2007 NEAEB NEXUS CAFÉ

Table 9. Developing lake Biocriteria: will lakes be able to have indices as powerful as those developed for streams?

Moderator: Neil Kamman

Attendees: R1: Steve Fiske, VTDEC; John Tipping, LOTIC, Inc.; Julia Eichman, EcoAnalysts; Ben Jessup, TetraTech; Jennie Bridge, EPA; Bob Estabrook, NHDES; Sarah MacDougall, ENSR; Bill Hanson, FPL. R2: none. R3: Tom Danielson, MEDEP; Warren Kimball, MADEP; Sonya Carlson, UNH; Elisha Allen, UNH; Don Mason, Normandeau Assoc.

Summary:

Initial discussions revolved around the use of phytoplankton and specifically diatom indicators. Participants articulated the existence of a variety of such indices that date to the late 1960's. While some were moderately complex, some were as simple as models of N:P and temperature that could be used as precursors of algal blooms. This sounded almost too good to be true amongst participants, and was shown as such. One participant was able to access the following EPA report: *Phytoplankton Water Quality Relationships in U.S. Lakes, Part VI, Working Paper 710* which concluded that "The results of this study clearly indicate that the more common phytoplankton genera are found to thrive over such a broad range of environmental conditions that no one genus emerges as a dependable indicator of water quality or trophic condition in lakes. As a result of this finding it is recommended that individual phytoplankton genera not be used as sole or primary indicators of water quality/trophic state in lakes."

Hence the need for more robust approaches, such as multimetric IBI's and inference models. Such have been developed using phytoplankton, macroinvertebrates and macrophytes, in locations as far widely-ranging as Maine, VT, Michigan, Wisconsin, New Jersey, Florida, and Idaho. New bug IBI approaches are continually being developed for lakes, and presently, FL, in their work with Tetra-Tech, is exploring the concept of a metric that described the life position of benthic fauna as "head-up" or "head down." There is currently an initiative underway, in conjunction with the National Lake Survey/New England Lakes and Ponds Project, to improve upon the northeast regional diatom inference model developed by Dixit et al, by focusing on a-priori classified and selected reference lakes, to construct a regional model reflecting ~2007 conditions.

One major discussion topic was that of lake metrics behaving in ecologically counter-intuitive ways. There are several examples of this in the VT Lake Condition Index and other indices, where metrics describing diversity or abundance are lowest under reference condition, and increase with disturbance. Consensus of participants was that this did not necessarily indicate inaccuracy, but rather was a reflection of intermediate disturbance or something else specific about lakes.

Additional discussion revolved around the sampling of littoral marginal wetlands as target habitats. Here the resource type differs with regard to target assemblages and habitat types. Examples have included muddy-littoral macroinvertebrates and periphyton. There also was some discussion in this portion regarding *Dittimosphenia sp.*, an aggressive aquatic invasive with the potential to vastly alter macrophyte communities. Fortunately, for now, Dittimo appears to be a flowing waters invasive, and not a lake issue, yet…

There was also discussion on zooplankton. Participants acknowledged inherent difficulties associated with seasonality, life history, and taxonomy. Zooplankton indices have certainly been constructed (such has been done using the EMAP-NE Lakes dataset by Stemberger et al, and more recently by Herlihy), but it can be difficult to interpret results in terms of the ecological meaning behind "sensitive" metrics. Of course the same can be said of bugs, reinforcing the need to maintain taxonomic expertise as the science of index development continues to improve. New approaches such as genetic barcoding are simplifying the taxonomy of zooplankton, potentially permitting genus/species discrimination in such life stages as early instars, and even diapause eggs (simple counts of these may be good indicators of trophic structuring).

The inevitable discussion regarding reservoirs emerged. Reservoirs are not lakes, nor are they streams. It is extremely difficult to construct a satisfactory reference condition for these water types, and some northeast states are faced with difficult decisions when assessing reservoirs. The TVA has in fact designed an excellent bioassessment program for reservoirs. However, it bears reiteration that reservoirs and lakes do not yield similar assessment results when assessed using similar assemblages and IBI's.

Finally, while signals in these multiple waterbody, habitat, and assemblage types may produce varied individual assessment results, it was noted that results can still be combined to comprise integrated assessments across linked hydrologic systems, through the use of a TALU. Herein is the potential strength of lake bioassessment approaches over those of streams. By integrating multiple habitats *and* multiple assemblages along a TALU gradient, a very large quantity of assessment information can be harmonized.