ISSN 0048-377X

Vol. 19 January-December 1986 Nos. 1 and 2

THE PHILIPPINE JOURNAL of FISHERIES

Published by the

BUREAU OF FISHERIES AND AQUATIC RESOURCES
Arcadia Bldg., 860 Quezon Avenue
Quezon City, Philippines
(P. O. Box 623, Manila, Philippines)

The PHILIPPINE JOURNAL OF FISHERIES

Official Publication of the Bureau of Fisheries and Aquatic Resources
Arcadia Bldg., 860 Quezon Avenue, Q.C.
Philippines

Vol. 19 **January-December 1986** **Nos. 1 and 2**

DISTRIBUTION AND RELATIVE ABUNDANCE OF NEMIPTERIDS AND CARANGIDS (PISCES: NEMIPTERIDAE AND CARANGIDAE) CAUGHT BY TRAWL IN THE VISAYAN SEA WITH NOTES ON THE BIOLOGY OF *Nemipterus oveni* AND *Selaroides leptolepis**

by

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ABSTRACT

This study is concerned with the distribution and relative abundance of the species of families Nemipteridae and Carangidae, including size composition, length-weight relationship, sex ratio and gonadal maturity of *Nemipterus oveni* (Bleeker) and *Selaroides leptolepis* Cuvier and Valenciennes.

The nemipterids (family Nemipteridae) comprised 12 percent and the carangids (family Carangidae) 2.5 percent of the total food fish caught during the whole survey period. Both groups have seasonal abundance with peaks in December for nemipterids and in August for carangids.

Both are widely distributed in the Visayan Sea. The nemipterids, however, are abundant at 90 meters to 140 meters and the carangids at 20 meters to 50 meters. The nemipterids were most abundant at the eastern tracks located northeast and northwest of Guintacan Island and southwest of Gigantangan Island. The carangids are concentrated in the western tracks, particularly near Panay, Sicogon and Pan de Azucar Islands.

INTRODUCTION

The Visayan Sea is one of the most important trawl fishing grounds in the country. In 1978 about 31 percent of the total fish production was derived from the area, thus making it the country's second most productive fishing ground (BFAR Fisheries Statistics).

The nemipterids or *bisugo* (family Nemipteridae) and the carangids or *salay-salay, talakitok,* etc. (family Carangidae) are among the abundant fish groups being caught from all the country's fishing grounds. In 1978 they contributed about five and three percent, respectively, to the total national fish production (BFAR Fisheries Statistics).

**A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science (Marine Biology), College of Arts and Sciences (Graduate Program), University of the Philippines, Diliman, Quezon City, Philippines.*

Statistics show that for a period of five years (1974-1978) the recorded catch for nemipterids in the whole country was 138,572 kg, 62 percent of which was taken from the Visayan Sea; the total catch for carangids was 83,059 kg, 46 percent of which came from the same area. About 99 percent of the nemipterids and 70 percent of the carangids were caught by trawl, thereby making this the most commonly used gear for exploiting these fishery resources.

In spite of the importance of the Visayan Sea as a fishing ground and the significance of nemipterids and carangids as food fish, no study had previously been made on the ecology and biology of these fish groups in the area.

This report provides the first documentation of the distribution and relative abundance of nemipterids and carangids caught by trawl in the Visayan Sea, including some aspects of the biology of selected species.

Importance of the Study

The results of this study provide baseline information which may be useful in evaluating the status of the fish resources of the Visayan Sea and in formulating policies for its rational exploitation. Aside from contributing to the knowledge in fish biology in particular and in marine biology in general, they also provide information on the seasonality and abundance of some species of food fish as well as on the productive trawling areas in the Visayan Sea which will enable the fishermen to increase their catch.

Objectives of the Study

The objectives of the study are:

1. To know the distribution and relative abundance of the families Nemipteridae and Carangidae;
2. To contribute to the knowledge of the biology of *Nemipterus oveni* and *Selaroides leptolepis* including:
   a. size composition
   b. length-weight relationship
   c. sex ratio and maturity.

REVIEW OF LITERATURE

Documented studies on the fisheries of the Visayan Sea are minimal.

Warfel and Manacop (1950), based on the results of some trawling explorations in the western Visayan Sea, presented a generic grouping of the trawl catch composition and reported an average catch of about 270 kg/hr of marketable fish which consisted mostly of large slipmouths, pomadasids, nemipterids, goatfishes and croakers. In 1957, when trawl fishing was still in its infancy, Rasalan conducted a study of the marine fisheries of the Central Visayas through actual survey and interviews with fishermen in the area and reported that: a) the Visayan Sea led in the production of anchovies, herrings, porgies and slipmouths and was second in the production of croakers, flatfishes and roundscads; b) demersal fishes were caught throughout the year; and c) pelagic species were seasonal. Encina (1972), using plastic bobbins and oval-shaped otter boards for experimental trawling in the western Visayan Sea, reported that the dominant fish were slipmouths, followed by parrotfishes and groupers.

Trawl fishing surveys have also been conducted in other fishing grounds of the country. Warfel and Manacop (1950) conducted otter trawl explorations in Lingayen Gulf, west of Bataan, Manila Bay and approaches, Tayabas Bay, Mangarin Bay, Ragay Gulf, Burias Pass, Alabat Sound, Sisiran Bay, Tabaco Bay, Samar Sea, Carigara Bay, San Pedro Bay, Leyte Gulf, Guimaras Strait, Panay Gulf, Panguil Bay, Sibuguey Bay, and off Taganak Island. In each of these areas surveyed, the catch composition, production by depth, etc., were reported. Ronquillo, Borja and Mines (1968) reported their preliminary findings on the trawl fishery of Manila Bay and compared the results obtained with those of Manacop and Warfel (1950). Trawling investigations were carried out in Lingayen Gulf in 1977 and Samar Sea in 1979 by the UP College of Fisheries and in Malampaya Sound, Bacuit Bay, Ulugan Bay and Imuruan Bay, Palawan in 1977-78 by the Bureau of Fisheries and Aquatic Resources. The results, however, are still unpublished.

In other countries intensive studies on the fish resources through trawl surveys of their fishing grounds have been conducted. In the South China Sea Region, the Gulf of Thailand has been extensively studied by Tiews *et al.* (1967), Chilvers (1972), Ruamragsa and Isarankura (1965), Ritragsa *et al.* (1968, 1969, 1970) and Ritragsa (1974). In Malaysia, resource surveys were undertaken and reported by Pathansali *et al.* (1966), Latiff *et al.* (1976), and Lui (1976) off the east and west coasts of Peninsular Malaysia, off the coast of Sarawak and Brunei, west coast of Sabah and the east coast of Malaysia. Resource surveys were carried out in the Java Sea and Malacca Strait by Seager and others (1976), Sujastani *et al.* (1976), Martosubroto and Pauly (1976), and Losse and Dwippongo (1977). Jayaraman *et al.* (1959), Rao (1966), Pruter (1966) and Hida *et al.* (1966) reported their studies on the resources of Indian waters. Studies on the Sunda Shelf demersal fish resources and trawling grounds were reported by Lester (1967), Lui and Lai (1977). Experimental trawl fishing in the South China Sea was reported by Chang (1968) and Chilvers (1972). All of the studies mentioned reported the species composition, relative abundance, distribution, catch rates and categories of trawl-caught fishes in the areas studied. Some of the studies included the mean length of important fish species in the area.

The biology of *Nemipterus oveni* has not been studied in the Philippines or elsewhere. However, biological studies were made on *Nemipterus japonicus* by Krishnamoorthi (1971 and 1974) and Kuthalingam (1966) in India; on *N. hexodon* by Isarankura and Pariyanond (1971) Rakvijai (1977) in Thailand; and on *N. virgatus* by Li (1960) in Hongkong and Eggleston (1970) in Thailand. Wongratana (1970) worked on the taxonomy of nemipterids in Thailand while Eggleston (1972) studied the biology of family Nemipteridae.

Similarly, studies on the biology of *Selaroides leptolepis* have not been done in the Philippines. However, studies on this species were made by Tandon (1961-1962) in India, and Naiyanetr (1963) and Morsuwan (1970) in Thailand. Roxas and Agco (1941) prepared a systematic account of Philippine Carangidae.

MATERIALS AND METHODS

This study was conducted as part of the PCARR-funded project No. 129 entitled "Trawl Fishing Investigation of Traditional and Non-Traditional Fishing Grounds of the Philippines" which was carried out under the leadership of Dr. Virginia L. Aprieto in the Institute of Fisheries Development and Research (IFDR), UP College of Fisheries. The specimens used were part of the catch obtained during experimental trawling conducted in the Visayan Sea by the IFDR researchers.

The Study Area

The Visayan Sea, the second most productive fishing ground in the country, is located approximately at longitudes 123° to 124° E and latitudes 11° to 12° N. The area is bounded on the north by Masbate, on the east by Gigantangan Island and Leyte, on the south by northern Cebu, Bantayan Island and northern Negros, and on the west by Panay Island, Jintotolo Island and Pulanduta Point of Masbate. It connects to Guimaras Strait on the southwest, Jintotolo Channel on the northwestern side, Asid Gulf on the north, Samar Sea on the northeastern side, Camotes Sea on the southeast, and Tañon Strait on the south.

The study area, according to the IFDR methodology, was divided into three sub-areas designated as A, B and C, with a total area of 2,085

square nautical miles with depths ranging from 14 to 140 m (Aprieto and Patolot, 1977; Aprieto, 1978). Twenty-one echo tracks were selected and drawn after a thorough study of areas with minimum seabed obstruction and of even soundings on the Philippine Coast and Geodetic Survey Navigational chart No. 4405 which covers the Visayan Sea. Of these, 12 echo tracks which were found to have level and smooth bottom profiles, and 13 oceanographic stations were selected. The positions of the fishing tracks (echo tracks) and oceanographic stations are shown in Figure 1.

Collection of Samples

Sampling was conducted on board the R/V Albacore, the 190-gross ton training and research vessel of the UP College of Fisheries, from July 1976 to March 1977. The gear used was a four-seam otter trawl net with a mesh size of 1.5 centimeters (stretched) at the cōd end or bag. Each fishing track was trawled once for two hours every month. The time of setting and hauling the net, and the depth of trawling, were recorded. After the catch per drag was landed on deck, the food fishes were sorted according to genus and species whenever possible, and their weights taken and recorded. All specimens of *Nemipterus oveni* and *Selaroides leptolepis* were collected for size measurement.

The trawl net was set 107 times and fished for a total of 211 fishing hours from July 1976 to March 1977.

Distributic nd Relative Abundance

After sorting, the total weight of each family per fishing track per mc n was recorded. The catch data were then converted into catch rates in lograms per hour (kg/hr) and relative percentage (individual weight divided by the total weight x 100).

Distribution was based on the catch rate (kg/hr) per fishing track and related to depth, temperature, salinity, dissolved oxygen, pH and plankton volume. Relative abundance as used in this study refers to the catch rate obtained in one fishing track in relation to other tracks and to the total catch, and was determined following Warfel and Manacop (1950) using catch rates in kilograms per hour as a meausre of abundance.

Size Composition

Length in centimeters and weight in grams were made on 3,274 fresh specimens of *Nemipterus oveni* and 1, 389 of *Selaroides leptolepis* on board the vessel.

Fork length, that is, the length from the tip of the snout to the

median caudal fin ray, was used for *N. oveni* and total length, that is, the length from the tip of the snout to the tip of the caudal fin was used for *S. leptolepis.*

Length-Weight Relationship

The following parabolic formula was used in the analysis of the length-weight relationship:

$$W = a L^b$$

where: W is the weight; a, intercept and b, slope – both of which are constant; and L is the length.

This may be rewritten, in the linear form, as

$$\log W = a + b \log L.$$

The length-weight pairs, ten observed weights per length interval and the average taken to offset the strong effect of single values representing single length-weight pairs, were selected randomly (Pauly, personal communication).

Sex Ratio and Maturity

A total of 538 specimens of *N. oveni* and 937 of *S. leptolepis* were dissected to determine their sexes and gonadal maturity.

The state of maturity of fish can be determined in field examination by opening the ventral cavity and exposing the gonads.

Criteria for the determination of maturity stages (Naier, for Buckmann, 1929). (FAO Manual of Methods on Fisheries Biology).

Stage I – *Virgin:* Very small sexual organs close to the vertebral column. Testis and ovary transparent, colorless to gray. Eggs invisible to naked eye.

Stage II – *Maturing virgin and recovering spent:* Testis and ovary translucent, gray-red. Length, half or slightly more than half of the length of ventral cavity. Single eggs can be seen with magnifying glass.

Stage III – *Developing:* Testis and ovaries opaque, reddish with blood capillaries. Occupy about half of ventral cavity. Eggs visible to the naked eye as whitish and granular.

Stage IV – *Developed:* Testis, reddish-white. No milt drops appear under pressure. Ovary orange-reddish. Eggs clearly discernible; opaque. Testis and ovary occupy about two-thirds of ventral cavity.

Stage V – *Gravid:* Sexual organs filling ventral cavity. Testis, white, drops of milt fall with pressure. Eggs completely round, some already translucent and ripe.

Stage VI – *Spawning:* Roe and milt run with slight pressure. Most eggs translucent with few opaque eggs left in ovary.

Stage VII – *Spent:* Not yet fully empty. No opaque eggs left in ovary.

Stage VIII – *Resting:* Testis and ovary empty, red. A few eggs in the state of reabsorption.

For purposes of this study, the stages of maturity were grouped into: Immature (Stages I and II), Maturing (Stages III and IV), Mature (Stages V and VI) and Spent (Stages VII and VIII). This grouping was in accordance with Magnusson (personal communication) usually used when doing analysis in the field or on board survey vessels.

RESULTS

During the nine-month study, a total of 8,670 kg of food fish were caught in Visayan Sea. Of these, 1,021 kg or 11.8 percent were nemipterids and 217 kg or 2.5 percent were carangids. The catch rates for nemipterids ranged from 2.47 kg/hr in February to 6.68 kg/hr in December and that of carangids ranged from 0.28 kg/hr in October to 2.16 kg/hr in August (Table 1).

NEMIPTERIDAE

Species Composition and Relative Abundance

The genus *Nemipterus* was represented by seven identified species, namely: *N. hexodon* (Quoy and Gaimard), *N. japonicus* (Bloch), *N. marginatus* (Cuvier and Valenciennes), *N. nematophorus* (Bleeker), *N. nemurus* (Bleeker), *N. oveni* (Bleeker) and *N. tambuloides* (Bleeker).

Table 1. Monthly catch and catch per hour of families Nemipteridae and Carangidae and the other families of food fish caught by trawl in Visayan Sea

Month	Nemipteridae		Carangidae		Other families		Total	
	C (kg)	C/hr	C (kg)	C/hr	C (kg)	C/hr	C (kg)	C/hr
July 1976	151.6	6.32	45.9	1.91	1044.1	43.5	1241.6	51.73
August	85.0	3.86	47.5	2.16	893.8	40.63	1026.3	46.65
September	149.9	6.24	25.4	1.06	1170.1	48.75	1345.4	56.06
October	116.9	4.87	6.8	0.28	498.6	20.78	622.3	25.93
November	94.7	4.30	15.8	0.72	623.1	28.32	733.6	33.34
December	160.2	6.68	20.9	0.87	895.4	37.31	1076.5	44.85
January 1977	97.3	4.23	14.5	0.63	890.0	38.69	1001.8	43.56
February	59.2	2.47	21.6	0.90	510.9	21.29	591.7	24.65
March	106.5	4.44	19.3	0.80	905.9	37.74	1031.7	42.99
Total	1021.3		217.7		7431.9		8670.9	
Percent	11.8		2.5		85.7			

Other species which were difficult to identify were classified as *Nemipterus* spp.

Nemipterus oveni was the most dominant species with a total catch of 293.1 kg or 28.7 percent of the nemipterid catch followed by *N. nematophorus,* 188.6 kg or 18.5 percent; *N. marginatus,* 112 kg or 11 percent; *N. tambuloides,* 89.9 kg or 8.8 percent; *N. hexodon,* 37.4 kg or 3.7 percent; *N. nemurus,* 36.1 kg or 3.5 percent and *N. japonicus,* 20.3 kg or 2.0 percent. The unidentified species amounted to 243.9 kg or 23.9 percent of the total nemipterid catch (Table 2).

