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Work Group Report on Binational Aquatic Invasive Species Rapid-Response Policy Framework

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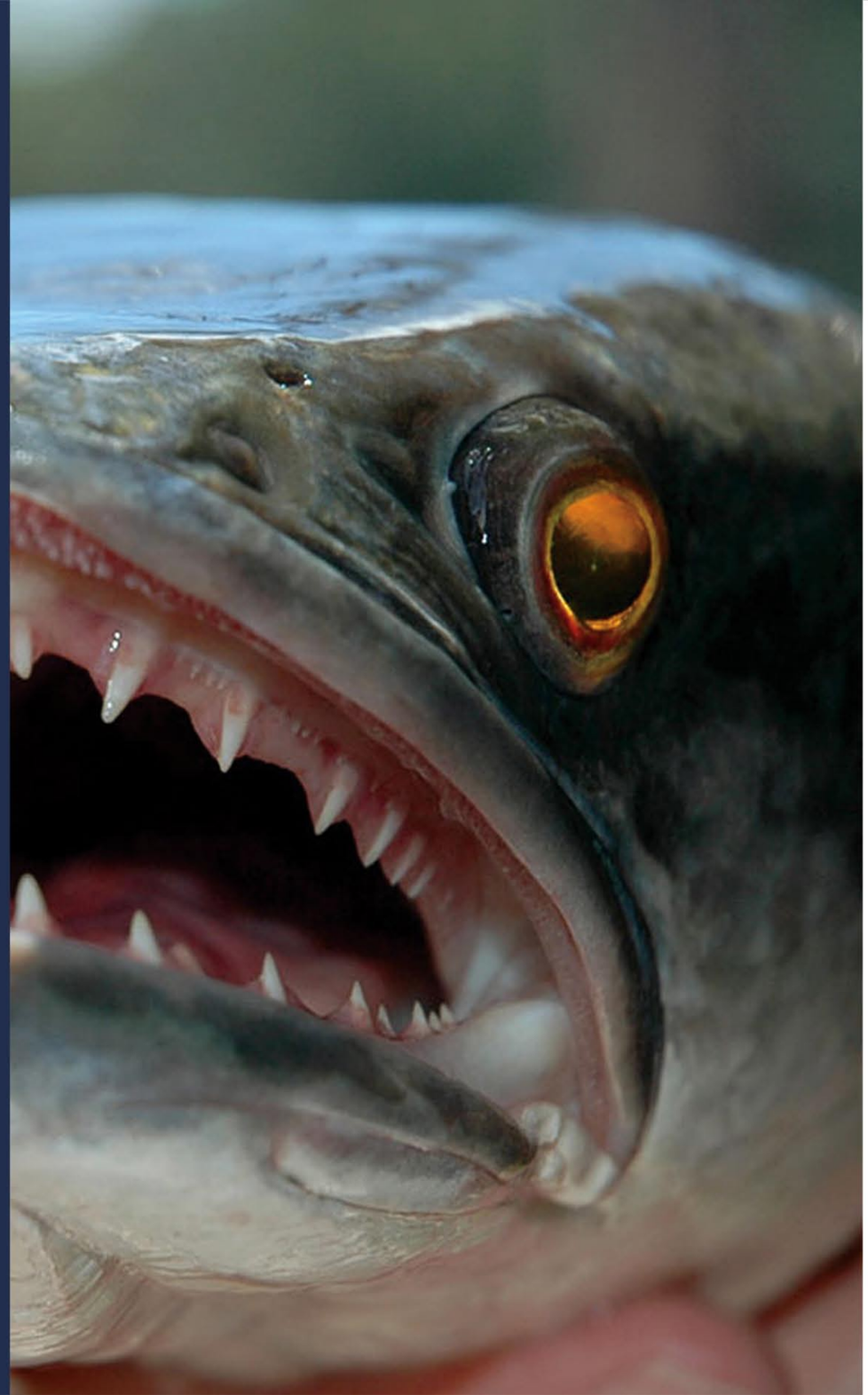

Aquatic invasive species (AIS) are organisms introduced into a new aquatic ecosystem that leads to harmful ecological or economic impacts. Once an AIS is introduced and spreads, it is extremely hard to get rid of. The best approach is to prevent the introduction of AIS; however, if this fails and a new AIS is discovered, a rapid response to destroy or control the AIS is our only option.

