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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:

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Research Events

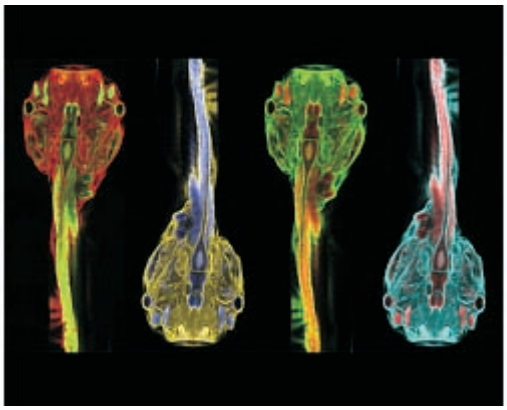
Pellston Workshop in ET & C with NHEERL Authors

Pellston workshops sponsored by the Society of Toxicology and Chemistry (SETAC) serve a critical role in addressing emerging issues and cultivating new ideas in environmental sciences. In April 2009, a Pellston workshop entitled "A Vision and a Strategy for Predictive Ecotoxicology in the 21st Century: Defining Adverse Outcome Pathways (AOPs) Associated with Ecological Risk" was held in Forest Grove, OR. The workshop was supported through contributions from the National Environment Research Council (UK), the U.S. Army Corps of Engineers, Proctor and Gamble, and EPA, and brought together 44 international experts to discuss the role of current and future predictive approaches in the field of ecotoxicology.

Workshop products are featured as a series of six papers published in the January 2011 issue of *Environmental Toxicology and Chemistry*. The manuscripts include a "Focus" article by the workshop co-chairs, Dan Villeneuve of the Mid-Continent Ecology Division (MED) and Natalia Garcia-Reyero of Jackson State University, providing background and major conclusions from the meeting, as well as papers from each of the five workgroups at the meeting dealing with (1) derivation of ecologically relevant AOPs from existing data, (2) use of network modeling approaches based on genomic data to develop AOPs, (3) consideration of the role of adaptation in assessing pathway-based toxicity, (4) species extrapolation of the effects of toxic chemicals, and (5) use of AOPs to translate mechanistic data into population-level responses. Among the authors of the other five papers were NHEERL researchers Kevin Crofton and Miyuki Breen (Integrated Systems Toxicology Division); Matthew Etterson, Gerald Ankley, and John Nichols (MED); and Stephen Edwards (Immediate Office of the Associate Director for Health). The workshop products speak to the need to develop a scientific foundation for the application of alternative data types (e.g., quantitative structure-activity relationships, in vitro, biomarkers, genomics) in support of chemical screening and risk assessment. **Contact**: Dan Villeneuve (218) 529-5217.

Depiction of adverse outcome pathways as a conceptual approach to bridge from mechanistic information generated at the sub-organismal level to predicted consequences at higher levels of organization (e.g., populations) considered relevant to ecological risk assessment – Kramer, V.J., M.A. Etterson, M. Hecker, C.A. Murphy, G. Roesijadi, D.J. Spade, J.A. Spromberg, M. Wang, and G.T. Ankley. 2011. Adverse outcome pathways and ecological risk assessment: Bridging to population-level effects. *Environmental Toxicology and Chemistry* 30 (1):64-76.

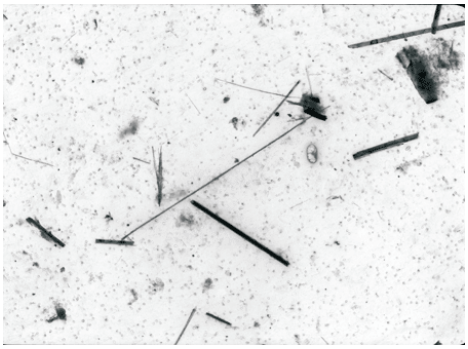
NHEERL/NRMRL Proposal Selected for ORD Pathfinder Innovation Project



Xenopus tadpoles, Tong Zhang, McGill University

An ORD Pathfinder Innovation Project proposal submitted by NHEERL and National Risk Management Research Laboratory (NRML) scientists was recently selected for award from among 117 total proposals. This project will use a transgenic *Xenopus laevis* tadpole containing a thyroid hormone responsive reporter gene to evaluate the utility and applicability of a newly developed portable flow-through fluorescence detection system for small aquatic species. This thyroid signaling "biosensor" will be used to identify thyroid disrupting potential of xenobiotics and environmental samples including receiving and effluent waters at waste water treatment facilities. Thyroid-disrupting chemicals can be structurally diverse due to the multiple potential target sites at which to perturb the thyroid axis, so an assay that can detect disruption of multiple pathways within this axis has advantages. Because thyroid hormone is critical for development of multiple organ systems including neural development, and it plays an important role in physiological homeostasis throughout life, there is considerable health concern related to thyroid-disrupting chemicals in the environment. Furthermore, the molecular action of thyroid hormones is well-conserved across species making this project a unique opportunity to integrate both human health and ecological environmental goals. Proposal title: Developing an Integrated Screening Assay for Detection of Thyroid Hormone Disruptors: Environmental Samples and Chemicals of Concern. Mary Gilbert (NHEERL/TAD), Marc Mills and Joel Allen (NRMRL), Kevin Crofton (NHEERL/ISTD) and Michael Hornung (NHEERL/MED). **Contact**: Mike Hornung (218) 529-5236.

