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SEASONAL FLUCTUATIONS OF CHAETOGNATHS IN THE COCHIN BACKWATER

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ABSTRACT

This study was based on the plankton collections taken at fortnightly intervals from two fixed stations in the Cochin Backwater, one at the Fairway Buoy area and the other at Aroor during the period January to December, 1968. An attempt was made to determine the species of Chaetognatha present, their relative abundance, seasonal fluctuations in relation to the monsoonal changes, breeding periods and vertical distribution in the backwaters.

Four species belonging to two genera were encountered in these collections. They were *Sagitta bedoti* Beraneck, *Sagitta enflata* Grassi, *Krohnitta pacifica* (Aida) and *Sagitta robusta* Doncaster in the order of their dominance in the surveyed stations. *S. bedoti* is a neritic form and breeds continuously in the backwaters. Numerical abundance of *S. enflata* was very low in the Aroor station, but at the Fairway Buoy station they dominated in all the collections from September to December. *K. pacifica* is an oceanic form and the sporadic occurrence of the species during the months of high salinity indicates the incursion of oceanic water affecting the inshore areas. *S. robusta* was recorded from only one collection taken from the Fairway Buoy station.

The distribution of chaetognaths at Aroor and Fairway Buoy stations reflects the differing characteristics of the two stations. Aroor is typically estuarine with a complete turnover of salt-water into fresh water and chaetognaths were found to be absent during the period of low salinity. Fresh recruits from the sea will be brought back to the system along with the incoming waters of the post-monsoon period. At Fairway Buoy area where the prevailing conditions are more marine, chaetognaths were present throughout the year.

INTRODUCTION

CONSIDERABLE work has been done on the chaetognaths of the Indian coastal waters. Tokioka (1962) and Silas and Srinivasan (1969) have reviewed the previous works in the area. However, there are only a few records of these organisms from estuaries and inland waters bordering the sub-continent. As can rightly be expected, chaetognaths are never found in abundance in such areas. Rao (1960) reported on the chaetognaths around Kakinada and Chandramohan (1963) from the Godavari estuary on the east coast of India. The only reference to the seasonal fluctuations of chaetognaths of the Cochin Backwater is that of George (1958) dealing chiefly with the species of *Sagitta* in the Narakkal Bunder canal, a part of the Cochin Backwater. His account was based on observations made from March 1953 to February 1954.

The present investigation was initiated with a view to studying in detail the occurrence and fluctuations of the chaetognath fauna of the Cochin Backwater in relation to the monsoonal changes. Such a study will also indicate the tolerance of different species to varying environmental conditions. Attempt was also made to find out the breeding periods of these organisms in the backwaters.

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Environment

The Cochin Backwater is part of a long chain of lakes and canals extending into the north and south of Cochin, parallel to the coast in Central Kerala. This is a tidal estuary and the conditions in the area are influenced both by the sea and by the fresh water influx which is considerable during the monsoon period.

Based on the hydrographical condition of the Cochin Backwater George and Kartha (1963) and Nair (1965) have recognised a pre-monsoon period (January to May) of high salinity, a monsoon period (June to September/October) of very low salinity, and a post-monsoon period (approximately September to January) of rising and fluctuating salinity. The hydrographical pattern characteristic of this area has been investigated by previous workers (Ramamritham and Jayaraman, 1960, 1963 ; Qasim and Gopinathan, 1969 and Sankaranarayanan and Qasim, 1969).

Material and Methods

Material for the study was based on the fortnightly collections made by the Indian Ocean Biological Centre, National Institute of Oceanography during the year 1968 (Menon *et al.*, 1972). The samples were taken from surface hauls of five minutes duration with a HT net (Tranter *et al.*, under publication) from two fixed stations, one at Fairway Buoy and the other at Aroor. During the course of this study collections were also made from two different depths (2·5 metres and 5 metres) at Fairway Buoy area using a Clarke-Bumpus plankton sampler (Tranter, 1965). The zooplankton samples were all preserved in 5 per cent formalin prepared in sea-water. Surface temperature and salinity were recorded during the time of collection. Fifty per cent of each collection (100 % in the case of Clarke-Bumpus samples) was analysed for chaetognaths. Specimens belonging to each species were subdivided into five different maturity stages based on the development of ovary and testis.

