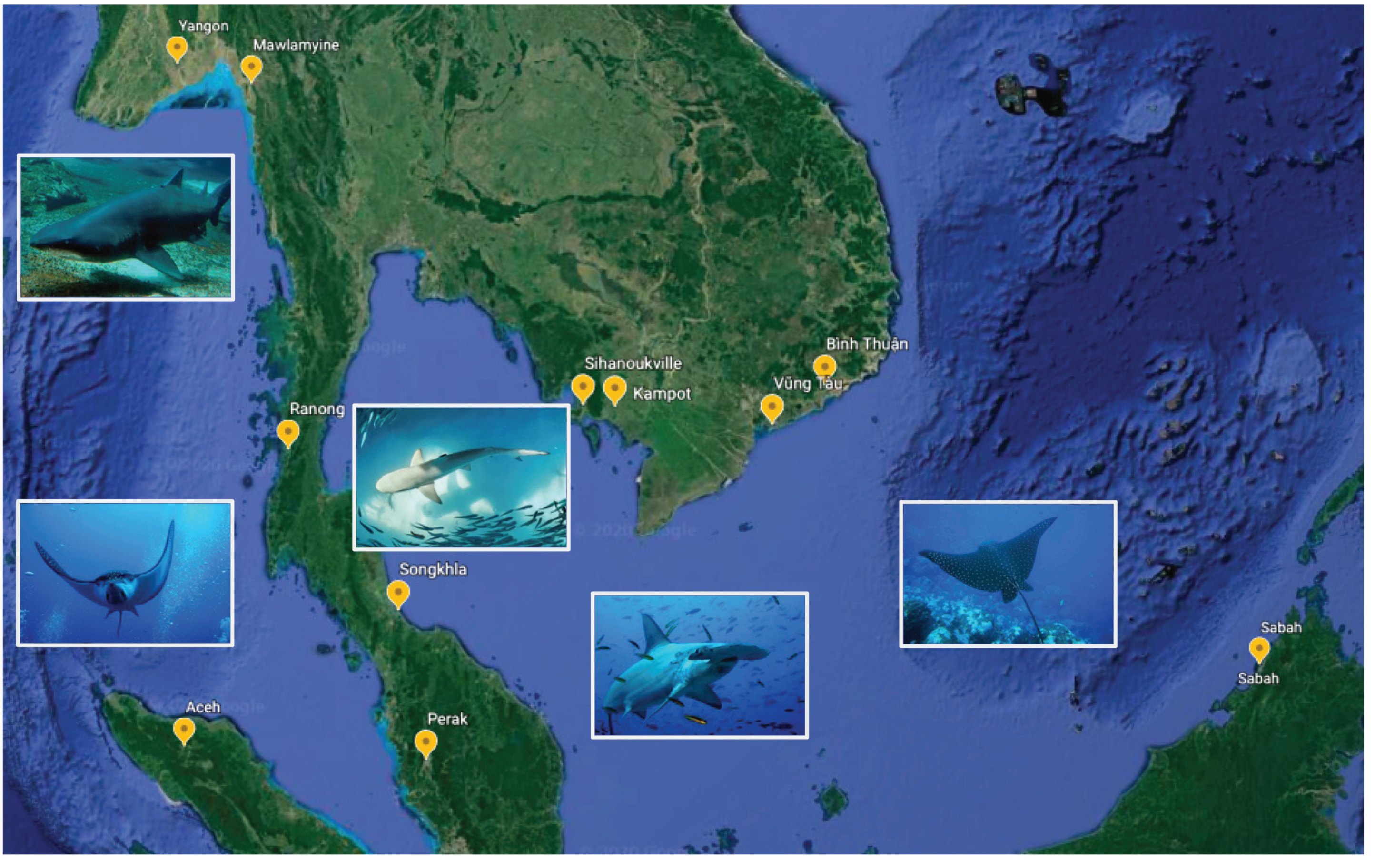
TERMINAL REPORT

REGIONAL SHARKS, RAYS AND SKATES DATA COLLECTION



SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER (SEAFDEC)

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TERMINAL REPORT

Regional Sharks, Rays and Skates Data Collection

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(SEAFDEC)

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PREPARATION AND DISTRIBUTION OF THIS DOCUMENT

This Terminal Report of the Collaborative Project between CITES Secretariat and SEAFDEC (CITES Project No.: S-521) under *EU-CITES implementation of decisions adapted by the 17th meeting of the Conference of the Parties to CITES (CoP-17)* – Sharks and Rays Data Collection in Southeast Asian Region (2015-2016) was prepared by the Southeast Asian Fisheries Development Center (SEAFDEC/SEC) in collaboration with the Marine Fisheries Resources Development and Management Department (SEAFDEC/MFRDMD). The publication is distributed to the SEAFDEC Member Countries, SEAFDEC Departments, and partner organizations represented during implementation of the Collaborative Project between CITES Secretariat and SEAFDEC.

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PART 1

SUMMARY OF THE RESULTS (2015-2016)

NOTES WHEN MAKING CITATION / REFERENCE 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.

EXECUTIVE SUMMARY

A one-year study on sharks data collection had been implemented from year 2015 to 2016 in collaboration with six SEAFDEC Member Countries with technical support from SEAFDEC Marine Fishery Resources Development and Management Department (SEAFDEC/MFRDMD) and SEAFDEC Training Department (SEAFDEC/TD) under financial support mainly from CITES Secretariat and the Japanese Government. The Standard Operation Procedures (SOP) for Sharks, Rays and Skates Data Collection in the Southeast Asian Waters published by SEAFDEC was used as regional standard for collecting and reporting national data. Information on trade and marketing were also included in this study. Another study was conducted in Cambodia and Myanmar in 2018-2019.

During 2015-2016 study, from a total of 18,097 tons of fish landed in the participating countries during this study, 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 range from 0.6-5.15% for rays, 0.2-20.7% for sharks, and 0.002-0.3% 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 448-4,254 kg for rays, 364-16,445 kg for sharks, and 7-1,650 kg for skates, respectively. A total of 33,495 individual of rays, sharks and skates comprising of 18,546 rays, 13,504 sharks and 1,445 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 *Telatrygon biasa* for rays, *Chiloscyllium punctatum* for sharks, and *Okamejei cairae* for skates. The highest landing by weight was *Mobula japonica* (37,573 kg with size range from 32-100cm DL) for rays, *Alopias superciliosus* (53,504 kg with size range from 65-366cm TL) for shark, and *Okamejei cairae* (17,501 kg, size range 10-58cm TL) for skate.

Regarding fishing effort (CPUE, kg/haul), it was reported that CPUE of trawl fishing range from 0.002-1.46kg, and 0.003-1.023kg for rays and sharks respectively. For gillnet, it was found that CPUE was from 0.008-19.5kg for rays, and 0.005-11.82kg for sharks. Catch per Unit Effort for longline was from 0.04-4.87kg for rays, and 0.5-6.6kg for sharks. For skates, CPUE was range from 0.01- 2.3kg/haul only in trawl fishing.

Regarding the price and marketing of sharks, rays and skates, it range from 1-7.34 USD/kg for rays, 0.22-8.99 USD/kg for sharks, and 0.2-2 USD/kg for skates. The price varies pending on species, size and demand. Almost all sharks, rays, and skates was mainly utilized locally and some products were for foreign markets.

1.0 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. In 2015, SEAFDEC has carried out a one-year regional project on sharks and rays data collection in six 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. SOP used during this studdy is as shown **Appendix I.**

1.1 Participating Countries and Financial Support

Six SEAFDEC Member Countries, namely Cambodia, Indonesia, Malaysia, Myanmar, Thailand, and Viet Nam, participated during 2015-2016 study and Cambodia and Myanmar continued in 2018-2019. Financial resources were mainly from SEAFDEC/EU-CITES (through CITES Secretariat) and Japanese Government through SEAFDEC under Japanese Trust Fund VI.

1.2 Period, National Appointed Technical Coordinator and Local Enumerators, and Methodology

One-year study of data collection at selected landing sites (**Figure 1**) was started from July in some counties and in August 2015 in other countries. The study were completed during the third quarter of 2016. For second phase, Myanmar started in August 2018 and completed in July 2019. Cambodia started in September 2018 and completed in August 2019. Participating countries collected all data by formally appointing local enumerators (**Table 1**) of their respective countries. In order to standardise all recorded data the regional standard – “Standard Operating Procedures for Sharks, Rays and Skates Data Collection (SOP) in the Southeast Asian Waters” developed by SEAFDEC were used. In addition to the landing data, information on marketing (trade and market chain with values) was also collected at several landing sites and wet markets during the study period.

At each landing site, 2-4 fishing vessels were selected for sampling. Sampling was conducted five (5) days a month. However. Sampling for Malaysia was conducted 12 days/month with financial support from government of Malaysia. Measurement of total length (TL) was taken for all shark, and disc length (DL) for all ray species except for species from families Rhinidae, Glaucostegidae, Rhinobatidae and Narcinidae. Measurement of total length was taken for these families as well as for skates. The length-weight of samples were individually measured with sampling size of about 10% of the total overall weight of catch of each vessel of sampling 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 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), Yano *et al.* (2005), Ahmad and Annie Lim (2012), Ahmad *et al.* (2013), Ahmad *et al.* (2014), Ebert *et al.* (2013), and Last *et al*. (2016). Numbers of landing sites, total number of landing sampled and type of fishing gears sampled are shown in **Table 2**. There are 13 landing sites in the participating countries. Data was from 4,394 landings and five (5) types of fishing gear.

2. 0 RESULTS

2.1 Species Composition (Table 3)

As shown in **Table 3**, a total of 18,097,240kg of fish was landed during study period. Rays, sharks, and skates made up 169,364kg, 249,259kg, and 19,896kg (0.9%, 1.4%, and 0.1%) respectively. Total landing of other fishes were 17,658,720kg (97.6%). The highest catch composition of rays and sharks was reported by Indonesia at 5.2% and 20.7%, respectively. Landings was ranged from 0.6-5.2% for rays, 0.2-20.7% for sharks and 0.002-0.35% for skates. Landing of skates was recorded only in Myanmar and Viet Nam.

Table 4 shows the average landing per month. The landing was ranged from 448-4,254kg for rays, 364-16,445kg for sharks, and 7-1,650 kg for skates. The highest average landings of ray was reported by Malaysia, Indonesia and Myanmar, and the highest average landings of shark was Indonesia, Malaysia and Viet Nam.

2.2 Sample Size

As shown in **Table 5a**, **Table 5b**, and **Table 5c**, a total of 33,495 individual comprising of 18,546 rays, 13,504 sharks and 1,445 skates were sampled. For the species that was clearly identified by national and regional shark experts, it was found that those comprised 63 species of rays (out of 78 species), 47 species of sharks (out of 60 species), and four (4) species of skates (out of 8 species). The most abundant ray species were *Telatrygon biasa*, followed by *Brevitrygon heterura* and *Neotrygon orientalis*. The most abundant shark species was *Chiloscyllium punctatum*, followed by *Chiloscyllium hasseltii*, and *Carcharhinus albimarginatus.* The most abundant skates species was *Okamejei cairae*.

2.3 Weight and Size Range of Sharks and Rays by Species

The highest landing by weight of rays was for *Mobula japonica* (37,573kg with size range from 32-100cm DL) followed by *Urogymnus asperrimus* (14,556 kg, size range from 66- 120cm DL) and *Brevitrygon heterura* (10,212 kg, size range 11-46cm DL). The lowest was *Temera hardwickii* (about 1kg, size 12.5cm DL). This species is considered as trash fish and rarely found at landing sites. Trash fish are sole separately from commercial species. The details are shown in **Table 6a** and **Table 7a.**

The highest landings by weight was for *Alopias superciliosus* (53,504 kg, size range from 65 -366cm TL) followed by *Alopias pelagicus* (51,160 kg, size range 162-338cm TL) and *Prionace glauca* (17,932 kg, size range 142-295cm TL). The lowest was *Halaelurus buergeri* (1 kg, size range 40-45 TL). The details are shown in **Table 6b** and **Table 7b.**
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 *boesemani* (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.

2.4 Fishing Effort and Catch Per Unit Effort (CPUE)

Summary of the fishing efforts and CPUE by type of fishing gear in each country are shown in **Table 8**. Fishing efforts and CPUE was compiled depending on the types of fishing gear from their sampling data. There are number of different parameters with regard to calculation of the fishing effort and CPUE for each type of fishing gear. 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 was ranged from 0.002-1.46kg, and 0.003-1.023kg respectively. For gillnets, CPUE was from 0.008-19.5kg for rays and 0.005-11.82kg for sharks. CPUE for longlines was from 0.04-4.87kg for rays, and 0.5-6.6kg for sharks. Landings of skates only recorded in trawl nets and CPUE was ranged from 0.01-2.3kg.

2.5 Usage And Marketing

Table 9 shows price and marketing destinations of shark, ray and skate. Range of prices was from 1-7.34 USD/kg for rays, 0.22-8.99 USD/kg for sharks, and 0.2-2 USD/kg for skates. The price varies from species to species, its size and season. It was found that most of of sharks, rays and skates were consumed locally and some products sold to foreign countries.

3.0 CONCLUSION AND WAY FORWARD

The study were successfully implemented at 13 landing sites in six (6) countries namely Cambodia (one site), Indonesia, Myanmar, Thailand and Viet Nam (2 sites for each country), and Malaysia (4 sites). SEAFDEC also conducted the same study in the region in 2003-2004. Results from both studied will be used as a basis information for future planning on stock assessment of sharks and rays in the Southeast Asian region. Even though, all participating countries were able to submit the results some data need extra validation due to some taxonomy changes especially in scientific names of rays. It was recommended that capacity building program especially on identification of species (taxonomy) and analysis of data should be continued especially to junior researcher. In addition, data from this study also used to develop NPOA-Sharks in Thailand and Myanmar. Other countries such as Cambodia and Viet Nam will also develop their own NPOA-Sharks in future based on data collected from this study to support available national data collected from other research activities.

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

Countries	Contact Address
Cambodia	**Study site**: 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, CAMBODIA Tel: +85577767763 Email: sharkandraycambodia@gmail.com
Indonesia	**Study site**: Cilacap Mr. Agung Ferieigha Nugroho Pelabuhan Perikanan Samudera Cilacap Jl. Lingkar Pantai Teluk Penyu, Cilacap-Central Java, INDONESIA **Study site**: Aceh Mr. Munawir Pelabuhan Perikanan Nusantara Lampulo Jl. Ateuk Jawo Lr. Tanggul Gampong Ateuk Jawo B. Aceh, INDONESIA
Malaysia	**Study site**: 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 **Study site**: 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 **Study site**: 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

Malaysia	Mr. Norhairul Bin Nordin Assistant Fisheries Officer Department of Fisheries Sabah Wisma Pertanian Sabah, Jalan Tasik Luyang (Off Jalan Maktab Gaya) 88624, Kota Kinabalu, Sabah, MALAYSIA Tel No.: +6 088 235966 Email: hairul_elut@yahoo.com **Study site**: Sandakan, Sabah Mr. Chin En Kiong Senior Assistant Fisheries Officer Department of Fsiheries Sabah P.O. BOX 1369, 90715, Sandakan, Sabah, MALAYSIA Tel No.: +6 089 208870 Email: EnKiong.Chin@sabah.gov.my Mr. Maurice @ Kassim bin Anchi Senior Assistant Fisheries Officer Department of Fisheries Sabah P.O.BOX 1369, 90715, Sandakan, Sabah, MALAYSIA Tel No.: +6 089 208870 Email : Maurice.anchi@sabah.gov.my
Myanmar	**Study site**: Yangon Mr. Min Naung Director, Ayawaddy Division No.312 North Okalar Pa Township, Rose Road. Yangon Division, MYANMAR Tel: +959044224257 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 Mr. Kyaw Swar Win Assistant Officer, Yangon Division No.33, Bank Road, Kyawktatar Township, DoF Apartment. Yangon Division. MYANMAR Tel. +959798571391 **Study site**: Mawlamyine Mr. Soe Nyunt Deputy Director, Mon State DoF Housing, Theingone Road, Mawlamyine. Mon State. MYANMAR Tel: +959450003916

Myanmar	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
Thailand	**Study site**: Ranong Province 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 Mr. Watchira Sodop Fishery Biologist Ranong Marine Fisheries Station 157 Paknam Subdistrict, Muang District, Ranong 85000, THAILAND Telephone: +66621613900 Email: wach623@gmail.com **Study site**: Songkhla 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 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
Viet Nam	**Study site**: Ba Ria (in Vung Tau), and Binh Thuan Province 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

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

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

No.	Species	Cambodia	Indonesia	Malaysia	Myanmar	Thailand	Viet Nam	Total
1	*Aetobatus flagellum*				2			**2**
2	*Aetobatus ocellatus*	15	5			3	1	**24**
3	*Aetobatus narinari*				4			**4**
4	*Aetomylaeus maculatus*						3	**3**
5	*Hemitrygon akajei*		1	59		62		**122**
6	*Hemitrygon* cf *sinensis*						3	**3**
7	*Hemitrygon fluviorum*			13			7	**20**
8	*Megatrygon microps*				3			**3**
9	*Hemitrygon parvonigra*	132					11	**143**
10	*Dasyatis thetidis*			1		3		**4**
11	*Hemitrygon sinensis*				4		10	**14**
12	*Dasyatis* sp.						10	**10**
13	*Telatrygon biasa*	190	1	1,344		4,463		**5,998**
14	*Telatrygon zugei*						14	**14**
15	*Glaucostegus* sp.				4			**4**
16	*Glaucostegus typus*				26			**26**
17	*Gymnura japonica*				62	2	9	**73**
18	*Gymnura poecilura*			21	5		5	**31**
19	*Gymnura zonura*		2					**2**
20	*Maculabatis* cf *gerrardi*			1				**1**
21	*Brevitrygon* cf *javaensis*				3		1	**4**
22	*Pateobatis fai*		1	11	4			**16**
23	*Maculabatis gerrardi*			1,905	36	32		**1,973**
24	*Brevitrygon imbricata*	211			4	1	132	**348**

25	*Pateobatis jenkinsii*		50	12	28	5	8	**103**
26	*Himantura leoparda*				19			**19**
27	*Urogymnus lobistoma*				8			**8**
28	*Maculabatis pastinacoides*			89	44			**133**
29	*Pateobatisa uarnacoides*			2	43	3		**48**
30	*Himantura uarnak*		1	3	5			**9**
31	*Urogymnus granulatus*		5	4	27		1	**37**
32	*Brevitrygon heterura*	404	2	1,730	413	1,698	194	**4,441**
33	*Mobula japonica*		311		26		3	**340**
34	*Mobula kuhlii*		3		1			**4**
35	*Mobula tarapacana*		19					**19**
36	*Mobula* sp.						1	**1**
37	*Mobula thurstoni*		44				24	**68**
38	*Myliobatis tobijei*						1	**1**
39	*Narcine brevilabiata*				11		3	**14**
40	*Narcine brunnea*				60		5	**65**
41	*Narcine* cf *indica*						1	**1**
42	*Narcine indica*						39	**39**
43	*Narcine lingula*				10			**10**
44	*Narcine maculata*			2				**2**
45	*Nacine* sp.			12			3	**15**
46	*Nacine* sp D.			6				**6**
47	*Nacine timlei*						2	**2**
48	*Narke dipterygia*						4	**4**
49	*Narke japonica*						1	**1**
50	*Neotrygon orientalis*		3	1,979	92	419	14	**2,507**
51	*Neotrygon* sp.						3	**3**

52	*Pastinachus ater*		1					**1**
53	*Pastinachus* cf *solocirostris*				1			**1**
54	*Pastinachus gracilicaudus*				2			**2**
55	*Pastinachus solocirostris*		2					**2**
56	*Pastinachus stellurostris*				2			**2**
57	*Platyrhina sinensis*						14	**14**
58	*Platyrhina tangi*						18	**18**
59	*Plesiobatis daviesi*		1		1	1	6	**9**
60	*Pteroplatytrygon violacea*		2					**2**
61	*Rhina ancylostoma*		1		41			**42**
62	*Rhinobatos* cf *borneensis*			10				**10**
63	*Rhinobatos* cf *formosensis*				396			**396**
64	*Rhinobatos formosensis*					549	34	**583**
65	*Rhinobatos penggali*		67					**67**
66	*Rhinobatos punctifer*				287			**287**
67	*Rhinobatos* sp.						2	**2**
68	*Rhinoptera adspersa*				1			**1**
69	*Rhinoptera javanica*		1		43			**44**
70	*Rhinoptera jayakari*		1		35			**36**
71	*Rhynchobatus australiae*		22	162	3	26	6	**219**
72	*Rhynchobatus laevis*			3				**3**
73	*Rhynchobatus palpebratus*						8	**8**
74	*Taeniura lymma*	5	12				4	**21**
75	*Taeniurops meyeni*		8	1	4	2		**15**
76	*Temera hardwickii*			1				**1**
77	*Urolophus aurantiacus*						4	**4**
78	*Urogymnus asperrimus*		2		8		1	**11**
	Total of Rays	957	570	7371	1768	7269	611	**18,546**

Table 5b: Sample Size of Sharks by Species

No.	**Species**	Cambodia	Indonesia	Malaysia	Myanmar	Thailand	Viet Nam	**Total**
1	*Alopias pelagicus*		671				3	**674**
2	*Alopias superciliosus*		720				1	**721**
3	*Atelomycterus* cf *baliensis*			26				**26**
4	*Atelomycterus* cf *erdmanni*			145				**145**
5	*Atelomycterus marmoratus*	176		615		362	32	**1,185**
6	*Carcharhinus albimarginatus*		5					**5**
7	*Carcharhinus amblyrhynchos*		49			1	5	**55**
8	*Carcharhinus amblynchoides*				5			**5**
9	*Carcharhinus brevipinna*		55	10	12			**77**
10	*Carcharhinus* cf *faciformis*						1	**1**
11	*Carcharhinus dussumieri*						5	**5**
12	*Carcharhinus faciformis*		315					**315**
13	*Carcharhinus leucas*	5	14	3	114	1		**137**
14	*Carcharhinus limbatus*			1	1		24	**26**
15	*Carcharhinus longimanus*		2					**2**
16	*Carcharhinus macloti*				35			**35**
17	*Carcharhinus plumbeus*		81					**81**
18	*Carcharhinus melanopterus*	10	13		1	14		**38**
19	*Carcharhinus sorrah*	18	33	310	12	47	239	**659**
20	*Carcharhinus* sp.						1	**1**
21	*Centrophorus* cf *lusitanicus*		4					**4**
22	*Centrophorus moluccensis*		47				1	**48**
23	*Cephaloscyllium ciruopullum*						5	**5**
24	*Cephaloscyllium pictum*		1					**1**

25	*Chiloscyllium plagiosum*					1	22	**23**
26	*Chiloscyllium* cf *hasseltii*			2				**2**
27	*Chiloscyllium* cf *punctatum*						1	**1**
28	*Chiloscyllium griseum*					51		**51**
29	*Chiloscyllium hasseltii*			1,823	18	95		**1,936**
30	*Chiloscyllium indicum*			22				**22**
31	*Chiloscyllium punctatum*	710	16	1,506	4	2,584	160	**4,980**
32	*Chiloscyllium* sp.			1			1	**2**
33	*Galeocerdo cuvier*		37	2	11	4	13	**67**
34	*Galeus* sp						1	**1**
35	*Halaelurus buergeri*						2	**2**
36	*Hemigaleus microstoma*		16		14	1	14	**45**
37	*Hemipristis elongata*				19			**19**
38	*Heptranchias perlo*		24			1	1	**26**
39	*Hexanchun* cf *griseus*						1	**1**
40	*Isurus oxyrinchus*		153					**153**
41	*Isurus paucus*		196					**196**
42	*Loxodon macrohinus*		28		71			**99**
43	*Mustelus manazo*						1	**1**
44	*Mustelus mosis*				48			**48**
45	*Mustelus* sp.				134			**134**
46	*Orectolobus leptolineatus*		2					**2**
47	*Prionace glauca*		295					**295**
48	*Pseudocarcharias kamoharai*		7					**7**
49	*Psudotriakis microdon*		2					**2**
50	*Rhincodon typus*		1					**1**

51	*Rhizoprionodon acutus*				30			**30**
52	*Scoliodon laticaudus*			1	499			**500**
53	*Sphyrna lewini*		69		472	1		**542**
54	*Sphyrna mokkaran*				1		3	**4**
55	*Squalus edmundsi*		6					**6**
56	*Squalus megalops*		25				3	**28**
57	*Squatina* sp.						12	**12**
58	*Squatina tergocellatoides*						1	**1**
59	*Stegostoma fasciatum*			1				**1**
60	*Trigenodon obesus*		10				3	**13**
	Total of Sharks	**919**	**2,897**	**4,468**	**1,501**	**3,163**	**556**	**13,504**

Table 5c: Sample Size of Skates by Species

No.	**Species**	Cambodia	Indonesia	Malaysia	Myanmar	Thailand	Viet Nam	**Total**
1	*Dipturus johannisdavisi*						50	50
2	*Dipturus* sp1		3					3
3	*Dipturus* sp2		5					5
4	*Okamejei cairae*						1,284	1,284
5	*Okamejei* cf *boesemani*						56	56
6	*Okamejei hollandi*						32	32
7	*Okamejei jensenae*				13			13
8	*Okamejei* sp.				2			2
	Total of Skates		**8**		**15**		**1422**	**1,445**

Table 6a: Weight of Rays by Species

No.	Species	Cambodia	Indonesia	Malaysia	Myanmar	Thailand	Viet Nam	Total
1	*Aetobatus flagellum*				37			**37**
2	*Aetobatus ocellatus*	239	37			76	5	**357**
3	*Aetobatus narinari*				34			**34**
4	*Aetomylaeus maculatus*						84	**84**
5	*Hemitrygon akajei*		4	341		209		**554**
6	*Hemitrygon* cf *sinensis*						18	**18**
7	*Hemitrygon fluviorum*			70			179	**249**
8	*Megatrygon microps*				352			**352**
9	*Hemitrygon parvonigra*	913					154	**1,067**
10	*Dasyatis thetidis*			81		150		**231**
11	*Hemitrygon sinensis*				31		143	**174**
12	*Dasyatis* sp.						96	**96**
13	*Telatrygon biasa*	1,059	0	972		3,157	193	**5,188**
14	*Telatrygon zugei*						193	**193**
15	*Glaucostegus* sp.				15			**15**
16	*Glaucostegus typus*				378			**378**
17	*Gymnura japonica*				2,102	3	16	**2,121**
18	*Gymnura poecilura*			39	28		196	**263**
19	*Gymnura zonura*		6					**6**
20	*Maculabatis* cf *gerrardi*			19				**19**
21	*Brevitrygon* cf *javaensis*				37		10	**47**
22	*Pateobatis fai*		86	2,250	54			**2,390**
23	*Maculabatis gerrardi*			10,839	343	63		**11,245**
24	*Brevitrygon imbricata*	1,248			74	0.2	1,497	**2,819**
25	*Pateobatis jenkinsii*		1,503	998	1,111	44	1,610	**5,266**

26	*Himantura leoparda*				1,339			**1,339**
27	*Urogymnus lobistoma*				141			**141**
28	*Maculabatis pastinacoides*			1,594	366			**1,960**
29	*Pateobatis uarnacoides*			12	1,954	92		**2,058**
30	*Himantura uarnak*		40	212	980			**1,232**
31	*Urogymnus granulatus*		258	93	2,415		9	**2,775**
32	*Brevitrygon heterura*	1,906	9	1,565	3,563	1,076	2,093	**10,212**
33	*Mobula japonica*		37,175		218		180	**37,573**
34	*Mobula kuhlii*		38		45			**83**
35	*Mobula tarapacana*		3,280					**3,280**
36	*Mobula* sp.						600	**600**
37	*Mobula thurstoni*		3,501				3,589	**7,090**
38	*Myliobatis tobijei*						52	**52**
39	*Narcine brevilabiata*				100		24	**124**
40	*Narcine brunnea*				4		65	**69**
41	*Narcine* cf *indica*						21	**21**
42	*Narcine indica*						323	**323**
43	*Narcine lingula*				99			**99**
44	*Narcine maculata*			1				**1**
45	*Nacine* sp.			8			29	**37**
46	*Nacine* sp D			5				**5**
47	*Nacine timlei*						59	**59**
48	*Narke diperygia*						5	**5**
49	*Narke japonica*						22	**22**
50	*Neotrygon orientalis*		523	7,713	391	692	269	**9,588**
51	*Neotrygon* sp.						1	**1**
52	*Pastinachus ater*		30					**30**

53	*Pastinachus* cf *solocirostris*				3			**3**
54	*Pastinachus gracilicaudus*				44			**44**
55	*Pastinachus solocirostris*		8					**8**
56	*Pastinachus stellurostris*				30			**30**
57	*Platyrhina sinensis*						509	**509**
58	*Platyrhina tangi*						243	**243**
59	*Plesiobatis daviesi*		8		3	11	541	**563**
60	*Pteroplatytrygon violacea*		7					**7**
61	*Rhina ancylostoma*		40		585			**625**
62	*Rhinobatos* cf *borneensis*			16				**16**
63	*Rhinobatos* cf *formosensis*				5,930			**5,930**
64	*Rhinobatos formosensis*					1,366	400	**1,766**
65	*Rhinobatos penggali*		306					**306**
66	*Rhinobatos punctifer*				2,529			**2,529**
67	*Rhinobatos* sp.						62	**62**
68	*Rhinoptera adspersa*				2			**2**
69	*Rhinoptera javanica*		3		1,082			**1,085**
70	*Rhinoptera jayakari*		12		838			**850**
71	*Rhynchobatus australiae*		406	467	38	73	304	**1,288**
72	*Rhynchobatus laevis*			5				**5**
73	*Rhynchobatus palpebratus*						64	**64**
74	*Taeniura lymma*	15	45				98	**158**
75	*Taeniurops meyeni*		142	119	215	120		**596**
76	*Temera hardwickii*			0.1				**0**
77	*Urolophus aurantiacus*						40	**40**
78	*Urogymnus asperrimus*		45		14,502		9	**14,556**
	Total of Rays	**5,380**	**47,512**	**27,419.1**	**42,012**	**7,132.2**	**13,812**	**143,267**

Table 6b: Weight of Sharks by Species

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

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

51	*Psudotriakis microdon*		70					**70**
52	*Rhincodon typus*		30					**30**
53	*Rhizoprionodon acutus*				97			**97**
54	*Scoliodon laticaudus*			0.3	3,000			**3,000**
55	*Sphyrna lewini*		7,155		2,837	1		**9,993**
56	*Sphyrna mokkaran*				1		80	**81**
57	*Squalus edmundsi*		22					**22**
58	*Squalus megalops*		296				43	**339**
59	*Squatina* sp.						78	**78**
60	*Squatina tergocellatoides*						2	**2**
61	*Stegostoma fasciatum*			17				**17**
62	*Trigenodon obesus*		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	*Okamejei cairae*						17,501	**17,501**
2	*Okamejei* cf *boesemani*						1,240	**1,240**
3	*Okamejei hollandi*						1,371	**1,371**
4	*Okamejei jensenae*				45			**0**
5	*Okamejei* sp.				22			**0**
6	*Dipturus johannisdavisi*						1	**1**
7	*Dipturus* sp1		1					**1**
8	*Dipturus* sp2		1					**1**
	Total of Skates		**2**		**67**		**20113**	**20182**

Table 7a: Size Range of Rays (Disc Length – DL, cm) and TL for species from families Rhinidae, Glaucostegidae, Rhinobatidae and Narcinidae

No.	Species of Rays	Cambodia		Indonesia		Malaysia		Myanmar		Thailand		Viet Nam	
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
1	*Aetobatus flagellum*							93.0	105.0				
2	*Aetobatus ocellatus*	14.0	100.0	25.0	47.0					62.0	62.0		
3	*Aetobatus narinari*							110.0	113.0				
4	*Aetomylaeus maculates*											34.5	193.0
5	*Hemitrygon akajei*			37.0	37.0	21.0	63.0			12.4	60.4		
6	*Hemitrygon* cf *sinensis*												
7	*Hemitrygon fluviorum*					24.0	73.0						
8	*Megatrygon microps*							124.0	145.0				
9	*Hemitrygon parvonigra*	12.0	42.0										
10	*Dasyatis thetidis*					120.0	120.0						
11	*Hemitrygon sinenis*							21.0	22.0			18.5	19.0
12	*Dasyatis* sp.											31.0	40.0
13	*Telatrygon biasa*	13.0	29.0	10.0	10.0	11.0	34.0			6.0	32.2		
14	*Telatrygon zugei*											16.0	29.0
15	*Glaucostegus* sp.												
16	*Glaucostegus typus*							35.0	250.0				
17	*Gymnura japonica*							11.0	54.0	37.0	37.0		
18	*Gymnura poecilura*					11.5	41.0	14.0	16.0				
19	*Gymnura zonura*			25.0	40.0								
20	*Maculabatis* cf *gerrardi*					75.0	75.0						
21	*Brevitrygon* cf *javaensis*							34.0	65.0				
22	*Pateobatis fai*			124.0	124.0	57.0	135.0	65.0	94.0				
23	*Maculabatis gerrardi*					14.0	104.0	19.0	108.0	18.0	73.5		

24	*Brevitrygon imbricata*	13.0	30.0					20.0	20.0	16.5	16.5	0.7	39.0
25	*Pateobatis jenkinsii*			29.0	147.0	26.5	96.0	50.0	95.0	41.5	77.0		
26	*Himantura leoparda*							51.0	113.0				
27	*Urogymnus lobistoma*							30.0	83.0				
28	*Maculabatis pastinacoides*					27.0	90.0	15.0	74.0				
29	*Pateobatis uarnacoides*					45.0	89.0	28.0	117.0	66.5	128.5		
30	*Himantura uarnak*			116.0	116.0	87.0	138.0	105.0	113.0				
31	*Urogymnus granulatus*			98.0	127.0	26.0	116.0	100.0	146.0				
32	*Brevitrygon heterura*	11.6	45.0	10.0	36.0	11.0	30.0	11.4	46.0	10.8	30.0	16.0	26.0
33	*Mobula japonica*			57.0	236.0			11.0	78.0			150.0	205.0
34	*Mobula kuhlii*			55.0	73.0			100.0	100.0	13.0	32.0		
35	*Mobula tarapacana*			165.0	270.0								
36	*Mobula* sp.												
37	*Mobula thurstoni*			93.0	232.0							90.0	240.0
38	*Myliobatis tobijei*											147.0	147.0
39	*Narcine brevilabiata*							29.0	34.0			18.0	29.0
40	*Narcine brunnea*							9.0	24.0			13.5	32.0
41	*Narcine* cf *indica*												
42	*Narcine indica*											19.0	39.0
43	*Narcine lingual*							29.0	32.0				
44	*Narcine maculata*					29.5	43.5						
45	*Narcine* sp.					31.5	38.0						
46	*Narcine* sp D					33.0	45.0						
47	*Narcine timlei*											25.0	44.0
48	*Narke dipterygia*												
49	*Narke japonica*											18.0	18.0
50	*Neotrygon orientalis*			13.0	116.0	12.0	61.0	10.0	39.0	12.5	36.5	25.0	40.0
51	*Neotrygon* sp.												

