

International Association for Great Lakes Research 62nd Annual Conference on Great Lakes Research June 10-14, 2019

### Revised January 16, 2019

To make it easier to find an appropriate session, we have grouped them below by theme. We encourage authors to submit abstracts for specific session topics but also will consider those submitted under "General Contributions." The program will be designed so that sessions within a theme will not run concurrently. The ordering of sessions within themes is arbitrary.

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## Chemical Contaminants and Emerging Issues: Sessions 1-5

### **#1.** Emerging issues and freshwater futures: From PFAS and plastics to parasites and pathogens

Emerging issues and freshwater futures depend upon healthy waters for both aquatic life and drinking water. Over the last few years, aquatic diseases, parasites, and pathogens have had negative impact on recreation and economics costing the US coastal and inland water billions of dollars. More recently, the image of clean bottled water has been challenged as microplastics have been identified in more than 90% our drinking supplies. Compounding such issues include PFAS toxicity contaminating our freshwater resources and possibly our air. What we know, what we need to know, and what are the solutions is the focus of this session.

Chaired by Kevin Strychar, Annis Water Resources Institute, Muskegon, MI; 361-960-1913; strychak@gvsu.edu

#### #2. Chemical monitoring and surveillance in the Great Lakes: multimedia

Chemical monitoring and surveillance of legacy persistent bioaccumulative toxic chemicals have historically been a priority for Great Lakes science. In recent years, contaminants of emerging concern (CECs) have become increasingly prioritized because of potential harm to the Great Lakes ecosystem. This session will highlight the key findings and



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trends form chemical monitoring and surveillance, with a special focus on Chemicals of Mutual Concern (CMCs) identified by the 2012 Great Lakes Water Quality Agreement, the Great Lakes Restoration Initiative, and the Canadian Chemicals Management Plan. The session will incorporate presentations across multiple media types (air, water, biota, sediment, etc.) as well as biological effects measurements in fish and wildlife populations, and the implications of results in managing the Great Lakes as a valuable resource.

Chaired by Elizabeth Murphy, U.S. EPA Great Lakes National Program Office, Chicago, IL; 312-353-4227; murphy.elizabeth@epa.gov Derek Ager, USEPA Region 5 Great Lakes National Program Office Chris Marvin, Environment and Climate Change Canada Robert Letcher, Environment and Climate Change Canada, Science and Technology Branch, Wildlife & Landscape Science

### **#3.** Chemical contaminants

This session will focus on the impacts of and potential solutions for chemical contaminants in the Great Lakes. Presentation topics could include assessing contaminant effects on ecosystems; fate and effects of chemicals from diffuse sources and stormwater; modeling and data analysis tools to predict the fate and impact of chemical contaminants; assessing the risk of chemical mixtures; contaminant trends in relation to regulatory action; and innovative solutions for chemical reductions.

Chaired by Lisa Sealock, Environment and Climate Change Canada, Toronto, ON; 416-574-8659; lisa.sealock@canada.ca

### #4. Microplastics in freshwater systems: Advances in chemistry, biology, and physics

Distribution and impacts of microplastics and other marine debris has been well documented in the world's oceans and marine ecosystems. Researchers have only recently begun to explore the abundance and impacts of plastic marine debris in freshwater environments, including lakes, tributary waters, effluents, and their associated sediments. This session will gather experts in the field of freshwater debris research to discuss and outline the current state of knowledge and recent advancements in understanding the distribution and transportation of microplastics in freshwater environments, as well as their chemical and biological impacts.

Chaired by Lorena Rios Mendoza, University of Wisconsin-Superior, Superior, WI; 715-394-8205; Iriosmen@uwsuper.edu Sarah Lowe, NOAA, Freestone Chelsea Rochman, University of Toronto Matthew Hoffman, Rochester Inst. of Technology, School of Mathematical Sci.

#### #5. Microplastics in the environment: Source, fate, impact, detection, and mitigation

Microplastics, including microbeads, fragments and fibers are defined as plastics smaller than 5mm in size. Microplastic pollution in the environment is a top emerging concern. Microplastics have been reported everywhere around the world, from wastewater, marine environment, fresh water bodies, to drinking water. Moreover, ingestion of microplastics by aquatic organisms has been documented in field studies. In the Great Lakes, studies found an average



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surface water concentration of 43,000 microplastic particles per km2 with a maximum of nearly two million particles per km2 in the Detroit River. It is estimated that 10,000 metric tons of plastic enter the Great Lakes every year. Microplastics present a significant threat to ecological and human health. Because of their tiny size (micro to nano-scale) they easily enter food systems, yet hard to be detected. They can absorb persistent organic pollutants and can perturb microbiota, such as bacteria and fungi, which play key roles in our ecosystem. With increased concerns of microplastics, critical knowledge is needed for better understanding microplastics in the environment and how to reduce microplastic pollution. To disseminate such critical knowledge, this session will focus on 1) the source, fate, and transport of micro-and nano-plastic particles in the environment, 2) analytical methods for detecting and characterizing micro- and nano-plastics, 3) the impact of micro- and nano-plastics on ecological and human health, and 4) mitigation strategies to reduce microplastic pollution in the environment.

Chaired by Yongli Zhang, Wayne State University, Detroit, MI; 313-577-9962; zhangyl@wayne.edu Carol Miller, Wayne State University Mark Cheng, Wayne State University, Electrical and Computer Engineering

## Education and Outreach: Sessions 6-9

### #6. Great Lakes outreach and education

The session will focus on innovative and exemplar education and outreach efforts being conducted around the Great Lakes Basin, including in both urban and rural areas. Papers are welcome from universities, Sea Grant programs, NGOs, agencies and others that discuss how these successful science-based programs were conducted and evaluated.

Chaired by Kristin TePas, Illinois-Indiana Sea Grant, Chicago, IL; 312-886-6224, ktepas@illinois.edu Helen Domske, SUNY @ Buffalo, NY Sea Grant - GL Program Chiara Zuccarino-Crowe, Michigan Sea Grant, MSU Extension

## #7. Beyond peer review: Why you must connect your science to stakeholders (and how to do it)

The importance of communicating science to stakeholders is increasingly recognized in research organizations and for many granting bodies it is a requirement (NSF). Engagement criteria / aspirations are commonplace in research proposals, job descriptions, and strategic plans - but how are we really doing? What is the global large lakes research community doing to connect with the general public? We are seeking presentations and posters by scientists and science communicators to share their stories. How are you communicating your research beyond the peer-reviewed journal science conference presentation? What audiences are you targeting? Are you communicating with stakeholders to guide your research? What worked, what didn't? In addition to presentations, this session will include a panel discussion of science communications thought leaders. We will explore what they see happening now and what they think the future looks like for connecting people and ideas for large lakes research. We will host a skills cafe and provide tips for interacting with the media, and provide opportunities to hone your speaking skills. Individuals will have the opportunity to do a mock interview session and be given feedback. We hope you will join us!



