

## AN INTERESTING OBSERVATION ON THE BEHAVIOUR OF CHAETOGNATHA IN THE COASTAL WATERS OF PURI, DURING THE TOTAL SOLAR ECLIPSE, 1980

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### ABSTRACT

The effect of the total solar eclipse of 16 February, 1980, on Chaetognatha from the plankton in the coastal waters of Puri, Orissa State, was investigated and reported here, based on the zooplankton samples collected during the solar eclipse and other periods prior to and after the eclipse.

### INTRODUCTION

Literature on the behaviour of zooplankton during the total solar eclipse is scanty and hence an attempt has been made to study this with special reference to Chaetognatha in the coastal waters of Puri, Orissa State on 16.2.1980. The investigation was carried out in the inshore waters of Pentakota, Puri, located on the approximate central line of the solar eclipse. At Puri, the eclipse began at 14.42 hrs and lasted till 17.00 hrs. The total eclipse was only for 137 seconds (between 15.54 and 15.56 hrs).

### MATERIAL AND METHODS

The zooplankton samples for this study were collected in the Bay of Bengal of Puri coast by one of us (S. K.) with a Nansen standard plankton net of 50 cms diameter. The net was operated from a catamaran and towed for five minutes from a fixed station. On 15 February, 1980, the observations were initiated by collecting zooplankton and water samples, first at 18.15 hrs. The next three samples were collected on the day of the solar eclipse. First sample was collected at 0615 hrs (9 hrs and 30 minutes before the

total solar eclipse), the second was collected at 15.50 hrs (during the total solar eclipse) and the third was collected at 1800 hrs (two hrs after the total eclipse). The last two samples were collected at 0630 and 1420 hrs on 17.2.1980.

The collected samples were preserved in 5% formalin and the total displacement volumes were determined following the techniques of Foxton (1957), Daniel and Premkumar (1965). The displacement volumes have been considered to be equivalent to the total biomass of the samples (Prasad, 1969). After the volume estimation, the Chaetognatha present in the samples were sorted out and identified.

### OBSERVATIONS AND RESULTS

The volume of the plankton collected from this fixed station varied from 2.0 to 7.0 ml, and the number of specimens in the sample varied from 5 to 36 (Fig. 1). The maximum volume and the maximum number of specimens were obtained from the sample collected during the total solar eclipse (15.50 to 15.55 hrs). In the sample collected on 15.2.1980, the chaetognaths were 19 in number.

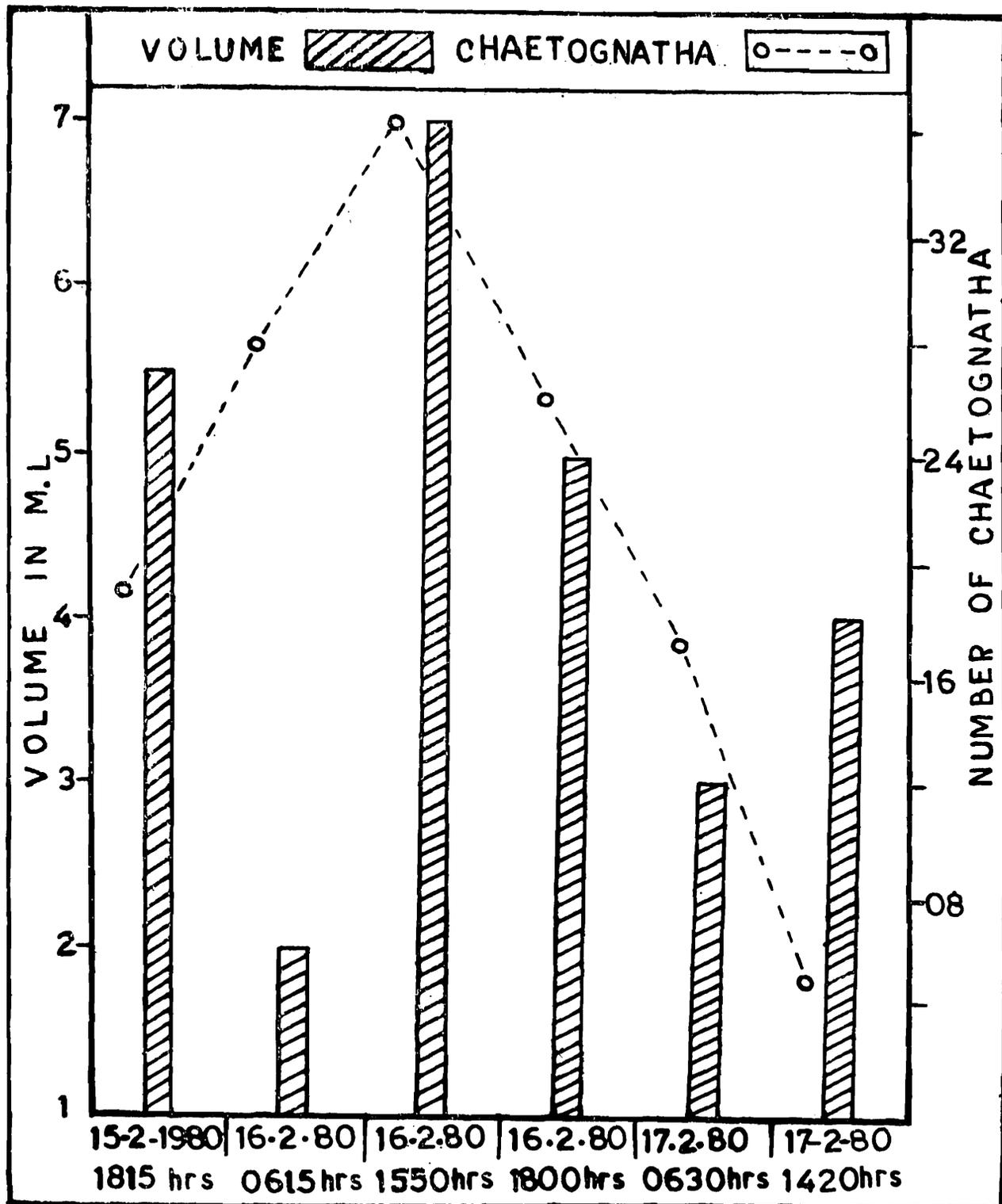


Fig. 1. Behaviour of chaetognatha and zooplankton in the coastal waters of Puri during the solar eclipse and other periods.

