*J. Mar. Biol. Ass. India*, **47** (2) : 169 - 174, July - Dec., 2005

# Shrimp fishery by mini-trawling along Alleppey coast, Kerala

G. Nandakumar*, E. V. Radhakrishnan, K. Chellappan and P.K. Baby

*Central Marine Fisheries Research Institute, P. B. No. 1603, Cochin-682 018, India*
*E-mail : nandakumar_gopalan@yahoo.co.uk*

**Abstract**

Penaeid shrimps from nearshore waters in 5-12 m depth range are regularly exploited by plank built boats locally known as *murivallam* which operate mini - trawl (cod end mesh size 15-20 mm) along Alleppey coast in Kerala. Observations made for three seasons at Valanjavazhy (1994-97) and at Pallithode (2002-05) indicated that 935 t (cpue 42 kg) and 145 t (37kg) of shrimps were landed by mini-trawl at these centres respectively. The fishing season extended from September to May/June depending on the onset of monsoon. *Parapenaeopsis stylifera* and *Metapenaeus dobsoni* were the main contributors to the shrimp fishery. While the former predominated (91%) the fishery at Valanjavazhi, both the species showed almost equal representation at Pallithode. Species-wise details on size distribution, sex ratio, maturity and spawning season have been indicated. In spite of discarding smaller *P. stylifera* (< 41 mm in total length), the commercial catch at Valanjavazhy consisted more than 50% juveniles during many months in the observation period. *P. stylifera* completes its nursery phase in the nearshore areas along the coast and fishing them at this stage is detrimental to the fishery of this species. The impact of mini-trawl operation on the shrimp resources off Kerala along with possible management measures is discussed.

**Keywords**: Mini-trawl, shrimp fishery, Kerala

## Introduction

Shrimps continue to be the major foreign exchange earner in the marine sector of India due to heavy demand for export purposes. Mechanised vessels operating shrimp trawl contribute about 90% of shrimp landings of our country. From single-day fishery in seventies in the inshore waters to multi-day fishing in deeper grounds, there have been drastic changes in the craft size, gear, engine power along with usage of sophisticated implements such as Global Positioning System (GPS) and echo-sounder to exploit these resources to the maximum level. In the traditional sector, the fishermen ingeniously devised in late eighties, a simple method of fishing for shrimps from nearshore regions. They operated a smaller version of shrimp trawl net locally called mini-trawl from plank-built boats, which fetched good returns.

Rao (1986) gave an account on the status of shrimp fishery of India along with review on the biology of important species. Suseelan and Pillai (1993) made an overview of crustacean resources (1984-92) of India. Observations on the shrimp fishery off Cochin were made by Suseelan *et al.* (1993). Shrimp fishery off Sakthikulangara in the context of monsoon trawling ban was reported by Nandakumar *et al.* (2001). Present status of penaeid shrimp fishery in India was discussed by Nandakumar and Maheswarudu (2003).

The mini-trawl was first introduced along the Alleppey coast in 1987, which subsequently spread to the northern coast of Kerala in later years. In 1998, the number of mini-trawl units operating along Kerala coast was estimated as 4351 of which 1589 units were fishing in different villages of Alleppey District (SIFFS-1998). Saly (2000) gave an account on the fishing by mini-trawl at Chellanam based on a three-months study during 1999. Ammini *et al.* (2004) gave a brief report on the general fishery by mini-trawl operation in Kerala. In the present paper, a detailed account on the shrimp fishery by mini-trawl along Alleppey coast is given for the first time. The impact of mini-trawl operation on the inshore shrimp fishery off Cochin-Sakthikulangara is also discussed along with suitable suggestions for proper management of the fishery.

