Coordinated Monitoring in the Trinity River Basin

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Biographical Sketch of Author

Mr. Clingenpeel is the Manager of Special Studies and Assessments for the Trinity River Authority of Texas. He has a BA and BS in Biology from the University of Texas and an MS in Environmental Sciences from the University of North Texas. Mr. Clingenpeel is the project manager for the Trinity Basin Clean Rivers Program and as such is responsible for coordinating monitoring efforts throughout the basin. He has been active in the Texas Water Quality Monitoring Congress and serves on the board of directors of the Texas Rivers and Reservoirs Management Society.

Abstract

The Trinity River basin slices through the middle of the state of Texas, covering some eighteen thousand square miles from its origins near the Red River to its terminus near Anahuac, where it empties into Trinity Bay. As the river proceeds through the Dallas-Fort Worth area, it receives approximately 550MGD's of domestic municipal effluent. The river is therefore routinely effluent dominated, especially during the region's dry summers. Concurrently, the river is a major source of drinking water for the Dallas-Fort Worth area and the City of Houston. There is therefore significant interest in Trinity basin water quality. Accordingly, numerous entities have established comprehensive monitoring programs, some of which have been in place for fifty years.

The Trinity River Authority, under the Texas Clean Rivers Program, is tasked with collecting water quality data in the Trinity basin. Data provided via this program are used in regulatory processes by the Texas Commission on Environmental Quality, the State's environmental regulatory body. In order to best meet this obligation, TRA partners with the aforementioned entities that have established independent monitoring programs. This strategy has had many advantages, including huge cost savings, outstanding watershed coverage, and the fostering of a spirit of coordination. The challenges of bringing these autonomous entities into a single coherent program however, have been daunting. Working through these issues a cohesive group of eight entities has emerged and a comprehensive, basin-wide monitoring program covering almost 200 stations, has been established. The key components that make this coordinated effort a success, include efforts to coordinate monitoring, annual training, data management and quality assurance.

Maryland Water Monitoring Council

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William Stack is a Program Administrator of the City of Baltimore's Water Quality Management Section in the Department of Public Works and has served in that capacity since 1989. He has a B.S. and M.S. Degree in Biology and is a registered Professional Engineer. The principal responsibilities of his section include the Municipal Stormwater Permit Program, Source Water Protection Program, and Flood Warning Program. His section is involved in numerous water monitoring studies involving the urban streams and source water tributaries and reservoirs. Mr. Stack participates in numerous professional organizations and is chair of the Maryland water Monitoring Council.

Robert J. Shedlock is the Associate Chief of the Maryland-Delaware-District of Columbia Office of the USGS in Baltimore, MD. He joined the U.S. Geological Survey in 1976 after earning a B.S. degree in geology from the University of Notre Dame and a Masters degree in geology from the University of Michigan. His professional experience includes published work in ground-water flow and quality, wetland hydrology, regional water-quality assessment, and urban hydrology. He is a member of the American Geophysical Union and the Society of Wetland Scientists. He currently serves as the vice chairman of the board of the Maryland Water Monitoring Council.

Abstract

The Maryland Water Monitoring Council (MWMC) was formed in 1995 to facilitate communication, coordination, and collaboration among government agencies and other organizations involved in water monitoring in Maryland. The council accomplishes these goals through a series of forums including an annual conference, topical workshops, and several standing and ad hoc committees that meet several times a year. MWMC committees deal with a range of topics including monitoring and assessment, data management, and program coordination.

An executive board consisting of members who serve multi-year rotational terms guides the council. The members represent several stakeholder groups including local, State, and federal government agencies, the academic community, consultants, and non-governmental organizations involved in water monitoring. The board is supported by an executive secretary whose time is provided by the Maryland Department of Natural Resources.

The council employs ad hoc workgroups and roundtables to address statewide monitoring issues. In 1997, MWMC formed a work group that produced an extensive report on the stream gage network including recommendations for addressing gaps in the network. The stream gage network subsequently grew by over 30%. Recently, a similar work group has been evaluating the ground-water level network and is preparing a report on its findings. The council also sponsors an annual stream roundtable meeting in late winter to allow agencies to present their stream monitoring plans for the next field season so that opportunities for collaboration can be identified.

In 2002 the Board of Directors began the process of developing a strategic plan to coordinate the activities of the Council and to identify the resources needed to accomplish the Council's goals.

