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MARKETING AND TRADE OF SHARKS AND RAYS IN JAVA AND SUMATERA (INDONESIA)

By

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FOREWORD

This study seeks to understand the domestic utilization and marketing of sharks and rays in Java and Sumatera as well as the international trade of Indonesia's shark and ray products. The study team would like to record their sincere thanks to the SEAFDEC Secretariat and Marine Fishery Resources Development and Management Department (SEAFDEC-MFRDMD) for initiating the idea to conduct the study in Indonesia. The study was conducted by officers from Center for Fisheries Research, Ministry of Marine Affairs and Fisheries, Jakarta Indonesia with financial and technical support from SEAFDEC-MFRDMD.

This pioneer marketing and trade study of sharks and rays in Indonesia sponsored by SEAFDEC has explored the status and trends of sharks and rays utilization, marketing and trade at 10 sites in Java and Sumatera. The findings of this study are useful to serve as an essential basis for developing appropriate fisheries management policies and actions, and thereby promote national responsibility for sharks and rays resource management issues including international trade issues such as Non-Detrimental Findings (NDFs). The findings from this study will also be useful as a guideline in expanding similar study to other islands in the future.

In particular, we are indebted to all officers from the Ministry of Marine Affairs and Fisheries and local officers based at all study sites in Jakarta, Palabuhanratu, Cirebon, Indramayu, (West Java), Tegal, Cilacap, Semarang (Central Java), Surabaya (East Java), Banda Aceh and Sibolga (Sumatera) for their continuous support and to facilitate our study either in terms of information or leads, is highly appreciated. Without their support, it can be safely said this study would have not been able to implement the field surveys and visits to landing centres and discussions with the fishers and industry players, who are the targeted stakeholders of the study. Their input serve as the core data for the study.

However, it was the readiness and warmness of the fishers at all study sites to share with us their experiences, insights and information that touched us deep with appreciation and admiration. Despite their struggle to earn a good income, their respect to the ocean and its content is remarkable that deserve respect and appreciation. This report is dedicated to them.

Last but not least, we would like to thank the Japanese Government for supporting this project under Japanese Trust Fund VI and express special thanks to Dr. Kom Silapajarn (Director-General of SEAFDEC), Mr. Raja Bidin bin Raja Hassan (Chief of SEAFDEC-MFRDMD), Dr. Kenji Taki (Deputy Chief of SEAFDEC-MFRDMD) for their endless support to conduct this study in Indonesia. Special thanks to Dr. Lilly Aprilya Pregiwati (SEAFDEC National Coordinator for Indonesia, MMAF) and Dr. Toni Ruchimat (Director of Center for Fisheries Research, Agency Research and Human Resources,MMAF) for their support in this study.

ABBREVIATION

CITES	The Convention on International Trade in Endangered Species of Wild Fauna and Flora
FAO	Food and Agriculture Organization of the United Nations
FMA	Fisheries Management Area
FishStatJ	Name of software for Fisheries Statistical Time Series of FAO
IPOA-Shark	International Plan of Action for Conservation and Management of Shark
MFRDMD	Marine Fishery Resources Development and Management Department
MMAF	Ministry of Marine Affair and Fisheries
MPA	Marine Protected Area
NDFs	Non-detrimental findings
NPOA-Sharks	National Plan of Action for Conservation and Management of Shark
PERSIPINDO	Perhimpunan Pengusaha Sirip Indonesia
SEAFDEC	Southeast Asian Fisheries Development Center

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Key Findings

- Zero waste; there is almost no part of the shark and ray being wasted. There is a high diversity of products that are produced from sharks and rays excluding fins, such as meat, skin, cartilages, teeth, intestine, stomach content, low quality fin (mostly anal and caudal fin), oil and even the tail of rays.
- Economic value; it generated massive livelihood not only to those directly involved, such as fisher, boat owner, exporter, collector, wholesaler, retailer and processor but also various labor workers at different level such as port workers and transportation. Every single part of the shark and ray has value, for instance the inconsumable stomach content is processed for animal feed.
- Protein source; Indonesia as one of the main chondrichthyan producer is known as an important exporter of shark and ray fins. However, the amount of shark and ray meat being exported is less than expected. Arguably, Indonesian's domestic consumption of shark and ray meat is higher than the export. In some areas, shark and ray meat is a traditional delicacy important to their culture.
- Affordable; Salted meat of sharks and rays is popular amongst the mountain communities across Indonesia, due to its affordability and durability of storage. This is important for security not only for coastal communities, but also terrestrial/mountain communities.
- High dependency; Livelihood and source of protein has been significantly generated by shark and ray resources. Communities depend on the resources as part of their livelihood and as an affordable source of protein.
- Multi-agent; The trade of sharks and rays in Indonesia have a complex chain within the country because of the mutual benefit in this trade. Some agents could act not only as exporter, but also as a supplier at the same time. It also need to take into account thousands of home-based business that rely on the resources.

1. Introduction

More than 118 species from 25 families of shark and rays are distributed throughout Indonesian waters (Dharmadi et al., 2015). This high diversity is detrimentally affected by the fact that Indonesia is the nation with the largest shark and ray catch (Lack and Sant, 2009, FAO-FishStatJ, 2015). In addition, Indonesia lacks systematic information on the numbers and species of sharks and rays caught in fisheries. This includes under-reported catches of small-scale fishing which appear to be a significant contributor to the shark and ray population decline (Jaiteh et al., 2016b). In 2010, 72% of shark and ray landings in Indonesia were taken as bycatch (Zainudin, 2011) by various fishing gears such as gillnets and droplines (Blaber et al., 2009) and bottom- and drift- longlines (Fahmi and Dharmadi, 2015). There are two Fisheries Management Areas (FMA) that mainly contributed to shark catches: Western Indian Ocean (FMA 572) and Eastern Indian Ocean (FMA 573).

Indonesia also has a National Plan of Action (NPOA) for sharks established in 2010 which implements FAO's International Plan of Action. The NPOA consist of key actions, such as data collection, status review, and improvement on research and management. There are some management measures that have been established to conserve sharks and rays in Indonesia, such as species protection for whale shark (18/KEPMEN-KP/2013) and manta rays (4/KEPMEN-KP/2014), export bans for oceanic whitetip and hammerhead sharks (34/PERMEN-KP/2015) and conservation measures for thresher sharks (30/PERMEN-KP/2012). At least 144 marine protected areas (MPAs) have been established across Indonesian waters to support marine conservation including for sharks and rays (DAFSC, 2016). In 2015, rays were included as an integral part of the NPOA, and a task force on sharks and rays was established.

Global attention called for conservation and protection of elasmobranchs around the world (Ward-Paige et al., 2010, Worm et al., 2013). However, this campaign in some level neglected social-economic (Jacques, 2010, Jaiteh et al., 2014), livelihood (Jaiteh et al., 2016a) and food security. It should also consider the complexity of Indonesia's fisheries, such as small-scale dominated fisheries, unreliable data collection and by-catch issues (Booth et al., 2018). Some studies highlighted the importance of shark as affordable sources of protein for coastal communities (Simpfendorfer and Dulvy, 2017, Glaus et al., 2019). The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) currently regulates the international trade of very few marine fish species, by listing them

in its Appendices and allows to trade Appendix II species by developing Non-detrimental findings (NDFs) scheme.

2. Problem Statement

As one of the major exporters of sharks and rays in the world, Indonesia needs to compile more information on the socio-economics profile of the fishers and traders who are involved in the sharks and rays business, its volume, and value of marketing and trading especially on CITES listed species in major landing sites in Sumatera and Java. All information on volume and trade especially on CITES listed species will be very useful for preparation of Non-Detrimental Findings (NDFs) document for export purposes.

In this regard, under the Japanese Trust Fund VI Project on "Research for Enhancement of Sustainable Utilization and Management of Sharks and Rays in the Southeast Asian Region", SEAFDEC/MFRDMD proposed to conduct preliminary survey on domestic utilisation, marketing and trade of sharks and rays in Indonesia at several major landing sites in Java and Sumatera. This survey was conducted in collaboration with Center for Fisheries Research, AMFRHR, Ministry of Marine Affairs and Fisheries, Republic of Indonesia.

3. Objectives of the Study

The overall objective of the survey was to collect information on socio-culture-economy, marketing and trade data to support Indonesia on the preparation of NDFs document in future. The specific objectives are:

i. To survey the dependencies of fishers at selected landing sites in Java and Sumatera towards shark and ray;

ii. To survey the impacts on socio-culture-economy of fishers after several shark and ray species listed in Appendix II CITES at selected landing sites;

iii. To survey the major actors in domestic marketing of shark and ray especially CITES listed species in Java and Sumatera;

iv. To survey shark and ray trade channels and practices at selected areas in Java and Sumatera; and

v. To evaluate the international trade of shark and ray at study areas.

4. Methodology

This section describes the methodologies and approaches to be applied to achieve the above objectives. The method for each objective is outlined below:

Objectives (i and ii) : Survey using forms as shown in Appendix I,

Objectives (iii and iv) : Marketing channel analysis and using forms as shown in Appendix II; and

Objective (v) : Descriptive analysis (using secondary data from local and federal fisheries statistic office or custom data).

A supply chain framework is used to guide the discussion and information seeking. The survey will ensure that major marketing functions will be covered. These include: exchange function (buying, selling and storage), physical (transportation, processing and standardization) and facilitating (risk bearing, financing and market intelligence). The major players along supply chain and product development will be identified and observed respectively from the landing centres until they reach the final destinations reported by the stakeholders. To capture the differences in the marketing network between localities, a case study approach will be adopted for the locality and specific firm chosen. Marketing channel analysis utilizes primary data collected from various middlemen in selected markets in Java and Sumatera. Descriptive analysis of trade patterns relies on secondary data sourced from local and federal fisheries statistic office or custom data.

