Marine Biology 48, 357-366 (1978)

MARINE BIOLOGY


# Some Development Patterns of Plankton Communities in the Upwelling Areas of the Pacific Ocean

M.E. Vinogradov and E.A. Shushkina

Shirshov Institute of Oceanology, Academy of Sciences USSR; Moscow, USSR

**Abstract**

The principal trophic levels, each subdivided into groups of organismic elements, are distinguished in the planktonic communities of the Eastern Equatorial and the Peruvian upwellings. Production intensity or metabolism have been determined experimentally for all elements. A scheme is suggested for computing production from data on metabolism for all the elements of a community, as well as for computing net and real production and other functional characteristics for definite trophic levels and the community as a whole. Based on the quantitative estimation of the efficiency of primary production and other functional characteristics, the development of communities is divided into production and destruction periods; they are, in turn, subdivided into steps associated with a certain degree of water trophicity. The balance of net production of the communities in the Peruvian upwelling indicates that the excess production of a community above the shelf is utilized completely in the narrow (100 to 150 sea miles) band of off-shore water. This paper describes an attempt to trace the changes taking place in the functional characteristics of plankton communities and to compare them with the changes observed in the communities of the Peruvian and East-Equatorial upwellings.

## Introduction

In modern bio-oceanology, increasing attention is being paid to the study of the patterns of functioning of marine communities and ecosystems. Biological processes in the ocean are most intensive in areas of tropical upwellings. Here, the earliest stages of development and patterns of matter and energy transformation in the communities may be traced in their "purest" form. That is why the study of the communities of these regions is of particular interest.

Several specific cruises were organized by the Plankton Laboratory of the Institute of Oceanology of the USSR Academy of Sciences on the R.V. "Vitiyaz" (Cruises 44, 50, 52) and the R.V. "Akademik Kurchatov" (Cruise 17) for the study of the pelagic communities of tropical regions and their zones of most intensive upwelling. The major results of investigations carried out in the areas of the Equatorial and Peruvian upwellings have been set out in "Ecosystems of the pelagic zone of the Pacific Ocean" (Vinogradov, 1975) and in articles by Vinogradov (1974, 1978), Vinogradov *et al.* (1976, 1977), Mikheev (1977), Sorokin (1977, 1978), Shushkina *et al.* (1978), Sukhanova *et al.* (1978) and others.

## Materials and Methods

Field material was collected during Cruise 17 of R.V. "Akademik Kurchatov" at the equator between 97° and 155°W (14 January-7 February, 1974), and along a 130-mile section from the coast of Peru (Cape Pacasmaio, 7°30'S) into the ocean (27 February-4 March, 1974), in the 0 to 150-200 m layer (Fig. 1). A detailed characterization of the area investigated, as well as sampling technique and treatment of collected material has been presented by Vinogradov (1974, 1975), Fedorov *et al.* (1975a, b), and Sorokin (1978).

The taxonomic composition of microplankton (organisms smaller than 1-2 mm) as well as its concentration and vertical distribution were estimated from samples taken with a 140 l Plexiglas water bottle. Sampling depths were deter-

0025-3162/78/0048/0357/$02.00