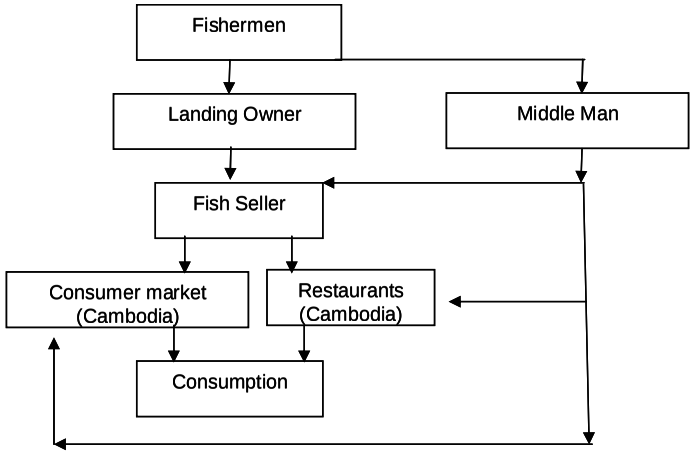

Figure 5. Market Circulation of Sharks Product

Figure 6. Restaurants with shark promotion

Figure 7. Shark soup made from fresh shark meat and fins served in the restaurant in Sihanoukville and restaurant in Siem Rap province.

Figure 8. Dried Shark meat imported from Viet Nam (left) and dried ray meat processed in local (right)

Figure 9. Imported dried-shark Fin, in restaurant in Phnom Penh

Figure 10. Shark Fins solve in local market, Sihanoukville

Figure 11. Finless shark solved in Sihanoukville Market

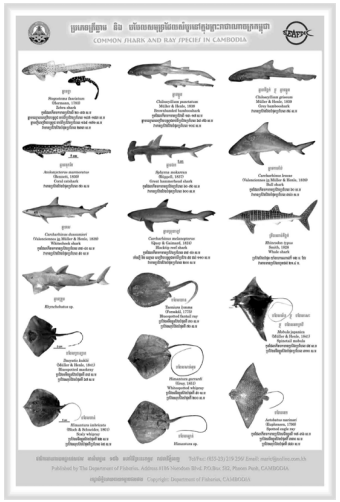

Figure 12. Poster showing Sharks and Rays species found during study period

DATA COLLECTION ON SHARK FISHERIES IN INDONESIA

Elia Suwardi and Adi Candra [5]

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1. INTRODUCTION

So far, most of the Indonesian landings of shark species are bycatch of a number of fisheries, for example bycatch of tuna fishing using gillnet and longline fishing gears and bycatch of pelagic purse seines or ringnet in parts of the waters. Nevertheless, a couple of fishing gear and fishing method have been developed recently which aimed to catch sharks as target species. For example, dogfish sharks of the family Squalidae are as target species of bottom longline in the Indian Ocean south of Java and a number of pelagic sharks are as target species of shark longline. Sharks are also caught in artisanal fisheries, by local inshore and offshore commercial fisheries.

A number of 91 shark species have been observed as the dominant sharks landed which are economically important products in the south of Java, Bali, and Nusa Tenggara. In Indonesia, sharks are used mainly for human consumption. Shark meat is especially marketed in dried-salted, smoked or fresh. Additionally, sharks fin, liver oils, leather as well as their bones are fully utilized by human being (BRKP, 2004).

In 1995 Indonesia is the second highest cartilaginous fish catch production in the world (75,000ton) after India (86,000 ton) followed by Pakistan, Taiwan, and the USA. Malaysia has catches of about 19,000 ton, while Thailand and Philippines have catches of about 9,000 ton each, and the Korean Republic is about 10,000 t (Compagno 1998). So far, national data on Indonesian cartilaginous landings have been divided into two categories, namely sharks and rays. In addition, for two landing sites of Pelabuhanratu and Cilacap, the shark landings have been specified into several categories, based on a number of dominant species.

In 2004, SEAFDEC proposed to conduct the regional study on status and trend of shark fisheries and utilization in ASEAN Region, including Indonesia. In accordance to this, a number of fishing harbor have been selected as sampling sites for data collection in Indonesia including Muara Baru in Jakarta, Pelabuhanratu and Cilacap in south coast of Java, Benoa in Bali and Bitung in North Sulawesi. This study was carried out by Directorate of Fish Resources, Directorate General of Capture Fisheries in collaboration with the Research Institute for Marine Fisheries, Research Agency for Marine Affairs and Fisheries, Ministry of Marine Affairs and Fisheries of Indonesia.

2. MATERIALS AND METHODS

The data was collected in January, April, July and October 2004 at Nizam Zachman-Jakarta, Pelabuhan Ratu, Cilacap, Benoa Bali and Bitung North Sulawesi. The data that was collected by Enumerators for 30 days duration in each month consists of the total and fork lengths, weight, sex, number of various fishing gears and fishing boats. Meanwhile, the data that was collected by Researcher consists of the biological data, marketing and trading process of sharks for 7 days in each month. The total number of shark collected during the study was 2,967, which consists of 35 species.

The data collection in this study covers both the primary and secondary data. The primary data includes general description of the lading sites (fisheries structure), shark fisheries (fishing gears, landings by volume and by categories of sharks and non-shark); the use and marketing of

[5] Fisheries Officers at Directorate of Fish Resources, Directorate General of Capture Fisheries

sharks; and biology of sharks. Meanwhile, the secondary data was collected from the fisheries statistics of the landing sites.

3. RESULTS

3.1 Fisheries structure and landing site descriptions

In Pelabuhanratu, the fishing seasons are usually between June and September (statistic data center, 2001) which fishing ground are in the Indian Ocean from the southern part of Java to Sumatra (Tinjil Island, Pamengpeuk Island, Belimbing Island, Enggano Island and Siberut Island).Similarly, In Cilacap, the fishing seasons are usually between June and September which fishing grounds are around the central Javanese waters (Nusakambangan island) ranged from latitudes 8 and 13^{o}S and longitudes 106 and 11.3^{o}E, and in Muara Baru, the fishing seasons are usually between June and September which fishing grounds are in the Southern Sumatra Waters, South China Sea until Kalimantan waters, namely between latitudes 3^{o}N and 7^{o}S and longitudes102 and 117^{o}E. Whereas, in Benoa-Bali, the fishing seasons are usually between July and October which fishing grounds are in the Jimbaran Bay until the Maselembo waters in latitudes 5 and 11.6^{o}S.

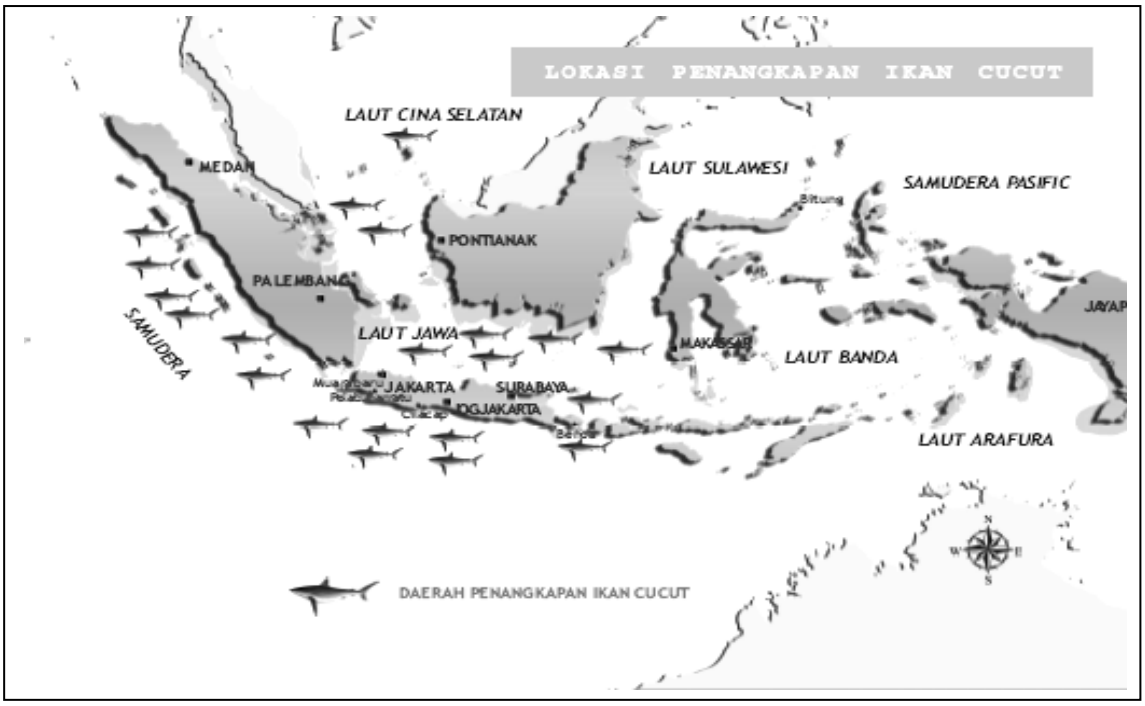


Figure 1. Landing sites for sharks data collection in Indonesia and the shark fishing grounds

a. Benoa – Bali

b. Cilacap – Center Java

c. Bitung – North Sulawesi

d. Muara Baru - Jakarta

e. Pelabuhanratu – West Java

Figure 2. The selected fishing ports as sampling sites for sharks' data collection in Indonesia

3.2 Total Catch Data

In Indonesia, generally sharks are incidentally caught by tuna longline and gillnet (drift gillnet), but sometime sharks are also caught by drift longline. Based on the Table 1, Longline shows to be the main fishing gear for catching shark (60.83% from the total production), while gillnet gave the second highest contribution (39.10%) to the total production of shark during the study period.

Table 1. Total Production of Sharks during the study period by major fishing gear

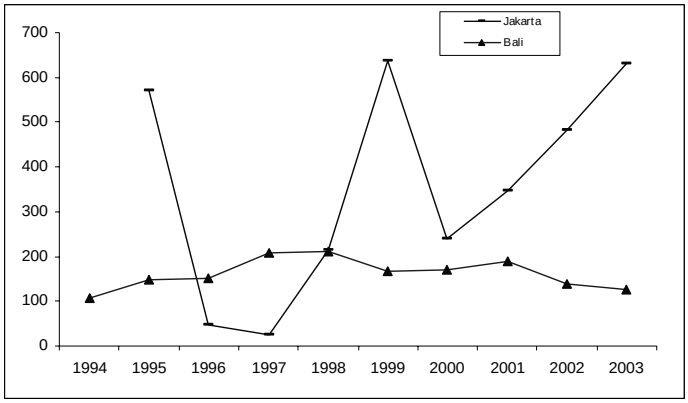
Total Shark Catches		**Production (in kg) for all month**	**Average number of boats for all month**
Shark Catches per fishing gear	Gillnet	39,768.50	45.5
	Longline	61,634.00	53.5
	Fish trawl	-	-
	Purse seine	-	-
	Others gears	68.00	0.75
Total Non Shark Catches		637,971.00	
Total Shark and Non Shark Catches		739,441.50	

Based on the statistical data, the trends of sharks' production during 1994 – 2003 are various among the landing sites. In Pelabuhan Ratu and Cilacap, the shark production tends to decrease where in Pelabuhan Ratu, the sharks production decreased by 82.68 %, namely from 562,891

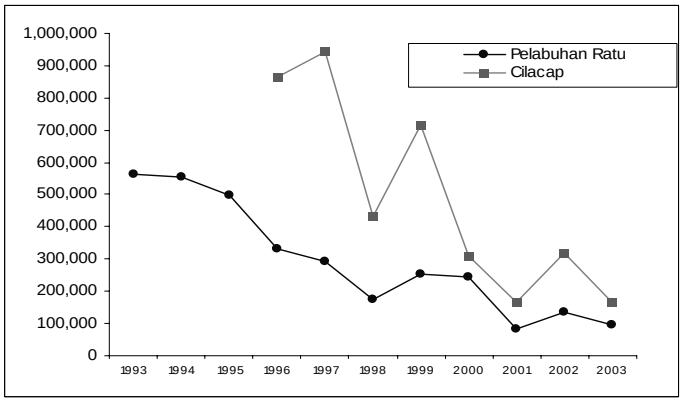
ton (1993) to 97,492 ton (2003), while in Cilacap, the sharks production decreased by 81.03 %, namely from 863,943 ton (1993) to 163,914 ton (2003). The decreasing of total sharks production in both landing sites were caused mostly by reducing of fishing efforts. In this case, the catching areas tend to be farther from the coastline resulting the difficulty of small boats to reach those areas as well as the increasing of operating cost due to the rising price of fuel.

Meanwhile, in Benoa Bali, the shark production tends to be more stable every year with increasing production from 106 ton (19.53%) in 1994 to 126.7 ton in 2003. Whereas, in Muara Baru (Jakarta) and Bitung (North Sulawesi), the sharks production have fluctuated in which the peak of production were 637.1 ton in 1999 in Muara Baru (Jakarta) and 10,500.5 ton in 1995 in Bitung (North Sulawesi).

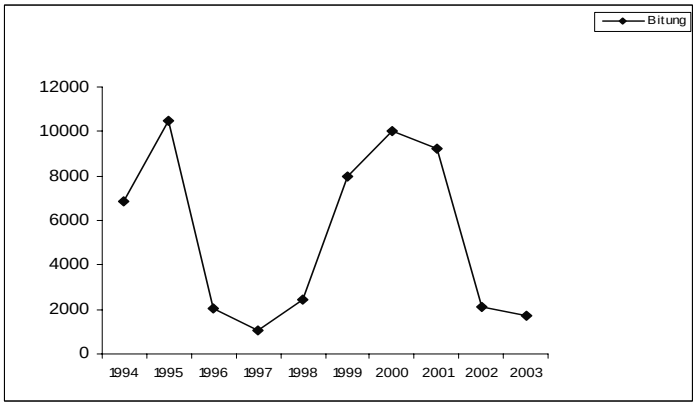
The figures of its shark productions are shown on following diagrams:



a. Muara Baru and Benoa



b. Pelabuhanratu and Cilacap



c. Bitung

Figure 3. Trends of shark production at landing sites from 1994 – 2003

3.3 Biology

The number of shark species was collected by the researchers during the study period consists of 17 species of which one species from ordo of hexanchiformes, 1 species from ordo of squaliformes, 3 species from ordo of lamniformes and 11 species from ordo of carcharhiformes.

According to the measurement of fork length, total length and weight (total sampled for 4 X 7 days), there were not found the significant differences in sizes among the same species of sharks collected in each landing place. The mean lengths of various sharks caught are as follows; *Carcharhinus almblirhynchos*which is 130,40 cm and 333, 10 kg; *Carcharhinus falciformis* 122,89 cm 798,97 kg; *Carcharhinus longimanus* 108,12 cm and 85 kg ; *Carharhinus sorrah* 74,5 cm and 9,3 kg; *Prionace glauca* 206,13 cm and 366 kg; *Alopias pelagicus* 258,78 cm and 352 kg; *Sphyrna lewini* 133,95 cm and 352 kg; *Mustelus sp* 108,67 cm and 16,75 kg; *Squalus megalops* 86,6 cm and 7,7 kg; *Heptranchias perlo* 84 cm and 1,5 kg; *Carcharhinus brevipinna* 111,725 cm and 102,6 kg; *Pseudocarcharias komoharai* 63,2 cm and 1,25 kg; *Hemipristis elongatus* 74 cm and 5 kg, *Carharhinus melanopterus* 82 cm and 11 kg; *Centroscymnus crepidater* 97 cm and 27 kg; *Isurus oxyrinchus* 145 cm and 43 kg; and *Mustelus manazo* 79 cm and 1,8 kg.

Meanwhile, the sex ration of male and female sharks per species are following ration of *Carcharhinus almblirhynchos* 53,33 % : 46,67 %, *Carcharhinus falciformis* 70,00 % : 30 %, *Carcharhinus longimanus* 40 % :d 60 %, *Carharhinus sorrah* 75 % : 25 %, *Prionace glauca* 100 : 0 , *Alopias pelagicus* 40 % : 60 %, *Sphyrna lewini* are 25 % are male and 75 % female, *Mustelus sp* 66,67 % are male and 33,33 % are female, *Squalus megalops* 100 % are female, *Heptranchias perlo* are 100 % are female, *Carcharhinus brevipinna* 25 % are male and 75 are female, *Pseudocarcharias komoharai* 100 % are female, *Hemipristis elongatus* 100 % are female, *Carharhinus melanopterus* 100 are female, *Centroscymnus crepidater* 100 % are male, *Isurus oxyrinchus* 100 % are female, and *Mustelus manazo* 100 % are female.

Table 2. Summary table for shark species composition during 1-year data collection

No	Shark Species	Mean	Male		Female		Maturity
			%	n	%	n	
1	*Carharhinus almbiyrhynchos*	130.40	53.33	8	46.67	7	13.33
2	*Carcharhinus falciformis*	122.89	70.00	21	30.00	9	10.00
3	*Carcharhinus longimanus*	108.12	40	2	60	3	
4	*Carcharhinus sorrah*	74.5	75	3	25	1	25.00
5	*Pronace glauca*	206.13	100	8			
6	*Alopias pelagicus*	258.78	40	2	60	3	
7	*Sphyrna lewini*	133.95	25	1	75	3	
8	*Mustelus sp*	108.67	66.67	2	33.33	1	
9	*Squalus megalops*	64.6			100	4	
10	*Heptranchia perlo*	84			100	1	
11	*Carcharhinus brevina*	111.725	25	1	75	3	
12	*Pseudo komoharai*	63.2			100	1	
13	*Hemipristis elongates*	74			100	1	
14	*Carcharhinus melanoterus*	82			100	1	
15	*Centroscymnus Crepidater*	97	100	1			
16	*Isurus oxyrinchus*	145			100	1	
17	*Mustelus manazo*	79			100	1	

Table 3. Summary table for other biological parameters on selected shark species during 1-year data collection

No	Shark Species	Total sampled (kg) for 7 days	Species observed for mow many days	% of total sampled catch
1	*Carharhinus almblyrhynchos*	333.10		13.25
2	*Carcharhinus falciformis*	798.97		31.78
3	*Carcharhinus longimanus*	85.00		3.38
4	*Carcharhinus sorrah*	9.30		0.37
5	*Pronace glauca*	366.00		14.56
6	*Alopias pelagicus*	352.00		14.00
7	*Sphyrna lewini*	352.00		14.00
8	*Mustelus sp*	16.75		0.67
9	*Squalus megalops*	7.70		0.31
10	*Heptranchia perlo*	1.50		0.06
11	*Carcharhinus brevina*	102.60		4.08
12	*Pseudo komoharai*	1.25		0.05
13	*Hemipristis elongates*	5.00		0.20
14	*Carcharhinus melanoterus*	11.00		0.44
15	*Centroscymnus crepidater*	27.00		1.07
16	*Isurus oxyrinchus*	43.00		1.71
17	*Mustelus manazo*	1.80		0.07
	Total	**2513.97**		**100.00**

3.4 Local Usage and Marketing

From the observation, the shark could potentially expand its usage as for the source of protein of the community or for the state surplus. Almost all of the parts of shark are valuable, for example food materials, medicines or even handicraft materials and souvenirs.

In Indonesia, shark caught by fishermen are usually sold to brokers/traders through an auction process before being marketed to the local consumer or exporter. The general pattern of shark market in Indonesia is shown on the following diagram:

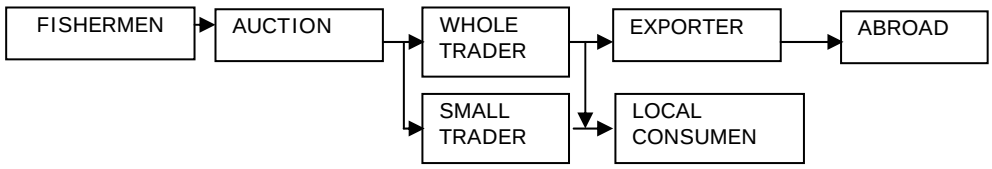


Figure 4. General pattern of shark market landed in Indonesia

The usage of shark's part body can be described as follows:

- **Fin:**

The shark fin usually can be used for soup materials, mixed materials for bread in Japan and China or as other forms of special food. From a first collector, fins are sold in fresh condition and to be dried by a second collector before marketing to Jakarta and Surabaya, some are also exported to Taiwan, Hong Kong, China and Japan.

The price of shark's fin are various, depend on the species and sizes of them. In Cilacap for the Carcharinidae and Alopidae for super quality (> 50 cm) is 11.97 US $/kg (Rp. 1,000,000,-/kg). Super 33 quality (40 – 48 cm) is 97.83 US $/kg (Rp. 900,000,-/kg); the middle quality (30 – 40 cm) is 96.96 US $/kg (Rp. 800,000,-/kg); BA quality (25 – 30 cm) is 59.78 US $/kg (Rp. 550,000,-/kg) and plan (< 25 cm) 13,59 US $/kg is (Rp. 125,000,-/kg). Furthermore for the fin of *Rhinobatos sp* for the super quality (> 40 cm) is 173.91 – 217.39 US $/kg (Rp.1,600,000-- Rp. 2,000,000,-); Super 33 (33 cm) is 130.43 – 163.04 US $/kg (Rp.1,200,000, – Rp.

1,500,000,-); middle (25 – 30 cm) is 108.70 – 130.43 US $/kg (Rp. 1,000,000,- - Rp. 1,200,000,-); BA – 1 (20 – 25 cm) is 86.96 – 108.70 US $/kg (Rp.800,000,- - Rp. 1,000,000,-); BA – 2 (15 – 20 cm) is 65.22 – 86.96 US $/kg (Rp.600,000,- - Rp.800,000,-); and Plan (12 – 15 cm) is 21.74 – 43.48 US $/kg (Rp.200,000,- - Rp.400,000,-).

In Pelabuhan Ratu noted as follows : *Prionace glauca* is 59,78 US $/kg (Rp.550,000,-); *Sphyrna lewini* is 59.78 US $/kg (Rp.550,000,-); *Isurus oxyrinchus is* 15.22 US $/kg (Rp.140,000,-); *Alopias pelagicus* is 17.39 US $/kg (Rp.160,000,-); *Alopias supercilious* is 17.39 US $/kg (Rp.160,000,-); *Galeocerdo cuvieri* is 48.91 US $/kg (Rp.450,000,-) and *Carcharhinus plumbeus is* 97.83 US $/kg (Rp.900,000,-)

- **Skin:**

Carcharhinus sorrah and *Stegostoma sp* which have harder and thicker skins, skin can be used as raw materials for bag or shoes, while the family of Allopiade and some of Carcharinade can be processed as snacks. In Pelabuhan Ratu the price of this kind snack at super grade is 9.70 US $/kg (Rp.80,000,-/kg), and for the lower grade 7.61 US $/kg (Rp.70,000,-/kg). Marketing of this shark's skin product is to local markets and some are delivered to Jakarta.

- **Meat:**

Shark meat is consumed as salted meat, fermented meat (if the size > 5 kg) and also for meatball. The Price is various which depends on the species. For example, *Carcharhinus almblyrhinchos is* 0.52 US $/kg (Rp.4,800,-); *Carcharhinus melanopterus* 0.51 US $/kg (Rp.4,700,-); *Carcharhinus cautus* is 0.51 US $/kg (Rp.4,700,-); *Carcharhinus brevipinna is* 0.51 US $/kg (Rp.4,700); *Carcharhinus fitzroyensis is* 0.51 US $/kg (Rp.4,700,-); *Alopias supercilosus is* 0.38 – 0.43 US $/kg (Rp.3,500,- - Rp.4,000,-); *Alopias pelagicus* is 0.49 – 0.54 US $/kg (Rp.4,500,- - Rp.5,000,-); *Isurus oxyrinchus* is 0.25 US $/kg (Rp.2,300,-); *Prionace glauca is* 0.20 US $/kg (Rp.1,800,-); *galeocerdo cuvier is* 0.27 US $/kg (Rp.2,500,-); *Squalus megalops* is 0.16 – 0.22 US $/kg (Rp.1,500,- - Rp. 2,000,-). Market for them are in West Java such as Kuningan, Lembang and Cirebon, Cisolok and also Bogor. Some Salted meat of shark is also exported to Srilanka and Colombo.

- **Bones:**

A backbone is processed in the form of powder which can be used as a medicine of cancer. This product is sold to Surabaya and Jakarta, also exported to Singapore. The price of dried shark's backbone at the first level collectors in Cirebon in 2004 is 1.74 – 2.07 US $/kg (Rp.16,000,- - Rp.19,000,-/kg).

- **Stomach parts:**

In Pelabuhan Ratu, Insides of the shark stomach is used for some types of snail's feed, and sold at 0.11 US $/kg (Rp.1,000,-/kg).

- **Liver:**

The species that its liver can be used is known as *Squalus megalops* species. Every liver can be extracted to produce 3 – 4 ounce liver oil. In Pelabuhan Ratu, the price of shark's liver is around 0.82 to 1.63 US$/kg (Rp.7,500,- - Rp.15,000,-/kg)

- **Teeth:**

The big size of shark teeth can be used as materials for handy craft such as medals and sold at 0,54 US $/kg (Rp. 5.000,-/kg); for local price or 2,17 US $/kg (Rp. 20.000,-/kg); for others. Dried shark's teeth and jaw are sold at 4,35 US $/kg (Rp. 40.000,-/kg).

Table 4. Local Usage and Marketing of Sharks in 1-year data collection

No	Species	Part	Fishing Boat	Abundance at landing site	Locally Consumed		Local Price per kg (US $)	Market destination
1	*Carcharhinus amblyrhynchos*	Meats	<10 GT	Gillnet	+++	dry salted	0.52	Local Markets
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
2	*Carcharhinus melanopterus*	Meats	31 GT	Longline	+	dry salted	0.52	Local Markets
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
3	*Carcharhinus cautus*	Meats	31 GT	Longline	+	dry salted	0.51	Local Markets
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
4	*Carcharhinus brevipinna*	Meats	31 GT	Longline	+	dry salted	0.51	Local Markets
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
5	*Carcharhinus fitzroyensis*	Meats	22 GT	Longline	++	dry salted	0.51	Local Markets
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
6	*Carcharhinus plumbeus*	Meats	22 GT	Longline	+	dry salted	0.51	Local Markets
		Fin				dried fins	97.51	Local Markets, Taiwan, Hongkong, China and Japan
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
7	*Alopias superciliosus*	Meats	<10 GT	Longline	+	dry salted	97.51	Local Markets
		Fin				dried fins	17.33	Local Markets, Taiwan, Hongkong, China and Japan
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets

8	*Alopias pelagicus*	Meats	6 GT	Gillnet	++	dry salted	0.38 - 0.43	Local Markets
		Fin				dried fins	17.33	Local Markets, Taiwan, Hongkong, China and Japan
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
9	*Isurus oxyrinchus*	Meats	31 GT	Longline	+	dry salted	0.49 - 0.54	Local Markets
		Fin				dried fins	15.17	Local Markets, Taiwan, Hongkong, China and Japan
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
10	*Prionace glauca*	Meats	31 GT	Longline	+++	dry salted	0.54	Local Markets
		Fin				dried fins	60.13	Local Markets, Taiwan, Hongkong, China and Japan
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
11	*Galeocerdo cuvieri OMAS*	Meats	16 GT	Longline	+	dry salted	0.20	Local Markets
		Fin				dried fins	48.75	Local Markets, Taiwan, Hongkong, China and Japan
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
12	*Squalus megalops*	Meats	31 GT	Longline	+	dry salted	0.27	Local Markets
		Liver				shark liver oil	0.81 - 1.63	Local Markets
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
13	*Sphyrna lewini*	Meats	<10 GT	Gillnet	++	dry salted	0.16 - 0.22	Local Markets
		Fin				dried fins	59.59	Local Markets, Taiwan, Hongkong, China and Japan
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets

Note:
(+) rarely (+++) abundant to plentiful
(++) relatively common 1 US $ = Rp.9230 (25 February 2005)

Figure 5. The process of shark's usage: (A) Skin ; (B) Fresh Meat; (C) Bones; and (D) Fin

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3. Mr. Agung Pramono (Cilacap landing site)
4. Mr. Ketut, I. (Beno landing site)

DATA COLLECTION AND FISHERIES MANAGEMENT OF SHARKS IN MALAYSIA

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This study comprised four components, namely (a) catch data, (b) fishery structure and landing sites description, (c) local usage and marketing and (d) biology. Six major fish landing sites were selected for sharks sampling; Hutan Melintang and Kuantan on the west coast and east coast of Peninsular Malaysia, respectively, Mukah and Bintulu in the state of Sarawak, Sandakan and Kota Kinabalu on the north-east and west coasts of the state of Sabah, respectively. The states of Sarawak and Sabah are located in north Borneo (Figure 1 and 2).

1. CATCH SUMMARY

1.1 Hutan Melintang

Fish trawl is the major fishing gear landing sharks at Hutan Melintang in Perak. This gear contributed 15,346.96 kg of sharks or 0.30% of the total landings (shark and non-shark) which were recorded from 502 landings during the study duration. An average of 4.3 trawlers/day have sharks among their catches (Table 1.1)

1.2 Kuantan

Fish trawl is the major fishing gear landing 99% of all sharks caught followed by longlines, purse seine and other gears (especially fish trap) at Kuantan. Total shark catches from these gears were 74,893 kg or 0.58% of the total landings (shark and non-shark). The 74,398 kg of sharks caught by trawlers came from 1,068 boat landings with an average of 8.68 trawlers/day having sharks in their catches (Table 1.2)

1.3 Bintulu

Fish trawl is also the major fishing gear landing sharks in Bintulu, Sarawak. It contributes 61% of the total sharks followed by gillnet (21%) and longline (18%). A total of 15,852 kg of sharks were landed by these three gears during the study duration which made up 4.0% of the total landings. The number of boats sampled were 53 fish trawlers, 34 gillnetters and 3 longliners. An average of 1.89 boats/day for both trawlers and gillnetters were found to have sharks in their catches (Table 1.3).

1.4 Mukah

Gillnet is the major fishing gear landing sharks in Mukah, Sarawak, and contributed 88.36% of the total shark landings by all gears, followed by longline (6.23%). The other fishing gears contributed 5.41% of the total shark landing. The total of 8,746.50 kg sharks landed by these gears made up 12.88% of the total landings. From a total of 312 gillnetters sampled during the study, an average of 4.22 gillnetters/day have sharks in their catches (Table 1.4)

1.5 Sandakan

Fish trawl is the major fishing gear landing sharks in Sandakan, Sabah. A total of 7,258 kg of sharks were landed from 133 fish trawlers landings sampled during the study duration. This

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amount contributed 94.63% of the total shark landings followed by longline (3.91%) and gillnet (1.46%). The shark landings from these three fishing gears contributed 3.64% of the total landings (shark and non-shark). An average of 1.27 fish trawlers/day, 1.0 longliners/day and 1.0 gillnetters/day were found to have sharks in their catches (Table 1.5)

1.6 Kota Kinabalu

Fish trawl is the only fishing gear landing sharks in Kota Kinabalu during the study duration. A total of 9,293 kg of sharks were landed from 138 trawler landings sampled. Sharks constituted 1.30% of the total landing (shark and non-shark). An average of 1.2 trawlers/day have sharks in their catches (Table 1.6).

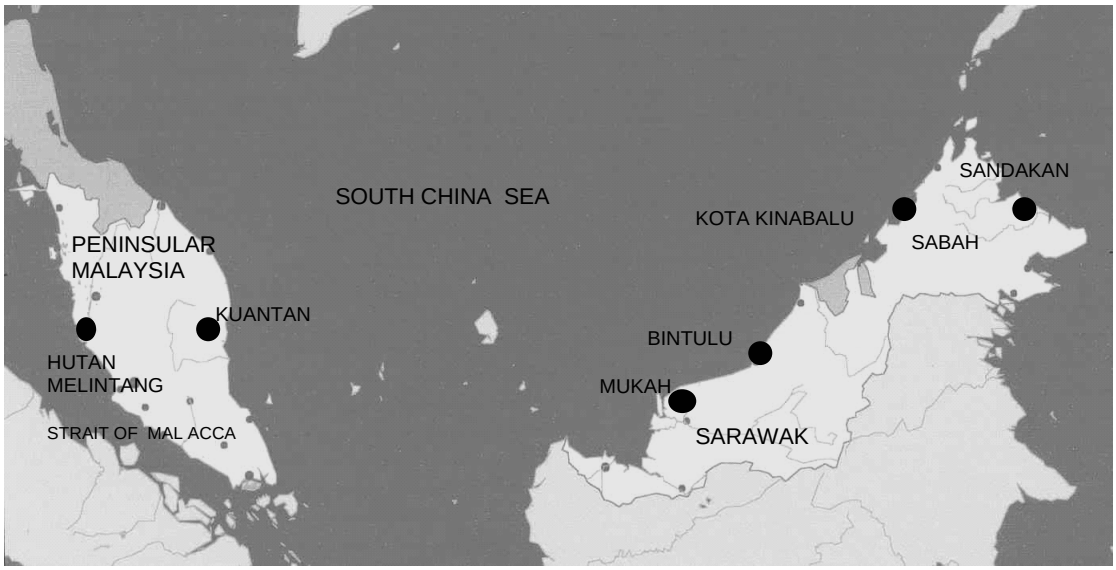


Figure 1 : The six landing sites covered during the study

Hutan Melintang, Perak

Kuantan, Pahang

Kota Kinabalu, Sabah

Bintulu, Sarawak

Figure 2: Landing sites

Table 1. Catch Summary

Table 1.1. Hutan Melintang Catch Summary Table for Year (4x30 Days)		Production (in kg) for all month	Average number of boats for all month
Total Shark Catches		15,364.54	
Shark catches per	Gillnet		
	Long line		
	Fish trawl	15,346.96	4.30
	Purse seine	17.58	1.00
	Other gears		
Total Non-shark Catches		5,020,172.85	
Total Shark and Non-Shark Catches		5,035,537.39	

Table 1.2. Kuantan Catch Summary Table for Year (4x30 Days)		Production (in kg) for all month	Average number of boats for all month
Total Shark Catches		74,893.00	
Shark catches per	Gillnet		
	Long line	403.00	1.10
	Fish trawl	74,398.00	8.68
	Purse seine	64.00	1.00
	Other gears	28.00	1.00
Total Non-shark Catches		12,715,393.00	
Total Shark and Non-Shark Catches		12,790,286.00	

Table 1.3. Bintulu Catch Summary Table for Year (4x30 Days)		Production (in kg) for all month	Average number of boats for all month
Total Shark Catches		15,852.00	
Shark catches per	Gillnet	3,407.00	1.89
	Long line	2,780.00	1.50
	Fish trawl	9,665.00	1.89
	Purse seine		
	Other gears		
Total Non-shark Catches		379,452.00	
Total Shark and Non-Shark Catches		395,304.00	

Table 1.4. Mukah Catch Summary Table for Year (4x30 Days)		Production (in kg) for all month	Average number of boats for all month
Total Shark Catches		8,746.50	
Shark catches per	Gillnet	7,728.40	4.22
	Long line	545.30	1.17
	Fish trawl		
	Purse seine		
	Other gears	472.80	1.33
Total Non-shark Catches		59,150.30	
Total Shark and Non-Shark Catches		67,896.80	

TABLE 1.5. Sandakan Catch Summary Table for Year (4x30 Days)		Production (in kg) for all month	Average number of boats for all month
Total Shark Catches		7,670.00	
Shark catches per	Gillnet	112.00	1.00
	Long line	300.00	1.00
	Fish trawl	7,258.00	1.27
	Purse seine		
	Other gears		
Total Non-shark Catches		202,906.00	
Total Shark and Non-Shark Catches		210,576.00	

Table 1.6. Kota Kinabalu Catch Summary Table for Year (4x30 Days)		Production (in kg) for all month	Average number of boats for all month
Total Shark Catches		9,293.00	
Shark catches per	Gillnet		
	Long line		
	Fish trawl	9,293.00	1.20
	Purse seine		
	Other gears		
Total Non-shark Catches		705,142.20	
Total Shark and Non-Shark Catches		714,435.20	

2. FISHERY STRUCTURE AND LANDING SITE DESCRIPTION

2.1 Hutan Melintang

Hutan Melintang in the state of Perak is one of the major landing area along the west coast of Peninsular Malaysia. The landing sites here are private enterprises with most of the shark landings coming from trawlers. These fishing boats are wooden hulled and normally manned by 3 to 7 crew members. The total number of licensed fishing boats landing their catches here is 267, involving 942 fishers. Most of the sharks are landed by 40-70 GRT boats that normally fish from 7 to 10 days per trip. The landing time for most of the trawlers is around 7.30 am to 10.00 am daily. The breakdown of the fishing boats by type of gears and GRT are given in Table 2.1.

Table 2.1. Numbers of licensed fishing boats and fishers by type of gear and size category based in Hutan Melintang.

Gear Type	No. of Boat	No. of Fishers
Fish Trawl		
0 – 9.9 GRT	Nil	Nil
10 – 24.9 GRT	5	10
25 – 39.9 GRT	8	16
40 – 69.9 GRT	167	501
> 70 GRT	69	276
Purse Seine		
0 – 9.9 GRT	Nil	Nil
10 – 24.9 GRT	Nil	Nil
25 – 39.9 GRT	Nil	Nil
40 – 69.9 GRT	10	120
> 70 GRT	1	12
Gill Net	1	1
Long Line	3	3
Other Gears	3	3
Total	267	942

2.2 Kuantan

The landing site sampled in Kuantan is owned by the government and managed by the Fisheries Development Authority of Malaysia (LKIM). All sharks landed at this site were caught in Malaysian waters of the South China Sea off the east coast of Peninsular Malaysia. There are 586 licensed fishing boats with a total of 2,399 fishers recorded using this site to land their catches. The breakdown of the fishing boats by types of gear and GRT are given in Table 2.2.

Table 2.2. Numbers of licensed fishing boats and fishers by type of gear and size category based in Kuantan.

Gear Type	No. of Boat	No. of Fishers
Fish Trawl		
0 – 9.9 GRT	13	39
10 – 24.9 GRT	16	48
25 – 39.9 GRT	11	33
40 – 69.9 GRT	90	450
> 70 GRT	56	280
Purse Seine		
0 – 9.9 GRT	Nil	Nil
10 – 24.9 GRT	Nil	Nil
25 – 39.9 GRT	Nil	Nil
40 – 69.9 GRT	24	600
> 70 GRT	3	75
Gill Net	266	532
Long Line	80	240
Other Gears	27	102
Total	586	2399

2.3 Bintulu

The main landing site is owned by the government and managed by the Bintulu Development Authority in Sarawak. Only trawlers of more than 40 GRT and gillnetters land their shark catches at this site. The fishing areas are from the shore to 100 nautical miles offshore including large patches of coral reefs and rough grounds. There were also a number of small landing jetties located 2-3 miles upriver that can only be approached during the high tide. These jetties are all privately owned. Landings of fish started as early as 3.00 am and also in the afternoon.

There are 275 licensed fishing boats operating in this area that involve 1,015 fishers. The number of boats by types of gear and size category is detailed out in Table 2.3.

Table 2.3. Numbers of licensed fishing boats and fishers by type of gear and size category based in Bintulu.

Gear Type	No. of Boat	No. of Fishers
Fish Trawl		
0 – 9.9 GRT	2	6
10 – 24.9 GRT	19	57
25 – 39.9 GRT	5	30
40 – 69.9 GRT	28	224
> 70 GRT	7	56
Purse Seine		
0 – 9.9 GRT	Nil	Nil
10 – 24.9 GRT	Nil	Nil
25 – 39.9 GRT	Nil	Nil
40 – 69.9 GRT	3	36
> 70 GRT	Nil	Nil
Gill Net	23	50
Long Lines	24	50
Other Gears	164	506
Total	275	1015

2.4 Mukah

Sharks landed at Mukah are mostly caught by gillnets which operate in coastal areas, less than 30 nautical miles from shore off Mukah, Sarawak. The bottom type is flat to undulating with mud/sand substrates and some areas are interphased with coral reefs.
There are 270 fishing boats involving 791 fishers at this site. The types of gears and GRT are as shown in Table 2.4.

Table 2.4. Numbers of licensed fishing boats and fishers by type of gear and size category based in Mukah.

Gear Type	No. of Boat	No. of Fishers
Fish Trawl		
0 – 9.9 GRT	1	3
10 – 24.9 GRT	30	36
25 – 39.9 GRT	3	12
40 – 69.9 GRT	Nil	Nil
> 70 GRT	Nil	Nil
Purse Seine		
0 – 9.9 GRT	Nil	Nil
10 – 24.9 GRT	Nil	Nil
25 – 39.9 GRT	Nil	Nil
40 – 69.9 GRT	3	36
> 70 GRT	2	24
Gill Net	207	560
Long Line	24	120
Other Gears	Nil	Nil
Total	270	791

2.5 Sandakan

Fishing areas are from Kudat down to Tambisan in the northern part of Sabah. Landing time for most of the trawlers is around 4 am - 10 am daily. The total number of boats and fishers landing at this site are 1461 and 3760, respectively. Most of boats are of 10-69.9 GRT and made of

wood with every boat manned by 3 to 6 fishers. The breakdown of the fishing boats by types of gears and GRT are as shown in Table 2.5.

Table 2.5. Numbers of licensed fishing boats and fishers by type of gear and size category based in Sandakan.

Gear Type	No. of Boat	No. of Fishers
Fish Trawl		
0 – 9.9 GRT	136	240
10 – 24.9 GRT	360	1090
25 – 39.9 GRT	220	800
40 – 69.9 GRT	3	15
> 70 GRT	-	-
Purse Seine		
0 – 9.9 GRT	-	-
10 – 24.9 GRT	-	-
25 – 39.9 GRT	-	-
40 – 69.9 GRT	-	-
> 70 GRT	2	25
Gill Net	320	740
Long Line	300	550
Other Gears	120	200
Total	1461	3760

2.6 Kota Kinabalu

The fishing grounds are around the Mengalun Island, Tiga Island and Mantanani Island with 7 to 9 fishers per boat. Fishing days ranged from 4-6 days per trip. Most of the boats landing sharks at the SAFMA jetty are of 10-69.9 GRT. There are 383 licensed fishing boats involving 1521 fishers at this site. The types of gears and GRT are as shown in Table 2.6.

Table 2.6. Numbers of licensed fishing boats and fishers by type of gear and size category based in Kota Kinabalu.

Gear Type	No. of Boat	No. of Fishers
Fish Trawl		
0 – 9.9 GRT	Nil	Nil
10 – 24.9 GRT	Nil	Nil
25 – 39.9 GRT	168	712
40 – 69.9 GRT	Nil	Nil
> 70 GRT	Nil	Nil
Purse Seine		
0 – 9.9 GRT	Nil	Nil
10 – 24.9 GRT	12	122
25 – 39.9 GRT	Nil	Nil
40 – 69.9 GRT	Nil	Nil
> 70 GRT	Nil	Nil
Gill Net	33	62
Long Line	146	437
Other Gears	34	188
Total	383	1521

3. LOCAL USAGE AND MARKETING

The study on the marketing structure and processing of shark in Malaysia covers the six main shark landing sites in Malaysia where daily landing and biological data were also collected.

3.1 Hutan Melintang (on the west coast of Peninsular Malaysia)

There are three main shark traders at this site. These traders buy sharks directly from the fishers which were then sent to local wholesale markets in the states of Perak and Selangor as well as Kuala Lumpur. Sharks sold to traders are mainly in whole form i.e. with fins. The prices of sharks at this landing site vary according to the species. Spot-tail shark (*Carcharhinus sorrah)* is much preferred and therefore fetches a higher price at US$1.31 to US$1.58 per kg. The prices of the other main species of sharks traded at this landing site usually range between US$0.26 to US$0.92 per kg. The prices of sharks at the main retail markets are about 20 to 30% higher than the prices at the landing site.

There are about 5 fish processors who purchase fish from the Hutan Melintang landing site. These processors are involved in the processing of surimi-based products such as fish balls and fish cakes. Smaller species sharks such as *Scoliodon laticaudus* are also used by these processors to mainly produce fish balls. Sharks for processing into surimi-based products are sold headless and gutted to processors at US$0.16 per kg. Details on usage and marketing are given in Table 3.1

3.2 Kuantan (on the east coast of Peninsular Malaysia)

Three traders are involved in the marketing of shark at this site. These shark traders buy sharks directly from the fishers and send them to wholesale markets in Kuala Lumpur and the states of Terengganu and Johore. Sharks are mainly traded as whole fish. However, some fishers will cut the fins of larger sharks to be marketed separately or for their own consumption.

At this landing site, sharks are classified into two main categories i.e**.** white shark and black shark before these are marketed to traders. *Chiloscyllium griesum, Chiloscyllium punctatum* and *Stegostoma fasciatum* are among the black sharks while the white sharks include species such as *Rhizoprionodon acutus, Carcharhinus sorrah, Carcharhinus sealei* and *Sphyrna lewini.* White sharks fetch a higher price than black sharks. White sharks, with or without fins, are sold for between US$0.79 and US$0.92 per kg, while the black ones are priced from US$0.53 to US$0.79 per kg. There is not much fluctuation in price as the quantity of shark landed is rather small and consistent throughout the year. The prices of wet white shark fin sold to traders are between US$52.63 and US$68.42 per kg. Wet black shark fin fetches a lower price from US$42.10 to US$47.37 per kg.

One of the traders is also involved in fish processing. Shark products comprise only about 20% of his sales due to the limited supply of sharks. The bulk of his sales comes from other fisheries products. Among the shark products produced in his factory include:

a) **Shark Fin**
   Shark fins are dried under the sun for 2 weeks and are sold to a wholesaler in Johore for between US$78.95 to US$157.89 per kg depending on the species of sharks. These dried fins are then exported to Singapore and Hong Kong.

b) **Dried Salted Shark Meat**
   Shark meats are cut and washed before being soaked in salt water for a day. The meats are then washed and dried under the sun for a week. These dried salted shark meats are marketed directly mainly to restaurants and consumers in Kuantan for US$1.32 per kg.

c) **Shark Cartilages**
   Shark cartilages, which are believed to have medicinal values, are marketed mainly around Kuantan in wet and dried forms. The price of shark cartilage is from US$0.79 to US$1.32 per kg.

d) **Shark Teeth**
Shark teeth are dried and sold as souvenirs. The price of the teeth is from US$7.89 to US$13.16 depending on the size.

Shark skins are sold to another processor for US$0.79 per kg. The skins will then be dried and fried before exported to Singapore and Hong Kong.

Details on usage and marketing by species of shark are given in Table 3.2

3.3 Bintulu, Sarawak

Three traders are involved in the marketing of sharks at this site. One of the traders is involved in the processing of dried salted shark meat and trading of wet unprocessed shark fins.

Sharks traded at this landing site are mainly without fins as fishers will cut out the fins of larger sharks before selling them to traders. The price of sharks sold at this landing site varies according to the size. Sharks of more than 1.5 kg are sold at US$0.53 per kg, while those between 1.0 and 1.5 kg are sold at US$0.39 per kg. Sharks of less than 1 kg, which comprise mainly of spadenose shark (*Scoliodon laticaudus*), are priced at between US$0.23 and US$0.26 per kg. Fins, in wet form, are sold separately to shark fin collectors from US$10.53 to US$11.84 per kg depending on the size. Among the main species of sharks traded at this site are *Carcharhinus sealei, Sphyrna lewini, Scoliodon laticaudus* and *Carcharhinus sorrah*. There is very little fluctuation in price as the quantity of sharks landed is rather small and if there is any glut, it will be absorbed by the shark processor.
Sharks landed at this site are sold mainly around Bintulu while a small amount is marketed to other towns. Sharks landed by trawlers are mainly sold to shark processors while those landed by gill nets are sold fresh mainly to retailers at the Bintulu main market. Smaller sized sharks are sold in bundle of about 3 kg at US$1.32 per bundle while the larger ones are sold from US$1.05 to US$1.32 per kg. Some retailers will cut the meat of bigger sharks and sold them at US$2.11 per kg. There is no difference in price among the various species of sharks traded in the market.

There is only one major shark processor in Bintulu. This processor is only involved in the processing of dried salted shark meat and trading of wet unprocessed shark fins. The smaller wet fins are sold to collectors at US$13.16 per kg while the larger ones (more than 23 cm) are sold at US$31.58 per kg. These collectors will further process the fins into wet consumable forms and sell them mainly to restaurants in Bintulu for between US$26.32 and US$42.11 per kg. The production of dried salted shark meat involves a simple processing technology such as removing, washing and soaking the meat in salt for a day before drying them in the sun for 3 to 4 days. The other parts of the sharks (i.e. the head, skin and gut) are discarded. The dried salted shark meats are sold at US$3.16 per kg. Details on usage and marketing of shark by species are given in Table 3.3.

3.4 Mukah, Sarawak

There are two shark traders at the LKIM jetty. These two traders are processors who purchase sharks for processing into dried fins and dried salted meat. These two processors purchase whole sharks with fins from fishers at various prices depending on the size of the sharks. Smaller sized sharks of less than 1kg. are sold for US$0.39 per kg. Sharks of size between 1 and 1.5kg are priced at US$0.66 per kg, while those above 1.5 kg are sold at US$0.92 per kg. Among the main species of sharks traded at this jetty are *Carcharhinus sorrah* and *Carcharhinus sealei*. There is no difference in price among the various species of sharks traded at this jetty. There is also very little fluctuation in prices as the amount of sharks traded is very small throughout the year. The quantity of sharks purchased by each processor is about 2 to 3 tonnes per month.

Dried shark fins of more than 13 cm are sold for from US$42.11 to US$47.37 per kg, while the smaller ones are priced at between US$22.37 and US$23.68 per kg. Processing of dried salted meat involves soaking the shark meat overnight in salt before drying them under the sun for 2 to 3 days. One of the processor discards all the other parts (i.e. head, skin and gut) of the sharks while the other processor keeps the skin for own consumption and gives the liver for free to the local people. Dried salted shark meats are sold for between US$2.29 and US$2.37 per kg.

The sharks traded at the main market are mainly the smaller sized spadenose shark (*Scoliodon laticaudus*) landed by small boats operating monofilament gill nets at the landing site located just behind the main market. Sharks traded at this market are very fresh as these small boats only operate for about 4 hours at sea. Due to its freshness, sharks are also used to prepare "umai", a popular local dish using raw fish. In the market, sharks are sold in whole form and in bundles of about 6 to 7 pieces per bundle. Each bundle weighs around 1.5kg and is sold for US$1.05. Details on usage and marketing of shark by species are given in Table 3.4

3. 5 Sandakan (the north-east coast of Sabah)

This landing site and market are managed by the Sandakan Local Council. Two traders are involved in the marketing of sharks at the landing site. These traders buy sharks directly from the fishers mainly through contract and they will then send them directly to consumers at the market. Fishers will sell large sharks, after cutting off their fins, to traders at US$0.39 per kg. Smaller sized sharks are sold as whole fish to traders at the same price. There is no variation in prices of shark sold among the two traders. There is also no difference in price among the various species and sizes of sharks traded in the market. Shark traders will lump all species and sizes of sharks together and sell them at a common price of US$0.53 per kg. Among the main species of sharks traded in this market are *Carcharhinus sp.*, *Sphyrna sp.* and *Loxodon macrorhinus*. There is very little fluctuation in price as the quantity of shark landed is rather small and consistent throughout the year.

There is one shark processor in this market. This processor will purchase the sharks from traders at US$0.53 per kg which are then cut and the meat sold at US$0.66 per kg. Almost all parts of the shark are sold. The head is sold for US$0.26 per kg as bait while the liver is sold at the same price for human consumption. Shark cartilages are sold at US$0.53 per kg to make broth or soup. The skin of the shark are dried and sold for US$13.16 per kg.

There are two main shark fin processors in Sandakan. These processors purchase the dried fins directly from fishers at between US$26.32 to US$105.26 per kg depending on the size and quality of the fins. These fins are then processed into three main consumable forms i.e. dried whole-fin, dried loose-fin and wet loose-fin. Dried fins are sold for between US$65.79 and US$131.58 per kg while wet loose-fins are cheaper at US$34.21 per kg since 1 kg of dried fins can be processed into 3 to 4 kg of wet fins. These two processors sell their products directly to consumers through their retail shops in Sandakan.

There is very little processing activities of sharks at Sandakan due to the small volume landed. There are about 10 fish processing factories in Sandakan producing frozen fish/fillets. Some of these factories also produce shark fillets if they are able to secure the supply from fishers. Sharks are sold to these factories at US$0.26 per kg for processing into fillets. These fillets are then sold to markets in Peninsular Malaysia for US$1.58 per kg. The other parts of the shark are used as feed for aquaculture. Details on usage and marketing by species of shark are given in Table 3.5.

3.6 Kota Kinabalu (the west coast of Sabah)

Fish caught by boats in Kota Kinabalu are mainly landed at the Sabah Fish Marketing (SAFMA) Complex. There are three fish traders involved in the trading of sharks in this complex. These traders purchase sharks directly from the fishers and sell them directly to local customers. Fishers will sell large sharks, after cutting off their fins, to traders at US$0.66 per kg. Smaller sized sharks are sold as whole fish to traders at the same price. Fishers will dry the fins and sell them to collectors/processors at US$7.37 per kg. Collectors/processors will further process the fins into consumable forms and sell them to consumers at US$12.63 per kg.

There is no difference in price among the various species of sharks traded in the complex. Shark traders will lump all species of sharks together and sell them at a common price of US$0.92 per kg. Among the main species of sharks traded in this complex are *Carcharhinus sp.*, *Chiloscyllium punctatum*, *Sphyrna sp.* and *Galeocerdo cuvier*. There is very little fluctuation in price as the quantity of sharks landed is very small and rather constant throughout the year. Of the three shark traders, only one trader will cut the shark meat out and sell them at US$1.31 per kg. The gut and skin of the sharks are discarded. Apart from dried shark fin, there is practically no processing activity of sharks at Kota Kinabalu due to the small volume landed. Details on usage and marketing by species of sharks are given in Table 3.6.

3.7 Shark Products

Sharks are mainly sold in fresh whole form for direct consumption. Sharks, especially the larger ones, are sold without fins. The prices of fresh whole sharks range from US$0.23 to US$2.05 per kg depending on various factors such as species, size and location. Wet shark meats are traded for between US$0.66 and US$2.10 per kg. In certain places, the shark head is also being sold as bait while the liver is sold for human consumption. Shark fins are mainly processed into three main forms i.e. dried whole-fin, dried loose-fin and wet loose-fin. Dried whole-fins are processed from larger and higher grade shark fins while the loose-fin products are mainly derived from smaller and lower grade fins. Other products, which are derived from sharks, include dried salted shark meat, shark skin, shark cartilage and shark jaw/teeth. The various types of shark products are as shown in Figure 3 while the prices and markets are shown in Table 3.7.

3.8 Shark Trade

Malaysia's trade in sharks and shark products are mainly confined to the domestic market due to the small volume of supply. Only shark fin products are being traded externally but the exports of these products from Malaysia were rather small amounting to only about 10 tonnes in 2001 (Table 3.8.1). Shark fin products are being traded in three categories i.e. dried, salted and prepared/preserved forms. Imports are mainly from China and Indonesia while most of the exports are destined for countries such as Hong Kong, Singapore and Thailand (Table 3.8.2). Substantial quantities of shark fin products traded are in the dried category while only a small amount is in the other two categories. Malaysia is a net importer of shark fin products with imports exceeding exports by 30 – 100 tonnes per annum.

