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Report of a Preliminary Investigation on Sharks and Rays in the Western Pacific Ocean

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Contents

Preface	1
Members	2
I. Distribution	2
I-1. Hokkaido	5
I-2. Sanriku	9
I-3. Choshi, Izu Islands and Ogasawara Islands	14
I-4. Suruga Bay	25
I-5. Mie(Kumano Nada)	34
I-6. Nagasaki and Okinawa	39
II. Report of preliminary investigation	
II-1. Taiwan	50
II-2. Philippines	55
II-3. Indonesia	68
III. Exploitation of Sharks and Rays in the Philippines	76
IV. Record of symposium held in Nagasaki	95

Report of a Preliminary Investigation on the Exploitation of Sharks and Rays in the Western Pacific Ocean

Elasmobranchs (sharks, rays and skates) are closely related with human beings. The relation will be split into positive and negative aspects. On the positive side, they provide food, medical supplies, leather and so on: their flesh and fins are used for food; their liver yields oils and vitamine A; their skin is processed into leather. Recently, squalene prepared from liver oils of deep-sea sharks has been used for the material of cosmetics. Especially, Japan has imported squalene from various countries of the world, because cosmetics containing squalene are believed to be effective on smoothing skin. On the negative side, elasmobranchs, paricularly some sharks attack upon man and sometimes lead to death. Researches on elasmobranchs have been developed from the viewpoint of shark repellent in the United States, that is, studying how to chase sharks. Furthermore, elasmobranchs often become a bother to fishermen since they are often entangled with net. In addition, some sharks do harm to tunas, swordfish and spearfishes caught with longline gear by eating some parts of them.

Recently, elasmobranchs have been re-evaluated as a new fishery resource, not only in Japan but in foreign countries including USA. Annual world catches of cartilagenous fishes (almost all elasmobranchs) ammount to 550,000-600,000 tons according to the fishery statistics of FAO. However, systematic exploitation of elasmobranchs should be carefully considered. If they are fished heavily, their population may collapse because of their low fecundity and slow growth. In fact, several heavily fished populations were destroyed in the past, e.g., soupfin shark, Galeorhinus zyopterus, school shark, G. australis, and porbeagle, Lamna nasus. Recently several species are said to be on the way to extinction on account of heavy fishing pressure, e.g., basking shark, Cetorhinus maximus, squalene sharks, Centrophorus spp. Thus elasmobranchs should be managed as fragile resources rather than stout ones. So it is necessary to make a rational exploitation for elasmobranchs. However, very little is known of the biology

and present status of utilization of elasmobranchs in the western Pacific, although they are exploited more extensively here than in any other areas in the world.

The report describes the result of a preliminary investigation on elasmobranchs in the western Pacific, especially Japan, Taiwan, Philippines and Indonesia.

Here we wish to express our sincere gratitude to President Eiji Toyota and the staff of the Toyata Foundation for their financial support.

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1. Distribution

Distribution of elasmobranchs were investigated in nine places in Japan, that is, Hokkaido, Sanriku District, Choshi, Izu and Ogasawara Islands, Suruga Bay, Mie Prefecture(Kumano Nada), Nagasaki and Okinawa, according to literatures and examination of specimens. These places are depicted in Fig. 1. Further-

more , Japanese investigators visited Taiwan, the Philippines and Indonesia to examine specimens newly collected for this study and/or deposited in laboratories in each country. Finally lists of species of elasmobranchs are constructed on the basis of literature and examination of specimens in collaboration with each counter part in each country. Scientific names are amended in accordance with up-to-date literatures.

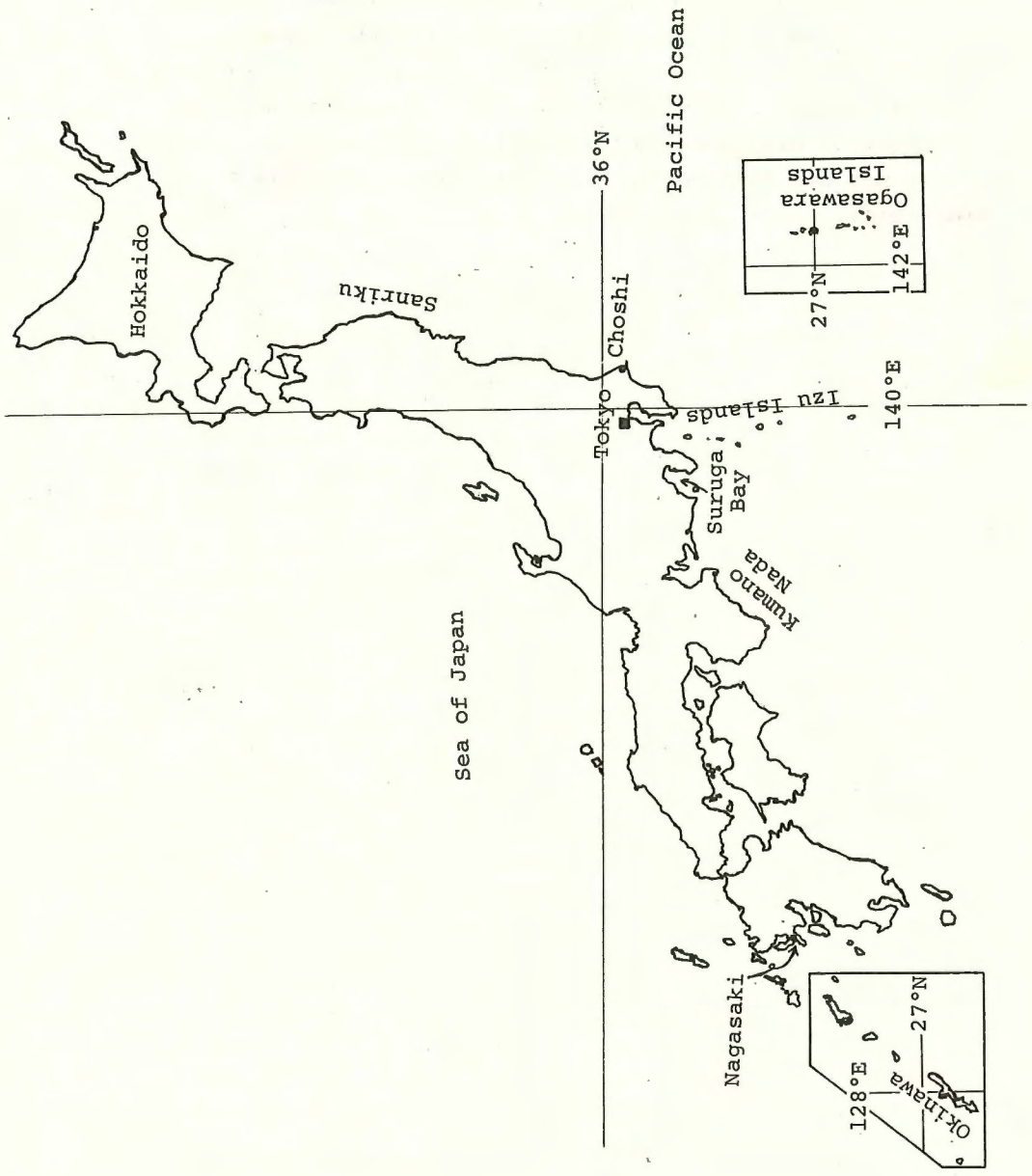

Fig. 1. Localities where lists are prepared on the basis of the examination of literatures and/or specimens.

1-1. Hokkaido

19 species of sharks and 28 species of batoid fishes have been recorded so far in Hokkaido. The list of elasmobranchs is tabulated in Table 1. The list was made principally according to Ueno(1971), and after 1971, eight species are added to the list from recent literatures. In Hokkaido, it is a striking feature that species of batoid fishes outnumber those of sharks. The prominence of batoid species is probably due to the difference in the distribution pattern between the two taxonomical groups. Most sharks are warm-water dwellers in general whereas skates(Rajidae) which constitute the bulk of batoid species made speciation in cooler waters. So almost all the species of the genus Bathyraja, cooler rajids, have been found to occur near Hokkaido among the species recorded in Japan. The records of the genus Raja are fewer than those of Bathyraja, which implies the center of the distribution is situated toward further north. On the contrary, only one-fourth of species of skates recorded in Japan have been reported so far from Hokkaido. Records of H. buergeri and R. acutus are doubtful because the two species are believed to occur in warm waters judging from investigation in Choshi region and Suruga Bay where we have made an extensive study on elasmobranchs. Sharks except for, Lamna ditropis, Cetorhinus maximus, Squalus acanthias and maybe Scyliorhinus torazame seem to be warm-water dwellers, although they have been reported to penetrate into cool waters. Among batoid fishes, the record of Dasyatis kuhlii is doubtful because this species usually occurs in warm seas. It is characteristic that there are no records of the occurrence of Rhinobatidae, Platyrhinidae and Mobulidae which are all warm-water species. (T. Taniuchi)

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Co. Ltd., Sapporo, Japan, 268 pp.
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Japan Fisheries Resource Conservation Association. 1983. Fishes from the north-eastern sea of Japan and the Okhotsk Sea off Hokkaido. 371 pp.

Table 1. List of elasmobranchs in Hokkaido.

Hexanchidae カグラザメ科

Heptranchias perlo (Bonnaterre) エドアブラザメ

Alopiidae オナガザメ科

Alopias vulpinus (Bonnaterre) マオナガ

Carcharhinidae メジロザメ科

Carcharhinus gangeticus (Müller et Henle)

Prionace glauca (Linnaeus) ヨシキリザメ

Rhizoprionodon acutus (Rüppell) ヒラガシラ

Cetorhinidae ウバザメ科

Cetorhinus maximus (Gunnerus) ウバザメ

Lamnidae ネズミザメ科

Isurus oxyrinchus Rafinesque アオザメ

Lamna ditropis Hubbs et Follett ネズミザメ

Scyliorhinidae トラザメ科

Halaelurus buergeri (Müller et Henle) ナガサキトラザメ

Scyliorhinus torazame (Tanaka) トラザメ

Sphyrnidae シュモクザメ科

Sphyrna zygaena (Linnaeus) シロシュモクザメ

Triakididae ドチザメ科

Mustelus manazo Bleeker ホシザメ

Pristiophoridae ノコギリザメ科

Pristiophorus japonicus Günther ノコギリザメ

Squalidae ツノザメ科

Centroscyllium ritteri Jordan et Fowler カスミザメ

Etmopterus frontimaculatus Pietschmann カラスザメ

Etmopterus lucifer Jordan et Snyder フジクジラ

Somniosus pacificus Bigelow et Schroeder オンデンザメ

Squalus acanthias Linnaeus アブラツノザメ

Squatinidae カスザメ科

Squatina japonica Bleeker カスザメ

Table 1. (Continued.)

Dasyatidae アカエイ科

Dasyatis akajei (Müller et Henle) アカエイ

Dasyatis kuhlii (Müller et Henle) ヤッコエイ

Dasyatis matsubarai Miyosi ホシエイ

Dasyatis ushiei Jordan et Hubbs ウシエイ

Gymnura japonica (Temminck et Schlegel) ツバクロエイ

Myliobatidae トビエイ科

Myliobatis tobijei Bleeker トビエイ

Rajidae ガンギエイ科

Bathyraja aleutica (Gilbert) アラスカカスベ

Bathyraja caeluronigricans Ishiyama et Ishihara ツムラカスベ

Bathyraja diplotaenia (Ishiyama) リボンカスベ

Bathyraja isotrachys (Günther) ソコガンギエイ

Bathyraja matsubarai (Ishiyama) マツバラエイ

Bathyraja notoroensis Ishiyama et Ishihara ノトロカスベ

Bathyraja parmifera (Bean) キタツノカスベ

Bathyraja simoterus (Ishiyama) ツノカスベ

Bathyraja smirnovi (Soldatov et Pavlenko) ドブカスベ

Bathyraja trachouros (Ishiyama) ザラカスベ

Bathyraja violacea (Suvorov) キタノカスベ

Bathyraja interrupta (Gill et Townsend) ベーリングカスベ

Bathyraja lindbergi Ishiyama et Ishihara コマンドルカスベ

Bathyraja minispinosa Ishiyama et Ishihara スベスベカスベ

Raja fusca Garman クロカスベ

Raja kenojei Müller et Henle ガンギエイ

Raja porosa Günther コモンカスベ

Raja pulchra Liu メガネカスベ

Raja tengu Jordan et Fowler テングカスベ

Rhinoraja kujiensis (Tanaka) クジカスベ

Rhinoraja longicauda Ishiyama オナガカスベ

Torpedinidae シビレエイ科

Torpedo tokionis (Tanaka) ヤマトシビレエイ

1-2. Sanriku District

Here Sanriku District is confined to the Pacific coast of Aomori Prefecture and Iwate Prefecture, where lists of fishes were prepared in the past(Murayama, 1971: Shiogaki, 1982). In addition, we add several species to ichthyofauna of Sanriku District according to up-to-date literatures. 33 sharks and 26 batoid fishes have been recorded so far here (Table 2). 14 species of sharks increase whereas 2 species of batoid decrease, compared with those in Hokkaido. Particularly, species number of sharks shows a large increase, reflecting the oceanographical condition in Sanriku District. On the contrary, Alopias vulpinus and Carcharhinus gangeticus are absent in Sanriku District, though these species are recorded in Hokkaido. This may be due to the lack of catch records and/or misidentification not to the true absence. The record of the occurrence of Squalus brevirostris is maybe due to the misidentification(Chen et al., 1979). The occurrence of batoid fishes showsgeneral accordance to those in Hokkaido. However, several differences in distribution pattern can be seen; Bathyraja violacea, B. interrupta, B. parmifera, B. notoroensis, B. minispinosa, B. lindbergi and B. simoterus which have recorded in Hokkaido are absent in Sanriku District, whereas all the species of Raja and Rhinoraja recorded in Hokkaido are present. The absence of these seven species implies that southernmost distribution of these species is Hokkaido, although the occurrence may be expected if the catching methods of cool and/or deep-sea skates develop. (T. Taniuchi)

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Table 2. List of elasmobranchs in Sanriku.

Heterodontidae ネコザメ科

Heterodontus japonicus (Duméril) ネコザメ

Hexanchidae カグラザメ科

Heptranchias perlo (Bonnaterre) エドアブラザメ

Alopiidae オナガザメ科

Alopias pelagicus Nakamura ニタリ

Carcharhinidae メジロザメ科

Carcharhinus japonicus (Temminck et Schlegel) メジロザメ

Prionace glauca (Linnaeus) ヨシキリザメ

Rhizoprionodon acutus (RÜppell) ヒラガシラ

Cetorhinidae ウバザメ科

Cetorhinus maximus (Gunnerus) ウバザメ

Lamnidae ネズミザメ科

Carcharodon carcharias (Linnaeus) ホホジロザメ

Isurus oxyrinchus Rafinesque アオザメ

Lamna ditropis Hubbs et Follett ネズミザメ

Rhincodontidae ジンベエザメ科

Rhincodon typus Smith ジンベエザメ

Scyliorhinidae トラザメ科

Apristurus macrorhynchus (Tanaka) ナガヘラザメ

Apristurus sp.1

Cephaloscyllium umbratile Jordan et Fowler ナヌカザメ

Halaelurus buergeri (Müller et Henle) ナガサキトラザメ

Scyliorhinus torazame (Tanaka) トラザメ

Sphyrnidae シュモクザメ科

Sphyrna lewini (Griffith et Smith) アカシュモクザメ

Sphyrna zygaena (Linnaeus) シロシュモクザメ

Triakididae ドチザメ科

Mustelus griseus Pietschmann シロザメ

Mustelus manazo Bleeker ホシザメ

Table 2. (Continued.)

Triakis scyllia Müller et Henle ドチザメ

Pristiophoridae ノコギリザメ科

Pristiophorus japonicus Günther ノコギリザメ

Squalidae ツノザメ科

Centrophorus atromarginatus Garman アイザメ

Centroscyllium ritteri Jordan et Fowler カスミザメ

Etmopterus frontimaculatus Pietschmann カラスザメ

Etmopterus lucifer Jordan et Snyder フジクジラ

Etmopterus unicolor (Engelhardt) ニセカラスザメ

Lepidorhinus squamosus (Bonnaterre) モミジザメ

Scymnodon squamulosus (Günther) ビロウドザメ

Somniosus pacificus Bigelow et Schroeder オンデンザメ

Squalus acanthias Linnaeus アブラツノザメ

Squalus mitsukurii Jordan et Fowler フトツノザメ

Squatinidae カスザメ科

Squatina japonica Bleeker カスザメ

Dasyatidae アカエイ科

Dasyatis akajei (Müller et Henle) アカエイ

Dasyatis kuhlii (Müller et Henle) ヤッコエイ

Dasyatis matsubarai Miyosi ホシエイ

Dasyatis ushiei Jordan et Hubbs ウシエイ

Gymnura japonica (Temminck et Schlegel) ツバクロエイ

Mobulidae イトマキエイ科

Mobula japanica (Müller et Henle) イトマキエイ

Myliobatidae トビエイ科

Myliobatis tobijei Bleeker トビエイ

Rajidae ガンギエイ科

Bathyraja aleutica (Gilbert) アラスカカスベ

Bathyraja caeluronigricans Ishiyama et Ishihara ツムラカスベ

Bathyraja diplotaenia (Ishiyama) リボンカスベ

Table 2. (Continued.)

Bathyraja isotrachys (Günther) ソコガンギエイ

Bathyraja matsubarai (Ishiyama) マツバラエイ

Bathyraja smirnovi (Soldatov et Pavlenko) ドブカスベ

Bathyraja trachouros (Ishiyama) ザラカスベ

Bathyraja abyssicola Gilbert チヒロカスベ

Bathyraja sp.1

Raja fusca Garman クロカスベ

Raja kenojei Müller et Henle ガンギエイ

Raja porosa Günther コモンカスベ

Raja pulchra Liu メガネカスベ

Raja tengu Jordan et Fowler テングカスベ

Raja sp.1

Rhinoraja kujiensis (Tanaka) クジカスベ

Rhinoraja longicauda Ishiyama オナガカスベ

Rhinobatidae サカタザメ科

Rhina ancylostoma Bloch et Schneider シノノメサカタザメ

Torpedinidae シビレエイ科

Torpedo tokionis (Tanaka) ヤマトシビレエイ

1-3. Distribution of elasmobranchs in Choshi, Izu Islands, and Ogasawara Islands

Toru Taniuchi

Many species of elasmobranchs have been recorded in Choshi area, partly because indeed many species are distributed around Choshi reflecting the richness of prey animals and partly because extensive surveys have been conducted on fishes and fisheries of Choshi. The list of elasmobranchs is presented in Table 3, together with that of Izu and Ogasawara Islands. So far 51 species of sharks and 20 species of batoid fishes have been recorded in Choshi. The occurrences of most elasmobranchs were confirmed by the examination on specimens. However, records of occurrence of Cetorhinus maximus, Rhinoraja kujiensis, Rhinoraja longicauda, Raja gigas, R. macrocauda, R. fusca, Bathyraja diplotaenia, and Mobula japonica followed those of Tamura et al.(1962) and Ishiyama(1969). Among sharks, Chlamydoselachus anguineus, Odontaspis ferox, and Parmaturus pilosus have been to occur widely from Choshi to Kumano Nada in this study, although these sharks were considered to be rare in Japan in the past. The distribution of Halaerulus buergeri in Hokkaido and Sanriku District is doubtful since we have not collected this species from Choshi in spite of extensive surveys. Apristurus spp. cannot be identified because some of them may be undescribed species. It is necessary to revise the genus Apristurus on worldwide basis. It is a noticeable feature that deep-sea sharks of the families of Scyliorhinidae and Squalidae are abundant in Choshi. Among others, sharks of Squalidae amount to 15 species. Concerning batoids, the number of species of Bathyraja decreased markedly compared with that of Hokkaido and Sanriku District. Only three species of Bathyraja were confirmed to occur in Choshi whereas 14 species of the genus were recorded in Hokkaido. On the contrary, 7 species of Raja were recorded in Choshi while 5 species occurred in Hokkaido and Sanriku District. The differences suggest that species of Bathyraja are distributed more northerly than those of Raja.

