



# DATA COLLECTION ON SHARKS AND RAYS BY SPECIES IN MALAYSIA (AUGUST 2015 – JULY 2016)

## (TERMINAL REPORT)

By

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## EXECUTIVE SUMMARY

This project was the outcome of 'The Regional Technical Working Group on Data Collection for Sharks in Southeast Asia' held in Phuket, Thailand on 22 – 24 April 2014. The European Union and The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) through the Southeast Asian Fisheries Development Center (SEAFDEC) had agreed to fund a one-year project for conducting activities in Malaysia with a grant of US\$6,000. Apart from that, the Malaysian Government allocated RM70,000 (about US\$19,000) more to ensure the smooth implementation of the project. With the funding in place, eight districts were identified with four fully sponsored by SEAFDEC and four more by the Malaysian Government.

The project aimed to enhance human resource development in elasmobranch taxonomy, to increase awareness on conservation, to improve landings data recording from generic 'sharks' and 'rays' to species level and as a preparation for Malaysia to conduct Non-detriment Findings (NDFs) study for sharks and rays in the near future. During the period of 12 months from August 2015 to July 2016, recording of landings data were conducted in eight districts, with four each in the states of Perak and Sabah. Thirteen staff from the Department of Fisheries Malaysia and the Department of Fisheries Sabah trained in shark taxonomy were involved in the endeavour, collecting data at least 12 days per month, compared to only five days per month in most of the other ASEAN member countries. Four districts, of which two facing the Straits of Malacca, namely Larut Matang and Selama, and Manjung Utara in Perak, and the districts of Kota Kinabalu and Sandakan in Sabah were selected as the study sites under the sponsorship of SEAFDEC. The other four districts that were funded by the Malaysian Government are Manjung Selatan and Hilir Perak in Perak and two on the east coast of Sabah, namely Semporna and Tawau.

For the purpose of this report, only the findings from the four SEAFDEC's funded study sites were used. The four districts are among the main landing sites of sharks and rays in both states and the landing data were collected at 13 jetties in Perak and two jetties in Sabah.

A total of 118 species of chondrichthyans belonging to 15 families of sharks (51 species) and 11 families of batoids (68 species) were recorded. Out of this 33 species of rays from nine families and 20 species of sharks from five families were recorded during the study period in Perak. For Sabah, a total of 25 species of rays from eight families and 21 species of sharks from 11 Families were recorded during the same period. Two species of sharks namely *Carcharhinus longimanus* and *Heptanchias perlo* confirmed found in Malaysian waters in Sabah. Another 17 species comprising of 13 species of rays and four species of sharks were unidentified and recorded at genus level or as 'cf' (close-for). Based on this study and previous research data, Malaysia recorded 70 species of sharks, 91 species of rays and one species of chimaeras. The details is as shown in **Appendix II and Appendix V**.

In Perak, Larut Matang recorded 19 species of rays from five families, and 14 species of sharks from three Families. Whereas Manjung Utara recorded 14 species of rays from four families, and six species of sharks three Families. In term of percentage of total marine landings, rays and sharks contributed 2.03% and 0.56% at Larut Matang, while for Manjung Utara at 1.38% and 0.38% respectively. For Sabah, Kota Kinabalu recorded the highest number of species with 20 rays from six families and 17 sharks from 11 families compare to Sandakan with 19 species of rays from six families and 14 sharks species from six families. The landings of rays and sharks were minimal in the state, with the contribution of 0.39% and



0.24% at Kota Kinabalu, and 1.81% and 0.53% at Sandakan respectively. These figures confirmed earlier data as published in Malaysian National Statistics that rays and sharks were only by-catch and not targeted and contributed less than 2% of the total annual marine landings.

The abundance of sharks and rays species varied between the study sites. The most abundant sharks species at Larut Matang were *Chiloscyllium hasseltii*, *Chiloscyllium punctatum*, *Atelomycterus marmoratus* and *Carcharhinus sorrah* while for rays were *Neotrygon kuhlii*, *Himantura gerrardi*, *Himantura walga* and *Dasyatis zugei*. The most abundant shark species at Manjung Utara were *Chiloscyllium hasseltii*, *Chiloscyllium punctatum* and *Atelomycterus marmoratus* while for rays were *Himantura walga*, *Himantura gerrardi*, *Neotrygon kuhlii*, and *Dasyatis zugei*. For Sabah, the most abundant sharks species at Kota Kinabalu were *Chiloscyllium punctatum* followed by *Chiloscyllium plagiosum* and *Atelomycterus marmoratus* and for rays *Neotrygon kuhlii* followed by *Himantura gerrardi* and *Dasyatis zugei*. As for Sandakan, the most abundant sharks species were *Chiloscyllium punctatum* followed by *Carcharhinus sorrah* and *Chiloscyllium plagiosum*, and for rays *Neotrygon kuhlii* followed by *Himantura gerrardi* and *Taeniura lymma*.

The top 10 catch per unit effort (CPUE) (kg/days and kg/hauls) for rays species captured by trawl net Zone C in Perak were *Neotrygon kuhlii*, *Himantura gerrardi* and *Himantura walga*, while for sharks were dominated by *Chiloscyllium hasseltii*, *Chiloscyllium punctatum* and *Carcharhinus sorrah*. The top 10 catch per unit effort (CPUE) rays and sharks species captured by trawl net, combined for Kota Kinabalu and Sandakan in Sabah, were determined in Zone 3 and Zone 4. For rays, *Himantura gerrardi* topped the list, followed by *Neotrygon kuhlii* and *Himantura fai* in Zone 3. In Zone 4, *Neotrygon kuhlii* was the main species, followed by *Himantura fai* and *Himantura uarnacoides*. For sharks, the top three species for both Zone 3 and Zone 4 were in the same order, with *Chiloscyllium punctatum* came first, followed by *Chiloscyllium plagiosum* and *Carcharhinus sorrah*.

Finally, based on the usage and marketing information gathered, this study confirmed that all sharks and rays were landed whole, indicated of these species full utilization with no finning activities on board of vessels.

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## **1.0 INTRODUCTION**

Malaysia is a home to a rich diversity of sharks, rays, skate and chimaeras (Class Chondrichthyes). However, sharks and rays landings contribute only about 1% and 2% of total marine landings respectively. Until 2016, Malaysia recorded 162 species of Chondrichthyans comprising 70 sharks, 85 rays, six skates and one chimaera, belonging to 18 families of sharks, 12 rays, two skates and one chimaera. The high diversity of sharks was recorded from the Order Carcharhiniformes with 50 species and Orectolobiformes with 10 species. However, low diversity was recorded for the Orders Hexanchiformes with three species, and Lamniformes and Squatiniformes with two species respectively. Species diversity in the Order Heterodontiformes was scanty where only one species was recorded. As for batoids, high diversity was recorded for the Order Myliobatiformes with 62 species followed by Torpediniformes with 12 species and Rhinobatiformes with eight species. Only six species were recorded from the Order Rajiformes and three species from Pristiformes. Even though the number of chondrichthyans species recorded in Malaysia was more than 160, the actual status of its biodiversity is still unknown. With new species continuously discovered, the number is expected to increase in the future. At present the deep water species are mostly unknown due to limited research activities. Most sharks and rays species landed especially from the Families Carcharhinidae and Dasyatidae and are very difficult to identify up to species level by untrained and inexperienced enumerators. Only well trained staff will be able to make the right and valid identification of species (Ahmad and Annie Lim, 2012).

### **1.1 Objective**

The objectives of this project were:

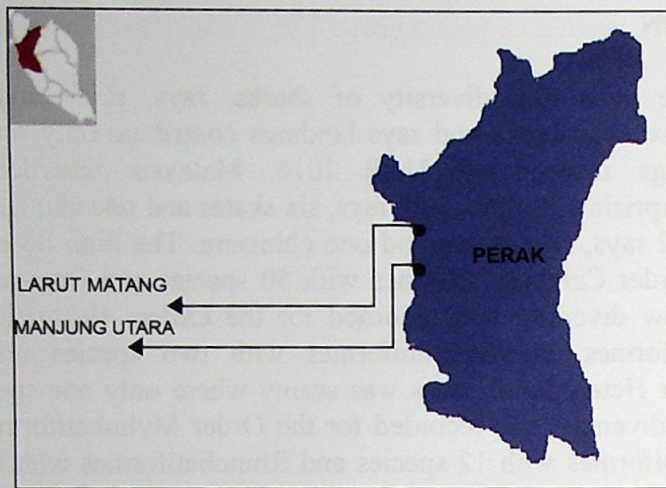
- to enhance human resource development in elasmobranch taxonomy, and
- to improve landing data recording from generic 'sharks' and 'rays' to species level.

### **1.2 Data Collection at Landing Sites**

#### **1.2.1 Selection of Study Sites**

The State of Perak on the west coast of Peninsular Malaysia is a major landing state for sharks and rays. Two districts facing the Straits of Malacca, namely Larut Matang and Selama, and Manjung Utara were selected as the study sites as they were the main landing sites of sharks and rays in the state. The landing data were collected at 13 jetties i.e 10 in Larut Matang and Selama and three in Manjung Utara. The landing sites are private enterprises with most of the sharks and rays landing coming from trawlers. The location of all landing sites are shown in **Figure 1**.





**Figure 1: Location of Study Sites in the State of Perak**

Sabah, with the population of 3.544 million (2015 census) is the second largest state in Malaysia, nicknamed ‘Negeri Di Bawah Bayu’ or Land Below The Wind and occupying the northern part of Borneo. The total land area of Sabah is about 73,631 square kilometres and famed for its 4,095 meter-tall Mt. Kinabalu, the highest peak in the country, as well as for its ethnic diversity, serene beaches, virgin rainforest, coral reefs and abundant flora and fauna species. Surrounded by South China Sea in the west, Sulu Sea in the northeast and Celebes (Sulawesi) Sea in the northeast, Sabah is indeed blessed with its marine resources, In 2015, the landing of marine fish in the state was 175,443 metric tonnes (mt) with the value of RM902.5 million. Sabah maintained its status as a net exporter of fisheries commodities, amounting 74,973 metric tonnes with the value of RM851.7 million in 2014.

There are 16 coastal districts in Sabah and for the purpose of this project, Sandakan in the east and Kota Kinabalu in the west, were selected as the study sites, due to the fact that both districts are major fisheries landing points in Sabah (Figure 2)



**Figure 2 : Location of Study Sites in the State of Sabah**

## 1.2.2 Fishery Structure and Background of Study Sites

### 1.2.2.1 Larut Matang

Larut Matang is one of the major landing sites for sharks and rays in Perak. All jetties belong to private enterprises. The major gears were trawl nets (583), followed by drift nets (144) and purse seine (29). All trawlers are normally operated by 4 - 5 crew members. Almost all of the sharks and rays were landed by trawlers operating beyond eight nautical miles from the coastline. Fishing operation normally between 5 - 12 days per trip. All catches were landed from 0500hr - 1000hr. The details of fishing vessels registered in this district are shown in Table 1.

**Table 1: Number of Licensed Fishing Vessels by Gears and Number of Fishers at Larut Matang**

Gear Type	Fishing Zone	Fishing operation (from coastline)	No. of Vessels	No. of Fishers
<b>Trawlers</b>				
10 -24.9 GRT	B	> 8 nm	380	760
25 - 39.9 GRT	B	> 8 nm	20	26
39.9 - 69.9 GRT	C	>12 nm	174	306
> 70 GRT	C2	>15 nm	9	36
<b>Total</b>			<b>583</b>	<b>1,128</b>
<b>Purse Seiners</b>				
> 70 GRT	C2	> 15 nm	29	721
<b>Total</b>			<b>29</b>	<b>721</b>
<b>Drift Netters</b>	A	All areas	144	514
<b>Longliners</b>	A	All areas	15	15
<b>Others (Fish trap etc.)</b>	A	All areas	954	1,260
<b>Total</b>			<b>1,113</b>	<b>1,789</b>
<b>Grand Total</b>			<b>1,725</b>	<b>3,638</b>

### 1.2.2.2 Manjung Utara

All jetties in Manjung Utara belong to private enterprises. The major gears were drift nets (560), followed by trawl nets (242) and purse seine (16). Other gears were longline (10) and handline (5). The details of the fishing vessels registered in this district are shown in Table 2. The major gears landing sharks and rays were trawl nets, gill nets and longlines. All trawlers are normally operated by 4 - 5 crew members. However, the number of crew for traditional gears such as gillnets and longlines was normally 2-3 fishers. The fishing operation for trawlers was normally between 5 - 12 days per trip while longlines and gill nets were normally a daily trip. All catches were landed from 0730hr - 1200hr.



**Table 2: Number of Licensed Fishing Vessels by Gears and Number of Fishers at Manjung Utara**

Gear Type	Fishing Zone	Fishing operation (from coastline)	No. of Vessels	No. of Fishers
<b>Trawlers</b>				
10 -24.9 GRT	B	> 8 nm	217	434
25 - 39.9 GRT	B	> 8 nm	1	4
39.9 - 69.9 GRT	C	> 12 nm	23	92
> 70 GRT	C2	> 15 nm	1	7
<b>Total</b>			<b>242</b>	<b>537</b>
<b>Purse Seiners</b>				
40 - 69.9 GRT	C	> 12 nm	3	83
> 70 GRT	C2	> 15 nm	13	312
<b>Total</b>			<b>16</b>	<b>395</b>
<b>Drift Netters</b>	A	All Areas	560	1,103
<b>Longliners</b>	A	All Areas	10	20
<b>Handliners</b>	A	All Areas	5	5
<b>Others</b>	A	All Areas	20	20
<b>Total</b>			<b>595</b>	<b>1,148</b>
<b>Grand Total</b>			<b>853</b>	<b>2,080</b>

### 1.2.2.3 Kota Kinabalu

Sabah Fisheries Marketing Authority (SAFMA) Jetty is the biggest fish landing jetty in Kota Kinabalu district. Commercial fishing vessels mainly operating trawl nets and purse seines landed their catch here on a daily basis. There are estimated around 30 fishing vessels utilizing the jetty during a particular period of landing time allowed, which is from 12 midnight until noon the next day.

There are 224 trawlers in Kota Kinabalu compare to purse seines which are only around 41. The operation duration per trip of trawl nets is up to a week while the purse seine's operations only take up to three days the most. The details of commercial fishing vessels in Kota Kinabalu are shown in Table 3.

**Table 3: Number of Licensed Fishing Vessels by Gears and Number of Fishers in Kota Kinabalu**

Gear Type	Fishing Zone	Fishing Operation (from coastline) (Nautical Mile)	No. of Vessels	No. of Fishers
<b>Trawlers</b>				
<10 GRT	West Coast	> 3 nm	9	27
10 – 24.9 GRT	West Coast	> 3 nm	51	180
25 – 39.9 GRT	West Coast	> 3 nm	124	496
40 – 69.9 GRT	West Coast	> 3 nm	27	123
> 70 GRT	West Coast	> 30 nm	13	79
<b>Total</b>			<b>224</b>	<b>905</b>

Gear Type	Fishing Zone	Fishing Operation (from coastline) (Nautical Mile)	No. of Vessels	No. of Fishers
<b>Purse Seiners</b>				
25 – 39.9 GRT	West Coast	> 3 nm	17	222
40 – 69.9 GRT	West Coast	> 3 nm	21	308
> 70 GRT	West Coast	> 30 nm	3	54
<b>Total</b>			<b>41</b>	<b>584</b>
<b>Grand Total</b>			<b>265</b>	<b>1,489</b>

#### 1.2.2.4 Sandakan

Sandakan was the first capital city of Sabah and used to be dubbed as ‘Little Hong Kong’ due to the booming commercial port activities back then. Sandakan has the highest number of trawl net vessels in Sabah, which is around 457 compare to 1,069 total of trawl net vessels state wide. In a big contrast, there are only twelve purse seines vessels operating in Sandakan waters. Sandakan is ranked third in marine fish landing in 2015 with 18,700 mt, behind Kota Kinabalu (61,800 mt) and Kudat (24,600 mt). The total landing of the state during that year was 175,400 mt. There are a number of fish landing jetties in Sandakan but the main landing point in the district is the Sandakan Fish Market Jetty where 45 estimated fishing vessels of various sizes landed their catch daily. The details of commercial fishing vessels in Sandakan are shown in Table 4.

**Table 4: Number of Licensed Fishing Vessels by Gears and Number of Fishers in Sandakan.**

Gear Type	Fishing Zone	Fishing Operation (from coastline) (Nautical Mile)	No. of Vessels	No. of Fishers
<b>Trawlers</b>				
<10 GRT	East Coast	> 3 nm	7	19
10 – 24.9 GRT	East Coast	> 3 nm	172	520
25 – 39.9 GRT	East Coast	> 3 nm	209	820
40 – 69.9 GRT	East Coast	> 3 nm	69	380
> 70 GRT	East Coast	> 30 nm	0	0
<b>Total</b>			<b>457</b>	<b>1,739</b>
<b>Purse Seiners</b>				
40 – 69.9 GRT	East Coast	> 3 nm	6	57
> 70 GRT	East Coast	> 30 nm	6	114
<b>Total</b>			<b>12</b>	<b>171</b>
<b>Grand Total</b>			<b>469</b>	<b>1,910</b>



### 1.3 Appointment of Enumerators

Two Assistant Fisheries Officers from the State Fisheries Office of Perak and two Assistant Fisheries Officers from the Department of Fisheries Sabah were appointed as enumerators for each district or study site. Their names and addresses are as follows:

Study site 1: Larut Matang and Selama, Perak
Mr. Abdul Rahman bin Haji Ali Hasan Pejabat Perikanan Daerah Taiping Tingkat 6, Wisma Persekutuan, Jalan Istana Larut 34000 Taiping, Perak. Tel: +6 058075311 Email: abd.rahman0865@gmail.com
Study site 2: Manjung Utara, Perak
Mr. Mahazir bin Baharom Pejabat Perikanan Daerah Manjung Utara Jalan Damar Laut 34900 Pantai Remis Perak Darul Ridzuan Tel: +6 056772224 Email: Mahazirbaharom@yahoo.com
Study site 3: Kota Kinabalu, Sabah
Mr. Justin Agon Senior Assistant Fisheries Officer Department of Fisheries Sabah Jalan Haji Saman 88000 Kota Kinabalu Sabah, MALAYSIA. Tel No.: +6 088 262359 Email : Justin.agon@sabah.gov.my
Mr. Norhairul Bin Nordin Assistant Fisheries Officer Department of Fisheries Sabah Wisma Pertanian Sabah, Jalan Tasik Luyang (Off Jalan Maktab Gaya) 88624, Kota Kinabalu Sabah, MALAYSIA. Tel No.: +6 088 235966 Email: Hairul_elut@yahoo.com
Study site 4 : Sandakan, Sabah
Mr. Chin En Kiong Senior Assistant Fisheries Officer

Department of Fisheries Sabah  
P.O. BOX 1369,  
90715, Sandakan,  
Sabah, MALAYSIA  
Tel No.: +6 089 208870  
Email: EnKiong.Chin@sabah.gov.my

Mr. Maurice @ Kassim bin Anchi  
Senior Assistant Fisheries Officer  
Department of Fisheries Sabah  
P.O. BOX 1369,  
90715, Sandakan,  
Sabah, MALAYSIA  
Tel No.: +6 089 208870  
Email: Maurice.anchi@sabah.gov.my

National Coordinator and Project Coordinator for Perak:

Mr. Abd Haris Hilmi bin Ahmad Arshad  
Senior Researcher  
Fisheries Research Institute, Capture Fisheries Division  
Kompleks Perikanan Kampung Acheh, Department of Fisheries Malaysia  
32000 Sitiawan Perak, MALAYSIA  
Tel: +6 056914752  
Email: haris\_hilmi@dof.gov.my

Project Coordinator for the Sabah :  
Mr. Lawrence Kissol  
Assistant Director (Marine Resource Management)  
Department of Fisheries Sabah  
Wisma Pertanian Sabah, Jalan Tasik Luyang (Off Jalan Maktab Gaya)  
88624, Kota Kinabalu,  
Sabah, MALAYSIA.  
Tel No.: +6 088 235966  
Email: Lawrence.kissol@sabah.gov.my

## **1.4 Materials and Methods**

### **1.4.1 Sampling Methods**

The sampling activity started in August 2015 until July 2016. All enumerators were requested to record landing data and other related information in a standard form at least 12 days per month. A standard SOP entitled 'SOP Sharks and Rays Data Collection in the Southeast Asian Waters' was produced. The content included Standard Operation Procedure and instructions to enumerators on how to measure, weigh, record sharks and rays species at sampling sites, name of enumerator, name of landing site, date of sampling, vessel registration number, vessel GRT, fishing area, price at landing sites, name of species (common name and scientific name), total catch of sharks, rays, commercial and low-value species from each sampling vessel.

The details of the standard form are shown in **Appendix I**. The completed data in excell were then submitted to the respective National Coordinator before submitted to SEAFDEC/MFRDMD before second week of the following month for verification. The data were analysed at the end of each quarter.

#### **1.4.2 Selection of Fishing Vessels and Sampling Activities**

Between 1 - 3 fishing vessels were selected for sampling each day for 12 days per month at each landing site. Measurement of Total length (TL) were taken for all skates, sharks and rays species from the Families Rhynchobatidae, Rhinobatidae and Narcinidae. While Disc Length (DL) were taken for all ray species where the tail is frequently absent or damaged (mainly from the Families Dasyatidae, Gymnuridae and Mobulidae). All sharks and rays specimens were measured and weighed individually if the total number was less than 50 tails per vessel. If the total number was more than 50 tails, only 10-50% were measured. The maturity stage for each individual was estimated according to Yano *et al.* (2005) and Ahmad and Annie Lim (2012). The total catch of all sharks and rays by species as well as the total catch of commercial and low-value species were also recorded for each sampling vessel. Some samples were brought back to the Fisheries Research Institute, Capture Fisheries Division, Kg. Aceh Sitiawan Perak and Fisheries Research Center, Likas, Kota Kinabalu for preservation and future references. Larger specimens were photographed, and their basic taxonomic and biological characteristics noted.

#### **1.4.3 Classification**

The classification (scientific names) used in this report follows that of Compagno (1999), Yano *et al.* (2005), Ahmad and Annie Lim (2012), Ahmad *et al.* (2013) and Ahmad *et al.* (2014), and Ebert *et al.* (2013).

## **2.0 RESULTS**

### **2.1 Larut Matang**

#### **2.1.1 Landing Samples**

A total of 336 landings were sampled during the study period. The highest by month was 33 in October followed by 29 in December 2015. The highest by gear type was 263 Zone C trawl net followed by 39 of longline, 14 of Zone C2 and 13 of Zone B trawl net. The details are shown in **Table 5**.

**Table 5: Number of Landings Sampled during the study at Larut Matang**

Type of Gear	Year/Month													Grand Total
	2015					2016								
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul		
Drift Net	1		1	2	1							1	6	
Longline	2	2	7	2	2		4	4	9	2	2	3	39	
Purse Seine C2		1											1	
Trawl Net B		2	3	2	1	1	3		1				13	
Trawl Net C	22	22	21	20	23	26	19	24	18	23	23	22	263	
Trawl Net C2	3	1	1	1	2		2			1	2	1	14	
<b>Total</b>	<b>28</b>	<b>28</b>	<b>33</b>	<b>27</b>	<b>29</b>	<b>27</b>	<b>28</b>	<b>28</b>	<b>28</b>	<b>26</b>	<b>27</b>	<b>27</b>	<b>336</b>	

### 2.1.2 Fishing Ground and Catch Composition by Gear Type

The main gear landing sharks at Larut Matang was trawl net at 5,344.7 kg (67.0%) followed by purse seine and drift net at very small amount (22 kg) while longline, which operated up to 30 nautical miles from the coastline landed the highest rays at 2,077 kg (26.0%) followed by drift net at 314 kg (3.9%) and trawl net at 219 kg (2.7%). Most trawlers operated beyond eight nautical miles from the coastline. Zone C trawl net landed the highest at 4,912 kg followed by Zone C2 trawl net (399 kg) and Zone B at 33 kg. The highest landing of rays by month was from longline at 499.6 kg in December 2015, while in April and July 2016 were 425.5 kg and 261.9 kg respectively. The highest landing of sharks by month came from Zone C trawl net in August 2015 at 600.4 kg followed by 542.2 kg in October 2015 and 501 kg in May 2016. The details are shown in **Table 6**.



**Table 6: Weight of Sharks and Rays (in kg) Caught by Different Types of Gear**

Type of Gear	Year/Month												
	2015						2016						
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Grand Total
Drift Net	23.3			163.0	97.2							30.6	314.0
Longline	53.1	48.5	158.9	51.1	499.6		153.5	155.9	407.0	106.5	162.7	261.9	2,077.0
Trawl Net B		10.1	21.6		19.1		5.8						56.6
Trawl Net C	75.9	57.7					2.6	26.3					162.5
<b>Total Catch Ray</b>	<b>152.3</b>	<b>116.3</b>	<b>180.5</b>	<b>214.0</b>	<b>615.9</b>		<b>161.9</b>	<b>182.2</b>	<b>407.0</b>	<b>106.5</b>	<b>162.7</b>	<b>292.4</b>	<b>2,610.1</b>
Drift Net			4.8										4.8
Purse Seine C2		17.1											17.1
Trawl Net B		2.5	2.6	5.5		19.5	1.8		1.1				33.0
Trawl Net C	600.4	397.9	542.2	461.4	350.7	469.6	287.3	248.4	375.4	501.9	313.8	363.2	4,912.3
Trawl Net C2	134.0	26.8	22.7	36.4	29.6		57.5			27.6	41.5	23.3	399.4
<b>Total Catch Shark</b>	<b>734.4</b>	<b>444.2</b>	<b>572.3</b>	<b>503.3</b>	<b>380.3</b>	<b>489.2</b>	<b>346.6</b>	<b>248.4</b>	<b>376.5</b>	<b>529.5</b>	<b>355.3</b>	<b>386.4</b>	<b>5,366.5</b>
<b>Grand Total</b>	<b>886.7</b>	<b>560.6</b>	<b>752.8</b>	<b>717.3</b>	<b>996.2</b>	<b>489.2</b>	<b>508.4</b>	<b>430.6</b>	<b>783.5</b>	<b>636.0</b>	<b>518.0</b>	<b>678.9</b>	<b>7,976.6</b>

### 2.1.3 Sharks and Rays Composition

A total of 1,578,271 kg of fish was landed from 336 landings during the study period. Rays and sharks made up 24,570 kg and 5,439 kg (1.4% and 0.4%) from the total landing respectively. Landings of bony fish was 1,548,281.8 kg or 98.2%. Average landings per month for sharks and rays were 453 kg and 2,048 kg respectively. The highest landing by month for rays was 8,790 kg in July, followed by 3,229 kg in May and 2,905 kg in June 2016. However, the highest landing for sharks was 807 kg in August 2015 followed by 572 kg in October 2015 and 530 kg in May 2016. In general, the landing of sharks and rays ranged between 0.2 – 0.8% and 0.7 - 4.7% respectively from total landing. The details are shown in Table 7.

