VIII PRAWN GROUNDS ON THE CONTINENTAL SHELF FISHED BY TRAWLERS

By

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In the last two decades, the operations of large, medium and small trawlers of the Central and State Government organisations, the Indo-Norwegian Project and the commercial concerns have revealed good prawn grounds on the continental shelf of the coasts of India. Although most of the operations were carried out with trawls suitable for netting miscellaneous varieties of fishes, prawn catches obtained incidentally have given a fairly reliable picture of the distribution of the prawn grounds. In the following account the regional abundance of prawns is given on the basis of trawling operations carried out on the east and west coasts of India. The results are dealt below under four different divisions viz., 1. North-Western Division (Kutch to Goa), 2. South. Western Division (Karwar to Cape Comorin), 3. South-Eastern Division (Cape Comorin to Krishnapatnam) and 4. North-Eastern Division (Masulipatnam to Diamond Harbour).

PRAWN LANDINGS IN THE NORTH-WESTERN DIVISION

This division includes areas on the continental shelf between latitudes 24^0 N to 15^0 N and longitudes 66^o E to 74^oE. Six regions are recognised viz., Kutch, Dwarka, Porbundar, Veraval, Cambay and Bombay (Rao *et al*, 1966). The bull-trawling operations of the New India Fisheries vessels (*Arnala cum Paj and Satpati cum Pilotan* 250 H.P. each) in this division from 1956 to ’63 have furnished some information. In 1956 and 1963 there was no fishing by these vessels in some of the months. In the rest of the period, taking all regions into consideration, it is seen that the catch and the catch rates were the highest in 1962 and the lowest catch and the catch rate were in 1959 and 1958 respectively. Regarding the regional abundance, it is seen from Table 1 and Fig 47 that the catch and the catch rate for prawns were the highest from Cambay region, but the percentage proportion of prawns in the region ranked next to that of Bombay. The catch per hour returns have been observed to be in the decreasing order in the rest of the region i.e. Bombay, Veraval, Porbundar,

Kutch and Dwarka, The maximum monthly catch per hour returns from each region has shown a north to southward increase from Kutch (18.23 kg/hr) to Bombay (200 kg/hr).

TABLE 1

Prawn landings by the New India Fisheries Company's vessels for 1957-'62.

(after Rao *et al*, 1966)

Region	Catch in kg	Region	Catch in kg
Kutch	3,707	Veraval	2, 685
Dwarka	1,321	Cambay	11,078
Porbundar	4,351	Bombay	336

The productive areas shown in Fig. 47 are based in the maximum monthly catch rates obtained. The areas are 600 square nautical miles each. Areas 2, 3, 4, 18, 24, 38, 43 and 43A are considered highly productive as they have given over 40 kg/hr; N,K, A, 10, 11, 12, 17 and 48 are moderately rich giving between 20.1 to 40kg/hr; Y, V, S, R, Q, M, L, I, H, E, D, B, 25, 30 and 31 are fair giving between 10.1 to 20 kg/hr and the rest of the areas which have given less than 10kg/hr are considered poor.

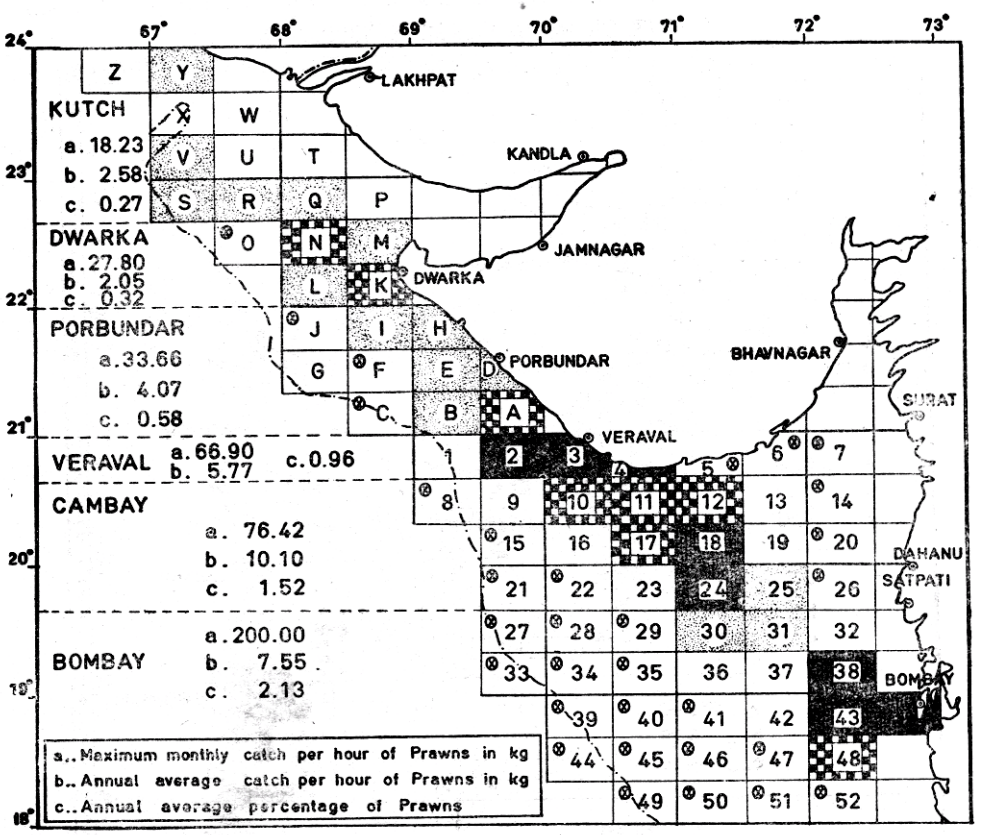
Kagwade (1967) working upon the data of New India Fisheries vessels for the eight year period has obtained very similar results.

