

International Joint Commission
Canada and United States



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Cameron Davis
Senior Advisor to the Administrator &
U.S. GLEC Co-Chair
U.S. Environmental Protection Agency
77 West Jackson Blvd.
Chicago, IL 60604-3590
U.S.A.

Mike Goffin
Regional Director General, Ontario Region &
Canadian GLEC Co-Chair
Environment and Climate Change Canada
4905 Dufferin Street
Toronto, ON M3H 5T4
Canada

Re.: Advice on Parties' 2017-2019 Science Priorities

Dear Messrs. Davis and Goffin,

Annex 10 of the *Great Lakes Water Quality Agreement* requires that the Parties establish science priorities on a three-year basis, considering advice developed by the Commission in consultation with the IJC's Great Lakes Science Advisory Board (SAB). At its September 13-15, 2016 meeting, the Commission reviewed and endorsed the attached SAB advice on the Parties draft 2017-19 Priorities for Science.

We trust the attached SAB advice will be helpful to the Parties as they consider revisions to the draft 2017-19 Priorities for Science. Consistent with its current policy, the Commission will make these comments available to the public.

Sincerely,

Lana Pollack
Co-Chair
U.S. Section

Gordon Walker
Co-Chair
Canadian Section

cc. Christopher Wilkie, Foreign Affairs Canada
Chris Sandrolini, U.S. Department of State

Attachment

**INTERNATIONAL JOINT COMMISSION
SCIENCE ADVISORY BOARD**

ADVICE ON PARTIES' DRAFT PRIORITIES FOR SCIENCE

August 30, 2016

Introduction

Annex 10 (Science) of the Great Lakes Water Quality Agreement assigns the International Joint Commission (IJC) and its Science Advisory Board (SAB) a role in providing input to the Parties on priority science issues on a three year basis.

The Parties' initial Draft Priorities for Science and Action (2017-19) was provided to the IJC and others at the Great Lakes Executive Meeting (GLEC) on June 1-2, 2016 (attached) for review and comment. The SAB understands that revised Priorities for Science and Action (2017-19) will be announced by the Parties at the Great Lakes Public Forum planned for October 4-6, 2016.

The relevant excerpt from Annex 10 of the Agreement is pasted below, with italics added for emphasis:

C. Science Review, Priority-Setting and Coordination

The Parties, in cooperation and consultation with State and Provincial Governments, Tribal Governments, First Nations, Métis, Municipal Governments, watershed management agencies, other local public agencies, and the Public, shall:

1. undertake a review of available scientific information to inform management actions and policy development. Priority issues to be addressed through this review of available scientific information shall be established on a three-year basis by the Parties in consultation with the Great Lakes Executive Committee, *considering advice developed by the Commission in consultation with the Great Lakes Science Advisory Board*;
2. *identify science priorities, taking into account recommendations of the Commission*;

This document summarizes the SAB's advice to the Parties on the attached Draft Priorities for Science¹. This advice benefitted from input provided by the IJC's Water Quality Board. General comments that apply to all Agreement Annexes are presented first, followed by general and specific advice on each of the Agreement's 10 Annexes. Editorial comments are presented last. The SAB's recommendations are **bolded** where they appear in this advice.

¹ The Agreement does not invite input on the Priorities for Action, and therefore comments are limited to Priorities for Science.

General

Through its review, the SAB found that a majority of the draft Priorities for Science are appropriate and consider many of the prevailing science issues associated with the subject matter related to each Annex. The Parties are to be commended for presenting such a complete draft on a timeline that allows for input and feedback from GLEC members, the IJC's SAB, and others.

The SAB finds that many of the draft Priorities for Science (2017-19) are similar to the Priorities for Science in place for 2014-16. This is presumably a reflection of the fact that science requirements to respond to the Basin's resource values and varied stressors are complex and take time to develop. **Where applicable, the SAB recommends that renewed Priorities for Science reflect any science advancements that have been made since the 2014-16 Priorities for Science were established.**

The SAB notes that some Priorities for Science are stated in more general terms than others. **To the extent possible, the SAB recommends that all Priorities for Science be stated with as much specificity as possible.** Some of SAB's recommendations related to various Annexes improve the specificity of draft Science Priorities. Additionally, the SAB encourages the Parties to develop and make available performance metrics associated with each Priority for Science. This would provide greater clarity and transparency on the Parties' own expectations for the triennial period, and improve accountability.