**Table 7: Catch Composition of Sharks, Rays and Bony Fish by Month from 336 Landings at Larut Matang, Perak. All Weights in Kilogram.**

Year	Month	Weight of Ray	% Ray	Weight of Shark	% Shark	Weight of Bony Fish	% Bony fish	Total Catch
2015	Aug	1,042.0	1.0	806.6	0.8	106,068.8	98.2	107,917.4
	Sep	1,199.2	0.9	444.2	0.3	137,587.5	98.8	139,230.9
	Oct	995.2	0.8	572.3	0.4	127,670.4	98.8	129,237.8
	Nov	1,110.5	0.8	503.3	0.3	146,917.7	98.9	148,531.5
	Dec	1,624.5	1.2	380.3	0.3	128,509.0	98.5	130,513.8
2016	Jan	985.8	0.7	489.2	0.4	133,506.1	98.9	134,981.0
	Feb	848.9	0.8	346.6	0.3	103,115.9	98.9	104,311.4
	Mar	759.8	0.7	248.4	0.2	114,584.1	99.1	115,592.3
	Apr	1,080.6	1.1	376.5	0.4	94,069.2	98.5	95,507.8
	May	3,228.5	2.2	529.5	0.4	141,227.4	97.4	144,985.4
	Jun	2,905.1	2.1	355.3	0.3	135,508.2	97.6	138,768.6
	July	8,789.7	4.7	386.4	0.2	179,517.5	95.1	188,693.6
<b>Grand Total</b>		<b>24,569.8</b>		<b>5,438.6</b>		<b>1,548,281.8</b>		<b>1,578,271.5</b>
<b>Average</b>		<b>2,047.5</b>	<b>1.4</b>	<b>453.2</b>	<b>0.4</b>	<b>129,023.5</b>	<b>98.2</b>	<b>131,522.6</b>

### 2.1.4 Sample Size

A total of 8,039 tails belonging to 4,873 rays and 3,166 sharks were sampled comprising 19 species of rays and 14 species of sharks during the study period. The most common and abundant rays species were *Neotrygon kuhlii*, *Himantura gerrardi*, *H. walga* and *Dasyatis zugei*. Other common rays species were *Rhynchobatus australiae*, *Himantura pastinacoides* and *Dasyatis akajei*. All these species were landed throughout the year. Other rays species such as *Dasyatis thetidis*, *Himantura undulata*, *Rhinobatos cf. borneensis*, *Rhynchobatus laevis*, were only landed between 1 - 3 months. The highest number of rays sampled by month was 474 tails in August followed by 455 tails in September 2015 and 446 tails in January 2016.

The most common and abundant sharks species recording in 12 months were *Chiloscyllium hasseltii*, *C. punctatum* and *Atelomycterus marmoratus*. Other common sharks species were *Atelomycterus cf. ermanni* and *Carcharhinus sorrah*. These species were landed between 10 - 12 months. Other sharks species such as *Carcharhinus brevipinna*, *C. limbatus*, *C. leucas* and *Galeocerdo cuvier* were only landed between 1 - 2 months. The highest number of sharks sampled by month was 324 tails in May, followed by 323 tails in January 2016 and 303 tails in August 2015. The details are as shown in Table 8.

**Table 8: Sample Size of Sharks and Rays by Species**

Species	Year/Month												Total
	2015						2016						
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<i>Dasyatis akajei</i>	1	2	12	11	1		5	8	11	3	4	1	59
<i>Dasyatis thetidis</i>				1									1
<i>Dasyatis zugei</i>	106	103	89	65	77	94	55	84	56	70	70	56	925
<i>Himantura cf. gerrardi</i>					1								1
<i>Himantura fai</i>										4	3		7
<i>Himantura gerrardi</i>	107	99	89	81	116	120	100	109	82	99	92	114	1,208
<i>Himantura jenkinsii</i>	2	1	1	1		1	1			3	3	1	11
<i>Himantura pastinacoides</i>	8	4	5	10	5		4	3	5	5	1	8	58
<i>Himantura uarnak</i>											1		1
<i>Himantura undulata</i>				1	3								4
<i>Himantura walga</i>	108	117	97	88	89	97	68	83	53	92	67	54	1,013
<i>Narcine maculata</i>	2						2						2
<i>Narcine sp</i>				10									12
<i>Neotrygon kuhlii</i>	127	125	121	92	124	113	103	118	96	141	104	135	1,399
<i>Rhinobatos cf. borneensis</i>				5	4								9
<i>Rhynchobatus australiae</i>	12	4	3	18	16	19	13	13	8	18	15	17	156
<i>Rhynchobatus laevis</i>			1							1	1		3
<i>Temera hardwickii</i>	1												1
<i>Narcine sp D</i>					4	2							6
<b>Total Rays</b>	<b>474</b>	<b>455</b>	<b>418</b>	<b>383</b>	<b>440</b>	<b>446</b>	<b>351</b>	<b>418</b>	<b>311</b>	<b>433</b>	<b>361</b>	<b>386</b>	<b>4,873</b>
<i>Atelomycterus cf. baliensis</i>	2	14	1	1	3	3				1	1		26
<i>Atelomycterus cf. erdmanni</i>	9	19	18	19	15	27	13	2	5	8	5	5	145
<i>Atelomycterus marmoratus</i>	52	52	31	30	33	58	50	35	35	48	26	40	490
<i>Carcharhinus brevipinna</i>			5	5									10
<i>Carcharhinus leucas</i>			1	2									3
<i>Carcharhinus limbatus</i>	1												1
<i>Carcharhinus sorrah</i>	9	2	11	6	2			4	52	73	38	11	208
<i>Chiloscyllium cf. hasseltii</i>						2							2
<i>Chiloscyllium hasseltii</i>	111	97	116	107	124	134	108	88	85	112	84	76	1,242
<i>Chiloscyllium indicum</i>		6	5				3	2	1				17
<i>Chiloscyllium punctatum</i>	120	106	105	81	91	99	80	71	51	81	58	76	1,019
<i>Chiloscyllium sp.</i>				1									1
<i>Galeocerdo cuvier</i>			1	1									2
<i>Scoliodon laticaudus</i>										1			1
<b>Total Sharks</b>	<b>304</b>	<b>296</b>	<b>294</b>	<b>253</b>	<b>268</b>	<b>323</b>	<b>254</b>	<b>202</b>	<b>229</b>	<b>324</b>	<b>212</b>	<b>208</b>	<b>3,166</b>
<b>Grand Total</b>	<b>778</b>	<b>751</b>	<b>712</b>	<b>635</b>	<b>708</b>	<b>769</b>	<b>605</b>	<b>620</b>	<b>540</b>	<b>757</b>	<b>573</b>	<b>593</b>	<b>8,039</b>

### 2.1.5 Weight of Sharks and Rays by Species

A total of 23,702 kg was landed from 336 landings comprising 18,351 kg of rays and 5,352 kg of sharks. For rays, the highest landing by weight was *Himantura gerrardi* amounting to 7,021 kg, followed by 5,053 kg of *Neotrygon kuhlii* and 1,938 kg of *Himantura fai*. The highest landing by month for *Himantura gerrardi* was 1,465 kg in July 2016, followed by 891 kg in December 2015 and 802 kg in Jun 2016. For *Neotrygon kuhlii*, the highest landing was 863 kg in May, followed by 814 kg in July and 674 kg in June 2016. For *Himantura fai*, the highest landing was 1,700 kg in May followed by 238 kg in June 2016. Other important species based on high landing were *Himantura jenkinsii* (992 kg), *H. walga* (994 kg), *H. pastinacoides* (688 kg), *Dasyatis zugei* (683 kg), *Rhynchobatus australiae* (408 kg) and *Dasyatis akajei* at 341 kg. Landing of other species was below 100 kg.

The highest landing of shark species was 2,433 kg for *Chiloscyllium hasseltii* followed by 1,835 kg for *Chiloscyllium punctatum*, 541 kg for *Carcharhinus sorrah* and 343 kg for *Atelomycterus marmoratus*. The highest landing by month for *Chiloscyllium hasseltii* was 329 kg in August 2015 followed by 275 kg in January 2016 and 268 kg in October 2015. For *Chiloscyllium punctatum*, the highest landing was 306 kg in August followed by 211 kg in October and 204 kg in September 2015. Landing of other species was below 100 kg. The details are shown in **Table 9**.



Table 9: Weight of Sharks and Rays (in Kg) by Species from 336 Landings at Larut Matang

Species	Year/Month												Total
	2015						2016						
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<i>Dasyatis akajei</i>	1.0	15.8	79.3	66.4	4.8		18.8	44.5	65.5	17.3	19.7	7.7	340.7
<i>Dasyatis thetidis</i>				81.0									81.0
<i>Dasyatis zugei</i>	82.5	80.4	57.1	54.8	46.4	66.5	40.4	50.9	39.6	52.3	54.5	57.9	683.2
<i>Himantura cf. gerrardi</i>					19.1								19.1
<i>Himantura fai</i>										1,700.0	238.0		1,938.0
<i>Himantura gerrardi</i>	373.3	458.7	336.7	397.0	891.3	508.2	452.3	360.5	596.0	380.7	801.7	1,464.9	7,021.2
<i>Himantura jenkinsii</i>	3.6	4.6	1.6	1.4		10.5	0.8				960.0	9.2	991.7
<i>Himantura pastinacoides</i>	72.3	32.7	39.1	122.5	28.8		61.8	66.3	78.1	91.7	26.0	68.5	687.7
<i>Himantura uarnak</i>											56.0		56.0
<i>Himantura undulata</i>				29.1	63.6								92.7
<i>Himantura walga</i>	113.3	125.9	93.3	67.5	80.5	62.6	52.1	69.1	50.0	101.2	48.6	80.3	944.2
<i>Narcine maculata</i>	1.3												1.3
<i>Neotrygon kuhlii</i>	374.3	469.9	379.8	233.0	424.4	288.8	169.2	138.2	224.5	863.4	673.6	814.1	5,053.3
<i>Rhinobatos cf. borneensis</i>				8.4	6.3								14.7
<i>Rhynchobatus australiae</i>	20.3	11.2	5.3	42.6	55.7	47.7	52.6	30.3	27.1	21.5	23.4	70.0	407.8
<i>Rhynchobatus laevis</i>			2.9							0.5	1.9		5.3
<i>Temere hardwickii</i>	0.1												0.1
<i>Narcine sp</i>				6.9			0.9						7.8
<i>Narcine sp D</i>					3.6	1.5							5.0
<b>Total Weight Rays</b>	<b>1,042.0</b>	<b>1,199.2</b>	<b>995.2</b>	<b>1,110.5</b>	<b>1,624.5</b>	<b>985.8</b>	<b>848.9</b>	<b>759.8</b>	<b>1,080.6</b>	<b>3,228.5</b>	<b>2,903.4</b>	<b>2,572.5</b>	<b>18,350.7</b>
<i>Atelomycterus cf. baliensis</i>	0.8	8.8	0.3	0.4	1.0	1.4				0.5	0.6		13.6
<i>Atelomycterus cf. erdmanni</i>	3.9	21.0	6.9	8.6	6.4	14.2	5.6	1.0	2.4	3.4	2.1	1.8	77.2
<i>Atelomycterus marmoratus</i>	60.2	35.5	13.6	15.5	14.6	38.2	42.3	19.4	15.8	49.8	13.1	24.7	342.6
<i>Carcharhinus brevipinna</i>			13.5	13.3									26.8

Species	Year/Month												
	2015						2016						
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
<i>Carcharhinus leucas</i>			4.8	33.2									38.0
<i>Carcharhinus limbatus</i>	1.4												1.4
<i>Carcharhinus sorrah</i>	33.1	20.0	37.4	27.3	8.2			7.5	128.6	158.0	84.4	37.0	541.5
<i>Chiloscyllium cf. hasseltii</i>						1.9							1.9
<i>Chiloscyllium hasseltii</i>	328.7	152.7	268.0	227.0	219.1	274.8	196.4	113.1	142.1	193.6	162.2	155.8	2,433.6
<i>Chiloscyllium indicum</i>		2.3	2.0				0.9	0.9	0.4				6.4
<i>Chiloscyllium punctatum</i>	306.3	204.0	211.1	144.8	131.1	158.6	101.3	106.6	87.3	124.0	93.0	167.2	1,835.3
<i>Chiloscyllium</i> sp				0.4									0.4
<i>Galeocerdo cuvier</i>			14.6	18.1									32.7
<i>Scoliodon laticaudus</i>										0.3			0.3
<b>Total Weight Sharks</b>	<b>734.4</b>	<b>444.2</b>	<b>572.3</b>	<b>488.5</b>	<b>380.3</b>	<b>489.2</b>	<b>346.6</b>	<b>248.4</b>	<b>376.5</b>	<b>529.5</b>	<b>355.3</b>	<b>386.4</b>	<b>5,351.7</b>
<b>Grand Total</b>	<b>1,776.4</b>	<b>1,643.4</b>	<b>1,567.5</b>	<b>1,599.0</b>	<b>2,004.8</b>	<b>1,474.9</b>	<b>1,195.5</b>	<b>1,008.2</b>	<b>1,457.1</b>	<b>3,758.0</b>	<b>3,258.7</b>	<b>2,959.0</b>	<b>23,702.4</b>

### 2.1.6 Size Range of Sharks and Rays

In general from August 2015 to January 2016, both mature and immature rays species were sampled. Generally, rays species sampled were mature except for *Himantura gerrardi*, *Himantura cf. gerrardi*, *H. jenkinsii*, *Rhynchobatus australiae* and *R. laevis*. The average size of *Himantura gerrardi* ranged between 33.1- 39.9 cm disc length. Most adult sized of *Himantura gerrardi* were immediately removed by middlemen upon being landed. First maturing size for *Himantura gerrardi* is about 59.0 cm (disc width). Male of *Rhynchobatus australiae* mature at 130 cm total length and female mature at 155 cm. However, almost all samples of *Dasyatis zugei*, *Neotrygon kuhlii* and *Rhinobatos cf. borneensis* were mature. Size range of rays species from August 2015 to January 2016 are shown in **Table 10A (i)**. Ray species sampled from February to July 2016 were mature except for *Himantura gerrardi*, *H. jenkinsii* and *Rhynchobatus australiae*. Almost all specimens of *Dasyatis zugei*, *Neotrygon kuhlii* and *Himantura walga* were matured. Size range of rays sampled from February to July 2016 are shown in **Table 10A (ii)**.

Most of shark species sampled between August 2015 to January 2016 were mature except for *Carcharhinus brevipinna*, *C. leucas*, *C. limbatus*, *C. sorrah* and *Galeocerdo cuvier*. Mature size for female of *C. brevipinna* is ranged between 170 - 220 cm total length and for male between 159 - 203 cm. First maturing size for female for *C. leucas* is ranged between 180 - 230 cm total length and for male between 197 - 226 cm. For *Carcharhinus sorrah* female is mature when total length between 110 -118 cm and for female between 103 -128 cm. Size range of all sharks species sampled from August 2015 to January 2016 are shown in **Table 10B (i)**. Almost all shark species sampled between February to July 2016 were mature except for *Carcharhinus sorrah*. Size range of all sharks sampled from February to July 2016 are shown in **Table 10B (ii)**.

**Table 10A (i): Size Range of Rays (Disc Length) Except for *Rhinobatos cf. borneensis*, *Narcine* spp, *Rhynchobatus australiae*, *R. laevis* and *Temera hardwickii* (Total Length) from August 2015 to January 2016. All Measurements in cm.**

Species	Year/Month														
	2015						2016								
	Aug		Sep		Oct		Nov		Dec		Jan				
Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	
<i>Rays</i>															
<i>Dasyatis akajei</i>	25.5	25.5	25.5	54.0	58.0	56.0	37.0	63.0	48.9	30.0	59.0	49.0	47.0	47.0	
<i>Dasyatis thetidis</i>										120.0	120.0	120.0			
<i>Dasyatis zugei</i>	16.0	33.0	23.7	15.0	33.0	23.5	15.0	32.0	24.1	19.0	34.0	24.6	16.0	33.0	24.3
<i>Himantura cf. gerrardi</i>													75.0	75.0	75.0
<i>Himantura gerrardi</i>	17.0	57.0	33.6	17.5	64.0	33.1	20.0	78.0	35.4	20.0	93.0	37.4	17.0	96.0	39.9
<i>Himantura jenkinsii</i>	30.0	37.0	33.5	46.0	46.0	46.0	33.0	33.0	33.0	32.0	32.0	32.0			
<i>Himantura pastinacoides</i>	27.0	75.0	55.5	52.0	64.0	57.0	49.0	61.0	56.6	41.0	64.0	54.5	40.0	53.0	45.1
<i>Himantura undulata</i>										93.0	93.0	93.0	26.0	116.0	56.7
<i>Himantura walga</i>	16.0	25.5	20.1	16.0	25.0	20.2	16.5	25.5	20.6	16.5	25.0	20.9	16.5	28.0	20.8
<i>Narcine maculata</i>	29.5	43.5	36.5												
<i>Narcine</i> sp.										31.5	38.0	34.5			
<i>Neotrygon kuhlii</i>	14.0	36.0	21.4	14.0	32.0	22.0	14.0	32.0	22.3	14.0	31.0	22.2	15.0	33.0	22.4
<i>Rhinobatos cf. borneensis</i>										78.5	89.0	83.4	75.0	80.5	78.4
<i>Rhynchobatus australiae</i>	29.5	85.0	65.3	50.0	113.0	73.5	53.0	92.0	67.3	48.5	126.0	73.3	48.0	146.0	77.4
<i>Rhynchobatus laevis</i>							84.0	84.0	84.0						
<i>Temera hardwickii</i>	12.5	12.5	12.5												
<i>Narcine</i> sp. D										33.0	34.0	33.5	35.0	35.0	40.0



**Table 10A (ii): Size Range of Rays (Disc Length) Except for *Narcine* spp, *Rhynchobatus australiae* and *R. laevis* (Total Length) from February to July 2016. All Measurements in cm.**

Species	Year/Month																							
	2016																							
	Feb			Mar			Apr			May			Jun			Jul								
Rays	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave			
<i>Dasyatis akajei</i>	21.0	57.0	37.2	32.0	59.0	48.8	37.0	60.0	50.8	38.0	55.0	48.0	36.0	52.0	46.5	52.0	52.0	46.5	52.0	52.0	52.0	52.0		
<i>Dasyatis zugei</i>	16.0	31.0	23.5	15.0	30.0	23.4	22.0	31.0	22.3	18.0	33.0	24.0	17.0	33.0	24.5	18.0	58.0	25.0						
<i>Himantura fai</i>										92.0	116.0	105.8	57.0	141.0	108.0									
<i>Himantura gerrardi</i>	16.0	83.0	37.0	18.0	76.0	33.0	17.5	73.0	39.8	21.0	84.0	37.7	19.0	93.0	42.0	20.5	92.0	48.9						
<i>Himantura jenkinsii</i>	26.5	26.5	26.5										94.0	96.0	94.7	59.0	59.0	59.0						
<i>Himantura pastinacoides</i>	56.0	81.0	69.0	62.0	90.0	78.0	45.0	80.0	68.1	49.0	80.0	63.2	85.0	85.0	85.0	47.0	69.0	56.8						
<i>Himantura uarnak</i>													110.0	110.0	110.0									
<i>Himantura walga</i>	15.0	28.0	20.9	15.0	26.5	20.5	15.0	25.0	20.8	16.5	25.0	20.6	14.0	26.5	20.1	16.0	27.0	21.1						
<i>Narcine</i> sp.	33.0	37.0	35.0																					
<i>Neotrygon kuhlii</i>	13.0	30.0	21.4	13.0	30.0	21.1	22.5	30.0	22.1	15.0	32.0	22.6	15.0	32.0	23.0	14.0	61.0	23.8						
<i>Rhynchobatus australiae</i>	52.0	145.0	83.7	57.0	174.0	83.8	63.0	109.0	85.3	23.5	119.0	52.7	48.0	111.0	63.4	52.0	137.0	86.6						
<i>Rhynchobatus laevis</i>										48.0	48.0	48.0	73.0	73.0	73.0									

**Table 10B (i): Size Range of Sharks (Total Length) from August 2015 to January 2016. All Measurements in cm.**

Species	Year/Month														
	2015						2016								
	Aug		Sep		Oct		Nov		Dec		Jan				
Min	Max	Av	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	
<b>Sharks</b>															
<i>Atelomycterus cf. baliensis</i>	45.5	52.0	48.8	43.0	53.5	49.6	44.0	44.0	50.0	50.0	44.0	46.0	49.0	47.7	51.3
<i>Atelomycterus cf. erdmanni</i>	48.0	54.0	50.4	37.0	55.0	49.0	34.0	54.0	43.0	56.0	46.6	43.0	54.0	50.6	48.6
<i>Atelomycterus marmoratus</i>	42.0	58.0	49.9	30.0	58.0	47.9	38.0	56.0	43.0	61.0	50.4	33.0	57.0	49.8	49.8
<i>Carcharhinus brevipinna</i>							74.5	89.0	77.0	87.0	80.7				
<i>Carcharhinus leucas</i>							89.0	89.0	78.0	155.0	89.0				
<i>Carcharhinus limbatus</i>	61.0	61.0	61.0												
<i>Carcharhinus sorrah</i>	73.0	83.0	78.9	83.0	142.0	112.5	61.0	95.0	93.0	97.0	84.4	88.0	96.0	92.0	
<i>Chiloscyllium cf. hasseltii</i>															62.3
<i>Chiloscyllium hasseltii</i>	42.0	82.0	62.3	18.5	86.0	59.6	40.0	93.0	46.0	79.0	62.0	46.0	81.0	62.2	61.0
<i>Chiloscyllium indicum</i>				47.0	56.0	52.3	49.0	55.5			52.0				
<i>Chiloscyllium punctatum</i>	29.0	96.0	69.6	42.0	91.0	67.5	40.0	90.0	31.0	95.0	70.0	43.0	88.0	64.8	64.8
<i>Chiloscyllium sp</i>									48.0	48.0					
<i>Galeocerdo cuvier</i>							144.0	144.0	157.0	157.0	144.0			157.0	

Table 10B (ii): Size Range of Sharks (Total Length) from February to July 2016. All Measurements in cm.

Species	Year/Month																	
	2016																	
	Feb			Mar			Apr			May			Jun			Jul		
Sharks	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
<i>Atelomycterus cf. baliensis</i>							52.0					52.0	54.0	54.0	54.0			
<i>Atelomycterus cf. erdmanni</i>	42.0	56.0	49.5	52.0	53.0	52.5	45.0	60.5	51.9	47.0	58.0	51.3	43.0	52.0	47.8	43.0	54.0	47.4
<i>Atelomycterus marmoratus</i>	41.0	59.0	50.4	40.0	56.0	48.9	39.0	55.0	49.5	25.0	71.0	50.9	40.0	57.0	50.2	40.0	61.0	51.2
<i>Carcharhinus sorrah</i>				46.0	106.0	64.5	52.0	135.0	60.0	50.0	104.0	60.8	44.0	143.0	66.9	62.0	128.0	81.2
<i>Chiloscyllium hasseltii</i>	41.0	77.0	60.1	45.0	79.0	60.2	47.0	81.0	61.8	42.0	86.0	61.5	39.0	82.0	63.0	42.0	91.0	63.3
<i>Chiloscyllium indicum</i>	46.5	51.0	49.2	52.0	54.0	53.0	52.0	52.0	52.0									
<i>Chiloscyllium punctatum</i>	37.0	89.0	63.1	42.0	90.0	68.4	43.0	92.0	68.9	39.0	88.0	68.4	39.0	90.0	68.8	45.0	95.0	70.4
<i>Scoliodon laticaudus</i>										41.0	41.0	41.0						

### 2.1.7 Usage and Marketing

Information on marketing at this landing site indicated that most sharks and rays meat were 'consumed locally and some were exported to Singapore. Ray's skin was exported to Thailand. The major markets were also in Perak, Johor, Penang and Kuala Lumpur. The price (RM/kg) varied according to species, size and season. The most expensive ray species *Himantura gerrardi* was sold at RM6 - RM21 followed by *H. undulata* (RM15 - RM20) *H. pastinacoides* (RM12 - RM15), *Neotrygon kuhli* (RM2 - RM12), *Rhynchobatus australiae* (RM7 - RM12), *R. laevis* (RM8 - RM10) and *Rhinobatos cf. borneensis* at RM4 - RM10/kg. The cheapest rays were electric rays (*Narcine* spp and *Temera hardwickii*) were sold at RM0.6 – RM0.7/kg to fishmeal processing plant. Fins from big size *Rhynchobatus australiae* were sold separately with the price ranging between RM100 - 300/kg based on sizes. In general, bigger sized rays were more expensive than the smaller ones. Ray's skin is processed before being sent to Thailand. Transport agent has been assigned to manage the ray's skin to be sent to Thailand's Border for processing in Thailand.

The most expensive sharks *Carcharhinus leucas* was sold at RM7 - RM40, *Carcharhinus sorrah* at RM6 - RM12 and *Galeocerdo cuvier* at RM8-10/kg. Market destinations for sharks and rays were similar. Some species such as *Chiloscyllium hasseltii* and *C. punctatum* were marketed to Penang where they are mainly used in traditional Indian cuisine. *Atelomycterus marmoratus* and *A. erdmanni* were also marketed to Penang. Fins of adult *Carcharhinus leucas*, *C. sorrah*, *C. brevipinna* and *C. limbatus* were sold separately, with the price ranging between RM70 - RM150 respectively based on sizes.

