Integrating Biological Monitoring Data from Diverse Sources: Lessons in Database Development and Data Synthesis from the Potomac Basinwide Assessment Project

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Biographical Sketch of Author

LeAnne Astin is employed as an Aquatic Ecologist with the Interstate Commission on the Potomac River Basin, an interstate compact agency that helps the Potomac Basin states and the federal government to cooperatively address water quality and related resource problems in the river. Since 2000, she has served as the principle researcher and analyst for the Potomac Basinwide Assessments Project, as well as assisting in a variety of other Commission programs. She is also the acting chair of the Methods and Data Comparability Board's Water Quality Data Elements workgroup.

Abstract

The Interstate Commission on the Potomac River Basin (ICPRB) relies on data collected by its member jurisdictions to assess the status and trends of the Potomac mainstem and its tributaries. While states' stream monitoring data cannot be compared directly, their agencies utilize similar assessment approaches, all variants of the US EPA's Rapid Bioassessment Protocols. ICPRB adapted this assessment framework toward developing a consistent, basin-wide approach for measuring the status of aquatic biota in the nontidal Potomac. To this end, a relational database management system (RDBMS) to integrate diverse biological monitoring data was developed. Considerable effort was required while designing and analyzing the database because of variability in the data provided. This presentation will highlight the challenges encountered in developing the database and in merging the diverse datasets for analysis. Results suggest that monitoring data from multiple sources can be combined into an analysis framework suitable for bioassessment, if the synthesis is done with care.

A Comparison of Single and Multiple Habitat Rapid Bioassessment Sampling Methods for Macroinvertebrates in Piedmont and Northern Piedmont Streams

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Karen Blocksom is a statistician in the Ecological Exposure Research Division (EERD) of the U.S. Environmental Protection Agency's National Exposure Research Laboratory (NERL) with training in both statistics and aquatic ecology. She has been involved with development and statistical evaluation of biological indicators, including multimetric indices, for the past six years. Karen also has been involved extensively with analysis of data from a study comparing large river methods for fish, macroinvertebrates, and algae, as well as the development of a new method for sampling macroinvertebrates in large rivers.

Joseph Flotemersch is an ecologist in the EERD of the U.S. Environmental Protection Agency's NERL with training in aquatic biology, fisheries, wildlife biology, and forest science. His primary area of interest is in large river ecology and assessment, but he is also interested in floodplain river ecology, and the comparison of field sampling methods. He is principal investigator on a study to compare large river sampling methods and a study to develop a new macroinvertebrate sampling method.

Brad Autrey is a biologist in the EERD of the U.S. Environmental Protection Agency's NERL with training in forest and aquatic ecology. He has been an integral part of studies on remote sensing in great rivers, methods comparison and development in large rivers, and methods comparison in wadeable streams. He has been involved in stressor identification studies and is key in maintaining quality assurance standards for the EERD.

Margaret Passmore is an environmental scientist in the Region 3 Wheeling Operations Office of the U.S. EPA with training in environmental chemistry and aquatic ecology. She has been involved with important regional issues, including assessment of the biological effects of mountaintop mining/valley fill coal mining, development of state aquatic reference conditions and indices of biotic integrity, and research on stream assessment methods for the past 12 years. She is also the biocriteria program lead for USEPA Region 3.

Abstract

Stream macroinvertebrate collection methods described in the Rapid Bioassessment Protocols (RBPs) have been used widely throughout the United States. The first edition of the RBP manual in 1989 described a single habitat approach that focused on riffles and runs, where macroinvertebrate diversity and abundance is high. This approach was adopted by many states, tribes, and regions. Many scientists interpreted the revised RBP protocol published in 1999 as a recommendation for multiple habitat sampling. However, no direct comparison of the two RBP protocols was presented in the second edition, and there were no recommendations for reconciling baseline data collected using the single habitat method with data collected using the multiple habitat method. As a result, scientists have been reluctant to switch from the single habitat approach, regardless of the merits that may exist in adopting the multiple habitat approach. In this study, both the single and multiple habitat methods were performed at each of 41 sites in the Piedmont and Northern Piedmont ecoregions. Differences between methods in collected macroinvertebrate assemblages were examined using both a family-level multimetric index for Virginia and a species-level index developed for the mid-Atlantic region. Though few statistically significant differences existed between methods, the relationship between single and multiple habitat metric values was often unpredictable and highly variable. The influence of abiotic factors on these relationships was examined to determine conditions under which the two methods collected similar samples. Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy.

Sensor Technology Information Exchange (SenTIX)

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Ms. Kingsbury is a project manager for WPI. She is currently managing several projects related to the environmental remediation of military installations. Ms. Kingsbury earned a B.S. in Biology from Iowa State University and a Masters of Environmental Management from Yale University.

Ms. Bohnen is a marketing specialist at WPI. Her specialties include target audience identification, strategy planning and implementation capabilities. Ms. Bohnen earned a B.S. in Public Relations and Marketing from Southwest Minnesota State and a Master of Arts in Communication from the University of Wisconsin-Stevens Point.

Abstract

SenTIX (www.sentix.org) is the result of a research initiative to build an Internet portal for information on innovative sensors used primarily for the detection and monitoring of environmental contaminants. Sensors offer an alternative to traditional data collection technologies and methodologies that can be time consuming, expensive and complex by providing accurate, inexpensive, real-time in situ analysis for environmental site characterization and monitoring. Although the advantages of using sensors for characterization and monitoring may seem obvious, locating information on these sensors may not always be as obvious.

SenTIX was designed to assist environmental decision makers, researchers and others find relevant information on sensors without having to perform numerous or lengthy information searches. The strength of SenTIX is its searchable database of sensor related information, organized into the following categories: research and development, government reports and documents, news, events and representative commercially available sensor technologies. SenTIX users can search this database by text string, by contaminant, by media, or by sensor type. Each search returns results that include information abstracts with hyperlinks to web sites, journal citations and contact information.

SenTIX is funded through a cooperative agreement between WPI and the U.S. Environmental Protection Agency.

Comparison of riparian and catchment land use effects on stream fauna in the context of landscape features

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David Bressler is an environmental scientist at the Baltimore, Maryland office of Tetra Tech, Inc. Since 1999 he has served as technical manager on a variety of stream assessment projects throughout the country that have often involved investigating the connection between land use activities and stream integrity.

Co-author, Jerry Diamond is employed as a principal scientist and project manager at Tetra Tech, Inc.

Victor Serveiss is an environmental scientist at the EPA's Office of Research and Development.

Abstract

The Clinch/Powell watershed in Virginia, USA historically harbored a high diversity of mussels and fish but species richness has declined precipitously over the past several decades. In a previous risk assessment, riparian corridor rather than upland land uses were more important in determining biological integrity and habitat quality. This study builds on that work by evaluating relationships between land uses in different size riparian corridors and biota and habitat quality, as mediated by landscape slope and drainage area size. Riparian land use, especially urban land, was more closely (negatively) associated with biotic and habitat integrity than whole catchment land use. Effects of urban and forested land within long riparian corridors (5 km) on mussel species richness were more evident in large drainage area streams than in small ones. Among high slope streams, urban land within long corridors was more closely correlated with fish IBI scores than within short corridors, suggesting that longer riparian buffer zones may be necessary to protect fish communities in high slope streams. Our results suggest that evaluating land use relationships with biotic and habitat stream characteristics, in the context of natural landscape characteristics, is important for developing or refining restoration strategies.

Laboratory Support for Microbiological Monitoring Projects in the U.S. Geological Survey

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Biographical Sketches of Authors

Rebecca Bushon is a hydrologist with the U.S. Geological Survey, Water Resources Discipline, in Columbus, Ohio. She received a bachelor's degree in Biology from Ohio State University. Ms. Bushon has training and experience in environmental microbiology with the U.S. Geological Survey for the last 7 years and has been the laboratory coordinator for the Ohio District Microbiology Laboratory for the last 4 years. She has been involved in several microbiology projects ranging from method development to microbiological monitoring and is currently the project chief of a study that is investigating a method for the rapid determination of bacterial concentrations.

Donna Francy is a hydrologist with the U.S. Geological Survey, Water Resources Discipline, Ohio District Office. She received a bachelor's degree in Biology from Indiana University and a Master's degree in Environmental Science from Rice University, Houston, Texas. She has 15 years experience in environmental microbiology and prior to that worked as a clinical microbiologist. At the U.S. Geological Survey, Ms. Francy has served as project chief on several projects that include studies that addressed recreational water quality in rivers and lakes, virus contamination in drinking-water supplies, or methods for monitoring protozoan and viral pathogens in streams.

Abstract

The U.S. Geological Survey (USGS), Ohio District Microbiology Laboratory (ODML) provides support for several projects by analyzing surface and ground-water samples for microorganisms of public health significance. These projects range from routine monitoring to investigating processes and factors that affect pathogens and indicators in the environment. For example, the ODML is partnering with the National Park Service to identify a rapid method for the detection of fecal-indicator bacteria so park managers can provide daily information on the safety of recreational waters. In another study, *Escherichia coli* loads of a major tributary are being estimated to determine whether changes to the sewage collection system result in improved water quality. The ODML is also working with local agencies to investigate the distribution and sources of *Escherichia coli* in sediments. The occurrence and factors related to the presence of enteric viruses and indicators in aquifers serving small public water supplies is being studied in a ground-water monitoring project. In another project, stream-water samples were collected to test modifications to the standard laboratory method used for detection of *Cryptosporidium*.

The ODML supports these projects, as well as other microbiological monitoring projects within the USGS nationally. Fecal-indicator bacteria analyzed by the ODML include: total coliforms, fecal coliforms, *Escherichia coli*, enterococci, and *Clostridium perfringens*. Viral indicators (coliphage) and viral pathogens, such as enterovirus and hepatitis A virus, as well as two protozoan pathogens, *Cryptosporidium* and *Giardia* are also analyzed at the ODML. These microorganisms and methods used to detect them will be discussed in this poster.

Abstract #159

Assessment of the variation in methods used by state agencies for collecting and processing benthic macroinvertebrate samples

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Jim Carter is an aquatic ecologist with the National Research Program, Water Resources Discipline of the U.S. Geological Survey. He studies the influence of physical and chemical factors on the composition and structure of benthic invertebrate assemblages in streams.

Vince Resh is a Professor of Entomology at the University of California, Berkeley, and has taught there for 25 y. He has done extensive research on stream and river bioassessment using macroinvertebrates.

Abstract

A survey of methods used by US state agencies for collecting and processing benthic macroinvertebrate samples from streams was conducted by questionnaire. The responses evaluated represent approximately 13,000-15,000 samples collected and processed per year. Kicknet devices are used in 64.5% of the methods. Mesh sizes vary among programs and within US EPA regions, but 80.2% use a mesh size between 500 and 600 mm. "Expert opinion" instead of random placement of the sampler is used by 70.6% of the methods, possibly making data obtained operator-specific. Only 26.3% of the methods sort all the organisms from a sample, the remainder subsample in the laboratory with most removing 100 organisms (range = 100-550). The magnification used for sorting ranges from 1× to 30×, which results in inconsistent separation of macroinvertebrates from detritus. Large/rare organisms are sorted by 53% of the methods, influencing estimates of richness. The taxonomic level used for identifying organisms varies among taxa; Ephemeroptera, Plecoptera, and Trichoptera are generally identified to a finer taxonomic resolution (genus and species) than other taxa. Although most programs use similar techniques, there currently exists a large range in how these techniques are applied, this would make calibration among programs challenging. Limited testing could be designed to evaluate whether these differences affect data comparability and, more importantly, determining levels of environmental impairment. A companion survey to evaluate methods used for data analysis is currently being finalized.

Effects of sediment contaminants on benthic macroinvertebrate communities in Northeast Florida

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Aisa Ceric is an environmental scientist with over twenty-five years experience in water resources management. During the last ten years she has been responsible for designing and conducting water quality, sediment and biological monitoring studies in Northeast Florida, preparing regional assessments and providing data to the public.

Palmer Kinser is an environmental scientist and manager with over twenty-five years experience in water resource assessment and the aquatic sciences. He currently oversees wetland, water quality, and other environmental monitoring and assessment studies in Northeast Florida and is currently focused on potential threats to Florida's wetlands, lakes, streams, and springs from drainage, water and sediment pollution, basin development, and groundwater withdrawal.

Doug Strom is an aquatic ecologist with over twenty-three years experience in environmental assessment. He has authored or co-authored many reports and articles reporting assessments of Florida lakes, streams, and estuaries. His primary areas of interest include taxonomy of chironomids and polychaetes and the use of statistics to relate macroinvertebrate community structure to water and sediment quality.

David Evans has over twenty-five years of experience in the field of aquatic and wetland ecology. Areas of expertise include water quality compliance monitoring and documentation, fish and macroinvertebrate surveys, mapping and quantitative characterization of aquatic macrophyte communities, wetland mitigation design and evaluation, natural resource audits, contamination audits, and biological inventories.

Greg Durell is a senior research scientist with over twenty years experience in environmental chemistry. Last fifteen years he has been involved in the planning and oversight of multidisciplinary environmental assessment projects, with particular interest in contaminated sediments. His emphasis has been on assessing the magnitude, distribution, and fate of contaminants in aquatic systems, establishing the ecological characteristics, and determining the environmental relevance of measured contamination.

Abstract

A baseline survey of sediment quality and benthic macroinvertebrate communities was conducted between 1999 and 2002 by staff and contractors of the St. Johns River Water Management District (SJRWMD), an agency created by the Florida legislature to protect, improve, or restore water resources in northeast Florida. The overall objective of the investigation was to document possible effects of organic and metallic sediment contaminants on benthic macroinvertebrate community composition and structure.

Sediment and benthos data were analyzed and interpreted to evaluate the relationships between biological metrics and sediment pollution indices. A Composite Benthic Sediment Quality Index (CBSI) was developed by combining biological metrics (Augmented Florida Index and Total Number of Taxa) that were significantly correlated with sediment Hazard Index (HI) values based on Threshold Effect Concentrations (HI-TEC). The correlation of CBSI with HI-TEC risk was tested on a series of lakes in the Ocklawaha River Basin. The average CBSI by lake was inversely correlated with HI-TEC (Spearman's Rank Correlation Coefficient = -0.699 and p = 0.011). Sites with average CBSI > 14 were considered to have good biological health and sediment quality, while

the sites with CBSI < 14 were judged as having poor biological health and polluted sediments. The CBSI or similar indices using benthic macroinvertebrates data may be valuable tools for screening candidate sites for sediment contaminant surveys and/or sediment toxicity - bioassay sampling.

Portrait of a Volunteer Monitor

Cheryl Cheadle

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Biographical Sketch
Cheryl Cheadle is the director of the Blue Thumb Water Pollution Education Program for Oklahoma Conservation Commission's Water Quality Division. In this position, Cheryl recruits volunteers, helps start new programs, offers volunteer training, and participates in educational activities. Cheryl is a graduate of Oklahoma State University with a BS degree in wildlife ecology. She has been in her present position for six years.

Abstract
"Portrait of a Volunteer Monitor" is a poster presentation that offers insight into several aspects of volunteerism, including:

- ✓ Blue Thumb volunteer duties
- ✓ Volunteer motivation
- ✓ The "good" volunteer
- ✓ Volunteer age variations
- ✓ The geographically distant volunteer
- ✓ Meeting volunteer needs
- ✓ Assessing program success/lack of success
- ✓ When a volunteer says "goodbye"

Observations will be offered by a program director who serves as a volunteer within her own program, and also with a completely different organization. This range of activities has allowed for very useful thoughts and comparisons to form about the Blue Thumb Program, and volunteers in general. This presentation will be at its best if folks in attendance are comfortable adding their own tales and leaping into discussions. Proposed time frame is 30 minutes.

Effective Networking for Successful and Sustainable Volunteer Stream Monitoring Programs in Urban Watersheds

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Abstract
Managing, monitoring, and maintaining urban watersheds require a collaborative approach. Fairfax County, located across the Potomac River from Washington D.C., depends on surface water as the drinking water source for its population of approximately 1 million residents. Our local model demonstrates how agencies and residents can combine their resources to encourage watershed protection. An extensive and organized volunteer stream monitoring program is an essential tool to gather seasonal stream health data and promote watershed stewardship. Monitoring teaches residents about the effects of urbanization; they witness severe erosion, trash, sedimentation, and poor stream habitats. Determining a stream's biological integrity builds residents' appreciation of the stream as a living system.

Establishing a sustainable volunteer stream monitoring program in Fairfax County relies on the collaborative efforts of many local agencies, including the Northern Virginia Soil and Water Conservation District, Fairfax County Department of Public Works and Environmental Services, the Reston Association and many others. Working together, these groups developed a productive network that shares resources, data, and effectively capitalizes on outreach and education efforts by engaging various audiences within the region. Thousands of students and adults participate in a variety of hands-on programs; such as monitoring, stream cleanups, watershed walks, and discussions. The results include better communication among various agencies and the community, a larger volunteer base, and more comprehensive data. All of this fosters and supports the watershed planning initiatives currently underway for all of Fairfax County's watersheds.

Abstract #163

The Regional Monitoring Program: Ten Years of Science in Support of Managing Water Quality in San Francisco Bay

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Biographical Sketches of Authors

Jay Davis has worked on contaminant issues in the San Francisco Estuary since 1986. Dr. Davis is manager of the Regional Monitoring Program for the San Francisco Estuary. His particular interests are in modeling the long term fate of organic contaminants in the Bay and accumulation of persistent contaminants in aquatic food webs of the Bay-Delta watershed.

Karen Taberski has worked on programs to monitor and assess water quality in California since 1980. Ms. Taberski has been the monitoring and assessment coordinator for the San Francisco Bay Regional Water Quality Control Board (Regional Board), the agency that regulates water quality in the region, for the past 14 years. In that capacity she worked on developing the Regional Monitoring Program (RMP) to answer regulatory and management questions and continues to be the lead technical coordinator between the Regional Board and the RMP.

Kevin Buchan has been with Western States Petroleum Association for 7 years representing the interests of the 5 Bay Area refineries to the local, state, and regional regulatory agencies. He chairs the Steering Committee to the RMP, who along with its other members, are responsible for providing oversight and direction to the $3 million annual budget program. He has a B.S. in Chemical Engineering from U.C. Davis.

David Tucker has worked on environmental contaminant issues in San Francisco Bay since 1988 in his capacity as Laboratory Manager for the City of San Jose's Environmental Laboratory. He presently chairs the technical committees for the Regional Monitoring Program and the Clean Estuary Partnership, both multi-agency scientific initiatives supporting monitoring and research efforts in the Bay, and has been a member of the National Water Quality Monitoring Council since 2000.

A. Russell Flegal has participated in the Regional Monitoring Program since its inception. He is Professor and Chair of the Department of Environmental Toxicology at UCSC. The principal focus of his research group is the biogeochemical cycles of inorganic contaminants in aquatic systems, most notably San Francisco Bay.

Andrew Gunther was the original manager of the Regional Monitoring Program (1993-1996), and is presently the Program Coordinator for the Clean Estuary Partnership, a collaborative effort to conduct science in the support of TMDLs. Dr. Gunther served as the Assistant Chief Scientist for the *Exxon Valdez* Oil Spill Restoration Program, and is working on recovery planning for threatened salmonids in California.

Sarah Lowe received her M.S. in Environmental Management from the University of San Francisco in 1998, and has worked on the Regional Monitoring Program for Trace Substances (RMP) since 1994. Her Master's research focused on developing benthic community assessments for several benthic communities in the San Francisco Estuary. Ms. Lowe became the Associate RMP Manager in November of 2001, overseeing the Status and Trends

Program, data management, QA/QC, and contract and financial management as well as participating in RMP Pilot and Special Studies.

Michael Connor is the Executive Director of the San Francisco Estuary Institute, a non-profit environmental science institute funded through grants, contracts, and discharge fees. Its mission is to foster development of the scientific understanding necessary to enhance and protect the San Francisco Estuary, through monitoring, research, and communication. He has led environmental programs for organizations in the private (Program Manager, Battelle Ocean Sciences), public (Director of Environmental Quality, Massachusetts Water Resources Authority), and non-profit (Vice President, New England Aquarium) sectors. He has over 50 scientific, technical, and popular publications.

Abstract
The Regional Monitoring Program for Trace Substances in the San Francisco Estuary (RMP) is an innovative model for providing the scientific foundation needed for managing water quality in a treasured aquatic ecosystem. Initiated in 1993, the RMP has matured into a multifaceted, sophisticated, and efficient program that has demonstrated the capacity for considerable adaptation in response to changing management priorities and advances in scientific understanding. The RMP is also a key source of information that helps define regulatory priorities. Through collective planning and management, the RMP has established a climate of cooperation and a commitment to participation among a wide range of stakeholders, including regulators, dischargers, industry representatives, community activists, and scientists. A sophisticated and well-supported QA/QC program has contributed to the development of an authoritative and reliable body of knowledge that is allowing the community to consider data-rich, science-based TMDLs and other water quality attainment strategies for the Estuary. Over the course of its development, the RMP has demonstrated some of the ingredients that are necessary to sustain a long-term water quality monitoring program that meets management needs: stable funding, collaboration, clear objectives, sound science, adaptation, and communication. Benefits of the Program and areas for improvement from the perspectives of regulators, the regulated community, and scientists are described.

Abstract #165

A Transferable Model of Stakeholder Partnerships for Addressing Nutrient Dynamics in Southeastern Watersheds

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Biographical Sketches of Authors

Bill Deutsch is an aquatic ecologist who has been a Research Fellow in the Department of Fisheries and Allied Aquacultures at Auburn University for 16 years. Prior to that, he worked 11 years as a Research Biologist and Director of Aquatic Research for private environmental consultants in Pennsylvania. He has been the Program Manager for Alabama Water Watch since it began in 1992, and directs Global Water Watch through AU's International Center for Aquaculture and Aquatic Environments.

