

DATA COLLECTION AND FISHERIES MANAGEMENT OF SHARKS IN MALAYSIA

Abd. Haris Hilmi Ahmad Arshad, Ahmad Ali, Albert Chuan Gambang, Ahemad Sade, Lim
Chai Fong, Abu Talib Ahmad, Ahmad Adnan Nuruddin⁶

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

⁶ Fisheries Researchers at the Department of Fisheries, Malaysia

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).

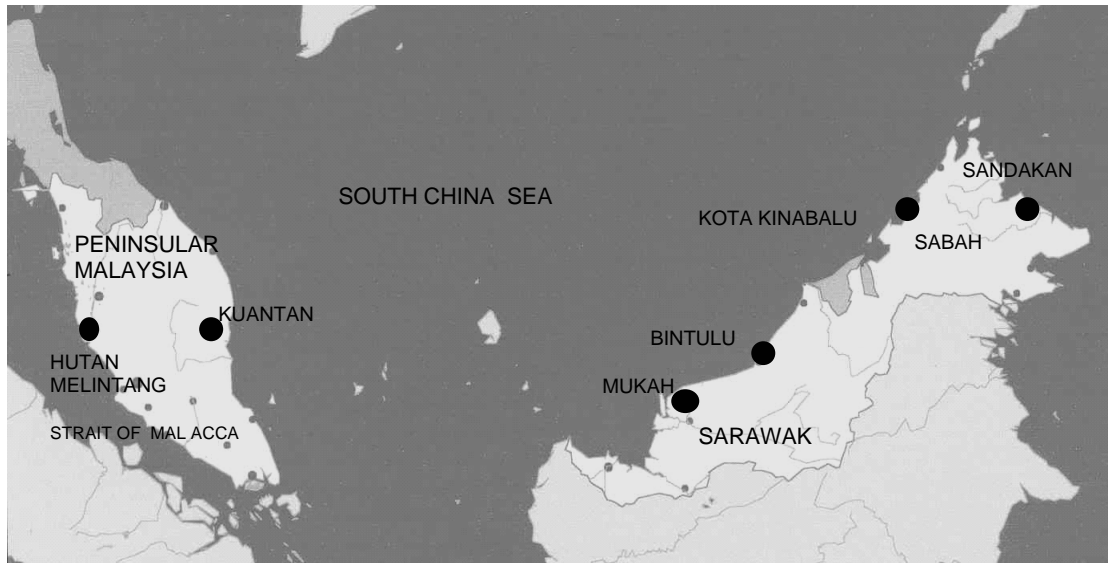


Figure 1 : The six landing sites covered during the study



Hutang 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				
<i>C. sorrah</i>	Whole	Trawlers	Fish Trawl	+	C,T Fresh whole shark & shark fin	1.32-1.58	Local markets in Perak & Selangor state including Kuala Lumpur
<i>C. sealei</i>	Whole	Trawlers	Fish Trawl	+	C,T Fresh whole shark	0.58-0.92	Local markets in Perak & Selangor state including Kuala Lumpur
<i>C. dussumieri</i>	Whole	Trawlers	Fish Trawl	+	C,T Fresh whole shark	0.58-0.92	Local markets in Perak & Selangor state including Kuala Lumpur
<i>C. punctatum</i>	Whole	Trawlers	Fish Trawl	+++	C,T Fresh whole shark	0.53-0.66	Local markets in Perak & Selangor state including Kuala Lumpur

<i>C. hasselti</i>	Whole	Trawlers	Fish Trawl	+++	C,T Fresh whole shark	2.00-2.50	Local markets in Perak & Selangor state including Kuala Lumpur
<i>R. acutus</i>	Whole	Trawlers	Fish Trawl	++	C,T Fresh whole shark & fish ball	0.53-0.61	Local markets in Perak & Selangor state including Kuala Lumpur
<i>S. laticaudus</i>	Whole	Trawlers	Fish Trawl	++	C,T Fresh whole shark	0.26-0.61	Local markets in Perak & Selangor state including Kuala Lumpur
<i>S. lewini</i>	Whole	Trawlers	Fish Trawl	+	C,T Fresh whole shark	0.53-0.79	Local markets in Perak & Selangor state including Kuala Lumpur
<i>C. lucas</i>	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				
<i>C. punctatum</i>	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
<i>C. griseum</i>	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.
<i>R. acutus</i>	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

