LONG-TERM BIOASSESSMENT DATA SETS – THEIR UTILITY IN DISCERNING CLIMATE CHANGE SIGNALS AND DIFFERENTIATING THESE FROM OTHER ENVIRONMENTAL EFFECTS

Anna Hamilton (Tetra Tech), Jeroen Gerritsen (Tetra Tech), Michael Paul (Tetra Tech), Britta Bierwagen (EPA/ORD/GCRP), Erik Leppo (Tetra Tech)
Tetra Tech, Inc., Center for Ecological Sciences
400 Red Brook Boulevard, Suite 200
Owings Mills, MD 21117

ABSTRACT

Bioassessment programs are designed to monitor the condition of aquatic communities over time, develop assessments of impairment based on comparison to reference conditions, and attribute causes of impairment. Analysis of bioassessment data to achieve these goals assumes that environmental impacts are accounted for in the sampling design, and that in the absence of observable anthropogenic environmental impacts, reference conditions will be stable within a predictable range of seasonal and interannual variation. Climate change acts on stream and river ecosystems as an additional global stressor, affecting hydrologic regime, temperature regime, sediment and nutrient runoff, as well as other variables. As climate change progressively affects aquatic ecosystems, the continued ability to accurately detect impairment due to other stressors will be impacted by climate-mediated changes in both reference and impaired conditions, and by potential interactions between direct climate effects and other stressors. This will have consequences to state and tribal environmental resource managers who rely on assessment using biological indicators to determine impairment and establish probable causes. The ability to partition climate change-related signals from other effects based on long-term data records appears to be a critical element to the long-term potential for bioassessment programs to fulfill program objectives.

We examined several state bioassessment long-term data sets to explore their utility and limitations in discerning long-term trends in the responses of various biological indicators associated with climate change, and partitioning climate-driven signals from other environmental effects. Elements evaluated included total duration of the data set, number of repeat data records within a location or stream reach, how locations could be combined within reaches or subwatersheds for analysis, types and extent of potential covariables measured, and ecological characteristics and sensitivities of particular biological indicators or indices. Rotating basin designs are effective in distributing limited monitoring resources in a manner that allows states to characterize condition of state-wide aquatic resources within a reasonable time frame, but limit the ability to define long-term trends. The results highlight the potential value of considering repeat sampling at some reference and non-reference locations to support long-term trend detection.

KEYWORDS

Climate change, long-term trends, biological indicators, aquatic ecosystems