Distribution of Recent Ostracoda in the Rappahannock Estuary, Virginia

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ABSTRACT: The distribution of recent Ostracoda as determined from 69 bottom samples in the Rappahannock Estuary, Virginia, is related to the pattern of estuarine circulation and different types of fresh and salty water. Three ostracode biofacies are established on the basis of dominant species: (1) a river biofacies, (2) a shoal biofacies, and (3) a basin biofacies.

Although estuarine-wide ostracode populations are small, shoals of the middle estuary have large and varied populations. This abundance of individuals and variety of species may be the result of greater production associated with the introduction of river-borne nutrients and with the growth of benthic plants, or it may be due largely to the redistribution and concentration of carapaces.

Introduction

Ostracods have long been used by paleontologists as indicators of stratigraphic position, and, more recently, as indicators of paleoecological conditions. In fact, so much attention has been directed toward fossil ostracods that they have become better known than their living counterparts. The present interest in ostracod ecology, therefore, stems in part from the initial interest in populations of fossil Ostracoda and the significance of these forms in deciphering the stratigraphic record.

This study was undertaken to determine the distribution of Recent Ostracoda in bottom sediments of the Rappahannock Estuary, and to attempt to correlate this distribution with characteristics of the environment that appear to influence it. In addition to being of ecological interest, this information is of potential importance as an aid in interpreting paleoecological conditions in ancient estuarine deposits.

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Environmental Setting

The Rappahannock Estuary is a brackish tributary of the Chesapeake Bay. Water depths in the channel and basin, along the longitudinal axis of the estuary, range from 18 to over 70 feet. From its mouth, where it is 3 miles wide, to the head of the estuary, where it is about 1 mile wide, the Rappahannock Estuary has an
irregularly sinuous outline that marks the submerged course of a former river valley.

During most of the year the estuary develops a typical two-layered system with moderate haline stratification. The upper layer, bathing shoals floored by sand or silty clay, consists of relatively freshened water with frequent wave-induced turbulence and a wide range in other environmental parameters. The lower layer, moving over the channel and basin floor of clayey silt, is relatively uniform salty water. Under normal conditions in summer, salinity increases downstream from almost zero at the head to 16% at the mouth, a distance of 40 miles. This downstream increase is most pronounced in the middle of the estuary, and corresponds to the "gradient" zone described by Rochford (1951).

Hydrographic data on temperature, dissolved oxygen concentration, and hydrogen ion concentration have been presented in a series of reports by the Chesapeake Bay Institute (1952, 1954, 1955, and 1963) and in data files of the Virginia Institute of Marine Science (unpublished). Variations in water temperature with time reflect variations in the air temperature; monthly mean temperature ranges from 5°C in winter to 26°C in summer. Dissolved oxygen concentrations are relatively low (2 ml/L) in waters of the lower layer during the summer; values generally decrease with depth and occasionally reach zero near the bottom.

Methods

Samples for this study consisted of the top 1 cm of two or more cored portions of bottom sediment. The area of a single core is about 20 cm² and the volume of a single sample is about 20 ml. The ostracods were picked from 114 samples collected at 69 stations during the summers of 1962 and 1963. These stations were located along ten transects on the river from the mouth to 40 miles upstream. The samples were examined initially for Foraminifera. Methods of preparation are given by Ellison, et al. (1965). Identification of living specimens by use of rose Bengal stain as commonly used for Foraminifera was not satisfactory for ostracods. All of the ostracods were picked from each sample and mounted on slides for identification and counting. Single valves and articulated specimens of both instars and adults were counted as single individuals in determining the total population.

Population Distribution and Abundance

Fifteen species in 12 genera of Ostracoda were tentatively identified from about 1,800 specimens collected in the estuary. Classifications largely follow those of Moore (1961). The distribution of total numbers, including both living and dead specimens, is shown in Figure 1. Populations are relatively large in the middle estuary, ranging up to 361 specimens per 40 ml of wet sediment. In the basin, and near the head of the estuary, the populations are relatively small. No ostracods were found in samples from 8 of the 69 stations. The average number of ostracods was plotted against distance upstream for stations on shoals (less than 18 feet deep) and for stations in the channel and basin (greater than 18 feet deep) as shown in Figure 2. Total populations are larger in the shoal zone than in the basin and channel zone; they are largest on the shoals in the gradient zone. In the channel and basin, populations are relatively small and vary irregularly upstream; numbers are smallest in the basin between 12 and 22 miles upstream from the mouth.

Biofacies

Three ostracod biofacies are distinguished in the Rappahannock Estuary on the basis of dominant species distributions; these include (1) a freshwater or river biofacies, (2) a shoal biofacies, and (3) a channel and basin biofacies (Fig. 3).

The freshwater biofacies is confined to the freshened part of the estuary near the head where salinities average less than 5% in the summer. Two species dominate this freshwater fauna: Darwinula stevensoni Brady and Robertson, and Cythero-