

Report of Regional Sharks Data Collection 2015 to 2016



Report of Regional Sharks Data Collection 2015 to 2016:
Results from Data Collection in Sharks Project Participating Countries

SEAFDEC Secretariat

PREPARATION AND DISTRIBUTION OF THIS DOCUMENT

Report of Regional Sharks Data Collection 2015-2016 was prepared by the Secretariat of Southeast Asian Fisheries Development Center (SEAFDEC), in collaboration with the SEAFDEC Marine Fisheries Research and Development Department (SEAFDEC/MFRDMD) and SEAFDEC Training Department (SEAFDEC/TD). The document is distributed to the ASEAN-SEAFDEC Member Countries, SEAFDEC Departments and concerned institution.

BIBLIOGRAPHIC CITATION

SEAFDEC. 2017. Report of Regional Sharks Data Collection 2015-2016: Results from Data Collection in the Shark Project Participating Countries. Southeast Asian Fisheries Development Center, Bangkok, Thailand.

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Part I: Summary Report

Part II: National Reports on Sharks Data Collection in the Participating Countries

1. Cambodia
2. Indonesia
3. Malaysia
4. Indonesia
5. Thailand
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PART I

SUMMARY OF THE RESULTS FROM DATA COLLECTION IN THE SHARKS PROJECT PARTICIPATING COUNTRIES

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EXECUTIVE SUMMARY

One-year study on shark data collection had been implemented from 2015 to 2016 in collaboration with six (6) SEAFDEC Member Countries with technical support from SEAFDEC Marine Fisheries Research and Development Department and SEAFDEC Training Department under financial arrangement mainly from CITES Secretariat and Japanese Government. The Standard Operation Procedures for Sharks Data Collection was used as regional standard for collecting and reporting national data. Information on trade and marketing were also included in this study.

From a total of 18,097 tons of fish landed in the participating countries during one-year data collection, it was found that catch composition of rays, sharks, and skates were only 0.9%, 1.4%, and 0.1%, respectively. It was recorded that the landing ranged from 0.6 to 5.15% for rays, 0.2 to 20.7% for sharks, and 0.002 to 0.3% for skates. It should be noted that the landing of skates was recorded only in Myanmar and Viet Nam. A range of landing per month in the participating countries was 448 to 4,254 kg for rays, 364 to 16,445 kg for sharks, and 7 to 1,650 kg for skates, respectively. A total of 33,437 tails of elasmobranches (rays, sharks, and skates) comprising of 18,546 rays, 13,504 sharks, and 1,387 skates were sampled. Total number of species recorded under this study was 70 species of rays, 53 species of sharks, and 5 species of skates. The most abundant species (by number) were *Dasyatis zugei* for ray, *Chiloscyllium punctatum* for shark, and *Okamejei cairae* for skate. The highest landing by weight was *Mobula japonica* (37,573 kg., size range from 32 to 100cm DL) for ray, *Alopias superciliosus* (53,504 kg, size range from 65 to 366cm TL) for shark, and *Okamejei cairae* (17,501 kg, size range 10 to 58cm DL) for skate.

Regarding fishing effort (CPUE, kg/hual), it was reported that CPUE of trawl fishing ranged from 0.002 to 1.46, and 0.003 to 1.023 for rays and sharks, respectively. For gillnet fishing, it was found that CPUE was from 0.008 to 19.5 for rays, and 0.005 to 11.82 for sharks. Regarding longline fishing, CPUE was from 0.04 to 4.87 for rays, and 0.5 to 6.6 for sharks. About skates, it was found that CPUE ranged from 0.01 to 2.3 in case of trawl fishing.

Concerning price and marketing of sharks, rays and skates in the participating countries, it was found that the price ranged from 1 to 7.34 USD/kg for rays, 0.22 to 8.99 USD/kg for sharks, and 0.2 to 2 USD/kg for skates. It is likely that the price varies from species to species depending on species, size, and demand. It was found that most of the landing of sharks, rays, and skates in the participating countries was mainly utilized at local and domestic levels.

INTRODUCTION

Regional attempts have been made by SEAFDEC to assist the ASEAN Member States (AMSs) in improving the system of compiling their national statistics of sharks and rays through strengthening national expertise of the AMSs in identification and compilation of biological data on sharks and rays. Regional activities on sharks in Southeast Asia

emphasized on improvement of data and information collection for commercially exploited aquatic species of sharks, starting from a series of events since 2011. Currently, SEAFDEC has carried out since 2015 a one-year regional project on sharks and rays data collection in six (6) participating countries totally involving 13 landing sites of data collection. The Standard Operating Procedures (SOP) on Sharks Data Collection was developed under the Project to serve as guide and reference for enumerators from the participating countries during the sampling activities on data collection of sharks and rays. This project started with preparation of the SOP, and undertaking activities that include national workshops and training sessions on sharks and rays species identification for enumerators, recording of landing data at species level, validation of data, mid-term evaluation meeting for data collection, and final meeting to review national reports.

PARTICIPATING COUNTRIES AND FINANCIAL SUPPORT

Six (6) SEAFDEC Member Countries, namely Cambodia, Indonesia, Malaysia, Myanmar, Thailand, and Viet Nam, participated in this one-year data collection on sharks. Financial resources for the activities during one-year data collection were mainly from SEAFDEC/EU-CITES (through CITES Secretariat) and Japanese Trust Fund Project through SEAFDEC.

PERIOD, NATIONAL APPOINTED TECHNICAL COORDINATOR AND LOCAL ENUMERATOR, AND METHODOLOGY

One-year data collection at selected landing sites (**Figure 1**) started from July or August 2015 in the participating countries. The data collection activities were completed during the third quarter of 2016. The participating countries collected data by formally appointing local enumerators (**Table 1**) of their respective countries. In order to facilitate data compilation after completion of one-year data collection in the participating countries, the regional standard – “Standard Operation Procedures for Sharks Data Collection (SOP) for Data Collection” developed by SEAFDEC were used in this study. In addition to the landing data, information on marketing (trade and market chain with values) was also collected at the landing sites during the study.

At each landing site, 2 to 4 fishing vessels were selected for one day with total of 5 sampling days a month. Measurement of total length (TL) was taken for all shark, and disc length (DL) for ray species. The length and body weight of shark and ray specimens were individually measured with sampling size of about 10% of the total overall weight of catch of each vessel of that day. The maturity stage for each individual was estimated according to Yano *et al.* (2005), and Ahmad and Annie Lim (2012), total catch of all sharks and rays by species as well as the total catch of other catches (fish, mollusk and crustacean species) were also recorded for each sampling vessel. Pictures of specimens were taken for recording the general taxonomic and biological characteristics. Classification (scientific names) used in this report follows that of Compagno (1999), Tano *et al.* (2005), Ahmad and Annie Lim (2012), Ahmad *et al.* (2013), Ahmad *et al.* (2014), and Ebert *et al.* (2013). Numbers of landing sites for data collection, total number of landing sampled during one-year data collection, and type of

fishing gears sampled are shown in **Table 2**. There are totally 13 landing sites in the participating countries with 4,394 total numbers of landing and 5 types of fishing gears for one-year data collection.

NOTES WHEN MAKING CITATION/REFERRNCE TO THIS REPORT

Due to limitation of period for verifying data submitted from all participating countries within the project period of one-year, this regional report was prepared for submission to EU/CITES Secretariat as terminal report for the project implementation. As planned, the author will carry out data and information correction/verification with that of the national reports when appropriate in the near future.

RESULTS

1. SPECIES COMPOSITION (Table 3)

As shown in **Table 3**, a total of 18,097,240 kg of fish was landed during one-year data collection. Rays, sharks, and skates made up 169,364 kg, 249,259 kg, and 19,811 kg (0.9%, 1.4%, and 0.1%, respectively) from the total landing while landings of other fishes were 17,658,720 kg (97.6%). The highest catch composition of rays and sharks among the participating countries was reported by Indonesia (5.2% and 20.7%, respectively). As reported by the participating countries, the landing ranged from 0.6 to 5.2% for rays, 0.2 to 20.7% for sharks, and 0.002 to 0.3% for skates. It should be noted that the landing of skates was recorded only in Myanmar and Viet Nam.

Table 4 shows the average landings per month. The average landing per month ranged from 448 to 4,254 kg for rays, 364 to 16,445 kg for sharks, and 7 to 1650 kg for skates, respectively. The highest average landing of rays was reported by Malaysia, Indonesia, and Myanmar, and average landing of sharks was Indonesia, Malaysia, and Viet Nam.

2. SAMPLE SIZE

As shown in **Table5a**, **Table5b**, and **Table5c**, a total of 33,437 tails of elasmobranches comprising of 18,546 rays, 13,504 sharks, and 1,387 skates were sampled. For the species that was clearly identified by national and regional shark experts, it was found that those comprised 70 species of rays, 53 species of sharks, and 5 species of skates. The most abundant ray species were *Dasyatis zugei*, followed by *Himantura walga*, and *Neotrygon kuhlii*. The most abundant shark species was *Chiloscyllium punctatum*, followed by *Chiloscyllium hasseltii*, and *Carcharhinus albimarginatus*. The most abundant skates species was *Okameijeji cairae*.

3. WEIGHT AND SIZE RANGE OF SHARKS AND RAYS BY SPECIES

The highest landing by weight of rays was from *Mobula japonica* (37,573 kg., size range from 32 to 100cm DL). The second largest for ray species by weight was *Urogymnus asperrimus* (14,556 kg, size range from 66 to 120cm DL), followed by *Himantura walga* (10,212 kg, size range 11 to 46cm DL). The lowest, considering as rare species, was *Temera hardwickii* (about 1kg, size 12.5cm DL) in this study. See **Table 6a** and **Table 7a** for more information on all landing of rays by weight and size range of each ray species.

For sharks, the highest landing by weight was from *Alopias superciliosus* (53,504 kg, size range from 65 to 366cm TL). *Alopius pelagicus* (51,160 kg, size range 162 to 338cm TL) was the second highest landing by weight, followed by *Prionace glauca* (17,932 kg, size range 142 to 295cm TL). The lowest, considering as rare species, was *Halaelutis buergeri* (1 kg, size range 40 to 45 TL) in this study. See **Table 6b** and **Table 7b** for more information on all landing of sharks by weight and size range of each shark species.

Okamejei cairae (17,501 kg, size range 10 to 58cm DL) was the highest landing by weight among the skates, followed by *Okamejei hollandi* (1,371 kg, size range from 16.5 to 49cm DL) and *Okamejei cf boeseimani* (1,240 kg, size range from 11 to 22.7cm DL). See **Table 6c** and **Table 7c** for more information on all landing of skates by weight and size range of each skate species.

4. FISHING EFFORT AND CPUE (CATCH PER UNIT EFFORT)

Summary of the fishing efforts and CPUE by type of fishing gear in each country shows in **Table 8**. However, it should be noted that in each participating country, fishing efforts and CPUE was compiled depending on the types of fishing gear of their sampling. There are a number of different parameters with regard to calculation of the fishing effort and CPUE for each type of fishing gear in each country where it is not that suitable to compare/compile by the submission of this report. Further data compilation is planned to take place soonest in close consultation among experts and countries' representatives.

The results indicate that CPUE (kg/haul or kg/operation) of trawl fishing for rays and sharks ranged from 0.002 to 1.46, and 0.003 to 1.023, respectively. For gillnet fishing, it was found that CPUE was from 0.008 to 19.5 for rays, and 0.005 to 11.82 for sharks. Regarding longline fishing operation, CPUE was from 0.04 to 4.87 for rays, and 0.5 to 6.6 for sharks. About skates, it was found that CPUE ranged from 0.01 to 2.3 in case of trawl fishing.

5. USAGE AND MARKETING

Table 9 shows price and marketing of sharks, rays and skates in the participating countries. Range of prices was from 1 to 7.34 USD/kg for rays, 0.22 to 8.99 USD/kg for sharks, and 0.2 to 2 USD/kg for skates. The price varies from species to species. It was found that most of the landing of sharks, rays, and skates in the participating countries was utilized at local and domestic levels.

CONCLUSION AND WAY FORWARD

The updated information was made by this study since the conduct of regional study by SAFDEC/MFRDMD in 2003. Results from this study could be used as a basis for future planning for the conduct of stock assessment study in Southeast Asian region. Even though, all project participating countries were able to submit the results of their respective one-year data collection based on timeframe of the project. However, since some data need completion and validation, the corrected data would be reported later. It was recommended in the process of project implementation that capacity building program/activity for SEAFDEC Member Countries should be continued. In addition, with regard to development of appropriate management and conservation plans for utilization of sharks in the Southeast Asian region, more complete information on CPUE and stock of shark resources should be available.

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Table 1 List of Nominated Local Enumerators for Data Collection in This Study

Countries	Contact Address
Cambodia	<p><u>Study site:</u> Phreah Sihanouk Province Mr. Ly Seyha Acting Chief of Aquaculture Technology Feed and Water Quality Group 12, Village 3, Sangkat 1, Preah Sihanouk town, Preah Sihanouk Province. CAMBIDIA Tel: +85577767763 Email: sharkandraycambodia@gmail.com</p>
Indonesia	<p><u>Study site:</u> Cilacap Mr. Agung Ferieigha Nugroho Pelabuhan Perikanan Samudera Cilacap Jl. Lingkar Pantai Teluk Penyus, Cilacap-Central Java, INDONESIA</p> <p><u>Study site:</u> Aceh Mr. Munawir Pelabuhan Perikanan Nusantara Lampulo Jl. Ateuk Jawo Lr. Tanggul Gampong Ateuk Jawo B. Aceh, INDONESIA</p>
Malaysia	<p><u>Study site:</u> 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, MALAYSIA Tel: +6 058075311 Email: abd.rahman0865@gmail.com</p> <p><u>Study site:</u> Manjung Utara, Perak Mr. Mahazir bin Baharom Pejabat Perikanan Daerah Manjung Utara Jalan Damar Laut 34900 Pantai Remis Perak Darul Ridzuan, MALAYSIA Tel: +6 056772224 Email: mahazirbaharom@yahoo.com</p> <p><u>Study site:</u> Kota Kinabalu, Sabah Mr. Justin Agon Senior Assistant Fisheries Officer Department of Fisheries Sabah, Jalan Haji Saman 88000 Kota Kinabalu, MALAYSIA Tel No.+6 088 262359 Email: justin.agon@sabah.gov.my</p> <p>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</p> <p><u>Study site:</u> Sandakan, Sabah</p>

	<p>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</p> <p>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</p>
Myanmar	<p><u>Study site: Yangon</u> Mr. Min Naung Director, Ayawaddy Division No.312 North Okalar Pa Township, Rose Road. Yangon Division, MYANMAR Tel: +959044224257</p> <p>Mr. Soe Win Deputy Officer, Nay Pyi Taw No. 39/201, Aung Zaya Housing, Main Road. Insein Township, Yangon Division. MYANMAR Tel: +959450016019 Email. soewin67@gmail.com</p> <p>Mr. Kyaw Swar Win Assistant Officer, Yangon Division No.33, Bank Road, Kyawktatar Township, DoF Apartment. Yangon Division. MYANMAR Tel. +959798571391</p> <p><u>Study site: Mawlamyine</u> Mr. Soe Nyunt Deputy Director, Mon State DoF Housing, Theingone Road, Mawlamyine. Mon State. MYANMAR Tel: +959450003916</p> <p>Mr. Nay Myo Aye Deputy Officer, Ye Township No.104, Bogyoke Road, Yangyiaung Quarter, Ye Township, Mon State. MYANMAR Tel: +959782244128 Email. naymyo.marine@gmail.com</p>

Thailand	<p><u>Study site:</u> Ranong province</p> <p>Mr. Montri Sumontha Fishery Biologist, Professional Level Ranong Marine Fisheries Station 157 Paknam Subdistrict, Muang District, Ranong 85000, THAILAND Telephone: +66870241486 Email: montri.sumontha@gmail.com</p> <p>Mr. Watchira Sodop Fishery Biologist Ranong Marine Fisheries Station 157 Paknam Subdistrict, Muang District, Ranong 85000, THAILAND Telephone: +66621613900 Email: wach623@gmail.com</p> <p><u>Study site:</u> Songkhla</p> <p>Ms. Suwantana Tossapornpitakkul Fishery Biologist, Professional Level Southern Marine Fisheries Research and Development Center 79/1 Wichianchom Rd., Muang District, Songkhla 90000, THAILAND Telephone: +66896551817 Email: tsuwantana@yahoo.com</p> <p>Ms. Jureerat Songnui Fishery Officer, Professional Level Southern Marine Fisheries Research and Development Center 79/1 Wichianchom Rd., Muang District, Songkhla, THAILAND 90000 Telephone: +66890178485 Email: juju_songnui@yahoo.com</p>
Viet Nam	<p><u>Study sites:</u> Ba Ria (in Vung Tau), and Binh Tuan Province</p> <p>Mr. Bui Quang Manh: Marine Biodiversity Researcher Mr. Cao Van Hung: Taxonomist as Researcher Mr. Nguyen Xuan Toan: Marine Aquaculture Researcher Mr. Dinh Xuan Hung: Fishing Oceanography Technologist Mr. Nguyen Phuoc Trieu: Taxonomist as Researcher</p>

Table 2 Total Numbers of Landing Site, Samples with Its Total Weight, and Fishing Gears Surveyed during in the Participating Countries during One Year Data Collection

Countries	No. of Landing Site in the Country	Total No. of Landings Sampled for One Year	Fishing Gears Sampled				
			Trawl	Gillnet	Purse Seine	Longline	Handline
Cambodia	1	179	•				
Indonesia	2	2,524		•	•	•	•
Malaysia	4	1,053	•	•	•		
Myanmar	2	197	•	•			
Thailand	2	185	•	•		•	
Viet Nam	2	256	•	•		•	
Total	13	4,394					

Table 3 Sharks and Rays Species Composition

Countries	Sub-total (kg)	Rays		Sharks		Skates		Other Fishes	
		kg for 1 year	%	kg for 1 year	%	kg for 1 year	%	kg for 1 year	%
Cambodia	912,301.9	5,379.57	0.590	8,527.43	0.935			898,394.94	98.476
Indonesia	950,279.5	48,957.79	5.152	197,336.27	20.766			703,985.40	74.082
Malaysia	4,563,662.4	51,049.90	1.119	15,482.90	0.339			4,497,129.60	98.542
Myanmar	3,740,112.2	41,899.00	1.120	9,576.50	0.256	84.50	0.002	3,688,552.20	98.621
Thailand	2,231,730.1	7,131.90	0.320	4,359.50	0.195			2,220,238.70	99.485
Viet Nam	5,699,154.2	14,945.90	0.262	13,976.80	0.245	19,811.50	0.348	5,650,420.00	99.145
Grand Total	18,097,240.3	169,364.06	0.936	249,259.40	1.377	19,896.00	0.110	17,658,720.84	97.577

Table 4 Average Catch per Month of Sharks, Rays, Skates, and Other Fishes by Countries

Countries	Average Catch (kg) per Month			
	Rays	Sharks	Skates	Other Fishes
Cambodia	448.00	711.00		74,866.00
Indonesia	4,079.82	16,444.69		58,665.00
Malaysia	4,254.16	1,290.24		374,760.80
Myanmar	3,491.58	798.04	7.04	307,379.35
Thailand	594.00	364.00		185,020.00
Viet Nam	1,245.49	1,164.73	1,650.96	470,868.33

Table 5a Sample Size of Rays by Species

	Species	Cambodia	Indonesia	Malaysia	Myanmar	Thailand	Viet Nam	Total
1	<i>Aetobatus flagellum</i>				2			2
2	<i>Aetobatus ocellatus</i>	15	5			3	1	24
3	<i>Aetobatus narinari</i>				4			4
4	<i>Aetomylaeus maculatus</i>						3	3
5	<i>Dasyatis akajei</i>		1	59		62		122
6	<i>Dasyatis cf sinensis</i>						3	3
7	<i>Dasyatis fluviorum</i>			13			7	20
8	<i>Dasyatis microps</i>				3			3
9	<i>Dasyatis parvonigra</i>	132					11	143
10	<i>Dasyatis thetidis</i>			1		3		4
11	<i>Dasyatis sinensis</i>				4		10	14
12	<i>Dasyatis sp</i>						10	10
13	<i>Dasyatis zugei</i>	190	1	1,344		4,463	14	6,012
14	<i>Dipturus johannisdavisi</i>						1	1
15	<i>Dipturus sp.1</i>		1					1
16	<i>Dipturus sp.2</i>		1					1
17	<i>Glaucostegus sp</i>				4			4
18	<i>Glaucostegus typus</i>				26			26
19	<i>Gymnura japonica</i>				62	2	9	73
20	<i>Gymnura poecilura</i>			21	5		5	31
21	<i>Gymnura zonura</i>		2					2
22	<i>Himantura cf gerrardi</i>			1				1
23	<i>Himantura cf javaensis</i>				3		1	4
24	<i>Himantura fai</i>		1	11	4			16
25	<i>Himantura gerrardi</i>			1,905	36	32		1,973

26	<i>Himantura granulata</i>		1					1
27	<i>Himantura imbricata</i>	211			4	1	132	348
28	<i>Himantura jenkinsii</i>		50	12	28	5	8	103
29	<i>Himantura leoparda</i>				19			19
30	<i>Himantura lobistoma</i>				8			8
31	<i>Himantura pastinacoides</i>			89	44			133
32	<i>Himantura uarnacoides</i>			2	43	3		48
33	<i>Himantura uarnak</i>		1	3	5			9
34	<i>Humantura undulata</i>		4	4	27		1	36
35	<i>Himantura walga</i>	404	2	1,730	413	1,698	194	4,441
36	<i>Mobula japonica</i>		311		26		3	340
37	<i>Mobula kuhlii</i>		3		1			4
38	<i>Mobula tarapacana</i>		19					19
39	<i>Mobula sp</i>						1	1
40	<i>Mobula thurstoni</i>		44				24	68
41	<i>Myliobatis tobijei</i>						1	1
42	<i>Narcine brevilabiata</i>				11		3	14
43	<i>Narcine brunnea</i>				60		5	65
44	<i>Narcine cf indica</i>						1	1
45	<i>Narcine indica</i>						39	39
46	<i>Narcine lingula</i>				10			10
47	<i>Narcine maculata</i>			2				2
48	<i>Nacine sp</i>			12			3	15
49	<i>Nacine sp D</i>			6				6
50	<i>Nacine timlei</i>						2	2
51	<i>Narke diperygia</i>						4	4
52	<i>Narke japonica</i>						1	1

53	<i>Neotrygon kuhlii</i>		3	1,979	92	419	14	2,507
54	<i>Neotrygon</i> sp						3	3
55	<i>Pastinachus atrus</i>		1					1
56	<i>Pastinachus</i> cf <i>solocirostris</i>				1			1
57	<i>Pastinachus gracilicaudus</i>				2			2
58	<i>Pastinachus solocirostris</i>		2					2
59	<i>Pastinachus stellurostris</i>				2			2
60	<i>Platyrhina sinensis</i>						14	14
61	<i>Platyrhina tangi</i>						18	18
62	<i>Plesiobatis daviesi</i>		1		1	1	6	9
63	<i>Pteroplatytrygon violacea</i>		2					2
64	<i>Rhina ancylostoma</i>		1		41			42
65	<i>Rhinobatos</i> cf <i>borneensis</i>			10				10
66	<i>Rhinobatos</i> cf <i>formosensis</i>				396			396
67	<i>Rhinobatos formosensis</i>					549	34	583
68	<i>Rhinobatos penggali</i>		67					67
69	<i>Rhinobatos punctifer</i>				287			287
70	<i>Rhinobatos</i> sp						2	2
71	<i>Rhinoptera adspersa</i>				1			1
72	<i>Rhinoptera javanica</i>		1		43			44
73	<i>Rhinoptera jayakari</i>		1		35			36
74	<i>Rhynchobatus australiae</i>		22	162	3	26	6	219
75	<i>Rhynchobatus laevis</i>			3				3
76	<i>Rhynchobatus palpebratus</i>						8	8
77	<i>Taeniura lymma</i>	5	12				4	21
78	<i>Taeniurops meyeri</i>		8	1	4	2		15
79	<i>Temera hardwickii</i>			1				1

80	<i>Urolophus aurantiacus</i>						4	4
81	<i>Urogymnus asperrimus</i>		2		8		1	11
	Total of Rays	957	570	7371	1768	7269	611	18,546

Table 5b Sample Size of Sharks by Species

	Species	Cambodia	Indonesia	Malaysia	Myanmar	Thailand	Viet Nam	Total
1	<i>Alopias pelagicus</i>		671				3	674
2	<i>Alopias superciliosus</i>		720				1	721
3	<i>Atelomycterus cf baliensis</i>			26				26
4	<i>Atelomycterus cf erdmanni</i>			145				145
5	<i>Atelomycterus marmoratus</i>	176		615		362	32	1,185
6	<i>Carcharhinus albimarginatus</i>		5					5
7	<i>Carcharhinus amblyrhynchos</i>		49			1	5	55
8	<i>Carcharhinus amblychoides</i>				5			5
9	<i>Carcharhinus brevipinna</i>		55	10	12			77
10	<i>Carcharhinus cf faciformis</i>						1	1
11	<i>Carcharhinus dussumieri</i>						5	5
12	<i>Carcharhinus faciformis</i>		315					315
13	<i>Carcharhinus leucas</i>	5	14	3	114	1		137
14	<i>Carcharhinus limbatus</i>			1	1		24	26
15	<i>Carcharhinus longimanus</i>		2					2
16	<i>Carcharhinus macloti</i>				35			35
17	<i>Carcharhinus plumbeus</i>		81					81
18	<i>Carcharhinus melanopterus</i>	10	13		1	14		38
19	<i>Carcharhinus sorrah</i>	18	33	310	12	47	239	659
20	<i>Carcharhinus sp</i>						1	1
21	<i>Centrophorus cf lusitanicus</i>		4					4
22	<i>Centrophorus moluccensis</i>		47				1	48
23	<i>Cephaloscyllium ciruopullum</i>						5	5
24	<i>Cephaloscyllium pictum</i>		1					1
25	<i>Chiloscyllium plagiosum</i>						16	16
26	<i>Chiloscyllium punctatum</i>						160	160
27	<i>Chiloscyllium cf hasseltii</i>			2				2
28	<i>Chiloscyllium cf punctatum</i>						1	1

29	<i>Chiloscyllium griseum</i>					51		51
30	<i>Chiloscyllium hasseltii</i>			1,823	18	95		1,936
31	<i>Chiloscyllium indicum</i>			22				22
32	<i>Chiloscyllium plagiosum</i>					1	6	7
33	<i>Chiloscyllium punctatum</i>	710	16	1,506	4	2,584		4,820
34	<i>Chiloscyllium sp</i>			1			1	2
35	<i>Galeocerdo cuvier</i>		37	2	11	4	13	67
36	<i>Galeus sp</i>						1	1
37	<i>Halaaelutus buergeri</i>						2	2
38	<i>Hemigaleus microstoma</i>		16		14	1	14	45
39	<i>Hemipristis elongata</i>				19			19
40	<i>Hepranchias perlo</i>		24			1	1	26
41	<i>Hexanchun cf griseum</i>						1	1
42	<i>Isurus oxyrinchus</i>		153					153
43	<i>Isurus paucus</i>		196					196
44	<i>Loxodon macrohinus</i>		28		71			99
45	<i>Mustelus manazo</i>						1	1
46	<i>Mustelus mosis</i>				48			48
47	<i>Mustelus sp</i>				134			134
48	<i>Orectolobus leptolineatus</i>		2					2
49	<i>Prionace glauca</i>		295					295
50	<i>Pseudocarcharias kamoharai</i>		7					7
51	<i>Psudotriakis microdon</i>		2					2
52	<i>Rhincodon typus</i>		1					1
53	<i>Rhizoprionodon acutus</i>				30			30
54	<i>Scoliodon laticaudus</i>			1	499			500
55	<i>Sphyrna lewini</i>		69		472	1		542
56	<i>Sphyrna mokkaran</i>				1		3	4
57	<i>Squalus edmundsi</i>		6					6
58	<i>Squalus megalops</i>		25				3	28

59	<i>Squatina</i> sp						12	12
60	<i>Squatina tergocellatoides</i>						1	1
61	<i>Stegostoma fasciatum</i>			1				1
62	<i>Trigenodon obesus</i>		10				3	13
	<i>Total of Sharks</i>	919	2,897	4,468	1,501	3,163	556	13,504

Table 5c Sample Size of Skates by Species

	Species	Cambodia	Indonesia	Malaysia	Myanmar	Thailand	Viet Nam	Total
1	<i>Okameijeji cairae</i>						1,284	1,284
2	<i>Okameijeji cf boeseimani</i>						56	56
3	<i>Okameijeji hollandi</i>						32	32
4	<i>Okameijeji jensenae</i>				13			13
5	<i>Okameijeji sp.</i>				2			2
	Total of Skates				15		1,372	1,387

Table 6a Weight of Rays by Species

No.	Species	Cambodia	Indonesia	Malaysia	Myanmar	Thailand	Viet Nam	Total
1	<i>Aetobatus flagellum</i>				37			37
2	<i>Aetobatus ocellatus</i>	239	37			76	5	357
3	<i>Aetobatus narinari</i>				34			34
4	<i>Aetomylaeus maculates</i>						84	84
5	<i>Dasyatis akajei</i>		4	341		209		554
6	<i>Dasyatis cf sinensis</i>						18	18
7	<i>Dasyatis fluviorum</i>			70			179	249
8	<i>Dasyatis microps</i>				352			352
9	<i>Dasyatis parvonigra</i>	913					154	1,067
10	<i>Dasyatis thetidis</i>			81		150		231
11	<i>Dasyatis sinensis</i>				31		143	174
12	<i>Dasyatis sp</i>						96	96
13	<i>Dasyatis zugei</i>	1,059	0	972		3,157	193	5,381
14	<i>Dipturus johannisdavisi</i>						50	50
15	<i>Dipturus sp.1</i>		3					3
16	<i>Dipturus sp.2</i>		5					5
17	<i>Glaucostegus sp</i>				15			15
18	<i>Glaucostegus typus</i>				378			378
19	<i>Gymnura japonica</i>				2,102	3	16	2,121
20	<i>Gymnura poecilura</i>			39	28		196	263
21	<i>Gymnura zonura</i>		6					6
22	<i>Himantura cf gerrardi</i>			19				19
23	<i>Himantura cf javaensis</i>				37		10	47
24	<i>Himantura fai</i>		86	2,250	54			2,390
25	<i>Himantura gerrardi</i>			10,839	343	63		11,245
26	<i>Himantura granulate</i>		5					5
27	<i>Himantura imbricate</i>	1,248			74	0.2	1,497	2,819
28	<i>Himantura jenkinsii</i>		1,503	998	1,111	44	1,610	5,266

29	<i>Himantura leopard</i>				1,339			1,339
30	<i>Himantura lobistoma</i>				141			141
31	<i>Himantura pastinacoides</i>			1,594	366			1,960
32	<i>Himantura uarnacoides</i>			12	1,954	92		2,058
33	<i>Himantura uarnak</i>		40	212	980			1,232
34	<i>Humantura undulate</i>		253	93	2,415		9	2,770
35	<i>Himantura walga</i>	1,906	9	1,565	3,563	1,076	2,093	10,212
36	<i>Mobula japonica</i>		37,175		218		180	37,573
37	<i>Mobula kuhlii</i>		38		45			83
38	<i>Mobula tarapacana</i>		3,280					3,280
39	<i>Mobula sp</i>						600	600
40	<i>Mobula thurstoni</i>		3,501				3,589	7,090
41	<i>Myliobatis tobijei</i>						52	52
42	<i>Narcine brevilabiata</i>				100		24	124
43	<i>Narcine brunnea</i>				4		65	69
44	<i>Narcine cf indica</i>						21	21
45	<i>Narcine indica</i>						323	323
46	<i>Narcine lingual</i>				99			99
47	<i>Narcine maculate</i>			1				1
48	<i>Nacine sp</i>			8			29	37
49	<i>Nacine sp D</i>			5				5
50	<i>Nacine timlei</i>						59	59
51	<i>Narke diperygia</i>						5	5
52	<i>Narke japonica</i>						22	22
53	<i>Neotrygon kuhlii</i>		523	7,713	391	692	269	9,588
54	<i>Neotrygon sp</i>						1	1
55	<i>Pastinachus atrus</i>		30					30
56	<i>Pastinachus cf solocirostris</i>				3			3
57	<i>Pastinachus gracilicaudus</i>				44			44
58	<i>Pastinachus solocirostris</i>		8					8

59	<i>Pastinachus stellurostris</i>				30			30
60	<i>Platyrhina sinensis</i>						509	509
61	<i>Platyrhina tangi</i>						243	243
62	<i>Plesiobatis daviesi</i>		8		3	11	541	563
63	<i>Pteroplatytrygon violacea</i>		7					7
64	<i>Rhina ancylostoma</i>		40		585			625
65	<i>Rhinobatos cf borneensis</i>			16				16
66	<i>Rhinobatos cf formosensis</i>				5,930			5,930
67	<i>Rhinobatos formosensis</i>					1,366	400	1,766
68	<i>Rhinobatos penggali</i>		306					306
69	<i>Rhinobatos punctifer</i>				2,529			2,529
70	<i>Rhinobatos sp</i>						62	62
71	<i>Rhinoptera adspersa</i>				2			2
72	<i>Rhinoptera javanica</i>		3		1,082			1,085
73	<i>Rhinoptera jayakari</i>		12		838			850
74	<i>Rhynchobatus australiae</i>		406	467	38	73	304	1,288
75	<i>Rhynchobatus laevis</i>			5				5
76	<i>Rhynchobatus palpebratus</i>						64	64
77	<i>Taeniura lymma</i>	15	45				98	158
78	<i>Taeniurops meyeri</i>		142	119	215	120		596
79	<i>Temera hardwickii</i>			0.1				0
80	<i>Urolophus aurantiacus</i>						40	40
81	<i>Urogymnus asperrimus</i>		45		14,502		9	14,556
	Total of Rays	5,380	47,520	27419.1	42012	7132.2	13862	143,325

Table 6b Weight of Sharks by Species

No.	Species	Cambodia	Indonesia	Malaysia	Myanmar	Thailand	Viet Nam	Total
1	<i>Alopias pelagicus</i>		50,945				215	51,160
2	<i>Alopias superciliosus</i>		53,332				172	53,504
3	<i>Atelomycterus cf baliensis</i>			14				14
4	<i>Atelomycterus cf erdmanni</i>			77				77
5	<i>Atelomycterus marmoratus</i>	879		389		216	93	1,577
6	<i>Carcharhinus albimarginatus</i>		170					170
7	<i>Carcharhinus amblyrhynchos</i>		771			7	124	902
8	<i>Carcharhinus amblychoides</i>				19			19
9	<i>Carcharhinus brevipinna</i>		7,630	27	40			7,697
10	<i>Carcharhinus cf faciformis</i>						110	110
11	<i>Carcharhinus dussumieri</i>						34	34
12	<i>Carcharhinus faciformis</i>		14,818					14,818
13	<i>Carcharhinus leucas</i>	66	1,161	38	423	50		1,738
14	<i>Carcharhinus limbatus</i>			1	2		673	676
15	<i>Carcharhinus longimanus</i>		46					46
16	<i>Carcharhinus macloti</i>				127			127
17	<i>Carcharhinus plumbeus</i>		13,013					13,013
18	<i>Carcharhinus melanopterus</i>	64	44		3	63		174
19	<i>Carcharhinus sorrah</i>	237	496	1,172	98	88	10,867	12,958
20	<i>Carcharhinus sp</i>						10	10
21	<i>Centrophorus cf lusitanicus</i>		98					98
22	<i>Centrophorus moluccensis</i>		1,231				5	1,236
23	<i>Cephaloscyllium cirrupullum</i>						30	30
24	<i>Cephaloscyllium pictum</i>		4					4

25	<i>Chiloscyllium plagiosum</i>						42	42
26	<i>Chiloscyllium punctatum</i>						864	864
27	<i>Chiloscyllium cf hasseltii</i>			2				2
28	<i>Chiloscyllium cf punctatum</i>						5	5
29	<i>Chiloscyllium griseum</i>					93		93
30	<i>Chiloscyllium hasseltii</i>			3,293	37	74		3,404
31	<i>Chiloscyllium indicum</i>			8				8
32	<i>Chiloscyllium plagiosum</i>					2		2
33	<i>Chiloscyllium punctatum</i>	7,282	68	2,870	3	3,683		13,906
34	<i>Chiloscyllium sp</i>			0.4				0
35	<i>Galeocerdo cuvier</i>		3,376	33	85	91	56	3,641
36	<i>Galeus sp</i>						300	300
37	<i>Halaelutis buergeri</i>						1	1
38	<i>Hemigaleus microstoma</i>		75		11	0.4	62	148
39	<i>Hemipristis elongata</i>				37			37
40	<i>Heptranchias perlo</i>		991			1	6	998
41	<i>Hexanchun cf griseus</i>						15	15
42	<i>Isurus oxyrinchus</i>		13,999					13,999
43	<i>Isurus paucus</i>		11,539					11,539
44	<i>Loxodon macrohinus</i>		227		357			584
45	<i>Mustelus manazo</i>						7	7
46	<i>Mustelus mosis</i>				1,572			1,572
47	<i>Mustelus sp</i>				837			837
48	<i>Orectolobus leptolineatus</i>		10					10
49	<i>Prionace glauca</i>		17,932					17,932
50	<i>Pseudocarcharias kamoharai</i>		9					9

51	<i>Pseudotriakis microdon</i>		70					70
52	<i>Rhincodon typus</i>		30					30
53	<i>Rhizoprionodon acutus</i>				97			97
54	<i>Scoliodon laticaudus</i>			0.3	3,000			3,000
55	<i>Sphyrna lewini</i>		7,155		2,837	1		9,993
56	<i>Sphyrna mokkaran</i>				1		80	81
57	<i>Squalus edmundsi</i>		22					22
58	<i>Squalus megalops</i>		296				43	339
59	<i>Squatina</i> sp						78	78
60	<i>Squatina tergocellatoides</i>						2	2
61	<i>Stegostoma fasciatum</i>			17				17
62	<i>Trigenodon obesus</i>		109				82	191
	Total of Sharks	8,528	199,667	7,942	9,586	4,369	13,976	244,068

Table 6c Weight of Skates by Species

No.	Species	Cambodia	Indonesia	Malaysia	Myanmar	Thailand	Viet Nam	Total
1	<i>Okameijeji cairae</i>						17,501	17,501
2	<i>Okameijeji cf boeseimani</i>						1,240	1,240
3	<i>Okameijeji hollandi</i>						1,371	1,371
4	<i>Okameijeji jensenae</i>				45			0
5	<i>Okameijeji sp.</i>				22			0
	Total of Skates				67		20,112	20,179

Table 7a Size Range of Rays (Disc Length – DL, cm)

No.	Species of Rays	Cambodia		Indonesia		Malaysia		Myanmar		Thailand		Viet Nam	
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
1	<i>Aetobatus flagellum</i>							93.0	105.0				
2	<i>Aetobatus ocellatus</i>	14.0	100.0	25.0	47.0					62.0	62.0		
3	<i>Aetobatus narinari</i>							110.0	113.0				
4	<i>Aetomylaeus maculates</i>											34.5	193.0
5	<i>Dasyatis akajei</i>			37.0	37.0	21.0	63.0			12.4	60.4		
6	<i>Dasyatis cf sinensis</i>												
7	<i>Dasyatis fluviorum</i>					24.0	73.0						
8	<i>Dasyatis microps</i>							124.0	145.0				
9	<i>Dasyatis parvonigra</i>	12.0	42.0										
10	<i>Dasyatis thetidis</i>					120.0	120.0						
11	<i>Dasyatis sinensis</i>							21.0	22.0			18.5	19.0
12	<i>Dasyatis sp</i>											31.0	40.0
13	<i>Dasyatis zugei</i>	13.0	29.0	10.0	10.0	11.0	34.0			6.0	32.2	16.0	29.0
14	<i>Dipturus sp.1</i>			50.0	50.0								
15	<i>Dipturus sp.2</i>			73.0	73.0								
16	<i>Glaucostegus sp</i>												
17	<i>Glaucostegus typus</i>							35.0	250.0				
18	<i>Gymnura japonica</i>							11.0	54.0	37.0	37.0		
19	<i>Gymnura poecilura</i>					11.5	41.0	14.0	16.0				
20	<i>Gymnura zonura</i>			25.0	40.0								
21	<i>Himantura cf gerrardi</i>					75.0	75.0						
22	<i>Himantura cf javaensis</i>							34.0	65.0				
23	<i>Himantura fai</i>			124.0	124.0	57.0	135.0	65.0	94.0				
24	<i>Himantura gerrardi</i>					14.0	104.0	19.0	108.0	18.0	73.5		
25	<i>Himantura granulata</i>			43.0	43.0								
26	<i>Himantura imbricata</i>	13.0	30.0					20.0	20.0	16.5	16.5	0.7	39.0
27	<i>Himantura jenkinsii</i>			29.0	147.0	26.5	96.0	50.0	95.0	41.5	77.0		
28	<i>Himantura leoparda</i>							51.0	113.0				

60	<i>Platyrrhina tangi</i>											36.0	55.0
61	<i>Plesiobatis daviesi</i>			72.0	72.0			42.0	42.0	78.0	78.0	58.0	116.0
62	<i>Pteroplatytrygon violacea</i>			56.0	61.0								
63	<i>Rhina ancylostoma</i>							58.0	175.0				
64	<i>Rhinobatos cf borneensis</i>					60.0	89.0						
65	<i>Rhinobatos cf formosensis</i>							20.0	89.0				
66	<i>Rhinobatos formosensis</i>									25.0	106.0	31.5	93.0
67	<i>Rhinobatos penggali</i>			46.0	96.0								
68	<i>Rhinobatos punctifer</i>							27.0	110.0				
69	<i>Rhinobatos sp</i>											40.0	40.5
70	<i>Rhinoptera adspersa</i>							33.0	33.0				
71	<i>Rhinoptera javanica</i>			38.0	38.0			23.0	77.0				
72	<i>Rhinoptera jayakari</i>			42.0	42.0			23.0	91.0				
73	<i>Rhynchobatus australiae</i>					29.5	174.0	52.0	53.0	50.0	182.0	102.0	248.0
74	<i>Rhynchobatus laevis</i>					48.0	84.0						
75	<i>Rhynchobatus palpebratus</i>											130.0	152.0
76	<i>Taeniura lymma</i>	72.0	12.0	24.0	37.0								
77	<i>Taeniurops meyeri</i>			50.0	107.0	117.0	117.0	90.0	140.0				
78	<i>Temera hardwickii</i>					12.5	12.5						
79	<i>Urolophus aurantiacus</i>											19.0	24.0
80	<i>Urogymnus asperrimus</i>			68.0	120.0			66.0	82.0				

Table 7b Size Range of Sharks (Total Length – TL, cm)

No.	Species of Sharks	Cambodia		Indonesia		Malaysia		Myanmar		Thailand		Viet Nam	
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
1	<i>Alopias pelagicus</i>			162.0	338.0							220.0	366.0
2	<i>Alopias superciliosus</i>			65.0	438.0							366.0	366.0
3	<i>Atelomycterus cf baliensis</i>					43.0	54.0						
4	<i>Atelomycterus cf erdmanni</i>					34.0	57.0						
5	<i>Atelomycterus marmoratus</i>	32.0	66.0			30.0	67.0			19.8	61.4	23.0	55.5
6	<i>Carcharhinus albimarginatus</i>												
7	<i>Carcharhinus amblyrhynchos</i>			62.0	166.0					96.0	96.0	90.0	100.0
8	<i>Carcharhinus amblyrhynchoides</i>							73.0	86.0				
9	<i>Carcharhinus brevipinna</i>			134.0	303.0	74.5	89.0	57.0	132.0				
10	<i>Carcharhinus cf faciformis</i>											305.0	305.0
11	<i>Carcharhinus dussumieri</i>											76.5	120.0
12	<i>Carcharhinus faciformis</i>			72.0	237.0								
13	<i>Carcharhinus leucas</i>	71.0	77.0	150.0	318.0	78.0	155.0	41.0	143.0				
14	<i>Carcharhinus limbatus</i>					61.0	61.0	73.0	73.0			80.0	150.0
15	<i>Carcharhinus longimanus</i>												
16	<i>Carcharhinus macloti</i>							70.0	78.0				
17	<i>Carcharhinus plumbeus</i>			180.0	343.0								
18	<i>Carcharhinus melanopterus</i>	50.0	62.0	149.0	149.0			77.0	77.0	55.4	128.0		
19	<i>Carcharhinus sorrah</i>	12.0	86.0	48.0	160.0	43.0	150.0	56.0	158.0	57.2	76.8	25.8	227.5
20	<i>Carcharhinus sp</i>											138.0	138.0
21	<i>Centrophorus cf lusitanicus</i>			53.0	67.0								
22	<i>Centrophorus moluccensis</i>			68.0	132.0							85.0	85.0

23	<i>Cephaloscyllium ciruopullum</i>											36.5	42.3
24	<i>Cephaloscyllium pictum</i>			72.0	72.0								
25	<i>Chiloscyllium plagiosum</i>											34.0	87.0
26	<i>Chiloscyllium punctatum</i>			55.0	153.0							34.0	107.0
27	<i>Chiloscyllium cf hasseltii</i>					61.5	63.0						
28	<i>Chiloscyllium cf punctatum</i>											56.0	56.0
29	<i>Chiloscyllium griseum</i>								31.0	66.0			
30	<i>Chiloscyllium hasseltii</i>					18.5	93.0	35.0	71.0	35.5	68.0		
31	<i>Chiloscyllium indicum</i>					46.5	56.0						
32	<i>Chiloscyllium plagiosum</i>									76.6	76.6	36.4	46.5
33	<i>Chiloscyllium punctatum</i>	18.0	103.0			27.0	96.0	57.0	69.0	12.2	96.4	21.0	115.0
34	<i>Chiloscyllium sp</i>					48.0	48.0					50.0	50.0
35	<i>Galeocerdo cuvier</i>			78.0	386.0	144.0	157.0	88.0	160.0	89.0	225.0	65.0	107.0
36	<i>Galeus sp</i>												
37	<i>Halaelutis buergeri</i>											40.0	45.0
38	<i>Hemigaleus microstoma</i>			79.0	125.0			40.0	81.0	49.6	49.6	42.0	118.0
39	<i>Hemipristis elongata</i>							41.0	69.0				
40	<i>Heptranchias perlo</i>			62.0	93.0					72.5	72.5	79.3	79.3
41	<i>Hexanchun cf griseus</i>											78.5	78.5
42	<i>Isurus oxyrinchus</i>			131.0	367.0								
43	<i>Isurus paucus</i>			140.0	271.0								
44	<i>Loxodon macrohinus</i>			51.0	116.0			31.0	88.0				
45	<i>Mustelus manazo</i>											110.0	110.0
46	<i>Mustelus mosis</i>							51.0	79.0				
47	<i>Mustelus sp</i>							12.0	82.0				
48	<i>Orectolobus leptolineatus</i>			97.0	98.0								

49	<i>Prionace glauca</i>			142.0	295.0								
50	<i>Pseudocarcharias kamoharai</i>			71.0	98.0								
51	<i>Psudotriakis microdon</i>			198.0	255.0								
52	<i>Rhincodon typus</i>			214.0	214.0								
53	<i>Rhizoprionodon acutus</i>							70.0	78.0				
54	<i>Scoliodon laticaudus</i>					41.0	41.0	26.0	78.0				
55	<i>Sphyrna lewini</i>			94.0	316.0			45.0	137.0				
56	<i>Sphyrna mokkaran</i>							70.0	70.0			59.0	245.0
57	<i>Squalus edmundsi</i>			49.0	68.0								
58	<i>Squalus megalops</i>			50.0	105.0							60.0	69.0
59	<i>Squatina</i> sp											60.0	120.0
60	<i>Squatina tergocellatoides</i>											59.0	59.0
61	<i>Stegostoma fasciatum</i>					163.0	163.0						
62	<i>Trigenodon obesus</i>			65.0	171.0							109.0	195.0

Table 7c Size Range of Skates (Disc Length – DL, cm)

No.	Species of Skates	Cambodia		Indonesia		Malaysia		Myanmar		Thailand		Viet Nam	
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
1	<i>Dipturus johannisdavisi</i>											95.0	95.0
2	<i>Okameijeji cairae</i>											10.0	58.0
3	<i>Okameijeji cf boeseimani</i>											11.0	22.7
4	<i>Okameijeji hollandi</i>											16.5	40.0
5	<i>Okameijeji jensenae</i>							18.0	48.0				
6	<i>Okameijeji sp.</i>							47.0	47.0				

Table 8a Range of CPUE (kg/haul) of Rays Catches by Type of Fishing Gear as Referred to Top Catches Species by Countries

Type of Fishing Gear	Cambodia		Indonesia		Malaysia		Myanmar		Thailand		Viet Nam	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
Single Trawl	0.002	0.267			0.050	1.460	0.190	1.060	0.010	0.670	0.012	0.368
Pair Trawl									0.140	0.630		
Gillnet			1.590	19.500			0.030	0.090			0.008	2.705
Longline			0.040	4.870								

Table 8a Range of CPUE (kg/haul) of Sharks Catches by Type of Fishing Gear as Referred to Top Catches Species by Countries

Type of Fishing Gear	Cambodia		Indonesia		Malaysia		Myanmar		Thailand		Viet Nam	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
Single Trawl	0.009	1.023			0.000	0.490	0.010	0.540	0.010	0.740	0.003	0.117
Pair Trawl									0.010	4.080		
Gillnet			0.060	11.820			0.010	0.150			0.005	2.700
Longline			0.500	6.630								

Table 7a Range of CPUE (kg/haul) of Skates Catches by Type of Fishing Gear as Referred to Top Catches Species by Countries

Type of Fishing Gear	Cambodia		Indonesia		Malaysia		Myanmar		Thailand		Viet Nam	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
Single Trawl							0.010	0.060			0.162	2.382

Table 9 Price of Sharks, Rays, Skates and Their Marketing as Referred to Top Catches by Countries

Countries	Rays		Sharks		Skates	
	Price (USD/kg)	Marketing	Price (USD/kg)	Marketing	Price (USD/kg)	Marketing
Cambodia	1.0 to 3.2	local land domestic markets	1.75 to 4.0	local land domestic markets		
Indonesia	0.45 to 2.61	local market	0.37 to 2.24	local market		
Malaysia	0.11 to 4.72	local and domestic markets, export skin to Thailand	0.22 to 8.99	local and domestic markets		
Myanmar	1.03 to 7.34	local market	1.47 to 6.6	local market		
Thailand	0.31 to 3.42	local market	0.68 to 3.14	local market		
Viet Nam	1 to 5	local and domestic markets export to China	1 to 6	local and domestic markets export to China	0.2 to 2	local and domestic markets export to China



Figure 1 Landing Sites for Data Collection in the Project Participating Countries, namely Cambodia, Indonesia, Malaysia, Myanmar, Thailand, and Viet Nam.

PART II

National Reports on Sharks Data Collection in the Participating Countries: Cambodia

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1.0 INTRODUCTION

Cambodia has 435 Km coastlines in the Gulf of Thailand, which is stretched between Vietnamese borders in the south to Thai border in the west. There are four (4) provinces located along this coastline namely, Koh Kong (237 Km), Preah Sihanouk (105 Km), Kampot (67 Km) and Kep (26 Km) provinces. There are 525 species of marine finfish, 20 species of marine crabs, 42 species of marine gastropods, 24 species of marine bivalves and 11 species of marine mammals (Tana 1997, Try 2003). Furthermore, the Kingdom of Cambodia has her own Exclusive Economic Zone (EEZ), the area extended from the shoreline to 200 nautical miles, which covers 55,600 Km². Marine fisheries of Cambodia are definitely pelagic due to the physical feature of the EEZs area (Maximum depth is not higher than 80 meters), and their productivity covers around 20% of national fish production. The introductions of modern fishing technologies were appeared around 1958s.

Fishing practices in Cambodia are classified three (3) types namely small-scale or family fisheries medium-scale and commercial-scale. The commercial-scale and middle-scale fisheries refer to those fishing activities that highly efficient fishing gears and have capacity to fish offshore and inshore using all fishing gears with exception of trawling in inshore waters. The official fisheries statistic of the Fisheries Administration has not been categorized by species but by higher taxonomy such as fish, shrimp, ray, squid, crab, snail, and mussels. In general, small pelagic fish have been classified by species (short mackerel and Indian mackerel), based on group of fish (round scads); and other group of fish by market size, while pelagic fish size was not fit to market size that was considered as trash fish. These species are usually caught by long-tailed boats applied with gill nets, and purse seine net vessel either in shallow or deep waters.

Additionally, SEAFDEC started to support Sharks/Rays data collection and data analysis for one year, beginning from September 2015 to August 2016.

1.1 Objective

The objectives of this project were:

- To enhance human resource development in elasmobranchs taxonomy, and
- To improve landing data recording from generic 'Sharks' and 'Rays' to species level.

1.2 Data Collection at Landing Sites

Preah Sihanouk Province is a major landing areas for sharks and rays

1.2.1 Selection of Study Sites (Tomnup Rolork BEP Jetty)

Tomnup Rolork, Phum III, Sangkat I Preah Sihanouk City, Sihanouk Province consists of four (4) main landing areas where selected as the project sites. BEP jetty was selected for data collection. This landing site owns by private sector. The most of Sharks and Rays catch production come from trawlers, long lines and seine nets. The trawler was selected as the representative gear for data collection. The project site as shown in **Figure 1**.



Figure 1. Map of tracking of BBO (0001-0003) vessel, Sihanouk ville

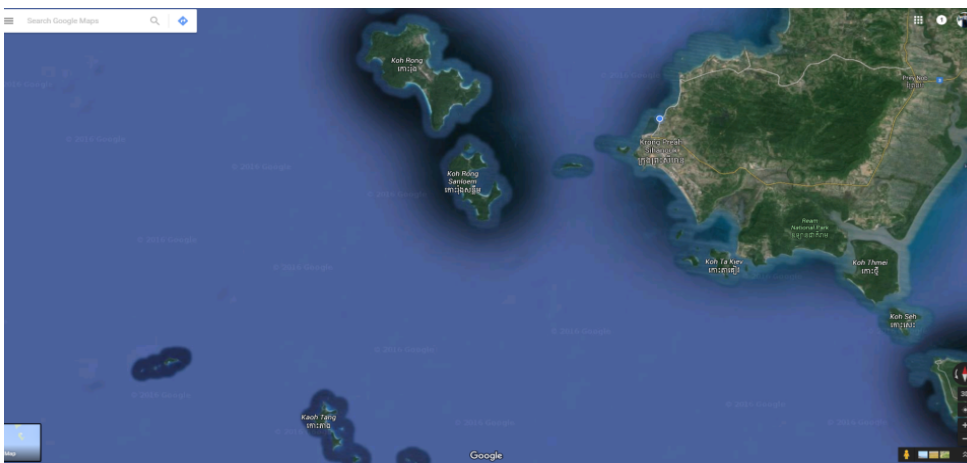


Figure 2. Map of tracking of BBO (0001-0004) vessel, Sihanouk ville

1.2.2 Fishery Structure and Background of Study Sites

Preah Sihanouk is one of the major province where comprises more landing sites for sharks and rays among the coastal provinces of Cambodia. All jetties belong to private owners. The major gear was trawl nets. Numbers of crew working on boat depend upon volume of the vessel which range from 3-8 crew members. Almost all sharks and rays were landed by trawlers with its fishing ground far from the coastline 8-57 nautical miles and its depth is 8-25 meters depth (As in Table 1). Fishing operation is 1-15 days per trip and 3-4 haul per day. All catches were landed from 6:00-10:00 a.m.

Table 1: Number of Licensed Fishing Vessels and Number of Fishers

Gear Type	Fishing Ground	Fishing Operation	No of Boat	No of Fisher
		(From Coastline)		
Trawlers				
20-50 GRT	Koh Daek Kol	8-11 miles	4	40
70-90 GRT	Koh pring	46-57 miles	33	343
20-80 GRT	Koh roeusey	11-31 miles	25	256
20-80 GRT	Koh Rong	13-40 miles	35	378
20-50 GRT	Koh Sdach	25-28 miles	9	96
50-90 GRT	Koh Tang	34-56 miles	67	710
24 GRT	North Koh Daek kol	12 miles	2	21
14-60 GRT	North Koh Rong	16-32 miles	4	31
Total			179	1,875

1.3 Appointment of Enumerators

Mr. Ly Seyha, fisheries officer from Marine Aquaculture Research and Development Center (MARDeC) was appointed as enumerator. His contact detail as follow:

Mr. Ly Seyha
Acting Chief of Aquaculture Technology Feed and Water Quality
Group 12, Village 3, Sangkat 1, Preah Sihanouk town,
Preah Sihanouk province

1.4 Materials and Methods

1.4.1 Sampling Methods

The sampling activity started on 10 September 2015 until 12 August 2016. The enumerator was requested to record landing data and others related information in a standard form at least 5 days/month. A standard operating procedures (SOPs) namely ‘SOP Sharks and Rays Data Collection in the Southeast Asian Waters’ was produced. The content included standard operation procedures and instructions to enumerators on how to measure, weight, 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 is shown in **Appendix I**. The completed data in excell were submitted to the respective sharks and rays focal point before submitted to SEAFDEC every month for verification. The data were analysed at the end of the month.

1.4.2 Selection of Fishing Vessels and Sampling Activities

Between 2-3 fishing vessels were selected for sampling each day for 5 days per month at the landing site. Measurement of Total Length (TL) was taken for all sharks and rays species

All sharks and rays specimens sampled were measured and weighed individually. 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. 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 Site BEP Jetty

2.1.1 Landing Samples

Landing site named **BEP**. The reason to selected this site is the largest site and the most variety vessels landed in this jetty. A total of 179 trawlers were sampled during the study period. The highest by gear type was 116 of trawl net commercial scale. The number of landing sample per month was 15 except in September 2015. The data are showed in **Table 2**.

Table 2: Landings Sampled during the Study at Fishing Ground

Count of Record No.	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Trawl Net Commercial Scale	2	3	11	13	12	12	5	13	11	12	12	10	116
Trawl Net Midium Scale	5	6				2	8	2	2	1	3	4	33
Trawl Net Small Scale	7	6	4	2	3	1	2		2	2		1	30
Grand Total	14	15	15	15	15	15	15	15	15	15	15	15	179

2.1.2 Fishing Ground and Catch Composition

The main gear landing sharks and rays was the trawl net commercial at 10,536 kg (75.8%) comprising 3,94.4 kg of rays and 6,541.6 kg of sharks. While trawl net medium scale contributed 870 kg of ray and 1,386.3 of shark and trawl net small scale contributed 515.2 kg of rays and 599.6 kg of shark. Koh Tang was the main fishing ground where longer distance from coastline and deeper depth. The highest landing of ray by month was from trawl net commercial scale at 774.0 kg in February 2016, followed by 536.0 kg in January 2016. While, the highest landing of shark by month was from trawl net commercial scale at 1,108.0 kg in December 2015, followed by 1,056.0 kg in February 2016. The detail is shown in **Table 3**.

Table 3: Weight of Sharks and Rays (in kg)

Type of Gear	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Trawl Net Commercial Scale	60.0	73.8	458.6	444.0	536.0	774.0	241.0	330.0	305.0	271.0	305.0	196.0	3,994.4
Trawl Net Midium Scale	74.3	96.7				111.0	292.0	40.0	24.0	26.0	83.0	123.0	870.0
Trawl Net Small Scale	44.2	45.0	75.0	38.0	76.0	78.0	44.0		38.0	64.0		13.0	515.2
Total Catch Ray	178.5	215.5	533.6	482.0	612.0	963.0	577.0	370.0	367.0	361.0	388.0	332.0	5,379.6
Trawl Net Commercial Scale	14.8	56.4	590.0	1,108.0	743.3	1,056.0	426.0	605.0	556.0	475.0	556.0	355.0	6,541.6
Trawl Net Midium Scale	124.2	209.1				173.0	442.0	99.0	43.0	43.0	73.0	180.0	1,386.3
Trawl Net Small Scale	25.0	36.2	57.0	38.0	98.3	80.0	66.0		22.0	127.0		50.0	599.6
Total Catch Ray	164.1	301.8	647.0	1,146.0	841.6	1,309.0	934.0	704.0	621.0	645.0	629.0	585.0	8,527.4
Grand Total	342.5	517.2	1,180.6	1,628.0	1,453.6	2,272.0	1,511.0	1,074.0	988.0	1,006.0	1,017.0	917.0	13,907.0

2.1.3 Sharks and Rays Composition

A total of 910,313.0 kg of sharks and rays was landed from **BEP** jetty during the study period. Sharks and rays made up 8,527.4 kg and 5,379.6 kg (0.9% and 0.6%) from the total landing respectively. While, landings of bony fish and others was 896,406.0 kg (98.5%). Average landings per month for sharks and rays were 710.6 kg and 448.3 kg, respectively. The highest landing by month for rays was 963.0 kg in February 2016, followed by 612.0 kg in January 2016 and 577.0 kg in March 2016. However, the highest landing for sharks was 1,309.0 kg in February 2016 followed by 1,146.0 kg in December 2015 and 934.0 kg in March. In general, the landing of sharks and rays ranged between 0.5-1.6% and 0.3-1.2%, respectively from total landing. The details are shown in **Table 4**.

