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Relationship among hypoxia, mucilage events and circulation in the Northern Adriatic Sea

S. Cozzi (1), C. Cantoni (1), R. Precali (2), D. Degobbis (2), G. Catalano (1), N. Supic (2), I. Ivančić (2), T. Djakovac (2)

(1) CNR – I.S.MAR., Marine Science Institute, Laboratory of Trieste. Viale R. Gessi 2, 34123 Trieste, ITALY. (carolina.cantoni@ts.ismar.cnr.it / Fax: +39 040 308941 / Phone : +39 040 305506)

(2) Rudjer Bošković Institute, Center for Marine Research (CMR). G. Paliaga 5, 52210 Rovinj, CROATIA.

Marked hypoxia (oxygen saturation $<$30 %) and anoxia events have often been observed in the Northern Adriatic Sea. The combined effects of an intense primary production, due to discharges of land-borne nutrients, and a prolonged stratification of the water column can led to strong dissolved oxygen consumption in the deeper waters of this basin, in areas with reduced circulation. As a result, degradation of the water quality, high mortality of sedentary benthic organisms, over-fishing of stressed species (e.g. flat fishes, shrimps) and negative consequences on the tourism have been reported.

The formation of huge organic aggregations over extended area of the Northern Adriatic (mucilage event) have been reported in the Northern Adriatic Sea since the 1729, while they were more recently observed in 1988, 1989, 1991, 1997, 2000, 2002 and 2003. The mechanisms of mucilage appearance are not yet fully understood. However, there is strong evidence that the phenomenon is induced by the phytoplankton exudation and lysis, which can be exacerbated by nutrient availability and by the high variability of the oceanographic conditions, often experienced by plankton communities in this basin. If the turbulent mixing does not dissolve them, mucilage aggregates mostly sink in the deeper waters, during the last phase of the phenomenon, where their degradation can lead to marked oxygen consumption.

Hydrological conditions and circulation of water bodies in the Northern Adriatic Sea

play an important role to determine the evolution of hypoxia and mucilage events. The presence of a closed circulation in the basin off the Istrian peninsula, particularly during summer months, is considered an important hydrological feature of this basin that favours hypoxia and mucilage events. The relationship between the strength of the Istrian Coastal Counter Current (ICCC) and the presence of a closed circulation structure in the basin has also been evidenced.

In this study, we present a detailed analysis of the relationship among hypoxia, mucilage events and the ICCC intensity, during the period from 1985 to 2003.

In the years with mucilage, hypoxic conditions (DO concentrations from 0.56 to 1.91 ml/l) were observed in the bottom N Adriatic waters. These values were found in different periods of the year, from August to October, in the last phase of the events or within one month after aggregates were disappeared from the water column. In the years without mucilage, hypoxic events (DO concentrations down to 1.07 ml/l) were observed in the 50% of the cases, and they were almost always concentrated in October. In the years with mucilage and marked hypoxia events the ICCC intensity was generally higher than the long-term average (1966-2002; 4 cm s^{-1}), in contrast, when events were not observed, the ICCC was not developed or mostly present with reduced velocities.