



Progress Report II of the Targeted Research on Indian Mackerel and Sharks and Plan of Action for Conservation and Management of Shark Resources

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September 2012 to August 2014





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The Department of Fisheries Thailand has entered into a Letter of Agreement (LOA /RAP/2012/34), with the FAO of the United Nations as part of the work under the Bay of Bengal Large Marine Ecosystem (BOBLME) Project in September 2012, on targeted research on Indian mackerel and sharks and plan of action for conservation and management of shark resources .

The work under the LOA is under progress and the following is the inception report in this regard. The inception of the work was also discussed in detail in a workshop held on 9th November 2012 on Work plan and Policy of the Bay of Bengal Large Marine Ecosystem Project in Thailand, 2013

Population structure of Indian mackerel in the Andaman Sea

Specimens of Indian mackerel are collected from all six provinces (Ranong, Phuket, Krabi, Trang, Satul) along the west coast of Thailand during a period of about three months (December –March). About 100 samples were collected from the northern area and 100 from the southern area with Phuket as midpoint

The tissue from each specimen was preserved in 95% Ethanol and the carcasses will be fixed in 10% formalin. The specimens were shipped on ice to the Chulalongkorn University fish lab within 4 hours after the fish were acquired from the dock. Genomic DNA was extracted from the tissue collected from the muscle above the opercle region on the right side of the specimens using Genomics DNA extraction kit Bioscience Inc. (catalog number YGT50). 14 microsatellite loci were amplified by using the annealing temperature in table 1. For the total volume of 12.5 μ l, the PCR reaction consists of 1.25 μ l 10x buffer, 0.75 μ l 25 mM MgCl₂, 0.25 μ l 10 mM DNTP, 0.5 μ l of 10 μ M each primer, 1.25 unit of taq polymerase, 2 μ l of genomic DNA and 7 μ l of ultrapure water. Null allele was checked by using Microchecker program. Arlequin was used to assess linkage disequilibrium, calculate F_{st} and F_{is} . and perform AMOVA.

Progress: 175 specimens (100 from Satun province and 75 from Ranong province) were collected. There were 25 specimens from Ranong province is still not collected. This is due to the monsoon season. At this point, we feel that is not practical to collect any more specimens because it is way pass the fish spawning season. The muscle tissue were collected and stored in 95 % Ethanol for all specimens. The DNA extraction was done on all tissues collected. The DNA extraction from the standard fish (from Malaysia) has poorly yielded DNA. Therefore, we still have not been able to get any amplification from them. More than 1800 PCR reactions were performed. Only 1575 PCR product were achieved from 9 loci (175 products per loci). There were five loci (RAKA 1, RAKA 10, RAKA 48, KSJ18 and KSJ 26) that we have not been able to optimize the PCR conditions (Table 1).



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Table1. Primers and their annealing temperature from 9 microsatellite loci that were successfully amplified (Loci RAKA 1, RAKA 10, RAKA 48, KSJ18 and KSJ 26 have not been successfully amplified so they were not listed here)

Sl. No.	Locus	Primer Sequence 5' --> 3'	Repeat motif	Ta(°C)	Product size	No. of alleles*
1	Raka2	F:TCATTGACTTTATTTCTGGCACG	AATAG	56	192-332	9
		R:AAAGCCCTGATGTCAAGATGG				
2	Raka12	F: TGGCTTCTGTAGTGTCAATTTGC	ATCT	62	284-380	10
		R:CATTCACTTGGTAAATGCCG				
3	Raka26	F:CTACATGTCCAGCTGCAGGG	ATT	60	183-198	10
		R:GCAGATGATAACTCAATATGTGTTGG				
4	Raka46	F:GAGGATATGCAGTGTCAAGAGG	ATT	60	228-243	9
		R: TTTATGTATCCATTATGGTCCAGG				
5	SA2068	F: CAAGACATGACAGTAGGACATTGAC	(GGA) ₉	56	147-177	9
		R: AGATTGGGAGTTTGTAGGGGTAATA				
6	SA2657	F: TGTCAGAGATGTAGCACATACGG	(CA) ₁₉	56	240-324	14
		R: AGCATTATCTGGTGCTGTAAGGA				
7	SA2770	F: AGAAATGAAAAGGGCTTTAAGGA	(CA) ₂₂	56	196-286	15
		R: ACTGAGCTGCTTAAAATGCAAAA				
8	SCA 8	F: TCAGCTGTTTCATTCCCATAGCCCA	(CA) ₂₁	55	140-174	13
		R: ATGAAGGAACAATGAGCCTCCAGC				
9	SCA30	F: TGGCTGTCTGGTCACTCTGCCTC	(GA/CA) ₂₃	55	114-130	7
		R: ACACACACGGGTACACACAGGG				



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National Plan of Action for conservation and management of sharks

The work of producing an updated NPOA (Natheewatana and Cheunpan, 2002) has commenced with a review of the existing draft plan and new information and concerns that have emerged since 2005 with the view of identifying what kind of updating might be desirable. This would include a review of other national plans such as that for Malaysia which is expected to be completed by April 2013

The most crucial existing and new issues of the plan will be discussed with the various stakeholders, i.e. the fishers, fish traders, fisheries associations, fishery port managers, fisheries researchers, officials, etc. Stakeholder meeting on NPOA of shark in Thailand will be held for public hearing from all stakeholders in November 2014 at Bangkok, Thailand. Ms. Prulai Nootmorn and her team will arrange and hold the meeting. The intention is to improve the understanding of need and measures for shark conservation among the stakeholders. It is envisaged that this will lead to better relationships between the stakeholders, which in turn will facilitate agreements on national conservation strategies. Please see the work plan in Annex.

The reports of the consultations will clearly show the relative importance of the issues discussed as well as the interests of the different stakeholder groups. Particular disagreements and agreements will be highlighted.

An updated plan, guided by the FAO IPOA Sharks format and contents, will be drafted after completion of the consultations and discussed in a workshop with stakeholder groups represented. The report of that workshop will include the final proposal on a revised NPOA. The topics are proposed the NPOA shark, including;

1. Monitoring and survey by port sampling and trawl survey.
2. Data collection and species identification of shark and products.
3. Research on shark and ray such as gene bank, biology and cultivated, stock assessment, species identification in national parks and artificial reefs, logistic of shark in the market and heavy metals in shark products.
4. Capacity building for DOF and relevant official staffs, such as identification of sharks and products.
5. Conservation and administration of shark, for instance; disseminate knowledge on shark conservation and public awareness, measures to control the import and export of shark species and shark-liked specie under cites list, appropriate measures to control the catch by determinate some fishing year and area
6. Shark released in the marine national park.



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A senior officer of the Department of Fisheries (DOF), will be responsible for the work. He/she will be assisted by staff of the Andaman Sea Research and Development Centre (AFRDEC), including a shark specialist, Mr. Tassapon Krajangara and a facilitator for the stakeholder consultations.

Heavy metals in shark products

The study on the heavy metal contamination including cadmium, lead and mercury in 2 species of sharks such as brownbanded bamboo shark (*Chiloscyllium punctatum*) and spottail shark (*Carcharhinus sorrah*) (Figure 1) in the Andaman Sea Coast of Thailand was carried out during the year of 2013-2014.

Ms. Panida Chalee, AFRDEC will be responsible. About 24 samples each of shark meat and liver will be tested for contents of Mercury, Lead and Cadmium at the Southern Marine Fisheries Research and Development Center in Songkla lab. The analysis of Hg by Mercury and analyse Pb and Cd by ICP-MS. Ms. Panida Chalee, a biologist of the AFRDEC will be responsible for the work and will be assisted by other staff collecting the samples.

In April 2013, June 2013, October 2013 and January 2014 were collected 24 samples of 3 male and 3 female each species were collected from trawl, shark meat and liver were be tested for contents of Mercury (Hg), Lead (Pb) and Cadmium (Cd) at the Southern Marine Fisheries Research and Development Center in Songkla lab. Tables 2-4 shows the analyses result, the contamination of cadmium in the liver of both male and female of *C. punctatum* were higher than the standard safety level (2 µg/g). The contamination values of the cadmium in the liver of male *C. punctatum* were in range of 3.190-12.412 µg/g (average value was 7.327 µg/g) and which of female were in range of 4.862-13.019 µg/g (average value was 8.520 µg/g). For the contamination of lead, the finding showed the similarity of values in livers and meats of 2 sharks. There were in range of 0.019-0.136 µg/g with average value was 0.047 µg/g and lower than the standard safety level (1 µg/g). The result of mercury contamination was same the result of lead contamination in 2 sharks. There were in range of 0.002-0.200 µg/g (average value was 0.038 µg/g) and lower than the standard safety level (0.5 µg/g), as well. Therefore the consumption meat of 2 sharks in the Andaman Sea Coast of Thailand is still safety for consumer.