Seasonality

The most productive month for nemipterids was December with a total catch of 160 kg or a catch rate of 6.7 kg/hr. July and September were likewise productive with a total catch of 151.6 kg or 6.3 kg/hr and 149.9 kg or 6.2 kg/hr, respectively. February was the least productive month with a total catch of only 59.2 kg, or a catch rate of 2.5 kg/hr (Table 1).

Among the nemipterid species, only *N. nematophorus, N. oveni* and *N. tambuloides* were caught throughout the survey period. Other species which were caught only in certain months were *N. marginatus* (July, September to March), *N. japonicus* (July, August, October to March), *N. hexodon* (July, October to March), and *N. nemurus* (August, October to March).

The abundance of each nemipterid species varied from month to

Table 2. Monthly catch, catch per hour and percentage of the different species of Nemipteridae caught by trawl in Visayan Sea.

Month	*N. hexodon*			*N. japonicus*			*N. marginatus*			*N. nematophorus*			*N. nemurus*			*N. oveni*			*N. tambuloides*			*Nemipterus spp.*			Total	
	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	%
J 1976	7.3	0.3	4.81	0.8	0.03	0.53	7.0	0.3	4.61	23.4	1.0	15.42	0	0	0	55.0	2.3	36.26	45.4	1.9	29.93	12.7	0.5	8.44	151.0	100.00
A	0	0	0	0.1	0.004	0.12	0	0	0	17.2	0.8	20.24	6.6	0.3	7.76	31.9	1.4	37.56	3.0	0.1	3.46	26.2	1.2	30.86	85.0	100.00
S	0	0	0	0	0	0	8.0	0.3	5.34	47.3	2.0	31.55	0	0	0	53.4	2.2	35.62	5.5	0.2	3.67	35.7	1.5	23.82	149.9	100.00
O	0.6	0.02	0.51	2.6	0.1	2.22	9.6	0.4	8.21	17.6	0.7	15.06	23.1	1.0	19.76	39.2	1.6	33.53	9.3	0.4	7.96	14.9	0.6	12.75	116.9	100.00
N	1.7	0.1	1.79	2.5	0.1	2.64	5.2	0.2	5.49	25.1	1.1	26.50	1.3	0.1	1.37	28.0	1.3	29.57	6.1	0.3	6.44	24.8	1.1	26.19	94.7	100.00
D	8.1	0.3	5.06	3.5	0.1	2.18	16.6	0.7	10.36	37.0	1.5	23.10	2.3	0.1	1.44	40.6	1.7	25.34	5.1	0.2	3.18	47.0	2.0	29.34	160.2	100.00
J 1977	4.4	0.2	4.52	4.4	0.2	4.52	24.5	1.1	25.18	9.8	0.4	10.07	1.5	0.1	1.54	9.9	0.4	10.18	8.9	0.4	9.15	33.9	1.5	34.84	97.3	100.00
F	7.6	0.3	12.84	3.8	0.2	6.42	17.7	0.7	29.90	5.8	0.2	9.80	1.0	0.04	1.69	10.8	0.4	18.24	4.2	0.2	7.09	8.3	0.3	14.02	59.2	100.00
M	7.7	0.3	7.23	2.6	0.1	2.44	23.4	1.0	21.97	5.4	0.2	5.07	0.3	0.01	0.28	24.3	1.0	22.82	2.4	0.1	2.25	40.4	1.7	37.93	106.5	99.99
J – M	37.4		3.66	20.3		1.99	112.0		10.97	188.6		18.47	36.1		3.53	293.1		28.7	89.9		8.8	243.9		23.88	1021.3	100.00

month. *N. oveni* was caught throughout the year but was relatively abundant in July and September; *N. tambuloides* in July; *N. marginatus* in January and March; *N. nematophorus* in September; and *N. nemurus* in October (Table 2).

Distribution

During the entire survey period, the nemipterids were more abundant at FT 7, with a value of 12.5 kg/hr, and were less abundant at FT 12, with a value of 0.7 kg/hr (Table 3).

The catch per hour and percentage (by fishing track) of the different species of *Nemipterus* is shown in Table 4. *N. oveni* was taken abundantly at FT 2, 3, 1, 4 and 6 with catch rates of 3.93 kg/hr, 2.81 kg/hr, 2.69 kg/hr, 2.29 kg/hr and 2.11 kg/hr, respectively; *N. tambuloides* at FT 6 with catch rate of 2.29 kg/hr; *N. nematophorus* at FT 8 and 7 with catch rates of 3.68 kg/hr and 2.43 kg/hr; *N. marginatus* at FT 7 with catch rate of 2.52 kg/hr. *N. nemurus*, *N. japonicus* and *N. hexodon* were almost evenly represented in all fishing tracks, with catch rates below 1 kg/hr.

CARANGIDAE

Species Composition and Relative Abundance

The genus *Caranx* was represented by five species, namely: *C. armatus* (Forskal), *C. crumenophthalmus* (Bloch), *C. djedaba* (Forskal), *C. kalla* (Cuvier and Valenciennes), and *C. malabaricus* (Bloch and Schneider). There were other species belonging to the same genus; they were not identified but were classified collectively as *Caranx* spp. The genera *Selaroides, Uraspis* and *Naucrates* were represented by one species each: *S. leptolepis* (Cuvier and Valenciennes), *U. helvola* (Bloch and Schneider), *N. ductor* (Linnaeus), respectively. Other species belonging to family Carangidae were *Decapterus* spp, *Hymnis momsa* (Herre) and *Megalaspis cordyla* (Linnaeus).

Of the carangids, the most abundant generic group was *Caranx*, which contributed 47.5 percent to the total carangid catch. In the order of their abundance in terms of relative percentage by weight, the next groups were *Selaroides*, 19.7 percent; *Uraspis*, 14.7 percent; *Naucrates*, 8.3 percent; and *Decapterus*, 7.1 percent (Table 5).

Seasonality

The most productive months for carangids were August and July

Table 3. Catch, catch per hour and percentage of families Nemipteridae and Carangidae per fishing track in Visayan Sea, July 1976 – March 1977.

FT No.	Depth Range (m)	No. of Fishing Hours	Nemipteridae			Carangidae		
			C (kg)	C/hr	%	C (kg)	C/hr	%
1	52.7– 95.5	17	83.2	4.9	8.15	24.2	1.4	11.12
2	40.6–123.9	18	127.0	7.1	12.44	7.4	0.4	3.40
3	73.2–134.1	16	109.1	6.8	10.68	9.5	0.6	4.36
4	60.9– 93.5	18	77.4	4.3	7.58	13.4	0.7	6.16
5	75.2– 77.2	16	43.9	2.7	4.30	9.2	0.6	4.22
6	91.5–109.8	18	145.2	8.1	14.22	8.2	0.5	3.77
7	107.6–125.9	18	225.1	12.5	22.04	5.9	0.3	2.71
8	128.1–142.2	18	120.3	6.7	11.78	17.8	1.0	8.18
9	22.3– 52.7	18	21.3	1.2	2.08	13.6	0.8	6.25
10	20.3– 50.7	18	36.1	2.0	3.53	51.8	2.9	23.79
11	30.4– 35.5	18	19.5	1.1	1.91	42.3	2.4	19.43
12	36.6– 38.6	18	13.2	0.7	1.29	14.4	0.8	6.61
Total		211	1021.3		100.00	217.7		100.00

Table 4. Catch, catch per hour and percentage (by fishing track), July 1976-March 1977.

FT No.	*N. hexodon*			*N. japonicus*			*N. marginatus*			*N. nematophorus*			*N. nemurus*			*N. oveni*			*N. tambuloides*			*Nemipterus spp.*			Total	
	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	%
1	3.2	0.2	3.88	0.3	0.02	0.36	8.9	0.52	10.79	3.2	0.2	3.88	2.0	0.12	2.42	45.7	2.69	55.39	5.0	0.29	6.06	14.2	0.84	17.21	82.5	99.99
2	1.0	0.06	0.79	0.3	0.02	0.24	13.7	0.76	10.79	6.9	0.38	5.43	0.5	0.03	0.39	70.8	3.93	55.75	11.6	0.64	9.13	22.2	1.23	17.48	127.0	100.00
3	0.2	0.01	0.18	0.5	0.03	0.44	7.0	0.44	6.22	25.0	1.56	22.22	2.0	0.12	1.78	45.0	2.81	40.00	4.7	0.29	4.18	28.1	1.96	24.98	112.5	100.00
4	1.4	0.08	1.79	1.3	0.07	1.67	7.8	0.43	10.00	5.3	0.29	6.79	1.8	0.10	2.31	41.2	2.29	52.82	7.6	0.42	9.74	11.6	0.64	14.87	78.0	99.99
5	1.2	0.08	2.69	1.7	0.11	3.82	6.8	0.42	15.28	13.3	0.83	29.89	1.3	0.08	2.92	16.9	1.06	37.98	0.8	0.05	1.80	2.5	0.16	5.62	44.5	100.00
6	0	0	0	0.6	0.03	0.42	7.8	0.43	5.49	24.6	1.37	17.31	3.0	0.17	2.11	37.9	2.11	26.67	41.2	2.29	28.99	27.0	1.56	19.00	142.1	99.99
7	2.0	0.11	0.89	0	0	0	45.4	2.52	20.20	43.7	2.43	19.45	3.3	0.18	1.47	14.7	0.82	6.54	11.1	0.62	4.94	104.5	5.80	46.51	224.7	100.00
8	0	0	0	0.2	0.01	0.17	2.3	0.13	1.91	66.3	3.68	55.07	10.3	0.57	8.55	10.7	0.59	8.89	0.8	0.04	0.66	29.8	1.66	24.75	110.4	100.00
9	3.9	0.22	17.03	3.1	0.17	13.54	5.9	0.33	25.76	0.3	0.02	1.31	1.9	0.10	8.30	3.3	0.18	14.41	2.4	0.13	10.48	2.1	0.12	9.17	22.9	100.00
10	13.0	0.72	37.68	10.6	0.59	30.72	1.7	0.09	4.93	0	0	0	6.0	0.33	17.39	0.1	0.01	0.29	3.1	0.17	8.98	0	0	0	34.5	99.99
11	7.1	0.39	36.60	1.5	0.08	7.73	3.0	0.17	15.46	0	0	0	3.0	0.17	15.46	2.5	0.14	12.89	0.6	0.03	3.09	1.7	0.09	8.76	19.4	99.99
12	4.4	0.24	34.38	0.2	0.01	1.56	1.7	0.24	13.28	0	0	0	1.0	0.06	7.81	4.3	0.24	33.59	1.0	0.06	7.81	0.2	0.01	1.56	12.8	99.99

Table 5. Monthly catch, catch per hour and percentage of the different species of Carangidae caught by trawl in Visayan Sea.

Month	*C. armatus*			*C. crumenophthalmus*			*C. djedaba*			*C. kalla*			*C. malabaricus*			*Caranx spp.*			*Decapterus spp.*			*H. momus*			*M. cordyla*			*N. ductor*			*S. leptolepis*			*U. helvola*			*Total*	
	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	C/hr	%	C(kg)	%
J 1976	3.0	0.12	6.53	0.5	0.02	1.09	3.7	0.15	8.06	0	0	0	0	0	0	13.6	0.57	29.63	3.0	0.13	6.53	3.0	0.12	6.53	0.2	0.01	0.44	2.9	0.12	6.32	10.4	0.43	22.66	5.6	0.23	12.20	45.9	99.99
A	1.3	0.06	2.74	1.6	0.07	3.37	0	0	0	2.4	0.11	5.05	0.8	0.04	1.68	26.3	1.2	55.37	0.6	0.03	1.26	0	0	0	0.1	0.004	0.21	0.4	0.02	0.84	11.9	0.54	25.05	2.1	0.10	4.42	47.5	99.99
S	0.8	0.03	3.15	0.5	0.02	1.97	0	0	0	0.8	0.03	3.15	0	0	0	6.6	0.28	25.98	3.3	0.14	12.99	0	0	0	0.1	0.04	0.39	2.9	0.12	11.42	1.6	0.07	6.30	8.8	0.37	34.64	25.4	99.99
O	0.2	0.01	2.92	0	0	0	0	0	0	0.3	0.01	4.38	0	0	0	1.8	0.08	26.32	0.04	0.001	0.58	0	0	0	0.1	0.004	1.46	1.5	0.07	21.93	2.1	0.09	30.70	0.8	0.04	11.70	6.84	99.99
N	0	0	0	0.1	0.004	0.63	0	0	0	0.1	0.004	0.63	0.3	0.01	1.9	4.4	0.2	27.85	5.3	0.24	33.54	0	0	0	0	0	0	2.0	0.09	12.66	3.6	0.16	22.78	0	0	0	15.8	99.99
D	1.5	0.06	7.18	1.0	0.04	4.78	1.4	0.06	6.70	0.1	0.004	0.48	1.6	0.07	7.66	3.0	0.12	14.35	1.3	0.05	6.22	0	0	0	0	0	0	2.0	0.08	9.57	4.6	0.19	22.01	4.4	0.18	21.05	20.9	100.00
J 1977	0.6	0.03	4.14	0	0	0	0.2	0.01	1.38	0.3	0.01	2.07	0	0	0	3.6	0.16	24.83	0.7	0.03	4.82	0	0	0	2.3	0.1	15.86	0	0	0	5.7	0.25	39.31	1.1	0.05	7.59	14.5	100.00
F	0	0	0	0.4	0.02	1.85	0	0	0	0	0	0	0	0	0	13.6	0.57	62.96	0.3	0.01	1.39	0	0	0	0	0	0	2.6	0.11	12.04	1.3	0.05	6.02	3.4	0.14	15.74	21.6	100.00
M	0.2	0.01	1.04	0.1	0.004	0.52	0	0	0	0	0	0	0.2	0.01	1.04	6.6	0.28	34.20	1.0	0.04	5.18	0	0	0	0.1	0.004	0.52	3.7	0.15	19.17	1.7	0.07	8.81	5.7	0.24	29.53	19.3	100.01
J – M	7.6		3.49	4.2		1.93	5.3		2.43	4.0		1.84	2.9		1.33	79.5		36.51	15.34		7.14	3.0		1.38	2.9		1.33	18.0		8.27	42.9		19.7	31.9		14.65	217.74	100.0

of only 6.8 kg, or a catch rate of 0.28 kg/hr (Table 1).

The monthly occurrence of the different species of carangids varied. *Caranx* spp, *Decapterus* spp and *S. leptolepis* were caught during the nine-month survey. Those which were caught only at certain months were *M. cordyla* (July to October, January and March), *N. ductor* (July to December, February and March), and *U. helvola* (July to October, December to March).

The peak in abundance for *Caranx* spp was August; for *Decapterus* spp, November; for *M. cordyla,* January; and *U. helvola,* September (Table 5).

Distribution

The carangids were more abundant at FT 10, with a total catch of 52 kg, or a catch rate of 2.9 kg/hr, and less abundant at FT 7, with a total catch of 5.9 kg, or a catch rate of 0.3 kg/hr (Table 3).

The catch per hour and percentage (by fishing track) of the species of carangids caught by trawl in the Visayan Sea is shown in Table 6. *Caranx* spp was more abundant at FT 10, with a catch rate of 2.66 kg/hr; *Decapterus* spp at FT 6, with a catch rate of 0.35 kg/hr; *N. ductor* at FT 7 (0.17 kg/hr); *S. leptolepis* at FT 11 (1.24 kg/hr) and *U. helvola* at FT 8 and 3, with catch rates of 0.48 kg/hr and 0.45 kg/hr respectively.

NOTES ON THE BIOLOGY OF:

Nemipterus oveni (Bleeker)

Size Composition

The sizes of *N. oveni* taken by trawl in the Visayan Sea during the survey period ranged from 5.5 cm to 24.5 cm fork length.

The size composition data is presented in Table 7. In August, the mean fork length was 14.73 cm; in September, 14.76 cm; in October, 13.31 cm; in November, 14.9 cm; in December, 14.61 cm; in January, 15.27 cm; in February, 14.48 cm; and in March, 14.22 cm.

Small *N. oveni* with sizes ranging from 5.5 cm to 8.0 cm were caught in October, December and February, and larger ones with sizes ranging from 20.0 to 24.5 cm were obtained in August and September and from December to March.

Length-Weight Relationship

The length-weight data for males and females are shown in Tables 8 and 9, respectively, and plotted in Figure 2. The computed values for

Table 6. Catch, catch per hour and percentage (by fishing track) of the different species of Carangidae in Visayan Sea, July 1976-March 1977.

