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- Office of Research and Development
  - National Health and Environmental Effects Research Laboratory
    - Mid-Continent Ecology Division, Duluth, Minnesota

In this Issue:

MED in Review Editor
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Research Events

Caged Fish Studies Focus on Contaminants of Emerging Concern

Team members with the Toxic Effects Characterization Research Branch took to the field–or should we say harbor–last summer in support of the Great Lakes Restoration Initiative. The overall goal of this research is to develop and validate methods using in vitro cell based systems (with field collected water samples) and caged fish exposures that are suitable for detecting and monitoring different classes of contaminants of emerging concern in the Great Lakes. Site locations focused primarily on wastewater treatment plant discharges and areas where endocrine disrupting compounds may be present. Some of these sites are currently monitored by the US Geological Survey, the Minnesota Pollution Control Agency, US Fish and Wildlife Service, and the University of St. Thomas.

Mike Kahl and Linnea Thomas, Student Services Contractor, at harbor landing

Linnea Thomas

One of the primary goals addressed this season was the development of an easily deployed caged fish exposure system for studies ranging from 2 to 10 days using sexually mature fathead minnows (*Pimephales promelas*). A preliminary study in July helped refine organism transport and deployment techniques as well as containment and sampling concerns. Four exposure sites were used for the definitive ten-day fish exposure in September. They were the upper St. Louis River in Fond du Lac, two sites near the Western Lake Superior Sanitary District, and one site near the Superior Municipal Wastewater Treatment Facility. Modified cages containing fish were secured to each of the three buoys at each of the four exposure sites. Deployment techniques developed last summer will be used at sites in the Great Lakes including New York, Ohio, Michigan, Wisconsin, and Minnesota in 2011 and 2012. **Contact**: Michael Kahl (218) 529-5179.

Fond du Lac site

R/V Lake Explorer II Works in Lake Michigan's Green Bay

MED researchers in the Ecosystem Assessment Research (ECAR) branch conducted a shakedown science cruise for the *R/V Lake Explorer II* in Lake Michigan's Green Bay August 23-27. The ship was recently transferred to MED from NOAA and is being retrofitted to support MED research activities. This cruise provided a first full scale operational test to evaluate the existing science configuration and identify additional ship outfitting needs. We also deployed and tested a new in situ nitrate analyzer (SUNA, from the Satlantic Corp.). The principle of detection for the nitrate analyzers is based on a characteristic NO3 UV absorption spectrum. The nitrate analyzer adds a nutrient component to our current tow system that monitors physical and biological parameters; it can make nutrient measurements at a frequency of every two seconds while being towed up and down through the water column. This will provide high-resolution data and spatially connect and extend fixed-station discrete depth sampling for NO3.

Lake Explorer II underway
Photo courtesy of John McDonough, Escanaba

Sunrise in Escanaba
Photo courtesy of John McDonough

The primary research objective for the cruise was to conduct a high-resolution survey using continuous towing technology along approximately 365 km of nearshore (<30 m depth) in Lake Michigan's Green Bay. The data (270,000 records consisting of multiple fields) provide geo-position based information on variability along the nearshore to be analyzed with respect to landscape characteristics of the adjacent coastal watersheds. The Green Bay tow covered a large portion of Lake Michigan, and complements a survey (1100 km) in September 8-15 from the *R/V Lake Guardian* (also an ECAR research activity). Both the August and September tow surveys 1) complete an initial field program for developing a nearshore monitoring program across the Great Lakes and 2) supported the 2010 Coordinated Science and Monitoring Initiative (CSMI) effort to sample Lake Michigan. The EPA Great Lakes National Program Office's CSMI will promote a coordinated comprehensive sampling of each Great Lake on a five-year rotational cycle by various bi-national government agencies. The Lake Michigan sampling completed the first round of organizational attempts in this effort. The August and September surveys also were concurrent with the first National Coastal Condition Assessment (NCCA) for the Great Lakes conducted by the Office of Water (with technical support from MED). The tow surveys provide an alternate comparison to the NCCA fixed-station (45 sites) sampling of Lake Michigan's nearshore region (<30 m depth or within 5 km from the shoreline).

Peder Yurista

ECAR staff participating in the Green Bay cruise included Tim Corry, Anne Cotter, Andrew Just (summer student), Sam Miller, Jill Scharold, Jon Van Alstine, and Peder Yurista.
Contact: Jack Kelly (218) 529-5119.

MED Paper Highlighted in *Tox Sci*

Hornung, M.W., S.J. Degitz, J.J. Korte, J.M. Olson, P.A. Kosian, A.L. Linnum, and J.E. Tietge. Inhibition of thyroid hormone release from cultured amphibian thyroid glands by methimazole, 6-propylthiouracil, and perchlorate. *Toxicological Sciences* 118:42-51.

