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INVASIVE SPECIES THAT POSE A THREAT TO THE GREAT LAKES SYSTEM

Report of the Standing Committee on Fisheries and Oceans

Rodney Weston
Chair

APRIL 2013

41st PARLIAMENT, FIRST SESSION

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has the honour to present its

FOURTH REPORT

Pursuant to its mandate under Standing Order 108(2) and the motion adopted by the Committee on Tuesday, December 13, 2011, the Committee has studied invasive species that pose a threat to the Great Lakes system and has agreed to report the following:

TABLE OF CONTENTS

Introduction 1
Background 1
A. Committee interest in invasive species 1
B. Invasive species 2
C. Managing invasive species 3
1. Prevention 3
2. Mitigating the impact 3
a. Containing the spread 4
b. Controlling the impact of established species 4
Canada's commitments and strategy 4
A. International obligations 4
B. Canada-United States cooperation 5
C. Canada's actions on aquatic invasive species 7
1. Invasive Alien Species Strategy 7
2. Ballast water regulations 7
3. Scientific research 8
4. *Fisheries Act* amendments 8
5. Public engagement 9
Aquatic invasive species in the Great Lakes 9
A. State of AIS in the Great Lakes: Old and new threats 9
B. Prevention: Managing pathways and related vectors 11
1. Shipping: Ballast water and hull fouling 12
2. Diversions: Chicago Area Waterway System 14
3. Live trade: Implementing and enforcing bans 18
C. Slowing the spread 19
1. Monitoring and rapid response 20
2. Unintentional movement 21
D. Control 23
Sea Lamprey: A case history 23

Conclusion 25
GLOSSARY 26
LIST OF RECOMMENDATIONS 27
APPENDIX A: LIST OF WITNESSES 29
APPENDIX B: LIST OF BRIEFS 33
REQUEST FOR GOVERNMENT RESPONSE 35

Introduction

On 13 December 2011, the House of Commons Standing Committee on Fisheries and Oceans (the Committee) decided to undertake a study on invasive species that pose a threat to the Great Lakes system in order to better understand the overall management of the Great Lakes fisheries.

The Committee began its study on 2 April 2012. It held 12 meetings and finished hearing from witnesses on 16 October 2012. Witnesses included officials and scientists from the Department of Fisheries and Oceans (DFO), anglers, academics, community organizations, commercial fishery representatives, binational bodies, as well as representatives from the Government of Ontario.

While this study focuses on the Great Lakes, it is widely acknowledged that aquatic invasive species (AIS) are a problem throughout Canada. Witnesses brought forward their experiences and concerns, as well as their recommendations for improving Canadian and binational responses to AIS in the Great Lakes region. Committee members would like to express their sincere thanks to the witnesses who appeared before them to share their knowledge, experience and recommendations. This report is based on their testimony before the Committee.

Background

A. Committee interest in invasive species

Aquatic invasive species have been the focus of this committee's work several times in the last decade. In 2001 and 2002, the Commissioner of the Environment and Sustainable Development (the Commissioner) reported twice on the management of AIS, once as part of a study on the St. Lawrence and Great Lakes[1] and again in 2002, where a chapter was devoted to invasive species, both terrestrial and aquatic.[2] That same year, the International Joint Commission (IJC) released its 11th biennial report with a chapter focussed on AIS,[3] and federal and provincial discussions culminated in the development of a national plan for alien species. This attention to the subject led the Committee to undertake a study on the issue, beginning in January 2003. It tabled its report, entitled *Aquatic Invasive Species: Uninvited Guests*, on 27 May 2003.[4]

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1 Office of the Auditor General, 2001 October Report of the Commissioner of the Environment and Sustainable Development, Chapter 1, *Section 6 – Fisheries*.

2 Office of the Auditor General, *2002 October Report of the Commissioner of the Environment and Sustainable Development*, *Chapter 4 – Invasive Species*.

3 International Joint Commission, *11th Biennial Report, Great Lakes Water Quality, The Challenge to restore and protect the Largest Body of Fresh Water in the World, Chapter 3, Toward Biological Integrity: The Challenge of Alien Invasive Species,* September 2002.

4 House of Commons Standing Committee on Fisheries and Oceans, *Aquatic Invasive Species: Uninvited Guests*, 27 May 2003.

In May 2005, the Committee followed up on this study and tabled a report[5] restating some of its recommendations for which it believed there had been an inadequate response. In particular, it reiterated the need for: action on ballast water; consolidating and streamlining of regulations; funding for rapid response and research; harmonizing binational efforts; and specific funding to the education efforts of the Ontario Federation of Anglers and Hunters (OFAH).

In 2008, the Commissioner tabled a report that included a chapter specifically devoted to the control of AIS[6] and the Committee followed up on this report with a meeting with the Commissioner.[7]

Given the time that has passed, the severity of the threat to the commercial and recreational fisheries, industries with an estimated value of $7 billion,[8] and because much has happened in this field, the Committee believes it is timely to once again examine federal efforts at controlling AIS in the Great Lakes.

B. Invasive species

Global trade in goods and services and the movement of people has introduced, intentionally or otherwise, thousands of species into habitats well outside their natural ranges. While some of these introductions have few or no adverse consequences, others have had significant impacts on the functioning of ecological systems. These impacts can be seen in both their existing biodiversity as well as their physical functioning. For example, invasive species may compete with, eat or parasitize other species, transmit diseases or change the physical and chemical environment, all of which can alter community structure and the growth and survival of other species. These in turn can affect the many services that functioning native ecosystems provide humans, and thereby affect the economy and human well-being.[9] With respect to AIS, the impact on commercial, Aboriginal and recreational fisheries can be devastating.

