PROFUNDAL MACROBENTHOS STRUCTURE AS A MEASURE OF LONG-TERM ENVIRONMENTAL STRESS IN A POLLED LAKE

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Abstract. Profundal macrobenthic community in a polluted lake (Lake Nemi, Italy) was analyzed in three distinct surveys from 1976 to 1984, in order to define long-term changes in environmental conditions of sediments. Profundal macrobenthos was mainly composed of Oligochaeta. Only a few Chironomidae and a few other taxa were characteristically found in the superior zone. The long-term stress, due to persistent hypolimnetic O₂ deficit, caused progressive simplification of the total community structure. This leads to a high faunal similarity among stations at different depths. The temporal trend of the community structure parameters and the significant role of some taxa (Potamothenix heuscheri, Procladius and Chaoborus flavicans) in the eutrophication process of the lake are also discussed.

1. Introduction

Profundal macrobenthos usually plays a significant role in lake water quality assessment (cf. Brinkhurst, 1974; Saether, 1979; Wiederholm, 1980; Milbrink, 1983), and provides a satisfactory synthesis of long-term effects of pollutants present in water and sediments (Andersson et al., 1975; Wiederholm, 1978; Kansanen and Aho, 1981; Jónasson, 1984). It is generally accepted that some information obtained from the study of macrobenthic community can rarely be deduced from chemical methods. Macrobenthic investigation still constitutes the best complementary tool in performing a correct environmental diagnosis. Although sediments represent an important step in the metabolism of water ecosystems, particularly in organic matter decay and nutrient release, chemical analyses are seldom performed on them. Moreover, benthic analysis can detect bottom organic enrichment which cannot always be revealed by chemical and biological analyses of overlying water (Laville, 1971; Lafont and Juget, 1981; Lafont, 1982; Wasson, 1984; Bazzanti and Seminara, 1985a).

In this paper we report the results of an analysis of profundal macrobenthos in a heavily eutrophicated lake (Lake Nemi, Italy) using the data from three surveys carried out in 1976–1978, 1979–1980, and 1983–1984*. Our aim is to define the changes in the profundal fauna of a polluted lake long subject to a strong hypolimnetic O₂ deficit, and to provide a further contribution to the knowledge of the benthic community role in lake water quality monitoring.


For more than 10 yr, Lake Nemi has shown symptoms of an accelerated eutrophication, caused by domestic discharges and fertilizers employed in the surrounding cultivated lands (Ferrero and Gelosi, 1977-1980; Stella et al., 1978; Bazzanti and Loret, 1982; Carunchio, 1982; Bazzanti, 1983; Mastrantuono, 1983). Blue-green algal blooms in 1974-1975 and massive coregonid kills in 1975-1976 were observed. These phenomena occasionally occurred to a lesser extent during the following years. Since 1974 up to now the hypolimnion of the lake has generally been subject to strong and persistent O₂ depletion during the thermochemical stratification (summer-autumn). In particular, in 1974-1975 total anoxia was recorded from 15 m to the bottom (Stella et al., 1978), whereas in 1976-1977, after the partial deviation of domestic discharges, total O₂ depletion occurred only in the deepest zone (Ferrero, 1978). From this time up to the recent years (1982-1984) the O₂ deficit progressively increased in all the hypolimnion, which became totally anoxic for 3 to 6 mo yr⁻¹ at 10 to 15 m and 6 to 8 mo yr⁻¹ in the underlying waters (Carunchio and Rolle, 1986). This environmental decay, spreading over the entire lake, led to serious consequences on its fisheries and recreational uses.

![Map of Lake Nemi with sampling depths. N, G, S, and C = sampling zones. Arrows indicate domestic discharges still active at present.](image-url)