## Materials and methods

In the Alleppey District of Kerala, maximum number of mini-trawl units are operated at Valanjavazhy as a base (44%; 700 units). This fishing centre has been selected initially for observation of mini-trawl landings during 1994-97 followed by study at Pallithode, which is the northern most centre of Alleppey District during 2002-05. Data on shrimp catch, effort expended and species composition by weight were estimated based on sampling

10-20% of mini-trawl units operated. Using the raising factor N/n where 'N' is the number of units landed on the day and 'n' is the units observed, total weight of the resource on the sampling day was estimated on the basis of sampling units. The monthly estimates were obtained by raising the estimated resource on the observation day to the number of fishing days in the month. Number of mini-trawling units went for fishing for the day is taken as boat days. A random sample of 1-2 kg of shrimps on the observation day was collected for studies on length distribution, sex ratio and maturity stages. Total length of shrimp was taken from tip of rostrum to tip of telson for both sexes separately. Based on colouration and thickness of the ovary, maturity stages in females were recorded as immature, early maturing, late maturing, mature and spent. Shrimps measuring lesser than the size at maturity (50% level) were considered as juveniles.

## Results

***Craft and gear*:** During late eighties the existing plank-built boat (*Thanguvallom*) was cut into two halves and used as two mini-trawl units, which gave the name *murivallom* (half-boat). Presently the boats are newly built, maintaining a similar pattern. The length overall (LOA) varies from 7.0 and 9.1 m and are fitted with outboard engines of 8.0-9.5 H.P. Nowadays 15H.P engines are also used by some units. At Valanjavazhy, during the last five years plank-built boats were being replaced by fibreglass units. At present about 55% of units are fibreglass/fibreglass coated crafts. The gear, mini-trawl, is a smaller version of the trawlnet used by mechanised trawlers for shrimp fishing. They are made of nylon with two otter-boards attached to them and are called *minivala*, *boardum vala* and *valikkanna vala* at different districts. D' Cruz (1999) has given the design details of the mini-trawl. The cod end mesh measures 15-16 mm at Valanjavazhy while at Pallithode it is 18-20 mm. During the monsoon months (June-September) the mini-trawl units are used as carrier boats for ring-seine boats.

***Fishery*:** Single-day fishing is normally carried out and the fishermen leave the shore in the early morning and return by late afternoon. The fishing is done in 5-15 m depth, mostly in the range of 8-10 m and the boats can be seen from shore. Depending on the availability of shrimps and water currents the depth of fishing is changed and if catch is less the net is dragged in 4-5 m depth even though, the shrimps caught are smaller in size. At Valanjavazhy, the fishers operate mini-trawl for shrimps between September and May/June depending on monsoon and roughness of the sea and the details collected during this period are, therefore, treated as annual in this paper. They do not operate any other gear. On the other hand, at Pallithode mini-trawl is operated by the fishers when shrimps, are available i.e. during November-May and at other times gillnets are operated for fishes.

**Valanjavazhy:** The mini-trawl catch at this centre consisted of mainly shrimps which formed 70-90%. Flatfishes (*Cynoglossus* spp.), crabs (*Portunus* spp.) and sciaenids formed the rest of the catch. *Oratosquilla nepa* caught in good quantities during certain months, was discarded. The shrimp catch which was 701 t in 1994-95 increased by 69% to 1183 t in 1995-96 but decreased by 22% to 921 t in 1996-97. The catch rate/unit also showed a similar trend as 28, 58 and 41 kg for the three consecutive years respectively. The average annual shrimp catch was 935 t with CPUE of 42 kg (Table 1). The main seasons for shrimp fishery were September-October and February-May.

The major constituents of shrimps caught were *Parapenaeopsis stylifera* and *Metapenaeus dobsoni* locally known as *Karikkadi* and *Poovalan*, respectively. Other commercial species such as *M. affinis* and *Fenneropenaeus indicus* were available in smaller quantities. The former species was available regularly during 1994-95 forming 1.4 % of the shrimp catch. *P. stylifera* was the predominant species which constituted between 88 and 94% of the total shrimp catch during 1994-97 and formed 91% of average annual shrimp catch. *M.dobsoni* contributed to 9% annually to the total shrimps.