David Bayne is a limnologist who has been a Professor in the Department of Fisheries and Allied Aquacultures at Auburn University for 32 years. He has directed aquatic studies from more than 100 grants and contracts, and served as a resident fisheries advisor to the government of El Salvador through AU's International Center for Aquaculture and Aquatic Environments.

Luoheng Han has been an Assistant or Associate Professor of Geography at the University of Alabama for ten years. Prior to that, he worked nine years as a Teaching Assistant at the Center for Advanced Land Management Information Technologies at the University of Nebraska and in the Department of Geography at the Northeast Normal University in China. He is widely published in the area of remote sensing for water quality analyses.

Abstract

A USDA-funded, three-year project (2003-2006) will integrate a variety of research, education and extension activities to provide relevant, locally-generated watershed information. Research will result in a comprehensive assessment of nutrient concentration and loadings in the Tallapoosa River system in Alabama and Georgia. It will also compare the cost-benefits of laboratory analyses, remote sensing and community-based water monitoring technologies for nutrient analyses. The data will be adapted for education and extension in the form of in-classroom curricula, teacher workshops, and a public display at a regional Environmental Center. The data will also be available to stakeholder groups through the Alabama Water Watch and Alabama Cooperative Extension System websites. The project will have mutually-beneficial interactions with the state regulatory agency and the Tallapoosa Clean Water Partnership, and should be adaptable for other southeastern watersheds.

The Volunteer Monitor Newsletter: An Effective Nationwide Communication Tool

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Biographical Sketches of Authors

Eleanor Ely is a science writer and editor specializing in environmental and aquatic science. She has been the editor of The Volunteer Monitor newsletter since 1990.

Alice Mayio is the national volunteer monitoring coordinator in U.S. EPA's Office of Wetlands, Oceans and Watersheds and is EPA Project Officer (as well as an editorial board member) for The Volunteer Monitor newsletter.

Abstract

As the only national publication devoted to volunteer watershed monitoring, The Volunteer Monitor newsletter serves as an essential networking and information-sharing tool enabling people involved in volunteer monitoring to communicate with colleagues all over the country. Produced biannually for 15 years with support from U.S. EPA Office of Water, the newsletter features in-depth articles and emphasizes practical information that readers can directly apply to their own projects.

The newsletter's mission is to serve the needs of the volunteer monitoring community, a large and diverse group. EPA's online National Directory of Volunteer Environmental Monitoring Programs lists 870 programs, which involve a total of 178,000 volunteers. These programs engage in a broad spectrum of monitoring activities—chemical water quality testing, macroinvertebrate monitoring, bacteria testing, measuring Secchi transparency, habitat assessment, and more.

Typically 17,000-20,000 copies of each issue are distributed. Additional readers access the publication online via the EPA's volunteer monitoring website. The readership includes volunteer monitoring program coordinators and participants, agency staff, university professors, classroom teachers, researchers and consultants, and others.

A recent survey confirmed that the newsletter is successfully meeting the information needs of its readers. 85% of respondents reported that they had used resources they learned about through the newsletter; 72% reported using information from the newsletter in workshops, trainings, or presentations; and 66% had used the newsletter for networking. The "overall quality and usefulness" of the newsletter was rated at 9.2 out of 10.

Guiding principles that have made the newsletter effective include: clearly identifying the audience and its information needs; focusing on providing information that readers cannot obtain elsewhere; providing a mix of topics that cover the range of volunteer monitoring activities; communicating clear guidance to contributors; and a careful editing and revision process.

Monitoring Groundwater Quality in Kentucky: From Network Design to Published Information

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Biographical Sketches of Authors

Stephen Fisher is a geochemist with research interests in groundwater chemistry; interactions between groundwater, soils, and bedrock; and the design of groundwater-monitoring networks. Dr. Fisher coordinates the Kentucky Geological Survey Groundwater Monitoring Network.

Peter Goodmann has worked for the Kentucky Department for Environmental Protection for 10 years and has managed the Groundwater Branch, Kentucky Division of Water, for over 8 years. Mr. Goodmann is responsible for overseeing the implementation of Kentucky's wellhead protection program, groundwater protection program, water-well driller certification program, karst research and mapping projects, groundwater data collection and compilation including statewide ambient groundwater monitoring, and developing groundwater quality reports.

James Webb is the Supervisor of the Technical Services Section of the Groundwater Branch. This section administers various groundwater monitoring programs and provides technical assistance to other state, federal, and local agencies, as well as to consultants and the public.

Abstract

The Kentucky Geological Survey and the Kentucky Division of Water are collaborating to characterize groundwater quality statewide, within major physiographic regions, and within major watersheds. Our goals are to determine the amounts and sources of solutes and evaluate whether nonpoint-source (NPS) chemicals have affected this valuable resource. The resulting information is needed to develop groundwater-quality standards, evaluate groundwater protection programs, and make informed decisions to protect groundwater resources.

Major activities include (1) selecting representative sample sites and analytes; (2) collecting and analyzing groundwater; (3) integrating water-quality data from various databases designed by diverse agencies for a variety of purposes; (4) reconciling different analytical methods, analyte names, detection limits, and documentation levels; (5) selecting appropriate statistical methods and graphical displays for data summation; and (6) producing and circulating reports.

Completed reports and ongoing investigations summarize and evaluate concentrations of nutrients, pesticides, and volatile organic compounds as well as naturally occurring solutes such as major and minor inorganic ions and metals. Results show that concentrations of most inorganic solutes, including metals, are primarily controlled by bedrock lithology. Some springs and shallow wells have exceptionally high levels of nutrients and detectable amounts of synthetic organic chemicals, suggesting that NPS chemicals have entered the shallow groundwater system. These findings are being used to evaluate the effects of natural processes, land uses, and NPS chemicals on regional groundwater systems and to improve groundwater protection efforts.

Enhancing Collaboration & Increasing Capacity in Extension Volunteer Monitoring Programs

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Linda Green is Project Director for the National Facilitation of Extension Volunteer Monitoring Efforts project. She is also Program Director of the seventeen-year old URI Watershed Watch Program, a part of the University of Rhode Island Cooperative Extension Water Quality Program, and has been since its inception. She is the Volunteer Monitoring Representative on the NWQMC and co-chairs its Collaboration and Outreach subcommittee. She is a member of the editorial board of *The Volunteer Monitor* newsletter.

Elizabeth Herron, Kelly Addy and Kris Stepenuck staff the National Facilitation of Extension Volunteer Monitoring Efforts project. Elizabeth Herron is Program Coordinator for the URI Watershed Watch program, and Region I Director, North American Lake Management Society. Kelly Addy is a Research Associate II in the URI Watershed Hydrology Laboratory and Web Content Coordinator for Regional and National Extension Water Quality sites. Kris Stepenuck is Volunteer Stream Monitoring Program Coordinator for Wisconsin Extension's Water Action Volunteers.

Arthur Gold is a Professor of Watershed Hydrology in the Department of Natural Resources Science at the University of Rhode Island. Robin Shepard is Assistant Dean and State Program Leader for Community Natural Resources and Economic Development, University of Wisconsin-Extension. Both serve as project advisors.

Abstract

In this presentation we will share what we have learned in our efforts to enhance collaboration & increase capacity in Extension volunteer monitoring programs. Extension is involved in water quality research, education, and outreach throughout the nation, regionally to locally, and in environments rural to urban. Extension brings university science to the community and community concerns and local knowledge to the university. Volunteer water quality monitoring is a growing focus of Extension water quality programs.

We staff a national USDA-CSREES project, *National Facilitation of Extension Volunteer Monitoring Efforts*, that is building a network and comprehensive support system for Extension-affiliated volunteer water quality monitoring efforts throughout the country. Our goal is to expand and strengthen existing programs and support new ones in a collegial and collaborative manner. Our flagship website (http://www.usawaterquality.org/volunteer/) lists all Extension volunteer monitoring programs and contains results from an extensive inquiry of these programs. Our "*Guide to Growing Programs*" has modules on program design, training techniques, quality assurance, volunteer support tools, outreach tools and funding- with special emphasis on materials that are available through existing monitoring programs. Regional and statewide workshops educate, motivate, and encourage those newly involved, revitalize long-term efforts and encourage new directions and activities. Communication and collaboration among programs are definitely leading to success in overcoming institutional obstacles. By linking with Extension, both professional *and* volunteer water quality monitoring programs can gain support in their efforts to educate the public, encourage citizens to adopt "water-friendly" behaviors, and solve environmental problems.

New England Extension Water Quality Program: Applying Knowledge to Improve Water Quality

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Abstract
The New England Extension Water Quality Program works to improve water quality management through educational knowledge and extension programming that emerges from research. The program builds on the strengths of the Extension Water Quality Programs at New England Land Grant Universities. The objectives are to: 1) Enhance integration of water quality efforts within the New England region, 2) Increase the accessibility of research, education, and extension resources of the Land Grant University system to federal, state, and local water quality improvement efforts, 3) Facilitate multi-partner efforts that minimize duplication of effort and leverage multiple funding sources into a collaborated effort, 4) Enhance progress toward place-based water quality goals, and 5) Improve Extension's capacity to draw on resources throughout the nation to address water quality issues.

Our approach creates and implements an effective region-wide, multi-partnered, water quality program in four focus areas: Volunteer water quality monitoring, Community-based watershed protection, Agricultural best management practices, and residential pollution prevention. Impacts, success stories, and partnerships will be highlighted within each focus area. For example, Extension volunteer water quality monitoring data in New England has been used to move lakes, ponds, and streams onto 303D Lists of Impaired Waters, make changes within watersheds to correct water quality problems, and document water quality improvements as a result of corrective actions. Extension volunteer monitoring is educating and engaging New Englanders in water quality issues. Through CSREES partnerships, New England Extension volunteer monitoring programs are designing and sharing watershed assessment tools and expanding their training network.

USDA-CSREES National Integrated Water Quality Program

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Abstract

The USDA-Cooperative State Research, Education and Extension Service (CSREES) National Integrated Water Quality Program (NIWQP) focuses the combined efforts of the Land Grant University System in research, teaching and extension to address major water resource issues across the United States. The program is supported largely by Section 406 of the Agricultural Research Extension and Education Reform Act of 1998 which created four funding categories: regional coordination projects, national facilitation projects, integrated projects and extension education projects. Ten regional coordination projects established based on EPA regional delineations serve as the core of the program. These projects function to enhance communication among state programs, facilitate information and resource exchange, and to develop and strengthen important external partnerships. In addition, a management team called the Committee for Shared Leadership (CSL) has been created with representatives from each region, external partners and CSREES to provide oversight and support to the program. Regional and national program efforts are being organized under eight key water quality themes: Watershed Management, Pollution Prevention and Assessment, Drinking Water and Human Health, Environmental Restoration, Nutrient and Pesticide Management, Water Conservation and Agricultural Water Management, Animal Waste Management, and Water Policy and Economics. Regional meetings and conferences as well as an annual national conference are being used for technology transfer and strategic planning. A national water quality website (http://www.usawaterquality.org) provides a direct link to regional efforts which in turn serve as a conduit to state-level water quality programs and resources.

Water Quality Monitoring Programs in the City of Greensboro

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Biographical Sketch of Author
Rebecca earned her Bachelor of Arts Degree in Geography with an Environmental Concentration from the University of North Carolina at Greensboro and has over three years experience as a Water Quality Specialist for the City of Greensboro's Stormwater Management Division. Her current duties involve overseeing the Lake Monitoring program, developing a Stream Channel Monitoring program, using GIS applications and analyzing data, inspecting and monitoring best management practices (BMPs), as well as identifying and eliminating illicit connections and improper disposals. Her recent accomplishments include developing and successfully implementing a Quality Assurance/Quality Control (QA/QC) program for the City's water quality monitoring programs.

Abstract
The City of Greensboro's Stormwater Management Division uses comprehensive, watershed-based water quality monitoring programs to identify pollution sources and determine long-term trends in water quality. The Instream Stormwater Monitoring (ISM) program utilizes the collection of instream stormwater samples during rain events to determine the effects of urban stormwater runoff on Greensboro's receiving stream water quality. The Ambient Monitoring program relies on collections of instream water samples during dry weather, or ambient, conditions to determine baseline water quality of our City's streams. Biological assessments of the aquatic life (macroinvertebrates and fish) within our streams are also conducted to complement chemical and physical water quality information related to the overall health of our streams. The Stream Channel Monitoring program uses permanent cross-sections to monitor long-term bank stability. Monitoring of various BMPs to determine pollutant removal of site-specific devices is also conducted to assess the pollutant removal efficiencies of conventional and non-conventional stormwater treatment devices.

The City has recently developed a web-based GIS application that allows our water quality data to be viewed by the public. This water quality index (WQI) is an unweighted index based upon the results of several pollutant parameters, which are then calculated into a single score to indicate the overall quality of the water. These WQI scores help water quality staff to easily analyze water quality trends over time as well as provide an easy way for the public, management or elected officials to interpret the data. The Water Quality Section has also produced and implemented a comprehensive QA/QC document for all monitoring programs to ensure that data collected and reported is of the highest quality. This document is currently being reviewed by the North Carolina Division of Water Quality.

Biological monitoring: Assessing environmental contaminants in large river systems

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Biographical Sketches of Authors
The BEST Large Rivers program has brought together scientists from the US Geological Survey and University of Florida that have years of experience and expertise examining the effects of contaminants in fish.

Abstract
The Biomonitoring of Environmental Status and Trends (BEST) Large Rivers program examines fish health in US river basins by using a suite of organismal and suborganismal endpoints, which monitor and assess the effects of environmental contaminants on aquatic biota. These endpoints include organismal health (condition factor, somatic indices, etc), residue analyses (elemental and organochlorides), immune system indicators (macrophage aggregate parameters), various molecular biomarkers (EROD, vitellogenin), and reproductive indicators (steroid hormones, gonadal histology). Biochemical, physiological, morphological, histopathological, organismal, and population metrics have been chosen to integrate responses at all of these levels of biological organization. Data are compared spatially and temporally by examining trends of various persistent contaminants and incorporating existing information from other monitoring efforts. As a national monitoring program, BEST is unique in that it utilizes biomarkers to evaluate less persistent chemicals in aquatic environments and to detect molecular-level changes before population effects may be evident. Efforts are being made to establish threshold levels or criteria for the various biomarker endpoints as the BEST dataset expands. Results from field studies, such as the BEST program, allows for the examination of the applicability of laboratory-based criteria. As new technologies and methods emerge, the BEST large rivers program will continue to reassess current methods and incorporate new technologies to ensure the program can address future issues and concerns in our nation's waters.

Development of ELISAs for quantification of surfactants, endocrine disruptors and estrogens, and their application for environmental and biological sample analysis

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Biographical Sketches of Authors

Masato Hirobe is a biochemical scientist and has served as a researcher of department of research and development, Japan EnviroChemicals. Since 2000, he has been developing the ELISA kits for monitoring environmental pollutants such as surfactants, endocrine disruptors and estrogens by generating monoclonal antibodies.

Fernando Rubio is biochemical scientist and a president of Abraxis, LCC. Fernando has developed immunoassays for analytes of clinical and environmental significance since 1976. His currents interests are the development of immunochemical products to serve the agricultural, environmental, food safety and clinical markets.

Masanori Fujita is a professor of department of environmental engineering, Osaka University. His laboratory covers various kinds of research areas such as 1) waste and waste water treatment, 2) bioremediation, 3) environmental monitoring and assessment and 4) recycling and reclaiming of waste and waste water by combining biological and engineering technology.

Hiroaki Shiraishi is a head of analytical quality assurance section, environmental chemistry division, National Institute for Environmental Studies (NIES) since 1997. Since 2001, he has also served as a head of exposure assessment section of research center for environmental risk, and as a team leader of chemical, bioassay & dynamics research team of endocrine disruptors & dioxin research project of NIES.

Abstract

Ten kinds of enzyme-linked immunosorbent assay (ELISA) systems were developed for the quantitative analysis of surfactants [linear alkylbenzene sulfonates (LAS), alkyl ethoxylates (AE), and alkylphenol ethoxylates (APE)], endocrine disruptors [alkylphenol (AP), AP+APE, and bisphenol A (BPA)] and estrogens [17beta-estradiol (E2), estrone (E1), estrogen (ES: E1+E2+estriol (E3)), 17alfa-ethynylestradiol (EE2)]. The lowest quantification limits of these ELISAs were 20 µg/L (LAS, AE and APE), 5µg/L (AP, AP+APE), 0.05 µg/L (BPA) and 0.05 µg/L (E2, E1, ES and EE2), when the following standards were used: LAS (alkyl chain length of 12), nonylphenol ethoxylate (average-ethoxy chain length of 10), AE (alkyl and ethoxy chain lengths were 12 and 7), nonylphenol (NP), NP, BPA, E2, E1, E2 and EE2, respectively. The specificity of each ELISA was confirmed by testing several compounds, which have structural resemblance to the compounds of interest. These ELISAs were also validated by comparing them with instrumental analytical methods such as high-performance liquid chromatography (HPLC), liquid chromatography-mass spectrometry (LC-MS) and liquid chromatography-tandem mass spectrometry (LC-MS/MS) with environmental and biological samples. Good correlations were observed between the ELISAs and instrumental analytical methods in all cases.

Overview of the National Wadeable Streams Assessment Program (WSA)

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Abstract

Recent critiques of water monitoring programs have claimed that EPA and states cannot make statistically valid inferences about water quality and ecological condition, and lack data to support management decisions regarding the Nation=s aquatic resources. These critiques have stemmed from reviews of the General Accounting Office (2000), the National Research Council (2001), the National Academy of Public Administration (2002), the Heinz Center Report (2002), and most recently, the draft Report on the Environment (2003). The primary reasons for this inability to produce adequate reporting of ecological condition are (1) the targeted monitoring designs used by water quality agencies, which are not conducive to extrapolation to comprehensive coverage, and (2) the question of comparability of the ecological data gathering tools, which, to date, have precluded aggregating data and/or assessments for regional and national scales.

WSA will maximize partnerships among EPA, states and tribes, and other agencies to use the best combination of monitoring tools and strategies to answer key environmental questions at national, and regional scales, and to establish a framework to address issues at state and local scales. The basic framework of WSA is to build upon previous large-scale programs, such as EMAP and NAWQA, and to benefit from existing state agency expertise and knowledge of aquatic resources. Randomly generated sampling locations stratified by ecoregion (Level II) and EPA region will enable reporting at regional scales. Standard Operating Procedures (SOPs) and a strict Quality Assurance Program will be used to ensure the highest data integrity for the assessment. The data collection from 600 stream sites in the western US (EPA Regions 8-10) over a two year period (2001 and 2002) will be complemented by a scheduled sampling of 500 stream sites in 2004 throughout EPA Regions 1-7.

An Innovative Approach to High Resolution GC/MS Analysis in Support of a PCB TMDL Study for the Delaware Estuary

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Biographical Sketches of Authors

Dale Hoover is employed with AXYS Analytical Services, a commercial environmental laboratory providing routine and custom trace organic analysis. Since 1990 he has served as the Quality Manager for numerous large analytical projects including the National Study of Chemical Residues in Lake Fish Tissue directed by EPA's Office of Water, the 2001 National Sewage Sludge Survey directed by EPA's Office of Water, the Ohio River Sanitation Commission (ORSANCO) TMDL, and the Contaminant Assessment Reduction Program for the New York/New Jersey Harbor and Hudson River Watershed.

Edward D. Santoro is the Basin Monitoring Coordinator for the Commission and serves within the Modeling and Monitoring Branch. Mr. Santoro is responsible for conducting and coordinating monitoring activities within the Delaware River Basin. Previously, he worked with a private sector engineering firm for 15 years doing environmental & hazardous waste site activities, Environmental Impact Studies and wetland surveys. Prior to this he served with the U.S. Environmental Protection Agency, Region II for 8 years. While at USEPA he worked on a number of major activities including the NPDES permitting of power plants, the Ocean Disposal Program, wetland permitting and fisheries investigations. Mr. Santoro received a Master of Science in Marine & Environmental Science from Long Island University. He has published over 30 technical articles in the field.

Abstract

The detection limit requirements for water TMDL studies can challenge the capabilities of modern analytical methods. Solid phase extraction sampling has increasingly been used as a means of collecting large volumes of sample and thereby achieving lower detection limits. However, the technique requires specialized equipment and skills and is more difficult and expensive to perform in the field than conventional grab water sampling. Field based solid phase extraction also offers limited information on target compound capture efficiency.

Conventional water grab sampling has been combined with large volume solid phase extraction and high resolution GC/MS analysis to achieve PCB congener detection limits of less than 0.5 pg/L. True isotope dilution quantification to the point of sampling was achieved by the addition of isotopically labeled standards to 20 L water samples in the laboratory followed by XAD solid phase extraction and high resolution GC/MS analysis. Capture rate on the XAD was directly monitored from recovery of the isotopically labeled standards and final concentrations were recovery corrected by the isotope dilution quantification procedure. This technique offers a means of achieving highly accurate, sensitive and reliable measurement of PCBs in water.

Evaluation of Three Algal Bioassessment Techniques as Indicators of Nutrient Enrichment and Changes in Stream Loading

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Biographical Sketches of Authors
Lisa Huff is an Environmental Scientist II with the Alabama Department of Environmental Management.

Ron Raschke specialized in diatom taxonomy and periphyton bioassessment techniques. He has conducted diatom surveys and bioassessments throughout the Southeastern United States during his career as a biologist for USEPA Region IV and RLR Associates.