No.	*C. armatus*		*C. crumenophthalmus*		*C. djedaba*		*C. kalla*		*C. malabaricus*		*Caranx* spp.		*Decapterus* spp.		*H. momus*		*M. cordyla*		*N. ductor*		*S. leptolepis*		*U. helvola*		*Total*	
	C(kg)	C/hr	C(kg)	C/hr	C(kg)	C/hr	C(kg)	C/hr	C(kg)	C/hr	C(kg)	C/hr	C(kg)	C/hr	C(kg)	C/hr	C(kg)	C/hr	C(kg)	C/hr	C(kg)	C/hr	C(kg)	C/hr	C(kg)	%
1	0.8	0.05	3.30	2.0	0.12	8.26	0	0	0	0	0.3	0.15	1.24	2.6	0.15	10.74	3.0	0.18	12.40	3.0	0.18	12.40	0	0	0	0	3.4	0.2	14.05	3.3	0.19	13.64	5.8	0.34	23.97	24.2	100.00
2	0.6	0.03	8.00	0	0	0	0	0	0	0	0	0	0	0.6	0.03	8.00	2.7	0.15	36.00	0	0	0	0	0	0	0	1.5	0.08	20.00	0.6	0.03	8.00	1.4	0.08	18.67	7.5	100.00
3	0	0	0	0	0	0	0	0	0	0	0.2	0.01	2.06	0.1	0.01	1.03	0.8	0.05	8.25	0	0	0	0	0	0	0	1.0	0.06	10.31	0.1	0.01	1.03	7.5	0.45	77.32	9.7	100.00
4	1.2	0.07	8.86	0.6	0.03	4.43	0.7	0.04	5.17	0.1	0.01	0.74	0.8	0.04	5.91	0.5	0.03	3.69	0.74	0.04	5.46	0	0	0	0	0	1.0	0.06	7.38	7.0	0.39	51.70	0.9	0.05	6.65	13.54	99.99
5	0.7	0.04	7.61	1.0	0.06	10.87	0.6	0.04	6.52	0	0	0	0	0	0	0.9	0.06	9.78	0.7	0.04	7.61	0	0	0	0	0.2	0.01	2.17	2.4	0.15	26.39	0.3	0.02	3.26	2.4	0.15	26.09	9.2	100.00
6	0	0	0	0	0	0	0.1	0.01	1.22	0	0	0	0	0	0	0.1	0.01	1.22	6.3	0.35	76.83	0	0	0	0	0	0	0	1.5	0.08	18.29	0	0	0	0.2	0.01	2.44	8.2	100.00
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0.03	10.17	0	0	0	0	0	0	0	3.0	0.17	50.85	0	0	0	2.3	0.13	38.98	5.9	100.00
8	0	0	0	0	0	0	0	0	0	0	0	0	0	7.0	0.39	39.77	0.3	0.02	1.70	0	0	0	0	0	0	0	1.5	0.08	8.52	0	0	0	8.7	0.48	49.43	17.6	99.99
9	0.3	0.02	2.29	0	0	0	0	0	0	1.0	0.06	7.63	0.5	0.03	3.82	4.3	0.24	32.82	0.4	0.02	3.05	0	0	0	0	0	0.3	0.02	2.29	1.8	0.1	13.74	2.4	0.13	18.32	2.1	0.12	16.03	13.1	99.99
10	4.0	0.22	7.69	0	0	0	3.9	0.22	7.50	0.3	0.02	0.58	0	0	0	39.6	2.2	76.15	0	0	0	0	0	0	0	0	0.1	0.01	0.19	0	0	0	4.1	0.23	7.88	0	0	0	52.0	99.99
11	0	0	0	0.5	0.03	1.18	0	0	0	2.6	0.14	6.15	0	0	0	14.5	0.8	34.28	0	0	0	0	0	0	0	0	2.2	0.12	5.20	0	0	0	223	1.24	52.72	0.2	0.01	0.47	423	100.00
12	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1	0.06	7.59	9.3	0.52	64.14	0	0	0	0	0	0	0	0	0	0	0.9	0.05	6.21	2.8	0.16	19.31	0.4	0.02	2.76	14.5	100.01

Table 7. Monthly size composition data for *N. oveni* caught by trawl in Visayan Sea, August 1976 – March 1977.

Fork Length (cm)	Aug. 1976		Sept.		Oct.		Nov.		Dec.		Jan. 1977		Feb.		Mar.	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
5.5																
6.0			1	0.16					3	0.45			1	0.45		
6.5			0	0					3	0.45			3	1.36		
7.0			0	0					0	0			3	1.36		
7.5	1	0.21	5	0.79					0	0			3	1.36		
8.0	0	0	6	0.95	1	0.23			0	0			1	0.45		
8.5	5	1.03	11	1.74	1	0.23			3	0.45			0	0		
9.0	3	0.61	6	0.95	3	0.68			00	0			1	0.45	2	0.46
9.5	7	1.43	7	1.10	7	1.58	1	0.35	0	0			3	1.36	11	2.52
10.0	14	2.57	23	3.63	16	3.62	0	0	2	0.30			10	4.55	16	3.66
10.5	8	1.64	19	3.00	26	5.88	3	1.06	8	1.21	3	2.75	7	3.18	22	5.03
11.0	9	1.84	23	3.63	38	8.60	6	2.11	9	1.36	0	0	8	3.64	2	0.46
11.5	9	1.84	22	3.48	35	7.92	14	4.93	11	1.66	2	1.83	4	1.82	7	1.60
12.0	10	2.05	13	2.05	38	8.60	11	3.87	27	4.09	1	0.92	7	3.18	17	3.89
12.5	26	5.33	25	3.95	44	9.95	19	6.69	22	3.33	3	2.75	7	3.18	35	8.01
13.0	24	4.92	23	3.63	43	9.73	30	10.56	41	6.20	6	5.50	18	8.18	39	8.92
13.5	47	9.62	11	1.74	22	4.98	47	16.55	45	6.81	6	5.50	9	4.09	38	8.70
14.0	45	9.22	31	4.90	21	4.75	32	11.27	64	9.68	11	10.09	6	2.73	34	7.78
14.5	53	10.86	40	6.32	15	3.39	20	7.04	63	9.53	7	6.42	8	3.64	24	5.49
15.0	33	6.76	53	8.37	27	6.11	17	5.99	69	10.44	8	7.34	5	2.27	19	4.35
15.5	38	7.79	58	9.16	25	5.65	21	7.39	57	8.62	13	11.93	8	3.64	22	5.03
16.0	27	5.53	56	8.45	26	5.88	20	7.04	38	5.75	11	10.09	13	5.91	17	3.89
16.5	26	5.33	44	6.95	16	3.62	10	3.52	46	6.96	6	5.50	18	8.18	16	3.66
17.0	25	5.12	31	4.90	16	3.62	12	4.23	42	6.36	3	2.75	6	2.73	18	4.12
17.5	20	4.10	31	4.90	6	1.36	5	1.76	26	3.93	5	4.59	16	7.27	13	2.97
18.0	18	3.69	29	4.58	8	1.81	3	1.06	19	2.87	4	3.67	18	8.18	21	4.81
18.5	9	1.84	19	3.00	2	0.45	4	1.41	14	2.12	3	2.75	8	3.64	11	2.52
19.0	10	2.05	18	2.84	6	1.36	4	1.41	16	2.42	8	7.34	7	3.18	13	2.97
19.5	9	1.84	7	1.10			5	1.76	11	1.67	3	2.75	6	2.73	13	2.97
20.0	1	0.21	7	1.10					6	0.91	1	0.92	6	2.73	8	1.83
20.5	6	1.23	5	0.79					7	1.06	2	1.83	2	0.91	7	1.60
21.0	1	0.21	4	0.63					2	0.30	1	0.92	2	0.91	7	1.60
21.5	3	0.61	2	0.32					3	0.45	0	0	1	0.45	2	0.46
22.0	0	0	2	0.32					0	0	1	0.92	2	0.91	1	0.23
22.5	1	0.21	1	0.16					1	0.15	0	0	0	0	1	0.23
23.0									0	0	1	0.92	1	0.45	0	0
23.5									1	0.15	1	0.92	1	0.45	0	0
24.0									1	0.15	1	0.92	1	0.45	0	0
24.5									1	0.15					0	0
															1	0.23
Total	488	99.99	633	99.99	442	100.00	284	100.00	661	99.98	109	99.98	220	99.97	437	99.99
$\bar{x}$	14.73		14.76		13.31		14.90		14.61		15.27		14.48		14.22	

Table 8. Length-weight data for male *Nemipterus oveni* caught by trawl in Visayan Sea.

n = 209

F.L. (cm)	Weight (gm)										
	1	2	3	4	5	6	7	8	9	10	Ave.
5.5	3.0	2.8	2.3								2.7
6	3.2	3.5									3.35
6.5											
7											
7.5											
8	8.2	9.2	8.3								8.57
8.5											
9	13.7	13.5	13.1								13.63
9.5	14.6	15.3	15.0	14.5	14.7	13.8					14.65
10	14.5	15.2	18.2	15.9	20.0	17.8	18.0	17.7	16.2	16.8	17.03
10.5	22.0	20.0	19.5	18.1							19.9
11	24.6	18.6	21.0	24.5	22.2	22.7	22.0				22.23
11.5	26.8	30.5	25.2	27.7	28.7	37.6	27.3	30.0			29.23
12	33.6	28.9	32.0	30.6	28.0	31.1	32.8	3.30	34.0		31.56
12.5	37.3	37.0	36.4	38.3	37.2	38.2	41.7	36.0	33.5	34.0	36.96
13	40.0	43.7	41.5	40.0	35.8	45.0	36.6	40.0	39.5	38.8	40.7
13.5	50.9	47.0	47.5	46.4	47.0	43.5	51.7	49.5	44.5	42.0	47.0
14	50.9	52.9	52.8	49.5	56.3	54.0	50.0	42.9	49.2	51.0	50.95
14.5	54.3	60.5	48.4	58.5	54.1	53.1	57.5	66.2	56.0	60.8	56.94
15	63.1	64.3	65.6	59.3	65.4	63.4	67.8	65.7	61.8	55.0	63.74
15.5	69.0	69.7	67.3	66.2	71.8	68.3	62.1	77.1	73.1	78.0	70.26
16	74.3	74.1	76.7	80.6	85.8	71.4	74.7	75.3	66.0	76.2	75.51
16.5	82.1	90.0	76.5	90.1	76.3	87.6	90.0	87.0			84.95
17	85.8	96.0	96.1	102.3	93.3	92.7	91.5	90.8	106.0		94.94
17.5	106.6	111.3	102.8	108.0	102.6	104.9	103.1	94.4	95.4	98.5	102.76
18	112.3	107.6	112.4	124.9							114.3
18.5	116.1	124.1	122.7	123.7	123.8	130.0	119.1	114.8	116.7	122.8	121.38
19	137.3	139.5	136.7	144.9	131.8	138.1					138.05
19.5	145.6	152.0	146.2	136.5	128.4	139.6					141.38
20	162.9	171.0	158.1	167.9	191.3						170.24
20.5	171.1	191.8	184.6	178.0	191.2						183.34
21	190.0	208.8	197.1								198.63
21.5	201.4										201.4
22	229.3	209.6									219.45
22.5	227.2										227.2
23	242.9										242.9
23.5	230.0										230.0
24	284.0										284.0
24.5	312.5										312.5

Table 9. Length-weight data for female *Nemipterus oveni* caught by traw in Visayan Sea.

n = 211

F.L. (cm)	Weight (gm)										
	1	2	3	4	5	6	7	8	9	10	Ave.
5.5	2.8	3.0	2.3								
6	3.2	3.5	4.1								2.7
6.5											3.6
7											
7.5											
8	8.2	9.2	8.3								
9	13.7	13.5	13.1								8.57
9.5	14.6	15.3	15.0	14.5	14.7	13.8					13.43
10	14.5	18.3	16.6	15.2	18.2	15.9	20.0	17.8	18.0	17.7	14.65
10.5	18.3	21.9	21.5	20.8	19.5	21.3	19.5	18.1			17.22
11	25.7	22.7									20.7
11.5	28.0	31.2	26.9	25.6	25.8	28.7					24.2
12	40.9	33.4	30.0	32.5	33.8	31.5	28.9	27.6	32.0	31.4	27.7
12.5	38.2	39.1	32.0	36.0	37.4	37.3	37.9	34.8	34.0	40.0	32.2
13	44.1	40.5	43.1	39.4	36.5	42.9	43.5	38.1	45.7	42.8	36.67
13.5	43.9	44.3	46.9	47.8	47.6	47.5	45.7	48.5	45.6	50.2	41.66
14	49.3	50.8	49.5	48.5	50.0	56.8	50.0	50.7	47.4	46.5	46.8
14.5	60.0	56.4	56.0	57.6	62.0	58.2	62.1	59.0	57.4	58.4	49.95
15	62.6	63.6	62.0	62.3	73.0	58.7	55.3	61.9	66.2	62.5	58.71
15.5	78.6	75.2	73.6	76.5	71.5	57.4	70.0	72.4	75.0	73.2	62.81
16	85.1	77.1	72.3	81.5	76.2	82.0	80.0	68.8	84.5	78.8	72.34
16.5	83.1	88.5	89.4	83.5	90.0	84.8	80.5	96.0	81.5	79.2	78.63
17	95.4	97.8	95.4	94.2	93.4	98.5	95.2	92.0	95.9	92.9	85.65
17.5	95.9	110.0	106.3	104.0	107.8	102.7	105.6	76.1	126.2	121.7	95.07
18	110.7	117.7	105.6	102.6	124.8	133.2	124.0	120.5	127.1	129.1	105.63
18.5	111.6	125.6	136.8	123.0	102.9	136.2	122.0	120.1	119.6	142.9	119.53
19	137.7	148.1	142.6	160.0	151.7	163.0	140.0	153.3	133.7	130.0	124.07
19.5	149.1	140.9	153.1	151.0	146.4	180.0	167.8	152.6			146.01
20	153.1	151.7	159.9	168.8							155.1
20.5	155.3	157.3	187.4								158.38
21	189.6	198.0									166.67
											193.8

Table 10. Size and gonadal maturity of male *N. oveni* caught by trawl in Visayan Sea.

F.L. (cm)	Immature		Maturing		Mature		Total
	n	%	n	%	n	%	
10.5	3	1.96					3
11	5	3.27					5
11.5	5	3.27					5
12	7	4.58					7
12.5	13	8.50					13
13	13	8.50					13
13.5	19	12.42	1	1.47			20
14	18	11.76	1	1.47			19
14.5	11	7.19	5	7.35			16
15	13	8.50	5	7.35			18
15.5	7	4.58	5	7.35			12
16	11	7.19	2	2.94			13
16.5	4	2.61	4	5.88			8
17	3	1.96	5	7.35			8
17.5	9	5.88	5	7.35			14
18	2	1.31	2	2.94			4
18.5	1	0.65	8	11.77			9
19	2	1.31	4	5.88			6
19.5	4	2.61	3	4.41			7
20	2	1.31	4	5.88			6
20.5	1	0.65	5	7.35			6
21			3	4.41			3
21.5			1	1.47			1
22			1	1.47			1
22.5							
23			1	1.47			1
23.5			1	1.47			1
24			1	1.47	1		2
24.5			1	1.47			1
Total	153	100.01	68	99.97	1		222
% of stages	68.92		30.63		0.45		
$\bar{X}$	15.54		18.98				

a, b and r^2 are shown below:

Sex	a	b	r^2	n
combined sexes	0.00895	3.26	0.999	420
male	0.00908	3.25	0.999	209
female	0.00880	3.27	0.999	211

where: *a* is intercept and *b*, slope; *r2* goodness of fit and *n*, number of fish.

Sex Ratio and Maturity

Of the 538 specimens dissected, 222 were males and 316 were females. The ratio obtained was 0.7 male to 1.0 female.

There was an overlapping of gonadal maturity at various length groups. Tables 10 and 11 show the size and maturity stages of the males and females, respectively. About 60 percent of the males sampled were immature with a mean length of 15.54 cm and 31 percent were maturing with a mean length of 19.0 cm. Of the females sampled, 41 percent were immature with a mean length of 13.5 cm and 47 percent were maturing with a mean length of 16.6 cm, and 11 percent were mature with a mean length of 18.7 cm.

