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Observations on the prawn fishery off Sakthikulangara in the light of monsoon trawling ban

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Abstract

Sakthikulangara is the most important prawn landing centre in Kerala. Study on the prawn fishery exploited by shrimp trawlers for a period of 15 years during 1986-2000 at this centre indicated a decline in the landings in the first five year period followed by improved fishery between 1991 and 1995. However, decline in catch and catch rate was registered in the next 5 years. Contribution of Sakthikulangara to the Kerala prawn fishery declined from 51% in seventies to 30% in eighties and 24% in nineties. 'Karikkadi' (*Parapenaeopsis stylifera*) contributed to 68% of the average annual production during 1986 - 2000. Extension of trawling to middle shelf waters and introduction of night trawling transformed the complexion of prawn fishery in the nineties with the addition of nonconventional species such as *Trachypenaeus curvirostris, Solenocera choprai* and *Penaeus canaliculatus*. Analysis of data on prawn fishery at Sakthikulangara for a period of 20 years (1981-2000) to study the impact of ban on monsoon trawling has indicated that trawling ban for a short duration of 45 days in the first half of the season is advantageous to the 'Karikkadi' fishery.

Introduction

Sakthikulangara is one of the leading prawn fishing centres in the country and enjoys a unique position in the prawn fishing map of Kerala. This centre contributes maximum prawn landings in the trawl sector in Kerala. Prawn landings at Sakthikulangara reported in this paper include the prawn catch landed by shrimp trawlers at the nearby Neendakara Fishing Harbour. Trawling, the most effective fishing method to exploit demersal resources, was initiated in the state by Indo-Norwegian Project. This project had its beginning at Neendakara in 1953. All the major initiatives in the trawl sector in the state had the roots at Sakthikulangara. Monsoon trawling which boosted the marine prawn production in Kerala was initiated at Sakthikulangara in the first half of seventies and this centre all alone contributed to 53% of the prawn landings in Kerala during this period. Until mid-eighties prawn fishing in Kerala was mainly aimed at conventional species such as *Metapenaeus dobsoni* (Poovalan) , *Parapenaeopsis stylifera* (Karikkadi), *Penaeus indicus* (Naran) and *Metapenaeus affinis* (Kazhanthan) and the trawling was confined to near shore waters. In the second half of eighties trawling was extended to deeper waters, which changed the complexion of prawn fishery in Kerala with the availability of a large number of non conventional species. This step had its beginning at Sakthikulangara . In 1999 coastal shrimp trawlers based at

Sakthikulangara ventured into deep sea fishing operations opening up, a new chapter in the deep sea fishing history of the country. In short, the success or failure of the prawn fishery in Kerala is largely determined by the performance of shrimp trawlers based at Sakthikulangara.

George *et al* (1980) studied in detail the prawn fishery of Sakthikulangara-Neendakara region for the period from 1973 to 1979. As a follow up to this report, an intensive study of monsoon prawn fishery from 1980 to 1982 was undertaken by George *et al.* (1983). Suseelan *et al* (1982) reported the availability of potential new resource of prawns such as *Trachypenaeus curvirostris, Penaeus canaliculatus* and *Solenocera choprai* from Neendakara area. Details of the deep sea prawn fishery of 'Quilon Bank' during 1999-2000 had been given in detail by Rajan *et al.* (2001).

The present communication deals with the prawn resources exploited by shrimp trawling in the inshore waters of Sakthikulangara over a period of 15 years from 1986 to 2000 and reflects the changes that have taken place during this long duration in the light of monsoon trawling ban implemented by Government of Kerala.

The authors are thankful to Dr. Mohan Joseph Modayil, Director, Central Marine Fisheries Research Institute, Cochin and Dr. E.V. Radhakrishnan, Head, Crustacean Fisheries Division, CMFRI for encouragement.

Data base: The catch and effort data was provided by Fishery Resources Assessment Division of Central Marine Fisheries Research Institute. Species composition of the fishery was based on the weekly observations carried out by Crustacean Fisheries Division of CMFRI between 1986 and 2000.