A Federal-Provincial Approach to Water Quality Monitoring

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Andrea Ryan is an Environmental Monitoring Scientist in the Aquatic and Atmospheric Sciences Division of the federal Department of the Environment, Pacific and Yukon region. Since 1990, Andrea has been involved in the Canada-British Columbia Water Quality Monitoring Agreement and currently serves as one of the Agreement Coordinators along with coauthor Les Swain from the Government of British Columbia. Andrea participates in many multiagency committees including the Columbia River Integrated Environmental Monitoring Program, Columbia River Transboundary Gas Group and the Quality Assurance Working Group.

Les Swain is the Water Quality Network Specialist for British Columbia Ministry of Water, Land and Air Protection. He has worked in the environmental field for 32 years. During that time, Les has sampled lakes and rivers in all areas of Manitoba and British Columbia, performed water quality assessments on major river systems, chaired a western Canada Committee to develop target loadings for acidic inputs, and developed a water quality index for BC (later adapted for use in all Canada) to interpret water quality information for the public. Les has been Chair of the CCME Water Quality Task Group, BC co-chair for the Puget Sound/Georgia Basin International Task Force and co-chair of the Columbia River Transboundary Gas Group.

Abstract

The Canada-British Columbia Water Quality Monitoring Program is a model of how effective partnership and collaboration can be in delivering a successful, sustainable monitoring program. In 1985, the federal Department of the Environment and the British Columbia Ministry of Water, Land and Air Protection signed an Agreement to coordinate and integrate federal and provincial monitoring, and produce joint, comprehensive assessments of water quality. The current program consists of 35 long-term ambient monitoring stations located on rivers of mutual jurisdiction. Most sites are sampled every two weeks for a range of water quality variables, including trace metals, nutrients, major ions, fecal coliforms, and other variables of site-specific importance.

Although the program is primarily designed to detect long-term changes in water quality, the data are used for a variety of other purposes, including determination of the state of water quality and ecosystem health, formulation of and assessment of compliance with water quality guidelines and objectives, and detection of emerging issues.

The Agreement's vision of coordination, integration, and reporting has been achieved. This has resulted in considerable cost savings for both parties, flexibility and synergy to accomplish much more than either party could achieve alone, and led to program sustainability through periods of fiscal restraint. Further benefits include improved quality assurance, standardized methods, and increased collaboration on other projects and studies. Public awareness of the program and water quality issues in the region has recently become heightened through the development of our regional water quality website (www.waterquality.ec.gc.ca), which allows on-line access and graphing of the data collected under the Agreement.

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

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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.

EPA's EMAP Probability Monitoring Approach: More Than Just 305(b)?

Michael E. McDonald

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Dr. Michael McDonald has a B.S. in Environmental Engineering and in Oceanography from the University of Michigan, an M.S. in Zoology from North Carolina State University, and a Ph.D. in Civil Engineering and Zoology from North Carolina State University. He has been with EPA as EMAP Director for 5 years. Prior to that, he was Director of the University of Minnesota Sea Grant Program and a Professor of Chemical Engineering. His research background is in simulation modeling, water and wastewater treatment, environmental and aquacultural engineering, toxic and hazardous waste management, and aquatic ecology.

Abstract

The Office of Research and Development's Environmental Monitoring and Assessment Program (EMAP) has been developing probabilistic monitoring frameworks for aquatic resources (streams, rivers, lakes, estuaries) to provide states with a more effective approach to assessing the condition of all their waters for Clean Water Act (CWA) 305(b) reporting. The EMAP approach uses biological assessment methods and randomized designs to generate cost-effective, comparable assessments of aquatic life use at local, state, and national scales. EMAP has been transferring this monitoring science and technology to our state and tribal partners through our regional and national demonstration projects. Current, large-scale EMAP demonstrations include: the National Coastal Assessment, Western EMAP streams, and the Great Rivers of the Central Basin. As more states are exposed to and adopt this approach, there is a need to incorporate information from probability monitoring for 305(b) into a more comprehensive, integrated monitoring program envisioned by EPA's Office of Water. EMAP has begun research on several aspects of such an integrated monitoring approach. We have established a research framework for this integration and have begun work to fill extant research gaps. As part of this, we have developed preliminary approaches for the use of probabilistic monitoring data to help develop thresholds of biological impairment for use with non-point source pollutants, and the development of probability of impairment models for more effective targeted monitoring in determining sites for CWA 303(d) listings.