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Chaired by Margaret Lansing, NOAA Great Lakes Environmental Research Laboratory, Ann Arbor, MI; 734-741-2210; margaret.lansing@noaa.gov Devin Gill, Cooperative Institute for Great Lakes Research, University of Michigan Kathe Glassner-Shwayder, Great Lakes Environ. Res. Lab., NOAA David Ruck, Great Lakes Outreach Media

### #8. Education, outreach, and citizen science: Engaging the community

Community engagement, citizen science, and public stewardship are increasingly recognized as vitally important activities that go hand in hand with restoration, remediation, and change in policy. For this session, we invite participation from all groups and individuals involved in community engagement and citizen science to share current activities and research-based efforts. Case studies, best practices, lessons learned, socio-ecological research, and pitfalls are welcome topics.

Chaired by Christy Tyler, Rochester Institute of Technology, Rochester, NY; 585-256-9951; actsbi@rit.edu Michael Boller, St. John Fisher College Paul Sawyko, Water Education Collaborative

### #9. Citizen science: Leveraging our love of the lakes

This session will focus on projects that engage citizen science and crowd sourcing efforts to further our knowledge and appreciation of the great lakes. We'll highlight the diversity and abundance of Great Lakes citizen science projects, challenges to implementing citizen science and the value of citizen science data for addressing management issues and increased community outreach. We will reserve 15 minutes at the end of the session for an open discussion.

Chaired by Tom Hollenhorst, EPA Mid Continent Ecology Division, Duluth, MN; 218-529-5220; hollenhorst.tom@epa.gov Molly Wick, EPA, Oak Ridge Institute for Science Marte Kitson, Minnesota Sea Grant Ryan Hueffmeier, Boulder Lake ELC

## Fisheries and Fishery Management: Sessions 10-14

### #10. Disease and mortality in fishes

The health of Micropterus dolomieu (Smallmouth Bass) in the Laurentian Great Lakes is of great concern because of both the economic and ecological value of this species to our fisheries. Specifically, intersex and mortality of Smallmouth Bass are of concern. While the cause(s) of intersex, particularly testicular oocytes, are not fully understood, exposure to endocrine-disrupting compounds have been shown to influence sex differentiation in fishes. Mortality episodes of young of year Smallmouth Bass have been reported in Pennsylvania rivers. These die-offs have created considerable concerns among the sport-fishing industry, and state and federal agencies, as the relative abundance of young of year and adult Smallmouth Bass decreased, and shifts in size structure occurred. This session will provide an opportunity to improve



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our understanding the occurrence of disease and mortality in Smallmouth Bass inhabiting the Great Lakes, the factors that influence Smallmouth Bass health, and the impact of adverse health effects on Smallmouth Bass populations.

Chaired by Sean Rafferty, Pennsylvania Sea Grant College Program, Erie, PA; 814-217-9011; sdr138@psu.edu Vicki Blazer, U.S. Geological Survey

## #11. Thiamine deficiency in the Great Lakes

Since the late 1960s, thiamine deficiency has impaired wildlife populations (e.g., fishes, birds, mammals) at the organismal and ecosystem levels. The factor(s) causing thiamine deficiency have not been determined in wild populations; however, degradation of thiamine by the enzyme thiaminase is one mechanism that may be involved. Through this session, we will bring scientists together to update our knowledge of this recurring issue, discuss the latest monitoring data, present new analytical methods to assess the deficiency, and explore the causative agents of this thiamine deficiency (e.g., thiaminase, unbalanced diet rich in fat).

Chaired by Jacques Rinchard, The College at Brockport, State University of New York, Brockport, NY; 585-395-5750; jrinchar@brockport.edu

Matthew Futia, The College at Brockport - State University of New York Donald Tillitt, U.S. Geological Survey, Columbia Environmental Research Ctr.

## #12. Restoration and management of the Great Lakes' fisheries

This session will focus on research and management activities that have been performed for the benefit of Great Lakes Fishes. Research should include any studies that have filled identified data gaps from existing management plans working towards the recovery and sustainability of Great Lakes fish species. Management actions should include habitat enhancements, increases in access and connectivity, as well as other management actions that have shown measurable support towards management objectives for fish species.

Chaired by Dimitry Gorsky, U.S. Fish and Wildlife Service, Basom, NY; 585-948-7045; dimitry\_gorsky@fws.gov Zy Biesinger, U.S. Fish and Wildlife Service Jeremy Holden, OMNRF

### #13. Great Lakes' fish habitat priorities development, implementation, and adaptive management

The Great Lakes Fishery Commission and its Council of Lake Committees (CLC) are developing a process to enhance Great Lakes fisheries restoration through habitat protection and improvement. Environmental principles for sustainable fish production were developed by the CLC in 2016 (www.glfc.org/pubs/clc) to help fisheries managers in the Great Lakes identify their environmental priorities at effective scales for implementation, supported by a science-driven adaptive management. The session will include an overview of the environmental principles, presentations on how prioritization of impediments and actions has occurred for each lake, presentations on potential implementation strategies, and an exploration of strategies for implementing science to inform adaptive management moving



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forward. The session will include experts from the Great Lakes as well as other systems to help inform restoration of Great Lakes fisheries.

Chaired by Jeff Tyson, Great Lakes Fishery Commission, Ann Arbor, MI; 734-669-3028; jtyson@glfc.org Christine Mayer, University of Toledo, Lake Erie Center Roger Knight, Great Lakes Fishery Commission

## #14. Contribution of Great Lakes' fisheries to livelihoods and food security

The world's large lakes make crucial contributions to livelihoods and food security, from the small pelagic fisheries of the African Great Lakes, which provide an important source of affordable micronutrient-dense protein, to the recreational fisheries of the Laurentian Great Lakes, which generate revenue for local and regional economies. Understanding the contributions of large lake fisheries to livelihoods and food security around the world is a key facet of communicating their importance and promoting their sustainability. Yet for many large lakes, the nature and magnitude of these contributions are not well-documented. Furthermore, more research is needed to shed light on how socio-economic dimensions affect ecological processes and vice versa in the context of large lake systems. This session brings together recent studies aiming to address knowledge gaps related to social and economic benefits derived from large lakes. Presentations in this session apply social science or interdisciplinary approaches to understand the livelihood and food security contributions of large lake fisheries, how these contributions vary across space and time, and interactions between social and natural systems. The session will also aim to synthesize research findings to discuss implications for policy and advocacy.