I treated only sharks in Izu Islands because there are no literatures concerning the distribution of batoid fishes. The records of most sharks followed those of Tokyo Metropolitan Fisheries Experiment Station(1979) but some pelagic sharks were examined on the basis of specimens collected by us. So far 39 species of sharks have been recorded here. As Izu Islands are situated near Choshi, most sharks are distributed in both areas. Sharks recorded here but not collected in Choshi are as follows: (and Ogasawara Is.) Halaelurus buergeri, Orectolobus japonicus, Rhincodon typus, Scapanorhynchus owstoni, Carcharhinus albimarginatus, C. brachyurus, C. obscurus, C. plumbeus, Hemigaleus balfouri, Triaenodon obesus, Centrophorus tessellatus, Isistius brasiliensis, and Squaliolus laticaudus. Among these sharks, C. albimarginatus, C. brachyurus and C. obscurus are not included in the list of Japanese fishes compiled by Japanese Society of Ichthyology(1981), although Garrick(1982) clearly stated the existence of these sharks in Japan. H. balfouri should be also added to the Japanese ichthyofauna. According to Tokyo Metro. Fish. Exp. Sta.(1979) specimens of I. brasiliensis was not collected but its occurrence near Ogasawara was estimated from the evidence of the presence of large fishes having crater wounds. The distributional pattern of sharks in Izu Islands is characterized by the abundance of pelagic, warm-water sharks, especially of the family Carcharhinidae, since Izu Islands are located further south than Choshi. Ogasawara Islands are situated approximately in latitude 27°N and are in the same latitude as Okinawa, so most species recorded here are also distributed in Okinawa. Similarly, as Ogasawara Islands are located near Izu Islands, a number of elasmobranchs are common in distribution in both areas. So far 32 species of sharks and 8 species of batoid fishes have been recorded here according to the reports by Zama and Fujita, Tokyo Metro. Fish. Exp. Sta.(1979) and Taniuchi(1983). Among these, Hexanchus sp. (Shirokagura in Japanese), Galeus sp. and Mustelus sp.(Sunazame in Japanese) are unrecorded species in Japan. Hexanchus sp. apparently different from H. griseus is now under examination because H. vitulus will probably be replaced by another senior synonym. Galeus sp. resembles G. nipponensis but clearly differs from the latter species in several aspects. This

species may be new to science. Mustelus sp. may be identified as species of Mustelus recorded outside Japan for example M. canis. In addition to these species, Heterodontus zebra, Alopias plagicus, Odontaspis taurus and Centrophorus scalpratus have not been reported yet from Izu Islands. C. scalpratus was reported from Okinawa under the name C. armatus by Abe(1973) but I followed Bass et al.(1976) who synonymized C. armatus with C. scalpratus. Originally Abe(1973) employed Japanese name Okinawa-yajirizame for the species in order to distinguish this shark from Yajiri-aizame, C. armatus barbatus, recorded in Taiwan by Teng(1962). I here use Yajiriaizame since there is no reason to separate Okinawa specimens from Ogasawara ones. Rhincodon typus, and Carcharhinus falciformis are distributed here indeed according to fishermen of longline fishery, though these species are not listed up here.

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Table 3. List of elasmobranchs in Choshi, Izu Islands, and Ogasawara Islands. ○--- a whole specimen is preserved. □--- part of specimen is preserved. ●--- occurrence confirmed by eye witness. △--- record by literature.

Species	Choshi	Izu Is.	Ogasawara Is.
Heterodontidae ネコザメ科			
Heterodontus japonicus (Duméril) ネコザメ	○	△	△
Heterodontus zebra (Gray) シマネコザメ			△
Chlamydoselachidae ラブカ科			
Chlamydoselachus anguineus Garman ラブカ	○	△	
Hexanchidae カグラザメ科			
Heptranchias perlo (Bonnaterre) ニドアブラザメ	○		○
Hexanchus griseus (Bonnaterre) カグラザメ	□	△	
Hexanchus sp.1			○
Alopiidae オナガザメ科			
Alopias pelagicus Nakamura ニタリ	●		△
Alopias superciliosus (Lowe) ハチワレ	●	○	△
Alopias vulpinus (Bonnaterre) マオナガ	●	○	

Table 3. (Continued.)

Species	Choshi	Izu Is.	Ogasawara Is.
Carcharhinidae メジロザメ科			
Carcharhinus brachyurus (Günther)		△	
Carcharhinus falciformis (Bibron) クロトガリザメ	○		
Carcharhinus longimanus (Poey) ヨゴレザメ	●	□	△
Carcharhinus melanopterus (Quoy et Gaimard) ツマグロ		△	
Carcharhinus plumbeus (Nardo) メジロザメ(ヤジブカ)		△	○
Carcharhinus albimarginatus (Rüppell) ツマジロ			△
Carcharhinus obscurus (Lesueur) ドタブカ	●	○	○
Galeocerdo cuvier (Péron et Lesueur) イタチザメ	●	△	△
Hemigaleus balfouri Day イバラザメ		△	
Hypoprion macloti (Müller et Henle) ホコサキ	●		
Prionace glauca (Linnaeus) ヨシキリザメ	●	□	△
Rhizoprionodon acutus (Rüppell) ヒラガシラ	△		△
Triaenodon obesus (Rüppell) ネムリブカ			○
Cetorhinidae ウバザメ科			
Cetorhinus maximus (Gunnerus) ウバザメ	△	△	
Lamnidae ネズミザメ科			
Carcharodon carcharias (Linnaeus) ホホジロザメ	●		

Table 3. (Continued.)

Species	Choshi	Izu Is.	Ogasawara Is.
Isurus oxyrinchus Rafinesque アオザメ	●	□	
Isurus paucus Guitart Manday パケアオザメ		△	
Lamna ditropis Hubbs et Follett ネズミザメ	○	□	△
Odontaspididae ミズワニ科			
Odontaspis ferox (Risso) オオワニザメ	○	△	
Odontaspis taurus (Rafinesque) シロワニ			●
Pseudocarcharias kamoharai (Matsubara) ミズワニ		△	
Orectolobidae テンジクザメ科			
Orectolobus japonicus Regan オオセ		△	
Rhincodontidae ジンベエザメ科			
Rhincodon typus Smith ジンベエザメ		△	
Scapanorhynchidae ミツクリザメ科			
Scapanorhynchus owstoni (Jordan) ミツクリザメ		△	
Scyliorhinidae トラザメ科			
Apristurus japonicus Nakaya ニホンヘラザメ	○		
Apristurus macrorhynchus (Tanaka) ナガヘラザメ	○		
Apristurus platyrhynchus (Tanaka) ヘラザメ	○		
Apristurus sp.2	○		

Table 3. (Continued.)

Species	Choshi	Izu Is.	Ogasawara Is.
Cephaloscyllium umbratile Jordan et Fowler ナヌカザメ	○	△	△
Galeus nipponensis Nakaya ニホンヤモリザメ	○	△	
Galeus sp.1			○
Halaelurus buergeri (Müller et Henle) ナガサキトラザメ		△	
Parmaturus pilosus Garman イモリザメ	○		
Scyliorhinus torazame (Tanaka) トラザメ	○		
Sphyrnidae シュモクザメ科			
Sphyrna lewini (Griffith et Smith) アカシュモクザメ	●	△	○
Sphyrna zygaena (Linnaeus) シロシュモクザメ	●	△	△
Triakididae ドチザメ科			
Hemitriakis japanica (Müller et Henle) エイラクブカ	○	△	
Mustelus griseus Pietschmann シロザメ	○	△	△
Mustelus manazo Bleeker ホシザメ	○	△	△
Mustelus sp.1			○
Triakis scyllia Müller et Henle ドチザメ	○	△	△
Pristiophoridae ノコギリザメ科			
Pristiophorus japonicus Günther ノコギリザメ	●	△	△

Table 3. (Continued.)

Species	Choshi	Izu Is.	Ogasawara Is.
Squalidae ツノザメ科			
Centrophorus acus Garman タロウザメ	○		
Centrophorus scalpratus McCulloch ヤジリザメ			○
Centrophorus atromarginatus Garman アイザメ	○		
Centrophorus tessellatus Garman ゲンロクザメ		△	
Centroscyllium ritteri Jordan et Fowler カスミザメ	○		
Cirrhigaleus barbifer Tanaka ヒゲツノザメ	○		
Dalatias licha (Bonnaterre) ヨロイザメ	○		
Deania eglantina Jordan et Snyder ヘラツノザメ	○		
Etmopterus frontimaculatus Pietschmann カラスザメ	○	△	△
Etmopterus lucifer Jordan et Snyder フジクジラ	○	△	
Etmopterus unicolor (Engelhardt) ニセカラスザメ	○		
Isistius brasiliensis (Quoy et Gaimard) ダルマザメ		△	△
Squalus acanthias Linnaeus アブラツノザメ	○		△
Squalus blainvillei (Risso) ヒレタカツノザメ	○		○
Squalus brevirostris Tanaka ツマリツノザメ	△		
Squalus japonicus Ishikawa トガリツノザメ	○	△	○
Squalus mitsukurii Jordan et Fowler フトツノザメ	○		○

Table 3. (Continued.)

Species	Choshi	Izu Is.	Ogasawara Is.
Lepidorhinus squamosus (Bonnaterre) モミジザメ	○		
Squaliolus laticaudatus Smith et Radcliffe ツラナガコビトザメ		△	
Squatinidae カスザメ科			
Squatina japonica Bleeker カスザメ	○	△	
Squatina nebulosa Regan コロザメ	●		
Dasyatidae アカエイ科			
Dasyatis akajei (Müller et Henle) アカエイ	○		△
Dasyatis kuhlii (Müller et Henle) ヤッコエイ			●
Dasyatis ushiei Jordan et Hubbs ウシエイ	●		
Dasyatis sp,1			△
Gymnura japonica (Temminck et Schlegel) ツバクロエイ	○		△
Urolophus aurantiacus Müller et Henle ヒラタエイ	○		
Mobulidae イトマキエイ科			
Mobula japanica (Müller et Henle) イトマキエイ			△
Myliobatidae トビエイ科			
Aetobatus narinari (Euphrasen) マダラトビエイ			△
Myliobatis tobijei Bleeker トビエイ	○		△
Rhinoptera javanica Müller et Henle ウシバナトビエイ			△

Table 3. (Continued.)

Species	Choshi	Izu Is.	Ogasawara Is.
Platyrhinidae ウチワザメ科			
Platyrhina sinensis (Bloch et Schneider) ウチワザメ	○		
Rajidae ガンギエイ科			
Bathyraja diplotaenia (Ishiyama) リボンカスベ	△		
Bathyraja isotrachys (Günther) ソコガンギエイ	○		
Bathyraja matsubarai (Ishiyama) マツバラエイ	○		
Raja fusca Garman クロカスベ	△		
Raja gigas Ishiyama ゾウカスベ	△		
Raja kenojei Müller et Henle ガンギエイ	○		
Raja macrocauda Ishiyama キツネカスベ	△		
Raja macrophthalma Ishiyama メダマカスベ	△		
Raja porosa Günther コモンカスベ	○		
Raja pulchra Liu メガネカスベ	△		
Rhinoraja kujiensis (Tanaka) クジカスベ	△		
Rhinoraja longicauda Ishiyama オナガカスベ	△		
Torpedinidae シビレエイ科			
Narke japonica (Temminck et Schlegel) シビレエイ	○		
Torpedo tokionis (Tanaka) ヤマトシビレエイ	○		

Chondrichthyes of Suruga Bay and adjacent waters

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Suruga Bay, reaching over 2500 m in depth, is the deepest bay of Japan. Its submarine topography is rough; namely, Seno-umi, the bank of only 32 m in depth, is located in the western side of central area of the bay and Suruga Trough over 1000 m in depth lies from south to north in the eastern side of its bank. The surface layer water of this bay consists of coastal water and Kuroshio current water, the middle layer is Oyashio current water and the bottom layer over 2000 m is Antarctic water. Consequently, many fishes inhabiting the warm or cold current areas, and the continental shelf, open-sea, or deep sea, are found in Suruga Bay and adjacent waters.

Kuroda[1] made out the list of the fishes of Suruga Bay, and several ichthyologists added more fishes to the list. The chondrichthyes of 23 families, 42 genera, 59 species has been reported from Suruga Bay.[2)-17)] The author has been studying the chondrichthyes of this area from 1980, and examined the Elasmobranchii of 21 families, 40 genera, 54 species and the Holocephali of 2 families, 3 genera, 3 species. This report presents the species composition of chondrichthyes in Suruga Bay and adjacent waters. The author wishes to express his gratitude to Mr.Kazunari Yano, graduate student of TOKAI UNIVERSITY for generous assistance in carrying out this work.

Materials and Methods

The specimens were caught with fixed shore net, bottom gill nets, mid-water trawl net, bottom trawl net, drop line, and bottom longline, either by our research vessels or by commercial fishing vessels, from 1980 to 1983. The drop line and bottom longline used on our vessels were set at depths from 300 to 2000 m. The structure of fishing gears is reported by Yano and Tanaka[18)]. The bottom longline used by fishermen was larger-scale and set at depths

from 450 to 800 m. The fixed shore net was set at depth of about 40 m off Mera and Yui. The bottom gill nets were set at depths from 30 to 350 m off Okitsu and Yaizu in February and March. The mid-water trawl net for shrimp, *Sergestes lucens*, was operated at depths from 60 to 230 m in spring and autumn. The bottom trawl net was operated at depths from 100 to 450 m between September and May. Fishing area is shown in Fig. 2. The specimens of 27 species of Elasmobranchii preserved in Marine Science Museum (MSM), TOKAI UNIVERSITY were examined too.

Results and Discussion

The fishing methods, depth of capture, number, and range of total length of the chondrichthyes collected from Suruga Bay and adjacent waters are shown in Table 4. The depth of capture is not necessary the depth at which the chondrichthyes in question was living.

The fixed shore net fishery yielded only three species, *Heterodontus japonicus*, *Cetorhinus maximus* and *Isurus oxyrinchus*. The bottom gill nets fishery yielded 25 species. The mid-water trawling yielded 4 species, *Chlamydoselachus anguineus*, *Prionace glauca*, *Etmopterus lucifer* and *Squaliolus laticaudatus*. The bottom trawling yielded 20 species, especially *Cephaloscyllium umbratile*, *Galeus eastmani*, *G. nipponensis*, *Etmopterus lucifer*, *E. frontimaculatus*, and *Chimaera phantasma* were caught in plenty. The drop lining and bottom longlining yielded 18 species, especially *Centrophorus acus*, *C. squamosus*, *Centroscymnus owstoni*, *C. coelolepis*, *Deania hystricosum* and *Etmopterus unicolor* were caught in plenty.

Most of the chondrichthyes examined in this study belonged to the group of shelf fish or deep-sea fish, because the catch of the fisheries which were intended for the pelagic fish with drift long-line, drift gill nets and surrounding nets was not investigated. Four pelagic species, *Alopias pelagicus*, *Prionace glauca*, *Isurus oxyrinchus* and *Sphyrna lewini* were caught in the head of Suruga Bay, and *Cetorhinus maximus* was caught in the entrance of the bay. Kuroda[19] reported that *Rhincodon typus* was caught with the fixed shore net in the head of this bay. These suggest that the pelagic sharks sometimes come into the head of the bay.

Squalidae included most species in all families examined. The species composition and vertical distribution of the family Squalidae in Suruga Bay and adjacent waters have been reported in detail by Yano and Tanaka[15]. The rare species in this area is *Hexanchus griseus*, *Odontaspis ferox*, *Scapanorhyncus owstoni*, *Parmaturus pilosus*, *Centroscyllium kamoharai*, *Cirrhigaleus barbifer*, *Scymnodon squamulosus*, *Somniosus pacificus* and *Rhinochimaera pacifica* (Plate 1,2). Among these species, *S. owstoni* has been often caught with bottom gill nets to some years ago.

The auhtor could not confirm the following 13 species reported by this time; *Pseudotriakis acrales*[1], *Rhincodon typus*[1) 19)], *Sphyrna zygaena*[1], *Centroscyllium ritteri*[1], *Somniosus longus*[3], *Squalus brevirostris*[1], *Urolophus aurantiacus*[1], *Raja fusca*[1], *R. kenojei*[1], *R. macrocauda*[1], *Rhina ancylostoma*[5) 17)], and *Hydrolagus ogilbyi*[9]. The specimen of *Alopias vulpinus* reported by Shiobara[16] was re-examined and identified as *A. pelagicus*. Nine species, *Cetorhinus maximus*, *Odontaspis ferox*, *Apristurus platyrhynchus*, *Galeus nipponensis*, *Parmaturus pilosus*, *Sphyrna lewini*, *Hemitriakis japonica*, *Squalus mitsukurii* and *Rhinochimaera pacifica* are given an account for the first time from Suruga Bay and adjacent waters. *A. platyrhynchus* was reported by Shiobara[16], but the specimens had already been identified as *A. macrorhynchus* by Nakaya[11]. Including these species, the chondrichthyes of Suruga Bay and adjacent waters consists of the sharks of 18 families, 34 genera, 51 species, the rays of 6 families, 10 genera, 13 species, and the Holocephali of 2 families, 3 genera, 4 species (Table 5).

