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ON THE QUANTITATIVE ABUNDANCE OF MYSIDACEA COLLECTED FROM THE EASTERN ARABIAN SEA AND THE BAY OF BENGAL

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Abstract

The members of the order Mysidacea formed one of the major components in the zooplankton collected from the upper 150m of the Indian EEZ and contiguous seas during the cruises of FORV *Sagar Sampada* undertaken from 1985 to '88. Their average abundance in the area investigated has been estimated to be 364 per 1000 m^3 of water. Areas of very high density with more than 10,000 individuals were found at certain localities in the eastern Arabian Sea namely southwest of Cape Comorin in the oceanic area, north of Cochin within the continental shelf and southwest of Veraval, again, in the oceanic water. As in the case of several other zooplankton, a significant difference in abundance was observed between shelf and oceanic waters, the shelf contributing almost double the quantity of mysids. The eastern Arabian Sea with an average density of 430 mysids was comparatively more populated than the Bay of Bengal. A definite seasonal variattion was noticed for both the sea areas. Off the west coast the southwest monsoon with 775 mysids accounted for the maximum whereas off the east coast the pre-monsoon season with 421 specimens yielded the maximum number. The maximum density in the eastern Arabian Sea was experienced south of 15°N during the southwest monsoon. In the Bay of Bengal the maximum population was observed north of latitude 15°N and it was during the pre-monsoon. The mysids were found to exhibit strong vertical diurnal migration. There was an increase of mysids by 74.11% in the night samples over the day samples.

Introduction

Animals belonging to the order Mysidacea (Crustacea) form a major constituent in the zooplankton especially in the continental shelf area, and form an important forage for higher pelagic organisms. In view of this, considerable attention has been given to the study of this group both qualitatively and quantitatively the world over. Eventhough the Mysidacea has been studied in some detail for its quantitative geographical distribution and aubndance in some of the world oceans (reviewed by Mauchline, 1980), the same of the Indian Ocean has been least investigated and this is especially so for the Indian seas. The earliest works on Mysidacea of the India seas are those of Wood-Mason and Alcock (1891 a, 1891 b) based on collections made onboard *Investigator*. Since then sporadic works have been carried out in some part or the other of the Indian coasts; all being faunistic studies. It was in the sixties when some major studies were carried out on mysids of the Indian Ocean especially that of the Arabian Sea and the Bay of Bengal based on samples collected during the International Indian Ocean Expedition (Pillai, 1964, 1965, 1973). The major thrust in these studies was, again, on taxonomy and occurrence, with very little or no information on quantitative distribution and abundance, ecology etc. The only work dealing with some aspects of ecology and distribution of Mysidacea of the Arabian Sea and the Bay of Bengal is that of Pillai (1973). However, he has made no attempt on the quantitative abundance in space and time of the total mysids or of the species. This being the stae of affairs, it was felt necessary to have precise information on various aspecs of distribution and abundance of mysids as a group. The enormous data collected onboard FORV *Sagar Sampada* from 1985 to 1988 have facilitated such a study for the EEZ of India and the adjacent seas.

The material and methods used in the present study have been detailed in the paper dealing with the zooplankton biomass by Mathew *et al.* (1990) given elsewhere in this volume. The quantitative estimates have been made as number per 1000 m^3 of water.

Results and Discussion

Quantitative abundance

The average abundance of mysids in the entire area investigated has been estimated to be 364 per 1000 m^3 of water. While they occurred at a rate of 430 in the eastern Arabian Sea, only 265 were present in the Bay of Bengal which was equal to 62 and 38% re-

spectively. A significant difference in abundance was noticed between shelf and oceanic areas, the shelf having almost double the population of the oceanic areas. However, when a coastwise consideration was made, it was found that the eastern Arabian Sea was comparatively more populated, with mysids at the rate of 430 per 1000 m^3 of water. A definite variation over seasons was discernible in both the sea areas. But the seasons of abundance were not the same in the two sea areas. Off the west coast the southwest monsoon season with 775 mysids accounted for the maximum whereas off the east coast the pre-monsoon season with 421 specimens yielded the maximum. In the Bay of Bengal the least occurrence of 95 per 1000 m^3 was during the southwest monsoon season. The mysids were found to exhibit strong vertical migration. There was an increase by 74.11% in the night samples over the day samples. Whereas their average occurrence during the day was only 282, the same during the night was 491 per 1000 m^3 of water.

