

## PELAGIC FISHERY RESOURCES OF LAWSON'S BAY, WALTAIR

K. VENKATA SUBBA RAO, V. RAMAMOHANA RAO, P. MOJUMDER,  
T. APPA RAO, S. REUBEN, S. S. DAN AND B. NARAYANA RAO  
*Central Marine Fisheries Research Institute Centre, Waltair.*

### ABSTRACT

At Lawson's Bay, the gears employed are shores seines, boat seines, hooks and lines, surface gillnets and bottom-set nylon nets. During the period 1970 to 1974, the estimated total annual landings by all gears were 654.8, 622.0, 577.08, 542.4 and 637.3 tonnes, respectively. The catches by hooks and lines alone accounted for 50-60% of the total landings during the period. Seasonal abundance of fish showed correlations with hydrological and planktological conditions and the food available in environment. For pelagic fishes, high catch rates were obtained during November to May and to a lesser extent during July-September. Prawns were caught in greater proportions by gillnets than by boat seines, the former being employed during May-September period. The adverse effects arising out of the introduction of bottom-set gillnets in the fishery are discussed.

### INTRODUCTION

Lawson's Bay, a shallow bay about 3.2 kilometers in length, is situated south of Kailasa Hill range and north of Waltair point (Lat. 17°-44' N, Long. 83-21' E). It is an important fishing area in Andhra Pradesh. There are four fishing villages, namely, Jalaripeta, Yendada, Vasupillipalem and Muvvalavani-palem along the coast of Lawson's Bay and the fishermen of these four Villages land their catches along this stretch. The number of active fishermen in these four Villages is about 1200. The main crafts used are the catamarans and the Masula boats, while the gears employed are boat seines, shores seines, surface gillnets, bottom-set gillnets, and hooks and lines.

The present paper gives an account of the important groups of fish caught by different gears at Lawson's Bay and of seasonal variations in their occurrence during 1970-74. An attempt is made to correlate the fluctuations in the fisheries with environmental factors and biology of the fishes concerned.

### MATERIAL AND METHODS

Observations were made at the landing place two days in a week from morning to evening. The composition of the catches by weight was noted in

respect of 10% of the total number of units of a particular gear operated on a particular day. The catch of the sampled units was raised to the total number of the same units operated for estimating the days catch. The monthly catches were estimated by raising the day's catches to the total number of fishing days in the month. The catch rate or catch per unit was calculated by dividing the month's catch with the total number of units operated in the month.

#### *Brief descriptions of the gears employed*

**Boatseine:** Locally called 'Iraga vala,' is a bag type of net with wings. The length of the bag varies from 15 to 20 m, the wings from 30 to 40 m and the width of the mouth of the bag from 5 to 8 m. The stretched mesh size gradually increases from 0.5 cm, in the cod end to 8 cm in the wings. The net is operated by two catamarans or two Masula boats at depth of 15 to 30 m. On each catamaran or boat, 2 to 4 persons are employed. Boat-seines are usually operated from April to September.

**Shoreseine:** Locally called 'Pedda vala.' It is similar to the boat-seine but differs from it in having long wings (length of bag 15 to 20 m; length of wings about 300 m; width at the mouth of the bag 6 to 10 m). As in the boatseine the stretched mesh size varies from 0.5 cm in the cod end to 8.0 cm in the wings. Ten to twelve men on each side hold the ropes and drag the net to the shore. This net is operated close to the shore in 5-10 m depth. Shoreseines are generally operated from November to April or May along Waltair coast.

**Gillnets:** Two types of gillnets are employed. (1) Surface driftnet (Vaddi vala) and (2) Bottom-set nylon gillnet. Surface drift net (Vaddi vala) is about 200 m in length and 1.5 m in width with a stretched mesh size varying from 1.5 to 3.8 cm. The two pieces are tied together in the middle, length-wise. It is made of cotton or hemp. These are operated almost throughout the year in waters 20-30 m deep. Bottom-set nylon gillnets were introduced in Lawson's Bay in September 1971. The net is made of nylon and consists of 5 or 6 pieces each 60 m in length and 4 m in width with a stretched mesh size of 3.8 cm. These nets are operated in 20-40 m depth almost throughout the year. The gillnet is operated by a Masula boat or a catamaran with a crew of 4 or 5.

#### CATCHES

The annual catches and catch per unit in respect of all fish and important groups of fishes realized by different gears during the period 1970 to 1974 are shown in Table 1. The number of units of different gears operated in each month from Lawson's Bay during 1970-1974 are shown in Table 2 and 3.

It can be seen from Table 1 that in the years 1970, 1971, 1972, 1973 and 1974, a total quantity of 654.8, 622.0, 577.8, 542.4 and 637.3 tonnes of fish were landed by all gears, the average annual catch for the entire period being

605.8 tonnes. As compared with 1970 (10.8 kg) the catch rates of hooks and lines showed a decline during 1971-74, the range in catch per unit being 8.78 to 9.10 kg (Table 1).

The catch rate of gill-nets was minimum in 1972 (18.66 kg) and maximum in 1971 (32.56 kg). This trend was observed in respect of the catch rates for sardines by gill-nets during the period. Catch rates for mackerel was highest in 1973 (0.7 kg) and lowest in 1971 (0.25 kg). Catch rate for 'other clupeoids' was found to be maximum in 1972 (1.14 kg) and minimum (0.06 kg) in 1974.

The annual catches and catch rates by boatseines were good during 1971, 1973 and 1974, although the highest catch rate was observed in 1974 (51.10 kg). Comparatively low catch rates were observed in 1970 and 1972, minimum being 17.02 kg in 1972. This trend could be observed, more or less, in respect of ribbon fish and anchovies caught by boatseines. The annual catch-rate for silver bellies in 1972 was higher than those in other gears.

In the case of shore seines the total catches and catch rates were high in 1971, 1972, 1973 and 1974 than in 1970. The catches and catch rates for anchovies showed an increase from 1970 to 1974 reflecting the trend for total catches also. The catch per unit for silver bellies increased from 1.51 kg in 1970 to 9.20 kg in 1972. The catch rate for sardines diminished from 7.93 kg in 1970 to 1.10 kg in 1974.

#### *Seasonal variations of catches by different gears*

The monthly total catches and catch rates realised by different gears are shown in Figs. 1-7 and an account of the seasonal trends in the catches is given below:

*Hooks and lines:* The total catch and catch rates obtained by hooks and lines showed two peaks, one in March to July and another in August to December period. The monthly catches ranged from 13 to 96 tonnes and the monthly catch per unit from 5.82 to 22.50 kg, the maximum being recorded in May 1970. These units landed 405, 330, 335, 253 and 318 tonnes of fish at catch rates of 10.8, 8.8, 9.0, 9.1 kg per unit in 1970, 1971, 1972, 1973 and 1974 respectively.