Normally the price at wet markets was about 20-50% higher than at landing site. The price was almost consistent for the whole year for all species but can fluctuate up to 50% when supply was limited and during festive seasons such as Chinese New Year and Hari Raya especially for species such as *Himantura gerarrdi*, *H. walga*, *Dasyatis zugei*, *Neotrygon kuhlii*, *Dasyatis akajei* and *Rhynchobatus australiae* for rays and, *Carcharhinus sorrah* and *C. leucas* for sharks. All sharks and rays were landed whole with fins. The details are shown in Table 11. Small, medium and big size category for each species is as shown in Appendix IV.

**Table 11: Price of Sharks and Rays by Species and Market Destination at Larut Matang Landing Site. All Prices in RM per Kilogram. (Exchange rate: RM3.70 = US\$1.00)**

Rays	Range Price RM/kg	Parts	Market Destination
<i>Dasyatis akajei</i>	3-12	Whole body	Local (Ipoh)
<i>Dasyatis zugei</i>	2-5	Whole body	Local (Sitiawan, Ipoh ,Seri Manjung, Pantai Remis, Kuala Kangsar), Penang, Kuala Lumpur, Johor Bahru
<i>Himantura fai</i>	2-6	Whole body, skin	Kuala Lumpur and Butterworth; Skin to Thailand
<i>Himantura gerrardi</i>	6-21	Whole body, skin	Local (Ipoh, Sitiawan, Seri Manjung, Pantai Remis) Penang, Kuala Lumpur, Johor Bahru, Singapore; Skin to Thailand
<i>Himantura jenkinsii</i>	3-12	Whole body, skin	Local (Sitiawan, Seri Manjung), Bukit Mertajam, Singapore
<i>Himantura pastinacoides</i>	12-15	Whole body, skin	Local (Sitiawan); Skin export to Thailand

Rays	Range Price RM/kg	Parts	Market Destination
<i>Himantura undulata</i>	15-20	Whole body, skin	Local (Sitiawan)
<i>Himantura walga</i>	1-8	Whole body	Local (Sitiawan, Ipoh, Seri Manjung, Pantai Remis), Penang, Kuala Lumpur, Johor Bahru
<i>Narcine maculata</i>	0.5-0.6	Whole body	Local (Fish meal factory)
<i>Narcine sp.</i>	0.5-0.6	Whole body	Local (Fish meal factory)
<i>Neotrygon kuhlii</i>	2-12	Whole body	Local (Seri Manjung, Pantai Remis, Sitiawan, Ipoh, Kuala Kangsar), Penang, Kuala Lumpur, Johor Bahru
<i>Rhinobatos cf. borneensis</i>	4-10	Whole body	Local (Sitiawan), Penang
<i>Rhynchobatus australiae</i>	7-12	Whole body, fins	Local (Sitiawan, Pantai Remis, Ipoh), Penang, Kuala Lumpur
<i>Rhynchobatus laevis</i>	8-10	Whole body	Local (Sitiawan), Kuala Lumpur
<i>Temera hardwickii</i>	0.5-0.6	Whole body	Local (Fish meal factory)
<i>Narcine sp D</i>	0.5-0.7	Whole body	Local (Fish meal factory)
<b>Sharks</b>			
<i>Atelomycterus cf. baliensis</i>	1-2	Whole body	Local (Ipoh, Pantai Remis, QL Surimi Factory at Hutan Melintang, Taiping, Lumut), Penang
<i>Atelomycterus cf. erdmanni</i>	1-3	Whole body	Local (Ipoh, Pantai Remis, QL Surimi Factory at Hutan Melintang, Taiping, Lumut), Penang
<i>Atelomycterus marmoratus</i>	1-5	Whole body	Local (QL Surimi Factory at Hutan Melintang, Pantai Remis, Taiping, Sitiawan), Penang, Ipoh
<i>Carcharhinus brevipinna</i>	8-10	Whole body, fins	Local (Pantai Remis), Penang
<i>Carcharhinus leucas</i>	7-40	Whole body, fins	Local (Sitiawan, Taiping)
<i>Carcharhinus limbatus</i>	10-15	Whole body, fins	Local (Sitiawan, Taiping)
<i>Carcharhinus sorrah</i>	6-12	Whole body, Fins	Local (QL Surimi Factory at Hutan Melintang, Pantai Remis), Penang, Ipoh, Kuala Lumpur
<i>Chiloscyllium hasseltii</i>	1-5	Whole body	Local (Sitiawan, Ipoh, Pantai Remis, QL Surimi Factory at Hutan Melintang), Penang, Kuala Lumpur
<i>Chiloscyllium indicum</i>	1-2	Whole body	Local (QL Surimi Factory at Hutan Melintang)
<i>Chiloscyllium punctatum</i>	1-5	Whole body	Local (Sitiawan, Pantai Remis, QL Surimi Factory at Hutan Melintang), Penang, Ipoh, Kuala Lumpur
<i>Galeocerdo cuvier</i>	8-10	Whole body, fins	Local (Sitiawan)
<i>Scoliodon laticaudus</i>	1-2	Whole body	Local (Sitiawan)

## 2.2 Manjung Utara

### 2.2.1 Landing Samples

A total of 308 landings were sampled during the study period. The highest landings by month was 30 in April 2016 followed by 29 in March and 28 in June 2016. The highest by gear type was 113 Zone C trawl net, followed by 72 of longline, 64 of drift net and 47 Zone B trawl net. The details are shown in Table 12.



**Table 12: Number of Landings Sampled During the Study at Manjung Utara**

Type of Gear	Year/Month												Grand Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Drift Net	3	3	2	3	3	1	2	10	10	8	8	11	64
Handline	1	2		1	2	1	2				2		11
Trawl Net B	6	5	6	4	3	4	2	4	4	3	3	3	47
Trawl Net C	9	9	11	11	10	8	15	9	8	7	8	8	113
Trawl Net C2				1									1
Longline	5	5	5	6	6	10	4	6	8	7	7	3	72
<b>Total</b>	<b>24</b>	<b>24</b>	<b>24</b>	<b>26</b>	<b>24</b>	<b>24</b>	<b>25</b>	<b>29</b>	<b>30</b>	<b>25</b>	<b>28</b>	<b>25</b>	<b>308</b>

### 2.2.2 Fishing Ground and Catch Composition by Gear Type

The main gear landing sharks at Manjung Utara was trawl net at 2,170 kg (39.7%) followed by drift net at 414.5 kg (7.65) while longline which operated up to 30 nautical miles from the coastline landed the highest rays at 2,571 kg (47.1%) followed by drift net at 231 kg (4.2%) and handline at 66 kg (1.2%). Most trawlers operated beyond eight nautical miles from the coastline. Zone C trawl net landed the highest at 2,067 kg followed by Zone B at 67.5 kg and Zone C2 at 35.6 kg. The highest landing of rays by month was from longline at 918 kg (May 2015) while in December 2015 and November 2015 were 284 kg and 248 kg respectively. The highest landing of sharks by month came from Zone C trawl net in February 2016 and November 2015 at 323 kg and 240 kg respectively. The details are shown in **Table 13**.

**Table 13: Weight of Sharks and Rays (in kg) Caught by Different Types of Gear**

Type of Gear	Year/Month												Grand Total				
	2015						2016										
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul					
<b>Ray</b>																	
Drift Net	3.8	7.4	7.8	17.2	23.4	1.4	0.1	126.1	6.7	22.3	9.9	4.8					230.9
Handline	4.9	23.8		4.3	8.5	3.6					20.7						65.7
Longline	108.5	185.6	156.1	248.5	284.1	160.8	49.6	66.3	115.8	917.9	190.0	87.5					2,570.6
Trawl Net B				4.0				1.3	1.0								6.4
<b>Total Ray</b>	<b>117.2</b>	<b>216.7</b>	<b>163.9</b>	<b>274.0</b>	<b>315.9</b>	<b>165.8</b>	<b>49.7</b>	<b>193.7</b>	<b>123.5</b>	<b>940.2</b>	<b>220.6</b>	<b>92.3</b>					<b>2,873.6</b>
<b>Shark</b>																	
Drift Net	3.5	0.9	4.7				0.9	27.0	44.1	6.9	156.7	169.8					414.5
Handline					1.1		2.2										3.3
Longline							0.9										0.9
Trawl Net B	11.0	7.2	23.1	1.7	2.3	5.5	1.5	1.6	4.3	4.5	2.2	2.8					67.5
Trawl Net C	78.6	162.1	215.1	239.6	170.7	167.1	322.5	185.3	138.1	171.7	121.5	94.3					2,066.6
Trawl Net C2				35.6													35.6
<b>Total Shark</b>	<b>93.1</b>	<b>170.1</b>	<b>242.9</b>	<b>276.9</b>	<b>174.1</b>	<b>172.6</b>	<b>328.0</b>	<b>213.8</b>	<b>186.5</b>	<b>183.1</b>	<b>280.5</b>	<b>266.9</b>					<b>2,588.3</b>
<b>Grand Total</b>	<b>210.3</b>	<b>386.8</b>	<b>406.8</b>	<b>550.8</b>	<b>490.0</b>	<b>338.3</b>	<b>377.7</b>	<b>407.6</b>	<b>310.0</b>	<b>1,123.3</b>	<b>501.1</b>	<b>359.2</b>					<b>5,461.9</b>

### 2.2.3 Sharks and Rays Composition

A total of 469,906 kg of fish was landed from 308 landings during the study period. Rays and sharks made up 9,068 kg and 2,588 kg (2.0% and 0.6%) from the total landing respectively. Landings of bony fish was 458,249.60 kg or 97.4 %. Average landings per month for sharks and rays were 216 kg and 756 kg respectively. The highest landing by month for rays was 1,400 kg in July 2016, followed by 1,327 kg in May 2016 and 921 kg in November 2015. For sharks, the highest landing was 328 kg in February 2016 followed by 280 kg in June 2016 and 277 kg in November 2015. In general, the landing of sharks and rays ranged between 0.3 - 0.9% and 0.9 - 4.4% respectively from total landing. The details are shown in **Table 14**.

**Table 14: Catch Composition of Sharks, Rays and Bony Fish by Month from 308 Landings at Manjung Utara, Perak. All Weights in Kilogram.**

Year	Month	Weight of Rays	% Ray	Weight of Sharks	% Sharks	Weight of Bony Fish	% Bony Fish	Total Catch
2015	Aug	484.2	1.6	93.1	0.3	30,051.0	98.1	30,628.3
	Sep	750.9	2.0	170.1	0.5	36,795.5	97.5	37,716.4
	Oct	496.7	1.3	242.9	0.6	37,778.1	98.1	38,517.8
	Nov	920.5	1.8	276.9	0.5	50,894.1	97.7	52,091.5
	Dec	873.4	2.3	174.1	0.5	36,384.1	97.2	37,431.6
2016	Jan	599.3	1.9	172.6	0.5	30,989.3	97.6	31,761.2
	Feb	728.8	1.3	328.0	0.6	56,462.8	98.1	57,519.6
	Mar	482.7	1.1	213.8	0.5	43,693.4	98.4	44,390.0
	Apr	380.2	0.9	186.5	0.4	42,070.7	98.7	42,637.3
	May	1327.5	3.9	183.1	0.5	32,302.6	95.6	33,813.2
	Jun	623.3	2.0	280.5	0.9	30,745.3	97.1	31,649.1
	Jul	1400.1	4.4	266.9	0.8	30,082.8	94.8	31,749.8
<b>Total</b>		<b>9067.7</b>		<b>2588.4</b>		<b>458,249.6</b>		<b>469905.6</b>
<b>Ave</b>		<b>755.6</b>	<b>2.0</b>	<b>215.7</b>	<b>0.6</b>	<b>38,187.5</b>	<b>97.4</b>	<b>39158.8</b>

### 2.2.4 Sample Size

A total of 3,800 tails belonging to 2,498 rays and 1,302 sharks were sampled during the study period comprising 14 species of rays and six (6) species of sharks. The most common and abundant rays species were *Himantura walga*, *H. gerrardi*, *Neotrygon kuhlii* and *Dasyatis zugei*. Other rays species such as *Dasyatis fluviatorum*, *Himantura uarnacoides*, *Himantura uarnak*, *Rhinobatos cf. borneensis* and *Rhynchobatus australiae* were rarely landed and only recorded between 1-4 months. The highest number of rays sampled by month was 280 tails in February 2016 followed by 277 tails in November and 212 tails in October 2015.

The most common and abundant sharks species were *Chiloscyllium hasseltii*, *C. punctatum* and *Atelomycterus marmoratus*. All these species were landed throughout the year. *Carcharhinus sorrah* was recorded in nine months. Other sharks species such as *Stegostoma fasciatum* and *Chiloscyllium indicum* only recorded in one and two months respectively during the study period. The highest number sampled by month was 175 tails in February 2016 followed by 127 tails in November and 126 tails in October 2015. The details are as shown in **Table 15**.

Table 15: Sample Size of Sharks and Rays by Species

Species	Year/Month												Total		
	2015						2016								
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul			
<i>Dasyatis fluviorum</i>	5	1	1	2	3	1									13
<i>Dasyatis zugei</i>	58	34	30	38	23	34	50	26	34	25	32	36			420
<i>Gymnura poecilura</i>	1	3	3	2	3			2	2	2	2	1			21
<i>Himantura fai</i>												4			4
<i>Himantura gerrardi</i>	43	59	63	85	66	61	82	46	49	52	51	40			697
<i>Himantura jenkinsii</i>				1											1
<i>Himantura pastinacoides</i>								3	1	16	8	3			31
<i>Himantura uarnacoides</i>								2							2
<i>Himantura uarnak</i>								1				1			2
<i>Himantura walga</i>	14	44	64	86	61	51	66	85	81	63	45	58			718
<i>Neotrygon kuhlii</i>	57	58	51	62	50	47	78	37	25	36	38	41			580
<i>Rhinobatos cf. borneensis</i>							2								2
<i>Rhynchobatus australiae</i>				1	2		2	1							6
<i>Taeniurops meyeri</i>												1			1
<b>Total rays</b>	<b>178</b>	<b>199</b>	<b>212</b>	<b>277</b>	<b>208</b>	<b>194</b>	<b>280</b>	<b>203</b>	<b>192</b>	<b>194</b>	<b>176</b>	<b>185</b>	<b>185</b>	<b>2,498</b>	
<i>Atelomycterus marmoratus</i>	17	9	10	16	3	11	19	2	9	11	5	14			126
<i>Carcharhinus sorrah</i>	7	1	3				1	2	20	17	33	18			102
<i>Chiloscyllium hasseltii</i>	52	52	57	59	49	49	81	49	38	34	28	33			581
<i>Chiloscyllium indicum</i>					2				3						5
<i>Chiloscyllium punctatum</i>	26	38	56	52	41	35	73	45	36	33	26	26			487
<i>Stegostoma fasciatum</i>							1								1
<b>Total sharks</b>	<b>102</b>	<b>100</b>	<b>126</b>	<b>127</b>	<b>95</b>	<b>95</b>	<b>175</b>	<b>98</b>	<b>106</b>	<b>95</b>	<b>92</b>	<b>91</b>	<b>91</b>	<b>1,302</b>	
<b>Grand total</b>	<b>280</b>	<b>299</b>	<b>338</b>	<b>404</b>	<b>303</b>	<b>289</b>	<b>455</b>	<b>301</b>	<b>298</b>	<b>289</b>	<b>268</b>	<b>276</b>	<b>276</b>	<b>3,800</b>	

### 2.2.5 Weight of Sharks and Rays by Species

A total of 11,656 kg was landed from 308 landings comprising 9,068 kg of rays and 2,588 kg of sharks. For rays, the highest landing by weight was from species *Himantura gerrardi* amounting to 3,818 kg followed by 2,660 kg of *Neotrygon kuhlii*, 907 kg of *Himantura pastinacoides* and 621 kg of *Himantura walga*. The highest landing by month for *Himantura gerrardi* was 596 kg in July 2016, followed by 531 kg in November and 380 kg in Disember 2015. For *Neotrygon kuhlii*, the highest landing was 363 kg in September 2015 followed by 348 kg in February and 290 kg in January 2016. For *Himantura pastinacoides*, the highest landing was 825 kg in May followed by 46 kg in June and 19 kg in July 2016. The highest landing for by month for *Himantura walga* was 100 kg in April 2016, followed by 93 kg in November 2015 and 81 kg in March 2016. Other important species were *Himantura fai* (312 kg), *Dasyatis zugei* (289 kg), *Himantura uarnak* (156 kg) and *Taeniurops meyeri* (119 kg). Landing of other species was less than 100 kg.

The highest landing of shark species were 1,035 kg of *Chiloscyllium punctatum* followed by 860 kg for *Chiloscyllium hasseltii* and 630 kg for *Carcharhinus sorrah*. The highest landing by month for *Chiloscyllium punctatum* was 170 kg in February 2016 followed by 138 kg in November and 128 kg in October 2015. For *Chiloscyllium hasseltii*, the highest landing was 132 kg in November 2015 followed by 114 kg in February 2016 and 107 kg in December 2015. Landing for *Carcharhinus sorrah* was the highest in June (209 kg) followed by 197 kg in July and 76 kg in April 2016. Landing of other species was less than 50 kg. The details are shown in **Table 16**.



**Table 16: Weight of Sharks and Rays (in Kg) by Species from 308 landings at Manjung Utara**

Species	Year/Month												Total				
	2015						2016										
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul					
<i>Dasyatis fluviorum</i>	27.4	10.2	7.8	3.0	18.4	3.6											70.3
<i>Dasyatis zugei</i>	28.6	11.5	12.9	17.5	50.8	46.8	28.2	15.9	15.8	30.4	13.3	17.2					288.9
<i>Gymnura poecilura</i>	3.8	7.4	2.1	6.5	4.9			2.6	2.6	6.0	1.5	1.7					39.1
<i>Himantura fai</i>												312.1					312.1
<i>Himantura gerrardi</i>	227.1	331.3	264.6	530.7	379.9	242.1	279.0	185.0	177.2	266.5	338.2	596.0					3,817.6
<i>Himantura jenkinsii</i>				5.8													5.8
<i>Himantura pastinacoides</i>								17.6		824.6	45.7	18.8					906.6
<i>Himantura uarnacoides</i>								11.6									11.6
<i>Himantura uarnak</i>								72.0				83.6					155.6
<i>Himantura walga</i>	6.0	27.6	50.1	92.7	63.2	16.8	69.9	81.6	100.1	53.1	29.2	31.0					621.2
<i>Neotrygon kuhlii</i>	191.4	363.0	159.3	263.8	330.4	290.0	348.2	66.4	84.4	146.9	195.4	220.8					2,659.9
<i>Rhinobatos cf. borneensis</i>							1.3										1.3
<i>Rhynchobatus australiae</i>					25.8		2.3	30.0									58.7
<i>Taeniurops meyeri</i>				0.6								119.0					119.0
<b>Total Weight Rays</b>	<b>484.2</b>	<b>750.9</b>	<b>496.7</b>	<b>920.5</b>	<b>873.4</b>	<b>599.3</b>	<b>728.8</b>	<b>482.7</b>	<b>380.2</b>	<b>1,327.5</b>	<b>623.3</b>	<b>1,400.1</b>					<b>9,067.6</b>
<i>Atelomycterus marmoratus</i>	6.0	3.1	3.9	6.6	0.8	3.9	7.1	0.9	3.3	4.0	1.8	4.4					45.9
<i>Carcharhinus sorrah</i>	13.4	0.9	57.2				19.8	1.6	76.0	54.7	209.3	197.3					630.1
<i>Chiloscyllium hasseltii</i>	37.5	76.7	54.0	132.2	107.1	80.1	114.5	86.8	43.1	71.4	28.5	27.9					859.6
<i>Chiloscyllium indicum</i>					0.9				0.3								1.2
<i>Chiloscyllium punctatum</i>	36.2	89.4	127.8	138.1	65.3	88.6	170.2	124.6	63.9	53.0	40.9	37.3					1,035.0
<i>Stegostoma fasciatum</i>							16.5										16.5
<b>Total Weight Sharks</b>	<b>93.1</b>	<b>170.1</b>	<b>242.9</b>	<b>276.9</b>	<b>174.1</b>	<b>172.6</b>	<b>328.0</b>	<b>213.8</b>	<b>186.5</b>	<b>183.1</b>	<b>280.5</b>	<b>266.9</b>					<b>2,588.3</b>
<b>Grand Total</b>	<b>577.3</b>	<b>921.0</b>	<b>739.6</b>	<b>1,197.4</b>	<b>1,047.5</b>	<b>771.9</b>	<b>1,056.8</b>	<b>696.6</b>	<b>566.7</b>	<b>1,510.6</b>	<b>903.8</b>	<b>1,667.0</b>					<b>11,656.0</b>

### 2.2.6 Size Range of Sharks and Rays

In general from August 2015 to January 2016, both mature and immature rays species were sampled. Most rays species were mature except for *Himantura gerrardi*, *H. jenkinsii*, *Rhynchobatus australiae* and *Gymnura poecilura*. The average size of *Himantura gerrardi* ranged between 35.4 - 39.3 cm disc length but no adult sized specimens were available because immediately removed by middlemen upon being landed. First maturing size for *Himantura gerrardi* is about 59.0 cm and for *Gymnura poecilura* about 45.0 cm disc length. However, almost all of *Dasyatis zugei*, *Neotrygon kuhlii*, *Dasyatis fluviatorum* and *Rhinobatos* cf. *borneensis* were mature. Most shark species landed were mature except for *Carcharhinus sorrah*. First maturing size for *Carcharhinus sorrah* is 90 cm total length. Size range of all sharks and rays species from August to December 2015 are shown in **Table 17A (i)** and **17A (ii)**.

Most of rays species landed from January to July 2016 were mature except for *Himantura gerrardi*, *Gymnura poecilura*, *Rhynchobatus australiae* and *Carcharhinus sorrah*. Similar to the August to December 2015 study duration, almost all of these species were juvenile. Others species such as *Dasyatis zugei*, *Dasyatis fluviatorum*, *Neotrygon kuhlii*, *Himantura walga* and *Rhinobatos* cf. *borneensis* were matured. Most shark species were mature except for *Carcharhinus sorrah*. Size range of all sharks and rays species from January to July 2016 are shown in **Table 17B (i)** and **17B (ii)**.

**Table 17A (i): Size Range of Rays (Disc Length) Except for *Rhynchobatus australiae* (Total Length) from August 2015 to January 2016.  
All Measurements in cm.**

Species	Year/Month														
	2015						2016								
	Aug		Sep		Oct		Nov		Dec		Jan				
Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	
<i>Dasyatis fluviorum</i>	24.0	73.0	51.4	58.0	58.0	61.0	61.0	61.0	30.0	32.0	31.0	37.0	67.0	45.0	45.0
<i>Dasyatis zugei</i>	11.0	29.5	22.3	14.5	30.0	22.4	16.0	31.5	16.5	31.0	22.6	16.0	29.0	16.0	23.1
<i>Gymnura poecitura</i>	32.0	32.0	32.0	30.0	32.0	31.3	11.5	23.0	23.0	41.0	32.0	19.0	27.0		
<i>Himantura gerrardi</i>	15.0	79.0	37.7	15.0	90.0	38.5	16.0	74.0	16.0	114.0	38.5	17.0	89.0	19.0	38.6
<i>Himantura jenkinsii</i>							48.0		48.0	48.0	48.0				
<i>Himantura walga</i>	16.0	23.0	19.9	16.0	24.0	20.3	15.0	25.0	11.0	26.0	19.6	14.0	30.0	14.0	19.8
<i>Neotrygon kuhlii</i>	12.0	29.0	21.2	13.0	30.0	22.1	15.0	30.0	14.0	31.0	21.9	12.0	30.0	13.0	22
<i>Rhynchobatus australiae</i>							48		48	48	48	64	114		

**Table 17A (ii): Size Range of Rays (Disc Length) Except for *Rhinobatos cf. borneensis* and *Rhynchobatus australiae* (Total Length) from February to July 2016. All Measurements in cm.**

Species	Year/Month																	
	2016																	
	Feb			Mar			Apr			May			Jun			July		
Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	
<i>Rays</i>																		
<i>Dasyatis zugei</i>	19.0	31.0	23.8	19.0	34.0	26.9	15.0	31.0	22.8	15.0	28.0	21.3	17.0	29.0	22.4	15.0	29.0	22.4
<i>Gymnura poecilura</i>				28.0	29.0	28.5	18.0	22.0	20.0	28.0	36.0	32.0	23.0	24.0	23.5	35.0	35.0	35.0
<i>Himantura fai</i>																110.0	135.0	123.0
<i>Himantura gerrardi</i>	16.0	67.0	33.8	14.0	104.0	34.6	17.0	78.0	37.1	17.0	102.0	37.1	19.0	72.0	44.3	17.0	84.0	49.0
<i>Himantura pastinacoides</i>				44.0	61.5	53.5	42.0	42.0	42.0	32.0	72.0	50.0	30.0	73.0	48.1	38.0	70.0	58.5
<i>Himantura uarnacoides</i>				45.0	89.0	67.0												
<i>Himantura uarnak</i>				138.0	138.0	138.0										87.0	87.0	87.0
<i>Himantura walga</i>	16.5	24.0	20.9	15.0	25.0	19.7	16.0	24.0	19.8	14.5	23.0	19.3	15.0	23.0	19.1	14.0	24.5	19.4
<i>Neotrygon kuhlii</i>	16.0	32.0	22.1	16.0	29.5	22.5	17.0	29.0	22.3	16.0	26.0	21.4	16.0	31.5	21.6	15.0	28.0	20.7
<i>Rhinobatos cf. borneensis</i>	60.0	62.5	61.3															
<i>Rhynchobatus australiae</i>	43.0	71.0	57.0	174.0	174.0	174.0												
<i>Taeniurops meyeri</i>																117.0	117.0	117.0

**Table 17B (i): Size Range of Sharks (Total Length) from August 2015 to January 2016. All Measurements in cm.**

Species	Year/Month																	
	2015						2016											
	Aug		Sep		Oct		Nov		Dec		Jan							
Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av				
<i>Sharks</i>																		
<i>Atelomycterus marmoratus</i>	37.0	54.0	46.1	43.0	53.0	45.9	32.0	54.0	45.1	40.0	55.0	48.3	38.0	41.0	39.7	35.0	55.0	45.0
<i>Carcharhinus sorrah</i>	43.0	87.0	65.1	45.0	45.0	45.0	88.0	148.0	113.3									
<i>Chiloscyllium hasseltii</i>	27.0	78.0	49.6	25.0	73.0	54.7	26.0	83.0	52.6	38.0	89.0	58.9	36.0	77.0	58.5	34.0	78.0	56.6
<i>Chiloscyllium indicum</i>													45.0	46.0	45.5			
<i>Chiloscyllium punctatum</i>	27.0	84.0	63.9	45.0	93.0	69.3	47.0	89.0	69.6	44.0	89.0	66.3	43.0	79.0	62.0	44.0	84.0	66.7

**Table 17B (ii): Size Range of Sharks (Total Length) from February to July 2016. All Measurements in cm.**

Species	Year/Month																				
	2016																				
	Feb		Mar		Apr		May		Jun		Jul		Aug								
Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av							
<i>Sharks</i>																					
<i>Atelomycterus marmoratus</i>	35.0	55.0	45.0	40.0	67.0	50.3	52.0	53.0	52.5	38.0	59.0	48.8	41.0	52.0	45.5	35.0	51.0	45.7	34.0	60.0	44.5
<i>Carcharhinus sorrah</i>				150.0	150.0	150.0	50.0	53.0	51.5	50.0	139.0	64.8	58.0	84.0	69.2	58.0	98.0	74.0	63.0	97.0	77.6
<i>Chiloscyllium hasseltii</i>	34.0	78.0	56.6	42.0	83.0	61.5	43.0	81.0	64.0	44.0	81.0	63.7	49.0	80.0	61.8	35.0	81.0	60.3	37.0	76.0	54.5
<i>Chiloscyllium indicum</i>							45.0	50.5	47.5												
<i>Chiloscyllium punctatum</i>	44.0	84.0	66.7	40.0	88.0	65.1	49.0	89.0	72.2	56.0	83.5	70.3	52.0	85.0	69.8	49.0	93.0	70.2	41.0	88.0	64.5
<i>Stegostoma fasciatum</i>				163.0	163.0	163.0															



### 2.2.7 Usage and Marketing

Information on marketing collected at this landing site indicated that most sharks and rays were consumed locally and some were exported to Singapore. The major markets were wholesale market in Kuala Lumpur, and other major towns in Perak such as Taiping, Sitiawan and Ipoh. Skins of some rays species was exported to Thailand. The price (RM/kg) varied according to species, size and season. The most expensive ray species such as *Himantura gerrardi* was sold at RM6 - RM18 followed by *Neotrygon kuhlii* (RM1 - RM13) and *Rhynchobatus australiae* at RM4 - RM10. The lowest price of rays species were *Dasyatis zugei* sold at (RM1 - RM5) and *Rhinobatos cf. borneensis* at RM3 - RM5. Ray's skin is processed before being sent to Thailand. Transport agent has been assigned to manage the ray's skin to be sent to Thailand's Border for processing in Thailand.

