Marine Fisheries Research and Management

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2000

8 Studies on the Mysidacea of the Indian coasts

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ABSTRACT

The available literature on the mysidacea of the Indian waters centred mainly around the taxonomic and systematic aspects rather than on the other facets of their biology or life history. A rich and varied mysid fauna exist in the littoral and shallow areas of the seas around India. Reports on the abundance of mysid population of the Indian seas reveal a greater concentration (74%) in the night-time collections indicating diel migrations, characteristic of the fauna. The population density was high during the postmonsoon (October-January) in the shelf waters and during the premonsoon (February-May) in the oceanic region in the northwestern Arabian sea. In general, the oceanic area off Veraval, Cape Comorin and the northern neritic area off Cochin are delineated as densely populated zones. Higher numbers (150-450/100m³) are reported to occur in the inshore waters of Cochin during the south west monsoon. In the Bay of Bengal the population of mysids occurred throughout the year even in the deeper layers beyond 200m. The predominance was prominent (63%) during the premonsoon and to lesser extent (23%) in the northeast monsoon seasons in the neritic area. In the northwestern Bay of Bengal and the Andaman-Nicobar islands ecosystem the mysidacea were present in larger numbers in the depth zone of 50-100m and 100 - 200m in the southwesten region.

Introduction

The shrimp-like animals with carapace like a shield fused often with the first three segments, possessing a statocyst in each endopodite of the uropod excluding some deep water forms, and with a brood pouch borne on the endopodites of thoracic limbs to carry the eggs and young ones in adult fe-

males form the order Mysidacea. A greater percentage of mysids are found to inhabit the area between the tidal and littoral environment, many species are typical hypoplankters living just above the bottom, others are benthic resting on the surface but quite a few actually burrow into the sediment. Apart from their association with the sea bed many species are strictly pelagic occupying the coastal and oceanic realms of the sea. Some of them live in the mesopelagic and bathypelagic zones and are larger in size, even upto 16 cm, compared to the shallow water epiplanktonic forms which are usually less than 30 mm in length. Mysids are observed to inhabit greater depths even upto 7,210m. They are also adapted to the conditions of brackish water, freshwater and even to the specialized environments of caves and wells, while a few exist as commensals of sea anemones.

The worldwide distribution of mysids shows 780 known species of under 120 genera (Mauchline, 1980) and the exact number at present may be a little more because of the later additions of new species. Mysids seldom form an important component of the zooplankton community. The mysid fauna of a sea area is difficult to sample and a variety of techniques and sampling equipments have to be used because of the variety of habitats they inhabit. But these animals do occur seasonally whether the collection is made by a pelagic or benthic sampler. Earlier investigators of zooplankton recorded stray occurrence of a few species of mysids obtained through plankton hauls using nets with different mesh sizes from the nearshore and estuarine environments of Indian coasts. However, pioneer work on the taxonomic and systematic aspects of the mysid population of the Indian waters was initiated by Pillai and a lot of information was generated as evident from his several publications during the years 1957-1964. Later Pillai (1965) reviewed the work on the rich and varied shallow water fauna of the Indian region recording 95 species which included the littoral species of the Kerala coast and the planktonic mysids in the collections of CMFRI, giving illustrations for the salient characters of each species, the much needed tools for specific identification. "Mysidacea of the Indian Ocean" as a handbook to the international zooplankton collections was published by the same author (Pillai, 1973) incorporating further additions and altogether accounting for 35 species collected from the Indian Ocean. New records were added by Panampunnayil (1977, 1999). The reproductive biology of *Mesopodopsis orientalis*, which is one of the most common mysids of the estuaries of India, was dealt with ear-

lier (Nair, 1939; Kaliyamurthy, 1972). Apart from the studies on the anatomical aspects, breeding habits and fecundity of a few species, such as *Spelaeomysis longipes* (Nath, 1973, Nath and Pillai, 1971) and *Gastrosaccus simulans* (Nath and Pillai, 1976), work on the ecology, reproductive biology and related aspects of the mysid fauna from the Indian region is limited. The most abundant and best known species are from the estuarine or inshore areas and some of these are harvested commercially in parts of Asia. The world population of the mysids is reviewed in a comprehensive manner by Mauchline (1980).