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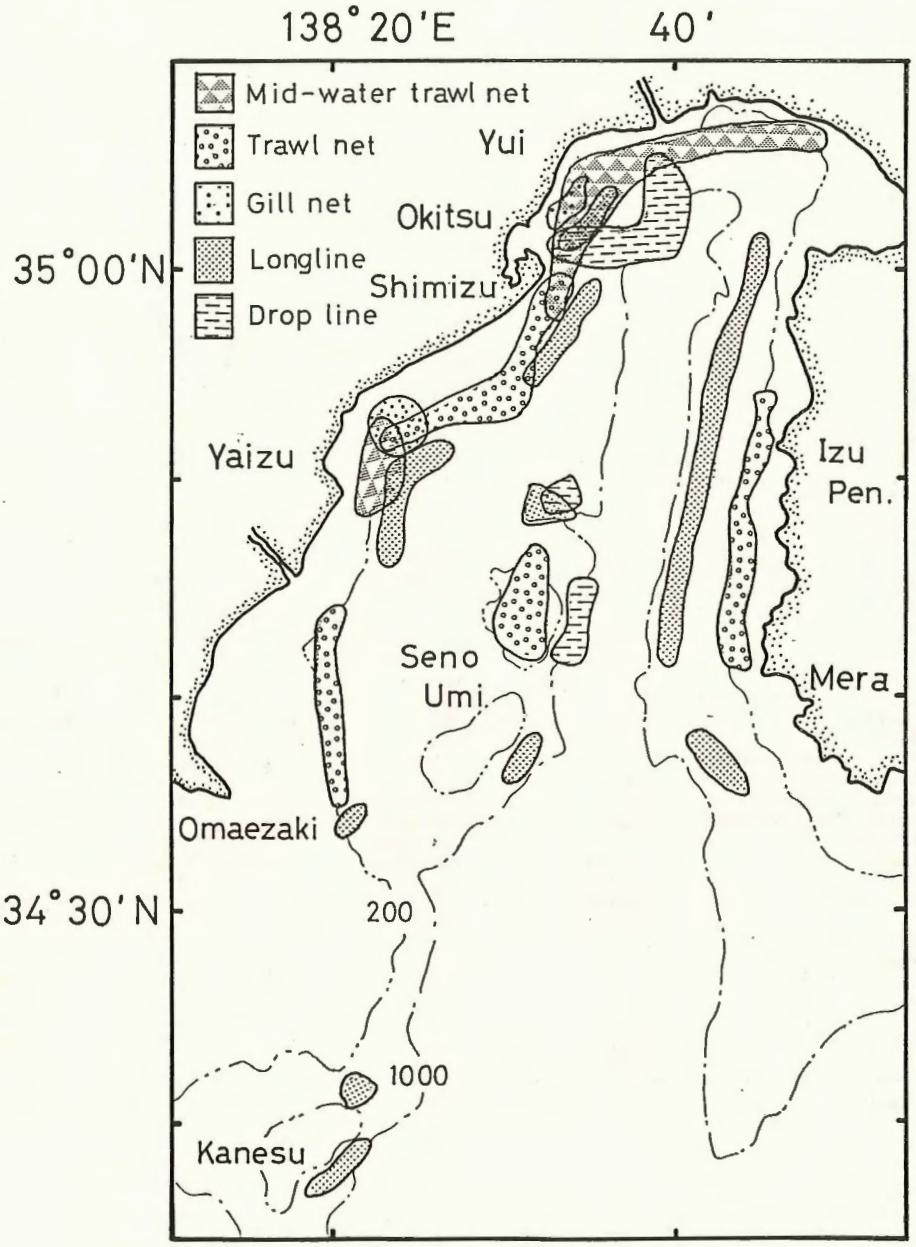

Fig. Fishing grounds in Suruga Bay and adjacent waters.

Table 4. Fishing methods, depth of capture, number, and range of total length of the chondrichthyes collected in Suruga Bay and adjacent waters

FN; Fixed shore net (0-40m), GN; Bottom gill net (30-350m)
MT; Mid-water trawl net (60-230m), BT; Bottom trawl net (100-450m)
LL; Bottom long-line (300-850m), DL; Drop line (400-2000m)

Species	Fishing gear	Depth of capture (m)	Male		Female	
			No.	Range (mm)	No.	Range (mm)
Heterodontus japonicus	FN	0-40	5	269-497	1	637
Chlamydoselachus anguineus	GN,MT,	60-300	11	1184-1523	8	1288-1852
Heptranchias perlo	BT	135-330	7	270-722	37	250-1168
Hexanchus griseus	GN	330			1	1420
Alopias pelagicus	GN	150			2	1572,1592
Prionace glauca	LL,MT,	70-905	2	675,795	3	820-1845
Isurus oxyrinchus	FN,LL,	0-805	1	1003	1	1191
Odontaspis ferox	GN	295			1	1624
Scapanorhynchus owstoni	GN	100-180			1	1798
Apristurus platyrhynchus	LL	675-800	2	560,739	5	600-680
Cephaloscyllium umbratile	BT,LL,	120-750	100	189-1035	89	190-994
Galeus eastmani	BT	120-450	5	349-365	51	353-419
G. nipponensis	BT	120-450	56	330-638	45	305-645
Parmaturus pilosus	LL	385-750			1	448
Sphyrna lewini	GN		1	913		
Hemitriakis japanica	BT	120			1	558
Mustelus griseus	GN		1	843		
M. manazo	BT,GN,	70-285	9	500-848	25	510-945
Triakis scyllia	GN				2	791,823
Pristiophorus japonicus	BT		11	395-1191	2	515,830
Centrophorus acus	GN,LL,DL,	150-800	54	465-1165	57	468-1608
C. atromarginatus	GN	150-350	8	735-919		
C. squamosus	LL,DL,	450-900	23	481-1012	35	390-1060
Centroscyllium kamoharai	LL	630-720			2	452
Centroscymnus owstoni	GN,LL,DL,	150-1200	235	337-846	309	506-1220
C. coelolepis	GN,LL,DL,	300-1200	44	637-924	33	662-1132
Cirrhigaleus barbifer	GN	30-60	1	695	1	1021
Dalatias licha	BT,GN,LL,DL,	150-800	9	389-1225	13	367-1575
Deania eglantina	GN,BT,	150-450	36	358-883	15	312-942
D. hystricosum	GN,LL,DL,	150-800	157	313-937	60	312-1217
Etmopterus frontimaculatus	BT	200-450	88	156-286	98	158-461
E. lucifer	BT,MT,LL,	60-750	452	124-432	396	125-474
E. unicolor	LL,DL,	450-1200	22	242-535	40	271-575
Scymnodon squamulosus	LL	450-830	4	522-547		
S. ichiharaii	LL,DL,	450-830	9	492-1011	7	1055-1455
Somniosus pacificus	GN,DL,	300,880	1	2540	1	2680
Squaliolus laticaudatus	MT	60-200	59	83.7-150.2	31	94.6-140.0
Squalus japonicus	BT	120-360	9	366-651	9	354-558
S. mitsukurii	BT,GN,	120-360	16	309-931	18	251-868
Squatina japonica	GN		1	399	1	690
S. nebulosa	GN,BT,	120-300	14	333-1509	19	326-1585
Dasyatis akajei	BT	135-285			1	410*
Rhinobatos schlegelii	BT	105	1	714	1	876
Narke japonica	GN,BT,	105-180	7	94-274	29	135-268
Torpedo tokionis	GN,BT,		1	635	2	926,980
Chimaera phantasma	GN,BT,	120-400	82	112-518	106	130-802**
Hydrolagus mitsukurii	GN,BT,	120-400	6	286-467	5	363-483**
Rhinochimaera pacifica	LL				1	656**

*;Disk width, **;Snout tip to upper caudal fin

Table 5. A list of the Chondrichthyes in Suruga Bay and adjacent waters

Elasmobranchii

Heterodontiformes

Heterodontidae
Heterodontus japonicus

Hexanchiformes

Chlamydoselachidae
Chlamydoselachus anguineus

Hexanchidae
Heptranchias perlo
Hexanchus griseus

Lamniformes

Alopiidae
Alopias pelagicus

Carcharhinidae
Prionace glauca

Cetorhinidae
Cetorhinus maximus

Lamnidae
Isurus oxyrinchus

Odontaspididae
Odontaspis ferox

Orectolobidae
Orectolobus japonicus

Pseudotriakidae
Pseudotriakis acrales[1)]

Rhincodontidae
Rhincodon typus[1)]

Scapanorhynchidae
Scapanorhynchus owstoni

Scyliorhinidae
Apristurus macrorhynchus[11)]
A. platyrhynchus
Cephaloscyllium umbratile
Galeus eastmani
G. nipponensis
Parmaturus pilosus

Sphyrnidae
Sphyrna lewini
S. zygaena[1)]

Triakididae
Hemitriakis japanica
Mustelus griseus
M. manazo
Triakis scyllia

Squaliformes

Pristiophoridae
Pristiophorus japonicus

Squatinidae
Squatina japonica
S. nebulosa

Squalidae
Centrophorus acus
C. atromarginatus
C. squamosus
Centroscyllium kamoharai
C. ritteri[1)]
Centroscymnus owstoni
C. coelolepis
Cirrhigaleus barbifer
Dalatias licha
Deania eglantina
D. hystricosum
Etmopterus frontimaculatus
E. lucifer
E. unicolor
Scymnodon ichiharaii
S. squamulosus[3)]
Somniosus longus
S. pacificus
Squaliolus laticaudatus
Squalus brevirostris[1)]
S. japonicus
S. mitsukurii

Rajiformes

Dasyatidae
Dasyatis akajei
Gymnura japonica
Urolophus aurantiacus[1)]

Mobulidae
Mobula japonica

Myliobatidae
Myliobatis tobijei

Rajidae
Raja fusca[1)]
R. kenojei[1)]
R. macrocauda[1)]

Rhinobatidae
Rhina ancylostoma[5)17)]
Rhinobatos hynnicephalus
R. schlegelii

Torpedinidae
Narke japonica
Torpedo tokionis

Holocephali

Chimaeriformes

Chimaeridae
Chimaera phantasma
Hydrolagus mitsukurii
H. ogilbyi[9)]

Rhinochimaeridae
Rhinochimaera pacifica

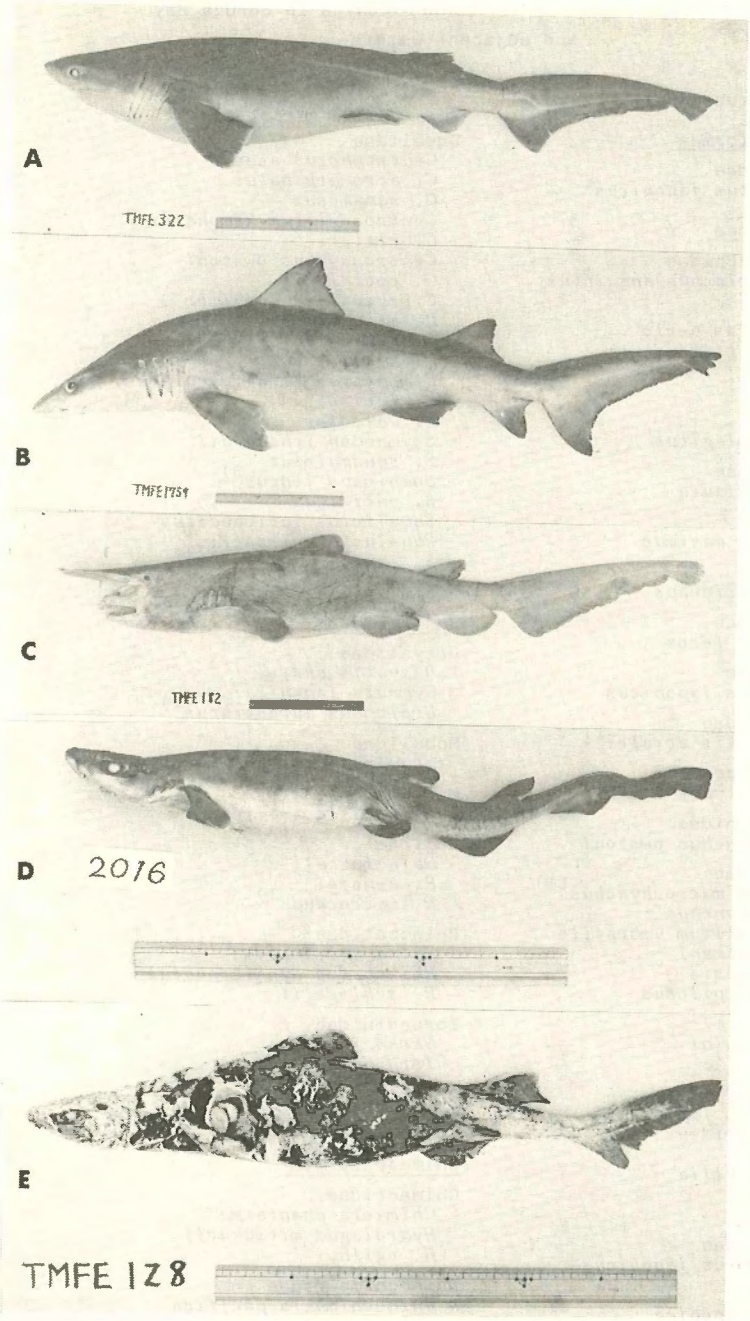

Plate 1 A; *Hexanchus griseus*, B; *Odontaspis ferox*, C; *Scapanorhynchus owstoni*, D; *Parmaturus pilosus*, E; *Centroscyllium kamoharai*, Scales indicate 30 cm.

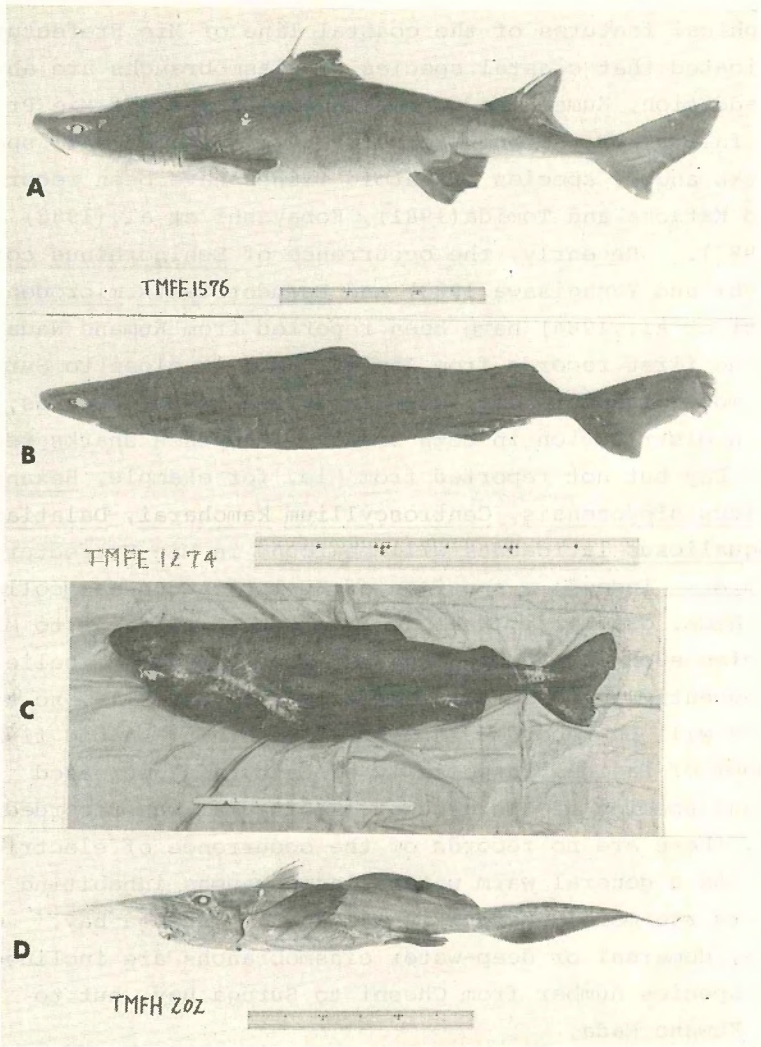

Plate 2 A; *Cirrhigaleus barbifer*, B; *Scymnodon squamulosus*, C; *Somniosus pacificus*, D; *Rhinochimaera pacifica*, Scales except C indicate 30 cm, and C scale indicates 100 cm.

1-5. Mie (Kumano Nada)

Geographical features of the coastal line of Mie Prefecture are so complicated that coastal species of elasmobranchs are abundant. In addition, Kumano Nada, continental slope off Mie Prefecture, is famous for the occurrence of rare animals. 44 species of sharks and 20 species of batoid fishes have been recorded according to Kataoka and Tomida(1981), Kobayashi et al.(1982) and Kobayashi(1983). Recently, the occurrence of Echinorhinus cookei (see, Taniuchi and Yanagisawa,1983) and Pseudotriakis microdon see, Taniuchi et al.,1984) have been reported from Kumano Nada. These were the first records from Japan. Mie is close to Suruga Bay so that most elasmobranchs, especially deep-water species, are common in distribution in both areas. Deep-sea sharks recorded in Suruga Bay but not reported from Mie, for example, Hexanchus griseus, Galeus nipponensis, and Squaliolus laticaudus will be found in Mie Prefecture in near future. Indeed, a specimen of S. laticaudus was collected from Kumano Nada, off Taiji, Wakayama Prefecture adjacent to Mie. Pelagic species such as A. pelagicus and A. valpinus are believed to occur frequently in the coastal area of Kii Peninsula, so the above species will be recorded in Mie. Concerning batoid fishes, species number of Rajidae, especially of Bathyraja decreased greatly. Only one species of the genus B. tobitsukai was recorded. Furthermore, there are no records of the occurrence of electric rays here. As a general warm water elasmobranchs inhabiting shallow waters are more numerous in Mie than in Suruga bay. On the contrary, demersal or deep-water elasmobranchs are inclined to increase in species number from Choshi to Suruga Bay, but to decrease in Kumano Nada. (T. Taniuchi)

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Table 6. List of elasmobranchs in Mie.

Heterodontidae ネコザメ科

Heterodontus japonicus (Duméril) ネコザメ

Hexanchidae カグラザメ科

Heptranchias perlo (Bonnaterre) エドアブラザメ

Carcharhinidae メジロザメ科

Prionace glauca (Linnaeus) ヨシキリザメ

Rhizoprionodon acutus (Rüppell) ヒラガシラ

Cetorhinidae ウバザメ科

Cetorhinus maximus (Gunnerus) ウバザメ

Lamnidae ネズミザメ科

Isurus oxyrinchus Rafinesque アオザメ

Odontaspididae ミズワニ科

Odontaspis ferox (Risso) オオワニザメ

Orectolobidae テンジクザメ科

Chiloscyllium indicum (Gmelin) テンジクザメ

Orectolobus japonicus Regan オオセ

Pseudotriakididae オシザメ科

Pseudotriakis acrales Jordan et Snyder オシザメ

Rhincodontidae ジンベエザメ科

Rhincodon typus Smith ジンベエザメ

Scapanorhynchidae ミツクリザメ科

Scapanorhynchus owstoni (Jordan) ミツクリザメ

Scyliorhinidae トラザメ科

Apristrus longicephalus Nakaya テングヘラザメ

Apristrus platyrhynchus (Tanaka) ヘラザメ

Cephaloscyllium umbratile Jordan et Fowler ナヌカザメ

Galeus eastmani (Jordan et Snyder) ヤモリザメ

Parmaturus pilosus Garman イモリザメ

Scyliorhinus torazame (Tanaka) トラザメ

Sphyrnidae シュモクザメ科

Sphyrna lewini (Griffith et Smith) アカシュモクザメ

Sphyrna zygaena (Linnaeus) シロシュモクザメ

Table 6. (Continued.)

