

Zooplankton as a bioindicator of ecological status of standing water bodies

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Summary of PhD Thesis

Ecological status and potential are used in order to assess the structure and functioning of aquatic ecosystems. It is determined based on standard biological quality elements (BQE) and supported by physical and chemical quality elements. The trophic state of reservoirs indicates their biological productivity and is usually assessed based on the concentrations of phosphorus or/ and chlorophyll a and Secchi Disk Transparency.

The study presents the first attempt of a targeted comparison of the results in determining the trophic or ecological state based on zooplankton communities in eight Bulgarian Reservoirs, incorporating also BQE benthic invertebrates, primary production, as well as physical and chemical parameters of the aquatic environment. We hypothesised that, on the one hand, the zooplankton assemblages could be associated with trophic state or ecological potential as determined through using descriptors of the environmental conditions in the pelagial. On the other hand, we aimed to identify zooplankton taxa, indicating various trophic states or specific ecological potential. Lastly, we discussed and compared the conditions in the littoral and in the pelagial of the studied reservoirs, as defined by our results.

Eight reservoirs with different typologies were selected after preliminary research: four in the Danube River (Basin Gorni Dabnik, Telish, Sopot and Bebresh), one in the West Aegean River Basin (Pchelina) and three in the East Aegean River Basin (Konush, Sinyata Reka and Chetiridesette Izvora Reservoirs). All of them have been classified as highly modified water bodies, are included in the national monitoring system and represent a broad range of environmental conditions.

Taxonomic composition, relative abundance, biomass, seasonal dynamics and biodiversity, trophic and saprobiological indices of the zooplankton and macrozoobenthic communities were determined, analysed and compared among the studied reservoirs. The ecological potential, based on the macrozoobenthic biotic index BMMI and nEQR, was assessed for the first time in the selected reservoirs, using the new type-specific system for Bulgarian standing water bodies.

We established 84 zooplankton taxa of the phylum Rotifera (56), superorder Cladocera (18) and subclass Copepoda (10). Rotifers were the most taxonomically diverse group in the summer samples, followed by the cladocerans and copepods in spring. The zooplankton in the studied reservoirs was represented mainly by highly tolerant taxa. 102 benthic invertebrate taxa were identified. The highest number of taxa were of family Chironomidae (Diptera) – 32 taxa, order Coleoptera (14), suborder Heteroptera (13) and subclass Oligochaeta (11).

According to the saprobic indices, the zooplankton community in the pelagic zone indicated oligosaprobic to β -mesosaprobic conditions, therefore suggesting the absence of serious organic pollution, while the littoral benthic invertebrates corresponded to β -mesosaprobic to α -mesosaprobic conditions. This discrepancy of one order in the saprobic indices for the pelagic and littoral could be due to both seasonal changes and changes in water levels, as well as to the specific conditions in the different zones of the reservoirs.

Twenty-one zooplankton indicator taxa were identified based on the established relationship among changes in the values of physical and chemical factors, the trophic state index and the concentrations of chlorophyll a.

Policy-driven approaches identified littoral macrozoobenthos as the key invertebrate group for the assessment of lentic water bodies, while science-driven studies focus more on the pelagial zooplankton communities in assessment of ecosystem health. The pelagial and the littoral of a lake or reservoir are very different in the conditions, which they provide. They could be affected by various stressors, thus triggering a specific response of their communities. Studying lentic communities in a more holistic way could result in more rigorous assessment schemes which, if incorporated in Bulgarian legislation, might improve management of ecosystem health.