A recently published paper from the Division is the subject of a "Highlight" article in the September 2010 issue of *Toxicological Sciences*. Papers selected to be highlighted generally are considered by the editorial staff of the journal to be exceptionally timely and of great importance to the broad toxicology community. The work by Hornung and co-investigators presents ongoing efforts to develop assays that can be used to test chemicals for thyroid hormone disruption using thyroid gland explant cultures from *Xenopus laevis* tadpoles. These assays are similar to high-throughput, cell-culture-based assays in that they are conducted in 96-well plates, and, yet, like the in vivo tadpole, the cultured thyroid gland retains the functional components necessary for thyroid hormone synthesis and secretion. In the highlighted editorial by Dr. Martin van den Berg, he states that ". . . the development of an in vitro/ex vivo assay with a thyroid gland that has kept its functional integrity and natural response to TSH, would be a significant step forward for the screening methodology of potential thyroid toxicants." These authors are continuing work with this assay, investigating structure-activity relationships for chemicals that can disrupt thyroid hormone synthesis and release and, are collaborating with NRMRL scientists to investigate the applicability of this assay as a tool to identify thyroid-hormone-disrupting activity in environmental water samples.
Contact: Mike Hornung, (218)529-5236, hornung.michael@epa.gov.

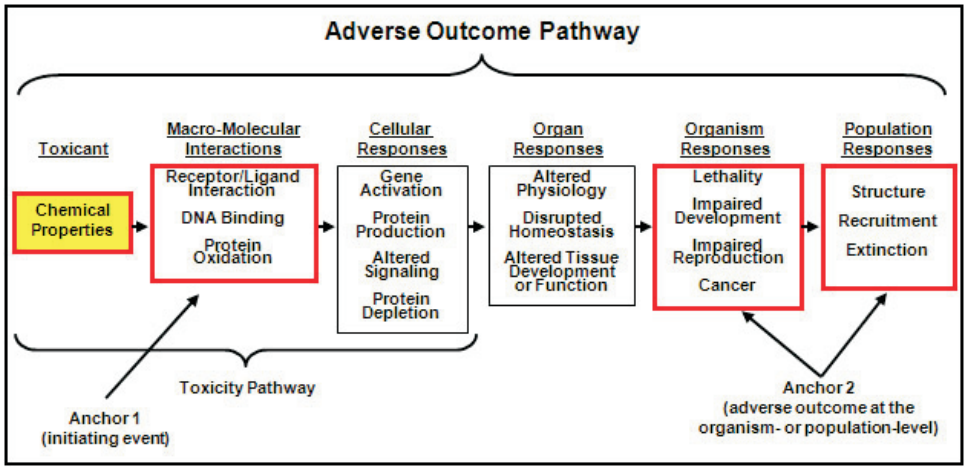
MED Scientists Advance Adverse Outcome Pathways

Ecological risk assessors face increasing demands to assess more chemicals, with greater speed and accuracy, and to do so using fewer resources and experimental animals. New approaches in biological and computational sciences may be able to generate mechanistic information that could help in meeting these challenges. However, to use mechanistic data to support chemical assessments, there is a need for effective translation of this information into endpoints meaningful to ecological risk-effects on survival, development, and reproduction in individual organisms and, by extension, impacts on populations.

These issues are addressed in an article authored by a group of MED scientists following a year's worth of spirited discussions about how ecotoxicology research fits into the newly emerging push to move toxicology testing away from standard whole-organism testing toward the use of more in vitro testing methods to evaluate chemical hazard. The paper, "Adverse outcome pathways: A conceptual framework to support ecotoxicology research and risk assessment," addresses issues and approaches that may be unique to ecotoxicology, and are not addressed in the National Research Council's (NRC) 2007 Report, "Toxicity Testing in the 21st Century: A Vision and a Strategy," which is focused on new approaches to toxicity testing in the context of protecting human health.

In this paper, the MED authors discuss the adverse outcome pathway (AOP), which is a conceptual construct that portrays existing knowledge concerning the linkage between a direct molecular initiating event and an adverse outcome at a biological level of organization relevant to risk assessment. The practical utility of AOPs for ecological risk assessment of chemicals is illustrated using five case examples. The examples demonstrate how the AOP concept can focus toxicity testing in terms of species and endpoint selection, enhance across-chemical extrapolation, and support prediction of mixture effects. The examples also show how AOPs facilitate use of molecular or biochemical endpoints (sometimes referred to as biomarkers) for forecasting chemical impacts on individuals and populations. The concluding sections of the paper include discussion of how AOPs can help to guide research that supports chemical risk assessments and advocate for the incorporation of this approach into a broader systems biology framework.

Since the publication of the NRC's report in 2007, there has been a continual scientific dialogue regarding how new emerging technology will help shape the conduct of toxicology in the future, and the AOP concept has been a part of this discussion.



For example, the AOP concept was an organizing theme for a SETAC-sponsored Pellston Workshop titled "A vision and strategy for predictive ecotoxicology in the 21st century: defining adverse outcome pathways associated with ecological risks," held in April 2009. The workshop, co-chaired by Dan Villeneuve (MED), considered approaches for developing and defining AOPs based on either consideration and review of the extant scientific literature or reverse engineering and biological network inference employing "omics." It also considered the application of AOPs and mechanistic information to address some long-standing challenges in ecotoxicology, including: 1) translating effects on individuals to potential population outcomes, 2) understanding the biological basis of complex concentration-duration-response relationships, and 3) species extrapolation. Results of this SETAC workshop are summarized in a series of journal articles in the January 2011 issue of *Environmental Toxicology and Chemistry* (Volume 30, No. 1) and were the basis of special sessions at SETAC North America, Society of Toxicology, and SETAC Europe annual meetings (2009-2010). Gary Ankley, Matt Etterson, Mike Hornung, John Nichols, and Dan Villeneuve participated in the workshop, presented at the technical sessions, and/or contributed to the papers.

