Abstracts

Wednesday, April 30

Session I7: Measuring Invertebrates to Quantify Lake and Reservoir Conditions

3:30 – 5:00 pm | Room 231

Impact of Invasive Dreissenid Mussels (*Dreissena polymorpha *and* Dreissena rostriformis bugensis*) and Invasive Round Goby (*Neogobius melanostomus*) on the Benthic Macroinvertebrate Community and Ecological State of Lake Simcoe (Ontario, Canada)

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Abstract
The invasion of zebra mussels in the Laurentian Great Lakes Region resulted in a profound shift in the ecological state of nutrient-enriched lakes from algal-dominated turbid systems to a clearwater state dominated by aquatic plants. Subsequent invasions by quagga mussels introduced resource competition, while the spread of round goby resulted in predation on zebra mussels and a shift in dominance toward quagga mussels. The changing dominance of these "ecosystem engineers" is having a direct impact on both the benthic community and the ecological state of invaded lakes.

As part of our lake monitoring program, benthic macroinvertebrate samples are collected annually at 52 sites in Lake Simcoe for tracking community trends and inferring lake environmental health. While invasion by *Dreissena* spp. resulted in an overall increase in benthic biomass, the community showed relatively stable trends in species diversity and abundance in 2005 and 2008- 2009. With the rapid expansion of round gobies in 2010, there was a sharp decrease in the abundance of prey species: zebra mussels and amphipods (Gammaridae). Shoreside (0-1 m depth) habitats changed from dominance by amphipods (2005, 2008-9) to chironomids (2010-11), although amphipods have since rebounded (2012). At littoral sites (3-15 m depth), dominance shifted from zebra mussels (2005, 2008-9) to chironomids (2010-11). In 2012, quagga mussels became dominant in many littoral habitats and have mostly replaced zebra mussels, likely due to a tolerance of cooler water temperatures; better access to food with longer siphons; and long byssal threads to colonize less ideal substrates. This pattern of dreissenid succession has been recorded in other systems such as Lake Erie and Lake Ontario: a decrease in algal biomass, increased water clarity, phosphorus uptake by an increasing macrophyte biomass, and increased complexity of the benthic environment (phosphorus dispersal on substrate, increased macroinvertebrate abundance and diversity). The ecological implications of a shift away from dominance by zebra mussels is a question needing further study in Lake Simcoe: Will the current clearwater state continue with filtering by quagga mussels (*e.g.*, Lake Ontario)? Or will a new state arise with algal and cyanobacterial blooms (*e.g.*, Lake Erie)?

Late Summer Crustacean Zooplankton Communities in Western US Reservoirs Reflect Ecoregion, Temperature and Latitude

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Abstract
We tested whether crustacean zooplankton community composition and size structure in western US reservoirs would be related to ecoregion designations, catchment land use, and temperature/latitude. We also examined whether the predictions for decreasing cladoceran body size with decreasing latitude as has been observed for natural lakes would be valid for western US reservoir systems. 318 zooplankton samples were collected in late summer 2010 from 102 western US reservoirs distributed over three major ecoregions from 32.5-48.6 °N latitude.

Large-bodied cladocerans and cyclopoid copepods were found in deeper, cooler reservoirs with forested catchments (Northwestern Forested Mountains). Small-bodied cladocerans and cyclopoid copepods were more important in reservoirs located in catchments influenced by agriculture (Great Plains). Increasing water temperature was associated with decreased mean Daphnia and cladoceran lengths and lower absolute Daphnia biomass. Mean cladoceran length increased with increasing latitude. Daphnids were rare or absent in warmer waters. Large-bodied daphnids dominated zooplankton community biomass in unproductive reservoirs at high elevations with cooler water temperature while smaller bodied daphnids were associated with more productive reservoirs at lower elevations with warmer water temperatures. Our study suggested that the interrelated attributes of ecoregion, catchment land use, temperature and latitude can be valuable in explaining the taxonomic and size structure of crustacean zooplankton community structure in reservoirs. In addition, our results underscore the influence of catchment setting on plankton assemblages and indicate that abiotic factors are more important determinants than biotic factors for crustacean zooplankton community composition when considered over large geographical scales.

