

# FISH FARMING INFLUENCE ON PHYSICAL AND CHEMICAL PROPERTIES OF SEDIMENT AND WATER COLUMN IN THE MIDDLE ADRIATIC

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## Abstract

Changes of basic hydrographic and chemical properties of water column and sediment were investigated in a semi-enclosed area of the middle Adriatic under the influence of fish farming. Changes were mainly expressed as water column enrichment with dissolved organic nitrogen and phosphorus as well as occurrence of negative sediment redox potential, enhanced sediment inorganic phosphorus concentrations and accumulation of sediment organic carbon.

**Keywords:** Adriatic Sea, sediments, phosphorus, organic carbon

## Introduction

According to the trophic TRIX index (1) the coastal area of eastern middle Adriatic can be characterized as oligotrophic. Due to low primary production and sedimentation of particulate organic matter, sediment in this area has an oxidative surface layer 3-4 cm thick (positive redox potential), inorganic phosphorus concentrations (2.94-38.62 mmol P kg<sup>-1</sup>) and organic carbon and total nitrogen content between 0.28-1.2 % and 0.02-0.12 % respectively. Strongly increasing fish farming activities (especially tuna breeding) for the last years has induced the development of a qualitative monitoring program of the marine environment in affected areas. Results of investigated changes of basic hydrographic and chemical parameters in water column and sediment for one fish farm will be documented in this paper.

## Materials and methods

Physical and chemical properties of sediment and water column were investigated at fish farm located in a semi-enclosed bay in the middle Adriatic during December 2001, May 2002 and March 2003. Samples were taken at 3 stations at the breeding farm area (B1, B2 and B3) and at one reference station (REF; 500 meters distanced from the farm). Investigated parameters in sediment were redox potential, organic and inorganic phosphorus concentrations, organic carbon and total nitrogen content. Parameters investigated in the bottom water were temperature, salinity, visibility, suspended matter content, oxygen saturation and dissolved inorganic and organic nutrient concentrations.

Redox potential of sediment was measured "in situ" with Pt-electrode after quinhydrone calibration. Surface sediment cores for phosphorus concentration, organic carbon and nitrogen measurements were frozen until the laboratory analysis. Analyses of phosphorus content in surface sediment layer (0-2 cm) were done according to Aspila (2). Organic carbon and total nitrogen sediment content were analyzed on CHNS-O analyzer (CE Instruments). Hydrographical and chemical data were obtained by CTD-probe, classical Winkler titration and spectrophotometric determination (3).

## Results and discussion

Redox-potential in the fish farming area were constantly more negative than in the sediment of reference station which indicates an oxidation of settled organic matter with sulfate as the dominant electron acceptor. Analyses of sediment phosphorus pool showed no significant increase in organic fraction at the fish-farming stations, but the concentrations of inorganic phosphorus (3.85 to 38.23 mmol P kg<sup>-1</sup>) were up to 7 times higher than at reference station (Fig. 1), which indicates that all phosphorus is in the inorganic form, probably bound as detrital and fish debris fraction (4).

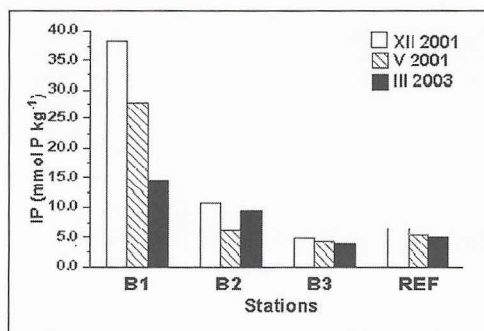


Fig. 1. Inorganic sediment phosphorus concentrations through investigated period.

Considering the role of seasonal variability of organic matter decomposition processes at sediment organic carbon content, its accumulation in sediment is calculated as ratio C-ORG at farm stations / C-ORG at reference station (Fig. 2).

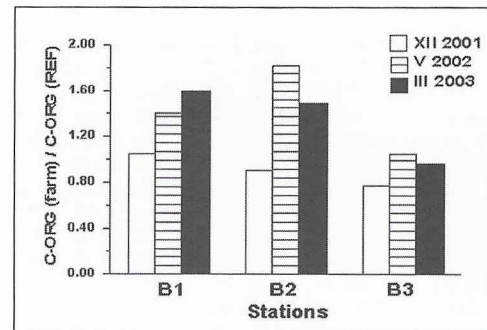


Fig. 2. Calculated ratios of C-org (farm stations) / C-ORG (reference station) through investigated period.

Ratios indicate a constant organic carbon accumulation in the most enclosed station B1, while at stations B2 and B3 mineralization seems to be more effective.

The main changes in the water column at the fish farming site were strongly increased suspended matter content (relatively to the reference station), lowered visibility and oxygen saturation, as well as enhanced dissolved organic nitrogen and phosphorus concentrations.

## Conclusion

Investigations of fish farming influence on the marine environment in the middle Adriatic showed negative changes of most basic parameters in sediment and water column. The high inorganic phosphorus increase in sediment indicates on high downward flux of this element from the water column to the sediment at fish farming areas.

## References

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