CINCINNATI, OHIO JANUARY 2006

Bioassessment of Large Rivers: Preparing EPA for the 2008 National Assessment

J.E. Flotemersch, K.A. Blocksom, and B. Johnson
National Exposure Research Laboratory, Cincinnati, Ohio

LTG 1 Poster 10

Science Questions

How can stressor levels, biological-response relationships, classification schemes, bioassessment methods, ecological risk assessments, and **indicators be applied across U.S. surface waters to set criteria for identifying/restoring impaired waters and maintaining designated uses?**

How Research Addresses the Water Quality MYP Goals

In comparison to wadeable streams, resource managers charged with working in non-wadeable streams and rivers are faced with:

- increased logistical challenges
- a reduced sample size (i.e., there are fewer rivers than streams)
- greater natural differences among rivers
- a narrow within-river disturbance gradient, especially in impounded systems

These realities have necessitated the development of new protocols for these systems.

The products of this research:

- have enabled the collection of statistically sound and scientifically relevant data from non-wadeable streams and rivers
- support state and tribal efforts to fulfill their present-day reporting requirements
- provide a sound foundation for future efforts by the Office of Water to conduct a National Survey of Non-Wadeable Streams and Rivers
- support the more long-term bioassessment* and monitoring goals being addressed by the EMAP program in Goal 4 (Healthy communities and ecosystems)

*Bioassessment = An evaluation of the biological condition of a waterbody using surveys of the structure and function of a community of resident biota

Research Objectives

Develop, test, document and demonstrate a full complement of field collection protocols suitable to support bioassessment, monitoring, stressor identification, restoration, and predictive modeling activities in non-wadeable streams and rivers. To support a National Survey, the protocols will need to be accepted by local, state, regional, and national assessment communities.

Describe the performance characteristics critical to the assessment of data quality and comparison with other methods or developed protocols. This includes quantitative or qualitative assessments of:

- precision
- bias
- performance range
- interferences
- sensitivity

Research Methods & Collaboration

Beginning in 1998, at the request of several EPA Regions, ORD began to systematically test existing sampling methodologies to determine their applicability to the bioassessment of rivers and to develop new methods where needed. Among the sampling methodologies compared were those for algae, benthic macroinvertebrates, fish, and physical habitat. From the outset, EPA scientists worked with their customers to ensure that the research conducted could be directly translated to application.

Criteria identified by customers as essential for broad customer acceptance:

- cost-effectiveness / logistical feasibility
- repeatability through time
- adaptability to multi-purpose needs of regulatory agencies
- ability to support larger scale assessments (i.e., river, basin, region, and national)
- compatibility with different study designs (e.g., random vs. targeted)
- applicability across different site types
- ability to reflect site conditions accurately
- ability to support stressor identification efforts

Beyond customer collaborations listed elsewhere on this poster, collaborative research efforts exist with scientists from:

- U.S. Army Corps of Engineers, Huntington District
- Ohio River Valley Water Sanitation Commission (ORSANCO)
- National Park Service, Eastern Rivers and Mountains Network
- U.S. EPA, Environmental Monitoring and Assessment Program-Great Rivers Ecosystems (EMAP-GRE)

US Army Corps of Engineers
Huntington District

Great Rivers Ecosystems

Research Results

Comparisons conducted among commonly used methods for the bioassessment and monitoring of the biotic assemblages of non-wadeable streams and rivers produced mixed results. Overall, results differed between sites classified as generally free-flowing and those with restricted flow (i.e., impounded). For the indicators listed below, revised or new protocols have been developed that provide for an integrated approach for the robust assessment of these systems.

Algae (periphyton-phytoplankton): Four sampling methods were compared and resulted in the collection of similar samples, but relationships with the existing disturbance gradients were generally weak. This resulted in little information useful for site assessment or stressor identification efforts. Increased efforts to develop metrics specifically designed for non-wadeable streams and rivers will likely resolve this issue.