The larger vessels viz., M.F.V. *Jheenga* (153 H.P.), M.F.V. *Meenabharathi* (260 H.P.) and M.T. *Kalyani's* III to V (300 H.P. each) of the Government of India Deep Sea Fishing Station were also fishing in this division using otter trawls. The latitude zone-wise abundance of prawns for the five year period 1963 to 1967 has been assessed and the results are shown in Fig.48. From 22^0 N latitude zone to 18^0 N latitude zone, there is an increase in the maximum monthly catch rates, annual average catch rates and the percentage proportion of prawns. South of 18^0 N latitude zone, there is a fall in the catch rates of prawns in 17^0,16^0 and 15^0 N latitude zones. Of the 3 last zones, 16^0 N latitude zone is a shade better than the other two zones. Subareas 16-73/4B; 17-72/6F; 18-72/10,1D, 1E, 3D, 4D, 5B, 5C, 5D, 5E, 6C, 6D, 6E; 19-71/3F; 19-72/10, 1D, 1E, 3A and 20-70/1D are very productive having given over 20 kg/hr; 15-73/2D, 3D;

NORTH-WESTERN DIVISION OF INDIA

REGIONAL ABUNDANCE AND PRODUCTIVE AREAS FOR PRAWNS

(N.I.F. BULL-TRAWLERS, 1957-'62)



ANNUAL LANDINGS

YEAR	CATCH kg	C.P.H kg	%
1956	12 204	4.28	0.53
1957	28 980	5.33	0.88
1958	15 210	3.00	0.42
1959	14 754	3.43	0.54
1960	22 338	4.32	0.52
1961	20 988	4.55	0.53
1962	38 604	9.78	1.09
1963	12 475	3.51	0.47
AVERAGE (1957-'62)	23 487	4.94	0.66

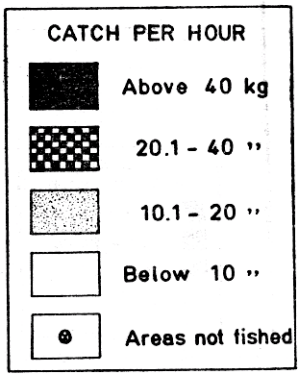


Fig. 47. Prawn landings in the North-Western Division of India fished by the commercial bull-trawlers for the period 1956-'63. Figure also shows productive areas for prawn in regions from Kutch to Bombay.

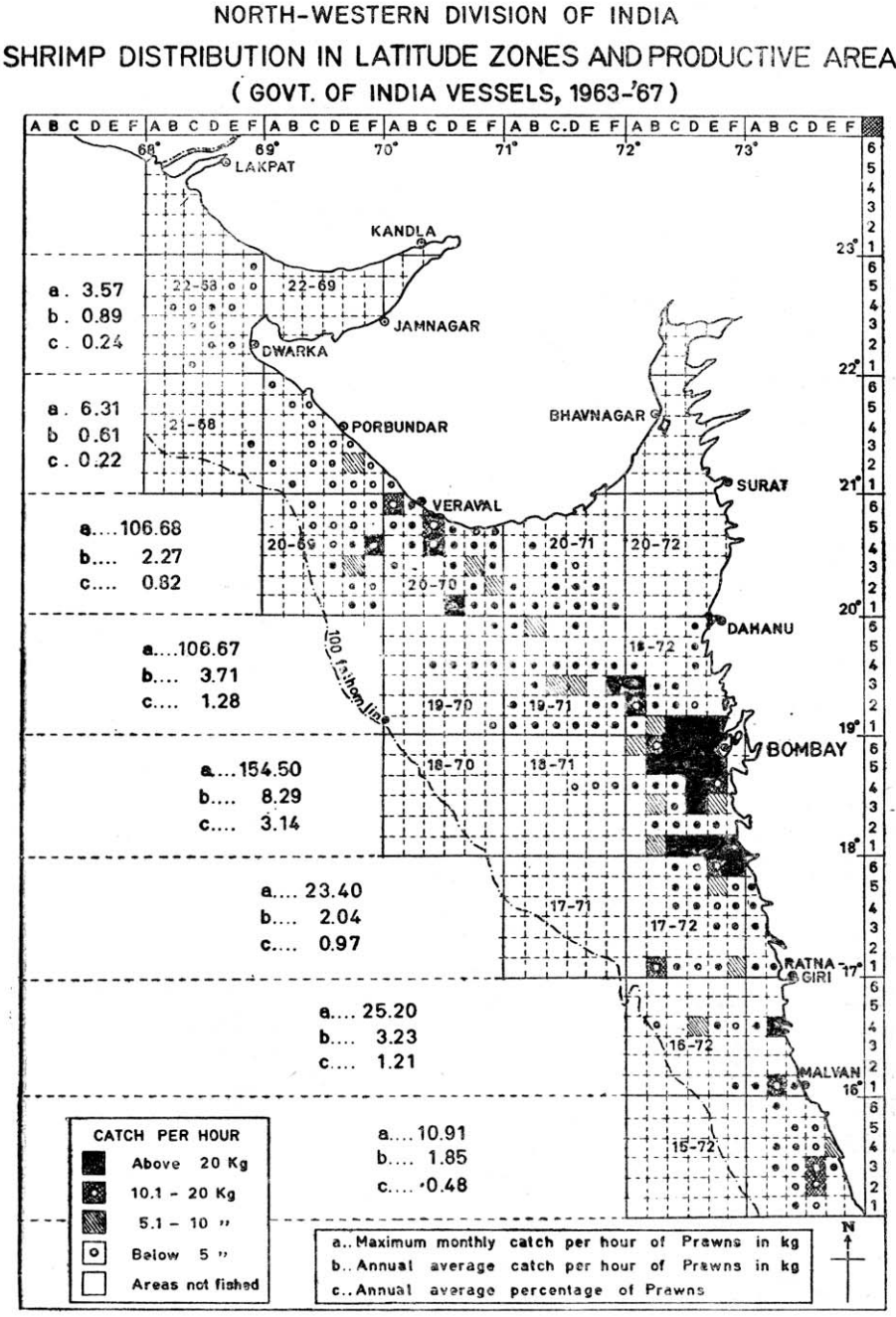


Fig. 48. Latitude zone-wise and area-wise abundance of prawns fished by the Government of India vessels of Bombay base for the period 1963-'67.

16-73/1B; 17-72/1B; 1E;18-72/1F, 4E, 6B; 19-72/2A; 20-69/4F; 20-70/40, 50 and 6A are good with 10.1 to 20 kg/hr; and 15-73/4E; 16-72/4D; 17-72/1F, 5E; 18-72/1B, 3B, 3E, 6A; 19-71/30, 3D, 6B; 19-72/1B; 20-69/3E; 20-70/2F, 3E and 21-69/E are fair giving 5.1 to 10 kg/hr. The rest of the areas fished have given below 5kg/hr.

It may be seen that the zonal or regional catch rates obtained by the bull-trawlers are higher than those of the otter trawlers. In bull -trawling the catch per hour returns are for a pair of vessels and in otter trawling they are for a single vessel. It is well known that the catch per hour returns of bull-trawling are always higher than those of otter trawling (Jayaraman *et al*, 1959 and Rao *et al*, 1968).

