Then and Now

In 1988, both the Great Lakes Fishery Commission (GLFC) and the International Joint Commission (IJC) alerted the governments of the United States and Canada that aquatic alien invasive species (AIS) in ballast water posed a significant threat to the Great Lakes. The two commissions urged the nations' Coast Guards to take immediate steps to end the ongoing introduction of exotic organisms via ballast water discharge.

Subsequently, the GLFC and IJC recognized a unique opportunity for the two governments to take immediate action to reduce the introduction of aquatic AIS into the Great Lakes ecosystem from shipping activities. At the same time, the commissions recognized the limited understanding of how AIS become established in new environments, and how this lack of knowledge hindered both countries' abilities to develop a fully effective and comprehensive strategy to address the threat. While they recognized that new and continuing investigations of all vectors and prevention strategies were needed, the more immediate concern of AIS introductions from ballast water discharge was the focus of the report.

Fourteen years have passed since the commissions published their *Exotic Species* report. While much has been accomplished to curtail AIS introductions from ship ballast water during this time, introductions of AIS continue. It is now generally agreed that aquatic AIS pose the single biggest threat to the future of the resource; yet many aspects of this complex problem remain unaddressed. Indeed, since the mid 1980's, seventeen new species have invaded the Great Lakes. Fifteen more species have been identified as high risk for potential introduction, proving that neither our recommendations nor the responses to them were sufficient to protect the biological integrity of the Great Lakes ecosystem.

The intent of this brief overview is to stimulate further dialogue on how the U.S. and Canada can better meet the challenges ahead, not only to prevent new invasions from shipping activities, but also to eliminate newly-recognized threats from other vectors such as AIS migration through canals, aquaculture escapement, intentional or accidental releases of bait and aquarium fish and live fish sold for human consumption.

Ballast Water

The *Exotic Species* report recommended three main areas where immediate attention was needed to reduce the risk of unplanned introductions of AIS from the discharge of ballast water from oceangoing ships coming into the Great Lakes: legislation and regulations; applied research and development; and international, intercontinental, and global considerations of the AIS issue.

Progress made in Legislation and Regulations

- Canada introduced voluntary ballast water exchange guidelines for the Great Lakes in 1989, requesting that ships exchange fresh water ballast with salt water before entering the St. Lawrence Seaway. Refusal to provide information or to knowingly provide false information was punishable under the *Canada Shipping Act*. The U.S. introduced parallel, voluntary guidelines in 1990.
- In 1990, the U.S. passed the *Nonindigenous Aquatic Nuisance Prevention and Control Act* (NANPCA) requiring ships coming from outside the Exclusive Economic Zone (EEZ) to exchange ballast before entering U.S. waters of the Great Lakes. The national Aquatic Nuisance Species Task Force (ANSTF) also was established and included a separate Great Lakes panel to address all vectors for aquatic invasions into the system. In 1996, NANPCA was reauthorized, strengthened and renamed the *National Invasives Species Act* (NISA).
- In 1993, U.S. Coast Guard regulations made mid-ocean ballast water exchange mandatory for all vessels operating outside the EEZ prior to entering ports of either nation in the Great Lakes. Compliance improved, but most vessels (from 70 to 90%) entering the system declared "No Ballast on Board" (NOBOB), and were, thus, exempt from existing regulations. Recent studies have reported finding live organisms in the residual water and sediment in virtually all ships reported as NOBOB. Clearly, because NOBOB vessels were not covered, these regulations had a significant gap in establishing maximum protection against AIS introductions.
  - In 2003, the *National Aquatic Invasive Species Act* (NAISA) was introduced into the U.S. House and Senate, providing comprehensive legislation to manage all major AIS vectors, including ballast water, canals, and organisms in trade. The legislation also authorized measures for rapid response and research. Since its introduction, despite widespread support, the legislation has not passed the House or the Senate.
- In 2004, Canada drafted regulations requiring mandatory ballast water management practices. They have yet to be enacted. A new mandatory ballast water management program for U.S. waters comes into effect in September, 2004 that requires mandatory ballast water management practices for all vessels equipped with ballast water tanks bound for or entering all U.S. waters.