Survey conducted within 30th July 2018-16th August 2018 that cover 10 locations i.e. Jakarta, Palabuhanratu, Cirebon, Indramayu, (West Java), Tegal, Cilacap, Semarang (Central Java), Surabaya (East Java), Banda Aceh dan Sibolga (Sumatera) (Figure 1). More than 40 representative respondents were interviewed to collect comprehensive information about trade and market of shark and ray products.

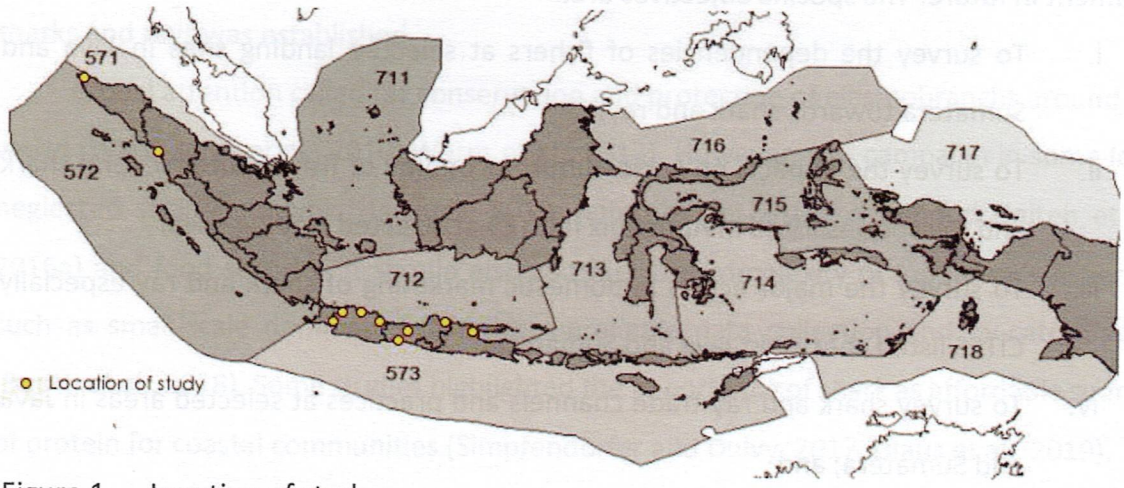

Figure 1. Location of study.

5. Production

5.1. Global

Globally, the main countries of shark fin consumption located in the East and Southeast Asia such as China, Hong Kong SAR, Taiwan Province of China, Singapore, Malaysia and Vietnam (Dent and Clarke, 2015). While shark meat mostly exported to South America and Europe, with the main importers being Italy, Brazil, Uruguay, Spain and the Republic of Korea. Indonesia and Spain are also the important "exporters" by considering the high amount of shark and ray being landed by fishing vessel. China and Hong Kong both have an important role as main importers and also processing exporter of shark and ray products to the world. The world's major shark fin exporting producers are Spain, Indonesia, Taiwan Province of China and Japan, however limited data (quality and reliability) requires further investigation.

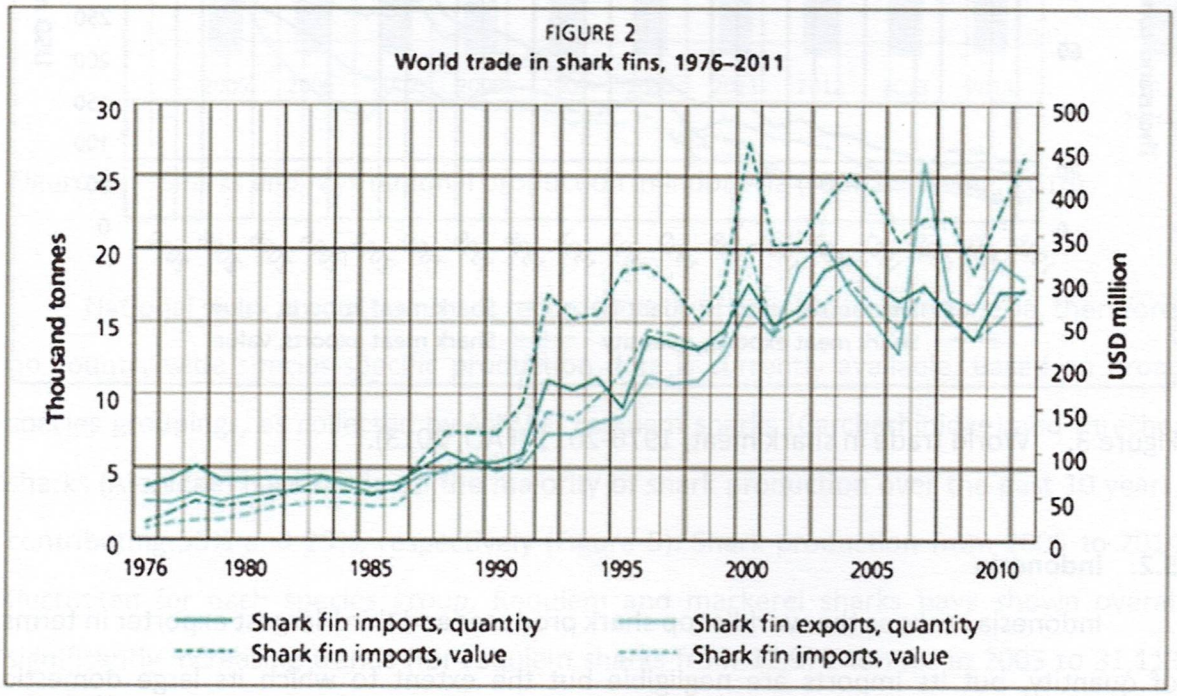

Figure 2. World trade in shark fins, 1976-2011 (FAO, 2013).

Global trade data shows the trade in shark meat expanding steadily over the last decade, it increased 42% in 2011 compared with 2000 (Dent and Clarke, 2015). This is probably due to an increase of seafood demand and also policy that required fishing vessels to land whole bodies of shark and ray instead of finning. Spain and Taiwan Province of China are the largest producers of shark meat and marketed mainly towards Italy and Brazil.

Moreover, Indonesia as one of the biggest shark producer, exported mostly fins instead of meat. It is arguable that domestic consumption of shark meat's is higher than export. Similarly Muttaqin et al. (2018) highlighted that, the growth of human population also affected an increase in demand of shark and ray products and the chain involving thousands of people as source of livelihood. However, since the new policy was established for fishing gear shifting especially in the Arafura Sea. There was an increase in catches of sharks and in 2016 several cold storages started to export mainly to Hong Kong.

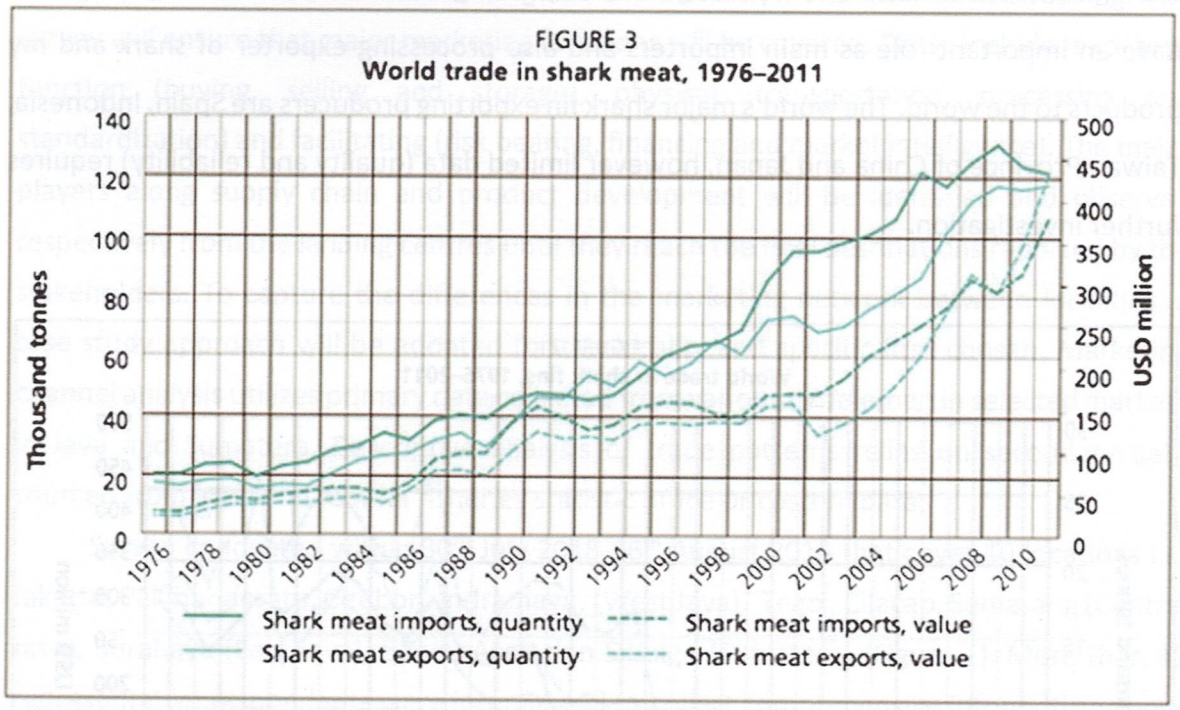

Figure 3. World trade in shark meat, 1976-2011 (FAO, 2013).

5.2. Indonesia

Indonesia ranks as the world's top shark producer and third-largest exporter in terms of quantity, but its imports are negligible but the extent to which its large domestic production is absorbed by the domestic market is not known (Dent and Clarke, 2015). We assume that the domestic demand of shark products is significant, it revealed the importance of shark product especially shark meat as an affordable source of protein.

