

DATA COLLECTION ON SHARK FISHERIES IN VIET NAM

Dr. Nguyen Long¹⁴

1. BACKGROUND

During the past decades, development of fishing technology and consumption demand of the shark products made total catch of cartilaginous fishes continuously constant increased. Total catch was estimated to be less than 300,000 tons in 1950, but in 1997 the total catch reached approximately to 800,000 tons (FAO, 1999).

In Vietnam, biological studies of shark have been carrying out since 1970. However, these studies were focussed only on classification and biological characteristics of sharks, but not yet having good enough condition for studying on stock assessment and distribution of sharks in Vietnamese waters. Up to now, there is no statistics on the total catch of cartilaginous fishes. However, interviews of fishermen and summations of different research works on offshore fishing in Vietnam show that shark fisheries started developing after 1980 and reached to the peak of catch in the end of 80's. The main reason would be highly increasing demand on shark fin for export and domestic consumption as well as change of consumption predilection for the productions made from shark such as skin, shark cartilage or shark liver oil.

In this development period, shark fisheries by hook & line and long line has been appeared in some localities such as Quang Binh, Binh Thuan and Vung Tau. However, due to catch of sharks in recent years decreases, fishing fleets specialized in shark fisheries changed their activities to tuna fisheries or both shark and tuna fisheries. In addition, other fishing gears such as trawling net, gillnet, purse seine can catch sharks although the sharks are not considered to be the main target object. And these fishing gears also make considerable decline of shark resource.

In order to sort out the matters on sustainable management approach to shark fisheries, the member ASEAN countries have launched "International Action Plan on Shark monitoring and Management" (IPOA-Shark). Comprehensive researches on shark and information exchange amongst countries are compulsory requirements of this program.

Currently in Vietnam, a completed study on shark has not been available to play as basics for forming policies of sustainable management and resources protection.

2. STUDY METHOD

2.1. Survey Area Selection

The selected survey area shall meet the requirements as follows:

- a) Having developed shark fisheries with remarkable catch.
- b) Being a substantial ecosystem representative of the country.
- c) With favorable conditions for shark processing and consumption; and survey data collection.

Based on the above requirements, two locations, namely Phan Thiet (Binh Thuan province) and Vung Tau (Ba Ria - Vung Tau province) were selected. Main characteristics of 2 areas are described as follows:

¹⁴ Deputy Director, Research Institute for Marine Fisheries Ministry of Fisheries, Viet Nam



Figure 1. Location of Phan Thiet

Phan Thiet located in Binh Thuan province, Phan Thiet is 200 km from Ho Chi Minh and lies south of Cam Ranh bay on the southernmost stretch of Central Vietnam. Phan Thiet is one of a famous place for shark catching as target species by longline. There are 2 main landing sites Phu Quy island and Con Tra for the region. Although Phu Quy seems to have higher volume of landing but Con Tra is easier to access and most of products are processing there. The catch in this area is representative for “deep” sea ecosystem.

+ Ba Ria - Vung Tau:

Vung Tau is an old port located on a 110 km² area, 125 km southeast of Ho Chi Minh city. This city has some shark products possessing. Shark landing in this areas was catching from long line, gillnet and bottom trawl. There are many landing sites in this city. However, Ben Da is a site where shark product mainly landing to compare with others. On the other hand, the site is representative for southern ecosystem and easier to access. Vung Tau is also a famous on trading of shark fin and other products..



Figure 2. Location of Vung Tau

2.2. Data Sources

Data was collected from 2 main sources as follows: survey data and available data in the RIMF (Research Institute for Marine Fisheries).

a) *Survey data in two sites Phan Thiet (Binh Thuan province) and Ba Ria -Vung Tau*

- Data collected from enumerators and researchers of RIMF for 4 quarters.
- Daily data collection for one month per quarter from enumerators.

Collected data:

- Collection of total catches of sharks and non-sharks
- Information on fisheries structure, fishing gears
- Information on local usage and marketing of sharks
- Data collection for one week per quarter per site from researchers

In each study area researchers deal with following data:

- Biological data
 - Species composition
 - Length frequency
 - Sex and maturity
- General description of landing site
- Information on fisheries structure, shark fishing gears
- Information on local usage and marketing of sharks

b) Available data in the RIMF

Data source of RIMF through the ALMRV (Assessment of Marine Living Resource in Vietnam) Project and data of the surveys carried out from 2001 to 2004 in the Tonkin Gulf, Southeast and Southwest areas such as 10 surveys by bottom trawl, 8 surveys by gillnet and 9 surveys by hook & line and long line are used in this report. The boundary of the studied areas is shown in Figure 3.

Estimation method and data analysis:

Data are drawn from the database “Vietfishbase” of RIMF and calculated as follows:

- Catch per Unit Effort (CPUE): the catch obtained in one (01) hour of net drawing up
- Catch per Unit Area (CPUA): the catch per unit of area kg/km^2
- For conversion of the catch of any vessel to the catch of the standard vessel, Babaina formula (1984) is applied:

$$A (\text{standard vessel}) = a (i) * ((S(\text{standard vessel})/s (i))$$

- Where:
- a (i) = average catch (kg/h) of the vessel to be converted
 - S (standard Boat) = the area where net swept over in 1 hour of the standard vessel
 - s (i) = the area where net swept over in 1 hour of the converted vessel
 - A (standard vessel)= converted catch

$$CPUA(\text{kg} / \text{km}^2) = C/A$$

- Where: C is volume in one catch (kg); A is a sweeping area of net (km^2), which is calculated by formula:

$$A = V \times W \times T$$

(V is an average speed of net towing of vessel; W is distance by horizontal of net mouth; T is duration of one haul)

Swept area method of Gulland (1969) is applied to estimate biomass of demersal fish.

Results obtaining after analyzing data:

After analyzing the available data sources of RIMF collected from the surveys by different fishing gears as well as fishing ground and seasons, the following issues are clarified:

1. Identification of species composition of sharks and rays caught in Vietnamese waters in recent years
2. Identification of caught species composition or species groups formed by geographical area, by depths (for trawl fishery) and by main fishing seasons.
3. Estimation on fishing productivity of sharks and rays in Tonkin Gulf, Southeast and Southwest areas.
4. Estimation on standing biomass of some shark species in other waters by otter trawl survey data and swept area method.

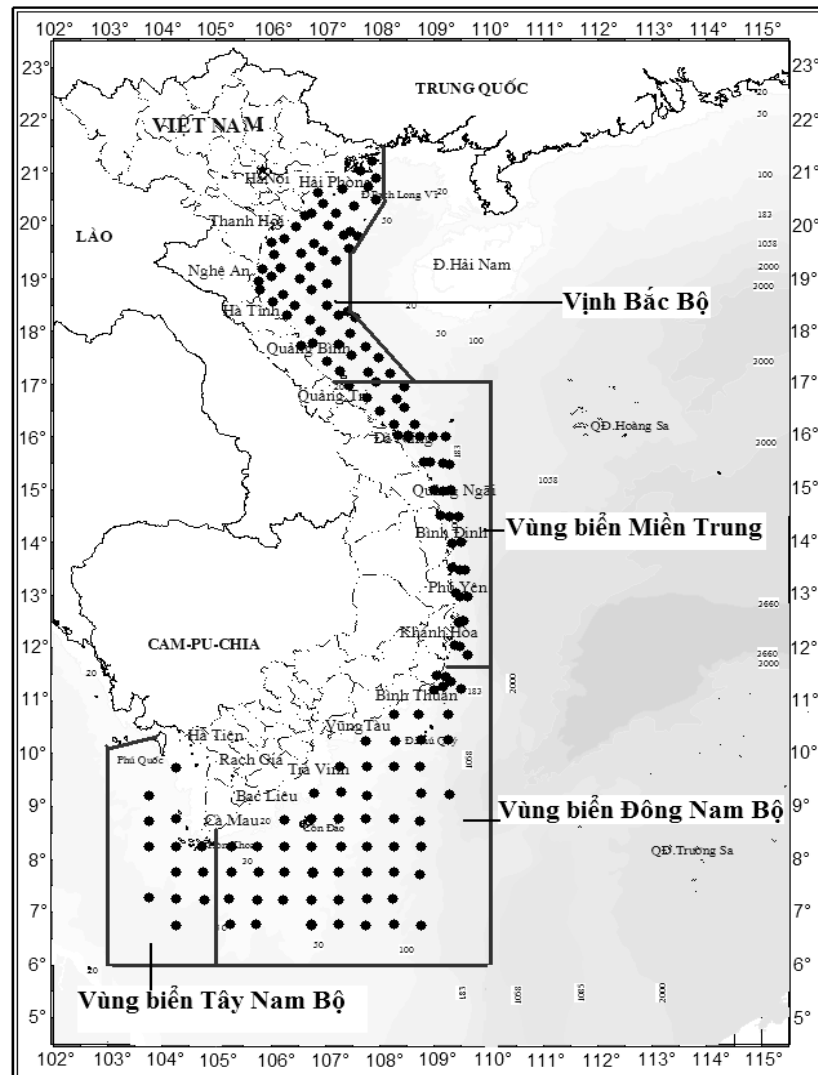


Figure 3. Sketch of Studied Area and Sample Collecting Station System for otter trawl survey

3. RESULTS OF STUDY

3.1. Fisheries Structure of Binh Thuan and Ba Ria - Vung Tau

3.1.1 Fisheries Structure of Binh Thuan Province

Fishery is developed in Binh Thuan province. According to the statistics of province, up to the end of 2003, total number of fishing boats is 5,168 with total capacity of 254,237 hp. In general, size of fishing boats in Binh Thuan is small: 89.5% of total fishing boats with engine capacity < 90 hp. Only 542 fishing boats have engine capacity >90 hp and correspond to 10.5% of the total number of fishing boats of the whole province. Total fishery production reached 138,000 tons. Binh Thuan is one of few provinces in Vietnam has offshore shark fishery. Currently, there are 1,464 shark boats, however, shark production becomes less and less. Therefore, only about 100 boats of Phu Quy island are still specialized on shark fishery. The remaining boats change their function to tuna, snapper and grouper or cutterfish & squid fishery, etc.

Table 1. Fishing Boat Fleet by Capacity in Binh Thuan Province (Up to 30 March 2004)

Locality	Capacity (hp)					Total (nos)
	<20	20÷ 45	46÷ 89	90÷ 299	≥300	
Tuy Phong	240	420	373	62	4	1,099
Bac Binh	4	6	2			12
Phan Thiet	363	780	830	223	24	2,220
Ham Thuan Nam	71	13				84
Ham Tan	145	336	567	175	15	1,238
Phu Quy	68	202	205	24	8	507
Exploitation enterprise				1	6	7
Joint Venture			1			1
Total	891	1,757	1,978	485	57	5,168

Table 2. Fishing Boat Fleet by Fishing Gear Group in Binh Thuan Province (Up to 30 March 2004)

Locality	Fishing gear group (nos.)							Total (nos)
	Trawl	Seine	Gillnet	Lift net	Hook & line	Push net	Service boat	
Tuy Phong	315	110	254	114	306			1,099
Bac Binh	2			6	4			12
Phan Thiet	809	175	458	332	361	78	7	2,220
Ham Thuan Nam			53	13	18			84
Ham Tan	413	114	246	166	298	1		1,238
Phu Quy	1	4	2	6	471		23	507
Exploitation enterprise		1			5	1		7
Joint Venture					1			1
Total	1,540	404	1,013	637	1,464	80	30	5,168

Other activities of the fishery in Binh Thuan include:

- Aquaculture area: 3,300 ha
- Processing factory/enterprise: 66 enterprises purchase and process marine products, among which 27 enterprises are in charge of processing and export of marine products.
- Fishing ports: there are 4 fishing ports, namely Phan Ri Cua, Phan Thiet, La Gi and Phu Quy fishing ports. Besides these fishing ports, some landing sites exist, such as Chi Cong, Lien Huong, Phuoc The, Mui Ne, Cua Phu Hai, Cua Ba Dang, etc.
- Boat repair and building enterprise: there are 17 enterprises, in which 3 enterprises are capable to build wooden hull for the boats of more than 300 hp.
- Manpower:
 - Fishing: 61,600 persons
 - Aquaculture: 2,830 persons
 - Fisheries processing: 8,180 persons
 - Fisheries service: 1,740 persons

3.1.2. Fisheries Structure of Ba Ria - Vung Tau

Fishery in Ba Ria - Vung Tau is developed highly. To the end of 2003, total number of fishing boats was 5,210 with total capacity of 457,900 hp. Size of fishing boats in Ba Ria - Vung Tau is rather large. 1,962 boats with capacity >90 hp exist that account for some 37.66% of the total number of fishing boats of the whole province.