Benthic macroinvertebrates: Six sampling techniques used by three government agencies were compared. It was found that methods produced different metric values, that metric response (i.e. positive vs. negative) to certain stressors varied among sampling methods, and that metrics detecting a specific stressor were not consistent among methods. As a result of these findings, research was conducted to support the development of a more consistent, yet logistically feasible, Large River Bioassessment Protocol (LR-BP) for non-wadeable streams and rivers. The protocol is now in use in multiple EPA regions and by multiple agencies.

Fish: Resource managers currently use a variety of electrofishing designs and distances. A study was conducted comparing the effects of these differences on assessment endpoints. Results were provided in a format that permits resource managers to design field efforts that meet data quality objectives.

Physical Habitat: We compared protocols ranging in field effort from light to heavy. Those having light requirements yielded useful data of limited quality and quantity. Those with heavy requirements in the field yielded extensive data of higher utility, but required significant effort in preparation for data analysis. A protocol intermediate to these extremes has been piloted and is being refined with each application.

Research Conclusions & Future Directions

As a result of this research, logistically feasible protocols that ***yield data of known quality*** are available for use by states, tribes, basin commissions, regions, and other federal agencies to report on the condition of non-wadeable streams and rivers and to identify impaired waters. This advancement has laid the foundation to move beyond political boundaries and aggregate data on larger scales, a process required if we are to effectively and efficiently assess non-wadeable streams and rivers on a national scale.

Future Directions: Customer interactions, pilot applications, and on-going collaborations have shown us how products can be reworked and used in applications beyond those originally targeted for this effort and ultimately appeal to a broader customer base. These activities assist in achieving broad acceptance of the products of this research.

Interactions with Customers

Principal Customers: EPA Office of Water, States, Tribes, Basin Commissions, and other federal agencies.

Customer Involvement: Collaboration with our customers has helped ensure that our products are in-line with customer needs and available resources.

Initial research design and planning:

- U.S. EPA Environmental Monitoring and Assessment Program
- U.S. Geological Survey's National Water-Quality Assessment program
- Ohio Environmental Protection Agency

Application of products to enhance an existing program:

- Delaware River Basin Commission (in collaboration with EPA Region 2 & 3 scientists)

Customer applications of products (demonstrations):

- Kentucky Division of Water (Region 4)
- Mississippi Department of Environmental Quality (Region 4)
- Fond du Lac band of Lake Superior Chippewa (Region 5)
- States of Region 5 (Region 5 Regional Methods Initiative)
- Additional pilot projects for 2006 have been proposed in regions 4, 7 and 10

Product Distribution and Communication to the Customer: Research products have been published in the peer reviewed literature and as EPA reports, and presented at regional and national forums. In addition, workshops geared to the customer and designed to provide hands-on training and experience have been conducted throughout the United States.

Outreach to date includes:

- 70+ presentations at formal and informal meetings, conferences and workshops
- 10 workshops with states, tribes, regions, basin commissions, and other federal agencies
- Workshops have now been attended by more than 40 states.

How Research Contributes to Outcomes

The Clean Water Act requires EPA to report to Congress on the condition of the nation's waters and to identify impaired waters. Much of the data needed to accomplish this task is supplied by the responsible states, tribes, basin commissions, and other federal agencies. While assessment protocols for wadeable streams have been available for some time, research in non-wadeable streams and rivers has lagged behind. Consequently, the condition and sources of impairment of these valued waters are largely unknown. As a product of the research presented, scientifically robust protocols now exist that states and tribes can use to accomplish this task.

The urgency of this activity becomes even more apparent when considering that the majority of rivers in the U.S. have been altered (especially through dam construction and major channel modification) to the extent that <2% are of a quality worthy of federal protection status[1].

With the development of adequate protocols that yield data of known quality, fulfilling this requirement for non-wadeable streams and rivers is now possible. These protocols are available and being used by states, tribes, basin commissions, regions, and other federal agencies throughout the nation.

Furthermore, working closely with the Office of Water, this research has served to greatly increase the U.S. EPA's capacity to conduct a National Survey of Non-Wadeable Streams and Rivers. This undertaking has tentatively been scheduled for FY2008 and 2009.

[1]Benke A.C. 1990. A perspective on America's vanishing streams. Journal of the North American Benthological Society 9:77-88

Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy.