ON THE COMMERCIAL TRAWL FISHERIES OFF KAKINADA DURING 1967-70

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ABSTRACT

Analysis of the trawler landings during 1967-70 showed the existence of rich prawn grounds off Kakinada, particularly in the shallower regions not exceeding 20 m in depth. In the fishing ground extending in a depth zone, 5-40 m, the important fishery resources were prawns (forming 24% of the total catch), sciaenids (14.8%), *Nemipterus* (9.7%), elasmobranchs (7.1%), silverbellies (6.4%), *Lactarius lactarius* (4.4%), ribbonfish (4.4%), clupeids (3.8%), eels (2.6%), carangids (2.6%), and other small miscellaneous fishes. Two peaks were observed in the total catch, one in February-April, which is the more predominant one, and the other in August-November. The catch rates, seasonal fluctuations and detailed species composition are dealt with in the paper.

INTRODUCTION

Off Kakinada, both exploratory and experimental trawling by the Central and State government organisations were in progress since 1960. But the commercial exploitation of the resources by the industry with small-sized trawlers began only in 1964. Since then, there is a continuous growth over the years both in the number and size of the trawlers. In view of the importance of detailed knowledge about the various aspects of a growing fishery, the relevant particulars collected during 1967-70 are presented in this article.

MATERIAL AND METHODS

The fishing operations were conducted off Kakinada between latitude 16° 15' N to 17° 10' N and longitude 82° 22'-35' E (Fig. 1) where the bottom is mostly muddy. Three types of boats constituted the commercial fleet. Their specifications together with the types of trawling gears used are given in Table 1.

All the boats conducted daily fishing from the early morning. The actual time spent on fishing by each boat per day varied from 4 to 6 h. The boats usually operated in 5-40 m depth, and landed at the Kakinada Fishing Harbour. As the vast majority of these vessels do not maintain any log books, the procedure followed by Ramamohan Rao *et al.* (1965) was adopted to get the estimates of catch and effort. The landings and the effort spent were first estimated on a

daily basis separately for the 3 types of boats and usually 20-100% of the number of the boats of each type were sampled on the days of observation, which varied from 1-2 per week. The observation-day totals were raised to get the monthly estimates. In this study, catch per hour of trawling was considered as a suitable index of the abundance of fish. For a period of fifteen months, from January 1967 to March 1968, the 3 types of boats were not segregated but treated as one type of unit. Majority of boats during this period were Pablos. However, from April 1968 to December 1970, the catch-and-effort particulars were collected separtely for each type of boat. Also, during the latter period, the complete specieswise break-up of the landings was recorded, while, in the

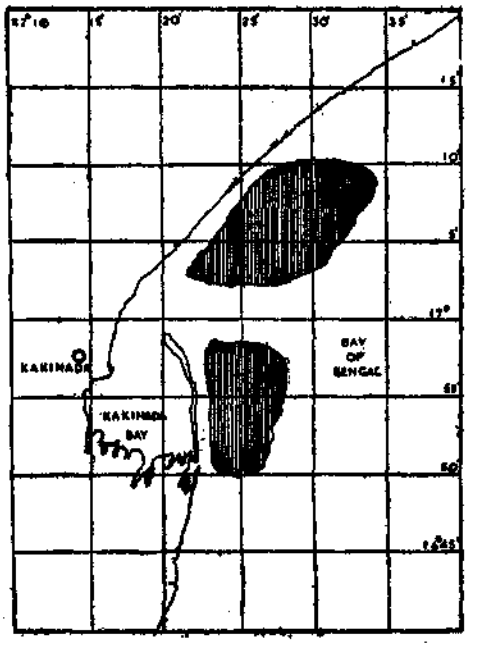

FIG. 1. Map showing the fishing grounds off Kakinada. Trawling grounds are shaded.

former period the catch particulars of prawns, ribbon fishes and other groups of fishes landed as a whole, were collected. This was due to the fact that initially the objective was to study the fishery of prawns and ribbon fishes only.

As the prawns fetch a high market price, and as there is much disparity in their price depending upon their size, the industry segregates them into 3 categories viz, 'big prawns', measuring 171-310 mm (total length), 'medium prawns', measuring 101-170 mm and 'small prawns', measuring 60-100 mm. From April 1968, catch data on prawns were also recorded on these lines.

TABLE 1. *The details of the craft and gear employed in the fishery.*

Details of vessels					Details of gears					
Pablo	9.14 m	2.49 m	0.87	20-30 HP	2-seam cotton trawl	11.89 & 12.95 m	7-6 cm	5.1-3.8 cm	2.5 cm	Hand* operated
Pomfret	9.75 m	2.9 m	1.67 m	45-60 HP	Do	14.94, 16.5 & 18.29 m	Do	Do	Do	Winch
Sorrah	11.41 m	3.20 m	1.22 m	60-75 HP	Do	Do	Do	Do	Do	Do

*Of late a few pablos are fitted with winches.

