ANNUAL VARIABILITY OF THE POPULATION DENSITY AND BIOVOLUME OF NON-LORICATE CILIATES IN THE KASTELA BAY

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Abstract

This paper presents data on population density and biovolume of non-loricate ciliates on a station in the Kastela Bay in 1995 (20 m depth). Maxima of population density and biovolume were recorded during spring and autumn at the surface, with maxima in October (702±540 ind./ l), and September (17.34±28.43*10^6 μm^3/l respectively, while minima were recorded in February during the lowest temperatures.

Keywords: zooplankton, biomass, Adriatic Sea

Introduction

An important role in the conversion of the organic matter to the higher trophic levels in the sea belongs to bacterioplankton, protozooplankton and micrometazoa (1, 2, 3). Researches over the last two decades indicate that cca 50 % of phytoplankton cell constituents may simply bypass the traditional food chain and instead pass through a complex "microbial loop" of bacteria - flagellates - microzooplankton, which is important in rapid recycling of nutrients (4, 5, 6). The abundance of ciliates in the eutrophicated area increases with the increase of the phytomass and necromass (7, 8). Because of that, several studies on ciliates distribution in the water column, which is particularly influenced by some environmental factors (1) and predator - prey relationship were carried out (9). In the last ten years, microzooplankton researches along the eastern Adriatic coast has been intensified (8, 10, 11, 12), but data on non-loricate ciliates are sporadic. For that reason, one-year study of the density and the biovolume of the non-loricate ciliates population in the artificially eutrophicated Kastela Bay (13, 14) have been carried out for the first time.

Materials and methods

Investigations were performed at one station in Kastela Bay (43°31'N and 16°19.5'E) in 1995 (fig. 1). Samples were taken monthly (except in August and December), at 5 m intervals from surface to the bottom (20 m), with 1.7 l Nansen bottle. A 100 ml aliquot was analysed. Plankton was preserved in 2.5 % formaldehyde solution, buffered with $CaCO_3$. Samples volume was reduced by sedimentation and decanting to a volume suitable for microscopic analysis (20 ml) (10). Analysis was performed on "Olympus" IMT- 2 inverted microscope. 1/4 of the total sample was analysed in glass chamber (76-47-6 mm) at a magnification of 200 x, while dimensions were measured with an eyepiece micrometar at a 400 x magnification. Biovolume was determined by comparing the shape of the plasmatic body with the geometrical shape (15). Temperature was measured by a reversing thermometer and salinity using a induction salinometer (model RS 10).

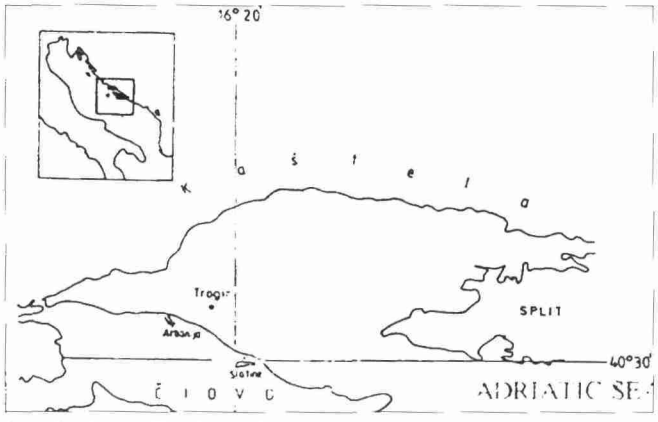

Fig. 1.Study area (The Kastela Bay).

Results

In the Kastela Bay microzooplankton community, non-loricate ciliates were present throughout the year (figs. 2 and 3), and the highest population density at the surface was recorded in September (1400 ind./l), with temperature of 21.71°C and 35.86 of salinity, while their average contribution to the total of protozoans was 80.76%. Lower densities were recorded in October at the surface and at 10 m depth where the average contribution to the total was 70.05%. Minimal population density of 40 ind./l for this group was recorded in February at 5 and 15 m depths, and in May at 20 m depth. During the year, density fluctuation at the surface was equal to 1311 ind./l, while at 15 m depth it was equal to 520 ind./l. As average 75.28% of the non-loricate ciliates abundance was found in the upper part of the water column (from the surface to 10 m depth). However, in July, the highest number of individuals was recorded at the bottom (914 ind./l). After the September mixing they arose at the surface. As the water column cooling, they sunk to 10 m depth, so that in November, only a slight difference between layers in population densities (120 ind./l) was found.

Values exceeding 10*10^6 μm^3/l of non-loricate ciliates biovolume were recorded in April, July, September and October. (Fig. 2) As for densities, two biovolume maxima were recorded, the first in April (12.17±10.00*10^6 μm3/l) and the second in September (17.34±11.09*10^6 μm^3/l, while the lowest average value was found in February (1.69±1.33*10^6 μm^3/l). Measured biovolume values ranged from 0.02*10^6 μm^3/l (recorded in May at 20 m depth) to 39.58*10^6 μm^3/l which was recorded at the same depth in July, with temperature of 14.59(C and 38.24 of salinity. Biovolume differences between surface and bottom were most evident in July (39.26*10^6 μm^3/l), while in February they were only 3.16*10^6 μm^3/l. Annual fluctuation of biovolume values varied from 6.03*10^6 μm^3/l at 15 m depth to 39.56*10^6

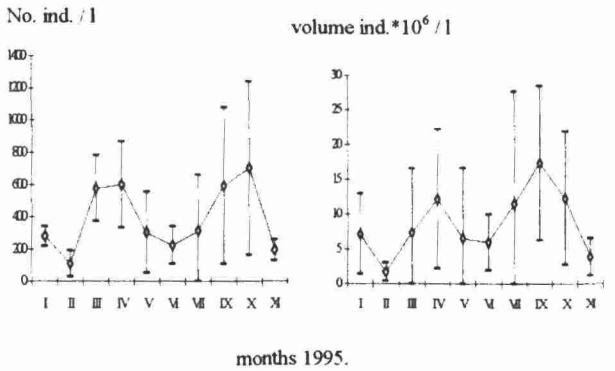

Fig. 2. The average population density and biovolume ($\mu m^3 l^{-1}$) of non-loricate ciliates at the station Trogir in 1995.

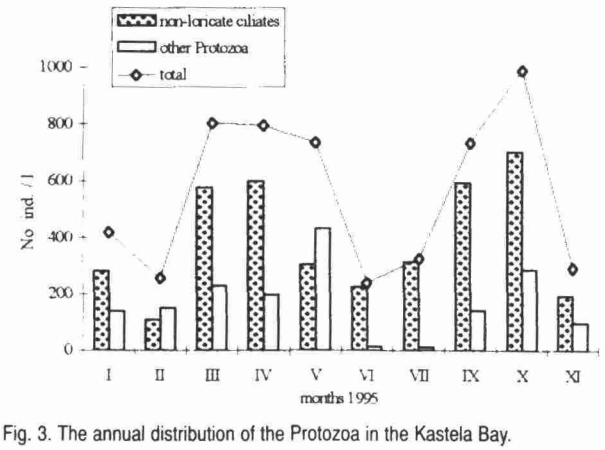

Fig. 3. The annual distribution of the Protozoa in the Kastela Bay.