Water Quality and Biological Assessment of the Lower Reservoirs of the Susquehanna River

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Abstract
During 2012 the Susquehanna River Basin Commission (SRBC) completed an initial exploratory monitoring and assessment study on the lower 45 river miles of the Susquehanna River. This section of river is characterized by three large reservoirs formed to serve multiple power generation facilities, both nuclear and hydroelectric. The hydrologic and water availability aspects of hydroelectric power generation in the lower Susquehanna River are fairly well understood but the long term impacts of the hydrologic alteration on water quality and river ecosystems has not been well documented. This complex dam and reservoir system presented a variety of challenges and required alternate sampling methodologies from those used to assess the free-flowing portion of the Susquehanna River. Seasonal water quality sampling at three locations along nine transects spaced throughout the reservoirs provided insight into horizontal and vertical mixing. Nitrogen and phosphorus pose the primary water quality threats. Macroinvertebrate communities were assessed using both multi-habitat composite sampling in shoreline habitats and artificial substrate colonization methods using Hester-Dendy (H-D) samplers. Chironomid genera heavily dominated the H-D samplers while multi-habitat assemblages were much more diverse, with between 26-36 taxa. These data represent some of the only recent macroinvertebrate data available for this portion of the Susquehanna River. A fish community survey in the each of reservoirs and below the most downstream dam was also completed using a combination of benthic trawling and boat electrofishing. This assessment supplied significant information about species presence, abundance and distribution, as well as data for the invasive flathead catfish, the catadromous American eel, and PA threatened Chesapeake logperch. Catch rate and overall health condition of smallmouth bass, a declining species of recent concern within the Susquehanna River Watershed, was also documented. The constant yet irregular hydrologic alterations in the reservoirs, a consequence of power generation, result in a lack of persistent shallow, near-shore habitat and compromise the quality of these ecologically critical areas. The data collected and lessons learned during this pilot study will be valuable as SRBC seeks to incorporate monitoring of the lower reservoirs into its routine monitoring program.

Assessing Water Quality Effects of the Taum Sauk Hydroelectric Facility Reservoir Breach and Evaluating Recovery and Restoration Efforts

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Abstract
On December 14, 2005 the Upper Reservoir of the AmerenUE Taum Sauk Hydroelectric Facility in rural Reynolds County, Missouri suffered a catastrophic failure. This resulted in the release of 1.3 billion gallons of water within the span of roughly 15 minutes. An estimated 20 foot wall of water from the 680-foot-wide reservoir breach,

scoured a 1.6 mile channel along the western slope of Proffit Mountain, completely removing trees, boulders and topsoil. The wall of water and debris entered the East Fork Black River, a biological criteria reference stream, in Johnson's Shut-Ins State Park sweeping away the park superintendent's home and family and burying the state park and stream under several feet of debris and sediment.

At the point of impact with the East Fork Black River, eroded debris was deposited as a debris dam, redirecting flow from the main channel to a high water channel and depositing up to four vertical feet of sand sized sediment in the original channel. The majority of flood water and debris was captured by the Lower Reservoir, approximately 2 miles downstream of the point of impact. However, sedimentation, turbidity and other water quality concerns extended an additional 30 miles. Assessment included parameters such as pH, specific conductivity, dissolved oxygen, temperature and turbidity, as well as, both quantitative and semi-quantitative biological assessment using macroinvertebrates.

The developed recovery and restoration plan included multiple agencies and private contractors and was the largest of its kind in Missouri, perhaps the nation. It included removal of thousands of cubic yards of woody debris, uncovering a buried nine acre fen, and removing boulders, some the size of vans, from the park grounds and stream's geologic features. The most challenging phase of restoration included complete reconstruction of a 0.5 mile stretch of stream.

Water quality monitoring played a crucial role in assessing damages, determining recovery steps and gauging restoration efforts. Eight years later restoration work still continues. This presentation will discuss monitoring efforts and how water quality and the aquatic community in the East Fork Black River have rebounded since the disaster.