52	*Pastinachus ater*			75.0	75.0								
53	*Pastinachus* cf *solocirostris*							48.0	48.0				
54	*Pastinachus gracilicaudus*							29.0	98.0				
55	*Pastinachus solocirostris*			36.0	53.0								
56	*Pastinachus stellurostris*							45.0	46.0				
57	*Platyrhina sinensis*											18.0	51.0
58	*Platyrhina tangi*											36.0	55.0
59	*Plesiobatis daviesi*			72.0	72.0			42.0	42.0	78.0	78.0	58.0	116.0
60	*Pteroplatytrygon violacea*			56.0	61.0								
61	*Rhina ancylostoma*							58.0	175.0				
62	*Rhinobatos* cf *borneensis*					60.0	89.0						
63	*Rhinobatos* cf *formosensis*							20.0	89.0				
64	*Rhinobatos formosensis*									25.0	106.0	31.5	93.0
65	*Rhinobatos penggali*			46.0	96.0								
66	*Rhinobatos punctifer*							27.0	110.0				
67	*Rhinobatos* sp.											40.0	40.5
68	*Rhinoptera adspersa*							33.0	33.0				
69	*Rhinoptera javanica*			38.0	38.0			23.0	77.0				
70	*Rhinoptera jayakari*			42.0	42.0			23.0	91.0				
71	*Rhynchobatus australiae*					29.5	174.0	52.0	53.0	50.0	182.0	102.0	248.0
72	*Rhynchobatus laevis*					48.0	84.0						
73	*Rhynchobatus palpebratus*											130.0	152.0
74	*Taeniura lymma*	72.0	12.0	24.0	37.0								
75	*Taeniurops meyeni*			50.0	107.0	117.0	117.0	90.0	140.0				
76	*Temera hardwickii*					12.5	12.5						
77	*Urolophus aurantiacus*											19.0	24.0
78	*Urogymnus asperrimus*			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	*Alopias pelagicus*			162.0	338.0							220.0	366.0
2	*Alopias superciliosus*			65.0	438.0							366.0	366.0
3	*Atelomycterus* cf *baliensis*					43.0	54.0						
4	*Atelomycterus* cf *erdmanni*					34.0	57.0						
5	*Atelomycterus marmoratus*	32.0	66.0			30.0	67.0			19.8	61.4	23.0	55.5
6	*Carcharhinus albimarginatus*												
7	*Carcharhinus amblyrhynchos*			62.0	166.0					96.0	96.0	90.0	100.0
8	*Carcharhinus amblyrhynchoides*							73.0	86.0				
9	*Carcharhinus brevipinna*			134.0	303.0	74.5	89.0	57.0	132.0				
10	*Carcharhinus* cf *faciformis*											305.0	305.0
11	*Carcharhinus dussumieri*											76.5	120.0
12	*Carcharhinus faciformis*			72.0	237.0								
13	*Carcharhinus leucas*	71.0	77.0	150.0	318.0	78.0	155.0	41.0	143.0				
14	*Carcharhinus limbatus*					61.0	61.0	73.0	73.0			80.0	150.0
15	*Carcharhinus longimanus*												
16	*Carcharhinus macloti*							70.0	78.0				
17	*Carcharhinus plumbeus*			180.0	343.0								
18	*Carcharhinus melanopterus*	50.0	62.0	149.0	149.0			77.0	77.0	55.4	128.0		
19	*Carcharhinus sorrah*	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	*Carcharhinus* sp.											138.0	138.0
21	*Centrophorus* cf *lusitanicus*			53.0	67.0								
22	*Centrophorus moluccensis*			68.0	132.0							85.0	85.0
23	*Cephaloscyllium ciruopullum*											36.5	42.3

24	*Cephaloscyllium pictum*			72.0	72.0								
25	*Chiloscyllium plagiosum*											34.0	87.0
26	*Chiloscyllium punctatum*			55.0	153.0							34.0	107.0
27	*Chiloscyllium* cf *hasseltii*					61.5	63.0						
28	*Chiloscyllium* cf *punctatum*											56.0	56.0
29	*Chiloscyllium griseum*									31.0	66.0		
30	*Chiloscyllium hasseltii*					18.5	93.0	35.0	71.0	35.5	68.0		
31	*Chiloscyllium indicum*					46.5	56.0						
32	*Chiloscyllium plagiosum*									76.6	76.6	36.4	46.5
33	*Chiloscyllium punctatum*	18.0	103.0			27.0	96.0	57.0	69.0	12.2	96.4	21.0	115.0
34	*Chiloscyllium* sp.					48.0	48.0					50.0	50.0
35	*Galeocerdo cuvier*			78.0	386.0	144.0	157.0	88.0	160.0	89.0	225.0	65.0	107.0
36	*Galeus* sp.												
37	*Halaelurus buergeri*											40.0	45.0
38	*Hemigaleus microstoma*			79.0	125.0			40.0	81.0	49.6	49.6	42.0	118.0
39	*Hemipristis elongata*							41.0	69.0				
40	*Heptranchias perlo*			62.0	93.0					72.5	72.5	79.3	79.3
41	*Hexanchun* cf *griseus*											78.5	78.5
42	*Isurus oxyrinchus*			131.0	367.0								
43	*Isurus paucus*			140.0	271.0								
44	*Loxodon macrohinus*			51.0	116.0			31.0	88.0				
45	*Mustelus manazo*											110.0	110.0
46	*Mustelus mosis*							51.0	79.0				
47	*Mustelus* sp.							12.0	82.0				
48	*Orectolobus leptolineatus*			97.0	98.0								
49	*Prionace glauca*			142.0	295.0								

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

Table 7c: Size Range of Skates (Total Length – TL, 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	*Dipturus johannisdavisi*											95.0	95.0
2	*Okamejei cairae*											10.0	58.0
3	*Okamejei* cf *boesemani*											11.0	22.7
4	*Okamejei hollandi*											16.5	40.0
5	*Okamejei jensenae*							18.0	48.0				
6	*Okamejei* sp.							47.0	47.0				
	Dipturus sp.1			50.0	50.0								
	Dipturus sp.2			73.0	73.0								

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 Gear	Cambodia		Indonesia		Malaysia		Myanmar		Thailand		Viet Nam	
Fishing Gear	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 8b: Range of CPUE (kg/haul) of Sharks Catches by Type of Fishing Gear as Referred to Top Catches Species by Countries

Type of Gear	Cambodia		Indonesia		Malaysia		Myanmar		Thailand		Viet Nam	
Fishing Gear	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 8c: Range of CPUE (kg/haul) of Skates Catches by Type of Fishing Gear as Referred to Top Catches Species by Countries

Type of Gear	Cambodia		Indonesia		Malaysia		Myanmar		Thailand		Viet Nam	
Fishing Gear	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 Marketing Destination 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 - 3.2	local land domestic markets	1.75- 4.0	local land domestic markets		
Indonesia	0.45 - 2.61	local market	0.37 - 2.24	local market		
Malaysia	0.11 - 4.72	local and domestic markets, export skin to Thailand	0.22 - 8.99	local and domestic markets		
Myanmar	1.03 - 7.34	local market	1.47 - 6.6	local market		
Thailand	0.31 - 3.42	local market	0.68 - 3.14	local market		
Viet Nam	1 - 5	local and domestic markets export to China	1 - 6	local and domestic markets export to China	0.2 - 2	local and domestic markets export to China

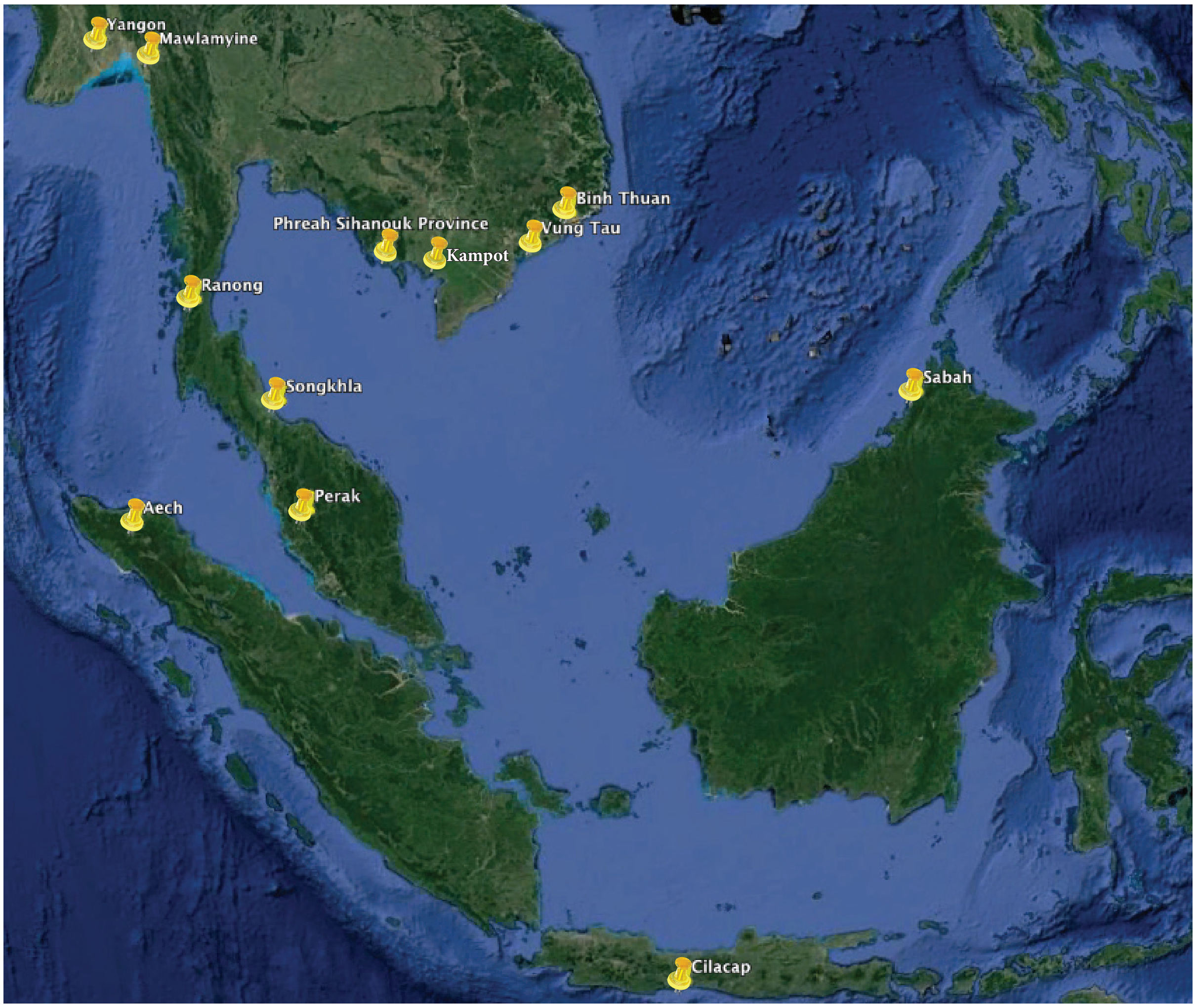

Figure 1: Landing Sites in Cambodia, Indonesia, Malaysia, Myanmar, Thailand, and Viet Nam.

Appendix

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 individuals or 10-50% of the landed catch if more than 50 individuals. 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: ____

PART 2

REPORT BY
CAMBODIA, INDONESIA, MALAYSIA, MYANMAR,
THAILAND AND VIET NAM

National Reports on Sharks Data Collection in Cambodia

By

Ly Seyha

1.0 INTRODUCTION

Cambodia has 435 km coastlines in the Gulf of Thailand, which is stretched between Vietnamese borders in the south to Thailand 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, Cambodia has her own Exclusive Economic Zone (EEZ), the area extended from the shoreline to 200 nautical miles, which covers 55,600 Km^2. Marine fisheries of Cambodia are pelagic due to the physical feature of the EEZs area (Maximum depth is not deeper than 80 meters), and their productivity covers around 20% of national fish production. The introduction of modern fishing technologies appeared around the 1958's.

Fishing practices in Cambodia can be classified into three (3) types namely small-scale, family fisheries medium-scale and commercial-scale. The middle-scale and commercial-scale fisheries refer to those fishing activities that have highly efficient fishing gears and can go both inshore and offshore 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 groups of fish (round scads); and other groups of fish by market size, while the pelagic fish size was not fit into the 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 vessels 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 study 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 area for sharks and rays

1.2.1 Selection of Study Sites (Tomnup Rolork BEP Jetty)

Tomnup Rolork, Phum III, Sangkat I Preah Sihanouk City in Sihanouk Province consists of four (4) main landing areas that were selected as the project sites. BEP Jetty was selected for data collection. This landing site is own by a private company. Most sharks and rays landings were from trawlers, long lines, and purse seines. The trawler was selected as the representative gear for data collection. The project sites are shown in **Figure 1** and **Figure 2**.

Figure 1: Ariel View of Sihanoukville Fishing Port

Figure 2: Map of Sihanoukville

1.2.2 Fishery Structure and Background of Study Sites

Preah Sihanouk is one of the major provinces where comprises more landing sites for sharks and rays among the coastal provinces of Cambodia. All jetties belong to private companies. The major gear was trawl nets. Numbers of the crews working on boat depend on the size of the vessel which ranges from 3-8 crew members. Almost all sharks and rays were landed by trawlers. The fishing ground was 8-57 nautical miles (nm) from the coastline with 8-25 m depth (**Table 1**). Fishing operations were between 1-15 days per trip and fishing operations were 3-4 hauls per day. All catches were landed from 06.00-10.00 a.m.

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

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

1.3 Appointment of Enumerators

Mr. Ly Seyha, a Fisheries Officer from Marine Aquaculture Research and Development Center (MARDeC) was appointed as an enumerator. His contact detail is 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 from 10 September 2015 until 12 August 2016. The enumerator was requested to record landings data and other related information using a standard form at least five days/month. A standard operating procedure (SOPs) entitled ‘Standard Operating Procedures Sharks and Rays Data Collection in the Southeast Asian Waters’ was used as a major reference. The content included standard operation procedures and instructions to enumerators on how to measure, weigh, record sharks and rays species at sampling sites, name of the enumerator, name of the landing site, date of sampling, vessel registration number, vessel GRT, fishing area, the price at landing sites, name of species (common name and scientific name), the total catch of sharks, rays, commercial and low-value species from each sampling vessel. The data were compiled in excel and submitted to the respective sharks and rays Cambodia 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 five days per month at the landing site. Measurement of Total Length (TL) was taken for all sharks and Disc Length (DL) for rays. All shark and ray 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), Ebert *et al.* (2013), Ahmad *et al.* (2013), Ahmad *et al.* (2014) and Last *et al.* (2016).

2.0 RESULTS

2.1 BEP Jetty

2.1.1 Landing Samples

This site is the largest landing site in this province and many types of fishing vessels landed their catch. A total of 179 trawlers were sampled during the study period. The highest gear type was 116 of the trawl net commercial scale. The numbers of landing samples per month were 15 except in September 2015 only 14. The details are shown 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 Comercial Scale	2	3	11	13	12	12	5	13	11	12	12	10	116
Trawl Net Medium 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**	**79**

2.1.2 Fishing Ground and Catch Composition

The main gear landing sharks and rays was trawl nets commercial scale at 10,536 kg (75.8%) comprising 3,994.4 kg of rays and 6,541.6 kg of sharks. While the trawl net of medium scale contributed 870 kg of rays and 1,386.3 of sharks and trawl net small scale contributed 515.2 kg of rays and 599.6 kg of shark. Koh Tang was the main fishing ground situated 34-56nm from the coastline. The highest landing of rays 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 sharks 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 details are shown in **Table 3.**

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

Type of Gear	2015				2016								Total
	Sept	Oct	Nov	Dec	Jan	Feb	Mac	Apr	Mei	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 Medium 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 Rays	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 Medium 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 Sharks	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 were 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**	**0.0**	**448.3**	**0.6**	**74,700.5**	**98.5**	**75,859.4**

2.1.4 Sample Size

A total of 1,876 sharks and rays which comprise 919 sharks and 957 rays were sampled comprising six (6) species of rays and five (5) species of sharks. The most abundant ray species by number was *Brevitrygon heterura* followed by *Brevitrygon imbricata* and *Telatrygon biasa*. 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 tails) while the scarce species was *Carcharhinus leuca*s (5 tails). 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 *Brevitrygon heterura* followed by *Brevitrygon imbricata* and *Telatrygon biasa,* 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**).

2.1.5 Weight of Sharks and Rays by Species

A total of 1,3907.0 kg was landed from the **BEP** landing site comprising 8,527.4 kg sharks and 537.6 kg rays. For Rays, the highest landing by weight was from *Brevitrygon heterura* amounting to 1,905.9 kg, followed by 1,247.5 kg *Brevitrygon imbricata* and 1,059.0 kg *Telatrygon biasa*. The highest landing by month was 266.0 kg for *Brevitrygon heterura* in July 2016 followed by 235.2 kg in June 2016 and 207.6 kg in December 2015. Weight of other rays species ranged between 14.2-207.1 kg. For the sharks, 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 5: Sample Size of Sharks and Rays by Species

Species	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
Rays	**76**	**99**	**98**	**84**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**75**	**957**
Aetobatus ocellatus	1		1					1		1	8	3	**15**
Hemitrygon parvonigra	11	7	18	14	11	21	24	5	9	1		11	**132**
Telatrygon biasa	22	13	25	17	23	4	7	26	26	12	5	10	**190**
Brevitrygon imbricata	15	33	26	13	19	25	25	12	10	5	14	14	**211**
Brevitrygon heterura	27	44	28	40	22	25	19	31	30	56	48	34	**404**
Taeniura lymma		2										3	**5**
Sharks	**58**	**84**	**93**	**85**	**75**	**74**	**75**	**75**	**75**	**75**	**75**	**75**	**919**
Atelomycterus marmoratus	6	18	24	16	34	13	26	1	9	6	7	16	**176**
Carharhinus leucas	1							1	1			2	**5**
Carharhinus melanopterus								5				5	**10**
Carharhinus sorrah									1	6	6	5	**18**
Chiloscyllium punctatum	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**	**1,876**

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

Species	2015				2016								Total
	Sep	Oct	Nov	Dec	Jan	Feb	Mac	Apr	May	Jun	Jul	Aug	
Rays	**178.5**	**215.5**	**533.6**	**482.0**	**612.0**	**963.0**	**577.0**	**370.0**	**367.0**	**361.0**	**38.0**	**332.0**	**5,379.6**
Aetobatus ocellatus	41.0		48.4					73.4		14.2	40.7	21.7	**239.4**
Hemitrygon parvonigra	15.0	26.2	99.4	81.6	97.7	286.4	160.1	21.9	44.3	28.7		51.4	**912.8**
Telatrygon biasa	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**
Brevitrygon imbricata	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**
Brevitrygon heterura	53.3	78.7	11.6	207.6	206.0	243.3	110.0	108.2	138.4	235.2	266.0	142.7	**1,905.9**
Taeniura lymma		1.7										13.3	**15.0**
Sharks	**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**
Atelomycterus marmoratus	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**
Carharhinus leucas	3.4							23.1	15.7			23.5	**65.6**
Carharhinus melanopterus								31.0				32.6	**63.6**
Carharhinus sorrah									52.2	66.9	28.7	89.4	**237.2**
Chiloscyllium punctatum	145.9	283.8	571.4	1,083.4	560.5	1,171.9	791.1	647.5	5380	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 of the ray species that were 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 *Hemitrygon parvonigra* about 19.0 cm disc length, *Telatrygon biasa* about 18.0-22.0 cm disc length, *Brevitrygon imbricata* about 18.0-21.0 cm disc length, and *Brevitrygon heterura* about 17.0-20.0 cm disc length. All these ray species were caught under the mature stage at 12 cm disc length for *Hemitrygon parvonigra* in September 2015, 13 cm disc length for *Telatrygon biasa* and *Brevitrygon imbricata* in September and October 2015, 11.6 cm disc length for *Brevitrygon heterura* in October 2015. Most of the sharks' species landed were mature except for *Carcharhinus sorrah* and *Carcharhinus melanopterus*. The first maturing sizes of *Atelomycterus marmoratus, Carcharhinus leucas,* and *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 the 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. The sizes 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.

Species	2015												2016					
	September			Oktober			November			December			January			February		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Rays																		
Aetobatus ocellatus	84.0	84.0	84.0				90.0	90.0	90.0									
Hemitrygon parvonigra	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
Telatrygon biasa	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
Brevitrygon imbricata	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
Brevitrygon heterura	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
Taeniura lymma				27.0	27.5	27.3												
Sharks																		
Atelomycterus marmoratus	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
Carharhinus leucas	74.1	74.1	74.1															
Carharhinus melanopterus																		
Carharhinus sorrah																		
Chiloscyllium punctatum	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.

Species	2015												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
Rays																		
Aetobatus ocellatus				100.0	100.0	100.0				31.0	31.0	31.0	14.0	21.0	16.8	17.0	20.0	18.7
Hemitrygon parvonigra	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
Telatrygon biasa	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
Brevitrygon imbricata	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
Brevitrygon heterura	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
Taeniura lymma																24.0	27.0	25.7
Sharks																		
Atelomycterus marmoratus	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
Carharhinus leucas				71.0	71.0	71.0	77.0	77.0	77.0							74.0	75.0	74.5
Carharhinus melanopterus				50.0	53.0	51.4										50.0	62.0	55.4
Carharhinus sorrah							86.0	86.0	86.0	53.0	62.0	59.3	61.0	63.0	62.3	60.0	63.0	61.0
Chiloscyllium punctatum	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 boats was collected randomly. In actual practice, the trawl net commercial scale found more numbers (1,351) compared to medium (310) and small (121) scales. The data of trawl net samples from September 2015 to August 2016 were used to calculated 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**.

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 Comercial 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 (km^2). The highest CPUE of rays from the trawl net was *Brevitrygon heterura* with 1.07 kg/day at operation (0.27 kg/number of operation and 3.15 kg/swept area (km^2)). 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 (km^2). 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 (km^2)). The details are shown in **Table 9B.**

Table 9A: CPUE Rays Species Captured by Trawl Net

Rank	Rays Species	Total weight (kg) Ray by Species	CPUE (kg/Days at Operation)	CPUE (kg/ Number of Operation)	CPUE (kg/ Swept area (Km2)
1	*Brevitrygon heterura*	1905.94	1.07	0.27	31.5
2	*Brevitrygon imbricata*	1247.51	0.70	0.18	2.06
3	*Telatrygon biasa*	1058.96	0.59	0.15	1.75
4	*Hemitrygon parvonigra*	912.76	0.51	0.13	1.51
5	*Aetobatus ocellatus*	239.40	0.13	0.03	0.40
6	*Taeniura lymma*	15.00	0.01	0.00	0.02

Table 9B: CPUE Sharks Species Captured by Trawl Net

Rank	Sharks Species	Total weight (kg) Shark by Species	CPUE (kg/Days at Operation)	CPUE (kg/ Number of Operation)	CPUE (kg/ Swept area (Km2)
1	*Chiloscyllium punctatum*	7282.17	4.09	1.0	12.05
2	*Carharhinus sorrah*	237.22	0.13	0.03	0.39
3	*Carharhinus melanopterus*	63.64	0.04	0.01	0.11
4	*Carharhinus leucas*	65.64	0.04	0.01	0.11
5	*Atelomycterus marmoratus*	878.77	0.49	0.12	1.45

2.1.8 Usage and Marketing

Marketing information 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 *Brevitrygon imbricata* and *Brevitrygon heterura*. 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 rays species, *Hemitrygon parvonigra* and *Telatrygon biasa* price ranged from 1-2.5 USD/kg. In general, bigger size rays were more expensive than smaller ones.

Smaller size sharks with a total weight of fewer than 3 tails/kg, were sold locally at 2 USD/kg. The most expensive sharks *Carcharhinus sorrah* was at 2.5-4 USD/kg 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 *Carcharhinus punctatum* at 1.75-3.3 USD/kg. Market destinations for sharks and rays were the same.

Normally the suppliers use trucks to deliver sharks and rays to the other markets for local consumption in the morning after landed. However, some sharks and rays were exported to Viet Nam by land and ships (cargo vessels). The price of the exported products was higher than the local markets. Both of the sharks and rays were sold between 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.

Rays Species	Price/kg/USD	Part	Marketing
Aetobatus ocellatus	1.5-2.5	Whold Body	Local, Phnom Penh and to VN
Hemitrygon parvonigra	1-2.5	Whold Body	Local, Phnom Penh and to VN
Telatrygon biasa	1-2.5	Whold Body	Local, Phnom Penh and to VN
Brevitrygon imbricata	1.5-3.2	Whold Body	Local, Phnom Penh and to VN
Brevitrygon heterura	1.5-3.2	Whold Body	Local, Phnom Penh and to VN
Taeniura lymma	1-3	Whold Body	Local, Phnom Penh and to VN
Sharks Species			
Atelomycterus marmoratus	1.75-3.75	Whold Body	Local, Phnom Penh and to VN
Carcharhinus leucas	2-4	Whold Body	Local, Phnom Penh and to VN
Carcharhinus melanopterus	2.5-4	Whold Body	Local, Phnom Penh and to VN
Carcharhinus sorrah	2.5-3.75	Whold Body	Local, Phnom Penh and to VN
Chiloscyllium punctatum	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 Tumnup Rolok of Preah Sihanouk province. During this project, three (3) officers of Marine Aquaculture Research and Development Center (MARDeC), and one (1) officer of Kampong Som Fisheries Administration Cantonment were trained in taxonomy and 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 species of sharks from two Orders and three Families; and six species of rays from one Order and two Families were recorded. Details are shown in **Appendix I**. In terms of the percentage of total marine landings, sharks and rays only contributed 0.9% and 0.60% in Preah Sihanouk province. These figures confirmed earlier data as published in Cambodian National Statistics that sharks were by-catch and was not targeted. However, the rays were not recorded in the Cambodia National Statistics.

The most abundant among sharks species was *Chiloscyllium punctatum* and for rays species was *Brevitrygon heterura.* The most common sharks species were *Atelomycterus marmoratus* and *Chiloscyllium punctatum*, while rays were *Aetobatus ocellatus*, *Brevitrygon imbricata*, *Telatrygon biasa*, and *Hemitrygon parvonigra.* The size of sharks which more than 103 centimeters in total length were *Chiloscyllium punctatum* and the medium sized sharks were *Carcharhinus sorrah* and *Carcharhinus leucas* was rarely caught due to nature of the 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 the national level
3.	Detailed information on the percentages of sharks and rays from the total landing at the pilot project site.	Confirmed earlier data published in Cambodian National Statistics. Sharks and rays were not targeted.
4.	Information on the relative dominance of the different species of sharks and rays obtained.	Increased awareness of needs and measures for shark conservation and management of 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 onboard vessels.
7.	A report on the 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 to another two landing sites for recording data of sharks and rays at the species level in Koh Kong and Kampot Provinces in 2017. Data collection at the current site will be retained. An awareness-raising program will be conducted in other coastal provinces of Cambodia.

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Appendix I

No	Orders/Families	Site 1
	ORDER MYLIOBATIFORMES	**BEP Jetty**
	Family Dasyatidae	
1	*Hemitrygon parvonigra*	+
2	*Telatrygon biasa*	+
3	*Brevitrygon imbricata*	+
4	*Brevitrygon heterura*	+
5	*Taeniura lymma*	+
	Family Myliobatidae	
6	*Aetobatus ocellatus*	+
	Total rays species	**6**
	ORDER CARCHARHINIFORMES	
	Family Scyliorhinidae	
1	*Atelomycterus marmoratus*	+
	Family Carcharhinidae	
2	*Carcharhinus leucas*	+
3	*Carcharhinus melanopterus*	+
4	*Carcharhinus sorrah*	+
	ORDER ORECTOLOBIFORMES	
	Family Hemiscylliidae	
5	*Chiloscyllium punctatum*	+
	Total sharks species	**5**

Appendix II

Photo 1 and 2: On-site Training at landing site

Photo 3 and 4: Enumerator working at landing site

National Reports on Sharks Data Collection in Indonesia

By

Dharmadi

1.0 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 mostly occurred as a by-catch (72%) and only 28% were targeted fishery (Zainuddin, 2011). Shark fishing ground is in the Indian Ocean. Most sharks landed in Indonesia are 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 were utilized such as their meat and fins for food, skins for leather industries, liver for oil and cartilages for medicines. The most valuable part of the shark body is its fins. Most fins are exported to Asian countries (Anon, 2003), and also to European 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 species are vulnerable to over exploitation (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 elasmobranchs 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. Whiles Sentolo Kawat is a smaller landing site, and only a few vessels landing here. 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 gillnets 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 Fishing Port is a medium-sized port on the north coast of Banda Aceh with a diverse range of gears such as 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 longlines. Surface longlines are the most common gear used by fishermen based at Lampulo Fishing Port and are employed to catch pelagic sharks. Based on fisheries statistics, shark production landed at Lampulo Fishing Port is less then 5% of the total landing of marine fishes. The location of all landing sites are shown in **Fig. 1**.

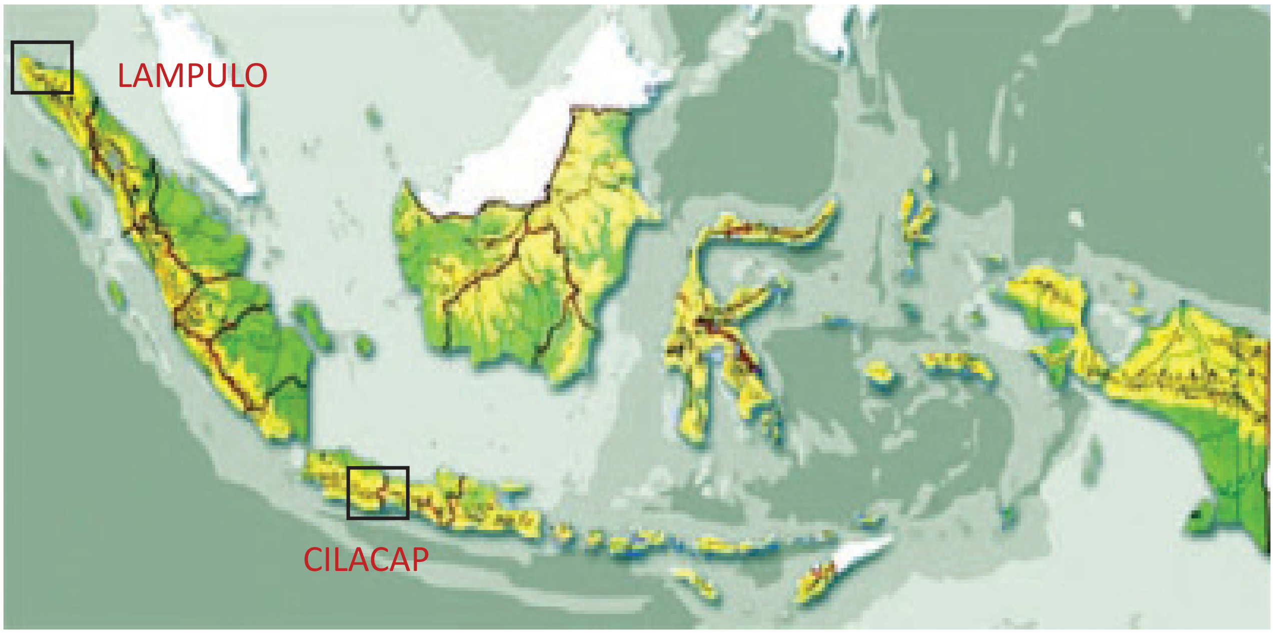

Figure 1: Location of Study Sites at Lampulo and Cilacap

1.2.2 Fishery Structure and Background of Study Sites

1.2.2.1 Cilacap Fish Landing Site

Cilacap is the biggest landing site 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. Almost all of the sharks and rays were landed by drift gillnet and surface longline operating between 8-121 nm from the coastline, while for the bottom gillnet between 1-10 nm. Fishing operation normally between 7-30 days per trip for drift gillnet, 10-20 days per trip for surface longline, and 12-15 days per trip for bottom gillnet. All catches were landed from 08.00-10.00am. 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

Type of Gear	Fishing zone	Fishing operation (from coastline)	No. of vessels	No. of fishers/crews
DRIFT GN				
13-20 GRT	Indian Ocean	8-89 nm	11	132
21-25 GRT	Indian Ocean	19-93 nm	59	708
26-30 GRT	Indian Ocean	21-121 nm	85	1,020
Total			**155**	**1860**
SURFACE LL				
16-22	Indian Ocean	31-32 nm	7	70
27-29	Indian Ocean	35-67 nm	24	240
Total			**31**	**310**
BOTTOM GN				
21-25	South of Java Sea	1-44 nm	9	90
24 GRT	South of Java Sea	1-10 nm	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 gears 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 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 07.30am – 12.00noon.

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

Type of Gear	Fishing zone	Fishing operation (from coastline)	No. of vessel	No. of fishers
SHARK LL				
6 GRT	Indian Ocean	3-94 nm	12	36
BOTTOM LL				
4-6 GRT	Indian Ocean	9-65 nm	14	56
18-24 GRT	Indian Ocean	10-67 nm	12	48
Total			**26**	**104**

PURSE SEINE				
7 GRT	Indian Ocean	5 nm	1	5
31-38 GRT	Indian Ocean	21-111 nm	6	60
49-60 GRT	Indian Ocean	24-100 nm	15	150
Total			**22**	**215**
HAND LINE				
4-6 GRT	Malacca Strait	2-14 nm	11	22
7-16 GRT	Indian Ocean	11-12 nm	3	42
Total			**14**	**64**
TUNA LL				
6 GRT	Indian Ocean	73 nm	1	12
Grand 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
   Jalan Lingkar Pantai Teluk Penyu, Cilacap-Central Java

2. Mr. Munawir
   Pelabuhan Perikanan Nusantara Lampulo
   Jalan Ateuk Jawo Lr. Tanggul Gampong Ateuk Jawo Banda Aceh

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 operating procedures (SOPs) entitled 'Standard Operating Procedures Sharks and Rays Data Collection in the Southeast Asian Waters' was used as a major reference. 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 completed data in excel were then submitted to the respective National Coordinator in Indonesia before submitted to SEAFDEC/ MFRDMD and SEAFDEC Secretariat 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 five days per month at each landing site. Measurement of Total length (TL) were taken for all skates, sharks species and rays from Families Rhinidae, Glaucostegidae, 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 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), Ebert *et al.* (2013)and Last *et al.* (2016)

2.0 RESULTS

2.1. Cilacap and Lampulo Fish Landing Sites

2.1.1 Landing Samples

A total of 168 landings were sampled during the study period at Cilacap. The highest by month was 43 landings in September and 34 landings in October 2015. The highest landings by gear type was 113 for drift gillnet followed by 44 and 11 for longline and bottom gillnet, respectively **(Table 3)**. A total of 107 landings were sampled during the study period at Lampulo. The highest by month was 15 landings in October 2015 and June 2016 and 12 landings in September, respectively. The highest landings by shark longline gear type was 41 of Indian ocean followed by 34 landings of purse seine and 25 landings from 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 231,196.5 kg kg comprising 187,321 kg sharks (81.0%) and 43,875.5kg rays (19.0%). Those fishing gears operated from the inshore to offshore the Indian Ocean. The highest landing of sharks by month was 26,794 kg in September while the highest landing of rays was 12,734 kg in October (**Table 5**).

