



# Littoral macroinvertebrates in Estonian lowland lakes: the effects of habitat, season, eutrophication and land use on some metrics of biological quality

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With 1 figure and 4 tables

**Abstract:** Due to requirements of EU Water Framework Directive, the popularity of littoral macroinvertebrate communities as indicators in quality assessment of lakes has continuously increased. However, it is not always clear what the indices actually reflect. The littoral is an area linking the lake and the adjacent terrestrial environment, and is integrating the influences from both habitats on the aquatic biota. In addition, natural and anthropogenic environmental factors cannot always be disentangled easily. Our study was based on littoral macroinvertebrate data from 296 hand net samples collected from 196 natural Estonian lowland lakes during 2000–2010. The aim was to identify relationships between relevant macroinvertebrate metrics and several natural and anthropogenic factors. Five metrics (total taxon richness, Shannon diversity  $H'$ , number of EPT taxa, Average Score Per Taxon (ASPT), and Swedish Acidity Index) were used. In addition, a new hydromorphological index, MESH (Macroinvertebrates in Estonia: Score of Hydromorphology) was tested against the environmental factors. First, we analysed the relationships between the metrics and factors according to Estonian lake typology. In order to estimate the effects of factors on biological quality, the effect of the lake type was thereafter eliminated. The highest number of significant relationships was found in relation to natural factors, such as diversity of vegetation types, general relative vegetation coverage, lake area and latitude. In general, the human-related factors had unexpectedly low relationships with most of the metrics. Average Score Per Taxon predictably increased with the percentage of natural land use area in the lake's catchment. However, the lake water concentration of total phosphorus – a typical indicator of eutrophication in freshwaters – did not reveal a significant relationship with any of the tested metrics. We suggest that the expected ecological relationships were obscured by a general low human stress on Estonian lakes, in combination with a high residual natural variability in the littoral.

**Key words:** macroinvertebrates, lakes, littoral, biological quality, Estonia.

## Introduction

According to the European Water Framework Directive (2000/60/EC), the Member States must protect and improve the quality of surface water bodies with the aim to achieve at least good ecological status. All

surface waters should be assessed using different biological quality elements; among these the benthic macroinvertebrate fauna is considered an element especially suited for classification of the ecological status of surface water bodies (Chave 2001). Benthic macroinvertebrates integrate the effects of various pres-

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