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# Distribution of deep sea prawns off Kerala

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**Abstract**

Exploratory trawling using High Speed Demersal Trawl II was conducted in $1^0$ x $1^0$ square grids at depth ranging from 100 to 750 m between $07^0$ and $12^0$N lat. onboard FORV *Sagar Sampada*. Altogether 2444 kg of deep sea prawns were caught off Kerala. The depth-related catch rates of deep sea prawns in different latitudes revealed that the region between $08^0$N and $09^0$N lat. which covers the Quilon bank (CPUE 49.9 kg/hr) is the most productive ground for deep sea prawns, mainly at 251-350 m. The deep sea prawns were represented by 11 species and *Parapandalus spinipes* was the most dominant species followed by *Heterocarpus woodmasoni*. *H. gibbosus* showed wider distribution from $08^0$ to $12^0$ N lat. at 251-500 m and *Metapenaeopsis andamanensis* with restricted distribution from $10^0$ to $12^0$N lat.

**Keywords:** Deep sea prawn, *Heterocarpus* sp., *Parapandalus* sp., *Aristeus* sp., *Plesionika* sp., *Solenocera* sp., *Metapenaeopsis* sp.

## Introduction

Exploratory surveys have shown immense scope for commercial exploitation of deep sea crustaceans along the Kerala coast (Suseelan 1985, 1988; Suseelan *et al*., 1989a, b). In order to make deep sea prawn fishery viable, knowledge on the distribution, area of abundance etc., is essential. Keeping this in view, the results of exploratory cruises of FORV *Sagar Sampada* during 1999-2002 were analysed and the results are presented.

## Material and methods

The data for the study were collected on board FORV *Sagar Sampada* (Centre for Marine Living Resources and Ecology, Ministry of Earth Sciences, Govt. of India) during exploratory cruise number 174 (June – July, 1999), 183 (April, 2000), 189 (October – November, 2000), 191 (January, 2001), 196 (July, 2001) and 197 (April, 2002). A total of 164 bottom trawl operations using High Speed Demersal Trawl II (HSDT-II crustacean) with 30 mm square cod end mesh were made at each $1^0$ x $1^0$ square grid at a depth ranging from 100 to 750 m between $07^0$ and $12^0$N lat.(Fig. 1). The latitudes were divided into 9 depth zones following

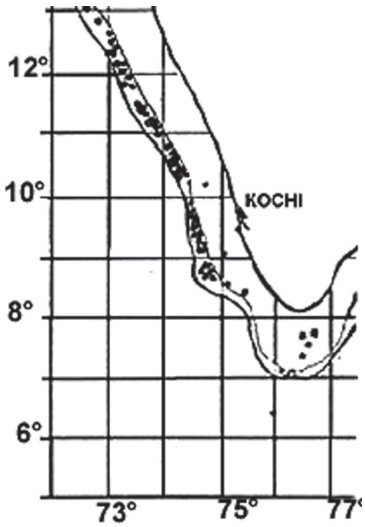


Fig. 1. Map showing the western continental shelf of Kerala with dots indicating the stations of bottom trawl operation

Suseelan (1985). At each station, the geographical position and depth of operation of the vessel, total catch, fishing effort and species composition were recorded. Prawns were identified using FAO identification keys. Catch per unit effort (CPUE)

was calculated separately for each depth zone in different latitudes.

## Results

Depthwise CPUE (kg/hr) of deep sea prawns at various latitudes off Kerala are given in Table 1. During the survey, the total trawl effort was 100 hours, in which 2444 kg of deep sea prawns were caught with a CPUE of 24.4 kg/hr. The region $08^0$ -$09^0$ N lat. was found to be very productive with the highest CPUE of 49.9 kg/hr followed by $09^o$ - $10^o$ N lat. with the CPUE of 44.9 kg/hr. The catch was found to be high in the region $09^0$ - $10^0$ N lat. with 1474.7 kg. The depth zone 301-350 m showed the maximum catch with 1218.8 kg while the highest CPUE (38.7 kg/hr) of deep sea prawns was registered at 251-300 m depth. In 601-700 m, the deep sea prawns were available in very small quantities ($12^o$ N lat.).

