

OCEANOGRAPHIC CONDITIONS RELATED TO THE EXTREME WARM SPRING-SUMMER OF 2016 AND 2017 IN THE NORTHERN ADRIATIC

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Abstract

Temperature, salinity, total inorganic nitrogen (TIN), orthophosphate (PO₄) and chlorophyll *a* concentrations in the surface, and oxygen saturation in the bottom layer of two stations in the northern Adriatic (NA) were measured in 2016 and 2017, and compared with the long-term data (1972-2015).

Keywords: Air-sea interactions, Temperature, Salinity, Nutrients, Adriatic Sea

The oceanographic conditions in the NA mostly depend on: a) air-sea heat and water fluxes, b) Po River freshwater input, and c) advection from the middle/south Adriatic, possibly related to the intensity of motions within the Ionian-gyre (BIOS; [1]). Extremely warm weather recorded in 2016 and particularly in 2017 in Croatian region, during spring and summer. In order to verify if this atmospheric event had a significant impact on the NA, oceanographic parameters, measured in 2016 and 2017 at two stations were compared with long-term data (1972-2015). While the western station (SJ101-12 Nm off the Po River delta, Italy) is under a prevailing influence of eutrophied Po River waters, the eastern station (SJ107-12 Nm off the Istrian coast, Croatia) is predominantly oligotrophic due to advection of higher salinity waters from the middle Adriatic. Sea surface temperatures were at both stations generally higher than the average, particularly in summer 2017 (Figs.1 and 2).

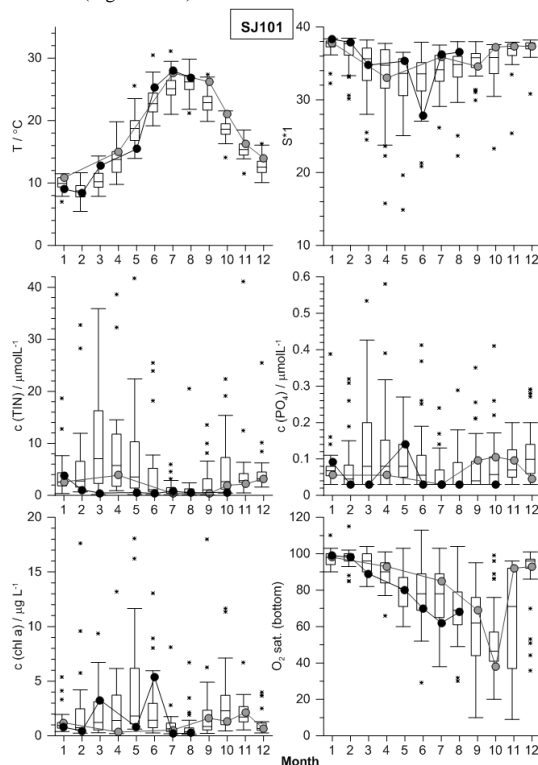


Fig. 1. 1972-2015 long-term data (Box-Whisker plot), 2016 (grey) and 2017 (black) monthly values of oceanographic parameters at the station SJ101. Surface salinity at SJ107 was higher than usual in the almost all the measured cases (Fig. 2). This occurred less frequently at SJ101, although still dominantly. As expected, the nutrient concentrations were correlated to the described oceanographic conditions (Figs. 1 and 2). At SJ101 the TIN concentrations were mostly remarkably below the averages, while at the SJ107, the differences were reduced, although still significant. The PO₄ values at this station were near the analytical limit, as typical. Some increased values were observed in the fall 2016 at SJ101 (Fig. 1). The chl *a*

concentrations were close or below the long-term average, with occasional higher values correlated with nutrient concentration increases, e.g. in June (SJ101) and November (SJ107) of 2016. Interestingly, during spring and summer 2017, as well as in October 2016 the bottom oxygen saturation ratios at SJ101 were lower than the averages (Fig. 1).

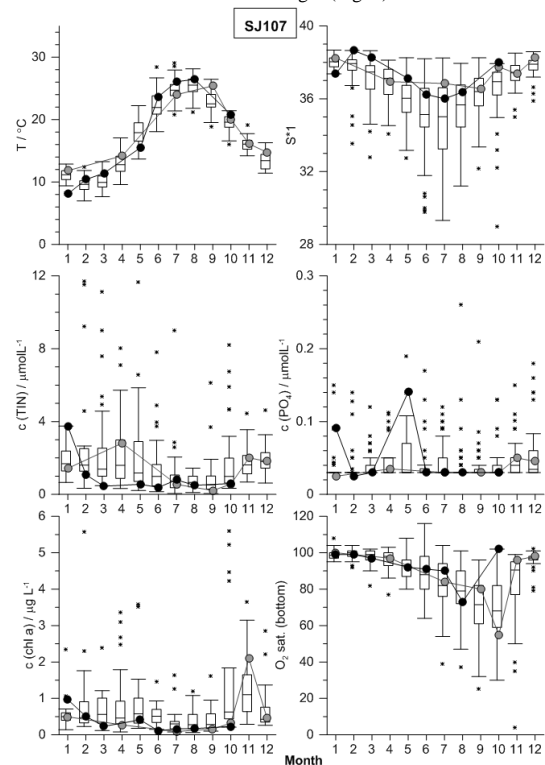


Fig. 2. 1972-2015 long-term data (Box-Whisker plot), 2016 (grey) and 2017 (black) monthly values of oceanographic parameters at the station SJ107.

Conclusions Oceanographic conditions in the NA during 2016 and 2017 were affected by increased air-sea heat fluxes and advection of high salinity waters from the middle/south Adriatic, concurrently with reduced Po river influence, particularly in spring and summer. Consequently, surface higher salinity, reduced nutrient concentrations and modest phytoplankton blooms, especially in spring, were observed.

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References

1 - Civitarese G., Gacic M., Lipizer M. and Borzelli G.L.E., 2010. On the impact of the bimodal oscillating system (BIOS) on the biogeochemistry and biology of the Adriatic and Ionian Seas (Eastern Mediterranean). *Biogeosciences*, 7: 3987–97.