



Contaminated Sediments News



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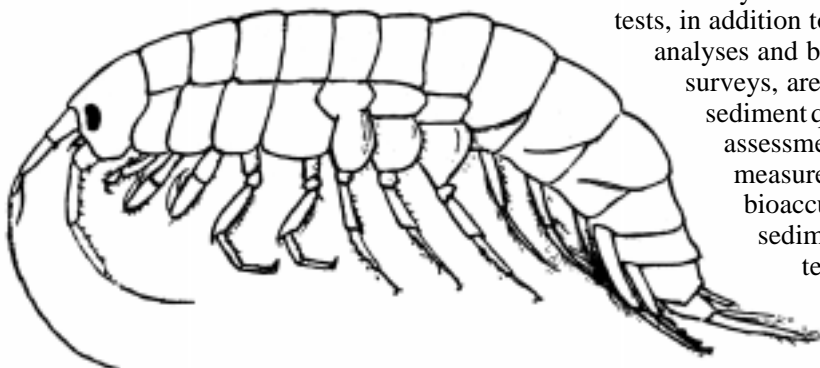
CS News is produced by the EPA Office of Science and Technology (OST) to exchange information on contaminated sediments and to increase communication among interested parties. To obtain copies of this report or to contribute information, contact Charles Kovatch, EPA OST, mail code 4305, 1200 Pennsylvania Ave., NW, Washington, DC 20460 at (202) 260-3754.

To be added to the mailing list or to make changes to your address, please fax your request to Charles Kovatch at (202) 260-9830 or e-mail kovatch.charles@epa.gov.

EPA Headquarters

New Freshwater Sublethal Sediment Toxicity Test Now Available

In March 2000, EPA's Office of Water (OW) and Office of Research and Development (ORD) published the second edition of *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates* (EPA/600/R-99/064). This edition of the "freshwater toxicity test manual" is an update of the 1994 edition (EPA/600/6-94/024), which provided methods to measure 10-day survival of the freshwater amphipod *Hyalella azteca*, 10-day survival and growth of the midge *Chironomus tentans*, and 28-day bioaccumulation in the oligochaete *Lumbriculus variegatus*. In the second edition, the manual has been expanded to include a 10-day growth test for *H. azteca*, as well as methods for evaluating longer-term survival and growth using a 42-day test with *H. azteca* and a 60-day full life-cycle test for *C. tentans*. The latter tests are the first published standard freshwater sediment toxicity tests for measuring long-term sublethal endpoints.



Background

Sediment is an integral component of aquatic ecosystems, providing habitat, feeding, spawning, and rearing areas for many aquatic organisms. Sediment also serves as a repository for pollutants. In fact, when pollutants such as pesticides, herbicides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and metals are introduced into surface waters, they can accumulate in sediments at concentrations much higher than water column concentrations. Contaminated sediments can be directly toxic to benthic (sediment-dwelling) and other sediment-associated organisms. Some sediment-associated pollutants can also bioaccumulate through the food chain and pose health risks to wildlife and human consumers even when benthic organisms are not themselves affected.



Sediment toxicity and bioaccumulation tests, in addition to chemical analyses and benthic community surveys, are valuable tools for sediment quality assessment. They directly measure the toxicity or bioaccumulation of a sediment sample to a test species under controlled laboratory conditions and



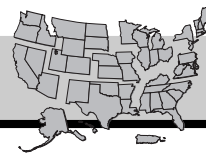
Status of EPA-OST Sediment Documents

Editor's Note: EPA's Office of Science and Technology within the Office of Water and EPA Labs within the Office of Research and Development continue to develop documents about sediment guidelines, management, implementation, guidance, assessment, and models. Some documents are being developed, while others are very near completion or are completed. The status and description of these documents are provided in the following table.