Spatial distribution

The mysids enjoyed a wide spread distribution in the area investigated (Fig. 1). In certain localities their density was over 10,000. However, in most of the areas, either in the shelf or the oceanic, their population size was not as large as some other crustacean zooplankters like copepods, euphausiids, ostracods or amphipods. With regard to population density, the eastern Arabian Sea was better than the Bay of Bengal. Areas of very high density with more than 10,000 individuals per 1000 m^3 of water were found at 3 localised ares in the eatern Arabian Sea namely southwest of Cape Comorin in the oceanic area, north of cochin within the continental shelf and southwest of Veraval, again in the oceanic waters.

In the Bay of Bengal, areas of moderate ocurence between 1,000 and 5,000 were found located east of Andaman Islands and in some places in the shelf and nearby oceanic areas off the east coast (Fig. 1).

Monthly variations

Excepting November, December and January, the group was well represented in all the other months. High abundance was observed during March, August, September and October (Fig. 2). The maximum monthly abundance of 1,132 individuals which was equal to 28.42% of the total mysids obtained was noticed in August. From August to November there was a declining trend with least in November when only 0.21% of the toal mysids was present. It was interesting to note that almost the same trend in abudance was maintained from March to July when the monthly percentage was around five. The picture of abundance becomes more clearer when an examination is made on the seasonal distribution off the east and west coasts. Three major seasons namely pre-monsoon (February-May), monsoon (June-September) and post-monsoon (October - January) were identified based on the southwest monsoon which has a profound influence on the two sea areas.

It has been found that off the west coast, about 65% of the mysids obtained was in the monsoon season, the pre-monsoon and post-monsoon having 16.58% and 18.83% respectively. The picture was quite different off the east coast, where the pre-monsoon accounted for 62.65% of mysids, the monsoon having the least of 14.14% and the post-monsoon 23.21%. The result indicates that while the breeding period of mysids is during the southwest monsoon season off the west coast, it is further advanced in the Bay of Bengal.

A further consideration was made on the monthly abundance off both the coasts separately (Fig. 3). In the eastern Arabian Sea, the period from June to September accounted for 81% of the total mysids obtained from this sea area. August alone contributed 43% of the total mysids taken from here. November with 0.2% and April with 1.7% were the months of least occurrence.

On the other hand, in the Bay of Bengal, the maximum share of 57.31% was taken during February (Fig. 3). The period of abundance was from February to May during which 78% of the total mysids obtained from this sea area was collected. August and December with 1.61 and 1.35% respectively, were the lean months for mysids in the Bay of Bengal. The monthly variations in this group indicate that sudden outbursts in populations is possible within a short period.

Monthly distribution in the shelf and oceanic waters

An analysis was made to understand the variations in abudance of mysids in the shelf and oceanic waters of the entire area of investigation (Fig. 4). It was understood that on the average, the density was almost double in the shelf areas. The period of abundance in the shelf and oceanic areas has been found to be different. Thus in the shelf area, February was the month of population outbreak when about

