Differential responses of macroinvertebrates and phytoplankton to river health status in different habitats

Changming Chen[1], Kejian He[1], Yangyidan He[1], Xuekai Feng[1], Hong Tang[1], Liling Yang[1], Yuan He[1], and Lyu Wenna[1]

[1]Yunnan University

July 3, 2023

Abstract

Assessing river health by combining different biological taxa can provide more reliable results. However, there is still a lack of in-depth research on how different taxa respond to river health and what kind of supplementary ecological data might be provided. In this study, we set up 31 survey sections in the main streams and major tributaries of the Babian River to investigate the conditions of river habitat, macroinvertebrates, phytoplankton, water quality, riparian zone, and societal value. Indexes of biotic integrity of macroinvertebrates and phytoplankton (B-IBI and P-IBI) were constructed, and assessments of biotic integrity, water quality, riparian zone, and societal value were conducted. The responses of macroinvertebrates and phytoplankton to river health were analyzed across the Babian River basin, as well as those in rivers with-various substrates, river widths, elevations, and flow velocities. The results showed that 1) both B-IBI and P-IBI could distinguish between reference and impaired sites, and could be used to assess the target watershed, but their assessment results were both sub-healthy. 2) Both B-IBI and P-IBI accurately reflected the overall water quality (comprehensive pollution index, CPI) and TN condition, and partially reflected the status of the riparian zone, but neither one was able to reflect the results of the societal value survey. 3) The applicability and assessment effectiveness of B-IBI and P-IBI in different habitats revealed obvious differences: phytoplankton more comprehensively reflected the river health than macroinvertebrates in pebble and sediment-dominated rivers, wider and narrower rivers, high-elevation rivers, and low-velocity rivers. However, phytoplankton were not able to indicate NH_3-N and COD_{Mn} conditions across the whole watershed or in different habitats. In contrast, macroinvertebrates responded better to CPI, NH_3-N, and COD_{Mn} throughout the entire watershed, as well as in rivers that were narrower, pebble-dominated, at low-elevation, and with high-velocity. In summary, macroinvertebrates could effectively account for the insufficiency of phytoplankton in the assessment of organic pollution and oxygen-consuming pollutants due to their sensitivity to NH_3-N and COD_{Mn}. The findings will provide data and theoretical support for selecting biological taxa and constructing multimetric indices in river health assessment.

Hosted file

`manuscript.docx` available at https://authorea.com/users/635258/articles/652725-differential-responses-of-macroinvertebrates-and-phytoplankton-to-river-health-status-in-different-habitats