Longline was the main gear at Lampulo with 6,991 kg landings for sharks, 2,002.9 kg of rays, and 8.0 kg of skates. Most longlines operated beyond 94 nm from the coastline. Fishing ground is in Indian Ocean. The highest landing of sharks by month was 2,087.6 kg in June while the highest landing of rays was in March with 1,097.4 kg. Landings of skates was only 8.0 kg 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 769,460.9 kg of fish was landed from 168 landings during the study period at Cilacap. Rays and sharks made up 44,993.5 kg (6%) and 184,539 kg (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 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 (2015), followed by 11,965 kg in September (2015) and 5,680 kg in August (2015). However, the highest landing for sharks was 26,798 kg in September (2015) followed by 22,114 kg in August (2015) and 21,623 kg in May (2016). In general, the landing of sharks and rays ranged between 10-100% and 0-20% respectively from total landings at Cilacap. The catch composition of sharks and rays landed at Cilacap are shown in **Table 7**.

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

Year/ Month	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 180,817.86kg 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 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 (2016), followed by 964.0 kg in November (2015) and 345.4 kg in October (2015).

The highest landing for sharks was 2,087.6 kg in June (2016) followed by 1,989.7 kg in September (2015) and 1,797.6 kg in December (2015). In general, landing of sharks and rays ranged between 3.7-49.3% and 0-43% respectively from total landings at Lampulo. However, only 8.0 kg (0.004%) of skate was landed only in January (2016). The details are shown in **Table 8**.

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

Year/ Month	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 15 species of sharks. The most abundant ray species were *Mobula japanica.* The highest number of rays sampled by month was 110 individual in September (2015) followed by 79 individual in October (2015) and 77 individual in February (2016). 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 individuals in November (2015), followed by 270 individuals in May (2016) and 285 individuals in April (2016). 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	Mac	Apr	May	Jun	Jul	
Mobula japanica	41	82	62	46	23	6	37			5	2	1	305
Mobula tarapacana	2	8	5		1							3	19
Mobula thurstoni		20	12			1	11						44
Rhinobatos penggali						38	29						**67**
Total Rays	**43**	**110**	**79**	**46**	**24**	**45**	**77**			**5**	**2**	**4**	**435**
Alopias pelagicus	28	56	23	24	46	15	25	127	84	69	55	42	594
Alopias superciliosus	23	31	56	50	26	64	8	50	101	112	117	72	710
Carcharhinus brevipinna	18	7	9	2		9	2			5		2	54
Carcharhinus falciformis	12	12	12	24	43	42	21	26	36	26	9		263
Carcharhinus longimanus					1								1
Carcharhinus plumbeus	10	7	18	7	4	8		5	2	14	3	3	81
Carcharhinus sorrah	1	1	2			12		3	1	8			28
Galeocerdo cuvier		1		2	3	4				1	6		17
Heptranchias perlo						5	19						24
Isurus oxyrinchus	14	35	28	26	19	7		4	9	6			148
Isurus paucus	7	45	26	56	25	15		6	12	3	1		196
Prionace glauca	5	12	35	96	59	51		4	12	20	1		295
Pseudocarcharias kamoharai		7											7
Sphyrna lewini	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 skates were sampled comprising 24 species of rays, 25 species of sharks, and two species of skates. The most abundant ray species were *Neotrygon orientalis* followed by *Pateobatis jenkinsii* and *Rhynchobatus australiae.* The highest number of rays sampled by month was 43 individuals in March (2016) and November (2015)followed by 28 individuals in January (2016) and 20 individuals in October and December (2015). The highest number of sharks sampled by month was 53 individual in June (2016) followed by 51 individuals in September (2015) and 47 individuals in December (2015). The most abundant shark species were *Alopias pelagicus* followed by *Carcharhinus amblyrhynchos* and *Centrophorus moluccensis. Alopias pelagicus* was 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 rays, sharks and skates	2015					2016							Total
Sc. Name	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Aetobatus ocellatus				1			2	1				1	5
Hemitrygon akajei					1								1
Telatrygon biasa					1								1
Gymnura zonura							2						2
Pateobatis fai				1									1
Urogymnus granulatus					1								1
Pateobatis jenkinsii		1	4	13	5		2	16	9				50
Himantura uarnak				1									1
Himantura undulata								4					4
Brevitrygon heterura				1	1								2
Mobula japanica	1	1		2			2						6
Mobula kuhlii				1			2						3
Neotrygon orientalis	2	5	3	13	10	20	5	13	3		5	5	84
Pastinachus ater			1										1
Pastinachus solocirostris						2							2
Plesiobatis daviesi			1										1
Pteroplatytrygon violacea						2							2
Rhina ancylostoma		1											1
Rhinoptera javanica												1	1
Rhinoptera jayakari				1									1
Rhynchobatus australiae	1	5	6	6		1		2	1				22
Taeniura lymma		1	4	1	1	2	1	2					12
Taeniurops meyeni			1	1		1		4	1				8
Urogymnus asperrimus				1				1					2
Rays	**4**	**14**	**20**	**43**	**20**	**30**	**16**	**43**	**14**		**5**	**7**	**214**
Alopias pelagicus	3	7	13	7	9	2	3	6	1	10	13	3	77
Alopias superciliosus		1	1		5					2		1	10

Carcharhinus albimarginatus									5				5
Carcharhinus amblyrhynchos	10	16	5			4	1	1	1		10	1	49
Carcharhinus brevipinna						1							1
Carcharhinus falciformis	9	10	5	2	3		2		6	1	4	2	44
Carcharhinus leucas		2	6	1	1						2	1	13
Carcharhinus melanopterus								1		11			12
Carcharhinus sorrah			1					3	1				5
Carcharinhus melanopterus									1				1
Centrophorus cf lusitanicus		4											4
Centrophorus moluccensis					14	13					12	8	47
Cephaloscyllium pictum						1							1
Chiloscyllium punctatum	5	2	2	1	1	1			1	1	1	1	16
Galeocerdo cuvier	1	2			7		2		7		1		20
Hemigaleus microstoma	1			1				3	6	4	1		16
Isurus oxyrinchus			1	2				1			1		5
Loxodon macrorhinus	1		2	2				7	10	6			28
Orectolobus leptolineatus				1				1					2
Pseudotriakis microdon					2								2
Rhincodon typus											1		1
Sphyrna lewini	1	2	1	1	4		6			3	7		25
Squalus edmundsi				6									6
Squalus megalops	7	5				13							25
Triaenodon obesus					1	4		1	1	3			10
Sharks	**38**	**51**	**37**	**24**	**47**	**39**	**14**	**24**	**40**	**41**	**53**	**17**	**425**
Dipturus sp.1						1							1
Dipturus sp.2						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 *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 (2015). Landings of *Mobula tarapacana* and *M. thurstoni* only fove and four months respectively. The highest landings of shark by species was 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 (2015) followed by *Alopias superciliosus* (10,394 kg) in May (2016) and *Prionace glauca (*5,218 kg) in November (2016). The details of are shown in **Table 11 and Table 12.**

Table 11: Weight of Sharks Landings by Species at Cilacap

Species of sharks	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mac	Apr	May	Jun	Jul	
Alopias pelagicus	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
Alopias superciliosus	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
Carcharhinus brevipinna	2,200	1,932	1,280	281		371	306.6			1,003		241	7,614.5
Carcharhinus falciformis	1,508	1,316	268	935	2,437	1,468	2,158	1,247	1,702	1,014	130		14,183.0
Carcharhinus leucas					105								105.0
Carcharhinus longimanus						30				16			46.0
Carcharhinus plumbeus	1,290	1,436	2,318	1,126	874	1,056		468	211	3,260	461	513	13,013.0
Carcharhinus sorrah	2	16	48			129		93	14	82			384.0
Galeocerdo cuvier		73		170	264.5	394			21	822			1,744.5
Heptranchias perlo						413.5	577.5						991.0
Isurus oxyrinchus	1,339	4,792	1,827	1,795	1,169	859		797	689	546			13,813.0
Isurus paucus	471	2,916	1,521	2,842	1,493	1,199		334	468	160	135		11,539.0
Prionace glauca	205	1,689	1,521	5,218	3,220	4,695		152	447	785			17,932.0
Pseudocarcharias kamoharai		9											9.0
Sphyrna lewini	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) Landings by Species at Cilacap

Species of rays	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mac	Apr	May	Jun	Jul	
Mobula japanica	4,895	8,760	11,104	5,475	1,167	999	3,970.50		283	136			36,789.5
Mobula tarapacana	270	1,643	635		326						406		3,280.0
Mobula thurstoni		1,562	995			77	866.5						3,500.5
Rhinobatos penggali						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 elasmobranchs was landed at Lampulo from 107 landings comprising 12,383.14 kg of sharks, 3,370.22 kg of rays and 8.0 kg of skates. For rays, the highest landings by weight was *Pateobatis jenkinsii* (1,502.9 kg), followed by *Neotrygon orientalis (*523.28 kg) and *Rhynchobatus australiae (*405.6 kg). The highest landings by month was *Pateobatis jenkinsii (*666.7 kg) in March (2016), followed by *Neotrygon orientalis* (256 kg) in November (2015) and *Rhynchobatus australiae (*111.8 kg) in October (2015). The highest landing of shark was *Alopias pelagicus (*4,167 kg) followed by *Galeocerdo cuvier* (1,632 kg) and *Centrophorus moluccensis* (1,231 kg). The highest landing by month was *Centrophorus moluccensis* (877,3 kg) in June followed by *Alopias pelagicus* (770 kg) in October and *Galeocerdo cuvier* (693 kg) in December. The details are shown in **Table 13 and Table 14**

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

Species of sharks	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Alopias pelagicus	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
Alopias superciliosus		60.0	40.0		240.0					95.0		40.0	475.0
Carcharhinus albimarginatus									170.0				170.0
Carcharhinus amblyrhynchos	152.0	448.3	51.0			24.1	3.8	3.2	8.0		75.8	5.0	771.2
Carcharhinus brevipinna						15.0							15.0
Carcharhinus falciformis	67.0	169.0	57.3	30.0	20.5		7.5		200.0	4.0	34.0	35.5	624.8
Carcharhinus leucas		240.0	461.0	110.0	70.0						115.0	60.0	1056.0
Carcharhinus melanopterus								15.0		29.3			44.3
Carcharhinus sorrah			8.2					46.5	13.0				67.7
Carcharinhus melanopterus									10.0				10.0
Centrophorus cf. *lusitanicus*		97.5											97.5
Centrophorus moluccensis					124.1	51.5					877.3	178.1	1231.0
Cephaloscyllium pictum						4.0							4.0
Chiloscyllium punctatum	18.1	5.0	4.3	4.0	9.0	4.2			4.0	6.0	9.0	4.0	67.6
Galeocerdo cuvier	30.0	103.5			693.0		150.0		575.0		80.0		1631.5
Hemigaleus microstoma	1.5			11.4				16.0	23.0	23.1			75.0
Isurus oxyrinchus			34.0	72.0				40.0			40.0		186.0
Loxodon macrorhinus	0.5		4.0	25.0				69.1	104.5	23.5			226.6
Orectolobus leptolineatus				5.0				4.5					9.5
Pseudotriakis microdon					70.0								70.0
Rhincodon typus											30.0		30.0
Sphyrna lewini	35.0	55.0	65.0	32.0	161.0		261.0			115.0	203.0		927.0
Squalus edmundsi				21.5									21.5
Squalus megalops	25.0	246.4				24.6							296.0
Triaenodon obesus						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 rays and skates	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Aetobatus ocellatus				6.0			6.9	1.5				23.0	37.4
Hemitrygon akajei					4.0								4.0
Telatrygon biasa					0.1								0.1
Gymnura zonura							5.8						5.8
Pateobatis fai				86.0									86.0
Urogyamnus granulatus					4.5								4.5
Pateobatis jenkinsii		10.0	171.3	352.0	68.9		21.0	666.7	213.0				1502.9
Himantura uarnak				40.0									40.0
Himantura undulata								253.0					253.0
Brevitrygon heterura				9.0	0.1								9.1
Mobula japanica	5.0	25.0		75.0			18.0						123.0
Mobula kuhlii				20.0			17.5						37.5
Neotrygon orientalis	1.5	24.0	6.6	256.0	14.2	155.2	6.3	25.2	21.0		7.9	5.4	523.3
Pastinachus ater			30.0										30.0
Pastinachus solocirostris						8.0							8.0
Plesiobatis daviesi			7.6										7.6
Pteroplatytrygon violacea						7.0							7.0
Rhina ancylostoma		40.0											40.0
Rhinoptera javanica												2.5	2.5
Rhinoptera jayakari				12.0									12.0
Rhynchobatus australiae	5.0	65.8	111.8	64.0		15.0		59.0	85.0				405.6
Taeniura lymma		5.0	11.6		3.5	11.6	1.7	11.0					44.4
Taeniurops meyeni			6.5	14.0		38.0		66.0	17.0				141.5
Urogymnus asperrimus				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**
Dipturus 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 Mobula thurstoni* ranged between 165-206.5 cm, 153.5-184.5 cm disc length, respectively. However, most sharks species landed were mature. These included *Alopias pelagicus, Alopias superciliosus, Isurus oxyrhynchus, Isurus paucus, Prionace glauca* and *Sphyrna lewini*. The average ranged size (Total Length) between 268.5-279.5 cm, 224.3-285.5 cm, 199.0-80.0 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 ranged of all sharks and rays species landed at Cilacap from August to May are shown in **Table 15A and Table 15B.**

Only *Neotrygon orientalis* was mature with average size ranged between 23-30 cm disc length. *Pateobatis jenkinsii* was immature. The matured sharks s were *Alopias pelagicus, Galeocedo cuvier,* and *Sphyrna lewini* with average size(TL) ranged between 249-276 cm, 168-298 cm, 171-267 cm respectively. The details 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 sharks and rays	2015														
	Aug			Sep			Oct			Nov			Dec		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Sharks															
Alopias pelagicus	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
Alopias superciliosus	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
Carcharhinus brevipinna	195.0	298.0	256.2	229.0	303.0	279.7	172.0	274.0	245.2	232.0	261.0	246.5			
Carcharhinus falciformis	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
Carcharhinus leucas													227.0	227.0	227.0
Carcharhinus longimanus															
Carcharhinus plumbeus	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
Carcharhinus sorrah	85.0	85.0	85.0	134.0	134.0	134.0	157.0	160.0	158.5						
Galeocerdo cuvier				240.0	240.0	240.0				211.0	231.0	221.0	183.0	254.0	216.0
Heptranchias perlo															
Isurus oxyrinchus	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
Isurus paucus	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
Prionace glauca	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
Pseudocarcharias kamoharai				71.0	98.0	87.3									
Sphyrna lewini	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															
Mobula japanica	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
Mobula tarapacana	124.0	182.0	153.0	101.0	177.0	139.4	108.0	167.0	136.4				165	165.0	165.0
Mobula thurstoni				51.0	130.0	91.1	63.0	114.0	93.5						
Rhinobatos penggali															

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 sharks and rays	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																					
Alopias pelagicus	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
Alopias superciliosus	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
Carcharhinus brevipinna	136.0	229.0	170.9	158.0	179.0	168.5							160.0	271.0	223.8				246.0	292.0	269.0
Carcharhinus falciformis	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			
Carcharhinus leucas																					
Carcharhinus longimanus	160.0	160.0	160.0										135.0	135.0	135.0						
Carcharhinus plumbeus	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
Carcharhinus sorrah	102.0	157.0	124.6				112.0	146.0	126.0	145.0	145.0	145.0	116.0	137.0	125.8						
Galeocerdo cuvier	164.0	279.0	227.8							152.0	152.0	152.0	236.0	344.0	271.5						
Heptranchias perlo	81.5	93.0	86.3	62.0	74.0	67.5															
Isurus oxyrinchus	148.0	367.0	205.1				210.0	364.0	280.0	181.0	346.0	230.3	176.0	238.0	217.2						
Isurus paucus	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			
Prionace glauca	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			
Pseudocarcharias kamoharai																					
Sphyrna lewini	148.0	296.0	201.9	179.0	271.0	209.3	211	316	273												
Rays																					
Mobula japanica	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			
Mobula tarapacana																159.0	180.0	166.7			
Mobula thurstoni	69.0	69.0	69.0	56.0	122.0	90.1															
Rhinobatos penggali	46.0	96.0	77.5	50.0	86.0	61.0															

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

Species of sharks and rays	2015														
	Aug			Sep			Oct			Nov			Dec		
	Min	Max	Aver	Min	Max	Aver	Min	Max	Aver	Min	Max	Aver	Min	Max	Aver
Sharks															
Alopias pelagicus	264	278	272.3	199	282	249.3	223	306	262.8	236	287	262.3	183	288	261.7
Alopias superciliosus				302	302	302	270	270	270				253	311	282.8
Carcharhinus albimarginatus															
Carcharhinus amblyrhynchos	63	129	98.6	62	166	119.6	75	119	100.4						
Carcharhinus brevipinna															
Carcharhinus falciformis	96	126	111.9	72	172	105.7	87	253	137.6	97	151	124	96	107	101.7
Carcharhinus leucas				173	301	237	150	318	225.2	207	207	207	269	269	269.0
Carcharhinus melanopterus															
Carcharhinus sorrah							101	101	101						
Carcharinhus melanopterus															
Centrophorus cf lusitanicus				53	67	59									
Centrophorus moluccensis													103	123	112.6
Cephaloscyllium pictum															
Chiloscyllium punctatum	73	85	81.0	55	95	75	71	79	75	86	86	86	77	77	77.0
Galeocerdo cuvier	169	169	169.0	78	258	168							225	361	279.3
Hemigaleus microstoma	79	79	79.0							110	110	110			
Isurus oxyrinchus							172	172	172	200	200	200			
Loxodon macrorhinus	51	51	51.0				85	87	86	74	109	91.5			
Orectolobus leptolineatus										97	97	97			
Pseudotriakis microdon													198	255	226.5
Rhincodon typus															
Sphyrna lewini	189	189	189.0	94	252	173	267	267	267	174	174	174	96	236	170.8

Squalus edmundsi										49	68	59.83			
Squalus megalops	50	96	75.7	68	103	91									
Triaenodon obesus													65	65	65.0
Rays															
Aetobatus ocellatus										47	47	47			
Hemitrygon akajei													37	37	37.0
Telatrygon biasa													10	10	10.0
Gymnura zonura															
Pateobatis fai										124	124	124			
Urogymnus granulatus													43	43	43.0
Pateobatis jenkinsii				46	46	46	87	113	102	40	147	82.31	46	84	66.2
Himantura uarnak										116	116	116			
Himantura undulata															
Brevitrygon heterura										36	36	36	10	10	10.0
Mobula japanica	5.5	5.5	5.5	65	65	65				62	109	85.5			
Mobula kuhlii										73	73	73			
Neotrygon orientalis	21	24.5	22.8	25	35	32	28	33	30	26	116	38.92	13	36	24.2
Pastinachus ater							75	75	75						
Pastinachus solocirostris															
Plesiobatis daviesi							72	72	72						
Pteroplatytrygon violacea															
Rhina ancylostoma															
Rhinoptera javanica															
Rhinoptera jayakari										42	42	42			
Rhynchobatus australiae	89	89	89.0	76	129	103.2	95	240	133.2	70	206	113.8			
Taeniura lymma				35	35	35	25	33	29.5	33	33	33	37	37	37.0
Taeniurops meyeni							54	54	54	58	58	58			
Uroqymnus asperrimus										120	120	120			

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

Species of sharks and rays	Jan			Feb			Mar			Apr			May			Jun			Jul		
	Min	Max	Aver	Min	Max	Aver	Min	Max	Aver	Min	Max	Aver	Min	Max	Aver	Min	Max	Aver	Min	Max	Aver
Sharks																					
Alopias pelagicus	257	266	262	268	275	271.3	233	287	256.5	250	250	250.0	237	283	256.0	143	296	258	262	284	276
Alopias superciliosus													239	299	269.0				270	270	270
Carcharhinus albimarginatus										144	197	163.8									
Carcharhinus amblyrhynchos	93	113	103	76	76	76	75	75	75.0	110	110	110.0				67	127	99.2	98	98	98
Carcharhinus brevipinna	134	134	134																		
Carcharhinus falciformis				75	77	76				125	260	179.0	85	85	85.0	74	128	109	112	139	125.5
Carcharhinus leucas																198	213	206	230	230	230
Carcharhinus melanopterus							124	124	124.0				47	107	62.3						
Carcharhinus sorrah							48	169	110.0	121	121	121.0									
Carcharinhus melanopterus										149	149	149.0									
Centrophorus cf lusitanicus																					
Centrophorus moluccensis	68	132	87.3													95	124	103	102	124	112.5
Cephaloscyllium pictum	72	72	72																		
Chiloscyllium punctatum	88	88	88							92	92	92.0	153	153	153.0	105	105	105	88	88	88
Galeocerdo cuvier				304	386	345				228	302	270.3				298	298	298			
Hemigaleus microstoma							103	125	110.3	87	107	99.0	89	99	93.0	94	94	94			
Isurus oxyrinchus							175	175	175.0							176	176	176			
Loxodon macrorhinus							59	90	77.9	75	116	88.4	84	90	86.3						
Orectolobus leptolineatus							98	98	98.0												
Pseudotriakis microdon																					
Rhincodon typus																214	214	214			
Sphyrna lewini				216	273	241.3							200	252	227.3	116	220	172			
Squalus edmundsi																					
Squalus megalops	7	105	61.1																		
Triaenodon obesus	99	171	130				123	123	123.0	156	156	156.0	101	122	108.0						
Rays																					
Aetobatus ocellatus				25	43	34	26	26	26.0							65	65	65			
Hemitrygon akajei																					
Telatrygon biasa																					

Gymnura zonura				25	40	32.5															
Pateobatis fai																					
Urogymnus granulatus																					
Pateobatis jenkinsii				57	61	59	39	145	83.1	29	113	72.0									
Himantura uarnak																					
Himantura undulata							98	127	115.8												
Brevitrygon heterura																					
Mobula japanica				57	62	59.5															
Mobula kuhlii				55	60	57.5															
Neotrygon orientalis	22	36	28.9	17	33	28	19	33	28.2	26	33	29.7	15	36	29.2	25	32	29			
Pastinachus ater																					
Pastinachus solocirostris	36	53	44.5																		
Plesiobatis daviesi																					
Pteroplatytrygon violacea	56	61	58.5																		
Rhina ancylostoma																					
Rhinoptera javanica																38	38	38			
Rhinoptera jayakari																					
Rhynchobatus australiae	127	127	127				112	213	162.5	270	270	270.0									
Taeniura lymma	28	33	30.5	24	24	24	26	29	27.5												
Taeniurops meyeni	103	103	103				50	107	83.3	83	83	83.0									
Urogymnus asperrimus							68	68	68.0												
Skates																					
Dipturus sp.1	50	50	50																		
Dipturus sp.2	73	73	73																		

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 *Mobula tarapacana* at 2.04 kg/day **(Table 20)**.

While the highest CPUE of sharks landed at Lampulo was 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 was 6.56 kg/day for *Pateobatis jenkinsii,* and followed by *Neotrygon orientalis* 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 sharks and rays	Total (kg)	CPUE Total Weight kg/days
Sharks		
Alopias superciliosus	52941.0	32.86
Alopias pelagicus	46778.0	29.04
Prionace glauca	17932.0	11.13
Carcharhinus falciformis	14183.0	8.80
Isurus oxyrinchus	13813.0	8.57
Carcharhinus plumbeus	13013.0	8.08
Isurus paucus	11539.0	7.16
Carcharhinus brevipinna	7614.5	4.73
Sphyrna lewini	6228.0	3.87
Galeocerdo cuvier	1744.5	1.08
Rays		
Mobula japanica	36789.5	22.84
Mobula thurstoni	3500.5	2.17
Mobula tarapacana	3280.0	2.04
Rhinobatos penggali	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 sharks and rays	Total (kg)	CPUE Total Weight kg/days
Sharks		
Alopias pelagicus	4167.0	18.20
Galeocerdo cuvier	1631.5	7.12
Centrophorus moluccensis	1231.0	5.38
Carcharhinus leucas	1056.0	4.61
Sphyrna lewini	927.0	4.05
Carcharhinus amblyrhynchos	771.2	3.37
Carcharhinus falciformis	624.8	2.73
Alopias superciliosus	475.0	2.07
Squalus megalops	296.0	1.29
Loxodon macrorhinus	226.6	0.99
Rays		
Pateobatis jenkinsii	1502.9	6.56
Neotrygon orientalis	523.3	2.29
Rhynchobatus australiae	405.6	1.77
Urogymnus granulatus	253.0	1.10
Taeniurops meyeni	141.5	0.62
Mobula japanica	123.0	0.54
Pateobatis fai	86.0	0.38
Urogymnus asperrimus	45.0	0.20
Taeniura lymma	44.4	0.19
Himantura uarnak	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, Carcharhinus leucas,* and *Carcharhinus brevipinna* sold at IDR 23,000/kg, followed by *Carcharhinus sorrah* and *Carcharhinus 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**			
	Alopias spp	8,000-14,000	Whole	Local
	Isurus spp	14,000	Whole	Local
	Sphyrna lewini	14,000	Whole	Local
	Carcharhinus falciformis	16,000	Whole	Local
	Carcharhinus sorrah	16,000	Whole	Local
	Prionace glauca	11,000	Whole	Local
	Carcharhinus plumbeus	23,000	Whole	Local
	Carcharhinus leucas	23,000	Whole	Local
	Carcharhinus brevipinna	23,000	Whole	Local
	Rays			
	Mobula spp.	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**					
	Alopias spp.		10,000	12,000	Whole	Local
	Carcharhinus leucas	20,000	25,000	30,000	Whole	Local
	Carcharhinus falciformis	18,000	23,000	28,000	Whole	Local
	Carcharhinus amblyrhynchos	17,000	20,000	25,000	Whole	Local
	Carcharhinus brevipinna		17,000	20,000	Whole	Local
	Carcharhinus albimarginatus		20,000	25,000	Whole	Local
	Galeocerdo cuvier	13,000	15,000	20,000	Whole	Local
	Sphyrna lewini	20,000	25,000	30,000	Whole	Local
	Isurus spp.		12,000	15,000	Whole	Local
	Squalus megalops	5,000	7,000		Whole	Local
	Centrophorus moluccensis	5,000	7,000		Whole	Local
	Triaenodon obesus		17,000	20,000	Whole	Local
	Chiloscyllium punctatum		10,000	13,000	Whole	Local
	Rays					
	Neotrygon orientalis	15,000	13,000		Whole	Local
	Taeniura lymna	8,000	6,000		Whole	Local
	Pateobatis jenkinsiii	10,000	8,000	6,000	Whole	Local
	Rhynchobatus australiae	25,000	30,000	35,000	Whole	Local

3.0 CONCLUSION

A total of 32 species of sharks belonging of 12 families, and 29 spesies of rays belonging of 12 families were recorded at two landing sites. The most abundant sharks species at Cilacap were *Alopias superciliosus* followed by *Alopias 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 *Pateobatis jenkinsii* followed by *Neotrygon orientalis* and *Rhynchobatus australiae.* The list of sharks and rays species are shown in **Appendix I**.

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 other commercial fish. 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 japanica* (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 2015. 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 (2015) followed by 10,394 kg *Alopias superciliosus* in May (2016) and 5,218 kg in November (2015) 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 *Pateobatis jenkinsii* amounting to 1,503 kg, followed by 523.3 kg *Neotrygon orientalis* and 405.6 kg for *Rhynchobatus australiae*. The highest landing by month was 667 kg for *Pateobatis jenkinsii* in March, followed by 256 kg *Neotrygon orientalis* in November and 112 kg *Rhynchobatus australiae* in October (2015). 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 (2015) followed by *Alopias pelagicus* at 770 kg in October (2015) and *Galeocerdo cuvier* at 693 kg in December (2015) . The ray species *Neotrygon orientalis* and *Rhynchobatus australiae* landed at Lampulo from August (2015) to May (2016) 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, Galeocedo 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 (2016) at Lampulo and September (2015) at Cilacap. Most sharks species caught were adult such as *Alopias pelagicus, A.superciliosus, Isurus oxyrhinchus, I. paucus, Prionace glauca, Galeocerdo cuvier* and *Sphyrna lewini.*

4.0 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 wet Laboratory at Cilacap and Lampulo.

5.0 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 II.**

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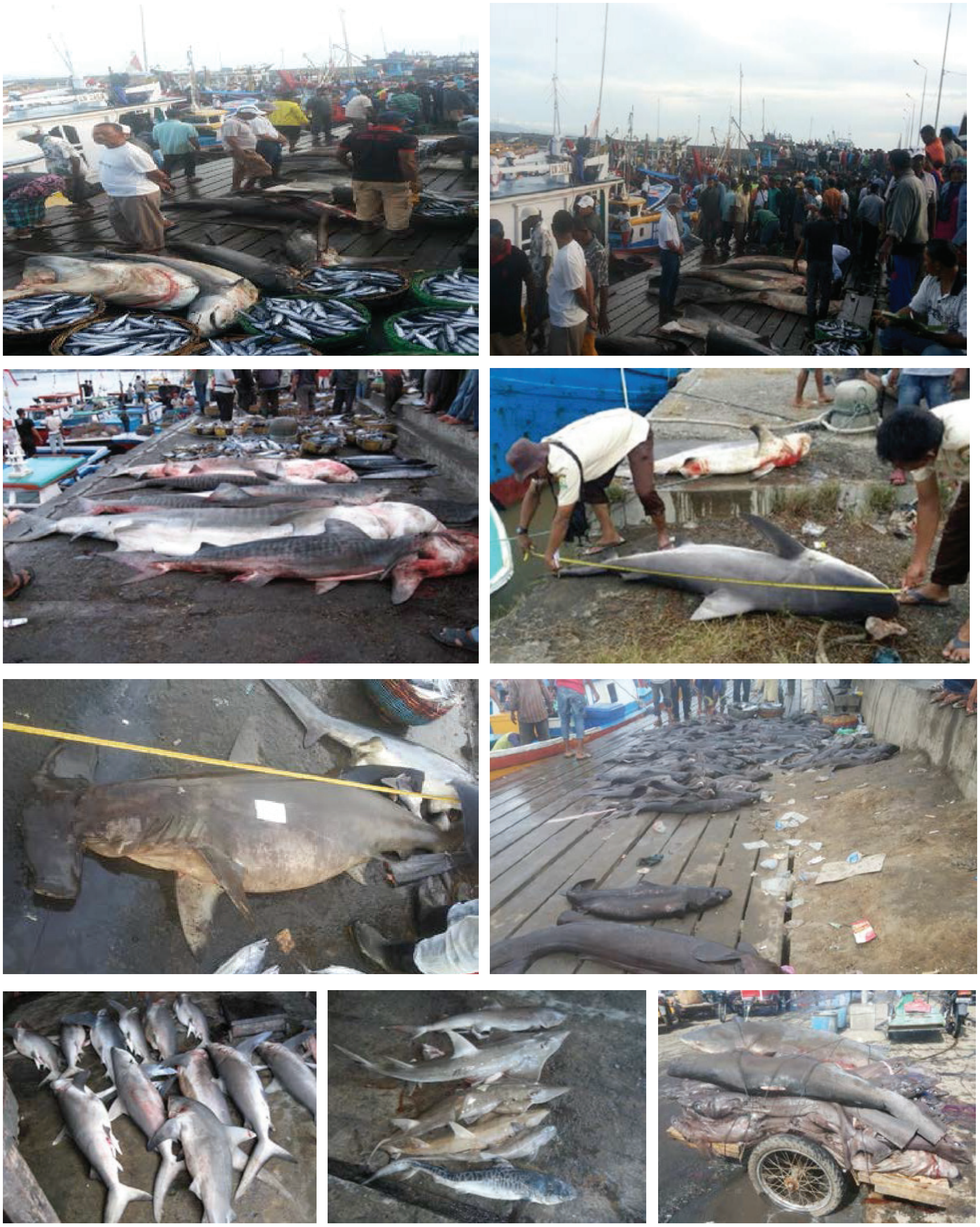
Appendix I

Checklist of Sharks and Rays Species Recorded During the Study

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

No	Families/Species	Site 1	Site 2
		Cilacap	Lampulo
	RAYS		
	Family Carcharhinidae		
1	*Mobula japanica*	+	+
2	*Mobula tarapacana*	+	
3	*Mobula thurstoni*	+	
	Family Rhinobatidae		
4	*Rhinobatos jimbaranensis*	+	
5	*Rhinobatos penggali*	+	
	Family Rhynchobatidae		
6	*Rhynchobatus australiae*		+
	Family Rhincodontidae		
7	*Rhyncodon typus*		+
	Family Dasyatidae		
8	*Neotrygon orientalis*		+
9	*Himantura uarnak*		+
10	*Urogymnus granulatus*		+
11	*Himantura undulata*		+
12	*Pateobatis jenkinsiii*		+
13	*Pateobatis fai*		+
14	*Brevitrygon heterura*		+
15	*Urogymnus asperrimus*		+
16	*Telatrygon biasa*		+
17	*Taeniura lymma*		+
18	*Taeniurops meyeni*		+
19	*Pteroplatrygon violacea*		+
	Family Plesiobatidae		
20	*Plesiobatis daviesi*		+
	Family Rajidae		
21	*Dipturus* sp.		+
	Family Myliobatidae		
22	*Aeobatus flagellum*		+
	Family Rhinopteridae		
23	*Rhinoptera javanica*		+
	Family Gymnuridae		
24	*Gymnura zonura*		+
	Total rays species	**6**	**20**

A. Lampulo Fishing Port



B. Cilacap Fishing Port






National Reports on Sharks Data Collection in Malaysia

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Hamizah Nadia Alias

1.0 INTRODUCTION

Malaysia is a home to a rich diversity of sharks, rays, skates 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**.

