

LONG-TERM INVESTIGATIONS OF ORGANIC MATTER IN THE NORTHERN ADRIATIC SEA AS AN INDICATION OF GLOBAL CHANGES

Jelena Dautovic ¹, Irena Ciglenecki ^{1*}, Vjeročka Vojvodic ¹, Natasa Tepic ² and Bozena Cosovic ¹

¹ Rudjer Boskovic Institute - irena@irb.hr

² National Center for External Evaluation of Education, Ulica D. Tomljenovica 11, 10020 Zagreb, Croatia

Abstract

An unique time series of organic matter (OM) content (dissolved organic carbon, DOC and its surface active fraction, SAS) collected between 1989 and 2017 with monthly or bimonthly temporal resolution along the transect Po River delta - Rovinj in the northern Adriatic (NA) will be presented and discussed according to available physico-chemical and biological conditions. Organic matter shows very pronounced changes in its amount and properties. In the investigated years the periods of high and low carbon content change is noticed with evident changes in reactivity regarding to presence of surface active organic material. Obtained results highlight the importance of long-term research on organic matter, especially DOC and its SAS fraction as possible indicators of changes in the NA ecosystem.

Keywords: *Organic matter, Adriatic Sea, Electrochemistry, Monitoring, Global change*

In this paper an unique time series of organic matter content (dissolved organic carbon, DOC and its surface active fraction, SAS) that were collected between 1989 and 2017 with monthly or bimonthly temporal resolution along the transect Po River delta - Rovinj (Figure 1) in the northern Adriatic (NA) will be presented.

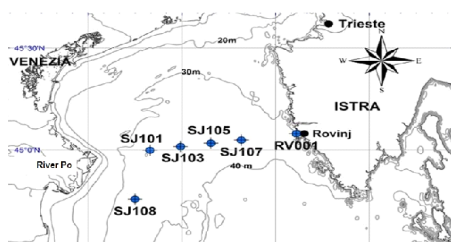


Fig. 1. Sampling stations along the transect Po River delta - Rovinj: SJ108 (44°45'24"N, 12°45'0"E); SJ101 (44°59'53"N, 12°49'48"E); SJ103 (45°1'0"N, 12°59'35"E); SJ105 (45°1'59"N, 13°9'18"E); SJ107 (45°2'52"N, 13°19'0"E); ZI032 (45°4'6"N, 13°30'54"E) and RV001 (45°4'48"N, 13°36'36"E).

The organic matter shows very pronounced changes in its amount and properties. During the investigated years the periods of high and low carbon content change may be noticed [1], with evident changes in reactivity regarding to presence of different surface active organic material which can be taken as a rough tracer for different phytoplankton composition and activities [2, 3]. Organic matter reactivity, is based on adsorption properties (hydrophobic-hydrophilic) measured by electrochemical methods, and expressed by so-called normalized surface activity (NPA = SAS / DOC), (Figure 2) [2, 3]. NPA for natural samples is always compared with model substances.

The OM changes indicate altering episodes of eutrophication and oligotrophication, embedded to an overall oligotrophication trend in the considered period [1]. Observed changes on a long-term scale can be discussed as a consequence of (a) annual fluctuations of freshwater input, mainly driven by the Po River, and (b) water circulation and alteration of water masses in the Adriatic Sea, due to changes in the Adriatic-Ionian Bimodal Oscillating System (BiOS) [1,4,5].

The BiOS is responsible for advection of either highly saline ultraoligotrophic Levantine Intermediate Water from the Eastern Mediterranean or nutrient-richer less saline Western Mediterranean waters into Adriatic, that according to our findings reflects on OM amounts (DOC, SAS) and properties.

Changes in the content and properties of organic matter in the NA coincide with other research that highlight significant changes in the NA ecosystem (amount of nutrients, composition and activities of phytoplanktonic organisms, Istrian coastal counter-current development, etc.) [1,6]. This study highlights the importance of long-term research of organic matter,

especially DOC and its SAS fraction as possible indicators of changes in the NA ecosystem.

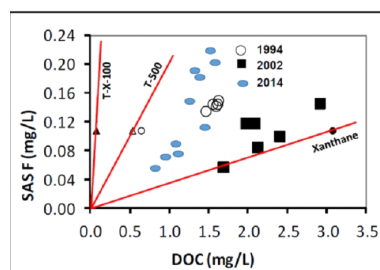


Fig. 2. Correlation of SAS_{dis}/DOC concentrations obtained for the surface seawater samples collected at stations 107, and 108 (Figure 1) in the NA in 1994, 2002, and 2014. Lines correspond to different model substances that were used as representatives for hydrophobic and hydrophilic SAS in natural samples (Triton-X-100, polysaccharide T-500 and xanthane).

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References

- 1 - Dautovic, J., Vojvodic, V., Tepic, N., Cosovic, B., Ciglenecki, I., 2017. Dissolved organic carbon as potential indicator of global change : A long-term investigation in the northern Adriatic. *Sci. Tot. Environ.* 587/588: 185-195
- 2 - Cosovic B., Vojvodic V., 1998. Voltammetric Analysis of Surface Active Substances in Natural Seawater, *Electroanalysis* 10(6): 429-434.
- 3 - Ciglenecki, I., Dautovic, J., Cvitešić, A., Pletikapić, G., 2019. Production of surface active organic material and reduced sulfur species during the growth of marine diatom *Cylindrotheca closterium*, *Croat. Chim. Acta*, 2019, in press.
- 4 - Civitarese G., Gacic M., Lipizer M., Eusebi Borzelli G.L., 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: 3987-3997.
- 5 - Mihanovic, H., Vilibic, I., Dunic, N., Šepić, J., 2015. Mapping of decadal middle Adriatic oceanographic variability and its relation to the BiOS regime. *J. Geoph. Res. Oceans*, doi: 10.1002/2015JC010725
- 6 - Giani, M., Đakovac, T., Degobbi, D., Cozzi, S., Solidoro, C., Fonda Umani, S., 2012. Recent changes in the marine ecosystems of the northern Adriatic Sea. *Estuar. Coast. Shelf Sci.* 115, 1-13