Table 3.1. Local Usage and Marketing of Sharks in Hutan Melintang, Perak

Species	Part	Shark Source		Abundance at landing site [1]	Locally consumed (C), Discarded (D), Traded (T), Processed (Type of processing)	Local price per kg (US$)	Market destination
		Type of Fishing Boat	Type of fishing gear				
C. sorrah	Whole	Trawlers	Fish Trawl	+	C,T Fresh whole shark & shark fin	1.32–1.58	Local markets in Perak & Selangor state including Kuala Lumpur
C. sealei	Whole	Trawlers	Fish Trawl	+	C,T Fresh whole shark	0.58-0.92	Local markets in Perak & Selangor state including Kuala Lumpur
C. dussumieri	Whole	Trawlers	Fish Trawl	+	C,T Fresh whole shark	0.58-0.92	Local markets in Perak & Selangor state including Kuala Lumpur
C. punctatum	Whole	Trawlers	Fish Trawl	+++	C,T Fresh whole shark	0.53-0.66	Local markets in Perak & Selangor state including Kuala Lumpur
C. hasselti	Whole	Trawlers	Fish Trawl	+++	C,T Fresh whole shark	2.00-2.50	Local markets in Perak & Selangor state including Kuala Lumpur
R. acutus	Whole	Trawlers	Fish Trawl	++	C,T Fresh whole shark & fish ball	0.53-0.61	Local markets in Perak & Selangor state including Kuala Lumpur
S. laticaudus	Whole	Trawlers	Fish Trawl	++	C,T Fresh whole shark	0.26-0.61	Local markets in Perak & Selangor state including Kuala Lumpur
S. lewini	Whole	Trawlers	Fish Trawl	+	C,T Fresh whole shark	0.53-0.79	Local markets in Perak & Selangor state including Kuala Lumpur
C. lucas	Whole	Trawlers	Fish Trawl	+	C,T, Shark meat & shark fin	1.32-1.58	Local markets in Perak & Selangor state including Kuala Lumpur

[1] Abundance : rarely (+), relatively common (++), abundant to plentiful (+++)
Note : Price at landing site

Table 3.2. Local Usage and Marketing of Sharks in Kuantan, Pahang

Species	Part	Shark Source		Abundance at landing site [1]	Locally consumed (C), Discarded (D), Traded (T), Processed (Type of processing)	Local price per kg (US$)	Market destination
		Type of Fishing boat	Type of fishing gear				
C. punctatum	Whole	Trawlers	Fish trawl	+++	C,T, Fresh whole shark, shark fin, salted meat, shark cartilage & shark skin	0.53-0.79	Wholesale markets in Malaysia, Singapore & Hong Kong
C. griseum	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark, shark fin, salted meat, shark cartilage & shark skin	0.53-0.79	Wholesale markets in Malaysia, Singapore & Hong Kong.
R. acutus	Whole	Trawlers	Fish trawl	++	C,T, Fresh whole shark, shark fin, salted meat, shark cartilage & shark skin	0.79-0.92	Wholesale markets in Malaysia, Singapore & Hong Kong

C. sealei	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark, shark fin, salted meat, shark cartilage & shark skin	0.79-0.92	Wholesale markets in Malaysia, Singapore & Hong Kong
C. sorrah	Whole	Trawlers	Fish trawl	++	C,T, Fresh whole shark, shark fin, salted meat, shark cartilage & shark skin	0.79-0.92	Wholesale markets in Malaysia, Singapore & Hong Kong
S. lewini	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark, shark fin, salted meat, shark cartilage & shark skin	0.79-0.92	Wholesale markets in Malaysia, Singapore & Hong Kong
S. fasciatum	Whole	Trawlers	Fish trawl	++	C,T, Fresh whole shark, shark fin, salted meat, shark cartilage & shark skin	0.53-0.79	Wholesale markets in Malaysia, Singapore & Hong Kong

[1] Abundance : rarely (+), relatively common (++), abundant to plentiful (+++)
Note : Price at landing site

Table 3.3. Local Usage and Marketing of Sharks in Bintulu, Sarawak

Species	**Part**	**Shark Source**		**Abundance at landing site [1]**	**Locally consumed (C), Discarded (D), Traded (T), Processed (Type of processing)**	**Local price per kg (US$)**	**Market destination**
		Type of Fishing Boat	**Type of fishing gear**				
H. microstoma	Whole	Trawlers, Gill Net	Fish Trawl, Gill Net	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.53	Local markets in Bintulu and Sibu.
C. punctatum	Whole	Trawlers, Gill Net	Fish Trawl, Gill Net	+	C,T, Fresh whole shark, shark fin & salted meat	0.21-0.39	Local markets in Bintulu and Sibu.
S. laticaudus	Whole	Trawlers, Gill Net	Fish Trawl, Gill Net	+	C,T, Fresh whole shark, shark fin & salted meat	0.21-0.39	Local markets in Bintulu and Sibu.
C. sealei	Whole	Trawlers, Gill Net	Fish Trawl, Gill Net	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.53	Local markets in Bintulu and Sibu.
C. sorrah	Whole	Trawlers, Gill Net	Fish Trawl, Gill Net	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.53	Local markets in Bintulu and Sibu.
S. lewini	Whole	Trawlers, Gill Net	Fish Trawl, Gill Net	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.53	Local markets in Bintulu and Sibu.
R. acutus	Whole	Trawlers, Gill Net	Fish Trawl, Gill Net	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.53	Local markets in Bintulu and Sibu.
C. dussumieri	Whole	Trawlers, Gill Net	Fish Trawl, Gill Net	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.53	Local markets in Bintulu and Sibu.

[1] Abundance : rarely (+), relatively common (++), abundant to plentiful (+++)

Note : Price at landing site and prices vary according to size of sharks

Table 3.4: Local Usage and Marketing of Sharks in Mukah, Sarawak

Species	Part	Shark Source		Abundance at landing site [1]	Locally consumed (C), Discarded (D), Traded (T), Processed (Type of processing)	Local price per kg (US$)	Market destination
		Type of Fishing Boat	Type of fishing gear				
C. sealei	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.92	Local markets in Mukah, Sibu and Kuching.
C. sorrah	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.92	Local markets in Mukah, Sibu and Kuching.
S. lewini	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.92	Local markets in Mukah, Sibu and Kuching.
H. microstoma	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.92	Local markets in Mukah, Sibu and Kuching.
S. laticaudus	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.66	Local markets in Mukah, Sibu and Kuching.
C. punctatum	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.66	Local markets in Mukah, Sibu and Kuching.
R. acutus	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.92	Local markets in Mukah, Sibu and Kuching.

[1] Abundance : rarely (+), relatively common (++), abundant to plentiful (+++)
Note : Price at landing site and prices vary according to size of sharks

Table 3.5. Local Usage and Marketing of Sharks in Sandakan, Sabah

Species	Part	Shark Source		Abundance at landing site [1]	Locally consumed (C), Discarded (D), Traded (T), Processed (Type of processing)	Local price per kg (US$)	Market destination
		Type of Fishing boat	Type of fishing gear				
C. sealei	Whole	TrawlersGill Net, Hooks & Lines	Fish Trawl, Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin, frozen shark meat & fish ball	0.39-0.53	Local markets in Sandakan, Peninsular Malaysia
L. macrorhinus	Whole	TrawlersGill Net, Hooks & Lines	Fish Trawl, Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin, frozen shark meat & fish ball	0.39-0.53	Local markets in Sandakan, Peninsular Malaysia
C. dussumieri	Whole	TrawlersGill Net, Hooks & Lines	Fish Trawl, Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin, frozen shark meat & fish ball	0.39-0.53	Local markets in Sandakan, Peninsular Malaysia

C. sorrah	Whole	TrawlersGill Net, Hooks & Lines	Fish Trawl, Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin, frozen shark meat & fish ball	0.39-0.53	Local markets in Sandakan, Peninsular Malaysia
R. acutus	Whole	TrawlersGill Net, Hooks & Lines	Fish Trawl, Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin, frozen shark meat & fish ball	0.39-0.53	Local markets in Sandakan, Peninsular Malaysia
H. microstoma	Whole	TrawlersGill Net, Hooks & Lines	Fish Trawl, Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin, frozen shark meat & fish ball	0.39-0.53	Local markets in Sandakan, Peninsular Malaysia
C. amblyrhynchoides	Whole	Trawlers, Gill Net, Hooks & Lines	Trawlers, Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin, frozen shark meat & fish ball	0.39-0.53	Local markets in Sandakan, Peninsular Malaysia
S. mokarran	Whole	Trawlers, Gill Net, Hooks & Lines	Trawlers, Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin, frozen shark meat & fish ball	0.39-0.53	Local markets in Sandakan, Peninsular Malaysia
S. fasciatum	Whole	Trawlers, Gill Net, Hooks & Lines	Trawlers, Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin, frozen shark meat & fish ball	0.39-0.53	Local markets in Sandakan, Peninsular Malaysia

[1] Abundance : rarely (+), relatively common (++), abundant to plentiful (+++)
Note : Price at landing site and prices are the same regardless of size and species

Table 3.6. Local Usage and Marketing of Sharks in Kota Kinabalu, Sabah

Species	**Part**	**Shark Source**		**Abundance at landing site [1]**	**Locally consumed (C), Discarded (D), Traded (T), Processed (Type of processing)**	**Local price per kg (US$)**	**Market destination**
		Type of Fishing boat	**Type of fishing gear**				
C. sealei	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
C. acutus	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
C. dussumieri	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
C. sorrah	Whole	Trawlers	Fish trawl	++	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
C. punctatum	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
S. macrorhinus	Whole	Trawlers	Fish trawl	++	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
S. mokarran	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
G.cuvier	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu

[1] Abundance : rarely (+), relatively common (++), abundant to plentiful (+++)
Note : Price at landing site and prices are the same regardless of size and species.

Table 3.7. Prices and Markets of Shark Products in Malaysia

Location	Products	Price (US$)	Market Destination
Hutan Melintang, Perak	Fresh whole shark	0.26 – 2.05/kg	Local market in Perak and Selangor state including Kuala Lumpur
	Headless and gutted small shark	0.16/kg	Processors of surimi-based products (fish ball and fish cake) in Hutan Melintang
Kuantan, Pahang	Fresh whole shark	0.53– 0.92/kg	Kuantan, Kuala Lumpur, Terengganu and Johore.
	Wet shark fin	42.11 – 68.42/kg	Fish processor in Kuantan
	Dried shark fin	78.95 – 157.89/kg	Johore and then to Singapore and Hong Kong
	Dried salted shark meat	1.32/kg	Kuantan
	Shark cartilage	0.79-1.32/kg	Kuantan
	Wet shark skin	0.79/kg	Fish processor in Kuantan
	Shark jaw/teeth	7.89 – 13.16/kg	Kuantan
Bintulu, Sarawak	Fresh whole shark (finless for bigger shark)	0.21 – 1.32/kg	Local market, Sibu and Kuching
	Wet shark meat	2.11/kg	Local Bintulu
	Small wet shark fin (< 23 cm)	10.53–13.16/kg	Shark fin collectors in Bintulu
	Big wet shark fin (=>23 cm)	31.58/kg	Shark fin collectors in Bintulu
	Wet consumable shark fin	26.32 – 42.11/kg	Restaurants in Bintulu
	Dried salted shark meat	2.37 – 3.16/kg	Bintulu and Sibu
Mukah, Sarawak	Fresh whole shark	0.39 – 0.92/kg	Consumers and processors in Mukah
	Dried salted meat	2.29 – 2.37/kg	Mukah, Sibu and Kuching
	Small dried shark fin (<13 cm)	22.37– 23.68/kg	Sibu and Kuching
	Big dried shark fin (=>13 cm)	42.11 –47.37/kg	Sibu and Kuching
Sandakan, Sabah	Fresh whole shark (finless for bigger shark)	0.39 – 0.53/kg	Local markets in Sandakan
	Wet shark meat	0.66/kg	
	Shark head	0.26/kg	
	Shark liver	0.26/kg	
	Shark cartilage	0.53/kg	
	Dried shark skin	13.16/kg	
	Fried dried shark skin	21.05/kg	
	Dried shark fin	26.32 – 131.58/kg	
	Wet loose-fin	34.21/kg	
Kota Kinabalu, Sabah	Fresh whole shark	0.66 – 0.92/kg	Local markets in Kota Kinabalu
	Wet shark meat	1.32/kg	
	Dried shark fin	7.37 – 12.63/kg	

Table 3.8.1. Malaysian Export and Import of Shark Fin Products, 1997 - 2001

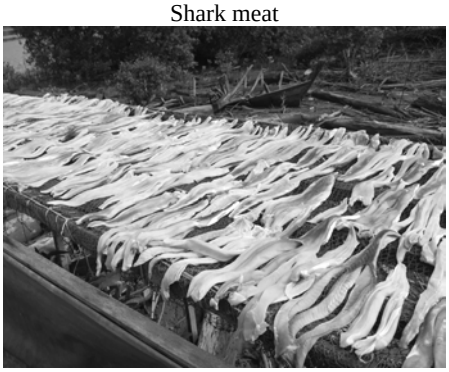
Product form	1997		1998		1999		2000		2001	
	Quantity (m.t)	Value (US$)	Quantity (m.t)	Value (US$)	Quantity (m.t)	Value (US$)	Quantity (m.t)	Value (US$)	Quantity (m.t)	Value (US$)
Export										
Dried shark fins (SITC : 035 130 300)	31.32	123,004	29.14	115,738	50	179,591	13.05	129,861	7.39	23,852
Salted shark fins (SITC : 035 299 200)	0.28	3,032	0.60	8,618	0.58	11,447	2.02	5,734	0.98	3,583
Shark fins (SITC : 037 160 910)	0.00		12.00	45,063	0.61	3,002	5.05	29,012	1.35	10,119
Total	31.60	126,036	41.74	169,419	51.19	194,040	20.12	164,606	9.72	37,555
Import										
Dried shark fins (SITC : 035 130 300)	121.91	468,059	87.38	419,600	101.46	517,075	55.94	241,168	65.00	226,832
Salted shark fins (SITC : 035 299 200)	0.23	5,175	0.00	0	0.00	0	1.22	9,076	0.85	8,924
Shark fins (SITC : 037 160 910)	1.71	13,819	0.56	7,940	0.38	1,420	0.12	1,418	0.35	3,880
Total	123.85	487,053	87.94	427,540	101.84	518,496	57.28	251,662	66.20	239,636

Table 3.8.2. Malaysian Import and Export of Shark Fin Products, 2001

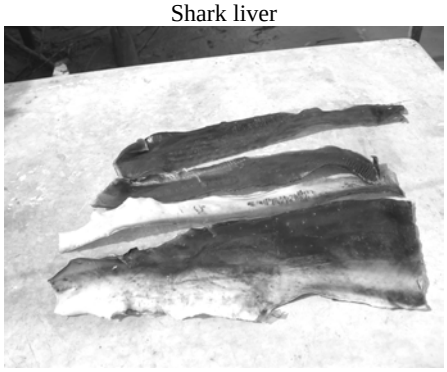
Product form	Country	Export		Import	
		Quantity (m.t)	Value (US$)	Quantity (m.t)	Value (US$)
Dried shark fins (SITC : 035 130 300)	Thailand	6.37	13,509	0.00	0
	Singapore	0.59	4,337	8.27	47,942
	Hong Kong	0.43	6,006	5.24	16,351
	China	0.00	0	24.27	39,978
	Germany	0.00	0	0.26	16,854
	Indonesia	0.00	0	18.13	77,289
	Philippines	0.00	0	0.45	1,490
	Sri Lanka	0.00	0	8.00	23,766
	Taiwan	0.00	0	0.18	1,832
	U.S.A.	0.00	0	0.20	1,328
	Total	**7.39**	**23,852**	**65.00**	**226,831**
Salted shark fins (SITC : 035 299 200)	Hong Kong	0.90	2,951	0.23	2,112
	Brunei	0.08	632	0.00	0
	Philippines	0.00	0	0.03	1,595
	Thailand	0.00	0	0.59	5,218
	Total	**0.98**	**3,583**	**0.85**	**8,924**
Shark fins (SITC : 037 160 910)	Singapore	1.35	10,119	0.00	0
	U.S.A.	0.00	0	0.35	3,880
	Total	**1.35**	**10,119**	**0.35**	**3,880**
	Grand Total	**9.72**	**37,555**	**66.20**	**239,636**

Shark meat

Shark liver



Drying shark meat



Dried shark skin

Dried whole-fin

Shark jaw

Figure 3. Shark products

4. BIOLOGY

The selection of the ten most dominant species is based on number of individuals landed during the study period rather than the total weight of individuals of the species. This is to reflect the real abundance of the species in the natural habitat.

4.1 Hutan Melintang

4.1.1 The ten most dominant shark species

The list of the ten most dominant species observed at this landing site is given in Table 4.1.1. The most abundant species are *Chiloscyllium punctatum* and *C. hasselti*, which were landed almost daily during the 28 days sampling period. These two species contributed 60% of the total weight of sharks sampled during that period. The least dominant species that were observed for less than 7 days are *Rhizoprionodon acutus*, *Carcharhinus leucas*, *Sphyrna mokarran* and *C. dussumieri.* These four species added about 23% to the total weight of sharks sampled.

Table 4.1.1. Summary Table For Shark Species Composition For Year In Hutan Melintang

Shark Species	Total sampled (kg) for 7 days	Species observed for how many days ?	% of total sampled catch
Chiloscyllium punctatum	951.46	28	44.00
Chiloscyllium hasselti	352.54	27	16.30
Scoliodon laticaudus	76.22	10	3.52
Carcharhinus sorrah	261.26	18	12.08
Atelomycterus marmoratus	15.46	9	0.71
Sphyrna lewini	14.80	8	0.68
Rhizoprionodon acutus	11.15	4	0.52
Carcharhinus leucas	475.00	3	21.97
Sphyrna mokarran	2.75	1	0.13
Carcharhinus dussumieri	1.77	1	0.08
Total for all shark species	2162.39		

4.1.2 Biological parameters of the ten most dominant species

The biological parameters of the ten most dominant species at this landing site are listed in Table 4.1.2. In term of body length, the top seven most dominant species were less than 80 cm. The biggest species is *Carcharhinus leucas* which was measured at 268 cm from only a single individual obtained during the study period. The ninth and tenth most dominant species has an average length of 70 and 66 cm, which were recorded from two and one specimen, respectively.

Males were more dominant in terms of percentage for the top seven species. The remaining three species are *Carcharhinus leucas* which were 100% female, and *Rhizoprionodon acutus* and S*phyrna mokarran* which have equal percentages between males and females. Both males and females have higher percentages of matured individuals for the top three dominant species.

Table 4.1.2. Summary Table For Other Biological Parameters On Selected Shark Species For Year In Hutan Melintang

Shark Species	Mean length (cm)	Sex				Maturity (% in each category of maturity)			
		male		female		Male		Female	
		%	n	%	n	Immature	Mature	Immature	Mature
Chiloscyllium punctatum	66.4	66.2	357	33.8	182	45.4	54.6	45.6	54.4
Chiloscyllium hasselti	59.3	68.8	139	31.2	63	48.9	51.1	34.9	65.1
Scoliodon laticaudus	41.1	52.2	48	47.8	44	14.6	85.4	13.6	86.4
Carcharhinus sorrah	71.1	78.1	50	21.9	14	98.0	2.0	100	
Atelomycterus marmoratus	49.5	61.9	13	38.1	8	15.4	84.6		100
Sphyrna lewini	55.8	53.8	7	46.2	6	100		100	
Rhizoprionodon acutus	70.4	50	1	50	1	100		100	
Carcharhinus leucas	267.7			100	1				100
Sphyrna mokarran	69.7	50	1	50	1	100		100	
Carcharhinus dussumieri	66.5	100	1			100			

4.2 Kuantan

4.2.1 The ten most dominant shark species

In terms of numbers *Chiloscyllium punctatum* is the most dominant species, while *Carcharhinus sorrah and Sphyrna lewini* were ranked fourth and eighth, respectively. However these three species were the top three in terms of catch weight and accounted for 70% of the total weight of the sampled sharks at this site. These three species were observed being landed almost every day or more than half the number of sampling days. The dominant species and their respective percentage contributions to the total catch are given in Table 4.2.1

Table 4.2.1. Summary Table For Shark Species Composition For Year In Kuantan

Shark Species	Total sampled (kg) for 7 days	Species observed for how many days ?	% of total sampled catch
Carcharhinus punctatum	253.09	26	20.58
Carcharhinus sealei	99.95	15	8.13
Chiloscyllium griseum	52.00	9	4.23
Carcharhinus sorrah	249.09	17	20.26
Loxodon macrorhinus	47.49	13	3.86
Rhizoprionodon acutus	66.83	15	5.44
Hemigaleus microstoma	59.95	14	4.88
Sphyrna lewini	364.42	16	29.64
Chiloscyllium indicum	11.22	8	0.91
Carcharhinus leucas	25.53	6	2.08
Total for all shark species	1229.57		

4.2.2 Biological parameters of the ten most dominant species

The biological parameters of the ten most dominant species at this landing site are listed in Table 4.2.2. The mean length of all the species were between 54 and 98 cm. The average sizes recorded in Kuantan were generally larger than those obtained in Hutan Melintang. However, the average size of *Carcharhinus leucas* at Kuantan was less than a third the average size at Hutan Melintang.

Four species have more than 60% male, only one species has less than 40% male while the remaining species have almost equal numbers of males and females. Contradictory maturity

stages were observed for *Hemigaleus microstoma* and *Chiloscyllium indicum*, and to a lesser extent for *Carcharhinus sorrah*, where the percentage of matured females were greatly different compared to the matured males. The other seven dominant species have uniform maturity stages between male and female.

Table 4.2.2. Summary Table For Other Biological Parameters On Selected Shark Species For Year In Kuantan

Shark Species	Mean length (cm)	Sex				Maturity (% in each category of maturity)			
		male		female		Male		Female	
		%	n	%	n	Immature	Mature	Immature	Mature
Chiloscyllium punctatum	77.2	43.0	52	57.0	69	13.5	86.5	5.8	94.2
Carcharhinus sealei	70.0	67.4	31	32.6	15	54.8	45.2	46.7	53.3
Chiloscyllium griseum	63.6	41.3	19	58.7	27	21.1	78.9	14.8	85.2
Carcharhinus sorrah	98.3	63.4	26	36.6	15	53.8	46.2	80.0	20.0
Loxodon macrorhinus	74.7	62.5	20	37.5	12	20	80	8.3	91.7
Rhizoprionodon acutus	81.2	64.3	18	35.7	10	16.7	83.3	40.0	60.0
Hemigaleus microstoma	78.6	48.1	13	51.9	14	61.5	38.5	35.7	64.3
Sphyrna lewini	91.0	46.2	12	53.8	14	83.3	16.7	85.7	14.3
Chiloscyllium indicum	54.2	47.1	8	52.9	9	75.0	25.0	22.2	77.8
Carcharhinus leucas	73.8	36.4	4	63.6	7	100		100	

4.3 Mukah

4.3.1 The ten most dominant shark species

The ten most dominant species listed in Mukah (Table 4.3.1) were not as frequently observed being landed at the site during the study period as compared to the dominant species in Hutan Melintang and Kuantan. On the average, most of them were observed less than once in every four days. The six most dominant species contributed 91% by weight of the total sharks sampled during the study period.

Table 4.3.1 Summary Table For Shark Species Composition For Year In Mukah

Shark Species	Total sampled (kg) for 7 days	Species observed for how many days ?	% of total sampled catch
Scoliodon laticaudus	116.24	8	22.03
Carcharhinus sealei	50.14	6	9.50
Carcharhinus sorrah	109.29	6	20.71
Carcharhinus borneensis	53.55	4	10.15
Carcharhinus amblyrhyncoides	73.67	5	13.96
Sphyrna lewini	78.47	3	14.87
Rhizoprionodon acutus	12.75	3	2.42
Chiloscyllium punctatum	19.89	4	3.77
Chiloscyllium indicum	3.37	2	0.64
Carcharhinus limbatus	10.37	1	1.97
Total for all shark species	527.74		

4.3.2 Biological parameters of the ten most dominant species

The biological parameters of the ten most dominant species at this landing site are listed in Table 4.3.2. The sizes of the ten species ranged from 38 to 78 cm. The larger species were *S. lewini*, *C. sorrah* and *C. limbatus*. The smallest species was *S. laticaudus*.

The percentage composition of females were higher for three of these species, i.e. *C. sealei*, *C. borneensis* and *C. indicum*, although the sample size of the last two species mentioned were small. There were almost 100% immature males in seven of these species while similar

observations were made for females in six species. Contradictory maturity stages between males and females were observed only for *R.* and *C. indicum.*

Table 4.3.2. Summary Table For Other Biological Parameters On Selected Shark Species For Year In Mukah

Shark Species	Mean length (cm)	Sex				Maturity (% in each category of maturity)			
		male		female		Male		Female	
		%	n	%	n	Immature	Mature	Immature	Mature
Scoliodon laticaudus	37.6	52.7	311	47.3	279	2.6	97.4	9.0	91.0
Carcharhinus sealei	46.2	39.8	39	60.2	59	94.9	5.1	100	
Carcharhinus sorrah	76.6	55.1	27	44.9	22	100		100	
Carcharhinus borneensis	59.5	33.3	2	66.7	4	100		100	
Carcharhinus amblyrhyncoides	66.9	57.1	20	42.9	15	100		100	
Sphyrna lewini	77.7	51.4	18	48.6	17	100		100	
Rhizoprionodon acutus	50.7	63.6	14	36.4	8	92.9	7.1	25.0	75.0
Chiloscyllium punctatum	61.7	57.1	12	42.9	9		100	33.3	66.7
Chiloscyllium indicum	42.5	33.3	5	66.7	10		100	80.0	20.0
Carcharhinus limbatus	73.0	69.2	9	30.8	4	100		100	

Note: Data not available for 2nd Quarter

4.4 Bintulu

4.4.1 The ten most dominant shark species

Scoliodon laticaudus is the most dominant species in terms of number, although its landing was only observed once during the 28 sampling days (Table 4.4.1). This species contributed only 1.27% of the total weight of sharks sampled. Five species of genus *Carcharhinus* contributed 84% of the total weight sampled.

Table 4.4.1. Summary Table For Shark Species Composition For Year In Bintulu

Shark Species	Total sampled (kg) for 7 days	Species observed for how many days ?	% of total sampled catch
Scoliodon laticaudus	17.17	1	1.27
Carcharhinus sorrah	223.45	4	16.50
Sphyrna lewini	130.90	7	9.67
Carcharhinus sealei	45.31	5	3.35
Rhizoprionodon acutus	16.64	3	1.23
Carcharhinus amblyrhynchoides	665.33	4	49.14
Chiloscyllium punctatum	34.51	1	2.55
Carcharhinus dussumieri	8.18	1	0.60
Carcharhinus leucas	194.00	1	14.33
Stegostoma fasciatum	18.44	2	1.36
Total for all shark species	1353.92		

4.4.2 Biological parameters of the ten most dominant species

The biggest species was *Carcharhinus amblyrhynchoides* with an average length of 207.5 cm (Table 4.4.2). About 80% of the individuals of this species were males, of which 55% were matured. The female individuals were all immatured. *Carcharhinus leucas*, the ninth most dominant and the second biggest in size were all immature males, while the two specimen of *Stegostoma fasciatum*, the tenth most dominant and third biggest species recorded, were both immature females.

Table 4.4.2. Summary Table For Other Biological Parameters On Selected Shark Species For Year In Bintulu

Shark Species	Mean length (cm)	Sex				Maturity (% in each category of maturity)			
		male		female		Male		Female	
		%	n	%	n	Immature	Mature	Immature	Mature
Scoliodon laticaudus	44.6	34.6	18	64.4	34	22.2	77.8	44.1	55.9
Carcharhinus sorrah	87.8	51.7	15	48.3	14	100		100	
Sphyrna lewini	80.5	54.2	26	45.8	22	96.2	3.8	100	
Carcharhinus sealei	167.5	59.5	25	40.5	17	84.0	16.0	88.2	11.8
Rhizoprionodon acutus	47.8	57.1	20	42.9	15	100		100	
Carcharhinus amblyrhynchoides	207.5	80.0	20	20.0	5	45.0	55.0	100	
Chiloscyllium punctatum	76.9	50.0	10	50.0	10	20.0	80.0		100
Carcharhinus dussumieri	56.7	42.9	3	57.1	4	100		75.0	25.0
Carcharhinus leucas	174.5	100	4			100			
Stegostoma fasciatum	136.0			100	2			100	

Note: Data not available for 2nd Quarter

4.5 Sandakan

4.5.1 The ten most dominant shark species

The list of ten most dominant species observed at this landing site is given in Table 4.5.1. The landings of these species were more frequently observed than the ten dominant species in Kota Kinabalu, Bintulu and Mukah. *Carcharhinus sorrah*, being the most dominant species, was observed at the landing site for 13 days or almost half of the sampling period. This species contributed almost 25% of the total sampled catch.

Table 4.5.1. Summary Table For Shark Species Composition For Year In Sandakan

Shark Species	Total sampled (kg) for 7 days	Species observed for how many days ?	% of total sampled catch
Carcharhinus sorrah	114.08	13	24.69
Carcharhinus dussumieri	42.40	11	9.18
Sphyrna lewini	22.10	5	4.78
Hemigaleus microstoma	19.20	6	4.16
Carcharhinus melanopterus	65.60	6	14.20
Rhizoprionodon acutus	21.50	9	4.65
Carcharhinus amblyrhynchoides	121.40	6	26.28
Carcharhinus brevipinna	27.90	5	6.04
Carcharhinus sealei	12.60	3	2.73
Loxodon macrohinus	15.20	6	3.29
Total for all shark species	461.98		

4.5.2 Biological parameters of the ten most dominant species

The biological parameters of the ten most dominant species at this landing site are listed in Table 4.5.2. The mean length of all the species were between 61 and 107 cm. The percentage of males are higher for seven species and two species has equal male and female percentages. Only *Loxodon macrohinus* had more females than males and all the female individuals sampled were matured. Many individuals of the other species were immature during the study period.

Table 4.5.2. Summary Table For Other Biological Parameters On Selected Shark Species For Year In Sandakan

Shark Species	Mean length (cm)	Sex				Maturity (% in each category of maturity)			
		male		female		Male		Female	
		%	n	%	n	Immature	Mature	Immature	Mature
Carcharhinus sorrah	93.4	55.0	11	45.0	9	72.7	27.3	33.3	66.7
Carcharhinus dussumieri	79.5	64.3	9	35.7	5	44.4	55.6	40.0	60.0
Sphyrna lewini	61.0	69.2	9	30.8	4	88.9	11.1	100.0	
Hemigaleus microstoma	79.1	60.0	6	40.0	4	100		75.0	25.0
Carcharhinus melanopterus	95.5	55.6	5	44.4	4	60.0	40.0	100	
Rhizoprionodon acutus	80.9	66.7	6	33.3	3	16.7	83.3	66.7	33.3
Carcharhinus amblyrhynchoides	106.9	50.0	4	50.0	4	50.0	50.0	50.0	50.0
Carcharhinus brevipinna	81.6	50.0	4	50.0	4	100		100	
Carcharhinus sealei	69.6	85.7	6	14.3	1	66.7	33.3	100	
Loxodon macrohinus	82.9	40.0	2	60.0	3	50.0	50.0		100

4.6 Kota Kinabalu

4.6.1 The ten most dominant shark species

The list of ten most dominant species observed at this landing site is given in Table 4.6.1. The top three most dominant species were *Hemigaleus microstoma*, *Sphyrna lewini* and *Carcharhinus sorrah.* On the average, the landings of these species were observed once in every four days and together they made up 56% of the total weight sampled during the study period. The landings of each of the remaining species were observed not more than three times throughout the 28 days sampling period.

Table 4.6.1. Summary Table For Shark Species Composition For Year In Kota Kinabalu

Shark Species	Total sampled (kg) for 7 days	Species observed for how many days ?	% of total sampled catch
Hemigaleus microstoma	35.53	7	28.96
Sphyrna lewini	14.08	7	11.48
Carcharhinus sorrah	19.05	6	15.53
Chiloscyllium punctatum	15.36	2	12.52
Carcharhinus dussumieri	3.75	2	3.06
Loxodon macrorhinus	5.10	3	4.16
Carcharhinus brevipinna	7.60	2	6.20
Carcharhinus limbatus	6.50	2	5.30
Alopias sp.	14.00	1	11.41
Carcharhinus amblyrhynchoides	1.70	1	1.39
Total for all shark species	122.66		

4.6.2 Biological parameters of the ten most dominant species

Mean length for all the ten dominant species were in the range of 60 to 86 cm except for *Alopias* sp. The single specimen of *Alopias* sp. was an immatured male with a total length of 185.5 cm. Males sharks from six of the species were predominantly immatured. This situation was also observed for females in four of the species. Table 4.6.2 gives details of some biological parameters for the ten most dominant species at this landing site.

Table 4.6.2. Summary Table For Other Biological Parameters On Selected Shark Species For Year In Kota Kinabalu

Shark Species	Mean length (cm)	Sex				Maturity (% in each category of maturity)			
		male		female		Male		Female	
		%	n	%	n	Immature	Mature	Immature	Mature
Hemigaleus microstoma	69.5	52	13	48	12	84.6	15.4	50.0	50.0
Sphyrna lewini	60.6	58.3	7	41.7	5	100		100	
Carcharhinus sorrah	73.1	62.5	5	37.5	3	100		66.7	33.3
Chiloscyllium punctatum	81.7	28.6	2	71.4	5		100		100
Carcharhinus dussumieri	53.5	25	1	75	3	100		100	
Loxodon macrorhinus	82.2	100	3				100		
Carcharhinus brevipinna	86.5	50	1	50	1	100		100	
Carcharhinus limbatus	79.5	100	2			100			
Alopias sp.	185.5	100	1			100			
Carcharhinus amblyrhynchoides	60.5			100	1			100	

4.7 Length-weight relationship and length frequency distribution

Length-weight relationships for the most abundance species sampled during the study was estimated. The results are shown in Table 4.7.1 which include the number of individuals, values of a, b and r^2. Although 32 shark species were observed during the study (Table 4.7.2), only 10 species has sufficient number of individuals for this purpose.

Figure 4 shows the length frequency distribution of four species caught in two different ecosystems: Straits of Malacca and South China Sea.

Table 4.7.1. Length-weight relationships for selected ten species of sharks in Malaysia (weight in kg, total length in cm)

No.	Species	N	a	b	r^2
1	*Chiloscyllium punctatum*	894	0.2179	3.1535	0.96
2	*Scoliodon laticaudus*	877	0.5353	2.9090	0.89
3	*Chiloscyllium hasselti*	541	0.1593	3.2540	0.95
4	*Carcharhinus sorrah*	266	0.2315	3.1828	0.97
5	*Carcharhinus sealei*	191	0.2913	3.1264	0.97
6	*Sphyrna lewini*	152	0.8628	2.8567	0.97
7	*Rhizoprionodon acutus*	113	0.2659	3.1216	0.98
8	*Carcharhinus amblyrhynchoides*	79	0.3830	3.1283	0.99
9	*Hemigaleus microstoma*	58	0.2472	3.0887	0.85
10	*Carcharhinus borneensis*	49	2.981	2.5458	0.92

Note : 1. Relationships are of the form $W = a \times 10^{-5} L^b$
2. N = numbers in sample; r^2 = correlation coefficient

Table 4.7.2. List and occurrence of sharks species landed at each landing sites

No.	AREA	WC PM	EC PM	Sarawak	West Sabah	East Sabah
	Species	Hutan Melintang	Kuantan	Mukah, Bintulu	Kota Kinabalu	Sandakan
1	*Alopias* sp.					
2	*Atelomycterus marmoratus*					
3	*Carcharhinus amblyrhynchoides*					
4	*Carcharhinus amblyrhynchos*					
5	*Carcharhinus borneensis*					
6	*Carcharhinus brevipinna*					
7	*Carcharhinus dussumieri*					
8	*Carcharhinus leucas*					
9	*Carcharhinus limbatus*					
10	*Carcharhinus melanopterus*					
11	*Carcharhinus plumbeus*					
12	*Carcharhinus sealei*					
13	*Carcharhinus sorrah*					
14	*Chiloscyllium griseum*					
15	*Chiloscyllium hasselti*					
16	*Chiloscyllium indicum*					
17	*Chiloscyllium plagiosum*					
18	*Chiloscyllium punctatum*					
19	*Galeocerdo cuvier*					
20	*Hemigaleus microstoma*					
21	*Hemipristis elongatus*					
22	*Heterodontus zebra*					
23	*Lamiopsis temmincki*					
24	*Loxodon macrorhinus*					
25	*Mustelus* sp.					
26	*Rhizoprionodon acutus*					
27	*Rhizoprionodon oligolinx*					
28	*Scoliodon laticaudus*					
29	*Sphyrna lewini*					
30	*Sphyrna mokarran*					
31	*Stegostoma fasciatum*					
32	*Triaenodon obesus*					

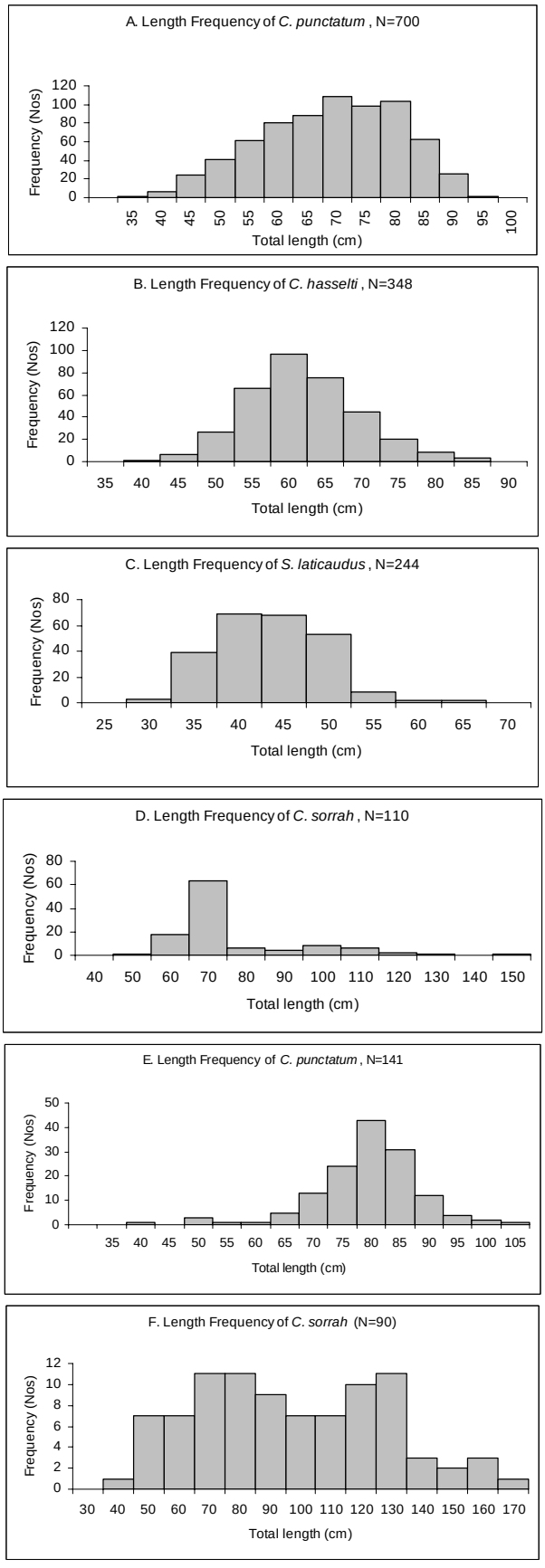


Figure 4. Length frequency distributions of sharks species on the west coast of Peninsular Malaysia landed at Hutan Melintang (A-D) and on South China Sea landed at Kuantan and Bintulu (E-F)

5. CONCLUSION

5.1 Fish trawl contributed almost 100% of sharks landed in Hutan Melintang, Kuantan, Sandakan and Kota Kinabalu, while in Bintulu, this gear contributed 61%. However, in Mukah, gill net is the major fishing gear with 88% of all shark landings. Other fishing gears which also landed sharks are long line and purse seine.

5.2 The ranking list of sharks species landed in term of numbers were different for each landing site. However, *Chiloscyllium punctatum* is the most common shark species caught in Hutan Melintang and Kuantan in Peninsular Malaysia, whereas *Scoliodon laticaudus* is the most common shark species in Mukah and Bintulu in Sarawak. There were also some sharks species that were recorded only in the South China Sea such as *C. borneensis* and *Lamiopsis temmincki.*

5.3 Most of the males and females of *C. punctatum, C. hasselti, C. griseum, S. laticaudus* sampled were mature, whereas the percentage of matured for *Carcharhinus* spp*., Sphyrna lewi, S. mokarran, H. microstoma* and other species were less than 50%.

5.4 The utilization, price and market destination is almost similar throughout the study duration. Once sharks are caught by fishers, the sharks are not discarded but are brought back where they were usually sold to the local markets and sometimes processed into other products. Shark products are mainly confined to the domestic markets except for shark fin and skin. Exports of shark fin products are rather small and Malaysia is a net importer of these products.

6. RECOMMENDATIONS

6.1 Information on marine and freshwater sharks in Malaysia is still inadequate in many aspects. More comprehensive data collection and biological studies will provide more accurate information on stock structure, abundance, life history, reproduction, habitat, seasonality, etc.

6.2 In this study, enumerators have been trained to identify sharks up to the species level. This should also be done in recording landing data for annual fisheries statistics which can later be used to indicate the status of the resources.

6.3 Standardization of maturity stages for the three reproductive types, oviparous, viviparous and ovoviviparous, in sharks is required for comparing data at the national and regional level.

6.4 Socio-economic information on fishers and traders involved in sharks are still lacking and need to be improved. Detailed information on these parameters will provide better understanding of the local situation required for formulating suitable management measures.

6.5 Information on the various products and by-products derived from sharks such as fresh meat, salted meat, skins, souvenirs, etc. and the marketing system employed for this products will also be helpful in understanding the utilization of this resource and its importance to the fishing industry.

6.6 Management measures should be taken to conserve sharks. One of the measures to be considered is to provide protection to the critical habitats (breeding area) for sharks in the coastal areas. Management measures should also ensure that there are no growth and recruitment overfishing of sharks.

7. PERSONNEL

7.1 List of Technical Staff

1. Mr. Abd. Haris Hilmi Ahmad Arshad – FRI, Penang
2. Mr. Abdul Rahman Abdul Majid - FRI, Penang
3. Mr. Rajendran R. Krishnan – FRI, Penang
4. Mr. Mohd. Nawab Arshad – FRI, Penang
5. Ms. Lim Chai Fong – Head Quarters of Fisheries Department, Kuala Lumpur
6. Mr. Ahmad Ali – MFRDMD-SEAFDEC, Terengganu
7. Mr. Solahuddin A. Razak - MFRDMD-SEAFDEC, Terengganu
8. Mr. Nor Azman Zakaria – MFRDMD-SEAFDEC, Terengganu
9. Mr. Albert Chuan Gambang – FRI, Bintawa Sarawak
10. Ms. Annie Lim Pek Khiok - FRI, Bintawa Sarawak
11. Mr. Mohd. Zakaria Morshidi – FRI, Bintawa Sarawak
12. Dr. Ahemad Sade – FRI, Likas Sabah
13. Mr. Irman Isnain – FRI, Likas Sabah
14. Mr. Abu Talib Ahmad – FRI, Penang
15. Mr. Ahmad Adnan Nuruddin – FRI, Penang

7.2 List of Enumerators Involved in Landing Data Collection

1. Mr. Mohd. Ali Hashim – Hutan Melintang, Perak
2. Ms. Maimunah Sulong – Kuantan, Pahang
3. Mr. Lim Hong Peng – Mukah, Sarawak
4. Mr. Hamzah Usop – Bintulu, Sarawak
5. Mr. Guraim Gueh – Kota Kinabalu, Sabah
6. Mr. Chin En Kiong – Sandakan, Sabah

7.3 State Coordinator of Landing Data Collection

1. Mr. Hj. Sidek bin Yahaya/ Ms. Azwa Abdul Hamid – Perak
2. Ms. Norazizah binti Kemat/ Ms. Hasniah Othman – Pahang
3. Mr. Samsimon Hj. Mohd. Bojeng – Sarawak
4. Dr. Ahemad Sade - Sabah

SHARK DATA COLLECTION IN MYANMAR

Thida Moe and Khin Maung Thein[7]

****

1. INTRODUCTION

The Union of Myanmar located in South East Asia between North Latitude 09˚ 32′ and 28˚ 31′ and East Longitude 92˚ 10′ and 101˚ 11′, the total coastline stretch from Naaf River to Kawthoung (Victoria point) approximately about 2831 Km. Southern part of the coastline the Mergui Archipelago is forming over 800 island, the continental shelf covers 225,000 square kilometer. The Exclusive Economic Zone cover 486,000 square kilometer.

The Rakhine coast, bordering Bay of Bengal with a narrow and deep shelf and has a few inlets down to about North Latitude 16˚.

The Ayeyawady coast, covering the most shallow and slightly sloping wide shelf between North Latitude 16˚ and 13˚ 30, and about East Longitude 94˚ and it is also dominant by the influence of the outflows of Ayeyawady, Sittaung and Thanlwin Rivers.

The Tanintharyi coast lays southern part of the country, situated between North Latitude 13˚ to 10˚, it is bordering the Andaman Sea, and it is also belongs the Mergui Archipelago. Inside the Archipelago there is numerous islands and inlets, between these island crystal water and medium depths, and it is end to the continental shelf.

The marine capture fisheries can be categorized into two main type, coastal or inshore fisheries and offshore fisheries. The coastal fisheries operate from the shore line out of five nautical miles in the northern area, especially Rakhine coastal area, ten nautical miles from Delta area (Ayeyawady) and in the southern area (Tanintharyi).

The people of Myanmar have been associated for centuries with their own natural resources of their surrounding areas. Many depend entirely on the harvesting of the aquatic resources, both marine and freshwater, including elasmobranches. Fisheries are the main activity for the people, who live in the coastal area for many generations, as coastal community has had little or no opportunities to earn a living from alternative livelihoods.

Shark has existed for twice as long as dinosaurs and first swim in the earth's ocean over 380 million years ago. They are superbly adapted to their habitat and play a very important ecological role.

Of the 370 or so species known, over 80% are completely harmless or never encounter people at all. Only four species may occasionally deliberately attack humans, the tiger, bull, great white and ocean white tip. In the case of the great white shark at least it is usually as a result of mistaken Identity.

There are about 30 families of sharks, with the total number of species thought to be between 376 and 481 (The total is unclear because many of the shark species caught have not yet been scientifically described, while there may be others that have still not be seen by humans) About 3 o r 5 new species of shark are still being described each year.

Shark fisheries in Myanmar are small scale, which utilize wooden boats with engine not more than 25 horse power. Most of the shark landings are coming from incidental catch. There are

[7] Fisheries Researchers at the Department of Fisheries, Myanmar

only few dedicated elasmobranches fishermen, although elasmobranches are caught by nearly an incidental catches.

Shark species were collected from many type of fishing gears, fishing boats which operate along the coastal area. The products of shark's fisheries were carried and sold in the country, since 1960'.

1.1 Fishing gear used in shark fishing

In Myanmar, shark are mainly caught as by-catch with several type of fishing gears, including long-line, gill net, grouper trap, and bottom trawl gear. And it is mostly caught by long-line and gill net, the Department of Fisheries does not permit or allowed specifically designed for catching shark fishing. There are a few direct fishing for elasmobranches; but most of the sharks are obtained as by otter-boat trawling and gill net fisheries. Fins form the basis of the lucrative shark fin industry. This trade is seriously threading shark population.

1.2 Recent Shark Experimental Fishing

Since 1986, The Marine Fisheries Resources Survey and Research Unit, conducted experimental fishing for deep sea shark, two experimental long line deepsea sharks were conducted off the Taninthayi Coast at the depth zone of 200m to 600 meters. The species of deepsea shark Squallus *megalops* were caught in 1986. In the second experiment in 1987, 3 species were collected, out of which 21 specimens comprised of *Centrospheres granulosus* species. This species is known to contain higher squalene content in the liver. These sharks are living in complete darkness due to great depth. In order to attack to the bait, various baits and shark attracting substance were tested. This experiment was intended to study appropriate bait for shark and resources potential. In 1982 one of the experimental fishing cruise at the Thaninthayi coastal area, Alligator shark, *Echinorhinus brucus* (estimate total length 10 feet) was caught alive outside the Margui Archipelago.

1.3 Shark Protected Area

Conservation of marine fisheries resources has always been the primary concern of the Department of Fisheries, Marine Park and Marine Reserves as well as fisheries protected area have been established under the Fisheries Law, as one of the Department management measure. This essential to protect, conserve and manage in perpetuity of marine environment in order that is remains undamaged for the future generation. Public awareness of the need to protected the coral and other marine flora and fauna in the water surrounding the islands of the coast is been promoted to ensure the conservation. Recently, Lampi island of Taninthayi coast have been gazette as Marine Park and Marine Reserve. In "Myanmar Marine Fisheries Law", Chapter VII, number 23 mentioned that *"The Director General may, for the purpose of carrying out the fishery systematically, and for the conservation and protection of the fish, issue conditions, prohibitions, orders, and directives relating to fishery"*.

In his capacity as a Director General, the Director-General of the Department of Fisheries using this law and issued order number 2/2004, regarding shark resources conservation on 5th May, 2004. According to this order, nobody can conduct shark fishing operation in the protected areas starting from "Ross" island (12º 13´ N, 98º 05.2´ E) to "Lampi" island (10º 48.´ N, 98º 16.1´ E). Sharks and rays can be used sustainable by tourism activities, especially shark-watching dive tours. Mergui Archipelago is famous for their sharks, rays, coral reef and other marine creature.

The Department of Fisheries determined to protect *Areas* for shark fishing under the following purposes;

1. The most biologically venerable creature in the ocean.
2. Grow slow, mature late and bare few young.
3. Some species do not produce until age 12 to 20 years.
4. Play the important role of top predator in Ocean eco-system.
5. Keep the Ocean balance.

The water around the island area also have been announced as shark fishing protected areas, whereby collection of marine fauna and flora is also prohibited.

1.4 Utilization of Shark

Small shark were sold in local market at coastal areas, Myanmar people almost preferred fresh water fishes. Shark from all fisher were landed in coastal areas market and also landing site, some market collected and auction species wise or depend on its size. They produced every part of shark body, liver oil for cosmetic and medicine purpose, dried shark skin, shark jaws for souvenirs, cartilage for medicine purpose; they especially sold shark fin for local china town market and export for Taiwan, China and Hong Kong. The local people usually utilized dried shark meat for their special event. Some fishermen and local people boiled the shark skin and make salad with chilly and lemon juice, No specific data for shark fisheries in Department of Fisheries yet.

Table 1. Shark species recorded from All Landing Site

Sr. No	Scientific Name	Common Name	Local Name
	I. Family - Carcharhinidae		
1.	*Carcharhinus leucas*	Bull shark	Nga-mann
2.	*Carcharhinus sorrah*	Spot tail shark	Nga-mann
3.	*Carcharhinus amblyrhynchoides*	Graceful shark	Nga-mann-gaung-waing
4.	*Carcharhinus brivipinna*	Spinner shark	Nga-mann
5.	*Carcharhinus melanopterus*	Blacktip reef shark	Nga-mann-taung-mae
6.	*Carcharhinus limbatus*	Blacktip shark	Nga-mann-pu
7.	*Carcharhinus dussumieri*	Whitecheek shark	Nga-mann
8.	*Carcharhinus amblimarginatus*	Silvertip shark	Nga-mann
9.	*Carcharhinus borneensis*	Borneo shark	Nga-mann
10.	*Carcharhinus falciformis*	Silky shark	Nga-mann
11.	*Carcharhinus galapagensis*	Galapagos shark	Nga-mann
12.	*Carcharhinus plumbeus*	Sandbar shark	Nga-mann
13.	*Carcharhinus amboineensis*	Pigeye shark	Nga-mann
14.	*Rhizoprionodon acutus*	Milk shark	Thae-nga-mann
15.	*Rhizoprionodon oligolinx*	Gray sharpnose shark	Nga-mann
16.	*Scoliodon laticaudus*	Spade nose shark	Lunn-nga-mann
17.	*Loxodon macrorhinus*	Sliteye shark	Nga-mann
18.	*Glyphis gangeticus*	Ganges shark	Nga-mann
19.	*Triaenodon obesus*	Whitetip reef shark	Nga-mann
	II. Family - Sphyrnidae		
20.	*Sphyrna mokarran*	Great hammerhead	Nga-mann- kywe-gyo-shae
21.	*Sphyrna lewini*	Scallop hammerhead	Nga-mann- kywe-gyo-toe
22.	*Eusphyrna blochii*	Winghead shark	Nga-mann- kywe-gyo-shae
23.	*Galeocerdo cuvier*	Tiger shark	Nga-mann-kyar-thit
	III. Family - Scyliorhinidae		
24.	*Halaelurus canescens*	Cat shark	Kyaung-nga-mann
	IV. Family - Hemiscyllidae		
25.	*Chiloscyllium griseum*	Gray bamboo shark	Nga-mann-aing-myaung
26.	*Chiloscyllium punctatum*	Brownbanded bamboo shark	

	V. Family - Stegostomidae		
27.	*Stegostoma fasciatum*	Zebra shark	Nga-mann
	VI. Family - Squalidae		
28.	*Squalus sp:*	Dogfish shark	Nga-mann
	VII. Family - Rhinidae		
29.	*Rhina amscylostoma*	Shark ray	Nga-mann-ba-lu
	VIII. Family - Hemigalidae		
30	*Hemipristes elongates*	Snaggletooth shark	Nga-mann
31.	*Chaenagaleus macrostoma*	Hooktooth shark	Nga-mann
32.	*Hemigaleus micristoma*	Sicklefin weasel shark	Nga-mann

2. EXPLOITATION

Uses of elasmobranch in Myanmar can be categorized at two levels, major and minor.

a. Major use

Shark fin products. Shark fin are the main target for shark fisheries. Fins are taken from all sizes and all species of sharks and shark-like batoids. Prices vary according to species, size, and the quality of the processing. Pectoral fins are the highest price. In addition, parts of the gill arches are used for yielding lower grade dried shark fin material. The processing of shark fins is complicated, time consuming and dependent on specific “know how". Fins are dried by sunlight or smoking, and may be salted. Well-dried fins may either export or further processed by boiling and removing skin and any excess material until only the fin rays and filaments remain. These are re-dried and packed. The grading of fins is based on size, color, species, cut and rendering, and the moisture content of the products. In Myanmar, there are very few large-scale shark fin industries; most only process up to the stage of drying the raw fins and then export them. The largest export destination for Myanmar shark fin products is China, followed by Thailand and Singapore.

b. Minor use

Some elasmobranch species are used for ornamental or other purposes, either whole or in parts. Shark jaws are usually processed by cleaning and drying, and then sold as curios or collectables. The rostrums of sawfishes *Pristis spp*: are sold for decoration or as curios. Present time sawfish are very rare to see in market or landing site, no sawfish were recorded in the survey period for these study area.

c. Sustainable use

There is no direct protective legislation for elasmobranches in Myanmar. However, Myanmar Marine Fisheries Law 1990 regulates fishing effort by quotas and seasonally. Sharks and rays can be used sustain ably by tourism activities, especially shark-watching dive tours. Myeik archipelagoes are famous for their sharks and rays.

Sharks and rays have much use which can be classified broadly in three groups: traditional use, modern use and novel or recently developed uses.

Table 2. Shark species recorded from Sittwe Landing Site

Sr. No	Scientific Name	Common Name	Local Name
	I. Family - Carcharhinidae		
1.	*Carcharhinus leucas*	Bull shark	Nga-mann
2.	*Carcharhinus sorrah*	Spot tail shark	Nga-mann
3.	*Carcharhinus amblyrhynchoides*	Graceful shark	Nga-mann-gaung-waing
4.	*Carcharhinus brivipinna*	Spinner shark	Nga-mann
5.	*Carcharhinus melanopterus*	Blacktip reef shark	Nga-mann-taung-mae
6.	*Carcharhinus limbatus*	Blacktip shark	Nga-mann-pu
7.	*Carcharhinus dussumieri*	Whitecheek shark	Nga-mann
8.	*Carcharhinus amblimarginatus*	Silvertip shark	Nga-mann
9.	*Carcharhinus borneensis*	Borneo shark	Nga-mann
10.	*Carcharhinus falciformis*	Silky shark	Nga-mann
11.	*Carcharhinus galapagensis*	Galapago shark	Nga-mann
12.	*Scoliodon laticaudus*	Spade nose shark	Lunn-nga-mann
13.	*Loxodon macrorhinus*	Sliteye shark	Nga-mann
14.	*Rhizoprionodon acutus*	Milk shark	Thae-nga-mann
15.	*Rhizoprionodon oligolinx*	Gray sharpnose shark	Nga-mann
	Glyphis gangeticus	Galapagos shark	Nga-mann
17.	**II. Family - Sphyrnidae**		
18.	*Sphyrna mokarran*	Great hammerhead	Nga-mann- kywe-gyo-shae
19.	*Sphyrna lewini*	Scallop hammerhead	Nga-mann- kywe-gyo-toe
	Eusphyrna blochii	Winghead shark	Nga-mann- kywe-gyo-shae
20.	*Galeocerdo cuvier*	Tiger shark	Nga-mann-kyar-thit
	III. Family - Scyliorhinidae		
21.	*Halaelurus canescens*	Cat shark	Kyaung-nga-mann
	IV. Family - Hemiscyllidae		
22.	*Chiloscyllium griseum*	Gray bamboo shark	Nga-mann-aing-myaung
	V. Family - Stegostomidae		
23.	*Stegostoma fasciatum*	Zebra shark	Nga-mann

Sittwe landing site Five Family and 23 species were record. The most dominant Family is Carcharhinidae.