MED Scientist to Brief MN Agencies on Mineral Fiber Toxicology



The elongated particles/fibers are ferroactinolite (amphibole) after simulated splitting in lung following inhalation.

For the past eight years Philip Cook has provided technical assistance to the state of Minnesota and EPA Region 5 with regard to data and models for assessment of potential health risks associated with inhalation exposures to complex mixtures of elongated amphibole mineral particles. Such particles are in airborne dusts associated with taconite (iron) mining in northeastern Minnesota. The state's goal is to promulgate a new, more scientifically based, site-specific air quality standard for Silver Bay, to replace the standard originally required by a federal court ruling in the 1970s. Technical issues include determination of relative cancer potencies for the elongated particles in taconite dust emissions. This involves using models established through ongoing research at MED, under EPA's Libby Action Plan, for a wide variety of mineral particles in toxicology studies. The state is seeking broader federal advice and assistance for completing their air standard. Phillip King, EPA Region 5 representative on the federal Interagency Asbestos Working Group (IAWG), has arranged a conference call briefing for the IAWG on May 5, 2011. Therein, Dr. Cook will present a summary of the relevant toxicological data and emerging dose-response and particokinetic models applicable to Minnesota's goal. State scientists then will provide an overview of their plans for development of the air quality standard, including components that would benefit from further federal consultation and assistance. **Contact**: Dr. Philip Cook (218) 529-5202.

Featured Research

Great Lakes Nearshore Assessment

The Great Lakes nearshore area supplies drinking water, is a nursery region to fisheries, and provides recreational opportunities, among many other ecosystem services. The nearshore area also receives waste water discharge and is a primary path for anthropogenic stress to the whole of the Great Lakes. Water is actively discharged (point-sources) or flows across the landscape and ultimately winds up in nearshore receiving waters (tributary mouths or direct coastal runoff) where it begins to mix into the lake. Complex processes often obscure the linkages between various stresses from human activities in the surrounding watersheds to water quality in the Great Lakes.

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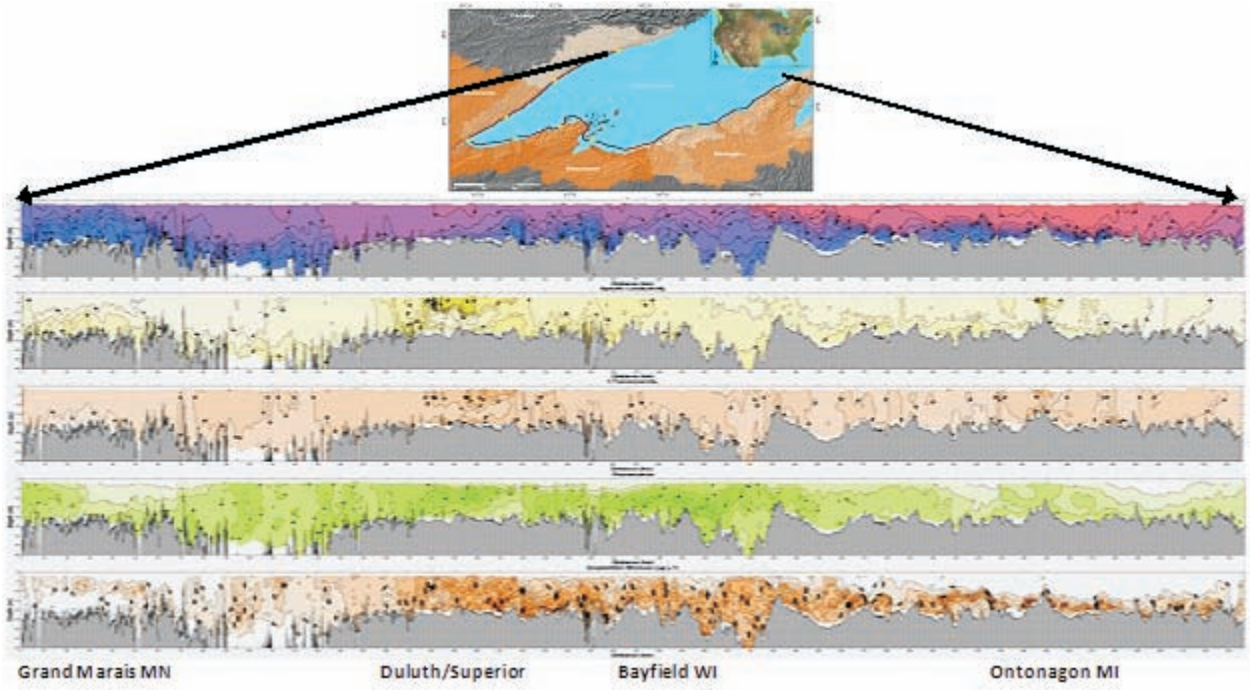
Our research supports legal obligations to restore and maintain the chemical, physical, and biological integrity of the Great Lakes Basin Ecosystem under both the Clean Water Act (1972) and the Great Lakes Water Quality Act (1972, amended in 1978) agreed to by the International Joint Commission (1909) between Canada and the United States. Monitoring programs have been established in open water offshore regions of the Great Lakes (EPA Great Lakes National Program Office, GLNPO), while the nearshore has been largely ignored until recently because it has been considered too variable and dynamic, and too difficult to monitor using traditional sampling techniques. We have been developing assessment methods and strategies for the Great Lakes nearshore that will complement the open water monitoring to deal with the large spatial scales and variability, and the identification of multiple stressors as part of our long range goal for a comprehensive observation system for the Great Lakes basin (Kelly and Yurista submitted).