The United Nations' *Convention on Biological Diversity* (CBD) defines "invasive species" as those whose introduction and spread threaten biodiversity. Elsewhere, such as for the purposes of Canada's *Invasive Alien Species Strategy*,[10] invasive species are those that threaten not only biodiversity, but also may threaten "the environment, the economy, or society." Thus, by definition, "invasive species" are only those species that

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5 House of Commons Standing Committee on Fisheries and Oceans, *Third Report*, 9 June 2005.

6 Office of the Auditor General, 2008 March Status Report of the Commissioner of the Environment and Sustainable Development, *Chapter 6 – Ecosystems – Control of Aquatic Invasive Species*.

7 House of Commons Standing Committee on Fisheries and Oceans, *Evidence*, 5 June 2008.

8 David Gillis. Director General, Ecosystems and Oceans Science Sector, Department of Fisheries and Oceans, *Evidence*, 2 April 2012.

9 United Nations Environment Programme, Convention on Biological Diversity, Subsidiary Body on Scientific, Technical and Technological Advice, *Invasive Alien Species: Status, impacts and trends of alien species that threaten ecosystems, habitats and species*, 26 February 2001 [available in English only].

10 Government of Canada, *An Invasive Alien Species Strategy for Canada*, September 2004.

are harmful and therefore do not include those fish species that have been introduced to create new and productive fisheries such as rainbow trout and Pacific salmon.

C. Managing invasive species

This section introduces key concepts and aspects of managing AIS. Terms in italics are those important to the discussion of managing AIS and are used to frame the discussion of AIS in the Great Lakes.

Managing invasive species involves two approaches: *preventing* the appearance of new species and *mitigating the impact* of those already introduced. In addition, throughout the study, it became clear that public awareness and education about the impacts of AIS are critical to the successful management of invasive species. Many witnesses such as the OFAH and the Ontario Ministry of Natural Resources (OMNR) stressed the need for targeted public education to prevent the entry and spread of AIS as well as mitigate their impact.

1. Prevention

Preventing the introduction of new species involves identifying *pathways* of introduction and their related *vectors*.[11] For instance, shipping may be a pathway and ballast water or hull fouling vectors.[12] International cooperation is necessary for preventing the introduction of alien species.[13] International and domestic actions are then taken to reduce the risks that alien species will be introduced via these pathways and vectors.

2. Mitigating the impact

Mitigating adverse effects of potentially invasive alien species occurs by *containing* its spread and *controlling* its impacts.[14] Not all introduced alien species become invasive and predicting which ones may become invasive is important in risk management.[15] Predicting invasive species is not a simple task, and it is a focus of research. International experience with introduced species becoming invasive is important evidence in this exercise.[16]

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11 Canadian Council of Fisheries and Aquaculture Ministers Aquatic Invasive Species Task Group, *A Canadian Action Plan to Address the Threat of Aquatic Invasive Species*, 2004.

12 David Gillis, *Evidence*, 2 April 2012.

13 William Taylor, Co-Chair, Science Advisory Board, Work Group on Aquatic Invasive Species Rapid Response, International Joint Commission, *Evidence*, 6 May 2012.

14 Government of Canada, *An Invasive Alien Species Strategy for Canada*, September 2004.

15 Becky Cudmore, Senior Science Advisor, Central and Arctic Region, Great Lakes Laboratory for Fisheries and Aquatic Sciences, Burlington, Department of Fisheries and Oceans, *Evidence*, 30 May 2012.

16 Sarah Bailey, Research Scientist, Central and Arctic Region, Great Lakes Laboratory for Fisheries and Aquatics Sciences, Burlington, Department of Fisheries and Oceans, *Evidence*, 30 May 2012.

a. Containing the spread

Early detection and *rapid response* increase the possibility of mitigating a species' effects.[17] Early detection requires comprehensive *monitoring*. Rapid response requires detailed planning. While eradication is often the most desired outcome, it requires a very quick response and the right set of circumstances (such as environmental conditions suitable for isolating the organism) to make it possible.[18] Containment requires monitoring to identify and eradicate new outbreaks.[19]

b. Controlling the impact of established species

Controlling the impact of established species generally involves methods to sufficiently reduce population size in order to reduce the negative impacts. These methods include a range of integrated management techniques, including mechanical control, chemical control, biological control and habitat management.[20] Regardless of management techniques used, the potential side effects on biodiversity and human health must be identified and the costs and benefits of action must be considered.

Canada's commitments and strategy

A. International obligations

Canada was the first developed country to ratify the CBD in 1992. In 2010, as a party to the CBD, Canada adopted the CBD's *Strategic Plan for Biodiversity 2011–2020*, including the Aichi Targets, which has the objective to guide efforts to improve the status of biodiversity.[21] Target 9 states that "by 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment."[22]

In 2010, Canada ratified the 2004 *International Convention for the Control and Management of Ships' Ballast Water and Sediments* (BWM Convention). The BWM Convention aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments.[23] It requires all ships to implement a Ballast Water and Sediments Management Plan. Ships also have to carry a Ballast Water Record Book and

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17 Canadian Council of Fisheries and Aquaculture Ministers Aquatic Invasive Species Task Group, *A Canadian Action Plan to Address the Threat of Aquatic Invasive Species*, 2004.

