

Some observations on the prawn fishery of Cochin

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ABSTRACT

The prawn fishery of Cochin area with particular reference to monsoon season and the present problems relating to management of the resource is reviewed based on the data collected during 1984-88. The fishery is mainly by shrimp trawlers which operate outside the territorial waters during monsoon season when the target species *Parapenaeopsis stylifera* (Karikkadi) migrates to deeper waters. Of the average annual prawn landings of 2908 tonnes recorded at Cochin Fisheries Harbour nearly 50% is landed during the monsoon period, mainly (80-98%) *P. stylifera*. *Metapenaeus dobsoni* dominates in the fishery of pre-monsoon (45.0%) and post-monsoon (69.5%) periods when the exploitation is confined to coastal waters.

Prawn catch by indigenous gears has diminished considerably over the years as a result of constant shrimp trawling in the coastal waters and destruction of young ones in the sea and backwaters. Analysis of the recent catch data of these gears operating in Ernakulam district shows an average annual production of 190 tonnes of prawns, of which nearly 52% is caught during the monsoon period. *Penaeus indicus* accounts for the bulk of the catch (91.3%), while *M. dobsoni* suffered a severe decline over the years. The catch of Karikkadi in indigenous gears is rather negligible during the monsoon season.

In the trawl fishery, considerable quantities (16-18%) of under-sized Karikkadi prawns are caught during the monsoon season. Low proportion (5-18%) of spawning population was observed in the fishery during monsoon season in contrast to a high percentage of the same during pre-monsoon (27-45%) and post-monsoon (32-62%) seasons.

The offshore population of Karikkadi may not return to contribute to the coastal fishery after the cessation of monsoon. Exploitation of this resource by shrimp trawlers beyond the territorial waters during the monsoon season is therefore recommended. To improve the traditional fishery there is a need for strict enforcement of the existing regulation preventing prawn fishing inside the 20 m depth line by shrimp trawlers, besides other conservation measures.

Shrimp fishery has played an important role in the socioeconomic growth of the coastal people in recent years. Prawn fishing is practised throughout the 590 km coast line of Kerala, but in the past 3-4 decades this industry has shown a remarkable development due to the mechanized fishing and processing of seafoods. In Cochin also prawns are exploited by the industrial as well as artisanal sectors, the former mainly in the sea and the latter in the backwaters. Commercial fishing of prawns by mechanized vessels began at Cochin in 1958 following the encouraging results of the exploratory trawling op-

erations of the erstwhile Indo-Norwegian Project along the Kerala coast during early fifties. Until about the end of sixties, however, the fishery continued to be mainly based on indigenous gears operating in the shallow coastal waters. Shrimp trawling became popular in the subsequent years and soon established itself as the most important gear for exploiting prawns. A unique feature of the trawl fishery of this centre and at Sakhikulangara (Quilon District) is that during monsoon period when shrimp trawling remains very weak or totally suspended in other parts of the state, it is most active here,

producing the highest catch of the year. The success of the fishery in a particular year largely depends on the magnitude of the monsoon catch of that year. The present paper deals with the prawn fishery at Cochin together with an assessment of the marine artisanal fishery at the respective district with particular reference to monsoon period.

Most of the studies so far carried out on the prawn fishery resources of Kerala have been from Cochin and its neighbouring areas (Panikkar 1937, Menon 1951, 1953, 1955, 1957, Panikkar and Menon 1955, George 1960, 1961). The studies of George *et al.* (1963) provided a detailed account of the offshore prawn fishery of the area based on the catches of the Government of India trawlers operating from 1956 to 1963. Subsequent studies made by George and George (1964), Banerji and George (1967), George and Rao (1967), George *et al.* (1968 a), Rao (1968, 1972), Mohamed (1973), Silas *et al.* (1984) and Suseelan and Rajan (1987) considerably augmented our knowledge of the fishery and population characteristics of prawns of this area. Alagaraja *et al.* (1986) carried out stock assessment of important species at Cochin and Sakthikulangara based on the trawl catches during 1981-82.