Figure 1 (A) *Chiloscyllium punctatum* and (B) *Carcharhinus sorrah*



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Table 2 Cadmium contamination in 2 species of sharks in the Andaman Sea.

Species/Sex		Apr,13	Jul,13	Oct,13	Jan,14	Range	Average
<i>C. punctatum</i> /male	liver	5.426	8.278	12.412	3.190	3.190-12.412	7.327 \pm 3.979
	meat	0.023	0.027	0.027	0.136	0.023-0.136	0.053 \pm 0.055
<i>C. punctatum</i> /female	liver	13.019	5.840	4.862	10.360	4.862-13.019	8.520 \pm 3.838
	meat	0.031	0.025	0.033	0.029	0.025-0.033	0.030 \pm 0.003
<i>C. sorrah</i> /male	liver	0.111	0.143	0.006	0.749	0.006-0.749	0.252 \pm 0.336
	meat	0.007	0.006	0.002	0.023	0.002-0.023	0.010 \pm 0.009
<i>C. sorrah</i> /female	liver	0.081	0.279	0.023	-	0.023-0.279	0.128 \pm 0.134
	meat	0.004	0.006	0.004	-	0.004-0.006	0.005 \pm 0.001

Table 3 Lead contamination in 2 species of sharks in the Andaman Sea.

Species/Sex		Apr,13	Jul,13	Oct,13	Jan,14	Range	Average
<i>C. punctatum</i> /male	liver	0.034	0.038	0.048	0.019	0.019-0.048	0.035 \pm 0.012
	meat	0.101	0.035	0.034	0.029	0.029-0.101	0.050 \pm 0.034
<i>C. punctatum</i> /female	liver	0.136	0.071	0.030	0.022	0.022-0.136	0.065 \pm 0.052
	meat	0.037	0.032	0.055	0.024	0.024-0.055	0.037 \pm 0.013
<i>C. sorrah</i> /male	liver	0.091	0.032	0.031	0.039	0.031-0.091	0.048 \pm 0.029
	meat	0.087	0.041	0.028	0.026	0.026-0.087	0.046 \pm 0.028
<i>C. sorrah</i> /female	liver	0.093	0.034	0.071	-	0.034-0.093	0.066 \pm 0.030
	meat	0.056	0.023	0.020	-	0.020-0.023	0.033 \pm 0.020

Table 4 Mercury contamination in 2 species of sharks in the Andaman Sea.

Species/Sex		Apr,13	Jul,13	Oct,13	Jan,14	Range	Average
<i>C. punctatum</i> /male	liver	0.010	0.043	0.022	0.002	0.002-0.043	0.019 \pm 0.018
	meat	0.131	0.032	0.050	0.004	0.004-0.131	0.054 \pm 0.055
<i>C. punctatum</i> /female	liver	0.100	0.022	0.040	0.004	0.004-0.100	0.042 \pm 0.042
	meat	0.200	0.044	0.060	0.019	0.019-0.200	0.081 \pm 0.081
<i>C. sorrah</i> /male	liver	0.006	0.045	0.010	0.007	0.006-0.045	0.017 \pm 0.019
	meat	0.007	0.022	0.080	0.019	0.007-0.080	0.032 \pm 0.033
<i>C. sorrah</i> /female	liver	0.010	0.050	0.015	-	0.010-0.050	0.025 \pm 0.022
	meat	0.010	0.010	0.056	-	0.010-0.056	0.025 \pm 0.025

Remark: Standard for Foods with Contamination of Ministry of Public Health Notification No. 98 B.E. 1986: quantity of Hg = 0.5 ppm, Pb = 1.0 ppm, Cd=2.0 ppm



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Data base on Rays

The improved data base on Rays will be achieved by a one-year survey programme to be implemented in Ranong, Phuket and Satun Provinces. The design of sampling and the sites has been finalized in 1st quarter in 2012 the sampling will start after completing the training course. The work will be followed as per the work plan given below.

Before commencing the sampling programme, a detailed field guide in Thai is prepared to facilitate the identification of different species of rays during first quarter of 2013.

About 10 data collectors are to be stationed in the three above mentioned provinces. They will be trained in the species identification and in collecting the data. The training course will be held during 18-22 March 2013 at AFRDEC meeting room. The training will be conducted as per the Mr. Tassapon Krajangara will be the ray specialist.

Data collection on rays in the Andaman Sea Coast of Thailand project was conducted during April, 2013 to March, 2014. The objectives to study were species composition of rays, male maturation and catches composition by trawl fishery and ray utilization, which landed at Ranong, Phuket and Satun fishing ports (Figure 2). The survey of ray each 3 ay per month by classifying and measuring the width of disc (DW) is measured in centimeters (Figure 3) and body weight (W) in grams. The male reproductive preliminary was examination of males from clasper, in case of Rhinidae, Rhinobatidae, Narcinidae and Narkidae were measured total length (TL).

Data were collected from trawl fishing vessels, including size of boat, catch per trip (kg/trip), fishing ground, no. of fishing (day), daily catch per landing place and other information by interview from skipper or master fishman and enumerator. Fish identification was followed the catalog of the species of stingray of Carpenter and Niem (1999), Last et al. (2010), Ali et al. (2013) and Tassapon (2014). The catch per unit of effort (kg./trip) and species composition were calculated as followed

$$\text{CPUE} = \text{Total catch} / \text{Number of fishing trip}$$

$$\text{Species composition} = (\text{Catch} / \text{Total catch}) \times 100$$

The results found 10 families, 17 genera and 37 species of ray with 8 new record species in Thai Waters as *Rhynchobatus springeri*, *Glaucostegus* cf. *granulatus*, *Rhinobatos obtusus*, *R. punctifer*, *Himantura fai*, *H. pastinacoides*, *H. toshi* and *Pastinachus atrus*. While the average size of 9 rays were smaller than male maturity size such as *Rhina ancylostoma*, *Rhynchobatus australiae*, *Himantura gerrardi*, *H. jenkinsii*, *H. pastinacoides*, *H. uarnacoides*, *H. uarnak*, *H. undulata* and *Gymnura poecilura* (Figure 4 and Table 5).

1. Family Rhinidae was Ronin and Ronan (Guitarfish or Wedgefish) as quite large stingray. The Thai waters have reported that all four species (Natheewatana and Cheunpan, 2002), but this survey found only 3 species of *Rhina ancylostoma*, *Rhynchobatus australiae* and *R. springeri*, while the range of length varied from 42 to 277 cm and percentage were recorded 0.808, 1.260, and 0.016 respectively from total sampling. *R. ancylostoma* and *R.*

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springeri found only at Ranong and Satun fishing ports, respectively, while *R. australiae* found in all areas of survey.

2. Family Rhinobatidae was Ronan (Guitarfish or Shovelnose ray). The Thai waters have reported that 4 species (Natheewatana and Cheunpan, 2002), this survey found 4 species. While *Glaucostegus* cf. *granulatus*, *Rhinobatos obtusus*, *R. punctifer* were the new recorded and *R. schlegelii* found at Ranong and Phuket. The range of length varied from 24 to 134 cm.

3. Family Narcinidae is the electric ray (Numbfish) which have been reported all 5 species (Natheewatana and Cheunpan, 2002), but this survey found 1 species, *Narcine prodorsalis* at Ranong fishing port.

4. Family Narkidae is the electric ray (sleeper ray) as a small stingray. Which have been reported 2 species (Natheewatana and Cheunpan, 2002), but found only 1 species is *Temera hardwickii* at Ranong and Phuket fishing ports. The length was in the range 11-14 cm.