In general, bigger sized rays and sharks were more expensive than smaller ones. Small size sharks such as *Chiloscyllium* spp with total length of less than 20 cm were sold locally at RM1-1.5/kg for local delicacies such as fish ball and Indian curry. *Carcharhinus sorrah* was sold at RM5 - RM9 and *Stegostoma fasciatum* at RM8 - RM9. Other sharks species such as *Chiloscyllium hasselti*, *C. indicum* and *C. punctatum* were sold at RM1-RM4. Market destinations for sharks and rays were similar.

The price was almost consistent for the whole year for all species but sometimes fluctuate up to 50% when supply was limited and during festive seasons such as Chinese New Year and Hari Raya; especially for *Himantura gerarrdi*, *H. pastinacoides*, *H. walga*, *Dasyatis zugei*, *Gymnura poecilura*, *Neotrygon kuhlii*, *Rhynchobatus australiae* and *Carcharhinus sorrah*. All sharks and rays were landed whole with fins. The details are shown in Table 18. Small, medium and big size category for each species is as shown in Appendix IV.

**Table 18: Price of Sharks and Rays by Species and Market Destination at Manjung Utara. All Prices in RM per Kilogram. (Exchange rate: RM3.70= US\$ 1.00)**

	Range Price RM/kg	Parts	Market Destination
Rays			
<i>Dasyatis fluviorum</i>	5-12	Whole body	Local (Manjung, Ipoh, Sitiawan, Taiping), Singapore
<i>Dasyatis zugei</i>	1-5	Whole body	Local (Manjung, Ipoh, Taiping), Kuala Lumpur, Singapore
<i>Gymnura poecilura</i>	1-9	Whole body	Local (Manjung, Ipoh, Taiping), Kuala Lumpur, Singapore
<i>Himantura fai</i>	8-13	Whole body, skin	Local (Manjung, Taiping), Kuala Lumpur; Skin export to Thailand
<i>Himantura gerrardi</i>	6-18	Whole body, skin	Local (Manjung, Ipoh, Taiping), Kuala Lumpur, Singapore; Skin export to Thailand
<i>Himantura jenkinsii</i>	8-10	Whole body	Local (Manjung), Singapore; Skin export to Thailand
<i>Himantura pastinacoides</i>	5-15	Whole body, skin	Local (Manjung, Taiping), Kuala Lumpur; Skin export to Thailand
<i>Himantura uarnacoides</i>	5-6	Whole body, skin	Local (Manjung); Skin export to Thailand
<i>Himantura uarnak</i>	5-15	Whole body, skin	Local (Manjung); Skin export to Thailand
<i>Himantura walga</i>	1-5	Whole body	Local (Manjung, Ipoh, Taiping), Kuala Lumpur, Singapore

	Range Price RM/kg	Parts	Market Destination
<i>Neotrygon kuhlii</i>	1-13	Whole body	Local (Manjung, Taiping, Ipoh), Kuala Lumpur, Singapore
<i>Rhinobatos cf. borneensis</i>	3-5	Whole body	Local (Manjung)
<i>Rhynchobatus australiae</i>	4-10	Whole body, fins	Local (Manjung, Ipoh, Taiping)
<i>Taeniurops meyeri</i>	8-15	Whole body	Local (Manjung, Taiping), Kuala Lumpur
<b>Sharks</b>			
<i>Atelomycterus marmoratus</i>	1-2	Whole body	Local (Manjung, Ipoh, Taiping), Kuala Lumpur
<i>Carcharhinus sorrah</i>	5-9	Whole body, fins	Local (Manjung, Taiping), Kuala Lumpur
<i>Chiloscyllium hasseltii</i>	1-4	Whole body	Local (Manjung, Taiping), Kuala Lumpur
<i>Chiloscyllium indicum</i>	2-3	Whole body	Local (Manjung)
<i>Chiloscyllium punctatum</i>	1-4	Whole body	Local (Manjung, Ipoh, Taiping), Kuala Lumpur
<i>Stegostoma fasciatum</i>	8-9	Whole body	Local (Manjung)

### 2.2.8 Fishing Effort and CPUE (Catch per Unit Effort)

Monthly fishing efforts (days at operation and total number of operation during the cruise) of the sampled vessels are summarized in Table 19 and Table 20.

**Table 19: Days at Operation by Gear Sampled during the study period in Perak (Larut Matang and Manjung Utara)**

Type Gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Drift Net	5	3	3	5	4	1	2	11	10	8	9	12	73
Handline		2		1	2	1	2				2		10
Longline	7	6	13	9	8	8	8	7	15	8	9	7	105
Purse Seine C2		2											2
Trawl Net B	8	11	16	17	8	10	9	6	13	9	5	5	117
Trawl Net C	167	170	190	178	191	196	192	181	149	168	168	166	2,116
Trawl Net C2	20	6	6	13	12		11			6	12	6	92

**Table 20: Total Number of Operation by Gear Sampled during the study period in Perak (Larut Matang and Manjung Utara)**

Type Gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Drift Net	29	24	27	48	40	13	26	124	70	85	53	94	633
Handline		22		5	13	5	12				14		71
Longline	35	35	54	50	52	62	27	23	37	31	47	26	479
Purse Seine C2		6											6
Trawl Net B	93	77	94	69	57	73	57	50	56	27	39	35	727
Trawl Net C	404	399	431	412	425	483	388	435	338	423	417	412	4,967
Trawl Net C2	60	18	18	24	36		33			18	36	18	261

**Table 21** shows the top 10 catch per unit effort (CPUE) rays species captured by trawl net Zone C, combined for Larut Matang and Manjung Utara. *Himantura gerrardi* topped the list with, 3.43 kg/days or 1.46 kg/hauls followed by *Neotrygon kuhlii* at 0.74 kg/days or 0.32 kg/hauls and *Himantura fai* at 0.38kg/days or 0.16 kg/hauls.

The top three catch per unit effort (CPUE) for sharks were *Chiloscyllium punctatum* on the top, followed by *Chiloscyllium hasseltii* and *Carcharhinus sorrah*. In terms of CPUE (kg/days), *Chiloscyllium punctatum* recorded 1.00, *C. hasseltii* at 0.89 and *Carcharhinus sorrah* at 0.41. The top 10 CPUE of rays and sharks species captured by trawl net Zone C are shown in **Table 21** and **Table 22**.

**Table 21: Top 10 CPUE Rays Species Captured by Trawl Net C during the study period in Perak (Larut Matang and Manjung Utara) (kg/Fishing Effort)**

	Scientific Name	Total weight (kg) by Species	CPUE (kg/day)	CPUE (kg/haul)
1	<i>Himantura gerrardi</i>	7,253.1	3.43	1.46
2	<i>Neotrygon kuhlii</i>	1,565.7	0.74	0.32
3	<i>Himantura fai</i>	795.9	0.38	0.16
4	<i>Himantura pastinacoides</i>	777.8	0.37	0.16
5	<i>Dasyatis zugei</i>	555.9	0.26	0.11
6	<i>Himantura walga</i>	555.9	0.26	0.11
7	<i>Rhynchobatus australiae</i>	450.1	0.21	0.09
8	<i>Dasyatis akajei</i>	328.7	0.16	0.07
9	<i>Himantura jenkinsii</i>	285.2	0.13	0.06
10	<i>Himantura uarnak</i>	211.6	0.10	0.04

**Table 22: Top 10 CPUE Sharks Species Captured by Trawl Net C during the study period in Perak (Larut Matang and Manjung Utara) (kg/Fishing Effort)**

	Scientific Name	Total weight (kg) by Species	CPUE (kg/day)	CPUE (kg/haul)
1	<i>Chiloscyllium punctatum</i>	2,122.4	1.00	0.43
2	<i>Chiloscyllium hasseltii</i>	1,891.2	0.89	0.38
3	<i>Carcharhinus sorrah</i>	867.1	0.41	0.17
4	<i>Atelomycterus marmoratus</i>	254.6	0.12	0.05
5	<i>Atelomycterus cf. erdmanni</i>	58.9	0.03	0.01
6	<i>Carcharhinus leucas</i>	38.0	0.02	0.01
7	<i>Galeocerdo cuvier</i>	32.7	0.02	0.01
8	<i>Carcharhinus brevipinna</i>	26.8	0.01	0.01
9	<i>Stegostoma fasciatum</i>	16.5	0.01	0.00
10	<i>Atelomycterus cf. baliensis</i>	10.7	0.01	0.00

## 2.3 Kota Kinabalu

### 2.3.1 Landing Samples

A total of 274 landings were sampled during the study period with average of 23 samples a month. The samples were catches from trawl nets, that operated mainly in Zone 3 with 137 vessels, followed by 113 vessels in Zone 4 and only 13 and 11 vessels in Zone 5 and Zone 2 respectively. The details are shown in **Table 23**.

**Table 23: Number of Landings by Gear Sampled During Study at Kota Kinabalu (SAFMA Jetty)**

Type of Gear	Year/Month												Grand Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Trawl Net Zone 2	1	2			3					2	1	2	11
Trawl Net Zone 3	16	10	13	13	10	9	10	10	11	11	12	12	137
Trawl Net Zone 4	6	8	7	10	7	10	12	14	11	11	9	8	113
Trawl Net Zone 5	1				3	4	1		2		2		13
<b>TOTAL</b>	<b>24</b>	<b>20</b>	<b>20</b>	<b>23</b>	<b>23</b>	<b>23</b>	<b>23</b>	<b>24</b>	<b>24</b>	<b>24</b>	<b>24</b>	<b>22</b>	<b>274</b>

### 2.3.2 Fishing Ground and Catch Composition by Gear Type

The total catch of trawl nets that sampled were 11,730 kg comprising 7,243 kg of rays (62%) and 4487 kg of sharks, which is only 38% of the combined catches. All trawlers operated beyond three nm (nautical miles) from coastline, and mainly between 12 - 30 nm from the coastline. Only vessels in Zone 5 operates beyond 30 nm from the coastline. A total of 3,398 kg of rays was landed by Zone 3 trawl nets followed by Zone 4 trawl nets at 3,388 kg. As for sharks, Zone 3 trawl nets also landed the highest catch, with 2,235 kg followed by Zone 4 trawl nets at 1,841 kg. The highest landing of rays by month was from Zone 3 trawl nets at 611 kg in August 2015 while 484 kg and 440 kg were both from Zone 4 in August 2015 and January 2016 respectively. For sharks, the highest and second highest landing by month came from Zone 3 trawl nets at 396 kg and 307 kg in August and October 2015 respectively and followed by Zone 4 trawl nets at 304 kg in January 2016. The details are shown in **Table 24**.

**Table 24: Weight of Sharks and Rays (in Kg) Caught by Different Types of Gear at Kota Kinabalu (SAFMA Jetty)**

Type of Gear	Year /Month												
	2015						2016						
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Grand Total
<b>Ray</b>													
Trawl Net Zone 2	5.5	8.6			95.4					17.4	34.6	19.9	181.4
Trawl Net Zone 3	610.7	117.1	188.2	277.5	275.7	293.3	203.5	258.4	296.7	191.0	418.3	268.0	3,398.3
Trawl Net Zone 4	484.4	176.7	80.6	356.6	139.8	439.7	399.8	397.7	206.3	300.9	237.6	169.0	3,388.8
Trawl Net Zone 5	56.1				43.8	71.1	24.9		55.0		23.4		274.2
<b>Total Ray</b>	<b>1156.7</b>	<b>302.4</b>	<b>268.8</b>	<b>634.1</b>	<b>554.7</b>	<b>804.0</b>	<b>628.1</b>	<b>656.1</b>	<b>557.9</b>	<b>509.2</b>	<b>713.9</b>	<b>456.9</b>	<b>7,242.7</b>
<b>Shark</b>													
Trawl Net Zone 2	20.4	37.8			40.4					37.0	1.0	49.8	186.4
Trawl Net Zone 3	395.7	161.5	307.1	228.9	244.3	151.7	121.5	128.8	114.4	127.5	128.7	125.3	2,235.3
Trawl Net Zone 4	67.6	151.6	102.6	133.6	100.6	304.1	185.4	233.0	110.9	94.4	145.3	212.3	1,841.3
Trawl Net Zone 5	22.4				56.5	80.3	6.2		38.8		20.1		224.2
<b>Total Shark</b>	<b>506.1</b>	<b>350.9</b>	<b>409.7</b>	<b>362.5</b>	<b>441.8</b>	<b>536.2</b>	<b>313.1</b>	<b>361.7</b>	<b>264.1</b>	<b>258.9</b>	<b>295.1</b>	<b>387.3</b>	<b>4,487.2</b>
<b>Grand Total</b>	<b>1,662.8</b>	<b>653.3</b>	<b>678.5</b>	<b>996.6</b>	<b>996.5</b>	<b>1,340.2</b>	<b>941.2</b>	<b>1,017.8</b>	<b>822.0</b>	<b>768.1</b>	<b>1,009.0</b>	<b>844.2</b>	<b>11,729.9</b>



### 2.3.3 Sharks and Rays Composition

A total of 1,856,510 kg of fish was landed from 274 landings during the study period. Rays and sharks made up 7,243 kg and 4,487 kg (0.4% and 0.2%) from the total landing respectively. Landings of bony fish was 1,844,779.90 kg or 99.4%. Average landings per month for sharks and rays were 374 kg and 604 kg respectively. The highest landing by month for rays was 1,157 kg in August 2015, followed by 804 kg in January and 714 kg in June 2016. The highest landing for sharks was 536 kg in January 2016, followed by 506 kg in August and 442 kg in December 2015. In general, the landing of sharks and rays ranged between 0.2 - 0.3% and 0.2 - 0.7% respectively from total landing. The details are shown in Table 25.

**Table 25: Catch Composition of Sharks, Rays and Bony Fish by Month from 274 Landings at Kota Kinabalu (SAFMA Jetty). All Weight in Kilogram.**

Year	Month	Weight of Ray	% Ray	Weight of Shark	% Shark	Weight of Bony Fish	% Bony Fish	Total Catch
2015	Aug	1,156.7	0.7	506.1	0.3	161,280.0	99.0	162,942.8
	Sept	302.4	0.2	350.9	0.2	155,500.0	99.6	156,153.3
	Oct	268.8	0.2	409.7	0.3	141,200.0	99.5	141,878.5
	Nov	634.1	0.4	362.5	0.2	158,100.0	99.4	159,096.6
	Dec	554.7	0.3	441.8	0.2	180,800.0	99.5	181,796.5
2016	Jan	804.0	0.4	536.2	0.3	189,800.0	99.3	191,140.2
	Feb	628.1	0.4	313.1	0.2	160,700.0	99.4	161,641.2
	Mar	656.1	0.5	361.7	0.3	134,173.0	99.2	135,190.8
	Apr	557.9	0.4	264.1	0.2	138,500.0	99.4	139,322.0
	May	509.2	0.4	258.9	0.2	132,547.9	99.4	133,316.0
	Jun	713.9	0.5	295.1	0.2	155,527.0	99.3	156,536.0
	Jul	456.9	0.3	387.3	0.3	136,652.0	99.4	137,496.2
<b>Total</b>		<b>7,242.7</b>		<b>4,487.2</b>		<b>1,844,779.9</b>		<b>1,856,509.8</b>
<b>Ave</b>		<b>603.6</b>	<b>0.4</b>	<b>373.9</b>	<b>0.2</b>	<b>153,731.7</b>	<b>99.4</b>	<b>154,709.2</b>

### 2.3.4 Sample Size

A total of 4,771 tails belonging to 2,546 rays and 2,225 sharks were sampled during the study period comprising 20 species of rays and 17 species of sharks. The most common and abundant rays species were *Neotrygon kuhlii* followed by *Himantura gerrardi* and *Dasyatis zugei*. All these species were landed throughout the year. Other common rays species were *Rhinobatos borneensis*, *Gymnura poecilura*, *Rhynchobatus australiae*, and *Pastinachus gracilicaudus*. These species were recorded between 8 - 11 months. *Dasyatis parvonigra* and *Himantura jenkinsii* were recorded in six (6) and four (4) months respectively. Other species such as *Gymnura japonica*, *H. uarnak*, *Aetomylaeus vespertilio*, *Himantura fai*, *H. leoparda*, *H. uarnacoides*, *Mobula japanica*, *Rhinoptera jayakari*, *Taeniura lymma* and *Taeniurops meyeri*, were only landed between 1 - 5 months. The highest number of rays sampled by month was 331 tails in January 2016 followed by 318 tails in November and 272 tails in December 2015.

The most common and abundant sharks species were *Chiloscyllium punctatum* and *C. plagiosum*. All these species were landed throughout the year. Other common sharks species were *Carcharhinus sorrah*, *Atelomycterus marmoratus*, *Sphyrna lewini* and *Hemipristis elongata*. All these species were landed between 10-12 months. Other species such as

*Hemigaleus microstoma*, *Heterodontus zebra* and *Mustelus manazo* were landed in four months; *Alopias pelagicus* and *Loxodon macrohinus* in three (3) months, while *Carcharhinus brevipinna*, *Carcharhinus sealei*, *Halaelurus buergeri*, *Orectolobus leptolineatus*, *Squatina tergocellatoides* and *Stegostoma fasciatum* were only landed between 1 - 2 months. The highest number of sharks sampled by month was 257 tails in January 2016, followed by 253 tails in September and 249 tails in December 2015. The details are as shown in Table 26.

**Table 26: Sample Size of Sharks and Rays by Species at Kota Kinabalu (SAFMA Jetty)**

Species	Year/Month												Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<i>Aetobatus ocellatus</i>	2					1		1			1		5
<i>Aetomylaeus vespertilio</i>		1											1
<i>Dasyatis parvonigra</i>				17	14	2	2			4		8	47
<i>Dasyatis zugei</i>	24	13	26	47	79	91	15	23	60	60	39	69	546
<i>Gymnura japonica</i>	1	1		5				1		5			13
<i>Gymnura poecilura</i>	4	3	2	6	1	1	4		8	23	3	8	63
<i>Himantura fai</i>	2												2
<i>Himantura gerrardi</i>	57	44	30	82	47	77	49	43	60	29	16	37	571
<i>Himantura jenkinsii</i>	1			1	3			2					7
<i>Himantura leoparda</i>	3											1	4
<i>Himantura uarnacoides</i>	5												5
<i>Himantura uarnak</i>	1					2				2			5
<i>Mobula japonica</i>	1												1
<i>Neotrygon kuhlii</i>	47	61	50	139	112	128	86	75	81	96	101	55	1,031
<i>Pastinachus gracilicaudus</i>	10		2	2	5	13	2		1		5		40
<i>Rhinobatos borneensis</i>	19	11	19	6	4	13	8	28	8	8		2	126
<i>Rhinoptera jayakari</i>	5						2						7
<i>Rhynchobatus australiae</i>		5	3	13	7	3	6	1	6	1	7	15	67
<i>Taeniura lymma</i>		1	3										4
<i>Taeniurops meyeri</i>		1											1
<b>Total Rays</b>	<b>182</b>	<b>141</b>	<b>135</b>	<b>318</b>	<b>272</b>	<b>331</b>	<b>174</b>	<b>174</b>	<b>224</b>	<b>228</b>	<b>172</b>	<b>195</b>	<b>2,546</b>
<i>Alopias pelagicus</i>	1					4		2					7
<i>Atelomycterus marmoratus</i>	9	22	29	22	29	28	10	5		9	24	15	202
<i>Carcharhinus brevipinna</i>	2	8											10
<i>Carcharhinus sealei</i>	2												2
<i>Carcharhinus sorrah</i>	12	7	7	3	6	3	2	2	9	24	23	23	121
<i>Chiloscyllium plagiosum</i>	82	126	94	71	68	49	32	33	33	45	40	49	722
<i>Chiloscyllium punctatum</i>	79	72	91	84	120	152	94	58	51	63	63	30	957
<i>Halaelurus buergeri</i>	1				1								2
<i>Hemigaleus microstoma</i>	1					2				1		2	6
<i>Hemipristis elongata</i>	2	1	3	2	8	8	1	4	3	3			35
<i>Heterodontus zebra</i>	2	2	3	1									8
<i>Loxodon macrohinus</i>		7		11						6			24
<i>Mustelus manazo</i>					5	6		1		2			14
<i>Orectolobus leptolineatus</i>		1											1
<i>Sphyrna lewini</i>	8	7	5	18	12	5	7		11	10	14	15	112
<i>Squatina tergocellatoides</i>	1												1
<i>Stegostoma fasciatum</i>												1	1
<b>Total Sharks</b>	<b>202</b>	<b>253</b>	<b>232</b>	<b>212</b>	<b>249</b>	<b>257</b>	<b>146</b>	<b>105</b>	<b>107</b>	<b>163</b>	<b>164</b>	<b>135</b>	<b>2,225</b>
<b>Grand Total</b>	<b>384</b>	<b>394</b>	<b>367</b>	<b>530</b>	<b>521</b>	<b>588</b>	<b>320</b>	<b>279</b>	<b>331</b>	<b>391</b>	<b>336</b>	<b>330</b>	<b>4,771</b>

### 2.3.5 Weight of Sharks and Rays by Species

A total of 11,711 kg was landed from 274 landings comprising 7,224 kg rays and 4,487 kg sharks. For rays, the highest landing by weight was from species *Neotrygon kuhlii* amounting to 2,733 kg, followed by *Himantura gerrardi* 1,717 kg, 952 kg for *Dasyatis zugei* and 465 kg for *Pastinachus gracilicaudus*. The highest landing by month for *Neotrygon kuhlii* was 334 kg in February, followed by 332 kg in June 2016 and 312 kg in November 2015. For

*Himantura gerrardi*, the highest landing was 298 kg in August 2015, followed by 204 kg in June and 195 kg in March 2016. For *Dasyatis zugei*, the highest landing was 166 kg in January followed by 127 kg in May 2016 and 120 kg in December 2015. The highest landing for *Pastinachus gracilicaudus* was in August 2015 (137 kg) followed by 116 kg in January and 62 kg in June 2016. Weigh of others species such as *Rhinoptera jayakari* was 281 kg, *Rhinobatus borneensis* (177kg), *Dasyatis parvonigra* (165 kg), *Gymnura poecilura* (136 kg), *Rhynchobatus australiae* (149 kg) and *Himantura leoparda* (112 kg). Weight of other species was below 100 kg.

The highest landing of shark species were 2,201 kg for *Chiloscyllium punctatum* followed by 1,017 kg for *C. plagiosum*, 469 kg for *Carcharhinus sorrah*, 266 kg for *Sphyrna lewini*, 162 kg for *Alopias pelagicus*, and 147 kg for *Atelomycterus marmoratus*. The highest landing by month for *Chiloscyllium punctatum* was 292 kg in January 2016, followed by 250 kg in December 2015 and March 2016 respectively. For *Chiloscyllium plagiosum*, the highest landing was 197 kg in August followed by 132 kg in October and 127 kg in September 2015. The highest landing for *Carcharhinus sorrah* was 88 kg in June followed by 84 kg in July 2016 and 76 kg in August 2015. The highest landing for *Sphyrna lewini* was in July 2016 (83 kg), *Alopias pelagicus* in January 2016 and for *Atelomycterus marmoratus* in January 2016 (25 kg). Weight of other species was below 50 kg. The details are shown in **Table 27**.