Prawn landings at Bombay base by the Government of India vessels for the year 1966 give a fair picture of their major area-wise and seasonal abundance in the region. The vessels finished 29,982 kg of prawns forming 6.01% of the total marine fish catch, the annual catch rate being 12.86 kg/hr of trawling. The split up figures for each quarter are given in Table II.

TABLE II

Prawn landings by the government of India vessels, Bombay base, 1966.

	1st quarter	2nd quarter	3rd quarter	4th quarter
Major areas fished	18-72, 19-72	18-72, 19-72	17-71, 17-73, 18-72	17-72
Prawn catch kg.	4, 600	17, 759	21,036	5, 587
Percentage	4.22	14.07	3.84	2.64
Catch rate kg.	5.99	29.21	10.52	7.33

Some of the hauls from Bombay region have been good for prawns with very high catch rates; in Table III, particulars of all hauls with over 200 kg in each, fished by M.F.V. *Jheenga* in 1966 are given.

TABLE III

Particulars of hauls by M. F. V. Jheenga (153 H. P.) with more than 200 kg of prawns in 1966.

Area	Date	Duration of haul in hrs.	Prawn catch (C. P. H.) in kg.	% of prawns in total catch
18-72/6E	31-3-66	1.50	500 (333.33)	70.13
”	”	1.50	501 (334.00)	68.07
”	”	1.00	200 (200.00)	63.29
”	”	1.25	230 (184.00)	42.44
”	1-4-66	1.50	350 (233.33)	56.36
”	”	1.50	400 (266.67)	54.35
18-72/6D	”	1.50	437 (291.33)	50.06
”	11-4-66	2.00	300 (150.00)	51.72
18-72/6E	”	1.50	241 (160.67)	53.92
”	12-4-66	2.00	300 (150.00)	47.92
”	”	2.00	335 (167.50)	47.99
”	15-4-66	1.50	200 (133.33)	44.74
”	16-4-66	1.50	200 (133.33)	46.95
”	”	1.50	208 (138.67)	51.23
18-72/6D	26-4-66	1.50	225 (150.00)	27.95
18-72/5D	1-11-66	1.50	235 (156.07)	25.82
18-72/6C	12-12-66	1.50	280 (186.67)	34.57

The prawns fishery off Ratnagiri has come into prominence in the past nine years. In November 1959, a single haul of shore seine landed about 25 metric tons of prawns although in a few days the catches dwindled considerably. Since then, the region has been explored and exploited regularly for prawns. The grounds lie between Harnai in the north to Vengurla in the south in the inshore areas of Ratnagiri district, about 20 miles in width along the coast. The number of trawlers has increased in this region from 3 in 1961 to 27 in 1964. In survey conducted with the help of 12 trawlers of the fisheries department of Maharashtra State from October 1963 to March 1964, a prawn catch of about 304 metric tons was obtained forming about 45 % of the total catch. Prawns catch was found to

be better in Ratnagiri (23.6%) than in Malvan (14.13%) (Ranade *et al*, 1965).

Off Dabhol ($17^0$35'N) and Vengurla (15^0 50'N) in depths from 16-22 metres, two of the larger vessels viz., *Akashi Marus* No. 23 and 25 and the smaller vessels the *Sudhas* I to VI of the New India fisheries Company, Bombay, during January-March 1967 landed about 145 metric tons of prawns. The overall catch rate for prawns in the quarter for the bigger vessels was 67.38 kg/hr and for the smaller vessels 77.90 kg/hr. Not only the catch rates but also the percentage proportion of prawns were higher for the smaller vessels (81.68%) as compared with those obtained by the bigger vessels (44.38%). During the year as a whole covering the areas north and south of Bombay, the New India fisheries vessels fished 237,246 kg of prawns which formed 22.2% at a catch rate of 48.95 kg/hr. The southern grounds have proved to be extremely productive as in the first quarter of the following year (1968) the smaller vessels had obtained 190 metric tons of prawns forming 59.38% of the total catch at 93.31 kg/hr.

In the North-Western Division, the common prawns species landed by the trawlers are *Metapenaeus affinis* (Milne Edw.), *M. monoceros* (Fabr.), *M. brevicornis* (Milne Edw.),. *Penaeus indicus* (Milne Edw.), *Parapenaeopsis stylifera* (Milne Edw.) and *P. hardwickii* (Miers). The less common ones are *Metapenaeus kutchensis* George *et al* from Kutch, *Solenocera indica* Natraj, *Palaemon tenuipes* Henderson, *Penaeus penicillatus* Aleock, *P. mondon* Fabricius and *Hippolysmata ensirostris* Kemp from Bombay and *Penaeus merguiensis* de Man off Goa.

PRAWN LANDINGS IN SOUTH – WESTERN DIVISION

The best of the prawn fishing grounds of India are located in the southern part of this division. The particulars of prawn landings by the offshore fishing vessels operating for different bases in recent years are furnished below.

a) **Karwar** (Between latitudes 14^0 N to 15^0 N and longitude 73^0 30' E to 74^0 30'E): Exploratory fishing by the medium vessels of the Indo- Norwegian Project viz., **INP-167** (24 H.P.), **Karwar1** (90 H.P.), **M1/M4**

(48 H.P.) was commenced in September 1963. In the years 1963-'64, 1964-'65 and 1965-'66 the vessles landed 11.3, 3.29 (data for one vessel not available) and 1.48 metric tons of prawns forming 6.66%, 2.2% and 1.29% of the total catches respectively, The major areas 14-73 and 14-74 have yielded fairly good catches of prawns, the latter being slightly better. 14-73/5F; 6F; 14-74/5A and 6A have been found to give good yields. The catch rates ranged from 8 to 62 kg/hr for the vessel **Karwar – 1**, 5 to 92 kg/hr for M1/M4 and 5 to 18 kg/hr for **INP – 167**. As shown in fig. 49 the maximum monthly catch rates of prawns obtained in the region for the period 1963-'67 is 225 kg/hr.