In Ba Ria - Vung Tau, number of boats specialized in trawl and hook & line fishing is rather high. There are 1,951 boats doing trawl fishery, 705 boats doing gillnet fishery and 1,273 boats doing hook & line fishery. Sharks and rays are often caught by these fishing gears. Although percentage of caught volume of sharks and rays in a catch was not high and they are not the target catching objects, total volume per year is not small.

Table 3. Fishing Boat Fleet by Capacity in Ba Ria - Vung Tau Province (Up to 30 March 2004)

Locality	Capacity (hp)					Total (nos)
	< 20	20 ÷ 45	46 ÷ 89	90 ÷ 140	≥ 140	
Vung Tau	640	188	257	102	402	1,589
Xuyen Moc	233	256	83		1	573
Long Dat	495	305	488	628	817	2,733
Tan Thanh	87	56	6			149
Ba Ria	22	46				68
Con Dao	75	7	2	1	2	87
Con Dao Import -Export Company					8	8
Ho Sen Import -Export Company		2			1	3
Total	1,552	860	836	731	1,231	5,210

Table 4. Fishing Boat Fleet by Fishing Gear Group in Ba Ria - Vung Tau Province (Up to 30 March 2004)

Locality	Fishing gear group (nos.)						Total (nos)
	Trawl	Seine	Gillnet	Hook & line	Fixed net	Others	
Vung Tau	636	11	100	258	93	491	1,589
Xuyen Moc	1	1		547		24	573
Long Dat	1,291	380	605	353		104	2,733
Tan Thanh	13			2	2	132	149
Ba Ria				41		27	68
Con Dao	1			72		14	87
Con Dao Import -Export Company	8						8
Ho Sen Import -Export Company	1					2	3
Total	1,951	392	705	1,273	95	794	5,210

Based on the statistics for September 2004, detailed information on the fishery in Ba Ria - Vung Tau include:

- Fishermen of the province: 30,892 persons
- Boat repair and building enterprise: 07 enterprises
- Fishing ports: there are 4 fishing ports, namely Cat Lo, Ben Da, Ben Dinh and Phuoc Tinh fishing ports. Besides these fishing ports, some landing sites exist, such as Long Hai, Sao Mai, Bai Truoc, Bai Sau, (belong Vung Tau), Phuoc Hai, Loc An and etc.
- In the province, there are 180 enterprises trade in fish powder processing, canned fish processing, frozen and dry products processing and general business.

3.1.3 Fishing Gears Used in Shark Catching

The fishing gears used in shark catching can be divided into 2 groups:

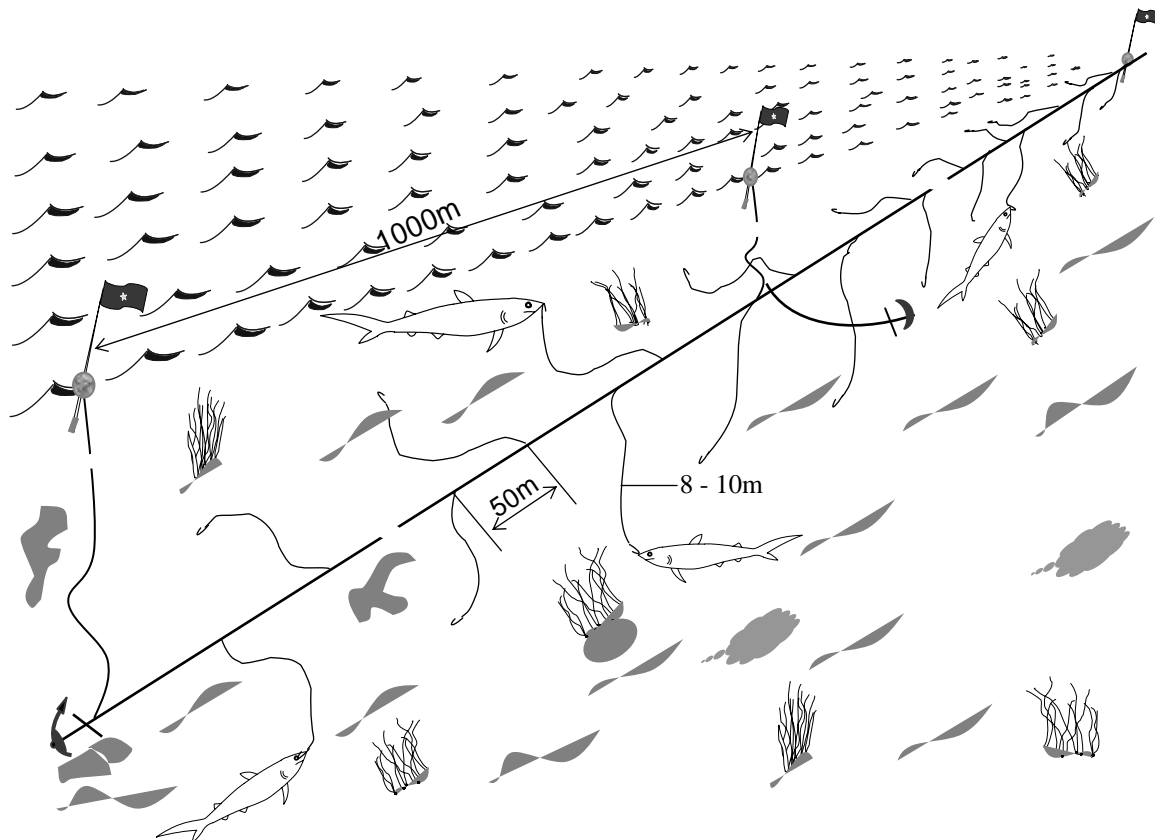
- The fishing gears specialized for shark catching:* the main fishing gear for catching shark is long line. Shark fishery was developed strongly in Vietnam from the end of 80's to 90's. Shark fishery is being developed in the central provinces, particularly in Phu Quy island (Binh Thuan province)

Fishing boat used popularly has hull length of 14-17m with engine of 45-60 hp. Season for shark catching lasts from January to September. The highest catch of shark can be reached from March to June.

Due to small size, fishing boats can operate offshore from March to June, which is the period of calm sea and also of the highest catch.

Length of long line often used ranges from 15 km to 30 km with 300 to 600 hooks respectively. Small pelagic fishes or 200gr of tuna or dolphin fish per hook is used as bait.

Catching of sharks by hook and line reaches high volume. Rate of sharks to the total fishery products is very high, which accounts for 45-100%. In every fishing trip, catch of sharks reaches 400 - 4,000 kg per boat.



Number of hooks : 300 - 600
Length of line : 15 - 30 km

Figure 4. Diagram of shark Long Line Fishery

- b) *Fishing gears can be used for shark catching (shark is not target catching object):* Some fishing gears can be used for catching sharks. The most considerable gears are trawling net and gillnet. During their operation, these gears can catch sharks and rays. Although volume of shark in one catch is not high (only about 0.7 – 1%), number of fishing boats and total fishery products by these 2 fishing gears is extremely high. Therefore, total catch of sharks and rays is remarkable.

3.2 Conducted Surveys

3.2.1 Survey No.1

This survey was carried out from 31 December 2004 to 15 January 2004 in Vung Tau and Phan Thiet.

The researchers made interviews to fishermen of trawlers, purse seiners, gillnet and long line boats at landing sites on the caught volume of sharks in the fishing trip and total caught products. Survey results are shown in Table 5.

- *Vung Tau*: interviews were made to fishermen of 86 fishing boats, which consist of 24 trawlers and 62 gill net boats. Volume of shark in one catch made up 0.03% of the total in case by trawl and 0.58% - by gill net.
- *Phan Thiet*: interviews were made to fishermen of 24 fishing boats, which consist of 10 trawlers and 14 gill net boats. Volume of shark in one catch made up 0.08% of the total in case by trawl and 1.1% - by gill net.

Table 5. Rate of Shark Catch by Some Fishing Gears in the Survey No.1

Survey area	Fishing gear	No. of boats to be interviewed	Catch of shark (kg)	Fishery products excluding sharks (kg)	Total catch (kg)	Rate of shark (%)
Vung Tau	Trawl	24	65	217,701	217,766	0.03%
	Gill net	62	1,007	172,283	173,290	0.58%
Phan Thiet	Trawl	10	45	55,771	55,816	0.08%
	Gill net	14	452	40,667	41,119	1.1%

3.2.2 Survey No.2

This survey was carried out from 23 March 2004 to 09 April 2004 in Vung Tau and Phan Thiet. Besides the results obtained from the researchers, there were data collected from the local collaborators. Survey results are shown in Table 6.

Table 6. Rate of Shark Catch by Some Fishing Gears in the Survey No.2

Survey area	Fishing gear	No. of boats to be interviewed	Catch of shark (kg)	Fishery products excluding sharks (kg)	Total catch (kg)	Rate of shark (%)
Vung Tau	Pair trawl	75	269	2,293,426	2,293,695	0.01%
	Single trawl	60	357	2,849,568	2,849,925	0.01%
	Gill net	120	6,659	429,322	435,981	1.53%
	Seine	35	0	196,740	196,740	0.00%
	Others	61	0	10,856	10,856	0.00%
	Total	351	7,285	5,779,912	5,787,197	0.13%
Phan Thiet	Pair trawl	1	10	2,000	2,010	0.50%
	Single trawl	9	45	38,500	38,545	0.12%
	Gill net	3	200	11,000	11,200	1.79%
	Seine	12	0	41,600	41,600	0.00%
	Long line	195	27,788	93,830	121,618	22.85%
	Others	77	0	31,730	31,730	0.00%
Total	297	28,043	218,660	246,703	11.37%	

- *Vung Tau*: 351 boats with different fishing gears had been interviewed. The catch of shark was 7,285 kg and total catch excluding sharks was 5,779,912 kg. Rate of shark volume to the total fishery products was lowest in case by seine (0%), then by single trawl and pair trawl(0.1%) and highest in case by gill net (1.53%). And rate of shark volume catching by all these fishing gears was 0.13%.
- *Phan Thiet*: 297 boats with different fishing gears have been interviewed. The catch of shark was 28,043 kg and total catch excluding sharks was 218,660 kg. Rate of shark volume

catching by seine was (0%), by single trawl ~ 0.12% and pair trawl was 0.5% and by gill net was 1.79%. The highest rate of shark volume was reached by long line fishery (22.85%). And rate of shark volume catching by all these fishing gears was 11.37%.

In Phu Quy island (Binh Thuan province) shark fishery by hook and line exists. As for the boats catching sharks by long line, rate of the caught shark volume is very high and higher than the other fishery products, which reaches to 45.9 – 100%. The highest volume of sharks caught in one trip is 1,970 kg. It is clearly shown in Table 7.

Table 7. Volume of Sharks Caught by Long Line in Binh Thuan

Register No. of boat	Fishing gears	Volume of shark (kg)	Volume of fishery products excluding sharks (kg)	Total catch (kg)	Rate of shark (%)
BTH8243	Long line	170	200	370	45.9
BTH8641	Long line	722	0	722	100
BTH8479	Long line	1,240	520	1,760	70.5
BTH8201	Long line	1,800	1,600	3,400	52.9
BTH8168	Long line	420	350	770	54.5
BTH8322	Long line	370	150	520	71.2
BTH8617	Long line	1,520	600	2,120	71.7
BTH8135	Long line	1,600	150	1,750	91.4
BTH8191	Long line	1,510	190	1,700	88.8
BTH8133	Long line	1,420	100	1,520	93.4
BTH8559	Long line	1,970	100	2,070	95.2
BTH8217	Long line	1,230	0	1,230	100

3.2.3 Survey No.3

This survey was carried out from 12 July 2004 to 02 August 2004 in Vung Tau and Phan Thiet.