***P. stylifera*:** As *P. stylifera* (*Karikkadi*) was the most important species in the mini-trawl landings, details on

Table 1. *Shrimp catch (t), cpue (kg) and species composition in mini-trawl landings at Valanjavazhy*

| Year | Units | *P.stylifera* | *M.dobsoni* | *F.indicus* | *M.affinis* | Total shrimps | Cpue (kg) |
|---|---|---|---|---|---|---|---|
| 1994-95 | 24,774 | 632.3 | 58.9 | - | 9.7 | 700.9 | 28.3 |
| % | | 90.2 | 8.4 | | 1.4 | | |
| 1995-96 | 20,481 | 1108.3 | 74.6 | - | - | 1182.9 | 57.8 |
| % | | 93.7 | 6.3 | | | | |
| 1996-97 | 22,360 | 811.1 | 106.8 | 1.2 | 2.1 | 921.2 | 41.2 |
| % | | 88.1 | 11.6 | 0.1 | 0.2 | 0.2 | |
| Av. | 22,538 | 850.6 | 80.1 | 0.4 | 3.9 | 935.0 | 41.5 |
| % | | 90.9 | 8.6 | 0.04 | 0.4 | | |

biological aspects of this species are mainly discussed here. Length range of this species was 41-125 mm for females and 41-100 mm for males. While females showed multiple modal groups in most of the months, males exhibited single monthly modal group during these three seasons of fishery. Females of 61-100 mm and males of 61-80 mm length range dominated the catch during most of the months. Larger size groups between 91 and 105 mm were noticed for both sexes mostly during September-November in all these three years. Dominant annual modes for females were at 81, 68 & 83 and 63 & 78 mm for the first, second and third years, respectively. Males showed 73 mm as annual dominant mode during 1994-95 and 1995-96, which decreased to 68 mm in the third year.

Based on the size at first maturity (at 50% level) *P. stylifera* measuring < 71 mm for females and < 66 mm for males were taken as juveniles. Juveniles of female predominated (60-83%) the catch during April-May in all the three years. They constituted 24 and 25% of the annual population during the first two years but doubled to 51% during 1996-97. Juveniles of male were abundant in the catch during December-May in 1994-95, February-May in 1995-96 and March-June in 1996-97. The annual catch composition of juveniles of male varied between 24% and 27%. The average annual composition of male and female juveniles in the *Karikkadi* catch during 1994-97 was 38% and 26% respectively (Fig. 1). When males and females were considered together, the monthly percentage composition of juveniles varied between 9 and 56 with an average annual percentage of 32. The peak period of juvenile abundance during the entire three years was April-June. The present result was compared with juvenile composition of *P. stylifera* in the commercial trawl operations in the natural habitat of this species off Kayamkulam-Ambalapuzha (20-30 m depth range) for the same observation period (Fig.2). While the commercial trawler catch during 1994-97 consisted of 7-9% juveniles, their destruction was to the tune of 25- 40% by mini-trawl. Declining catch trend of this species from two major fish landing centres of Kerala for the past fifteen years (1990-2004) is given in order to highlight the vulnerability of juveniles to fishing (Fig.3).

Females outnumbered males regularly during September-October 1994-97 and in other months both sexes showed dominance over the other without any general trend. When the total fishing season (September-June) was considered, females formed about 55% of *P. stylifera* catch. The higher percentage of late maturing and mature females in the catch, indicated two peak spawning seasons for this species, one during September-November and another during February-April.

