STUDY OF NITROGENOUS SPECIES IN A COASTAL LAGOON IN CENTRAL GREECE UNDER PROGRESSIVE DEPLETION OF DISSOLVED OXYGEN CONCENTRATION. RESULTS OF A SIMULATING EXPERIMENT

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Abstract
The aim of this study is to determine the response of nitrogen species to gradually decreasing dissolved oxygen (d.o.) conditions taking place at a shallow coastal Mediterranean lagoon within the Maliakos gulf, Central Greece. The results showed that even minor changes in the redox conditions at the water-sediment interface have significant impacts on the concentrations of the various dissolved nitrogen species.
Keywords : Oxygen, Redox, Sediments, Coastal Management.

Surface sediment from a coastal lagoon located within the Maliakos gulf, along with the overlying water was sampled using a benthic chamber (May 2006) and transported undisturbed to the laboratory. The chamber is equipped with an electronic system allowing the fine regulation of dissolved oxygen [1].
Total Dissolved Nitrogen (TDN) was determined following a persulfate oxidation [2]. Ammonium, nitrate and nitrite in sea water samples were determined with standard spectrophotometric methods [3]. Dissolved Organic Nitrogen (DON) was calculated as the difference between TDN and Dissolved Inorganic Nitrogen (DIN - sum of nitrate, nitrite and ammonium). This experimental phase lasted 8 days from 3 to 10 May 2006 and the dissolved oxygen concentration in the benthic chamber was gradually decreased from 6.10 mg/l to 2.45 mg/l (Fig. 1a).
During this phase a rapid and significant increase in the concentration of DON (Fig.1b) was observed followed by a major increase of $NH_4{}^+$ (Fig. 1c) which prevailed over all other forms of inorganic nitrogen. The concentration of $NO_2{}^-$ (Fig.1d) and $NO_3{}^-$ (Fig.1e) showed an increasing trend. Consequently the TDN concentration was rising.

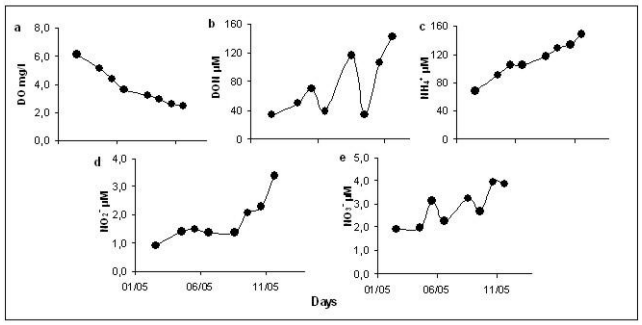

Fig. 1. The evolution of (a) dissolved oxygen, (b) dissolved organicnitrogen, (c) ammonium, (d) nitrite and (e) nitrate concentrationsthroughout the dissolved oxygen depletion experiment.

Increase of DON concentration indicates a transformation of particulate nitrogen forms into soluble ones linked to complex biochemical reactions taking place at the surface sediment, including the autolysis of dead cells and the decomposition of particulate organic nitrogen by bacterial exoenzymes [4]. The significant ammonium concentrations seem to originate from the hydrolysis of dissolved organic nitrogen species (e.g. aminoacid macromolecules) which are common degradation products of the dead organic matter [5]. It is worth noting that, despite the relatively low oxygen content of the water column, part of the ammonium seems to be oxidised to nitrite and further on to nitrate. Apparently the oxygen levels are sufficient to support the bacterial biomass (*nitrosomonas*, *nitrobacter*). There are strong correlations between ammonia and nitrite ($p<0.003$, $s_{est}= 0.39$, R-Sq = 78.3%) as well as between nitrates and nitrites ($p<0.029$, $s_{est}= 0.56$, R-Sq = 57.8%).
For the statistical treatment of data we used the p value (that determines whether the association between the variables is statistically significant), the s_{est} (standard deviation of the data about the regression line), and the R-Sq predictor (the explained amount of variation in the observed response values).

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