But with so many different Great Lakes organizations, how do we ensure cooperation when rapid response is needed? AIS do not respect national boundaries, so how will the U.S. and Canada coordinate a timely and effective response? Are there even government policies in place that allow a well-coordinated rapid response to the discovery of an AIS?

In October 2007, the International Joint Commission formed a work group to address these questions and more. Members came from the Great Lakes Water Quality Agreement (GLWQA) advisory boards and the Council of Great Lakes Research Managers. In addition to preparing this report, the work group will host a session on AIS rapid response on Wednesday, October 7, 2009 at the GLWQA Biennial Meeting in Windsor, Ontario. Using the work group report as background material, work group members will present findings and discuss the issue with the public to elicit various perspectives and to inform the Commission's 15th Biennial Report.

Northern Snakehead
(Channa Argus)

Work Group Report on Binational Aquatic Invasive Species Rapid Response Policy Framework

Great Lakes Water Quality Agreement Priorities 2007–09 Series

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I. Background and Methods

A. Description of Issue

Aquatic Invasive Species (AIS) are plants, animals and microscopic organisms that have been introduced into new aquatic ecosystems and that produce harmful impacts on natural resources in these ecosystems, the human use of these resources or human health. Scientists, policymakers and resource managers generally agree that aquatic invasive species pose a significant and, in fact, leading threat to the Great Lakes basin ecosystem. Varieties of impacts are associated with AIS and include those that compromise both ecological integrity and economic health.

The ecological impacts of AIS on the Great Lakes basin ecosystem are increasingly well documented, although not yet fully understood. Challenges include the large number of AIS present, interactions among AIS and, more generally, the overall complexity of the aquatic ecosystem, its food web, habitat characteristics and other considerations. Such impacts include habitat degradation, loss of native species and biodiversity (e.g., placing threatened and endangered species at heightened risk), disruption of food webs, habitat alteration, water quality degradation (e.g., increased turbidity, concentration of toxins), and harmful algal blooms.

Economic impacts associated with AIS include degradation of beaches and swimming areas, altered composition and reduced quality of the sport fishery, impaired stocks of native fish species for commercial harvest (e.g., sea lamprey impacts on lake trout), disruption to water infrastructure (i.e., clogging intake and discharge pipes, costs of retrofitting), damages to submerged equipment and structures (including boat hull fouling), aesthetic implications (e.g., odor and visual problems), lowered property values, increased water user costs, and the costs of regulatory compliance. A definitive study of the total economic impact of AIS on the Great Lakes economy has yet to be undertaken, although a number of more limited analyses collectively provide an "order of magnitude" understanding of the impact. For example, an ongoing study by the University of Notre Dame's Center for Aquatic Conservation (in conjunction with the University of Wyoming) conservatively estimates the lost value of ecosystem goods and services - due to the ballast water pathway alone - at $200 million annually on the U.S. side alone. Other studies (both species-specific and

more general) suggest that total annual costs may range from hundreds of millions to several billion dollars.

B. Assessment of Condition

More than 180 AIS have been detected in the Great Lakes basin, with approximately 10% of this total prompting significant concern given increasingly well-documented environmental, economic and human health impacts.[1] Among many others, some of the AIS presently in the system and of particular concern (and public profile) include the sea lamprey (*Petromyzon marinus*), zebra mussel (*Dreissena polymorpha*), quagga mussel (*Dreissena rostriformis bugensis*), Eurasian ruffe (*Gymnocephalus cernuus*), round goby (*Neogobius melanostomus*), spiny waterflea (*Bythotrephes longimanus*), purple loosestrife (*Lythrum salicaria*), and Eurasian watermilfoil (*Myriophyllum spicatum*).

Pathways for the introduction and spread of AIS are many and varied, although transport in the ballast water of transoceanic commercial vessels is believed to be responsible for approximately 55% to 70% of the introductions since the opening of the St. Lawrence Seaway in 1959. Other pathways (both intentional and unintentional) include the aquaculture industry, aquarium trade, live food fish industry, recreational boating, sport fish stocking, bait bucket transfers, canals and waterways, and various horticultural practices. The challenge associated with AIS prevention and control is self-evident given the large number and diverse nature of these various pathways, the large number and unique characteristics of individual AIS, and the immensity of the Great Lakes system.