Table 8 - Rate of Shark Catch by Some Fishing Gears in the Survey No.3

Survey area	Fishing Gear	No. of boats to be interviewed	Catch of shark (kg)	Fishery products excluding sharks (kg)	Total catch (kg)	Rate of shark (%)
Phan Thiet	Pair trawl	72	300	46,500	46,800	0.64
	Single trawl	68	0	105,800	105,800	0
	Gill net	29	590	44,700	45,290	1.3
	Seine	8	0	4,562	4,562	0
	Long line	432	47,687	538,350	586,037	8.14
	Others	125	0	192,800	192,800	0
	Total		734	48,577	932,712	981,289
Vung Tau	Pair trawl	166	2,504	7,290,090	7,292,594	0.03
	Single trawl	69	529	2,437,459	2,437,988	0.02
	Gill net	115	10,088	540,750	550,838	1.83
	Seine	103	0	1,580,000	1,580,000	0
	Long line	0	0	0	0	0
	Others	62	0	50,494	50,494	0
	Total		515	13,121	11,898,793	11,911,914

- *Phan Thiet*: 734 boats by some fishing gears have been interviewed. The catch of shark was 48,577 kg and total catch excluding sharks was 932,712 kg. Rate of shark volume to the total fishery products was lowest in case by seine (0%) , single trawl and other fishing gears, then by pair trawl(0.64%) , gill net (1.3%) and highest in case by long line (8.14%). And rate of shark volume catching by all these fishing gears was 4.95%.
- *Vung Tau*: 515 boats by some fishing gears have been interviewed. The catch of shark was 13,121 kg and total catch excluding sharks was 11,898,793 kg. Rate of shark volume catching by seine and long line was (0%), by single trawl – 0.02% and pair trawl was 0.03% and by gill net was 1.83 % . Data was not collected from long line fishery . And rate of shark volume catching by all these fishing gears was 0.11%.

3.2.4 Survey No.4

This survey was carried out from 20 October 2004 to 05 November 2004 in Vung Tau and Phan Thiet. Besides, survey forms of the local collaborators made from July to November were included. Survey results are shown in Table 9.

Table 9 - Rate of Shark Catch by Some Fishing Gears in the Survey No.4

Survey area	Fishing gear	No. of boats to be interviewed	Catch of shark (kg)	Fishery products excluding sharks (kg)	Total catch (kg)	Rate of shark (%)
Phan Thiet	Pair trawl	4	0	34,000	34,000	0
	Single trawl	65	0	190,500	190,500	0
	Gill net	1	100	12,000	12,100	0.83
	Seine	18	0	75,000	75,000	0
	Long line	-	-	-	-	-
	Others	-	-	-	-	-
	Total	88	100	311,500	311,600	0.03
Vung Tau	Pair trawl	123	2,045	6,366,339	6,368,384	0.03
	Single trawl	55	740	2,139,592	2,140,332	0.03
	Gill net	70	13,618	396,463	410,081	3.43
	Seine	80	0	1,380,400	1,380,400	0
	Long line	-	-	-	-	-
	Others	40	0	30,740	30,740	0
	Total	368	16,403	10,313,534	10,329,937	0.16

- *Phan Thiet*: 88 boats by different fishing gears have been interviewed. The catch of shark was 100 kg and total catch excluding sharks was 311,500 kg. Rate of shark volume to the total fishery products was lowest in case by seine , single trawl and pair trawl(0%), highest in case by gill net (0.83%). And rate of shark volume catching by all these fishing gears was 0.03%.
- *Vung Tau* : 368 boats by some fishing gears have been interviewed. The catch of shark was 16,403 kg and total catch excluding sharks was 10,313,534 kg. Rate of shark volume catching by seine was (0%), by single trawl and pair trawl was 0.03% .The highest rate of shark volume was reached by gill net (3.43%) . The long line fishery for shark was stopped in this time because bag weather. And rate of shark volume catching by all these fishing gears was 0.16%.

3.3 Use and Trade of Shark

3.3.1 Use of shark

In Vietnam, sharks are processed and traded as follows:

- *Fresh shark*: the caught sharks are kept fresh and in whole in the trawlers and gill net boats until landing. As for the shark of more than 6-7 kg, its fin will be cut, but the shark of less than 6 kg will be sold in whole unit with fin.
- *Dried shark*: dried shark can be seen in the long line boats. They usually go fishing offshore, so the caught sharks are dried up: dried fish meat, dried skin and dried bone.
- *Liver of shark*: livers of sharks are cut into small parts then processed into oil and contained in plastic cans.
- *Stomach of shark*: stomachs of sharks are used as food
- *Fin of shark*: fins of sharks are preferable product for export

3.3.2 Trade of shark

Shark products are traded in different markets:

- Fresh shark meat is sold in domestic market
- Dried shark meat is sold in market of Ho Chi Mink city, which can be processed into pieces soaked in spices.
- Skin, bone and liver of shark: are exported to China. According to survey data, there are 3 big magnates, who specializes in buying sharks. Volume of shark skin bought by one magnate in 2003 was 14 tons. Only in the first quarter of January 2004 one magnate bought 5 tons of skin and 50 kg of bone.
- In Phu Quy island (Binh Thuan province), in the first 6 months of 2003, 137 tons of shark meat and 3.9 tons of fin are reached.
- Price of shark products: according to the surveys in markets of 2 provinces, prices of shark products are shown in Table 10.

Table 10. Prices of Shark Products

Name of products	Price/kg	
	VND	USD
Dried skin	90,000	6.00
Head bone	90,000	6.00
Other bones	10,000	0.66
Dried fin – class 1 (>42 cm)	600,000 – 700,000	40 – 46.67
Dried fin – class 2 (>32 cm)	300,000 – 350,000	20.00 – 23.33
Dried fin – class 3 (>22 cm)	120,000 – 150,000	8.00 – 10.00
Dried fin – class 4 (>12 cm)	40,000 – 50,000	2.67 – 3.33
Dried fin – class 5 (<12 cm)	20,000 – 30,000	1.33 – 2.00
Fresh fish with fin	10,000 – 12,000	0.67 – 0.80
Fresh fish without fin	8,000	0.53
Dried fish meat	30,000-35,000	1.9– 2.3

Table 11. Local Consumption and Marketing of Shark

Species	Part	Shark Source		Abundance at Landing site	Locally consumed (C) Discarded (D), Traded (T), Processed (type of processing)	Local price per kg (VND)	Market destination Local (L) ; Out (O)
		Type of fishing boat (HP)	Type of fishing gear				
1. <i>Atopias pelagicus</i>	All	33-60	Gn	++	(C), (T)	12.000	L, O
2. <i>Carcharhinus brachiurus</i>	All	33-60	Gn	+	C, T, P	12.000	L, O
3. <i>Carcvharhinus falciformis</i>	All	100 – 500	Tr	+	T, P	15.000	O
4. <i>Carharhinus sorah</i>	All	33 – 500	Tr, Gn, Lo	+++	C, T, P	15.000	L, O
5. <i>Mustelus griseus</i>	All	33-60	Gn	+	C, T	10.000	L
6. <i>Chiloscyllium griseum</i>	All	100-500	Tr	+	C, T	12.000	L
7. <i>Stegostoma fasciatum</i>	All	100-500	Tr	++	C, T	10.000	L
8. <i>Heterodontus zebra</i>	All	100-500	Tr	+	C, T	12.000	L, O
9. <i>Heptranchias perlo</i>	All	33-60	Gn	+	C, T	12.000	L, O
10. <i>Chiloscyllium plagisoum</i>	All	100-500	Tr	++	C, T	10.000	L
11. <i>Halaelurus buergeri</i>	All	33-500	Tr, Gn	+	C, T	10.000	L
12. <i>Atelomycterus marmoratus</i>	All	100-500	Tr	++	C, T	10.000	L
13. <i>Sphyrna lewini</i>	All	33-500	Tr, Gn	++	C, T, P	12.000	L, O

1. Give abundance as follow: rarely (+), relatively common (++), abundant to plentiful (+++)
2. Give currency (Dong) and currency exchange rate with US\$ during 2004 (1 US\$ = 15,550 D)
3. Tr = Trawl ; Gn = Gill net ; Pn = Purse seine ; Lo = Long line .



Figure 5. Dried Shark Meat Sold in Ba Ria Market

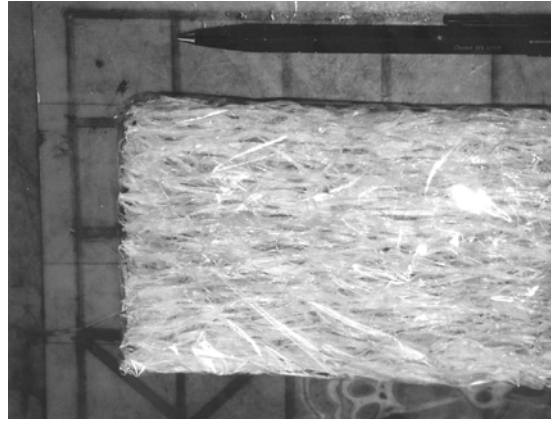


Figure 6. Finished Shark Fins Sold in Shops at a shop next to Con Cha landing site, Phan Thiet



Figure 7. Dried Shark Skin Sold in Shops at a shop next to Con Cha landing site, Phan Thiet



Figure 8. Finished Shark Fins Sold in Shops at a shop next to Con Cha landing site, Phan Thiet



Figure 9. Finished Shark Fins Sold in Shops at a shop next to Con Cha landing site, Phan Thiet

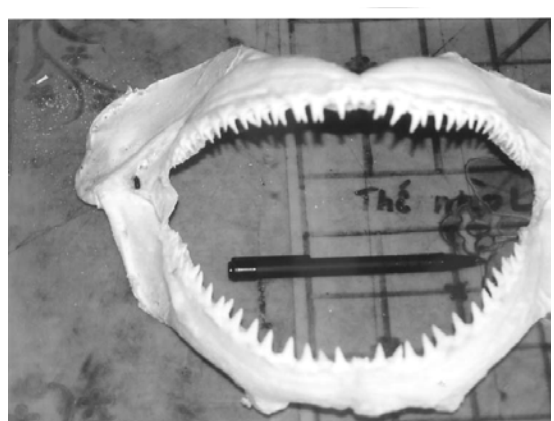


Figure 10. Dried Shark Teeth Sold in Shops

3.4 Biological Analysis

3.4.1 Caught shark species

In 4 surveys, the researchers conducted investigations in fishing berths. 13 species under 10 genera of 8 families were seen, including:

- I. Family: ***Alopiidae* (C, nh, m @u<i dui)**
- I.1. Genus: *Alopias Rafinesque, 1810*
- I.1. Species: *Alopias pelagicus* Nakamura, 1935

- II. Family: ***Carcharhinidae* (C, mÊp)**
- II.2. Genus: *Carcharhinus Blainville, 1816*
- II.2. Species: *Carcharhinus brachyurus* (Günther, 1870), Copper shark
- II.3. Species: *Carcharhinus falciformis* (Müller and Henle, 1839), **Silky shark**
- II.4. Species: *Carcharhinus sorahh* (Mulleret Henle, 1841)
- II.3. Genus: *Mustelus Linck*
- II.5. Species: *Mustelus griseus* Pietschmann, 1908

- III. Family: ***Hemiscyllidae* (C, nh, m r©u)**
- III.4. Genus: *Chiloscyllium Muller et Henle, 1837*
- III.6. Species: *Chiloscyllium griseum* (Müller and Henle, 1838) (C, nh, m chã)
- III.7. Species: *Chiloscyllium plagiosum* (Bennett, 1830)

- IV. Family: ***Heterodontidae* (C, nh, m hæ)**
- IV.5. Genus: *Heterodontus blainville, 1816*
- IV.8. Species: *Heterodontus zebra* (Gray, 1831)