Document Title	Description	Status
1. <i>Introduction to Contaminated Sediments</i> (EPA-823-F-99-006) (brochure) and <i>A Healthy Ecosystem</i> (EPA-H-99-001) (poster).	Educates the public, including citizens groups and high school students, on the definition and extent of contaminated sediment, sources of contamination, remediation and pollution prevention solutions, and what citizens can do to protect sediment. Contact: Rich Healy (202) 260-7812	Published December 1999.
2. <i>Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment: Status and Needs</i> (EPA-823-R-00-001) and <i>Appendix</i> (EPA-823-R-00-002)	Describes how EPA programs currently use bioaccumulation tests and models in evaluating whether contaminated sediments pose an ecological or human health risk. Appendix provides detailed technical data on individual bioaccumulative chemicals of concern. Contact: Rich Healy (202) 260-7812.	Published February 2000.
3. <i>Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants in Freshwater Invertebrates</i> (EPA-600-R-99-064)	The second edition of the 1994 freshwater standard sediment test methods manual includes updates of the two short-term standard freshwater sediment toxicity test methods (<i>Chironomus tentans</i> and <i>Hyalella azteca</i>) and the standard bioaccumulation method (<i>Lumbriculus variegatus</i>). This edition also includes two new long-term sediment toxicity test methods for <i>C. tentans</i> and <i>H. azteca</i> . Contact: Scott Ireland (202) 260-6091.	Published March 2000.
4. <i>Draft Implementation Framework for Use of Equilibrium Partitioning Sediment Guidelines</i>	Describes the use of equilibrium partitioning sediment guidelines (ESG) in water quality standards, TMDL development, NPDES permitting, Superfund, and RCRA programs. Contact: Kathy Zirbser (202) 260-0710.	Expected <i>Federal Register</i> announcement of availability of draft implementation framework fall 2000.
5. <i>Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: Nonionics Compendium</i>	Contains the chemistry and toxicity data used to derive ESGs for 32 nonionic organic contaminants. Contact: Scott Ireland (202) 260-6091.	Final scheduled for fall 2000.
6. <i>Technical Basis for the Derivation of Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: Nonionic Organics</i>	Presents technical basis for establishing ESGs for non-ionic organic chemicals using equilibrium partitioning (EqP). Contact: Heidi Bell (202) 260-5464.	Final scheduled for fall 2000.

Document Title	Description	Status
7. <i>Methods for the Derivation of Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: Nonionic Organics</i>	Provides guidance that can be used to modify national ESGs for nonionic organic chemicals to reflect specific local conditions. Contact: Heidi Bell (202) 260-5464.	Final scheduled for fall 2000
8. <i>Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: Dieldrin</i>	Recommends a sediment concentration for the insecticide dieldrin that is EPA's best estimate of the concentration protective of the presence of benthic organisms. Contact: Heidi Bell (202) 260-5464.	Final scheduled for fall 2000
9. <i>Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: Endrin</i>	Recommends a sediment concentration for the insecticide endrin that is EPA's best estimate of the concentration protective of the presence of benthic organisms. Contact: Heidi Bell (202) 260-5464.	Final scheduled for fall 2000
10. <i>Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: Metals Mixtures (Cadmium, Copper, Lead, Nickel, Silver, Zinc)</i>	Recommends a sediment concentration for mixtures of Cd, Cu, Pb, Ni, Ag, Zn that is EPA's best estimate of the concentration of the mixtures that will protect benthic organisms from the direct toxicity of these metals in sediments. Contact: Heidi Bell (202) 260-5464.	Final scheduled for fall 2000
11. <i>Draft Equilibrium Partitioning Sediment Guidelines (ESGs) for the Protection of Benthic Organisms: PAH Mixtures</i>	Recommends a sediment concentration for PAH mixtures that is EPA's best estimate of the concentration of the mixtures that will protect benthic organisms from the direct toxicity of these PAHs in sediments. Contact: Heidi Bell (202) 260-5464.	Draft to peer review scheduled for fall 2000.
12. <i>Methods for Assessing the Chronic Toxicity of Marine and Estuarine Sediment-associated Contaminants with the Amphipod Leptocheirus plumulosus</i>	Will be a joint EPA/U.S. Army Corps of Engineers publication that contains a standard 28-day marine and estuarine sediment toxicity test method using <i>Leptocheirus plumulosus</i> with endpoints for survival, growth, and reproduction. Contact: Scott Ireland (202) 260-6091.	Final scheduled for FY 2001.
13. <i>Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analysis</i>	Will cover the following topics: 1) collecting, handling, and transporting field sediments; 2) manipulating sediments in the laboratory for chemical analysis and toxicological testing; and (3) preparing formulated sediments for toxicological testing. Contact: Rich Healy (202) 260-7812.	Final scheduled for summer 2001.
14. <i>The Incidence and Severity of Contamination in Surface Waters of the United States</i>	Will report on the quality of aquatic sediments in the United States from studies conducted from 1980 through 1999. Contact: Scott Ireland (202) 260-6091	Final scheduled for FY 2001.

