Abstract #94

Water quality improvement through international cooperation on the Rhine

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Biographical Sketch of Author

From January 1, 2003 Peter Stoks is director of the Rhine Water utility association RIWA in the Netherlands, and acting director of the International Association of Waterworks along the Rhine IAWR. Until 2003 he was Head of the Water Quality Division and Member of the Directory Board of the Dutch WRK Water works. His main interests in Water management include policy development, monitoring and assessment, and early warning strategies.

Abstract

Historically, the water utilities along the Rhine river have had to deal with serious pollution of their source water. This forced them to spend energy and resources on the improvement of treatment techniques. In addition, however, these utilities have effectively struggled to reduce this pollution, by addressing water authorities, governments and industry as well as by confrontation of polluters with the results of joint utility monitoring and research programs. For this reason an international cooperation among these utilities was started as early as 1970, leading to the formation of the IAWR, the International Association of Waterworks along the Rhine. The IAWR is, today, considered an NGO representing well over 25 million consumers and is recognized as a serious player in the field of water management along the entire river. One very effective instrument is the periodic publication of a Rhine Memorandum stating water quality demands in order to ensure the production of good drinking water using only simple treatment.

Such Memoranda are presented to the Governments of the riparian states as well as to industry and are brought to the attention of the general public.

Even though the current water quality of the Rhine is fairly good, the drinking water utilities still need highly advanced treatment techniques, such as ozone, and activated carbon to assure an acceptable drinking water quality. The ultimate goal of both RIWA and IAWR is to achieve such a water quality that the Rhine river may be used as the source for drinking water production using only simple techniques such as bank filtration.

Multi-Jurisdictional Issues In International Water Quality Monitoring: The Case of Lake Chad Basin of West Africa

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Dr Edmund is an assistant professor with the Department of Urban and Regional Planning at Jackson State University. He has nearly 10 years of experience in the areas of Global environmental planning, national and regional environmental accounting for oil and gas and agricultural land use change, Hydro-politics of the Middle East and Africa. Edmund is an experienced researcher, scholar, writer, analyst, and teacher on a variety of domains such as natural resources management, rural planning and development, sustainability, plan implementation and international development. He has been quite active in environmental ethics; corporate social responsibility, ecological economics, growth management, environmental analysis and assessment, as well as community based environmental initiatives. He is very fluent in a number of European and African languages.

Abstract

In the last decades of the twentieth century when countries of Sub-Saharan Africa were busy forming their respective economic blocks under the aegis of globalization, trans-boundary water quality monitoring emerged as a key regional issue. Accordingly, the degradation of water quality continues to erode the integrity of valuable ecosystems and the well being of local communities in Sub-Saharan Africa along the Lake Chad Basin. With the Chad Basin agreement entering its fourth decade, signatories to the accord who pledged to meet the water needs of their local population are today faced with unprecedented water quality related problems.

Considering that several attempts have been made to remedy these concerns over the years, coordinated monitoring of water quality across the various political boundaries remains elusive. The current state of affairs remain compounded due to a wide range of multi-jurisdictional/international factors that are predicated upon politics, environment, technology, demography, social-cultural setting and economy. To address these issues, the paper suggests the adoption of strategies based upon ecosystem approach for water protection, coherent policy objectives, effective monitoring program, consultation among stakeholders, financial consideration in water management and capacity building. This paper examines the multi-jurisdictional and international issues embedded in trans-boundary water quality monitoring with a synthesis of the situation in the Lake Chad Basin of West Africa. Several strategies for dealing with the problem are also provided.

Canadian Water Quality Monitoring Networks

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Rob Kent has a B.Sc in Environmental Biology from Trent University and a M.Sc. in Aquatic Toxicology from the University of Ottawa. He has worked in the area of water quality and environmental pollution assessment and management for the federal and provincial governments and consulting sector for almost 20 years. He led the development of national water quality guidelines and assessments under the federal-provincial-territorial Canadian Council of Ministers of the Environment (CCME) for 8 years, and has authored/co-authored over 35 publications in the areas of water quality, toxicology, guidelines and risk assessments. Over the last 3 years, his new Branch in Environment Canada has been spearheading the re-vitalization of water quality monitoring networks in Canada and he currently directing the national coordination and delivery of water quality monitoring programs and activities.

Abstract

As public awareness increases, so do the concerns and expectations relating to water quality and the overall health of Canadian freshwater ecosystems. In Canada, responsibility for assessing and managing water quality and aquatic ecosystem health is shared by all levels of government, with significant contributions by industry, academia, and non-government organizations. Due to this wide range of practitioners, there are many water quality related programs, activities and partnerships. However, there is currently no established national or *Canada-wide* water quality monitoring program or network in Canada. As a result, monitoring and surveillance activities are temporally and spatially fragmented; individual networks remain unlinked; monitoring of some key issues and stressors is lacking; and the data and information generated by monitoring activities is often not fully exploited. Consequently, water quality scientists and managers are seriously challenged to provide a comprehensive, national picture of the status and trends of water quality in Canada.