Table 4: Catch Composition of Sharks, Rays, Bony Fish and Others by Month from September 2015 to August 2016 at Tomnup Rolork, All Weights in Kilogram

Year	Month	Weight of Shark (kg)	% of Shark	Weight of Ray (kg)	% of Ray	Weight of Bony Fish and Others	% of Bony Fish and Others	Weight of Total Catch (kg)
2015	September	164.1	0.5	178.5	0.5	34,630.5	99.0	34,973.0
	October	301.8	0.6	215.5	0.4	48,032.8	98.9	48,550.0
	November	647.0	1.1	533.6	0.9	55,119.4	97.9	56,300.0
	December	1,146.0	1.1	482.0	0.5	100,272.0	98.4	101,900.0
2016	January	841.6	1.0	612.0	0.7	86,446.4	98.3	87,900.0
	February	1,309.0	1.6	963.0	1.2	78,128.0	97.2	80,400.0
	March	934.0	1.3	577.0	0.8	72,989.0	98.0	74,500.0
	April	704.0	1.0	370.0	0.5	69,526.0	98.5	70,600.0
	May	621.0	0.7	367.0	0.4	83,012.0	98.8	84,000.0
	June	645.0	0.8	361.0	0.5	79,094.0	98.7	80,100.0
	July	629.0	0.7	388.0	0.4	95,073.0	98.9	96,090.0
	August	585.0	0.6	332.0	0.3	94,083.0	99.0	95,000.0
Grand Total		8,527.4		5,379.6		896,406.0		910,313.0
Avg		710.6	0.9	448.3	0.6	74,700.5	98.5	75,859.4

2.1.4 Sample Size

A total of 1,876 belonging to 957 rays and 919 sharks were sampled comprising six (6) species of rays and five (5) species of sharks. The most abundant ray species by number was *Himantura walga* followed by *Himantura imbricata* and *Dasyatis zugei*. The highest number of rays sampled by month was 99 in October 2015 followed by 98 in November 2015 and 84 in December 2015. The most abundant shark species was *Chiloscyllium punctatum* (710 head) while the scarce species was *Carcharhinus leucas* (5 head). The highest number of sharks sampled by month was 93 in November 2015, followed by 85 in December 2015 and 84 in October 2015. The most common ray species were *Himantura walga* followed by *Himantura imbricata* and *Dasyatis zugei*, while the most common shark species were *Chiloscyllium punctatum* and *Atelomycterus marmoratus*. All these species were landed all year around. Other species, *Aetobatus ocellatus*, *Taeniura lymma*, *Carcharhinus sorrah*, *Carcharhinus leucas*, and *Carcharhinus melanopterus* were rarely landed during the study period (**Table 5**).

Table 5: Sample Size of Sharks and Rays by Species

	2015				2016								Total	
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug		
Ray	76	99	98	84	75	75	75	75	75	75	75	75	75	957
<i>Aetobatus ocellatus</i>	1		1						1		1	8	3	15
<i>Dasyatis parvonigra</i>	11	7	18	14	11	21	24	5	9	1			11	132
<i>Dasyatis zugei</i>	22	13	25	17	23	4	7	26	26	12	5	10		190
<i>Himantura imbricata</i>	15	33	26	13	19	25	25	12	10	5	14	14		211
<i>Himantura walga</i>	27	44	28	40	22	25	19	31	30	56	48	34		404
<i>Taeniura lymna</i>		2											3	5
Shark	58	84	93	85	75	74	75	75	75	75	75	75	75	919
<i>Atelomycterus marmoratus</i>	6	18	24	16	34	13	26	1	9	6	7	16		176
<i>Carcharhinus leucas</i>	1							1	1			2		5
<i>Carcharhinus melanopterus</i>								5				5		10
<i>Carcharhinus sorrah</i>									1	6	6	5		18
<i>Chiloscyllium punctatum</i>	51	66	69	69	41	61	49	68	64	63	62	47		710
Grand Total	134	183	191	169	150	149	150	150	150	150	150	150	150	1,876

2.1.5 Weight of Sharks and Rays by Species

A total of 1, 3907.0 kg was landed from **BEP** landing site comprising 537.6 kg rays and 8,527.4 kg sharks. For Rays, the highest landing by weight was from *Himantura walga* amounting to 1,905.9 kg, followed by 1,247.5 kg *Himantura imbricata* and 1,059.0 kg *Dasyatis zugei*. The highest landing by month was 266.0 kg for *Himantura walga* in July 2016 followed by 235.2 kg in June 2016 and 207.6 kg in December 2015. Weight of other ray species ranged between 14.2-207.1 kg. For shark, the highest landing by weight was from *Chiloscyllium punctatum* amounting to 7,282.2 kg, followed by 878.8 kg *Atelomycterus marmoratus* and 237.2 kg *Carcharhinus sorrah*. The highest landing by month was 1,171.9 kg for *Chiloscyllium punctatum* in February 2016 followed by 1,083.35 kg in December 2015 and 77.1 kg in March 2016. Weight of other shark species ranged between 3.4-281.1 kg. The details are shown in **Table 6**.

Table 6: Weight of Sharks and Rays (in Kg) by Species from BEP landing site

	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Ray	178.5	215.5	533.6	482.0	612.0	963.0	577.0	370.0	367.0	361.0	388.0	332.0	5,379.6
<i>Aetobatus ocellatus</i>	41.0		48.4					73.4		14.2	40.7	21.7	239.4
<i>Dasyatis parvonigra</i>	15.0	26.2	99.4	81.6	97.7	286.4	160.1	21.9	44.3	28.7		51.4	912.8
<i>Dasyatis zugei</i>	48.8	34.0	119.6	100.8	191.1	80.1	99.7	106.8	142.2	68.4	18.0	49.2	1,059.0
<i>Himantura imbricata</i>	20.3	74.9	149.7	92.0	117.2	353.2	207.2	59.6	42.0	14.5	63.3	53.7	1,247.5
<i>Himantura walga</i>	53.3	78.7	116.6	207.6	206.0	243.3	110.0	108.2	138.4	235.2	266.0	142.7	1,905.9
<i>Taeniura lymma</i>		1.7										13.3	15.0
Shark	164.1	301.8	647.0	1,146.0	841.6	1,309.0	934.0	704.0	621.0	645.0	629.0	585.0	8,527.4
<i>Atelomycterus marmoratus</i>	14.8	17.9	75.6	62.6	281.1	137.1	136.9	2.4	15.1	31.1	17.0	87.1	878.8
<i>Carcharhinus leucas</i>	3.4							23.1	15.7			23.5	65.6
<i>Carcharhinus melanopterus</i>								31.0				32.6	63.6
<i>Carcharhinus sorrah</i>									52.2	66.9	28.7	89.4	237.2
<i>Chiloscyllium punctatum</i>	145.9	283.8	571.4	1,083.4	560.5	1,171.9	797.1	647.5	538.0	547.0	583.3	352.4	7,282.2
Grand Total	342.5	517.2	1,180.6	1,628.0	1,453.6	2,272.0	1,511.0	1,074.0	988.0	1,006.0	1,017.0	917.0	13,907.0

2.1.6 Size Range of Sharks and Rays

Most Ray species sampled from September 2015 to August 2016 were mature except *Aetobatus ocellatus*, and *Taeniura lymma*. The size of *Aetobatus ocellatus* ranged between 84.0-90.0 cm disc lengths. First maturing size for *Dasyatis parvonigra* about 19.0 cm disc length, *Dasyatis zugei* about 18.0-22.0 cm disc length, *Himantura imbricata* about 18.0-21.0 cm disc length, and *Himantura walga* about 17.0-20.0 cm disc length. All these ray species were caught under mature stage at 12 cm disc length for *Dasyatis parvonigra* in September 2015, 13 cm disc length for *Dasyatis zugei* and *Himantura imbricata* in September and October 2015, 11.6 cm disc length for *Himantura walga* in October 2015. Most of shark species landed were mature except for *Carcharhinus sorrah*, *Carcharhinus melanopterus*. First maturing size of *Atelomycterus marmoratus*, *Carcharhinus leucas*, *Chiloscyllium punctatum* are 40.0 cm, 70.0 cm and 50.0 cm total length, respectively. For shark species, the only *Chiloscyllium punctatum* was caught under adult stage at 28.5 cm in September 2015, 19.5 cm in October, 18.0 cm in December 2015, 29.0 cm in January 2016, and 12 cm in March 2016. Size range of all sharks and rays species from September 2015 to August 2016 are shown in **Table 7A** and **Table 7B**.

Table 7A: Size Range of Sharks (Total Length) and Rays (Disc Length) from September 2015-February 2016, All Measurements in cm.

	2015												2016					
	September			October			November			December			January			February		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Ray																		
<i>Aetobatus ocellatus</i>	84.0	84.0	84.0				90.0	90.0	90.0									
<i>Dasyatis parvonigra</i>	12.0	29.5	18.5	18.0	27.5	20.2	17.0	21.0	19.6	14.0	26.0	19.5	16.0	34.0	21.5	16.0	22.0	19.8
<i>Dasyatis zugei</i>	13.0	27.0	18.3	15.0	21.0	18.6	15.0	25.0	19.2	16.0	25.0	20.3	15.0	24.0	19.1	21.0	23.0	21.5
<i>Himantura imbricata</i>	13.5	30.0	20.0	13.0	21.0	18.1	16.0	23.0	19.0	17.0	22.0	19.4	15.0	21.0	19.1	16.0	24.0	19.6
<i>Himantura walga</i>	13.5	45.0	19.8	11.6	22.0	18.3	16.0	28.0	19.3	16.0	22.0	19.2	17.0	23.0	19.5	15.0	22.0	19.5
<i>Taeniura lymma</i>				27.0	27.5	27.3												
Shark																		
<i>Atelomycterus marmoratus</i>	44.5	53.5	49.8	33.0	53.0	44.1	32.0	64.0	44.7	35.0	61.0	45.8	35.0	57.0	42.8	37.0	66.0	49.2
<i>Carcharhinus leucas</i>	74.1	74.1	74.1															
<i>Carcharhinus melanopterus</i>																		
<i>Carcharhinus sorrah</i>																		
<i>Chiloscyllium punctatum</i>	28.5	92.0	54.8	19.5	103.0	55.0	30.0	84.0	61.1	18.0	86.0	60.5	29.0	84.0	57.6	35.0	76.0	55.3

Table 7B: Size Range of Sharks (Total Length) and Rays (Disc Length from March-August 2016, All Measurements in cm.

	2016																		
	March			April			May			June			July			August			
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	
Ray																			
<i>Aetobatus ocellatus</i>				100.0	100.0	100.0				31.0	31.0	31.0	14.0	21.0	16.8	17.0	20.0	18.7	
<i>Dasyatis parvonigra</i>	13.0	24.0	19.1	14.0	20.0	17.6	19.0	25.0	20.8	42.0	42.0	42.0				16.0	24.0	20.3	
<i>Dasyatis zugei</i>	17.0	26.0	20.4	14.0	29.0	20.0	16.0	26.0	20.9	16.0	26.0	23.0	18.0	20.0	19.0	18.0	26.0	20.6	
<i>Himantura imbricata</i>	13.0	25.0	19.7	19.0	25.0	20.0	17.0	28.0	19.8	18.0	22.0	20.6	16.0	26.0	20.4	17.0	30.0	20.2	
<i>Himantura walga</i>	16.0	24.0	19.7	17.0	22.0	19.5	16.0	22.0	18.9	16.0	22.0	19.3	15.0	23.0	19.1	18.0	24.0	19.9	
<i>Taeniura lymma</i>																	24.0	27.0	25.7
Shark																			
<i>Atelomycterus marmoratus</i>	31.0	61.0	42.8	59.0	59.0	59.0	37.0	56.0	43.7	41.0	60.0	48.0	37.0	61.0	53.0	48.0	64.0	57.8	
<i>Carcharhinus leucas</i>				71.0	71.0	71.0	77.0	77.0	77.0							74.0	75.0	74.5	
<i>Carcharhinus melanopterus</i>				50.0	53.0	51.4										50.0	62.0	55.4	
<i>Carcharhinus sorrah</i>							86.0	86.0	86.0	53.0	62.0	59.3	61.0	63.0	62.3	60.0	63.0	61.0	
<i>Chiloscyllium punctatum</i>	12.0	72.0	48.7	32.0	91.0	63.3	34.0	81.0	58.1	42.0	88.0	64.4	37.0	85.0	62.2	32.0	81.0	58.2	

2.1.7. Fishing Effort and CPUE (Catch per Unit Effort)

Trawl net fishing gear for sharks and rays divided by three types: 1) Trawl Net Commercial Scale, 2) Trawl Net Medium Scale, and 3) Trawl Net Small Scale. Data collection of trawl boat was collected randomly. In actual practice, trawl net commercial scale found more numbers (1,351) compared to medium (310) and small (121) scales. For trawl net samples during September 2015 to August 2016, all data were used to calculate catch per unit effort (CPUE) as follows: The days at operation by trawl net 1,351 days (5,404 hauls). The detail is shown in **Table 8A** and **8B**. The

Table 8A: Days at Operation by Gears Sampled during the Study Period 2015-2016

Type of Gear	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Trawl Net Commercial Scale	18	32	132	175	150	153	54	127	124	129	133	124	1,351
Trawl Net Medium Scale	55	45				22	69	22	17	13	16	51	310
Trawl Net Small Scale	22	23	14	8	13	3	8		8	16		6	121
Grand Total	95	100	146	183	163	178	131	149	149	158	149	181	1,782

Table 8B: Number of Operation during the Study Period

Type of Gear	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Trawl Net	380	400	584	732	652	712	524	596	596	632	596	724	7,128

The CPUE of rays by trawl net range between 0.01 – 1.07 kg/day at operation, 0.00-0.27 kg/number of operation and 0.02-3.15 kg/swept area(km²). The highest CPUE of rays from trawl net was *Himantura walga* with 1.07 kg/day at operation (0.27 kg/number of operation and 3.15 kg/swept area(km²)). The details are shown in **Table 9A**.

The CPUE of sharks by trawl net range between 0.04 – 4.09 kg/day at operation, 0.01-1.02 kg/number of operation and 0.11-12.05 kg/swept area(km²). The highest CPUE of shark from trawl net was *Chiloscyllium punctatum* with 4.09 kg/day at operation (1.02 kg/number of operation and 12.05 kg/swept area(km²)). The details are shown in **Table 9B**.

Table 9A: CPUE Ray Species Captured by Trawl Net

Rank	Ray Species	Total weight (kg) Shark by Species	CPUE (kg/Days at Operation)	CPUE (kg/Number of Operation)	CPUE (kg/Swept area(Km ²))
1	<i>Himantura walga</i>	1905.94	1.07	0.27	3.15
2	<i>Himantura imbricata</i>	1247.51	0.70	0.18	2.06
3	<i>Dasyatis zugei</i>	1058.96	0.59	0.15	1.75
4	<i>Dasyatis parvonigra</i>	912.76	0.51	0.13	1.51
5	<i>Aetobatus ocellatus</i>	239.40	0.13	0.03	0.40
6	<i>Taeniura lymma</i>	15.00	0.01	0.00	0.02

Table 9B: CPUE Shark Species Captured by Trawl Net

Rank	Shark Species	Total weight (kg) Shark by Species	CPUE (kg/Days at Operation)	CPUE (kg/Number of Operation)	CPUE (kg/Swept area(Km ²))
1	<i>Chiloscyllium punctatum</i>	7282.17	4.09	1.02	12.05
2	<i>Carcharhinus sorrah</i>	237.22	0.13	0.03	0.39
3	<i>Carcharhinus melanopterus</i>	63.64	0.04	0.01	0.11
4	<i>Carcharhinus leucas</i>	65.64	0.04	0.01	0.11
5	<i>Atelomycterus marmoratus</i>	878.77	0.49	0.12	1.45

2.1.8 Usage and Marketing

Information on marketing collected at this landing site revealed that most sharks and rays were consumed locally and some were exported to Viet Nam. The major market of local consumption was Phnom Penh Capital city. The price varied not much among the six (6) species. The most expensive rays are *Himantura imbricata* and *Himantura walga*. They were sold around 1.5-3.2 USD/kg followed by *Taeniura lymma* around 1-3 USD/kg and *Aetobatus ocellatus* around 1.5-2.5 USD/kg. The other ray species, *Dasyatis parvonigra* and *Dasyatis zugei* price ranged from 1-2.5 USD/kg. In general, bigger size rays were more expensive than smaller ones.

Small size sharks with total weight of less than 3 head/kg, head were sold locally at 2 USD/kg. The most expensive sharks *Carcharhinus sorrah* was at 2.5-4 USD/kg, and followed by *Carcharhinus melanopterus* selling at 2.5-4 USD/kg, *Carcharhinus leucas* at 2-4 USD/kg, and *Atelomycterus marmoratus* at 1.75-3.75 USD/kg. The cheapest price was and *Carcharhinus punctatum* at 1.75-3.3 USD/kg. Market destinations for sharks and rays were the same.

Normally the suppliers use truck to deliver shark and ray to the other markets for local consumption in the morning after landed. However, the distribution of sharks and rays to Viet Nam transported by land and ships (cargo vessels). The price of exported product was higher than local consumption, both sharks and rays at UDS 3-4/kg. The details are shown in **Table 10**.

Table 10: Price of Sharks and Rays by Species at the Landing Site, All Prices in USD per Kilogram.

Ray Species	Price/kg /USD	Part	Marketing
<i>Aetobatus ocellatus</i>	1.5-2.5	Whold Body	Local, Phnom Penh and to VN
<i>Dasyatis parvonigra</i>	1-2.5	Whold Body	Local, Phnom Penh and to VN
<i>Dasyatis zugei</i>	1-2.5	Whold Body	Local, Phnom Penh and to VN
<i>Himantura imbricata</i>	1.5-3.2	Whold Body	Local, Phnom Penh and to VN
<i>Himantura walga</i>	1.5-3.2	Whold Body	Local, Phnom Penh and to VN
<i>Taeniura lymma</i>	1-3	Whold Body	Local, Phnom Penh and to VN
Shark Species			
<i>Atelomycterus marmoratus</i>	1.75-3.75	Whold Body	Local, Phnom Penh and to VN
<i>Carcharhinus leucas</i>	2-4	Whold Body	Local, Phnom Penh and to VN
<i>Carcharhinus melanopterus</i>	2.5-4	Whold Body	Local, Phnom Penh and to VN
<i>Carcharhinus sorrah</i>	2.5-3.75	Whold Body	Local, Phnom Penh and to VN
<i>Chiloscyllium punctatum</i>	1.75-3.3	Whold Body	Local, Phnom Penh and to VN

3.0 CONCLUSION

A pilot project on recording landing data of sharks and rays up to species level was conducted in Tumnap Rolok of Preah Sihanouk province. During this project, three (3) officers of Marine Aquaculture Research and Development Center (MARDeC), and one officer of Kampong Som Fisheries Administration Cantonment were trained in taxonomy and in data collection using the new harmonized format. One landing site (jetty) namely BEP was selected as the study site as it was the main landing site of sharks and rays in the province.

A total of five (5) species of sharks from two (2) Orders and three (3) Families, and six (6) species of rays from one (1) Order and two (2) Families were recorded. Details are shown in **Appendix II**. In term of percentage of total marin landings, sharks and rays only contributed 0.9% and 0.60% at Preah Sihanouk province. These figures confirmed earlier data as published in Cambodian National Statistics that shark was by catch and not targeted and contributed about 39.41% of the total Shark caught by weight. Ray was not recorded in the National Statistic before.

The most abundant shark species was *Chiloscyllium punctatum* and ray species was *Himantura walga*. The most common shark species were *Atelomycterus marmoratus* and *Chiloscyllium punctatum*, while rays were *Aetobatus ocellatus*, *Himantura imbricata*, *Dasyatis zugei*, and *Dasyatis parvonigra*. The size of shark which more than 103 centimetres in total length was *Chiloscyllium punctatum* and medium sized Sharks were *Carcharhinus sorrah* and *Carcharhinus leucas* was rarely caught due to nature of fishing area and gear used. Sharks and Rays production distributed to domestic consumption and exportation.

4.0 OUTPUT AND OUTCOME

The project outputs and outcomes are summarised in **Table 11** as shown below.

Table 11: Output and Outcome

No	Output	Outcome
1.	Four trained personnel in sharks and rays taxonomy from the Department of Fisheries Malaysia.	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 pilot project site.	Confirmed earlier data published in Cambodian National Statistics. Sharks and rays were not targeted.
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 pilot project.	Sharks and rays are landed whole, fully utilised with no finning activities on board vessels.
7.	A report on landing of sharks and rays up to species level from Tomnup Rolork.	Information sharing to Fishery Stakeholders.
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

5.0 FUTURE ACTIVITIES

Cambodia will expand up to two landing sites for recording data of shark and ray at species level in Koh Kong and Kampot provinces in 2017. Data collection at the current site will be retained. Awareness raising programme will be conducted in other coastal provinces of Cambodia.

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SAMPLE OF STANDARD FORM

Data Collection Project on Shark and Ray Data Collection

Name of Enumerator: _____ Date: _____

Name of Landing Site: _____ Vessel Registration No: _____

GRT : _____

Type of Gear: _____ Fishing Area: _____ No. of days/trip: _____

A. Standard Operation Procedure:

1. This form is for a single sampling vessel.
2. Collect all fish (sharks, skates and rays) if catch is less than 50 tails or 10-50% of the landed catch if more than 50 tails. Take samples randomly.
3. Separate them by species and sex.
4. Measure total length for all sharks, skates and rays from the Family Rhynchobatidae, Rhinobatidae, Narcinidae and Narkidae. Measure disc length for other ray species.
5. Record weight of all sharks, skates and rays by species.
6. Record weight of commercial and low-value species.

B. Measurement of sample (Sharks)

No.	Species	Sex	Total length (mm)					
1								
2								
3								

C. Actual Weight of Sharks by Species

No	Species	Weight (Kg)
1		
2		
3		

D. Measurement of sample (Rays)

No.	Species	Sex	Total length/Disc Length (mm)					
1								
2								
3								
4								

D. Actual Weight of Rays by Species

No	Species	Weight (Kg)
1		
2		
3		
4		
5		

3. Total Catch of Sampling Vessel

No.	Vessel Registration No	All Sharks	All Rays	Commercial species	Low-value species	TOTAL
1.						

5. Price of Sharks

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

6. Price of Rays

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

Note: _____

Checklist of Species Recorded During the Study

No	Orders/Families	Site 1
	ORDER MYLIOBATIFORMES	BEP Jetty
	Family Dasyatidae	
1	<i>Dasyatis parvonigra</i>	+
2	<i>Dasyatis zugei</i>	+
3	<i>Himantura imbricata</i>	+
4	<i>Himantura walga</i>	+
5	<i>Taeniura lymma</i>	+
	Family Myliobatidae	
6	<i>Aetobatus ocellatus</i>	+
	Total ray species	6
	ORDER CARCHARHINIFORMES	
	Family: Scyliorhinidae	
1	<i>Atelomycterus marmoratus</i>	+
	Family Carcharhinidae	
2	<i>Carcharhinus leucas</i>	+
3	<i>Carcharhinus melanopterus</i>	+
4	<i>Carcharhinus sorrah</i>	+
	ORDER ORECTOLOBIFORMES	
	Family: Hemiscylliidae	
5	<i>Chiloscyllium punctatum</i>	+
	Total shark species	5

Pictures from 1-Year Data Collection

Photo 1. Practicing of participants under supervision of resource persons



Photo 2. Enumerator analysed taxonomy on shark species



PART II

*National Reports on Sharks Data Collection in the Participating
Countries: Indonesia*

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1. INTRODUCTION

Indonesian waters have a high diversity of sharks and rays, with at least 118 species belonging to 25 families of sharks and 106 species belonging to 19 families of rays found throughout the vast archipelago (Dharmadi et al., 2015). In general, the most common shark species found in Indian Ocean was *Carcharhinus falciformis*, and the dominant families were Carcharhinidae and Squalidae (Dharmadi et al., 2012). FAO data indicate that Indonesia is the world's largest shark producer (Lack & Sant, 2009), contributing around 12.3% of total world production. However, shark production in Indonesia only contributes about 2% of the total marine fishery production. Over the past several decades, national shark production has declined by 28.3 %, from 68,366 in 2000 to 49,020 in 2014 (DGCF, 2015). Shark fishing activities in Indonesia were mostly occurred as a by-catch (72%) and only 28% were done as a targeted fishery (Zainuddin, 2011). In Indonesia, the shark fisheries region with the most potential is the Indian Ocean. Most of the sharks landed in Indonesia are taken as bycatch in artisanal fisheries using various types of fishing gear, such as gillnets, longlines, seine-nets and bottom trawlnets (Fahmi and Dharmadi 2013). Tuna fisheries, whether using longlines or gillnets, also frequently catch sharks as incidental bycatch (Dharmadi and Fahmi 2003; Fahmi and Dharmadi 2013). Various parts of shark body could be utilized such as their meats and fins for foods, skins for leather industries, and liver oil and cartilages for medicines. The most valuable part of the shark body is its fins, and they are usually exported to Asian countries (Anon, 2003), and also to Europe countries.

The high price of shark fins in the international market has led to sustained, intensive, shark fishing activities, which, if not controlled, will continue to pose a serious threat to the conservation of shark resources in Indonesian waters. Sharks have the potential to be exploited sustainably if carefully managed (Walker 1998). However, many sharks are vulnerable to overexploitation (and even extinction) due to their slow growth, late maturity (of the order of decades for some species) and low fecundity (Last and Stevens 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

Cilacap has two landing sites; Pelabuhan Perikanan Cilacap (PPC) and Sentolo Kawat. PPC is the main fish-landing site in Cilacap, and most of large vessels are landed here. While Sentolo Kawat is a smaller landing site, and only a few vessels landing at this site. Gillnets, trammel nets and longlines are the most common fishing gears which applied to catch sharks and rays in Cilacap. However, most of sharks were caught as bycatch in the gillnet and tuna longlines fisheries. There are also surface longlines to catch shark as a target fishery at Sentolo Kawat operated by fishermen from east Java.

Lampulo is a medium-sized port on the north coast of Banda Aceh with a diverse range of fisheries operating, including purse seines, set longlines, and hand lines. This landing site is the biggest landing for sharks in Banda Aceh that are caught in the West Sumatera waters in the Indian Ocean. There are three types of fishing gear used to catch sharks as by-catch i.e. drift long line/surface longline, drift gillnet, and deep/bottom long line. Surface long lines are most commonly used by fishermen fishing out of ports at Lampulo and are employed to catch pelagic sharks. Based on fisheries statistics, shark production landed at Lampulo fishing port is less than 5% of the total landing of fishes. The location of all landing sites are shown in **Fig. 1**.



Figure 1: Location of Study Sites at Lampulo and Cilacap

1.2.2 Fishery Structure and Background of Study Sites

1.2.2.1 Cilacap Fish Landing Site

Cilacap is the biggest landing of sharks and rays at Central Java. The major gears were drift gillnet (155), followed by surface longline (31), and bottom gillnet (11). All drift gillnets, surface longline, and bottom gillnet are normally operated by 10 – 12 crew members, respectively. Almost all of the sharks and rays were landed by drift gillnet and surface longline operating between 8-121 miles from the coastline, while for the bottom gillnet between 1-10 miles. Fishing operation normally between 7-30 day per trip for drift gillnet, 10-20 day per trip for surface longline, and 12-15 day per trip for bottom gillnet. All catches were landed from 08.00 hr – 10.00 hr. 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 Cilacap

Gear Type	Fishing zone	Fishing operation (from coastline)	No. of vessels	No. of fishers/crews
DRIFT GN				
13-20 GRT	Indian ocean	8-89 miles	11	132
21-25 GRT	Indian ocean	19-93 miles	59	708
26-30 GRT	Indian ocean	21-121 miles	85	1,020
Total			155	1860
SURFACE LL				
16-22	Indian ocean	31-32 miles	7	70
27-29	Indian ocean	35-67 miles	24	240
Total			31	310
BOTTOM GN				
21-25	South of Java sea	1-44 miles	9	90
24 GRT	South of Java sea	1-10 miles	2	20
Total			11	110
Grand total			197	2,280

1.2.2.2 Lampulo Fish Landing Site

Lampulo is a medium-sized port on the north coast of Banda Aceh with a diverse range of fisheries operating, including purse seines, set longlines, and hand lines. The major

gears were bottom longlines (22), followed by purse seiners (15), hand lines (13), and shark longlines (9). The details of the fishing vessels registered in this district are shown in **Table 2**. The major gears landing sharks and rays were longlines, purse seines, and hand line. All longlines are normally operated by 4 - 5 crew members. However, the number of crew for traditional gears such as gillnets and longlines was normally 2-4 and 4-6 fishers, respectively. The fishing operation for longlines was normally between 3 - 7 days per trip while gill nets were normally 8-9 days per trip. All catches were landed from 07.30 hr – 12 00 hr.

Table 2: Number of Licensed Fishing Vessels by Gears and Number of Fishers at Lampulo

Gear Type	Fishing zone	Fishing operation (from coastline)	No. of vessel	No. of fishers
SHARK LL 6 GRT	Indian ocean	3-94 miles	12	36
BOTTOM LL 4-6 GRT	Indian ocean	9-65 miles	14	56
18-24 GRT	Indian ocean	10-67 miles	12	48
Total			26	104
PURSE SEINE 7 GRT	Indian ocean	5 miles	1	5
31-38 GRT	Indian ocean	21-111 miles	6	60
49-60 GRT	Indian ocean	24-100 miles	15	150
Total			22	215
HAND LINE 4-6 GRT	Malacca strait	2-14 miles	11	22
7-16 GRT	Indian ocean	11-12 miles	3	42
Total			14	64
TUNA LL 6 GRT	Indian ocean	73 miles	1	12
Gran total			75	431

1.3 Appointment of Enumerators

Two Assistant Fisheries Officers from the State Fisheries Office of Cilacap and Lampulo were appointed as enumerators. Their names and addresses are as follows:

1. Mr. Agung Ferieigha Nugroho
Pelabuhan Perikanan Samudera Cilacap
Jl. Lingkar Pantai Teluk Penyus, Cilacap-Central Java
2. Mr. Munawir
Pelabuhan Perikanan Nusantara Lampulo

1.4 Materials and Methods

1.4.1 Sampling Methods

The sampling activity started in August 2015 until 15 July 2016. All enumerators were requested to record landing data and other related information in a standard form at least 5 days/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 5 days per month at each landing site. Measurement of Total length (TL) were taken for all skates, sharks species and rays 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 Laboratory at Cilacap and Lampulo and preserved for future reference. 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. RESULTS

2.1. Cilacap and Lampulo Fish Landing Site

2.1.1 Landing Samples

A total of 168 landings were sampled during the study period at Cilacap. The highest by month was 43 in September and 34 in October 2015. The highest by gear type was 113 in drift gillnet followed by 44 and 11 for longline and bottom gillnet, respectively (**Table 3**). While a total of 107 landings were sampled during the study period at Lampulo. The highest by month was 15 in October 2015 and June 2016 and 12 in September, respectively. The highest by shark longline gear type was 41 of Indian ocean followed by 34 of purse seine and 25 units vessel of handline (**Table 4**).

Table 3: Number of Landings Sampled During the Study at Cilacap

Type of gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Bottom Gillnet						3	6		1	1			11
Drift Gillnet	23	41	32	11	2	1					3		113
Longline	1	2	2	4	7	5	2	6	4	5	3	3	44
Total	24	43	34	15	9	9	8	6	5	6	6	3	168

Table 4: Number of Landings Sampled During the Study at Lampulo

Type of gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Gillnet			2	2		1		1			1		7
Hand Line	4	2	6	3	2	2		2			2	2	25
Longline	1	3	2	4	3	4	3	3	6	3	5	4	41
Purse Seine	4	7	5	2	1	1	2			2	7	3	34
Total	9	12	15	11	6	8	5	6	6	5	15	9	107

2.1.2 Fishing Ground and Catch Composition by Gear Type

The main gear landing sharks and rays at Cilacap was the bottom gillnet, drift gillnet and longline. The total catch was 231,385 (231,196.5 kg) kg comprising 187,247 (187,321 kg) kg sharks (81.0%) and 44,138 (43,875.5 kg) kg rays (19.0%). Those fishing gears operated from the inshore to offshore of the Indian ocean. The highest landing of sharks by month was 26,794 kg in September while the highest landing of rays was 12,706 kg (12,734 kg) in October (**Table 5**).

While longline was the main gear landing at Lampulo, 6,991 kg for sharks, 2,002.9 kg of rays, and 8.0 kg of skates. Most longlines operated beyond 94 nautical miles from the coastline (in Indian ocean). The highest landing of sharks by month was 2,087.6 kg in June while the highest landing of rays was caught 1,097.4 kg in March and only 8.0 kg of skates was caught in January 2016 (**Table 6**).

Table 5: Weight of Sharks and Rays (in kg) Caught by Different Types of Gear at Cilacap

Type of gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Bottom Gillnet						413.5	884.0			182.0			1479.5
Drift Gillnet	15194.0	14349.0	5016.0	1539.0	99.5	1126.0					135.0		37458.5
Longline	6920.0	12445.0	9207.0	14971.0	15407.0	15386.0	6176.0	16193.0	14596.0	21441.0	9285.0	6356.0	148383.0
Sharks	22114.0	26794.0	14223.0	16510.0	15506.5	16925.5	7060.0	16193.0	14596.0	21623.0	9420.0	6356.0	187321.0
Bottom Gillnet						1066.5	5065.0		207.0	136.0			6474.5
Drift Gillnet	5097.0	11965.0	12734.0	5475.0	1252.0	54.0					406.0		36983.0
Longline	68.0				241.0	33.0			76.0				418.0
Rays	5165.0	11965.0	12734.0	5475.0	1493.0	1153.5	5065.0		283.0	136.0	406.0		43875.5
Total	27279.0	38759.0	26957.0	21985.0	16999.5	18079.0	12125.0	16193.0	14879.0	21759.0	9826.0	6316.0	231196.5

Table 6: Weight of Sharks, Rays and Skates (in kg) Caught by Different Types of Gear at Lampulo

Type of gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Gillnet				104.5							30.0		134.5
Hand Line	41.6	5.0	444.0	327.0	6.0	15.6		134.3			45.5	172.0	1,190.9
Longline	25.0	879.9	306.5	59.4	1,557.1	166.8	361.0	382.5	1,152.5	396.9	1406.3	297.1	6,991.0
Purse Seine	542.5	1,104.8	744.3	160.0	234.5	146.0	221.3			272.0	605.8	35.5	4,066.7
Sharks	609.1	1,989.7	1,494.7	650.9	1,797.6	328.4	582.3	516.8	1,152.5	668.9	2,087.6	504.6	12,383.1
Gillnet			149.8	407.0		45.2		299.4					901.4
Hand Line	11.5	76.0	149.4	110.0	9.8	46.2							402.9
Longline		53.8	46.2	447.0	85.5	143.4	77.2	798.0	336.0		7.9	7.9	2,002.9
Purse Seine		40.0										23.0	63.0
Rays	11.5	169.8	345.4	964.0	95.3	242.8	77.2	1,097.4	336.0		7.9	30.9	3,370.2
Longline						8.0							8.0
Skates						8.0							8.0
Total	620.6	2,159.5	1,840.1	1,614.9	1,892.9	571.2	659.5	1,614.2	1,488.5	668.9	2,095.5	535.5	15,761.4

2.1.3 Sharks, Rays and Skates Composition

A total of 769,420.9 kg of fish was landed from 168 landings during the study period at Cilacap. Rays and sharks made up 44,993.5 kg and 184,539 kg (6% and 24%) from the total landing respectively. While landings of bony fishes were 539,295.4 kg (70%) and there is no catch of low value species of trash fish. Average landings per month for sharks and rays were 15,378.25 kg and 3,749.5 kg, respectively. The highest landing by month for rays was 12,822 kg in October, followed by 11,965 kg in September and 5,680 kg in August. However, the highest landing for sharks was 26,798 kg in September followed by 22,114 kg in August and 21,623 kg in May. In general, the landing of sharks and rays ranged between 10-100% and 0-20% respectively from total landing at Cilacap. The catch shark and ray composition landed at Cilacap are shown in **Table 7**.

Table 7: Catch Composition of Sharks, Rays, Bony Fish and Others by Month from 168 landings at Cilacap. All Weights in Kilogram.

	Weight of ray	% ray	Weight of shark	% shark	Weight of bony fish	% bony fish	Total
2015							
Aug	5,680.00	4.04	22,114.00	15.72	113,100.20	80.38	140,744.20
Sep	11,965.00	4.95	26,798.00	11.09	202,145.30	83.66	241,628.30
Oct	12,822.00	8.70	14,259.00	9.67	120,318.60	81.59	147,462.60
Nov	5,475.00	8.12	16,561.00	24.55	45,420.70	67.33	67,456.70
Dec	2,008.00	5.84	15,516.50	45.12	16,865.90	49.04	34,390.40
2016							
Jan	1,153.50	3.44	16,925.50	50.45	15,467.00	46.11	33,546.00
Feb	5,065.00	20.17	7,060.00	28.12	12,984.50	51.71	25,109.50
Mar	0.00	0.00	16,183.00	77.15	4,792.20	22.85	20,975.20
Apr	283.00	1.56	14,600.00	80.59	3,233.00	17.85	18,116.00
May	136.00	0.56	21,623.00	89.67	2,355.50	9.77	24,114.50
Jun	406.00	3.71	7,927.00	72.42	2,612.50	23.87	10,945.50
Jul	0.00	0.00	4,972.00	100.00	0.00	0.00	4,972.00
Total	44,993.50	5.85	184,539.00	23.98	539,295.40	70.09	769,460.90
Ave.	3,749.46		15,378.30		44,941.28		64,118.41

A total of 180,809.86 kg of fish was landed from 107 landings during the study period at Lampulo. Sharks, rays and skates made up 12,757.3 kg, 3,379.3 kg, and 8.0 kg (7.1%, 1.9%, and 0.004%) from the total landing respectively. While landings of bony fishes were 164,690 kg (91.1%) and there is no catch of low value species of trash fish. Average landings

per month for sharks and rays were 1063.11 kg and 307.21 kg respectively. The highest landing by month for rays was 1,097.4 kg in March, followed by 964.0 kg in November and 345.4 kg in October. The highest landing for sharks was 2,087.6 kg in June followed by 1,989.7 kg in September and 1,797.6 kg in December. In general, the landing of sharks and rays ranged between 3.7-49.3 % and 0-43% respectively from total landing at Lampulo. However, only 8.0 kg (0.004%) of skate was landing in January. The details are shown in **Table 8**.

Table 8: Catch Composition of Sharks, Rays, Skates, Bony Fish and Others by Month from 105 landings at Lampulo. All Weights in Kilogram.

	Weight of shark	% shark	Weight of ray	% ray	Weight of skate	% skate	Weight of Bony fish	% bony fish	Total
2015									
Aug	609.10	3.66	11.50	0.07	0.00	0.00	16,005.00	96.27	16,625.60
Sep	1,989.70	5.72	169.80	0.49	0.00	0.00	32,600.00	93.79	34,759.50
Oct	1,494.73	4.39	345.40	1.01	0.00	0.00	32,200.00	94.59	34,040.13
Nov	650.90	8.02	964.00	11.88	0.00	0.00	6,500.00	80.10	8,114.90
Dec	1,797.60	21.68	95.29	1.15	0.00	0.00	6,400.00	77.17	8,292.89
2016									
Jan	328.40	19.08	234.80	13.64	8.00	0.46	1,150.00	66.81	1,721.20
Feb	582.30	4.77	77.20	0.63	0.00	0.00	11,540.00	94.59	12,199.50
Mar	516.79	20.23	1,097.40	42.96	0.00	0.00	940.00	36.80	2,554.19
Apr	1,249.50	49.28	336.00	13.25	0.00	0.00	950.00	37.47	2,535.50
May	767.90	9.00		0.00	0.00	0.00	7,780.00	91.19	8,531.20
Jun	2,087.60	5.66	7.90	0.02	0.00	0.00	34,790.00	94.32	36,885.50
Jul	682.75	4.69	32.00	0.22	0.00	0.00	13,835.00	95.09	14,549.75
Total	12,757.27	7.06	3,379.29	1.86	8.00	0.004	164,690.00	91.08	180,817.86
Ave.	1,063.11		307.21		8.00		13,724.17		15,068.15

2.1.4 Sample Size

A total of 2,899 individuals belonging to 435 rays and 2,464 sharks were sampled comprising four species of rays and 16 species of sharks. The most abundant ray species were *Mobula japonica*. The highest number of rays sampled by month was 110 in September followed by 79 in October and 77 in February. The most abundant shark species were *Alopias superciliosus* followed by *A. pelagicus* and *Prionace glauca*. However, the highest number of sharks sampled by month was 290 in November, followed by 270 in May and 285 in April. All these species were landed throughout the year. The details are as shown in **Table 9**.

Table 9: Sample Size of Sharks and Rays by Species at Cilacap

Species of rays and sharks	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<i>Mobula japonica</i>	41	82	62	46	23	6	37		5	2	1		305
<i>Mobula tarapacana</i>	2	8	5		1						3		19
<i>Mobula thurstoni</i>		20	12			1	11						44
<i>Rhinobatos penggali</i>						38	29						67
Total Rays	43	110	79	46	24	45	77		5	2	4		435
<i>Alopias pelagicus</i>	28	56	23	24	46	15	25	127	84	69	55	42	594
<i>Alopias superciliosus</i>	23	31	56	50	26	64	8	50	101	112	117	72	710
<i>Carcharhinus brevipinna</i>	18	7	9	2		9	2			5		2	54
<i>Carcharhinus falciformis</i>	12	12	12	24	43	42	21	26	36	26	9		263
<i>Carcharhinus leucas</i>					1								1
<i>Carcharhinus longimanus</i>						1				1			2
<i>Carcharhinus plumbeus</i>	10	7	18	7	4	8		5	2	14	3	3	81
<i>Carcharhinus sorrah</i>	1	1	2			12		3	1	8			28
<i>Galeocerdo cuvier</i>		1		2	3	4			1	6			17
<i>Heptranchias perlo</i>						5	19						24
<i>Isurus oxyrinchus</i>	14	35	28	26	19	7		4	9	6			148
<i>Isurus paucus</i>	7	45	26	56	25	15		6	12	3	1		196
<i>Prionace glauca</i>	5	12	35	96	59	51		4	12	20	1		295
<i>Pseudocarcharias kamoharai</i>		7											7
<i>Sphyrna lewini</i>	4	5	3	3	8	9	4	8					44
Total Sharks	122	219	212	290	234	242	79	233	258	270	186	119	2,464
Total	165	329	291	336	258	287	156	233	263	272	190	119	2,899

A total of 641 individuals belonging to 214 rays, 425 sharks, and two (2) skates were sampled comprising 24 species of rays, 25 species of sharks, and two (2) species of skates. The most abundant ray species were *Neotrygon kuhlii* followed by *Himantura jenkinsii* and *Rhynchobatus australiae*. The highest number of rays sampled by month was 43 in March and November followed by 28 in January and 20 in October and December. The most abundant shark species were *Alopias pelagicus* followed by *Carcharhinus amblyrhynchos* and *Centrophorus moluccensis*. However, the highest number of sharks sampled by month was 53 in June followed by 51 in September and 47 in December. All these species were landed throughout the year. The details are as shown in **Table 10**.

Table 10: Sample Size of Sharks, Rays, and Skate by Species at Lampulo

Species of ray, shark and skate	2015					2016							Total	
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul		
<i>Aetobatus ocellatus</i>					1			2	1				1	5
<i>Dasyatis akajei</i>														1
<i>Dasyatis zugei</i>														1
<i>Gymnura zonura</i>								2						2
<i>Himantura fai</i>					1									1
<i>Himantura granulata</i>														1
<i>Himantura jenkinsii</i>			1	4	13	5		2	16	9				50
<i>Himantura uarnak</i>					1									1
<i>Himantura undulata</i>									4					4
<i>Himantura walga</i>					1	1								2
<i>Mobula japanica</i>	1	1			2			2						6
<i>Mobula kuhlii</i>					1			2						3
<i>Neotrygon kuhlii</i>	2	5	3	13	10	20	5	13	3		5	5		84
<i>Pastinachus atrus</i>				1										1
<i>Pastinachus solocirostris</i>								2						2
<i>Plesiobatis daviesi</i>				1										1
<i>Pteroplatytrygon violacea</i>								2						2
<i>Rhina ancylostoma</i>			1											1
<i>Rhinoptera javanica</i>												1		1
<i>Rhinoptera jayakari</i>					1									1
<i>Rhynchobatus australiae</i>	1	5	6	6		1		2	1					22
<i>Taeniura lymma</i>			1	4	1	1	2	1	2					12
<i>Taeniurops meyeri</i>				1	1		1		4	1				8
<i>Urogymmus asperrimus</i>					1				1					2
Rays	4	14	20	43	20	28	16	43	14		5	7		214
<i>Alopias pelagicus</i>	3	7	13	7	9	2	3	6	1	10	13	3		77
<i>Alopias superciliosus</i>			1	1	5					2		1		10
<i>Carcharhinus melanopterus</i>										1				1
<i>Carcharhinus albimarginatus</i>										5				5
<i>Carcharhinus amblyrhynchos</i>	10	16	5			4	1	1	1		10	1		49
<i>Carcharhinus brevipinna</i>						1								1
<i>Carcharhinus falciformis</i>	9	10	5	2	3		2		6	1	4	2		44
<i>Carcharhinus leucas</i>			2	6	1	1					2	1		13
<i>Carcharhinus melanopterus</i>								1		11				12
<i>Carcharhinus sorrah</i>				1				3	1					5
<i>Centrophorus cf. lusitanicus</i>			4											4
<i>Centrophorus moluccensis</i>					14	13					12	8		47
<i>Cephaloscyllium pictum</i>						1								1
<i>Chiloscyllium punctatum</i>	5	2	2	1	1	1			1	1	1	1		16
<i>Galeocerdo cuvier</i>	1	2			7		2		7		1			20
<i>Hemigaleus microstoma</i>	1				1			3	6	4	1			16
<i>Isurus oxyrinchus</i>				1	2			1			1			5
<i>Loxodon macrorhinus</i>	1		2	2				7	10	6				28
<i>Orectolobus leptolineatus</i>					1			1						2
<i>Pseudotriakis microdon</i>						2								2
<i>Rhincodon typus</i>												1		1
<i>Sphyrna lewini</i>	1	2	1	1	4		6			3	7			25
<i>Squalus edmundsi</i>					6									6
<i>Squalus megalops</i>	7	5				13								25
<i>Triaenodon obesus</i>						4		1	1	3				10
Sharks	38	51	37	24	47	39	14	24	40	41	53	17		425
<i>Dipturus sp.1</i>								1						1
<i>Dipturus sp.2</i>								1						1
Skates								2						2
Grand Total	42	65	57	67	67	69	30	67	54	41	58	24		641

2.1.5 Weight of Sharks and Rays by Species

A total of 231,197 kg of sharks and rays was landed at Cilacap from 168 landings comprising 43,876 kg rays and 187,321 kg sharks. For rays, the highest landing by weight was from species *Mobula japanica* amounting to 36,789.5 kg, followed by 3,500.5 kg *Mobula thurstoni* and 3,280 kg *Mobula tarapacana*. The highest landing by month was 11,104 kg for *Mobula japanica* in October, followed by 8,760 kg in September and 4,895 kg in August. However there is no every month landing for *Mobula tarapacana* and *M. thurstoni*. The highest landing of shark species were 52,941 kg for *Alopias superciliosus* followed by 46,778 kg for *Alopias pelagicus* and 17,932 kg for *Prionace glauca*. The highest landing by month for *Alopias pelagicus* was 11,753 kg in August followed by 10,394 kg *Alopias superciliosus* in May and 5,218 kg in November for *Prionace glauca*. The details of weight of Sharks and Rays by species landed at Cilacap are shown in Table 11 and Table 12.

Table 11: Weight of Sharks by Species at Cilacap

Species of sharks	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<i>Alopias pelagicus</i>	11,753	6,538	1,455	1,104	3,119	1,429	2,387	8,144	3,687	3,541	1,906	1,715	46,778.0
<i>Alopias superciliosus</i>	2,665	5,482	3,407	2,420	2,123	4,217	684	3,517	7,357	10,394	6,788	3,887	52,941.0
<i>Carcharhinus brevipinna</i>	2,200	1,932	1,280	281		371	306.5			1,003		241	7,614.5
<i>Carcharhinus falciformis</i>	1,508	1,316	268	935	2,437	1,468	2,158	1,247	1,702	1,014	130		14,183.0
<i>Carcharhinus leucas</i>					105								105.0
<i>Carcharhinus longimanus</i>						30				16			46.0
<i>Carcharhinus plumbeus</i>	1,290	1,436	2,318	1,126	874	1,056		468	211	3,260	461	513	13,013.0
<i>Carcharhinus sorrah</i>	2	16	48			129		93	14	82			384.0
<i>Galeocerdo cuvier</i>		73		170	264.5	394			21	822			1,744.5
<i>Heptranchias perlo</i>						413.5	577.5						991.0
<i>Isurus oxyrinchus</i>	1,339	4,792	1,827	1,795	1,169	859		797	689	546			13,813.0
<i>Isurus paucus</i>	471	2,916	1,521	2,842	1,493	1,199		334	468	160	135		11,539.0
<i>Prionace glauca</i>	205	1,689	1,521	5,218	3,220	4,695		152	447	785			17,932.0
<i>Pseudocarcharias kamoharai</i>		9											9.0
<i>Sphyrna lewini</i>	681	595	578	619	702	665	947	1,441					6,228.0
Total	22,114	26,794	14,223	16,510	15,506.5	16,925.5	7,060	16,193	14,596	21,623	9,420	6,356	187,321.0

Table 12: Weight of Rays (in Kg) by Species Landings at Cilacap

Species of rays	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<i>Mobula japanica</i>	4,895	8,760	11,104	5,475	1,167	999	3,970.50		283	136			36,789.5
<i>Mobula tarapacana</i>	270	1,643	635		326						406		3,280.0
<i>Mobula thurstoni</i>		1,562	995			77	866.5						3,500.5
<i>Rhinobatos penggali</i>						77.5	228						305.5
Grand Total	5,165	11,965	12,734	5,475	1,493	1,153.50	5,065		283	136	406		43,875.5

A total of 15,761.36 kg was landed at Lampulo from 107 landings comprising 12,383.14 kg sharks, 3,370.22 kg rays and 8.0 kg skates. For rays, the highest landing by weight was from species *Himantura jenkinsii* amounting to 1,502.9 kg, followed by 523.28 kg *Neotrygon kuhlii* and 405.6 kg *Rhynchobatus australiae*. The highest landing by month was 666.7 kg for *Himantura jenkinsii* in March, followed by 256 kg *Neotrygon kuhlii* in November and 111.8 kg *Rhynchobatus australiae* in October. However there is no every month landing for all species of rays at Lampulo fish landing site. The highest landing of shark species were 4,167 kg for *Alopias pelagicus* followed by 1,632 kg for *Galeocerdo cuvier* and 1,231 kg for *Centrophorus moluccensis*. The highest landing by month for *Centrophorus moluccensis* was 877,3 kg in June followed by *Alopias pelagicus* was 770 kg in October and *Galeocerdo cuvier* was 693 kg in December. The details of weight of sharks and rays by species landed at Lampulo are shown in Table 13 and Table 14

Table 13: Weight of Sharks (in Kg) by Species Landings at Lampulo

Species of shark	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<i>Alopias pelagicus</i>	280.0	565.0	770.0	340.0	410.0	146.0	160.0	307.5	35.0	348.0	623.5	182.0	4167.0
<i>Alopias superciliosus</i>		60.0	40.0		240.0					95.0		40.0	475.0
<i>Carcharhinus albimarginatus</i>									170.0				170.0
<i>Carcharhinus amblyrhynchos</i>	152.0	448.3	51.0			24.1	3.8	3.2	8.0		75.8	5.0	771.2
<i>Carcharhinus brevipinna</i>						15.0							15.0
<i>Carcharhinus falciformis</i>	67.0	169.0	57.3	30.0	20.5		7.5		200.0	4.0	34.0	35.5	624.8
<i>Carcharhinus leucas</i>		240.0	461.0	110.0	70.0						115.0	60.0	1056.0
<i>Carcharhinus melanopterus</i>								15.0		29.3			44.3
<i>Carcharhinus sorrah</i>			8.2					46.5	13.0				67.7
<i>Carcharhinus melanopterus</i>									10.0				10.0
<i>Centrophorus cf. lusitanicus</i>		97.5											97.5
<i>Centrophorus moluccensis</i>					124.1	51.5					877.3	178.1	1231.0
<i>Cephaloscyllium pictum</i>						4.0							4.0
<i>Chiloscyllium punctatum</i>	18.1	5.0	4.3	4.0	9.0	4.2			4.0	6.0	9.0	4.0	67.6
<i>Galeocerdo cuvier</i>	30.0	103.5			693.0		150.0		575.0		80.0		1631.5
<i>Hemigaleus microstoma</i>	1.5			11.4				16.0	23.0	23.1			75.0
<i>Isurus oxyrinchus</i>			34.0	72.0				40.0			40.0		186.0
<i>Loxodon macrorhinus</i>	0.5		4.0	25.0				69.1	104.5	23.5			226.6
<i>Orectolobus leptolineatus</i>				5.0				4.5					9.5
<i>Pseudotriakis microdon</i>					70.0								70.0
<i>Rhincodon typus</i>											30.0		30.0
<i>Sphyrna lewini</i>	35.0	55.0	65.0	32.0	161.0		261.0			115.0	203.0		927.0
<i>Squalus edmundsi</i>				21.5									21.5
<i>Squalus megalops</i>	25.0	246.4				24.6							296.0
<i>Triaenodon obesus</i>						59.0		15.0	10.0	25.0			109.0
Total	609.1	1990	1495	650.9	1798	328.4	582.3	516.8	1153	668.9	2088	504.6	12383.1

Table 14: Weight of Rays and Skates (in Kg) by Species Landings at Lampulo

Species of ray and skate	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<i>Aetobatus ocellatus</i>				6.0			6.9	1.5				23.0	37.4
<i>Dasyatis akajei</i>					4.0								4.0
<i>Dasyatis zugei</i>					0.1								0.1
<i>Gymnura zonura</i>							5.8						5.8
<i>Himantura fai</i>				86.0									86.0
<i>Himantura granulata</i>					4.5								4.5
<i>Himantura jenkinsii</i>		10.0	171.3	352.0	68.9		21.0	666.7	213.0				1502.9
<i>Himantura uarnak</i>				40.0									40.0
<i>Himantura undulata</i>								253.0					253.0
<i>Himantura walga</i>				9.0	0.1								9.1
<i>Mobula japanica</i>	5.0	25.0		75.0			18.0						123.0
<i>Mobula kuhlii</i>				20.0			17.5						37.5
<i>Neotrygon kuhlii</i>	1.5	24.0	6.6	256.0	14.2	155.2	6.3	25.2	21.0		7.9	5.4	523.3
<i>Pastinachus atrus</i>			30.0										30.0
<i>Pastinachus solocirostris</i>						8.0							8.0
<i>Plesiobatis daviesi</i>			7.6										7.6
<i>Pteroplatytrygon violacea</i>						7.0							7.0
<i>Rhina ancylostoma</i>		40.0											40.0
<i>Rhinoptera javanica</i>												2.5	2.5
<i>Rhinoptera jayakari</i>				12.0									12.0
<i>Rhynchobatus australiae</i>	5.0	65.8	111.8	64.0		15.0		59.0	85.0				405.6
<i>Taeniura lymma</i>		5.0	11.6		3.5	11.6	1.7	11.0					44.4
<i>Taeniurops meyeri</i>			6.5	14.0		38.0		66.0	17.0				141.5
<i>Urogymnus asperrimus</i>				30				15					45
Total Rays	11.5	169.8	345.4	964.0	95.3	234.8	77.2	1097.4	336.0		7.9	30.9	3370.2
<i>Dipturus</i> sp.						8.0							
Total Skates						8.0							
Total	11.5	169.8	345.4	964.0	95.3	242.8	77.2	1097.4	336.0		7.9	30.9	3378.2

2.1.6 Size Range of Sharks and Rays

In general most rays species sampled from August 2015 to July 2016 were immature. The average size of *Mobula japanica*, and *M.thurstoni* ranged between 165- 206.5 cm, 153.5 - 184.5 cm disc length, respectively. Most shark species landed were mature are *Alopias pelagicus*, *A.superciliosus*, *Isurus oxyrinchus*, *I. paucus*, *Prionace glauca*, and *Sphyrna lewini*. The average size of those species of shark ranged between 268.5 - 279.5 cm, 224.3 - 285.5 cm, 199.0 – 280.0 cm, 185 – 235.0 cm, 198.2 – 256.0 cm, and 201.8 – 305.0 cm total length, respectively. *Alopias pelagicus* from the Indian Ocean can reach the maximum length of 365 cm. Males reach adult at size about 240-250 cm and females at 260-285 cm (White *et.al.*, 2006; White, 2007). Liu *et al.* (1999) reported that the total length at maturity was 282-292 cm for females and 267- 276 cm for males. Based on the results of the study, it can be said that most of *Alopias pelagicus* caught from the Indian Ocean in the years 2002-2007 are commonly at adult stage (mature non reproductive or mature sexually) (Dharmadi *et al.*, 2012). Size range of all sharks and rays species landed at Cilacap from August to May are shown in **Table 15A and Table 15B**.

The ray landed at Lampulo from August 2015 to July 2016 were mature for *Neotrygon kuhlii* in average size ranged between 23-30 cm disc length. Others species of ray was *Himantura jenkinsii* but immature condition. There is no every month landing of rays at this site. The shark were mature condition found on some species were *Alopias pelagicus*, *Galeocedo cuvier*, and *Sphyrna lewini* in average size ranged between 249-276 cm, 168-298 cm, 171-267 cm total length, respectively. Size range of all sharks and rays species landed at Lampulo from August to May are shown in **Table 16A and Table 16B**.

Table 15A: Size Range of Sharks (Total Length) and Rays (Disc Length) August – December 2015. at Cilacap.

Measurement for *Rhinobatos penggali* is TL, *Alopias pelagicus* from Jan-July and *A. superciliosus* from Feb-July in 2016 is PCL.

Species of shark and ray	2015														
	Aug			Sep			Oct			Nov			Dec		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Sharks															
<i>Alopias pelagicus</i>	214.0	325.0	274.4	162.0	330.0	268.5	177.0	372.0	275.0	183.0	334.0	271.1	228.0	338.0	279.5
<i>Alopias superciliosus</i>	177.0	378.0	273.2	174.0	438.0	285.5	65.0	382.0	269.7	178.0	334.0	259.6	109.0	334.0	224.3
<i>Carcharhinus brevipinna</i>	195.0	298.0	256.2	229.0	303.0	279.7	172.0	274.0	245.2	232.0	261.0	246.5			
<i>Carcharhinus falciformis</i>	103.0	197.0	164.7	87.0	182.0	146.3	117.0	188.0	152.1	130.0	271.0	184.0	95.0	234.0	170.3
<i>Carcharhinus leucas</i>													227.0	227.0	227.0
<i>Carcharhinus longimanus</i>															
<i>Carcharhinus plumbeus</i>	241.0	296.0	276.8	265.0	335.0	299.6	214.0	330.0	272.6	232.0	338.0	271.3	257.0	310.0	283.0
<i>Carcharhinus sorrah</i>	85.0	85.0	85.0	134.0	134.0	134.0	157.0	160.0	158.5						
<i>Galeocerdo cuvier</i>				240.0	240.0	240.0				211.0	231.0	221.0	183.0	254.0	216.0
<i>Heptranchias perlo</i>															
<i>Isurus oxyrinchus</i>	144.0	278.0	211.5	153.0	270.0	215.7	171.0	257.0	210.8	131.0	265.0	201.0	152.0	252.0	199.1
<i>Isurus paucus</i>	160.0	247.0	200.6	154.0	260.0	207.7	130.0	244.0	207.1	159.0	271.0	196.1	140.0	241.0	201.0
<i>Prionace glauca</i>	170.0	223.0	202.4	178.0	283.0	230.9	202.0	264.0	230.4	176.0	292.0	226.1	161.0	290.0	221.0
<i>Pseudocarcharias kamoharai</i>				71.0	98.0	87.3									
<i>Sphyrna lewini</i>	190.0	310.0	254.0	194.0	265.0	238.2	301.0	311.0	305.0	197.0	298.0	262.3	171	263.0	222.8
Rays															
<i>Mobula japanica</i>	48.0	150.0	112.5	58.0	140.0	105.9	49.0	143.0	107.4	65.0	148.0	110.4	63	144.0	103.9
<i>Mobula tarapacana</i>	124.0	182.0	153.0	101.0	177.0	139.4	108.0	167.0	136.4				165	165.0	165.0
<i>Mobula thurstoni</i>				51.0	130.0	91.1	63.0	114.0	93.5						
<i>Rhinobatos penggali</i>															

Table 15B: Size Range of Sharks (Total Length) and Rays (Disc Length) January – July 2016. at Cilacap.

Measurement for *Rhinobatos penggali* is TL, *Alopias pelagicus* from Jan-July and *A. superciliosus* from Feb-July in 2016 is PCL.

