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Key Recommendations from IJC's 15th and 16th Biennial Reports for the Governments to Implement

Science Priority Committee,
International Joint Commission

In the 15th and 16th Biennial reports, the Commission provided so many recommendations to the Parties that priorities were unclear and it was therefore difficult for the Parties to respond. During the same timeframe, the Parties were deeply engaged with renewal of the Great Lakes Water Quality Agreement (GLWQA) that was signed in 2012. In the current interim between the last biennial report and the first triennial report (late 2016), we have reconsidered the recommendations from the 15th and 16th biennial reports in order to provide clearer priorities. Here we offer five of the earlier recommendations as key priorities. We have winnowed the earlier lists of recommendations in order to elicit more detailed responses from the Parties and ultimately to motivate key actions to improve the restoration and protection of the Great Lakes.

Process by which the SPC selected key recommendations

We excluded from our consideration the important goal of improving nutrient management because that issue is being addressed by the IJC's LEEP initiative (e.g., the 2014 report on *A Balanced Diet for Lake Erie*). Also, we excluded the topic of atmospheric deposition because that is the topic of another IJC report. Likewise we excluded recommendations related to indicators because of the on-going IJC effort on choosing indicators for the Great Lakes. Multiple key recommendations reinforce ongoing discussions within the GLWQA annex working groups.

To identify our key priorities, all the members of the SPC were invited to submit their top few priorities (no more than six), along with justification for their choices, chosen from the complete list of priorities in the 15th and 16th biennial reports (excluding the nutrient and indicator categories as explained above). Seventeen recommendations were selected by at least one SPC member. Five of these were excluded because at least one member of the SPC explicitly objected to their inclusion. From the remaining 12 items, five additional items were excluded because they appeared on only one SPC member's list. That left seven items representing five of the major categories from the original reports. The overrepresented category was Beaches, but the spirit of the inputs from SPC members did not weight beaches (in general) more than the other remaining categories. Thus we chose among the three equally supported (2 votes each) priorities within the Beach category, retaining the most inclusive Beach recommendation. That left the five key recommendations listed below, which collectively represent five major categories.

The five recommendations are quoted verbatim from the original reports and appear in **bold**, while our commentary on each recommendation is in plain font. The recommendations appear in the order in which they appeared in the biennial reports.

<u>Nearshore Framework</u> (from 15th Biennial Report)**. Ensure that the various orders of government address impacts of urban and rural areas on nearshore water and ecosystem quality, including the development of appropriate goals, targets and indicators, infrastructure improvements, and research and monitoring to track progress in sustainable land use that is protective of Great Lakes receiving waters.**

Most of the 40 million people living in the Great Lakes watershed live near the shore; most human impacts are greatest on nearshore habitats; and most people's experience of the lakes is limited to the nearshore regions (Allan et al. 2015). Furthermore these nearshore habitats are often disproportionally important as breeding or nursery sites for multiple species of fish and wildlife. Thus restoration and protection of nearshore waters and habitats is foundational to other priorities. Nearshore habitats face a host of threats, especially agricultural and urban development, best addressed through actions directed at land use and tributary transport of nutrients, sediments and contaminants; and shoreline modifications including dredging, shoreline hardening and degradation or loss of wetland habitat. The 2012 GLWQA recognizes "that nearshore areas must be restored and protected because they are the major source of drinking water for communities within the basin, are where most human commerce and recreation occurs, and are the critical ecological link between watersheds and the open waters of the Great Lakes". Further, the GLWQA calls for an integrated nearshore framework to be implemented collaboratively through the lakewide management process. However research to quantify the type, amount, and effectiveness of potential mitigation and restoration activities continues to lag behind management and policy needs.