The common species landed by trawlers in Karwar are *Metapenaeus affinis*, *M. dobsoni* (Miers), *Parapenaeopos stylifera* and *Penaeus merguiensis*.

b) **Mangalore** (Between latitude 12^{o} 10' N to 14^{o} N and longitude 73^{o} 30^{o}' E to 75^{o}E) : The Government of India exploratory fishing vessels (M.F.V. *Tarpon* (42 H.P.), M.V. *Samudra* (42 H.P.) and M.V. *Sagarvihari* (42 H.P.)) and a large number of mechanised boats of the Directorate of Fisheries of Mysore State have operated from this base providing information on the existence of rich prawn grounds in this region. The catch particulars are furnished in the Table IV.

TABLE IV

Prawn landings by the Government of India vessels and mechanised boats of Mangalore base, 1963-'64 to 1966-'67.

Year	Government of India vessels			Mechanised boats	
	Catch kg	C. P. H. kg	%	Catch kg	%
1963-´64	12,659	31.72	14.74	540,888.5	16.93
1964-´65	6,493	10.34	10.40	582,877.0	18.18
1965-´66	7,478	18.97	18.03	1135,948.0	28.87
1966-´67	..	..	..	1007,996.0	25.03
1967-´68	..	..	..	996,231.0	26.05

The Government of India vessels operated off Mangalore, Malpe and Coondapore. Some of the subareas in the two major areas viz., 12-74 and 13-74 have proved to be very productive. In 1963-'66 in some of the months from subareas 12-74/3E, 4E, 4F 5D, 5E, 6E; 13-74/1D, 1E and 3D the catch rates for prawns were over 50 kg/hr up to 360 kg/hr. The catch rates (monthly maximum and annual average) and the percentage proportion of prawns in the total catches have been observed to be very much higher in this region than in Karwar (fig. 49).

The mechanised boats of the Fisheries Directorate operating in the inshore grounds at Mangalore and Malpe have landed quantities of prawns forming a big proportion in the total landings (Table IV). The prawn percentage in the total catch was higher at Mangalore (35%) than at Malpe (3.6%).

The common prawn species landed by trawlers in this region are *Metapenaeus affinis, M. dobsoni, Parapenaeopsis stylifera* and *Penaeus indicus*.

c) **Cannanore** (Between latitudes 11^0 20'N to 12^0 10' N and longitudes 74^0 E to 73^0 40' E):- The vessels of the Indo-Norwegian Project (*Ashtamudi, Norind* (48, H.P.) AND *M1/M4*) explored the inshore region up to 20 fathoms. The operations were commenced in 1963. In 1963-'64, 66.16 metric tons of prawns were obtained which formed 49.72% in the total catch; in the following year 18.107 metric tons of prawn catch was obtained forming 19.66% of the total fish. In th subsequent years the landings by the Indo-Norwegian Project's vessels were still poorer. In the four year period the catch rates had shown a very much downward trend from 151.3 kg/hr in 1963 to 53.5 kg/hr in 1964, 16.3 kg/hr in 1965 and 27.7 kg/hr in 1966. Areas 11-75/5B, 5C, 6A, 6B and 12-75/1A had given monthly catch rates ranging from 25 to 73 kg/hr.

The mechanised boats operating in the region in 1966-'67 have obtained a fairly high estimated catch of 130.483 metric tons of prawns forming 32.85% of all fish; the yields were still better in 1967-'68, being 896.984 metric tons forming 67.31% of all fish.

The common prawn species landed by trawlers in Cannanore were *Metapenaeus affinis, M. dobsoni, Parapenaeopsis stylifera* and *Penaeus indicus.*

d) **Cochin** (Between latitudes 7^0 30' N to 11^0 20'N and longitudes 75^o 50'e to 78^oe): This region is well known for prawn grounds which are comparable to the world's best grounds in Mexico and the United States of America. Prawn fishing with indigenous non-mechanised craft and gear in the inshore region and the backwaters is an ancient occupation in Kerala, but the introduction of mechanised craft and particularly fishing with trawlers is more recent. In 1956 *Ashok* and *Pratap* (240 H.P. each) commenced trawling (bull-trawling) in the region, followed in the subsequent years by a number of other trawlers belonging to the Government of India, Offshore Fishing Station. Large and medium trawlers of the Indo-Norwegian Project and several commercial concerns, besides a number of smaller mechanised craft of the fisheries co-operative and processing concerns are now regularly operating from this base for prawn fishing.

Bull-trawling operation by *Ashok* and *Pratap* in 1956-'59 period, in grounds between Cannanore and Wadge Bank resulted in rather low yields of prawns which constituted about 1.3% of the total fish catches. In Table V are given the catch particulars of the prawns by some of the trawlers in recent years. A downward tend is seen in the catch rates of prawns obtained by the Government of India vessels for all the years from 1963-'64 to 1967-'68. The Indo-Norwegian Project's medium vessels also showed a downward trend in the catch rates, but only up to 1965-'66 and then an increase. As compared with these results, the catch rates of prawns by the cochin company's vessels were more or less steady in the entire period, the reason being that these vessels were seeking to find productive grounds only for fishing.

In areas explored by the government of India vessels for the period 1963-'66, the following graded pattern of catch rates was observed. In 9-75/5F and 9-76/5B the catch rates for prawns were over 40 kg/hr: in 9-76/2B, 4B, 6A, 6B; 10-75/1E, 5F; 10-76/1A and 11/75/1D the catch rates were from 21 to 40 kg/hr; in 9-75/6f; 9-76/1A, 1C, 4A, 5A; 10-75/1F, 4E;

10-76/1B, 4a; 11-75/1E and 1F they were from 10 to 20 kg/hr. Areas 8-76/4D, 4E; 9-75/6E; 9-76/1B; 10-75'2F, 3E, 3F, 4E, 5E, 6F; 10-76/2A and 11-75/1C gave below 10 kg/hr.

TABLE V

Landings of prawns in Cochin by some trawlers, 1963-'64 to 1967'68

	1963-´64	1964-´65	1965-´66	1966-´67	1967-´68
Govt. of India vessels:					
Catch kg	44,160	27,508	18,587	40,626.5	12,947.5
Catch/hr. kg	47.01	19.61	15.80	16.50	9.65
Percentage	37.01	17.16	14.13	20.57	11.65
INP median vessels:					
Catch kg	20,323	3,546	3,901	25,730	103,334
Catch/hr. kg	23.49	17.04	13.96	14.28	23.00
Percentage	20.68	14.21	13.17	25.59	44.96
INP larger vessels:					
Catch kg	…	…	…	19,992	41,526.5
Catch/hr. kg	…	…	…	30.75	34.07
Percentage	…	…	…	27.38	12.80
Cochin Company's vessels:					
Catch kg	…	14,112*	55,168	88,856.5	59,207
Catch/hr. kg	…	18.38	20.69	24.83	23.12
Percentage	…	9.16	27.90	36.62	45.67

* 3 months fishing only.