Table 27: Weight of Sharks and Rays (in kg) by Species from Kota Kinabalu (SAFMA Jetty)

Species	Year/Month												Total			
	2015						2016									
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul				
<i>Aetobatus ocellatus</i>	2.20					18.20							24.00			73.90
<i>Aetomylaeus vesperilio</i>		6.90														6.90
<i>Dasyatris parvonigra</i>																
<i>Dasyatris zugei</i>	65.00	25.00	23.60	64.20	50.00	4.53	12.55							12.80		21.35
<i>Gymnura japonica</i>	0.60	0.80		44.80	119.50	166.29	88.75	53.30	75.80	126.55	59.35	104.00		15.20		951.94
<i>Gymnura poecilura</i>	11.70	2.50	3.70	19.90	3.50	5.00	4.30	5.50	21.75	38.15	11.95	13.80				36.50
<i>Himantura fai</i>	80.00															136.25
<i>Himantura gerrardi</i>	298.40	105.90	83.60	112.80	118.90	161.72	108.15	195.35	143.00	62.65	204.40	122.40				80.00
<i>Himantura jenkinsii</i>	10.20			8.60	24.20			15.65								1,717.27
<i>Himantura leoparda</i>	82.30											30.00				58.65
<i>Himantura uarnacooides</i>	34.00															112.30
<i>Himantura uarnak</i>	12.90					3.45					1.60					34.00
<i>Mobula japonica</i>	21.00															17.95
<i>Neotrygon kuhlii</i>	127.20	136.30	108.10	312.10	170.10	302.51	334.25	304.50	252.05	240.00	332.45	113.80				21.00
<i>Pastinachus gracilicaudus</i>	136.90		26.10	22.70	49.50	115.57	26.10		18.50		69.20					2,733.36
<i>Rhinobatos borneensis</i>	28.20	9.10	16.40	6.60	5.50	15.61	8.35	50.45	23.35	11.35		2.00				464.57
<i>Rhinoptera jayakari</i>	246.10						34.50									176.91
<i>Rhynchobatus australiae</i>		11.30	4.90	28.00	13.50	11.15	11.15	1.80	23.45	0.90	12.50	30.60				280.60
<i>Taeniura lymna</i>		1.80	2.40													149.25
<i>Taeniurops meyeri</i>		2.80														4.20
<b>Total Weight Rays</b>	<b>1,156.70</b>	<b>302.40</b>	<b>268.80</b>	<b>634.10</b>	<b>554.70</b>	<b>804.03</b>	<b>628.10</b>	<b>656.05</b>	<b>557.90</b>	<b>509.20</b>	<b>713.85</b>	<b>437.95</b>				<b>7,223.78</b>
<i>Atopias pelagicus</i>	26.00					105.05		30.50								161.55
<i>Atelomycterus marmoratus</i>	6.10	15.80	19.60	17.90	17.40	25.01	5.85	3.50			19.90	10.70				146.71
<i>Carcharhinus brevipinna</i>	4.80	22.60														27.40
<i>Carcharhinus sealiei</i>	2.90															2.90
<i>Carcharhinus sorrah</i>	76.20	25.00	42.00	13.80	37.90	16.47	14.90	19.15	14.70	36.30	88.25	84.45				469.12
<i>Chiloscyllium plagiosum</i>	197.30	126.80	131.60	84.70	76.70	59.15	33.65	52.80	62.65	63.30	46.25	82.25				1,017.15
<i>Chiloscyllium punctatum</i>	170.40	122.20	187.20	172.10	250.40	292.14	245.75	250.40	161.45	135.35	129.20	84.15				2,200.74
<i>Halaelurus buergeri</i>	0.20				0.50											0.70
<i>Hemigaleus microstoma</i>	1.30					3.98				0.35		1.60				7.23
<i>Hemipristis elongata</i>	1.90	1.30	6.00	3.40	11.80	9.14	2.65	3.40	6.70	2.30						48.59

Species	Year/Month												Total	
	2015						2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul		
<i>Heterodontus zebra</i>	3.20	6.60	5.80	3.80										19.40
<i>Loxodon macrorhinus</i>		7.60		16.10						5.35				29.05
<i>Mustelus manazo</i>					19.70	16.62		1.95		2.50				40.77
<i>Orectolobus leptolineatus</i>		7.00												7.00
<i>Sphyrna lewini</i>	13.40	16.00	17.50	50.70	27.40	8.60	10.25		18.55	8.45	11.50	83.15		265.50
<i>Squatina tergocellatoides</i>	2.40													2.40
<i>Stegostoma fasciatum</i>												41.00		41.00
<b>Total Weight Sharks</b>	<b>506.10</b>	<b>350.90</b>	<b>409.70</b>	<b>362.50</b>	<b>441.80</b>	<b>536.16</b>	<b>313.05</b>	<b>361.70</b>	<b>264.05</b>	<b>258.85</b>	<b>295.10</b>	<b>387.30</b>		<b>4,487.21</b>
<b>Grand Total</b>	<b>1,662.80</b>	<b>653.30</b>	<b>678.50</b>	<b>996.60</b>	<b>996.50</b>	<b>1,340.19</b>	<b>941.15</b>	<b>1,017.75</b>	<b>821.95</b>	<b>768.05</b>	<b>1,008.95</b>	<b>825.25</b>		<b>11,710.99</b>



### 2.3.6 Size Range of Sharks and Rays

During the first six (6) months of the project, from August 2015 to January 2016, most rays species sampled in general were juvenile, except for some species that matured such as *Dasyatis parvonigra* caught in November and Disember 2015, *Rhinobatos borneensis* (August 2015 to January 2016) and *Taeniura lymma* caught in September 2015. Size range of all rays species from August 2015 to January 2016 are shown in **Table 28A (i)** from February to July 2016, some rays species were mature such as *Dasyatis parvonigra* that caught in February, *Dasyatis zugei* and *Rhinobatos borneensis* almost throughout the period. Size range of all rays species sampled from February to July 2016 in **Table 28A (ii)**.

As for sharks, some species sampled from August 2015 to January 2016 were mature such as *Atelomycterus marmoratus*, *Chiloscyllium plagiosum* and *C. punctatum*. *Halaelurus buergeri* sampled in August 2015 and January 2016, and *Hemigaleus microstoma* in August 2015 were also mature. Other species such as *Heterodontus zebra*, *Laxodon macrorhinus*, *Mustelus manazo* and *Orectolobus leptolineatus* were also mature. Size range of all sharks species sampled from August 2015 to January 2016 are shown in **Table 28B (i)**. During the second phase from February to July 2016, *Atelomycterus marmoratus*, *Chiloscyllium plagiosum* and *C. punctatum* were mature in the whole period. Other species were at juvernile stage or young. Size range of all sharks species sampled from February to July 2016 are shown in **Table 28B (ii)**.

**Table 28A (i): Size Range of Rays (Disc Length) Except for *Rhinobatus borneensis* and *Rhynchobatus australiae* (Total Length) for Six Months from August 2015 to January 2016. All Measurements in cm.**

Species	Year/Month													
	2015						2016							
	Aug		Sep		Oct		Nov		Dec		Jan			
Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av
<i>Rays</i>														
<i>Aetobatus ocellatus</i>	32.0	73.0	52.5									65.2		65.2
<i>Aetomylaeus vesperitilio</i>				47.5	47.5	47.5								
<i>Dasyatris parvonigra</i>														
<i>Dasyatris zugei</i>	19.0	30.0	25.2	20.0	30.0	27.1	20.0	31.0	26.4	19.0	23.0	29.0	58.0	38.07
<i>Gymnura japonica</i>	19.5	19.5	19.5	23.0	23.0	23.0				19.0	21.0	15.0	32.0	24.94
<i>Gymnura poecilura</i>	29.0	39.0	35.0	21.0	22.0	21.3	24.0	34.0	29.0	25.0	41.0	36.3	38.0	38.00
<i>Himantura fai</i>	99.0	104.0	101.5											
<i>Himantura gerrardi</i>	22.5	76.0	44.5	18.0	52.0	33.6	20.0	70.0	34.3	18.0	62.0	25.5	73.0	28.19
<i>Himantura jenkinsii</i>	58.0	58.0	58.0							57.0	57.0	49.0	57.0	52.67
<i>Himantura leoparda</i>	81.0	92.0	87.0											
<i>Himantura uarnacoides</i>	50.0	62.0	55.3											
<i>Himantura uarnak</i>	68.0	68.0	68.0											
<i>Mobula japonica</i>	77.0	77.0	77.0											
<i>Neotrygon tahiti</i>	19.0	32.0	24.3	11.0	31.5	24.1	16.0	33.0	21.8	13.0	33.0	21.2	14.0	22.67
<i>Pastinachus gracilicaudus</i>	51.0	80.0	59.2				59.0	62.0	60.5	56.0	58.0	57.0	48.0	53.60
<i>Rhinobatus borneensis</i>	63.0	86.0	76.8	51.0	81.0	67.2	48.0	88.0	65.8	59.0	78.0	72.2	63.0	74.00
<i>Rhinoptera jayakari</i>	37.5	60.0	49.1											
<i>Rhynchobatus australiae</i>				47.5	80.0	68.9	62.0	81.5	68.5	56.0	100.0	76.4	50.0	73.79
<i>Taeniura lymna</i>				34.0	34.0	34.0	25.0	27.5	25.8					
<i>Taeniurops meyeri</i>				41.0	41.0	41.0								

**Table 28A (ii): Size Range of Rays (Disc Length) Except for *Rhinobatos borneensis* and *Rhynchobatus australiae* (Total Length) for Six Months from February to July 2016. All Measurements in cm.**

Species	Year/Month																	
	2016																	
	Feb			Mar			Apr			May			Jun			Jul		
Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	
<b>Rays</b>																		
<i>Aetobatus ocellatus</i>				83.3	83.3	83.3									71.3	71.3	71.3	
<i>Dasyatis parvonnigra</i>	49.5	51.2	50.4				20.1	31.3	24.4	19.2	31.2	23.9	30.2	46.3	38.3			
<i>Dasyatis zugei</i>	17.2	34.2	23.8	43.3	43.3	43.3							24.5	40.4	35.6			
<i>Gymnura japonica</i>	20.3	33.3	25.3				22.5	42.3	33.1	16.2	41.0	28.0	32.3	45.3	38.3	22.2	40.2	29.4
<i>Himantura fai</i>																		
<i>Himantura gerrardi</i>	17.20	67.50	28.4	18.0	58.3	31.4	18.2	62.5	31.1	19.2	69.2	30.9	25.3	61.3	47.0	18.0	67.3	28.4
<i>Himantura jenkinsii</i>				44.5	62.3	53.4												
<i>Himantura leoparda</i>																95.0	95.0	95.0
<i>Himantura uarnak</i>										27.0	27.2	27.1						
<i>Neotrygon tukihii</i>	16.0	32.2	23.3	16.1	31.3	21.7	15.5	33.2	21.6	15.5	30.2	21.6	15.0	30.3	22.6	14.0	26.3	20.1
<i>Pastinachus gracilicaudus</i>	53.3	68.3	60.8				71.3	71.3	71.3				43.2	70.3	58.1			
<i>Rhinobatos borneensis</i>	44.1	85.3	68.0	51.3	88.3	73.3	65.5	89.3	78.6	55.5	92.5	75.7				67.2	71.3	69.3
<i>Rhinoptera jayakari</i>	64.3	64.5	64.4															
<i>Rhynchobatus australiae</i>	59.4	85.2	72.4	74.2	74.2	74.2	67.5	107.3	90.5	60.20	60.2	60.2	51.2	95.4	70.1	57.3	125.3	72.7

**Table 28B (i): Size Range of Sharks (Total Length) for Six Months from August 2015 to January 2016. All Measurements in cm.**

Species	Year/Month																	
	2015									2016								
	Aug			Sep			Oct			Nov			Dec			Jan		
Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	
<b>Sharks</b>																		
<i>Alopias pelagicus</i>	122.0	122.0	122.0															
<i>Atelomyxterus marmoratus</i>	52.0	63.0	59.1	49.0	69.0	59.7	48.0	71.0	60.3	53.0	84.0	62.9	43.0	69.0	57.3	164.3	327.0	208.9
<i>Carcharhinus brevipinna</i>	70.0	81.0	75.5	77.0	86.0	81.8												
<i>Carcharhinus sealei</i>	55.0	79.0	67.0															
<i>Carcharhinus sorrah</i>	74.5	149.0	93.6	71.5	116.0	86.2	89.0	123.0	101.4	96.0	99.5	97.2	92.0	120.0	103.5	98.2	102.0	100.1
<i>Chiloscyllium plagiosum</i>	25.0	82.0	68.5	48.0	80.5	67.6	49.0	96.0	68.4	51.0	84.0	69.3	46.0	84.0	69.0	42.1	79.3	64.3
<i>Chiloscyllium punctatum</i>	56.0	94.0	74.0	37.0	92.0	73.3	49.0	94.0	73.2	49.0	100.0	74.9	44.0	96.0	73.8	36.2	94.1	74.1
<i>Halaelurus buergeri</i>	38.5	38.5	38.5										48.0	48.0	48.0			
<i>Hemigaleus microstoma</i>	72.5	72.5	72.5													75.4	88.2	81.8
<i>Hemipristis elongata</i>	57.0	73.0	65.0	58.0	58.0	58.0	59.0	93.0	74.0	69.0	82.0	75.5	47.0	98.0	71.6	43.3	84.0	62.9
<i>Heterodontus zebra</i>	54.5	73.0	63.8	66.0	80.0	73.0	55.0	75.5	63.8	76.0	76.0	76.0						
<i>Loxodon macrorhinus</i>				59.0	85.0	69.4				58.0	88.0	75.3						
<i>Mustelus manazo</i>													97.0	107.0	100.8	78.2	107.0	92.9
<i>Orectolobus leptolineatus</i>				95.0	95.0	95.0												
<i>Sphyrna lewini</i>	47.0	76.0	67.9	71.0	84.0	77.6	51.0	133.0	75.6	44.0	93.0	66.5	56.0	93.0	69.7	47.2	101.0	74.9
<i>Squatina tergocellatoides</i>	64.2	64.2	64.2															

**Table 28B (ii): Size Range of Sharks (Total Length) for Six Months from February to July 2016. All Measurements in cm.**

Species	Month/Year																	
	2016																	
	Feb			Mar			Apr			Mar			Jun			Jul		
Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	
<b>Sharks</b>																		
<i>Alopias pelagicus</i>				194.3	199.3	196.8												
<i>Atelomycterus marmoratus</i>	52.0	63.2	58.8	39.2	66.3	58.5				44.2	65.0	58.0	48.2	69.1	59.6	42.2	74.5	59.9
<i>Carcharhinus sorrah</i>	96.2	104.5	100.4	100.3	122.3	111.3	55.5	71.3	61.5	57.2	128.3	64.1	56.2	132.2	80.6	51.3	124.3	81.3
<i>Chiloscyllium plagiosum</i>	51.4	85.3	70.1	48.5	81.4	68.0	54.5	83.3	70.0	50.3	93.4	70.4	54.3	82.4	67.0	54.2	83.3	70.5
<i>Chiloscyllium punctatum</i>	42.1	101.2	74.1	36.2	99.5	73.2	49.1	96.5	78.0	49.5	95.2	76.1	52.1	94.3	73.6	49.2	104.5	78.5
<i>Hemigaleus microstoma</i>										51.2	51.2	51.2				58.2	67.3	62.8
<i>Hemipristis elongate</i>	89.3	89.3	89.3	55.2	65.2	59.3	62.3	105.2	77.2	52.3	70.5	60.8						
<i>Loxodon macrorhinus</i>										60.2	77.3	67.2						
<i>Mustelus manazo</i>				82.2	82.2	82.2				61.3	88.3	74.8						
<i>Spinyrna lewini</i>	55.2	78.2	68.0				50.5	95.5	67.1	49.5	82.2	56.4	50.1	73.4	58.0	53.4	74.2	65.0
<i>Stegostoma fasciatum</i>																204.0	204.0	204.0



### 2.3.7 Usage and Marketing

As a non-targeted species, and the landings represent only less than 1% of trawl nets total catch, sharks and rays are mainly consumed locally. The price (RM/kg) varied according to species, size and season. For rays, the catches are for local consumption as well as for outside markets, especially to Peninsular Malaysia. Grilled rays are special delicacies that highly enjoyed by locals and tourists alike. At SAFMA landing jetty, wholesale price of rays are between the range of RM1 - RM4 depending on the species and size. *Himantura walga* and *Dasyatis zugei* were priced RM1 - RM1.50 while *Neotrygon kuhlii* and *Rhynchobatus australiae* can fetch up to RM4/kg. The prices were eventually doubled or even more once the rays sold at the fish markets. Among the favourite species for consumption are *Himantura uarnak*, *H. gerrardi*, *H. undulata*, *H. leoparda* and *Urogymnus asperrimus*.

Ray's skin for some species can fetch a bigger value than the meat. Ray's skin of *Himantura uarnacoides*, *H. gerrardi*, *H. pastinacoides*, *H. lobistoma*, *H. jenkinsii*, *H. fai*, *Pastinachus atrus*, *P. gracilicaudus* and *P. solocirostris* is processed before being sent to Kuala Lumpur by plane or container. The prices are varied according to species and size of skin.

For sharks, except for the fins, shark meat are mostly to cater domestic demand and sold mainly at fish wet markets in Kota Kinabalu, though some were brought to interior part of Sabah. Some of the fins, however, are exported mainly to Peninsular Malaysia. All part of sharks are fully utilised. For example, sharks teeths and jaws are used as souvenirs and shark head's skin are considered as a new delicacy.

Whole sharks body, without the fins, are sold at the average price of RM2.50 at SAFMA landing jetty in Kota Kinabalu. The prices however increased to double or even triple once its reach the fish markets. For example, *Carcharhinus sorrah* and *Chiloscyllium plagiosum* are sold at RM2/kg at SAFMA jetty before sold at RM4/kg at nearby Kota Kinabalu fish market. The same species of sharks fetch higher value, as expensive as RM6/kg at fish markets that situated outside of Kota Kinabalu City. The details of the price range and market destination by species is shown in Table 29.

**Table 29: Price of Sharks and Rays by Species and Market Destination in Kota Kinabalu**

	Range Price (RM/kg)	Part	Market Destination
<b>Ray</b>			
<i>Aetobatus ocellatus</i>	2 - 2.5	Whole body	Local (Kota Kinabalu), P. Malaysia
<i>Aetomylaeus vespertilio</i>	2.5 - 3.0	Whole body	Local (Kota Kinabalu), P. Malaysia
<i>Dasyatis pavronigra</i>	2.0 - 3.0	Whole body	Local (Kota Kinabalu), P. Malaysia
<i>Dasyatis zugei</i>	1.5 - 3.0	Whole body	Local (Kota Kinabalu)
<i>Gymnura japonica</i>	2.0 - 2.5	Whole body	Local (Kota Kinabalu)
<i>Gymnura poecilura</i>	2.0 - 2.5	Whole body	Local (Kota Kinabalu)
<i>Himantura fai</i>	2.5 - 3.0	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to Peninsular Malaysia
<i>Himantura gerrardi</i>	2.0 - 2.5	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to Peninsular Malaysia
<i>Himantura jenkinsii</i>	2.0 - 2.5	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to Peninsular Malaysia
<i>Himantura leoparda</i>	2.0 - 2.5	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to P. Malaysia
<i>Himantura uarnacoides</i>	2.5 - 3.0	Whole body, skin	Local (Kota Kinabalu), P. Malaysia;

	Range Price (RM/kg)	Part	Market Destination
			Skin sold to P. Malaysia
<i>Himantura uarnak</i>	1.5 - 3.0	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to P. Malaysia
<i>Himantura walga</i>	1.0 - 2.0	Whole body	Local (Kota Kinabalu)
<i>Mobula japanica</i>	2.0 - 2.5	Whole body	Local (Kota Kinabalu), P. Malaysia
<i>Neotrygon kuhlii</i>	2.0 - 4.0	Whole body	Local (Kota Kinabalu)
<i>Pastinachus gracilicaudus</i>	2.5 - 3.0	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to P. Malaysia
<i>Pastinachus stellurostris</i>	2.0 - 2.5	Whole body, skin	Local (Kota Kinabalu), P. Malaysia Skin sold to P. Malaysia
<i>Rhinobatos borneensis</i>	3.0 - 3.5	Whole body	Local (Kota Kinabalu)
<i>Rhinoptera jayakari</i>	2.0 - 2.5	Whole body	Local (Kota Kinabalu)
<i>Rhynchobatus australiae</i>	3.5 - 4.0	Whole body, fins	Local (Kota Kinabalu), P. Malaysia
<i>Taeniura lymma</i>	2.0 - 2.5	Whole body	Local (Kota Kinabalu)
<i>Taeniurops meyeri</i>	2.0 - 2.5	Whole body	Local (Kota Kinabalu)
<b>Shark</b>			
<i>Alopias pelagicus</i>	2.0 - 2.5	Whole body, fins	Local Market (Kota Kinabalu)
<i>Atelomycteris marmoratus</i>	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
<i>Carcharhinus brevipinna</i>	2.5 - 3.0	Whole body, fins	Local Market (Kota Kinabalu)
<i>Carcharhinus sealei</i>	3.0 - 3.5	Whole body, fins	Local Market (Kota Kinabalu)
<i>Carcharhinus sorrah</i>	3.0 - 3.5	Whole body, fins	Local Market (Kota Kinabalu)
<i>Chiloscyllium hasseltii</i>	3.0 - 3.5	Whole body	Local Market (Kota Kinabalu)
<i>Chiloscyllium plagiosum</i>	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
<i>Chiloscyllium punctatum</i>	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
<i>Halaelurus buergeri</i>	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
<i>Hemigaleus microstoma</i>	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
<i>Hemipristis elongata</i>	3.0 - 3.5	Whole body, fins	Local Market (Kota Kinabalu)
<i>Heterodontus zebra</i>	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
<i>Loxodon macrorhinus</i>	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
	Range Price (RM/kg)	Part	Market Destination
<i>Mustelus manazo</i>	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
<i>Orectolobus leptolineatus</i>	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
<i>Sphyrna lewini</i>	3.0 - 3.5	Whole body, fins	Local Market (Kota Kinabalu)
<i>Squatina tergocellatoides</i>	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
<i>Stegostoma fasciatum</i>	2.5 - 4.0	Whole body	Local Market (Kota Kinabalu)

## 2.4 Sandakan

### 2.4.1 Landing Samples

A total of 135 landings were sampled during the study period with average of 12 samples a month. The samples were catches from trawl nets, that operated mainly in Zone 3 with 84 vessels, followed by 29 vessels in Zone 2 and 22 vessels in Zone 4. The details of are shown in **Table 30**.

**Table 30: Number of Landings by Gear Sampled during the Study at Sandakan (Sandakan Fish Market Jetty)**

Type of Gear	Year/Month												Grand Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Trawl net Zone 2	2	2	2	2	5	2	1	3	3	1	3	3	29
Trawl net Zone 3	7	10	6	6	6	9	9	8	5	8	5	5	84
Trawl net Zone 4	4		2	4	1	1	3	1	2	2	2		22
<b>Total</b>	<b>13</b>	<b>12</b>	<b>10</b>	<b>12</b>	<b>12</b>	<b>12</b>	<b>13</b>	<b>12</b>	<b>10</b>	<b>11</b>	<b>10</b>	<b>8</b>	<b>135</b>

#### 2.4.2 Fishing Ground and Catch Composition by Gear Type

The total catch of trawl nets that sampled were 13,138 kg comprising 10,170 kg of rays (77.4%) and 2,969 kg of sharks, which is only 22.6% of the combined catches. All trawlers operated beyond three nm from coastline, and mainly between 12 nm to 30 nm from the coastline. A total of 5,611 kg of rays was landed by Zone 3 trawl nets followed by Zone 4 trawl nets at 3,279 kg. As for sharks, Zone 3 trawl nets also landed the highest catch, with 1,882 kg followed by Zone 4 trawl nets at 677 kg. The highest landing of rays by month was from Zone 3 trawl nets at 1,217 kg in August while 788 kg, also from Zone 3 in January and followed by 703 kg from Zone 4 in August. For sharks, the highest landing by month came from Zone 3 trawl nets at 532 kg in September 2015, followed by 331 kg from Zone 4 trawl nets in August 2015 and 240 kg from Zone 3 trawl nets in July 2016. The details are shown in Table 31.