*Boatseine:* Landed 53, 77, 9, 26 and 81 tonnes of fish at annual catch rates of 17.3, 29.9, 17.0, 41.4 and 51.1 kg/unit in 1970, '71, '72, '73 and '74 respectively. The monthly catch per unit ranged from 3.0 to 176.3 kg and high catch rates were obtained from May to August during the years 1970 to 1974; although a high catch rate was noticed in September, 1971.

*Shoreseine:* Landed 6, 19, 19, 73 and 96 tonnes at catch rate of 17.86, 35.97, 35.90, 72.80 and 76.20 kg/unit in the years 1970, 1971, 1972, 1973 and 1974, respectively. The monthly catch rates ranged from 1.0 to 125.0 kg/unit. High catch rates were realized during the period November to May.

TABLE 1. *The annual catches and catch rates realised by different gear operatin*

	<i>S. guttatus</i>		<i>S. commersoni</i>		<i>Mackerel</i>		<i>Ribbon fish</i>		<i>Sard</i>
	c	c/u	c	c/u	c	c/u	c	c/u	c
<i>Hooks and lines</i>									
70	149072	3.96	34972	0.93	—	—	—	—	—
71	70835	1.88	40548	1.07	—	—	—	—	—
72	65401	1.76	51810	1.39	—	—	—	—	—
73	65239	2.3	36125	1.3	—	—	—	—	—
74	109856	3.1	29032	0.8	—	—	—	—	—
<i>Gillnets</i>									
70	—	—	—	—	3585	0.50	—	—	182734
71	—	—	—	—	1187	0.25	328	0.07	138432
72	—	—	—	—	850	0.29	47	0.02	49818
73	—	—	—	—	923	0.70	—	—	28177
74	—	—	—	—	—	—	—	—	91389
<i>Boat seines</i>									
70	994	0.33	—	—	1457	0.48	5554	1.82	211
71	614	0.24	—	—	167	0.31	10433	4.03	2447
72	106	0.20	—	—	167	0.31	1978	3.73	12
73	45	0.1	—	—	4925	8.00	4360	7.00	—
74	520	0.3	—	—	171	0.1	54524	32.7	798
<i>Shore seines</i>									
70	252	0.89	—	—	92	0.33	570	2.02	2229
71	47	0.10	—	—	3124	6.04	206	0.40	1416
72	47	0.09	—	—	501	0.95	232	0.44	1091
73	7	0.01	—	—	1143	1.1	225	0.2	3527
74	—	—	—	—	15534	12.4	16903	13.4	1343
<i>Bottom-set Gill nets</i>									
72	6457	0.78	—	—	15446	1.87	926	0.11	109
73	13358	1.49	2306	0.26	8813	0.9	2419	0.3	322
74	1513	0.40	—	—	21176	5.5	3671	1.0	—

*g from Lawson's Bay during 1970-74 (c= Catch in kg; c/u= Catch per Unit)*

<i>ines</i>	<i>Other clupeoids</i>		<i>Anchovies</i>		<i>Silver-bellies</i>		<i>Prawns</i>		<i>Total</i>	
	<i>c</i>	<i>c/u</i>	<i>c</i>	<i>c/u</i>	<i>c</i>	<i>c/u</i>	<i>c</i>	<i>c/u</i>	<i>c</i>	<i>c/u</i>
—	3605	0.11	—	—	—	—	—	—	404968	10.8
—	4343	0.11	—	—	—	—	—	—	330480	8.78
—	2869	0.08	—	—	—	—	—	—	334781	9.00
—	9354	0.3	—	—	—	—	—	—	252955	9.10
—	5675	0.2	—	—	—	—	—	—	318231	9.10
25.27	3407	0.47	—	—	—	—	—	—	191352	26.47
29.05	4712	1.0	—	—	421	0.08	—	—	155165	32.56
16.87	3372	1.14	4	0.001	369	0.46	—	—	55115	18.66
20.4	317	0.2	—	—	—	—	—	—	30258	21.9
19.9	268	0.06	60	0.01	—	—	—	—	92323	20.1
0.06	6777	2.21	2980	0.97	3109	1.0	4732	1.55	52900	17.30
0.94	21189	8.19	24470	9.46	1370	0.52	4773	1.84	77400	29.92
0.02	1078	21.03	579	1.09	1267	2.39	446	0.84	9035	17.02
—	542	0.90	7807	12.60	366	0.60	2	0.003	25620	41.40
0.5	617	0.4	17885	10.7	1318	0.8	820	0.5	80526	51.10
7.93	46	0.16	1493	5.31	426	1.51	4	0.01	5619	17.86
2.73	6114	11.82	5008	9.68	1143	2.20	12	0.02	18596	35.97
2.06	1251	2.36	6732	12.70	4824	9.10	29	0.05	19038	35.90
3.6	809	0.8	58526	58.5	2061	2.1	—	—	72789	72.8
1.10	1446	1.20	51019	40.6	4096	3.3	—	—	95776	76.2
0.01	49165	6.01	983	0.12	348	0.04	5347	0.65	159808	19.35
0.04	57260	6.4	—	—	553	0.1	5073	0.60	160752	18.0
—	7945	2.1	—	—	783	0.2	589	0.2	50486	13.2

TABLE 2. *The number of units of Hooks and lines, gillnets and Bottom-set gillnets operated in each month from Lawson's Bay during 1970-'74.*

	Hooks and lines								Gillnets		Bottomset gillnets				
	70	71	72	73	74	70	71	72	73	74	70	71	72	73	74
Jan	3212	3397	3655	2873	3240	992	857	323	638	1050	—	—	323	616	60
Feb	2139	2359	3150	1500	3133	574	294	636	108	216	—	—	370	508	568
Mar	1938	2975	3950	1984	1995	2015	136	82	310	991	—	—	86	50	1170
Apr	1950	3052	3986	2052	2091	1875	1656	165	—	1517	—	—	314	36	205
May	4260	3627	4738	2704	2763	32	1255	242	—	431	—	—	117	348	—
June	2651	3323	2440	2640	3090	—	18	623	—	75	—	—	356	1323	98
Jul	3089	3781	2596	1470	2838	—	1050	289	—	—	—	—	1098	1329	310
Aug	4204	3420	2418	2243	2178	—	—	62	—	—	—	—	2356	1930	493
Sep	2540	3654	1722	1541	2847	30	39	43	—	—	—	—	1393	1251	559
Oct	4580	2878	1905	2527	3320	38	—	180	30	—	—	—	1144	626	318
Nov	3875	2780	4246	2501	2774	562	240	213	98	124	—	—	587	874	—
Dec	3162	2400	2406	2850	4831	1112	320	95	195	186	—	—	115	45	44
Total	37600	37646	37212	27785	35100	7230	4765	2953	1379	4590	—	—	8259	8936	3825

*Gillnet*: The annual catches in 1970, 1971, 1972, 1973 and 1974 were 191, 155, 55, 30 and 92 tonnes, respectively, while the catch per unit values were 26.47, 32.56, 18.66, 21.90 and 20.10 kg, respectively. High catch rates were obtained during December to July period.