Regional Activities



EPA Region 5

Great Lakes Dredging Team Announces New Publication and Updated Web Site

The Great Lakes Dredging Team published *Dredging and the Great Lakes* in October, 1999. The document addresses the dredging history of the Lakes, the importance of dredging, environmental and economic considerations, and public input. The document also covers Great Lakes commercial navigation, recreational boating, sedimentation, dredging activities (dredging equipment, environmental dredging, environmental windows, disposal, beneficial uses of dredged material), and the public's role in dredging. Information on how to obtain a hard copy, an electronic copy, or a video can be found at www.glc.org/projects/dredging.

Updated Web Site

Great Lakes Dredging Team announces a new look for its web site. The web site continues to provide important dredging-related information, but the new format

allows for easier viewing and navigation and better accommodates new information. It boasts two new features: a New Scoop page to highlight new dredging-related information and current events in the region, and a page for case studies. Eventually, a "dredging around the lakes" page will be activated using a map as an interface to link to geography-specific information: www.glc.org/projects/dredging.

The Great Lakes Dredging Team is a federal-state-private partnership with the primary objective of ensuring that the navigational dredging of the Great Lakes harbors and channels is conducted in a timely and cost-effective manner while meeting environmental protection, restoration, and enhancement goals. The Team provides an interactive forum for all stakeholders regarding the dredging process and dredged material-related issues and their resolution, and also works with local advocates to bring information about dredging and dredged material management to a larger public audience. For more information contact Bonnie Eleder at (312) 886-4885 or e-mail: eleder.bonnie@epa.gov.

EPA Laboratories



Atlantic Ecology Division

Sediment Toxicity Assessment: Comparison of Standard and New Testing Designs

Standard methods of sediment toxicity testing are fairly well accepted; however, as with all else, evolution of these methods is inevitable. As part of this evolution, EPA compared a standard American Society for Testing and Methods (ASTM), 10-day amphipod toxicity testing method with shorter, 48- and 96-hour test methods. In addition, they compared parallel exposures of single species in a test chamber versus multiple species cohabiting the smaller,

shorter exposure chambers. There was no overall change in mortality for the organisms, and the smaller chambers were predictive of the results obtained with larger, longer, exposures. EPA also concluded that in whole sediment exposures there was no change in toxicity to either the amphipod *Ampelisca abdita*, or the mysid *Americamysis bahia* when they cohabited the same chamber. In contrast, for water-only or porewater exposures, *A. bahia* demonstrated less sensitivity when cohabiting the same chamber as *A. abdita*. For more information, contact Kay T. Ho at (401) 782-3196 or e-mail: ho.kay@epa.gov.

Identification of Metal Toxicity in Marine Sediments

A multi-Agency effort is under way to develop methods for characterizing and identifying the causes of toxicity in contaminated sediments. This effort includes researchers from ORD laboratories in Duluth (MN) and Narragansett (RI) as well as the USGS facility in Columbia (MS). In the context of this research, causes of contaminated sediment toxicity are divided into three chemical classes: ammonia, organics, and metals. To characterize and identify toxicity caused by metals in marine sediments, a method has been developed, adding chelating resin to toxic sediments. Under laboratory conditions and with metal-spiked sediments, they have found this

resin to be very effective at reducing toxicity to the amphipod *A. abdita* and mysid *M. bahia*. Metals for which the resin chelated include cadmium, copper, nickel, lead, and zinc. The resin is nontoxic to control organisms in the quantities used and does not alter the toxicity of ammonia and a representative organic contaminant. Furthermore, following a toxicity test, the resin can be removed from the sediment and the metals extracted for further identification. Currently, the researchers are in the process of verifying the utility of this method with field-contaminated sediments and are interested in discussing with other scientists any sediments known to be contaminated and toxic due primarily to divalent transition metals. For more information, contact Rob Burgess at (401) 782-3106 or e-mail: burgess.robert@epa.gov.