28 specimens were seen in the first sample collected on 16.2.1980 at 0615 hrs, 36 were in the second sample collected at 1550 hrs and 26 were in the sample collected at 1800

hrs. 17 specimens were found in the sample collected at 0630 hrs and 5 were in the sample collected on 17.2.1980 (Fig. 1).

In the samples collected, six species of

Chaetognatha, belonging to two genera, *Sagitta* Quoy and Gaimard, 1827 and *Krohnitta* Ritter-Zahony, 1910 were found. The species are *Sagitta neglecta* Aida, 1897 (57 specimens), *S. bedoti* Beraneck, 1895(32), *S. inflata* Grassi, 1881 (29), *S. pulchra* Doncaster, 1903 (8), *S. robusta*, Doncaster 1903 (4) and *K. pacifica* (Aida, 1897) (1). Among these six species, *S. neglecta* tops the list (57 specimens) in the order of abundance. *S. inflata* was found in five of the six samples collected, whereas *S. neglecta* was found in four samples, *S. bedoti* and *S. pulchra* in two samples and *S. robusta* and *K. pacifica* in only one sample.

As in the case of volume of the plankton, the number of specimens of Chaetognatha was also more (36) in the sample collected during the total eclipse and the species present in the sample were *S. inflata*, *S. neglecta*, *S. robusta* and *K. pacifica*. Total length of the specimens of *S. bedoti* varied from 5.9 to 7.9 mm. and include specimens belonging to maturity stages O, I, II, and III. Fully mature (stage IV) specimens were not found in the samples. In the case of *S. neglecta* which was more abundant than other species in the samples, the size ranged from 1.8 to 6.2 mm. Specimens of all the stages of maturity (stage O-IV) were found in the samples. Specimens of *S. inflata* measure from 2.7 to 11.0 mm. in total length and include all stages of maturity, other than fully mature forms (stage IV). Specimens of *S. pulchra* varied from 5.5 to 12.5 mm in total length and have specimens of the maturity stages O-II. Specimens of *S. robusta* measured between 3.5 and 12.6 mm in total length. All stages of maturity except stage IV (fully mature) were present. Only one specimen of *K. pacifica* was seen, measuring 3.8 mm in length belonging to maturity stage II.

Along with plankton samples, hydrographic features such as, temperature and dissolved oxygen were also recorded. The surface temperature, where the plankton samples were collected, varied from 27.0 to 28.5°C and the maximum temperature (28.5°C) was noted during the total eclipse period. The dissolved oxygen ranged between 4.3 and 5.3 MI/L during the study and at the time of total eclipse, it was 5.0 MI/L.

#### DISCUSSION

The results of this investigation show that the volume of the zooplankton and the number of specimens of Chaetognatha were at their peak in the sample collected during the total eclipse period (Fig. 1). Generally, the volume of the zooplankton samples collected during the day time will be less than the night samples. But here, the reverse has happened, despite the collection of samples was during the after-noon (1550 to 1555 hrs). As suggested by Petipa (1955), a sharp and unexpected dimming of light during a solar eclipse, perhaps activated the organisms for a rapid upward migration.

It has been a controversial issue, whether animals are guided by the directional proportions of light or by successive changes in irradiance perceived during the course of their random movement (Kinne, 1975). However, in stream insects, it has been observed that exogenous light conditions have actually been found to have a marked effect on the occurrence of nocturnal forms and it is considered that, if an endogenous rhythm exists then it is weak and influenced by environmental light conditions (Elliot, 1965 ; Holt and Walters, 1967 ; Chaston, 1968 ; Bishop, 1969 and Vinogradov, 1970). Michael (1911) has stated that each plankter tends to remain at the level of optimum light conditions ; as

the intensity of light diminishes towards the sun set, the animal follows the waning intensity towards the surface and with the onset of dawn, it descends, as the intensity of light increases with full daylight. He found that *Sagitta bipunctata* of the San Diego region exhibited a typical diurnal migration, appearing in maximum abundance at or near the surface between 6 and 8 P. M. and 4 and 6 A. M. and descending by noon to depths of 80 to 150 M.

Backus *et al.* (1965) have stated that the scattering layer and bioluminescent organisms of the ocean respond to the eclipsing sun much as they normally behave to the setting sun. Their behaviour from mid-eclipse to eclipse end resembled dawn behaviour. The response of these organisms to change from decreasing to increasing light, near mid-eclipse, was rapid. Thus, it appears, the exogenous factor of changing light largely controls the behaviour, overriding such endogenous rhythm as may exist.

In the present investigation the samples collected during the eclipse period were characterised by the dominance of chaetognaths. These are well known for diurnal migration, rising towards the surface at night and descending at dawn. This reaction is usually regarded as a reaction to light, although other factors also could be involved (Hyman, 1959). During eclipse light is reduced and that might have resulted in the upward movement of the organisms like chaetognaths. This is probably the reason for the abundance of these organisms in the sample collected during the total solar eclipse.

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