According to government production statistics, annual elasmobranch production has been relatively steady over the past decade (2005-2014), oscillating between approximately 90,000 to 120,000 tonnes per year, with a 10-year annual average of 104,898 (SD 8,124)

tonnes per year (MMAF, 2016). On average, 46% of total annual production consists of shark species, while 54% consists of rays (Figure 4). It is also important to note that MMAF monitoring systems currently classify sawfishes as 'sharks', however they have been classified as rays for the purpose of this analysis in terms of their scientific classification as Rhinopristiformes.

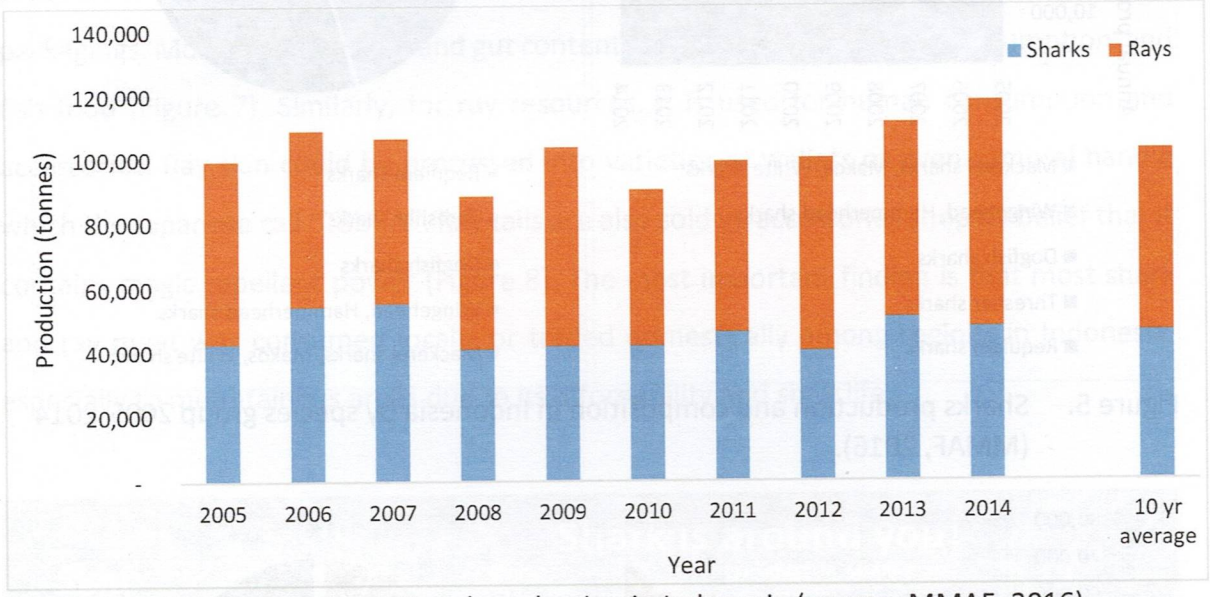

Figure 4. Sharks and rays national production in Indonesia (source: MMAF, 2016).

National shark production is not recorded at the species level in Indonesia, therefore, no country-wide species-specific production data is currently available. Based on broad species groupings, as collected by MMAF, requiem sharks (Carcharhinidae) and thresher sharks (Alopidae) have made up the majority of shark production over the past 10 years, contributing 55% and 25%, respectively (Figure 5). Shark production from 2005 to 2014 fluctuated for each species group. Requiem and mackerel sharks have shown overall significantly increasing trends (for requiem sharks from 12,972 tonnes in 2005 to 31,113 tonnes in 2014, and for mackerel sharks from 272 tonnes in 2005 to 704 tonnes in 2015). CITES-listed silky sharks (*Carcharhinus falciformis)* and oceanic whitetip sharks (*Carcharhinus longimanus)* fall within the broader requiem shark group.

Moreover, rays, stingrays make up the majority of production over the past ten years, at 69% of total ray production, followed by white-spotted wedgefish (16%) and eagle rays (8%). Ray production for most species has generally increased over time, although white-spotted wedgefish saw dramatic declines between 2005 and 2008 (Figure 6).

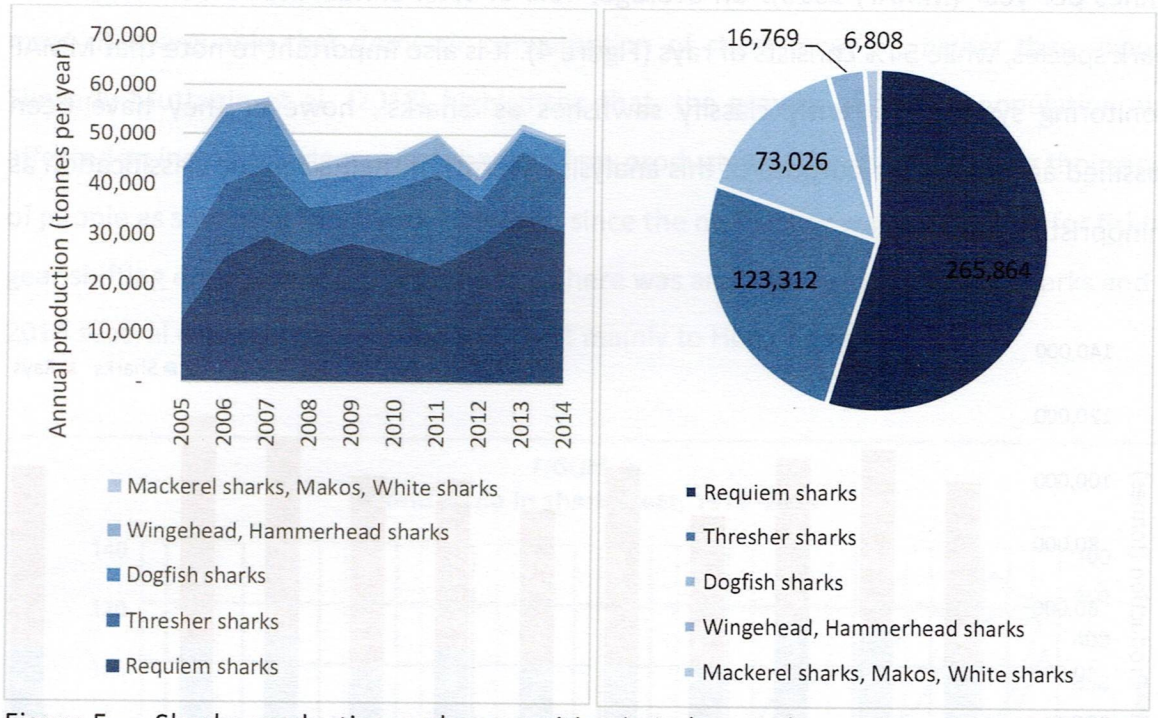

Figure 5. Sharks production and composition in Indonesia by species group 2005-2014 (MMAF, 2016).

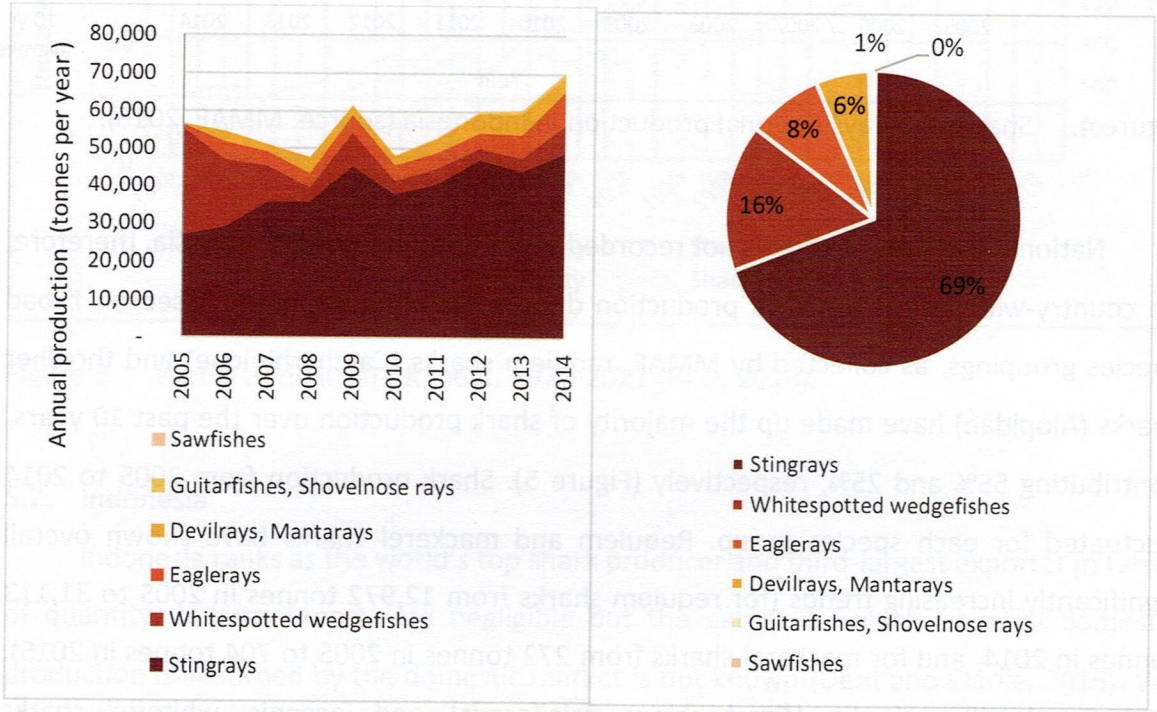

Figure 6. Rays production and composition in Indonesia by species group 2005-2014 (MMAF, 2016).