Table 3. Shark species recorded from Haing-Gyi Landing Site

Sr. No	Scientific Name	Common Name	Local Name
	I. Family - Carcharhinidae		
1.	*Carcharhinus brivipinna*	Spinner shark	Nga-mann
2.	*Carcharhinus plumbeus*	Sandbar shark	Nga-mann
3.	*Carcharhinus sorrah*	Spot tail shark	Nga-mann
4.	*Carcharhinus amblyrhynchoides*	Graceful shark	Nga-mann-gaung-waing
5.	*Carcharhinus melanopterus*	Blacktip reef shark	Nga-mann-taung-mae
	II. Family - Sphyrnidae		
6.	*Sphyrna lewini*	Scallop hammerhead	Nga-mann- kywe-gyo-toe
7.	*Sphyrna mokarran*	Great hammerhead	Nga-mann- kywe-gyo-shae
	III. Family - Hemigalidae		
8.	*Chaenogaleus macrostoma*	Hooktooth shark	Nga-mann

Hyi-Gyi landing site Three Family and 8 species were recorded, the dominant Family was Carcharhinidae.

Table 4. Shark species recorded from Myeik Landing Site

Sr. No	Scientific Name	Common Name	Local Name
	I. Family - Carcharhinidae		
1.	*Carcharhinus sorrah*	Spot tail shark	Nga-mann
2.	*Carcharhinus amblyrhynchoides*	Graceful shark	Nga-mann-gaung-waing
3.	*Carcharhinus melanopterus*	Blacktip reef shark	Nga-mann-taung-mae
4.	*Carcharhinus falciformis*	Silky shark	Nga-mann
5.	*Carcharhinus amboineensis*	Pigeye shark	Nga-mann
6.	*Carcharhinus leucas*	Bull shark	Nga-mann
7.	*Scoliodon laticaudus*	Spade nose shark	Lunn-nga-mann
8.	*Rhizoprionodon acutus*	Milk shark	Thae-nga-mann
9.	*Triaenodon obesus*	Whitetip reef shark	Nga-mann
	II. Family - Hemigalidae		
10.	*Hemigaleus micristoma*	Sicklefin weasel shark	Nga-mann
11.	*Hemipristes elongatus*	Snaggletooth shark	Nga-mann
12.	*Chaenagaleus macrostoma*	Hooktooth shark	Nga-mann
	III. Family - Hemiscyllidae		
13.	*Chiloscyllium griseum*	Grey carpet shark	Nga-mann-ga-byone
14.	*Chiloscyllium punctatum*	Brownbanded bamboo shark	Nga-mann
	IV. Family - Sphyrnidae		
15.	*Sphyrna lewini*	Scallop hammerhead	Nga-mann- kywe-gyo-toe
16.	*Eusphyrna blochii*	Winghead shark	Nga-mann- kywe-gyo-shae
17.	*Stegostoma fasciatum*	Zebra shark	Nga-mann
18.	*Galeocerdo cuvier*	Tiger shark	Nga-mann-kyar-thit
	V. Family - Squalidae		
19.	*Squalus sp:*	Dog shark	Nga-mann
	VI. Family - Rhinidae		
20.	*Rhina amscylostoma*	Shark ray	Nga-mann-ba-lu

Myeik landing site total 6 Family, 20 species were recorded, and 7 Carcharhinus, 1-Tiger, 1-Blacktip, 1-Zebra and 1-Bull shark were recorded. No record of Hammerhead shark in this landing site.

d. Traditional use

The two main traditional uses of sharks and rays have been for food, and for the production of tools and weapons. Elasmobranches as food are sold mainly fresh on ice, although in tropical countries their meat and fins are usually salt-dried.

3. SHARK FISHERIES DATA COLLECTION

Shark, ray, and many specific species resources and research have not yet been studied in Myanmar detailed. In order to collect current information about shark fisheries in Myanmar, three appropriate lending sites, “Sittway” from Rakhine Coastal Area, “Haing-Gyi” from Ayeyawady Delta Coastal Area and “Myeik” from Taninthayi Coastal Area were selected. Three research staffs from Marine Fishery Resources Survey and Research Unit were assigned in the respective landing sites for one month to conduct their duty as an enumerator and a researcher. They visited to the fish markets, fishing ports, fish buyer's house etc. to collect information about shark fisheries in their respective areas. Two approaches were used: interviews with fishers and sale data collection and analysis. Interviews of those fishermen engaged in directed shark fisheries were more detailed and included: dominant species catch volumes, fishing grounds, and timing of operation and fishing gears. For other fisheries with sharks as by catch more general information was collected, including the proportion of sharks to total catch and dominant species. First quarter of the projected was started in mid of January, 2004 to mid of February, 2004. Similarly, the second quarter of this project was conducted in mid of March, 2004 to mid of April, 2004, the third quarter of this project was started in end of June to end of July, and the fourth quarter was conducted in mid of September to mid of October.

4. SURVEY RESULT

After the data collection of all landing site, 8 Family and 32 species were recorded. All result data from Sittwe landing site 23 species of sharks were found, and out of these species,11 species of Carcharhinidae, 2,-Hammerhead, 1,Tiger shark, 2- Blacktips were recorded. In Haing-Gyi landing site 5 -Carcharhinidae, and 2, Hammerhead was recorded.
Hyi-Gyi landing site Three Family and 8 species were recorded, the dominant Family was Carcharhinidae. Myeik landing site total 20 species were recorded, and 7 -Carcharhinus, 1-Tiger, 1-Blacktip, 1- Zebra and 1-Bull shark were recorded. No record of Hammerhead shark in this landing site.

In " Sittway " sharks are captures as target species of shark-longline, while as by catch of fish trawlers and shrimp trawlers. During the whole year of observation in the year of 2004, sharks were captured as 19.9% of total landings in first quarter, 51.5 % of total landings in second quarter, 52.4% of total landings in third quarters and 8.7% of total landings in fourth quarter. It showed that shark-longline were effective for catching in this area. The percentage of shark landing in this area is a little bit more than the other two landing sites, " Haing-Gyi" and " Myeik " due to data collection error. This calculation is only base on information gathered from the shark buyer's house not on the whole landing data. The percentage of the shark landing will be nearly the same with the other two landing sites if the calculation is based on the whole landing data. From this survey, we can observe that sharks were captured as 17.6 % of total landings in this area during project period in 2004.

In " Haing-Gyi " sharks are captures as target species of shark-longline, while as by catch of fish trawlers and shrimp trawlers. During the whole year of observation in the year of 2004, sharks were captured 0.43% of total landings in first quarter, 0.63% of total landings in second quarter, 1.99% of total landings in third quarter and 0.26% of total landings in fourth quarter. For the whole year round of the survey period, it was found that shark composition in the total landings of " Haing-Gyi" is only (0.38 %).

In " Myeik " sharks are captures as target species of shark-longline, while as by catch of fish trawlers and shrimp trawlers. During the whole year of observation in the year of 2004, sharks were captured 0.08% of total landings in first quarter, 0.03% of total landings in second quarter, 0.07% of total landings in third quarter and 0.065% of total landings in fourth quarter. For the whole year round of the survey period, it was found that shark composition in the total landings of " Myeik " is only (0.06 %).

Table 5. 1st ,2nd, 3rd, 4th, Quarter (Shark catches data at Sittway)

	Sharks	%	Non Sharks	%	Total	Fishing Gear
I Q	2251.50	19.9	9053.10	80.1	11304.60	L.L
II Q	21094.06	51.4	19949.30	48.6	41043.36	Gill net
IIIQ	7972.00	8.7	83396.00	91.27	91368.00	
IV	392.00	1.01	35092.00	98.89	35484.00	
Total	31709.56		147490.4		179199.96	

Table 6. 1st ,2nd, 3rd, 4th, Quarter (Shark catches data at Haing-Gyi)

	Sharks	%	Non Sharks	%	Total	Fishing Gear
I Q	483.23	0.43	110368.0	99.56	110851.23	L.L
II Q	1435.19	0.63	224648.32	99.36	226083.51	Gill net, L.L
IIIQ	356.15	1.99	17478.38	98.0	17834.53	Gill net
IV	2040.156	0.26	780621.92	99.68	782662.07	G.N,L.L, Fish trawl
Total	4314.726		1133116.6		1137431.2	

Table 7. 1st ,2nd, 3rd, 4th Quarter (Shark catches data at Myeik)

Quarter	Sharks	%	Non Sharks	%	Total	Fishing Gear
I Q	4822.2	0.08	5727575.0	99.65	5732397.2	
II Q	2099.5	0.03	6327959.8	99.35	6330059.3	L.L
IIIQ	4625.15	0.07	6151433.80	99.6	6156058.95	G.N,L.L, Fish trawl
IV	4221.0	0.065	6434470.0	99.73	6438691.0	G.N,L.L, Fish trawl
Total	15767.85		24645658.0		24661426.0	

Table 8. Shark catches data of Three landing site (1st ,2nd, 3rd, 4th Quarter)

Sr. no	Landing Site	Sharks	%	Non Sharks	%	Total	Fishing Gear
1.	Sittway	31709.56	17.69	147490.4	82.30	179199.96	G.N,L.L, Trawl
2.	Haing-Gyi	4314.726	0.38	1133116.6	99.60	1137431.3	G.N,L.L, Trawl
3.	Myeik	15767.85	0.06	24645658.0	98.58	24661426.0	G.N,L.L, Trawl
Total		51792.14		25926265.0		25978057.0	

5. PROBLEMS AND CONSTRAINTS

As this is the first systematic survey project on shark fisheries in Myanmar, there are a lot of problems and constraints met by project staffs. First fishermen from the selected landing site area misunderstood on the activities of the project staffs. Because they afraid that staffs from the Department of Fisheries are coming to record shark fisheries activity in their respective areas to ban shark fisheries in the future. For this reason, it was very difficult for the project staff to collect accurate data from the fishermen and they don't want to cooperative with the staff. The fishers and buyers move new landing site, to protect the reverse effect for them, if the Department of Fisheries should take an action plan or Law enforcement for their business. Some project staff presents food or some useful things to the fisher/ buyer to make encourage and more familiar to get information of shark fisheries. With kind assistance from the local authorities and local DOF staff and good organization of the project staff, the project activities become smoother after one week.

Due to lack of experience in biological study on shark, even length frequency and weight data are recorded from some species, maturity stage data of the shark are still lacking. It was found that more training on shark biology are need for the project staff to implement the project successfully and effectively. But after discussion and sharing their experiences among researchers and national project coordinator, it is envisage that the outcome from the second quarter will gain more fruitful results for this project.

6. CONCLUSION

This preliminary data indicated that, some shark species were rare in Myanmar waters or not? It is also need to answer this question, the researcher also need to collect data different month, and different landing site. The comparison of the shark species recorded from various recent researches record and the present shark data recorded by researcher. It was shown that some shark species were hidden from the shark fisheries. Elasmobranches are very important to marine and freshwater ecosystems as ' keystone species '. They are at the top tropic level of the aquatic food web, and act as bio-indicators for the health of aquatic environments. Management for sustainable use of this group of fish needs to be implemented globally. In Myanmar, this implementation is needed urgently, based on:

- Inventory surveys on systematic, biology and fisheries within Myanmar and adjacent
- waters. Collaborative research activities are welcome.
- Conservation measures relevant to elasmobranches, including protection of their habitats.
- Appropriate proposals for regulating the international trade in shark products should be considered.

- Myanmar is both a signatory state to CITES and a member country of FAO, and thus is require to implement a national plan of action for the conservation and sustainable use of shark resources.

LANDED CATCH AND EFFORT MONITORING AND BIOLOGICAL STUDY OF SHARKS IN SELECTED LANDING SITES IN THE PHILIPPINES[8]

Noel C. Barut [9]

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1. INTRODUCTION

Shark fisheries have been in the country for decades now. Catching of sharks is a major livelihood to some of the fishers of the country. Although fishing for sharks is highly seasonal, these fisheries have attracted quite a number of fishers basically because of the good income they get from this fisheries. The high price of dried fins not only locally but in the international market as well and recently the meat is now utilized for fish balls which are also exported to foreign markets have created more interest for fishers to go into shark fishing. Fishers have observed

Four known landing sites of shark were selected as the monitoring sites. These are the following landing sites: 1) Coron/Panlaitan, Palawan, 2) Aparri, Cagayan, 3) San Jose, Occidental Mindoro, and 4) Mabua, Surigao del Norte (Figure 1). Out of the total 78 species of sharks recorded to occur in Philippine waters, 24 species were observed landed in the four landing sites during the months of October and January (Table 1).

Table 1. Species of sharks observed landed in the four landing sites

Alopias pelagicus	*Galeocerdo cuvier*	*Sphyrna lewini*
Aptychotrema sp.	*Hexanchus gresius*	*Squaliformes sp.*
Carcharhinus amboinensis	*Isurus oxyrinchus*	*Squalos megalops*
C. albimarginatus	*Nebrius ferugenius*	*Trieanodon obesus*
C. altimus	*Negaprion acutidens*	
C. leucas	*Orectulobus ornatu*	
C.limbatus	*Rhina ancylostoma*	
Centrophorus mulloccencis	*Rhinubatus sp.*	
Chillocylium punctatum	*Rhizoprionodon acutus*	
Eugomphodus taurus	*Rhycobatus djiddensi*	

2. CATCH DATA

The combined total catch observed in the four landing sites for the month of October was 5,846.1 kg. The breakdown of total landed catch by sampling site is presented in table 2. The total landed catch for the month of January 2004 is 5,385.2 kg composed of 619 individuals from 27 different species of shark.

Total landed catch for the rest of the months was also gathered from the traders in Mindoro and Palawan if available. For Mindoro the catch of shark was 3,892 kg for the month of November and 3,500 kg for December 2003. While that for Palawan the total landed catch are as follows: October 2003, 1,800kg and December 2,000 kg.

[8] Based on the 1st and wnd quaterly reports only as submitted to SEAFDEC

[9] Division Chief, Marine Fisheries Research Division, National Fisheries Research and Development Institute

Table 2. Total landed catch of shark by sampling site for the month of October 2003.

Landing Sites	No. of Species	No. of Individual sharks	Total Weight (kg)	Remarks
San Jose, Mindoro	19	670	4,000.4	Generally small sharks
Mabua, Surigao del Norte	3	17	690.7	
Aparri, Cagayan	1	1	55	
Coron, Palawan	-	-	1,100	Cut into pieces when landed

Table 3. Total landed catch of shark by sampling site for the month of January 2004.

Landing Sites	No. of Species	No. of Individual sharks	Total Weight (kg)	Remarks
San Jose, Mindoro	21	598	4,574.2	
Mabua, Surigao del Norte	1	2	150	
Aparri, Cagayan				No catch
Coron, Palawan	5	19	661	

3. FISHERY STRUCTURE AND LANDING SITE DESCRIPTION

A. San Jose, Occidental Mindoro

Two landing sites were established namely Caminawit and Pagasa. These two landing sites are the major sites where sharks are landed. They are ideally located because of the presence of four ice plants, where ice is being use by the fishers and the traders as well. The ice is not only use for the sharks but for all other fish species landed in these two sampling sites.

The major gear used in catching sharks in these two sampling sites are gillnet and longline. The average fishing days per trip is around 4-5 days before the fishermen return back to port to unload their shark catch. However, if the catch is good the fishers come back at once to deliver their catch.

The major fishing ground is the northern Palawan waters where sharks are known to be present in large quantities. Fishers from Mindoro fishing in Palawan waters are catching the smaller or immature sharks while Palawan base fishers are catching the bigger sharks.

B. Mabua, Surigao City

In Surigao, one landing site is established where shark and other marine products are unloaded. The main gear that is use in catching shark is multiple hook and line. One fishing operation normally last from 3-4 days. The fishing ground for this landing site is the eastern Mindanao waters or the Pacific Ocean.

C. Aparri, Cagayan

Aparri is known to be one of the major landing sites of sharks in Region 2. There is a buying station of sharks in the area. Aparri has only one established landing site and that is the landing site located along the side of the municipal market. However, you can also observe unloading along the whole stretched of the seashore of non-shark species. The sharks unloaded beside the market are directly sold to the market as well as the other fish species.

The longline and the multiple hook and line are the two major gear use in capturing sharks in the area. The fishing operations normally last from 3-5 days and their fishing ground is the Babuyan Channel.

D. Salvacion and Coron, Palawan

These two municipalities in Palawan have been the major landing sites of sharks for the past several years. However, shark fishing is seasonal and unloading of sharks depends upon the market price in the locality and other landing sites nearby. Fishers normally land their catch in landing sites where the price of the sharks is higher. Although, the fishing boat operators are from Salvacion, sometimes they unload their catch in Coron or elsewhere where they can get a higher return or buying price. Most of the catch in these area are bigger in size.

The main gear used in catching shark is longline. Other gear use are the gillnet and multiple hook and line. Similarly, the number of fishing days is about the same for all the areas in the country and in Palawan the average fishing days is also from 3-5 days.

jaws and other parts of the sharks are also sold in the souvenir shops. In recent years, the meat of sharks is exported to the United States as fish balls. Generally,

4. Local usage and marketing

Almost all parts of sharks are sold in the local markets like the meat and fins. However, the target buyer for the shark fins is the international market especially the fins from large sharks. Smaller size fins are sold to local restaurants and sometimes also sold to the foreign market. In some areas the meats of the sharks are utilized in the local fish balls industry.

Dried fins trade is actually the target market of the shark fishers because it commands a very high price in the international market. The price of dried fins varies according to species and size. Dried fins of the shovel nosed shark is priced from P3,500 to P8,000 per kg. The price of the dried fins is categorized according to the size of the shovel nosed shark that is - small is price is at P3,500 per kg, then the medium at P 5,000 per kg and the large at P 8,000 per kg. The size and weight of the dried fins of one shovel nosed shark will also determine to what category the shark belongs correspondingly the price of the dried fins.

The price of the meat varies during certain months of the year as it is dictated by the demand in market. During December and January where sea condition is rough and fishing is limited the price of the shark meat can go up to P80.00 per kg in the market. While for the rest of the month the market price ranges from P 40.00-60.00 per kg

Table 4. Landing prices of shark in Philippine peso.

Landing Sites	Meat	Dried Fins	Liver oil	Jaws
San Jose, Mindoro	15-20	3500-7000 (shovel nosed) 500-600 (all other species)	500/gallon	150-300/pcs
Mabua, Surigao del Norte	40-50	2500-3000		
Aparri, Cagayan	30-45	2000-2500		
Coron, Palawan	28-35	2500-8000		

5. BIOLOGY

The size of the shark sampled varies from site to site. Most of the sharks landed in Mindoro are the immature or small sharks while those landed in Palawan are the bigger or mature sharks. Likewise in Surigao and Cagayan the sharks landed are the mature ones. The size ranges of sharks monitored during sampling days is presented in Table 5.

Table 5. Number, size ranges and weight of sharks in the four landing sites

Species	Number of individuals	Size ranges (cm)	Weight (kg)	Remarks
Alopias pelagicus	12	273-320	623	
Carcharhinus amboinensis	1	170	25	
C. albimarginatus	5	210-240	115	
C. altimus	1	178	2	
C. leucas	1	150	13	
C.limbatus	13	140-220	150	
Chillocylium punctatum	51	89-121	183	Headless/gutted
Eugomphodus taurus	1	145	12	
Galeocerdo cuvier	6	200-290	760	
Hexanchus gresius	1	90	2	
Nebrius ferugenius	2	140-150	11	
Negaprion acutidens	13	120-187	62	
Orectulobus ornatu	1	92	3	
Rhina ancylostoma	5	110-175	99	
Rhinubatus sp.	71	70-93	104	
Rhizoprionodon acutus	1	138	9	
Rhycobatus djiddensi	15	120-210	298	
Sphyrna lewini	2	283-320	110	
Squalos megalops	186	40-105	333	
Trieanodon obesus	294	75-167	1490	Headless/gutted

DATA COLLECTION ON SHARK FISHERIES IN THAILAND

Ratanawalee Phoonsawat, Somchai Vibunpant, Tassapon Kjandara[10], Saowamol Puteeka[11], Reangckai Sujittosakul[12] and Rangsan Chayakul[13]

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1. INTRODUCTION

The growing concern of international community focuses on the control of shark harvesting in the global fisheries. Recently, FAO has adopted the International Plan of Action for the Conservation and Management of Shark (IPOA of shark). FAO urged the coastal states to adopt management measures on shark fisheries and other fishing activities i.e. gillnet, trawl, longline, purse seine, etc. These capture fisheries have been recognized that sharks and their relatives (skates, rays and chimeras) were found as by-catches or incidental catch.

To strengthen the conservation on the utilization of shark for sustainable fisheries based on the IPOA of shark 2002, Department of fisheries has initiated to establish the draft National Plan of Action for the shark security and harmonized with this International Plan of Action. But not yet finished.

However, the unprogressive of shark conservation and management policy is due to current status of shark fisheries in Thailand are limit. Information on catch composition, catch, effort, landing and some biological data such as distribution, maturity stage, etc. are scarce and inadequate.

To formulate appropriate policy for shark management in Thailand and to maintain the food security policy for regional people, effective implementation on shark data collection is needed to be done which aiming to provide preparation of the accurate basic information for shark management.

Three fishing areas have been chosen as sampling sites. The selected sampling sites in the Gulf of Thailand were Samut Prakhan province and Songkhla province and in The Andaman Sea was Phuket province. Data collection has been carried out by the research centers under Marine Fisheries Research and Development Bureau, Department of Fisheries. The expected outcome of this project is to gather and analyze data for figure out the present situation of shark. These all of comprehensible knowledge about shark will be used as a basic tool for establishment of the National Policy on Shark Conservation and Management that has to be harmonized and relevant to the IPOA of shark 2002 and CITES COP13.

2. OBJECTIVES

1. To conduct the surveys on shark capture fishing gears and methods, including the incidental catch in Thailand.
2. To build up dataset of shark fisheries in Thailand including landing site .
3. To investigate sexual maturity of shark species in Thailand.
4. To study on shark utilization processes since capture from the sea to post harvest step including market mechanism on shark trading in Thailand.

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3. METHODOLOGY

In order to collect the information data on current status of shark fisheries in Thailand, three main landing sites has been chosen. Project timeframe was set up to 1 year. Progress of the project had to be report every quarter. Final report would be sent to committee in the last quarter. Data collection and scientific research will be conducted in four quarters. Project activities have been divided into 2 parts:

Part 1: Establishment of study frame work and survey method.

Consultation meeting between the core staffs, i.e. national coordinator, project coordinator, project advisor and fisheries scientist who take responsible for the data collection at the selected site will be conducted at phase I. Outcome of the consultation meeting are in following:

1.1 Developing and publishing standard method of shark classification in taxonomic level and field sheet on identification of shark species, as a manual for fisheries scientists who in charge with this project and fishermen.

1.2 Training program of shark biology and classification by experts from Kasetsart University will be held for training project's enumerators and fisheries scientist.

Part 2: Conduct of survey and data collection

The survey and data collection will be managed by fisheries scientists and enumerators from the 3 marine fisheries research and development centers i.e. 1) the Upper Gulf Marine Fisheries Research and Development Center 2) Southern Marine Fisheries Research and Development Center and 3) Andaman Sea Marine Fisheries Research and Development Center. Fisheries scientists and enumerators will be assigned to collect the data and cooperate with the fishermen. Landed shark will be sampled for biological investigation.

4. CURRENT MANAGEMENT POLICY

Department of Fisheries of Thailand has implemented various regulations through the Fisheries Act of 1947, revised in 1953 and 1985. However, there are no existing management policies which concerning to shark, except a whale shark species (*Rhincodon typus*). The important regulations of this Act are as follows:

- The Department of Fisheries of Thailand has established the regulations to prohibit fishing by trawlers and push netters within a distance of 3,000 m from the shoreline and within a perimeter of 400 m of any stationary gear.
- The number of new entry trawler is limited and push netter is banned.
- A conservation area in the Gulf of Thailand about 26,000 km^2 is decleared to protect fish during their spawning and breeding seasons from February 15 to May 15 each year. This regulation prohibits all types and sizes of trawlers except beam trawlers, all type of purse seiner and encircling gill netters with less than 4.7 cm mesh size in area along the coastline of Prachuap Khirikhan Chumphon and Surat Thani as well as Khanom District in Nakhon Sri Thamarat. And this regulation was extended to the Andaman Sea by declearation of 1,800 km^2 in Phangnga and Krabi

5. RESULTS

5.1 General Description

The biggest shark landing sites in the gulf of Thailand are Samut Prakhan province and Songkhla province while Phuket province is the biggest landing site in The Andaman sea (Fig.1).

Although, there were many kinds of the fishing boats landed in sampling site such as pair trawler, otter board trawler, gill netter, push netter and purse seiner, but the data collection on shark fisheries in Thailand were only recorded from otter board trawler and pair trawler which are the main fishing gears for catching shark. However, Sharks caught from these two gears are only 0.19 percent of total fish landing.

Otter board trawler is operated both in day time and night time consisting of 2 hauls of day time and 2 hauls of night time operation. (Table1) Each haul take 5 hours in a period. Pair trawler also operated both in day time and night time which operated 2 hauls in day time and 1 haul in night time operation. Hauling period of pair trawler take 5 hours per haul in day time and 8 hours per haul in night time. While enumerators collected data at the landing site, biological investigation of shark were also collected.(Fig 2-3).

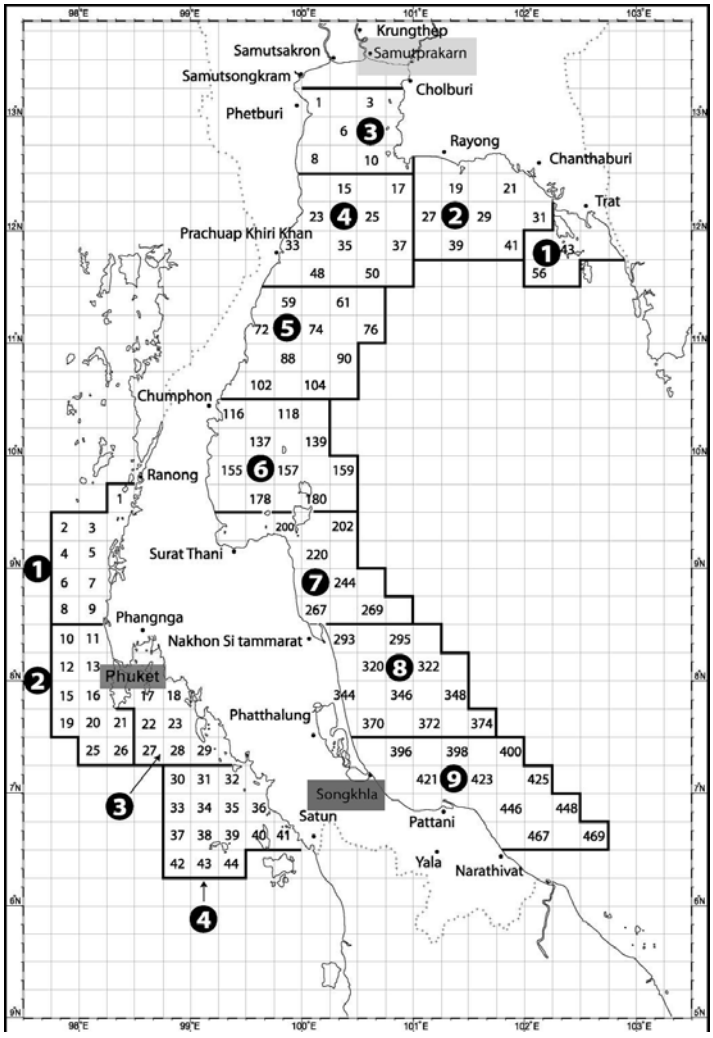


Figure1. Landing site

Table 1 Fishery structure and landing site description

Fishing gear	Size of boats (m)	No. of Crews	Fishing grounds	Landing site	Characteristics of fishing
Pair trawl - Samut Prakhan	16-23	16-20	Phetchaburi, Prachuap Khirikhan	Klong Dan sub-district Bang Poo district Samut Prakhan	Operated - day: 2 haul (5 hr./haul) - night:1 haul (8 hr./haul)
- Songkhla	12-18	10-12	Songkhla, Pattani, Nakhon Sithammarat	Songkhla, Pattani, Nakon Srithammarat	Operated - day: 3 haul (4 hr./haul) - night:1 haul (7 hr./haul)
- Phuket	16-22	16-20	Ranong, Phangnga, Phuket and Kabi	Ratsada subdistrict Muang district Phuket	Operated - 4-5 hual/day (4 hr./haul)
Otter Board Trawl - Samut Prakhan	-	-	-	-	-
- Songkhla	12-18	4-6	Songkhla, Pattani, Nakhon Sithammarat	Songkhla, Pattani, Nakhon Sithammarat	Operated - day: 2 haul (5 hr./haul) - night:2 haul (5 hr./haul)
	16-22	6-7	Off shore Indonesia, Malaysia	Songkhla, Pattani, Nakhon Sithammarat	Operated - day: 2 haul (5 hr./haul) - night:2 haul (5 hr./haul)
- Phuket	19-22	10	Ranong, Phangnga, Phuket and Krabi	Ratsada subdistrict Muang district Phuket, and Fish Marketing Organization	Operated - 4-5 hual/day (4 hr./haul)

During the first to forth quarter of this project, enumerators had collected data from 823 fishing boats in the Gulf of Thailand (587 pair trawlers, 226 otter board trawlers, 5 gill netters, 3 hook and line, 1 push netter and 1 purse seiner) and 295 fishing boats in the Andaman Sea (127 pair trawlers and 168 otter board trawlers). Annual data showed the shark catch in the Gulf of Thailand were 8,315.82 kg or 0.10 percent whereas in the Andaman Sea were 13,547 kg or 0.44 percent of the total catch. From the result it could be concluded that the catch of shark was only 0.19 percent of the total landing in Thai waters (Table 2). In general, it could be implied that shark is not the target species of fisheries in Thai waters.

For the offshore fisheries, two type of fishing gears i.e. pair trawler and otter board trawler were selected as target fishing gear for shark's data collecting as well as in near shore fisheries. Both kind fishing gears are operated in Arafura Sea (southern part of Indonesian) under Indonesian government license. There are about 440 vessels of fishing vessel size more than 20 m in this area. Fishing vessel do not landed all catch themselves. Therefore carrier vessel has an important role in transportation of catch from fishing boat to market. There are 40 carrier vessels with capacity 1,000-3,000 ton per vessel. These can be classified to carrier vessel not more than 1,000 ton which engaged to 5-6 fishing boat while carrier vessel more than 1,000 ton engaged to 10-15 fishing boat. One trip for carrier vessel is 30 days long. Enumerator had collected data from 16 carrier vessels and 51 fishing boats the data showed that shark catch were 16,234.50 kg or 0.39 percent of total catch. (Table 2)

Table 2. Shark production from variety fishing gears

	Production (in kg)										number of boats
	Shark		**Ray**		**Shark+Ray**		**Non-Shark Catch**		**Shark and non-shark**		
	production	%	production	%	production	%	production	%	production	%	
Gulf of Thailand											
Pair Trawl	6,534.40	0.09	3,984.30	0.05	10 ,518.70	0.14	7,592,789.50	99.86	7,603,308.20	100	587
Fish Gill Net	86.50	0.52	-	-	86.50	0.52	16,480.50	99.48	16,567.00	100	5
Otter Board Trawl	982.92	0.14	3,460.80	0.48	4,443.72	0.62	715,217.98	99.38	719,661.70	100	226
Hook and Line	211.00	9.05	-	-	211.00	9.05	2,120.00	90.95	2,331.00	100	3
Push Net	1.00	0.52	0.60	0.31	1.60	0.83	190.40	99.17	192.00	100	1
Purse Seine	500.00	4.76	-	-	500.00	4.76	10,000.00	95.24	10,500.00	100	1
sub-total Gulf	8,315.82	0.10	7,445.70	0.09	15,761.52	0.19	8,336,798.38	99.81	8,352,559.90	100	823
The Andaman Sea											
Pair Trawl	471.00	0.03	628.00	0.04	1,099.00	0.07	1,568,773.00	99.93	1,569,872.00	100	127
Otter Board Trawl	13,076.00	0.87	46,265.00	3.08	59,3 41.00	3.95	1,443,996.00	99.05	1,503,337.00	100	168
Sub-total The Andaman Sea	13,547.00	0.44	46,893.00	1.53	60,440.00	1.97	3,012,769.00	99.03	3,073,209.00	100	295
Total in Thai water	**21,862.82**	**0.19**	**54,338.70**	**0.48**	**76,201.52**	**0.67**	**11,349,567.38**	**99.33**	**11,425,768.90**	100	**1,118**
Otter board trawl	1,317.00	0.21	4,855.00	0.79	6,172.00	1.00	608,750.00	99.00	614,922.00	100	51
Carrier vessel	14,917.50	0.42	24,131.50	0.68	39,049.00	1.10	3,516,827.76	98.90	3,555,876.76	100	16
Total outside Thai water	**16,234.50**	**0.39**	**28,986.50**	**0.69**	**45,221.00**	**1.08**	**4,125,577.76**	**98.92**	**4,170,798.76**	100	**67**
Total	**38,097.32**	**0.24**	**83,325.20**	**0.53**	**121,422.52**	**0.78**	**15,475,145.14**	**99.22**	**15,596,567.66**	**100**	**1,185**

5.2 Catch of Shark and ray from fisheries statistic in 1995-2002

Total catch of sharks in Thai waters from fisheries statistical gazette, Department of Fisheries (year 1995-2002) showed catch of shark in the Gulf of Thailand up to 55.73% and 44.27% in the Andaman Sea.(Table 3) Average catch in the Gulf of Thailand were 5,201 tons. Otter board trawler is the maximum shark fishing gear (4,765 tons) followed with pair trawler (275 tons) and other fishing gears (153 tons). Average shark catch in the Andaman Sea was 4,132 tons. Otter board trawler is the maximum shark fishing gear with 3,209 tons followed with pair trawler (898 tons) and other fishing gears (28 tons).

Ray's production in the Gulf of Thailand was 59.66% and in the Andaman sea was 40.34%. Otter board trawler is the maximum rays fishing gear 6,353 tons followed with pair trawler 511 tons and other fishing gears 142 tons. Average ray catch in the Andaman Sea was 4,736 tons. Otter board trawler is the maximum shark fishing gear with 3,433 tons followed with pair trawler 796 tons and other fishing gears 508 tons. .(Table 4)

From sharks and rays fisheries statistical year 1995-2005 showed main fishing gears of shark and rays were otter board trawler and pair trawler.

Table 3. Catch of Shark (ton) from fisheries statistic in the Gulf of Thailand and Andaman Sea (1995-2002)

Year	Gulf of Thailand				Andaman				Total in Thai water
	OBT	PT	Other	Total	OBT	PT	Other	Total	
1995	2,429	233	150	2,812	1,873	648	4	2,501	5,313
1996	2,781	294	85	3,160	2,873	1,738	4	4,615	7,775
1997	2,640	279	75	2,994	2,847	1,776	-	4,623	7,617
1998	2,945	268	93	3,306	3,601	742	88	4,431	7,737
1999	6,060	174	68	6,302	3,008	773	35	3,816	10,118
2000	6,834	254	45	7,133	3,346	548	12	3,906	11,039
2001	5,938	267	580	6,785	3,848	470	43	4,361	11,146
2002	8,558	430	130	9,118	4,278	487	35	4,800	13,918
Avg.	4,765	275	153	5,201	3,209	898	28	4,132	9,333
Percent	51.06	2.95	1.64	55.73	34.38	9.62	0.3	44.27	100

Note: OBT: Otter board trawler, PT : Pair trawler

Table 4. Catch of ray (ton) from fisheries statistic in the Gulf of Thailand and Andaman Sea (1995-2002)

Year	Gulf of Thailand				Andaman				Total in Thai water
	OBT	PT	Other	Total	OBT	PT	Other	Total	
1995	5,692	446	310	6,448	2,400	672	448	3,520	9,968
1996	4,247	464	192	4,903	3,004	1,287	784	5,075	9,978
1997	4,628	441	45	5,114	2,973	1,319	946	5,238	10,352
1998	3,708	345	51	4,104	2,979	632	574	4,185	8,289
1999	7,140	370	81	7,591	3,373	776	539	4,688	12,279
2000	8,108	558	140	8,806	3,817	626	401	4,844	13,650
2001	7,214	677	156	8,047	4,364	524	197	5,085	13,132
2002	10,089	786	159	11,034	4,555	530	171	5,256	16,290
Avg.	6,353	511	142	7,006	3,433	796	508	4,736	11,742
Percent	54.11	4.35	1.21	59.66	29.24	6.78	4.32	40.34	100

Figure 2. Shark landing at the landing sites

Figure 3. Weighing and measuring of catch in laboratory and in field survey

5.3 Quantity and value of shark import-export

From Customs Department's statistics indicated that shark frozen flesh export was not conducted every years. Since year 2001-2004, Thailand exported shark frozen flesh only in year 2001 and 2002. During 4 years, Total amount of shark frozen flesh export from Thailand was 114,131 kg. This exported value was 1,671,851 Baht. All of shark frozen flesh was only export to Singapore. Shark frozen was imported from 8 countries. Import quantity and value were 509,890 tons and 23,911,980 Baht respectively. Major shark importer is USA (37.09%)followed with Spain (23.20%) and Norway (19%)..(Table 5,6).

For dried shark fins import and export statistics from Customs Department since year 1997 to September 2004, Thailand has exported dried shark fins to 22 countries over the world with 467,488 kg in quality and 419,833,623 Baht in value. .(Table 7,8) Hong Kong is the main importer of dried shark fins from Thailand 54.82% both in quantity and value follow with Sri Lanka 26.25% Singapore 12.05%. Thailand has also imported dries shark fins from 30 countries with 620,428 in quantity and 269,105,588 Baht in value. Hong Kong was the main dried fins exporter to Thailand 60.60% in quantity and 64.10% in value. The other exporters to Thailand were China (11.79%) and Canada (4.19%). Therefore, this report indicated that Thailand has import value more than export value. At present, there are no study about difference in quality and type of export and import dried shark fins. Thailand has export less quality of dried shark fin than import at 152,940 kg. But when considered with value export value was more than import value 150,728,035 Baht.

Table 5. Thai exports of frozen dogfish and other shark, excluding livers roes (Quantity in kilogram, value in Thai baht, From Customs Department)

Country	2001		2002		2003		2004		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Singapore	9,910	201,054	104,221	1,470,797	-	-	-	-	114,131	1,671,851
Total	**9,910**	**201,054**	**104,221**	**1,470,797**	-	-	-	-	**114,131**	**1,671,851**

Table 6. Thai imports of frozen dogfish and other shark, excluding livers roes (Quantity in kilogram, value in Thai baht, From Customs Department)

Country	2001		2002		2003		2004		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Japan	-	-	-	-	-	-	10	2,043	10	2,043
Italy	-	-	-	-	-	-	6,792	208,760	6,792	208,760
Malaysia	-	-	20,238	920,312	14,000	325,500	-	-	34,238	1,245,812
Spain	-	-	8,035	564,658	20,157	1,432,991	18,825	1,436,834	47,017	3,434,483
New Zealand	-	-	-	-	16,024	527,049	-	-	16,024	527,049
Norway	29,343	1,131,088	34,253	1,267,717	-	-	15,414	531,362	79,010	2,930,167
U.S.A.	136,768	6,447,963	101,566	4,263,779	48,367	2,500,856	30,098	1,652,398	316,799	14,864,996
Taiwan	-	-	-	-	-	-	10,000	698,670	10,000	698,670
Total	**166,111**	**7,579,051**	**164,092**	**7,016,466**	**98,548**	**4,786,396**	**81,139**	**4,530,067**	**509,890**	**23,911,980**

Table7. Thai export of shark fins, dried, whether or not salted (Quantity in kilogram, value in Thai baht, From Customs Department)

Country	1997		1998		1999		2000		2001		2002		2003		2004		Total	
	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
Australia	355	161,836	295	215,025	420	437,154	12	65,386	-	-	485	155,242	305	179,313	480	126,067	2,352	1,340,023
Belgium	-	-	-	-	-	-	175	86,015	-	-	-	-	-	-	-	-	175	86,015
Russia					-	-	-	-	-	-	-	-	-	-	43	3,667	43	3,667
Canada	60	87,648	160	307,831	500	37,639		-	-	-	-	-	-	-	45	25,622	765	458,740
China	-	-	330	135,247	-	-		-	-	-	-	-	130	13,522	140	10,877	600	159,646
France	-	-	-	-	-	-	325	182,088	18	133,808	239	939,882	-	-	-	-	582	1,255,778
Hong Kong	73,532	103,934,498	19,617	18,981,574	20,918	3,725,550	55,450	88,507,221	40,496	44,988,068	17,779	21,617,735	17,021	20,266,661	11,467	13,284,113	256,280	315,305,420
Indonesia	-	-	-	-	-	-	-	-	-	-	325	450,399	-	-	-	-	325	450,399
India	2	14,743	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	14,743
Japan	680	1,335,203	519	1,591,877	-	-	418	2,487,807	410	1,875,177	330	1,720,214	400	2,550,972	382	2,384,059	3,139	13,945,309
Cambodia	50	12,530	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	12,530
Macao	-	-	500	139,558	-	-	-	-	-	-	-	-	-	-	-	-	500	139,558
Malaysia	-	-	193	577,534	80	5,035	604	299,243	1,245	861,319	1,611	1,381,045	1,756	720,735	782	188,933	6,271	4,033,844
New Zealand	100	163,863	291	715,136	107	214,105	-	-	100	221,556			-	-	-	-	598	1,314,660
Singapore	3,805	5,656,852	853	1,468,744	7,082	9,087,467	7,459	7,011,461	8,699	8,718,207	13,361	15,347,193	8,805	13,703,015	6,289	8,898,420	56,353	69,891,359
Srilanka	-	-	116,500	2,900,076	9,500	216,691	-	-	-	-	-	-	-	-	-	-	126,000	3,116,767
Sweden	-	-	8	1,600	-	-	-	-	-	-	-	-	-	-	-	-	8	1,600
Switzerland	-	-	10	1,608	-	-	-	-	-	-	-	-	-	-	-	-	10	1,608
U.S.A.	4	1,553	-	-	-	-	25	19,607	-	-	-	-	-	-	-	-	29	21,160
Taiwan	-	-	-	-	-	-	2,835	2,824,993	5,754	662,426	153	44,301	300	70,525	842	189,855	9,884	3,792,100
Greece	-	-	-	-	-	-	-	-	-	-	-	-	2	16,468	-	-	2	16,468
Vietnam	-	-	-	-	120	146,488	2,324	2,407,710	1,076	1,918,031	-	-	-	-	-	-	3,520	4,472,229
Total	**78,588**	**111,368,726**	**139,276**	**27,035,810**	**38,727**	**13,870,129**	**69,627**	**103,891,531**	**57,798**	**59,378,592**	**34,283**	**41,656,011**	**28,719**	**37,521,211**	**20,470**	**25,111,613**	**467,488**	**419,833,623**

Table 8. Thai imports of shark fins, dried, whether or not salted (Quantity in kilogram, value in Thai baht, From Customs Department)

Country	1997		1998		1999		2000		2001		2002		2003		มค.04-กย.04		Total	
	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V	Q	V
Argentina	-	-	-	-	-	-	-	-	10,472	5,707,845	-	-	-	-	200	94,472	10,672	5,802,317
Australia	-	-	-	-	-	-	3	3,041	-	-	-	-	-	-	1,549	770,921	1,552	773,962
Austria	-	-	-	-	-	-	4,263	3,347,318	-	-	-	-	-	-	-	-	4,263	3,347,318
Canada	6,925	2,153,138	-	-	13,889	6,094,601	-	-	2,585	1,341,767	1,572	819,080	998	522,522	-	-	25,969	10,931,108
China	-	-	-	-	-	-	1,644	674,331	4,837	1,342,373	18,925	4,223,289	29,743	6,923,942	17,982	5,126,308	73,131	18,290,243
Hongkong	55,766	20,567,091	30,953	15,296,643	61,403	28,350,969	55,334	26,328,863	38,180	18,723,517	28,561	12,953,951	58,712	28,191,704	47,084	22,084,226	375,993	172,496,964
Indonesia	5,050	2,318,581	2,800	732,848	3,105	1,597,799	212	91,795	7,926	3,611,852	2,501	2,532,654	609	317,735	1,447	763,608	23,650	11,966,872
India	-	-	10	9,076	-	-	-	-	10,423	3,934,194	-	-	-	-	-	-	10,433	3,943,270
Japan	-	-	2,169	943,869	-	-	-	-	-	-	1,765	900,186	6,405	4,243,204	3,727	3,652,993	14,066	9,740,252
Madagascar	-	-	-	-	-	-	175	88,847	526	282,472	1,020	535,467	1,091	535,995	1,768	837,668	4,580	2,280,449
Myanmar	-	-	-	-	2,300	644,000	600	865,811	-	-	-	-	-	-	-	-	2,900	1,509,811
New Zealand	-	-	-	-	2,950	1,312,585	-	-	-	-	-	-	-	-	-	-	2,950	1,312,585
Norway	-	-	1,848	916,927	7,019	3,091,771	1,050	467,746	-	-	-	-	-	-	10,275	1,001,767	20,192	5,478,211
Pakistan	2,771	853,573	-	-	2,000	892,097	2,540	1,225,902	3,516	1,736,536	-	-	-	-	-	-	10,827	4,708,108
Philippines	4,350	1,671,381	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,350	1,671,381
Turkey	-	-	2,310	1,170,474	1,085	485,602	-	-	-	-	1,670	806,338	2,088	1,084,379	512	246,833	7,665	3,793,626
Singapore	-	-	-	-	-	-	-	-	176	163,610	1,266	434,739	1,991	955,161	93	46,344	3,526	1,599,854
U.S.A.	8,601	2,847,085	2,368	966,650	4,474	1,707,372	-	-	233	128,413	639	329,628	720	297,699	49	97,627	17,084	6,374,474
Spain	-	-	-	-	-	-	-	-	-	-	500	305,000	-	-	-	-	500	305,000
United Arab Emirates	-	-	-	-	-	-	-	-	-	-	403	192,786	-	-	-	-	403	192,786
Taiwan	-	-	3	7,431	-	-	-	-	1,984	923,349	316	163,591	-	-	-	-	2,303	1,094,371
Bangladesh	-	-	-	-	-	-	-	-	-	-	200	106,360	100	52,171	-	-	300	158,531
Tansania	-	-	-	-	-	-	100	41,534	124	66,968	185	96,641	365	179,716	90	42,721	864	427,580
Yemen Republic	-	-	-	-	-	-	-	-	-	-	26	2,554	-	-	-	-	26	2,554
Monaco	-	-	-	-	-	-	-	-	-	-	-	-	40	20,012	220	104,413	260	124,425
Bulgaria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	708	338,781	708	338,781
Morocco	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200	98,836	200	98,836
Mauritania	-	-	-	-	-	-	-	-	-	-	-	-	-	-	113	56,314	113	56,314
New Caledonia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	550	84,662	550	84,662
Vietnam	-	-	-	-	-	-	278	138,007	120	62,936	-	-	-	-	-	-	398	200,943
Total	**83,463**	**30,410,849**	**42,461**	**20,043,918**	**98,225**	**44,176,796**	**66,199**	**33,273,195**	**81,102**	**38,025,832**	**59,549**	**24,402,264**	**102,862**	**43,324,240**	**86,567**	**35,448,494**	**620,428**	**269,105,588**

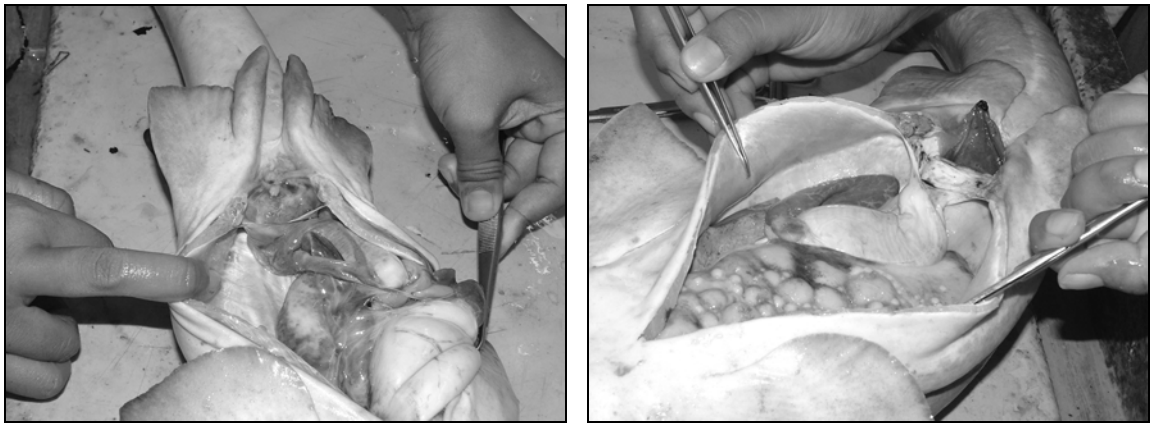
5.4 Biological Study

Biological studies of shark were done with 900 samples of individual shark. Result found 25 species of shark in Thai waters (table 3) which could be classified to 10 families i.e. Heterodontidae (1 species), Hemiscylliidae (4 species), Stegostomatidae (1 species), Alopiidae (2 species), Scyliorhinidae (1 species), Hemigaleidae (1 species), Carcharhinidae (12 species), Sphyrnidae (1 species), Triakidae (1 species) and Orectolobidae (1 species). The shark species *Mustelus* sp.B and *Orectolobus* are the new record in Thai waters. However incomplete biological data of shark in Thai waters is due to uncover sample sized of shark. In study period, there were small size and small number of sharks in each species had landed. Not only small number of sample size but limited budget was also an obstacle of this project. The study has encountered the difficulty in gaining and accessing to the large size of sharks. Because price for the whole shark is rather high and most of them are already sold to the middle man. Most shark samples were in immature stage. Only specimen in family Hemiscylliidae could be collected all size. The result of biological study in the Gulf of Thailand and the Andaman Sea showed in Table 9.

Table 9. Biological data of sharks in Thai waters

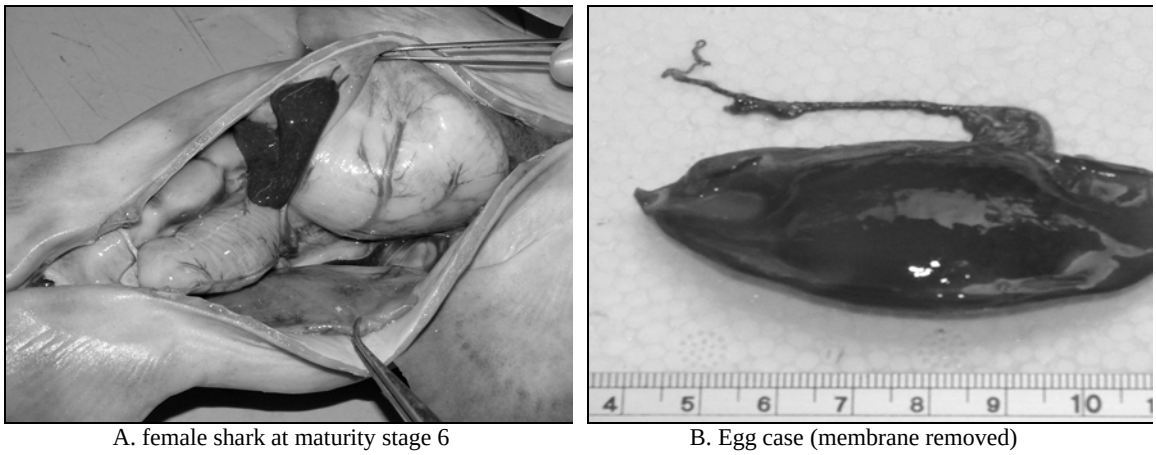
No	Species	Areas	Number of specimens	Size (cm) min-max	% Sex male	% Sex female	% Mature male	% Mature female
	Heterodontidae							
1	*Heterodontus zebra*	Gulf of Thailand	10	46-91	50	50	0	20
	Hemiscylliidae							
2	*Chiloscyllium plagiosum*	Gulf of Thailand	133	36-100	63	37	44	63
3	*C. griseum*	Gulf of Thailand, Andaman Sea	53	30-81	55	45	48	58
4	*C. hasselti*	Gulf of Thailand	4	50-78	75	25	100	0
5	*C. punctatum*	Gulf of Thailand, Andaman Sea	454	16-98	62	38	62	46
	Stegostomatidae							
6	*Stegostoma fasciatum*	Gulf of Thailand, Andaman Sea	6	98-220	50	50	33	100
	Alopiidae							
7	*Alopias superciliosus*	Andaman sea	6	260-310	33	67	100	100
8	*A. vulpinus*	Gulf of Thailand	10	130-322	70	30	71	100
	Scyliorhinidae							
9	*Atelomycterus marmoratus*	Gulf of Thailand	15	49-69	40	60	50	100
	Hemigaleidae							
10	*Hemipristis elongatus*	Gulf of Thailand, Andaman Sea	5	84-180	0	100	0	80
	Carcharhinidae							
11	*Gleocerdo cuvier*	Gulf of Thailand, Andaman Sea	7	100-170	71	29	50	100
12	*Triaenodon obesus*	Andaman sea	1	173	0	100	-	100
13	*Rhizoprionodon acutus*	Andaman sea	1	83	100	0	100	-
14	*Carcharhinus sorrah*	Gulf of Thailand, Andaman Sea	52	47-145	56	44	21	22
15	*C. altimus*	Gulf of Thailand	8	67-100	75	25	50	50
16	*C. melanopterus*	Gulf of Thailand, Andaman Sea	34	35-124	47	53	69	67
17	*C. amboinensis*	Andaman sea	1	229	0	100	0	100
18	*C.dussumieri*	Gulf of Thailand, Andaman Sea	10	50-67	60	40	0	0

19	*C. leucas*	Gulf of Thailand, Andaman Sea	15	62-185	67	33	50	100
20	*C. amblyrhynchos*	Gulf of Thailand	12	68-95	67	33	63	100
21	*C. amblyrhynchoides*	Gulf of Thailand, Andaman Sea	4	110-197	50	50	100	100
22	*C.obscurus*	Andaman sea	1	95	0	100	-	0
	Sphyrnidae							
23	*Sphyrna lewini*	Gulf of Thailand, Andaman Sea	48	26-180	38	62	33	43
	Triakidae							
24	*Mustelus* sp.B ... (New recorded)	Andaman sea	5	95-102	100	0	100	0
	Orectolobidae							
25	*Orectolobus maculates*.. (New recorded)	Gulf of Thailand	5	60-89	67	33	33	50
	Total		**900**					



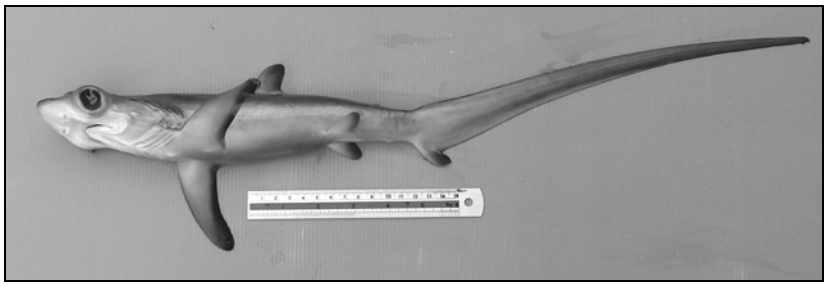
A. male shark at maturity stage 4. B. female shark at maturity stage 6

Figure 4. Mature stage of gonad in *Ch. punctatum.*



A. female shark at maturity stage 6 B. Egg case (membrane removed)

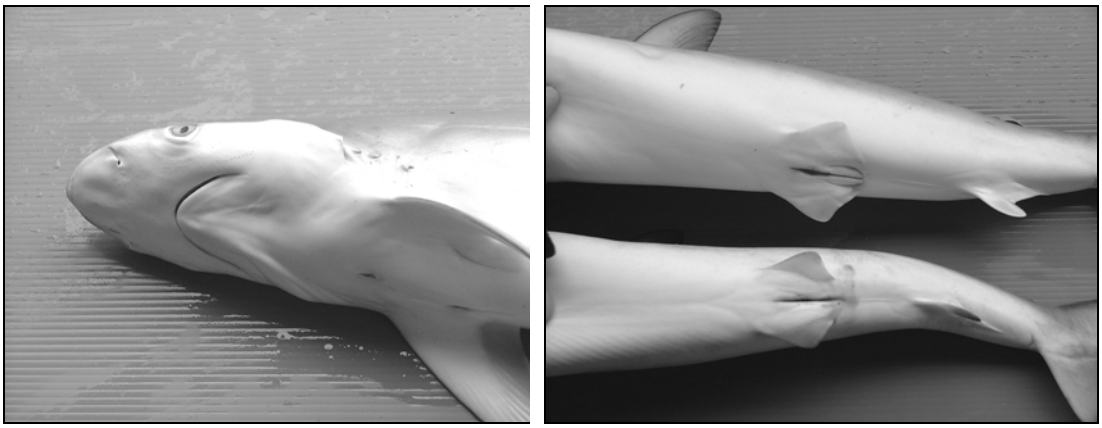
Figure 5. Mature stage of gonad in female *Ch. griseum.*



A. superciliosus's embryo

A. Mouth without teeth B. Trunk

Figure 6. *A.*. *superciliosu*'s embryo found in uterus.