TOTAL-CATCH TRENDS

The annual catches, fishing effort and average catch rates for the different types of boats are summarised in Table 2. There is an increase in the average daily catch and the c.p.h. of fish with increase in the size of boat, obviously due to the greater horse power and larger nets of the bigger boats. The catch rates of Sorrahs are only slightly more than those of Pomfrets and this is probably due to the fact that both types of boats used trawlnets of similar size. The average annual catch rates of the Pablos remained more or less constant throughout the period while the other boats showed some fluctuations; however there was no regular trend, either increasing or decreasing.

The monthly fluctuations in the catch rates for the 3 types of boats as shown in Figure 2 indicate that in general there are two peaks in the abundance of ground fish, one during February-April and the other in August-November period. In the former period the catch rates are usually much higher than in the latter period. The intervening months of June and July, particularly in 1969 and 1970, witnessed a general scarcity of fish.

IMPORTANT TRAWL FISHERIES

Categorywise break-up of the landings for a 33-month period (April 68 to December 70) for the 3 types of boats combined (Table 3) showed that prawns formed 24.4%, sciaenids 14.8%, *Nemipterus* spp 9.7%, elasmobranchs 7.1%, silver-bellies 6.4%, *Lactarius lactarius* and ribbon fish 4.4% each, clupeoids 4.0%, eels and carangids 2.6% each and the rest, other varieties of fish. In all, the above 10 categories of fishes constituted 80.4% of the groundfish resources.

TABLE 2. *Catch (kg), effort (trawling hours) and catch rates for different trawlers during* 1967-70.

Year		1967	1968 (Jan-Mar)	1968 (Apr-Dec)	1969	1970	Total
Fishing days		252	76	206	240	264	710
3 types of boats pooled together	Total catch	792403	364523				
	Average no of boats per day	18	27				
	Effort (hours)	20484.3	9394.0				
	Catch per boat per day	174.7	177.6				
	Catch per trawling hour	38.7	38.8				
Pablos	Total catch			622555	585174	723812	1931541
	Average no of boats per day			22	19	21	20.67
	Effort (hours)			20090.5	19867.8	24102.0	64060.3
	Catch per boat per day			137.4	128.3	130.5	131.6
	Catch per trawling hour			31.0	29.5	30.0	30.1
Pomfrets	Total catch			464239	552414	416776	1433429
	Average no of boats per day			12	10	8	30
	Effort (hours)			10474.5	10838.8	8788.5	30101.8
	Catch per boat per day			187.8	230.2	197.3	201.9
	Catch per trawling hour			44.3	51.0	47.4	47.6
Sorrahs	Total catch			227943	162651	315752	706346
	Average no of boats per day			5	4	5	14
	Effort (hours)			4557.5	3528.1	5310.0	13395.0
	Catch per boat per day			221.3	169.4	149.5	213.0
	Catch per trawling hour			50.0	46.1	59.5	52.7

Prawns

A reference to Figure 3 will show that the c.p.h. for prawns in Pablos varied from 3.55 to 14.20 kg with an average of 11.42 kg; for Pomfrets from 2.47 to 15.0 kg (average 7.79) and for Sorrahs from 3.80 to 13.74 kg (average 6.59). The Pablos recorded higher catch rates for prawns when compared to the other two types of boats. If Pablos alone are considered, the peak catch rates for prawns (>9 kg/hr) were obtained throughout the year excepting March-April period (Figure 3) where as similar catch rates (>9 kg/hr) were obtained by Pomfrets in April-July and by Sorrahs in May-June. Catch rates for different

months during different years showed that there are marked fluctuations in the abundance of prawns for the same month during different years. In general, prawns are abundant during May-December period; however, in 1967 and 68, in October-December poor prawn catches were obtained and in 1970, the prawn abundance was unusually high in January-February period. Peak occurrence of prawns in May for all the units is conspicuous.