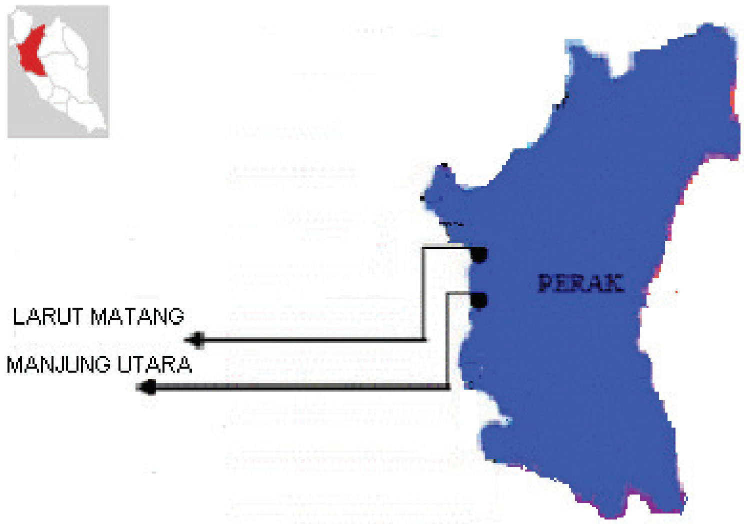

Figure 1: Location of Study Sites in the State of Perak

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

Type of Gear	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 etcs.)	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

Type of Gear	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 untill 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 at Kota Kinabalu

Type of Gear	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 is 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 at Sandakan

Type of Gear	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 Sabah, MALAYSIA. Tel No. : +6 088 235966 Email: Hairul_elut@yahoo.com

Mr. Chin En Kiong Senior Assistant Fisheries Officer Department of Fsiheries Sabah P.O. BOX 1369, 90715, Sandakan, Sabah, MALAYSIA Tel No. : +6 089 208870 Email : EnKiong.Chin@sabah.gov.my Mr. Maurice @ Kassim bin Anchi Senior Assistant Fisheries Officer Department of Fisheries Sabah P.O. BOX 1369, 90715, Sandakan, Sabah, MALAYSIA Tel No. : +6 089 208870 Email : Maurice.anchi@sabah.gov.my
National Coordinator and Project Coordinator for Perak
Mr. Abd Haris Hilmi bin Ahmad Arshad Senior Researcher Fisheries Research Institute, Capture Fisheries Division Kompleks Perikanan Kampung Acheh, Department of Fisheries Malaysia 32000 Sitiawan Perak, MALAYSIA Tel: +6 056914752 Email:haris_hilmi@dof.gov.my
Project Coordinator for the Sabah Mr. Lawrence Kissol Assistant Director (Marine Resource Management) Department of Fisheries Sabah Wisma Pertanian Sabah, Jalan Tasik Luyang (Off Jalan Maktab Gaya) 88624, Kota Kinabalu, Sabah, MALAYSIA. Tel No. : +6 088 235966 Email : Lawrence.kissol@sabah.gov.my

1.4 Materials and Methods

1.4.1 Sampling Methods

The sampling activity started in August 2015 until July 2016. All enumerators were requested to record landing data and other related information in a standard form at least 12 days per month. A Standard Operating Procedure entitled 'SOP Sharks, Rays and Skates Data Collection in the Southeast Asian Waters' was used as a guide. 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 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. Acheh 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), Ebert *et al.* (2013) and Last *et al*. (2016).

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												
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Grand Total
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							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Grand Total
Drift Net	23.3			163.0	97.2							30.6	314.0
Longline	53.1	48.5	158.9	51.1	499.6		153.5	155.9	407.0	106.5	162.7	261.9	2,077.0
Trawl Net B		10.1	21.6		19.1		5.8						56.6
Trawl Net C	75.9	57.7					2.6	26.3					162.5
Total Catch Rays	**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 Sharks	**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 orientalis, Maculabatis gerrardi, Brevitrygon heterura* and *Telatrygon biasa.* Other common rays species were *Rhynchobatus australiae, Maculabatis pastinacoides* and *Hemitrygon akajei.* All these species were landed throughout the year. Other rays species such as *Dasyatis thetidis*, *Urogymnus granulatus, Rhinobatos* cf. *borneensis, Rhynchobatus laevis,* were only landed between 1 - 3 months. The highest number of rays sampled by month was 474 tails in August followed by 455 tails in September 2015 and 446 tails in January 2016.

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

Table 8: Sample Size of Sharks and Rays by Species

Species	Year/Month												Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Hemitrygon akajei	1	2	12	11	1		5	8	11	3	4	1	59
Dasyatis thetidis				1									1
Telatrygon biasa	106	103	89	65	77	94	55	84	56	70	70	56	925
Maculabatis cf. *gerrardi*					1								1
Pateobatis fai										4	3		7
Maculabatis gerrardi	107	99	89	81	116	120	100	109	82	99	92	114	1,208
Pateobatis jenkinsii	2	1	1	1		1	1				3	1	11
Maculabatispastinacoides	8	4	5	10	5		4	3	5	5	1	8	58
Himantura uarnak											1		1
Urogymnus granulatus				1	3								4
Brevitrygon heterura	108	117	97	88	89	97	68	83	53	92	67	54	1,013
Narcine maculata	2												2
Narcine sp				10			2						12
Neotrygon orientalis	127	125	121	92	124	113	103	118	96	141	104	135	1,399
Rhinobatos cf. *borneensis*				5	4								9
Rhynchobatus australiae	12	4	3	18	16	19	13	13	8	18	15	17	156
Rhynchobatus laevis			1							1	1		3
Temera hardwickii	1												1
Narcine sp D					4	2							6
Total Rays	**474**	**455**	**418**	**383**	**440**	**446**	**351**	**418**	**311**	**433**	**361**	**386**	**4,873**
Atelomycterus cf. *baliensis*	2	14	1	1	3	3				1	1		26
Atelomycterus cf. *erdmanni*	9	19	18	19	15	27	13	2	5	8	5	5	145
Atelomycterus marmoratus	52	52	31	30	33	58	50	35	35	48	26	40	490
Carcharhinus brevipinna			5	5									10
Carcharhinus leucas			1	2									3
Carcharhinus limbatus	1												1
Carcharhinus sorrah	9	2	11	6	2			4	52	73	38	11	208
Chiloscyllium cf.*hasseltii*						2							2
Chiloscyllium hasseltii	111	97	116	107	124	134	108	88	85	112	84	76	1,242
Chiloscyllium indicum		6	5				3	2	1				17
Chiloscyllium punctatum	120	106	105	81	91	99	80	71	51	81	58	76	1,019
Chiloscyllium sp.				1									1
Galeocerdo cuvier			1	1									2
Scoliodon laticaudus										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 *Maculabatis gerrardi* amounting to 7, 021 kg, followed by 5,053 kg of *Neotrygon orientalis* and 1,938 kg of *Pateobatis fai*. The highest landing by month for *Maculabatis gerrardi* was 1,465 kg in July 2016, followed by 891 kg in December 2015 and 802 kg in Jun 2016. For *Neotrygon orientalis,* the highest landing was 863 kg in May, followed by 814 kg in July and 674 kg in June 2016. For *Pateobatis 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 *Pateobatis jenkinsii* (992 kg), *Brevitrygon heterura* (994 kg), *Maculabatis pastinacoides* (688 kg), *Telatrygon biasa* (683 kg), *Rhynchobatus australiae* (408 kg) and *Hemitrygon 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	
Hemitrygon akajei	1.0	15.8	79.3	66.4	4.8		18.8	44.5	65.5	17.3	19.7	7.7	**340.7**
Dasyatis thetidis				81.0									**81.0**
Telatrygon biasa	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**
Maculabatis cf. *gerrardi*					19.1								**19.1**
Pateobatis fai										1,700.0	238.0		**1,938.0**
Maculabatis gerrardi	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**
Pateobatis jenkinsii	3.6	4.6	1.6	1.4		10.5	0.8				960.0	9.2	**991.7**
Maculabatis pastinacoides	72.3	32.7	39.1	122.5	28.8		61.8	66.3	78.1	91.7	26.0	68.5	**687.7**
Himantura uarnak											56.0		**56.0**
Urogymnus granulatus				29.1	63.6								**92.7**
Brevitrygon heterura	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**
Narcine maculata	1.3												**1.3**
Neotrygon orientalis	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**
Rhinobatos cf. *borneensis*				8.4	6.3								**14.7**
Rhynchobatus australiae	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**
Rhynchobatus laevis			2.9							0.5	1.9		**5.3**
Temere hardwickii	0.1												**0.1**
Narcine sp				6.9			0.9						**7.8**

Species	Year/Month												Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Narcine sp D					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**
Atelomycterus cf. *baliensis*	0.8	8.8	0.3	0.4	1.0	1.4				0.5	0.6		**13.6**
Atelomycterus cf. *erdmanni*	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**
Atelomycterus marmoratus	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**
Carcharhinus brevipinna			13.5	13.3									**26.8**
Carcharhinus leucas			4.8	33.2									**38.0**
Carcharhinus limbatus	1.4												**1.4**
Carcharhinus sorrah	33.1	20.0	37.4	27.3	8.2			7.5	128.6	158.0	84.4	37.0	**541.5**
Chiloscyllium cf. *hasseltii*						1.9							**1.9**
Chiloscyllium hasseltii	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**
Chiloscyllium indicum		2.3	2.0				0.9	0.9	0.4				**6.4**
Chiloscyllium punctatum	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**
Chiloscyllium sp				0.4									**0.4**
Galeocerdo cuvier			14.6	18.1									**32.7**
Scoliodon laticaudus										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 *Maculabatis gerrardi, Maculabatis* cf. *gerrardi, Pateobatis jenkinsii, Rhynchobatus australiae* and *R. laevis*. The average size of *Maculabatis gerrardi* ranged between 33.1- 39.9 cm disc length. Most adult sized of *Maculabatis gerrardi* were immediately removed by middlemen upon being landed. First maturing size for *Maculabatis 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 *Telatrygon biasa, Neotrygon orientalis* 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 *Maculabatis gerrardi, Pateobatis jenkinsii* and *Rhynchobatus australiae.* Almost all specimens of *Telatrygon biasa, Neotrygon orientalis* and *Brevitrygon heterura* 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 sorah*. 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., *Rhychobatus 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**
Hemitrygon akajei	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			
Dasyatis thetidis										120.0	120.0	120.0						
Telatrygon biasa	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
Maculabatis cf. *gerrardi*													75.0	75.0	75.0			
Maculabatis gerrardi	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
Pateobatis jenkinsii	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
Maculabatis pastinacoides	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			
Urogymnus granulatus										93.0	93.0	93.0	26.0	116.0	56.7			
Brevitrgon heterura	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
Narcine maculata	29.5	43.5	36.5															
Narcine sp.										31.5	38.0	34.5						
Neotrygon orientalis	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
Rhinobatos cf. *borneensis*										78.5	89.0	83.4	75.0	80.5	78.4			
Rhynchobatus australiae	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
Rhynchobatus laevis							84.0	84.0	84.0									
Temera hardwickii	12.5	12.5	12.5															
Narcine 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., *Rhychobatus 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**
Hemitrygon akajei	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
Telatrygon biasa	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
Pateobatis fai										92.0	116.0	105.8	57.0	141.0	108.0			
Maculabatis gerrardi	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
Pateobatis jenkinsii	26.5	26.5	26.5										94.0	96.0	94.7	59.0	59.0	59.0
Maculabatis pastinacoides	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
Himantura uarnak													110.0	110.0	110.0			
Brevitrygon heterura	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
Narcine sp.	33.0	37.0	35.0															
Neotrygon orientalis	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
Rhynchobatus australiae	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
Rhynchobatus laevis										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**
Atelomycterus cf. *baliensis*	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
Atelomycterus cf. *erdmanni*	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
Atelomycterus marmoratus	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
Carcharhinus brevipinna							74.5	89.0	80.7	77.0	87.0	82.2						
Carcharhinus leucas							89.0	89.0	89.0	78.0	155.0	116.5						
Carcharhinus limbatus	61.0	61.0	61.0															
Carcharhinus sorrah	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			
Chiloscyllium cf. *hasseltii*																61.5	63.0	62.3
Chiloscyllium hasseltii	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
Chiloscyllium indicum				47.0	56.0	52.3	49.0	55.5	52.0									
Chiloscyllium punctatum	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
Chiloscyllium sp										48.0	48.0	48.0						
Galeocerdo cuvier							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**
Atelomycterus cf. *baliensis*										52.0	52.0	52.0	54.0	54.0	54.0			
Atelomycterus cf. *erdmanni*	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
Atelomycterus marmoratus	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
Carcharhinus sorrah				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
Chiloscyllium hasseltii	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
Chiloscyllium indicum	46.5	51.0	49.2	52.0	54.0	53.0	52.0	52.0	52.0									
Chiloscyllium punctatum	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
Scoliodon laticaudus										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 *Maculabatis gerrardi* was sold at RM6 - RM21 followed by *Urogymnus granulatus* (RM15 - RM20) *Maculabatis 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 *Maculabatis gerarrdi, Brevitrygon heterura, Telatrygon biasa, Neotrygon orientalis, Hemitrygon 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 III**.

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
Hemitrygon akajei	3-12	Whole body	Local (Ipoh)
Telatrygon biasa	2-5	Whole body	Local (Sitiawan, Ipoh ,Seri Manjung, Pantai Remis, Kuala Kangsar), Penang, Kuala Lumpur, Johor Bahru
Pateobatis fai	2-6	Whole body, skin	Kuala Lumpur and Butterworth; Skin to Thailand
Maculabatis gerrardi	6-21	Whole body, skin	Local (Ipoh, Sitiawan, Seri Manjung, Pantai Remis) Penang, Kuala Lumpur, Johor Bahru, Singapore; Skin to Thailand
Pateobatis jenkinsii	3-12	Whole body, skin	Local (Sitiawan, Seri Manjung), Bukit Mertajam, Singapore
Maculabatis pastinacoides	12-15	Whole body, skin	Local (Sitiawan); Skin export to Thailand

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

Rays	Range Price RM/ kg	Parts	Market Destination
Chiloscyllium punctatum	1-5	Whole body	Local (Sitiawan, Pantai Remis, QL Surimi Factory at Hutan Melintang), Penang, Ipoh, Kuala Lumpur
Galeocerdo cuvier	8-10	Whole body, fins	Local (Sitiawan)
Scoliodon laticaudus	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	
Rays													
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 Rays	**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**
Sharks													
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 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	**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	% Rays	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 *Brevitrygon heterura*, *Maculabatis gerrardi, Neotrygon orientalis* and *Telatrygon biasa.* Other rays species such as *Hemitrygon fluviorum, Pateobatis uarnacoides, Himantura uarnak, Rhinobatos* cf. *borneensis* and *Rhynchobatus australiae* were rarely landed and only recorded between 1-4 months. The highest number of rays sampled by month was 280 tails in February 2016 followed by 277 tails in November and 212 tails in October 2015.

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

Table 15: Sample Size of Sharks and Rays by Species

Species	Year/Month												Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Hemitrygon fluviorum	5	1	1	2	3	1							13
Telatrygon biasa	58	34	30	38	23	34	50	26	34	25	32	36	420
Gymnura poecilura	1	3	3	2	3			2	2	2	2	1	21
Pateobatisa fai												4	4
Maculabatis gerrardi	43	59	63	85	66	61	82	46	49	52	51	40	697
Pateobatis jenkinsii				1									1
Maculabatis pastinacoides								3	1	16	8	3	31
Pateobatis uarnacoides								2					2
Himantura uarnak								1				1	2
Brevitrygon heterura	14	44	64	86	61	51	66	85	81	63	45	58	718
Neotrygon oriantalis	57	58	51	62	50	47	78	37	25	36	38	41	580
Rhinobatos cf. *borneensis*							2						2
Rhynchobatus australiae				1	2		2	1					6
Taeniurops meyeni												1	1
Total rays	**178**	**199**	**212**	**277**	**208**	**194**	**280**	**203**	**192**	**194**	**176**	**185**	**2,498**
Atelomycterus marmoratus	17	9	10	16	3	11	19	2	9	11	5	14	126
Carcharhinus sorrah	7	1	3				1	2	20	17	33	18	102
Chiloscyllium hasseltii	52	52	57	59	49	49	81	49	38	34	28	33	581
Chiloscyllium indicum					2				3				5
Chiloscyllium punctatum	26	38	56	52	41	35	73	45	36	33	26	26	487
Stegostoma fasciatum							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 *Maculabatis gerrardi* amounting to 3,818 kg followed by 2,660 kg of *Neotrygon orientalis,* 907 kg of *Maculabatis pastinacoides* and 621 kg of *Brevitrygon heterura.* The highest landing by month for *Maculabatis gerrardi* was 596 kg in July 2016, followed by 531 kg in November and 380 kg in Disember 2015. For *Neotrygon orientalis,* the highest landing was 363 kg in September 2015 followed by 348 kg in February and 290 kg in January 2016. For *Maculabatis 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 *Brevitrygon heterura* was 100 kg in April 2016, followed by 93 kg in November 2015 and 81 kg in March 2016. Other important species were *Pateobatis fai* (312 kg), *Telatrygon biasa* (289 kg), *Himantura uarnak* (156 kg) and *Taeniurops meyeni* (119 kg). Landing of other species was less than 100 kg.

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

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

Species	Year/Month												Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Hemitrygon fluviorum	27.4	10.2	7.8	3.0	18.4	3.6							70.3
Telatrygon biasa	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
Gymnura poecilura	3.8	7.4	2.1	6.5	4.9			2.6	2.6	6.0	1.5	1.7	39.1
Pateobatis fai												312.1	312.1
Maculabatis gerrardi	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
Pateobatis jenkinsii				5.8									5.8
Maculabatis pastinacoides								17.6		824.6	45.7	18.8	906.6
Pateobatis uarnacoides								11.6					11.6
Himantura uarnak								72.0				83.6	155.6
Brevitrygonn heterura	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
Neotrygon orientalis	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
Rhinobatos cf. *borneensis*							1.3						1.3
Rhynchobatus australiae				0.6	25.8		2.3	30.0					58.7
Taeniurops meyeni												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**
Atelomycterus marmoratus	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
Carcharhinus sorrah	13.4	0.9	57.2				19.8	1.6	76.0	54.7	209.3	197.3	630.1
Chiloscyllium hasseltii	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
Chiloscyllium indicum					0.9				0.3				1.2
Chiloscyllium punctatum	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
Stegostoma fasciatum							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 *Maculabatis gerrardi, Pateobatis jenkinsii, Rhynchobatus australiae* and *Gymnura poecilura*. The average size of *Maculabatis 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 *Maculabatis gerrardi* is about 59.0 cm and for *Gymnura poecilura* about 45.0 cm disc length. However, almost all of *Telatrygon biasa, Neotrygon orientalis*, *Hemitrygon 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 *Maculabatis 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 *Telatrygon biasa, Hemitrygon fluviorum, Neotrygon orientalis, Brevitrygon heterura* and *Rhinobatos* cf. *borneensis* were matured. Most shark species were mature except for *Carcharhinus sorah.* 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. 0All 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**
Hemitrygon fluviorum	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
Telatrygon biasa	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
Gymnura poecilura	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			
Maculabatis gerrardi	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
Pateobatis jenkinsii										48.0	48.0	48.0						
Brevitrygon heterura	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
Neotrygon orientalis	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
Rhynchobatus australiae										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
Telatrygon biasa	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
Gymnura poecilura				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
Pateobatis fai																110.0	135.0	123.0
Maculabatis gerrardi	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
Maculabatis pastinacoides				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
Pateobatis uarnacoides				45.0	89.0	67.0												
Himantura uarnak				138.0	138.0	138.0										87.0	87.0	87.0
Brevitrygon heterura	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
Neotrygon orintalis	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
Rhinobatos cf. *borneensis*	60.0	62.5	61.3															
Rhynchobatus australiae	43.0	71.0	57.0	174.0	174.0	174.0												
Taeniurops meyeni																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
Atelomycterus marmoratus	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
Carcharhinus sorrah	43.0	87.0	65.1	45.0	45.0	45.0	88.0	148.0	113.3									
Chiloscyllium hasseltii	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
Chiloscyllium indicum													45.0	46.0	45.5			
Chiloscyllium punctatum	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
Atelomycterus marmoratus	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
Carcharhinus sorrah				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
Chiloscyllium hasseltii	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
Chiloscyllium indicum										45.0	50.5	47.5									
Chiloscyllium punctatum	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
Stegostoma fasciatum				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 *Maculabatis gerrardi* was sold at RM6 - RM18 followed by *Neotrygon oreentalis* (RM1 - RM13) and *Rhynchobatus australiae* at RM4 - RM10. The lowest price of rays species were *Telatrygon biasa* 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 *Maculabatis gerarrdi, maculabatis pastinacoides, Brevitrygon heterura, Telatrygon biasa, Gymnura poecilura, Neotrygon orientalis, 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 III**

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)

Species	Range Price RM/kg	Parts	Market Destination
Rays			
Hemitrygon fluviorum	5-12	Whole body	Local (Manjung, Ipoh, , Sitiawan, Taiping), Singapore
Telatrygon biasa	1-5	Whole body	Local (Manjung, Ipoh, Taiping), Kuala Lumpur, Singapore
Gymnura poecilura	1-9	Whole body	Local (Manjung, Ipoh, Taiping), Kuala Lumpur, Singapore
Pateobatis fai	8-13	Whole body, skin	Local (Manjung, Taiping), Kuala Lumpur; Skin export to Thailand
Maculabatis gerrardi	6-18	Whole body, skin	Local (Manjung, Ipoh, Taiping), Kuala Lumpur, Singapore; Skin export to Thailand
Pateobatis jenkinsii	8-10	Whole body	Local (Manjung), Singapore; Skin export to Thailand
Maculabatis pastinacoides	5-15	Whole body, skin	Local (Manjung, Taiping), Kuala Lumpur; Skin export to Thailand

Species	Range Price RM/kg	Parts	Market Destination
Pateobatis uarnacoides	5-6	Whole body, skin	Local (Manjung); Skin export to Thailand
Himantura uarnak	5-15	Whole body, skin	Local (Manjung); Skin export to Thailand
Brevitrygon heterura	1-5	Whole body	Local (Manjung, Ipoh, Taiping), Kuala Lumpur, Singapore
Neotrygon orientalis	1-13	Whole body	Local (Manjung, Taiping, Ipoh), Kuala Lumpur, Singapore
Rhinobatos cf. *borneensis*	3-5	Whole body	Local (Manjung)
Rhynchobatus australiae	4-10	Whole body, fins	Local (Manjung, Ipoh, Taiping)
Taeniurops meyeni	8-15	Whole body	Local (Manjung, Taiping), Kuala Lumpur
Sharks			
Atelomycterus marmoratus	1-2	Whole body	Local (Manjung, , Ipoh, Taiping), Kuala Lumpur
Carcharhinus sorrah	5-9	Whole body, fins	Local (Manjung, Taiping), Kuala Lumpur
Chiloscyllium hasseltii	1-4	Whole body	Local (Manjung, Taiping), Kuala Lumpur
Chiloscyllium indicum	2-3	Whole body	Local (Manjung)
Chiloscyllium punctatum	1-4	Whole body	Local (Manjung, Ipoh, Taiping), Kuala Lumpur
Stegostoma fasciatum	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 of Gear	2015					2016							Total
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Drift Net	5	3	3	5	4	1	2	11	10	8	9	12	73
Handline		2		1	2	1	2				2		10
Longline	7	6	13	9	8	8	8	7	15	8	9	7	105
Purse Seine C2		2											2
Trawl Net B	8	11	16	17	8	10	9	6	13	9	5	5	117
Trawl Net C	167	170	190	178	191	196	192	181	149	168	168	166	2,116
Trawl Net C2	20	6	6	13	12		11			6	12	6	92

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

Type of 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. *Maculabatis gerrardi* topped the list with, 3.43 kg/days or 1.46 kg/hauls followed by *Neotrygon orientalis* at 0.74 kg/days or 0.32 kg/hauls and *Pateobatis 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)

No.	Scientific Name	Total weight (kg) by Species	CPUE (kg/day)	CPUE (kg/haul)
1	*Maculabatis gerrardi*	7,253.1	3.43	1.46
2	*Neotrygon orientalis*	1,565.7	0.74	0.32
3	*Pateobatis fai*	795.9	0.38	0.16
4	*Maculabatis pastinacoides*	777.8	0.37	0.16
5	*Telatrygon biasa*	555.9	0.26	0.11
6	*Brevitrygon heterura*	555.9	0.26	0.11
7	*Rhynchobatus australiae*	450.1	0.21	0.09
8	*Hemitrygon akajei*	328.7	0.16	0.07
9	*Pateobatis jenkinsii*	285.2	0.13	0.06
10	*Himantura uarnak*	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)

No.	Scientific Name	Total weight (kg) by Species	CPUE (kg/day)	CPUE (kg/haul)
1	*Chiloscyllium punctatum*	2,122.4	1.00	0.43
2	*Chiloscyllium hasseltii*	1,891.2	0.89	0.38
3	*Carcharhinus sorrah*	867.1	0.41	0.17
4	*Atelomycterus marmoratus*	254.6	0.12	0.05
5	*Atelomycterus* cf. *erdmanni*	58.9	0.03	0.01
6	*Carcharhinus leucas*	38.0	0.02	0.01
7	*Galeocerdo cuvier*	32.7	0.02	0.01
8	*Carcharhinus brevipinna*	26.8	0.01	0.01
9	*Stegostoma fasciatum*	16.5	0.01	0.00
10	*Atelomycterus* cf. *baliensis*	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												
	2015					2016							Grand
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
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												Grand Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
Rays													
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 Rays	**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**
Sharks													
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 Sharks	**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 orientalis* followed by *Maculabatis gerrardi* and *Telatrygon biasa.* 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. *Hemitrygon parvonigra* and *Pateobatis jenkinsii* were recorded in six (6) nd four (4) months respectively. Other species such as *Gymnura japonica, H. uarnak, Aetomylaeus vespertilio*, *Pateobatis fai, H. leoparda, Pateobatis uarnacoides, Mobula japanica*, *Rhinoptera jayakari, Taeniura lymma and Taeniurops meyeni,* 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 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	
Aetobatus ocellatus	2					1		1			1		**5**
Aetomylaeus vespertilio		1											**1**
Hemitrygon parvonigra				17	14	2	2			4		8	**47**
Telatrygon biasa	24	13	26	47	79	91	15	23	60	60	39	69	**546**
Gymnura japonica	1	1		5				1		5			**13**
Gymnura poecilura	4	3	2	6	1	1	4		8	23	3	8	**63**
Pateobatis fai	2												**2**
Maculabatis gerrardi	57	44	30	82	47	77	49	43	60	29	16	37	**571**
Pateobatis jenkinsii	1			1	3			2					**7**
Himantura leoparda	3											1	**4**
Pateobatis uarnacoides	5												**5**
Himantura uarnak	1					2				2			**5**
Mobula japanica	1												**1**
Neotrygon orientalis	47	61	50	139	112	128	86	75	81	96	101	55	**1,031**
Pastinachus gracilicaudus	10		2	2	5	13	2		1		5		**40**
Rhinobatos borneensis	19	11	19	6	4	13	8	28	8	8		2	**126**
Rhinoptera jayakari	5						2						**7**
Rhynchobatus australiae		5	3	13	7	3	6	1	6	1	7	15	**67**
Taeniura lymma		1	3										**4**
Taeniurops meyeni		1											**1**
Total Rays	**182**	**141**	**135**	**318**	**272**	**331**	**174**	**174**	**224**	**228**	**172**	**195**	**2,546**
Alopias pelagicus	1					4		2					**7**
Atelomycterus marmoratus	9	22	29	22	29	28	10	5		9	24	15	**202**
Carcharhinus brevipinna	2	8											**10**
Carcharhinus sealei	2												**2**
Carcharhinus sorrah	12	7	7	3	6	3	2	2	9	24	23	23	**121**
Chiloscyllium plagiosum	82	126	94	71	68	49	32	33	33	45	40	49	**722**
Chiloscyllium punctatum	79	72	91	84	120	152	94	58	51	63	63	30	**957**
Halaelurus buergeri	1				1								**2**
Hemigaleus microstoma	1					2				1		2	**6**
Hemipristis elongata	2	1	3	2	8	8	1	4	3	3			**35**
Heterodontus zebra	2	2	3	1									**8**
Loxodon macrorhinus		7		11						6			**24**
Mustelus manazo					5	6		1		2			**14**
Orectolobus leptolineatus		1											**1**
Sphyrna lewini	8	7	5	18	12	5	7		11	10	14	15	**112**
Squatina tergocellatoides	1												**1**
Stegostoma fasciatum												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 orientalis* amounting to 2,733 kg, followed by *Maculabatis gerrardi* 1,717 kg, 952 kg for *Telatrygon biasa* and 465 kg for *Pastinachus gracilicaudus*. The highest landing by month for *Neotrygon orientalis* was 334 kg in February, followed by 332 kg in June 2016 and 312 kg in November 2015. For *Maculabatis gerrardi,* the highest landing was 298 kg in August 2015, followed by 204 kg in June and 195 kg in March 2016. For *Telatrygon biasa*, 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), *Hemitrygon 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 *Chilosycyllium 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	
Aetobatus ocellatus	2.20					18.20		29.50			24.00		73.90
Aetomylaeus vespertilio		6.90											6.90
Hemitrygon parvonigra				64.20	50.00	4.53	12.55			12.80		21.35	165.43
Telatrygon biasa	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
Gymnura japonica	0.60	0.80		14.40				5.50		15.20			36.50
Gymnura poecilura	11.70	2.50	3.70	19.90	3.50	5.00	4.30		21.75	38.15	11.95	13.80	136.25
Pateobatis fai	80.00												80.00
Maculabatis gerrardi	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
Pateobatis jenkinsii	10.20			8.60	24.20			15.65					58.65
Himantura leoparda	82.30											30.00	112.30
Pateobatis uarnacoides	34.00												34.00
Himantura uarnak	12.90					3.45				1.60			17.95
Mobula japanica	21.00												21.00
Neotrygon orientalis	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
Pastinachus gracilicaudus	136.90		26.10	22.70	49.50	115.57	26.10		18.50		69.20		464.57
Rhinobatos borneensis	28.20	9.10	16.40	6.60	5.50	15.61	8.35	50.45	23.35	11.35		2.00	176.91
Rhinoptera jayakari	246.10						34.50						280.60
Rhynchobatusa australiae		11.30	4.90	28.00	13.50	11.15	11.15	1.80	23.45	0.90	12.50	30.60	149.25
Taeniura lymma		1.80	2.40										4.20
Taeniurops meyeni		2.80											2.80

Species	Year/Month												Total
	2015					2016							
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	
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**
Alopias pelagicus	26.00					105.05		30.50					161.55
Atelomycterus marmoratus	6.10	15.80	19.60	17.90	17.40	25.01	5.85	3.50		4.95	19.90	10.70	146.71
Carcharhinus brevipinna	4.80	22.60											27.40
Carcharhinus sealei	2.90												2.90
Carcharhinus sorrah	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
Chiloscyllium plagiosum	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
Chiloscyllium punctatum	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
Halaelurus buergeri	0.20				0.50								0.70
Hemigaleus microstoma	1.30					3.98				0.35		1.60	7.23
Hemipristis elongata	1.90	1.30	6.00	3.40	11.80	9.14	2.65	3.40	6.70	2.30			48.59
Heterodontus zebra	3.20	6.60	5.80	3.80									19.40
Loxodon macrorhinus		7.60		16.10						5.35			29.05
Mustelus manazo					19.70	16.62		1.95		2.50			40.77
Orectolobus leptolineatus		7.00											7.00
Sphyrna lewini	13.40	16.00	17.50	50.70	27.40	8.60	10.25		18.55	8.45	11.50	83.15	265.50
Squatina tergocellatoides	2.40												2.40
Stegostoma fasciatum												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 *Hemitrygon parvonigra* caught in November and Disember 2015, *Rhinobatos borneensis* (August 2015 to January 2016) and *Taeniura lymma* caught in September 2015. Size range of all rays species from August 2015 to January 2016 are shown in **Table 28A (i)** from February to July 2016, some rays species were mature such as *Hemitrygon parvonigra* that caught in February, *Telatrygon biasa* and *Rhinobatos borneensis* almost throughout the period. Size range of all rays species sampled from February to July 2016 in **Table 28A (ii)**.