Species of shark and ray	2016																				
	Jan			Feb			Mar			Apr			May			Jun			Jul		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Sharks																					
<i>Alopias pelagicus</i>	101.0	144.0	127.0	76.0	143.0	121.2	95.0	166.0	124.4	89.0	168.0	124.9	90.0	154.0	119.6	101.0	167.0	123.9	97.0	157.0	125.3
<i>Alopias superciliosus</i>	172.0	308.0	225.7	99.0	144.0	125.8	71.0	181.0	130.7	92.0	202.0	142.7	98.0	190.0	138.8	101.0	213.0	139.8	91.0	212.0	137.3
<i>Carcharhinus brevipinna</i>	136.0	229.0	170.9	158.0	179.0	168.5							160.0	271.0	223.8				246.0	292.0	269.0
<i>Carcharhinus falciformis</i>	100.0	210.0	156.1	97.0	220.0	158.6	96.0	220.0	154.5	134.0	237.0	189.2	105.0	244.0	162.8	115.0	138.0	127.1			
<i>Carcharhinus leucas</i>													135.0	135.0	135.0						
<i>Carcharhinus longimanus</i>	160.0	160.0	160.0																		
<i>Carcharhinus plumbeus</i>	180.0	304.0	256.5				197.0	268.0	233.2	249.0	253.0	251.0	230.0	311.0	260.7	256.0	287.0	269.0	301.0	343.0	318.7
<i>Carcharhinus sorrah</i>	102.0	157.0	124.6				112.0	146.0	126.0	145.0	145.0	145.0	116.0	137.0	125.8						
<i>Galeocerdo cuvier</i>	164.0	279.0	227.8							152.0	152.0	152.0	236.0	344.0	271.5						
<i>Heptranchias perlo</i>	81.5	93.0	86.3	62.0	74.0	67.5															
<i>Isurus oxyrinchus</i>	148.0	367.0	205.1				210.0	364.0	280.0	181.0	346.0	230.3	176.0	238.0	217.2						
<i>Isurus paucus</i>	182.0	219.0	202.9				161.0	232.0	184.5	125.0	241.0	188.3	223.0	242.0	229.7	235.0	235.0	235.0			
<i>Prionace glauca</i>	173.0	295.0	227.5				142.0	229.0	198.3	174.0	243.0	203.8	176.0	264.0	205.4	256.0	256.0	256.0			
<i>Pseudocarcharias kamoharai</i>																					
<i>Sphyrna lewini</i>	148.0	296.0	201.9	179.0	271.0	209.3	211	316	273												
Rays																					
<i>Mobula japanica</i>	92.0	128.0	112.7	69.0	144.0	102.7				69	130	109.2	106	129	117.5	88.0	88.0	88.0			
<i>Mobula tarapacana</i>																159.0	180.0	166.7			
<i>Mobula thurstoni</i>	69.0	69.0	69.0	56.0	122.0	90.1															
<i>Rhinobatos penggali</i>	46.0	96.0	77.5	50.0	86.0	61.0															

**Table 16A: Size Range (cm.) of Sharks (Total Length), Rays and Skates (Disc Length)
from August – December 2015 at Lampulo**

Species of shark, ray and skate	2015														
	Aug			Sep			Oct			Nov			Dec		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Sharks															
<i>Alopias pelagicus</i>	264.0	278.0	272.3	199.0	282.0	249.3	223.0	306.0	262.8	236.0	287.0	262.3	183.0	288.0	261.7
<i>Alopias superciliosus</i>				302.0	302.0	302.0	270.0	270.0	270.0				253.0	311.0	282.8
<i>Carcharhinus melanopterus</i>															
<i>Carcharhinus albimarginatus</i>															
<i>Carcharhinus amblyrhynchus</i>	63.0	129.0	98.6	62.0	166.0	119.6	75.0	119.0	100.4						
<i>Carcharhinus brevipinna</i>															
<i>Carcharhinus falciformis</i>	96.0	126.0	111.9	72.0	172.0	105.7	87.0	253.0	137.6	97.0	151.0	124.0	96.0	107.0	101.7
<i>Carcharhinus leucas</i>				173.0	301.0	237.0	150.0	318.0	225.2	207.0	207.0	207.0	269.0	269.0	269.0
<i>Carcharhinus melanopterus</i>															
<i>Carcharhinus sorrah</i>							101.0	101.0	101.0						
<i>Centrophorus cf. lusitanicus</i>				53.0	67.0	59.0									
<i>Centrophorus moluccensis</i>													103.0	123.0	112.6
<i>Cephaloscyllium pictum</i>															
<i>Chiloscyllium punctatum</i>	73.0	85.0	81.0	55.0	95.0	75.0	71.0	79.0	75.0	86.0	86.0	86.0	77.0	77.0	77.0
<i>Galeocerdo cuvier</i>	169.0	169.0	169.0	78.0	258.0	168.0							225.0	361.0	279.3
<i>Hemigaleus microstoma</i>	79.0	79.0	79.0							110.0	110.0	110.0			
<i>Isurus oxyrinchus</i>							172.0	172.0	172.0	200.0	200.0	200.0			
<i>Loxodon macrorhinus</i>	51.0	51.0	51.0				85.0	87.0	86.0	74.0	109.0	91.5			
<i>Orectolobus leptolineatus</i>										97.0	97.0	97.0			
<i>Pseudotriakis microdon</i>													198.0	255.0	226.5
<i>Rhincodon typus</i>															
<i>Sphyrna lewini</i>	189.0	189.0	189.0	94.0	252.0	173.0	267.0	267.0	267.0	174.0	174.0	174.0	96.0	236.0	170.8
<i>Squalus edmundsi</i>										49.0	68.0	59.8			
<i>Squalus megalops</i>	50.0	96.0	75.7	68.0	103.0	91.0									
<i>Triaenodon obesus</i>													65.0	65.0	65.0
Rays															
<i>Aetobatus ocellatus</i>										47.0	47.0	47.0			
<i>Dasyatis akajei</i>													37.0	37.0	37.0
<i>Dasyatis zugei</i>													10.0	10.0	10.0
<i>Gymnura zonura</i>															
<i>Himantura fai</i>										124.0	124.0	124.0			
<i>Himantura granulata</i>													43.0	43.0	43.0
<i>Himantura jenkinsii</i>				46.0	46.0	46.0	87.0	113.0	102.0	40.0	147.0	82.3	46.0	84.0	66.2
<i>Himantura uarnak</i>										116.0	116.0	116.0			
<i>Himantura undulata</i>															
<i>Himantura walga</i>										36.0	36.0	36.0	10.0	10.0	10.0
<i>Mobula japonica</i>	5.5	5.5	5.5	65.0	65.0	65.0				62.0	109.0	85.5			
<i>Mobula kuhlii</i>										73.0	73.0	73.0			
<i>Neotrygon kuhlii</i>	21.0	24.5	22.8	25.0	35.0	32.0	28.0	33.0	30.0	26.0	116.0	38.9	13.0	36.0	24.2
<i>Pastinachus atrus</i>							75.0	75.0	75.0						
<i>Pastinachus solocirostris</i>															
<i>Plesiobatis daviesi</i>							72.0	72.0	72.0						
<i>Pteroplatytrygon violacea</i>															
<i>Rhina ancylostoma</i>															
<i>Rhinoptera javanica</i>															
<i>Rhinoptera jayakari</i>										42.0	42.0	42.0			
<i>Rhynchobatus australiae</i>	89.0	89.0	89.0	76.0	129.0	103.2	95.0	240.0	133.2	70.0	206.0	113.8			
<i>Taeniura lymma</i>				35.0	35.0	35.0	25.0	33.0	29.5	33.0	33.0	33.0	37.0	37.0	37.0
<i>Taeniurus meyeni</i>							54.0	54.0	54.0	58.0	58.0	58.0			
<i>Urogymnus asperrimus</i>										120.0	120.0	120.0			
Skates															
<i>Dipturus sp.</i>															

**Table 16B: Size Range (cm.) of Sharks (Total Length), Rays and Skates (Disc Length)
January – July 2016 at Lampulo**

Species of shark, ray and skate	2016																				
	Jan			Feb			Mar			Apr			May			Jun			Jul		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Sharks																					
<i>Alopias pelagicus</i>	257.0	266.0	261.5	268.0	275.0	271.3	233.0	287.0	256.5	250.0	250.0	250.0	237.0	283.0	256.0	143.0	296.0	257.7	262.0	284.0	276.0
<i>Alopias superciliosus</i>													239.0	299.0	269.0				270.0	270.0	270.0
<i>Carcharhinus melanopterus</i>										149.0	149.0	149.0									
<i>Carcharhinus albimarginatus</i>										144.0	197.0	163.8									
<i>Carcharhinus amblyrhynchos</i>	93.0	113.0	103.3	76.0	76.0	76.0	75.0	75.0	75.0	110.0	110.0	110.0				67.0	127.0	99.2	98.0	98.0	98.0
<i>Carcharhinus brevipinna</i>	134.0	134.0	134.0																		
<i>Carcharhinus falciformis</i>				75.0	77.0	76.0				125.0	260.0	179.0	85.0	85.0	85.0	74.0	128.0	109.0	112.0	139.0	125.5
<i>Carcharhinus leucas</i>													198.0	213.0	205.5	230.0	230.0	230.0			
<i>Carcharhinus melanopterus</i>							124.0	124.0	124.0				47.0	107.0	62.3						
<i>Carcharhinus sorrah</i>							48.0	169.0	110.0	121.0	121.0	121.0									
<i>Centrophorus cf. lusitanicus</i>																					
<i>Centrophorus moluccensis</i>	68.0	132.0	87.3													95.0	124.0	103.4	102.0	124.0	112.5
<i>Cephaloscyllium pictum</i>	72.0	72.0	72.0																		
<i>Chiloscyllium punctatum</i>	88.0	88.0	88.0							92.0	92.0	92.0	153.0	153.0	153.0	105.0	105.0	105.0	88.0	88.0	88.0
<i>Galeocerdo cuvier</i>				304.0	386.0	345.0				228.0	302.0	270.3				298.0	298.0	298.0			
<i>Hemigaleus microstoma</i>							103.0	125.0	110.3	87.0	107.0	99.0	89.0	99.0	93.0	94.0	94.0	94.0			
<i>Isurus oxyrinchus</i>							175.0	175.0	175.0							176.0	176.0	176.0			
<i>Loxodon macrorhinus</i>							59.0	90.0	77.9	75.0	116.0	88.4	84.0	90.0	86.8						
<i>Orectolobus leptolineatus</i>							98.0	98.0	98.0												
<i>Pseudotriakis microdon</i>																					
<i>Rhincodon typus</i>																214.0	214.0	214.0			
<i>Sphyrna lewini</i>				216.0	273.0	241.3							200.0	252.0	227.3	116.0	220.0	171.6			
<i>Squalus edmundsi</i>																					
<i>Squalus megalops</i>	7.0	105.0	61.1																		
<i>Triaenodon obesus</i>	99.0	171.0	130.0				123.0	123.0	123.0	156.0	156.0	156.0	101.0	122.0	108.0						
Rays																					
<i>Aetobatus ocellatus</i>				25.0	43.0	34.0	26.0	26.0	26.0							65.0	65.0	65.0			
<i>Dasyatis akajei</i>																					
<i>Dasyatis zugei</i>																					
<i>Gymnura zonura</i>				25.0	40.0	32.5															
<i>Himantura fai</i>																					
<i>Himantura granulata</i>																					
<i>Himantura jenkinsii</i>				57.0	61.0	59.0	39.0	145.0	83.1	29.0	113.0	72.0									
<i>Himantura uarnak</i>																					
<i>Himantura undulata</i>							98.0	127.0	115.8												
<i>Himantura walga</i>																					
<i>Mobula japonica</i>				57.0	62.0	59.5															
<i>Mobula kuhlii</i>				55.0	60.0	57.5															
<i>Neotrygon kuhlii</i>	22.0	36.0	28.9	17.0	33.0	28.0	19.0	33.0	28.2	26.0	33.0	29.7	15.0	36.0	29.2	25.0	32.0	29.0			
<i>Pastinachus atrus</i>																					
<i>Pastinachus solocirostris</i>	36.0	53.0	44.5																		
<i>Plesiobatis daviesi</i>																					
<i>Pteroplatytrygon violacea</i>	56.0	61.0	58.5																		
<i>Rhina ancylostoma</i>																					
<i>Rhinoptera javanica</i>																38.0	38.0	38.0			
<i>Rhinoptera jayakari</i>																					
<i>Rhynchobatus australiae</i>	127.0	127.0	127.0				112.0	213.0	162.5	270.0	270.0	270.0									
<i>Taeniura lymma</i>	28.0	33.0	30.5	24.0	24.0	24.0	26.0	29.0	27.5												
<i>Taeniurops meyeri</i>	103.0	103.0	103.0				50.0	107.0	83.3	83.0	83.0	83.0									
<i>Urogymnus asperrimus</i>							68.0	68.0	68.0												
Skates																					
<i>Dipturus sp.</i>	50.0	73.0	61.5																		

2.1.7 CPUE (Catch per Unit Effort)

Catch per Unit Effort (CPUE) of some species of sharks and rays caught by drift gillnet and purse seine during study shown in **Table 17** and **Table 18**.

Table 17: Days at operation (Number of operation) by gears sampled During the Study Period at Cilacap

Type of gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Bottom Gillnet						43	85		14	14			156
Drift Gillnet	388	537	414	170	31	30					41		1611
Longline	12	29	29	70	106	87	30	97	60	69	40	21	650
Total	400	566	443	240	137	160	115	97	74	83	81	21	2417

Table 18: Days at operation by gears sampled During the Study Period at Lampulo

Type of gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Gillnet			11	16		4		8			1		40
Hand Line	22	8	44	15	7	5		6			5	8	120
Longline	8	15	15	19	23	27	18	16	23	16	29	17	226
Purse Seine	21	46	31	12	7	7	11			15	41	15	206
Total	51	69	101	62	37	43	29	30	23	31	76	40	592

Table 19: Number of operation by gears sampled During the Study Period at Lampulo

Type of gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Gillnet			11	15		4		8			1		39
Hand Line	28	8	44	13	7	5		6			5	8	124
Longline	12	13	17	19	23	27	17	16	23	16	29	17	229
Purse Seine	23	42	26	10	5	5	9			14	32	12	178
Total	63	63	98	57	35	41	26	30	23	30	67	37	570

The highest CPUE of sharks landed at Cilacap were 32.86 kg/day for *Alopias pelagicus* followed by 29.04 kg/day for *Alopias superciliosus* and 11.13 kg/day for *Isurus oxyrinchus*. For ray, the highest CPUE was 22.84 kg/day for *Mobula japanica*, followed by *M. thurstoni* at 2.17 kg/day and *M. tarapacana* at 2.04 kg/day (**Table 20**).

While the highest CPUE of sharks landed at Lampulo were 18.21 kg/day for *Alopias pelagicus*, followed by 7.12 kg/day *Galeocerdo cuvier* and 5.38 kg/day *Centrophorus moluccensis*. The highest CPUE of rays were 6.56 kg/day for *Himantura jenkinsii*, and

followed by *Neotrygon kuhlii* at 2.29 kg/day and *Rhynchobatus australiae* at 1.77 kg/day (Table 21).

Table 20: Catch per Unit Effort (CPUE) of sharks and rays caught by drift gillnet landed at Cilacap

Species of shark and ray	Total (kg)	CPUE Total Weight kg/days
Sharks		
<i>Alopias superciliosus</i>	52941.0	32.86
<i>Alopias pelagicus</i>	46778.0	29.04
<i>Prionace glauca</i>	17932.0	11.13
<i>Carcharhinus falciformis</i>	14183.0	8.80
<i>Isurus oxyrinchus</i>	13813.0	8.57
<i>Carcharhinus plumbeus</i>	13013.0	8.08
<i>Isurus paucus</i>	11539.0	7.16
<i>Carcharhinus brevipinna</i>	7614.5	4.73
<i>Sphyrna lewini</i>	6228.0	3.87
<i>Galeocerdo cuvier</i>	1744.5	1.08
Rays		
<i>Mobula japanica</i>	36789.5	22.84
<i>Mobula thurstoni</i>	3500.5	2.17
<i>Mobula tarapacana</i>	3280.0	2.04
<i>Rhinobatos penggali</i>	305.5	0.19

Table 21: Catch per Unit Effort (CPUE) of sharks and rays caught by longline landed at Lampulo-Banda Aceh

Species of shark and ray	Total (kg)	CPUE Total Weight kg/days
Sharks		
<i>Alopias pelagicus</i>	4167.0	18.20
<i>Galeocerdo cuvier</i>	1631.5	7.12
<i>Centrophorus moluccensis</i>	1231.0	5.38
<i>Carcharhinus leucas</i>	1056.0	4.61
<i>Sphyrna lewini</i>	927.0	4.05
<i>Carcharhinus amblyrhynchos</i>	771.2	3.37
<i>Carcharhinus falciformis</i>	624.8	2.73
<i>Alopias superciliosus</i>	475.0	2.07
<i>Squalus megalops</i>	296.0	1.29
<i>Loxodon macrorhinus</i>	226.6	0.99
Rays		
<i>Himantura jenkinsii</i>	1502.9	6.56
<i>Neotrygon kuhlii</i>	523.3	2.29
<i>Rhynchobatus australiae</i>	405.6	1.77
<i>Himantura undulata</i>	253.0	1.10
<i>Taeniurops meyeri</i>	141.5	0.62
<i>Mobula japanica</i>	123.0	0.54
<i>Himantura fai</i>	86.0	0.38
<i>Urogymnus asperrimus</i>	45.0	0.20
<i>Taeniura lymma</i>	44.4	0.19
<i>Himantura uarnak</i>	40.0	0.17

2.1.8 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 China, Hong Kong, Bangladesh, and Sri Lanka. The major markets were wholesale markets in Cilacap and Banda Aceh. The price varied according to species. Market destinations for sharks and rays were similar in local market. The price was almost consistent for the whole year for all species. All sharks and rays were landed whole with fins. The details price of shark and ray at Cilacap are shown in **Table 22** and **Table 23**.

The most expensive sharks at Cilacap were *Carcharhinus plumbeus*, *C. leucas*, and *C. brevipinna* sold at IDR 23,000/kg, followed by *Carcharhinus sorrah* and *C. falciformis* at IDR16,000/kg, and *Sphyrna lewini* and *Isurus* spp. at IDR14,000/kg. The price for *Mobula* spp. was IDR80,000/kg.

The most expensive sharks (big size) at Lampulo were *Carcharhinus leucas*, and *Sphyrna lewini* sold at IDR 30,000/kg, followed by *Carcharhinus falciformis* at IDR 28,000/kg. Price for *Carcharhinus amblyrhynchos* and *C. albimarginatus* at IDR 25,000/kg. The price for medium and small sizes, the highest price were for *Sphyrna lewini* and *C. leucas* at IDR 25,000/kg and IDR 20,000/kg, respectively. The most expensive ray at Lampulo was *Rhynchobatus australiae* at IDR 35,000/kg for big size, IDR 30,000/kg for medium size and IDR 25,000/kg for small size.

Table 22: Price of Sharks and Rays by Species at Cilacap Landing Site in 2016.
All Prices in IDR per Kilogram. (Exchange rate: IDR 13,500= US\$ 1.00).

Location	Species	Range price (Rp/kg)	Part	Market destination
CILACAP	Sharks			
	<i>Alopias spp</i>	8,000-14,000	Whole	Local
	<i>Isurus spp</i>	14,000	Whole	Local
	<i>Sphyrna lewini</i>	14,000	Whole	Local
	<i>Carcharhinus falciformis</i>	16,000	Whole	Local
	<i>Carcharhinus sorrah</i>	16,000	Whole	Local
	<i>Prionace glauca</i>	11,000	Whole	Local
	<i>Carcharhinus plumbeus</i>	23,000	Whole	Local
	<i>Carcharhinus leucas</i>	23,000	Whole	Local
	<i>Carcharhinus brevipinna</i>	23,000	Whole	Local
	Rays			
	<i>Mobula spp.</i>	8,000	Whole	Local

Table 23: Price of Sharks and Rays by Species at Lampulo Landing Site in 2016.
All Prices in IDR per Kilogram. (Exchange rate: IDR 13,500= US\$ 1.00).

Location	Species	Range price (Rp/kg)			Part	Market destination
		small size	medium size	big size		
LAMPULO	Sharks					
	<i>Alopias</i> spp.		10,000	12,000	Whole	Local
	<i>Carcharhinus leucas</i>	20,000	25,000	30,000	Whole	Local
	<i>Carcharhinus falciformis</i>	18,000	23,000	28,000	Whole	Local
	<i>Carcharhinus amblyrhynchos</i>	17,000	20,000	25,000	Whole	Local
	<i>Carcharhinus brevipinna</i>		17,000	20,000	Whole	Local
	<i>Carcharhinus albimarginatus</i>		20,000	25,000	Whole	Local
	<i>Galeocerdo cuvier</i>	13,000	15,000	20,000	Whole	Local
	<i>Sphyrna lewini</i>	20,000	25,000	30,000	Whole	Local
	<i>Isurus</i> spp.		12,000	15,000	Whole	Local
	<i>Squalus megalops</i>	5,000	7,000		Whole	Local
	<i>Centrophorus moluccensis</i>	5,000	7,000		Whole	Local
	<i>Triaenodon obesus</i>		17,000	20,000	Whole	Local
	<i>Chiloscyllium punctatum</i>		10,000	13,000	Whole	Local
	Rays					
	<i>Neotrygon kuhlii</i>	15,000	13,000		Whole	Local
	<i>Taeniura lymna</i>	8,000	6,000		Whole	Local
	<i>Himantura jenkinsii</i>	10,000	8,000	6,000	Whole	Local
<i>Rhynchobatus australiae</i>	25,000	30,000	35,000	Whole	Local	

3. CONCLUSION

A total of 32 species of sharks belonging of 12 families, and 29 species of rays belonging of 12 families were recorded at two landing sites. The most abundant sharks species at Cilacap were *Alopias superciliosus* followed by *A. pelagicus* and *Prionace glauca*, while the dominant rays were *Mobula japanica* followed by *Mobula thurstoni* and *Mobula tarapacana*. The most abundant sharks species landed at Lampulo were *Alopias pelagicus* followed by *Galeocerdo cuvier* and *Centrophorus moluccensis*, while the dominant rays were *Himantura jenkinsii* followed by *Neotrygon kuhlii* and *Rhynchobatus australiae*. The list of sharks and rays species are shown in **Appendix II**.

The fishes landed at Cilacap consist of rays and sharks made up 6% and 24 % from the total landing respectively, and for commercial species were 70%. The main gear landing sharks and rays at Cilacap was the longline comprising sharks (64.2 %) and rays (0.2 %). In general, the landing of sharks and rays ranged between 10-100% and 0 – 20% respectively. The fishes was landed at Lampulo consist of rays and sharks made up 1.9% and 7.1% from the total landing respectively, and 91.1% for commercial species. In general, the landing of sharks and rays ranged between 3.7-49.3 % and 0-43% respectively.

A total of 229,352.5 kg of sharks and rays was landed at Cilacap from 168 landings comprising 184,539 kg sharks and 44,993.5 kg rays. The highest landing by weight from ray species were *Mobula japonica* (36,789.5 kg), followed by 3,500.5 kg *Mobula thurstoni* and 3,280 kg *Mobula tarapacana*. The highest landing by month was 11,104 kg for *Mobula japonica* in October, followed by 8,760 kg in September and 4,895 kg in August. The highest landing of shark species were 52,941 kg for *Alopias supercliosus* followed by 46,778 kg for *Alopias pelagicus* and 17,932 kg for *Prionace glauca*. The highest landing by month for *Alopias pelagicus* was 11,753 kg in August followed by 10,394 kg *Alopias superciliosus* in May and 5,218 kg in November for *Prionace glauca*.

A total of 15,761.4 kg was landed at Lampulo from 107 landings comprising 3,378 kg rays and 12,383.1 kg sharks. For rays, the highest landing by weight was from species *Himantura jenkinsii* amounting to 1,503 kg, followed by 523.3 kg *Neotrygon kuhlii* and 405.6 kg for *Rhynchobatus australiae*. The highest landing by month was 667 kg for *Himantura jenkinsii* in March, followed by 256 kg *Neotrygon kuhlii* in November and 112 kg *Rhynchobatus australiae* in October. The highest landing of shark species were 4,167 kg for *Alopias pelagicus* followed by 1,632 kg for *Galeocerdo cuvier* and 1,231 kg for *Centrophorus moluccensis*. The highest landing by month for *Centrophorus moluccensis* was 877 kg in June followed by *Alopias pelagicus* at 770 kg in October and *Galeocerdo cuvier* at 693 kg in December. The ray species *Neotrygon kuhlii* and *Rhynchobatus australiae* landed at Lampulo from August to May were mature with average size between 28.2-41.4 cm and 121.8-133.2 cm disc length, respectively. The shark species *Alopias pelagicus*, *Galeocerdo cuvier*, and *Sphyrna lewini* were mature with average size between 257-262 cm, 276-279 cm and 241-255 cm total length, respectively.

The catch of sharks fluctuated but the peak season occurred in June at Lampulo and September at Cilacap. Most shark species caught were adult such as *Alopias pelagicus*, *A. superciliosus*, *Isurus oxyrinchus*, *I. paucus*, *Prionace glauca*, *Galeocerdo cuvier*, and *Sphyrna lewini*.

4. OUTPUT AND OUTCOME

The project outputs and outcomes are summarised in **Table 24.** as shown below.

Table 24: Output and Outcome

No	Output	Outcome
1.	Four trained personnel in sharks and rays taxonomy from the Ministry of Fisheries Indonesia.	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 pilot project sites.	Confirmed earlier data published in Indonesia National Statistics. Sharks and rays were targeted and bycatch and contributed to only about 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.	Stage of maturity for the different species of sharks and rays determined.	Increased awareness of needs and measures for shark conservation and management among stakeholders
7.	Information on usage and marketing of the landed sharks and rays were obtained from the pilot project.	Confirmed earlier report in current NPOA-Sharks that all sharks and rays are landed whole, fully utilised with no finning activities onboard vessels.
8.	A report on landing of sharks and rays up to species level from three sites in Perak.	Data recording on sharks and rays will be improved from generic terms 'sharks' and 'rays' to species level.
9.	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
10.	Specimens collected during sampling activities deposited for future reference.	A specimen laboratory for elasmobranchs has been established at the awet Laboratory at Cilacap and Lampulo.

5. FUTURE ACTIVITIES

Indonesia will continue to record landing data up to species level at an additional some fish landing sites in 2017. Data collection at the current three landing sites is to be continued. Awareness programme will be continued in other parts of the country. All activities are shown in **Appendix III.**

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SAMPLE OF STANDARD FORM

Data Collection Project on Shark and Ray Data Collection

Name of Enumerator: _____ Date: _____

Name of Landing Site: _____ Vessel Registration No: _____

GRT : _____

Type of Gear: _____ Fishing Area: _____ No. of days/trip: _____

A. Standard Operation Procedure:

1. This form is for a single sampling vessel.
2. Collect all fish (sharks, skates and rays) if catch is less than 50 tails or 10-50% of the landed catch if more than 50 tails. Take samples randomly.
3. Separate them by species and sex.
4. Measure total length for all sharks, skates and rays from the Family Rhynchobatidae, Rhinobatidae, Narcinidae and Narkidae. Measure disc length for other ray species.
5. Record weight of all sharks, skates and rays by species.
6. Record weight of commercial and low-value species.

B. Measurement of sample (Sharks)

No.	Species	Sex	Total length (mm)					
1								
2								
3								

C. Actual Weight of Sharks by Species

No	Species	Weight (Kg)
1		
2		
3		

D. Measurement of sample (Rays)

No.	Species	Sex	Total length/Disc Length (mm)					
1								
2								
3								
4								

E. Actual Weight of Rays by Species

No	Species	Weight (Kg)
1		
2		
3		
4		
5		

3. Total Catch of Sampling Vessel

No.	Vessel Registration No	All Sharks	All Rays	Commercial species	Low-value species	TOTAL
1.						

5. Price of Sharks

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

6. Price of Rays

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

Note: _____

Checklist of Shark and Ray Species Recorded During the Study

No	Families/Species	Site 1	Site 2
		Cilacap	Lampulo
	SHARKS		
	Family Carcharhinidae		
1	<i>Carcharhinus leucas</i>	+	+
2	<i>Carcharhinus brevipinna</i>	+	
3	<i>Carcharhinus plumbeus</i>	+	
4	<i>Carcharhinus longimanus</i>	+	
5	<i>Carcharhinus falciformis</i>	+	+
6	<i>Carcharhinus sorrah</i>	+	+
7	<i>Carcharhinus melanopterus</i>		+
8	<i>Carcharhinus amblyrhynchos</i>		+
9	<i>Carcharhinus albimarginatus</i>		+
10	<i>Prionace glauca</i>	+	
11	<i>Galeocerdo cuvier</i>	+	
12	<i>Triaenodon obesus</i>		+
13	<i>Loxodon macrorhinus</i>		+
	Family Pseudocarchariidae		
14	<i>Pseudocarcharias kamoharai</i>	+	
	Family Pseudotriakidae		
15	<i>Pseudotriakish microdon</i>		+
	Family Hemigalidae		
16	<i>Hemigaleus microstoma</i>		+
	Family Orectolobidae		
17	<i>Orectolobus cf. ornatus</i>		+
	Family Hemiscylliidae		
18	<i>Chiloscyllium punctatum</i>		+
	Family Alopiidae		
19	<i>Alopias pelagicus</i>	+	+
20	<i>A. superciliosus</i>	+	+
	Family Sphyrnidae		
21	<i>Sphyrna lewini</i>	+	+
	Family Lamnidae		
22	<i>Isurus paucus</i>	+	
23	<i>I. oxyrinchus</i>	+	+
	Family Hexanchidae		
24	<i>Heptranchias perlo</i>	+	
	Family Squalidae		
25	<i>Squalus edmundsi</i>		+
26	<i>Squalus megalops</i>		+
	Family Centrophoridae		
27	<i>Centrophorus moluccensis</i>		+
28	<i>Centrophorus cf. lusitanicus</i>		
	Total shark species	15	19

No	Families/Species	Site 1	Site 2
		Cilacap	Lampulo
	RAYS		
	Family Carcharhinidae		
1	<i>Mobula japonica</i>	+	+
2	<i>Mobula tarapacana</i>	+	
3	<i>Mobula thurstoni</i>	+	
4	Family Rhinobatidae		
5	<i>Rhinobatos jimbaranensis</i>	+	
6	<i>Rhinobatos penggali</i>	+	
7	Family Rhynchobatidae		
8	<i>Rhynchobatus australiae</i>		+
9	Family Rhincodontidae		
10	<i>Rhyncodon typus</i>		+
11	Family Dasyatidae		
12	<i>Neotrygon kuhlii</i>		+
13	<i>Himantura uarnak</i>		+
	<i>Himantura granulata</i>		+
14	<i>Himantura undulata</i>		+
	<i>Himantura jenkinsii</i>		+
15	<i>Himantura fai</i>		+
	<i>Himantura walga</i>		+
16	<i>Urogymnus asperrimus</i>		+
	<i>Dasyatis zugei</i>		+
17	<i>Taeniura lymma</i>		+
	<i>Taeniurops meyeri</i>		+
18	<i>Pteroplatrygon violacea</i>		+
	Family Plesiobatidae		
19	<i>Plesiobatis daviesi</i>		+
20	Family Rajidae		
	<i>Dipturus sp.</i>		+
21	Family Myliobatidae		
	<i>Aeobatus flagellum</i>		+
22	Family Rhinopteridae		
23	<i>Rhinoptera javanica</i>		+
	Family Gymnuridae		
24	<i>Gymnura zonura</i>		+
	Total ray species	6	20

A. Lampulo Fishing Port



B. Cilacap Fishing Port



PART II

*National Reports on Sharks Data Collection in the Participating
Countries: **Malaysia***

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

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2016

ACKNOWLEDGEMENTS

The authors would like to thank The Honourable Datuk Haji Ismail bin Abu Hassan, Director-General of Fisheries Malaysia and Mr. Zulkafli bin Abd Rashid, Deputy Director-General of Fisheries Malaysia (Development) for their continuous support in the implementation of this project as well as the conservation and management of sharks and rays in Malaysia.

We would particularly like to thank to Dr. Chumnarn Pongsri, Former Secretary-General of SEAFDEC, Dr. Kom Silapajarn, Secretary-General of SEAFDEC for their support and to Dr. Haruko Okusu from CITES Secretariat Office in Geneva for supporting this project especially for securing funding from the European Union (EU).

We are grateful to all the people for their encouragement and support in the implementation of this project especially Mr. Ahmad Adnan bin Nuruddin, former Chief of SEAFDEC/MFRDMD; Mr. Raja Bidin bin Raja Hassan, Chief of SEAFDEC/MFRDMD; Dr. Osamu Abe, Deputy Chief of SEAFDEC/MFRDMD; Mr. Haji Sani bin Mohd Isa, former Director of Fisheries Management, Department of Fisheries Malaysia; Mr. Ahmad Hazizi bin Aziz, former Director of Planning and International, Department of Fisheries Malaysia; Ms. Tan Geik Hong, Director of Fisheries Management, Department of Fisheries Malaysia; Mr. Abu Talib bin Ahmad, Senior Research Director, Fisheries Research Institute; Datuk Rayner Datuk Stuel Galid, former Director of the Department of Fisheries Sabah; Dr. Ahemad bin Sade, Director of the Department of Fisheries Sabah and Dr. Bah Piyan Tan, Director of the Department of Fisheries, Perak.

We are highly appreciated of the effort by all Fisheries District Officers in Sabah and Perak especially Mr. Mohd Zamani bin Haji Nayan, Mr. Jum bin Abbas, Mr. Sallehudin bin Ismail and Mr. Rajandran S/O Ramasamy for helping and co-ordinated the project at states level.

Last but not least, we appreciated the services provided by enumerators Mr. Abdul Rahman bin Haji Ali Hasan (Larut Matang and Selama, Perak), Mr. Mahazir bin Baharom (Manjung Utara, Perak), Mr. Justin Agon and Mr. Norhairul bin Nordin (Kota Kinabalu, Sabah) and Mr. Chin En Kiong and Mr. Maurice@ Kassim bin Anchi (Sandakan, Sabah); supporting staff from SEAFDEC/MFRDMD Mr. Adam Luke Anak Pugas, Mr. Mohd Saki bin Noor, Mr. Nor Azman bin Zakaria, Mr. Ruzelan bin Jusoh and Mr. Wahab bin Daud; supporting staff from the Department of Fisheries Sabah Ms. Angelene Lojutan, Ms. Midah Gintin and Ms. Norsimah binti Kassim; supporting staff from FRI Kg. Acheh, Perak Mr. Hashim bin Suhaimi, Ms. Nur Fazleana binti Mohd Azlee (Industrial Training Student, UMT) and Mr. Muhammad Anuar bin Lasiman (contract staff) who are actively involved in data analysis.

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 *Heptranchias 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 marin 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**.

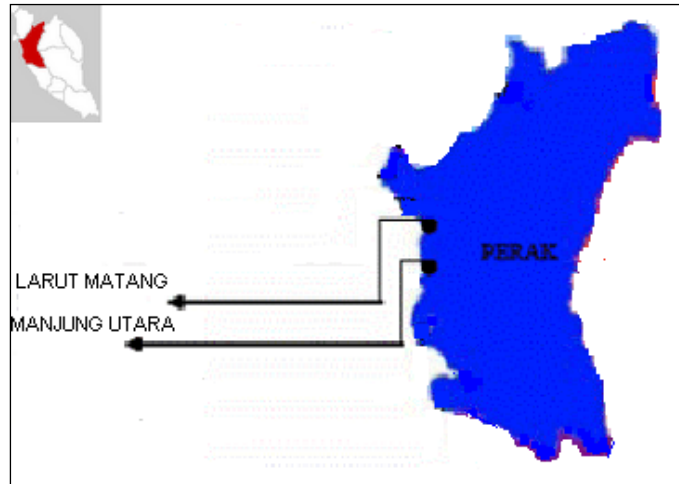


Figure 1: Location of Study Sites in the State of Perak

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**)

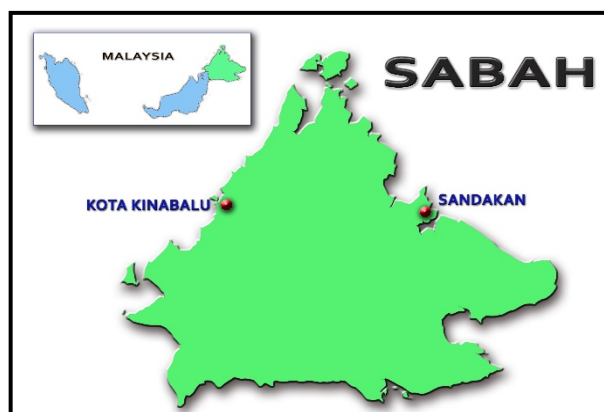


Figure 2 : Location of Study Sites in the State of Sabah

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
Trawlers				
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
Total			583	1,128
Purse Seiners				
> 70 GRT	C2	> 15 nm	29	721
Total			29	721
Drift Netters	A	All areas	144	514
Longliners	A	All areas	15	15
Others (Fish trap etc.)	A	All areas	954	1,260
Total			1,113	1,789
Grand Total			1,725	3,638

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
Trawlers				
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
Total			242	537
Purse Seiners				
40 - 69.9 GRT	C	> 12 nm	3	83
> 70 GRT	C2	> 15 nm	13	312
Total			16	395
Drift Netters	A	All Areas	560	1,103
Longliners	A	All Areas	10	20
Handliners	A	All Areas	5	5
Others	A	All Areas	20	20
Total			595	1,148
Grand Total			853	2,080

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
Trawlers				
<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
Total			224	905
Purse Seiners				
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
Total			41	584
Grand Total			265	1,489

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
Trawlers				
<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
Total			457	1,739

Purse Seiners				
40 – 69.9 GRT	East Coast	> 3 nm	6	57
> 70 GRT	East Coast	> 30 nm	6	114
Total			12	171
Grand Total			469	1,910

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

<p>Sabah, MALAYSIA. Tel No. : +6 088 235966 Email: Hairul_elut@yahoo.com</p>
<p>Study site 4 : Sandakan, Sabah</p>
<p>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</p> <p>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</p>
<p>National Coordinator and Project Coordinator for Perak:</p>
<p>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</p>
<p>Project Coordinator for the Sabah :</p> <p>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</p>

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
Total	28	28	33	27	29	27	28	28	28	26	27	27	336

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							Grand Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
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
Total Catch Ray	152.3	116.3	180.5	214.0	615.9		161.9	182.2	407.0	106.5	162.7	292.4	2,610.1
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
Total Catch Shark	734.4	444.2	572.3	503.3	380.3	489.2	346.6	248.4	376.5	529.5	355.3	386.4	5,366.5
Grand Total	886.7	560.6	752.8	717.3	996.2	489.2	508.4	430.6	783.5	636.0	518.0	678.9	7,976.6

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
Grand Total		24,569.8		5,438.6		1,548,281.8		1,578,271.5
Average		2,047.5	1.4	453.2	0.4	129,023.5	98.2	131,522.6

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												
	2015					2016							Total
	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	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
<i>Narcine sp</i>				10			2						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
Total Rays	474	455	418	383	440	446	351	418	311	433	361	386	4,873
<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
Total Sharks	304	296	294	253	268	323	254	202	229	324	212	208	3,166
Grand Total	778	751	712	635	708	769	605	620	540	757	573	593	8,039

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
Total Weight Rays	1,042.0	1,199.2	995.2	1,110.5	1,624.5	985.8	848.9	759.8	1,080.6	3,228.5	2,903.4	2,572.5	18,350.7
<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												Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<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 sp</i>				0.4									0.4
<i>Galeocerdo cuvier</i>			14.6	18.1									32.7
<i>Scoliodon laticaudus</i>										0.3			0.3
Total Weight Sharks	734.4	444.2	572.3	488.5	380.3	489.2	346.6	248.4	376.5	529.5	355.3	386.4	5,351.7
Grand Total	1,776.4	1,643.4	1,567.5	1,599.0	2,004.8	1,474.9	1,195.5	1,008.2	1,457.1	3,758.0	3,258.7	2,959.0	23,702.4

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		
Rays	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av
<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	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	15.5	33.0	23.5
<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	14.5	66.0	34
<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				59.0	59.0	59.0
<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	13.5	25	20.3
<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	15.0	30.5	21.7
<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	47.0	116.0	71.0
<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	45.0	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
<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	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		
Sharks	Min	Max	Av	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
<i>Atelomycterus cf. baliensis</i>	45.5	52.0	48.8	43.0	53.5	49.6	44.0	44.0	44.0	50.0	50.0	50.0	46.0	49.0	47.7	48.0	53.0	51.3
<i>Atelomycterus cf. erdmanni</i>	48.0	54.0	50.4	37.0	55.0	49.0	34.0	54.0	46.6	43.0	56.0	49.3	43.0	54.0	50.6	37.0	57.0	48.6
<i>Atelomycterus marmoratus</i>	42.0	58.0	49.9	30.0	58.0	47.9	38.0	56.0	50.4	43.0	61.0	51.4	33.0	57.0	49.8	42.0	58.0	49.8
<i>Carcharhinus brevipinna</i>							74.5	89.0	80.7	77.0	87.0	82.2						
<i>Carcharhinus leucas</i>							89.0	89.0	89.0	78.0	155.0	116.5						
<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	84.4	93.0	97.0	95.7	88.0	96.0	92.0			
<i>Chiloscyllium cf. hasseltii</i>																61.5	63.0	62.3
<i>Chiloscyllium hasseltii</i>	42.0	82.0	62.3	18.5	86.0	59.6	40.0	93.0	62.0	46.0	79.0	61.8	46.0	81.0	62.2	44.0	86.0	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	70.0	31.0	95.0	66.8	43.0	88.0	64.8	45.5	91.0	64.8
<i>Chiloscyllium sp</i>										48.0	48.0	48.0						
<i>Galeocerdo cuvier</i>							144.0	144.0	144.0	157.0	157.0	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	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
<i>Himantura undulata</i>	15-20	Whole body, skin	Local (Sitiawan)

Rays	Range Price RM/kg	Parts	Market Destination
<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)
Sharks			
<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
Total	24	24	24	26	24	24	25	29	30	25	28	25	308

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	
Ray													
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
Total Ray	117.2	216.7	163.9	274.0	315.9	165.8	49.7	193.7	123.5	940.2	220.6	92.3	2,873.6
Shark													
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
Total Shark	93.1	170.1	242.9	276.9	174.1	172.6	328.0	213.8	186.5	183.1	280.5	266.9	2,588.3
Grand Total	210.3	386.8	406.8	550.8	490.0	338.3	377.7	407.6	310.0	1,123.3	501.1	359.2	5,461.9

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
Total		9067.7		2588.4		458,249.6		469905.6
Ave		755.6	2.0	215.7	0.6	38,187.5	97.4	39158.8

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												
	2015					2016							Total
	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
Total rays	178	199	212	277	208	194	280	203	192	194	176	185	2,498
<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
Total sharks	102	100	126	127	95	95	175	98	106	95	92	91	1,302
Grand total	280	299	338	404	303	289	455	301	298	289	268	276	3,800

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 was 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												
	2015					2016							Total
	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>				0.6	25.8		2.3	30.0					58.7
<i>Taeniurops meyeri</i>												119.0	119.0
Total Weight Rays	484.2	750.9	496.7	920.5	873.4	599.3	728.8	482.7	380.2	1,327.5	623.3	1,400.1	9,067.6
<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
Total Weight Sharks	93.1	170.1	242.9	276.9	174.1	172.6	328.0	213.8	186.5	183.1	280.5	266.9	2,588.3
Grand Total	577.3	921.0	739.6	1,197.4	1,047.5	771.9	1,056.8	696.6	566.7	1,510.6	903.8	1,667.0	11,656.0

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 fluviorum* 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 fluviorum*, *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		
Rays	Min	Max	Ave	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	58.0	61.0	61.0	61.0	30.0	32.0	31.0	37.0	67.0	52.3	45.0	45.0	45.0
<i>Dasyatis zugei</i>	11.0	29.5	22.3	14.5	30.0	22.4	16.0	31.5	23.0	16.5	31.0	22.6	16.0	29.0	23.2	16.0	29.0	23.1
<i>Gymnura poecilura</i>	32.0	32.0	32.0	30.0	32.0	31.3	11.5	23.0	17.5	23.0	41.0	32.0	19.0	27.0	22.7			
<i>Himantura gerrardi</i>	15.0	79.0	37.7	15.0	90.0	38.5	16.0	74.0	39.3	16.0	114.0	38.5	17.0	89.0	35.4	19.0	75.0	38.6
<i>Himantura jenkinsii</i>										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	19.9	11.0	26.0	19.6	14.0	30.0	19.9	14.0	26.0	19.8
<i>Neotrygon kuhlii</i>	12.0	29.0	21.2	13.0	30.0	22.1	15.0	30.0	22.6	14.0	31.0	21.9	12.0	30.0	20.8	13.0	28.0	22
<i>Rhynchobatus australiae</i>										48	48	48	64	114	89			

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		
Rays	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
<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		
Sharks	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av
<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		
Sharks	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av
<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
Sharks			
<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	Ma y	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
TOTAL	24	20	20	23	23	23	23	24	24	24	24	22	274

2.3.2 Fishing Ground and Catch Composition by Gear Type

The total catch of trawl nets that sampled were 11,730 kg comprising 7,243kg of rays (62%) and 4487kg 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 1,841kg. The highest landing of rays by month was from Zone 3 trawl nets at 611kg in August 2015 while

484kg 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 396kg and 307kg in August and October 2015 respectively and followed by Zone 4 trawl nets at 304kg 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							Grand Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Ray													
Trawl Net Zone2	5.5	8.6			95.4					17.4	34.6	19.9	181.4
Trawl Net Zone3	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 Zone4	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 Zone5	56.1				43.8	71.1	24.9		55.0		23.4		274.2
Total Ray	1156.7	302.4	268.8	634.1	554.7	804.0	628.1	656.1	557.9	509.2	713.9	456.9	7,242.7
Shark													
Trawl Net Zone2	20.4	37.8			40.4					37.0	1.0	49.8	186.4
Trawl Net Zone3	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 Zone4	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 Zone5	22.4				56.5	80.3	6.2		38.8		20.1		224.2
Total Shark	506.1	350.9	409.7	362.5	441.8	536.2	313.1	361.7	264.1	258.9	295.1	387.3	4,487.2
Grand Total	1,662.8	653.3	678.5	996.6	996.5	1,340.2	941.2	1,017.8	822.0	768.1	1,009.0	844.2	11,729.9

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
Total		7,242.7		4,487.2		1,844,779.9		1,856,509.8
Ave		603.6	0.4	373.9	0.2	153,731.7	99.4	154,709.2

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
Total Rays	182	141	135	318	272	331	174	174	224	228	172	195	2,546
<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 macrorhinus</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
Total Sharks	202	253	232	212	249	257	146	105	107	163	164	135	2,225
Grand Total	384	394	367	530	521	588	320	279	331	391	336	330	4,771

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		29.50			24.00		73.90
<i>Aetomylaeus vespertilio</i>		6.90											6.90
<i>Dasyatis parvonigra</i>				64.20	50.00	4.53	12.55			12.80		21.35	165.43
<i>Dasyatis zugei</i>	65.00	25.00	23.60	44.80	119.50	166.29	88.75	53.30	75.80	126.55	59.35	104.00	951.94
<i>Gymnura japonica</i>	0.60	0.80		14.40				5.50		15.20			36.50
<i>Gymnura poecilura</i>	11.70	2.50	3.70	19.90	3.50	5.00	4.30		21.75	38.15	11.95	13.80	136.25
<i>Himantura fai</i>	80.00												80.00
<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	1,717.27
<i>Himantura jenkinsii</i>	10.20			8.60	24.20			15.65					58.65
<i>Himantura leoparda</i>	82.30											30.00	112.30
<i>Himantura uarnacoides</i>	34.00												34.00
<i>Himantura uarnak</i>	12.90					3.45				1.60			17.95
<i>Mobula japonica</i>	21.00												21.00
<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	2,733.36
<i>Pastinachus gracilicaudus</i>	136.90		26.10	22.70	49.50	115.57	26.10		18.50		69.20		464.57
<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	176.91
<i>Rhinoptera jayakari</i>	246.10						34.50						280.60
<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	149.25
<i>Taeniura lymma</i>		1.80	2.40										4.20
<i>Taeniurops meyeri</i>		2.80											2.80
Total Weight Rays	1,156.70	302.40	268.80	634.10	554.70	804.03	628.10	656.05	557.90	509.20	713.85	437.95	7,223.78
<i>Alopias 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		4.95	19.90	10.70	146.71
<i>Carcharhinus brevipinna</i>	4.80	22.60											27.40
<i>Carcharhinus sealei</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>Halaehurus 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
<i>Heterodontus zebra</i>	3.20	6.60	5.80	3.80									19.40

Species	Year/Month												Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<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
Total Weight Sharks	506.10	350.90	409.70	362.50	441.80	536.16	313.05	361.70	264.05	258.85	295.10	387.30	4,487.21
Grand Total	1,662.80	653.30	678.50	996.60	996.50	1,340.19	941.15	1,017.75	821.95	768.05	1,008.95	825.25	11,710.99

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 Desember 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 juvenile 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 *Rhinobatos 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		
Rays	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av	Min	Max	Av
<i>Aetobatus ocellatus</i>	32.0	73.0	52.5													65.2	65.2	65.2
<i>Aetomylaeus vesperilio</i>				47.5	47.5	47.5												
<i>Dasyatis parvonigra</i>										23.0	50.0	38.4	29.0	58.0	38.07	27.5	41.2	34.4
<i>Dasyatis zugei</i>	19.0	30.0	25.2	20.0	30.0	27.1	20.0	31.0	26.4	19.0	32.0	25.2	15.0	32.0	24.94	17.1	31.2	24.8
<i>Gymnura japonica</i>	19.5	19.5	19.5	23.0	23.0	23.0				21.0	40.0	34.2						
<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	38.0	38.00	43.5	43.5	43.5
<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	16.0	73.0	28.19	17.0	81.0	28.2
<i>Himantura jenkinsii</i>	58.0	58.0	58.0							57.0	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													32.4	34.5	33.5
<i>Mobula japanica</i>	77.0	77.0	77.0															
<i>Neotrygon kuhlii</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	33.0	22.67	12.0	32.2	21.9
<i>Pastinachus gracilicaudus</i>	51.0	80.0	59.2				59.0	62.0	60.5	56.0	58.0	57.0	48.0	60.0	53.60	47.4	58.3	52.2
<i>Rhinobatos 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	82.0	74.00	53.0	92.0	72.1
<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	91.5	73.79	88.3	97.3	91.9
<i>Taeniura lymma</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
Rays																		
<i>Aetobatus ocellatus</i>				83.3	83.3	83.3							71.3	71.3	71.3			
<i>Dasyatis parvonigra</i>	49.5	51.2	50.4							30.2	46.3	38.3				27.2	50.1	37.2
<i>Dasyatis zugei</i>	17.2	34.2	23.8	20.1	31.3	25.9	19.2	31.3	24.4	19.3	31.2	23.9	19.5	31.2	23.3	19.2	32.3	25.0
<i>Gymnura japonica</i>				43.3	43.3	43.3				24.5	40.4	35.6						
<i>Gymnura poecilura</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 kuhlii</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
Sharks																		
<i>Alopias pelagicus</i>	122.0	122.0	122.0													164.3	327.0	208.9
<i>Atelomycterus 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	52.3	67.3	60.5
<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>Halaehurus 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
Sharks																		
<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>Sphyrna 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
Ray			
<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)
Shark			
<i>Alopias pelagicus</i>	2.0 - 2.5	Whole body, fins	Local Market (Kota Kinabalu)
<i>Atelomycterus 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>Halaaelurus 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)
<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
Total	13	12	10	12	12	12	13	12	10	11	10	8	135

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	
Ray													
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
Total Ray	1,987.1	1,096.2	908.1	791.6	644.1	998.1	442.6	541.9	857.8	735.5	635.0	531.8	10,169.7
Shark													
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
Total Shark	610.7	560.8	133.0	321.2	215.6	155.3	110.5	99.7	175.7	154.5	169.3	262.6	2,968.7
Grand Total	2,597.8	1,657.0	1,041.1	1,112.8	859.7	1153.4	553.1	641.5	1,033.5	890.0	804.2	794.4	13,138.3

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
Total		10,169.7		2,968.7		568,220.0		581,358.3
Ave		847.5	1.8	247.4	0.5	47,351.7	97.7	48,446.5

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

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. uarnacoides* (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>Aetobatus 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 uarnacoides</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>												1.9	1.9
<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		37.0	35.0			37.0				181
<i>Rhinobatos borneensis</i>			1.0				0.3			1.5			2.8
<i>Rhinoptera jayakari</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>Taeniura lymma</i>	6.7	16.5	3.0	3.4	0.7	31	14.6	7.1		13.3	16.3	31.0	143.5
Total Weight Rays	1,987.1	1,096.2	908.1	791.6	644.1	998.1	442.6	541.9	857.8	735.5	635	531.8	10,169.7
<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								297
<i>Carcharhinus limbatus</i>		7.2	3.5			1.8	4.8		5.5		4.3		27.1
<i>Carcharhinus sealei</i>	2.8	1.6	0.9	0.9	13.7	2.4		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
Total Weight Sharks	610.7	560.8	133.0	321.2	215.6	155.3	110.5	99.7	175.7	154.5	169.3	262.6	2,968.7
Grand Total	2,597.8	1,657.0	1,041.0	1,113	859.7	1,153.4	553.1	641.5	1,034	890.0	804.2	794.4	13,138.3

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 February 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

	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	Min	Max	Ave
Rays																		
<i>Aetobatus ocellatus</i>	24.0	75.0	35.6							25.0	33.0	29.3				81.0	81.0	81.0
<i>Dasyatis zugei</i>	20.0	30.0	26.4	19.0	30.0	24.7							19.0	30.0	24.1			
<i>Himantura fai</i>	63.0	108.0	97.3	57.0	110.0	89.9	75.0	107.0	93.8	64.0	108.0	82.8	57.0	109.0	79.4	63.0	109.0	83.6
<i>Himantura gerrardi</i>	23.0	64.0	41.9	30.0	64.0	44.2	22.0	40.0	34.8	24.0	61.0	41.8	24.0	62.0	38.4	22.0	64.0	40.0
<i>Himantura jenkinsii</i>	42.0	114.0	93.2	42.0	89.0	74.0	42.0	88.0	58.0	38.0	89.0	53.1	85.0	90.0	87.3	88.0	90.0	89.0
<i>Himantura leoparda</i>	65.0	130.0	105.0	65.0	120.0	95.0	65.0	112.0	93.8	100.0	122.0	111.3	99.0	99.0	99.0	65.0	120.0	99.0
<i>Himantura uarnacoides</i>	70.0	112.0	91.6	72.0	112.0	95.5	70.0	98.0	82.2	71.0	115.0	99.7	71.0	112.0	95.0	70.0	113.0	94.0
<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	122.0				80.0	80.0	80.0
<i>Himantura undulata</i>																		
<i>Himantura walga</i>																		
<i>Mobula thurstoni</i>	44.5	44.5	44.5															
<i>Neotrygon kuhlii</i>	18.0	32.0	25.9	20.0	30.0	26.7	21.0	32.0	27.3	15.5	32.0	23.4	24.0	32.0	28.2	20.0	32.0	27.5
<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	36.0	40.0	40.0	40.0
<i>Rhynchobatus australiae</i>	109.0	168.0	138.5	74.0	74.0	74.0	165.0	165.0	165.0	104.0	110.0	107.0	59.0	80.0	72.3	104.0	110.0	107.0
<i>Taeniura lymma</i>	23.0	25.0	24.3	24.0	25.0	24.8	25.0	30.0	27.5	23.0	34.0	27.7	24.0	24.0	24.0	22.0	25.0	24.0

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
Ray																		
<i>Aetobatus ocellatus</i>	75.0	81.0	78.0	81.0	81.0	81.0				33.0	33.0	33.0	75.0	75.0	75.0			
<i>Dasyatis zugei</i>				20.0	30.0	25.4	27.0	30.0	28.5				23.0	30.0	26.3	19.0	29.0	23.5
<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 uarnacoides</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>																28.0	93.0	68.3
<i>Himantura walga</i>																17.0	24.0	20.7
<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>																55.0	95.0	75.0
<i>Pastinachus gracilicaudus</i>							83.0	83.0	83.0							77.0	80.0	78.5
<i>Rhina ancylostoma</i>																		
<i>Rhinobatos borneensis</i>	50.0	50.0	50.0							51.0	67.0	57.7						
<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 plagiosum</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	77.00	77.00	77.00				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

	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
Shark																		
<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>																		
<i>Carcharhinus limbatus</i>	57.0	84.0	70.5				60.0	86.0	73.0				60.0	60.0	60.0			
<i>Carcharhinus sealei</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 sorrah</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>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
Ray			
<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>Rhynchobatus 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)
Sharks			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	
Trawl Net Zone 2	19	26	12	12	52	12	6	18	18	20	25	18	238
Trawl Net Zone 3	162	139	135	129	109	121	123	121	108	132	116	33	1,428
Trawl Net Zone 4	69	62	66	100	56	81	111	110	91	93	81		920
Trawl Net Zone 5	8				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	
Trawl Net Zone 2	51	76	29	35	148	26	16	42	48	54	63	46	634
Trawl Net Zone 3	499	405	423	390	315	352	353	365	342	398	337	95	4,274
Trawl Net Zone 4	206	186	209	307	165	240	327	328	278	284	257		2,787
Trawl Net Zone 5	24				66	87	21		45		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.