Craft and gear and fishing grounds

Small and medium sized trawlers (26-65 ft OAL) operating 2 or 4 seam shrimp trawl nets with cod end mesh size of 20 to 25 mm were engaged in prawn fishing. Small trawlers were engaged in single day fishing confining the operations upto to 30 m in non- monsoon months. These operations were mainly targeted at conventional species such as *P. stylifera* and *M. dobsoni*. Multiday and night trawling operations extended upto 60 m was mainly aimed at non conventional prawn species such as 'Pullan' (*T. curvirostris*), 'Ocean black' (*P. canaliculatus*) and 'Ridge back shrimp' (*S. choprai*). In the monsoon months, trawling was mainly carried out at depths between 30 and 60 m targeting 'Karikkadi' prawn which migrate to deeper grounds.

General trend of prawn production

Yearwise catch, effort, species composition and catch rate on the prawn fishery for the period 1986-2000 are given in Table 1. The data was segmented into 3 blocks of 5 years and average of each block is presented.

Catch: Annual prawn catch ranged between a minimum of 4046 t in 1989 and

Table.1 *Details of prawn landings (t) at Sakthikulangara by shrimp trawlers during 1986-2000*
(Species composition in percentage given in parenthesis)

Year	No. of boat trips	Trawling hours	*P. indicus*	*P.monodon*	*P.semisulcatus*	*P.canaliculatus*	*M. monoceros*	*M. affinis*	*M.dobsoni*	*P.stylifera*	*T.curvirostris*	*S.choprai*	Others	Total prawn catch(t)	Catch/hr (kg)	Catch/boat trip (kg)
1986	120779	660242	588	-	15	55	191	19	365	5594	136	-	6	6969	10.6	57.7
1987	139326	733361	752	-	58	65	87	205	1046	10509	166	-	4	12892	17.6	92.5
1988	159138	696288	647	4	133	20	139	302	556	7251	183	-	1	9236	13.3	58.0
1989	110458	448226	209	2	8	2	143	267	388	2795	209	-	23	4046	9.0	36.6
1990	146614	590441	1210	2	16	144	271	10	819	5276	965	69	-	8782	14.9	59.9
Average																
1986-1990	135263	625712	681	2	46	57	166	161	635	6285	332	14	7	8386	13.4	62.0
%			(8.1)	-	(0.5)	(0.7)	(2.0)	(1.9)	(7.6)	(74.9)	(4.0)	(0.2)	(0.1)			
1991	155939	806954	1138	7	70	268	301	358	2511	7537	1781	176	-	14147	17.5	90.7
1992	176413	853824	650	4	43	308	241	306	943	11266	1599	73	-	15433	18.1	87.5
1993	178009	857056	547	9	3	131	293	90	1701	13041	1196	56	71	17138	20.0	96.3
1994	191189	1016258	602	1	26	195	575	267	641	7599	2078	357	8	12349	12.2	64.6
1995	153982	871156	189	-	13	112	204	509	404	12391	1199	54	2	15077	17.3	97.9
Average																
1991-1995	171106	881050	625	4	31	203	323	306	1240	10367	1571	143	16	14829	16.8	86.7
%			(4.2)	-	(0.2)	(1.4)	(2.2)	(2.1)	(8.4)	(69.9)	(10.6)	(0.9)	(0.1)			
1996	164503	1117443	501	-	18	214	458	603	805	7497	2574	364	-	13034	11.7	79.2
1997	141412	1233766	415	13	103	202	686	48	1424	4933	2147	366	221	10558	8.6	74.7
1998	126185	1191237	393	9	13	196	661	121	529	6293	2175	336	57	10783	9.1	85.7
1999	114358	1422074	214	2	84	186	614	48	1043	3525	1368	356	-	7440	5.2	65.1
2000	97685	1059567	213	7	14	39	717	-	1434	11550	776	6	-	14756	13.9	151.1
Average																
1996-2000	128829	1204817	347	6	46	167	627	164	1047	6760	1808	286	56	11314	9.4	87.8
%			(3.1)	(0.1)	(0.4)	(1.5)	(5.5)	(1.4)	(9.3)	(59.7)	(16.0)	(2.5)	(0.5)			
Average																
1986-2000	145066	903860	551	4	41	142	372	210	974	7804	1237	148	26	11509	12.7	79.3
%			(4.8)	(-)	(0.4)	(1.2)	(3.2)	(1.8)	(8.5)	(67.8)	(10.8)	(1.3)	(0.2)			