We have developed a time efficient observation strategy for assessing the nearshore that is effective at detecting conditions and depicting significant water quality and biology features at multiple scales from localized regions to the whole nearshore for a lake (Yurista and Kelly 2009). Three primary elements are intertwined in the strategy: electronic instrumentation for high resolution and high-density data (backed up by point samples), a towing approach to optimize coverage at multiple spatial scales that is time efficient, and a GIS for linkage to landscape stress. The electronic instrumentation we have deployed included a CTD (conductivity, temperature, and depth), fluorometer (algal fluorescence), transmissometer (light transmittance), nitrate analyzer (NO_3), and LOPC (laser optical plankton counter). The tow approach consists of a long continuous tow at a specified depth contour (20-m). The GIS (Danz et al. 2005) was developed under an EPA STAR grant project (Niemi et al. 2006).

We conducted a pilot exercise in 2004 (Figure 1) that provided us with an unprecedented set of nearshore data to explore and some additional concerns to address (Yurista and Kelly 2009).

Figure 1



Our continued studies have allowed us to address some these issues more fully (Yurista et al. submitted JGLR, submitted CJFAS): 1) How broadly can a single depth contour represent the nearshore environment using in situ sensors? 2) Does water quality condition in the nearshore region across all the Great Lakes correlate with the character of adjacent watersheds? 3) How dependable is a single tow during summer peak production as an estimate of conditions in the nearshore? We also addressed tow survey measurements across multiple spatial scales and time. The tow at a depth contour (20-m) was representative of a broader depth region (10 to 30 m). The observed patterns have continuity over time given the dynamic nature of the nearshore environment (Yurista et al. submitted JGLR, submitted CJFAS). The high-density data we have collected provided strong statistical power for correlating nearshore water quality with adjacent landscape character (Yurista and Kelly 2009, Yurista et al. submitted AEHMS, submitted JGLR, submitted CJFAS). The relationship between nearshore water variables and GIS characterization of associated landscape was observed to be strong (Yurista and Kelly 2009, Yurista et al. submitted CJFAS). Landuse in the associated watersheds explained as much as 73% of

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the variance in various variables measured along the nearshore. The nearshore region retains a consistent pattern that is not substantially changed by weather patterns and events, and gives confidence to a single monitoring event during a reference time frame (Yurista et al. submitted AEHMS, submitted JGLR, submitted CJFAS).

Status

- We have completed our major field operations in all of the Great Lakes (2010).
- Some analyses have been published, submitted, and some in preparation for publication.
- We have provided technology transfer and basic training in data processing to GLNPO personnel.
- Much data mining still ahead (giga bytes).

Our basic conclusion is that for the nearshore, while highly variable, monitoring is tractable and we have demonstrated a powerful monitoring strategy to accomplish it.

References

Danz, N.P., R.R. Regal, G.J. Niemi, V. Brady, T. Hollenhorst, L.B. Johnson, G.E. Host, J.M. Hanowski, C.A. Johnston, T. Brown, J. Kingston, J.R. Kelly. 2005. Environmentally stratified sampling design for the development of Great Lakes environmental indicators. *Environmental Monitoring and Assessment* 102: 41-65.

Kelly, J.R. and P.M. Yurista. Integrated assessment of large lakes with synoptic *in situ* technologies: linking nearshore conditions with adjacent watersheds. submitted AEHMS, *Aquatic Ecosystem Health and Management Society*.