Besides the above investigations, a number of studies have also been conducted on the biology and exploitation of prawns from Cochin backwaters (Menon 1954, Menon and Raman 1961, George 1962 a, b, 1963, George and Suseelan 1982, George *et al.*, 1968b, Mohamed and Rao 1971, Suseelan and Rajan 1988) which serve as the nursery ground for many species of marine prawns contributing to the fishery.

MATERIALS AND METHODS

Catch, effort and biological data collected from the commercial shrimp trawlers operating from Cochin Fisheries Harbour and

the indigenous gears operating in the coastal waters of Ernakulam District (Sy. zone 5) during 1984-1988 formed the main data base of this study. Monthly estimates of catch and effort were made by the stratified random sampling method (Jacob *et al.* 1983), treating Cochin Fisheries Harbour as one of the single centre zones. Biological sampling of trawl catch was made at weekly intervals which synchronized with the collection of catch and effort statistics. On each sampling day a random sample of unsorted catch weighing 1-2 kg was drawn and analysed for length frequency and maturity stages species-wise and sex-wise. The length measurements were taken to the nearest millimetre from the tip of rostrum to the tip of telson. For length frequency analysis the measurements were grouped into 5 mm size classes and raised to the total estimated landings.

In indigenous fishery, detailed biological data were collected from Cochin during the monsoon period of 1988 also. Gear-wise prawn samples were collected from Puthuvyppu, Narakkal and Fort Cochin and analysed. Additional data on catch and effort of the indigenous gears operating from these centres were also recorded as and when visited for biological sampling.

The catch, effort and biological data thus collected were compiled season-wise, dividing the year into premonsoon (February-May), monsoon (June-August) and postmonsoon (September-January) seasons.

OBSERVATIONS

Trawl fishery

The fishery is entirely based on small mechanized vessels of the size 8-13 m powered by 25 to 90 BHP engines. These vessels make single day cruises starting from the base early in the morning and returning in the afternoon after taking 3 or 4 hauls.

The gear used is generally a 4 seam or 2 seam shrimp trawl of 12-28 m headrope length, having cod-end mesh size around 25 mm. The fishing ground extends up to a depth of about 60 m. During the non-monsoon period trawling is mostly confined to the coastal waters within 25 m depth while during the monsoon period (June-August) the vessels move out to deeper areas and operate between 30 and 60 m depth (Suseelan *et al.* 1988, 1989).

Shrimp trawling is carried out throughout the year with peak fishing activities during the south-west monsoon period from June to August/September. At present an average of about 200 trawlers operate from this centre every day.

Prawn production : The season-wise break up of prawn landings at Cochin Fisheries Harbour is shown in Table 1. The average annual prawn landings amounted to

2 908 tonnes, of which nearly 50% (1 432 t) was registered during the monsoon period and the rest during the non-monsoon period. The contributions of pre-monsoon and post-monsoon seasons worked out to 38% and 12% respectively. In the average annual fishing effort of 42 802 boat trips expended on the fishery, 13 724 boat trips (32%) were performed during the monsoon period yielding the highest CPUE of 91 kg/boat trip. Though the effort expended during the pre-monsoon season, was much higher (44%) than in the monsoon season the catch rate was only 61 kg/boat trip. Post-monsoon recorded the lowest CPUE of 35 kg/boat trip.