**Table 31: Weight of Sharks and Rays (in kg) Caught by Different Types of Gear at Sandakan (Sandakan Fish Market Jetty)**

Type of Gear	Year/Month												Grand Total			
	2015						2016									
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul				
<b>Ray</b>																
Trawl net Zone 2	67.4	181.7	206.5	62.7	128.6	26.6	35.9	58.3	83.2	3.8	349.8	75.9	1,280.2			
Trawl net Zone 3	1,217.2	914.5	289.6	279.3	271.5	788.4	168.1	325.1	264.6	460.0	176.5	455.9	5,610.7			
Trawl net Zone 4	702.5		412.0	449.6	244.0	183.1	238.6	158.5	510.0	271.8	108.7		3,278.8			
<b>Total Ray</b>	<b>1,987.1</b>	<b>1,096.2</b>	<b>908.1</b>	<b>791.6</b>	<b>644.1</b>	<b>998.1</b>	<b>442.6</b>	<b>541.9</b>	<b>857.8</b>	<b>735.5</b>	<b>635.0</b>	<b>531.8</b>	<b>10,169.7</b>			
<b>Shark</b>																
Trawl net Zone 2	82.0	28.2	17.1	42.1	47.1	49.2	17.2	45.6	47.9	0.8	9.9	23.1	410.1			
Trawl net Zone 3	197.9	532.6	86.8	190.3	135.5	106.1	66.0	54.1	127.8	93.9	51.1	239.5	1,881.5			
Trawl net Zone 4	330.8		29.1	88.8	33.0		27.3			59.8	108.3		677.0			
<b>Total Shark</b>	<b>610.7</b>	<b>560.8</b>	<b>133.0</b>	<b>321.2</b>	<b>215.6</b>	<b>155.3</b>	<b>110.5</b>	<b>99.7</b>	<b>175.7</b>	<b>154.5</b>	<b>169.3</b>	<b>262.6</b>	<b>2,968.7</b>			
<b>Grand Total</b>	<b>2,597.8</b>	<b>1,657.0</b>	<b>1,041.1</b>	<b>1,112.8</b>	<b>859.7</b>	<b>1,153.4</b>	<b>553.1</b>	<b>641.5</b>	<b>1,033.5</b>	<b>890.0</b>	<b>804.2</b>	<b>794.4</b>	<b>13,138.3</b>			

### 2.4.3 Sharks and Rays Composition

A total of 581,358 kg of fish was landed from 135 landings during the study period. Rays and sharks made up 10,170 kg and 2,969 kg (1.8% and 0.5%) from the total landing respectively. Landings of bony fish was 568,220 kg or 97.7 %. Average landings per month for sharks and rays were 247 kg and 848 kg respectively. The highest landing by month for rays was 1,987 kg in August, followed by 1,096 kg in September 2015 and 998 kg in January 2016. However, the highest landing for sharks was 611 kg in August, followed by 561 kg in September and 321 kg in November 2015. In general, the landing of sharks and rays ranged between 0.2 – 1.1% and 0.8 – 3.2% respectively from total landing. The details are shown in Table 32.

**Table 32: Catch Composition of Sharks, Rays and Bony Fish by Month from 135 Landings at Sandakan (Sandakan Fish Market Jetty). All Weight in Kilogram**

Year	Month	Weight of Ray	% Ray	Weight of Shark	% Shark	Weight of Bony Fish	% Bony Fish	Total Catch
2015	Aug	1,987.1	3.2	610.7	1.0	58,980.0	95.8	61,577.8
	Sep	1,096.2	2.1	560.8	1.1	51,540.0	96.8	53,197.0
	Oct	908.1	1.8	133.0	0.3	49,140.0	97.9	50,181.1
	Nov	791.6	1.3	321.2	0.5	58,910.0	98.2	60,022.8
	Dec	644.1	1.0	215.6	0.3	66,100.0	98.7	66,959.7
2016	Jan	998.1	2.1	155.3	0.3	46,570.0	97.6	47,723.4
	Feb	442.6	0.8	110.5	0.2	55,940.0	99.0	56,493.1
	Mar	541.9	1.1	99.7	0.2	50,150.0	98.7	50,791.5
	Apr	857.8	1.9	175.7	0.4	44,510.0	97.7	45,543.5
	May	735.5	2.0	154.5	0.4	35,900.0	97.6	36,790.0
	Jun	635.0	2.2	169.3	0.6	27,760.0	97.2	28,564.2
	Jul	531.8	2.3	262.6	1.1	22,720.0	96.6	23,514.4
<b>Total</b>		<b>10,169.7</b>		<b>2,968.7</b>		<b>568,220.0</b>		<b>581,358.3</b>
<b>Ave</b>		<b>847.5</b>	<b>1.8</b>	<b>247.4</b>	<b>0.5</b>	<b>47,351.7</b>	<b>97.7</b>	<b>48,446.5</b>



#### 2.4.4 Sample Size

A total of 1,733 tails belonging to 882 rays and 851 sharks were sampled comprising 19 species of rays and 14 species of sharks. The most common and abundant rays species were *Neotrygon kuhlii* followed by *Himantura gerrardi* and *Taeniura lymma*. The most common species were *H. jenkinsii*, *Rhynchobatus australiae*, *Himantura uarnacoides*, *Rhinoptera jayakari*, *Himantura uarnak*, *Himantura fai*, *Himantura leoparda* and *Himantura uarnacoides*. These species were recorded between 11-12 months. Other species such as *Aetobatus ocellatus* and *Dasyatis zugei* were landed in seven months; *Pastinachus gracilicaudus* and *Rhina encylostoma* in five months during study period. The highest number of rays sampled by month was 145 tails in August 2015 followed by 88 tails in July and 85 tails in June 2016.

The most common and abundant shark species were *Chiloscyllium punctatum* followed by *Carcharhinus sorrah* and *Chiloscyllium plagiosum*. Common species were *Atelomycterus marmoratus*, *Rhizoprionodon acutus*, *Sphyrna lewini*, *Carcharhinus sealei*, *Hemigaleus microstoma* and *Stegostoma fasciatum*. All these species were landed between 8 - 12 month. Other species such as *Hemipristis elongata*, *Carcharhinus limbatus*, *C. leucas*, *C. brevipinna* and *Galeocerdo cuvier*, were only landed between 3 - 7 months during the study period. The highest number of sharks sampled by month was 196 tails in August, followed by 74 tails in September 2015 and 69 tails in May 2016. The details are as shown in **Table 33**

Table 33: Sample Size of Sharks and Rays by Species at Sandakan (Sandakan Fish Market Jetty)

Species	Year/Month												Total			
	2015						2016									
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul				
<i>Aetobatus ocellatus</i>	5			3		1	2	1		1			1			14
<i>Dasyatis zugei</i>	14	14			15					8	4		4		7	75
<i>Himantura fai</i>	9	8	5	5	7	9	2	4		3			6	3	2	60
<i>Himantura gerrardi</i>	21	16	11	12	15	19	15	7	19	20	19		19	28	14	197
<i>Himantura jenkinsii</i>	9	5	3	7	3	2	3	2	1	5	2		1	5	2	43
<i>Himantura leoparda</i>	3	3	4	3	1	3	2	1	2	4	1		2	4	1	27
<i>Himantura uarnacooides</i>	16	4	6	3	4	6	6	4	1	5	1		1	5	2	57
<i>Himantura uarnak</i>	1	4	5	1		1	2	2	1	1			1	1	3	22
<i>Himantura undulata</i>																4
<i>Himantura walga</i>																4
<i>Mobula thurstoni</i>	1															5
<i>Neotrygon kuhlii</i>	43	6	6	16	9	17	19	10	13	22	27		13	22	30	218
<i>Pastinachus atris</i>																2
<i>Pastinachus gracilicaudus</i>	3	1	2													2
<i>Rhina ancylostoma</i>	1		1			1			1				1		2	2
<i>Rhinobatos borneensis</i>			2		1	1	1		1				1			9
<i>Rhinoptera jayakari</i>		3	2	1	1	1	1		2				2	3		5
<i>Rhynchobatus australiae</i>	8	1	1	5	4	5	5	2	2	5	3		2	5	4	45
<i>Taeniura lymna</i>	11	4	2	3	1	10	10	5	5	11	11		11	11	9	77
<b>Total Rays</b>	<b>145</b>	<b>69</b>	<b>50</b>	<b>59</b>	<b>61</b>	<b>75</b>	<b>68</b>	<b>48</b>	<b>53</b>	<b>81</b>	<b>85</b>		<b>88</b>	<b>81</b>	<b>88</b>	<b>882</b>
<i>Atelomycterus marmoratus</i>	16	5	4	2	2	6	8	3	10	4	8		8	4	8	76
<i>Carcharhinus brevipinna</i>						2					1				5	8
<i>Carcharhinus leucas</i>	4	2		3	1											10
<i>Carcharhinus limbatus</i>		3	1			1	2		2		1					10
<i>Carcharhinus sealei</i>	3	1	1	1	2	2	2	2		1	1			1	7	21
<i>Carcharhinus sorrah</i>	33	9	1	12	3	10	5	9	7	10	17		7	10	16	132
<i>Chiloscyllium plagiosum</i>	29	9	8	7		11	16	5	3	19	12		4	19	4	123
<i>Chiloscyllium punctatum</i>	70	30	28	19	13	19	19	6	18	25	15		13	25	13	275
<i>Galeocerdo cuvier</i>	4	1		1	1	1										8
<i>Hemigaleus microstoma</i>	4		12	3	10		2	6		3	2			3	4	46
<i>Hemipristis elongata</i>	2	4				2	2	3	3	2				2	1	16
<i>Rhizoprionodon acutus</i>	17	6	10	6	3	5	1	2	8	4	4		3	4	3	69
<i>Sphyrna lewini</i>	9	2	3	9		3	1	3	4	1	3		4	1	4	42
<i>Stegostoma fasciatum</i>	5	2		1	3	1	1	1	1		1				1	15
<b>Total Sharks</b>	<b>196</b>	<b>74</b>	<b>68</b>	<b>64</b>	<b>38</b>	<b>63</b>	<b>57</b>	<b>36</b>	<b>56</b>	<b>69</b>	<b>65</b>		<b>65</b>	<b>69</b>	<b>65</b>	<b>851</b>
<b>Grand Total</b>	<b>341</b>	<b>143</b>	<b>118</b>	<b>123</b>	<b>99</b>	<b>138</b>	<b>125</b>	<b>84</b>	<b>109</b>	<b>150</b>	<b>150</b>		<b>153</b>	<b>150</b>	<b>153</b>	<b>1,733</b>

#### 2.4.5 Weight of Sharks and Rays by Species

A total of 13,138 kg was landed from 135 landings comprising 10,170 kg rays and 2,969 kg sharks. For rays, the highest landing by weight was from species *Himantura fai* amounting to 2,315 kg, followed by *H. uarnacides* (1,465 kg), *H. leoparda* (1,367 kg), *Himantura gerrardi* (1,013 kg), *H. jenkinsii* (985 kg), *H. uarnak* (896 kg) and *Neotrygon kuhlii* (571 kg). The highest landing by month was 445 kg for *H. fai* in August, followed by 331 kg in September 2015 and 287 kg in January 2016. For *H. uarnacoides*, the highest landing was 421 kg in August 2015, followed by 176 kg in January 2016 and 121 kg in December 2015. For *H. leoparda*, the highest landing was 211 kg in May 2016 followed by 187 kg in November and 182 kg in August 2015. The highest landing for *Himantura gerrardi* and *H. jenkinsii* was in August 2015 at 119 kg and 380 kg respectively. For *Himantura uarnak*, the highest landing was 168 kg in September 2015 and for *Neotrygon kuhlii* was 88 kg in August 2015. Weight of other species was less than ranged between 2 kg (*Himantura walga*) to 382 kg (*Rhynchobatus australiae*).

The highest landing of shark species were 896 kg for *Chiloscyllium punctatum* followed by 695 kg for *Carcharhinus sorrah*, 343 kg for *Stegostoma fasciatum*, 297 kg for *Carcharhinus leucas*, and 251 kg for *Chiloscyllium plagiosum*. The highest landing by month for *Chiloscyllium punctatum* was 190 kg in September, followed by 135 kg in August and 108 kg in November 2016. For *Carcharhinus sorrah*, the highest landing was 235 kg in August 2015 followed by 110 kg in July 2016 and 69 kg in September 2015. The highest landing for *Stegostoma fasciatum* was 88 kg in August, followed by 72 kg in December and 66 kg in September 2015. Weight of other species ranged between 21 kg (*Galeocerdo cuvier*) to 95 kg (*Atelomycterus marmoratus*). The details are shown in **Table 34**.



**Table 34: Weight of Sharks and Rays (in kg) by Species at Sandakan (Sandakan Fish Market Jetty)**

Species	Year/Month												Total
	2015						2016						
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<i>Alopius ocellatus</i>	27.2			5.0		31.5	54.5	31.0		2.4	39		190.6
<i>Dasyatis zugei</i>	24.4	15.4			28			7.7	3.4	2.4	3.7	20.9	105.9
<i>Himantura fai</i>	445.0	330.8	229.0	163.0	206.5	286.5	27.0	126.0	243.0	144.3	114		2,315.1
<i>Himantura gerrardi</i>	119.1	106.2	42.8	64.3	63.9	108.2	79.9	36.4	123.0	96.2	92.7	80.0	1,012.6
<i>Himantura jenkinsii</i>	380.0	99.2	34.5	65.5	83.0	59.5	17.4	58.0	57.0	59.8	59.6	11.0	984.5
<i>Himantura leoparda</i>	182.0	137.0	157.0	187.0	44.0	151.0	55.0	11.0	135.0	211.0	97.0		1367
<i>Himantura uarnacooides</i>	420.5	119.0	113.0	102.0	121.0	176.0	66.2	102.0	63.0	109.0	72.8		1,464.5
<i>Himantura uarnak</i>	78.0	168.0	144.0	79.0		27.0	61.0	108.0	79.0	31.0	79.0	42.0	896
<i>Himantura undulata</i>												59.5	59.5
<i>Himantura walga</i>								4.5				1.9	9
<i>Mobula thurstoni</i>	4.5							4.5					9
<i>Neotrygon kuhlii</i>	88.0	31.0	33.1	69.7	32.5	58.7	41.1	25.2	23.6	45.8	55.8	66.4	570.7
<i>Pastinachus atrus</i>												74	74
<i>Pastinachus gracilicaudus</i>	94.0	39.0	68.0						39.0			65.7	305.7
<i>Rhina ancylostoma</i>	35.0		37.0			35.0			37.0				181
<i>Rhinobatos borneensis</i>			1.0				0.3			1.5			2.8
<i>Rhinoptera javakari</i>		31.5	6.7	3.3	3.3	5.0	12.0	12.0	11.7	4.9		13.5	103.9
<i>Rhynchobatus australiae</i>	82.8	2.6	39.0	49.4	24.2	28.8	13.7	13.0	43.1	13.9	5.2	66.0	381.6
<i>Taenitura lymna</i>	6.7	16.5	3.0	3.4	0.7	31	14.6	7.1		13.3	16.3	31.0	143.5
<b>Total Weight Rays</b>	<b>1,987.1</b>	<b>1,096.2</b>	<b>908.1</b>	<b>791.6</b>	<b>644.1</b>	<b>998.1</b>	<b>442.6</b>	<b>541.9</b>	<b>857.8</b>	<b>735.5</b>	<b>635</b>	<b>531.8</b>	<b>10,169.7</b>
<i>Atelomycterus marmoratus</i>	18.4	9.1	7.8	1.4	1.1	7.5	6.7	2.0	15.4	4.77	13.3	8.0	95.4
<i>Carcharhinus brevipinna</i>						11.2					1.8	24.0	37
<i>Carcharhinus leucas</i>	48.0	154.0		81.0	14.0		4.8		5.5		4.3		297
<i>Carcharhinus limbatus</i>		7.2	3.5			1.8							27.1
<i>Carcharhinus sealei</i>	2.8	1.6	0.9	0.9	13.7	2.4	4.8	2.7		0.9	4.2	22.5	52.6
<i>Carcharhinus sorrah</i>	234.7	68.8	4.4	49.8	11.8	33.1	12.9	52.2	30.9	32.9	53.2	110.0	694.7
<i>Chiloscyllium plagiosum</i>	44.3	33.8	11.9	15.4		37	27.6	12.4	5.8	28.9	12.1	22.0	251.2
<i>Chiloscyllium punctatum</i>	135.0	190.4	80.4	108.2	74.2	41.5	48.0	15.0	55.4	67.0	39.2	41.2	895.5
<i>Galeocerdo cuvier</i>	12.4	1.3		3	1.3	3.4							21.4
<i>Hemigaleus microstoma</i>	5.6	8.0	16.9	5.3	26.7		1.2	11.4		6.8	1.3	5.4	88.6
<i>Hemipristis elongata</i>	6.3	16.0				6.2	1.7		11.0	10.0		14.3	65.5
<i>Rhizoprionodon acutus</i>	8.4	3.1	5.0	9.2	1.35	2.5	0.8	1.05	10.2	2.0	2.2	1.5	47
<i>Sphyrna lewini</i>	7.4	1.5	2.2	12		2.7	0.6	2.9	5.5	1.2	2.7	13.7	52.4
<i>Stegostoma fasciatum</i>	87.5	66.0		35	71.5	6.0	6.2		36.0		35.0		343.2
<b>Total Weight Sharks</b>	<b>610.7</b>	<b>560.8</b>	<b>133.0</b>	<b>321.2</b>	<b>215.6</b>	<b>155.3</b>	<b>110.5</b>	<b>99.7</b>	<b>175.7</b>	<b>154.5</b>	<b>169.3</b>	<b>262.6</b>	<b>2,968.7</b>
<b>Grand Total</b>	<b>2,597.8</b>	<b>1,657.0</b>	<b>1,041.0</b>	<b>1,113</b>	<b>859.7</b>	<b>1,153.4</b>	<b>553.1</b>	<b>641.5</b>	<b>1,034</b>	<b>890.0</b>	<b>804.2</b>	<b>794.4</b>	<b>13,138.3</b>

#### 2.4.6 Size Range of Sharks and Rays

In general from August 2015 to January 2016, both mature and immature rays species were sampled. Mature species included *Dasyatis zugei* sampled in August and September 2015, *Himantura fai* (August, September, October 2015), *Himantura jenkinsii* (August, Disember 2015 and January 2016), *Himantura leoparda* (August and November 2016), *Himantura uarnacoides* (August, September, November, December 2015 and January 2016), *Himantura uarnak* (August and November 2015), *Rhynchobatus australiae* (August and October 2015) and *Taeniura lymma* in October and November 2016. Other species were mostly immature. Size range of all rays species sampled from August 2015 to January 2016 are shown in **Table 35A (i)**.

During the second period from February to July 2016, mature rays species were *Himantura jenkinsii* sampled in March and April, *Himantura leoparda* (April and July), *Himantura uarnacoides* (March and April), *Himantura uarnak* (March, April and July), and *Taeniura lymma* in February, March, May, June and July. Other species were mostly immature. Size range of all rays species sampled from February to July 2016 are shown in **Table 35A (ii)**.

As for sharks, in general from August 2015 to January 2016, both mature and immature species were sampled. Mature species included *Atelomycterus marmoratus* sampled from August 2015 to January 2016, *Chiloscyllium plagiosum* (August, October and November 2015), *C. punctatum* (September and December 2015), *Hemigaleus microstoma* (August, October, November and December 2015) and *Stegostoma fasciatum* in September, November and December 2015. First maturing size of these species (total length) are 45 cm for male *Atelomycterus marmoratus*, 50 cm for *Chiloscyllium plagiosum*, and 147 cm for *Stegostoma fasciatum*. Other species were mostly immature such as *Carcharhinus leucas*, *C. limbatus*, *C. sorrah*, *C. sealei*, *Galeocerdo cuvier*, *Rhizoprionodon acutus* and *Sphyrna lewini*. Size range of all sharks species from August 2015 to January 2016 are shown in **Table 35B (i)**.

During the second period from February to July 2016, most mature sharks species were *Atelomycterus marmoratus* and *Chiloscyllium plagiosum* sampled from Febuary to July, *Chiloscyllium punctatum* (May and June), *Hemigaleus microstoma* (March and May), and *Stegostoma fasciatum* in April and June. Other species were mostly immature. Size range of all sharks species sampled from February to July 2016 are shown in **Table 35B (ii)**.



**Table 35A (i): Size Range of Rays Species (Disc Length) Except for *Rhinobatos borneensis* and *Rhynchobatus australiae* (Total Length) for Six Months at Sandakan (Sandakan Fish Market Jetty) from August 2015 to January 2016**

Rays	Year/Month														
	2015						2016								
	Aug	Aug	Sep	Sep	Oct	Oct	Nov	Nov	Dec	Dec	Jan	Jan			
Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	
<i>Aetobatus ocellatus</i>	24.0	75.0	35.6												
<i>Dasyatis zugei</i>	20.0	30.0	26.4	19.0	30.0	24.7									
<i>Himantura fai</i>	63.0	108.0	97.3	57.0	110.0	89.9	75.0	107.0	93.8	108.0	82.8	57.0	109.0	79.4	63.0
<i>Himantura gerrardi</i>	23.0	64.0	41.9	30.0	64.0	44.2	22.0	40.0	34.8	61.0	41.8	24.0	62.0	38.4	22.0
<i>Himantura jenkinsii</i>	42.0	114.0	93.2	42.0	89.0	74.0	42.0	88.0	58.0	89.0	53.1	38.0	90.0	87.3	88.0
<i>Himantura leoparda</i>	65.0	130.0	105.0	65.0	120.0	95.0	65.0	112.0	93.8	122.0	111.3	100.0	99.0	99.0	65.0
<i>Himantura uarnacoides</i>	70.0	112.0	91.6	72.0	112.0	95.5	70.0	98.0	82.2	115.0	99.7	71.0	112.0	95.0	70.0
<i>Himantura uarnak</i>	121.0	121.0	121.0	80.0	121.0	95.8	80.0	91.0	84.2	122.0	122.0				80.0
<i>Himantura undulata</i>															
<i>Himantura walga</i>	44.5	44.5	44.5												
<i>Mobula thurstoni</i>	18.0	32.0	25.9	20.0	30.0	26.7	21.0	32.0	27.3	32.0	23.4	15.5	24.0	28.2	20.0
<i>Neotrygon kuhlii</i>															
<i>Pastinachus atrus</i>															
<i>Pastinachus gracilicaudus</i>	75.0	84.0	78.0	83.0	83.0	83.0	75.0	84.0	79.5						
<i>Rhinobatos borneensis</i>							52.0	67.0	59.5						
<i>Rhinoptera jayakari</i>				36.5	83.0	52.0	37.0	38.0	37.5	36.0	36.0	36.0	36.0	36.0	40.0
<i>Rhynchobatus australiae</i>	109.0	168.0	138.5	74.0	74.0	74.0	165.0	165.0	165.0	110.0	107.0	104.0	80.0	72.3	104.0
<i>Taeniura lymma</i>	23.0	25.0	24.3	24.0	25.0	24.8	25.0	30.0	27.5	34.0	27.7	24.0	24.0	24.0	22.0

**Table 35A (ii): Size Range of Rays Species (Disc Length) Except for *Rhinobatos borneensis* and *Rhynchobatus australiae* (Total Length) for Six Months at Sandakan (Sandakan Fish Market Jetty) from February to July 2016**

	2016																	
	Feb			Mar			Apr			May			Jun			Jul		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
<b>Ray</b>																		
<i>Aetobatus ocellatus</i>	75.0	81.0	78.0	81.0	81.0	81.0												
<i>Dasyatis zugei</i>				20.0	30.0	25.4	27.0	30.0	28.5									
<i>Himantura fai</i>	63.0	71.0	67.0	75.0	99.0	82.5	63.0	107.0	88.7	99.0	106.0	101.3	62.0	99.0	80.5			
<i>Himantura gerrardi</i>	31.0	62.0	44.2	32.0	61.0	42.8	24.0	63.0	43.9	23.0	63.0	40.8	20.0	54.0	32.4	19.0	63.0	34.9
<i>Himantura jenkinsii</i>	35.0	58.0	45.7	88.0	90.0	89.0	89.0	89.0	89.0	38.0	88.0	57.4	37.0	89.0	63.0	59.0	59.0	59.0
<i>Himantura leoparda</i>	65.0	99.0	82.0	65.0	65.0	65.0	100.0	100.0	100.0	65.0	120.0	102.3	100.0	100.0	100.0			
<i>Himantura uarnacooides</i>	56.0	84.0	70.3	73.0	111.0	91.3	115.0	115.0	115.0	71.0	99.0	82.4	57.0	115.0	86.0			
<i>Himantura uarnak</i>	90.0	91.0	90.5	80.0	122.0	101.0	122.0	122.0	122.0	91.0	91.0	91.0	122.0	122.0	122.0	67.0	69.0	67.7
<i>Himantura undulata</i>																		
<i>Himantura walga</i>																		
<i>Mobula thurstoni</i>				44.5	44.5	44.5												
<i>Neotrygon kuhlii</i>	20.0	31.0	27.3	19.0	32.0	26.8	16.0	32.0	23.4	16.0	33.0	26.4	15.5	30.5	22.3	13.0	30.0	20.9
<i>Pastinachus atrus</i>																		
<i>Pastinachus gracilicaudus</i>																		
<i>Rhina ancylostoma</i>																		
<i>Rhinobatos borneensis</i>	50.0	50.0	50.0															
<i>Rhinoptera jayakari</i>	53.0	53.0	53.0	53.0	53.0	53.0	36.5	49.8	43.2	39.8	39.8	39.8				63.0	63.0	63.0
<i>Rhynchobatus australiae</i>	56.0	103.0	78.4	102.0	102.0	102.0	92.0	165.0	128.5	56.0	107.0	77.9	57.0	85.0	68.3	85.0	85.0	85.0
<i>Taeniura lymma</i>	23.0	34.0	26.5	23.0	34.0	26.20				24.0	34.0	27.6	24.0	34.0	26.2	24.0	34.0	28.7

**Table 35B (i): Size Range of Sharks (Total Length) for Six Months at Sandakan (Sandakan Fish Market Jetty) from August 2015 to January 2016**

Shark	2015																		2016		
	Aug			Sep			Oct			Nov			Dec			Jan					
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave			
<i>Atelomycterus marmoratus</i>	47.0	95.0	61.5	54.0	57.0	55.2	54.0	58.0	55.5	54.0	74.0	64.0	58.0	60.0	59.0	53.0	58.0	55.3			
<i>Carcharhinus brevipinna</i>																98.0	100.0	99.0			
<i>Carcharhinus leucas</i>	117.0	123.0	119.0	160.0	160.0	160.0				123.0	160.0	147.0	123.0	123.0	123.0						
<i>Carcharhinus limbatus</i>				58.0	86.0	68.0	84.0	84.0	84.0							59.0	59.0	59.0			
<i>Carcharhinus sealei</i>	50.0	55.0	53.0	57.0	57.0	57.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	58.0	56.5	55.0	57.0	56.0			
<i>Carcharhinus sorrah</i>	73.0	186.0	90.9	72.0	93.0	83.9	90.0	90.0	90.0	55.0	120.0	85.6	82.0	92.0	87.0	71.0	92.0	83.2			
<i>Chiloscyllium plagiolum</i>	42.0	99.0	63.6	42.0	73.0	60.2	42.0	71.0	62.5	61.0	80.0	70.6				42.0	73.0	58.5			
<i>Chiloscyllium punctatum</i>	40.0	82.0	67.2	50.0	82.0	70.1	40.0	82.0	66.1	40.0	83.0	65.5	56.0	82.0	70.1	41.0	82.0	61.5			
<i>Galeocerdo cuvier</i>	77.0	95.0	89.5	77.0	77.0	77.0				93.0	93.0	93.0	77.0	77.0	77.0	94.0	94.0	94.0			
<i>Hemigaleus microstoma</i>	47.0	95.0	64.3				47.0	96.0	65.4	54.0	95.0	70.7	47.0	95.0	61.2						
<i>Hemipristis elongata</i>	64.0	105.0	84.5	64.0	108.0	96.0										64.0	109.0	86.5			
<i>Rhizoprionodon acutus</i>	41.0	55.0	48.1	41.0	55.0	49.3	46.0	54.0	49.7	46.0	54.0	50.0	45.0	52.0	49.7	46.0	54.0	48.5			
<i>Sphyrna lewini</i>	50.0	57.0	53.4	53.0	54.0	53.5	52.0	54.0	53.3	50.0	82.0	61.2				51.0	57.0	54.3			
<i>Stegostoma fasciatum</i>	102.0	202.0	144.2	181.0	201.0	191.0				200.0	200.0	200.0	106.0	185.0	158.3	107.0	107.0	107.0			

**Table 35B (ii): Size Range of Sharks (Total Length) for Six Months at Sandakan (Sandakan Fish Market Jetty) from February to July 2016**

Shark	2016																	
	Feb			Mar			Apr			May			Jun			Jul		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
<i>Atelomycterus marmoratus</i>	54.0	74.0	61.3	54.00	58.00	56.33	48.0	74.0	56.1	49.0	74.0	60.5	49.5	57.0	53.9	48.0	60.5	53.6
<i>Carcharhinus brevipinna</i>													74.0	74.0	74.0	74.0	89.0	81.6
<i>Carcharhinus leucas</i>	57.0	84.0	70.5				60.0	86.0	73.0				60.0	60.0	60.0			
<i>Carcharhinus limbatus</i>				55.00	56.00	55.50				55.0	55.0	55.0	57.0	57.0	57.0	41.0	58.0	51.4
<i>Carcharhinus sealei</i>	55.0	86.0	76.0	55.00	92.00	80.78	55.0	120.0	83.3	55.0	93.0	80.0	46.0	106.0	70.2	46.0	135.0	71.3
<i>Carcharhinus sorrah</i>																		
<i>Chiloscyllium plagiosum</i>	41.0	80.0	62.9	62.00	72.00	67.20	72.5	74.5	73.7	42.0	80.0	69.8	42.0	72.3	66.3	42.0	72.0	62.3
<i>Chiloscyllium punctatum</i>	40.0	82.0	67.0	44.0	80.0	56.8	40.0	82.0	67.0	43.0	83.0	71.4	49.0	86.0	73.3	46.0	82.0	63.6
<i>Galeocerdo cuvier</i>																		
<i>Hemigaleus microstoma</i>	54.00	61.00	57.50	47.0	95.0	67.7				54.0	95.0	70.7	43.5	63.0	53.3	54.0	63.0	59.5
<i>Hemipristis elongata</i>	64.00	64.00	64.00				64.0	108.0	92.3	105.0	107.0	106.0				148.0	148.0	148.0
<i>Rhizoprionodon acutus</i>	55.00	55.00	55.00	46.0	53.0	49.5	46.0	55.0	50.4	46.0	54.0	48.8	46.0	55.5	50.0	47.0	52.0	50.3
<i>Sphyrna lewini</i>	51.00	51.00	51.00	50.0	56.0	53.3	51.0	56.0	53.8	55.0	55.0	55.0	59.0	65.5	62.3	50.0	55.0	52.3
<i>Stegostoma fasciatum</i>	107.00	107.00	107.00				201.0	201.0	201.0				197.0	197.0	197.0			

## 2.4.7 Usage and Marketing

The scenario for usage and marketing for sharks and rays in Sandakan is more or less are similar to Kota Kinabalu. Sharks and rays are mainly consumed locally. For rays, the catches are for local consumption as well as to fulfill demand from Peninsular Malaysia. At Sandakan Fish Market jetty, wholesale price of rays are between the range of RM0.80 – RM4/kg depending on the species. *Neotrygon kuhlii* and *Dasyatis zugei* are priced as cheap as RM 0.80/kg while *Pastinachus atrus*, *Rhinobatos borneensis* and *Rhynchobatus australiae* can fetch a price as high as RM4/kg. The prices are eventually doubled or even more once the rays sold at the fish markets. Ray's skin can fetch a bigger price than the meat. The prices are varied according to species and size of skin. Ray's skin is processed before being sent to Kuala Lumpur by plane or container. The prices are varied according to species and size of skin.

For sharks, shark meat are mostly to cater domestic demand and sold mainly at fish wet markets in Kota Kinabalu. While shark fins soup are still served in some Chinese restaurants in Sandakan, some are sent mainly to Peninsular Malaysia. Apart from the fin and meat, other parts of sharks such as the teeth, jaw and skin are all fully utilised. For example, sharks' teeth and jaws are used as souvenirs and shark head's skin are considered as a new delicacy.

Whole sharks body, without the fins, are sold between RM0.80 – RM2.50/kg at Sandakan Fish Market jetty. The prices however increased to double or even triple once its reach the fish markets. For example, *Carcharhinus sorrah* are sold up to RM2.50/kg at Sandakan Fish Market jetty but the price doubled at nearby fish markets. The details of the price range and market destination by species is shown in Table 36. Small, medium and big size category for each species is as shown in Appendix IV

**Table 36: Price of Sharks and Rays by Species and Market Destination in Sandakan**

	Range Price (RM/kg)	Part	Market Destination
<b>Ray</b>			
<i>Aetobatus ocellatus</i>	1.5 - 3.0	Whole body	Local (Sandakan), Peninsular Malaysia
<i>Dasyatis zugei</i>	0.8 - 1.0	Whole body	Local (Sandakan)
<i>Himantura fai</i>	1.5 - 3.5	Whole body, skin	Local (Sandakan), Peninsular Malaysia; Skin sold to Peninsular Malaysia
<i>Himantura gerrardi</i>	0.8 - 2.5	Whole body, skin	Local (Sandakan), Peninsular Malaysia; Skin sold to Peninsular Malaysia
<i>Himantura jenkinsii</i>	1.5 - 3.5	Whole body, skin	Local (Sandakan), Peninsular Malaysia; Skin sold to Peninsular Malaysia
<i>Himantura leoparda</i>	1.5 - 3.5	Whole body, skin	Local (Sandakan), Peninsular Malaysia; Skin sold to Peninsular Malaysia
<i>Himantura uarnacoides</i>	1.5 - 3.5	Whole body, skin	Local (Sandakan), Peninsular Malaysia; Skin sold to Peninsular Malaysia
<i>Himantura uarnak</i>	1.5 - 3.5	Whole body, skin	Local (Sandakan), Peninsular Malaysia; Skin sold to Peninsular Malaysia



	Range Price (RM/kg)	Part	Market Destination
<i>Himantura undulata</i>	1.5 - 3.5	Whole body, skin	Local (Sandakan), Peninsular Malaysia; Skin sold to Peninsular Malaysia
<i>Himantura walga</i>	1.0 - 1.2	Whole body	Local (Sandakan)
<i>Mobula thurstoni</i>	1.0 - 2.0	Whole body	Local (Sandakan)
<i>Neotrygon kuhlii</i>	0.8 - 2.0	Whole body	Local (Sandakan), Peninsular Malaysia
<i>Pastinachus atrus</i>	3.0 - 4.0	Whole body, skin	Local (Sandakan), Peninsular Malaysia
<i>Pastinachus gracilicaudus</i>	1.5 - 3.0	Whole body, skin	Local (Sandakan), Peninsular Malaysia
<i>Rhina ancylostoma</i>	1.5 - 2.0	Whole body, fins	Local (Sandakan)
<i>Rhinobatos borneensis</i>	1.5 - 4.0	Whole body, fins	Local (Sandakan)
<i>Rhinoptera jayakari</i>	1.0 - 3.0	Whole body	Local (Sandakan)
<i>Rhychobatus australiae</i>	1.5 - 4.0	Whole body, fins	Local (Sandakan), Peninsular Malaysia
<i>Taeniura lymma</i>	0.8 - 2.0	Whole body	Local (Sandakan)
<b>Sharks</b>			Market Destination
<i>Atelomycterus marmoratus</i>	1.0 - 1.2	Whole body	(Local) Sandakan
<i>Carcharhinus brevipinna</i>	0.8 - 2.0	Whole body	(Local) Sandakan
<i>Carcharhinus leucas</i>	1.5 - 2.5	Whole body	(Local) Sandakan
<i>Carcharhinus limbatus</i>	1.0 - 2.0	Whole body	(Local) Sandakan
<i>Carcharhinus sealei</i>	0.8 - 2.5	Whole body	(Local) Sandakan
<i>Carcharhinus sorrah</i>	1.0 - 2.5	Whole body	(Local) Sandakan
<i>Chiloscyllium plagiosum</i>	0.8 - 1.5	Whole body	(Local) Sandakan
<i>Chiloscyllium punctatum</i>	0.8 - 1.5	Whole body	(Local) Sandakan
<i>Galeocerdo cuvier</i>	1.0 - 1.5	Whole body	(Local) Sandakan
<i>Hemigaleus microstoma</i>	0.8 - 1.5	Whole body	(Local) Sandakan
<i>Hemipristis elongata</i>	1.0 - 2.0	Whole body	(Local) Sandakan
<i>Heterodontus zebra</i>	1.0 - 1.5	Whole body	(Local) Sandakan
<i>Loxodon macrorhinus</i>	0.8 - 2.0	Whole body	(Local) Sandakan
<i>Rhizoprionodon acutus</i>	0.8 - 1.5	Whole body	(Local) Sandakan
<i>Sphyrna lewini</i>	0.8 - 2.0	Whole body	(Local) Sandakan

### 2.4.8 Catch Per Unit Effort (CPUE)

**Table 37: Days at operation by gears sampled during the study period in Sabah (Kota Kinabalu and Sandakan)**

Full Gear	2015												2016					Total								
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun	Jul	
Trawl Net Zone 2	19	26	12	12	52	12	6	18	18	12	12	6	18	18	12	12	52	12	6	18	18	20	25	18	18	238
Trawl Net Zone 3	162	139	135	129	109	121	123	121	108	121	121	123	121	108	121	108	109	121	123	121	108	132	116	33	33	1,428
Trawl Net Zone 4	69	62	66	100	56	81	111	110	91	81	81	111	110	91	81	81	56	81	111	110	91	93	81			920
Trawl Net Zone 5	8				22	29	7		15	29	29	7		15	29	22	29	7		15			13			94

**Table 38: Numbers of operation by gears sampled during the study period in Sabah (Kota Kinabalu and Sandakan)**

Full Gear	2015												2016					Total								
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun	Jul	
Trawl Net Zone 2	51	76	29	35	148	26	16	42	48	26	16	16	42	48	26	16	148	26	16	42	48	54	63	46	46	634
Trawl Net Zone 3	499	405	423	390	315	352	353	365	342	352	353	353	365	342	352	353	315	352	353	365	398	337	95	95	4,274	
Trawl Net Zone 4	206	186	209	307	165	240	327	328	278	240	327	327	328	278	240	327	165	240	327	328	284	257			2,787	
Trawl Net Zone 5	24				66	87	21		45	87	21	21		45	87	21	66	87	21				39			282

The top 10 catch per unit effort (CPUE) ray species captured by trawl net, combined for Kota Kinabalu and Sandakan, differed between zone. For zone 3, *Himantura gerrardi* topped the list with 1.21 kg per days or 0.40 kg per hauls, followed by *Neotrygon kuhlii* with 1.07 kg per days or 0.36 per hauls. For zone 4, *Neotrygon kuhlii* was on top of the list with 1.48 kg per days or 0.49 kg per hauls compare with *Himantura fai* with 1.00 kg per days or 0.33 kg per hauls. The same species that dominated in both zone 3 and zone 4 are *Himantura gerrardi*, *H. fai*, *H. uarnacoides*, *H. leoparda*, *H. uarnak*, *Neotrygon kuhlii*, *Pastinachus gracilicaudus*, *Dasyatis zugei* and *Rhynchobatus australiae*.

The first 3 species of sharks in the top 10 catch per unit effort (CPUE) for both zone 3 and zone 4 were in the same order, with *Chiloscyllium punctatum* on the top, followed by *Chiloscyllium plagiosum* and *Carcharhinus sorrah*. In terms of CPUE (kg/days), *Chiloscyllium punctatum* recorded 1.15, *C. plagiosum* with 0.50 and *Carcharhinus sorrah* with 0.42 in zone 3 compare to 1.12, 0.39 and 0.36 in zone 4 respectively. The top 10 CPUE of rays and sharks species captured by trawl net zone 3 and zone are shown in Table 39A and Table 39B.

**Table 39A: Top 10 CPUE ray species captured by Trawl Net Zone 3 during the study period in Sabah (Kota Kinabalu and Sandakan)**

	Scientific Name	Total weight (kg) by Species	CPUE (kg/days)	CPUE (kg/hauls)
1	<i>Himantura gerrardi</i>	1721.4	1.21	0.40
2	<i>Neotrygon kuhlii</i>	1525.7	1.07	0.36
3	<i>Himantura fai</i>	1149.0	0.80	0.27
4	<i>Himantura uarnacoides</i>	775.7	0.54	0.18
5	<i>Himantura jenkinsii</i>	728.8	0.51	0.17
6	<i>Himantura leoparda</i>	660.0	0.46	0.15
7	<i>Himantura uarnak</i>	414.9	0.29	0.10
8	<i>Pastinachus gracilicaudus</i>	414.7	0.29	0.10
9	<i>Dasyatis zugei</i>	371.0	0.26	0.09
10	<i>Rhynchobatus australiae</i>	213.0	0.15	0.05

**Table 39B: Top 10 CPUE ray species captured by Trawl Net Zone 4 during the study period in Sabah (Kota Kinabalu and Sandakan)**

	Scientific Name	Total weight (kg) by Species	CPUE (kg/days)	CPUE (kg/hauls)
1	<i>Neotrygon kuhlii</i>	1,358.0	1.48	0.49
2	<i>Himantura fai</i>	921.3	1.00	0.33
3	<i>Himantura uarnacoides</i>	638.0	0.69	0.23
4	<i>Himantura gerrardi</i>	637.3	0.69	0.23
5	<i>Himantura leoparda</i>	589.3	0.64	0.21
6	<i>Dasyatis zugei</i>	479.9	0.52	0.17
7	<i>Himantura uarnak</i>	393.1	0.43	0.14
8	<i>Rhinoptera jayakari</i>	280.7	0.31	0.10
9	<i>Rhynchobatus australiae</i>	264.9	0.29	0.10

**Table 39C: Top 10 CPUE shark species captured by Trawl Net Zone 3 during the study period in Sabah (Kota Kinabalu and Sandakan)**

	Scientific Name	Total weight (kg) by Species	CPUE (kg/days)	CPUE (kg/hauls)
1	<i>Chiloscyllium punctatum</i>	1,643.6	1.15	0.38
2	<i>Chiloscyllium plagiosum</i>	713.6	0.50	0.17
3	<i>Carcharhinus sorrah</i>	603.5	0.42	0.14
4	<i>Carcharhinus leucas</i>	211.0	0.15	0.05
5	<i>Stegostoma fasciatum</i>	187.5	0.13	0.04
6	<i>Sphyrna lewini</i>	129.2	0.09	0.03
7	<i>Atelomycterus marmoratus</i>	107.9	0.08	0.03
8	<i>Hemipristis elongata</i>	83.8	0.06	0.02
9	<i>Alopias pelagicus</i>	56.5	0.04	0.01
10	<i>Hemigaleus microstoma</i>	47.3	0.03	0.01

**Table 39D: Top 10 CPUE shark species captured by Trawl Net Zone 4 during the study period in Sabah (Kota Kinabalu and Sandakan)**

	Scientific Name	Total weight (kg) by Species	CPUE (kg/days)	CPUE (kg/hauls)
1	<i>Chiloscyllium punctatum</i>	1,028.7	1.12	0.37
2	<i>Chiloscyllium plagiosum</i>	354.7	0.39	0.13
3	<i>Carcharhinus sorrah</i>	332.3	0.36	0.12
4	<i>Stegostoma fasciatum</i>	149.5	0.16	0.05
5	<i>Atelomycterus marmoratus</i>	98.6	0.11	0.04
6	<i>Carcharhinus leucas</i>	86.0	0.09	0.03
7	<i>Sphyrna lewini</i>	78.9	0.09	0.03
8	<i>Alopias pelagicus</i>	76.0	0.08	0.03
9	<i>Hemipristis elongata</i>	24.7	0.03	0.01
10	<i>Carcharhinus brevipinna</i>	22.6	0.02	0.01

### 3.0 OUTPUT AND OUTCOME

The project outputs and outcomes are summarised in **Table 40** as shown below.

**Table 40: Output and Outcome**

No	Output	Outcome
1.	Thirteen (13) trained personnel in sharks and rays taxonomy from the Department of Fisheries Malaysia and Fisheries Department of Sabah.	Trained staffs are now able to make the right and valid identification of species. Training materials stored electronically and easy to excess.
2.	A standardised format for data collection for national activity produced.	Improved technique of data collection for implementation at national level.
3.	Detailed information on the percentages of sharks and rays from the total landing at	Confirmed earlier data published in Malaysian National Statistics. Sharks

No	Output	Outcome
	project sites.	and rays were not targeted and contributed to less than 2% of total marine landing.
4.	Information on relative dominance of the different species of sharks and rays obtained.	Increased awareness of needs and measures for shark conservation and management on specific species.
5.	Information on the monthly fluctuation of the different species of sharks and rays obtained.	Trends of landings by species analysed for national level management.
6.	Information on usage and marketing of the landed sharks and rays were obtained from the project.	Confirmed earlier report in current NPOA-Sharks that all sharks and rays are landed whole, fully utilised with no finning activities onboard vessels.
7.	A report on landing of sharks and rays up to species level from two sites in Perak and Sabah respectively.	Data recording on sharks and rays will be improved from generic terms 'sharks' and 'rays' to species level.
8.	Issues and problems arising from this activity identified and improvements made especially with the data collection format.	Development of a comprehensive national data collection system for sharks and rays as part of the National Plan of Action Sharks
9.	Specimens collected during sampling activities deposited for future reference.	A national repository for elasmobranchs has been established at the Fisheries Research Institute, Kg. Acheh, Perak and Fisheries Research Centre, Likas, Kota Kinabalu.

#### 4.0 FUTURE ACTIVITIES

Malaysia is highly committed in managing and conserving its sharks and rays. Some future activities had been underlined, as follows;

- i. Continuing to record landing data up to species level at the existing sites.
- ii. Extending the program to other states in Malaysia.
- iii. Seeking national funding to;
  - a. Continue the sharks data collection program
  - b. Conduct trainings/courses at national level
  - c. Attend meetings and seminars at national and international level
  - d. Conduct public awareness
  - e. Publish materials (posters, templates, identification manuals)
- iv. Using the current program finding to ;
  - a. Conduct Non-detriment Findings (NDFs) study on sharks.
  - b. Rectify various issues concerning sharks management ant national and international level.
  - c. Provide input for the next Malaysia NPOA-Shark.



- v. Conducting training for fisheries staff on sharks data collection (SEAFDEC, Terengganu and on-sites)
- vi. Continuing public awareness campaign, such as on the current regulation of listing on endangered species, government policy on not serving shark fin soup during official events and rectifying the misconception of 'shark finning' and 'shark fishing' terms.
- vii. Enhancing enforcement capacity through relevant training, such as the identification of sharks and rays species and its parts.
- viii. Expending the ongoing study on the usage and marketing, as well as the socioeconomy related to sharks and rays in Sabah, to other states of Malaysia.

## 5.0 CONCLUSION

A project on recording landing data of sharks and rays up to species level was conducted in two districts in the State of Perak and Sabah respectively. During this project thirteen (13) staff from Department of Fisheries Malaysia and Department of Fisheries Sabah trained in taxonomy and in data collection using the agreed regional format. Two facing the Straits of Malacca, namely Larut Matang and Manjung Utara in Perak, and Kota Kinabalu and Sandakan in Sabah were selected as the study sites, as they were the main landing sites of sharks and rays in the states. The landing data were collected at thirteen (13) jetties in Perak and two (2) jetties in Sabah.

A total of thirty three (33) species of rays from five (5) Order and nine (9) Families while twenty (20) species of sharks from four (4) Order and five (5) Families were recorded during the study period in Perak.

Larut Matang recorded nineteen (19) species of rays from three (3) Orders and five (5) Families, and fourteen (14) species of sharks from two (2) Orders and three (3) Families. Whereas Manjung Utara recorded fourteen (14) species of rays from two (2) Order and four (4) Families, and six (6) species of sharks from two (2) Orders and three (3) Families. Details are shown in Appendix II. In term of percentage of total marin landings, rays and sharks contributed 2.03% and 0.56% at Larut Matang, while for Manjung Utara at 1.38% and 0.38% for rays and sharks respectively.

The most abundant sharks species at Larut Matang were *Chiloscyllium hasseltii*, *Chiloscyllium punctatum*, *Atelomycterus marmoratus* and *Carcharhinus sorrah* while for rays were *Neotrygon kuhlii*, *Himantura gerrardi*, *Himantura walga* and *Dasyatis zugei*. The most abundant sharks species at Manjung Utara were *Chiloscyllium hasseltii*, *Chiloscyllium punctatum* and *Atelomycterus marmoratus* while for rays were *Himantura walga*, *Himantura gerrardi*, *Neotrygon kuhlii*, and *Dasyatis zugei*.

A total of twenty one (21) species of sharks from five (5) Orders and eleven (11) Families while twenty five (25) species of rays from two (2) Orders and eight (8) Families were recorded during the study period in Sabah. Kota Kinabalu recorded the highest with seventeen (17) species of sharks and twenty (20) rays compare to Sandakan with fourteen (14) species of sharks and nineteen (19) rays (Appendix II). For Sabah, the landings of sharks and rays were also minimal, with the contribution of 0.24% and 0.39% at Kota Kinabalu, and 0.53% and 1.81% at Sandakan respectively. These figures confirmed earlier data as

published in Malaysian National Statistics that sharks and rays were only by-catch and not targeted and contributed less than 2% of the total marine landing.

For Sabah, the most abundant sharks species at Kota Kinabalu were *Chiloscyllium punctatum* followed by *Chiloscyllium plagiosum* and *Atelomycterus marmoratus* and rays *Neotrygon kuhlii* followed by *Himantura gerrardi* and *Dasyatis zugei*. The most common sharks species were *Chiloscyllium punctatum*, *Chiloscyllium hasseltii* and *Carcharhinus sorrah* while for rays *Neotrygon kuhlii*, followed by *Himantura gerrardi* and *Dasyatis zugei*.

In the district of Sandakan, the most abundant sharks species were *Chiloscyllium punctatum* followed by *Carcharhinus sorrah* and *Chiloscyllium plagiosum*, and rays *Neotrygon kuhlii* followed by *Himantura gerrardi* and *Taeniura lymma*. The most common sharks species were *Chiloscyllium punctatum*, *Carcharhinus sorrah*, *Atelomycterus marmoratus* and *Rhizoprionodon acutus* while for rays *Neotrygon kuhlii*, followed by *Himantura gerrardi*, *H. jenkinsii* and *Rhynchobatus australiae*.

In Perak, sharks and rays were caught mainly by trawl nets. Other gears used were longlines and drift nets. In Sabah, trawl net is the main gear to catch sharks and rays.

The top 10 catch per unit effort (CPUE) (kg/days and kg/hauls) for rays species captured by trawl net Zone C in Perak were *Neotrygon kuhlii*, *Himantura gerrardi* and *Himantura walga*, while for sharks were dominated by *Chiloscyllium hasseltii*, *Chiloscyllium punctatum* and *Carcharhinus sorrah*.

The top 10 catch per unit effort (CPUE) ray and shark species captured by trawl net, combined for Kota Kinabalu and Sandakan, were determined in zone 3 and zone 4. For ray, - *Himantura gerrardi* topped the list, followed by *Neotrygon kuhlii* and *Himantura fai* in zone 3. In zone 4, *Neotrygon kuhlii* was the main species, followed by *Himantura fai* and *Himantura uarnacoides*. For shark, the top 3 species for both zone 3 and zone 4 were in the same order, with *Chiloscyllium punctatum* came first, followed by *Chiloscyllium plagiosum* and *Carcharhinus sorrah*.

Usage and marketing information from this study confirmed that all sharks and rays were landed whole, fully utilised with no finning activities on board of vessels.

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**SAMPLE OF STANDARD FORM**  
**Data Collection Project on Sharks and Rays (SEAFDEC)**

Country		State/Province	
Landing Site		Day/Month/Year	
Name of Enumerator		Record No	

**Vessel Information**

Type of Fishing Gear			
Vessel Name		Registration No	
GRT		No of Crew	

**Trip Information**

Days at Sea		Days at Operation	
Total Number of Operation			

**Fishing Ground Information**

Fishing Zone		Depth (average)	
Distance from port		Distance from coastline	
Longitude		Latitude	

**Gear Information (Select and Check One Gear below)** Trawl Net

Width of Mouth	(m)	Height of Mouth	(m)
Length of Net	(m)	Mesh Size (Cod End)	(cm)
No of Operation/day	(times)	Time of Operation/haul	(hours)
Vessel Speed	(knot)	Fishing Layer	Mid / Bottom

 Gill Net/Drift Net

Length of Net	(m)	Height of Net	(m)
Fishing Layer		Mesh Size	(cm)
No of Operation/day		Time of Operation/haul	(hours)

 Hook and Line / Troll

No of Hooks		Size of Hook	Cm
Time of Operation/day	(hours)	Vessel Speed	(knot)

 Longline

Total No of Hooks		Size of Hook	Cm
Length of Mainline	(km)	Fishing Layer	Mid /Bottom
No of Operation/day	(times)	Time of Operation/set	(hours)

 Purse Seine

Length of Net	(m)	Mesh Size (Bunt)	(cm)
No of Operation/day	(times)	Duration of Operation	(hours)
Fish Searching	Luring / FADs / Wild / Others ( )		

Other gears:
--------------



**A. Standard Operation Procedure:**

1. This form is for a single sampling vessel.
2. Collect all fish (sharks and rays) if catch is less than 50 tails or 10-20% of the landed catch if more than 50 tails. Take samples randomly.
3. Separate them by species and sex.
4. Record Total Length-Weight for all sharks, rays and skates from the Family Pristidae, Rhynchobatidae, Rhinidae, Rhinobatidae, Narcinidae and Narkidae. Measure Disc Length-Weight for other ray species.
5. Measured Pre Caudal Length (PCL) for Alopias spp or other sharks and rays (Rhynchobatidae, Rhinidae, Rhinobatidae) if tail damage or cut.
6. Record total weight of all sharks and rays by species.
7. Record total weight of commercial bony fish and trash fish.