Abstract
Despite the prevalence of eutrophication in streams, few methods have been shown to effectively monitor biological impairment from nutrients. Three periphyton bioassessment methods (periphyton biomass a chlorophyll *a*, diatom community assessment, and a field-based rapid periphyton survey) were tested at 20 stream segments with known or suspected impairment caused by nutrient enrichment. The methods were also tested at 14 ecoregional reference sites for comparison. Training in sample collection and taxonomy was an integral part of the project. To provide the most complete characterization of water quality conditions, habitat quality and the macroinvertebrate and fish communities were also assessed at the reference and study reaches. Water quality data was also collected. Pearson correlation coefficients showed significant redundancy among several biological variables. Preliminary results suggest that periphyton chlorophyll a and percent cover of suitable substrate (CSS) effectively detect nutrient enrichment problems. Periphyton as chlorophyll *a* was significantly correlated with average total phosphorus (TP) concentrations ($p=0.05$; $r=0.88$). The correlation between average TP and percent CSS was not as strong ($p=0.02$; $r=0.64$).

Opportunities for Individual Organizations using National Databases: The Utah Experience

Arne Hultquist

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Biographical Sketch of Author
Arne Hultquist is an environmental scientist with the Utah State Division of Water Quality. He has 18 years experience including 16 years as the Quality Assurance Officer and STORET Coordinator, and has recently been extensively involved in development of the STORET Interface Module (SIM). Arne originally coordinated an UMTRA project at the Salt Lake City Vitro site for Utah Radiation Control. Arne is an alumnus of the University of Utah with a BS in Mathematics and Chemistry and is a candidate for a BS in Environmental Studies at the U of U. Arne has been the Utah Mountain Running Race Series Overall Champion eight times during the last decade.

Abstract
During the late 1990's the Utah Division of Water Quality was faced with replacing a 20-year-old water quality database. After determining the current data storage needs and the extent of financial and technical support, Utah chose to use the nationally available Modernized STORET (STORET) for its water related monitoring data. Molding a one-size-fits-all database to individual program(s) needs was a daunting task. The presentation exposes the difficulties encountered getting individual data sets and data types into the database. Details on electronic data set characteristics manipulated with custom reformatting software into files that can be used by the importation tools currently available are discussed. The use and development of auxiliary tables that Utah has linked to the STORET tables to meet program specific data storage and reporting requirements are detailed. The tables provide storage of chemical numerical water quality standards used for assessments including 305(b) reports, management of sampling analyses plans and laboratory analyses requests. Finally, the software capabilities and reporting functions developed by Utah to meet requirements of our various programs are explained. Custom-reporting functions that include comparison of temporal chemical results to water quality standards can also be created in a variety of formats. Quality assurance analyses reports were also developed. Utah's experience illustrates that it is possible and practical to use a national database as a "starter" database that can be enhanced to meet a variety of state objectives.

NOAA's National Status and Trends Program: An Overview

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Abstract

NOAA has developed and managed its National Status and Trends Program since 1984 to carry out environmental monitoring and assessment, and associated research, to provide data and information products that contribute toward an effective stewardship of the Nation's estuarine, coastal and Great Lakes resources. The principal components of the program have included long-term monitoring (the Mussel Watch Project) to evaluate the status and trends of coastal pollution; documentation of contaminant residues in fish and measures of adverse biological effects (Benthic Surveillance Project); geographically comprehensive regional assessments to determine the nature and extent of sediment toxicity and its associated adverse biological effect in specific waterbodies (Bioeffects Assessment Project); development and application of environmental indicators, such as biomarkers and ecological indices; and dissemination of quality assured data and information products. The program has also been instrumental in developing quality assurance protocols, applying new measurement techniques, providing interpreted data and information products to users. A significant new effort is underway to compile and organize the program's data and make them accessible to users via Internet from a NOAA website. The website dissemination of data is intended not only to ensure wider distribution of data, it will also allow mapping and analyses and visualization capabilities through a variety of data display and analytical tools. Its use will greatly facilitate sharing of coastal environmental data among researchers, resource managers and the public at large, thereby promoting more informed and transparent decisions.

From Wildcat Creek to STORET: Journey of Data

Revital Katznelson[1] and David Wilcox[2]

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Revital Katznelson received her Ph.D. from the Hebrew University of Jerusalem, Israel, in 1984. She has extensive experience in performing, interpreting, and assuring quality of field and laboratory analyses of chemical, biological, toxicological, and bacteriological water quality parameters. She is currently implementing a Data Quality Management system with the Citizen Monitoring Program of the California State Water Resources Control Board.

Dave Wilcox is Vice President of Gold Systems, Inc, and serves as the Practice Manager for all environmental projects. Dave has overseen the development of the STORET Interface Module (SIM) products and has completed many STORET integration and data management projects across the country.

Abstract

A data quality management (DQM) system consisting of an array of forms, spreadsheet templates, and guidance documents, has been implemented for collection and streamlined processing of monitoring data. The DQM system provides for the primary data management functions of documentation and quality assurance in a way that allows generation and reporting of reliable, defensible, and usable data of known quality. This paper focuses on field measurements and describes the major phases of the process. Data generation and processing at the Project level include field measurements and associated documentation, error calculation, data verification and validation, and assignment of qualifiers to each measurement Result. Data then "move" to the next phase, which includes selection of information fields to export, application of a crosswalk for conversion into a format appropriate for a given central database, and export into that central database. The steps of uploading data into the new STORET (the USEPA national database) via the STORET Interface Module (SIM) demonstrate this process. Finally, data storage and retrieval options in STORET enable retrieval of Results together with information about their accuracy and their precision.

Expert System for Identifying CBR Agents in Water Supplies

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Biographical Sketch of Presenting Author
Lawrence H. Keith has over 35 years of experience in environmental sampling and analysis including developing new methods, validating methods, and applying them to many specific projects. He also is past co-chair of the National Environmental Monitoring Index (NEMI) workgroup and contributes to the development of NEMI-CBR, a database of methods for chemical, biological, and radiological (CBR) methods. He began working with expert systems 20 years ago and is currently developing the CBR Methods Advisor for EPA's Water Security Division.

Abstract
An "expert system" is an interactive computer program that emulates a human expert's decision-making process in a particular domain of knowledge. The Water Anti-Terrorism Expert-system Response Advisor (WATER Advisor) is an expert system that provides advice on using analytical methods for chemical, biological, and radiological (CBR) agents in drinking water from a national database. The WATER Advisor is designed for planning, training, or use in an emergency. In the latter it is used to advise applicable methods as quickly as possible, even when the identity of the agent may not be known. It is also used to provide advice for methods that are appropriate for environmental monitoring or for confirming a suspected analyte or organism identity. In addition, the expert system also provides general advice on where and how to sample for CBR agents within a drinking water system.

Achieving high temporal resolution, parts-per-trillion per minute, mercury field-measurements in aqueous, environmental and industrial systems

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Biographical Sketches of Authors

Philip Kilner is an environmental chemist for Frontier Geosciences. As a research associate, Mr. Kilner has been involved in a variety of research projects. These have ranged from analytical method development; including work on a number of methods for low level cyanide speciation in water and soils, to research into innovative waste treatment methods; including the investigation of trace metal removal in wastewater and industrial stack emissions. Mr. Kilner is currently devoting much of his time to work on an automated on-line analyzer for total mercury.

Dr. Hensman's research focus' on understanding, developing, and implementing waste emission treatment systems for cleanup of toxic trace metals—specifically Hg—in mining, industrial, and municipal facilities. Sponsors of these projects include national and international industrial clients and government agencies. The US EPA has repeatedly recognized Dr. Hensman's innovations in this area through the award of multiple research grants. He also maintains an active interest in on-line process analysis and product development.

Abstract

Most natural water systems, industrial process and wastewater streams are monitored using analysis of periodic grab samples or 'spot' monitoring. Spot monitoring results in a low-resolution understanding of the aqueous stream's chemistry. With a limited number of data points, transient events may positively bias an analyte's temporally averaged concentration; even worse brief high or low concentration events may not be detected.

To better understand and monitor temporal variability of mercury in natural and industrial wastewater streams with complex matrices, Frontier Geosciences has developed an innovative, robust, continuous mercury monitoring prototype system for onsite use. The system is relatively low in cost and customized to the client's needs. The on-line system is based on well-established mercury measurement methods and laboratory instrumentation, modified to accomplish the difficult demands of online analysis.

The system utilizes online chemical, thermal, and ultra-violet digestion, followed by sample cooling and gas liquid separation to prepare the sample for analysis. On-line sample preparation is tested in the laboratory on the matrix of interest prior to setting the system up in the field. Optimization in this manner allows us to insure that the custom tailored on-line system is able to perform the analysis of simple or complex matrices specific to the client in the most effective and cost efficient manor possible.

Detection is achieved by cold vapour atomic florescence spectrophotometry (CVAFS). A working range of 5 orders of magnitude can be realized with sub ppt detection limits. The analyzer can be run for compliance measurements using ether US-EPA method 1631 or 245.7.

For this presentation the analyzer has been optimised for the analysis of an urban stream, municipal wastewater treatment plant effluent and produced water from an offshore natural gas possessing platform. The details of the method and results of a number of field studies will be presented.

Abstract #184

Temporal Changes in Water Quality of two Karst Springs in Northern Alabama, 1999-2001

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Biographical Sketch of Author
James Kingsbury is a ground-water hydrologist for the Lower Tennessee River unit of the National Water Quality Assessment Program of the U.S. Geological Survey.

Abstract
Temporal variability of water quality was investigated at two springs in a karst aquifer in northern Alabama from 1999 to 2001. Monthly water samples analyzed for major inorganic constituents from the two springs indicate variability in water quality, both seasonally and in response to storms. Decreases in specific conductance and calcite-saturation indices in samples from the smaller spring within several days of moderate rainfall indicate that spring discharge contains a component of water with short residence times. In contrast, an increase in specific conductance and calcite-saturation indices in samples from the larger spring after heavy rainfall indicate a contribution of water to the spring discharge with relatively long residence times. In samples from both springs, nitrate concentrations vary seasonally in response to an increase in recharge to the aquifer in the fall and early spring. Concentrations in the smaller spring also are affected by short-term dilution following storms. Pesticides and pesticide degradates were detected in all samples collected from the springs, but concentrations generally were low (less than 1 microgram per liter). The herbicides fluometuron, atrazine, and their degradates were the most frequently detected pesticides. Fluometuron concentrations in samples from the smaller spring varied seasonally; however, fluometuron concentrations in samples from the larger spring did not fluctuate appreciably. In both springs, atrazine concentrations were highest after storms in the early spring. Variation of degradate concentrations was similar to the parent compounds.

Rainfall variability introduced by data collection methods

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Biographical Sketches of Authors

Sandra Kinnaman is a hydrologist within the U. S. Geological Survey's Hydrologic Records Section of the Florida Integrated Science Center, Center for Aquatic Resource Studies. Sandra came to the USGS in 2000 from working as an environmental consultant. During her time at the USGS she has been involved with an evapotranspiration study relating to the Greater Everglades Ecosystem Restoration in addition to coauthoring the semi-annual publication of the potentiometric surface map of the Upper Floridan Aquifer since September 2001. In 2003 she was tasked with overseeing the data collection and quality assurance of rainfall data collected by the Hydrologic Records Section within the central Florida region.

Sonny Anderson and Edward Simonds are hydrologic technicians within the U. S. Geological Survey's Hydrologic Records Section of the Florida Integrated Science Center, Center for Aquatic Resource Studies. As hydrologic technicians, their primary duty is data collection and both have extensive knowledge of instrumentation of monitoring stations. Both coauthors have supported the development and implementation of the study and continue to assist in the data collection process.

Abstract

Rainfall is the primary input to the hydrologic budget. Rainfall data are being used for studies ranging from simple water budgets to large complex computer models. Naturally occurring variability, especially spatial variability, is acknowledged and can be compensated for by various statistical techniques; however, variability introduced by the rainfall data collection process is rarely considered and could be significant. Two main sources of error exist: the effects of "non-ideal" data collection conditions, and instrument limitations. Entities such as the National Oceanic and Atmospheric Administration and the World Meteorological Organization have very specific protocols for collecting quality rainfall data. These require the data collection to be under "ideal conditions" such as the use of ground-level gages or wind shields to reduce wind-induced errors. However, data are rarely collected under such conditions. How does not meeting these standards increase the error in the measurement, and by what amount? The second source of error in the collection of rainfall data is from the limitations of the instrumentation. Accuracy of rain gages varies with instrument design and rainfall intensity. Quantifying the variation in point measurements of rainfall resulting from instrument type and rainfall intensity variations is important for consistent interpretation of rainfall data. By identifying and reducing the main sources of error in the data-collection process, higher quality data can be achieved.

A Database of Mercury in the Fishery Resources of the Gulf of Mexico

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Biographical Sketch

Frederick Kopfler received a PhD in Food Science from LSU. After completing a postdoctoral appointment with USDA, he worked for the Public Health Service investigating the pesticide and trace metal contaminants in shellfish. As a charter employee of the USEPA he worked on the health effects of chemical contaminants in drinking water. In 1989 he joined the newly formed Gulf of Mexico Program to work on public health issues associated with the use of the Gulf's waters and its seafood products including chemical contaminants of seafood; sewage pollution of shellfish growing waters and recreational waters; and harmful algal blooms.

Brent Ache is a physical scientist with NOAA's Ocean Service, Special Projects Division. He holds a master's degree in Coastal Environmental Management from Duke University's Nichols School of the Environment.

Jennifer Field is an environmental scientist with Battelle, specializing in marine ecology. In addition to designing and conducting field sampling studies, she has several years experience analyzing environmental data. She also has experience conducting ecological and human health risk assessments and environmental impact assessments. She has a master's degree in biological science from Old Dominion University.

Don Axelrad is an environmental administrator in the Mercury Program of the Florida Department of Environmental Protection (DEP), Tallahassee. Don received a B.S. degree in Chemistry from Wayne State University, an M.S. degree in Environmental Health Science from the University of Michigan, and a Ph.D. in Marine Science from the College of William and Mary (1974). Subsequently, Don worked for the Department of Conservation, Victoria, Australia for 17 years before joining DEP. For the past 7 years, he has been involved in managing research on mercury sources, biogeochemistry, bioaccumulation, wildlife and human toxicology and model development, particularly directed at identifying options for reducing mercury concentrations in Everglades' fish and wildlife.

Abstract

Mercury finds it way into aquatic ecosystems in a variety of ways. Atmospheric deposition is one major pathway. Not only can mercury in the atmosphere cross political and jurisdictional boundaries, migratory pelagic predator fish do also. After a preliminary assessment indicated that mercury was a widespread contaminant in edible tissue of fish taken from the Gulf, the Gulf of Mexico Program Management Committee directed the Program Office to conduct an analysis of the occurrence of mercury in the fishery resources of the Gulf of Mexico. A steering committee consisting of persons with knowledge of environmental mercury analysis from state health and environmental agencies of the five states surrounding the Gulf of Mexico, EPA, FDA, and NOAA was formed to oversee the project. Emphasis was placed on data collected during and after 1990 as the steering committee concluded that analytical methods had been improved and standardized sufficiently that the results from the various laboratories were comparable.

Tissue monitoring data sets from Florida, Alabama, Mississippi, Louisiana, and Texas state monitoring programs; the EPA EMAP; the NOAA Mussel Watch Program; and the NMFS GulfChem Study were acquired. These data sets were aggregated into a regional database, which is available over the internet with data mapper software that allows the user to query the database, produce maps of the query results, and zoom in to specific estuaries. The database was updated in September 2003, and contains almost 27,000 records. The database can also be downloaded in its entirety for use on a local computer.

The Development of an Index of Biotic Integrity for Headwater Streams in Northern New Jersey

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Richard Horwitz received a B.A. from Cornell University and a Ph.D. from the University of Chicago. He is currently leader of the Fisheries Section of the Patrick Center for Environmental Research (PCER) at The Academy of Natural Sciences. He has also served as the leader of the Biometry Section at PCER. His research interests include factors affecting distribution and abundance of freshwater and estuarine fishes, particularly effects of watershed land use, hydrology, dams and habitat on stream fishes. He is also interested in the monitoring, assessment, and analysis of trends of ecological condition, such as measures of biotic integrity, abundance and contaminant concentrations. He is concerned with the design and evaluation of projects for the restoration of aquatic and terrestrial ecosystems, and he recently completed master planning for natural lands restoration within Fairmount Park in Philadelphia, one of the nation's largest urban parks.

Christina Faust is a Biologist with the Bureau of Freshwater and Biological Monitoring within New Jersey's Department of Environmental Protection. Her background includes research on both freshwater and marine fish. She is currently working on New Jersey's Index of Biotic Integrity monitoring program and headwater IBI development.

Abstract

Due to naturally low species richness, headwater streams are excluded from New Jersey's current Fish Index of Biotic Integrity (IBI) monitoring program. Recognizing their ecological significance and the need to monitor the health of headwater streams, the New Jersey Department of Environmental Protection (NJDEP), in collaboration with the Philadelphia of Academy of Natural Sciences (ANS) has begun the development of an IBI for streams smaller than five square miles. During the summer of 2003, NJDEP and ANS collected fish, amphibians and crayfish from eight reference and seven stressed headwater streams in northern New Jersey. Our poster will outline the sampling methodologies used and present preliminary findings from the first year of sampling.

Advanced Water Quality Monitoring and Sampling Technology in the Study of Deicers at Dallas/Fort Worth International Airport, Texas

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Biographical Sketch of Author
Kurt Kraske is a hydrologist with the U.S. Geological Survey, Fort Worth Field Office, with a background in geology/hydrogeology and extensive training and experience in environmental field investigations throughout the United States. Kurt has served in the Fort Worth area since 2002, and has been a primary water quality team member on the Dallas/Fort Worth International Airport project. He has also served as a hydrologic technician and volunteer with the USGS Water Resources Division in DeKalb, Illinois.

Abstract
The U.S. Geological Survey is using state-of-the-art remote sampling and monitoring technology in a water quality study at Dallas/Fort Worth International Airport (DFW), Texas. The DFW study focuses on determining the potential water quality effects of deicing fluids on receiving water bodies. Potential effects may include increased biological oxygen demand, subsequent decreases in dissolved oxygen concentrations, and toxicity. Sampling/monitoring stations were established at 8 locations throughout the Big Bear Creek watershed and Trigg Lake. Flow-weighted samples are collected at 5 of the stations continuously and during selected storm events. Samples are analyzed for constituents such as biological and chemical oxygen demand, ethylene and propylene glycol, surfactants, *Microtox*, and tolytriazoles. Manual samples are also collected at specific times for analysis of chronic/acute bioassay and glycol-hydrolyzing bacteria.

The technology used in the DFW study makes real-time, remote monitoring and sampling information available at the office desktop, as well as allowing complete control of all remote sampling/monitoring stations from a personal computer. Most monitoring data is continuously displayed on a website, including stream water level and discharge, precipitation amount and intensity, water and air temperature, and water dissolved oxygen. Sampling data can also be monitored in real-time. Communication software, in combination with a cellular telephone system, allows the user to control such items as: 1) changing the bottle into which samples are collected by each automatic sampler, 2) changing the flow-weight volume for each sample bottle, and 3) the station paging the user when pre-set sampling conditions are met. Each sampling/monitoring station is automated, with power supplied and regulated automatically at the site, through a combination of AC power, batteries, solar panels, and propane generators. Floating water quality monitoring stations operate independently at the lake site, transmitting data through a radio system, as well as storing it on the raft as a back-up.

Training Oregon Volunteers to Develop Meaningful Monitoring Plans

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Beth Lambert is a watershed management extension agent with the Oregon State University Extension Service. She works with landowners, agencies, non-profits, teachers, and the general public to encourage stream habitat and water quality restoration. Beth specializes in riparian restoration, water quality monitoring, and capacity-building for community-based watershed councils. She works in Tillamook and Clatsop Counties on Oregon's north coast and teaches statewide workshops as well.

Abstract

Water quality monitoring is a popular activity for Oregon's community-based watershed councils. Much training is available to these volunteers to help them learn to use monitoring equipment and collect accurate measurements. But, little training has been available to help them develop strong monitoring plans that lead to the collection of useful data.

To train volunteers to develop meaningful monitoring plans, Oregon State University Extension Service developed a monitoring curriculum for its Watershed Stewardship Education Program (WSEP). WSEP is a series of workshops offered around the state that provides information about watershed processes, and stream ecology to watershed council members, landowners, and others. WSEP participants attend 40 hours of training, and may choose to complete a 40-hour volunteer project and receive Master Watershed Steward certification. At least 300 people have completed WSEP since its start in 1998. A survey of Master Watershed Stewards revealed that 30 % intended to become involved in water quality monitoring.

WSEP's water quality monitoring curriculum consists of a two-hour presentation / discussion and a three-hour hands-on session that helps volunteers learn to develop monitoring plans and interpret water quality data. During the lecture / discussion, participants are introduced to baseline, trend, and effectiveness monitoring. Participants examine graphed data sets and discuss when and where data should be collected in order to better achieve monitoring goals. During the hands-on session, participants work in small groups to develop monitoring plans for one of Oregon's watersheds. Participants are given maps of the topography, land use, and land ownership along with some initial water quality data. A worksheet leads the participants through the process of identifying water quality concerns; developing monitoring goals, objectives, specific questions or hypotheses; and developing a monitoring plan to meet their objectives. Each group then shares its monitoring plans with the larger group.