Triakididae ドチザメ科

Hemitriakis japanica (Müller et Henle) エイラクブカ

Mustelus griseus Pietschmann シロザメ

Mustelus manazo Bleeker ホシザメ

Triakis scyllia Müller et Henle ドチザメ

Pristiophoridae ノコギリザメ科

Pristiophorus japonicus Günther ノコギリザメ

Squalidae ツノザメ科

Centrophorus acus Garman タロウザメ

Centrophorus atromarginatus Garman アイザメ

Centrophorus tessellatus Garman ゲンロクザメ

Centroscyllium kamoharai Abe ハダカカスミザメ

Centroscyllium ritteri Jordan et Fowler カスミザメ

Centroscymnus owstoni Garman ユメザメ

Dalatias licha (Bonnaterre) ヨロイザメ

Deania eglantina Jordan et Snyder ヘラツノザメ

Echinorhinus cookei Pietschmann コギクザメ

Etmopterus frontimaculatus Pietschmann カラスザメ

Etmopterus lucifer Jordan et Snyder フジクジラ

Etmopterus unicolor (Engelhardt) ニセカラスザメ

Lepidorhinus squamosus (Bonnaterre) モミジザメ

Scymnodon squamulosus (Günther) ピロウドザメ

Scymnodon sp.1

Somniosus pacificus Bigelow et Schroeder オンデンザメ

Squalus blainvillei (Risso) ヒレタカツノザメ

Squatinidae カスザメ科

Squatina japonica Bleeker カスザメ

Squatina nebulosa Regan コロザメ

Table 6. (Continued.)

Dasyatidae アカエイ科

Dasyatis akajei (Müller et Henle) アカエイ

Dasyatis ushiei Jordan et Hubbs ウシエイ

Gymnura japonica (Temminck et Schlegel) ツバクロエイ

Urolophus aurantiacus Müller et Henle ヒラタエイ

Mobulidae イトマキエイ科

Mobula japanica (Müller et Henle) イトマキエイ

Myliobatidae トビエイ科

Aetobatus narinari (Euphrasen) マダラトビエイ

Myliobatis tobijei Bleeker トビエイ

Platyrhinidae ウチワザメ科

Platyrhina sinensis (Bloch et Schneider) ウチワザメ

Rajidae ガンギエイ科

Bathyraja tobitukai (Hiyama) トビツカエイ

Raja fusca Garman クロカスベ

Raja gigas Ishiyama ゾウカスベ

Raja kenojei Müller et Henle ガンギエイ

Raja macrocauda Ishiyama キツネカスベ

Raja porosa Günther コモンカスベ

Raja pulchra Liu メガネカスベ

Raja schmidti Ishiyama ツマリカスベ

Raja tengu Jordan et Fowler テングカスベ

Rhinobatidae サカタザメ科

Rhina ancylostoma Bloch et Schneider シノノメサカタザメ

Rhinobatos schlegelii Müller et Henle サカタザメ

Torpedinidae シビレエイ科

Narke japonica (Temminck et Schlegel) シビレエイ

1-6. Nagasaki and Okinawa

Seas around Nagasaki are favoured with abundant marine organisms because this region is adjacent to a continental shelf and slope and shallow East China Sea where a cool and a warm water masses encounter. Fisheries especially trawls have been developed since Meiji era. Therefore, many kinds of elasmobranchs have been reported. So far 57 species of sharks and 24 species of batoid fishes have been recorded according to Makihata(1967), Matsuo(1968), Faculty of Fisheries, Nagasaki University(1973) and Okano(1980). Species of elasmobranchs are more numerous in Nagasaki than in any other places in this study, either because elasmobranchs are abundant indeed here or because many kinds of fisheries have been conducted. Species names recorded only from Nagasaki in this study are as follows; Notorhynchus cepedianus, Mustelus kanekonis, Hypogaleus hyugaensis, Hemigaleus macrostoma, Carcharhinus dussumieri, C. brevipinna, Pristis cuspidatus, Raja hollandi and R. acutispina. Of these elasmobranchs, H. macrostoma and P. cuspidatus are excluded from the list of Japanese fishes compiled by The Ichthyological Society of Japan. M. kanekonis is treated here as a valid species, although it was synonymized with M. griseus(see, Teshima and Koga,1971) or M. manazo(see, Taniuchi,1978). The feature of distributional pattern in Nagasaki generally resembles that in Okinawa. Particularly most sharks of the family Carcharhinidae and Squalidae are distributed in both regions. It is also a feature in Nagasaki that six species of the genus Raja have been reported here but that none of Bathyraja and Rhinoraja have not been recorded. Probably because skates of Raja are captured more easily with trawl net in the shallow East China Sea. The record of P. cuspidatus is worth noticing, although the locality was not refered. Okinawa, which is composed of the Ryukyu Islands, is adjacent westward to Taiwan, northward to the shallow East China Sea, southward to deep Pacific Ocean and eastward to southern Kyushu. Accordingly, many kinds of elasmobranchs are distributed around here. Total number of 70 sharks and 22 rays has been reported by

Masuda et al.(1976), Uchida(1982) and Shirai(1983). It is marked that elasmobranchs reported from here are almost exclusively warm-water species reflecting the topographical features. Species recorded only in Okinawa in this study are as follows; Pseudocarcharias kamoharai, Nebrius concolor, Carcharhinus leucas or amboinensis, C. altimus, Negaprion acutidens, Rhinoptera javanica, Mobula diabolus, Mobula sp.(M.formosana) and Manta birostris. Of these elasmobranchs P.kamoharai was firstly described from off Kochi, although this species is not recorded in this study. C. leucas or amboinensis and C. altimus have not been reported yet in the scientific literatures. D. uarnak is called Minami-ōtomeei here but Torafuei in Nagasaki. Anyhow, D. uarnak should be added to the Japanese Ichthyofauna, whether Japanese name is Torafuei or Minami-otomeei. Nebrius concolor was recorded in Taiji, Wakayama Prefecture(Yanagisawa,1982). It is a striking feature in the distributional pattern of elasmobranchs in Okinawa that there are the largest number of species of Carcharhinidae, Dasyatidae and Mobulidae of nine places in this study. On the other hand, only one species of Rajidae was recorded(Uchida,1982). (K. Mizue)

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Table 7. List of elasmobranchs in Nagasaki.

Heterodontidae ネコザメ科

Heterodontus japonicus (Duméril) ネコザメ

Heterodontus zebra (Gray) シマネコザメ

Hexanchidae カグラザメ科

Heptranchias perlo (Bonnaterre) エドアブラザメ

Hexanchus griseus (Bonnaterre) カグラザメ

Notorhynchus cepedianus (Péron) エビスザメ

Alopiidae オナガザメ科

Alopias pelagicus Nakamura ニタリ

Alopias superciliosus (Lowe) ハチワレ

Carcharhinidae メジロザメ科

Carcharhinus brevipinna (Müller et Henle) ハナザメ

Carcharhinus dussumieri (Valenciennes) スミツキザメ

Carcharhinus falciformis (Bibron) クロトガリザメ

Carcharhinus longimanus (Poey) ヨゴレザメ

Carcharhinus melanopterus (Quoy et Gaimard) ツマグロ

Carcharhinus plumbeus (Nardo) ヤジブカ

Carcharhinus albimarginatus (Rüppell) ツマジロ

Carcharhinus gangeticus (Müller et Henle)

Carcharhinus limbatus (Valenciennes) カマストガリザメ

Carcharhinus obscurus (Lesueur) ドタブカ

Galeocerdo cuvier (Péron et Lesueur) イタチザメ

Hypoprion macloti (Müller et Henle) ホコサキ

Prionace glauca (Linnaeus) ヨシキリザメ

Rhizoprionodon acutus (Rüppell) ヒラガシラ

Hemigaleus macrostoma Bleeker ホソイバラザメ

Cetorhinidae ウバザメ科

Cetorhinus maximus (Gunnerus) ウバザメ

Lamnidae ネズミザメ科

Carcharodon carcharias (Linnaeus) ホホジロザメ

Isurus oxyrinchus Rafinesque アオザメ

Table 7. (Continued.)

Odontaspididae ミズワニ科

Odontaspis taurus (Rafinesque) シロワニ

Orectolobidae テンジクザメ科

Chiloscyllium indicum (Gmelin) テンジクザメ

Cirrhoscyllium expolitum (Smith et Radcliffe) ヒゲザメ

Orectolobus japonicus Regan オオセ

Stegostoma fasciatum (Hermann) トラフザメ

Scyliorhinidae トラザメ科

Cephaloscyllium umbratile Jordan et Fowler ナヌカザメ

Galeus eastmani (Jordan et Snyder) ヤモリザメ

Galeus sauteri (Jordan et Richardson) タイワンヤモリザメ

Halaelurus buergeri (Müller et Henle) ナガサキトラザメ

Scyliorhinus torazame (Tanaka) トラザメ

Sphyrnidae シュモクザメ科

Sphyrna lewini (Griffith et Smith) アカシュモクザメ

Sphyrna zygaena (Linnaeus) シロシュモクザメ

Triakididae ドチザメ科

Hemitriakis japanica (Müller et Henle) エイラクブカ

Hypogaleus hyugaensis (Miyosi) ツマグロエイラクブカ

Mustelus griseus Pietschmann シロザメ

Mustelus manazo Bleeker ホシザメ

Add "Mustelus kanekonis Tanaka ソウボウシロザメ" in the list

Proscyllium habereri (Hilgendorf) ヒョウザメ

Triakis scyllia Müller et Henle ドチザメ

Pristiophoridae ノコギリザメ科

Pristiophorus japonicus Günther ノコギリザメ

Squalidae ツノザメ科

Centrophorus atromarginatus Garman アイザメ

Cirrhigaleus barbifer Tanaka ヒゲツノザメ

Deania eglantina Jordan et Snyder ヘラツノザメ

Etmopterus frontimaculatus Pietschmann カラスザメ

Etmopterus lucifer Jordan et Snyder フジクジラ

Table 7. (Continued.)

Isistius brasiliensis (Quoy et Gaimard) ダルマザメ

Squalus blainvillei (Risso) ヒレタカツノザメ

Squalus brevirostris Tanaka ツマリツノザメ

Squalus japonicus Ishikawa トガリツノザメ

Squalus mitsukurii Jordan et Fowler フトツノザメ

Squatinidae カスザメ科

Squatina japonica Bleeker カスザメ

Squatina nebulosa Regan コロザメ

Dasyatidae アカエイ科

Dasyatis akajei (Müller et Henle) アカエイ

Dasyatis bennetti (Müller et Henle) オナガエイ

Dasyatis melanospilos (Bleeker) マダラエイ

Dasyatis ushiei Jordan et Hubbs ウシエイ

Dasyatis zugei (Müller et Henle) ズグエイ

Dasyatis uarnak (Forsskål) トラフエイ

Gymnura japonica (Temminck et Schlegel) ツバクロエイ

Urolophus aurantiacus Müller et Henle ヒラタエイ

Mobulidae イトマキエイ科

Mobula japanica (Müller et Henle) イトマキエイ

Myliobatidae トビエイ科

Aetobatus narinari (Euphrasen) マダラトビエイ

Myliobatis tobijei Bleeker トビエイ

Platyrhinidae ウチワザメ科

Platyrhina sinensis (Bloch et Schneider) ウチワザメ

Rajidae ガンギエイ科

Raja acutispina Ishiyama モヨウカスベ

Raja hollandi Jordan et Richardson イサゴガンギエイ

Raja kenojei Müller et Henle ガンギエイ

Raja macrophthalma Ishiyama メダマカスベ

Raja porosa Günther コモンカスベ

Raja tengu Jordan et Fowler テングカスベ

Table 7. (Continued.)

Rhinobatidae サカタザメ科

Rhina ancylostoma Bloch et Schneider シノノメサカタザメ

Rhinobatos hynnicephalus Richardson コモンサカタザメ

Rhinobatos schlegelii Müller et Henle サカタザメ

Rhynchobatus djiddensis (Forsskål) トンガリサカタザメ

Torpedinidae シビレエイ科

Narke japonica (Temminck et Schlegel) シビレエイ

Pristidae ノコギリエイ科

Pristis cuspidatus Latham ノコギリエイ

Table 8. List of elasmobranchs in Okinawa.

Heterodontidae ネコザメ科

Heterodontus japonicus (Duméril) ネコザメ

Heterodontus zebra (Gray) シマネコザメ

Hexanchidae カグラザメ科

Heptranchias perlo (Bonnaterre) エドアブラザメ

Hexanchus griseus (Bonnaterre) カグラザメ

Hexanchus sp.1

Notorhynchus cepedianus (Péron) エビスザメ

Notorhynchus pectorosus Garman ミナミエビスザメ

Alopiidae オナガザメ科

Alopias pelagicus Nakamura ニタリ

Alopias superciliosus (Lowe) ハチワレ

Alopias vulpinus (Bonnaterre) マオナガ

Carcharhinidae メジロザメ科

Carcharhinus dussumieri (Valenciennes) スミツキザメ

Carcharhinus falciformis (Bibron) クロトガリザメ

Carcharhinus japonicus (Temminck et Schlegel) メジロザメ

Carcharhinus longimanus (Poey) ヨゴレザメ

Carcharhinus melanopterus (Quoy et Gaimard) ツマグロ

Carcharhinus plumbeus (Nardo) ヤジブカ

Carcharhinus sorrah (Valenciennes) ホウライザメ

Carcharhinus albimarginatus (Rüppell) ツマジロ

Carcharhinus leucas (Valenciennes)

(*Carcharhinus amboinensis* (Müller et Henle)) オオメジロザメ

Carcharhinus altimus (Springer) ハビレ

Carcharhinus obscurus (Lesueur) ドタブカ

Carcharhinus limbatus (Valenciennes) カマストガリザメ

Galeocerdo cuvier (Péron et Lesueur) イタチザメ

Hypoprion macloti (Müller et Henle) ホコサキ

Prionace glauca (Linnaeus) ヨシキリザメ

Table 8. (Continued.)

Rhizoprionodon acutus (Rüppell) ヒラガシラ

Rhizoprionodon oligolinx Springer アンコウザメ

Scoliodon laticaudus (Müller et Henle) トガリアンコウザメ

Triaenodon obesus (Rüppell) ネムリブカ

Negaprion acutidens (Rüppell) レモンザメ

Hemigaleus balfouri Day イバラザメ

Hemigaleus macrostoma Bleeker ホソイバラザメ

Cetorhinidae ウバザメ科

Cetorhinus maximus (Gunnerus) ウバザメ

Lamnidae ネズミザメ科

Carcharodon carcharias (Linnaeus) ホホジロザメ

Isurus oxyrinchus Rafinesque アオザメ

Lamna ditropis Hubbs et Follett ネズミザメ

Odontaspididae ミズワニ科

Odontaspis taurus (Rafinesque) シロワニ

Pseudocarcharias kamoharai (Matsubara) ミズワニ

Orectolobidae テンジクザメ科

Chiloscyllium indicum (Gmelin) テンジクザメ

Chiloscyllium punctatum (Müller et Henle) イヌザメ

Cirrhoscyllium expolitum (Smith et Radcliffe) ヒゲザメ

Orectolobus japonicus Regan オオセ

Orectolobus maculatus (Bonnaterre) クモハダオオセ

Stegostoma fasciatum (Hermann) トラフザメ

Nebrius concolor Rüppell オオテンジクザメ

Rhincodontidae ジンベエザメ科

Rhincodon typus Smith ジンベエザメ

Scyliorhinidae トラザメ科

Cephaloscyllium umbratile Jordan et Fowler ナヌカザメ

Galeus eastmani (Jordan et Snyder) ヤモリザメ

Galeus sauteri (Jordan et Richardson) タイワンヤモリザメ

Table 8. (Continued.)

Halaelurus buergeri (Müller et Henle) ナガサキトラザメ

Scyliorhinus sp.1

Sphyrnidae シュモクザメ科

Sphyrna lewini (Griffith et Smith) アカシュモクザメ

Sphyrna mokarran (Rüppell) ヒラシュモクザメ

Sphyrna zygaena (Linnaeus) シロシュモクザメ

Triakididae ドチザメ科

Hemitriakis japanica (Müller et Henle) エイラクブカ

Mustelus griseus Pietschmann シロザメ

Mustelus manazo Bleeker ホシザメ

Proscyllium habereri (Hilgendorf) ヒョウザメ

Triakis scyllia Müller et Henle ドチザメ

Pristiophoridae ノコギリザメ科

Pristiophorus japonicus Günther ノコギリザメ

Squalidae ツノザメ科

Centrophorus scalpratus McCulloch ヤジリザメ

Centrophorus atromarginatus Garman アイザメ

Centrophorus sp.1

Deania eglantina Jordan et Snyder ヘラツノザメ

Etmopterus lucifer Jordan et Snyder フジクジラ

Squalus brevirostris Tanaka ツマリツノザメ

Squalus mitsukurii Jordan et Fowler フトツノザメ

Squalus sp.1

Squatinidae カスザメ科

Squatina japonica Bleeker カスザメ

Squatina nebulosa Regan コロザメ

Table 8. (Continued.)

Dasyatidae アカエイ科

Dasyatis bennetti (Müller et Henle) オナガエイ

Dasyatis kuhlii (Müller et Henle) ヤッコエイ

Dasyatis ushiei Jordan et Hubbs ウシエイ

Dasyatis melanospilos (Bleeker) マダラエイ

Dasyatis uarnak (Forsskål) ミナミオトメエイ

Gymnura japonica (Temminck et Schlegel) ツバクロエイ

Urolophus aurantiacus Müller et Henle ヒラタエイ

Mobulidae イトマキエイ科

Manta birostris (Donndorff) オニイトマキエイ

Mobula diabolus (Shaw) ヒメイトマキエイ

Mobula japonica (Müller et Henle) イトマキエイ

Mobula sp.1 (*Mobula formosana* Teng) タイワンイトマキエイ

Myliobatidae トビエイ科

Aetobatus narinari (Euphrasen) マダラトビエイ

Rhinoptera javanica Müller et Henle ウシバナトビエイ

Platyrhinidae ウチワザメ科

Platyrhina sinensis (Bloch et Schneider) ウチワザメ

Rajidae ガンギエイ科

Raja sp.2

Rhinobatidae サカタザメ科

Rhina ancylostoma Bloch et Schneider シノノメサカタザメ

Rhinobatos hynnicephalus Richardson コモンサカタザメ

Rhinobatos schlegelii Müller et Henle サカタザメ

Rhynchobatus djiddensis (Forsskål) トンガリサカタザメ

Torpedinidae シビレエイ科

Narke japonica (Temminck et Schlegel) シビレエイ

Torpedo tokionis (Tanaka) ヤマトシビレエイ

Pristidae ノコギリエイ科

Pristis cuspidatus Latham ノコギリエイ科

The sharks of the east coast of Taiwan

Che-Tsung Chen*

Since Teng(1962) reported the species of sharks around the waters of Taiwan, there are little studies concerning systematic or taxonomy of sharks in past two decades in this area. However, at that time the fisheries in the eastern waters of Taiwan was not so developed as today. Teng concentarated his work on sharks upon the western and southern waters of Taiwan. Today the situation of the fisheries in eastern Taiwan has highly developed than 20 years ago. In order to establish the more complete list of sharks in Taiwan, it must cover the species of sharks, which are found in the waters of eastern Taiwan. From October 1978 to June 1981 and from July 1982 to June 1983, the author has collected samples of sharks from eastern Taiwan waters and identified them.