The potential utility of the AOP concept in supporting the development and acceptance of credible alternatives to whole animal testing in ecotoxicology was a prominent topic at the HESI-sponsored International Workshop on Development of Alternatives to Chronic Ecotoxicity Tests held in June 2009. Such alternative approaches are of particular interest in Europe in response to REACH legislation that calls for replacement, refinement, and reduction of animal use in research and toxicity testing. Dan Villeneuve and

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Adverse Outcome Pathways – *continued*

Teresa Norberg-King (MED) were invited to provide plenary presentations on the AOP concept and the state-of-the-science in aquatic toxicity testing with fish. AOP case studies were used to focus discussions regarding potential assays, endpoints, and computational approaches that may ultimately prove predictive of ecological hazard.

These issues were the focus of the 2010 fall meeting of the Northland Chapter of the Society of Toxicology held in St. Paul, MN in October. Speakers included Mel Anderson, one of the primary authors of the NRC Report on Toxicity Testing in the 21st Century; David Dix, of USEPA's National Center for Computational Toxicology; James McKim of CeeTox, Inc. who discussed alternative in vitro methods to in vivo toxicity testing; and Mike Hornung who presented the highlights of the AOP paper.

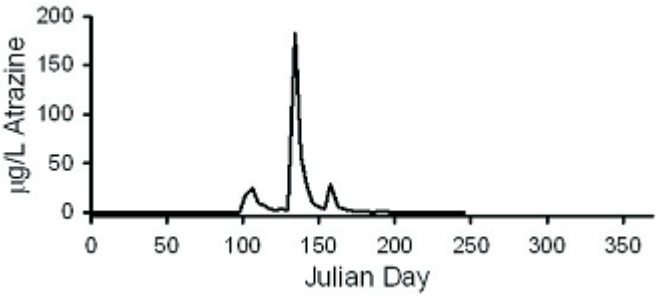
Most recently a workshop was held by the Organisation for Economic Cooperation and Development (OECD) in Washington, DC on December 7-10, to discuss "Using mechanistic information in forming chemical categories to fill data gaps for regulatory purposes." In this workshop the AOP framework was the guiding tool for discussions on how to approach linking structure activity relationships to endpoints used for regulatory purposes. MED was well-represented at this meeting. Chris Russom was one of the organizers of this workshop, and Gary Ankley, Mike Hornung, Pat Schmieder, and Dan Villeneuve also participated.

MED scientists continue to provide leadership in the application of the AOP concept to support the transition to a more mechanistically-based paradigm in ecotoxicity testing and ecological risk assessment.
Contact: Mike Hornung (218) 529-5236, Dan Villeneuve 529-5217.

Reference: Gerald T. Ankley, Richard S. Bennett, Russell J. Erickson, Dale J. Hoff, Michael W. Hornung, Rodney D. Johnson, David R. Mount, John W. Nichols, Christine L. Russom, Patricia K. Schmieder, Jose A. Serrano, Joseph E. Tietge, and Daniel L. Villeneuve. 2010. Adverse outcome pathways: A conceptual framework to support ecotoxicology research and risk assessment. *Environmental Toxicology and Chemistry* 29:730-741.

Setting Levels of Concern for Atrazine Exposures to Freshwater Plant Communities

Atrazine is one of the most extensively used herbicides in the United States, principally for pre-emergent treatment in corn cultivation. Atrazine enters natural freshwater systems primarily in rainfall-driven runoff, resulting in highly variable and episodic aquatic exposures (see Figure) that depend on spatial and temporal rainfall distribution, atrazine application patterns, topography, and soil properties. Such highly variable exposures are in marked contrast to exposures in the toxicity tests typically used for aquatic risk characterizations, leading to uncertainties in estimated effects. Furthermore, even if toxic effects on individual plant species can be adequately estimated for these variable exposures, it is uncertain what level of such effects should be considered a level of concern (LOC) for an entire aquatic plant community.



In cooperation with the Environmental Fate and Effects Division (EFED) of the Office of Pesticide Programs, MED developed an assessment methodology that addresses the above issues and provides EFED with the means to specify whether atrazine exposures observed in monitoring efforts exceed an LOC for aquatic plant communities. The general approach was to first use the effects of atrazine on plant growth rates in single-species laboratory tests to calculate an index that describes the average expected severity of toxicity (the "Plant Assemblage Toxicity Index," or PATI) across an assemblage of aquatic plant species, for any atrazine exposure time-series. An LOC for this index was then specified based on experimental ecosystem studies regarding the effects of atrazine on aquatic plant communities. PATI values for field sites of concern can then be compared to this effects-based LOC to make risk management decisions.