Assessing the Feasibility of Monitoring Aquatic Ecosystems on a Landscape Scale in Central Alaska

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Amy is an aquatic ecologist with the National Park Service. She has been monitoring aquatic ecosystems in Alaska for over 10 years. For the past three years she has been working with the Central Alaska Network Parks to develop a long-term monitoring strategy for lotic and lentic ecosystems. Prior to her work with the National Park Service she worked on the effects of flooding on wetland ecosystem dynamics in subarctic and arctic Alaska.

Maggie MacCluskie coordinates the Inventory and Monitoring program for the Central Alaska Network. Her network of parks encompasses the Yukon-Charley Rivers National Preserve, Denali National Park and Preserve, and Wrangell-St. Elias National Park and Preserve. Prior to joining the National Park Service her research work focused on waterfowl nesting in the boreal forest of Alaska and Canada. She resides in Fairbanks, Alaska where she enjoys taking part in as many outdoor activities as possible with her family.

Abstract

We developed a preliminary strategy for long term monitoring of aquatic ecosystems in National Parks in the central portion of Alaska. This strategy focuses on collecting data on a small suite of physical and chemical conditions, and biodiversity and community structure of biologic organisms. Because little is known about the waters in central Alaska we chose to focus our efforts on characterizing the full range of conditions and variation rather than on understanding specific ecosystem processes within our Parks. Our primary goal is to detect landscape scale change. Here we describe the results from a 1-year pilot study to test the feasibility of a large scale sampling regime and share our insights into developing a long-term monitoring program designed for relatively pristine ecosystems. During the pilot study we collected water quality, macroinvertebrate and vegetation data from 10 ponds and 5 streams within Yukon-Charley Rivers National Preserve. We analyzed water samples for basic water quality parameters including temperature, DO, specific conductance, pH, total N and P, NO_3/NO_2, and alkalinity. We also collected macroinvertebrate/zooplankton samples from each site to determine community structure and biodiversity. We estimated species composition and percent cover of riparian and littoral vegetation for each site. Basic diagnostic statistics and trend analysis were used to detect patterns among the data. We evaluated these data for trends and determined what measures would be good indicators of landscape scale changes. Specific conductance and NO_3/NO_2 were successfully linked to landscape scale disturbances.

Comparability of Biological Assessment Methods – Prince George's County and the Maryland Biological Stream Survey

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Mr. Erik Leppo is a biologist in Tetra Tech's Baltimore Office. He has 10 years of experience collecting and analyzing biological data for use within the biological indicators framework.

Dr. James Stribling is a biologist in Tetra Tech's Baltimore Office and a Director in the Center for Ecological Sciences. He has over 20 years of experience in the development and calibration of biological indicators for assessment of water resource quality. An integral part of that process is ensuring that implementation of routine monitoring programs using those indicators is directly applicable to technical and programmatic objectives.

Sharon Meigs works in the Programs and Planning Division of Prince George's County, Maryland Department of Environmental Resources. Since 1999 she has served as the project manager of the County's biological monitoring program.

Abstract

To make any statement of comparability between biological monitoring and assessment protocols, attention must be given to characterizing random and systematic error that can arise not only from sample to sample within a method, but between methods even when monitoring the same locations. If internal method error sources and the resulting variability are not documented and accounted for, the fact that similar assessments were attained may be no more than a random phenomenon. Thus, we hold that sufficient information for analysis of method comparability must include documentation of 1) the performance characteristics of a method (what a method is capable of), and 2) the fact that an existing dataset represents those characteristics (how a method actually performed). To examine method and data comparability between Prince George's County Department of Environmental Resources (DER) and the Maryland Biological Stream Survey (MBSS), 15 sites were sampled by both agencies during the same index period (Spring 2001). Benthic macroinvertebrate samples were collected by both agencies using similar field methods, and assessments performed using the same multimetric index; however, there were differences in reach length, specific subsampling procedures, taxonomists, and data entry QC.

While methods performed equally well (intra-method) and arrived at similar final assessments (inter-method), there were several differences that could be attributed to field methods (variability of sample unit allocation), laboratory procedures (subsampling and taxonomy), and database management (metric calculation). In this paper, we discuss similarities and differences in the methods, and evaluate the acceptability of combining these datasets.

Direct Measurement of Ground Water Contaminant Discharge to Surface Water

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James Lundy is a hydrogeologist at the Minnesota Pollution Control Agency in St. Paul, Minnesota. He has performed ground water studies at leaking underground storage tank sites and superfund sites, and contributed to remediation policy development efforts. He currently works on issues related to ground water contaminant discharge to surface waters.

Mark Ferrey is an environmental scientist at the Minnesota Pollution Control Agency. Before working at the MPCA, he researched the attenuation and biological degradation of the herbicide alachlor in soil. He is currently studying the role of abiotic natural attenuation in the remediation of solvents in ground water at Superfund sites.

Abstract

Defining zones of strongly discharging ground water is one way to characterize threats posed to surface water quality by contaminated ground water in both point source and non-point source settings. The three techniques most useful techniques for mapping areas of upward-discharging ground water and downward-discharging surface water are: temperature contrast, vertical gradient, and seepage flux. Pore water samples collected in zones of strong upward discharge show whether ground water contaminants affect surface water quality. Estimates of contaminant loading to surface water via the ground water pathway are made by combining pore water quality data with seepage flux rates.

At one site, the actual locations of contaminant discharge to surface water were not consistent with the conceptual model developed from up-gradient monitoring well data. Differences in streambed hydraulic conductivity are one factor in the departure. Hydrogeologic heterogeneity along or between flow paths, variations in recharge or natural attenuation capacity along flow paths, and other factors may play a role as well.

Although reductive dehalogenation of chlorinated ethenes does occur in the upgradient ground water, natural biodegradation processes do not appear to be enhanced in the hyporheic zone as ground water enters the surface water environment. This is consistent with the iron-reducing ground water geochemistry that predominates in the last 100 cm of ground water flow. Phospholipid and fatty acid analyses revealed variation in microbial community structure with depth, but this did not correlate to apparent attenuation of contaminants.

Development of a Habitat Assessment Tool for PDA

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Henry Manguerra is a principal engineer at the Fairfax, Virginia Office of Tetra Tech, Inc. His experience includes the management and technical oversight of projects involving development of GIS, decision support systems, models, databases, and web applications to support various Clean Water Act programs of EPA, states, and the tribes. For example, he was Tt's project manager for EPA BASINS 3.0 development and its customization for various states and tribes. More recently, he led the development of a web-based user interface of STORET and other state's water quality databases to support impairment analysis, 303(d) listing, and TMDL development.

Vaishal Sheth is a GIS software engineer at the Fairfax, VA office of Tetra Tech, Inc. He has practical experience in all parts of the software systems development life cycle including the assessment of user requirements, system design, implementation, testing, quality assurance and deployment. Mr. Sheth has been a lead developer for the Habitat Assessment Tool for PDA, Utah Data Assessment and Integration Tool, EPA American Indian Environmental Office Grant Tracking Tool and Florida DEP Environmental Data Extraction Tool.

Brian Watson is a civil engineer specializing in environmental engineering and water resources engineering, including hydraulics, hydrology, water quality modeling, and land development. He has experience with watershed, groundwater and water quality models including HEC-1, HEC-2, SWMM, HSPF, NWS DAMBRK and FLDWAV, MODFLOW, WQMAP, WASP, and EFDC. He also has experience in GIS related programs including ArcInfo, ArcView and BASINS. He has performed numerous hydrologic and hydraulic studies for various land development projects, and has worked on a variety of Total Maximum Daily Load (TMDL) projects.

Abstract

With advances in computer technology, the traditional use of paper-based forms to collect field data are now slowly being replaced by software applications that run on Personal Digital Assistants (PDAs) or pocket computers. This paper describes the design and development of a similar application for habitat assessment for the Tennessee Department of Environmental Conservation (TDEC). The application which runs on a Windows CE Operating System provides the user a form-based user interface for conducting the assessment and recording habitat data such as physical stream characteristics; land use and other watershed characteristics; water quality and biota measurements; and other qualitative observations. The application assists in ensuring that the habitat assessment is conducted completely and consistently with all other assessments. It also facilitates and enhances data entry through the use of predefined lists, automated error checking, and built-in calculators (e.g., total habitat score) thereby minimizing errors in data entry. Once data are recorded in the PDA, they can be uploaded and consolidated to a common Microsoft Access database in a desktop computer allowing near real-time sharing of data among many users. This also eliminates the intermediate step of manually transferring the data from the paper format into the computer, thereby saving valuable time and resources. The application allows bi-directional data transfer between the PDA and the MS Access database allowing users to transfer predefined station data from the MS Access to the PDA. The MS Access database is also customized to provide users a form-based interface for browsing, editing, and reporting the consolidated habitat data. On-going efforts include pilot field-testing of the application by TDEC staff. Future development objectives include the integration of this application with other field data capture technologies such as a GPS receiver to receive location information.

Evaluating Agricultural Best Management Practice (BMP) Effectiveness in the Lower St. Johns River Basin, Florida

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Pam Livingston-Way is the Lower St. Johns River (LSJR) Basin Agricultural Non-point Source Pollution Program manager. Prior to joining the SJRWMD in 1990, she earned her MS in agronomy from Western Kentucky University and served as an NRCS Soil Conservation Service District Conservationist. Pam's work with local growers and stakeholders determined the impact of agricultural non-point source pollution on LSJR water quality. Her program to develop and implement pollution reduction BMPs has done much toward meeting TMDLs established for the LSJR. She also serves on the Board of Directors for the St. Johns County Soil and Water Conservation District.

Lori McCloud is a SJRWMD environmental scientist and the Lower St. Johns River Basin Management Program Database Manager. She earned her MS in biological oceanography in 2000 from the Florida Institute of Technology, while working at the Florida Marine Research Institute designing, implementing, and evaluating biological impact assessments in coastal habitats. Since joining the District in 2001, she has been responsible for the development and maintenance of a multi-program scientific database. She also supports project managers in data analysis and project management.

Abstract

The lower St. Johns River (LSJR) is adjacent to approximately 28,000 acres of agricultural cropland commonly known as the Tri-County Agricultural Area (TCAA). This area generates large amounts of sediment and nutrient-enriched runoff that drains from a system of ditches and canals into the receiving waters of the LSJR. Studies have shown that agricultural operations are a major anthropogenic source of pollution to the freshwater portion of the river, contributing to favorable conditions for algal blooms.

The District has been working cooperatively with the TCAA growers since 1994 to develop and evaluate cost-effective best management practices (BMPs) implemented by local growers to decrease pollution loading to the LSJR. Baseline monitoring was conducted prior to BMP implementation, and is currently ongoing using nested-paired watershed sites, paired watersheds and multiple watershed stations. In addition to baseline monitoring, stormwater monitoring at these sites is now being conducted, and will allow the evaluation of BMP effectiveness during loading spikes, which typically contribute the majority of the nutrient load.

The combination of data collection during baseline conditions as well as storm events will allow a complete understanding of how BMP implementation affects water quality. This study addresses how to apply the two sampling methodologies in a way that will allow the evaluation of BMPs for both base flow and storm flow events, the temporal effects of BMPs on water quality, and will provide a comparison of the spatial monitoring designs to evaluate how they complement each other.

High School Student Success in Perennial Stream Classification

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Mike Meyer received his master's degree from Indiana University-Bloomington in Science Education. His field experience includes surveying Great Grays and Spotted owls in Oregon, surveying Mexican Spotted owls in California, and participating in a study comparing habitat preferences of various bat species in old-growth redwood forests versus younger forest ecosystems in Northern California. He currently teaches AP Biology and chemistry at Herndon High School in Herndon, Virginia and has been at the school for five years. His academic interests include working with student-scientist partnerships and bringing hands-on science into his classrooms.

Ryan Albert is a PhD student in Environmental Science and Policy at George Mason University and a student of Dr. R. Chris Jones. His research examines urbanization and water quality in the rapidly developing Northern Virginia area. His field experience includes monitoring water quality in the tidal portions of the Potomac River, biomonitoring in freshwater streams, and a study examining the applicability of North Carolina's perennial stream protocol in the Northern Virginia area. He also has experience with both George Mason and part-time with Tetra Tech Inc. working on TMDL development.

Abstract

Qualified instructors can teach high school students the necessary skills for stream monitoring while furthering the students' education. This study examines whether data collected by high school students examining perennial and intermittent streams is valid for both research and analysis and use by policy makers. The paper also examines if students can learn from the data collection process.

The study was designed using Fairfax County's Perennial Stream Protocol. Fairfax County recently designed this protocol to map perennial streams, and to serve as a basis for reclassifying them in order to extend Resource Protection Area (RPA) protections to additional riparian habitat. Utilizing this protocol to assess two streams in Herndon Virginia, students took part in an authentic scientific project. The study has spanned two years with a modified methodology in the second year based on experiences from the first. Lesson plans were designed to teach students the basic theory and skills needed for data collection. The second year's study also included the EPA's Rapid bioassessment protocol habitat sheet; however, this was used primarily as a teaching tool. Results indicate that students do gain traditional 'academic' knowledge from the field component ($p < .01$) and that the data collected may be usable under certain circumstances.

Evolution Of A Successful Monitoring Program In Suisun Marsh, CA

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Biographical Sketches of Authors

Ken Minn is a senior water resources engineer in Division of Environmental Services within California Department of Water Resources. He is the chief of Suisun Marsh Compliance and Monitoring Section that implements Suisun Marsh Monitoring Program. He has worked in numerous water resources projects including water quality and monitoring over last 14 years. His expertise is in water resources and geohydrology including water quality.

Kate Le is a water resources engineer with the Department of Water Resources (DWR), Division of Environmental Services, Suisun Marsh Planning. She has ten years of experience with the department. Her specialty is in computer simulation models. She has been applying the Delta Simulation Models (DSM1 and DSM2) over the years, to plan and analyze impacts of water projects on Suisun Marsh and Delta hydrodynamics and constituents transport. In addition, she also monitors conditions in the Suisun Marsh and Delta to adhere to regulatory standards.

Abstract

Suisun Marsh is the largest contiguous brackish water marsh remaining on the west coast of North America. It is a critical part of the San Francisco Bay-Delta estuary ecosystem. Encompassing 116,000 acres, the Suisun Marsh includes 52,000 acres of managed wetlands, 27,700 acres of upland grasses, 6,300 acres of tidal wetlands, and 30,000 acres of bays & sloughs. In 1987, Department of Water Resources (DWR), the California Department of Fish and Game (DFG), US Bureau of Reclamation (USBR), and Suisun Resource Conservation District (SRCD) signed the Suisun Marsh Preservation Agreement (SMPA). DWR, in collaboration with federal and local partners, has been implementing a compliance monitoring program under the SMPA. The monitoring parameters include electrical conductivity, stage, dissolved oxygen, temperature, pH and soil salinity. The monitoring program and methodologies have been evolving in response to following developments: significant differential settlements, environmental regulations and awareness, and advancement in monitoring and data management technology. To overcome challenges and to capitalize the technological advancement, DWR is implementing a system-wide upgrade for the monitoring network including: tidal datum reestablishment (NAVD88), minimizing structural profile of existing stations, and implementing real-time access for data and development of data warehouse and replication. This upgrade is being implemented through collaborative efforts among State, federal and local organizations, new and emerging methods and technologies to collect and share data.

Determination of Stream Biological Integrity Based on Fish Population Surveys

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Biographical Sketch of Author
Karyn Molines is the naturalist and education coordinator for the Jug Bay Wetlands Sanctuary. Since 1995, she has coordinated several ecological monitoring studies of freshwater tidal and nontidal systems. Over fifty volunteers assist her with fish population surveys, benthic macroinvertebrate sampling, amphibian studies (with specific efforts in monitoring the breeding migration of Ambystoma opacum), and plant inventories. She will receive her Masters in Environmental Science and Policy from Johns Hopkins University on May 21, 2004.

Abstract
We have conducted fish population surveys in the tidal and nontidal waters in Maryland's Coastal Plain geophysical province since 1987. Two study sites were shallow Patuxent River tidal flats, two were nontidal permanent creeks, and one was a beaver pond, all within the Jug Bay Wetlands Sanctuary, in Lothian, Maryland. In 1993 we began using 4-m and 10-m seine nets to capture the fish. We developed a seining technique in 1997 to standardize the Farm Point data. We collected data on species composition, size, and habitat use. We identified 45 species at the five sites. Seven species were common to all sites. Species diversity varied by tidal regime as well as by habitat. Striped bass and hogchokers were found only in the tidal sites, while rosy-sided dace and least brook lamprey were found only in the nontidal creeks. The two creeks had similar species composition, yet the dominant species varied. The two tidal sites had similar species composition, whereas the beaver pond supported both tidal and nontidal fish species. Species diversity and abundance were used to determine an Index of Biotic Integrity for the nontidal creeks. Volunteers were critical partners in collecting and identifying fish. This study demonstrated the valuable role volunteers play as "citizen scientists" in collecting biological monitoring data.

Multiparameter approach to tracking improved water quality and habitat conditions in Onondaga Lake New York

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Dr. Elizabeth Moran is President of EcoLogic LLC, a small environmental consulting firm specializing in water resources issues. She has been a technical advisor in limnology to Onondaga County for about 15 years, as the County implements an extensive series of improvements to its wastewater collection and treatment infrastructure. Jeanne Powers manages Onondaga County's Ambient Monitoring Program and is responsible for oversight and reporting on this complex program. She is trained in environmental engineering and integrates the decisions related to the level of treatment of wastewater and location of discharge with the water quality monitoring and modeling efforts.

Abstract

There is a need to develop effective strategies to communicate progress on complex issues of science and public policy. Onondaga County Department of Water Environment Protection (OCDWEP) monitors and reports on several key metrics of water quality and biology to assess progress towards improvement in Onondaga Lake. OCDWEP is responsible for designing and implementing a comprehensive monitoring program of Onondaga Lake and its watershed. The Ambient Monitoring Program (AMP) is designed to provide data and information regarding the effectiveness of a series of improvements to the County's wastewater collection and treatment system. Effectiveness is measured in terms of progress on two fronts: (1) compliance with water quality standards and guidance values and (2) restoration of a balanced ecological community of plants and animals. Onondaga Lake has been the subject of intense monitoring and research since the 1970s. The AMP builds on the historical data but includes an expanded program of biological monitoring; phytoplankton, zooplankton, fish, macrophytes, benthic macroinvertebrates and zebra mussels are now included in an integrated program to assess water quality conditions and biological response. We have developed a series of metrics to analyze and report findings of this integrated program. The metrics describe conditions related to specific desired uses:

- Water contact recreation (indicator bacteria and water clarity in nearshore areas)
- Aesthetics (total phosphorus, frequency, intensity, and duration of algal blooms, percent cyanobacteria)
- Aquatic life protection (ammonia and nitrite N, dissolved oxygen)
- Fish reproduction (success of target warmwater species)

World Water Monitoring Day - Cleaner Water, Closer World
Connecting the Global Water Monitoring Community Through a Focal Event

Edward Moyer

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Biographical Sketch of Author
Ed Moyer is America's Clean Water Foundation's (ACWF) International Coordinator for World Water Monitoring Day. He joined ACWF in June 2002 and assisted in the planning and execution of the World Watershed Summit, the National Youth Watershed Summit and National Water Monitoring Day, all taking place in 2002 as part of the Year of Clean Water. He presently coordinates the foundation's day-to-day planning and conduct of World Water Monitoring Day and serves as the principal contact for monitoring participants throughout the year.

Prior to joining the ACWF staff, Ed worked for twenty years as an analyst and manager in Michigan's water quality programs. He holds a BA in Education from Michigan State University.

Abstract
Lessons learned through three decades of the U.S. Clean Water Act continue to point to the need for citizens to better understand how their daily lives both impact, and are impacted by, their local water resources. Now, in times of decreasing fiscal resources that impair staffing plans for water monitoring programs, partnerships to expand the roles of volunteer monitors can result in more "hands in the water" to watch over the health of local watersheds across the globe.

America's Clean Water Foundation created World Water Monitoring Day and serves as its international coordinator. Aided by other primary sponsors such as the International Water Association, the Association of State and Interstate Water Pollution Control Administration and the U.S. Environmental Protection Agency, ACWF has introduced an annual worldwide event that focuses international attention on the importance of water monitoring and the accompanying water quality issues that affect local watersheds on a daily basis. ACWF believes recognizing existing efforts and providing an annual opportunity to connect often-localized events into a bigger global scope best accomplish this. By engaging citizens in a positive, hands-on monitoring experience, we hope to increase their understanding and encourage their continued participation as stewards of their local watersheds.

In October 2003 an estimated 80,000 participants from 24 countries registered 5,275 sites on the World Water Monitoring Day website (www.worldwatermonitoringday.org) and conducted water fairs, training and other related activities. Participants provided results for dissolved oxygen, pH, temperature and turbidity. In addition, media representatives throughout the world helped educate citizens by relating the vision and message of World Water Monitoring Day and encouraging participation in the event.

Mr. Moyer will share highlights from the first World Water Monitoring Day and discuss the benefits and challenges of connecting existing volunteer monitoring efforts. The 2003 World Water Monitoring Day Summary report will also be available.

The Presence, Levels and Relative Risks of Priority Pesticides in Selected Canadian Aquatic Ecosystems

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Janine Murray is a Senior Environmental Monitoring Specialist with the Water Quality Monitoring Branch of the National Water Research Institute of Environment Canada. Janine has worked on environmental monitoring issues since 1992, firstly in northern ecosystems with the Northern Contaminants Program of Indian and Northern Affairs Canada and with the international Arctic Monitoring and Assessment Program in Norway. Since 2000, Janine has worked with Environment Canada on national coordination of water quality monitoring. Janine currently manages a national surveillance project on pesticides in water, working closely with water quality monitoring scientists across Canada.