Niemi, G.J., R.P. Axler, V.J. Brady, J. Brazner, T.N. Brown, J.H. Ciborowski, N.P. Danz, J.M. Hanowski, T.P. Hollenhorst, R. Howe, L.B. Johnson, C.A. Johnston, E.D. Reavie, M. Simcik, D. Swackhamer. 2006. Environmental indicators of the U.S. Great Lakes coastal region. Report NRRI/TR-2006/11 to the USEPA STAR Program, ver.1. Agreement R82-8675, Washington, DC. Prepared by Great Lakes Environmental Indicators Collaboration, Natural Resources Research Institute, University of Minnesota Duluth.

Yurista, P.M. and J.R. Kelly. 2009. Spatial patterns of water quality and plankton from high-resolution continuous *in situ* sensing along a 537-km nearshore transect of western Lake Superior, 2004. In: M. Munawar, I.F. Munawar (Eds.), State of Lake Superior, Aquatic Ecosystem Health and Management Society, Burlington, ON, Canada; pp. 439-471.

Yurista, P.M., J.R. Kelly, S.E. Miller.Lake Superior: nearshore variability and a landscape driver concept. submitted AEHMS, *Aquatic Ecosystem Health and Management Society*.

Yurista, P.M., J.R. Kelly, S. Miller, J. VanAlstine. Lake Ontario: nearshore variability. submitted JGLR, *Journal of Great Lakes Research*.

Yurista, P.M., J.R. Kelly, S. Miller, J. VanAlstine. Water quality and plankton in the US nearshore waters of Lake Huron. submitted CJFAS, *Canadian Journal of Fisheries and Aquatic Sciences*.

Contact: Peder Yurista (218) 529-5148.

USING LARVAL FISH IN COASTAL WETLANDS TO INDICATE WETLAND CONDITION AND CONNECTIVITY

G. Peterson (left) and J. Hoffman (center) retrieve a tucker trawl sample from aboard the *R/V Prairie Sounder*. The trawl is used to collect fish larvae in the water column. The instrument mounted to the top bar of the trawl measures water conductivity, temperature, and depth and transmits the data in real-time to the research vessel.

Great Lakes coastal wetlands are highly productive ecosystems that support a large portion of Great Lakes fishes. Coastal wetlands, however, are highly responsive to watershed development, and continued anthropogenic change will alter the condition and function of these systems. Our research has focused on evaluating chemical biomarkers, particularly carbon (^{13}C) and nitrogen (^{15}N) stable isotope values, in fish larvae as indicators of wetland function. Our interest in using fish larvae is two-fold. First, a fish-based indicator would have an immediate connection to the general public. Second, fish larvae have relatively fast responses to environmental conditions (weeks to months) on potentially small spatial scales (kilometers), and thus could be used to test functional differences with respect to time, hydrology, or landscape character. The importance of this work to EPA is that it will advance our understanding of landscape-scale effects on coastal ecosystem function, and fish production, a high-value ecosystem service of coastal wetlands.

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Our first research objective was to characterize how these biomarkers change along river-lake transition zones in coastal wetlands where seiches force lake water inland. The ^{13}C and ^{15}N are useful biomarkers because they provide information on the functional attributes of ecosystems. In consumers such as fish ^{13}C values are conserved along a food chain; thus, where primary producers (e.g., aquatic vegetation versus phytoplankton) have different ^{13}C values, ^{13}C can trace energy sources fueling a food web. In contrast, the ^{15}N value of a consumer is consistently much higher than its prey and so ^{15}N is useful for determining trophic level. However, in systems where two different hydrologic sources with distinct geochemistry mix, such as estuaries (where river and sea water mix) or perhaps Great Lakes coastal tributaries ("freshwater estuaries," where river and Great Lake water mix), there is strong geochemical control on the natural abundance of stable isotopes. This aspect of geochemical control needs to be understood to utilize these biomarkers.

In 2006, for our pilot study, we characterized stable isotope mixing along the river-Great Lake transition zone in the St. Louis River, an important fish nursery in western Lake Superior. At five stations in the lower river that ranged from low to high lake influence, we measured all components of the food web to determine the change in ^{13}C and ^{15}N. We found that all food web components shared a common isotopic pattern and generalized spatial trend along the river-lake transition zone. The most plausible underlying cause was strong geochemical influence arising from physical mixing of Lake Superior and St. Louis River waters. Specifically, we found that the ^{13}C change along the mixing zone was recorded in the isotopic signatures of primary producers such as phytoplankton and benthic algae. This was important because it meant that the seiche-driven interaction between lake and river water produced a biomarker (^{13}C) that contained spatial information.