To address these critical issues, the establishment of a Canadian Integrated Network on Water Quality Monitoring is being explored. The aim of this approach would be to encourage and facilitate a *network of networks* of strategic monitoring programs that are driven by current scientific and policy questions, where information is collectively shared. An integrated network should also provide a balance between the generation of data and the timely interpretation and reporting of this information to Canadians.

Partnerships are fundamental to building this *network of networks* approach. The first step will be to bring together existing water quality monitoring programs, such as those conducted by various levels of government, industry, academia, and communities, and determine what water quality monitoring is currently underway. A national steering body could be established to oversee an analysis of national monitoring priorities and gaps. This would be followed by an assessment of new monitoring activities, capacities and technologies needed to address current and emerging issues and threats, such as microbial pathogens, pesticides, EDCs, pharmaceuticals, and GMOs.

The long-term goal is to achieve an integrated, national water quality monitoring network that is responsive to a wide range of relevant water quality issues and provides Canadians and decision-makers with timely, integrated and comprehensive water quality information needed to make informed decisions.

Water Quality Data Assessment in the Saale River Basin, State of Thuringia, Germany

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Dr. Bongartz has been involved with different aspects of hydrological research and integrated water resources management since more than 10 years in Germany. Since 1997, when he went from the University of Bonn to the University of Jena, and concentrates his professional research on hydrological modeling and integrated water resources management focusing especially on process regionalisation. During his professional career he has been involved in two applied research projects as Partner and coordinator. At the University he also did the job of lecturing undergraduate students. So he combined teaching and working in a successful research team quite successfully during the last years. Within that period, he has developed cooperation with various research teams in Germany and the U.S, China, India and the Philippines involving the Environmental Research Center (UFZ) the Department of Agriculture (USDA), the USGS, the IIT, and the Chinese Academy of Science respectively. Recently Dr. Bongartz is involved in a European-Asian teaching program for Integrated Watershed Management and in a European Community Integrated Project dealing with IWRM in Europe and Africa.

Dr. Steele's career encompasses nearly 38 years in water-quality hydrology and regional assessments of water resources. During over 24 years as a consultant, he has managed many multidisciplinary projects as well as hydrologic baseline and modeling studies for water-resources planning and management studies and various mining-related projects. He has consulted on numerous 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 and subsurface water-quality modeling, use-attainability analyses, water-quality stream standards and total maximum daily loads (TMDLs) assessments, as well as regional ground-water planning and international water-resources management. He has given expert testimony or provided litigation support for a range of topics of concern. His professional career has included overseas experience in eleven foreign countries. Since 1999, Dr. Steele has conducted block (short) courses dealing with concepts of integrated watershed approaches – the *3M* approach (*m*onitoring, *m*odelling, and *m*anagement) at university institutes located in Darmstadt and Jena, Germany.

Abstract
Over the past decade, hydrologic and water-quality data have been collected at several sites within the Saale River basin, a tributary of the Elbe River in eastern Germany. Primary emphasis has been placed upon variables related to salinity. Historically, numerous health spas with (sometimes) hot, saline springs as well as salt mining areas are located within this river basin, resulting in contributions of salinity to the main stem Saale River and one of its main tributaries the Unstrut. Water-quality data, along with model applications, have been developed for this basin in a multidisciplinary study by a consortium of German Universities and Agencies. The purpose of this paper is to provide an introduction to the water-quality related studies in the river basin, as well as describing selected results using available hydrologic and water-quality monitoring data.

National Water-Quality Monitoring Programs of the U.S. Geological Survey

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Richard Coupe is a Supervisory Hydrologist with the U.S. Geological Survey in Pearl, Mississippi, and has worked for the Survey since 1980 in a variety of locations –Virginia, Illinois, and Mississippi. He is currently the Chief of the Mississippi Embayment Study Unit of the National Water Quality Assessment (NAWQA) Program and also serves as the Mississippi Basin coordinator of the National Stream Quality Accounting Network (NASQAN). Richard has an undergraduate degree in mathematics from George Mason University, a Masters degree from Mississippi State University, and is completing a PhD from Mississippi State University.