a maximum of 17138 t in 1993. Good fishery was reported in 1991 (14147 t), 1992 (15433 t), 1993 (17138 t), 1995 (15077 t), 1996 (13034 t), and 2000 (14756 t). The fishery was poor in 1986 (6969 t), 1988 (9236 t), 1989 (4046 t) 1990 (8782 t) and 1999 (7440 t). The average annual production of 8386 t between 1986-90 increased to 14829 t between 1991and '95, which declined to 11314 t in the next 5 year block of 1996-2000. Extension of fishing to deeper waters, increased night trawling operations and optimum effort resulted in good performance of prawn fishery between 1991 and 1995.

Fishing effort: The fishing effort was minimum in 1989 (448226 hrs) and maximum in 1999 (1422074 hrs). Average annual effort of 625712 in 1986-90 increased to 881050 hrs in the next 5 year period. Between 1996-2000 the average annual effort reached a maximum of 1204817 hrs. It is interesting to observe here that despite a ban on trawling for 45 days in the monsoon season since 1989, the effort registered a progressive increase.

Average annual boat trip of 135263 in 1986-90 increased to 171106 in 1991-95 period registering an increase of 27%. Average number of boat trips heavily declined to 128829 in the following 5 years. However, no corresponding decline in trawling hours was registered during this period. On the contrary, trawling hours were on the increase during 1986-2000 periods due to multiday fishing trip.

Catch rate: Maximum catch of 20 kg per hour of trawling was recorded in 1993, and a minimum of 5.2 kg in 1999. Catch rates were poor in 1986, 1989, 1997, 1998 and 1999; moderate in 1988, 1994, 1996 and 2000. Catch rates were good in 1987, 1991, 1992, 1993 and 1995 (Fig.1). Average annual catch rate of 13.4 kg in 1986-1990 increased to 16.8 kg during 1991-96. However, the next 5 year period registered a decline of 44% in the catch rate which came down to 9.4 kg/hr.

Fishing season: Details on the quarter wise prawn landings are given in Table 2. During 1986-2000 more than 60% of the average annual landings were harvested in the 3rd quarter of the year (July-Sept). This quarter contributed to 61.4% of the annual prawn catch in 1986-'90, 63.6% in 1991-95and 58.1% in the succeeding 5 years. As peak fishing season for 'Karikkadi' coincides with the 3rd quarter of each year maximum percentage of the annual prawn landings of Sakthikulangara occurred during this period. Second quarter (April-June) contributed to 15.1% of average annual land-

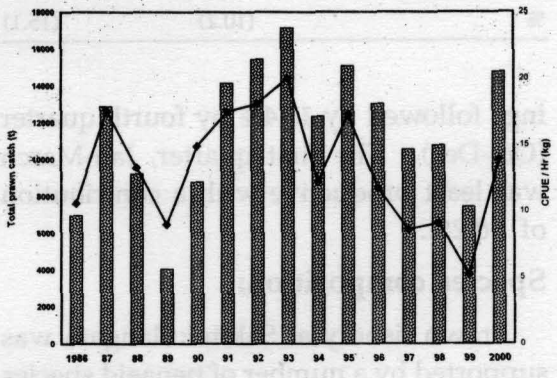

Fig. 1. *Details on the catch and catch per unit effort/hr on the prawn fishery off Sakthikulangara during 1986-2000.*

Table 2. *Quarter wise prawn landings (1) at Sakthikulangara by shrimp trawlers between 1986-2000 (Quarterwise percentage composition in parenthesis)*