No	Output	Outcome
3.	Detailed information on the percentages of sharks and rays from the total landing at project sites.	Confirmed earlier data published in Malaysian National Statistics. Sharks 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. Aceh, 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 socio-economy 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) spesies 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*, *Himatura walga* and *Dasyatis zugei*. The most abundant sharks species at Manjung Utara were *Chiloscyllium hasseltii*, *Chiloscyllium punctatum* and *Atelomycterus marmoratus* while for rays were *Himatura 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) spesies 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. Measure 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

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: _____

Appendix II

Checklist of Sharks and Rays Species Recorded During the Study Period

No	Orders/Families	Site 1	Site 2	Site 3	Site 4
Batoids/Rays					
	ORDER MYLIOBATIFORMES	Larut Matang	Manjung Utara	Kota Kinabalu	Sandakan
	Family Dasyatidae				
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>	+	+	+	/
	Family Gymnuridae				
22	<i>Gymnura poecilura</i>	+	/	/	+
23	<i>Gymnura japonica</i>	+	+	/	+
	Family Mobulidae				
24	<i>Mobula thurstoni</i>	+	+	+	/
25	<i>Mobula japanica</i>	+	+	/	+
	Family Rhinopteridae				
26	<i>Rhinoptera jayakari</i>	+	+	/	/
	Family Myliobatidae				
27	<i>Aetobatus ocellatus</i>	+	+	/	/
28	<i>Aetomylaeus vespertilio</i>	+	+	/	+
	ORDER RHINOBATIFORMES				
	Family Rhinobatidae				
29	<i>Rhinobatos cf. borneensis</i>	/	/	+	+
30	<i>Rhinobatos borneensis</i>	+	+	/	/

No	Orders/Families	Site 1	Site 2	Site 3	Site 4
	Family: Rhynchobatidae				
31	<i>Rhynchobatus australiae</i>	/	/	/	/
32	<i>Rhynchobatus laevis</i>	/	+	+	+
	Family Rhinidae				
33	<i>Rhina ancylostoma</i>	+	+	+	/
	ORDER TORPEDINIFORMES				
	Family Torpedinidae				
34	<i>Narcine prodorsalis</i>	+	+	+	+
35	<i>Narcine maculata</i>	/	+	+	+
36	<i>Narcine</i> sp. D	/	+	+	+
37	<i>Narcine</i> sp.	/	+	+	+
	Family Narkidae				
38	<i>Temera hardwickii</i>	/	+	+	+
	Total ray species	<i>19</i>	<i>14</i>	<i>20</i>	<i>19</i>
Sharks					
	ORDER CARCHARHINIFORMES				
	Family: Scyliorhinidae				
1	<i>Atelomycterus marmoratus</i>	/	/	/	/
2	<i>Halaaelurus buergeri</i>	+	+	/	+
3	<i>Atelomycterus</i> cf. <i>baliensis</i>	/	+	+	+
4	<i>Atelomycterus</i> cf. <i>erdmanni</i>	/	+	+	+
	Family Carcharhinidae				
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>			/	+
	Family Sphyrnidae				
15	<i>Sphyrna lewini</i>	+	+	/	/
	Family Hemigaleidae				
16	<i>Hemigaleus microstoma</i>	+	+	/	/
17	<i>Hemipristis elongata</i>	+	+	/	/
	Family Triakidae				
18	<i>Mustelus manazo</i>	+	+	/	+
	ORDER ORECTOLOBIFORMES				
	Family: Orectolobidae				

No	Orders/Families	Site 1	Site 2	Site 3	Site 4
19	<i>Chiloscyllium hasseltii</i>	/	/	+	+
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>	+	+	/	+
	ORDER HETERODONTIFORMES				
	Family Heterodontidae				
27	<i>Heterodontus zebra</i>	+	+	/	+
	ORDER SQUATINIFORMES				
	Family Squatinidae	+	+	+	+
28	<i>Squatina tergocellatoides</i>	+	+	/	+
	ORDER LAMNIFORMES				
	Family Alopidae				
29	<i>Alopias pelagicus</i>	+	+	/	+
	Total shark species	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
	Rays						
	Family Dasyatidae						
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
	Family Rhinopteridae						
12	<i>Rhinoptera jayakari</i>				< 20	20 - 50	> 50
	Family: Rhynchobatidae						
13	<i>Rhynchobatus australiae</i>	< 40	40 - 100	> 100	< 50	50 - 100	> 100
	Family Rhinidae						
14	<i>Rhina ancylostoma</i>				< 50	50 - 100	> 100
	Sharks						
	Family: Scyliorhinidae						
15	<i>Atelomycterus marmoratus</i>	< 32	32 - 44	> 44			
16	<i>Atelomycterus cf. erdmanni</i>	< 32	33 - 49	> 50			
	Family Carcharhinidae						
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
	Family Sphyrnidae						
20	<i>Sphyrna lewini</i>				< 50	50 - 00	> 100
	Family Hemigaleidae						
21	<i>Hemigaleus microstoma</i>				< 50	50 - 100	> 100
	Family: Orectolobidae						
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:

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[2] Ahmad, A. and Lim, A.P.K. 2012. Field guide to sharks of the Southeast Asian Region. SEAFDEC/MFRDMD/SP/18. 210p

[3] Ahmad, A. and Lim, A.P.K., Fahmi, Dharmadhi and Tassapon, K. 2014. Field guide to rays, skates and chimaeras of the Southeast Asian Region. SEAFDEC/MFRDMD/SP/25. 288p

[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. Caira., 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 ¹	New record for Malaysia (Recorded in Sabah)
X ²	New record for Malaysia (Recorded in Perak)
X ³	New record for Malaysia (Recorded in Pahang)
X ⁴	New record for Malaysia (Recorded in Sarawak)
X ⁵	New record for Malaysia (Recorded in Terengganu)

	SHARKS		<i>[1]</i>	<i>[2]</i>	<i>[3]</i>	<i>[4]</i>	<i>[5]</i>	<i>[6]</i>
	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)	Bluntnose sixgill shark	X	X				X
2	<i>Heptranchias perlo</i> (Bonnaterre, 1788)	Sharpnose sevengill shark						X¹
	SQUALIFORMES	DOGFISHES						
	2. Squalidae	Dogfish sharks						
3	<i>Squalus altipinnis</i> Last, White & Stevens, 2007	Western highfin spurdog					X	X
4	<i>Squalus megalops</i> (Macleay, 1881)	Snortnose spurdog	X	X				
	3. Centrophoridae	Gulper sharks						
5	<i>Centrophorus moluccensis</i> Bleeker, 1860	Smallfin gulper shark	X	X			X	
	SQUATINIFORMES	ANGEL SHARKS						
	4. Squatinidae	Angel sharks						
6	<i>Squatina tergocellatoides</i> Chen, 1963	Ocellated angelshark	X	X			X	X
7	<i>Squatina</i> sp. 1	Brunei angelshark		X				
	HETERODONTIFORMES	BULLHEAD SHARKS						
	5. Heterodontidae	Bullhead sharks						
8	<i>Heterodontus zebra</i> (Gray, 1831)	Zebra bullhead shark	X	X			X	X
	ORECTOLOBIFORMES	CARPET SHARKS						
	6. Orectolobidae	Wobbegongs						
9	<i>Orectolobus leptolineatus</i> Last, Pogonoski & White, 2010. Identified as <i>Orectolobus maculatus</i> (Bonnaterre, 1788) in [1]	Indonesian wobbegong Spotted wobbegong		X			X	X
	7. Hemiscylliidae	Longtailed carpet sharks						

10	<i>Chiloscyllium</i> cf. <i>griseum</i> Muller & Henle, 1838. Identified as <i>Chiloscyllium griseum</i> Muller & Henle, 1838 in [1], [2]	Grey bambooshark	X	X				X
11	<i>Chiloscyllium hasseltii</i> Bleeker, 1852	Indonesian bambooshark	X	X			X	X
12	<i>Chiloscyllium indicum</i> Bleeker, 1853	Slender bambooshark	X	X			X	X
13	<i>Chiloscyllium plagiosum</i> Bleeker, 1854	White-spotted bambooshark	X	X			X	X
14	<i>Chiloscyllium punctatum</i> Bleeker, 1855	Brown-banded bambooshark	X	X			X	X
15	<i>Chiloscyllium</i> sp.	Perak bambooshark						X²
	8. Ginglymostomatidae	Nurse sharks						
16	<i>Nebrius ferrugineus</i> (Lesson, 1830)	Tawny nurse shark	X	X			X	X
	9. Rhincodontidae	Whale sharks						
17	<i>Rhincoon typus</i> Smith, 1828	Whale shark	X	X			X	X
	10. Stegostomatidae	Zebra sharks						
18	<i>Stegostoma fasciatum</i> (Hermann, 1783)	Zebra shark	X	X			X	X
	LAMNIFORMES	MACKEREL SHARKS						
	11. Alopidae	Thresher sharks						
19	<i>Alopias pelagicus</i> Nakamura, 1935	Pelagic thresher	X	X			X	X
	12. Lamnidae	Mackerel sharks						
20	<i>Isurus oxyrinchus</i> Rafinesque, 1810	Shortfin mako	X	X				
	CARCHARHINIFORMES	GROUND SHARKS						
	13. Scyliorhinidae	Catsharks						
21	<i>Apristurus platyrhynchus</i> (Tanaka, 1909)	Bigfin catshark					X	
22	<i>Atelomyxterus</i> cf. <i>baliensis</i> White, Last & Dharmadi, 2005	Bali catshark						X²
23	<i>Atelomyxterus</i> cf. <i>erdmani</i> Fahmi & White, 2015	Spotted-belly catshark						X²
24	<i>Atelomyxterus marmoratus</i> (Bennett, 1830)	Coral catshark	X	X			X	X

25	<i>Cephaloscyllium circulopullum</i> Yano, Ahmad & Gambang, 2005	Circle-blotched pygmy swellshark	X	X				
26	<i>Cephaloscyllium sarawakensis</i> Yano, Ahmad & Gambang, 2005	Sarawak pygmy swellshark	X	X				X
27	<i>Cephaloscyllium</i> cf. <i>speccum</i> Last, Seret & White, 2008	Speckled swellshark		X				
28	<i>Cephaloscyllium</i> cf. <i>variagatum</i> Last & White, 2008	Stripes swellshark		X				
29	<i>Galeus eastmani</i> (Jordan & Snyder, 1904)	Gecko catshark		X				
30	<i>Halaelurus buergeri</i> (Muller & Henle, 1838)	Blackspotted catshark		X				X
31	<i>Halaelurus maculosus</i> White, Last & Steven, 2007. Identified as <i>Halaelurus buergeri</i> (Muller & Henle, 1838) and in [1]	Indonesian speckled catshark Darkspot catshark	X	X				
	14. Proscylliidae	Finback catsharks						
32	<i>Eridacnis radcliffei</i> Smith, 1913. Identified as <i>Eridacnis</i> cf. <i>radcliffei</i> Smith, 1913 in [2]	Pygmy ribbontail catshark		X				
	15. Triakidae	Hound sharks						
33	<i>Mustelus manazo</i> Bleeker, 1854	Star-spotted smoothhound	X	X			X	X
34	<i>Mustelus mosis</i> Hemprich & Ehrenberg, 1899. Identified as <i>Mustelus manazo</i> Bleeker, 1854 in Last <i>et al.</i> (2010)	Arabian smoothhound Starspotted smoothhound	X	X				X
35	<i>Mustelus widodoi</i> White & Last, 2006. Identified as <i>Mustelus</i> sp. 1 [Manjaji, 2002]	Whitefin smoothhound Grey smoothhound						X
36	<i>Mustelus</i> sp. [1]	Sarawak smoothhound	X	X				
	16. Hemigaleidae	Weasel sharks						
37	<i>Chaenogaleus macrostoma</i> (Bleeker, 1852)	Hooktooth shark	X	X			X	X
38	<i>Hemigaleus microstoma</i> Bleeker, 1852	Sicklefin weasel shark	X	X			X	X
39	<i>Hemipristis elongatus</i> (Klunzinger, 1871)	Fossil shark	X	X			X	X

40	<i>Paragaleus tengi</i> (Chen, 1963)	Straighttooth weasel shark	X				X	
	17. Carcharhinidae	Requiem sharks						
41	<i>Carcharhinus albimarginatus</i> (Ruppell, 1837)	Silvertip shark		X			X	
42	<i>Carcharhinus amblyrhynchos</i> (Bleeker, 1856)	Gray reef shark	X	X			X	X
43	<i>Carcharhinus</i> cf. <i>amboinensis</i> (Muller & Henle, 1839)	Pigeye shark						X³
44	<i>Carcharhinus amblyrhynchoides</i> (Whitley, 1934)	Graceful shark	X	X				X
45	<i>Carcharhinus borneensis</i> (Bleeker, 1859)	Borneo shark	X	X			X	
46	<i>Carcharhinus brevipinna</i> (Muller & Henle, 1839)	Spinner shark	X	X			X	X
47	<i>Carcharhinus dussumieri</i> (Muller & Henle, 1839)	Whitecheek shark	X	X			X	X
48	<i>Carcharhinus falciformis</i> (Muller & Henle, 1839)	Silky shark	X	X			X	X
49	<i>Carcharhinus leucas</i> (Muller & Henle, 1839)	Bull shark	X	X			X	X
50	<i>Carcharhinus limbatus</i> (Muller & Henle, 1839)	Common blacktip shark	X	X			X	X
51	<i>Carcharhinus longimanus</i> (Poey, 1861)	Oceanic whitetip shark		X				X¹
52	<i>Carcharhinus macloti</i> (Muller & Henle, 1839)	Hardnose shark	X	X				
53	<i>Carcharhinus melanopterus</i> (Quoy & Gaimard, 1824)	Blacktip reef shark	X	X			X	X
54	<i>Carcharhinus plumbeus</i> (Nardo, 1827)	Sandbar shark	X	X			X	X
55	<i>Carcharhinus sealei</i> (Pietschmann, 1916)	Blackspot shark	X	X			X	X
56	<i>Carcharhinus sorrah</i> (Muller & Henle, 1839)	Spottail shark	X	X			X	X
57	<i>Galeocerdo cuvier</i> (Peron & Lesueur, 1822)	Tiger shark	X	X			X	X

58	<i>Glyphis fowlerae</i> Campagno, White & Cavanagh, 2010	Borneo river shark		X			X	
59	<i>Glyphis</i> sp. [Last <i>et al.</i> , 2010]	Mukah river shark		X			X	
60	<i>Lamiopsis tephrodes</i> (Fowler, 1905) Identified as <i>Lamiopsis temmincki</i> (Muller & Henle, 1839) in [1]	Borneo broadfin shark	X	X			X	X
61	<i>Loxodon macrorhinus</i> Muller & Henle, 1839	Sliteye shark	X	X			X	X
62	<i>Prionace glauca</i> (Linnaeus, 1758)	Blue shark		X				X
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
	18. Sphyrnidae	Hammerhead sharks						
68	<i>Eusphyra 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
	RAYS							
	ORDER / Family /Scientific name	Common name (English)						
	PRISTIFORMES	SAWFISHES						
	1.Pristidae	Sawfishes						
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	
	RHINOBATIFORMES	GUITARFISHES						
	2.Rhinidae	Shark ray						

4	<i>Rhina ancylostoma</i> Bloch & Schneider, 1801	Shark ray	X		X		X	X
	3.Rhynchobatidae	Wedgefishes						
5	<i>Rhynchobatus australiae</i> Whitley, 1939	Whitespotted wedgefish	X		X		X	X
6	<i>Rhynchobatus laevis</i> (Bloch & Schneider, 1801)	Smoothnose wedgefish			X		X	X
7	<i>Rhynchobatus springeri</i> Campagno & Last, 2010	Broadnose wedgefish			X	X	X	X
	4.Rhinobatidae	Shovelnose rays						
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	X¹
11	<i>Rhinobatos cf. borneensis</i> Last, Seret & Naylor, 2016. Identified as <i>Rhinobatos formosensis</i> Norman, 1926 in [1], [3]		X		X			X²
	TORPEDINIFORMES	ELECTRIC RYAS						
	5. Narcinidae	Numbfishes						
12	<i>Narcine brevilabiata</i> Bessednov, 1966	Shortlip numbfish			X		X	X
13	<i>Narcine brunnea</i> Annandale, 1909	Brown numbfish	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			
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

18	<i>Narcine</i> sp A	Perak Numbfish (small spot)						X²
19	<i>Narcine</i> sp B	Perak Numbfish (large spot)						X²
20	<i>Narcine</i> sp C	Perak Numbfish (many spots)						X²
	6. Narkidae	Sleeper rays						
21	<i>Narke dipterygia</i> (Bloch & Schneider, 1801)	Spottail sleeper			X		X	X
22	<i>Narke</i> sp	Sarawak sleeper ray						X⁴
23	<i>Temera hardwickii</i> Gray 1831	Finless sleeper ray			X		X	X
	RAJIFORMES	SKATES						
	7.Rajidae	Skates						
24	<i>Dipturus kwangtungensis</i> (Chu, 1960)	Kwangtung skate			X		X	
25	<i>Dipturus</i> sp	Sarawak skate						X⁴
26	<i>Okamejei cairae</i> Last, Fahmi & Ishihara, 2010	Borneo sand skate			X	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	
28	<i>Okamejei jensenae</i> Last & Lim, 2010	Philippine ocellate skate			X	X	X	X
	8.Anacanthobatidae	Legskate						
29	<i>Sinobatis borneensis</i> (Chan, 1965)	Borneo leg skate			X		X	
	MYLIOBATIFORMES	STINGRAYS						
	9.Plesiobatidae	Stingarees						
30	<i>Plesiobatis daviesi</i> (Wallace, 1967)	Giant stingaree	X		X		X	
	10.Dasyatidae	Stingrays						
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 ushieii</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	X²
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
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
53	<i>Himantura cf. signifer</i> Compagno & Robert, 1983	Pahang Yellow-edge freshwater whipray			X			X³
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</i> cf. <i>uarnak</i>	Sandakan and Kuantan Reticulate whipray						X¹
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
59	<i>Himantura</i> sp. A [Yano, <i>et al.</i> 2005]	Penang whipray	X					
60	<i>Neotrygon</i> cf. <i>annotata</i> Last, 1987	Javanese maskray						X
61	<i>Neotrygon</i> cf. <i>leylandi</i> Last, 1987	Painted maskray			X			
62	<i>Neotrygon kuhlii</i> (Muller & Henle, 1841)	Bluespotted stingray	X		X		X	X
63	<i>Neotrygon</i> cf. <i>picta</i> Last & White 2008,	Peppered maskray			X			
64	<i>Neotrygon</i> sp	Pointed snout maskray (Terengganu)						X⁵
65	<i>Pastinachus atrus</i> (Macleay, 1883)	Eastern cowtail stingray			X		X	X
66	<i>Pastinachus gracilicaudus</i> Last & Manjaji-Matsumoto, 2010	Narrowtail stingray			X	X	X	X
67	<i>Pastinachus solocirostris</i> Last, Manjaji & Yearsley, 2005	Roughnose stingray			X	X	X	X
68	<i>Pastinachus</i> cf. <i>stellurostris</i> Last, Fahmi & Nyalor, 2010	Starrynose stingray						X¹
69	<i>Pteroplatytrygon violacea</i> (Bonnaparte, 1832)	Pelagic stingray	X		X		X	
70	<i>Taeniura lymma</i> (Forsskal, 1775)	Ribbontail stingray	X		X		X	X
71	<i>Taeniurops meyeri</i> Muller & Henle, 1841	Round ribbontail stingray	X		X		X	X
72	<i>Urogymnus asperrimus</i> (Bloch & Schneider, 1801)	Porcupine ray	X		X		X	X
	11. Gymnuridae	Butterfly rays						
73	<i>Gymnura japonica</i> (Temminck & Schlegel, 1805)	Japanese butterfly ray	X		X			X
74	<i>Gymnura poecilura</i> (Shaw, 1804)	Longtail butterfly ray	X		X		X	X

75	<i>Gymnura zonura</i> (Bleeker, 1852). Identified as <i>Aetoplatea zonura</i> Bleeker, 1851 in [1]	Zonetail butterfly ray	X		X		X	X
76	<i>Gymnura</i> sp	Perak butterfly ray						X ²
	12.Myliobatidae	Eagle rays						
77	<i>Aetobatus flagellum</i> (Bloch & Schneider, 1801)	Longhead eagle ray			X		X	X
78	<i>Aetobatus ocellatus</i> (Kuhl, 1823)	Ocellated eagle ray	X		X		X	X
79	<i>Aetomylaeus maculatus</i> (Gray, 1834)	Mottled eagle ray			X		X	
80	<i>Aetomylaeus narinari</i> (Euphrasen, 1790)	White-spotted eagle ray	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
	13.Rhinopteraidae	Cownose rays						
83	<i>Rhinoptera adspersa</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
	14.Mobulidae	Devil rays						
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 japonica</i> (Muller & Henle, 1841)	Spinetail devil ray					X	X
89	<i>Mobula kuhlii</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	
	ORDER CHIMAERIFORMES							
	1. 1. Chimaeridae							
1	<i>Chimaera phantasma</i> Jordan & Snyder, 1900	Silver chimaera	X		X		X	

PART II

*National Reports on Sharks Data Collection in the Participating
Countries: Myanmar*

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

(TERMINAL REPORT)

By
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Department of Fisheries Myanmar

2016

ACKNOWLEDGEMENTS

This research of Sharks and Rays data collection in Myanmar is part of a project funded by Japanese Trust Fund VI (JTF-VI) and EU-CITIES Fund / (SEAFDEC) Southeast Asian Fisheries Development Centre. We wish to express our sincerest first gratitude to U Khin Mg Maw (DG) Department of Fisheries, Ministry of Agriculture Livestock and Irrigation for his encouragement and Guidance during this survey. We also thank to U Myint Zin Htoo (DDG) for his supervision throughout the data collection period. We extend our sincere appreciation to U Soe Myint, Director for his forbearing guidance and constructive criticisms in this research, U Mg Mg Lwin and Dr. Tun Thein, for valuable comments and suggestions. We also wish to express our gratitude to U Khin Maung Aye, U Saw Han Shein for their enthusiasm, encouragement and forbearing guidance. We also would like to thank all fisheries officers from Yangon Division and their staff in study areas who assisted in sample collection. Finally, we especially we also would like to thanks to Dr. Worawit Wanchana SEAFDEC Secretariats, Dr. Ahmad Ali (Senior researcher) Marine Fisheries Resources Development Location SEAFDEC-MFRDMD for their help in taxonomy training by SEAFDEC-SOP.

EXECUTIVE SUMMARY

This project was conducted at Ye Township and Yangon Region. Three landing sites of Yangon, namely Annawar Aung, Shwe Zinyaw Hein and Annawar Holding Fisheries and three landings sites of Ye Township were selected as the study sites as they were the main landing sites of sharks and rays in the country. A total of 18 species of sharks from two (2) Orders and five (5) Families, and 38 species of rays from three (3) Orders and 10 Families, two (2) species of skates from one (1) Order and one (1) Family were recorded in Yangon. Study at Ye Township recorded six (6) species of sharks from one (1) Order and two (2) Families and 14 species of rays from three (3) Orders and five (5) Families. In term of percentage of total marine landings, sharks, rays and skates only contributed 0.2%, 1.1% and 0.002% at Yangon, and 1.3% for sharks and 1.6% for rays at Ye Township respectively. These figures confirmed earlier data that sharks and rays were only by-catch and not targeted and contributed to about 2% of the total marine landing.

The most abundant shark species at Yangon were, *Sphyrna lewini* and *Scoliodon laticaudus* and for rays, *Himantura walga* and *Rhinobatos punctifer*. The most common shark species were *Scoliodon laticaudus* and *Chiloscyllium hasseltii*, *Mustelus* sp. The most abundant shark species at Mawlamyine were *Carcharhinus leucas* and *Scoliodon laticaudus* while for rays *Himantura pastinacoides* and *Himantura uarnacoides*. The most common shark species were *Carcharhinus brevipinna* and *Scoliodon laticaudus* while for rays *Himantura walga*.

All big sized sharks of more than 1.5 meters in total length such as *Carcharhinus leucas*, *Carcharhinus sorrah*, *Galeocerdo cuvier*, *Sphyrna lewini*, and medium sized sharks such as *Rhizoprionodon acutus*, *Carcharhinus melanopterus* were rarely caught due to nature of fishing area and gear used. All rays and sharks were landed whole, fully used with no finning activities on fishing vessels. Base on latest checklist a total of 59 species of sharks from six (6) Order and 15 Families, and 85 species of rays from four (4) Order and 14 Families, and two (2) species of skates from one (1) Order and one (1) Family found in Myanmar waters including freshwater ecosystem.

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1.0 INTRODUCTION

Myanmar has a rich diversity of sharks (locally call 'nga-man'), rays and skates (nga-leik-kyauk). Ahmad and Lim (2012) in their Field Guide to Sharks of the Southeast Asian Region lists 34 shark and 44 ray species for Myanmar. However, Howard *et al*, (2015) reported that based on their studies at several landing sites as well as a review of literatures on shark studies suggest there may be as many as 58 species of sharks and 71 species rays and skates found in Myanmar waters. The high diversity of sharks was recorded from the Order Carcharhiniformes with 43 species followed by Order Orectolobiformes and Squaliformes with six (6) species respectively. However, low diversity was recorded for the Orders Lamniformes, Hexanchiformes and Squatiniformes where only one (1) species were recorded from each Order. As for batoids, high diversity was recorded for the Order Myliobatiformes with 46 species followed by Rhinobatiformes (11 species) and Torpediniformes (nine (9) species). Only three (3) species were recorded from Order Pristiformes and two (2) species for Order Rajiformes.

Even though the number of chondrichthyans species recorded in Myanmar was more than 129, the actual status of its biodiversity is still unknown. With new species continuously discovered in Andaman Sea, the number is expected to increase in the future. At present the deep water species are mostly unknown due to limited research activity. Most sharks and rays species landed especially from the Families Carcharhinidae and Dasyatidae and are difficult to identify up to species level by untrained and inexperienced enumerators. Only trained staff will be better able to make the right and valid identification of species in the future.

1.1 Objectives

The objectives of this project were:

- to enhance human resource development in elasmobranch taxonomy, and
- to develop 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 main sharks and rays fishing grounds in Myanmar are in Rakhine State, Mon State and Ayeyarwaddy Region. For the purpose of this studies, data and information were collected from Ye Township in Mon State and Yangon Region. The landing data were collected at three landing jetties namely Annawar Aung, Shwe Zinyaw Hein and Annawar Holding Fisheries in Yangon Region, and two jetties in Ye Township namely Zee Phyu Thaung and Asin in Mon State. The landing sites are private enterprises with all sharks and rays landing coming from trawlers and giant set bag nets for Yangon Region, and small set bag nets, gillnets, stow net and longlines from Mon State. The location of all landing sites are shown in **Figure 1**.

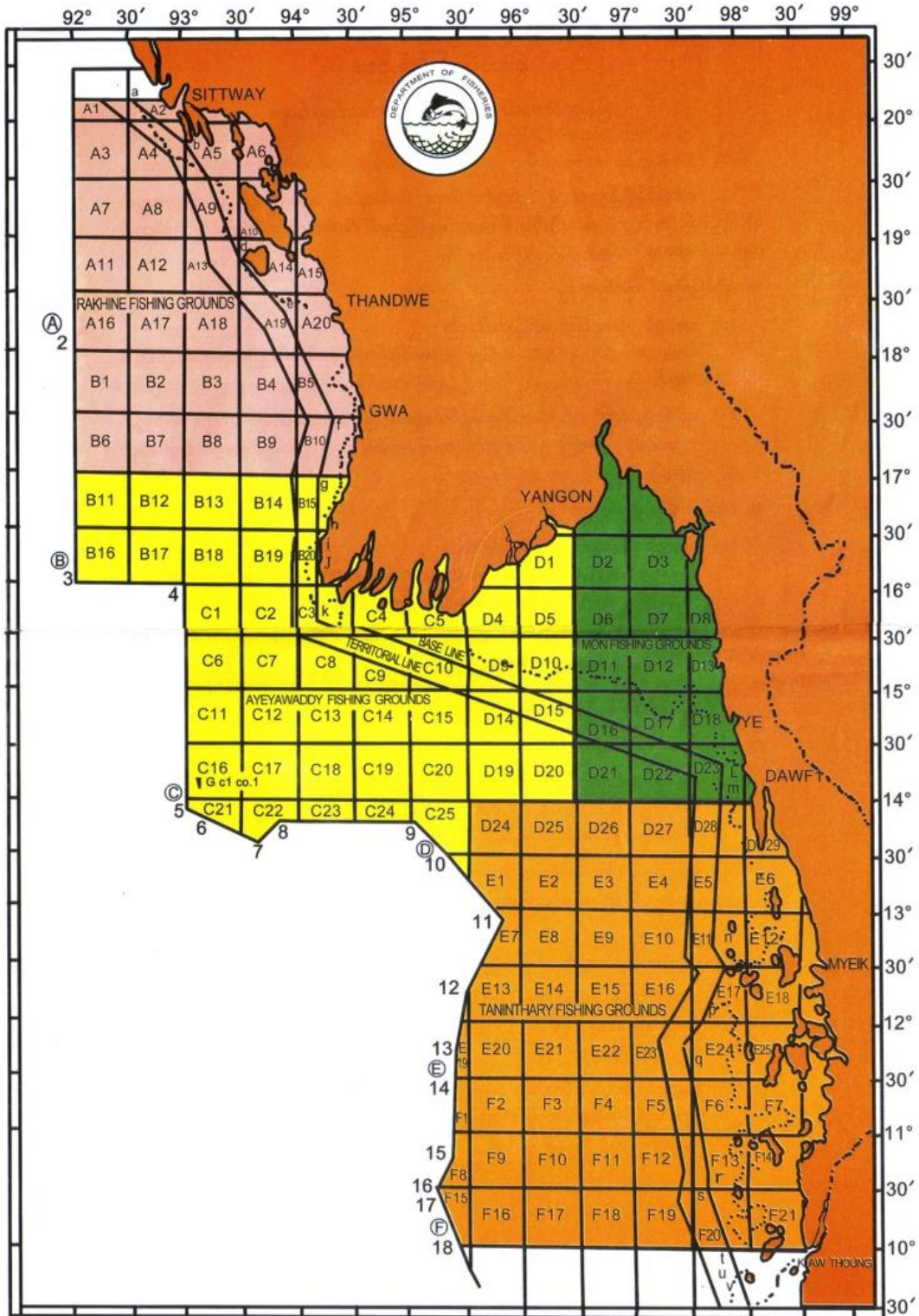


Figure 1: Location of Study Sites in Myanmar

1.2.1.1 Fisheries Structure and Background of Study Sites

1.2.1.2 Yangon Landing Site

Yangon is one (1) of the major landing sites for sharks and rays in Myanmar. All jetties belong to private enterprises. The major gears were trawl nets (502), followed by giant set bag nets (150) and set bag net (50). All trawlers are normally operated by 20 - 21 crew members. Almost all of the sharks and rays were landed by trawlers and giant set bag nets operating beyond 10 nautical miles from the coastline. Fishing operation normally 90 days per trip. Carrier vessels normally conveying the catch from fishing vessels within 10 to 15 days. The details of fishing vessels registered in Yangon Region are shown in **Table 1**.

Table 1: Number of Licensed Fishing Vessels by Gears and Number of Fishers at Yangon Landing Site

Gear type	Fishing area	Fishing operation (from coastline)	No. of vessels	No. of fishers
Trawlers 50-220 GRT	Ayawaddy, Mon, Rakhine	> 10 miles	502	10,040
Giant set bag nets 50-220 GRT	Ayawaddy, Mon, Rakhine	> 10 miles	150	3,000
Set bag nets 50-220 GRT	Ayawaddy, Mon	> 10 miles	50	1,000
Grand Total			702	14,040

1.2.1.3 Ye Township Landing Site

All jetties in Ye Township belong to private enterprises. The major gears were stow nets (217), followed by gillnets, (91) longlines (33), and set bag nets (60). The details of the fishing vessels registered in this district are shown in **Table 2**. The major gears landing sharks and rays were stow nets, gillnets and longlines. All set bag nets are normally operated by 19 - 20 crew members and all catches were carried by carrier vessels to jetties. Normally carrier vessels collected the catch three days per trip. The number of crew for traditional gears such as gillnets and longlines was normally 9-10 fishers. The fishing operation for set bag nets was normally 90 days per trip while longlines and gillnets were normally a daily trip. All catches from longlines and gillnets operated in coastal areas were landed within 12 hours.

Table 2: Number of Licensed Fishing Vessels by Gears and Number of Fishers at Ye Township Landing Site

Gear Type	Fishing Zone	Fishing operation (from coastline)	No. of Vessels	No. of Fishers
Set Bag Net 15-60 GRT	Mon	> 10 miles	60	1,200
Gillnet	Mon	< 10 miles	91	910
Longline	Mon	< 10 miles	33	132
Stow Net	Mon	< 10 miles	217	651
Grand Total			401	2,893

1.3 Appointment of Enumerators

Three (3) Assistant Fisheries Officers from the Region and State Fisheries Office of Yangon Landing Site were appointed as enumerators. Their names and addresses are as follows:

Yangon Landing Site

1. Mr. Min Naung (Director, Ayawaddy Division)
No.312, North Okalar Pa Township, Rose Road.
Yangon Division.
Tel: +959044224257

2. Mr. Soe Win (Fisheries Officer, Nay Pyi Taw)
No. 39/201, Aung Zaya Housing, Main Road.
Insein Township.
Yangon Division.
Tel: +959450016019
Email: soewinn67@gmail.com

3. Mr. Kyaw Swar Win (Assistant Officer, Yangon Division)
No.33, Bank Road, Kyauk-ta-tar Township, DoF Apartment.
Yangon Division.
Tel. +959798571391

Ye Township Landing Site

1. Mr. Soe Nyunt (Deputy Director, Mon State)
DoF Housing, Thein-gone Road, Mawlamyine.
Mon State.
Tel: +959450003916
2. Mr. Nay Myo Aye (Deputy Officer, Ye Township)
No.104, Bogyoke Road, Yan-gyi-aung Quarter, Ye Township,
Mon State.
Tel: +959782244128
Email: naymyo.marine@gmail.com

1.4 Materials and Methods

1.4.1 Sampling Methods

The sampling activity started in July 2015 until 31 June 2016. All enumerators were requested to record landing data and other related information in a standard form at least five days/month. A standard SOP entitled 'SOP Sharks and Rays Data Collection in the Southeast Asian Waters' was produced by SEAFDEC as reference. The content included 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, skates, commercial and other species from each sampling vessel. The details of the standard form are shown in **Appendix I**. The completed data in excel 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 - 2 fishing vessels were selected for sampling each day for five (5) days per month at each landing site. Measurement of total length (TL) were taken for all rays, sharks species and skates species from the Families Rhynchobatidae, Rhinobatidae, Rajidae 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, Mobulidae, Rajidae and Myliobatidae). All rays, sharks and skates 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% 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 other species were also recorded for each sampling vessel. Some samples were brought back to the Institute of Fisheries Technology, Yangon and preserved for future reference.

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 Yangon Landing Site

2.1.1 Landing Samples

A total of three (3) landing sites were sampled during the study period namely **Annawar Aung, Shwe Zinyaw Hein** and **Annawar Holding Fisheries**. The highest by month was 17 samples in February 2016 followed by 15 in August and November 2015 and 13 in July, September, October and December 2015. The highest by gear type was 110 of trawl net followed by 15 of giant set bag net and 10 of set bag net. The details are shown in **Table 3**.

Table 3: Number of Landings Sampled during the Study at Yangon Landing Site

Type of Gear	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Giant Set Bag Net	2	3		1	3		1	5					15
Set Bag Net	3		2		1	1		1		1		1	10
Trawl Net	8	12	11	12	11	12	7	11	9	4	6	7	110
Grand Total	13	15	13	13	15	13	8	17	9	5	6	8	135

2.1.2 Fishing Ground and Catch Composition by Gear Type

A total of 50,465.7 kg of sharks, rays and skates were landed during the study period. The main gear landing sharks, rays and skates was the trawl net at 27,479.7 kg (54.45%) comprising 21,066.6 kg rays, 6,351.9 kg sharks and 61.2 kg skates, while set bag nets contributed 18,723.8 kg (37.10%) comprising of 17,013.0 kg of rays and 1,685.9 kg of shark and 24.8 kg of skates. Giant set bag nets contributed 4,262.2 kg (8.45%) comprising of 3,279.0 kg rays and 983.3 kg of sharks. Most trawlers operated beyond 10 nautical miles from the coastline in Mon State, Ayawaddy and Rakhine fishing

grounds. The highest landing of rays by month was from set net bag at 15,708.5 kg in April 2016. However, the highest landing of sharks by month came from trawl nets in January 2016 at 1,591.4 kg. The details are shown in **Table 4**.

Table 4. Weight of Sharks, Rays and Skates (in kg) Caught by Different Types of Gear at Yangon Landing Site

Type of Gear		2015						2016						Total
Group	Gear	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Shark	Giant Set Bag Net	173.8	358.0		41.3	197.0		102.9	110.4					983.3
	Set Bag Net	468.1		1,046.2		18.7	56.2				0.1		96.5	1,685.9
	Trawl Net	421.5	786.6	483.5	1,528.9	358.1	262.0	1,591.4	210.1	232.7	26.2	401.6	49.4	6,351.9
Shark Total		1,063.4	1,144.6	1,529.8	1,570.2	573.8	318.2	1,694.2	320.5	232.7	26.3	401.6	145.9	9,021.1
Ray	Giant Set Bag Net	527.9	513.9		441.1	237.7		976.6	581.7					3,279.0
	Set Bag Net	166.5		81.2		25.7	994.2		14.6		15,708.5		22.2	17,013.0
	Trawl Net	291.7	1,212.7	1,917.7	1,928.5	1,298.1	2,962.3	1,359.4	2,323.6	4,350.8	260.4	1,315.9	1,845.6	21,066.6
Ray Total		986.1	1,726.6	1,999.0	2,369.6	1,561.5	3,956.6	2,336.0	2,919.9	4,350.8	15,968.9	1,315.9	1,867.8	41,358.6
Skate	Set Bag Net										24.8			24.8
	Trawl Net				39.8	1.5				19.9				61.2
Skate Total					39.8	1.5				19.9	24.8			86.0
Grand Total		2,049.5	2,871.2	3,528.7	3,979.6	2,136.8	4,274.8	4,030.2	3,240.4	4,603.3	16,020.1	1,717.5	2,013.7	50,465.7

2.1.3 Sharks, Rays and Skates Composition

Total of 3,697,905.9 kg of fish was landed during the study period from 135 landings. Sharks, rays and skates made up 9,021.1 kg, 41,358.6 kg, and 86.0 kg respectively from the total landing. In term of landing composition, sharks and rays contributed about 0.2% and 1.1% respectively. While landings of bony fishers and other species was 3,647,440.2 kg, average landings per month for sharks, rays and skates were 751.8 kg, 3,446.5 kg, and 7.2 kg respectively. The highest landing by month for rays was 15,968.9 kg in April 2016, followed by 4,350.8 kg in March 2016 and 3,956.6 kg in December 2015. However, the highest landing for sharks was 1,694.2 kg in January 2016 followed by 1,570.2 kg in October and 1,529.8 kg in September 2015. The landing of rays and sharks ranged between 0.4 - 7.5% and 0.0 - 1.2% respectively. Landing of skates was very small. The average landing of rays and sharks was 1.1% and 0.2% respectively from total landing. The details are shown in **Table 5**.

Table 5: Catch Composition of Sharks, Rays, Skates, and Bony Fishes and Others by Month from three (3) Landings at Yangon Landing Site. All Weights in Kilogram.

Year	Month	All Shark (kg)	%Shark	All Ray (kg)	%Ray	All Skate (kg)	%Skate	Bony Fish and Others (kg)	%Bony Fish and Others	Total Catch (kg)
2015	July	1,063.4	1.2	986.1	1.2	0.00	0.0	83,537.6	97.6	85,587.1
	August	1,144.6	1.0	1,726.6	1.6	0.00	0.0	107,202.1	97.4	110,073.3
	September	1,529.8	0.7	1,999.0	0.9	0.00	0.0	230,253.7	98.5	233,782.4
	October	1,570.2	0.3	2,369.6	0.5	39.8	0.0	485,497.8	99.2	489,477.3
	November	573.8	0.2	1,561.5	0.5	1.5	0.0	304,266.7	99.3	306,403.4
	December	318.2	0.1	3,956.6	0.8	0.00	0.0	489,734.8	99.1	494,009.6
2016	January	1,694.2	0.7	2,336.0	0.9	0.00	0.0	256,265.0	98.5	260,295.2
	February	320.5	0.0	2,919.9	0.4	0.00	0.0	692,783.7	99.5	696,024.1
	March	232.7	0.1	4,350.8	2.0	19.9	0.0	214,784.1	97.9	219,387.4
	April	26.3	0.0	15,968.9	7.5	24.8	0.0	198,282.0	92.5	214,302.1
	May	401.6	0.1	1,315.9	0.4	0.00	0.0	296,832.3	99.4	298,549.8
	June	145.9	0.1	1,867.8	0.6	0.00	0.0	288,000.5	99.3	290,014.2
Grand Total		9,021.1		41,358.6		86.0		3,647,440.2		3,697,905.9
Average		751.8	0.2	3,446.5	1.1	7.2	0.0	303,953.4	98.6	308,158.8

2.1.4 Sample Size

A total of 2,999 tails belonging to 1,668 rays, 1,316 sharks and 15 skates were sampled comprising 37 species of rays 18 species of sharks and two (2) species of skates. The most abundant and common ray species were *Himantura walga* followed by *Rhinobatos cf. formosensis*, *Rhinobatos punctifer*, *Neotrygon kuhlii* and *Gymnura japonica*. The highest number of rays sampled by month was 205 in August followed by 187 in September and 172 in November 2015. Other species such as *Glaucostegus sp.*, *Dasyatis microps*, *Himantura uarnak*, *Himantura imbricata*, *Gymnura poecilura*, *Aetobatus flagellum*, *Dasyatis sinensis*, *Himantura cf. javaensis*, *Himantura fai*, *Mobula kuhlii*, *Mobula japonica*, *Plesiobatis daviesi*, *Rhinoptera adspersa*, *Narcine lingula*, *Okamejei sp.*, *Urogymnus asperrimus*, *Himantura lobistoma*, *Pastinachus gracilicaudus*, *Pastinachus cf. solocirostris*, and *Pastinachus stellurostris*, were very rare and only landed between 1 - 7 months during the study period. The details are as shown in **Table 6A**.

Table 6A: Sample Size of Rays and Skates by Species

Species	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
<i>Aetobatus flagellum</i>		1				1							2
<i>Aetobatus cf. narinari</i>		4											4
<i>Dasyatis microps</i>				1			1	1					3
<i>Dasyatis sinensis</i>				1	3								4
<i>Glaucostegus sp.</i>		4											4
<i>Glaucostegus typus</i>				2				8	1	15			26
<i>Gymnura japonica</i>	14	17	20		1		2	6					60
<i>Gymnura poecilura</i>									1	4			5
<i>Himantura fai</i>								1			3		4
<i>Himantura gerrardi</i>	3	9	2			13	2	4				1	34
<i>Himantura imbricata</i>					4								4
<i>Himantura cf. javaensis</i>	2	1											3
<i>Himantura jenkinsii</i>						2	5	10	1		6	4	28
<i>Himantura leopard</i>		5				4			1		8	1	19
<i>Himantura lobistoma</i>		2		3	3								8
<i>Himantura pastinacoides</i>	2	14		11				1	1	6	9		44
<i>Himantura uarnacoides</i>			9	4		2		2	8	18			43
<i>Himantura uarnak</i>						2			1			1	4
<i>Himantura undulate</i>	2					2		1	3		5	13	26
<i>Himantura walga</i>	45	70	53	38	44	48	3	13	9	23	23	22	391
<i>Mobula japanica</i>	3	4	16					3					26
<i>Mobula kuhlii</i>							1						1
<i>Narcine brevilabiata</i>				11									11
<i>Narcine lingual</i>				10									10
<i>Neotrygon kuhlii</i>	2	9		3	13	9	14	16	3	13	10		92
<i>Pastinachus gracilicaudus</i>				1									1
<i>Pastinachus cf. solocirostris</i>											1		1
<i>Pastinachus stellurostris</i>				1						1			2
<i>Plesiobatis daviesi</i>									1				1
<i>Rhina ancylostoma</i>				14	2	4	5		3		10	3	41
<i>Rhinobatos cf. formosensis</i>				46	46	39	13	24	44	15	26	20	273
<i>Rhinobatos penggali</i>	22	35	66										123
<i>Rhinobatos punctifer</i>	14	16	9	24	29	25	31	49	23	24	17	26	287
<i>Rhinoptera javanica</i>		13	12					5	2	10			42
<i>Rhinoptera jayakari</i>	6	1				4	13					2	26
<i>Rhynchobatus australiae</i>				2							1		3
<i>Taeniurops meyeri</i>					1	1		2					4

<i>Urogymnus asperrimus</i>									3	5			8
Total Rays	115	205	187	172	146	156	90	146	105	134	119	93	1,668
<i>Okamejei jensenae</i>				2					3	8			13
<i>Okamejei</i> sp.				1	1								2
Total Skates				3	1				3	8			15

The most common and abundant shark species were *Sphyrna lewini*, *Scoliodon laticaudus*, *Mustelus* sp., *Carcharhinus leucas* and *Mustelus mosis*. All these species were landed throughout the year. Other species such *Carcharhinus melanopterus*, *Sphyrna mokarran*, *Carcharhinus sorrah*, and *Carcharhinus limbatus* were rarely landed and only landed between 1 -7 months during the study period. The highest number of sharks sampled by month was 255 in September, followed by 202 in October, 185 in August and 166 in July 2015. The details are as shown in **Table 6B**.

Table 6B: Sample Size of Sharks by Species

Species	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
<i>Carcharhinus brevipinna</i>							1		1		4	1	7
<i>Carcharhinus leucas</i>	7	4	42	8	9	3	1	6			5		85
<i>Carcharhinus limbatus</i>								1					1
<i>Carcharhinus macloti</i>				17	17		1						35
<i>Carcharhinus melanopterus</i>	1												1
<i>Carcharhinus sorrah</i>	3												3
<i>Chiloscyllium hasseltii</i>	2			3					5	6	1	1	18
<i>Chiloscyllium punctatum</i>									1	1	1	1	4
<i>Galeocerdo cuvier</i>		2	2	4		2					1		11
<i>Hemigaleus microstoma</i>				2	4		1		1		5	1	14
<i>Hemipristis elongata</i>					2	5	4	1			7		19
<i>Loxodon macrorhinus</i>				5	18	1		9	8		15	15	71
<i>Mustelus mosis</i>		7	9	19			10	1	1			1	48
<i>Mustelus</i> sp.	4	17		12	8	18	3	14	24		25	9	134
<i>Rhizoprionodon acutus</i>	2	9	19										30
<i>Scoliodon laticaudus</i>	44	34	91	61	27	6	12	33	4	14	7	41	374
<i>Sphyrna lewini</i>	103	112	92	71	27	3	3	15	3		21	10	460
<i>Sphyrna mokarran</i>						1							1
Total Sharks	166	185	255	202	112	39	36	80	48	21	92	80	1,316
Grand Total (Sharks, Rays, Skates)	281	390	442	377	259	195	126	226	156	163	211	173	2,999

2.1.5 Weight of Sharks, Rays and Skates by Species

A total of 50,465.7 kg of sharks, rays and skates was landed from three landing sites comprising 41,358.6 kg rays, 9,021.1 kg sharks and 86.0 kg skates. For rays, the highest landing by weight was from species *Urogymnus asperrimus* amounting to 14,501.5 kg followed by *Rhinobatos cf. formosensis* (5,930.5 kg), *Himantura walga* (3,529.6 kg), *Rhinobatos punctifer* (2,528.9 kg), *Himantura undulata* (2,411.1 kg) and *Gymnura japonica* (2,089.6 kg). The highest landing by month was 15,968.9 kg in April 2016, followed by 4,350.8 kg in March 2016 and 3,956.6 kg in December 2015. For *Himantura walga*, the highest landing was 894.7 kg in August, followed by 500.8 kg in October and 435.5 kg in November 2015. The highest landing for *Rhinobatos cf. formosensis* was 1,599.2 kg in March 2016, followed by 1,201.1 kg in December and 856.3 kg in September 2015. For *Rhinobatos punctifer* the highest landing was 786.8 kg in January followed by 395.1 kg in March 2016 and 287.3 kg in November 2015.

The highest shark species landing were 2,802.6 kg for *Sphyrna lewini* followed by 2,726.4 kg for *Scoliodon laticaudus* and 1,572.3 kg for *Mustelus mosis*. The highest landing by month for *Sphyrna lewini* was 754.4 kg in July followed by 745.2 kg in October and 445.5 kg in August 2015. For *Scoliodon laticaudus*, the highest landing was 964.7 kg in September followed by 551.4 kg in October and 383.6 kg in August 2015. Landing of skates, *Okamejei jenseanae* and *Okamejei* sp. was 64.4 kg and 21.4 kg respectively. The details are shown in **Table 7**.

Table 7: Weight of Sharks, Rays and Skates (in Kg) by Species at Yangon Landing Site

Species	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
<i>Aetobatus flagellum</i>		16.5				19.8							36.3
<i>Aetobatus cf. narinari</i>		34.0											34.0
<i>Dasyatis microps</i>				148.5			55.0	148.4					351.9
<i>Dasyatis sinensis</i>				0.3	30.7								31.0
<i>Glaucostegus sp.</i>		15.0											15.0
<i>Glaucostegus typus</i>				75.9				154.8	2.0	83.1			315.8
<i>Gymnura japonica</i>	58.2	123.3	679.1		9.8		2.8	1,216.4					2,089.6
<i>Gymnura poecilura</i>									9.8	17.8			27.6
<i>Himantura fai</i>								8.7			45.1		53.8
<i>Himantura gerrardi</i>	50.9	78.7	30.9			105.4	34.4	39.7				1.7	341.6
<i>Himantura imbricate</i>					74.1								74.1
<i>Himantura cf. javaensis</i>	30.0	7.2											37.2
<i>Himantura jenkinsii</i>						41.0	276.9	464.0	33.0		97.6	198.9	1,111.3
<i>Himantura leopard</i>		33.8				782.1			207.0		274.7	41.3	1,338.9
<i>Himantura lobistoma</i>		19.8		76.3	45.3								141.4
<i>Himantura pastinacoides</i>	1.6	70.9		105.4				5.1	5.1	55.8	46.2		290.1
<i>Himantura uarnacoides</i>			70.8	39.0		58.0		15.9	104.5	1,366.4			1,654.6
<i>Himantura uarnak</i>						568.5			321.0			38.0	927.4
<i>Himantura undulate</i>	96.2					517.5		49.2	420.1		223.5	1,104.6	2,411.1
<i>Himantura walga</i>	237.3	894.7	153.0	500.8	435.5	216.9	4.5	57.6	337.4	98.7	299.6	293.7	3,529.6
<i>Mobula japonica</i>	41.3	24.8	148.5					3.3					217.8

<i>Mobula kuhlii</i>							45.0						45.0
Species	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
<i>Narcine brevilabiata</i>				100.0									100.0
<i>Narcine lingula</i>				99.0									99.0
<i>Neotrygon kuhlii</i>	26.5	16.3		13.6	12.3	12.5	220.7	17.9	3.8	54.5	12.6		390.7
<i>Pastinachus gracilicaudus</i>				38.4									38.4
<i>Pastinachus cf. solocirostris</i>											2.7		2.7
<i>Pastinachus stellurostris</i>				27.7						2.6			30.2
<i>Plesiobatis daviesi</i>									3.3				3.3
<i>Rhina ancylostoma</i>				297.3	6.5	60.3	42.2		103.6		48.1	26.9	584.8
<i>Rhinobatos cf. formosensis</i>				634.7	594.0	1,201.1	340.7	17.1	1,599.2	19.0	188.1	53.6	4,647.5
<i>Rhinobatos penggali</i>	219.0	207.8	856.3										1,283.0
<i>Rhinobatos punctifer</i>	190.6	24.5	24.9	210.5	287.3	201.4	786.8	262.3	395.1	50.1	42.2	53.5	2,528.9
<i>Rhinoptera javanica</i>		158.5	35.6					360.5	360.5	165.0			1,080.1
<i>Rhinoptera jayakari</i>	34.7	0.9				122.9	527.0					55.7	741.1
<i>Rhynchobatus australiae</i>				2.3							35.5		37.8
<i>Taeniuroops meyeri</i>					66.0	49.5		99.2					214.7
<i>Urogymnus asperrimus</i>									445.5	14,056.0			14,501.5
Total Weight Rays	986.1	1,726.6	1,999.0	2,369.6	1,561.5	3,956.6	2,336.0	2,919.9	4,350.8	15,968.9	1,315.9	1,867.8	41,358.6
<i>Carcharhinus brevipinna</i>							2.0		4.4		8.2	8.2	22.9
<i>Carcharhinus leucas</i>	29.3	8.8	73.9	65.3	53.1	7.8	7.6	18.6			11.6		275.8
<i>Carcharhinus limbatus</i>								2.0					2.0
<i>Carcharhinus macloti</i>				23.8	89.6		14.0						127.4
<i>Carcharhinus melanopterus</i>	3.3												3.3

<i>Carcharhinus sorrah</i>	21.1												21.1
Species	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
<i>Chiloscyllium hasseltii</i>	2.5			2.2					24.1	6.1	1.2	1.2	37.3
<i>Chiloscyllium punctatum</i>									0.7	0.7	1.2	0.7	3.3
<i>Galeocerdo cuvier</i>		4.7	3.4	51.0		16.5					9.6		85.2
<i>Hemigaleus microstoma</i>				1.4	2.2		0.7		1.7		3.6	1.7	11.1
<i>Hemipristis elongata</i>					17.9	3.9	9.2	0.8			5.6		37.4
<i>Loxodon macrorhinus</i>				18.8	87.1	17.7		2.8	17.7		136.6	76.8	357.4
<i>Mustelus mosis</i>		118.8	26.1	50.8			1,372.2	1.3	1.6			1.6	1,572.3
<i>Mustelus sp.</i>	2.0	161.3		60.4	8.2	224.1	2.3	60.4	127.5		185.5	5.7	837.4
<i>Rhizoprionodon acutus</i>	4.1	22.0	71.3										97.4
<i>Scoliodon laticaudus</i>	246.7	383.6	964.7	551.4	132.3	43.2	166.8	128.1	39.3	19.6	19.8	31.0	2,726.4
<i>Sphyrna lewini</i>	754.4	445.5	390.4	745.2	183.4	4.2	119.4	106.4	15.8		18.7	19.1	2,802.6
<i>Sphyrna mokarran</i>						0.9							0.9
Total Weight Sharks	1,063.4	1,144.6	1,529.8	1,570.2	573.8	318.2	1,694.2	320.5	232.7	26.3	401.6	145.9	9,021.1
<i>Okamejei jensenae</i>				19.9					19.9	24.8			64.6
<i>Okamejei sp.</i>				19.9	1.5								21.4
Total Weight Skates				39.8	1.5				19.9	24.8			86.0

2.1.6 Size Range of Sharks, Rays and Skates

In general, most ray species sampled from July to December 2015 were mature except for *Dasyatis sinensis*, *Glycostegus* sp., *Gymnura japonica*, *Himantura leoparda*, *Mobula japonica*, *Pastinachus stellurostris*, *Rhina encylostoma*, *Rhinoptera javanica*, *Rhinoptera jayakari* and *Rhynchobatus australiae*. The average size of *Mobula japonica* ranged between 22.0 - 78.0 cm disc length but no adult sized specimens were available. First maturing size for *Mobula japonica* is about 90 cm, for *Gymnura japonica* is about 30 cm disc length, *Rhynchobatus australiae* about 130 cm total length, *Rhinoptera javanica* about 90 cm total length, *Dasyatis sinensis* about 35 cm disc length, *Pastinachus stellurostris* about 65 cm disc length, and *Rhina encylostome* about 155 cm total length. It could be inferred that most of these species were exploited at the juvenile stage. However, almost all of *Aetobatus flagellum*, *Aetobatus* cf. *narinari*, *Dasyatis microps*, *Neotrygon kuhlii*, *Glaucostegus typus*, *Rhinobatos punctifer*, *Rhinobatos* cf. *formosensis*, *Himantura gerrardi*, *Himantura walga*, *Himantura undulata*, *Himantura uarnak*, *Himantura imbricata*, *Himantura uarnacoides* and *Himantura pastinacoides* were mature. Most shark species landed were immature except for *Carcharhinus macloiti*, *Carcharhinus melanopterus*, *Chiloscyllium hasseltii*, *Loxodon macrorhinus* and *Rhizoprionodon acutus*. First maturing size for these species are 70 cm, 100 cm, 50 cm, 60 cm and 70 cm total length respectively. Size range of all sharks and rays species from July to December 2015 are shown in **Table 8A**.

Table 8A: Size Range of Sharks (Total Length), Rays and Skates (Disc Length) Except for *Glaucostegus* sp., *Glaucostegus typus*, *Narcine brevilabiata*, *Narcine lingula*, *Rhina ancylostoma*, *Rhinobatos cf. formosensis*, *Rhinobatos penggali*, *Rhinobatos punctifer*, and *Rhynchobatus australiae* (Total Length) from July - December 2015. All Measurements in cm.

Species	2015																	
	July			August			September			October			November			December		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Rays																		
<i>Aetobatus flagellum</i>				93.0	93.0	93.0										105.0	105.0	105.0
<i>Aetobatus cf. narinari</i>				110.0	113.0	111.5												
<i>Dasyatis microps</i>										145.0	145.0	145.0						
<i>Dasyatis sinensis</i>										21.0	21.0	21.0	22.0	22.0	22.0			
<i>Glaucostegus</i> sp.				88.0	93.0	90.8												
<i>Glaucostegus typus</i>										210.0	210.0	210.0						
<i>Gymnura japonica</i>	12.0	30.0	22.1	11.0	32.0	20.8	14.0	32.0	19.5				20.0	20.0	20.0			
<i>Himantura gerrardi</i>	61.0	63.0	62.0	60.0	68.0	65.0	67.0	67.0	67.0							21.0	108.0	37.8
<i>Himantura imbricata</i>													20.0	20.2	20.1			
<i>Himantura</i> cf. <i>javaensis</i>	34.0	35.0	34.5	35.0	35.0	35.0												
<i>Himantura jenkinsii</i>																79.0	80.0	79.5
<i>Himantura leoparda</i>				51.0	59.0	56.8										104.0	111.0	109.0
<i>Himantura lobistoma</i>				33.4	33.5	33.5				30.0	65.0	53.3	33.5	83.0	63.8			
<i>Himantura pastinacoides</i>	15.0	17.5	16.3	15.0	56.0	33.6				36.0	65.0	51.5						
<i>Himantura uarnacoides</i>							49.0	115.0	75.9	32.0	76.0	44.3				78.0	117.0	97.5
<i>Himantura uarnak</i>																112.0	113.0	112.5
<i>Himantura undulata</i>	100.0	100.0	100.0													110.0	112.0	111.0
<i>Himantura walga</i>	11.4	28.0	19.9	18.0	24.0	21.5	15.0	24.0	19.8	18.0	24.0	21.3	16.0	24.0	20.8	18.0	27.0	22.1
<i>Mobula japonica</i>	45.0	46.0	45.7	22.0	29.0	26.0	22.0	78.0	57.1									
<i>Narcine brevilabiata</i>										29.0	34.0	31.2						
<i>Narcine lingula</i>										29.0	32.0	30.9						

<i>Neotrygon kuhlii</i>	34.0	35.0	34.5	16.0	36.0	32.2				24.0	39.0	32.3	15.5	39.0	23.2	15.5	30.0	19.9	
<i>Pastinachus gracilicaudus</i>										98.0	98.0	98.0							
<i>Pastinachus stellurostris</i>										45.0	45.0	45.0							
Species	2015																		
	July			August			September			October			November			December			
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	
<i>Rhina ancylostoma</i>										61.0	175.0	113.9	72.0	75.0	73.5	73.0	110.0	100.8	
<i>Rhinobatos cf. formosensis</i>										34.0	81.0	54.4	40.0	77.0	59.3	40.0	79.0	64.8	
<i>Rhinobatos penggali</i>	20.0	75.0	53.6	35.0	83.0	70.7	27.0	86.0	63.6										
<i>Rhinobatos punctifer</i>	35.0	83.0	50.3	30.0	83.0	52.4	35.0	65.0	50.8	44.0	78.0	60.0	44.0	80.0	62.2	30.0	72.0	49.8	
<i>Rhinoptera javanica</i>				23.0	77.0	42.2	30.0	35.0	32.6										
<i>Rhinoptera jayakari</i>	23.0	29.0	26.2	24.0	24.0	24.0											35.0	78.0	46.0
<i>Rhynchobatus australiae</i>										52.3	53.0	52.7							
<i>Taeniurops meyeri</i>													140.0	140.0	140.0	90.0	90.0	90.0	
Sharks																			
<i>Carcharhinus leucas</i>	71.0	143.0	84.9	70.0	75.0	72.5	40.5	142.0	66.8	61.0	76.0	70.1	70.0	76.0	73.0	71.0	71.0	71.0	
<i>Carcharhinus macloti</i>										78.0	87.0	80.5	70.0	81.0	76.4				
<i>Carcharhinus melanopterus</i>	77.0	77.0	77.0																
<i>Carcharhinus sorrah</i>	70.0	158.0	101.0																
<i>Chiloscyllium hasseltii</i>	68.0	69.0	68.5							35.0	67.0	56.3							
<i>Galeocerdo cuvier</i>				87.5	87.5	87.5	91.0	92.0	91.5	87.6	138.0	111.9				110.0	119.0	114.5	
<i>Hemigaleus microstoma</i>										59.0	59.0	59.0	40.0	45.0	41.5				
<i>Hemipristis elongata</i>													41.0	62.0	51.5	58.0	63.0	59.0	
<i>Loxodon macrorhinus</i>										57.0	81.0	72.2	55.0	74.0	66.0	60.0	60.0	60.0	
<i>Mustelus mosis</i>				56.0	68.0	60.9	55.0	59.0	57.0	54.0	64.0	60.2							
<i>Mustelus sp.</i>	45.0	58.0	51.5	28.0	63.0	44.1				43.0	61.0	47.7	39.0	58.0	46.6	32.0	58.0	45.5	
<i>Rhizoprionodon acutus</i>	73.0	77.0	75.0	72.0	76.0	74.2	70.0	78.0	74.4										

<i>Scoliodon laticaudus</i>	37.0	65.0	47.6	31.0	61.0	46.7	29.0	82.0	40.6	35.0	63.0	45.3	34.0	56.0	42.8	44.0	50.0	45.7
<i>Sphyrna lewini</i>	48.0	69.0	58.4	47.0	79.0	64.9	49.0	93.0	70.9	49.0	77.0	70.8	70.0	76.0	72.4	50.0	75.0	65.7
<i>Sphyrna mokarran</i>																70.0	70.0	70.0
Skates																		
<i>Okamejei jensenae</i>										47.0	47.0	47.0						
<i>Okamejei sp</i>										47.0	47.0	47.0	47.0	47.0	47.0			

In general, most ray species sampled from January to June 2016 were mature except for *Glycostegus typus*, *Gymnura poecilura*, *Himantura fai*, *Himantura pastinacoides*, *Mobula japanica*, *Pastinachus stellurostris*, *Rhina encylostoma*, *Rhinobatos cf. formosensis*, *Rhinoptera javanica*, *Rhinoptera jayakari* and *Taenuirops meyeri*. However, almost all of *Aetobatus flagellum*, *Aetobatus cf. narinari*, *Dasyatis microps*, *Himantura gerrardi*, *Himantura jenkinsii*, *Himantura leoparda*, *Himantura uarnacoides*, *Himantura uarnak*, *Himantura undulata*, *Himantura walga*, *Mobula kuhlii*, *Neotrygon kuhlii*, *Rhinobatos punctifer* were mature. Most shark species landed were immature except for *Carcharhinus macloti*, *Chiloscyllium hasseltii*, *Hemigaleus microstoma*, *Mustelus mosis* and *Scoliodon laticaudus*. Size range of all sharks and rays species from January to June 2016 are shown in **Table 8B**.

Table 8B: Size Range of Sharks (Total Length), Rays and Skates (Disc Length) Except for *Glaucostegus typus*, *Rhina ancylostoma*, *Rhinobatos cf.formosensis*, and *Rhinobatos punctifer* (Total Length) from January - June 2016. All Measurements in cm.

Species	2016																	
	January			February			March			April			May			June		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Ray																		
<i>Dasyatis microps</i>	144.0	144.0	144.0	143.0	143.0	143.0												
<i>Glaucostegus typus</i>				35.0	83.0	67.4	65.0	65.0	65.0	36.0	83.0	62.7						
<i>Gymnura japonica</i>	15.0	67.0	41.0	14.0	26.0	17.7												
<i>Gymnura poecilura</i>							15.0	15.0	15.0	14.0	16.0	15.1						
<i>Himantura fai</i>				65.0	65.0	65.0							67.0	94.0	84.3			
<i>Himantura gerrardi</i>	64.0	69.0	66.5	34.0	67.0	48.8										35.0	35.0	35.0
<i>Himantura jenkinsii</i>	68.0	70.0	68.6	69.0	95.0	82.4	53.0	53.0	53.0				50.0	80.0	61.2	91.0	93.0	92.1
<i>Himantura leoparda</i>							110.0	110.0	110.0				100.0	113.0	107.3	110.0	110.0	110.0
<i>Himantura pastinacoides</i>				37.0	37.0	37.0	38.0	38.0	38.0	37.0	74.0	55.0	37.0	56.0	51.4			
<i>Himantura uarnacoides</i>				77.0	78.0	77.5	36.0	97.0	66.9	35.0	97.0	73.1						
<i>Himantura uarnak</i>							105.0	105.0	105.0							105	105	105
<i>Himantura undulata</i>				111.0	111.0	111.0	116.0	146.0	130.7				105	112	110	110	130	116
<i>Himantura walga</i>	17.0	20.0	18.3	20.0	26.0	21.8	20.0	22.0	21.1	15.0	24.0	20.4	15	24	20	14	26	21
<i>Mobula japonica</i>				25.0	27.0	26.3												
<i>Mobula kuhlii</i>	100.0	100.0	100.0															
<i>Neotrygon kuhlii</i>	18.0	35.0	23.1	10.0	37.0	24.8	23.0	25.0	24.3	15.0	35.0	23.3	19.0	37.0	31.2			
<i>Pastinachus cf solocirostris</i>													48.0	48.0	48.0			
<i>Pastinachus stellurostris</i>										46.0	46.0	46.0						
<i>Plesiobatis daviesi</i>							42.0	42.0	42.0									
<i>Rhina ancylostoma</i>	86.0	137.0	104.2				68.0	83.5	73.5				58.0	112.0	74.6	73.0	110.0	88.8
Species	2016																	

	January			February			March			April			May			June		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
<i>Rhinobatos cf formosensis</i>	25.0	83.0	57.7	35.0	59.0	48.7	24.0	89.0	49.9	33.0	89.0	56.3	24.0	88.0	51.5	40.0	89.0	56.8
<i>Rhinobatos punctifer</i>	33.0	83.0	50.7	27.0	84.0	60.4	32.0	86.5	49.9	32.0	85.0	58.7	32.0	86.0	54.6	30.0	110.0	54.6
<i>Rhinoptera javanica</i>				30.0	34.0	32.0	62.0	63.0	62.5	30.0	64.0	38.5						
<i>Rhinoptera jayakari</i>	23.0	91.0	46.5													35.0	53.0	44.0
<i>Taeniurops meyeri</i>				90.0	91.0	90.5												
<i>Urogymnus asperrimus</i>							201.0	220.0	208.0	200.0	221.0	209.0						
Shark																		
<i>Carcharhinus brevipinna</i>	74.0	74.0	74.0				96.0	96.0	96.0				57.0	95.0	70.8	96.0	96.0	96.0
<i>Carcharhinus leucas</i>	76.0	76.0	76.0	70.0	77.0	74.8							70.0	84.0	76.8			
<i>Carcharhinus limbatus</i>				73.0	73.0	73.0												
<i>Carcharhinus macloti</i>	78.0	78.0	78.0															
<i>Chiloscyllium hasseltii</i>							54.0	70.0	65.0	57.0	71.0	66.5	65.0	65.0	65.0	71.0	71.0	71.0
<i>Chiloscyllium punctatum</i>							57.0	57.0	57.0	57.0	57.0	57.0	69.0	69.0	69.0	57.0	57.0	57.0
<i>Galeocerdo cuvier</i>													130.0	130.0	130.0			
<i>Hemigaleus microstoma</i>	55.0	55.0	55.0				81.0	81.0	81.0				53.0	65.0	57.8	81.0	81.0	81.0
<i>Hemipristis elongata</i>	64.0	65.0	64.3	68.0	68.0	68.0							63.0	69.0	65.6			
<i>Loxodon macrorhinus</i>				44.0	56.0	51.3	39.0	88.0	66.6				37.0	88.0	65.3	31.0	79.0	53.9
<i>Mustelus mosis</i>	51.0	65.0	55.6	79.0	79.0	79.0	77.0	77.0	77.0							77.0	77.0	77.0
<i>Mustelus sp.</i>	60.0	63.0	61.7	24.0	50.0	36.3	12.0	82.0	42.7				25.0	60.0	44.0	39.0	82.0	50.3
<i>Scoliodon laticaudus</i>	30.0	53.0	42.4	30.0	55.0	42.8	33.0	45.0	38.3	29.0	50.0	38.5	30.0	50.0	38.6	26.0	68.0	41.6
<i>Sphyrna lewini</i>	81.0	85.0	82.3	60.0	67.0	63.7	64.0	137.0	88.7				45.0	65.0	55.3	45.0	82.0	59.7
Skate																		
<i>Okamejei jensenae</i>							18.0	28.0	22.5	17.0	48.0	34.3						

2.1.7 Fishing Effort and CPUE (Catch per Unit Effort)

Total day of operation for all gears was 1,168 days. Operation of trawl nets was the highest with 917 days compared to giant set bag net 147 days and set bag net 104 days. For trawl net, total day of operation in 2015 was 511 days and 406 days in 2016. For giant set bag net, day at operation in 2015 was 78 days and 69 days in 2016. Monthly fishing efforts (days at operation) of the sampled vessels are summarized in **Table 9A**.