Selaroides leptolepis (Cuvier and Valenciennes)

Size Composition

The sizes of *S. leptolepis* caught by trawl in the Visayan Sea ranged from 3.5 cm to 18.5 cm in total length. The monthly size composition data are presented in Table 12. The mean lengths were 13.46 cm in July, 13.61 cm in August, 13.99 cm in September, 13.61 cm in October, 11.43 cm in December, 10.59 cm in January, 11.68 cm in February and 12.38 cm in March.

Small size groups with lengths ranging from 3.5 to 6.0 cm were caught in July and October and from January to March. Larger ones with lengths ranging from 15.0 to 18.5 cm were caught during the entire survey period. The largest specimens measuring 18.5 cm were obtained only in August and September.

Table 11. Size and gonadal maturity of female *N. oveni* caught by trawl in Visayan Sea.

F.L. (cm)	Immature		Maturing		Mature		Total
	n	%	n	%	n	%	n
10	1	0.77					1
10.5	5	3.85					5
11							
11.5	5	3.85					5
12	9	6.92					9
12.5	16	12.31	1	0.67			17
13	21	16.15	1	0.67			22
13.5	17	13.07	1	0.67			18
14	17	13.07	3	2.01			20
14.5	14	10.77	10	6.71			24
15	15	11.54	10	6.71			25
15.5	5	3.85	22	14.76	1	2.70	28
16	4	3.08	16	10.74			20
16.5	1	0.77	23	15.44	1	2.70	25
17			15	10.07	4	10.81	19
17.5			14	9.40	7	18.92	21
18			8	5.37	4	10.81	12
18.5			14	9.40	6	16.22	20
19			3	2.01	7	18.92	10
19.5			3	2.01	4	10.81	7
20			1	0.67	2	5.40	3
20.5			2	1.34	1	2.70	3
21			2	1.34			2
21.5							
Total	**130**	**100.00**	**149**	**99.99**	**37**	**99.99**	**316**
% of stages	**41.14**		**47.15**		**11.71**		**100.0**
$\bar{X}$	**13.5**		**16.61**		**18.7**		

Table 12. Monthly size composition data for *S. leptolepis* caught in Visayan Sea, July 1976 – March 1977.

Total Length; (cm)	July '76		Aug.		Sept.		Oct.		Dec.		Jan. '77		Feb.		Mar
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
3.5							1	1.19							
4.0							3	3.57			1	0.42			
4.5	1	0.42					7	8.33			0	0			
5.0	0	0					1	1.19			4	1.68			
5.5	0	0					6	7.14			2	0.84			1
6.0	0	0					1	1.19	1	0.36	10	4.20	1	2.04	1
6.5	7	2.94					0	0	1	0.36	30	12.61	0	0	4
7.0	2	0.84					0	0	2	0.72	26	11.77	1	2.04	1
7.5	0	0					0	0	2	0.72	21	8.82	1	2.04	0
8.0	0	0					1	1.19	3	1.08	12	5.04	2	4.08	0
8.5	1	0.42					5	5.95	8	2.88	2	0.84	7	14.29	1
9.0	6	2.52	1	0.27			8	9.52	20	7.19	0	0	1	2.04	0
9.5	9	3.78	1	0.27			2	2.38	25	8.99	1	0.42	0	0	0
10.0	10	4.20	4	1.10			1	1.19	22	7.91	0	0	3	6.12	2
10.5	7	2.94	5	1.37			0	0	11	3.96	0	0	4	8.16	3
11.0	3	1.26	26	7.12	3	7.50	0	0	22	7.91	0	0	4	8.16	9
11.5	0	0	41	11.23	1	2.50	0	0	33	11.87	10	4.20	3	6.12	9
12.0	3	1.26	51	13.97	5	12.50	0	0	33	11.87	5	2.10	0	0	14
12.5	5	2.10	12	3.29	4	10.0	0	0	29	10.43	5	2.10	0	0	15
13.0	10	4.20	8	2.19	0	0	0	0	14	5.04	18	7.56	3	6.12	4
13.5	21	8.82	10	2.74	3	7.50	1	1.19	18	6.47	14	5.88	2	4.08	3
14.0	32	13.44	40	10.96	2	5.00	6	7.14	22	7.91	28	11.77	6	12.25	6
14.5	49	20.59	62	16.99	7	17.50	6	7.14	8	2.88	23	9.66	4	8.16	10
15.0	36	15.13	36	9.86	7	17.50	16	19.05	2	0.72	11	4.62	1	2.04	7
15.5	19	7.98	29	7.95	3	7.50	11	13.10	0	0	9	3.78	4	8.16	4
16.0	8	3.36	11	3.01	3	7.50	2	2.38	0	0	4	1.68	1	2.04	1
16.5	5	2.10	15	4.11	0	0	4	4.76	2	0.72			1	2.04	1
17.0	2	0.84	7	1.92	1	2.50	1	1.19							0
17.5	2	0.84	3	0.82	0	0	1	1.19							1
18.0			1	0.27											
18.5			2	0.55	1	2.50									
Total	238	99.98	365	99.99	40	100.0	84	99.98	278	99.99	238	99.99	49	99.98	97
$\bar{x}$	13.46		13.61		13.99		13.61		11.43		10.59		11.68		12.38

Table 13. Length-Weight data for male *Selaroides leptolepis* caught by trawl in Visayan Sea.

n = 203

T.L. (cm)	Weight (gm)										Ave.
	1	2	3	4	5	6	7	8	9	10	
4.5	1.0										1.0
5											
5.5	1.9										1.9
6	3.1	3.9	1.9								2.97
6.5	2.5	2.8	2.7	3.2	3.0	3.1					2.88
7	3.0	3.2	4.3	4.1	4.6	3.6					3.80
7.5	3.9	3.7	5.4								4.33
8	4.6	3.5	4.8	6.9	6.6						5.28
8.5	6.4	4.5	5.2	5.7	5.6	6.5	5.5	7.8	5.8	7.6	6.06
9	7.0	7.2	7.5	7.1	8.6	8.2	7.8	6.9	5.9	6.5	7.27
9.5	7.5	9.0	7.7	8.9	7.3	8.5	8.1	8.3	9.7	8.0	8.30
10	9.5	9.8	9.4	8.7	10.0	9.0	11.1	10.7	10.2	9.7	9.81
10.5	10.8	11.5	10.2	13.5	14.9	13.6	11.5	12.7	12.1	13.0	12.38
11	12.7	13.5	13.4	14.0	13.3	14.1	13.9	15.5	16.2	13.1	13.97
11.5	16.0	15.1	15.8	16.2	17.5	14.8	16.9	16.3	14.2	15.5	15.83
12	20.6	16.5	19.0	20.0	16.6	16.7	16.8	15.8	17.7	18.5	17.82
12.5	19.9	23.5	20.0	21.0	21.3	18.3	19.1	17.1	17.2	20.3	19.77
13	25.6	22.0	24.3	26.4	24.5	27.7	21.5	22.9	20.0	19.1	23.4
13.5	28.0	25.0	27.4	28.7	26.9	27.2	29.6	31.5	27.8	27.0	27.91
14	32.2	31.3	33.9	32.0	28.6	29.4	33.2	32.5	33.0	34.6	32.07
14.5	38.2	30.2	33.2	35.2	37.0	34.0	32.5	35.0	34.4	31.7	34.24
15	45.0	40.0	39.9	41.0	36.3	30.9	35.3	37.0	37.0	40.6	38.3
15.5	40.0	42.3	43.4	40.3	40.9	42.6	40.6	40.5	43.7	46.3	42.06
16	50.0	48.5	48.4	53.9	44.7	41.0	51.5	45.3	48.6	55.3	48.72
16.5	52.0	53.7	55.7	49.8	52.1	51.5	47.2	55.7			52.21
17	56.0	58.5	54.1								56.2
17.5	56.0	66.5	62.6	59.9	67.7						62.54
18	71.3										71.3
18.5	78.0										78.0

Length-Weight Relationship

The length-weight data for males and females are presented in Tables 14 and 15, respectively, and plotted in Figure 3. The regression data obtained are shown below:

Sex	a	b	r^2	n
combined sexes	0.00630	3.19	0.994	390
male	0.00629	3.19	0.995	203
female	0.00632	3.19	0.992	187

where: a is intercept and b, slope; r^2, goodness of fit; n, number of fish

Sex Ratio and Maturity

Of the 937 specimens dissected, 486 were males and 451 were females, or a ratio of 1.08 males to 1.0 female.

An overlapping of maturity stages was observed at various length groups. The sizes and stages of maturity for males and females are presented in Tables 15 and 16, respectively. About 44 percent of the males and 41 percent of the females sampled were maturing with a mean length of 14.0 and 14.8 cm, respectively. The males mature at a mean length of 15.2 cm and the females, at a mean length of 15.4 cm.

DISCUSSION

NEMIPTERIDAE

Species Composition, Relative Abundance and Distribution

Of the 18 species of *Nemipterus* reported by Herre (1953) as present in Philippine waters, seven were readily identified in the Visayan Sea, namely: *Nemipterus hexodon, N. japonicus, N. marginatus, N. nematophorus, N. nemurus, N. oveni* and *N. tambuloides,* and about five other species which could not be readily identified on board. *N. oveni* was the most abundant, followed in the order of their abundance in terms of relative percentage by weight by *N. nematophorus, N. marginatus* and *N. tambuloides.*

Tiews (1959) reported that in Manila Bay, *N. japonicus* was the most abundant. Wongratana (1970) reported 11 identified species and one un-

Table 14. Length-weight data for female *Selaroides leptolepis* caught by trawl in Visayan Sea.

T.L. (cm)	Weight (gm) 1	2	3	4	5	6	7	8	9	10	Ave.
4.5	1.0										1.0
5											
5.5											
6	3.1	3.9									3.5
6.5	2.5	2.8	2.7	3.2	3.0	3.1					2.89
7	3.0	3.2	4.3	4.1	4.6	3.6					3.8
7.5	3.9	3.7	5.4								4.33
8	4.6	3.5	4.8	6.9	6.6						5.28
8.5	6.4	4.5	5.2	5.7	5.6	6.5	5.5	5.8	7.6	7.8	6.06
9	7.0	7.2	7.5	7.1	8.6	8.2	7.8	6.9	5.9	6.5	7.27
9.5	7.5	9.0	7.7	8.9	7.3	8.5	8.1	8.3	9.7	8.0	8.30
10	9.5	9.8	9.4	8.7	10.0	9.0	10.7	9.7	8.9	9.5	9.52
10.5	11.3	10.8	14.9	13.6	11.9	11.5	12.1	13.0	10.4		12.17
11	12.7	13.2	15.8	15.2	13.9	14.5	11.0	12.3	12.9	12.2	13.37
11.5	14.0	17.0	16.5	14.7	18.6	18.2	15.0	16.6	14.5	14.8	15.99
12	18.7	20.0	18.5	19.2	21.0	18.3	18.4	16.0	16.5	16.9	18.35
12.5	23.0	24.7	24.3	20.0	22.7	20.2	19.1	21.3	17.7	19.5	21.25
13	25.3	26.5	25.1	28.5	27.3	27.7	27.4	22.2	24.8	19.5	25.43
13.5	29.0	30.3	26.4	28.0	33.7	31.0	30.5	30.0	30.1	25.9	25.49
14	34.6	30.9	33.0	30.0	32.1	33.5	38.1	32.0	35.8	37.1	33.71
14.5	30.2	39.3	22.6	34.8	34.0	36.9	31.6	34.9	40.0	37.8	35.21
15	39.8	39.1	38.0	36.8	38.3	36.0	35.6	35.7	36.1	35.8	37.12
15.5	44.3	42.0	46.4	42.3	43.8	41.9	40.7	44.7	46.4	40.0	43.25
16	43.6	52.3	47.6	44.8	46.7	46.1					46.85
16.5	52.5	47.1	50.0	54.4	48.5	44.1	46.7				49.04
17	50.5										50.5
17.5	63.5										63.5

Table 15. Size and gonadal maturity of male *S. leptolepis* caught by trawl in Visayan Sea.

T.L. (cm)	Immature		Maturing		Mature		Total
	n	%	n	%	n	%	
10	5	5.0					5
10.5	7	7.0	1	0.47			8
11	16	16.0	3	1.41			19
11.5	23	23.0	1	0.47			24
12	19	19.0	7	3.28			26
12.5	19	19.0	6	2.82	1	0.58	26
13	9	9.0	22	10.33	4	2.31	35
13.5	2	2.0	36	16.90	13	7.51	51
14			57	26.76	33	19.08	90
14.5			36	16.90	38	21.96	74
15			23	10.80	33	19.08	56
15.5			8	3.76	26	15.03	34
16			7	3.28	11	6.36	18
16.5			4	1.88	6	3.47	10
17			1	0.47	3	1.73	4
17.5			1	0.47	3	1.73	4
18					1	0.58	1
18.5					1	0.58	1
Total	100	100.0	213	100.00	173	100.00	486
% of stages	20.58		43.83		35.6		100.01
$\bar{x}$	11.73		14.02		15.17		

Table 16. Size and gonadal maturity of female *S. leptolepis* caught by trawl in Visayan Sea.

T.L. (cm)	Immature		Maturing		Mature		Total
	n	%	n	%	n	%	
10	3	2.56					3
10.5	6	5.13					6
11	20	17.09					20
11.5	20	17.09					20
12	19	16.24	2	1.07			21
12.5	21	17.95	4	2.14	1	0.68	26
13	8	6.84	17	9.09	8	5.44	33
13.5	6	5.13	27	14.44	12	8.16	45
14	8	6.84	50	26.74	24	16.33	82
14.5	5	4.27	41	21.92	39	26.53	85
15	1	0.85	27	14.44	32	21.77	60
15.5			12	6.42	17	11.56	29
16			3	1.60	6	4.08	9
16.5			2	1.07	6	4.08	8
17					2	1.36	2
17.5			2	1.07			
18							
18.5							
Total	117	99.99	187	100.00	147	99.99	451
% of stages	25.94		41.46		32.59		99.99
$\bar{x}$	12.88		14.77		15.36		

identified in Thailand, but did not mention which of the species was abundant. Weber and Jothy (1977) recorded 11 species during the survey conducted in the East Malaysian waters and reported that *N. japonicus* was the most dominant, consisting about 31% of the catch of nemipterids, followed by *N. mesoprion;* the least abundant were *N. bleekeri, N. nemurus* and an unidentified species. Krishnamoorthi (undated) reported three species, namely: *N. tolu, N. marginatus* and *N. japonicus* as present in the trawl catches off the Andhra Orissa coasts and that among them, *N. japonicus* was the most common and constituted a good fishery.

The nemipterids were caught throughout the survey period in the area but were more abundant in December and least abundant in February. This seasonality in abundance may be affected by the monsoon winds – the northeast monsoon, which blows constantly from October to January, and the southwest monsoon winds, from May to September, and the tradewinds, during the remaining months (Manacop, 1955). The lean month, February, falls within the period wherein the tradewinds prevail and the weather is very variable. The work of Rasalan (1957) on the marine fisheries of Central Visayas mentioned that the nemipterids *(bisugo)* were caught throughout the year, without mentioning any particular month wherein this group was abundant. He did not also mention any relationship between the monsoon winds and the abundance of nemipterids in the area.

Krishnamoorthi (undated) stated that there appeared to be a coincidence between the peak months in abundance of *N. japonicus* and the extensive hydrological changes and/or upwelling but his investigations were not adequate to provide an answer. In the Gulf of Thailand, there is no specific fishing season for *N. hexodon* as these are fished throughout the year with many other demersal fishes and the switch in trawl fishing from the east to the west coast and vice versa was due to the effect of the monsoon season rather than to the fishing season (Isarankura, 1970).

The nemipterids were distributed throughout the Visayan Sea but were collected abundantly at the eastern tracks located northeast and northwest of Guintacan Island and southwest of Gigantangan Island, or approximately between Long. 123°40'E and Long. 124°00'E and between Lat. 11°20'N and Lat. 11°40'N. They were likewise abundant near Panay, between Pan de Azucar and Sicogon Islands, or approximately between Long. 123°00'E and Long. 123°20'E and Lat. 11°20'N (Figure 4).