18 Anthony Ricciardi, Associate Professor, McGill University, *Evidence*, 25 April 2012.

19 Ibid.

20 Ontario Ministry of Natural Resources, "Invasive Species Prevention, Management and Control," 27 August 2012.

21 Environment Canada, "Canada celebrates historic agreements for biodiversity," EnviroZine, December 2010.

22 Convention on Biological Diversity, "Aichi Biodiversity Targets," Strategic Plan 2011–2020.

23 International Maritime Organization, "Ballast Water Management," Marine Environment.

to operate ballast water management procedures to a given standard.[24] To date, the BWM Convention has not entered into force.[25]

B. Canada-United States cooperation

Canada and the United States (U.S.) signed the *Boundary Waters Treaty* (1909)[26] (BWT) and the *Great Lakes Water Quality Agreement* (GLWQA) (1972, 1978, 1987, 2012), and, under the BWT, created the International Joint Commission (IJC), which now assists in the administration of both of these agreements. The IJC supports the governments in preventing disputes related to waters along the Canada-U.S. border.[27] Under the GLWQA, the IJC assesses the adequacy and effectiveness of programs and progress to restore and maintain the health of the Great Lakes, reports its findings and makes recommendations to governments biennially. The IJC monitors and assesses progress under the GLWQA and advises the governments on matters related to the quality of the boundary waters of the Great Lakes system. The IJC also assists the governments with joint programs under the GLWQA, and provides for two binational advisory boards — the Great Lakes Water Quality Board and the Great Lakes Science Advisory Board.[28]

The work of the IJC has often focussed on AIS. The 2011 IJC Biennial Report[29] as well as the 2009–2011 IJC *Priority Cycle Report on Binational Aquatic Invasive Species Rapid Response*[30] called for the establishment of a formal binational Great Lakes AIS rapid response plan. These reports also recommended that Canada and the U.S. better align research efforts with rapid response needs and ensure that early detection and monitoring programs are responsive to emerging issues and feature the latest technology.

To facilitate the coordination of fisheries management, Canada and the U.S. ratified the 1954 *Convention on Great Lakes Fisheries*,[31] which created the Great Lakes Fishery

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24 International Maritime Organization, "International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM)."

25 The Convention will enter into force 12 months after ratification by 30 States, representing 35% of world merchant shipping tonnage. As of 6 March 2013, 36 States, representing 29% of world tonnage, had ratified the Convention. International Maritime Organization, "Status of Conventions."

26 Treaty Between the United States and Great Britain Relating to Boundary Waters, and Questions Arising Between the United States and Canada

27 Joe Comuzzi, Canadian Chair, International Joint Commission, *Evidence*, 6 June 2012.

28 International Joint Commission, *Treaties and agreements*, "About the Great Lakes Water Agreement."

29 International Joint Commission, *15th Biennial Report on Great Lakes Water Quality,* January 2011.

30 International Joint Commission, "2009-2011 Priority Cycle Report on Binational Aquatic Invasive Species Rapid Response," October 2011.

31 Great Lakes Fishery Commission, "Convention on Great Lakes Fisheries between the United States of America and Canada," September 1954.

Commission (the Commission). The Commission was formed in part to control the sea lamprey.[32] It works on a consensus basis under a non-binding agreement.[33] It cooperates with DFO, the U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers to control sea lampreys in the Great Lakes.[34] Both the U.S. and Canadian governments fund the Commission. Pursuant to the Convention, the Commission recommended that the U.S. and Canada respectively contribute 69% and 31% of the Commission's budget for the Integrated Sea Lamprey Management Program.[35]

Binational activity has evolved as knowledge and concern regarding AIS in general, and specific threats in particular, have increased. In 2012, Canada joined the Asian Carp Regional Coordinating Committee (ACRCC).[36] The ACRCC aims to "create an Asian carp control program to prevent introduction and implement coordinated actions to protect the integrity of the Great Lakes ecosystem from an Asian carp invasion via all viable pathways."[37] ACRCC's Monitoring and Rapid Response Plan details monitoring, sampling and rapid response activities to be conducted by the members. It includes ongoing evaluations of the effectiveness of barriers and technology used to keep Asian carps from establishing in the Chicago Area Waterway System (CAWS) and Lake Michigan.[38]

In addition, in September 2012, the two governments signed an updated GLWQA which included a new Annex on AIS.[39] This Annex commits Canada and the U.S. to implement programs to eliminate new introductions of AIS through ballast water discharge efforts and other binational prevention-based approaches. It also requires that the two parties, within two years, implement an early detection and rapid response initiative. Importantly, these efforts are to be informed by binationally coordinated risk assessments. The Committee was informed of one such risk assessment that had been performed for the bigheaded (Asian) carps.[40] The GLWQA is implemented in Canada to a large extent

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32 Robert Lambe, Commissioner, Great Lakes Fishery Commission, *Evidence*, 11 June 2012.

33 Marc Gaden, Communications Director and Legislative Liaison, Great Lakes Fishery Commission, *Evidence*, 11 June 2012.

34 Terry Quinney, Provincial Manager, Fish and Wildlife Services, Ontario Federation of Anglers and Hunters, *Evidence*, 23 April 2012.