Table 9A: Days at Operation by Gears Sampled during the Study Period

Type of Gear	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Giant Set Bag Net	24	26		7	21		9	60					147
Set Bag Net	36		19		7	10		12		10		10	104
Trawl Net	56	87	81	90	82	115	59	106	90	36	52	63	917
Grand Total	116	113	100	97	110	125	68	178	90	46	52	73	1,168

A total of 4,672 operations by all gears were sampled during the study period. Operation by trawl net was the highest at 3,668 followed by giant set bag net 588 and set bag net 416 operations. In 2015, number of operation for trawl net was 2,044 and 1,624 operations in 2016. For giant set bag net, number of operation in 2015 was 312 and 276 operations in 2016. The details are shown in **Table 9B**.

Table 9B: Numbers of Operation by Gears Sampled during the Study Period

Total Number of Operation	2015						2016						Grand Total
	Gear	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
Giant Set Bag Net	96	104		28	84		36	240					588
Set Bag Net	144		76		28	40		48		40		40	416
Trawl Net	224	348	324	360	328	460	236	424	360	144	208	252	3,668
Grand Total	464	452	400	388	440	500	272	712	360	184	208	292	4,672

In case of the gear of which annual effort excess 1,000 days of operation or 1,000 number of operations, CPUE for 12 months was estimated by weight and number of individuals by species. *Sphyrna lewini* was the top with 2.17 kg/day operation, 0.54 kg/operation and 2.81 kg/km² followed by *Mustelus mosis* at 1.59 kg/day of operation, 0.40 kg/number of operation and 2.05 kg/km², and *Scoliodon laticaudus* at 1.53 kg/day of operation, 0.38 kg/number of operation and 1.97 kg/km². CPUE for other species are shown in **Table 10A**.

Table 10A: Top 10 CPUE Sharks Species by Weight Captured by Trawl Net during the Study Period

Rank	Species	Total Weight (kg) by species	CPUE (kg/Day of Operation)	CPUE (kg/Number of Operation)	CPUE (kg/Swept Area (km ²))
1	<i>Sphyrna lewini</i>	1,991.84	2.17	0.54	2.81
2	<i>Mustelus mosis</i>	1,453.53	1.59	0.40	2.05
3	<i>Scoliodon laticaudus</i>	1,399.23	1.53	0.38	1.97
4	<i>Mustelus sp.</i>	613.72	0.67	0.17	0.86
5	<i>Loxodon macrorhinus</i>	283.70	0.31	0.08	0.40
6	<i>Carcharhinus leucas</i>	211.94	0.23	0.06	0.30
7	<i>Rhizoprionodon acutus</i>	84.98	0.09	0.02	0.12
8	<i>Carcharhinus macloti</i>	81.06	0.09	0.02	0.11
9	<i>Galeocerdo cuvier</i>	77.07	0.08	0.02	0.11
10	<i>Chiloscyllium hasseltii</i>	36.12	0.04	0.01	0.05

In term of CPUE by number of individual, *Scoliodon laticaudus* was the highest with 3.87 tails/day of operation, 0.97 tails/number of operation and 5.00 tails/km² followed by *Mustelus mosis* with 2.57 tails/day of operation, 0.64 tails/number of operation and 3.32 tails/km² and *Mustelus sp* at 2.24 tails/day of operation, 0.56 tails/operation and 2.90 tails/km². Details are shown in **Table 10B**.

Table 10B: Top Nine (9) CPUE Sharks Species by Number of Individual Captured by Trawl Net during the Study Period

Rank	Species	Estimated Number of Individual	CPUE (Number of individual/Day of Operation)	CPUE (Number of individual/ Number of Operation)	CPUE (Number of individual/ Swept Area (km ²))
1	<i>Scoliodon laticaudus</i>	3,546.48	3.87	0.97	5.00
2	<i>Mustelus mosis</i>	2,356.74	2.57	0.64	3.32
3	<i>Mustelus sp.</i>	2,056.80	2.24	0.56	2.90
4	<i>Sphyrna lewini</i>	1,376.54	1.50	0.38	1.94
5	<i>Loxodon macrorhinus</i>	363.19	0.40	0.10	0.51
6	<i>Carcharhinus leucas</i>	108.52	0.12	0.03	0.15
7	<i>Carcharhinus macloti</i>	58.66	0.06	0.02	0.08
8	<i>Chiloscyllium hasseltii</i>	54.08	0.06	0.01	0.08
9	<i>Hemipristis elongata</i>	50.57	0.06	0.01	0.07

In term of CPUE by weight for rays, *Rhinobatos cf formosensis* was the top with 4.26 kg/day operation, 1.06 kg/number of operation and 5.50 kg/km² followed by *Himantura walga* at 3.41 kg/day operation, 0.85 kg/number of operation and 4.41 kg/km², and *Rhinobatos punctifer* at 3.11 kg/day operation, 0.78 kg/number of operation and 4.02 kg/km². CPUE for other species by weight are shown in **Table 10C**.

Table 10C: Top Nine (9) CPUE Rays Species by Weight Captured by Trawl Net during the Study Period

Rank	Species	Total Weight (kg) by species	CPUE (kg/Day of Operation)	CPUE (kg/Number of Operation)	CPUE (kg/Swept Area (km ²))
1	<i>Rhinobatos cf formosensis</i>	3,906.05	4.26	1.06	5.50
2	<i>Himantura walga</i>	3,127.75	3.41	0.85	4.41
3	<i>Rhinobatos punctifer</i>	2,852.17	3.11	0.78	4.02
4	<i>Himantura undulata</i>	2,067.16	2.25	0.56	2.91
5	<i>Gymnura japonica</i>	2,043.13	2.23	0.56	2.88
6	<i>Himantura leoparda</i>	1,131.97	1.23	0.31	1.59
7	<i>Himantura jenkinsii</i>	971.04	1.06	0.26	1.37
8	<i>Rhinoptera javanica</i>	756.59	0.83	0.21	1.07
9	<i>Himantura uarnak</i>	679.85	0.74	0.19	0.96

In term of CPUE for rays by number of individual, *Himantura walga* is the highest with 11.53 tails/day of operation, 2.88 tails/number of operation and 14.9 tails/km² followed by *Rhinobatis cf formosensis* with 7.27 tails/day of operation, 1.82 tails/number of operation and 9.4 tails/km² and *Gymnura japonica* at 7.09 tails/day of operation, 1.77 tails/number of operation and 9.15 tails/km². Details are shown in **Table 10D**.

Table 10D: Top Nine (9) CPUE Rays Species by Number of Individual Captured by Trawl Net during the Study Period

Rank	Species	Estimated Number of Specimen	CPUE (Number of specimen/Day of Operation)	CPUE (Number of specimen /Number of Operation)	CPUE (Number of specimen/ Swept Area (km ²))
1	<i>Himantura walga</i>	10,576.46	11.53	2.88	14.90
2	<i>Rhinobatos cf formosensis</i>	6,670.94	7.27	1.82	9.40
3	<i>Gymnura japonica</i>	6,498.91	7.09	1.77	9.15
4	<i>Rhinobatos punctifer</i>	3,881.08	4.23	1.06	5.46
5	<i>Rhinoptera javanica</i>	428.35	0.47	0.12	0.60
6	<i>Narcine brevilabiata</i>	371.62	0.41	0.10	0.52
7	<i>Narcine lingula</i>	339.04	0.37	0.09	0.48

8	<i>Himantura imbricata</i>	246.25	0.27	0.07	0.35
9	<i>Neotrygon kuhlii</i>	235.28	0.26	0.06	0.33

For skate CPUE by weight for *Okamejei jensenae* was 0.04 kg/day operation, 0.01 kg/number of operation and 0.06 kg/km² and for *Okamejei* sp was 0.02 kg/day operation, 0.01 kg/number of operation and 0.03 kg/km² as shown in **Table 10E**.

Table 10E: CPUE for Skate Species by Weight Captured by Trawl Net during the Study Period

Species	Total Weight (kg) by Species	CPUE (kg/Day of Operation)	CPUE (kg/Number of Operation)	CPUE (kg/Swept Area (km ²))
<i>Okamejei jensenae</i>	39.80	0.04	0.01	0.06
<i>Okamejei</i> sp	21.40	0.02	0.01	0.03

Table 10F showed CPUE by number of individual for skate. For *Okamejei jensenae* CPUE was 0.22 tails/day of operation, 0.06 tails/number of operation and 0.29 tails/km², and for *Okamejei* sp 0.08 tails/day of operation, 0.02 tails/number of operation and 0.1 tails/km².

Table 10F: CPUE for Skate Species by Number of Individual Captured by Trawl Net during the Study Period

Species	Estimated Number of Specimen	CPUE (Number of specimen/Day of Operation)	CPUE (Number of specimen/Number of Operation)	CPUE (Number of specimen/Swept Area (km ²))
<i>Okamejei jensenae</i>	205.17	0.22	0.06	0.29
<i>Okamejei</i> sp	71.33	0.08	0.02	0.10

2.1.8 Usage and Marketing

Information on marketing collected at this landing site indicated that most sharks and rays were consumed locally. Local middleman bought at jetties and distributed to local markets around Yangon. The price at landing sites varied according to species. The most expensive rays species were *Himantura undulata*, *Himantura uarnak*, *Himantura pastinacoides* and *Himantura gerrardi* and was sold at K8,500-9,000/kg followed by *Neotrygon kuhlii*, *Rhynchobatus australiae*, *Mobula kuhlii* at K8,000-k9,000/kg. The cheapest rays were *Rhinoptera jayakari*, *Rhinobatos* cf *formosensis*, *Rhinoptera javanica*, *Dasyatis microp*, *Mobula japonica* were sold at K7,500-8,500/kg. In general, bigger sized rays were more expensive than smaller ones.

Small sized sharks with total length of less than 23 cm were sold locally at K3,000-5,000/kg. The most expensive sharks *Carcharhinus leucas* and *Carcharhinus sorrah* were sold at K9,000/kg, and *Sphyrna lewini* at K8,000/kg. Market destinations for sharks and rays were similar. 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 sometimes fluctuate up to 50% when supply was limited; especially for *Himantura gerardi*, *Rhynchobatus australiae*, *Carcharhinus sorrah* and *Carcharhinus leucas*. Fins of adult *Rhynchobatus australiae* and *Carcharhinus leucas* were sold separately, with the price ranging between K30,000 - K45,000/kg and K35,000-K55,000/kg respectively. 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**.

Table11: Price of Sharks and Rays by Species from Yangon Landings Site in 2015.
(All prices in Kyat per kilogram)

Species	Range price (Kyats/kg)	Part	Market Destination
Sharks			
<i>Carcharhinus amblyrhynchoides</i>	3,000-5,000	Whole body	Local in Yangon
<i>Carcharhinus brevipinna</i>	5,000-9,000	Whole body	Local in Yangon
<i>Carcharhinus leucas</i>	3,000-9,000	Whole body	Local in Yangon
<i>Carcharhinus melanopterus</i>	3,000-7,000	Whole body	Local in Yangon
<i>Carcharhinus macloti</i>	5,000-5,700	Whole body	Local in Yangon
<i>Carcharhinus sorrah</i>	3,000-9,000	Whole body	Local in Yangon
<i>Carcharhinus limbatus</i>	5,000-7,000	Whole body	Local in Yangon
<i>Chiloscyllium punctatum</i>	3,000-5,500	Whole body	Local in Yangon
<i>Chiloscyllium hasseltii</i>	3,000-5,000	Whole body	Local in Yangon
<i>Sphyrna lewini</i>	3,000-8,000	Whole body	Local in Yangon
<i>Mustelus sp.</i>	3,000-5,000	Whole body	Local in Yangon
<i>Rhizoprionodon acutus</i>	3,000-5,500	Whole body	Local in Yangon
<i>Galeocerdo cuvier</i>	3,000-5,900	Whole body	Local in Yangon
<i>Mustelus mosis</i>	3,000-5,000	Whole body	Local in Yangon
<i>Loxodon macrorhinus</i>	5,000-7,000	Whole body	Local in Yangon
<i>Hemigaleus microstoma</i>	4,500-5,500	Whole body	Local in Yangon
<i>Hemipristis elongata</i>	4,500-5,500	Whole body	Local in Yangon
<i>Sphyrna mokarran</i>	5,000-8,500	Whole body	Local in Yangon
<i>Scoliodon laticaudus</i>	3,000-4,000	Whole body	Local in Yangon
Rays			
<i>Mobula japanica</i>	3,000-8,000	Whole body	Local in Yangon
<i>Mobula kuhlii</i>	2,900-8,500	Whole body	Local in Yangon

Species	Range price (Kyats/kg)	Part	Market Destination
<i>Himantura gerrardi</i>	2,700-8,700	Whole body	Local in Yangon
<i>Okamejei</i> sp.	2,000-3,500	Whole body	Local in Yangon
<i>Okamejei jensenae</i>	2,500-3,500	Whole body	Local in Yangon
<i>Himantura undulata</i>	2,500-9,500	Whole body	Local in Yangon
<i>Rhinobatos punctifer</i>	2,400-3,900	Whole body	Local in Yangon
<i>Himantura walga</i>	1,400-4,000	Whole body	Local in Yangon
<i>Rhinoptera jayakari</i>	2,000-9,500	Whole body	Local in Yangon
<i>Gymnura japonica</i>	2,000-8,700	Whole body	Local in Yangon
<i>Neotrygon kuhlii</i>	3,000-3,500	Whole body	Local in Yangon
<i>Himantura pastinacoides</i>	4,500-8,500	Whole body	Local in Yangon
<i>Himantura javaensis</i>	4,500-5,500	Whole body	Local in Yangon
<i>Himantura leoparda</i>	5,000-8,500	Whole body	Local in Yangon
<i>Aetobatus ocellatus</i>	5,000-8,000	Whole body	Local in Yangon
<i>Himantura lobistoma</i>	5,000-6,000	Whole body	Local in Yangon
<i>Aetobatus flagellum</i>	3,000-8,900	Whole body	Local in Yangon
<i>Glaucostegus</i> sp.	3,000-4,000	Whole body	Local in Yangon
<i>Himantura lobistoma</i>	3,000-5,500	Whole body	Local in Yangon
<i>Glaucostegus</i> sp.	3,000-5,500	Whole body	Local in Yangon
<i>Himantura uarnacoides</i>	3,000-4,000	Whole body	Local in Yangon
<i>Rhinoptera javanica</i>	3,000-9,000	Whole body	Local in Yangon
<i>Rhina ancylostoma</i>	3,000-4,000	Whole body	Local in Yangon
<i>Narcine brevilabiata</i>	3,000-5,000	Whole body	Local in Yangon
<i>Pastinachus stellurostris</i>	3,000-3,500	Whole body	Local in Yangon
<i>Dasyatis sinensis</i>	1,500-3,500	Whole body	Local in Yangon
<i>Rhinobatos formosensis</i>	2,500-4,000	Whole body	Local in Yangon
<i>Himantura imbricata</i>	2,500-3,900	Whole body	Local in Yangon
<i>Taeniurops meyeri</i>	2,500-4,500	Whole body	Local in Yangon
<i>Himantura uarnak</i>	2,500-8,700	Whole body	Local in Yangon
<i>Himantura jenkinsii</i>	1,500-3,600	Whole body	Local in Yangon
<i>Dasyatis microps</i>	3,500-8,500	Whole body	Local in Yangon
<i>Himantura fai</i>	1,500-2,500	Whole body	Local in Yangon
<i>Urogymnus asperrimus</i>	2,500-3,500	Whole body	Local in Yangon
<i>Plesiobatis daviesi</i>	1,500-4,700	Whole body	Local in Yangon
<i>Gymnura poecilura</i>	1,500-2,500	Whole body	Local in Yangon
<i>Pastinachus</i> cf. <i>solocirostris</i>	1,500-4,000	Whole body	Local in Yangon

2.2 Ye Township, Mon State Landing Site

2.2.1 Landing Samples

Specimens were collected at two (2) jetties namely Ze Phyu Thaung and Asin during the study period. The highest by month was six (6) in December 2015 and May 2016 followed by five (5) in other months. The highest by gear type was 45 of gillnet followed by 10 of longline, four (4) of set bag net and three (3) of stow net. The details are shown in **Table 12**.

Table 12: Number of Landings Sampled during the Study at Ye Township

Type of Gear	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Gillnet	3	1	5	3	5	4	3	4	5	4	4	4	45
Longline	2	1		2		2	2			1			10
Set Bag Net		3						1					4
Stow Net											2	1	3
Grand Total	5	5	5	5	5	6	5	5	5	5	6	5	62

2.2.2 Fishing Ground and Catch Composition by Gear Type

The main gear landing sharks and rays was gillnet at 758.5 kg comprising 312.0 kg rays and 446.5 kg sharks. While set bag nets contributed 180.7 kg of rays and 112.0 kg of sharks. Longline contributed 155.0 kg of rays and 9.9 kg of shark, and stow net contributed 3.3 kg of rays. Most gillnet operated between 10 nautical miles from the coastline in Mon State fishing ground. The highest landing of rays by month was from gillnets at 68.3 kg in September 2015, and the highest landing of sharks by month was from gillnets in July 2015 at 122.6 kg respectively. The details are shown in **Table 13**.

Table 13: Weight of Sharks and Rays (in Kg) Caught by Different Types of Gear at Ye Township

Type of Gear/Group		2015						2016						Grand Total
Group	Gear	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Ray	Gillnet			68.3	4.7	7.3	11.5	35.5	57.3	63.9	23.5	9.5	30.5	312.0
	Longline	16.3	15.8		77.5		11.2	25.2			9.0			155.0
	Set Bag Net		126.7						54.0					180.7
	Stow Net											2.8	0.5	3.3
Ray Total		16.3	142.5	68.3	82.2	7.3	22.7	60.7	111.3	63.9	32.5	12.3	31.1	651.0
Shark	Gillnet	122.6	16.0	45.0	30.6	52.2	14.4	29.5	5.2	11.7	36.6	25.4	57.3	446.5
	Longline		5.9				4.0							9.9

	Set Bag Net		112.0											112.0
Shark Total		122.6	133.9	45.0	30.6	52.2	18.4	29.5	5.2	11.7	36.6	25.4	57.3	568.4
Grand Total		138.9	276.4	113.3	112.9	59.5	41.0	90.2	116.5	75.6	69.1	37.7	88.3	1,219.4

2.2.3 Sharks and Rays Composition

Total of 42,331.1 kg of fish was landed from 62 landings during the study period. Rays and sharks made up 651.0 kg and 568.4 kg or 1.5% and 1.3% from the total landing respectively. Landings of bony fish and others was 41,111.8 kg or 97.1%. Average landings per month for rays and sharks were 54.2 kg and 47.4 kg respectively. The highest landing by month for rays was 142.5 kg in August 2015, followed by 111.3 kg in February 2016 and 82.2 kg in October 2015. The highest landing for sharks was 133.9 kg also in August followed by 122.6 kg in July 2015 and 57.3 kg in June 2016. In general, the landing of rays and sharks ranged between 0.2 - 6.0% and 0.1 - 10.6% respectively from total landing. The details are shown in **Table 14**.

Table 14: Catch Composition of Sharks, Rays, and Bony Fishes and Others by Month from Three (3) Landing Sites at Ye Township. All Weights in Kilogram.

Year	Month	All Sharks (kg)	%Shark	All Rays (kg)	%Ray	Bony fishes and others (kg)	%Bony fishes and others	Total Catch (kg)
2015	July	122.6	10.6	16.3	1.4	1,016.0	88.0	1,154.9
	August	133.9	1.9	142.5	2.0	6,856.0	96.1	7,132.4
	September	45.0	2.4	68.3	3.6	1,760.0	94.0	1,873.3
	October	30.6	1.2	82.2	3.2	2,429.0	95.6	2,541.8
	November	52.2	1.3	7.3	0.2	4,048.0	98.6	4,107.5
	December	18.4	0.4	22.7	0.5	4,080.0	99.0	4,121.0
2016	January	29.5	2.9	60.7	6.0	928.0	91.1	1,018.2
	February	5.2	0.1	111.3	1.2	8,804.8	98.7	8,921.3
	March	11.7	0.4	63.9	2.4	2,576.0	97.1	2,651.6
	April	36.6	1.3	32.5	1.1	2,760.0	97.6	2,829.1
	May	25.4	0.9	12.3	0.4	2,716.0	98.6	2,753.7
	June	57.3	1.8	31.1	1.0	3,138.0	97.3	3,226.3
Grand Total		568.4		651.0		41,111.8		42,331.1
Average		47.4	1.3	54.2	1.5	3,426.0	97.1	3,527.6

2.2.4 Sample Size

A total of 350 tails belonging to 165 rays and 185 sharks were sampled comprising 14 species of rays and six species of sharks. The most abundant ray species were *Himantura uarnacoides* and *Himantura pastinacoides* followed by *Himantura walga*. The highest number of rays sampled by month was 53 in May followed by 15 in June 2016 and 11 in September 2015 and

January 2016. The most abundant shark species were *Scoliodon laticaudus* followed by *Carcharhinus leucas* and *Sphyrna lewini*. The highest number of sharks sampled by month was 51 in August 2016, followed by 24 in July 2015 and 20 in October, November 2015 and June 2016. The most common ray species were *Himantura uarnacoides* and *Himantura pastinacoides*. These species recorded in seven (7) months during the study period. The most common shark species were *Scoliodon laticaudus* and *Carcharhinus leucas*. These species were landed also in seven (7) months during the study period. Other species were rarely landed and only landed between 1 - 4 months during the study period. The details are as shown in **Table 15**.

Table 15: Sample Size of Sharks and Rays by Species

Species	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
<i>Glaucostegus typus</i>						1		2		1			4
<i>Gymnura japonica</i>						1		1					2
<i>Himantura gerrardi</i>								2					2
<i>Himantura pastinacoides</i>			3		2		7		4	4	3	1	24
<i>Himantura sp.</i>		2											2
<i>Himantura uarnacoides</i>	7	10		8		2	3		1	2			33
<i>Himantura uarnak</i>								1					1
<i>Himantura undulata</i>											1		1
<i>Himantura walga</i>								3	4			15	22
<i>Narcine brunnea</i>											49	11	60
<i>Pastinachus gracilicaudus</i>		3											3
<i>Rhinoptera adspersa</i>				1									1
<i>Rhinoptera javanica</i>				1									1
<i>Rhinoptera jayakari</i>			8				1						9
Total Rays	7	15	11	10	2	4	11	9	9	7	53	27	165
<i>Carcharhinus amblyrhynchoides</i>		2							3				5
<i>Carcharhinus brevipinna</i>		1	2	1	1								5
<i>Carcharhinus leucas</i>			3	5	7	4	1	1		8			29
<i>Carcharhinus sorrah</i>	5		1									3	9
<i>Scoliodon laticaudus</i>	19	48		14	12		6				16	10	125
<i>Sphyrna lewini</i>			2								3	7	12
Total Sharks	24	51	8	20	20	4	7	1	3	8	19	20	185
Grand Total	31	66	19	30	22	8	18	10	12	15	72	47	350

2.2.5 Weight of Sharks and Rays by Species

A total of 1,219.4 kg was landed from 62 landings comprising 651.0 kg rays, and 568.4 kg sharks. For rays, the highest landing by weight was from species *Himantura uarnacoides* amounting to 291.9 kg, followed by 96.4 kg for *Rhinoptera jayakari* and 76.4 kg for *Himantura pastinacoides*. The highest landing by month for *Himantura uarnacoides* was 128.7 kg in

August and for *Rhinoptera jayakari* was 62.9 kg in September 2015. Weight of other species ranged between 1 - 62 kg. The highest landing of shark species was 274.2 kg for *Scoliodon laticaudus* followed by *Carcharhinus leucas* 146.8 kg, *Carcharhinus sorrah* 77.2 kg and *Sphyrna lewini* 33.8 kg. The highest landing by month for *Scoliodon laticaudus* was 124.5 kg in August, 39.6 kg in September for *Carcharhinus leucas*, 72.7 kg for *Carcharhinus sorrah* in July 2015, and for *Sphyrna lewini* was 32.0 kg in June 2016. Weight of other species ranged between 17 - 19 kg. The details are shown in **Table 16**.

Table 16: Weight of Sharks and Rays (in kg) by Species

Species	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
<i>Glaucostegus typus</i>						2.6		55.3		3.9			61.8
<i>Gymnura japonica</i>						11.2		1.3					12.5
<i>Himantura gerrardi</i>								0.3					0.3
<i>Himantura pastinacoides</i>			5.4		7.3		20.1		19.1	13.6	6.0	4.9	76.4
<i>Himantura sp.</i>		8.3											8.3
<i>Himantura uarnacoides</i>	16.3	128.7		77.5		8.9	7.2		38.4	15.0			291.9
<i>Himantura uarnak</i>								53.3					53.3
<i>Himantura undulata</i>											3.5		3.5
<i>Himantura walga</i>								1.0	6.4			25.6	33.0
<i>Narcine brunnea</i>											2.8	0.5	3.3
<i>Pastinachus gracilicaudus</i>		5.6											5.6
<i>Rhinoptera adspersa</i>				3.2									3.2
<i>Rhinoptera javanica</i>				1.5									1.5
<i>Rhinoptera jayakari</i>			62.9				33.5						96.4
Total Rays	16.3	142.5	68.3	82.2	7.3	22.7	60.7	111.3	63.9	32.5	12.3	31.1	651.0
<i>Carcharhinus amblyrhynchoides</i>		7.5							11.7				19.2
<i>Carcharhinus brevipinna</i>		1.9	3.3	10.0	2.0								17.2
<i>Carcharhinus leucas</i>			39.6	16.6	24.9	18.4	5.5	5.2		36.6			146.8
<i>Carcharhinus sorrah</i>	72.7		1.7									2.9	77.2
<i>Scoliodon laticaudus</i>	50.0	124.5		4.0	25.3		24.0				24.0	22.4	274.2
<i>Sphyrna lewini</i>			0.4								1.4	32.0	33.8
Total Sharks	122.6	133.9	45.0	30.6	52.2	18.4	29.5	5.2	11.7	36.6	25.4	57.3	568.4
Grand Total	138.9	276.4	113.3	112.9	59.5	41.0	90.2	116.5	75.6	69.1	37.7	88.3	1,219.4

2.2.6 Size Range of Sharks and Rays

In general most ray species sampled from July to December 2015 were immature except for some specimens of *Himantura uarnacoides* caught in August and October 2015. For sharks almost all specimens were immature except for *Scoliodon laticaudus*. Almost all of this species was mature. The range average size of all sharks and rays were considered as juvenile and sub-adult. Size range of all sharks and rays species from July to December 2016 are shown in **Table 17A**. During January - June 2016, most specimens of *Glycostegus typus*, *Himantura uarnak*,

Himantura walga, *Rhinoptera jayakari*, *Narcine brunnea* and all *Scoliodon laticaudus* were mature. Other specimens mostly juvenile or sub-adult. Size range of all sharks and rays species from January to June 2016 are shown in **Table 17B**.

Table 17A: Size Range of Sharks (Total Length) and Rays (Disc Length) Except for *Glaucostegus typus* (Total Length) from July - December 2015. All Measurements in cm.

Species	2015																	
	July			August			September			October			November			December		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Rays																		
<i>Glaucostegus typus</i>																85.0	85.0	85.0
<i>Gymnura japonica</i>																54.0	54.0	54.0
<i>Himantura pastinacoides</i>							34.0	40.0	36.3				40.0	48.0	44.0			
<i>Himantura</i> sp.				44.0	48.0	46.0												
<i>Himantura uarnacoides</i>	34.0	50.0	42.4	28.0	76.0	59.3				43.0	99.0	64.0				28.0	65.0	46.5
<i>Pastinachus gracilicaudus</i>				29.0	41.0	34.7												
<i>Rhinoptera adpersa</i>										33.0	33.0	33.0						
<i>Rhinoptera javanica</i>										27.0	27.0	27.0						
<i>Rhinoptera jayakari</i>							28.5	42.0	35.6									
Sharks																		
<i>Carcharhinus amblyrhynchooides</i>				80.0	81.0	80.5												
<i>Carcharhinus brevipinna</i>				76.0	76.0	76.0	73.0	75.0	74.0	132.0	132.0	132.0	74.0	74.0	74.0			
<i>Carcharhinus leucas</i>							75.0	99.0	85.0	77.0	81.0	79.0	69.0	82.0	75.0	79.0	86.0	82.5
<i>Carcharhinus sorrah</i>	65.0	71.0	69.0				73.0	73.0	73.0									
<i>Scoliodon laticaudus</i>	35.0	42.0	39.0	33.0	50.0	41.9				32.0	52.0	41.1	33.0	50.0	40.8			
<i>Sphyrna lewini</i>							74.0	80.0	77.0									

Table 17B: Size Range of Sharks (Total Length) and Rays (Disc Length) Except for *Glaucostegus typus* and *Narcine brunnea* (Total Length) from January - June 2016. All Measurements in cm.

Species	2016																	
	January			February			March			April			May			June		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Rays																		
<i>Glaucostegus typus</i>				76.0	250.0	163.0				115.0	115.0	115.0						
<i>Gymnura japonica</i>				28.0	28.0	28.0												
<i>Himantura gerrardi</i>				19.0	19.0	19.0												
<i>Himantura pastinacoides</i>	28.0	60.0	43.0				45.0	59.0	50.5	34.0	53.0	43.5	34.0	41.0	36.7	48.0	48.0	48.0
<i>Himantura uarnacoides</i>	34.0	53.0	42.7				113.0	113.0	113.0	53.0	73.0	63.0						
<i>Himantura uarnak</i>				107.0	107.0	107.0												
<i>Himantura undulata</i>													46.0	46.0	46.0			
<i>Himantura walga</i>				21.0	23.0	22.0	20.0	24.0	21.6							18.0	27.0	22.5
<i>Narcine brunnea</i>													8.6	23.5	18.0	8.5	24.5	15.6
<i>Rhinoptera jayakari</i>	78.0	78.0	78.0															
Sharks																		
<i>Carcharhinus amblyrhynchoides</i>							73.0	86.0	79.7									
<i>Carcharhinus leucas</i>	89.0	89.0	89.0	87.0	87.0	87.0				72.0	89.0	81.9						
<i>Carcharhinus sorrah</i>																56.0	61.0	59.3
<i>Scoliodon laticaudus</i>	33.0	50.0	42.2										35.0	45.0	39.8	37.0	52.0	45.0
<i>Sphyrna lewini</i>													45.0	51.0	48.3	45.0	50.0	47.6

2.2.7 Fishing Effort and CPUE (Catch per Unit Effort)

Total day of operation for all gears was 628 days. Operation of gillnets was the highest with 540 days compared to longline (45 days), set bag net (40 days) and stow net only three days. For gillnets, total day of operation in 2015 was 192 days and 288 days in 2016. For longline day at operation in 2015 was 42 days and only three days in 2016. Monthly fishing efforts (days at operation) of the sampled vessels are summarized in **Table 18A**.

Table 18A: Days at Operation by Gears Sampled during the Study Period

Days of Operation Gear	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Gillnet	36	12	60	36	60	48	36	48	60	48	48	48	540
Longline	10	5		10		17	2			1			45
Set Bag Net		30						10					40
Stow Net											2	1	3
Grand Total	46	47	60	46	60	65	38	58	60	49	50	49	628

A total of 1,417 operations by all gears were sampled during the study period. Operation by gillnet was the highest at 1,080 followed by longline (171), set bag net (160) and stow net six (6) operations. In 2015, number of operation for gillnet was 504 and 576 operations in 2016. For longline, number of operation in 2015 was 168 but in 2016 only three (3) operations. The details are shown in **Table 18B**.

Table 18B: Number of Operation by Gears Sampled during the Study Period

Total Number of Operation Gear	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Gillnet	72	24	120	72	120	96	72	96	120	96	96	96	1,080
Longline	40	20		40		68	2			1			171
Set Bag Net		120						40					160
Stow Net											4	2	6
Grand Total	112	164	120	112	120	164	74	136	120	97	100	98	1,417

In case of the gear of which annual effort excess 1,000 days of operation or 1,000 number of operations, CPUE for 12 months was estimated by weight and number of individuals by species.

Scoliodon laticaudus was the top with 0.31 kg/day of operation, 0.15 kg/number of operation and 0.04 kg/km followed by *Carcharhinus leucas* at 0.26 kg/day of operation, 0.13 kg/number of operation and 0.03 kg/km, and *Carcharhinus sorrah* at 0.14 kg/day of operation, 0.07 kg/number of operation and 0.02 kg/km. CPUE for other species are shown in **Table 19A**.

Table 19A: Top Six (6) CPUE Sharks Species by Weight Captured by Gillnet during the Study Period

Rank	Species	Total Weight (kg) by Species	CPUE (Kg/Day of Operation)	CPUE (Kg/Number of Operation)	CPUE (kg/Total Length of Net (Km))
1	<i>Scoliodon laticaudus</i>	165.69	0.31	0.15	0.04
2	<i>Carcharhinus leucas</i>	142.78	0.26	0.13	0.03
3	<i>Carcharhinus sorrah</i>	77.24	0.14	0.07	0.02
4	<i>Sphyrna lewini</i>	33.83	0.06	0.03	0.01
5	<i>Carcharhinus brevipinna</i>	15.26	0.03	0.01	0.00
6	<i>Carcharhinus amblyrhynchoides</i>	11.71	0.02	0.01	0.00

In term of CPUE by number of individual, *Scoliodon laticaudus* was the highest with 1.02 tails/day of operation, 0.51 tail/number of operation and 0.13 tail/km followed by *Sphyrna lewini* with 0.15 tail/day of operation, 0.08 tail/number of operation and 0.02 tail/km, and *Carcharhinus sorrah* at 0.09 tail/day of operation, 0.04 tail/number of operation and 0.01 tail/km. Details are shown in **Table 19B**.

Table 19B: Top Six (6) CPUE Sharks Species by Number of Individual Captured by Gillnet during the Study Period

Rank	Species	Estimated Number of Individual	CPUE (Number of Individual /Days of Operation)	CPUE (Number of Individual /Numbers of Operation)	CPUE (Number of Individual /Total Length of Net (km))
1	<i>Scoliodon laticaudus</i>	549.90	1.02	0.51	0.13
2	<i>Sphyrna lewini</i>	83.31	0.15	0.08	0.02
3	<i>Carcharhinus sorrah</i>	47.82	0.09	0.04	0.01
4	<i>Carcharhinus leucas</i>	33.29	0.06	0.03	0.01
5	<i>Carcharhinus amblyrhynchoides</i>	4.57	0.01	0.00	0.00
6	<i>Carcharhinus brevipinna</i>	3.78	0.01	0.00	0.00

Rhinoptera jayakari was the top with 0.18 kg/day of operation, 0.09 kg/number of operation and 0.02 kg/km followed by *Himantura uarnacoides* at 0.12 kg/day of operation, 0.06 kg/number of operation and 0.02 kg/km, and *Himantura uarnak* at 0.10 kg/day of operation, 0.05 kg/number of operation and 0.01 kg/km. CPUE for other species are shown in **Table 19C**.

Table 19C: Top 10 CPUE Rays Species by Weight Captured by Gillnet during the Study Period

Rank	Species	Total Weight (kg) by Species	CPUE (Kg/Day of Operation)	CPUE (Kg/Number of Operation)	CPUE (kg/Total Length of Net (km))
1	<i>Rhinoptera jayakari</i>	96.43	0.18	0.09	0.02
2	<i>Himantura uarnacoides</i>	64.30	0.12	0.06	0.02
3	<i>Himantura uarnak</i>	53.30	0.10	0.05	0.01
4	<i>Himantura pastinacoides</i>	51.22	0.09	0.05	0.01
5	<i>Himantura walga</i>	33.04	0.06	0.03	0.01
6	<i>Glaucostegus typus</i>	3.85	0.01	0.00	0.00
7	<i>Himantura undulata</i>	3.52	0.01	0.00	0.00
8	<i>Rhinoptera adspersa</i>	3.20	0.01	0.00	0.00
9	<i>Rhinoptera javanica</i>	1.50	0.00	0.00	0.00
10	<i>Gymnura japonica</i>	1.32	0.00	0.00	0.00

In term of CPUE by number of individual, *Himantura walga* was the highest with 0.16 tail/day of operation, 0.08 tail/number of operation and 0.02 tail/km followed by *Rhinoptera jayakari* with 0.04 tail/day of operation, 0.02 tail/number of operation and less than 0.00 tail/km and *Himantura pastinacoides* at 0.03 tail/day of operation, 0.01 tail/number of operation and less than 0.00 tail/km. Details are shown in **Table 19D**.

Table 19D: Top 10 CPUE Rays Species by Number of Individual Captured by Gillnet during the Study Period

Rank	Species	Estimated Number of Individual	CPUE (Number of Individual /Days of Operation)	CPUE (Number of Individual /Numbers of Operation)	CPUE (Number of Individual /Total Length of Net (km))
1	<i>Himantura walga</i>	85.59	0.16	0.08	0.02
2	<i>Rhinoptera jayakari</i>	19.78	0.04	0.02	0.00
3	<i>Himantura pastinacoides</i>	14.21	0.03	0.01	0.00
4	<i>Himantura uarnacoides</i>	5.32	0.01	0.00	0.00
5	<i>Glaucostegus typus</i>	2.00	0.00	0.00	0.00
6	<i>Himantura gerrardi</i>	2.00	0.00	0.00	0.00
7	<i>Gymnura japonica</i>	1.00	0.00	0.00	0.00
8	<i>Himantura uarnak</i>	1.00	0.00	0.00	0.00
9	<i>Himantura undulata</i>	1.00	0.00	0.00	0.00
10	<i>Rhinoptera adspersa</i>	1.00	0.00	0.00	0.00

2.2.8 Usage and Marketing

Information on marketing collected at this landing site indicated that most sharks and rays were consumed locally. The major markets were wholesale market in Ye Market and other market in Mawlamyine. The price varied according to species. The most expensive rays species were *Himantura undulata*, *Himantura gerrardi*, *Himantura uarnak* and *Gymnura japonica* sold at K2,000 - 10,000/kg followed by *Glaucostegus typus* at K2,000 - 10,000/Viss. The cheapest rays were *Rhinoptera jayakari*, *Rhinoptera adspersa*, *Himantura walga* sold at K2,000 - 4,000/Viss and *Narcine brunnea* sold at K1,000/Viss. In general, bigger sized rays were more high-priced than smaller ones.

Small sized sharks with total length of less than 23 cm were sold locally at K3,000 - 4,000/Viss. The most expensive sharks were *Carcharhinus leucas*, *Carcharhinus sorrah* and *Sphyrna lewini* sold at K8,000/Viss. Market destinations for sharks and rays were similar. Market where they are mainly used for consume during traditional water festival. 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 occasionally fluctuate up to 50% when supply was limited; especially for *Himantura gerarrdi*, *Carcharhinus sorrah* and *Carcharhinus leucas*. Some species such as *Scoliodon laticaudus* were sold to buyers in Ye Market and Mawlamyine. Fins of adult *Carcharhinus leucas* were sold separately, with the price ranging between K30,000 - 55,000/Viss. All sharks and rays were landed whole with fins. The details are shown in **Table 20**. Small, medium and big size category for each species is as shown in **Appendix IV**.

Table 20: Price of Sharks and Rays by Species and Market Destination at Ye Township.

Note: 1 Viss=1.5 kg

Species	Range Price (Kyats/Viss)	Part	Market Destination
Sharks			
<i>Scoliodon laticaudus</i>	2,000-3,000	Whole body	Local in Ye
<i>Carcharhinus sorrah</i>	4,000-8,000	Whole body	Local in Ye
<i>Carcharhinus brevipinna</i>	4,000-8,000	Whole body	Local in Ye
<i>Carcharhinus amblyrhynchoides</i>	4,000-8,000	Whole body	Local in Ye
<i>Carcharhinus leucas</i>	4,000-8,000	Whole body	Local in Ye
<i>Sphyrna lewini</i>	2,000-8,000	Whole body	Local in Ye
Rays			
<i>Himantura uarnacoides</i>	2,000-10,000	Whole body	Local in Ye
<i>Himantura garrardi</i>	2,000-10,000	Whole body	Local in Ye
<i>Himantura undulate</i>	2,000-10,000	Whole body	Local in Ye
<i>Himantura uarnak</i>	2,000-10,000	Whole body	Local in Ye
<i>Himantura walga</i>	1,000-3,000	Whole body	Local in Ye
<i>Himantura sp.</i>	2,000-10,000	Whole body	Local in Ye
<i>Pastinachus gracilicaudus</i>	2,000-10,000	Whole body	Local in Ye

Species	Range Price (Kyats/Viss)	Part	Market Destination
<i>Himantura pastinacoides</i>	2,000-10,000	Whole body	Local in Ye
<i>Rhinoptera jayakari</i>	2,000-4,000	Whole body	Local in Ye
<i>Rhinoptera javanica</i>	2,000-4,000	Whole body	Local in Ye
<i>Rhinoptera adspersa</i>	2,000-4,000	Whole body	Local in Ye
<i>Glaucostegus typus</i>	2,000-10,000	Whole body	Local in Ye
<i>Gymnura japonica</i>	2,000-10,000	Whole body	Local in Ye
<i>Narcine brunnea</i>	1,000-3,000	Whole body	Local in Ye

3. OUTPUT AND OUTCOME

The project outputs and outcomes are summarised in **Table 21** as shown below.

Table 21: Outputs and Outcomes

No.	Output	Outcome
1.	Three (3) trained personnel in sharks and rays taxonomy from the Department of Fisheries Myanmar.	Trained staffs are now able to make the right and valid identification of species. Training materials stored electronically and easy to overload.
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 pilot project sites.	Confirmed previous data published in Myanmar National Statistics. Sharks and rays were not targeted and contributed to only about 2.2% 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.	Stage of maturity for the different species of sharks and rays determined.	Enlarged awareness of needs and measures for shark conservation and management among stakeholders.

7.	Information on usage and marketing of the landed sharks and rays were obtained from the pilot project.	All rays and sharks are landed whole, fully used with no finning activities on fishing vessels.
8.	A report on landing of sharks and rays up to species level from two sites in Myanmar.	Data recording on sharks and rays will be better from generic terms 'sharks' and 'rays' to species level.
9.	Issues and problems arising from this activity identified and improvements made especially with the data collection format.	Enhance of a comprehensive national data collection system for sharks and rays as part of the National Plan of Action for Sharks.

4.0 FUTURE ACTIVITIES

Myanmar will continue to record landing data up to species level at an additional two (2) sites including Yangon and Mawlamyine in all Myanmar coastal regions in 2017 pending fund from SEAFDEC. Department of Fisheries, Myanmar would like to collect the reliable data and information in all coastal areas. Data collection at the current two (2) landing sites is to be continued if budget available. Awareness programme will be continued in other parts of the country. All activities are shown in **Appendix III**.

5.0 CONCLUSION

During this project four (4) officers from Department of Fisheries Myanmar were trained in taxonomy and in data collection using the new harmonized format. There are from Ye Township and Yangon Region. Three (3) landing sites of Yangon, namely Annawar Aung, Shwe Zinyaw Hein and Annawar Holding Fisheries were selected as the study sites as they were the main landing sites of sharks and rays in the country. A total of 18 species of sharks from two (2) Orders and five (5) Families, and 38 species of rays from three (3) Orders and 10 Families, two (2) species of skates from one (1) Order and one (1) Family were recorded in Yangon. Study at Ye Township recorded six (6) species of sharks from one (1) Order and two (2) Families and 14 species of rays from three (3) Orders and five (5) Families. Details are shown in **Appendix II**. In term of percentage of total marine landings, sharks, rays and skates only contributed 0.2%, 1.1% and 0.002% at Yangon, and 1.3% for sharks and 1.6% for rays at Ye Township respectively. These figures confirmed earlier data that sharks and rays were only by-catch and not targeted and contributed to about 2% of the total marine landing.

The most abundant shark species at Yangon were, *Sphyrna lewini* and *Scoliodon laticaudus* and for rays, *Himantura walga*, *Rhinobatos punctifer*. The most common shark species were *Scoliodon laticaudus* and *Chiloscyllium hasseltii*, *Mustilus* sp. The most abundant shark species at Mawlamyine were *Carcharhinus leucas* and *Scoliodon laticaudus* while for rays *Himantura pastinacoides* and *Himantura uarnacoides*. The most common shark species were *Carcharhinus brevipinna* and *Scoliodon laticaudus* while for rays *Himantura walga*.

All big sized sharks of more than 1.5 meters in total length such as *Carcharhinus leucas*, *Carcharhinus sorrah*, *Galeocerdo cuvier*, *Sphyrna lewini*, and medium sized sharks such as *Rhizoprionodon acutus*, *Carcharhinus melanopterus* were rarely caught due to nature of fishing area and gear used. All rays and sharks were landed whole, fully used with no finning activities on fishing vessels. Base on latest checklist a total of 59 species of sharks from six (6) Order and 15 Families, and 85 species of rays from four (4) Order and 14 Families, and two (2) species of skates from one (1) Order and one (1) Family found in Myanmar waters including freshwater ecosystem.

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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

 Gillnet/Drift Net

Length of Net		(m)	Height of Net		(m)
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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)

D. Length-weight of rays

No	Species	Sex	DL or DW	Wgt (kg)

E. Actual Weight of Rays by Species

No	Species	Weight (Kg)

F. Total Catch of Sampling Vessel (kg)

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

G. Price of Sharks and Marketing Information (Local Currency)

Species	Price/Kg (Small size)	Price/Kg (Medium size)	Price/Kg (Big size)	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*

H. 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: _____

Appendix II

Checklist of Shark and Ray Species Recorded During the Study Period

No	Orders/Families	Site 1	Site 2	REMARKS
	ORDER MYLIOBATIFORMES	Yangon	Ye Township	
	Family Dasyatidae			
1	<i>Dasyatis microps</i>	+		
2	<i>Dasyatis sinensis</i>	+		
3	<i>Himantura fai</i>	+		
4	<i>Himantura gerrardi</i>	+	+	
5	<i>Himantura imbricata</i>	+		
6	<i>Himantura cf. javaensis</i>	+		
7	<i>Himantura jenkinsii</i>	+		
8	<i>Himantura leoparda</i>	+		
9	<i>Himantura lobistoma</i>	+		
10	<i>Himantura pastinacoides</i>	+	+	
11	<i>Himantura uarnacoides</i>	+	+	
12	<i>Himantura uarnak</i>	+	+	
13	<i>Himantura undulata</i>	+	+	
14	<i>Himantura walga</i>	+	+	
15	<i>Himantura sp.</i>		+	
16	<i>Neotrygon kuhlii</i>	+		
17	<i>Pastinachus gracilicaudus</i>	+	+	
18	<i>Pastinachus cf. solocirostris</i>	+		
19	<i>Pastinachus stellurostris</i>	+		
20	<i>Taeniurops meyeri</i>	+		
21	<i>Urogymnus asperrimus</i>	+		
	Family Plesiobatidae			
22	<i>Plesiobatis daviesi</i>	+		
	Family Rhinopteridae			
23	<i>Rhinoptera adspersa</i>		+	
24	<i>Rhinoptera javanica</i>	+	+	
25	<i>Rhinoptera jayakari</i>	+	+	
	Family Myliobatidae			
26	<i>Aetobatus flagellum</i>	+		
27	<i>Aetobatus cf. narinari</i> (Identified as <i>Aetobatus ocellatus</i>)	+		
	Family Gymnuridae			
28	<i>Gymnura japonica</i>	+	+	
29	<i>Gymnura poecilura</i>	+		
	Family Mobulidae			
30	<i>Mobula japonica</i>	+		
31	<i>Mobula kuhlii</i>	+		
	ORDER RHINOBATIFORMES			

	Family Rhinobatidae			
32	<i>Glaucostegus</i> sp.	+		
33	<i>Glaucostegus typus</i>	+	+	
34	<i>Rhinobatos</i> cf. <i>formosensis</i>	+		
35	<i>Rhinobatos penggali</i>	+		
36	<i>Rhinobatos punctifer</i>	+		
	Family Rhynchobatidae			
37	<i>Rhynchobatus australiae</i>	+		
	Family Rhinidae			
38	<i>Rhina ancylostoma</i>	+		
	ORDER TORPEDINIFORMES			
	Family Narcinidae			
39	<i>Narcine brevilabiata</i>	+		
40	<i>Narcine brunnea</i>		+	
41	<i>Narcine lingula</i>	+		
	Total ray species	38	14	
	ORDER RAJIFORMES			
	Family Rajidae			
42	<i>Okamejei jensena</i>	+		
43	<i>Okamejei</i> sp.	+		
	Total skate species	2	0	
	ORDER CARCHARHINIFORMES			
	Family Carcharhinidae			
1	<i>Carcharhinus amblyrhynchoides</i>		+	
2	<i>Carcharhinus brevipinna</i>	+	+	
3	<i>Carcharhinus leucas</i>	+	+	
4	<i>Carcharhinus limbatus</i>	+		
5	<i>Carcharhinus macroti</i>	+		
6	<i>Carcharhinus melanopterus</i>	+		
7	<i>Carcharhinus sorrah</i>	+	+	
8	<i>Galeocerdo cuvier</i>	+		
9	<i>Loxodon macrorhinus</i>	+		
10	<i>Rhizoprionodon acutus</i>	+		
11	<i>Scoliodon laticaudus</i>	+	+	
	Family Hemigaleidae			
12	<i>Hemigaleus microstoma</i>	+		
13	<i>Hemipristis elongata</i>	+		
	Family Sphyrnidae			
14	<i>Sphyrna lewini</i>	+	+	
15	<i>Sphyrna mokarran</i>	+		
	Family Triakidae			
16	<i>Mustelus mosis</i>	+		
17	<i>Mustelus</i> sp.	+		
	ORDER ORECTOLOBIFORMES			

	Family Hemiscylliidae			
18	<i>Chiloscyllium hasseltii</i>	+		
19	<i>Chiloscyllium punctatum</i>	+		
	Total shark species	18	6	

Appendix III

Photos : Taken during the Training Sessions and Data Collection Activities at SEAFDEC/MFRDMD (30 November 2014)



Photo 1. Participants and resource persons



Photo 2. Participants during lecture session



Photo 3. Some common sharks specimens used during the training session



Photo 4. Some of the common rays specimens used during the training session at Maylamyine University



Photo 5. Group exercise in shark species identification at SEAFDEC/MFRDMD



Photo 6. Group exercise under the guidance of experts at Maylamyine University



Photo 7. Participants being guided on the biology of sharks at SEAFDEC/MFRDMD



Photo 8. Participants undergoing test session on their understanding of taxonomy and biology and SEAFDEC/MFRDMD



Photo 9. Participants and resource persons at Mawlamyine University



Photo 10. Data analysis workshop involving enumerators and researchers at DoF Yangon



Photo 11. Sorting of sharks and rays species at landing jetty in “Anawa Aung” in Yangon



Photo 12. Sharks sorted, packed and ready for market at landing site



Photo 13. Rays as by-catch of trawlers at landing site



Photo 14. Sharks as by-catch of trawlers



Photo 15. Sharks sold together with other bony fishes in market at Anawa Holding jetty in Yangon

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.