Chaired by Abigail Bennett, Michigan State University, East Lansing, MI; benne592@msu.edu So-Jung Youn, Michigan State University

## Great Lakes Limnology and Health: Sessions 15-22

### #15. Physical processes in lakes

This session's focus is on the physical limnology of the Great Lakes and other lakes of the world. Papers are solicited dealing with modeling, experimental and laboratory studies of physical processes in lakes (waves, currents, turbulence, stratification, sediment transport, etc.) ranging in sizes from small to medium and large.

Chaired by Dmitry Beletsky, CIGLR, SEAS, University of Michigan, Ann Arbor, MI; 734-741-2360; beletsky@umich.edu Chin Wu, University of Wisconsin-Madison Cary Troy, Purdue University Joseph Atkinson, University of Buffalo, Dept. of Civil, Struct. & Env Eng.

### #16. Environmental indicators for society: Measuring social, economic, and socio-economic impact

We seek to extend and deepen our dialogue around the societal benefits of Great Lakes ecosystem health and how to benchmark and measure them. We include research investigating social, cultural, economic and socio-economic



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perspectives and include investigations of indicators, ecosystem services and the variety of economic evaluations that have accompanied recent restoration activities in the region.

Chaired by Jennifer Read, University of Michigan Water Center, Ann Arbor, MI; 734-763-2642; jenread@umich.edu Victoria Pebbles, Great Lakes Commission Rajesh Bejankiwar, International Joint Commission Marc Gaden, Great Lakes Fishery Commission

### #17. Great Lakes primary production: Methods results, and management implications

Estimates of primary production are critical for understanding ecosystem dynamics, yet measurements are limited across the Laurentian Great Lakes. In the past several decades, primary production dynamics have been changing in many of the lakes, with some regions experiencing reduced offshore productivity but increased nearshore benthic productivity. This session invites contributions from field-based and modeling studies that reveal current spatio-temporal patterns in benthic algal and phytoplankton production in the Great Lakes. We are particularly interested in contributions that describe novel techniques for estimating primary production, and those that discuss management implications associated with changes in nearshore and offshore primary productivity.

Chaired by Katelyn Bockwoldt, ORISE-GLNPO, Chicago, IL; 804-405-1348; bockwoldt.katelyn@epa.gov Barry Lesht, University of Illinois-Chicago

### #18. State of Lake Ontario: 2003-2018 CSMI overview

The Lake Ontario ecosystem experienced significant ecological and trophic changes as a result of exposure to multiple stressors. Over the past 40 years, various biotic and abiotic factors like eutrophication, phosphorus abatement, contaminants, invasive species, habitat degradation, algal blooms and climate change have altered the lake significantly. In 2003 the CSMI binational program was launched on Lake Ontario to provide in-depth lake wide ecosystem-based assessments which have greatly enhanced our understanding of the ecology and dynamics of Lake Ontario. The goal of this session is to bring together diverse studies in order to characterize the physical, chemical and biological regimes that affect all trophic levels from phytoplankton to fish. In order to obtain a holistic top down assessment of Lake Ontario, we invite comparative studies covering the past 15 years of CSMI studies (2003 to 2018) which would include application of new tools, techniques, and models for exploring the biotic and abiotic linkages in a fast changing ecosystem.

Chaired by Joseph Atkinson, University of Buffalo, Dept. of Civil, Struct. & Env Eng., Buffalo, NY; 716-645-2220; atkinson@buffalo.edu Tom Hollenhorst, EPA Mid Continent Ecology Division Jesse Lepak, NY Sea Grant James Watkins, Cornell University Mohiuddin Munawar, Fisheries & Oceans Canada



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### #19. Large lakes' response to climate: Past, present, and future

The climate system impacts and includes large lakes, and processes in lakes link into the global atmosphere-oceansurface system, as well as ecosystems regionally and globally. Climate variability and change spread across time scales, from seasons to millennia, and can interact with land use, human socioeconomic systems, lake levels, and more. We welcome contributions that address how lakes and their ecosystems interact with all aspects of the climate system at this wide range of time scales in any lake-influenced region of the world.

Chaired by Brent Lofgren, NOAA/GLERL, Ann Arbor, MI; 734-741-2383; Brent.Lofgren@noaa.gov Jia Wang, NOAA, GLERL

### #20. Physical ecology in large lakes and their watersheds

This session will highlight biological-physical interactions in the benthic and pelagic zones of lakes as well as streams and rivers in their watersheds. We encourage contributions that address important ecological functions as well organismal responses to abiotic stress.

Chaired by Chris Farrow, University of Guelph, Guelph, ON; 519-803-1187; farrow@uoguelph.ca Josef Ackerman, University of Guelph

### #21. Nutrient Sources, transport, and internal cycling

Non-point nutrient sources, their transport pathways, and internal transformations remain enigmatic for most catchments across the Great Lakes Basin. Surprisingly little is known about the effects of seasonality, storm events, land use, and management practices on particulate and aqueous speciation and the bioavailability of key nutrients such as carbon, nitrogen, phosphorus, silicon, iron, and sulfur. We invite contributions from field studies, laboratory experiments, and modeling investigations to examine key processes driving nutrient dynamics and their effects on primary productivity. We are particularly interested in work related to coupled nutrient cycles, nutrient speciation, nutrient source signatures, nutrient legacies, the effects of seasonality, and high flow events.

Chaired by Jiying Li, University of Minnesota Duluth, Duluth, MN; jiying.li@utoronto.ca Maria Dittrich, University of Toronto Scarborough

### #22. Oxygen cycling and hypoxia: Processes, impacts, and management

We welcome contributions describing the physical and ecological dynamics of oxygen in aquatic systems including continuous monitoring, modeling on multiple scales, and management. Oxygen depletion, for example, has become a major global problem in freshwater and coastal marine systems. Oxygen is fundamental to aquatic ecosystems, and the cycling of oxygen is complex, involving production, respiration, boundary layer exchanges, and climate change. Eutrophication causes excessive production of organic matter, resulting in elevated biochemical oxygen demand, while stratification of the water column prevents replenishment of oxygen from the epilimnion often leading to hypoxia. Hypoxia impacts aquatic ecosystems by limiting the distribution of benthic organisms, by limiting access of fish to preferred habitat, and by interrupting (e.g., enhancing or decoupling) prey-predation interactions. Oxygen also plays



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an important role in biogeochemistry and management, for example, though impacts of oxygen depletion on phosphorus cycling, and through impacts of the release of reduced iron and manganese on drinking water treatment.