Annex 1 – Areas of Concern

The SAB observes that Annex 1 is one of three Annexes which have no draft Priorities for Science.

Notwithstanding the fact that the Parties have ongoing long term monitoring programs for each lake, the SAB has observed that the intensity of monitoring activities in an AOC diminishes substantially once an AOC is delisted, to the extent that deterioration of conditions in an AOC following delisting may not be detected in a timeframe that is appropriate. **Accordingly, the SAB recommends the following Priorities for Science be added:**

- **Define long-term monitoring requirements to ensure the status of continuous recovery in delisted AOCs.**
- **Develop a set of general best practices criteria for long-term monitoring for each BUI, modified as appropriate by local conditions.**

Two Annex 1 Task Team reports were recently released by the Parties – a situational analysis and guidance related to AOCs in recovery. The SAB observes that those reports included several recommendations related to science-based issues. **The SAB recommends that those report recommendations be included in the Parties Priorities for Science, as appropriate.**

The Agreement includes language related to listing new AOCs. **The SAB recommends that the Parties define the criteria for listing new AOCs² and ensure that ongoing monitoring programs at potential (i.e., degraded) sites are adequate to warn that a potential AOC may be developing.**

² The IJC's List/Delist Criteria for Great Lakes AOCs provides useful guidance (available at <http://www.ijc.org/rel/focus/listdelist/lidemain.html>).

Annex 2 – Lakewide Action and Management Plans

The SAB recommends that connecting channels (including Lake St. Clair) be added to the Priority for Science to make it consistent with the language included in Annex 2 (changes in italics):

- **Identify and address lake-specific priorities for science and monitoring through CSMI and LAMP processes. The Lake Partnerships will identify CSMI-focused science and monitoring priorities for Lake Erie *and the St. Clair River, Lake St. Clair, and the Detroit River* in 2017, Lake Michigan in 2018, and Lake Superior in 2019.**

Annex 3 – Chemicals of Mutual Concern

The role of Annex 3 in developing indicators/performance measures related to CMCs is ambiguous in the first draft Priority for Science. This ambiguity should be clarified. If the evaluation of new CMCs as indicators is an output of other work flow processes, then the first Priority for Science should be revised to read:

- Undertake research, monitoring and surveillance activities identified in binational strategies, to address information gaps and needs for Chemicals of Mutual Concern ~~as well as~~ in support of future performance measurement/indicators work.

Both the U.S. and Canada have domestic programs to screen for chemicals that may eventually be nominated as CMCs (e.g., Canadian Environmental Protection Act, and as part of the revised Toxic Substances Control Act), however, it is important to consider an approach that is useful and appropriate under the Great Lakes Water Quality Agreement. Existing processes need to be harmonized to the extent possible. **Therefore, the SAB recommends an additional Priority for Science:**

- **Examine potential approaches to screen for chemicals that may eventually be nominated as CMCs.**

It is important that this be completed expeditiously to develop a complete list of candidate CMCs.

Annex 4 – Nutrients

The SAB observes that significant progress in establishing a science-based phosphorus reduction target for Lake Erie has been made by the Parties in collaboration with state and provincial governments, and others since 2013. The first Priority for Science could be adjusted to reflect this.

The SAB recommends the first Priority for Science be revised to acknowledge current monitoring activities, the importance of adaptive management, and the influence of watershed sources of phosphorus (changes in italics):

- ***Standardize and coordinate ~~Establish~~ monitoring techniques and modeling approaches within an adaptive management framework to enable tracking of progress in reducing watershed sources of phosphorus and attaining towards Lake Erie phosphorus load reduction targets. Improve knowledge on approaches for reducing loss of phosphorus from the watershed to Lake Erie.***

The SAB recommends the second Priority for Science be revised to reflect the importance of climate change on nutrient dynamics by adding a sentence to that Priority (changes in italics):

- **Continue to identify and fill gaps in research, monitoring and modeling to support future establishment of phosphorus concentrations, loading targets and allocations in the remaining lakes. *Address gaps in our knowledge on how climate change will affect nutrient dynamics and moderate ecosystem response.***