Materials and methods

It is evident from the literature that there is no uniformity in the methods of collection, filtering efficiency of the cone or the subsequent treatment of the gathered data. Earlier investigators upto 1960 used 50 cm diameter ring with the net usually of organdie, as a filtering cone and it was later replaced with nylobolt of 0.33-0.505 mm mesh size. The samples collected usually by horizontal hauls of 5-15 minutes duration on country crafts and later by mechanised boats. Indian Ocean Standard Net was used to collect the samples by vertical hauls in *M.T. Muraena* cruises. Bongo 20 or 60 nets fitted with calibrated flow meter were used in the collection of zooplankton samples by oblique hauls, the former in the coastal sea of Cochin from the"Cadalmin" boats and the latter in the cruises of FORV *Sagar Sampada.*

Mysids from the Indian coasts

A perusal of the literature on zooplankton around the Indian subcontinent highlight that a great majority of the authors have only recorded the occurrence and numerical abundance of mysidacea either from the nearshore or estuarine areas during certain seasons. Some have identified two or three of the most common species present in their area of investigations. Most often the mysid component of the zooplankton collection was confined to a few individuals. Hence detailed investigations leading to an understanding of their biology, development, population dynamics, food and feeding of the many species are rather far and few in between. The littoral, coastal, mesopelagic and bathypelagic nature of the habitats of these species

might have rendered proper sampling by the nets difficult. However, the shelf and oceanic areas of the seas around India recorded the occurrence of mysids in considerable numbers throughout the year as evident from the cruises undertaken by FORV *Sagar Sampada* (Mathew *et al.* 1990). This enabled a quantitative assessment with respect to months/seasons/ latitude/ depths in relation to environmental parameters.

Northwestern region of the Arabian sea: (14°-23° N lat.)

In the northwestern region beyond 14°N lat. between Panjum and Veraval Bapat *et al.* (1982) observed that the mysidacea were present throughout the year during the cruises of *M.T.Muraena* and in appreciable numbers in the premonsoon and postmonsoon months. In the shallow coastal waters off Karwar upto 12 m depth, mysids were rare in the collections, a few *Rhopalophthalmus* spp. were encountered during April and again in October (Naomi, 1986). Radhakrishnan and Pillai (1978) found the group to be abundant during March-April in the offshore waters off Bombay. Southwest coast of Veraval registered high densities of mysids over 10,000/1000m^3 in the oceanic area during the cruises of FORV *Sagar Sampada*. But in the northernmost region (20°-23°N) the postmonsoon season (October-January) represented the maximum number (1,769/1000m^3) from the neritic regions. The night samples accounted for about 90% of the fauna and the concentration was the highest in June-July and September (Mathew *et al.*, 1990). In the area between 17°-24°N, Daniel and Jothinayagam (1977) came across dense aggregations of mysids in association with amphipods in the neuston samples at night-time from the upper 10cm water column. The highest abundance recorded was 3,800 per 5 minute vertical haul.

Southwestern region: (04° 30'-14° N lat.)

The southern waters of the eastern Arabian sea showed higher densities of mysid population when compared to the north, particularly in the oceanic region upto 10°N lat., during the monsoon as reported by Mathew *et al.* (1990). Beyond Cochin and upto Marmagoa mysidacea are comparatively less abundant in the shelf and oceanic areas.

The available literature shows that the biota of the Cochin backwaters had undergone a thorough investigation using different types of sam-

piers and the spatial and temporal variations of the faunal composition of its zooplankton community in relation to hydrography have been dealt with in detail by many workers. George (1958) remarked that *M.orientalis* was the most commmon mysid of the backwaters and it occurred in high abundance during August-October when the salinity registered lower values. Eggs and young ones of *M.orientalis* were found in the population along with large numbers of berried females. A steady decline in the numerical abundance was observed from November and was the lowest in summer months. *M.orientalis* exhibited an inverse relationship with the salinity variation, in the Cochin backwaters. When summer rains brought down the salinity *M.orientalis* showed an abrupt increase. Later studies conducted by Pillai *et al* (1975) and Silas and Pillai (1975) lent support to these findings. An unidentified species, though present in small numbers in the backwaters showed a close and direct relationship with salinity becoming almost absent when the values were the lowest. Pillai and Pillai (1973) encountered large numbers of mysids during the flood water period of the day while conducting a study on the tidal influence on diel variations of zooplankton in a water column of 8 m depth in the Cochin backwaters. A primary peak noted in their numbers at the surface in the night at 2200 hrs irrespective of the ebb indicated the nocturnal migration, characteristic of mysids. In the inshore waters of Cochin upto 30 m depth zone (Rajagopalan *et al.*,1992), mysids were in large numbers (150-450/100m^3) in the monsoon months when the average salinity (32 ppt.) and temperature (25.7°C) of the surface were low. *Rhopalophthalmus* spp. was common. Mysids were encountered in small numbers during the other months also. In the nearshore area off Vizhinjam upto 30 m depth mysids could be seen in abundance in any one of the months, namely, June, August, October, January and May as evident from a five year study of the area. The hydrographic parameters of temperature and salinity showed a range of 23°-30°C and 31.5-35 ppt respectively. Observations made on the plankton fauna of the rich grounds known for pelagic fishes off Colachel (8°11'N-77° 15'E) within 20m depth revealed the sporadic occurrence of the littoral mysid *Gastrosaccus* spp. (Suseelan *et al.*, 1985).