The research vessels *Kalava* (120 H.P.) and *Varuna* (400 H.P.) and some of the larger exploratory fishing vessels viz., *Klaus Sunnana* (220 H.P.), *Tuna* and *Velameen* (480 H.P. each) of the Indo-Norwegian Project fishing in the deeper waters beyond the continental shelf have landed prawn species *Aristeus semidentatus* (Bate), *Penaeopsis rectacuta* (Bate), *Metapenaeopsis* spp., *Parapandalus spinipes* De Man, *Plesionika martia* (A.M. Edw.), *Heterocarpus gibbosus* (Bate), *H. Wood-masoni* Alock, *Oplophorous gracilorostris* A.M. Edw., etc. the existence of which was hitherto not known. Some of the

species were found in dense populations to support fisheries if the grounds are further and carefully exploited (George, 1966; George & Rao 1966; Menon 1968).

The productive areas fished by the larger INP vessels giving monthly catch of over 200 kg/hr of prawns in the period 1967-'68 in the region between Alleppey and Quilon are given in Table VI.

TABLE VI

Productive areas giving over 200 kg/hr, fished by INP larger vessels 1967-'68.

Area	Vessel	Month	Depth (metres)	Catch/hour (kg)
8-75/5D	*Klaus Sunnana*	December ´67	289	285.00
8-75/5E	*Velameen*	February ´68	348	260.50
8-75/6D	"	January ´68	342-353	273.33
8-75/6E	"	"	342-346	214.44
9-75/1E	*Klaus Sunnana*	December ´67	320-358	248.57
"	*Tuna*	January ´68	351-366	309.64
"	*Velameen*	February ´68	348	244.09
9-75/1F	*Tuna*	December ´67	344-366	415.93
"	"	January ´68	366-369	206.31

The New India Fisheries Company's vessels at cochin base in the five year period from 1963-64' to 1967-'68 have landed, 11, 442 metric tons of prawns and fish sold at about Rs. 2.82 crores. The annual average landings were 2, 288 metric tons.

It may be mentioned here that usually very heavy prawn catches are landed by the mechanised boats at Azhikode fishing centre also. In 1962-'63 a prawn catch of 449.4 metric tons was landed at 50.35 kg/hr forming 73.0% of the total; the corresponding figures for 1963-'64 being a catch of 159.8 metric tons at 37.97 kg/hr forming 70.73% (Data C.M.F.R.I. Annual Reports 1962-'63 and 1963-'64).

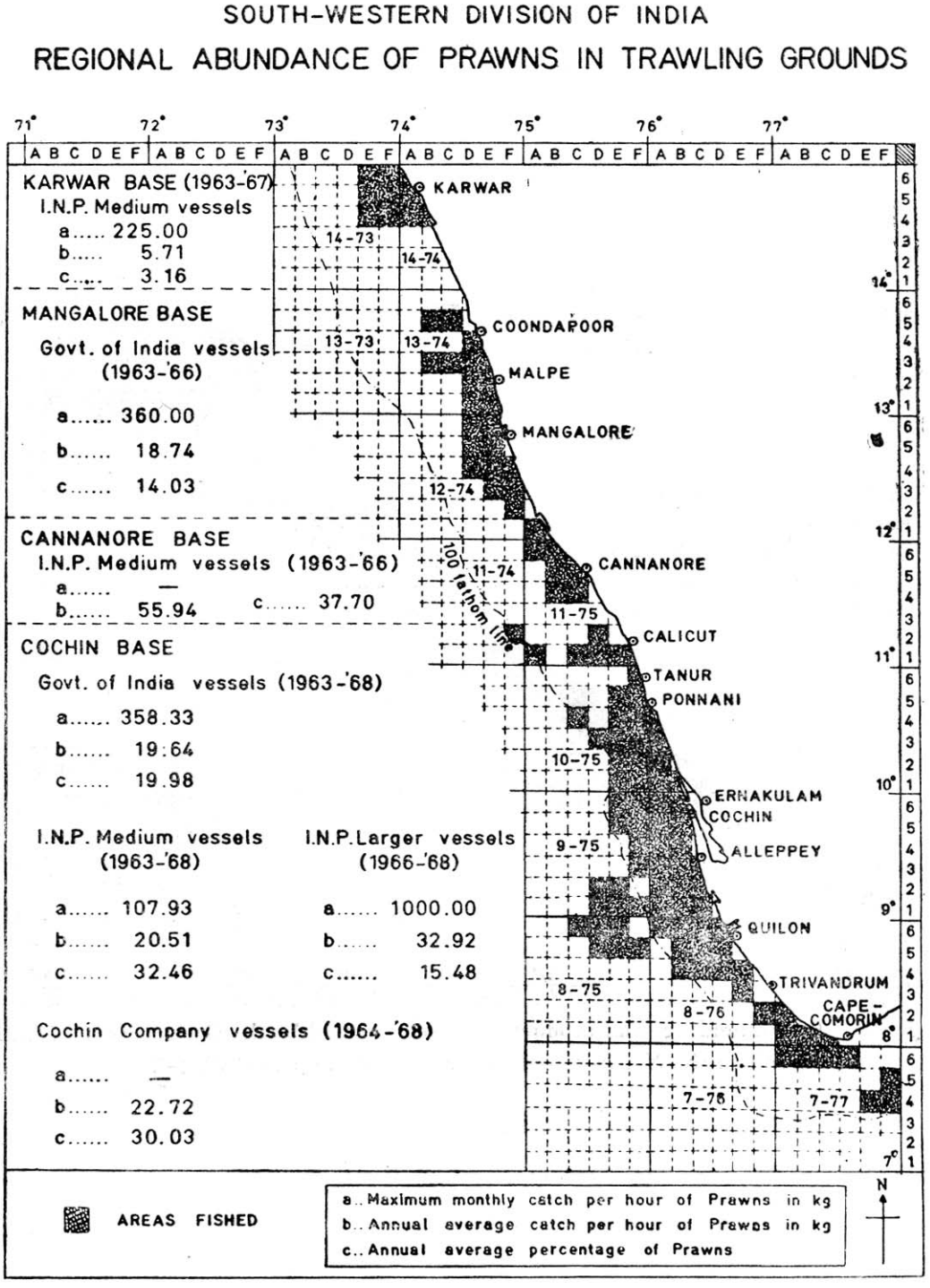


Fig. 49. Regional abundance of prawns in trawling grounds of the South-Western Division of India from Karwar to Cape Comorin.