A. Head B. Trunk

Figure 7. Young Spottail shark; *Ca. sorrah*

Figure 8. Young Scalloped hammerhead shark; *Sp. lewini.*

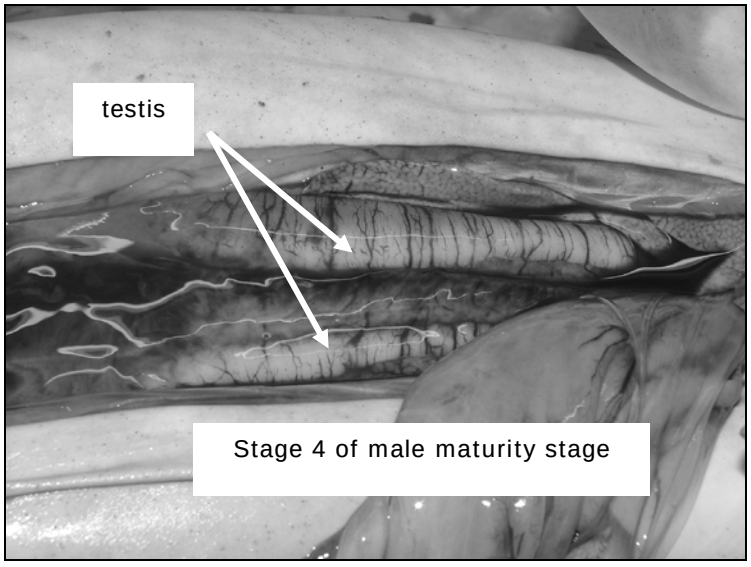


Figure 9. Mature stage of gonad in male *Mustelus* sp.B.

5.5 Marketing and Usage

Marine fishing ground within Thailand exclusive economic zone lie in part of the Gulf of Thailand and part of the Andaman Sea. The collection of landing data from sampling sites in Thailand had been done from 1,118 fishing boats. Shark are caught by almost all kinds of gears (pair trawl, otter board trawl, fish gill net, hook and line, push net, purse seine and other fishing gears) as incidental target or secondary target (by-catch). The total marine fishery production was 11,425,768.90 kg of which included 76,201.52 kg of shark and ray (0.67 %) shark only 21,862.82 kg (0.19 %) and ray 54,338.70 kg (0.48 %) from total fisheries production (Table 2).

The most catch of shark and ray in Thai waters was consumed fresh or processed into products such as dried salted meat and fish balls. Price of the auctioned fresh sharks and ray at the fish markets is rather low. Average price for shark is 15 to 60 Baht/kg in landing price and local or domestic market price is 30 to 80 Baht/kg. However, the price is varies by size and species; for example, the price of grey bamboo shark *Chiloscyllium griseum*, slender bamboo shark *Chiloscyllium indicum*, Brown-banded bamboo shark *Chiloscyllium punctatum*, white-spotted bamboo shark *Chiloscyllium plagiosum* were lower than the price of grey reef shark *Carcharhinus amblyrhynchos*, big nose shark *Carcharhinus altimus*, blacktip reef shark *Carcharhinus melanopterus*, scallop hammerhead *Sphyrna lewini*. A small number of shark's jaws, and even teeth, are sold as rare souvenir items to collectors (Fig 12). Discarded part of the

fish such as head and cartilage are used as bait for fish and crab traps or sold to fish mill factories for fertilizers.(Fig 13) In Thailand the first middle men (purchaser) at landing site will gather all of total catches of sharks and sale to the second middle men (purchaser). For rays are mostly consumed fresh and salted, average price at landing site is 10 to 15 Baht/kg (Table 10).

Table 10. Local usage and marketing of shark

Species	Part	Local consumed (*C*), Discarded (D), Traded (T), Processed (type of processing)	Local price per Kg US$	Market destination	Landing price per Kg US$	Total sam. for Q1 Q2 (kg)
Gulf of Thailand						**649.34**
1. *Chiloscyllium punctatum*	Whole	C,T	1.25	C:Samutprakan	0.30-1.00	196.51
	"	C,T	1.25	C, T:Songkhla	0.5	
2. *C.plagiosum*	"	C,T	1.25	T:fish processing at Samutsakorn	0.30-0.75	40.34
3. *C.griseum*	"	C	1.25	T:fish processing at Samutsakorn	0.45-1.00	18.24
	"	C,T	0.75	C, T:Songkhla	0.5	
4. *C.hasselti*	"	C	1.25		0.45-0.75	0.65
5. Alopias vulpinus	Whole	C,T	0.75	C, T:Songkhla	0.4	99
6. Atelomycterus marmoratus	"	C,T	1.25	C, T:Songkhla	0.81	3.27
7. Carcharhinus amblyrhynchos	"	C	4.38	C, T:Songkhla	2.5	14.8
8. Carcharhinus amblyrhynchoides	"	C	1.75	C, T:Songkhla	1.3	9.6
9. Carcharhinus altimus	"	C,T	1.75	C, T:Songkhla	1.3	8.8
10. Carcharhinus leucas	"	C,T	1.75	C, T:Songkhla	1.3	8.42
11. Carcharhinus melanopterus	"	C	1.88	C, T:Songkhla	1.3	44.36
12. Carcharhinus sorrah	"	C	1.88	C, T:Songkhla	1.3	48.95
13. Chiloscyllium indicum	"	C,T	1.25	C, T:Songkhla	0.75	30.97
14. Hemipristis elongatus	"	C,T	1.75	C, T:Songkhla	1.3	5.9
15. Sphyrna Lewini	"	C	2.13	C, T:Songkhla	1.5	95.53
16. Stegostona fasciatum	"	C,T	0.75	C, T:Songkhla	0.5	24
The Andaman Sea						**633.8**
1. *Chiloscyllium punctatum*	Whole	C	0.35-1.0	C: Phuket	0.17-0.50	36.87
2. *C.griseum*	"	C	0.35-1.0	T: fish processing	0.17-0.50	10
3. *Hemipristis elongatus*	"	T	1.8	at Phuket	1.25	50
4. *Carcharhinus amboinensis*	"	T	4.5		2.5	110
5 *C.sorrah*	"	C	1.65		1.25	1.95
6. *Mustelus* sp.B (New Record in Thai water)	"	C	0.8		0.4	17.6
7. Alopias superciliosus	"	T	1.88		1.03	221
8. *Sphyrna lewini*	"	C	1.5		0.8	7.87
9. C.leucas	"	T	1.5		0.75	12.00
10. Triaenodon obesus	"	T	1.5		0.75	53.70
11. Rhizoprionodon acutus	"	T	1.5		0.75	2.81
11. Carcharhinus amblyrhynchoides	"					110.00
Total						**1283.14**

Exchange rate: 1US$=40 Baht

In the Gulf of Thailand landing site at Sumut Prakhan, middlemans are buying fish directly from the fishermen and selling them to the wholesale markets in Sumut Prakhan, Sumut Sakhon and Bangkok province. Production of shark is fresh meat. The market price is 60-80 Baht/kg, major market was used as locally consumption in province and adjacent area. The preferred species products of shark by the middle man is spot-tail shark *Carcharhinus sorrah*

In the southern Gulf of Thailand landing site at Songkhla, Songkhla province the first middlemen are buying fish directly from the fishermen and selling them to the wholesale markets in Songkhla province. The preferred species products of shark in the market is grey bamboo shark *Chiloscyllium griseum*, slender bamboo shark *Chiloscyllium indicum*, Brown-banded bamboo shark *Chiloscyllium punctatum*, white-spotted bamboo shark *Chiloscyllium*

plagiosum. Production of shark meat is dried salted meat of which market price is 150 Baht/kg, the major market was used locally consumption in province near shore. For dried fins, market price is 500 to 15,000 Baht/kg. The preferred species products of shark in the market is spot-tail shark *Carcharhinus sorrah*, grey reef shark *Carcharhinus amblyrhynchos*, big nose shark *Carcharhinus altimus*, blacktip reef shark *Carcharhinus melanopterus*, scallop hammerhead *Sphyrna lewini*, thresher shark *Alopias vulpinus*, snaggletooth shark *Hemipristis elongates*. The major markets are Bangkok before export to China, Hong Kong and Singapore.

In the Andaman Sea of Thailand landing site at Phuket province, middleman are buying fish directly from the fishermen and selling them to the wholesale markets in Phuket province. Production of shark meat is dried salted meat of which market price is 150-200 Baht/kg, the major market was used locally consumption in province and adjacent area. The preferred species by the middle man is grey bamboo shark *Chiloscyllium griseum*, Brown-banded bamboo shark *Chiloscyllium punctatum*, for dried fins; market price is 500 to 15,000 Baht/kg. The preferred species by the middlemans is spot-tail shark *Carcharhinus sorrah*, graceful shark *Carcharhinus amblyrhynchoides*, scallop hammerhead *Sphyrna lewini*, Bigeye thresher shark *Alopias supercilliosus*, snaggletooth shark *Hemipristis elongates*.The major market is Bangkok before export to China, Hong Kong and Singapore

The shark trade in Thailand neither well documented have not been recorded nor information is difficult to obtain. There are no specific information on shark meats, fins and shark fin trades available in the fisheries statistics except for the import and export statistics conducted by Customs Department.

Figure 10. Processing: dried salted.

Figure 11. Production : dried shark fins

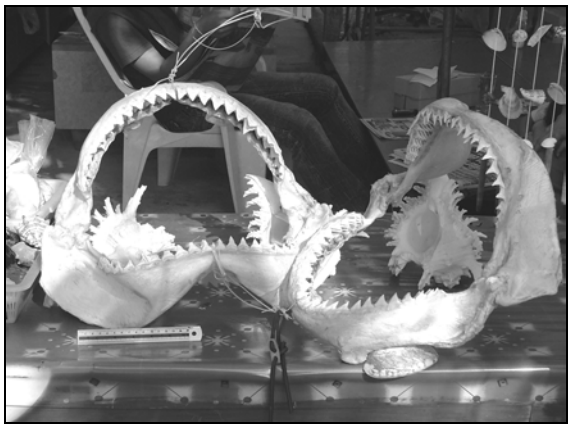


Figure 12. Tooth and jaws of sharks were sold in Phuket souvenir shops

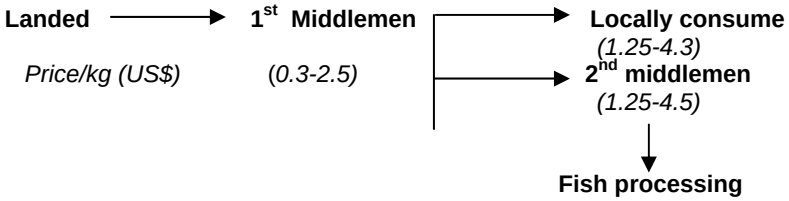


Figure 13. Marketing channel of shark landed in Thai

The utilization of shark product in Thailand are

1. Fresh meat are locally consumed in their province and it adjacent area.
2. Dry salted
3. Fish ball
4. Dried fins especially for export and some of them marketed locally.
5. Head skin and stomach are processed for fishmeal.
6. livers are use for feeding in shrimp culture.
7. Teeth for decoration

We can say that all of the shark part was used.

Table 11. Utilization of shark products

Part	Product type	Market
Meat	Fresh meat, Dry salted meat, Fish ball	Mainly locally used
Fin	Dried fin	Mainly export
Liver	Shrimp culture	Mainly locally used
Head	fishmeal	Mainly locally used
Skin	fishmeal	Mainly locally used
Stomach	fishmeal	Mainly locally used
Bone	fishmeal	Mainly locally used
Jaw	Dried jaw (for souvenir)	Mainly locally used
Teeth	Dried teeth (for souvenir)	Mainly locally used

6. PROBLEM

With regard to the collection of samples to identify their maturity, the study has encountered the difficulty to gain access to the large size of shark due to the fact that their price for whole shark is rather high and most of them are already sold to traders.

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DATA COLLECTION ON SHARK FISHERIES IN VIET NAM

Dr. Nguyen Long[14]

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1. BACKGROUND

During the past decades, development of fishing technology and consumption demand of the shark products made total catch of cartilaginous fishes continuously constant increased. Total catch was estimated to be less than 300,000 tons in 1950, but in 1997 the total catch reached approximately to 800,000 tons (FAO, 1999).

In Vietnam, biological studies of shark have been carrying out since 1970. However, these studies were focussed only on classification and biological characteristics of sharks, but not yet having good enough condition for studying on stock assessment and distribution of sharks in Vietnamese waters. Up to now, there is no statistics on the total catch of cartilaginous fishes. However, interviews of fishermen and summations of different research works on offshore fishing in Vietnam show that shark fisheries started developing after 1980 and reached to the peak of catch in the end of 80's. The main reason would be highly increasing demand on shark fin for export and domestic consumption as well as change of consumption predilection for the productions made from shark such as skin, shark cartilage or shark liver oil.

In this development period, shark fisheries by hook & line and long line has been appeared in some localities such as Quang Binh, Binh Thuan and Vung Tau. However, due to catch of sharks in recent years decreases, fishing fleets specialized in shark fisheries changed their activities to tuna fisheries or both shark and tuna fisheries. In addition, other fishing gears such as trawling net, gillnet, purse seine can catch sharks although the sharks are not considered to be the main target object. And these fishing gears also make considerable decline of shark resource.

In order to sort out the matters on sustainable management approach to shark fisheries, the member ASEAN countries have launched "International Action Plan on Shark monitoring and Management" (IPOA-Shark). Comprehensive researches on shark and information exchange amongst countries are compulsory requirements of this program.

Currently in Vietnam, a completed study on shark has not been available to play as basics for forming policies of sustainable management and resources protection.

2. STUDY METHOD

2.1. Survey Area Selection

The selected survey area shall meet the requirements as follows:

a) Having developed shark fisheries with remarkable catch.
b) Being a substantial ecosystem representative of the country.
c) With favorable conditions for shark processing and consumption; and survey data collection.

Based on the above requirements, two locations, namely Phan Thiet (Binh Thuan province) and Vung Tau (Ba Ria - Vung Tau province) were selected. Main characteristics of 2 areas are described as follows:

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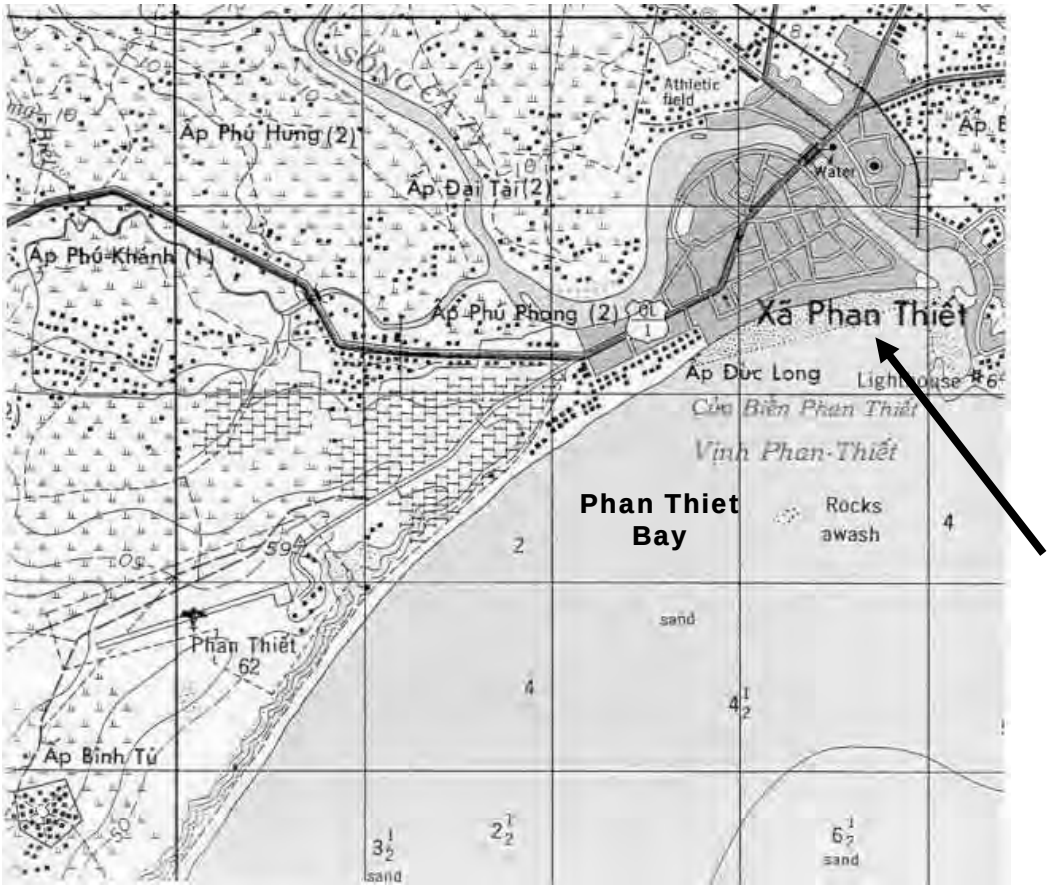


Figure 1. Location of Phan Thiet

Phan Thiet located in Binh Thuan province, Phan Thiet is 200 km from Ho Chi Minh and lies south of Cam Ranh bay on the southernmost stretch of Central Vietnam. Phan Thiet is one of a famous place for shark catching as target species by longline. There are 2 main landing sites Phu Quy island and Con Tra for the region. Although Phu Quy seems to have higher volume of landing but Con Tra is easier to access and most of products are processing there. The catch in this area is representative for "deep" sea ecosystem.

+ Ba Ria - Vung Tau:

Vung Tau is an old port located on a 110 km^2 area, 125 km southeast of Ho Chi Minh city. This city has some shark products possessing. Shark landing in this areas was catching from long line, gillnet and bottom trawl. There are many landing sites in this city. However, Ben Da is a site where shark product mainly landing to compare with others. On the other hand, the site is representative for southern ecosystem and easier to access. Vung Tau is also a famous on trading of shark fin and other products..

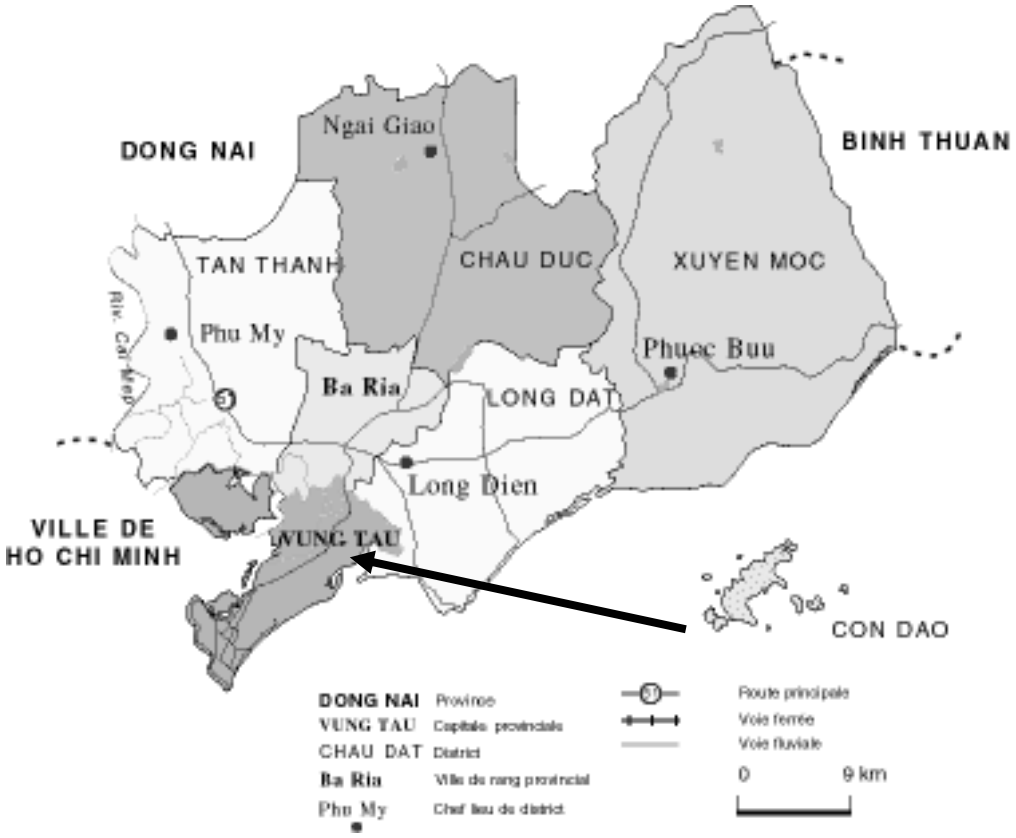


Figure 2. Location of Vung Tau

2.2. Data Sources

Data was collected from 2 main sources as follows: survey data and available data in the RIMF (Research Institute for Marine Fisheries).

a) Survey data in two sites Phan Thiet (Binh Thuan province) and Ba Ria -Vung Tau

- Data collected from enumerators and researchers of RIMF for 4 quarters.
- Daily data collection for one month per quarter from enumerators.

Collected data:

- Collection of total catches of sharks and non-sharks
- Information on fisheries structure, fishing gears
- Information on local usage and marketing of sharks
- Data collection for one week per quarter per site from researchers

In each study area researchers deal with following data:

- Biological data
  - Species composition
  - Length frequency
  - Sex and maturity
- General description of landing site
- Information on fisheries structure, shark fishing gears
- Information on local usage and marketing of sharks

b) Available data in the RIMF

Data source of RIMF through the ALMRV (Assessment of Marine Living Resource in Vietnam) Project and data of the surveys carried out from 2001 to 2004 in the Tonkin Gulf, Southeast and Southwest areas such as 10 surveys by bottom trawl, 8 surveys by gillnet and 9 surveys by hook & line and long line are used in this report. The boundary of the studied areas is shown in Figure 3.

Estimation method and data analysis:

Data are drawn from the database "Vietfishbase" of RIMF and calculated as follows:

- Catch per Unit Effort (CPUE): the catch obtained in one (01) hour of net drawing up
- Catch per Unit Area (CPUA): the catch per unit of area kg/km^2
- For conversion of the catch of any vessel to the catch of the standard vessel, Babaina formula (1984) is applied:

$$A\ (standard\ vessel) = a\ (i) * ((S(standard\ vessel)/s\ (i))$$

Where: a (i) = average catch (kg/h) of the vessel to be converted
S (standard Boat) = the area where net swept over in 1 hour of the standard vessel
s (i) = the area where net swept over in 1 hour of the converted vessel
A (standard vessel)= converted catch

$$CPUA(kg/km^2) = C/A$$

Where: C is volume in one catch (kg); A is a sweeping area of net (km^2), which is calculated by formula:

$$A = V \times W \times T$$

(V is an average speed of net towing of vessel; W is distance by horizontal of net mouth; T is duration of one haul)

Swept area method of Gulland (1969) is applied to estimate biomass of demersal fish.

Results obtaining after analyzing data:

After analyzing the available data sources of RIMF collected from the surveys by different fishing gears as well as fishing ground and seasons, the following issues are clarified:

1. Identification of species composition of sharks and rays caught in Vietnamese waters in recent years
2. Identification of caught species composition or species groups formed by geographical area, by depths (for trawl fishery) and by main fishing seasons.
3. Estimation on fishing productivity of sharks and rays in Tonkin Gulf, Southeast and Southwest areas.
4. Estimation on standing biomass of some shark species in other waters by otter trawl survey data and swept area method.

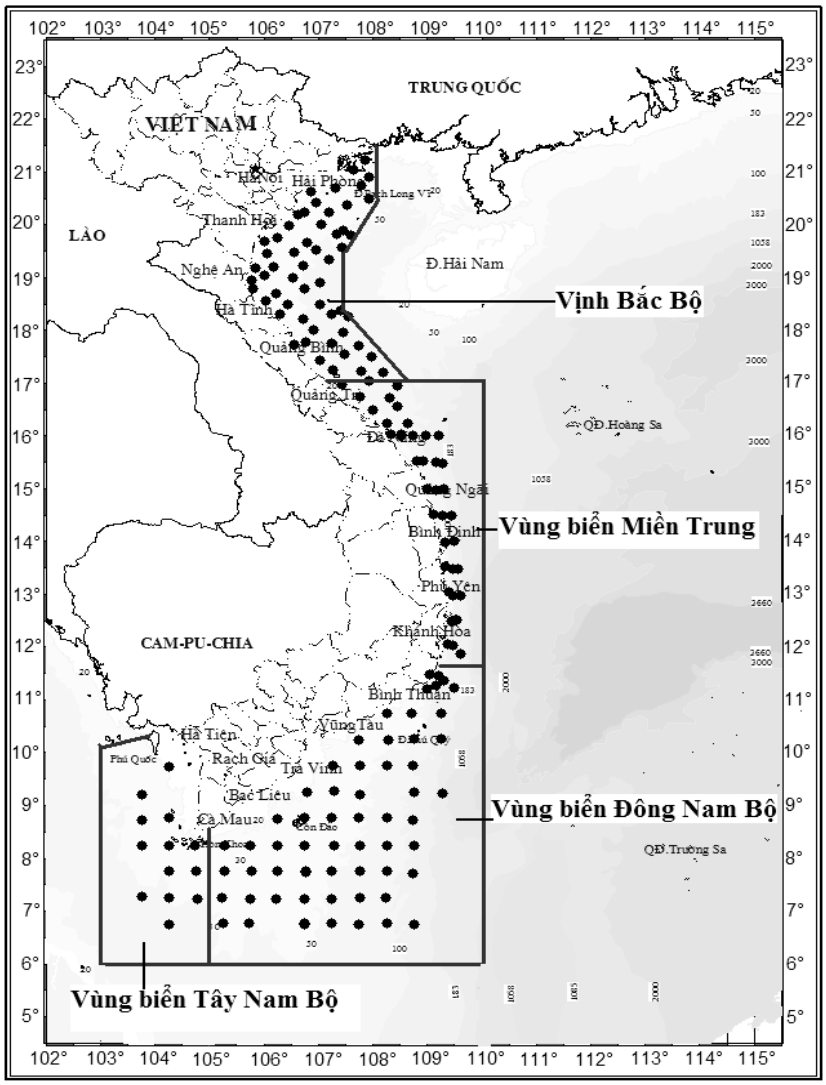


Figure 3. Sketch of Studied Area and Sample Collecting Station System for otter trawl survey

3. RESULTS OF STUDY

3.1. Fisheries Structure of Binh Thuan and Ba Ria - Vung Tau

3.1.1 Fisheries Structure of Binh Thuan Province

Fishery is developed in Binh Thuan province. According to the statistics of province, up to the end of 2003, total number of fishing boats is 5,168 with total capacity of 254,237 hp. In general, size of fishing boats in Binh Thuan is small: 89.5% of total fishing boats with engine capacity < 90 hp. Only 542 fishing boats have engine capacity >90 hp and correspond to 10.5% of the total number of fishing boats of the whole province. Total fishery production reached 138,000 tons.
Binh Thuan is one of few provinces in Vietnam has offshore shark fishery. Currently, there are 1,464 shark boats, however, shark production becomes less and less. Therefore, only about 100 boats of Phu Quy island are still specialized on shark fishery. The remaining boats change their function to tuna, snapper and grouper or cutterfish & squid fishery, etc.

Table 1. Fishing Boat Fleet by Capacity in Binh Thuan Province (Up to 30 March 2004)

Locality	Capacity (hp)					Total (nos)
	<20	20÷ 45	46÷ 89	90÷ 299	≥300	
Tuy Phong	240	420	373	62	4	1,099
Bac Binh	4	6	2			12
Phan Thiet	363	780	830	223	24	2,220
Ham Thuan Nam	71	13				84
Ham Tan	145	336	567	175	15	1,238
Phu Quy	68	202	205	24	8	507
Exploitation enterprise				1	6	7
Joint Venture			1			1
Total	**891**	**1,757**	**1,978**	**485**	**57**	**5,168**

Table 2. Fishing Boat Fleet by Fishing Gear Group in Binh Thuan Province (Up to 30 March 2004)

Locality	Fishing gear group (nos.)							Total (nos)
	Trawl	Seine	Gillnet	Lift net	Hook & line	Push net	Service boat	
Tuy Phong	315	110	254	114	306			1,099
Bac Binh	2			6	4			12
Phan Thiet	809	175	458	332	361	78	7	2,220
Ham Thuan Nam			53	13	18			84
Ham Tan	413	114	246	166	298	1		1,238
Phu Quy	1	4	2	6	471		23	507
Exploitation enterprise		1			5	1		7
Joint Venture					1			1
Total	**1,540**	**404**	**1,013**	**637**	**1,464**	**80**	**30**	**5,168**

Other activities of the fishery in Binh Thuan include:

- Aquaculture area: 3,300 ha
- Processing factory/enterprise: 66 enterprises purchase and process marine products, among which 27 enterprises are in charge of processing and export of marine products.
- Fishing ports: there are 4 fishing ports, namely Phan Ri Cua, Phan Thiet, La Gi and Phu Quy fishing ports. Besides these fishing ports, some landing sites exist, such as Chi Cong, Lien Huong, Phuoc The, Mui Ne, Cua Phu Hai, Cua Ba Dang, etc.
- Boat repair and building enterprise: there are 17 enterprises, in which 3 enterprises are capable to build wooden hull for the boats of more than 300 hp.
- Manpower:
  - Fishing: 61,600 persons
  - Aquaculture: 2,830 persons
  - Fisheries processing: 8,180 persons
  - Fisheries service: 1,740 persons

3.1.2. Fisheries Structure of Ba Ria - Vung Tau

Fishery in Ba Ria - Vung Tau is developed highly. To the end of 2003, total number of fishing boats was 5,210 with total capacity of 457,900 hp. Size of fishing boats in Ba Ria - Vung Tau is rather large. 1,962 boats with capacity >90 hp exist that account for some 37.66% of the total number of fishing boats of the whole province.

In Ba Ria - Vung Tau, number of boats specialized in trawl and hook & line fishering is rather high. There are 1,951 boats doing trawl fishery, 705 boats doing gillnet fishery and 1,273 boats doing hook & line fishery. Sharks and rays are often caught by these fishing gears. Although percentage of caught volume of sharks and rays in a catch was not high and they are not the target catching objects, total volume per year is not small.

Table 3. Fishing Boat Fleet by Capacity in Ba Ria - Vung Tau Province (Up to 30 March 2004)

Locality	Capacity (hp)					Total (nos)
	< 20	20 ÷ 45	46 ÷ 89	90 ÷ 140	≥ 140	
Vung Tau	640	188	257	102	402	1,589
Xuyen Moc	233	256	83		1	573
Long Dat	495	305	488	628	817	2.733
Tan Thanh	87	56	6			149
Ba Ria	22	46				68
Con Dao	75	7	2	1	2	87
Con Dao Import -Export Company					8	8
Ho Sen Import -Export Company		2			1	3
Total	**1,552**	**860**	**836**	**731**	**1,231**	**5,210**

Table 4. Fishing Boat Fleet by Fishing Gear Group in Ba Ria - Vung Tau Province (Up to 30 March 2004)

Locality	Fishing gear group (nos.)						Total (nos)
	Trawl	Seine	Gillnet	Hook & line	Fixed net	Others	
Vung Tau	636	11	100	258	93	491	1.589
Xuyen Moc	1	1		547		24	573
Long Dat	1.291	380	605	353		104	2.733
Tan Thanh	13			2	2	132	149
Ba Ria				41		27	68
Con Dao	1			72		14	87
Con Dao Import -Export Company	8						8
Ho Sen Import -Export Company	1					2	3
Total	**1,951**	**392**	**705**	**1,273**	**95**	**794**	**5,210**

Based on the statistics for September 2004, detailed information on the fishery in Ba Ria - Vung Tau include:

- Fishermen of the province: 30,892 persons
- Boat repair and building enterprise: 07 enterprises
- Fishing ports: there are 4 fishing ports, namely Cat Lo, Ben Da, Ben Dinh and Phuoc Tinh fishing ports. Besides these fishing ports, some landing sites exist, such as Long Hai, Sao Mai, Bai Truoc, Bai Sau, (belong Vung Tau), Phuoc Hai, Loc An and etc.
- In the province, there are 180 enterprises trade in fish powder processing, canned fish processing, frozen and dry products processing and general business.

3.1.3 Fishing Gears Used in Shark Catching

The fishing gears used in shark catching can be divided into 2 groups:

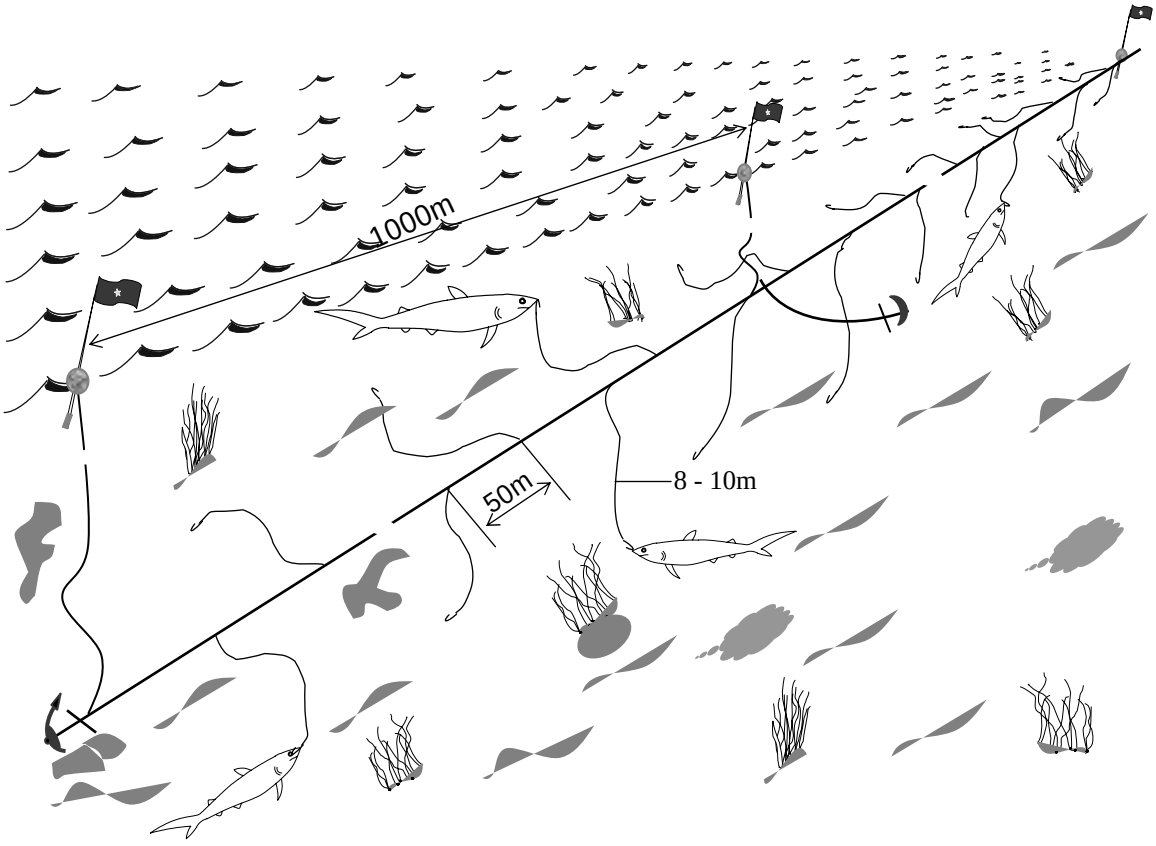
a) *The fishing gears specialized for shark catching:* the main fishing gear for catching shark is long line. Shark fishery was developed strongly in Vietnam from the end of 80's to 90's. Shark fishery is being developed in the central provinces, particularly in Phu Quy island (Binh Thuan province)

Fishing boat used popularly has hull length of 14-17m with engine of 45-60 hp. Season for shark catching lasts from January to September. The highest catch of shark can be reached from March to June.

Due to small size, fishing boats can operate offshore from March to June, which is the period of calm sea and also of the highest catch.

Length of long line often used ranges from 15 km to 30 km with 300 to 600 hooks respectively. Small pelagic fishes or 200gr of tuna or dolphin fish per hook is used as bait.

Catching of sharks by hook and line reaches high volume. Rate of sharks to the total fishery products is very high, which accounts for 45-100%. In every fishing trip, catch of sharks reaches 400 - 4,000 kg per boat.



Number of hooks : 300 - 600
Length of line : 15 - 30 km

Figure 4. Diagram of shark Long Line Fishery

b) *Fishing gears can be used for shark catching (shark is not target catching object):* Some fishing gears can be used for catching sharks. The most considerable gears are trawling net and gillnet. During their operation, these gears can catch sharks and rays. Although volume of shark in one catch is not high (only about 0.7 – 1%), number of fishing boats and total fishery products by these 2 fishing gears is extremely high. Therefore, total catch of sharks and rays is remarkable.

3.2 Conducted Surveys

3.2.1 Survey No.1

This survey was carried out from 31 December 2004 to 15 January 2004 in Vung Tau and Phan Thiet.

The researchers made interviews to fishermen of trawlers, purse seiners, gillnet and long line boats at landing sites on the caught volume of sharks in the fishing trip and total caught products. Survey results are shown in Table 5.

- *Vung Tau:* interviews were made to fishermen of 86 fishing boats, which consist of 24 trawlers and 62 gill net boats. Volume of shark in one catch made up 0.03% of the total in case by trawl and 0.58% - by gill net.
- *Phan Thiet:* interviews were made to fishermen of 24 fishing boats, which consist of 10 trawlers and 14 gill net boats. Volume of shark in one catch made up 0.08% of the total in case by trawl and 1.1% - by gill net.

Table 5. Rate of Shark Catch by Some Fishing Gears in the Survey No.1

Survey area	Fishing gear	No. of boats to be interviewed	Catch of shark (kg)	Fishery products excluding sharks (kg)	Total catch (kg)	Rate of shark (%)
Vung Tau	Trawl	24	65	217,701	217,766	0.03%
	Gill net	62	1,007	172,283	173,290	0.58%
Phan Thiet	Trawl	10	45	55,771	55,816	0.08%
	Gill net	14	452	40,667	41,119	1.1%

3.2.2 Survey No.2

This survey was carried out from 23 March 2004 to 09 April 2004 in Vung Tau and Phan Thiet. Besides the results obtained from the researchers, there were data collected from the local collaborators. Survey results are shown in Table 6.

Table 6. Rate of Shark Catch by Some Fishing Gears in the Survey No.2

Survey area	Fishing gear	No. of boats to be interviewed	Catch of shark (kg)	Fishery products excluding sharks (kg)	Total catch (kg)	Rate of shark (%)
Vung Tau	Pair trawl	75	269	2,293,426	2,293,695	0.01%
	Single trawl	60	357	2,849,568	2,849,925	0.01%
	Gill net	120	6,659	429,322	435,981	1.53%
	Seine	35	0	196,740	196,740	0.00%
	Others	61	0	10,856	10,856	0.00%
	Total	**351**	**7,285**	**5,779,912**	**5,787,197**	**0.13%**
Phan Thiet	Pair trawl	1	10	2,000	2,010	0.50%
	Single trawl	9	45	38,500	38,545	0.12%
	Gill net	3	200	11,000	11,200	1.79%
	Seine	12	0	41,600	41,600	0.00%
	Long line	195	27,788	93,830	121,618	22.85%
	Others	77	0	31,730	31,730	0.00%
	Total	**297**	**28,043**	**218,660**	**246,703**	**11.37%**

- *Vung Tau:* 351 boats with different fishing gears had been interviewed. The catch of shark was 7,285 kg and total catch excluding sharks was 5,779,912 kg. Rate of shark volume to the total fishery products was lowest in case by seine (0%), then by single trawl and pair trawl(0.1%) and highest in case by gill net (1.53%). And rate of shark volume catching by all these fishing gears was 0.13%.
- *Phan Thiet:* 297 boats with different fishing gears have been interviewed. The catch of shark was 28,043 kg and total catch excluding sharks was 218,660 kg. Rate of shark volume

catching by seine was (0%), by single trawl ~ 0.12% and pair trawlwas 0.5% and by gill net was 1.79%. The highest rate of shark volume was reached by long line fishery (22.85%). And rate of shark volume catching by all these fishing gears was 11.37%.

In Phu Quy island (Binh Thuan province) shark fishery by hook and line exists. As for the boats catching sharks by long line, rate of the caught shark volume is very high and higher than the other fishery products, which reaches to 45.9 – 100%. The highest volume of sharks caught in one trip is 1,970 kg. It is clealy shown in Table 7.

Table 7. Volume of Sharks Caught by Long Line in Binh Thuan

Register No. of boat	Fishing gears	Volume of shark (kg)	Volume of fishery products excluding sharks (kg)	Total catch (kg)	Rate of shark (%)
BTH8243	Long line	170	200	370	45.9
BTH8641	Long line	722	0	722	100
BTH8479	Long line	1,240	520	1,760	70.5
BTH8201	Long line	1,800	1,600	3,400	52.9
BTH8168	Long line	420	350	770	54.5
BTH8322	Long line	370	150	520	71.2
BTH8617	Long line	1,520	600	2,120	71.7
BTH8135	Long line	1,600	150	1,750	91.4
BTH8191	Long line	1,510	190	1,700	88.8
BTH8133	Long line	1,420	100	1,520	93.4
BTH8559	Long line	1,970	100	2,070	95.2
BTH8217	Long line	1,230	0	1,230	100

3.2.3 Survey No.3

This survey was carried out from 12 July 2004 to 02 August 2004 in Vung Tau and Phan Thiet.

Table 8 - Rate of Shark Catch by Some Fishing Gears in the Survey No.3

Survey area	Fishing Gear	No. of boats to be interviewed	Catch of shark (kg)	Fishery products excluding sharks (kg)	Total catch (kg)	Rate of shark (%)
Phan Thiet	Pair trawl	72	300	46,500	46,800	0.64
	Single trawl	68	0	105,800	105,800	0
	Gill net	29	590	44,700	45,290	1.3
	Seine	8	0	4,562	4,562	0
	Long line	432	47,687	538,350	586,037	8.14
	Others	125	0	192,800	192,800	0
	Total	**734**	**48,577**	**932,712**	**981,289**	**4.95**
Vung Tau	Pair trawl	166	2,504	7,290,090	7,292,594	0.03
	Single trawl	69	529	2,437,459	2,437,988	0.02
	Gill net	115	10,088	540,750	550,838	1.83
	Seine	103	0	1,580,000	1,580,000	0
	Long line	0	0	0	0	0
	Others	62	0	50,494	50,494	0
	Total	**515**	**13,121**	**11,898,793**	**11,911,914**	**0.11**

- *Phan Thiet:* 734 boats by some fishing gears have been interviewed. The catch of shark was 48,577 kg and total catch excluding sharks was 932,712 kg. Rate of shark volume to the total fishery products was lowest in case by seine (0%) , single trawl and other fishing gears, then by pair trawl(0.64%) , gill net (1.3%) and highest in case by long line (8.14%). And rate of shark volume catching by all these fishing gears was 4.95%.

- *Vung Tau:* 515 boats by some fishing gears have been interviewed. The catch of shark was 13,121 kg and total catch excluding sharks was 11,898,793 kg. Rate of shark volume catching by seine and long line was (0%), by single trawl – 0.02% and pair trawlwas 0.03% and by gill net was 1.83 %. Data was not collected from long line fishery . And rate of shark volume catching by all these fishing gears was 0.11%.

3.2.4 Survey No.4

This survey was carried out from 20 October 2004 to 05 November 2004 in Vung Tau and Phan Thiet. Besides, survey forms of the local collaborators made from July to November were included. Survey results are shown in Table 9.

Table 9 - Rate of Shark Catch by Some Fishing Gears in the Survey No.4

Survey area	Fishing gear	No. of boats to be interviewed	Catch of shark (kg)	Fishery products excluding sharks (kg)	Total catch (kg)	Rate of shark (%)
Phan Thiet	Pair trawl	4	0	34,000	34,000	0
	Single trawl	65	0	190,500	190,500	0
	Gill net	1	100	12,000	12,100	0.83
	Seine	18	0	75,000	75,000	0
	Long line	-	-	-	-	-
	Others	-	-	-	-	-
	Total	**88**	**100**	**311,500**	**311,600**	**0.03**
Vung Tau	Pair trawl	123	2,045	6,366,339	6,368,384	0.03
	Single trawl	55	740	2,139,592	2,140,332	0.03
	Gill net	70	13,618	396,463	410,081	3.43
	Seine	80	0	1,380,400	1,380,400	0
	Long line	-	-	-	-	-
	Others	40	0	30,740	30,740	0
	Total	**368**	**16,403**	**10,313,534**	**10,329,937**	**0.16**

- *Phan Thiet:* 88 boats by different fishing gears have been interviewed. The catch of shark was 100 kg and total catch excluding sharks was 311,500 kg. Rate of shark volume to the total fishery products was lowest in case by seine , single trawl and pair trawl(0%), highest in case by gill net (0.83%). And rate of shark volume catching by all these fishing gears was 0.03%.

- *Vung Tau :* 368 boats by some fishing gears have been interviewed. The catch of shark was 16,403 kg and total catch excluding sharks was 10,313,534 kg. Rate of shark volume catching by seine was (0%), by single trawl and pair trawlwas 0.03% .The highest rate of shark volume was reached by gill net (3.43%) . The long line fishery for shark was stopped in this time because bag weather. And rate of shark volume catching by all these fishing gears was 0.16%.

3.3 Use and Trade of Shark

3.3.1 Use of shark

In Vietnam, sharks are processed and traded as follows:

- *Fresh shark:* the caught sharks are kept fresh and in whole in the trawlers and gill net boats until landing. As for the shark of more than 6-7 kg, its fin will be cut, but the shark of less than 6 kg will be sold in whole unit with fin.
- *Dried shark:* dried shark can be seen in the long line boats. They usually go fishing offshore, so the caught sharks are dried up: dried fish meat, dried skin and dried bone.
- *Liver of shark:* livers of sharks are cut into small parts then processed into oil and contained in plastic cans.
- *Stomach of shark:* stomachs of sharks are used as food
- *Fin of shark:* fins of sharks are preferable product for export

3.3.2 Trade of shark

Shark products are traded in different markets:

- Fresh shark meat is sold in domestic market
- Dried shark meat is sold in market of Ho Chi Mink city, which can be processed into pieces soaked in spices.
- Skin, bone and liver of shark: are exported to China. According to survey data, there are 3 big magnates, who specializes in buying sharks. Volume of shark skin bought by one magnate in 2003 was 14 tons. Only in the first quarter of January 2004 one magnate bought 5 tons of skin and 50 kg of bone.
- In Phu Quy island (Binh Thuan province), in the first 6 months of 2003, 137 tons of shark meat and 3.9 tons of fin are reached.
- Price of shark products: according to the surveys in markets of 2 provinces, prices of shark products are shown in Table 10.

Table 10. Prices of Shark Products

Name of products	Price/kg	
	VND	USD
Dried skin	90,000	6.00
Head bone	90,000	6.00
Other bones	10,000	0.66
Dried fin – class 1 (>42 cm)	600,000 – 700,000	40 – 46.67
Dried fin – class 2 (>32 cm)	300,000 – 350,000	20.00 – 23.33
Dried fin – class 3 (>22 cm)	120,000 – 150,000	8.00 – 10.00
Dried fin – class 4 (>12 cm)	40,000 – 50,000	2.67 – 3.33
Dried fin – class 5 (<12 cm)	20,000 – 30,000	1.33 – 2.00
Fresh fish with fin	10,000 – 12,000	0.67 – 0.80
Fresh fish without fin	8,000	0.53
Dried fish meat	30,000-35,000	1.9– 2.3

Table 11. Local Consumption and Marketing of Shark

Species	**Part**	**Shark Source**		**Abundance at Landing site**	**Locally consumed (C) Discaded (D), Traded (T), Processed (type of processing)**	**Local price per kg (VND)**	**Market destination Local (L) ; Out (O)**
		Type of fishing boat (HP)	**Type of fishing gear**				
1.*Alopias pelagicus*	All	33-60	Gn	++	(C) , (T)	12.000	L,O
2.*Carcharhinus brachiurus*	All	33-60	Gn	+	C , T , P	12.000	L , O
3.*Carcvharhinus falciformis*	All	100 – 500	Tr	+	T , P	15.000	O
4.*Carharhinus sorah*	All	33 – 500	Tr,Gn, Lo	+++	C,T,P	15.000	L , O
5. *Mustelus griseus*	All	33-60	Gn	+	C , T	10.000	L
6. *Chiloscyllium griseum*	All	100-500	Tr	+	C , T	12.000	L
7.*Stegostoma fasciatum*	All	100-500	Tr	++	C , T	10.000	L
8.*Heterodontus zebra*	All	100-500	Tr	+	C , T	12,000	L , O
9.*Heptranchias perlo*	All	33-60	Gn	+	C , T	12.000	L , O
10.*Chiloscylium plagisoum*	All	100-500	Tr	++	C , T	10.000	L
11.*Halaelurus buergeri*	All	33-500	Tr,Gn	+	C , T	10.000	L
12.*Atelomycterus marmoratus*	All	100-500	Tr	++	C , T	10.000	L
13. *Sphyrna lewini*	All	33-500	Tr,Gn	++	C , T , P	12.000	L , O

1. Give abundance as follow: rarely (+), relatively common (++), abundant to plentiful (+++)
2. Give currency (Dong) and currency exchange rate with US$ during 2004 (1 US$ = 15,550 D)
3. Tr = Trawl ; Gn = Gill net ; Pn = Purse seine ; Lo = Long line .