Abstract

Pesticides are a unique group of toxic substances, as they are deliberately released into the environment. Currently, there are only limited data on the occurrence, distribution and fate of current-use pesticides in surface waters, groundwaters, and sediments of Canada. Correspondingly, the ability to predict or assess the potential for deleterious health and environmental effects is compromised. In order to address this knowledge gap, Environment Canada is conducting a geographically diverse national pesticides surveillance program focused on vulnerable watersheds (e.g. drinking water sources and sensitive aquatic habitats). Sampling of surface and ground waters, sediment and biota is being conducted over 2 to 3 years, to confirm the presence and levels of in-use pesticides based on the following priorities: regional usage, chemical persistence, environmental fate and bioaccumulation/biomagnification potential.

A recent report by, Environment Canada's National Water Research Institute, entitled Threats to Sources of Drinking Water and Aquatic Ecosystem Health in Canada, highlighted the need for targeted pesticides monitoring data to determine trends, assess hazards, and provide knowledge for regulatory decisions. The data from this surveillance project is also expected to inform the Canadian public and federal, provincial and municipal resource managers on the environmental presence, levels and relative risks of pesticides, identify specific priorities and areas for future effects investigations, and ultimately assist the development of recommended risk management measures.

Old Mans Creek and Clear Creek, East-Central Iowa – The Role of Volunteers in a Snapshot Sampling

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Jacklyn Neely is the IOWATER Field Coordinator for the Iowa Department of Natural Resources. Jacklyn's primary duties include training volunteers and coordinating watershed groups. She holds a BS in biology and earth science from the University of Wisconsin. Jacklyn has participated in a variety of biological research projects including herpetological studies with the University of Wisconsin - Stevens Point, a study on caddisflies with the University of Wisconsin - La Crosse, and a fish-monitoring program with the Upper Mississippi Long Term Resource Monitoring Program, the University of Wisconsin, and the Iowa DNR. Jacklyn has been with the Iowa DNR since May 2000.

Dave Ratliff was project leader for the first snapshot of Old Mans Creek and Clear Creek in Johnson and Iowa counties in September, 2003. Dave attended the first IOWATER workshop held at Springbrook Conservation Education Center in Guthrie Center, IA and then continued his Water Quality Monitoring education to receive his Level 2 Certification. His work with the United States Geological Society allowed Dave to start K.D. Engineering in 1976, which later evolved into the development and implementation of the first Microprocessor-controlled RJE station to be built. Today, Dave still heads K.D. Engineering, which is involved in computer systems support.

Abstract

In September 2003, 50 volunteers sampled more than 50 sites throughout Old Mans Creek (245 sq. mi.) and Clear Creek (103 sq. mi.) watersheds as part of a snapshot sampling. A snapshot sampling is when multiple sites throughout a geographic area are sampled within a short period of time. While these events enable collection of baseline data and can highlight areas for follow-up monitoring, they are beneficial in getting volunteers in the IOWATER Program (Iowa's volunteer water monitoring program) involved in collecting water quality data on a watershed or county scale. This snapshot was one of the most intensive studies conducted by volunteers in Iowa, as it included chemical, physical, biological, and discharge measurements. Monitoring of 16 sites on the main stem of Old Mans Creek under low-flow conditions showed a relationship between the number of microhabitats and benthic macroinvertebrate diversity, as well as the impact of a small community's wastewater facility, located within the watershed, on ammonia, chloride, and phosphorus concentrations in the creek. Elevated chloride concentrations were also reported for Clear Creek, with chloride concentrations declining downstream in both streams. Monitoring of many of these same sites one month later revealed the same elevated chloride trend. Results from this sampling provide a baseline for future events, as monitoring of these sites will occur on a tri-annual basis (spring, summer, fall).

Bacterial Source Tracking in the Upper Iowa Watershed Using *E. coli* Ribotyping

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Eric O'Brien completed his master's research in Environmental Science at the University of Northern Iowa in May 2003. His primary interest of focus is environmental microbiology, specifically focusing on bacterial source tracking. Currently, he directs most of his efforts toward the ongoing bacterial monitoring of Iowa's State Park beaches as well as tracking of bacterial sources at these beaches through intensive watershed sampling and source tracking methodologies.

Ms. Hall is the Supervisor of the Environmental Microbiology section at the University of Iowa Hygienic Laboratory. In this capacity Ms. Hall is responsible for the supervision of scientists, microbiologists, and technicians performing various environmental microbiology and chemistry. Ms. Hall currently serves on a number of Joint Task Group for Standard. She also is a member of the Microbiology Revision Subcommittee for the EPA Manual for the Certification of Laboratories Analyzing Drinking Water and she is the Editor for the Iowa Groundwater *Quarterly*. Her current research interests are bacterial source tracking using the RiboPrinter and method development for pathogen recovery in environmental samples.

Ms. Owens received her B.A degree in Biotechnology from the University of Northern Iowa, Cedar Falls, Iowa in 1996. She began employment with the Hygienic Laboratory as a Public Health Microbiologist I in September 2000. Her responsibilities at UHL include analyzing water samples for Total Coliforms, Fecal Coliforms, *Pseudomonas aeruginosa*, and Heterotrophic Plate Count. Ms. Owens is UHL's principal analyst for bacterial source tracking using the Qualicon's RiboPrinter®.

Richard Langel received his master's degree in geology from the University of Iowa in 1996, and began working for the IGS in 1998. He has worked on a variety of projects, ranging from working with well drillers to coordinating a watershed-monitoring program. Rick designed the sample collection strategy used in the Upper Iowa River source tracking project.

Abstract

The Upper Iowa River is a valuable natural and economic resource located in northeast Iowa and southeast Minnesota. The Upper Iowa River watershed is a 1,005 square mile watershed recognized as a priority watershed for water quality protection because of its recreational value. Since 1999, the Upper Iowa River Watershed Alliance has monitored 39 stream sites throughout the Upper Iowa River Watershed in an effort to identify subwatersheds that are contributing elevated levels of fecal bacteria. Three subwatersheds were selected for a bacteria source tracking project; Coldwater Creek, Silver Creek near Cresco, and Silver Creek near Waukon.

The Upper Iowa Bacteria Source Tracking Project, begun in 2002, used DNA ribotyping to identify fecal sources in the Upper Iowa River Watershed. This was the first project of its type in Iowa and it was used to build a statewide E. coli bacteria DNA fingerprint database. A total of 200 E. coli isolates from known fecal sources and 50 E. coli isolates from water samples taken from the subwatersheds were collected and analyzed. DNA ribotyping successfully discriminated between human and cattle bacterial sources; however, the number of isolates was insufficient to distinguish between other animal sources. Project results have guided researchers and conservation specialists in the local area toward more accurate targeting of best management practices in watersheds to address and reduce fecal contamination. Consequently, because of the success of this project, researchers have continued building the DNA fingerprint library and applied other source tracking tools to ongoing studies throughout the state.

Evaluating the Effects of Conservation Practices: Watershed-Scale Research and Monitoring

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Mike O'Neill is the National Program Leader for Water Quality with the Cooperative State Research, Education, and Extension Service. Mike received a Ph.D. in Geography from the State University of New York at Buffalo. He was a faculty member at Virginia Tech and Utah State University and also served as the Watershed Extension Specialist at Utah State prior to joining CSREES in 1998.

Robert Kellogg is the coordinator of the National Assessment component of the Conservation Effects Assessment Project (CEAP) with the Natural Resources Conservation Service, USDA. Robert received a Ph.D. in Agricultural Economics and a Masters of Biomathematics from North Carolina State University. He has been working at NRCS as a natural resources policy analyst for 11 years.

Carl Myers is the CEAP Team Leader for NRCS. Prior to his current detail to USDA/NRCS, Carl has held a series of positions at EPA since the 1970's, including serving as Deputy Director of the Assessment & Watershed Protection Division for the last 12 years. Carl has a B.E.S. [mechanical engineering] from Johns Hopkins University and a M.S., Environmental Engineering, from Stanford University.

Abstract

The U.S. Department of Agriculture (USDA) has an extensive history of support for conservation and agricultural management practices on the Nation's croplands, rangelands, and forest lands. This support has come in the form of basic and applied research, technical and financial assistance, educational programs, and information gathering and dissemination through the Department's many agencies. While there is an extensive body of literature demonstrating the effectiveness of conservation and agricultural management practices at the plot and field scale, very little information exists to demonstrate how these effects are manifested at the watershed scale. USDA is offering a competitive grants program for evaluating the effectiveness of conservation and agricultural management practices at the watershed scale. In particular, the program attempts to address how the spatial distribution and temporal implementation of conservation and management practices affect water quality within intermediate-sized watersheds. Given the potential for long lag times between the implementation of practices and their manifestation as water quality improvements, the program will focus on capturing and expanding upon the value of existing monitoring programs. We are particularly interested in determining how existing monitoring data can be used to unravel the complex interactions among conservation practices implemented over time and space within a given watershed. Related to this effort is a need to understand how to design an effective monitoring strategy to capture the effects of conservation and agricultural management practices implemented within a watershed.

The success of this program hinges upon the ability of investigators to assemble existing monitoring data, evaluate gaps in monitoring data and identify how interactions among practices impact water quality. We expect to fund four or five different watershed projects (each project will last three years) in each of the next three years. At the conclusion of the final set of projects, we anticipate conducting a summary evaluation of the measurable effects of conservation and agricultural management practices on water quality.

Mosquitoes and Stormwater Ponds…Testing the Perception

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Kristen Pavlik is an aquatic biologist for Tetra Tech, Inc. She is currently assisting the US EPA with the implementation of the national Wadeable Streams Assessment project. She is also the technical lead for a countywide biological monitoring program (Howard County), and monthly stormwater sampling (Anne Arundel County), both in Maryland. She has also been involved in field sampling, laboratory sample processing and taxonomy, data management, QA/QC, and report writing.

Abstract
Mosquitoes are important pests and disease vectors, whose management is often a top priority in areas affected by some of the diseases they carry. The life cycle of important pest species relies on standing water. In response to concerns about mosquito breeding in stormwater ponds, we studied the distribution of mosquito populations, especially those associated with stormwater ponds, during the summer of 2003 in Prince George's County, Maryland. We designed and implemented a survey of different areas, including those with stormwater management ponds, to determine the distribution of mosquito populations. Twenty-nine randomly selected stormwater ponds were selected for sampling, as well as standing water in a variety of different land use areas: 14 forested, 2 high-density residential, 6 low-density residential, 8 agricultural, and 3 urban. At each pond, 20 dips were made along the periphery using a telescoping dip pole with a 750 ml sample container. Mosquito larvae and pupae were collected at all of the other land uses using a baster and sieve. Standing water habitats included, but were not limited to, water-filled tree holes, puddles, wheel ruts or other surface impressions, birdbaths, containers (e.g., garbage can lids, flower pots), and abandoned tires. The number of samples and volume sampled were recorded, along with semi-quantitative data on the nature of the sampling site. Mosquito larvae and pupae were rarely found in pond samples, (an average of 1 individual in 5 of 29 ponds, or 17%). By contrast, they were much more commonly found in all other habitat types, with the highest numbers (by far) found in standing water from agricultural, forested, and residential areas. Many of the individual samples from these areas yielded, on average, several hundreds (sometimes thousands) of individuals per sample, regardless of the type of site. Analysis of these data and ancillary factors suggest that well designed and maintained stormwater retention ponds are an insignificant source of mosquitoes in the County.

The Importance of Rare Taxa to Multimetric Indices

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Kristen Pavlik is an aquatic biologist for Tetra Tech, Inc., in Baltimore, MD. She is currently assisting the US EPA with the implementation of the national Wadeable Streams Assessment project. She is also the technical lead for a countywide biological monitoring program (Howard County), and monthly stormwater sampling (Anne Arundel County), both in Maryland. She has also been involved in field sampling, laboratory sample processing and taxonomy, data management, QA/QC, and report writing.

Erik Leppo is a biologist in Tetra Tech's Baltimore Office. He has 10 years of experience collecting and analyzing biological data for use within the biological indicators framework.

Abstract

The usefulness of including rare taxa in bioassessment scores has been widely contested. The variable definition of a rare taxon complicates the issue, varying from "very seldomly occurring", to "a species known to exist in a community that is absent from a sample series from that community". These frequency of occurrence definitions are functional, but too broad or conceptual to serve as a definition of taxa encountered in any routine and practical biological sampling activity. Two operational definitions of rare taxa that we have used are: 1) those taxa that occur at only a single site in a geographic area, or 2) those taxa occurring at many sites, but only in relatively low numbers (e.g., less than 5). The importance of rare taxa to biological assessments potentially has serious effects on the level of effort required for both field and laboratory activities.

Prince George's and Howard Counties (Maryland) currently operate independent biological monitoring programs that sample sites on 1^{st} – 4^{th} order streams on a rotating basin schedule. Prince George's County is located in the Coastal Plain, and therefore uses the Maryland benthic index of biological integrity (B-IBI) calibrated for streams of that physiographic region; Howard County is located in the lower Piedmont physiographic region, and uses the B-IBI calibrated for non-Coastal Plain streams. Defining rare taxa as above, we address the question of effects on multimetric indices by directly comparing those calculated with, to those calculated without rare taxa. Other factors are kept constant, allowing for an effective comparison between the degree of index correspondence using taxa of these different rarity classes.

The New Jersey Toxics Reduction Workplan for NY-NJ Harbor: Blank Contamination Impacts on the Useability of Ambient Water Sample Data

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The author is a Research Scientist I in the Division of Science, Research and Technology of the New Jersey Department of Environmental Protection, and Project Manager of the New Jersey Toxics Reduction Workplan for New York-New Jersey Harbor. He has a Masters of Science degree (Botany) from the University of British Columbia, and Bachelor of Science degrees (Marine Science, Biology) from Southampton College of Long Island University.

Abstract

As part of the New York-New Jersey Harbor Estuary Program Contaminant Assessment and Reduction Program, the New Jersey Toxics Reduction Workplan for NY-NJ Harbor has collected ambient surface water samples at 20 locations throughout the estuary. Large-volume water samples were collected using the Stevens-Trace Organics Platform Sampler, which included glass fiber filters (to collect suspended sediments and associated organic contaminants) and XAD resin columns (to collect dissolved fraction PCBs and pesticides). The samples were analyzed using high-resolution methods for PCBs (USEPA Method 1668a), dioxins/furans (USEPA Method 1613b), PAHs, and pesticides. Grab samples were collected and analyzed for Cd and Pb (USEPA Method 1638), Hg and methyl-Hg (USEPA Method 1631), and dissolved PAHs. Field, equipment, and laboratory method blanks were collected and analyzed in association with the ambient water samples. Based on USEPA guidelines, blank contamination impacts on the sample data were evaluated using a "5X Maximum Blank Approach" developed specifically for this project. Blank contamination impacts on the sample data for the suspended sediment fraction of the organic contaminants were minimal. The dissolved fraction PAH data was consistently impacted by blank contamination, particularly for naphthalene compounds, fluorene, and dibenz(a,h)anthracene. Sample data for dissolved Hg and methyl-Hg were also frequently impacted by blank contamination. This poster will present and discuss observed blank contamination impacts (or the lack of such impacts) on the sample data in relation to analytical quantitation levels and observed ambient concentrations.

WQ-WET: A Web-Based Application to Allow Local Water Quality Monitoring Projects to Submit Data for Storage in a STORET Database

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James M. Porter is the Minnesota Pollution Control Agency's STORET database administrator. Educated as an environmental scientist, his early career responsibilities included acquiring water quality monitoring data from local projects throughout Minnesota and storing them in the legacy STORET system. He has participated in a number of water quality assessment, GIS, and database development projects over the last 12 years.

Hafiz M. Munir is a senior hydrologist with the Minnesota Pollution Control Agency. He received his Ph.D. in 1991 from the University of Minnesota, St. Paul with an emphasis in surface and subsurface hydrology, water resources management, and hydrologic modeling. He worked as a consultant for about ten years. Currently, he provides contract administration and project management for statewide TMDL projects in the State of Minnesota Impaired Water Program. He has authored several technical reports and papers in professional journals.

Louise E. Hotka, monitoring coordinator at the Minnesota Pollution Control Agency, draws on her experience with field operations, lab analysis, legacy STORET, and local project monitoring to help develop the WQ-WET application. She came to state service 17 years ago from the USGS Water Resources Division Iowa District.

Jennifer Oknich, monitoring data coordinator at the Minnesota Pollution Control Agency, graduated from the University of Minnesota with a Bachelor of Science in Natural Resources and Environmental Studies, with a hydrology emphasis. Her responsibilities include acquiring ambient monitoring data from local projects throughout Minnesota and preparing them for storage in STORET. She will be the primary user and point of contact for the WQ-WET application. Since 2000, she has worked in a wide variety of environmental positions.

Akira Matoba is a senior programmer at the Minneapolis, Minnesota office of URS, Inc. For the past year, he has worked very closely with Minnesota Pollution Control Agency staff in their task of collecting and converting water quality data for storage in STORET. He has authored numerous programs to expedite the process, including development of the web server for automated data collection, validation, and conversion via the web.

Abstract

The Minnesota Pollution Control Agency's STORET database serves as a clearinghouse for ambient lake and stream water quality monitoring data collected by local monitoring projects throughout the state. Collecting the data has historically been labor intensive despite efforts to standardize data formats. To improve efficiency and accuracy, the Minnesota Pollution Control Agency developed a web-based application to allow monitoring projects to submit data as a spreadsheet and ultimately produce a STORET Interface Module (SIM) import file.

The Water Quality Web Entry Tool (WQ-WET) application will serve as a central access point for data providers. Each user will have an account referencing one or more projects. A user will be able to look up allowable STORET values or request new values while preparing result files. Upon receiving an uploaded result file, WQ-WET will validate the file and facilitate user aliasing of unrecognized field names and result values. Once the user has correctly configured the result file and aliases, WQ-WET can load the data and produce a SIM import file. Data imported to STORET are made available a short time later on the Minnesota Pollution Control Agency's separate Environmental Data Access (EDA) web site, providing quick turnaround to data providers. For security reasons, neither WQ-WET nor any user has direct access to the STORET database. The allowable value tables are rewritten nightly in a separate database. Minnesota Pollution Control Agency staff will establish new values and load SIM import files independently from the WQ-WET application.

The Influence of Scale, Design, and Indicators in Watershed Assessment Outcomes

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Edward T. Rankin is a Senior Research Associate for the Center for Applied Bioassessment & Biocriteria (CABB) in Columbus, Ohio. He previously worked for 18 years for the State of Ohio Environmental Protection Agency as a fishery ecologist in their Ecological Assessment Section. He has worked on projects related to assessing the effects of multiple stressors on aquatic life in streams, development and application of stream habitat assessment methodologies and development and application of biological criteria.

Chris O. Yoder is involved in the national development of biological assessments and biocriteria, including multimetric index development for large rivers and wadeable streams. He is presently the principal investigator of a cooperative agreement with the U.S. EPA, Office of Water for monitoring and assessment, indicators, and biological criteria development and implementation. He was most recently Manager of the Ecological Assessment Section at Ohio EPA (1989 – 2001) and supervisor and staff member since 1976. His experience also includes service on national, regional, and state working groups and committees dealing with monitoring and assessment, environmental indicators, biological assessment, biological criteria, and WQS development and implementation. Recently he served as a member of the National Research Council committee on the role of science in the TMDL process. He has 33 years of experience in the assessment of fish assemblages and other aquatic organism groups, their associated habitats, and 28 years in water quality management including the integration of multiple indicators of stress, exposure, and response.

Abstract

The geometric watershed sampling design developed and implemented by Ohio EPA provides an opportunity to examine the issues of scale, design, and indicators usage in the outcomes of watershed assessments. The geometric sampling design is a dense selection of sites determined by halving the drainage area at the mouth of the watershed which is then continued down to a watershed size of as small as 1-2 sq mi. Biological (fish and macroinvertebrates), habitat, and water column chemistry data are typically collected at each station and integrated with other information from the watershed. Stations are assessed for attainment of aquatic life uses and a weight of evidence approach is used to identify causes and sources of impairment at stations. Basic questions about how watershed assessment design influences the knowledge and outcomes about specific management issues were approached by iterative analysis of the assessment outcomes for aquatic life use issues. For example, at what point does adding spatial resolution to the watershed sampling design cease to offer unique information for one or more management purposes? Do different management objectives influence this? How do these choices influence the environmental accuracy of the watershed assessment? Are there implications and consequences to broader issues such as indicator, criteria, and tool development?

Monitoring input-output ion budgets in subalpine watersheds of central Colorado

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Chuck Rhoades is a Research Biogeochemist with the USDA Rocky Mountain Research Station. His current work focuses on plant, soil and water nutrient processes in subalpine watersheds and riparian areas in Colorado. Prior to joining the USFS he was assistant professor of Restoration Ecology at the University of Kentucky.

Banning Starr has conducted field and laboratory work associated with numerous biogeochemical and hydrological research projects at the Fraser Experimental Forest since 1999. He recently graduated with an M.S. in Ecology from the Graduate Degree Program in Ecology at Colorado State University.

Robert Stottlemyer is a Research Biogeochemist with the National Park Service / U.S. Geological Survey. In addition to long-term watershed research at the Fraser Experimental Forest, he maintains projects at Isle Royale National Park, Agashashok Watershed, Noatak National Preserve and the Calumet watershed in Michigan.

Louise O'Deen has worked as chemist and laboratory manager for the Rocky Mountain Research Station since 1989. She oversees water, plant and soil analyses for long-term monitoring and research at the Fraser Experimental Forest and a variety of national parks and conducts analyses for monitoring network of wilderness lakes on U.S.F.S. land in the western U.S.