Species	Small	Medium	Big
Rays			
<i>Aetobatus flagellum</i>	<20	20-50	>50
<i>Aetobatus cf. narinari</i>	<20	20-50	>50
<i>Dasyatis microps</i>	<20	20-50	>50
<i>Dasyatis sinensis</i>	<14	14-21	>21
<i>Glaucostegus sp.</i>	<40	40-100	>100
<i>Glaucostegus typus</i>	<40	40-100	>100
<i>Gymnura japonica</i>	<18	18-20	>20
<i>Gymnura poecilura</i>	<20	20-25	>25
<i>Himantura fai</i>	<20	20-50	>50
<i>Himantura gerrardi</i>	<19	19-50	>50
<i>Himantura imbricata</i>	<12	12-18	>18
<i>Himantura cf. javaensis</i>	<14	14-21	>21
<i>Himantura jenkinsii</i>	<18	18-20	>20
<i>Himantura leoparda</i>	<20	20-50	>50
<i>Himantura lobistoma</i>	<18	18-20	>20
<i>Himantura pastinacoides</i>	<25	25-45	>45
<i>Himantura uarnacoides</i>	<20	20-50	>50
<i>Himantura uarnak</i>	<20	20-50	>50
<i>Himantura undulata</i>	<20	20-50	>50
<i>Himantura walga</i>	<12	12-18	>18
<i>Mobula japonica</i>	<20	20-50	>50
<i>Mobula kuhlii</i>	<20	20-50	>50
<i>Narcine brevilibiata</i>	<10	10-20	>20
<i>Narcine lingula</i>	<10	10-20	>20
<i>Narcine brunnea</i>	<10	10-15	>15
<i>Neotrygon kuhlii</i>	<20	20-25	>25
<i>Pastinachus gracilicaudus</i>	<20	20-50	>50
<i>Pastinachus stellurostris</i>	<20	20-50	>50
<i>Pastinachus cf. solosirostris</i>	<20	20-50	>50
<i>Plesiobatis daviesi</i>	<15	15-20	>20
<i>Rhina ancylostoma</i>	<40	40-100	>100
<i>Rhinobatos cf. formosensis</i>	<30	30-50	>50
<i>Rhinobatos punctifer</i>	<20	20-50	>50
<i>Rhinoptera javanica</i>	<20	20-50	>50
<i>Rhinoptera jakyari</i>	<20	20-50	>50

Species	Small	Medium	Big
<i>Rhynchobatus australiae</i>	<20	20-50	>50
<i>Taeniurops meyeri</i>	<20	20-50	>50
<i>Urogymnus asperrimus</i>	<15	15-20	>20

Sharks			
<i>Carcharhinus amblyrhynchoides</i>	< 50	50 - 100	> 100
<i>Carcharhinus brevipinna</i>	< 50	50 - 100	> 100
<i>Carcharhinus leucas</i>	< 50	50 - 100	> 100
<i>Carcharhinus limbatus</i>	< 50	50 - 100	> 100
<i>Carcharhinus macloti</i>	< 50	50 - 100	> 100
<i>Carcharhinus melanopterus</i>	< 50	50 - 100	> 100
<i>Carcharhinus sorrah</i>	< 50	50 - 100	> 100
<i>Chiloscyllium hasseltii</i>	< 35	35 - 50	> 50
<i>Chiloscyllium punctatum</i>	< 35	35 - 50	> 50
<i>Galeocerdo cuvier</i>	< 50	50 - 100	> 100
<i>Hemigaleus microstoma</i>	< 50	50 - 100	> 100
<i>Hemipristis elongata</i>	< 50	50 - 100	> 100
<i>Loxodon macrorhinus</i>	< 35	35 - 50	> 50
<i>Mustelus mosis</i>	< 35	35 - 50	> 50
<i>Mustelus sp.</i>	< 35	35 - 50	> 50
<i>Rhizoprionodon acutus</i>	< 35	35 - 50	> 50
<i>Scoliodon laticaudus</i>	<20	20-30	>30
<i>Sphyrna lewini</i>	< 50	50 - 100	> 100
<i>Sphyrna mokarran</i>	< 50	50 - 100	> 100
Skates			
<i>Okamejei jensenae</i>	<12	12-18	>18
<i>Okamejei sp.2</i>	<12	12-18	>18

Check list of Sharks, rays and skates in Myanmar 2016

Sources of information:

[1] Ahmad, A. and Lim, A.P.K. 2012. Field guide to sharks of the Southeast Asian Region. SEAFDEC/MFRDMD/SP/18. 210p

[2] Ahmad, A. and Lim, A.P.K., Fahmi, Dharmadhi and Tassapon, K. 2014. Field guide to rays, skates and chimaeras of the Southeast Asian Region. SEAFDEC/MFRDMD/SP/25. 288p

[3] Robert, H., **Ahmad, A.**, and U Saw, H. S. 2015. Status of the sharks and rays fishery within Myanmar Including socio-economic importance. TCP Report No 12, May 2015. BOBLME/FFI. 36p

[4] Current Research

SHARKS		Common name (English)	Myanmar name	[1]	[2]	[3]	Yangon [4]	Ye Township [4]
	ORDER / Family / Scientific name							
	HEXACHIFORMES	COW AND FRILLED SHARKS						
	1.Hexanchidae	Sixgill and sevengill sharks						
1	<i>Heptranchias perlo</i> (Bonnaterre, 1788)	Sharpnose sevengill shark				X		
	SQUALIFORMES	DOGFISHES						
	2. Echinorhionidae	Bramble sharks						
2	<i>Echinorhinus brucus</i> Bonnaterre, 1788	Bramble sharks		X		X		
	3. Squalidae	Dogfish sharks						
3	<i>Squalus</i> sp.	Dogfish sharks		X		X		
4	<i>Squalus megalops</i> (Macleay, 1881)	Snortnose spurdog		X		X		
	4. Centrophoridae	Gulper sharks						
5	<i>Centrophorus granulosus</i> (Bloch & Schneider, 1801)	Gulper shark				X		

6	<i>Centrophorus moluccensis</i> Bleeker, 1860	Smallfin gulper shark		X		X		
7	<i>Centrophorus</i> sp.	gulper shark				X		
	SQUATINIFORMES	ANGEL SHARKS						
	5. Squatinidae	Angel sharks						
8	<i>Squatina</i> sp.	Angel shark				X		
	ORECTOLOBIFORMES	CARPET SHARKS						
	6. Hemiscylliidae	Longtailed carpet sharks						
9	<i>Chiloscyllium</i> cf. <i>griseum</i> Muller & Henle, 1838. Identified as <i>Chiloscyllium griseum</i> Muller & Henle, 1838 in [1]	Grey bambooshark	Nga-mann-kywe-Tauktei	X		X	X	
10	<i>Chiloscyllium hasseltii</i> Bleeker, 1852	Indonesian bambooshark	Nga-mann-kywe-Tauktei	X		X	X	
11	<i>Chiloscyllium punctatum</i> Bleeker, 1855	Brown-banded bambooshark	Nga-mann-Tauktei	X		X	X	
12	<i>Hemiscyllium</i> sp.	Carpet shark				X		
	7. Rhincodontidae	Whale sharks						
13	<i>Rhincoon typus</i> Smith, 1828	Whale shark		X		X		
	8. Stegostomatidae	Zebra sharks						
14	<i>Stegostoma fasciatum</i> (Hermann, 1783)	Zebra shark		X		X		
	LAMNIFORMES	MACKEREL SHARKS						
	9. Alopiidae	Thresher sharks						
15	<i>Alopias superciliosus</i> (Lowe, 1839)	Bigeye thresher				X		
	CARCHARHINIFORMES	GROUND SHARKS						
	10. Scyliorhinidae	Catsharks						
16	<i>Apristurus</i> sp.	catshark				X		
17	<i>Atelomycterus marmoratus</i> (Bennett, 1830)	Coral catshark		X		X		
18	<i>Bythaelurus</i> sp.	Catshark				X		
19	<i>Bythaelurus lutarius</i> (Springer & D'Aubrey, 1972)	Mud catshark				X		

20	<i>Haploblepharus edwardsii</i> (Schinz, 1822)	Puffadder shyshark				X		
	11. Proscylliidae	Finback catsharks						
21	<i>Eridacnis radcliffei</i> Smith, 1913.	Pygmy ribbontail catshark				X		
22	<i>Proscyllium habereri</i> Hilgendorf, 1904	Graceful catshark				X		
23	<i>Proscyllium magnificum</i> Last & Vongpanich, 2004	Finback catshark		X		X		
	12. Triakidae	Hound sharks						
24	<i>Iago omanensis</i> (Norman, 1939)	Bigeye houndshark				X		
25	<i>Mustelus mosis</i> Hemprich & Ehrenberg, 1899. Identified as <i>Mustelus manazo</i> Bleeker, 1854 in Last <i>et al.</i> (2010)	Arabian smoothhound Starspotted smoothhound	Nga-mann- kalain-heike- khone			X	X	
26	<i>Mustelus</i> sp.	Smoothhound	Nga-mann- kalain-heike- khone				X	
27	<i>Triakis megalopterus</i> (Smith, 1839)	Sharptooth houndshark				X		
	13. Hemigaleidae	Weasel sharks						
28	<i>Chaenogaleus macrostoma</i> (Bleeker, 1852)	Hooktooth shark		X		X		
29	<i>Hemigaleus microstoma</i> Bleeker, 1852	Sicklefin weasel shark	Nga mann	X		X	X	
30	<i>Hemipristis elongatus</i> (Klunzinger, 1871)	Fossil shark	Nga- mann	X		X	X	
	14. Carcharhinidae	Requiem sharks						
31	<i>Carcharhinus albimarginatus</i> (Ruppell, 1837)	Silvertip shark		X		X		
32	<i>Carcharhinus amblyrhynchos</i> (Bleeker, 1856)	Gray reef shark				X		
33	<i>Carcharhinus amboinensis</i> (Muller & Henle, 1839)	Pigeye shark		X		X		
34	<i>Carcharhinus amblyrhynchoides</i> (Whitley, 1934)	Graceful shark	Nga-mann	X		X		X
35	<i>Carcharhinus brevipinna</i> (Muller & Henle, 1839)	Spinner shark	Nga-mann	X		X	X	X
36	<i>Carcharhinus dussumieri</i> (Muller & Henle, 1839)	Whitecheek shark		X		X		
37	<i>Carcharhinus falciformis</i> (Muller & Henle, 1839)	Silky shark		X		X		
38	<i>Carcharhinus galapagensis</i> (Snodgrass & Heller, 1905)	Galapagos shark		X				

39	<i>Carcharhinus leucas</i> (Muller & Henle, 1839)	Bull shark	Nga-mann-wyan-pu	X		X	X	X
40	<i>Carcharhinus limbatus</i> (Muller & Henle, 1839)	Common blacktip shark	Nga-mann-pu	X		X	X	
41	<i>Carcharhinus macloti</i> (Muller & Henle, 1839)	Hardnose shark	Nga mann				X	
42	<i>Carcharhinus melanopterus</i> (Quoy & Gaimard, 1824)	Blacktip reef shark	Nga-mann-taung-mae	X		X	X	
43	<i>Carcharhinus plumbeus</i> (Nardo, 1827)	Sandbar shark		X		X		
44	<i>Carcharhinus sealei</i> (Pietschmann, 1916)	Blackspot shark		X		X		
45	<i>Carcharhinus sorrah</i> (Muller & Henle, 1839)	Spottail shark	Nga-mann-aut-mee-mae	X		X		X
46	<i>Carcharhinus</i> sp.					X		
47	<i>Galeocerdo cuvier</i> (Peron & Lesueur, 1822)	Tiger shark	Nga-mann-kyar	X		X	X	
48	<i>Glyphis gangeticus</i> (Müller & Henle, 1839)	Ganges shark				X		
49	<i>Glyphis siamensis</i> (Steindachner, 1896)	Irrawaddy River shark		X		X		
50	<i>Loxodon macrorhinus</i> Muller & Henle, 1839	Sliteye shark	Nga-mann-loon-shay	X		X	X	
51	<i>Rhizoprionodon acutus</i> (Ruppell, 1837)	Milk shark	Thae-nga-mann	X		X	X	
52	<i>Rhizoprionodon oligolinx</i> Springer, 1964	Grey sharpnose shark		X		X		
53	<i>Scoliodon laticaudus</i> Muller & Henle, 1838 (identified as <i>Scoliodon macrorhynchus</i> , (Bleeker, 1852))	Spadenose shark	lunn-nga-mann	X		X	X	X
54	<i>Triaenodon obesus</i> (Ruppell, 1837)	Whitetip reef shark		X		X		
	15. Sphyrnidae	Hammerhead sharks						
55	<i>Eusphyra blochii</i> (Cuvier, 1817)	Winghead shark		X				
56	<i>Sphyrna lewini</i> (Griffith & Smith, 1834)	Scalloped hammerhead	Nga-mann-kywe-gyo-toe	X		X	X	X
57	<i>Sphyrna mokarran</i> (Ruppell, 1837)	Great hammerhead	Nga-mann	X		X	X	

58	<i>Sphyrna</i> sp.	Hammerhead				X		
59	<i>Sphyrna zygaena</i> (Linnaeus, 1758)	Smooth hammerhead				X		
RAYS								
	ORDER / Family /Scientific name	Common name (English)	Myanmar Name					
	PRISTIFORMES	SAWFISHES						
	1.Pristidae	Sawfishes						
1	<i>Anoxypristis cuspidata</i> (Latham,1794)	Narrow sawfish			X	X		
2	<i>Pristis pectinata</i> Latham,1794	Smalltooth sawfish			X	X		
3	<i>Pristis pristis</i> (Linnaeus, 1758). Identified as <i>Pristis microdon</i> Latham, 1851 in [1]	Freshwater sawfish			X	X		
4	<i>Pristis zijsron</i> Bleeker, 1851	Green sawfish			X			
	RHINOBATIFORMES	GUITARFISHES						
	2.Rhinidae	Shark ray						
5	<i>Rhina ancylostoma</i> Bloch & Schneider, 1801	Shark ray	Nga-mann-balu		X		X	
	3.Rhynchobatidae	Wedgefishes						
6	<i>Rhynchobatus australiae</i> Whitley, 1939	Whitespotted wedgefish	Nga-mann-pyar			X	X	
7	<i>Rhynchobatus</i> sp.	wedgefish				X		
	4.Rhinobatidae	Shovelnose rays						
8	<i>Glaucostegus granulatus</i> (Cuvier,839)	Granulated guitarfish			X	X		
9	<i>Glaucostegus halavi</i> (Forsskal,1775)	Halavi guitarfish			X	X		
10	<i>Rhinobatos obtusus</i> Muller & Henle, 1841	Widenose guitarfish			X			
11	<i>Glaucostegus thouin</i>	Clubnose guitarfish					X*	
12	<i>Glaucostegus typus</i> (Bennett, 1830). Identified as <i>Rhinobatus typus</i> (Bennett,1830) in [1]	Giant guitarfish	Nga-mann-pyar			X	X	X

13	<i>Rhinobatos cf. formosensis</i> Norman, 1926	Taiwan guitarfish	Nga-mann-pyar			X	X	
14	<i>Rhinobatos punctifer</i> Compagno & Randall, 1987	Spotted guitarfish	Nga-mann-pyar			X	X	
15	<i>Rhinobatos</i> sp.	guitarfish				X		
16	<i>Rhinobatos schlegelii</i> Müller and Henle, 1841	Brown guitarfish				X		
	TORPEDINIFORMES	ELECTRIC RYAS						
	5. Narcinidae	Numbfishes						
17	<i>Narcine brevilabiata</i> Bessednov, 1966	Shortlip numbfish	Nga- Dat-lite				X	
18	<i>Narcine brunnea</i> Annandale, 1909	Brown numbfish	Nga- Dat-lite		X	X		X
19	<i>Narcine lingula</i> Richardson, 1846	Rough numbfish	Nga- Dat-lite		X	X	X	
20	<i>Narcine prodorsalis</i> Bessednov, 1966	Tonkin numbfish			X	X		
21	<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		
22	<i>Narcine</i> sp					X		
	6. Narkidae	Sleeper rays						
23	<i>Narke dipterygia</i> (Bloch & Schneider, 1801)	Spottail sleeper			X	X		
24	<i>Temera hardwickii</i> Gray 1831	Finless sleeper ray			X	X		
	7. Torpedinidae							
25	<i>Torpedo nobiliana</i> Bonaparte, 1835	Atlantic torpedo				X		
26	<i>Torpedo</i> sp.	Torpedo ray				X		
	RAJIFORMES	SKATES						
	8. Rajidae	Skates						
27	<i>Dipturus kwangtungensis</i> (Chu, 1960)	Kwangtung skate			X			
28	<i>Dipturus</i> sp.	Sarawak skate			X			
29	<i>Okamejei cairae</i> Last, Fahmi & Ishihara, 2010	Borneo sand skate			X			

30	<i>Okamejei cf. powelli</i> (Alcock, 1898)	Whiteblotched skate				X		
31	<i>Okamejei cf. jensenae</i> Last & Lim, 2010	Philippine ocellate skate	Nga-latt-htone-sue				X	
32	<i>Okamejei</i> sp.	Thailand ocellate skate (pointed snout)	Nga-latt-htone-sue				X	
33	<i>Raja</i> sp.	Skate				X		
	MYLIOBATIFORMES	STINGRAYS						
	9. Plesiobatidae	Stingarees						
34	<i>Plesiobatis daviesi</i> (Wallace, 1967)	Giant stingaree	Leik-kyauk			X	X	
	10. Hexatrygonidae	Sixgill stingrays						
35	<i>Hexatrygon bickelli</i> Heemstra & Smith, 1980	Sixgill stingray				X		
	11. Dasyatidae	Stingrays						
36	<i>Dasyatis akajei</i> (Muller & Henle, 1841)	Red stingray				X		
37	<i>Dasyatis bennettii</i> (Muller & Henle, 1841)	Bennett's stingray			X	X		
38	<i>Dasyatis fluviorum</i> Ogilby, 1908	Estuary stingray				X		
39	<i>Dasyatis microps</i> (Annandale, 1908)	Smalleye stingray	Leik-kyauk-Bay Line -phyu -sat		X	X		X
40	<i>Dasyatis sinensis</i> (Steindachner, 1892)	Chinese stingray	Leik-kyauk-amee-kyar			X	X	X
41	<i>Dasyatis zugei</i> (Muller & Henle, 1841)	Sharpnose stingray			X	X		
42	<i>Dasyatis</i> sp.					X		
43	<i>Himantura bleekeri</i> (Blyth, 1860)	Bleeker's whipray				X		
44	<i>Himantura fai</i> Jordan & Seale, 1906	Pink whipray	Leik-kyauk		X	X	X	
45	<i>Himantura gerrardi</i> (Gray, 1851)	Whitespotted whipray	Leik-kyauk		X	X	X	X
46	<i>Himantura imbricata</i> (Bloch & Schneider, 1801)	Scaly whipray	Sa-ma -sue-nit		X	X	X	
47	<i>Himantura cf. javaensis</i> Last & White, 2013	Javanese whipray	Leik-khway				X	
48	<i>Himantura jenkinsii</i> (Annandale, 1909)	Jenkin's whipray	Leik-kyauk		X	X	X	

49	<i>Himantura leoparda</i> Manjaji-Matsumoto & Last, 2008	Leopard whipray	Leik-kyauk-kyar-thit				X	
50	<i>Himantura lobistoma</i> Manjaji-Matsumoto & Last, 2006	Tubemouth whipray	Leik-kyaukchun				X	
51	<i>Himantura pastinacoides</i> (Bleeker, 1852)	Round whipray	Sa-mad				X	X
52	<i>Himantura toshi</i> Whitley, 1939	Brown whipray			X	X	X	
53	<i>Himantura uarnacoides</i> (Bleeker, 1852)	Whitenose whipray	Leik-kyauk		X	X	X	X
54	<i>Himantura uarnak</i> (Forsskal, 1775)	Reticulate whipray	Leik-kyauk-kyar thit		X	X	X	X
55	<i>Himantura undulata</i> (Bleeker, 1852)	Honeycomb whipray	Nga-Leik-kyauk-kyar		X	X	X	X
56	<i>Himantura walga</i> (Muller & Henle, 1841)	Dwarf whipray	Sa-ma		X	X	X	X
57	<i>Himantura</i> sp.					X		
58	<i>Neotrygon annotata</i> Last, 1987	Javanese maskray				X		
59	<i>Neotrygon kuhlii</i> (Muller & Henle, 1841)	Bluespotted stingray	Nga-latt-htone		X	X	X	
60	<i>Pastinachus atrus</i> (Macleay, 1883)	Eastern cowtail stingray			X	X		
61	<i>Pastinachus gracilicaudus</i> Last & Manjaji-Matsumoto, 2010	Narrowtail stingray	Leik-kyauk-a mee-pyar					X
62	<i>Pastinachus</i> cf. <i>solocirostris</i> Last, Manjaji & Yearsley, 2005	Roughnose stingray	Leik-kyauk-a mee-pyar			X	X	
63	<i>Pastinachus stellurostris</i> Last, Fahmi & Nyalor, 2010	Starrynose stingray	Leik-kyauk-a mee-pyar				X	
64	<i>Taeniura lymma</i> (Forsskal, 1775)	Ribbontail stingray			X	X		
65	<i>Taeniurops meyeri</i> Muller & Henle, 1841	Round ribbontail stingray	Leik-kyauk-Ame-Pyar-Ato		X	X	X	
66	<i>Urogymnus asperrimus</i> (Bloch & Schneider, 1801)	Porcupine ray	Leik-kyauk		X	X	X	
	12. Gymnuridae	Butterfly rays						

67	<i>Gymnura japonica</i> (Temminck & Schlegel, 1805)	Japanese butterfly ray	Nga-Leik - pya				X	X
68	<i>Gymnura micrura</i> (Bloch & Schneider, 1801)	Smooth butterfly ray			X	X		
69	<i>Gymnura poecilura</i> (Shaw, 1804)	Longtail butterfly ray	Nga-Leik- pya		X	X	X	
70	<i>Gymnura zonura</i> (Bleeker, 1852).	Zonetail butterfly ray				X		
	13.Myliobatidae	Eagle rays						
71	<i>Aetobatus flagellum</i> (Bloch & Schneider, 1801)	Longhead eagle ray	Ball-Leik ,Htin-aill		X	X	X	
72	<i>Aetomylaeus maculatus</i> (Gray, 1834)	Mottled eagle ray			X	X		
73	<i>Aetobatus milvus</i> (Muller & Henle, 1841)	Ocellated eagle ray				X		
74	<i>Aetobatus narinari</i> (Euphrasen, 1790). Identified as <i>Aetobatus ocellatus</i> (Kuhl, 1823) in [2]	White-spotted eagle ray	Leik-son		X	X	X	
75	<i>Aetomylaeus nichofii</i> (Bloch & Schneider, 1801)	Banded eagle ray			X	X		
76	<i>Aetomylaeus vespertilio</i> (Bleeker, 1852)	Ornate eagle ray				X		
77	<i>Myliobatis</i>					X		
	14.Rhinopteraidae	Cownose rays						
78	<i>Rhinoptera adspersa</i> Muller & Henle, 1841	Rough cownose ray	Leik-son		X	X		X
79	<i>Rhinoptera javanica</i> Muller & Henle, 1841	Javanese cownose ray	Leik-son		X	X	X	X
80	<i>Rhinoptera jayakari</i> Boulenger, 1895	Short-tail cownose ray	Leik-son				X	X
81	<i>Rhinoptera neglecta</i> Ogilby, 1912	Australian cownose ray				X		
	15.Mobulidae	Devil rays						
82	<i>Manta birostris</i> (Walbaum, 1792)	Manta ray				X		
83	<i>Mobula eregoodootenkee</i> (Bleeker, 1859)	Longfin devil ray				X		
84	<i>Mobula japonica</i> (Muller & Henle, 1841)	Spinetail devil ray	Ball-Leik ,Htin-aill			X	X	
85	<i>Mobula kuhlii</i> (Muller & Henle, 1841)	Shortfin devil ray	Leik-son			X	X	
86	<i>Mobula thurstoni</i> (Lloyd, 1908)	Sicklefin devil ray				X		
87	<i>Mobula</i> sp.					X		

PART II

National Reports on Sharks Data Collection in the Participating Countries: Thailand

by

Tassapon KRAJANGDARA

Montri SUMONTHA

Suwantana TOSSAPORNPITAKKUL

Department of Fisheries, THAILAND

August, 2016

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1.0 INTRODUCTION

The marine fishery production of Thailand was harvested from the Gulf of Thailand and the Andaman Sea. Most of the production (90%) was caught by commercial fishing gears and the rest was caught by small scale fishing gears. Trawl fishery landed about 70% of the total production in Thai Waters. But, there is no shark's fishery in Thailand. Sharks and rays are caught by a number of fishing gears such as trawls, purse seines, long lines, gill nets and others, especially by the otter-board trawl. Generally, sharks and rays are not the target species but caught as by-catch or incidental catch by marine capture fisheries. There are no specific types of fishing gears to catch only for sharks and rays. Sharks and rays in the total catch were less than 0.5% of total marine fishery production. Moreover, shark and ray productions are fully utilised in Thailand. Species diversity of sharks and rays in Thai Waters and adjacent areas recorded 135 species comprising 64 sharks and 71 rays (including 1 skate), belonging to 19 families of sharks and 11 families of rays (Krajangdara, 2014).

The cartilaginous fishes or chondrichthyans in Thai Waters and adjacent areas are currently revised and updated in 2016 for supporting database system of NPOA-Sharks, Thailand. The new checklist of cartilaginous fishes was included the record of 162 species, composed of 76 sharks, 79 rays, 5 skates, and 2 chimaeras. These belong to 21 families of sharks, 14 rays, 2 skates, and 1 chimaeras. The high diversity of sharks was recorded from the Orders Carcharhiniformes, Orectolobiformes, Lamniformes and Squaliformes with 49, 10, 7 and 5 species, respectively. (In this checklist, Family Echinorhinidae is in Order Squaliformes. But Ebert *et al.* (2015) and Weigmann (2016) classified this family to new order, Echinorhiniformes). However, low diversity was record for the Orders Hexanchiformes and Squatiniformes with 2 species in each order. Species diversity in the Order Heterodontiformes was scanty and found only 1 species. As for batoids, high diversity was recorded for the Order Myliobatiformes with 54 species followed by Rhinobatiformes and Torpediniformes with 14 and 8 species, respectively. Only 5 species were recorded from the Order Rajiformes and 3 species from Pristiformes. The details of the cartilaginous fishes checklist are shown in **Appendix I**. Even though the stock status of chondrichthyans species in Thailand is still insufficient. With the new record of chondrichthyans species continuously discovered and expected to increase in the future. At present the deep water species are mostly unknown due to limited research activity. Most sharks and rays species landed in Thailand are mainly from the Families Carcharhinidae and Dasyatidae, however, it was very difficult to identify up to species level by untrained and inexperienced enumerators. Only well-trained staff will be better able to make the right and valid identification of species.

1.1 Objectives

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 Southern Thailand is a major landing site for sharks and rays. The selected sampling sites in the Gulf of Thailand was Songkhla province (comprising 6 districts in namely Ranot, Sathing Phra, Singhanakhon, Muang Songkhla, Chana and Thepa) and in the Andaman Sea was Ranong province (comprising 3 districts in namely Muang Ranong, Kapoe and Suk Samran). Although, there were many type of fishing boats landed in sampling sites such as paired trawler, otter-board trawler, purse seiner, gillnetter and longliner, but the 1-year data collection on sharks and rays in Thailand were only recorded from paired trawler and otter-board trawler which are the main fishing gears for catching sharks and rays. The landing data were collected at 2 fishing ports of fish marketing organization of Songkhla and Ranong where located in Muang district of both sites. The location of landing sites are shown in **Figure 1**.



Figure 1: Location of Study Sites in the Southern Thailand

1.2.2 Fishery Structure and Background of Study Sites

Songkhla Fish Marketing Organization or Songkhla Fishing Port is one of the major landing sites for sharks and rays in the east coast of Southern Thailand. The major gears were trawl nets (260) comprising 247 otter-board trawls and 13 paired trawls. All trawlers are normally operated by 4-6 crew members. All catches were landed from 0500-1100hr by trawlers operating more than 3 nautical miles from the coastline. Fishing operations normally were operated between 4 to 30 days per trip. While Ranong Fish Marketing Organization or Ranong Fishing Port is one of the major landing sites for sharks and rays in the northern of west coast, Thailand. The major gears were trawl nets (243) comprising 211 otter-board trawls and 32 paired trawls. All trawlers are normally operated by 6-13 crew members. All catches were

landed from 0000-0600 hr by trawlers operating more than 3 nautical miles from the coastline. Fishing operation normally between 20-25 day per trip, both day and night time. The catches were sold between 0600- 1000hr, almost by auction method. The details of trawlers registered of both provinces are shown in **Table 1**.

Table 1: Number of Licensed Trawlers at Songkhla and Ranong Province

Gear type	Fishing operation (from coastline)	No. of Vessels in Songkhla	No. of Vessels in Ranong
Otter-board trawl	> 3 NM		
10-19.9 GRT	> 3 NM	56	1
20-59.9 GRT	> 3 NM	146	94
60-150 GRT	> 3 NM	45	116
Total		247	211
Paired trawl			
20-59.9 GRT	> 3 NM	8	7
60-150 GRT	> 3 NM	5	25
Total		13	32
Grand Total		260	243

1.3 Appointment of Enumerators

Three Fishery Biologists and one fisheries officer from Department of Fisheries were appointed as enumerators. Their names and addresses are as follows:

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1.4 Materials and Methods

1.4.1 Sampling Methods

The sampling activity started in August, 2015 until August, 2016. But no landing sharks and rays at Ranong fishing port in August, 2015. Therefore 12-month data collection at Songkhla conducted from August, 2015 to July, 2016 and Ranong conducted from September, 2015 to August, 2016. All enumerators were requested to record landing data and other related information in a standard form at least 5 days/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 II**. The completed data in excel sheet were 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 5 days per month at each landing site. Measurement of Total length (TL) were taken for all sharks species, skates and rays from the Families Rhinidae, Rhynchobatidae, Rhinobatidae, Narcinidae and Narkidae. While Disc Length (DL) were taken for all ray species where the tail is frequently absent or damaged (mainly from the Families Dasyatidae, Gymnuridae, Myliobatidae 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 Compagno *et al.* (2005), Ahmad and Lim (2012), Ahmad *et al.* (2014) and Ebert *et al.* (2015). 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 Southern Marine Fisheries Research and Development Center (Songkhla) and Ranong Marine Fisheries Station then preserved for future reference. 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 (1998), Compagno and Last (1999), de Carvalho *et al.* (1999), Compagno *et al.* (2005), Ahmad and Lim (2012), Ahmad *et al.* (2014), Ebert *et al.* (2015) and Weigmann (2016)

2.0 RESULTS

2.1 Songkhla

2.1.1 Landing Samples

A total of 115 trawlers were sampled during the study period. The highest by month was 15 in June, followed by 13 in January. The highest by gear type was 114 of Otter-board trawls. The details are shown in **Table 2**.

Table 2: Number of Landings Sampled during the Study at Songkhla Fishing Port

Type of Gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Otter-board trawl	7	11	10	11	7	13	11	7	8	5	15	9	114
Paired trawl			1										1
Total	7	11	11	11	7	13	11	7	8	5	15	9	115

2.1.2 Fishing Ground and Catch Composition by Gear Type

The main gear landing sharks and rays was the otter-board trawl at 8,017 kg (98.1%) comprising 4,141 kg of rays and 3,876 kg of sharks. While paired trawl contributed 10 kg (0.1%) of rays and 144 kg (1.8%) of sharks. All trawlers operated more than 3 nautical miles from the coastline. The highest landing of rays by month was from otter-board trawl at 671 kg in February, followed by 628 kg in June. While the highest landing of sharks by month from otter-board trawl in July at 773 kg and 502 kg in April. The details are shown in **Table 3**.

Table 3: Weight of Sharks and Rays (in kg) Caught by Trawls at Songkhla Fishing Port

Type of Gear	2015					2016							Grand Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Otter-board trawl	74.0	306.6	202.3	305.5	448.0	447.0	671.0	181.5	322.5	109.5	627.8	445.0	4,140.7
Paired trawl	0.0	0.0	10.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3
Total catch ray	74.0	306.6	212.6	305.5	448.0	447.0	671.0	181.5	322.5	109.5	627.8	445.0	4,151.0
Otter-board trawl	246.7	198.7	151.7	260.8	167.2	473.1	347.6	147.1	502.0	304.9	303.1	773.0	3,875.9
Paired trawl	0.0	0.0	144.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	144.0
Total catch shark	246.7	198.7	295.7	260.8	167.2	473.1	347.6	147.1	502.0	304.9	303.1	773.0	4,019.9
Grand Total	320.7	505.3	508.3	566.3	615.2	920.1	1,018.6	328.6	824.5	414.4	930.9	1,218.0	8,170.9

2.1.3 Sharks and Rays Composition

A total of 1,075,826 kg of catches was landed from 115 trawlers during the study period. Rays and sharks made up 4,151 kg and 4,020 kg (0.4% and 0.4%) from the total landing, respectively. Total landings of bony fish were 1,067,655kg or 99.2%. Average landings per month for sharks and rays were 335 and 346 kg, respectively. The highest landing by month for rays was 671 kg in February, followed by 628 kg in June and 448 kg in December. However, the highest landing for sharks was 773 kg in July, followed by 502 kg in April and 473 kg in January. In general, the landing of sharks and rays ranged between 0.2–0.8% and 0.1–0.7%, respectively from total landing. The details are shown in **Table 4**.

Table 4: Catch Composition of Sharks, Rays and Bony Fishes by Month from 115 Trawler Landings at Songkhla Fishing Port. All Weights in Kilogram.

Year	Month	Weight of Rays	% Rays	Weight of Sharks	% Sharks	Weight of Bony Fishes	% Bony Fishes	Total Catch
2015	Aug	74.0	0.1	246.7	0.4	72,643.1	99.5	72,963.8
	Sep	306.6	0.3	198.7	0.2	111,190.3	99.5	111,695.6
	Oct	212.6	0.2	295.7	0.2	121,292.3	99.6	121,800.6
	Nov	305.5	0.3	260.8	0.3	95,355.7	99.4	95,922.0
	Dec	448.0	0.7	167.2	0.2	69,348.5	99.1	69,963.7
2016	Jan	447.0	0.4	473.1	0.4	116,740.4	99.2	117,660.5
	Feb	671.0	0.7	347.6	0.4	91,228.8	98.9	92,247.4
	Mar	181.5	0.4	147.1	0.3	43,368.4	99.3	43,697.0
	Apr	322.5	0.4	502.0	0.6	88,394.3	99.0	89,218.8
	May	109.5	0.3	304.9	0.8	38,837.0	98.9	39,251.4
	Jun	627.8	0.5	303.1	0.3	112,625.6	99.2	113,556.5
	Jul	445.0	0.4	773.0	0.7	106,631.0	98.9	107,849.0
Total		4,151.0		4,019.9		1,067,655.4		1,075,826.3
Ave		345.9	0.4	335	0.4	98,317.9	99.2	89,652.2

2.1.4 Number of Sample

A total of 8,590 tails belonging to 5,612 rays and 2,978 sharks were sampled comprising 7 species of rays and 9 species of sharks. The most abundant ray species by number were *Dasyatis zugei* followed by *Himantura walga* and *Dasyatis akajei*. The highest number of rays sampled by month was 858 in February, followed by 703 in November and 675 in June. The most abundant shark species were *Chiloscyllium punctatum* followed by *Atelomycterus marmoratus* and *Carcharhinus sorrah*. However, the highest number of sharks sampled by month was 468 in January, followed by 396 in April and 296 in July. The most common ray species were *Dasyatis zugei* followed by *Himantura walga*. The most common shark species were *Chiloscyllium punctatum* and *Atelomycterus marmoratus*. All these species were landed throughout the year. Other species such as *Aetobatus ocellatus*, *Himantura gerrardi*, *Carcharhinus amblyrhynchos*, *C. melanopterus*, *C. sorrah*, *Chiloscyllium hasseltii*, *C.*

plagiosum, and *Hemigaleus microstoma*, were rarely landed and only landed between 1-3 months during the study period. The details are as shown in **Table 5**.

Table 5: Number of Sample of Sharks and Rays by Species at Songkhla Fishing Port

Species	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<i>Aetobatus ocellatus</i>					1								1
<i>Dasyatis akajei</i>		6	7	17	7	6	11	1			4	1	60
<i>Dasyatis zugei</i>	108	334	292	545	444	400	635	234	231	187	617	436	4,463
<i>Himantura gerrardi</i>							1						1
<i>Himantura walga</i>	20	48	123	126	69	193	211	49	57	11	49	87	1,043
<i>Neotrygon kuhlii</i>	1	2		15	1			2	5	9	1		36
<i>Rhynchobatus australiae</i>								1	2	1	4		8
Total Rays	129	390	422	703	522	599	858	287	295	208	675	524	5,612
<i>Atelomycterus marmoratus</i>	41	25	30	12	6	62	7	14	68	44	33	20	362
<i>Carcharhinus amblyrhynchos</i>			1										1
<i>Carcharhinus melanopterus</i>											5	8	13
<i>Carcharhinus sorrah</i>	35												35
<i>Chiloscyllium griseum</i>							2	1	4		2	6	15
<i>Chiloscyllium hasseltii</i>		4	1	2									7
<i>Chiloscyllium plagiosum</i>	1												1
<i>Chiloscyllium punctatum</i>	155	147	249	168	115	406	253	115	324	118	231	262	2,543
<i>Hemigaleus microstoma</i>											1		1
Total Sharks	232	176	281	182	121	468	262	130	396	162	272	296	2,978
Grand Total	361	566	703	885	643	1,067	1,120	417	691	370	947	820	8,590

2.1.5 Weight of Sharks and Rays by Species

A total of 8,171 kg was landed from 115 trawler landings comprising 4,151 kg rays and 4,020 kg sharks. For rays, the highest landing by weight was from *Dasyatis zugei* amounting to 3,157 kg, followed by 668 kg *Himantura walga* and 207 kg *Dasyatis akajei*. The highest landing by month was 550 kg for *Dasyatis zugei* in June, followed by 473 kg in February and 379 kg in July. For *Himantura walga*, the highest landing was 178 kg in February, followed by 130 kg in January and 66 kg in July. Weight of other ray species ranged between 0.2–114.2 kg. The highest landing of sharks was 3,620 kg for *Chiloscyllium punctatum* followed by 216 kg for *Atelomycterus marmoratus*. The highest landing by month for *Chiloscyllium punctatum* was 644 kg in July followed by 458 kg in April and 433 kg in January. For *Atelomycterus marmoratus*, the highest landing was 41 kg in January followed by 40 kg in April and 25 kg in

July. Weight of other shark species ranged between 0.4–59.4 kg. The details are shown in **Table 6**.

2.1.6 Size Range of Sharks and Rays

In general, most samples of *Dasyatis zugei*, *Himantura walga* and *Neotrygon kuhlii* were mature size, while most sample of *Dasyatis akajei* and *Rhynchobatus australiae* were immature size. For *Aetobatus ocellatus* and *Himantura gerrardi* were found only one tail as immature size. Most of small shark species (*Atelomycterus marmoratus*, *Chiloscyllium griseum*, *C. hasseltii* and *C. plagiosum*) landed were mature except for *Chiloscyllium punctatum*, that average sizes were less than mature size. First maturing size for this species is 65 cm, but most sample were immature size. For three (3) species of genus *Carcharhinus* and *Hemigaleus microstoma* were immature size. Size range of all sharks and rays species from are shown in **Table 7**.

Table 6: Weight of Sharks and Rays (in Kg) by Species from 115 Trawler Landings at Songkhla Fishing Port

Species	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
<i>Aetobatus ocellatus</i>					14.0								14.0
<i>Dasyatis akajei</i>		14.4	8.6	33.8	114.2	1.4	19.6	0.2			14.6	0.3	207.1
<i>Dasyatis zugei</i>	62.8	261.8	161.0	222.3	266.2	315.6	472.9	130.8	246.3	88.8	550.3	378.6	3,157.4
<i>Himantura gerrardi</i>							0.3						0.3
<i>Himantura walga</i>	9.9	29.0	43.0	37.1	53.0	130.0	178.2	15.0	49.8	4.9	51.6	66.1	667.6
<i>Neotrygon kuhlii</i>	1.3	1.4		12.3	0.6			2.5	24.4	12.2	1.0		55.7
<i>Rhynchobatus australiae</i>								33.0	2.0	3.6	10.3		48.9
Total weight rays	74.0	306.6	212.6	305.5	448.0	447.0	671.0	181.5	322.5	109.5	627.8	445.0	4,151.0
<i>Atelomycterus marmoratus</i>	23.8	12.8	19.4	7.4	4.1	40.5	2.9	5.2	40.4	21.7	13.3	24.5	216.0
<i>Carcharhinus amblyrhynchos</i>			7.2										7.2
<i>Carcharhinus melanopterus</i>											3.3	45.6	48.9
<i>Carcharhinus sorrah</i>	51.6												51.6
<i>Chiloscyllium griseum</i>							0.5	1.7	3.7		1.0	59.4	66.3
<i>Chiloscyllium hasseltii</i>		2.1	0.6	4.8									7.5
<i>Chiloscyllium plagiosum</i>	1.6												1.6
<i>Chiloscyllium punctatum</i>	169.7	183.8	268.5	248.6	163.1	432.6	344.2	140.2	457.9	283.2	285.1	643.5	3,620.4
<i>Hemigaleus microstoma</i>											0.4		0.4
Total weight sharks	246.7	198.7	295.7	260.8	167.2	473.1	347.6	147.1	502.0	304.9	303.1	773.0	4,019.9
Grand Total	320.7	505.3	508.3	566.3	615.2	920.1	1,018.6	328.6	824.5	414.4	930.9	1,218.0	8,170.9

Table 7: Size Range (cm) of Sharks and *Rhynchobatus australiae* (Total Length) and Rays (Disc Length) at Songkhla Fishing Port.

Species	Month														
	Aug-15			Sep			Oct			Nov			Dec		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Rays															
<i>Aetobatus ocellatus</i>													62.0	62.0	62.0
<i>Dasyatis akajei</i>				12.6	53.5	27.0	13.4	38.3	26.4	12.4	59.2	27.0	14.6	36.8	22.7
<i>Dasyatis zugei</i>	11.3	30.0	21.5	10.8	30.3	21.7	10.7	31.5	19.6	6.0	32.2	19.2	9.5	32.0	20.6
<i>Himantura gerrardi</i>															
<i>Himantura walga</i>	14.0	24.0	20.3	12.0	24.7	19.3	11.9	24.5	18.7	11.8	27.5	18.3	10.8	23.4	18.6
<i>Neotrygon kuhlii</i>	26.6	26.6	26.6	25.0	25.7	25.4				13.0	32.0	23.1	20.0	20.0	20.0
<i>Rhynchobatus australiae</i>															
Sharks															
<i>Atelomycterus marmoratus</i>	28.7	53.6	44.9	38.2	54.5	47.8	33.5	56.0	45.8	19.8	54.6	45.9	26.6	50.8	45.9
<i>Carcharhinus amblyrhynchos</i>							96.0	96.0	96.0						
<i>Carcharhinus melanopterus</i>															
<i>Carcharhinus sorrah</i>	57.2	76.8	66.3												
<i>Chiloscyllium griseum</i>															
<i>Chiloscyllium hasseltii</i>				39.2	57.0	46.2	52.3	52.3	52.3	48.8	54.6	51.7			
<i>Chiloscyllium plagiosum</i>	76.6	76.6	76.6												
<i>Chiloscyllium punctatum</i>	24.5	93.0	56.1	25.7	91.6	56.7	12.2	82.7	51.6	17.4	94.4	54.6	27.2	87.8	54.4
<i>Hemigaleus microstoma</i>															

Table 7: (con't)

Species	Month																				
	Jan-16			Feb			Mar			Apr			May			Jun			Jul		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Rays																					
<i>Aetobatus ocellatus</i>																					
<i>Dasyatis akajei</i>	15.0	21.8	18.2	16.8	46.0	30.8	16.0	16.0	16.0							13.8	60.4	39.8	14.4	14.4	14.4
<i>Dasyatis zugei</i>	10.5	32.2	20.6	8.8	29.2	18.6	12.8	31.2	21.5	14.2	32.1	23.6	10.8	31.2	20.2	10.1	32.5	20.3	9.8	35.2	20.1
<i>Himantura gerrardi</i>				20.2	20.2	20.2															
<i>Himantura walga</i>	12.0	30.0	18.7	8.8	23.0	17.4	13.2	29.9	21.2	15.0	24.4	20.7	18.1	22.7	20.3	12.0	25.6	19.1	13.0	23.8	19.4
<i>Neotrygon kuhlii</i>							25.0	27.5	26.3	21.6	31.6	27.6	14.2	33.8	23.1	26.2	26.2	26.2			
<i>Rhynchobatus australiae</i>							182.0	182.0	182.0	54.2	61.0	57.6	52.0	52.0	52.0	66.2	93.0	79.9			
Sharks																					
<i>Atelomycterus marmoratus</i>	34.0	61.4	48.8	37.6	52.0	44.6	30.2	51.2	41.2	31.5	56.0	45.7	29.6	55.4	46.0	27.8	58.8	45.5	29.3	53.7	45.0
<i>Carcharhinus amblyrhynchos</i>																					
<i>Carcharhinus melanopterus</i>																55.4	62.5	59.7	58.6	70.9	63.5
<i>Carcharhinus sorrah</i>																					
<i>Chiloscyllium griseum</i>				31.0	46.2	38.6	56.8	56.8	56.8	36.0	51.2	43.8				46.0	53.0	49.5	43.2	62.1	54.9
<i>Chiloscyllium hasseltii</i>																					
<i>Chiloscyllium plagiosum</i>																					
<i>Chiloscyllium punctatum</i>	24.4	90.0	51.0	23.4	84.8	57.4	27.0	93.0	56.7	21.4	96.0	55.6	30.3	96.4	62.5	27.0	88.2	61.7	21.8	86.4	56.9
<i>Hemigaleus microstoma</i>																49.6	49.6	49.6			

2.1.7 Catch Per Unit Effort

Most of sharks and rays were caught by otter-board trawl and paired trawl. For trawls sampled during August 2015 to July 2016, all data were used to calculate catch per unit effort (CPUE) as follows: The days at operation by otter-board trawl and paired trawl were 1,432 days (4,697 hauls) and 8 days (32 hauls), respectively. The details are shown in **Table 8A-8B**. The CPUE of rays by otter-board trawl ranged between 0.03-2.20 kg/day at operation and 0.01-0.67 kg/haul. The highest CPUE of rays from otter-board and paired trawl were *Dasyatis zugei* with 2.20 kg/day at operation (0.67 kg/haul) and 0.74 kg/day at operation (0.18 kg/haul). The details are shown in **Table 9A-9B**. The highest CPUE of sharks from otter-board and paired trawl were *Chiloscyllium punctatum* with 2.44 kg/day at operation (0.74 kg/haul) and 16.33 kg/day at operation (4.08 kg/haul). The details are shown in **Table 9C-9D**. The number of ray individual calculated by using CPUE of ray was caught by otter-board trawl and paired trawl ranged between 0.04-8.12 ind/day and 1.88-2.50 ind/day, respectively. The details are shown in **Table 10A-10B**. While the number of shark individual calculated by using CPUE of shark was caught by otter-board trawl and paired trawl ranged between 0.03-2.84 ind/day and 0.13-18.88 ind/day, respectively. The highest shark species of both gears were *Chiloscyllium punctatum*. The details are shown in **Table 10C-10D**.

Table 8A: Days at Operation by Trawls Sampled during August 2015-July 2016 at Songkhla Fishing Port

Gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Otter-board trawl	75	113	84	107	80	180	129	90	128	66	220	160	1,432
Paired trawl			8										8

Table 8B: Numbers of Haul by Trawls Sampled during August 2015-July 2016 at Songkhla Fishing Port

Gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Otter-board trawl	156	446	336	365	275	642	496	301	451	143	553	533	4,697
Paired trawl			32										32

Table 9A: CPUE of Rays Captured by Otter-board Trawl during August 2015-July 2016 at Songkhla Fishing Port

Rank	Species	Total Weight (kg) by Species	CPUE (kg/Day at Operation)	CPUE (kg/Haul)
1	<i>Dasyatis zugei</i>	3,151.5	2.20	0.67
2	<i>Himantura walga</i>	663.2	0.47	0.14
3	<i>Dasyatis akajei</i>	207.1	0.14	0.04
4	<i>Neotrygon kuhlii</i>	55.7	0.04	0.01
5	<i>Rhynchobatus australiae</i>	48.9	0.03	0.01

Table 9B: CPUE of Rays Captured by Paired Trawl during August 2015-July 2016 at Songkhla Fishing Port

Rank	Species	Total Weight (kg) by Species	CPUE (kg/Day at Operation)	CPUE (kg/Haul)
1	<i>Dasyatis zugei</i>	5.9	0.74	0.18
2	<i>Himantura walga</i>	4.4	0.55	0.14

Table 9C: CPUE of Sharks Captured by Otter-board Trawl during August 2015-July 2016 at Songkhla Fishing Port

Rank	Species Name	Total Weight (kg) by Species	CPUE (kg/Day at Operation)	CPUE (kg/Haul)
1	<i>Chiloscyllium punctatum</i>	3,489.9	2.44	0.74
2	<i>Atelomycterus marmoratus</i>	202.6	0.14	0.04
3	<i>Chiloscyllium griseum</i>	66.1	0.05	0.01
4	<i>Carcharhinus sorrah</i>	51.6	0.04	0.01
5	<i>Carcharhinus melanopterus</i>	48.9	0.03	0.01

Table 9D: CPUE of Sharks Captured by Paired Trawl During August 2015-July 2016 at Songkhla Fishing Port

Rank	Species Name	Total Weight (kg) by Species	CPUE (kg/Day at Operation)	CPUE (kg/Haul)
1	<i>Chiloscyllium punctatum</i>	130.6	16.33	4.08
2	<i>Atelomycterus marmoratus</i>	13.4	1.68	0.42

Table 10A: CPUE of Rays (Individuals) Captured by Otter-board Trawl during August 2015-July 2016 at Songkhla Fishing Port

Rank	Scientific Name	Estimated No. of Species	CPUE (Ind/Day at Operation)	CPUE (Ind/Haul)
1	<i>Dasyatis zugei</i>	11,628.0	8.12	2.48
2	<i>Himantura walga</i>	2,974.0	2.08	0.63
3	<i>Dasyatis akajei</i>	151.0	0.11	0.03
4	<i>Neotrygon kuhlii</i>	61.0	0.04	0.01

Table 10B: CPUE of Rays (Individuals) Captured by Paired Trawl during August 2015-July 2016 at Songkhla Fishing Port

Rank	Scientific Name	Estimated No. of Species	CPUE (Ind/Days at Operation)	CPUE (Ind/Haul)
1	<i>Himantura walga</i>	20	2.50	0.63
2	<i>Dasyatis zugei</i>	15	1.88	0.47

Table 10C: CPUE of Sharks (Individuals) Captured by Otter-board Trawl during August 2015-July 2016 at Songkhla Fishing Port

Rank	Scientific Name	Estimated No. of Species	CPUE (Ind/Day at Operation)	CPUE (Ind/Haul)
1	<i>Chiloscyllium punctatum</i>	4,068	2.84	0.87
2	<i>Atelomycterus marmoratus</i>	601	0.42	0.13
3	<i>Chiloscyllium griseum</i>	119	0.08	0.03
4	<i>Carcharhinus melanopterus</i>	44	0.03	0.01
5	<i>Carcharhinus sorrah</i>	39	0.03	0.01

Table 10D: CPUE of Sharks (Individuals) Captured by Paired Trawl during August 2015-July 2016 at Songkhla Fishing Port

Rank	Scientific Name	Estimated No. of Species	CPUE (Ind/Day at Operation)	CPUE (Ind/Haul)
1	<i>Chiloscyllium punctatum</i>	151	18.88	4.72
2	<i>Atelomycterus marmoratus</i>	1	0.13	0.03

2.1.8 Usage and Marketing

Information on marketing collected at this landing site indicated that most sharks and rays were consumed locally. The major markets were wholesale market in Songkhla Province. The price varied according to species. The most expensive ray, *Aetobatus ocellatus* was sold at 50-120 Baht/kg followed by *Rhynchobatus australiae* at 60-80 Baht/kg. The price of *Dasyatis akajei*, *D. zugei*, *Neotrygon kuhlii*, *Himantura gerrardi* and *H. walga* were varied by size and sold at 20-60 Baht/kg. In general, bigger sized rays were more expensive than smaller ones. For sharks, the local price ranged between 20-125 Baht/kg. The most expensive sharks, *Carcharhinus amblyrhynchos* and *C. sorrah* were sold at 80-120 Baht/kg. While small sharks, *Chiloscyllium* spp. and *Atelomycterus marmoratus* were sold at 20-65 Baht/kg.

Normally the price at wet markets was about 20-50% higher than at landing site. 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 V**.

Table 11: Price of Sharks and Rays by Species at Songkhla Landing Site during 2015-2016. All Prices in Baht per Kilogram. (Exchange rate: Baht 35= US\$ 1.00)

Species	Range Price (Baht/kg)	Part	Market Destination
Rays			
<i>Aetobatus ocellatus</i>	50-120	Whole body	Local market in Songkhla Province
<i>Dasyatis akajei</i>	20-60	Whole body	Local market in Songkhla Province
<i>Dasyatis zugei</i>	20-60	Whole body	Local market in Songkhla Province
<i>Himantura gerrardi</i>	20-60	Whole body	Local market in Songkhla Province
<i>Himantura walga</i>	20-60	Whole body	Local market in Songkhla Province
<i>Neotrygon kuhlii</i>	20-60	Whole body	Local market in Songkhla Province
<i>Rhynchobatus australiae</i>	60-80	Whole body	Local market in Songkhla Province
Sharks			
<i>Atelomycterus marmoratus</i>	20-50	Whole body	Local market in Songkhla Province
<i>Carcharhinus amblyrhynchos</i>	80-120	Whole body	Local market in Songkhla Province
<i>Carcharhinus sorrah</i>	80-120	Whole body	Local market in Songkhla Province
<i>Chiloscyllium griseum</i>	20-65	Whole body	Local market in Songkhla Province
<i>Chiloscyllium hasseltii</i>	20-65	Whole body	Local market in Songkhla Province
<i>Chiloscyllium plagiosum</i>	20-65	Whole body	Local market in Songkhla Province
<i>Chiloscyllium punctatum</i>	20-65	Whole body	Local market in Songkhla Province

2.2 Ranong

2.2.1 Landing Samples

A total of 70 trawlers were sampled during the study period. The highest by month was 11 in December, followed by 10 in January. The highest by gear type was 55 of otter-board trawls. The details are shown in **Table 12**.

Table 12: Number of Landings Sampled during the Study at Ranong Fishing Port

Type of Gear	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Otter-board trawl	2	5	5	10	10	5	3	1	2	4	6	2	55
Paired trawl	1	2	3	1	-	2	3	2	1	-	-	-	15
Total	3	7	8	11	10	7	6	3	3	4	6	2	70

2.2.2 Fishing Ground and Catch Composition by Gear Type

The main gear landing sharks and rays was the trawl nets at 3,330 kg comprising from otter-board trawl 2,538 kg (76.2%) and paired trawl 792 kg (23.8%). The trawlers operated more than 3 nautical miles from the coastline. The highest landing of rays by month was from otter-

board trawl at 651 kg in January and from paired trawl in February at 191 kg. While the highest landing of sharks by month from paired trawl in September at 91 kg and from otter-board trawl in October at 73 kg. The details are shown in **Table 13**.

Table 13: Weight of Sharks and Rays (in kg) Caught by Trawls at Ranong Fishing Port

Type of Gear	2015				2016								Grand Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Otter-board trawl	177.8	261.2	325.5	323.7	651.2	92.2	88.9	7.1	87.0	96.0	206.9	15.1	2,332.8
Paired trawl	180.0	19.0	133.1	46.2	0.0	190.9	25.4	52.6	0.9	0.0	0.0	0.0	648.1
Total catch ray	357.8	280.2	458.6	369.9	651.2	283.1	114.3	59.7	87.9	96.0	206.9	15.1	2,980.9
Otter-board trawl	3.4	73.0	53.4	8.1	28.8	2.0	1.1	0.0	34.8	0.5	0.0	0.0	205.1
Paired trawl	91.4	10.9	6.7	2.4	0.0	21.7	5.6	4.9	0.0	0.0	0.0	0.0	143.6
Total catch shark	94.8	83.9	60.1	10.5	28.8	23.7	6.7	4.9	34.8	0.5	0.0	0.0	348.6
Grand Total	452.7	364.1	518.6	380.4	680.0	306.9	121.9	64.6	122.7	96.5	206.9	15.1	3,329.5

2.2.3 Sharks and Rays Composition

A total of 1,155,913 kg of fish was landed from 70 landings during the study period. Rays and sharks made up 2,981 kg and 349 kg (0.26% and 0.03%) from the total landing, respectively. Total landings of bony fish were 1,152,529 kg or 99.71 %. Average landings per month for sharks and rays were 29 kg and 248 kg, respectively. The highest landing by month for rays was 651 kg in January, followed by 459 kg in November, and 370 kg in December. However, the highest landing for sharks was 95 kg in September, followed by 84 kg in October and 60 kg in November. In general, the landing of sharks and rays ranged between less than 0.01–0.20% and 0.08–0.75%, respectively from total landing. The details are shown in **Table 14**.

Table 14: Catch Composition (kg) of Sharks, Rays and Bony fishes by Month from 70 Trawler Landings at Ranong Fishing Port

Year	Month	Weight of Rays	% Rays	Weight of Sharks	% Sharks	Weight of Bony fishes	% Bony fishes	Total Catch
2015	Sep	357.8	0.8	94.8	0.2	46,997.30	99.0	47,450.0
	Oct	280.2	0.2	83.9	0.1	144,584.20	99.7	144,948.3
	Nov	458.6	0.5	60.1	0.1	96,728.50	99.4	97,247.1
	Dec	369.9	0.2	10.5	0.0	152,215.60	99.8	152,596.0
2016	Jan	651.2	0.4	28.8	0.0	184,086.30	99.6	184,766.3
	Feb	283.1	0.2	23.7	0.0	131,602.20	99.8	131,909.0
	Mar	114.3	0.1	6.7	0.0	148,762.00	99.9	148,883.0
	Apr	59.7	0.1	4.9	0.0	64,629.40	99.9	64,694.0
	May	87.9	0.1	34.8	0.1	61,998.30	99.8	62,121.0
	Jun	96.0	0.2	0.5	0.00	53,039.30	99.8	53,190.0
	Jul	206.9	0.4	0.0	0.00	56,128.10	99.6	56,335.0
	Aug	15.1	0.1	0.0	0.00	11,757.90	99.9	11,773.0
Total		2,980.9		348.6		1,152,529.1		1,155,912.8
Ave		248.4	0.26	29.1	0.03	96,048.6	99.71	96,326.1

2.2.4 Number of Sample

A total of 1,818 tails belonging to 1,657 rays and 161 sharks were sampled comprising 14 species of rays and 9 species of sharks. The most abundant ray species was *Rhinobatos formosensis* followed by *Himantura walga* and *Neotrygon kuhlii*. The highest number of rays sampled by month was 289 in January, followed by 245 in February and 230 in July. The most abundant shark species was *Chiloscyllium hasseltii* followed by *C. punctatum* and *C. griseum*. However, the highest number of sharks sampled by month was 74 in October, followed by 20 in January and 19 in February. The most common ray species were *Neotrygon kuhlii* followed by *Rhinobatos formosensis*, *Himantura walga* and *H. gerrardi*. All these species were landed throughout the year. The most common shark species were *Chiloscyllium punctatum* and *C. hasseltii*. Both species were landed at least half of the year. Other species such as *Aetobatus narinari*, *Dasyatis akajei*, *D. thetidis*, *Gymnura japonica*, *Himantura imbricata*, *H. jenkinsii*, *H. uanacoides*, *Plesiobatis daviesi*, *Rhynchobatus australiae*, *Taeniurops meyeri*, *Chiloscyllium griseum*, *Carcharhinus leucas*, *C. melanopterus*, *C. sorrah*, *Galeocerdo cuvier*, *Heptranchias perlo* and *Sphyrna lewini*, were rarely landed and only landed between 1-4 months during the study period. The details are as shown in **Table 15**.

Table 15: Number of Sample of Sharks and Rays by Species at Ranong Fishing Port

Species	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
<i>Aetobatus narinari</i>			1						1				2
<i>Dasyatis akajei</i>				1						1			2
<i>Dasyatis thetidis</i>			3										3
<i>Gymnura japonica</i>						1				1			2
<i>Himantura gerrardi</i>	2	5	2	2	8	5		1		2	4		31
<i>Himantura imbricata</i>					1								1
<i>Himantura jenkinsii</i>	1			2	2								5
<i>Himantura uanacoides</i>						3							3
<i>Himantura walga</i>		49	42	35	71	91	25	19		130	162	31	655
<i>Neotrygon kuhlii</i>	41	11	11	66	69	69	32	23	9	49	3		383
<i>Plesiobatis daviesi</i>								1					1
<i>Rhinobatos formosensis</i>	29	1	16	105	123	75	74	38	27		61		549
<i>Rhynchobatus australiae</i>			1		15	1			1				18
<i>Taeniurops meyeri</i>	1		1										2
Total Rays	74	66	77	211	289	245	131	82	38	183	230	31	1,657
<i>Carcharhinus leucas</i>			1										1
<i>Carcharhinus melanopterus</i>	1												1
<i>Carcharhinus sorrah</i>		2							10				12

<i>Chiloscyllium griseum</i>					5	15	1			1			22
<i>Chiloscyllium hasseltii</i>	2	55	7	8	5	1							78
<i>Chiloscyllium punctatum</i>	1	17	2	5	9	3	3		1				41
<i>Galeocerdo cuvier</i>	2				1			1					4
<i>Heptranchias perlo</i>							1						1
<i>Sphyrna lewini</i>									1				1
Total Sharks	6	74	10	13	20	19	5	1	12	1	0	0	161
Grand Total	80	140	87	224	309	264	136	83	50	184	230	31	1,818

2.2.5 Weight of Sharks and Rays by Species

A total of 3,330 kg was landed from 70 trawler landings comprising 2,981 kg rays and 349 kg sharks. For rays, the highest landing by weight was *Rhinobatos formosensis* amounting to 1,366 kg, followed by 636 kg *Neotrygon kuhlii* and 408 kg *Himantura walga*. The highest landing by month was 432 kg for *R. formosensis* in January, followed by 287 kg in December and 155 kg in November. For *Neotrygon kuhlii*, the highest landing was 210 kg in October, followed by 150 kg in September. For *Himantura walga*, the highest landing was 123 kg in January followed by 66 kg in October. Weight of other ray species ranged between 0.2–150.0 kg. The highest landing of shark species was 91 kg for *Galeocerdo cuvier* followed by 66 kg for *Chiloscyllium hasseltii* and 63 kg for *C. punctatum*. The highest landing by month for *G. cuvier* was 77 kg in September. For *Chiloscyllium hasseltii* and *C. punctatum*, the highest landing in October were 47 kg and 32 kg, respectively. Weight of other shark species ranged between 0.5–50.0 kg. The details are shown in **Table 16**.

2.2.6 Size Range of Sharks and Rays

In a half of ray species sampled in 2015 were mature, namely *Dasyatis thetidis*, *Himantura walga*, *Neotrygon kuhlii*, *Rhinobatos formosensis* and *Taeniurops meyeri*. The other species such as *Aetobatus narinari*, *Dasyatis akajei*, *Himantura jenkinsii*, *H. gerrardi* and *Rhynchobatus australiae* were immature. The average size of *Himantura gerrardi*, which common species ranged between 21.0- 46.5 cm disc length but no adult sized specimens were available (immediately removed by middlemen upon being landed). First maturing size for *Himantura gerrardi* is about 59.0 cm. It could be inferred that most of these species were exploited at the juvenile stage. Most shark species landed were mature except for *Carcharhinus sorrah* and *Galeocerdo cuvier*. First maturing size for these species are 105 cm and 230 cm total length, respectively. However, it could not be inferred the both sharks were exploited at the juvenile stage, because they were collected only one month for each species. While in 2016, half of ray species sample were mature except for *Gymnura japonica*, *Himantura gerrardi*, *Plesiobatis daviesi* and *Rhynchobatus australiae*. All of these species were juvenile. Almost of common rays, *Neotrygon kuhlii*, *Himantura walga* and *Rhinobatus formosensis* were mature during this period. Most common shark species, *Chiloscyllium griseum*, *C. hasseltii* and *C.*

punctatum were mature, but other sharks, *Carcharhinus sorrah*, *Heptranchias perlo* and *Sphyrna lewini* were immature. First maturing size for these species are 105 cm, 85 cm and 140 cm total length, respectively. Size range of all sharks and rays species are shown in **Table 17**.

Table 16: Weight of Sharks and Rays (in Kg) by Species from 70 Trawler Landings at Ranong Fishing Port

Species	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
<i>Aetobatus narinari</i>			30.0						32.0				62.0
<i>Dasyatis akajei</i>				0.2						1.5			1.7
<i>Dasyatis thetidis</i>			150.0										150.0
<i>Gymnura japonica</i>						3.0				0.2			3.2
<i>Himantura gerrardi</i>	17.8	2.3	16.5	1.3	19.3	1.8		0.3		1.7	1.0		62.2
<i>Himantura imbricata</i>					0.2								0.2
<i>Himantura jenkinsii</i>	3.0			16.6	24.2								43.8
<i>Himantura uanacoides</i>						92.2							92.2
<i>Himantura walga</i>		65.7	16.7	16.6	122.8	54.5	5.9	4.9		49.8	56.5	15.1	408.3
<i>Neotrygon kuhlii</i>	150.0	209.6	44.3	48.2	36.1	41.6	26.6	24.5	12.1	42.7	0.5		636.3
<i>Plesiobatis daviesi</i>								11.1					11.1
<i>Rhinobatos formosensis</i>	107.0	2.6	155.3	287.0	431.7	89.5	81.9	19.0	42.8		149.0		1,365.7
<i>Rhynchobatus australiae</i>			5.8		17.0	0.5			0.9				24.3
<i>Taeniurops meyeri</i>	80.0		40.0										120.0
Total weight rays	357.8	280.2	458.6	369.9	651.2	283.1	114.3	59.7	87.9	96.0	206.9	15.1	2,980.9
<i>Carcharhinus leucas</i>			50.0										50.0
<i>Carcharhinus melanopterus</i>	14.3												14.3
<i>Carcharhinus sorrah</i>		4.7							32.0				36.7
<i>Chiloscyllium griseum</i>					4.7	20.4	1.1			0.5			26.7
<i>Chiloscyllium hasseltii</i>	1.3	47.4	6.6	5.3	4.6	1.0							66.1
<i>Chiloscyllium punctatum</i>	2.1	31.7	3.5	5.2	11.0	2.3	4.5		2.2				62.5
<i>Galeocerdo cuvier</i>	77.2				8.5			4.9					90.5
<i>Heptranchias perlo</i>							1.2						1.2
<i>Sphyrna lewini</i>									0.6				0.6
Total weight sharks	94.8	83.9	60.1	10.5	28.8	23.7	6.7	4.9	34.8	0.5	0.0	0.0	348.6
Grand Total	452.7	364.1	518.6	380.4	680.0	306.8	121.0	64.6	122.7	96.5	206.9	15.1	3,329.5

Table 17: Size Range (cm) of Sharks, Rhinobatiformes (Total Length) and Rays (Disc Length) at Ranong Fishing Port.

