

DATA COLLECTION ON SHARK FISHERIES IN INDONESIA

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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

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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°S and longitudes 106 and 11.3°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°N and 7°S and longitudes 102 and 117°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°S.

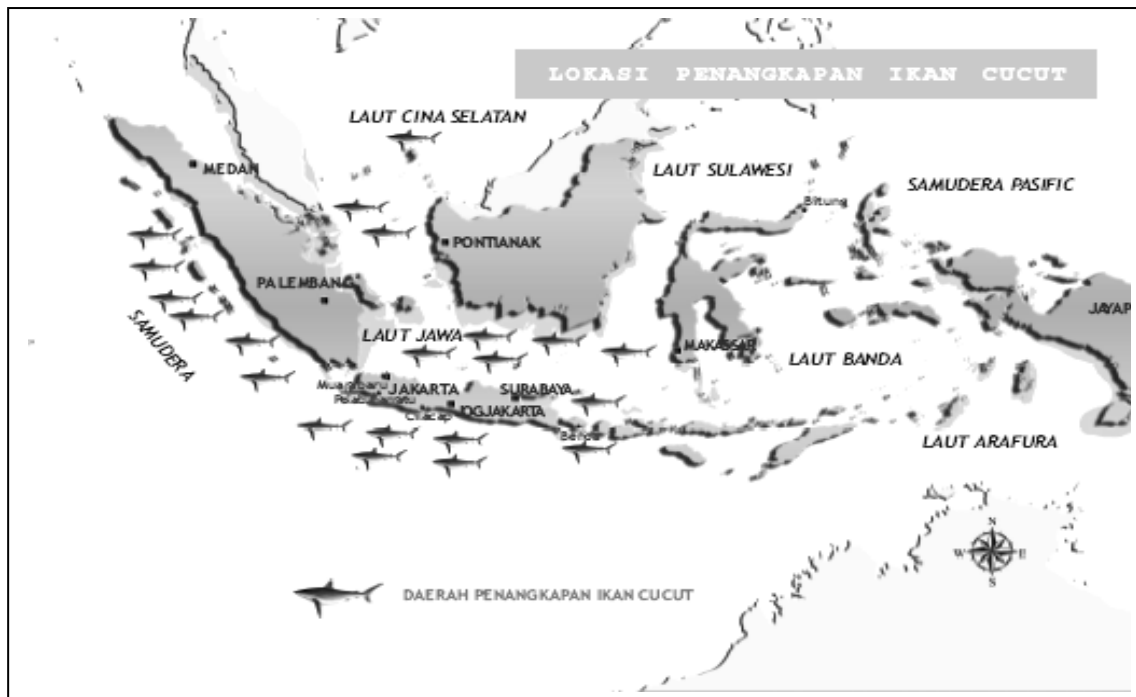


Figure 1. Landing sites for sharks data collection in Indonesia and the shark fishing grounds



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

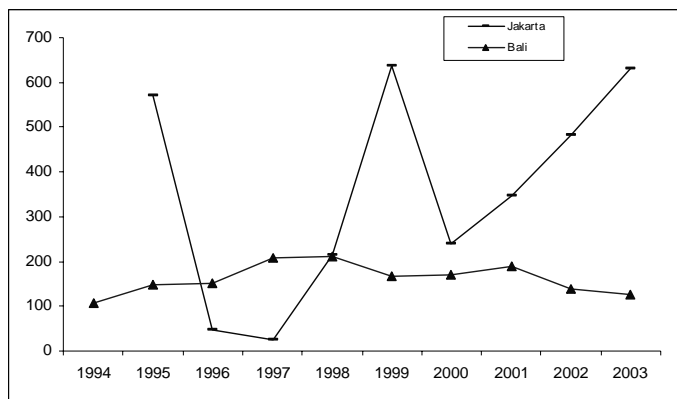
Total Shark Catches		Production (in kg) for all month	Average number of boats for all month
Shark Catches per fishing gear	Gillnet	39,768.50	45.5
	Longline	61,634.00	53.5
	Fish trawl	-	-
	Purse seine	-	-
	Others gears	68.00	0.75
Total Non Shark Catches		637,971.00	
Total Shark and Non Shark Catches	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

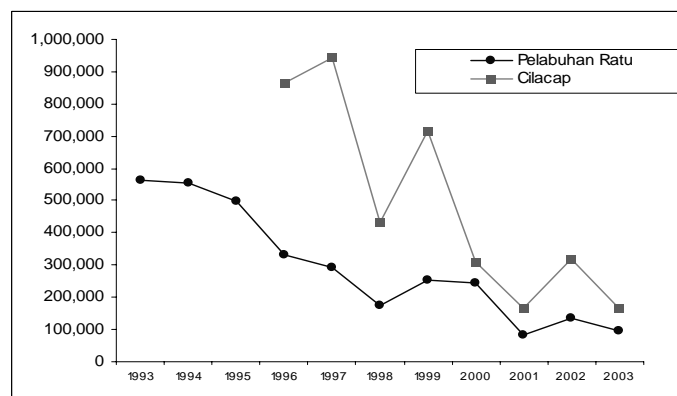
ton (1993) to 97,492 ton (2003), while in Cilacap, the sharks production decreased by 81.03 %, namely from 863,943 ton (1993) to 163,914 ton (2003). The decreasing of total sharks production in both landing sites were caused mostly by reducing of fishing efforts. In this case, the catching areas tend 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 Bena 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).