Development of a Probability-Based Monitoring and Assessment Program for the Ohio River

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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, and temporal trends in Ohio River fish community condition. Erich began his career with ORSANCO in 1993.

Abstract

The great rivers of the central basin of the United States are the inland receiving waters for the majority of the Nation's heartland, are the link between small upland streams and the Gulf of Mexico, and have been burdened by long-term loading of nutrients, sediment, toxic chemicals as well as extensive habitat alterations. Achieving the capacity for States or ORSANCO to quantify the extent of impairments, ascertain the relative contribution of stressors to overall condition, and track trends in ecological condition, remains a challenge. The Clean Water Act (CWA) specifies that States and Tribes must report on the condition of the waters, describe temporal changes, and determine what factors or conditions bring about the changes. It is fiscally and logistically impossible to census a resource the size of the Ohio River in a timely fashion. As such, ORSANCO is investigating the utility of adopting some form of probability survey to serve as a more cost-effective approach to monitor using biological indicators. ORSANCO has received grants to examine the effectiveness of probability designs of various spatial densities, will be participating in EPA's EMAP-GRE (Environmental Monitoring and Assessment Program – Great River Ecosystems) program, and hopes to expand the scope of probability sampling beyond the mainstem Ohio River to include the lower reaches of the major tributaries to this river. Results from the first rounds of probability-based sampling will be presented as well as data collected following a targeted design that contributed to the overall approach to developing a probability design.

Initial Use Of Probabilistic Monitoring Techniques In Tennessee

Gregory M. Denton

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Gregory M. Denton is currently the manager of the Planning and Standards Section in the Tennessee Department of Environment and Conservation's Division of Water Pollution Control. His current responsibilities include water quality standards, water quality monitoring and assessment, stream posting, data management, and general planning activities such as workplan development. He has been with the Division of Water Pollution Control since 1982.

Abstract
In January 2000, the Division of Water Pollution Control initiated a probabilistic monitoring study to assess water quality in subecoregion 71i (Inner Nashville Basin), one of five ecological subregions within the Interior Plateau in Tennessee. Chemical, biological, and bacteriological samples as well as flow measurements and habitat assessments were completed at each of 50 randomly selected sites beginning in January 2000 and ending in June 2001 (the winter 2001 quarter was not sampled).

The project was designed to meet the following objectives:

1. Characterize water quality at each of the probabilistic monitoring stations. Document violations of water quality standards and determine the degree of support of designated uses. Identify likely sources of pollutants in impacted segments.

2. Extrapolate probabilistic data to the entire subecoregion, providing information for the development of the statewide assessment report.

3. Compare water quality assessment information extrapolated from probabilistic sampling to historical assessments within 71i to provide a sense of the accuracy of targeted monitoring efforts.

4. Determine if random sampling would identify additional reference quality streams in the subecoregion.

As a follow-up to this project, probabilistic techniques are again being employed in a study of streams below small impoundments. At fifty randomly selected sites directly downstream of small to medium sized dams, streams will be sampled to determine the frequency in which the impoundment of small streams leads to violation of water quality standards. At those locations in which standards are not violated, the conditions or impoundment management techniques that translate into maintenance of water quality values will be identified.

Assessing Pinellas County Water Quality Using a Three-Tiered Monitoring Approach

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Kelli Hammer Levy is the Environmental Program Manager for the Water Resources Management Section of the Pinellas County Department of Environmental Management. Kelli received her Masters Degree from the University of South Florida's College of Marine Science in Marine Chemistry with an emphasis in nutrient chemistry. Since 1998, Kelli has worked on a variety of projects including watershed management, phytoplankton taxonomy, and lake habitat restoration.

Mark Flock is a Senior Environmental Scientist in the Water Resources Management Section of the Pinellas County Department of Environmental Management. Mark received his Masters Degree from the University of South Florida's College of Marine Science in Marine Fisheries. Since 1990, Mark has been involved in many fisheries, seagrass and water quality related projects in the Tampa Bay area. Together with co-authors, David Wade and Anthony Janicki of Janicki Environmental, Inc., the Water Resources Management Section developed and implemented a probabilistic water quality monitoring program for Pinellas County open water bodies.