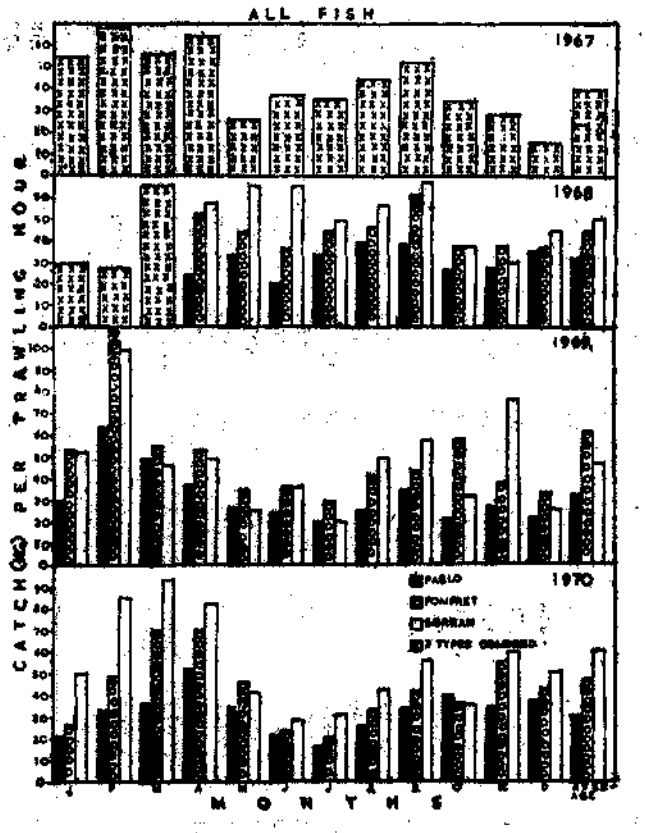

FIG. 2. The monthly and annual catch rates for all fish during 1967-70.

The monthly percentage occurrence of prawns (Fig. 4) in the 3 types of boats, in general, showed the same trend as the catch rates. The average annual percentage of prawns in total catch worked out to 34.78% in Pablos, 16.32% in Pomfrets and 12.49% in Sorrahs. The prawn landings gradually increased from 16.7% in 1967 to 27.7% in 1970 and the average for the period of study was 22.0% (Table 4). The nonpenaeids formed 6.0-9.4% of the prawn catch during different years with an average of 7.8%. They were mostly composed of *Leander tenuipes* and *Hippolysmata ensirostris*. Among the penaeids, which are the mainstay of the commercial prawns, more than a dozen species contributed to

TABLE 3. *Specieswise break-up values (kg) and percentage composition of fish landed, during April 1968-December 1970.*

Type of boat			Pablo		Pomfret			Sorrah			
Year	1968	1969	1970	1968	1969	1970	1968	1969	1970	Total	%
Prawns	205029	172026	294773	89998	73329	71116	27852	23492	36873	994488	24.40
Crabs	10796	17759	5936	4436	7741	1084	1742	823	807	51124	1.25
Cephalopods	1807	7473	9670	1231	6495	6024	982	1737	3362	38781	0.95
Elasmobranchs	32391	41529	71515	18421	29354	29296	15306	10922	41691	290425	7.13
Eels	26697	7196	19316	15844	13498	6100	9981	4251	4474	107357	2.63
Cat fish	6343	8550	5587	18880	14908	13005	12717	9154	11593	100737	2.47
Sardines	—	1565	—	—	7085	615	—	396	1374	11025	0.27
Other Clupeoids	18871	33895	35232	12088	18174	9329	6152	7026	12969	153736	3.77
Bombayduck	29666	240	5468	3210	24	1579	86	—	818	41091	1.01
Saurida	1328	3436	7346	7713	10448	17192	3619	2480	12172	65734	1.61
Perches	4781	5504	5697	8956	8856	4664	5782	2375	5001	51616	1.27
Nemipterus	15564	33679	20727	59356	108452	59104	27149	21534	48704	394269	9.67
Upeneoides	3410	3762	5185	2762	3912	5926	3705	1263	6460	36385	0.89
Polynemus	1022	9021	5403	1205	12107	7890	964	3875	7033	48520	1.19
Sciaenids	111991	95953	88099	77861	79311	51762	38982	23569	35583	603111	14.80
Ribbonfish	35426	26619	26465	20413	17641	22554	9604	10198	10372	179292	4.40
Carangids	4459	14125	10241	12641	25613	16897	6066	6496	10788	107326	2.63
Silverbellies	32788	25785	55016	35842	27074	32823	21050	7696	24587	262661	6.44
Lectarius	26296	23059	13167	33768	27617	13664	19926	9162	13436	180095	4.42
Pomfrets	448	765	492	170	1096	902	759	481	579	5892	0.14
Mackerel	—	18541	—	—	25444	84	—	1808	238	46115	1.13
Sphyraena	—	—	212	—	1419	1556	175	201	477	4040	0.10
Flat fish	8615	11080	12765	16669	13624	17696	8504	5242	9453	103648	2.54
Kurtus	39479	6119	14041	7320	776	1517	2741	738	842	73573	1.80
Psenes	162	3269	—	13547	8362	14514	2878	2686	9327	54745	1.34
Miscellaneous	5186	14234	11459	1708	10054	9883	1221	5046	6739	65530	1.61
Total	622555	585174	723812	464239	552414	416776	227943	162651	315752	4071316	

the fishery, but 3 species, namely *Metapenaeus dobsoni, M. monoceros* and *M. affinis* accounted for 57.4% of the total prawn catch. The large-sized prawns, *Penaeus indicus* and *P. monodon,* which are much sought-after by the frozen-prawn industry, formed 14.4% of the prawn catch. Among the interesting trends, seen in Table 4, are the increase of *M. dobsoni* from a meagre 2.9% in 1967 to a sizable 34.6% in 1970 and the decline in the catch of *M. affinis* from 27.9% in 1967 to 10.4% in 1970 and the more or less stable landings of the other species.