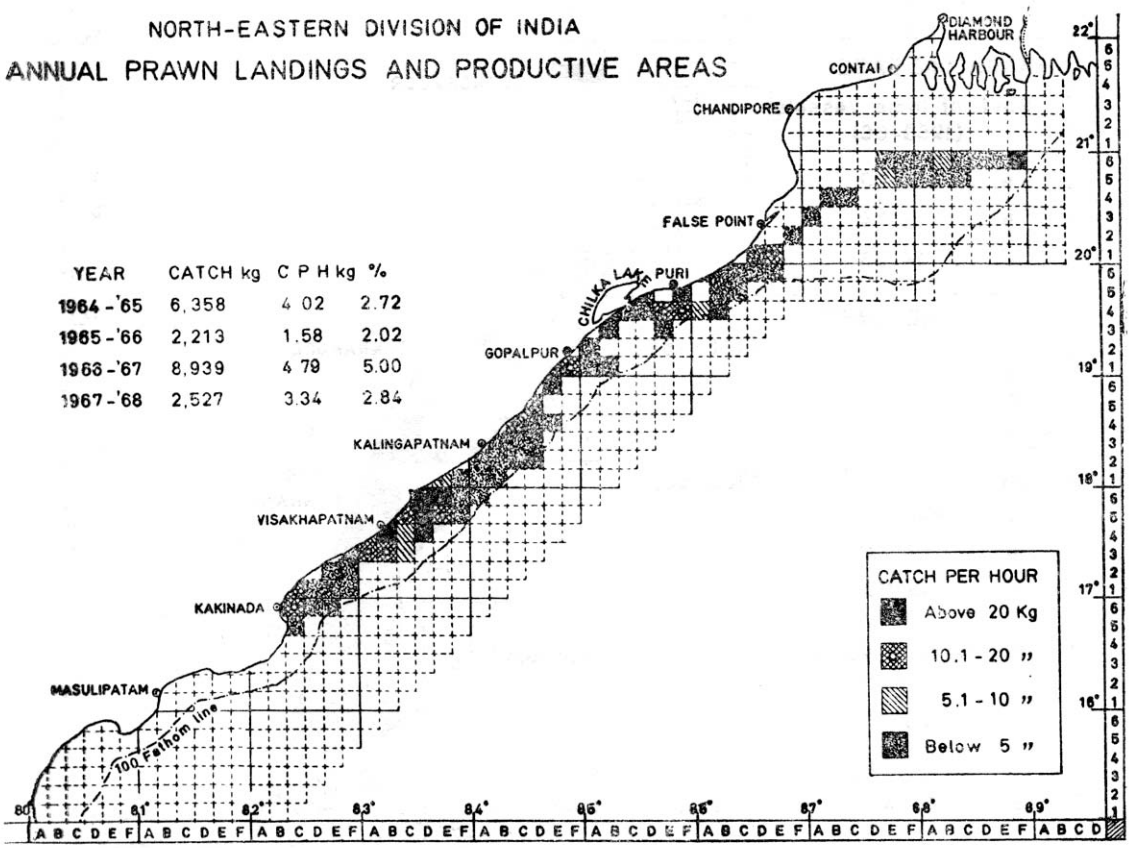


Fig. 50. Prawn landings and productive areas revealed by the Government of India vessels in the North-Eastern Division for the period 1964–'68.

All the areas covered by the powered fishing vessels operating from cochin base for the period 1963-'68 are shown in Fig. 49. The maximum monthly catch rates of prawns for different groups of vessels are very high. The highest catch rate registered by INP larger vessels in 1000 kg/hr. The annual average catch rates and the percentage of prawns in total catches are also very high, but they seem to rank next to the corresponding values obtained by vessels which operated from Cannanore base. Cochin is undoubtedly the best region for prawn grounds. In this region the vessels have operated almost all round the year except when the weather was very unfavourable during monsoon whereas in Cannanore fishing during the years for which the average have been estimated was confined to the seasons in which the prawns were best obtained. Further during 1963 the catch rates at Cannanore were exceptionally high (151.3 kg/hr), although in subsequent years the annual catch rates ranged only between 16.3 kg/hr and 53.5 kg/hr. It is due to these differences that the annual average catch rates and the percentage proportion of prawns are found higher from Cannanore than in cochin.

The common species supporting marine prawn fishery at present in Cochin region are *Metapenaeus dobsoni, M. affinis, M. monoceros, Penaeus indicus* and *Parapenaeopsis stylifera*. It may be noted that the giant prawn *Macrobrachium rosenbergii* (de Man) does not support a fishery in the coastal or offshore waters, although fairly common in backwaters and rivers.

PRAWN LANDINGS IN SOUTH-EASTERN DIVISION

The marine fish catch of the east coast is only about a fifth of the total catch form both the east and west coasts. Prawn landings too are considerably less on the east coast forming only about 10% of the total prawn production of India. However, fairly good prawn grounds are now known to occur in several regions on east coast as revealed by the trawling operations of vessels belonging to different agencies.

a) **Tuticorin**: With Tuticorin as the base of operations, the vessels of the offshore fishing station of the Government of India which was

opened in 1959, surveyed trawl fishing grounds (latitude 8^0 N to 12^0 10'N and longitude 77^0 e to 81^0 E) in the vicinity of Tuticorin (Major areas 8-78, 9-78 and 9-79) and Pondicherry (major areas 11-79, 11-80, 12-79 and 12-80). In the period from 1960-'66 good prawn catches were obtained only from the major area 8-78 near Tuticorin. Possibly some good grounds may be near Pondicherry region also but the few operations carried out so far did not reveal any productive areas.