6. Trade

6.1. Shark and ray products

Product and derivative products of sharks and rays may vary based on source, process, quality and purpose. Based on our findings, zero waste scheme is shown to utilise all parts of sharks and rays during the processing of materials. For instance, shark meat was processed into fresh food, dried and frozen meat with a variety of techniques and packagings. Moreover, intestine and gut content are also used for human consumption and fish food (Figure 7). Similarly, for ray resources, it is used for human consumption and accessories. Ray skin could be processed into varieties of wallets or even samurai handle which the Japanese call "TSUKA". Ray tails are also sold in accessories shop by belief that it contains magic repellent power (Figure 8). The most important finding is that most shark and ray meat was consumed locally or traded domestically among regions in Indonesia, especially to mountainous areas due to its affordability and shelf life.

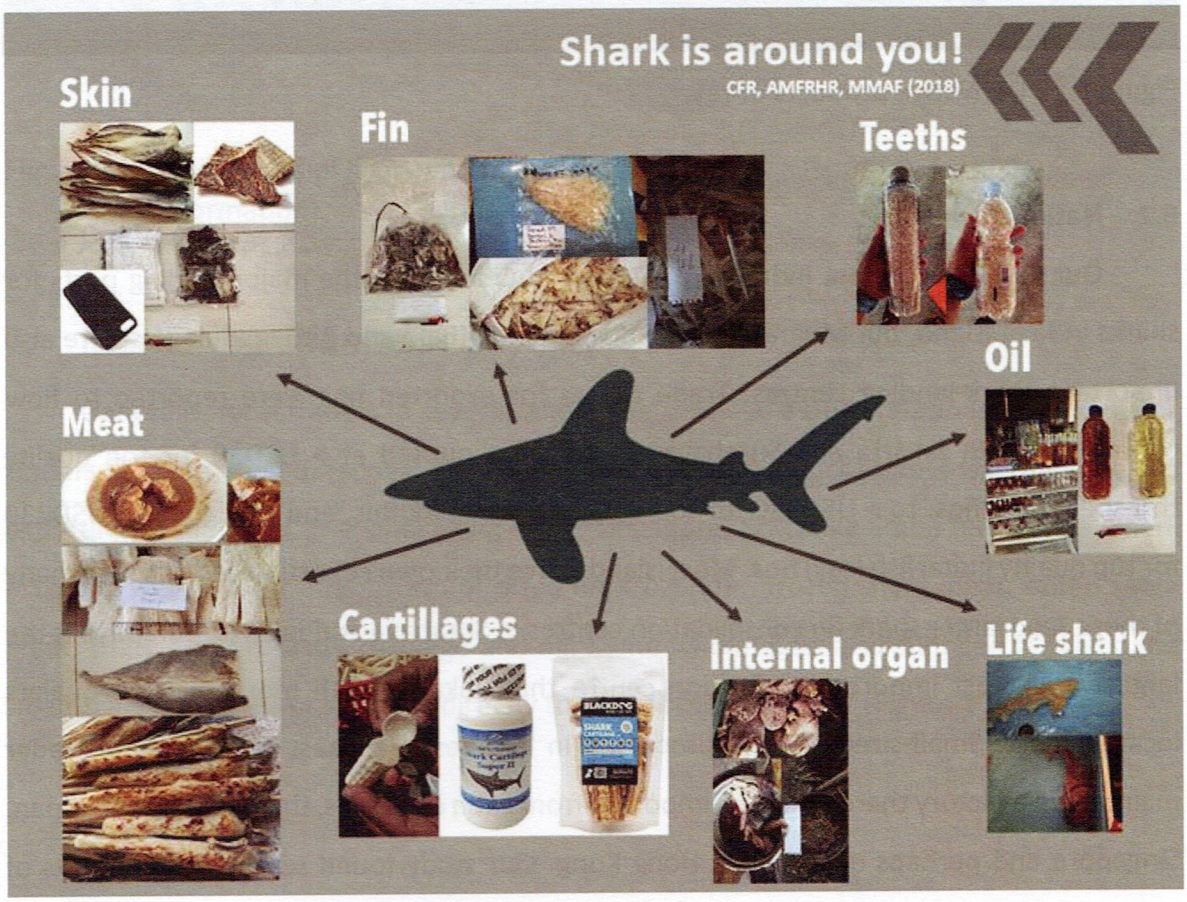

Figure 7. Derivative products of shark.

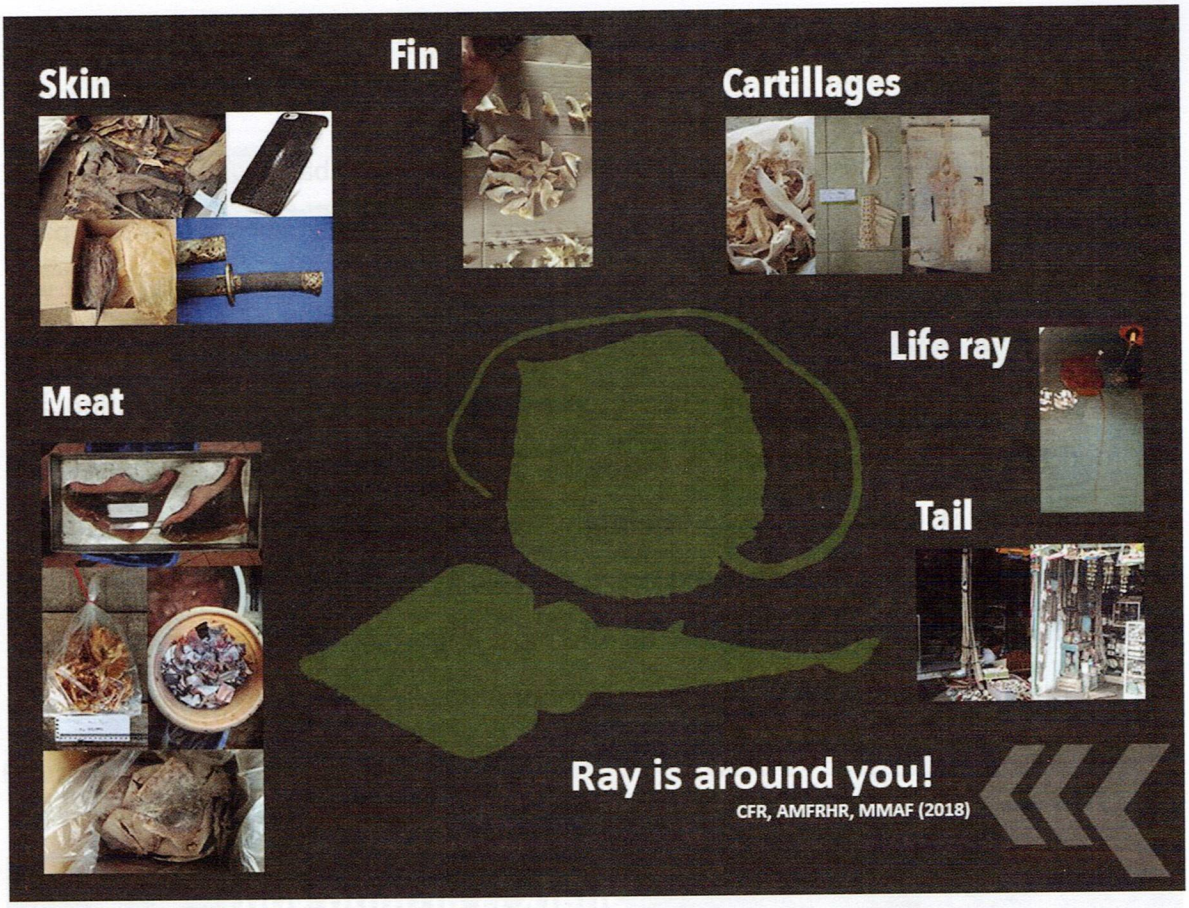

Figure 8. Derivative products of ray.

6.2. National trade

Our study found that Indramayu, Tegal and Cilacap are the major landing ports for sharks in Java Island, but Muara Baru (Jakarta), Benoa (Bali) and Bitung (Sulawesi) are also important shark-landing centres. Trade routes for exported fins were reported to flow towards hubs in Jakarta and Surabaya. Prices were quoted at > USD50 for top quality thresher shark fins, to > USD130 for top quality tiger shark fins, and as high as > USD230 for top quality guitarfish (ray) fins. Most islands have their own collection centres, and many of these feed larger shark fin consolidation centres in Surabaya and Jakarta. Surabaya is the largest and most important collection centre than Jakarta, with more than 10 dealers located there. Small-sized fins are processed in Indonesia (at least one Japanese trader maintained a factory there) and also imported from Latin countries, then exported to Japan, Singapore and perhaps even China, Hong Kong. Our study found several initial points of landing centre that supply catches to dealers in big cities (Jakarta and Surabaya) (Figure 9).

Moreover, since the Ministry of Marine Affairs and Fisheries (MMAF) established regulation on moratorium of fishing in the fisheries management area (FMA) of Republic of Indonesia no. 56/2014 and regulation no. 2/2015 concerning trawl and seine-nets, the ban has had a significant effect on fisheries in the Arafura Sea. Reducing illegal fishing and converting trawlers into trammel-netters increased the bycatch of sharks. Within two years, processing plants in Jakarta increased the production of shark product that supply from Arafura fishing fleet and also nearest fishing centre, such as Indramayu.