Species	Month																	
	Sep-15			Oct			Nov			Dec			Jan-16			Feb		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Rays																		
<i>Aetobatus narinari</i>																		
<i>Dasyatis akajei</i>																		
<i>Dasyatis thetidis</i>																		
<i>Gymnura japonica</i>																37.0	37.0	37.0
<i>Himantura gerrardi</i>	35.3	46.5	40.9	22.0	35.3	46.5	40.9	22.0	35.3	46.5	40.9	22.0	18.0	73.5	26.2	19.5	22.0	21.0
<i>Himantura imbricata</i>													16.5	16.5	16.5			
<i>Himantura jenkinsii</i>	41.5	41.5	41.5		41.5	41.5	41.5		41.5	41.5	41.5		45.5	77.0	61.3			
<i>Himantura uanacoides</i>																66.5	128.5	99.3
<i>Himantura walga</i>				14.5				14.5				14.5	12.0	23.7	18.6	14.5	26.0	19.6
<i>Neotrygon kuhlii</i>	15.5	33.0	23.7	27.0	15.5	33.0	23.7	27.0	15.5	33.0	23.7	27.0	12.5	31.5	19.8	12.5	34.0	20.4
<i>Plesiobatis daviesi</i>																		
<i>Rhinobatos formosensis</i>	25.0	93.0	52.6	93.3	25.0	93.0	52.6	93.3	25.0	93.0	52.6	93.3	25.5	91.5	48.5	27.8	106.0	64.3
<i>Rhynchobatus australiae</i>													50.0	81.5	60.4			
<i>Taeniurops meyeri</i>																		
Sharks																		
<i>Carcharhinus leucas</i>																		
<i>Carcharhinus melanopterus</i>	128.0	128.0	128.0		128.0	128.0	128.0		128.0	128.0	128.0							
<i>Carcharhinus sorrah</i>				69.0				69.0				69.0						
<i>Chiloscyllium griseum</i>													53.0	66.0	59.5	39.5	62.5	53.9
<i>Chiloscyllium hasseltii</i>	55.0	63.0	59.0	35.5	55.0	63.0	59.0	35.5	55.0	63.0	59.0	35.5	41.5	68.0	58.1	62.5	62.5	62.5
<i>Chiloscyllium punctatum</i>	82.0	82.0	82.0	48.0	82.0	82.0	82.0	48.0	82.0	82.0	82.0	48.0	48.5	78.0	66.0	42.5	69.0	57.0
<i>Galeocerdo cuvier</i>	89.0	225.0	157.0		89.0	225.0	157.0		89.0	225.0	157.0		126.5	126.5	126.5			
<i>Heptranchias perlo</i>																		
<i>Sphyrna lewini</i>																		

Table 17: (con't)

Species	Month																	
	Mar-16			Apr			May			Jun			Jul			Aug		
	Min	Max	Ave	Min	Max	Min	Max	Ave	Min	Max	Min	Max	Ave	Min	Max	Min	Max	Ave
Rays																		
<i>Aetobatus narinari</i>																		
<i>Dasyatis akajei</i>																		
<i>Dasyatis thetidis</i>																		
<i>Gymnura japonica</i>																		
<i>Himantura gerrardi</i>				21.0	21.0				21.0	21.0			21.0	21.0				
<i>Himantura imbricata</i>																		
<i>Himantura jenkinsii</i>																		
<i>Himantura uanacoides</i>																		
<i>Himantura walga</i>	16.5	25.7	19.7	15.0	24.0	16.5	25.7	19.7	15.0	24.0	16.5	25.7	19.7	15.0	24.0	14.5	23.0	19.0
<i>Neotrygon kuhlii</i>	17.0	34.5	23.8	15.5	36.5	17.0	34.5	23.8	15.5	36.5	17.0	34.5	23.8	15.5	36.5			
<i>Plesiobatis daviesi</i>				78.0	78.0				78.0	78.0				78.0	78.0			
<i>Rhinobatos formosensis</i>	45.0	105.5	68.8	30.0	90.5	45.0	105.5	68.8	30.0	90.5	45.0	105.5	68.8	30.0	90.5			
<i>Rhynchobatus australiae</i>																		
<i>Taeniurops meyeri</i>																		
Sharks																		
<i>Carcharhinus leucas</i>																		
<i>Carcharhinus melanopterus</i>																		
<i>Carcharhinus sorrah</i>																		
<i>Chiloscyllium griseum</i>	63.8	63.8	63.8			63.8	63.8	63.8			63.8	63.8	63.8					
<i>Chiloscyllium hasseltii</i>																		
<i>Chiloscyllium punctatum</i>	64.0	75.0	71.2			64.0	75.0	71.2			64.0	75.0	71.2					
<i>Galeocerdo cuvier</i>				105.5	105.5				105.5	105.5				105.5	105.5			
<i>Heptranchias perlo</i>	72.5	72.5	72.5			72.5	72.5	72.5			72.5	72.5	72.5					
<i>Sphyrna lewini</i>																		

2.2.7 Catch Per Unit Effort

Sharks and Rays were catch by otter-board trawl and paired trawl. For trawls sampled during September, 2015-August, 2016, all data were used to calculated catch per unit effort (CPUE) as follows: The total number of days at operation by otter-board trawl and paired trawl were 541 days (2,164 hauls) and 123 days (369 hauls), respectively. The details are shown in **Table 18A-18B**. The CPUE rays by otter-board trawl ranged between 0.04-2.17 kg/day at operation and 0.01-0.54 kg/haul, and by paired trawl was 0.02-1.88 kg/day at operation and 0.01-0.63 kg/haul. The highest CPUE rays from otter-board and paired trawl were *Rhinobatos formosensis* with 2.17 kg/day at operation (0.54 kg/haul) and 1.88 kg/day at operation (0.63 kg/haul), respectively. The details are shown in **Table 19A-19B**. The highest CPUE sharks from otter-board was *Chiloscyllium hasseltii* with 0.11 kg/day at operation (0.03 kg/haul) and paired trawl was *Galeocerdo cuvier* with 0.67 kg/day at operation (0.22 kg/haul). The details are shown in **Table 19C-19D**. The number of ray individual calculated by using CPUE of ray was caught by otter-board trawl and paired trawl ranged between 0.03-3.19 and 0.02-1.89, respectively. The details are shown in **Table 20A-20B**. While the number of shark individual calculated by using CPUE of shark was caught by otter-board trawl and paired trawl ranged between 0.02-0.15 and 0.02-0.24, respectively. The highest shark species of both gears were *Chiloscyllium hasseltii* and *C. griseum*, respectively. The details are shown in **Table 20C-20D**.

Table 18A: Days at Operation by Trawls Sampled during September 2015-August 2016 at Ranong Fishing Port

Gear	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Otter-board trawl	20	42	43	107	97	47	40	10	14	40	63	18	541
Paired trawl	11	11	14	7		24	32	17	7				123

Table 18B: Numbers of Haul by Trawls Sampled during September 2015-August 2016 at Ranong Fishing Port

Gear	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Otter-board trawl	80	168	172	428	388	188	160	40	56	160	252	72	2,164
Paired trawl	33	33	42	21		72	96	51	21				369

Table 19A: CPUE of Rays Captured by Otter-board Trawl during September 2015- August 2016 at Ranong Fishing Port

Rank	Species	Total Weight (kg) by Species	CPUE (kg/Day at Operation)	CPUE (kg/Haul)
1	<i>Rhinobatos formosensis</i>	1,134.8	2.17	0.54
2	<i>Neotrygon kuhlii</i>	492.1	0.94	0.24
3	<i>Himantura walga</i>	368.4	0.68	0.17
4	<i>Taeniurops meyeri</i>	120.0	0.23	0.06
5	<i>Aetobatus narinari</i>	62.0	0.12	0.03
6	<i>Himantura gerrardi</i>	46.2	0.09	0.02
7	<i>Himantura jenkinsii</i>	43.8	0.08	0.02
8	<i>Dasyatis thetidis</i>	40.0	0.08	0.02
9	<i>Rhynchobatus australiae</i>	23.4	0.04	0.01

Table 19B: CPUE of Rays Captured by Paired Trawl during September 2015- August 2016 at Ranong Fishing Port

Rank	Species	Total Weight (kg) by Species	CPUE (kg/Day at Operation)	CPUE (kg/Haul)
1	<i>Rhinobatos formosensis</i>	230.9	1.88	0.63
2	<i>Neotrygon kuhlii</i>	144.2	1.17	0.39
3	<i>Dasyatis thetidis</i>	110.0	0.89	0.30
4	<i>Himantura uanacoides</i>	92.2	0.75	0.25
5	<i>Himantura walga</i>	39.9	0.32	0.11
6	<i>Himantura gerrardi</i>	16.0	0.13	0.04
7	<i>Plesiobais deviesi</i>	11.1	0.09	0.03
8	<i>Gymnura japonica</i>	3.0	0.02	0.01

Table 19C: CPUE of Sharks Captured by Otter-board Trawl during September 2015- August 2016 at Ranong Fishing Port

Rank	Species Name	Total Weight (kg) by Species	CPUE (kg/Day at Operation)	CPUE (kg/Haul)
1	<i>Chiloscyllium hasseltii</i>	59.4	0.11	0.03
2	<i>Carcharhinus leucas</i>	50.0	0.10	0.02
3	<i>Chiloscyllium punctatum</i>	46.3	0.09	0.02
4	<i>Carcharhinus sorrah</i>	34.0	0.06	0.02

Table 19D: CPUE of Sharks Captured by Paired Trawl during September 2015- August 2016 at Ranong Fishing Port

Rank	Species Name	Total Weight (kg) by Species	CPUE (kg/Haul)	CPUE _{pue} (kg/Haul)
1	<i>Galeocerdo cuvier</i>	82.1	0.67	0.22
2	<i>Chiloscyllium griseum</i>	20.4	0.17	0.06
3	<i>Chiloscyllium punctatum</i>	16.3	0.13	0.04
4	<i>Carcharhinus melanopterus</i>	14.3	0.12	0.04
5	<i>Chiloscyllium hasseltii</i>	6.8	0.05	0.02
6	<i>Carcharhinus sorrah</i>	2.7	0.02	0.01

Table 20A: CPUE of Rays (Individuals) Captured by Otter-board Trawl during September 2015- August 2016 at Ranong Fishing Port

Rank	Scientific Name	Estimated No. of Species	CPUE (Ind/Day at Operation)	CPUE (Ind/Haul)
1	<i>Himantura walga</i>	1,727	3.19	0.80
2	<i>Rhinobatos formosensis</i>	1,642	3.04	0.76
3	<i>Neotrygon kuhlii</i>	661	1.22	0.31
4	<i>Himantura gerrardi</i>	35	0.07	0.02
5	<i>Rhynchobatus australiae</i>	17	0.03	0.01

Table 20B: CPUE of Rays (Individuals) Captured by Paired Trawl during September 2015- August 2016 at Ranong Fishing Port

Rank	Scientific Name	Estimated No. of Species	CPUE (Ind/Day at Operation)	CPUE (Ind/Haul)
1	<i>Rhinobatos formosensis</i>	232	1.89	0.63
2	<i>Neotrygon kuhlii</i>	215	1.75	0.58
3	<i>Himantura walga</i>	161	1.31	0.44
4	<i>Himantura gerrardi</i>	27	0.22	0.07
5	<i>Himantura uanacoides</i>	3	0.02	0.01
6	<i>Dasyatis thetidis</i>	2	0.02	0.01

Table 20C: CPUE of Sharks (Individuals) Captured by Otter-board Trawl during September 2015- August 2016 at Ranong Fishing Port

Rank	Scientific Name	Estimated No. of Species	CPUE (Ind/Day at Operation)	CPUE (Ind/Haul)
1	<i>Chiloscyllium hasseltii</i>	80	0.15	0.04
2	<i>Chiloscyllium punctatum</i>	31	0.06	0.01
3	<i>Carcharhinus sorrah</i>	11	0.02	0.01

Table 20D: CPUE of Sharks (Individuals) Captured by Paired Trawl during September 2015- August 2016 at Ranong Fishing Port

Rank	Scientific Name	Estimated No. of Species	CPUE (Ind/Day at Operation)	CPUE (Ind/Haul)
1	<i>Chiloscyllium griseum</i>	29	0.24	0.08
2	<i>Chiloscyllium punctatum</i>	10	0.08	0.03
3	<i>Chiloscyllium hasseltii</i>	7	0.06	0.02
4	<i>Galeocerdo cuvier</i>	3	0.02	0.01

2.2.8 Usage and Marketing

Information on marketing collected at this landing site indicated that most sharks and rays were consumed locally similar to Songkhla. The major markets were wholesale market in Ranong Province. The price varied according to species. The most expensive ray, *Aetobatus narinari* was sold at 50-120 Baht/kg followed by *Himantura gerrardi* at 12-100 Baht/kg. The price of *Dasyatis akajei*, *D. zugei*, *Neotrygon kuhlii*, *Himantura walga* and *Rhynchobatus australiae* were varied by size and sold at 20-60 Baht/kg. In general, bigger sized rays were more expensive than smaller ones. Utilization of *Aetobatus narinari* is used only for consumption and *Himantura gerrardi* is the major species using for leather industries and consumption. The normal price of sharks ranged between 20-125 Baht/kg. The most expensive sharks, *Carcharhinus leucas*, *C. melanopterus* and *C. sorrah* were sold at 80-110 Baht/kg.

Normally the price at wet markets was about 20-50% higher than at landing site. All sharks and rays were landed whole with fins. The details are shown in **Table 21**. Small, medium and big size category for each species is as shown in **Appendix V**.

Table 21: Price of Sharks and Rays by Species at Ranong Landing Site during 2015-2016. All Prices in Baht per Kilogram. (Exchange rate: Baht 35= US\$ 1.00)

Species	Range Price (Baht/kg)	Part	Market Destination
Rays			
<i>Aetobatus narinari</i>	50-120	Whole body	Local market in Ranong Province
<i>Dasyatis akajei</i>	15-50	Whole body	Local market in Ranong Province
<i>Dasyatis thetidis</i>	20	Whole body	Local market in Ranong Province
<i>Gymnura japonica</i>	15-45	Whole body	Local market in Ranong Province
<i>Himantura gerrardi</i>	12-100	Whole body	Local market in Ranong Province
<i>Himantura imbracata</i>	15-52	Whole body	Local market in Ranong Province
<i>Himantura jenkinsii</i>	20-60	Whole body	Local market in Ranong Province
<i>Himantura uanacoides</i>	15-65	Whole body	Local market in Ranong Province
<i>Himantura walga</i>	15-52	Whole body	Local market in Ranong Province
<i>Neotrygon kuhlii</i>	11-57	Whole body	Local market in Ranong Province
<i>Plesiobatis deviesi</i>	20	Whole body	Local market in Ranong Province
<i>Rhinobatos formosensis</i>	8-40	Whole body	Local market in Ranong Province
<i>Rhynchobatus australiae</i>	15-60	Whole body	Local market in Ranong Province
<i>Taeniurops meyeri</i>	12	Whole body	Local market in Ranong Province
Sharks			
<i>Carcharhinus leucas</i>	80-110	Whole body	Local market in Ranong Province
<i>Carcharhinus melanopterus</i>	80-110	Whole body	Local market in Ranong Province
<i>Carcharhinus sorrah</i>	80-110	Whole body	Local market in Ranong Province
<i>Chiloscyllium griseum</i>	33-63	Whole body	Local market in Ranong Province
<i>Chiloscyllium hasseltii</i>	24-70	Whole body	Local market in Ranong Province
<i>Chiloscyllium punctatum</i>	24-70	Whole body	Local market in Ranong Province
<i>Galeocerdo cuvier</i>	30-50	Whole body	Local market in Ranong Province
<i>Heptranchias perlo</i>	39-64	Whole body	Local market in Ranong Province
<i>Sphyrna lewini</i>	35-50	Whole body	Local market in Ranong Province

3. CONCLUSION

A pilot project on recording landing data of sharks and rays up to species level was conducted in the Southern Thailand. During this project 20 officers of Department of Fisheries were trained in taxonomy and in data collection using the new harmonized format. Two provinces of Southern Thailand, namely Songkhla and Ranong were selected as the study sites as they were the main landing sites of sharks and rays in the Southern Thailand. The landing data were collected at 2 fishing ports under Fish Marketing Organization of each province.

A total of 13 species of sharks from 3 Orders and 6 Families, and 16 species of rays from 2 Orders and 6 Families were recorded. Ranong recorded the highest with 9 species of sharks and 14 rays and Songkhla with 9 species of sharks and 7 rays. Details are shown in **Appendix**

III. In term of percentage of total marin landings, sharks and rays only contributed 0.37% and 0.39% at Songkhla, and 0.03% and 0.26% at Ranong respectivley. These figures confirmed earlier data as published in Fisheries Statistics of Thailand that both of sharks and rays were only by-catch and not targeted and contributed less than 0.5% of the total marine landing.

The most abundant shark species at Songkhla were *Chiloscyllium punctatum* and *Atelomycterus marmoratus* and for rays were *Dasyatis zugei* and *Himantura walga*. The most common shark species were *Chiloscyllium. punctatum*, and *Atelomycterus marmoratus* while for rays were *Dasyatis zugei*, *Himantura walga*, *D. akajei* and *Neotrygon kuhlii*.

The most abundant sharks species at Ranong were *Chiloscyllium hasseltii*, *C. punctatum* and *C. griseum* while for rays were *Rhinobatos formosensis*, *Himantura walga* and *Neotrygon kuhlii*. The most common shark species were *Chiloscyllium punctatum* and *C. hasseltii* while for rays were *Neotrygon kuhlii*, *Rhinobatos formosensis*, *Himantura walga*, and *H. gerrardi*.

All big sized sharks of more than 2 meters in total length such as *Carcharhinus leucas* and *Galeocerdo cuvier*, medium sized sharks such as *C. melanopterus*, *C. amblyrhynchos* and *C. sorrah* were rarely caught due to nature of fishing area and gear used. Usage and marketing information from this study also confirmed earlier report in the draft NPOA-Shark that all sharks and rays were landed whole, fully utilised with no finning activities on board of vessels.

4.0 OUTPUT AND OUTCOME

The project outputs and outcomes are summarised in **Table 22** as shown below.

Table 22: Output and Outcome

No	Output	Outcome
1.	Twenty trained personnel in sharks and rays taxonomy from the Department of Fisheries, Thailand.	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 pilot project sites.	Confirmed earlier data published in Fisheries Statistics of Thailand. Both of sharks and rays were not targeted and contributed less than 0.5% 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.	Stage of maturity for the different species of sharks and rays determined.	Increased awareness of needs and measures for shark conservation and management among stakeholders
7.	Information on usage and marketing of the landed sharks and rays were obtained from the pilot project.	Confirmed earlier report in the draft NPOA-Sharks that all sharks and rays are landed whole, fully utilised with no finning activities onboard vessels.
8.	A report on landing of sharks and rays up to species level from 2 sites in Southern Thailand.	Data recording on sharks and rays will be improved from generic terms 'sharks' and 'rays' to species level.
9.	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
10.	Specimens collected during sampling activities deposited for future reference.	Some specimens were collected at Reference Collection of Phuket Marine Biological Center (PMBC)

5.0 FUTURE ACTIVITIES

Thailand recorded landing data up to species level at landing sites along the coastal province of Thailand since 2011. Data collection at the current 2 landing sites is to be continued. The draft NPOA-Sharks is completing, that Department of Fisheries has a plan for organizing stakeholder consultation in this year before the improvement of NPOA-Sharks and proclamation next year. All activities are shown in **Appendix IV**

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Checklist of Cartilaginous Fishes (Class Chondrichthyes) in Thai Water and Adjacent Areas, 2016

Order	Family	No.	Thai name	English name	Scientific name
Sharks					
1) Hexanchiformes	1) Hexanchidae	1	cha-lam-pak-jing-jog	Sharpnose sevengill shark	<i>Hepranchias perlo</i> (Bonnaterre, 1788)
		2	cha-lam-ngueg-hok-chong	Bigeye sixgill shark	<i>Hexanchus nakamurai</i> Teng, 1962
2) Squaliformes	2) Echinorhinidae	3	cha-lam-naum	Bramble shark	<i>Echinorhinus brucus</i> (Bonnaterre, 1788)
	3) Squalidae	4	cha-lam-naum-yaw	Indonesian shortsnout spurdog	<i>Squalus hemipinnis</i> White, Last & Yearsley, 2007
		5	cha-lam-lang-naum	Shortnose spurdog	<i>S. megalops</i> (Macleay, 1881)
		6	cha-lam-lang-naum	Spiny dogfish	<i>Squalus</i> sp.
	4) Etmopteridae	7	cha-lam-tong-dam	Sculpted lanternshark	<i>Etmopterus sculpus</i> Ebert, Compagno & De Vries, 2011
3) Squatiniformes	5) Squatinidae	8	cha-lam-nang-fah	Angels shark	<i>Squatina</i> sp.
		9	cha-lam-nang-fah	Ocellated angels shark	<i>S. tergocellatoides</i> Chen, 1963
4) Heterodontiformes	6) Heterodontidae	10	cha-lam-na-wua-lai	Zebra bullhead shark	<i>Heterodontus zebra</i> (Gray, 1831)
5) Orectolobiformes	7) Orectolobidae	11	cha-lam-kob-yi-pun	Japanese wobbegong	<i>Orectolobus cf. japonicus</i> Regan, 1906
		12	cha-lam-pak-nuad	Indonesian wobbegong	<i>O. leptolineatus</i> Last, Pogonoski & White, 2010
	8) Hemiscylliidae	13	cha-lam-kob	Grey bambooshark	<i>Chiloscyllium griseum</i> Müller & Henle, 1838
		14	cha-lam-kob	Indonesian bambooshark	<i>C. hasseltii</i> Bleeker, 1852
		15	cha-lam-lai	Slender bambooshark	<i>C. indicum</i> (Gmelin, 1789)
		16	cha-lam-kob-lai	Whitespotted bambooshark	<i>C. plagiosum</i> (Bennett, 1830)
		17	cha-lam-kob	Brownbanded bambooshark	<i>C. punctatum</i> Müller & Henle, 1838
	9) Ginglymostomatidae	18	cha-lam-ki-sao	Tawny nurse shark	<i>Nebrius ferrugineus</i> (Lesson, 1831)
	10) Stegostomatidae	19	cha-lam-suea-dao	Zebra shark	<i>Stegostoma fasciatum</i> (Hermann, 1783)
	11) Rhincodontidae	20	cha-lam-wan	Whale shark	<i>Rhincodon typus</i> Smith, 1828
6) Lamniformes	12) Odontaspidae	21	cha-lam-sai	Sand tiger shark	<i>Carcharias taurus</i> Rafinesque, 1810
	13) Megachasmidae	22	cha-lam-pak-gwang	Megamouth shark	<i>Megachasma pelagios</i> Taylor, Compagno & Struhsaker, 1983
	14) Alopiidae	23	cha-lam-hang-yaw	Pelagic thresher	<i>Alopias pelagicus</i> Nakamura, 1935
		24	cha-lam-hang-yaw-na-nu	Bigeye thresher	<i>A. superciliosus</i> (Lowe, 1841)
		25	cha-lam-hang-yaw	Thresher shark	<i>A. vulpinus</i> (Bonnaterre, 1788)
	15) Lamnidae	26	cha-lam-pak-ma	Shortfin mako shark	<i>Isurus oxyrinchus</i> Rafinesque, 1810
		27	cha-lam-pak-mom	Longfin mako	<i>I. paucus</i> Guitart, 1966
7) Carcharhiniformes	16) Scyliorhinidae	28	cha-lam-kob-lai-hin-on	Coral catshark	<i>Atelomycterus marmoratus</i> (Bennett, 1830)
		29	cha-lam-kiaw	Bristly catshark	<i>Bythaelurus hispidus</i> (Alcock, 1891)
		30	cha-lam-tong-pong	Australian reticulate swellshark	<i>Cephaloscyllium cf. hiscosellum</i> White & Ebert, 2008
		31	cha-lam-tong-pong	Indian swellshark	<i>C. silasi</i> (Talwar, 1974)
		32	cha-lam-tong-pong	Speckled swellshark	<i>C. cf. speccum</i> Last, Seret & White, 2008
		33	cha-lam-kob-jud	Blackspotted catshark	<i>Halaelurus buergeri</i> (Müller & Henle, 1838)
	17) Proscylliidae	34	cha-lam-lai-mek	Magnificent catshark	<i>Proscyllium magnificum</i> Last & Vongpanich, 2004
	18) Triakidae	35	cha-lam-ma-ta-to	Bigeye houndshark	<i>Iago omanensis</i> (Norman, 1939)
		36	cha-lam-ma-jud-kao	Starspotted smooth-hound	<i>Mustelus manazo</i> Bleeker, 1854
		37	cha-lam-na	Arabian smooth-hound	<i>M. mosi</i> Hemprich & Ehrenberg, 1899
		38	cha-lam-ma-jud-kao	White-spotted gummy shark	<i>M. cf. stevensi</i> White & Last, 2008
	19) Hemigaleidae	39	cha-lam-nu	Hooktooth shark	<i>Chaenogaleus macrostoma</i> (Bleeker, 1852)
		40	cha-lam-nu	Sicklefin weasel shark	<i>Hemigaleus microstoma</i> Bleeker, 1852
		41	cha-lam-nu	Snaggletooth shark	<i>Hemipristis elongata</i> (Klunzinger, 1871)
		42	cha-lam-nu	Slender weasel shark	<i>Paragaleus randalli</i> Compagno, Krupp & Carpenter, 1996
		43	cha-lam-nu	Straight-tooth weasel shark	<i>P. tengi</i> (Chen, 1963)
	20) Carcharhinidae	44	cha-lam-hu-kao	Silvertip shark	<i>Carcharhinus albimarginatus</i> (Rüppell, 1837)
		45	cha-lam-ja-muk-to	Bignose shark	<i>C. altimus</i> (Springer, 1950)
		46	cha-lam-hu-dam	Graceful shark	<i>C. amblyrhynchoides</i> (Whitley, 1934)
		47	cha-lam-krib-dam-yai	Grey reef shark	<i>C. amblyrhynchus</i> (Bleeker, 1856)
		48	cha-lam-ta-lek	Pigeon shark	<i>C. amboinensis</i> (Müller & Henle, 1839)
		49	cha-lam-krib-diang	Copper shark	<i>C. brachyurus</i> (Günther, 1870)
		50	cha-lam-hu-dam	Spinner shark	<i>C. brevipinna</i> (Müller & Henle, 1839)
		51	cha-lam-nu	Whitecheek shark	<i>C. dussumieri</i> (Müller & Henle, 1839)
		52	cha-lam-thao	Silky shark	<i>C. falciformis</i> (Müller & Henle, 1839)
		53	cha-lam-hua-baht	Bull shark	<i>C. leucas</i> (Müller & Henle, 1839)
		54	cha-lam-hu-dam-lek	Blacktip shark	<i>C. limbatus</i> (Müller & Henle, 1839)
		55	cha-lam-krib-yaw	Oceanic whitetip shark	<i>C. longimanus</i> (Poey, 1861)
		56	cha-lam-ja-muk-yaw	Hardnose shark	<i>C. macloti</i> (Müller & Henle, 1839)
		57	cha-lam-hu-dam	Blacktip reef shark	<i>C. melanopterus</i> (Quoy & Gaimard, 1824)
		58	cha-lam-thao	Dusky shark	<i>C. obscurus</i> (LeSueur, 1818)
		59	cha-lam-ka-dong-sung	Sandbar shark	<i>C. plumbeus</i> (Nardo, 1827)
		60	cha-lam-nu	Blackspot shark	<i>C. sealei</i> (Pietschmann, 1913)
		61	cha-lam-hu-dam	Spottail shark	<i>C. sorrah</i> (Müller & Henle, 1839)
		62	cha-lam-suea	Tiger shark	<i>Galeocerdo cuvier</i> (Peron & LeSueur, 1822)
		63	cha-lam-mae-nam	Ganges shark	<i>Glyphis cf. gangeticus</i> (Müller & Henle, 1839)
		64	cha-lam-mae-nam	Borneo broadfin shark	<i>Lamiopsis tephrodes</i> (Fowler, 1905)
		65	cha-lam-ta-chik	Sliteye shark	<i>Loxodon macrorhinus</i> Müller & Henle, 1839
		66	cha-lam-krib-kong	Sicklefin lemon shark	<i>Negaprion acutidens</i> (Rüppell, 1837)
		67	cha-lam-sri-nam-ngem	Blue shark	<i>Prionace glauca</i> (Linnaeus, 1758)
		68	cha-lam-nu-hua-learn	Milk shark	<i>Rhizoprionodon acutus</i> (Rüppell, 1837)
		69	cha-lam-nu-hua-learn	Grey sharpnose shark	<i>R. oligolinx</i> Springer, 1964

Order	Family	No.	Thai name	English name	Scientific name
		70	cha-lam-nu-hua-learn	Spadenose shark	<i>Scoliodon laticaudus</i> Müller & Henle, 1838
		71	cha-lam-nu-hua-learn	Pacific spadenose shark	<i>S. macrorhynchus</i> (Bleeker, 1852)
		72	cha-lam-krib-kae	Whitetail reef shark	<i>Triaenodon obesus</i> (Rüppell, 1837)
	21) Sphymidae	73	cha-lam-hua-kon-yaw	Winghead shark	<i>Eusphyrus blochii</i> (Cuvier, 1816)
		74	cha-lam-hua-kon	Scalloped hammerhead shark	<i>Sphyrna lewini</i> (Griffith & Smith, 1834)
		75	cha-lam-hua-kon	Great hammerhead shark	<i>S. mokarran</i> (Rüppell, 1837)
		76	cha-lam-hua-kon	Smooth hammerhead shark	<i>S. zygaena</i> (Linnaeus, 1758)
Rays					
1) Pristiformes	1) Pristidae	1	cha-nag-pak-laem	Point sawfish	<i>Anoxypristis cuspidata</i> (Latham, 1794)
		2	cha-nag-yak	Large-tooth sawfish	<i>Pristis pristis</i> (Linnaeus, 1758)
		3	cha-nag-khiao	Green sawfish	<i>P. zijsron</i> Bleeker, 1851
2) Rhinobatiformes	2) Rhinidae	4	ro-nin-gra-ben-tong-nam	Bowmouth guitarfish	<i>Rhina ancylostoma</i> Bloch & Schneider, 1801
	3) Rhynchobatidae	5	ro-nan-jud-kae	Whitespotted wedgetail	<i>Rhynchobatus australiae</i> Whitley, 1939
		6	ro-nan-jud-kae	Smooth nose wedgetail	<i>R. laevis</i> (Bloch & Schneider, 1801)
		7	ro-nan-jud-kae	Eyebrow wedgetail	<i>R. palpebratus</i> Compagno & Last, 2008
		8	ro-nan-jud-kae-lai	Broadnose wedgetail	<i>R. springeri</i> Compagno & Last, 2010
	4) Rhinobatidae	9	ro-nan-med	Granulated guitarfish	<i>Glaucoctegus granulatus</i> (Cuvier, 1829)
		10	ro-nan-hua-sai-yak	Thailand pointed guitarfish	<i>G. cf. granulatus</i> (Cuvier, 1829)
		11	ro-nan-ja-mug-kwang	Widenose guitarfish	<i>G. obtusus</i> Müller & Henle, 1841
		12	ro-nan-hua-jing-jog	Clubnose guitarfish	<i>G. thouin</i> (Anonymous [Lacepede], 1798)
		13	ro-nan-hua-sai-yak	Giant shovelnose ray	<i>G. typus</i> (Bennett, 1830)
		14	ro-nan-hua-sai	Taiwan guitarfish	<i>Rhinobatos formosensis</i> Norman, 1926
		15	ro-nan-hua-sai-jud-kae	Spotted guitarfish	<i>R. punctifer</i> Compagno & Randall, 1987
		16	ro-nan-hua-sai	Brown guitarfish	<i>R. schlegelii</i> Müller & Henle, 1841
	5) Platyrrhinidae	17	ro-nan-hua-korm	Thailand fanray	<i>Platyrrhina</i> sp.
3) Torpediniformes	6) Narcinidae	18	gra-ben-fai-fa-jud-nam-tan	Shortlip numbfish	<i>Narcine brevilibata</i> Bessednov, 1966
		19	gra-ben-fai-fa-nam-tan	Brown numbfish	<i>N. brunnea</i> Annandale, 1909
		20	gra-ben-fai-fa-in-dia	Largespotted numbfish	<i>N. indica</i> Henle, 1834
		21	gra-ben-fai-fa-jod	Darkfined numbfish	<i>N. maculata</i> (Shaw, 1804)
		22	gra-ben-fai-fa-jud-lek	Tonkin numbfish	<i>N. prodorsalis</i> Bessednov, 1966
		23	gra-ben-fai-fa-jud-dam	Blackspotted numbfish	<i>N. timlei</i> (Bloch & Schneider, 1801)
	7) Narkidae	24	gra-ben-fai-fa-hang-jud	Spottail sleeper ray	<i>Narke dipterygia</i> (Bloch & Schneider, 1801)
		25	gra-ben-fai-fa-lang-riab	Finless sleeper ray	<i>Temera hardwickii</i> Gray, 1831
4) Rajiformes	8) Anacanthobatidae	26	gra-ben-kra-yaw	Thailand legskate	<i>Anacanthobatis</i> sp.1
	9) Rajidae	27	gra-ben-lang-naum-jud	Borneo sand skate	<i>Okamejei cairae</i> Last, Fahmi & Ishihara, 2010
		28	gra-ben-lang-naum-jud	Yellow-spotted skate	<i>O. hollandi</i> (Jordan & Richardson, 1909)
		29	gra-ben-lang-naum-jud	Sulu sea skate	<i>O. jensenae</i> Last & Lim, 2010
		30	gra-ben-lang-naum-jud	Whiteblotched skate	<i>O. cf. powelli</i> (Alcock, 1898)
5) Myliobatiformes	10) Plesiobatidae	31	gra-ben-nam-luek	Deepwater stingray	<i>Plesiobatis daviesi</i> (Wallace, 1967)
	11) Urolophidae	32	gra-ben-nam-luek	Java stingaree	<i>Urolophus javanicus</i> (Martens, 1864)
	12) Dasyatidae	33	gra-ben-hang-hwai	Whip stingray	<i>Dasyatis akajei</i> (Müller & Henle, 1841)
		34	gra-ben-hang-san	Short tail stingray	<i>D. breviceaudata</i> (Hutton, 1875)
		35	gra-ben-pak-mae-nam	Estuary stingray	<i>D. fluviarium</i> Ogilby, 1908
		36	gra-ben-lao	Mekong stingray	<i>D. laosensis</i> Roberts & Kamasuta, 1987
		37	gra-ben-ta-lek	Smalleye stingray	<i>D. microps</i> (Annandale, 1908)
		38	gra-ben-krae-dam	Dwarf black stingray	<i>D. parvonigra</i> Last & White, 2008
		39	gra-ben-hang-naum-yai	Thomtail stingray	<i>D. thetidis</i> Ogilby, 1899
		40	gra-ben-hang-naum-lek	Cow stingray	<i>D. ushieii</i> (Jordan & Hubbs, 1925)
		41	gra-ben-pak-laem	Sharpnose stingray	<i>D. zugei</i> (Müller & Henle, 1841)
		42	gra-ben-jud-dam	Blackspotted whipray	<i>Himantura astra</i> Last, Manjaji-Matsumoto & Pogonoski, 2008
		43	gra-ben-chao-phra-ya	Giant freshwater stingray	<i>H. chaophraya</i> Monkolprasit & Roberts, 1990
		44	gra-ben-lai-dok	Pink whipray	<i>H. fai</i> Jordan & Seale, 1906
		45	gra-ben-ma-laeng-wan	Whitespotted whipray	<i>H. gerrardi</i> (Gray, 1851)
		46	gra-ben-jud-kae	Mangrove whipray	<i>H. granulata</i> (Macleay, 1883)
		47	gra-bang	Scaly whipray	<i>H. imbricata</i> (Bloch & Schneider, 1801)
		48	gra-ben-tong-hang-naum	Golden whipray	<i>H. jenkinsii</i> (Annandale, 1909)
		49	gra-ben-mae-kong	Maeklong whipray	<i>H. kittipongi</i> Vidthayanon & Roberts, 2005
		50	gra-ben-lai-suea-dao	Leopard whipray	<i>H. leoparda</i> Manjaji-Matsumoto & Last, 2008
		51	gra-ben-bua	Tubemouth whipray	<i>H. aff. lobistoma</i> Manjaji-Matsumoto & Last, 2006
		52	gra-ben-lai-suea	Longnose marble whipray	<i>H. oxyrhynchus</i> (Sauvage, 1878)
		53	gra-ben-bua	Round whipray	<i>H. pastinacoides</i> (Bleeker, 1852)
		54	gra-ben-kae	White-edge freshwater whipray	<i>H. signifer</i> Compagno & Roberts, 1982
		55	gra-ben-ja-muk-kae	Whitenose whipray	<i>H. uarnacoides</i> (Bleeker, 1852)
		56	gra-ben-lai-suea-lek	Reticulate whipray	<i>H. uarnak</i> (Forskål, 1775)
		57	gra-ben-lai-suea-yai	Leopard whipray	<i>H. undulata</i> (Bleeker, 1852)
		58	gra-ben-tuk-ta	Dwarf whipray	<i>H. walga</i> (Müller & Henle, 1841)
		59	gra-ben-ja-muk-to	Bluespotted maskray	<i>Neotrygon kuhlii</i> (Müller & Henle, 1841)
		60	gra-ben-pic-tai	Peppered maskray	<i>N. cf. picta</i> Last & White, 2008
		61	gra-ben-thong	Banana-tail ray	<i>Pastinachus atrus</i> (Macleay, 1883)
		62	gra-ben-thong	Narrowtail stingray	<i>P. gracilicaudus</i> Last & Manjaji-Matsumoto, 2010
		63	gra-ben-thong	Starrynose stingray	<i>P. stellurostris</i> Last, Fahmi & Naylor, 2010
		64	gra-ben-dam	Pelagic stingray	<i>Pteroplatytrygon violacea</i> (Bonaparte, 1832)
		65	gra-ben-tong	Ribbontail stingray	<i>Taeniura lymma</i> (Forskål, 1775)
		66	gra-ben-tok-ka	Blotched fantail stingray	<i>Taeniurops meyeri</i> (Müller and Henle, 1841)
		67	gra-ben-bi-ka-nun	Porcupine ray	<i>Urogymnus asperrimus</i> (Bloch & Schneider, 1801)
	13) Gymnuridae	68	gra-ben-phi-suea-yi-pun	Japanese butterfly ray	<i>Gymnura japonica</i> (Temminck & Schlegel, 1850)
		69	gra-ben-phi-suea	Smooth butterfly ray	<i>G. cf. micrura</i> (Bloch & Schneider, 1801)
		70	gra-ben-phi-suea-hang-yai	Longtail butterfly ray	<i>G. poecilura</i> (Shaw, 1804)
		71	gra-ben-phi-suea-hang-lai	Zonetail butterfly ray	<i>G. zonura</i> (Bleeker, 1852)
	14) Myliobatidae	72	gra-ben-nok	Whitespotted eagle ray	<i>Aetobatus ocellatus</i> (Kuhl, 1823)
		73	gra-ben-nok-jud-kae	Mottled eagle ray	<i>Aetomylaeus maculatus</i> (Gray, 1834)
		74	gra-ben-nok	Ocellate eagle ray	<i>A. milvus</i> (Müller & Henle, 1841)
		75	gra-ben-nok-bang	Banded eagle ray	<i>A. nichofii</i> (Bloch & Schneider, 1801)
		76	gra-ben-nok	Ornate eagle ray	<i>A. vespertilio</i> (Bleeker, 1852)

Order	Family	No.	Thai name	English name	Scientific name
	15) Rhinopteridae	77	gra-ben-ja-muk-wua	Javanese cownose ray	<i>Rhinoptera javanica</i> Müller & Henle, 1841
	16) Mobulidae	78	gra-ben-man-ta	Reef manta ray	<i>Manta alfredi</i> (Kreff, 1868)
		79	gra-ben-man-ta-yak	Giant manta ray	<i>M. birostris</i> (Walbaum, 1792)
		80	gra-ben-ra-hu-kao-yaw	Longhomed mobula	<i>Mobula eregoodootenkee</i> (Bleeker, 1859)
		81	gra-ben-ra-hu-hang-naum	Spinetail devil ray	<i>M. japonica</i> (Müller & Henle, 1841)
		82	gra-ben-ra-hu-krib-san	Shortfin devil ray	<i>M. kuhlii</i> (Müller & Henle, 1841)
		83	gra-ben-ra-hu-krib-learn	Sicklefin devil ray	<i>M. tarapacana</i> (Philippi, 1892)
		84	gra-ben-ra-hu	Smoothtail devil ray	<i>M. thurstoni</i> (Lloyd, 1908)
Chimaera					
1) Chimaeriformes	1) Chimaeridae	1	cha-lam-pi, pra-nu	Silver chimaera	<i>Chimaera</i> cf. <i>phantasma</i> Jordan & Snyder, 1900
		2	cha-lam-pi, pra-nu	Ghostshark	<i>Hydrolagus</i> sp.

SAMPLE OF STANDARD FORM

Data Collection Project on Shark and Ray Data Collection

Name of Enumerator: _____ Date: _____

Name of Landing Site: _____ Vessel Registration No: _____

GRT : _____

Type of Gear: _____ Fishing Area: _____ No. of days/trip: _____

A. Standard Operation Procedure:

1. This form is for a single sampling vessel.
2. Collect all fish (sharks, skates and rays) if catch is less than 50 tails or 10-50% of the landed catch if more than 50 tails. Take samples randomly.
3. Separate them by species and sex.
4. Measure total length for all sharks, skates and rays from the Family Rhynchobatidae, Rhinobatidae, Narcinidae and Narkidae. Measure disc length for other ray species.
5. Record weight of all sharks, skates and rays by species.
6. Record weight of commercial and low-value species.

B. Measurement of sample (Sharks)

No.	Species	Sex	Total length (mm)					
1								
2								
3								

C. Actual Weight of Sharks by Species

No	Species	Weight (Kg)
1		
2		
3		

D. Measurement of sample (Rays)

No.	Species	Sex	Total length/Disc Length (mm)					
1								
2								
3								
4								

E. Actual Weight of Rays by Species

No	Species	Weight (Kg)
1		
2		
3		
4		
5		

F. Total Catch of Sampling Vessel

No.	Vessel Registration No	All Sharks	All Rays	Commercial species	Low-value species	TOTAL
1.						

G. Price of Sharks

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

I. Price of Rays

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

Note: _____

Checklist of Shark and Ray Species Recorded During the Study Period

No	Orders/Families	Site 1	Site 2
	ORDER MYLIOBATIFORMES	Songkhla	Ranong
	Family Plesiobatidae		
1	<i>Plesiobatis daviesi</i>		+
	Family Dasyatidae		
2	<i>Dasyatis akajei</i>	+	+
3	<i>Dasyatis thetidis</i>		+
4	<i>Dasyatis zugei</i>	+	
5	<i>Himantura gerrardi</i>	+	+
6	<i>Himantura imbricata</i>		+
7	<i>Himantura jenkinsii</i>		+
8	<i>Himantura uarnacooides</i>		+
9	<i>Himantura walga</i>	+	+
10	<i>Neotrygon kuhlii</i>	+	+
11	<i>Taeniurops meyeri</i>		+
	Family Gymnuridae		
12	<i>Gymnura japonica</i>		+
	Family Myliobatidae		
13	<i>Aetobatus narinari</i>		+
14	<i>Aetobatus ocellatus</i>	+	
	ORDER RHINOBATIFORMES		
	Family Rhinobatidae		
15	<i>Rhinobatus formosensis</i>		+
	Family: Rhynchobatidae		
16	<i>Rhynchobatus australiae</i>	+	+
	Total ray species	7	14
	ORDER CARCHARHINIFORMES		
	Family: Scyliorhinidae		
1	<i>Atelomycterus marmoratus</i>	+	
	Family Hemigaleidae		
2	<i>Hemigaleus microstoma</i>	+	
	Family Carcharhinidae		
3	<i>Carcharhinus amblyrhynchos</i>	+	
4	<i>Carcharhinus leucas</i>		+
5	<i>Carcharhinus melanopterus</i>	+	+
6	<i>Carcharhinus sorrah</i>	+	+
7	<i>Galeocerdo cuvier</i>		+
	Family Sphyrnidae		
8	<i>Sphyrna lewini</i>		+
	ORDER HEXANCHIFORMES		
	Family Hexanchidae		

9	<i>Heptranchias perlo</i>		+
	ORDER ORECTOLOBIFORMES		
	Family: Hemiscylliidae		
10	<i>Chiloscyllium griseum</i>	+	+
11	<i>Chiloscyllium hasseltii</i>	+	+
12	<i>Chiloscyllium plagiosum</i>	+	
13	<i>Chiloscyllium punctatum</i>	+	+
	Total shark species	9	9

Photos Taken During the On site, Training Sessions and Data collection Activities at Landing Sites (During 2011-2016)



Photo 1. Participants and resource persons in 2011 and 2013



Photo 2. Participants and resource persons in 2015



Photo 3. Participants during lecture and practical session



Photo 4. Enumerators worked at fishing ports



Photo 5. Common sharks in Thailand



Photo 5. Common rays in Thailand

Appendix V

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

Species	Small	Medium	Big
Rays			
<i>Aetobatus narinari</i>	30-60	>60	
<i>Aetobatus ocellatus</i>	30-60	>60	
<i>Dasyatis akajei</i>	10-60		
<i>Dasyatis thetidis</i>			
<i>Dasyatis zugei</i>	10-30		
<i>Gymnura japonica</i>	20-50		
<i>Himantura gerrardi</i>	20-50	>50	
<i>Himantura imbricata</i>	10-20		
<i>Himantura jenkinsii</i>	20-50	51-100	>100
<i>Himantura uarnacoides</i>	20-50	51-100	>100
<i>Himantura walga</i>	10-20		
<i>Neotrygon kuhlii</i>	10-30		
<i>Plesiobatis daviesi</i>			
<i>Rhinobatus formosensis</i>	20-40	41-100	
<i>Rhynchobatus australiae</i>	20-50	51-120	>120
<i>Taeniurops meyeri</i>			
Sharks			
<i>Atelomycterus marmoratus</i>	45-70		
<i>Carcharhinus amblyrhynchos</i>	80-120	121-200	>200
<i>Carcharhinus leucas</i>	80-120	121-200	>200
<i>Carcharhinus melanopterus</i>	80-120	121-200	
<i>Carcharhinus sorrah</i>	80-120	121-160	
<i>Chiloscyllium griseum</i>	45-90		
<i>Chiloscyllium hasseltii</i>	45-70		
<i>Chiloscyllium plagiosum</i>	45-90		
<i>Chiloscyllium punctatum</i>	45-120		
<i>Galeocerdo cuvier</i>	80-120	121-200	>200
<i>Hemigaleus microstoma</i>	70-100		
<i>Heptranchias perlo</i>	80-120		
<i>Sphyrna lewini</i>	80-120	121-200	>200

PART II

*National Reports on Sharks Data Collection in the Participating Countries: **Viet Nam***

Project-End-Meeting on Sharks Data Collection in Southeast Asia

16 to 18 August 2016

Southeast Asian Fisheries Development Center

Country Report

VIETNAM



Edited by:

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I. INTRODUCTION

Vietnam is a home to a rich diversity of sharks, rays, skate and chimaeras (Class Chondrichthyes). However, sharks, rays and skates landings contribute only under 1% of total marine landings. Research on sharks, rays and skates have not conducted fully in freshwater, estuarine and the Economic Exclusive Zone of Vietnam. In the period from 2000 -2005, thirty-six independent research surveys using different fishing gear were conducted in seawater of Vietnam. A total of 40 species belonging to 19 genera in 9 families of 2 Orders were statistically recorded. Species richness was observed in the South-eastern and central waters. Family of Dasyatidae got the highest abundance with 14 speices. Distribution of rays was species specific and showed seasonal differences (Tran Van Cuong and Vu Viet Ha, 2005).

1.1. OBJECTIVES

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

Ba Ria - Vung Tau and Binh Thuan are two provinces in the Southeast regional with the main regionals of fishing landing in Vietnam. Vung Tau and Lagi towns of two major locals were selected as study sites as sharks and rays main landing sites. The landing data were collected at 07 jetties, such as Ben Da, Incomat, Cat Lo, Phuoc Tinh and Ward 5 jetties in Ba Ria Vung Tau province and Lagi, Phan Thiet jetties in Binh Thuan province. Whole jetties that are government enterprises with the most of sharks, rays and skates landing coming from trawlers, gillnets and longlines fisheries. The location of all landing sites are shown in Figure 1.

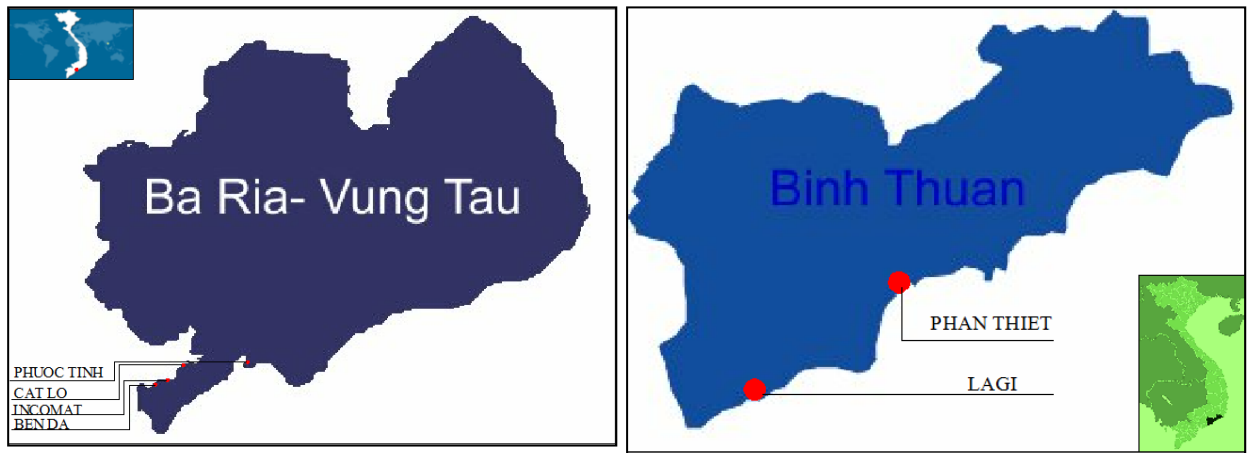


Figure 1: Location of Study Sites in Ba Ria-Vung Tau and Binh Thuan Provinces

1.2.2. Fishery Structure and Background of Study Sites

1.2.2.1. Vung Tau

Vung Tau is one of the major landing sites for sharks and rays in Ba Ria Vung Tau. The major gears were trawl nets (520), followed by gillnets (200) and purse seine (50). All trawlers are normally operated by 2 - 10 crew members. Almost all of the sharks and rays were landed by trawlers and Gillnets operating beyond 24 nautical miles from the coastline. Fishing operation normally between 10 - 30 day per trip. 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 Site Vung Tau

No	Gear type	Fishing operation (from coastline)	No. of Vessel	No. of fisher
1	Trawler			
	<90 HP	< 24 miles	11	22
	90-<250 HP	>24 miles	10	50
	250-<400 HP	>24 miles	54	540
	>=400 HP	>24 miles	445	4,450
2	Gillnets			
	<90 HP	< 24 miles	12	24
	>=90 HP	>24 miles	188	940
3	Purse seiners			
	<90 HP	< 24 miles	04	08
	>=90 HP	>24 miles	46	230
4	Hook			
	<90 HP	<24 miles	97	194
	>=90 HP	>24 miles	403	2,015
5	Other		930	1,860
	Total		2,200	10,333

1.2.2.2. Binh Thuan

La Gi and Phan Thiet are two of the major landing sites for sharks and rays in Binh Thuan. The major gears were gillnets (463), followed by longlines (412) and trawl nets (411) and Other gears (572). 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, gillnets and longlines. All trawlers are normally operated by 2 - 10 crew members. The fishing operation for trawlers and longlines was normally between 10-20 days per trip.

Table 2. Number of licensed Fishing Vessels by Gears and Number of Fishers Site Binh Thuan

No	Gear type	Fishing operation (from coastline)	No. of Vessel	No. of fisher
1	Trawler			
	<90 HP	< 24 miles	34	68
	90-<250 HP	>24 miles	46	230
	250-<400 HP	>24 miles	119	595
	>=400 HP	>24 miles	212	2,120
2	Gillnets			
	<90 HP	< 24 miles	320	640
	>=90 HP	>24 miles	143	715
3	Purse seiner			
	<90 HP	< 24 miles	21	42
	>=90 HP	>24 miles	168	840
4	Hook			
	<90 HP	<24 miles	195	390
	>=90 HP	>24 miles	217	1,085
5	Other		572	1,144
Total			2,047	7,869

1.3. APPOINTMENT OF ENUMERATORS

Five Assistant Fisheries Officers from South Research Sub-Institute for Marine Fisheries, Vung Tau city, Vietnam were appointed as enumerators. Their names are as follows:

- 1) Bui Quang Manh, marine biodiversity researcher.
- 2) Cao Van Hung, taxonomist as researcher.
- 3) Nguyen Xuan Toan, marine aquaculture researcher.
- 4) Dinh Xuan Hung, fishing oceanography technologist.
- 5) Nguyen Phuoc Trieu, taxonomist as researcher.

1.4. MATERIALS AND METHODS

1.4.1. Sampling Methods

The sampling activity started in September 2015 until 31 August 2016. All enumerators were requested to record landing data and other related information in a standard form at least 5 days/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 excel 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 1-4 fishing vessels were selected for sampling each day for 5 days per month at each landing site. Measurement of Total length (TL) were taken for all skates, sharks species and rays 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 ray 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 South Research sub Institute for marine fisheries and preserved for future reference. 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).

II. RESULTS

2.1. Binh Thuan province

2.1.1. Landing sample

In total 123 fishing vessels were sampled during the study period, 103 trawlers were sampled and only 09 vessels of gillnet and 11 vessels of longlines fisheries. The highest landing sample by month was 14 vessels in December, followed by 13 in November. In August, the only 07 vessels were surveyed because the storm touched Vietnam land so many vessels in Binh Thuan province could not fishing at all.

Table 3. Number of Landing Sampled During the Study at Binh Thuan province

Gear	Group HP	Months												Total
		J	F	M	A	M	J	J	A	S	O	N	D	
Gillnet	<90											1		1
	150-250											3	1	4
	>250	1						2	1					4
Longline	90-150						2							2
	150-250					5	4							9
Trawl net	<90												1	1
	90-150								1					1
	150-250					2	2					1		5
	>250	10	9	10	10	2	2	8	6	10	9	8	12	96
Binh Thuan Total		11	9	10	10	9	10	10	7	11	9	13	14	123

2.1.2. Fishing Ground and Catch Composition by Gear Type

In the study, rays and skates mainly were sampled from Trawl net fishery. The highest catch of rays was 1,046.9 kg in September and skates was 1,798.0 kg in April. Sharks mainly were sampled from longline fishery reached 80% in only May and June 2016, but sharks were sampled every month in gillnet and Trawl net in light weight. Catch of skates and rays reached over 90% from Trawl net. The details are shown on Table 6.

Table 4. Weight of Sharks, Rays and Skates (Kg) Caught by Difference Type of Gear

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Grand Total
Ray	336.0		56.0	172.0	273.0	496.8	628.2	71.7	1,046.9	521.7	767.02	611.0	4,980.38
Gillnet								8.8				60.0	68.84
Trawl net	336.0		56.0	172.0	273.0	496.8	628.2	62.9	1,046.9	521.7	767.02	551.0	4,911.53
Shark	50.0				2,550.0	3,894.9	563.5	9.2	319.1	7.2	224.0	300.8	7,918.7
Gillnet	50.0						530.3	9.2			52.0		641.5
Longlines					2,500.0	3,844.9							6,344.9
Trawl net					50.0	50.0	33.2		319.1	7.2	172.0	300.8	932.3
Skate	1,414.0	1,280.0	1,401.0	1,798.0	577.0	85.2	601.8	559.1	1,082.9	1,245.2	392.0	1,020.2	11,456.4
Gillnet								2.0					2.0
Trawl net	1,414.0	1,280.0	1,401.0	1,798.0	577.0	85.2	601.8	557.1	1,082.9	1,245.2	392.0	1,020.2	11,454.4
Grand Total	1,800.0	1,280.0	1,457.0	1,970.0	3,400.0	4,476.9	1,793.5	640.0	2,448.9	1,774.1	1,383.02	1,932.0	24,355.42

2.1.3. Sharks and Rays Composition

A total of 2,096,590.5 kg of fish was landed from 133 landings during the study period, catch of sharks, rays and skates made up 0.4 % and 0.3% and 0.5% from the total landing respectively. While landings of bony fish species was 98.81 %. The average landings per month for sharks, rays and skates were 659.9 kg, 491.3 and 929.7 kg respectively. The highest landing by month for sharks was 3,894.9 kg in June, followed by 2,550.0 kg in May. From February to April of 2016, sharks were not sampled. The highest landing of rays was 1,421.7kg in October, followed by 1,046.9 kg in September, for skates was 1,798.0 kg in April, followed by 1,414.0 kg in January. The catch of sharks, rays and skates was under 1% in total catch of all fisheries in Binh Thuan province. The details are shown on Table 5.

Table 5. Catch Composition of Sharks, Rays, Skates, Commercial and Low-value Species by Month from 133 Landings at Binh Thuan Province. All Weight in Kilogram.

M	Weight								
	All Sharks (kg)	% Shark	All Rays (kg)	% Ray	All Skates (kg)	% Skate	Bony fish (kg)	% Bony fish	Total Catch (kg)
Jan	50.0	0.02	336.0	0.14	1,414.0	0.61	230,200.0	99.22	232,000.0
Feb	0.0	0.00	0.0	0.00	1,280.0	0.93	135,800.0	99.07	137,080.0
Mar	0.0	0.00	56.0	0.04	1,401.0	0.93	149,000.0	99.03	150,457.0
Apr	0.0	0.00	172.0	0.10	1,798.0	1.07	166,000.0	98.83	167,970.0
May	2,550.0	2.44	273.0	0.26	577.0	0.55	101,000.0	96.74	104,400.0
June	3,894.9	3.77	496.8	0.48	85.2	0.08	98,700.0	95.66	103,176.9
July	563.5	0.38	628.2	0.42	601.8	0.40	147,000.0	98.79	148,793.5
Aug	9.2	0.01	71.7	0.05	559.1	0.36	155,000.0	99.59	155,640.1
Sept	319.1	0.13	1,046.9	0.44	782.9	0.33	238,500.0	99.11	240,648.9
Oct	7.2	0.003	1,421.7	0.53	1,245.2	0.46	266,000.0	99.00	268,674.1
Nov	224.0	0.09	782.0	0.33	392.0	0.16	238,220.0	99.42	239,618.0
Dec	300.8	0.20	611.0	0.41	1,020.2	0.69	146,200.0	98.70	148,132.0
Total	7,918.8	0.38	5,895.4	0.28	11,156.4	0.53	2,071,620.0	98.81	2,096,590.5
Ave.	659.9		491.3		929.7		172,635.0		174,715.9

2.1.4. Sample Size

A total of 1,589 tails belong to 409 rays, 199 sharks and 981 skates were sampled consisting twenty-eight species of rays, three species of skates and twelve species of sharks. The most abundant ray species were *Himantura walga*, followed by *H. imbricata*. The highest number of rays were sampled by month was 74 tails in June and October, followed by 73 tails in December. Rays were sampled mainly in from June to December of the year. While the highest number of sharks were sampled by month was 94 tails in

June, followed by 41 tails in May, the highest number of sharks was *Carcharhinus sorrah* species with 129 tails in the study. The highest number of skate were sampled by month was 138 tails in January, followed by 117 in December. Skates were sampled only three species of *Okamejei cairae*, *O. hollandi* and *O. cf. boesemani* while *O. cairae* species was sampled in all months with rate of over 90% in total skate. The details are shown on Table 6.

Table 6. Sampled Size of Sharks, Rays and Skates by Species

Species	Months												Grand total
	J	F	M	A	M	J	J	A	S	O	N	D	
Ray	24		3	6	22	37	36	14	43	74	40	73	372
<i>Aetobatus ocellatus</i>										1			1
<i>Aetomylaeus maculatus</i>											3		3
<i>Dasyatis cf. sinensis</i>										3			3
<i>Dasyatis fluviourum</i>									6		1		7
<i>Dasyatis parvonigra</i>						3			5			3	11
<i>Dasyatis sinensis</i>							3			1			4
<i>Dasyatis sp.</i>											1	9	10
<i>Dasyatis zugei</i>							1						1
<i>Gymnura japonica</i>												9	9
<i>Gymnura poecilura</i>						4			1				5
<i>Himantura cf. javaensis</i>	1												1
<i>Himantura imbricata</i>	3				7	17	17	13	15	12	9	9	102
<i>Himantura walga</i>	13		1	5	15	5	14		1	51	22	40	167
<i>Mobula sp.</i>											1		1
<i>Myliobatis tobijei</i>											1		1
<i>Narcine cf. indica</i>									1				1
<i>Narcine indica</i>	6		1	1									8
<i>Narcine sp.</i>											2	1	3
<i>Narcine timlei</i>			1										1
<i>Narke dipterygia</i>						4							4
<i>Neotrygon sp.</i>										3			3
<i>Platyrrhina sinensis</i>									4				4
<i>Platyrrhina tangi</i>	1												1
<i>Rhynchobatus australiae</i>							1	1					2
<i>Rhinobatos formosensis</i>									9	3			12
<i>Rhinobatos sp.</i>												2	2
<i>Taeniura lymma</i>						4							4
<i>Urogymnus asperrimus</i>									1				1
Shark	2				41	47	20	1	7	2	29	3	152
<i>Alopias superciliosus</i>											1		1
<i>Atelomycterus marmoratus</i>											7	1	8
<i>Carcharhinus dussumieri</i>											1		1

<i>Carcharhinus limbatus</i>					7	3							10
<i>Carcharhinus sorrah</i>	2				30	39	14	1	2	2			90
<i>Carcharhinus</i> sp.									1				1
<i>Chiloscyllium</i> cf. <i>punctatum</i>											1		1
<i>Chiloscyllium plagiosum</i>											6		6
<i>Chiloscyllium punctatum</i>					4	5	6		3		13		31
<i>Chiloscyllium</i> sp.												1	1
<i>Galeus</i> sp.												1	1
<i>Halaelurus buergeri</i>									1				1
Skate	138	93	110	116	27	9	79	55	52	64	112	117	972
<i>Okamejei cairae</i>	138	93	110	116	22	9	71	55	44	5	112	117	892
<i>Okamejei</i> cf. <i>boesemani</i>										56			56
<i>Okamejei hollandi</i>					5		8		8	3			24
Grand Total	164	93	113	122	90	93	135	70	102	140	181	193	1,496

2.1.5. Weight of Sharks and Rays by Species

A total shark and ray species of 24,355.5 kg was landed from 133 landings comprising 4,980.4 kg rays, 11,456.4 kg skates and 7,918.8 kg sharks. For rays, the highest landing by weight was *Himantura walga* amounted 1,586.5 kg, followed by 1,053.6 kg for *H. imbricata*. For sharks, the highest landing was 6,995.3 kg for species of *Carcharhinus sorrah*, followed by 329.5 kg and 300.0 kg for *C. limbatus* and *Galeus* sp., respectively. For skates, *Okamejei cairae* reached highest weight of 9,904.8 kg, the months of from January to May and December was over 1,000 kg for the species.