The annual trend in prawn production during the monsoon season indicated that the fishery was relatively poor in 1984 and 1985 seasons when greater portion of the catch (57-67%) was obtained during the pre-monsoon season. In the subsequent 2 years, catch

Table 1. Prawn landings, fishing effort and CPUE by shrimp trawlers during monsoon and non-monsoon periods at Cochin Fisheries Harbour, 1984-85 to 1988

Year	Particulars	Monsoon (June-August)	Non-monsoon		Annual (Feb.-Jan.)
			Premonsoon (Feb.-May)	Postmonsoon (Sep.-Jan.)	
1984-85	Catch (t)	883.3	1353.1	158.6	2395
	No. of boat trips	14815	19787	3812	38414
	Catch/boat trip (kg)	59.6	68.4	41.6	62.3
1985-86	Catch (t)	181.6	1049.9	327.1	1558.6
	No. of boat trips	6229	15458	8641	30328
	Catch/boat trip (kg)	29.2	67.9	37.9	51.4
1986-87	Catch (t)	2087.1	1101.4	321.4	3509.9
	No. of boat trips	16031	19175	11195	46401
	Catch/boat trip (kg)	130.2	57.4	28.7	75.6
1987-88	Catch (t)	2575.2	1012.0	582.7	4169.9
	No. of boat trips	17819	20115	18133	56067
	Catch/boat trip (kg)	144.5	50.3	32.1	74.4
1987-88	Catch (t)	1295.8	1326.6		
	No. of boat trips	18097	18387		
	Catch/boat trip (kg)	71.6	72.2		

and CPUE steadily increased to 2 575 t and 144.5 kg/boat trip in 1987 season contributing the bulk (61.7%) to the fishery of that year. In 1988 season a drop in the catch as well as CPUE was noticed in spite of a substantial increase in fishing effort.

Within the monsoon season the peak of the fishery varied between the months, the maximum frequency of peak landings having been recorded in July (Table 2). In all the years, except in 1988, over 90% of the monsoon catch was registered during June-July. In 1988 season, which was characterized by a peak in August, exceptionally high CPUE (135.8 kg) was recorded.

Species composition

The fishery was exclusively constituted by penaeid prawns which form the backbone of the seafood export industry. Though several species were encountered in the catches only *Penaeus indicus* (Naren), *Metapenaeus dobsoni* (Poovalan), *M. monoceros* (Choodan) and *Parapenaeopsis stylifera* (Karikkadi) formed the main components. Their percentage composition in different seasons of the year is shown in Table 3. The dominant species in the catch exhibited marked variations during the monsoon and non-monsoon periods. During the monsoon season *P. stylifera* formed the bulk of the

Table 2. Monthly trends in production of prawns by shrimp trawlers at Cochin Fisheries Harbour during the monsoon period 1984-88 (monthly percentage of catch in parentheses)

Year	Particulars	June	July	August
1984	Catch (t)	193.6 (21.9)	640.9 (72.6)	48.8 (5.5)
	No. of boat trips	4726	5850	4239
	Catch/boat trips (kg)	41.0	109.6	11.5
1985	Catch (t)	96.4 (53.1)	82.0 (45.1)	3.2 (1.8)
	No. of boat trips	3531	2320	378
	Catch/boat trip (kg)	27.3	35.3	8.5
1986	Catch (t)	367.0 (17.56)	1516.9 (72.7)	203.2 (9.7)
	No. of boat trips	6371	6028	3632
	Catch/boat trip (kg)	57.6	251.6	55.9
1987	Catch (t)	912.8 (35.4)	1513.7 (58.8)	148.7 (5.8)
	No. of boat trips	6276	5687	5856
	Catch/boat trip (kg)	145.4	266.2	25.4
1988	Catch (t)	454.1 (35.0)	298.0 (23.0)	543.7 (42.0)
	No. of boat trips	10855	3238	4004
	Catch/boat trip (kg)	41.8	92.0	135.8

fishery throughout the study. The mean percentage values for the various species during this period were : *P. stylifera* 89.7%, *M. monoceros* 5.4%, *M. dobsoni* 3.6% and *P. indicus* 0.8%. *P. stylifera* accounted for almost the entire catch when the fishery was at its peak, while the other species occurred in sizeable proportions only in the beginning of the season. *M. dobsoni* dominated in the fishery during the pre-monsoon and postmonsoon periods (Table 3).