The results of catch composition in different latitudinal and bathymetric regions revealed that the deep sea prawn resources are multispecies in nature, available in varying proportions and comprised of 11 species viz., *Parapandalus spinipes, Heterocarpus woodmasoni, H. gibbosus, H. alfonsi, Metapenaeopsis anadamanensis, Aristeus alcocki, Plesionika martia, P. ensis, Parapenaeopsis investigatoris, Penaeopsis jerri* and *Solenocera hextii.* The depthwise species composition and CPUE (kg/hr) of 11 species of deep sea prawns encountered from $07^0$-$12^0$ N lat. is given in Table 2. The highest number of species was recorded from $10^0$-$11^0$ N lat. with nine species

Table 1. Catch (C in kg), effort (E in hr) and CPUE (C/hr in kg) of deep sea prawns off Kerala

| Latitude | | Depth Zones (m) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 150-200 | 201-250 | 251-300 | 301-350 | 351-400 | 401-450 | 451-500 | 501-600 | 601-700 | Total |
| $07^o$ N | C | 3.6 | | 5.5 | | | | | | | 9.1 |
| | E | 1.6 | | 1.9 | | | | | | | 3.5 |
| | C/hr | 2.3 | | 3.0 | | | | | | | 2.6 |
| $08^o$ N | C | | 0.3 | 149.0 | 126.0 | 89.0 | | | | | 364.3 |
| | E | | 0.5 | 1.3 | 1.3 | 4.3 | | | | | 7.3 |
| | C/hr | | 0.6 | 114.6 | 96.9 | 20.9 | | | | | 49.9 |
| $09^o$ N | C | | 83.0 | 210.0 | 659.7 | 379.0 | 121.0 | 9.0 | 13.0 | | 1474.7 |
| | E | | 2.2 | 1.5 | 9.3 | 12.5 | 1.5 | 3.0 | 3.0 | | 32.9 |
| | C/hr | | 38.6 | 144.8 | 71.3 | 30.3 | 80.7 | 3.0 | 4.3 | | 44.9 |
| $10^o$ N | C | | | 3.0 | 319.1 | 0.8 | 10.0 | 2.0 | | | 334.9 |
| | E | | | 1.0 | 19.2 | 1.0 | 3.9 | 0.3 | | | 25.4 |
| | C/hr | | | 3.0 | 16.6 | 0.8 | 2.6 | 6.7 | | | 13.2 |
| $11^o$ N | C | 8.0 | | 16.4 | 106.0 | 2.0 | | | | | 132.4 |
| | E | 2.5 | | 2.8 | 6.0 | 1.5 | | | | | 12.8 |
| | C/hr | 3.2 | | 5.9 | 17.7 | 1.3 | | | | | 10.3 |
| $12^o$ N | C | | 28.0 | 42.0 | 8.0 | 7.5 | 10.0 | 3.0 | 2.0 | 0.3 | 100.8 |
| | E | | 2.2 | 1.4 | 0.5 | 6.0 | 1.5 | 0.3 | 0.6 | 1.0 | 13.4 |
| | C/hr | | 13.0 | 31.1 | 17.8 | 1.3 | 6.7 | 10.0 | 3.3 | 0.3 | 7.5 |
| $13^o$ N | C | | | 8.0 | | | 8.0 | | 12.0 | | 28.0 |
| | E | | | 1.5 | | | 1.4 | | 2.0 | | 4.9 |
| | C/hr | | | 5.5 | | | 5.7 | | 6.0 | | 5.8 |
| Total | C | 11.6 | 111.3 | 433.9 | 1218.8 | 478.3 | 149.0 | 14.0 | 27.0 | 0.3 | 2444.1 |
| | E | 4.1 | 4.8 | 11.2 | 36.2 | 25.3 | 8.3 | 3.6 | 5.6 | 1.0 | 100.0 |
| | C/hr | 2.8 | 23.4 | 38.7 | 33.7 | 18.9 | 18.0 | 3.9 | 4.8 | 0.3 | 24.4 |