Table 7. Weight of Sharks, Rays and Skates by Species in Binh Thuan

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Ray	336.0		56.0	172.0	273.0	496.8	628.2	71.7	1,046.9	521.7	767.0	611.0	4,980.4
<i>Aetobatus ocellatus</i>										5.0			5.0
<i>Aetomylaeus maculatus</i>											84.2		84.2
<i>Dasyatis cf. sinensis</i>										18.0			18.0
<i>Dasyatis fluviorum</i>									172.5		6.6		179.1
<i>Dasyatis parvonigra</i>						4.7			74.0			75.0	153.7
<i>Dasyatis sinensis</i>							49.1			14.0			63.1
<i>Dasyatis sp.</i>											2.0	93.7	95.7
<i>Dasyatis zugei</i>							17.7						17.7
<i>Gymnura japonica</i>												16.0	16.0
<i>Gymnura poecilura</i>						42.4			154.0				196.4
<i>Himantura cf. javaensis</i>	10.0												10.0
<i>Himantura imbricata</i>	45.0				75.0	231.2	292.5	62.9	253.8	62.0	4.9	26.3	1,053.6
<i>Himantura walga</i>	207.0		8.0	162.0	198.0	115.3	126.5		39.0	411.2	16.4	303.0	1,586.5
<i>Mobula sp.</i>											600.0		600.0
<i>Myliobatis tobijei</i>											52.0		52.0
<i>Narcine cf. indica</i>									21.0				21.0
<i>Narcine indica</i>	50.0		19.0	10.0									79.0
<i>Narcine sp.</i>											1.0	35.0	36.0
<i>Narcine timlei</i>			29.0										29.0
<i>Narke dipterygia</i>						4.9							4.9
<i>Neotrygon sp.</i>										0.5			0.5
<i>Platyrrhina sinensis</i>									243.5				243.5
<i>Platyrrhina tangi</i>	24.0												24.0
<i>Rhynchobatus australiae</i>							142.4	8.8					151.2
<i>Rhinobatos formosensis</i>									80.1	11.0			91.1

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
<i>Rhinobatos</i> sp.												62.0	62.0
<i>Taeniura lymma</i>						98.2							98.2
<i>Urogymnus asperrimus</i>									9.0				9.0
Shark	50.0				2,550.0	3,894.9	563.5	9.2	319.1	7.2	224.0	300.8	7,918.8
<i>Alopias superciliosus</i>											172.0		172.0
<i>Atelomycterus marmoratus</i>											9.5	0.4	9.9
<i>Carcharhinus dussumieri</i>											4.0		4.0
<i>Carcharhinus limbatus</i>					300.0	29.5							329.5
<i>Carcharhinus sorrah</i>	50.0				2,250.0	3,815.4	563.5	9.2	300.0	7.2			6,995.3
<i>Carcharhinus</i> sp.									10.0				10.0
<i>Chiloscyllium cf. punctatum</i>											5.0		5.0
<i>Chiloscyllium plagiosum</i>											7.0		7.0
<i>Chiloscyllium punctatum</i>						50.0			8.8		26.5		85.3
<i>Chiloscyllium</i> sp.												0.4	0.4
<i>Galeus</i> sp.												300.0	300.0
<i>Halaaelurus buergeri</i>									0.3				0.3
Skate	1,414.0	1,280.0	1,401.0	1,798.0	577.0	85.2	601.8	559.1	1,082.9	1,245.2	392.0	1,020.2	11,456.4
<i>Okamejei cairae</i>	1,414.0	1,280.0	1,401.0	1,798.0	476.0	85.2	508.6	559.1	967.2	3.4	392.0	1,020.2	9,904.8
<i>Okamejei cf. boesemani</i>										1,240.0			1,240.0
<i>Okamejei hollandi</i>					101.0		93.2		115.7	1.8			311.6
Grand Total	1,800.0	1,280.0	1,457.0	1,970.0	3,400.0	4,476.9	1,793.5	640.1	2,448.9	1,774.1	1,383.0	1,932.0	24,355.5

2.1.6. Size Range of Sharks and Rays

In general, all ray species sampled from January to May were mature. Size range of all rays from January to May was shown on Table 6.

The most ray species landed from September to December were mature except for *Aetobatus ocellatus* (mature at 100-110cm), *Gymnura poecilura* (mature at 45cm). Size range of all rays from September to December were shown on Table 7.

The most shark species landed from January, May and September to December were mature except for *Carcharhinus limbatus* (mature at 120-190cm), *C. sorrah* (mature at 103cm), *Chiloscyllium plagiosum* (mature at 50cm) and *C. punctatum* (mature at 68cm). Size range of sharks in January, May and from September to December was shown on Table 8.

Table 8. Size Range of Sharks (Total Length), Rays and Skates (Disc Length) Except for *Platyrrhina tangi*, *Rhynchobatus australiae* and *Okamejei* spp. Binh Thuan from Sep to Dec 2015. All Measurement in cm.

Sc. Name	September			October			November			December		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Rays												
<i>Aetobatus ocellatus</i>				45	45	45	19	107	48.5			
<i>Dasyatis</i> sp.							75	75	75	11	28	21.4
<i>Myliobatis tobijei</i>							80	80	80			
<i>Platyrrhina sinensis</i>	18.0	45.0	36.0									
<i>Rhinobatos formosensis</i>	58.0	82.0	70.4	58.0	77.0	67.7						
<i>Rhinobatos</i> sp.										40.0	40.5	40.3
Sharks												
<i>Alopias superciliosus</i>							366.0	366.0	366.0			
<i>Atelomycterus marmoratus</i>							44.5	55.5	51.0	51.0	51.0	51.0
<i>Carcharhinus dussumieri</i>							82.0	82.0	82.0			
<i>Carcharhinus sorrah</i>	65.0	86.0	75.5	80.0	85.0	82.5						
<i>Carcharhinus</i> sp.	138.0	138.0	138.0									
<i>Chiloscyllium</i> cf. <i>punctatum</i>							56.0	56.0	56.0			
<i>Chiloscyllium plagiosum</i>							36.4	46.5	42.2			
<i>Chiloscyllium punctatum</i>	21.0	103.0	67.3				32.0	54.0	43.7			
<i>Chiloscyllium</i> sp.										50.0	50.0	50.0
<i>Halaehurus buergeri</i>	45.0	45.0	45.0									
Skates												
<i>Okamejei cairae</i>	21.0	42.0	33.7	22.4	39.2	32.7	21.0	43.5	29.6	18.7	44.0	30.2
<i>Okamejei</i> cf. <i>boesemani</i>				11.0	22.7	15.2						
<i>Okamejei hollandi</i>	25.0	40.0	35.3	28.5	39.0	32.5						

Table 9. Size Range of Sharks (Total Length), Rays and Skates (Disc Length) Except for *Platyrrhina tangi*, *Rhynchobatus australiae* and *Okamejei* spp. in Binh Thuan from Jan. to Aug. 2016. All Measurement in cm.

Sc. Name	January			February			March			April			May			June			July			August			
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	
Rays																									
<i>Himantura imbricata</i>	19.0	20.0	19.5													16.0	22.0	19.0	15.4	39.0	24.0				
<i>Himantura walga</i>	18.0	24.5	20.5										14.0	23.0	19.27	20.0	22.5	21.5	16.0	21.5	18.6				
<i>Narcine indica</i>	22.5	30.0	26.3																						
<i>Narcine timlei</i>							44.0	44.0	44.0																
<i>Platyrrhina tangi</i>	50.0	50.0	50.0																						
<i>Rhynchobatus australiae</i>																			127.0	127.0	127.0	127.0	127.0	127.0	127.0
Sharks																									
<i>Carcharhinus limbatus</i>													100.0	130.0	116.7	110.0	120.0	115.0							
<i>Carcharhinus sorrah</i>	99.0	101.0	100.0										95.2	227.5	124.2	59.0	190.0	131.6	89.0	136.0	105.5	126.0	126.0	126.0	
<i>Chiloscyllium punctatum</i>													90.0	100.0	94.0	100.0	115.0	107.8	32.0	41.0	37.4				
Skates																									
<i>Okamejei cairae</i>	21.0	44.0	31.7	22.0	40.0	30.8	18.7	44.0	32.6	21.0	58.0	32.4	18.0	37.5	26.7	21.0	38.0	28.3	12.0	42.1	31.4	18.0	44.1	32.1	
<i>Okamejei hollandi</i>													28.3	30.0	29.4				29.5	40.0	33.8				

2.1.7. Fishing Effort and CPUE (Catch per Unit Effort)

Monthly fishing efforts (days at operation, total number of operation during the cruise) of the sampled vessels are summarized in Table 10 to Table 11.

Table 10. Days at Operation by Gear Sampled During the Study Period at Landing Site in 2015-2016 in Binh Thuan.

	2015				2016								Total
	S	O	N	D	J	F	M	A	M	J	J	A	
Gillnet			43	8	12						32	8	103
Long line									68	67			135
Trawl net	124	160	92	75	152	114	120	119	56	43	110	104	1,269
Total	124	160	135	83	164	114	120	119	124	110	142	112	1,507

Table 11. Numbers of Operation by Gears Sampled During the Study Period at Landing Site in 2015-2016 in Binh Thuan.

	2015				2016								Total
	S	O	N	D	J	F	M	A	M	J	J	A	
Gillnet			71	8	12						32	16	139
Long line									68	67			135
Trawl net	410	583	295	243	589	342	383	357	168	129	330	328	4,157
Total	410	583	366	251	601	342	383	357	236	196	362	344	4,431

In case of the gear of which annual effort excess 1000 days of operation or 1000 number of operations, CPUE (total of 12 months) was estimated by weight and number of individuals by species. The top 10 species for sharks, rays and skates are summarized in Table 12 - Table 15.

Table 12. Top 10 CPUE Sharks Species Captured by the Trawl Net During the Study Period at Binh Thuan (catch/FE)

No.	Species	Catch of sharks (kg)	CPUE (catch/days of operation)	CPUE (catch/no.operation)
1	<i>Carcharhinus sorrah</i>	390.40	0.31	0.09
2	<i>Galeus</i> sp.	300.00	0.24	0.07
3	<i>Alopias superciliosus</i>	172.00	0.14	0.04
4	<i>Chiloscyllium punctatum</i>	58.80	0.05	0.01
5	<i>Carcharhinus</i> sp.	10.00	0.01	0.00
6	<i>Chiloscyllium</i> sp.	0.42	0.00	0.00
7	<i>Atelomycterus marmoratus</i>	0.40	0.00	0.00
8	<i>Halaelurus buergeri</i>	0.30	0.00	0.00

Table 13. Top 10 CPUE Shark Species Captured by the Trawl Net During the Study Period at Binh Thuan (No. indi/FE)

No.	Species	No.indi sharks	CPUE (catch/days of operation)	CPUE (catch/no.operation)
1	<i>Carcharhinus sorrah</i>	91	0.07	0.02
2	<i>Chiloscyllium punctatum</i>	16	0.01	0.00
3	<i>Alopias superciliosus</i>	1	0.00	0.00
4	<i>Atelomycterus marmoratus</i>	1	0.00	0.00
5	<i>Carcharhinus</i> sp.	1	0.00	0.00
6	<i>Chiloscyllium</i> sp.	1	0.00	0.00
7	<i>Galeus</i> sp.	1	0.00	0.00
8	<i>Halaelurus buergeri</i>	1	0.00	0.00

Table 14. Top 10 CPUE Ray Species by the Trawl Net During the Study Period at Binh Thuan State (catch/FE)

No.	Species	Catch of rays (kg)	CPUE (catch/days of operation)	CPUE (catch/no.operation)
1	<i>Himantura walga</i>	1,531	1.21	0.37
2	<i>Himantura imbricata</i>	1,054	0.83	0.25
3	<i>Mobula</i> sp.	600	0.47	0.14
4	<i>Platyrrhina sinensis</i>	243.5	0.19	0.06
5	<i>Gymnura poecilura</i>	196.4	0.16	0.05
6	<i>Dasyatis fluviorum</i>	179.1	0.14	0.04
7	<i>Dasyatis parvonigra</i>	153.7	0.12	0.04
8	<i>Rhynchobatus australiae</i>	142.4	0.11	0.03
9	<i>Taeniura lymma</i>	98.24	0.08	0.02
10	<i>Rhinobatos formosensis</i>	91.12	0.07	0.02

Table 15. Top 10 CPUE Ray Species Captured by the Trawl Net During the Study Period at Binh Thuan State (No. indi/FE)

No.	Species	No. individual rays	CPUE (catch/days of operation)	CPUE (catch/no.operation)
1	<i>Himantura walga</i>	5,909	4.66	1.42
2	<i>Himantura imbricata</i>	4,472	3.52	1.08
3	<i>Dasyatis</i> sp.	638	0.50	0.15
4	<i>Narcine indica</i>	453	0.36	0.11
5	<i>Dasyatis fluviorum</i>	302	0.24	0.07

6	<i>Gymnura poecilura</i>	291	0.23	0.07
7	<i>Platyrhina sinensis</i>	240	0.19	0.06
8	<i>Dasyatis parvonigra</i>	226	0.18	0.05
9	<i>Rhinobatos</i> sp.	181	0.14	0.04
10	<i>Dasyatis sinensis</i>	168	0.13	0.04

Table 16. Top 10 CPUE Skates Species Captured by the Trawl Net During the Study Period at Binh Thuan State

No.	Species	Catch of skates (kg)	CPUE (kg/days of operation)	CPUE (catch/no.operation)
1	<i>Okamejei cairae</i>	9,902.76	7.80	2.38
2	<i>Okamejei</i> cf. <i>boesemani</i>	1,240.00	0.98	0.30
3	<i>Okamejei hollandi</i>	311.64	0.25	0.08

Table 17. Top 10 CPUE skates species captured by the trawl net during the study period at Binh Thuan State (NO.indi/FE)

No.	Species	No. Individual skates	CPUE (Individual/days of operation)	CPUE (Individual/no. operation)
1	<i>Okamejei cairae</i>	64,190	50.58	15.44
2	<i>Okamejei</i> cf. <i>boesemani</i>	11,143	8.78	2.68
3	<i>Okamejei hollandi</i>	1,767	1.39	0.43

2.1.8. 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 China. The major markets were whole sale market in Lagi, Phan Thiet towns and other major towns in Ho Chi Minh city. The price varied according to species. The most expensive rays were families of Myliobatidae and Mobulidae. All rays and sharks were sold in price of whole body, but some species were cut in parts. The detail was shown in Table 18.

Table 18. Price of Sharks, Rays and Skates by Species at Binh Thuan Landing Sites 2015. All prices in USD per Kilogram (1USD=22,260VND)

Sc. name	Range price USD/kg	Part	Marketing destination
<i>Himantura</i> cf. <i>javaensis</i>	1.0-1.2	Whole body	Local market
<i>Platyrhina sinensis</i>	0.4-1.0	Whole body	Local market
<i>Dasyatis</i> sp.	2-4	Whole body	Local market

<i>Dasyatis cf. sinnensis</i>	1-3	Whole body	Local market
<i>Dasyatis fluviatorum</i>	0.1-5	Whole body	Local market
<i>Dasyatis parvonigra</i>	0.4-4	Whole body	Local market
<i>Dasyatis sinensis</i>	1-2	Whole body	Ho Chi Minh city and Local markets
<i>Neotrygon</i> sp.	1-4	Whole body	Local market
<i>Gymnura japonica</i>	0.9-1.7	Whole body	Local market
<i>Gymnura poecilura</i>	0.4-1	Whole body	Local market
<i>Platyrrhina tangi</i>	0.2-1	Whole body	Local markets
<i>Narcine indica</i>	0.2-4.1	Whole body	
<i>Narcine timlei</i>	0.2-1.3	Whole body	Local market
<i>Himantura imbricata</i>	0.2-4	Whole body	Local market
<i>Himantura walga</i>	0.4-1.2	Whole body	Local
<i>Rhinobatos formosensis</i>	0.2-0.8	Whole body	Local market
<i>Mobula</i> sp.	3-7	Whole body	Local market
<i>Aetobatus ocellatus</i>	2-4	Whole body	Local market
<i>Aetomylaeus maculatus</i>	2-4	Whole body	Local market, China
<i>Urolophus asperrimus</i>	0.3-0.8	Whole body	Local markets
<i>Myliobatis tobijei</i>	0.2-1	Whole body	Local markets
<i>Rhinobatos formosensis</i>	0.2-0.4	Whole body	Local market
<i>Platyrrhina sinensis</i>	0.4-1	Whole body	Local market
<i>Alopias superciliosus</i>	1-4	Whole body	Local market, China
<i>Atelomycterus marmoratus</i>	1-4	Whole body	Local market, China
<i>Carcharhinus dussumieri</i>	1-4	Whole body	Local market, China
<i>Carcharhinus limbatus</i>	3-5	Whole body	Local market, China
<i>Carcharhinus sorrah</i>	0.9-5	Whole body	China, Local market

<i>Chiloscyllium punctatum</i>	0.9-5	Whole body	Local market, China
<i>Halaaelurus buergeri</i>	0.9-5.5	Whole body	Local market and China
<i>Okamejei cairae</i>	0.1-1	Whole body	Local market
<i>Okamejei cf. boesemani</i>	0.1-1	Whole body	Local market
<i>Okamejei hollandi</i>	0.1-1	Whole body	Local market

2.2. Ba Ria-Vung Tau Province

2.2.1. Landing sample

In total 112 fishing vessels were sampled during the study period, 50 trawler were sampled and only 62 vessels of gillnet fisheries. The highest landing sample by month was 12 vessels in May, August, September.

Table 19. Number of Landing Sampled During the Study at Ba Ria-Vung Tau Province

	Months												Total
	J	F	M	A	M	J	J	A	S	O	N	D	
Gillnet	5	6	6	8		5	9		7	6		10	62
>250	5	4	6	6		5	9		7	6		9	57
150-250		1		2								1	4
90-150		1											1
Trawl Net	7	1	3	2	12	7	2	12	5	6	12	2	71
>250	7	1	3	2	12	7	2	12	5	6	11	2	70
150-250											1		1
Total Vung Tau	12	7	9	10	12	12	11	12	12	12	12	12	133

2.2.2. Fishing Ground and Catch Composition by Gear Type

In Ba Ria-Vung Tau, rays and skates mainly were sampled from trawl net and gillnet fisheries. The highest catch of rays and skates were 4,534.6 kg and 2,235.4 kg in October respectively. Sharks mainly were sampled from both gillnet and trawl net in Baria-Vung Tau in whole of months with 73 % from gillnet and 27 % from trawl net. Skates were collected only from trawl net fishery and reached 37 % in total elasmobranch catch. Catch of skates and rays are higher than of sharks in the study. The details are shown on Table 18.

Table 20. Weight of Sharks, Rays and Skates (Kg) Caught by Different Type of Gear at Vung Tau

	2015				2016								Grand Total
	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	
Rays	301.1	4534.6	672.4	30.0	1,221.3	151.0	497.0	40.0	466.1	621.7		351.4	8,886.6
Gillnet	54.3	4112.7			1047.3		422.0			294.7			5,931.0
Trawl net	246.7	421.9	672.4	30.0	174.0	151.0	75.0	40.0	466.1	327.0		351.4	2,955.6
Sharks	1,337.8	1,397.9	435.2	288.4	424.8	64.6	282.6	75.9	341.3	414.5	900.0	95.0	6,057.8
Gillnet	1,271.0	1,338.0		246.6	365.4	54.6	56.6	68.0		132.5	900.0		4,432.7
Trawl net	66.8	59.9	435.2	41.8	59.4	10.0	226.0	7.9	341.3	282.0		95.0	1,625.1
Skates	100.0	2,235.4	1,221.0	140.0	568.0	4.0	150.0	150.0	1,793.0	555.0	350.0	1,388.7	8,655.1
Trawl net	100.0	2,235.4	1,221.0	140.0	568.0	4.0	150.0	150.0	1793.0	555.0	350.0	1,388.7	8,655.1
Grand Total	1,738.8	8,167.9	2,328.6	458.4	2,214.1	219.6	929.6	265.9	2,600.4	1,591.2	1,250.0	1,835.1	23,599.5

2.2.3. Sharks and Rays Composition

A total of 3,602,563.6 kg of fish was landed from 112 landings during the study period. Sharks, rays and skates made up 0.2%, 0.3% and 0.2% in total catch landing respectively, while landings of bony fish species were 99.34%. The elasmobranch catches gained small rate under 0.5% in total catch. The average landings per month for sharks, rays and skates were 504.8kg, 754.2 and 721.3kg respectively. The highest landing by month for sharks was 1,397.9kg in October, followed by 1,222.1kg in January. The highest landing of rays was 4,497.7kg in October, followed by 1,046.9kg in September. The highest landing of skates was 2,235.4kg in October, followed by 1,793.0kg in May. The details are shown on Table 19.

Table 21. Catch Composition of Sharks, Rays, Skates, commercial and Low-value Species (LVS) by Month from 112 Landings at Ba Ria-Vung Tau. All Weight Kilogram.

M	Weight								
	All Sharks (kg)	% shark	All Rays (kg)	% ray	All Skates (kg)	% skate	Bony fish (kg)	% Bony fish	Total Catch (kg)
Jan	425.0	0.11	1,222.1	0.31	568.0	0.15	386,000.0	99.43	388,215.1
Feb	64.6	0.04	151.0	0.08	4.0	0.00	177,800.0	99.88	178,019.6
Mar	282.6	0.09	497.0	0.16	150.0	0.05	308,300.0	99.70	309,229.6
April	75.9	0.03	40.0	0.02	150.0	0.07	226,000.0	99.88	226,265.9
May	341.3	0.07	466.1	0.10	1,793.0	0.39	460,500.0	99.44	463,100.4
June	414.5	0.15	621.7	0.23	555.0	0.20	270,000.0	99.41	271,591.2
July	900.0	0.63	0.0	0.00	350.0	0.24	142,200.0	99.13	143,450.0
Aug	95.0	0.03	351.4	0.11	1,388.7	0.45	304,000.0	99.40	305,835.1
Sept	1,337.8	1.17	301.1	0.26	100.0	0.09	112,500.0	98.48	114,238.8
Oct	1,397.9	0.43	4,497.7	1.39	2,235.4	0.69	314,500.0	97.48	322,631.0
Nov	435.2	0.08	872.4	0.16	1,221.0	0.22	559,000.0	99.55	561,528.6
Dec	288.4	0.09	30.0	0.01	140.0	0.04	318,000.0	99.86	318,458.4
Total	6,058.0	0.17	9,050.5	0.25	8,655.1	0.24	3,578,800.0	99.34	3,602,563.6
Ave.	504.8		754.2		721.3		298,233.3		300,213.6

2.2.4. Sample Size

A total of 1,037 tails belong to 239 rays, 398 sharks and 400 skates were sampled consisting twenty-two species of rays, two species of skates and twenty-two species of sharks. The most ray species were *Narcine indica*, *Himantura walga* and *Himantura imbricata*. The most shark species were *Carcharhinus sorrah* and *Chiloscyllium punctatum*. The highest number of rays were sampled by month was 74 tails in June and October, followed by 73 tails in December. Rays were sampled mainly in from June to December of the year. While the highest number of sharks were sampled by month was

94 tails in June, followed by 41 tails in May, the highest number of sharks was *Carcharhinus sorrah* species with 129 tails in the study. Skates were sampled only two species of *Okamejei cairae* and *Okamejei hollandi* with the mostly *Okamejei cairae* reached over 90%. The details are shown on Table 20.

Table 22. Sampled Size of Sharks, Rays and Skates by species

	J	F	M	A	M	J	J	A	S	O	N	D	Total
Ray	13	4	17	6	22	44		14	24	52	37	6	239
<i>Dasyatis sinensis</i>											6		6
<i>Dasyatis zugei</i>						5			6	2			13
<i>Himantura imbricata</i>		3	4			2			6	6	9		30
<i>Himantura jenkinsii</i>										8			8
<i>Himantura undulata</i>					1								1
<i>Himantura walga</i>					4	6		13	4				27
<i>Mobula thurstoni</i>	1		4			4				15			24
<i>Mobula japonica</i>						3							3
<i>Narcine breviliabiata</i>	2					1							3
<i>Narcine brunnea</i>						3				2			5
<i>Narcine indica</i>	2					5		1	3	6	10	4	31
<i>Narcine timlei</i>						1							1
<i>Narke japonica</i>									1				1
<i>Neotrygon kuhlii</i>	2		9						3				14
<i>Platyrrhina sinensis</i>				2					1		7		10
<i>Platyrrhina tangi</i>					10	7							17
<i>Plesiobatis daviesi</i>	2	1				2				1			6
<i>Rhynchobatus australiae</i>	4												4
<i>Rhinobatos formosensis</i>				4	2					12	2	2	22
<i>Rhynchobatus palpebratus</i>					5						3		8
<i>Urolophus aurantiacus</i>						4							4
Shark	37	18	16	15	48	27	59	8	34	22	72	42	398
<i>Alopias pelagicus</i>						1			2				3
<i>Atelomycterus marmoratus</i>		3			4					9	8		24
<i>Carcharhinus amblyrhynchos</i>						3				2			5
<i>Carcharhinus cf. falciformis</i>	1												1
<i>Carcharhinus dussumieri</i>	3											1	4
<i>Carcharhinus limbatus</i>	1		3	2						3		5	14
<i>Carcharhinus sorrah</i>	8	15	6	8		6	59	8	22	3		14	149
<i>Centrophorus moluccensis</i>						1							1
<i>Cephalocyllium circulopullum</i>					2				1		2		5
<i>Chiloscyllium plagiosum</i>	2				2	1					4	1	10
<i>Chiloscyllium punctatum</i>	9		5	5	35	11			4	3	47	10	129
<i>Galeocerdo cuvier</i>	1				3				1	2	6		13
<i>Halaehurus buergeri</i>									1				1

<i>Hemigaleus microstoma</i>	1								1		3	9	14
<i>Heptranchias perlo</i>						1							1
<i>Hexanchus griseus</i>						1							1
<i>Mustelus manazo</i>	1												1
<i>Sphyrna mokarran</i>	2											1	3
<i>Squalus megalops</i>	1					1						1	3
<i>Squatina</i> sp.	5		2		2	1					2		12
<i>Squatina tergocellatoides</i>	1												1
<i>Triaenodon obesus</i>	1								2				3
Skate	23	8	15	11	79	25	16	105	9	41	61	7	400
<i>Dipturus</i> cf. <i>johannisdavisi</i>						1							1
<i>Okamejei cairae</i>	23	8	15	11	79	23	16	105	9	35	61	7	392
<i>Okamejei hollandi</i>						2				6			8
Grand Total	73	30	48	32	149	96	75	127	67	115	170	55	1,037

2.2.5. Weight of Sharks and Rays by Species

A total of 23,599.5kg was landed from 112 landings comprising 8,886.6kg rays, 8,655.1kg skates and 6,057.8kg sharks. For rays, the highest landing by weight was *Mobula thurstoni*, followed by *Himantura jenkinsii*. For sharks, the highest landing was 10,810.73kg for species of *Carcharhinus sorrah*, followed by 359.0kg and 300.0kg for *Carcharhinus limbatus* and *Galeus* sp. respectively. The highest landing of sharks by month was 3,871.2kg of *Carcharhinus sorrah*, followed by *Chiloscyllium punctatum* was 779.2kg. For skates, *Okamejei cairae* reached highest weight of 7,596.1kg, the months of May, August, October and November was over 1,000kg for the species.

Table 23. Weight of Sharks, Rays and Skates (in kg) by Species from 06 Landings at Ba Ria-Vung Tau

	J	F	M	A	M	J	J	A	S	O	N	D	Total
Ray	1,221.3	151.0	497.0	40.0	466.1	621.7		351.4	301.1	4534.6	672.4	30.0	8,836.6
<i>Dasyatis sinensis</i>											80.0		80.0
<i>Dasyatis zugei</i>						50.0			70.0	55.0			175.0
<i>Himantura imbricata</i>		2.0	75.0			7.0			53.0	56.0	250.0		443.0
<i>Himantura jenkinsii</i>										1,610.0			1,610.0
<i>Himantura undulata</i>					9.1								9.1
<i>Himantura walga</i>					112.0	46.0		331.4	17.0				506.4
<i>Mobula thurstoni</i>	710.0		262.0			114.7				2,502.7			3,589.4
<i>Mobula japanica</i>						180.0							180.0
<i>Narcine brevilibiata</i>	21.0					3.0							24.0
<i>Narcine brunnea</i>						22.0				43.0			65.0
<i>Narcine indica</i>	11.0					5.0		20.0	49.0	118.9	30.0	10.0	243.9
<i>Narcine timlei</i>						30.0							30.0
<i>Narke japonica</i>									21.6				21.6
<i>Neotrygon kuhlii</i>	54.6		160.0						54.3				268.9
<i>Platyrhina sinensis</i>				10.0					36.1		219.0		265.1
<i>Platyrhina tangi</i>					195.0	24.0							219.0
<i>Plesiobatis daviesi</i>	272.0	149.0				50.0				70.0			541.0
<i>Rhynchobatus australiae</i>	152.7												152.7
<i>Rhinobatos formosensis</i>				30.0	90.0					79.0	90.0	20.0	309.0
<i>Rhynchobatus palpebratus</i>					60.0						3.4		63.4
<i>Urolophus aurantiacus</i>						40.0							40.0
Shark	424.8	64.6	282.6	75.9	341.3	414.5	900.0	95.0	1337.8	1397.9	435.2	288.4	6,057.8
<i>Alopias pelagicus</i>						160.0			55.0				215.0
<i>Atelomycterus marmoratus</i>		10.0			10.0					53.3	10.0		83.3
<i>Carcharhinus amblyrhynchos</i>						70.0				54.0			124.0

<i>Carcharhinus cf. falciformis</i>	110.0												110.0
<i>Carcharhinus dussumieri</i>	14.5											15.0	29.5
<i>Carcharhinus limbatus</i>	74.0		7.2	6.8						233.0		22.4	343.4
<i>Carcharhinus sorrah</i>	169.8	54.6	228.2	61.2		67.5	900.0	95.0	1,150.0	1,010.0		134.9	3,871.2
<i>Centrophorus moluccensis</i>						5.0							5.0
<i>Cephalocyllium circulopullum</i>					15.0				0.4		15.0		30.4
<i>Chiloscyllium plagiosum</i>	2.4				15.0	4.0					4.0	10.0	35.4
<i>Chiloscyllium punctatum</i>	4.4		40.0	7.9	280.0	33.0			10.1	6.6	377.0	20.3	779.2
<i>Galeocerdo cuvier</i>	4.2				3.5				1.1	41.0	6.3		56.1
<i>Halaelurus buergeri</i>									0.2				0.2
<i>Hemigaleus microstoma</i>	3.3								44.0		5.1	10.0	62.4
<i>Heptranchias perlo</i>						6.0							6.0
<i>Hexanchus cf. griseus</i>						15.0							15.0
<i>Mustelus manazo</i>	6.5												6.5
<i>Sphyrna mokarran</i>	5.6											74.0	79.6
<i>Squalus megalops</i>	1.6					40.0						1.8	43.4
<i>Squatina</i> sp.	21.5		7.2		17.8	14.0					17.8		78.3
<i>Squatina tergocellatoides</i>	1.9												1.9
<i>Triaenodon obesus</i>	5.2								77.0				82.2
Skate	568.0	4.0	150.0	150.0	1,793.0	555.0	350.0	1,388.7	100.0	2,235.4	1,221.0	140.0	8,705.1
<i>Dipturus johannisdavisi</i>						50.0							50.0
<i>Okamejei cairae</i>	568.0	4.0	150.0	150.0	1,793.0	505.0	350.0	1,388.7	100.0	1,226.4	1,221.0	140.0	7,596.1
<i>Okamejei hollandi</i>						50.0				1,009.0			1,059.0
Grand Total	2,214.1	219.6	929.6	265.9	2,600.4	1,591.2	1,250.0	1,835.1	1,738.8	8,167.9	2,328.6	458.4	23,599.5

2.2.6. Size Range of Sharks and Rays

In general, most rays and shark species landed from January to May and from September to December were mature except to *Mobula thurstoni* (mature 198cm), *Plesiobatis daviesi* (mature at 130cm), *Atelomycterus marmoratus* (mature at 45cm), *Carcharhinus limbatus* (mature at 120cm), *Carcharhinus sorrah* matures at 103-128 (male) 110-118cm (female). *Chilocyllium punctatum* matures at 68-76cm. *Galeocerdo cuvier* matures at 300-305cm for males and 250-350cm for females (TL). The details are shown on Table 22 and 23.

Table 24. Size Range of Sharks, Rays and Skates (Disc length) except for *Narcine* spp., *Narke* spp., *Platyrrhina sinensis*, *Rhinobatos formoensis*, *Rhynchobatus australiae* and *Okamejei* spp. from September - December 2015. All Measurements in cm.

	2015											
	Sep			Oct			Nov			Dec		
	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.
Ray												
<i>Dasyatis sinensis</i>							20.0	25.0	22.0			
<i>Himantura imbricata</i>	19.5	23.0	21.2	21.0	22.5	21.8	17.0	24.0	20.6			
<i>Narcine brunnea</i>				13.5	29.0	21.3						
<i>Narcine indica</i>	19.0	24.0	22.0	24.0	35.5	30.7	24.5	35.0	30.1	20.0	39.0	26.8
<i>Narcine timlei</i>												
<i>Narke japonica</i>	18.0	18.0	18.0									
<i>Neotrygon kuhlii</i>	12.0	30.0	23.4									
<i>Platyrrhina sinensis</i>	37.0	37.0	37.0				44.0	51.0	47.3			
<i>Rhinobatos formosensis</i>				61.0	93.0	79.1	31.5	77.0	54.3	65.0	65.5	65.3
<i>Rhynchobatus palpebratus</i>							135.0	152.0	142.3			
Shark												
<i>Alopias pelagicus</i>	220.0	310.0	265.0									
<i>Atelomycterus marmoratus</i>				23.0	55.0	40.4	30.0	50.0	44.3			
<i>Carcharhinus amblyrhynchos</i>				92.0	92.0	92.0						
<i>Carcharhinus dussumieri</i>										76.5	76.5	76.5
<i>Carcharhinus limbatus</i>				105.0	142.0	119.0				94.0	150.0	107.0
<i>Carcharhinus sorrah</i>	77.0	90.0	83.0	200.0	225.0	215.0				88.0	149.0	102.9
<i>Cephaloscyllium cir culopullum</i>	40.0	40.0	40.0				37.0	42.0	39.5			
<i>Chiloscyllium plagiosum</i>							58.0	87.0	67.6	85.5	85.5	85.5
<i>Chiloscyllium punctatum</i>	38.0	107.0	75.5	75.0	142.0	99.0	37.5	89.0	60.4	36.0	74.0	51.4
<i>Galeocerdo cuvier</i>	77.0	77.0	77.0	105.0	107.0	106.0	65.0	85.0	76.5			
<i>Halaaelurus buergeri</i>	40.0	40.0	40.0									

<i>Hemigaleus microstoma</i>	118.0	118.0	118.0							80.0	83.5	81.8	42.0	51.0	45.0
<i>Sphyrna mokarran</i>													245.0	245.0	245.0
<i>Squalus megalops</i>													69.0	69.0	69.0
<i>Squatina</i> sp.										113.0	120.0	116.5			
<i>Triacnodon obesus</i>	154.0	195.0	174.5												
Skate															
<i>Okamejei cairae</i>	18.0	24.0	20.8	10.0	28.8	17.1	22.0	37.0	29.1	37.0	42.0	39.3			
<i>Okamejei hollandi</i>				16.5	33.0	22.6									
Grand Total	18.0	37.0	22.0	10.0	93.0	31.3	0.7	152.0	34.7	20.0	65.5	39.4			

Table 25. Size Range of Sharks, Rays and Skates (Disc length) except for *Dasyatis zugei*, *Mobula japonica*, *Narcine* spp., *Narke* spp., *Neotrygon kuhlii*, *Platyrrhina* spp., *Rhinobatos formoensis*, *Rhynchobatus* spp., *Urolophus auranticus* and *Okamejei* spp. from January - August 2016. All Measurements in cm.

	2016																							
	Jan			Feb			March			April			May			June			July			Aug		
	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.
Ray																								
<i>Dasyatis zugei</i>																16.0	29.0	20.7						
<i>Himantura imbricata</i>				24.0	30.0	26.4																		
<i>Himantura walga</i>													18.0	24.0	21.0							18.5	23.0	20.7
<i>Mobula thurstoni</i>																42.0	47.5	45.2						
<i>Mobula japonica</i>																150.0	205.0	178.3						
<i>Narcine brevilabiata</i>	27.0	29.0	28.0													18.0	18.0	18.0						
<i>Narcine brunnea</i>																18.0	32.0	26.0						
<i>Narcine indica</i>	24.0	25.0	24.5													23.0	35.0	28.2				29.0	29.0	29.0
<i>Narcine timlei</i>																25.0	25.0	25.0						
<i>Neotrygon kuhlii</i>	31.0	32.0	31.5				25.0	40.0	31.4															

<i>Chiloscyllium punctatum</i>	46.0	58.0	53.3					50.0	63.0	57.6	70.0	85.0	78.0	37.5	77.0	60.1	34.0	66.5	49.0						
<i>Galeocerdo cuvier</i>	106.0	106.0	106.0											73.2	83.0	78.9									
<i>Hemigaleus microstoma</i>	97.0	97.0	97.0																						
<i>Heptranchias perlo</i>																	79.3	79.3	79.3						
<i>Hexanchus cf. griseus</i>																	78.5	78.5	78.5						
<i>Mustelus manazo</i>	110.0	110.0	110.0																						
<i>Sphyrna mokarran</i>	59.0	105.0	82.0																						
<i>Squalus megalops</i>	60.0	60.0	60.0														62.0	62.0	62.0						
<i>Squatina</i> sp.	60.0	105.0	87.4				60.0	100.0	80.0					113.0	120.0	116.5	65.0	65.0	65.0						
<i>Squatina tergocellatoides</i>	59.0	59.0	59.0																						
<i>Triaenodon obesus</i>	109.0	109.0	109.0																						
Skate																									
<i>Dipturus johannisdavisi</i>																	95.0	95.0	95.0						
<i>Okamejei cairae</i>	39.0	51.0	43.7	14.0	21.0	15.9	13.0	49.0	33.7	10.0	33.0	20.8	20.2	36.5	28.9	10.0	36.0	25.0	24.0	34.0	29.3	21.0	43.0	31.2	
<i>Okamejei hollandi</i>																	16.5	17.0	16.8						
Grand Total	24.0	248.0	58.0	14.0	21.0	15.9	13.0	100.0	38.5	10.0	82.0	37.5	20.2	150.3	37.2	10.0	240.0	39.0	24.0	34.0	29.3	21.0	43.0	31.2	

2.2.7. Fishing Effort and CPUE (Catch per Unit Effort)

Monthly fishing efforts (days at operation. total number of operation during the cruise) of the sampled vessels are summarized in Table 26-27.

Table 26. Total Days at Operation by Gears Sampled During the Study Period at Ba Ria-Vung Tau State in 2015-2016.

Gears	2015				2016								Total
	S	O	N	D	J	F	M	A	M	J	J	A	
Gillnet	167	155		174	108	115	115	155		102	176		1,267
Trawl net	167	294	480	61	225	46	147	82	374	147	65	239	2,327
Total	334	449	480	235	333	161	262	237	374	249	241	239	3,594

Table 27. Total Numbers of Operation by Gears Sampled During the Study Period at Ba Ria-Vung Tau State in 2015-2016.

Gears	2015				2016								Total
	S	O	N	D	J	F	M	A	M	J	J	A	
Gillnet	167	155		174	108	115	115	155		102	236		1,327
Trawl net	501	756	1434	183	649	138	441	246	914	441	166	651	6,520
Total	668	911	1434	357	757	253	556	401	914	543	402	651	7,847

In case of the gear of which annual effort excess 1,000 days of operation or 1,000 number of operations. CPUE (total of 12 months) was estimated by weight and number of individuals by species. The top 10 species for sharks, rays and skates are summarized in Table 28-37.

Table 28. Top 10 CPUE of Sharks Species Captured by the Trawl Net During the Study Period at Ba Ria-Vung Tau State (catch/fishing Effort)

No.	Species	Catch (kg)	CPUE (catch/days of operation)	CPUE (catch/No. of operation)
1	<i>Chiloscyllium punctatum</i>	763.9	0.33	0.12
2	<i>Carcharhinus sorrah</i>	288.5	0.12	0.04
3	<i>Alopias pelagicus</i>	215.0	0.09	0.03
4	<i>Atelomycterus marmoratus</i>	83.3	0.04	0.01
5	<i>Squatina</i> sp.	71.1	0.03	0.01
6	<i>Squalus megalops</i>	43.4	0.02	0.01
7	<i>Chiloscyllium plagiosum</i>	35.4	0.02	0.01
8	<i>Cephaloscyllium circlupullum</i>	30.4	0.01	0.01
9	<i>Carcharhinus dussumieri</i>	29.5	0.01	0.01
10	<i>Hemigaleus microstoma</i>	18.4	0.01	0.00

Table 29. Top 10 CPUE of Sharks Species Captured by the Trawl Net During the Study Period at Ba Ria-Vung Tau State (No. of individual/Fishing Effort)

No.	Species	No. individual	CPUE (No. indi/days of operation)	CPUE (No. indi/No. of operation)
1	<i>Chiloscyllium punctatum</i>	1,050.0	0.45	0.16
2	<i>Atelomyxerus marmoratus</i>	325.0	0.14	0.05
3	<i>Cephaloscyllium cir culopullum</i>	151.0	0.07	0.02
4	<i>Carcharhinus sorrah</i>	125.0	0.05	0.02
5	<i>Chiloscyllium plagiosum</i>	60.0	0.03	0.01
6	<i>Hemigaleus microstoma</i>	27.0	0.01	0.00
7	<i>Squalus megalops</i>	26.0	0.01	0.00
8	<i>Squatina</i> sp.	15.0	0.01	0.00
9	<i>Hexanchus griseus</i>	14.0	0.01	0.00
10	<i>Galeocerdo cuvier</i>	10.0	0.00	0.00

Table 30. Top 10 CPUE of Shark Species Captured by the Gillnet During the Study Period at Ba Ria-Vung Tau State (catch/Fishing Effort)

No.	Species	Catch (kg)	CPUE (catch/days of operation)	CPUE (catch/No. of operation)
1	<i>Carcharhinus sorrah</i>	3,582.7	2.83	2.70
2	<i>Carcharhinus limbatus</i>	343.4	0.27	0.26
3	<i>Carcharhinus amblyrhynchos</i>	124.0	0.10	0.09
4	<i>Carcharhinus</i> cf. <i>falciformis</i>	110.0	0.09	0.08
5	<i>Triaenodon obesus</i>	82.2	0.07	0.06
6	<i>Sphyrna mokarran</i>	78.7	0.06	0.06
7	<i>Galeocerdo cuvier</i>	45.2	0.04	0.03
8	<i>Hemigaleus microstoma</i>	44.0	0.04	0.03
9	<i>Chiloscyllium punctatum</i>	15.3	0.01	0.01
10	<i>Squatina</i> sp.	7.2	0.01	0.01

Table 31. Top 10 CPUE of Shark Species Captured by the Gillnet During the Study Period at Ba Ria-Vung Tau State (No. of individual/ Fishing Effort)

No.	Species	No. individual	CPUE (No. indi/days of operation)	CPUE (No. indi/No. of operation)
1	<i>Carcharhinus sorrah</i>	1,113.0	0.88	0.84
2	<i>Carcharhinus limbatus</i>	53.0	0.04	0.04
3	<i>Carcharhinus amblyrhynchos</i>	27.0	0.02	0.02
4	<i>Galeocerdo cuvier</i>	14.0	0.01	0.01
5	<i>Chiloscyllium punctatum</i>	7.0	0.01	0.01

6	<i>Hemigaleus microstoma</i>	4.0	0.00	0.00
7	<i>Triaenodon obesus</i>	3.0	0.00	0.00
8	<i>Sphyrna mokarran</i>	2.0	0.00	0.00
9	<i>Carcharhinus cf. falciformis</i>	1.0	0.00	0.00
10	<i>Squatina</i> sp.	1.0	0.00	0.00

Table 32. Top 10 CPUE of Rays Species Captured by the Trawl Net During the Study Period at Ba Ria-Vung Tau State (catch/Fishing Effort)

No.	Species	Catch (kg)	CPUE (catch/days of operation)	CPUE (catch/No. of operation)
1	<i>Himantura walga</i>	506.4	0.22	0.08
2	<i>Himantura imbricata</i>	443.0	0.19	0.07
3	<i>Rhinobatos formosensis</i>	309.0	0.13	0.05
4	<i>Plesiobatis daviesi</i>	269.0	0.12	0.04
5	<i>Platyrrhina sinensis</i>	265.1	0.11	0.04
6	<i>Narcine indica</i>	243.9	0.11	0.04
7	<i>Platyrrhina tangi</i>	219.0	0.09	0.03
8	<i>Dasyatis zugei</i>	175.0	0.08	0.03
9	<i>Rhynchobatus australiae</i>	142.0	0.06	0.02
10	<i>Dasyatis sinensis</i>	80.0	0.03	0.01

Table 33. Top 10 CPUE Of Rays Species Captured by the Trawl Net During the Study Period at Ba Ria-Vung Tau State (No. of individual/fishing Effort)

No.	Species	No. individual	CPUE (No. indi/days of operation)	CPUE (No. indi/No. of operation)
1	<i>Himantura imbricata</i>	1,416.0	0.61	0.22
2	<i>Himantura walga</i>	1,106.0	0.48	0.17
3	<i>Narcine indica</i>	1,077.0	0.46	0.17
4	<i>Dasyatis zugei</i>	619.0	0.27	0.10
5	<i>Platyrrhina sinensis</i>	570.0	0.25	0.09
6	<i>Platyrrhina tangi</i>	435.0	0.19	0.07
7	<i>Rhinobatos formosensis</i>	315.0	0.14	0.05
8	<i>Narcine brunnea</i>	298.0	0.13	0.05
9	<i>Dasyatis sinensis</i>	200.0	0.09	0.03
10	<i>Narcine timlei</i>	188.0	0.08	0.03

Table 34. Top 10 CPUE of Ray Species Captured by the Gillnet During the Study Period at Ba Ria-Vung Tau State (Catch/Fishing Effort)

No.	Species	Catch (kg)	CPUE (catch/days of operation)	CPUE (catch/No. of operation)
1	<i>Mobula thurstoni</i>	3,589.4	2.83	2.71
2	<i>Himantura jenkinsii</i>	1,610.0	1.27	1.21
3	<i>Plesiobatis daviesi</i>	272.0	0.22	0.21
4	<i>Neotrygon kuhlii</i>	268.9	0.21	0.20
5	<i>Mobula japanica</i>	180.0	0.14	0.14
6	<i>Rhynchobatus australiae</i>	10.7	0.01	0.01

Table 35. Top 10 CPUE of Ray Species Captured by the Gillnet During the Study Period at Ba Ria-Vung Tau State (No. of individual/Fishing Effort)

No.	Species	No. individual	CPUE (No.indi/days of operation)	CPUE (No.indi/No. of operation)
1	<i>Himantura jenkinsii</i>	412.0	0.33	0.31
2	<i>Mobula thurstoni</i>	371.0	0.29	0.28
3	<i>Neotrygon kuhlii</i>	127.0	0.10	0.10
4	<i>Plesiobatis daviesi</i>	13.0	0.01	0.01
5	<i>Mobula japanica</i>	3.0	0.00	0.00
6	<i>Rhynchobatus australiae</i>	2.0	0.00	0.00

Table 36. Top 10 CPUE of Skates Species Captured by the Trawl Net During the Study Period at Ba Ria-Vung Tau State (Catch/Fishing Effort)

No.	Species	Catch (kg)	CPUE (catch/days of operation)	CPUE (catch/No. of operation)
1	<i>Okamejei cairae</i>	7,596.1	3.26	1.17
2	<i>Okamejei hollandi</i>	1,059.0	0.46	0.16
3	<i>Dipterus johannisdavisi</i>	3.7	0.00	0.00

Table 37. Top 10 CPUE of Skates Species Captured by the Trawl Net During the Study Period at Ba Ria-Vung Tau State (No. of individual/Fishing Effort)

No.	Species	No. individual	CPUE (No.indi/days of operation)	CPUE (No.indi/No. of operation)
1	<i>Okamejei cairae</i>	39,261.0	16.87	6.02
2	<i>Okamejei hollandi</i>	4,967.0	2.13	0.76
3	<i>Dipterus johannisdavisi</i>	1.0	0.00	0.00

2.2.8. 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 China. The major markets were wholesale market in Vung Tau city, Tan Thanh and in Ho Chi Minh city. The price varied according to species. The most expensive rays were families of Myliobatidae and Mobulidae. All rays and sharks were sold in price of whole body, but some species were cut in parts. The skates species is the cheapest. The details are shown in Table 38.

Table 38. Price of sharks, Rays and Skates by species at Ba Ria-Vung Tau landing sites 2015. All price in USD/kg (apply for 01 USD=22260 VND)

Group	Sc.name	Rang price (USD/kg)	Marketing
Ray	<i>Dasyatis sinensis</i>	1-2	local market and Ho Chi Minh city
	<i>Dasyatis zugei</i>	1-2	Ho Chi Minh city and local market
	<i>Himantura imbricata</i>	1-2.2	Local market, Ho Chi Minh city and China
	<i>Himantura jenkinsii</i>	1-2	local market and Ho Chi Minh city and China
	<i>Himantura undulata</i>	2-5	Local market an Ho Chi Minh city
	<i>Himantura walga</i>	1-2	local market and Ho Chi Minh city
	<i>Mobula thurstoni</i>	1-1.8	Local market and Ho Chi Minh city and China
	<i>Nacine brevilabiata</i>	1-2	China, Ho Chi Minh city and local market
	<i>Narcine indica</i>	0.2-1.7	China, Ho Chi Minh city and Local market
	<i>Narke japonica</i>	0.2-2	China, local market
	<i>Neotrygon kuhlii</i>		China, Ho Chi Minh city and local market
	<i>Platyrrhina sinensis</i>	0.2-1.5	China, local market and Ho Chi Minh city
	<i>Platyrrhina tangi</i>	1,5-1,6	Local market
	<i>Plesiobatis daviesi</i>	1-2	Ho Chi Minh city, China and local market
	<i>Rhinobatos formosensis</i>	1-2	China, Ho Chi Minh city and Local market
	<i>Rhynchobatus australiae</i>	1-2	Local market and Ho Chi Minh city
	<i>Rhynchobatus palpebratus</i>	1.7-2	Local marlet, China and Ho Chi Minh city
Shark	<i>Alopias pelagicus</i>	3-5	China, Ho Chi Minh city local market
	<i>Atelomycterus marmoratus</i>	1-2	Ho Chi Minh city and local market
	<i>Atelomycterus marmoratus</i>	1.5-5	Local market and China
	<i>Carcharhinus amblyrhynchos</i>	1-2	Local market and Ho Chi Minh city and China
	<i>Carcharhinus cf. falciformis</i>	1-2	Local market and Ho Chi Minh city

	<i>Carcharhinus dussumieri</i>	1-2	Local market and Ho Chi Minh city
	<i>Carcharhinus limbatus</i>	1-2.5	China, Ho Chi Minh city and local market
	<i>Carcharhinus sorrah</i>	1-6	China, Ho Chi Minh city, China and local market
	<i>Cephalocyllium circulopullum</i>	1-2	China, local market and Ho Chi Minh city
	<i>Chiloscyllium plagiosum</i>	1-2	China, local market and Ho Chi Minh city
	<i>Chiloscyllium punctatum</i>	1-2	china, local market and Ho Chi Minh city
	<i>Galeocerdo cuvier</i>	1-2	Local market and Ho Chi Minh city and china
	<i>Halaelurus buergeri</i>	1-2	China, local market
	<i>Hemigaleus microstoma</i>	1-6	China, Ho Chi Minh city and local market
	<i>Mustelus manazo</i>	1-2	Ho Chi Minh city and local market
	<i>Sphyrna mokarran</i>	1-3	China, Ho Chi Minh city and local market
	<i>Squalus megalops</i>	1-2	Ho Chi Minh city and local market
	<i>Squatina</i> sp	1-2	Ho Chi Minh city and local market
	<i>Squatina tergocellatoides</i>	1-2	Ho Chi Minh city and local market
	<i>Triaenodon obesus</i>	1-2	China, Ho Chi Minh city and local market
Skates	<i>Okamejei cairae</i>	0.2-2	China, Ho Chi Minh city and local market
	<i>Okamejei hollandi</i>	0.2-2	China, Ho Chi Minh city and local market

3. CONCLUSION

A pilot project on recording landing data of sharks and rays up to species level was conducted in the State of Binh Thuan and Ba Ria-Vung Tau. During this project 4 researchers of RIMF and SORESIMF were trained in taxonomy and in data collection using the new harmonized format. Three districts (towns) facing the Vung Tau city, La Gi and Phan Thiet towns were selected as the study sites as they were the main landing sites of sharks, rays and skates in the states. The landing data were collected at 7 jetties i.e five in Vung Tau city and two in Binh Thuan province.

A total of 27 species of sharks from seven (7) Orders and 12 Families, and 39 species of rays from five Orders and 14 Families, and 3 species of skate from one Order and one family were recorded. Ba Ria-Vung Tau recorded the highest with 23 species of sharks and 24 species of rays and skates. Binh Thuan recorded with 12 species of sharks and 31 rays and skates. Details are shown in **Appendix II**. In term of percentage of total marine landings, sharks, rays and skates only contributed 0.4%, 0.3% and 0.5% at Binhthuan province and 0.2%, 0.3% and 0.2% at Baria-Vungtau province respectively.

The most abundant shark species at Binh Thuan were *Chiloscyllium punctatum*, *Carcharhinus sorrah* and for rays *Himantura imbricata*, *Dasyatis zugei* and *H. walga* and for skates, *Okamejei cairae*, *O. holandii*. Species of *O. cairae* reached huge catch from trawl net in Binh Thuan (Lagi jetty).

The most abundant shark species at Ba Ria-Vung Tau were *Chiloscyllium punctatum*, *Carcharhinus sorrah* and *Atelomyxerus marmoratus* while for rays *Himantura walga*, *H. imbricata*, *Neotrygon kuhlii*, *H. jenkinsii* and *Dasyatis zugei*. The most common shark species were *C. sorrah* while for rays *H. walga*, *D. zugei* and *Gymnura japonica*.

All big sized sharks of less than two meters (except to *Alopias pelagicus*) in total length. Usage and marketing information from this study also confirmed at jetties that all sharks and rays were sold to buyer at local jetty. The prize of whole catch was determined by buyers at fishing ports that cannot get the information from fishermen.

4. OUTPUT AND OUTCOME

The project outputs and outcomes are summarised in Table 37 as shown below.

Table 39. Output and Outcome

No	Output	Outcome
1.	Six trained personnel in sharks and rays taxonomy from the Research Institute for Marine Fisheries (RIMF) and South Research sub - Institute for Marine Fisheries (SORESIMF).	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 pilot project sites.	Confirmed earlier data published in Vietnam National Statistics. Sharks and rays were not targeted and contributed to only about 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.	Stage of maturity for the different species of sharks and rays determined.	Increased awareness of needs and measures for shark conservation and management among stakeholders
7.	Information on usage and marketing of the landed sharks and rays were obtained from the pilot project.	Confirmed earlier report in current NPOA-Sharks that all sharks and rays are landed whole, fully utilised with no finning activities onboard vessels.
8.	A report on landing of sharks and rays up to species level from three sites in Binh Thuan and Vung Tau.	Data recording on sharks and rays will be improved from generic terms 'sharks' and 'rays' to species level.
9.	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
10.	Specimens collected during sampling activities deposited for future reference.	A national repository for elasmobranchs has been established at the Research Institute Marine Fisheries

5. FUTURE ACTIVITIES

In Vietnam should be collected more elasmobranch not only in the south of Nation but include from North and centre of the country to get more new record; Build National Plan of Action Sharks in Vietnam;

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(SEAFDEC will replace this form)

SAMPLE OF STANDARD FORM**Data Collection Project on Shark and Ray Data Collection**

Name of Enumerator: _____ Date: _____

Name of Landing Site: _____ Vessel Registration No: _____

GRT : _____

Type of Gear: _____ Fishing Area: _____ No. of days/trip: _____

A. Standard Operation Procedure:

1. This form is for a single sampling vessel.
2. Collect all fish (sharks, skates and rays) if catch is less than 50 tails or 10-50% of the landed catch if more than 50 tails. Take samples randomly.
3. Separate them by species and sex.
4. Measure total length for all sharks, skates and rays from the Family Rhynchobatidae, Rhinobatidae, Narcinidae and Narkidae. Measure disc length for other ray species.
5. Record weight of all sharks, skates and rays by species.
6. Record weight of commercial and low-value species.

B. Measurement of sample (Sharks)

No.	Species	Sex	Total length (mm)					
1								
2								
3								

C. Actual Weight of Sharks by Species

No	Species	Weight (Kg)
1		
2		
3		

D. Measurement of sample (Rays)

No.	Species	Sex	Total length/Disc Length (mm)					
1								

2								
3								
4								

D. Actual Weight of Rays by Species

No	Species	Weight (Kg)
1		
2		
3		
4		
5		

3. Total Catch of Sampling Vessel

No.	Vessel Registration No	All Sharks	All Rays	Commercial species	Low-value species	TOTAL
1.						

5. Price of Sharks

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

6. Price of Rays

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

Note: _____

Checklist of Sharks, Rays and Skates Species Recorded During the Study Period

No.	Order/Families/species	Ba Ria-Vung Tau	Binh Thuan
	Total ray species	25	29
	MYLIOBATIFORMES		
	Urolophidae		
1	<i>Urolophus aurantiacus</i>	+	
	Dasyatidae		
2	<i>Dasyatis cf. sinensis</i>		
3	<i>Dasyatis fluviatorum</i>		+
4	<i>Dasyatis parvonigra</i>		+
5	<i>Dasyatis sinensis</i>	+	+
6	<i>Dasyatis sp.</i>		+
7	<i>Dasyatis zugei</i>	+	+
8	<i>Himantura cf. javaensis</i>		+
9	<i>Himantura imbricata</i>	+	+
10	<i>Himantura jenkinsii</i>	+	
11	<i>Himantura undulata</i>	+	
12	<i>Himantura walga</i>	+	+
13	<i>Neotrygon kuhlii</i>	+	+
14	<i>Neotrygon sp.</i>		+
15	<i>Taeniura lymma</i>		+
	Gymnuridae		
15	<i>Gymnura japonica</i>		+
17	<i>Gymnura poecilura</i>		+
	Mobulidae	+	+
18	<i>Mobula sp.</i>		+
19	<i>Mobula thurstoni</i>	+	
	Myliobatidae		
20	<i>Aetobatus ocellatus</i>		+
21	<i>Aetomylaeus maculatus</i>		+
22	<i>Mobula japonica</i>	+	
23	<i>Myliobatis tobijei</i>		+
24	<i>Plesiobatis daviesi</i>	+	
25	<i>Urogymnus asperrimus</i>		+
	RHINOBATIFORMES		
	Platyrrhinidae		
26	<i>Platyrrhina sinensis</i>	+	+
27	<i>Platyrrhina tangi</i>	+	+
	Rhinobatidae		
28	<i>Rhinobatos formosensis</i>	+	+
29	<i>Rhinobatos sp.</i>	+	
	Rhynchobatidae		

30	<i>Rhynchobatus australiae</i>	+	+
31	<i>Rhynchobatus palpebratus</i>	+	
32	TORPEDIFORMES		
	Narcinidae	+	+
33	<i>Narcine brevilabiata</i>	+	
34	<i>Narcine brunnea</i>	+	
35	<i>Narcine cf. indica</i>		+
36	<i>Narcine indica</i>	+	+
37	<i>Narcine sp.</i>		+
38	<i>Narcine timlei</i>	+	+
	Narkidae		
39	<i>Narke dipterygia</i>		+
40	<i>Narke japonica</i>	+	
	Total sharks speices	24	12
	SQUALIFORMES		
	Centrophoridae		
41	<i>Centrophorus moluccensis</i>	+	
42	CARCHARHINIFORMES		
	Carcharhinidae		
43	<i>Galeocerdo cuvier</i>	+	
	Carcharhinidae		
44	<i>Carcharhinus amblyrhynchos</i>	+	
45	<i>Carcharhinus cf. falciformis</i>	+	
46	<i>Carcharhinus dussumieri</i>	+	+
47	<i>Carcharhinus limbatus</i>	+	+
48	<i>Carcharhinus sorrah</i>	+	+
49	<i>Carcharhinus sp.</i>		+
50	<i>Galeocerdo cuvier</i>	+	
51	<i>Triaenodon obesus</i>	+	
	Hemigaleidae		
52	<i>Hemigaleus microstoma</i>	+	
	Scyliorhinidae		
53	<i>Atelomycterus marmoratus</i>	+	+
54	<i>Cephaloscyllium cirulopullum</i>	+	
55	<i>Galeus sp.</i>		+
56	<i>Halaelurus buergeri</i>	+	+
	Sphyrnidae		
57	<i>Sphyrna mokarran</i>	+	
	Triakidae		
58	<i>Mustelus manazo</i>	+	
	HEXANCHIFORMES		
	Hexanchidae		
59	<i>Heptranchias perlo</i>	+	
60	<i>Hexanchus cf. griseus</i>	+	
	LAMNIFORMES		

	Alopiidae		
61	<i>Alopias pelagicus</i>	+	
62	<i>Alopias superciliosus</i>		+
	ORECTOLOBIFORMES		
	Hemiscyllidae		39
63	<i>Chiloscyllium cf. Punctatum</i>		+
64	<i>Chiloscyllium plagiosum</i>	+	+
65	<i>Chiloscyllium punctatum</i>	+	+
66	<i>Chiloscyllium sp.</i>		+
	SQUALIFORMES		
	Squalidae		
67	<i>Squalus megalops</i>	+	
	SQUATINIFORMES		
	Squatinae		
68	<i>Squalus megalops</i>	+	
69	<i>Squatina sp.</i>	+	
70	<i>Squatina tergocellatoides</i>	+	
	Total skates species	3	3
	RAJIFORMES		
	Rajidae		
71	<i>Dipturus johannisdavisi</i>	+	
72	<i>Okamejei cairae</i>	+	+
73	<i>Okamejei cf. boesemani</i>		+
74	<i>Okamejei hollandi</i>	+	+

Photos Taken During the Onsite Training Sessions and Data collection Activities at Landing Sites(23-27 May 2016)



Photo 1. Participants and resource persons



Photo 2. Participants during lecture session



Photo 3. Some taxonomy guiding from experts during the training session



Photo 4. Some of the common shark specimens from La Gi jetty



Photo 5. Trainers working on taxonomy sharks



Photo 6. Experts and trainers working at Incomat jetty

Appendix IV

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

Species	Small	Medium	Big
Rays			
<i>D. fluviorum</i>			
<i>D. zugei</i>			
<i>G. poecilura</i>			
<i>H. gerrardi</i>			
<i>H. uarnacoides</i>			
<i>H. walga</i>			
<i>N. kuhlii</i>			
<i>R. formosensis</i>			
<i>R. australiae</i>			
Sharks			
<i>A. marmoratus</i>			
<i>C. leucas</i>			
<i>C. sorrah</i>			
<i>C. hasseltii</i>			
<i>C. indicum</i>			
<i>C. plagiosum</i>			
<i>C. punctatum</i>			
<i>S. laticaudus</i>			
<i>S. lewini</i>			