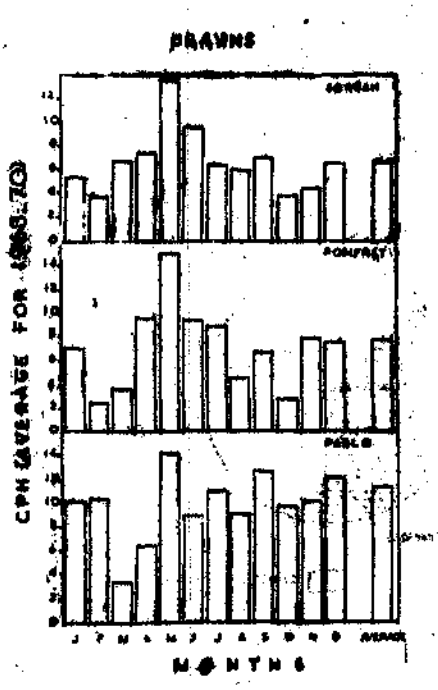

FIG. 3. Catch (Kg) per hour of trawling for prawns.

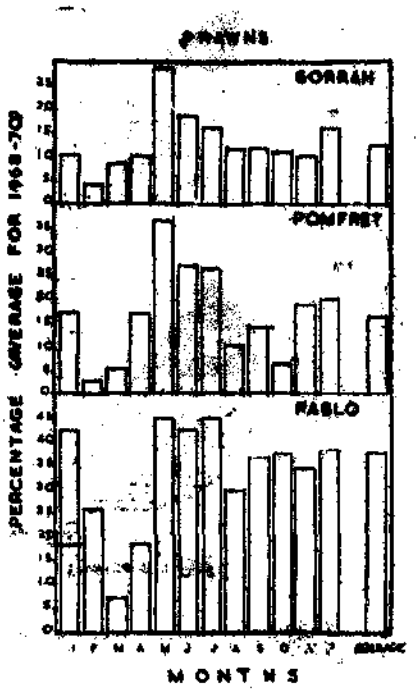

FIG. 4. Percentage composition of prawns.

The big prawns formed 11.9% of the prawn catch and were composed of *P. indicus* and *P. monodon* (Fig. 5). It is significant that their contribution increased from 8.6% in 1968, to 14.5% in 1970. Bulk of the prawn catch (60.5%) was formed of medium-sized prawns represented by *M. affinis, M. monoceros, Parapenaeopsis stylifera* and *P. hardwickii.* The small prawns, consists of *M. dobsoni, Hippolysmata ensirostris, Leander tenuipes* and the smaller size groups of a number of penaeids, formed 27.6%.

Sciaenids: In Pablos the c.p.h. for sciaenids varied from 2.12 to 8.43 kg, with an average of 4.62 kg, in Pomfrets, 2.87 to 10.33 kg, with an average of 6.94 kg, and in Sorrahs, 1.87 to 12.55 kg, with an average of 7.33 kg (Fig. 6). There

were two peaks in their abundance, one during February-April and the other during August-September Small-sized (10 to 25 cm T.L.) species of *Sciaena*, *Pseudosciaena* and *Johnius* constituted the fishery. *Otolithus* spp. were also present.

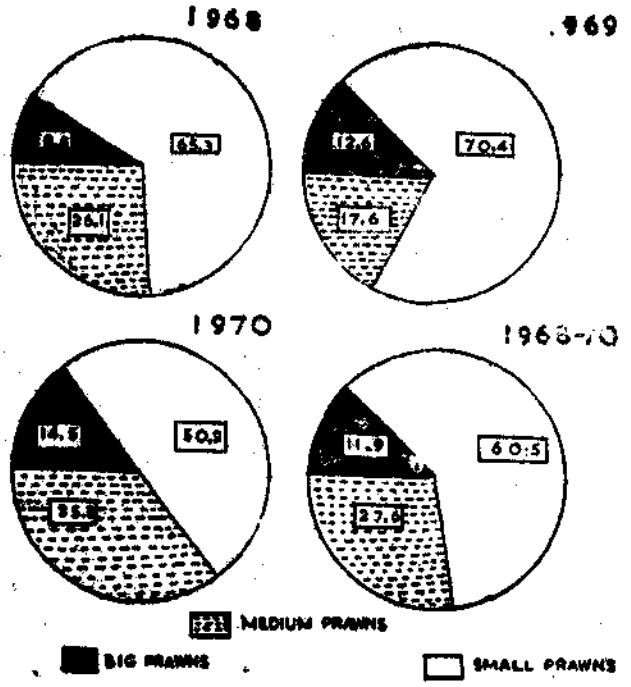

FIG. 5. Percentage size composition of prawns.