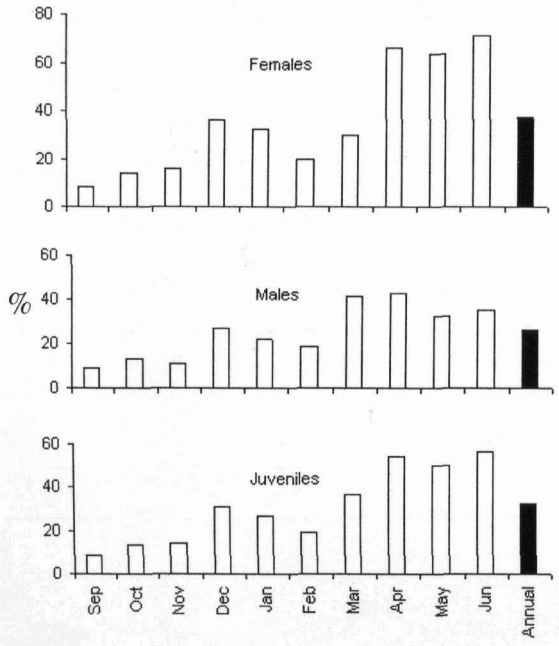


Fig.1. Average annual percentage composition of juvenile *P. stylifera* in mini-trawl catch at Valanjavazhy during 1994-97.

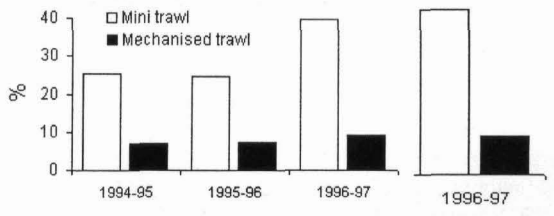


Fig.2. Juvenile composition in *P. stylifera* landings of mini-trawlers and mechanised trawlers during 1994-97.

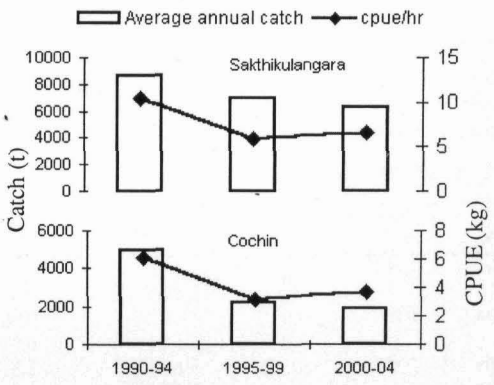


Fig.3. Catch trend of *P. stylifera* in trawl landings at Sakthikulangara and Cochin during 1990-2004.

***M. dobsoni*:** Landing of this species during 1994-97 period showed an increasing trend with a catch of 59 t, 75 t and 107 t in the three years of observation respectively. Unlike *P. stylifera*, availability of this species started only from October and extended till June (Table 1). Length ranged from 36-110 mm for females and 46-95 mm for males. Major size group that contributed to the fishery was 51-85 mm. The dominant mode was at 63 mm for both sexes during 1994-95, which increased to 73 mm for females and 68 mm for males in the following two years. Peak breeding was observed in October, December and February. Males outnumbered the females throughout the observation period forming between 54% (1994-95) and 65% (1995-96).

An attempt was made to find out the proportion of juvenile (females < 66 mm and males < 61 mm in total length ) population of *M. dobsoni* in the mini-trawl catch during 1994-95 when this species was regularly available. The monthwise juvenile composition in the catch varied between 14% (May) and 72% (February) in females; and from 12% (May) to 75% (December) in males. Juveniles formed more than 50% during December-March and December-January in females and males, respectively (Fig.4). When percentage composition of both sexes were considered together, December–March was found to be the peak period of occurrence. In the commercial trawl landings at Cochin centre for the same year (1994-95) the juveniles formed only 9% compared to 41% in the mini-trawl.

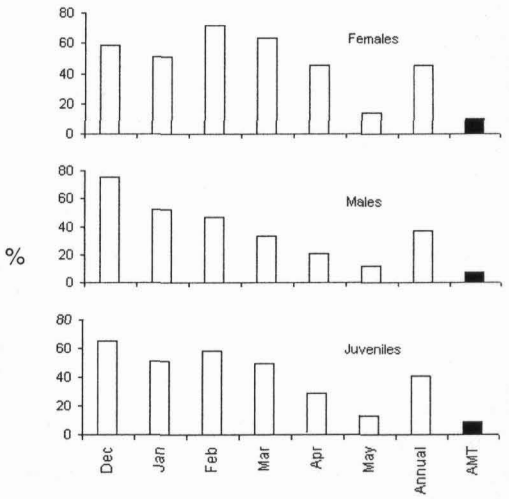


Fig.4. Juvenile composition in *M. dobsoni* landings of mini-trawlers at Valanjavazhy during 1994-95. (AMT – Annual juvenile composition in mechanised trawl catch)

