

## DEMERSAL FISHERY RESOURCES OFF KAKINADA WITH A NOTE ON ECONOMICS OF COMMERCIAL TRAWLING

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### ABSTRACT

The trawl fishing industry in the Kakinada area had shown a phenomenal growth in the past decade. The important demersal fisheries resources during the period 1971-74 are given in this paper. The economics of commercial trawling by the three types of boats operated by the industry are worked out.

### INTRODUCTION

The commercial exploitation of the demersal fisheries resources off Kakinada with small-sized trawlers (9.14m) began in 1964. Since then there is a continuous increase in the number of trawlers over the years. Muthu et al (1975) have furnished the various particulars of trawl fisheries of this area for the period 1967-70. Further data collected on the commercial trawl fisheries during 1971-74 are given in this paper. Also the economics of commercial trawling have been considered.

### MATERIAL AND METHODS

The trawling grounds lie off Kakinada between latitude 16°35'N to 17° 25'N and longitude 82° 20'E to 83° 10' E (see Muthu et al 1975). Three types of commercial trawlers, namely, Pablo (9.14 m, 20-30 H.P. engine), Pomfret/Royya (9.75-10 m, 45-60 H.P. engine) and Sorrah (11.41 m, 60-75 H.P. engine) conducted daily-fishing, returning to Kakinada base after the end of day's fishing. The constructional details of the boats and nets are given by Muthu et al (1975). The duration of trawling per trip varied from 4-10 h. The boats operated in 5-70m depth range, but more effort was put in depth less than 50 m. The method of data collection is the same as given by Muthu et al (1975) which in short consisted of weekly sampling of 20-10% of the boats and the observed data being raised to get the monthly estimation. As the price of prawns depends much on their size, they are separated into 3 categories, namely, big prawns measuring 171-310mm total length, medium prawns measuring 101-170mm and small prawns measuring 60-100 mm. Prawn catches were recorded on these lines also in addition to specieswise landings.

The economics of trawling by three types of boats was calculated uniformly for 250 fishing days per year which is reasonable under the local conditions. The monetary returns were calculated by dividing the fish catch into three categories viz, A-class fish composed of *Polynemus* spp, *Lactarius lactarius*, pomfrets, mackerel, eels, *Saurida* spp, *Sphyraena* spp, perches, carangids (excluding *Decapterus* spp) and anchovies, B-class fish constituted by crabs, Cephalopods, elasmobranchs, cat fish, sardines, *Opisthopterus tardoore*, *Engraulis* spp, other clupeoides, *Nemipterus* spp, sciaenids, flat fish *Psenes* spp and C-class fish made up of Bombay duck, ribbon fish, silver bellies, *Kurtus* spp, *Decapterus* spp, and miscellaneous fishes.

#### TOTAL CATCH TRENDS

The annual catches, the effort expended, and the catch rates for the 3 types of boats are given in Table 1. While the average number of Pablos operated per day showed slight decrease from 30 in 1971 to 24 in 1974, the Pomfrets (Royyas included) and Sorrah boats registered over three-fold increase during the period. The catch-per-trawling-hour data in 1971 and 1972 for the three types of boats were high and compare favourably with the catch rates obtained during 1968-70 (Muthu et al 1975). However, in 1973 and 1974 the catch

TABLE 1. Particulars of catch (kg), effort (trawling hours) and catch rates (kg) for the three types of trawlers during 1971-74.

	1971	1972	1973	1974
<i>Pablo</i>				
Total catch	1336,701	1306,240	950,758	1117,056
Average No. of boats per day	30	25	24	24
Effort	37561.5	35028	48566	52292
Catch per boat day	157.44	179.55	123.80	145.91
Catch per trawling hour	35.59	37.29	19.58	21.36
<i>Pomfret and Royya</i>				
Total catch	557,865	830,337	1272,666	2142,041
Average No. of boats per day	9	13	23	30
Effort	10611	18406	47521	72760
Catch per boat per day	219.03	220.25	172.92	223.83
Catch per trawling hour	52.57	45.11	26.78	29.44
<i>Sorrah</i>				
Total catch	414,111	732,882	1273,839	1769,773
Average No. of boats per day	6	10	18	20
Effort	7681.5	14072.5	38032	52295
Catch per boat per day	243.88	251.85	221.15	277.39
Catch per trawling hour	53.91	52.08	33.49	33.84

