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6 Studies on ostracods of the Indian seas

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ABSTRACT

An account of the past five decades of research carried out on ostracods by the staff of the Central Marine Fisheries Research Institute and most relevant works carried out by others on the topic from the Indian seas are presented. This is a review of the major work done especially the distribution and abundance in space and time along with descriptions of species in the inshore as well as in the oceanic regions of the Indian seas

Present status of research on ostracods

Ostracods being an important group of zooplankton under the class Crustacea, the Central Marine Fisheries Research Institute initiated research on ostracods from the very inception of the Institute, as a result of which, good amount of literature are available covering the Indian coasts and the oceanic waters of Indian EEZ including Lakshadweep and Andaman seas. As CMFRI could participate in the Antarctic Expedition some information have been brought out based on third Indian Antarctic Expedition also.

The descriptions of species under the families Cypridinidae, Rutidermatidae, Sarriellidae, Asteropidae, Thanmatocypridae, Halocypridae and Conchoecinae are given in detail in the Dana Report by Poulsen (1962, 1965, 1969&1973). Recent marine podocopid ostracods were studied by Benson (1966) while Angel described the planktonic ostracods (1972) and bioluminescence in planktonic halocyprid ostracods (1968). Bioluminescence has been observed in 11 species of ostracods and the sites of secretion are also described.

Puri (1965) studied the ecology of distribution of recent ostracods in the Indian Ocean. The commensal and free-living species of *Pontocypria* Muller 1894 (Ostracoda-Pontocyprididae) from the Indian and southern oceans were dealt by Maddocks (1968).

Remarkable contributions on ostracods were made by Jacob George (1969). His contributions include a preliminary report on the distribution and abundance of planktonic ostracods in space and time in the Indian Ocean, based on the data from the I.I.O.E. . In this report the variations of population during the southwest and the northeast monsoon periods has been presented. He noticed a high population of ostracods in the northern part of the Arabian sea. As a result of the analysis of a few samples collected from different locations of the Arabian sea, he recorded that out of the 24 species observed, *Cypridina dentata* is the most dominant one. Again, he studied the cypridinid ostracods in the Indian Ocean plankton (1976) and described a halocyprid ostracod, *Bathyconchoecia angeli* sp.nov., from the Malacca Strait, Indian Ocean (1977). George *et al.* (1975) gave an account of the distribution of 14 speciesic of plankton ostracods along the SW coast of India based on collections of 2 cruises of *Blue Fin* (February and April 1970). Of these *Euconchoecia aculeata* and *Cypridina dentata* were the most common and abundant species which showed agg regation above the thermocline. For species, viz. *Microconchoecia curta, Orthoconchoecia atlantica* and *Spinoecia porrecta*, discontinuity layer did not act as a barrier in their vertical movements. Some species like *Conchoecetta giesbrechti and Metaconchoecia rotundata* showed aggregation below the thermocline. George and Nair (1980) investigated planktonic ostracods of the northern Indian Ocean and 32 species of ostracods were identified; 2 of them belonging to Cypridinidae and the rest to Halocypridae. In general, Arabian sea sustained a rich ostracod fauna. They noticed *Euconchoecia aculeata* as the dominant species in the northern Indian Ocean and in the Arabian sea *Cypridina dentata* was the most abundant species confining largely to the neritic areas and off the west coast of India. They also observed that most of the widely distributed species could tolerate a salinity range of 32-37ppt and statistical analysis of the data using students 't' test indicated that 5 species showed seasonal variations and 4 species gave significant 't' values for day and night variations.

Nair *et al.* (1973) studied distribution of ostracods in the Indian Ocean and observed a very high population in the Arabian sea round the year with

their peak abundance always associating with high saline waters. They noticed the peak abundance (>12,500 / haul) in patches off Karachi, Gujarat, Kerala, north of Sumatra and in the central Java sea. They observed that ostracods were more abundant during night thereby illustrating pronounced diurnal vertical migration. Nair (1978) noticed coincident occurrence of *Sagitta enflata* (Chaetognath) and *Cypridina dentata* (Ostracoda) off Maharashtra coast during the 12 th cruise of RV *Gaveshani* along the west coast of India. An account of the ostracod species obtained from zooplankton samples collected along a transect in the western Indian Ocean in January-February 1981 is given by Nair and Madhupratap (1984) and they noticed maximum richness of species north of 10° S. All the sixteen species of planktonic ostracods were cosmopolitan. They also observed that ostracods contributed 2.6% of the total zooplankton and their counts ranged from 75 to 344 / 100 m^3. Distribution of living benthic ostracods in the Bimili backwaters (Gosthani estuary), east coast of India was studied by Annapurna and Rama sarma (1989). Recently Rosamma and Meenakshikunjamma (1996) studied distribution of 12 species of ostracods around Andaman-Nicobar area. According to them *Euconchoecia aculeata* was the most abundant species occurring mostly as swarms with a maximum density of 9732 specimens / 1000 m^3. *Cypridina dentata* was represented only in a few stations. They also observed high abundance for most of the species during premonsoon period. Again, Hussain *et al.* (1996) studied distribution of ostracods in waters off Tuticorin, southeast coast of India.