The samples of sharks which were caught from eastern Taiwan waters were all fished by surface and bottom longline, gill net and spear fishing mainly in the coast of Taitung, Suao and Tasi. Based on the investigations of the past 3 years, the sharks which were taken off from eastern Taiwan waters contained 45 species and 11 of them are the species which have never been recorded in Taiwan. The near complete list of sharks in Taiwan is shown as follow:

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A list of sharks in Taiwan waters

Eastern waters of Taiwan
* New record species

Hexanchidae	*Notorhynchus pectorosus*
	# *Heptranchias perlo*
	# *Hexanchus griseus*
	H. griseus nakamurai
Heterodintiade	*Heterodontus japonicus*
	H. zebra
Rhincodontidae	# *Rhincodon typus*
Orectolobidae	*Orectolobus maculatus*
	# *O. japonicus*
	# *Cirrhoscyllium formosanum*
	Ginglymostoma ferrugineum
	*# *G. cirratum*
	Stegostoma fasciatum
	# *Chiloscyllium punctatum*
	C. plagiosum
	# *C. colax*
Scyliorhinidae	*Galeus sauteri*
	# *Cephaloscyllium umbratile*
	C. formosanum
	# *Atelomycterus marmuratus*
	Halaelurus burgeri
	Apristurus macrorhynchus
	Calliscyllium venustum
Isuridae	# *Isurus glaucus*
	Carcharodon carcharias
Cetorhinidae	*Cetorhinus maxinus*
Pseudotriakidae	# *Pseudotriakis acrages*

Alopiidae	# *Alopias pelagicus*
	A. vulpinus
	# *A. supercilosus*
Carchariidae	# *Carcharias taurus*
	C. yangi
Triakidae	*Mustelus griseus*
	M. manazo
	M. kanekonis
	Triakis scyllia
	T. venusta
	# *Triaenodon obesus*
	Proscyllium habereri
Carcharhinidae	# *Scoliodon walbeemii*
	S. palasorrah
	S. sorrakowah
	# *Hypoprion macloti*
	# *Carcharhinus brachyurus*
	# *C. sorrah*
	# *C. melanopterus*
	C. dussumeiri
	# *C. albimarginatus*
	# *C. longimanus*
	# *C. plumbeus*
	*# *C. leucas*
	*# *C. obscurus*
	*# *C. falciformis*
	# *Prionace glauca*
	Hemigaleus balfouri
	H. microstoma
	H. macrostoma
	H. tengi

Carcharhinidae	# *Galeocerdo cuvier*
	G. rayneri
	# *Hemitriakis japonicus*
	H. hyugaensis
Sphyrnidae	*Sphyrna mokarran*
	# *S. lewini*
	# *S. zygaena*
Squalidae	*Etmopterus lucifer*
	Deania eglantina
	*# *D. calcea*
	Squalus acanthias
	S. megalops
	# *S. japonicus*
	*# *S. blainville*
	*# *S. mitsukurii*
	*# *Cirrhiqaleus barbifer*
	# *Centrophorus armatus*
	# *C. lustitanicus*
	# *C. niauking*
	*# *C. acus*
	*# *C. scalpratus*
	*# *Scymnodon squamulosus*
Dalatiidae	*Squaliolus alii*
	# *Dalatias licha*
Echinorhinidae	# *Echinorhinus brucus*
Pristiophoridae	*Pristiophorus japonicus*

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Preliminary investigation of sharks and rays in the Philippines

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Sharks and rays in the Philippines were preliminary investigated by Drs.T.Taniuchi(Univ. of Tokyo), S.Tanaka(Tokai Univ.), T.Otake(Ocean Research Inst. Univ. of Tokyo) and E.Flores(Univ. of the Philippines) from Dec.26 to Dec.31 in 1981.

Recently, several Japanese companies have exploited deep-sea shark fishery in the Philippines for the purpose of collecting "Squalene". Before visiting the Philippines, we got in touch with Mr.Fujii, the owner of Alhana Enterprises Company that deals with "Squalene". He informed us three main fishing grounds for deep-sea sharks, that is, Aparii, norhtern part of Luzon Island; Butuan, northern part of Mindanao Island; Kalibo, northern part of Panay Island.

T.Taniuchi, S.Tanaka and T.Otake went to Manila on Dec.26 and joined E.Flores. In the Philippines, we first met Mr.R. Barrican, the local manager of Alhana Enterprises Company, and got more detail information on the shark fishery in the Philippines. According to him, shark fishery is also carried out in Selebes sea, Sulu sea, eastern coastal waters of Palawan Island and southern Panay Island. Fig.1 shows the fishing areas of sharks. Then he introduced us to Mr.Kamacho who was a sharkfisherman in San Jose of Mindro Island. Mr.Kamacho employed seven or eight fishermen and was operating long line fishing for deep-sea sharks.

T.Taniuchi, S.Tanaka and T.Otake went to San Jose on Dec. 29 and joined Mr.Kamacho to get on a fishing boat. The fishing boat,called "Banka" with out-rigger, is about 10m long and 1m wide(Fig.2). Usually, two or three people board and cruise for two or three days. The bottom long line with about 400 hooks at 10m intervals is set between 400 and 1000m in depth.

Usually, 15 sharks, being composed of Centrophorus spp., were caught on the average. Specimens caught were disected just after landed on the beach. Viscera except for livers were thrown and meat was eaten after dried. During our boarding, one specimen of Squalus brevirostris, S. japonicus, Eridachnis radcliffei, Centrophorus scalpratus and six specimens of Chimaera phantasma (Fig.3,4) were caught, although the long line was set at 300m in depth which is different from the depth of usual operation. Fig.5 shows our fishing. Fishing was done by human power. After fishing, we visited their village and met a fisherman who possessed two jaws of sharks (Fig.6). They were identified as the jaws of Odontaspis ferox from their dental formula. The dental formulae are shown in Table 1.

Before visiting San Jose, we went to Univ. of the Philippines (UP) on Dec.27. UP has carried out the routine research on bottom fishes in Philippine waters by using the research vessel "Sardinella". We observed specimens of elasmobranchs collected by the research vessel and found Chiloscyllium colax, Sphyrna lewini, Pristiophorus cirratus and Dasyatis kuhlii (Fig.7). Then we had a chance to see and talk with Dr.Jose Carreon, director of fishery division of UP. He was very afraid of recent decrease in the population of elasmobranchs in Philippine waters. Furthermore he regretted that their elasmobranch study, especially of population dynamics, taxonomy and reproductive biology was not conducted. So he anticipated our research plan and kindly promised to help us as possible as he could, for example, providing facilities for research.

After visiting UP, we went to fish market in Navotas under the guidance of Mr.Ave who was an assistant researcher of Dr.E.Flores. In the fish market, fishes were landed from eight p.m. and were auctioned at midnight.

Although elasmobranchs were few, Scoliodon, Mustelus, Sphyrna, Rhinobatos and Dasyatis spp. were observed there (Fig.8).

We concluded as follows from the result of preliminary investigation:

(1) In fish market of Navotas , both pelagic and coastal sharks and rays can be collected and studied on their biology.

(2) By using the research vessel of UP, bottom sharks and rays can be taken, Many tropical sharks and rays are known to have no special reproductive season, so it is possible to collect specimens of every reproductive stage within short period. As a result many interesting physiological and ecological informations about the reproduction would be obtained.

(3) Deep-sea sharks can be taken by bottom long line fishing near San Jose. It would be more advantageous to charter the fishing boat.

Lastly the sharks and rays of Philippine waters are listed in Table 2 by the help of Dr.T.Taniuchi.

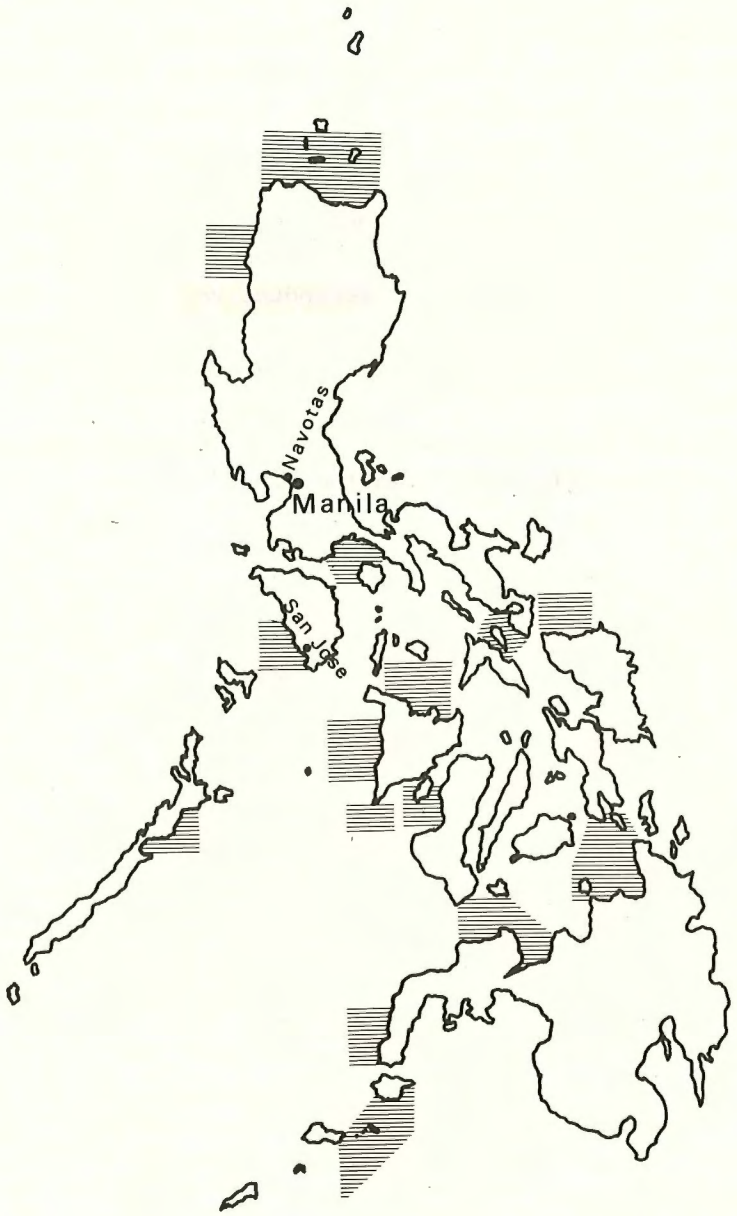

Fig. 1. Fishing areas of sharks in Philippines.

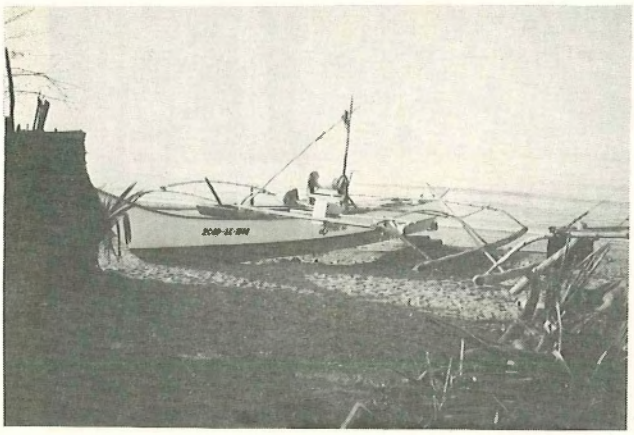

Fig. 2. Fishing boat, called "Banka", used in Philippines.

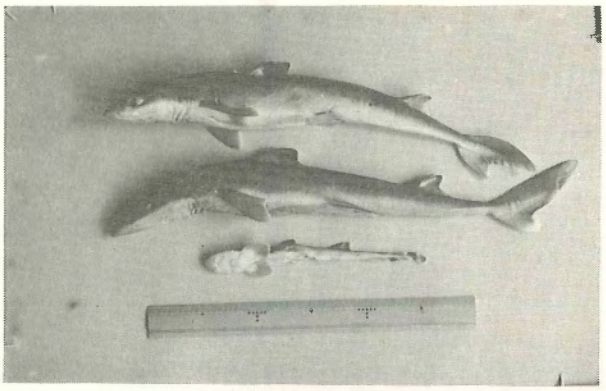

Fig. 3. Sharks caught by our bottom longline fishing. From upper, Squalus brevirostris, female, 412mm TL., S.japonicus, male, 448mm TL., Eridacnis radcliffei, female, 203mm TL.

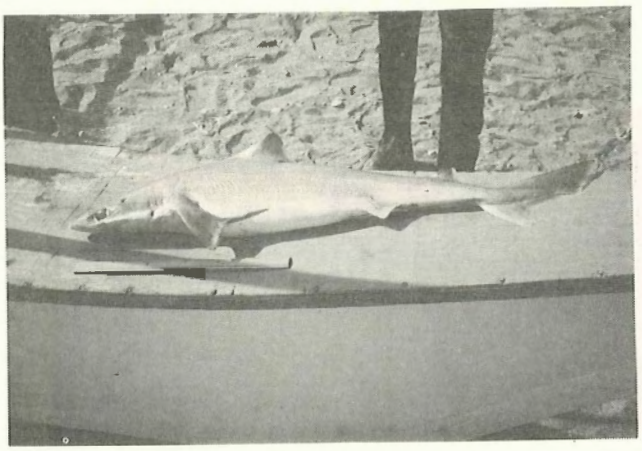

Fig. 4. Centrophorus scalpratus, male, 790mm TL.

Fig. 5. The fishing of bottom longline.

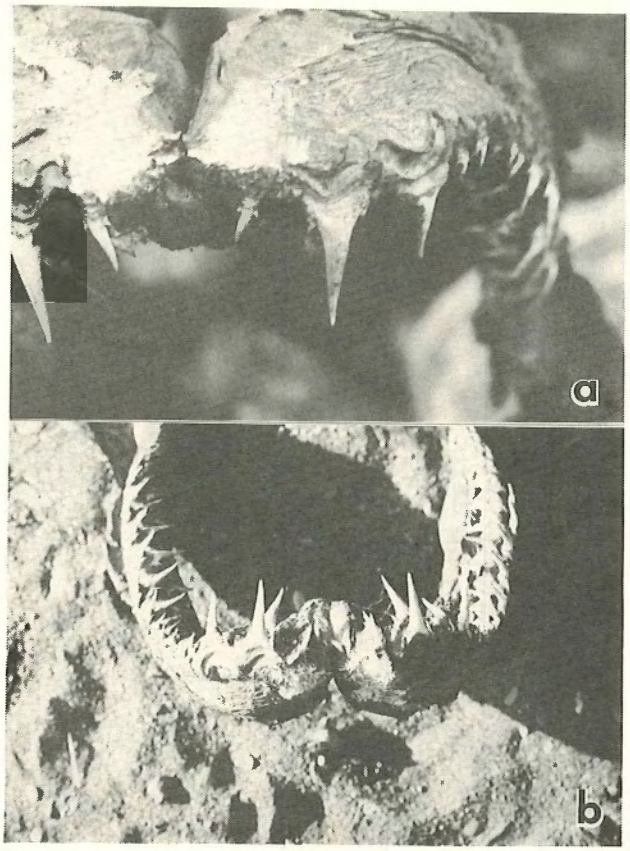

Fig.6 The jaw of Odontaspis ferox observed in San Jose, Mindro Island. a: upper jaw, b: lower jaw.

Table 1. Dental formulae of jaws of Odontaspis ferox(Risso) observed in San Jose, Mindro Island, Philippines. A figure in parenthesis demonstrates the presence of a gap which seems to replace two intermediates. P=posteriors, L=laterals, I=intermediates, A=anteriors, and S=symphyseals, according to Applegate(1965).

	Upper jaw								Lower jaw							
	Left				Right				Left				Right			
	S	A	I	P+L	S	A	I	P+L	S	A	I	P+L	S	A	I	P+L
No.1	1	2	4	16	1	2	4	19	1	3		13	1	3		17
No.2	1	2	6	20	1	2	(2)+1	18	1	3		17	1	3		18

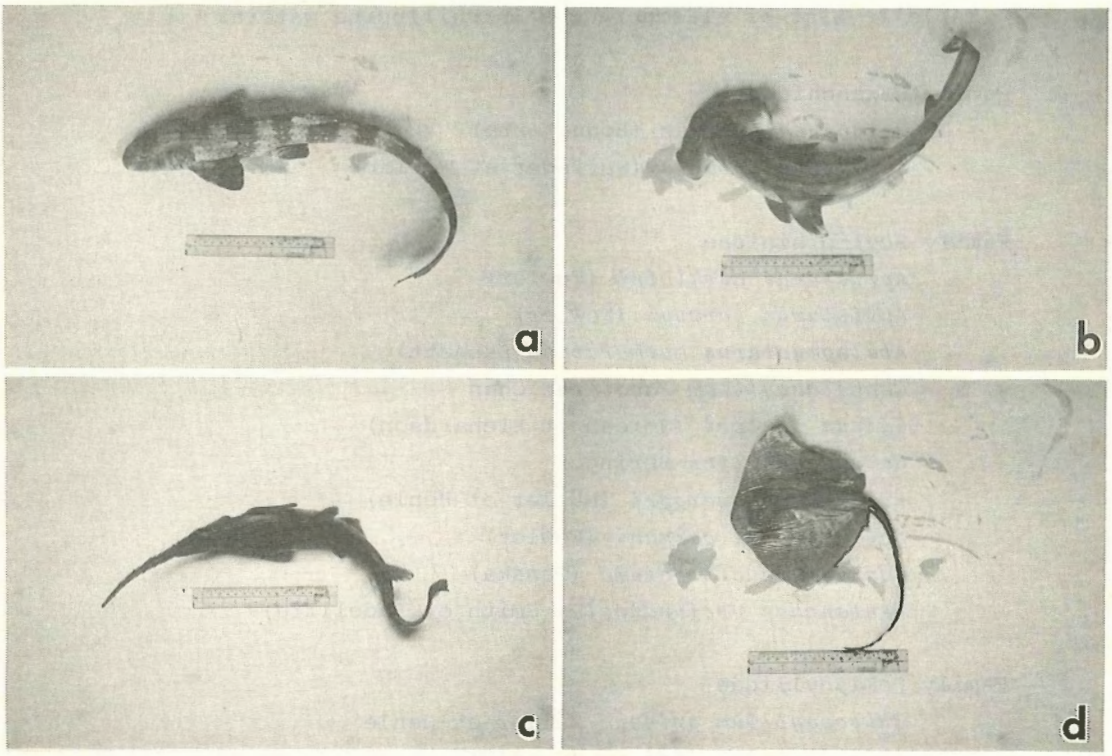

Fig. 7. Sharks and rays observed in UP.
a: Chiloscyllium colax, b: Sphyrna lewini,
c: Pristiophorus cirratus, d: Dasyatis kuhlii.