U.S. Army Corps of Engineers



High Throughput, Rapid, Economical Bioassays to Assess Sediment Toxicity

Contaminated Sediments

Although contaminated sediments may contain hot spots, the majority of the volume of contaminated sediments contain only low to moderate levels of contaminants. Accurate assessment of the environmental hazard posed by sediments containing low to moderate levels of contaminants derived with standard analytical methods is uncertain due to questions about the bioavailability of hydrophobic contaminants, synergistic effects of contaminant mixtures, and the speciation of metals. This uncertainty leads regulatory agencies to define contaminated sediments by conservative standards. Chronic exposure of benthic macrofauna is one of the best accepted methods for determining the toxicity of low to moderately contaminated sediments, but the general application of chronic bioassays is limited by the time (usually 1 life cycle of the bioassay species) and expense of conducting these tests.

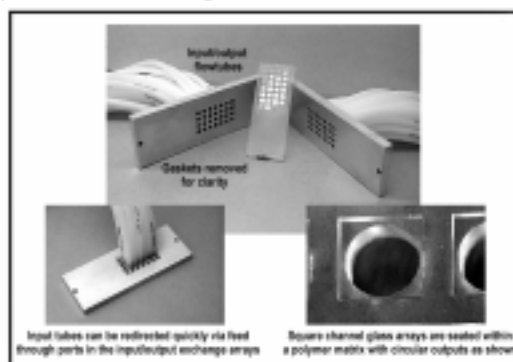
Transcriptional Level Environmental Toxicity Assessment

Transcriptional level (mRNA) toxicity assessments offer great advantages in terms of speed, cost, and sample throughput.

The U.S. Army Corps of Engineers has developed a Genosensor system (Figure 1) specifically to meet the needs of transcription-level environmental toxicity assessment. The Genosensor system is comprised of (1) flow-through, high-density nucleic acid hybridization array based on nanochannel glass; (2) newly developed nucleic acid hybridization probe software that enables probes to be designed to meet requisite thermodynamic and biological (i.e., consensus-degenerate) needs; (3) tandem hybridization strategy that minimizes non-specific hybridization; and (4) a multi-channel physical format designed to boost sample throughput.

Figure 1. A low-volume, flow-through manifold system was built for the simultaneous hybridization of nucleic acids extracted from 24 environmental samples. Each cell contains nanochannel glass spotted with 64 different hybridization probes. The standard microscopic slide format permits use of automated microarray readers. Within 2

hours of hybridization, an automated reader with a 24-slide capacity and a 5 minute per slide reading time can determine the expression levels of 64 different stress response genes in a maximum of 576 environmental samples.



Results

The environmental relevance of transcriptional level toxicity data was determined by correlating whole-organism responses to expression levels of stress response genes. Chronic and acute exposures using fresh water (*Chironomus tentans* and *Hyalella azteca*) and saltwater (*Neanthes arenaceodentata* and *Leptocheirus plumulosus*) benthic macrofauna were conducted. Mortality, growth rates, and reproductive success were directly compared to the expression (mRNA) levels of hundreds of stress response genes (e.g., P₄₅₀, superoxide dismutase, DNA topomerase, etc.). Transcription levels of some stress response genes were highest during the

initial low-level exposures (P₄₅₀) whereas others were not transcribed until after long or high-level exposures.

For More Information

This work resulted from the collaborative research efforts of Dr. Kenneth Beattie (Oak Ridge National Laboratory), Dr. Ronald Tonucci (Naval Research Laboratory), Dr. James Fleming (University of Tennessee at Knoxville), Dr. Todd Bridges (US Army Engineer Research and Development Center (ERDC)), Dr. Edward Perkins (ERDC), and Dr. Herbert Fredrickson (ERDC). For more information, contact Dr. Herbert Fredrickson at (601) 634-3716, Fax (601) 634-3120, e-mail: fredrih@wes.army.mil.