*Bottom-set gillnet*: These units landed 159, 161 and 50 tonnes at catch rates of 19.35, 18.0 and 13.2 kg per unit during the years 1972, 1973 and 1974, respectively. High catch rates were observed during June to November period although in February '73 and March '74, high catch rates were also encountered.

*Seasonal variations of the catches of important groups of fishes*

The monthly catches and catch rates of the important groups of fishes are presented in Figs. 1 to 7.

*Seer fish*: Two species, namely *Scomberomorus guttatus* *S. commersonii* are caught mainly by hooks and lines. *S. guttatus* is caught by boatseines and shore-seines also while *S. commersonii* was not observed in the catches of these two gears. The average annual catch of seer fishes by all the gears was 131 tonnes. The bulk of the catches was landed by Hooks and lines. Three peaks could be made out in the catch rates of *S. guttatus*. i.e., December-February, May and

TABLE 3. Number of units of boatseines and shoreseines operated in Lawson Bay during 1970-74.

	<i>Boat-seine</i>					<i>Shore-seine</i>				
	70	71	72	73	74	70	71	72	73	74
Jan.	25	—	—	—	—	5	94	—	158	220
Feb.	—	—	—	—	—	9	43	20	296	46
Mar.	—	21	60	37	—	—	152	120	43	187
Apr.	428	—	26	—	41	—	157	43	102	227
May	367	240	125	285	88	34	12	116	—	282
Jun.	626	538	124	155	480	—	—	4	—	—
Jul.	673	780	26	62	609	—	—	—	—	—
Aug.	392	658	93	12	378	—	—	—	—	—
Sep.	490	230	41	19	69	—	—	—	—	—
Oct.	—	—	—	—	—	—	—	—	—	—
Nov.	57	80	—	—	—	130	32	97	86	33
Dec.	—	40	36	49	—	103	27	130	315	262
<b>Total</b>	<b>3058</b>	<b>2587</b>	<b>531</b>	<b>619</b>	<b>1665</b>	<b>281</b>	<b>517</b>	<b>530</b>	<b>1000</b>	<b>1257</b>

September-October periods (Fig. 1). High catch rates for *S. commersoni* was observed in March-April, June-July and December. The maximum catch rate recorded for *S. guttatus* was in May 1970 (11.86 kg per unit) while for *S. com-*

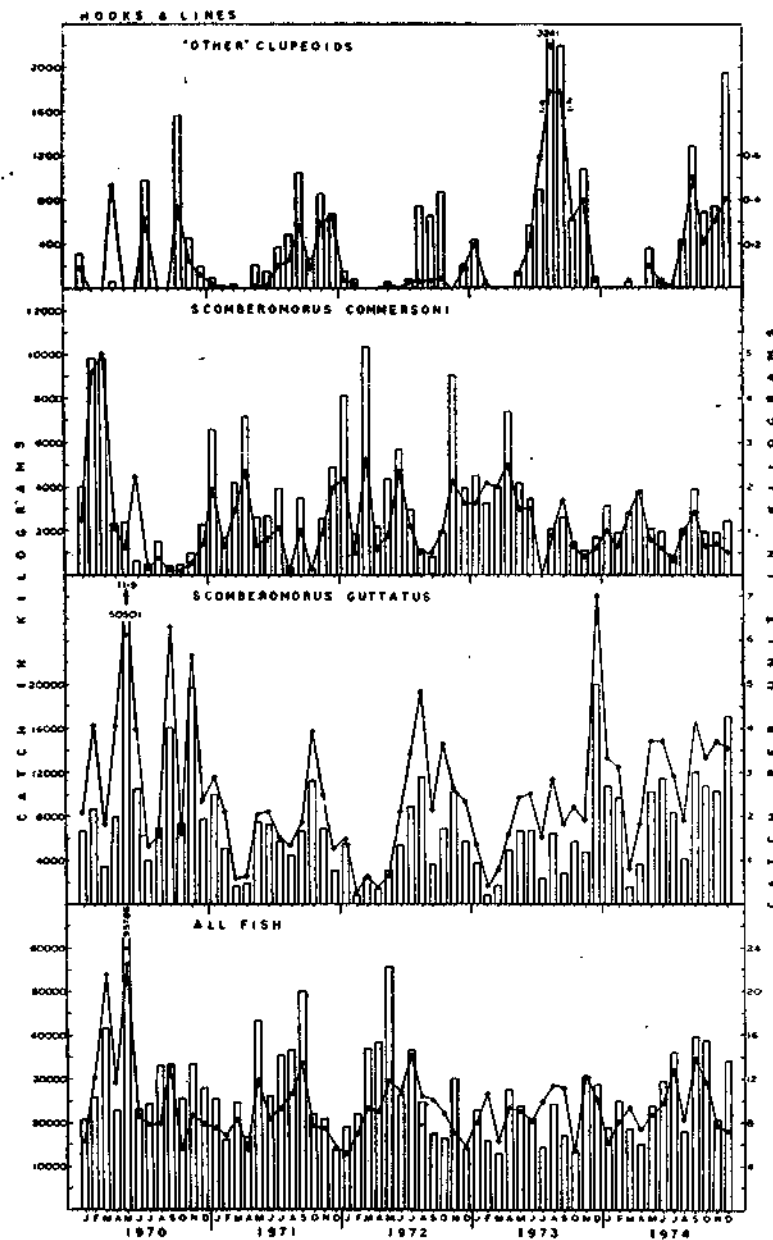


FIG. 1. Hooks and lines: Catch and catch per unit of all fish, *Scomberomorus guttatus*, *S. commersoni* and "Other" clupeoids. Bars represent catch and lines catch per unit



*mersoni* the highest catch rate was realized in March 1970 (5.03 kg per unit). The catch rates realized for *S. guttatus* by boatseines and Shore-seines were very poor.

**Mackerel** (*Rastrelliger kanagurta*): About 16 tonnes on an average were annually by all gears. The bulk of the catches was landed by bottom-set gillnets. This gear landed mackerel throughout the year. The other gears landed mackerel sporadically. Mackerel were landed by boat-seine from April to September and by shore-seines from November to May. The monthly catch rates for mackerel by bottom-set gillnets (Fig. 2) show peaks in January to April, July and September months.

**Ribbon fish** (*Trichiurids*): The average annual landings of ribbon fish were of the magnitude of 21.4 tonnes of which about 15.4 tonnes are landed by the boatseines and the rest by shoreseines and gillnets. These fishes are caught in boatseines from March to September and high catch rates were realised during June-July and August-September periods. The monthly catch rates ranged from 1.8 to 63.4 kg/unit, the maximum was recorded in July 1973. Four species of ribbon fishes, namely, *Trichiurus lepturus*, *Lepturacanthus savala*, *Eupleurogrammus muticus* and *E. intermedius* occur in the catches and of these *T. lepturus* and *L. savala* are dominant.