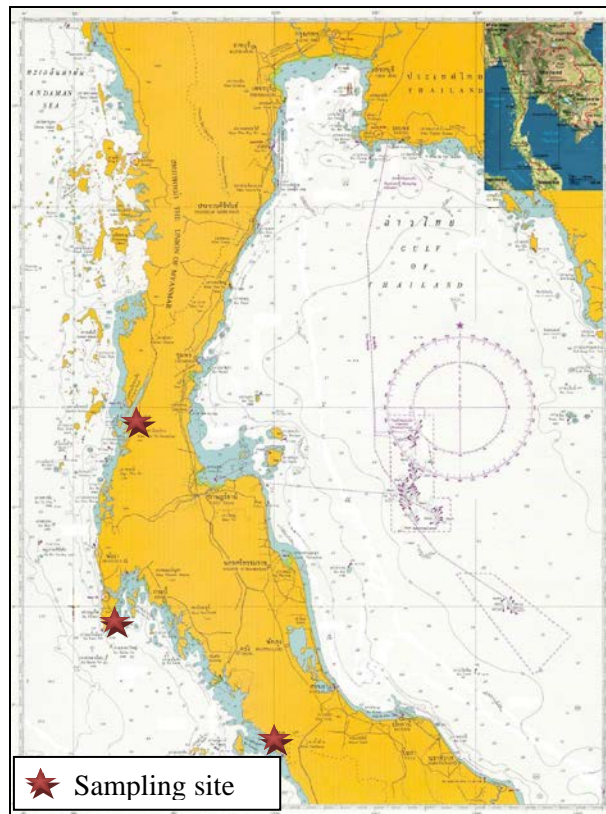


Figure 2. Sampling sites of rays by trawlers in the Andaman Sea.

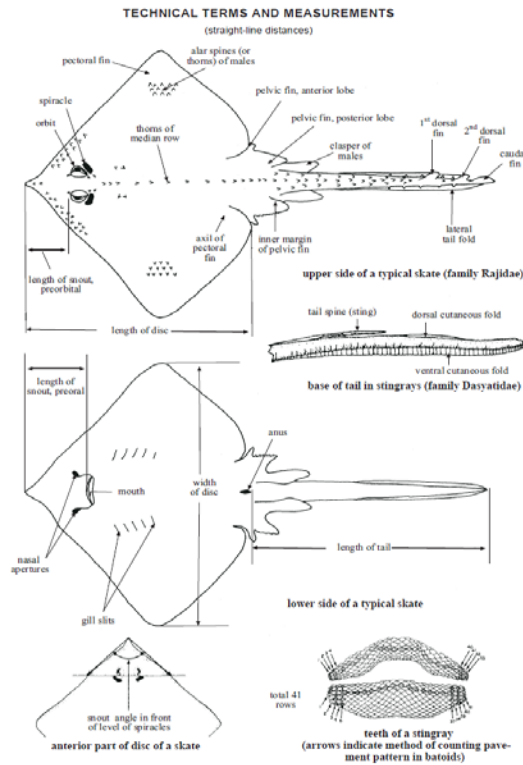


Figure 3. Measurement in ray (Carpenter and Niem, 1999).

5. Family Rajidae found one species of skate as *Okamejei jensenae* at Ranong and Phuket fishing ports, this family found 0.646 percent of total sampling. The DW ranged from 13 to 39 cm. This species as deep-sea skate is found infrequently.

6. Family Dasyatidae is general stingray and the most common family found 19 species. This study found 4 new recorded at Ranong fishing port, namely; *Himantura fai*, *H. pastinacoides*, *H. toshi* and *Pastinachus atrus*. The common species were recorded *H. walga*, *Neotrygon kuhlii*, *H. gerrardi*, *H. imbricata* and *Dasyatis zugei* as 32.241, 27.249, 8.868, 5.346, and 2.601 % of total sampling. This family found 84.721 percent of total sampling and the DW ranged from 7 to 165 cm. Natheewatana and Cheunpan (2002) reported a total of 21 species that found in the Thai waters.

7. Family Gymnuridae was butterflyray. In Thai waters have been reported 4 species (Natheewatana and Cheunpan, 2002), but this study found only 3 species, namely; *Gymnura japonica*, *G. poecilura* and *G. zonura*. The DW ranged from 22 to 100 cm. The species composition of 3 species equaled 1.841, 0.969, and 0.016 %, respectively. *G. zonura* found only at Ranong fishing port.

8. Family Myliobatidae was eagle ray and was quite large size. The Thai waters have been reported 6 species (Natheewatana and Cheunpan, 2002), but this study found only 3 species, namely; *Aetobatus narinari*, *A. ocellatus* and *Aetomylaeus vespertilio*. The DW



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ranged from 54 to 232 cm. Species composition was found 0.016, 0.662, and 0.016 %, respectively. *A. ocellatus* found in all landing places.

9. Family Rhinopteridae was Cow-nose ray. In Thai water has reported 2 species (Natheewatana and Cheunpan, 2002), this study found only 1 species as *Rhinoptera javanica*. The DW ranged from 53-137 cm and it composed of 0.291% from total sampling at Ranong fishing port.

10. Family Mobulidae was Devil ray as quite large stingray and has found very rare at the landing place. In Thai waters have been reported 4 species (Natheewatana and Cheunpan, 2002), but this study found only 1 species as *Mobula japonica*. The DW ranged from 115 to 191 cm and it composed of 0.032 % from total sampling at Ranong and Phuket fishing ports.

The species list of ray have been reported in the Thai waters, 10 families 19 genera 56 species (Natheewatana and Cheunpan, 2002), when combined with the results of this study. The species list of ray in Thai waters and adjacent areas was 11 families, 22 genus, 71 species (Table 5), which found 8 new recorded, mostly recorded from Ranong fishing port.

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Figure 4. Eight new record rays found in the Andaman Sea of Thailand (Apr,13-Mar,14).



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Table 5 Species list of rays found in the Andaman Sea of Thailand (Apr,13-Mar,14).