Also in the News



Marine Transportation System Task Force

The U.S. Marine Transportation System (MTS) consists of more than 25,000 miles of navigable U.S. waterways, ports, and their intermodal connections, vessels, vehicles, and system users. The MTS facilitates the bulk of U.S. exports and imports and provides economic, national security, environmental, and recreational values to millions of Americans. The MTS annually (1) moves more than 2 billion tons of domestic and international freight; (2) imports 3.3 billion barrels of oil to meet U.S. energy demands; (3) transports 134 million passengers by ferry; (4) serves 78 million Americans engaged in recreational boating; (5) hosts more than 5 million cruise ship passengers; and (6) supports 110,000 commercial fishing vessels and recreational fishing watercraft, which contribute \$111 billion to state economies.

The MTS initiative began in spring 1998 with seven Regional Listening Sessions. The Sessions were used to gather stakeholder input on the current state and future needs of the MTS. The input provided from the sessions helped in developing agenda items for a National

Conference in November 1998. Following the conference, the Secretary of Transportation established the congressionally mandated MTS Task Force. The Task Force was formed to conduct an assessment of the MTS and its adequacy to operate in a safe, efficient, secure, and environmentally sound manner. Members of the Task Force include the U.S. Coast Guard, the Maritime Administration, the Army Corps of Engineers, the National Oceanic and Atmospheric Administration, the Environmental Protection Agency, and other federal agencies. One of the initiatives identified by the MTS Task Force includes systematic approach for identifying and addressing environmental protection risks and promoting effective sediment management and watershed protection. The MTS Task Force has sponsored seven Regional Dialogue Sessions throughout the country in summer 2000. Stakeholder input from the Sessions will be incorporated into the forthcoming MTS Implementation Plan and Strategic Plan.

For information on the Marine Transportation System, visit the web site at www.dot.gov/mts/ or contact Sharon Lin at lin.sharon@epa.gov.

TOXICITY TEST *Continued from page 1*

are especially useful because they account for interactive effects of chemical mixtures. The freshwater toxicity test manual was developed to promote the use of uniform sediment testing procedures, which is expected to increase data accuracy and precision, facilitate test replication, improve the comparative value of test results, and ultimately increase the efficiency of regulatory processes requiring sediment tests. By providing long-term methods, this addition allows for a more comprehensive sediment evaluation.

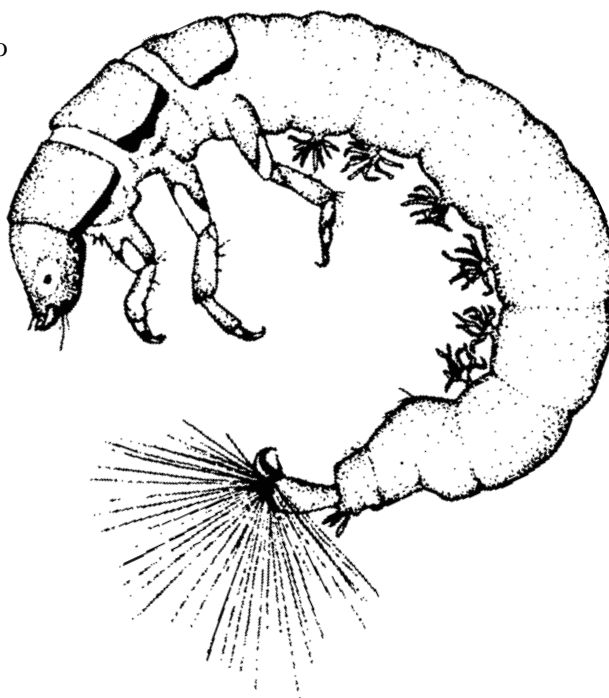
New Test Method

The addition of the two long-term sediment toxicity test methods for *H. azteca* and *C. tentans* is the most notable manual revision. The long-term sediment exposures with *H. azteca* begin with 7- to 8-day-old amphipods. On Day 28 of the sediment exposure, the amphipods are isolated from the sediment and placed in water-only chambers, where reproduction is measured on Days 35 and 42. Endpoints measured in the long-term amphipod test include survival (Days 28, 35, and 42), growth (Days 35 and 42), and reproduction (number of young per female produced from Days 28 to 42).

The long-term sediment exposures with *C. tentans* start with newly hatched larvae (less than 24 hours old) and continue through emergence, reproduction, and hatching of the next generation (about a 60-day sediment exposure). Survival and growth are measured at Day 20. From Day 23 to the end of the test, emergence and reproduction of *C. tentans* are monitored daily. Egg masses are isolated to count the number of eggs per female, then incubated for 6 days to determine hatching success.