**Pallithode:** From this centre, as a base, one hundred mini-trawl units are operated, and the fishing operation usually starts from October after the monsoon season. Till November all the units operate gill nets for exploiting fishes such as sardines, mackerels and sciaenids. During 2002-05, shrimp fishery at this centre started from November and extended till May. Penaeid shrimps were the major contributors to the fishery forming between 78 and 87% of the mini-trawl catch. Fishes (*Cynoglossus* spp. sciaenids and silverbellies) and crabs (*Portunus* spp. and *Charybdis* spp.) formed the rest of the catch. Shrimp catch gradually increased from 117 t in 2002-03 to 195 t in 2004-05 with an average annual landing of 145 t (Table 2). Catch rate per unit also reflected the same trend showing more than two fold increase between 2002-03 (27 kg) and 2004-05 (58 kg). As at Valanjavazhi, *P. stylifera* and *M. dobsoni* were the two major constituents of the shrimp fishery at this centre. In the first two years the latter formed about 51% of shrimp catch while in 2004-05, domination of *P. stylifera* was observed (66%). Peak fishery seasons were December-January and March-May for *M. dobsoni*. There was one important fishing season between February and May for *P. stylifera*. For the entire period of observation (2002-05), *P. stylifera* was the major contributor (56%) followed by *M. dobsoni* forming 43% of shrimp catch. Among the other species, *F. indicus* (0.8%) was available in the catch during most of the months while, *M. affinis* and *M. monoceros* were present sporadically.

Length range of females of *P. stylifera* was 46-115 mm in total length during 2002-05 with dominant modes at 73 and 83 mm in the first two years, followed by a

Table. 2. *Catch (t), effort and species composition of shrimps in mini-trawl at Pallithode*

| Year | Units | *P. stylifera* | *M. dobsoni* | *F. indicus* | *M. affinis* | *M. monoceros* | Total shrimps | Cpue (kg) |
|---|---|---|---|---|---|---|---|---|
| 2002-03 | 4,414 | 57.2 | 59.2 | 0.45 | - | - | 116.9 | 26.5 |
| % | | 48.9 | 50.7 | 0.4 | | | | |
| 2003-04 | 4,156 | 59.0 | 62.9 | 0.98 | 0.1 | 0.13 | 123.2 | 29.6 |
| % | | 47.9 | 51.1 | 0.8 | 0.1 | 0.1 | | |
| 2004-05 | 3,383 | 130.0 | 63.8 | 1.8 | 0.16 | 0.08 | 195.9 | 57.9 |
| % | | 66.4 | 32.6 | 0.9 | 0.08 | 0.04 | | |
| Av. | 3,984 | 82.1 | 62.0 | 1.1 | 0.08 | 0.07 | 145.3 | 36.5 |
| % | | 56.5 | 42.7 | 0.7 | 0.06 | 0.05 | | |

Table 3. *Percentage composition of juveniles in the mini-trawl shrimp landings at Pallithode during 2002-05 (Av. annual)*

| Months | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | Total |
|---|---|---|---|---|---|---|---|---|
| *P.stylifera* | | | | | | | | |
| Female | 9 | 39 | 16 | 25 | 22 | 34 | 28 | 23 |
| Male | - | 21 | 7 | 16 | 17 | 34 | 14 | 20 |
| All juveniles | 5 | 30 | 11 | 19 | 19 | 34 | 21 | 22 |
| *M.dobsoni* | | | | | | | | |
| Female | 12 | 16 | 38 | 21 | 32 | 46 | 13 | 25 |
| Male | 8 | 16 | 20 | 18 | 10 | 12 | 7 | 14 |
| All juveniles | 11 | 16 | 29 | 19 | 21 | 33 | 10 | 20 |

lower mode at 68 mm during 2004-05. Males varied between 41 and 105 mm in total length with one predominant mode at 73 mm for all the three years. Length range of *M. dobsoni* was 36-115 mm with dominant modes at 63, 73 and 83 mm for females and 63 & 73 mm for males. Sex ratio analysis showed that variations existed in the dominance of males and females in the shrimp catch, between months, for both species. Males of *P. stylifera* formed about 52% of the catch in all the three years. In the case of *M. dobsoni*, females outnumbered males and formed 60.2, 53.6 and 55.5% of the catch during the consecutive three years, respectively.