In the Visayan Sea, the nemipterids were caught at all depths but were relatively abundant from 90 meters down. In Lingayen Gulf, Guimaras Strait and vicinities, although present at all depths were more abundant at 29 m to 45 m (Warfel and Manacop, 1950). Martosubroto and Pauly (1976) found that they were present at all depths but higher catch rates were obtained at areas deeper than 30 m. In the Gulf of Thailand, they were caught at all depths but higher catch rates were at areas less than 30 m

(Ruamragsa and Isarankura, 1965). Off the coast of Sarawak, Brunei, west coast of Sabah and east coast of Malaysia, the nemipterids, though present at all depths, appeared to be more abundant at 30 m to 60 m (Lui *et al.*, 1976; Latiff *et al.*, 1976; Lamp and Latiff, 1976). Off the coast of Pakistan, highest catch rates for the threadfin breams were obtained at 74-110 m depth range (Hida and Pereyra, 1966).

It is known that there is no consistent pattern relating distribution and abundance of the different groups of fish to depth; they are either equally abundant at all depths or showed marked difference from area to area (Simpson, personal communication). The same result has been obtained in the present study.

The species of *Nemipterus* show some depth preference. *N. oveni, N. nemurus, N. marginatus* and *N. tambuloides,* though present at all depths, appeared to be more abundant at a depth range of 50-140 m, 110-140 m, 80-110 m and 80-110 m, respectively. *N. hexodon* and *N. japonicus* were more abundant at a depth range of 20-50 m but were absent in fishing tracks with depths of 80 m and down. *Nemipterus nematophorus* was abundant at a depth range of 110-140 m but was absent at depths shallower than 35 m (Figure 5). Based on the above findings in the Visayan Sea, it can be inferred that among the *Nemipterus* species, *N. hexodon* and *N. japonicus* may be considered as shallow-water fish species and *N. nematophorus* as deep-water fish species. Other *Nemipterus* species found more abundant at certain depths were *N. virgatus* between 35 and 75 m in the northern part of South China Sea (Eggleston, 1970) and from 69 to 128 m in Hong Kong (Au Lai Shing, 1972). The highest average catch rates for *N. japonicus* and *N. hexodon* were obtained at a depth range of 30-39 m; for *N. marginatus* and *N. nemurus,* 40-49 m; and for *N. nematophorus,* 50 m and above in the coastal waters of East Malaysia (Weber and Jothy, 1977). *N. nematophorus* preferred areas beyond 40 m deep (Lamp and Latiff, 1976).

CARANGIDAE

Species Composition, Relative Abundance and Distribution

Roxas and Agco (1941) reported in their systematic account of Philippine Carangidae that there were 15 genera and sub-genera and 36 species present in our waters. The present study came up with the identification of seven genera and the presence of ten species in the Visayan Sea. There were other species which were not identified as this group is very difficult to study taxonomically. The systematics of Carangidae need to be clarified fully (Ronquillo, personal communication).

The carangid abundance fluctuated monthly during the entire survey

period but the highest catch rate was obtained in August and the lowest in October. The peak in abundance for *Caranx* spp was August; for *Decapterus* spp, November; for *M. cordyla,* January; for *N. ductor,* March; for *S. leptolepis,* August; and for *U. helvola,* September.

Rasalan (1957) reported that in the Visayan Sea, the cavallas were caught throughout the year white the round scads were caught from October to November; along the coasts of Capiz, the big-eyed scads and the cavallas were caught throughout the year; in Pilar Bay, the latter were caught from April to October and along the coasts of Aklan, big-eyed scads and cavallas were caught from January to November. The shift in season of the different groups of carangids in the areas studied was not related to any environmental conditions or monsoons prevailing in the areas mentioned.

In Palk Bay and the Gulf of Mannar, *S. leptolepis* occurred throughout the year and forms a good fishery from February to May and from August to September, the peak periods being February and September. The fishing season is shifted from Palk Bay to the Gulf of Mannar during the northeast monsoon when Palk Bay becomes rough and vice versa during the southwest monsoon when the Gulf of Mannar becomes rough (Tandon, 1962).

The findings of this study and those of others showed that different species of carangids have varying seasons or peak months in diverse fishing grounds.

The carangids were widely distributed in the Visayan Sea. They were concentrated in the western side near Panay, Sicogon and Pan de Azucar Islands, or approximately between Long. $123^{o}00'$E and Long. $123^{o}20'$E and between Lat. $11^{o}10'$N and Lat. $11^{o}25'$N. They were also caught at the eastern side of the Visayan Sea, approximately between Long. $123^{o}40'$E and Long. $124^{o}00'$E and between Lat. $11^{o}25'$N and Lat. $11^{o}40'$N but in lesser quantities (Figure 6).

The carangids were caught at all depths in various areas studied but were relatively abundant at shallower depths. In the Visayan Sea, they were found to be more abundant at 20-50 m (this study). In Guimaras Strait and vicinities, they were abundant at 18-36 m (Warfel and Manacop, 1950). In Java Sea, higher catch rates were obtained at depths ranging from 40-60 m (Martosubroto and Pauly, 1976). In the Gulf of Thailand they were caught in areas less than 30 m (Ruamragsa and Isarankura, 1965). Off the east coast of Sarawak, Brunei, west coast of Sabah and east coast of Malaysia, they were abundant at depths ranging from 10 to 30 m (Lui *et al.,* 1976; Latiff *et al.,* 1976; Lamp and Latiff, 1976).

At the species level, the distribution by depth varied. *C. armatus* and *C. crumenophthalmus,* though present at all depths, were more abundant at a depth range of 50-80 m; *C. djedaba, C. kalla* and *C. malabaricus* were caught at depths ranging from 20-80 m; *M. cordyla* at 20-50 m and 110-140 m; *N. ductor* at 80-110 m; *S. leptolepis* at 20-5[illegible]

at 110-140 m (Figure 7).

Considering these findings in the Visayan Sea and in other areas, it may be stated that there is a distinct distribution and relative abundance by depth at the species level although more detailed studies on the species distribution by depth should be undertaken in the country's fishing grounds.

Sasaki and Koike (1959) determined variations in catches of some trawl-caught fish species in the east coast of China Sea between daytime and nighttime and related these to the vertical movements of fishes as influenced by the light intensities in the environment.

NOTES ON THE BIOLOGY OF:

Nemipterus oveni (Bleeker)

Size Composition

As shown in Figure 8, the minimum size of *N. oveni* vulnerable to the trawl gear was 5.5 cm (FL) and the largest was 24.5 cm.

The size distribution is normal with a mean length of 15.0 cm. Most of the fishes caught were of sizes ranging from 11.0 cm to 18.0 cm, which would suggest that *N. oveni* is exploited at this size group. Very few fishes could grow to a size bigger than 20.0 cm.

Length-Weight Relationship

The length and the weight of a fish are closely related such that knowing the value of one, the other may be calculated using the parabolic equation $W = aL^{b}$. If the value of b is equal to 3 it indicates isometric growth, that is, the relative growth of the body parts is constant; but if the value of b is less or greater than 3, allometric growth (different body parts grow at different rates) is indicated. However, variations in the values of b may be due to the degree of fullness of the stomach, stage of maturity and season. It may also be a distinct characteristic of a species (Ricker, 1975).

The observed values for the corresponding lengths and weights of *N. oveni* closely fit with the calculated values as shown in Figure 2. The values obtained to convert length (in cm) to weight (in g) were $W = 0.00908\ L^{3.25}$ for the males and $W = 0.00880\ L^{3.27}$ for the females.

Rakvijai (1977) obtained length-weight conversion values of $W = 0.01765\ L^{2.9241}$ for the females of *N. hexodon.* Boonyubol (1965) as cited by Isarankura (1970) obtained from the west coast of Thailand the values of $W = 0.01219\ L^{2.9882}$ for the males and $W = 0.01186\ L^{3.004}$ for the females and from the east coast, the values of $W = 0.01044\ L^{3.0451}$ for the males and $W = 0.00773\ L^{3.1341}$ for the females of *N. hexodon*

Sex Ratio and Maturity

The male to female ratio of *N. oveni* was 0.7 to 1.0.

The trawl catches of *N. oveni* in the Visayan Sea are composed of immature, mature and maturing individuals. The males start maturing at lengths of 13.5 cm and the females at 12.5 cm. The females mature from 15.5 cm although the majority were matured at 17.5 and 19.0 cm in length. In both males and females, there was an overlapping of gonadal maturity at various length groups (Figure 9). Only one mature male was taken while there were 37 mature females. This big difference in number of mature individuals between sexes is observed probably because the mature females group together when they are about to spawn and move to the spawning ground and the mature males are probably in the spawning ground already. However, the observation in this study is not sufficient to prove this hypothesis. In the case of *Pleuronectes* sp. in Europe, it was observed that the mature females dominated the catch at certain periods of the year and no mature males were caught with them. This observation was made as basis to establish the spawning season of this group (Simpson, personal communication).

The sex ratio for *N. hexodon* was 1:0.84 in the Gulf of Thailand (Isarankura and Pariyanond, 1963); 1:0.82 in the west coast of Thailand and 1:0.87 in the east coast (Boonyubol, 1965) in favor of females. In Hong Kong the female-to-male ratio for *N. virgatus* was 1:1.13 (Eggleston, 1970). *N. hexodon* spawn when they attain a size of about 18 cm or larger (Boonyubol, 1965) while *N. japonicus* were immature at 9-12 cm, maturing at 17-20 cm and mature at 21-25 cm (Kuthalingam, 1966) and the minimum size at first sexual maturity was 16.5 cm. All were mature at sizes larger than 22.0 cm (Krishnamoorthi, 1974). *N. virgatus* was sexually mature at 19.5 cm L.C.F. (females) and at 20.2 cm L.C.F. (males) in Hong ong (Li, 1960). In Manila Bay, the females of *N. japonicus* mature at a minimum size of 7.6 cm and at a maximum size of 8.1 cm (SL); the stages of maturity of the males were not ascertained as the testis appeared to be poorly developed in all size groups examined (Manacop, 1936). Tiews (1959) stated that the *bisugo* in Manila Bay mature at lengths of 10-12 cm.

Selaroides leptolepis (Cuvier and Valenciennes)

Size Composition

As shown in Figure 10, the size distribution of *S. leptolepis* in the Visayan Sea is polymodal. About six modes can be recognized: modal lengths of 4.5 cm, 6.5 cm, 9.5 cm, 12.0 cm, 15.0 cm and 17.0 cm. Most

of the exploited fish belong to sizes ranging from 11.0 to 15.5 cm. The smallest size caught by the trawl was 3.5 cm and the largest was 18.5 cm. It is likely that *S. leptolepis* enter the Visayan Sea when they are about to mature, as evidenced by the gonadal stages observed in the catch, and probably spawn in the area.

Tandon (1961), in his study of *S. leptolepis* in the Gulf of Mannar and Palk Bay, found that the species is composed of size groups ranging from 8 to 13 cm. The maximum size caught was 15.3 cm.

Length-Weight Relationship

The length-weight relationship as plotted in Figure 3 shows a very good fit between the observed values and the calculated values. The length-weight relationship between the males and the females does not differ so much. The conversion value obtained was $W = 0.00630\ L^{3.19}$ for both sexes. Tandon (1961) found the length-weight relationship of *S. leptolepis* to be $W = 0.01089\ L^{3.1182}$ sexes combined.

Considering the values obtained for various species of *Nemipterus* and for *S. leptolepis*, it may be inferred that the L-W relationship varies by species and thus be considered a distinct characteristic of a particular species.

The length-weight relationship is valuable in expressing all the data in terms of either the length or the weight (Everhart *et al.*, 1975).

Sex Ratio and Maturity

The male to female ratio of *S. leptolepis* obtained in this study was 1.08:1.0 while that of Tandon (1961) was 1:1.25, 1:1.57 and 1:2.18 in some places in India, but he observed that during the spawning season, the differences between the sexes were much less – the males and females appear to congregate in almost equal number during the spawning season. The same possibility may exist in the Visayan Sea.

The catches of *S. leptolepis* in the Visayan Sea are composed of immature, maturing and mature individuals. The immature males and females were 10.0 to 13.0 cm in total length. Maturing males were observed at lengths of 10.5 cm while that of the females, at 12.0 cm. Matured males and females were observed from 12.5 cm and above. It appears that the males and females mature at almost the same size, beginning at 12.5 cm (Figure 11). Tandon (1961) observed that *S. leptolepis* attain its first maturity at about 8.8 cm and mature from 10.1 cm and above. Prabhu (1956), as quoted by Tandon (1961), stated that the females of *S. leptolepis* attain a size of 13.9 cm at first maturity, but it was not clear whether it is the total length or the fork length.

SUMMARY

1. Several species of *Nemipterus* are present in the Visayan Sea. Those which were identified are *N. hexodon, N. japonicus, N. marginatus, N. nematophorus, N. nemurus, N. oveni* and *N. tambuloides.*

2. The species of Carangidae identified were *Caranx armatus, C. crumenophthalmus, C. djedaba, C. kalla, C. malabaricus, Decapterus russelli, D. macrosoma, Selaroides leptolepis, Naucrates ductor, Uraspis helvola, Hynnis momsa* and *Magalaspis cordyla.*

3. For the nemipterids, the highest catch rate obtained was 7 kg/hr in March and the lowest was 2.5 kg/hr in February. For the carangids, the highest was 2.2 kg/hr in August and the lowest was 0.3 kg/hr in October.

4. The nemipterids were more abundant at FT 7 with a value of 12.5 kg/hr while the carangids were more abundant at FT 10 with a value of 2.9 kg/hr.

5. By depth, the highest catch rate for nemipterids was obtained at 90-140 m while that of the carangids was obtained at 20 to 50 m.

6. Of the species of *Nemipterus, N. oveni* was the most abundant species, contributing 28.7 percent to the total nemipterid catch. This was followed by *N. nematophorus, N. marginatus* and *N. tambuloides.*

7. Of the carangids the genus *Caranx* was the most abundant, followed by the genera *Selaroides, Uraspis, Naucrates* and *Decapterus,* in the order of their abundance.

8. The nemipterids were distributed throughout the Visayan Sea but were taken abundantly at the eastern tracks located northeast and northwest of Guintacan Island, or approximately at Longitude 123°40'E to 124°0'E and Latitudes 11°20'N to 11°40'N.

9. The carangids were concentrated in the western side of the Visayan Sea near Panay, Sicogon and Pan de Azucar Islands, or approximately at longitudes 123°00'E to 123°20'E and latitudes 11°20'N to 11°40'N.

10. The sizes of *N. oveni* caught by trawl in the Visayan Sea ranged from 5.5 cm to 24.5 cm fork length. The size distribution is normal. Small size groups with lengths ranging from 5.5 to 8.0 cm were caught in October, December and February. Larger ones, with sizes ranging from 20.0 to 24.5 cm, were obtained in August, September, December to March.

11. The sizes of *S. leptolepis* caught in the Visayan Sea ranged from 3.5 cm to 18.5 cm total length. The size distribution is polymodal. Small size groups ranging from 3.5 to 6.0 cm were found in July, October, January, February and March while the larger groups, 15.0 to 18.5 cm were present throughout the nine-month study.

12. The length-weight conversion values obtained for *N. oveni* was $W = 0.00895\ L^{3.26}$ and for *S. leptolepis*, $W = 0.00630\ L^{3.19}$.

13. The male-to-female ratio for *N. oveni* was 0.7 to 1.0. Males of *N. oveni* mature at about 19.0 cm while the females mature at a mean length of 18.7 cm.

14. The male-to-female ratio of *S. leptolepis* was 1.08 to 1.0. The males mature at a mean length of 15.2 cm and the females, at a mean length of 15.4 cm.

REFERENCES

ALVERSON, D.L. and W.T. PEREYRA.
1972 Demersal fish explorations in the Northeastern Pacific Ocean – an evaluation of exploratory fishing methods and analytical approaches to stock size and yield forecasts. *Proc. Indo-Pacific Fisheries Council.* 13 (III): 224-254.

APRIETO, V.L.
1978 Hydrobiological studies of the Visayan Sea demersal fisheries. A report on trawl fishing investigations on traditional and non-traditional fishing grounds in the Philippines. IFDR, UPCF: 218p. (mimeo copy).

_____ and J.N. PATOLOT.
1977 Echo survey of the Visayan Sea. *Fish. Res. J. Phil.* 2(1): 70-82.

_____ and E.P. VILLOSO.
1977 Fishes caught by otter trawl in the Visayan Sea. *Fish. Res. J. Phil.* 2(2): 40-49.

_____ and E. VILLOSO.
1979 Catch composition and relative abundance of trawl-caught fishes in the Visayan Sea. *Fish. Res. J. Phil.* 4(1): 9-18.