<i>C. sealei</i>	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
<i>C. sorrah</i>	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
<i>S. lewini</i>	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
<i>S. fasciatum</i>	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				
<i>H. microstoma</i>	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 Sibü.
<i>C. punctatum</i>	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 Sibü.
<i>S. laticaudus</i>	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 Sibü.
<i>C. sealei</i>	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 Sibü.
<i>C. sorrah</i>	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 Sibü.
<i>S. lewini</i>	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 Sibü.
<i>R. acutus</i>	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 Sibü.
<i>C. dussumieri</i>	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 Sibü.

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				
<i>C. sealei</i>	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.92	Local markets in Mukah, Sibü and Kuching.
<i>C. sorrah</i>	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.92	Local markets in Mukah, Sibü and Kuching.
<i>S. lewini</i>	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.92	Local markets in Mukah, Sibü and Kuching.
<i>H. microstoma</i>	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.92	Local markets in Mukah, Sibü and Kuching.
<i>S. laticaudus</i>	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.66	Local markets in Mukah, Sibü and Kuching.
<i>C. punctatum</i>	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.66	Local markets in Mukah, Sibü and Kuching.
<i>R. acutus</i>	Whole	Gill Net	Gill Net, Hooks & Lines	+	C,T, Fresh whole shark, shark fin & salted meat	0.39-0.92	Local markets in Mukah, Sibü 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				
<i>C. sealei</i>	Whole	Trawlers Gill 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
<i>L. macrorhinus</i>	Whole	Trawlers Gill 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
<i>C. dussumieri</i>	Whole	Trawlers Gill 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

<i>C. sorrah</i>	Whole	Trawlers Gill 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
<i>R. acutus</i>	Whole	Trawlers Gill 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
<i>H. microstoma</i>	Whole	Trawlers Gill 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
<i>C. amblyrhynchoides</i>	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
<i>S. mokarran</i>	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
<i>S. fasciatum</i>	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				
<i>C. sealei</i>	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
<i>C. acutus</i>	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
<i>C. dussumieri</i>	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
<i>C. sorrah</i>	Whole	Trawlers	Fish trawl	++	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
<i>C. punctatum</i>	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
<i>S. macrorhinus</i>	Whole	Trawlers	Fish trawl	++	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
<i>S. mokarran</i>	Whole	Trawlers	Fish trawl	+	C,T, Fresh whole shark	0.58-0.74	Local markets in Kota Kinabalu
<i>G. cuvier</i>	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, Sibul 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 Sibul
Mukah, Sarawak	Fresh whole shark	0.39 – 0.92/kg	Consumers and processors in Mukah
	Dried salted meat	2.29 – 2.37/kg	Mukah, Sibul and Kuching
	Small dried shark fin (<13 cm)	22.37– 23.68/kg	Sibul and Kuching
	Big dried shark fin (=>13 cm)	42.11 –47.37/kg	Sibul 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 (mt)	Value (US\$)	Quantity (mt)	Value (US\$)	Quantity (mt)	Value (US\$)	Quantity (mt)	Value (US\$)	Quantity (mt)	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



