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Anoxic monimolimnia: Nutrients devious feeders or bombs ready to explode?

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Coastal regions are under strong human influence and its environmental impact is reflected into their water quality. Oligotrophic estuaries and coastal systems have changed in mesotrophic and/or eutrophic, shown an increase in toxic algal blooms, hypoxic/anoxic events, and massive mortalities of many aquatic and benthic organisms.

In strongly stratified and productive water basins, bottom water dissolved oxygen is depleted due to the excessive organic matter decomposition in these depths. Distribution and recycling of nutrients in their water column is inextricably dependent on oxygenation and redox conditions. Bottom water anoxia accelerates PO43-, NH4+ and H2S recycling and accumulation from organic matter decomposition. The anoxic, H2S, PO43- and NH4+ rich bottom water constitutes a toxic layer, threatening the balance of the entire ecosystem.

In permanently stratified water basins, storm events could result in stratification destruction and water column total mixing. The turnover brings large amounts of H2S to the surface resulting in low levels of oxygen and massive fish kills. PO43- and NH4+ are released to the interface and surface waters promoting algal blooms. ore organic matter is produced fueling anoxia.
The arising question is, whether the balance of an anoxic water ecosystem is under the threat of its hypolimnetic nutrient and sulfide load, only in the case of storm events and water column total mixing. In polymictic water basins it is clear that the accumulated, in the bottom layer, nutrients will supply surface waters, after the pycnocline overturn. Besides this mechanism of basins' water quality degradation is nowadays recognized as one of the biggest obstacles in eutrophic environments management and restoration efforts. The role of internal load, in permanently stratified water basins, is not so clear.

In the present study the impact of storm events on water column stability and bottom water anoxia of meromictic coastal basins, is investigated. The importance of internal load is emerged, presenting the disturbance on the main nutrients, dissolved oxygen, hydrogen sulfide and chlorophyll distribution, caused by the total water column mixing. Additionally, the relationship between temporal nutrients variations in surface layers, of permanent anoxic coastal basins with a) changes on the physicochemical characteristics of their water column, b) changes on the bottom water phosphorus and nitrogen concentration and c) their effect on the basin's primary productivity, is sought.

In order to achieve the objectives of this study, two different sets of Aitoliko basin's (western Greece) data were used. The first one includes measurements of physicochemical parameters, nutrients, chlorophyll and hydrogen sulfide, four days after a storm event and the consequent anoxic crisis in Aitoliko basin on 4th of December 2008. The second one contains respective data obtained from a biennial (May 2006-May 2008) basin's monitoring.

The changes in the physical, chemical and biological characteristics, of Aitoliko basin water column, after its total mixing, highlighted the importance of the accumulated nutrients and sulfides in the bottom layer. In addition, turned out that bottom layer can supply with nutrients the surface waters, even during periods of high water column stratification. Small scale, subtle, changes in physicochemical and hydrological basin's characteristics promoted this supply, affecting both quantitative and qualitative the ecosystem's primary productivity and shifting its quality character.