Year	1st quarter (Jan-Mar)	2nd quarter (Apr-Jun)	3rd quarter (July-Sept)	4th quarter (Oct-Dec)	Total
1986	583	1232	4912	242	6969
1987	601	2074	8991	1226	12892
1988	646	848	6883	859	9236
1989	443	1500	1447	656	4046
1990	1641	2059	3520	1562	8782
Average	783	1543	5151	909	8386
%	(9.3)	(18.4)	(61.4)	(10.9)	
1991	1647	2697	6068	3735	14147
1992	1438	1886	9847	2262	15433
1993	1308	1537	11988	2305	17138
1994	1189	1663	7414	2083	12349
1995	904	1713	11873	587	15077
Average	1297	1899	9438	2194	14828
%	(8.8)	(12.8)	(63.6)	(14.8)	
1996	1527	1617	7492	2398	13034
1997	1722	2436	4660	1740	10558
1998	1334	2022	5469	1958	10783
1999	1601	1573	3932	334	7440
2000	970	1229	11332	1225	14756
Average	1431	1775	6577	1531	11314
%	(12.6)	(15.7)	(58.1)	(13.6)	
Average for 1986-2000	1170	1739	7055	1545	11509
%	(10.2)	(15.1)	(61.3)	(13.4)	

ings followed by 13.4% by fourth quarter (Oct-Dec). The first quarter, Jan-March was least productive with a contribution of 10.2%.

Species composition:

Prawn fishery at Sakthikulangara was supported by a number of penaeid species belonging to different genera. *P. stylifera* was the most dominant constituent of the prawn fishery (Fig. 2). Others in order of abundance were *T. curvirostris, M. dobsoni, P. indicus, M. monoceros, M. affinis, S. choprai, P. canaliculatus, P. semisulcatus* and *P. monodon*. Other species represented in small numbers were *Parapenaeopsis acclivirostris, Metapenaeopsis* spp., *T. sedili* and *P. maxillipedo*. Of the miscellaneous prawns, *Metapenaeopsis* spp. supported a sizeable fishery in 1997.

Eventhough annual variations in the

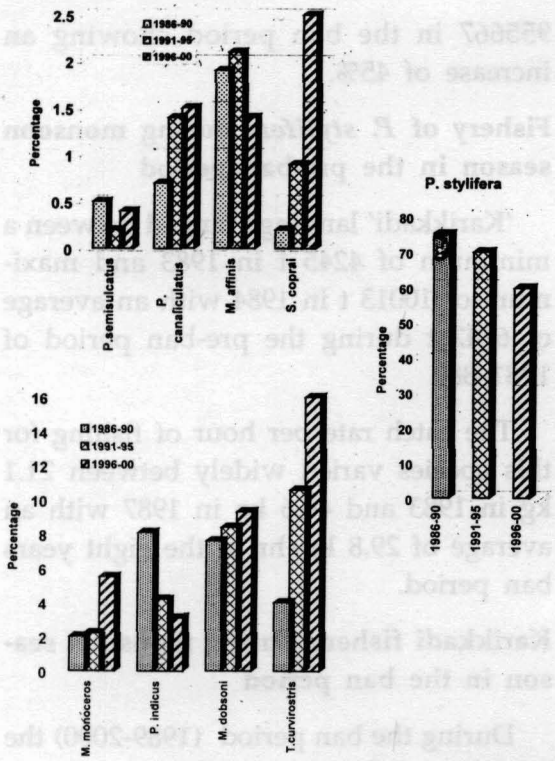

Fig. 2. Specieswise percentage composition of prawn landings at Sakthikulangara during 1986-2000.

peak fishing period for individual species of prawns were noticed during 1986-2000, a general picture on the peak season of fishery for constituent species is given.

P. indicus	:	February-May
P. monodon	:	No season
P. semisulcatus	:	October-December and March-May
P. canaliculatus	:	October – December and April – May
M. dobsoni	:	March-May
M. affinis	:	July-August
M. monoceros	:	July, August and February-May
P. stylifera	:	June - September
T. curvirostris	:	October-May
S. choprai	:	October, November and February-May

Impact of ban on monsoon trawling on the prawn fishery at Sakthikulangara

On the recommendation of Prof. Balakrishnan Nair Committee report, Government of Kerala imposed a ban on monsoon trawling in the territorial waters of Kerala in 1988. However, Sakthikulangara was exempted from the implementation of ban during this year. Trawling ban during monsoon is in operation at this centre since 1989. An attempt is made here to study the impact of ban on the monsoon prawn fishery at this centre. For this study, prawn landings by shrimp trawlers for 20 years between 1981 and 2000 were analysed to study the availability of 'Karikkadi' (*P. stylifera*) in particular and penaeid prawns in general during pre-ban period (1981 to 1988) and ban period (1989-2000). Emphasis is made on 'Karikkadi' landings as nearly 92% of the average monsoon landings during the 20 year period was contributed by this prawn. Moreover, 86% of the average annual landings of 'Karikkadi' was recorded during the monsoon season. This exercise is only of a limited nature since only prawn resource in a single centre is dealt with here. This study is not intended to go into wider ramification of this controversial issue.