Abstract

The Pinellas County Department of Environmental Management (DEM) has conducted a surface water quality monitoring program at a series of fixed stations since 1991. The site locations were selected to represent ambient surface water quality conditions. However, the 1991-2002 program does not allow statistical estimation or trend analysis for the receiving water bodies, limiting inferences to the location of the fixed station. In addition, the design of the 1991-2002 program resulted in many large geographic data gaps. In order to better assess water quality status and trends, provide loading estimates, and to expand the geographical range of the program, the DEM employed a three-tiered monitoring program in 2003. The first tier of the program is a coastal and open water body monitoring program that incorporates a probabilistic design that parallels the Environmental Protection Agency's (EPA's) Environmental Monitoring and Assessment Program (EMAP). A probabilistic approach includes randomly selected station locations where each site represents an unequal but known proportion of the population of interest. This approach eliminates bias associated with site selection and allows for statistically defensible inferences of seasonal, annual and long-term water quality status and trends. The second tier of the program is designed to provide loading estimates from water quality and flow data collected at a series of fixed stream locations. Lastly, the focus of third tier is on the development of basin specific storm event mean concentrations (EMCs) to evaluate stormwater improvement projects and provide EMC loading data to meet the County's NPDES permit requirements.

Multimedia Monitoring of PCBs in the Delaware River Estuary in Support of TMDL Development

Edward D. Santoro, Gregory J. Cavallo, John R. Yagecic, Thomas J. Fikslin

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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.

Gregory J. Cavallo is the Project Manager for the Ground Water Team for the Commission and serves within the Modeling and Monitoring Branch. Mr. Cavallo is responsible for groundwater modeling, hydrologic assessments and PCB source identification in the basin. He also chairs the Data Quality subcommittee to the DRBC's Toxic Advisory Committee, and is responsible for managing data submission in support of the PCB TMDL for the Delaware Estuary. Previously, he served as the hydrologist directing review and analysis of ground water withdrawal projects within the Project Review Branch. Prior to his service with the Commission Mr. Cavallo was a hydrologist with the New Jersey Department of Environmental Protection, where he served as a case manager for remediation of polluted ground water facilities. Mr. Cavallo received his degree from State University of New York at Binghamton.

John R. Yagecic is a Water Resources Engineer and Modeler in the Modeling and Monitoring Branch. Mr. Yagecic is responsible for development of conceptual and mathematical models, and supporting data collection and engineering computations, to simulate and predict transport and fate of contaminants in the natural environment, in support of numerous programs and initiatives including total maximum daily loads (TMDLs). Prior to DRBC, he worked for the U.S. Army Corps of Engineers in Chicago and Galveston for nine years in several positions including Environmental Engineer and Regulatory Specialist. At the Corps, Mr. Yagecic was an Environmental Engineering Team Leader, performing engineering and assessments in support of military site cleanups, brownfields redevelopment, and dredging projects, as well as evaluation of wetland mitigation and creation projects. Mr. Yagecic received a Master of Science in Environmental and Water Resources Engineering from the University of Illinois at Chicago. He is a registered professional engineer.

Thomas J. Fikslin is the head of the Modeling and Monitoring Branch and the Director of the Estuary Toxics Management Program for the Commission. The branch is responsible for conducting and coordinating monitoring activities within the Delaware River Basin, as well as the development and implementation of hydrodynamic and water quality models for toxic and conventional pollutants. Previously, he worked with the U.S. Environmental Protection Agency, Region II for 19 years. From 1986 to 1989, he served as the Assistant Director of the U.S. EPA Region II laboratory in Edison, NJ. From 1979 to 1986 he directed the toxicity testing and microbiology section of the Region II laboratory. From 1974 to 1979, he was involved in the NPDES permitting of power plants, specializing in impacts to aquatic life. Dr. Fikslin received a Master of Science in Biological Sciences from the University of Delaware, and was awarded a Doctor of Philosophy in Ecology and Evolution from Rutgers University

Abstract
Polychlorinated biphenyls (PCBs) are present in the environment in various media including air, water and sediment. While the manufacture of PCBs was essentially banned in the late 1970's, they continue to be dispersed in the environment by human activity. They enter the atmosphere as a gas, spill into soils and waterways, and lodge in sediments. PCBs can also be generated as a byproduct by some industrial processes. The states of Delaware, New Jersey and Pennsylvania have listed the Delaware Estuary as impaired due to elevated levels of PCBs in the tissue of fish caught in this portion of the Delaware River. This required the development of TMDLs for an 85-mile reach of the estuary.