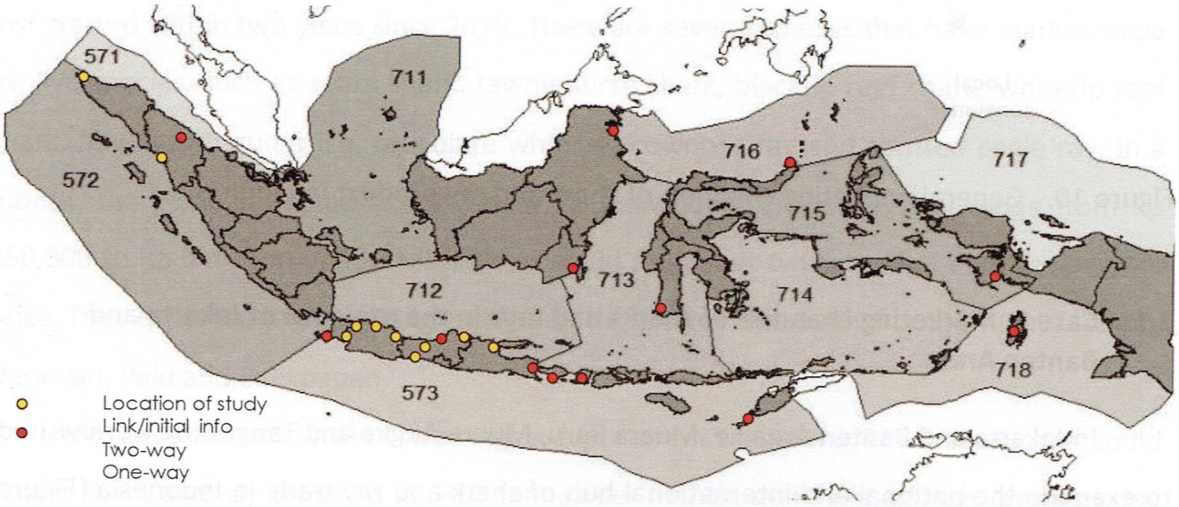

Figure 9. Trade flows of shark and ray product in Indonesia (study and initial information).

7. Marketing Channels

Generally, local traders in several landing places have a close relationship with major traders in Jakarta and Surabaya. They supplied shark ray products across the island before exporting to Malaysia, Thailand, Hong Kong, Singapore, Sri Lanka and a few others. Shark products were mainly in the form of dried fin, frozen fin, frozen shark meat, salted shark meat, shark and ray skins, cartilage and oil. Some wholesalers also supplied retailers and small-scale industries or supplied directly to the processing plants (Figure 10).

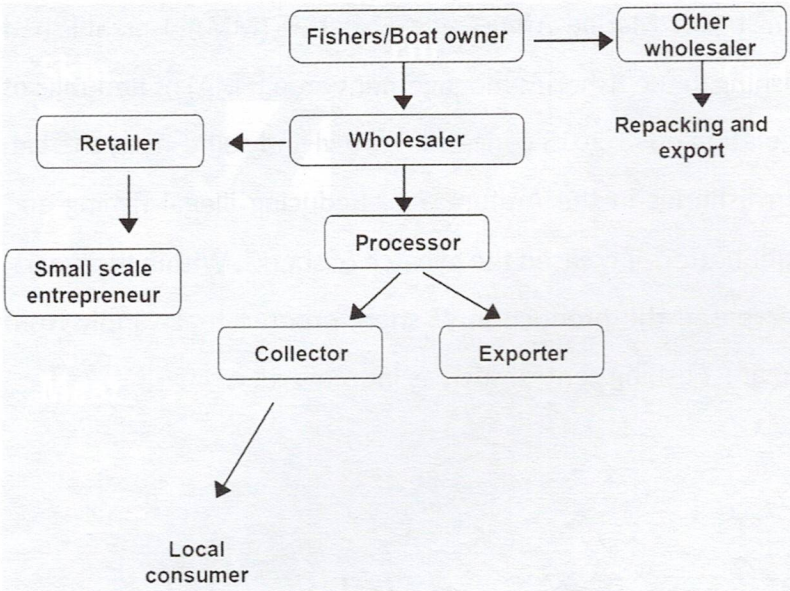

Figure 10. General marketing channels of shark and ray product in Indonesia.

7.1. Case 1: Marketing channels of sharks and rays in the province of Jakarta and Banten Area

In Jakarta and Banten Area i.e. Muara Baru, Muara Angke and Tangerang were visited to examine the national and international hub of shark and ray trade in Indonesia (Figure 11). Some factories in Muara Baru (more than 5 factories), mainly cold storage recently started their business in 2016 and 2017 when the policy was introduced to shift trawlers into trammel nets in Arafura. Small size of shark (1-3 kg / tail) is the dominant size being stored. The frozen trunk (headless, finless and/or gutted) are also sorted by their size category i.e. 3-5 kg/fish and more than 5 kg/fish. Products of 3-5 kg/fish and for more than 5kg/fish were exported to China and Thailand respectively. These products are used to produce fishball, siomay, dumpling, etc. Non-export quality shark products (< 1 kg) was sold to Muara Angke to produce salted meat or for catering businesses. There is no price variation by species instead it is defined by size category. The factory got its materials from their own fleet that operated in the Eastern Indonesia (Makassar and Kaimana). The catch are shipped by carrier boat to Muara Baru or Surabaya and shipped by cargo ship to Tanjung Priuk Port. Within 1-2 months, the factory has shipped 2-3 containers which weigh about 27-28 tonnes/container to imported countries. If less than two containers, the factory will postpone the shipment or get other materials from other factories. There is no processing involved. The product is only stored in cold storage. Factory owners argued that there is not

enough space to process it and required several permits. Generally, it is bought for Rp 11,000 - Rp 16,000 per kg (0.77-1.12) and sold for 1.34-1.4 USD per kg. The by-product of processing shark trunk namely stomach content and head are sold to Muara Angke to be processed into animal feed. Several species have been identified by inspectors as the common species namely spinner, blacktip, and whitecheek sharks.

We also visited several collectors in Muara Angke. They exported trunk of sharks and rays to China, skins to Hong Kong and fins to Hong Kong. The supply came from Muara Baru, Indramayu, Cirebon and Tegal. There are also exporters for live sharks and rays, the business just started within two years since 2016. There are several species that have market value as live species, such as zebra shark, tawny nurse shark, blacktip reef shark, whitetip reef shark, bowmouth guitarfish, reticulate whipray, cownose ray and spotted eagle ray. In a month, the company could export about 20 individuals. The price may range from Rp 250,000 to Rp 6 million per individual that could sell about twice as high than the original price. They exported to Hong Kong and SeaWorld and got the supply from Natuna, Tarakan, Derawan, Palu and Balikpapan.

Moreover, we also visited two biggest exporters in Tangerang. The first exporter could export shark and ray products at 5-20 tonnes per month, mainly fins, fresh ray meat, ray skin, live sharks and rays. They take a profit margin of 40-200% depending on the type of product and period, such as the price increase during Chinese New Year. They got supply from various locations, mainly from Surabaya, Makassar, Jakarta, Bengkulu, Bangka Belitung, Indramayu, etc. Major markets for ray meat are Singapore (60%) and Malaysia (40%), while ray skin are shipped to Philippines, while for dried fins, 80% are exported to Hong Kong, Singapore (10%) and Malaysia (10%). Other fin products i.e. peeled fin are exported to Singapore and Malaysia.

The second exporter also exported shark meat about 30-40 tonnes/month. This exporter also a forwarder. About four tonnes of fins and two tonnes of skin of sharks and rays were exported every month. Shark cartilage and oil are also traded but the market price is low as compared to meat. Several exporters exported shark oil to Japan and cartilage to Vietnam. Shark and ray meat are exported in several types of products, such as finless-headless, headless, fillet and salted. Those products are mainly exported to Hong Kong, while fillet meat to Sri Lanka and Thailand.

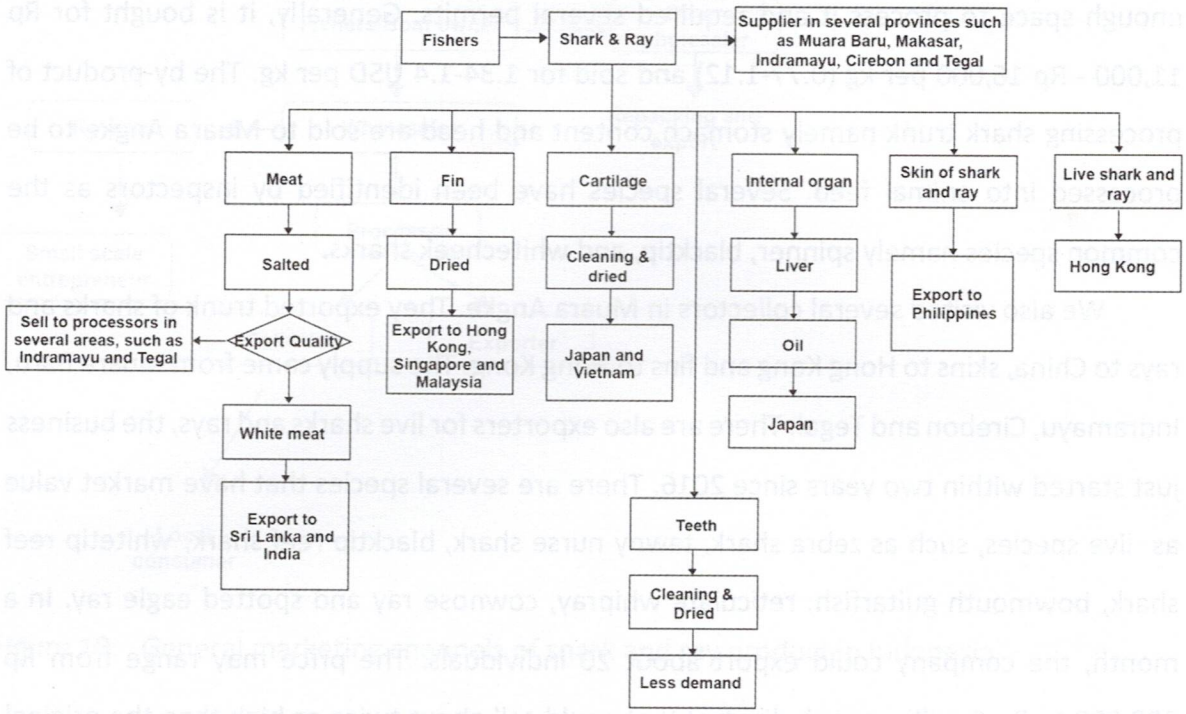

Figure 11. Generalized marketing channels of shark and ray product in the Province of DKI Jakarta and Banten.