Figure 5. Dried Shark Meat Sold in Ba Ria Market

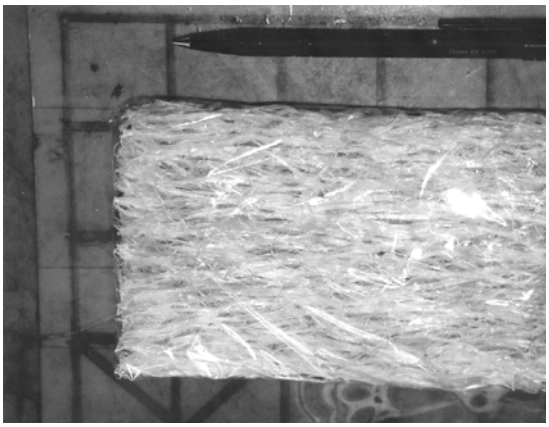


Figure 6. Finished Shark Fins Sold in Shops at a shop next to Con Cha landing site,Phan Thiet

Figure 7. Dried Shark Skin Sold in Shops at at a shop next to Con Cha landing site, Phan Thiet

Figure 8. Finished Shark Fins Sold in Shops at at a shop next to Con Cha landing site, Phan Thiet

Figure 9. Finished Shark Fins Sold in Shops at at a shop next to Con Cha landing site, Phan Thiet

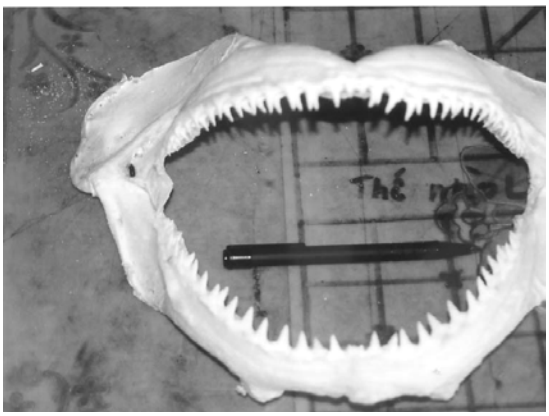


Figure 10. Dried Shark Teeth Sold in Shops

3.4 Biological Analysis

3.4.1 Caught shark species

In 4 surveys, the researchers conducted investigations in fishing berths. 13 species under 10 genera of 8 families were seen, including:

I.	Family:	***Alopiidae*** **(C¸ nh¸m ®u«i dµi)**
I.1.	Genus:	*Alopias Rafinesque, 1810*
I.1.	Species	*Alopias pelagicus* Nakamura, 1935
II.	Family:	***Carcharhinidae*** **(C¸ mËp)**
II.2.	Genus:	*Carcharhinus Blainville,1816*
II.2 .	Species:	*Carcharhinus brachyurus* (Günther, 1870), Copper shark
II.3.	Species:	*Carcvharhinus falciformis* (Müller and Henle, 1839)**, Silky shark**
II.4.	Species:	*Carcharhinus sorahh (Mulleret Henle, 1841)*
II.3.	Genus:	*Mustelus Linck*
II.5.	Species:	*Mustelus griseus Pietschmann, 1908*
III.	Family:	***Hemiscyllidae*** **(C¸ nh¸m r©u)**
III.4.	Genus:	*Chiloscyllium Muller et Henle,* 1837
III.6.	Species:	*Chiloscyllium griseum (Müller and Henle, 1838)* **(C¸ nh¸m chã)**
III.7.	Species:	*Chiloscylium plagiosum (Bennett, 1830)*
IV.	Family:	***Heterodonitae*** **(C¸ nh¸m hæ)**
IV.5.	Genus:	*Heterodontus blainville, 1816*
IV.8.	Species:	*Heterodontus zebra (Gray, 1831)*
V.	Family:	***Hexanchidae*** **(Nh¸m 1 v©y l-ng)**
V.6.	Genus:	*Heptranchias Rafinesque , 1810*
V.9.	Species:	*Heptranchias perlo (Bonaterre, 1788)*
VI.	Family:	***Orectolobidae (Hä c¸ nh¸m tróc)***
VI.7.	Genus:	*Stegostoma Müller et Henle,* 1837
VI.10.	Species:	*Stegostoma fasciatum (Hermann, 1783)*
VII.	Family:	***Scyliorhinidae*** **(C¸ nh¸m mÌo)**
VII.8.	Genus:	*Halaelurus Gill, 1861*
VII.11.	Species:	*Halaelurus buergeri (Müller et Henle, 1841)*
VII.9.	Genus:	*Atelomycterus Garman, 1913* **(Gièng c¸ nh¸m chÊm)**
VII.12.	Species:	*Atelomycterus marmoratus (Bennett, 1830),* Coral cat shark
VIII.	Family:	***Sphyrnidae*** **(C¸ nh¸m bóa)**
VIII.10.	Genus:	*Sphyrna Rafinesque, 1810*
VIII.13.	Species:	*Sphyrna lewini (Griffth, 1834)*

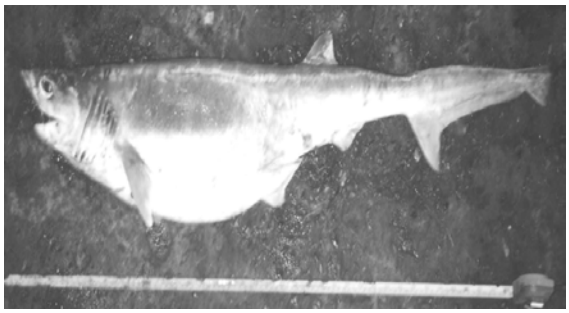


Figure 11. *Heptranchias Perlo*

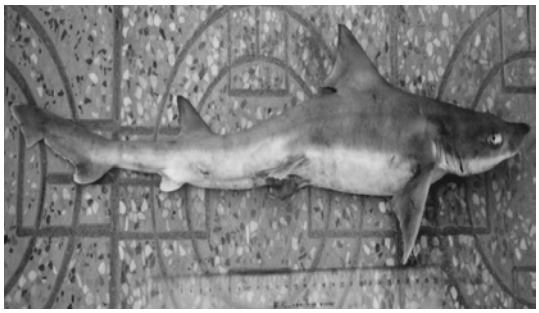


Figure 12. *Mustelus Griseus*

Figure 13. *Carcharhinus Sorrah* (Müller and Henle, 1839)*(C¸ mËp miÖng réng)* at fishing berth Con Cha, Phan Thiet

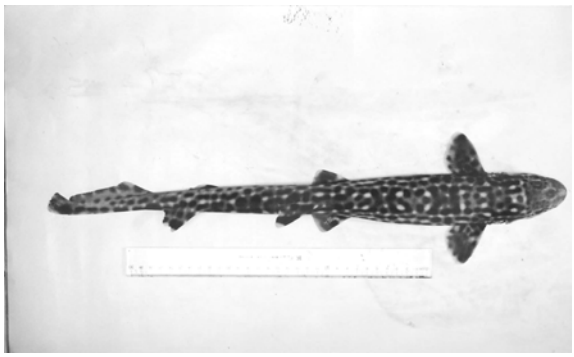


Figure 14. *Atelomycterus Marmoratus* (Bennett, 1830) *(C¸ nh¸m chÊm)* at fishing berth Con Cha, Phan Thiet

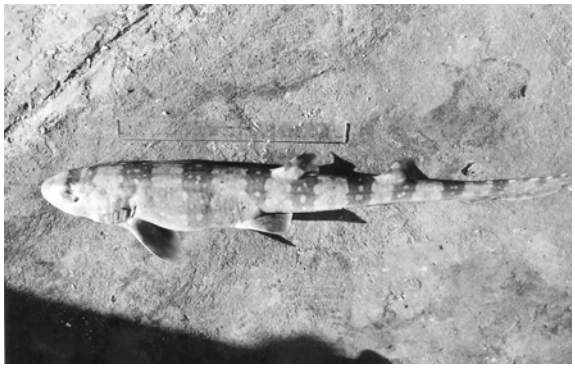


Figure 15. *Chiloscyllium plagiosum* (Bennett, 1830)*(C¸ nh¸m tróc v»n)* at fishing berth Con Cha, Phan Thiet

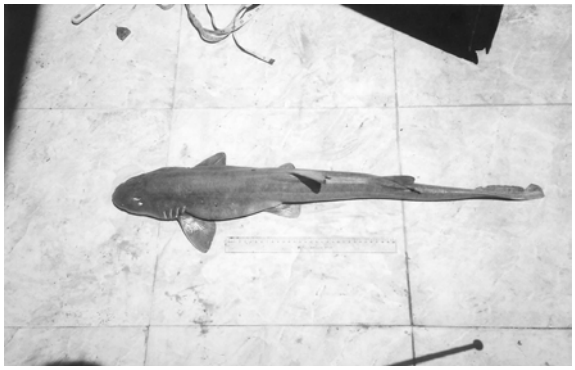


Figure 16. *Chiloscyllium griseum* (Müller and Henle, 1838)*(C¸ nh¸m chã*) at fishing berth Cat Lo – Vung Tau

Figure 17. *Heterodontus zebra (*Gray, 1831) *(C¸ nh¸m hæ)* and Chiloscyllium plagiosum (Bennett, 1830) *(C¸ nh¸m tróc v»n)* at fishing berth Cat Lo - Vung Tau

Figure 18. *Sphyrna lewini* (Griffith, 1838) *(C¸ nh¸m bóa)* at Vung Tau

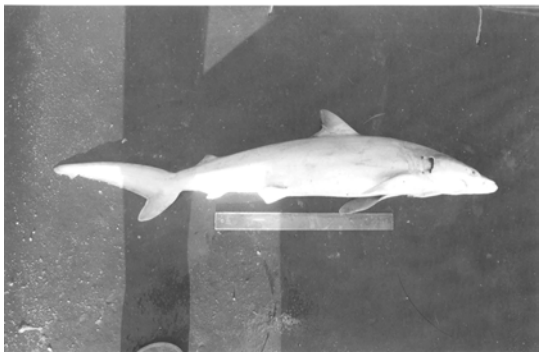


Figure 19. *Carcharhinus brachyurus (C¸ mËp ®u«i ng¾n)* at Con Cha, Phan Thiet

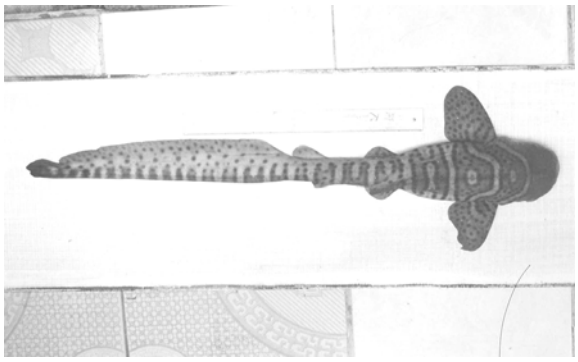


Figure 20. *Stegostoma fasciatum (C¸ nh¸m nhu m×)* at Con Cha, Phan Thiet

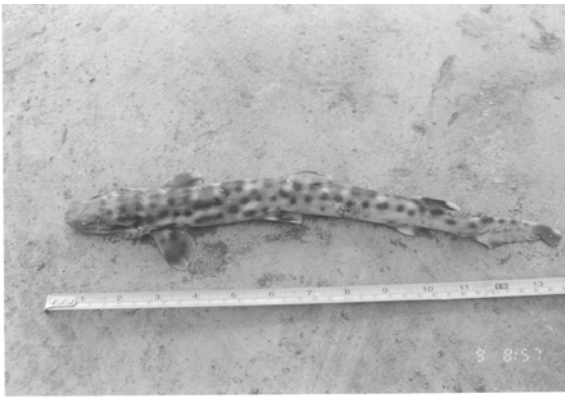


Figure 21. *Halaelurus buergeri* (Müller et Henle 1841)

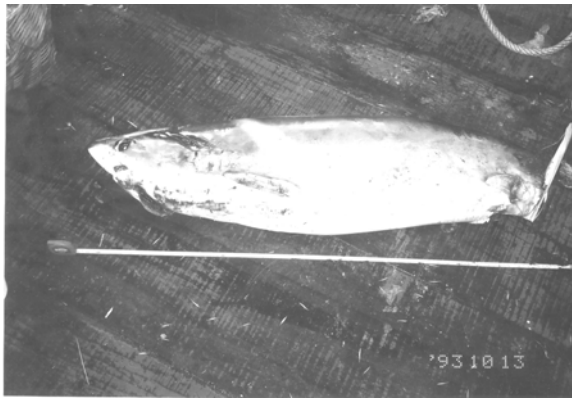


Figure 22. *Alopias pelagicus* (The fin was cut)

Figure 23. *Carcharhinus falciformis* (Müller and Henle, 1839) at Fishing Berth in Con Cha, Phan Thiet

3.4.2 Biological analysis for surveys

- **Survey No.1 (January 2004)**

Table 12. Species Composition of Shark in January 2004 Caught by Gill Net

No.	Latin name	Local name	Quantity (unit)	Volume (kg)
1	*Stegostoma fasciatum*	Nhu Mi	1	1.5
2	*Carcharhinus sorrah*	Map mieng rong	7	52
3	*Sphyrna lewini*	Nham bua	1	1.1

Table 13. Species Composition of Shark in January 2004 Caught by Trawl

No.	Latin name	Local name	Quantity (unit)	Volume (kg)
1	*Chiloscyllum plagiosum*	Truc van	12	8.05
2	*Chiloscyllum griseum*	Truc van	1	0.25
3	*Halaelurus buergeri*	Nham hoa mai	4	3
4	*Heterodontus zebra*	Nham ho, nham van	4	17

Table 14. Shark Species Composition (January) in Binh Thuan and Vung Tau

Shark species	Total sample (kg) for 2 places x 7 days	Species observed (days)	% of total sampled catch
Do not fill	Do not fill	Do not fill	
1.Stegostoma fasciatum	1.5	1	1.80
2.Carcharhinus sorrah	52	5	62.73
3.Sphyrna lewini	1.1	1	1.33
4.Chiloscyllium plagiosum	8.05	4	9.71
5.Chiloscyllium griseum	0.25	1	0.30
6.Halaelurus buergeri	3	2	3.62
7.Heterodontus zebra	17	3	20.51
Total	82.9	Do not fill	Do not fill

Table 15. Sample Species for Biological analyses from collected samples in Binh Thuan and Vung Tau (January)

Shark species	Mean length (cm)	Sex		Maturity (% in each category of maturity)
		% male	% female	
1.Stegostoma fasciatum	75	0	100	-
2.Carcharhinus sorrah	93-123	43	57	-
3.Sphyrna lewini	61	0	100	-
4.Chiloscyllum plagiosum	35-78	58	42	-
5.Chiloscyllum griseum	49	0	100	-
6.Halaelurus buergeri	59-62	0	100	-
7.Heterodontus zebra	59-81	50	50	-
See in Annx. 1 , Fig. 20 ; 13 ; 18 ; 15 ; 16 ; 21 ; 17.				

- **Survey course No.2 (March - April 2004)**

Table 16. Species Composition of Shark in March - April 2004 Caught by Trawl

No.	Latin name	Local name	Quantity (unit)	Volume (kg)
1	*Chiloscyllium griseum*	Nh¸m chã	93	164,86
2	*Chiloscyllium plagiosum*	Tróc v»n	6	1,13
3	*Stegostoma fasciatum*	Nhu m×	12	14,6

Table 17. Study on Species Composition of Shark in March - April 2004 Caught by Gill Net

No.	Latin name	Local name	Quantity (unit)	Volume (kg)
1	*Alopias pelagicus*	Nh¸m chuét	2	107
2	*Heptranchias perlo*	Nh¸m 1 v©y l-ng	1	3.8
3	*Mustelus griseus*	Nh¸m tro	1	0.5

Biological study was carried out on sex, length, volume, maturity of every individual. Number of samples to be studied is shown in the table below.

Table 18. Shark Species Composition (March - April) in Binh Thuan and Vung Tau

Shark species	Total sample (kg) for 2 places x 7 days	Species observed (days)	% of total sampled catch
Do not fill	Do not fill	Do not fill	
Chiloscyllum griseum	164.86	6	54.16
Chiloscyllum plagiosum	1.13	2	0.37
Stegostoma fasciatum	14.6	3	4.80
Alopias pelagicus	107	2	35.15
Heptranchias perlo	3.8	1	1.25
Mustelus griseus	0.5	1	0.16
Carcharhinus sorrah	12.5	1	4.11
Total	304.39	Do not fill	Do not fill

Table 19. Sample Species for Biological Study (March - April) in Binh Thuan and Vung Tau

Shark species	Mean length (cm)	Sex		Maturity (% in each category of maturity)
		% male	% female	
Chiloscyllum griseum	43-107	56	44	-
Chiloscyllum plagiosum	32-40	0	100	-
Stegostoma fasciatum	35-88	63	27	-
Alopias pelagicus	255	-	-	-
Heptranchias perlo	104.5	0	100	100 in stage 5
Mustelus griseus	55	100	0	100 in stage 2
Carcharhinus sorrah	130	100	0	100 in stage 2
See in Annx . 2 , Fig. 16 ; 15 ; 20 ; 22 ; 11 ; 12 ; 13.				

Table 20 - Number of Individuals to be Studied Biologically in 2 Survey Courses

No.	Latin name	Number of individual (unit)	
		Course No.1	Course No.2
1	*Stegostoma fasciatum*	1	38
2	*Carcharhinus sorrah*	7	1
3	*Chiloscyllum plagiosum*	12	4
4	*Sphyrna lewini*	1	
5	*Chiloscyllum griseum*	1	93
6	*Halaelurus buergeri*	4	2
7	*Heterodontus zebra*	4	
8	*Heptranchias perlo*	1	
9	*Mustelus griseus*		1
10	*Alopias pelagicus*		1
	Total	**171**	

- **Survey course No.3 (July - August 2004)**

In July 2004, the researchers made biological classification for 326 individuals of 07 species, they were:

- Carcharhinus sorrah: 301 individuals
- Chiloscyllium plagiosum: 6 individuals
- Carcharhinus falciformis: 1 individuals
- Atelomycteus marmoratus: 2 individuals
- Sphyrna lewini: 2 individuals
- Chiloscyllium griseum: 13 individuals
- Heterodontus zebra: 1 individuals

With an aim to assess development period of individuals of each species, the individuals of each species were divided by weight group for the species of much individuals, which are *carcharhinus sorrah* and *chiloseyllium griseum*. Average weight and length of the above species were calculated and shown in Tables 21 and 22.

Table 21. Average Weight and Length of *Carcharhinus Sorrah*

Group by weight (kg)	Quantity (individual)		Rate (%)		Average weight (kg)		Average body length Ls (cm)		Average total length Lt (cm)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
<1	32	21	60.38	39.62	0.82	0.85	41.47	42.21	59.77	60.21
1 ÷ 2	104	77	57.46	42.54	1.27	1.31	47.13	47.05	67.55	67.74
2.1 ÷ 4	6	2	75	25	2.65	3.33	60.42	64.0	83.25	87.25
4.1 ÷ 10	16	10	61.54	38.46	6.6	8.57	79.0	87.7	110.19	121.9
> 10	30	3	90.9	9.1	11.42	13.97	90.73	101.0	126.68	130.67

Table 21shows that:

- Rate of male fish accounts for 62.5% and female 37.5%
- Average weigh of female fish in one group is higher than male fish
- Average length of female fish in one group is larger than male fish

Table 22. Average Weight and Length of *Chiloscyllium Griseum*

Group by weight (kg)	Quantity (individual)		Rate (%)		Average weight (kg)		Average body length Ls (cm)		Average total length Lt (cm)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1 – 2	4	3	57,14	42,86	1,70	1,62	56,50	53,70	76,88	73,17
> 2	3	3	50	50	2,60	2,57	64,00	65,30	86,00	83,67

Table 22 shows that:

- Rate of male fish accounts for 53.8% and female - 46.2%.
- Average weight of male fish in one group is higher than female male fish
- Average length of male fish in one group is large than female fish

Besides 2 species which have been identified, namely *Carcharhinus sorrah* and *Chiloseyllium griseum, Chiloscyllium plagiosum* in one group have nearly the same weight and length.

Table 23. Species Composition of Sharks Caught by Gill Net in July 2004

No.	Latin name	Local name	Binh Thuan		Ba Ria – Vung Tau	
			Quantity (individual)	Volume (kg)	Quantity (individual)	Volume (kg)
1	*Carcharhinus sorrah*	C¸ mËp			125	237.77
2	*Sphyrna lewini*	C¸ nh¸m cµo			1	3.6

Table 24 - Species Composition of Sharks Caught by Trawl in July 2004

No.	Latin name	Local name	Binh Thuan		Ba Ria - Vung Tau	
			Quantity (individual)	Volume (kg)	Quantity (individual)	Volume (kg)
1	*Chiloscyllium griseum*	C¸ nh¸m chã mµu tro			13	27.15
2	*Chiloscyllium plagiosum*	C¸ nh¸m tróc v»n	6	4.95	1	3.1
3	*Heterodontus zebra*	C¸ nh¸m hæ			1	1.9
4	*Atelomycterus marmoratus*	C¸ nh¸m chÊm	1	0.43		
5	*Carcharhinus falciformis*	C¸ mËp nhän	1	80.0		

Table 25. Biological Study on Sharks in July 2004

No.	Latin name	Local name	Sex	Maturity	Full of stomach	Volume (kg)	Length (cm)	
							Ls	Lt
1	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Male	II	3	10.7	86	122
2	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Female	II	3	9.2	89	125
3	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Male	JUV	3	1.2	48	66
4	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Female	JUV	3	1.1	44	63
5	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Male	II	4	10.7	86	122
6	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Female	VI -2	3	8.3	86	119
7	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Female	VI-2	3	8.6	90	123
8	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Female	VI-2	4	8.2	86	120
9	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Male	JUV	3	1.5	45	64.5
10	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Female	JUV	2	1.3	47.5	67.5
11	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Male	II	0	1.4	48.1	70.5
12	*Carcharhinus sorrah*	C¸ mËp tr¾ng	Female	JUV	1	1.1	44	63
13	*Chiloscyllium plagiosum*	C¸ nh¸m tróc v»n	Female	V	3	1.9	57	77
14	*Chiloscyllium plagiosum*	C¸ nh¸m tróc v»n	Female	V	4	2.2	59	81
15	*Chiloscyllium plagiosum*	C¸ nh¸m tróc v»n	Female	II	3	0.18	27	38.5
16	*Chiloscyllium plagiosum*	C¸ nh¸m tróc v»n	Male	III	4	0.25	31	43
17	*Chiloscyllium plagiosum*	C¸ nh¸m tróc v»n	Male	II	3	0.15	26	36.5
18	*Chiloscyllium plagiosum*	C¸ nh¸m tróc v»n	Male	II	3	0.27	29	42
19	*Atelomycterus marmoratus*	C¸ nh¸m chÊm	Female	V	4	0.43	37	42
20	*Chiloscyllium griseum*	C¸ nh¸m chã mµu tro	Male	III	2	2.2	60	81
21	*Chiloscyllium griseum*	C¸ nh¸m chã mµu tro	Female	IV	3	2.0	58	79.5

Notes: *Ls: body length of fish; Lt: total length of fish*

In the table of biological study for the survey carried out in July 2004, the researchers analyzed 25 individuals of 4 species:

- Carcharhinus sorrah (C¸ mËp miÖng réng): 12 individuals
- Chiloscyllium plagiosum (C¸ nh¸m tróc v»n): 6 individuals
- Atelomycterus marmoratus (C¸ nh¸m chÊm): 1 individual
- Chiloscyllium griseum (C¸ nh¸m chã mµu tro): 2 individuals

Table 25 shows that:

1. Carcharhinus sorrah .
   - As for the individual of less than 2 kg, gonad has not been developed, even of male and female fishes
   - As for the individual of 8.2-10.7 kg, female fish has past reproduction period and male fish is in stage II development
2. Chiloscyllium plagiosum .
   - As for the individual of 0.15-0.27 kg, both male and female fishes are in stage II maturity
   - As for the individual of 1.9-2.2 kg, they are in stage V maturity
3. Atelomycterus marmoratus
   - As for the individual of 0.43 kg, it is in stage V maturity

4. Chiloscyllium griseum .
   - Most of individuals of ≥ 2 kg are in stage III or IV maturity

Almost of individuals analyzed in the survey in July 2004 have eaten rather fully.

Table 26. Shark Species Composition (July) in Binh Thuan and Vung Tau

Shark species	Total sample (kg) for 2 places x 7 days	Species observed (days)	% of total sampled catch
Do not fill	Do not fill	Do not fill	
Carcharhinus sorrah	237.77	9	66.25
Sphyrna lewini	3.6	1	1.00
Chiloscyllium griseum	27.15	1	7.56
Chiloscyllium plagiosum	8.05	4	2.24
Heterodontus zebra	1.9	1	0.53
Atelomycterus marmoratus	0.43	1	0.12
Carcharhinus falciformis	80.0	1	22.29
Total	358.9	Do not fill	Do not fill

Table 27. Sample Species for Biological Study (July) in Binh Thuan and Vung Tau

Shark species	Mean length (cm)	Sex		Maturity (% in each category of maturity)
		% of male	% of female	
Carcharhinus sorrah	44-90	42	58	33% in stage 2 42% in stage 4 25% in stage 6
Sphyrna lewini				
Chiloscyllium griseum	58-60	50	50	50% in stage 3 50% in stage 4
Chiloscyllium plagiosum	26-59	50	50	50% in stage 2 33% in stage 5 22% in stage 3
Atelomycterus marmoratus	37	0	100	100% in stage 5
See in Annx . 3 , Fig. 13 ; 18 ; 16 ; 15 ; 14.				

- **Survey course No.4 (November 2004)**

In the survey on shark in October and November 2004 in Binh Thuan and Ba Ria - Vung Tau, the researchers made biological study for only 63 individuals of 6 species. Biological study of these individuals was made in Phan Thiet (Binh Thuan). Biological study was not made in Ba Ria - Vung Tau because the researchers could not see sharks in landing site due to it was time of middle of lunar phase.

Biological study was made for the following species of sharks:
- *Atelomycterus marmoratus* (C¸ nh¸m chÊm):14 individuals
- *Stegostoma fasciatum* (C¸ nh¸m nhu m×): 1 individual
- *Chiloscyllium plagiosum* (C¸ nh¸m tróc v»n): 1 individual
- *Chiloscyllium griseum* (C¸ nh¸m chã mµu tro): 1 individuals
- *Carcharhinus brachyurus* (C¸ mËp ®u«i ng¾n): 1 individual
- *Carcharhinus sorrah* (C¸ mËp miÖng réng): 45 individuals

Table 28. Biological Study for Shark (November 2004)

No.	Latin name	Local name	Sex (Male,Female)	Volume (Kg)	Length (cm)	
					Ls	Lt
1	***Atelomycterus marmoratus*** (Bennett, 1830)	C¸ Nh¸m ChÊm	Female	0,67	47,0	59,0
2	-	-	Male	0,22	33,0	41,5
3	-	-	Male	0,13	27,7	35,5

4	-	-	Female	0,27	33,3	43,0
5	-	-	Female	0,17	28,0	36,0
6	-	-	Female	0,14	29,0	37,0
7	-	-	Male	0,10	25,5	32,0
8	-	-	Female	0,12	27,5	34,5
9	-	-	Female	0,11	26,7	33,6
10	-	-	Male	0,11	27,3	34.0
11	-	-	Female	0,10	25,0	31,5
12	-	-	Female	0,08	24,5	30,7
13	-	-	Male	0,05	21,2	27,2
14	-	-	Male	0,23	32,5	42,0
15	***Stegostoma fasciatum*** (Hermann, 1783)	C¸ Nh¸m Nhu M×	Male	0,84	34,0	68,7
16	***Chiloscyllium plagiosum*** (Bennett, 1830)	C¸ Nh¸m Tróc V»n	Male	0,08	20,4	28,5
17	***Chiloscyllium griseum*** (Müller and Henle, 1838)	C¸ Nh¸m Chã Mµu Tro	Male	2,35	62,5	86,0
18	***Carcharhinus sorrah*** (Müller and Henle, 1839)	C¸ MËp MiÖng Réng	Female	2,85	59,0	84,0
19	-	-	Male	2,75	57,0	82,0
20	-	-	Male	2,80	57,5	82,0
21	-	-	Male	2,80	57,0	82,5
22	-	-	Female	2,80	59,0	84,6
23	-	-	Female	2,95	59,5	85,0
24	-	-	Male	5,10	72,0	101,0
25	-	-	Male	3.40	69,0	98,0
26	-	-	Male	3,20	67,0	96,0
27	-	-	Male	2,45	54,0	73,0
28	-	-	Male	5,60	71,0	98,0
29	-	-	Male	2,35	54,0	72,5
30	-	-	Male	3,40	69,5	95,0
31	-	-	Male	2,20	58,5	80,0
32	-	-	Male	5,70	70,0	102,0
33	-	-	Female	2,85	60,0	84,5
34	-	-	Female	1,70	52,0	74,0
35	-	-	Male	11,20	91,0	123,0
36	-	-	Female	9,60	86,0	119,0
37	-	-	Male	14,00	98,0	140,0
38	-	-	Male	10,80	101,0	135,0
39	-	-	Male	11,20	96,0	129,0
40	-	-	Male	11,30	91,0	125,0
41	-	-	Female	9,50	87,0	121,5
42	-	-	Male	14,40	102,0	136,0
43	-	-	Male	14,10	96,0	131,0
44	-	-	Female	7,50	78,0	112,0
45	-	-	Female	9,50	84,0	118,0
46	-	-	Male	11,30	91,0	124,0
47	-	-	Male	2,50	55,0	73,0
48	-	-	Female	2,80	58,5	84,4
49	-	-	Male	5,50	70,0	97,0
50	-	-	Male	3,30	68,0	94,0
51	-	-	Male	5,60	70,0	101,0
52	-	-	Male	11,40	91,5	124,0
53	-	-	Male	5,70	71,0	101,0
54	-	-	Female	9,50	86,0	118,5
55	-	-	Male	11,20	91,0	122,0
56	-	-	Female	2,80	60,0	84,0
58	-	-	Male	5,10	71,0	100,0
59	-	-	Male	1,95	51,0	70,5
60	-	-	Female	1,83	49,0	68,5
61	-	-	Male	2,70	56,0	82,0
62	-	-	Male	1,65	52,0	73,5
63	***Carcharhinus brachyurus*** (Günther, 1870)	C¸ MËp §u«i Ng¾n	Male	2,47	57,0	78,0

Table 29. Species Composition Caught by Gill Net in Binh Thuan in October 2004

No.	Latin name	Local name	Quantity (individual)	Volume (kg)
1	Stegostoma fasciatum	C¸ Nh¸m Nhu M×	1	0.84
2	*Carcharhinus brachyurus*	C¸ MËp §u«i Ng¾n	1	2.47
3	*Carcharhinus sorrah*	C¸ MËp MiÖng Réng	22	111.70

Table 30. Biological analyses of Shark

No.	Latin name	Local name	Sex	Maturity	Full of stomach	Volume (kg)	Length (cm)	
							Ls	Lt
1	*Atelomycterus marmoratus*	C¸ Nh¸m ChÊm	Female	IV	3	0.67	47.0	59.0
2	-	-	Male	II	4	0.22	33.0	41.5
3	-	-	Male	I	1	0.13	27.7	35.5
4	-	-	Female	I	2	0.27	33.3	43.0
5	-	-	Female	I	4	0.17	28.0	36.0
6	-	-	Female	I	1	0.14	29.0	37.0
7	-	-	Male	II	3	0.10	25.5	32.0
8	-	-	Female	I	2	0.12	27.5	34.5
9	-	-	Female	I	2	0.11	26.7	33.6
10	-	-	Male	I	1	0.11	27.3	34.0
11	-	-	Female	I	1	0.10	25.0	31.5
12	-	-	Female	I	0	0.08	24.5	30.7
13	-	-	Male	I	1	0.05	21.2	27.2
14	-	-	Male	II	2	0.23	32.5	42.0
15	*Stegostoma fasciatum*	C¸ Nh¸m Nhu M×	Male	II	4	0.84	34.0	68.7
16	*Chiloscyllium Plagiosum*	C¸ Nh¸m Tróc V»n	Female	I	4	0.08	20.4	28.5
17	*Chiloscyllium Griseum*	C¸ Nh¸m Chã Mµu Tro	Male	III	3	2.35	62.5	86.0
18	*Carcharhinus brachyurus*	C¸ MËp §u«i Ng¾n	Male	II	1	2.47	57.0	78.0
19	*Carcharhinus Sorrah*	C¸ MËp MiÖng Réng	Female	II	1	2.85	59.0	84.0
20		-	Male	II	4	2.75	57.0	82.0
21		-	Male	I	3	2.45	54.0	73.0
22		-	Male	II	3	14.10	96.0	131.0
23		-	Female	I	2	9.50	87.0	121.2
24		-	Female	I	2	2.80	60.0	84.0
25		-	Male	II	4	3.30	68.0	94.0
26		-	Male	JUV	1	1.95	51.0	70.5
27		-	Female	JUV	1	1.83	49.0	68.5
28		-	Male	I	2	2.70	56.0	82.0
29		-	Male	JUV	1	1.65	52.0	73.5

Notes: *- Ls: body length of fish; Lt: total length of fish*

Referring to the above table of biological study on sharks made in the survey in October and November 2004 in Binh Thuan and Ba Ria – Vung Tau, 29 sharks of 4 species were analyzed.

- *Atelomycterus marmoratus* (C¸ nh¸m chÊm):14 individuals
- *Stegostoma fasciatum* (C¸ nh¸m nhu m×): 1 individual
- *Chiloscyllium plagiosum* (C¸ nh¸m tróc v»n): 1 individual
- *Chiloscyllium griseum* (C¸ nh¸m chã mµu tro): 1 individuals
- *Carcharhinus brachyurus* (C¸ mËp ®u«i ng¾n): 1 individual
- *Carcharhinus sorrah* (C¸ mËp miÖng réng): 11 individuals

The table shows that:

- *Atelomycterus marmoratus* (c¸ nh¸m chÊm) of 0.05-0.27 kg, including male and female fishes, have gonad in development of stage I and II. Only one individual of 0.67 kg is in stage IV.
- As for *Carcharhinus sorrah* (c¸ mËp miÖng réng) of less than 2 kg including both male and female individuals, their gonads have not been developed clearly. As for the individual of 2.45 kg, including male and female ones, their gonads are in stage I and II development.

Table 31. Shark Species Composition (November) in Binh Thuan and Vung Tau

Shark species	Total sample (kg) for 2 places x 7 days	Species observed (days)	% of total sampled catch
Do not fill	Do not fill	Do not fill	
Atelomycterus marmoratus	2.5	3	0.92%
Stegostoma fasciatum	0.84	1	0.31%
Chiloscyllium plagiosum	0.08	1	0.03%
Chiloscyllium griseum	2.35	1	0.87%
Carcharhinus brachyurus	2.47	1	0.91%
Carcharhinus sorrah	262.83	6	96.96%
Total	271.07	Do not fill	Do not fill

Table 32. Sample Species for Biological Study (November) in Binh Thuan and Vung Tau

Shark species	Mean length (cm)	Sex		Maturity (% in each category of maturity)
		% male	% female	
Atelomycterus marmoratus	21.2 - 47	50	50	71% in stage 1 21% in stage 2 8% in stage 4
Stegostoma fasciatum	34	100	0	100% in stage 2
Chiloscyllium plagiosum	20.4	0	100	100% in stage 1
Chiloscyllium griseum	62.5	100	0	100% in stage 3
Carcharhinus brachyurus	57	100	0	100% in stage 2
Carcharhinus sorrah	49-96	64	36	36% in stage 2 36% in stage 1 28% in stage 4
See in Annex. 4 , Fig. 14 ; 20 ; 15 ; 16 ; 19 ; 13.				

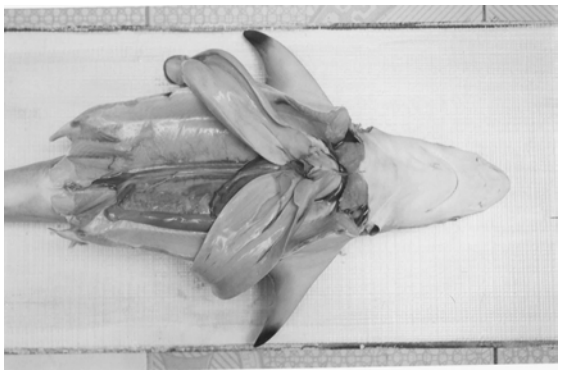


Figure 24. Biological Study for *Carcharhinus sorrah* in Phan Thiet

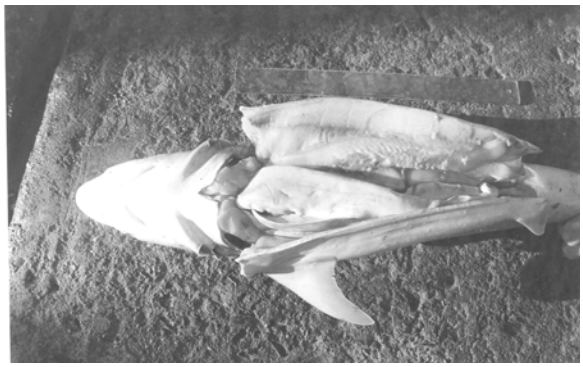


Figure 25. Biological Study for *Carcharhinus brachyurus* in Phan Thiet

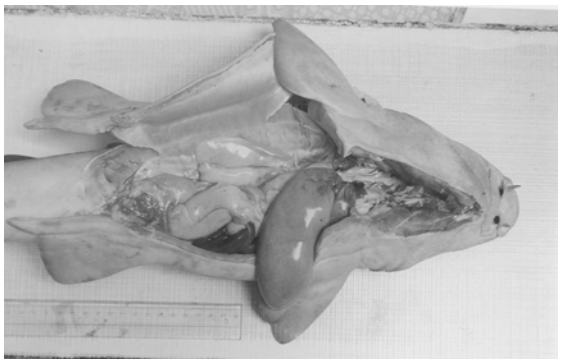


Figure 26. Biological Study for *Chiloscyllium griseum* in Phan Thiet

Figure 27. Biological Study for *Stegostoma fasciatum* in Phan Thiet

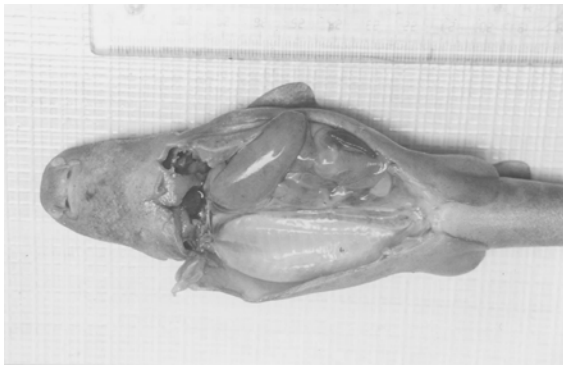


Figure 28. Biological Study for *Chiloscyllium plagiosum* in Phan Thiet

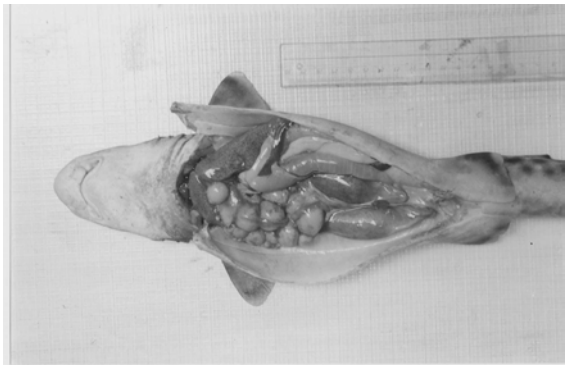


Figure 29. Biological Study for *Atelomycterus marmoratus* in Phan Thiet

4. STUDY RESULTS BASED ON SURVEY DATA OF RIMF

4.1. Species Composition

Results of surveys conducted by 10 cruises of trawl, 8 cruises of gill net and 9 cruises of hook & line and long line showed that, 38 species of cartilaginous fish that belong to 14 families have been identified in the Vietnamese waters, of which 16 species of sharks and 22 species of rays. The detailed information on species composition of the catch is shown in Table 33.

Table 33. Species Composition of Cartilaginous Fish Caught in the Vietnamese Waters

Group	Name of family	Name of Species	English name	Vietnamese name
R A Y S	Dasyatidae	*Dasyatis kuhlii*	Bluespotted stingray	Cá Đuối
		Dasyatis zugei	Pale-edged stingray	Cá Đuối
		Taeniura meyeni	Blotched fantail ray	Cá Đuối đen
	Gymnuridae	*Gymnura japonica*	Japanese butterflyray	Cá Đuối đen
		Gymnura poecilura	Longtail butterfly ray	Cá Đuối bướm hoa
		Gymnura sp.	Butterfly ray	Cá Đuối bướm
	Myliobatidae	*Aetobatus flagellum*	Longheaded eagle ray	Cá ó
		Aetomylaeus nichofii	Banded eagle ray	Cá ó
		Mobula diabolus	not known	Cá ó dơi
		Mobula japanica	Spinetail mobula	Cá Đuối dơi
		Mobula sp.	Manta	Cá Đuối dơi
	Narcinidae	*Narcine indica*	Largespotted numbfish	Cá Đuối điện
		Narcine maculata	Darkfinned numbfish	Cá Đuối điện
		Narcine sp.	Numbfish	Cá Đuối điện

		Narcine timlei	Blackspotted numbfish	Cá Đuối điện
		Narke japonica	Japanese sleeper ray	Cá Đuối điện
	Rhinobatidae	*Platyrhina limboonkengi*	Amoy fanray	Cá Đuối
		Platyrhina sinensis	Fanray	Cá Đuối đĩa Trung hoa
		Rhinobatos hynnicephalus	Angel fish	Cá Đuối lưỡi cày
		Rhinobatos schlegelii	Yellow guitarfish	Cá Đuối lưỡi cày
		Rhinobatos sp.	Guitarfish	Cá Đuối lưỡi cày
	Rhynchobatidae	*Rhynchobatus djiddensis*	Giant guitarfish	Cá Giống sao (lưỡi cày)
	Alopiidae	*Alopias pelagicus*	Pelagic thresher	Cá Nhám
	Carcharhinidae	*Carcharhinidae*	Requiem sharks	Cá Nhám
		Carcharhinus albimarginatus	Silvertip shark	Cá Nhám
		Carcharhinus dussumieri	Whitecheek shark	Cá Nhám
		Carcharhinus falciformis	Silky shark	Cá mập Mã lai
		Carcharhinus galapagensis	Galapagos shark	Cá mập
S		*Carcharhinus sorrah*	Spottail shark	Cá mập
H	Hemiscylliidae	*Chiloscyllium griseum*	Grey bambooshark	Cá Nhám trúc vằn
A		*Chiloscyllium plagiosum*	Whitespotted bambooshark	Cá Nhám trúc vằn
R		*Chiloscyllium sp.*	Carpet shark	Cá Nhám trúc vằn
K	Heterodontidae	*Heterodontus zebra*	Zebra bullhead shark	Cá Nhám hổ
S	Sphyrnidae	*Sphyrna lewini*	Scalloped hammerhead	Cá Nhám búa
		Sphyrna mokarran	Great hammerhead	Cá Nhám búa
		Sphyrna zygaena	Smooth hammerhead	Cá Nhám búa
	Squalidae	*Squalus sp.*	Piked dogfish	Cá Nhám góc
	Stegostomatidae	*Stegostoma fasciatum*	Zebra shark	Cá Nhu mỳ
	Triakidae	*Mustelus griseus*	Spotless smooth-hound	Cá Nghoéo

The Table 33 showed that:

- In the Tonkin Gulf: 23 species of cartilaginous fish of 10 different families have been identified, of which 8 species were sharks (belonging to 5 families) and 15 species of rays (of the remaining 5 families).
- In the Southeast Area: 24 species of cartilaginous fish of 12 different families have been identified: 11 species of shark s(of 7 families) and 13 species of rays of 5 remaining families.
- In the Southwest Area: 16 species of cartilaginous fish of 7 different families were found: 8 species of sharks (of 4 families) and 8 species of rays of 3 remaining families.

In conclusion, the comparison of species composition made for these waters at the same time, showed that the highest number of cartilaginous fish as well as species of sharks can be found in the Southeast area. However, the waters of the highest number of catch of rays is in the Tonkin Gulf.

4.2. Catch Per Unit of Efforts (CPUE) by Bottom Trawl

4.2.1. Shark

In the Tonkin Gulf, CPUE of the period 2001-2004 in southwest monsoon gradually decreases from 0.57 kg/h (± 1.17) in 2001 to 0.35 kg/h (± 1.01) and then to 0.34 kg/h (± 0.9) in 2003 and 2004. Change of catch by depths is not so clear. In general, catch at the depth of 30-50m exceeds an average level. (Figure 30)

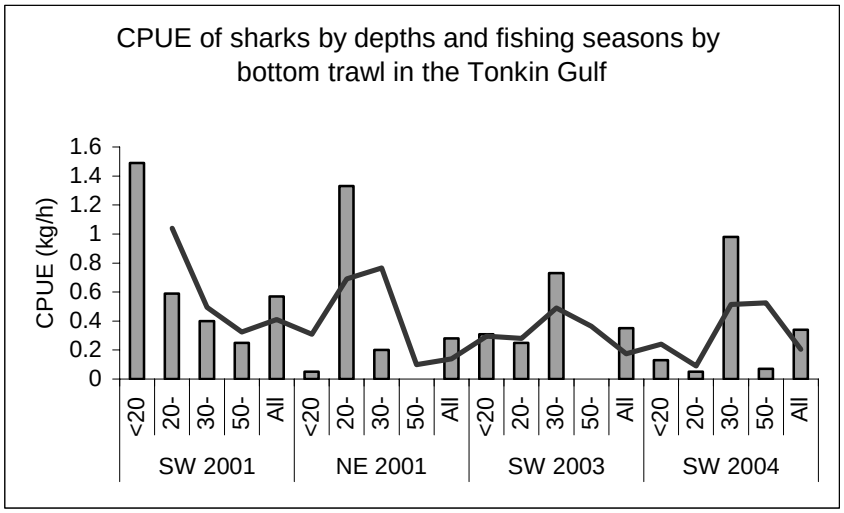


Figure 30. CPUE of sharks by depths and fishing seasons by bottom trawl in the Tonkin Gulf

In the Southeast area, CPUE by bottom trawl varies in small range. In the southwest monsoon, catch in the shallow waters (<50m) is higher than in the waters of over 50m deep. But catch in the northeast monsoon is in contrary tendency: rather high catch can be attained in the deep waters (Figure 31).

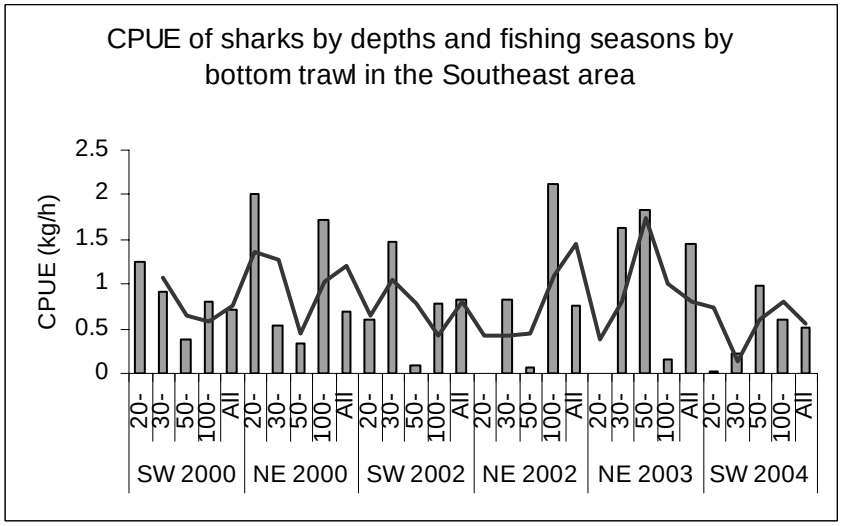


Figure 31. CPUE of sharks by depths and fishing seasons by bottom trawl in the Southeast Area

Similarly, as for the Southwest area, CPUE by bottom trawl changes inconsiderably by fishing seasons and depths (Figure 32). However, CPUE of this area (0.56 kg/h) and the Tonkin Gulf (0.385 kg/h) is lower than the one of the Southeast area (0.83 kg/h).

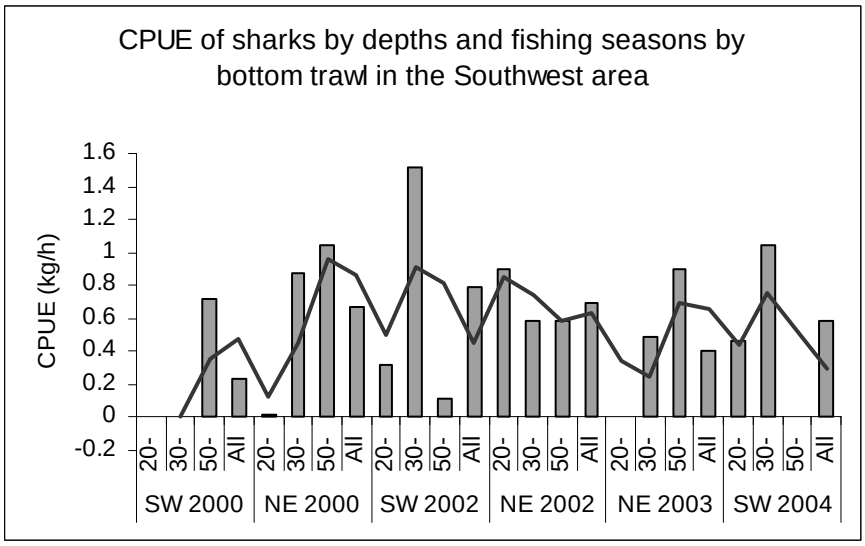


Figure 32. CPUE of sharks by depths and fishing seasons by bottom trawl in the Southeast Area

4.2.2. Rays

Comparison is made for 3 survey areas, CPUE of rays by bottom trawl in the Tonkin Gulf (Figure 33) is highest (about 2.9 kg/h) while the catch of rays in both Southeast area and Southwest area by the same kind of fishing gear is nearly the same and much lower than the catch in the Tonkin Gulf (about 1.7 and 1.75 kg/h).

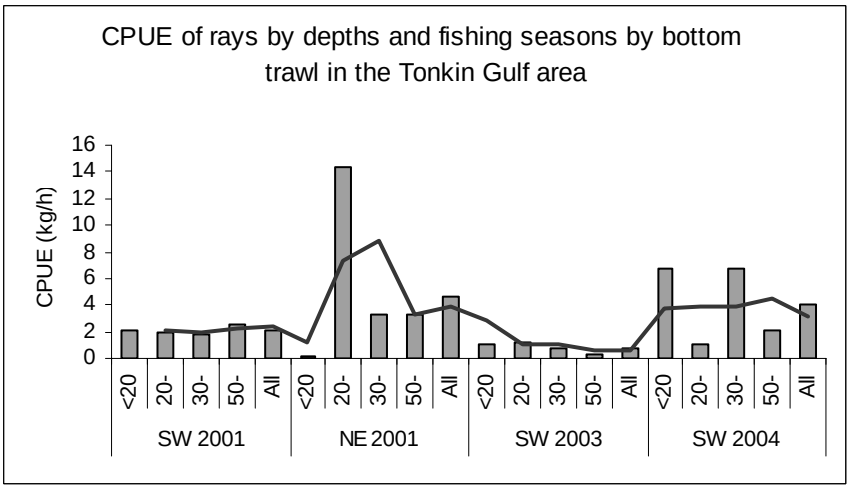


Figure 33. CPUE of ray by depths and fishing seasons by bottom trawl in the Tonkin Gulf

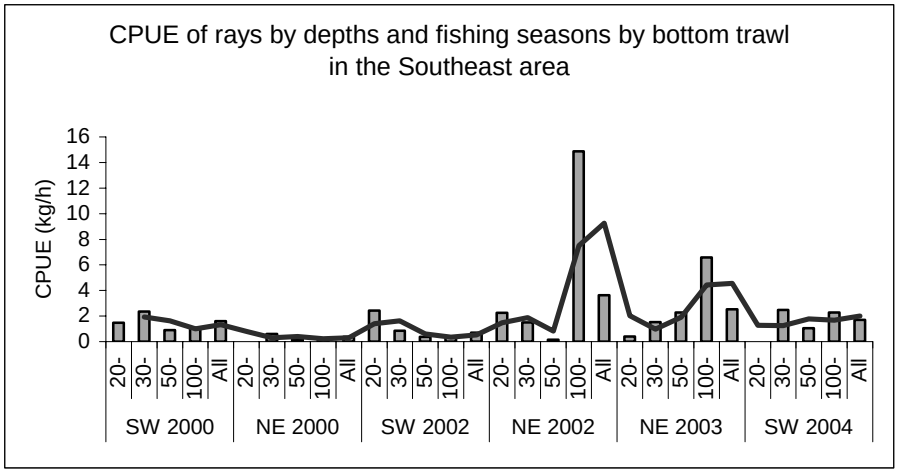


Figure 34. CPUE of ray by depths and fishing seasons by bottom trawl in the Southeast Area

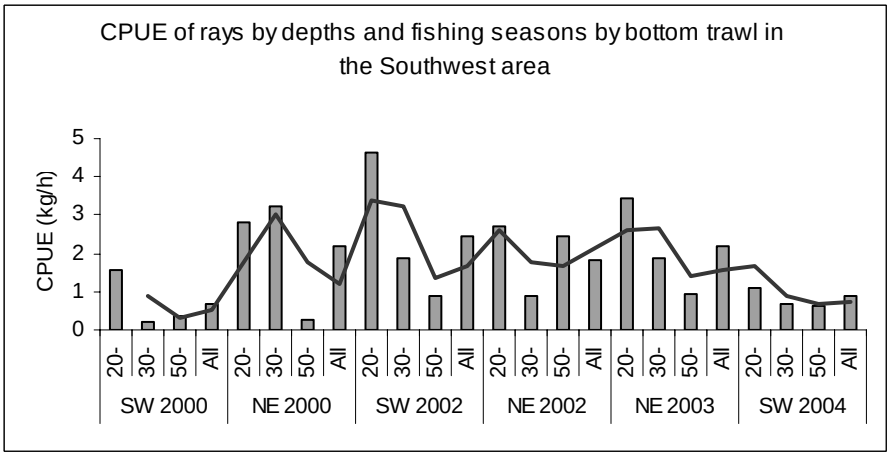


Figure 35. CPUE of ray by depths and fishing seasons by bottom trawl in the Southwest Area

4.2. Catch by Gillnet and Long line

As for gillnet fisheries, catch is in tendency to be decreased gradually in period of 2000 - 2003. The highest catch was reached in 2001 (about 0.41 kg/km) and the lowest - in 2002 (about 0.18 kg/km).

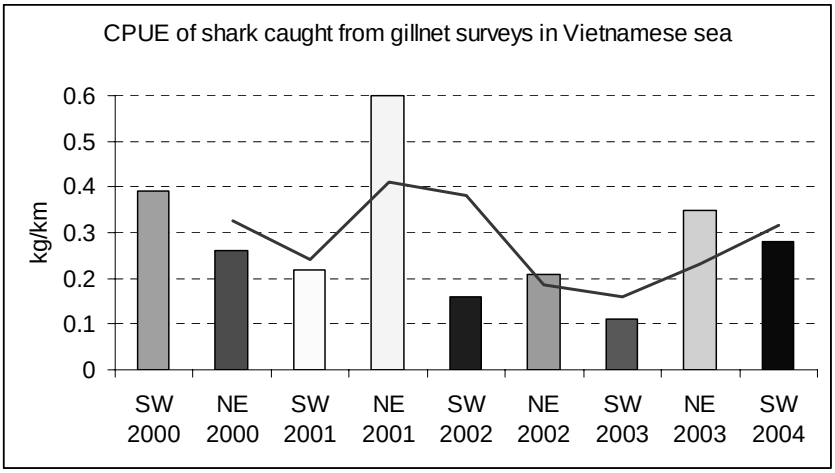


Figure 36. CPUE of shark caught from Gill Net Surveys Vietnamese Sea

Catch presents obvious seasonality. In general, catch in the northeast monsoon is higher than in the southwest monsoon. Typically, in the northeast monsoon of 2001 catch reached to 0.6 kg/km. On the contrary, the lowest catch was encountered in the southwest monsoon of 2003, about 0.18 kg/km. Particularly, in this monsoon catch decreased rather clearly in period from 2000 to 2003. And then the catch trends to be increased from 2003 to 2004.

On the other hand, mesh size affects considerably to catch. The study results show that with mesh size of 2a = 123m, the highest catch can be reached (0.56 kg/km), and with mesh size of 2a = 73 mm, the lowest catch is reached by meshsize 2a = 73 mm (about 0.04 kg/km).

As for long line fishery, CPUE of all surveys from 2000 to 2003 is about 1.5kg/100 hooks.

4.3. Percentage of Catch of Shark and Rays

In the whole Vietnamese sea area, catch of cartilaginous fish by trawl makes up 3.3% of the total catch, where catch of sharks makes up 0.72 % and rays - 2.58%.

Regarding gillnet fisheries, total catch of cartilaginous fish makes up about 13.4%. Catch of sharks makes up 1% of the total catch, while catch of rays is rather high, about 12.4%.

As for the long line fisheries, catch of cartilaginous fish hold the highest density, about 29.2%, of which sharks are dominant species (about 21.5%), catch of rays contributes only 7.7% of the total catch. Long line is considered as the main fishing gears for cartilaginous fish, especially for sharks in Vietnam. Catch percentage of sharks by fishing gears and fishing areas is as follows:

Trawl fishery:
- In the Tonkin Gulf: cartilaginous fish comprise of 3.31% of total catch, of which sharks – 0.41%, rays-2.9 %.
- In the Southeast area: cartilaginous fish comprise of 3.09 % of total catch, of which sharks-0.99% and rays-2.1%.
- In the Southwest are: cartilaginous fish comprise of 3.58% of total catch, of which sharks-0.88% and rays-2.7%.

In general, percentage of cartilaginous fish caught by trawl fishery is highest in the Southwest area and lowest in the Southeast are. However, if considering the catch of sharks only, the catch percentage in the Southeast area is highest and in the Tonkin Gulf is the lowest.

Gillnet fishery:
For gillnet fishery, with the mesh size of 2a= 123 mm catch of sharks is obtained the highest percentage (about 1.52 % of total catch) and then followed by catch of mesh-size of 2a= 150, 2a= 85 and 2a = 100 mm, the catch percentages are 1.13; 1.07; and 1.05 % respectively. The lowest catch percentage is found for the mesh size 2a=73mm (0.2 %).

5. ESTIMATION OF STANDING BIOMASS

Standing biomass estimation of sharks (Table 34) showed the declining tendency. Standing biomass of sharks in the Tonkin Gulf has been dramatically decreasing from 2001 to 2004. In the Southwest monsoon of 2002, standing biomass of sharks is estimated to be about 1068 tons and decreased in 2003, 2004 at level of 648 and 626 tons respectively.

Table 34. Standing Biomass Estimation of Sharks in the Tonkin Gulf (Ton)

			Season			
Name	Depth strata (m)	Square (km^2)	SW 2001	NE 2001	SW 2003	SW 2004
Shark	<20	13700	526	18	114	46
	20-30	16250	245	583	108	22
	30-50	20640	196	105	426	526
	50-100	16780	102			32
Shark Total			**1068**	**706**	**648**	**626**

In the Southeast area, standing biomass of sharks is estimated to be 2,473 - 5,629 tons in 2000-2004. The highest standing biomass of sharks is observed in the Southwest monsoon of 2003 and lowest in the Southwest monsoon of 2004. Standing biomass of sharks in different monsoon seasons in the Southeast area is shown in Table 35.

Table 35. Standing Biomass of Sharks by Monsoon Season/ Year in the Southeast Area (ton)

Name	Depth strata (m)	Square (km2)	Season					
			SW2000	NE2000	SW2002	NE2002	SW2003	SW2004
Shark	20-30	24640	796	1,274	372			10
	30-50	68120	1,667	885	3,275	1,638	3,016	429
	50-100	51950	503	444	111	90	2506	1,569
	100-200	27910	598	1,149	587	1,605	107	465
Shark Total			**3,565**	**3,753**	**4,345**	**3,333**	**5,629**	**2,473**

In the Southwest area, standing biomass of sharks by fishing season ranged from 518 tons in Southwest monsoon of 2000 and 1,534 tons in Northeast monsoon of 2002.

Standing biomass of sharks in the same monsoon season (Southwest monsoon) of 2002-2004 was increased from 1,531 tons (2002) to 1,061 tons (2003) and 1,002 tons (2004) (Table 36).

Table 36. Standing Biomass of Sharks by Monsoon Season, Year in the Southwest Area (ton)

Name	Depth strata (m)	Square (km2)	Season					
			SW2000	NE2000	SW2002	NE2002	SW2003	SW2004
Shark	20-30	18400		9	151	482		200
	30-50	31350		704	1296	590	408	802
	50-100	28080	518	745	84	462	654	
Shark Total			518	1459	1531	1534	1061	1002

In conclusion, standing biomass of sharks in the Southeast area was estimated highest comparing with other areas of Vietnam. The lowest standing biomass of sharks was found in the Tonkin Gulf.

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APPENDIX 2

TRADE IN SHARK PRODUCTS IN MALAYSIA, SINGAPORE AND THAILAND

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Consultant

November 2003

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1 INTRODUCTION

1.1 Background to this Study

This study is one of three related investigations, jointly undertaken by the Association of Southeast Asian Nations (ASEAN) and the Southeast Asian Fisheries Development Center (SEAFDEC), designed to document shark fisheries and trade in the region. These studies were initiated following an agreement at the ASEAN-SEAFDEC Regional Technical Consultation on Shark Fisheries held in Vientiane, Lao PDR in May 2003. This component of the study characterizes the trade in shark products while parallel studies will explore the status and trends of shark fisheries and the utilization of shark products in Southeast Asia.

In concert, these studies are intended to serve as an essential basis for developing appropriate fisheries management policies and actions, and thereby promote national and regional responsibility for marine resource management issues. Documenting and strengthening data collection and monitoring systems for shark fisheries and shark product trade in this way will facilitate implementation of national programs which underpin international policies articulated by the United National Food and Agriculture Organization (FAO) such as the Code of Conduct for Responsible Fisheries and the International Plan of Action for Sharks. Effective national management of shark resource issues is the most reliable means of ensuring sustainable harvests while supporting the local communities and industries which depend on shark products.

1.2 Scope of this Study

Although trade in shark products occurs throughout Southeast Asia, it was agreed that the scope of this study would encompass Malaysia, Singapore and Thailand in this initial stage, and that based on the results presented here, trade studies may been extended to other ASEAN countries in the future. The rationale for focusing this study on Malaysia, Singapore and Thailand was that the regional trade in shark fins, which is the most valuable of all shark-derived products, was believed to be concentrated in these three countries. In order to complement the parallel study of shark utilization, the range of products included in the present study was not limited to shark fins although the bulk of available information was expected to pertain to this product.

This report first presents an introduction to the trade in shark products which highlights the variety of useful goods derived from sharks. The remainder of the report is organized around four research questions intended to elucidate key features of the shark trade in Southeast Asia:

- **Product Sources**: What contribution do regional shark resources make to local and world shark production figures and how is excess regional demand met?
- **Trade Volume**: What is the volume of regional trade in shark products and its context in the global trade?
- **Product Disposition**: What quantities of various shark products are consumed within, as opposed to being transshipped through, the region and what factors influence regional demand?
- **Trade Characteristics**: How do the features and trends of the shark product trade differ by country and as a region from other world markets?