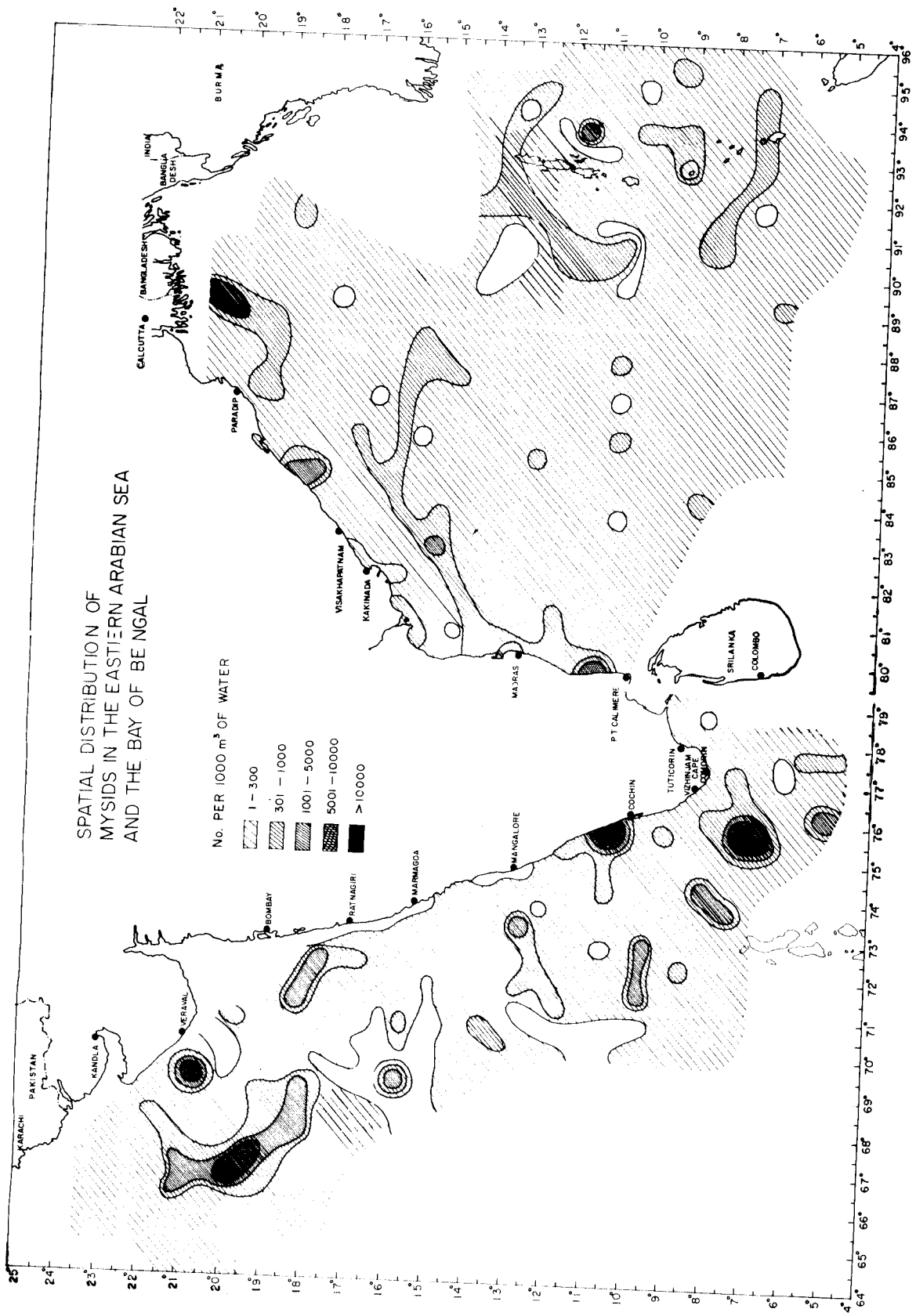

Fig. 1. Spatial distribution of Mysidacea in the EEZ of India and adjacent seas.

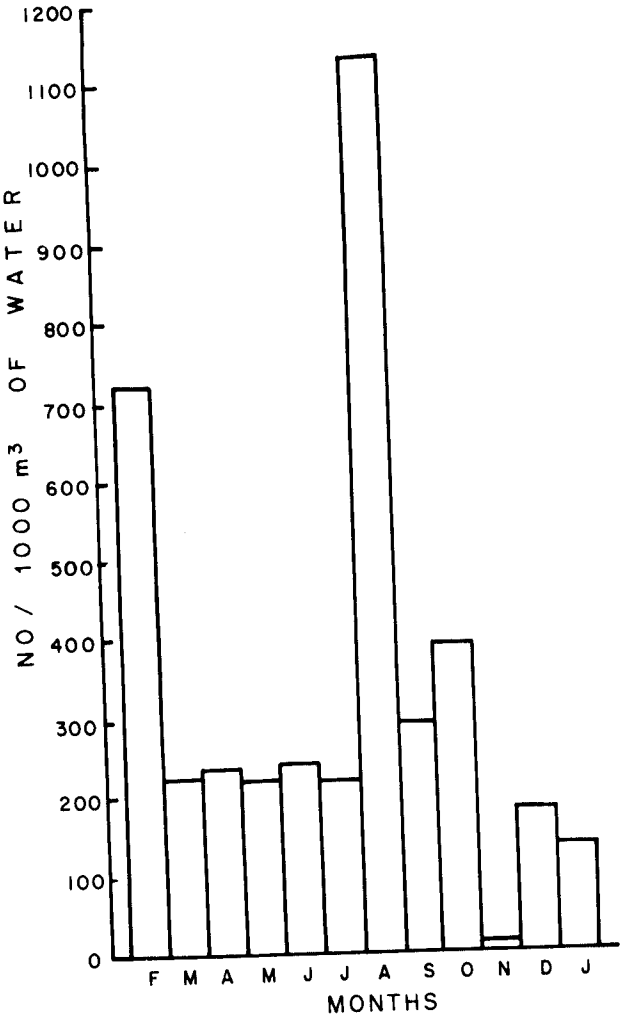

Fig. 2. Monthly abundance of Mysidacea in the area investigated.