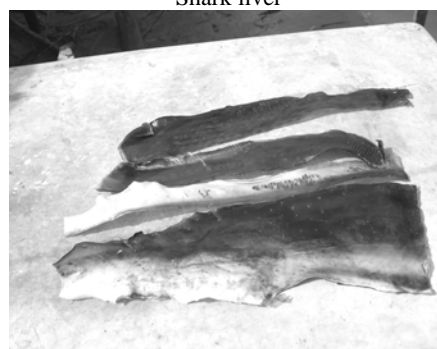
Shark meat



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
<i>Chiloscyllium punctatum</i>	951.46	28	44.00
<i>Chiloscyllium hasselti</i>	352.54	27	16.30
<i>Scoliodon laticaudus</i>	76.22	10	3.52
<i>Carcharhinus sorrah</i>	261.26	18	12.08
<i>Atelomycterus marmoratus</i>	15.46	9	0.71
<i>Sphyrna lewini</i>	14.80	8	0.68
<i>Rhizoprionodon acutus</i>	11.15	4	0.52
<i>Carcharhinus leucas</i>	475.00	3	21.97
<i>Sphyrna mokarran</i>	2.75	1	0.13
<i>Carcharhinus dussumieri</i>	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 *Sphyrna 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
<i>Chiloscyllium punctatum</i>	66.4	66.2	357	33.8	182	45.4	54.6	45.6	54.4
<i>Chiloscyllium hasselti</i>	59.3	68.8	139	31.2	63	48.9	51.1	34.9	65.1
<i>Scoliodon laticaudus</i>	41.1	52.2	48	47.8	44	14.6	85.4	13.6	86.4
<i>Carcharhinus sorrah</i>	71.1	78.1	50	21.9	14	98.0	2.0	100	
<i>Atelomycterus marmoratus</i>	49.5	61.9	13	38.1	8	15.4	84.6		100
<i>Sphyrna lewini</i>	55.8	53.8	7	46.2	6	100		100	
<i>Rhizoprionodon acutus</i>	70.4	50	1	50	1	100		100	
<i>Carcharhinus leucas</i>	267.7			100	1				100
<i>Sphyrna mokarran</i>	69.7	50	1	50	1	100		100	
<i>Carcharhinus dussumieri</i>	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
<i>Carcharhinus punctatum</i>	253.09	26	20.58
<i>Carcharhinus sealei</i>	99.95	15	8.13
<i>Chiloscyllium griseum</i>	52.00	9	4.23
<i>Carcharhinus sorrah</i>	249.09	17	20.26
<i>Loxodon macrorhinus</i>	47.49	13	3.86
<i>Rhizoprionodon acutus</i>	66.83	15	5.44
<i>Hemigaleus microstoma</i>	59.95	14	4.88
<i>Sphyrna lewini</i>	364.42	16	29.64
<i>Chiloscyllium indicum</i>	11.22	8	0.91
<i>Carcharhinus leucas</i>	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
<i>Chiloscyllium punctatum</i>	77.2	43.0	52	57.0	69	13.5	86.5	5.8	94.2
<i>Carcharhinus sealei</i>	70.0	67.4	31	32.6	15	54.8	45.2	46.7	53.3
<i>Chiloscyllium griseum</i>	63.6	41.3	19	58.7	27	21.1	78.9	14.8	85.2
<i>Carcharhinus sorrah</i>	98.3	63.4	26	36.6	15	53.8	46.2	80.0	20.0
<i>Loxodon macrorhinus</i>	74.7	62.5	20	37.5	12	20	80	8.3	91.7
<i>Rhizoprionodon acutus</i>	81.2	64.3	18	35.7	10	16.7	83.3	40.0	60.0
<i>Hemigaleus microstoma</i>	78.6	48.1	13	51.9	14	61.5	38.5	35.7	64.3
<i>Sphyrna lewini</i>	91.0	46.2	12	53.8	14	83.3	16.7	85.7	14.3
<i>Chiloscyllium indicum</i>	54.2	47.1	8	52.9	9	75.0	25.0	22.2	77.8
<i>Carcharhinus leucas</i>	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
<i>Scoliodon laticaudus</i>	116.24	8	22.03
<i>Carcharhinus sealei</i>	50.14	6	9.50
<i>Carcharhinus sorrah</i>	109.29	6	20.71
<i>Carcharhinus borneensis</i>	53.55	4	10.15
<i>Carcharhinus amblyrhyncoides</i>	73.67	5	13.96
<i>Sphyrna lewini</i>	78.47	3	14.87
<i>Rhizoprionodon acutus</i>	12.75	3	2.42
<i>Chiloscyllium punctatum</i>	19.89	4	3.77
<i>Chiloscyllium indicum</i>	3.37	2	0.64
<i>Carcharhinus limbatus</i>	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