**Sardines**: On an average 101 tonnes of sardines were landed annually by all gears. Surface drift-nets (Vaddi vala) contributed 98 tonnes on an average, while the catches by boat-seines and shoreseines were very poor or negligible. The sardines were landed almost throughout the year. High catch rates were realised by gill nets during the December-July period (Fig. 3). *Sardinella gibbosa* and *S. fimbriata* are the two species contributing to the fishery, of which the latter is the dominant. Highest catch rate (41.8 kg/unit) was recorded in July, 1971.

**Other clupeoids**: Under this group are included *Ilisha* spp., *Pellona* spp., *Thrisocles* spp, *Hilsa* spp, *Anadomtosoma chakunda*, *Opisthopterus tardoore* and *Raconda russelliana*. On an average 38.5 tonnes of this group were landed annually by all gears and bottom-set gillnets alone contributed about 60% of the catch. There was a gradual decline in the catches of this group by boatseines from 1972 to 1974. In the case of shoreseines the landings were very poor or negligible in 1970, 1972, 1973 and 1974 but moderate in 1971. High catch rates for this group were realised by bottom-set gillnets from April to September. The bulk of the catch of this group is accounted mainly *Ilisha filigera*.

**Anchovies**: are caught mainly by boatseines and shoreseines only. The average annual landings by both gears during 1970-1974 were 35 tonnes, of which 24 tonnes were landed by shoreseines. The catches of anchovies in 1973 and 1974 were higher than those in 1970 to 1972. These fishes are landed by boatseines

mainly from April to September and by shoreseines from November to May. High catch rates were obtained by boatseines during May to September period. The annual average catch rates in boatseines ranged from 0.88 to 118 kg per unit, the maximum being in 1974, May. Two species *Stolephorus devisi* and *S. bataviensis* contribute to the fishery. *S. bataviensis* is the dominant species in

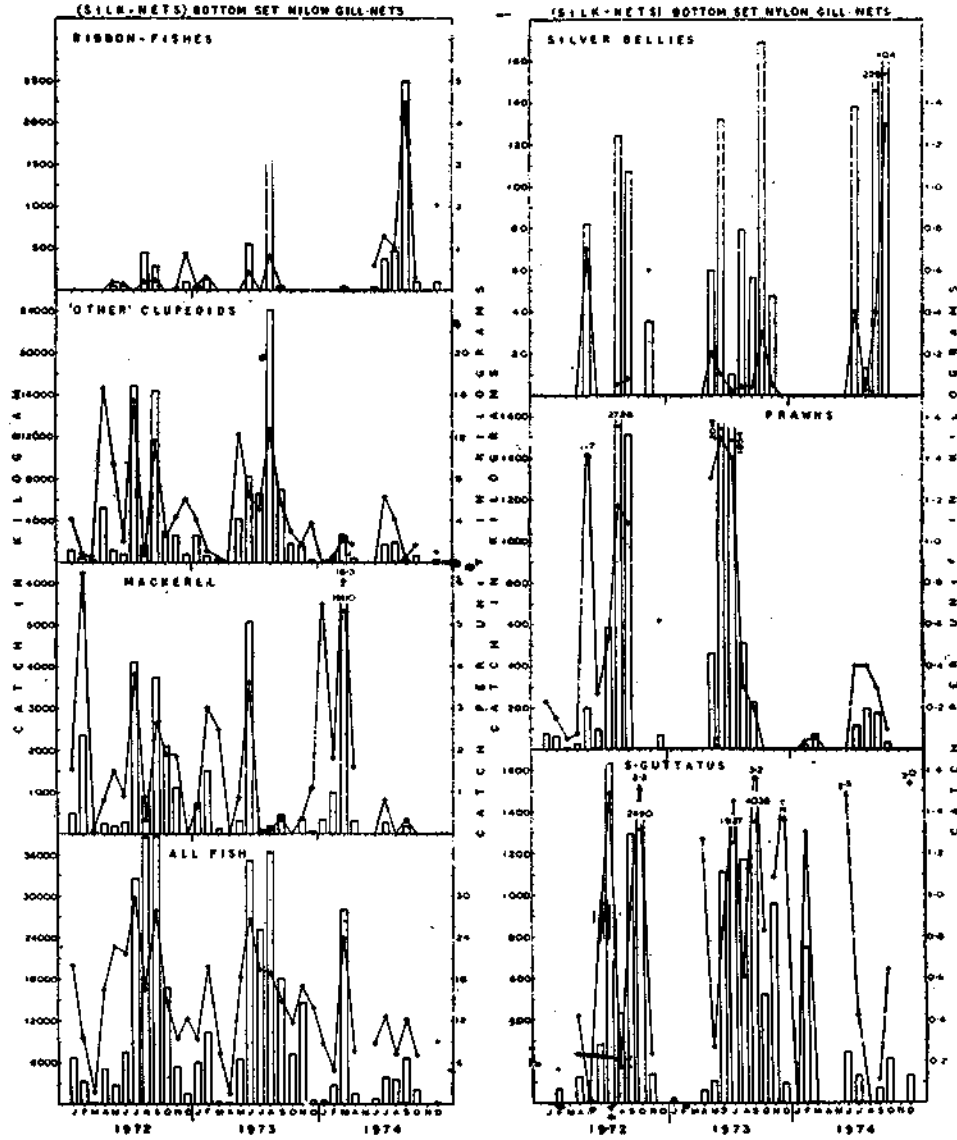


FIG. 2. Bottom-set gillnets: Catch and catch per unit of all fish, mackerel, "other" clupeoids, ribbon fishes, *S. guttatus*, prawns and silver bellies. Bars represent catch and lines catch per unit.