A review of single-species plant toxicity tests using atrazine was conducted and used to estimate concentration/effects relationships for the growth rates of a wide variety of species in a large and diverse set of studies. For any specified atrazine concentration, the instantaneous value for PATI is equated to the average expected reduction in growth rate across a selected assemblage of these species. This provides two improvements over the species sensitivity curves (SSDs) often used in aquatic risk assessments – it uses a continuum of effect levels, rather than a single one such as an EC50, and it represents an integration over an entire species assemblage, rather than just addressing a single species representing a specified sensitivity level (e.g. 5%) in the assemblage.

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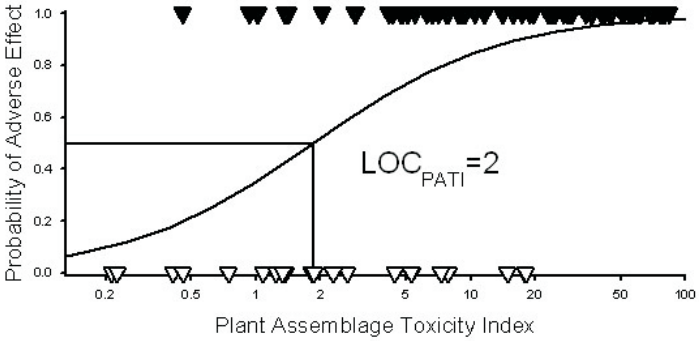
ATRAZINE EXPOSURES – *CONTINUED*

The instantaneous PATI values are in turn averaged over a designated time period to obtain an average PATI value that characterizes the severity of toxicity in any exposure time-series of interest. Such a simple averaging is possible because rapid recovery of plant growth rates from atrazine exposure results in very little carryover of toxicity from day to day. This also represents an improvement over typical aquatic risk characterization methodology in that it provides a chemical-specific treatment of the time-dependence of toxicity, so that effects of time-variable exposures can by more rigorously and appropriately addressed.



An LOC for PATI was developed based on an extensive set of experimental ecosystem studies with atrazine that were reviewed and compiled by EFED, with each experimental treatment being categorized as to whether effects on the aquatic plant community were large enough to be of concern. This binary categorization (1 for effect, 0 for no effect) was necessary because the diverse nature of these studies precluded any consistent quantitative measure of effect. PATI values were calculated for each experimental ecosystem treatment and a binary regression of the effect categorization versus PATI was conducted. The adjacent figure shows such a regression, demonstrating both the correlation of effects with PATI value (although considerable overlap does occur) and the regression line representing the probability of observing an effect in such a collection of experimental ecosystems at a particular PATI value. In this example, the LOC is set to the PATI value at which this probability is 50%.

Additional work by EFED has converted this PATI-based LOC into a concentration-based LOC that is more convenient for regulatory purposes. However, in either form, this methodology provides an effective means to more completely and rigorously use existing ecotoxicological data to characterize risks, and has applicability for risk assessments for other chemicals. Sensitivity analyses have demonstrated little variation in risk characterizations due to uncertainties in the single-species toxicity data used or from the averaging period selected, with the main source of variation for risk estimates being due to the composition of the experimental ecosystem data. **Contact**: Russ Erickson (218) 529-5157.

NITROGEN REMOVAL POTENTIAL OF THE NATION'S RIVERS AND STREAMS

Nitrogen (N) export to the Gulf of Mexico has increased dramatically from the 1950s, and is correlated with an even greater increase in N fertilizer application in the Mississippi River Basin. In addition to the impacts on the gulf, water quality throughout the Mississippi River Basin has been degraded by excess nutrients, and most states in the Basin have significant river miles impaired by high nutrient concentrations and are not fully supporting aquatic life uses. The recent EPA Wadeable Streams Assessment indicated that excess nitrogen was the most pervasive stressor impacting the condition of US streams.

The EPA Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico suggests two basic approaches to reducing hypoxia in the Gulf of Mexico: 1) reducing N export from streams draining the Mississippi River Basin and 2) restoration of watershed processes that enhance nitrogen retention and/or removal within the Basin. There are three factors regulating N export from watersheds: influx of N from atmospheric and terrestrial sources, in-stream processing (e.g., nitrification/denitrification), and long-term storage. The first approach recommended in the Action Plan, reducing export, may be achieved by simply reducing N inputs--by reducing the amount of fertilizer runoff from agricultural lands to receiving streams. Reducing N export may also be achieved by in-stream processing of N, or by increasing long-term storage as buried sediments in-stream channels and adjacent riparian areas. The second approach, restoration of processes, is a targeted approach incorporating all three regulating factors.

Critical to estimating N removal potential of streams is the calculation of N uptake velocity (*Vf*), the theoretical rate at which N moves through the water column to the stream substratum. Uptake velocity may be estimated by mass balance of N inputs and outflows, or as a function of stream depths, stream velocity, and N uptake over a stream reach. Either approach must also account for the inverse relationship between *Vf* and N availability.