- V. Family: ***Hexanchidae* (Nh, m 1 v©y l-ng)**
- V.6. Genus: *Heptranchias Rafinesque, 1810*
- V.9. Species: *Heptranchias perlo* (Bonaterre, 1788)

- VI. Family: ***Orectolobidae* (Hä c, nh, m tróc)**
- VI.7. Genus: *Stegostoma Müller et Henle, 1837*
- VI.10. Species: *Stegostoma fasciatum* (Hermann, 1783)

- VII. Family: ***Scyliorhinidae* (C, nh, m mĩo)**
- VII.8. Genus: *Halaelurus Gill, 1861*
- VII.11. Species: *Halaelurus buergeri* (Müller et Henle, 1841)
- VII.9. Genus: *Atelomycterus Garman, 1913* (**Giêng c, nh, m chÊm**)
- VII.12. Species: *Atelomycterus marmoratus* (Bennett, 1830), Coral cat shark

- VIII. Family: ***Sphyrnidae* (C, nh, m bóa)**
- VIII.10. Genus: *Sphyrna Rafinesque, 1810*
- VIII.13. Species: *Sphyrna lewini* (Griffith, 1834)

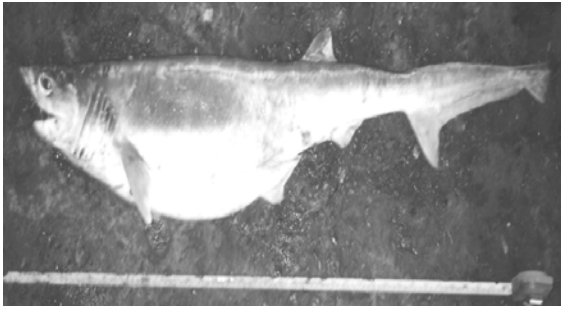


Figure 11. *Heptanchias Perlo*

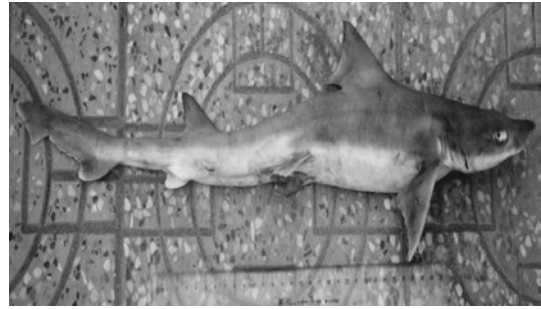


Figure 12. *Mustelus Griseus*



Figure 13. *Carcharhinus Sorrah*
(Müller and Henle, 1839) (*C, mĒp miÖng réng*) at fishing berth Con Cha, Phan Thiet

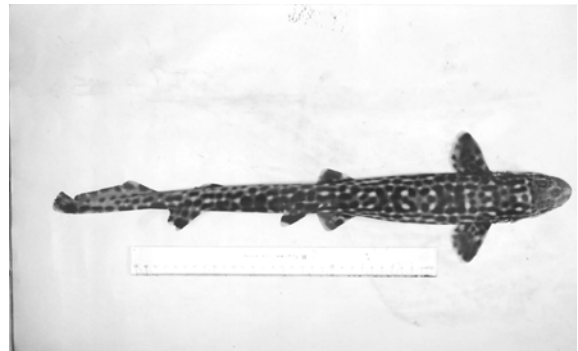


Figure 14. *Atelomycterus Marmoratus*
(Bennett, 1830) (*C, nh, m chĒm*) at fishing berth Con Cha, Phan Thiet



Figure 15. *Chiloscylidium plagiosum*
(Bennett, 1830) (*C, nh, m tróc v»n*) at fishing berth Con Cha, Phan Thiet



Figure 16. *Chiloscylidium griseum*
(Müller and Henle, 1838) (*C, nh, m chã*) at fishing berth Cat Lo – Vung Tau



Figure 17. *Heterodontus zebra* (Gray, 1831) (C, nh, m hæ) and *Chiloscyllium plagiosum* (Bennett, 1830) (C, nh, m tróc v»n) at fishing berth Cat Lo - Vung Tau



Figure 18. *Sphyrna lewini* (Griffith, 1838) (C, nh, m bóa) at Vung Tau

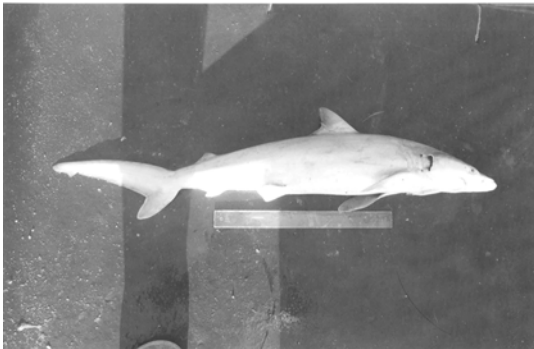


Figure 19. *Carcharhinus brachyurus* (C, mÉp @u«i ng³/n) at Con Cha, Phan Thiet

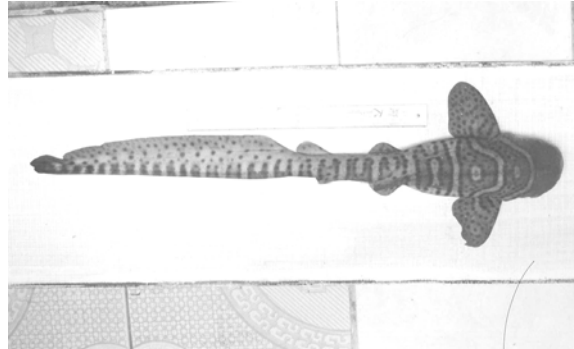


Figure 20. *Stegostoma fasciatum* (C, nh, m nhu m×) at Con Cha, Phan Thiet



Figure 21. *Halaaelurus buergeri* (Müller et Henle 1841)

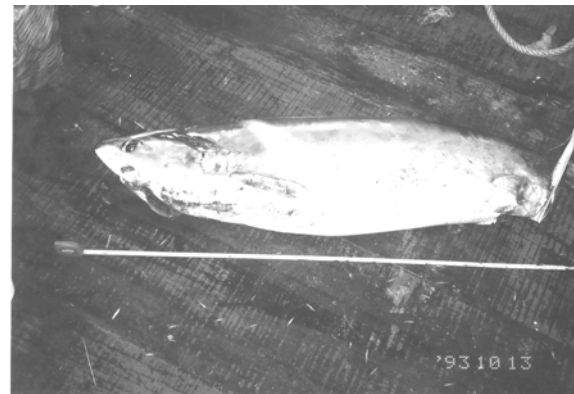


Figure 22. *Alopias pelagicus* (The fin was cut)



Figure 23. *Carcharhinus falciformis* (Müller and Henle, 1839) at Fishing Berth in Con Cha, Phan Thiet

3.4.2 Biological analysis for surveys

- **Survey No.1 (January 2004)**

Table 12. Species Composition of Shark in January 2004 Caught by Gill Net

No.	Latin name	Local name	Quantity (unit)	Volume (kg)
1	<i>Stegostoma fasciatum</i>	Nhu Mi	1	1.5
2	<i>Carcharhinus sorrah</i>	Map mieng rong	7	52
3	<i>Sphyrna lewini</i>	Nham bua	1	1.1

Table 13. Species Composition of Shark in January 2004 Caught by Trawl

No.	Latin name	Local name	Quantity (unit)	Volume (kg)
1	<i>Chiloscyllium plagiosum</i>	Truc van	12	8.05
2	<i>Chiloscyllium griseum</i>	Truc van	1	0.25
3	<i>Halaelurus buergeri</i>	Nham hoa mai	4	3
4	<i>Heterodontus zebra</i>	Nham ho, nham van	4	17

Table 14. Shark Species Composition (January) in Binh Thuan and Vung Tau

Shark species	Total sample (kg) for 2 places x 7 days	Species observed (days)	% of total sampled catch
Do not fill	Do not fill	Do not fill	
1. <i>Stegostoma fasciatum</i>	1.5	1	1.80
2. <i>Carcharhinus sorrah</i>	52	5	62.73
3. <i>Sphyrna lewini</i>	1.1	1	1.33
4. <i>Chiloscyllium plagiosum</i>	8.05	4	9.71
5. <i>Chiloscyllium griseum</i>	0.25	1	0.30
6. <i>Halaelurus buergeri</i>	3	2	3.62
7. <i>Heterodontus zebra</i>	17	3	20.51
Total	82.9	Do not fill	Do not fill

Table 15. Sample Species for Biological analyses from collected samples in Binh Thuan and Vung Tau (January)

Shark species	Mean length (cm)	Sex		Maturity (% in each category of maturity)
		% male	% female	
1. <i>Stegostoma fasciatum</i>	75	0	100	-
2. <i>Carcharhinus sorrah</i>	93-123	43	57	-
3. <i>Sphyrna lewini</i>	61	0	100	-
4. <i>Chiloscyllum plagiosum</i>	35-78	58	42	-
5. <i>Chiloscyllum griseum</i>	49	0	100	-
6. <i>Halaaelurus buergeri</i>	59-62	0	100	-
7. <i>Heterodontus zebra</i>	59-81	50	50	-

See in Annx. 1 , Fig. 20 ; 13 ; 18 ; 15 ; 16 ; 21 ; 17.

• **Survey course No.2 (March - April 2004)**

Table 16. Species Composition of Shark in March - April 2004 Caught by Trawl

No.	Latin name	Local name	Quantity (unit)	Volume (kg)
1	<i>Chiloscyllium griseum</i>	Nh ₂ m chã	93	164,86
2	<i>Chiloscyllium plagiosum</i>	Tróc v»n	6	1,13
3	<i>Stegostoma fasciatum</i>	Nhu m×	12	14,6

Table 17. Study on Species Composition of Shark in March - April 2004 Caught by Gill Net

No.	Latin name	Local name	Quantity (unit)	Volume (kg)
1	<i>Alopias pelagicus</i>	Nh ₂ m chuét	2	107
2	<i>Hepranchias perlo</i>	Nh ₂ m 1 v©y l-ng	1	3.8
3	<i>Mustelus griseus</i>	Nh ₂ m tro	1	0.5

Biological study was carried out on sex, length, volume, maturity of every individual. Number of samples to be studied is shown in the table below.

Table 18. Shark Species Composition (March - April) in Binh Thuan and Vung Tau

Shark species	Total sample (kg) for 2 places x 7 days	Species observed (days)	% of total sampled catch
Do not fill	Do not fill	Do not fill	
<i>Chiloscyllum griseum</i>	164.86	6	54.16
<i>Chiloscyllum plagiosum</i>	1.13	2	0.37
<i>Stegostoma fasciatum</i>	14.6	3	4.80
<i>Alopias pelagicus</i>	107	2	35.15
<i>Hepranchias perlo</i>	3.8	1	1.25
<i>Mustelus griseus</i>	0.5	1	0.16
<i>Carcharhinus sorrah</i>	12.5	1	4.11
Total	304.39	Do not fill	Do not fill

Table 19. Sample Species for Biological Study (March - April) in Binh Thuan and Vung Tau

Shark species	Mean length (cm)	Sex		Maturity (% in each category of maturity)
		% male	% female	
<i>Chiloscyllum griseum</i>	43-107	56	44	-
<i>Chiloscyllum plagiosum</i>	32-40	0	100	-
<i>Stegostoma fasciatum</i>	35-88	63	27	-
<i>Alopias pelagicus</i>	255	-	-	-
<i>Hepranchias perlo</i>	104.5	0	100	100 in stage 5
<i>Mustelus griseus</i>	55	100	0	100 in stage 2
<i>Carcharhinus sorrah</i>	130	100	0	100 in stage 2

See in Annx . 2 , Fig. 16 ; 15 ; 20 ; 22 ; 11 ; 12 ; 13.

