

# CHAETOGNATHS FROM THREE DIFFERENT ENVIRONMENTS

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## ABSTRACT

A comparative account on the chaetognaths in the Arabian Sea, Laccadive atolls and Cochin backwaters is given. The upper 200 m of the Arabian Sea sustains nineteen species and the species composition indicates the homogeneity of the Indo-Pacific fauna. Most of the species were abundant near Somalian and Arabian coasts. Population maxima of chaetognaths were found not adjacent to the centre of upwelling but shifted to the fringe of the enriched area. Fourteen species were found in and around the Laccadive atolls and their density was considerably reduced inside the lagoon. The Cochin Backwaters presents a distinct ecosystem and the fauna is constituted of relatively few species. There is no permanent chaetognath population in this estuary. Here the maintenance of population is dependent on recruitment of individuals from the sea and it occurs during the post monsoon period.

## INTRODUCTION

The areas under investigation represent three distinct ecological realms, open ocean, atolls and an estuary. These three environments are distinct ecosystems and the chaetognaths in these regions form an interesting group for a comparative study. Chaetognaths constitute an important part of plankton community. Most of them are oceanic, but a few of them have succeeded in invading the brackish water.

In this communication studies on the following three environments have been summarised.

1. Arabian Sea
2. Laccadive atolls
3. Cochin backwaters

## ARABIAN SEA

The samples collected during the International Indian Ocean Expedition (IIOE, 1960 - 65) give a substantial amount of information on the chaetognaths of the Arabian Sea (Vijayalakshmi & Rao, 1973 a). Nineteen species were found in the upper 200 m. On the basis of spatial and bathymetric distribution the species can be grouped as follows:

1. Epiplanktonic

(a) Cosmopolitan - *Krohnitta pacifica*, *K. subtilis*, *Pterosagitta draco*, *Sagitta bipunctata*, *S. enflata*, *S. hexaptera*, *S. minima*

(b) Tropical, - *S. bedoti*, *S. ferox*,  
Equatorial *S. neglecta*, *S. pacifica*,  
& restricted *S. pulchra*, *S. regularis*,  
to the Indo-Pacific *S. robusta*

(c) Endemic to - *S. bombayensis*  
the east and  
west coast  
of India

2. Mesoplanktonic - *S. decipiens*, *S.*  
(Cosmopolitan) *lyra*, *S. zetesios*

3. Bathyplanktonic - *Eukrohnia fowleri*  
(Cosmopolitan)

*S. enflata* was the dominant chaetognath species and the other common species were *S. pacifica*, *S. bedoti*, *Pt. draco*, *S. bipunctata* and *S. regularis*. The species composition indicates the homogeneity of the Indo-Pacific fauna. All the recorded epiplanktonic species are common to the Indo-Pacific and seven of them are exclusive to this region.

Arabian Sea is the northwest area of the Indian Ocean and its surface currents and upwelling systems are mainly regulated by the monsoonal regime. The western Arabian Sea, especially the Somalian and the Arabian areas had the maximum density for most of the common species. Seasonal studies on the group showed that the southwest monsoon period (April 16 -

October 15) had the highest density for most of the species than in the north-east monsoon period (October 16 - April 15). The IIOE data on the volume of zooplankton suggest that primary production is able to support a good standing stock of higher organisms in the northern and western part of the Arabian sea, with a peak during the southwest upwelling season (Prasad, 1968).

A few samples available from the Red Sea and Gulf of Aden showed differences in the distribution of chaetognaths. Along with the reduction in the number of chaetognath species there is a general lowering of the population density of the different species of chaetognaths in the Red Sea. Most of the epiplankton of the Red Sea are dependent on individuals for the population maintenance from the adjacent Gulf of Aden and Arabian Sea (Kimor, 1973). However, the hot highly saline waters of the Red Sea along with other unfavourable factors act as a barrier for the successful maintenance of many species found in the Arabian Sea and Gulf of Aden.

Since the IIOE samples were from the upper 200 m of the Indian Ocean, meso and bathyplanktonic species naturally did not form a significant part of the chaetognath population. It has been found that individual species of chaetognaths occur generally at about the same level throughout the oceans (Alvarino, 1964). Certain mesoplanktonic and bathyplanktonic forms occupied the epiplanktonic zone suggesting that this bathymetric grouping is arbitrary and it is subjected to variability consequent

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on the influence of certain ecological factors (Vijayalakshmi & Rao, 1973 a). Similar to other planktonic groups, variability in chaetognaths is enormous and is dependent on the changes in the environment. Investigations on the total abundance of the different species in selected areas indicate seasonal variation (Vijayalakshmi, 1972). The shifting of the maximum population of the surface layer chaetognaths towards the west or east can be explained on the basis of the reversing system of currents for the two monsoon periods. The abundance of chaetognaths towards the west during the north-east monsoon was probably as a result of the westerly drift and highest values towards the east during the southwest monsoon was due to the easterly drift. The latitudinal variation of the species showed the occurrence of two categories of species - one having a preference to northern latitudes and the other having higher abundance towards the southern latitudes. Statistical analysis of these variations indicate that seasonal difference, difference in areas and latitudinal variation affect the relative abundance of the different species.