Once established in the waters of the Great Lakes – St. Lawrence Basin, it is difficult / virtually impossible to eradicate AIS populations, and similar challenges are faced in efforts to limit or control their spread. Consequently, the primary focus in recent years has been on preventive measures as the "first line of defense," with an array of initiatives developed at the state, provincial, federal and international levels. Historically, one new AIS is discovered in the system on an average of every seven months;

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1 A distinction is often made between non-native species and invasive species. For example, USEPA and EC consider non-native species to be invasive if they negatively impact ecosystem health (reference below); however because the negative ecosystem impacts of any non-native species may be disputed, these definitions are frequently subject to debate.

U.S. Environmental Protection Agency & Environment Canada. (2009). *State of the Great Lakes 2009 highlights* (p. 2, Invasive Species).

however, since 2006 the rate of discovery has declined. This decline could be attributed to several factors, including the implementation and enforcement of mandatory ballast water management regulations by Canadian, U.S. and Seaway authorities.[2] Species of great concern threatening the Great Lakes include Bighead Carp, Silver Carp, Northern Snakehead, Hydrilla, Killer Shrimp and several other high-risk species from the Ponto-Caspian region that have a history of invasive spread.

Climate change and degraded/impacted habitat further complicate AIS management efforts. A 2008 study by the U.S. Environmental Protection Agency, *Climate Change and Aquatic Invasive Species (Final Report)*, highlights the effects of climate change. These may include new and/or altered pathways for AIS from increased tourism, commerce or recreation opportunities; international transportation (e.g., Northwest Passage); extreme weather; longer or more favorable shipping season; enhanced survivorship; increased propagule pressure and assisted migration. For example, increases in nearshore temperatures around the Great Lakes have likely contributed to the expansion of the spiny water flea, zebra and quagga mussels, round goby and various carp species.[3] Degraded habitats hosting established populations of invasive species such as zebra and quagga mussels facilitate establishment of new invaders in a process described as "invasional meltdown."[4]

If preventive measures are not successful, an early detection and rapid response program to eradicate isolated populations is a widely accepted "second line of defense."[5] The need for a well-defined and universally accepted protocol for rapid response has been demonstrated in recent years with efforts to eradicate populations of Northern Snakehead carried out in Maryland, New York and Arkansas. In the Great Lakes, an unsuccessful effort to eradicate the Eurasian ruffe (*Gymnocephalus cernuus*) when first detected in Duluth-Superior Harbor in the mid-1990s is a notable example. Following the discovery of an isolated population that could potentially have been eradicated, a cumbersome decision-making process ensued that was exacerbated by the absence of established guidance; the resulting delays ultimately rendered rapid

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2 MacIsaac, H. (2009). Can We Predict (and Prevent) Aquatic Invasions? Abstract. *16th International Conference on Aquatic Invasive Species*, Montreal, Canada, April 19-23.
Deneau, M., Bailey, S., Jean, L., Wiley, C. (2009). Have the New Ballast Water Regulations and Inspection Program Reduced the Risk of NIS Introductions for the Laurentian Great Lakes? Abstract. *16th International Conference on Aquatic Invasive Species*, Montreal, Canada, April 19-23.

3 Chiotti, Q. and Lavender, B. (2008): Ontario; *in* From Impacts to Adaptation: Canada in a Changing Climate 2007, *edited by* D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 241.

4 Ricciardi, A. (2001). Facilitative interactions among aquatic invaders: is an "invasional meltdown" occurring in the Great Lakes? *Canadian Journal of Fisheries and Aquatic Sciences*, *58(12)*, 2513-2525.

5 This approach has been accepted by the Great Lakes Regional Collaboration, the Great Lakes Panel on Aquatic Nuisance Species (ANS), the Mississippi River Basin ANS Panel, and other regional ANS panels all representing a myriad of federal, state/provincial, and local agencies/organizations.

response a moot point. Since that time, the Eurasian ruffe has slowly expanded its range and serves as a constant reminder of the need for improved policies that can enable managers to quickly and effectively respond to future discoveries of AIS.