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

Table 28A (i): Size Range of Rays (Disc Length) Except for *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**
Aetobatus ocellatus	32.0	73.0	52.5													65.2	65.2	65.2
Aetomylaeus vespertilio				47.5	47.5	47.5												
Hemitrygon parvonigra										23.0	50.0	38.4	29.0	58.0	38.07	27.5	41.2	34.4
Telatrygon biasa	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
Gymnura japonica	19.5	19.5	19.5	23.0	23.0	23.0				21.0	40.0	34.2						
Gymnura poecilura	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
Pateobatis fai	99.0	104.0	101.5															
Maculabatis gerrardi	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
Pateobatis jenkinsii	58.0	58.0	58.0							57.0	57.0	57.0	49.0	57.0	52.67			
Himantura leoparda	81.0	92.0	87.0															
Pateobatis uarnacoides	50.0	62.0	55.3															
Himantura uarnak	68.0	68.0	68.0													32.4	34.5	33.5

Mobula japanica	77.0	77.0	77.0															
Neotrygon orientalis	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
Pastinachus gracilicaudus	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
Rhinobatos borneensis	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
Rhinoptera jayakari	37.5	60.0	49.1															
Rhynchobatus australiae				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
Taeniura lymma				34.0	34.0	34.0	25.0	27.5	25.8									
Taeniurops meyeni				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																		
Aetobatus ocellatus				83.3	83.3	83.3							71.3	71.3	71.3			
Hemitrygon parvonigra	49.5	51.2	50.4							30.2	46.3	38.3				27.2	50.1	37.2
Telatrygon biasa	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
Gymnura japonica				43.3	43.3	43.3				24.5	40.4	35.6						
Gymnura poecilura	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
Pateobatis fai																		
Maculabatis gerrardi	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
Pateobatis jenkinsii				44.5	62.3	53.4												
Himantura leoparda																95.0	95.0	95.0
Himantura uarnak										27.0	27.2	27.1						
Neotrygon orientalis	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
Pastinachus gracilicaudus	53.3	68.3	60.8				71.3	71.3	71.3				43.2	70.3	58.1			
Rhinobatos borneensis	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
Rhinoptera jayakari	64.3	64.5	64.4															
Rhynchobatus australiae	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																		
Alopias pelagicus	122.0	122.0	122.0													164.3	327.0	208.9
Atelomycterus marmoratus	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
Carcharhinus brevipinna	70.0	81.0	75.5	77.0	86.0	81.8												
Carcharhinus sealei	55.0	79.0	67.0															
Carcharhinus sorrah	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
Chiloscyllium plagiosum	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
Chiloscyllium punctatum	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
Halaelurus buergeri	38.5	38.5	38.5										48.0	48.0	48.0			
Hemigaleus microstoma	72.5	72.5	72.5													75.4	88.2	81.8
Hemipristis elongata	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
Heterodontus zebra	54.5	73.0	63.8	66.0	80.0	73.0	55.0	75.5	63.8	76.0	76.0	76.0						
Loxodon macrorhinus				59.0	85.0	69.4				58.0	88.0	75.3						
Mustelus manazo													97.0	107.0	100.8	78.2	107.0	92.9
Orectolobus leptolineatus				95.0	95.0	95.0												
Sphyrna lewini	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
Squatina tergocellatoides	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																		
Alopias pelagicus				194.3	199.3	196.8												
Atelomycterus marmoratus	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
Carcharhinus sorrah	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
Chiloscyllium plagiosum	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
Chiloscyllium punctatum	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
Hemigaleus microstoma										51.2	51.2	51.2				58.2	67.3	62.8
Hemipristis elongate	89.3	89.3	89.3	55.2	65.2	59.3	62.3	105.2	77.2	52.3	70.5	60.8						
Loxodon macrorhinus										60.2	77.3	67.2						
Mustelus manazo				82.2	82.2	82.2				61.3	88.3	74.8						
Sphyrna lewini	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
Stegostoma fasciatum																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 depanding on the species and size. *Brevitrygon heterura* and *Telatrygon biasa* were priced RM1 - RM1.50 while *Neotrygon orientalis* and *Rhychobatus 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, Maculabatis gerarrdi, Urogymnus granulatus, Himantura leoparda* and *Urogymnus asperrimus.*

Ray's skin for some species can fetch a bigger value than the meat. Ray's skin of *Pateobatis uarnacoides, Maculabatis gerrardi, Maculabatis pastinacoides, Urogymnus lobistoma, Pateobatis jenkinsii, Pateobatis fai, Pastinachus ater, 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 Penisular 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

Species	Range Price (RM/kg)	Part	Market Destination
Rays			
Aetobatus ocellatus	2 - 2.5	Whole body	Local (Kota Kinabalu), P. Malaysia
Aetomylaeus vespertilio	2.5 - 3.0	Whole body	Local (Kota Kinabalu), P. Malaysia
Hemitrygon pavronigra	2.0 - 3.0	Whole body	Local (Kota Kinabalu), P. Malaysia
Telatrygon biasa	1.5 - 3.0	Whole body	Local (Kota Kinabalu)
Gymnura japonica	2.0 - 2.5	Whole body	Local (Kota Kinabalu)
Gymnura poecilura	2.0 - 2.5	Whole body	Local (Kota Kinabalu)
Pateobatis fai	2.5 - 3.0	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to Peninsular Malaysia
Maculabatis gerrardi	2.0 - 2.5	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to Peninsular Malaysia

Species	Range Price (RM/kg)	Part	Market Destination
Pateobatis jenkinsii	2.0 - 2.5	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to Peninsular Malaysia
Himantura leoparda	2.0 - 2.5	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to P. Malaysia
Pateobatis uarnacoides	2.5 - 3.0	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to P. Malaysia
Himantura uarnak	1.5 - 3.0	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to P. Malaysia
Brevitrygon heterura	1.0 - 2.0	Whole body	Local (Kota Kinabalu)
Mobula japanica	2.0 - 2.5	Whole body	Local (Kota Kinabalu), P. Malaysia
Neotrygon orientalis	2.0 - 4.0	Whole body	Local (Kota Kinabalu)
Pastinachus gracilicaudus	2.5 - 3.0	Whole body, skin	Local (Kota Kinabalu), P. Malaysia; Skin sold to P. Malaysia
Pastinachus stellurostris	2.0 - 2.5	Whole body, skin	Local (Kota Kinabalu), P. Malaysia Skin sold to P. Malaysia
Rhinobatos borneensis	3.0 - 3.5	Whole body	Local (Kota Kinabalu)
Rhinoptera jayakari	2.0 - 2.5	Whole body	Local (Kota Kinabalu)
Rhychobatus australiae	3.5 - 4.0	Whole body, fins	Local (Kota Kinabalu), P. Malaysia
Taeniura lymma	2.0 - 2.5	Whole body	Local (Kota Kinabalu)
Taeniurops meyeni	2.0 - 2.5	Whole body	Local (Kota Kinabalu)
Sharks			
Alopias pelagicus	2.0 - 2.5	Whole body, fins	Local Market (Kota Kinabalu)
Atelomycterus marmoratus	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
Carcharhinus brevipinna	2.5 - 3.0	Whole body, fins	Local Market (Kota Kinabalu)
Carcharhinus sealei	3.0 - 3.5	Whole body, fins	Local Market (Kota Kinabalu)
Carcharhinus sorrah	3.0 - 3.5	Whole body, fins	Local Market (Kota Kinabalu)
Chiloscyllium hasseltii	3.0 - 3.5	Whole body	Local Market (Kota Kinabalu)
Chiloscyllium plagiosum	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
Chiloscyllium punctatum	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
Halaelurus buergeri	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
Hemigaleus microstoma	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
Hemipristis elongata	3.0 -3.5	Whole body, fins	Local Market (Kota Kinabalu)
Heterodontus zebra	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
Loxodon macrorhinus	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
Mustelus manazo	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)

Species	Range Price (RM/kg)	Part	Market Destination
Orectolobus leptolineatus	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
Sphyrna lewini	3.0 - 3.5	Whole body, fins	Local Market (Kota Kinabalu)
Squatina tergocellatoides	2.0 - 2.5	Whole body	Local Market (Kota Kinabalu)
Stegostoma fasciatum	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	
Rays													
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 Rays	**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**
Sharks													
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 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**	**1,041.1**	**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 orientalis* followed by *Maculabatis gerrardi* and *Taeniura lymma*. The most common species were *Patobatis jenkinsii*, *Rhynchobatus australiae, Pateobatis uarnacoides, Rhinoptera jayakari, Himantura uarnak, Pateobatis fai, Himantura leoparda* and *Pateobatis uarnacoides.* These species were recorded between 11-12 months. Other species such as *Aetobatus ocellatus* and *Telatrygon biasa* 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	
Aetobatus ocellatus	5			3		1	2	1		1	1		**14**
Telatrygon biasa	14	14			15			8	4		7	13	**75**
Pateobatis fai	9	8	5	5	7	9	2	4	6	3	2		**60**
Maculabatis gerrardi	21	16	11	12	15	19	15	7	19	20	28	14	**197**
Pateobatis jenkinsii	9	5	3	7	3	2	3	2	1	5	2	1	**43**
Himantura leoparda	3	3	4	3	1	3	2	1	2	4	1		**27**
Pateobatis uarnacoides	16	4	6	3	4	6	6	4	1	5	2		**57**
Himantura uarnak	1	4	5	1		1	2	2	1	1	1	3	**22**
Urogymnus granulatus												4	**4**
Brevitrgon heterura												5	**5**
Mobula thurstoni	1							1					**2**
Neotrygon orientalis	43	6	6	16	9	17	19	10	13	22	27	30	**218**
Pastinachus ater												2	**2**
Pastinachus gracilicaudus	3	1	2						1			2	**9**
Rhina ancylostoma	1		1		1	1			1				**5**
Rhinobatos borneensis			2				1			3			**6**
Rhinoptera jayakari		3	2	1	1	1	1	1	2	1		1	**14**
Rhynchobatus australiae	8	1	1	5	4	5	5	2	2	5	3	4	**45**
Taeniura lymma	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**
Atelomycterus marmoratus	16	5	4	2	2	6	8	3	10	4	8	8	**76**
Carcharhinus brevipinna						2					1	5	**8**
Carcharhinus leucas	4	2		3	1								**10**
Carcharhinus limbatus		3	1			1	2		2		1		**10**
Carcharhinus sealei	3	1	1	1	2	2		2		1	1	7	**21**
Carcharhinus sorrah	33	9	1	12	3	10	5	9	7	10	17	16	**132**
Chiloscyllium plagiosum	29	9	8	7		11	16	5	3	19	12	4	**123**
Chiloscyllium punctatum	70	30	28	19	13	19	19	6	18	25	15	13	**275**
Galeocerdo cuvier	4	1		1	1	1							**8**
Hemigaleus microstoma	4		12	3	10		2	6		3	2	4	**46**
Hemipristis elongata	2	4				2	2		3	2		1	**16**
Rhizoprionodon acutus	17	6	10	6	3	5	1	2	8	4	4	3	**69**
Sphyrna lewini	9	2	3	9		3	1	3	4	1	3	4	**42**
Stegostoma fasciatum	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 *Pateobatis fai* amounting to 2,315 kg, followed by *H. uarnacides* (1,465 kg), *H. leoparda* (1,367 kg), *Maculabatis gerrardi* (1,013 kg), *Pateobatis jenkinsii* (985 kg), *Himantura uarnak* (896 kg) and *Neotrygon orientalis* (571 kg). The highest landing by month was 445 kg for *Pateobatis fai* in August, followed by 331 kg in September 2015 and 287 kg in January 2016. For *Pateobatis uarnacoides,* the highest landing was 421 kg in August 2015, followed by 176 kg in January 2016 and 121 kg in December 2015. For *Himantura 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 *Maculabatis gerrardi* and *Pateobatis jenkinsii* was in August 2015 at 119 kg and 380 kg respectively. For *Himantura uarnak*, the highest landing was 168 kg in September 2015and for *Neotrygon orientalis* was 88 kg in August 2015. Weight of other species was less than ranged between 2 kg (*Brevitrygon heterura*) 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	
Aetobatus ocellatus	27.2			5.0		31.5	54.5	31.0		2.4	39		**190.6**
Telatrygon biasa	24.4	15.4			28			7.7	3.4	2.4	3.7	20.9	**105.9**
Pateobatis fai	445.0	330.8	229.0	163.0	206.5	286.5	27.0	126.0	243.0	144.3	114		**2,315.1**
Maculabatis gerrardi	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**
Pateobatis jenkinsii	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**
Himantura leoparda	182.0	137.0	157.0	187.0	44.0	151.0	55.0	11.0	135.0	211.0	97.0		**1367**
Pateobatis uarnacoides	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**
Himantura uarnak	78.0	168.0	144.0	79.0		27.0	61.0	108.0	79.0	31.0	79.0	42.0	**896**
Urogymnus granulatus												59.5	**59.5**
Brevitrygon heterura												1.9	**1.9**
Mobula thurstoni	4.5							4.5					**9**
Neotrygon orientalis	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**
Pastinachus ater												74	**74**
Pastinachus gracilicaudus	94.0	39.0	68.0						39.0			65.7	**305.7**
Rhina ancylostoma	35.0		37.0		37.0	35.0			37.0				**181**
Rhinobatos borneensis			1.0				0.3			1.5			**2.8**
Rhinoptera jayakari		31.5	6.7	3.3	3.3	5.0	12.0	12.0	11.7	4.9		13.5	**103.9**
Rhynchobatus australiae	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**
Taeniura lymma	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**
Atelomycterus marmoratus	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**
Carcharhinus brevipinna						11.2					1.8	24.0	**37**
Carcharhinus leucas	48.0	154.0		81.0	14.0								**297**
Carcharhinus limbatus		7.2	3.5			1.8	4.8		5.5		4.3		**27.1**
Carcharhinus sealei	2.8	1.6	0.9	0.9	13.7	2.4		2.7		0.9	4.2	22.5	**52.6**
Carcharhinus sorrah	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**
Chiloscyllium plagiosum	44.3	33.8	11.9	15.4		37	27.6	12.4	5.8	28.9	12.1	22.0	**251.2**
Chiloscyllium punctatum	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**
Galeocerdo cuvier	12.4	1.3		3	1.3	3.4							**21.4**
Hemigaleus microstoma	5.6	8.0	16.9	5.3	26.7		1.2	11.4		6.8	1.3	5.4	**88.6**
Hemipristis elongata	6.3	16.0				6.2	1.7		11.0	10.0		14.3	**65.5**
Rhizoprionodon acutus	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**
Sphyrna lewini	7.4	1.5	2.2	12		2.7	0.6	2.9	5.5	1.2	2.7	13.7	**52.4**
Stegostoma fasciatum	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 *Telatrygon biasa* sampled in August and September 2015, *Pateobatis fai* (August, September, October 2015), *Pateobatis jenkinsii* (August, Disember 2015 and January 2016), *Himantura leoparda* (August and November 2016), *Pateobatis 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 *Pateobatis jenkinsii* sampled in March and April, *Himantura leoparda* (April and July), *Pateobatis uarnacoides* (March and April), *Himantura uarnak* (March, April and July), and *Taeniura lymma* in February, March, May, June and July. Other species were mostly immature. Size range of all rays species sampled from February to July 2016 are shown in **Table 35A (ii)**.

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

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

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

Species	Year/Month																	
	2015															2016		
	Aug			Sep			Oct			Nov			Dec			Jan		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Rays																		
Aetobatus ocellatus	24.0	75.0	35.6							25.0	33.0	29.3				81.0	81.0	81.0
Telatrygon biasa	20.0	30.0	26.4	19.0	30.0	24.7							19.0	30.0	24.1			
Pateobatis fai	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
Maculabatis gerrardi	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
Pateobatis jenkinsii	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
Himantura leoparda	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
Pateobatis uarnacoides	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
Himantura uarnak	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
Urogymnus granulatus																		
Brevitrygon heterura																		
Mobula thurstoni	44.5	44.5	44.5															
Neotrygon orientalis	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
Pastinachus ater																		
Pastinachus gracilicaudus	75.0	84.0	78.0	83.0	83.0	83.0	75.0	84.0	79.5									
Rhinobatos borneensis							52.0	67.0	59.5									
Rhinoptera jayakari				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
Rhynchobatus australiae	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
Taeniura lymma	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) Excep for *Rhinobatos borneensis* and *Rhynchobatus australiae* (Total Length) for Six Months at Sandakan (Sandakan Fish Market Jetty) from February to July 2016

Species	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
Rays																		
Aetobatus ocellatus	75.0	81.0	78.0	81.0	81.0	81.0				33.0	33.0	33.0	75.0	75.0	75.0			
Telatrygon biasa				20.0	30.0	25.4	27.0	30.0	28.5				23.0	30.0	26.3	19.0	29.0	23.5
Pateobatis fai	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			
Maculabatis gerrardi	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
Pateobatis jenkinsii	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
Himantura leoparda	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			
Pateobatis uarnacoides	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			
Himantura uarnak	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
Urogymnus granulatus																28.0	93.0	68.3
Brevitrygon heterura																17.0	24.0	20.7
Mobula thurstoni				44.5	44.5	44.5												
Neotrygon orientalis	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
Pastinachus ater																55.0	95.0	75.0
Pastinachus gracilicaudus							83.0	83.0	83.0							77.0	80.0	78.5
Rhina ancylostoma																		
Rhinobatos borneensis	50.0	50.0	50.0							51.0	67.0	57.7						
Rhinoptera jayakari	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
Rhynchobatus australiae	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
Taeniura lymma	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

Species	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
Sharks																		
Atelomycterus marmoratus	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
Carcharhinus brevipinna																98.0	100.0	99.0
Carcharhinus leucas	117.0	123.0	119.0	160.0	160.0	160.0				123.0	160.0	147.0	123.0	123.0	123.0			
Carcharhinus limbatus				58.0	86.0	68.0	84.0	84.0	84.0							59.0	59.0	59.0
Carcharhinus sealei	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
Carcharhinus sorrah	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
Chiloscyllium plagiosum	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
Chiloscyllium punctatum	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
Galeocerdo cuvier	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
Hemigaleus microstoma	47.0	95.0	64.3				47.0	96.0	65.4	54.0	95.0	70.7	47.0	95.0	61.2			
Hemipristis elongata	64.0	105.0	84.5	64.0	108.0	96.0										64.0	109.0	86.5
Rhizoprionodon acutus	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
Sphyrna lewini	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
Stegostoma fasciatum	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

Species	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
Sharks																		
Atelomycterus marmoratus	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
Carcharhinus brevipinna													74.0	74.0	74.0	74.0	89.0	81.6
Carcharhinus leucas																		
Carcharhinus limbatus	57.0	84.0	70.5				60.0	86.0	73.0				60.0	60.0	60.0			
Carcharhinus sealei				55.00	56.00	55.50				55.0	55.0	55.0	57.0	57.0	57.0	41.0	58.0	51.4
Carcharhinus sorrah	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
Chiloscyllium plagiosum	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
Chiloscyllium punctatum	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
Galeocerdo cuvier																		
Hemigaleus microstoma	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
Hemipristis elongata	64.00	64.00	64.00				64.0	108.0	92.3	105.0	107.0	106.0				148.0	148.0	148.0
Rhizoprionodon acutus	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
Sphyrna lewini	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
Stegostoma fasciatum	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 fullfill demand from Peninsular Malaysia. At Sandakan Fish Market jetty, wholesale price of rays are between the range of RM0.80 – RM4/kg depanding on the species. *Neotrygon orientalis* and *Telatrygon biasa* are priced as cheap as RM 0.80/kg while *Pastinachus ater, Rhinobatos borneensis* and *Rhychobatus 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 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 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 III**

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

Species	Range Price (RM/kg)	Part	Market Destination
Rays			
Aetobatus ocellatus	1.5 - 3.0	Whole body	Local (Sandakan), Peninsular Malaysia
Telatrygon biasa	0.8 - 1.0	Whole body	Local (Sandakan)
Pateobatis fai	1.5 - 3.5	Whole body, skin	Local (Sandakan), Peninsular Malaysia; Skin sold to Peninsular Malaysia
Maculabatis gerrardi	0.8 - 2.5	Whole body, skin	Local (Sandakan), Peninsular Malaysia; Skin sold to Peninsular Malaysia
Pateobatis jenkinsii	1.5 - 3.5	Whole body, skin	Local (Sandakan), Peninsular Malaysia; Skin sold to Peninsular Malaysia
Himantura leoparda	1.5 - 3.5	Whole body, skin	Local (Sandakan), Peninsular Malaysia; Skin sold to Peninsular Malaysia

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

Type of 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)

Type of 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, *Maculabatis gerrardi* topped the list with 1.21 kg per days or 0.40 kg per hauls, followed by *Neotrygon orientalis* with 1.07 kg per days or 0.36 per hauls. For zone 4, *Neotrygon orientalis* was on top of the list with 1.48 kg per days or 0.49 kg per hauls compare with *Pateobatis 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 *Maculabatis gerrardi, Pateobatis fai, Pateobatis uarnacoides, Himanturan leoparda, Himantura uarnak, Neotrygon orientalis, Pastinachus gracilicaudus, Telatrygon biasa* 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)

No.	Scientific Name	Total weight (kg) by Species	CPUE (kg/ days)	CPUE (kg/hauls)
1	*Maculabatis gerrardi*	1721.4	1.21	0.40
2	*Neotrygon orientalis*	1525.7	1.07	0.36
3	*Pateobatis fai*	1149.0	0.80	0.27
4	*Pateobatis uarnacoides*	775.7	0.54	0.18
5	*Pateobatis jenkinsii*	728.8	0.51	0.17
6	*Himantura leoparda*	660.0	0.46	0.15
7	*Himantura uarnak*	414.9	0.29	0.10
8	*Pastinachus gracilicaudus*	414.7	0.29	0.10
9	*Telatrygon biasa*	371.0	0.26	0.09
10	*Rhynchobatus australiae*	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)

No.	Scientific Name	Total weight (kg) by Species	CPUE (kg/ days)	CPUE (kg/hauls)
1	*Neotrygon orientalis*	1,358.0	1.48	0.49
2	*Pateobatis fai*	921.3	1.00	0.33
3	*Pateobatis uarnacoides*	638.0	0.69	0.23
4	*Maculabatis gerrardi*	637.3	0.69	0.23
5	*Himantura leoparda*	589.3	0.64	0.21
6	*Telatrygon biasa*	479.9	0.52	0.17
7	*Himantura uarnak*	393.1	0.43	0.14
8	*Rhinoptera jayakari*	280.7	0.31	0.10
9	*Rhynchobatus australiae*	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)

No.	Scientific Name	Total weight (kg) by Species	CPUE (kg/ days)	CPUE (kg/hauls)
1	*Chiloscyllium punctatum*	1,643.6	1.15	0.38
2	*Chiloscyllium plagiosum*	713.6	0.50	0.17
3	*Carcharhinus sorrah*	603.5	0.42	0.14
4	*Carcharhinus leucas*	211.0	0.15	0.05
5	*Stegostoma fasciatum*	187.5	0.13	0.04
6	*Sphyrna lewini*	129.2	0.09	0.03
7	*Atelomycterus marmoratus*	107.9	0.08	0.03
8	*Hemipristis elongata*	83.8	0.06	0.02
9	*Alopias pelagicus*	56.5	0.04	0.01
10	*Hemigaleus microstoma*	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)

No.	Scientific Name	Total weight (kg) by Species	CPUE (kg/ days)	CPUE (kg/hauls)
1	*Chiloscyllium punctatum*	1,028.7	1.12	0.37
2	*Chiloscyllium plagiosum*	354.7	0.39	0.13
3	*Carcharhinus sorrah*	332.3	0.36	0.12
4	*Stegostoma fasciatum*	149.5	0.16	0.05
5	*Atelomycterus marmoratus*	98.6	0.11	0.04
6	*Carcharhinus leucas*	86.0	0.09	0.03
7	*Sphyrna lewini*	78.9	0.09	0.03
8	*Alopias pelagicus*	76.0	0.08	0.03
9	*Hemipristis elongata*	24.7	0.03	0.01
10	*Carcharhinus brevipinna*	22.6	0.02	0.01

3.0 OUTPUT AND OUTCOME

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

Table 40: Output and Outcome

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

4.0 FUTURE ACTIVITIES

Malaysia is highly commited 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 I.** 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 orientalis, Maculabatis gerrardi, Brevitrygon heterura* and *Telatrygon biasa.* The most abundant sharks species at Manjung Utara were *Chiloscyllium hasseltii, Chiloscyllium punctatum* and *Atelomycterus marmoratus* while for rays were *Brevitrygon heterura, Maculabatis gerrardi, Neotrygon orientalis*, and *Telatrygon biasa.*

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 orientalis* followed by *Maculabatis gerrardi* and *Telatrygon biasa*. The most common sharks species were *Chiloscyllium punctatum*, *Chiloscyllium hasseltii* and *Carcharhinus sorrah* while for rays *Neotrygon orientalis,* followed by *Maculabatis gerrardi* and *Telatrygon biasa.*

In the district of Sandakan, the most abundant sharks species were *Chiloscyllium punctatum* followed by *Carcharhinus sorrah* and *Chiloscyllium plagiosum,* and rays *Neotrygon orientalis* followed by *Maculabatis gerrardi* and *Taeniura lymma*. The most common sharks species were *Chiloscyllium punctatum*, *Carcharhinus sorrah, Atelomycterus marmoratus* and *Rhizoprionodon acutus* while for rays *Neotrygon orientalis,* followed by *Maculabatis gerrardi, Pateobatis 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 orientalis, Maculabatis gerrardi* and *Brevitrygon heterura,* 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, *Maculabatis gerrardi* topped the list, followed by *Neotrygon orientalis* and *Pateobatis fai* in zone 3. In zone 4, *Neotrygon orientalis* was the main species, followed by *Pateobatis fai* and *Pateobatis 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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Appendix I

Checklist of Sharks and Rays Species Recorded During the Study Period

No	Orders/Families	Site 1	Site 2	Site 3	Site 4
	Batoids/Rays				
No	**ORDER MYLIOBATIFORMES**	**Larut Matang**	**Manjung Utara**	**Kota Kinabalu**	**Sandakan**
	Family Dasyatidae				
1	*Hemitrygon akajei*	/	+	+	+
2	*Dasyatis thetidis*	/	+	+	+
3	*Hemitrygon fluviorum*	+	/	+	+
4	*Telatrygon biasa*	/	/	/	/
5	*Maculabatis gerrardi*	/	/	/	/
6	*Maculabatis* cf. *gerrardi*	/	+	+	+
7	*Hemitrygon parvonigra*			/	
8	*Pateobatis fai*	/	/	/	/
9	*Pateobatis jenkinsii*	/	/	/	/
10	*Maculabatis pastinacoides*	/	/	+	+
11	*Himantura uarnak*	/	/	/	/
12	*Pateobatis uarnacoides*	+	/	/	/
13	*Himantura granulata*	+	+	+	+
14	*Brevitrygon heterura*	/	/	+	/
15	*Urogymnus granulatus*	/	+	+	/
16	*Himantura leoparda*	+	+	/	/
17	*Neotrygon orientalis*	/	/	/	/
18	*Taeniura lymma*	+	+	/	/
19	*Pastinachus gracilicaudus*	+	+	/	/
20	*Taeniurops meyeni*	+	/	/	
21	*Pastinachus ater*	+	+	+	/
	Family Gymnuridae				
22	*Gymnura poecilura*	+	/	/	+
23	*Gymnura japonica*	+	+	/	+
	Family Mobulidae				
24	*Mobula thurstoni*	+	+	+	/
25	*Mobula japanica*	+	+	/	+
	Family Rhinopteridae				
26	*Rhinoptera jayakari*	+	+	/	/
	Family Myliobatidae				
27	*Aetobatus ocellatus*	+	+	/	/
28	*Aetomylaeus vespertilio*	+	+	/	+
	ORDER RHINOBATIFORMES				
	Family Rhinobatidae				
29	*Rhinobatos* cf. *borneensis*	/	/	+	+
30	*Rhinobatos borneensis*	+	+	/	/

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

No	Orders/Families	Site 1	Site 2	Site 3	Site 4
21	*Chiloscyllium indicum*	/	/	+	+
22	*Chiloscyllium plagiosum*	+		/	/
23	*Chiloscyllium punctatum*	/	/	/	/
24	*Chiloscyllium* sp.	/	+	+	+
25	*Stegostoma fasciatum*	+	/	/	/
26	*Orectolobus leptolineatus*	+	+	/	+
	ORDER HETERODONTIFORMES				
	Family Heterodonitidae				
27	*Heterodontus zebra*	+	+	/	+
	ORDER SQUATINIFORMES				
	Family Squatinidae	+	+	+	+
28	*Squatina tergocellatoides*	+	+	/	+
	ORDER LAMNIFORMES				
	Family Alopidae				
29	*Alopias pelagicus*	+	+	/	+
	Total sharks 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. Acheh, Perak

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)		
	Rays	Small	Medium	Big	Small	Medium	Big
	Family Dasyatidae						
1	*Hemitrygon akajei*	< 25	25 – 40	> 40			
2	*Telatrygon biasa*	< 20	20 - 26	> 26			
3	*Maculabatis gerrardi*	< 19	19 - 50	> 50	< 20	20 - 50	> 50
4	*Pateobatis fai*				< 20	20 - 50	> 50
5	*Pateobatis jenkinsii*				< 20	20 - 50	> 50
6	*Maculabatis pastinacoides*	< 25	26 - 45	> 46			
7	*Pateobatis uarnacoides*				< 20	20 - 50	> 50
8	*Brevitrygon heterura*	< 18	18 - 20	> 20			
9	*Himantura leoparda*				< 20	20 - 50	> 50
10	*Neotrygon orientalis*	< 14	14 - 21	> 21	< 20	20 -50	> 50
11	*Pastinachus gracilicaudus*				< 50	50 - 100	> 100
	Family Rhinopteridae						
12	*Rhinoptera jayakari*				< 20	20 - 50	> 50
	Family Rhynchobatidae						
13	*Rhynchobatus australiae*	< 40	40 - 100	> 100	< 50	50 - 100	> 100
	Family Rhinidae						
14	*Rhina ancylostoma*				< 50	50 - 100	> 100
	Sharks						
	Family Scyliorhinidae						
15	*Atelomycterus marmoratus*	< 32	32 - 44	> 44			
16	*Atelomycterus* cf. *erdmanni*	< 32	33 - 49	> 50			
	Family Carcharhinidae						
17	*Carcharhinus sorrah*				< 50	50 - 100	> 100
18	*Carcharhinus limbatus*				< 50	50 -100	> 100
19	*Rhizoprionodon acutus*				< 50	50 - 100	> 100
	Family Sphyrnidae						
20	*Sphyrna lewini*				< 50	50 - 00	> 100
	Family Hemigaleidae						
21	*Hemigaleus microstoma*				< 50	50 - 100	> 100
	Family Orectolobidae						
22	*Chiloscyllium hasseltii*	< 35	40 - 50	> 56			
23	*Chiloscyllium punctatum*	< 35	36 - 55	> 56	< 50	50 - 100	> 100

National Reports on Sharks Data Collection in Myanmar

By

Soe Win
Nay Myo Aye

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 literature 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 Objective

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**.

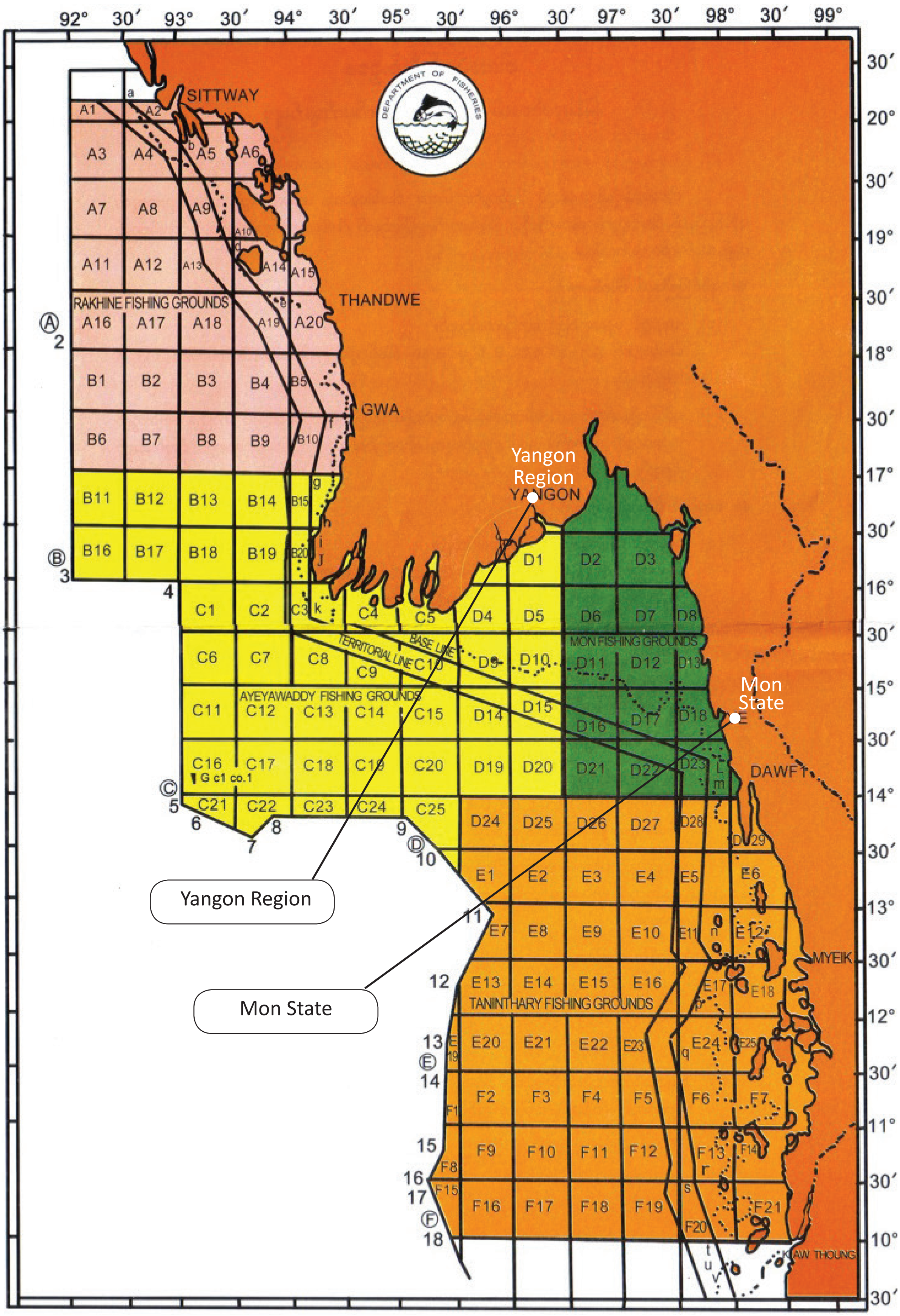

Figure 1: Location of Study Sites in Myanmar

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

Type of Gear	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

Type of Gear	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 Operating Procedure entitled 'SOP Sharks, Rays and Skates Data Collection in the Southeast Asian Waters' was used as a guide. 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 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) and Last *et al.* (2016).

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	
Sharks	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
Sharks 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
Rays	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
Rays 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
Skates	Set Bag Net										24.8			24.8
	Trawl Net				39.8	1.5				19.9				61.2
Skates 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 constributed 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**.