No.	Thai name	Common name	Family/Sci.name	TL/DW (cm)	N	%	Sampling site
			Rhinidae		3		
1	โรนิน, กระเบนท้องน้ำ	Bowmouth guitarfish	<i>Rhina ancylostoma</i> Bloch & Schneider, 1801	49-231	50	0.808	R
2	โรนินจุดขาว	Whitespotted wedgefsh	<i>Rhynchobatus australiae</i> Whitley, 1939	42-277	78	1.260	R, P, S
3*	โรนินจุดขาวลาย	Broadnose wedgefsh	<i>R. springeri</i> Compagno & Last, 2010	136	1	0.016	S
			Rhinobatidae		4		
4*	โรนินหัวไสยักซ์	Granulated guitarfish	<i>Glaucostegus cf. granulatus</i> (Cuvier, 1829)	75-134	6	0.097	R
5*	โรนินจมูกกว้าง	Widenose guitarfish	<i>Rhinobatos obtusus</i> Müller & Henle, 1841	65	1	0.016	R
6*	โรนินหัวใสจุดขาว	Spotted guitarfish	<i>R. punctifer</i> Compagno & Randall, 1987	46-96	89	1.438	R
7	โรนินหัวใส, โรนินปุ่ม	Brown guitarfish	<i>R. schlegelii</i> Muller & Henle, 1841	24-102	440	7.107	R, P
			Narcinidae		1		
8	กระเบนไฟฟ้าจุดเล็ก	Tonkin numbfish	<i>Narcine prodorsalis</i> Bessednov, 1966	38	1	0.016	R
			Narkidae		1		
9	กระเบนไฟฟ้าหลังเรียบ	Finless sleeper ray	<i>Temera hardwickii</i> Gray, 1831	11-14	2	0.032	R, P
			Rajidae		1		
10	กระเบนไฟฟ้าหลังหนามจุด	Sulu sea skate	<i>Okamejei jensenae</i> Last & Lim, 2010	13-39	40	0.646	R, P
			Dasyatidae		19		
11	กระเบนหางหาว	Whip stingray	<i>Dasyatis akajei</i> (Muller & Henle, 1841)	24-70	82	1.325	R, P, S
12	กระเบนตาเล็ก	Smalleye stingray	<i>D. microps</i> (Annandale, 1908)	137-165	4	0.065	R
13	กระเบนหางหนาม	Cow stingray	<i>D. ushieii</i> (Jordan & Hubbs, 1925)	113-140	9	0.145	R, P
14	กระเบนปากแหลม	Sharppnose stingray	<i>D. zugei</i> (Muller & Henle, 1841)	12-33	161	2.601	R, P, S
15*	กระเบนลายคอกไม้	Pink whipray	<i>Himantura fai</i> Jordan & Seale, 1906	73	1	0.016	R
16	กระเบนแมลงวัน, กระเบนบัว	Whitespotted whip ray	<i>H. gerrardi</i> (Gray, 1851)	15-107	549	8.868	R, P, S
17	กระเบนจุดขาว	Mangrove whip ray	<i>H. granulata</i> (Macleay, 1883)	33-112	22	0.355	R
18	กระเบนบาง, กระเบนปากแหลม	Scaly whip ray	<i>H. imbricata</i> (Bloch & Schneider, 1801)	7-33	331	5.346	R, P, S
19	กระเบน	Golden whip ray	<i>H. jenkinsii</i> (Annandale, 1909)	25-139	110	1.777	R, P, S
20*	กระเบนบัว	Round whip ray	<i>H. pastinacoides</i> (Bleeker, 1852)	19-72	34	0.549	R
21*	กระเบนจุดดำ	Black-spotted whipray	<i>H. toshi</i> Whitley, 1939	56-79	2	0.032	R
22	กระเบนจมูกขาว	Whitenose whip ray	<i>H. uarnacoides</i> (Bleeker, 1852)	21-161	132	2.132	R
23	กระเบนลายเสื่อเล็ก	Reticulate whip ray	<i>H. uarnak</i> (Forsskal, 1775)	24-153	76	1.228	R, S
24	กระเบนลายเสื่อใหญ่	Leopard whip ray	<i>H. undulata</i> (Bleeker, 1852)	32-135	29	0.469	R
25	กระเบนตุ๊กตา, กระเบนบาง	Dwarf whip ray	<i>H. walga</i> (Muller & Henle, 1841)	7-36	1996	32.241	R, P, S
26	กระเบนจมูกโต, กระเบนจุดฟ้า	Bluespotted stingray	<i>Neotrygon kuhlii</i> (Müller & Henle, 1841)	7-52	1687	27.249	R, P, S
27*	กระเบนธง	Cowtail stingray	<i>Pastinachus atrus</i> (Macleay, 1883)	69-114	8	0.129	R
28	กระเบนธง	Cowtail stingray	<i>P. sephen</i> (Forsskal, 1775)	33-116	7	0.113	R, S
29	กระเบนตกรกระ	Round ribbontail ray	<i>Taeniura meyeri</i> Muller and Henle, 1841	58-129	5	0.081	R
			Gymnuridae		3		
30	กระเบนผีเสื้อญี่ปุ่น	Japanese butterflyray	<i>Gymnura japonica</i> (Temminck & Schlegel, 1850)	22-100	114	1.841	R, P, S
31	กระเบนผีเสื้อหางยาว	Longtail butterfly ray	<i>G. poecilura</i> (Shaw, 1804)	22-85	60	0.969	R, P, S
32	กระเบนผีเสื้อหางลาย	Zonetail butterfly ray	<i>G. zonura</i> (Bleeker, 1852)	36	1	0.016	R
			Myliobatidae		3		
33	กระเบนค้างคาว	Spotted eagle ray	<i>Aetobatus narinari</i> (Euphrasen, 1790)	72	1	0.016	S
34	กระเบนนกปีกแหลม	Ocellated eagle ray	<i>A. ocellatus</i> (Kuhl, 1823)	54-188	41	0.662	R, P, S
35	กระเบนนกรางกระแสด	Ornate eagle ray	<i>Aetomylaeus vesperilio</i> (Bleeker, 1852)	232	1	0.016	R
			Rhinopterae		1		
36	กระเบนจมูกวัว, ยี่ส่น	Flapnose ray	<i>Rhinoptera javanica</i> Muller & Henle, 1841	53-137	18	0.291	R
			Mobulidae		1		
37	กระเบนราหูหางหนาม	Spinetail devil ray	<i>Mobula japonica</i> (Muller & Henle, 1841)	115-191	2	0.032	R, P
			Total		6191	100.000	

Remarks: * = new record species, P = Phuket, R = Ranong, S = Satun



The average length and reproductive biology of ray

From sampling survey from Ranong, Phuket and Satun fishing ports, the measurement of DW and TL was recorded male and female of 37 species of rays. In addition, the percentage of maturity stage and size at first mature were collected from 30 species of male's ray (Table 6).

Ray was found in both males and females of 28 species most have an average length of female bigger than males. The rays were female with an average length bigger than males from 5 cm, 12 species, namely; *Rhynchobatus australiae*, *Glaucostegus cf. granulatus*, *Rhinobatos punctifer*, *R. schlegelii*, *Okamejei jensenae*, *Dasyatis ushieii*, *Himantura gerrardi*, *H. jenkinsii*, *H. undulata*, *Gymnura japonica*, *G. poecilura* and *Aetobatus ocellatus*. While 10 species were with an average size of males and females were similar, namely; *Rhina ancylostoma*, *D. akajei*, *D. zugei*, *H. imbricata*, *H. . pastinacoides*, *H uarnacoides*, *H. uarnak*, *H. walga*, *Neotrygon kuhlii* and *Taeniura meyeri*. Moreover 4 species of ray were the average size of males bigger than female, namely; *H. granulata*, *Pastinachus atrus*, *P. Sephen* and *Rhinoptera javanica*.

Percentage of maturity stage and size at first mature of 30 species of male's ray found that 9 species, namely; *Rhina ancylostoma*, *Rhynchobatus australiae*, *Himantura gerrardi*, *H. jenkinsii*, *H. pastinacoides*, *H. uarnacoides*, *H. uarnak*, *H. undulata*, and *Gymnura poecilura* less than 50% of size at first mature.

Available sizes at first mature of male in this study were compared with the data from Ali et al. (2014) reported in 25 species of ray in Southeast Asia region. The size first mature of 16 species of rays in this study were smaller than the previous reported. In addition, 7 species of *Glaucostegus cf. granulatus*, *Rhinobatos punctifer*, *R. schlegelii*, *Okamejei jensenae*, *Dasyatis akajei*, *Pastinachus sephen* and *Rhinoptera javanica* were new reported of size at first mature in this region as followed 75, 58, 41, 19, 31, 116 and 112 cm, respectively. This information will be used as a reference in the future.

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Table 6 Mean length and percentage of maturity male rays from sampling.

No.	Scientific name	Number of specimens		Mean TL/DW (cm)		Mature male (%)	Mature male size (cm)	
		male	female	male	female		This study	Reference*
1	<i>Rhina ancylostoma</i>	29	21	92.1	94.4	97.9	114	150-175
2	<i>Rhynchobatus australiae</i>	40	38	75.5	85.3	24.3	106	130
3	<i>R. springeri</i>	1	-	136.0	-	100.0	136	130
4	<i>Glaucostegus cf. granulatus</i>	3	3	92.3	124.3	100.0	75	-
5	<i>Rhinobatos obtusus</i>	-	1	-	65.0	-	-	-
6	<i>R. punctifer</i>	24	65	62.2	71.4	50.0	58	-
7	<i>R. schlegelii</i>	122	318	49.3	62.2	48.9	41	-
8	<i>Narcine prodorsalis</i>	-	1	-	38.0	-	-	-
9	<i>Temera hardwickii</i>	2	-	12.5	-	100.0	11	11-12
10	<i>Okamejei jensenae</i>	20	20	20.5	28.6	75.0	19	-
11	<i>Dasyatis akajei</i>	33	49	37.5	41.5	85.3	31	-
12	<i>D. microps</i>	-	4	-	152.5	-	-	-
13	<i>D. ushiei</i>	2	7	122.0	131.9	0.0	-	117
14	<i>D. zugei</i>	91	70	18.1	20.0	59.8	15	16
15	<i>Himantura fai</i>	-	1	-	73.0	-	-	108-115
16	<i>H. gerardi</i>	268	281	29.3	34.4	9.8	52	46
17	<i>H. granulata</i>	11	11	60.8	46.5	54.6	46	55-65
18	<i>H. imbricata</i>	188	143	15.1	14.9	27.6	13	16
19	<i>H. jenkinsii</i>	55	55	57.1	64.2	45.5	69	70-85
20	<i>H. pastinacoides</i>	13	21	51.0	52.3	38.5	57	43-46
21	<i>H. toshi</i>	1	1	56.0	79.0	100.0	56	-
22	<i>H. uamacooides</i>	59	73	50.1	51.3	27.1	51	50-60
23	<i>H. uamak</i>	39	37	61.3	57.7	40.0	80	82-84
24	<i>H. undulata</i>	18	11	69.1	75.6	33.3	94	60-70
25	<i>H. walga</i>	1211	785	17.5	17.6	65.0	14	16-18
26	<i>Neotrygon kuhlii</i>	886	801	24.8	26.5	27.8	24	26
27	<i>Pastinachus atrus</i>	6	2	102.0	70.5	83.3	91	96-98
28	<i>P. sephen</i>	1	6	116.0	43.8	100.0	116	-
29	<i>Taeniura meyeni</i>	2	3	86.5	90.8	100.0	83	100-110
30	<i>Gymnura japonica</i>	39	75	41.9	47.8	76.9	42	55-59
31	<i>G. poecilura</i>	24	36	29.7	37.3	21.7	33	45
32	<i>G. zonura</i>	1	-	36.0	-	100.0	36	46-50
33	<i>Aetobatus narinari</i>	1	-	72.0	-	0.0	-	-
34	<i>A. ocellatus</i>	16	25	114.6	121.5	87.5	100	100-110
35	<i>Aetomylaeus vesperilio</i>	-	1	-	232.0	-	-	170
36	<i>Rhinoptera javanica</i>	7	11	106.6	62.8	71.4	112	-
37	<i>Mobula japonica</i>	1	1	191.0	115.0	100.0	191	198-205

