

**Key Accomplishments**  
**In Water Quality Research from 1995-2005**  
**January 9, 2006**

<b>LTG 1</b>	<b>ANALYZING STRESSOR EFFECTS FOR CRITERIA DEVELOPMENT</b>
<b>LTG 1</b>	<b>Guidelines for Multiple Stressors (note: other research below also addresses multiple stressors)</b>
2001	<i>Evaluation Guidelines for Ecological Indicators.</i> These guidelines address conceptual relevance, feasibility of implementation, response variability, interpretation and utility, and include examples of three very different types of indicators: a direct chemical measurement (dissolved oxygen concentration), and two multi-metric indices, an estuarine benthic community index, and a stream fish community index of biotic integrity.
2002	<i>Landscape disturbance gradient design developed to provide sampling strategy for the Great lakes.</i> GLEI-EPA study established framework for field study site selection to establish stressor-response models.
2002	<i>Aquatic Stressors: Framework and Implementation Plan for Effects Research.</i> This peer reviewed document was instrumental in providing the framework, context and approach for NHEERL research addressing risks posed by toxic chemicals, nutrients, habitat alteration, and suspended and embedded sediments. Primary focus on the effects of those stressors on coastal ecosystems. Produced in response to high priority research needs of EPA program offices and other clients.
2002-2005	Many published studies and reports on hydrologic, biogeographic and other ecosystem classification factors that may influence biological responses in Great Lakes coastal wetlands. Evaluation of the response classification factors needed to develop disturbance-response trends, including linking landscape character to coastal condition.
2003	Risk-based Wildlife Criteria: Conducted a 1-day symposium at The Wildlife Society Annual Meeting entitled 'Assessing Risks To Wildlife Populations From Multiple Stressors'. This session brought together 15 scientists in wildlife ecology, environmental protection and conservation who are working to develop, test and apply methods that quantify and predict risks to a variety of wildlife species subject to multiple stressors.
2004	<i>Aquatic Stressors: Review of the Research.</i> ORD organized a meeting with key EPA program offices and regions to review all aquatic stressor research conducted under the 2002 <i>Aquatic Stressors Framework</i>
2005	<i>Wildlife Research Strategy:</i> This peer reviewed document is instrumental in shaping the research needed to establish the technical basis for risk-based wildlife criteria.
<b>LTG 1</b>	<b>Methods for assessing risks of Toxic Chemicals</b>
1995	<i>Amphipod sediment toxicity test:</i> This method has become the standard for the dredging program and for conducting marine/estuarine risk assessments (ASTM document).
1995-2000	<i>Sediment Quality Criteria:</i> Developed and validated the Sum-PAH model which provides a means for developing sediment quality guidelines based on the probability that a PAH-contaminated sediment will be toxic to marine and estuarine amphipods.
1999	Developed methods for testing the chronic toxicity of contaminated sediments to freshwater organisms; published EPA guidance manual
2000	Toxics: In cooperation with Office of Water, developed and published OW's <i>Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health.</i> Often used by States to set water quality standards that determine allowable discharge of pollutants into US waters.
2002	Toxics: Developed inter-species correlation estimation (ICE) method for predicting toxicological sensitivity of infrequently tested species, including a user-friendly computer interface
2002	Toxics: In cooperation with the Office of Water, prepared Analysis Document-Copper Prototype for use in conducting Biological Evaluations for WQC chemicals

2002	Toxics: In cooperation with the Office of Water, FWS and NMFS, prepared Methods Manual for conducting Biological Evaluations for WQC chemicals. Initial work in this area demonstrated an inter agency coordination under the CWA and ESA that resulted in MOA between EPA, FWS, and NMFS.
2002	Toxics: Developed Version 1.00 of Toxicity Response Analysis Program – software for analysis of toxicity test data for use in developing new aquatic life criteria for copper by the Office of Water
2002	Draft Action Plan for the Development of a Framework for Metals Assessment and Guidance for Characterizing and Ranking Metals. First of two documents representing the Agency's strategy and recommendations on the incorporation of the latest science in Agency risk assessments of inorganic metal compounds.