Coastal waters of the west coast of India

Along the west coast, ostracods of the coastal waters of Bombay, Karwar, Calicut, Cochin, Vizhinjam and Colachel were studied. Of the ostracods, *Pyrocypris* was present during the period February to April 1967 and stray specimens were noticed during November 1966 along Bombay coast (Pillai, 1970). Along north Kanara coast ostracods were rare (10 per ml) during February, March, April and May (Ramamurthy, 1966) and in the inshore waters of Karwar during 1980-'81, they occurred only during November -December (Naomi, 1986). In another study George (1953) observed that ostracods occurred more in the offshore hauls during summer and rare at other parts of the year in the coastal waters of Calicut.

In the Cochin backwater, one species of ostracoda occurred in quite

small numbers mostly in the months of low salinity, the maximum having been observed in September and October (George, 1958). While studying the tidal influence on the diel variations of zooplankton in the Cochin backwater, ostracods were observed only during the period of low high water when salinity showed a secondary peak and their fluctuations were closely associated with the state of tide, their maximum being recorded only during the flood period (Pillai & Pillai, 1974). Silas & Pillai (1977) observed *Cypridina dentata* near the mouth of the estuary during the high salinity period, being rare during premonsoon and absent during other seasons. Also, at a fixed station at Thoppumpady in the Cochin backwater, the ostracods were present only as a minor group during spring tide (Rengarajan and David Raj,1984). Swarming of *Pyrocypris* sp. at Cochin was noticed in August, '87 (Rajagopalan *et al.*, 1992) and during May-September, ostracods were observed in the estuary (Maya & Selvaraj, 1993). But, in prawn culture fields it was recorded during monsoon and postmonsoon months (Sheeba & Menon, 1993).

In the inshore waters of Vizhinjam, the percentage occurrence of ostracods was observed to be small when compared to other zooplankton groups and they were quite prominent during December, 1980 and in July 1981 (Rani *et al.*, 1986). The peak occurrence of ostracods at Vizhinjam was recorded during monsoon season in 1984-'85 & 1985-'86 ; it was during premonsoon period in 1987-'88 and no peaks were noticed during 1986-'87 and 1988-'89 (Rajagopalan *et al.*, 1992). They also studied the relation between these peaks with salinity and temperature and noticed 33 ppt., 32.5 ppt. and 34.5 ppt. and 25.2°C, 24.2°C and 29.8°C at which the peaks recorded during 1984-'85, 1985-'86 and 1987-'88 respectively. At Colachel, during 1973-'74, *Cypridina* sp. was observed as the common ostracod which occurred throughout the period of observation and the maximum occurrence was in the southwest monsoon months of July and August, and the minimum was in September (Suseelan *et al.*, 1985).

Mud banks

Along the west coast of India, formation of mud banks is a common phenomenon at certain places with considerable effect on the fishery of that area. So a few studies have been carried out on the mud banks which included studies on zooplankton and benthos in the mud banks of Alleppey area in Kerala (Mathew *et al.*, 1984 & Regunathan *et al.*, 1984). In the

zooplankton samples, larvae of one species of ostracoda, *Cypridina dentata* were numerically abundant during June and July 1972, when 28125 and 130 specimens respectively per 10 minutes haul, were collected which was 17.4% and 0.1% respectively of the total zooplankton (Mathew *et al.*, 1984). In the benthos collected from mud banks, considerable number of ostracods were recorded and the maximum of 64,800/0.1 m^2 was observed in December (Regunathan *et al.*, 1984).

Indian EEZ

Investigations on ostracoda were carried out along Indian EEZ and adjoining seas, and brought out useful information. Along the Exclusive Economic Zone of the northwest coast of India, the fluctuations of ostracods in the three seasons-premonsoon, southwest monsoon and postmonsoon were studied (Bapat *et al.*, 1982) and among the zooplankters ostracods formed second in abundance in the premonsoon (2.4%), followed by southwest monsoon. It was the third abundant group during the postmonsoon season (3.1%). In the inshore waters of the seas around India (Girijavallabhan *et al.*, 1983) ostracods formed 5% of total plankton in November, 1981 although they were poorly represented. While studying zooplankton in the northern Arabian sea with reference to oil spill in the Gulf waters, Mathew and Solomon (1996) observed very high numbers of ostracods at three stations to the tune of 626,819, 510,993 and 3784,800 respectively per 1000 m^3 of water and being a surface swarming group it showed considerable variations in their abundance. They showed a gradual increase towards the west. The general distribution and numerical abundance of planktonic ostracods collected from the Arabian sea and Bay of Bengal, based on 1,086 collections from cruises 1-44 (1985-'99) of FORV *Sagar sampada* are described by Mathew *et al.* (1996). According to the study the average density of ostracods in the EEZ was amounted to be 17,395/1000 m^3 of water. It has become evident that ostracods occur far more abundantly in the shelf waters than in the oceanic areas. Samples collected off the west and the east coasts indicated that 95% of the ostracod population occurred off the west coast round the year. They were found remarkably high (61,168/1000 m^3 or 63.3%) between 10°N and 15°N off the west coast, while their abundance in the same sector off the east coast was low reaching 624/1000 m^3 (0.65%) only. The abundance of ostracods was always associated with monsoon when the maximum of 31,920/1000 m^3 was obtained and this was mainly due to the swarming nature of these organ-

isms. The minimum was observed during the premonsoon period when an average of 1,508 ostracods per 1000 m^3 occurred. Comparison of ostracod distribution in the EEZ of India between day and night yielded values of 30.95 and 69.05% respectively illustrating pronounced diurnal vertical migration.