Nemipterus spp: The catch rate for Pablos (Fig. 7) varied from 0.88 to 5.73 kg/h, with an average of 1.09 kg/h, for Pomfrets from 1.28 to 32.67 kg/h with an average of 7.54 kg and for Sorrahs from 3.13 to 24.03 kg/h, with an average of 7.27 kg/h. There is a major peak for this fishery in February-April followed by a minor one in August-December. In the latter period, at times very high catch rates were obtained, such as 61.1 kg/h landed by Pomfrets in February 1969. *N. japonicus*, with a size range of 9-22 cm, is the common species.

Elasmobranchs: The catch per hour of trawling for Pablos (Fig. 8) varied from 1.25 to 6.44 kg (average 2.27), for Pomfrets, from 1.13 to 4.65 (average 2.56 kg) and for Sorrahs, from 2.04 to 18.18 kg (average 5.07 kg). They are abundant during January-March. Sharks formed 1.8%, skates 17.9% and rays 80.3%. *Scoliodon* spp. (15 to 35 cm T.L.) and *Carcharhinus* spp. (35 to 200 cm T.L.) are the common sharks. Among the rays, *Dasyatis* spp. (20 to 150 cm

TABLE 4. *Species composition of prawns landed by trawlers (kg).*
(Figures in brackets indicate percentages.)

	Penaeus monodon	*P. indicus*	*Metapenaeus monoceros*	*M. affinis*	*M. dobsoni*	*M. brevicornis*	*Parapenaeopsis stylifera*	*P. hardwickii*	*Solenocera indica*	Other penaeids	Non-penaeids	Total	Percentage of prawns in total catch
1967	16559	15468	20324	36956	3870	11789	1968	2011	3240	7725	12414	132324	16.7
	(12.5)	(11.7)	(15.4)	(27.9)	(2.9)	(8.9)	(1.5)	(1.5)	(2.5)	(5.8)	(9.4)		
1968	22137	13346	82735	68963	41803	35140	14915	5111	21053	18819	20759	344781	20.5
	(6.4)	(3.9)	(24.0)	(20.0)	(12.1)	(10.2)	(4.3)	(1.5)	(6.1)	(5.5)	(6.0)		
1969	19523	14534	46066	49761	66254	17289	8550	5139	7012	11945	22774	268847	20.7
	(7.3)	(5.4)	(17.1)	(18.5)	(24.7)	(6.4)	(3.2)	(1.9)	(2.6)	(4.4)	(8.5)		
1970	38792	25259	60626	41979	139419	27619	9531	9429	8197	8285	33626	402762	27.7
	(9.6)	(6.3)	(15.0)	(10.4)	(34.6)	(6.9)	(2.4)	(2.3)	(2.0)	(2.1)	(8.4)		
Pooled	97011	68607	209751	197659	251346	91837	34964	21690	39502	46771	89573	1148714	22.0
	(8.4)	(6.0)	(18.3)	(17.2)	(21.9)	(8.0)	(3.0)	(1.9)	(3.4)	(4.1)	(7.8)		

across the disc) *Aetomylus* spp. (15 to 40 cm across the disc) and *Pteroplatea* spp. (20-40 cm across the disc) are dominant. The skates landed are *Rhinobatus* spp, *Rhyncobatus* spp. (50-200 cm) etc.

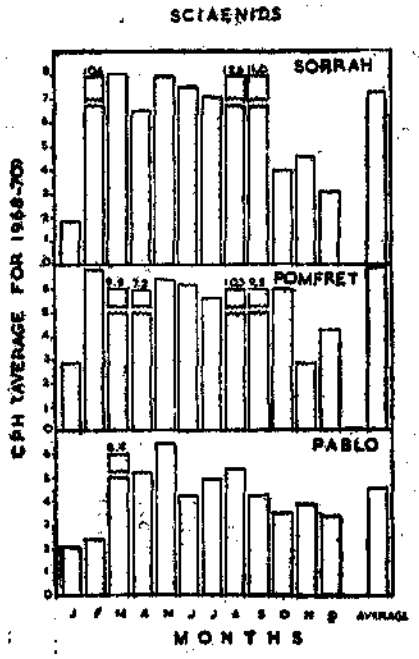

FIG. 6. Catch rates (Kg|h) for Sciaenids.