2002	Acute to Chronic Toxicity Estimation (ACE): Developed time-concentration-effect models for use in predicting chronic toxicity to aquatic organisms from acute toxicity data
2003	Toxics: Published Equilibrium-Partitioning Sediment Benchmarks (ESBs) for endrin and dieldrin
2003	Toxics: In cooperation with the Office of Water, published the <i>Methodology for Deriving Ambient Water Quality for the Protection of Human Health</i> (2000). Technical Support Document Volume 2: Development of National Bioaccumulation Factors
2003	Toxics: Provided an evaluation of methodology for predicting response to fluctuating exposure for incorporation into water quality criteria
2003	Toxics: Published Equilibrium-Partitioning Sediment Benchmarks (ESBs) for PAH mixtures
2003	Toxics: Published effects of aryl hydrocarbon receptor mediated early life stage toxicity on lake trout populations in Lake Ontario during the 20th century
2003	Toxics: Developed a draft framework for the application of the toxicity equivalence methodology for polychlorinated dioxins, furans and biphenyls in ecological risk assessment
2003	Risk-based Wildlife Criteria: Created the Wildlife Mercury Database to support development of risk-based wildlife criteria.
2004	Toxics: Published interspecies correlation estimations (ICE) for acute toxicity to aquatic organisms and wildlife. II. User manual and software
2004	Toxics: Published acute-to-chronic estimation (ACE v 2.0) with time-concentration-effect models. User manual and software
2004	Toxics: Developed a framework for assessing risks from photo-activated toxicity of PAHs to aquatic organisms
2004	Framework for Inorganic Metals Risk Assessment (Peer Review Draft). Second of two documents representing the Agency's strategy and recommendations on the incorporation of the latest science in Agency risk assessments of inorganic metal compounds.
2004-2006	Pharmaceuticals and Personal Care Products (PPCPs): Polar Organic Chemical Integrative Sampling (POCIS) and LC-ES/ITMS for Assessing Selected Prescription and Illicit Drugs in Treated Sewage Effluents; Levels of synthetic musks in municipal wastewater for estimating biota exposure in receiving waters; Closed-loop stripping of synthetic musk compounds from fish tissues and analysis by GC/MS/SIM; Virtual Symposium: <i>State of the Science — PPCPs as Environmental Pollutants</i> ; Review article on environmental forensic techniques (e.g., high resolution MS and ICE software) over the last decade; Determination of a bound musk xylene metabolite in carp hemoglobin as a biomarker of exposure by gas chromatography-mass spectrometry using selected ion monitoring.
2005	Toxics : Published Equilibrium-Partitioning Sediment Benchmarks (ESBs) for metal mixtures
2005	Toxics: In cooperation with the Office of Water, developed a new framework for developing water quality criteria for the protection of aquatic life and presented it to the EPA Science Advisory Board. Provides approaches for developing risk- based Water Quality Criteria for protecting aquatic life and aquatic-dependent wildlife.
2005	Toxics: In cooperation with the Office of Water, drafting the document: <i>Methodology for Deriving Ambient Water Quality for the Protection of Human Health</i> (2000). <i>Technical Support Document Volume 3: Development of Site-Specific Bioaccumulation Factors</i>
2005	<i>Predicting Toxicity to Amphipods from Sediment Chemistry</i> . This report describes the development of

	logistic regression models that quantify relationships between the concentration of contaminants in field-collected sediments and the likelihood that those sediments will cause toxicity to marine amphipods. These models are being used to evaluate the ecological risks associated with chemicals in marine and estuarine sediments; inform sampling designs; and were used by the Office of Water to evaluate the quality of the Nation's sediments in the report to Congress ( <i>National Inventory of Sediment Quality</i> .)