Indigenous fishery

The role of indigenous gears in harvesting prawns from the sea has considerably diminished over the years as is evident from the poor landings in the traditional sector. At Cochin, an active fishery by indigenous gears continues to exist only in Cochin backwaters and the adjacent paddy-cum-prawn culture fields where juvenile prawns are exploited in large quantities. In the sea, prawns are caught occasionally in a variety of traditional gears such as boat seines, ring seines,

gill-nets, cast nets, stake nets (off Cochin bar mouth) and mini trawls, operated from mechanized and non-mechanized country crafts very close to the shore (<10 m depth). An annual average production of 190 tonnes of prawns was observed, of which 51.7% was landed during the monsoon season and the rest during the non-monsoon season (Table 4). Greater portion of the monsoon catch was recorded in June when the coastal waters experience environmental changes due to upwelling resulting in shoreward migration of some of the species of prawns which are eventually caught by indigenous gears. Of the non-monsoon periods, the post-monsoon season recorded better catch (32.6%) than the pre-monsoon season (15.7%). Boat seines (64%) and gill nets (18%) together accounted for about 82% of the total indigenous fishery.

The fishery as a whole was chiefly supported by *P. indicus*, *M. dobsoni* and *P. stylifera* in the order of their abundance (Table 4). The most characteristic feature no-

Table 3. Seasonal percentage composition of important species in the prawn landings by shrimp trawlers at Cochin Fisheries Harbour, 1984-88

Season	Year	<i>P. indicus</i>	<i>M. dobsoni</i>	<i>M. monoceros</i>	<i>P. stylifera</i>	Other prawns
Pre-monsoon (February-May)	1984	6.6	28.6	2.9	60.4	1.5
	1985	14.0	60.5	1.2	23.3	1.0
	1986	14.4	43.1	4.9	36.8	0.8
	1987	3.8	50.3	5.4	39.9	0.6
	1988	4.1	42.0	18.3	31.1	4.5
Monsoon (June-August)	1984	-	-	10.2	89.3	0.5
	1985	0.2	4.0	3.0	92.4	0.4
	1986	0.8	0.3	0.7	98.1	0.1
	1987	1.9	5.7	2.9	89.1	0.4
	1988	1.3	8.2	10.3	79.7	0.5
Post-monsoon (September- January)	1984-85	22.7	62.3	2.5	10.6	1.9
	1985-86	11.8	82.5	0.6	4.9	0.2
	1986-87	5.6	86.8	3.3	3.9	0.4
	1987-88	3.8	46.3	10.5	38.8	0.6

ticed during the monsoon season was that *P. indicus* accounted for 91.3% of the catch which was mainly harvested by boat-seines and gill-nets. During the premonsoon period *M. dobsoni* (82%) dominated in the fishery, whereas in the post-monsoon period both *P. indicus* (46.7%) and *M. dobsoni* (37.2%) accounted for the bulk of the fishery. It is interesting to note that the catch of Karikkadi (*P. stylifera*) among the indigenous fishes was rather negligible during the monsoon season when compared to its absolute predominance and high catch rates in the trawl fishery.

STRUCTURE OF EXPLOITED POPULATION AND BIOLOGICAL FEATURES

Size distribution : The trawl fishery is supported by adults and subadults that might have completed at least 4-5 months of life. In *P. stylifera* the size ranged from 36 to

100 mm for male and 37 to 125 mm for female, the bulk of the fishery being contributed by the size groups 66-85 mm and 66-95 mm for the 2 sexes respectively. There was no marked variation in the size composition of the species in different seasons of the year. The monthly size frequency distribution for the monsoon season of different years was studied. In general, the peak production of the species during June and July was characterized by greater abundance of younger population. The modal size of males during this period was at 71-75 mm in most of the years when the catches were high except in July 1987 when the mode was at 81-85 mm. In females, the mode generally fell within the range of 71-75 mm and 81-85 mm except in July 1987 when a higher mode at 91-95 mm was also seen. In August, the Karikkadi stock was mainly composed of