7.2. Case 2: Marketing channels of sharks and rays in the West Java Province

In West Java, there are three locations that are representative hubs of shark and ray trade i.e. Palabuhanratu - Sukabumi Regency, Kejawanan and Sumber - Cirebon Regency, and Karangsong - Indramayu Regency (Figure 12). Palabuhanratu Coastal Fishing Port was previously one of the major landing centre for sharks and rays for longline vessel that operated in South Indian Ocean. However, since 2015 long-liner fleets decreased dramatically as new regulation on reducing permits of landing centre and also dramatic shift of fishing gear from longline into gillnet. Generally, blue shark is the dominant species in Palabuhanratu. The price was about Rp 14,000/kg. Generally, one boat that operated for 3-4 days/trip landed about one tonne. Those catches are usually sold locally as well as to Bogor and Bandung, especially for their meat, while majority of fins are supplied to middleman in Jakarta. However, there is a small entrepreneur that processes low price shark and ray, such as *Heptrachias perlo*, *Centrophorus isodon*, and *Rhinobatos* spp. He processed into several products such as fresh, dried fin, salted meat and oil. These product are marketed locally or sometimes sold to local tourists. His gross income per month would range between Rp 2,000,000 to Rp 10,000,000. There is also a small-scale operator that processed shark and ray skin into crisps. Previously he got the raw materials from local

fishers, but since 2005 he gets semi-process products from Cirebon, West Java and Muara Angke, Jakarta about 40 kg within two months. Then he processed it into small pieces and repacked it to be sold for local tourist.

Similarly, in Kejawanan Coastal Fishing Port in Cirebon, most fishers shifted from fishing for fish into squid-jigger. This reduced catch of sharks and rays. However, there is one company that operated bottom gillnet. The company processed fresh ray which is marketed to Jakarta (fin, especially from guitar fish) Indramayu (skin). Frozen ray meat was sold to local enterprise in Sumber or to retailers in Tegal and Cirebon. The common ray species that are caught such as *Hemitrygon akajei*, *Aetobatus* sp., *Himantura uarnak*, *Taeniura lymma*, *Maculabatis gerrardi* and small portion (about 1/3 of cacthes) of *Rhynchobatus* spp. and *Rhinobatos* spp. Investigation towards Sumber, Cirebon as one of major area known for small-scale processors found that supply of ray material is not only from Kejawanan, but also received supply from Gebang, Eretan and Indramayu. All body parts of shark and ray were fully utilised including cartilage from head and vertebral column. Other parts such as skin (dried and wet-salted), teeth (dried), meat (salted and/or dried (whole and chuck), smoked), intestine (steamed) and gut content were processed for consumption. Non-edible parts were given to collectors for free to be processed as animal feed. They work as a cooperation that consisted of 26 households and in a day they are able to process three tonnes of sharks and rays. For instance, smoked meat is able to sell for Rp 50,000/kg, while salted meat is sold for Rp 35,000/kg with a margin of about 10-20%. The common species that they process are low priced including requiem sharks, wedgesfish, *Rhina ancylostoma*, *Himantura leoparda*, *Urogymnus lobistoma*, *Maculabatis astra* and *Maculabatis gerrardi*.

At Karangson Fish Landing Site, Indramayu since two years ago (2016), shark catches increased dramatically as trammel-net operated in Arafura Sea replaced trawlers. More than 10 tonnes of shark were landed per day during peak season. There are several wholesalers in the area that supplied fresh sharks to several retailers/processors. Fins are processed to be dried. While meat are re-sold to other retailers with a margin of Rp 1,000 - Rp 2,000 to be smoked and dried in Cirebon, Tegal, Subang dan Pekalongan. Some processors shipped nine tonnes of salted meat a week. It need one tonne of fresh meat to produce 500 kg salted meat. Similarly, almost part of shark and ray has been processed into various products. The products are marketed to several areas such as local market

(Indramayu), Surabaya (mostly fin), Jakarta, Bandung and Bogor. While, some raw materials are traded to local buyers in Tegal, Brebes and Pemalang. Some traders used social media to market their products, using application such as Facebook and Instagram.

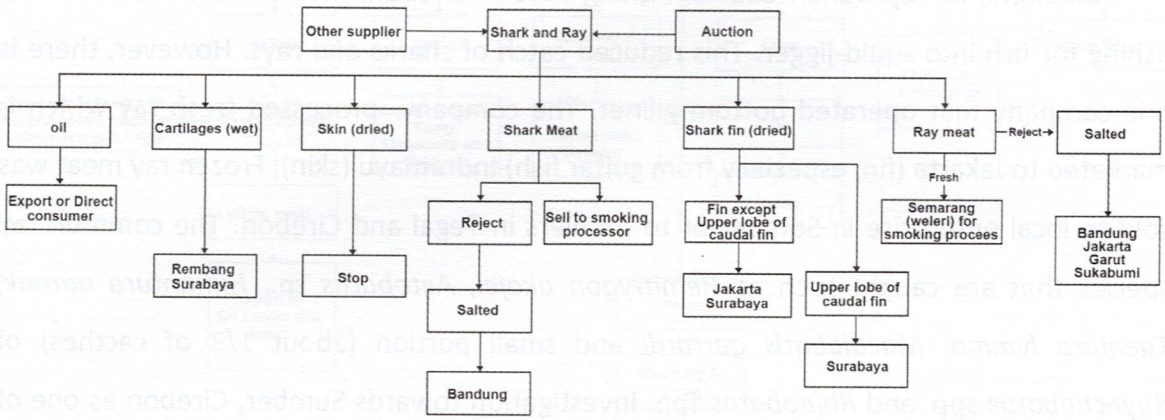

Figure 12. Generalized marketing channels of shark and ray product in the West Java Province.

7.3. Case 3: Marketing channels of sharks and rays in the Central Java Province

Cilacap, Semarang and Tegal were visited as representative of Central Java. Cilacap is known as one of main landing place of sharks and rays in Indonesia, especially long-line and gill-net fleets that operated in the Indian Ocean (Figure 13). Blue shark and thresher sharks are dominant species landed in Cilacap. Meat of pelagic thresher sharks are mainly used for consumption and marketed to restaurants in Bandung and Jakarta at about Rp 17,000 - Rp 20,000 per kg. Some wholesalers are also boat owners, several portions of their catch are self-processed and sold to local wholesalers. Operational cost per month may vary from Rp 100,000,000 - Rp 300,000,000 depending on fishing season and market price. Prices vary depending on species and size, for instance general requiem, thresher, hammerhead, blue and mako sharks that were bought by wholesalers could reach the highest price at Rp 15,000; Rp 14,500; Rp 22,000; Rp 26,000; Rp 10,000 and Rp 16,000 per kg and resale at about 10-20% higher. Some acted as middleman that gets money from export-oriented traders in the city to search for sharks and rays for them, they rely on the trustworthiness of the trader. Some traders also appoint successors, so they pass the business to their children or families. In several cases, the workers are also their families. For fin trading, the price is dependent on the species, size and quality and is updated daily by exporters and buyers from destination countries. The highest price is fins of wedgefish. While the lowest fin price is for guitarfish and shark-ray at Rp 650,000 - Rp 300,000/kg for fin size less than

10 cm respectively. One of wholesaler in Cilacap gathered raw products from several places which excludes his boats and other retailers from Cilacap, such as Probolinggo, Tegal, Brebes, Pacitan, Muncar, Batang and Indramayu. Some of the biggest wholesaler process fins, meat, skin, cartilage and oil, while other parts such intestine and stomach content were sold as fish feed. Salted meat (chunk) were exported to Sri Lanka and India through Jakarta about three tonnes per week, while dried fins (dorsal, pectoral and caudal) were exported to Surabaya and Jakarta about 300 kg per month. Dried cartilage is traded to collectors in Jakarta priced at Rp 40,000/kg for the head section and Rp 15,000/kg for the vertebral column, while the oil were sold at about Rp 35,000 - Rp 115,00 per litre depending on the quality.

In Semarang the capital city of Central Java, there is a factory that produced shark and ray steam hissit (shred collagen fibres) from fins. All products were exported to Japan. Steam hissit vary in price depending on species, composition and shred size. The factory produced steam hissit using intermediate material i.e. dried collagen fibres (without denticle and cartilaginous platelet) that came from traditional processors in Tegal in the Central Java and Bawean and Gresik in the East Java. The factory processed small fins (locally called "plen" and/or "tokek"; which refer to small/juvenile shark or catshark species) and fins from blue shark. The factory also tried to export cartilage of frozen blue shark, jaws and dried cartilaginous platelets, but did not find the market yet. The intermediate materials of fin were bought at about Rp 500,000 to Rp 2,700,000 per kilo depends on species and size. The factory also marketed ray meat from pale-edge sharpnose ray (*Telatrygon zugei*). The fish were from Tegal and only pectoral fins were marketed. Other parts such head, skin, stomach content and middle part were sold back to Tegal. The factory also exported about 1-3 tonnes of steam hissit to Japan. There is another company started to export frozen fin of blue shark to Hong Kong, Thailand, Taiwan and Singapore since 2017. There are also exporters in Semarang that exported fresh ray to Malaysia and Singapore daily. The companies only export fresh whitespotted whipray (*Maculabatis gerrardi*) and bluespotted stingray (*Neotrygon kuhlii*) about 2-3 tonnes per month. The supply were bought from local collectors in Batang, Rembang and Jepara at about Rp 18,000 - Rp 20,000/kg. Low quality or rejected rays and other waste products were sold to local collectors to produce local culinary of Semarang such as "mangut pe" (ray with coconut cream) and also to home-based industries that produce smoked ray meat.