* Ali, A. and et al. 2014. Field guide to Rays, Skates and Chimaeras of the Southeast Asian Region. SEAFDEC, Malaysia. 289 pp.



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Trawl fishery and catch rate of rays in the Andaman Sea

Sampling data of rays shows trawler as the main gear, where the fishing grounds found at Ko Phayam, Ranong province; Similan Archipelago, Ko Yao Yai, Phang-nga; Ko Racha Yai, Ko Racha Noi, Ko Kaew, Patong, Phuket province; Phi phi island, Ko Lanta, Krabi province; Ko Rok, Trang province; Ko Tarutao, Ko Klang, Ko Koi, Satun province. Trawl fishery was divided to be 2 types, namely; pair trawl and otter board trawl.

Pair trawlers (PT) were lengths of boat 14-26 m with using 2 boats during fishing operation, 6-15 days/ trip. The PT were operated the fish net about 4-5 hauls/day and spent 3-4 hours/haul. The main target of this gear was demersal fish and average catch ranged 5,000 to 30,000 kg/trip. In this study, total number of trip were collected 353 trips, average catch of ray equaled 52.40 kg/trip or 0.025 to 1.486 kg/hr, then it was 4.52 percent of ray from total sampling.

Otter Board trawlers (OPT) were classified to be 2 sizes of fishing vessel, namely; large OPT and small OPT.

Large OPT was the wooden boat, length of boat 18-22 m. The fishing operation was 5-15 days/trip and operated 4-5 hauls/day and spent 3-5 hours/haul. The main target of this gear was demersal fish and average catch ranged 5,000 to 20,000 kg/trip. In this study, total number of trip were collected 2,009 trips, average catch of ray equaled 190.43 kg/trip or 0.005-1.868 kg/hr, then it was 93.48 percent of ray from total sampling.

Small OPT was the wooden boat, length of boat 14 m. The fishing operation only night time were 2-9 days/trip and operated 2 hauls/day and spent 4-5 hours/haul. The main target of this gear was shrimp and average catch ranged 500 to 3,000 kg/trip. In this study, total number of trip were collected 320 trips, average catch of ray equaled 25.61 kg/trip or 0.003-0.167 kg/hr, then it was 2.00 percent of ray from total sampling.

Table 7 Catch of rays by trawls in the Andaman Sea by sampling at fishing ports.

Fishing gear	CPUE (kg/hr)	Fishing trip	CPUE (kg/trip)	Rays (%)
PT	0.025-1.486	353	52.40	4.52
OBT 18-22 m.	0.005-1.868	2,009	190.43	93.48
OBT 14 m.	0.003-0.167	320	25.61	2.00



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Average catch rate of ray from trawl fisheries was relatively low, from 0.003 to 1.868 kg/hr. Large OBT was the main fishing gear (93.48%), followed by PT (4.52%) and small OBT (4.52%), which average catch rate were 190.43, 52.40 and 25.61 kg/trip. The average catch rate in this study was same as the result from previous study (Krajangdara, 2005).

The daily sampling data of shark and ray from trawlers was collected by enumerators at Ranong, Phuket and Satun fishing ports. At Ranong fishing port, the main data collected from large OBT, data from Phuket fishing port was collected from PT and Large OBT, and data from Satun fishing port was collected from small OBT. Table 8 show the high proportion of ray in June, October-November 2013, and January to March 2014 (>39,000 kg), while shark found the high proportion in July and September 2013 (>34,000 kg). The total proportion of ray and shark show 1.52 and 1.16 % of total landing data.

Table 8 Monthly shark and ray sampling data from trawlers, where landed at Ranong, Phuket and Satun fishing ports.

Month	Total catches	Sharks	Rays
Apr,13	1,995,127	15,041	13,734
May	2,282,850	17,518	16,005
Jun	2,402,253	19,490	42,518
Jul	2,380,116	34,372	26,231
Aug	2,176,459	24,566	24,032
Sep	2,326,370	36,735	30,900
Oct	2,335,625	28,140	43,986
Nov	2,227,375	26,767	39,455
Dec	2,202,218	28,811	27,158
Jan,14	2,071,535	28,628	47,208
Feb	2,181,284	27,257	45,939
Mar	2,352,186	26,441	52,094
Total	26,933,398	313,766	409,260
Percentage	100.00	1.16	1.52

Species composition of ray by weight and number showed in Table 9. Seven species found more than 5 % of total sapling weight, namely; *Himantura gerrardi*, *Neotrygon kuhlii*, *H. uarnacoides*, *Aetobatus ocellatus*, *H. jenkinsii*, *H. uarnak* and *Rhina ancylostoma*. In addition, the high abundance by number of fish was *H. walga*, *N. kuhlii*, *H. gerrardi*, *Rhinobatos schlegelii*, *H. imbricata*, *D. zugei* and *H. uarnacoides*. *H. gerrardi*, *N. kuhlii* and *H. uarnacoides* were found the high abundance by weight and number of fish.



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Table 9 Length and species composition of rays found in the Andaman Sea of Thailand