<b>LTG 1</b>	<b>Tools to assess response to Nutrients</b>
2000	<i>Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras.</i> Ambient water quality criteria are often used by States to set water quality standards that determine the allowable discharge of pollutants in the Nation's waters. Although this document was aimed initially at coastal regions within the Virginian Province, it has been used to help develop State standards for dissolved oxygen in estuaries throughout the coastal United States.
2001	Workshop on classification of ecological responses in coastal systems (EMAP symposium) Helped establish attributes to test in empirical NHEERL field studies across loading gradients.
2002	Estuarine Nutrient Criteria and Management: Applied long-term monitoring information to determine the processes regulating nutrient dynamics, chlorophyll distributions and hypoxia in a Gulf of Mexico estuary. Results demonstrate that phosphorus pollution, in addition to nitrogen, must be considered in comprehensive nutrient management plans.
2002	<i>Comparative Systems Empirical Modeling Approach: The Empirical Regression Method to Determine Nutrient Load-Ecological Response Relationships for Estuarine and Coastal Waters.</i> This is part of EPA's Nutrient Criteria Technical Guidance for Estuaries and Coastal Waters. It outlines the use of comparative ecology along a nutrient gradient as a method to derive load-response models
2003	<i>Development of Nitrogen Loading – Response Relationships for Estuarine Waters using an Empirical Comparative Systems Approach.</i> This is the first national presentation of AED's approach to development of nitrogen load-response models supportive of Office of Water's Nutrient Criteria Development for estuaries.
2003	<i>Development of Nitrogen Loading-Response Models for Northeast U.S. Estuaries.</i> This is an OW/ORD jointly produced summary of the method for development of load-response models
2003	<i>Proposed Classification Scheme for Predicting Sensitivity of Coastal Receiving Waters to Effects of Nutrients.</i> This report outlined a methodology for development of a function classification of nutrient load-response models for US estuaries and Great Lakes waters
2003	<i>National Saltwater Criteria for Dissolved Oxygen: Potential Addenda to Virginia Province Saltwater Criteria for Warmer and Colder Waters.</i> The document was created to address the growing demand for using the Virginian Province dissolved oxygen criteria approach to regions outside the this Province. Specifically, there was a need to evaluate potential alterations to the criteria when Standards were developed for States that have surface waters that are warmer or colder than those within the Virginian Province.
2003	Estuarine Nutrient Criteria and Management: Demonstrated the critical role of microbial communities in seagrass bed sediments to seagrass growth and condition and developed a model of microbial community interactions and seagrass condition.
2004	Nutrients: Produced seagrass, nutrient stress-response model capable of dealing with multiple stressors.
2004	Estuarine Nutrient Criteria and Management: Applied comprehensive historical water quality information in Chesapeake Bay to determine the long-term change in hypoxia in relation to nutrient loading and river flow. The results are being used by the Chesapeake Bay Program and its partners to refine nutrient management and restoration goals.
2005	Estuarine Nutrient Criteria and Management: Participated in development of a technical document comparing and contrasting the causes and consequences of nutrient enrichment and the prospects for management of eutrophication in two estuaries, Choptank River (primarily affected by agricultural activities) and Patuxent River (primarily affected by sewage inputs).
2005	Convened symposium entitled " <i>Response of Aquatic Food Webs to Nutrient Enrichment: Assessing the State of the Science</i> " that included invited academic experts and EPA. A synthesis report from the

	symposium is in preparation.
2005	Nutrients: Produced summary report of state of science in relation to setting nutrient criteria protective of Submerged Aquatic Vegetation (SAV)
2005	Nutrients: Produced new food web model using stable isotopes as flux constraints to describe effects of freshwater input, nutrient loading, and other stressors on estuarine ecosystem.
2005	Produced sediment diagenetic model for Gulf of Mexico hypoxia zone
2005	Nutrients: <i>Landscape disturbance gradient design for the Great lakes.</i> GLEI-EPA study establishes framework for stressor-response studies of coastal systems, enables evaluation of integrated biological indicators for coastal monitoring.