Observations

The salinity variations were found to be very different from each other in the two stations surveyed (Aroor and Fairway Buoy). The salinity of the Aroor region varies from that of fresh water to practically that of sea-water during the course of the year. In general, the latter part of June to November is the period of low salinity (0.4 to 22.2‰) and December to May of high salinity (27.2 to 32.8‰). Fairway Buoy area is also influenced by the monsoon cycle, having low salinity water during the southwest monsoon period (11.6 to 21.5‰).

Temperature of the water was almost constant at both these stations throughout the year except for a slight decline during the southwest monsoon period.

The maximum density of chaetognaths at Aroor was observed at the end of February (3295/100 m^3). At Fairway Buoy high density of this group (25186/100 m^3) were found in the middle of September and another peak (5036/100 m^3) during early

May. It can be seen that at the Aroor station chaetognaths were present from December to early June whereas at Fairway Buoy station they were present throughout the year except during November.

Only four species *Krohnitta pacifica* (Aida), *Sagitta bedoti* Beraneck, *Sagitta enflata* Grassi and *Sagitta robusta* Doncaster were encountered in these collections, of which *S. bedoti* and *S. enflata* were the more common. The monthly occurrence of

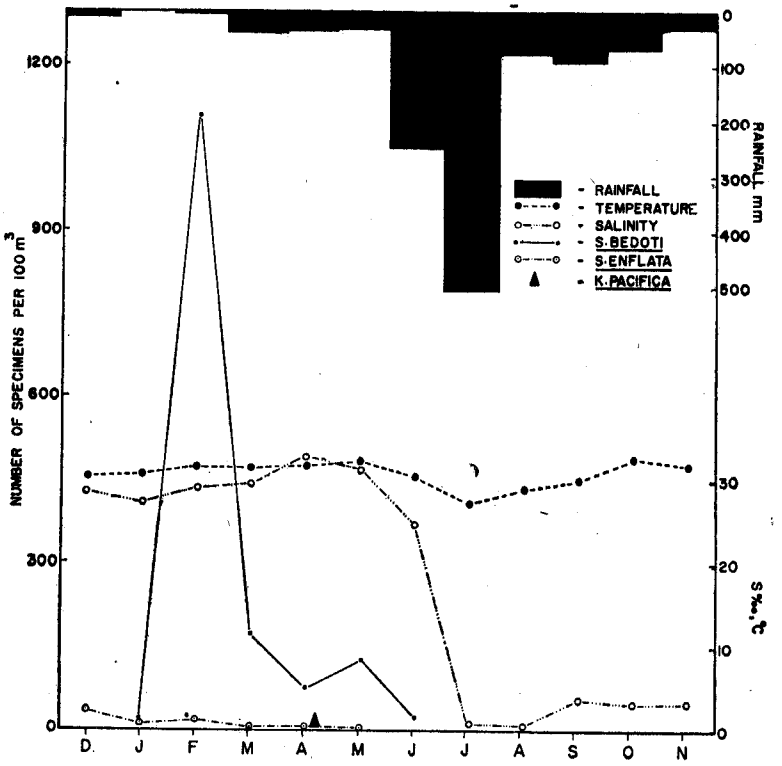

FIG. 1. The seasona l distribution of different species of chaetognaths at Aroor Station in relation to temperature, salinity and rainfall.

the chaetognaths at the Aroor and Fairway Buoy stations are represented in Figs. 1 and 2 respectively. The average monthly rainfall is also shown in the figures.

Sagitta bedoti Beraneck

Salinity range	..	11.6‰ -33.0‰
Temperature range	..	25.7°C -32.6°C

At the Aroor station *S. bedoti* was the dominant species and the peak occurrence of the species was noticed during February (1105/100 m³). At Fairway Buoy area also *S. bedoti* was dominant from January to August. The highest value at the Fairway Buoy area was during September (5533/100 m³) and lesser abundance was

noticed during April and May (4060 and 3700/100 m³). Only a few mature specimens were obtained from these collections.