Obtaining the Document

Copies of the complete document, *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates, Second Edition* (EPA-600-R-99-064) can be obtained from the National Service Center for Environmental Publications, P.O. Box 42419, Cincinnati, OH, 45242; by phone at 1-800-490-9198 or at www.epa.gov/ncepihom/orderpub.html on the Internet. A pdf version of this document is available on the EPA Office of Science and Technology web site at <http://www.epa.gov/ost/cs/freshfact.html>.



Contaminated Sediment Web Pages



Interested in checking out some contaminated-sediment web sites? Here are a few you can browse:

- **MPCA's Contaminated Sediments.**

The Minnesota Pollution Control Agency (MPCA) recently completed a multipurpose Contaminated Sediments web page (www.pca.state.mn.us/netscape.shtml). The web page illustrates how MPCA is using an ecosystem-based management approach to involve the public and other interested stakeholders in decision-making processes about contaminated sediments. The web page features educational information on the assessment, management, and remediation of contaminated sediments (including guidance documents and web-related links); fact sheets; and geographic information about contaminated sediment areas in Minnesota, including data and reports (especially for the St. Louis River Area of Concern). For more information about contaminated sediment issues in Minnesota, contact Judy Crane at (651) 297-4068, Fax (651) 297-7709, or e-mail judy.crane@pca.state.mn.us.

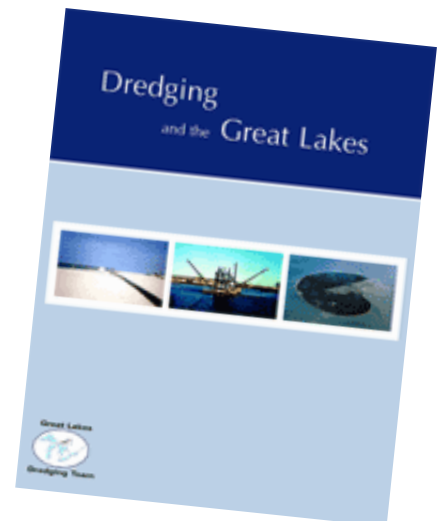
- **Sediments Research Web.** This is an online community designed to promote improvements in the management and remediation of contaminated sediments. You participate in the community by registering as a member, joining in online discussions of pertinent technical topics, contributing articles to the online library, or placing items on the bulletin board. This web site (www.sediments.org) is sponsored by the South and Southwest region of the Hazardous Substance Research Centers (HSRC), a five-center consortium established and supported by USEPA. Any questions or comments about this web site may be directed to Mark Hodges at (404) 894-6987, e-mail: mark.hodges@gtri.gatech.edu.

- **Great Lakes Dredging Team.** The web site boasts a new look—adding features such as a new “scoop” page and a page for case studies. More information can be found on page 4 or at www.glc.org/projects/dredging.

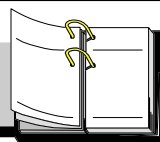
Announcements



The Great Lakes Dredging Team announces the publication of *Dredging and the Great Lakes*. This a full-color, illustrated booklet that highlights issues such as the beneficial use of dredged material, the role of sedimentation, the dredging connection with commercial navigation and the citizen's role in the dredging process. See the article on page 4 for more information. To obtain a hard copy or electronic copy of the book, visit www.glc.org/projects/dredging.



CSN Activities Timeline



September 7-9, 2000

Annual Ohio Lake Erie Conference, Sandusky, OH. This conference is sponsored by Ohio Lake Erie Commission. For more information, contact Jill Woodyard at jill.woodyard@www.epa.state.oh.us.

September 11-14, 2000

8th National Nonpoint Source Monitoring Workshop: Monitoring and Modeling Nonpoint Source Pollution in the Rural-Urban Interface, Hartford, CT. Contact John Clausen, University of Connecticut, Department of Natural Resources Management & Engineering, 1376 Storrs Rd, U-4087, Storrs, CT 06269-4087. Phone: (860) 486-2840, Fax: (860) 486-5408; e-mail: jclausen@canr.uconn.edu; web site: www.ce.uconn.edu/nps.html.