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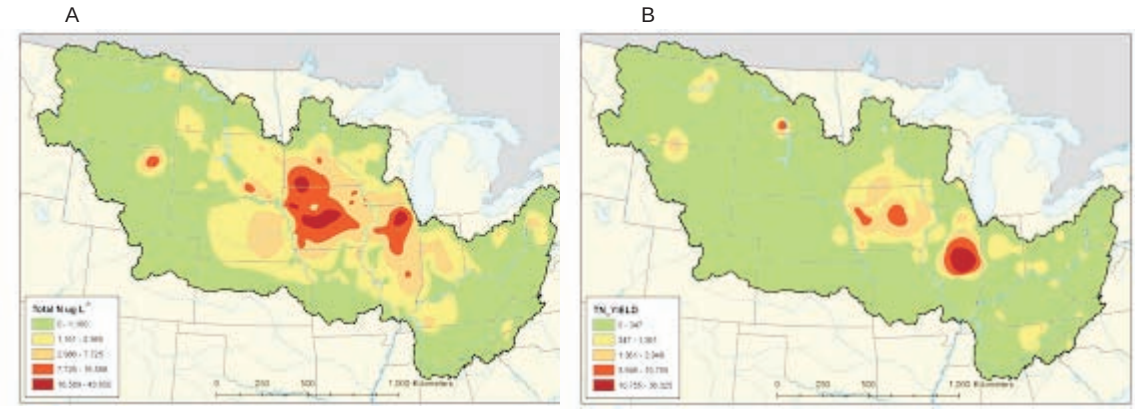
Approach

Phase I: Potential N removal based on existing monitoring data: Mississippi River Basin
Stream chemistry and physical attributes collected from streams and rivers sampled as parts of EPA's Wadeable Streams Assessment (WSA) and the Environmental Monitoring and Assessment Program (EMAP) on great rivers were paired with estimated hydrology, land cover data, and atmospheric N deposition. Total N input, export, and uptake were modeled for each site based on stream N concentrations, widths, and depths. N yields were estimated by dividing N export by watershed area. Nitrogen removal potential was estimated as the difference between N inputs and N exports (Figure). (Product: Hill, B.H., D.W. Bolgrien, 2011. Nitrogen removal by streams and rivers of the Upper Mississippi River basin. *Biogeochemistry* 102:183-194).



Total N input (A, kg ha-1 yr-1) and yield (B, kg ha-1 y-1) in Upper Mississippi River Basin streams and rivers. Nitrogen removal is the difference between N inputs and N yield.

Phase II: Potential N removal using enhanced monitoring data: Mississippi River basin (2012) and
Phase III: National-scale estimate of potential N removal by streams and rivers (2013) [in collaboration with EPA Office of Water]

Phases II and III of this project are similar to Phase I in that they rely on data collected during the Office of Water's national survey of rivers and streams. The survey used in these phases is the 2008-2009 National Rivers and Streams Assessment (NRSA) of 900 wadeable streams and 900 non-wadeable rivers in the conterminous US. Chemistry, hydrology, land cover, atmospheric N deposition, and the calculation of N export, yield, and removal are the same as in Phase I.

In addition to these measures and estimates, microbial enzyme activities will be measured on sediments and biofilm collected from these 1800 sites. **Contact**: Brian Hill (218) 529-5224.

Current Events

DIVISION STAFF ATTEND 2010 ESRP CONFERENCE

Several Division staff attended the annual conference of ORD's Ecosystem Services Research Program. The conference was held in Las Vegas in October. Brian Hill, David Bolgrien, Ted Angradi, Russell Kreis, Mark Rowe, Tom Hollenhorst, and Janet Keough attended. Brian Hill contributed to a presentation on nitrogen services, and all participated in discussions associated with indicators of services and other aspects of the program. **Contact**: Janet Keough (218) 529-5025.

ANNUAL POSTER SOCIAL

The Division held its fifth annual Poster Social on December 1. Twin Ports Freshwater Folks co-hosted the event, which featured 18 posters presented at meetings in 2010. The social was well-attended, with lively scientific discussions with the authors and co-authors. **Contact**: Dan Villeneuve (218) 529-5217.

Upcoming Events

Health and Environmental Sciences Institute Workshop

The Health and Environmental Sciences Institute (HESI) is sponsoring a February 2011 invited workshop entitled "Moving bioaccumulation assessments to the next level: Progress made and challenges ahead." The goals of this workshop, which will be held in Washington, DC, are to review the state-of-the-science of bioaccumulation assessment methods, determine research needed to advance these methods, and identify barriers to incorporation of new data and methods into governmental regulatory activities. Specific topics will include integration of modeled predictions with laboratory measurements, extrapolation of bioaccumulation data from the laboratory to the field, prediction of ADME process from in vitro systems, and communication of scientific advancements to the risk assessment community. Division scientists are helping to organize this meeting. NHEERL also is providing a grant to support travel for non-federal employees. Included among the invited participants are EPA employees from several program offices including the Office of Chemical Safety and Pollution Prevention and Office of Solid Waste and Emergency Response.
Contact: Dr. John Nichols (nichols.john@epa.gov), (218) 529-5160.

