Estuarine, Coastal and Shelf Science xxx (2012) 1–12

Contents lists available at SciVerse ScienceDirect

Estuarine, Coastal and Shelf Science

journal homepage: www.elsevier.com/locate/ecss

# Benthic diatom response to changing environmental conditions

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ARTICLE INFO

*Article history:*
Received 21 June 2011
Accepted 25 March 2012
Available online xxx

*Keywords:*
benthic diatom
sea temperature
nutrients
sublittoral site
freshwater influence
mucilage
45° 42.050′ N
13° 42.600′ E
45° 39.800′ N
13° 35.700′ E

ABSTRACT

In the Gulf of Trieste (northern Adriatic Sea, Italy) the benthic diatom community dynamics has been studied for seven years (1999–2005) at two sublittoral stations and related to variations of temperature, salinity, nutrient concentrations, freshwater inflow and mucilage. Bin-averaged temperature versus abundance of the main genera revealed that *Nitzschia* and *Navicula* presented a positive stepped trend with increasing temperature. An increase of ca. 860 ± 150 cells per $cm^3$ per °C was calculated for *Navicula* and up to 590 ± 170 cells per $cm^3$ per °C for *Nitzschia*. The genus *Pleurosigma* revealed a negative trend with increasing temperature, with a calculated decrease of ca. 140 ± 60 cells per $cm^3$ per °C. A negative relation between *Diploneis* and temperature was found only in the shallower site. A peak of the tycho-pelagic genus *Cylindrotheca* was observed in correspondence with high salinity, but no significant results between bin-averaged salinity and benthic diatom abundance were found. Significant negative relations were obtained between bin-averaged abundance of *Pleurosigma* and $H_4SiO_4$ and $NO_3^-$ at the deeper station and between the bin-averaged abundance of *Gyrosigma* and $NH_4^+$ at the coastal station. In this site the abundance of *Gyrosigma* showed a significant increasing trend over the study period. *Navicula* and *Nitzschia* seemed to suffer from the presence of mucilage events occurred in summer 2000 and 2004 whereas *Diploneis* occupied the ecological niche which remained temporarily uncovered by *Navicula* and *Nitzschia*. An exceptional freshwater plume with extremely high terrigenous input in November 2000 completely covered the benthic diatom community, causing a remarkable decrease in its total abundance in late autumn and winter 2000–01. The Gulf of Trieste may be considered a natural megacosm due to its geomorphologic characteristics and therefore the benthic diatom response to changing environmental conditions observed in this site could be extended beyond the geographical limits of this particular ecosystem.



## 1. Introduction

Diatoms have been proven to be excellent indicators of environmental change in aquatic systems (Kelly et al., 1995) and are increasingly being used also in marine monitoring programs both in the water column (Weckström and Juggins, 2005) and in the sediment (Facca and Sfriso, 2007). While diatom response to water quality parameters has been modelled in freshwater aquatic environments (Weckström and Juggins, 2005 and references therein), similar studies in coastal marine environments are still rare (Agatz et al., 1999).

It is still under discussion on which taxonomic level a system of different diatom associations in relation to environmental parameters should be based. While Lange-Bertalot (1979) definitely preferred the species level, Kelly et al. (1995) did not find a significant difference between a system based on either the genus or the species level. Finally, Agatz et al. (1999) found a feasible compromise between genus and species level. Besides this conceptual issue, when long-term in situ observations are considered, it is important to have a continuous data set for statistical analyses. Due to different biotic and abiotic factors (light availability and temperature at the bottom, grazing) some species belonging to one genus can be substituted by others belonging to the same genus. Consequently, although a species can reach high abundance within a period, prolonged gaps often occur also for the keystone species, not allowing an adequate data set for statistical analyses and their interpretation. Therefore, statistical analyses performed on the genus level are often preferred (Vyverman et al., 2007; Verleyen et al., 2009).

*Abbreviations:* DGR, surface daily global radiation; %CSV, cumulative percentage of specific variance; %PAR, percentage of measured irradiance at the bottom with respect to surface irradiance; %SV, percentage of specific variance; RA, relative abundance.

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doi:10.1016/j.ecss.2012.03.033