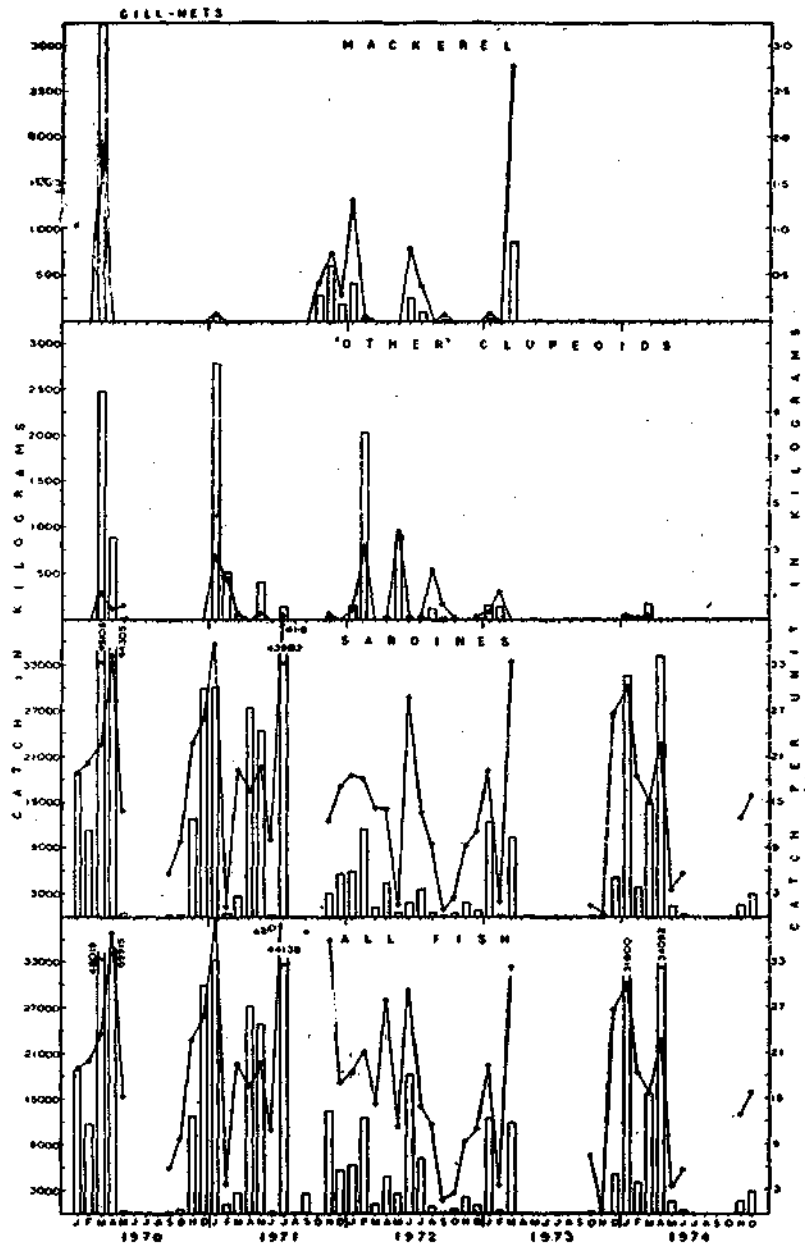


FIG. 3. Gillnets: Catch and catch per unit of all fish, sardines, "other" clupeoids and mackerel. Bars represent catch and lines catch per unit.

the catches of the boat-seines while *S. devisi* formed the bulk of the catches of the shore seines. In the shoreseines high catch rates are observed from November to May period.

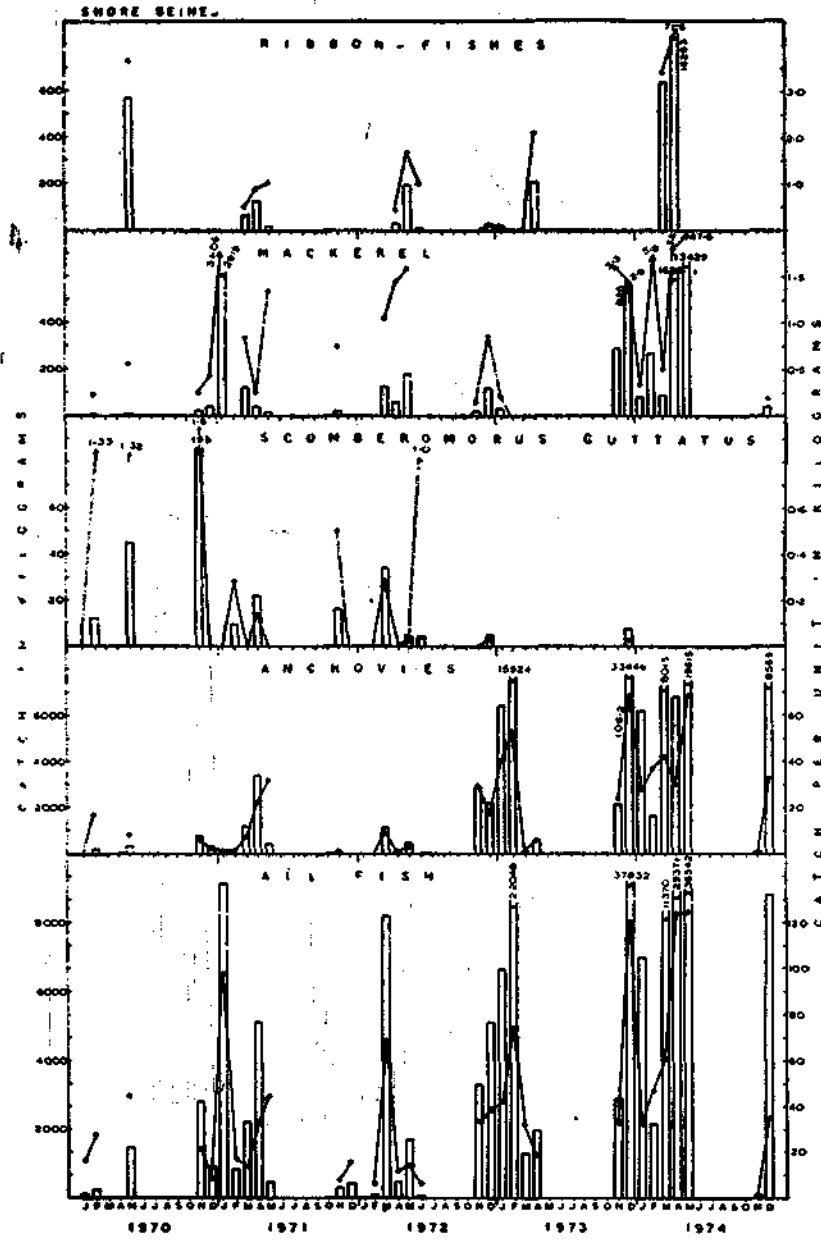


FIG. 4. *Shoreseines*: Catch and catch per unit of all fish, anchovies, *S. guttatus*, mackerel and ribbon fishes. Bars represent catch and lines catch per unit.