rates (c.p.h.) showed significant decline. Analysis of the species-wise break up of the total catches showed that this declining trend was reflected in all the important groups of fish (including prawns) and this probably reflects a general scarcity of fish in 1973 and 1974. It may be seen that this trend (sharp fall in catch rates in 1973 and 1974) was not manifested in the catch-per-boat-per-day figures. This is because the trawlers compensated the fall in c.p.h. by increasing the trawling time. Thus, while on an average, the trawling time per boat per day was 4.2 to 4.9 h in 1971 and 1972, it was 6.2 to 8.4 h in 1973 and 1974.

The monthly variations in the catch rates for the 3 types of boats are given in Fig. 1.

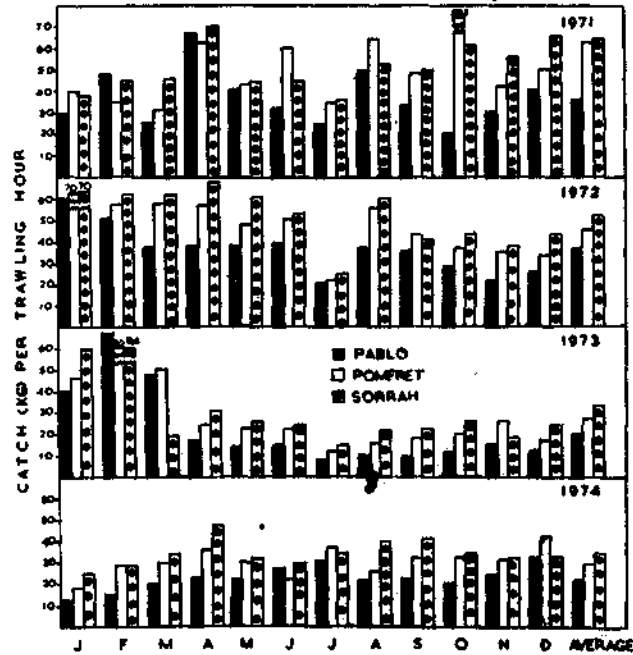


FIG. 1. The monthly and annual catch rates for all fish during 1971-74.

1971: The monthly catch rates for Pablos varied from 19.7 kg/h to 66.6 kg/h (average 35.6), for Pomfrets 31.4 kg/h to 87.3 kg/h (average 52.6) and for Sorrahs 35.8 kg/h to 71.0 kg/h (average 53.9). The catch rates were high in April and August and low in January and June. The very high catch rate of 87.3 kg/h recorded by Pomfrets in October was due to large catch of ribbon fish (36.7 kg/h).

1972: The catch per hour of trawling by Pablos varied from 23.5 to 59.4 kg (average 37.3) for Pomfrets 22.8-70.2 kg (average 45.1) and for Sorrahs 24.7-70.5 kg (average 52.1). High catch rates were obtained in January-April

and August while catch rates were very low in July and November. The peak catch rates obtained in January were due to heavy prawn landings which formed 41.2% to 51.5% of the total catch in the 3 types of boats.

1973: Pablos recorded 7.9-66.5 kg/h (average 19.6), Pomfrets 12.1-82.3 kg/h (average 26.8) and Sorrahs 14.9-124.2 kg/h (average 33.5). The high catch rates in January-March (Fig. 1) were mainly due to heavy catches of *Decapтерus* spp and *Psenes* spp which constituted 17.5% in January, 76.5% in February and 41.3% in March in the total catches. During this year the catch rates touched an all time low in July for the 3 types of boats.

1974: The variations in the catch rates for Pablos was 12.5-32.1 kg/h (average 21.4), for Pomfrets 18.3-42.2 kg/h (average 29.4) and for Sorrahs 24.7-47.3 kg/h (average 33.8). During this year the catch rates were uniformly low when compared to 1971 and 72. They were slightly better off in April and December and very low in January.