During the past three years the DRBC and Federal and State partners have embarked on an aggressive program to identify and characterize sources of PCBs by monitoring a number of different matrices in support of TMDL development. The types of matrices monitored were driven by the properties of PCBs, principal transport and fate mechanisms, and the need for data to inform the development of a PCB model.

The monitoring program included the collection and analysis of PCBs in air, ambient water, sediments including core samples collected in tidal marshes, NPDES dischargers and tributaries to the estuary during both dry and wet weather at varying freshwater inflow conditions. PCB Congener specific analyses have been undertaken in the various media and have achieved sample specific detection limits of 0.5 pg/L, when sample volumes of 20L were employed. A uniform list of 124 congeners has been analyzed for in the different media using Method 1668A or equivalent GC- ECD techniques.

The work also included the estimation of sedimentation rates through the collection of core samples and the analysis of Cesium-137, for use in a penta PCB homolog model. Sediment depositional, erosional and reworked areas were documented through the use of sidescan and chirp sonar.

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.

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.

Sampling and Testing for Perchlorate at DoD Installations – Method Development and Improvement Initiatives

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Abstract

On 29 September 2003, the Office of the Under Secretary of Defense issued the Interim Policy on Perchlorate Sampling. Under the Policy, where required by regulation or where a reasonable basis exists to suspect a perchlorate release has occurred, Components are to assess perchlorate occurrence in drinking water systems, permitted wastewater discharges, environmental restorations sites, and training ranges.

At this time, the only EPA-approved method for the analysis of perchlorate is Method 314.0, which was developed and validated for use in drinking water samples. Method 314.0 is a non-specific method, subject to false positive results from interfering substances. The Method Reporting Limit for Method 314.0 is 4 ppb. In order to monitor perchlorate concentrations below 4 ppb, test for perchlorate in other environmental media, or confirm the presence of perchlorate detected using Method 314.0, alternative technology will need to be used.

The DoD Environmental Data Quality Workgroup (EDQW) and the Intergovernmental Data Quality Task Force (IDQTF) are collaborating on efforts to discuss emerging technology and recommend a path forward for developing, validating, and publishing perchlorate sampling and analysis methods with improved sensitivity and specificity for perchlorate in environmental samples.

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

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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.

Embedding metadata in the data: An integrated approach

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Marc Vayssières is an Environmental Scientist for the California Department of Water Resources. He works in the Environmental Monitoring Program (EMP) for the Sacramento-San Joaquin Delta, Suisun Bay, and San Pablo Bay conducted under the auspices of the Interagency Ecological Program (IEP). The EMP was initiated in 1971 to monitor water quality, phytoplankton, zooplankton and benthos. Marc's specializes in the management, analysis and reporting of these long term monitoring data.

Abstract
Addressing ecological questions such as the cumulative impacts of human activities on water resources and aquatic communities often requires integrating data from several different monitoring programs. Such integration is not possible without good metadata. We propose that that embedding much of the metadata with the data, in a self-documenting database, is a flexible and advantageous approach to maintaining metadata.

In essence, metadata need to answer these basic questions: who, what, when, where, why, and how. But often the user of the data will also need to know the answer to combinations of these questions: e.g. what-when, where-when, and what-how-when.

Traditionally, metadata are stored in separate text documents describing the databases. In our experience such an approach leads to: a lack of synchronization between data and metadata, extra work to conform to "standards" and to maintain cross-tabulations such as what-when or what-where, and a tendency to treat the metadata as an afterthought. Embedding metadata in the database may begin with adding a few extra columns of information to tables. It is more thorough when it involves structuring of a database to store monitoring data in distinct time series that explicitly carry data attributes such as units, method of analysis, equipment used to acquire the data, etc. Queries, including cross-tabulations of these attributes, can then be used to produce and update metadata documents. Examples from long-term (25-30 years) monitoring databases of water quality and benthic invertebrates in the San Francisco Upper Estuary are used to discuss the advantages of metadata embedding.

Developing Procedures for Water Quality Reporting for National Parks

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Biographical Sketch of Presenting Author
Dwane Young is an environmental scientist with 5 years of experience in environmental research. He currently is developing database applications for the National Park Service and U.S. Environmental Protection Agency (EPA). He has extensive experience with Visual Basic programming and database design, including Oracle, Access, and SQL Server databases.