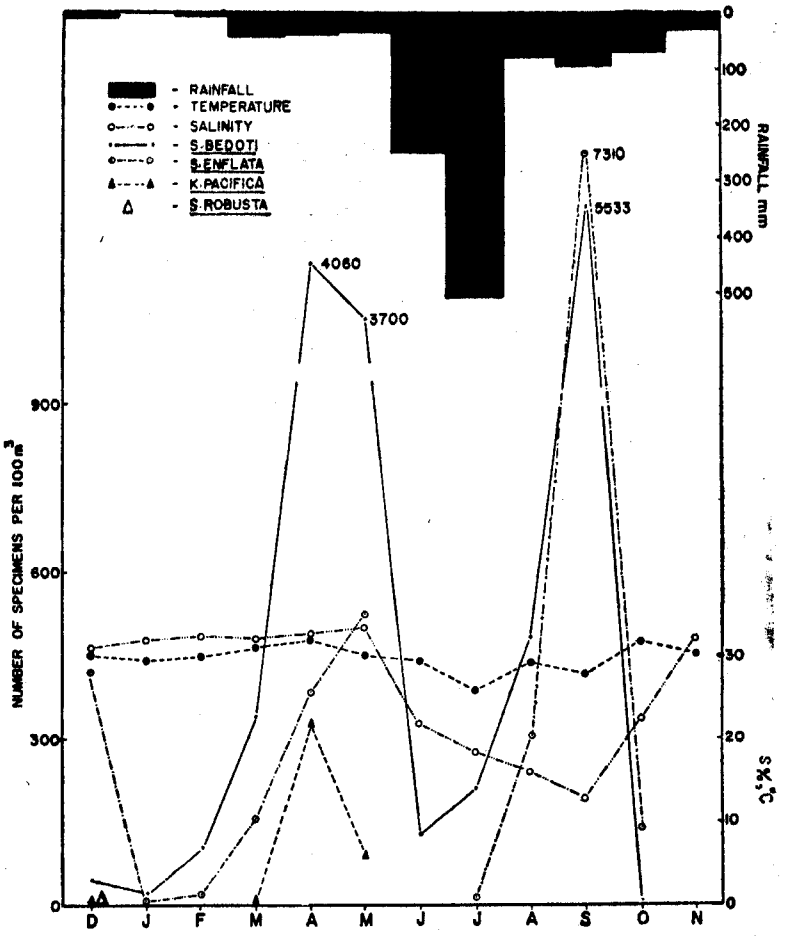

FIG. 2. The seasonal distribution of different species of chaetognaths at Fairway Buoy Station in relation to temperature, salinity and rainfall.

Sagitta enflata Grassi

Salinity range	..	11.6‰ -33.0‰
Temperature range	..	25.7°C -32.6°C

At Aroor numerical abundance of *S. enflata* was much lower than *S. bedoti* and no peak period was observed. But at the Fairway Buoy station they were dominating in all the collections from September to December, the maximum density being in September (7310/100 m³). Only a few mature specimens were obtained from these collections.

Sagitta robusta Doncaster

Salinity	.. 30.0‰
Temperature	.. 29.4°C

Some stray individuals were found only in one collection taken during December from the Fairway Buoy area. All specimens were immature forms.

Krohnitta pacifica Aida

Salinity range	.. 30.0‰-33.0‰
Temperature range	.. 29.4°C- 31.8°C

Two specimens were obtained at Aroor in April. However, at the Fairway Buoy *K. pacifica* was recorded from March to May and again reappeared in December, maximum number being in April (327/100 m^3) when all the five maturity stages were represented.

From the foregoing account it will be seen that at Aroor the chaetognath population is less dense than at the Fairway Buoy. The average number of different species (no/100 m^3) observed at the two stations are as follows:

	S. bedoti	*S. enflata*	*S. robusta*	*K. pacifica*
Fairway Buoy ..	1397	941	0.6	27.8
Aroor	175	6	..	0.1

The vertical distribution of *S. bedoti*, *S. enflata* and *K. pacifica* is represented in Fig. 3. *S. bedoti* had the maximum concentration at the surface throughout the period of collection except during July and for *S. enflata* between 0 to 2.5 metres depth except during July. During July surface salinity went down to 18‰. *K. pacifica* was more common in the surface collections except during April when the maximum number of specimens were recorded.