On the whole it may be seen from Fig. 1 that in general the ground fish abundance has two peaks; the January-April peak was much prominent compared to the one obtained in August-October. Except in 1974, which year presented a somewhat different picture, lowest catches were invariably recorded in July.

#### IMPORTANT DEMERSAL FISHERIES

The category-wise analysis of the landings for the 3 types of boats combined for the 4-year period revealed that the prawns are by far the most important component, forming 27.1% of the total catches (Table 2). Next came sciaenids which accounted for 13.7% of the landings, followed by ribbon fish 6.9%, leiognathids 6.3% and *Nemipterus* spp 5.2%. These five groups have accounted for 59.2% of the demersal resources while the balance of 40.8% was made up by 27 categories of fishes. The monthly and average annual catch rates pooled for the 4-year period and the species composition for the 5 dominant categories of ground fish are given below.

##### *Prawns*

The monthly catch per hour of trawling for Pablos varied from 5.7-13.2 kg (annual average 8.7), for Pomfrets 6.9-12.8 kg (average 9.9) and for Sorrahs 4.3-11.9 kg (average 9.5). It may be seen that the annual average catch rates by Pomfrets and Sorrahs were only slightly higher than that obtained by Pablos. From Fig 2.A. it is obvious that prawns were available throughout the year with fluctuations in their abundance during different months with low catch rates in July and December. Analysis of monthly prawn landings for different

TABLE 2. Showing the species-wise break-up and percentage composition of fish landed by trawlers during 1971-1974. 94

	PABLO				POMFRET				SORRAH				Pooled	
	71	72	73	74	71	72	73	74	71	72	73	74	totals	%
Prawns-big	27164	63015	17771	29716	10899	49831	35820	66845	7987	40782	31815	54239	434184	3.17
Prawns-medium	230468	216332	57227	139044	62322	110079	103128	235611	29308	97209	97655	180291	1558674	11.37
Prawns-small	161161	149133	141596	200152	52260	84461	170782	301000	20955	56693	166089	224998	1729280	12.62
Crabs	17279	39764	10092	34282	3434	13934	11962	23900	2692	9776	11935	11135	190185	1.39
Cephalopods	17754	21676	9271	10090	7337	11695	18131	21108	3977	10894	15475	19761	167169	1.22
Sharks	—	1381	105	1768	952	297	984	22806	412	2070	3404	2981	37160	0.27
Rays	85086	30886	18307	29525	20629	18111	25913	61020	23456	15837	31824	24530	385124	2.81
Skates	14461	14350	8157	3040	8662	8507	5410	6216	1940	23330	2238	8802	105118	0.77
Eels	12166	19361	20098	22741	7136	12082	23442	40300	2943	11562	20660	65606	258097	1.88
Catfish	13039	25588	17361	19294	8261	26612	23236	46506	6541	22340	25589	74811	309178	2.26
Lesser sardines	144	1660	6405	250	1504	3268	15574	4786	176	1510	14926	572	50775	0.37
Anchovies	17477	31768	12241	15335	3910	15292	16622	30058	3770	14820	16924	25400	203617	1.49
<i>Opisthopterus</i> sp.	14339	3827	2947	5501	5902	2338	3905	22499	3429	2266	3078	14680	84711	0.62
<i>Engraulis</i> spp.	12031	27493	16370	19856	4405	12959	17496	37735	3270	13146	13080	26948	204789	1.49
Other clupeids	7680	14156	8018	7145	3530	7291	23759	16166	3769	6609	19731	10945	128799	0.94
<i>Saurida</i> spp.	37657	36559	11153	20954	11386	24741	8405	94406	14500	22377	4331	61893	348362	2.54
Bombay duck	14247	30407	22396	44083	4830	22239	36186	28829	3200	6937	30129	22950	266433	1.94
Perches	16603	8323	6633	11409	6069	11468	9519	22084	6810	6428	11148	28895	145389	1.06
<i>Nemipterus</i> spp.	63824	41622	50222	63408	17130	34734	72295	124791	20375	36383	84637	103212	712633	5.20
Upenids	33482	67766	14412	47937	28131	40238	22942	89199	27370	41114	26660	78321	517572	3.78
Polynemids	13006	8230	7015	9262	9801	7717	7168	23137	10320	6396	9765	28931	140748	1.03
Sciaenids	207535	164229	87874	141552	60841	143502	133544	357593	65996	134346	127184	264133	1882929	13.74
Ribbonfish	82379	48947	54683	59903	87731	38974	81292	153242	66120	28470	81539	158414	941694	6.87
Carangids	13942	15408	3337	6971	7288	9710	6270	15130	7196	7407	3730	31888	128214	0.94
<i>Decapterus</i> spp.	1440	1896	106269	1356	—	5450	120975	912	200	5095	91082	84	334759	2.44
Leiognathids	149477	103821	47772	63121	86637	46622	57762	74556	45693	43332	57328	91652	867773	6.33
<i>Lactarius lactarius</i>	20352	24013	4181	25625	13464	12440	9643	53685	11875	11806	6279	39057	232420	1.70
Pomfrets	3076	1315	1538	2079	2726	1717	3848	7895	5120	2987	1835	5783	39969	0.29
Mackerel	—	7110	711	—	—	3882	1421	1344	72	4665	4842	1724	25771	0.19
<i>Sphyræna</i> spp.	—	3513	4075	—	—	1624	3325	3276	—	1989	7778	1033	26613	0.19
Soles	20704	27303	17990	37399	8148	19874	27258	81877	6920	17888	33040	56613	355014	2.59
<i>Psettodes</i> spp.	464	4194	1398	2289	660	2214	2494	5225	48	2207	4039	3544	28776	0.21
<i>Kurtus indicus</i>	10600	17961	3308	20005	2542	9056	2537	26663	1350	8441	6182	18154	126799	0.92
<i>Psenes indicus</i>	—	—	144870	4365	28	—	153380	15463	—	—	199890	9426	527422	3.85
Miscellaneous	17664	33233	14905	17593	9310	19078	16301	26178	6321	15770	13398	18367	208118	1.52
Total	1336701	1306240	950758	1117055	557865	830337	1272666	2142041	414111	732882	1273839	1769773	13704268	