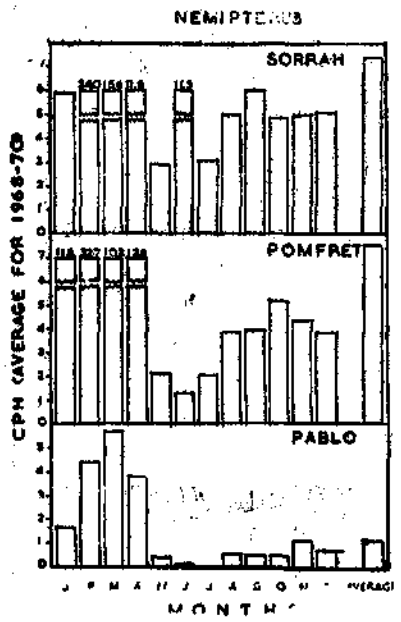

FIG. 7. Catch rates (Kg|h) of *Nemipterus*.

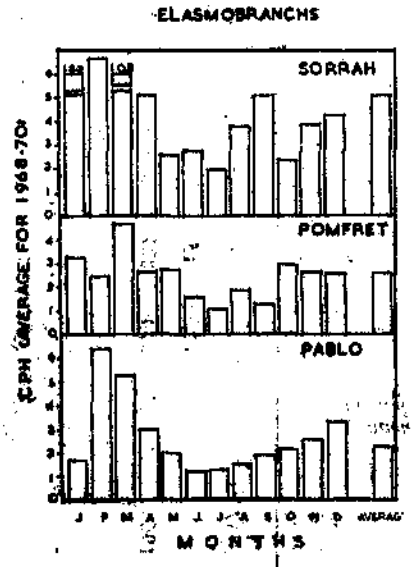

FIG. 8. Catch rates (Kg|h) of elasmobranchs.

Silverbellies: The catch rates for Pablos (Fig. 9) varied from 0.13-4.14 kg|h (average 1.77 kg|h), for Pomfrets 1.67-4.77 kg|h (average 3.18 kg|h) and in Sorrahs 1.23-10.24 kg|h (average 3.98 kg|h). *Leiognathus* spp. (10-25 cm) are dominant. They are abundant in December-May period.

Lactarius lactarius: For Pablos (Fig. 10) the catch rate varied from 0.13-3.01 kg|h (average 0.85 kg|h), for Pomfrets, 0.92-7.25 kg|h (average 2.43 kg|h) and for Sorrahs, 1.02-5.19 kg|h (average 3.17 kg|h). They are caught mostly in February-March and again in August-November. The common size range of the species is 7 to 22 cms.

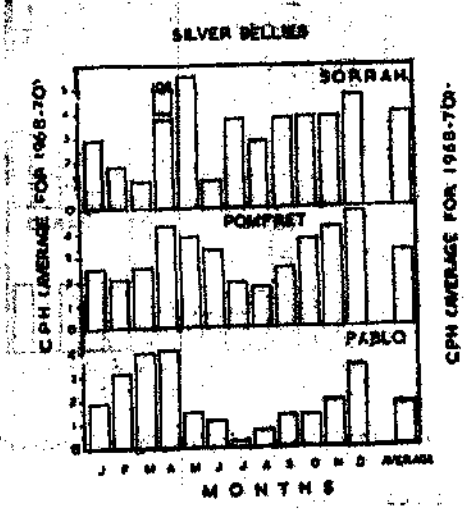

FIG. 9. Catch rates (Kg|h) of silverbellies.

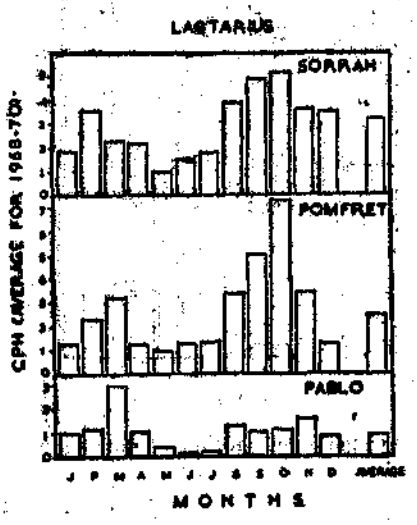

FIG. 10. Catch rates (Kg|h) of *Lactarius lactarius*.

Ribbonfish: The c.p.h. for ribbonfish of Pablos (Fig. 11) varied 0.31-3.33 kg (average 1.38 kg), for Pomfrets 0.57-7.82 (average 2.01 kg) and for Sorrahs 0.58-4.31 kg (average 2.25 kg). July-November is the peak season for ribbonfish. In November 1970, Pomfrets got a very high catch rate of 25°1 kg|h. *Trichiurus lepturus* with a size range of 20-114 cm is the most dominant species.

Clupeoids: Pablos (Fig. 12) recorded 0.66-4.39 kg|h (average 1.40), Pomfrets 0.34-3.49 kg|h (average 1.57 kg|hr) and Sorrahs 0.79-5.68 kg|h (average 2.68). They are dominant during February-April and again in September. Sardines (mostly *Sardinella gibbosa*, of size range 6-20 cm) formed 6.7%, anchovies (8-20 cm) 44.7%, *Opisthopterus tardoore* (6-20 cm) 33.4% and other clupeoids 15.2%.