In large part due to actions implemented following the original Great Lakes Water Quality Agreement, nutrient loads to the lakes have declined dramatically since the 1970s. Reduced loadings coupled with more recent changes (notably the influence of dreissenid mussels) has resulted in conditions in many locations throughout the lakes where the nearshore is nutrient enriched and the pelagic zone is nutrient deficient. This has led to discussion in the management realm of further nutrient reductions, which may have significant implications for further declines in pelagic productivity. For each lake this issue requires a consideration of tributary loadings, upstream contributions, and internal cycling. **The SAB recommends an additional Priority for Science:**

- **Conduct the research necessary to develop a lake-specific quantitative understanding of the relationship between setting and achieving loading targets for nearshore eutrophication response indicators and the response of offshore trophic conditions.**

Annex 5 – Discharges from Vessels

The SAB observes that Annex 5 is one of three Annexes which has no draft Priorities for Science. **The SAB recommends the following Priority for Science be added:**

- **Complete an evaluation of the effectiveness of ballast water management technologies for the prevention, detection and treatment of AIS and conduct research into effective monitoring of the performance of those systems.**

Annex 6 – Aquatic Invasive Species

The SAB recommends the fourth draft Priority for Science be revised to read (changes in italics):

- **Research and develop technologies and methods for control and eradication of AIS *including prediction of their impacts on ecosystems, with attention to unintended consequences and ecological risks.***

The SAB supports the listed Priorities for Science, but notes that none of them directly addresses the impacts of AIS. A major priority should be to identify and rank emerging and future invasion threats for management attention, based on their likelihood to disrupt ecosystems or harm a valuable resource. This likelihood can vary greatly across species and even across populations of a single species through space and time. For example, under changing environmental conditions (e.g. water temperature), some high-impact species may become less problematic, whereas others that are currently innocuous could be triggered to become an invasive pest. **Therefore the SAB recommends an additional Priority for Science:**

- **Further develop risk assessment methods to predict high-impact invasion threats under changing environmental conditions.**

Another scientific area that should be prioritized is the risk of invasion of Great Lakes tributaries. Limited attention has been given to AIS in Great Lakes tributaries, apart from sea lamprey control. Most of what is known about invaders in the basin is from populations in the Great Lakes proper, yet tributaries are quite vulnerable, as shown through the ongoing colonization by the round goby, rusty crayfish and other species. The St. Lawrence River is also vulnerable to AIS entering from the Great Lakes. These vulnerabilities can be altered by climate change (potentially more rapidly than for the lakes) and by management decisions related to flow regulation and dams. **Therefore the SAB recommends an additional Priority for Science:**

- **Determine the vulnerability of Great Lakes tributaries to AIS, under different management and climate change scenarios.**

Annex 7 – Habitat and Species

Wetlands are one of the most productive and diverse habitat types in the Great Lakes basin, and are also one of the most imperiled. **Therefore the SAB recommends an additional Priority for Science:**

- **Continue monitoring Great Lakes coastal wetland ecosystems and conducting research necessary to understand their response to cumulative effects of human-induced changes in water levels and flows, invasive species advance, and other stressors.**

The SAB also recommends that the Parties develop scale-up predictive models of individual species persistence to species interactions and community function to inform assessments of ecosystem-service impacts.

The nearshore is where most people experience the lakes, and is also subject to multiple stressors, yet this zone (including the landward area extending to the shoreline) is still relatively poorly studied. The Parties' Integrated Nearshore Framework provides a useful approach to improving nearshore conditions. **The SAB recommends that a Priority for Science be added to specifically focus on nearshore research, monitoring and surveillance.**

Annex 8 – Groundwater

The Parties' recent report *Groundwater Science Relevant to the Great Lakes Water Quality Agreement: A Status Report* provides a useful and thorough review of groundwater in the basin, including an identification of major science needs.

An additional issue that the SAB believes is important for improved management of the nearshore is a better understanding of how groundwater influences that zone. **Therefore the SAB recommends an additional Priority for Science:**

- **Evaluate the quantity of groundwater discharging into the nearshore at an appropriately resolved spatial scale and evaluate critical relationships between groundwater discharge and nearshore water quality and ecosystem health.**

The SAB also recommends that the Parties develop scaled-up models of the regional effects of groundwater interaction on Great Lakes water quality that are based on understandings gained from local-scale assessments.