Abstract

During the 20th century, the U.S. Geological Survey began collecting data to evaluate the quality of water for the Nation's streams and rivers. The earliest effort was in 1906-07 when water was collected and analyzed from more than 150 streams and rivers across the Nation and were used to calculate the flux of sediment and dissolved solids into the Atlantic and Pacific oceans and the Gulf of Mexico. These data have proved valuable in recent years in determining changes in water quality throughout the 20th century. Beginning in 1973, the U.S. Geological Survey began operation of its National Stream Quality Accounting Network (NASQAN): for the next 20 years water-quality data were collected and analyzed from hundreds of streams and rivers as part of the NASQAN Program. The objectives of the program were to (1) measure the quantity and quality of stream water quality, (2) describe spatial variability in stream water quality, (3) evaluate trends in water quality, and (4) guide future water-quality assessments. The program was successful and generated needed data to assess trends, to calculate the flux of material from NASQAN basins, and to investigate relations between water quality and streamflow. The NASQAN program was redesigned in 1995 and now operates on the Nation's largest rivers (Colorado, Columbia, Mississippi, Rio Grande, and the Yukon) with redefined objectives to (1) characterize these large subbasins, (2) determine regional source areas, and (3) assess the effects of human influences on observed concentrations and fluxes.

Spatial Assessment and Optimization of the Synoptic Sampling Network in the Great Smoky Mountains National Park using Multivariate Techniques

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Kenneth R. Odom is the Director of Engineering and Development for the City of Maryville, Tennessee and is a registered professional engineer in Tennessee and Alabama. He completed his Ph.D. in Civil Engineering in August 2003 under the direction of the co-author, Dr. Bruce Robinson, at the University of Tennessee, Knoxville. He previously worked as an engineer for a Mobil Oil in Beaumont, Texas and a consulting engineer for Almon Associates in Tuscaloosa, Alabama.

R. Bruce Robinson is a Professor of Civil and Environmental Engineering at the University of Tennessee, Knoxville and is a registered professional engineer in Tennessee and Iowa. He previously worked for the Iowa Departmental of Environmental Quality, Iowa Department of Transportation, and Iowa State University and has worked as a consultant for several industries. He has also served as chair and member of several national professional society committees including the ASCE Water Supply Committee and AWWA's Small Systems Research Committee.

Abstract

A multivariate analysis of the synoptic water quality monitoring network in the Great Smoky Mountains National Park was performed to develop a scheme for scoring the information content of each sampling site based on cluster centroid distances. This information would be used to spatially optimize the network using a simulated annealing (SA) algorithm. Analysis methods included principal components analysis, cluster analysis, and discriminant analysis. The data analyzed for the 83-site network included historical water quality data (pH, ANC, conductivity, chloride, nitrate, sulfate, sodium, and potassium) and watershed characteristics (geology, morphology, and vegetation). The monitoring network was analyzed in each of the four categories (water quality, geology, morphology, and vegetation) rather than performing the analysis on the data as a whole so that a composite score could be calculated for each sampling site. The composite score was then used to apportion monetary benefits to each of the sampling sites in the SA algorithm where the objective function was to maximize the net benefits. One SA algorithm was written to optimize the network as a whole and a second SA algorithm was written to generate an optimized network based on a user-specified number of sampling sites in the final network. The first SA algorithm identified an optimized network consisting of 67 of the existing 83 sampling sites. The second SA algorithm bracketed the same 67 sites in terms of maximized net benefit. Additionally, the second SA algorithm also provided a tool for an ordered discontinuation of sampling sites should this ever become necessary.

Building a Water Quality Monitoring Program for Alabama Lakes

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Fred is Chief of the Aquatic Assessment Unit (AAU) of the Alabama Department of Environmental Management (ADEM). The AAU is responsible for the Ambient Trend Monitoring Program, Alabama Monitoring and Assessment Program (ALAMAP), Nonpoint Source Assessment Program, Reservoir Water Quality Monitoring Program, and Fish Tissue Monitoring Program. From 1984 to 1989, he worked as a research assistant in the Rivers and Reservoirs Laboratory of the Auburn University Department of Fisheries, graduating with an M.S. in Fisheries Science. In 1989, he began work for the ADEM, with primary involvement in the initiation and development of the Reservoir Water Quality Monitoring and Fish Tissue Monitoring Programs.

Abstract

In 1985, the need for information on the trophic state of Alabama lakes led to an initial survey conducted by ADEM/USEPA. The survey established limited baseline information and was used to rank lakes according to trophic condition.

In 1989, Clean Lakes Program funds enabled the ADEM to conduct lake assessments a second time. Trophic state index values from the 1989 study indicated potentially significant increases when compared to values from 1985.

In 1990, the Reservoir Water Quality Monitoring (RWQM) Program was initiated by ADEM. Through 1997, limited monitoring was conducted regularly. Additional Clean Lakes funds enabled expansion of the Program to include extensive monitoring of lakes for which water quality concerns were greatest, and the inclusion of border lakes.

During 1997, intensive monitoring of lakes by basin was initiated. Intensive monitoring consisted of monthly sampling of mainstem reservoir and tributary embayment sites through the algal growing season.

Compliance monitoring of lakes for lake-specific nutrient criteria was initiated in 2001, with intensive monitoring of many other lakes conducted 2002-2004 to acquire additional data needed for future criteria development.

With the demise of the Clean Lakes Program in 1997, continued development of the RWQM program has been uncertain and funding an unsteady patchwork. The program continues, though the future is by no means clear as Section 319 funds decline. This presentation will examine the path chosen by the ADEM in the development of this program, and the many factors that have been influential.