A combination of existing literature, statistical trade and production records, and field surveys involving trader interviews was used to address each of these research questions. Compilation and analysis was undertaken during the period September through November 2003 and thus represents the situation at that time. As is often the case with trade analyses, data sources may be incomplete or otherwise unreliable due to the protection of confidential business information as well as other factors This report attempts to provide the most accurate description of the trade based on available information, acknowledging shortcomings of the data wherever applicable. Cases of data interpretation and presentation of quantitative information are clearly

distinguished and objectively interpreted. Methodologies used in each analysis are described in the following sections.

2 OVERVIEW OF SHARK PRODUCTS IN TRADE

2.1 Introduction

The diversity of shark products is remarkable among fisheries commodities (Figure 2.1), and this range of products is matched by the exceptionally large variability in the value of the products (Vannuccini 1999). Shark meat harvested by subsistence fishermen may provide an important source of protein (Rose 1996; Joseph 1999; Almada-Villela 2002; Shehe and Jiddawi 2002), but sharks caught in more profitable fisheries, such as longliners targeting tuna or swordfish, are often considered bycatch due to the low market value of the flesh. In contrast to the relatively low value of shark meat, shark fins, particularly those from highly desirable species, are some of the most expensive food products in the world (Fong and Anderson 2002). The markets for other shark products, including skin, liver oil, cartilage, and teeth are difficult to characterize due to a lack of information and apparent instability due to frequent shifts in market demand (Rose 1996; Vannuccini 1999).

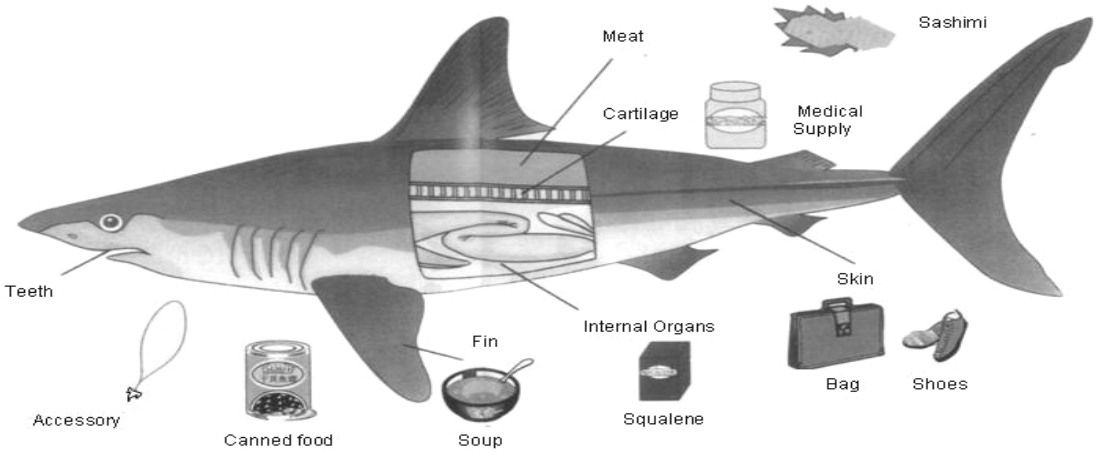


Figure 2.1 Illustration of the range of products derived from sharks.
(Figure courtesy of the Global Guardian Trust, Japan).

2.2 Shark Meat

The quality of shark meat varies both by species and according to handling practices. In developed countries, shark meat is generally sold as fillets and usually only the more desirable pelagic species, such as shortfin mako (*Isurus oxyrinchus*), common thresher (*Alopias vulpinus*), and porbeagle (*Lamna nasus*), are marketed (Vannuccini 1999). A greater variety of sharks are utilized for a greater number of products in Asia, but use of shark meat as the raw material for "fish balls" through either mechanized or manual processing is most common. Other edible shark products are derived from shark stomach (e.g. smoked thresher shark stomach in Taiwan), heart (e.g. salmon shark sashimi in Japan), or other organs. Blue shark (*Prionace glauca*) meat is often smoked, and meat from the whale shark (*Rhincodon typus*), known as the "tofu shark" in Chinese, is popular in Taiwan.

The most comprehensive source of information on production and trade in shark meat is the Food and Agriculture Organization (FAO) Production and Trade Database, 1976-2001 (FAO 2003a). This dataset provides statistics for fourteen commodity types which specifically reference shark meat although some of the categories also include rays and/or chimaeras (i.e. the elasmobranch group of fishes). Also, since shark meat products are undoubtedly sometimes

included in undefined categories of fish (i.e. fish fillets, fish meat, fish paste, fish not elsewhere indicated (nei), etc.), FAO figures for shark products are expected to underestimate the true figures (Shotton 1999). In the past decade, the combined production quantities of all elasmobranch meat products grew from approximately 57,000 mt in 1992 to over 76,000 mt in 1998, but declined to just under 63,000 mt in 2001. Reported production quantities represent between 7 and 9% of reported elasmobranch capture production in each year throughout this period. In 2001, most elasmobranch meat production was in the form of frozen sharks (64%), with 35% in the form of dried sharks, and the remainder in fresh or chilled form (Figure 2.2). In terms of trade in shark meat, Italy was consistently the world's largest importer throughout the 1990s until Spain surpassed it in 2000 and 2001 by importing approximately 14 to 16 thousand mt per annum. Spain also exports the greatest quantities of shark meat (12,377 mt in 2001).

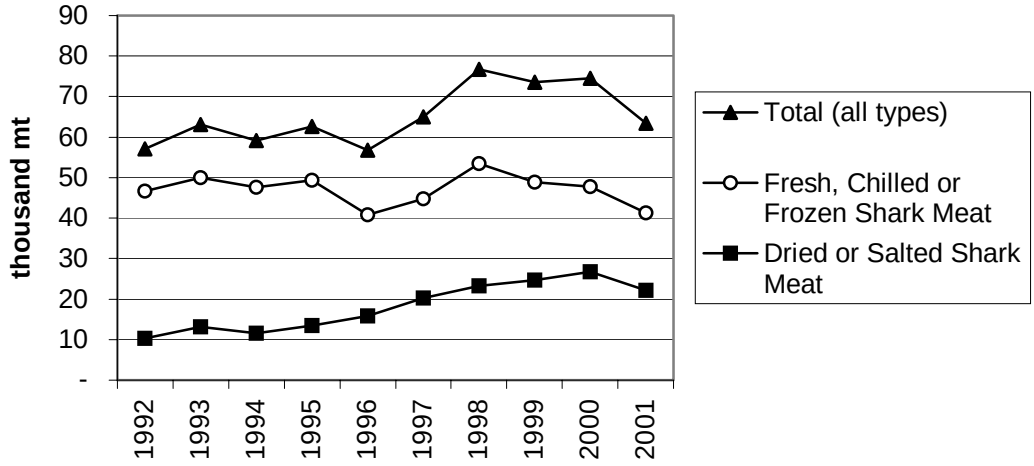


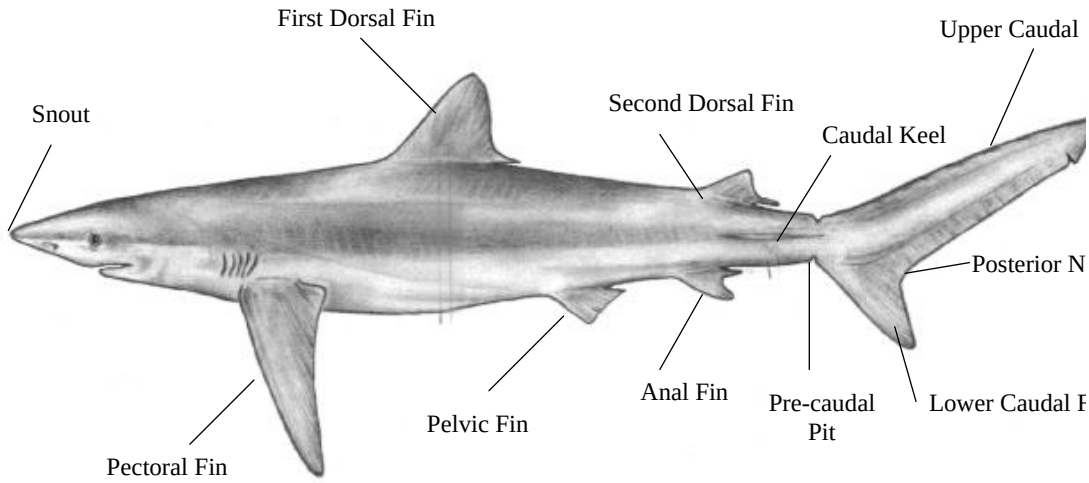
Figure 2.2 Global production of shark meat, 1992-2001 (FAO 2003a).

There is not necessarily a strong or direct relationship between production of shark meat and traded quantities, particularly when domestic consumption is high. For example, in 2001 Pakistan was the world's largest producer of shark meat (22,000 mt, all products), but none of this production was exported indicating a high domestic consumption. In contrast, although Spain reports high shark meat exports, the difference between the sum of its production plus its imports of all types of shark meat (27,492 mt in 2000), and its exports/re-exports (12,377 mt in 2001), is sufficiently large (15,115 mt) to rank it second behind Pakistan in domestic consumption (FAO 2003a).

Price information for various species of sharks was compiled under a survey of FAO's GLOBEFISH worldwide network of industry information and other sources (Vannuccini 1999). Blue sharks and threshers were the least valuable at $1.00-$1.60 and $0.49-$3.35 US per kg, respectively, whereas makos sold for $1.37-$3.62 US per kg. The most expensive shark meat in the survey was spiny dogfish originating in the United Kingdom and sold in Italy for $8.13-$9.91 US per kg (Vannuccini 1999). Chen and Phipps (2002) reported retail prices for whale shark meat of up to $17 US per kg in Taiwan.

2.3 Shark Fins

Fins command the highest price of any shark product and are utilized primarily in Chinese haute cuisine for soups and casseroles. For most species, four fins are used from each shark: the first dorsal fin, the two pectoral fins, and the lower lobe of the caudal fin (Figure 2.3). In dorso-ventrally compressed species, the two dorsal fins and the caudal fin are most valued (Kreuzer and Ahmed 1978). Other fins, including the upper caudal, second dorsal, pelvic and anal fins (if present), may also be taken but are not mixed with the other fins and command a much lower market value.



Drawing of *Prionace glauca* (blue shark) sourced from Grace (2001).

The use of a "half moon" cut to remove the fin from the shark without leaving any attached tissue is preferred by traders and commonly practiced by fishermen, particularly for higher value fins (Lai 1983, McCoy and Ishihara 1999). While fins may be sold as sets by fishermen, traders often break these sets and re-sort fins into lots by fin position and size prior to marketing. Most restaurants serving shark fin will describe the product in terms of the grade of fin (e.g. ordinary versus superior), with only specialty restaurants making note of other details such as the type of shark.

A fin's value is ultimately determined by the number and quality of ceratotrichia, or fin needles, that can be produced from it. On this basis, traders prefer certain types of fin (e.g. the lower caudal) and types of shark, as well as fins which are large, well preserved and free of urea tainting from attached meat (Rose 1996). Traders state that they classify shark fins into 30-40 different shark categories (Yeung et al. 2000, Vannuccini 1999). A recent study asked 17 Hong Kong traders to rank their preferences for seven types of shark fins (Fong and Anderson 2000). In descending order of preference the ranking was 'tiger', 'hammerhead', 'sandbar', 'blacktip', 'brown', 'blue', 'porbeagle/salmon'. The same study found that the most valuable fins were caudal, dorsal and pectoral fins, respectively. However, it also concluded that a given fin's value is a function of shark type (species), fin size and fin cut and this may explain why previous studies have produced inconsistent results and have not been able to clearly establish which shark fins are most highly sought after (Rose 1996, Anak 2002).

Definitive attribution of common names (in English or Chinese) for various types of sharks or shark fins to taxonomically distinct species or families is problematic since traders may aggregate less distinctive species into broad trade categories. A study using DNA techniques to match trade names to species and estimate species composition in the Hong Kong market found that blue shark fins comprised at least 18% of traded fins by weight whereas hammerheads (*Sphyrna* sp.) and silky shark (*Carcharhinus falciformis*) constituted at least 6% and 4% by weight, respectively. All of the other identified species were found to comprise 3% or less by weight, but all figures were considered minimum estimates as nearly half of the market could not be characterized (Clarke 2003).

Most published information on prices for shark fin consist of anecdotal data recorded in Hong Kong. Information collected in 1996 indicated that retail prices generally ranged from 166 to 564 USD per kg but that a single large fin could fetch prices of up to 846 USD per kg. Restaurants serving shark fin soup were quoted as charging from 4.50 to 90 USD per bowl

(Parry-Jones 1996). Fong and Anderson (1998) quote prices for processed fins in Hong Kong ranging from 125 to 415 USD per kg.

Identification of key supply countries or fishing fleets for shark fins is complicated by foreign (or 'third party') landings and transshipment of fins at sea. These practices serve to obscure catches from particular fisheries, since the products of different vessels or fisheries are often combined and recorded in the port of landing, regardless of location of capture. There is also confusion in existing databases regarding unprocessed and processed forms of shark fin. For example, in the FAO Production and Trade Database, the People's Republic of China (PRC) is the leading country for shark fin production in 2001 but these figures are likely to represent processed fins produced from raw materials sourced overseas. In contrast, figures from Indonesia, which in 2001 ranks second in shark fin production and first in elasmobranch capture fisheries, are likely to represent local production of raw as well as processed fins.

Countries reporting the greatest export or re-export quantities of shark fins in 2001 were, in descending order, Hong Kong, the PRC, Taiwan, Indonesia, the United Arab Emirates, the United States, Yemen and Japan and represent a mixture of producers of unprocessed fins, trade entrepôts, and processing countries. Imports are dominated by Hong Kong and the PRC to the extent that reported quantities from these two countries comprise 97% of global imports (14,046 mt) in 2001 (FAO 2003a). Singapore is also known to be a key trading center (Kreuzer and Ahmed 1978, Ferdouse 1997, Vannuccini 1999), but does not report trade in this product to FAO (see Section 4.1).

2.4 Shark Skin, Liver Oil, Cartilage and Teeth

In addition to their harvest for meat and fins, sharks are also utilized for their skin, liver oil, cartilage and teeth. The markets for these products have fluctuated over the past few decades and, based on available information, do not appear to be major components of the marine products trade. In most cases, the value of shark skin, liver oil, cartilage and teeth do not appear to be high enough to drive fishing effort on their own; they are more likely to be secondary products of sharks caught either as bycatch or as targets for higher value shark products such as fins or meat.

Untanned shark skin, known as shagreen, has historically been used as a polishing cloth, as a grip for sword hilts in Japan, and in dried or smoked form as food (Rose 1996, Vannuccini 1999). However, it was the development of a tanning process for shark skin in the United States in the 1930s which created the market for shark leather products. Shark skin boots and shoes are still produced in the United States and Mexico (Rose 1998), and India, Spain, Japan and France use shark and ray skin for handbags, wallets, watchstraps, and belts (Rose 1996, Vannuccini 1999). The handling processes for shark meat and shark skin are largely incompatible since the quality of the skin is degraded if placed in contact with freshwater or ice, or cut in the preparation of shark trunks for meat (Rose 1996). The preferred species for shark skin production appears to be the tiger shark (*Galeocerdo cuvier*) (Kreuzer and Ahmed 1978, Rose 1996) and the skin of the abundant blue shark is considered to be of low quality (Rose 1996). Another reported use of shark skin in Taiwan and Mainland China is as 'filler' material for shark fin soup. Restaurants in these countries and also other areas marketing low grade soup products reportedly scrape the denticles from the skin and finely shred it, then add it to soup servings to bulk up the shark content. FAO does not maintain production and trade figures for shark skin and the worldwide volume of trade is unknown.

The large liver oil content of sharks was heavily exploited as a vitamin A supplement in the early 1900s until the late 1940s when synthetic production of vitamin A caused the market to crash (Rose 1996, 1998). Another useful compound found within shark liver oil is squalene, although sharks that have a high squalene level tend to have a lower vitamin A content in their liver oil (Subasinghe 1998). Industrial uses of shark liver oil have included lighting oil,

machine oil, and anti-foulant hull coating but the most visible trade in shark liver oil involves its promotion as a cure for cancer (Vannuccini 1999). In addition to these labeled uses of shark liver oil, it may used as source of either vitamin A or squalene compounds which then may be used as an unidentified ingredient in various hand lotion, sunscreen, skin healing products and health foods (Subasinghe 1998). European markets for shark liver oil or squalene products appear to be growing (Subasinghe 1998). As of the mid 1990s the world's largest consumer of shark liver oil was thought to be South Korea (Rose 1996, Vannuccini 1999). However, reported domestic production in South Korea has dropped from 35 mt in 1994 to less than 2 mt in 1995-1997 and nil production thereafter. Imports have also declined from a high of 699 mt in 1991 to less than 100 mt per annum from 1997-2001 (FAO 2003a). Indonesia was known to be the major supplier of shark liver oil to South Korea (Rose 1996) but does not report any statistics for shark liver oil to FAO. It is difficult to identify preferred species, as almost any shark can be used for production of shark liver oil, although quantity and quality of the oil will vary (Rose 1996).

Much publicity was generated by claims in the early 1990s that application of concentrated shark cartilage extracts can inhibit vascularization of tumors and thereby aid in the treatment of cancer. As a result the production and sale of alternative medicine products from shark cartilage boomed (Rose 1996). Market investigation revealed that prices of shark cartilage tablets have fallen perhaps due to brand competition, and press reports disputing the benefits (Vannuccini 1999), although overall the market may be expanding (Fowler et al., in press). Production and trade of shark cartilage is not well-described (Vannuccini 1999) although the total value of the cartilage of a shark is expected to be extremely low relative to the value of the meat and fins (Rose 1996). Shark cartilage products are formed from either dried or frozen vertebrae, heads, jaws or gills, or from cartilage extracted from fins during processing (Rose 1996, Subasinghe 1998). Traders report that processing of shark cartilage into chondroitin is centered in Japan where this compound is used in eye drop formulations. While the popular literature touts 'deepsea' sharks as superior for medicinal purposes, in practice cartilage products are made from a variety of different sharks (Vannuccini 1999).

There is a minor market for shark teeth and jaws but as for cartilage, these are in most cases expected to be produced as by-products of existing fisheries. Rose (1996) reports the preferred species as mako, great white, and tiger sharks presumably due to their tooth size. The dearth of reliable statistics on shark curios may be attributable to the relatively low volume trade and a lack of businesses focusing specifically on these products.

3 PRODUCT SOURCES

The objective of this section is to present and discuss trade information relating to the source of shark products traded in Malaysia, Singapore and Thailand. The most direct means of addressing production of shark products from the waters of, or by fishing fleets based in, these countries is to study the disposition of catches landed at local fishing ports. Therefore, the parallel study on shark landings and utilization should be consulted as the primary source of domestic production information. The discussion in this section provides supplemental information on domestic production based on trade sources and can be combined with the utilization study results to present a integrated description of the supply chain. To further supplement the discussion of domestic production provided here and in the parallel report, this section analyzes import information to determine the extent to which shark products are sourced through external trade.

3.1 Sources of Shark Products within Malaysia, Singapore and Thailand

As reported in the previous chapter, world production of shark meat totaled approximately 63,000 mt in 2001, the vast majority of which was in frozen (65%) or dried, salted or in brine (35%) forms (FAO 2003a). Neither Malaysia nor Singapore reported any elasmobranch meat

production between 1976 and 2001, whereas Thailand's production was estimated at approximately 3,500 mt per annum through 1990 but was not reported in later years. The only ASEAN country to report any shark meat production in 2001 was Indonesia which recorded production of 26 mt of frozen shark meat (FAO 2003a). Within ASEAN the only countries reporting production of shark fins between 1997 and 2001 were Indonesia (200-1,200 mt per annum), Singapore (100 to 500 mt per annum) and the Philippines (10-90 mt per annum). It is not clear from the data whether these quantities refer to processed or unprocessed fins, but given Singapore's reported capture production for sharks of less than 100 mt per annum between 1997 and 2001 (FAO 2003a), Singapore's production of shark fin most likely refers to production of processed fins from imported raw product. Indonesia's reported production may be either raw fins derived from domestic landings or processed fins produced in Indonesia factories (see Section 6).

Although these figures suggest that large quantities of shark products are not originating in Malaysia and Thailand, other evidence indicates that this may not be the case. Ali and Isa (2002) report average shark landings between 1988 and 1995 of 2,280 mt per annum for Peninsular Malaysia and 3,672 mt per annum for Sarawak and Sabah, and of over 3,000 mt per annum for Thailand. FAO elasmobranch (sharks, skates and rays) capture production statistics for 2001 report figures of 25,200 mt for Malaysia and 22,000 mt for Thailand, ranking these countries tenth and thirteenth worldwide, respectively, for elasmobranch landings (FAO 2003a). As mentioned above Singapore's capture production for sharks has not exceeded 100 mt per annum for several years and thus domestic production shark products is expected to be minimal (FAO 2003a).

According to conversion factors developed by the International Union for the Conservation of Nature (IUCN) Shark Specialist Group, the carcass weight of a shark which has been headed, gutted and finned should be approximately 40% of the whole shark weight, and the fin weight should be 2% of the whole shark weight (IUCN 2003). On this basis, the landings reported by Malaysia and Thailand in 2001 should equate to approximately 10,000 mt and 8,500 mt per annum of shark meat production, and 500 mt and 175 mt, respectively of wet shark fins. It is noted, however that comparison of the ratio of elasmobranch landings to production for most countries reporting to FAO reveals a much lower level of production than would be expected on the basis of the conversion factors above. This situation may arise from separate reporting systems for landings (capture production) and production datasets in each country and/or the fact that production figures are only compiled for commodities which are processed or preserved, and thus may exclude any fresh products (FAO 2003b).

Another way of exploring national production of shark products is to examine whether there is a continuous trend of exports exceeding imports for a given commodity. According to conventional interpretation, consistently higher export figures would be expected to arise from excess domestic production. A comparison of exports to imports of shark meat (fresh, chilled and frozen forms) for Malaysia (Anon. 1998, 1999a, 2000, 2001 and 2003a), Singapore (Anon. 1999b, Anon. 2002, Anon. 2003b, Anon. 2003c), and Thailand (Anon. 2003d) from 1997 to 2002 showed only a few instances in which exports were substantially higher (i.e. >20 mt). Specifically, Malaysia's exports of frozen shark meat exceeded its imports by 92 mt in 1998, and Singapore's exports of the same product exceeded its imports by 180, 420 and 220 mt, respectively in 1997, 1999 and 2000. In the latter case, since Singapore does not produce shark meat, the surplus must arise from unreported or undisclosed imports of shark meat, or misclassification of an exported product. For shark fins, exports greatly exceeded imports only for Thailand and only in 1998 when a difference of 100 mt may have derived from domestic production.

On the whole, this comparison between imports and exports does not provide a basis for inferring large amounts of domestic production of shark products within the three studied countries. However, comparison of landings with production data for Malaysia and Thailand

suggests actual figures for shark production are not reflected in the FAO dataset. Such under- or non-reporting of production may arise from data not been reported in shark-specific categories or simply not being recorded in the statistical systems at all. This situation is common not only for most countries catching sharks, but also across a wide range of fisheries products. While this is therefore a widespread issue in fisheries statistics, further strengthening and linking of landings, production and trade databases in the Southeast Asian region would be useful in facilitating future discussions of shark utilization. It is therefore recommended that improvement of statistical systems for monitoring production be considered alongside measures to improve fishery catch statistics as discussed in the parallel study on shark fisheries and utilization.

3.2 Sources of Shark Products External to Malaysia, Singapore and Thailand

The preceding section presents evidence which suggests that an unknown, but possibly substantial, portion of the raw materials for Malaysia and Thailand's shark commodity production derives from local resources. This section explores the external sources of shark products supplying Singapore and supplementing local resources in Malaysia and Thailand. National customs statistics for imports as well as information from trade surveys are used to determine which countries are major suppliers. Only two types of shark products, meat and fins, are included in national trade statistics for Malaysia, Singapore and Thailand, therefore only these products are discussed.

Of the three countries covered in this study, Singapore has the lowest shark landings and thus relies most heavily on trade to provide supplies of shark meat. Between 1997 and 2002, Singapore reported importing between 1,000 and 2,000 mt of shark meat per annum. The majority of Singapore's frozen shark meat in whole and fillet forms (200 to 1,000 mt per annum) was supplied by the British Indian Ocean Territory, Thailand, Taiwan and Japan (Anon. 1999b, Anon. 2002, Anon. 2003b, Anon. 2003c). In recent years, South Korea and South Africa have exported substantial quantities of frozen shark meat (>100 mt per annum) to Singapore. Considerably lesser quantities of fresh shark meat in whole and fillet forms are imported to Singapore (<170 mt per annum) and most is sourced from Malaysia and Thailand.

The preceding discussion of imports to Singapore is based on official statistics released by the Singapore government which, for reasons of policy, do not include imports from Indonesia. In order to assess whether shark meat imports from Indonesia would substantially effect the overall tally of Singapore's imports, data for shark products exported from Indonesia to Singapore was compiled from Indonesian government sources (Anon. 2003e). From 1997 to 1999, Indonesian exports of frozen shark meat to Singapore were less than 1 mt per annum, but in more recent years quantities have totaled 50 mt in 2000 and approximately 8 mt in 2001 and 2002. Nevertheless, on this basis, Indonesia does not meet the criteria established above for major suppliers of shark meat.

Although Malaysia and Thailand's shark meat imports are low relative to Singapore's imports, these countries' trade is similar in focusing primarily (>97% in each year) on frozen rather than fresh forms. Import statistics for 1997 through 2002 show that Malaysia usually imports 10 to 70 mt of frozen meat per annum, whereas Thailand's import volumes are higher and generally range from 110 to 320 mt per annum. Major suppliers (>20 mt in a single year) to Malaysia between 1997 and 2002 include Indonesia, New Zealand, Singapore and Spain. Major suppliers to Thailand (>100 mt in a single year) during the same years are the United States and Canada. For both Malaysia and Thailand, the absence of commodity codes specifically for frozen fins may result in some frozen shark fins being declared as frozen shark meat. While this is suggested by the declared value of some shipments of frozen shark meat, it cannot be verified on the basis of existing information.

Similar to the situation for shark meat, Singapore obtains most of its shark fin supplies through imports. When examining the sources of unprocessed shark fins imported by Singapore, it is important to note unprocessed frozen fins are tallied as prepared shark fin in published statistics. Therefore the following discussion is based on both the dried shark fin and prepared shark fin import statistics (Anon. 1999b, Anon. 2002, Anon. 2003b and Anon. 2003c). Between 2000 and 2002, Singapore imported 600 to 1,500 mt per annum of dried and frozen shark fins from 63 countries. Major suppliers (>90 mt per annum, dried or frozen) to Singapore during this period included the British Indian Ocean Territory (frozen and dried), Hong Kong (dried), Spain (frozen), India (dried), Taiwan (dried), Costa Rica (frozen) and Yemen (dried). Records also indicate between 60-90 mt per annum of frozen fins were imported from the United Kingdom in 2000-2002. Traders indicate that substantial quantities of shark fins derive from Indonesia but quantities are not disclosed in official statistics. Export records from Indonesia showing quantities of dried shark fins shipped to Singapore are given in Table 3.1. When added to the official Singapore imports of shark fin, the quantities in Table 3.1 represent 7 to 29% of Singapore's total imports, but according to information reviewed as part of this study, these figures are likely to under-represent the true quantity of shark fins in trade between these two countries.

Table 3.1 Indonesian exports of shark fins to Singapore, 1997-2002 (Anon. 2003e).

	1997	1998	1999	2000	2001	2002
Shark Fins, Dried (mt)	369	93	155	172	73	164

Thailand imports smaller quantities of shark fins (100-200 mt per year)and sources imports from a smaller number of countries: 20-25 countries per annum supplied shark fin to Thailand between 1997 and 2002(Anon. 2003d). In 1997 and 1998 approximately 70% of Thailand's imports were sourced from Hong Kong, and Hong Kong remained the major supplier through 2002. This finding is consisting with the statement in Ferdouse (1997) that as of the mid 1990s Thailand was receiving medium and low grade unprocessed fins from Hong Kong for the manufacture of ready-to-eat consumer packs. Based on more recent statistics from Hong Kong (Anon. 2003f), both processed and unprocessed forms of shark fins are shipped to Thailand in approximately equal proportions (i.e. if unprocessed fin weights converted to their processed equivalents using a factor of 0.35, the amount is nearly equivalent to the exports of processed fin; Clarke 2003). Between 1999 and 2001 Thailand's sources of shark fin diversified as the proportion of imports from Hong Kong decreased and supplier countries such as Canada, Argentina, and India began contributing over 10 mt per annum. In 2002, China became Thailand's second largest supplier (19 mt) contributing 32% of annual imports.

Malaysia imports even smaller quantities of shark fins (50-125 mt per annum) and from a smaller number of countries (8-14 per annum) than Thailand (Anon. 2003a). Malaysia's largest and most consistent external supplier of shark fin (> 15 mt dried or 'salted' per annum) between 1997 and 2002 was Indonesia. Interviews with Malaysian traders indicated that Sumatra was the primary source of their shark fins and that there are processing operations based there. Singapore was Malaysia's largest supplier in 1997, contributing over 55 mt of dried fins, but imports from Singapore have declined annually since then and dropped below 10 mt per annum in 2001 and 2002. A preference for importing from Singapore may arise from favorable tariff rates for trade within ASEAN countries (Ferdouse 1997), although higher costs associated with using Singapore as a transshipment point (e.g. Singapore's 5% Goods and Service Tax) may erode this advantage. In addition to Indonesia and Singapore, countries supplying over 10 mt in any one year to Malaysia included Mauritius (11 mt in 1997), Hong Kong (10 mt in 1997, 16 mt in 2000), Chile (14 mt in 1998), Spain (44 mt in 1999), and China (24 mt in 2001). India was also considered a major supplier by two of the Malaysian traders interviewed for this study.

Information on external sources of shark products for Malaysia, Singapore and Thailand is summarized in Figure 3.1. Singapore represents a key regional trading hub, receiving meat and

fins from a large number of countries. In contrast, Malaysia's external sources for shark meat and fins are more limited to its close neighbors (Indonesia and Singapore), while Thailand is more likely to obtain shark fins from Hong Kong and China and shark meat from North America.

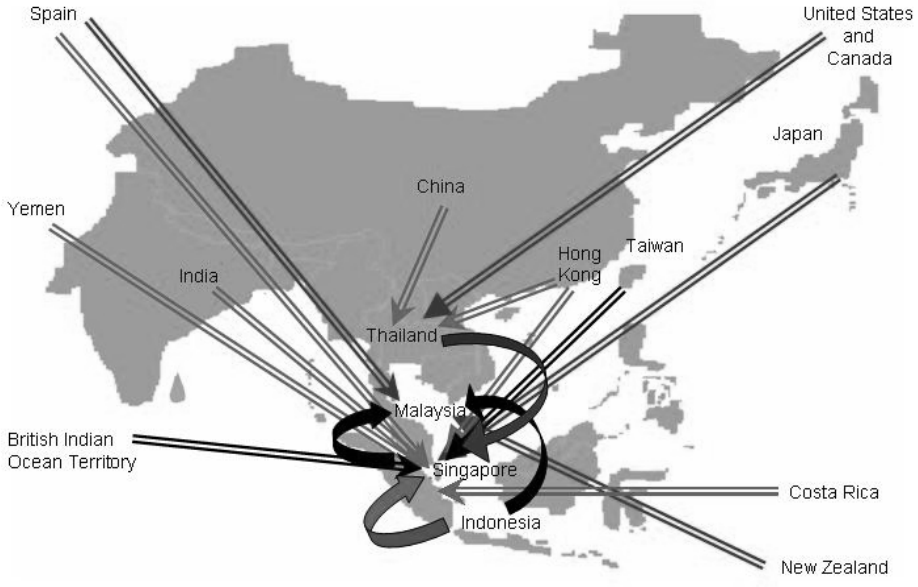


Figure 3.1 Major suppliers of shark meat and fins to Malaysia, Singapore and Thailand. Red arrows indicate shipments of meat, blue arrows indicate shipments of fins and black arrows indicate shipments of both meat and fins. Curved arrows represent trade within ASEAN whereas straight arrows represent non-ASEAN trade. Criteria for 'major suppliers' vary for Malaysia, Singapore and Thailand and are given in the text.

4 TRADE VOLUMES

This section assesses the total volume of trade in shark products transiting Malaysia, Singapore and Thailand using an international trade database for fisheries products (FAO 2003a). The analysis focuses on comparing reported trade volumes between the three countries and other countries participating in the trade. Subsequently, and where possible, reported quantities are adjusted for double counting and product form (e.g. water content) in order to provide an more accurate estimate of the world trade and each country's share. Based on the availability of national trade records, this discussion is again limited to shark meat and shark fins.

4.1 Global Comparison of Trade Volumes

The only standardized global dataset of trade volumes in fisheries commodities is the FAO Commodities Production and Trade Database (FAO 2003a). Despite shortcomings associated with product aggregation, and under- and non-reporting (see Section 2), this dataset provides the best basis for comparison between all countries trading in shark products[1]. The database includes import and export data for 14 categories of chondrichthyan (shark, skate, ray and chimaera) meat, two categories of shark fins and two categories of shark liver oil. (The

[1] For consistency, figures cited for Malaysia, Singapore and Thailand in this section are those given by FAO, rather than those given by national customs authorities, but any inconsistencies are noted.

database also includes production data which were discussed in Section 3). Of these 18 shark product categories, Malaysia, Singapore and Thailand only report trade in three to FAO: 'sharks, frozen', 'sharks, fresh or chilled' and 'shark fins, dried, salted, etc'.

Given the potential for overlap in the FAO commodity categories (e.g. 'sharks, frozen'; 'shark fillets, frozen'; 'sharks, rays, chimaeras, nei frozen'), in order to avoid excluding similar products reported in slightly different categories when comparing at a global level it is necessary to group chondrichthyan meat products into subsets. For this reason, the 14 categories of chondrichthyan meat were divided into frozen, fresh/chilled and dried subsets, and the frozen and fresh/chilled commodity subsets were tallied for each of the three target countries, the ASEAN member states, the Asian continent and worldwide. The dried meat subset was excluded on the basis that none of the three target countries report trade in this commodity.

The results for 1992 through 2001 show that imports and exports of fresh or chilled chondrichthyan meat by Malaysia and Thailand are either not reported or nil in most years (Table 4.1). Imports of fresh or chilled meat to Singapore account for nearly all of the ASEAN reported imports but overall ASEAN imports comprise only 20% of Asian reported imports. Exports of fresh or chilled meat from Malaysia, Singapore and Thailand, though very limited, similarly account for most of the ASEAN exports, with the notable exception of 1998, and again ASEAN exports are a small portion of reported Asian exports (<2%). Overall, imports and exports of fresh or chilled shark meat by Asian countries are negligible in comparison to global trade volumes (Table 4.1).

Malaysia, Singapore and Thailand report greater quantities of chondrichthyan meat in frozen form than in fresh or chilled form, but the sum of this trade is still low (<4%) when compared to global totals (Table 4.1). Imports to these three countries comprise nearly all of ASEAN imports of frozen meat. Exports of frozen meat by ASEAN countries in the early 1990s were not dominated by Malaysia, Singapore, and Thailand but since 1998 these three countries' share has increased, and as of 2001 these countries' exports comprised 98% of ASEAN exports. ASEAN trade in frozen shark meat constitutes 13 to 34% of Asian imports and 18 to 85% of Asian exports, respectively. Asian imports and exports total approximately one sixth to one third of the global trade in frozen meat between 1992 and 2001[2].

Import and export of shark fins was assessed by summing the quantities given in the FAO database for 'shark fins, dried, unsalted' and 'shark fins, dried, salted, etc.' for each of the regions of interest (Table 4.2). Shark fin data from Singapore has not been reported to FAO since 1996[3] therefore the usefulness of the database in assessing regional contributions to the trade for these years is limited. Nevertheless, from 1992 through 1996 Singapore dominated ASEAN imports (60-80%) and contributed 45-65% of ASEAN exports. During these years, ASEAN imports represented only 10-20% of Asian imports, with the majority of imports recorded by Hong Kong and China. ASEAN countries played a larger role in shark fin exports contributing 40-70% of all exports recorded by Asian countries. Given the concentration of the market for shark fins in Asia, it is not surprising that Asian imports account for almost all global imports. Asian exports of shark fins are also high compared to global totals (80-90%) but as discussed in Section 2.3 this is believed to result from a combination of producers, trade

[2] As discussed in Section 3.2, the possibility that frozen shark fins are reported as frozen shark meat, particularly in countries which do not offer a commodity code specific to frozen shark fins, is noted but cannot be investigated further given existing information.

[3] Singapore is not a member of FAO and therefore it is not required to provide its trade data to FAO on a free-of-charge basis. Singapore's policy is to charge for all data reported in the 9-digit classification system which identifies shark fin as a separate commodity (pers. comm., A. Crispoldi, Senior Fishery Statistician, Fisheries Information, Data and Statistics Unit, FAO, Rome, Italy, October 2003). Sinagpore's import/export trade data on shark fins are however available to the public for purchase from the Singapore Trade Connection 1996-1998 and 1999-2001 CD-ROM.

Table 4.1 Import and export quantities in metric tonnes for chondrichthyan meat products, 1992-2001 (FAO 2003a).

		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Sum '92-'01
Shark Meat (Fresh or Chilled)												
Imports	Malaysia	na	na	na	na	na	na	na	na	na	na	-
	Singapore	na	na	na	85	66	52	33	24	103	108	471
	Thailand	na	0	22	na	0	0	0	0	0	0	22
	Subtotal	*na*	*na*	*22*	*85*	*66*	*52*	*33*	*24*	*103*	*108*	*493*
	ASEAN	na	0	22	85	66	52	33	24	103	108	493
	Asia Region	2	6	117	161	160	482	210	246	477	542	2,403
	Global	5,979	5,605	6,775	6,254	7,285	6,660	6,631	5,728	8,653	9,839	69,409
Exports	Malaysia	na	na	na	na	na	na	2	0	0	0	-
	Singapore	na	na	na	2	10	0	11	0	0	0	23
	Thailand	na	na	na	18	0	0	0	0	0	10	28
	Subtotal	*na*	*na*	*na*	*20*	*10*	*0*	*13*	*0*	*0*	*10*	*51*
	ASEAN	na	na	na	20	10	0	258	0	1	10	299
	Asia Region	597	1,374	1,402	1,914	1,472	1,208	1,475	1,602	1,615	3,162	15,821
	Global	7,953	10,575	13,195	11,784	12,836	11,279	13,135	11,874	13,562	15,522	121,715
Shark Meat (Frozen)												
Imports	Malaysia	27	24	41	36	20	28	77	23	21	18	315
	Singapore	na	na	na	1,401	954	1,326	1,473	1,443	1,447	1,793	9,837
	Thailand	531	462	614	390	415	316	114	187	210	166	3,405
	Subtotal	*558*	*486*	*655*	*1,827*	*1,389*	*1,670*	*1,664*	*1,653*	*1,678*	*1,977*	*13,242*
	ASEAN	558	486	655	1,827	1,391	1,670	1,664	1,654	1,681	1,994	13,580
	Asia Region	3,733	3,486	4,149	6,831	6,263	6,701	4,957	6,826	12,190	11,261	66,397
	Global	19,366	20,495	21,413	28,972	29,907	32,940	37,980	36,864	46,522	63,551	338,010
Exports	Malaysia	48	8	23	34	28	35	126	28	1	0	331
	Singapore	na	na	na	1,870	1,624	1,566	1,450	1,860	1,671	1,415	11,456
	Thailand	70	0	102	3	198	na	0	95	0	103	571
	Subtotal	*118*	*8*	*125*	*1,907*	*1,850*	*1,601*	*1,576*	*1,983*	*1,672*	*1,518*	*12,358*
	ASEAN	3,184	8,301	5,491	10,156	2,640	3,955	3,044	2,382	1,813	1,544	42,510
	Asia Region	5,750	9,761	7,237	12,666	5,323	7,156	6,337	6,586	7,488	8,586	76,890
	Global	19,937	23,935	20,979	33,142	27,899	34,862	37,665	35,059	43,845	42,629	319,952

Notes:
ASEAN countries include Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam.
The Asia regional total is based on the FAO-defined set of Asian countries.

Table 4.2 Import and export quantities in metric tonnes for shark fins, 1992-2001 (FAO 2003a).

		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Sum '92-'01
Shark Fins (Dried, Salted or Unsalted)												
Imports	Malaysia	221	165	238	123	396	122	90	132	57	72	1,616
	Singapore	1,066	1,133	1,230	983	931	na	na	na	na	na	5,343
	Thailand	60	100	127	137	138	83	42	98	66	81	932
	Subtotal	*1,347*	*1,398*	*1,595*	*1,243*	*1,465*	*205*	*132*	*230*	*123*	*153*	*7,891*
	ASEAN	1,352	1,401	1,597	1,249	1,480	303	252	233	256	198	8,321
	Asia Region	10,467	9,980	10,830	8,713	13,836	13,409	12,864	13,464	16,581	13,992	124,136
	Global	10,809	10,234	11,005	8,885	13,937	13,505	12,940	13,528	16,669	14,046	125,558
Exports	Malaysia	2	30	18	22	21	31	22	46	10	9	211
	Singapore	977	869	1,042	871	797	na	na	na	na	na	4,556
	Thailand	18	22	35	61	27	79	139	39	70	61	551
	Subtotal	*997*	*921*	*1,095*	*954*	*845*	*110*	*161*	*85*	*80*	*70*	*5,318*
	ASEAN	1,524	1,514	1,751	1,756	1,827	820	392	738	1,246	549	12,117
	Asia Region	3,670	3,800	3,834	2,627	4,873	3,941	3,564	4,025	5,353	3,883	39,570
	Global	4,262	4,416	4,403	3,408	5,421	4,352	4,266	4,524	6,049	4,551	45,652

Notes:
ASEAN countries include Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam.
The Asia regional total is based on the FAO-defined set of Asian countries.
Although not contained in FAO database, Singapore's shark fin import & export quantities for 1997-2001 can be found in Table 4.3 under 'Fins, dried' of this report.

entrepôts, and processors located within Asia, and does not necessarily suggest that all shark products derive from Asian waters.

These comparisons have highlighted the importance of Singapore as an entrepôt for trade in shark products despite the absence of Singapore trade data in the FAO database since 1996. In many of the years examined, Singapore dominated reported ASEAN imports and exports of shark meat products, but these quantities represented only a small portion of global trade. For years in which its figures were reported (1992-1996) Singapore also dominated ASEAN shark fin imports and exports, and in contrast to the shark meat trade, Singapore's trade quantities are large relative to global totals. The role of Malaysia and Thailand in the shark meat and fin trade in recent years, both within ASEAN and globally, appears to be small based on reported figures.

4.2 Detailed Analysis of Trade Volumes in Malaysia, Thailand and Singapore

As illustrated by the preceding discussion, gaps in the data for the countries of interest (e.g. some meat data for Malaysia and some fin data for Singapore) limit the ability to draw definitive conclusions about the volume of trade in these countries. In addition, the commodity categories used the FAO dataset do not distinguish between processed and unprocessed, and wet and dry, forms of shark fins and thus will not necessarily provide an accurate picture of trade volumes. For these reasons, this section uses national customs data for the three countries to characterize trends in trade by each product reported in the national databases.

4.2.1 Malaysia

Malaysia's customs data for two forms of shark meat (fresh and frozen) and three forms of shark fins ('shark fins, dried, whether or not salted but not smoked', 'shark fins, salted but not dried or smoked and in brine' and 'shark fins') are shown in Table 4.3 (Anon. 1998, Anon. 1999a, Anon. 2000, Anon. 2001, Anon. 2003a). Exports of domestic goods and re-exports of transshipped goods are combined into a single export figure for each product in each year. According to Chen (1999) the first and second categories represent dried shark fin and the third category is the simplified name for a former commodity code describing prepared shark fin. In accordance with Chen (1999), and given that the third commodity code begins with the prefix '1604' indicating a processed product, this category is assumed to contain processed shark fin in either wet or dry form. Furthermore, despite the possibility that frozen fins may be classified as frozen shark meat (see Section 3.2), the second category (i.e. 'salted') is assumed to contain frozen fins. This is for two reasons: 1) the presence of frozen shark fins exported from Singapore and imported to Malaysia is confirmed by the Singapore statistics (Anon. 2003c); and 2) a similarly labeled commodity category in Hong Kong (i.e. 'salted') is used refer to frozen fins (Clarke and Mosqueira 2002). Assuming frozen fins weigh four times as much as the equivalent dried quantity (Clarke 2003) requires that recorded imports or exports of unprocessed frozen fins be divided by four before being added to unprocessed dried fin weights.

Fresh and frozen shark meat products can be summed without adjustment as both products are assumed to have a similar water content and thus are already standardized. The fresh shark meat trade data given in Table 4.3 confirms that the unreported FAO data for imports and export of fresh shark meat (Table 4.1) is in fact negligible, and the frozen shark meat trade data (Table 4.3) is broadly consistent with the frozen meat data reported by FAO (Table 4.1). Comparison between the Malaysia national data and FAO data for shark fin trade also indicates a close match. However, it is not clear whether only fins in the 'dried' category are reported to FAO since between 1997 and 2001 the majority of Malaysia's traded fins were in this category. Once FAO figures for 2002 become available, a comparison for this year will indicate whether fins recorded in the 'salted' category are compiled since 2002 is the first year in which 'salted' fins were imported and exported in substantial quantities (Table 4.3).

Table 4.3 National import and export statistics for shark meat and fins in metric tonnes, 1997-2002.

Country	Product Form	1997	1998	1999	2000	2001	2002
Imports							
Malaysia	Meat, Fresh	<0.1	0	0	0	0	0
	Meat, Frozen	28	66	23	21	16	12
	Meat, Reported Total	28	66	23	21	16	12
	Fins, Dried	122	87	101	56	65	28
	Fins, Salted	0.2	0	0	1.2	0.8	35
	Fins, Prepared	1.7	0.6	4	0.1	0.4	2
	Fins, Reported Unprocessed Total	122	87	101	57	66	63
	Fins, Adjusted Unprocessed Total	122	87	101	56	65	37
Singapore	Meat, Fresh	52	34	24	102	109	140
	Meat, Frozen	1,334	1,482	1,443	1,448	1,792	1,519
	Meat, Reported Total	1,386	1,516	1,467	1,550	1,901	1,659
	Fins, Dried	820	538	692	629	507	632
	Fins, Prepared	72	48	402	541	406	784
	Fins, Reported Unprocessed Total	892	586	1,094	1,170	913	1,416
	Fins, Adjusted Unprocessed Total	838	550	793	764	609	828
	Fins, Adjusted plus Indonesian exports	1,207	643	948	936	682	992
Thailand	Meat, Fresh	0	0	0	0	0	0
	Meat, Frozen	316	114	187	210	166	164
	Fins, Dried	83	42	98	66	81	60
Exports							
Malaysia	Meat, Fresh	0	4	0	0	0	0
	Meat, Frozen	35	158	32	12	7	25
	Meat, Reported Total	35	162	32	12	7	25
	Fins, Dried	31	29	50	15	7	7
	Fins, Salted	0.3	0.6	0.6	0.3	1	9
	Fins, Prepared	0	12	0.6	5	1	4
	Fins, Reported Unprocessed Total	31	30	51	15	8	16
	Fins, Adjusted Unprocessed Total	31	29	50	15	7	9
Singapore	Meat, Frozen	1,516	1,455	1,860	1,670	1,416	974
	Fins, Dried	593	406	581	548	447	613
	Fins, Prepared	24	44	164	419	180	377
	Fins, Reported Unprocessed Total	617	450	745	967	627	990
	Fins, Adjusted Unprocessed Total	599	417	622	653	492	707
Thailand	Meat, Fresh	0	0	<1	0	10	104
	Meat, Frozen	<1	0	95	0	103	7
	Meat, Reported Total	<1	0	95	0	113	111
	Fins, Dried	78	139	39	71	61	34

4.2.2 Singapore

Singapore publishes shark meat in two categories ‘dogfish and other sharks frozen excluding livers and roes’ and ‘dogfish and other sharks fresh or chilled excluding livers and roes’, but has reported no exports in the latter category since 1997 (Anon. 1999b, Anon. 2002, Anon. 2003b, Anon. 2003c). Quantities of traded shark meat reported in Table 4.3 for Singapore closely match those given by FAO for Singapore in Table 4.1. However, other traded shark products in live, dried/salted, and fillet forms are recorded as shark-derived in internal Singapore databases but when published are aggregated in general categories (Anon. 2003c). Quantities in these shark-specific, unpublished categories are small with the exception of substantial volumes of shark fillets in fresh/chilled (50 to 60 mt per annum imports, negligible exports) and frozen (1,000 to 1,600 mt per annum imports, 100 to 600 mt per annum exports) forms which are presumably included in generic ‘fish fillets’ categories. These unpublished quantities further accentuate Singapore’s position as a regional entrepôt for trade in shark meat products.

Shark fin trade data for Singapore are published in two categories, 'sharks' fins dried whether or not salted excluding smoked' and 'sharks' fins prepared ready for use', but more detailed records (Anon. 2003c) indicate that quantities reported in the latter category consist of both frozen (99%) and canned (1%) forms. It is thus assumed that all shark fin quantities published in the prepared category are in fact unprocessed frozen fins. Unadjusted shark fin imports and exports from the Singapore dataset (Anon. 1999b, Anon. 2002, Anon. 2003b) are shown to fluctuate around levels shown in the FAO data for Singapore in the early and mid 1990s (Table 4.2) with the lowest figures in recent years (Table 4.3) occurring in 1998 (586 mt) at the time of the Asian financial crisis in late 1997 to early 1999 (Wang 1999). Adjusted figures for Singapore's shark fin imports and exports (Table 4.3) have been calculated by applying the adjustment factor of 0.25 to the reported weight of prepared (assumed to be frozen) shark fin, and adding reported exports from Indonesia to Singapore (since Singapore does not report imports from Indonesia; Table 3.1). These data demonstrate that with increasing trade in frozen forms of shark fins during this time period, the total reported (unadjusted) quantities of shark fin traded by Singapore are inflated by up to 40% due to water content.

4.2.3 Thailand

Quantities of shark products traded by Thailand are recorded consistently in the Thai national statistics and the FAO statistics (Tables 4.2 and 4.3)[4]. No adjustments are possible for Thailand's shark fin customs statistics given that processed and unprocessed, and dried and frozen, forms cannot be distinguished within the single commodity code used by Thailand for shark fin (Anon. 2003d).

4.2.4 Summary

Unadjusted national trade statistics for shark meat (Table 4.3) have in the majority of cases closely matched figures given by FAO (Tables 4.1 and 4.2) thus confirming that available FAO figures for Malaysia, Singapore and Thailand accurately reflect the shark trade in these countries. However, the absence in the FAO dataset of Singapore shark fin data since 1996 causes the FAO figures to substantially under-estimate the ASEAN contribution to both imports and exports of shark fins, as well as the total global quantity of shark fin imports (Table 4.2). This is because Singapore has imported an average of 1,000 mt of unprocessed fins per annum between 1997 and 2002 (unadjusted figures), and if included in the FAO figures for 1997 to 2001 (Table 4.2), these additional imports would increase the global shark fin import tally by 15 to 25%. Therefore, as a result of the non-reporting of Singapore, the FAO dataset does not accurately portray regional and global trade levels for shark fin.

This comparison between FAO and national customs databases has shown that national statistics arguably provide the most up-to-date, accurate and detailed sources of trade information for the three countries of interest. However, product form and commodity code differences between national systems can impede meaningful comparison of trade data between countries. For example, since shark fins are traded in a variety of forms, systems such as the FAO database, which do not distinguish between these different forms and double count fins imported to more than one country are likely to misrepresent total traded quantities. As described above, trade statistics from Malaysia, Singapore and Thailand can be adjusted using logical assumptions and conversion factors to produce standardized estimates of traded quantities (Table 4.3). These methods are now used in the following section to extend this analysis to other major shark fin trading countries in order to estimate global trade volumes and thus characterize each of these three countries' share of the global trade.

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[4] Thailand's foreign trade statistics for 2001 onward are available online at http://www.customs.go.th but when accessed for this study in October 2003 gave erroneous, nil figures for frozen shark meat imports and exports. The figures given in Table 4.3 are derived from Anon. (2003d) and match those in the FAO dataset (Table 4.2).

4.3 Global comparison

Establishing any individual country's share of global trade requires an unbiased estimate of the individual country's trade as well as a similar unbiased global estimate. The individual country estimates for the shark fin trade in Malaysia, Singapore and Thailand are provided in Table 4.3 but for the reasons given above, the FAO tally of shark fin imports does not accurately represent the global level of trade. An unbiased estimate of world trade should be based only on imports of unprocessed fins to avoid double counting the same fin twice in unprocessed and processed form. Furthermore, double counting of unprocessed fins passing through more than one country before processing (and thus being counted as an import twice) should also be avoided. Finally, unprocessed fins should be adjusted for water content, where possible, to provide estimates based on a standardized dried form.

The task of compiling a global estimate of shark fin trade volume is considerably facilitated by the concentration of the trade in a handful of Asian countries. China, Hong Kong, Singapore, Taiwan and Malaysia are believed to control nearly 90% of the dried shark fins traded in international markets (Ferdouse 1997). Hong Kong, Mainland China and Singapore represent the major shark fin trading centers but report no substantial catch of sharks (FAO 2003a), therefore imports were tallied for each of these three areas excluding imports from the other two to avoid double counting of fins. (For example, any unprocessed fins passing from Hong Kong to Singapore were first recorded as imports in Hong Kong, therefore they must be excluded from the Singapore estimates to avoid double counting). Major shark fishing nations that are also key shark fin markets, i.e. Taiwan and Japan, were also included in the analysis (Chen et al. 1996, Sonu 1998). For these countries, imports were tallied in the same manner as for the entrepôts (i.e. subtracting the other countries' shares), but exports were also included to account for excess domestic production entering the trade. Although available data do not suggest that either Malaysia's or Thailand's shark catches or shark fin consumption are high relative to the other countries included in the analysis, Malaysia and Thailand were included in the same manner as Taiwan and Japan (i.e. as both producers and traders) to better reflect the regional focus of this study.

The methodology is summarized in Table 4.4. Imports were tallied for the entrepôts by excluding imports for the other two entrepôts, whereas imports for the other producer/trader countries were tallied by excluding imports from all three of the entrepôts ('Yes', top half of the table). Japan does not record any imports of shark fins, therefore exports of the producer/trader countries (other than Japan) to Japan were tallied to account for Japan imports ('Yes', center of bottom half of the table). In addition, all producer/trader country exports to countries other than the entrepôts and each other were included to account for any excess production ('Yes', right side of bottom half of the table). Unfortunately, production of shark fin which is consumed domestically in the producer/trader countries is not recorded in trade statistics and thus cannot be accounted for in this methodology. This factor constitutes a potentially large bias toward under-reporting in Taiwan and Japan, and to a lesser extent, in Thailand and Malaysia.

Table 4.4 Methodology for compiling an unbiased estimate of the total quantity of global trade in shark fins.

Trading Countries (Include imports in tally? (read down columns))								
	Imported to:							
	Singapore	*Hong Kong*	*China*	*Taiwan*	*Japan*	*Malaysia*	*Thailand*	*Other countries*
from:								
Singapore		No	No	No	na	No	No	No
Hong Kong	No		No	No	na	No	No	No
China	No	No		No	na	No	No	No
Taiwan	Yes	Yes	Yes		na	Yes	Yes	No
Japan	Yes	Yes	Yes	Yes		Yes	Yes	No
Malaysia	Yes	Yes	Yes	Yes	na		Yes	No
Thailand	Yes	Yes	Yes	Yes	na	Yes		No
All other Countries	Yes	Yes	Yes	Yes	na	Yes	Yes	No
Producer Countries (Include exports in tally? (read across rows))								
	Imported to:							
	Singapore	*Hong Kong*	*China*	*Taiwan*	*Japan*	*Malaysia*	*Thailand*	*Other countries*
from:								
Taiwan	No	No	No		Yes (na above)	No	No	Yes
Japan	No	No	No	No		No	No	Yes
Malaysia	No	No	No	No	Yes (na above)		No	Yes
Thailand	No	No	No	No	Yes (na above)	No		Yes

The total unbiased contribution of each party to global trade is shown in Table 4.5. Where possible, national figures were adjusted to exclude processed fins (Hong Kong and Malaysia only) and correct for water content of frozen fins (Hong Kong, Singapore, Taiwan and Malaysia, see Section 4.2 for correction factor). In cases whether countries report re-exports or re-imports of shark fins, these quantities were excluded on the assumption that such fins would be processed.

