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Protozoa: Augmenting the Headwater Bioassessment Toolbox

Headwater streams, fundamental to the overall health of lotic systems and ecosystem service production, represent eighty percent of the total length of stream and river channels in the nation. Landuse degradation, predominantly agricultural, profoundly impacts headwater stream integrity because of the tight interface with the landscape (<5 mi2 drainage area). Commonly-used biological indicators in stream assessment (fishes, salamanders, and macroinvertebrates) may not be sufficient to determine human-induced impacts on water quality in intermittent headwater streams. Protozoa, present under most hydrologic conditions because of the ubiquitous and cosmopolitan distributional nature and reproductive prowess, can be used as a biological indicator tool to augment current bioassessment protocol. Twenty-four 100m reaches impacted by a landuse gradient of wooded lots, urbanization, feedlots, and agriculture were identified in two subwatersheds, across two ecoregions in the Sugar Creek, Ohio watershed. Polyurethane foam units submerged in the water column and placed in contact with the benthos using a hybrid reach design of longitudinal transects and macrohabitats was used to collect two seasonal, protozoan sample sets and abiotic parameters. Protozoan abundance, diversity, and assemblage composition were microscopically assessed. Indication of impacted water quality obtained via protozoan bioassessment “signatures” were analyzed using a multivariate statistical procedure. Protozoan assemblage composition clustered in response to the headwater stream’s impact gradient and across ecoregions. A community shift from microbial organisms responsible for primary production (e.g., algae) to those predominately responsible for secondary production (e.g., nanoflagellates and ciliates) was apparent in the highly impacted stream reaches. Future efforts will focus on development of a Protozoan Community Index (IPC) for comparison with traditional fish and macroinvertebrate indices. A protozoan bioassessment tool may provide a more accurate evaluation of water quality in certain types of headwater streams.

Author: Deborah K. Hersha
University Affliation: Ohio State University
Co-Author(s): Lance Williams