years showed that their abundance fluctuated considerably during the same month for different years and as such there was no sharply defined season for the peak abundance of prawns.

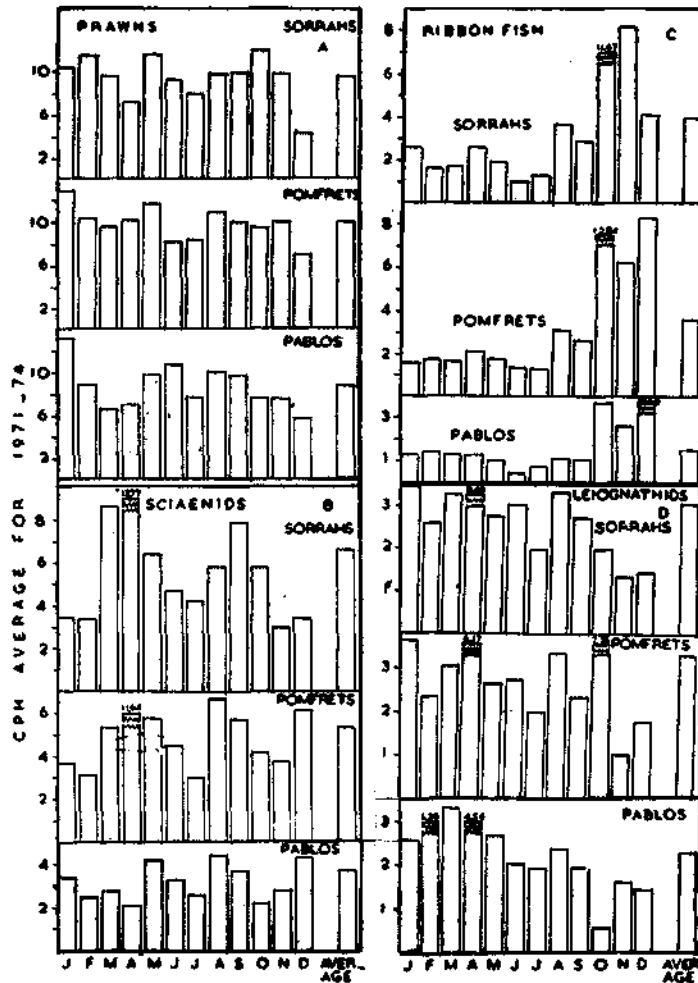


FIG. 2. Catch (Kg) per hour of trawling: A for prawns, B for Scienids, C for ribbon fish and D for Leignathids.

The average percentage of prawns in the total catch for the 4 years worked to 30.40 in Pablos, 26.28 in Pomfrets and 24.05 in Sorrahs. For the 3 types of units combined the prawns formed 20 to 30.2% (Table 2). *Metapenaeus dobsoni* (31.2%) was most dominant followed by *M. monoceros* (21.3%) and *M. brevicornis* (11.3%). It may be seen from the table that the above three species contributed to the bulk of the prawn landings in all the years. The percentage contribution of *M. monoceros* increased slightly from 12.1 in

1971 to 16.8 in 1973. In 1974 it doubled and stood at 33.9%. The contribution of *M. dobsoni* also increased from 32.4% in 1971 to 39.3% in 1973 but came down to 22.7% in 1974. *M. brevicornis* showed slight decrease, from 14.2% in 1971 to 9.0% in 1974. *M. affinis* also showed similar decreasing trend. The percentage composition of other penaeid prawns showed some fluctuations, but a definite trend was not discernible. The non-peneids formed 3.1% to 7.1% of the total prawn catch and were mostly represented by *Leander tenuipes* and *Hippolysmata ensirostris*.

TABLE 3. Species composition of prawns landed in kg by trawlers during 1971-74  
Figures in brackets indicate percentages.

	1971	1972	1973	1974	Pooled
Prawn catch	602524	865835	821863	1431896	3722118