C. Work Group Approach and Activities

The International Joint Commission (IJC) has a long-standing interest in the AIS issue, recognizing its ecological and economic implications for the Great Lakes-St. Lawrence Basin. More specifically, the IJC recognizes that the ability of the United States and Canadian federal governments to meet Great Lakes Water Quality Agreement objectives will be determined, in part, by the ability of the two nations to successfully design and implement AIS prevention and response protocols at the binational level. As such, the IJC identified AIS as one of five focal points for its "nearshore priorities" emphasis, and charged a collaborative work group comprised of members of the Water Quality Board, the Science Advisory Board and the Council of Great Lakes Research Managers with the development of a "Binational Aquatic Invasive Species Rapid Response Policy Framework."

A literature review, a series of personal interviews, three species-specific case study analyses, and an "expert's workshop" were employed to extract "critical success factors" to guide development of a binational rapid response policy framework.

For purposes of this report, a working definition adapted from the (U.S.) National Invasive Species Council (NISC) Management Plan for rapid response will be used: Rapid response is a systematic effort to eradicate or contain invasive species while infestations are still localized. It may address totally new introductions or expanding infestations of previously established species.

II. Science and Policy

A. State of Science, Research, and Monitoring

More than 180 AIS have been detected in the Great Lakes system to date; dozens more have been identified as immediate threats; and perhaps hundreds more pose longer-term concerns. The sheer number of AIS, coupled with limited knowledge of the biology, behavior and ecosystem impacts of most species, introduces a high degree of scientific uncertainty into the development of rapid response protocols. Other factors contributing to the challenge include a limited understanding of interactions among AIS, difficulties in detecting many species, and added uncertainties associated with the magnitude, complexity and dynamic nature of the Great Lakes basin ecosystem within which the AIS reside. Given this complexity and high degree of uncertainty, there is no guarantee of success even if the response is timely; each case is a unique challenge for the development and application of scientifically sound and effective prevention, control and eradication technologies.

Currently there is concern with the apparent lack of connection between AIS research initiatives and the pragmatic needs of rapid response practitioners. Enhanced coordination between these two communities is needed to better align research efforts with rapid response needs, establish a "technology transfer" process to convert research findings into practical application, provide for on-site scientific advice, and ensure that early detection and monitoring programs are responsive to emerging needs and feature the latest technology. In addition, practitioners note that rapid scientific assessment is a critically important initial step when a new AIS introduction is discovered. Ready access to relevant expertise and methodologies, perhaps through formal involvement of researchers in the rapid response organizational structure, is therefore essential. Mechanisms to encourage dialogue among scientists and practitioners also are essential in advancing rapid response capabilities and effectiveness.

Agencies in both Canada and the United States carry out a great deal of environmental monitoring and assessment to support established science programs and provide the capacity to monitor for invasive species. Early detection and monitoring is an essential adjunct to rapid response, and will greatly enhance the efficiency and cost

effectiveness of any response action. The sooner an invasion is detected the higher the probability that the species is localized and that eradication / control efforts will be successful. It needs to be an integral component of the overall process and receive funds and resources commensurate with this importance.

B. State of Governance, Policy, Management, and Resources

Developing a binational policy framework for rapid response to AIS is the main goal of this study. The various levels of government in the U.S. and Canada have significantly different ways of doing business and implementing policy; however, they share many common goals. Accordingly, this framework represents a set of recommended principles that lay the foundation for consistent and cooperative policies in both nations. Such policies will enable agencies to take charge and develop the detailed plans necessary to mount an effective unified response to an AIS incident occurring in our shared waters.

While AIS introductions and impacts have been observed in the binational Great Lakes basin for decades (e.g., sea lamprey), the late 1980s saw a pronounced increase in public awareness and policy actions, thanks largely to the discovery and rapid spread of the Eurasian ruffe and zebra mussel. Since that time, an elaborate framework of laws, regulations, policies and programs has been developed and continues to evolve. Various entities (e.g., the Aquatic Nuisance Species Task Force at the U.S. federal level, Great Lakes Panel on Aquatic Nuisance Species at the binational level) have been actively engaged in promoting the development and implementation of state/ provincial/ regional comprehensive management plans addressing AIS prevention and control. The Great Lakes Panel has worked closely with all ten Great Lakes states and provinces to promote a consistent and coordinated approach via Panel meetings, specialty workshops, model planning and legislative guidance, among others. Presently, all jurisdictions have some form of AIS prevention and control plan in place.