AU, LAI SHING.
1972 An inventory of demersal fisheries in Hongkong. *Proc. Indo-Pacific Fish. Council.* 13(3): 270-297.

CACES-BORJA P.
1972 On the ability of otter trawls to catch pelagic fish in Manila Bay. *Phil. J. Fish.* 10(1 & 2): 39-56. (Ja-D).

CHANG, J.H.
1968 The results of experimental trawl fishing in South China

CHILVERS, R.M.
1972 A preliminary report on a bottom trawl survey of the north shelf region of the South China Sea, March 1972-March 1973. The Kuroshio III. *Proc. Third CSK Symposium.* Bangkok, Thailand, Mongkol Karnpin Press and Publ. p. 367-368.

CLARKE, G.L.
1954 Elements of ecology. Singapore, Toppan Printing Co., Pte. Ltd. 549p.

DE JESUS, A. and A.R. MANIULIT.
1973 Preliminary report on the trial of bottom trawl rigged with plastic roller bobbins and oval boards. *Phil. J. Fish.* 11(1 & 2): 36-50: (Ja-D).

DRUZHININ, A.D. and U.P. HLAING.
1972 Observations of the trawl fishery of southern Burma. *Proc. Indo-Pacific Fish. Council.* 13(3): 151-209.

ENCINA, V.B.
1971 A report on two-boat bottom trawl fishing in the Phil. *Phil. J. Fish.* 9(1 & 2): 72-91: (Ja-D).

———.
1972 A preliminary report on the use of plastic bobbins and oval shaped otter boards for trawling operations in the Western Visayan Sea with the aid of echo sounder. *Phil. J. Fish.* 10(1 & 2): 85-118: (Ja-D).

EGGLESTON, D.
1970 Biology of *Nemipterus virgatus* in the northern part of the South China Sea. *In the Kuroshio:* A symposium on the Japan Current, edited by John C. Marr. Honolulu, East-West Center Press. p. 417-424.

———.
1972 Pattern of biology in the Nemipteridae. *J. Mar. Biol. Assn. India.* 14(1): 357-364.

EVERHART, W.H., A.W. ELIPPER and W.D. YOUNGS.
1975 Principles of fishery science. Ithaca, N.Y., Cornel Univ. Press. 288p.

FERNANDO, E.F.W.
1968 Species composition of fish captured by trawlers in the Wadge Bank. *Proc. Indo-Pacific Fish. Council.* 13(3): 521-530.

Food and Agriculture Organization of the United Nations.
1974 FAO Species identification sheets for fishery purposes. Eastern Indian Ocean (fishing area 57) and Western Central Pacific (fishing area 71), edited by W. Fischer and Whiteheads. Rome, Italy, FAO.

HERRE, A.W.C.T.
1950 Checklist of Philippine Fishes. USDI-FWS *Res. Rep.* 20. 976p.

HIDA, T.S. and W.T. PEREYRA.
1966 Results of bottom trawling in Indian Seas by r/v Anton Brunn in 1963. *Proc. Indo-Pacific Fish.* Council. 11(2): 156-171.

HUSSAIN, A.G. et al.
1972 Analysis of demersal catches taken from the exploratory fishing off the coast of West Pakistan. *Proc. Indo-Pacific Fish. Council.* 13(3): 61-84.

ISARANKURA, A.P.
1970 Synopsis of biological data on threadfin bream, *Nemipterus hexodon* (Quoy and Gaimard) 1824. *In the Kuroshio:* A symposium of the Japan Current, edited by John C. Marr. Honolulu, East-West Center Press. p. 455-465.

——— and S. PARIYANOND.
1963 Preliminary studies of life history of threadfin bream *(Nemipterus hexodon)* in the Gulf of Thailand. *Dept. of Fish Contribution.* 1:21-28.

JAYARAMAN, R.G. et al.
1959 Observation on the trawl fisheries of the Bombay and Saurastra waters, 1949-50 to 1954-55. *Indian J. Fish.* 6(1): 58-144.

KIM, Y.M. and Y.S. KIM
1970 Geographical distribution of the bottom fishes in the southwestern waters of Korea. *In the Kuroshio:* A symposium on the Japan Current, edited by John C. Marr. Honolulu, East-West Center Press. p. 505-516.

KRISNAMOORTHI, B.
1971 Biology of the threadfin bream *Nemipterus japonicus* (Bloch). Reprinted from *Indian J. Fish.* 18: 1-21.
1974 A note on the size difference between males and females in *Nemipterus japonicus* (Vloch). Reprinted from *Indian J. Fish.* 21(2): 608-609: (S 1976).

———— .
n.d. An assessment of *Nemipterus* fishery in Andhra-Orissa Coasts based on exploratory fishing. *Proc.* Symposium on Living Resources of the seas around India. (Reprint) p. 495-516.

KUTHALINGAM, M.D.K.
1966 Notes on some aspects of the fishery and biology of *Nemipterus japonicus* (Bloch) with special reference to feeding behavior. Reprinted from *Indian J. Fish.* Sect. A. 12(2): 500-506.

LAEVASTU, T.
1965 Manual of methods in fisheries biology. *FAO Manuals* in Fish. Sci. no. 1. Fasc. 9, Sect. 4: Res. on fish. stocks. 51p.

LAMP, P. and M.S.B.S.A. LATIFF.
1976 Demersal fish resources in Malaysian waters – 10. Fourth trawl survey of the coastal waters of the east coast of Peninsular Malaysia. *Fish. Bull. no. 12.* 25p.

LATIFF, M.S.B.S.A., W. WEBER, A.K. LEE and W.C. LAM.
1976 Demersal fish resources in Malaysian waters – 6. First trawl survey off the coasts of Sarawak Brunei and the west coast of Sabah. *Fish. Bull.* 11(1): 1-64.

LESTER, R.J.G.
1967 Notes on the trawling grounds of the Sunda Shelf and adjacent seas. *Current Affairs Bull.* Indo-Pacific Fish. Comm. 49: 1-13.

LI KWANG MING.
1960 On the biology of the HK golden thread, *Nemipterus virgatus* (Houttuyn). *Fish. J. H.K. Univ.* 3:1-18.

LOSSE, G.F. and A. DWIPONGGO.
1977 Special report on the Java sea southeast monsoon trawl survey, June-Dec. 1976. *Mar. Fish. Res. Rep.* 3: 1-93.

LUI, H.C. and H.L. LAI.
1977 Demersal fish resources of the Sunda Shelf. 11p. (mimeo copy).

LUI, Y.P. et al.
1976 Demersal fish resources in Malaysian waters – 12. Third trawl survey off the coast of Sarawak. *Fish. Bull.* 14: 1-35.

MANACOP, P.R.
1936 The sexual maturity of some commercial fishes caught in Manila Bay. *Phil. J. Sci.* 59(3): 383-391. From selected Ichtyological papers, Smithsonian Inst. v3. Art. 60 1969.

———— .
1955 Commercial trawling in the Philippines. *Phil. J. Fish.* 3(2): 117-188.

MARTOSUBROTO, P. and D. PAULY.
1976 Special report: R/V Mutiara IV Survey Data, Nov. 1974-Jul 1976. *Mar. Fish. Res. Rep.* 2: 1-136.

MORSUWAN, P.
1970 On the biology of slender travally, *Caranx leptolepis,* in the Gulf of Thailand. 16p. (mimeo copy).

NAIYANETR, P.
1963 Preliminary studies on the life history of pampano *(Caranx leptolepis)* in the Gulf of Thailand. *Dept. Fish Contrib.* 2: 1-29.

OVIATT, C.A. and S.W. NIXON.
1973 The demersal fish of Narragansett Bay: an analysis of community structure, distribution and abundance. *Estuarine and Coastal Mar. Sci.* 1(4): 361-378.

PATHANSALI, D., K.S. ONG, S.S. LATIFF and J.L. CARVALHO.
1966 Preliminary results of trawling investigations off Penang. *Proc. Indo-Pac. Fish. Counc.* 12(11): 181-201.

PHILIPPINES (REPUBLIC). Bureau of Fisheries and Aquatic Resources.
1974 Fisheries Statistics of the Philippines. 101p.

_____. *Ibid.* 115 p.
1975

_____. *Ibid.* 258 p.
1976

_____. *Ibid.* 417 p.
1977

_____. *Ibid.* 373 p.
1978.

PRUTER, A.T.
1966 Trawling results of the R/V Anton Brunn in the Bay of Bengal and Arabian Sea. *Comm. Fish. Rev.* 26(11a): 27-34.

RAKVIJAI, K.
1977 Preliminary study on the life history of threadfin bream *(Nemipterus hexodon)* in the Inner Gulf of Thailand. *Demersal Fish Invest. Unit Rep.* 1: 26. (mimeo copy, Text in Thai).

RASALAN, S.B.
1957 Marine fisheries of the Central Visayas. *Phil. J. Fish.* 5(J): 53-89.

RICKER, W.E.
1975 Computation and interpretation of biological statistics of fish populations. *Bull. Fish. Res. Bd. Canada.* 191: 382 pp.

RONQUILLO, I.A., P.C. BORJA and A. MINES.
1960 Preliminary observations on the trawl fishery of Manila Bay. *Phil. J. Fish.* 8(1): 47-57: (Ja-Je).

ROXAS, H.A. and A.G. AGCO.
1941 A review of Philippine Carangidae. *Phil. J. Sci.* 74(1): 1-82. From selected Icthyological Papers, Smithsonian Inst. 8(Art 78): 69.

RUAMRAGSA, S. and A.P. ISARANKURA.
1965 An analysis of demersal fish catches taken from the experimental trawling operations in the Gulf of Thailand. *Dept. of Fish. Contrib.* 3: 1-51.

SASAKI, Y. and A. KOIKE.
1959 Variations of the catches, in daytime and night, of some species of fish by trawl net. *Bull. Jap. Soc. Sci. Fish.* 25(2): 111-116. *Biological Abstracts* 36(4): 26288: (May 1981). (Text in Japanese with English summary).

TANDON, K.K.
1961 Biology and fishery of 'Choo Parai' *Selaroides leptolepis* (Cuvier and Valenciennes) Part II: Biology and fishery. Reprinted from *Indian J. Fish.* 8(1): 127-144.

_____.
1961 Size at first maturity in *Selaroides leptolepis* (Cuv. & Val.) as evidenced by the occurrence of mature individuals in the commercial catches. Reprinted from *Sci. and Cult.* 27: 258-259.

_____.
1962 *Selaroides leptolepis* (Cuv. & Val.) I: Fishery and fishing methods. *Res. Bull.* (N.S.) Panjab Univ. 13(III & IV): 26-268.

_____.
1962 *Selaroides leptolepsis* (Cuv. & Val.) II: Age and Growth. *Res. Bull.* (N.S.) Panjab Univ. 13(III & IV): 269-275.

TIEWS, K.
1959 Report to the government of the Philippines on marine fishery resources. Rep. FAO/ETAP. 1141: 1-88. *Phil. J. Fish.* 6(2): 107-208: (1962).

_____ and P.C. BORJA.
1965 On the availability of fish of the family Leiognathidae Lacepede in Manila Bay and San Miguel Bay and on their accessibility to controversial gears. *Phil. J. Fish.* 7(1): 59-83.

_____, A. MINES and I.A. RONQUILLO.
1975 On the biology of *Saurida tumbil* (Bloch, 1801) Family Synodontidae in Phil. waters. *Phil. J. Fish.* 10(1 & 2): 1-29.

UMALI, A.F.
1932 The Japanese beam trawl used in Phil. waters. *Phil. J. Sci.* 48: 389-410.

WARFEL, H. and P.R. MANACOP.
1950 Otter trawl explorations in Phil. waters. *USDI-FWS* Res. Rep. 25: 49.

WEBER, M. and L.F. DE BEAUFORT.
1936 The fishes of the Indo-Australian Archipelago. Leiden: E.J. Brill. 7: 561.

WEBER, W. and A.A. JOTHY.
1977 Observations on the fish *Nemipterus* spp. (Family Nemipteridae) in the coastal waters of East Malaysia. *Arch. Fisch. Wiss.* 28(2/3): 109-122. (photocopy).

WONGRATANA, T.
1970 Identification of *Nemipterus* in Thailand. *Proc. 2nd CSK Symposium*, Tokyo, Japan. p. 465-487. (photocopy).

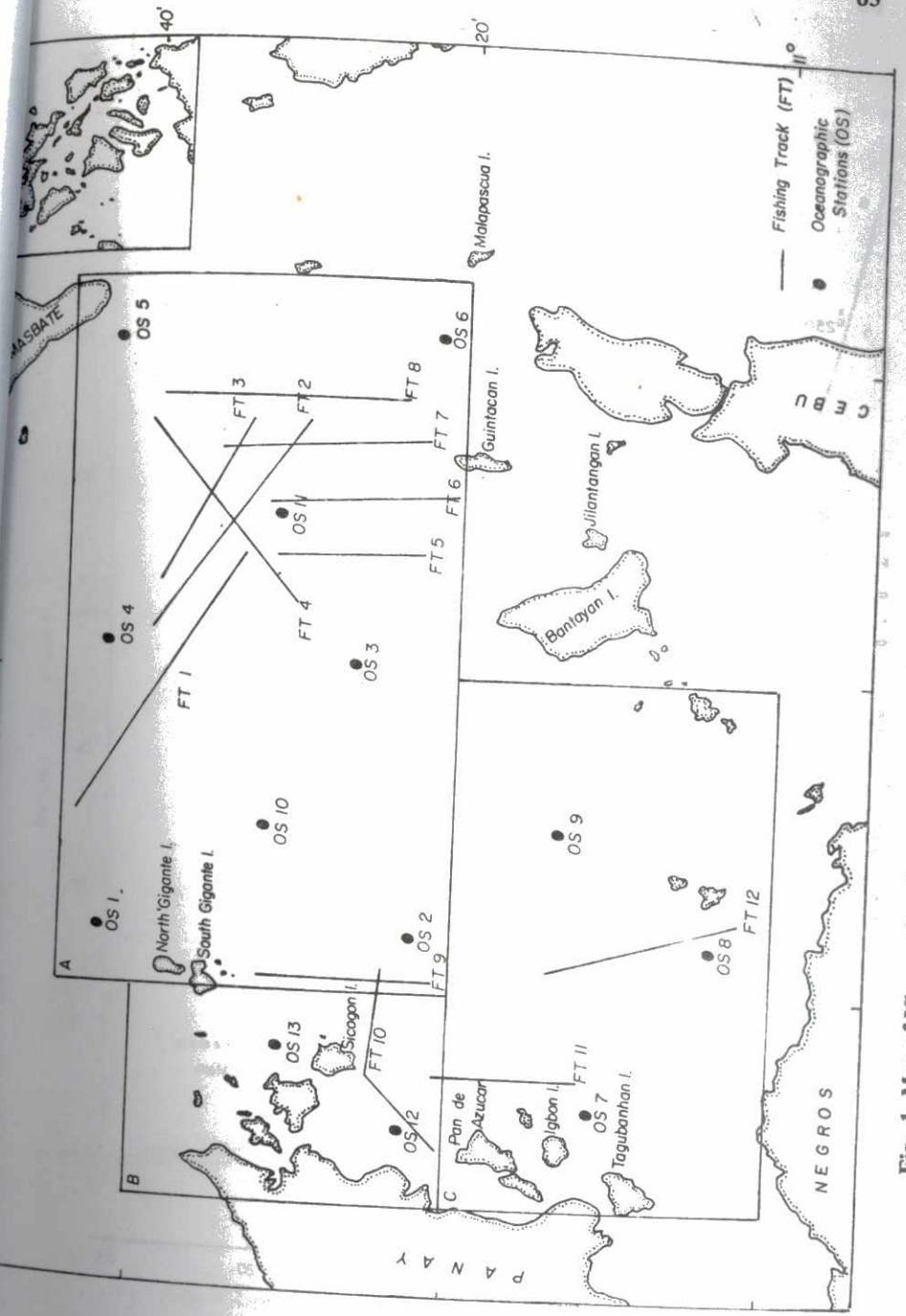


Fig. 1. Map of Visayan Sea showing the positions of the fishing tracks and oceanographic stations.