No.	Scientific name	Number of specimens			Mean TL/DW (cm)		Weight		
		Total	male	female	male	female	(g)	(%)	Mean
1	<i>Rhina ancylostoma</i> Bloch & Schneider, 1801	50	29	21	92.1	94.4	551,590	5.094	11,031.80
2	<i>Rhynchobatus australiae</i> Whitley, 1939	78	40	38	75.5	85.3	332,778	3.073	4,266.38
3	<i>R. springeri</i> Compagno & Last, 2010	1	1	-	136.0	-	12,400	0.115	12,400.00
4	<i>Glaucostegus cf. granulatus</i> (Cuvier, 1829)	6	3	3	92.3	124.3	27,050	0.250	4,508.33
5	<i>Rhinobatos obtusus</i> Müller & Henle, 1841	1	-	1	-	65.0	900	0.008	900.00
6	<i>R. punctifer</i> Compagno & Randall, 1987	89	24	65	62.2	71.4	111,620	1.031	1,254.16
7	<i>R. schlegelii</i> Muller & Henle, 1841	440	122	318	49.3	62.2	381,415	3.522	866.85
8	<i>Narcine prodorsalis</i> Bessednov, 1966	1	-	1	-	38.0	710	0.007	710.00
9	<i>Temera hardwickii</i> Gray, 1831	2	2	-	12.5	-	235	0.002	117.50
10	<i>Okamejei jensenae</i> Last & Lim, 2010	40	20	20	20.5	28.6	10,920	0.101	273.00
11	<i>Dasyatis akajei</i> (Muller & Henle, 1841)	82	33	49	37.5	41.5	264,236	2.440	3,222.39
12	<i>D. microps</i> (Annandale, 1908)	4	-	4	-	152.5	315,000	2.909	78,750.00
13	<i>D. ushieii</i> (Jordan & Hubbs, 1925)	9	2	7	122.0	131.9	472,400	4.363	52,488.89
14	<i>D. zugei</i> (Muller & Henle, 1841)	161	91	70	18.1	20.0	35,030	0.324	217.58
15	<i>Himantura fai</i> Jordan & Seale, 1906	1	-	1	-	73.0	12,500	0.115	12,500.00
16	<i>H. gerrardi</i> (Gray, 1851)	549	268	281	29.3	34.4	1,318,490	12.177	2,401.62
17	<i>H. granulata</i> (Macleay, 1883)	22	11	11	60.8	46.5	279,570	2.582	12,707.73
18	<i>H. imbricata</i> (Bloch & Schneider, 1801)	331	188	143	15.1	14.9	38,675	0.357	116.84
19	<i>H. jenkinsii</i> (Annandale, 1909)	110	55	55	57.1	64.2	945,450	8.731	8,595.00
20	<i>H. pastinacoides</i> (Bleeker, 1852)	34	13	21	51.0	52.3	206,790	1.910	6,082.06
21	<i>H. toshi</i> Whitley, 1939	2	1	1	56.0	79.0	15,500	0.143	7,750.00
22	<i>H. uarnacoides</i> (Bleeker, 1852)	132	59	73	50.1	51.3	991,820	9.160	7,513.79
23	<i>H. uarnak</i> (Forsskal, 1775)	76	39	37	61.3	57.7	753,340	6.957	9,912.37
24	<i>H. undulata</i> (Bleeker, 1852)	29	18	11	69.1	75.6	508,240	4.694	17,525.52
25	<i>H. walga</i> (Muller & Henle, 1841)	1996	1211	785	17.5	17.6	382,605	3.533	191.69
26	<i>Neotrygon kuhlii</i> (Müller & Henle, 1841)	1687	886	801	24.8	26.5	1,000,970	9.244	593.34
27	<i>Pastinachus atrus</i> (Macleay, 1883)	8	6	2	102.0	70.5	169,650	1.567	21,206.25
28	<i>P. sephen</i> (Forsskal, 1775)	7	1	6	116.0	43.8	67,780	0.626	9,682.86
29	<i>Taeniura meyeni</i> Muller and Henle, 1841	5	2	3	86.5	90.8	113,950	1.052	22,790.00
30	<i>Gymnura japonica</i> (Temminck & Schlegel, 1850)	114	39	75	41.9	47.8	200,980	1.856	1,762.98
31	<i>G. poecilura</i> (Shaw, 1804)	60	24	36	29.7	37.3	35,220	0.325	587.00
32	<i>G. zonura</i> (Bleeker, 1852)	1	1	-	36.0	-	410	0.004	410.00
33	<i>Aetobatus narinari</i> (Euphrasen, 1790)	1	1	-	72.0	-	4,600	0.042	4,600.00
34	<i>A. ocellatus</i> (Kuhl, 1823)	41	16	25	114.6	121.5	979,540	9.046	23,891.22
35	<i>Aetomylaeus vespertilio</i> (Bleeker, 1852)	1	-	1	-	232.0	90,000	0.831	90,000.00
36	<i>Rhinoptera javanica</i> Muller & Henle, 1841	18	7	11	106.6	62.8	184,690	1.706	10,260.56
37	<i>Mobula japonica</i> (Muller & Henle, 1841)	2	1	1	191.0	115.0	11,000	0.102	5,500.00
		6,191	3,214	2,977			10,828,054	100.000	



Utilization of Ray in the Andaman Sea

The utilization of ray from Ranong, Phuket and Satun fishing ports by trading purposes (Table 10) as follows.

1. Local consumption or processed to be dried fish: most of raw material was small size of ray; namely, *Himantura imbricata*, *H. walga*, *Dasyatis zugei*, *D. akajei*, *Neotrygon kuhlii* and *Gymnura* spp. The price of this fish was 15-65 baht/kg. It is also found that larger size of ray such as, *Dasyatis microps*, *Pastinachus* spp., *Aetobatus ocellatus*, and *Rhinoptera javanica* were to be sold 20-100 baht/kg depending on the size of the fish and quality.
2. The processing of shark fins by using the fin of *Rhynchobatus australiae* and *Rhinobatus* spp. The rest part was processed, salted fish, or sold to fish meal plant with the price of 10-70 baht/kg, depending on the size of fish and freshness of the fish. In addition, the snout part of *Rhinobatus* spp was cooked or prepare to be the Chinese medicine as well.
3. To make jewelry or decoration: special part of thorns row of *Rhina ancylostoma* was prepare the ring setting, while the rest part was processed and salted fish or sale to fish meal plant, a price as the 45-110 baht / kg for fish weighing more than 25 kg if fish was weighs less than 25 kg as a price of 10-40 baht / kg.
4. To make the leather processing: the leather panels on the central body were a solid blister, which can be processed into leather, such as *Himantura gerrardi*, *H. jenkinsii*, *Pastinachus* spp. and *H. uarnacoides*. The meal was sold to fish meal plant; a price was the 15-100 baht/kg depending on the size of the ray. However, if a large size was be auction before sold whole fish.
5. Export to Malaysia was sold to consumer or processed to be salted fish and leather, which selected only the two species of ray, namely; *Himantura uarnak* and *H. undulata*; a price was approximately 20-70 baht / kg, depending on the size and freshness of the fish. However, if a large size was be auction before sold whole fish.
6. To be used as raw material for the production of fishmeal. The rays were too small size and the fish was not fresh, including some species of ray which was not widely consumed. It was sold to a fishmeal plant at 5-10 baht / kg.



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Table 10 The utilization of rays found in the Andaman Sea of Thailand.