Rapid response protocols, many employing the Incident Command System (ICS, an organizational structure used to manage major emergencies), have been successfully applied in such areas as human and animal disease, forest pathogens and insects, invasive plants, fire management, and oil and hazardous material spills. Recently, experiences with the spread of Bighead and Silver Carp in the Mississippi River basin, Northern Snakehead and invasive aquatic plants such as Hydrilla and Eurasian Milfoil have helped garner public support for action and demonstrate the value of a rapid response protocol for AIS. In fact, in several recent incidents in 2008, AIS managers successfully used elements of ICS in actual response operations, as well as in AIS rapid response "table top" exercises undertaken in Pennsylvania and Illinois. This

experience has demonstrated the value of this approach. Additionally, the Great Lakes Regional Collaboration has pushed forward with an effort to establish a rapid response communications protocol, which is an essential part of any plan.

While these examples have contributed to increased "grass roots" support for AIS rapid response planning, current plans are limited in number and scope, are largely untested and, in most cases, consist of broad frameworks rather than detailed operational guidance. At present, a binational protocol capable of rapidly mobilizing agencies, resources and species-specific treatment techniques in the Great Lakes-St. Lawrence Basin is not available. This is due in part to the lack of "top-down" support and resources that agencies require from governments in order to confidently take charge and marshal an effective multi-agency response that covers multiple jurisdictions.

Issues associated with leadership responsibility for any given rapid response event or protocol have proved to be an overriding institutional challenge, particularly at the regional (i.e., inter-jurisdictional) level. Generally speaking, agencies tend to be hesitant to take on leadership responsibilities in the absence of a clear legislative directive or funded mandate. This hesitancy appears to be founded in numerous factors, including resource limitations (i.e., staffing, equipment, budget, skill set), real or perceived limitations in authority in addressing an inter-jurisdictional issue, prospective liability associated with eradication activities, and the political capital and investment required to develop and maintain a program. Other significant policy challenges entail "harmonizing" inconsistencies in legislation, policies and programs to ensure that all relevant parties (leaders or otherwise) approach rapid response with a consistent set of goals and objectives. In addition, a binational approach to rapid response will require individual jurisdictions to develop policy in a collaborative, inter-jurisdictional manner, likely involving compromise and negotiation to achieve shared policy goals.

These challenges aside, institutional arrangements in the Great Lakes basin also possess characteristics that can contribute to a successful rapid response effort at the binational level. For example:

- The basin has a highly developed and sophisticated institutional structure that includes an array of binational public and non-governmental entities.
- These institutional arrangements include AIS-specific entities (e.g., Great Lakes Panel on Aquatic Nuisance Species, Great Lakes Fishery Commission) with a long-standing focus on issues associated with rapid response.
- Public agencies in the basin have a history of working cooperatively on Great Lakes issues, both at the domestic and binational levels.
- Basin institutions have decades of experience with AIS prevention and control (both successes and failures), as well as with rapid response associated with other issues (e.g., oil and hazardous spill response).

III. Findings and Recommendations

A. Science and Policy Gaps That Need to Be Addressed

Project outcomes included a series of findings reflecting broad areas of consensus derived from the literature, case study analyses, personal interviews and the "experts workshop." Briefly stated, the investigation concluded that:

- Despite notable progress in AIS prevention and control efforts over the past two decades, the Great Lakes basin ecosystem remains highly vulnerable to the introduction and spread of new AIS.
- Rapid response is increasingly recognized as a critically important adjunct to more established AIS prevention and control programs. It is also recognized that rapid response might not be implemented in all situations, and that the decision to use rapid response needs to be based on a disciplined risk assessment and a high probability of success.
- Great Lakes jurisdictions recognize the continuing vulnerability of the system to new AIS introductions, and share a sense of urgency in calling for the development and implementation of AIS rapid response plans. However, those produced to date are few in number, limited in scope, and generally have a minimal focus on the *binational* dimension of AIS.
- The "institutional dimension" of binational rapid response is as complex and challenging as the scientific and technical dimensions. Institutional aspects of a rapid response program (e.g., agency leadership, allocation of responsibilities, allocation of funds) must be explicitly defined in a plan, drawing on "lessons learned" and best practices from other experiences.
- The Incident Command System (ICS) offers a well-established framework for developing rapid response procedures, given its relevance to emergency situations in complex settings where key considerations include timely and decisive response, clear lines of authority, and defined roles and responsibilities.