2005	<i>Implementation Spreadsheet for Interpreting Ambient Dissolve Oxygen Concentrations</i> —This is an Excel-based spreadsheet that allows States and Regions to estimate the % impairment to larval recruitment using measured or estimated concentrations of dissolved oxygen from the field. The spreadsheet was specifically developed for Region 4.
<b>LTG 1</b>	<b>Responses to Habitat Alteration</b>
2003	Habitat Alteration: Developed prototype stream network modeling approach for Coho salmon and native fish.
2003-2004	Habitat Alteration: Technical review of Region 10 water temperature standards for ORD and Region 10, and recently the Office of Water
2003	Estuarine Habitat Criteria and Management: ORD organized a regional workshop on monitoring tidal wetlands to assess their ecological condition” for EPA Region 1, the New England Interstate Water Pollution Control Commission, MA Bays Program, MA Coastal Zone Management, MA Office of Ecosystem Restoration, and Wells National Estuarine Research Reserve, ME.
2003	Estuarine Habitat Criteria and Management: ORD co-organized one day symposium at the Annual Meeting of the National Shellfish Association (New Orleans, LA) entitled: Effect of Habitat Alteration of Shellfish Populations. This meeting brought together scientists from across the country to discuss the relations between habitat alterations and shellfish populations.
2004	Provided support to Office of Water on the ecology of isolated wetlands in response to a 2001 US Supreme Court decision.
2004	Estuarine Habitat Criteria and Management: ORD organized scientific session on Habitat Alteration in the Gulf of Mexico with the Gulf Estuarine Research Society and the Society for Wetland Scientists in Pensacola FL.
2004	Estuarine Habitat Criteria and Management: Conducted a 2-day symposium at the Northeast Aquaculture Conference and Exposition (Manchester, NH) entitled ‘ International Bay Scallop Restoration Aquaculture Symposium’ This session brought together scientists from the Atlantic States to discuss research needs to support restoration of Bay Scallop populations.
2004	Estuarine Habitat Criteria and Management: ORD co-organized meeting with OW to consolidate research directions and programs in habitat alteration in Washington, DC. Every part of OW that deals with habitat was represented, as were NHEERL, NCEA, NRMRL, NERL, NCER, and OSP.
2005	Estuarine Habitat Criteria and Management: ORD organized a national workshop to enhance coordination of wetland projects, with the goal of promoting transfer of ORD’s wetland science to EPA Regions, states, tribes, and local officials. The workshop was sponsored jointly by the Office of Water’s Office of Wetlands, Oceans and Watersheds and ORD’s Office of Science Policy.
2005	Estuarine Habitat Criteria and Management: ORD and Region 1 organized framework for Tiered Aquatic Life Uses and Habitat Alteration at the ANEP conference in Newport RI.
2005	Estuarine Habitat Criteria and Management: ORD organized national working group and national synthesis meeting on Headwater Streams and Isolated Wetlands in response to OW needs.
<b>LTG 1</b>	<b>Methods for Monitoring Pathogens</b>

1995	<i>PLUMES model</i> : Provides methods to design and analyze aquatic outfall systems that form plumes in the environment, having the ability to predict dilution, plume rise, bacterial decay, and other plume properties.
2002	<i>Method 1604: Total Coliforms and Escherichia coli in Water by Membrane Filtration Using a Simultaneous Detection Technique (MI Medium)</i> Reduced culture method to 24 hours and is being used extensively for water quality monitoring.
2004	<i>EMPACT beaches project: Results from a study on microbiological monitoring in recreational waters</i> . A scientifically-sound measurement protocol for collecting samples to more effectively monitor and assess the safety of beach waters.
2004	Rapid (>2hour) fecal indicator method developed (Q-PCR; flow cytometry) for measuring fecal contamination at public beaches (currently being used in recreational water epidemiology study to obtain associations with adverse health effects for OW to use to develop new recreational water criteria).