Table 20 - Number of Individuals to be Studied Biologically in 2 Survey Courses

No.	Latin name	Number of individual (unit)	
		Course No.1	Course No.2
1	<i>Stegostoma fasciatum</i>	1	38
2	<i>Carcharhinus sorrah</i>	7	1
3	<i>Chiloscyllum plagiosum</i>	12	4
4	<i>Sphyrna lewini</i>	1	
5	<i>Chiloscyllum griseum</i>	1	93
6	<i>Halaelurus buergeri</i>	4	2
7	<i>Heterodontus zebra</i>	4	
8	<i>Hepranchias perlo</i>	1	
9	<i>Mustelus griseus</i>		1
10	<i>Alopias pelagicus</i>		1
	Total	171	

• **Survey course No.3 (July - August 2004)**

In July 2004, the researchers made biological classification for 326 individuals of 07 species, they were:

- *Carcharhinus sorrah*: 301 individuals
- *Chiloscyllium plagiosum*: 6 individuals
- *Carcharhinus falciformis*: 1 individuals
- *Atelomyctes marmoratus*: 2 individuals
- *Sphyrna lewini*: 2 individuals
- *Chiloscyllium griseum*: 13 individuals
- *Heterodontus zebra*: 1 individuals

With an aim to assess development period of individuals of each species, the individuals of each species were divided by weight group for the species of much individuals, which are *carcharhinus sorrah* and *chiloseyllium griseum*. Average weight and length of the above species were calculated and shown in Tables 21 and 22.

Table 21. Average Weight and Length of *Carcharhinus Sorrah*

Group by weight (kg)	Quantity (individual)		Rate (%)		Average weight (kg)		Average body length Ls (cm)		Average total length Lt (cm)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
<1	32	21	60.38	39.62	0.82	0.85	41.47	42.21	59.77	60.21
1 ÷ 2	104	77	57.46	42.54	1.27	1.31	47.13	47.05	67.55	67.74
2.1 ÷ 4	6	2	75	25	2.65	3.33	60.42	64.0	83.25	87.25
4.1 ÷ 10	16	10	61.54	38.46	6.6	8.57	79.0	87.7	110.19	121.9
> 10	30	3	90.9	9.1	11.42	13.97	90.73	101.0	126.68	130.67

Table 21 shows that:

- Rate of male fish accounts for 62.5% and female 37.5%
- Average weigh of female fish in one group is higher than male fish
- Average length of female fish in one group is larger than male fish

Table 22. Average Weight and Length of *Chiloscyllium Griseum*

Group by weight (kg)	Quantity (individual)		Rate (%)		Average weight (kg)		Average body length Ls (cm)		Average total length Lt (cm)	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1 – 2	4	3	57,14	42,86	1,70	1,62	56,50	53,70	76,88	73,17
> 2	3	3	50	50	2,60	2,57	64,00	65,30	86,00	83,67

Table 22 shows that:

- Rate of male fish accounts for 53.8% and female - 46.2%.
- Average weight of male fish in one group is higher than female male fish
- Average length of male fish in one group is large than female fish

Besides 2 species which have been identified, namely *Carcharhinus sorrah* and *Chiloseyllium griseum*, *Chiloscyllium plagiosum* in one group have nearly the same weight and length.

Table 23. Species Composition of Sharks Caught by Gill Net in July 2004

No.	Latin name	Local name	Binh Thuan		Ba Ria – Vung Tau	
			Quantity (individual)	Volume (kg)	Quantity (individual)	Volume (kg)
1	<i>Carcharhinus sorrah</i>	C, mẾp			125	237.77
2	<i>Sphyrna lewini</i>	C, nh, m cươ			1	3.6

Table 24 - Species Composition of Sharks Caught by Trawl in July 2004

No.	Latin name	Local name	Binh Thuan		Ba Ria - Vung Tau	
			Quantity (individual)	Volume (kg)	Quantity (individual)	Volume (kg)
1	<i>Chiloscyllium griseum</i>	C, nh, m chấ mươ tro			13	27.15
2	<i>Chiloscyllium plagiosum</i>	C, nh, m tróc v»n	6	4.95	1	3.1
3	<i>Heterodontus zebra</i>	C, nh, m hæ			1	1.9
4	<i>Atelomycterus marmoratus</i>	C, nh, m chẾm	1	0.43		
5	<i>Carcharhinus falciformis</i>	C, mẾp nhần	1	80.0		

Table 25. Biological Study on Sharks in July 2004

No.	Latin name	Local name	Sex	Maturity	Full of stomach	Volume (kg)	Length (cm)	
							Ls	Lt
1	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Male	II	3	10.7	86	122
2	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Female	II	3	9.2	89	125
3	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Male	JUV	3	1.2	48	66
4	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Female	JUV	3	1.1	44	63
5	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Male	II	4	10.7	86	122
6	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Female	VI -2	3	8.3	86	119
7	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Female	VI-2	3	8.6	90	123
8	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Female	VI-2	4	8.2	86	120
9	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Male	JUV	3	1.5	45	64.5
10	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Female	JUV	2	1.3	47.5	67.5
11	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Male	II	0	1.4	48.1	70.5
12	<i>Carcharhinus sorrah</i>	C, mẾp tr³⁄⁴ng	Female	JUV	1	1.1	44	63
13	<i>Chiloscyllium plagiosum</i>	C, nh, m tróc v»n	Female	V	3	1.9	57	77
14	<i>Chiloscyllium plagiosum</i>	C, nh, m tróc v»n	Female	V	4	2.2	59	81
15	<i>Chiloscyllium plagiosum</i>	C, nh, m tróc v»n	Female	II	3	0.18	27	38.5
16	<i>Chiloscyllium plagiosum</i>	C, nh, m tróc v»n	Male	III	4	0.25	31	43
17	<i>Chiloscyllium plagiosum</i>	C, nh, m tróc v»n	Male	II	3	0.15	26	36.5
18	<i>Chiloscyllium plagiosum</i>	C, nh, m tróc v»n	Male	II	3	0.27	29	42
19	<i>Atelomycterus marmoratus</i>	C, nh, m chÊm	Female	V	4	0.43	37	42
20	<i>Chiloscyllium griseum</i>	C, nh, m chã mµ tro	Male	III	2	2.2	60	81
21	<i>Chiloscyllium griseum</i>	C, nh, m chã mµ tro	Female	IV	3	2.0	58	79.5

Notes: Ls: body length of fish; Lt: total length of fish

In the table of biological study for the survey carried out in July 2004, the researchers analyzed 25 individuals of 4 species:

- *Carcharhinus sorrah* (C, mẾp miÖng réng): 12 individuals
- *Chiloscyllium plagiosum* (C, nh, m tróc v»n): 6 individuals
- *Atelomycterus marmoratus* (C, nh, m chÊm): 1 individual
- *Chiloscyllium griseum* (C, nh, m chã mµ tro): 2 individuals

Table 25 shows that:

1. *Carcharhinus sorrah* .
 - As for the individual of less than 2 kg, gonad has not been developed, even of male and female fishes
 - As for the individual of 8.2-10.7 kg, female fish has past reproduction period and male fish is in stage II development
2. *Chiloscyllium plagiosum* .
 - As for the individual of 0.15-0.27 kg, both male and female fishes are in stage II maturity
 - As for the individual of 1.9-2.2 kg, they are in stage V maturity
3. *Atelomycterus marmoratus*
 - As for the individual of 0.43 kg, it is in stage V maturity

4. *Chiloscyllium griseum* .

- Most of individuals of ≥ 2 kg are in stage III or IV maturity

Almost of individuals analyzed in the survey in July 2004 have eaten rather fully.

Table 26. Shark Species Composition (July) in Binh Thuan and Vung Tau

Shark species	Total sample (kg) for 2 places x 7 days	Species observed (days)	% of total sampled catch
Do not fill	Do not fill	Do not fill	
<i>Carcharhinus sorrah</i>	237.77	9	66.25
<i>Sphyrna lewini</i>	3.6	1	1.00
<i>Chiloscyllium griseum</i>	27.15	1	7.56
<i>Chiloscyllium plagiosum</i>	8.05	4	2.24
<i>Heterodontus zebra</i>	1.9	1	0.53
<i>Atelomycterus marmoratus</i>	0.43	1	0.12
<i>Carcharhinus falciformis</i>	80.0	1	22.29
Total	358.9	Do not fill	Do not fill

Table 27. Sample Species for Biological Study (July) in Binh Thuan and Vung Tau

Shark species	Mean length (cm)	Sex		Maturity (% in each category of maturity)
		% of male	% of female	
<i>Carcharhinus sorrah</i>	44-90	42	58	33% in stage 2 42% in stage 4 25% in stage 6
<i>Sphyrna lewini</i>				
<i>Chiloscyllium griseum</i>	58-60	50	50	50% in stage 3 50% in stage 4
<i>Chiloscyllium plagiosum</i>	26-59	50	50	50% in stage 2 33% in stage 5 22% in stage 3
<i>Atelomycterus marmoratus</i>	37	0	100	100% in stage 5
See in Annx . 3 , Fig. 13 ; 18 ; 16 ; 15 ; 14.				

• **Survey course No.4 (November 2004)**

In the survey on shark in October and November 2004 in Binh Thuan and Ba Ria - Vung Tau, the researchers made biological study for only 63 individuals of 6 species. Biological study of these individuals was made in Phan Thiet (Binh Thuan). Biological study was not made in Ba Ria - Vung Tau because the researchers could not see sharks in landing site due to it was time of middle of lunar phase.

Biological study was made for the following species of sharks:

- *Atelomycterus marmoratus* (C, nh, m chÊm): 14 individuals
- *Stegostoma fasciatum* (C, nh, m nhu m×): 1 individual
- *Chiloscyllium plagiosum* (C, nh, m tróc v>n): 1 individual
- *Chiloscyllium griseum* (C, nh, m chã mµu tro): 1 individuals
- *Carcharhinus brachyurus* (C, mËp @u<i ng³4n): 1 individual
- *Carcharhinus sorrah* (C, mËp miÖng réng): 45 individuals

Table 28. Biological Study for Shark (November 2004)

No.	Latin name	Local name	Sex (Male,Female)	Volume (Kg)	Length (cm)	
					Ls	Lt
1	<i>Atelomycterus marmoratus</i> (Bennett, 1830)	C, Nh, m ChÊm	Female	0,67	47,0	59,0
2	-	-	Male	0,22	33,0	41,5
3	-	-	Male	0,13	27,7	35,5

4	-	-	Female	0,27	33,3	43,0
5	-	-	Female	0,17	28,0	36,0
6	-	-	Female	0,14	29,0	37,0
7	-	-	Male	0,10	25,5	32,0
8	-	-	Female	0,12	27,5	34,5
9	-	-	Female	0,11	26,7	33,6
10	-	-	Male	0,11	27,3	34,0
11	-	-	Female	0,10	25,0	31,5
12	-	-	Female	0,08	24,5	30,7
13	-	-	Male	0,05	21,2	27,2
14	-	-	Male	0,23	32,5	42,0
15	<i>Stegostoma fasciatum</i> (Hermann, 1783)	C, Nh, m Nhu Mx	Male	0,84	34,0	68,7
16	<i>Chiloscyllium plagiosum</i> (Bennett, 1830)	C, Nh, m Tróc V»n	Male	0,08	20,4	28,5
17	<i>Chiloscyllium griseum</i> (Müller and Henle, 1838)	C, Nh, m Chã Mµu Tro	Male	2,35	62,5	86,0
18	<i>Carcharhinus sorrah</i> (Müller and Henle, 1839)	C, MËp MiÖng Réng	Female	2,85	59,0	84,0
19	-	-	Male	2,75	57,0	82,0
20	-	-	Male	2,80	57,5	82,0
21	-	-	Male	2,80	57,0	82,5
22	-	-	Female	2,80	59,0	84,6
23	-	-	Female	2,95	59,5	85,0
24	-	-	Male	5,10	72,0	101,0
25	-	-	Male	3,40	69,0	98,0
26	-	-	Male	3,20	67,0	96,0
27	-	-	Male	2,45	54,0	73,0
28	-	-	Male	5,60	71,0	98,0
29	-	-	Male	2,35	54,0	72,5
30	-	-	Male	3,40	69,5	95,0
31	-	-	Male	2,20	58,5	80,0
32	-	-	Male	5,70	70,0	102,0
33	-	-	Female	2,85	60,0	84,5
34	-	-	Female	1,70	52,0	74,0
35	-	-	Male	11,20	91,0	123,0
36	-	-	Female	9,60	86,0	119,0
37	-	-	Male	14,00	98,0	140,0
38	-	-	Male	10,80	101,0	135,0
39	-	-	Male	11,20	96,0	129,0
40	-	-	Male	11,30	91,0	125,0
41	-	-	Female	9,50	87,0	121,5
42	-	-	Male	14,40	102,0	136,0
43	-	-	Male	14,10	96,0	131,0
44	-	-	Female	7,50	78,0	112,0
45	-	-	Female	9,50	84,0	118,0
46	-	-	Male	11,30	91,0	124,0
47	-	-	Male	2,50	55,0	73,0
48	-	-	Female	2,80	58,5	84,4
49	-	-	Male	5,50	70,0	97,0
50	-	-	Male	3,30	68,0	94,0
51	-	-	Male	5,60	70,0	101,0
52	-	-	Male	11,40	91,5	124,0
53	-	-	Male	5,70	71,0	101,0
54	-	-	Female	9,50	86,0	118,5
55	-	-	Male	11,20	91,0	122,0
56	-	-	Female	2,80	60,0	84,0
58	-	-	Male	5,10	71,0	100,0
59	-	-	Male	1,95	51,0	70,5
60	-	-	Female	1,83	49,0	68,5
61	-	-	Male	2,70	56,0	82,0
62	-	-	Male	1,65	52,0	73,5
63	<i>Carcharhinus brachyurus</i> (Günther, 1870)	C, MËp şu«i Ng³/4n	Male	2,47	57,0	78,0