Fig. 8. Sharks and rays observed in Nabotas.

Table 2. List of elasmobranchs in Philippine waters.

Family Hexanchidae
Hexanchus griseus (Bonnaterre)
Hexanchus vitulus Springer et Waller

Family Scyliorhinidae
Apristurus herklotsi (Fowler)
Apristurus verweyi (Fowler)
Atelomycterus marmoratus (Bennett)
Cephaloscyllium fasciatum Chan
Galeus sauteri (Jordan et Richardson)
Galeus schultzi Springer
Halaelurus buergeri (Müller et Henle)
Scyliorhinus garmani (Fowler)
Scyliorhinus torazame (Tanaka)
Pentanchus profundicolus Smith et Radcliffe

Family Hemiscyllidae
Chiloscyllium griseum Müller et Henle
Chiloscyllium indicum (Gmelin)
Chiloscyllium plagiosum (Bennett)
Chiloscyllium punctatum Müller et Henle

Family Orectolobidae
Cirrhoscyllium expolitum Smith et Radcliffe
Orectolobus japonicus Regan
Stegostoma varium (Seba)

Family Rhincodontidae
Rhincodon typus Smith

Family Lamnidae
Carcharodon carcharias (Linnaeus)

Family Carcharhinidae
Negaprion acutidens (Rüppell)
Negaprion sitankaiensis (Herre)

Table 2. (Continued)

Family Carcharhinidae (continued)

Carcharhinus brevipinna (Muller et henle)
Carcharhinus albimarginatus (Ruppell)
Carcharhinus limbatus (Valenciennes)
Carcharhinus amblyrhynchoides (Whitley)
Carcharhinus melanopterus (Quoy et Gaimard)
Carcharhinus amblyrhynchos (Bleeker)
Carcharhinus falciformis (Bibron)
Carcharhinus sorrah (Valenciennes)
Carcharhinus dussumieri (Valenciennes)
Eridacnis radcliffei Smith
Galeocerdo cuvier (Peron et Lesueur)
Hemigaleus machlani Herre
Hypoprion hemiodon (Muller et Henle)
Scoliodon laticaudus Muller et Henle
Loxodon macrorhinus Muller et Henle
Rhizoprionodon acutus (Ruppell)
Triaenodon obesus (Ruppell)

Family Triakidae

Hemitriakis leucoperiptera Herre
Triakis scyllia Muller et Henle

Family Sphyrnidae

Sphyrna blochii (Cuvier)
Sphyrna lewini (Griffith et Smith)
Sphyrna zygaena (Linnaeus)
Sphyrna mokarran (Ruppell)

Family Squalidae

Deania profundorum (Smith et Radcliffe)
Etmopterus lucifer Jordan et Snyder
Etmopterus brachyurus Smith et Radcliffe
Lepidorhinus squamosus (Bonnaterre)
Squalus philippinus Smith et Radcliffe
Squaliolus laticaudus Smith et Radcliffe

Table 2. (Continued)

Family Pristiophoridae
Pristiophorus cirratus (Latham)

Family Pristidae
Pristis microdon Latham
Pristis cuspidatus Latham

Family Rhinobatidae
Rhina ancylostoma Bloch et schneider
Rhynchobatus djiddensis (Forsskål)
Rhinobatos armatus Gray
Rhinobatos formosensis Norman
Rhinobatos granulatus Cuvier
Rhinobatos schlegelii Müller et Henle
Rhinobatos microphthalmus Teng

Family Rajidae
Raja fusca Garman
Raja kenojei Müller et Henle

Family Torpedinidae
Narcine timlei (Bloch et Schneider)
Torpedo marmorata Risso
Narke dipterygia (Bloch et Schneider)

Family Dasyatidae
Dasyatis bleekeri (Blyth)
Dasyatis imbricatus (Bloch et Schneider)
Dasyatis kuhlii (Müller et Henle)
Dasyatis sephen (Forsskål)
Dasyatis uarnak (Forsskål)
Dasyatis zugei (Müller et Henle)
Taeniura lymma (Forsskål)
Urogymnus africanus (Bloch et Schneider)
Gymnura poecilura (Shaw)

Table 2. (Continued)

Family Myliobatidae

Aetobatus narinari (Euphrasen)

Aetomylus milvus (Müller et Henle)

Family Rhinopteridae

Rhinoptera javanica Müller et Henle

Family Mobulidae

Mobula diabolus (Shaw)

Report of preliminary investigation on elasmobranchs in Indonesia

Masashi Taguchi and Muchtar Ahmad

There was very little information on elasmobranchs in Indonesia when this program was planned. So in the first place the junior author made an effort to collect information on the fish markets where sharks and rays would be landed. Several fish markets, that is, Tanjunpinang(Bintan Is.), Dabo(Singakep Is.), Pelubuhan(Java Is.), Cilicap(Java Is.) and Bali Is., were found to be the best places for the investigation of elasmobranchs(Fig. 1). Firstly the senior author visited Bali Island from September 6 to 22,1982 and then both authors investigated elasmobranchs in Bintan and Singakep Is. from May 5 to June 14,1983. Here we intend to report the result of both investigations.

1. Elasmobranchs in the Bali Is.

Bali Is. is situated east of Java with a population of about 2,500 thousand. Fishing villages are found throughout the coastal area of the island and amount to 16 in the number(Fig. 2). Of these villages, we visited Kedouganan, Jimbaran and Nagara. Fishermen there do fishing during the new moon using gill net. We observed Alopias pelagicus(150cm BL), Sphyrna lewini and Carcharodon(230cm TL) in Kedouganan. These sharks were sold at the price of about 100 RP per kg on the beach. Sometimes they were brought to the fish market of Dempasar. Most sharks fished there were packed with ice and were sent to Nagara. After their fins and viscera were removed, meats were salted and were sent to Bandung. We visited P.T.Perikanan Samudra Bear(National Tuna Fishing Company), since we were told that large pelagic sharks are caught with floating longline aiming to catch tunas. In response with our inquiry, Mr. L. Soewito, local manager of the company, said that he could keep specimens of sharks in a large refrigerator. There we observed a refrigerated specimen of Carcharhinus falciformis. According to Mr. L. Soewito, the price per capita was between 5,000-6,000 RP in the case of the first class meat and about 3,000 RP

in the case of the second class meat.

2. Bintan Is. and Singakep Is.

Tanjunpinang, Bintan Is. is very close to Singapore. Fishes caught around there are sold at the fish market situated near Piers. We observed Carcharhinus melanopterus, C. sorrah, C. dussumieri and Rhizoprionodon acutus. The price per capita in the fish market was between 900-1,500 RP. Sometimes they are sold after drying(Fig. 3). We bought some specimens and made measurements(Table 1). In Dabo, Singakep Is., fishing was conducted from 10 in the morning to 4 in the afternoon, using gill net and hand line. Here batoid fishes were found to be more numerous than in Tanjunpinang. We observed Aetobatus narinari, Dasyatis kuhlii, D. uarnak and Rhinobatos schlegelii. Here we observed numerous small sharks, for example, Scoliodon laticaudus and C.melanopterus. Shark meat is roasted with salt or boiled with hot peppers and palm oil. We made some measurements of sharks there.

Finally, we tried to prepare preliminary list of elasmobranchs in Indonesia. This list is so incomplete that in future we intend to construct a more satisfactory one(Table 2).

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Fig. 1. Map of fish markets where elasmobranchs are landed.

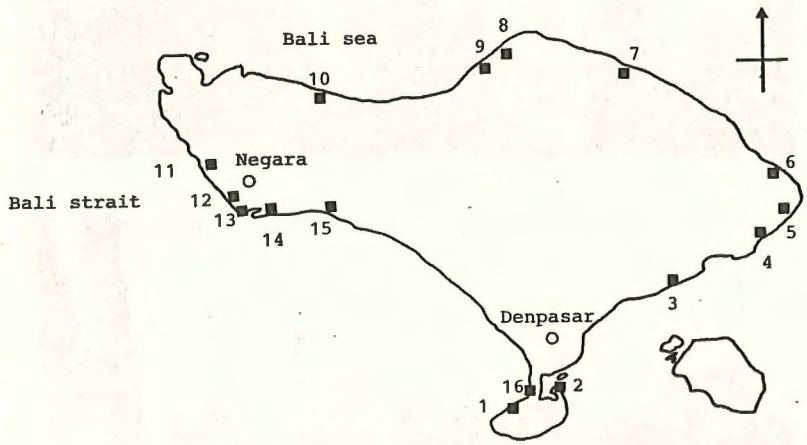

Fig. 2. Fishing villages in Bali Islands.
1, Jimbaran 2, Janjung Benoa 3, Kusamba
4, Seraya 5, Ujung 6, Amwd 7, Tejakula
8, Sangit 9, Singaraja 10, Grokgak
11, Candikesuma 12, Cupel 13, Pengambengan
14, Perancak 15,Medewi 16, Kedouganan

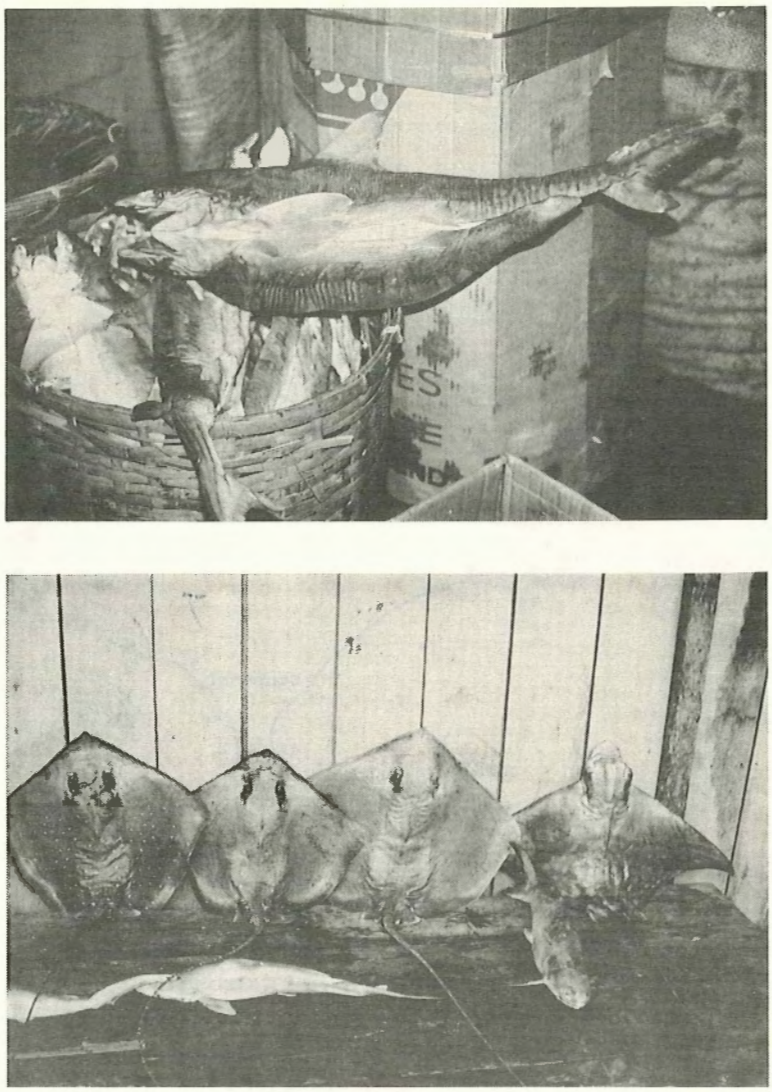

Fig. 3. Elasmobranchs in the fish market of Tandjungpinang, Bintan Is. upper; a dried shark, lower; rays.

Table 1. Sharks sampled in fish market of Tanjunpinang and Dabo

Japanese name	Scientific name	Date	Locality	Sex	TL(mm)	SL(mm)
Tsumaguro	Carcharhinus melanopterus	May 27, 1983	Tanjunpinang	male	500	375
Horaizame	C. sorrah	May 28, 1983	"	female	409	350
Hiragashira	Rhizoprionodon acutus	"	"	male	655	470
Sumitsukizame	C. dussumieri	"	"	female	563	410
Tsumaguro	C. melanopterus	May 29, 1983	Dabo	female	503	369
Togariankozame	Scoliodon laticaudus	"	"	male	500	370
"	"	"	"	female	495	363
"	"	"	"	female	485	382

Table 2. Elasmobranchs in the waters of Indonesia

Family Heterodontidae
Heterodontus zebra (Gray)

Family Scyliorhinidae
Apristurus sibogae (Weber)
Apristurus verweyi (Fowler)
Apristurus herklotsi (Fowler)
Halaelurus buergeri (Müller et Henle)
Halaelurus garmani Fowler
Pentanchus profundicolus Smith et Radcliffe
Atelomycterus marmoratus (Bennett)

Family Orectolobidae
Nebrius ferrugineus (Lesson)
Nebrius concolor Rüppell
Hemiscyllium ocellatum (Bonnaterre)
Hemiscyllium trispeculare Richardson
Hemiscyllium freycineti (Quoy et Gaimard)
Chiloscyllium punctatum Müller et Henle
Chiloscyllium plagiosum (Bennett)
Chiloscyllium griseum Müller et Henle
Chiloscyllium indicum (Gmelin)
Orectolobus dasypogon (Bleeker)
Stegostoma fasciatum (Hermann)

Family Isuridae
Isurus oxyrinchus Rafinesque

Family Rhincodontidae
Rhincodon typus Smith

Family Odontaspididae
Odontaspis taurus (Rafinesque)

Family Carcharhinidae
Rhizoprionodon acutus (Rüppell)
Scoliodon laticaudus Müller et Henle
Hypoprion macloti (Müller et Henle)
Hypoprion hemiodon (Müller et Henle)

Table 2. (Continued).

Family Torpedinidae

Narcine maculata (Shaw)

Narke dipterygia (Bloch et Schneider)

Family Rajidae

Raja annandalei Weber

Breviraja sibogae Weber

Family Dasyatidae

Taeniura lymma (Forsskål)

Dasyatis sephen (Forsskål)

Dasyatis kuhlii (Müller et Henle)

Dasyatis imbricatus (Schneider)

Urogymnus africanus (Schneider)

Urolophus javanicus (Martens)

Gymnura zonura (Bleeker)

Gymnura poecilura (Shaw)

Gymnura micrura (Schneider)

Family Myliobatidae

Aetomylus maculatus (Gray)

Aetomylus vespertilio (Bleeker)

Aetomylus milvus (Müller et Henle)

Aetomylus nichofii (Schneider)

Aetobatus narinari (Euphrasen)

Aetobatus ocellatus (Kuhl)

Rhinoptera javanica Müller et Henle

Family Mobulidae

Mobula diabolus (Shaw)

Manta birostris (Walbaum)

Exploitation of Sharks and Rays in the Philippines 1/

by

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Introduction

The Philippines has a total marine waters of about 1.9 million square kilometers(Fig. 1). The 12-mile archipelagic baseline contains 696,483 km^2 of marine waters. The Philippine Territorial Limit based on the Treaty of Paris between the United States of America and Spain(1898) adds 784,048 km^2 of mainly oceanic waters. The Philippine declaration of the Exclusive Economic Zone(EEZ) by Presidential Decree 1599 increased the marine water under the Philippine jurisdiction by by 451,782 km^2.

Even with the vast marine waters, the marine fisheries activities of the Philippines are concentrated in the coastal areas of about 266,000 km^2(Fig. 2). The coastal areas extend up to water depth of 200 meters. The production of these areas in 1982 was roughly 1.24 million tons(MT)2/, which is 65% of the total Philippine fisheries production(Fig. 3). Aquaculture contributed 21%(0.39MT) while that of freshwaters fishing was 14%(0.27MT).

As a whole the Philippine fishing activities continuously increased over the past 20 years from 1962 to 1982(Fig. 4). However a closer examination shows that the commercial marine fisheries production remained almost constant at 0.5MT since 1975. "Commercial fisheries" means those fishing operation with the use of vessels that are three(3) gross tons or more

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1/ Presented at the seminar on Sharks and Ray Biology and Exploitation, Nagasaki University, Japan, February 10, 1984.
2/ All statistical data in this paper were taken from the Bureau of Fisheries & Aquatic Resources Statistics(1962-1982)

while "municipal fishing" uses vessels less than three(3) gross tons or none at all.

On the other hand municipal fishing showed a rapid increase in production over the same period. However, since 1975, this rapid increase was brought about by the start of increased fishing activities in the municipal freshwater fishing(in lakes, rivers, reservoirs). The production from the municipal marine fishing from 1975 remained at about 0.7MT.

The stagnant fish production of both the marine commercial and municipal fishing may have been caused by reduction in fishing effort due to increase in fuel cost and/or over exploitation of target fishes in the coastal areas.

The government program to increase fish production is to develop the pelagic fisheries in oceanic waters. In the coastal areas, increased fish production may be achieved by developing the coral reef fisheries and by further exploiting the "less attractive" fishes such as sharks and rays for food and other products.

Shark and Ray Production

The Philippine shark and ray production from 1977 to 1981 was constant at about 9,000 tons at about equal proportion except for 1978 when the ray production was at about 10,000 tons and for 1981 when the shark production was at about 7,500 tons(Fig. 5). Shark and ray are mainly harvested using municipal fishing gears and crafts. For 1981, only 5% of the shark and ray production was realized by commercial fishing(Table 1).

Shark and Ray Fishing Gears

In commercial fisheries, sharks and rays are mainly harvested using otter trawl nets producing about 5% of shark and ray production for 1981(Table 1). The rest of the production was realized using municipal fishing gears such as hook and line (41%), gill net(23%), longline(17%), spear(8%) and others(6%).

Shark and Ray Fishing Grounds

The main fishing grounds for shark and ray as shown by their production for 1981 are in Regions IX, X and V which produced 25%, 21% and 19% respectively(Table 2). For shark alone, Regions IX, X and VIII are the top fishing areas while for rays Regions V, VII, IX and X.

Region V is in southern Luzon covering the province of Camarines Sur, Albay and Sorsogon. The major fishing grounds are San Miguel, Lagonoy Gulf, Albay Gulf, Ragay Gulf, Burias Pass, Ticao Pass, San Bernardino Strait and Asid Gulf(Fig. 6). The Lagonoy Gulf statistical area covering Lagonoy Gulf, Albay Gulf and San Bernardino Strait, had in 1981 a total production of 807 tons of shark and ray.

Region VIII is composed of the islands of Samar and Leyte (Fig. 7). Leyte Gulf statistical area had in 1981 a total production of 1,124 tons of shark and ray.

Region X covers the coastal provinces of Surigao del Norte, Misamis Oriental, Lanao del Norte and Misamis Occidental (Fig. 8). The Bohol Sea statistical area covering Butuan Bay, Gingoog Bay, Macajalar Bay, Iligan Bay and Murcielagos Bay had, in 1981 a total shark and ray production of 2,997 tons.