Table 2. CPUE (kg/hr) of different species of deep sea prawns off Kerala

| Species | Depth zones (m) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 150-200 | 201-250 | 251-300 | 301-350 | 351-400 | 401-450 | 451-500 | 501-600 | 600-700 |
| | | | | 07° N lat. | | | | | |
| *S.hextii* | 2.25 | | | | | | | | |
| *P.spinipes* | | 0.97 | | | | | | | |
| *P.jerryi* | | 2.00 | | | | | | | |
| | | | | 08° N lat. | | | | | |
| *P.spinipes* | | 0.25 | 79.63 | 18.99 | | | | | |
| *H.woodmasoni* | | | 26.51 | 58.91 | 6.21 | | | | |
| *H.gibbosus* | | | 5.73 | 16.98 | 14.73 | | | | |
| *S.hextii* | | 0.31 | 2.75 | 2.04 | | | | | |
| | | | | 09° N lat. | | | | | |
| *P.spinipes* | | 24.51 | 66.20 | 5.02 | 0.80 | | | | |
| *H.woodmasoni* | | | 55.92 | 46.06 | 10.72 | 3.69 | 0.31 | 0.2 | |
| *P.martia* | | | 9.23 | 0.6 | 1.22 | 0.12 | | | |
| *H.gibbosus* | | | 0.93 | 19.13 | 16.92 | 24.31 | 0.95 | | |
| *S.hextii* | | 6.09 | 8.0 | | 0.66 | | | | |
| *A.alcocki* | | | | 0.5 | | 49.76 | 1.76 | 2.8 | |
| *P.ensis* | | | 0.03 | | | 2.79 | | | |
| *P.jerryi* | | 8.00 | 4.52 | | | | | | |
| | | | | 10° N lat. | | | | | |
| *P.spinipes* | | | 0.31 | 0.89 | | | | | |
| *H.woodmasoni* | | | | 1.99 | 0.24 | | | | |
| *P.martia* | | | 0.10 | | | | | | |
| *H.gibbosus* | | | | 13.06 | 0.56 | 0.75 | | | |
| *S.hextii* | | | 0.08 | | | | | | |
| *A.alcocki* | | | | | | 1.81 | 6.38 | | |
| *P.investigatoris* | | | | | 0.10 | | | | |
| *M.andamanensis* | | | 2.61 | 0.68 | | | | | |
| *H.alphonsii* | | | | | | | 0.29 | | |
| | | | | 11° N lat. | | | | | |
| *P.spinipes* | 0.3 | | 1.21 | 2.1 | | | | | |
| *H.gibbosus* | | | 2.46 | 6.53 | 0.63 | | | | |
| *A.alcocki* | | | | 3.42 | 0.7 | | | | |
| *S.hextii* | | | 0.26 | | | | | | |
| *M.andamanensis* | 2.9 | | 1.57 | 5.62 | | | | | |
| *P.martia* | | | 0.36 | | | | | | |
| | | | | 12° N lat. | | | | | |
| *P.spinipes* | | 7.98 | 10.65 | | | | 3.21 | 0.33 | |
| *H.gibbosus* | | | 9.25 | 11.82 | 0.25 | 3.21 | 2.61 | | |
| *A.alcocki* | | | | 5.96 | 1.0 | 3.46 | 4.18 | 3.0 | 0.25 |
| *M.andamanensis* | | 5.04 | 11.21 | | | | | | |
| | | | | 13° N lat. | | | | | |
| *P.spinipes* | | | 2.0 | | | | | | |
| *A.alcocki* | | | | | | 5.71 | | 6.0 | |
| *P.ensis* | | | 3.52 | | | | | | |

followed by $09^0$-$10^0$ N lat. with eight species. The depth zones 251-300 m in the $09^0$-$10^o$ N lat showed the highest species diversity of deep sea prawns both qualitatively and quantitatively. While examining the pattern of abundance in respect of the commercially important species, *Parapandalus spinipes* and *Heterocarpus woodmasoni* were found relatively abundant in the depth zones 251-300 m and 301 - 350 m in the $08^0$-$10^0$ N lat. *Aristeus alcocki,* another species constituting the deep sea prawn fishery in Kerala, is distributed in the southern latitude zones $09^0$-$10^0$ N lat. (off Alleppey and Cochin) at 401-500 m and at $12^0$-$13^0$ N lat. (off Ezhimala) towards north. *Parapaeneopsis spinipes* also showed a wider distribution between $08^0$ and $12^0$ N lat. at the depth 201-350 m. The distribution of *Metapenaeopsis andamanensis* was restricted to $10^0$-$12^0$N lat. in the depth zones 200-350 m. *Solenocera hextii* and *Plesionika ensis* were found relatively abundant in shallower depths (150-300 m).