Discussion

The above account on the distribution of chaetognaths at Aroor and Fairway Buoy stations reflects the differing characteristics of the two stations. Aroor is typically estuarine with a complete turnover of salt-water into fresh water and chaetognaths were found to be absent during the period of low salinity. There exists a distinct periodicity in the occurrence and density distribution of the different species of chaetognaths. But at the Fairway Buoy area where salinity of the water was never lower than 11.6‰, chaetognaths were present throughout the year. Chaetognaths as a class are mainly oceanic forms and this may account for the general decrease in numerical representation of chaetognaths in the Aroor region. The predominant occurrence of *S. bedoti* at the Aroor area may be an indication that this particular species alone is tolerant to low salinity.

K. pacifica is a new record for the area. The present investigations pertaining to the Aroor collections corroborate the findings of George (1958). The only difference noticed was the predominant occurrence of *S. bedoti* while George (1958) reported *S. enflata* to be dominant.

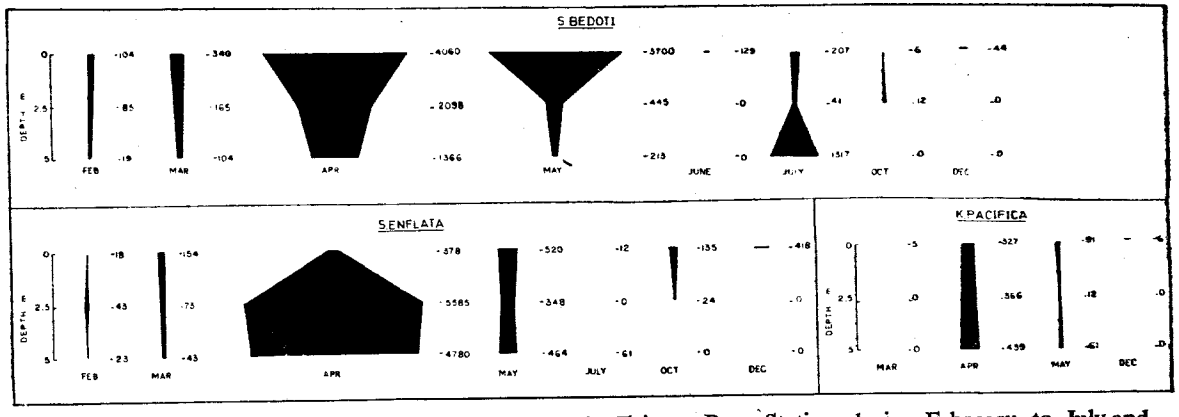

FIG. 3. Vertical distribution of chaetognaths at the Fairway Buoy Station, during February to July and October to December. Numbers at the extreme left indicate the depth in metres and at right of each profile the number of specimens per 100 m^3.

Reviewing the previous work on the west coast of India, Rao (1958) points out that there seems to be a south to north shifting of the peak period of *S. enflata*. The peak period for the occurrence of *S. enflata* appears from July to September at Trivandrum, at Calicut during October to November while near Bombay they were reported to be abundant from November to December. The present collections from Fairway Buoy area show the peak occurrence during the second week of September, agreeing with the previous records.

Occurrence of immature specimens of *S. bedoti* and *S. enflata* in almost all collections suggests that breeding is continuous in this tropical estuary. However, large numbers of immature specimens of *S. bedoti* in the Aroor collection during February indicates that this is the peak breeding period of the species. For *S. enflata* no such peak period was observed at Aroor. At Fairway Buoy area *S. bedoti* and *S. enflata* were having intense spawning during April to May and September. Numerical representation of immature specimens of *S. enflata* was much higher in September than in April to May period. This indicates that periods of heavy spawning are superimposed on continual spawning.

K. pacifica is purely oceanic (Alvarino, 1965) and was present in Fairway Buoy area during the pre-monsoon period when the maximum salinity was noticed and reappeared in the collection taken during December when the salinity was high. This species was also obtained from the Aroor station during April. The sporadic occurrence of this species seems to be correlated with the rise in salinity indicating the possibility of an influx of oceanic water affecting the inshore area.

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