Table 4. Prawn catch (tonnes) by indigenous gears from the inshore waters of Ernakulam district, 1984-88

Season	Year	<i>P. indicus</i>	<i>M. dobsoni</i>	<i>P. stylifera</i>	Other species	Total
Pre-monsoon	1984	23	..	..	..	23
	1985	..	1	..	..	1
	1986	..	..	..	..	..
	1987	..	112	1	1	114
	1988	..	..	..	..	..
Monsoon	1984	46	..	..	..	46
	1985	147	3	..	..	150
	1986	..	..	..	..	..
	1987	193	28	..	2	223
	1988	30	2	5	..	37
Post-monsoon	1984	132	30	34	..	196
	1985	..	76	4	..	80
	1986	..	..	..	..	..
	1987	2	1	7	1	11

larger size groups for both sexes during the years 1986 to 1988 when the fishery was much better than in the previous years. The modal size during these years was invariably at 81-85 mm for males, whereas in females two principal modes — one at 81-85 mm and the other at 91-95 mm — were observed. To understand the proportion of under-sized prawns in the fishery, which were generally discarded by the industry, the length frequency data of 1986-1988 period were pooled into 'discards' (<65 mm) and 'commercial sizes' (>65 mm) season-wise (Table 5). The percentage of discards in the annual catch amounted to 16.2% in 1986-87 and 18.3% in 1987-88 periods. In the total discards about 70-90% was recorded during the monsoon season. Month-wise data revealed that the peak of discards in the fishery occurred in June and July. The important size group of *M.dobsoni* was 66-100 mm in the month of June when it appeared in the fishery in fair quantities.

In the indigenous fishery observed at Puthuvyppu, Narakkal and Fort Cochin *P. indicus* had a size range of 71-155 mm for males, and 76-170 mm for females. The modal sizes were at 136-145 mm for both the sexes throughout the monsoon period ex-

cept in June when the males had mode at 121-125 mm. *M. dobsoni* was represented in the size range 51-105 mm with mode at 86-90 mm for females. Though the contribution of *P. stylifera* in the indigenous fishery was insignificant, detailed biological data were collected whenever catches were encountered for comparison with the trawl fishery. An overall picture of the size composition of the species in different gears including trawl nets during the monsoon season, was assessed. The size of the prawns caught by all the non-selective indigenous gears (cast nets, stake nets and boat seines) operating in the shallow coastal waters was much larger than the size constituting the trawl fishery. The major size groups in the indigenous gears were 81-100 mm for males and 91-110 mm for females, whereas in the trawl fishery they were 71-85 mm and 71-95 mm for the two sexes, respectively, when the data for the entire period of study were combined. Studying the coastal shrimp fishery by indigenous gears at Narakkal, George (1961) also observed the modal length of the species attaining the maximum (86-90 mm) by August-September.

Sex ratio : In the trawl fishery, the distribution of sexes for *P. stylifera* during the

Table 5. Proportion between discards and commercial sizes of *P. stylifera* in the trawl fishery at Cochin during monsoon and non-monsoon seasons (percentage of discards in parentheses)

Seasons	Catch in thousand numbers			
	1986-87		1987-88	
	Discards	Commercial size	Discards	Commercial size
Pre-monsoon	45917	105936	10674	111123
	(5.06)	-	(1.06)	-
Monsoon	100480	651758	171614	657430
	(11.07)	-	(17.07)	-
Post-monsoon	324	3120	1935	52611
	(0.04)	-	(0.19)	-

monsoon period was characterized by dominance of females whose percentage in the catch ranged mostly between 51 and 72. The maximum disparity was noticed in August when larger size groups accounted for the bulk of the fishery. During the pre-monsoon and post-monsoon seasons also females were generally more in the catch than males. The overall sex ratio for *M. dobsoni* was more or less 50:50.