Planning a St. Louis River Estuary Summit, February 7-8, 2011


Photo by Tom Duffus

The Division is part of an organizing team for a workshop on integration of research information into management decisions for the St. Louis River Estuary. Located on the border between Minnesota and Wisconsin, the Estuary is the largest on the Great Lakes. At the present time, the Estuary is an "Area of Concern" designated by the Great Lakes Binational Program under the Great Lakes Water Quality Agreement. The Estuary is also a "hot-spot" for invasions of exotic species from ballast water. There are interests in chemicals of emerging concern and their effects, since the Estuary receives discharge from the Western Lake Superior Sanitary District facility. Also, the Lake Superior National Estuarine Research Reserve, the second NERR in the Great Lakes, was designated by NOAA in 2010. The NERR occupies several key parcels of land owned by the State of Wisconsin along the St. Louis River Estuary. Many organizations are interested in the Estuary, and many of them are conducting studies or actively managing or restoring it. The workshop will offer a forum for integration and collaboration among scientists and managers, and will be held on February 7-8, 2011 at the University of Wisconsin - Superior. Beyond serving as an organizing party, the Division will be contributing posters on our research on the Estuary and platform presentations. **Contact**: Janet Keough (keough.janet@epa.gov), (218) 529-5025.

New Publications since August 15, 2010

Angradi, T.R. and T.M. Jicha. 2010. Mesohabitat-specific macroinvertebrate assemblage responses to water quality variation in mid-continent (North America) great rivers. *Ecological Indicators* 10:943-954.

Ankley, G.T., K.M. Jensen, M.D. Kahl, E.J. Durhan, E.A. Makynen, J.E. Cavallin, D. Martinovic, L.C. Wehmas, N.D. Mueller, and D.L. Villeneueve. 2010. Use of chemical mixtures to differentiate mechanisms of endocrine action in a small fish model. *Aquatic Toxicology* 99:389-396.

Collette, T.W., Q. Teng, K.M. Jensen, M.D. Kahl, E.A. Makynen, E.J. Durhan, D.L. Villeneuve, D. Martinovic-Weigelt, G.T. Ankley, and D.R. Ekman. 2010. Impacts of an anti-androgen and an androgen/anti-androgen mixture on the metabolite profile of male fathead minnow urine. *Environmental Science & Technology* 44:6881-6886.

Erickson, R.J. 2010. Toxicity Relationship Analysis Program (TRAP) Version 1.21. Online, http://www.epa.gov/med/Prods_Pubs/trap.htm.

French, J.B. Jr., R.S. Bennett, and R. Rossmann. 2010. Mercury in the blood and eggs of American kestrels fed methylmercury chloride. *Environmental Toxicology and Chemistry* 29:2206-2210.

Haring, H.J., K.A. Blocksom, M.E. Smith, T.R. Angradi, M.C. Wratschko, B. Armstrong, D.W. Bolgrien, and J.M. Lazorchak. Sediment toxicity in mid-continent great rivers (USA). Published online, DOI 10.1007/s00244-010-9592-4. *Archives of Environmental Contamination and Toxicology*.

Hill, B.H. and D.W. Bolgrien. 2011. Nitrogen removal by streams and rivers of the Upper Mississippi River basin. *Biogeochemistry* 102:183-194.

Hoffman, J.C., G.S. Peterson, A.M. Cotter, and J.R. Kelly. 2010. Using stable isotope mixing in a Great Lakes coastal tributary to determine food web linkages in young fishes. *Estuaries and Coasts* 33:1391-1405.

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Hornung, M.W., S.J. Degitz, J.J. Korte, J.J. Korte, L.M. Korte, J.M. Olson, P.A. Kosian, A.L. Linnum, and J.E. Tietge. 2010. Inhibition of thyroid hormone release from cultured amphibian thyroid glands by methimazole, 6-propylthiouracil, and perchlorate. *Toxicological Sciences* 118:42-51.

Martinovic-Weigelt, D., R.-L. Wang, D.L. Villeneuve, D.C. Bencic, J. Lazorchak, and G.T. Ankley. 2011. Gene expression profiling of androgen receptor antagonists flutamide and vinclozolin in zebrafish (*Danio rerio*) gonads. *Aquatic Toxicology* 101:447-458.

Miller, D.H., R.G. Kreis Jr., W.-C. Huang, and X. Xia. 2010. Application of a lower food web ecosystem productivity model for investigating dynamics of the invasive species *Bythrotrepes longimanus* in Lake Michigan. *Biological Invasions* 12:3513-3524.

Richards, C. 2010. EPA research strengthens Great Lakes restoration initiative. ORD fact sheet, EPA/600/F-11/001, online, http://www.rtord.epa.gov/ordfactsheets/index.cfm.

Salinas, K.A., L. Higgins, L.B. Anderson, A.D. Benninghoff, D.E. Williams, C. Walker, M.J. Hemmer, and J.A. Serrano. 2010. Identification of estrogen-responsive vitelline envelope protein fragments from rainbow trout (*Oncorhynchus mykiss*) plasma using mass spectrometry. *Molecular Reproduction & Development* 77:963-970.

Spehar, R.L., L.T. Brooke, T.P. Markee, and M.D. Kahl. 2010. Comparative toxicity and bioconcentration of nonylphenol in freshwater organisms. *Environmental Toxicology and Chemistry* 29:2104-2111.

