SEASONAL PHYTOPLANKTON DISTRIBUTION IN THE OFFSHORE SOUTHERN ADRIATIC WATERS

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Abstract

Seasonal variations of phytoplankton, thermohaline conditions and nutrients in the oligotrophic, offshore southern Adriatic have not been published to date. Data were collected at five stations along the Bari-Dubrovnik transect (across the southern Adriatic Pit), in the 0-50 m layer, during irregularly performed case studies - from January to September, in the period from 1980 to 1990. Mixing and inflowing currents from the Ionian Sea predominate in the period from January to April, resulting in higher salinity and renewal of nutrients in the euphotic layer. The offshore southern Adriatic is characterised by microphytoplankton blooms, appearing usually in April. In May, average temperature reach 18°C, phytoplankton bloom exhaust nitrates to average concentration lower than 0.5 μmol l^{-1} and disappear. In May, phytoplankton blooms could be recorded in the eastern or western neritic waters. Following May, phytoplankton density remains low until next spring.

Key-words: Nutrients, temperature, salinity, open sea, Adriatic Sea

Introduction

The southern Adriatic is the deepest part of the Adriatic, an area with unknown dynamics of phytoplankton, because regular seasonal sampling during the same year has not been ever performed in this area. Present knowledge of natural characteristics in the southern Adriatic mainly refer to water circulation (1, 2, 3, 4), and thermohaline characteristics (5, 6). The current system in the southern Adriatic is characterised by the inflowing northerly oligotrophic current of more saline water from the Ionian Sea (predominant along the eastern coast in winter), and the outflowing southerly current of eutrophicated Adriatic water of lower salinity (predominant along the western coast in summer). The discharge of the river Po, and the exchange of water masses through the Otranto strait, influence plankton production (7), and phytoplankton distribution (8, 9). The cyclonic gyre in the southern Adriatic Pit area is a permanent physical factor (2), inducing winter/early spring upwelling and accumulation of phytoplankton in its interior, mostly in April (10, 11).

The scope of this paper is 1) to present seasonal changes of phytoplankton cell density, thermohaline conditions and nutrient concentrations along the Bari-Dubrovnik (SW-NE) transect across the Southern Adriatic Pit, and 2) to find out possible reasons of variability in phytoplankton cell density and distribution.

Materials and methods

Water samples for the analyses of phytoplankton were collected from five stations (15, 14, 13, 12, 11 in the SW-NE direction) located across the Southern Adriatic Pit, using 5-litter Niskin bottles, in the 0-50 m layer (at 0, 10, 20, 50 m), during five irregularly performed cruises of the R.V. *Andrija Mohorovicic* (January 1980, March 1990, April 1986, May 1990, July 1989, August 1986 and September 1988) (Fig. 1). Samples were preserved in a 2% (final concentration) neutralised formaldehyde solution. The cell counts were obtained by the inverted microscope method (12).

Salinity and temperature were determined using an Autolab-MK-IV inductive salinometer and Richter-Wiese reversing thermometers and CTD multisond (SEA Bird Electronics Inc., USA), respectively. The nutrient samples were taken with Niskin bottles and stored in polyethylene bottles. Phosphate and nitrate were determined by using standard methods (13). The absorbance readings were made on a Varian-Super Scan 3 spectrophotometer with 10-cm cells.

Results and discussion

Data from different cruises (from January to September in the period from 1980 to 1990) are pooled together in order to obtain an approximative seasonal variation of phytoplankton density, thermohaline conditions and nutrient concentrations in the offshore southern Adriatic.

Presented results indicated several ecological characteristics in the investigated area:

1) Thermic stratification of water column becomes evident in April, and culminate in August (Fig. 2). Temperature and salinity values are represented by single depth determinations. The thermic stratification at any one station (in figure 2) can be determined by measuring distance between upper point (warmer surface layer) and the lowermost point (colder, 50 m -layer). Mixing and inflowing current from the Ionian Sea predominate in the period from January to April, resulting in higher salinity (1, 6). On the other hand, the increased discharge of the river Po induce stronger outflowing current from the northern Adriatic. Such an transport of water of lower salinity (37.5‰ at station 15), along the Italian coast was recorded in the period from April to August. Relatively low salinity values (<38‰) were also recorded at the easternmost station 11, due to snow melting and discharge of Albanian rivers in May 1990. In August 1986, relatively low surface salinity was evident, probably due to intensive surface outflowing current, throughout the southern Adriatic.

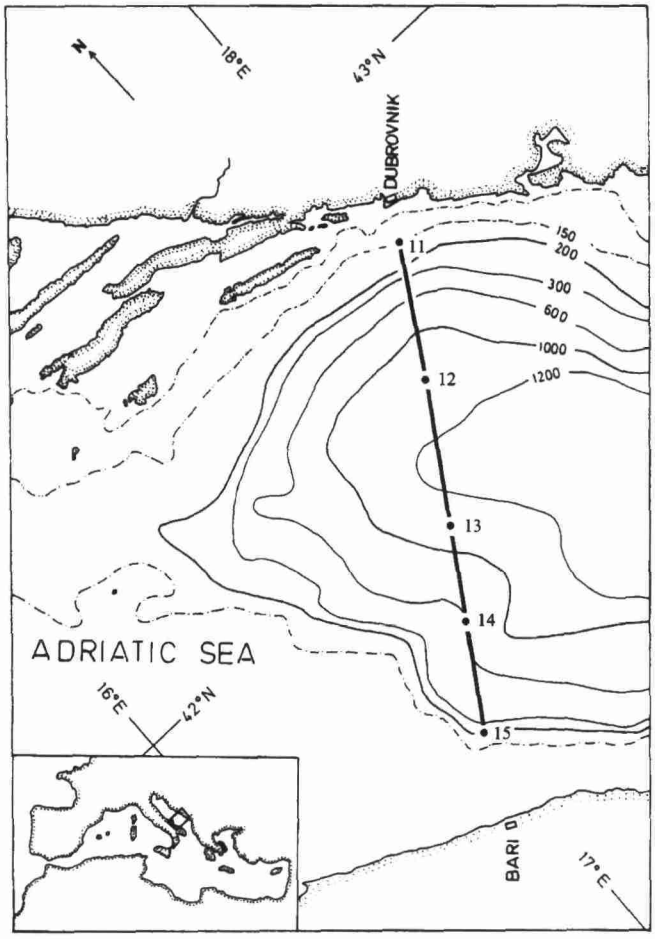

Fig. 1. Location of stations along the Bari-Dubrovnik transect.

2) Southern Adriatic contains extremely oligotrophic water, with <0.2 μmol l^{-1} PO_4 (most frequently about 0.1 μmol l^{-1}) and <3 μmol l^{-1} NO_3 (most frequently about 1 μmol l^{-1} NO_3)(Fig. 3). Winter mixing enrich upper euphotic layer with nitrate, providing short pulses of 2.5 μmol l^{-1}. In winter-spring period, concentration of orthophosphate is relatively low and constant, and progressively decrease to the minimum values (<0.03 μmol l^{-1}) in September.