In the indigenous fishery *P. indicus* catch showed greater proportion of males (51-65%), while in *M. dobsoni* only females were encountered. The sex ratio of *P. stylifera* was in favour of females (61-70%) in all the gears operated during the monsoon period.

Spawning stock : In *P. stylifera* landed by shrimp trawlers, the abundance of females in spawning condition (maturity stages III and IV) was the least during the monsoon period (5.3-18.1%) as compared to the pre-monsoon (27.2-44.5%) and post-monsoon (32.4-61.9%) fisheries. In the indigenous gears, on the other hand, the proportion of spawners was considerably higher than in the trawl catches during the monsoon period. The overall percentage of mature females in the trawl fishery was only 12, it was as high as 39 in stake nets, 42 in boat seines and 55 in cast nets operating in the shallow coastal waters. In *P. indicus*, caught by indigenous gears during the monsoon period, spawners were totally absent.

DISCUSSION

A comparison of the prawn fishery of Cochin as seen today with the fishery that existed about two and a half decades ago (George 1961, George *et al.* 1963) revealed that the fishery has undergone considerable changes over the years in regard to the nature of exploitation and output by the different sectors of fishing. Naturally the question

arises as to who has gained and who has lost with the passing of time from a socio-economic angle. What is required in a proper management system is a pragmatic approach to minimize the imbalance in the progress of the different sectors sharing the same resource, and also at the same time taking maximum advantage of the resource by judicious exploitation. At present the fishery is governed by the Kerala Marine Fishing Regulation Rules, 1980, under which the following restrictions are enforced on mechanized fishing in the territorial waters of the state :

1. Fishing by all fishing vessels fitted with mechanical means of propulsion except motorized country crafts in the area from the shore up to 30 m line in the sea along the coastline of the State from Kallengode to Paravoor Pozhikkara for a length of 78 km and the area up to 20 m line in the sea along the coastline from Paravoor Pozhikkara to Manjeswaram for a length of 512 km has been prohibited.
2. The use of all bottom trawl nets (and also other types) which have less than 35 mm mesh size in stretched condition for fishing in the sea along the entire coastline of the State has been prohibited.
3. The use of all bottom trawl nets from sunset to sunrise, in the sea along the entire coastline of the state has been prohibited.

These restrictions on fishing are intended to (1) protect the interests of the traditional sector, (2) conserve fishery resources and regulate fishing on a scientific basis, and (3) maintain law and order in the territorial waters of the State.

The shrimp trawling grounds currently under exploitation along the Kerala coast lie mostly in the region between Paravoor Pozhikkara and Manjeswaram. Shrimp fish-

ing and processing industry have been active in the southern part of this region with the main centres of activity at Sakthikulangara and Cochin. The most striking feature associated with prawn fishing in this part of the coast is monsoon trawling and the huge income generated from the catch of a single species, the 'Karikkadi'. Monsoon trawling has progressed tremendously since the early seventies and enabled greatly in augmenting shrimp production in the state. Traditional fishing community feels that the monsoon trawling has been adversely affecting the conservation of fish wealth and their share of earning from fishing. The increasing conflicts that followed between the two sectors of fishing culminated in a ban on trawling up to 22 km from the shore line during the monsoon season of 1988 throughout the Kerala coast except Sakthikulangara-Neendakara area.

The present analysis of available data on the shrimp fishery at Cochin reveals a few important facts which deserve attention in the context of management of the fishery during the monsoon period.

The prawn landings of the monsoon period, which account for about half of the annual prawn production at the centre, are almost entirely the contribution of shrimp trawlers whose area of operation is quite different from the area exploited by the traditional fishermen. This is because of the peculiar behaviour of *P. stylifera* which migrates in large numbers to the deeper waters during the monsoon period (June-August) as a result of changes in the environmental conditions of the inshore areas. The fact that the abundance of spawners in the trawl fishery is very low during the monsoon season as compared to other seasons of the year precludes the possibility of offshore migration of the species for breeding purpose.