Mr. Young also supports EPA's total maximum daily load (TMDL), 305(b), and water quality programs and has contributed to geographic information system (GIS) waterbody reach indexing work. He is responsible for analyzing the Water Quality Standards Database and the TMDL database to ensure consistency with reach indexing work. Mr. Young also has extensive experience with EPA's STOrage and RETrieval Database (STORET). He has helped several states port their data into STORET. He has maintained the EPA air docket and has managed confidential business information (CBI) for several maximum achievable control technology (MACT) standards. Mr. Young studied natural resource policy as an intern for Senator Robert F. Bennett, assisted in urban water development for North Logan City, and assisted in agricultural experiments for the Agriculture Research Service.

Abstract
The National Park Service (NPS) Water Resources Division (WRD) has a program that is responsible for reporting on water quality in National Parks. The program has used customized software procedures for efficiently and effectively retrieving water quality data from various federal data sources and building reports. The WRD has already prepared more than 200 of these reports. The reports prepared to date have been developed with procedures that extracted and processed data from legacy data systems. The WRD is updating these procedures based on the evolution of the databases that house the data of interest. New procedures have been developed to retrieve data from EPA's Modernized STORET (National Data Warehouse and Legacy Data Center) database, the USGS National Water Information System (NWIS), and other data sources, perform QA/QC for retrieved data, analyze data with summary statistics, tabular output, and plots, and create customized reports for each National Park. The retrievals: are based on user-defined geographic boundaries; include ancillary data (e.g., dams, flow gages, permitted dischargers); and support harmonization of data from the various sources. The resulting procedures, hyperlinked text documents, and database provide an important foundation for integrating monitoring information into water management activities in National Parks. This presentation will describe the procedures employed and present examples of reporting features and assessment activities being pursued in the National Park system, and in doing so, provide an example for those interested in accessing, working with, and reporting on the wealth of data and information housed in federal water related data systems.

Implementation of an Integrated Groundwater Database System for Linking and Sharing Data Between Agencies in Illinois Using GIS and the Web

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Biographical Sketches of Authors

Steve Wilson is a groundwater hydrologist at the ISWS. He has a Masters Degree in Civil Engineering from the University of Illinois. Mr. Wilson has been involved in numerous groundwater assessment projects dealing with both groundwater quantity and quality issues. He is currently involved in the collection of water quality data in a cooperative effort with the Illinois EPA, Illinois Department of Public Health and six county health departments in the Chicago area. He recently completed an evaluation of the statewide arsenic occurrence in groundwater and is working with ISWS staff in converting historical data into a new, user-friendly system.

H. Allen Wehrmann is a Senior Hydrologist and Head of the Groundwater Section at the ISWS with over 25 years of experience in conducting groundwater resource and contamination investigations. Mr. Wehrmann is a registered Professional Engineer in Illinois, and is a certified Professional Groundwater Hydrologist by the American Institute of Hydrology. Throughout his career, Mr. Wehrmann has conducted and analyzed numerous aquifer tests across Illinois through which he became intimately familiar with the Survey's Aquifer Hydraulic Properties Database. Mr. Wehrmann's research interests include the use of new technologies for hydrogeologic site characterization and data-sharing.

Jonathan Foote is a Programmer/Analyst at the Illinois State Water Survey. His education and experience is in engineering and software design. His expertise is with client/server database software development. Mr. Foote has served as project leader on several large information systems projects. He is presently working with the Groundwater section of the Illinois State Water Survey where he has developed and is currently managing various integrated information systems.

Kingsley Allan is Associate Professional Scientist and heads the ISWS GIS group. His work involves map making, modeling, and database building for various projects including past and current contracts with Illinois EPA, Illinois Emergency Management Agency, and National Science Foundation. He authors/maintains a GIS help site of more than 50 web pages (http://www.sws.uiuc.edu/chief/gis). He is a strong advocate of data sharing, and helped publish the first CD-ROM of statewide GIS data for Illinois. Kingsley is an active GIS software trainer. He is a recipient of an Illinois GIS Association (ILGISA) service award and is currently co-Chair of the association.

Abstract

Formed in 1895, the Illinois State Water Survey (ISWS) is a truly unique state agency, charged with collecting data and conducting research on the water resources of Illinois. The ISWS Groundwater Section maintains numerous groundwater-related databases. These include groundwater quality, water use (withdrawals), groundwater levels, aquifer hydraulic properties, and drillers records for water wells (private, public, industrial, irrigation, etc.). The databases are being integrated into a SQL-structured system that will link information by well and location. A key feature of database development is the addition of spatial location information for all data, allowing the data to be imported into ArcSDE and ArcIMS, so that public information can be shared dynamically over the web within a GIS environment.

