ENVIRONMENTAL FACTOR TRIGGERING THE LATE-WINTER DIATOM BLOOM IN THE NORTH ADRIATIC SEA

Bastianini M. [1] *, Acri F. [1], Bernardi Aubry F. [1], Casotti R. [2], D'Ortenzio F. [2], Miralto A. [2], Socal G. [1]

[1] Istituto di Scienze Marine, CNR, Venezia, Italy - mauro.bastianini@ismar.cnr.it
[2] Stazione Zoologica "A. Dohrn", Napoli, Italy

Abstract

A late-winter diatom bloom (*Skeletonema costatum*) typically occurs in the NW Adriatic Sea, triggered by nutrient inputs from the Po River and by increasing irradiance and temperature. In 2002, the onset of the bloom was delayed with respect to previous years, due to light limitation caused by cloud coverage in the form of fog. Therefore, phytoplankton could not efficiently use the available (and abundant) nutrients originating from the river outflow until the weather conditions and the total amount of irradiance improved to the point of triggering cell growth. In fact, when at the end of February an increased rainfall boosted Po river discharge, dissolved nutrients became available in significant amount, but irradiance was still low due to the fog. Only in March, mutated climatic conditions allowed sufficient light availability, which, coupled with available nutrients, triggered the *S. costatum* bloom. The temporal dynamics of bloom initiation may be fundamental in determining species composition, which, in turn, has been shown to have a strong impact on consumers recruitment.

Keywords: diatoms, bloom, Skeletonema costatum, fronts, Adriatic Sea

The annual cycle of phytoplankton populations in the Northern Adriatic Sea is mainly driven by thermal and irradiance fluxes. A key role is also played by the dilution processes that affect the distribution of water masses and the selection of phytoplankton populations (1).

The NW Adriatic shows a strong variability in duration and extension of phytoplankton patchiness, driven by river outflows and seasonal dynamics. Phytoplankton blooms can be observed all over the year in the area influenced by river discharge, but diatoms are the first group to burst in late winter, when the light availability increases, and dominate the phytoplankton community, both relatively and absolutely. Usually *Skeletonema costatum* is the dominant species in these late-winter blooms, followed by other species (e.g. *Chaetoceros*) later on (2).

The new production processes related to these blooms influence the entire basin and have a great impact on the evolution of plankton community for the whole year (3).

In February-March 2002 six stations, along a coast-to-offshore transect in correspondence to the Po river delta (Fig. 1), were sampled on a weekly basis. The phytoplankton and picoplankton community, was studied using flow cytometry, microscopy, and remote sensing (SeaWifs). Data on hydrology (temperature, salinity, dissolved oxygen, turbidity, fluorescence, dissolved nutrients) and meteorology (air temperature, pressure, wind direction and speed, irradiance) were also obtained using standard oceanographic methods.

During the first 45 days of 2002 precipitations in the whole northern Italy were very scant and the Po river discharge, which usually accounts for 1500 m^3s^{-1} in the same period, was as low as 700 m^3s^{-1} (Fig. 2). Dissolved nutrients and phytoplankton abundance were very low (Fig. 2).

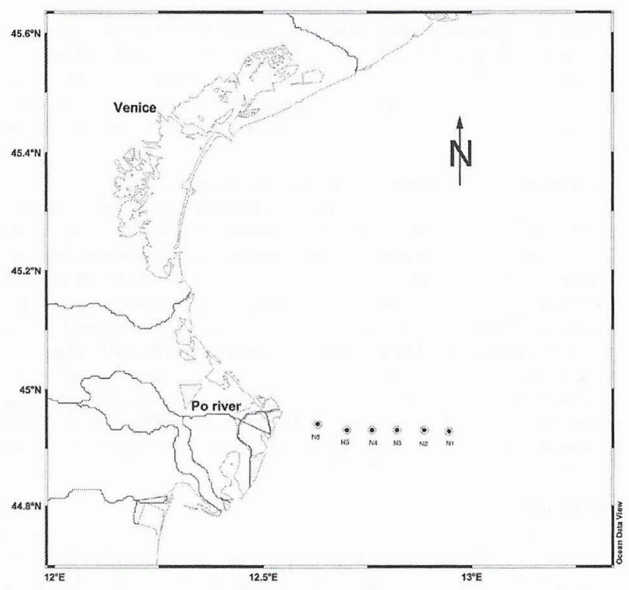

Fig. 1. Location of sampling stations.

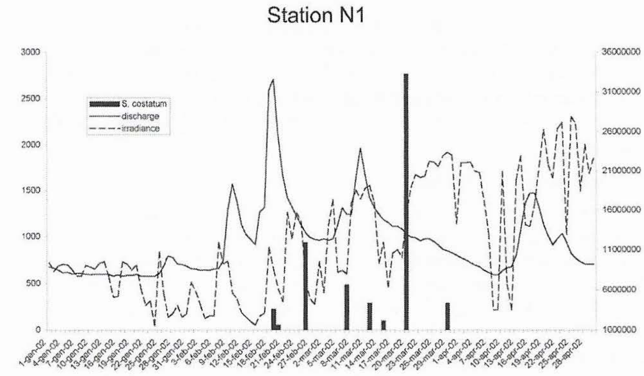

Fig. 2. Po river discharge, irradiance and *S. costatum* abundance.

During the second half of February, the rainfall increased significantly, and correspondingly river discharge increased. Even if higher concentrations of dissolved nutrients were measured, phytoplankton abundances were low along the whole transect. Finally, during the first weeks of March, meteorological conditions were favorable and the increased solar irradiation, conjugated with the constant relevant river discharge, triggered the beginning of the bloom. Therefore, light represented the ultimate triggering factor for the diatom bloom, and strongly favored *S. costatum*, a typical r-selected species (4). This species reached the maximum abundance (5.3 x 10^6 cells dm^{-3}) on 20^{th} of March, in the station (N3), situated 10 miles offshore the Po river (Fig. 1). Here, the growth of *S. costatum* was enhanced by the most suited hydrologic conditions (low turbidity-sufficient nutrient concentration). The bloom was evident in all the three most offshore stations (N1 to N3 in Fig. 2). The spatial variability of phytoplankton abundance along the transect could be explained by the interdependence of microalgal growth from the main forcing factors: nutrient concentration and light availability. On the other side N6 is constantly supplied with nutrients that, therefore, never became a limiting factor, microalgal abundance is always quite high with a freshwater species composition, although high turbidity usually limits its growth.

References

1 - Harding L.W., Degobbis D., Precali R., 1999. Production and fate of phytoplankton: annual cycles and interannual variability. Ecosystem at the land-sea margin: drainage basin to coastal sea. *Coastal and Estuarine Studies*, 55: 131-172.

2 - Bernardi Aubry F., Berton A., Bastianini M., Socal G., Acri F., 2003. Phytoplankton succession in a coastal area of the NW Adriatic, over a 10-year sampling period. *Continental Shelf Research* in press.

3 - Fonda Umani S., Franco P., Ghirardelli E., Malej A., 1992. Outline of oceanography and the plankton of the Adriatic Sea. Proceedings of the 25^{th} EMBS: 347-365.

4 - Gallagher J.C. (1980). Population Genetics of *Skeletonema costatum* (Bacillariophyceae) in Narragansett Bay. *J. Phycol.*, 16, 3: 464-474.