Annex 9 – Climate Change Impacts

The SAB observes that Annex 9 is one of three Annexes which has no Priorities for Science in the attached draft, although climate change is referenced in the draft Science Priorities for Annex 6. It is therefore unclear whether the Parties think there are no science priorities, or if they are intended to be covered elsewhere – in either case, the SAB recommends that be clarified.

The SAB recommends the following Priorities for Science related to climate change impacts be added:

- **Continue work on potential implications of climate change for nutrient loads to the lakes, particularly for eutrophic areas.**
- **Increase assessments on potential implications of climate change on toxic chemical loads, cycling and exposures.**

Available evidence suggests that the Parties concur with the SAB and others that climate change is one of the most significant stressors on the Great Lakes. The SAB encourages the Parties to give consideration to the following in developing additional priorities related to climate change impacts:

- Given that climate change is a factor in all other Annexes it is essential that Annexes coordinate their efforts to identify their highest priority needs for climate change information and efforts to deliver the necessary information. Science must inform implementation, including actions that are forward looking to adapt to climate change.
- With respect to using the report *State of Climate Change Science in the Great Lakes Basin: A Focus on Climatological, Hydrologic and Ecological Effects* as an inventory for coordination of priorities, it is important to note that the report doesn't identify priorities and this should be noted in the binational science priority wording. Annexes will need to work together to identify work underway, confirm gaps and their highest priorities for further work to meet commitments which should include coordination on where there are overlaps/sharing of work areas.
- The development and reporting on indicators related to climate change is essential. Although five climate change indicators have been identified currently, work is still needed to incorporate climate change into other relevant indicators.
- Binational priorities related to climate change would benefit from more specificity in key areas so that they more closely align with the science needs identified in Annex 9 of the Great Lakes Water Quality Agreement. These include linking projected climate change outputs from regional models to Great Lakes models to better predict climate change impacts, as well as enhancing monitoring to provide the information required to validate models and assess climate change impacts on water quality.

Annex 10 – Science

The SAB notes that unlike the other Annexes, Annex 10 in the attached draft does not specify whether the listed items are Priorities for Science, or Priorities for Action, or both. This should be clarified.

The SAB recommends that the second Priority for Science refer to the importance of considering any improvements or revisions to metrics, as part of the indicator process.

The SAB recommends that the third draft Priority be revised to read (changes in italics):

- **Develop ~~tools~~ requirements for GLWQA federal annex co-chairs, program managers (e.g., SOLEC) and project managers (e.g., nearshore framework) ~~to assess the usefulness of the various data access systems/platforms for their work~~ to adhere to federal open data access standards and publish data through the Great Lakes Observing System.**

For the third draft Priority, the SAB notes that it may involve working backwards from the demands of the current ecosystem models being employed, which involves an examination of the applicable temporal and spatial scales involved, as well as the variables and parameters that serve as inputs to those models. In addition, the bias for continuing past sampling protocols for continuity and trend comparison should be considered in an assessment of data needs and gaps.

The SAB recommends that the fourth draft Priority be revised to read (changes in italics):

- ***Identify and integrate science activities across all Annexes to ensure that essential knowledge gaps are filled and that science needs across the Agreement are effectively managed.***

The fourth draft Priority lacks specificity, and would benefit from an elaboration on how it will be achieved. This relates to the performance metrics comment offered earlier in this advice.