Monsoon trawling in Kerala is largely confined to Sakthikulangara -Neendakara

and Kochi because of infrastructural advantages available at these centres to berth the trawlers in the unfavourable weather conditions prevailing during the season.

Trawl ban for the entire monsoon period was never imposed in any of the years. There was no uniformity in the duration and period of ban between 1989 and 1995. During these years the actual ban lasted between 24 and 43 days per season. Since 1996, 45 days of trawling ban from 15th June to 29th July was regularly in operation.

Fishing effort

Table 3 shows the catch, effort and catch rate of prawns landed by shrimp trawlers in the pre-ban (1981-88) and ban periods (1989-2000).

In the pre-ban period of 1981-'88 trawling hours in the monsoon season ranged between 180557 in 1986 and 286739 in 1984 with an average of 226247 hrs. In the ban period between 1989 and 1994 trawling hours declined and ranged between 78756 in 1989 and 189175 in 1994. Since 1995, despite a ban of one and half months there was a sharp increase in the trawling hours during monsoon period. During 1995-2000 the fishing hours ranged between 211464 in 1996 and 479050 hours in 2000. The average fishing effort in the monsoon period during ban duration (1989-'00) was 236899 hrs.

Average annual trawling effort in hours in the pre-ban period was 657926 against 955667 in the ban period showing an increase of 45%.

Fishery of *P. stylifera* during monsoon season in the pre-ban period

'Karikkadi' landings ranged between a minimum of 4245 t in 1983 and maximum of 10013 t in 1984 with an average of 6747 t during the pre-ban period of 1981-88.

The catch rate per hour of fishing for this species varied widely between 21.1 kg in 1983 and 46.6 kg in 1987 with an average of 29.8 kg/hr in the eight years ban period.

Karikkadi fishery during monsoon season in the ban period

During the ban period (1989-2000) the catch rate / hr of trawling was high in 1992 (55.1 kg), 1993 (86.7 kg) and 1995 (44.8 kg). Catch rates were poor between 1997 and 1999 ranging between 7.5 kg and 11.6 kg. Catch rate was moderate in other years. The average catch rate of 'Karikkadi' per hour of fishing during monsoon season was 25.8 kg

Landings of *P.* stylifera during monsoon season ranged between 2472 t in 1999 and 11452 t in 1995 with an average of 6116 t during 1989-2000. Despite a ban lasting several days, landings were good in 1992 (7978 t), 1993 (10778 t), 1995 (11452 t) and 2000 (10602 t), Landings were poor in 1989 (1979 t), 1990 (3350 t), 1991 (4701 t), 1997 (3416 t), 1998 (4819 t) and 1999 (2472 t). Catch was moderate in the rest of the years.

Table 3. *Particulars of prawn landings(t) at Sakthikulangara in the pre-ban and ban years (catch rate per hour in kg in parenthesis)*