Chaired by Mark Rowe, NOAA Great Lakes Environmental Research Laboratory, Ann Arbor, MI; 734-741-2172; mark.rowe@noaa.gov J. Val Klump, School of Freshwater Sciences Reza Valipour, Environment and Climate Change Canada Stuart Ludsin, The Ohio State University, Aquatic Ecology Laboratory

## HABs and Nutrients: Sessions 23-25

## #23. Harmful algal blooms: From ecosystem drivers to ecosystem impacts

Cyanobacterial Harmful Algal Blooms have become increasingly common across the Laurentian Great Lakes region with blooms now occurring in systems once thought to be immune to toxic cyanobacterial blooms. The temptation is to treat all these systems as responding to the same drivers (high phosphorus) even though we know that these lakes are often quite different in terms of the trophic state, hydrodynamics and the ecosystem services that they provide. In this session, we will compare and contrast the different drivers that lead to blooms in large lake systems around the world, as well as explore the different impacts these blooms have on the lake ecosystem and their surrounding communities.

Chaired by Gregory Boyer, SUNY-ESF, Syracuse, NY; 315-470-6825; glboyer@esf.edu Arthur Zastepa, Environment and Climate Change Canada Roxanne Razavi, SUNY College of Environmental Science and Forestry

### #24. Harmful algal blooms (HABs) and their toxicity: Remote sensing and modeling approaches

Harmful Algal Blooms (HABs) are a worldwide problem that has been widely recognized over the past several decades. While freshwater HABs can occur naturally, human activities leading to increased eutrophication as well as climate change have been linked to the increased occurrence and intensity of HABs. HABs can be both non-toxic or toxic. While non-toxic HABs can negatively impact water quality, fisheries and recreational facilities, toxic blooms may additionally cause illness and death in humans and wildlife. Therefore, it is vital to be able to understand and predict the toxicity of HABs. Though a variety of physical, chemical and biological variables have been suggested as factors triggering HAB toxicity, much remains to be done to improve our predictive and response capabilities, including the early detection and tracking of blooms, monitoring of HAB toxicity, and the development of scale-adaptive modeling tools. The primary goal of this session is to create a valuable opportunity for the interdisciplinary exchange of ideas and experiences between the lake modeling, remote sensing, and Earth System Modeling communities. The session will facilitate in-depth discussions of emerging concepts, field and satellite observations, as well as statistical and mechanistic modeling approaches. We particularly welcome presentations on field observations of HABs, predictive modeling studies, statistical analyses of the environmental factors that control algal and nutrient dynamics in lakes, and recent advances in estimating Chl-a and other relevant variables using field and remotely-sensed observations for seasonal and inter-annual forecasting of HABs.



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Chaired by Homa Kheyrollah Pour, University of Waterloo, Waterloo, ON; 519-888-4567 ex38752; h2kheyro@uwaterloo.ca Serghei Bocaniov, University of Waterloo Philippe Van Cappellen, University of Waterloo

## #25. Beyond the edge of the field: Mitigating the impacts of nutrient pollution on HABs

Cyanobacterial blooms in the nearshore of the Great Lakes continue to impact ecosystem services provided to surrounding communities. In this session we bring together studies from across the entire causal network that link nutrient loss to impacts caused by harmful algal blooms. This causal network includes nutrient reductions and retention at nutrient loading sites; including point sources, agricultural fields, and other fertilized lands; but also nutrient retention throughout the wetland-stream-rivermouth transport network and practices within lakes that mitigate HABs or their effects on receiving waterbodies and sites of ecosystem service provision.

Chaired by Rebecca Kreiling, United States Geological Survey, La Crosse, WI; 608-781-6346; rkreiling@usgs.gov James Larson, US Geological Survey Kenneth Gibbons, Great Lakes Commission

## Integration of Science and Management: Sessions 26-32

## #26. Application of genomic tools to inform management of the Great Lakes

Over the past few years, many geneticists studying the Great Lakes have begun to transition from traditional genetic tools to genomics. Currently, a number of these initial genomics projects are under way or nearing completion. The goal of this session is to provide a forum to discuss the initial results of genomics research in the Great Lakes and to brainstorm a road map for how genomics can be best integrated into management in the future.

Chaired by Wesley Larson, U.S. Geological Survey, Stevens Point, WI; 715-346-3150; wes.larson@uwsp.edu Wendylee Stott, Michigan State University, USGS Great Lakes Science Center

## #27. Ecosystem-based management: Challenges and opportunities on the Great Lakes' coasts

Ecosystem-based management is (EBM) is an interdisciplinary approach to management that considers the multitude of interconnected processes and the environmental, social, and economic trade-offs associated with actionable goals for protection and restoration of healthy, productive, and resilient ecosystems. EBM may be particularly valuable in Great Lakes coastal ecosystems where multiple interacting stressors of terrestrial and freshwater environments come together in a critical socioeconomic realm. Talks discussing EBM implementation in the Great Lakes and identifying major scientific knowledge gaps impeding the progress of EBM are particularly encouraged.

Chaired by Amie West, University of Maryland Center for Environmental Science, California, MD; awest@umces.edu Felix Martinez, NOAA/National Centers for Coastal Ocean Science



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### #28. Building an early warning system for the Great Lakes

The International Joint Commission's Great Lakes Science Advisory Board (SAB) has finalized the report Towards an Early Warning System for the Great Lakes, which relies on background review and expert input to present a preliminary list of five groups of threats and stressors, and a preferred organizational approach for an early warning system. This session invites contributions that explore different data types or analytical approaches that can be used to operationalize an early warning system. Data types might include paleolimnological cores, eDNA, radioisotopes, along with remote sensing; analytical approaches might include (among others) formal elicitation methods that rank stressors and their effects, application of statistical approaches for assessing trends for detecting tipping points and thresholds, and risk analysis approaches. Insights gained through this session will be used by the SAB to develop its advice and recommendations for operationalizing a Great Lakes early warning system.

Chaired by Matthew Child, International Joint Commission, Windsor, ON; 519-551-5149; childm@windsor.ijc.org Michael Twiss, Clarkson University, Dept. of Biology & Great Rivers Center Lizhu Wang, International Joint Commission Lucinda Johnson, University of Minnesota Duluth

#### #29. Connecting management needs and science information

This session will focus on science, management, and restoration connections within the Great Lakes Restoration Initiative (GLRI) and beyond. We invite presentations on science projects directed by management information needs, management and restoration activities informed by recent scientific discoveries, the inclusion of scientific assessment in restoration projects, and programs that complete the adaptive management cycle of planning, management, assessment, and plan revision.

Chaired by Mary Evans, USGS, Ann Arbor, MI; 734-214-7221; maevans@usgs.gov Jeffrey Schaeffer, USGS Great Lakes Science Center Josh Miller, U.S. Geological Survey - Great Lakes Science Center Emily Wimmer, USGS - Great Lakes Science Center

### #30. A regional science-based strategy for assessing impacts from water uses

The Great Lakes-St. Lawrence Agreement and Compact require eight US states and two Canadian provinces "to provide leadership for the development of a collaborative strategy with other regional partners to strengthen the scientific basis for sound decision making." As part of this strategy, the states and provinces collect annual water use data and report to a regional database. The states and provinces also assess cumulative water use impacts for the basin every five years. In 2013, the first basin-wide assessment of cumulative water use impacts was completed. The assessment focused on the cumulative impacts of consumptive uses, withdrawals, and diversions relative to the Basin water budget. However, two recent water diversion projects have highlighted the challenges inherent to estimating the significance of impacts from diversions and withdrawals from individual projects to a source watershed and to the Great Lakes-St. Lawrence basin overall. These presentations will focus on impact assessment methods, indicators, technologies and management practices employed worldwide to improve the process and understanding of water withdrawal impact assessment.