<b>LTG 1</b>	<b>Methods for Bioassessment</b>
2002	<i>Report on the Biological Condition of Mid-Atlantic Shallow Streams and Deep Rivers Based on Macroinvertebrates as a Basis for Management Action</i> . This report demonstrated that a macroinvertebrate biotic integrity index responded well to the presence of stressors in shallow streams, and it identified the percentage of streams in the Mid-Atlantic highlands region that were in good, fair and poor condition. By contrast, the study showed that the index responded differently in deep rivers.
2004	<i>Bioassessment: A Review of Biological Assessment Tools and Biocriteria in New England States</i> was provided to state and regional biologists, as well as to the Office of Water and the Office of Environmental Information. This report helps improve the quality and consistency in bioassessment and biocriteria programs to provide for more scientifically sound waterbody protection and restoration decisions.
2004	<i>Statistical Guidance for Developing Indicators for Rivers and Streams: A Guide for Constructing Multimetric and Multivariate Predictive Bioassessment Models</i> . This document was incorporated in EPA's Office of Science and Technology's document <i>Methods for the use of statistics in bioassessments and biocriteria development</i> .
2004	<i>Association among invertebrates and habitat indicators for large rivers in the Midwest - How sampling distance, point-sampling of habitat, and subsample size affect measures of large river macroinvertebrate assemblages</i> . With development of this standardized method, regulatory agencies responsible for protecting and restoring water quality have a new tool for determining the condition of large rivers. The method is already in use as the standardized approach for a project in Region 5.
2004	<i>Prototype indicators of condition for deep river fish assemblages developed - electrofishing in boatable rivers: does sampling design affect bioassessment metrics?</i> This research detected significant differences in many common measures of fish assemblage condition as a result of field design. The method is beginning to be adopted as the standard method for conducting state-wide assessments (currently use by U.S. Army Corps of Engineers and Kentucky).
2004	<i>A Review of Biological Assessment Tools and Biocriteria in New England States</i> . This report provides a central resource to compare stream and river bioassessment programs across six New England states.
2004	<i>Statistical Guidance for Developing Indicators for Rivers and Streams: A Guide for Constructing Multimetric and Multivariate Predictive Bioassessment Model</i> . This guidance document provides step-by-step approaches for the developing bioindicators for use in water quality monitoring and promotes the use of biocriteria to more effectively protect and restore ecosystems and water quality.
2004	Two Reports: <i>Association among invertebrates and habitat indicators for large rivers in the Midwest; and Prototype indicators of condition for deep river fish assemblages developed</i> . New large-river sampling methods for macroinvertebrate and fish communities, respectively, now in use in several Midwestern states.

2005	<i>Report on the Field and Laboratory Performance Characteristics of a New Sampling Method for Riverine Macroinvertebrate Assemblages.</i> Quantifies the precision, sensitivity, performance range, bias, and interferences of a large-river macroinvertebrate sampling method so that managers can interpret biomonitoring program results accurately.
2005	<i>A comparison of random and modified random site selection for assessment of wadeable streams in Wisconsin.</i> Quantifies the bias that results from using nearest bridge crossing rather than fully random site selection, so that State water quality assessment programs understand the trade-offs between sampling cost and data quality.
<b>LTG 1</b>	<b>Suspended and Bedded Sediments (SABS)</b>
1996	<i>Sediment bioaccumulation test:</i> Developed standard (ASTM) methods for bedded sediment bioaccumulation test for marine/estuarine waters in support of the dredging program and marine/estuarine risk assessments.
1998	<i>Sediment Quality Criteria:</i> Multi-laboratory effort on development of Agency sediment quality criteria based on equilibrium partitioning theory.
2003	In cooperation with the Office of Water, presented approaches for the development of water quality criteria for Suspended and Bedded Sediments (SABS) to the Science Advisory Board
2005	In cooperation with Office of Water, prepared a draft national strategy for the development of water quality criteria for Suspended and Bedded Sediments (SABS). Provides a synthesis of procedures (tool box) to the states for developing SABS criteria.