Table 29. Species Composition Caught by Gill Net in Binh Thuan in October 2004

No.	Latin name	Local name	Quantity (individual)	Volume (kg)
1	<i>Stegostoma fasciatum</i>	C, Nh ₃ m Nhu M×	1	0.84
2	<i>Carcharhinus brachyurus</i>	C, MẾp §u«i Ng¾n	1	2.47
3	<i>Carcharhinus sorrah</i>	C, MẾp MiÕng Réng	22	111.70

Table 30. Biological analyses of Shark

No.	Latin name	Local name	Sex	Maturity	Full of stomach	Volume (kg)	Length (cm)	
							Ls	Lt
1	<i>Atelomycterus marmoratus</i>	C, Nh ₃ m ChÊm	Female	IV	3	0.67	47.0	59.0
2	-	-	Male	II	4	0.22	33.0	41.5
3	-	-	Male	I	1	0.13	27.7	35.5
4	-	-	Female	I	2	0.27	33.3	43.0
5	-	-	Female	I	4	0.17	28.0	36.0
6	-	-	Female	I	1	0.14	29.0	37.0
7	-	-	Male	II	3	0.10	25.5	32.0
8	-	-	Female	I	2	0.12	27.5	34.5
9	-	-	Female	I	2	0.11	26.7	33.6
10	-	-	Male	I	1	0.11	27.3	34.0
11	-	-	Female	I	1	0.10	25.0	31.5
12	-	-	Female	I	0	0.08	24.5	30.7
13	-	-	Male	I	1	0.05	21.2	27.2
14	-	-	Male	II	2	0.23	32.5	42.0
15	<i>Stegostoma fasciatum</i>	C, Nh ₃ m Nhu M×	Male	II	4	0.84	34.0	68.7
16	<i>Chiloscyllium plagiosum</i>	C, Nh ₃ m Tróc V»n	Female	I	4	0.08	20.4	28.5
17	<i>Chiloscyllium griseum</i>	C, Nh ₃ m Chã Mµu Tro	Male	III	3	2.35	62.5	86.0
18	<i>Carcharhinus brachyurus</i>	C, MẾp §u«i Ng¾n	Male	II	1	2.47	57.0	78.0
19	<i>Carcharhinus Sorrah</i>	C, MẾp MiÕng Réng	Female	II	1	2.85	59.0	84.0
20	-	-	Male	II	4	2.75	57.0	82.0
21	-	-	Male	I	3	2.45	54.0	73.0
22	-	-	Male	II	3	14.10	96.0	131.0
23	-	-	Female	I	2	9.50	87.0	121.2
24	-	-	Female	I	2	2.80	60.0	84.0
25	-	-	Male	II	4	3.30	68.0	94.0
26	-	-	Male	JUV	1	1.95	51.0	70.5
27	-	-	Female	JUV	1	1.83	49.0	68.5
28	-	-	Male	I	2	2.70	56.0	82.0
29	-	-	Male	JUV	1	1.65	52.0	73.5

Notes: - Ls: body length of fish; Lt: total length of fish

Referring to the above table of biological study on sharks made in the survey in October and November 2004 in Binh Thuan and Ba Ria – Vung Tau, 29 sharks of 4 species were analyzed.

- *Atelomycterus marmoratus* (C, nh₃m chÊm): 14 individuals
- *Stegostoma fasciatum* (C, nh₃m nhu m×): 1 individual
- *Chiloscyllium plagiosum* (C, nh₃m tróc v»n): 1 individual
- *Chiloscyllium griseum* (C, nh₃m chã mµu tro): 1 individuals
- *Carcharhinus brachyurus* (C, mẾp §u«i ng¾n): 1 individual
- *Carcharhinus sorrah* (C, mẾp miÕng réng): 11 individuals

The table shows that:

- *Atelomycterus marmoratus* (c, nh, m chÊm) of 0.05-0.27 kg, including male and female fishes, have gonad in development of stage I and II. Only one individual of 0.67 kg is in stage IV.
- As for *Carcharhinus sorrah* (c, mËp miÖng réng) of less than 2 kg including both male and female individuals, their gonads have not been developed clearly. As for the individual of 2.45 kg, including male and female ones, their gonads are in stage I and II development.

Table 31. Shark Species Composition (November) in Binh Thuan and Vung Tau

Shark species	Total sample (kg) for 2 places x 7 days	Species observed (days)	% of total sampled catch
Do not fill	Do not fill	Do not fill	
<i>Atelomycterus marmoratus</i>	2.5	3	0.92%
<i>Stegostoma fasciatum</i>	0.84	1	0.31%
<i>Chiloscyllium plagiosum</i>	0.08	1	0.03%
<i>Chiloscyllium griseum</i>	2.35	1	0.87%
<i>Carcharhinus brachyurus</i>	2.47	1	0.91%
<i>Carcharhinus sorrah</i>	262.83	6	96.96%
Total	271.07	Do not fill	Do not fill

Table 32. Sample Species for Biological Study (November) in Binh Thuan and Vung Tau

Shark species	Mean length (cm)	Sex		Maturity (% in each category of maturity)
		% male	% female	
<i>Atelomycterus marmoratus</i>	21.2 - 47	50	50	71% in stage 1 21% in stage 2 8% in stage 4
<i>Stegostoma fasciatum</i>	34	100	0	100% in stage 2
<i>Chiloscyllium plagiosum</i>	20.4	0	100	100% in stage 1
<i>Chiloscyllium griseum</i>	62.5	100	0	100% in stage 3
<i>Carcharhinus brachyurus</i>	57	100	0	100% in stage 2
<i>Carcharhinus sorrah</i>	49-96	64	36	36% in stage 2 36% in stage 1 28% in stage 4
See in Annex. 4 , Fig. 14 ; 20 ; 15 ; 16 ; 19 ; 13.				

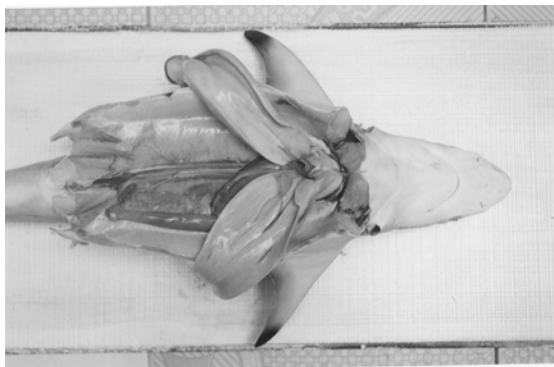


Figure 24. Biological Study for *Carcharhinus sorrah* in Phan Thiet

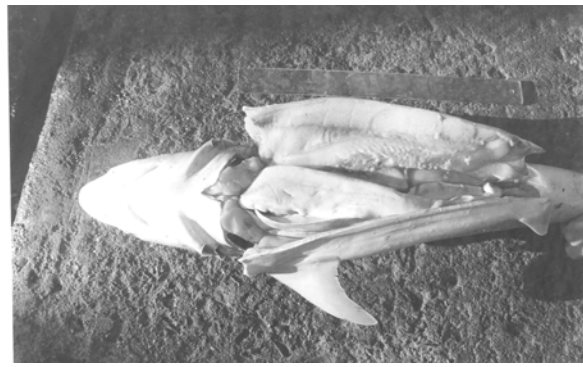


Figure 25. Biological Study for *Carcharhinus brachyurus* in Phan Thiet

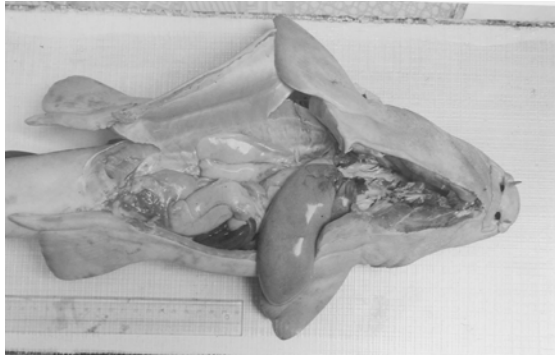


Figure 26. Biological Study for *Chiloscyllium griseum* in Phan Thiet

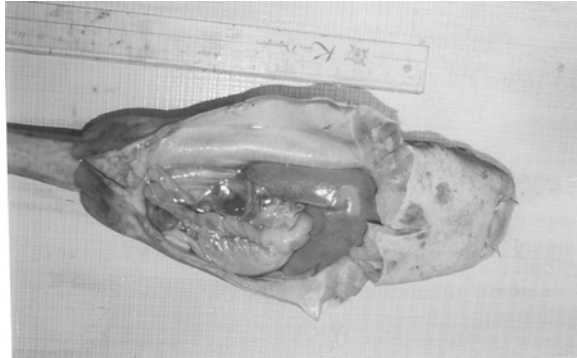


Figure 27. Biological Study for *Stegostoma fasciatum* in Phan Thiet

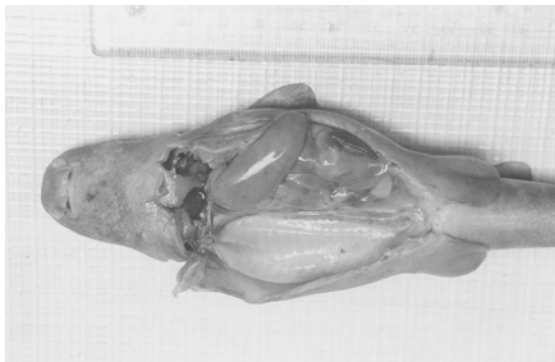


Figure 28. Biological Study for *Chiloscyllium plagiosum* in Phan Thiet



Figure 29. Biological Study for *Atelomycterus marmoratus* in Phan Thiet

4. STUDY RESULTS BASED ON SURVEY DATA OF RIMF

4.1. Species Composition

Results of surveys conducted by 10 cruises of trawl, 8 cruises of gill net and 9 cruises of hook & line and long line showed that, 38 species of cartilaginous fish that belong to 14 families have been identified in the Vietnamese waters, of which 16 species of sharks and 22 species of rays. The detailed information on species composition of the catch is shown in Table 33.