Significant knowledge gaps to be filled include identification of nearshore areas subject to high stress in order to provide an overall assessment of the state of nearshore waters, and identification of areas of high ecological value and human benefit, both within an information system that assists in priority setting and management decisions. Effective management requires an analysis of factors causing stress, information-sharing and collaboration amongst agencies to ensure effective actions that will be protective of lake ecosystems, and appropriate monitoring to evaluate progress. Thus the challenge of developing a framework that is protective of nearshore waters of the Great Lakes is in many ways an over-arching challenge intended to address the waters that are most impacted by human activities. Because many infrastructure and land use decisions are made at state/provincial, Indigenous Peoples, and local levels, comprehensive actions are needed by the Parties and by other groups that can be influenced by the Parties, including lower levels of government, the private sector, and civil society organizations.

<u>Beaches</u> (from 15th Biennial Report)**. In consultation with various orders of governments, develop testing methods to improve the scientific basis for advisory and closure decisions at Great Lakes beaches; improve early-warning communication to the public about beach advisories and closures.**

Recreation at or near beaches is the most common interaction most people have with the Great Lakes, and is a major economic driver. Beach advisories and closures issued due to poor microbial water quality considerably diminish the recreational and economic benefits derived from beaches (The Brookings Institution 2007). The presence of *E. coli* bacteria is used as the indicator for human fecal contamination and thus public health risk. Current shortcomings for *E. coli* testing methods including less pathogenic bacteria being mistaken for human fecal contamination, and lengthy sample processing times (up to 24 hours), often lead to false information regarding microbial water quality and associated health risk being conveyed to the public (Nevers et al. 2014). This can lead to prohibitions for swimming at beaches that actually meet the public health criteria (i.e., *E. coli* water quality criteria) or the public unknowingly swimming in beach water that is contaminated.

There is an urgent need for new novel indicators and tests that are able to rapidly quantify human fecal contamination in beach recreational waters to improve decision-making for beach advisories and thus better protect human health. Water quality forecasting models based on real-time data such as rainfall, wave height and turbidity also hold significant promise for providing advanced warning of beach advisories to the public, including Indigenous Peoples. More efforts should also be devoted to the development of effective early communication systems. Improving testing and forecasting methods, combined with effective communication tools, are essential for providing safe recreational opportunities to millions of people who visit the beaches of the Great Lakes.

Groundwater (from 15th Biennial Report)**. Designate a lead agency with responsibility for compiling and regularly reporting to the Commission on relevant research, monitoring and program information on key groundwater issues because of the importance of groundwater quality to human and ecosystem health.**

Groundwater discharge to surface waters in the Great Lakes Basin is estimated to account for up to 5-25% of the total water inflow into the Great Lakes (Kornelsen & Coulibaly 2014). Groundwater is an important factor in maintaining ecosystem function in surface water bodies (e.g., streams, wetlands) in the Great Lakes Basin and also impacts surface water quality (Grannemann et al. 2000). Groundwater quantity and quality are also essential for the health of millions of people in the Great Lakes Basin who rely on groundwater for drinking water. An increasing number of acute issues with groundwater quality and quantity has revealed the vulnerability of these systems and potential threats to human and ecosystem health, but the scope of the threats remains largely unknown. While the importance of protecting groundwater for human and ecosystem health in the Great Lakes Basin has become better recognized in recent years (e.g., inclusion of Annex 8 focused on Groundwater in the GLWQA Protocol in 2012), groundwater quality and quantity issues including groundwater-surface water connectivity are still not well understood and are poorly managed. Greater investments in groundwater research and monitoring are urgently needed to better understand and manage current and future threats for the public, including Indigenous Peoples.

Chemicals of Emerging Concern (from 16th Biennial Report)**. The governments should continue to invest in research to better understand human health and ecological effects of mixtures of chemicals, including chemicals of emerging concern.**

Water quality research and monitoring with increasingly sensitive techniques is revealing the occurrence of an increasing array of anthropogenic chemicals and nanoparticles in surface waters, groundwaters, and wastewaters. Sources of these chemicals include commercial and personal care products, pesticides, and pharmaceuticals (Klecka et al. 2010, Hull et al. 2015, Metcalfe et al. 2013). Concerns regarding these chemicals can include biological activity at very low concentrations (Vandenberg et al. 2012) and harm to the health of humans, including Indigenous Peoples who often rely on wild-harvested organisms (http://www.chiefs-of-ontario.org/node/115). For most of these chemicals, more information is needed in multiple areas, including sources, physical-chemical properties (with implications for environmental transport), exposures and effects for humans, fish, wildlife, and other organisms. Also needed is more information regarding impacts on individuals, populations, and ecosystems of the mixtures of these chemicals that we now know are common in our waters (Goodson et al. 2015, Overturf et al. 2015).

