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State of the benthic ecosystem on western Black Sea shelf in spring 2008

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Since the changes in the economies in the Black Sea countries in the 1990's, the momentarily associated decrease in anthropogenic pressures has put the ecosystem of Black Sea western shelf on a trajectory to recovery. However, the suspected non-linearity of recovery and the ecological instability of the benthic shelf ecosystem in particular became evident in the field surveys supported by the BSERP in 2003, 2004, 2005 and 2006, e.g. in the spread of opportunistic species taking new niches and the re-occurrence of large-scale bottom water hypoxia like in 2001. The temporal dynamics of the recovery (as well as of the decline) may also be tied to climatic effects. The Black Sea is known to respond to north Atlantic oscillation (NAO) forcing and decadal climate changes.

The target of the 363th cruise of R/V Poseidon in March 2008 has been to map the current state of the benthic ecosystem in a quasi-winter situation. We assessed: a) the current state of the benthic ecosystem on the north-western shelf; to what degree it recovered during the past decade from its collapse in the 1980's. In this respect, we investigated the role of the seabed as storage media of nutrients from past eutrophication, and the role of the sediments as internal source of nutrients to the pelagic system. We focused on zoo- and phytobenthos distribution, the interaction of benthic biota with the sediment, accumulation of nutrients in the sediment, and the flux of nutrients from the sediments to the water. b) The benthic-pelagic coupling, i.e. how the nutrients nitrogen, phosphorus and silica for algal growth are transported from the seafloor to the sea surface and thus fuel biologic productivity. c) The exchange of water between the shelf and the open Black Sea, and hence the transport of nutrients, i.e. the fertilization of the open Black Sea with nutrients from the shelf.

Here, we are presenting results from the spring 2008 survey and compare them to findings from a summer survey in 2006: thermal heating and freshwater input created a double front structure on the western shelf, and intrusion of the Cold Intermediate Layer (CIL) into shelf waters was observed. Surface distribution of dissolved nutrients reflects clear signals of silica and total dissolved nitrogen input from the Danube River. Phosphate appears to have a different source, e.g. benthic and/or from the CIL. The benthic ecosystem remains fragile; diversity indices reflect small recovery, quantities in biomass of both zoo- and phytobenthos indicate ongoing perturbations in nearshore areas. A full recovery of historical beds of Phyllophora is not evident, coverage both in winter and summer is less than 10%, and its role as habitat could be compromised by overgrowth of filamentous algae. The benthic system with an epibenthic community in balance releases less nutrients than a disturbed system without benthic life. Nutrients release from the sediment is lower in winter than in summer. The oxygen penetration depth in the sediment triggers denitrification. A spectacular population development of opportunistic species both in zoo- and phytobenthos was observed. The question remains whether or not those opportunistic species can ensure ecosystem functionality and stability.

Our findings will help to identify locations crucial for the functioning for the benthic shelf ecosystem, to define "Good Environmental Status" and help to provide recommendations for Marine protected areas on the western Black Sea shelf. It is hoped that the data will make an important contribution to the information base underpinning the new European Marine Strategy Directive and the Bucharest Convention for the Protection of the Black Sea.