35 David Burden, Acting Regional Director General, Department of Fisheries and Oceans, *Evidence*, 2 April 2012.

36 Asian Carp Regional Coordinating Committee, "Canada Joins Obama Administration's Asian Carp Regional Coordinating Committee," August 2012.

37 Asian Carp Regional Coordinating Committee, "Leading the way in Asian carp control and management."

38 Asian Carp Regional Coordinating Committee.

39 Environment Canada, "Annex 6 – Aquatic Invasive Species," Full Text: The 2012 Great Lakes Water Quality Agreement, September 2012.

40 Department of Fisheries and Oceans, *Binational ecological risk assessment for bigheaded carps (Hypophthalmichthys spp.)in the Great Lakes Basin*, DFO Canadian Science Advisory Secretariat, Science Advisory Report, July 2012.

through the Canada-Ontario Agreement, which is currently being negotiated between Environment Canada and Ontario.[41]

C. Canada's actions on aquatic invasive species

1. Invasive Alien Species Strategy

In 2004, Canada introduced its *An Invasive Alien Species Strategy for Canada*, as a coordinated effort to reduce the risk of invasive species.[42] The Strategy was produced by federal government departments and agencies as well as several provinces. It responds to the challenge of invasive species by adopting the following hierarchical approach:

1) Prevention of new invasions;

2) Early detection of new invaders;

3) Rapid response to new invaders; and

4) Management of established and spreading invaders (containment, eradication and control).

As a response to the Strategy, *A Canadian Action Plan to Address the Threat of Aquatic Invasive Species*[43] was approved by the Canadian Council of Fisheries and Aquaculture Ministers and is used as the basis to guide development of programs related to AIS. These programs include the establishment of ballast water regulations, scientific research, the development of a legislative framework through amendments to the *Fisheries Act* and public engagement.

2. Ballast water regulations

Ship ballast water is an important vector for the introduction of AIS. The Commissioner recommended in 2002 that Transport Canada, the department responsible for regulating ballast water in commercial ships, establish ballast water regulations. The development of the BWM Convention also built momentum toward such regulations.[44] Mandatory regulations for the control and management of ballast water came into force through the *Canada Shipping Act* in 2006.[45] Canadian requirements were

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41 Minister of the Environment, "Letter of intention to negotiate new COA," 15 June 2012.

42 Environment Canada, "An Invasive Alien Species Strategy for Canada," September 2004.

43 Canadian Council of Fisheries and Aquaculture Ministers Aquatic Invasive Species Task Group, *A Canadian Action Plan to Address the Threat of Aquatic Invasive Species*, 2004.

44 Office of the Auditor General, 2008 March Status Report of the Commissioner of the Environment and Sustainable Development, "Chapter 6—Ecosystems—Control of Aquatic Invasive Species."

45 The *Ballast Water Control and Management Regulations* were updated in October 2011 to harmonize the language of the regulations with the *Canada Shipping Act, 2001*, the relevant provisions of which came into force in 2007.

adopted as a harmonized regulation by the St. Lawrence Seaway Authority in 2008.[46] The Regulatory Impact Analysis Statement for the regulation stated the following:

> As a solution to the issue of harmful aquatic organisms and pathogens entering Canadian ecosystems via ballast water, the Regulations prescribe how ships traveling to Canadian ports must manage their ballast water. Exchange, treatment, disposal (at a reception facility) or retention on board are all considered to be best management practices for ballast water and accumulated sediment. Of these management practices, ballast water exchange that occurs 200 nautical miles from shore in waters that are at least 2000 meters deep is, at this time, recognized as the most effective means available to control the potential of an invasive exotic species being transported in ballast water.[47]

While ballast water exchange is currently recognized as the most effective means available, research continues into technologies to more effectively reduce the risks of introducing new species.[48]

3. Scientific research

DFO officials told the Committee that it has two main roles with respect to scientific research on AIS. First, DFO has partnered with and provides funding to the Canadian Aquatic Invasive Species Network (CAISN), which is a program administered by the Natural Sciences and Engineering Research Council (NSERC). Second, through the Centre for Expertise for Aquatic Risk Assessment (CEARA), established in 2006 in Burlington, Ontario, DFO has conducted a number of risk assessments of AIS to determine the risk of a species arriving in Canada, the risk of it establishing itself if it does arrive, and the potential associated consequences.[49] Advice stemming from risk assessment is used to determine effective actions and use of resources by targeting highest-risk species, pathways, and locations. To date, CEARA has conducted full risk assessments for 25 species and two pathways — ship-mediated and the Ontario baitfish pathway. Along with Asian carps, Northern snakehead and the organisms in trade pathways are some of CEARA's top concerns in the Great Lakes.[50]

4. *Fisheries Act* amendments

In 2012, Parliament passed amendments to the *Fisheries Act*, the principal statute that manages Canadian fisheries resources.[51] The amendments specifically allow the federal government to make regulations establishing a list of AIS and regulations to control

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46 Anthony Ricciardi, *Evidence*, 25 April 2012.

47 Government of Canada, "Canada Shipping Act, Ballast Water Control and Management Regulations," *Canada Gazette*, 28 June 2006.

48 See Transport Canada, "Ballast Water Management," and links therein.

49 David Gillis, *Evidence*, 2 April 2012.

50 Becky Cudmore, *Evidence*, 30 May 2012.

51 *Bill C-38, An Act to implement certain provisions of the budget tabled in Parliament on March 29, 2012 and other measures,* Division 5 of Part 3. See also: Department of Fisheries and Oceans, "Responsible Protection and Conservation of Canada's Fisheries," April 2012.