Continuous Water-Quality Monitoring in Karst Basins – Issues in Assessing Nitrate-Nitrogen and Dissolved Solutes Concentrations

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Joseph Taraba is an extension specialist and researcher in areas of agricultural waste management, qroundwater quality and more recently watershed surface water quality monitoring strategies for assessment of agricultural BMP implementation in karst basins.

Alex Fogle is a hydrologist for the Kentucky Geological Survey and has been working within the Biosystems and Agricultural Engineering Department. Since 1995, he has been overseen the Animal Research Center water quality monitoring network and maintained the database. He is performing data analysis and writing research reports and publications.

Abstract

The assessment of the Total Maximum Daily Load (TMDL) and the effectiveness of Best Management Practices (BMPs) on water quality in watersheds require the accurate measurement of constituent concentration and stream flow. Due to the volatile nature of stream flow and constituent concentration in upland watersheds, and especially in karst basins, interest in continuous water-quality monitoring has increased. Continuous flow measurement has been relatively simple and inexpensive to accomplish in comparison with the continuous measurement of the concentration of constituents such as Nitrate-Nitrogen.

Although expensive, continuous concentration monitoring allows researchers and planners to assess not only yearly and seasonal variations, but sub-seasonal variations as small as diurnal changes in concentration. The ability to monitor these types of variations can shed light on the dynamics of constituent generation and fate. Continuous monitoring can also help ascertain whether coarser sampling strategies such as biweekly, monthly, and even storm sampling are adequate or inadequate for TMDL and BMP analyses.

Given the advantages of continuous monitoring, a major issue arises around the reliability of certain ion-specific probes and the aspects of QA/QC of data generated by these probes. These issues are important but can be adequately addressed by proper procedures.

Based on affirming probe reliability, our suggests that diurnal patterns (the timing of diurnal concentration max/mins and amplitudes) may be correlated to stream status and ecosystem equilibrium as the stream corridor recovers from a disturbance or the landuse within a stream corridor shifts.

Back to Basics – Using Hydrology to Communicate Data as Information

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Bruce Cleland is a TMDL "Circuit Rider" for the Clean Water Foundation, where he specializes in providing detailed technical assistance, technical education, and information transfer to States to assist them in their efforts to develop TMDLs. He is currently on loan to ACWF from EPA's Seattle Office where he worked in the water quality program, including over 10 years as the Region's TMDL Coordinator. At Region 10, Bruce was also involved with the ambient water quality monitoring program, the nonpoint source program, and the permits / compliance program.

Abstract

With the wide array of issues facing water quality managers, limited resources, and the complex, inter-related nature of water programs – the "two Ps": practical approaches and partnerships – are critical to successful watershed planning and implementation. Dependable tools are needed, which promote effective communication between analysts, planners and implementers, so that actions will lead to measurable water quality improvements. Over the past several years, basic hydrology in the form of flow duration curves has been used to support the development of TMDLs.

Flow duration curve analysis identifies intervals, which can be used as a general indicator of hydrologic condition (i.e. wet versus dry and to what degree). Duration curves help refine assessments by expanding the characterization of water quality concerns, linking concerns to key watershed processes, and prioritizing source evaluation efforts. The extended use of monitoring information using duration curves offers an opportunity for enhanced targeting, both in field investigation efforts and implementation planning.

Duration curves provide another way of presenting water quality data, which characterizes concerns and describes patterns associated with impairments. This framework can help elevate the importance of monitoring information to stakeholders, which in turn can encourage locally driven data collection efforts (e.g. through watershed groups, conservation districts, point sources). As an assessment and communication tool, duration curves can also help narrow potential debates, as well as inform the public and stakeholders so they become engaged in efforts to improve water quality. This presentation will use several examples to illustrate opportunities where duration curves can strengthen watershed assessments and enhance the water quality management process.

Interpretation of Water-Quality Data Using Ion-Pair Relationships

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Biographical Sketches of Authors

Tim Kresse is the Ground-Water Protection Program manager in the Water Division of the Arkansas Dept. of Environmental Quality. Mr. Kresse received his B.S. and M.S. in geology at the University of Arkansas in Fayetteville, is a professional geologist, and has worked in the water-quality field within both the private consulting and state government arenas for more than 18 years. He has authored or co-authored more than 30 professional papers and has presented numerous papers at professional seminars. His area of interest resides primarily in geochemistry and water-quality interpretation.

John Fazio is a Geologist in the Planning Branch of the Water Division of the Arkansas Department of Environmental Quality. Mr. Fazio worked for 6 years in the Underground Storage Tank Program at ADEQ, and for the past four years has been managing the Ambient Ground-Water Monitoring Program in the Water Division. He has co-authored several professional papers and has been involved in several 319 Nonpoint Source investigations. His areas of interest include geohydrology and water-quality interpretation. Mr. Fazio received his B.S. Degree in Geology from the University of Arkansas, and his post-graduate studies focused on sedimentology.