Even though females in advanced stages of maturity were present in all months, based on their higher percentage compositions, it was inferred that there were two peak spawning periods i.e. November-February and May for *M. dobsoni* and one prolonged period (January-May) for *P. stylifera*.

Juveniles of *P. stylifera* formed 30% and 34% of catch in December and April, respectively when all the three seasons (2002-05) were considered together indicating peak months of occurrence (Table 3). Their catch composition was about 19.0% during February-March and 21.3% in May. The average annual juvenile composition was 21.6% in *P. stylifera* catch. In the case of *M. dobsoni*, average annual percentage composition of juveniles during 2002-05 was 20.2%. The primary season of availability of juveniles was January-April (19.2-33.1%) and their maximum occurrence was observed in April.

## Discussion

The present study on mini-trawl operation along Alleppey coast revealed that penaeids were the major contributors to the catch and *P. stylifera* and *M. dobsoni* were the dominant species. Tomy Chacko (1991) based on his observations on traditional fishing along Alleppey coast stated that major catch of mini-trawl included prawns (*P. stylifera*), carangids and soles. Saly (2000) and Ammini *et al* (2004) also observed that mini-trawl is mainly intended to harvest shrimps available in shallow waters.

The fishers at Valanjavazhy operate mini-trawl alone during September-June for their livelihood, mainly targeting the shrimps. On the other hand, the fishermen at Pallithode operate gill nets immediately after monsoon during October-November and then switch over to mini-trawl operation for fetching shrimps till May. Even during November-May, they operate any one of the nets as per availability of shrimps and fishes, which is actually advantageous to fetch better income.

The average annual percentage composition of juveniles of *P. stylifera* at Valanjavazhy was 32.3 with maximum availability during April-June (50-56%). Apart from this, *P. stylifera* lesser than 41 mm in length were discarded which amounted to about 5% in weight during September-November and about 7-10% during April-June. The destruction of juvenile *Karikkadi* by mini-trawl operation at Valanjavazhy was about four times more than the commercial trawl operation in deeper shrimp grounds off the same coastline. Thus the enormity of destruction of juvenile population of *P. stylifera* by mini-trawling all along Kerala coast can be visualised.

Sakthikulangara is the most important shrimp landing centre in Kerala and *P. stylifera* contributed 68% of the average annual shrimp production during 1986-2000 (Nandakumar *et al*., 2001). About 1000 mini-trawl units based at Valanjavazhy-Thrikkunnapuzha coast in Alleppey district, operate mostly in 5-10 m depth in the nearshore waters around their respective landing centres. Shrimps in the 20-30 m depth range between Kollam and Ambalapuzha exploited by mechanised trawlers based at Sakthikulangara includes, the same coast line utilized by mini-trawl units mentioned earlier. Decline in catch and catch rate of *P. stylifera* was observed in trawl landings at Sakthikulangara for the past fifteen years. Catch and catch rate/hr have decreased from 8596 t and 10kg during 1990-94 to 6270 t and 6 kg during 2000-04, respectively within a span of 15 years. *Karikkadi* unlike other penaeids, completes its entire life cycle in sea itself and uses the nearshore shallow region (1-5 m depth) as its nursery ground. Hence exploitation of these juveniles along