The Government of India fishing vessel M.V. *Sagarsundari* (42 H.P.) during 1966-'67 obtained 19, 492 kg of prawns at 29.11 kg/hr forming 12.07% and in 1965-'66 a catch of 4,670 kg at 8.21 kg/hr forming 5.59% of the total catch. In 1966-'67 the subareas 8-78/4B proved to be very good with an annual catch rate of 30.63 kg/hr, followed by 4C with 19.24 kg/hr and 5B with 3.21 kg/hr. In 1965-'66 prawn yield rates in the respective areas were 19.12 kg/hr, 6.51 kg/hr and 1.71 kg/hr. Prawns being of good size for export trade and the yield rates being high in some of the earlier years there was in the year 1967-'68 a more intensive exploration, some of the vessels from Bombay having been shifted to this base for the purpose. However, there was a fall in the total catch (9,958 kg), catch rate (4.94 kg/hr) and the percentage proportion (3.53%) of the prawns fished by the vessels; the highest monthly catch rate was only 20.32 kg/hr. These results appear to indicate that the high yields of prawns are rather sporadic than regular in this region.

b) **Mandapam**: The medium vessels of the Indo-Norwegian Project using shrimp trawls fished up to 20 fathomas depth in Palk Bay (latitudes 9^0 20'N to 9^0 40'N and longitude 79^0 E to 79^0 10'E) and the Gulf of Mannar (latitudes $8^0 5^0$'N to 9^0 15'N and longitude 79^0 e to 79^0 30' E). in 1965-'66 the total catch by two vessels was 175, 663 kg of which prawns formed about 1%. Prawns from the Gulf of Mannar region formed 1.41% and from the Palk Bay region 1.05% of the total regional catches. In 1966-'67 the total catch by trawling was 54,929 kg of which prawns formed 0.95%. After March 1967 the vessels stopped fishing operations from this base. 5 to 20 kg/hr of prawns were obtained from a large number of areas in the Gulf of Mannar (8A, 9A, 9B, 10A, 10B, 14B, 15B, 15D, 16D and 17C) and from very few only in the Palk Bay (2A and 3A).

In the South-Eastern Division *Penaeus indicus, P. monodon, Metapenaeus dobsoni, M. affinis* and *M. monoceros* are the common species landed.

PRAWN LANDINGS IN NORTH-EASTERN DIVISION

As compared with the south-Eastern Division, this division is slightly better for prawn yields in offshore fishing grounds. Fairly productive grounds off Kakinada, Visakhapatnam and in the vicinities of Chilka lake have been located in the exploratory fishing operations. However, intensive offshore fishing surveys for prawns using shrimp trawls have not so far been undertaken in this region.

a) **Kakinada**: Experimental shrimps trawling with 30 and 32 ft. mechanised boats with 30 and 45 H.P. engines have been tried off kakinada by the Research Unit of the Central Institute of Fisheries Technology and the Training Institute of the Andhra State Fisheries Department in grounds between latitudes 16^0 50'N & 17^0 10'N and longitude 82^0 20'E & 82^0 30'E. Grounds which are fairly productive off Uppada and Hope Island have been located (Anon; 1967). Some of the catch particulars of prawns are given below.

Year	Results of operations by boats of					
	Central Institute of Fish. Tech.			Training Institute of A. S. F. D.		
	Catch kg	C. P. H. kg	Percentage	Catch kg	C. P. H. Kg	Percentage
1964	7,304.5	11.75	22.83	5,927	9.39	18.11
1965	8,806	15.45	20.00	40,103	3.99	14.11
1966	5,887	9.66	28.07	3,512	5.29	12.08

b) **Visakhapatnam** : Since 1959, when the Offshore Fishing Station was opened, the Government of India fishing trawlers have explored the fishery resources of a long strip of continental shelf, off the coast of Andhra and Orissa States, between the river mouths of Godavari and Mahanadi. In the annual landings by trawlers prawns formed 2 to 3% of the total catches. In 1966-'67 the prawn landings were much higher than in the previous years.

The annual landings of prawns, their catch rates and the percentage proposition in total landings are given in fig. 50. The latitude zone-wise maximum monthly catch returns are given below.

Year	Latitude zone	Highest monthly catch/hour kg
1964-´65	$17^0 – 18^0$ N	9.40
	$18^0 – 19^0$ N	13.57
	$19^0 – 20^0$ N	13.50
	$20^0 – 21^0$ N	4.20
1965-´66	16^0 40´ N	3.00
	17^0 40´ N	6.80
	18^0 10´ N	7.13
1966-´67	17^0 40´ N	13.10
	18^0 10´ N	22.20
1967-´68	17^0 40´ N	25.10

There is in general an increase in prawn landings from southern to northern latitude zones. Grounds in the vicinity of Chilka Lake in the latitude zone $19^0 – 20^0$ N and those in the next below southern latitude zone of $18^0 – 19^0$ appear to be fairly productive.

Based on the results of the Government of India fishing vessels operating from this base during March 1963 to April 1968, the productive areas for prawns are shown in fig. 4. In some months areas 17-83/4B, 4D, 5D, 6D, 6E and 20-886F have given over 20 kg/hr of prawns: 17-83/3A, 3B, 5C, 5E; 18-84/4c, 5D; 19-84/1F; 19-85/4E, 4F and 20-86/1E between 10.1 and 20 kg/hr and 17-83/3C, 4A, 4C; 18-82/1E; 19-86/4A; 20-87/5E and 20-87/5E and 20-88/6B between 5.1 and 10 kg/hr.

c) **West Bengal**: from 1950-'51 to 1961-'62 two Danish cutters and three Japanese type of trawlers (M.T. *Kalyanis* I to V – 300 H.P. each) of the Directorate of Fisheries of the West Bengal were used for intensive surveys and commercial exploitation of the fishing grounds off Gopalpur in the south to Diamond Harbour and adjacent areas in the north. Fairly productive grounds have been found for demersal fishes in general but not for

prawns. In 1957 the prawn yield was 6.1 metric tons (forming 1.26% in total catch) at 235.11 kg/voyage; in 1958, 6.3 metric tons (1.81%) at 204/kg/voyage and in 1959, 1.4 metric tons (0.55%) at 64.42 kg/ voyage.

Based on observations made on board the vessels in 1960, it has been found that proportion of prawns in the regional catches was the highest being 2.22% in the Eastern Channel (latitude 20^0 52' N to 20^0 55'N and longitude 88^0 05 E to 88^0 30'E), followed by 1.73% and 1.23% in the landings from the grounds, off Debi-Prachi Rivers (latitude 19^0 54' N to 20 N longitude 86^0 27' E to 86^0 30' E) and Western Channel (latitude 20^0 50' N to 20^0 55' N and longitude 87^0 50' E to 87^0 52' E) respectively; prawn percentage was poor being 0.5 in grounds off Mahanadi (latitude 20^0 05' N to 20^0 11' N and longitude 86^0 35' E to 86^0 47' E) and 0.69 off Black Pagoda (latitude 19^0 45' N to 19^0 49' N and longitude 86^0 11' E to 86^0 24' E).