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Chaired by Peter Johnson, Great Lakes St. Lawrence Governors & Premiers, Chicago, IL; 312-407-0177; pjohnson@gsgp.org Don Zelazny, New York Department of Environmental Conservation

### #31. A possible new paradigm to improve the International Great Lakes' datum and its maintenance

The Great Lakes are the largest freshwater bodies on Earth and supplies over 34 million people in the US and Canada for water resources, food, recreation, farming, and transportation. NOAA is the cognizant U.S. government agency with a mission to support the citizens and private and government entities in the Great Lakes for safe and efficient navigation, sound ecosystem stewardship, coastal hazards preparedness and response, and the understanding of climate change. NOAA's NGS and CO-OPS, along with Canada's NRCan and DFO-CHS operate a network of precise US CORS and Canadian CACs stations, as well as a water level network around the Great Lakes for near-real time monitoring of the 3D shoreline motions, and long-term geocentric water level changes, realized through an updated IGLD consistent with the ITRF. This session solicits presentations with the following, but not limited to, themes towards establishment and efficient maintenance of the next generation IGLD: (1) CORS/CACs GNSS data processing to monitor the Great Lakes 3D shoreline, accounting for GIA, erosion and subsidence processes; (2) approaches to improve and validate the IGLD dynamic heights, and GEOID2022; (3) approaches to efficiently link water level, land velocities, to IGLD, NAPGD2022, and ITRF; (4) design of instrument packages which would efficiently maintain the geodetic network to robustly tie to IGLD; (5) use techniques including GNSS buoys, GNSS-R, and satellite altimetry to link and help validate IGLD and GEOID2022 in US and Canada; and (6) to quantify the importance of geocentric water level observations to possibly improve the GLCFS and GLOFS, for safe navigation, coastal management, and hazards early warning.

Chaired by C.K. Shum, School of Earth Sciences, Ohio State University, Columbus, OH; 614-292-7118; ckshum@osu.edu Dana Caccamise, NOAA/NGS Laura Rear McLaughlin, NOAA/CO-OPS Jeffery Oyler, NOAA/NOS CO-OPS Michael Craymer, Canadian Geodetic Survey, Surveyor General Branch Natural Resources Canada, Government of Canada

## #32. Systems practice: A solution to address "wicked" problems?

The increasingly complex nature of today's problems (e.g., invasive species, climate change) calls for solutions that require interdisciplinary thinking, multi-stakeholder involvement, and cross-sector collaboration. In this session, we explore the systems practice approach, which accounts for how the actions of individuals, organizations, and governments affect our efforts to understand and manage the world's large lakes.

Chaired by Stephen Hensler, Cerulean Center, Traverse City, MI; 734-972-5251; steve@ceruleancenter.org Paula McIntyre, Loracs Design LLC



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## Specific Lakes and Places: Sessions 33-36

#### #33. Interacting threats on the African Great Lakes

The African Great Lakes, like all large lakes globally, are subject to numerous threats (environmental, ecological, political, social). This session will focus on how these threats are affecting the African Great Lakes, with a particular focus on interactions and links among these threats.

Chaired by Jessica Ives, University of Windsor, Windsor, ON; 226-246-2732, Jess.Ives@uwindsor.ca Theodore Lawrence, African Center for Aquatic Research and Education Timothy Davis, Bowling Green State University Richard Ogutu-Ohwayo, National Fisheries Resources Research Institute

#### #34. Finger Lakes water quality

The Finger Lakes of central and western New York State are ideal natural laboratories to investigate timely limnological topics impacting the Great Lakes and other systems. The topics include but are not limited to: nutrient loading and cycling, cyanobacterial blooms, invasive species, food webs, citizen science and stewardship, pollutants, lake dynamics, and watershed-lake interactions. We welcome submissions on any limnological sub-discipline that focuses on the Finger Lakes or comparable systems.

Chaired by John Halfman, Hobart & William Smith Colleges, Geoscience/Environmental Studies Program, Geneva, NY; 315-781-3918; halfman@hws.edu

Lisa Cleckner, Finger Lakes Institute

#### #35. The Erie Canal: An interdisciplinary approach

This interdisciplinary session will focus on a wide array of topics associated with the famous Erie Canal. Topics may include (among others) the historical and economic significance of the Erie Canal, engineering details and obstacles, recreational importance for the region, biological significance of the Canal, and environmental impacts of the Canal.

Chaired by Courtney McDaniel, The College at Brockport, State University of New York, Brockport, NY; 585-395-5746; cmcdaniel@brockport.edu

Michael Chislock, The College at Brockport, State University of New York T. Gregory Garvey, The College at Brockport, State University of New York Jose Torre, The College at Brockport, State University of New York

#### #36. Hydraulics, hydrology, and human interactions in the Lake Champlain/Richelieu River basin

The Lake Champlain-Richelieu River (LCRR) basin is a large, binational North American lake impacted by floods, nutrient loadings, and human uses of the lake/river system such as fishing and recreational boating. The LCRR basin contains steeply sloped topography that quickly drains into Lake Champlain, where water is retained before it flows north into



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the Richelieu River and exits to the St. Lawrence River. The flow rate through the Richelieu River governs the level of the lake, and in 2011 high inflows into the lake caused by deep snowpack and heavy precipitation caused flooding around the lake shore and into the Richelieu River floodplain, causing extensive damages. The lake is also plagued by high nutrient loadings and cyanobacterial blooms, particularly in its shallow eastern basins. The binational nature of the LCRR basin means that management strategies to address LCRR flooding and nutrient loads must be coordinated between U.S. and Canadian stakeholders. This session invites research projects focused on the LCRR basin, including basin hydrology; observations, circulation, and modeling of Lake Champlain; flood prediction and mitigation; nutrient impacts; potential effects of a changing climate on the basin; and the human dimensions and social science around society's use of the LCRR system.

