# Phytoplankton response to anomalous physical-chemical conditions in the Gulf of Trieste (Northern Adriatic Sea)

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We studied the influence of anomalous meteorological and hydrological conditions that occurred in the Gulf of Trieste from March 2006 to February 2007 on phytoplankton structure and function. We computed monthly mean (or median) air temperature, total precipitation, wind speed, river discharge, seawater temperature, salinity, photosynthetic available radiation (PAR), cyanobacteria, nano- and microphytoplankton abundances during the study year and compared them to climatological (1999-2014 for PAR; 1999-2007 for nanophytoplankton; 1998-2015 for the other variables) mean/median data. We then related the cyanobacteria (0.2-2 µm), nano- (2-20 µm) and microphytoplankton (20-200 µm) of the study year to inorganic nutrient concentrations. Median river inputs in October and November were 9- and 15-fold lower, respectively, than the time series medians, with consequent high salinity from May to November (up to +1.26 compared to the climatological data). Monthly mean seawater temperatures were lower than the climatological values (-2.95 °C at the surface) from March to August 2006 and higher (+2.15 °C at the surface) from September to February 2007. Reductions in freshwater input and nutrient depletion were likely responsible for a decrease in microphytoplankton (median annual abundance over 60% lower than the climatologic median) and cyanobacteria (up to 47% lower than the climatology). Significant seasonal differences in cyanobacteria and microphytoplankton abundances ($R_{ANOSIM}$= 0.52; $p<0.05$), as well as in seawater temperature and salinity ($R_{ANOSIM}$= 0.73; $p<0.05$) between the study period and the climatology were highlighted. The late spring diatom bloom was not reflected in high photosynthetic rates whereas an unusually high primary production was estimated in November (7.11 ± 1.01 µgC $L^{-1}$ $h^{-1}$), when a mucilage event occurred due to very stable atmospheric and oceanographic conditions. The typical seasonal succession of pelagic phototrophs (micro-, nanophytoplankton and cyanobacteria) was altered since an exceptional cyanobacteria bloom first developed in April, followed by a delayed diatom bloom in May. The reduced availability of phytoplankton biomass had several repercussions on both the pelagic and benthic trophic webs.

The Gulf of Trieste may be considered a natural megacosm due to its peculiar geomorphologic characteristics and we believe that the structural and functional response of phytoplankton to anomalous physical-chemical conditions observed in this area may have broader implications and could be extended beyond the geographical limits of this particular ecosystem.

Keywords: microphytoplankton; nanophytoplankton; cyanobacteria; primary production; river discharge; extreme meteorological event