No.	Thai name	Scientific name	Sampling site	Utilization	Price* (Baht/kg)
1	โรนิน, กระเบนท้องน้ำ	<i>Rhina ancylostoma</i> Bloch & Schneider, 1801	R	ds, f, s	10-110
2	โรนินจุดขาว	<i>Rhynchobatus australiae</i> Whitley, 1939	R, P, S	c, df, ds, f	35-70
3	โรนินจุดขาวลาย	<i>R. springeri</i> Compagno & Last, 2010	S	c	60
4	โรนินหัวไสยักษ์	<i>Glaucostegus cf. granulatus</i> (Cuvier, 1829)	R	df, f	30-40
5	โรนินจมูกกว้าง	<i>Rhinobatos obtusus</i> Müller & Henle, 1841	R	c, df, f	15-35
6	โรนินหัวใสจุดขาว	<i>R. punctifer</i> Compagno & Randall, 1987	R	c, df, f	15-35
7	โรนินหัวใส, โรนินปุม	<i>R. schlegelii</i> Muller & Henle, 1841	R, P	c, df, f	10-40
8	กระเบนไฟฟ้าจุดเล็ก	<i>Narcine prodorsalis</i> Bessednov, 1966	R	-	-
9	กระเบนไฟฟ้าหลังเรียบ	<i>Temera hardwickii</i> Gray, 1831	R, P	-	-
10	กระเบนไฟฟ้าหลังหนามจุด	<i>Okamejei jensena</i> Last & Lim, 2010	R, P	ds	15-20
11	กระเบนหางหว่าย	<i>Dasyatis akajei</i> (Muller & Henle, 1841)	R, P, S	c, ds, f	5-65
12	กระเบนตาเล็ก	<i>D. microps</i> (Annandale, 1908)	R	ds	20-25
13	กระเบนหางหนาม	<i>D. ushieii</i> (Jordan & Hubbs, 1925)	R, P	ds, f	5-30
14	กระเบนปากแหลม	<i>D. zugei</i> (Muller & Henle, 1841)	R, P, S	c, ds	20-65
15	กระเบนลายดอกไม้	<i>Himantura fai</i> Jordan & Seale, 1906	R	f, l	25
16	กระเบนแมลงวัน, กระเบนบัว	<i>H. gerrardi</i> (Gray, 1851)	R, P, S	c, f, l	20-100
17	กระเบนจุดขาว	<i>H. granulata</i> (Macleay, 1883)	R	ds, f, l	10-25
18	กระเบนบาง, กระเบนปากแหลม	<i>H. imbricata</i> (Bloch & Schneider, 1801)	R, P, S	c, ds, f	5-65
19	กระเบน	<i>H. jenkinsii</i> (Annandale, 1909)	R, P, S	c, ds, f, l	20-100
20	กระเบนบัว	<i>H. pastinacoides</i> (Bleeker, 1852)	R	f, l	35-100
21	กระเบนจุดดำ	<i>H. toshi</i> Whitley, 1939	R	c, f, l	25-70
22	กระเบนจมูกขาว	<i>H. uarnacoides</i> (Bleeker, 1852)	R	f, l	15-90
23	กระเบนลายเสือเล็ก	<i>H. uarnak</i> (Forsskal, 1775)	R, S	c, ds, ex, f, l	20-70
24	กระเบนลายเสือใหญ่	<i>H. undulata</i> (Bleeker, 1852)	R	c, ds, ex, f, l	20-70
25	กระเบนตุ๊กตา, กระเบนบาง	<i>H. walga</i> (Muller & Henle, 1841)	R, P, S	c, ds, f	5-65
26	กระเบนจมูกโต, กระเบนจุดฟ้า	<i>Neotrygon kuhlii</i> (Müller & Henle, 1841)	R, P, S	c, ds	15-65
27	กระเบนธง	<i>Pastinachus atrus</i> (Macleay, 1883)	R	ds, l	15-25
28	กระเบนธง	<i>P. sephen</i> (Forsskal, 1775)	R, S	c, ds, l	10-60
29	กระเบนตกรกระ	<i>Taeniura meyeni</i> Muller and Henle, 1841	R	ds, f	5-15
30	กระเบนผีเสื้อญี่ปุ่น	<i>Gymnura japonica</i> (Temminck & Schlegel, 1850)	R, P, S	c, ds	15-65
31	กระเบนผีเสื้อหางยาว	<i>G. poecilura</i> (Shaw, 1804)	R, P, S	c, ds	15-65
32	กระเบนผีเสื้อหางลาย	<i>G. zonura</i> (Bleeker, 1852)	R	c, ds	15-65
33	กระเบนคางคาว	<i>Aetobatus narinari</i> (Euphrasen, 1790)	S	c, ds	55
34	กระเบนนกปีกแหลม	<i>A. ocellatus</i> (Kuhl, 1823)	R, P, S	c, ds	25-100
35	กระเบนนกกรางกระแสด	<i>Aetomylaeus vesperilio</i> (Bleeker, 1852)	R	ds	50
36	กระเบนจมูกกว้าง, ยี่สน	<i>Rhinoptera javanica</i> Muller & Henle, 1841	R	ds	15-40
37	กระเบนราหูหางหนาม	<i>Mobula japonica</i> (Muller & Henle, 1841)	R, P	ds	40

Remarks: P = Phuket, R = Ranong, S = Satun

c = consumption, df = dried fin, ds = dried salted fish, ex = exported to Malaysia, f = fish meal, l = leather, s = souvenir

* price vary on size, freshness and utilization of ray



Conclusion

The data collection on rays in the Andaman Sea Coast of Thailand project was conducted in April 2556 until March 2557. Species list of rays found 10 families, 17 genera, and 37 species. The high abundance of rays found 7 species, namely; *Himantura walga*, *Neotrygon kuhlii*, *H. gerrardi*, *Rhinobatos schlegelii*, *H. imbricata*, *D. zugei* and *H. uarnacoides* and found the 8 new recorded species in Thai Waters, namely; *Glaucostegus cf. granulatus*, *R. obtusus*, *R. punctifer*, *H. fai*, *H. pastinacoides*, *H. toshi* and *Pastinachus atrus* at Ranong fishing port, *Rhynchobatus springeri* at Satun fishing port.

As the percentage of maturity and size at first mature of 30 species of rays found mainly the average size of males was less than the size at first mature. Percentage of maturity males were less than 50 percent, which were found in rays 9 species, namely, *Rhina ancylostoma*, *Rhynchobatus australiae*, *Himantura gerrardi*, *H. jenkinsii*, *H. pastinacoides*, *H. uarnacoides*, *H. uarnak*, *H. undulata*, and *Gymnura poecilura*. As an indicator that there were 9 species of rays, smaller than utilized prematurely.

For the amount of rays collected from Ranong, Phuket and Satun fishing ports found a ray caught from trawlers was a very small amount (1.52 % of total catch sampling from trawl). The ray caught mainly large OBT, followed by PT and small OBT as 93.48 per cent, 4.52 and 2.00, respectively. The amount of rays in the Andaman Sea was landing mainly at Ranong fishing port, followed by Phuket and Satun fishing ports. Rays were be sole to local consumer, processed into dried fish, jewelry, leather goods and raw materials in the production of fishmeal.

The data from this study will be the database of ray in Thailand. This information will be applied to be the guide of conservation and management of resources ray in Thailand.

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Appendix 1 Checklist of rays in Thai Waters and adjacent areas, 2014.

Family	No.	Thai name	Common name	Scientific name	Status
1) Pristidae	1	ฉนากปากแหลม	Point sawfish	<i>Anoxypristis cuspidata</i> (Latham, 1794)	-
	2	ฉนากยักษ์	Largetooth sawfish	<i>Pristis microdon</i> Latham, 1794	-
	3	ฉนากฟันเล็ก	Smalltooth sawfish	<i>P. pectinata</i> Latham, 1794	-
	4	ฉนากเขียว	Green sawfish	<i>P. zijsron</i> Bleeker, 1851	-
2) Rhinidae	5	โรนิน, กระเบนท้องน้ำ	Bowmouth guitarfish	<i>Rhina ancylostoma</i> Bloch & Schneider, 1801	++
	6	โรนินจุดขาว	Whitespotted wedgfish	<i>Rhynchobatus australiae</i> Whitley, 1939	++
	7	โรนินจุดขาว	Smooth nose wedgfish	<i>R. laevis</i> (Bloch & Schneider, 1801)	++
	8	โรนินจุดขาวลาย	Broadnose wedgfish	<i>R. springeri</i> Compagno & Last, 2010	+
3) Rhinobatidae	9	โรนินเม็ด, อิมุด, อิมุด	Granulated guitarfish	<i>Glaucostegus granulatus</i> (Cuvier, 1829)	+
	10	โรนินหัวจิ้งจก, อิมุด, อิมุด	Clubnose guitarfish	<i>G. thouin</i> (Lacepede, 1798)	+
	11	โรนินหัวไสยักษ์	Thailand granulated guitarfish	<i>Glaucostegus cf. granulatus</i> (Cuvier, 1829)	+
	12	โรนินจมูกกว้าง	Widenose guitarfish	<i>Rhinobatos obtusus</i> Müller & Henle, 1841	+
	13	โรนินหัวใสจุดขาว	Spotted guitarfish	<i>R. punctifer</i> Compagno & Randall, 1987	+
	14	โรนินหัวใส, โรนินปุม	Brown guitarfish	<i>R. schlegelii</i> Muller & Henle, 1841	++
	15	โรนินเม็ด	Granulated shovelnose ray	<i>R. ligonifer</i> (Cantor, 1849)	-
4) Narcinidae	16	กระเบนไฟฟ้าน้ำตาล	Brown numbfish	<i>Narcine brunnea</i> Annandale, 1909	+
	17	กระเบนไฟฟ้าอินเดีย	Largespotted numbfish	<i>N. indica</i> Henle, 1834	+
	18	กระเบนไฟฟ้าจุดเข้ม	Darkfined numbfish	<i>N. maculata</i> (Shaw, 1804)	+
	19	กระเบนไฟฟ้าจุดเล็ก	Tonkin numbfish	<i>N. prodorsalis</i> Bessednov, 1966	+
	20	กระเบนไฟฟ้าจุดดำ	Blackspotted numbfish	<i>N. timlei</i> (Bloch & Schneider, 1801)	+
5) Narkidae	21	กระเบนไฟฟ้าหางจุด, ปลาเสี้ยว	Spottail sleeper ray	<i>Narke dipterygia</i> (Bloch & Schneider, 1801)	+
	22	กระเบนไฟฟ้าหลังเรียบ	Finless sleeper ray	<i>Temera hardwickii</i> Gray, 1831	+
6) Rajidae	23	กระเบนไฟฟ้าหลังหนามจุด	Sulu sea skate	<i>Okamejei jensenae</i> Last & Lim, 2010	+
7) Dasyatidae	24	กระเบนหางหวาย	Whip stingray	<i>Dasyatis akajei</i> (Muller & Henle, 1841)	++
	25	กระเบนหางสั้น	Short tail stingray	<i>D. brevicaudata</i> (Hutton, 1875)	+
	26	กระเบนลาว	Mekong freshwater stingray	<i>D. laosensis</i> Roberts & Karnasuta, 1987	+
	27	กระเบนตาเล็ก	Smalleye stingray	<i>D. microps</i> (Annandale, 1908)	+
	28	กระเบนหางหนาม	Cow stingray	<i>D. ushieii</i> (Jordan & Hubbs, 1925)	+
	29	กระเบนปากแหลม	Sharpnose stingray	<i>D. zugei</i> (Muller & Henle, 1841)	+++
	30	กระเบนขาว	Whiptail stingray	<i>Himantura bleekeri</i> (Blyth, 1860)	++
	31	กระเบนเจ้าพระยา	Giant freshwater stingray	<i>H. chaophraya</i> Monkolprasit & Roberts, 1990	++
	32	กระเบนลายดอกไม้	Pink whipray	<i>H. fai</i> Jordan & Seale, 1906	+
	33	กระเบนแมลงวัน, กระเบนบัว	Whitespotted whip ray	<i>H. gerrardi</i> (Gray, 1851)	+++
	34	กระเบนจุดขาว	Mangrove whip ray	<i>H. granulata</i> (Macleay, 1883)	+
	35	กระเบน, กระเบนปากแหลม	Scaly whip ray	<i>H. imbricata</i> (Bloch & Schneider, 1801)	+++
	36	กระเบน	Golden whip ray	<i>H. jenkinsii</i> (Annandale, 1909)	++
37	กระเบนแมงกลอง	Maekong whipray	<i>H. kittipongi</i> Vidthayanon & Roberts, 2005	+	
38	กระเบนน้ำจืดลาย	Marbled freshwater whip ray	<i>H. krempfi</i> (Chabanaud, 1923)	++	
39	กระเบนน้ำจืด	Longnose marble whip ray	<i>H. oxyrhynchus</i> (Sauvage, 1878)	++	
40	กระเบนบัว	Round whip ray	<i>H. pastinacoides</i> (Bleeker, 1852)	+	