Because ^{13}C carries both food web and spatial information, we could use it to characterize the spatial dynamics of fish production in the St. Louis River. This is an important aspect of understanding the spatial scale to which fish respond; because they are highly mobile, there is a good deal of uncertainty as to whether a fish can provide information about the quality of a specific place. In brief, we found that the fish assemblage specific to any location along the transition zone incorporated energy sources from across the watershed. Notably, black crappie and rock bass fed within a small geographic range on consumers that utilize local primary producers such as phytoplankton and epiphytic algae, implying these species can indicate local conditions. Other fishes fed throughout the transition zone or fed on prey from adjacent habitat (Lake Superior). This approach for delineating trophic linkages is widely applicable to estuaries and Great Lakes coastal wetlands because this physical property of hydrologic mixing inherent to the St. Louis River is held in common with many coastal receiving waters, both freshwater and marine. We conclude that fishery production within the St. Louis River is supported at multiple spatial scales. Thus, we would expect a complex response to watershed disturbance. Results from our pilot study were recent published in the Coastal and Estuarine Research Federation's journal *Estuaries and Coasts*.

Our second research goal was to evaluate the use of larval fish ^{13}C and ^{15}N as indicators of landscape-scale processes. In 2007-2008, we sampled coastal wetlands in five Lake Superior south shore tributaries that had contrasting landcover attributes, but similar agricultural practices within their watersheds and their receiving coastal waters. Preliminary results demonstrate that ^{13}C was largely controlled by the source geochemistry of the water in which the fish was caught, which reflected the mixing of river and lake water in the lower portions of these rivers, giving rise to pronounced river-to-lake ^{13}C gradients within these tributaries. This is consistent with our pilot study that demonstrated the importance of geochemical control on ^{13}C. Likewise, the ^{15}N value in fish was strongly influenced by mixing of river and lake water. However, after accounting for this influence, we found that the ^{15}N in larval fish is strongly correlated to both the nitrogen concentration of the water in which the fish was captured, as well as the human pressure on the landscape (measured as either the percent of developed land or the human population density in the watershed; Figure 1). Our ^{15}N findings are particularly interesting with respect to indicator development because they suggest that there are nested scales of watershed response to human-caused change. At a lake basin scale, researchers at MED have shown ^{15}N responds to regional-scale changes in agriculture practices. At a regional scale in which agriculture practices are similar, our study suggests ^{15}N is sensitive to human pressures, likely responding to sources of waste water contributed by humans to the local watershed. Thus, larval fish are a potentially powerful indicator of nutrient pollution at both watershed and within-watershed scales.

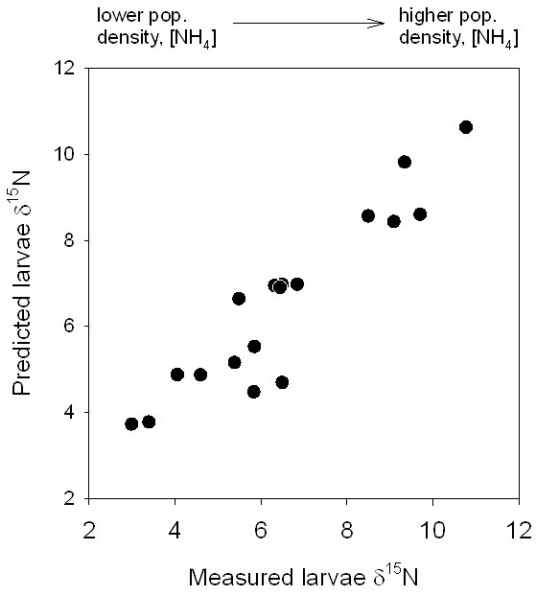

Figure 1. Measured fish larvae ^{15}N versus predicted fish larvae ^{15}N based on the population density within the watershed and the average ammonium concentration, [NH4], at each station. Measured values are the average of the various species captured at each station. Predicted values are based on the multiple linear regression: $^{15}N = 5.072 + 0.249$(population density) + 1.367(ln(NH4)), $p<0.001$, r2 = 0.87.

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Numerous individuals have contributed to this research effort, including Jon Van Alstine, Tim Corry, Anne Cotter, John R. Kelly, Greg Peterson, Lindsey Seifert, Mike Sierszen, Matthew Starry, and Corlis West.

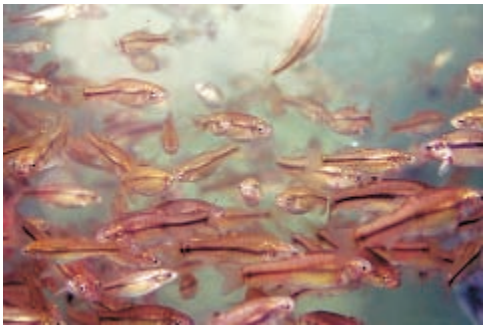
For more information, see Hoffman, J.C., A.M. Cotter, G.S. Peterson, and J.R. Kelly. 2010. Using stable isotope mixing in a Great Lakes coastal tributary to determine food web linkages in young fishes. *Estuaries and Coasts* 33:1391-1405, DOI: 10.1007/s12237-010-9295-0.