*Silver-bellies*: are caught mostly by boatseines, shoreseines and gillnets. The average annual catch by all gears was about 4 tonnes, for which nearly half was landed by boat-seines, 2/5th by shoreseines and the rest by gillnets. Silver

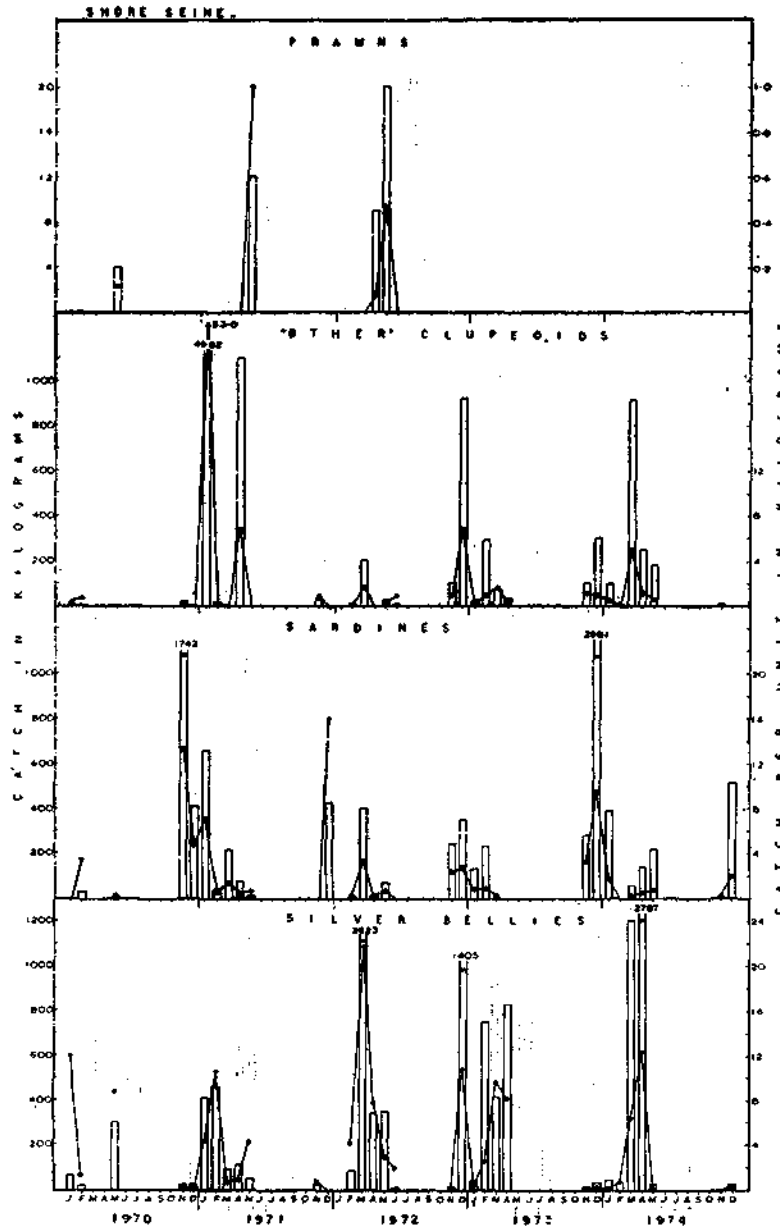


FIG. 5. *Shoreseines*: Catch and catch per unit of Silver bellies, sardines, "other" clupeoids and prawns. Bars represent catch and lines catch per unit.

bellies are caught almost throughout the year by different gears. High catch rates were obtained by boatseines (Fig. 6) during May to September in some years; by shore-eseines from December to May. The average annual catch rate ranged

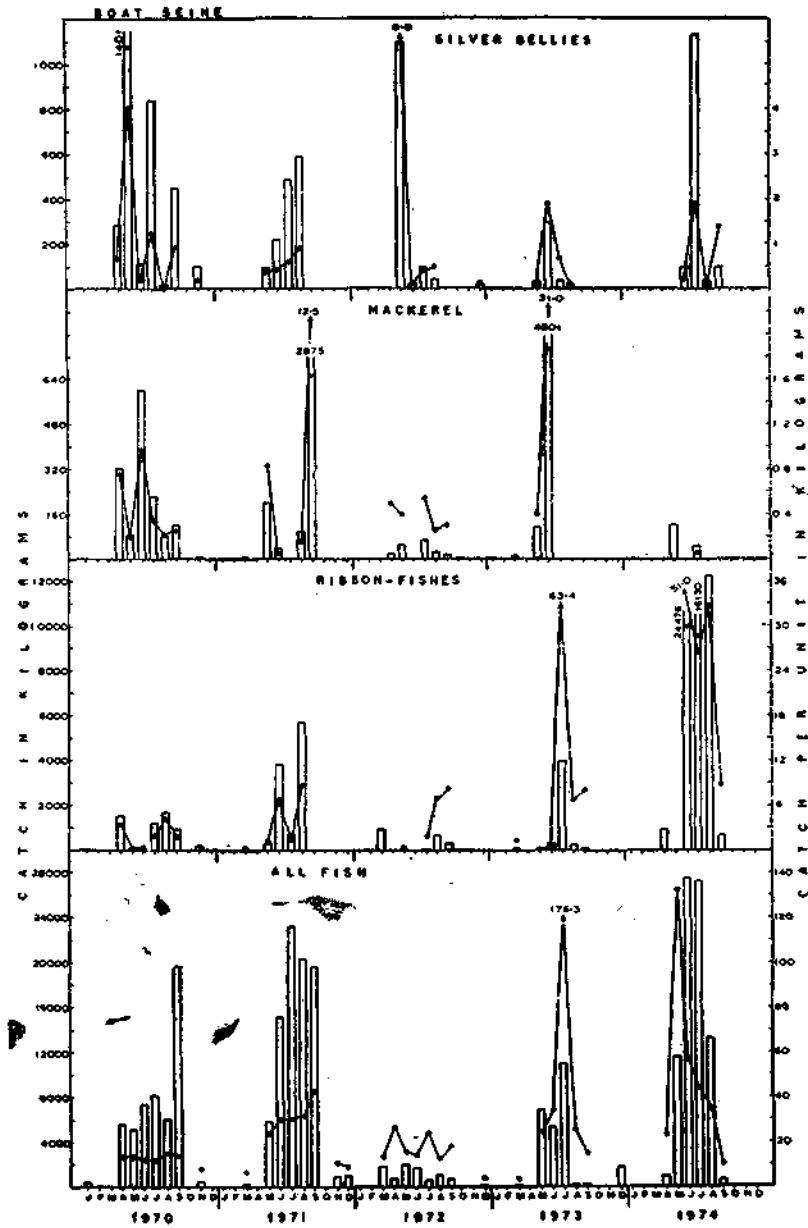


FIG. 6. Boatseines: Catch and catch per unit of all fish, ribbon fishes, mackerel and silver bellies. Bars represent catch and lines catch per unit.

from 0.52 to 2.39 kg for boatseines; 1.5 to 9.1 kg for shoreseines, while the catch rates realised by gillnets were very poor (Table 1). Thirteen species of silver bellies have been observed in the catches and of these *Leiognathus bindus*,