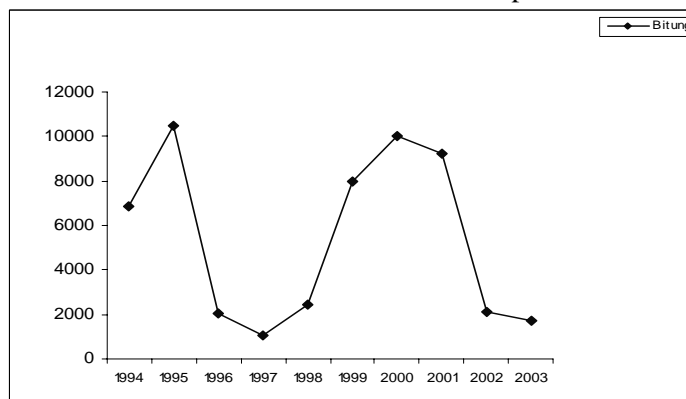
The figures of its shark productions are shown on following diagrams:



a. Muara Baru and Bena



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 almbliirhynchos* 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 almbliirhynchos* 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	<i>Carharhinus almbiyrhynchos</i>	130.40	53.33	8	46.67	7	13.33
2	<i>Carcharhinus falciformis</i>	122.89	70.00	21	30.00	9	10.00
3	<i>Carcharhinus longimanus</i>	108.12	40	2	60	3	
4	<i>Carcharhinus sorrah</i>	74.5	75	3	25	1	25.00
5	<i>Pronace glauca</i>	206.13	100	8			
6	<i>Alopias pelagicus</i>	258.78	40	2	60	3	
7	<i>Sphyrna lewini</i>	133.95	25	1	75	3	
8	<i>Mustelus sp</i>	108.67	66.67	2	33.33	1	
9	<i>Squalus megalops</i>	64.6			100	4	
10	<i>Heptranchia perlo</i>	84			100	1	
11	<i>Carcharhinus brevina</i>	111.725	25	1	75	3	
12	<i>Pseudo komoharai</i>	63.2			100	1	
13	<i>Hemipristis elongates</i>	74			100	1	
14	<i>Carcharhinus melanoterus</i>	82			100	1	
15	<i>Centroscymnus Crepidater</i>	97	100	1			
16	<i>Isurus oxyrinchus</i>	145			100	1	
17	<i>Mustelus manazo</i>	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 how many days	% of total sampled catch
1	<i>Carharhinus almblyrhynchos</i>	333.10		13.25
2	<i>Carcharhinus falciformis</i>	798.97		31.78
3	<i>Carcharhinus longimanus</i>	85.00		3.38
4	<i>Carcharhinus sorrah</i>	9.30		0.37
5	<i>Pronace glauca</i>	366.00		14.56
6	<i>Alopias pelagicus</i>	352.00		14.00
7	<i>Sphyrna lewini</i>	352.00		14.00
8	<i>Mustelus sp</i>	16.75		0.67
9	<i>Squalus megalops</i>	7.70		0.31
10	<i>Hepranchia perlo</i>	1.50		0.06
11	<i>Carcharhinus brevina</i>	102.60		4.08
12	<i>Pseudo komoharai</i>	1.25		0.05
13	<i>Hemipristis elongates</i>	5.00		0.20
14	<i>Carcharhinus melanoterus</i>	11.00		0.44
15	<i>Centroscyrmus crepidater</i>	27.00		1.07
16	<i>Isurus oxyrinchus</i>	43.00		1.71
17	<i>Mustelus manazo</i>	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:

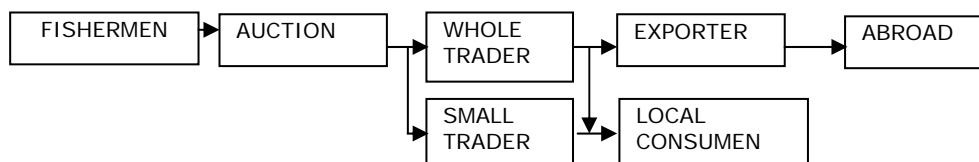


Figure 4. General pattern of shark market landed in Indonesia

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 Alopiidae 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 superciliosus* 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 superciliosus* 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	<i>Carcharhinus amblyrhynchos</i>	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	<i>Carcharhinus melanopterus</i>	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	<i>Carcharhinus cautus</i>	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	<i>Carcharhinus brevipinna</i>	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	<i>Carcharhinus fitzroyensis</i>	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	<i>Carcharhinus plumbatus</i>	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	<i>Atopias superciliosus</i>	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	<i>Atopias pelagicus</i>	Meats	6 GT	Gillnet	++	dry salted dried fins	0.38 - 0.43 17.33	Local Markets Local Markets, Taiwan, Hongkong, China and Japan
		Fin						
		Stomach				Head and stomach are used in feeding aquaculture	0.11	Local Markets
		Skins				dried cartilaginous	7.58 - 8.67	Local Markets
9	<i>Isurus oxyrinchus</i>	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	<i>Prionace glauca</i>	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	<i>Galeocerdo cuvieri</i> 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	<i>Squalus megalops</i>	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	<i>Sphyrna lewini</i>	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
(++) relatively common
(+++) abundant to plentiful
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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TEAM OF ENUMERATORS

1. Mr. Gatot Irianto (Muara Baru landing site)
2. Ms. Imas Masriah (Pelabuhan Ratu landing site)
3. Mr. Agung Pramono (Cilacap landing site)
4. Mr. Ketut, I. (Beno landing site)