2022 State of Lake Erie Conference

Presented by IAGLR, March 16-17, 2022, Cleveland | Virtual

SESSIONS

A daily listing of sessions organized alphabetically by session title.

Wednesday, March 16, 2022

Ecological Modeling of Lake Erie
Chairs: Reza Valipour, Mark Rowe
This session focuses on the recent developments and applications of process-based numerical models to study physical, biochemical and biogeochemical processes in Lake Erie. We also welcome studies on field observations, laboratory experiments, data analysis, image and video analysis, machine learning, and deep learning that could bring new perspectives to existing modeling approaches.

Insights on Lake Erie Emerging Contaminants of Concern
Chairs: Jill Bartolotta, Sarah Lowe, John Lenhart
This session will highlight recent research advances on evaluating the presence, fate and effects of contaminants of concern in Lake Erie, showcase outreach and education related to these problematic pollutants, and connect researchers, resources managers, and educators from the around the Great Lakes.

Lake Erie Harmful and Nuisance Algal Blooms
Chairs: Mary Anne Evans, Mike Murray, Dave Depew
Harmful cyanobacterial and algal blooms (collectively, HABs) and nuisance algal blooms (NABs) degrade water quality with many potential ecological and socio-economic consequences. HABs are seasonal features of the western basin of Lake Erie, Sandusky Bay, and Lake St. Clair. HABs also occur sporadically in the central basin and various enclosed bays and rivermouths. HABs have also been observed in the eastern basin, along with benthic NABs. This session invites presentations on HABs and NABs causes, dynamics, and effects from all areas of Lake Erie and Lake St. Clair and from a variety of perspectives, including: (1) Physics and ecology of bloom dynamics; (2) Toxin production, detection, and treatment; (3) Health risks of algal toxins and exposure routes; (4) Socio-economic and cultural impacts of blooms; (5) Watershed nutrient sources and management; and (6) other related interdisciplinary topics.

Lake Erie Hypoxia: State of the Science and Approaches to Track Future Progress
Chairs: Craig Stow, Mike McKay, Casey Goodwin
Hypoxia in Lake Erie's central basin is one of the most widely-recognized symptoms of eutrophication and degraded water quality in the Great Lakes. The Lake Erie hypoxic zone routinely covers several thousand square kilometers each summer/fall season, with low dissolved oxygen (DO) concentrations threatening drinking water quality, impacting fishery habitat, and altering biogeochemical cycling of nutrients, contaminants, and greenhouse gases. In response to these impacts, under the Nutrients Annex of the 2012 Great Lakes Water Quality Agreement (GLWQA), the United States and Canada committed to "minimize the extent of hypoxic zones in the Waters of the Great Lakes associated with excessive phosphorus loading, with particular emphasis on Lake Erie. As the region works towards this goal, it is an important time to examine the current state of the science on this topic and map approaches for tracking future progress. For this session, we invite contributions focused on: history of hypoxia based on contemporary observations or paleolimnology; the physical and biogeochemical drivers of hypoxia in the lake; consequences for element cycling, contaminants, and greenhouse gases; impacts of hypoxia on source water quality, habitat, food webs and fisheries; or application of modeling and observing systems technologies to study this phenomenon.