Table 4.5 Adjusted national tallies contributing to an estimate of the global trade in shark fins.

	1997	**1998**	**1999**	**2000**	**2001**	**2002**
Imports						
Hong Kong	2,270	4,086	4,489	5,501	5,130	4,995
Mainland China	3,941	3,893	3,645	3,960	2,312	2,044
Singapore	612	451	678	645	537	719
Taiwan	11	20	66	130	111	87
Malaysia	57	64	70	26	28	33
Thailand	27	11	37	9	38	11
Exports						
Taiwan	214	211	452	493	662	645
Japan	23	1	2	1	1	2
Malaysia	0	0	0	0	0	0
Thailand	0	118	11	5	5	1
TOTAL	7,155	8,854	9,450	10,771	8,824	8,536

The estimates of the total quantity of shark fins traded per annum from 1997 to 2002 range from 7,155 to 10,771 mt. However, these annual estimates of the global trade in shark fin must be evaluated in the context of several important caveats regarding under-estimation. Firstly, all figures are based on reported data thus any unreported trade, which may be substantial in some cases (Clarke 2004), is necessarily excluded from the estimate. Secondly, since only trade in the largest shark fin markets was included, the actual global trade total would undoubtedly be higher. Thirdly, for customs systems which do not distinguish between processed and unprocessed fin imports and exports, such as Mainland China, Taiwan, Japan, and Thailand, this analysis assumed the declared weights were unprocessed fins. If, however, the declared weights were actually processed fins, the equivalent unprocessed weight could be on the order of three or more times higher (Parry-Jones 1996). Finally, shark fins produced and consumed within a single country (i.e. domestic consumption) are not recorded in trade statistics and are therefore excluded from this estimate.

Biases leading to overestimation may also be present in the database, but these influences are expected to be minimal compared to those underestimation biases discussed above. The main concern in this regard is the assumption in the Mainland China, Japan, and Thailand databases that unspecified fins were dried rather than frozen. If substantial quantities were indeed frozen, the actual quantity of shark fins in those shipments would be overestimated by a factor of four.

Estimates of the percentage of the global trade passing through Malaysia, Singapore and Thailand can be calculated by dividing the adjusted total for each country from Table 4.3 by the global tally above. The numerator in this estimate must be one of the total trade figures given in Table 4.3 rather than the national figures in the rows of Table 4.5 since the latter may arbitrarily discount trade in some entrepôts for the sake of avoiding double counting, i.e. a fin is only counted at its first point of import. The results for 1997-2002 shown in Table 4.6 reflect the proportion of the total trade passing through each of the three target countries regardless of whether any recorded fin is subsequently counted in another country.

Table 4.6 Percentage of the global trade passing through Malaysia, Singapore and Thailand, 1997-2002.

	1997	1998	1999	2000	2001	2002
Malaysia	2	1	2	1	1	1
Singapore	17	7	10	9	8	12
Thailand	2	2	1	1	2	1

Based on available data and the caveats listed above, Malaysia and Thailand appear to be minor players in the international shark fin trade (2% or less of global trade volumes). However, since domestic production and consumption is excluded from this calculation, actual consumption of shark fin in these countries may be higher than indicated by these figures. Singapore annually handles between 7 and 17% of the trade ($\bar{x}$ =10%). As Singapore does not source shark fins domestically, and thus should not have additional, unreported trade deriving from domestic production, these figures for Singapore are expected to more accurately represent the scope of its market than those for Malaysia and Thailand. The degree to which shark fin traded through each country is consumed in that country is explored in the following section.

5 PRODUCT DISPOSITION

This section analyzes the disposition of shark products traded through Malaysia, Singapore and Thailand, in order to characterize each market's mix of export and domestic consumption. A description of potential factors influencing market demand in the region, and a discussion of whether available shark fin price data determine or reflect demand, is also provided.

5.1 Analysis of Exports and Domestic Consumption

A common means of assessing consumption of traded products is to compare imported and exported quantities and assume that the amount by which exports exceed imports is production (discussed in Section 3) and the amount by which imports exceed exports is domestic consumption (Kreuzer and Ahmed 1978). The following discussion draws inferences about consumption where possible based on the available data for Malaysia, Singapore and Thailand. Export markets, either for domestically produced goods (exports) or transshipped goods (re-exports), are also characterized based on customs data.

5.1.1 Malaysia

Based on national data shown in Table 4.3, Malaysia's trade in fresh shark meat is negligible. Trade in frozen shark meat is greater, but since exports exceed imports in most years, and Malaysia also produces shark meat domestically, it is not possible to estimate domestic consumption from trade figures. According to Ali and Isa (2002) meat is sold in fresh or dried forms but only five species (*Carcharhinus falciformis*, *C. limbatus*, *C. macloti*, *C. sorrah* and *Scoliodon laticaudus*) are considered palatable. Malaysia's exports of frozen shark meat are primarily destined for China (>50% in 4 out of 6 years).

Between 1997 and 2001, most shark fins were traded in the 'dried' category, and imports exceeded exports in this category by 40-90 mt per annum. In 2002, the first year to record substantial quantities of shark fin in 'salted' form, the difference between 'dried' imports and exports was just over 20 mt but an additional 35 mt were recorded as 'salted' imports, and if added to the dried imports, places the unadjusted import tally for 2002 within the range of the preceding years. In combination, these annual figures suggest that Malaysia consumes at least several dozen metric tonnes of imported unprocessed shark fin per year in addition to any shark fin produced locally for the domestic market and very small quantities of imported processed fins.

Countries receiving greater than 5,000 mt per annum of dried unprocessed shark fin exports from Malaysia between 1997 and 2002 include Thailand, Singapore and Hong Kong. Based on trader interviews, it is likely that most unprocessed exports of shark fin originate from East Malaysia (Sarawak and Sabah) and are exported directly without passing through West Malaysia. Processed shark fin exports from Malaysia during these years were only destined for Singapore and Hong Kong.

5.1.2 Singapore

As demonstrated in Section 4, Singapore's role in the trade of shark meat is large relative to the ASEAN volume of trade but small relative to global figures. Between 1997 and 2002 Singapore consistently directed substantial volumes (>200 mt per annum) of frozen shark meat exports to Italy, one of the world's largest importers (see Section 2) and to South Korea. Similar quantities were recorded in some years to Taiwan, the Netherlands and Greece. Comparison of import and export quantities for frozen shark in these years shows a fluctuating trend encompassing several hundred mt of production in some years (see Section 3), nearly equal quantities in 1998, and an apparent domestic consumption of almost 550 mt in 2002. Singapore does not export fresh or chilled sharks, therefore all fresh meat imports are assumed to be for consumption. These products derived primarily from Malaysia and totaled 25 to 140 mt per annum.

Singapore was recognized as a burgeoning shark fin entrepôt as early as the mid 1970s, and at that time the volume of retained imports had declined to 415 mt or 45% of the trade (Kreuzer and Ahmed 1978). A comparison of Singapore's adjusted shark fin imports to exports ratio between 1997 and 2002 shows a surplus of imports of 110 to 240 mt per annum. In comparison to the previous figures, this indicates a reduced and fairly stable level of domestic consumption representing 15-30% of traded quantities (based on adjusted figures). A trader cited in Chen (1996) estimated that 500 mt of shark fin are consumed in Singapore each year and Ferdouse (1997) reported consumption figures of 100-200 mt per annum. Trader surveys conducted for this study indicated that domestic consumption is now estimated to be approximately 300-400 mt per annum. Presumably these consumption estimates apply to processed fins which can be converted to unprocessed equivalent weights using a factor of 3 (Parry-Jones 1996). Therefore consumption estimates of 100-500 mt per annum in Singapore would equate to 300 to 1,500 mt of unprocessed shark fin per year. This range of estimates is also in line with Singapore's reported shark fin production figures between 1997 and 2001 (100 to 500 mt per annum according to FAO (2003a)), assuming this quantity is given in processed fin weights, and that, due to cost, fins processed in Singapore are destined for domestic consumption. Singapore imports more canned shark fin (25 to 75 mt per annum) than it exports (8 and 30 mt per annum), but after adjustment for packaging and other constituent weight, the quantity of shark fin represented is small and would not appreciably alter domestic consumption estimates (Anon. 2003c).

Those shark fins that are not consumed in Singapore are exported primarily to Hong Kong (240 to 500 mt per annum) and Malaysia (50 to 150 mt per annum) in dried form. Frozen shark meat in quantities greater than 20 mt per annum is exported to Hong Kong, Taiwan, China and Malaysia.

5.1.3 Thailand

Exports of fresh and frozen shark meat from Thailand between 1997 and 2002 were primarily destined for Singapore, China and Hong Kong (> 20 mt in any year). In most years, frozen meat comprised >90% of all exports but the ratio of frozen to fresh exports reversed in 2002 when 94% of exports were declared as fresh shark meat. Thailand consistently imports greater quantities of frozen shark meat than it exports suggesting that domestic consumption is on the order of at least 100-300 mt per annum in addition to quantities of shark meat derived from domestic production.

Domestic consumption of shark fin in Thailand is difficult to determine given that unprocessed shark fin may be both imported and exported, and processed shark fin may also flow both out of and into the country. Assessing consumption on the basis of single commodity code for shark fin is thus problematic. Perhaps because of this, Thailand's annual production to consumption ratio fluctuates substantially with the highest apparent consumption (i.e. imports – exports) of nearly 100 mt in 1998. The major recipients of exports of shark fin from Thailand (consistently >5mt per annum) are Hong Kong and Singapore.

5.1.4 Summary

As illustrated by the preceding discussion, this method of estimating domestic consumption can oversimplify a complex trading system involving multiple product forms. The methodology is particularly difficult to apply to countries which both produce and consume shark products, such as Malaysia and Thailand. The case for Singapore's consumption of shark fins is clearer suggesting that between 100 and 500 mt of processed shark fins per year are consumed, equating to 300 to 1,500 mt of unprocessed fins or 3 to 21% of the estimated global trade over the years 1997-2002.

Export routes for shark meat and fins that are not consumed domestically within Malaysia, Singapore and Thailand are summarized in Figure 5.1. These illustrated routes are consistent with a pattern of consolidation of products from Southeast Asia in Singapore before shipment to a variety of receiving countries mostly located in East Asia. However, Malaysia and Thailand also export shark products directly to Hong Kong and Mainland China and this trade is expected to increase as the Mainland economy develops and trade links expand.

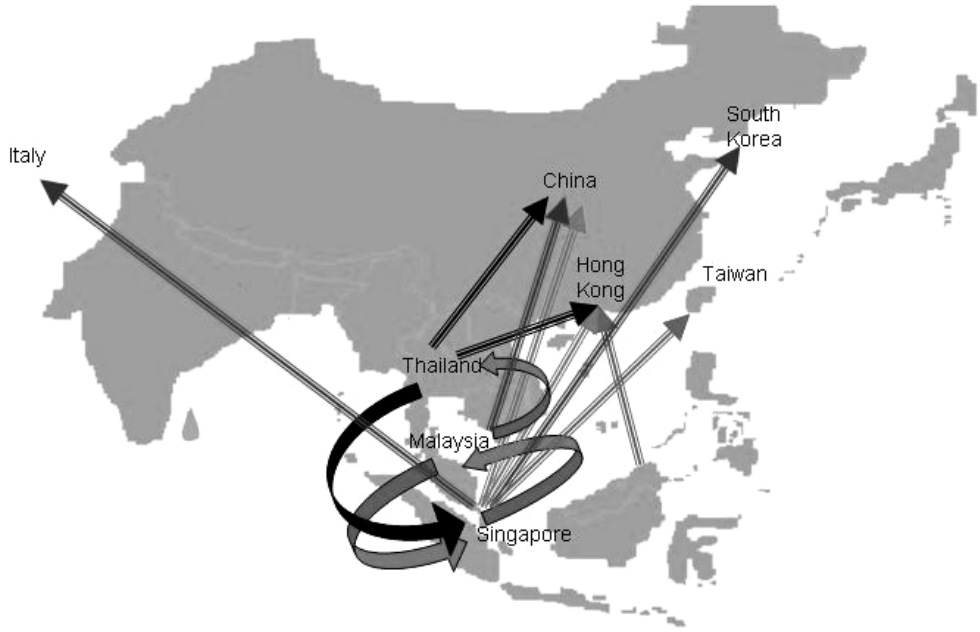

Figure 5.1 Major export destinations for shark meat and fins from Malaysia, Singapore and Thailand. Red arrows indicate shipments of meat, blue arrows indicate shipments of fins, and black arrows indicate shipments of both meat and fins. Curved arrows represent trade within ASEAN whereas straight arrows represent non-ASEAN trade. Criteria for 'major' export destinations vary between Malaysia, Singapore and Thailand and are given in the text.

5.2 Market Demand

The proportion of the shark product trade servicing domestic consumption in Malaysia, Singapore and Thailand depends directly on the strength of the market in each country. This in turn is believed to depend on a variety of factors including, but not necessarily limited to, overall economic performance, system 'shocks' such as the outbreak of Severe Acute Respiratory Syndrome (SARS), and standard seasonal patterns. Once these factors are identified, shark fin price data can be examined to assess whether the influence of these factors can be discerned, and if so whether the market can be characterized as being driven by demand as opposed to supply. Due to limited economic data for other shark products, this discussion is focused on shark fins only.

Shark fin is known to be a luxury good consumed on celebratory occasions such as weddings and at high profile business functions (Vannuccini 2000). By definition, demand for luxury goods is more susceptible to changes in income than other non-luxury goods such as dietary staples (Eastwood 1985). For example in this case, when consumers have more money to spend they would tend to purchase more shark fin whereas their demand for soya sauce (醬油, *jiang you*) may remain constant. The reverse should also be true: if income decreases, lesser quantities of shark fin should be consumed. Changes in demand may be related to actual income, or a combination of actual income and consumer propensity to spend thereby incorporating a broad range of factors influencing economic sentiment.

Surveys of shark fin traders in Hong Kong identified a downturn in the economy in 2001 as a major influence on consumer demand and thus sales (Clarke 2004). This downturn extended into 2003 and coincided with the occurrence of Severe Acute Respiratory Syndrome (SARS) outbreaks in several of the key shark fin markets (i.e. Mainland China, Hong Kong, Singapore and Taiwan) in April and May 2003. According to a Singapore Department of Statistics survey, restaurant receipts declined by 50% in April 2003, the height of the SARS period, as compared to March 2003 (Straits Times 2003). Traders in Malaysia, Singapore and Thailand interviewed for this study in autumn 2003 specifically cited the poor performance of the economy, and traders in Singapore and Thailand mentioned SARS, as factors which have directly suppressed local demand by residents, or indirectly impacted restaurant sales to foreign visitors through a decrease in tourist arrivals. The SARS episode would be expected to have had a more severe, though shorter-term impact on sales, whereas the poor economic situation is part of a longer term trend.

Another factor believed to influence shark fin markets is the traditional seasonal patterns of consumption. Several authors have identified that the cool weather months of fall to early spring are the months of highest demand either because they are the favored months for weddings or because a number of holidays celebrated by the Chinese (e.g. Winter Solstice, Christmas, New Year and the Chinese (Lunar) New Year) fall within this period (Lai 1983, Fong and Anderson 2000). In order to determine whether imports of shark fins increased in preparation for the peak winter months on a regular basis, imports to Hong Kong were examined on a monthly basis over a period of three years, but no consistent patterns were apparent (Clarke 2003). In this case, the existence of seasonal patterns in sales of shark fins may be obscured in import statistics by the practice of stockpiling processed or unprocessed fins.

The only known standardized, publicly available dataset on shark fin prices is compiled by INFOFISH, a partner within the FAO-initiated GLOBEFISH international network, providing marketing information and technical advisory services for fishery products in the Asia and Pacific region. INFOFISH's biweekly bulletin of wholesale prices for various fisheries products includes data for shark fin consisting of product form and grading, indicative price, market area (i.e. point of sale) and product origin (INFOFISH 2003). Each price data point is

based on a quoted price in a given market for a given form or grade of the product, originating from a particular country. While prices are standardized in US dollars, the nomenclature of the products follows the custom of the originating country and thus commodity categories and gradings are often inconsistent from one entry to the next. Also, many of the quoted prices are marked as 'c&f' (cost and freight) and represent the price to be paid by the buyer at the receiving port. Since freight charges will vary based on the distance between the origin and the destination market, only c&f prices for the same product, originating and arriving at the same ports can be validly compared.

Monthly shark fin price quotes were compiled from published INFOFISH newsletters from January 1990 through July 2003. Accounting for the inconsistencies discussed above resulted in a focus on three types of shark fins, 'ocean white', 'blue' and 'mako' described as 'half moon cut', i.e. trimmed of attached tissue (Lai 1983), full fin sets delivered to Singapore from the South Pacific. Prices quoted in US dollars beginning in January 1997 (the earliest reported data point) were adjusted using US dollar inflation rates (Anon. 2003g) calculated from a base period of July 2003.

The adjusted time series shows consistent trends for the highest priced (ocean white), medium priced (blue) and lowest priced (mako) fins (Figure 5.2). Prices for all three types of fins were constant in 1997 but began to decline precipitously in early 1998 at the time of the Asian financial crisis which began in late 1997 and lasted through early 1999 (Wang 1999). Ocean white and blue shark fin prices began to rebound in early summer 1999, but mako shark fin prices remained low throughout 1999. Despite a brief correction after the Chinese (Lunar) New Year in 2000, prices for all fins continued to rise until early 2001 when prices fell sharply again at about the time the onset of the current global economic downturn was acknowledged. Since that time prices have fluctuated within a small range, generally 25% lower than the 1997 level. The final three data points in the series reflect the post-SARS months of May through July 2003, but aside from a slight dip in price of ocean white fins, no major price shifts were observed during this period. One possible explanation for the lack of price changes due to SARS could be that overseas shark fin dealers, who provide these data, were content to hold their stocks of shark fins without lowering the price in anticipation of a rapid return to normalcy post-SARS. Overall, the price data suggest that the short-term effects of SARS had little impact on the shark fin industry, but that longer-term, and more widely distributed economic trends may have dampened consumer demand and encouraged traders to lower prices in order to clear inventories.

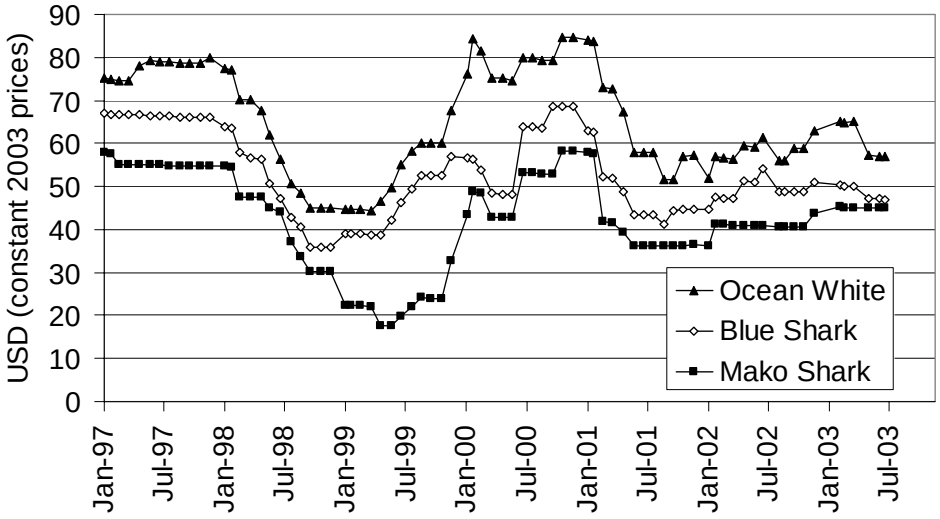

Figure 5.2 Prices for half-moon cut, whole sets of three types of shark fins originating in the South Pacific and shipped to Singapore (price includes freight charges) in US dollars adjusted to a constant price based on the value of the US dollar as of July 2003.

6 TRADE CHARACTERISTICS

The preceding discussion has broadly characterized the demand for shark fin in Southeast Asia based on factors which affect the region as a whole. Where relevant to the particular topics of analysis, information from a total of 13 interviews conducted with importers, processors and retailers in Malaysia, Singapore and Thailand has been integrated into the preceding discussion. This section describes the interview findings in more detail and provides a market-by-market description highlighting information particularly relevant to each location. Since none of the interviewed dealers traded shark meat, the contents of this section focuses exclusively on shark fins.

6.1 Malaysia

Field visits were conducted in the Kuala Lumpur and Pulau Pinang areas with the assistance and facilitation of the Malaysia Fisheries Department. Five interviews were conducted with importers, processors and retailers, and price information was obtained from vendors in Pasar Seni, the central market area of Kuala Lumpur, and Georgetown, Pulau Pinang. Several large companies dealing in shark fin products were identified in both areas but these refused to participate in interviews for various reasons. With one exception, interview participants either did not specialize in shark fin or were no longer actively engaged in the industry. Observed or quoted prices are converted to US dollars using the exchange rate of 3.8 RM to 1 USD.

6.1.1 Products, Species, Grades and Prices

Information on species used and wholesale prices was obtained from one Malaysian processor. This trader stated that *Carcharhinus dussumieri*, *C. sorrah*, *Scoliodon laticaudus*, and *Rhynchobatus djiddensis* were used in his business. However, since a guide to Indian seafood species was used to identify these sharks and rays, and given that the number of elasmobranchs illustrated in the guide was very limited (< 10), this species list should be considered indicative rather than definite. This processor described four grades of shark fin marketed by his firm, all of which were packed in plastic pouches in liquid and frozen for wholesale, as follows:

- 'L' grade consisting of 85% 'blacktip' shark fin and 15% artificial shark fin for 11 RM (3 USD) per kg;
- 'SP1' grade consisting of 85% small dogfish fins and 15% artificial shark fin for 13 RM (3.5 USD) per kg;
- 'SP5' grade consisting of 85% large dogfish fins and 15% artificial shark fin for 100 RM (26 USD) per kg;
- 'LLL' grade consisting of 100% guitarfish fins for 150 RM (40 USD) per kg.

A wholesaler in the Kuala Lumpur area was also interviewed and quoted prices for two types of frozen processed shark fin in plastic pouches at 67 RM (18 USD) per kg for medium thick fin needles and 83 RM (22 USD) per kg for thick fin needles. This dealer stated that he did not mix real and artificial shark fin in any of his products, however he sells pouches of artificial shark fin, produced in Japan, for 5 to 10 RM (1 to 3 USD) per kg and restaurants can create their own mixtures.

In Pasar Seni, Kuala Lumpur several dried seafood and other dried foodstuff vendors were observed, but only one carried processed shark fins and only two offered dried shark cartilage for sale. Given the number of shops selling fish maws, the number of vendors dealing in shark products was surprisingly low. No information on species was obtained but the following retail prices were observed:

- Dried processed shark fin cartilage or vertebral cartilage (packaged separately, i.e. not mixed) at 60 RM (16 USD) per kg;

- Very small (5 to 8 cm) dried processed whole shark fins at 980 RM (258 USD) per kg;
- Medium-sized (15 cm) dried processed whole shark fins at 1,380 RM (363 USD) per kg;
- Large-sized (20 cm) dried processed whole shark fins at 1,780 RM (468 USD) per kg; and
- Extra large-sized (35 cm) dried processed whole shark fin (rays) at 2,100 RM (553 USD) per kg.

The stock of shark fins on hand in this shop consisted of only a few kilograms and these were not prominently displayed, suggesting that demand by retail shoppers is not particularly high. Relative to shark fins, greater amounts of dried shark cartilage were stocked but this was still a minor product among the range and quantity of goods on display.

In Georgetown, the only shark fin product observed in shops was dried low grade loose fin needles shaped to resemble a whole fin and packed in plastic (Figure 6.1). These fin 'nests' were retailing for 28 RM per 50 grams or 147 USD per kilogram.

Figure 6.1 Dried low grade loose fin needles shaped to resemble whole fins and marketed as fin 'nests' or 'baskets'. (Photo: Tan Sen Min, SEAFDEC MFRD)

6.1.2 Trader and Consumer Attitudes

None of the interview participants in Malaysia were aware that shark species had been listed on the appendices to the Convention on Trade in Endangered Species of Wild Fauna and Flora (CITES) (Anon. 2003h). However, most were familiar with campaigns against shark finning through cable television programs aired in Malaysia. None of those expressing an opinion on the influence of these campaigns believed that environmental or animal welfare concerns were having any impact on their business. One trader suggested that such concerns would never exert a strong influence on a trade as widely distributed and diversified as the shark fin trade.

All respondents except one noted that sales had declined due to the ongoing economic downturn, with one processor citing a decline of 40% over last year. One retailer claimed that shark fin was becoming 'more and more popular' and mentioned that sales were typically brisk from September (an auspicious month for Chinese weddings) through Chinese New Year and during this period prices could rise by 200 to 400%. Both processors mentioned the increasing

acceptance of mixtures of real and artificial shark fin by the market due to improved quality of the artificial product and consumers' desire for lower prices during the current recession. One of these respondents believed that shark fin might be losing its appeal as consumers grow bored and turn toward new products.

The consensus view of the Malaysian traders was that relative to the China market, the market for shark fin in Southeast Asia is small and locally orientated, and uses poorer quality fins. One processor complained that Mainland China buyers were fiercely competing for raw fins all over the world, and another former processor explained that his factory in Indonesia had folded because the quality of his product could not meet the high standards required by the China market. Competition among traders aside, most respondents did not consider that the supply of shark fins was either increasing or decreasing with time although some mentioned the political instability in Aceh, Indonesia and impacts of marine pollution in coastal areas as negative influences on fin supplies. None of the participants carried any shark products besides fins. The processors stated that shark meat was always fully utilized (specifically in Indonesia), but that there were no markets for skin, cartilage or liver oil produced by the source fisheries.

Although most respondents stated that the shark fin trade in Malaysia was based in Kuala Lumpur and Pinang, this survey did not cover the East Malaysia provinces of Sarawak and Sabah and cannot assess the extent of the shark fin trade in these areas. However, most of the interviewed traders stated that their raw materials were derived almost exclusively from imports, not from East Malaysia. Shark landings have been documented as higher in East Malaysia (Ali and Isa 2002), but it is likely that any fins derived from these landings are directly exported to Hong Kong or China without passing through one of the Southeast Asian trading centers (see Suzuki 2002).

6.2 Singapore

The interview program in Singapore consisted of five individual interviews and two group interviews with members of the Singapore Marine and Land Products Association (Hai Swee Kow Kong So). Meetings were facilitated by the Agri-Food and Veterinary Authority (AVA) of the Singapore Government which maintains close contact with trade organizations through their role in regulating food safety. The individual interview participants consisted of importers and processors, some of whom are believed to represent key companies in the Singapore market. Group interviews with members of the trade association were advantageous in their potential to gather the opinions of large number of traders simultaneously. However, one of the drawbacks of this interview format is that the information offered tends to be generalized in order to avoid revealing confidential business details in an open forum with potential competitors present (Martin-Smith et al. 2003). In addition to the interviews, price quotes for retail products were obtained from three Singapore vendors and translated to US dollars at the rate of 1 USD = 1.75 Singapore dollars ($).

6.2.1 Products, Species, Grades and Prices

Information on the species of sharks used in the Singapore market was compiled from several interviews, but no confirmatory studies were undertaken to verify matches between market categories and actual taxonomy. Interviews indicated that Singapore traders recognize and may use the Chinese trade names for shark fins used in Hong Kong (Clarke 2003, Clarke et al. in press), although the Singapore traders employ different Chinese character pronunciations based on their native dialect. However, traders usually communicate with suppliers using common names familiar in the supplying region, and lacking an auction system as in Hong Kong, do not use standardized trade names to the extent observed in Hong Kong. The most common names cited by shark fin importers are listed in Table 6.1 along with any alternative names known to traders and, where available, indicative prices.

Table 6.1 Types of shark fin used in the Singapore market and their wholesale (W) and retail (R), presumably processed, prices. Dashes indicate information not available.

English Name Given	**Alternative Names**	**Expected Taxonomy**	**Price**
Blue	-	*Prionace glauca*	-
Black	Wu Yang (五洋), etc.	*Carcharhinus* spp.	$170 (97 USD) per kg (R, small size)
White	Qun (群), Bai (白)	Rhinobatidae	-
Thresher	-	*Alopias* spp.	-
Mako	Ma Jiao (馬交) Hei Qi (黑其)	*Isurus* spp.	Caudal fin $300 (171 USD) per kg (R)
Rough Sand	Cu Sha (粗沙)	Orectolobidae (?)	$80 (46 USD) per kg (W)
Spiny Dogfish	Gou Sha (狗沙)	*Squalus acanthias*	$68 (39 USD) per kg (W) $280 (160 USD) per kg (R)
Velvet Dogfish	You Chi (油翅)	*Scymnodon squamulosus*	$45 (26 USD) per kg (W) $220 (126 USD) per kg (R)
School	-	*Galeorhinus galeus*	$200 (114 USD) per kg (W) $500 (286 USD) per kg (R)
Rig	-	*Mustelus lenticulatus*	$68 (39 USD) per kg (W) $280 (160 USD) per kg (R)
Elephantfish	Da Ben Xiang (大本象)	*Callorhincus milii*	$70 (40 USD) per kg (W)
Pearl	Zhen Zhu (珍珠) Chang Ming(長明)	-	-

Retail prices were obtained for a variety of shark fin products in dried form. Fine loose fin needles formed into 'nests' retailed for $19-24 for approximately 60 g (or 197 to 238 USD per kg). Thicker loose fin ray 'nests' were priced considerably higher at $54-62 for 100 g (or 310 to 354 USD per kg). Small whole fins in dried form (10-12 cm in length) sold at $60 to 165 for approximately 200g and $400 for 600 g (or 230 to 380 USD per kg). Canned shark fin soup, with an unknown shark fin content, retailed for $4 to 8 (or 2 to 5 USD).

Singapore processors were found to concentrate on production of shark fin products in a wet form. Small whole fins in this form are referred to as '*xiaobaochi*' (小包翅) and were said to wholesale for $90 (51 USD) per kg which is substantially lower than similarly sized fins in dried form presumably due to water content (Figure 6.2). Processors noted that whole fins were popular with customers who insisted on 100% real shark fin. Loose fin needles contained in lower grade shark fin products are more susceptible to substitution with artificial shark fin despite regulation by the Singapore government preventing sale of incorrectly labeled shark fin products. Restaurants in Singapore selling shark fin dishes as part of a set banquet menu will offer a low price set menu, including loose shark fin needles in a soup, at $500 (285 US), and a high price set menu, including small whole fins in a soup, at $1000 (571 US).

During one of the group interviews traders stated that blue shark fins were the most common type comprising as much as 40 to 50% of the market. An individually interviewed trader described a decrease in profits over the past two decades resulting from an increased awareness among fishermen in the value of fins and a ten-fold or more increase in price 'at the dock'. One trader discussed the effect of the SARS crisis in detail, commenting that shark fin prices fell by 30% during this period (see Section 5.2).

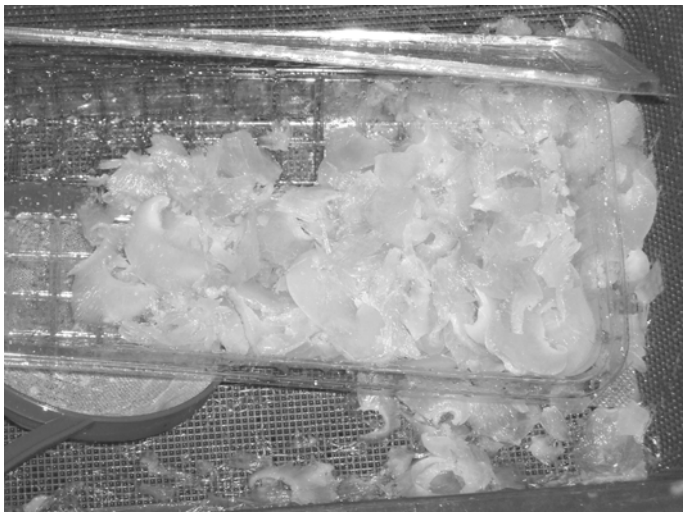

Figure 6.2 Small processed fins in wet form from a Singapore processing plant. (Photo: Goh Kian Heng, SEAFDEC MFRD)

6.2.2 Trader and Consumer Attitudes

Most interviewed traders in Singapore were aware that some species of sharks had been listed by CITES, but several appeared unfamiliar with either the actual species listed and/or the requirements for continued trading of these species (i.e. the basking (*Cetorhinus maximus*) and whale (*Rhincodon typus*) sharks) under the requirements of CITES Appendix II. When asked whether they supported further listings of sharks by CITES, several well-informed traders insisted they were neutral on such proposals but preferred sharks to be managed by national authorities under agreements coordinated by FAO. Through utilizing existing channels of communication in Singapore between AVA and shark fin traders, this study was able to inform traders of an important linkage between the current lack of information about the shark fin trade in Southeast Asia and future shark management actions. In particular, all interviews were introduced by explaining that effective management of shark resources cannot occur without information, and a continued dearth of trade data may actually encourage actions by international treaty organizations such as CITES.

Most traders stated they were amenable to, or in some cases even welcoming of, greater future management of sharks, but at the same time considered that the shark fin trade provides important economic benefits to fishermen in developing countries without other sources of income. Some traders questioned whether many, or even any, sharks are finned and then discarded, citing anecdotal evidence of whole shark utilization in several countries including India. Several examples of utilization of shark products other than fins were offered, but of the 19 association members represented by the group interview, only 3 to 4 pursued a limited trade in shark meat or cartilage or skin, and none dealt in shark liver oil.

All individually interviewed traders indicated they would not take any action if more shark species were listed, or they would shift their focus to products that were not regulated. These respondents stated the existing CITES listings of sharks had no effect on their business. In contrast, the group interview with the association responded that the listings have had an impact and stated that if more listings were proposed lobbying would be undertaken on behalf of the trade. The difference in response from within and outside the association highlights the importance of associations in organizing and spearheading lobbying activities.

Given previous and ongoing shark conservation campaigns in Singapore, respondents were asked whether there had been any effect of these campaigns on their business. The group interview with association members and two of the individually interviewed traders

acknowledged that the younger generation's appetite for shark fin had possibly been affected. Other respondents, however, claimed that there was no effect. Despite mixed responses on this question, only one of the traders cited conservation campaigns or international regulations/bans as one of his concerns for the future.

There was consensus among all interview respondents that the poor state of the economy in Singapore had hurt sales. In particular, most traders stressed that the market was driven by demand in China and that only the medium and low grade fins were retained for the local market. All respondents felt that the growing demand for fins in Mainland China was detracting from Singapore's formerly key role as a trade entrepôt. In addition to the economy and the China market, some traders cited SARS, as well as Singapore's rising taxes (such as the 5% Goods and Services Tax) and operating costs, as factors suppressing their trade. Several interview participants were openly pessimistic about the shark fin trade in Singapore calling it a 'dying trade'.

Traders were also asked whether they believed that high quality shark fins were becoming more difficult to obtain. Nominally, many respondents agreed that this was the case, but it became clear that in most cases that this was a result of the increased competition between Singapore traders and traders from Mainland China for shark fin supplies. Most traders maintained that fin supplies were either constant or fluctuating naturally in response to seasonal patterns, shark migrations and/or climatic changes such as global warming. Only one importer mentioned seeing localized effects of over fishing in some countries.

6.3 Thailand

Surveys in Thailand were severely limited by importers' and processors' unwillingness to consent to interviews and by retailers' refusal to respond to even basic questions about their business. The reasons why the shark fin trade in Thailand appeared to be more reticent than in the other countries surveyed in this study may be related to recent shark conservation campaigns publicizing findings of high mercury content in shark fin products (Anon. 2001b). Despite approaching numerous traders both by telephone and in drop-by situations (retailers only) with the facilitation and participation of personnel from the Thailand Department of Fisheries, only one abbreviated interview with a retailer in Bangkok's Chinatown district was conducted. Information on product grades and prices was collected from observations in several shops and restaurants in the same area.

The one interviewed retailer stated that his customers were largely tourists including those from Singapore, Taiwan and Hong Kong. He indicated that business was slow due to the poor economy and a decline in tourist arrivals, although he did not mention the SARS outbreak specifically. According to this source, shark fin goods were sold on consignment, and since the shop owner did not purchase the goods, he had a somewhat distant and fluid relationship with suppliers. The name and address of his supplier(s) would not be divulged, nor could any details of the fin sources or processing be obtained.

Only one of the shark fin products in the observed retail outlets was branded with a label showing a company name. This product was produced by the Kwan Kee company which is headquartered in Hong Kong. (A shark fin and bird's nest restaurant in the area also distributed name cards which also indicated that the parent company was located in Hong Kong.) For the most part, however, brands consisted of circular red labels with a gold embossed picture, e.g. a 'thumb's up', or Chinese characters for 'double happiness', 'star' or 'dragon' (Figure 6.3).

Figure 6.3 Typical packaging of shark fins in the Bangkok market. Prices are quoted per bag rather than per unit weight (see Note 3). (Photo: Tan Sen Min, SEAFDEC MFRD)

Figure 6.4 The most expensive dried processed shark fins observed in the Bangkok market (20,000 Baht (500 USD) per bag). The retailer described the fins as '*ming*' and indicated they were imported from Africa. (Photo: Tan Sen Min, SEAFDEC MFRD)

Many of Bangkok's Chinatown retailers stocked shark fin products. Prices for various product forms and grades were observed, and translated to US dollars using a conversion rate of 1 USD=40 Baht, as follows[5]:

- fin 'nests' in a standard size of 20 cm by 12 cm for 500 Baht (based on weights observed in Malaysia and Singapore probably equal to 250 USD per kg);
- very small (5 to 8 cm, yellowish, locally caught and processed shark dorsal and pectoral fins for 1,650 to 1,850 Baht per bag (83 to 93 USD per kg);
- small (10 cm, yellowish, locally caught and processed shark dorsal and pectoral fins for 2,700 to 3,000 Baht per bag (135 to 150 USD per kg);
- small (8 to 10 cm, yellowish, locally caught and processed shark lower caudal fins for 3,500 to 4,000 Baht per bag (175 to 200 USD per kg);
- imported high grade, pearly white dried processed fins of up to 20 cm in length for 7,500 Baht per bag (375 USD per kg);
- imported high grade, pearly white dried processed fins of 30 to 35 cm in length (described by the trader as '*ming*' (明) from 'Africa') for 20,000 Baht per bag (1,000 USD per kg (Figure 6.4));
- wet whole fins (小包翅, '*xiaobaochi*'), 7 to 15 cm, ready to eat in a restaurant for 1,500 to 4,000 Baht (38 to 100 USD) per fin;
- bowls of shark fin soup for 300 Baht (8 USD) for a small bowl up to 1,500 Baht (38 USD) for a large bowl (shark fin content not specified).

6.4 Summary

These market observations and interviews have provided insights into how processed shark fin products are graded and priced. Prices were found to be relatively consistent between markets.

[5] Products in the Bangkok market were priced per pre-packed bag not by unit weight. Given that most bagged shark fin products in Malaysia were priced per 500-600 g, and given that the size of the bags was similar in Bangkok, prices quoted in Thailand per bag have been doubled to produce approximate price per kg figures.

Dried loose fin needles in 'nests' sold for approximately 150 to 250 USD per kg, whereas small (< 10 cm) whole fins in dried form were priced at 200 to 400 USD per kg (with the exception of lower grade offerings in Thailand said to derive from local fisheries). Similarly sized fins in whole wet form were offered at a lower price, 40 to 100 USD per kg, presumably due to water content. Small-sized loose fin needles in wet form are popular with restaurants, but subject to mixing with artificial shark fin, and were priced at 3 to 40 USD per kg.

It was not possible to obtain extensive, reliable information regarding the species used in the shark fin trade due to the apparent absence of a standardized nomenclature within the various trade communities. While Chinese trade names used in Hong Kong were recognized by some traders, most dealers were only familiar with the types of fins common in the supply countries they trade with, and they tended to employ the vernacular names used in these countries rather than applying their own terminology. Furthermore, as market categories are based on the length and thickness of fin needles, shark fins are grouped into categories producing differing grades of fin needles, and thus the number and identity of species in each category is of little practical business interest.

Despite many individual differences in traders' type of operation and market focus, e.g. exporters versus processors in three different countries, common themes in attitudes and outlooks were identified. The majority of interview respondents in all three countries believed the supply of shark fin was steady, and that shark meat was nearly always fully utilized in the source country even though shark skin, cartilage and liver oil markets were underdeveloped. Nearly all respondents attributed the recent downturn in the trade to the ongoing economic recession, and in some cases to SARS (notably not in Malaysia). All traders acknowledged that the Southeast Asian market specializes in lower grade fins because the China market commands the top quality products. Many also expressed concern that the supply of shark fin was becoming increasingly controlled by Mainland buyers and this was in some cases siphoning business away from Southeast Asia. Alongside the dual factors of the economy and China, traders were relatively untroubled by shark conservation campaigns, although traders working in areas which have been targeted by environmental groups (specifically Singapore and Bangkok) displayed a heightened sensitivity to information gathering activities.

Key differences in some markets were, however, identified. In Malaysia, there appeared to be a growing acceptance of real and artificial shark fin mixtures, perhaps fuelled by a desire to reduce spending while the economy is poor. This factor may also explain why dried shark fin products did not appear to be prominent items in Chinese shops in urban areas since the mixtures would most likely be sold in restaurants. Singapore traders demonstrated the highest awareness of CITES and shark management issues. As a result, participation in trade association lobbying or individual efforts to keep abreast of the latest developments was common. Individual attitudes ranged from a sophisticated appreciation of the need to engage in the international debate to an overall sense of frustration at what they considered misrepresentation of their trade. The market in Thailand was the most difficult to characterize. From available information, it appears that the shark fin business in Bangkok is more heavily orientated toward the tourist market than in Singapore or Malaysia. The variety of high grade fins commonly available in small retail shops in Bangkok, and observed business linkages with Hong Kong, suggest that the market in Thailand may be more closely tied to China than other ASEAN countries.

7 CONCLUSIONS AND RECOMMENDATIONS

Sharks are arguably used for a wider variety of products than any other fish. The demand for shark products determines the degree to which sharks are targeted and utilized by fisheries, but extreme differences in market value among products worldwide have led to concerns regarding full utilization of these valuable resources. Expansion of markets for shark products, especially shark fin, have also sparked concerns about the sustainability of shark fisheries. Since

Southeast Asian countries host some of the world's largest shark fisheries and key shark fin trading centers, complementary studies of shark fisheries and trade have been undertaken in the region to support further development of shark fisheries management. A brief review of global trade in shark cartilage, skin, liver oil and teeth indicated that these markets appear to fluctuate over time but are not well documented in existing trade statistics. Shark fins and meat, two of the most commonly-traded and valuable shark products, were thus the focus of this study centered on the markets of Malaysia, Singapore and Thailand.

The study began by investigating shark production in the three countries to determine the role of domestic resources in supplying the market. Despite substantial reported elasmobranch (shark, skate and ray) landings in Thailand and Malaysia, available data for production of shark products in these countries indicates low quantities. This may be the result of statistical systems which do not differentiate shark products from other seafood and/or do not count unprocessed shark products such as fresh or frozen meat as production. Although under-reporting of fish commodity production is common in many countries, improved reporting of shark commodity production figures by ASEAN countries, possibly through linking shark landings monitoring and commodity production statistical systems, is recommended.

Regardless of the actual levels of domestic production in Malaysia, Singapore and Thailand, all three countries need to import shark meat and fins to satisfy domestic demand and/or entrepôt trade requirements. Of the three, Singapore is the largest importer of shark meat (1,000 to 2,000 mt per annum). Singapore's primary suppliers for shark meat are the British Indian Ocean Territory, Thailand, Taiwan and Japan. Malaysia and Thailand report lower levels of shark meat imports at 10 to 70 mt, and 110 to 320 mt, per annum, respectively. Singapore is also the largest importer of shark fins (600 to 1,500 mt per annum), in this case from the British Indian Ocean Territory, Hong Kong, Spain, India, Taiwan, Costa Rica, Yemen and Indonesia. Malaysia's shark fin imports are the lowest of the three, totaling 50 to 125 mt per annum, mainly from Indonesia and Singapore. Thailand's shark imports are slightly higher (100 to 200 mt per annum) and derive primarily from Hong Kong, and more recently, Mainland China.

This study also examined the role of each of the three countries as trading centers for shark products. The fresh and frozen shark meat trade in Malaysia, Singapore and Thailand comprises nearly all of the reported ASEAN imports. However, when compared to global totals, ASEAN's fresh and frozen shark meat trade figures are consistently less than 10%. In contrast, Singapore appears to be a major shark fin trading center controlling 10% of global imports and up to a quarter of world exports, at least through 1996 after which shark fin trade figures were no longer reported to FAO. Malaysia and Thailand have continuously submitted shark fin trade figures to FAO but their trade quantities are low. Given the importance of Singapore as a shark fin entrepôt, it is recommended that Singapore's shark fin trade figures be included in FAO statistics in order to facilitate accurate global shark fin trade monitoring. The continuing absence of these figures causes the FAO database to substantially under-estimate the ASEAN contribution to both imports and exports of shark fins, and to misrepresent the true scale of the shark fin trade.

Since the FAO database lacks data for Singapore, double counts transshipped imports, and does not distinguish between dried and frozen shark fins, it will not necessarily provide a reliable estimate of the quantity of shark fins in trade. Therefore, an alternative estimate was prepared using customs data from the three countries of interest and Hong Kong, Mainland China, Taiwan and Japan. Despite adjustments and corrections, the results are still believed to underestimate the total volume of shark fins marketed worldwide, primarily due to under-reporting in trade databases and because domestic consumption within countries that both produce and consume shark fins could not be included. Nevertheless, the global trade was estimated at 7,155 to 10,771 mt per annum between 1997 and 2002, considerably lower than the average for 1997-2001 of 14,138 mt per annum from the FAO database. The adjusted estimate for 2002 (8,536 mt) was the lowest figure since 1997, but showed Singapore handling 12% of

the global trade. In previous years, Singapore's share ranged from 7 to 17%, but neither Malaysia's nor Thailand's share ever exceeded 2%.

The analysis next turned to consumption of shark products and endeavored to estimate consumption by calculating the difference between imports and exports. Due to methodological complications presented by domestic production in Malaysia and Thailand, estimates were generated for Singapore only. No consistent trend of consumption versus export was observed in Singapore in terms of shark meat, but shark fin trade statistics and other sources suggested that between 100 and 500 mt of shark fin are consumed in Singapore each year, equating to 3 to 21% of the global trade total.

Export markets for the three countries of interest were also characterized. Singapore was found to be a consolidation hub for shark products from Southeast Asia before onward shipment to markets primarily located in East Asia. In addition to relying on Singapore as a transshipment center, Malaysia and Thailand also export shark products directly to Hong Kong and Mainland China. These trade channels are likely to expand as the demand for shark products in China grows and trade networks proliferate.

Price data for three types of shark fin offered for sale to Singapore by South Pacific dealers were compiled to examine market trends. Major effects on the shark fin trade, as indicated by price reductions, were observed with the onset of the Asian financial crisis in early 1998, the global economic downturn beginning in early 2001, and the SARS outbreak in April 2003. These data suggest that the market is demand-driven since changes in price appear to be closely tuned to factors likely to affect consumers' propensity to spend on luxury items such as shark fin.

Field surveys of shark fin markets in Malaysia, Thailand and Singapore allowed compilation of retail prices for a variety of shark fin products. Prices as high as 400 USD per kg for dried whole shark fin were commonly observed, with the most expensive of such products believed to be selling for 1,000 USD per kg. The lowest grade of shark fin consisted of loose, wet fin needle products in which the shark fin content could not be verified in advance of purchase and/or was subject to mixing with artificial shark fin. Such products retailed for under 10 USD per serving. Some information was gathered on the species used in the shark fin trade, but the practicality of such studies was limited by the apparent absence of standardized terminology for fins in these markets and the tendency to classify fins by needle quality rather than according to shark taxonomy.

The field surveys also provided insights into traders' attitudes and outlooks. In spite of the highly individual nature of each business, traders were generally in agreement on the importance of a healthy economy to their trade, the growing influence of Mainland Chinese consumers and overseas operatives on the market, and the full utilization of shark fins and meat in source fisheries. Differing views on CITES and the future of shark fisheries management were expressed, and individual traders adopted more or less proactive approaches to participating in debates that will shape these issues in the future. To the extent that this study opened a channel of communication with the trade community on these topics, it represents an important step forward for all parties.

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APPENDIX 3

PRELIMINARY RESULTS OF MICROSCOPIC OBSERVATION ON DERMAL DENTICLES OF SHARK FINS

By Ahmad Ali
Mahyam Mohd. Isa
Noor Azman Zakaria
Sollahuddin A. Razak
Annie Lim Pheik Khiok

SHARKS AND RAY SPECIES USED FOR DERMAL DENTICLES STUDY DURING 2004

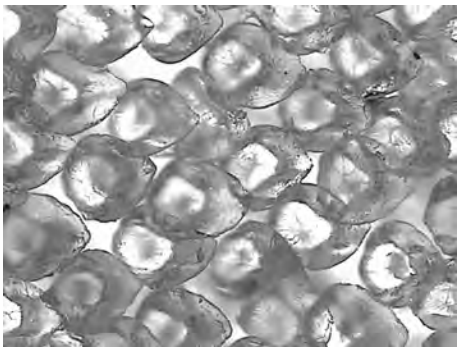
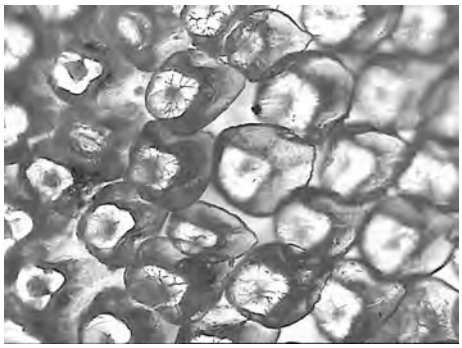
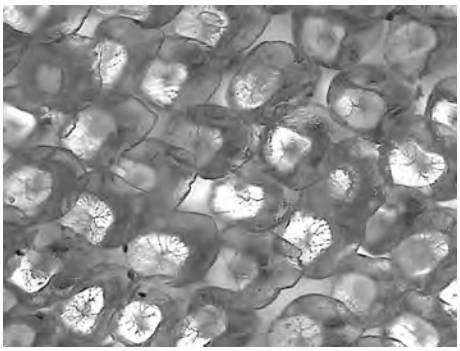
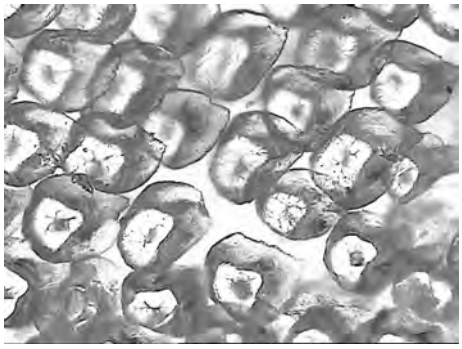
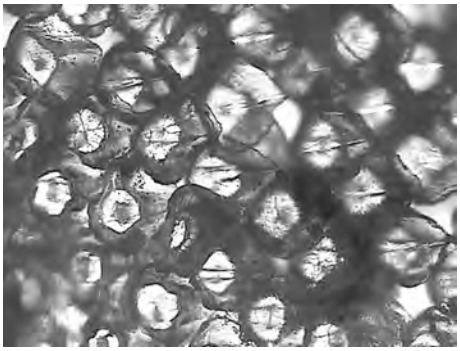
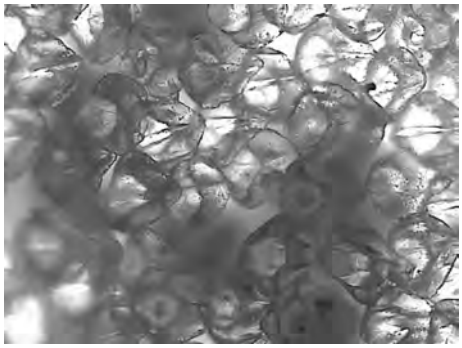
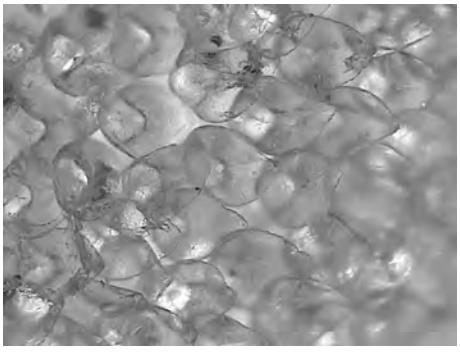
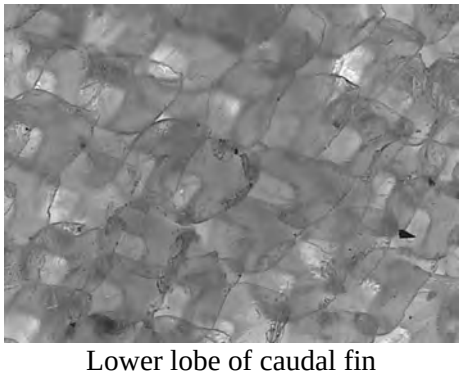
No	Family/Species	Sex	Total Length (cm)	Body Weight (kg)
	Family Sphyrnidae			
1.	*Sphyrna lewini*	♀	50.5	0.6
2.	*Sphyrna lewini*	♀	50.2	0.6
3.	*Sphyrna lewini*	♂	89.4	3.1
4.	*Sphyrna lewini*	♂	46.4	0.4
5.	*Sphyrna lewini*	♂	44.0	0.6
6.	*Sphyrna lewini*	♀	59.5	1.1
7	*Sphyrna lewini*	♂	56.2	0.8
8.	*Sphyrna mokarran*	♂	73.4	1.0
9.	*Sphyrna mokarran*	♂	197	33
	Family Carcharhinidae			
10.	*Carcharhinus amblyrhynchoides*	♀	90.2	5.6
11.	*Carcharhinus amblyrhynchoides*	♀	83.2	4.2
12.	*Carcharhinus amblyrhynchoides*	♀	80.2	3.7
13.	*Carcharhinus amblyrhynchoides*	♂	107	NA
14.	*Carcharhinus amblyrhynchoides*	NA	NA	NA
15.	*Carcharhinus leucas*	NA	NA	NA
16.	*Carcharhinus leucas*	NA	NA	NA
17.	*Carcharhinus sorrah*	♀	84.8	2.6
18.	*Carcharhinus sorrah*	♂	83.8	2.8
19.	*Carcharhinus sorrah*	♀	83.4	2.9
20.	*Carcharhinus sorrah*	♀	88.2	3.4
21.	*Carcharhinus sorrah*	NA	NA	NA
22.	*Carcharhinus sorrah*	♂	86.1	3.3
23.	*Carcharhinus sorrah*	♀	91.3	4.2
24.	*Loxodon macrorhinus*	♂	74.6	1.2
25.	*Loxodon macrorhinus*	♂	73.8	1.4
26.	*Loxodon macrorhinus*	♂	78	1.4
27.	*Loxodon macrorhinus*	♀	74.4	1.5
28.	*Loxodon macrorhinus*	♀	64.1	0.7
29.	*Loxodon macrorhinus*	♀	70.4	1.2
30.	*Loxodon macrorhinus*	♀	57.7	0.6
31.	*Rhizoprionodon acutus*	♂	84.6	2.1
32.	*Rhizoprionodon acutus*	♀	57.2	0.8
33.	*Rhizoprionodon acutus*	♂	52.8	0.6
34.	*Rhizoprionodon acutus*	♀	51.6	0.6
35.	*Rhizoprionodon acutus*	♂	49.0	0.5
36.	*Rhizoprionodon acutus*	♀	54.6	0.7
37.	*Rhizoprionodon acutus*	♀	52.8	0.6
38.	*Rhizoprionodon acutus*	♂	85.2	2.8
39.	*Rhizoprionodon acutus*	♂	72.7	1.3
40.	*Rhizoprionodon acutus*	♀	87.1	3.5
41.	*Carcharhinus sealei*	♀	70	1.2
42.	*Carcharhinus sealei*	♂	41	0.3
43.	*Carcharhinus sealei*	♂	67	1.4
44.	*Carcharhinus sealei*	♂	53.5	0.7
45.	*Carcharhinus sealei*	♀	57.4	0.9
46.	*Carcharhinus sealei*	♀	45	0.4

47.	*Carcharhinus dussumieri*	♀	44.3	0.4
48.	*Carcharhinus macloti*	NA	NA	NA
49.	*Carcharhinus borneensis*	NA	NA	NA
50.	*Lamniopsis temmnicki*	NA	NA	NA
51.	*Scoliodon laticaudus*	NA	NA	NA
	FAMILY HEMIGALEIDAE			
52.	*Hemigaleus microstoma*	♀	39.6	0.2
53.	*Hemigaleus microstoma*	♀	47.1	0.3
54.	*Hemigaleus microstoma*	♂	51.0	0.4
55.	*Hemigaleus microstoma*	♂	50.0	0.4
56.	*Hemigaleus microstoma*	♀	61.8	0.8
57.	*Hemigaleus microstoma*	♂	98	4.0
58.	*Hemigaleus microstoma*	♀	84.3	2.4
59.	*Hemigaleus microstoma*	♀	75.3	1.4
	HEMISCYLLIDAE			
60.	*Chiloscyllium plagiosum*	♀	82.1	1.7
61.	*Chiloscyllium indicum*	♀	58.5	0.6
62.	*Chiloscyllium hasselti*	NA	NA	NA
	STEGOSTOMATIDAE			
63.	*Stegostoma fasciatum*	NA	NA	NA
	RHINIDAE			
64.	*Rhynchobatus australiae*	♀	76.2	1.92

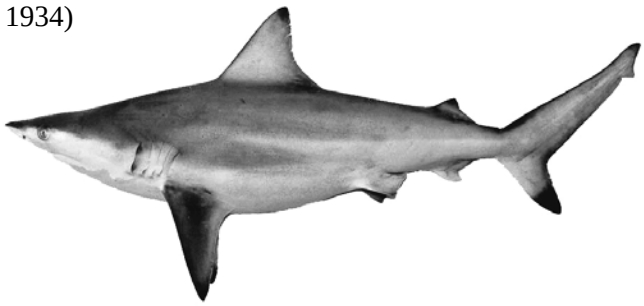
Note NA: Information not available.