Abstract

The Fraser Experimental Forest (FEF), located in the central Rocky Mountains of Colorado includes both subalpine and alpine ecosystems and ranges in elevation from 2,684 m to 3,905 m. The 9,300 ha research forest is drained by more than a dozen first or second-order streams that form part of the headwaters of the Colorado River. Watershed-level manipulations have been employed at FEF to investigate the effects of various forest canopy removal strategies on snow accumulation and stream discharge. Water chemistry and sediment load have been assessed in conjunction with snow and stream flow measurements. Two manipulated and untreated watershed pairs dating to the mid 1940s and 1980s provide a unique opportunity to study the biogeochemical processes controlling the water quality of pristine and recovering subalpine watersheds. Here we present input-output ion budgets for the dominant nutrient cation and anion species in order to evaluate patterns of nutrient retention and export during a 10-year period for the main watershed pair. In these high elevation watersheds, snowpack water equivalent controls stream discharge and nutrient export, so we address the relations between seasonal and annual stream flow and nutrient concentrations and volume-weighted loads. The precipitation chemistry at FEF is relatively pristine relative to most collection sites within Colorado and weekly monitoring has shown few long-term trends since the monitoring program was initiated. Watershed nutrient budgets from FEF therefore, provide valuable baseline conditions to help land managers and policy makers assess management manipulations and detect long-term climate change or anthropogenic influences on atmospheric deposition.

Monitoring, Education and Partnerships Through the Georgia Southeast and Coastal Region Training Center

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Joseph P. Richardson is a professor of marine sciences in the Marine Sciences Program at Savannah State University. He joined Savannah State University in 1979 after earning a Ph.D. in Marine Sciences from the University of North Carolina. A native of Tennessee, he earned a BA in Biology from the University of Tennessee. His research includes coastal water quality and Caribbean seaweeds. Presently he teaches graduate and undergraduate marine science courses at Savannah State, and he serves as the Director of the Coastal Region Training Center for the Georgia Adopt A Stream Program that serves southeastern Georgia counties.

Abstract

The Coastal Region Training Center at Savannah State University was established in 1996 to promote participation in the volunteer-based Georgia Adopt A Stream Program throughout southeastern and coastal Georgia. Since its initial establishment, the Center has maintained operation through acquisition of external grants. Presently the Center is supported by grants from the Coastal Zone Management Program of the Georgia Department of Natural Resources Coastal Division, and from the Georgia Sea Grant College Program. The Center promotes participation in the Georgia Adopt A Stream Program by: providing assistance to individuals and partners interested in starting a local volunteer-based water quality monitoring program; conducting training workshops for visual, chemical and biological water quality monitoring (including QAQC certification); serving as a technical and educational resource; collecting, reviewing and transmitting water quality data from local volunteer groups; and by providing supplies and equipment to school-based monitoring groups. Since the Center's development, interest in water quality and watershed issues in southeast Georgia has increased, and the establishment of volunteer-based water quality monitoring programs has increased steadily. Since its establishment, three southeastern Georgia Riverkeeper programs have become established, and the Center provided chemical monitoring training for each. Recently many school-based watershed education projects have been developed which provide for local hands-on field and lab activity-based educational opportunities for students and teachers in southeastern Georgia. Water quality chemical parameters collected by participating groups include: temperature, Secchi disk depth, settleable solids, pH, dissolved oxygen, salinity, nitrate-nitrogen, and phosphate. Biological monitoring utilizes macro-invertebrate collection, identification and quantification.

Elemental Analysis of Clastic Sediments to Determine Fluvial Sediment Sources

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David S Leigh (dleigh@uga.edu) is a Professor of Geomorphology in the Geography Department, University of Georgia, Athens.

Abstract

The forested southern Appalachians provide water for approximately ten million people and hydroelectric reservoirs that generate more than ten billion dollars of electricity, annually. However, excessive sedimentation of surface waters have threatened water supplies and resulted in the establishment of sediment TMDLs for once pristine mountain streams. Forestland conversion for residential, commercial and industrial uses is largely unregulated, occurring at unprecedented rates and predicted to continue increasing over the next fifty years. This development drives the construction of steep, gravel roads into the steep, unstable mountain slopes. Such roads are estimated to account for 30% to over 80% of the contemporary sediment sources to streams. We have researched road erosion and sediment yield for a number of decades and used the results of our work to develop forest road best management practices. However, it is only recently that we have been able to directly quantify the sources of sediments within streams. We have employed total elemental analysis to characterize the mineralogical composition of clastic sediments from native soils, gravel roads and streambeds from southern Appalachian mountain streams. This method allows us to differentiate between weathered, native sources of coarse streambed sediments (sand size and greater) and fresh quarry-sources of streambed sediment. The strongest elemental signals occur as elevated sodium and calcium signatures in the road gravel and enrichment in stream sediments. We are using this method to directly quantify sediment budgets for these streams and improve our development of forest road best management practices.

The Clickable Map Concept: Status of the Maryland Water Monitoring Council's Efforts to Provide Metadata Through a Geographic Information System

Matthew Rowe[1], Chris Swan[2], and Marty Hurd[3]

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Matthew Rowe has worked for the last five years as an environmental scientist with the Maryland Department of the Environment. His duties include compilation of the State's list of impaired waters (e.g., 303[d] List), environmental oversight of dredging projects, and using biological communities as indicators of water quality. Matt has worked for the Oregon Department of Fish and Wildlife in stream restoration and received a National Network for Environmental Management Studies (NNEMS) fellowship from EPA. Matt's interests include TMDL implementation, stream restoration techniques and Smart Growth approaches to sustainable development.

Chris Swan recently became an Assistant Professor at the University of Maryland Baltimore County and is affiliated with the University's Center for Urban Environmental Research and Education. Chris received his Ph.D. in biology from the University of Maryland in 2003. His academic interests include stream ecology, restoration and the transfer of energy from riparian corridors to the stream channel. Chris's current research focuses on the mechanisms by which allochthonous resource management interacts with benthic habitat characteristics to provide the energy base for stream food webs.

Martin Hurd obtained his Master of Science degree from West Virginia University in 1995. Since then, he has worked as a biologist for the Maryland Department of the Environment and the Department of Natural Resources. Martin is currently working on the State's biological stream survey; collecting and analyzing data on aquatic macroinvertebrates, fish, amphibians, reptiles, water quality, and stream habitat. His current interests include using advanced GIS techniques and predictive models to assess water quality and protect aquatic biodiversity.

Abstract

The Maryland Water Monitoring Council (MWMC) was established in Maryland over 10 years ago. The Council consists of representatives from State and federal agencies, local governments, academia, volunteer monitoring groups, and the private sector who donate their time to enhance coordination and collaboration among the water monitoring community. In fulfillment of this mission, the MWMC's Data Management Committee (DMC) recently developed on-line tools to survey and display planned water quality monitoring activities in the State. A Web survey form (http: //mddnr.chesapeakebay.net/mwmc/data_request_04.cfm.) was created to allow water monitoring groups to quickly and easily enter standardized monitoring program metadata into a central database. Data from this web form is then joined to the geographically referenced data and posted on the Web using ArcIMS GIS software (located at http://cuereims.umbc.edu/MWMC). This ArcIMS system allows any user with an Internet connection and browser to view or query water quality monitoring stations, and their associated metadata, sampled by multiple organizations throughout the State. Combining monitoring program information in this way across multiple levels of government and the private sector allows previously disparate groups to use limited monitoring resources more effectively as well as better target data gaps among monitoring programs.

Development of the map and Web form is a cooperative endeavor between the Maryland Department of the Environment, the Maryland Department of Natural Resources and the University of Maryland Baltimore County. The DMC is currently developing ideas to improve the mapping interface such as including more detailed monitoring program data, watershed status and trends, enhanced query capability, expanded data layers, and Web links to other related data and sites. The DMC is also drafting funding proposals for a full-time GIS staff person

to accelerate map and Web form enhancements as well as soliciting input and suggestions from the water monitoring community on ways to make the MWMC's ArcIMS system a more useful collaboration tool.

Monitoring of Selected Herbicides, Antibiotics, Steroids, and Industrial Chemicals in Water by ELISA

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Fernando Rubio is a biochemical scientist and president of Abraxis, LCC. Fernando has developed immunoassays for analytes of clinical and environmental significance since 1976. His currents interests are the development of immunochemical products to serve the agricultural, environmental, food safety and clinical markets.

Kristy Ramsey has served as a researcher in the department of research and development, Abraxis LLC. Since 2000, she has developed ELISA kits for monitoring environmental pollutants such as pesticides, endocrine disruptors, industrial chemicals and algal toxins.

Paul Stackelberg has worked as a hydrologist with the Water Resources Discipline of the USGS since 1988. Paul participates on the National Water Quality Assessment (NAWQA) Program, assessing the occurrence of pesticides in ground-water samples from across the Nation and identifying those natural and anthropogenic factors most clearly associated with pesticide occurrence. Recently Paul has been working in cooperation with the NJDEP and the Centers for Disease Control to assess the occurrence of contaminants of emerging concern in New Jersey's water resources. Specifically, Paul has focused on the occurrence of pharmaceuticals and other wastewater-related compounds in the State's streams and their persistence and fate through conventional and advanced drinking-water-treatment facilities.

Dr. Meyer has served as a research assistant and research scientist with the U.S. Geological Survey (USGS) since 1988. Mike was the Chief Research Scientist of the USGS, Florida District, Water Quality and Research Laboratory from 2000 to 2003 and is currently the director of the USGS, Kansas District Organic Geochemistry Research Group. The focus of his research is development of analytical methods to study the nature of organic contaminants in surface water and ground water. His primary interest is the study of "emerging contaminants" such as pesticide degradates and pharmaceutical compounds. Dr. Meyer has initiated and participated in several field, watershed, regional, and national scale studies of selected "emerging organic contaminants" in surface and ground water.

Abstract

Concerns due to the potential health effects on human health and wildlife resulting from the production, use, and disposal of numerous chemicals used in agriculture, pharmaceuticals, industry, and household conveniences, have increased over the years. Many of these compounds find their way into rivers and streams from agriculture run offs, raw sewage waste overflows, incomplete waste treatment, other point discharges and diffuse sources. Very sensitive methods are required to analyze for these contaminants in water samples because in many instances, they are present at very low concentrations (ng/mL). Enzyme linked immunosorbent assay (ELISA) technology was used to analyze water samples collected during the summer of 2003 at various locations of water treatment plants (WTP) in New Jersey, and from stream providing raw water to those plants. Each sample was analyzed for selected herbicides, antibiotics, steroids, and industrial chemicals. Details of the technology, testing procedures, and results obtained will be presented.

Making Sense of Turbidity Measurements – Advantages In Establishing Traceability Between Measurements and Technology

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Biographical Sketch of Author
Mr. Sadar has over 14 years experience in the research, development, and application of turbidity and particle analysis technologies as applied to environmental waters. He is a well-known authority on turbidity and membrane technology, has authored several papers on the science of turbidity and its applications, and serves on several American Society for the Testing of Materials (ASTM) sub-committees related to turbidity and suspended sediments measurement. Mr. Sadar received his Bachelor of Science degree in analytical chemistry from Colorado State University in 1988.

Abstract
While turbidity is well recognized as a key indicator of water quality in stream and watershed monitoring, the platforms employed to detect and quantify turbidity yields diverging results. The measurement of turbidity is highly influenced by the instrument's use of radiant incident-light and scattered light detection angle. Further, the accuracy of measurement is subject to particle shape and size, its distribution in a water sample, morphology, and color. As a consequence, interpretation of turbidity values can be perplexing, leading to under- or overstating of measurement values.

Historically, the collection of turbidity data is logged and interpreted without knowledge or trace to the type of platform used and its bias to the measurement. To reconcile this problem, the USGS and ASTM D-19 technical subcommittees on high-level turbidity have begun re-structuring turbidity reporting to lend traceability to the type of platform used in performing the measurement.

The purpose of this paper is to present an overview as to the variety of turbidity measuring platforms used in stream monitoring and to categorize them into equivalent or like measuring units. The value of understanding the difference and bias for each measuring platform should lead to a better interpretation of turbidity as it is related to water quality. The traceability to the technology will provide for better data comparability from a historical perspective.

Sediment and Water Quality Assessment in the Conasauga River Basin

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Adam Sharpe is a graduate student in the natural resources program at North Carolina State University. The focus of his program is in hydrology. Adam's undergraduate degree is from the State University of New York at Cortland, from which he received a degree in biology with a concentration in secondary education. After graduation from SUNY Cortland, Adam taught high school biology, chemistry, and earth science for three years before returning to graduate school. Adam's role in this research project involves the production of the sampling design, sampling protocols, as well as the quality control/quality assurance plans for the research. His role also includes carrying out the sample collection, processing, and analysis.

Abstract
Recent biological inventory data shows a consistent decline in molluscan abundance and biodiversity in the Conasauga River Basin in Northwest GA. The river is impacted by various land uses that include row crop, livestock operations, urban impacts, recreational human uses, and transportation corridors. Preliminary toxicity screening using Vibrio fischeri and the Flash Luminescent Assay indicates acute toxicity of river sediments, particularly at low flow events. One time sampling may not always capture the full impact due to various meteorological events and changing land use patterns. Planned activities include seasonal, monthly, and diurnal sampling of targeted sites in the Conasauga watershed. Analysis of sites will involve traditional biological and chemical characterization of water and sediments. In addition, target sites will be monitored by stable isotope ratio analysis (IRMS), passive sampling devices (PSD), and polar organic chemical integrative samplers (POCIS). PSDs will be used as time integrative samplers to screen for particular monitor hydrophobic organic contaminants in the water. Analysis of sediment and mollusks by IRMS should indicate sources of nitrogen inputs into the river system. POCIS will be used to monitor polar chemicals known to cause acute toxicities in aquatic environments. Sampling will span a twelve-month period, and the data collected will used to determine potential factors responsible for the declines in mollusk biodiversity, abundance, and survival.

Project A.W.A.R.E. – One Week, One Mission, One Piece of Junk at a Time

Brian Soenen

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Biographical Sketch of Author
Brian joined the IOWATER team in March 2002. He graduated from the University of Northern Iowa in 2000 with a bachelor's degree in Natural History Interpretation. Prior to coming to the IDNR, Brian worked as an Interpretive Ranger for the U.S. Army Corps of Engineers at Coralville Lake in Johnson County. His primary duties with IOWATER include program and workshop development, public relations, and coordination of the IDNR's annual Project AWARE.

Abstract
Tenacious rains and bone-chilling winds were no match for dozens of hard-nosed Iowans who spent the first week of National Rivers Month 2003 slogging through mud, wrenching canoes over sand bars and shallow riffles, and spending their vacations dungy, drenched, and dead tired – all in the name of water quality. Project AWARE (A Watershed Awareness River Expedition) is an Iowa DNR-sponsored, weeklong canoe trip down an interior Iowa River. The project is a collaborative effort amongst governmental agencies and private organizations and has proven to be a wonderful tool for engaging citizens in a hands-on, water quality monitoring action project. Over one hundred volunteers from the first annual Project AWARE hauled 109 tires, 16 chairs, 20 barrels, 91 bags of trash, some methamphetamine lab items, a BMX bicycle, and an Easy-Bake® Oven, and much more junk, from the Maquoketa River.

Although daily rains dampened gear, spirits soared as volunteers participated in wildlife and water quality monitoring, educational programs, and streamside cleanup. The 100-mile expedition stretched from the headwaters to the mouth of the river, allowing participants to observe the affects of the watershed surrounding it. Scenic, rocky-bottomed, riparian-protected stretches of the river sharply contrast the cut-banks, silty streambeds, pastures, and junk piles that exist along the way.

Project AWARE strengthens personal connections with natural resources, illustrates the power of volunteerism, promotes advocacy for the environmental ethic, and increases environmental awareness, all of which will help future generations of Iowans respect and honor the legacy they will inherit.

EPA's National Study of Chemical Residues in Lake Fish Tissue

Leanne Stahl[1], Blaine D. Snyder[2], and Jennifer Pitt[2]

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Leanne Stahl is an environmental scientist in the Office of Science and Technology within the U.S. Environmental Protection Agency's Office of Water, with training and experience as a fisheries biologist. Since 1999, she has served as the project manager of the National Study of Chemical Residues in Lake Fish Tissue, moving the project from its planning phase into full implementation. Leanne moved to EPA's Office of Water from the National Oceanic and Atmospheric Administration in 1990 and has worked in a variety of water programs over the last 14 years.

Blaine Snyder is employed as a principal scientist and director of the Baltimore, Maryland office of Tetra Tech, Inc. He is an American Fisheries Society Certified Fisheries Scientist, specializing in the design, implementation and interpretation of environmental impact assessments and aquatic ecological investigations. Mr. Snyder has been involved with the National Study of Chemical Residues in Lake Fish Tissue since the preliminary planning stages, and currently serves as the study's National Sampling Support Manager. Together with coauthor Jennifer Pitt, he has supported the U.S. EPA in the development of the study design, sampling methods, and quality assurance plan, and continues to coordinate all national sampling activities.

Abstract

The Office of Water is conducting the largest national freshwater fish contamination survey undertaken by EPA, the National Study of Chemical Residues in Lake Fish Tissue. Two features distinguish this study from other fish monitoring programs. It includes the largest set of chemicals ever studied in fish, and it is the first national fish contamination survey to have sampling sites statistically selected. When completed in 2005, this study will provide the first national estimates of mean concentrations and distributions of 268 chemicals in fish. It will also provide a national baseline for assessing progress of pollution control activities limiting release of these chemicals into the environment.

Partnerships made this study possible. Agencies in 47 states, three tribes, and two other federal agencies collaborated with EPA for four years to collect fish from 500 lakes and reservoirs in the lower 48 states. Sampling teams applied consistent methods nationwide to obtain samples of predator and bottom-dwelling species from each lake. EPA is analyzing the fish tissue for mercury, arsenic, dioxins and furans, PCBs, pesticides, and other organic chemicals such as phenols.

Results for the first three years of the study show that dioxins and furans, PCBs and mercury were detected in predator species at all sites sampled during the three years. Several chemicals have not been detected in the fish samples, including organophosphate pesticides and other organic chemicals, such as hexachlorobenzene.

Abstract #220

Upper Clear Creek Watershed (Colorado) – A Decade of Systematic Monitoring

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Dr. Steele's career encompasses nearly 38 years in water-quality hydrology and regional assessments of water resources. He has managed many multidisciplinary projects, hydrologic baseline and modeling studies for water-resources planning and management, and mining-related projects. He has consulted on projects dealing with hydrogeochemical interactions, ground-water contamination, aquifer and lake restoration, tailings disposal, hazardous waste/residuals management, design/evaluation of hydrologic monitoring networks, statistical analysis of hydrologic data, stream/subsurface modeling, use-attainability analyses, stream standards, total maximum daily loads assessments, regional ground-water planning, and international water-resources. He has given expert testimony and litigation support. He has developed and taught a short course on *Integrated Watershed Approaches – Monitoring, Modelling, and Management (The 3M Concept)*, offered at two German universities since the year 2000. He has been working as the water-quality technical advisor on behalf of the Upper Clear Creek Watershed Association since 1994, advising on its monitoring programs, conducting QUAL2E model applications, and participating in a range of watershed and stream-standards issues.

Mr. Abel is a professional engineer who has worked for the Colorado Department of Public Health and Environment in the Superfund program for the past 15 years. He is the project manager for the remedial investigation/feasibility study for Operable Unit #4 of the Clear Creek Superfund Site. His prior projects included managing the Argo Tunnel water treatment plant design and construction, a facility that treats acid mine drainage. He wrote the Record of Decision for the Denver Radium Superfund Site in 1992. Mr. Abel also has served as the Department of Health's construction procurement officer since 1997.

Ms. Fendel is a professional engineer with Leonard Rice Engineers, a water resources consulting firm located in Denver, Colorado. She is experienced in water quality standards, NPDES permitting, water quality monitoring, pretreatment, 404 permitting, Endangered Species Act compliance, and other Clean Water Act and Safe Drinking Water Act issues. She worked for the city of Golden (population 15,000) for ten years managing the water treatment division, utilities division and environmental services division and was responsible for environmental regulatory and compliance programs. Prior to that Ms. Fendel worked in water resources for the U.S. Environmental Protection Agency for 7 years.

Abstract

Since 1994, a systematic water-quality monitoring-program network design has been in operation in the upper Clear Creek watershed, located west of the Denver metropolitan area in Colorado. The two major components are: (1) physical, nutrients, and sediment-related variables; and (2) trace metals (both total and dissolved species). At most monitoring sites, streamflows are recorded directly by the U.S. Geological Survey (USGS); otherwise, streamflows are estimated using interstation correlations. Examples of uses of the data include: (a) annual monitoring reports for the watershed; (b) evaluation of seasonal variability and long-term trends in the data; (c) assessment of loadings for selected variables (total phosphorus, and dissolved and total trace metals) which assists in identifying contributing source areas; (d) water-quality stream standards and determination of impaired water quality for specific trace metals; and (e) inputs to water-quality (QUAL2E and WMM) model applications. Finally, resultant data from this systematic program (currently 16 sites, with 8 sampling surveys annually) are evaluated and compared with other sources of water-quality data in the watershed (USEPA, USGS, CDPHE, CDOT, CDMG, and others).