43% of the total mysids taken in all the months was collected. Afterwards upto June the density of mysids in the shelf area remained around 8% and thereafter a gradual decline was observed and came down to the least value of 0.17% in November. On the contrary, the poulation outburst in the oceanic areas occurred in August with about 42%. In the subsequent two months the density was considerably reduced and the percentage contribution of the mysids was around 9. However, as in the case of shelf area, the month of least availability in the oceanic waters was November when only 0.22% was present.

Latitudinal abundance off the west and east coasts

Off the west coast, the first region which is the southernmost had the maximum quanitity of 43.14%

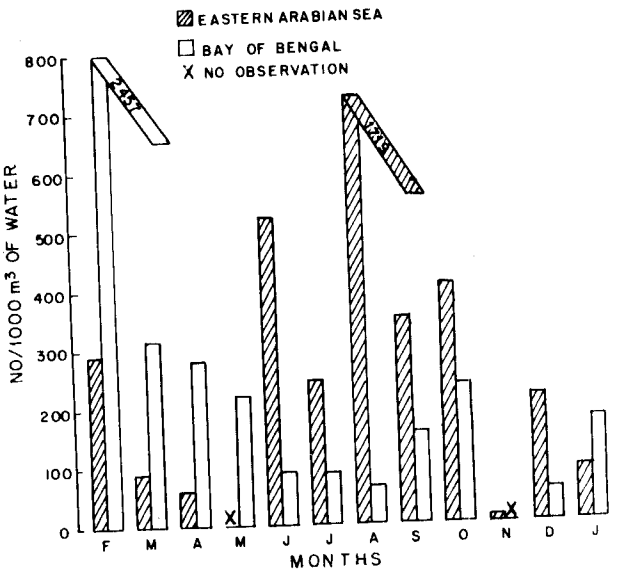

Fig. 3. Monthly abundance of Mysidacea in the eastern Arabian Sea and the Bay of Bengal.

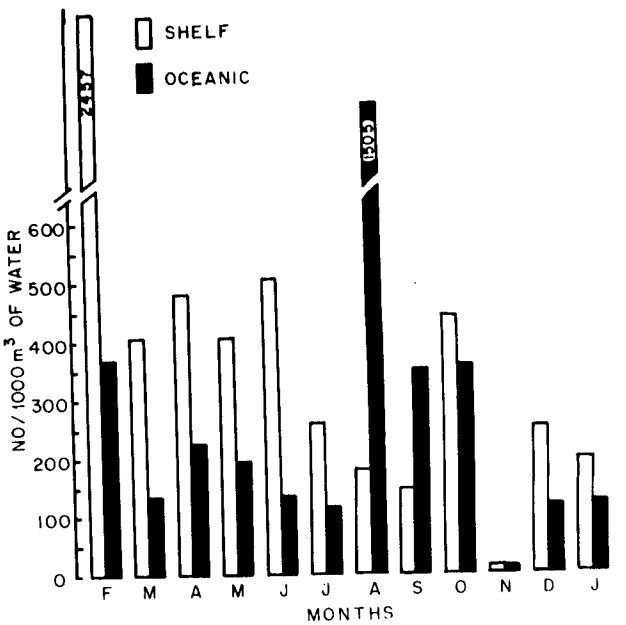

Fig. 4. Monthly abundance of Mysidacea in the shelf and oceanic waters.

of mysids, the 2nd and 3rd regions having about 10 and 18% only respectively. A slight improvement towards 28% was noticed in the 4th region. In the Bay of Begnal the southernmost region has the least of 14%. The other 3 regions had an almost equal portion of mysids being around 30% (Fig. 5).

A much more detailed analysis was made for understanding the microlevel distribution of mysids (Fig. 6). In regions I and II in the eastern Arabian Sea,