Research on such effects is needed to provide a foundation for future actions to prevent the use or release of harmful chemicals (e.g., through greater use of green chemistry and related practices; Wilson & Schwarzman 2009) and to discover methods to remove such chemicals from wastewater (Arvai et al. 2014). Communication of research results to policymakers, industry, and the public is needed to guide policy changes and industrial practices relating to the use and management of harmful substances (Ward et al. 2008).

Aquatic Invasive Species (from 16th Biennial Report)**. Prevention: The governments should provide incentives for private industry to implement ballast water treatment technologies that further reduce the likelihood of introductions from this pathway. Public education and outreach programs should be expanded to increase awareness of AIS and reduce the spread from live trade and recreational boating. Control measures and legislation are needed to address hull fouling, anti-fouling paints and species sold in live trade.**

Although we do not endorse the part of the first sentence above that calls for "incentives for private industry," we selected this recommendation from among the several aquatic invasive species (AIS) recommendations in the 15th and 16th biennial reports because it most strongly emphasizes prevention (while other recommendations emphasize early detection, eradication, control or other aspects of AIS management). Improvements in policies and practices to lower the rate of introductions of aquatic invasive species into the Great Lakes from ballast water seem to have succeeded (Pagnucco et al. 2015). Nevertheless ships (ballast water and biofouling), canals, the live trade (e.g., pets, plants, watergardens, live bait), and other pathways remain significant threats for introductions of species that might be harmful to Great Lakes environments and the regional economy (Keller & Lodge 2007). While research, development, and implementation of the rapidly improving early detection and rapid response (EDRR) technologies (e.g., genetic based technologies) should proceed, the continued absence of feasible, effective, and affordable control technologies applicable to the Great Lakes proper (vs. inland lakes where eradication and control are often feasible) limits the current usefulness of EDRR in the Great Lakes proper. Because it is often not clear what can or should be done when EDRR efforts detect a nascent invasion in the Great Lakes, such discoveries often lead to frustration by management agencies and the public.

Given the present limitations of control technologies at large aquatic spatial scales, investments in prevention will continue for the foreseeable future to bring the biggest long-term bang for the buck for the Great Lakes economy (Keller et al. 2009). This is because prevention efforts—especially when tailored to pathways—can reduce the introduction of many harmful species simultaneously at low cost, while just one harmful species can cause damages that grow in magnitude and geographical coverage for decades, often crossing boundaries of political jurisdictions (Rothlisberger and Lodge 2013). Prevention is also likely to promote social equity because poor populations of humans are often those most severely affected by AIS because they rely most strongly on fisheries and wildlife, and because they can least afford to adapt to changing conditions (Warziniak et al. 2011). Thus Indigenous Peoples could be strong allies in prevention and early detection because they are likely to suffer disproportionately from AIS and because they are keen observers of nature.

Recently developed risk assessment tools to identify species that are likely to be harmful if introduced to the Great Lakes should be expanded and implemented to enhance cost effective prevention (www.takeaim.org). If such risk assessments and related risk management strategies were harmonized among Great Lakes political jurisdictions, the weakest link problems that now characterize AIS prevention policies would be reduced, improving the likelihood of long-term successful prevention across the Great Lakes basin (Peters & Lodge 2009). An ounce of prevention to limit the spread or introduction into the Great Lakes of the next harmful species would indeed be worth a pound of cure. This recommendation is consistent with Annex 6 of GLWQA 2012.

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