This research was also featured in EPA's Science Notebook: http://www.epa.gov/epahome/sciencenb/wetlands/wetlands-grtlakes.html

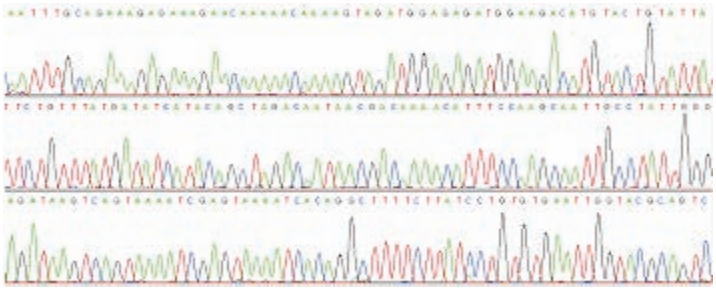
Contact: Joel Hoffman (218) 529-5420.

NEW FATHEAD MINNOW SEX DETERMINATION METHOD

Division scientists recently published a manuscript in *Environmental Science & Technology* describing the developmental of methods for determining the genetic sex of fathead minnows (*Pimephales promelas*). The article was featured in a news story in *Chemical and Engineering News*. Fathead minnows are one of the most utilized model testing species in environmental toxicology and have been used in toxicity testing for over 50 years. Until this work, it was not possible to determine the genetic sex, as the sex chromosomes in this species have not been identified. The ability to evaluate genetic sex is particularly important in assessing endocrine disruptors, which are chemicals that interfere with and mimic an organism's hormones. Early larval exposure to these types of toxicants can result in aberrant sexual development and can lead to complete sex reversal. In these cases, an individual will possess all the normal characteristics of the opposite sex and even be fully capable of reproducing. The only difference between a sex-reversed and normal fish would be in the DNA, which the described genetic sexing method would be able to determine.



Development of this method was accomplished by using amplified fragment length polymorphism analysis to identify sex-linked DNA markers. From one of these markers, a simple PCR-based method was developed for determining genetic sex in experiments. This PCR method was designed to be simple and cost-effective, such that any laboratory possessing basic molecular biology instruments would be able to incorporate genetic sexing into their research. A major advantage to using this method in toxicity testing of endocrine disruptors is that it allows for greater statistical power in assessing changes to gonad differentiation and development, and also reduces the numbers of animals needed for testing.



Chromatogram trace of the DNA sequence of the sex-linked marker used in the method.

This method is currently being employed along several lines of research here at the Division and in collaboration with other research groups. In a research effort headed by Carlie Lalone, Division postdoctoral researcher, to characterize the effects of pharmaceuticals, this method has been incorporated into toxicity testing to assess the ability of a chemical to alter sexual differentiation of fathead minnows. This method is also being used to evaluate sexually-dimorphic patterns of growth in juvenile fathead minnows for use in population-level modeling efforts by Division research teams. Researchers at St. Cloud State and Purdue Universities are using genetic sex information to characterize the earliest events of gonad differentiation, both histologically and through gene expression, at developmental stages in which the differences between males and females are not readily apparent.

References:

Olmstead, A.W., D.L. Villeneuve, G.T. Ankley, J.E. Cavallin, A. Lindberg-Livingston, L.C. Wehmas, and S.J. Degitz. 2011. A method for the determination of genetic sex in the fathead minnow, *Pimephales promelas*, to support testing of endocrine-active chemicals. *Environmental Science & Technology* 45:3090-3095.

Cassiday, L. New Method Spots Gender-Bending Minnows, *Chemical & Engineering News*, 89(11), March 14, 2011.

Contact: Allen Olmstead (218) 529-5122.

Current Events

ORD Leaders Visit the Division to Highlight the Path Forward

April brought visits to the Division by two ORD leaders to discuss EPA Assistant Administrator Paul Anastas' "Path Forward." Dr. Hal Zenick, Director of ORD's National Health and Environmental Effects Laboratory, visited on April 11-12 to discuss future research directions under the new integrated transdisciplinary research themes. Division managers and staff discussed with Dr. Zenick future research under the ORD programs in Chemicals for Safety and Sustainability, Sustainable and Healthy Communities, and Sustainable and Safe Water. On April 21, Ramona Trovato, ORD Associate Administrator, visited the Division to hold discussions with Division managers and a Town Hall meeting with staff to highlight progress under the Path Forward. Ms. Trovato also attended the Division's Earth Day Pancake Breakfast. **Contact**: Janet Keough (218) 529-5025.