Abstract

In past years, water-quality data collected by both federal and state agencies focused on ground-water quality in reference to drinking water standards, with little attention toward identifying geochemical data trends. These early reports often included some basic descriptive statistics, Piper diagrams, and identification of general water type. The use of graphical analysis of ion-pair relationships can enrich water-quality reports by providing underlying links to geochemical processes influencing geochemical evolution and redox conditions of ground water along identified and/or inferred flow paths.

Ion-pair relationships can be used in quality control of analyses, which generally requires conductance, TDS, and the major ions contributing to TDS. Ion-pair relationships, together with simple statistical analyses, also have been used to obtain strong corollary evidence for the geochemical evolution of ground water, in addition to identifying sources of elevated (>10 µg/L) arsenic, in the alluvial aquifer in eastern Arkansas. The data can be expressed in various units (i.e., mg/L, meq/L, etc.) depending on the relationships under investigation. The use of data in equivalent concentrations often provides far more beneficial results over the use of concentrations by weight, especially for use in assessing the stoichiometry involved in mineral dissolution and precipitation, cation exchange, and other processes affecting the geochemical evolution of ground water. The identification of chemical sources and sinks affecting ground-water geochemistry provides a framework for future geochemical modeling or prioritizing locations for site-specific investigations.

Combining Observed Water-Quality Variables for Trend Analysis

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Carl E. Zipper has been a member of the Virginia Tech faculty at since 1986. Current activities are in the areas of mine restoration, water quality, and watershed management. He serves as an Extension Specialist, researcher, and instructor within the Department of Crop and Soil Environmental Sciences. His instructional activities include a junior-level course, Fundamentals of Environmental Science, since 1989, and leadership of his department's Graduate Seminar since 2002. He serves as Director of the Powell River Project, a Virginia Tech program that conducts research and education to address coal mine restoration. He served as Associate Director of the Virginia Center for Coal and Energy Research, which conducts research and disseminates information on energy-related issues, from 1989 through 2003.

Golde Ivan Holtzman is an associate professor in Virginia Tech's Department of Statistics. He has been a member of the Virginia Tech faculty since 1980. He retains research interests in the area of biomathematics, his Ph.D. area, and provides statistical consulting to research in departments throughout the university with emphases on natural resource and medical applications. He has served as president of the Virginia Academy of Science, and as chair of the ASA Committee on Professional Ethics. Within the department he has served as graduate program director, acting department head, and director of the Statistical Consulting Center. Classes he has taught recently include Biometry, Nonparametric Methods, and Introductory Statistics.

Abstract

Water-quality trend analysis is being used increasingly as a scientific and public policy analysis tool. The seasonal Kendall technique is a common water-quality trend analysis procedure. When conducting trend analyses of water-quality data prepared for other purposes, it can be advantageous to aggregate observed variables so as to construct and analyze for trend a combined variable that has not been observed directly. Such analyses are hindered when one or more (but not all) of the observed variables being combined are censored (reported as being below an analytical detection limit); when the data series being combined include variations in censoring levels; and/or the variables being combined have been analyzed and recorded at differing levels of precision.

A method for combining observed values and analyzing the resultant aggregated value for trend using the seasonal Kendall technique, which accommodates these data characteristics, is described and demonstrated through application to Virginia water quality nitrogen data collected from 157 locations by Virginia Department of Environmental Quality over the 1978 – 95 time period. Variables of interest were nitrate-nitrite N (NN), total Kjeldahl N (TKN), and total N (TN) concentrations. TN was not measured directly, but was calculated by combining the NN and TKN forms. NN was calculated by combining measured values of nitrate-N and nitrite-N, where both components were available but NN was not measured directly. Seasonal and overall TN medians were calculated and allocated among NN and TKN components, and analyzed statistically for differences among ecoregions. NN, TKN, and TN trends were analyzed for each location using seasonal Kendall analysis, by ecoregion and for the state as a whole. The distribution of N among NN and TKN forms varies both seasonally and regionally. TN concentrations were found to be increasing in 6 of the state's 7 ecoregions over the study period, with the strongest increases occurring as TKN and in the state's eastern portions.

Beyond Data Download: Data Analysis Tools

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Edward Johnson is an environmental scientist in the National Centers for Coastal Ocean Science of NOAA's National Ocean Service with training and experience in environmental chemistry and toxicology. He joined the Center for Coastal Monitoring and Assessment in 1997 after twelve years with the USDA's Agricultural Research Service. Since moving to NOAA he has been active with the National Status and Trends Program particularly the Mussel Watch and Bioeffects Assessment Projects.