Needed Follow-up

- Canada should immediately finalize its ballast water regulations.
- The U.S. should immediately enact NAISA, which would provide for more stringent and effective ballast water standards for vessels entering the U.S. Great Lakes.

Progress made in Applied Research and Development

- Canadian and U.S. Coast Guards outlined a joint research strategy for the Great Lakes in 1996. The IJC and GLFC recommended to the governments it be adopted.
- Several significant research studies have been conducted, including:
  - The Great Lakes NOBOB Assessment Study (2000) identified and characterized the threat NOBOB vessels posed to the Great Lakes. Scientists from Canada and the U.S. worked collaboratively with the funding agencies and with participation from the transoceanic shipping industry.
  - In 2001, the Northeast-Midwest Institute and the U.S. Lake Carriers' Association completed a joint project to examine the effectiveness of filtration technologies.
  - Several other studies were conducted to identify Ponto-Caspian species posing a high risk of potentially invading the Great Lakes.

  Although these studies and others have furthered our understanding of the complexities of the NOBOB problem, overall funding for such studies has been inadequate.
- In September 2001, the Ballast Water and Shipping Committee of the ANSTF finalized a set of comprehensive recommendations on ballast water research priorities. These recommendations are available online at www.anstaskforce.gov/BW&S_Com_Research.htm (case sensitive).
- In 2003, a ballast water test facility was established in Florida to support the U.S. EPA's Environmental Technology Verification program to develop protocols to verify performance of new ballast water treatment technologies.

- In 2003, Canada created an Invasive Species Research Chair to establish an invasive species research network to more effectively manage AIS threats.

Needed Follow-up

Provide additional funding for research to:

- Dedicate ships for full-scale testing of ballast water treatment technologies in the Great Lakes;
- Develop and adopt alternative technologies to surpass standards set by the International Maritime Organization (IMO);
- Validate the effectiveness of ballast water exchange and treatment techniques in protecting the Great Lakes ecosystem; and
- Develop analytical tools, models, and monitoring procedures to detect new, high-risk invasive species, as well as techniques such as DNA finger printing that could be used to trace the point of origin of these species.

Progress made in International, Intercontinental, and Global Considerations

- In 1988, the Lake Carriers Association implemented voluntary ballast water management practices to minimize the risk of its members in spreading Eurasian ruffe, a highly invasive fish species, from Lake Superior to the lower Great Lakes.
- In 1989, Canada raised the ballast water issue with the IMO. Shortly after, in 1991, the IMO developed ballast water exchange guidelines and published them in 1997.
- The Great Lakes Waterways Management Forum was established in 1999, consisting of 26 U.S. and Canadian agencies and organizations representing both governments and the private sector. The forum's primary purpose was to identify and develop operational solutions that maintain or improve the value of the Great Lakes for everyone.
- The Shipping Federation of Canada adopted a Code of Best Practices for ballast water management in September 2000. The Lake Carriers' Association and the Canadian Shipowners' Association followed suit in January 2001, by adopting voluntary management practices to reduce the transfer aquatic AIS within the Great Lakes by U.S. and Canadian domestic shipping.
- The IMO adopted the *Convention for the Control and Management of Ship's Ballast Water and Sediments* in 2004. The new convention requires all ships to: implement a ballast water and sediment management plan; carry and complete a ballast water management record book; and undertake ballast water management procedures to a specific standard. The convention also allows member states to adopt stricter standards and requires ships to implement ballast water exchange by a certain date. It also states that no ship will be exempted indefinitely from complying with these standards.

Needed Follow-up

- The U.S. and Canada, along with other member states, should ratify and implement the IMO's convention on ship's ballast water and sediments.
- The U.S. and Canada should pursue development of more stringent regional measures for the Great Lakes than are required by the IMO Convention, and commit to rapid implementation.
- Assess the effectiveness of best management practices in minimizing the threat of new species invasions via ballast water into the Great Lakes ecosystem.