Results

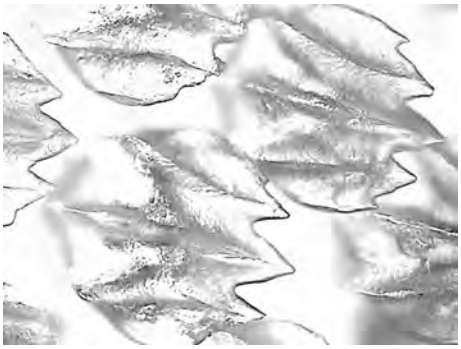
Rhynchobatus australiae (Whitley, 1939)
English name: White-spotted guitarfish

WET FINS	DRIED FINS
	
First dorsal fin	First dorsal fin
	
Second dorsal fin	Second dorsal fin
	
Pelvic fin	Pelvic fin
	
Lower lobe of caudal fin	Lower lobe of caudal fin

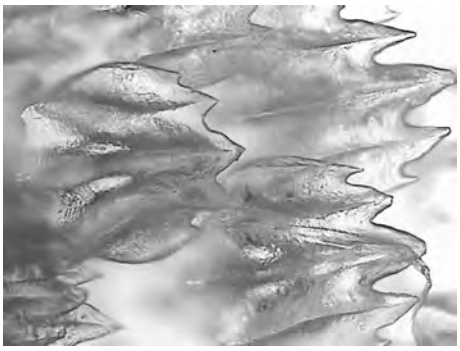
Carcharhinus amblyrhynchoides (Whitley, 1934)
English name: Graceful shark
Female; TL 90 cm; BW 5.5 kg



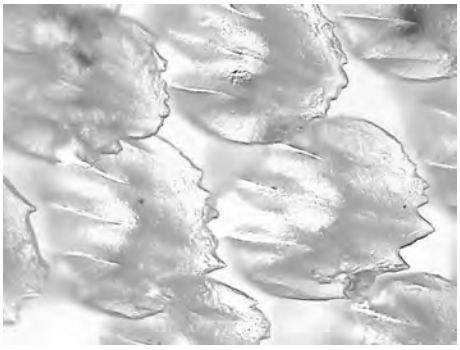
WET FINS



Dorsal fin

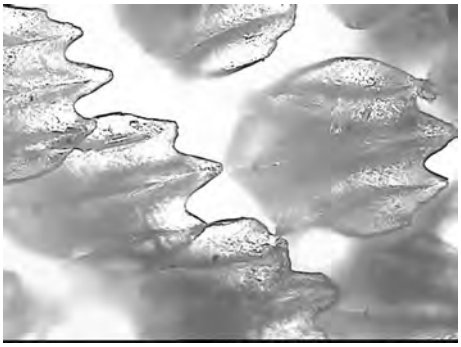


Pectoral fin

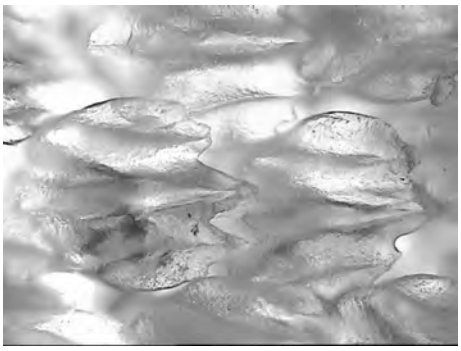


Lower lobe of caudal fin

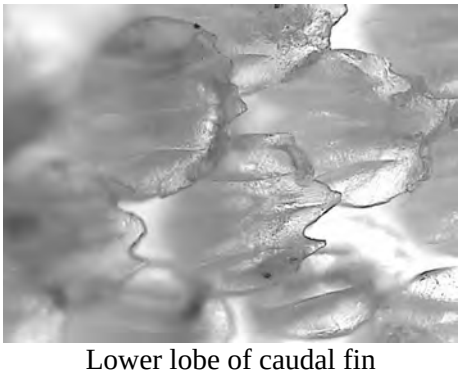
DRIED FINS



Dorsal fin

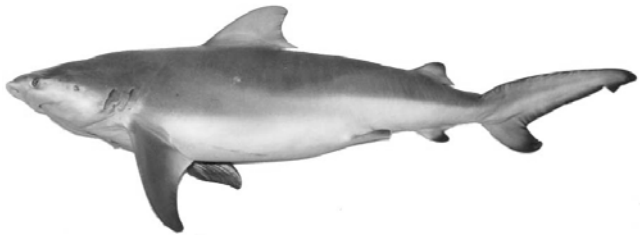


Pectoral fin

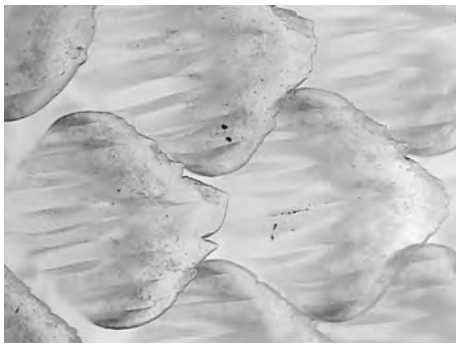


Lower lobe of caudal fin

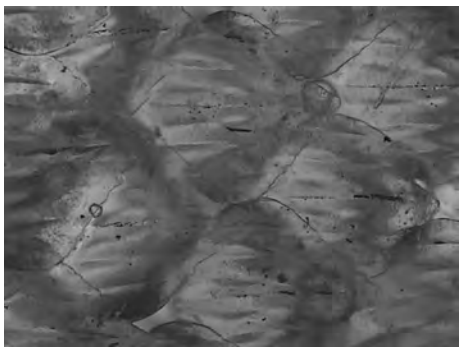
Carcharhinus leucas (Valenciennes *in* Müller and Henle, 1839)
English name: Bull shark



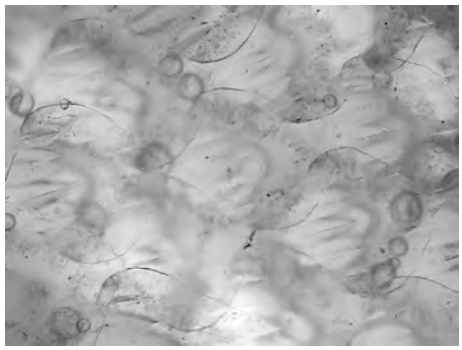
WET FINS



Dorsal fin

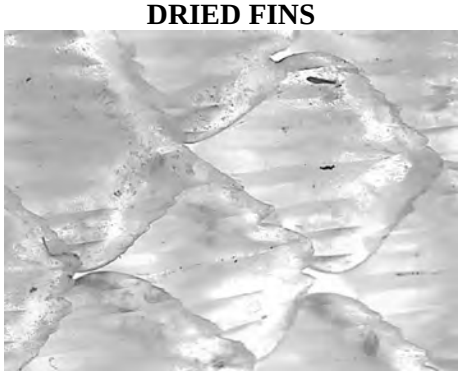


Pectoral fin

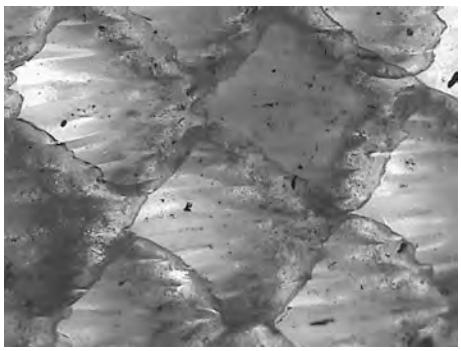


Lower lobe of caudal fin

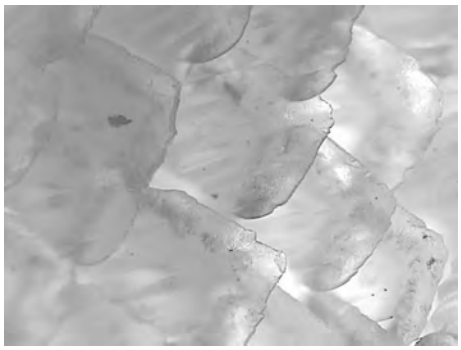
DRIED FINS



Dorsal fin

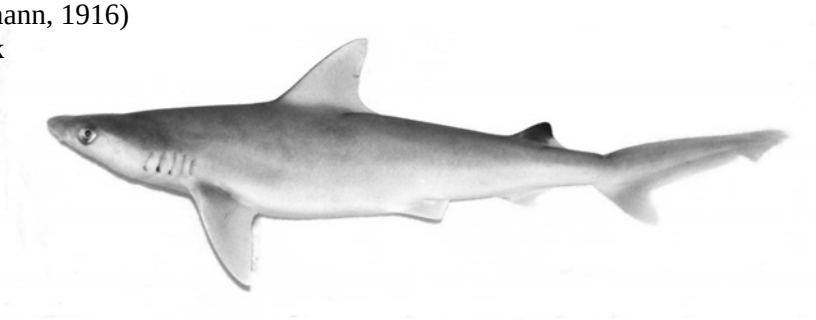


Pectoral fin

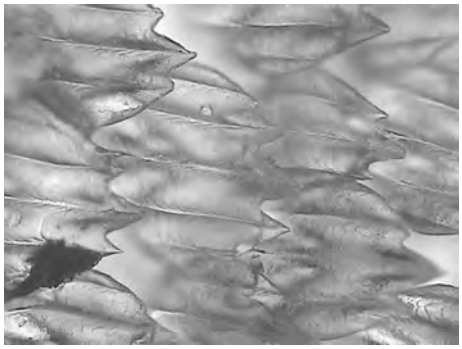


Lower lobe of caudal fin

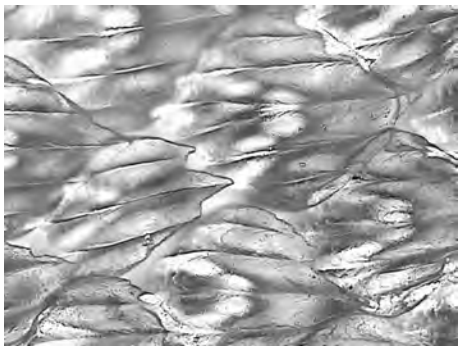
Carcharhinus sealei (Pietschmann, 1916)
English name: Blackspot shark
Female, TL 70 cm, BW 1.2 kg



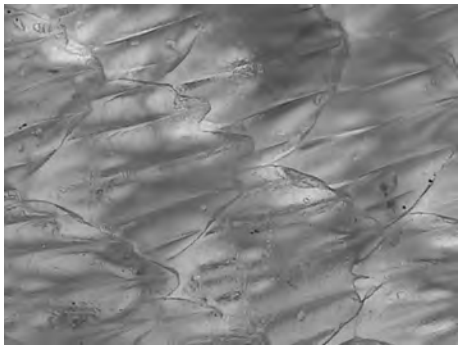
WET FINS



Dorsal fin

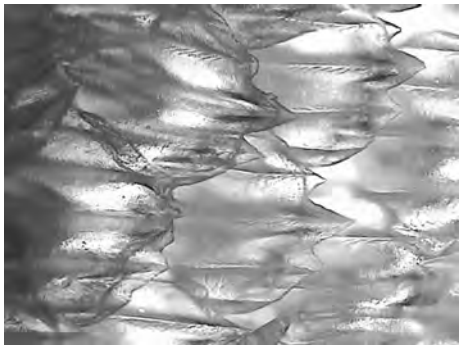


Pectoral fin

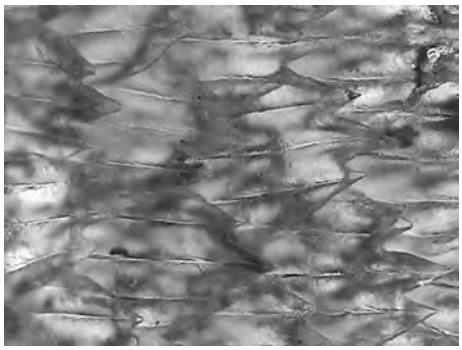


Lower lobe of caudal fin

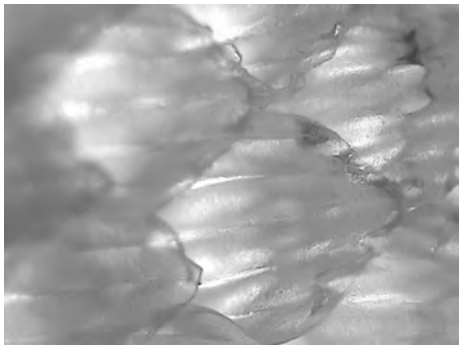
DRIED FINS



Dorsal fin

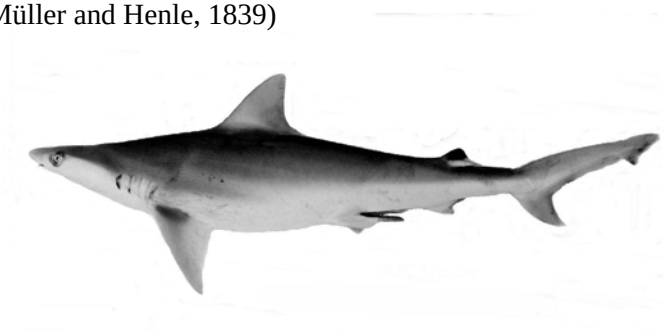


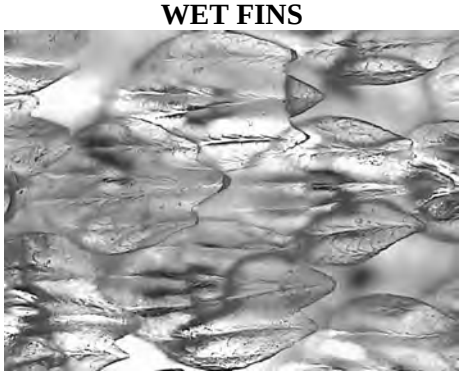
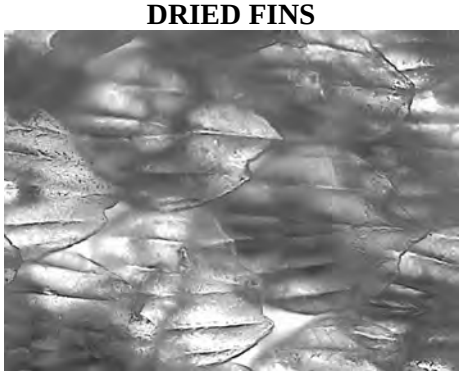
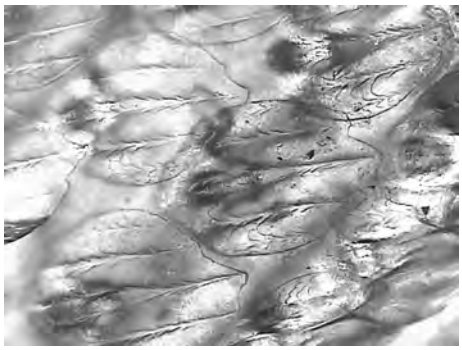
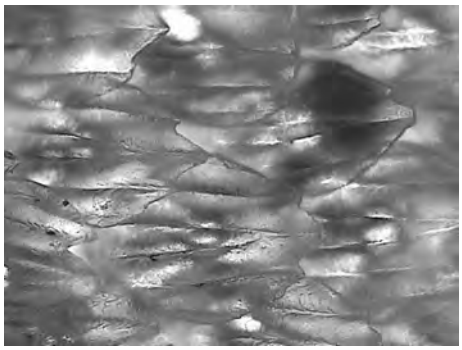
Pectoral fin



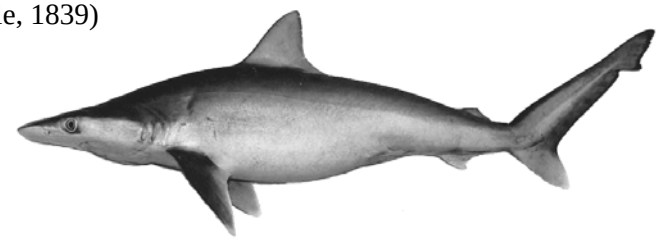
Lower lobe of caudal fin

Carcharhinus dussumieri (Valenciennes *in* Müller and Henle, 1839)
English name: Whitecheek shark
Female, TL 44 cm, BW 45 gm

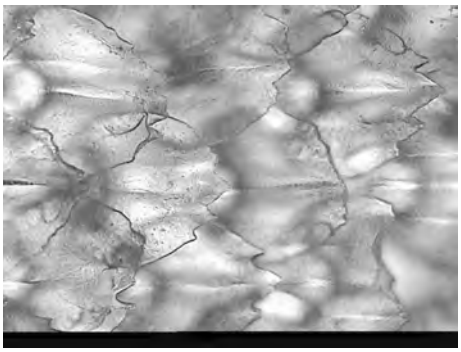


WET FINS	DRIED FINS
	
Dorsal fin	Dorsal fin
	
Pectoral fin	Pectoral fin
	
Lower lobe of caudal fin	Lower lobe of caudal fin

Carcharhinus macloti (Müller and Henle, 1839)
English name: Hardnose shark



Note: Only dried fins available

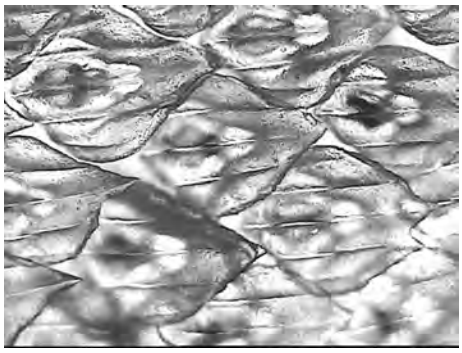


Dorsal fin

Pectoral fin

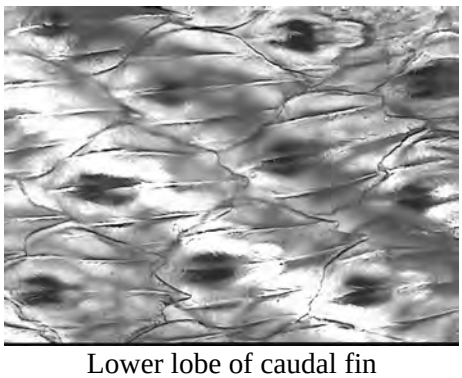
Loxodon macrorhinus Müller and Henle, 1839
English name: Sliteye shark
Female, TL 74 cm, BW 1.48 kg

WET FINS



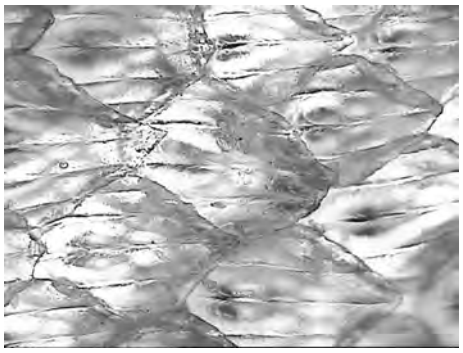
Dorsal fin

Pectoral fin

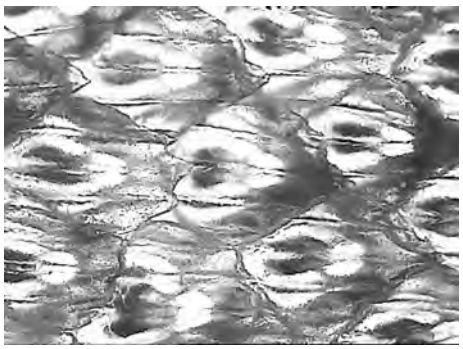


Lower lobe of caudal fin

DRIED FINS



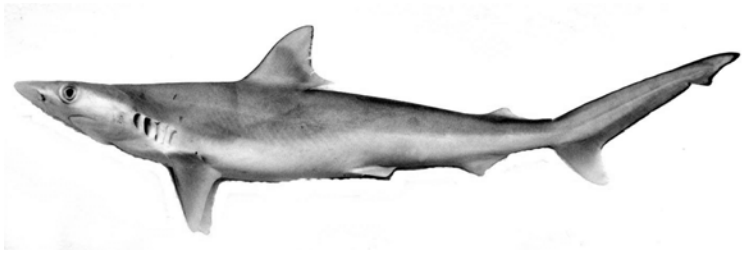
Dorsal fin



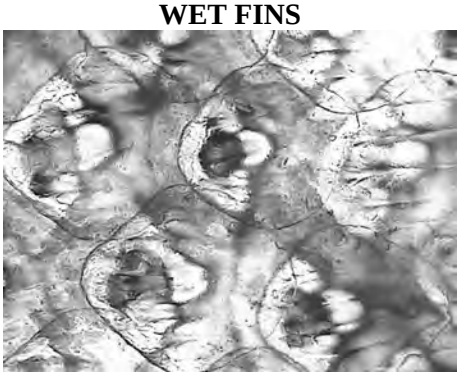
Pectoral fin

Lower lobe of caudal fin

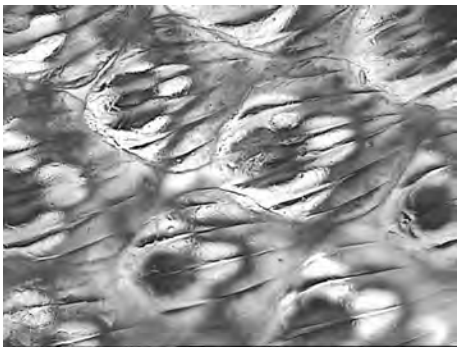
Rhizoprionodon acutus (Rüppell, 1837)
English name: Milk shark
Male,TL 85 cm, BW 2.1 kg



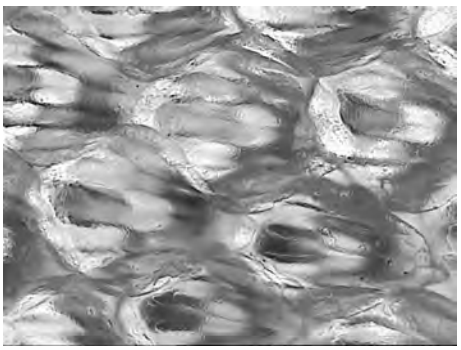
WET FINS



Dorsal fin

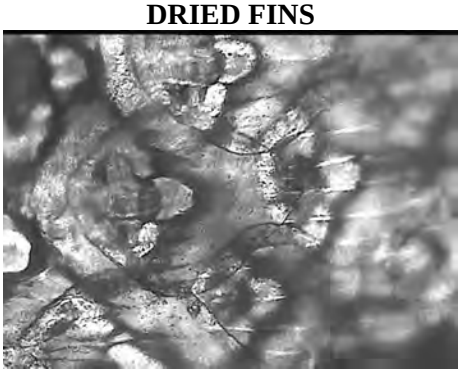


Pectoral fin



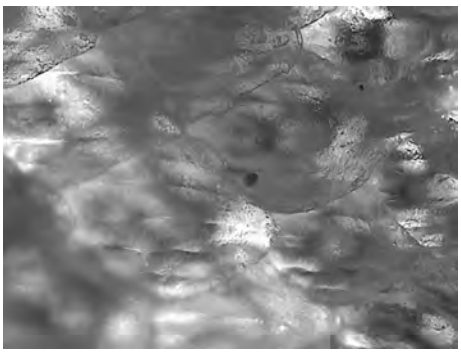
Lower lobe of caudal fin

DRIED FINS



Dorsal fin

Pectoral fin

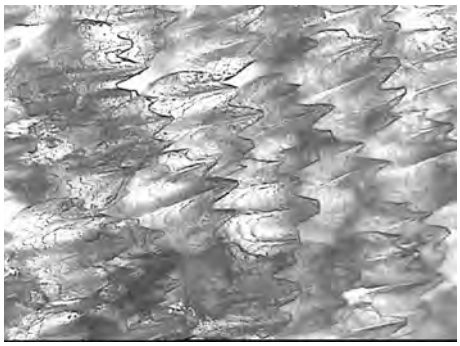


Lower lobe of caudal fin

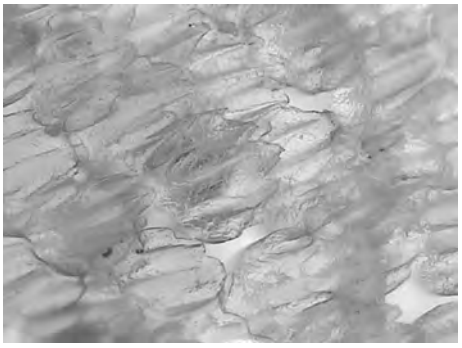
Sphyrna mokarran (Rüppell, 1837)
English name: Great hammerhead shark
Male; TL 73 cm, BW 1.04 kg

WET FINS

Dorsal fin

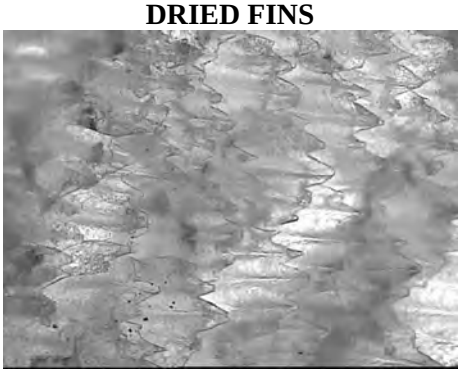


Pectoral fin

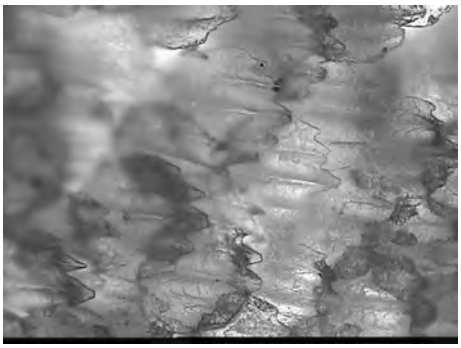


Lower lobe of caudal fin

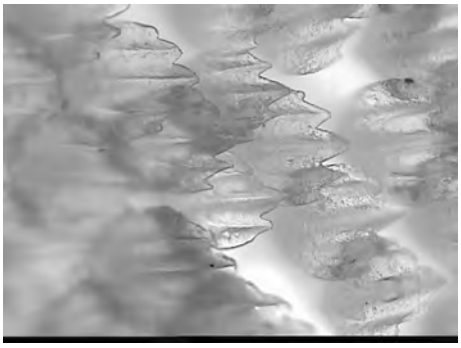
DRIED FINS



Dorsal fin



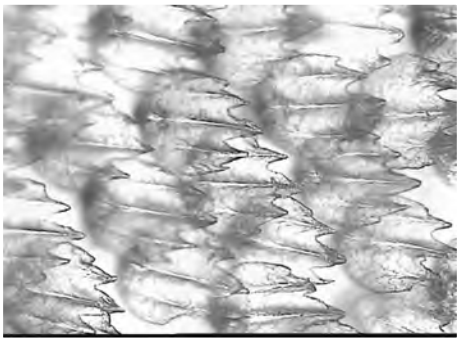
Pectoral fin



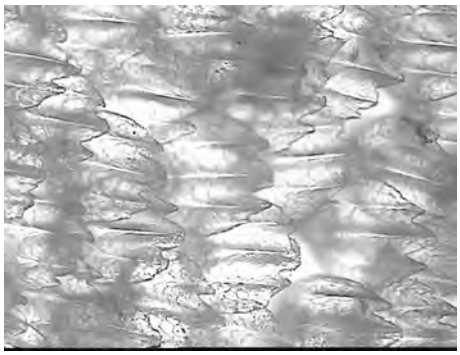
Lower lobe of caudal fin

Sphyrna lewini (Griffith and Smith, 1834)
English name: Scalloped hammerhead shark
Female;TL 50 cm; BW 625 gm

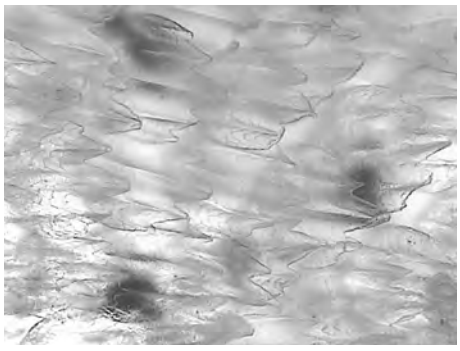
WET FINS



Dorsal fin

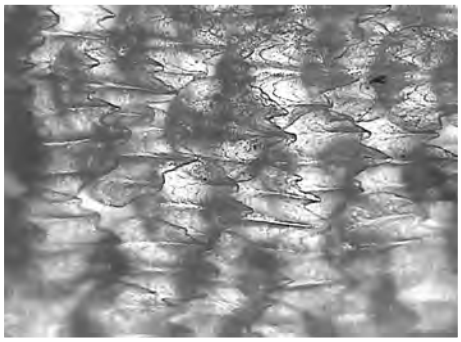


Pectoral fin

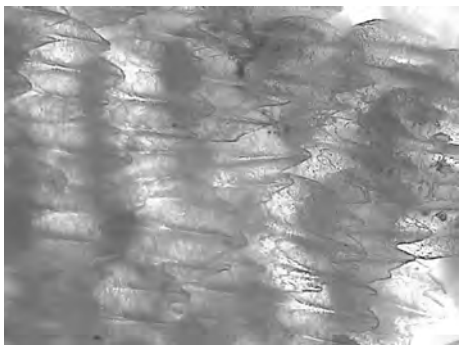


Lower lobe of caudal fin

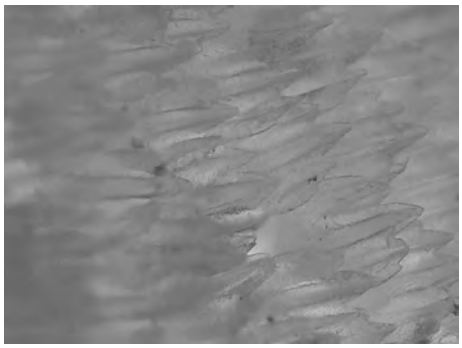
DRIED FINS



Dorsal fin

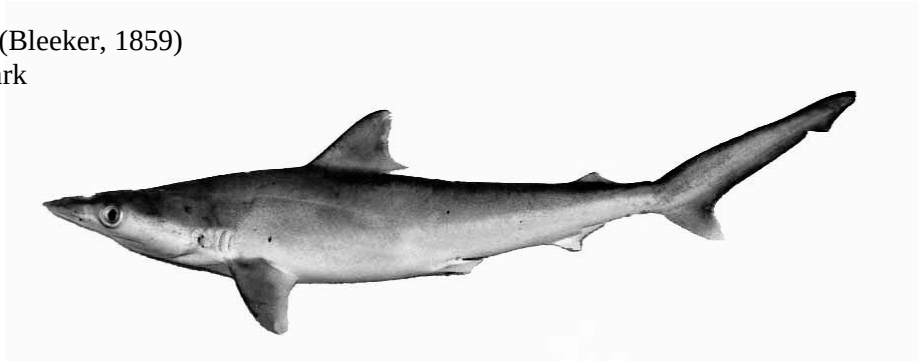


Pectoral fin

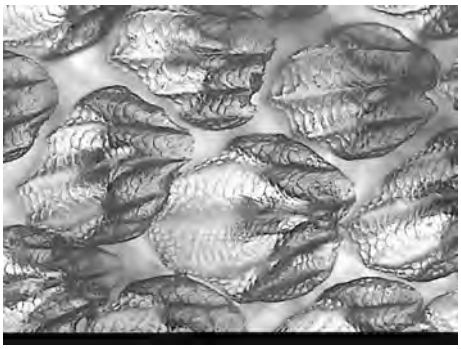


Lower lobe of caudal fin

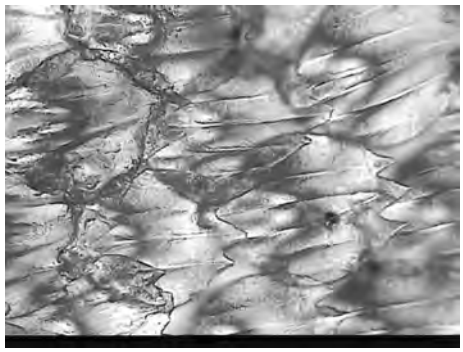
Carcharhinus borneensis (Bleeker, 1859)
English name: Borneo shark



Note: Only dried fins available

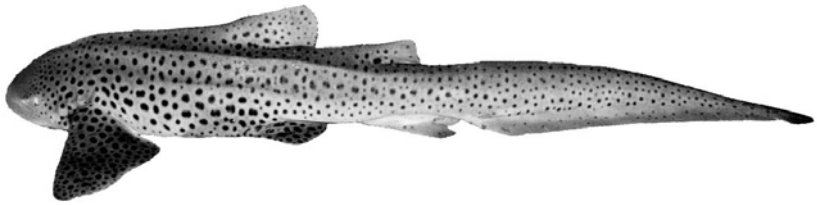


Dorsal fin

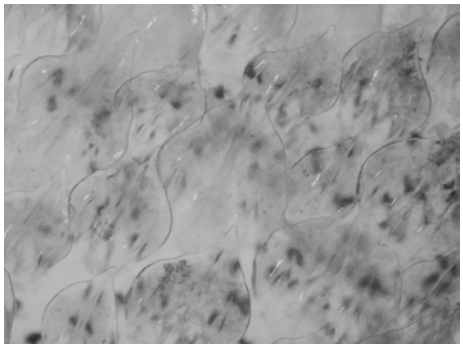


Pectoral fin

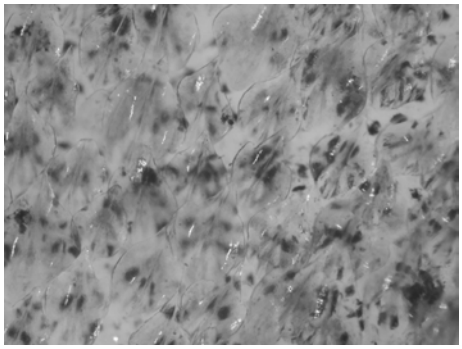
Stegostoma fasciatum (Hermann, 1783)
English name: Zebra shark



WET FINS

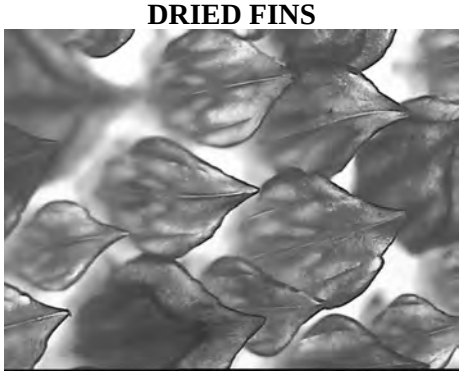


Dorsal fin

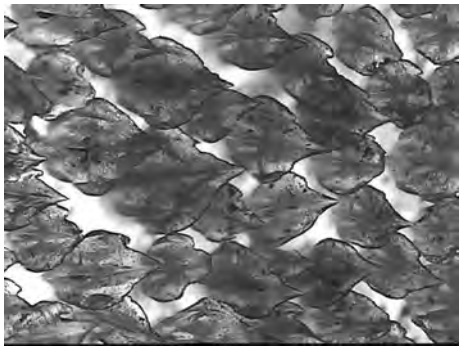


Pectoral fin

DRIED FINS

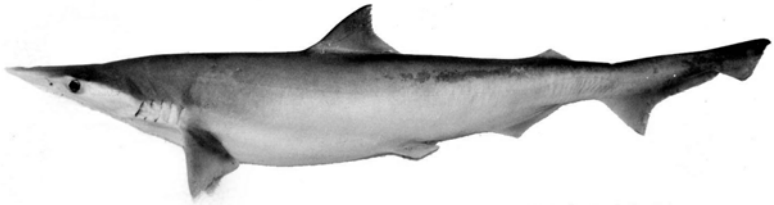


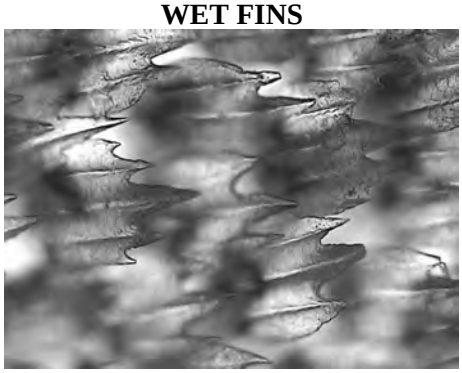
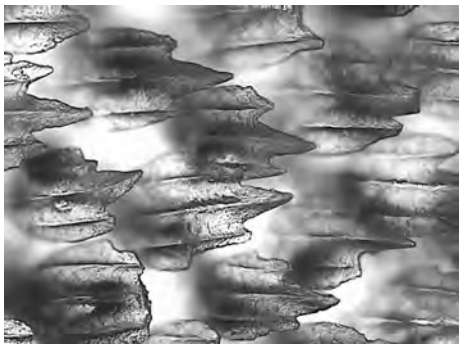
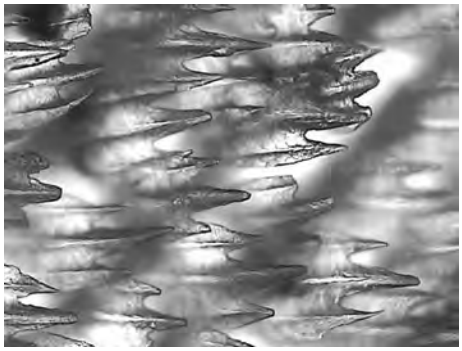
Dorsal fin



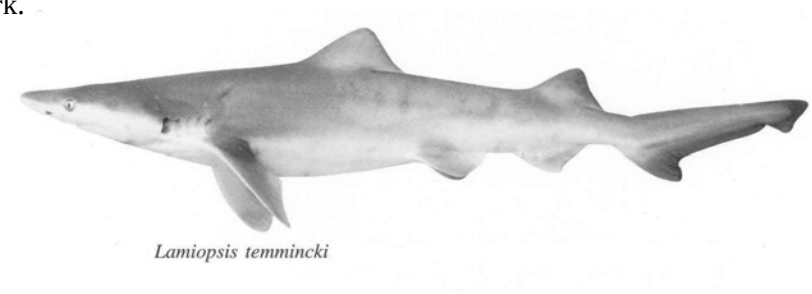
Pectoral fin

Scoliodon laticaudus Müller and Henle, 1838
English name: Spadenose shark



WET FINS	DRIED FINS
	
Dorsal fin	Dorsal fin
	
Pectoral fin	Pectoral fin
	
Lower lobe of caudal fin	Lowerlobe caudal fin

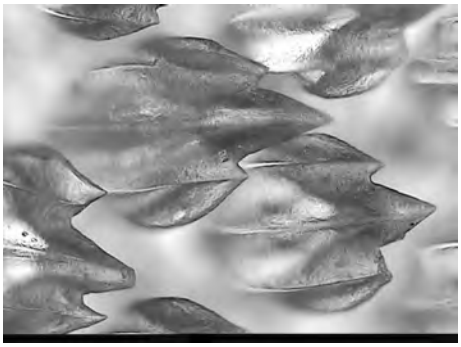
Lamiopsis temmincki (Müller and Henle, 1839)
English name: Broadfin shark.


Lamiopsis temmincki

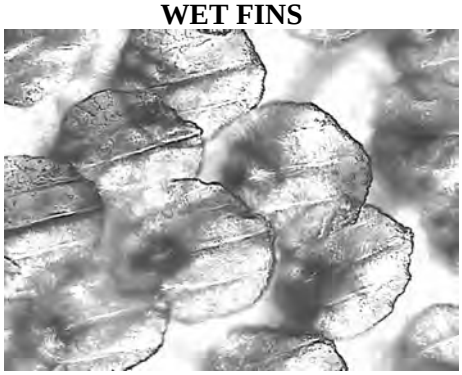
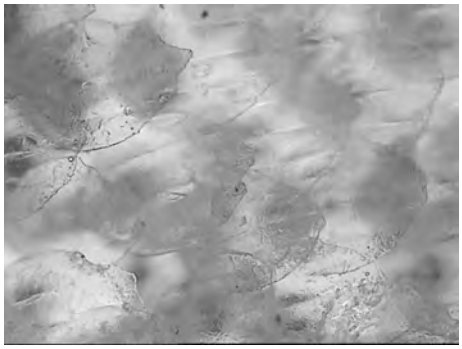
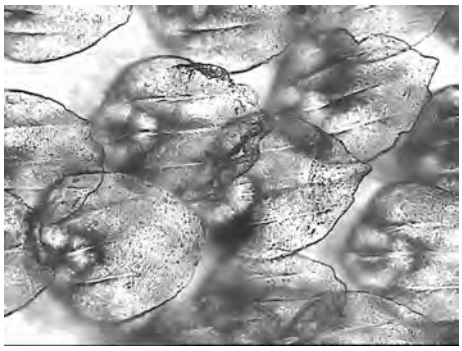
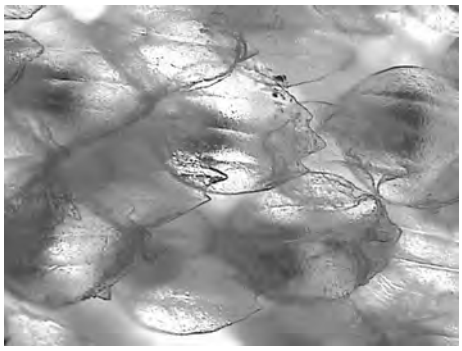
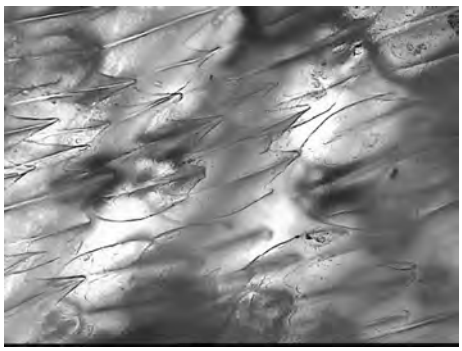
Note: Only dried fins available

DRIED FINS


Dorsal fin

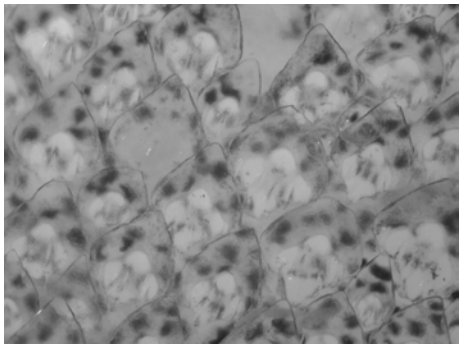

Pectoral fin

Hemigaleus microstoma Bleeker, 1852
English name: Weasel shark

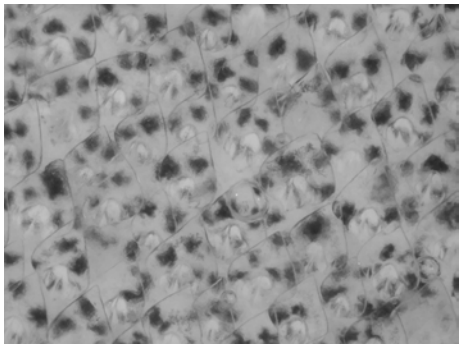
WET FINS	DRIED FINS
	
Dorsal fin	Dorsal fin
	
Pectoral fin	Pectoral fin
	
Lower lobe of caudal fin	Lower lobe of caudal fin

Chiloscyllium hasselti Bleeker, 1852
English name: Indonesian bamboo shark.

WET FINS

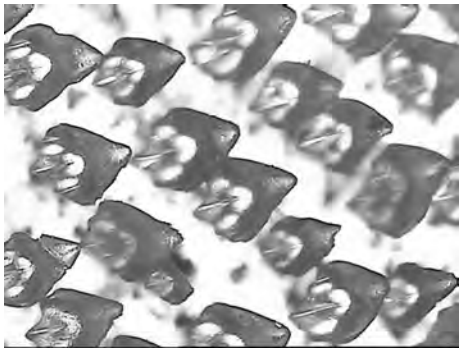


Dorsal fin

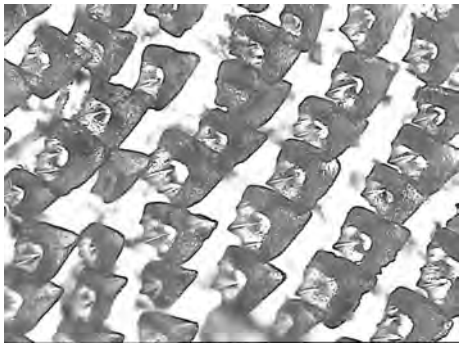


Pectoral fin

DRIED FINS

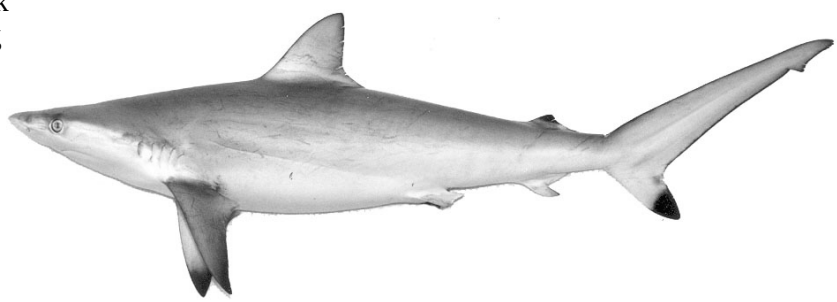


Dorsal fin



Pectoral fin

Carcharhinus sorrah (Valenciennes *in* Müller and Henle, 1839)
English names: Spot-tail shark
Female, TL85 cm, BW 2.6 kg



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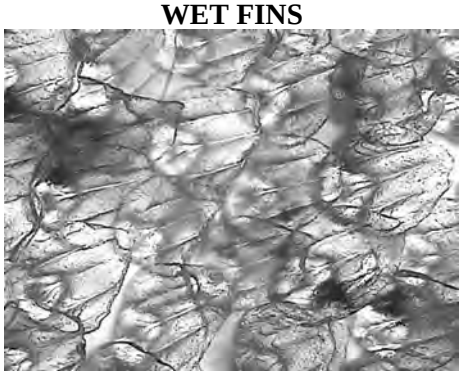
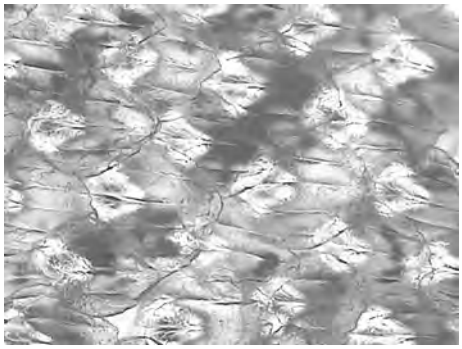
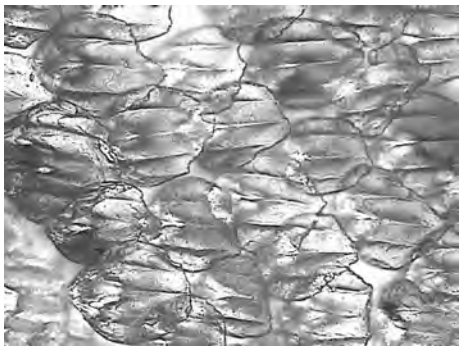


Dorsal fin

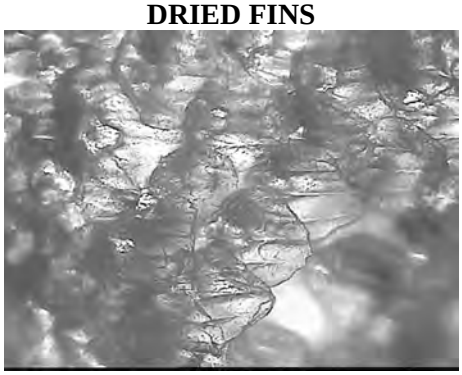


Pectoral fin

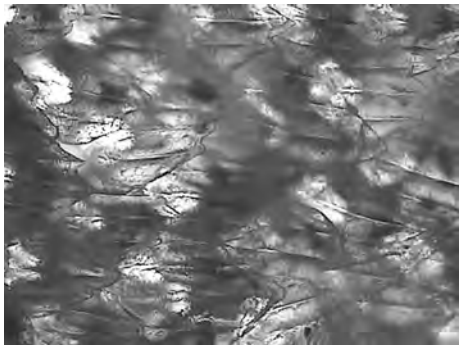


Lower lobe of caudal fin

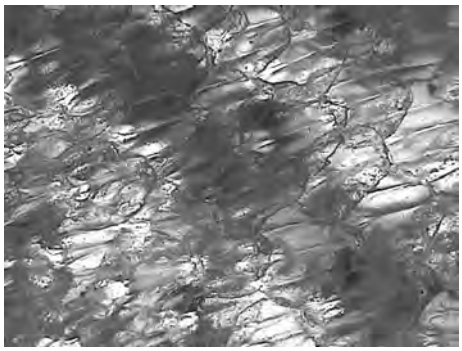
DRIED FINS



Dorsal fin



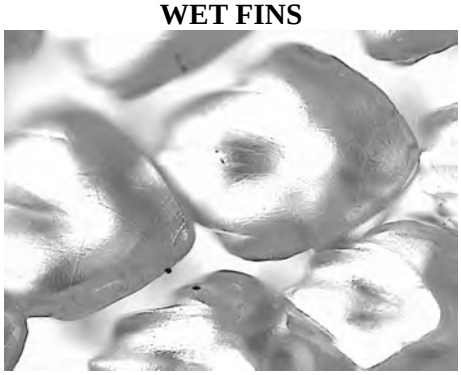
Pectoral fin



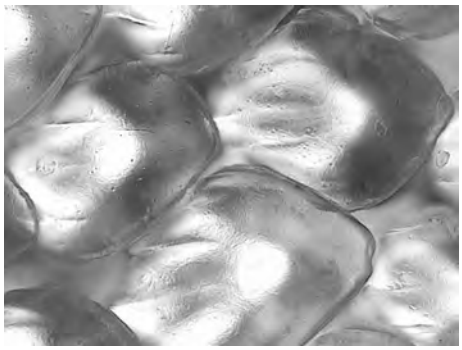
Lower lobe of caudal fin

Chiloscyllium plagiosum (Bennett, 1830)
English name: Whitespotted bambooshark
Female, TL 82 cm, BW 1.7 kg

WET FINS



Dorsal fin



Pectoral fin

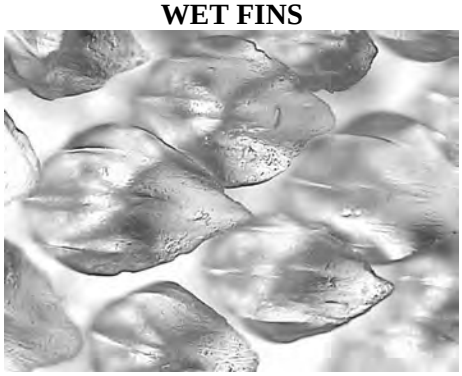
DRIED FINS

Dorsal fin

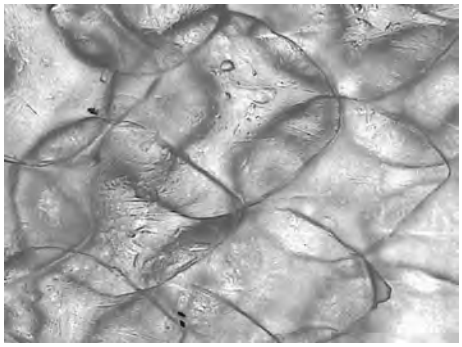
Pectoral fin

Chiloscyllium indicum (Gmelin, 1789)
English name: Slender bambooshark
Female, TL 59 cm, BW 550 gm

WET FINS

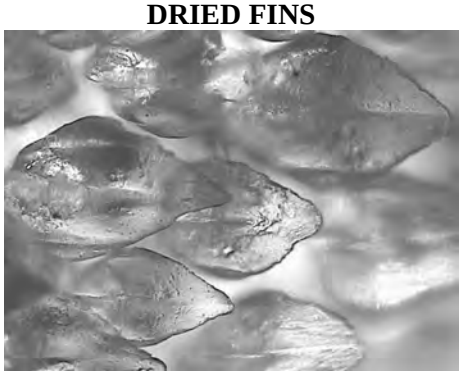


Dorsal fin

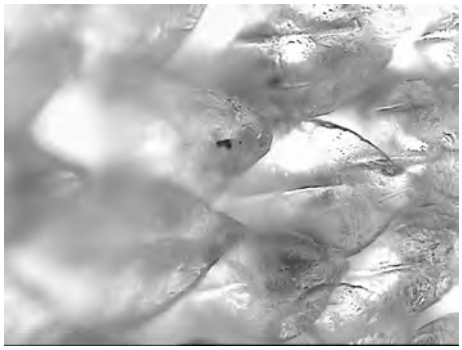


Pectoral fin

DRIED FINS



Dorsal fin



Pectoral fin

Southeast Asian Fisheries Development Center (SEAFDEC)

What is SEAFDEC?

SEAFDEC is an autonomous intergovernmental body established as a regional treaty organization in 1967 to promote sustainable fisheries development in Southeast Asia.

Objectives

SEAFDEC aims specifically to develop fishery potentials in the region through training, research and information services in order to improve food supply through rational utilization of fisheries resources in the region.

Functions

To achieve its objectives the Center has the following functions:

1. To offer training courses, and to organize workshops and seminars, in fishing technology, marine engineering, extension methodology, post-harvest technology, and aquaculture;
2. To conduct research and development in fishing gear technology, fishing ground surveys, post-harvest technology and aquaculture, to examine problems related to the handling of fish at sea and quality control, and to undertake studies on the fisheries resources in the region; and
3. To arrange for the transfer of technology to the countries in the region and to make available the printed and non-printed media, which include the publication of statistical bulletins for the exchange and dissemination related to fisheries and aquaculture development.

Membership

SEAFDEC membership is open to all Southeast Asian Countries. The Member Countries of SEAFDEC at present are Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam.

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The Southeast Asian Fisheries Development Center (SEAFDEC) is an intergovernmental organization established in December 1967 for the purpose of promoting sustainable fisheries development in the region. Its current Member Countries are Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam.

Representing the Member Countries is the Council of Directors, the policy-making body of SEAFDEC. The chief administrator of SEAFDEC is the Secretary-General whose office, the Secretariat is based in Bangkok, Thailand.

SEAFDEC undertakes research on appropriate fishery technologies, trains fisheries technicians, and disseminates fisheries information. Four Departments were established to pursue the objectives of the Center:

- The **Training Department (TD)** in Samutprakan, Thailand, established in 1967 for marine capture fisheries development;
- The **Marine Fisheries Research Department (MFRD)** in Singapore, established in 1967 for fishery post-harvest technology;
- The **Aquaculture Department (AQD)** in Iloilo, the Philippines, established in 1973 for aquaculture research and development; and
- The **Marine Fishery Resources Development and Management Department (MFRDMD)** in Kuala Terrengganu, Malaysia, established in 1992 for the development and management of the marine fishery resources in the exclusive economic zones (EEZs) of SEAFDEC Member Countries.