AIS, such as who may possess one of these species, how they may be handled, and requiring records to be kept.[52] An example of how these regulatory powers may be used is to prohibit the import, transport and possession of live AIS, such as Asian carps.[53] Also, DFO would be able to enter into agreements with third parties, such as conservation groups, to enable them to undertake measures to enhance fisheries protection, including support for AIS outreach and engagement.

5. Public engagement

Invasive species cannot be controlled by governments alone. The public and specific stakeholders, such as hunter and angler associations, are vital players in reducing the spread and impact of invasive species.[54] The federal government acknowledged this by making education programs and stakeholder engagement important aspects of its invasive species strategy.

The OFAH emphasized the importance of partnerships, the key role of the Government of Canada and the leveraging they provide.

> We're a member of the Great Lakes panel on aquatic invasive species under the aegis of the aquatic invasive species task force, and we work with major groups such as the Great Lakes Fishery Commission, the International Joint Commission, the Canadian Sportfishing Industry Association, and the Ontario Commercial Fisheries Association. On the ground we also work with important fish hatcheries such as Bluewater, conservation authorities, lake and cottage associations, and bait and marina operators, who have an interest in preventing the introduction and spread of aquatic invasive species and invasive plants.[55]

Aquatic invasive species in the Great Lakes

A. State of AIS in the Great Lakes: Old and new threats

According to Dr. Anthony Ricciardi, Associate Professor, Invasion Ecology, McGill University, the Great Lakes are likely the most highly invaded freshwater system in the world.[56] Approximately 182 non-native species have been introduced into the Great Lakes since the 1800s. Some of these, such as zebra mussels, the sea lamprey, and the round goby have become invasive and have caused significant negative impacts to the lakes.[57]

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52 *Fisheries Act*, R.S.C. 1985, c. F-14, section 43.

53 Department of Fisheries and Oceans, "Speaking Notes for the Honourable Keith Ashfield, P.C., M.P. Minister of Fisheries and Oceans at the Protection and Conservation Announcement," Ottawa, Ontario, 24 April 2012.

54 Becky Cudmore, *Evidence*, 30 May 2012.

55 Greg Farrant, Manager, Government Affairs and Policy, Ontario Federation of Anglers and Hunters, *Evidence*, 23 April 2012.

56 Anthony Ricciardi, *Evidence*, 25 April 2012.

57 David Gillis, *Evidence*, 2 April 2012.

The Committee heard extensive evidence on how AIS have affected commercial and recreational fisheries. AIS have also imposed important control costs on industry and all levels of government. Though some of these costs are obvious and associated with specific species such as the lamprey and zebra mussel, it was also noted that the true impact of introduced species remains unknown since they have not all been studied.[58]

A commercial fisher explained to the Committee how, with the introduction of each new invasive species, changes spread throughout the food chain affecting the predominant species at all trophic levels. The sea lamprey, for example, wiped out lake herring and lake trout populations, which caused the industry to transition towards fishing lake sturgeon, walleye and yellow perch instead. The arrival of the alewife, however, then caused the walleye and yellow perch stocks to decline, followed by the arrival of the zebra mussel, which further affected walleye and lake whitefish.[59] While some species were able to adapt by changing their diets and feeding habits, commercial fishers often observed slower growth rates, smaller fish and smaller catch for a number of years, with resulting economic impacts for the industry.[60]

If an invasive species is successful in establishing itself, it can have serious ecological impacts as well as negative effects on tourism, recreational and commercial fisheries, and municipal and industrial infrastructure. It can also result in billions of dollars being spent on management and control costs over decades.[61] For example, zebra mussels alone cost Ontarians about $100 million annually in control measures at nuclear power facilities and water treatment plants.[62] The sea lamprey control program, for its part, has cost Canada and the U.S. more than $300 million since 1956 in addition to the billions of dollars lost to commercial and recreational fisheries and spent by all levels of governments to rehabilitate and propagate the impacted fisheries.[63]

Therefore, witnesses highlighted the importance of prevention, as preventing an AIS from entering an ecosystem is less disruptive and significantly less costly than attempting to manage it once it becomes established. Identifying new threats and preventing their negative impacts were mentioned by witnesses as a priority. The Asian carps and the Northern snakehead were mentioned as species of particular concern. They are new threats for Canada and will have significant negative effects on native

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58 Anthony Ricciardi, *Evidence*, 25 April 2012.

59 Tim Purdy, Vice-President, Purdy Fisheries Limited, *Evidence*, 2 May 2012. Note that Mr. Purdy refers to “pickerel” in his testimony, but for the purposes of this report “walleye” is the common name used for this species. See the Glossary for a list of common and scientific names of fish.

60 Ibid.

61 Robert Lambe, *Evidence*, 11 June 2012.

62 Anne Neary, Director, Applied Research and Development Branch, Ontario Ministry of Natural Resources, *Evidence*, 7 May 2012.