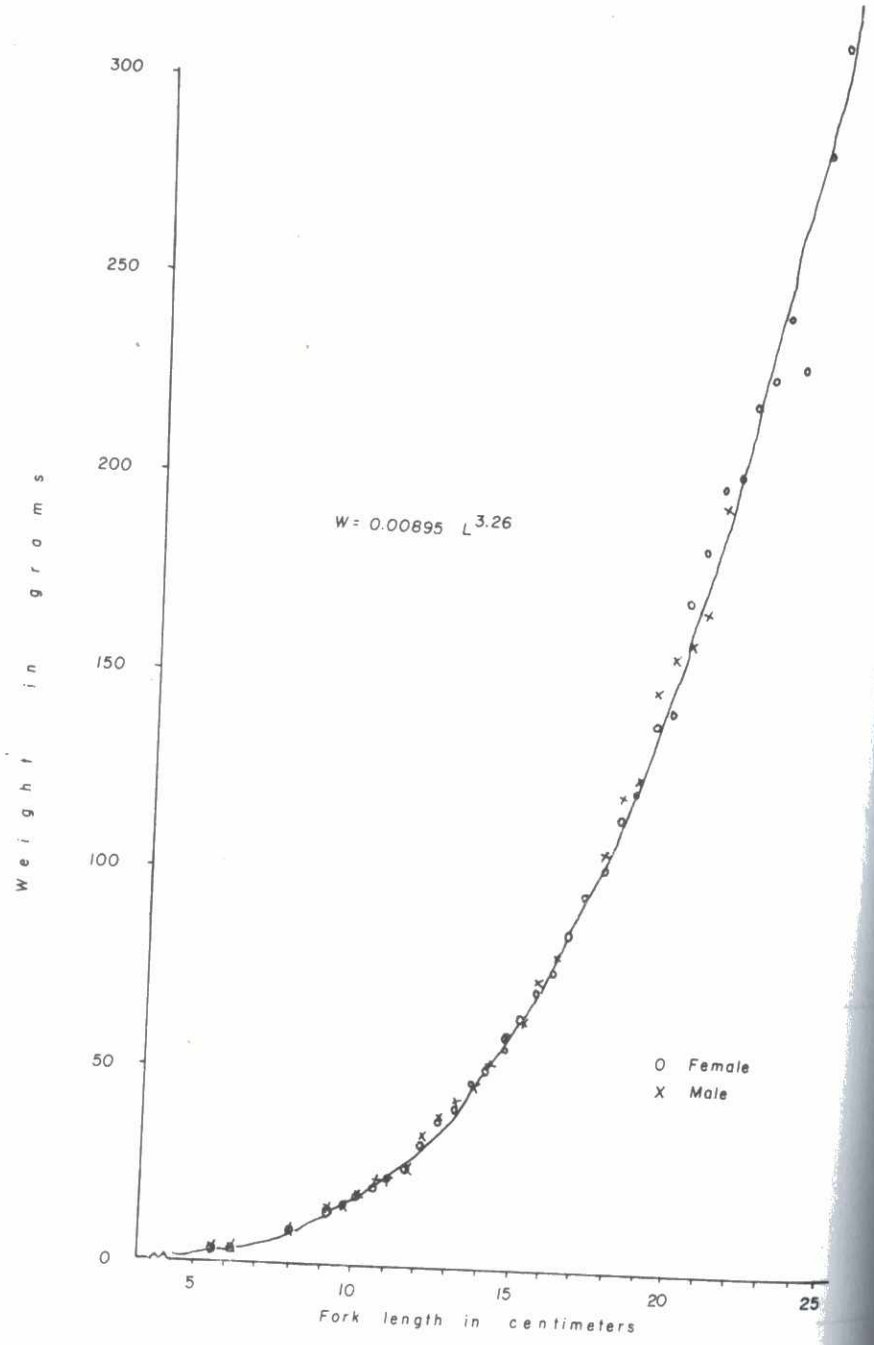


Fig. 2. Length-Weight relationship of *Nemipterus japonicus*.

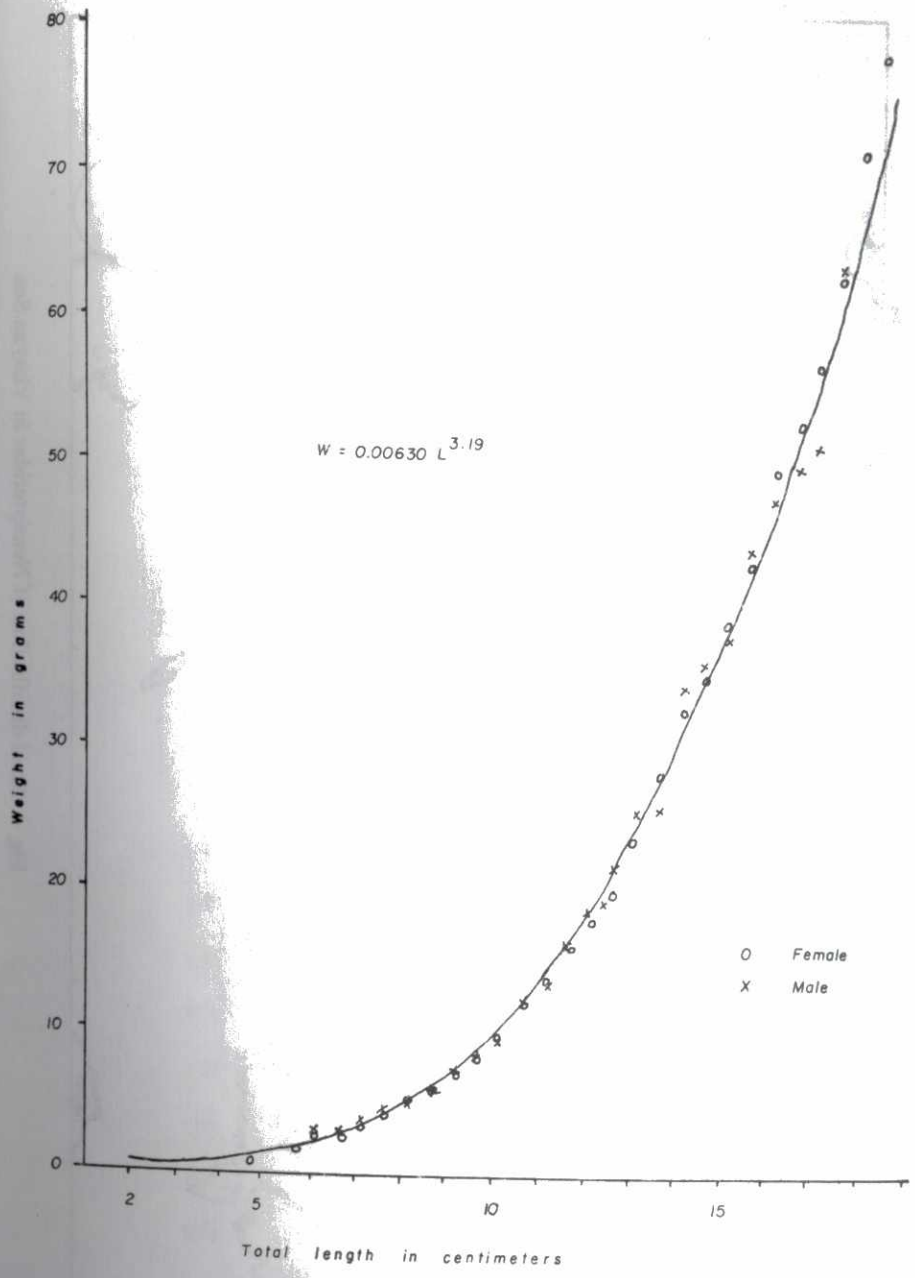


Fig. 3. Length-Weight relationship of *Selaroides leptolepis*.

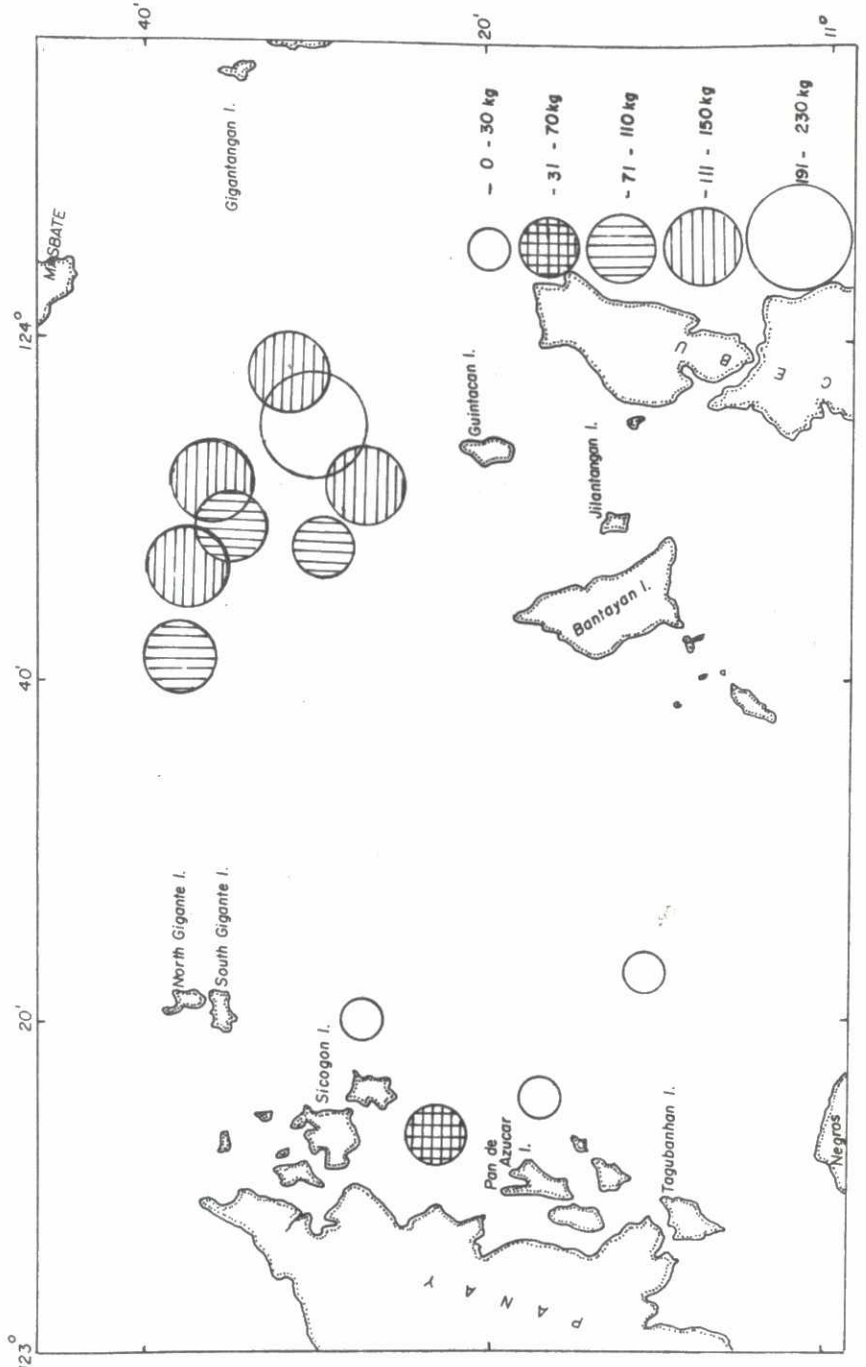
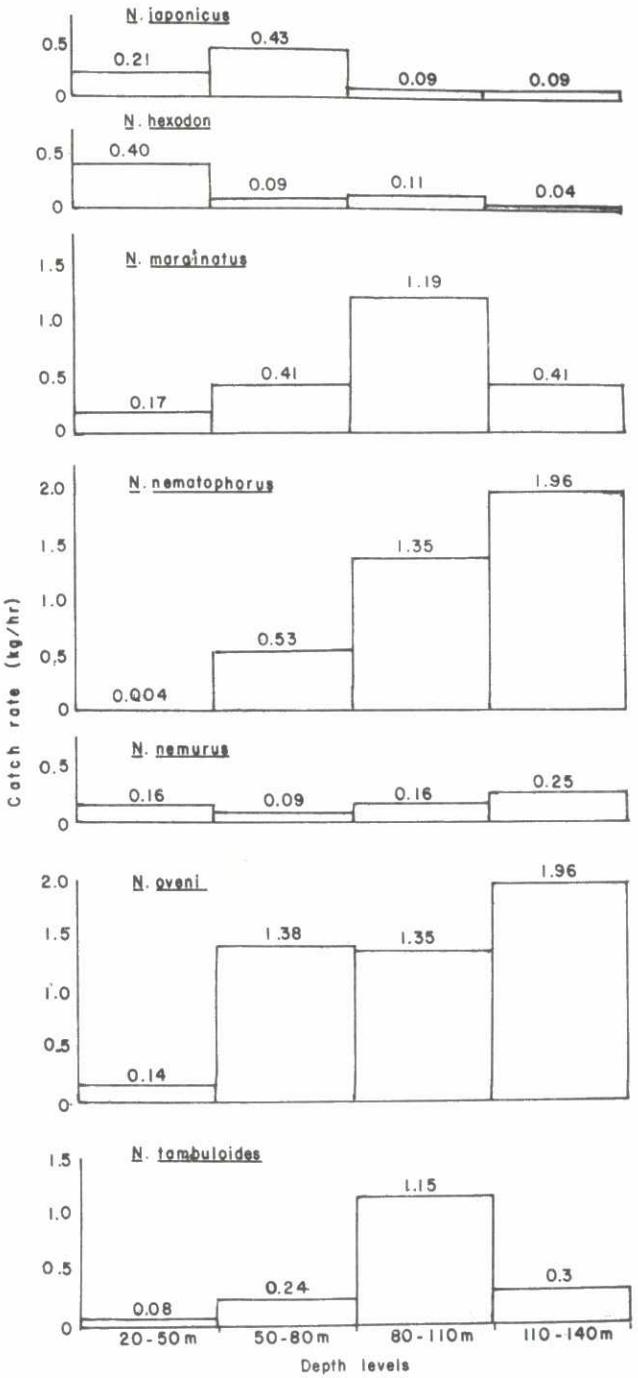


Fig. 4. Areal distribution of Nemipteridae in Visayan Sea.



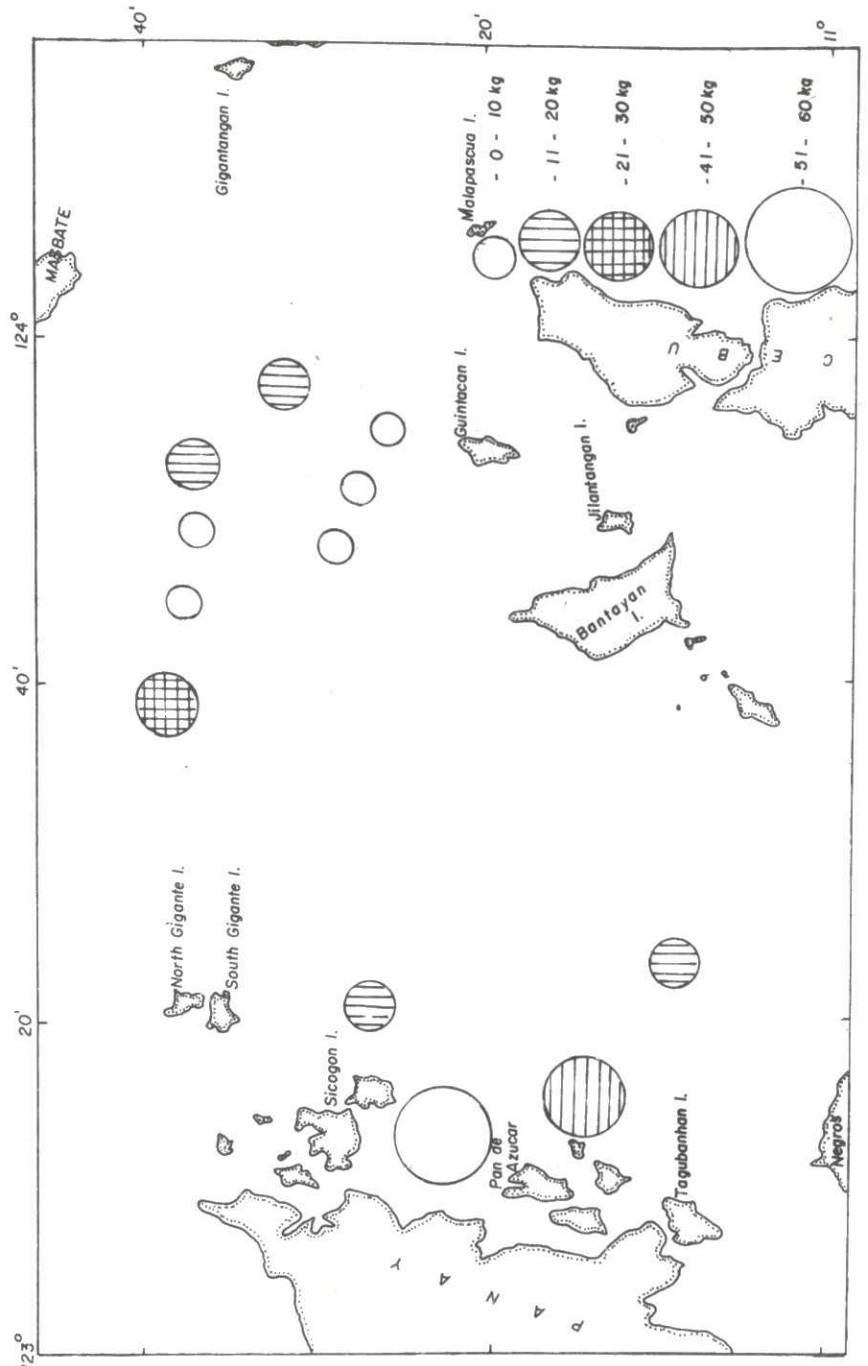


Fig. 6. Areal distribution of Carangidae in Visayan Sea.