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Appendix 1 (Cont.)

Family	No.	Thai name	Common name	Scientific name	Status
7) Dasyatidae	41	กระเบนน้ำจืดขาว	White-edge whip ray	<i>H. signifer</i> Compagno & Roberts, 1982	++
	42	กระเบนจุดดำ	Black-spotted whipray	<i>H. toshi</i> Whitley, 1939	+
	43	กระเบนจมูกขาว	Whitenose whip ray	<i>H. uarnacoides</i> (Bleeker, 1852)	++
	44	กระเบนลายเสื่อเล็ก	Reticulate whip ray	<i>H. uarnak</i> (Forsskal, 1775)	++
	45	กระเบนลายเสื่อใหญ่	Leopard whip ray	<i>H. undulata</i> (Bleeker, 1852)	++
	46	กระเบนตึกตา, กระเบนบาง	Dwarf whip ray	<i>H. walga</i> (Muller & Henle, 1841)	+++
	47	กระเบนจมูกโต, กระเบนจุดฟ้า	Bluespotted stingray	<i>Neotrygon kuhlii</i> (Müller & Henle, 1841)	+++
	48	กระเบนพริกไทย	Peppered maskray	<i>N. cf. picta</i> Last & White, 2008	+
	49	กระเบนธง	Cowtail stingray	<i>Pastinachus atrus</i> (Macleay, 1883)	+
	50	กระเบนธง	Cowtail stingray	<i>P. sephen</i> (Forsskal, 1775)	++
	51	กระเบนดำ	Pelagic stingray	<i>Pteroplatytrygon violacea</i> (Bonaparte, 1832)	+
	52	กระเบนทอง, กระเบนหิน	Ribbontail stingray	<i>Taeniura lymma</i> (Forsskal, 1775)	++
	53	กระเบนตกกระ	Round ribbontail ray	<i>T. meyeri</i> Muller and Henle, 1841	+
	54	กระเบนใบขนุน	Porcupine ray	<i>Urogymnus asperrimus</i> (Bloch & Schneider, 1801)	+
	8) Gymnuridae	55	กระเบนผีเสื้อญี่ปุ่น	Japanese butterflyray	<i>Gymnura japonica</i> (Temminck & Schlegel, 1850)
56		กระเบนผีเสื้อเผือก	Smooth butterfly ray	<i>G. micrura</i> (Bloch & Schneider, 1801)	++
57		กระเบนผีเสื้อหางยาว	Longtail butterfly ray	<i>G. poecilura</i> (Shaw, 1804)	++
58		กระเบนผีเสื้อ, อ้ายเปี้ยก	Tentacled butterfly ray	<i>G. tentaculata</i> (Muller & Henle, 1841)	-
59		กระเบนผีเสื้อหางลาย	Zonetail butterfly ray	<i>G. zonura</i> (Bleeker, 1852)	++
9) Myliobatidae	60	กระเบนค่างขาว	Spotted eagle ray	<i>Aetobatus narinari</i> (Euphrasen, 1790)	++
	61	กระเบนนกปีกแหลม	Ocellated eagle ray	<i>A. ocellatus</i> (Kuhl, 1823)	++
	62	กระเบนนกจุดขาว	Mottled eagle ray	<i>Aetomylaeus maculatus</i> (Gray, 1834)	+
	63	กระเบนนก	Ocellate eagle ray	<i>A. milvus</i> (Muller & Henle, 1841)	-
	64	กระเบนนกบั้ง	Banded eagle ray	<i>A. nichofii</i> (Bloch & Schneider, 1801)	+
	65	กระเบนนกรางกระแสด	Ornate eagle ray	<i>A. vespertilio</i> (Bleeker, 1852)	+
10) Rhinopteridae	66	กระเบนจมูกวัว, ยี่สน	Flapnose ray	<i>Rhinoptera javanica</i> Muller & Henle, 1841	+
	67	กระเบนจมูกวัว	Indian cow-nose ray	<i>R. sewelli</i> Misra, 1946	-
11) Mobulidae	68	กระเบนราหูเขายาว	Longhorned mobula	<i>Mobula eregoodootenkee</i> (Bleeker, 1859)	+
	69	กระเบนราหูทางหนาม	Spinetail devil ray	<i>M. japonica</i> (Muller & Henle, 1841)	+
	70	กระเบนราหูครีบสั้น	Shortfin devil ray	<i>M. kuhlii</i> (Muller & Henle, 1841)	+
	71	กระเบนราหู	Smoothtail devil ray	<i>M. thurstoni</i> (Lloyd, 1908)	+

สถานภาพ (Status) ของปลากะเบนจากการสำรวจ ณ ทำเทียบเรือประมง

- +++ พบมาก (จำนวนมากและพบเป็นประจำ) [dominant]
- ++ พบทั่วไป แต่ไม่มาก (พบเป็นประจำ) [normal]
- + พบน้อย (นานๆพบ) [rare]
- ไม่พบ (มีเพียงรายงาน) [only recorded]



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Work plan and Timeframe (Duration) the cooperation project between DOF, Thailand and BOBLME

The duration of the Agreement is sixteen (16) months, September 2012 – August 2014 which may now to be extended upto 30th November 2014. A schedule for producing the defined outputs is given in the table below.

Major activities	2012	2013				2014			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Population structure of Indian Mackerel									
1 Organization of sampling programme									
2 Collection and preservation of fish specimen									
3 Genetic laboratory work									
4 Analysis and reporting									
National action Plan for sharks	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1 Review of material and identification of desirable updates									
2 Stakeholder consultations									
3 Drafting of updated plan									
4 Workshop for finalization of plan									
Heavy metals in shark products	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1 Design and organization of sampling and measuring									
2 Sampling and measuring									
3 Analysis and reporting									
Data base on Rays	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1 Design of data base									
2 Preparation of field guide									
3 Training of data collectors									
4 Implementation of surveys									
5 Analysis and reporting									