Monitoring and Progress in the St. Clair-Detroit River System
Chairs: Robin DeBruyne, Justin Chiotti, Michelle Selzer
The St. Clair-Detroit River System (SCDRS) is the connecting waterway between Lake Huron and Lake Erie, including Lake St. Clair, and provides most of the water into western Lake Erie. Historically this system had numerous islands, reefs, embayments, wetlands, and tributaries that provided vast amounts of pristine spawning and nursery habitat for fishes such as lake sturgeon, walleye, and lake whitefish. Following human settlement, the SCDRS experienced environmental degradation from urbanization, agriculture, industry and associated pollutants, dredging, and hydrologic modification. Types of habitat degradation include wetlands loss, invasive species invasions, loss of critical habitat function including connectivity to wetlands and within tributaries. These degraded conditions resulted in six river systems within the SCDRS geography being designated as Great Lakes Areas of Concern, including the St. Clair River, Clinton River, Detroit River, Rouge River, River Raisin, and Maumee River. Restoration and management of resources in the SCDRS involves interjurisdictional cooperation and collaboration. Documented successes in the SCDRS include expanded lithophilic spawning habitat to support lake sturgeon population, softening shorelines to provide shallow water nursery habitat, and other actions to address beneficial use impairments identified by the Area of Concern designation. The purpose of this symposium is to highlight recent research and management activities occurring in the SCDRS and provide the scientific community with an update on status and concerns of environmental conditions, habitat, and fish populations. Presentations will emphasize interjurisdictional and multi-disciplinary approaches to research and management in the SCDRS.

Remediation to Restoration to Revitalization: Examining the Current State of Lake Erie Areas of Concern
Chairs: Scott Hardy, Lynn Garrity, Bryan Stubbs
To respond to the remediation needs of the most severely affected sites around the Great Lakes, in 1987 the U.S.-Canada Great Lakes Water Quality Agreement established Areas of Concern. Areas of Concern (AOCs) are locations where environmental conditions resulting from human activities – officially termed as beneficial use impairments – locally prevent certain uses of the lakes. This

session seeks to provide updates, and catalyze research and restoration actions, within Lake Erie AOCs and neighboring communities.

State of Community Science: Credible Data and Innovative Partnerships
Chairs: Max Herzog, Jon Bratton
Lake Erie and its watersheds are more significantly impacted by human activity than any other Great Lake. These impacts are fueled by a mix of longstanding challenges like agriculture-driven harmful algal blooms and industry-driven heavy metal pollution as well as emerging contaminants such as microplastics, pharmaceuticals, and PFAS. At the same time, budget reductions challenge the scope of State agency monitoring programs across the region, significantly limiting the scope and granularity of water quality data collected across the Lake Erie Basin. Lake Erie residents feel a powerful sense connection to and responsibility for their water resources. Local organizations have been harnessing this energy to power "Citizen" or "Community" science groups, water quality monitoring programs staffed by non-expert volunteers, in communities across the region for years. Now, through the Smart Citizen Science Initiative, Cleveland Water Alliance is leading a network of "Local Champions" that connect and accelerate Lake Erie community science and serve as a platform for ongoing water quality innovation. But where do we go from here? A number of innovative efforts around student engagement, field technologies, and regional collaborations are being tested out through CWA's work but we know we are only scratching the surface of activities across Lake Erie's three basins. This session would focus on interesting partnerships and uses of technology for community resource outcomes. Particular interest will be shown to talks exploring the intersection of community science with traditional ecological knowledge, environmental justice, and/or water equity.

State of Smart Lake Erie: Innovation, Collaboration and Entrepreneurship for a Great Lake
Chairs: Max Herzog, Ed Verhamme
Over the last decade, the rapid pace of technological innovation has enabled radical shifts in environmental monitoring. Newly affordable solutions for distributed in-situ monitoring, remote sensing, community science, and data fusion offer immense opportunities to build the research, management, and community capacity needed to understand, protect and restore our water resources across the Lake Erie Basin. New technology is enabling a broader movement of water monitoring by community groups, municipal actors, cross-sector partnerships and industry leaders across the states and province that form Lake Erie's shores. This session will use case studies and interactive technology demonstrations to explore the next generation of Lake Erie data collection and analysis systems. These systems will range from high-frequency sondes and software-defined networking, to observational science and low-cost wireless gateways. 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 navigating 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 across Lake Erie's watersheds and stewardship within the Great Lakes and large lakes of the world.