In Tegal, dominant ray species especially wedgefish, blue-spotted ray, pale-edge

sharpnose ray, whitespotted whipray, eagle ray, butterfly ray and whitenose whip ray are caught by Danish seine. Sharks mainly sold to Jakarta and local processors as whole body. There are several processors in Tegal that processed shark and ray into smoke meat and sold to local markets for domestic consumption. One processor produced salted ray meat and marketed to Bandung, Jakarta, Garut and Sukabumi. In Tegal and Pemalang rays were sold to local processor to be processed as salted and smoked ray meat for local consumption. The raw materials bought from fishers for Rp 12,000 - Rp 15,000 and resold at 10% margin. Some wholesalers have several suppliers and marketing channels, such as Semarang, Cilacap, Batang, Rembang, Brebes, Brondong, Bandung, Sumedang, Yogyakarta and Jakarta. More than two tonnes of rays per day are landed in Tegal generating livelihood income for more than 500 people directly and indirectly, such as labour and transportation workers. Some processors employed more than 20 people to run their factories. There is also a relationship between wholesalers in local and other areas whether as a supplier, buyer or exporter.

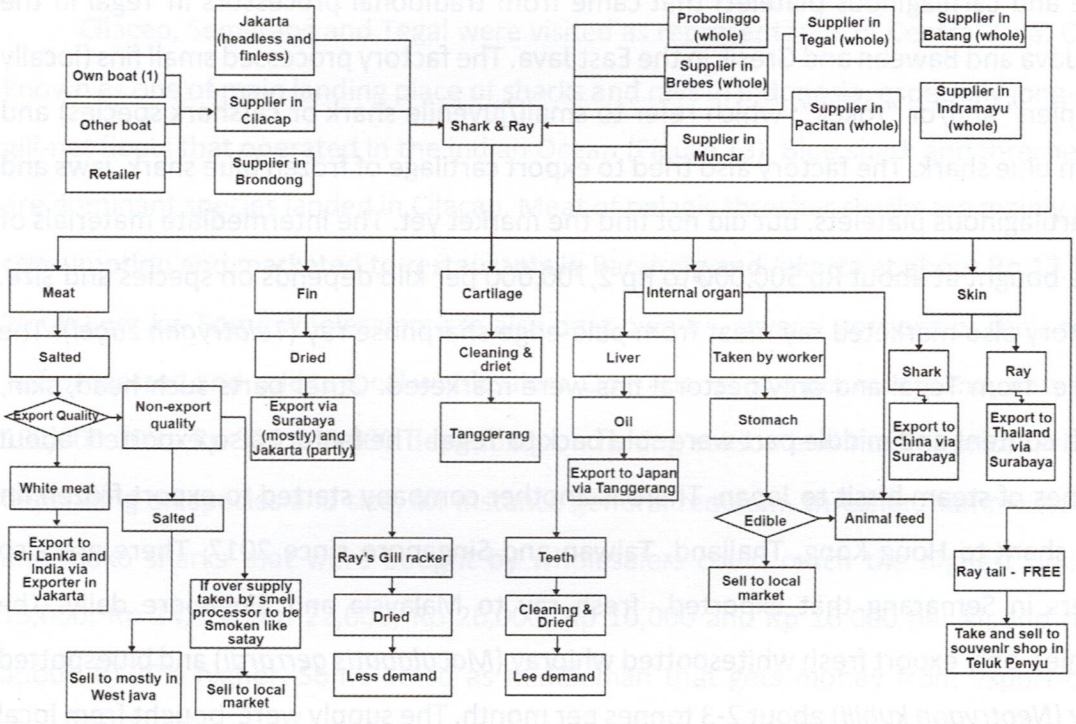

Figure 13. Generalized marketing channels of shark and ray product in the Centra Java Province.

7.4. Case 4: Marketing channels of sharks and rays in the East Java Province

In East Java, Surabaya and Gresik were chosen as both are the important hubs for exporting shark and ray products. Surabaya is one of main hub for shark fin trading in eastern part of Indonesia, such as Banyuwangi, Gorontalo, Bengkulu, Makassar, Denpasar, Manado in North Sulawesi, Palu in Central Sulawesi, Merauke, Sorong and Biak in Papua. There are at least seven exporters located and one of the exporters is connected to more than 30 wholesalers across Indonesia (Figure 14). All exporters mainly focus on dried fins targeted towards China market. The most dominant species is silky shark comprising of 40% total export commodities. However, due to zero quota permit export by the government, this species is prohibited to be traded under CITES mechanism. The exporters continuously buy this species since they need to maintain good relationship with wholesalers as there are a lot of competitors. Several exporters established an association to support their business, such as quota distribution and advocating named PERSIPINDO ("Perhimpunan Pengusaha Sirip Indonesia"). There are also factories operated to process fins into steam hissit and exported directly to Japan. The framework are similar to the factory in Semarang. However, significant portion of their raw materials i.e. frozen fins was imported from Latin America mainly Argentina. The factory only focus their business on blue shark, narrownose smooth-hound shark, salmon shark and mako sharks. This factory also bought shark skins from Lamongan as additional ingredient of steam hissit; usually blackspot shark, sandbar shark and spot-tail shark. In a month, this factory required two tonnes of supply to be processed into various products. Caudal and anal fins are also export products, but the value was lower than dorsal and pectoral fins. However, this fins were used as additional ingredient of steam hissit. Shark skin is also exported as a commodity that mainly trades to Hong Kong in dried form.

In Gresik, there is one factory that exports frozen pectoral fins of ray. The products were exported to Korea, Malaysia and Singapore at about 10-20 tonnes per month. The supply comes from local collectors, in Brondong, Rembang and Madura at about 20 tonnes per month. Other by-products such as skin, cartilage and intestine were sold to local collectors to be processed as smoked fish at Rp 1,500 - Rp 2,000 per kg. Three main species are used, namely whitespotted whipray, pale-edged stingray and bluespotted maskray. In Gresik, there are traditional processors that supplies semi-process materials of fins to Semarang and Surabaya. They received raw materials from Bali, Batang and Sarang which

are mostly blue shark and catshark. While, caudal fins are sold to traders in Surabaya. There are five traditional processors in that area. Each processor hired 3-7 local people as labour.

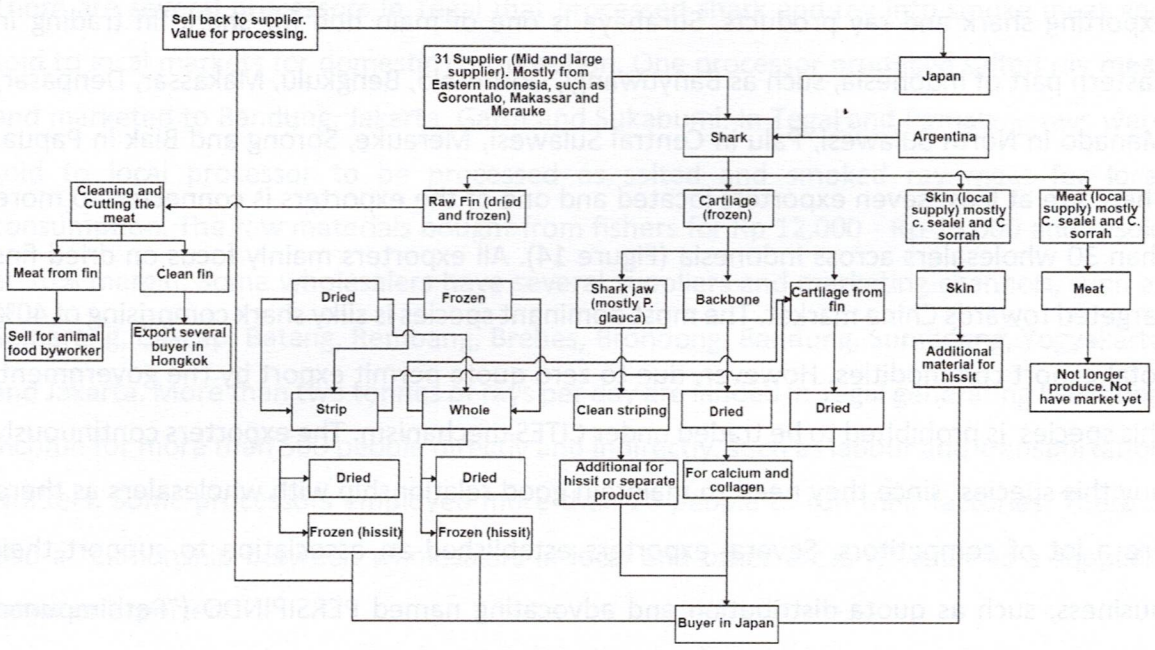

Figure 14. Generalized marketing channels of shark and ray product in the East Java Province.