**Discussion**

The catch recorded from different latitude zones showed that there is distinct species variation in the availability and abundance in different depth zones. The highest catch rate was observed at $8^0$-$09^0$ N lat. (49.9 kg/hr) followed by $09^0$-$10^0$N lat. (44.9 kg/hr). The results of the exploratory surveys of Indo-Norwegian Project vessels such as M.V. *Velameen*, M.V. *Tuna* and M.V. *Klaus Sunnana* (Oommen, 1980) corroborate with the present findings. The catch rate of deep sea prawns by M.V. *Tuna* were 48.65 kg/hr at $08^0$ - $09^0$N lat. while M.V. *Velameen* registered 34.73 kg/hr. At lat. $09^0$-$10^0$N, M.V. *Velameen* registered a catch rate of 37.06 kg/hr (Suseelan, 1985). It seems that the depth zone 201-500 m is rich in deep sea prawn resources, which can support a commercial fishery. Suseelan (1985) reported similar findings based on the results compiled from the exploratory surveys of R.V. *Varuna* along the southwest coast of India. The fishing grounds off Ponnani and Aleppey were delineated as another important deep sea prawn ground from the commercial point of view due to the abundance of penaeid prawns as well as pandalid shrimps at 251-500 m depth. The existence of good grounds for aristeid and pandalid shrimps was recorded north off Ezhimala between 300 and 600 m depth. Deep sea trawlers, which operated from various harbours also recorded very good catches of *A. alcocki* from these grounds during February - April (Radhika and Kurup, 2005).

Penaeid prawns showed maximum abundance at shallow depths in tropical and sub-tropical seas (Gulland, 1971; Holthuis, 1980), followed by solenocerid shrimps (Anderson and Lindner, 1971). The depth and latitude-related variations in the distribution and abundance of species might be due to the difference in the nature of substratum, bottom contour, water temperature or owing to some other environmental factors that influence the habitat of the species (Dow, 1967; Cartes and Sarda, 1993; Farina *et al*., 1997; Chou *et al*., 1999). Mary and Loannis (1999) also reported similar observation in five deep water decapods from the experimental trawl surveys conducted along the continental slope of Eastern Mediterranean. According to them, the differences in the distribution patterns of *Plesionika ensis, Polycheles typhlops, Parapenaeus longirostris* and *Plesionika heterocarpus* between the depth gradient 100-1000 m were due to highly diverse dietary habits among the species. The species occurring at shallower depths are active predators with higher dietary diversity than those living above 500 m depth. Food analysis of *H. gibbosus* and *H. woodmasoni* supports this view as the deep water dwelling *H. gibbosus* showed less dietary diversity when compared to the shallower water dwelling *H. woodmasoni* (Radhika, 2004).

Results of depth-related catch rates of deep sea prawns in different latitudes reveal that the region between $08^0$N and $09^0$N lat. which covers Quilon bank is the most productive ground for deep sea prawns, at 251-350 m depth. This region was also demarcated as the most important ground for pandalid shrimps where the dominance of *H. woodmasoni, H. gibbosus, P. spinipes,* and *P. ensis* was discernible. The present survey shows that depth between 251 and 350 m is good for commercial exploitation of deep sea prawns off Kerala.

In contrast to the observations made in the exploratory surveys by Suseelan (1985), *P. spinipes* was the principal species in the trawl catches in the present survey. In the commercial deep sea prawn landings also, *P. spinipes* was the dominant species contributing 19% and 40% during 2000-01 and 2001-02, respectively to the total deep sea prawn landings at Kerala (Radhika and Kurup, 2005). The data provide an understanding on the spatial and depth of occurrence of various species of deep sea prawns, which may be useful for the commercial fisheries.

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