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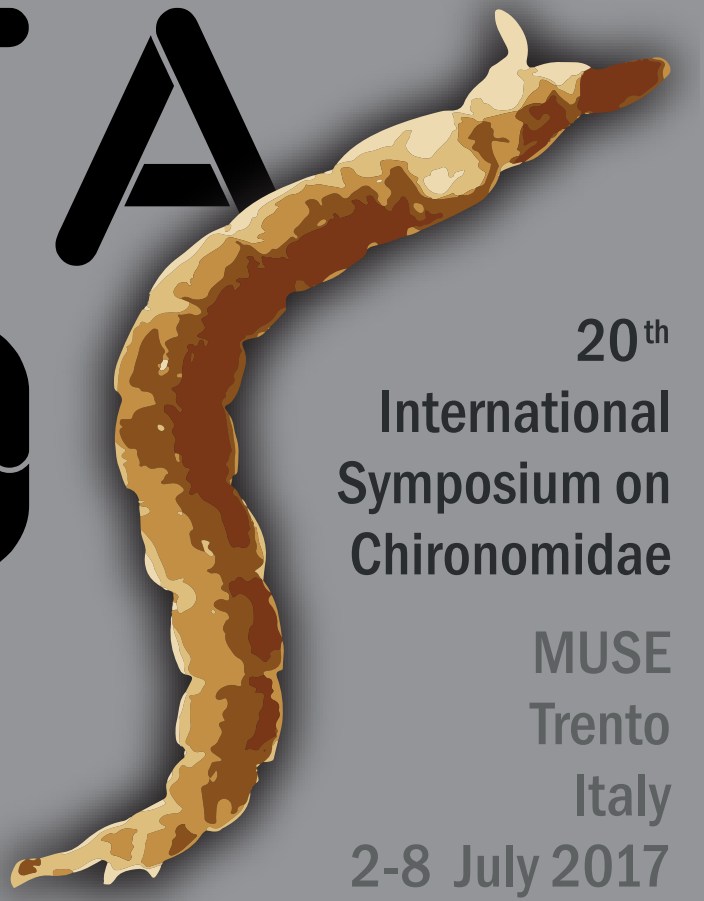

20th International Symposium on Chironomidae

MUSE
Trento
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2-8 July 2017

Abstract Book

Edited by Valeria Lencioni

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Patterning the variability of chironomid-based metrics: the potential in the bioassessment of non-wadeable rivers

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Multimetric indices based on aquatic macroinvertebrates are used in many bioassessment programs of freshwater ecosystems worldwide, simplifying complex biological data, but keeping a sufficient amount of information regarding ecosystem health. The majority of them do not rely on the data on the chironomid community due to the complicated identification and great natural variability they show along the longitudinal gradient. In addition, all these routine monitoring programs are defined for smaller streams but not for large, non-wadeable rivers. Thus we conducted a survey of two large rivers, i.e. the Danube and the Sava River, forming a network of 96 sampling sites. The main goal of the study was to model the variability of chironomid-based metrics on spatial gradients and environmental gradients which indicate different types of pollution. To accomplish this, macroinvertebrates, including Chironomidae larvae, were sampled by applying the multi-habitat approach and 16 environmental parameters were measured simultaneously. Chironomid community structure was patterned using the self-organizing map (SOM). This multivariate visualization technique constructed two-dimensional neural network where all sampling sites were ordinated and clustered into three groups of neurons. Passively, not influencing previous ordination, we introduced into the SOM 15 biotic metrics based on the proportion of sensitive and tolerant chironomid taxa and 17 environmental parameters. As an output of SOM analysis, component planes present a variability pattern for each passive parameter distributed on the SOM network, and a clearly formed gradient indicates a high influence of the parameter on the community pattern. In this study, natural variability (the distance to the source), conductivity, water elements from natural (nitrates, dissolved oxygen) and anthropogenic sources (orthophosphate and ammonium) and heavy metal pollution (Zn, Cu, As and Cd) formed clear gradients, indicating their important contribution to the chironomid community pattern. This was confirmed by the Kruskal–Wallis test since the values of visualized parameters significantly differed ($P<0.01$) between groups of neurons obtained by the SOM. The same analysis revealed 6 biotic metrics which concordantly changed together with significant environmental parameters on the SOM network. The variability of the chironomid community was driven by the longitudinal gradient and multiple stressors. The proportion of sensitive and tolerant taxa regularly alternated along the longitudinal gradient, indicating a particular complex of stressors. Chironomid-based metrics showed a promising variability pattern since they predictably changed along both natural and stressor gradients. After the scoring system is established, this type of metrics could be included in the routine monitoring programs and provide useful information regarding ecosystem health.

Key words:

larvae, large rivers, multimetric indices, self-organizing map, bioassessment