7.5. Case 5: Marketing channels of sharks and rays in the Aceh Province

In Aceh, a survey was conducted in Kota Raja Oceanic Fishing Port (formerly known as Lampulo Coastal Fishing Port) (Figure 15). There are several wholesalers operated here. Shark meat is traded and consumed by local people at Rp 15,000 - Rp 40,000 per kg depending on the species with a margin of 30%. Sharks were mainly caught by hand-line fishers that operated near Nicobar Islands. Fresh shark skin, head and teeth usually marketed to Medan. Some wholesalers own processing plants to produce salted meat. They also got raw materials from Meulaboh, Blangpidie, Loksemawe, Sibolga and Belawan. Most fins were processed in Bireun due to lower price of raw materials. Dried fins were sold to Medan and Jakarta. However, if fresh fins were in high demand and the price is higher at Bireun, wholesalers sold all fins to Medan. Collectors in Medan marketed their products to Jakarta, Bengkulu and Surabaya. Moreover, shark meat are considered as one of popular traditional cuisine in Aceh and locals believe that consumed shark meat makes them healthier.

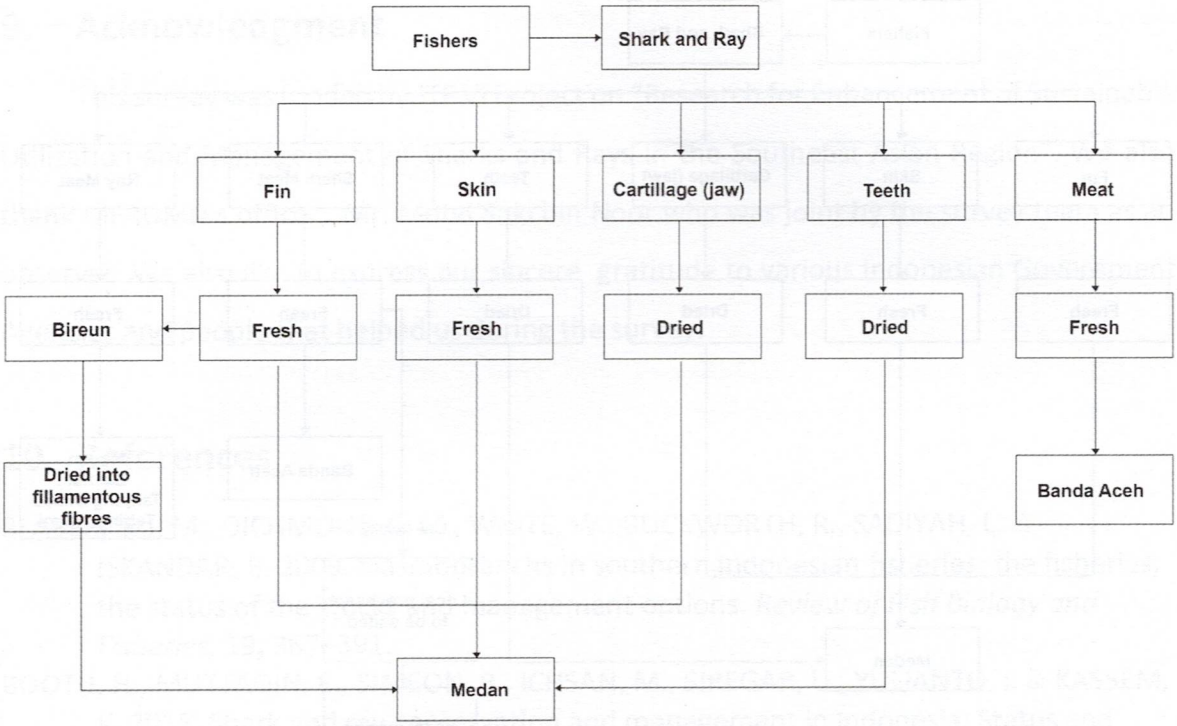

Figure 15. Generalized marketing channels of shark and ray product in the Aceh Province.

7.6. Case 2: Marketing channels of sharks and rays in the North Sumatra Province

Sibolga was chosen to study the trade of sharks and rays in North Sumatra (Figure 16). Similar to Aceh, locals in Sibolga also consumed shark meat in their traditional cuisine (shark curry). Sibolga Fishing Port is a major landing site for purse seine fisheries facing Indian Ocean. Requiem shark and whitespotted whipray are the most common shark and ray species landed at Sibolga Fishing Port. Shark meat priced at Rp 7,000 to Rp 32,000/kg depending on species and quality, can be sold for about Rp 2,000 - Rp 4,000 margin. Some rays were sold at Rp 7,000 except for whitespotted whipray and bluespotted stingray that are sold at Rp 18,000 - Rp 20,000/kg. Shark fins are mostly dried before marketed to Surabaya, Medan, Siantar and Tebing Tinggi. High quality shark meat including skins were sold locally or to Banda Aceh for consumption or ingredient to produce fishball. Low quality shark meats were sold to salted processors in Sibolga. Moreover, whole fresh rays were shipped daily to Medan, Siantar, Tanjung Dumai and Tebing Tinggi. The buyers are different from buyers of shark products.

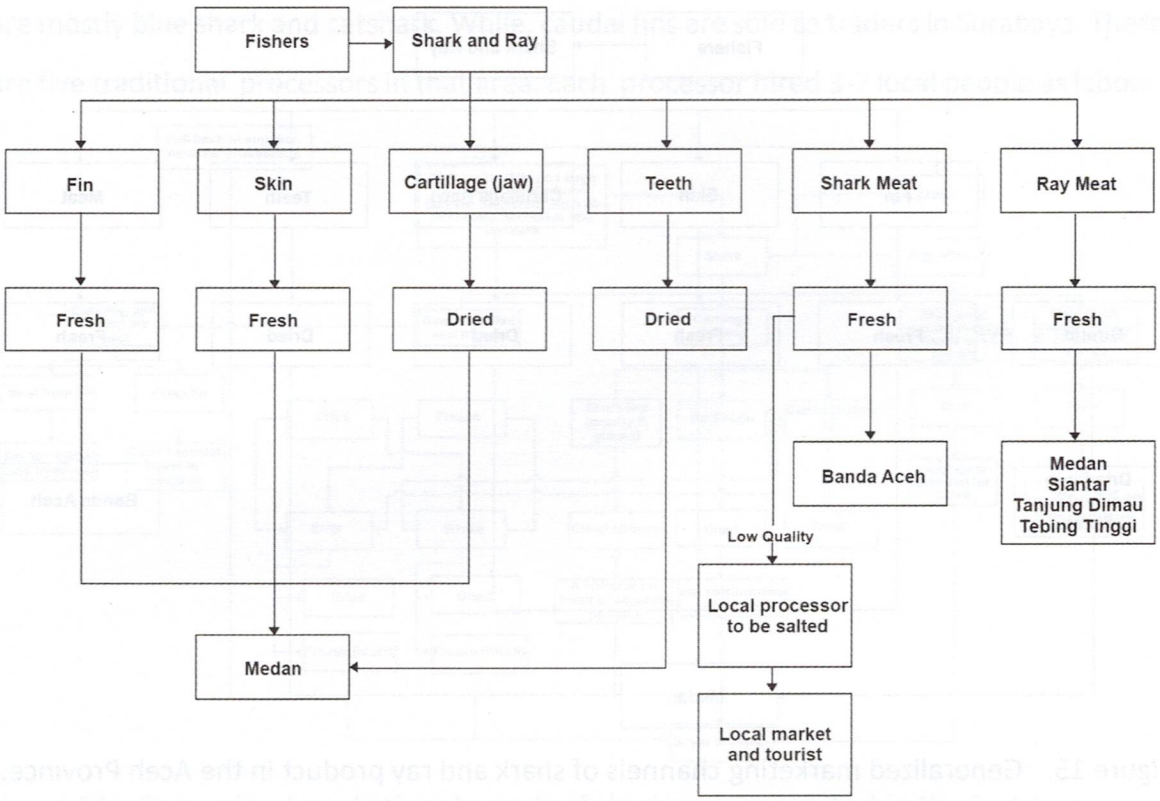

Figure 16. Generalized marketing channels of shark and ray product in the North Sumatera Province.

8. Conclusion

Indonesia is one of the top shark and ray producers in the world. The biggest markets are in Asia and Southeast Asian countries. Indonesia contributes significantly in the global fin trade, however very low amount of other derivatives of sharks and rays were being exported. Initial hypothesis stated that, the domestic consumption of non-fin products in Indonesia is high, especially the meat. Our survey proved, there is a high dependency of the community for shark and ray resources in Indonesia, not only as their livelihood but also as a source of protein. There is a high complicity in the marketing and trade mechanism of shark and ray products across Indonesia. There are two main hubs of export in Indonesia i.e. Jakarta (to cover western part Indonesia) and Surabaya (to cover eastern part Indonesia). Further survey is required to cover other Eastern part of Indonesia, such as Kalimantan, Sulawesi, Bali, Maluku, Nusa Tenggara and Papua to a build better understanding on sharks and rays marketing and trade in Indonesia.

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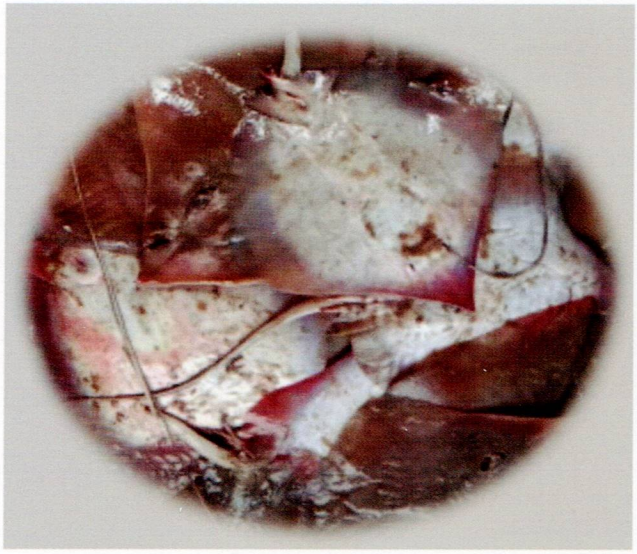

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