Percy Pacheco is an environmental engineer with the Special Projects in NOAA's Management and Budget Office. His responsibilities have been instrumental in the successful planning, design and data analysis of coastal pollution assessment projects. Percy is skilled in data synthesis and assessment, and advanced technical services (e.g., GIS and web mapping, database development, and information visualization tools). Nipa Parikh, also with the Special Projects Office is a skilled GIS specialist and expert computer programmer in the support and development of several applications in her division.

Jawed Hameedi is manager of NOAA's National Status and Trends Program, a comprehensive monitoring and assessment program to observe and report on coastal contamination and its associated biological effects in U.S. coastal waters and estuaries. The program also develops environmental indicators, guidelines, models and other diagnostic tools to infer the severity of contamination, forecast contaminant levels, and evaluate the performance of governmental programs to abate degradation of coastal ecosystems. Prior to joining NOAA, he worked in private industry and a university on energy and environmental sciences.

Abstract

The purpose of NOAA's thematic website is to provide easy access to data and information in a way that facilitates environmental assessment and decision making. Data from three long-term projects of the National Status and Trends Program (NS&T) are being compiled and managed to make them available over the Internet in a distributed data model system. The three projects are Benthic Surveillance Project, Mussel Watch Project, and Bioeffects Assessment Project.

The foundation of the web capabilities are built on three relational databases, one for each of the three major project areas of NS&T. These databases are built with the SAS software (SAS Institute, Cary, NC). Presently the databases are accessed with Active Server Pages (ASP) software. Enhancements are under way that utilize SAS web application software to access the SAS databases and dynamically produce web pages of information requested by the user. Data mapping tools allow the user to display the sampling locations on to overlay other geo-referenced data published on the web such as wastewater discharge locations, or satellite imagery. These web-based data analysis and display tools and protocols operate in a distributed information system environment (as opposed to a centralized data system) to improve data retrieval, mapping, analysis, assessments, comparative studies, and visualization capabilities for users with different levels of data and analysis needs. This web site is intended to also increase awareness and understanding of specific coastal issues (e.g., water quality) so that the coastal management community and the interested public can make more informed decisions about solutions to coastal resource use issues, many of which are of national and international significance.

Compliance Monitoring in a Performance Based Environment

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Herb 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

A performance based, or flexible, approach to analytical measurements permits the use of any scientifically appropriate method that demonstrates the ability to meet established method performance criteria (e.g., accuracy sensitivity, bias, precision) and complies with specified data quality needs or requirements. Key aspects of a performance-based system include; a) the need to establish concise measurement quality objectives (MQOs) or data quality objectives (DQOs) for each parameter reported; b) the need for demonstrated methods capable of meeting these MQOs or DQOs or regulatory limits; c) the need for adequate reference materials to assist laboratories in demonstrating the appropriateness of a given method; d) the need for laboratories to adequately document method performance, and e) the successful completion of a pilot program to demonstrate the advantages and viability of a performance-based approach.

There are significant issues concerning how such an approach would be implemented in compliance monitoring programs. The training requirements are extensive due to the diversity of programs and varying data requirements. Adequate training and education of data generators, auditors, and users is central to the successful implementation of a performance-based system. Mechanisms for determining liability must be established, and compliance data must be recognized in a court of law.

EPA approaches to a performance based system, in a compliance setting, include EPA's so-called streamlining initiative that includes validation requirements for new and modified methods and the development of new methods according to a protocol where validation is included in the methods development process.

Can The Laboratory Meet My Monitoring DQO's? Methods for Assessment of Laboratory Capabilities and Data Quality Analysis

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Dennis McChesney is an environmental scientist, currently in the Division of Enforcement and Compliance Assistance, at U.S. EPA Region 2. Until recently, Dennis was a hydrologist in Region 2's Division of Environmental Science and Assessment, where he planned and implemented monitoring projects in New York, New Jersey, and Puerto Rico, and oversaw quality management for the water programs throughout the Region. His previous experience was in the drinking water/ groundwater programs where he focused on groundwater protection and remediation. Dennis previously served as co-chair of EPA's Groundwater Protection Technical Forum, and as a member of the Methods and Data Comparability Board where he chaired the Board's Outreach Workgroup. Dennis earned a B.S. in Biology from the University of San Francisco, an M.B.A. from Fairleigh Dickinson University, and M.S. in Environmental Sciences from Rutgers University, where he is currently a doctoral candidate.