Northeast coast of the Bay of Bengal (16° -20° N lat.)

In the northwestern Bay of Bengal (Mathew *et al.*, 1996) mysidacea were encountered throughout the year and even beyond 200 m depth zone in

moderate numbers. The numerical abundance was high in the northeast and premonsoon seasons (October-May) and low in the southwest monsoon (June-September). High density of the mysid fauna was noticed when the temperature and salinity were low (26-5° C, 33.12 ppt) and also in the night collections. The maximum number (1,808/1000m^3) was observed in February in the 50-100 m depth zone.

Andaman and Nicobar Islands (06° -14° 30'N lat., 90° 30'-95° E long.)

Recent studies (Antony *et al.*, 1997) in the seas around Andaman-Nicobar Islands have shown the presence of mysids in large numbers especially in the northeastern part of the island ecosystem. Mysids are present all through the year in the Andaman-Nicobar seas from the nearshore to the deeper zones and beyond 200 m. The night-time abundance was evident in the samples. The general pattern of occurrence showed a large population during the premonsoon season culminating in the maximum (8,268/1000 m^3) in May when the temperature and salinity were 30° C and 33.59 ppt. Greater numbers were found in the 50-100 m depth around the islands during this season. The fauna was abundant 1,555-1,699/1000m^3 in the deeper waters during the northeast monsoon and the hydrographic parameters recorded were 27.9° C and 31.68 ppt.

Southeastern region of the Bay of Bengal (10° -16° N lat.)

According to an earlier investigation (Mathew *et al.*, 1990) mysids were largely abundant in the neritic area during the premonsoon season between 10° -15° N lat. Later studies concluded that these animals were preponderant during the premonsoon as well as the northeast monsoon and the peak of the population observed was in December (3,382/1000m^3) in the night-time collections and the hydrographic parameters were 23.5° C and 33.15 ppt. The depth zone between 100-200 m accounted for the higher concentration in the southeastern part of the Bay of Bengal. Mysids were present throughout the year and abound in the night collections and also when the average temperature and salinity were comparatively low.

Discussion

According to Daniel and Jothinayagam, 1977, Mathew *et al.*, 1990, 1996, the occurrence and abundance of the mysidacea in the Indian seas

delineate that in the northwestern part of the Arabian sea, the group was abundant in the shelf and oceanic waters during the premonsoon (February-May) and postmonsoon (October-January) months when the environmental parameters were comparatively stable. In the southwestern areas mysids were preponderant during the southwest monsoon season when the surface temperature and salinity recorded low values. However, the peak abundance was most often in the night collections showing vertical migration, typical of mysids. In the northern and southern areas of the Bay of Bengal and the Andaman-Nicobar waters these animals were predominant during the north-east monsoon (October-January) and premonsoon (February-May) seasons. In the northwestern Bay of Bengal and the Andaman-Nicobar ecosystem mysids abound in depth zone of 50-100m while in the southwestern part an increasing trend is visible further down in the depth zone of 100-200 m. The mysids were often plentiful in the water column when the environmental parameters recorded were between 23.5° -27.9°C and 31.68-33.15 ppt.

According to Mauchline (1980) there are around 36 species non-marine, living in freshwater, caves and wells, while about 160 spp. are more or less restricted to the littoral environment. About 300 species are confined to the neritic region, 30 are epipelagic and over 200 live in the meso and bathypelagic regions. The distributional records collated for many species thus become incomplete in most cases due to the difficulties that arise in successfully sampling the mysid fauna of a region or sea area due to their wide range of habitats. Mysids are included in the diet of several freshwater and a large number of marine fishes, more so in the coastal waters. The diet of perch, goby, horse-mackerel, cat fish, anchovies and sardines prefer mysids when available. A certain percentage of mysids was encountered (Menon *et al.*, 1996) in the stomach contents of photichyids, myctophids and tunas. Patnaik and Jena (1978) observed that the fingerlings of *Lates calcarifer* feed predominantly on the mysids. Ctenophores, gastropods, isopods and decapods include mysids in their diet. Mysids in turn consume the small harpacticoid and cyclopoid copepods which feed on phytoplankton and organic matter. Swarming mysids are exploited commercially in the South-East Asian countries (Mauchline, 1980) and *M.orientalis* and *Gangemysis assimilis* are sold in the markets of Calcutta. In freshwater fish farming systems mysids are used as live food resource to increase the growth rates of the residents or introduced fish. Ivanov (1972) and Ogle and Price (1976) recorded increased growth

rates for fish and shrimps respectively when fed on a diet of mysids comparable to that obtained when fed with *Artemia* nauplii. The importance of the fauna in the complex food web of the sea, as live feed in culture systems, the comparatively easy way to maintain them in the laboratories (Nath and Pillai, 1976), and their ability to withstand fluctuations in the environmental parameters, all these make the shrimp like animals unique crustaceans.

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