Years	No. of boat trips in monsoon	Trawling hours in monsoon	*Karikkadi* catch in monsoon	Total prawn catch in monsoon	Annual boat trips	Annual trawling hours	Annual *Karikkadi* catch	Annual total prawn landings
				Pre-ban years				
1981	54190	219676	6725 (30.6)	7269 (33.1)	124114	541058	7816 (14.4)	9399 (17.4)
1982	56093	233698	6269 (29.8)	6969 (29.8)	125499	607429	7375 (12.1)	9487 (15.6)
1983	40413	201424	4245 (21.1)	5616 (27.9)	108350	604268	5446 (9.0)	7815 (12.9)
1984	50804	286739	10013 (34.9)	11774 (41.1)	130357	807325	10838 (13.4)	14204 (17.6)
1985	52695	248596	6015 (24.2)	7940 (31.9)	124544	613437	6871 (11.2)	10605 (17.3)
1986	41937	180557	5166 (28.6)	5618 (31.1)	120779	660242	5594 (8.5)	6969 (10.6)
1987	43050	194536	9065 (46.6)	9624 (49.5)	139326	733361	10509 (14.3)	12892 (17.6)
1988	60172	244747	6479 (26.5)	7028 (28.7)	159138	696288	7251 (10.4)	9236 (13.3)
Average	49919	226247	6747 (29.8)	7730 (34.2)	129013	657926	7713 (11.7)	10076 (15.3)
				Ban years				
1989	20553	78756	1979 (25.1)	2263 (28.7)	110458	448226	2795 (6.2)	4046 (9.0)
1990	38050	139639	3350 (23.9)	4187 (30.0)	146614	590441	5276 (8.9)	8782 (14.9)
1991	37563	139021	4701 (33.8)	5902 (42.5)	155939	806954	7537 (9.3)	14147 (17.5)
1992	38099	144797	7978 (55.1)	8497 (74.0)	176413	853824	11266 (13.2)	15433 (18.1)
1993	42570	124308	10778 (86.7)	11127 (89.5)	178009	857056	13041 (15.2)	17138 (20.0)
1994	52937	189175	6244 (33.0)	7196 (38.0)	191189	1016258	7599 (7.5)	12349 (12.2)
1995	55485	255701	11452 (44.8)	12272 (48.0)	153982	871156	12391 (14.2)	15077 (17.3)
1996	39060	211464	5603 (26.5)	6557 (31.0)	164503	1117443	7497 (6.7)	13034 (11.7)
1997	37222	333673	3416 (10.2)	5006 (15.0)	141412	1233766	4933 (4.0)	10558 (8.6)
1998	32765	416697	4819 (11.6)	5614 (17.0)	126185	1191237	6293 (5.3)	10783 (19.1)
1999	31628	330505	2472 (7.5)	3411 (8.2)	114358	1422074	3525 (2.5)	7440 (5.2)
2000	31619	479050	10602 (22.13)	11333 (23.7)	97685	1059567	11550 (10.9)	14756 (13.9)
Average	38129	236899	6116 (25.8)	6947 (29.3)	146396	955667	7809 (8.2)	11962 (12.5)

Total prawn landings in the monsoon season during pre-ban and ban periods

Total prawn catch in pre ban period ranged between 5616 t in 1983 and 11774 t in 1984 with an average of 7730 t. In the ban period this ranged between 2263 t in 1989 and 12272 t in 1995 with an average of 6947 t. Catch rate per hour for

total prawns amounted to 34.2 kg and 29.3 kg respectively in the pre-ban and ban periods (Table. 3).

'Karikkadi' contributed to 87.2% and 88.0% of average annual prawn landings in the monsoon season during pre-ban and ban period respectively. In addition to *P. stylifera* other species represented in the fishery during monsoon in small quantities were *M. dobsoni, M. affinis, M. monoceros, P. indicus* and *T. curvirostris.*

As monsoon period was the peak fishing season for *P. stylifera* the contribution of its fishery during this period towards its annual catch at Sakthikulangara was 87.5% and 78.3% during pre-ban and ban period respectively. During the entire period of observation (1981-2000) its average percentage contribution was 82.0 (Fig.3).

Annual prawn landings in the pre ban and ban periods

Annual prawn landings in the pre-ban period ranged between 6969 t in 1986 and 14204 t in 1984 with an average of 10076 t (Table 3). In the ban period this ranged between 4046 t in 1989 and 17138 t in 1993. The average annual prawn landings at Sakhikulangara during ban period amounted to 11962 t. An increase of 18.7% in the landings during the ban period was recorded. Average catch rate for the pre-ban period was 15.3 kg/hr against 12.5 kg in the ban period. The average annual effort which was 657926 hrs in the pre-ban duration went upto 955667 hrs, during ban period showing an increase of 45.2%.