New Partnerships for Regional Water Quality Coordination in the Great Lakes Region

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Kristine Stepenuck coordinates Wisconsin's Water Action Volunteers (WAV) Program. In addition to her role within Wisconsin, she works with partners at the University of Rhode Island Cooperative Extension towards enhancing the capacity of volunteer water quality monitoring within Extension programs across the nation. Regionally, Ms. Stepenuck coordinates with volunteer monitoring program coordinators in 6 other Midwestern states. For this poster presentation, she is representing the co-authors to share information about regional coordination within CSREES Water Quality Programs in the Great Lakes Region.

Abstract

Many water quality issues related to agriculture are regional in scope and require new collaborative approaches to meet these challenges. It is important that USDA Cooperative State Research Education and Extension Service (CSREES) programs contribute to the process of identifying and implementing solutions to address these challenges. In 2000, the Great Lakes Regional Water Quality Leadership Team (RWQLT) formed to enhance partnership opportunities across the region and with EPA Region 5. Comprised of the six State Water Quality Extension Coordinators at the Land Grant Institutions in Region 5, the RWQL Team's goals are to increase communication and collaboration, and leverage University Extension and Research resources across the region to address high priority water quality issues related to agriculture. This poster highlights regional coordination efforts and partnership successes achieved by the RWQLT and demonstrates the role of CSREES programs in addressing water quality issues facing agriculture.

Virtual Fish

Roger E. Stewart II[1], James N. Huckins, Ph.D[2], Tom Pheiffer (retired)[3]

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Roger E. Stewart II, directs the scientific activities of the Agency's Statewide Water Quality Monitoring Program by establishing the priorities, policies, objectives, and procedures; approves the use of technologies and methodologies; manages complex special projects which result in the establishment of new technologies; presents scientific findings for peer review by the scientific community; manages development of project manuals and guidance; works with the public through formal meetings to establish technical regulations. Roger has established the largest most comprehensive trace clean metals monitoring program among all 50 states.

James N. Huckins has been an analytical chemist with the U.S. Fish and Wildlife Service's (F&WS) Fish Pesticide Research Laboratory now the U.S. Geological Survey since 1970. During this period he developed or co developed a number of widely used analytical methods for organic contaminants, which include Semipermeable Membrane Devices (SPMDs, lead inventor). He is a National Research Council adviser (aquatics committee) for postdoctoral research associates. He has served as an adjunct professor of environmental chemistry at Clemson University, South Carolina. He is the recipient of seventeen research performance awards and has published over seventy peer-reviewed research articles.

Abstract

As part of a Federal grant from the USEPA Mid-Atlantic Integrated Assessment program the Virginia Department of Environmental Quality in cooperation with the US Geological Survey Contaminants Effect Research Center has investigated the occurrence of trace organic compounds in freshwater streams. Many states have adopted water quality standards for anthropogenic bioaccumlative organic toxics. The WQS are generally expressed as a water column concentration not to exceed a four day limit more than once in three years. The standards are generally very low and not easily detected using conventional analytical techniques. Semi Permeable Membrane Devices were selected for this study because they overcome the detection limitations of traditional analytical techniques and they are integrative samplers, representing the average water column concentration over a greater than 30 day exposure period.

Sample locations for the study were based on a stratified random design developed by USEPA EMAP. Know as probabilistic monitoring the one year survey was integrated into the VADEQ's long term probmon program, sampling at approximately 50 different sites each year for a variety of water column chemistry, benthic macro invertebrates, and habitat.

The advantage of a probabilistic design is that for a relatively small number of sites, statewide freshwater estimates of the concentrations of most of the hydrophobic trace organic toxics for which we have water quality standards could be determined.

The results and conclusions will be discussed as well as the significance of new technologies and collaborative efforts between the states, USEPA, and the USGS.

The Relationship of Performance Characteristics and Data Quality to the Comparability of Biological Assessments

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Drs. James Stribling and Jerome Diamond are biologists in Tetra Tech's Baltimore Office and Directors in the Center for Ecological Sciences. Dr. Stribling has over 20 years of experience in the development and calibration of biological indicators for assessment of water resource quality. An integral part of that process is ensuring that implementation of routine monitoring programs using those indicators is directly applicable to technical and programmatic objectives.

Dr. Diamond has over 100 years of experience in designing and performing laboratory toxicity tests with emphasis on defining the relationship of controlled laboratory results to actual field conditions. Both have worked off and on for approximately 10 years with the Methods and Data Comparability Board in developing their approach for documenting and reporting data quality characteristics.

Abstract

There is strong interest in the defensibility of combining different datasets for use in developing biological indicators and ecological assessments. Any efforts to combine are contingent upon the quality of data that users are willing to accept (i. e., their data quality objectives). Definition of data quality must occur at the level of the method; direct comparisons of only final assessments are inadequate. Data comparability should be evaluated at two levels: the method and the program. For a method, it is necessary to determine: what level of quality is attainable, and, what level of quality has been attained? Any measurement system (i. e., assessment protocol) is a series of methods (field sampling, laboratory sorting/subsampling [for benthic macroinvertebrates], taxonomic identification, enumeration, data entry, metric calculation, and site assessment), each of which has potential error sources associated with them. The key is to evaluate several data quality characteristics that are traditional to standard QC activities (such as precision, bias, representativeness, completeness, and sensitivity) for each of the methods that make up the biological assessment process. Once the capacity of a method to meet a certain level of quality is demonstrated, then that level becomes the performance characteristic. Thus, a series of performance characteristics is necessary to describe the quality of data produced by an assessment protocol. We demonstrate a framework for organizing performance characteristics and present case studies of their documentation; specifically, field sampling representativeness, laboratory sorting and subsampling bias, and taxonomic precision, as they relate to biological assessment accuracy and comparability.

Squeezing blood from a turnip: Using limited monitoring data, impervious cover and land use information to establish subwatershed management goals and implementation strategies

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Paul Sturm is a watershed planner and biologist at the Center with ten years experience researching and implementing urban and agricultural BMPs and producing local watershed plans. He is knowledgeable in the use and evaluation of best management practices (BMPs) in both urban and agricultural environments and also proficient in the monitoring and interpretation of chemical, physical and biological parameters. His responsibilities at the Center include working with local governments, non-profits and small watershed groups to manage and protect watersheds, performing conservation area assessments and writing technical guidance documents in areas including urban stormwater and site design.

Abstract
The Paxton Creek watershed, a 27 square mile tributary to the Susquehanna River in Dauphin County, Pennsylvania, contains portions of the City of Harrisburg and the suburbs draining from the north and northeast. Typical of most urban watersheds, a variety of monitoring data exists ranging in quality and geographic coverage. Based on disparate monitoring information, how should different management practices be employed and how should goals and expectations be set?

In Paxton Creek, the impervious cover model (the relationship between impervious cover and stream health) provided a backdrop to view limited water quality and biological data, allowing more effective tailoring of goals and management strategies on a subwatershed basis. Three management categories were created for ten subwatersheds (1-10 sq. miles): protection, rehabilitation and enhancement. Five protection subwatersheds featured 10-25% impervious cover, fair/good macroinvertebrates, and forested headwaters. Recommendations designed to help preserve and even improve the biological community in these subwatersheds included land conservation, water quality and groundwater recharge stormwater retrofits, environmentally sensitive design with proposed new development, increased riparian buffers, and improved sediment erosion control. Four subwatersheds targeted for rehabilitation all had impervious cover >25%, fair/poor macroinvertebrate communities, and urbanized headwaters. Recommendations geared towards reducing pollutant loads in these subwatersheds included water quality retrofits, channel protection retrofits, stream rehabilitation, pollution prevention education, illicit discharge detection and elimination, and riparian buffer plantings along with an improved greenway/trail system. The enhancement subwatershed, Paxton Creek mainstem through Harrisburg, is channelized with concrete along much of its length, and has an estimated impervious cover of 56%, poor water quality, suspected illicit discharges (baseflow high ammonia and fecal coliform levels), and combined sewer overflows (CSOs). Rehabilitation of the mainstem for supporting sensitive biological communities is unlikely, therefore tracking down illicit discharges, reducing CSOs, and actively encouraging redevelopment centered on an improved “Creekscape” were recommended.

Abstract #225

NEMI: An Online Tool to Assist Methods Comparability

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Biographical Sketches of Authors

Daniel J. Sullivan is a Hydrologist with the USGS with a background in water quality and information technology for Internet applications. He is currently the co-chair and database developer for NEMI, as well as Acting Co-Chair for the Methods and Data Comparability Board. He is also the Lead Scientist for the Upper Mississippi River, Ohio, and Great Lakes River Basin Regional Synthesis Team for the National Water-Quality Assessment Program.

Lawrence H. Keith has over 35 years of experience in environmental sampling and analysis including developing new methods, validating methods, and applying them to many specific projects. He also is past co-chair of the National Environmental Monitoring Index (NEMI) workgroup and contributes to the development of NEMI-CBR, a database of methods for chemical, biological, and radiological (CBR) methods. He began working with expert systems 20 years ago and is currently developing the CBR Methods Advisor for EPA's Water Security Division.

James Boiani is an Environmental Consultant with Computer Science Corporation (CSC). Mr. Boiani supports NEMI's design and development as a work assignment manager through CSC's EPA contracts. Mr. Boiani also serves as a Task Manager for EPA's Alternate Test Procedure program (which evaluates the comparability of new analytical methods to EPA-approved compliance monitoring procedures), and has served as the lead contractor on a number of EPA regulatory projects related to environmental chemistry and methods development.

Herbert J. Brass is the Analytical Methods Team Leader in USEPA's Office of Ground Water and Drinking Water. He is the Co-Chair of the Methods and Data Comparability Board, a sub-group of the National Water Quality Monitoring Council, whose goal is to achieve comparability, so that data can be assessed across programs and organizations. He also coordinates EPA's drinking water alternative test procedure program that evaluates methods for use in compliance monitoring.

Abstract

The selection of analytical methods is a critical part of environmental monitoring program planning. During planning, monitoring objectives usually influence criteria for the program. Limitations of analytic techniques (e.g., sensitivity, selectivity, accuracy, precision, etc.) often determine the capability and evaluative power of the entire program, and hence proper selection of analytical methods is paramount. Comparing method quality and suitability from the methods themselves is difficult because method protocols contain detailed instructions, typically exist in different formats, are often lengthy, and may not contain all of the information needed to compare one method versus another. The National Environmental Methods Index (*NEMI*) was created to provide a database of method summaries that contain all the kinds of information necessary for method comparison.

NEMI's objective is to provide a user-friendly database of method summaries that is searchable over the Internet. Its development under the Methods and Data Comparability Board ensures that data on critical aspects of methods will receive multi-organizational review and meet interagency needs in this complex technical discipline. *NEMI* is not primarily a database of complete analytical methods. Rather, it is primarily a database of method summaries that include all available information from which to make a scientific comparison of one method versus another.

Secondarily, full methods of public domain methods can be downloaded directly from the database in PDF format. For commercially-available methods, links are provided to websites where these methods may be obtained.

An Assessment of Volunteer Data for Anchorage Streams

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Biographical Sketches of Authors

Shayla Swedlund graduated from the Masters of Science in Environmental Science program at Alaska Pacific University in Anchorage, AK in May 2004. During the summer of 2003, she served as the Quality Assurance/Quality Control intern for the Anchorage Waterways Council. At the AWC she conducted parallel sampling with volunteer monitors to assess the quality control objectives outlined in the Quality Control Plan and continued her thesis research assessing the nutrient and bacteria data obtained by the program.

Richard Myers is Professor and Chair of the Environmental Science Department at Alaska Pacific University. During the 80s and early 90s, his research dealt with air quality and he completed a number of studies on topics such as wood burning impacts using receptor models, indoor air pollution and sick building syndrome. During the last decade most of his work has focused on water quality, primarily working with citizen monitoring groups on the water quality of Anchorage streams. He has worked collaboratively with a number of organizations including USGS, National Park Service, Anchorage Waterways Council, and Municipality of Anchorage.

Abstract

Anchorage Waterways Council's (AWC) volunteer collected data were evaluated to assess the quality of measurements made using methods outlined in AWC's EPA approved Quality Assurance/Quality Control Plan (QA/QCP). Researchers from Alaska Pacific University' s Environmental Science Department conducted paired sampling with volunteer stream monitors following the same test protocols as outlined in the QA/QCP. Additional measurements on several parameters were made using EPA approved procedures. Intensive sampling was conducted on coliforms and nutrients. Total and *E.coli* bacteria concentrations were measured using both volunteer Coliscan® and EPA accepted Hach m-Coli Blue24® membrane filtration methods. Nitrate-nitrogen and ortho-phosphate concentrations were measured using color comparator volunteer methods and a Hach DR890 colorimeter. Several conclusions drawn from this study include:

1) There are statistically significant differences in concentrations of nitrate-nitrogen and ortho-phosphate when comparing volunteer and colorimeter methods;
2) Volunteer monitors are unable to detect potentially harmful phosphate concentrations due to the subjectivity of the color comparator its high method detection limit;
3) There is a statistically significant difference in the concentrations of total coliforms between the volunteer and EPA accepted method, but no significant difference between methods in the counts of *E.coli*;
4) Total coliform bacteria concentrations differ by one order of magnitude during a four- hour span under same stream flow conditions.

Advances in High-Volume Sampling and Trace Analysis of Persistent Organic Pollutants

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David Thal is the Specialty Organics Laboratory Manager at STL Knoxville, where he supervises production and research activities. The activities include organic extractions, purifications and GC/MS analysis. He provides consultation on analytical data/reports; assisting clients in determining analysis needs, training new personnel in isotope dilution, low- and high-resolution mass spectrometry; method development and applications. He has 15 years of experience in analysis of drinking water, waste water, soil, tissues, incinerator ash, sludges, oils, and gaseous mixtures. He has experience in analytical program design and management. Other experience includes, instrument control programming, and statistical process control.

Timothy Wilson is a hydrologist with the US Geological Survey in West Trenton, New Jersey. His current research involves large volume sampling for trace organics at the head-of-tides of the major tributaries to Newark and Raritan Bays in New Jersey. This work is being performed as part of the NY/NJ Harbor Estuary Plan and the NJDEP Contaminant Assessment and Reduction Program. He holds a Ph.D. in low-temperature geochemistry from Michigan State University, and has over 15 years experience working for academic, consulting, and government concerns.

Abstract

TMDL development and contaminant transport modeling require accurate, sensitive measurements of persistent organic pollutants (POPs) in estuarine waters. Detection in the fg/L to ng/L range is often needed to determine inputs from tributary and discharge waters. The exact detection limit required depends on the toxicity and presence of each compound, and is often below the limit obtainable by conventional EPA methods. Conventional water grab sampling and analyses result in frequent non-detects, that offer and little insight into loadings and background levels. New approaches to sampling and analysis have been developed, and applied, to overcome these problems.

Isotope dilution SIM-LRMS technique has been successfully applied to determine PAHs in aqueous and suspended matrices. Isotope dilution HRMS analysis has been evaluated as an option for organochlorine pesticides in environmental matrices. These methods and adaptations of EPA Methods 1613B (PCDD/PCDFs) and 1668A (PCB congeners) have been applied to components of a high-volume water sampling system. Trace organics platform samplers (TOPS) have been used in conducting sampling for the New Jersey Toxic Sediment Reduction Plan, in support of TMDL development. This innovative sampling method allows the effective sampling size to be increased to 50-1000 L.

The TOPS flow-integrated, high-volume sampling, coupled with high-specificity extraction, cleanup and analysis provided detection limits several orders of magnitude lower than established EPA grab sampling and analytical methodology. Good recovery and precision have been demonstrated in the laboratory methods. This approach has provided the Contaminant Assessment and Reduction Program (CARP) previously unattainable information regarding the background contamination and loading mechanisms for the Newark Bay estuary. The techniques are expected to be applicable in other water body systems, as well.

Abstract #228

An Innovative Approach for Evaluating the Horizontal and Vertical Distribution of Chlorinated Ethenes in a Fractured Bedrock Aquifer

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Dennis R. Theoret, P.G., is a Vice President and Senior Project Manager with Apex Environmental Engineering & Compliance, Inc. and has over 18 years of experience applying geologic and hydrogeologic principles to the hazardous waste industry. He holds both a Bachelors and Masters degree in geology.

Tim M. Jellett is a geologist and Project Manager with Apex Environmental Engineering & Compliance, Inc. He manages and coordinates field operations using various innovative field investigation techniques for hazardous waste site investigations.

Abstract

During the completion of an RI/FS project in a complex geologic setting in north Florida, multiple techniques were utilized to develop a comprehensive Conceptual Site Model (CSM) for a bedrock aquifer. The CSM was developed upfront using a combination of: literature research; USGS topographic maps; bedrock topography maps; fracture trace analysis; geophysical borehole logging; review of private bedrock well logs; and review of publicly available ground water data. The CSM provided an initial understanding of the geology and hydrogeology of the bedrock aquifer.

Validation of the bedrock CSM consisted of the following field investigations: continuous lithologic logging of two boreholes located within the approximate chlorinated ethenes plume axis using Sonic drilling from 100 to 250-ft below land surface; collection of ground water samples at 10-ft depth intervals as boreholes were advanced using inflatable packers in conjunction with temporary 5-ft well screens; and the subsequent installation and sampling of four, 1.25-inch temporary vertical profiling wells (TVPWs) within each borehole.

Based on the results of the continuous packer and TVPW sampling, two horizontal flow zones representative of the upper 50-ft of affected aquifer were identified for multi-level piezometer (MLP) installations. The subsequent permanent monitoring well network consisted of 9 bedrock compliance wells to monitor the plume, which equates to about 1 well every 20 acres. By developing the comprehensive CSM upfront, and validating the model using TVPW and MLP screening methodology, the horizontal and vertical distribution of the plume was estimated, and the anticipated field investigation and long-term monitoring costs were reduced significantly.

Detection of temporal trends in Ohio River fish assemblages based on lockchamber surveys (1957-2001)

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Biographical Sketches of Authors

Jeff Thomas is an aquatic biologist for the Ohio River Valley Water Sanitation Commission (ORSANCO). Jeff has served as a crew leader in the biological program since beginning with ORSANCO in 2000. He has done extensive electrofishing work on the Ohio River and is currently responsible for managing ORSANCO's fish database and assisting with the fish tissue program. His work with Ohio River fish caused him to be involved in the creation of an Ohio River fish index (ORFIn).

Erich Emery is an aquatic biologist and manager of ORSANCO's biological programs. His primary research efforts have focused on developing fish community-based assessment methods for the Ohio River, culminating in the recent development of the Ohio River Fish Index, a multi-metric tool for assessing fish community condition. His other areas of research have included the study of macroinvertebrate and fish community responses to disturbance, influences of in-stream habitats on Ohio River fish, and temporal trends in Ohio River fish community condition. Erich began his career with ORSANCO in 1993.

Dr. Frank H. McCormick was a research ecologist with the US Environmental Protection Agency from 1991 to 2003 conducting research on responses of aquatic ecosystems to anthropogenic disturbance regimes, particularly environmental contaminants. In 2003, he became a fish biologist and team leader with the Pacific Northwest Research Station of the US Forest Service in Olympia, WA studying aquatic and landscape interactions.

Abstract

ORSANCO, along with cooperating state and federal agencies, sampled fish assemblages from the lockchambers of Ohio River navigational dams from 1957 to 2001. To date, 377 lockchamber rotenone events have been conducted, resulting in the collection of nearly three million fishes, representing 116 taxa, in 19 families. We observed significant temporal trends in Ohio River fish populations riverwide at the assemblage, guild, and species levels. In all, 40 of the 116 taxa collected in the lockchamber surveys changed significantly over time. Sixteen species did not change. Sixty species could not be analyzed either because of incomplete data or insufficient abundance. Modified index of well-being (MIWB) scores and changes in guild structure indicated significantly ($p<0.05$) improving fish assemblages throughout the Ohio River. Quantile regression of the abundance of individual species by year revealed significant declines ($p<0.05$) in populations of several pollution-tolerant species (e.g., *Ameiurus* spp., *Carassius auratus*) with time, while some intolerant species (e.g., *Moxostoma macrolepidotum, Hiodon tergisus*) have increased in recent years. Fish assemblage metrics that would be expected to decrease with improving conditions in the Ohio River (percent tolerant individuals, percent non-indigenous individuals, and percent detritivore individuals) also declined ($p<0.05$). These changes coincide with marked improvement of the water quality in the Ohio River over the last 50 years, particularly in the aftermath of the Clean Water Act (1972).

Watershed Approach to Project Implementation and Effectiveness Monitoring

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Kathy Thornburgh has 19 years of experience in monitoring and directing habitat and water quality programs. Kathy currently works for the Surface Water Management Division of Snohomish County, Washington, and directs programs in ambient monitoring, water quality complaint response, technical assistance to businesses in reducing pollution, project evaluation, and habitat restoration. Past experience includes work with the Tulalip Tribes, Alaska Department of Fish and Game, University of Washington Friday Harbor Laboratories, and The Nature Conservancy. Kathy is a member of the Pacific Northwest Native Freshwater Mussel Workgroup, the Northwest Biological Assessment Workgroup, and is a Certified Fisheries Professional through the American Fisheries Society.

Karen Wood-McGuiness has 10 years of experience in natural resource planning and management. Presently, Karen works for the Surface Water Management Division of Snohomish County, Washington as a watershed steward implementing water quality monitoring programs and developing and implementing stream restoration projects within watersheds. Previous experience includes work with the Snohomish County Planning and Development Services, Alaska Department of Natural Resources, and the Massachusetts Department of Environmental Quality Engineering.

Abstract

Snohomish County, Washington, approaches project implementation by focusing work in watersheds of 15 square miles or less to effectively produce measurable changes in water quality and aquatic habitat. We choose relatively small watersheds to focus intensive project implementation in an effort to produce improvements in water quality more quickly than in larger watersheds. We monitor at the watershed, sub-watershed, and reach scales to identify problems and to assess the effectiveness of our projects.