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 *Brevitrygon heterura* followed by *Rhinobatos* cf. *formosensis, Rhinobatos punctifer*, *Neotrygon orientalis* 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, Brevitrygon imbricata, Gymnura poecilura, Aetobatus flagellum, Hemitrygon sinensis, Brevitrygon* cf. *javaensis, Pateobatis fai, Mobula kuhlii, Mobula japanica, Plesiobatis daviesi, Rhinoptera adspersa, Narcine lingula, Okamejei* sp., *Urogymnus asperrimus, Urogymnus 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 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**

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	
Aetobatus flagellum		1				1							2
Aetobatus cf. *narinari*		4											4
Dasyatis microps				1			1	1					3
Hemitrygon sinensis				1	3								4
Glaucostegus sp.		4											4
Glaucostegus typus				2				8	1	15			26
Gymnura japonica	14	17	20		1		2	6					60
Gymnura poecilura									1	4			5
Pateobatis fai								1			3		4
Maculabatis gerrardi	3	9	2			13	2	4				1	34
Brevitrygon imbricata					4								4
Brevitrygon cf. *javaensis*	2	1											3
Pateobatis jenkinsii						2	5	10	1		6	4	28
Himantura leoparda		5				4			1		8	1	19
Urogymnus lobistoma		2		3	3								8
Maculabatis pastinacoides	2	14		11				1	1	6	9		44
Pateobatis uarnacoides			9	4		2		2	8	18			43
Himantura uarnak						2			1			1	4
Urogymnus granulatus	2					2		1	3		5	13	26
Brevitrygon heterura	45	70	53	38	44	48	3	13	9	23	23	22	391
Mobula japanica	3	4	16					3					26
Mobula kuhlii							1						1
Narcine brevilabiata				11									11
Narcine lingual				10									10
Neotrygon orientalis	2	9		3	13	9	14	16	3	13	10		92
Pastinachus gracilicaudus				1									1
Pastinachus cf. *solocirostris*											1		1
Pastinachus stellurostris				1						1			2
Plesiobatis daviesi									1				1
Rhina ancylostoma				14	2	4	5		3		10	3	41
Rhinobatos cf. *formosensis*				46	46	39	13	24	44	15	26	20	273
Rhinobatos penggali	22	35	66										123
Rhinobatos punctifer	14	16	9	24	29	25	31	49	23	24	17	26	287
Rhinoptera javanica		13	12					5	2	10			42
Rhinoptera jayakari	6	1				4	13					2	26
Rhynchobatus australiae				2							1		3
Taeniurops meyeni					1	1		2					4
Urogymnus asperrimus									3	5			8
Total Rays	**115**	**205**	**187**	**172**	**146**	**156**	**90**	**146**	**105**	**134**	**119**	**93**	**1,668**
Okamejei jensenae				2					3	8			13
Okamejei 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	
Carcharhinus brevipinna							1		1		4	1	7
Carcharhinus leucas	7	4	42	8	9	3	1	6			5		85
Carcharhinus limbatus								1					1
Carcharhinus macloti				17	17		1						35
Carcharhinus melanopterus	1												1
Carcharhinus sorrah	3												3
Chiloscyllium hasseltii	2			3					5	6	1	1	18
Chiloscyllium punctatum									1	1	1	1	4
Galeocerdo cuvier		2	2	4		2					1		11
Hemigaleus microstoma				2	4		1		1		5	1	14
Hemipristis elongata					2	5	4	1			7		19
Loxodon macrorhinus				5	18	1		9	8		15	15	71
Mustelus mosis		7	9	19			10	1	1			1	48
Mustelus sp.	4	17		12	8	18	3	14	24		25	9	134
Rhizoprionodon acutus	2	9	19										30
Scoliodon laticaudus	44	34	91	61	27	6	12	33	4	14	7	41	374
Sphyrna lewini	103	112	92	71	27	3	3	15	3		21	10	460
Sphyrna mokarran						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), *Brevitrygon heterura* (3,529.6 kg), *Rhinobatos punctifer* (2,528.9 kg), *Urogymnus granulatus* (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 *Brevitrygon heterura,* 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	
Aetobatus flagellum		16.5				19.8							36.3
Aetobatus cf. *narinari*		34.0											34.0
Dasyatis microps				148.5			55.0	148.4					351.9
Hemitrygon sinensis				0.3	30.7								31.0
Glaucostegus sp.		15.0											15.0
Glaucostegus typus				75.9				154.8	2.0	83.1			315.8
Gymnura japonica	58.2	123.3	679.1		9.8		2.8	1,216.4					2,089.6
Gymnura poecilura									9.8	17.8			27.6
Pateobatis fai								8.7			45.1		53.8
Maculabatis gerrardi	50.9	78.7	30.9			105.4	34.4	39.7				1.7	341.6
Brevitrygon imbricata					74.1								74.1
Brevitrygon cf. *javaensis*	30.0	7.2											37.2
Pateobatis jenkinsii						41.0	276.9	464.0	33.0		97.6	198.9	1,111.3
Himantura leoparda		33.8				782.1			207.0		274.7	41.3	1,338.9
Urogymnus lobistoma		19.8		76.3	45.3								141.4
Maculabatis pastinacoides	1.6	70.9		105.4				5.1	5.1	55.8	46.2		290.1
Pateobatis uarnacoides			70.8	39.0		58.0		15.9	104.5	1,366.4			1,654.6
Himantura uarnak						568.5			321.0			38.0	927.4
Urogymnus granulatus	96.2					517.5		49.2	420.1		223.5	1,104.6	2,411.1
Brevitrygon heterura	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
Mobula japanica	41.3	24.8	148.5					3.3					217.8
Mobula kuhlii							45.0						45.0

Species	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Narcine brevilabiata				100.0									100.0
Narcine lingula				99.0									99.0
Neotrygon orientalis	26.5	16.3		13.6	12.3	12.5	220.7	17.9	3.8	54.5	12.6		390.7
Pastinachus gracilicaudus				38.4									38.4
Pastinachus cf. *solocirostris*											2.7		2.7
Pastinachus stellurostris				27.7						2.6			30.2
Plesiobatis daviesi									3.3				3.3
Rhina ancylostoma				297.3	6.5	60.3	42.2		103.6		48.1	26.9	584.8
Rhinobatos cf. *formosensis*				634.7	594.0	1,201.1	340.7	17.1	1,599.2	19.0	188.1	53.6	4,647.5
Rhinobatos penggali	219.0	207.8	856.3										1,283.0
Rhinobatos punctifer	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
Rhinoptera javanica		158.5	35.6					360.5	360.5	165.0			1,080.1
Rhinoptera jayakari	34.7	0.9				122.9	527.0					55.7	741.1
Rhynchobatus australiae				2.3							35.5		37.8
Taeniurops meyeni					66.0	49.5		99.2					214.7
Urogymnus asperrimus									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**
Carcharhinus brevipinna							2.0		4.4		8.2	8.2	22.9
Carcharhinus leucas	29.3	8.8	73.9	65.3	53.1	7.8	7.6	18.6			11.6		275.8
Carcharhinus limbatus								2.0					2.0
Carcharhinus macloti				23.8	89.6		14.0						127.4

Species	2015						2016						Grand Total
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Carcharhinus sorrah	21.1												21.1
Chiloscyllium hasseltii	2.5			2.2					24.1	6.1	1.2	1.2	37.3
Chiloscyllium punctatum									0.7	0.7	1.2	0.7	3.3
Galeocerdo cuvier		4.7	3.4	51.0		16.5					9.6		85.2
Hemigaleus microstoma				1.4	2.2		0.7		1.7		3.6	1.7	11.1
Hemipristis elongata					17.9	3.9	9.2	0.8			5.6		37.4
Loxodon macrorhinus				18.8	87.1	17.7		2.8	17.7		136.6	76.8	357.4
Mustelus mosis		118.8	26.1	50.8			1,372.2	1.3	1.6			1.6	1,572.3
Mustelus sp.	2.0	161.3		60.4	8.2	224.1	2.3	60.4	127.5		185.5	5.7	837.4
Rhizoprionodon acutus	4.1	22.0	71.3										97.4
Scoliodon laticaudus	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
Sphyrna lewini	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
Sphyrna mokarran						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**
Okamejei jensenae				19.9					19.9	24.8			64.6
Okamejei sp.				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 *Hemitrygon sinensis, Glycostegus* sp.*, Gymnura japonica, Himatura leoparda, Mobula japanica, Pastinachus stellurostris*, *Rhina encylostoma, Rhinoptera javanica, Rhinoptera jayakari and Rhynchobatus australiae.* The average size of *Mobula japanica* ranged between 22.0 - 78.0 cm disc length but no adult sized specimens were available. First maturing size for *Mobula japanica* 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*, Hemitrygon 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 orientalis*, *Glaucostegus typus, Rhinobatos punctifer, Rhinobatos* cf. *formosensis, Maculabatis gerrardi*, *Brevitrygon heterura, Urogymnus granulatus*, *Himantura uarnak, Brevitrygon imbricata, Pateobatis uarnacoides* and *Maculabatis pastinacoides* were mature. Most shark species landed were immature except for *Carcharhinus macloti, 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 (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)and Skates (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																		
Aetobatus flagellum				93.0	93.0	93.0										105.0	105.0	105.0
Aetobatus cf. *narinari*				110.0	113.0	111.5												
Megatrygon microps										145.0	145.0	145.0						
Hemitrygon sinensis										21.0	21.0	21.0	22.0	22.0	22.0			
Glaucostegus sp.				88.0	93.0	90.8												
Glaucostegus typus										210.0	210.0	210.0						
Gymnura japonica	12.0	30.0	22.1	11.0	32.0	20.8	14.0	32.0	19.5				20.0	20.0	20.0			
Maculabatis gerrardi	61.0	63.0	62.0	60.0	68.0	65.0	67.0	67.0	67.0							21.0	108.0	37.8
Brevitrygon imbricata													20.0	20.2	20.1			
Brevitrygon cf. *javaensis*	34.0	35.0	34.5	35.0	35.0	35.0												
Pateobatis jenkinsii																79.0	80.0	79.5
Himantura leoparda				51.0	59.0	56.8										104.0	111.0	109.0
Urogymnus lobistoma				33.4	33.5	33.5				30.0	65.0	53.3	33.5	83.0	63.8			
Maculabatis pastinacoides	15.0	17.5	16.3	15.0	56.0	33.6				36.0	65.0	51.5						
Pateobatis uarnacoides							49.0	115.0	75.9	32.0	76.0	44.3				78.0	117.0	97.5

Himantura uarnak																112.0	113.0	112.5
Urogymnus granulatus	100.0	100.0	100.0													110.0	112.0	111.0
Brevitrygon heterura	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
Mobula japanica	45.0	46.0	45.7	22.0	29.0	26.0	22.0	78.0	57.1									
Narcine brevilabiata										29.0	34.0	31.2						
Narcine lingula										29.0	32.0	30.9						
Neotrygon orientalis	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
Pastinachus gracilicaudus										98.0	98.0	98.0						
Pastinachus stellurostris										45.0	45.0	45.0						
Rhina ancylostoma										61.0	175.0	113.9	72.0	75.0	73.5	73.0	110.0	100.8
Rhinobatos cf. *formosensis*										34.0	81.0	54.4	40.0	77.0	59.3	40.0	79.0	64.8
Rhinobatos penggali	20.0	75.0	53.6	35.0	83.0	70.7	27.0	86.0	63.6									
Rhinobatos punctifer	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
Rhinoptera javanica				23.0	77.0	42.2	30.0	35.0	32.6									
Rhinoptera jayakari	23.0	29.0	26.2	24.0	24.0	24.0										35.0	78.0	46.0
Rhynchobatus australiae										52.3	53.0	52.7						
Taeniurops meyeni													140.0	140.0	140.0	90.0	90.0	90.0
Sharks																		
Carcharhinus leucas	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
Carcharhinus macloti										78.0	87.0	80.5	70.0	81.0	76.4			

Carcharhinus melanopterus	77.0	77.0	77.0															
Carcharhinus sorrah	70.0	158.0	101.0															
Chiloscyllium hasseltii	68.0	69.0	68.5							35.0	67.0	56.3						
Galeocerdo cuvier				87.5	87.5	87.5	91.0	92.0	91.5	87.6	138.0	111.9				110.0	119.0	114.5
Hemigaleus microstoma										59.0	59.0	59.0	40.0	45.0	41.5			
Hemipristis elongata													41.0	62.0	51.5	58.0	63.0	59.0
Loxodon macrorhinus										57.0	81.0	72.2	55.0	74.0	66.0	60.0	60.0	60.0
Mustelus mosis				56.0	68.0	60.9	55.0	59.0	57.0	54.0	64.0	60.2						
Mustelus sp.	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
Rhizoprionodon acutus	73.0	77.0	75.0	72.0	76.0	74.2	70.0	78.0	74.4									
Scoliodon laticaudus	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
Sphyrna lewini	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
Sphyrna mokarran																70.0	70.0	70.0
Skates																		
Okamejei jensenae										47.0	47.0	47.0						
Okamejei sp										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, Pateobatis fai, Maculabatis pastinacoides, Mobula japanica, Pastinachus stellurostris*, *Rhina encylostoma*, *Rhinobatos* cf. *formosensis*, *Rhinoptera javanica, Rhinoptera jayakari* and *Taenuirops meyeni*. However, almost all of *Aetobatus flagellum, Aetobatus* cf. *narinari*, *Megatrygon microps*, *Maculabatis gerrardi*, *Pateobatis jenkinsii*, *Himantura leoparda*, *Pateobatis uarnacoides, Himantura uarnak, Urogymnus granulatus, Brevitrygon heterura, Mobula kuhlii, Neotrygon orientalis, 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 (Disc Length) Except for *Glaucostegus typus, Rhina ancylostoma, Rhinobatos* cf. *formosensis,* and *Rhinobatos punctifer* (Total Length)and Skates (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																		
Dasyatis microps	144.0	144.0	144.0	143.0	143.0	143.0												
Glaucostegus typus				35.0	83.0	67.4	65.0	65.0	65.0	36.0	83.0	62.7						
Gymnura japonica	15.0	67.0	41.0	14.0	26.0	17.7												
Gymnura poecilura							15.0	15.0	15.0	14.0	16.0	15.1						
Pateobatis fai				65.0	65.0	65.0							67.0	94.0	84.3			
Maculabatis gerrardi	64.0	69.0	66.5	34.0	67.0	48.8										35.0	35.0	35.0
Pateobatis jenkinsii	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
Himantura leoparda							110.0	110.0	110.0				100.0	113.0	107.3	110.0	110.0	110.0
Maculabatis pastinacoides				37.0	37.0	37.0	38.0	38.0	38.0	37.0	74.0	55.0	37.0	56.0	51.4			
Pateobatis uarnacoides				77.0	78.0	77.5	36.0	97.0	66.9	35.0	97.0	73.1						
Himantura uarnak							105.0	105.0	105.0							105	105	105
Urogymnus granulatus				111.0	111.0	111.0	116.0	146.0	130.7				105	112	110	110	130	116
Brevitrygon heterura	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
Mobula japanica				25.0	27.0	26.3												

Mobula kuhlii	100.0	100.0	100.0															
Neotrygon orientalis	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			
Pastinachus cf *solocirostris*													48.0	48.0	48.0			
Pastinachus stellurostris										46.0	46.0	46.0						
Plesiobatis daviesi							42.0	42.0	42.0									
Rhina ancylostoma	86.0	137.0	104.2				68.0	83.5	73.5				58.0	112.0	74.6	73.0	110.0	88.8
Rhinobatos cf *formosensis*	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
Rhinobatos punctifer	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
Rhinoptera javanica				30.0	34.0	32.0	62.0	63.0	62.5	30.0	64.0	38.5						
Rhinoptera jayakari	23.0	91.0	46.5													35.0	53.0	44.0
Taeniurops meyeni				90.0	91.0	90.5												
Urogymnus asperrimus							201.0	220.0	208.0	200.0	221.0	209.0						
Sharks																		
Carcharhinus brevipinna	74.0	74.0	74.0				96.0	96.0	96.0				57.0	95.0	70.8	96.0	96.0	96.0
Carcharhinus leucas	76.0	76.0	76.0	70.0	77.0	74.8							70.0	84.0	76.8			
Carcharhinus limbatus				73.0	73.0	73.0												
Carcharhinus macloti	78.0	78.0	78.0															
Chiloscyllium hasseltii							54.0	70.0	65.0	57.0	71.0	66.5	65.0	65.0	65.0	71.0	71.0	71.0
Chiloscyllium punctatum							57.0	57.0	57.0	57.0	57.0	57.0	69.0	69.0	69.0	57.0	57.0	57.0

Galeocerdo cuvier													130.0	130.0	130.0			
Hemigaleus microstoma	55.0	55.0	55.0				81.0	81.0	81.0				53.0	65.0	57.8	81.0	81.0	81.0
Hemipristis elongata	64.0	65.0	64.3	68.0	68.0	68.0							63.0	69.0	65.6			
Loxodon macrorhinus				44.0	56.0	51.3	39.0	88.0	66.6				37.0	88.0	65.3	31.0	79.0	53.9
Mustelus mosis	51.0	65.0	55.6	79.0	79.0	79.0	77.0	77.0	77.0							77.0	77.0	77.0
Mustelus sp.	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
Scoliodon laticaudus	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
Sphyrna lewini	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
Skates																		
Okamejei jensenae							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	Jun	
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/km^2 followed by *Mustelus mosis* at 1.59 kg/day of operation, 0.40 kg/number of operation and 2.05 kg/km^2, and *Scoliodon laticaudus* at 1.53 kg/day of operation, 0.38 kg/number of operation and 1.97 kg/km^2. 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	*Sphyrna lewini*	1,991.84	2.17	0.54	2.81
2	*Mustelus mosis*	1,453.53	1.59	0.40	2.05
3	*Scoliodon laticaudus*	1,399.23	1.53	0.38	1.97
4	*Mustelus* sp.	613.72	0.67	0.17	0.86
5	*Loxodon macrorhinus*	283.70	0.31	0.08	0.40
6	*Carcharhinus leucas*	211.94	0.23	0.06	0.30
7	*Rhizoprionodon acutus*	84.98	0.09	0.02	0.12
8	*Carcharhinus macloti*	81.06	0.09	0.02	0.11
9	*Galeocerdo cuvier*	77.07	0.08	0.02	0.11
10	*Chiloscyllium hasseltii*	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/km^2 followed by *Mustelus mosis* with 2.57 tails/day of operation, 0.64 tails/number of operation and 3.32 tails/km^2 and *Mustelus* sp at 2.24 tails/day of operation, 0.56 tails/operation and 2.90 tails/km^2. 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	*Scoliodon laticaudus*	3,546.48	3.87	0.97	5.00
2	*Mustelus mosis*	2,356.74	2.57	0.64	3.32
3	*Mustelus* sp.	2,056.80	2.24	0.56	2.90
4	*Sphyrna lewini*	1,376.54	1.50	0.38	1.94
5	*Loxodon macrorhinus*	363.19	0.40	0.10	0.51
6	*Carcharhinus leucas*	108.52	0.12	0.03	0.15
7	*Carcharhinus macloti*	58.66	0.06	0.02	0.08
8	*Chiloscyllium hasseltii*	54.08	0.06	0.01	0.08
9	*Hemipristis elongata*	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/km^2 followed by *Brevitrygon heterura* at 3.41 kg/day operation, 0.85 kg/number of operation and 4.41 kg/km^2, and *Rhinobatos punctifer* at 3.11 kg/day operation, 0.78 kg/number of operation and 4.02 kg/km^2. 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	*Rhinobatos* cf *formosensis*	3,906.05	4.26	1.06	5.50
2	*Brevitrygon heterura*	3,127.75	3.41	0.85	4.41
3	*Rhinobatos punctifer*	2,852.17	3.11	0.78	4.02
4	*Urogymnus granulatus*	2,067.16	2.25	0.56	2.91
5	*Gymnura japonica*	2,043.13	2.23	0.56	2.88
6	*Himantura leoparda*	1,131.97	1.23	0.31	1.59
7	*Pateobatis jenkinsii*	971.04	1.06	0.26	1.37
8	*Rhinoptera javanica*	756.59	0.83	0.21	1.07
9	*Himantura uarnak*	679.85	0.74	0.19	0.96

In term of CPUE for rays by number of individual, *Brevitrygon heterura* is the highest with 11.53 tails/day of operation, 2.88 tails/number of operation and 14.9 tails/km^2 followed by *Rhinobatis* cf *formosensis* with 7.27 tails/day of operation, 1.82 tails/number of operation and 9.4 tails/km^2 and *Gymnura japonica* at 7.09 tails/day of operation, 1.77 tails/number of operation and 9.15 tails/km^2. 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	*Brevitrygon heterura*	10,576.46	11.53	2.88	14.90
2	*Rhinobatos* cf *formosensis*	6,670.94	7.27	1.82	9.40
3	*Gymnura japonica*	6,498.91	7.09	1.77	9.15
4	*Rhinobatos punctifer*	3,881.08	4.23	1.06	5.46
5	*Rhinoptera javanica*	428.35	0.47	0.12	0.60
6	*Narcine brevilabiata*	371.62	0.41	0.10	0.52
7	*Narcine lingula*	339.04	0.37	0.09	0.48
8	*Brevitrygon imbricata*	246.25	0.27	0.07	0.35
9	*Neotrygon orientalis*	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/km^2 and for *Okamejei* sp was 0.02 kg/day operation, 0.01 kg/number of operation and 0.03 kg/km^2 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))
Okamejei jensenae	39.80	0.04	0.01	0.06
Okamejei 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/km^2, and for *Okamejei* sp 0.08 tails/day of operation, 0.02 tails/number of operation and 0.1 tails/km^2.

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 (km2))
Okamejei jensenae	205.17	0.22	0.06	0.29
Okamejei 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 *Urogymnus granulatus, Himantura uarnak, Maculabatis pastinacoides* and *Maculabatis gerrardi* and was sold at K8,500-9,000/kg followed by *Neotrygon orientalis, Rhynchobatus australiae, Mobula kuhlii* at K8,000-k9,000/kg. The cheapest rays were *Rhinoptera jayakari, Rhinobatos* cf *formosensis, Rhinoptera javanica, Dasyatis microp, Mobula japanica* 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 gerarrdi, 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 III**.

Table 11: 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			
Carcharhinus amblyrhynchoides	3,000-5,000	Whole body	Local in Yangon
Carcharhinus brevipinna	5,000-9,000	Whole body	Local in Yangon
Carcharhinus leucas	3,000-9,000	Whole body	Local in Yangon
Carcharhinus melanopterus	3,000-7,000	Whole body	Local in Yangon
Carcharhinus macloti	5,000-5,700	Whole body	Local in Yangon
Carcharhinus sorrah	3,000-9,000	Whole body	Local in Yangon
Carcharhinus limbatus	5,000-7,000	Whole body	Local in Yangon
Chiloscyllium punctatum	3,000-5,500	Whole body	Local in Yangon
Chiloscyllium hasseltii	3,000-5,000	Whole body	Local in Yangon
Sphyrna lewini	3,000-8,000	Whole body	Local in Yangon
Mustelus sp.	3,000-5,000	Whole body	Local in Yangon
Rhizoprionodon acutus	3,000-5,500	Whole body	Local in Yangon
Galeocerdo cuvier	3,000-5,900	Whole body	Local in Yangon
Mustelus mosis	3,000-5,000	Whole body	Local in Yangon
Loxodon macrorhinus	5,000-7,000	Whole body	Local in Yangon
Hemigaleus microstoma	4,500-5,500	Whole body	Local in Yangon
Hemipristis elongata	4,500-5,500	Whole body	Local in Yangon
Sphyrna mokarran	5,000-8,500	Whole body	Local in Yangon
Scoliodon laticaudus	3,000-4,000	Whole body	Local in Yangon
Rays			
Mobula japanica	3,000-8,000	Whole body	Local in Yangon
Mobula kuhlii	2,900-8,500	Whole body	Local in Yangon
Maculabatis gerrardi	2,700-8,700	Whole body	Local in Yangon
Okamejei sp.	2,000-3,500	Whole body	Local in Yangon
Okamejei jensenae	2,500-3,500	Whole body	Local in Yangon
Urogymnus granulatus	2,500-9,500	Whole body	Local in Yangon
Rhinobatos punctifer	2,400-3,900	Whole body	Local in Yangon
Brevitrygon heterura	1,400-4,000	Whole body	Local in Yangon
Rhinoptera jayakari	2,000-9,500	Whole body	Local in Yangon
Gymnura japonica	2,000-8,700	Whole body	Local in Yangon
Neotrygon orientalis	3,000-3,500	Whole body	Local in Yangon
Maculabatis pastinacoides	4,500-8,500	Whole body	Local in Yangon
Brevitrygon cf *javaensis*	4,500-5,500	Whole body	Local in Yangon
Himantura leoparda	5,000-8,500	Whole body	Local in Yangon
Aetobatus ocellatus	5,000-8,000	Whole body	Local in Yangon

Species	Range price (Kyats/kg)	Part	Market Destination
Himantura lobistoma	3,000-6,000	Whole body	Local in Yangon
Aetobatus flagellum	3,000-8,900	Whole body	Local in Yangon
Glaucostegus sp.	3,000-4,000	Whole body	Local in Yangon
Glaucostegus sp.	3,000-5,500	Whole body	Local in Yangon
Pateobatis uarnacoides	3,000-4,000	Whole body	Local in Yangon
Rhinoptera javanica	3,000-9,000	Whole body	Local in Yangon
Rhina ancylostoma	3,000-4,000	Whole body	Local in Yangon
Narcine brevilabiata	3,000-5,000	Whole body	Local in Yangon
Pastinachus stellurostris	3,000-3,500	Whole body	Local in Yangon
Hemitrygon sinensis	1,500-3,500	Whole body	Local in Yangon
Rhinobatos formosensis	2,500-4,000	Whole body	Local in Yangon
Brevitrygon imbricata	2,500-3,900	Whole body	Local in Yangon
Taeniurops meyeni	2,500-4,500	Whole body	Local in Yangon
Himantura uarnak	2,500-8,700	Whole body	Local in Yangon
Pateobatis jenkinsii	1,500-3,600	Whole body	Local in Yangon
Megatrygon microps	3,500-8,500	Whole body	Local in Yangon
Pateobatis fai	1,500-2,500	Whole body	Local in Yangon
Urogymnus asperrimus	2,500-3,500	Whole body	Local in Yangon
Plesiobatis daviesi	1,500-4,700	Whole body	Local in Yangon
Gymnura poecilura	1,500-2,500	Whole body	Local in Yangon
Pastinachus cf. *solocirostris*	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	
Rays	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
Rays 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**
Sharks	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
Sharks 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)	% Sharks	All Rays (kg)	% Rays	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 *Pateobatis uarnacoides* and *Maculabatis pastinacoides* followed by *Brevitrygon heterura.* 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, Novenmer 2015 and June 2016. The most common ray species were *Pateobatis uarnacoides* and *Maculabatis 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	
Glaucostegus typus						1		2		1			4
Gymnura japonica						1		1					2
Maculabatis gerrardi								2					2
Maculabatis pastinacoides			3		2		7		4	4	3	1	24
Himantura sp.		2											2
Pateobatis uarnacoides	7	10		8		2	3		1	2			33
Himantura uarnak								1					1
Urogymnus granulatus											1		1
Brevitrygon heterura								3	4			15	22
Narcine brunnea											49	11	60
Pastinachus gracilicaudus		3											3
Rhinoptera adspersa				1									1
Rhinoptera javanica				1									1
Rhinoptera jayakari			8				1						9
Total Rays	**7**	**15**	**11**	**10**	**2**	**4**	**11**	**9**	**9**	**7**	**53**	**27**	**165**
Carcharhinus amblyrhynchoides		2							3				5
Carcharhinus brevipinna		1	2	1	1								5
Carcharhinus leucas			3	5	7	4	1	1		8			29
Carcharhinus sorrah	5		1									3	9
Scoliodon laticaudus	19	48		14	12		6				16	10	125
Sphyrna lewini			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 *Pateobatis uarnacoides* amounting to 291.9 kg, followed by 96.4 kg for *Rhinoptera jayakari* and 76.4 kg for *Maculabatis pastinacoides.* The highest landing by month for *Pateobatis 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 **Table16.**

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	
Glaucostegus typus						2.6		55.3		3.9			61.8
Gymnura japonica						11.2		1.3					12.5
Maculabatis gerrardi								0.3					0.3
Maculabatis pastinacoides			5.4		7.3		20.1		19.1	13.6	6.0	4.9	76.4
Himantura sp.		8.3											8.3
Pateobatis uarnacoides	16.3	128.7		77.5		8.9	7.2		38.4	15.0			291.9
Himantura uarnak								53.3					53.3
Urogymnus granulatus											3.5		3.5
Brevitrygon heterura								1.0	6.4			25.6	33.0
Narcine brunnea											2.8	0.5	3.3
Pastinachus gracilicaudus		5.6											5.6
Rhinoptera adspersa				3.2									3.2
Rhinoptera javanica				1.5									1.5
Rhinoptera jayakari			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**
Carcharhinus amblyrhynchoides		7.5							11.7				19.2
Carcharhinus brevipinna		1.9	3.3	10.0	2.0								17.2
Carcharhinus leucas			39.6	16.6	24.9	18.4	5.5	5.2		36.6			146.8
Carcharhinus sorrah	72.7		1.7									2.9	77.2
Scoliodon laticaudus	50.0	124.5		4.0	25.3		24.0				24.0	22.4	274.2
Sphyrna lewini			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 *Pateobatis 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, Brevitrygon heterura, 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																		
Glaucostegus typus																85.0	85.0	85.0
Gymnura japonica																54.0	54.0	54.0
Maculabatis pastinacoides							34.0	40.0	36.3				40.0	48.0	44.0			
Himantura sp.				44.0	48.0	46.0												
Pateobatis uarnacoides	34.0	50.0	42.4	28.0	76.0	59.3				43.0	99.0	64.0				28.0	65.0	46.5
Pastinachus gracilicaudus				29.0	41.0	34.7												
Rhinoptera adspersa										33.0	33.0	33.0						
Rhinoptera javanica										27.0	27.0	27.0						
Rhinoptera jayakari							28.5	42.0	35.6									
Sharks																		
Carcharhinus amblyrhynchoides				80.0	81.0	80.5												
Carcharhinus brevipinna				76.0	76.0	76.0	73.0	75.0	74.0	132.0	132.0	132.0	74.0	74.0	74.0			
Carcharhinus leucas							75.0	99.0	85.0	77.0	81.0	79.0	69.0	82.0	75.0	79.0	86.0	82.5
Carcharhinus sorrah	65.0	71.0	69.0				73.0	73.0	73.0									
Scoliodon laticaudus	35.0	42.0	39.0	33.0	50.0	41.9				32.0	52.0	41.1	33.0	50.0	40.8			
Sphyrna lewini							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																		
Glaucostegus typus				76.0	250.0	163.0				115.0	115.0	115.0						
Gymnura japonica				28.0	28.0	28.0												
Maculabatis gerrardi				19.0	19.0	19.0												
Maculabatispastinacoides	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
Pateobatis uarnacoides	34.0	53.0	42.7				113.0	113.0	113.0	53.0	73.0	63.0						
Himantura uarnak				107.0	107.0	107.0												
Urogymnus granulatus													46.0	46.0	46.0			
Brevitrygon heterura				21.0	23.0	22.0	20.0	24.0	21.6							18.0	27.0	22.5
Narcine brunnea													8.6	23.5	18.0	8.5	24.5	15.6
Rhinoptera jayakari	78.0	78.0	78.0															
Sharks																		
Carcharhinus amblyrhynchoides							73.0	86.0	79.7									
Carcharhinus leucas	89.0	89.0	89.0	87.0	87.0	87.0				72.0	89.0	81.9						
Carcharhinus sorrah																56.0	61.0	59.3
Scoliodon laticaudus	33.0	50.0	42.2										35.0	45.0	39.8	37.0	52.0	45.0
Sphyrna lewini													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	2015						2016						Grand Total
Gear	**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	2015						2016						Grand Total
Gear	**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	*Scoliodon laticaudus*	165.69	0.31	0.15	0.04
2	*Carcharhinus leucas*	142.78	0.26	0.13	0.03
3	*Carcharhinus sorrah*	77.24	0.14	0.07	0.02
4	*Sphyrna lewini*	33.83	0.06	0.03	0.01
5	*Carcharhinus brevipinna*	15.26	0.03	0.01	0.00
6	*Carcharhinus amblyrhynchoides*	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**.

Table19B: 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	*Scoliodon laticaudus*	549.90	1.02	0.51	0.13
2	*Sphyrna lewini*	83.31	0.15	0.08	0.02
3	*Carcharhinus sorrah*	47.82	0.09	0.04	0.01
4	*Carcharhinus leucas*	33.29	0.06	0.03	0.01
5	*Carcharhinus amblyrhynchoides*	4.57	0.01	0.00	0.00
6	*Carcharhinus brevipinna*	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 *Pateobatis 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	*Rhinoptera jayakari*	96.43	0.18	0.09	0.02
2	*Pateobatis uarnacoides*	64.30	0.12	0.06	0.02
3	*Himantura uarnak*	53.30	0.10	0.05	0.01
4	*Maculabatis pastinacoides*	51.22	0.09	0.05	0.01
5	*Brevitrygon heterura*	33.04	0.06	0.03	0.01
6	*Glaucostegus typus*	3.85	0.01	0.00	0.00
7	*Urogymnus granulatus*	3.52	0.01	0.00	0.00
8	*Rhinoptera adspersa*	3.20	0.01	0.00	0.00
9	*Rhinoptera javanica*	1.50	0.00	0.00	0.00
10	*Gymnura japonica*	1.32	0.00	0.00	0.00

In term of CPUE by number of individual, *Brevitrygon heterura* 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 *Maculabatis 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	*Brevitrygon heterura*	85.59	0.16	0.08	0.02
2	*Rhinoptera jayakari*	19.78	0.04	0.02	0.00
3	*Maculabatis pastinacoides*	14.21	0.03	0.01	0.00
4	*Pateobatis uarnacoides*	5.32	0.01	0.00	0.00
5	*Glaucostegus typus*	2.00	0.00	0.00	0.00
6	*Maculabatis gerrardi*	2.00	0.00	0.00	0.00
7	*Gymnura japonica*	1.00	0.00	0.00	0.00
8	*Himantura uarnak*	1.00	0.00	0.00	0.00
9	*Urogymnus granulatus*	1.00	0.00	0.00	0.00
10	*Rhinoptera adspersa*	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 *Urogymnus granulatus, Maculabatis 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*, *Brevitrygon heterura* 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. S*ome 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 III**.