Table 33. Species Composition of Cartilaginous Fish Caught in the Vietnamese Waters

Group	Name of family	Name of Species	English name	Vietnamese name
R A Y S	Dasyatidae	<i>Dasyatis kuhlii</i>	Bluespotted stingray	Cá Đuối
		<i>Dasyatis zugei</i>	Pale-edged stingray	Cá Đuối
		<i>Taeniura meyeni</i>	Blotched fantail ray	Cá Đuối đen
	Gymnuridae	<i>Gymnura japonica</i>	Japanese butterflyray	Cá Đuối đen
		<i>Gymnura poecilura</i>	Longtail butterfly ray	Cá Đuối bướm hoa
		<i>Gymnura sp.</i>	Butterfly ray	Cá Đuối bướm
	Myliobatidae	<i>Aetobatus flagellum</i>	Longheaded eagle ray	Cá ó
		<i>Aetomylaeus nichofii</i>	Banded eagle ray	Cá ó
		<i>Mobula diabolus</i>	not known	Cá ó dơi
		<i>Mobula japonica</i>	Spinetail mobula	Cá Đuối dơi
		<i>Mobula sp.</i>	Manta	Cá Đuối dơi
	Narcinidae	<i>Narcine indica</i>	Largespotted numbfish	Cá Đuối điện
		<i>Narcine maculata</i>	Darkfinned numbfish	Cá Đuối điện
<i>Narcine sp.</i>		Numbfish	Cá Đuối điện	

S H A R K S		<i>Narcine timlei</i>	Blackspotted numbfish	Cá Đuối điện
		<i>Narke japonica</i>	Japanese sleeper ray	Cá Đuối điện
	Rhinobatidae	<i>Platyrhina limboonkengi</i>	Amoy fanray	Cá Đuối
		<i>Platyrhina sinensis</i>	Fanray	Cá Đuối đĩa Trung hoa
		<i>Rhinobatos hynnicephalus</i>	Angel fish	Cá Đuối lưới cày
		<i>Rhinobatos schlegelii</i>	Yellow guitarfish	Cá Đuối lưới cày
		<i>Rhinobatos sp.</i>	Guitarfish	Cá Đuối lưới cày
	Rhynchobatidae	<i>Rhynchobatus djiddensis</i>	Giant guitarfish	Cá Giống sao (lưới cày)
	Alopiidae	<i>Alopias pelagicus</i>	Pelagic thresher	Cá Nhám
	Carcharhinidae	<i>Carcharhinidae</i>	Requiem sharks	Cá Nhám
		<i>Carcharhinus albimarginatus</i>	Silvertip shark	Cá Nhám
		<i>Carcharhinus dussumieri</i>	Whitecheek shark	Cá Nhám
		<i>Carcharhinus falciformis</i>	Silky shark	Cá mập Mã lai
		<i>Carcharhinus galapagensis</i>	Galapagos shark	Cá mập
		<i>Carcharhinus sorrah</i>	Spottail shark	Cá mập
	Hemiscylliidae	<i>Chiloscyllium griseum</i>	Grey bambooshark	Cá Nhám trúc vằn
		<i>Chiloscyllium plagiosum</i>	Whitespotted bambooshark	Cá Nhám trúc vằn
		<i>Chiloscyllium sp.</i>	Carpet shark	Cá Nhám trúc vằn
	Heterodontidae	<i>Heterodontus zebra</i>	Zebra bullhead shark	Cá Nhám hồ
	Sphyrnidae	<i>Sphyrna lewini</i>	Scalloped hammerhead	Cá Nhám búa
		<i>Sphyrna mokarran</i>	Great hammerhead	Cá Nhám búa
		<i>Sphyrna zygaena</i>	Smooth hammerhead	Cá Nhám búa
	Squalidae	<i>Squalus sp.</i>	Piked dogfish	Cá Nhám góc
Stegostomatidae	<i>Stegostoma fasciatum</i>	Zebra shark	Cá Nhu mỹ	
Triakidae	<i>Mustelus griseus</i>	Spotless smooth-hound	Cá Nghoéo	

The Table 33 showed that:

- In the Tonkin Gulf: 23 species of cartilaginous fish of 10 different families have been identified, of which 8 species were sharks (belonging to 5 families) and 15 species of rays (of the remaining 5 families).
- In the Southeast Area: 24 species of cartilaginous fish of 12 different families have been identified: 11 species of shark s(of 7 families) and 13 species of rays of 5 remaining families.
- In the Southwest Area: 16 species of cartilaginous fish of 7 different families were found: 8 species of sharks (of 4 families) and 8 species of rays of 3 remaining families.

In conclusion, the comparison of species composition made for these waters at the same time, showed that the highest number of cartilaginous fish as well as species of sharks can be found in the Southeast area. However, the waters of the highest number of catch of rays is in the Tonkin Gulf.

4.2. Catch Per Unit of Efforts (CPUE) by Bottom Trawl

4.2.1. Shark

In the Tonkin Gulf, CPUE of the period 2001-2004 in southwest monsoon gradually decreases from 0.57 kg/h (± 1.17) in 2001 to 0.35 kg/h (± 1.01) and then to 0.34 kg/h (± 0.9) in 2003 and 2004. Change of catch by depths is not so clear. In general, catch at the depth of 30-50m exceeds an average level. (Figure 30)

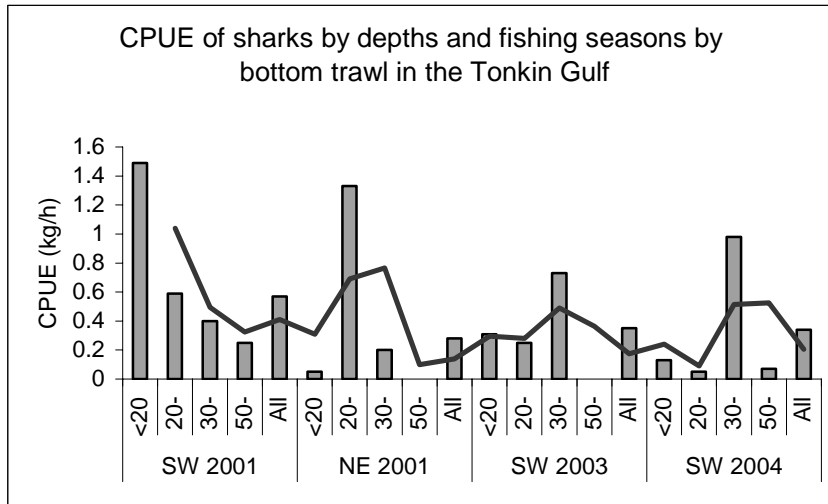


Figure 30. CPUE of sharks by depths and fishing seasons by bottom trawl in the Tonkin Gulf

In the Southeast area, CPUE by bottom trawl varies in small range. In the southwest monsoon, catch in the shallow waters (<50m) is higher than in the waters of over 50m deep. But catch in the northeast monsoon is in contrary tendency: rather high catch can be attained in the deep waters (Figure 31).

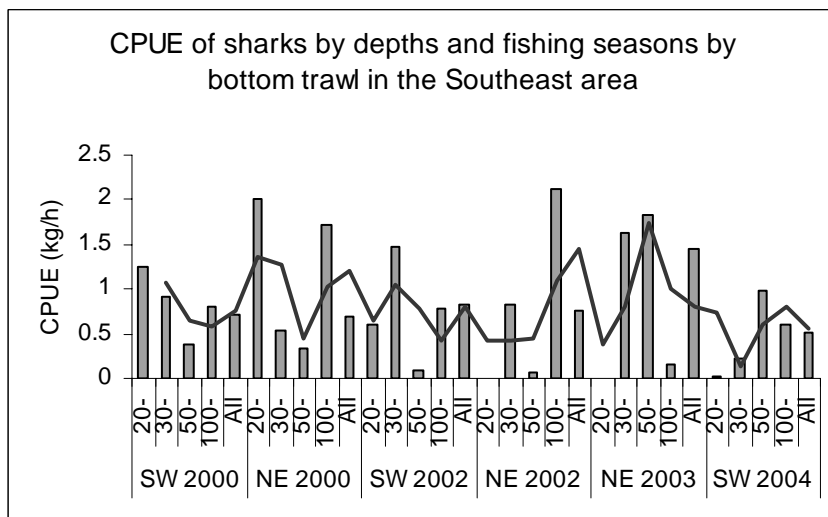


Figure 31. CPUE of sharks by depths and fishing seasons by bottom trawl in the Southeast Area

Similarly, as for the Southwest area, CPUE by bottom trawl changes inconsiderably by fishing seasons and depths (Figure 32). However, CPUE of this area (0.56 kg/h) and the Tonkin Gulf (0.385 kg/h) is lower than the one of the Southeast area (0.83 kg/h).

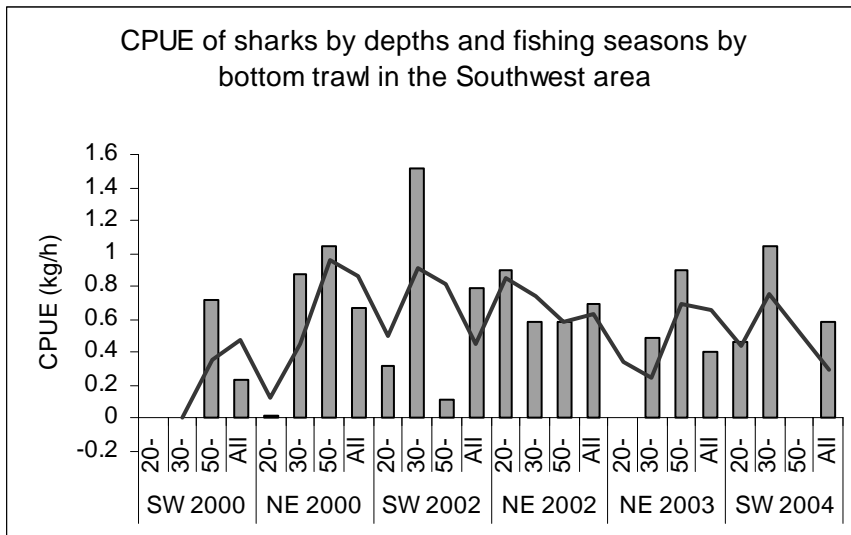


Figure 32. CPUE of sharks by depths and fishing seasons by bottom trawl in the Southeast Area

4.2.2. Rays

Comparison is made for 3 survey areas, CPUE of rays by bottom trawl in the Tonkin Gulf (Figure 33) is highest (about 2.9 kg/h) while the catch of rays in both Southeast area and Southwest area by the same kind of fishing gear is nearly the same and much lower than the catch in the Tonkin Gulf (about 1.7 and 1.75 kg/h).