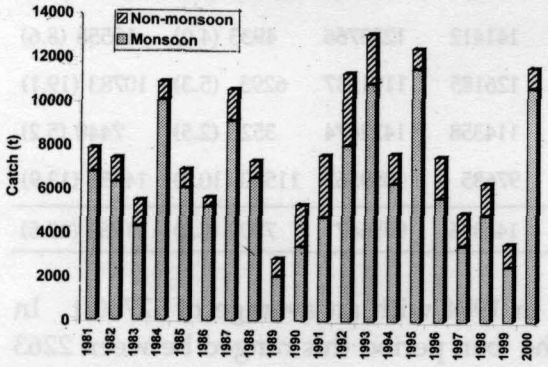

Fig. 3. Seasonwise landings of Parapenaeopsis stylifera at Sakthikulangara during 1981-2000.

Discussion

Shrimp grounds off Sakthikulangara is the most intensely exploited area for penaeid prawns in the entire country. Intensive trawling in the seventies resulted in the landings of an average annual prawn catch of 24095 t. Trawling continued unabated in eighties in spite of sharp fall in the average annual prawn catch to 12121 t registering a 50% decline in the landings. Upto the middle of the eighties, trawling was mainly carried out in the inshore areas targeting conventional resources such as *P. stylifera, M. dobsoni, P. indicus, M. monoceros* and *M. affinis.* Faced with diminishing catch and consequent uneconomic returns, trawlers ventured into middle shelf operations upto 60 meters in the second half of eighties. Night trawling was resorted to in a large scale. These steps changed the entire complexion of the fishery with the addition of nonconventional resources such as *T. curvirostris, S. choprai, P. semisulcatus* and *P. canaliculatus. T. curvirostris* became the second dominant constituent of the fish-

ery, relegating *M. dobsoni* to the third position. This medium sized prawn which was initially marketed at a rate of Rs.15 to Rs.20 per kg, fetched Rs.40/- towards the end of nineties. The 'tiger' prawns (*P. monodon*, *P. semisulcatus* and *P. canaliculatus*) though caught in moderate quantities fetched an exorbitant price in the export market which added solidity to the fishery.

Despite a ban on trawling in the peak fishing months of June and July, 'Karikkadi' fishery improved in the first half of nineties. With ever-increasing fishing effort, production suffered in the second half of nineties, which in turn, resulted in the decline in the catch of both 'Karikkadi' and 'Pullan'.

Contribution of Sakthikulangara to the prawn fishery of Kerala declined from 51% in seventies to 30% in eighties and 24% in nineties. George *et al.* (1980) studied in detail the shrimp resources along the Neendakara coast for the period 1973 – '80 and indicated a definite case of economic overfishing and advised restriction of effort as the only possible approach to manage the fishery. George *et al.* (1983) investigated the monsoon prawn fishery at Neendakara from 1980 to 1982 and strongly recommended implementation of some effective conservation methods for proper management of the fishery. Taking into account both the biological and economic aspects of fishery they recommended limitation in the number of vessels in operation by suitable licensing method and by restricting the entry of boats from other states. The present study reveals that current fishing effort in hours has more than doubled when compared with 1981-85 period. Both catch and catch rate registered sharp decline over the years. It is high time to decide the optimum number of trawlers required to exploit the available prawn stock of Kerala coast and take necessary steps to implement the decision strictly.

'Karikkadi' contributes to nearly 90% of the monsoon prawn catch at Sakthikulangara and maximum catch of this species in Kerala is generally landed at this centre. Ban on monsoon trawling is in operation at Sakthikulangara since 1989. Studies carried out on the impact of ban on 'Karikkadi' catch based on the data collected from 1981 to 2000 revealed some interesting facts. 'Karikkadi' landings in better quantities in 20 years period were recorded in ban years: 1992, 93, 95 and 2000. Despite a ban of trawling for half of the monsoon fishing season, average monsoon landings of *P. stylifera* during pre-ban and ban period were almost equal. Notwithstanding the ban, actual fishing effort in hours during ban years improved over the pre-ban period by more than 45%. Studies carried out on the dynamics of 'Karikkadi' fishery in the monsoon months by Suseelan *et al.* (1989, 1990, 1992, 1993 and 1998) by utilizing the facilities of Research Vessels, R.V. *Skipjack* and FORV *Sagar Sampada* revealed that this species leave the inshore grounds in large numbers with the commencement of southwest monsoon and remain in 20-40 m depth zone in June and in 40-60 m