63 Robert Lambe, *Evidence*, 11 June 2012.

species if they become established in the Great Lakes since they have already proved to be a costly problem in the U.S.[64]

The Asian carps could have an important impact on commercial and sport fishing industries across the Great Lakes. Two species are of greatest concern to the Great Lakes: bighead carp (*Hypophthalmichthys nobilis*) and silver carp (*H. molitrix*). Asian carps were first introduced in the southern U.S. to eat excess algae in fish farms. Unfortunately, some escaped and have spread throughout the Mississippi River basin. They have caused significant changes to the Mississippi and Illinois River ecosystems, and represent a great concern to fishers due to their rapid growth and associated consumption of plankton, which has seriously impacted the food supply of native species. Asian carps can also jump out of the water when disturbed, posing a physical threat to boaters.[65] While self-sustaining populations of Asian carp species have not yet been observed in the Great Lakes, they have been detected close to this ecosystem, and environmental DNA (eDNA)[66] has been detected in the Lake Michigan basin. The binational risk assessment found that once bigheaded carps have gained entry into the basin, they are expected to spread to other lakes within 20 years, especially lakes Michigan, Huron and Erie.[67]

The Northern snakehead is a voracious predator. In addition, it has specialised anatomy and physiology which allow it to migrate overland and survive out of water for extended periods. It is therefore well-equipped to spread from one area to another and could have a significant impact. Though it is yet to be found in the Great Lakes, it has been found in the eastern U.S.[68]

B. Prevention: Managing pathways and related vectors

Witnesses, including Mr. Lambe, Mr. Ullrich, Dr. Quinney, Ms. Cudmore and Ms. Bailey, highlighted shipping, the Chicago Sanitary and Ship Canal, and live trade as critical pathways to be managed to prevent the introduction of AIS into the Great Lakes.

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64 David Gillis, *Evidence*, 2 April 2012.

65 Ibid.

66 For more information on eDNA, see the section on monitoring.

67 Department of Fisheries and Oceans, *Binational ecological risk assessment for bigheaded carps (*Hypophthalmichthys *spp.) in the Great Lakes Basin*, DFO Canadian Science Advisory Secretariat, Science Advisory Report, July 2012.

68 David Gillis, *Evidence*, 2 April 2012.

1. Shipping: Ballast water and hull fouling

Several species of mussels are believed to have entered the Great Lakes through ballast water and hull fouling,[69] causing changes to water chemistry, the loss of several species of native mussels and other species, and costly impacts to municipal and industrial infrastructure.[70] Since the 2006 and 2008 changes in ballast water regulations in Canada and the U.S., no ballast-mediated invasion has been reported in the Great Lakes. The importance of inspection of ocean-going vessels by Transport Canada to the success of these regulations was stressed.[71]

However, it may be too early to conclude that the ballast water problem has been solved since some AIS could remain hidden for several years before being discovered.[72] Therefore, some witnesses still expressed concerns about the potential for ballast water to introduce new AIS into the Great Lakes.[73] The Georgian Bay Association also called on DFO to work with Transport Canada to align Canadian ballast water regulations with the new U.S. rules that took effect in June 2012. As the Committee was told, these rules specify that, as of 2014, any new vessel entering the Great Lakes or any vessel that has had a dry dock since 2014 will be required to have approved ballast water treatment technology on board.[74] The rules also establish a standard for the allowable concentration of living organisms in ballast water discharged from ships in waters of the U.S.[75] It was noted by the IJC that the U.S. and Canadian ballast water standards are more or less the same.[76]

The fact that ships that stay within the Great Lakes St. Lawrence basin (such as the laker-class ships) remain unregulated was another issue raised by a witness. These ships commonly carry ballast water from freshwater ports on the St. Lawrence River for discharge in the Great Lakes and, therefore, could potentially carry species present in the St. Lawrence into the Great Lakes.[77] The amount of water discharged by laker-class ships into the Great Lakes is equivalent to the amount of water discharged from foreign vessels

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69 Hull fouling is "the process whereby organisms, including invertebrates, attach themselves to ship hulls and other submerged appendages of the ship. The organisms latch onto submerged surface areas, creating small, living communities that travel with the ship to areas where they can then be introduced as invasive species." Transport Canada, "Hull Fouling/Anti-Fouling Paint."

70 David Gillis, *Evidence*, 2 April 2012.

71 Anne Neary, *Evidence*, 7 May 2012.

72 Ibid.

73 John Van Rooyen, Hatchery Manager, Board of Directors, Bluewater Anglers, *Evidence*, 23 April 2012.

74 John Wilson, Director and Chair, Fisheries Committee, Georgian Bay Association, *Evidence*, 30 April 2012.

75 United States Coast Guard, "Ballast Water Management."

76 Camille Mageau, Secretary, International Joint Commission, *Evidence*, 6 June 2012.

77 Hugh MacIsaac, Professor, Great Lakes Institute for Environmental Research, University of Windsor, and Director, Canadian Aquatic Invasive Species Network, *Evidence*, 16 May 2012.

from overseas.[78] According to a 2011 DFO study, nine species native to rivers of the North American east coast or the St. Lawrence River have established in the Great Lakes, four of which are believed to have been introduced by ballast transfer of domestic shipping activities. At least 13 non-native species which first established in the St. Lawrence River have since invaded the Great Lakes.[79] A 2012 study, co-authored by DFO witness Sarah Bailey, identified the following invasive species from sampled laker-class ships: spiny waterflea, fish-hook waterflea, zebra mussel and quagga mussel. All these taxa are considered established in all five Great Lakes except the fish-hook waterflea, which is not yet established in Lake Superior.[80]

Laker-class vessels appear to be a transport pathway of ballast-mediated invasive species in the region but would play a more prominent role in the spread of invasive species, rather than the introduction of new invasive species from foreign sources. The 2011 DFO study indicated that unregulated domestic vessels should be the focus of future efforts to reduce impacts of invasive species in the Great Lakes St. Lawrence region.[81] However, Professor Hugh MacIsaac, Director of the Canadian Aquatic Invasive Species Network, also noted that more study is required on impacts of domestic ballast operations on the Great Lakes and the potential difficulties in regulating laker-class vessels.

