

ZOOPLANKTON*

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It is a pleasure and honour for me to introduce the plankton session and for this opportunity I thank the organisers. I shall focus now our attention on a few points only that appear to have singular relevance. Two major events in the world of oceanography will take place this year : the Cochin and the Kiel Symposia, both on the Indian Ocean.

Why so much fuss about the Indian Ocean ?

The reasons are those that spurred the IIOE into being and are well known but not only is the Indian Ocean the least known of all the Oceans, it is also geographically different from all the others. Now as the results are beginning to emerge, the scientific world has to get together to study them and compare the conclusions so far, straighten the course and carry on. Thus, it is expected that at the end of the two meetings it will be possible to make an assessment of the gains. Somehow I feel that 'Closing Remarks' would be more appropriate than an Introductory Note.

We do not wish to touch here on the general problems of plankton research that are more than others in need of urgent attention, since this has been better discussed elsewhere to greater depth, it is partly stated, for instance, in the Long Term and Expanded Programme. A few words may, however, be appropriate on : first, the *specific features* of Indian Ocean, if any, as far as plankton problems are concerned and : second, *where and when can general problems* be studied better in the Indian Ocean than elsewhere, or, in comparison with other systems in other Oceans.

(1) Among the most interesting problems specific to the Indian Ocean, one of the first seems to be a study of the qualitative and quantitative distribution of plankton superimposed on or studied in correlation with the hydrography ; in other words, the peculiarities of the movements of the surface and subsurface water masses in the Bay of Bengal and in the Arabian Sea (the north-east and north-west monsoon areas) that show seasonal reversal of surface currents, may pose many problems, i.e., do these movements tend to maintain the populations isolated from the rest of the Indian Ocean? To what extent are these areas separate ecosystems, if at all? To what extent, if any, does the Equatorial divergence play a part in this process of separation? How well defined is stratification and to what degree and extent do the areas of upwelling interfere with the isolation of the systems? How does the enrichment through land drainage by mighty river systems like the Ganga-Brahmaputra, Indus or Irawaddi compare to enrichment by upwelling? The large number of endemisms in the Bay of Bengal, is

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it real, is it apparent or, if real, how is it maintained? Are the endemisms due only to a peculiar combination of high temperature and low salinity and a salinity gradient from north to south in the surface layer, or are they also due to the concurrence of other hydrographical factors? How great is the degree of endemisms in the Persian Gulf and in the Red Sea? Penetration of Mediterranean species in the Indian Ocean is another specific problem.

Problems of general interest that can be studied better in the Indian Ocean include: how far is the enrichment by upwelling dispersed by surface currents; how far does it extend? What about the enrichment brought about by land drainage?

(2) Coastal lagoons under monsoonal systems at low latitudes have peculiarities of their own; e.g.: Cochin Backwater (before it is too late due to pollution). Pollution in tropical waters and the persistence or break down of pollutants should be studied.

(3) Specific problems of the fisheries: development of eggs and larvae may be over night, early maturity? Fecundity/length/growth relationships and dispersal of larvae and young and the maintenance or not of separate populations under tropical conditions are to a great degree unknown.

(4) How widely spread is the bottom fauna?

(5) Other unique and peculiar ecologically limited problems are numerous in the Indian Ocean and I feel that still a lot of basic survey work has to be done with time/space series of samples and data. Such series and seasonal data are surely needed. Taxonomy, geographical variation, life histories, the basic biology of species, food habits and rearing of marine animals are fundamental for ecological understanding, for system analysis and for the establishment of mathematical models. Only too often does one stumble against the block of insufficient biological information of even the commonest species. Measurement of turnover rate, for instance, is virtually impossible without such simple data as what and how much do animals feed upon.

We have already been amazed at some of the results of the IIOE, such as for instance our knowledge on the flow and velocity, perhaps also transport, of the Somali Current and the intensity of upwelling there and off the Saudi Arabian Coast, but the biological implications of this very large system are barely guessed; incidentally this is a system of an extraordinary large geographical magnitude and one that is bound to be different from the other major upwelling systems like the one off Peru and different also from the upwelling in the Eastern Arabian Sea off the coast of Kerala.

Well, I think that I have already talked far too much and asked too many questions, we shall now listen to the speakers of this session who will give us the replies to some of them at least, but we may conclude by saying that the Indian Ocean is certainly an amazing and wonderful part of the world to the delight of Oceanographers.