Region IX-B is composed of the provinces of Zamboanga del Norte and Zamboanga del Sur(Fig. 9). The shark and ray production(1981) of East Sulu Sea statistical area and covering Dapitan Bay, Dipolog Bay, Sindagan Bay and Sibuco Bay was 1,818 tons. Moro Gulf facing Zamboanga del Sur for the same year had a production of 342 tons.

Region IX-A covers the province of Basilan, Sulu and Tawi-Tawi(Fig. 10). The production of this area under South Sulu Sea statistical area was 1,205 tons for 1981.

As shown in the shark and ray fishing grounds mentioned about these fishing grounds are all within the coastal areas mostly in bays, gulf and bodies of water between islands.

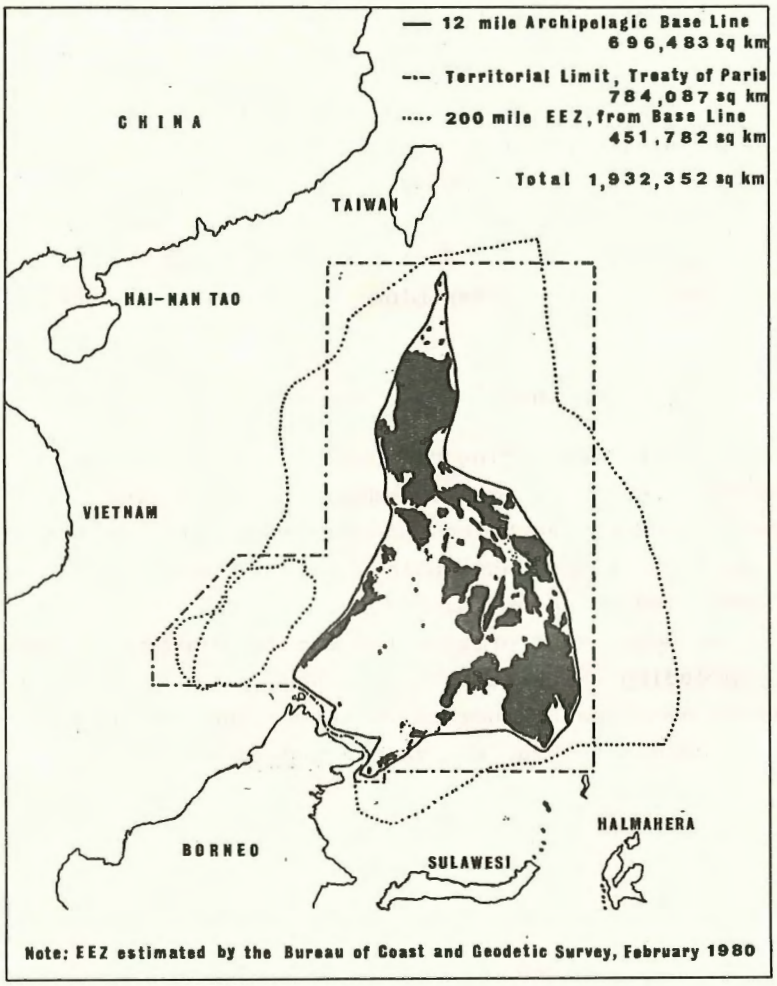
This is to be expected since the fishing gears used in catching the target fishes are municipal fishing gears such as hook and line, longline and gill nets on board fishing crafts of less than three gross tons(Fig. 11).

Shark Products

The main products from shark are shark fin and shark liver oil(Table 3). The main processing centers for shark products are Manila(National Capital Region), Antique and Iloilo(Region VI), Zamboanga del Norte(Region IX-B) and Cebu(Region VII). The shark fin is mainly exported to Singapore, Hongkong and Taiwan. Japan is the main importer of Philippine shark liver oil followed by the Federal Republic of Germany and Taiwan (Table 4).

Development of Shark and Ray Fisheries

Presently, the harvesting of shark by hook and line is maintained because of the export demand of shark liver oil. Developmental studies are being undertaken to fully utilize the shark meat for human consumption. Shark meat may be processed into product acceptable to the consumers such as fish sausage. The government program for the development of coastal fisheries includs the extension of financial and technical assistance to municipal fishermen in harvesting the less exploited resources such as the sharks and rays.



PHILIPPINE 200-MILE EEZ AND TERRITORIAL WATERS

Fig. 1. The Philippine 200-mile EEZ and Territorial Waters.

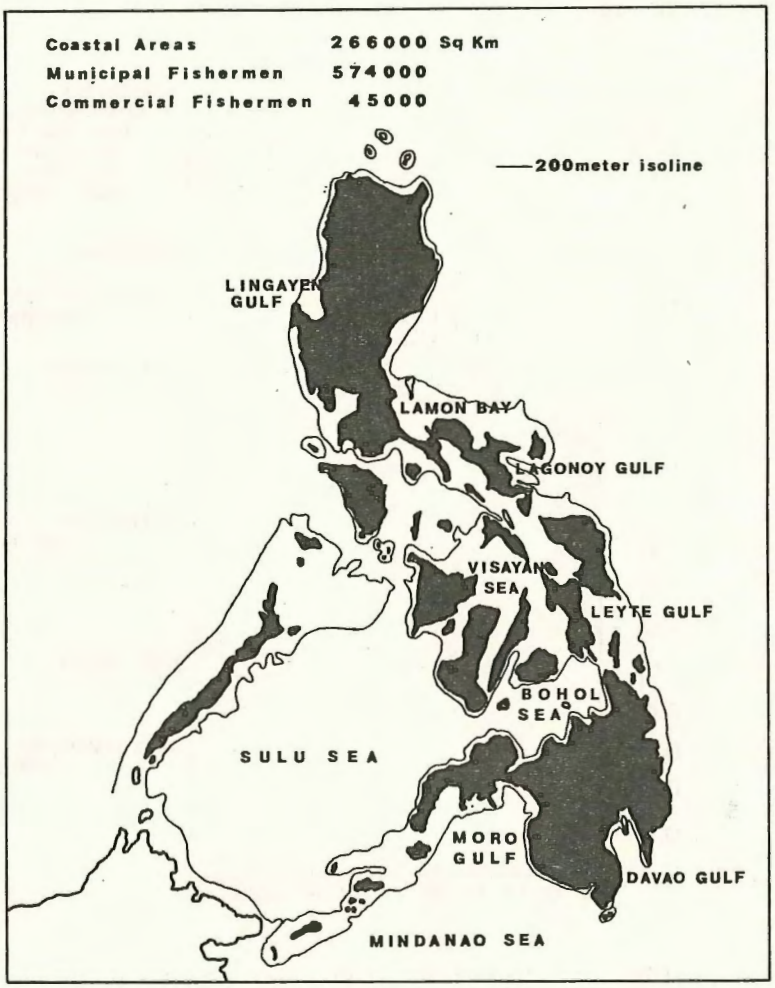


Fig. 2. Philippine Coastal Waters.

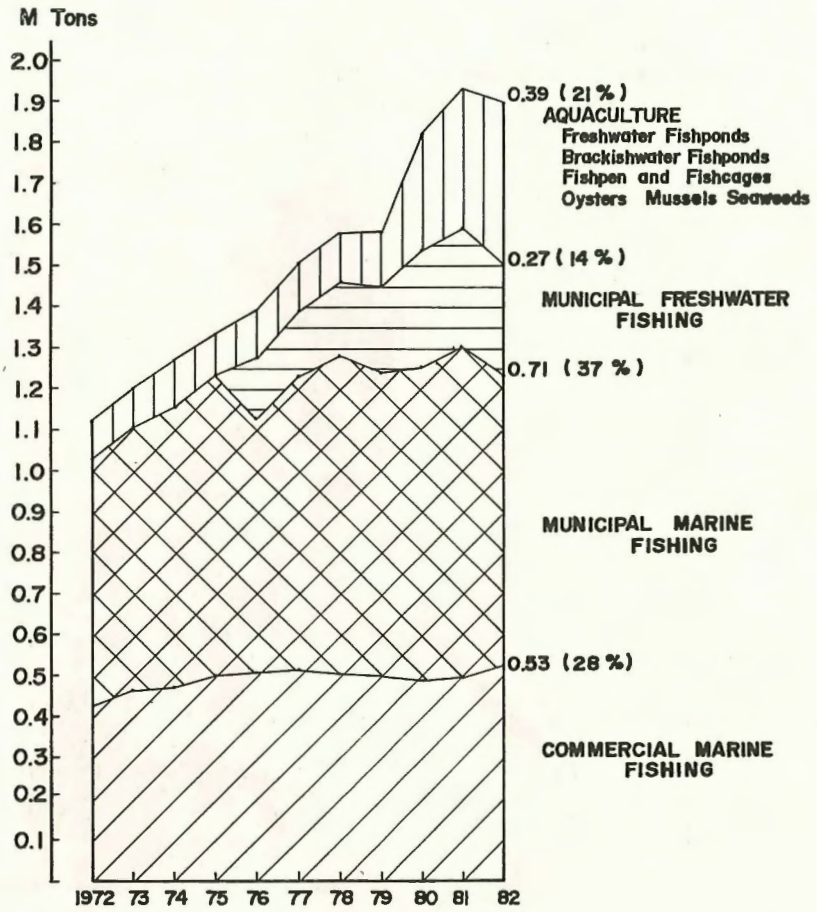


Fig. 3. Fisheries production of the Philippines 1972-1982.
Source: Bureau of Fisheries and Aquatic Resources.

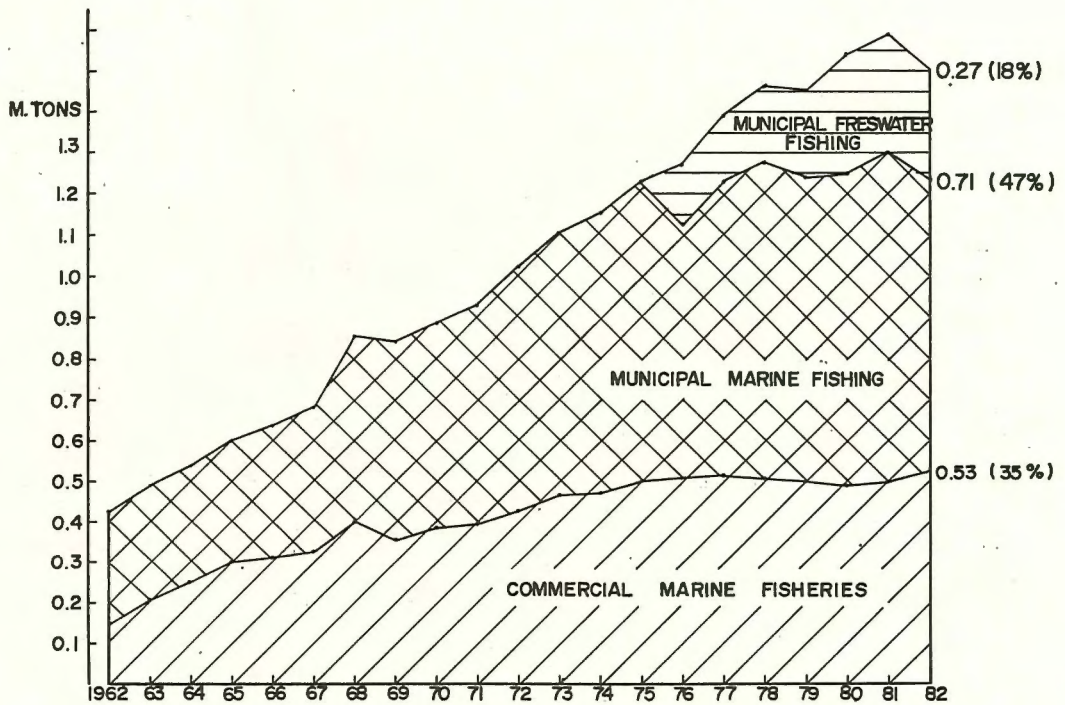


FIG. 4 FISHING PRODUCTION IN THE PHILIPPINES 1962 – 1982
Source: Bureau of Fisheries and Aquatic Resources Statistics

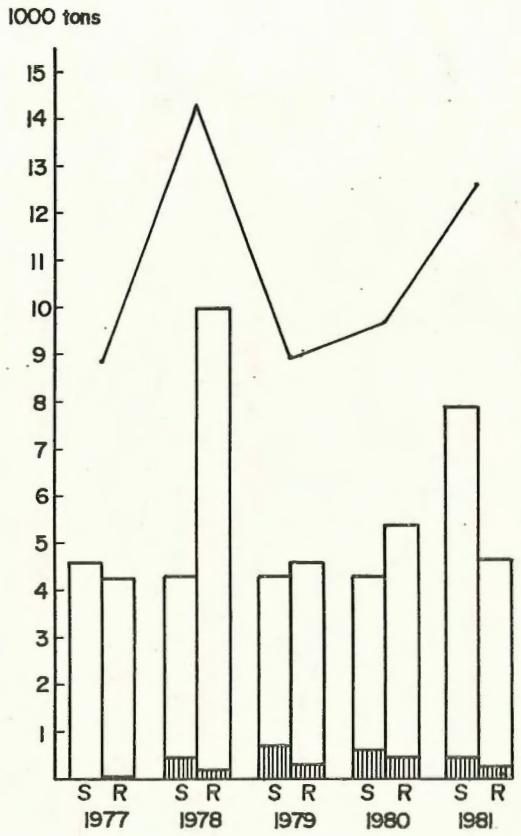


FIG. 5 PHILIPPINE SHARKS AND RAYS PRODUCTION

— Total production

□ Municipal fishing

▥ Commercial fishing

S Sharks

R Rays

Table 1.

PHILIPPINE SHARK AND RAY PRODUCTION BY FISHING GEAR 1981 (MT)

FISHING	COMMERCIAL			MUNICIPAL							
FISHING GEAR	TRAWL	PURSE SEINE	OTHERS (Bagnet, Hook & Line)	HOOK and LINE	GILL NET	LONG LINE	SPEARS	FISH CORRAL	TROLL LINE	BEACH SEINE	OTHERS (Baby trawl, Pole & Line, Fish Pots)
SHARKS	442	—	2	3486	1311	2091	393	106	58	—	100
RAYS	212	29	5	1816	1532	97	552	161	36	92	103
TOTAL	654	29	7	5302	2843	2188	945	267	94	92	203
%	5	—	—	41	23	17	8	2	1	1	2

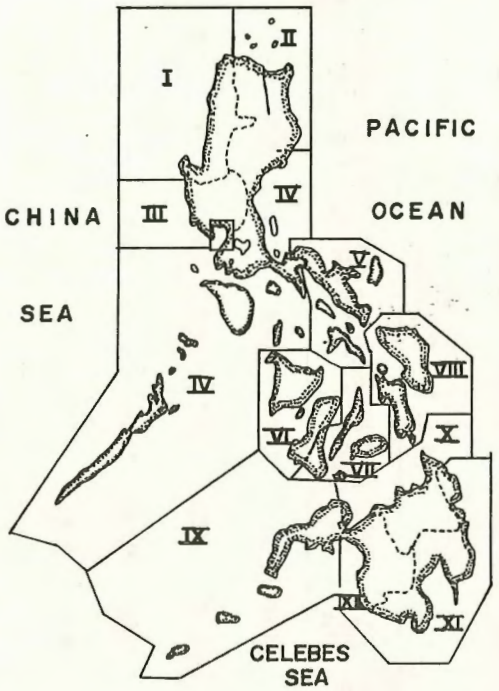


Table. 2 Municipal Fishing Production of Sharks & Rays by Region 1981 (MT)

Region	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Sharks	114	424	15	438	578	148	234	782	2382	1939	281	210
Rays	47	—	1	420	1637	28	716	163	623	622	56	76
Total	161	424	16	858	2215	176	950	945	3005	2561	337	286
%	1.5	4	—	7	19	1.5	8	8	25	21	3	2

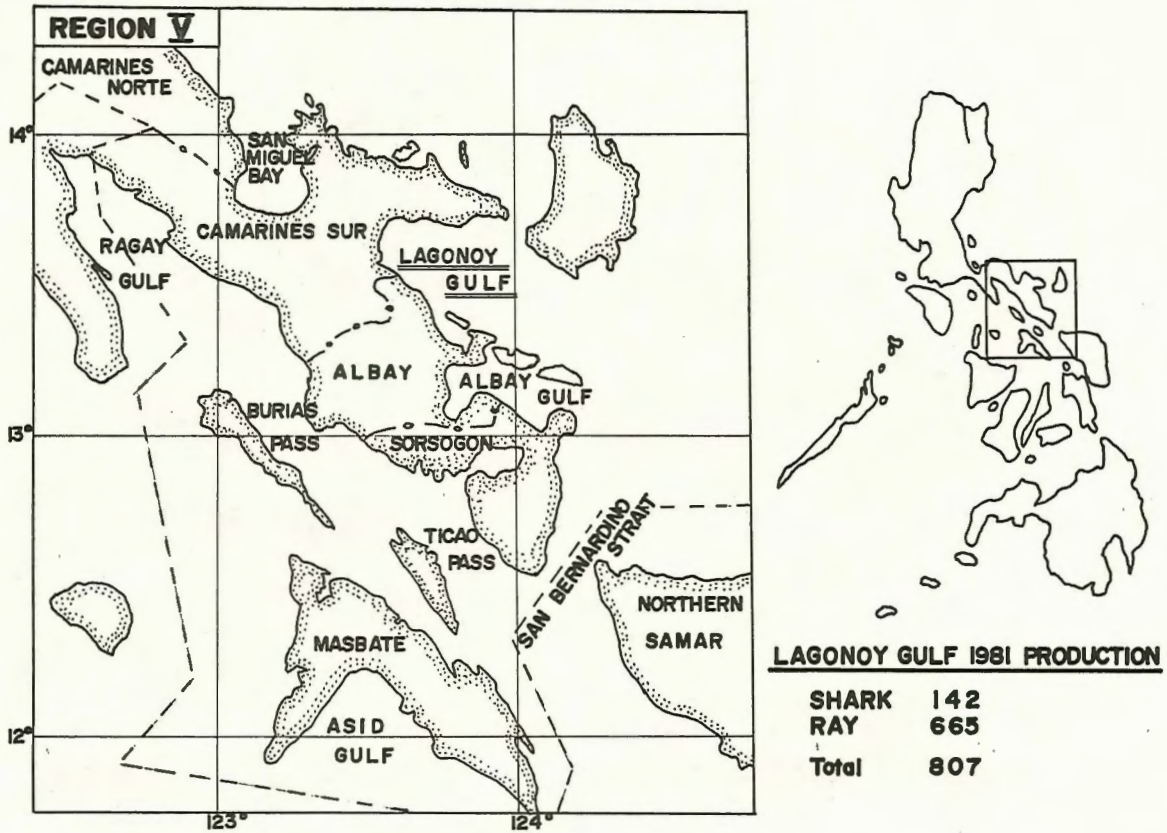


Fig. 6. Shark and ray fishing ground, Region V.