> The problem with the lakers is that there's no good place for them to do ballast water exchange. We want mid-ocean salinity, which Transport Canada defines as salinity greater than 30 parts per 1,000. Fresh water is zero parts per 1,000. So the vessels have to come in with greater than 30 parts per 1,000, and there's no place on the St. Lawrence River where you're going to find 30 parts per 1,000. The only way you could potentially use ballast water exchange as a mechanism to reduce risk of lakers is to make them go well out into the Gulf of St. Lawrence and then come back.[82]

In the U.S., the *Clean Water Act* requires states to apply the Environmental Protection Agency's ballast water regulations and allows states to add conditions that apply to vessels while in their waters.[83] New York State has proposed much more stringent requirements that would have resulted in a patchwork of inconsistent regulations for the Great Lakes. However, in February 2012, it postponed the application of the new

78 Ibid.

79 DFO, *Risk Assessment for ship-mediated introductions of aquatic nonindigenous species to the Great Lakes and freshwater St. Lawrence River*, DFO Canadian Science Advisory Secretariat, Research Document 2011/104, 2011.

80 Elizabeta Briski et al., "Role of domestic shipping in the introduction or secondary spread of nonindigenous species: biological invasions within the Laurentian Great Lakes", *Journal of Applied Ecology*, Vol. 49, 2012, pp. 1124-1130.

81 DFO, *Risk Assessment for ship-mediated introductions of aquatic nonindigenous species to the Great Lakes and freshwater St. Lawrence River*, DFO Canadian Science Advisory Secretariat, Research Document 2011/104, 2011.

82 Hugh MacIsaac, *Evidence*, 16 May 2012.

83 Transport Canada, "Ballast water and the Great Lakes-St. Lawrence Seaway System," 23 October 2012.

requirements until the end of 2013 while working with other states and stakeholders towards uniform ballast water requirements.[84]

Recommendation 1

The Committee recommends that the Government of Canada continue to explore the feasibility of regulating ballast water for lake ships internal to the Great Lakes St. Lawrence basin and that any potential regulations be harmonized with those of the United States.

It was pointed out by Professor MacIsaac that hull fouling is potentially a more threatening vector for the introduction of AIS than ballast water in marine ecosystems. Hull fouling can be prevented on vessels by coating them with special paints, a measure that is effective for at least 180 days.[85] Australia and New Zealand have developed risk assessment tools to determine the threat of ship hulls before the vessels actually arrive in their coastal waters. Australian regulations use a 90-day window: if a vessel had been treated in the previous 90 days, it is not viewed as a threat. However, if it has been more than 90 days, there will be inspections required for fouling organisms on the side of the ship.[86] Professor MacIsaac indicated that Canada still lacks a hull fouling policy.

Recommendation 2

The Committee recommends that the Government of Canada develop a hull fouling policy.

2. Diversions: Chicago Area Waterway System

There are many possible routes by which invasive species, in particular the Asian carps, could make their way from the Mississippi Basin to the Great Lakes (Figure 1). It should be noted however, that though the Asian carps are of primary concern, the Committee was told that there have been 39 species identified in the Great Lakes or Mississippi basin which could invade either basin.[87]

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84 New York State Department of Environmental Conservation, "New York Pursues Uniform, National Ballast Water Requirements," 22 February 2012.