## Chaired by Jesse Feyen, NOAA-GLERL, Ann Arbor, MI; 734-741-2019; jesse.feyen@noaa.gov Deborah Lee, Great Lakes Environmental Research Laboratory, National Oceanic and Atmospheric Administration

## Remote Sensing, Networking, and Modeling: Sessions 37-40

## #37. Smart lakes: real-time monitoring, networks

Over the last decade, the rapid pace of technological innovation has enabled a radical shift towards distributed and coordinated sensor networks. While often leveraged in urban contexts for transportation or energy management, these advances offer immense opportunities to accelerate the research community's capacity to understand, protect and restore our water resources. This session will use case studies and interactive demonstrations to explore the next generation of data collection and analysis systems being designed and implemented across the Laurentian and other large lakes of the world. These systems will range from high-frequency in-situ sensors and remote sensing products to digital twin modelling systems and scaled, low-cost wireless networks. By bringing together perspectives from research, nonprofit, and industry, this session will not only showcase technologies and research methods, it will highlight the collaborations and partnerships that enable development, piloting and field operation. Consider this session a water-tech symposium, with submissions including experiential components such as on-stage demonstrations of wireless sensor networking or navigations of real-time data with VR technology along with conventional research presentations. Through these activities, attendees will be able to interactively participate in defining the future of data for freshwater science and stewardship across the Laurentian Great Lakes and large lakes of the world.

Chaired by Max Herzog, Cleveland Water Alliance, Cleveland, OH; 314-359-7319; mherzog@clewa.org Ed Verhamme, LimnoTech

### #38. Improving model predictions through coupled system and data assimilation

Numerical models are a useful tool for understanding, simulating and predicting physical, biological and ecological processes. Most models, however, were developed and implemented to simulate a single class of processes in a standalone mode. With advances in high performance computing and software coupling, it is now possible to couple multiple models which can dynamically exchange information. Model coupling has great potential to increase the accuracy of models in the Great Lakes, but it is currently not widely used. In addition to coupling models together, data can also be integrated into numerical models. The Great Lakes region has a fairly dense and long-term observational record of meteorological and physical parameters, especially compared to other coastal areas and deep oceans. These





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in-situ measurements and remotely sensed data have been widely used for model initialization and verification, but rarely get blended into model simulations to improve short-term forecasts or create reanalyses through data assimilation--which is one of the most effective approaches for statistically combining observational data and model dynamics to provide the best estimate of system state. This session invites contributions focusing on model improvement through model coupling (atmospheric, hydrologic, hydrodynamics, wave, ice, water quality and ecological models) and data assimilation.

Chaired by Matthew Hoffman, Rochester Inst. of Technology, School of Mathematical Sci., Rochester, NY; 585-420-6288; mjhsma@rit.edu Philip Chu, NOAA/GLERL Pengfei Xue, Michigan Tech

#### #39. Remote sensing, visualization, and spatial data

Contributions are invited on all aspects of remote sensing (including data collection, data analysis/interpretation, data applications, etc.) in the Great Lakes or other large lakes from satellite, airborne, ship, or other platforms. Presentations highlighting the role of remote sensing in interdisciplinary studies are encouraged, as are presentations describing the utilization of new or innovative sensors (such as scatterometer, hyperspectral, or acoustic) or techniques (such as data fusion and data visualization) for research or operational use.

Chaired by Mike Sayers, Michigan Tech. Research Inst., Ann Arbor, MI; 734-913-6852; mjsayers@mtu.edu Robert Shuchman, Michigan Technological University Philip Chu, NOAA/GLERL George Leshkevich, Great Lakes Env. Research Lab, NOAA

#### #40. Seeing below the surface

The recent proliferation of increasingly cost-effective technologies to gather and analyze underwater still and video imagery creates new opportunities to address ongoing challenges of sampling and assessing benthic ecosystems. These advances also present new challenges to be overcome for data acquisition, processing, and analysis. The purpose of this symposium is to expose the IAGLR membership to the exciting advances made possible by underwater image analysis, and to identify key challenges to their successful application. A range of image acquisition strategies will be explored from vessel-based sampling to towed camera sleds to autonomous underwater vehicles, and use of stereographic and monocular imagery. Case studies highlighting the use of underwater images for benthic habitat characterization, species identification, abundance estimation, species sizing, species behavior, and mapping of underwater cultural features will be shared with emphasis on data acquisition, image interpretation, and technical challenges. Solutions to the central challenge of "feature extraction" from thousands or tens of thousands of image frames using crowd sourcing and model-based approaches will be explored, and their promise for the future elaborated.

Chaired by Knut Mehler, Great Lakes Center at SUNY Buffalo State, Buffalo, NY; 716-878-4614; mehlerk@buffalostate.edu Peter Esselman, U.S. Geological Survey



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Molly Wick, EPA, Oak Ridge Institute for Science Theodore Angradi, U.S. EPA Mid-Continent Ecology Division

## Trophic Food Web: Dynamics, Function, and Technology: Sessions 41-47

## #41. Imperiled species in the Great Lakes basin: Identifying threats and restoring populations

The Great Lakes basin supports a wealth of aquatic biodiversity, but also contains some of the most imperiled freshwater species. Threats to these species, like increased turbidity, temperature and species invasions, are extensive and often interacting. As a result, quantifying the impacts of threats on imperiled species and elucidating their proximate and diffuse causes is imperative. Alongside understanding threats, immediate restoration efforts are needed to prevent extinctions. Restoration can include habitat improvements to mitigate threats, as well as reintroductions of species to areas where they were historically extirpated. Translocating species from the wild or rearing them in captivity possess challenges and opportunities for imperiled freshwater species recovery. In the first half of this two-part session, presenters will describe their work on advancing our understanding of threats to imperiled freshwater species. In the second half of the session, presentations will focus on efforts to restore populations of imperiled freshwater species.

Chaired by Karl Lamothe, Fisheries and Oceans Canada, Burlington, ON; karl.lamothe@dfo-mpo.gc.ca Jacob Ziegler, Fisheries and Oceans Canada Rowshyra Castaneda, University of Toronto Scarborough Fielding Montgomery, University of Toronto

### #42. Invasive species

An invasive species is an organism that causes ecological or economic harm in a new environment where it is not native. Approximately 188 non-native species have become established in the Laurentian Great Lakes with varying degrees of associated harm – and many more in other large lakes of the world. This session welcomes presentations on all aspects of invasive species science –biology, ecology, data management, risk assessment, development of prevention and control technologies, social science and economics.

Chaired by Rochelle Sturtevant, GLERL/NOAA, Sea Grant Extension, Ann Arbor, MI; 734-741-2287; rochelle.sturtevant@noaa.gov Ed Rutherford, NOAA Great Lakes Environmental Research Laboratory

## #43. Spatial dynamics in the pelagia of large lakes: Technological advances and applications

Large lakes of the world requires oceanographic technology to measure ecological variables at relevant temporal and spatial scales. This session welcomes presentations on the use of technology such as hydro-acoustics, laser optical plankton counters, video samplers, and various towed and autonomous sensors, to infer distributions of organisms at a range of temporal and spatial scales. We welcome contributions on new applications, solutions of methodological problems, and comparisons of patterns observed with different sensors. We encourage authors to also explore the ecological consequences of such patterns.