Abstract

The production of data which meets a user's direct needs, determined through development of a project's data quality objectives (DQO's), is essential to a monitoring project's success. Production of data which can be compared to other data, or meet other needs, is increasingly recognized as crucial to efficient, effective water quality evaluations. A cornerstone of the project implementation process is selection of a laboratory to analyze project samples. Private sector and government laboratories usually offer services for analytes of interest. However, the actual methods employed, laboratory instrument capabilities, and the analyst's training and experience at a particular laboratory can, and unfortunately does, often result in acquisition of data which fails to meet the project DQO's. Consequently, an evaluation of a laboratory's capabilities is a critical element in assessing whether to utilize their services. In this presentation, a process for selecting laboratories will be described where candidate laboratories provide potential clients with an Initial Demonstrations of Capability (IDC). The IDC is designed to provide information to show that the laboratory has the technical capability to meet the project DQO's under the conditions expected during the monitoring. The sample analysis data required in an IDC, determinations of the limits of data acceptability, assessment of IDC data, and ranking of multiple laboratories will be discussed. Finally, methods to employ in evaluation of project data will be presented, including format of the laboratories reports, and interpretation and integration of QC sample results to assess the overall quality of the monitoring data.

Abstract #108

The DQO/MQO Process for Comparability in Monitoring: Nitrate as an Example

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Katherine Alben is a Research Scientist at New York State Dept. of Health and a faculty member in the Dept. of Environmental Health and Toxicology, State University of New York at Albany. For 25 years, she has contributed to development of analytical methods, primarily to assess water quality. She co-chairs the MDCB Biology Workgroup, which has helped to prepare biological methods for NEMI.

Jerry Diamond is a Director of Tetra Tech's Baltimore office, where he manages toxicological and biological monitoring projects for a variety of sponsors. He has been providing EPA contract support to the Methods Board for the past 8 years.

Larry Keith chairs the NEMI workgroup and has over 35 years of experience with developing and using environmental methods. His current work involves developing an expert system for systematic planning with environmental monitoring and private consulting through Instant Reference Sources, Inc.

Herb Brass is the Analytical Methods Team Leader in the Office of Ground Water and Drinking Water at the USEPA and has over 25 years of experience in managing environmental methods and monitoring programs. He is also Co-Chair of the Methods and Data Comparability Board (MDCB) under whose auspices NEMI is being developed.

Abstract
The DQO/MQO process is a systematic, iterative, and planning process, based on the scientific method (US EPA 1994, 2000). This paper illustrates the DQO/MQO process, using nitrate to provide a focused case study:

1) Development of historical perspective: site-specific data for nitrate are analyzed, using examples from the USGS National Water Information System (NWIS: www.waterdata.usgs.gov/nwis/) and the classic statistical methods of interpretation for comparing data
2) Development of DQOs and MQOs: side-by-side comparisons of DQO/MQO criteria are made for two hypothetical monitoring scenarios, regulatory versus ambient monitoring, as suggested by the historical data for nitrate
3) Method selection: appropriate choices for the compliance and ambient monitoring scenarios are discussed, using nitrate methods from the National Environmental Monitoring Index (NEMI www.nemi.gov), an online compendium of analytical methods for water quality monitoring (Peters et al 2000, Brass et al 2000)

The results of this exercise show how the comparability of methods and data is determined by the choice of DQO/MQOs and corresponding project design. In the examples given, it is somewhat surprising to find that DQO/MQOs and criteria for establishing the comparability of methods and data are more restrictive for the ambient monitoring scenario, than for the compliance monitoring scenario.

Ensuring Data and Information Comparability Using Expert Systems

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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.

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.

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.

Abstract

An "expert system" is an interactive computer program that emulates a human expert's decision-making process in a particular domain of knowledge. Environmental monitoring programs are often complex and require detailed planning such as designing to meet specific objectives, selecting sampling and analytical methods, determining what and how many QA and QC samples are needed, determining where to sample and how many samples to analyze, deciding how to compile and manage the data and then how to assess and interpret it, and finally, how to convey results and findings. The Environmental Monitoring and Measurement Advisor (EMMA) is an expert system that provides consistent and detailed advice for designing programs and selecting methods for field and laboratory data. The latter advice draws from the National Environmental Methods Index (NEMI) and, through a cooperative research and development agreement (CRADA) with US EPA and USGS, will be linked directly to the NEMI database. The advantages of extending programming and advice from an expert system such as EMMA to the complete Water Monitoring Framework will be presented.

A Comparative Analysis of Water Quality Monitoring Programs in the Southeast: Lessons for Tennessee

Ruth Anne Hanahan[1] and Caitlin Cottrill[2]
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Ruth Anne Hanahan is a Senior Research Associate at the TN Water Resources Research Center (TN WRRC) located at the University of Tennessee. Over the past six years, her primary focus has been to build and manage the Knox County Adopt-A-Watershed Program. She conducts the program on behalf of the Water Quality Forum, a consortium dedicated to protecting and improving regional water quality. In addition to coordinating this hands-on environmental education program for the Forum, Ruth Anne has been integral in assisting with the development of other Forum educational/community outreach and technical projects including the recently established Adopt-A-Stream Program.

Caitlin Cottrill was employed as a Graduate Research Assistant at the TN WRRC while receiving her master's degree in urban planning from the University of Tennessee. She has participated in a number of planning activities involving environmental monitoring and planning for sustainable development. Caitlin is currently employed as a transportation planner at the Mid-America Regional Council in Kansas City, Missouri.