We use various assessment techniques to evaluate conditions, to identify water quality and resource problems, and to prioritize restoration efforts. We use water quality monitoring to assess pollutant loading. Surveys of benthic invertebrates and freshwater mussel populations indicate watershed health and determine baseline conditions. Stream habitat surveys and temperature monitoring identify physical limitations to fish production that could be moderated or removed by habitat rehabilitation.

We monitor projects for effectiveness at the project reach scale of several hundred feet. Effectiveness monitoring is a key to determine if projects produce measurable changes in water quality and aquatic habitat. We develop individual three- to five-year effectiveness monitoring plans for each project based on the specific goals and objectives for that project. While most of our watershed efforts target reductions in bacteria levels and increases in dissolved oxygen, we include improvements in fish habitat and increases in community education and involvement as goals in our watershed restoration efforts.

Abstract #231

Bay-Delta and Tributaries Cooperative Data Management System

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Karl Jacobs is Chair of the Interagency Ecological Program Data Utilization Work Group, as well as manager/member of the team developing the comprehensive Bay/Delta and tributaries databases for the Interagency Ecological Program, Central Valley Improvement Act, Stakeholders and other groups who collect and need access to environmental data within this region. He is Section Chief for the Interagency Information Systems Section within the CA Department of Water Resources.

Liz Cook and Chris Fox primarily work with data providers for the data management system, working in MS Access. Catalina Guillen and Danny Luong provide Informix database administrative support. Kris Lightsey is our Web pages developer, as well as providing support on Informix. Marc Vayssieres provided overall database support and assistance with web design.

Abstract

The Bay/Delta and Tributaries (BDAT) Cooperative Data Management system is a data sharing process that provides data organization and distribution services for water resources-related information through collaborative efforts at local, state and national levels. The system's infrastructure is centered on modern relational database and associated data distribution technologies. Three main elements include: 1) local desk-top relational database applications, 2) large centralized comprehensive relational databases, and 3) web based applications and user interfaces built using the best state-of-the-art technologies available, including data query tools, WWW-oriented distribution strategies and map serving software.

The first element encourages groups to participate in the system by providing customized applications that support superior data management and sharing. These applications also include automated features that enable users to transfer data to the comprehensive databases; the second element is where attributes such as the names of fish species, locations, analytes etc. are standardized. The third element makes data selection and retrieval from the comprehensive databases available to any user with internet access.

Data users and decision makers are gaining access to multiple standardized data sets from a single source as data from many groups become centralized and available on the web. This enables users to focus on analyzing data instead of spending time trying to find, clean up and organize diverse data sets. The BDAT Cooperative Data Management system has improved access to data collected from the San Francisco Bay/Delta and their tributaries.

Abstract #232

Comparing Monitoring Methods: The Grind About Sonicated Chlorophyll

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Anke Mueller-Solger and Marc Vayssières are Environmental Scientists at the California Department of Water Resources (DWR). Both received doctoral degrees in Ecology from the University of California, Davis, in 1998. Their work at DWR centers on long-term interagency environmental monitoring and shorter term studies of water quality and lower trophic level organisms in the upper San Francisco Estuary. Anke Mueller-Solger also holds a part-time position as a Staff Research Associate in charge of two estuarine ecology projects at the University of California, Davis.

Kitty Triboli worked for DWR as a senior water quality engineering associate for over three decades until her retirement in fall 2003. She was in charge of carrying out the study presented here. Due to travel restrictions, Anke Mueller-Solger and Kitty Triboli will not be able to attend this conference. Please e-mail questions and comments to Anke Mueller-Solger at amueller@water.ca.gov.

Abstract

Method continuity is an essential attribute of long-term monitoring programs, ensuring data comparability over time and enabling comprehensive time series analyses. Nevertheless, sampling and analysis methods often undergo modifications, e.g. to upgrade and modernize instrumentation, improve sampling or analytical efficiency, or to better comply with recognized standard methods. For each change in methods, method comparison tests should be conducted, and the results should be incorporated into metadata files to demonstrate continued data comparability. Here, we report the results of a recent year-long study comparing methods for sampling and extraction of chlorophyll *a* (CHL) used by the California Interagency Ecological Program's Environmental Monitoring Program (EMP) before and after 1998 as well as from a historical comparison of CHL extraction methods conducted in 1978. To analyze the method comparison data, we used two statistical techniques commonly used in clinical studies (bias plots and Deming regression) that may not be familiar to many environmental scientists. Overall, we found good agreement between the historical and current EMP CHL methods. Where present, differences in methods were usually not greater than variability due to method imprecision. We hope that our study will inspire more comparisons of methods used by environmental monitoring programs and bring greater awareness to the critical issues of method validation and data comparability in long-term ecological studies. Details about this study can be found at http://www.iep.water.ca.gov/report/newsletter/2003fall/IEPNewsletter_fall2003_mar23.pdf.

A Probability-based Monitoring Program for Assessing Status and Trends in the Biological Condition of Maryland Non-tidal Streams at Multiple Spatial Scales

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Dr. Jon Vølstad is the Versar Leader for Statistics & Fisheries. He has directed the development and implementation of many large-scale research surveys and monitoring programs for local, state, regional, national, and international institutions. Dr. Vølstad played an integral role in the development of the Maryland Biological Stream Survey, a nationally recognized ecological assessment program, developing the survey design and the analytical methods for evaluating stream condition. He also helped the Maryland Department of the Environment develop and implement biological criteria for streams and the Chesapeake Bay.

Dr. Mark Southerland is a principal ecologist with Versar, Inc. He was the primary author of the 1990 EPA program guidance on the use of biocriteria in surface waters and drafted the first summary of state efforts to develop and implement biocriteria. Dr. Southerland now directs Versar's support of the Maryland Biological Survey, including the development of biological indicators for fish, benthic invertebrates, amphibians and reptiles, and physical habitat. He also recently completed development of biological criteria for the Hudson River.

Nancy Roth is a senior scientist and program manager with Versar, Inc. Since 1996, she has been the lead author of comprehensive statewide reports for the Maryland Biological Stream Survey. Ms. Roth was instrumental in developing and validating the fish IBI for Maryland streams and has assisted the state in developing biological criteria for streams. Ms. Roth also develops assessments and management plans for priority watersheds in Frederick County, MD, Fairfax County, VA, and other local jurisdictions.

Paul Kazyak has been an aquatic scientist with Maryland DNR since 1993. He oversees the Maryland Biological Stream Survey and also serves as Training and QC Officer for the program. Since 1994, he has taught several courses in aquatic ecology to graduate students at Johns Hopkins University.

Dr. Ron Klauda joined the Maryland Department of Natural Resources in 1990. He is currently Director of the Monitoring and Non-Tidal Assessment Division, a group that is responsible for monitoring and assessing the condition of Maryland's surface waters from the mountains to the sea. Ron is an aquatic ecologist who received his Master's and Doctoral degrees from Penn State University.

Abstract

The Maryland Biological Stream Survey (MBSS) is a statewide probability-based survey for assessing the status and trends in the water chemistry, physical habitat, and biological condition of wadeable, non-tidal, streams in Maryland. The MBSS evolved into a statewide survey in 1995, following pilot studies in 1993 and 1994 to develop sampling methods and identify management objectives. Field data are collected from a representative sample of 75-meter stream segments across the state over a three to five-year cycle to facilitate cost-effective use of field crews. During the first (1995-1997) and second (2000-2004) rounds, a lattice sampling design was used to select watersheds randomly in time and space, while sites along the network of streams within each watershed were selected by stratified or simple random sampling. In the second round, changes in management objectives resulted in a design focused on the assessment of smaller Maryland 8-digit watersheds. Using this design, biological indicators for fish and benthic invertebrate communities from the MBSS provided the basis for the State's biocriteria framework and 303d listing of impaired waters under the Clean Water Act. In this paper, we discuss how past and future changes in monitoring objectives have been and can be accommodated in a long-term MBSS. For example, a panel design could be used for scheduling future sampling of watersheds over time. In addition, sampling with partial replacement could be conducted within watersheds to improve the ability to detect trends in watershed condition.

Using Fatty Acid Profiles of Fishes to Diagnose Watershed Health

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Dr. Martha J.M. Wells, an environmental chemist, is Professor of chemistry with the Center for the Management, Utilization and Protection of Water Resources and Chemistry Department at Tennessee Technological University. She has professional experience in federal, industrial, and academic laboratories and has conducted extensive research in sample preparation and chromatographic techniques. Wells' current research interests are focused on pollutant fate and transport, fatty acid characterization in fishes, humic substances and disinfection by-products, endocrine disrupting chemicals, and environmental justice. Wells currently serves as Alternate Councilor on the Executive Committee of the American Chemical Society Division of Environmental Chemistry.

Le-Ellen Dayhuff-Nelson is an Assistant Professor of Mathematics at Volunteer State Community College, and a Ph.D. candidate in Environmental Sciences—Chemistry Concentration at Tennessee Technological University. She is researching fatty acids in fish under the direction of Dr. M.J.M. Wells at the Center for the Management, Utilization and Protection of Water Resources. Their study of specimens collected from the Ohio River demonstrated that the fatty acid profile indicates existence of geographic subpopulations of fishes.

Abstract

This presentation promotes the potential use of fish fatty acid profiling in a water quality monitoring program for diagnosing watershed health.

The lipid content of an organism and the fatty acid composition of these lipids depend on biological and physiological processes and environmental conditions. The lipid content and distribution of individual fatty acids in fishes may vary among age, sex, species, location, or season. All of these factors may be influenced by diet, as the food supply of fishes differs among bodies of water over time according to environmental conditions. Bodily lipid stores of fishes also directly influence the retention of hydrophobic organic pollutants.

To date, percent total lipids in the white muscle fillet has been measured in our laboratory for 846 individual fish, and the fatty acid profiles of 731 of those individual fish were evaluated. Fish species examined included: largemouth bass (wild and cultured), black crappies (wild and cultured), black-nose crappies (cultured), white crappies (wild and cultured), walleyes (wild and cultured), white bass (wild), striped bass (wild), *Morone* hybrids (wild), channel catfish (wild), smallmouth buffalo (wild), sauger (wild), and paddlefish (wild). The fishes analyzed in our research were sampled from various locations including: Chicamauga Reservoir (TN), Norris Reservoir (TN), Cherokee Reservoir (TN), Tims Ford Reservoir (TN), Greers Ferry Reservoir (AR), Huntsville Creek (AL), Eagle Bend State Hatchery (TN), Hopper-Stevens Hatchery (AR), American Sport Fish Hatchery (AL), and six locations in the Ohio River (WV, OH, KY, IN, IL).

Top Down or Bottom Up?
ALLARM's Experience with Two Operational Models for Community Science

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Candie C. Wilderman is a Professor of Environmental Sciences at Dickinson College in Carlisle, PA. She earned a B.S. in Geology from Tufts University, an M.A. in Geology from Harvard University and a Ph.D. in Geography and Environmental Engineering from Johns Hopkins University. She is also Founder and Science Director of ALLARM (Alliance for Aquatic Resource Monitoring), a community-based volunteer stream monitoring network in Pennsylvania, founded in 1986 and staffed by Dickinson College faculty and students. Her teaching and research interests include: operational models for community-based research, watershed assessment and management, aquatic ecology, and Chesapeake Bay restoration and protection issues.

Alissa Barron served as the first Assistant Director of ALLARM (The Alliance for Aquatic Resource Monitoring) from 2001-2003. She directed ALLARM's involvement in a statewide network of watershed service providers, providing capacity-building technical assistance to watershed organizations and coordinating a statewide quality control program for water chemistry. Alissa currently serves as the Outreach and Education Coordinator of the National Oceanic and Atmospheric Administration's Coral Reef Conservation Program. She holds a B.A. in Environmental Studies from Brown University.

Lauren Imgrund is the Director of The Alliance for Aquatic Resource Monitoring (ALLARM) at Dickinson College. She is responsible for leadership of the ALLARM program including overseeing the operation, managing the budget, fundraising, training, and supervising the staff. She develops and executes technical assistance to watershed organizations and represents ALLARM on state and non-profit advisory panels. Lauren has worked in the conservation field for 15 years and has a B.S. in Environmental Science from Juniata College, Huntingdon, PA.

Abstract

Most operational options for community science in the US can be categorized along a multi-dimensional continuum of community involvement -- from community-based participatory research or "science by the people" to the "community workers model", where the role of volunteers may be limited to sample collection for a scientific institution or agency. The Alliance for Aquatic Resource Monitoring (ALLARM), a project of the Environmental Studies Department at Dickinson College in Carlisle, PA, partners with Pennsylvania communities and individuals who are working to protect and restore watersheds. For the first ten years of the program, ALLARM enlisted hundreds of volunteers across the state of Pennsylvania in research on the effects of acid deposition on Pennsylvania waterways. In 1996, our focus shifted to work cooperatively with volunteer stream monitoring groups to identify watershed issues specific to each community and to provide training for volunteers to address these issues. ALLARM's experience of evolving from a single-issue, "top-down" program to a multi-issue, "bottom up" program has given us some special insights into the strengths and challenges of the different models.

Attributes of the two models that we have used will be examined in terms of: 1) differences in the nature and scope of the issues addressed, 2) the required investment by the service provider to meet the mentoring needs of the community to achieve the goals of the project, and 3) the outcomes of the projects in terms of the interest and engagement in the project, community-building, ownership and understanding of data, and empowerment of community members.

Buzzards Bay Embayment Health Baywatchers: The Coalition for Buzzards Bay Citizen's Water Quality Monitoring Program

Tony Williams

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Biographical Sketch of Author

Tony Williams is the water monitoring coordinator for The Coalition for Buzzards Bay Citizen's Water Quality Monitoring Program, or Baywatchers. Since1996, he has organized and trained 100+ volunteers each summer as the program is moving into its 13th year of monitoring 30 Harbors and Coves of Buzzards Bay. He has expanded the monitoring design, quality assurance plan, and sampling methods, and continues to coordinate all sample collection activities for the Coalition. Tony moved to Cape Cod and joined the Coalition after working a number years on different ground water projects, coastal marine habitat research and with public environmental education programs. He has worked for the Northern Virginia Park Authority, Mevers and Associates- Environmental Consultants, Pennsylvania Department of Agriculture and Penn State University, and with the Florida Department of Natural Resources Marine Research Institution. Together with technical support from the Coastal Systems Group at the UMass Dartmouth School for Marine Science and Technology, he has maintained one of the largest coastal monitoring programs in the Commonwealth of Massachusetts.

Abstract

Baywatchers: The Coalition for Buzzards Bay Citizen's Water Quality Monitoring Program was initiated in 1992 to document and evaluate nitrogen-related water quality and long-term ecological trends in Buzzards Bay. The research objective is to better understand the Bay ecosystem and its response to human– related impacts in order to guide restoration and protection. What's at Stake: Although much of the Bay ecosystem remains relatively healthy, major changes in land use and nutrient loading from the surrounding watershed are resulting in significant changes in habitat health along the Bay coastline. At greatest risk are the Bay's more than 30 harbors, coves and river mouths which receive the bulk of the nutrient load from the watershed. Widespread Problem: Nutrient overloading, or eutrophication, is the greatest long-term threat to the Bay ecosystem. The difficulty with managing nitrogen loading is its widespread distribution from a wide array of sources all of these sources are rooted in the watershed's ever-growing population which has more than doubled this century alone to now include 370,000 people. Citizen Volunteers: Involving citizen volunteers allows the Coalition to achieve the ambitions goal of monitoring all of the Bay's major embayments – an area covering more than ¼ of the Massachusetts coast. The program has the dual benefit of collecting comprehensive water quality data while education and empowering people. This encourages citizens to get involved with management and restoration of the Bay's resources at the local level, and also provide water quality data to both the Local and State Environmental Managers.

Sampling Strategies for Determining Volatile Organic Compound Concentrations and Loads at Karst Springs

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Shannon Williams (swilliam@usgs.gov) is a hydrologist with the U.S. Geological Survey. He has worked with the USGS in Tennessee since 1994. His recent research activities have focused on examining the fate and transport of contaminants in karst and developing water-quality monitoring techniques.

William Wolfe (wjwolfe@usgs.gov) is a hydrologist with the U.S. Geological Survey. He has worked with the USGS in Nashville, Tennessee since 1990. Dr. Wolfe's research interests include contaminant movement in karst aquifers, hydrology and ecology of karst wetlands, and the ecological effects of climate change. He is currently working on developing models of unsaturated-zone water balances in relation to forest cover in low-relief karst landscapes.

James Farmer (jfarmer@usgs.gov) is a geologist/biologist with the U.S. Geological Survey. His recent research activities have focused on examining the hydrogeology of karst aquifers and developing microbiological monitoring techniques.

Abstract

The influence of different sampling strategies on estimating volatile organic compound (VOC) loads and characterizing VOC concentrations was evaluated at three karst springs in Tennessee. During a six-month period, VOC samples were collected weekly at all three springs and as frequently as every 20 minutes during storms at the two springs with variable water-quality conditions. Total 6-month loads were calculated using the VOC data and the data were systematically subsampled data to simulate several potential sampling strategies.

Results from the study indicate that sampling strategies for karst springs need to be developed on a site-specific basis. The use of fixed sampling intervals (as infrequently as quarterly or semiannually) produced accurate concentration and load estimates at one of the springs; however, additional sampling was needed to detect storm related changes at a second spring located in a similar hydrogeologic setting. High frequency or flow-controlled sampling was needed at the third spring, which had the most variable water-quality conditions. The use of fixed sampling intervals at the third spring significantly affected the accuracy of load calculations and the detection of pulses of high contaminant concentrations that might exceed toxicity levels for aquatic organisms.

Assessing Restoration Efforts in the Lake Okeechobee Watershed Through a Nutrient Load Monitoring Program

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Abstract

Lake Okeechobee is the heart of south Florida's water supply and flood control system and is a major source of water for the Everglades. Agricultural development in the watershed and canal construction during the last century have resulted in excess nutrient inputs and more efficient delivery of stormwater to the lake, causing a decline in ecosystem health. The 2000 Lake Okeechobee Protection Act (Chapter 00-130, Laws of Florida) and the congressionally-authorized Comprehensive Everglades Restoration Plan/Lake Okeechobee Watershed Project (LOWP) have committed the State of Florida and the Federal Government to restoring and protecting Lake Okeechobee through a coordinated effort among the South Florida Water Management District, the State of Florida, and the U.S. Army Corps of Engineers. The U.S. Geological Survey, in cooperation with the U.S. Army Corps of Engineers and South Florida Water Management District, is operating a 10-year water-quality and streamflow monitoring program at the sub-basin scale in the LOWP area. The objectives of the monitoring program are to examine spatial and temporal trends in nutrient loads and to compare pre- and post-restoration activity conditions. The LOWP area is a low-gradient watershed that has numerous flow-control structures and streams which are subject to bi-directional flow and backwater conditions. These factors pose unique challenges to the data collection process.

Temporal Variation in Ohio River Macroinvertebrates: A Historical Rock Basket Comparison, 1960s to Present

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Matt Wooten is an aquatic biologist for the Ohio River Valley Water Sanitation Commission (ORSANCO). Matt began his career with ORSANCO in 1999 and has served as a crew leader in the biological program the entire time. He has done extensive electrofishing work on the Ohio River and is currently the macroinvertebrate program lead. His work with macroinvertebrates has focused on the development of an Index of Biotic Integrity for the Ohio River. Prior to coming to ORSANCO, Matt worked the West Virginia District of USGS during the Kanawha/New River NAQWA program.

Erich Emery is an aquatic biologist and manager of ORSANCO's biological programs. His primary research efforts have focused on developing fish community-based assessment methods for the Ohio River, culminating in the recent development of the Ohio River Fish Index, a multi-metric tool for assessing fish community condition. His other areas of research have included the study of macroinvertebrate and fish community response to disturbance, influences of in-stream habitats on Ohio River fish, temporal trends in Ohio River fish community condition. Erich began his career with ORSANCO in 1993.

Brent Johnson is an aquatic ecologist with the Ecological Exposure Research Division of the U.S. Environmental Protection Agency. Since starting with EPA in 2003, Brent has worked as a Principal Investigator with the Ecosystem Research Branch. Brent came to EPA after earning his PhD from the University of Georgia. His primary research efforts have focused on developing assessment methods in streams and rivers for macroinvertebrates. Prior to coming to EPA, Brent also spent time employed the Florida Department of Environmental Protection and the Kentucky Division of Water.

Abstract

Collecting macroinvertebrates from the Ohio River has historically presented researchers with the challenge of collecting adequate samples. One method, rock basket artificial substrates, was utilized in the 1960's and 1970's. With this method, a steel basket (7" diameter, 11" long) was filled with 2 – 3 inch limestone aggregate and suspended by steel cable in 2 – 3 feet of water. The baskets were generally suspended from lock chamber walls, although other permanent structures, such as concrete water intakes, were also used. The objective of this study was to repeat these rock basket surveys in order to observe temporal trends within the macroinvertebrate community. Rock baskets were deployed in the same area (when possible) of the previous studies and remained in the water for a colonization period of six weeks. The macroinvertebrate communities were examined using to methods: (1) a draft index developed for Ohio River macroinvertebrates and (2) the Shannon-Wiener Community Similarity Index. Box and whisker plots are used to demonstrate the increase in macroinvertebrate index scores over time. These same trends are observed among the individual metrics of the index. The Shannon-Wiener index also produced higher values in the recent samples, indicating a more evenly distributed macroinvertebrate community. These results indicate marked improvement in the macroinvertebrate community over the past 35 years.