Eels: In Pablos eels were caught at the rate of 0.03-2.04 kg|h (average 0.83), in Pomfrets 0.01-2.01 kg|h (average 1.18) and in Sorrahs 0.1-3.41 kg|hr (average 1.4). They were available mostly in April-May and in September. *Muraenesox talabonoides* (size 70-100 cm) is the common species (Fig. 13).

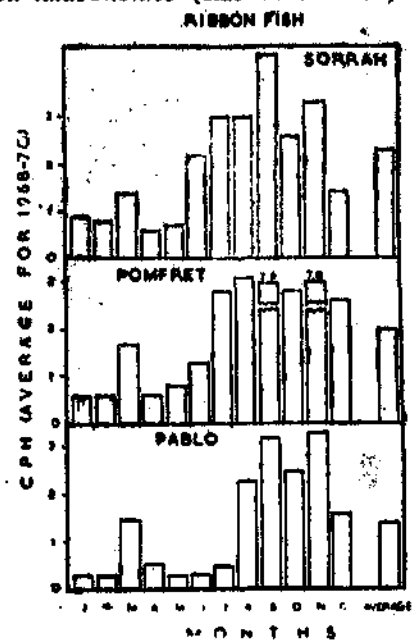

FIG. 11. Catch rates (Kg|h) of ribbonfish.

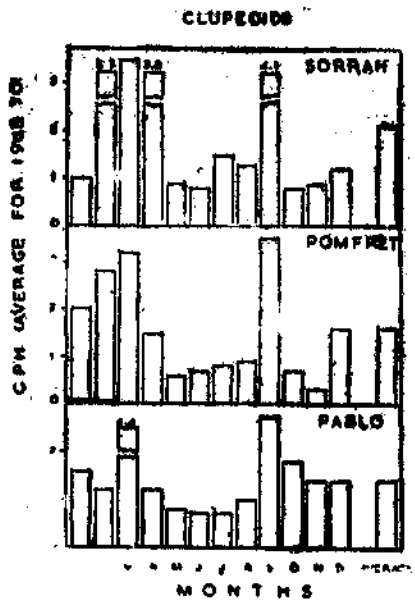

FIG. 12. Catch rates (Kg|h) of clupeoides.

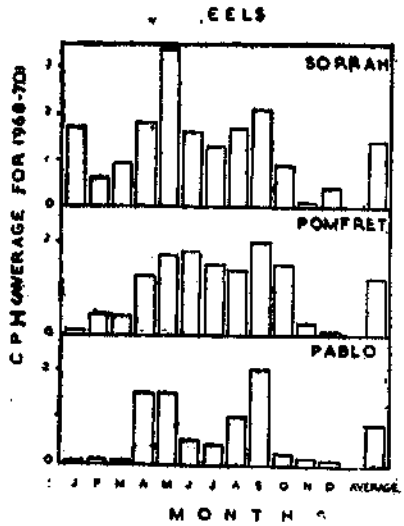

FIG. 13. Catch rates (Kg|h) of eels.

Carangids: In Pablos (Fig. 14) the catch rates varied from nil to 2.4 kg|h (average 0.45), in Pomfrets 0.47-4.94 kg|h (average 1.83) and in Sorrahs 0.61-5.19 kg|h (average 1.74). Peak occurrence for carangids is February-April period. The abundance during the above period is mainly due to *Decapterus* spp. (size 15-30 cm) which formed 31.7% of the total landings.

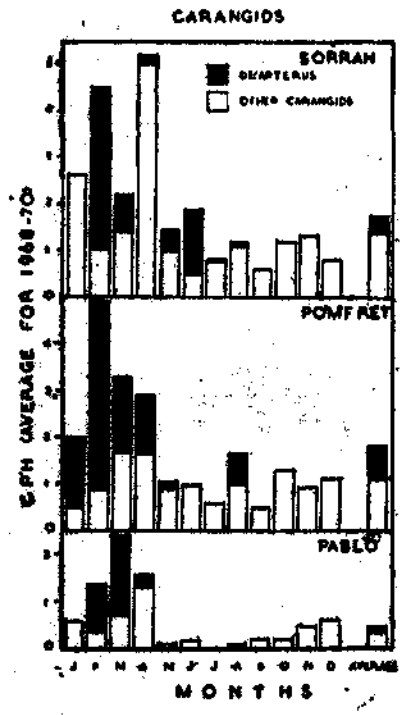

FIG. 14. Catch rates (Kg|h) of carangids.