<i>Scoliodon laticaudus</i>	37.6	52.7	311	47.3	279	2.6	97.4	9.0	91.0
<i>Carcharhinus sealei</i>	46.2	39.8	39	60.2	59	94.9	5.1	100	
<i>Carcharhinus sorrah</i>	76.6	55.1	27	44.9	22	100		100	
<i>Carcharhinus borneensis</i>	59.5	33.3	2	66.7	4	100		100	
<i>Carcharhinus amblyrhynchoides</i>	66.9	57.1	20	42.9	15	100		100	
<i>Sphyrna lewini</i>	77.7	51.4	18	48.6	17	100		100	
<i>Rhizoprionodon acutus</i>	50.7	63.6	14	36.4	8	92.9	7.1	25.0	75.0
<i>Chiloscyllium punctatum</i>	61.7	57.1	12	42.9	9		100	33.3	66.7
<i>Chiloscyllium indicum</i>	42.5	33.3	5	66.7	10		100	80.0	20.0
<i>Carcharhinus limbatus</i>	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
<i>Scoliodon laticaudus</i>	17.17	1	1.27
<i>Carcharhinus sorrah</i>	223.45	4	16.50
<i>Sphyrna lewini</i>	130.90	7	9.67
<i>Carcharhinus sealei</i>	45.31	5	3.35
<i>Rhizoprionodon acutus</i>	16.64	3	1.23
<i>Carcharhinus amblyrhynchoides</i>	665.33	4	49.14
<i>Chiloscyllium punctatum</i>	34.51	1	2.55
<i>Carcharhinus dussumieri</i>	8.18	1	0.60
<i>Carcharhinus leucas</i>	194.00	1	14.33
<i>Stegostoma fasciatum</i>	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 immature. *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
<i>Scoliodon laticaudus</i>	44.6	34.6	18	64.4	34	22.2	77.8	44.1	55.9
<i>Carcharhinus sorrah</i>	87.8	51.7	15	48.3	14	100		100	
<i>Sphyrna lewini</i>	80.5	54.2	26	45.8	22	96.2	3.8	100	
<i>Carcharhinus sealei</i>	167.5	59.5	25	40.5	17	84.0	16.0	88.2	11.8
<i>Rhizoprionodon acutus</i>	47.8	57.1	20	42.9	15	100		100	
<i>Carcharhinus amblyrhynchoides</i>	207.5	80.0	20	20.0	5	45.0	55.0	100	
<i>Chiloscyllium punctatum</i>	76.9	50.0	10	50.0	10	20.0	80.0		100
<i>Carcharhinus dussumieri</i>	56.7	42.9	3	57.1	4	100		75.0	25.0
<i>Carcharhinus leucas</i>	174.5	100	4			100			
<i>Stegostoma fasciatum</i>	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
<i>Carcharhinus sorrah</i>	114.08	13	24.69
<i>Carcharhinus dussumieri</i>	42.40	11	9.18
<i>Sphyrna lewini</i>	22.10	5	4.78
<i>Hemigaleus microstoma</i>	19.20	6	4.16
<i>Carcharhinus melanopterus</i>	65.60	6	14.20
<i>Rhizoprionodon acutus</i>	21.50	9	4.65
<i>Carcharhinus amblyrhynchoides</i>	121.40	6	26.28
<i>Carcharhinus brevipinna</i>	27.90	5	6.04
<i>Carcharhinus sealei</i>	12.60	3	2.73
<i>Loxodon macrohinus</i>	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
<i>Carcharhinus sorrah</i>	93.4	55.0	1	45.0	9	72.7	27.3	33.3	66.7
<i>Carcharhinus dussumieri</i>	79.5	64.3	9	35.7	5	44.4	55.6	40.0	60.0
<i>Sphyrna lewini</i>	61.0	69.2	9	30.8	4	88.9	11.1	100.0	
<i>Hemigaleus microstoma</i>	79.1	60.0	6	40.0	4	100		75.0	25.0
<i>Carcharhinus melanopterus</i>	95.5	55.6	5	44.4	4	60.0	40.0	100	
<i>Rhizoprionodon acutus</i>	80.9	66.7	6	33.3	3	16.7	83.3	66.7	33.3
<i>Carcharhinus amblyrhynchoides</i>	106.9	50.0	4	50.0	4	50.0	50.0	50.0	50.0
<i>Carcharhinus brevipinna</i>	81.6	50.0	4	50.0	4	100		100	