IJC Consultation on Effect-Based Monitoring and Surveillance for the Great Lakes - April 6-7, 2011, Chicago, IL

The International Joint Commission (IJC), the bi-national commission authorized by the 1909 Boundary Waters Treaty to help coordinate and resolve boundary water issues between Canada and the United States, held a consultation at the Great Lake National Program Office (GLNPO) to address the need for a strategy to deal with so called "Chemicals of Emerging Concern" (CECs). Historically, both countries have had strong analytical monitoring programs which evaluate concentrations of chemicals in various Great Lakes media. Such monitoring programs have been instrumental in understanding the distribution and occurrence of selected chemicals, including legacy compounds. Recently, these monitoring efforts have been broadened in scope and consequently have detected various CECs (pharmaceuticals, personal care products, flame retardants, etc.) across the Great Lakes. Despite a strong history of systematic analytical monitoring, less effort has been put forth on monitoring biota for effects. Consequently, significant uncertainties exist with respect to the assessment of CECs. Recognizing this gap in information, the GLNPO has been working, with ORD support, to develop a strategy to implement broader effects-based monitoring and surveillance programs across the Great Lakes. This meeting initiated an IJC discussion about how to move forward with monitoring and surveillance recommendations. The consultation was attended by approximately 40 scientists from Canadian and US governmental agencies, industry, and academia. It was also attended by Commissioner Lana Pollack, the US Section Chair. Division scientists, Joe Tietge and Gary Ankley, also participated in the meeting in support of GLNPO's effort. Following the consultation, a draft strategy will be prepared, taking into account the discussions at the consultation, and this strategy will be submitted to the IJC for consideration. **Contact**: Joe Tietge (218) 529-5176.

Upcoming Events

MED Science and Scientists Play Central Role in Upcoming IAGLR Conference

The 54th International Conference on Great Lakes Research – "Big Lakes - Big World" – will be held in Duluth May 30-June 3. A great program is in store with plenary talks on Lake Baikal, African lakes, and invasive species, plus more than 35 scientific sessions exploring large-lakes research that crosses borders, disciplines, and temporal and spatial scales. Also on the agenda are Great Lakes science and policy, including areas as diverse as ecology, limnology, habitat, fisheries, invasive species, contaminants, climate, and water quality, as well as the vital intersections of these topics. The Division is co-hosting this event, along with University of MN Duluth (UMD), MN Sea Grant Program, Great Lakes Maritime Research Institute, MN Pollution Control Agency, and others. MED ecologist Dr. Anett Trebitz is co-chair for the scientific program, with Dr. Jay Austin of UMD's Large Lakes Observatory. MED research intersects Great Lakes issues across a broad spectrum of science including toxicology, nutrient effects, and biological condition. MED staff are authors or co-authors on over 15 oral or poster presentations to be given at this meeting, and will co-chair these sessions:

- Exploring Food Web Linkages and Dynamics in the Upper Great Lakes: Past, Present and Future - Jack Kelly
- Linkages between the Landscape and Great Lakes Coastal Ecosystems - Joel Hoffman, Peder Yurista, John Morrice
- Assessing Effects of Toxic Substances in the Great Lakes - Joe Tietge
- Nutrients, Eutrophication, Hypoxia, and Harmful Algal Blooms - Mark Rowe, James Pauer/ICF, David Miller
- Science to Management in the St. Louis River Area of Concern - Brent Bellinger.

Contact: Anett Trebitz (218) 529-5209, http://www.iaglr.org/conference/index.php

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LAKE SUPERIOR BINATIONAL SURVEY

The Division and the Ashland station of the USGS are conducting a set of field surveys at the request of the Binational Lake Superior Work Group (SWG), a group of state, federal, tribal, and provincial agencies who are implementing priorities of the Lake Superior Lakewide Management Plan (LaMP). Through the LaMP, the SWG has been leading efforts for Lake Superior under a Coordinated Science and Monitoring Initiative (CSMI) over the past few years. MED and USGS agreed to lead the design and coordination of this 2011 effort, partnering to accomplish a historic, integrated (water quality to fish) lakewide sampling using the same sampling design framework for all measures. Funds for field and laboratory analyses have been provided by EPA's Great Lakes National Program Office (GLNPO) in Chicago.

Lakewide sampling of a 56-station set, using a spatially-balanced random probability survey design, is planned for summer 2011. Planned measurements include: water quality (nutrients and carbon, cations, anions, vertical CTD++ profiles), "lower" food web (LFW) components (microbial biomass and activity; species composition and abundance; and biomass of phytoplankton, zooplankton, mysids, and benthos), and fish (species abundance and biomass from bottom trawls and acoustic mid-water surveys).

Photo by John Simenson, UMD Large Lakes Observatory

Surveys will be conducted in three phases at the whole set of sites. A survey using bottom trawls (day sampling) will run from 27 June to 22 July. A second fish survey with acoustics (night sampling) will be conducted from 1 August to 22 September. A third survey for LFW components and water quality will be conducted in early September (~Sept 6-16), duplicating the time of previous extensive biological lakewide surveys (1973, 2005/2006). The first two (fisheries) surveys will be conducted from the *R/V Kiyi*, operated for fisheries assessment by the USGS Ashland station. The September survey will be conducted from the *R/V Lake Guardian*, operated for lake monitoring/assessment by GLNPO. A fourth, complementary, survey is currently planned in late August/early September: the *R/V Lake Explorer II*, operated for ecosystem assessment research by MED, will use continuously-towed in situ sensors to conduct high resolution spatial transects from shore to mid-lake, to supplement the 56-station data.