Thursday, March 17, 2022

Agricultural practices and water quality
Chairs: Khandakar, R Islam, Arif Rahman
Current high-input agriculture produces greater amounts of food, feed, and fiber, but effects of these farming practices, together with climate change, are adversely affecting soil health and water quality with increased agroecosystem disservices. By 2050 agricultural production may have to double to support for food security, which will make existing farmland increasingly dependent on reactive agrochemicals, freshwater, and energy inputs. Such intensification of high-input farming will accelerate edge-of-field reactive nutrient loss. The reactive nutrients together with climate change effects are expected to accelerate harmful algal blooms and release their cyanotoxins in lakes, reservoirs, and other freshwater systems associated with major public health and socioeconomic concerns. Ohio surface waters have experienced substantial eutrophication over time from agricultural land use practices. In Lake Erie, the Ohio and Maumee rivers and Grand Lake St. Mary's, have frequent and severe algal blooms in late summer. In recent years, widely present harmful algae species (i.e., cyanobacteria) have worsened the blooms (Cyanotoxin-producing algal - blooms) by releasing multiple toxins and threaten the public health. However, the challenges and opportunities are emerging with the advent of expanding science-based knowledge, technology and information systems that encouraging us to envision water quality treatment renaissance in the 21st century. We envision that our proposed session will bring diverse clientele together from multi-disciplinary but related fields to work locally and regionally to address the challenges and opportunities to emphasize the connection among edge-of-field nutrient loss, climate change effects, algal blooms and cyanotoxins, and novel and holistic approaches of water quality management.

A Systems View of Lake Erie Biogeochemistry
Chairs: Brice Grunert, Fasong Yuan
Lake Erie biogeochemistry is tied to the combination of natural rhythms and disruptions from human activity, from agricultural activity and introduction of invasive species to toxic metal pollution and the emergence of persistent organic pollutants. Our understanding of how these processes interact and influence Lake Erie water quality, from safe beaches and drinking water to the health of our fisheries, is tied to the observations we make. The spatial and temporal extent of observations impacts the conclusions we form, in turn, impacting how we manage the system. In this proposed session, we aim to provide an overview of recent advancements in our understanding of the cycling of phosphorus, nitrogen and carbon within Lake Erie and relate these observations to our understanding of spatial and temporal variability in Lake Erie biogeochemistry, to observe Lake Erie at increasing spatial and temporal resolutions (e.g., remote sensing, coastal buoys, UAVs). Lake Erie is an increasingly observed system, and our ability to integrate these diverse datasets will provide an improved understanding of Lake Erie biogeochemistry as a connected system. Additionally, these datasets are critical to continue improving our ability to model Lake Erie biogeochemistry. Multi-scale diverse observations begin unifying datasets and approaches for an improved understanding of spatial and temporal variability in Lake Erie biogeochemistry. Oral presentations dealing with basic and applied research on the spatial and temporal dynamics of dissolved, colloidal and particulate carbon, nutrients, trace elements and emerging contaminants in Lake Erie and its tributaries will be solicited.

Building a Lake Erie Monitoring Program to Inform Biological Condition
Chairs: Douglas Kane, James Watkins, Lyubov Burlakova
What should we be monitoring and striving to understand within the lake and watershed to better understanding, and possibly predict, ecosystem change within the lake?

Community Science and Outreach
Chair: Amy B. Alford
Over 10 million people directly rely on Lake Erie daily for clean drinking water and commerce while millions more rely on its waters, islands, and shorelines for recreation. Moreover, historical issues such as establishment of the Clean Water Act and contemporary issues such as harmful algal blooms and shoreline erosion highlight the importance of Lake Erie as a living laboratory for science and policy. Outreach and educational programs targeting specific user-audience are therefore integral to the conservation and sustainability of Lake Erie's resources. This session presents ongoing community science and outreach activities across Lake Erie. This session's goal is to highlight programs that are community-driven and centered such as pollution reduction education, ecosystem monitoring, environmental justice advocacy. Extension efforts of Local, State, Federal, Academic, and Non-Governmental agencies will also be presented.