Percentage of prawns in total catch	26.1	30.2	24.0	20.0	27.1
<i>Metapenaeus monoceros</i>	72822 (12.1)	117920 (13.6)	138428 (16.8)	485611 (33.9)	814781 (21.9)
<i>M. affinis</i>	56025 (9.3)	77836 (9.0)	62076 (7.6)	83366 (5.8)	279303 (7.5)
<i>M. dobsoni</i>	195258 (32.4)	319237 (36.9)	323160 (39.3)	324685 (22.7)	1162340 (31.2)
<i>M. brevicornis</i>	85884 (14.2)	106831 (12.3)	98324 (12.0)	128433 (9.0)	419472 (11.3)
<i>Penaeus monodon</i>	24814 (4.0)	60274 (7.0)	41313 (5.0)	92114 (6.4)	218515 (5.9)
<i>P. indicus</i>	27015 (4.5)	90695 (10.5)	42219 (5.1)	88312 (6.2)	248241 (6.7)
<i>P. merguensis</i>	1841 (0.3)	5427 (0.6)	4207 (0.5)	8561 (0.6)	20036 (0.5)
<i>Parapenaeopsis stylifera</i>	35249 (5.8)	21215* (2.4)	19537 (2.4)	51705 (3.6)	127706 (3.4)
<i>P. hardwickii</i>	16759 (2.8)	—	7356 (0.9)	23228 (1.6)	47343 (1.3)
<i>Solenocera indica</i>	26455 (4.4)	12236 (1.4)	29011 (3.5)	35723 (2.5)	103425 (2.8)
Other penaeids	17510 (3.0)	26855 (3.1)	25402 (3.1)	59242 (4.1)	129009 (3.5)
Non-peneids	42892 (7.1)	27309 (3.1)	30830 (3.8)	50916 (3.6)	151947 (4.1)

\* includes *P. hardwickii* also

Big prawns contributed 7.6 to 17.6% (average 11.7%) of the total prawn catch for different years (Table 4). *P. monodon* and *P. indicus* mostly contributed to this category. The medium sized prawns formed 31.4-53.5% (average 41.9%) and were represented by *M. affinis*, *M. monoceros*, *M. dobsoni*, *P. stylifera* and *P. hardwickii*. Small prawns made up to 33.5-58.2% (average 46.4%) during different years. This group dominated during 1973-74 and was made up by *M. dobsoni* and smaller size groups of a number of other penaeid species.

TABLE 4. Percentage size composition of prawns.

	<i>Big prawns</i>	<i>Medium prawns</i>	<i>Small prawns</i>
1971	7.6	53.5	38.9
1972	17.6	48.9	33.5
1973	10.4	31.4	58.2
1974	10.5	38.8	50.7
Pooled	11.7	41.9	46.4

#### *Sciaenids*

The monthly catch rates varied from 2.2 to 4.4 kg/h (annual average 3.7) in Pablos, 3.2 to 11.6 kg/h (average 5.3) in Pomfrets and 3.0 to 13.8 kg/h (average 6.6) in Sorrahs (Fig. 2B). Small-sized species of *Pseudosciaena*, *Sciaena* and *Johnius* mainly formed the fishery. There were two peaks in their abundance; once in March-April and again in August-September.

#### *Ribbonfish*

*Trichiurus lepturus* contributed to over two thirds of the ribbon fish catch. The monthly c.p.h. in Pablos was 0.4 to 10.1 kg (annual average 1.5), in Pomfrets 1.3 to 12.8 kg (average 3.5), and in Sorrahs 1.0 to 11.7 kg (average 3.9). It was observed that large shoals of ribbon fish invade the trawling grounds in the last quarter. In the first half of the year the catch rates were usually poor (Fig. 2 C).

#### *Leiognathids*

Reference to Fig. 2D shows that in Pablos the monthly catch rates varied from 0.5 to 5.4 kg/h (annual average 2.3), in Pomfrets 0.9 to 7.2 kg/h (average 3.2) and in Sorrahs 1.3 to 8.5 kg/h (average 3.1). They were abundant in January-April and at times in August also.

#### *Nemipterus* spp.

Pablos recorded 0.2 to 3.1 kg/h (Average 1.3), Pomfrets 0.2 to 4.2 kg/h (average 1.7) and Sorrahs 0.4 to 4.6 kg/h (average 2.3). The peak season for their occurrence was December-May. (Fig. 3).



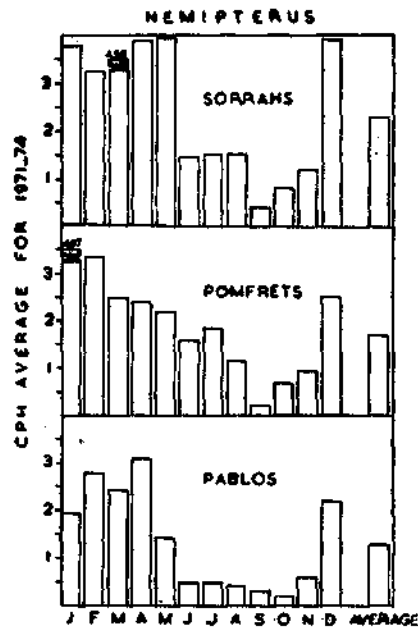


FIG. 3. Catch rates (Kg/h) for *Nemipterus* spp.

#### ECONOMICS OF COMMERCIAL TRAWLING

The income and expenditure statement for the 3 types of boats are given in Table 5. The catch per boat per year was calculated by raising the average catch per days fishing (Table 1) by 250 days. It may be seen from Table 5 that the rate of return on the investment was 10.5% on Pablos, 20.9% on Pomfrets and 17.0% on Sorrahs. From this the performance of Pomfrets and Sorrahs appears to be better than that of Pablos.