Addressing Other Vectors

While oceangoing shipping activities are still recognized as the most significant pathway leading to introductions of AIS, other vectors have been increasingly recognized for their potential to undermine the biological integrity and economic prosperity of the Great Lakes basin. Many aquatic AIS organisms can survive short trips in an angler's bait bucket or a quick ride on a boat's hull, or be intentionally or unintentionally released into the Great Lakes. Here, the commissions have loosely grouped all other vectors into intentional and unintentional releases.

Intentional releases that are of concern include **aquaria and live foodfish**. These vectors have received much recent media attention. For example, species of the snakehead fish have been cited for their capacity to decimate native fish. Researchers have noted that approximately 2000 species are imported to the U.S. annually. Demand for live foodfish for human consumption has been steadily increasing. In 1999, more than 700,000 kg of live freshwater fish, 85% of which were non-native species of carp and Tilapia, were imported to the Greater Toronto Area. Live foodfish such as the bighead and silver carp have the ability to feed voraciously, grow rapidly, and quickly outnumber native fish species, nearly overwhelming invaded ecosystems. This has raised significant concern over potential intentional release into the aquatic ecosystem for cultural or subsistence reasons.

Unintentional releases are also a concern. For instance, **canals** often connect once-separated aquatic ecosystems and are a troubling vector for AIS. Sea lamprey and alewives, for example, entered and have spread throughout the Great Lakes through canals; Asian carp have a path to all Great Lakes canals as well. **Recreational boating** in the Great Lakes is intense and growing. Recreational users enjoying the Great Lakes may inadvertently spread AIS as these species adhere to boat hulls and trailers transiting to a neighboring lake. **Baitfish**, and the residual water that can harbor AIS larvae, can be transported and dumped into waters many miles away from their original point of sale.

Progress made in Research and Prevention of AIS from other Vectors

- To prevent migration of invasive species between the Great Lakes and Mississippi River drainage basins, a temporary electric fish dispersal barrier was activated in April 2002, on the Chicago Sanitary and Ship Canal. A second, permanent dispersal barrier is under construction. Together, these barriers are designed to prevent the movement of Asian carp and other species into the Great Lakes. However, a serious funding gap exists as a result of unexpected costs and design changes leaving the project's future in doubt. Agencies also have worked together to develop a rapid response plan should Asian carp approach, or breach, the barrier.
- In 2003, Canada and its provinces adopted a *National Code on Introductions and Transfers of Aquatic Organisms*. This code provides a framework for risk assessment and a means for input from affected jurisdictions (provincial and state) prior to introduction or transfer of an aquatic organism to a fish-rearing facility (or fish-bearing waters).
- In 2003-04, a number of Great Lakes municipalities, states and the province of Ontario initiated actions to prohibit the sale/transport of live Asian carp and other species of specific concern (e.g., goby and snakehead) in their jurisdictions. Law enforcement agencies are cooperating through the Council of Lake Committees to ensure that transport of live illegal organisms does not occur.
- One U.S. Executive Order was signed in 1999 to promote improved regional interagency AIS coordination among federal and state agencies in the Great Lakes. Another order was signed in 2004 and formed the Great Lakes Interagency Task Force to better coordinate all Great Lakes activities across federal agencies. Canada has expressed its willingness to work with this newly formed task force. Both the U.S. and Canada continue to seek opportunities to more effectively address invasive species and other environmental issues through binational coordination and cooperation.
- In 2004 Canada developed a proposal for a *National Action Plan to Address the Threat of Aquatic Species*. This plan is the aquatic component of the *National Alien Invasive Species Strategy*.

Needed Follow-up

- Canada and its provinces should quickly adopt and implement the *National Alien Invasive Species Strategy* to effectively address the threat of invasive aquatic, terrestrial and plant species.
- U.S. Congress should fully fund the electric fish dispersal barriers on the Chicago waterway system.
- U.S. Congress should immediately pass and fully fund NAISA, which comprehensively addresses **all** major vectors including ballast, canals and organisms in trade.