DISCUSSION

The present study shows that off Kakinada the ground fish are most abundant in February-April period. La Fond (1954), Ganpathi and Subba Rao (1957) and Mojumder (1967) reported extensive upwelling off Visakhapatnam during February-June period. Sekharan *et al* (1973) observed that off Visakhapatnam (Lat 17° 40' N Zone) the peak abundance of ground fish is in April-June period and believed that this is perhaps related to hydrological conditions resulting in upwelling and plankton production. As Kakinada is less than 150 km south of Visakhapatnam, it is possible that a similar relationship may hold good here too. Also *Decapterus* spp. *Psenes indicus* and *Nemipterus* spp. are important constituents during February-April in the commercial catches and these fishes were found to be either absent or poorly represented in the rest of the months. Narayanappa *et al* (1972) have shown that off Kakinada the above

3 species are totally absent in the trawl catches in February 1968 in the 15-50 m depth while they are mostly abundant in 51-100 m depth during March to 11th April 1968. Our data indicate that in April and May 1968 (no data for January-March) these 3 species formed 51.9% and 6.1% respectively, in total catch. This suggests that they moved into the shallow fishing grounds (<40 m depth) from deeper waters in April 1968, and by May disappeared from the present fishing grounds. However, detailed information about any possible upwelling here and its effects on plankton production, together with data on seasonal ground fish distribution in the offshore waters (>40 m depth) off Kakinada, is essential before any conclusions are drawn regarding the depthwise movement of fishes.

The 4-year study showed, that as a group, the prawns forming 22% of the catches formed the most important component in the ground-fish resources off Kakinada. In a 9-month study from July 1963 to March 1964 from a 9.1 m (30') mechanised boat (Fish Tech No. 1) Sebastian *et al* (1965) observed that 18.59% of the total trawl fish caught off Kakinada was made up of prawns. Recently, Sree Krishna and Narayanappa (1970), based on a 3-year study during 1963-66, also off Kakinada from the same boat, stated that the prawns formed 22.5% of the catch. These findings by the earlier authors are in close agreement with what has been observed in the present study. Off Cochin George *et al* (1968) noted that prawns formed 19.1% to 53.5% during different years for an average of 34.02%, (average for 7 fishing seasons during 1956-62) of the total fish landed by trawlers.

Sebastian *et al* (1965) indicated December-March period as the season for prawns with maximum catch in February while Sree Krishna and Narayanappa (1970) observed that prawns are available throughout the year with 2 seasons, one from November to February and again from April-June. In the present study it is seen that prawns are available throughout the year with marked fluctuations in their abundance for the same month during different years. They usually formed a dominant component during May-December and on occassions extending up to February and are generally less abundant in March-April. Thus the season for prawns off Kakinada is an extended one, their abundance showing distinct peaks, which were found to vary from year to year. Since a number of penaeid species constitute the prawn fishery, a detailed study of the monthly abundance of the component species would throw valuable light on the year-to-year differences observed in the abundance of prawns. Three species namely *M. dobsoni, M. monoceros* and *M. affinis* deserve such a study as they formed 57.4% of the total prawn catch in the 4-year period. This aspect is being dealt with seperately.

The relative abundance of prawns in the various depth ranges are reflected on the catch rates and percentage composition obtained by the three types of boats. The Pablos, which on account of their smaller size and other limitations

confine their operations generally to zones less than 20 m in depth, obtained distinctly better catch rates and percentage composition of prawns, compared to Pomfrets and Sorrahs which venture to deeper zones. These results are in conformity with the findings of Sree Krishna and Narayanappa (1970) that off Kakinada the most productive grounds for prawns are in depth range, 11-15 m. Similar higher concentration of prawns in the shallower zones are reported from off Cochin by Tholasilingam *et al* (1968). Sekharan *et al* (1973) giving allowance to the limitations of their survey. for assessing the prawn resources, remarked that the region around Kakinada might be particularly promising in this connection. The present study sufficiently demonstrated the existence of rich prawn grounds off Kakinada.

Sree Krishna and Narayanappa (1970) observed that the catch per hour of trawling for prawns varied from 7.12 to 17.82 kg during different years and the average was 12.33 kg by a 9.1 m (30') boat from the same fishing grounds. This compares well with the annual average of 11.42 kg|h obtained for Pablos.

The study by Sree Krishna (1970) showed that next to prawns sciaenids are the most conspicuous ground fish off Kakinada. This is borne out well in the present study also.

While cat fishes formed 20.8% of the ground fish on the continental shelf along the north-western part of the Bay of Bengal (Sekharan *et al* 1973) they formed only 2.5% off Kakinada. Since the present study is confined to depth up to 40 metres only, and as these fishes are usually dominant in >30 m depth (Sekharan *et al* 1973), detailed studies on the grounds farther on the continental shelf off Kakinada may throw more light on these resources. Krishnamoorthi (1973) noted that along the Andhra and Orissa coasts the peak months of abundance of *Nemipterus japonicus* were generally from January to April. In the present study also peak catches for this species were obtained in February-April period.

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