The first implementation of this new data structure/integration will link selected sets of the ISWS data to the Illinois Environmental Protection Agency's (IEPA) Source Water Assessment and Protection (SWAP) Program website. SWAP-linked data include annual water withdrawals from Illinois community and self-supplied

industries, ambient groundwater quality data, and aquifer hydraulic properties data from hundreds of aquifer tests performed throughout Illinois over the past 50+ years. These data are now available to SWAP users, which includes local, county, and state units of government, as well as the USGS, allowing scientists and agency personnel access to the wealth of groundwater information stored at the ISWS. This has led to efforts to share new research findings and results with ISWS scientists and help promote collaboration between agencies in evaluating and analyzing groundwater quality conditions in Illinois.

Maryland's Volunteer Monitoring Programs

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Rita Bruckler received a B.S. in biology in 1976 and M.S. in vision physiology from Florida State University in 1978. She studied environmental physiology at Texas A&M University and received a Ph.D. in Wildlife and Fisheries Biology in 1995. Her professional experience includes research in environmental physiology of fish and teaching, including several years with the University of Maryland's Asian Division in Japan. She has worked for the Maryland Department of Natural Resources as the Volunteer Water Monitoring Coordinator since 1999.

Abstract
Across Maryland, volunteer water monitors work with communities, local governments, and the State to provide valuable information on water quality. Recognizing the value of volunteer monitoring in bridging the gaps left by professional monitoring programs, Maryland began the Stream Waders Program in 2000. The goals of the Stream Waders Program are: to increase the density of sampling sites for use in stream quality assessments; to educate the local community about the relationship between land use and stream quality; to provide quality assured information on stream quality to state, local, and federal agencies, environmental organizations, and others; and to improve stream stewardship ethics and encourage local action to improve watershed management. Many Stream Waders are members of watershed organizations who use the training and data to complement their own stewardship and restoration programs. In addition, many local governments have worked with Stream Waders to obtain data needed for watershed management plans.

The Missouri Volunteer Water Quality Monitoring Program: Balancing the Demand for Data and Education

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Tim Rielly is a streams biologist with Missouri Department of Conservation. For the past two years he has been the coordinator of the Volunteer Water Quality Monitoring (VWQM) Program, which is part of the Missouri Stream Team Program. Previously, Tim was employed with Missouri Department of Natural Resources and coordinated Quality/Assurance Quality Control for the VWQM Program. In addition, he conducted special water quality monitoring projects for the state unconnected to volunteer monitoring. Tim has over 10 years experience in water quality monitoring and is experienced in all monitoring and sampling for surface water, specializing in streams. Tim is an experienced trainer, speaker, and technical writer, and has worked with agencies of all levels to improve water quality conditions.

Chris Riggert is a streams biologist with Missouri Department of Conservation. He has been working in water quality issues for seven years with a varied background in fisheries, crayfish studies, and Volunteer Water Quality Monitoring. Chris works with all facets of the VWQM Program such as training, database management, and development of new education materials. He also coordinates the Stash Your Trash Program for the Stream Team Program which provides over 300,000 bags to canoe liveries per year. He is very energetic and will do anything for a fishing trip.

Abstract

The Volunteer Water Quality Monitoring Program (VWQM Program) is a part of the Missouri STREAM TEAM Program which, is a multi-agency sponsored water quality monitoring program formed for citizens in Missouri with an interest in water quality. The VWQM Program is a free training program open to anyone and teaches volunteers to monitor the water of Missouri's rivers and streams. Program priorities are education and data collection. The VWQM Program has evolved to currently offer four levels of training, an Introductory (Intro) course, Level 1, Level 2, and Level 3. Classes must be taken in sequence. The sponsoring state agencies benefit directly not only from the data collected by volunteers but they also benefit directly and indirectly from a public educated on water quality and water quality issues. While many volunteer programs focus on either data or education, the VWQM Program's challenge has been to address the need for both education and data. This creates many challenges such as; how to separate education and data workshops with limited staff, data QA/QC, volunteer recruitment, how to address stream stewardship and advocacy, among many other issues. The need for both data and education has forced the VWQM Program to balance program needs by combining both components into workshops. While all workshops teach water quality education and data collection, workshops have been tailored to meet both objectives. Introductory and Level 1 workshops focus on education while the primary emphasis in the Level 2 and 3 workshops is on data.