In a marine environment individual groups are distributed according to their place in the tropic level (Vino-grad and Voronima, 1962). Population maxima of chaetognaths were found not adjacent to the centre of upwelling but shifted to the fringe of the enriched area. Chaetognaths which occupy the tertiary level in the food chain need more time for their development and hence the areas of their maximum abundance appear at a greater distance from the centre of upwelling.

Statistical analyses were found to be highly significant, thus supporting this ecological explanation (Rao & Vijayalakshmi, 1973).

LACCADIVE ISLANDS

Data on the chaetognaths from these islands are from the collections taken in and around the Kavaratti and Kalpeni atolls during the year 1968 (Vijayalakshmi & Rao, 1973b). Thirteen species recorded from the Arabian Sea were found to be inhabiting the waters in and around these atolls. *Spadella angulata*, a benthic form was restricted to the Kalpeni lagoon. Similarity in the faunal composition of chaetognaths in the Laccadive atolls and those of the Great Barrier Reef and Pacific lagoons suggests the identity of the Indo-Pacific fauna. Chaetognaths were abundant in all the collections taken around the atolls, whereas the density is considerably reduced inside the lagoon. It is assumed that they were lost during the transport of water across the reef into the lagoon and are probably utilised by the coral community.

COCHIN BACKWATERS

The area under investigation is a typical tidal estuary with an influx of fresh water at the upper end and the inflow of sea water and an outflow of diluted sea water at the seaward end. Here both marine and neritic species are encountered during different periods of the year based chiefly on the prevailing salinity.

During the year 1968, fortnightly collections were made from two stations in the backwaters, one at Fairway

Buoy and the other at Aroor region. Two series of collections were made between Barmouth and Alleppey during the postmonsoon and premonsoon periods in 1968 and 1969. These collections provide information on the seasonal fluctuations, vertical distribution, breeding and growth of chaetognaths in this estuarine habitat (Vijayalakshmi, 1971 a & b; 1973).

Aroor region is typically estuarine with a complete turn over of salt water into fresh water and chaetognaths were found to be absent during the period of low salinity (mid-June to November). At Fairway Buoy area where the prevailing conditions were marine chaetognaths were present throughout the year. The species found in the backwaters were *K. pacifica*, *S. bedoti*, *S. enflata*, *S. oecania* and *S. robusta*. *S. bedoti* was the dominant chaetognath. Representatives of different size groups of *S. bedoti* belonging to two maturity cycles were encountered in these samples. Usually most of the chaetognaths reproduce only once in their life span. The recurring maturity cycles noticed in *S. bedoti* may ensure sufficient reproductive potential to maintain the population in an estuarine habitat. (Vijayalakshmi, 1971 b). The sporadic occurrence of *K. pacifica*, an oceanic species during the months of high salinity was correlated with the incursion of oceanic water affecting the inshore areas.

The vertical disposition of the species showed that they were more abundant at the surface waters. Incidence of juveniles of the common species throughout the year suggests the continuity of breeding in tropical

waters. The periods of heavy spawning are superimposed on continual spawning and such intense breeding periods are coincident with peaks in the abundance of copepods. Growth studies show that size at maturity is exceedingly variable and length is considered to be a poor indicator of any stages of development. In general they attain larger size during the period of high salinity.

Salinity plays a major part in controlling the distribution of chaetognaths in this estuary. They penetrate to the southern most part of the estuary during the premonsoon period when uniformly high salinity prevailed throughout the system. In the postmonsoon period, the chaetognath population followed the steep gradient in salinity along the estuary and was restricted to its seaward end. There is no permanent chaetognath population in this estuary. During the monsoon period they are absent from the area and fresh recruits from the sea will be brought back to the system along with the incoming waters of the postmonsoon period.

#### CONCLUSIONS

Of the five genera represented in the three different types of environments, the genus *Sagitta* is the most widely distributed group showing a maximum species diversity. Seventy six percent of the species belong to this genus and they have succeeded in invading the cold deeper levels as well as brackish waters. It is the most successful group and has attained the highest evolutionary level in the phylum.

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Studies in these three types of environment show variation in the faunal composition and their comparative abundance. The upper 200m of the Arabian Sea sustains nineteen species and most of them are widely distributed. Thirteen species recorded from the Arabian Sea were found in the seas around Kavaratti and Kalpeni atolls. However, there is general impoverishment of chaetognath population inside the lagoon and only scarce representation of the common species was noticed inside the lagoon. The Cochin backwaters present a very

special ecosystem and the fauna is constituted of a relatively few species that can tolerate lower salinities. The estuarine chaetognaths are transients that are periodically recruited from the open sea.

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