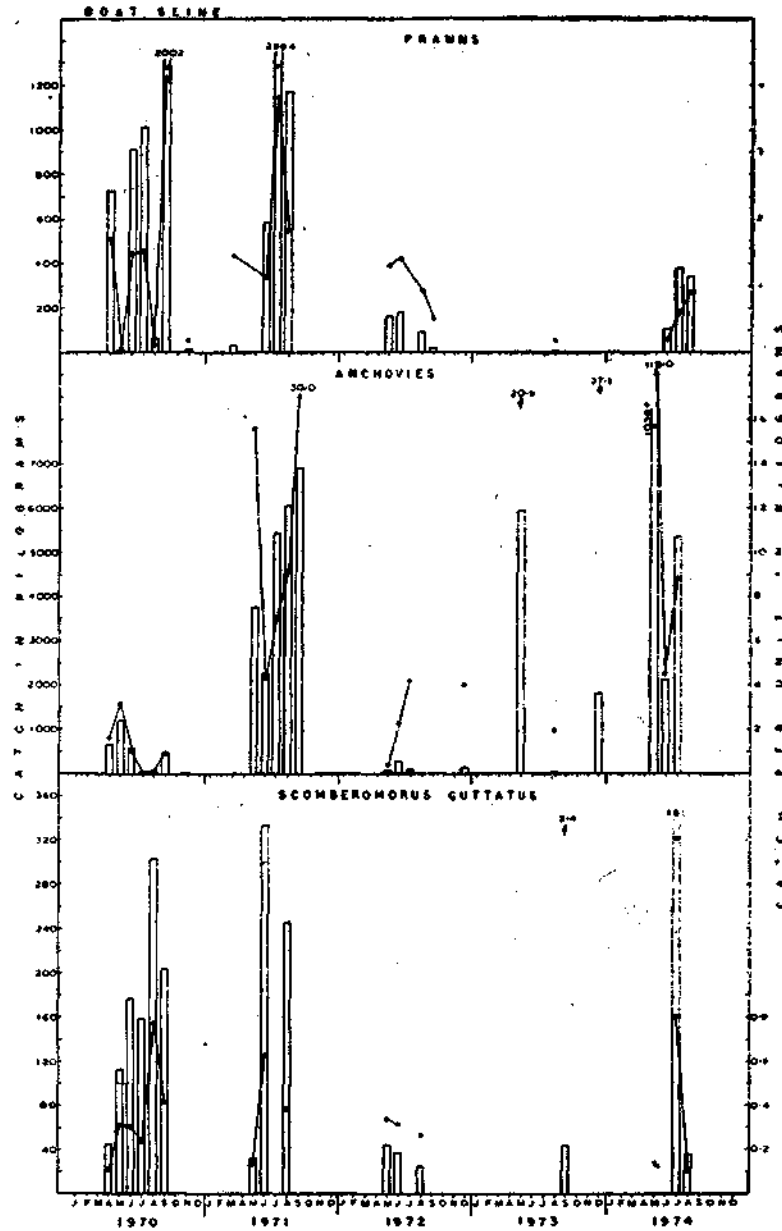


FIG. 7. Boatseines: Catch and catch per unit of *S. guttatus*, anchovies and prawns. Bars represent catch and lines catch per unit.

*Secutor insediator*, *S. ruconnis*, *Gazza minuta* and *L. splendens* are important, contributing to the fishery. *L. bindus* is the dominant species occurring almost throughout the year.

**Prawns:** Though prawns are demersal, they are caught along with pelagic fish in shoreseines and boatseines. In view of their commercial importance they have been included in the present study. Prawns were landed by boatseines from April to September (Fig. 7) and by shoreseines from April to May (Fig. 5). Prawns were caught in the bottom-set nylon gillnets in majority of months with peak catches during May to September. They were not observed in the catches of the small meshed drift-nets (Vaddi vala). During the period 1970-1974, annually, about 8 tonnes of prawns were landed by all the gears and of these about 50% of the catches were landed by nylon gillnets (nylon gillnets were introduced in September 1971). Next in importance were the boatseines which landed on an average 2 tonnes annually. The catches of prawns in shoreseines were negligible. *Penaeus indicus* and *P. monodon* formed the bulk of the catches. *Metapenaeus monoceros* ranked next in abundance.

#### BIOLOGY

The sardines, anchovies and mackerel are important plankton feeding shoaling fishes. The sizes of sardines in the catches ranged from 6 cm to 16.5 cm in total length and the minimum size at maturity was reported as 11 to 12 cm.

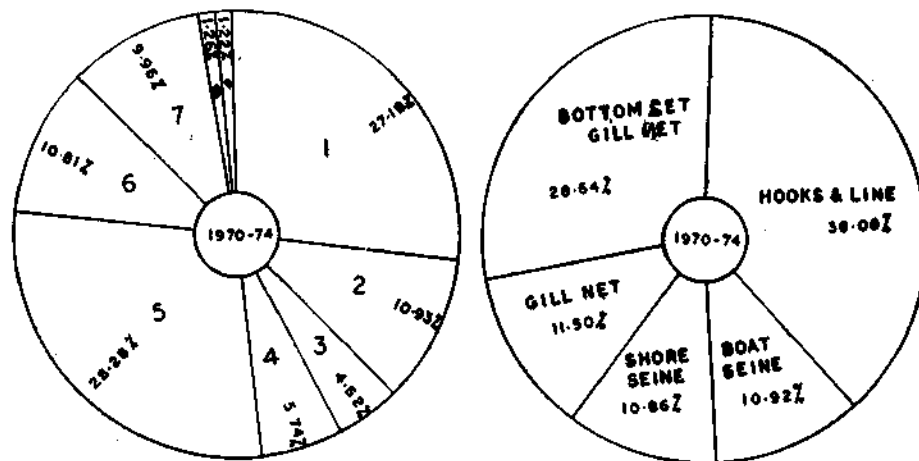


FIG. 8. Left: Annual average catch composition of different groups of fishes in the total catch during 70-74; 1. *S. guttatus*; 2. *S. commersoni*; 3. mackerel; 4. ribbon fish; 5. sardine; 6. other clupeoids; 7. anchovies; 8. silver bellies; 9. prawns. Right: Annual average catch contribution (percentage) by different gears during 70-74.



The feeding habits of *Stolephorus devisi* and *S. bataviensis* were studied by one of the authors. Both species were observed to feed mainly on copepods, *Euterpina acutifrons*, *Oithona rigida*, *Acroclanus* sp, *Paracalanus* sp, *Acartia erythroa*, *Temora turbinata*, *Centropages* sp, *Labidocera* sp, *Oncaea* sp, *Corycaeus* sp, *Schmackeria serricaudatus* and *Eucalanus* sp were the most commonly found in the stomach contents. Besides copepods, these fish occasionally feed on *Acetes* sp, *Leucifer* sp, amphipods, larval bivalves and gastropods.

The length of both the species of anchovies found in the catches ranged from 3.5 cm to 10.0 cm. Fish in advanced stages of maturity were observed almost throughout the year. Dharmamba (1959) studied the diameter frequency of the intraovarian eggs of *S. devisi* and observed three groups of maturing ova. It is likely that this species spawn throughout the year. It is likely that *S. bataviensis* also spawns throughout the year as continuous recruitment of the juveniles was observed.