September 11-14, 2000

Oceans 2000, Providence, RI. For more information, go to the conference web site at www.OCEANS2000.com.

September 18-20, 2000

Coastal Environment 2000—Environmental Problems in Coastal Regions, Third International Conference, Las Palmas de Gran Canaria, Spain. Contact Sally Walsh, Conference Secretariat, Wessex Institute of Technology, Ashurst Lodge, Ashurst Southampton, SO40 7AA, UK. Phone: +44 (0) 238 029 3223; Fax: +44 (0) 238 029 2853; e-mail: slwalsh@wessex.ac.uk.

September 18-22, 2000

Wildland Hydrology's River Short Courses 2000: River Morphology and Applications, Pagosa Springs, CO. Contact Wildland Hydrology, 1481 Stevens Lake Road, Pagosa Springs, CO 81147. Phone: (970) 731-6100; Fax: (970) 731-6105; e-mail: wildlandhydrology@pagosasprings.net.

September 22-24, 2000

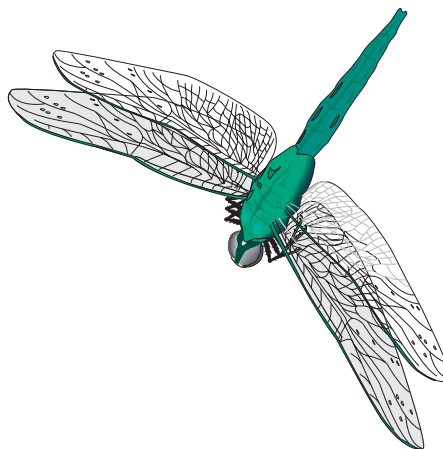
Environmental Problem Solving with GIS, Cincinnati, OH. Contact Lisa Enderle, (412) 741-5462, e-mail: lisa.e.enderle@cpmx.saic.com; web site: www.epa.gov/ttbnrml/.

October 1-4, 2000

27th Annual Aquatic Toxicity Workshop, St. John's, Newfoundland, Canada. The ATW program includes platform and poster presentations and short courses, dealing with pulp and paper, mining, commercial chemicals, water quality, risk assessment, toxicity test methods, marine and freshwater environments, contaminant fate/transport, endocrine disruption, and environmental policy. For more information, contact Kathy Penney, Jacques Whitford Environment Ltd., at (709) 576-1458; Fax (709) 576-2126; e-mail: kpenney@jacqueswhitford.com. or Kim Coady, Environment Canada, at (709) 772-4087; Fax (709) 772-5097; e-mail: kim.coady@ec.gc.ca.

October 10-19, 2000

Wildland Hydrology's River Short Courses 2000: River Restoration and Natural Channel Design, Pagosa Springs, CO. Contact Wildland Hydrology, 1481 Stevens Lake Road, Pagosa Springs, CO 81147. Phone: (970) 731-6100; Fax: (970) 731-6105; e-mail: wildlandhydrology@pagosasprings.net.



October 11-13, 2000

Brownfields 2000 Conference, Atlantic City Convention Center, Atlantic City, NJ. The national Brownfields Conferences bring together key experts from all levels of government, business, and finance and from local communities to share ideas and experiences in the field of urban and environmental development. Participants in the conferences focus their efforts on properties known as "brownfields"—abandoned, idle, or underused industrial and commercial properties at which real or perceived contamination interferes with efficient expansion or redevelopment efforts. For more information about the program, visit the Brownfields 2000 Web Site at www.brownfields2000.org or phone (412) 261-0710, ext. 32. Presented by The Engineers' Society of Western Pennsylvania. Co-Sponsored by EPA and others.

October 14-18, 2000

Water Environment Federation Technology (WEFTEC) 2000 Exhibition, Anaheim, CA. Will provide the most up-to-date information on every wastewater treatment and water quality subject. Choose workshops and technical sessions with over 500 relevant presentations—not to mention almost 100 poster presentations over the course of five days. For more information, go to www.wef.org/Weftec/index.htm.

October 15-16, 2000

Annual Meeting of Great Lakes Commission, Hamilton, Ontario. For more information, e-mail mdonahue@glc.org or visit www.glc.org.