- The success of a binational AIS rapid response plan will be a function of both its public profile and its structural and operational characteristics. The planning effort must be sanctioned at the highest political levels, and the AIS threat must be declared - and publicly regarded - as an emergency. *Structural* characteristics (i.e., how relevant parties are organized to provide rapid response functions) and o*perational* characteristics (i.e., what those functions are and how they are performed) must be clearly articulated and based upon successful past experiences.
- A timely and aggressive response to a newly detected AIS introduction is essential, given the expansiveness of the Great Lakes system and the difficulty in eradicating/ controlling a population once it has been established and dispersed. A key component in such a response is an established organization structure, a detailed decision-making process, and pre-approved treatments (with all necessary permits and regulatory requirements in place). Lacking this, a response action will encounter undue delays that will compromise its effectiveness.
- Many of the "building blocks" for binational AIS rapid response planning are presently available, given the basin's well-established institutional arrangements, existing binational agreements/ mechanisms, legal/ regulatory regime, policies, programs, and tradition of binational cooperation. Harmonizing and assembling these elements, while identifying and addressing unmet needs, will expedite the planning process.
- As a binational entity charged with restoring the "chemical, physical and biological" integrity of the Great Lakes-St. Lawrence system, the IJC has a long-standing interest in AIS prevention and control issues. As such, it is ideally suited to undertake, support or otherwise promote the development of a binational AIS rapid response plan that draws from the strengths (and addresses the weaknesses) of current rapid response initiatives.

B. Research, Monitoring and Coordination Needs

Research, monitoring and coordination needs have been articulated by agencies and organizations involved with efforts such as the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA), State of the Lakes Ecosystem Conference (SOLEC), the Great Lakes Regional Collaboration, and the Great Lakes Panel on Aquatic Nuisance Species (ANS). The Great Lakes ANS Panel has consolidated AIS research needs into a single reference document that is maintained by its research subcommittee and periodically updated.[6]

6 http://wiki.glin.net/display/ANS/Research+Coordination+Committee+Priorities

The work group recognized detection, monitoring, information sharing and scientific support for rapid response as recurring themes highlighted as critical needs by those participating in the workshop, interviews and work group discussions. These findings agree with the needs summarized by the Great Lakes ANS Panel as well as the Commission for Environmental Cooperation in their report on Trinational Risk Assessment Guidelines for Aquatic Alien Invasive Species.

Project participants emphasized the need to target applied research, filling the needs of responders who must decide whether eradication is feasible and advisable in full knowledge of the consequences of their action or failure to act. The capacity to conduct intensive detection and monitoring exists in current government monitoring, fisheries assessment, public outreach and education programs if additional resources were made available for cooperative work and information sharing.

C. Recommended Policy Framework

The United States and Canada should develop policy and regulations based on the following framework:

- A lead agency will be designated in each country to carry out AIS rapid response, with a responsibility to coordinate with its counterpart in the other country.
- Binational rapid response will be mandated by a formal agreement between the two nations, such as the Great Lakes Water Quality Agreement, and well grounded in national implementing legislation.
- The discovery of a potentially harmful AIS in the boundary waters between Canada and the United States will be recognized as an urgent environmental threat that can impact the biosecurity of both nations.
- Response to the discovery of AIS will be handled in the same manner as other national emergencies such as disease outbreaks and natural disasters that call for a unified multi-agency command structure.
- Pre-designated AIS rapid response on-scene commanders will be identified and assigned responsibility for specific geographical regions/watersheds.
- Memoranda of Understanding will be established to clarify jurisdictions and facilitate movement of personnel and equipment.
- A federal AIS rapid response fund will be established.