Abstract
The upsurge of state volunteer monitoring programs across the nation has been heralded as a way for citizens to turn knowledge into action including empowering them to make informed decisions and involving them in activities that directly protect state waterways. Tennessee does not currently have a statewide volunteer monitoring program, although there has been some preliminary discussion within the state's nonpoint source program to sponsor one. Building on this national movement and state interest, the TN Water Resources Research Center at the University of Tennessee has recently completed a study comparing three southeastern statewide volunteer monitoring programs, including Alabama Water Watch, Kentucky Water Watch and Georgia Adopt-A-Stream. The purpose of this comparative analysis was to examine how these programs have been implemented and learn from their experiences so that we could recommend to Tennessee policy decision makers and other stakeholders possible approaches to establishing such a program here in our state.

In order to provide a more substantive set of recommendations, we were also interested in acquiring information on the perceptions of the general benefits and limitations of volunteer monitoring. To that end, we surveyed volunteer monitors participating in the three state programs as well those in Tennessee who have an interest ("a stake") in expanding volunteer monitoring in the state. It is our hope that this study and its accompanying set of recommendations will advance a productive dialogue among Tennessee stakeholders on the viability of initiating a statewide volunteer monitoring program including actions necessary to make it happen.

Meeting Needs of Volunteers Using Trained Trainers

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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.

Tim Rielly is 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.

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. The number one priority is education with data as a close second. The program has evolved to currently offer four levels of training, an Intro course, Level 1, Level 2 and Level 3. Each course or "Level" builds upon the previous course. Since its inception in 1993, the VWQM Program has grown exponentially; Introductory VWQM workshops are full or have waiting lists. While the Program continues to grow, staff levels have remained static due to budgetary requirements. As a result, VWQM Program staff had to be creative to meet the demand for training. As a solution, VWQM Program staff promoted and held several “Train the Trainers” workshops designed to train selected people to assist with teaching water quality workshops. Trainers were selected from a pool of dedicated volunteers, teachers and agency personnel that have all attended VWQM workshops prior to training. Trainers have helped to reduce staff time by reducing the amount of staff needed to teach a workshop. Trainers are beneficial to the Program by enabling staff by to meet the demand for training by the public and offering expanded workshop schedules. While there are many more benefits to using trainers there can be some draw backs such as; scheduling, data quality, consistency and, keeping them on track with presentations. How do you keep them on track and follow through?

Sustaining A Successful Monitoring Program

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Ginger first joined the Delaware Nature Society as a Naturalist for the Education Department at Ashland in 1992 and taught a variety of programs for them. She has worked with the Delaware Stream Watch program in the Natural Resource Conservation department since 1995, first as the Technical Monitoring Assistant, then as Stream Watch Assistant Coordinator, and most recently as the Stream Watch Coordinator.

She received a Master of Science degree in Genetics from the University of Delaware, and a Bachelor of Science degree in Biology/Marine Biology from the University of Long Island. She taught biology laboratories for four years at the University of Delaware. She also has an extensive background in Quality Control, both in a clinical microbiology laboratory and in a hospital endocrinology laboratory.

Abstract

What does it take to maintain a successful monitoring program? Join us for one perspective from a volunteer monitoring program staring its 19th year. Delaware Stream Watch is a grassroots volunteer waterway protection program focusing on citizen monitoring, education, and advocacy. Founded in 1985 as a partnership between the Delaware Nature Society and the Division of Water Resources of the Delaware Department of Natural Resources and Environmental Control (DNREC), it is one of the oldest statewide volunteer water quality monitoring programs in the nation, and one of the few joint efforts between a state agency and a non-profit environmental organization. Delaware Stream Watch is recognized as a national example of the acceptance and use of volunteer data by state and federal agencies in the Total Maximum Daily Load (TMDL) modeling process. This presentation will focus on the successes and challenges in sustaining the Delaware Stream Watch program, specifically volunteer retention, quality assurance/control for data collection, use of volunteer data, and maintaining strong partnerships with state agencies.

Community-based Water Monitoring: A Decade of Global Experiences

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Biographical Sketch of Author

Bill Deutsch has degrees in Zoology, Biology, Anthropology and Aquatic Ecology and 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.

Abstract

With partnerships and funding from numerous state and federal agencies and nongovernmental organizations, Auburn University has initiated community-based water monitoring projects (CBWM) in Alabama, the Philippines, Ecuador, Brazil and Thailand. Participants range from U.S. middle class, lakefront property owners to peasant farmers of the upland tropics. More than 10 years of experience with these efforts has led to the development of a CBWM model designed for the practitioner. The model includes the process of organizing groups and selecting appropriate technologies, collecting and managing credible data, and data-to-action strategies that lead to sustainable projects and improved watershed management. Each project generated lessons that were shared among all, and a Global Water Watch network of monitoring groups is expanding with indigenous leadership.