Plankton collections obtained during the research cruises of *R.V.Varuna* along the southwest coast of India and the Lakshadweep sea were examined for a detailed study of ostracods (James, 1972) and specimens of a hitherto undescribed species of *Conchoecia* were observed from six stations, and the species *C.indica* has been described as new to science. Again, James (1973) noticed *B.lacunosa* (Muller) one of the lesser known bathypelagic ostracods, the male of which has remained undescribed. Muller's original description of *B.lacunosa* was also incomplete in some respects being based on a juvenile female obtained from the Antarctic waters. So in this paper James embodie a redescription of the species based on adult males and females and confirmed its earlier record from the Indian seas.

Investigations on the DSL in the Lakshadweep sea was conducted and the fluctuations in the abundance of ostracods in the day and night collections was studied (Silas, 1972). Of the total, 60% was recorded at night and the rest at day. The numerical abundance of ostracods among total zooplankton was 56 per m^3 of water which formed 11%. In the seas around Lakshadweep, higher biomass values were recorded at surface by night when dense swarms of ostracods swarmed at the rate of 1,000 individuals per m^3 of water (Nair *et al.*, 1986); while in the lagoons and open sea of different islands during January-March, 1987, the contribution of ostracods was less than 1% especially in the lagoon of Kadmat island, in the lagoons and open sea of Kiltan island and in the open sea of Chetlat & Agatti islands (Girijavallabhan et al., 1989).

Antarctic waters

As CMFRI could participate in the third Indian Antarctic Expedition, some studies were carried out on the zooplankton including general distribution and relative abundance of ostracods in Antarctic region. Ostracods had a meagre representation of less than 1% of the total zooplankton off Queen Maud Land (Mathew, 1986) and they showed an almost cosmopolitan distribution. The latitudinal difference in distribution was remarkable being more

towards the north. The latitudinal distribution of ostracods in the southern ocean covering Antarctic, Sub-Antarctic and Sub-tropical zones were studied in detail (Mathew & Vincent, 1986) and ostracods were observed at all the stations sampled. It formed 1.58% of the zooplankters and they were relatively more in the sub-Antarctic zone. The abundance in different regions viz. 20°-30°, 30°-40°, 40°-50°, 50°-60° and 60°-70° S indicated an increasing trend towards north. Relative abundance of ostracods expressed as no./1000 m^3 of water Antarctic, Sub in Antarctic and Sub latitudinal zones were tropical 163(3.85%), 3.053(72.12%) and 1,017(24.03%) respectively.

Relative abundance (%) within ostracods in every 100 latitudinal zones such as 20°-30°, 30°-40°, 40-50°, 50°-60° and 60°-70° were 20, 15,60, 3 and 3 respectively. Relative abundance (%) of ostracods among zooplankton in 100 latitudinal zones like 60°-70°, 50°-60°, 40°-50°, 30°-40° and 20°-30° were 0.15, 0.22, 3.52, 2.64 and 3.57 respectively. Daily variations in the abundance of ostracods in the coastal waters off Queen Maud Land, during summer 1983-'84 was studied (Mathew & Vincent, 1986) by carrying out daily sampling from 12th January 1984 to 25th February, 1984 (from mid summer to the beginning of winter). Ostracods were very poorly represented and therefore according to them any conclusions on the population size, relative abundance and percentage of addition to or removal from the population might be far from true. Their average weekly abundance ranged from 28 in the first week to 176 in the last week per 1000 m^3 of water. Their % abundance in the various weeks showed a gradual increase from 1st week (6.03%) to the sixth week (37.93%) with a little higher value in the second week. Surprisingly this group was not collected in the last week of observation. The rate of increase or decrease in population in due course of time when worked out, it was found that there was an increase by 150% in the second week over the first week population. But in the third week there was a reduction by 105.88% which appears to be significant. From this week onwards the rate was on the ascent. In the 5th & 6th weeks ostracods showed remarkable increase in number registering an increase of more than 100% over the preceding week's population. In the last week of observation, ostracods showed an increase but relatively of a low magnitude indicating a depletion in the standing crop towards the beginning of the winter. Presence of ostracods was observed in 1st, 2nd, 3rd, 4th, 5th & 6th weeks, the highest being in sixth week (40% of zooplankton).

Percentage of increase or decrease in the weekly mean numerical abundance of ostracods during the Antarctic summer months:

2nd	3rd	4th	5th	6th weeks
+150	-105.88	+44.12	+118.37	+64.49

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