October 16-19, 2000

16th Annual International Conference on Contaminated Soils, Sediments, and Water, Amherst, MA. Topics will include bioremediation, environmental fate and modeling, risk assessment, soil chemistry, regulatory programs, chemical analysis, and many others. For further information, go to the conference web site at www.aehs.com or contact Denise Leonard at (413) 545-1239 or e-mail: dleonard@schoolph.umass.edu.

October 17-19, 2000

4th State of the Lakes Ecosystem Conference (SOLEC), Hamilton, Ontario. For more information, visit www.epa.gov/glindicator or e-mail paul.horvatin@epa.gov.

October 17-21, 2000

Spanning Cultural and Ecological Diversity Through Environmental Education, The 29th Annual Conference of the North American Association for Environmental Education, South Padre Island, TX. For more information, visit www.naaee.org.

October 24-26, 2000

Conference 2000, University of Delaware, Newark, DE. The conference will focus on erosion, sediment, and stormwater management. Early registration fee is \$195 and \$235 after September 15, 2000. Contact Jeanne Feurer, Conference Coordinator, Delaware Department of Natural Resources and Environmental Control, Division of Soil and Water Conservation, 89 Kings Highway, Dover, DE 19901. Phone: (302) 739-4411; Fax: (302) 739-6724; e-mail: jfeurer@dnrec.state.de.us.

October 26-28, 2000

National Carbon Sequestration Conference, Missoula, MT. Contact Karen Reiter at (406) 587-6965; e-mail: kreiter@mt.nrcs.usda.gov.

October 30, 2000

Healthy Watersheds: Community Based Partnerships for Environmental Decision-making, Aurora, CO. Contact Phyllis O'Meara at (303) 671-1034, e-mail: paomeara@opm.gov.

October 31- November 4, 2000

Combined Conferences of the American Society of Agronomy, Crop Science Society of America and Soil Science Society of America, Salt Lake City, UT. Web site: www.asa-cssa-sssa.org/olr99/.

November 8-10, 2000

Facilitating and Mediating Effective Environmental Agreements, Berkeley, CA. Contact CONCUR, Inc. at (510) 649-8008; web site: www.concurinc.com.

November 10-11, 2000

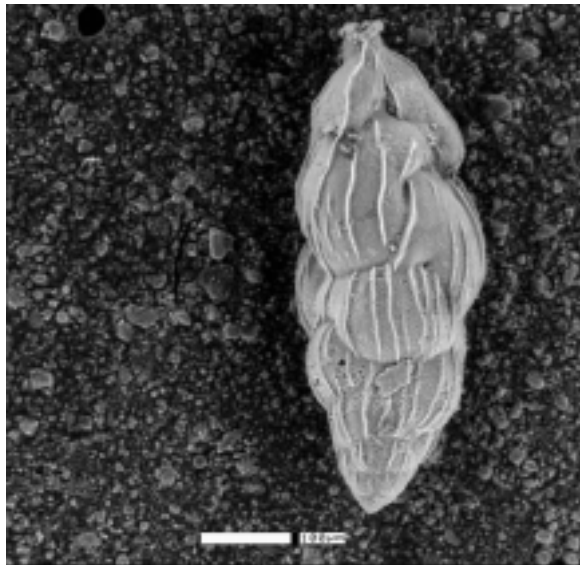
8th ACM Symposium on Advances in Geographic Information Systems, Washington, DC. For more details, contact Robert Laurini at +33-4-72-43-8713; Fax +33-4-72-43-8172; e-mail: Robert.Laurini@if.insa-lyon.fr.

November 12-16, 2000

SETAC 21st Annual Meeting, Nashville Convention Center, Nashville, TN. Environmental Science in the 21st Century: Paradigms, Opportunities, and challenges. For more information, contact: SETAC Office, 1010 North 12th Avenue, Pensacola, FL 32501-3367. Phone: (850) 469-1550; Fax: (850) 469-9778; e-mail: setac@setac.org.

Creature Feature

This single celled organism declared – I think, therefore I am. . . *What am I?*



(Answer) Meiobenthic Foraminiferan – Uvigerinella californica

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web site <http://www.ucmp.berkeley.edu/foram/foram.html>

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