A map of planned stations, and more details of still-emerging plans will be available soon. Future plans include a schedule for preliminary report out of information, and possibly another Ecology of Lake Superior-style conference in late 2012 or early 2013. **Contact**: John R. (Jack) Kelly (218) 529-5119.

New Publications since January 12, 2011

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MED Seminars

January 26
- Olufemi Adedeji, University of Ibadan, Nigeria
  Surface water pollution in Nigeria – impacts on aquaculture and prospects

February 2
- Pamela Shubat & Helen Goeden, MN Dept. of Health
  Prioritization strategies related to pharmaceuticals in the environment

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

February 16: MED Research Forum
- Dr. Dan Villeneuve, Elucidating adverse outcome pathways associated with the reproductive axis – small fish computational toxicology

March 2
- Dr. Phil Cook, MED
  The long search for a holistic model of relative potency for assessment of complex mixtures of respirable elongated particles for mesothelioma potential

March 16: MED Research Forum
- Dr. Peder Yurista, Great Lakes nearshore research – monitoring designs
- Dr. Jan Keough, ORD research planning updates

March 30
- Drs. Chris & Tom Custer, USGS, LaCrosse, WI
  Birds as indicators of contaminant exposure in the Great Lakes

April 13
- Michelle Embry, ILSI-HESI, Washington, DC
  A seat at the table: improving environmental risk assessment through HESI's global collaborative programs

April 20: MED Research Forum
- Mike Sierszen, Developing indicators of ecosystem services for Great Lakes coastal wetlands
- Chris Russom, What's new with the ECOTOX Knowledge System?

April 27
- Dr. Brent Bellinger, MED
  Ecosystem responses to active management in a eutrophic area of the Florida Everglades

May 4
- Don Schreiner, MNDNR – topic pending

May 11
- Dr. John Nichols, MED
  In vitro models for metabolism

May 18: MED Research Forum
- Dr. David Bolgrien, Ecosystem benefits from Great Lakes embayments
- Dr. Sig Degitz, Development of the EDSP Tier 2 frog reproductive development test

May 25
- Nathan Johnson, UMD Water Resources, Dept. of Civil Engineering – topic pending

People

Guest Worker **Olufemi Bolarinwa Adedeji** (Femi) joined the Division January 5, coming from the Department of Veterinary Public Health and Preventive Medicine, University of Ibadan, Nigeria.

The Niger Delta has an enormously rich natural endowment of land, water, forests, and fauna. Oil prospecting and spills have severely degraded these assets, pushing many people into poverty, as natural resources have traditionally been primary sources of sustenance. Other pollution sources include agricultural chemicals, dredging activities, waste dumping and gas flaring, mining, thermal sources, logging, effluent from slaughterhouse and food processing outlets, and dumps – all with generally inadequate clean up.

Nigeria is entirely within the tropics and subject to heavy rains. Most of the landfills and dumpsites are usually unlined, so toxic wastes leak or leach into the soil, contaminating underground water. Waste from dump sites, landfills, and land spreads wash into surface water bodies, and inland and coastal waters are used for waste disposal. This pollution poses a serious threat to the sustainability of the water resources through damage to soil, water, and air, causing loss of biodiversity; loss of aquatic resources/food security/food safety; loss of means of subsistence, especially fishing; and public health hazards.

Nigeria lacks appropriate methods, facilities, and staff to detect, monitor, and mitigate pollution. The way forward to environmental protection requires political will, education and research, effective government policy, enforceable legislation, recognition of the right to an adequate standard of living, monitoring of pollution sources and aquatic ecosystem health, and clean up and rehabilitation.

Femi is particularly interested in the use of biomarkers (naturally occurring molecules, genes, or characteristics by which a particular pathological or physiological process, disease, etc. can be identified) as a sensitive early warning tool to measure biological effects in environmental quality assessments. Biomarkers can give information on the biological effects of pollutants, rather than a mere quantification of environmental levels, and applied both in laboratory and field studies, can provide an important linkage between laboratory toxicity and field-based assessments.

Femi's goal while at MED is to improve his teaching and research abilities, to learn to use biotechnology in ecological studies and pollution monitoring, to be exposed to current trends in ecotoxicological studies, and to learn more about the use of biomarkers. He hopes to bridge the gap in knowledge and skilled personnel in both the University and Nigeria, to translate existing knowledge into practice towards environmental protection. The University will grow as a leader in ecosystem health studies, and will benefit from its current and future connection with EPA. Femi will be here until the end of June. He is in room 140, x5250.