HETEROTROPHIC BACTERIOPLANKTON DYNAMICS IN RELATIONSHIPS TO ENVIRONMENTAL FACTORS SPECIFIC FOR THE ROMANIAN BLACK SEA COAST

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Abstract

The heterotrophic bacterioplankton dynamics and their relationship with the environmental factors characteristic for Romanian Black Sea coastal zone were investigated during the year 2002. Bacteriological parameters exhibited more or less distinct temporal variations over the whole investigation period, with usually higher values during summer. Water temperature varied between 8.3-28.2°C and salinity between 2.47-17.07‰. Bacterial abundance, assessed by the MPN method, ranged from 3.8 x 10^4 cell ml^{-1} to 9.2 x 10^7 cell ml^{-1}. A strong relationship between bacterial properties and temperature was found with clear seasonal trends. Also bacterial properties were strongly related to changes in salinity, particularly for the Romanian coast.

Keywords: bacterioplankton dynamics, environmental factors, Black Sea

Introduction

Microorganisms, especially heterotrophic bacterioplankton, play an important role in processing of organic matter (1). However, there are several environmental factors (such as biological, as well as physical and chemical factors) involved in the control of the dynamics and bacterial distribution in the coastal zone (2).

Due to its location, the Romanian Black Sea coast is a dynamic regions characterized by gradients in temperature, salinity and nutrient concentrations. Moreover, during the past four decades, the Romanian Black Sea coast has been affected by eutrophication due to increasing input of anthropogenically-derived nutrients (3).

Therefore, in this study, spatial and temporal patterns of heterotrophic bacterioplankton abundance and biomass were investigated and related to environmental factors potentially controlling bacterial abundance and production. Bacterioplankton abundance and biomass were determined along the Romanian coast during spring, summer and autumn 2002 at five sites: Sulina, Sf. Gheorghe, Portita, Constanta and Manglia. These sites cover two areas of the Romanian the Black Sea coast with a high anthropogenic impact: the northern sector (between Sulina and Portita) is under the influence of the Danube river, and the southern sector (from Constanta to Vama Veche) is affected by industrial and domestic discharges.

The MPN technique on liquid ZoBell medium was used for the determination of heterotrophic bacterial abundance and is expressed as cell ml^{-1} after 7 days of incubation of 21°C. Bacterial biomass (BB) was calculated from abundances using 20 fg C $cell^{-1}$ (4). Chemical (salinity), physical (temperature) and biological (total phytoplankton density) analyses of sea water were also performed (3, 5).

Results and disscution

The results of the microbiological observations along the Romanian coast at the 5 stations are summarized in Table 1.

Table 1. Heterotrophic bacterioplankton abundance and biomass and environmental factors in seawater samples (Romanian Black Sea coast)

Station	Month	Bacteria (cells ml^{-1})	Bacteria (µg C l^{-1})	Temp (°C)	Salinity (g ‰)	phytoplankton (cells l^{-1})
Sulina	April	47000	0.94	9.75	16.17	88320
Sulina	July	160000	32	28.18	12.75	2880100
Sulina	September	160000	32	22.25	7.42	3017200
Sf. Gheorghe	April	1600000	32	8.92	15.99	1127000
Sf. Gheorghe	July	1600000	32	27.6	15.5	2117720
Sf. Gheorghe	September	1600000	32	22.03	2.47	255350
Portita	April	3500000	70	9.97	14.61	642550
Portita	July	1600000	32	nd	nd	1075000
Portita	September	nd	nd	nd	nd	2872600
Constanta	April	920000	18.4	12.45	9.95	1091820
Constanta	July	1600000	32	25.38	14.25	21350
Constanta	September	1600000	32	23.47	14.1	6025380
Constanta	October	2400000	48	18.32	17.07	nd
Mangalia	April	92000000	1840	11.82	11.96	484660
Mangalia	July	38000	0.76	25.73	15.25	262800
Mangalia	September	nd	nd	nd	nd	496440
Mangalia	October	16000000	320	17.53	16.38	nd

Heterotrophic bacterial abundance and biomass in the surface waters along the entire Romanian Black Sea coast were generally higher in the year 2002 than in previous years (data not shown).

The annual maximum and minimum of heterotrophic bacterial abundance and biomass in all studied stations was observed in April (9.2 x 10^7 cell ml^{-1} and 1840.0 µg C l^{-1}, respectively) and in July (3.8 x 10^4 ml^{-1} and 0.76 µg C l^{-1}), respectively, at Mangalia station (Table 1). The abundance and biomass of heterotrophic bacteria in the northern sector (under the Danube river influence) was similar to those of the southern sector (under the sewage discharges influence).

Bacterial abundance and biomass exhibited more or less distinct seasonal variations. The differences in abundance of bacteria imply different limiting factors for bacterial populations along the coastal waters (substrate and nutrients, temperature, oxygen conditions). During the investigation period, periodical oscillations in the main biotic and abiotic factors were observed. These fluctuations seemed to be interrelated in many instances.

One of the most important factors influencing the seasonal distribution of bacteria in the shallow waters of the Black Sea was temperature. The pattern of total heterotrophic bacteria correlated significantly with that of temperature over the entire year.

Besides temperature, organic matter concentration was another important factor affecting the distribution of the heterotrophic bacteria. Ours results indicate that in Romanian coastal waters the sources for organic matter for heterotrophic bacteria are allochthonous input (continental sources) and autochthonous sources (produced directly by phytoplankton exudation or indirectly after cell lysis subsequent to stress conditions).

The enrichment with allochtonous organic material from the land, led to an increase in heterotrophic bacterial abundance in the stations at the southern area (Constanta and Mangalia) as well as at the northern area (Sulina, Sfantu Gheorghe, Portita). Furthermore, the availability of organic compounds released by primary producers (phytoplankton) led also to a high level of bacterial population density (in both coastal area) during the decline of the spring and autumn algal blooms. Heterotrophic bacteria and total phytoplankton density were also significant correlated.

References

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