We Can Do Better

We have outlined steps that the governments of U.S. and Canada should immediately take to halt the flow of AIS into the Great Lakes. However, a Great Lakes solution to invasive species also must be a cooperative effort by **all** interests. Maintaining the biological integrity of the Great Lakes begins with making a commitment, whether at the personal or business level, to modify our current behavior sufficiently to prevent further introductions or spread of AIS. It also extends to all responsible authorities, who must be innovative in responding to the AIS threat, who must monitor and enforce regulations, who must educate all interests, and, ultimately, who must remain accountable for progress. The Great Lakes are a vital natural resource – an unparalleled international treasure. While progress has been made in the 14 years since our first report on AIS, many challenges remain.

For further information visit our websites at:

International Joint Commission
http://www.ijc.org

Great Lakes Fishery Commission
http://www.glfc.org

Le texte est aussi disponible en français

We Can We Can

We Must We Must

Do Better Do Better

Aquatic Alien Invasive Species

in the Great Lakes – St. Lawrence Ecosystem

1830's
Sea lamprey observed in the lower Great Lakes. In 1921 sea lamprey spread to all of the Great Lakes via the Welland Canal.

1959
Opening of the St. Lawrence Seaway: "mixing water from the Seven Seas."

1984
Spiny water flea discovered in Lake Ontario.

1987
Great Lakes Water Quality Agreement calls for U.S. and Canadian Coast Guards to study ballast discharge problem.

1988
Zebra mussel reported in Lake St. Clair and western Lake Erie.

1988
Introduction of ruffe reported to Lake Superior Committee, which asks GLFC to work to see that AIS discharge in ballast water ceases.

1988
Canadian Ballast Exchange Guidelines published. They were voluntary, however there is a penalty provision under the *Canadian Shipping Act* for nondisclosure.

1990
The U.S. enacted the *Nonindigenous Aquatic Nuisance Prevention and Control Act* (NANPCA), the first comprehensive AIS legislation for the Great Lakes. NANPCA was reauthorized and strengthen in 1996 with passage of *National Invasive Species Act* (NISA).

1990
GLFC and IJC publish *Exotic Species and the Shipping Industry*, a joint report urging the governments of the U.S. and Canada to take immediate action on ballast water discharges and develop a strategy to address the threat of AIS to the Great Lakes.

1992
Ontario Federation of Anglers and Hunters develop the *Species Awareness Program* for Ontario, noting accidental or intentional release of bait fish is also a vector that needs to be addressed in the control and management of AIS.

1993
U.S. Office of Technology Assessment issues the report, *Harmful Non-Indigenous Species in the United States*, which estimates $3.1 billion in costs for zebra mussel remediation.

1993
U.S. Coast Guard issues mandatory regulations for controlling ballast water in the Great Lakes.

1995
Round Goby first discovered in Lake Superior.

1998
Fish hook flea discovered in Lake Ontario.

2002
IJC issues its *11th Biennial* report recommending the governments issue a reference to the IJC to coordinate and harmonize binational efforts for action to stop the ongoing threat to the economy and to the biological integrity of the Great Lakes.

2002
Canadian Auditor General and the U.S. General Accounting Office issue concurrent reports noting the slow pace of progress in addressing aquatic AIS in the Great Lakes. In 2003 the Canadian Standing Committee on Fisheries and Oceans reinforces the auditors' conclusions and recommends several actions including better coordination of federal AIS activities, an AIS reference to the IJC, and more funds for sea lamprey control.

2003
Great Lakes authorities initiate actions to prohibit the sale/transport of live Asian carp.

2004
IMO adopts Convention on Ballast Water and Sediments

We Can We Can

We Must We Must

Do Better Do Better

Then and Now

Aquatic Alien Invasive Species and the Great Lakes-St. Lawrence Ecosystem

Progress and Future Needs
A review of progress since the joint report, *Exotic Species and the Shipping Industry: The Great Lakes - St. Lawrence Ecosystem at Risk*, September 1990

International Joint Commission

Great Lakes Fishery Commission

September 2004