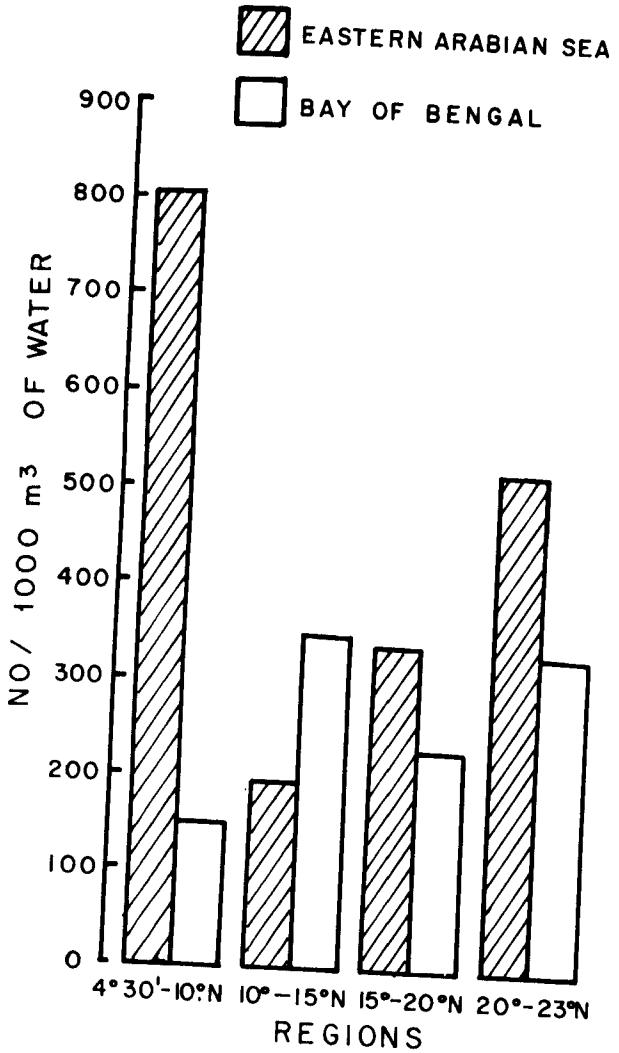

Fig. 5. Latitudinal abundance of Mysidacea in the eastern Arabian Sea and the Bay of Bengal.

the monsoon season accounted for the maximum mysids which was 86 and 82% respectively of the total for the 3 seasons. The pre-monsoon and post-monsoon almost equally shared the rest of the population. In region III while the mysids dominated during the pre-monsoon with 68%, in region IV the post-monsoon had the maximum with 93%.

Contrary to the above finding, in the Bay of Bengal, the first two regions had a pre-monsoon dominance of mysids with 76 and 83% each. As in the eastern Arabian Sea, a pre-monsoon dominance was noticed in the 3rd region with 45% of mysids. Comparable data was not available for the 4th region.

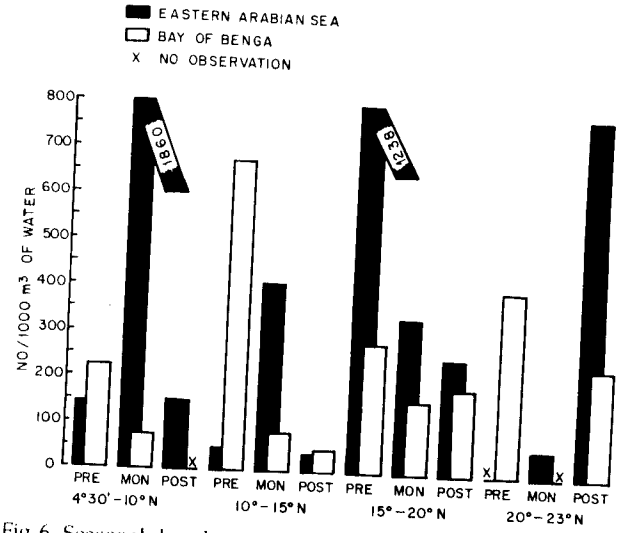

Fig. 6. Seasonal abundance of Mysidacea in the various latitudinal zones of the eastern Arabian Sea and the Bay of Bengal.

Latitudinal seasonal distibution in the shelf and oceanic areas off the west and east coasts

A study of the seasonal abundance in the shelf and oceanic waters of the respective sea areas in the various latitudinal regions revealed the following facts (Fig. 7). In the first place it is to be mentioned that a consistent nature of variations between the shelf and oceanic waters was not noticeable during the various seasons, in that, while the shelf had the dominance of mysids in certain seasons, it was the oceanic area which accounted for the maximum in certain other seasons. Thus it could be seen that there was an unprecedented increase of the population of the order of 3,121 equal to 92% in the oceanic area of region-I in the eastern Arabian Sea during the monsoon. Another oceanic dominance to the extent of 1,769 per 1000 m^3 was noticed in the 3rd region, but it was during the monsoon season. The only instance when the shelf had a fairly large population was in the nothernmost region and the same was during the post-monsoon season.