Partnerships: The Key to Successful Volunteer Monitoring Ventures in Pennsylvania

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Biographical Sketch of Author

Cheryl Snyder works as a biologist in the Pennsylvania Department of Environmental Protection's (DEP), Bureau of Watershed Management and is DEP's Citizens' Volunteer Monitoring Coordinator. She coordinates various activities for this statewide program and provides assistance to volunteer monitors in water quality sampling, biological monitoring, habitat assessment, streamside physical monitoring and watershed restoration project monitoring as well as helping volunteers develop study designs for their monitoring programs. Cheryl has worked in a number of water programs for DEP since 1986.

Abstract

Volunteer monitoring has increased in Pennsylvania with the addition of resources from the Pennsylvania Department of Environmental Protection's (DEP) Citizens' Volunteer Monitoring Program (CVMP) and the increased availability of watershed restoration grant monies. To meet volunteer needs, the CVMP developed numerous partnerships. Three of these successful partnerships (a combination agency/volunteer driven partnership, an agency-driven partnership and a partnership where the CVMP provides oversight and technical assistance) will be discussed. A volunteer lake monitoring program partnership exists between the CVMP and the Clean Lakes Program (a program supported by the Department's Nonpoint Source Management Section). This combination agency/volunteer driven partnership has involved 24 volunteer groups monitoring a total of 28 lakes since 2001 with the CVMP providing a monitoring protocol, training, supplies and equipment. The volunteer bacteria-monitoring partnership, an agency-driven partnership, provides the DEP with data to confirm stream bacterial contamination and data for use in the 305(b) process. The CVMP provides sampling training, bottles, lab analysis and acts as a liaison between the volunteers and the Department's Assessments and Standards Division. The Environmental Alliance for Senior Involvement monthly water quality monitoring partnership engages senior volunteers in a monthly water quality monitoring program. The volunteers monitor flow and water quality monthly while assessing habitat and identifying macroinvertebrates twice a year. The CVMP provides technical guidance to the program that currently services 51 of 67 counties in Pennsylvania. These partnerships are the key to successful volunteer monitoring projects and demonstrate that collaboration between volunteers and agencies results in grassroots watershed stewardship in Pennsylvania.

NJ Watershed Watch Network: A Collaborated Effort Between the Volunteer Community and the NJ Department of Environmental Protection

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Danielle Donkersloot is Volunteer Water Quality Monitoring Coordinator for the New Jersey Department of Environmental Protection. She graduated from Stockton State College in 1998 with a degree in Environmental Studies. She is currently working at facilitating interaction between the volunteer monitoring community and the NJDEP and has been working on creating the Watershed Watch Network.

In 2000, Division of Watershed Management hired her as the Education and Outreach Coordinator for the Northeast Watershed Region. Her duties included: training volunteers, coordinating and presenting workshops, writing and editing for 5 watershed newsletters, GIS mapping coordinator, and facilitating watershed area meetings. She began working for the NJDEP, Endangered and Nongame Species Program, in 1999, where she worked on the Statewide Osprey Survey.

Abstract

Over the past year, the New Jersey Department of Environmental Protection (NJDEP) Volunteer Water Quality Monitoring Program has been remodeled to establish consistency across the state in terms of who is collecting data and for what purpose. This presentation will discuss the approach that is being used in NJ to collect and use volunteer data. The presentation will include a description of the four-tiered approach to volunteer monitoring: Tier A-Environmental Education, Tier B-Stewardship, Tier C-Community and/ Watershed Level Assessment, Tier D-Indicators/Regulatory Response. Each tier has a specified data users group, data uses and data quality requirements. This will allow for volunteers to collect data that is acceptable to the NJDEP standards, and provide volunteers with a process for submitting data. This presentation will also discuss the collaboration effort between the NJDEP and volunteer monitors throughout the state by using two advisory committees and the Office of Outreach and Education. The Internal Advisory Committee consists of water quality data users and water resource managers throughout the NJDEP. This committee has a vested interest in being able to insure the level of quality assurance needed for data collection, which varies from low to high levels of rigor. The second committee is the Watershed Watch Network Council, which consists of volunteer monitoring representatives throughout the state. Their programs vary from tidal, freshwater, chemical, visual, habitat, and biological, and are customized to their watershed's needs.