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Monitoring the Formation of Hypoxia on the North-Western Black Sea Shelf

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Oxygen depletion is widely used as an indicator for the indirect effects of nutrient enrichment in aquatic systems. No other environmental variable of such ecological importance to coastal marine ecosystems around the world has changed so drastically in such a short period of time as dissolved oxygen. The severity of hypoxic events has increased over the past decades, i.e. their duration, intensity and spatial extension, in locations historically affected by hypoxia as well as in areas where it did not occur in the past. This led to substantial losses in ecosystem function and biodiversity in the impacted ecosystems and hence calls for ecosystem management and environmental protection.

Funded by the EU-FP7 project HYPOX “In situ monitoring of oxygen depletion in hypoxic ecosystems of coastal and open seas, and land-locked water bodies”, we monitored the formation of hypoxia in a hypoxia-prone area on the north-western shelf during summer 2010. A seafloor mooring, consisting of an Aanderaa SEAGUARD RCM9 sensor package attached to an acoustic release was deployed from RV Mare Nigrum in 30 m water depth in the Portita region in late May, and successfully recovered in early September 2010. To our knowledge, this is the first time that long-term in-situ measurements of oxygen on the seafloor have been carried out on the Black Sea’s north-western shelf. The so-called observatory recorded a continuous 3 months time-series of oxygen, temperature, turbidity, salinity and currents speed and direction. The high time resolution of 10 minutes enables to resolve even diurnal changes in the oxygen regime. The time-series information from the observatory is complemented by measurements of benthic nutrient fluxes from the sediment to the water, at the beginning (May) and the end (September) of the monitoring period. Benthic nutrient fluxes are crucially important to interpret the oxygen data from the observatory, as the nutrients released from the sediment feed productivity in the benthic and pelagic systems, and hence, support eutrophication and hypoxia. In turn, the benthic oxygen regime triggers the pathways of nutrient recycling. The continuous data record allows identifying both climatologic and environmental factors that led to the formation of hypoxia during the observation period and hence, provides a deeper insight into the mechanisms that control hypoxia on the shelf.