depth zone in the remaining monsoon months. Results of FORV *Sagar Sampada* cruises showed that the offshore migration of 'Karikkadi' took place along the southwest coast between Quilon in the south and Marmagoa in the north. Unless the *P.* stylifera stock is exploited during monsoon from these deeper grounds, it is unlikely that this stock will be available for capture in the postmonsoon months. An experimental ban on trawling for the entire monsoon season and an indepth study on the impact of this on the resource will alone prove whether the 'Karikkadi' stock migrated to the deeper grounds will return to their regular grounds in the inshore waters to support a postmonsoon fishery. Before attempting to implement a complete ban on trawling, adequate steps should be taken to safeguard the economic interests of the fish workers who will be thrown out of jobs on account of this.

Heavy recruitment of juvenile prawns to the *P.* stylifera fishery takes place in the months of June and July. These juveniles below 70 mm in size are totally discarded by processing industry because of poor meat content. Before the implementation of trawl ban nearly 25% of the monsoon catch in June and July was constituted by these discards. As a result of the trawling ban in the first half of monsoon, these juveniles got a chance to grow into larger size groups which in turn improved the fishery in August. Annual mean size of 'Karikkadi' prawn had improved by 5 mm during the ban period. Heaps of rotten discards which were an ugly spectacle at Sakthikulangara before the imposition of ban is a thing of past in the ban period.

Traditional fishing sector advocating for ban on trawling contends that monsoon coincides with peak spawning season for 'Karikkadi' which is far from truth. Spawning takes place throughout the year with peaks during November-December and March-April. Spawners of *P.* stylifera are sparsely represented in the monsoon fishery.

Based on this detailed study made on the prawn fishery of Sakthikulangara, it is suggested that the partial ban on monsoon trawling for 45 days during June-July of every year being implemented along Kerala coast can be continued as it improves the quality of 'Karikkadi' fishery during monsoon season.

References

George, M.J., C. Suseelan, M.M. Thomas and N.S. Kurup. 1980. A case of overfishing: Depletion of shrimp resources along Neendakara coast, Kerala. *Mar. Fish. Infor. Serv., T & E Ser.*, No. 18:1-8.

George, M.J., C.Suseelan, M.M. Thomas, N.S. Kurup, K.N. Rajan, V.S.Kakati, K.N. Gopalakrishnan, K. Chellappan, K.N. Balasubramanian and C. Nalini.1983. Monsoon prawn fishery of Neendakara coast, Kerala - A critical study *Ibid*, No. 53: 1-8.

Rajan, K.N., G. Nandakumar and K. Chellappan 2001. Innovative exploitation of deep- sea crustaceans along the Kerala coast. *Ibid*, No. 168: 1-11.

Suseelan, C., M.M. Thomas, N.S. Kurup and K.N. Gopalakrishnan. 1982. A potential new resource of prawns from Neendakara area in Kerala coast. *Ibid*, No. 35: 15-17.

------ K.N. Rajan and G. Nandakumar, 1989. The 'Karikkadi' fishery of Kerala. *Ibid*, No. 102: 4-8.

------ G. Nandakumar and K.N. Rajan. 1990. Results of bottom trawling by FORV *Sagar Sampada* with special reference to catch and abundance of edible crustaceans. *Proc. First Workshop Scient. Result. FORV Sagar Sampada*, 5-7 June 1989: 337-346.

------ G.Nandakumar, N.S. Kurup, V.D. Deshmukh, K.N. Rajan, M. Aravindakshan and P.T. Sarada 1992. Present status of exploitation of fish and shell fish resources: Prawns. *Bull. Cent. Mar. Fish. Res. Inst.* 1992, **45** : 205-225.

K.N. Rajan and G.Nandakumar. 1993. Some observations on the prawn fishery of Cochin. *Indian J. Fish.*, **40**(4): 213-224.

P.E. Sampson Manickam, M. Rajamani, K.R. Manmadhan Nair, K. Prabhakaran Nair, K.N. Rajan and K. Chellappan 1998. Further observations on the spatial distribution and population characteristics of 'Karikkadi' prawn (*Parapenaeopsis stylifera*) along the Kerala coast during monsoon season. *Ibid*, **45**(3): 285-292.