**B. Length-weight of sharks**

No	Species	Sex	TL	Wgt (kg)

**Note:**

All sharks and rays specimens should be measured and weighed if total number are less than 50 tails/boat

If total numbers are more than 50 tails, only 10 – 20% (multi size and sex) should be selected for length – weight measurement.

**C. Actual Weight of Sharks by Species**

No	Species	Weight (Kg)

**C. Length-weight of rays**

No	Species	Sex	DL or DW	Wgt (kg)

**D. Actual Weight of Rays by Species**

No	Species	Weight (Kg)

**3. Total Catch of Sampling Vessel (kg)**



No.	All Sharks	All Rays	Commercial Bony Fish	Trash Fish	TOTAL

### 5. Price of Sharks and Marketing Information (Local Currency)

Species	Price/Kg (Small size)	Price/Kg (Medium size)	Price/Kg (Big size) (Peso)	Market Destination	Utilization

Please record:

Small Size (TL/PCL):           cm ~ cm *ca*

Medium Size (TL/PCL):       cm ~ cm *ca*

Big Size (TL/PCL):           cm ~ cm *ca*

Small Size (kg):               kg ~ kg *ca*

Medium Size (kg):           kg ~ kg *ca*

Big Size (TL/PCL):          kg ~ kg *ca*

### 6. Price of Rays and Marketing Information (Local Currency)

Name of Rays	Price/Kg (Small size)	Price/Kg (Medium size)	Price/Kg (Big size)	Market Destination	Utilization

Please record:

Small Size (DL/TL/PCL):     cm ~ cm *ca*

Medium Size (DL/TL/PCL):   cm ~ cm *ca*

Big Size (DL/TL/PCL):       cm ~ cm *ca*

Small Size (kg):               kg ~ kg *ca*

Medium Size (kg):           kg ~ kg *ca*

Big Size (TL/PCL):          kg ~ kg *ca*

Note: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Checklist of Sharks and Rays Species Recorded During the Study Period

No	Orders/Families	Site 1	Site 2	Site 3	Site 4
<b>Batoids/Rays</b>					
	<b>ORDER MYLIOBATIFORMES</b>	<b>Larut Matang</b>	<b>Manjung Utara</b>	<b>Kota Kinabalu</b>	<b>Sandakan</b>
	<b>Family Dasyatidae</b>				
1	<i>Dasyatis akajei</i>	/	+	+	+
2	<i>Dasyatis thetidis</i>	/	+	+	+
3	<i>Dasyatis fluviorum</i>	+	/	+	+
4	<i>Dasyatis zugei</i>	/	/	/	/
5	<i>Himantura gerrardi</i>	/	/	/	/
6	<i>Himantura cf. gerrardi</i>	/	+	+	+
7	<i>Dasyatis parvonigra</i>			/	
8	<i>Himantura fai</i>	/	/	/	/
9	<i>Himantura jenkinsii</i>	/	/	/	/
10	<i>Himantura pastinacoides</i>	/	/	+	+
11	<i>Himantura uarnak</i>	/	/	/	/
12	<i>Himantura uarnacoides</i>	+	/	/	/
13	<i>Himantura granulata</i>	+	+	+	+
14	<i>Himantura walga</i>	/	/	+	/
15	<i>Himantura undulata</i>	/	+	+	/
16	<i>Himantura leoparda</i>	+	+	/	/
17	<i>Neotrygon kuhlii</i>	/	/	/	/
18	<i>Taeniura lymma</i>	+	+	/	/
19	<i>Pastinachus gracilicaudus</i>	+	+	/	/
20	<i>Taeniurops meyeri</i>	+	/	/	
21	<i>Pastinachus atrus</i>	+	+	+	/
	<b>Family Gymnuridae</b>				
22	<i>Gymnura poecilura</i>	+	/	/	+
23	<i>Gymnura japonica</i>	+	+	/	+
	<b>Family Mobulidae</b>				
24	<i>Mobula thurstoni</i>	+	+	+	/
25	<i>Mobula japonica</i>	+	+	/	+
	<b>Family Rhinopteridae</b>				
26	<i>Rhinoptera jayakari</i>	+	+	/	/
	<b>Family Myliobatidae</b>				
27	<i>Aetobatus ocellatus</i>	+	+	/	/
28	<i>Aetomylaeus vespertilio</i>	+	+	/	+
	<b>ORDER RHINOBATIFORMES</b>				
	<b>Family Rhinobatidae</b>				
29	<i>Rhinobatos cf. borneensis</i>	/	/	+	+
30	<i>Rhinobatos borneensis</i>	+	+	/	/

No	Orders/Families	Site 1	Site 2	Site 3	Site 4
	<b>Family: Rhynchobatidae</b>				
31	<i>Rhynchobatus australiae</i>	/	/	/	/
32	<i>Rhynchobatus laevis</i>	/	+	+	+
	<b>Family Rhinidae</b>				
33	<i>Rhina ancylostoma</i>	+	+	+	/
	<b>ORDER TORPEDINIFORMES</b>				
	<b>Family Torpedinidae</b>				
34	<i>Narcine prodorsalis</i>	+	+	+	+
35	<i>Narcine maculata</i>	/	+	+	+
36	<i>Narcine</i> sp. D	/	+	+	+
37	<i>Narcine</i> sp.	/	+	+	+
	<b>Family Narkidae</b>				
38	<i>Temera hardwickii</i>	/	+	+	+
	<b>Total ray species</b>	<b>19</b>	<b>14</b>	<b>20</b>	<b>19</b>
<b>Sharks</b>					
	<b>ORDER CARCHARHINIFORMES</b>				
	<b>Family: Scyliorhinidae</b>				
1	<i>Atelomycterus marmoratus</i>	/	/	/	/
2	<i>Halaelurus buergeri</i>	+	+	/	+
3	<i>Atelomycterus</i> cf. <i>baliensis</i>	/	+	+	+
4	<i>Atelomycterus</i> cf. <i>erdmanni</i>	/	+	+	+
	<b>Family Carcharhinidae</b>				
5	<i>Carcharhinus leucas</i>	/	+	+	/
6	<i>Carcharhinus sorrah</i>	/	/	/	/
7	<i>Carcharhinus melanopterus</i>	+	+	+	+
8	<i>Carcharhinus limbatus</i>	/	+	+	/
9	<i>Carcharhinus brevipinna</i>	/	+	/	/
10	<i>Rhizoprionodon acutus</i>	+	+	+	/
11	<i>Scoliodon laticaudus</i>	/	+		
12	<i>Carcharhinus sealei</i>	+	+	/	/
13	<i>Galeocerdo cuvier</i>	/	+	+	/
14	<i>Loxodon macrorhinus</i>			/	+
	<b>Family Sphyrnidae</b>				
15	<i>Sphyrna lewini</i>	+	+	/	/
	<b>Family Hemigaleidae</b>				
16	<i>Hemigaleus microstoma</i>	+	+	/	/
17	<i>Hemipristis elongata</i>	+	+	/	/
	<b>Family Triakidae</b>				
18	<i>Mustelus manazo</i>	+	+	/	+
	<b>ORDER ORECTOLOBIFORMES</b>				
	<b>Family: Orectolobidae</b>				
19	<i>Chiloscyllium hasseltii</i>	/	/	+	+

No	Orders/Families	Site 1	Site 2	Site 3	Site 4
20	<i>Chiloscyllium cf. hasseltii</i>	/	+	+	+
21	<i>Chiloscyllium indicum</i>	/	/	+	+
22	<i>Chiloscyllium plagiosum</i>	+		/	/
23	<i>Chiloscyllium punctatum</i>	/	/	/	/
24	<i>Chiloscyllium sp.</i>	/	+	+	+
25	<i>Stegostoma fasciatum</i>	+	/	/	/
26	<i>Orectolobus leptolineatus</i>	+	+	/	+
	<b>ORDER HETERODONTIFORMES</b>				
	<b>Family Heterodontidae</b>				
27	<i>Heterodontus zebra</i>	+	+	/	+
	<b>ORDER SQUATINIFORMES</b>				
	<b>Family Squatinidae</b>	+	+	+	+
28	<i>Squatina tergocellatoides</i>	+	+	/	+
	<b>ORDER LAMNIFORMES</b>				
	<b>Family Alopidae</b>				
29	<i>Alopias pelagicus</i>	+	+	/	+
	<b>Total shark species</b>	14	6	17	14





Photo 1: Malaysia National Workshop on Sharks and Rays Data Collection in Sandakan, Sabah, August 2015.



Photo 2: Monthly Data Collection on Sharks and Rays from August 2015 to August 2016





Photo 3: Training for project enumerators in SEAFDEC, Terengganu, June 2015



Photo 4 (i), (ii) & (iii): 'On-site Training' at Sandakan Fish Market jetty during the National Workshop, August 2015





Photo 5: SAFMA Jetty, main landing site in Kota Kinabalu



Photo 6 (i) & (ii): Kota Kinabalu enumerators in action at SAFMA jetty



Photo 7: Sandakan Fish Market Jetty, main landing site in Sandakan





Photo 8 (i) & (ii): Sandakan enumerators in action at Sandakan Fish Market jetty.



Photo 9: Workshop on Data Validation, 12- 13 April 2016 at FRI Kg. Aceh, Perak

Appendix IV

Range size of small, medium and big by species (in cm). Disc Length for all rays (except for species in family *Rhinobatidae*, *Rhynchobatidae* and *Rhinidae*) and Total Length for all shark species

No.	Species	Perak (Larut Matang)			Sabah (Sandakan)		
		Small	Medium	Big	Small	Medium	Big
	<b>Rays</b>						
	<b>Family Dasyatidae</b>						
1	<i>Dasyatis akajei</i>	< 25	25 – 40	> 40			
2	<i>Dasyatis zugei</i>	< 20	20 - 26	> 26			
3	<i>Himantura gerrardi</i>	< 19	19 - 50	> 50	< 20	20 - 50	> 50
4	<i>Himantura fai</i>				< 20	20 - 50	> 50
5	<i>Himantura jenkinsii</i>				< 20	20 - 50	> 50
6	<i>Himantura pastinacoides</i>	< 25	26 - 45	> 46			
7	<i>Himantura uarnacoides</i>				< 20	20 - 50	> 50
8	<i>Himantura walga</i>	< 18	18 - 20	> 20			
9	<i>Himantura leoparda</i>				< 20	20 - 50	> 50
10	<i>Neotrygon kuhlii</i>	< 14	14 - 21	> 21	< 20	20 - 50	> 50
11	<i>Pastinachus gracilicaudus</i>				< 50	50 - 100	> 100
	<b>Family Rhinopteridae</b>						
12	<i>Rhinoptera jayakari</i>				< 20	20 - 50	> 50
	<b>Family: Rhynchobatidae</b>						
13	<i>Rhynchobatus australiae</i>	< 40	40 - 100	> 100	< 50	50 - 100	> 100
	<b>Family Rhinidae</b>						
14	<i>Rhina ancylostoma</i>				< 50	50 - 100	> 100
	<b>Sharks</b>						
	<b>Family: Scyliorhinidae</b>						
15	<i>Atelomycterus marmoratus</i>	< 32	32 - 44	> 44			
16	<i>Atelomycterus cf. erdmanni</i>	< 32	33 - 49	> 50			
	<b>Family Carcharhinidae</b>						
17	<i>Carcharhinus sorrah</i>				< 50	50 - 100	> 100
18	<i>Carcharhinus limbatus</i>				< 50	50 - 100	> 100
19	<i>Rhizoprionodon acutus</i>				< 50	50 - 100	> 100
	<b>Family Sphyrnidae</b>						
20	<i>Sphyrna lewini</i>				< 50	50 - 00	> 100
	<b>Family Hemigaleidae</b>						
21	<i>Hemigaleus microstoma</i>				< 50	50 - 100	> 100
	<b>Family: Orectolobidae</b>						
22	<i>Chiloscyllium hasseltii</i>	< 35	40 - 50	> 56			
23	<i>Chiloscyllium punctatum</i>	< 35	36 - 55	> 56	< 50	50 - 100	> 100

### Check list of Sharks, rays, skates and chimaeras in Malaysia 2016

Sources of information:

- [1] Yano, K. Ahmad, A., Gambang, A.C., Idris, A.H. Solahuddin, A.R., and Aznan, Z. 2005. Sharks and rays of Malaysia and Brunei Darussalam. SEAFDEC/MFRDMD/SP/12. 557p
- [2] Ahmad, A. and Lim, A.P.K. 2012. Field guide to sharks of the Southeast Asian Region. SEAFDEC/MFRDMD/SP/18. 210p
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- [4] Last, P.R., White, W.T. and Pogonoski, J.J. 2010. Description of new sharks and rays from Borneo. CSIRO Marine and Atmospheric Research Paper No. 032. 165 pp
- [5] Last, P.R., W.T. White, J.N. Cairn, Dharmadi., Fahmi, K. Jensen, Annie, P.K.Lim., B.M. Manjaji-Matsumoto., G.J.P. Nyalor., J.J. Pogonoski., Stevens., J.D. and G.K. Yearsley. 2010. Sharks and rays of Borneo. CSIRO, Australia. 290 pp

Notes

[6]	Species recorded during EU-CITES project and SEAFDEC 2015-2016 Data collection Activities
X <sup>1</sup>	New record for Malaysia (Recorded in Sabah)
X <sup>2</sup>	New record for Malaysia (Recorded in Perak)
X <sup>3</sup>	New record for Malaysia (Recorded in Pahang)
X <sup>4</sup>	New record for Malaysia (Recorded in Sarawak)
X <sup>5</sup>	New record for Malaysia (Recorded in Terengganu)

	SHARKS	[1]	[2]	[3]	[4]	[5]	[6]
	ORDER / Family /Scientific name						
	Common name (English)						
	HEXACHIFORMES						
	COW AND FRILLED SHARKS						
	1.Hexanchidae						
	Sixgill and sevengill sharks						
1	<i>Hexanchus griseus</i> (Bonnaterre, 1788)	X	X				X
	Bluntnose sixgill shark						













63	<i>Rhizoprionodon acutus</i> (Ruppell, 1837)	Milk shark	X	X				X	X
64	<i>Rhizoprionodon oligolinx</i> Springer, 1964	Grey sharpnose shark	X	X				X	X
65	<i>Scoliodon laticaudus</i> Muller & Henle, 1838	Spadenose shark	X						X
66	<i>Scoliodon macrorhynchus</i> (Bleeker, 1852)	Pacific spadenose shark		X				X	X
67	<i>Triaenodon obesus</i> (Ruppell, 1837)	Whitetip reef shark	X	X				X	X
	<b>18. Sphyrnidae</b>	<b>Hammerhead sharks</b>							
68	<i>Eusphyrna blochii</i> (Cuvier, 1817)	Winghead shark	X	X				X	
69	<i>Sphyrna lewini</i> (Griffith & Smith, 1834)	Scalloped hammerhead	X	X				X	X
70	<i>Sphyrna mokarran</i> (Ruppell, 1837)	Great hammerhead	X	X				X	X
	<b>RAYS</b>								
	<b>ORDER / Family /Scientific name</b>	<b>Common name (English)</b>							
	<b>PRISTIFORMES</b>	<b>SAWFISHES</b>							
	<b>1. Pristidae</b>	<b>Sawfishes</b>							
1	<i>Anoxypristis cuspidata</i> (Latham, 1794)	Narrow sawfish					X		X
2	<i>Pristis pristis</i> (Linnaeus, 1758). Identified as <i>Pristis microdon</i> Latham, 1851 in [1]	Freshwater sawfish	X				X		X
3	<i>Pristis zijsron</i> Bleeker, 1851	Green sawfish	X				X		X
	<b>RHINOBATIFORMES</b>	<b>GUITARFISHES</b>							
	<b>2. Rhinidae</b>	<b>Shark ray</b>							
4	<i>Rhina ancylostoma</i> Bloch & Schneider, 1801	Shark ray	X				X		X
	<b>3. Rhynchobatidae</b>	<b>Wedgefishes</b>							
5	<i>Rhynchobatus australiae</i> Whitley, 1939	Whitespotted wedgefish	X				X		X
6	<i>Rhynchobatus laevis</i> (Bloch & Schneider, 1801)	Smoothnose wedgefish					X		X
7	<i>Rhynchobatus springeri</i> Campagno & Last, 2010	Broadnose wedgefish					X	X	X
	<b>4. Rhinobatidae</b>	<b>Shovelnose rays</b>							

8	<i>Glaucostegus thouin</i> (Anonymous, 1798). Identified as <i>Rhinobatus thouin</i> (Anonymous, 1789) in [1]	Clubnose guitarfish	X		X		X		X
9	<i>Glaucostegus typus</i> (Bennett, 1830). Identified as <i>Rhinobatus typus</i> (Bennett, 1830) in [1]	Giant guitarfish	X		X		X		X
10	<i>Rhinobatos borneensis</i> Last, Seret & Naylor, 2016. Identified as <i>Rhinobatos formosensis</i> Norman, 1926 in [1], [3]	Borneo guitarfish	X		X		X		X <sup>1</sup>
11	<i>Rhinobatos cf. borneensis</i> Last, Seret & Naylor, 2016. Identified as <i>Rhinobatos formosensis</i> Norman, 1926 in [1], [3]		X		X		X		X <sup>2</sup>
	<b>TORPEDINIFORMES</b>	<b>ELECTRIC RYAS</b>							
	<b>5. Narcinidae</b>	<b>Numbfishes</b>							
12	<i>Narcine brevibrabiata</i> Bessednov, 1966	Shortlip numbfish			X		X		X
13	<i>Narcine brunnea</i> Annandale, 1909	Brown numbfish	X		X		X		X
14	<i>Narcine lingula</i> Richardson, 1846	Rough numbfish			X		X		
15	<i>Narcine maculata</i> (Shaw, 1804)	Darkfinned numbfish	X		X		X		X
16	<i>Narcine prodorsalis</i> Bessednov, 1966	Tonkin numbfish	X		X		X		
17	<i>Narcine timlei</i> (Bloch & Schneider, 1801). Identified as <i>Narcine indica</i> Henle, 1834 in Ahmad <i>et al</i> (2014)	Blackspotted numbfish	X		X		X		X
18	<i>Narcine</i> sp A	Perak Numbfish (small spot)							X <sup>2</sup>
19	<i>Narcine</i> sp B	Perak Numbfish (large spot)							X <sup>2</sup>
20	<i>Narcine</i> sp C	Perak Numbfish (many spots)							X <sup>2</sup>
	<b>6. Narkidae</b>	<b>Sleeper rays</b>							
21	<i>Narke dipterygia</i> (Bloch & Schneider, 1801)	Spottail sleeper			X		X		X
22	<i>Narke</i> sp	Sarawak sleeper ray							X <sup>4</sup>
23	<i>Temera hardwickii</i> Gray 1831	Finless sleeper ray			X		X		X

	RAJIFORMES	SKATES							
	<b>7. Rajidae</b>	<b>Skates</b>							
24	<i>Dipturus kwangtungensis</i> (Chu, 1960)	K wangtung skate				X			X
25	<i>Dipturus</i> sp	Sarawak skate							X <sup>4</sup>
26	<i>Okamejei cairae</i> Last, Fahmi & Ishihara, 2010	Borneo sand skate				X		X	X
27	<i>Okamejei hollandi</i> (Jordan & Richardson, 1909). Identified as <i>Raja (Okamejei) boesemani</i> Ishihara, 1987 in [1]	Yellowspotted skate				X		X	X
28	<i>Okamejei jenssenae</i> Last & Lim, 2010	Philippine ocellate skate				X		X	X
	<b>8. Anacanthobatidae</b>	<b>Legskate</b>							
29	<i>Sinobatis borneensis</i> (Chan, 1965)	Borneo leg skate				X		X	
	<b>MYLIOBATIFORMES</b>	<b>STINGRAYS</b>							
	<b>9. Plesiobatidae</b>	<b>Stingarees</b>							
30	<i>Plesiobatis daviesi</i> (Wallace, 1967)	Giant stingaree			X	X		X	
	<b>10. Dasyatidae</b>	<b>Stingrays</b>							
31	<i>Dasyatis akajei</i> (Muller & Henle, 1841)	Red stingray			X	X			X
32	<i>Dasyatis</i> cf. <i>acutirostra</i> Nishida & Nakaya, 1988	Pointed snout stingray				X			
33	<i>Dasyatis fluviatorum</i> Ogilby, 1908	Estuary stingray			X	X			
34	<i>Dasyatis microps</i> (Annandale, 1908)	Smalleye stingray			X	X		X	X
35	<i>Dasyatis parvonigra</i> Last & White, 2008	Dwarf black stingray				X		X	X
36	<i>Dasyatis sinensis</i> (Steindachner, 1892)	Chinese stingray				X			
37	<i>Dasyatis thetidis</i> Ogilby, 1899	Thorntail stingray			X	X			X
38	<i>Dasyatis ushiei</i> (Jordan & Hubbs, 1925)	Cow stingray						X	X
39	<i>Dasyatis zugei</i> (Muller & Henle, 1841)	Sharpnose stingray			X	X		X	X
40	<i>Himantura astra</i> Last, Manjaji-Matsumoto & Pogonoski, 2008)	Blackspotted whipray				X			

41	<i>Himantura fai</i> Jordan & Seale, 1906	Pink whipray	X			X		X		X
42	<i>Himantura gerrardi</i> (Gray, 1851)	Whitespotted whipray	X			X		X		X
43	<i>Himantura cf. gerrardi</i>	Whitespotted whipray (whole body)								X
44	<i>Himantura granulata</i> (Macleay, 1883)	Whitespotted mangrove whipray	X			X		X		
45	<i>Himantura imbricata</i> (Bloch & Schneider, 1801)	Scaly whipray	X			X				
46	<i>Himantura jenkinsii</i> (Annandale, 1909)	Jenkin's whipray	X			X		X		X
47	<i>Himantura kittipongi</i> Vidthayanon & Roberts, 2005	Roughback whipray				X		X		X <sup>2</sup>
48	<i>Himantura leoparda</i> Manjaji-Matsumoto & Last, 2008	Leopard whipray				X		X		X
49	<i>Himantura lobistoma</i> Manjaji-Matsumoto & Last, 2006	Tubemouth whipray				X		X		X
50	<i>Himantura pastinacoides</i> (Bleeker, 1852)	Round whipray				X		X		X
51	<i>Himantura polylepis</i> (Bleeker, 1852)	Giant freshwater whipray				X		X		X
52	<i>Himantura signifer</i> Compagno & Robert, 1982	White-edge freshwater whipray	X			X		X		X
53	<i>Himantura cf. signifer</i> Compagno & Robert, 1983	Pahang Yellow-edge freshwater whipray				X		X		X <sup>3</sup>
54	<i>Himantura uarnacoides</i> (Bleeker, 1852)	Whitenose whipray	X			X		X		X
55	<i>Himantura uarnak</i> (Forsskal, 1775)	Reticulate whipray	X			X		X		X
56	<i>Himantura cf. uarnak</i>	Sandakan and Kuantan Reticulate whipray								X <sup>1</sup>
57	<i>Himantura undulata</i> (Bleeker, 1852)	Honeycomb whipray	X			X		X		X
58	<i>Himantura walga</i> (Muller & Henle, 1841)	Dwarf whipray	X			X		X		X
59	<i>Himantura</i> sp. A [Yano, <i>et al.</i> 2005]	Penang whipray	X							
60	<i>Neotrygon cf. annotata</i> Last, 1987	Javanese maskray								X
61	<i>Neotrygon cf. leylandi</i> Last, 1987	Painted maskray				X		X		
62	<i>Neotrygon kuhlii</i> (Muller & Henle, 1841)	Bluespotted stingray	X			X		X		X





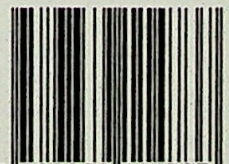
81	<i>Aetomylaeus nichofii</i> (Bloch & Schneider, 1801)	Banded eagle ray	X		X		X		X
82	<i>Aetomylaeus vespertilio</i> (Bleeker, 1852)	Ornate eagle ray	X		X		X		X
	<b>13. Rhinopteridae</b>	<b>Cownose rays</b>							
83	<i>Rhinoptera adpersa</i> Muller & Henle, 1841	Rough cownose ray	X		X				
84	<i>Rhinoptera javanica</i> Muller & Henle, 1841	Javanese cownose ray			X		X		X
85	<i>Rhinoptera jayakari</i> Boulenger, 1895	Short-tail cownose ray			X		X		X
	<b>14. Mobulidae</b>	<b>Devil rays</b>							
86	<i>Manta alfredi</i> (Krefft, 1868)	Alfred manta							X
87	<i>Manta birostris</i> (Walbaum, 1792)	Manta ray	X		X				X
88	<i>Mobula japanica</i> (Muller & Henle, 1841)	Spinetail devil ray					X		X
89	<i>Mobula kuhii</i> (Muller & Henle, 1841)	Shortfin devil ray	X		X				X
90	<i>Mobula thurstoni</i> (Lloyd, 1908)	Sicklefin devil ray	X		X				X
91	<i>Mobula</i> sp	Borneo devil ray			X		X		
	<b>ORDER CHIMAERIFORMES</b>								
	<b>1. 1. Chimaeridae</b>								
1	<i>Chimaera phantasma</i> Jordan & Snyder, 1900	Silver chimaera	X		X				X





SEATDE

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