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Chaired by Lars Rudstam, Cornell University, Ithaca, NY; 607-255-1555; lgr1@cornell.edu Doran Mason, NOAA Great Lakes Environmental Research Lab David Warner, USGS Anne Scofield, Purdue University

### #44. Cross-Lake comparisons: Frameworks for understanding ecosystem change

Comparative analysis across systems can be a powerful approach to investigate hypotheses about a range of topics, from the mechanisms of ecological change to the drivers of adaptive differences among populations. The Laurentian Great Lakes (and other large lakes in the area) have a similar geographical location and in several cases similar species composition, although each also has its unique history of ecological conditions and change. The Great Lakes system thus offers an opportunity for studying responses to ecosystem change across various factors such as trophic status, invasive species impacts, and ecoregion (offshore, nearshore, upwelling zone, etc.). For example, differences among lakes can be exploited to investigate the likelihood of proposed mechanisms of change (such as altered nutrient cycling, invasive species, etc.) in one lake causing ecological change in other areas in the future. Differences in fish life-history patterns across lakes may offer insights about ecosystem function, which allows for better assessments of the possible outcomes of management and restoration efforts. In this session, we invite contributions that use a comparative approach across large lake ecosystems to gain insights into mechanisms that cause differences in ecological function, from nutrient cycling to food web structure and life-history adaptations. We especially encourage submissions that consider conceptual frameworks for understanding ecosystem responses to changing conditions.

Chaired by Anne Scofield, Purdue University, West Lafayette, IN; ascofiel@purdue.edu Lars Rudstam, Cornell University Bio Field Station, Dept. of Natural Resources Tomas Höök, Purdue University, Dept. Forestry and Natural Resources

### #45. Exploring predator-prey dynamics and feeding ecology in the Great Lakes

Much of fisheries management in the Great Lakes is predicated on understanding energetic capacities and available resources. Rapid systemic changes brought on by invasive species introductions have created instabilities which are changing long-standing beliefs about the capacity of the Great Lakes to support previously abundant fish and invertebrate populations. As such, many discussions are focused on improving understanding of feeding ecology, prey selection, and complex population dynamics. In this session we will explore the science supporting our understanding of predator-prey dynamics and foraging patterns in Great Lakes fishes.

Chaired by Jory Jonas, Michigan Department of Natural Resources, Charlevoix, MI; 231-547-2914; jonasj@michigan.gov Brian Weidel, U.S. Geological Survey, Great Lakes Science Center Matthew S. Kornis, U.S. Fish and Wildlife Service



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#### #46. Great Lakes lower trophic level community dynamics

In the Great Lakes changes in lower trophic levels have a rippling effect throughout a lake's ecosystem. Changes in lower trophic level communities are reflective of variety of factors. This session invites presentations on the topics of monitoring and study of Great Lakes lower food web communities.

Chaired by Elizabeth Whitmore, Cornell University, Bridgeport, NY; 315-317-8738; beth.whitmore34@gmail.com

#### #47. Mud, macrofauna, and microbes: Benthic organism-abiotic interactions at varying scales

Benthic environments are dynamic habitats, subject to variable sources and rates of sediment delivery, reworking from the abiotic and biotic processes, and complex biogeochemistry. These activities do not occur in a vacuum, and interact synergistically to influence food webs, biogeochemistry and water quality. Understanding these environments and impacts to them requires a holistic approach that reflects their complexity. This session seeks submissions from ecologists, biologist, geologists, and physical oceanographers which directly address microbial redox chemistry, ecosystem engineering including bioturbation, bio-irrigation and biodeposition, advances in the characterization of sediment physical properties, and the role of seabed disturbance on the composition and function of benthic environments at all scales. By bringing together scientists addressing all scales relevant to benthic food webs (micro and macro biota) and physicochemical environments (geology, biogeochemistry), we will strive to identify and fill knowledge gaps concerning ecology of benthic sediments in Great Lakes and estuarine systems.

Chaired by Elizabeth Hinchey Malloy, U.S. EPA GLNPO, Chicago, IL; 312-886-3451; hinchey.elizabeth@epa.gov Lyubov Burlakova, Great Lakes Center at SUNY Buffalo State Knut Mehler, Great Lakes Center at SUNY Buffalo State Janet Nestlerode, US. EPA ORD Gulf Ecology Division Alexander Karatayev, Sasha Karatayev, Great Lakes Center at SUNY Buffalo State

## Watersheds, Groundwater, Tributaries, and Coastal Issues: Sessions 48-53

#### #48. Soil health: Role of nutrients losses from agricultural sites

This session will include research on how best management practices (BMPs) influence soil health and its correlation with nutrient retention and loss from farm soils. BMPs includes, but are not limited to, tillage, cover crop, crop rotation, 4R Nutrient Stewardship, precision agriculture and dredged amendment practices.

Chaired by Angélica Vázquez-Ortega, Bowling Green State University, Bowling Green, OH; 419-372-9385; avazque@bgsu.edu

#### #49. Great Lakes tributaries: Connecting land and lakes

From small streams to large rivers, Great Lakes tributaries provide a crucial link between terrestrial and aquatic ecosystems. Tributaries are dynamic systems and understanding how their internal processes influence the broader Great Lakes requires an interdisciplinary approach. To that end, this session seeks submissions that explore the role of





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tributaries in influencing the Great Lakes, including, but not limited to biodiversity, biogeochemistry, ecosystem services, geomorphology, habitat availability, harmful algal blooms, nutrient and sediment dynamics, and international policy.

# Chaired by Nathan Manning, National Center for Water Quality Research at Heidelberg University, Tiffin, OH; 419-448-2443; nmanning@heidelberg.edu

*Laura Johnson, Heidelberg University, National Ctr for Water Quality Res. Douglas Kane, Defiance College, Division of Natural Sciences* 

## #50. Application of simulation models in watershed science and lake ecology

Computer simulation models are very useful for studying and analyzing freshwater systems. Watershed models help us understand and predict the transport of chemical and hydrologic inputs to aquatic systems; Water quality and ecological models can be used to assess the impacts of those inputs in aquatic systems. These models can be used benificially in a number of ways. Some are intended to improve basic scientific understanding of watershed/aquatic systems. Others are best applied as management tools to assess impacts of "what-if" scenarios. Still others are valuable as teaching tools for both students and the public. This session will include presentations about simulation models and the varied ways they can be applied to lakes and other freshwater systems.