In the Bay of Bengal the pre-monsoon season had a clear dominance of mysids in 2nd, 3rd and 4th regions with maximum of 2,349 individuals per 1000 m^3 of water in the 2nd regions (Fig. 7). During the other seasons mostly the oceanic areas of the various regions had relatively more mysids.

Day-night variations

Another study made on this group was on the diurnal variations in abudance. As in the case of

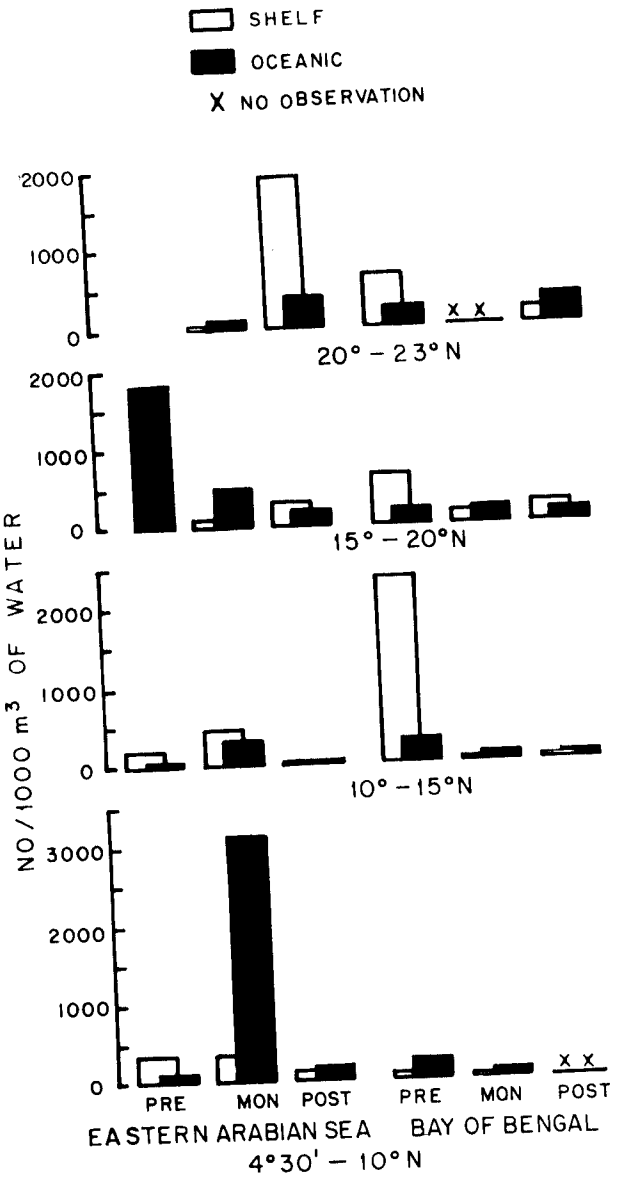

Fig. 7. Seasonal abundance of Mysidacea in the various latitudinal zones of the eastern Arabian Sea and the Bay of bengal.

other zooplankters, the mysids also showed considerable difference in the day and night samples. On the whole, while 62% of the total mysids was present in the night samples, only 38% was present in the day samples which indicates strong diurnal vertical migration.

The day-night abundance during different months revealed some significant results and the same are given in Fig. 8. The night samples accounted for around 90% of mysids during June and

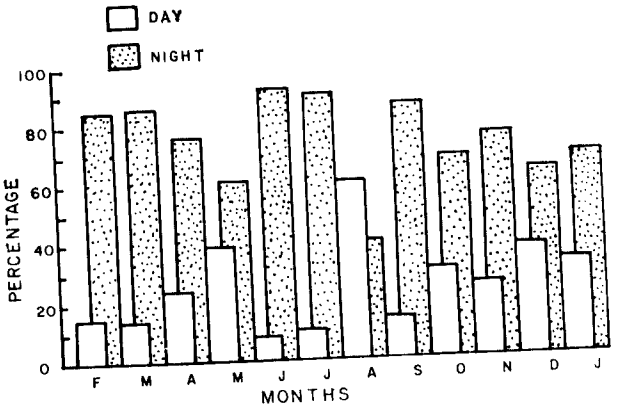

Fig. 8. Monthly day-night variations in the abundance of Mysidacea.

July. All other months except August had a night time abundance which came to the tune of 63 to 86%. Interestingly enough the August had a day time abundance which came to 60%.

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