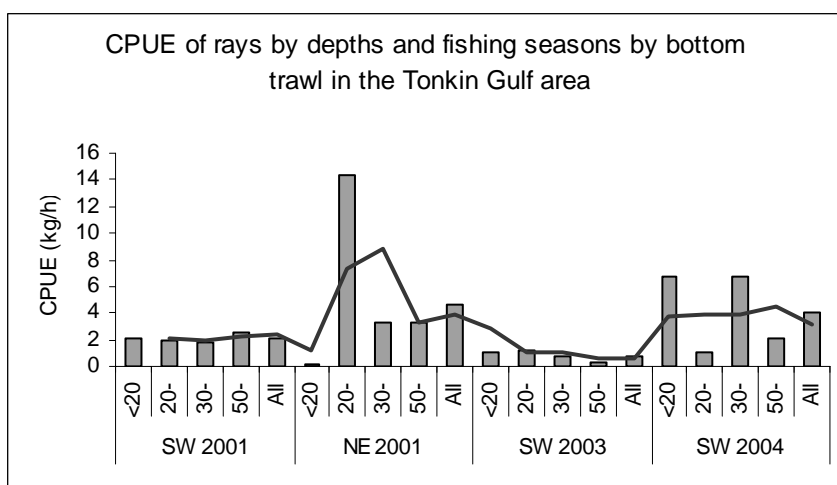


Figure 33. CPUE of ray by depths and fishing seasons by bottom trawl in the Tonkin Gulf

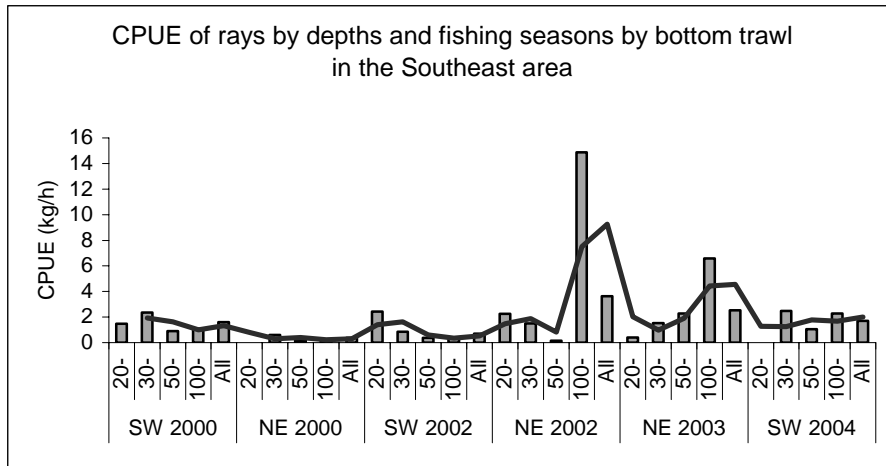


Figure 34. CPUE of ray by depths and fishing seasons by bottom trawl in the Southeast Area

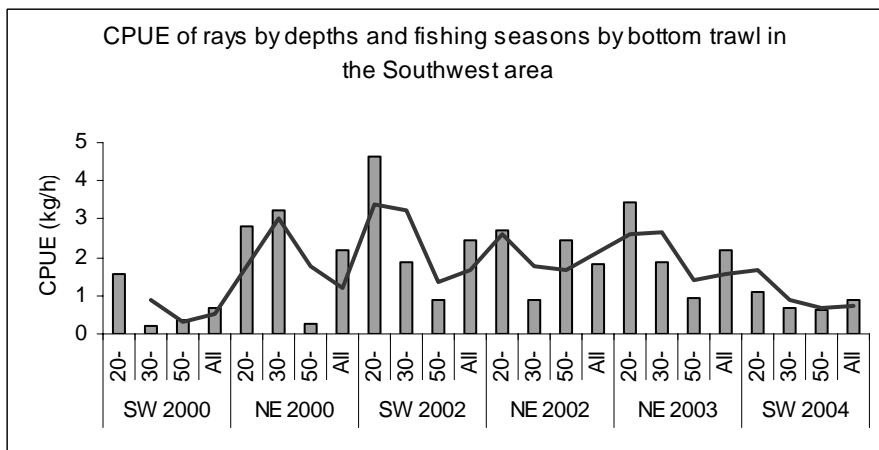


Figure 35. CPUE of ray by depths and fishing seasons by bottom trawl in the Southwest Area

4.2. Catch by Gillnet and Long line

As for gillnet fisheries, catch is in tendency to be decreased gradually in period of 2000 - 2003. The highest catch was reached in 2001 (about 0.41 kg/km) and the lowest - in 2002 (about 0.18 kg/km).

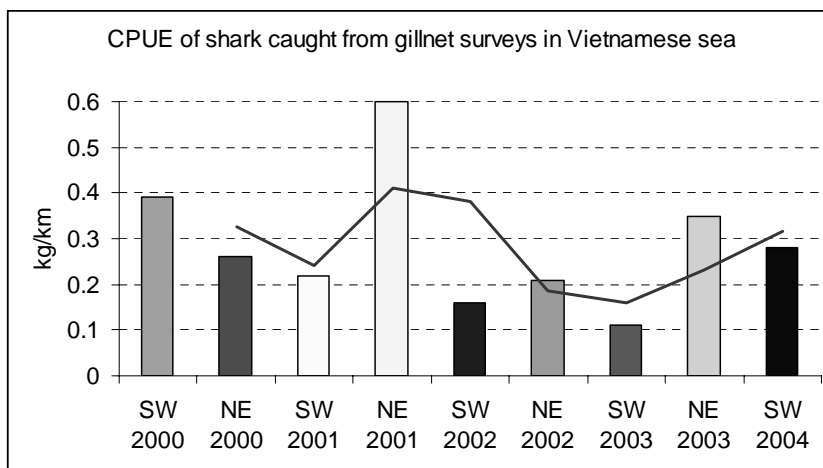


Figure 36. CPUE of shark caught from Gill Net Surveys Vietnamese Sea

Catch presents obvious seasonality. In general, catch in the northeast monsoon is higher than in the southwest monsoon. Typically, in the northeast monsoon of 2001 catch reached to 0.6 kg/km. On the contrary, the lowest catch was encountered in the southwest monsoon of 2003, about 0.18 kg/km. Particularly, in this monsoon catch decreased rather clearly in period from 2000 to 2003. And then the catch trends to be increased from 2003 to 2004.

On the other hand, mesh size affects considerably to catch. The study results show that with mesh size of $2a = 123\text{m}$, the highest catch can be reached (0.56 kg/km), and with mesh size of $2a = 73\text{ mm}$, the lowest catch is reached by meshsize $2a = 73\text{ mm}$ (about 0.04 kg/km).

As for long line fishery, CPUE of all surveys from 2000 to 2003 is about 1.5kg/100 hooks.

4.3. Percentage of Catch of Shark and Rays

In the whole Vietnamese sea area, catch of cartilaginous fish by trawl makes up 3.3% of the total catch, where catch of sharks makes up 0.72 % and rays - 2.58%.

Regarding gillnet fisheries, total catch of cartilaginous fish makes up about 13.4%. Catch of sharks makes up 1% of the total catch, while catch of rays is rather high, about 12.4%.

As for the long line fisheries, catch of cartilaginous fish hold the highest density, about 29.2%, of which sharks are dominant species (about 21.5%), catch of rays contributes only 7.7% of the total catch. Long line is considered as the main fishing gears for cartilaginous fish, especially for sharks in Vietnam. Catch percentage of sharks by fishing gears and fishing areas is as follows:

Trawl fishery:

- In the Tonkin Gulf: cartilaginous fish comprise of 3.31% of total catch, of which sharks – 0.41%, rays-2.9 %.
- In the Southeast area: cartilaginous fish comprise of 3.09 % of total catch, of which sharks- 0.99% and rays-2.1%.
- In the Southwest are: cartilaginous fish comprise of 3.58% of total catch, of which sharks- 0.88% and rays-2.7%.

In general, percentage of cartilaginous fish caught by trawl fishery is highest in the Southwest area and lowest in the Southeast are. However, if considering the catch of sharks only, the catch percentage in the Southeast area is highest and in the Tonkin Gulf is the lowest.

Gillnet fishery:

For gillnet fishery, with the mesh size of $2a = 123\text{ mm}$ catch of sharks is obtained the highest percentage (about 1.52 % of total catch) and then followed by catch of mesh-size of $2a = 150$, $2a = 85$ and $2a = 100\text{ mm}$, the catch percentages are 1.13; 1.07; and 1.05 % respectively. The lowest catch percentage is found for the mesh size $2a = 73\text{mm}$ (0.2 %).

5. ESTIMATION OF STANDING BIOMASS

Standing biomass estimation of sharks (Table 34) showed the declining tendency. Standing biomass of sharks in the Tonkin Gulf has been dramatically decreasing from 2001 to 2004. In the Southwest monsoon of 2002, standing biomass of sharks is estimated to be about 1068 tons and decreased in 2003, 2004 at level of 648 and 626 tons respectively.

Table 34. Standing Biomass Estimation of Sharks in the Tonkin Gulf (Ton)

Name	Depth strata (m)	Square (km ²)	Season			
			SW 2001	NE 2001	SW 2003	SW 2004
Shark	<20	13700	526	18	114	46
	20-30	16250	245	583	108	22
	30-50	20640	196	105	426	526
	50-100	16780	102			32
Shark Total			1068	706	648	626

In the Southeast area, standing biomass of sharks is estimated to be 2,473 - 5,629 tons in 2000-2004. The highest standing biomass of sharks is observed in the Southwest monsoon of 2003 and lowest in the Southwest monsoon of 2004. Standing biomass of sharks in different monsoon seasons in the Southeast area is shown in Table 35.

Table 35. Standing Biomass of Sharks by Monsoon Season/ Year in the Southeast Area (ton)

Name	Depth strata (m)	Square (km ²)	Season					
			SW2000	NE2000	SW2002	NE2002	SW2003	SW2004
Shark	20-30	24640	796	1,274	372			10
	30-50	68120	1,667	885	3,275	1,638	3,016	429
	50-100	51950	503	444	111	90	2506	1,569
	100-200	27910	598	1,149	587	1,605	107	465
Shark Total			3,565	3,753	4,345	3,333	5,629	2,473

In the Southwest area, standing biomass of sharks by fishing season ranged from 518 tons in Southwest monsoon of 2000 and 1,534 tons in Northeast monsoon of 2002.

Standing biomass of sharks in the same monsoon season (Southwest monsoon) of 2002-2004 was increased from 1,531 tons (2002) to 1,061 tons (2003) and 1,002 tons (2004) (Table 36).

Table 36. Standing Biomass of Sharks by Monsoon Season, Year in the Southwest Area (ton)

Name	Depth strata (m)	Square (km ²)	Season					
			SW2000	NE2000	SW2002	NE2002	SW2003	SW2004
Shark	20-30	18400		9	151	482		200
	30-50	31350		704	1296	590	408	802
	50-100	28080	518	745	84	462	654	
Shark Total			518	1459	1531	1534	1061	1002

In conclusion, standing biomass of sharks in the Southeast area was estimated highest comparing with other areas of Vietnam. The lowest standing biomass of sharks was found in the Tonkin Gulf.

THE LIST OF RESEARCHERS IN PROJECT

- | | |
|--------------------------------------|---|
| 1. Nguyen Long - Project Coordinator | Research Institute for Marine Fisheries |
| 2. Nguyen Khac Bat | Research Institute for Marine Fisheries |
| 3. Nguyen Dinh Nhan | Research Institute for Marine Fisheries |
| 4. Pham Van Tuyen | Research Institute for Marine Fisheries |
| 5. Tran Chu | Research Institute for Marine Fisheries |
| 6. Tran Dinh | Research Institute for Marine Fisheries |
| 7. Nguyen Phi Uy Vu | Nha Trang Oceanography Institute |
| 8. Nguyen Vy | Vung Tau Fisheries Department |
| 9. Pham Van Son | Binh Thuan Fisheries Department |

REFERENCES

- Nguyen Huu Phung and other, 1994. Name List of marine fish in Vietnam . Order Amphioxi ; Subclass Elasmobranchii ; Volume I. Technique Science Publishing House, 116 pages.
- Research Institute for marine , 1973. Marine fish in Vietnam , Order Amphioxi ; Subclass Elasmobranchii , Volume I. Technique Science Publishing House , 154 pages.
- Identify Family – Genus –Species by FISHBASE 2000, www, fishbase, org
- Allen, Gerald R, 1997. Marine Fishes of Tropical Australia and South – East Asia, Western Australian Museum, Perth, Western Australia, 292p
- Carpenter, K.E.; Niem, V.H. (eds). *FAO species identification guide for fishery purposes*. The living marine resources of the Western Central Pacific. Volume 2. Cephalopods, crustaceans, holothurians and sharks. Rome, FAO. 1998. 687-1396p.
- Compagno, L.J.V. Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Volume 2. Bullhead, mackerel and carpet sharks (Heterodontiformes, Lamniformes and Orectolobiformes). *FAO Species Catalogue for Fishery Purposes*. No. 1, Vol. 2. Rome, FAO. 2001. 269p.
- Compagno, L.J.V., FAO species catalogue. Vol. 4. 1984. Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Part 2. Carcharhiniformes. FAO Fish.Synop.,(125)Vol. 4,Pt.2:251-655.
- De Bruin, G.H.P.; Russell, B.C.; Bogusch, A. *FAO species identification field guide for fishery purposes*. The marine fishery resources of Sri Lanka. FAO, Rome. 1995. 400p.
- FAO, 1999- Shark Utilization, Marketing and Trade Stefania Vannuccini FAO Consultant FAO Fisheries Technical Paper 389.