Reuben (1968) while studying the stomach contents of *Carangoides malabaricus* recorded the presence of *Euphausia distinguenda* in high percentages on two occasions i.e., 18-7-64 and 8-8-66.

These fish usually feed mainly on *Acetes* sp, prawn, *Squilla* sp, crabs and small fishes. The occurrence of an oceanic planktonic organism in the stomach contents of fish caught in the inshore area indicates the influence of currents and upwelling in this area. The length of *C. malabaricus* caught in the inshore area ranged from 3.0 cm to 15.5 cm, while those in the trawl catches ranged from 8.0 cm to 28.6 cm.

Some species of fish are caught in the demersal region as well as in the column. The authors studied the feeding habits of few such species. In the stomach contents of *Ilisha filigera*, *Acetes* spp was a dominant item. Mojumder (1972) reported the occurrence of *Pseudosciaena aneus*, *Trichiurus* spp, *Decapterus* spp, *Polynemus* spp, *Saurida* spp, *Sardinella* spp, *Leiognathus*, mackerel and Engraulids in the stomach contents of *Tachysurus thalassinus*. Cephalopods were also observed during some seasons. Stomach contents of *T. tenuispinis* revealed the presence of *Stolephorus* spp, and *Thryssa* spp. The length ranges of *T. thalassinus* available in the catches varied between 15 cm to 50 cm in total length but fishes in length range 30-40 cms were pre-dominant in the commercial catches. The minimum size at maturity of this fish is 36 cms and the peak period of spawning is observed to extend from May to July. The males are proportionately more than females in the commercial catches.

*T. tenuispinis* observed in commercial catches ranged in Length from 12 cm to 42 cm in total length. Fish in the length range 18-32 cm were common. Minimum size at maturity in this species is 27.5 cm and the fish in advanced stages of maturity were found during May-September period.

## DISCUSSION

Bottom-set nylon gillnets were introduced in September 1971 with the prime objective of improving fish catches. Finding that this net landed good quantities of prawns, the traders supplied these nets to the fishermen on credit and this gear had become popular and was widely used in a short time. But after the introduction of this gear on a massive scale, the total landings of fish at this centre declined during the years 1971, 1972 and 1973. However, the landings recovered in 1974 apparently due to the fact that during that year Nylon gillnets were employed to a lesser extent and effort was diverted to the other gears. Three fourths of the prawn catch during the years 1972-74 was landed by nylon gillnets. Hooks and lines usually accounted for 55% of total catch by all indigenous gears, but during 1973 the effort by this gear was less and consequently the catch came down. Boatseine catches declined in 1972 and 1973 due to poor effort. The surface gillnets also landed poor catches during 1972 and 1973, and showed recovery only in 1974. Shoreseine catches showed improvement during 1973 and 1974 mainly due to increased efforts.

Correlations could be seen between the seasonal abundance of fish and the availability of the food of their choice in the environment. The plankton feeding fish were abundant from November to May when upwelling and high plankton production were reported to occur (Ganapathi and Sarma 1958). The secondary bloom of plankton in July or August also produced some favourable influence on fishery. The maxima in the catches of seer fishes coincide with those of anchovies and sardines. The column feeders showed high catch rates during May to September period, which might have some correlation with the influence of current and upwelling/sinking efforts in this area.

Although there is a mass of information available on hydrological and planktonological conditions of the inshore area off Waltair coast (Bhavanarayana and La Fond 1957, Ganapati and Murthy 1954, Ganapati and Rao 1954, Ganapati and Sarma 1958, La Fond 1954 and 1955 and Mojumder 1957) these conditions have not been correlated with fishery fluctuations. The environmental parameters on fishery and fish production have to be studied in greater detail. The information available so far on the seasonal abundance of the various groups in the inshore area and the gear by which they are caught in greater proportion will help in channelising the effort in proper manner to the most suitable gear to obtain maximum catches. The catamaran, which is employed in operating hooks and lines can perhaps be mechanised by fixing an out-board motor. The data have also shown conclusively that this gear landed about 60% of the catch at Lawson's Bay. Fluctuations in the effort of this gear affects the total catches. This gear lands quality fish like seer fishes, tunas and perches. The nylon gillnet may be employed during seasons when prawns are expected in good quantities, unplanned diversion of effort to newly introduced gear may adversely affect the catches and ultimately the economy of the fishermen community.

## ACKNOWLEDGEMENTS

The authors are thankful to Dr. B. Krishnamoorthi for going through the paper and offering valuable suggestions. Sincere thanks are due to Dr. K. V. Sekharan (late), Senior Fishery Scientist and Dr. E. G. Silas, Director, Central Marine Fisheries Research Institute for the encouragement given during the course of this work.

## REFERENCES

- BHAVANARAYANA, P. V., AND E. C. LA FOND. 1957. On the replenishment of some plant nutrients during the upwelling period on the East coast of India. *Indian J. Fish* 4: 75-80.
- DHARMAMBA, M. 1959. Studies on the maturation and spawning habits of some common clupeoids of Lawson's Bay, Waltair. *Indian J. Fish* 6: 374-388.
- GANAPATI, P. N., AND V. S. R. MURTHY. 1954. Salinity and temperature variations of the surface waters off Visakhapatnam coast. *Andhra Univ. Memo. in Oceanogr.* 1: 125-142.
- GANAPATI, P. N. AND V. RAMAMOohana RAO. 1954. Studies on planktonic copepods. Seasonal fluctuations in the distribution with reference to temperature and salinity. *Andhra University Memo. in Oceanogr.* 1: 151-162.
- GANAPATI, P. N. AND D. V. R. SARMA. 1958. Hydrography in relation to production of plankton off Waltair coast. *Andhra Univ. Memo. in Oceanogr.* 2: 168-192.
- LA FOND, E. C. 1954. On upwelling and sinking off the East coast of India. *Andhra Univ. Memo. in Oceanogr.* 1: 117-121.
- LA FOND, E. C. 1955. On upwelling and fisheries. *Curr. Sci.*, 24: 258-259.
- MOJUMDER, P. 1967. Observations on the hydrological conditions of the surface waters off Waltair (Bay of Bengal) during 1964-66. *J. mar. biol. Assn. India* 9: 164-172.
- MOJUMDER, P. 1972. Food of the cat fish *Tachysurus thalassinus* (Ruppel). *Indian J. Fish.* 16: 161-169.
- RAO, K. S. 1964. Observations on the food and feeding habits of *Scomberomorus guttatus* (Bloch and schneider) and juveniles of *S. lineolatus* (Cuvier and Valenciennes) and *S. commersoni* (Lacepede) from the Waltair coast. In *Symposium on Scombroid fishes.* 592-598.
- RUBEN, S. 1968. On the occurrence of *Enphausia distinguenda* Hansen in the north-western Bay of Bengal. *Curr. Sci.*, 37: 703-704.