- Both countries will establish an integrated binational center of excellence for AIS risk assessment. The Centre of Expertise for Aquatic Risk Assessment (CEARA) is a good model to build on; and the CEARA protocol for AIS risk assessments should be considered for extended use in both countries.
- A binational group will be designated to convene periodic binational rapid response drills, and to report on progress.
- A consistent approach to AIS rapid response will be used in all boundary water regions on a watershed basis.
- Existing monitoring programs for fish and wildlife will be given the responsibility to establish a comprehensive integrated AIS monitoring network.
- Hotlines and incentives for rapid reporting of AIS discoveries will be established and coordinated.
- Existing public outreach and education programs will enlist the support of anglers, commercial fishers, hunters, naturalists, and recreational boaters to detect, report and, if possible, turn in suspected AIS specimens.
- Response plans will be worked out with orders of governments in consideration of the rights of property owners.
- Appropriate methods to eradicate different AIS threats will be pre-approved for rapid deployment.

It is the work group's opinion that the lead federal agencies for rapid response in the United States and Canada be the U.S. Fish and Wildlife Service and the Department of Fisheries and Oceans. These two agencies will be able to draw upon a history of cooperative work on sea lamprey control and fisheries management. In addition, in the Great Lakes, given the necessary resources to carry out a broader mandate, the Great Lakes Fishery Commission is requested to consider serving as a convening authority for binational rapid response planning operations, response exercises and reporting on the state of binational rapid response readiness. This concept should be extended to all boundary waters, and the IJC would be positioned to address the effectiveness of rapid response policy in shared watersheds on a periodic basis.

Three key recommendations are offered for consideration by the IJC:

- **Develop an AIS rapid response plan tailored to the binational dimensions of the Great Lakes - St. Lawrence system.** Drawing from the policy framework provided within this report, the IJC should work with the parties (i.e., Canadian and United States federal governments) and supporting agencies (i.e., Great Lakes Fisheries Commission) to produce a detailed, prescriptive plan (and implementation process) that ensures a timely and aggressive response to new AIS introductions. The plan should embrace a Unified Command System (UCS) approach to provide for Joint Canada - United States leadership, and should reflect the structural and operational characteristics described in the report findings above. In addition, plan development and content should draw, where applicable and available, from existing rapid response framework documents within and beyond the Great Lakes basin.

- **Promote a consistent and coordinated approach to rapid response planning and implementation within the binational Great Lakes - St. Lawrence system.** Working within existing institutional arrangements (where available), the IJC should engage the AIS community and, where rapid response planning efforts are underway or anticipated, ensure that the binational dimension is addressed in a consistent and coordinated manner. All states and provinces within the Great Lakes - St. Lawrence basin have some form of AIS prevention and response program with a rapid response component (in varying stages of detail) that should be consulted in preparing a binational plan.

- **Amend the Canada-United States Great Lakes Water Quality Agreement (GLWQA) to explicitly address the AIS issue and its impacts, and provide for a binational rapid response program.** The IJC should formulate and offer amendment language for consideration by the parties, including a new annex calling for their cooperation and leadership in the development, maintenance and implementation of a binational rapid response plan.

IV. Next Steps

A. Near-term Policy - Summary of Actions and Resources Needed by Identified Order of Government or Entity

- Address specific agency roles and responsibilities in a recommended organizational response structure informed by discussions with representatives of the affected organizations. (IJC)
- Address rapid response in current review of the GLWQA. (EPA/EC; DOS/DFAIT)
- Use an Executive Order and the Canadian equivalent to define agency responsibilities, designate leads and institute detailed planning efforts. (DOS/DFAIT)
- Establish AIS rapid response monitoring networks within the capacity of existing monitoring and communications programs. (DFO/FWS; GLRC)

B. Future Role for the IJC and GLWQA Priority Process

- The IJC should formulate recommended amendment language for consideration and gather public comment.
- The IJC should dedicate funding toward the 2009-2011 Priority Process toward additional workshops and reports guided by the binational framework for AIS rapid response policy. Products of this additional work would include:
  - identifying specific elements of the binational rapid response network
  - a process diagram showing how the process would work
  - a process to incorporate species specific and site-specific information.

Appendix URL

The Appendix "Toward a Binational AIS Rapid Response Policy Framework" is available at: http://www.ijc.org/en/priorities/2009/invasive-species/appendix