In fact the usual breeding ground of *P. stylifera* is considered to be the coastal waters within about 22 m depth (Menon 1953), and even during the monsoon season the small population of the species lingering very close to the shore and being caught sporadically in the indigenous gears (Suseelan *et al.* 1989) contains a high percentage of spawners. The little fishery that is existing in the traditional sector is chiefly supported by other species that tend to migrate shore-ward with the commencement of monsoon. Thus, apparently there is no clash of interest as far as the exploitation of shrimp resource is concerned during the monsoon season.

Taking into account the crucial role played by *karikkadi* in earning foreign exchange worth several millions of rupees during the monsoon period it is imperative that this resource has to be exploited at the appropriate time. The only possible way of achieving this is by shrimp trawling since the indigenous gears cannot harvest *karikkadi* from the deeper waters. Opinion is expressed from certain quarters that if *karikkadi* is not exploited during the monsoon period by shrimp trawlers it will be available to the indigenous fishery in the nearshore waters after the monsoon is over. Though direct evidences are lacking to fully rule out this possibility there are indications to presume that the species may not return to the coastal waters and unless they are fished out they may perish due to prolonged exposure to the unfavourable hydrographic conditions prevailing in the offshore waters. Analysing the catch data of FORV Sagar Sampada, Suseelan *et al.* (1990) observed the occurrence of *karikkadi* in varying densities in the offshore water, up to 53 m depth during the south-west monsoon period almost as a continuous belt between Quilon and Marmagoa. This would indicate that the offshore migra-

tion of *karikkadi* stock is taking place throughout the west coast during the monsoon season. But its fishery at the northern centres like Calicut and Mangalore, where monsoon trawling is non-existent, becomes active only by November or December. Even at Cochin and Sakthikulangara the postmonsoon fishery for *karikkadi* is preceded by a lean period of 1 or 2 months when the catch includes mainly fresh recruits which are much smaller than the dominant sizes constituting the trawl catches of August. George (1961) also observed that after August-September shrimps of larger size groups disappear from the catches and the smaller groups become dominant. All these indirectly suggest that the offshore population of *karikkadi* may not return to contribute to the coastal fishery after the cessation of monsoon. However, a detailed study is needed to arrive at a definite conclusion in this regard.

The prawn production in the artisanal sector has considerably declined over the years is evident from the available catch statistics. According to George (1961) an active fishery prevailed at Cochin in late fifties with peak catches during July-September when the fishery was mainly supported by *M.dobsoni* (65-99%). *P.stylifera*, though formed second in abundance in the fishery, was prominent only in the post-monsoon period. The present analysis of the catch data (Table 4) indicates that the production of *M.dobsoni* in the artisanal sector is now relegated to a secondary position by *P.indicus*. The decline could have been the cumulative effect of many attributes like constant fishing pressure in the coastal waters by shrimp trawlers, destruction of young ones and other man-made activities in the nursery grounds of important species. Unlike *P.stylifera* which spends its entire life in the sea, *M.dobsoni* and *P.indicus* face commercial fishing in both

the environments — adults in the sea and juveniles in estuaries and backwaters. The extensive backwater system of Vambanad lake has been the grazing field of thousands of traditional fishermen for *thelli*, the juvenile of *M.dobsoni*, from time immemorial. Added to this, many man-made changes in these nursery areas and other destructive processes on the juvenile population (Suseelan 1987) would have caused far-reaching effects on the stock leading to gradual decline in the coastal fishery. In the inshore sea also many kinds of destructive fishing have been in vogue for ages, like indiscriminate capture of undersized prawns and heavy exploitation of the spawning population of *P.stylifera* and *M.dobsoni* by shrimp trawlers during the non-monsoon period. More recently a type of 'mini trawl', which has mesh sizes as small as 16 mm at cod-end, is increasingly operated along the coastal waters by motorized country crafts. This is highly detrimental to the fishery since the catch includes an alarming proportion of juvenile prawns.

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