

## Tools for the development of a benthic quality index for Italian lakes

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### ABSTRACT

*In this paper, we propose a methodology to develop a benthic quality index useful for Italian lakes. The existing data about benthic macroinvertebrates of the Italian lakes were collected over a period of 50 years, but only a few lakes such as the Maggiore and the Mergozzo have been intensely studied. Some large lakes such as Lake Como are still almost uninvestigated. In total, 570 benthic macroinvertebrate taxa were identified; of which 373 belong to Chironomidae and 85 to Oligochaeta. With the aim of relating environmental variables with macrobenthos assemblages, we carried out a canonical correlation analysis (CANON) using a database that included 1060 sampling points. Both environmental (13 variables describing morphology and hydrochemistry) and biological data (57 taxa) were available, but only taxa present in at least 10 samples were selected for data analysis. Three canonical variates were ecologically significant. The first one was correlated with conductivity, pH and alkalinity and accounted for 20% of the total variation. The second one was positively correlated with total phosphorus and N-NH<sub>4</sub>, and inversely with dissolved oxygen, and accounted for 18% of the total variation. The third one showed a direct correlation with maximum lake depth and volume and an inverse correlation with water temperature, and accounted for 17% of the total variation. A Trophic Status Index (TSI), based on the table 11 of the Italian Law 152/99 (without including chlorophyll), was calculated by ranking percent oxygen saturation, transparency and total phosphorus. TSI was used to test a Benthic Quality Index for Italian Lakes (BQIL) which is proposed in the present paper. The algorithm considered three steps. First, the means of three variables were calculated: percent oxygen saturation, transparency and total phosphorus weighted by the taxa abundances. These values are interpreted as optimum for each taxon and used to assign an indicator weight (BQIW). Second, the mean of these three variables was calculated for each taxon (mean BQIW). Third, the mean BQIW was multiplied by taxa abundance and divided by the total number of specimens present at each site for which the BQIL was obtained. Using a regression between BQIL and TSI values, lake sites were assigned to 5 quality classes as required by the Italian Law 152/99 and the WFD 2000/60/CE. This assignment must be considered as tentative, because different lake types should be considered separately to develop an index. At present the lack of information from different lake typologies hinders the development of a more sophisticated index such as the French Lake Biotic Index (LBI).*

*Key words: bioindicators, lakes, chironomids, oligochaetes, multivariate analysis, trophic status*

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