#### DISCUSSION

The present study corroborates the main conclusions drawn by Muthu *et al* (1975) on the following points. 1. There are two peaks in the ground fish abundance; the January/February-April peak was more prominent than the one obtained in August-October/November. 2. Prawns are the most important demersal fishery resources followed by seaenids. 3. Prawns are available throughout the year and their abundance fluctuated for the same month during different years. *M. dobsoni* and *M. nonoceros* are the most dominant species. Non-penaeids formed less than 10% of the total prawn catch. The percentage of prawns was highest in Pablos and lowest in Sorrahs. Important differences observed are as follows: 1. Significant fall in the catch rates in 1973 and 1974. 2. The third to fifth positions in the ground fish resources were occupied by ribbon fish, leiognathids and *Nemipterus* spp, while in 1968-70 these positions

TABLE 5. *The expenditure and receipts for the three types of trawlers during 1974*

	<i>Pablos</i> Rs.	<i>Pomfrets &amp;</i>		<i>Sorrahs</i> Rs.		
		<i>Royyas</i> Rs.				
<b>I. Capital expenditure</b>						
(1) Cost of hull, complete with decking (includes cost of winch wire rope and Navigational equipment)	32435	50994		74340		
(2) Cost of engine	49164	59218		81725		
(3) Miscellaneous	3000	4000		4000		
(4) Sale tax (4.5%)	3672	4960		7023		
Total Rs.	88271	119172		167088		
<b>II. Recurring expenditure</b>						
(1) Cost of oil	21600	26800		32800		
(2) Cost of nets and otter boards	1200	1500		1800		
(3) Maintenance of gear and boat	4000	6000		7000		
(4) Depreciation of hull 6.67%	2163	3401		4958		
(5) Depreciation of engine 10%	4916	5922		8172		
(6) Insurance 2.5%	2200	2950		4100		
(7) Unforeseen	850	1100		1365		
(8) Wages to boat crew	15000	20500		23900		
Total Rs.	51929	68173		84095		
<b>III. Catch and Receipts</b>						
	<i>Kgs.</i>	<i>Rs.</i>	<i>Kgs.</i>	<i>Rs.</i>	<i>Kgs.</i>	<i>Rs.</i>
(1) Big prawns	985	15760	1734	27744	2150	34400
(2) Medium prawns	4523	22615	6155	30775	7074	35370
(3) Small prawns	6529	8161	7889	9861	8808	11010
(4) A class fish	4486	4486	7609	7609	11373	11373
(5) B class fish	14006	8404	24430	14670	27809	16685
(6) C Class fish	5946	1784	8113	2434	12136	3641
Total	36475	61210	55950	93093	69350	112479
<b>IV. Profits</b>						
Percentage of profit on Capital	Rs.	9281	24920	28380		
		10.51	20.91	16.98		

were occupied by *Nemipterus* spp, elasmobranchs and ribbon fish. 3. In this study *M. brevicornis* relegated *M. affinis* from the third rank to the fourth position. Also the percentage of small prawns was higher (46.4%) in this study than the 27.6% obtained in 1968-70. 4. During 1967-70 the boats operated in 5-40 m depth while during the period of this study the depth of operation was extended upto 70 m waters.

An important difference in the species composition of the ground fish in the 5-50 m and 51-70 m zones was noticed. While the former zone was conspicuous by the presence of prawns, sciaenids, ribbon fish, leiognathids and *Nemipterus* spp, the catches in the latter zone were dominated by *Nemipterus* spp, *Psenes* spp, sciaenids, and *Decapterus* spp. Similar observations were made by Narayanappa et al (1972 and 1974).

Perusal of data given by Muthu et al (1975), the present study and unpublished records reveal that the average number of boats operated increased from 18 in 1968 to 106 in 1976 with corresponding increase in effort. Also the total catches increased from 1679 tonnes in 1968 to 11056 tonnes in 1976. Although the catch rates declined considerably in 1973 and 74, they improved in 1975 and 1976. Thus while the total catches and the effort showed an increasing trend during these 9 years, the catch rates revealed some fluctuations but did not show any trend. This suggests that the trawl fisheries are presently expanding.

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