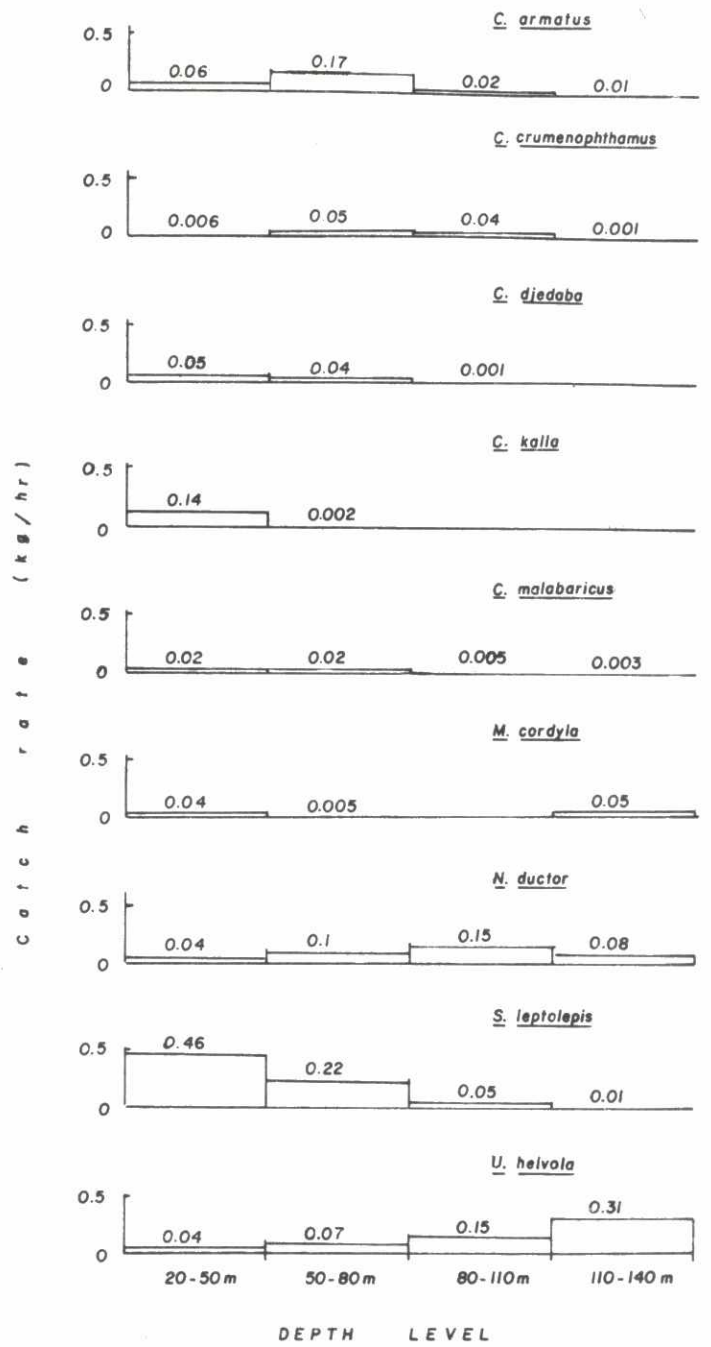


Fig. 7. Depth distribution of some species of Carangidae caught by

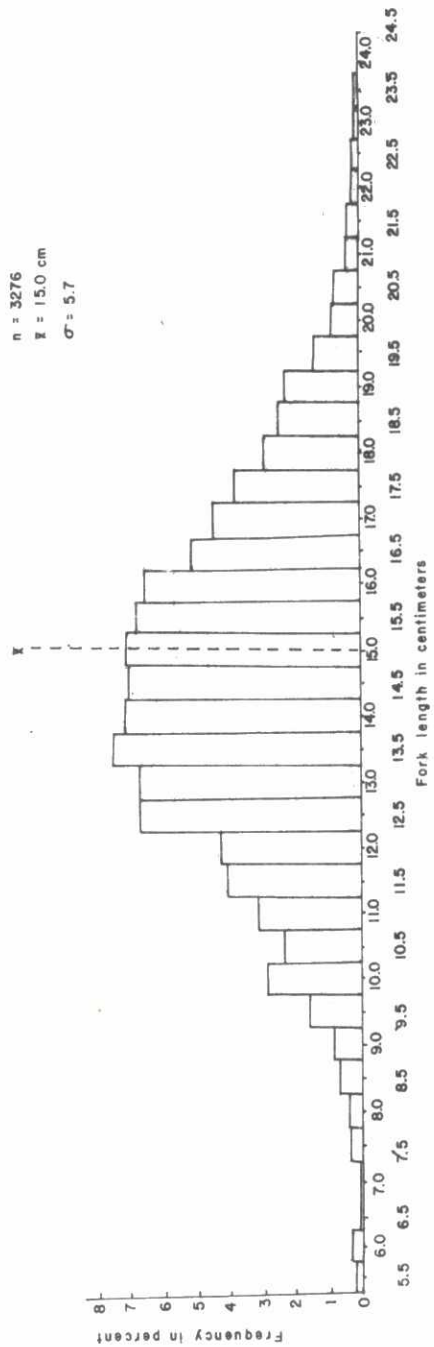


Figure 8. Size composition of *Nemipterus oveni* caught by trawl in Visayan Sea, August 1976-March 1977.

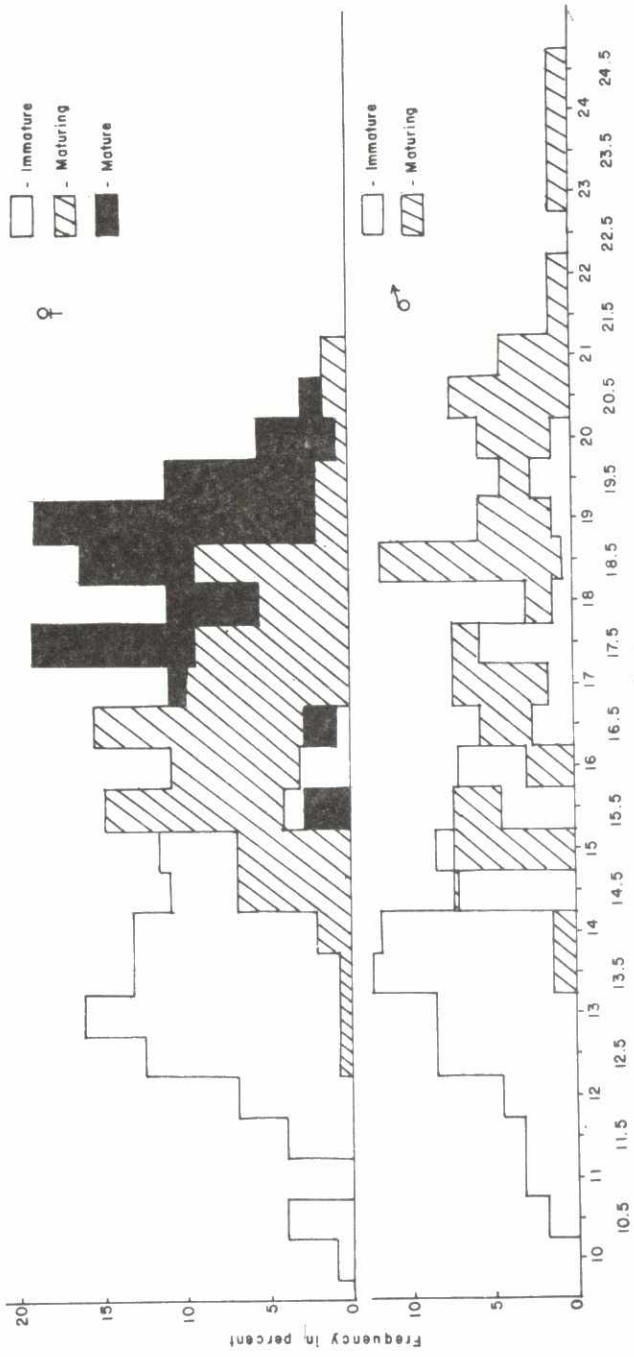


Figure 9. Size and gonadal maturity of male and female *Nemipterus oveni* caught by trawl in Visayan Sea.

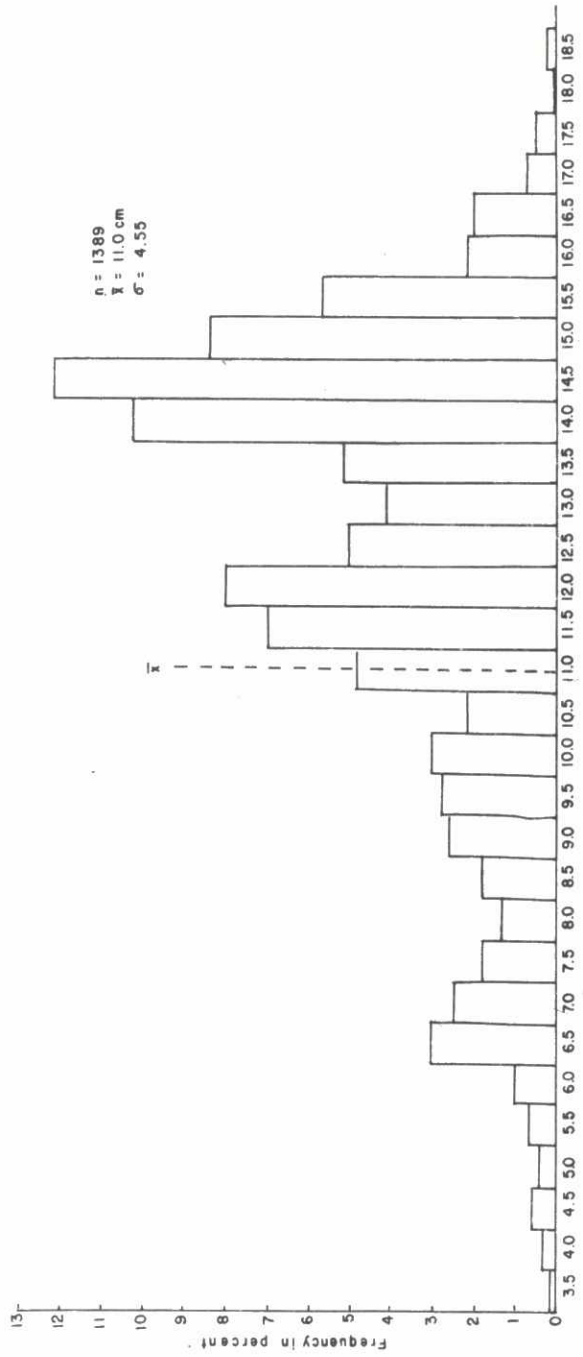


Figure 10. Size composition of *Selaroides leptolepis* caught by trawl in Visayan Sea, July 1976-March 1977.

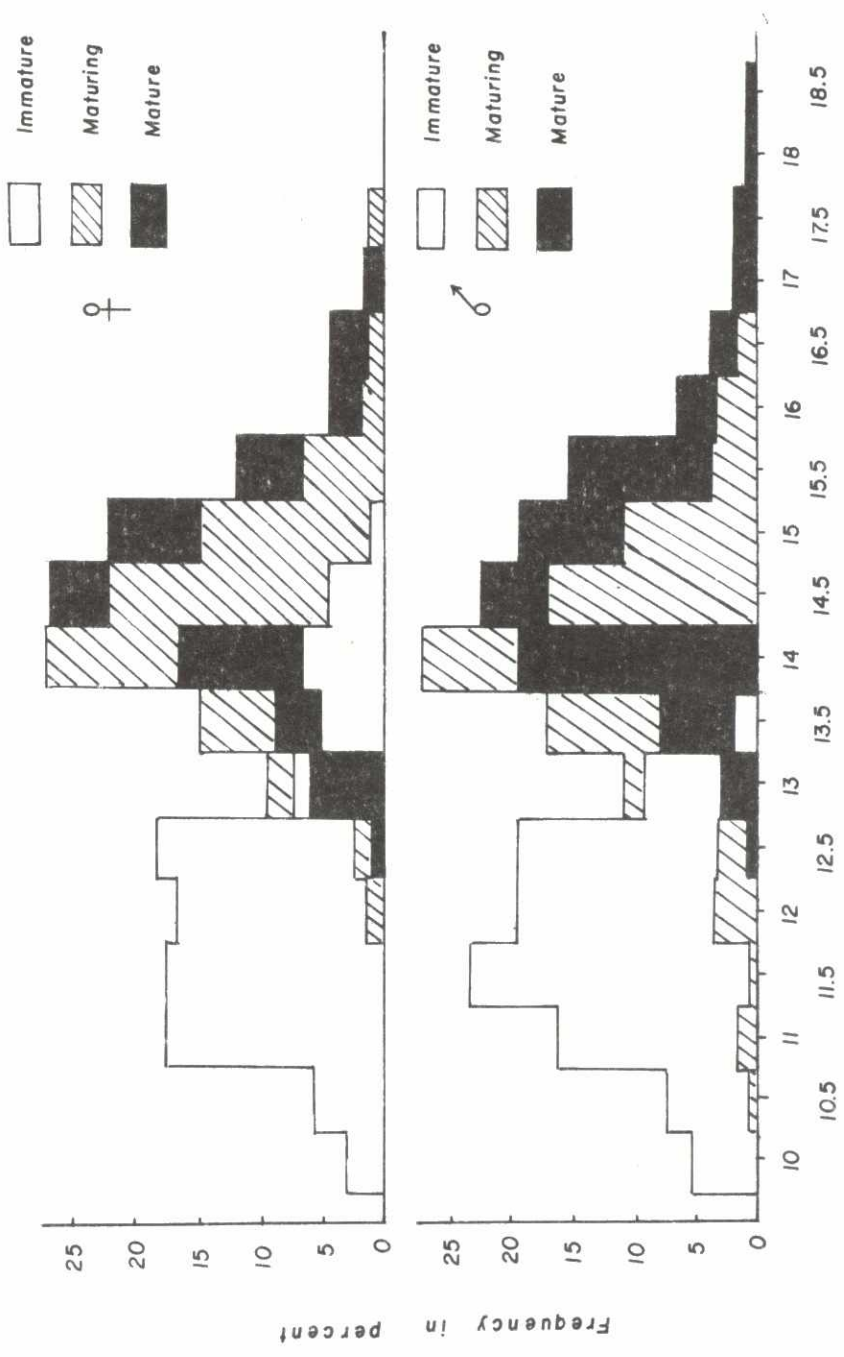


Fig. 11. Size and gonadal maturity of male and female *S. leptolepis* caught by trawl in Visayan Sea.