Related to the first draft Priority (i.e., CSMI) the SAB recommends that the Parties review the last two complete cycles of CSMI activities (i.e., 10 years) and assess the success of the program and the extent to which the initiative has provided new data and information otherwise lacking or absent from ‘off year’ monitoring. This assessment should include an examination of:

- What assets have been employed, and how are they deployed differently than off years?
- Are undersampled periods (e.g., winter conditions) or regions (e.g., nearshore) or processes (e.g., air-water exchange, nitrogen biogeochemistry) being identified and addressed?
- Does a five year cycle make the most sense? To what degree does this preclude an examination of certain dynamics i.e., comparisons across five years within an individual lake across a large range of processes?
- How can the focus on the connecting channels and St. Lawrence River be improved?
- How much is being invested in the CSMI effort and how is it apportioned?
- Is there a readily available repository of CSMI data and results?
- Is there merit in considering a ‘Comparative Science and Monitoring Initiative’ that examines processes across the basin rather than on a lake-by-lake progression with a focus on a particular issue, not a particular lake?
- To what extent is the larger research community engaged? Universities are already involved but would more academic involvement enrich the pursuit of priority science activities or appropriately adjust recurring CSMI activities? Would a greater emphasis on joint agency-academic activities enlarge the network of experts focusing on advancing science related to the lakes?

Science information is extensively used to inform program and policy decisions; arguably, those decisions do not consider the economic benefits and costs to the same extent. **The SAB recommends an additional Priority be added to Annex 10:**

- **Complete a quantitative and rigorous economic analysis of a variety of human activities that impact environmental quality e.g., land use and agricultural practices, to supplement available science information in informing program and policy decisions.**

Editorial

For several of the draft Priorities every line is bulleted instead of every science priority e.g., Annex 2 - this formatting issue should be corrected.

For some Annexes Priorities for Science are listed followed by Priorities for Action, and for some Annexes Priorities for Science and Priorities for Action alternate; a consistent approach should be used.

2017-2019 Draft Binational Priorities for Science and Action

Chris Korleski, U.S. Environmental Protection Agency

Carla Torchia, Environment and Climate Change Canada

GLEC Secretariat

Binational Priorities for Science and Action

Current Status and Next Steps

- **GLWQA Article 5:** *“The Parties shall establish, in consultation with the Great Lakes Executive Committee, binational priorities for science and action to address current and future threats to the quality of the Water of the Great Lakes.”*
- **Preliminary draft priorities have been developed by Annex Co-Leads**
- **Next Steps:**
 - Finalize draft priorities
 - GLEC members to provide input by June 30, 2016
 - Draft priorities discussed at the Great Lakes Public Forum (Oct 4-6, 2016)
 - Priorities finalized following the Forum

2017-2019 Draft Binational Priorities for Science and Action

Annex 1 Areas of Concern Priority for Action

- Canada and the United States will continue to vigorously implement remedial action plans to restore beneficial uses within domestic and binational Areas of Concern.

Annex 2 Lakewide Management

Priority for Science:

- Identify and address lake-specific priorities for science and monitoring through the Cooperative Science and Monitoring Initiative and Lakewide Action and Management Plan processes. The Lake Partnerships will identify CSMI-focussed science and monitoring priorities for Lake Erie in 2017, Lake Michigan in 2018, and Lake Superior in 2019.

Priorities for Action:

- Implement the 2016 Lake Superior and Lake Huron Lakewide Action and Management Plans
- Publish and begin implementation of Lakewide Action and Management Plans for Lake Ontario in 2017, Lake Erie in 2018, and Lake Michigan in 2019.
- Publish LAMP Annual Reports.
- Pilot the nearshore framework assessment in select areas to refine the approach for implementation at a basin wide scale.
- Increase outreach and engagement efforts.

2017-2019 Draft Binational Priorities for Science and Action

Annex 3 Chemicals of Mutual Concern

Priorities for Science:

- Undertake research, monitoring and/or surveillance activities identified in binational strategies, to address information gaps and needs for Chemicals of Mutual Concern as well as in support of future performance measurement/indicators work.
- Coordinate research, monitoring and/or surveillance activities to provide an early warning for chemicals that could become Chemicals of Mutual Concern.

Priorities for Action:

- Continue the development of Binational Strategies for Chemicals of Mutual Concern.
- Identify existing water quality standards, objectives, criteria and guidelines for Chemicals of Mutual Concern as Binational Strategies are developed.
- Recommend Candidate Chemicals of Mutual Concern for consideration by the Great Lakes Executive Committee through applying the binational process and considerations to government as well as external stakeholder chemical nominations.
- Continue to designate Chemicals of Mutual Concern.

