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Phytoplankton temporal changes in a coastal northern Adriatic site during the last 25 years

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ABSTRACT

There is an increasing awareness of the relationships among key phytoplankton groups and their role in biogeochemical cycles; however, less is known about the temporal scales of variability in biodiversity of the phytoplankton community. In the present study a long-term data set (1986–2010) of phytoplankton abundance is used to investigate the temporal variability of the phytoplankton community at a coastal site in the Gulf of Trieste (northern Adriatic Sea). The interannual variability of the phytoplankton community shows two major periods in terms of abundance and community composition. The first one, 1986–1994, was characterized by the highest abundances of microalgae and the dominance of phytoflagellates. The second period (1995–2007) showed lower abundances and a collapse of phytoflagellates. Lastly, an apparent new increase in abundances has been recorded during recent years (2008–2010). On a seasonal scale, a classical cycle with two maxima (spring and autumn) and a summer minimum is evident. Diatoms are the most abundant group of the late winter–early spring bloom whereas phytoflagellates, the most abundant group throughout the year, dominate the late spring blooms. Dinoflagellates and coccolithophores have low abundances and show their maxima in summer and autumn, respectively. The species composition has been analysed according to the Indicator Value Index, highlighting the more frequent and abundant taxa for each month. Results show that the winter months are characterized by coccolithophores, in spring small diatoms are dominant, dinoflagellates and larger diatoms are typical in summer, and coccolithophores and diatom colonies characterise the autumn.

1. Introduction

Microalgae play a key role in regulating atmospheric carbon dioxide concentrations and in fuelling marine and freshwater food webs, and may be a useful index for recognising the consequences of climate change in coastal areas. The phytoplankton community can change even within a few weeks and therefore only long-term studies at coastal sites provide fundamental insights into the phytoplankton cycle (Smetacek and Cloern, 2008). The first study on the phytoplankton community in the Gulf of Trieste (northern Adriatic Sea) dates back more than a century (Steuer, 1903); subsequently, many taxa were described for the first time in this area (Schiller, 1933, 1937) and these early studies are still fundamental to the taxonomic knowledge of phytoplankton diversity. Regular observations on plankton dynamics and environmental conditions began in the early 1970s; the results obtained indicated a high temporal variability in the ecosystem (Specchi et al., 1979; Fonda Umani et al., 1992), while information on the seasonal evolution of phytoplankton community structure was still lacking. More recently, in order to explain the mechanism controlling the phytoplankton variability, constant and consistent observations were started in the western (Cabrini et al., 1994, 2000) and eastern (Malej and Malačič, 1995; Mozetič et al., 1998, 2010) parts of the Gulf of Trieste. The analyses have shown a large spatial, seasonal and interannual variability in the phytoplanktonic community (Cabrini et al., 2000; Mozetič et al., 2002; Comisso et al., 2003) due to the influence of multiple drivers. In particular, the phytoplankton dynamics are influenced by physiological responses, by modifications in hydrological properties and by grazing pressures (Cataletto et al., 1993; Fonda Umani et al., 2005, 2007, this issue; Zingone et al., 2010a). Furthermore, since community composition and its temporal modification are the result of the synergy of multiple environmental conditions, they represent useful indicators for the definition of good environmental status (GES) as required by the European Marine Strategy Framework Directive (MSFD). The aim of

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