Chaired by James Zollweg, SUNY Earth Sciences, Brockport, NY; jzollweg@brockport.edu

## #51. Coastal resilience in the face of change

Recent extreme fluctuations in water levels, plus changes to sediment movement patterns and supply, have the potential to affect the condition and integrity of Great Lakes coastal areas. Further changes are expected as climate change alters runoff patterns and shorelines continue to be converted from natural to developed states. As a result, property owners, communities, and coastal resource managers face significant challenges related to the management of Great Lakes shorelines. For this session, we invite research in any area of coastal resilience, including in-lake hydrodynamics, shoreline erosion and accretion, shoreline hardening, groundwater inputs, water retention, and green infrastructure. We invite scientists from any discipline to consider submitting their work to this session, and encourage presentations on physical dynamics, landscape design, economics, stakeholder perceptions, and any other topic area that can contribute to the long-term resiliency of Great Lakes coasts.

Chaired by Joseph Atkinson, University of Buffalo, Dept. of Civil, Struct. & Env Eng., Buffalo, NY; 716-645-2220; atkinson@buffalo.edu Carolyn Foley, Illinois-Indiana Sea Grant Henry Bokuniewicz, Stony Brook University

### #52. Furthering interdisciplinary urban groundwater quality and urban sustainability research

Urban groundwater quality in the Great Lakes Basin is an issue largely overlooked due to the region's reliance on its surface water resources for drinking water in urban areas. By looking at the issue of groundwater through urban sustainability, we can more holistically understand water quality and water access in our cities. This session will be co-chaired by an interdisciplinary group of students from engineering, pharmacology, and anthropology that currently work



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on addressing water security concerns in southeast Michigan. Presentations will illustrate the scientific, social, cultural perspective of how water contaminants affect daily life in urban settings.

Chaired by Brendan O'Leary, Wayne State University – Engineering, Birmingham, MI; 248-227-7483; brendanfoleary@gmail.com Colleen Linn, Wayne State University – Anthropology

Camille Akemann, Wayne State University – Pharmacology

## #53. Watershed and lake science informing management

Clearly, we are seeing an increased interest across funding entities in the broader impacts of research efforts throughout the Great Lakes and their respective watersheds. In such, we have arguably seen an increase in the quantity and variety of research projects that are being deployed to address state and federal agency management needs and to, when appropriate, inform policy. The goal of this session is to provide the opportunity for researchers to highlight how they have sought research direction from agency personal, mobilized research efforts, and/or effectively communicated their findings. This session welcomes broad examples that highlight academic and agency partnerships. Not intended to be an exhaustive list, but examples include: (1) harmful algal bloom science (e.g., nutrient control/reduction, toxin removal to protect drinking water, assessment of toxicity to inform public health decisions, etc.), (2) fisheries work (e.g., understanding spawning and recruitment, "nature-based" shoreline practices, etc.), (3) crude oil transport (e.g., risk analysis, economic evaluation of transport methods, spill and emergency preparedness, etc.), (4) pharmaceutical identification and treatment (e.g., impacts to biota, ability of both wastewater and water treatment facilities to remove, concentrations within receiving waterbodies, etc.), (5) beneficial use of dredge (e.g., material to market, beach/near shore nourishment, habitat creation, land reclamation, construction materials, etc.), (6) hazard resilience (e.g., identification of vulnerable coastal communities), and (7) green infrastructure (e.g., performance analysis, models and decision support tools, etc.).

Chaired by Christopher Winslow, Ohio Sea Grant College Program, Columbus, OH; 614-247-6684; winslow.33@osu.edu Christine Mayer, University of Toledo, Lake Erie Center Kristen Fussell, Ohio Sea Grant & Stone Laboratory Sandra Kosek-Sills Heather Raymond, Ohio EPA

## Wetlands and Reefs: Sessions 54-57

### #54. Great Lakes' coastal wetlands: Innovative research to improve restoration

Coastal wetlands provide valuable ecosystem services, including water filtration, flood mitigation, and fish and wildlife habitat; however, they are among the most degraded ecosystems on the planet. To regain wetland functions on the landscape, U.S. and Canada have prioritized Great Lakes coastal wetland restoration through programs such as the Great Lakes Restoration Initiative. The objective of this session is to highlight advances in wetland research pertaining to Great Lakes coastal wetland restoration, including applications of Coastal Wetland Monitoring Program data, innovative techniques, and illustrative case studies.



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Chaired by Rachel Schultz, SUNY Brockport, Dept. of Env. Science and Ecology, Brockport, NY; rschultz@brockport.edu Douglas Wilcox, SUNY Brockport, Dept. of Environmental Sci. & Biol.

## #55. Wetland restoration in the Great Lakes: Research and innovation

Wetland restoration in the Great Lakes Basin occurs at a variety of scales, from small (1000 ha) shoreline efforts. Outcomes are frequently determined by a complex array of site specific environmental and socioecological drivers. We invite presentations from across the spectrum of restoration, especially those that describe research and innovation in construction, management, policy and community engagement.

Chaired by Christy Tyler, Rochester Institute of Technology, Rochester, NY; 585-256-9951; actsbi@rit.edu Carmody McCalley, Rochester Institute of Technology Jim Howe, The Nature Conservancy David Klein, The Nature Conservancy

## #56. Great Lakes' reefs: Research, monitoring, creation, and maintenance

Deposits of rocky substrates (i.e., reefs) provide important spawning habitat for many fishes of the Laurentian Great Lakes and are critical to the recovery of multiple fish stocks. However, many historically important spawning reefs have been lost or degraded due to land use changes leading to increased sedimentation, biocolonization by invasive species, and direct removal. In this session, we will highlight ecological research and monitoring on the function and value of natural and constructed reefs as fish habitat, methods and projects to restore lost or degraded reefs, and the role of reef maintenance in a dynamic and changing environment.

Chaired by Jason Fischer, University of Toledo, Dept. of Env. Science, Toledo, OH; jason.fischer2@rockets.utoledo.edu Robin DeBruyne, Univ. of Toledo / USGS Great Lakes Sci. Ctr Edward Roseman, USGS-Great Lakes Science Center

## #57. Linking human well-being, quality of life, and ecosystem services to conservation efforts

There is growing interest in how coastal wetlands deliver ecosystem services and impact human well-being and quality of life of residents and visitors to Great Lakes coastal communities. This session will highlight research unveiling and demonstrating the value of these connections and how metrics related to ecosystem services and human well-being are being used to guide protection and restoration efforts across the Great Lakes.

Chaired by Mauri Liberati, The Nature Conservancy, Lansing, MI; (517) 316-0300 x2214; marjorie.liberati@tnc.org Douglas R Pearsall, The Nature Conservancy



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## General: Session 58

#### **#58. General Contributions**

This general session is designed for presentations that fit within the broad scope of IAGLR but that do not align with any other specific session.

Chaired by Joseph Makarewicz, The College at Brockport, State University of New York, Brockport, NY; 585-352-9724; jmakarew@brockport.edu