2017-2019 Draft Binational Priorities for Science and Action

Annex 4 Nutrients

- **Priority for Action:** Engage stakeholders in the development and begin implementation of phosphorus reduction strategies and domestic action plans for Lake Erie not later than 2018.
- **Priority for Science:** Establish monitoring techniques and modeling approaches to enable tracking progress towards Lake Erie phosphorus load reduction targets.
- **Priority for Action:** Establish phosphorus loading reduction targets that will minimize impacts from nuisance algae in the eastern basin of Lake Erie.
- **Priority for Science:** Continue to identify and fill gaps in research, monitoring and modeling to support the future establishment of phosphorus concentrations, loading targets and allocations in the remaining Lakes.

Annex 5 Discharges from Vessels

- None

2017-2019 Draft Binational Priorities for Science and Action

Annex 6 Aquatic Invasive Species

Priorities for Science:

- Determining feasibility and effectiveness of AIS eradication and containment methods to inform rapid response decision making.
- Develop technology and methods to achieve effective barriers that prevent the spread of AIS while allowing the movement of other ecosystem components through canals and waterways.
- Develop and evaluate early AIS detection technologies and methods.
- Research and develop technologies and methods for control and eradication of AIS.
- Determine the effects of habitat and climate change on risks of AIS establishment.

Priorities for Action:

- Refine and enhance the early detection and rapid response initiative that coordinates effective domestic and, when necessary, binational response to prevent AIS from becoming established in the Great Lakes.
- Support harmonization of and access to risk assessments of species, pathways, and vectors of AIS.

2017-2019 Draft Binational Priorities for Science and Action

Annex 7 Habitats and Species

Priority for Science:

- Pilot the Habitat Baseline Survey in select areas to refine the approach to evaluate habitat (including understanding climate change effects) for implementation at a Great Lakes wide scale.

Priority for Action:

- Complete a review of existing Great Lakes habitat and species conservation strategies and strategic plans to identify gaps and common priorities as the basis for developing a binational framework for prioritizing actions.

Annex 8 Groundwater

Priorities for Science:

- Develop better tools to assess groundwater – surface water interaction and use them to advance assessment of regional-scale groundwater discharge (quantity) to surface water in the Basin.
- Establish science-based priorities to advance the assessment of the geographic distribution of known and potential sources of groundwater contaminants relevant to Great Lakes water quality, and the efficacy of mitigation efforts.
- Advance monitoring, surveillance, and assessment of groundwater quality in the Great Lakes Basin.

2017-2019 Draft Binational Priorities for Science and Action

Annex 9 Climate Change Impacts

Priorities for Action:

- Work with other Annexes to identify their highest priority needs for climate change information to support implementation of their commitments and to ensure climate change impacts are considered throughout the GLWQA.
- Work with the Science Annex to provide guidance on climate change indicators for use in the State of the Great Lakes (SOGL) reporting; and provide guidance on how to incorporate climate change information in other relevant SOGL indicators.
- Assess which agencies or individuals are best suited to address, or are already addressing, high
- priority needs identified in the "State of Climate Change Science in the Great Lakes Basin: A Focus on Climatological, Hydrologic and Ecological Effects" report.
- Refine and continue to issue "Great Lakes Climate Summaries and Outlooks" fact sheets with enhanced bi-national collaboration to produce and deliver climate information on a regular basis.

2017-2019 Draft Binational Priorities for Science and Action

Annex 10 Science

- Continue to implement the Cooperative Science and Monitoring Initiative that coordinates planning, delivery and reporting of science on a lake-by-lake five-year rotation.
- Finalize and release the State of the Great Lakes 2017 reports; maintain and improve the suite of Great Lakes ecosystem indicators used to assess conditions, including initiating the process to identify endpoints for some indicators.
- Develop tools for GLWQA annex co-chairs, program managers (e.g., SOLEC) and project managers (e.g., nearshore framework) to assess the usefulness of the various data access systems/platforms for their work.
- Integrate science activities across all Annexes to ensure that essential knowledge gaps are filled and that science needs across the Agreement are effectively managed.
- In consultation with Annex co-leads, the International Joint Commission and others, identify potential subject areas for science assessments that would contribute to management actions and policy development. Final selection of subject area(s) to be made by the Great Lakes Executive Committee in consultation with the Co-Chairs.