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			
Scoliodon laticaudus	2,000-3,000	Whole body	Local in Ye
Carcharhinus sorrah	4,000-8,000	Whole body	Local in Ye
Carcharhinus brevipinna	4,000-8,000	Whole body	Local in Ye
Carcharhinus amblyrhynchoides	4,000-8,000	Whole body	Local in Ye
Carcharhinus leucas	4,000-8,000	Whole body	Local in Ye
Sphyrna lewini	2,000-8,000	Whole body	Local in Ye
Rays			
Pateobatis uarnacoides	2,000-10,000	Whole body	Local in Ye
Maculabatis gerrardi	2,000-10,000	Whole body	Local in Ye
Urogymnus granulatus	2,000-10,000	Whole body	Local in Ye
Himantura uarnak	2,000-10,000	Whole body	Local in Ye
Brevitrygon heterura	1,000-3,000	Whole body	Local in Ye
Himantura sp.	2,000-10,000	Whole body	Local in Ye
Pastinachus gracilicaudus	2,000-10,000	Whole body	Local in Ye
Maculabatis pastinacoides	2,000-10,000	Whole body	Local in Ye
Rhinoptera jayakari	2,000-4,000	Whole body	Local in Ye
Rhinoptera javanica	2,000-4,000	Whole body	Local in Ye

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

3.0 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 avaiable. 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 spesies 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 spesies of rays from three (3) Orders and five (5) Families. Details are shown in **Appendix I**. 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 respectivley. 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*, Brevitrygon heterura, Rhinobatos puntifer.* 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 *Maculabatis pastinacoides* and *Pateobatis uarnacoides.* The most common shark species were *Carcharhinus brevipinna* and *Scoliodon laticaudus* while for rays *Brevitrygon heterura.*

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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Appendix I

Checklist of Sharks and Rays Species Recorded During the Study Period

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

33	*Glaucostegus typus*	+	+	
34	*Rhinobatos* cf. *formosensis*	+		
35	*Rhinobatos penggali*	+		
36	*Rhinobatos punctifer*	+		
	Family Rhynchobatidae			
37	*Rhynchobatus australiae*	+		
	Family Rhinidae			
38	*Rhina ancylostoma*	+		
	ORDER TORPEDINIFORMES			
	Family Narcinidae			
39	*Narcine brevilabiata*	+		
40	*Narcine brunnea*		+	
41	*Narcine lingula*	+		
	Total rays species	38	14	
	ORDER RAJIFORMES			
	Family Rajidae			
42	*Okamejei jensenae*	+		
43	*Okamejei* sp.	+		
	Total skates species	2	0	
	ORDER CARCHARHINIFORMES			
	Family Carcharhinidae			
1	*Carcharhinus amblyrhynchoides*		+	
2	*Carcharhinus brevipinna*	+	+	
3	*Carcharhinus leucas*	+	+	
4	*Carcharhinus limbatus*	+		
5	*Carcharhinus macloti*	+		
6	*Carcharhinus melanopterus*	+		
7	*Carcharhinus sorrah*	+	+	
8	*Galeocerdo cuvier*	+		
9	*Loxodon macrorhinus*	+		
10	*Rhizoprionodon acutus*	+		
11	*Scoliodon laticaudus*	+	+	
	Family Hemigaleidae			
12	*Hemigaleus microstoma*	+		
13	*Hemipristis elongata*	+		
	Family Sphyrnidae			
14	*Sphyrna lewini*	+	+	
15	*Sphyrna mokarran*	+		
	Family Triakidae			
16	*Mustelus mosis*	+		
17	*Mustelus* sp.	+		
	ORDER ORECTOLOBIFORMES			
	Family Hemiscylliidae			
18	*Chiloscyllium hasseltii*	+		
19	*Chiloscyllium punctatum*	+		
	Total sharks species	18	6	

Appendix II

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 and resource person 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 at 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 III

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			
Aetobatus flagellum	<20	20-50	>50
Aetobatus cf. *narinari*	<20	20-50	>50
Megatrygon microps	<20	20-50	>50
Hemitrygon sinensis	<14	14-21	>21
Glaucostegus sp.	<40	40-100	>100
Glaucostegus typus	<40	40-100	>100
Gymnura japonica	<18	18-20	>20
Gymnura poecilura	<20	20-25	>25
Pateobatis fai	<20	20-50	>50
Maculabatis gerrardi	<19	19-50	>50
Brevitrygon imbricata	<12	12-18	>18
Brevitrygon cf *javaensis*	<14	14-21	>21
Pateobatis jenkinsii	<18	18-20	>20
Himantura leoparda	<20	20-50	>50
Urogymnus lobistoma	<18	18-20	>20
Maculabatis pastinacoides	<25	25-45	>45
Pateobatis uarnacoides	<20	20-50	>50
Himantura uarnak	<20	20-50	>50
Urogymnus granulatus	<20	20-50	>50
Brevitrygon heterura	<12	12-18	>18
Mobula japanica	<20	20-50	>50
Mobula kuhlii	<20	20-50	>50
Narcine brevilabiata	<10	10-20	>20
Narcine lingula	<10	10-20	>20
Narcine brunnea	<10	10-15	>15
Neotrygon orientalis	<20	20-25	>25
Pastinachus gracilicaudus	<20	20-50	>50
Pastinachus stellurostris	<20	20-50	>50
Pastinachus cf solosirostris	<20	20-50	>50
Plesiobatis daviesi	<15	15-20	>20
Rhina ancylostoma	<40	40-100	>100
Rhinobatos cf *formosensis*	<30	30-50	>50

Species	Small	Medium	Big
Rhinobatos punctifer	<20	20-50	>50
Rhinoptera javanica	<20	20-50	>50
Rhinoptera jayakari	<20	20-50	>50
Rhynchobatus australiae	<20	20-50	>50
Taeniurops meyeni	<20	20-50	>50
Urogymnus asperrimus	<15	15-20	>20
Sharks			
Carcharhinus amblyrhynchoides	< 50	50 - 100	> 100
Carcharhinus brevipinna	< 50	50 - 100	> 100
Carcharhinus leucas	< 50	50 - 100	> 100
Carcharhinus limbatus	< 50	50 - 100	> 100
Carcharhinus macloti	< 50	50 - 100	> 100
Carcharhinus melanopterus	< 50	50 - 100	> 100
Carcharhinus sorrah	< 50	50 - 100	> 100
Chiloscyllium hasseltii	< 35	35 - 50	> 50
Chiloscyllium punctatum	< 35	35 - 50	> 50
Galeocerdo cuvier	< 50	50 - 100	> 100
Hemigaleus microstoma	< 50	50 - 100	> 100
Hemipristis elongata	< 50	50 - 100	> 100
Loxodon macrorhinus	< 35	35 - 50	> 50
Mustelus mosis	< 35	35 - 50	> 50
Mustelus sp.	< 35	35 - 50	> 50
Rhizoprionodon acutus	< 35	35 - 50	> 50
Scoliodon laticaudus	<20	20-30	>30
Sphyrna lewini	< 50	50 - 100	> 100
Sphyrna mokarran	< 50	50 - 100	> 100
Skates			
Okamejei jensenae	<12	12-18	>18
Okamejei sp.2	<12	12-18	>18

National Reports on Sharks Data Collection in Thailand

By

Tassapon Krajangdara
Montri Sumontha
Suwantana Tossapornpitakkul

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. Even though the stock status of chondrichthyans species in Thailand is still insuficient. 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 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 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 0000-0600hr 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 province are shown in **Table 1**.

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

Type of Gear	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:

i. Mr. Montri SUMONTHA
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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 "Standard Operating Procedures Sharks, Rays and Skates Data Collection in the Southeast Asian Waters" was used as a guide. 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 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), Last *et al.* (2016) 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 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**
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 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**

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 was 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 *Telatrygon biasa* followed by *Brevitrygon heterura* and *Hemitrygon 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 *Telatrygon biasa* followed by *Brevitrygon heterura.* 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, Maculabatis 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	
Aetobatus ocellatus					1								**1**
Hemitrygon akajei		6	7	17	7	6	11	1			4	1	**60**
Telatrygon biasa	108	334	292	545	444	400	635	234	231	187	617	436	**4,463**
Maculabatis gerrardi							1						**1**
Brevitrygon heterura	20	48	123	126	69	193	211	49	57	11	49	87	**1,043**
Neotrygon orientalis	1	2		15	1			2	5	9	1		**36**
Rhynchobatus australiae								1	2	1	4		**8**
Total Rays	**129**	**390**	**422**	**703**	**522**	**599**	**858**	**287**	**295**	**208**	**675**	**524**	**5,612**
Atelomycterus marmoratus	41	25	30	12	6	62	7	14	68	44	33	20	**362**
Carcharhinus amblyrhynchos			1										**1**
Carcharhinus melanopterus											5	8	**13**
Carcharhinus sorrah	35												**35**
Chiloscyllium griseum							2	1	4		2	6	**15**
Chiloscyllium hasseltii		4	1	2									**7**
Chiloscyllium plagiosum	1												**1**
Chiloscyllium punctatum	155	147	249	168	115	406	253	115	324	118	231	262	**2,543**
Hemigaleus microstoma											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 *Telatrygon biasa* amounting to 3,157 kg, followed by 668 kg *Brevitrygon heterura* and 207 kg *Hemitrygon akajei*. The highest landing by month was 550 kg for *Telatrygon biasa* in June, followed by 473 kg in February and 379 kg in July. For *Brevitrygon heterura*, 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 *Telatrygon biasa*, *Brevitrygon heterura* and *Neotrygon orientalis* were mature size, while most sample of *Hemitrygon akajei* and *Rhynchobatus australiae* were immature size. For *Aetobatus ocellatus* and *Maculabatis gerrardi* were found only one individual 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 immure 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	
Aetobatus ocellatus					14.0								14.0
Hemitrygon akajei		14.4	8.6	33.8	114.2	1.4	19.6	0.2			14.6	0.3	207.1
Telatrygon biasa	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
Maculabatis gerrardi							0.3						0.3
Brevitrygon heterura	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
Neotrygon orientalis	1.3	1.4		12.3	0.6			2.5	24.4	12.2	1.0		55.7
Rhynchobatus australiae								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**
Atelomycterus marmoratus	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
Carcharhinus amblyrhynchos			7.2										7.2
Carcharhinus melanopterus											3.3	45.6	48.9
Carcharhinus sorrah	51.6												51.6
Chiloscyllium griseum							0.5	1.7	3.7		1.0	59.4	66.3
Chiloscyllium hasseltii		2.1	0.6	4.8									7.5
Chiloscyllium plagiosum	1.6												1.6
Chiloscyllium punctatum	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
Hemigaleus microstoma											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															
Aetobatus ocellatus													62.0	62.0	62.0
Hemitrygon akajei				12.6	53.5	27.0	13.4	38.3	26.4	12.4	59.2	27.0	14.6	36.8	22.7
Telatrygon biasa	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
Maculabatis gerrardi															
Brevitrygon heterura	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
Neotrygon orientalis	26.6	26.6	26.6	25.0	25.7	25.4				13.0	32.0	23.1	20.0	20.0	20.0
Rhynchobatus australiae															
Sharks															
Atelomycterus marmoratus	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
Carcharhinus amblyrhynchos							96.0	96.0	96.0						
Carcharhinus melanopterus															
Carcharhinus sorrah	57.2	76.8	66.3												
Chiloscyllium griseum															
Chiloscyllium hasseltii				39.2	57.0	46.2	52.3	52.3	52.3	48.8	54.6	51.7			
Chiloscyllium plagiosum	76.6	76.6	76.6												
Chiloscyllium punctatum	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
Hemigaleus microstoma															

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																					
Aetobatus ocellatus																					
Hemitrygon akajei	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
Telartygon biasa	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
Maculabatis gerrardi				20.2	20.2	20.2															
Brevitrygon heterura	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
Neotrygon orientalis							25.0	27.5	26.3	21.6	31.6	27.6	14.2	33.8	23.1	26.2	26.2	26.2			
Rhynchobatus australiae							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																					
Atelomycterus marmoratus	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
Carcharhinus amblyrhynchos																					
Carcharhinus melanopterus																55.4	62.5	59.7	58.6	70.9	63.5
Carcharhinus sorrah																					
Chiloscyllium griseum				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
Chiloscyllium hasseltii																					
Chiloscyllium plagiosum																					
Chiloscyllium punctatum	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
Hemigaleus microstoma																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 calculated 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 *Telatrygon biasa* 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

Type of 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

Type of 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	*Telatrygon biasa*	3,151.5	2.20	0.67
2	*Brevitrygon heterura*	663.2	0.47	0.14
3	*Hemitrygon akajei*	207.1	0.14	0.04
4	*Neotrygon orientalis*	55.7	0.04	0.01
5	*Rhynchobatus australiae*	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	*Telatrygon biasa*	5.9	0.74	0.18
2	*Brevitrygon heterura*	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	*Chiloscyllium punctatum*	3,489.9	2.44	0.74
2	*Atelomycterus marmoratus*	202.6	0.14	0.04
3	*Chiloscyllium griseum*	66.1	0.05	0.01
4	*Carcharhinus sorrah*	51.6	0.04	0.01
5	*Carcharhinus melanopterus*	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	*Chiloscyllium punctatum*	130.6	16.33	4.08
2	*Atelomycterus marmoratus*	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	*Telatrygon biasa*	11,628.0	8.12	2.48
2	*Brevitrygon heterura*	2,974.0	2.08	0.63
3	*Hemitrygon akajei*	151.0	0.11	0.03
4	*Neotrygon orientalis*	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	*Brevitrygon heterura*	20	2.50	0.63
2	*Telatrygon biasa*	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	*Chiloscyllium punctatum*	4,068	2.84	0.87
2	*Atelomycterus marmoratus*	601	0.42	0.13
3	*Chiloscyllium griseum*	119	0.08	0.03
4	*Carcharhinus melanopterus*	44	0.03	0.01
5	*Carcharhinus sorrah*	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	*Chiloscyllium punctatum*	151	18.88	4.72
2	*Atelomycterus marmoratus*	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 *Hemitrygon akajei*, *Telatrygon biasa*, *Neotrygon orientalis*, *Maculabatis gerrardi* and *Brevitrygon heterura* 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 III**.

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			
Aetobatus ocellatus	50-120	Whole body	Local market in Songkhla Province
Hemitrygon akajei	20-60	Whole body	Local market in Songkhla Province
Telatrygon biasa	20-60	Whole body	Local market in Songkhla Province
Maculabatis gerrardi	20-60	Whole body	Local market in Songkhla Province
Brevitrygon heterura	20-60	Whole body	Local market in Songkhla Province
Neotrygon orientalis	20-60	Whole body	Local market in Songkhla Province
Rhynchobatus australiae	60-80	Whole body	Local market in Songkhla Province
Sharks			
Atelomycterus marmoratus	20-50	Whole body	Local market in Songkhla Province
Carcharhinus amblyrhynchos	80-120	Whole body	Local market in Songkhla Province
Carcharhinus sorrah	80-120	Whole body	Local market in Songkhla Province
Chiloscyllium griseum	20-65	Whole body	Local market in Songkhla Province
Chiloscyllium hasseltii	20-65	Whole body	Local market in Songkhla Province
Chiloscyllium plagiosum	20-65	Whole body	Local market in Songkhla Province
Chiloscyllium punctatum	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 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**
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 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**	**306.9**	**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 was 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 individuals 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 *Brevitrygon heterura* and *Neotrygon orientalis.* 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 orientalis* followed by *Rhinobatos formosensis*, *Brevitrygon heterura* and *Maculabatis 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, Hemitrygon akajei, D. thetidis, Gymnura japonica, Brevitrygon imbricata, Pateobatis jenkinsii, Pateobatis uanacoides, Plesiobatis daviesi, Rhynchobatus australiae, Taeniurops meyeni, 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	
Aetobatus narinari			1						1				**2**
Hemitrygon akajei				1						1			**2**
Dasyatis thetidis			3										**3**
Gymnura japonica						1				1			**2**
Maculabatis gerrardi	2	5	2	2	8	5		1		2	4		**31**
Brevitrygon imbricata					1								**1**
Pateobatis jenkinsii	1			2	2								**5**
Pateobatis uanacoides						3							**3**
Brevitrygon heterura		49	42	35	71	91	25	19		130	162	31	**655**
Neotrygon orientalis	41	11	11	66	69	69	32	23	9	49	3		**383**
Plesiobatis daviesi								1					**1**
Rhinobatos formosensis	29	1	16	105	123	75	74	38	27		61		**549**
Rhynchobatus australiae			1		15	1			1				**18**
Taeniurops meyeni	1		1										**2**
Total Rays	**74**	**66**	**77**	**211**	**289**	**245**	**131**	**82**	**38**	**183**	**230**	**31**	**1,657**
Carcharhinus leucas			1										**1**
Carcharhinus melanopterus	1												**1**
Carcharhinus sorrah		2							10				**12**
Chiloscyllium griseum					5	15	1			1			**22**
Chiloscyllium hasseltii	2	55	7	8	5	1							**78**
Chiloscyllium punctatum	1	17	2	5	9	3	3		1				**41**
Galeocerdo cuvier	2				1			1					**4**
Heptranchias perlo							1						**1**
Sphyrna lewini									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 orientalis* and 408 kg *Brevitrygon heterura*. 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 orientalis*, the highest landing was 210 kg in October, followed by 150 kg in September. For *Brevitrygon heterura*, 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

About half of rays species sampled in 2015 were mature, namely *Dasyatis thetidis, Brevitrygon heterura, Neotrygon orientalis, Rhinobatos formosensis* and *Taeniurops meyeni*. The other species such as *Aetobatus narinari, Hemitrygon akajei, Pateobatis jenkinsii, Maculabatis gerrardi* and *Rhynchobatus australiae* were immature. The average size of *Maculabatis 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 *Maculabatis 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, Maculabatis gerrardi, Plesiobatis daviesi* and *Rhynchobatus australiae.* All of these species were juvenile. Almost of common rays, *Neotrygon orientalis, Brevitrygon heterura* 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	
Aetobatus narinari			30.0						32.0				**62.0**
Hemitrygon akajei				0.2						1.5			**1.7**
Dasyatis thetidis			150.0										**150.0**
Gymnura japonica						3.0				0.2			**3.2**
Maculabatis gerrardi	17.8	2.3	16.5	1.3	19.3	1.8		0.3		1.7	1.0		**62.2**
Brevitrygon imbricata					0.2								**0.2**
Pateobatis jenkinsii	3.0			16.6	24.2								**43.8**
Pateobatis uanacoides						92.2							**92.2**
Brevitrygon heterura		65.7	16.7	16.6	122.8	54.5	5.9	4.9		49.8	56.5	15.1	**408.3**
Neotrygon orientalis	150.0	209.6	44.3	48.2	36.1	41.6	26.6	24.5	12.1	42.7	0.5		**636.3**
Plesiobatis daviesi								11.1					**11.1**
Rhinobatos formosensis	107.0	2.6	155.3	287.0	431.7	89.5	81.9	19.0	42.8		149.0		**1,365.7**
Rhynchobatus australiae			5.8		17.0	0.5			0.9				**24.3**
Taeniurops meyeni	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**
Carcharhinus leucas			50.0										**50.0**
Carcharhinus melanopterus	14.3												**14.3**
Carcharhinus sorrah		4.7							32.0				**36.7**
Chiloscyllium griseum					4.7	20.4	1.1			0.5			**26.7**
Chiloscyllium hasseltii	1.3	47.4	6.6	5.3	4.6	1.0							**66.1**
Chiloscyllium punctatum	2.1	31.7	3.5	5.2	11.0	2.3	4.5		2.2				**62.5**
Galeocerdo cuvier	77.2				8.5			4.9					**90.5**
Heptranchias perlo							1.2						**1.2**
Sphyrna lewini									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																		
Aetobatus narinari																		
Hemitrygon akajei																		
Dasyatis thetidis																		
Gymnura japonica																37.0	37.0	37.0
Maculabatis gerrardi	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
Brevitrygon imbricata													16.5	16.5	16.5			
Pateobatis jenkinsii	41.5	41.5	41.5		41.5	41.5	41.5		41.5	41.5	41.5		45.5	77.0	61.3			
pateobatis uanacoides																66.5	128.5	99.3
Brevitrygon heterura				14.5				14.5				14.5	12.0	23.7	18.6	14.5	26.0	19.6
Neotrygon orientalis	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
Plesiobatis daviesi																		
Rhinobatos formosensis	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
Rhynchobatus australiae													50.0	81.5	60.4			
Taeniurops meyeni																		
Sharks																		
Carcharhinus leucas																		
Carcharhinus melanopterus	128.0	128.0	128.0		128.0	128.0	128.0		128.0	128.0	128.0							
Carcharhinus sorrah				69.0				69.0				69.0						
Chiloscyllium griseum													53.0	66.0	59.5	39.5	62.5	53.9
Chiloscyllium hasseltii	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
Chiloscyllium punctatum	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
Galeocerdo cuvier	89.0	225.0	157.0		89.0	225.0	157.0		89.0	225.0	157.0		126.5	126.5	126.5			
Heptranchias perlo																		
Sphyrna lewini																		

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																		
Aetobatus narinari																		
Hemitrygon akajei																		
Dasyatis thetidis																		
Gymnura japonica																		
Maculabatis gerrardi				21.0	21.0				21.0	21.0				21.0	21.0			
Brevitrygon imbricata																		
Pateobatis jenkinsii																		
Pateobatis uanacoides																		
Brevitrygon heterura	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
Neotrygon orientalis	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			
Plesiobatis daviesi				78.0	78.0				78.0	78.0				78.0	78.0			
Rhinobatos formosensis	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			
Rhynchobatus australiae																		
Taeniurops meyeni																		
Sharks																		
Carcharhinus leucas																		
Carcharhinus melanopterus																		
Carcharhinus sorrah																		
Chiloscyllium griseum	63.8	63.8	63.8			63.8	63.8	63.8			63.8	63.8	63.8					
Chiloscyllium hasseltii																		
Chiloscyllium punctatum	64.0	75.0	71.2			64.0	75.0	71.2			64.0	75.0	71.2					
Galeocerdo cuvier				105.5	105.5				105.5	105.5				105.5	105.5			
Heptranchias perlo	72.5	72.5	72.5			72.5	72.5	72.5			72.5	72.5	72.5					
Sphyrna lewini																		

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.*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

Type of 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

Type of 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	*Rhinobatos formosensis*	1,134.8	2.17	0.54
2	*Neotrygon orientalis*	492.1	0.94	0.24
3	*Brevitrygon heterura*	368.4	0.68	0.17
4	*Taeniurops meyeni*	120.0	0.23	0.06
5	*Aetobatus narinari*	62.0	0.12	0.03
6	*Maculabatis gerrardi*	46.2	0.09	0.02

7	*Pateobatis jenkinsii*	43.8	0.08	0.02
8	*Dasyatis thetidis*	40.0	0.08	0.02
9	*Rhynchobatus australiae*	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	*Rhinobatos formosensis*	230.9	1.88	0.63
2	*Neotrygon orientalis*	144.2	1.17	0.39
3	*Dasyatis thetidis*	110.0	0.89	0.30
4	*Pateobatis uanacoides*	92.2	0.75	0.25
5	*Brevitrygon heterura*	39.9	0.32	0.11
6	*Maculabatis gerrardi*	16.0	0.13	0.04
7	*Plesiobais deviesi*	11.1	0.09	0.03
8	*Gymnura japonica*	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	*Chiloscyllium hasseltii*	59.4	0.11	0.03
2	*Carcharhinus leucas*	50.0	0.10	0.02
3	*Chiloscyllium punctatum*	46.3	0.09	0.02
4	*Carcharhinus sorrah*	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)	CPUEpue (kg/Haul)
1	*Galeocerdo cuvier*	82.1	0.67	0.22
2	*Chiloscyllium griseum*	20.4	0.17	0.06
3	*Chiloscyllium punctatum*	16.3	0.13	0.04
4	*Carcharhinus melanopterus*	14.3	0.12	0.04
5	*Chiloscyllium hasseltii*	6.8	0.05	0.02
6	*Carcharhinus sorrah*	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	*Brevitrygon heterura*	1,727	3.19	0.80
2	*Rhinobatos formosensis*	1,642	3.04	0.76
3	*Neotrygon orientalis*	661	1.22	0.31
4	*Maculabatis gerrardi*	35	0.07	0.02
5	*Rhynchobatus australiae*	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	*Rhinobatos formosensis*	232	1.89	0.63
2	*Neotrygon orientalis*	215	1.75	0.58
3	*Brevitrygon heterura*	161	1.31	0.44
4	*Maculabatis gerrardi*	27	0.22	0.07
5	*Pateobatis uanacoides*	3	0.02	0.01
6	*Dasyatis thetidis*	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	*Chiloscyllium hasseltii*	80	0.15	0.04
2	*Chiloscyllium punctatum*	31	0.06	0.01
3	*Carcharhinus sorrah*	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	*Chiloscyllium griseum*	29	0.24	0.08
2	*Chiloscyllium punctatum*	10	0.08	0.03
3	*Chiloscyllium hasseltii*	7	0.06	0.02
4	*Galeocerdo cuvier*	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 *Maculabatis gerrardi* at 12-100 Baht/kg. The price of *Hemitrygon akajei*, *Telatrygon biasa*, *Neotrygon orientalis*, *Brevitrygon heterura* 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 *Maculabatis 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 III.**

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			
Aetobatus narinari	50-120	Whole body	Local market in Ranong Province
Hemitrygon akajei	15-50	Whole body	Local market in Ranong Province
Dasyatis thetidis	20	Whole body	Local market in Ranong Province
Gymnura japonica	15-45	Whole body	Local market in Ranong Province
Maculabatis gerrardi	12-100	Whole body	Local market in Ranong Province
Brevitrygon imbricata	15-52	Whole body	Local market in Ranong Province
Pateobatis jenkinsii	20-60	Whole body	Local market in Ranong Province
Pateobatis uanacoides	15-65	Whole body	Local market in Ranong Province
Brevitrygon heterura	15-52	Whole body	Local market in Ranong Province
Neotrygon orientalis	11-57	Whole body	Local market in Ranong Province
Plesiobatis deviesi	20	Whole body	Local market in Ranong Province
Rhinobatos formosensis	8-40	Whole body	Local market in Ranong Province
Rhynchobatus australiae	15-60	Whole body	Local market in Ranong Province
Taeniurops meyeni	12	Whole body	Local market in Ranong Province
Sharks			
Carcharhinus leucas	80-110	Whole body	Local market in Ranong Province
Carcharhinus melanopterus	80-110	Whole body	Local market in Ranong Province
Carcharhinus sorrah	80-110	Whole body	Local market in Ranong Province
Chiloscyllium griseum	33-63	Whole body	Local market in Ranong Province
Chiloscyllium hasseltii	24-70	Whole body	Local market in Ranong Province
Chiloscyllium punctatum	24-70	Whole body	Local market in Ranong Province
Galeocerdo cuvier	30-50	Whole body	Local market in Ranong Province
Heptranchias perlo	39-64	Whole body	Local market in Ranong Province
Sphyrna lewini	35-50	Whole body	Local market in Ranong Province

3.0 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 spesies 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 I**. 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 *Telatrygon biasa* and *Brevitrygon heterura.* The most common shark species were *Chiloscyllium. punctatum,* and *Atelomycterus marmoratus* while for rays were *Telatrygon biasa, Brevitrygon heterura, Hemitrygon akajei* and *Neotrygon orientalis.*

The most abundant sharks species at Ranong were *Chiloscyllium hasseltii, C. punctatum* and *C. griseum* while for rays were *Rhinobatos formosensis*, *Brevitrygon heterura* and *Neotrygon orientalis.* The most common shark species were *Chiloscyllium punctatum* and *C. hasseltii* while for rays were *Neotrygon orientalis*, *Rhinobatos formosensis*, *Brevitrygon heterura*, and *Maculabatis 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 II**

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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

Carcharhinus sorrah

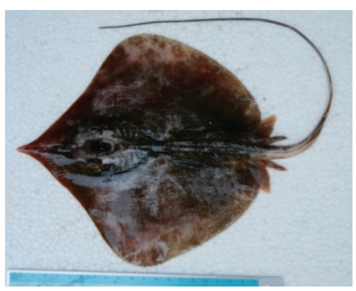
Chiloscyllium punctatum

Chiloscyllium hasseltii

Chiloscyllium griseum

Photo 5: Common sharks in Thailand

Neotrygon orientalis



Telatrygon biasa

Brevitrygon heterura

Photo 6: Common rays in Thailand

Appendix II

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			
Aetobatus narinari	30-60	>60	
Aetobatus ocellatus	30-60	>60	
Hemitrygon akajei	10-60		
Dasyatis thetidis			
Telatrygon biasa	10-30		
Gymnura japonica	20-50		
Maculabatis gerrardi	20-50	>50	
Brevitrygon imbricata	10-20		
Pateobatis jenkinsii	20-50	51-100	>100
Pateobatis uarnacoides	20-50	51-100	>100
Brevitrygon heterura	10-20		
Neotrygon orientalis	10-30		
Plesiobatis daviesi			
Rhinobatus formosensis	20-40	41-100	
Rhynchobatus australiae	20-50	51-120	>120
Taeniurops meyeni			
Sharks			
Atelomycterus marmoratus	45-70		
Carcharhinus amblyrhynchos	80-120	121-200	>200
Carcharhinus leucas	80-120	121-200	>200
Carcharhinus melanopterus	80-120	121-200	
Carcharhinus sorrah	80-120	121-160	
Chiloscyllium griseum	45-90		
Chiloscyllium hasseltii	45-70		
Chiloscyllium plagiosum	45-90		
Chiloscyllium punctatum	45-120		
Galeocerdo cuvier	80-120	121-200	>200
Hemigaleus microstoma	70-100		
Heptranchias perlo	80-120		
Sphyrna lewini	80-120	121-200	>200

National Reports on Sharks Data Collection in Viet Nam

By

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1.0 INTRODUCTION

Vietnam is a home to a rich diversity of sharks, rays, skates and chimaeras (Class Chondrichthyes). However, sharks, rays and skates landings contributed less than 1% of total marine landings. Research on sharks, rays and skates had not been fully conducted in freshwater, estuarine and the Economic Exclusive Zone of Vietnam. During 2000 -2005, thirty-six independent research surveys using different fishing gears were conducted in Vietnamese waters. A total of 40 species belonging to 19 genera in 9 families of two Orders were recorded. Species richness was observed in the South-eastern and central waters. Family of Dasyatidae is the highest abundance with 14 species. Distribution of rays was showed seasonal differences (Tran Van Cuong and Vu Viet Ha, 2005).

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

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 were selected as study sites. Both sites are major landing sites of shark and ray. The landing data were collected at seven 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. All jetties are government enterprises with the most of sharks, rays and skates landing were from trawlers, gillnets and longlines fisheries. Locations of all landing sites are shown in Figure 1.

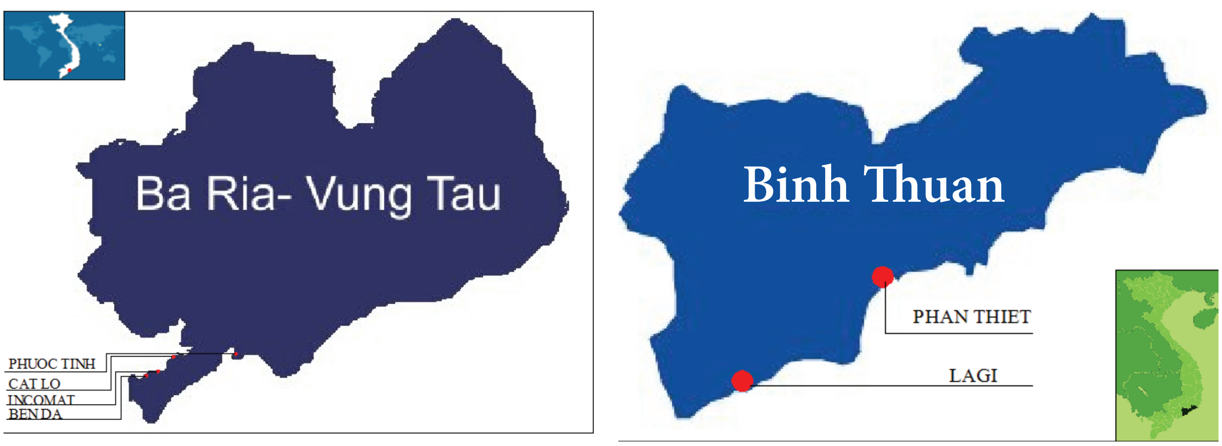

Figure 1: Location of Study Sites in Ba Ria-Vung Tau and Binh Thuan Provinces

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 (nm) 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	Type of Gear	Fishing Operation (from coastline)	No. of Vessel	No. of fishers
1	Trawler			
	<90 HP	< 24 nm	11	22
	90-<250 HP	>24 nm	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	Type of Gear	Fishing Operation (from coastline)	No. of Vessel	No. of fishers
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, Viet Nam 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 was 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 ‘Standard Operating Procedures Sharks, Rays and Skates Data Collection in the Southeast Asian Waters’ was used as a guide. 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 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 five 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 individuals per vessel. If the total number was more than 50 individuals, 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), Ebert *et al.* (2013) and Last *et al.* (2016).

2.0 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 nine 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 seven 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

Type of Gear	Group HP	Month												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 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 gillnets and trawl nets 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

Species	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Grand Total
Rays	**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
Sharks	**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
Skates	**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 was1,421.7 kg 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 Pfisheries 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.

Month	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 individuals belong to 409 rays, 199 sharks and 981 skates were sampled consisting of 28 species of rays, three species of skates and 12 species of sharks. The most abundant ray species were *Brevitrygon heterura*, followed by *Brevitrygon imbricata.* The highest number of rays were sampled by month was 74 individuals in June and October, followed by 73 individuals 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 individuals in June, followed by 41 individuals in May, the highest number of sharks was *Carcharhinus sorrah* species with 129 individuals in the study. The highest number of skate were sampled by month was 138 individuals in January, followed by 117 in December. Only Three species of skates were recorded namely *Okamejei cairae, O. hollandi* and *O.* cf. *boesemani* . *Okamejei 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	Month												Grand Total
	J	F	M	A	M	J	J	A	S	O	N	D	
Rays	**24**		**3**	**6**	**22**	**37**	**36**	**14**	**43**	**74**	**40**	**73**	**372**
Aetobatus ocellatus										1			1
Aetomylaeus maculatus											3		3
Hemitrygon cf. *sinensis*										3			3
Hemitrygon fluviorum									6		1		7
Hemitrygon parvonigra						3			5			3	11
Hemitrygon sinensis							3			1			4
Dasyatis sp.											1	9	10
Telatrygon zugei							1						1
Gymnura japonica												9	9
Gymnura poecilura						4			1				5
Brevitrygon cf. *javaensis*	1												1
Brevitrygon imbricata	3				7	17	17	13	15	12	9	9	102
Brevitrygon heterura	13		1	5	15	5	14		1	51	22	40	167
Mobula sp.											1		1
Myliobatis tobijei											1		1
Narcine cf. *indica*									1				1
Narcine indica	6		1	1									8
Narcine sp.											2	1	3
Narcine timlei			1										1
Narke dipterygia						4							4
Neotrygon sp.										3			3
Platyrhina sinensis									4				4
Platyrhina tangi	1												1
Rhynchobatus australiae							1	1					2
Rhinobatos formosensis									9	3			12
Rhinobatos sp.												2	2

Taeniura lymma						4							4
Urogymnus asperrimus									1				1
Sharks	**2**				**41**	**47**	**20**	**1**	**7**	**2**	**29**	**3**	**152**
Alopias superciliosus											1		1
Atelomycterus marmoratus											7	1	8
Carcharhinus dussumieri											1		1
Carcharhinus limbatus					7	3							10
Carcharhinus sorrah	2				30	39	14	1	2	2			90
Carcharhinus sp.									1				1
Chiloscyllium cf. *punctatum*											1		1
Chiloscyllium plagiosum											6		6
Chiloscyllium punctatum					4	5	6		3		13		31
Chiloscyllium sp.												1	1
Galeus sp.												1	1
Halaelurus buergeri									1				1
Skates	**138**	**93**	**110**	**116**	**27**	**9**	**79**	**55**	**52**	**64**	**112**	**117**	**972**
Okamejei cairae	138	93	110	116	22	9	71	55	44	5	112	117	892
Okamejei cf. *boesemani*										56			56
Okamejei hollandi					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 *Brevitrygon heterura* amounted 1,586.5 kg, followed by 1,053.6 kg for *Brevitrygon 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 from January to May and in December landings was more than 1,000 kg.