Alleppey coast, without doubt, hinders recruitment to their inshore natural habitat. It may be one of the major reasons for reduction in the landings of this species at Sakthikulangara-Neendakara centres. Similar trend in the landings of *P. stylifera* was noticed at Cochin where the catch and catch rate declined by 60% and 40%, respectively between 1990 and 2004 which may be due to exploitation of juveniles in the nearby regions like Pallithode, Chellanam and Vypeen by mini-trawl. Menon (1996) stated that generally a large proportion of the mini-trawl catch composed of juveniles/subadults of flatfish and prawn (*P. stylifera*), causing damage to recruitment. Exploitation of juvenile *M. dobsoni* was almost at the high level as *P. stylifera* at Valanjavazhi. This species depends on backwaters and estuaries for their nursery phase and return back to sea for further growth and reproduction. However, it is better to avoid catching juveniles by mini-trawl, in order to enhance the stock level of *M. dobsoni.*

The gear sweeps up the bottom in the near shore waters and the smaller mesh size catches juveniles efficiently. The cumulative damage to fish stocks would be high (D'Cruz, 1999). The above observation sums up the conclusions made in the present study decisively. Exploitation of shrimps by mini-trawl cannot be banned suddenly, as it would be a threat to the livelihood of thousands of fishers. Such a step should have been taken at the initial stage in early nineties, by foreseeing the detrimental effects of this gear. It is a solace to note that no further increase in the fleet size of mini-trawl units operating off Alleppey from the 1998 level was reported. Attempts should be made to prevent further proliferation of the fleet size.

An ideal option would be to fix minimum legal size for the export of shrimps, as done in lobsters. Cod end mesh size of the mini-trawl has to be increased to 25 mm from the present 15-20 mm. Strengthening of the existing extension programmes to educate the fisherfolk also merits urgent attention.

**Acknowledgement**

This paper was presented at the 7th Indian Fisheries Forum held at Bangalore, during 8-12 November, 2005.The authors are thankful to Prof. (Dr.) Mohan Joseph Modayil, Director, C.M.F.R. Institute, Cochin-18 for constant encouragement.

**References**

Ammini, P.L., C.J. Prasad and G. Subbaraman. 2004. The mini-trawl fishery of Kerala. *Mar. Fish. Infor. Serv. T & E Ser.*, 181: 4-5.

D'Cruz, T. 1999. *Artisanal Fishing Gears of Kerala, Design Specifications*. South Indian Federation of Fishermen Societies. Karamana, Thiruvananthapuram: p.1-59.

Menon, N.G. 1996. Impact of bottom trawling on exploited resources. *In*: Menon, N.G. and Pillai, C.S.G. (Eds.). *Marine Biodiversity, Conservation and Management*. p. 97-102. Central Marine Fisheries Research Institute, Cochin.

Nandakumar, G., K. N. Rajan and K. Chellappan. 2001. Observations on the prawn fishery off Sakthikulangara in the light of monsoon trawling ban. *J. Mar.Biol. Ass. India.*, 43(1&2): 136-147.

_____, and G. Maheswarudu. 2003. Penaeid Shrimps. *In*: Mohan Joseph, M. and Jayaprakash. A.A. (Eds.). *Status of Exploited Marine Fishery Resources of India*. (22), p. 176-181. Central Marine Fisheries Research Institute, Cochin.

Rao, P. Vedavyasa. 1986. A review of the present status of the prawn fishery of India. *In*: James, P.S.B.R. (Ed.). *Recent advances in Marine Biology*. Today and Tomorrow's Printers and Publishers: p. 367-404.

Saly N. Thomas. 2000. Shrimp trawling with motorized traditional crafts. INFOFISH International. No. 1: 60-61.

SIFFS. 1998. *A census of the artisanal marine fishing fleet of Kerala*. South Indian Federation of Fishermen Societies. Karamana. Thiruvananthapuram: p.1-132.

Suseélan, C. and N.N. Pillai. 1993. Crustacean fishery resources of India – An overview. *Indian J. Fish.*, 40(1, 2): 104-111.

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

Tomy Chacko. 1991. Traditional Fishing along Alleppey coast-A study. *Proc. Nat. Workshop on Low Energy Fishing*. Society of Fisheries Technology (India) Matsyapuri. Kochi: p. 126-129.

Accepted: 25 January 2006