Stanley, J.K., A.J. Kennedy, J.D. Farrar, D.R. Mount, and J.A. Steevens. Evaluation of reduced sediment volume procedures for acute toxicity tests using the estuarine amphipod *Leptocheirus plumulosus*. Published online, DOI: 10.1002/etc.333. *Environmental Toxicology and Chemistry*.

Trebitz, A.S., C.W. West, J.C. Hoffman, J.R. Kelly, G.S. Peterson, and I.A. Grigorovich. 2010. Status of non-indigenous benthic invertebrates in the Duluth-Superior harbor and the role of sampling methods in their detection. *Journal of Great Lakes Research* 36:747-756.

MED Seminars

September 28
- Dr. Lisa Wainger, U. of MD, Chesapeake Biological Lab, Solomons, MD
  Risk-adjusted social benefit metrics for prioritizing restoration investments

September 29
- Dr. Jose Serrano, EPA/MED
  Cellular biomarkers of traumatic brain injury in humans and animals: Correlation to endocrine disruption research at MED

October 6
- Dr. Gil Veith, International QSAR Foundation
  QSAR and the wonderland of predicting chemical hazards

October 13
- Dr. Julieta Werner, Lakehead University, Thunder Bay, ON
  Cell lines as models to study pulp and paper mill effluents

October 20
- Dr. Scott Lynn, MI State University, East Lansing, MI
  Hypoxia: A novel form of endocrine disruption

October 27
- Dr. Randall Hicks, UM Duluth Biology, Duluth, MN
  Research in the cause of corrosion in the Duluth-Superior Harbor

November 3
- Hongbo Ma, NRC Post-doc, EPA/MED
  Evaluation of ecotoxicity of manufactured metal oxide nanoparticles

December 8
- Chuck Madenjian, USGS Great Lakes Science Center, Ann Arbor, MI
  Lake trout population dynamics in the northern refuge of Lake Michigan: Implications for future rehabilitation

January 12
- Dr. Mark Rowe, EPA/MED/Grosse Ile, MI
  Estimating effects of biofuels production scenarios on aquatic ecosystem services for the Future Midwestern Landscapes study

January 26
- Dr. Phil Cook, EPA/MED
  Amphibole fiber toxicology: Then and now

February 2
- Pamela Shubat & Helen Goedon, MN Dept. of Health
  Carlie LaLone, EPA/MED
  Prioritization strategies related to pharmaceuticals in the environment

February 9
- Dr. Robert E. Hecky, UM Duluth Biology & Large Lakes Observatory, Duluth, MN
  Paleolimnological application of carbon and nitrogen stable isotopes to reconstruct the productivity history of African and North American Great Lakes

Awards

Sig Degitz and **Joe Tietge** received silver medals for their work on the Endocrine Disrupter Screening Program's Tier 1 Screening Battery Validation Team. This award, submitted by OCSPP, recognized the work of 20 individuals in ORD and OCSPP, "*In recognition of exceptional leadership and scientific contributions towards the development, validation, and regulatory acceptance of the Tier 1 Screening Battery for EPA's Endocrine Disrupters Screening Program.*" This work was the culmination of several years of effort by MED staff, who developed a fish-based screen for estrogen and androgen activity and an amphibian-based screen for thyroid activity. Sig and Joe both want to thank the MED staff who have been involved in these projects and to acknowledge the outstanding efforts and scientific contributions that enabled this success.

People

Staff Change


Karis Boerner

Karis Boerner has accepted a new position as Program Analyst with NHEERL Program Operations Staff. Her new duties include managing the NHEERL Working Capital Fund, coordinating Freedom of Information Act requests for NHEERL, and assisting with budget formulation. Karis is co-located here in Duluth in room 152, x5035.

Guest Worker

Patrick Collins is here as the US Fish and Wildlife Service's St. Louis River Conservation Coordinator. The temporary position was created through an Interagency Personnel Agreement (IPA) between the Minnesota Department of Natural Resources and the Fish and Wildlife Service (FWS). The IPA began in August of 2010 and is scheduled to run through July of 2011. Collins works in a cross-disciplinary role to bring FWS programs and funding opportunities to bear on local issues within the St. Louis River Area of Concern, largely focused on habitat related Beneficial Use Impairments. Being co-located at MED provides opportunities for inter-agency coordination such as the up-coming St. Louis River Estuary Summit, an opportunity for collaboration between research scientists and resource managers working locally on issues related to the lower St. Louis River ecosystem. Collins received his undergraduate (BS in biology and BAS in teaching life science, 1987) and graduate degrees (MS in biology, 1991) from the University of Minnesota Duluth and has lived in Duluth since 1983. He is in room 152, x5171.