<i>Carcharhinus sealei</i>	69.6	85.7	6	14.3	1	66.7	33.3	100	
<i>Loxodon macrohinus</i>	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
<i>Hemigaleus microstoma</i>	35.53	7	28.96
<i>Sphyrna lewini</i>	14.08	7	11.48
<i>Carcharhinus sorrah</i>	19.05	6	15.53
<i>Chiloscyllium punctatum</i>	15.36	2	12.52
<i>Carcharhinus dussumieri</i>	3.75	2	3.06
<i>Loxodon macrorhinus</i>	5.10	3	4.16
<i>Carcharhinus brevipinna</i>	7.60	2	6.20
<i>Carcharhinus limbatus</i>	6.50	2	5.30
<i>Alopias sp.</i>	14.00	1	11.41
<i>Carcharhinus amblyrhynchoides</i>	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
<i>Hemigaleus microstoma</i>	69.5	52	13	48	12	84.6	15.4	50.0	50.0
<i>Sphyrna lewini</i>	60.6	58.3	7	41.7	5	100		100	
<i>Carcharhinus sorrah</i>	73.1	62.5	5	37.5	3	100		66.7	33.3
<i>Chiloscyllium punctatum</i>	81.7	28.6	2	71.4	5		100		100
<i>Carcharhinus dussumieri</i>	53.5	25	1	75	3	100		100	
<i>Loxodon macrorhinus</i>	82.2	100	3				100		
<i>Carcharhinus brevipinna</i>	86.5	50	1	50	1	100		100	
<i>Carcharhinus limbatus</i>	79.5	100	2			100			
<i>Alopias sp.</i>	185.5	100	1			100			
<i>Carcharhinus amblyrhynchoides</i>	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	<i>Chiloscyllium punctatum</i>	894	0.2179	3.1535	0.96
2	<i>Scoliodon laticaudus</i>	877	0.5353	2.9090	0.89
3	<i>Chiloscyllium hasselti</i>	541	0.1593	3.2540	0.95
4	<i>Carcharhinus sorrah</i>	266	0.2315	3.1828	0.97
5	<i>Carcharhinus sealei</i>	191	0.2913	3.1264	0.97
6	<i>Sphyrna lewini</i>	152	0.8628	2.8567	0.97
7	<i>Rhizoprionodon acutus</i>	113	0.2659	3.1216	0.98
8	<i>Carcharhinus amblyrhynchoides</i>	79	0.3830	3.1283	0.99
9	<i>Hemigaleus microstoma</i>	58	0.2472	3.0887	0.85
10	<i>Carcharhinus borneensis</i>	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	<i>Alopias</i> sp.					
2	<i>Atelomycterus marmoratus</i>					
3	<i>Carcharhinus amblyrhynchoides</i>					
4	<i>Carcharhinus amblyrhynchos</i>					
5	<i>Carcharhinus borneensis</i>					
6	<i>Carcharhinus brevipinna</i>					
7	<i>Carcharhinus dussumieri</i>					
8	<i>Carcharhinus leucas</i>					
9	<i>Carcharhinus limbatus</i>					
10	<i>Carcharhinus melanopterus</i>					
11	<i>Carcharhinus plumbeus</i>					
12	<i>Carcharhinus sealei</i>					
13	<i>Carcharhinus sorrah</i>					
14	<i>Chiloscyllium griseum</i>					
15	<i>Chiloscyllium hasselti</i>					
16	<i>Chiloscyllium indicum</i>					
17	<i>Chiloscyllium plagiosum</i>					
18	<i>Chiloscyllium punctatum</i>					
19	<i>Galeocerdo cuvier</i>					
20	<i>Hemigaleus microstoma</i>					
21	<i>Hemipristis elongatus</i>					
22	<i>Heterodontus zebra</i>					
23	<i>Lamiopsis temmincki</i>					
24	<i>Loxodon macrorhinus</i>					
25	<i>Mustelus</i> sp.					
26	<i>Rhizoprionodon acutus</i>					
27	<i>Rhizoprionodon oligolinx</i>					
28	<i>Scoliodon laticaudus</i>					
29	<i>Sphyrna lewini</i>					
30	<i>Sphyrna mokarran</i>					
31	<i>Stegostoma fasciatum</i>					
32	<i>Triaenodon obesus</i>					