Designing and evaluating wetlands to optimize environmental and ecological benefits
Chairs: Lauren Kinsman-Costello, Janice Kerns, Laura Johnson
This session seeks to provide insight on which wetland designs, restoration activities, and management strategies are most effective at cultivating nutrient removal as well as other co-benefits. Presentations could include studies that focus on our understanding of soil biogeochemistry, microbiomes, vegetation dynamics, modeling, and hydro geophysics at both local and watershed levels. Additionally, studies that evaluate other co-ecological benefits of these restoration and management activities (e.g., habitat and wildlife diversity) are also desired.

Lake Erie Field Year 2019 Results - Cooperative Science and Monitoring Initiative (CSMI)
Chairs: Kristen Fussell, Christopher Winslow, Paris Collingsworth
The Cooperative Science and Monitoring Initiative (CSMI) is a binational effort instituted under the Science Annex (Annex 10) of the Great Lakes Water Quality Agreement to coordinate science and monitoring activities in the five Great Lakes. Each year one of the five Great Lakes is examined intensively to generate data and information for environmental management agencies. This intensive monitoring includes both US and Canadian agency efforts and the recruitment of academic institutions. These science and monitoring results are used to assess and report on the state of the lake in annual reports and Lakewide Action and Management Plans. This session will highlight research conducted during the 2019 intensive field sampling year in Lake Erie. The binational CSMI has been instrumental in supporting adaptive management under changing conditions in Lake Erie. Research highlighted in this session will include information on the status of nutrient and contaminant loading and cycling, the lower food web, and the health of the fishery. For 2019, consideration was given to ensuring that priorities related to eutrophication align with the science and monitoring needs of the state, provincial and federal agencies implementing Domestic Action Plans and other efforts to reduce and understand Phosphorus loads under the GLWQWA Nutrients Annex (Annex 4).

Lake Erie Literacy and Education

Chairs: Lyndsey Manzo, Kristin TePas, Angela Greene

Long term sustainability of Lake Erie's critical ecosystems and resources, as well as resiliency of residents and communities in Lake Erie's watershed, rely on translating scientific research to forms and applications necessary to build an environmentally literate public. A Lake Erie literate person (1) understands the characteristics, functioning and value of Lake Erie; (2) communicates accurately about Lake Erie's influence on systems and people in and beyond its watershed; and (3) makes informed and responsible decisions regarding Lake Erie and the resources of its watershed. Presentations in this session will help to answer the following questions: How are we educating stakeholders of all ages about the current state of Lake Erie? What are the characteristics of successful initiatives to improve Lake Erie literacy with K-12 students, formal and nonformal educators, or adult learners? What strategies are being used to reduce or overcome barriers and challenges to improving Lake Erie literacy? How can we ensure future education efforts reach traditionally underserved and underrepresented populations?

Living Laboratory Ontario – part of the Canadian Agroecosystem Living Laboratories network

Chairs: Pamela Joosse, Chris Parsons

The Living Laboratories Initiative is a new approach to agricultural innovation in Canada, that brings together farmers, scientists, and other collaborators to co-develop and test innovative practices and technologies to address agri-environmental issues. Through a nation-wide network of living labs, the initiative focuses on innovative solutions to environmental issues related to agriculture, such as climate change, soil health, water quality and biodiversity. The goal of the Living Laboratories Initiative is to accelerate the development and adoption of sustainable practices and technologies by Canadian farmers. Lake Erie was selected through regional consultation as the geographic area of priority for the Living Laboratory Ontario because of the importance of reducing the loss of agricultural nutrients and soil from agricultural landscapes into Lake Erie. Led by the Ontario Soil and Crop Improvement Association (OSCIA), Living Lab – Ontario collaborators include farmers, agricultural organizations, Conservation Authorities and scientists from Agriculture and Agri-Food Canada and Environment and Climate Change Canada. As this project was just initiated in 2020 there are limited results to present. This session will focus on providing an overview of the Living Lab Ontario project and the various partners and components, as well as more detail of how aquatic endpoint and biogeochemical cycling components are being studied.