Pat Collins

New Post-docs


Brent Bellinger

Brent Bellinger is from Milwaukee's south side but went to Vincent High (for any state basketball people). He received his undergrad degree from UW - Stevens Point in limnology/fisheries and biology in 2002, doing a semester in the South Pacific and a winterim ecological course in Costa Rica. For grad school he went to Michigan Tech and worked on estuarine algal biofilm biopolymer characterization, a collaboration with the University of Essex in England where the field site, the Colne Estuary, is located. Brent also did research on tributaries to Lake Tanganyika. He graduated in 2006 with his PhD and moved to West Palm Beach, FL to work as a post-doc through the U of Florida with the South Florida Water Management District. He did field research in the Everglades on periphyton biogeochemistry, and used explicit ecological and biological measures in addition to biomarkers to assess the impacts of active management of eutrophic regions in the Everglades. Brent is now part of the Ecosystem Services Research Program working for Dr. Brian Hill as an EPA post-dlc. The goal is to apply his biogeochemical background in wetlands and "real" estuarine environments to systems around the great lakes, putting that information into an ecosystem services perspective which will hopefully influence management and restoration decisions. Brent is in room A200, x5247.


Kellie Fay

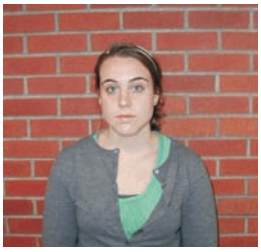
Kellie Fay was born and raised in Appleton, WI and earned her BS degrees in chemistry and molecular biology at the University of Wisconsin-Madison. She worked for the Wisconsin DNR and the Forest Service for a couple of years before starting graduate school in Seattle at the University of Washington. Ten years and two kids later, she has returned to the Midwest with a MS in oceanography and a PhD in environmental toxicology. Her oceanographic research involved modeling greenhouse gas emissions from the Amazon as well as the denitrification of ocean water from the Arctic subcontinental shelf. Her toxicological research involved wood smoke toxicity, nanotoxicity (quantum dots), and the development of in vitro alternatives using isolated mouse hepatocytes. Although her dissertation research involved mammalian systems, she is happy to be doing her post-doc work in ecotoxicology. Kellie is working in John Nichols' lab as an EPA post-doc using isolated trout hepatocytes to support the modeling of chemical metabolism and bioaccumulation in fish. She is in room A106, x5159.


Ted Valenti

Dr. Theodore (Ted) W. Valenti joined the Ecotoxicology Analysis Research Branch as an NRC postdoctoral research associate in October. Ted received a BA from Hamilton College, Clinton, NY in 2001 and continued his education at Virginia Tech, Blacksburg, VA, where he earned his MS, focusing on aquatic ecotoxicology in the laboratory of Dr. Donald Cherry in 2004. As a Hokie, he developed methods for assessing the effects of various stressors to early life stages of freshwater mussels (Unionidae) and also investigated the effects of acid-mine drainage on watersheds impacted by coal mining. For his PhD education, he worked with Dr. Bryan Brooks at Baylor University, Waco, TX and was the first student to graduate from The Institute of Ecological, Earth, and Environmental Science (TIEEES) in May of 2010. His doctoral research focused on site-specific water quality and refining ecological risk assessments for ionizable contaminants with a particular emphasis on pharmaceuticals and personal care products. In addition, he also conducted research and published several papers on harmful algal bloom (HAB) species and the use of behavior as an alternative sublethal endpoint for toxicity tests. Ted's NRC funding at the MED is provided by the EPA Great Lakes Restoration Initiative and he will focus on aspects of sediment risk assessments. He is working under Branch Chief Dale Hoff and is currently mentored by Dave Mount. He is in room 140, x 5214.

GRO INTERNS

Last summer MED hosted two students under the EPA GRO program (Greater Research Opportunities Undergraduate Student Fellowships).

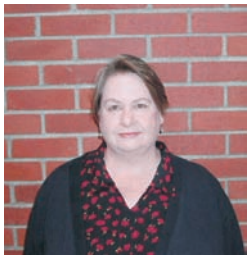

Elizabeth Medlock

Elizabeth Medlock worked in the Toxic Effects Characterization Research Branch on integrated toxicological approaches for assessing the ecological risks of dexamethasone in the environment. She created a poster on the topic as part of her report to DePauw University (Greencastle, IN) about her internship. Dan Villeneuve was her advisor, and Carlie LaLone her mentor.


Casey Stephenson

Casey Stephenson worked in the Ecosystem Assessment Research Branch, with Anett Trebitz as advisor and Joel Hoffman as mentor. Casey looked at how different fish species use shallow water habitats in the St. Louis River, and gave a presentation to the branch on her research. She attends Ft. Lewis College in Durango, CO.

NEW SEE


Brucette Zirn

Brucette Zirn, new Senior Environmental Employee, is working with Stephanie Warhol in the Program Operations Branch, acting as primary backup for secretarial duties, handling property management, front desk, "etc." Brucette, named after her father, is an Illinois native who fell in love with the Northland and Lake Superior after attending Northland College from 1972-76, receiving a BA in biology with environmental studies minor. She has two children, Silas and Rachel, and a menagerie of animals: three black cats, one Welsh Corgi, one box turtle, and one cockatiel. Brucette loves to vegetable garden, kayak, and walk, and loves movies and books. She was on a PBS cooking show twice, for her signature dish Chicken Brucetta, and for Garden Lasagna. Brucette is in Room 142, x5012.