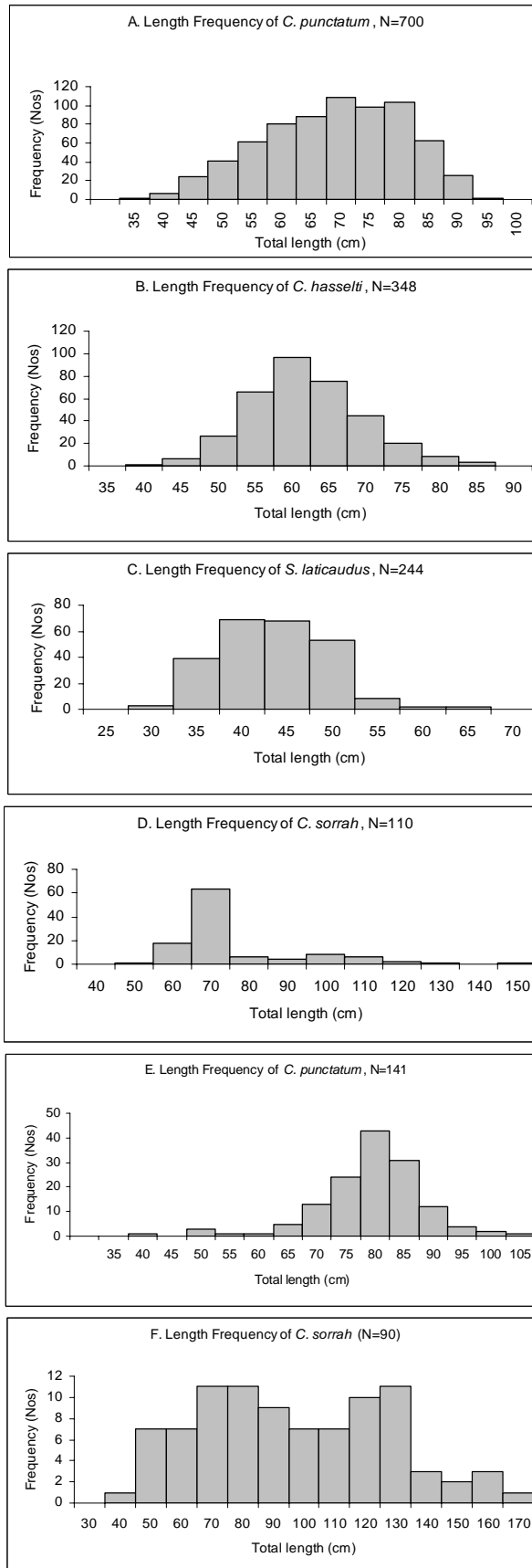


Figure 4. Length frequency distributions of sharks species on the west coast of Peninsular Malaysia landed at Hutan Melintang (A-D) and on South China Sea landed at Kuantan and Bintulu (E-F)

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