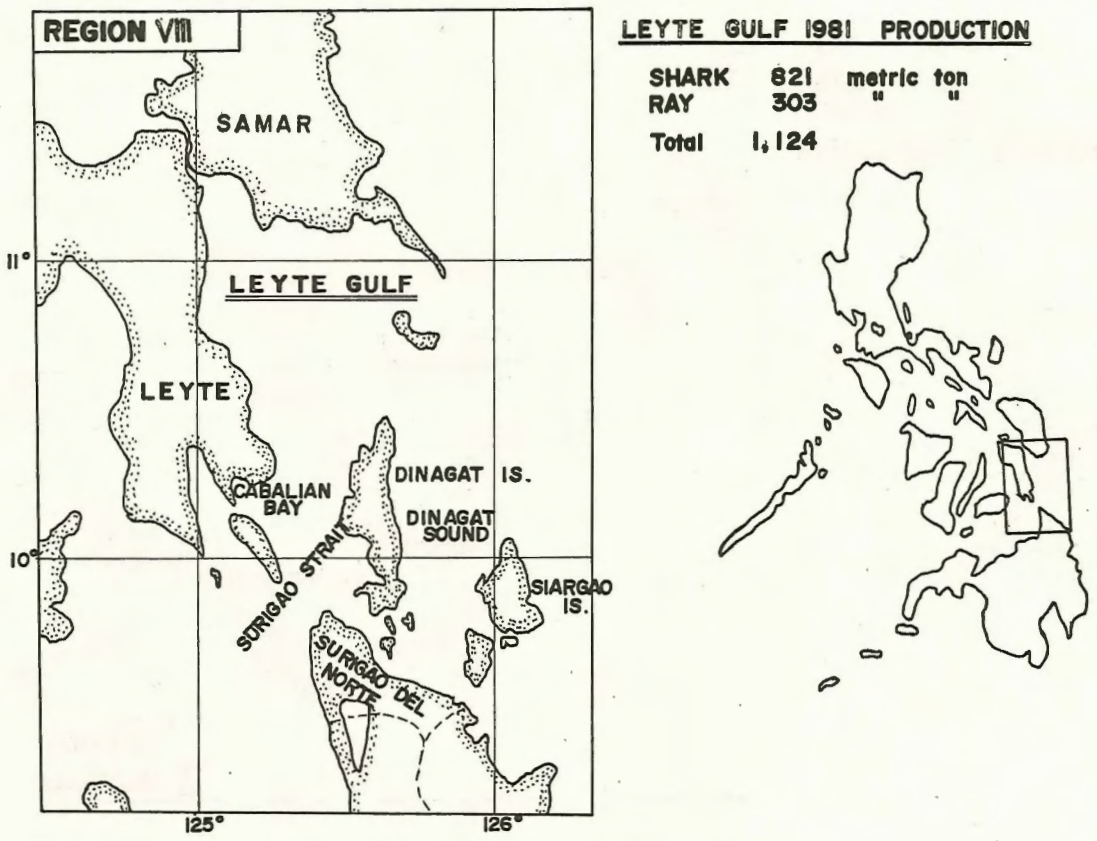


Fig. 7. Shark and ray fishing ground, Region VIII.

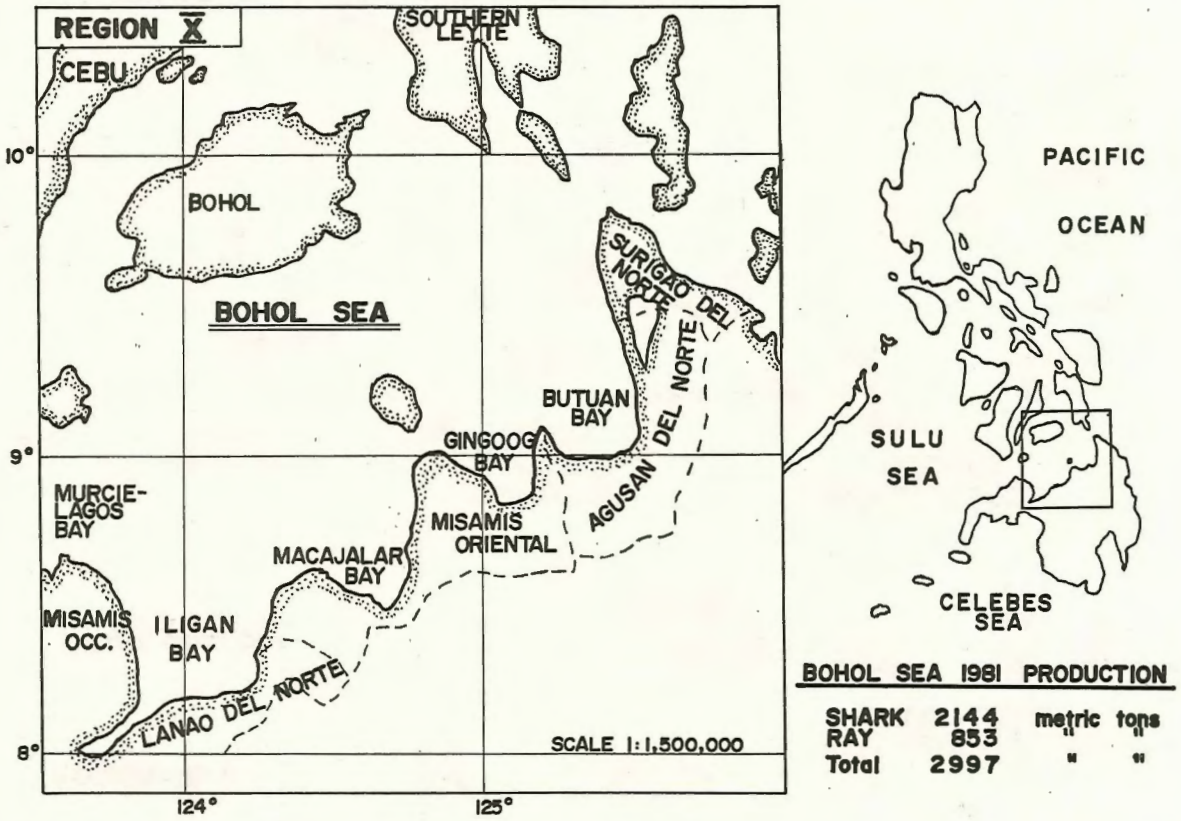
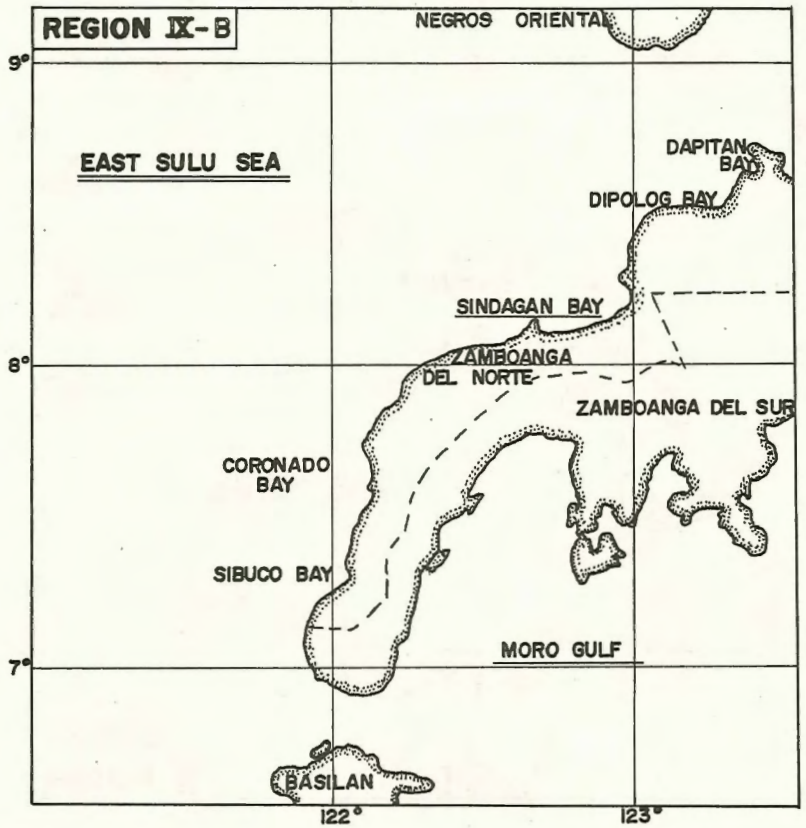


Fig. 8. Shark and ray fishing ground, Region X.



EAST SULU SEA 1981 PRODUCTION

SHARK	1522	metric tons
RAY	296	" "
Total	1818	" "

MORO GULF 1981 PRODUCTION

SHARK	220
RAY	122
Total	342

Fig. 9. Shark and ray fishing ground, Region IX-B.

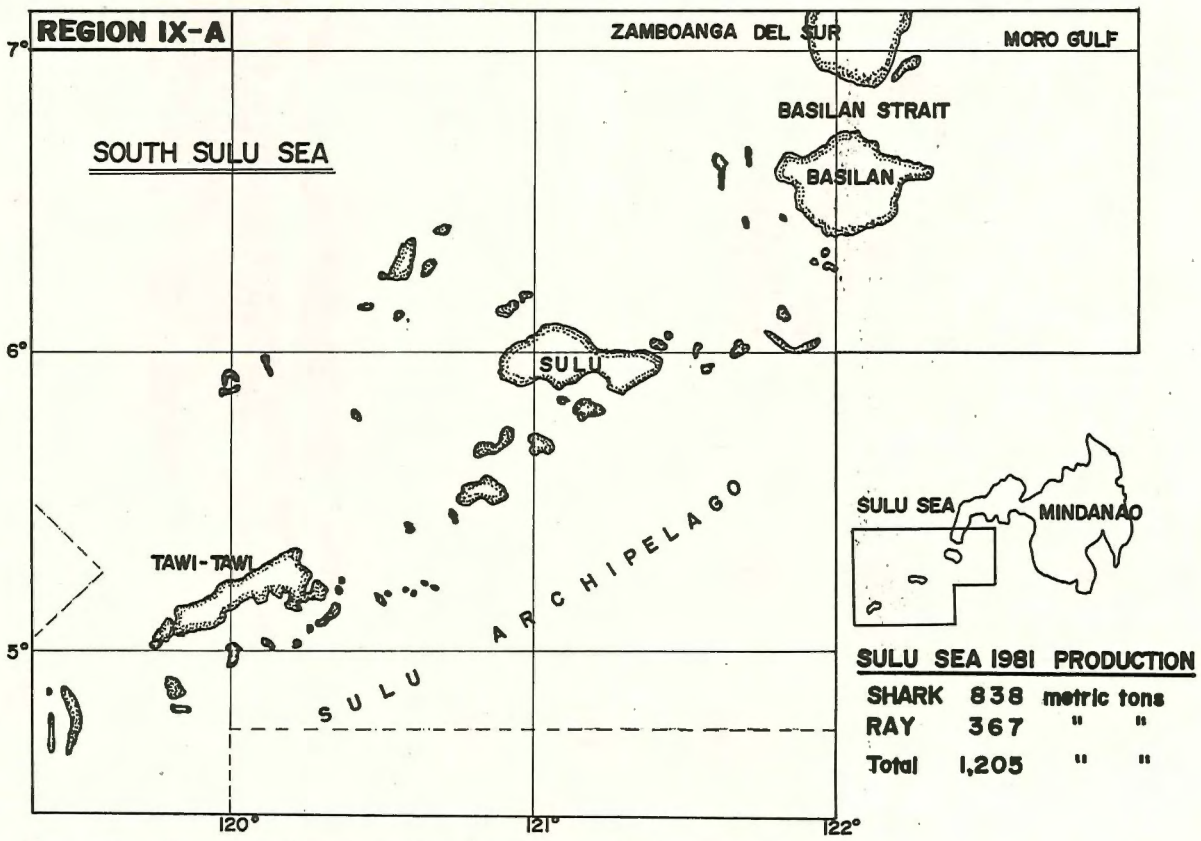
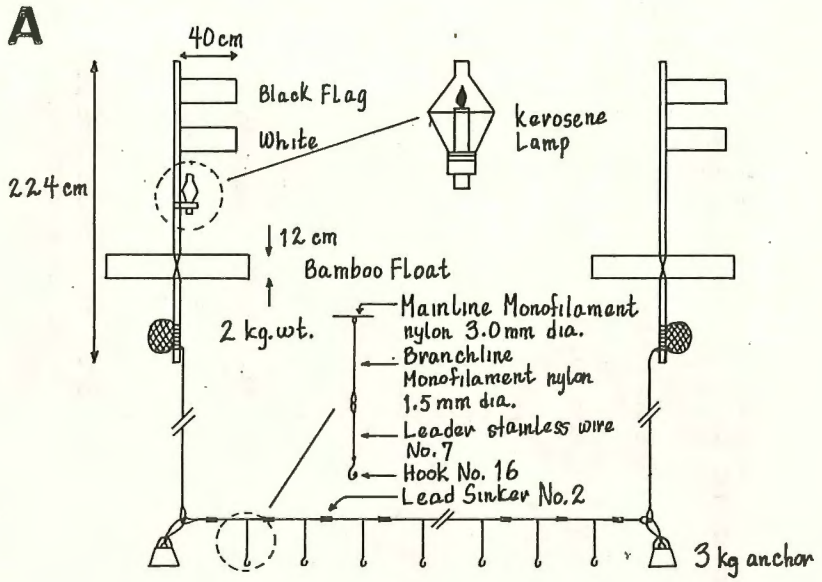


Fig. 10. Shark and ray fishing ground, Region IX-A.



B

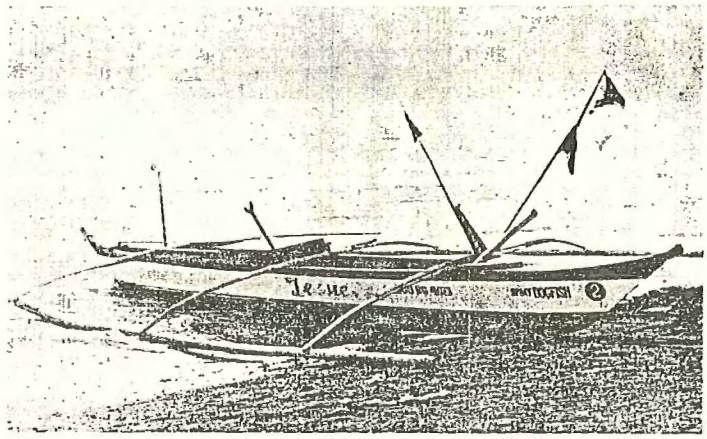


Fig. 11. Set bottom longline(A) and fishing craft(B) for spiny dogfish, Batangas Bay (Encina, 1975).

Table 3. Philippine shark products by origin. 1981*

Unit: Kilogram

PLACE	SHARK FIN	SHARK OIL
NCR[1]		
Manila	430	36,240
PFMA[2]	-	13,250
Region II		
Cagayan	-	6,610
Region IV		
Palawan	275	-
Marinduque	-	800
Mindoro Occidental	-	1,500
Region VI		
Aklan	1,522	1,000
Antique	8,500	24,318
Iloilo	55,570	7,243
Negros Occidental	600	1,800
Region VII		
Bohol	-	820
Cebu	-	5,835
Region VIII		
Samar	-	2,410
Region IX-A		-
Tagi-tawi	335	
Basilan	455	
Sulu	3,856	
Region IX-B		
Zamboanga del Sur	7,989	400
Zamboanga del Norte	3,450	10,860
Region X		
Agusan del Norte	-	700
Misamis Oriental	-	3,000
Agusan del Sur	-	3,260
Misamis Occidental	-	360
Region XI		
Surigao del Sur	60	-
Davao del Norte	-	1,260
Davao del Sur	-	2,160
South Cotabato	-	180
Davao Oriental	4,000	-
Total	87,042	124,486

*Source: Bureau of Fisheries and Aquatic Resources Statistics 1981

[1]NCR: National Capital Region

[2]PFMA: Philippine Fish Marketing Authority

Table 4. Philippine export of shark products*

Product / Country	1980 Quantity (kg)	1980 Value (Pesos)	1981 Quantity (kg)	1981 Value (Pesos)
I. Shark Fin (Dried)	1,951	290,427	41,478	1,486,659
Brunei	-	-	130	3,900
Hongkong	850	134,972	5,255	495,040
Malaysia	-	-	66	1,320
Japan	1	35	-	-
Singapore	1,100	155,420	6,000	915,000
Taiwan	-	-	30,027	71,399
II. Shark Jawbone	110	4,274	-	-
France	5	50	-	-
Taiwan	103	3,824	-	-
U.S.A	2	400	-	-
III. Shark Liver Oil	336,079	11,849,896	380,539	12,113,589
Germany, Fed. Rep. of	96,403	3,692,715	28,800	1,309,268
Japan	204,873	6,565,925	287,883	9,597,162
Korea, Rep. of	4,198	177,600	2,000	103,600
Norway	14,405	652,833	14,406	650,634
Taiwan	-	-	47,450	452,925
U.S.A.	16,200	760,823	-	-

*Source: Bureau of Fisheries and Aquatic Resources Statistics

Symposium on the exploitation of sharks and rays in the western Pacific

The above symposium was held on 10 February, 1984 at the Conference Room, Faculty of Fisheries, Nagasaki University, supported by the Toyota Foundation. Over thirty scientists attended the symposium and discussed eagerly the problems concerning elsmobranchs. Most papers contributed there are included in this report. Titles and names of contributors are as follows;

I. Distributional characteristics of elasmobranchs around Japan
- Chairperson — A. Takemura (Nagasaki Univ.)
- I-1.* Choshi and Ogasawara — T. Taniuchi (Univ. Tokyo)
- I-2.* Suruga Bay — S. Tanaka (Tokai Univ.)
- I-3.* Nagasaki and Okinawa — K. Mizue (Nagasaki Univ.)
- I-4. Deep-sea sharks in Kumano Nada — H. Kobayashi (Mie Univ.)
- I-5. Distribution and ecology of the whale shark — S. Uchida (Okinawa Expo Aquarium)

II. Oversea exploitations and some topics of elasmobranchs
- Chairperson — Y. Dotsu (Nagasaki Univ.)
- 6. Morphological differences during the process of spermatogenesis — M. Hara (Univ. Tokyo)
- 7.* Distribution and some biological aspects of sharks in the eastern Taiwan — C. Chen (Taiwan College of Marine Science)
- 8.* Report of preliminary investigation of sharks and rays in the Philippines — T. Otake (Univ. Tokyo)
- 9.* Report of preliminary investigation of sharks and rays in Indonesia — M. Masashi (Nat. Inst. Publ. Health)

III. Perspective and problems of elasmonranch studies
- Chairperson — T. Taniuchi (Univ. Tokyo)
- 10. International cooperation for elasmobranch studies — K. Mizue (Nagasaki Univ.)
- 11.* Fisheries and elasmobranchs as fishery resources in the Philippines — E.Ed.C. Flores (Univ. Philippines)
- 12. Fisheries in Taiwan — C. Chen (Taiwan College of Marine Science)

(Asterisks show the papers included in this report)