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

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rays	**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**
Aetobatus ocellatus										5.0			5.0
Aetomylaeus maculatus											84.2		84.2
Hemitrygon cf. *sinensis*										18.0			18.0
Hemitrygon fluviorum									172.5		6.6		179.1
Hemitrygon parvonigra						4.7			74.0			75.0	153.7
Hemitrygon sinensis							49.1			14.0			63.1
Dasyatis sp.											2.0	93.7	95.7
Telatrygon zugei							17.7						17.7
Gymnura japonica												16.0	16.0
Gymnura poecilura						42.4			154.0				196.4
Brevitrygon cf. *javaensis*	10.0												10.0
Brevitrygon imbricata	45.0				75.0	231.2	292.5	62.9	253.8	62.0	4.9	26.3	1,053.6
Brevitrygon heterura	207.0		8.0	162.0	198.0	115.3	126.5		39.0	411.2	16.4	303.0	1,586.5
Mobula sp.											600.0		600.0
Myliobatis tobijei											52.0		52.0
Narcine cf. *indica*									21.0				21.0
Narcine indica	50.0		19.0	10.0									79.0
Narcine sp.											1.0	35.0	36.0
Narcine timlei			29.0										29.0
Narke dipterygia						4.9							4.9
Neotrygon sp.										0.5			0.5
Platyrhina sinensis									243.5				243.5

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Platyrhina tangi	24.0												24.0
Rhynchobatus australiae							142.4	8.8					151.2
Rhinobatos formosensis									80.1	11.0			91.1
Rhinobatos sp.												62.0	62.0
Taeniura lymma						98.2							98.2
Urogymnus asperrimus									9.0				9.0
Sharks	**50.0**				**2,550.0**	**3,894.9**	**563.5**	**9.2**	**319.1**	**7.2**	**224.0**	**300.8**	**7,918.8**
Alopias superciliosus											172.0		172.0
Atelomycterus marmoratus											9.5	0.4	9.9
Carcharhinus dussumieri											4.0		4.0
Carcharhinus limbatus					300.0	29.5							329.5
Carcharhinus sorrah	50.0				2,250.0	3,815.4	563.5	9.2	300.0	7.2			6,995.3
Carcharhinus sp.									10.0				10.0
Chiloscyllium cf. *punctatum*											5.0		5.0
Chiloscyllium plagiosum											7.0		7.0
Chiloscyllium punctatum						50.0			8.8		26.5		85.3
Chiloscyllium sp.												0.4	0.4
Galeus sp.												300.0	300.0
Halaelurus buergeri									0.3				0.3
Skates	**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**
Okamejei cairae	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
Okamejei cf. *boesemani*										1,240.0			1,240.0
Okamejei hollandi					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 in **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 in 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 in **Table 8.**

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

Species	September			October			November			December		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Rays												
Aetobatus ocellatus				45	45	45	19	107	48.5			
Dasyatis sp.							75	75	75	11	28	21.4
Myliobatis tobijei							80	80	80			
Platyrhina sinensis	18.0	45.0	36.0									
Rhinobatos formosensis	58.0	82.0	70.4	58.0	77.0	67.7						
Rhinobatos sp.										40.0	40.5	40.3
Sharks												
Alopias superciliosus							366.0	366.0	366.0			
Atelomycterus marmoratus							44.5	55.5	51.0	51.0	51.0	51.0
Carcharhinus dussumieri							82.0	82.0	82.0			
Carcharhinus sorrah	65.0	86.0	75.5	80.0	85.0	82.5						
Carcharhinus sp.	138.0	138.0	138.0									
Chiloscyllium cf. *punctatum*							56.0	56.0	56.0			
Chiloscyllium plagiosum							36.4	46.5	42.2			
Chiloscyllium punctatum	21.0	103.0	67.3				32.0	54.0	43.7			
Chiloscyllium sp.										50.0	50.0	50.0
Halaelurus buergeri	45.0	45.0	45.0									
Skates												
Okamejei cairae	21.0	42.0	33.7	22.4	39.2	32.7	21.0	43.5	29.6	18.7	44.0	30.2
Okamejei cf. *boesemani*				11.0	22.7	15.2						
Okamejei hollandi	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 *Platyrhina tangi*, *Rhynchobatus australiae* and *Okamejei* spp. in Binh Thuan from Jan. to Aug. 2016. All Measurement in cm.

Species	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																								
Brevitrygon imbricata	19.0	20.0	19.5													16.0	22.0	19.0	15.4	39.0	24.0			
Brevitrygon heterura	18.0	24.5	20.5										14.0	23.0	19.27	20.0	22.5	21.5	16.0	21.5	18.6			
Narcine indica	22.5	30.0	26.3																					
Narcine timlei							44.0	44.0	44.0															
Platyrhina tangi	50.0	50.0	50.0																					
Rhynchobatus australiae																			127.0	127.0	127.0	127.0	127.0	127.0
Sharks																								
Carcharhinus limbatus													100.0	130.0	116.7	110.0	120.0	115.0						
Carcharhinus sorrah	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
Chiloscyllium punctatum													90.0	100.0	94.0	100.0	115.0	107.8	32.0	41.0	37.4			
Skates																								
Okamejei cairae	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
Okamejei hollandi													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** and **Table 11**.

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

Type of Gear	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.

Type of Gear	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	*Carcharhinus sorrah*	390.40	0.31	0.09
2	*Galeus* sp.	300.00	0.24	0.07
3	*Alopias superciliosus*	172.00	0.14	0.04
4	*Chiloscyllium punctatum*	58.80	0.05	0.01
5	*Carcharhinus* sp.	10.00	0.01	0.00
6	*Chiloscyllium* sp.	0.42	0.00	0.00
7	*Atelomycterus marmoratus*	0.40	0.00	0.00
8	*Halaelurus buergeri*	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. individual sharks	CPUE (catch/days of operation)	CPUE (catch/no.operation)
1	*Carcharhinus sorrah*	91	0.07	0.02
2	*Chiloscyllium punctatum*	16	0.01	0.00
3	*Alopias superciliosus*	1	0.00	0.00
4	*Atelomycterus marmoratus*	1	0.00	0.00
5	*Carcharhinus* sp.	1	0.00	0.00
6	*Chiloscyllium* sp.	1	0.00	0.00
7	*Galeus* sp.	1	0.00	0.00
8	*Halaelurus buergeri*	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	*Brevitrygon heterura*	1,531	1.21	0.37
2	*Brevitrygon imbricata*	1,054	0.83	0.25
3	*Mobula* sp.	600	0.47	0.14
4	*Platyrhina sinensis*	243.5	0.19	0.06
5	*Gymnura poecilura*	196.4	0.16	0.05
6	*Hemitrygon fluviorum*	179.1	0.14	0.04
7	*Hemitrygon parvonigra*	153.7	0.12	0.04
8	*Rhynchobatus australiae*	142.4	0.11	0.03
9	*Taeniura lymma*	98.24	0.08	0.02
10	*Rhinobatos formosensis*	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	*Brevitrygon heterura*	5,909	4.66	1.42
2	*Brevitrygon imbricata*	4,472	3.52	1.08
3	*Dasyatis* sp.	638	0.50	0.15
4	*Narcine indica*	453	0.36	0.11
5	*Hemitrygon fluviorum*	302	0.24	0.07
6	*Gymnura poecilura*	291	0.23	0.07
7	*Platyrhina sinensis*	240	0.19	0.06
8	*Hemitrygon parvonigra*	226	0.18	0.05
9	*Rhinobatos* sp.	181	0.14	0.04
10	*Hemitrygon sinensis*	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	*Okamejei cairae*	9,902.76	7.80	2.38
2	*Okamejei* cf. *boesemani*	1,240.00	0.98	0.30
3	*Okamejei hollandi*	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	*Okamejei cairae*	64,190	50.58	15.44
2	*Okamejei* cf. *boesemani*	11,143	8.78	2.68
3	*Okamejei hollandi*	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 details 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)

Species name	Range price USD/kg	Part	Marketing destination
Brevitrygon cf. *javaensis*	1.0-1.2	Whole body	Local market
Platyrhina sinensis	0.4-1.0	Whole body	Local market
Dasyatis sp.	2-4	Whole body	Local market
Dasyatis cf. *sinnensis*	1-3	Whole body	Local market
Hemitrygon fluviorum	0.1-5	Whole body	Local market
Hemitrygon parvonigra	0.4-4	Whole body	Local market
Hemitrygon sinensis	1-2	Whole body	Ho Chi Minh city and Local markets
Neotrygon sp.	1-4	Whole body	Local market
Gymnura japonica	0.9-1.7	Whole body	Local market
Gymnura poecilura	0.4-1	Whole body	Local market
Platyrhina tangi	0.2-1	Whole body	Local markets
Narcine indica	0.2-4.1	Whole body	
Narcine timlei	0.2-1.3	Whole body	Local market
Brevitrygon imbricata	0.2-4	Whole body	Local market

Brevitrygon heterura	0.4-1.2	Whole body	Local
Rhinobatos formosensis	0.2-0.8	Whole body	Local market
Mobula sp.	3-7	Whole body	Local market
Aetobatus ocellatus	2-4	Whole body	Local market
Aetomylaeus maculatus	2-4	Whole body	Local market, China
Urolophus asperrimus	0.3-0.8	Whole body	Local markets
Myliobatis tobijei	0.2-1	Whole body	Local markets
Rhinobatos formosensis	0.2-0.4	Whole body	Local market
Platyrhina sinensis	0.4-1	Whole body	Local market
Alopias superciliosus	1-4	Whole body	Local market, China
Atelomycterus marmoratus	1-4	Whole body	Local market, China
Carcharhinus dussumieri	1-4	Whole body	Local market, China
Carcharhinus limbatus	3-5	Whole body	Local market, China
Carcharhinus sorrah	0.9-5	Whole body	China, Local market
Chiloscyllium punctatum	0.9-5	Whole body	Local market, China
Halaelurus buergeri	0.9-5.5	Whole body	Local market and China
Okamejei cairae	0.1-1	Whole body	Local market
Okamejei cf. *boesemani*	0.1-1	Whole body	Local market
Okamejei hollandi	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 and September.

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

Type of Gear	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	**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 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 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 in **Table 18**.

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

Species	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 504.8 kg, 754.2 and 721.3kg respectively. The highest landing by month for sharks was 1,397.9 kg in October, followed by 1,222.1 kg in January.The highest landing of rays was4,497.7 kg in October, followed by 1,046.9 kg in September. The highest landing of skates was 2,235.4 kg in October, followed by 1,793.0 kg in May. The details are shown in **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.

Month	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 individuals belong to 239 rays, 398 sharks and 400 skates were sampled consisting 22 species of rays, two species of skates and 22 species of sharks. The most ray species were *Narcine indica*, *Brevitrgon heterura* and *Brevitrygon imbricata.* The most shark species were *Carcharhinus sorrah* and *Chiloscyllium punctatum*. The highest number of rays were sampled by month was 74 individuals in June and October, followed by 73 individuals in December. Rays were sampled mainly from June to December of the year. While the highest number of sharks were sampled by month was 94 individuals in June, followed by 41 individuals in May, the highest number of sharks was *Carcharhinus sorrah* species with 129 individuals 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 in **Table 20.**

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

Species	J	F	M	A	M	J	J	A	S	O	N	D	Total
Rays	**13**	**4**	**17**	**6**	**22**	**44**		**14**	**24**	**52**	**37**	**6**	**239**
Hemitrygon sinensis											6		6
Telatrygon zugei						5			6	2			13
Brevitrygon imbricata		3	4			2			6	6	9		30
Pateobatis jenkinsii										8			8
Urogymnus granulatus					1								1
Brevitrygon heterura					4	6		13	4				27
Mobula thurstoni	1		4			4				15			24
Mobula japanica						3							3
Narcine brevilabiata	2					1							3
Narcine brunnea						3				2			5
Narcine indica	2					5		1	3	6	10	4	31
Narcine timlei						1							1
Narke japonica									1				1
Neotrygon orientalis	2		9						3				14
Platyrhina sinensis				2					1		7		10
Platyrhina tangi					10	7							17
Plesiobatis daviesi	2	1				2				1			6
Rhynchobatus australiae	4												4
Rhinobatos formosensis				4	2					12	2	2	22
Rhynchobatus palpebratus					5						3		8
Urolophus aurantiacus						4							4
Sharks	**37**	**18**	**16**	**15**	**48**	**27**	**59**	**8**	**34**	**22**	**72**	**42**	**398**
Alopias pelagicus						1			2				3
Atelomycterus marmoratus		3			4					9	8		24
Carcharhinus amblyrhynchos						3				2			5
Carcharhinus cf. *falciformis*	1												1
Carcharhinus dussumieri	3											1	4
Carcharhinus limbatus	1		3	2						3		5	14
Carcharhinus sorrah	8	15	6	8		6	59	8	22	3		14	149
Centrophorus moluccensis						1							1
Cephalocyllium circulopullum					2				1		2		5

Chiloscyllium plagiosum	2				2	1					4	1	10
Chiloscyllium punctatum	9		5	5	35	11			4	3	47	10	129
Galeocerdo cuvier	1				3				1	2	6		13
Halaelurus buergeri									1				1
Hemigaleus microstoma	1								1		3	9	14
Heptranchias perlo						1							1
Hexanchus griseus						1							1
Mustelus manazo	1												1
Sphyrna mokarran	2											1	3
Squalus megalops	1					1						1	3
Squatina sp.	5		2		2	1					2		12
Squatina tergocellatoides	1												1
Triaenodon obesus	1								2				3
Skates	**23**	**8**	**15**	**11**	**79**	**25**	**16**	**105**	**9**	**41**	**61**	**7**	**400**
Dipturus cf. *johannisdavisi*						1							1
Okamejei cairae	23	8	15	11	79	23	16	105	9	35	61	7	392
Okamejei hollandi						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 23,599.5 kg was landed from 112 landings comprising 8,886.6 kg rays, 8,655.1 kg skates and 6,057.8 kg sharks. For rays, the highest landing by weight was *Mobula thurstoni,* followed by *Pateobatis jenkinsii*. For sharks, the highest landing was 10,810.73 kg for species of *Carcharhinus sorrah*, followed by 359.0 kg and 300 kg for C*archarhinus limbatus* and *Galeus* sp. respectively. The highest landing of sharks by month was 3,871.2kg of *Carcharhinus sorrah*, followed by *Chiloscyllium punctatum* was 779.2 kg. For skates, *Okamejei cairae* reached highest weight of 7,596.1kg, the months of May, August, October and November was over 1,000 kg for the species.

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

Species	J	F	M	A	M	J	J	A	S	O	N	D	Total
Rays	**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**
Hemitrygon sinensis											80.0		80.0
Telatrygon zugei						50.0			70.0	55.0			175.0
Brevitrygon imbricata		2.0	75.0			7.0			53.0	56.0	250.0		443.0
Pateobatis jenkinsii										1,610.0			1,610.0
Urogymnus granulatus					9.1								9.1
Brevitrygon heterura					112.0	46.0		331.4	17.0				506.4
Mobula thurstoni	710.0		262.0			114.7				2,502.7			3,589.4
Mobula japanica						180.0							180.0
Narcine brevilabiata	21.0					3.0							24.0
Narcine brunnea						22.0				43.0			65.0
Narcine indica	11.0					5.0		20.0	49.0	118.9	30.0	10.0	243.9
Narcine timlei						30.0							30.0
Narke japonica									21.6				21.6
Neotrygon orientalis	54.6		160.0						54.3				268.9
Platyrhina sinensis				10.0					36.1		219.0		265.1
Platyrhina tangi					195.0	24.0							219.0
Plesiobatis daviesi	272.0	149.0				50.0				70.0			541.0
Rhynchobatus australiae	152.7												152.7
Rhinobatos formosensis				30.0	90.0					79.0	90.0	20.0	309.0
Rhynchobatus palpebratus					60.0						3.4		63.4
Urolophus aurantiacus						40.0							40.0
Sharks	**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**
Alopias pelagicus						160.0			55.0				215.0

Atelomycterus marmoratus		10.0			10.0					53.3	10.0		83.3
Carcharhinus amblyrhynchos						70.0				54.0			124.0
Carcharhinus cf. *falciformis*	110.0												110.0
Carcharhinus dussumieri	14.5											15.0	29.5
Carcharhinus limbatus	74.0		7.2	6.8						233.0		22.4	343.4
Carcharhinus sorrah	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
Centrophorus moluccensis						5.0							5.0
Cephalocyllium circulopullum					15.0				0.4		15.0		30.4
Chiloscyllium plagiosum	2.4				15.0	4.0					4.0	10.0	35.4
Chiloscyllium punctatum	4.4		40.0	7.9	280.0	33.0			10.1	6.6	377.0	20.3	779.2
Galeocerdo cuvier	4.2				3.5				1.1	41.0	6.3		56.1
Halaelurus buergeri									0.2				0.2
Hemigaleus microstoma	3.3								44.0		5.1	10.0	62.4
Heptranchias perlo						6.0							6.0
Hexanchus cf. *griseus*						15.0							15.0
Mustelus manazo	6.5												6.5
Sphyrna mokarran	5.6											74.0	79.6
Squalus megalops	1.6					40.0						1.8	43.4
Squatina sp.	21.5		7.2		17.8	14.0					17.8		78.3
Squatina tergocellatoides	1.9												1.9
Triaenodon obesus	5.2								77.0				82.2
Skates	**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**
Dipturus johannisdavisi						50.0							50.0
Okamejei cairae	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
Okamejei hollandi						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 puctatum* matures at 68-76cm. *Galeocerdo cuvier* matures at 300-305cm for males and 250-350cm for females (TL). The details are shown in **Table 22** and **Table 23.**

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

Species	2015											
	Sep			Oct			Nov			Dec		
	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.	Min	Max	Ave.
Rays												
Hemitrygon sinensis							20.0	25.0	22.0			
Brevitrygon imbricata	19.5	23.0	21.2	21.0	22.5	21.8	17.0	24.0	20.6			
Narcine brunnea				13.5	29.0	21.3						
Narcine indica	19.0	24.0	22.0	24.0	35.5	30.7	24.5	35.0	30.1	20.0	39.0	26.8
Narcine timlei												
Narke japonica	18.0	18.0	18.0									
Neotrygon orientalis	12.0	30.0	23.4									
Platyrhina sinensis	37.0	37.0	37.0				44.0	51.0	47.3			
Rhinobatos formosensis				61.0	93.0	79.1	31.5	77.0	54.3	65.0	65.5	65.3
Rhynchobatus palpebratus							135.0	152.0	142.3			
Sharks												
Alopias pelagicus	220.0	310.0	265.0									
Atelomycterus marmoratus				23.0	55.0	40.4	30.0	50.0	44.3			
Carcharhinus amblyrhynchos				92.0	92.0	92.0						
Carcharhinus dussumieri										76.5	76.5	76.5
Carcharhinus limbatus				105.0	142.0	119.0				94.0	150.0	107.0
Carcharhinus sorrah	77.0	90.0	83.0	200.0	225.0	215.0				88.0	149.0	102.9
Cephalocyllium circulopullum	40.0	40.0	40.0				37.0	42.0	39.5			
Chiloscyllium plagiosum							58.0	87.0	67.6	85.5	85.5	85.5
Chiloscyllium punctatum	38.0	107.0	75.5	75.0	142.0	99.0	37.5	89.0	60.4	36.0	74.0	51.4
Galeocerdo cuvier	77.0	77.0	77.0	105.0	107.0	106.0	65.0	85.0	76.5			
Halaelurus buergeri	40.0	40.0	40.0									
Hemigaleus microstoma	118.0	118.0	118.0				80.0	83.5	81.8	42.0	51.0	45.0
Sphyrna mokarran										245.0	245.0	245.0
Squalus megalops										69.0	69.0	69.0
Squatina sp.							113.0	120.0	116.5			
Triaenodon obesus	154.0	195.0	174.5									
Skates												
Okamejei cairae	18.0	24.0	20.8	10.0	28.8	17.1	22.0	37.0	29.1	37.0	42.0	39.3
Okamejei hollandi				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 *Telatrygon zugei*, *Mobula japonica*, *Narcine* spp., *Narke* spp., *Neotrygon orientalis*, *Platyrhina* spp., *Rhinobatos formoensis*, *Rhynchobatus* spp., *Urolophus auranticus* and *Okamejei* spp. from January - August 2016. All Measurements in cm.

Species	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.
Rays																								
Telatrygon zugei																16.0	29.0	20.7						
Brevitrygon imbricata				24.0	30.0	26.4																		
Brevitrygon heterura													18.0	24.0	21.0							18.5	23.0	20.7
Mobula thurstoni																42.0	47.5	45.2						
Mobula japanica																150.0	205.0	178.3						
Narcine brevilabiata	27.0	29.0	28.0													18.0	18.0	18.0						
Narcine brunnea																18.0	32.0	26.0						
Narcine indica	24.0	25.0	24.5													23.0	35.0	28.2				29.0	29.0	29.0
Narcine timlei																25.0	25.0	25.0						
Neotrygon orientalis	31.0	32.0	31.5				25.0	40.0	31.4															
Platyrhina sinensis										48.0	50.0	49.0												
Platyrhina tangi													44.5	55.0	48.1	36.0	48.0	42.1						
Plesiobatis daviesi				115.0	115.0	115.0										58.0	116.0	87.0						
Rhynchobatus australiae	102.0	248.0	169.3																					
Rhinobatos formosensis										70.0	82.0	77.5	31.5	77.0	54.3									

Rhynchobatus palpebratus													130.0	150.3	139.4									
Urolophus aurantiacus																19.0	24.0	21.4						
Sharks																								
Alopias pelagicus																366.0	366.0	366.0						
Atelomycterus marmoratus				26.0	32.0	28.3							30.5	50.0	41.6									
Carcharhinus amblyrhynchos																90.0	100.0	95.0						
Carcharhinus cf. *falciformis*	305.0	305.0	305.0																					
Carcharhinus dussumieri	85.0	120.0	106.7																					
Carcharhinus limbatus	92.0	92.0	92.0				80.0	89.0	84.7	70.0	85.0	77.5												
Carcharhinus sorrah	77.0	168.0	107.8	54.0	121.0	72.3	90.0	22 0.0	160.5	60.0	155.0	101.9				55.0	75.0	65.7	42.0	80.1	65.1	25.8	80.1	62.1
Centrophorus moluccensis																85.0	85.0	85.0						
Cephalocyllium circulopullum													36.5	42.3	39.4									
Chiloscyllium plagiosum	75.0	76.0	75.5										58.5	67.0	62.8	34.0	34.0	34.0						
Chiloscyllium punctatum	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						
Galeocerdo cuvier	106.0	106.0	106.0										73.2	83.0	78.9									
Hemigaleus microstoma	97.0	97.0	97.0																					
Heptranchias perlo																79.3	79.3	79.3						
Hexanchus cf. *griseus*																78.5	78.5	78.5						
Mustelus manazo	110.0	110.0	110.0																					

Sphyrna mokarran	59.0	105.0	82.0																					
Squalus megalops	60.0	60.0	60.0													62.0	62.0	62.0						
Squatina 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						
Squatina tergocellatoides	59.0	59.0	59.0																					
Triaenodon obesus	109.0	109.0	109.0																					
Skates																								
Dipturus johannisdavisi																95.0	95.0	95.0						
Okamejei cairae	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
Okamejei hollandi																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 **Tabl**e 26 and **Table 27**.

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

Type of Gear	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.

Type of Gear	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** to **Table 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	*Chiloscyllium punctatum*	763.9	0.33	0.12
2	*Carcharhinus sorrah*	288.5	0.12	0.04
3	*Alopias pelagicus*	215.0	0.09	0.03
4	*Atelomycterus marmoratus*	83.3	0.04	0.01
5	*Squatina* sp.	71.1	0.03	0.01
6	*Squalus megalops*	43.4	0.02	0.01
7	*Chiloscyllium plagiosum*	35.4	0.02	0.01
8	*Cephalocyllium circulopullum*	30.4	0.01	0.01
9	*Carcharhinus dussumieri*	29.5	0.01	0.01
10	*Hemigaleus microstoma*	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	*Chiloscyllium punctatum*	1,050.0	0.45	0.16
2	*Atelomycterus marmoratus*	325.0	0.14	0.05
3	*Cephalocyllium circulopullum*	151.0	0.07	0.02
4	*Carcharhinus sorrah*	125.0	0.05	0.02
5	*Chiloscyllium plagiosum*	60.0	0.03	0.01
6	*Hemigaleus microstoma*	27.0	0.01	0.00
7	*Squalus megalops*	26.0	0.01	0.00
8	*Squatina* sp.	15.0	0.01	0.00
9	*Hexanchus griseus*	14.0	0.01	0.00
10	*Galeocerdo cuvier*	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	*Carcharhinus sorrah*	3,582.7	2.83	2.70
2	*Carcharhinus limbatus*	343.4	0.27	0.26
3	*Carcharhinus amblyrhynchos*	124.0	0.10	0.09
4	*Carcharhinus* cf. *falciformis*	110.0	0.09	0.08
5	*Triaenodon obesus*	82.2	0.07	0.06
6	*Sphyrna mokarran*	78.7	0.06	0.06
7	*Galeocerdo cuvier*	45.2	0.04	0.03
8	*Hemigaleus microstoma*	44.0	0.04	0.03
9	*Chiloscyllium punctatum*	15.3	0.01	0.01
10	*Squatina* 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	*Carcharhinus sorrah*	1,113.0	0.88	0.84
2	*Carcharhinus limbatus*	53.0	0.04	0.04
3	*Carcharhinus amblyrhynchos*	27.0	0.02	0.02
4	*Galeocerdo cuvier*	14.0	0.01	0.01
5	*Chiloscyllium punctatum*	7.0	0.01	0.01
6	*Hemigaleus microstoma*	4.0	0.00	0.00
7	*Triaenodon obesus*	3.0	0.00	0.00
8	*Sphyrna mokarran*	2.0	0.00	0.00
9	*Carcharhinus* cf. *falciformis*	1.0	0.00	0.00
10	*Squatina* 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	*Brevitrygon heterura*	506.4	0.22	0.08
2	*Brevitrygon imbricata*	443.0	0.19	0.07
3	*Rhinobatos formosensis*	309.0	0.13	0.05
4	*Plesiobatis daviesi*	269.0	0.12	0.04
5	*Platyrhina sinensis*	265.1	0.11	0.04
6	*Narcine indica*	243.9	0.11	0.04
7	*Platyrhina tangi*	219.0	0.09	0.03
8	*Telatrygon zugei*	175.0	0.08	0.03
9	*Rhynchobatus australiae*	142.0	0.06	0.02
10	*Hemitrygon sinensis*	80.0	0.03	0.01

Table 33. Top 10 CPUE 0f 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	*Brevitrygon imbricata*	1,416.0	0.61	0.22
2	*Brevitrygon heterura*	1,106.0	0.48	0.17
3	*Narcine indica*	1,077.0	0.46	0.17
4	*Telatrygon zugei*	619.0	0.27	0.10
5	*Platyrhina sinensis*	570.0	0.25	0.09
6	*Platyrhina tangi*	435.0	0.19	0.07
7	*Rhinobatos formosensis*	315.0	0.14	0.05
8	*Narcine brunnea*	298.0	0.13	0.05
9	*Hemitrygon sinensis*	200.0	0.09	0.03
10	*Narcine timlei*	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	*Mobula thurstoni*	3,589.4	2.83	2.71
2	*Pateobatis jenkinsii*	1,610.0	1.27	1.21
3	*Plesiobatis daviesi*	272.0	0.22	0.21
4	*Neotrygon orientalis*	268.9	0.21	0.20
5	*Mobula japanica*	180.0	0.14	0.14
6	*Rhynchobatus australiae*	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	*Pateobatis jenkinsii*	412.0	0.33	0.31
2	*Mobula thurstoni*	371.0	0.29	0.28
3	*Neotrygon orientalis*	127.0	0.10	0.10
4	*Plesiobatis daviesi*	13.0	0.01	0.01
5	*Mobula japanica*	3.0	0.00	0.00
6	*Rhynchobatus australiae*	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	*Okamejei cairae*	7,596.1	3.26	1.17
2	*Okamejei hollandi*	1,059.0	0.46	0.16
3	*Dipterus johannisdavisi*	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	*Okamejei cairae*	39,261.0	16.87	6.02
2	*Okamejei hollandi*	4,967.0	2.13	0.76
3	*Dipterus johannisdavisi*	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 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
Rays	*Hemitrygon sinensis*	1-2	local market and Ho Chi Minh City
	Telatrygon zugei	1-2	Ho Chi Minh City and local market
	Brevitrygon imbricata	1-2.2	local market, Ho Chi Minh city and China
	Pateobatis jenkinsii	1-2	local market and Ho Chi Minh City and China
	Urogymnus granulatus	2-5	local market an Ho Chi Minh City
	Brevitrygon heterura	1-2	local market and Ho Chi Minh City
	Mobula thurstoni	1-1.8	Local market and Ho Chi Minh City and China
	Nacine brevilabiata	1-2	China,Ho Chi Minh City and local market
	Narcine indica	0.2-1.7	China, Ho Chi Minh City and Local market
	Narke japonica	0.2-2	China, local market
	Neotrygon orientalis		China, Ho Chi Minh city and local market
	Platyrhina sinensis	0.2-1.5	China, local market and Ho Chi Minh City
	Platyrhina tangi	1,5-1,6	Local market
	Plesiobatis daviesi	1-2	Ho Chi Minh City, China and local market
	Rhinobatos formosensis	1-2	China, Ho Chi Minh City and Local market
	Rhynchobatus australiae	1-2	Local market and Ho Chi Minh City
	Rhynchobatus palpebratus	1.7-2	Local market, China and Ho Chi Minh City
Sharks	*Alopias pelagicus*	3-5	China, Ho Chi Minh City local market
	Atelomycterus marmoratus	1-2	Ho Chi Minh City and local market
	Atelomycterus marmoratus	1.5-5	Local market and China
	Carcharhinus amblyrhynchos	1-2	Local market and Ho Chi Minh City and China
	Carcharhinus cf. *falciformis*	1-2	Local market and Ho Chi Minh City
	Carcharhinus dussumieri	1-2	Local market and Ho Chi Minh City
	Carcharhinus limbatus	1-2.5	China, Ho Chi Minh City and local market
	Carcharhinus sorrah	1-6	China, Ho Chi Minh City, China and local market
	Cephalocyllium circulopullum	1-2	China, local market and Ho Chi Minh City
	Chiloscyllium plagiosum	1-2	China, local market and Ho Chi Minh City
	Chiloscyllium punctatum	1-2	China, local market and Ho Chi Minh City
	Galeocerdo cuvier	1-2	local market and Ho Chi Minh City and china
	Halaelurus buergeri	1-2	China, local market
	Hemigaleus microstoma	1-6	China, Ho Chi Minh City and local market
	Mustelus manazo	1-2	Ho Chi Minh City and local market
	Sphyrna mokarran	1-3	China, Ho Chi Minh City and local market
	Squalus megalops	1-2	Ho Chi Minh City and local market
	Squatina sp	1-2	Ho Chi Minh City and local market
	Squatina tergocellatoides	1-2	Ho Chi Minh City and local market
	Triaenodon obesus	1-2	China, Ho Chi Minh City and local market
Skates	*Okamejei cairae*	0.2-2	China, Ho Chi Minh City and local market
	Okamejei hollandi	0.2-2	China, Ho Chi Minh City and local market

3.0 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 four 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 29 species of sharks from seven (7) Orders and 12 Families, and 39 species of rays from five Orders and 14 Families, and four species of skate from one Order and one family were recorded. Ba Ria-Vung Tau recorded the highest with 24 species of sharks and 23 species of rays and three skates. Binh Thuan recorded with 12 species of sharks and 27 rays and three skates. Details are shown in **Appendix I**. In term of percentage of total marine landings, sharks, rays and skates only contributed 0.4%, 0.3% and 0.5% at Binh Thuan 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 *Brevitrygon imbricata, Telatrygon zugei* and *Brevitrygon heterura* and for skates, *Okamejei cairae, O. holandi.* Species of *O. cairae* very common catch from trawl net in Binh Thuan (Lagi jetty).

The most abundant shark species at Ba Ria-Vung Tau were *Chiloscyllium punctatum, Carchahinus sorrah* and *Atelomycterus marmoratus* while for rays *Brevitrygon heterura, Brevitrygon imbricata, Neotrygon orientalis*, *Pateobatis jenkinsii* and *Telatrtygon zugei.* The most common shark species were *C. sorrah* while for rays *Brevitrygon heterura, Telatrygon 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 middlemen at local jetty. The price of whole catch was determined by buyers at fishing ports.

4.0 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

5.0 FUTURE ACTIVITIES

In Vietnam should be collected more elasmobranchs data not only in the south of Nation but include from North and Centre of the country to get more information. All information will be useful to develop National Plan of Action for Conservation and Management of Sharks in Vietnam

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Appendix I

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

No.	Order/Families/Species	Ba Ria-Vung Tau	Binh Thuan
	Total rays species	**23**	**27**
	MYLIOBATIFORMES		
	Urolophidae		
1	*Urolophus aurantiacus*	+	
	Dasyatidae		
2	*Hemitrygon* cf. *sinensis*		
3	*Hemitrygon fluviorum*		+
4	*Hemitrygon parvonigra*		+
5	*Hemitrygon sinensis*	+	+
6	*Dasyatis* sp.		+
7	*Telatrygon zugei*	+	+
8	*Brevitrygon* cf. *javaensis*		+
9	*Brevitrygon imbricata*	+	+
10	*Pateobatis jenkinsii*	+	
11	*Urogymnus granulatus*	+	
12	*Brevitrgon heterura*	+	+
13	*Neotrygon orientalis*	+	+
14	*Neotrygon* sp.		+
15	*Taeniura lymma*		+
	Gymnuridae		
16	*Gymnura japonica*		+
17	*Gymnura poecilura*		+
	Mobulidae		
18	*Mobula* sp.	+	+
19	*Mobula thurstoni*	+	
	Myliobatidae		
20	*Aetobatus ocellatus*		+
21	*Aetomylaeus maculatus*		+
22	*Mobula japonica*	+	
23	*Myliobatis tobijei*		+
24	*Plesiobatis daviesi*	+	
25	*Urogymnus asperrimus*		+
	RHINOBATIFORMES		
	Platyrhinidae		
26	*Platyrhina sinensis*	+	+
27	*Platyrhina tangi*	+	+
	Rhinobatidae		
28	*Rhinobatos formosensis*	+	+
29	*Rhinobatos* sp.	+	
	Rhynchobatidae		
30	*Rhynchobatus australiae*	+	+

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

60	*Alopias superciliosus*		+
	ORECTOLOBIFORMES		
	Hemiscyllidae		
61	*Chiloscyllium* cf. *Punctatum*		+
62	*Chiloscyllium plagiosum*	+	+
63	*Chiloscyllium punctatum*	+	+
64	*Chiloscyllium* sp.		+
	SQUALIFORMES		
	Squalidae		
65	*Squalus megalops*	+	
	SQUATINIFORMES		
	Squatinidae		
66	*Squalus megalops*	+	
67	*Squatina* sp.	+	
68	*Squatina tergocellatoides*	+	
	Total skates species	**3**	**3**
	RAJIFORMES		
	Rajidae		
69	*Dipturus johannisdavisi*	+	
70	*Okamejei cairae*	+	+
71	*Okamejei* cf. *boesemani*		+
72	*Okamejei hollandi*	+	+

Appendix II

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

Photo 1: Group photo of participants and resource persons

Photo 2: Participants and resource persons


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

Southeast Asian Fisheries Development Center (SEAFDEC)

What is SEAFDEC?

SEAFDEC is an autonomous intergovernmental body established as a regional treaty organization in 1967 to promote sustainable fisheries development in Southeast Asia. SEAFDEC currently comprises 11 Member Countries: Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam.

Vision

Sustainable management and development of fisheries and aquaculture to contribute to food security, poverty alleviation and livelihood of people in the Southeast Asian region

Mission

To promote and facilitate concerted actions among the Member Countries to ensure the sustainability of fisheries and aquaculture in Southeast Asia through:

i. Research and development in fisheries, aquaculture, post-harvest, processing, and marketing of fish and fisheries products, socio-economy and ecosystem to provide reliable scientific data and information.

ii. Formulation and provision of policy guidelines based on the available scientific data and information, local knowledge, regional consultations and prevailing international measures.

iii. Technology transfer and capacity building to enhance the capacity of Member Countries in the application of technologies, and implementation of fisheries policies and management tools for the sustainable utilization of fishery resources and aquaculture.

iv. Monitoring and evaluation of the implementation of the regional fisheries policies and management frameworks adopted under the ASEAN-SEAFDEC collaborative mechanism, and the emerging international fisheries-related issues including their impacts on fisheries, food security and socio-economics of the region.


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