In the North-eastern Division as a whole, *Penaeus indicus, P. mondon, P. semisulcatus* Alock, *Metapenaeus dobsoni, M. affinis, M. monoceros, M. brevicornis, Parapenaeopsis sculptilis, Solenocera indica* are common.

CONCLUSION

The major component of the prawn landings by the mechanised vessels is constituted by the penaeid prawns which as far as is known spend their life histories in two environments viz., the marine and the estuarine or brackishwater environments, exception to this being *Parapenaeopsis stylifera* which spends its entire life in the marine environment. Other penaeid prawns like *Penaeus indicus, Metapenaeus affinis*, etc. bread in the sea either in the shallow water or a little beyond in the deeper waters, The eggs, larvae and post-larvae of most species are found abundant in the inshore waters in certain seasons. The younger stages migrate to the estuarine or brackishwater environments, where they grow to fairly large size and migrate back into the sea, where sexual maturity is attained for spawning to complete the life cycle. , Because of these migratory habits the abundance of penaeid prawn resources is relatively much higher in the

shallower depth zones of the inshore than in the very deep waters. Rao *et al*, (1968) have stated that high catch rates for prawns were observed from the shallower and also the deeper depth zones up to 80 metres in some of the latitude zones in the Bombay-Saurashtra waters, but taking all latitude zones together the relatively greater abundance of the prawns was from the shallower grounds up to 30 metre depths. The results of bottom trawling in the Indian seas by R.V. *Anton Brunn* have also shown that the prawn catches were mostly from shallower depths (Hida and Pereyra, 1966).

In Cochin region the major portion of the catches of prawns come from the shallower depth zones up to 24 metres, the highest prawns percentage observed being from 15 to 19 metre depth zone (Rao, 1968). There seems to be also variation in the species distribution in the different depth zones. In depths from 14 to 20 metres *Metapenaeus dobsoni, Parapenaeopsis stylifera, M.affinis, M. monoceros* and *Penaeus indicus* were in the order of abundance, where as in depths between 21 to 27 metres *Penaeus indicus* dominated over *M.monoceros* and *M. affinis.* In still deeper waters up to 35 metres *P. indicus* and *M. affinis* were of equal abundance (Annual Report, CMFRI, 1967).

The contribution of non-penaeid prawns Like *Palaemon tenuipes* to the inshore fishery especially in the north-western region is fairly high but their proportion in the offshore fishery is very negligible. That the pandalids like *Parapandalus spinipes* along with few other deep sea prawns as stated earlier occur in depths beyond 100 fathoms in some concentrations is now well established but the extent to which they can be harvested yet remains unexplored.

Regarding the fishing season for prawns in the inshore waters Mohamed (1967) states that the period generally extends on the west coast from November to May and on the east coast from December to August. Fishing is generally suspended during the monsoon but in the Gulf of Kutch and in the regions where there is formation of 'Mud Banks' in Kerala, some good catches of prawns are obtained even during monsoon months. In the offshore fishing grounds from Bombay to Kutch, Kagwade (1967) states that the prawns occur throughout the year but the catches begin to increase

from March onwards, the best months of fishing being July to October and in some regions extending even up to December. Rao *et al* (1968) states that in the offshore fishing ground in the latitude zone from 15° N to 22° N in the north-western division prawns generally show two peaks, the first in April-May and the second in about October. The seasonal pattern of movements in different depth zones in the annual cycle for some of the regionally important penaeid prawn species is given by George *et al* (1968). For instance in *M. monoceros* the offshore migration commences from November and by about April those above 80 mm size move into the depth zones 9.1 to 18.3 metres and by June all around 95mm size move into the deeper waters of 18.3 to 27.4 metres. It has also been observed that in still deeper waters prawns of large size only have been encountered. *P. stylifera* which does not enter the backwaters at all in its life history, is comparatively more abundant in deeper waters up to November but gets dispersed subsequently to shallower zones.

The efficiency of the gear is one of the main factors determining the catch per unit effort. The types of gear used in exploratory fishing operations, detailed in the earlier section, are varied. The New India Fisheries Company's vessels from Bombay base were operating the bulltrawls, the specifications of which are given by Kagwade (1967). The Government of India vessels at various bases were using mostly otter trawls and in a few cases of shrimp-trawls. These are of varied specifications suited to different types of vessels using them, the details of which are given by Rao *et al* (1968) and Rao (1968). The Indo-Norwegian Projects's vessels at all bases were operating mainly shrimp-trawls. For comparison in this paper the results obtained by similar types of vessels only are taken into consideration for assessing the regional abundrance. The recent findings have shown that the efficiency of the gear can be considerably increased by suitably modifying some ot the specifications of the gear (Kurian, 1965). By attaching a tickler chain to a 10 foot beam trawl net, it was found that the catch of the prawns increased by 47%, but this had no effect on the fish catches. To the otter trawls the attachment of the tickler chain increased the prawns landings by

71%. The increase in catch in apparently due to the disturbance caused by the movement of the chain attached to the foot rope (Anonymous, 1962). The dragging of the heavy iron chain for scaring the prawns has been in vogue in prawns fishing in Kerala backwaters (Panikkar and Menon, 1956) The prawns catches in an otter trawl were more when the number of floats attached to the net was less, bringing about a comparatively less bouyancy on the head rope. When additional wings were attached to the otter trawls a 50% increase in the prawns catch was noticed, but this needs confirmation as the results obtained from different regions showed significat diffrerence (Kurian *loc. cit.*).

It has also been found that for a shrimp trawl a deep belly is not necessary and that by reducing it by one-third, a considerable saving of the nylon or cotton can be effected without decreasing the efficiency of the trawl (Mhalathkar and Krishna Iyer, 1967).

The rapid introduction of small, medium and larger types of trawlers in the Cochin region has no doubt increased to total volume of the prawn landed in recent years, but the catch per unit of effort has condierably decreased. Very recently the exploratory and commercial fishing operations have shown an abundance of economic varieties of prawns in the grounds off Bombay, Ratnagiri and Goa. Instead of increasing any further fishing effort in Cochin region it is desirable that the as yet not adequately exploited resources elsewhere are tapped to a greater extent than is obtained at present. It is generally stated that the facilities for handling the catches at these newly discovered centres are sadly lacking. If adequate facilities for cold storage, freezing and processing are provided at Bombay, Ratnagiri and Goa the locally available resources can be satisfactorily exploited to earn the much needed foreign exchange.