85 Hugh MacIsaac, *Evidence*, 16 May 2012.

86 Ibid.

87 David Ullrich, Executive Director, Great Lakes and St. Lawrence Cities Initiative, *Evidence*, 18 June 2012.

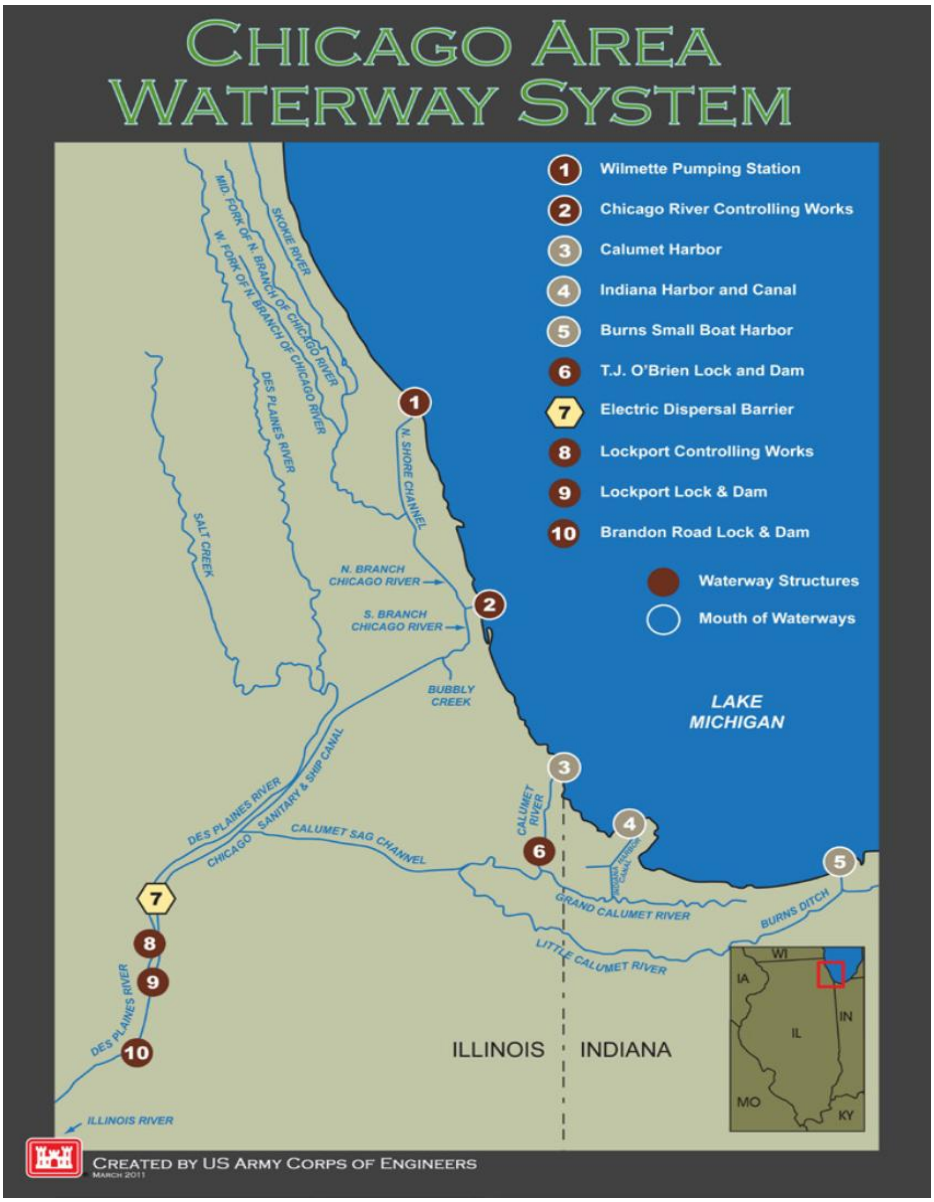
Figure 1: Pathways other than the Chicago Area Waterway System between the Great Lakes and Mississippi Basins.

Source: U.S. Army Corps of Engineers, Great Lakes and Mississippi River Interbasin Study, *Other Pathways Map*.

Of the possible routes, the Chicago Area Waterway System (CAWS) has been identified as the most likely point of entry between the two basins, at least for the Asian carps.[88] The CAWS comprises over 100 miles of rivers and canals which connect Lake Michigan with the Mississippi River via the Lower Des Plaines and Illinois rivers. The CAWS includes the Chicago River, the Chicago Sanitary and Ship Canal, the Cal-Sag Channel and the Calumet River (Figure 2).

88 Department of Fisheries and Oceans, *Binational ecological risk assessment for bigheaded carps (Hypophthalmichthys spp.) in the Great Lakes Basin*, DFO Canadian Science Advisory Secretariat, Science Advisory Report, July 2012.

Figure 2: Map of the Chicago Area Waterway System



Source: U.S. Army Corps of Engineers, Great Lakes and Mississippi River Interbasin Study, *Map of the Chicago Area Waterway System (CAWS)*.

Though the CAWS as a whole was identified as a likely route, it is specifically the Chicago Sanitary and Ship Canal that has received the most attention. The Canal is an artificial waterway that was built largely in order to separate Chicago's sewage from its drinking water source, but is also used as a shipping route between the Mississippi River system and Lake Michigan. While it is the only direct hydraulic connection between the Mississippi and the waters of the CAWS that drain into Lake Michigan,[89] it also runs

89 U.S. Army Corp of Engineers, *Reconnaissance Report, Great Lakes Navigation System Review Appendix D – Chicago Sanitary and Ship Canal*, June 2002.

parallel and close to the Des Plaines River (which flows to the Mississippi) for a number of kilometres, posing a risk that flood waters could be exchanged between the two. Many witnesses expressed their concerns that this canal could act to allow Asian carps to make their way into the Great Lakes.

Recognizing this threat, electrical barriers have been placed in the Canal by the U.S. federal government and operated by the U.S. Army Corps of Engineers that inhibit movement of fish. There are three barriers. The first demonstration barrier was activated in 2002. A second set of barriers consists of two units, IIA and IIB, which have stronger electrical fields and other improvements in design over the demonstration barrier. Barrier IIA was activated in 2009 and barrier IIB in 2011, at which point in time barrier IIA was put on standby mode.

The effect of the electric barriers is felt to a greater extent by larger fish because the longer the fish, the greater the electrical gradient that develops across the fish. Very small fish may not be immobilized by the barriers as currently operated.[90] The Committee heard concerns regarding the observation that the barriers might be ineffective on smaller fish in addition to allowing other organisms such as plants to get through.[91] Compounding these worries, eDNA from Asian carp has been found in multiple places of the CAWS, as well as Western Lake Erie, though it may not be from live fish, and no live fish have been found in the Great Lakes.[92]

Due to these concerns, witnesses such as the OFAH and the Georgian Bay Association recommended that Canada support the efforts of the Great Lakes and St. Lawrence Cities Initiative and the Great Lakes Fishery Commission to obtain physical separation of the Great Lakes Basin from the Mississippi River Basin.[93] Initial estimates of the cost of such separation range from US$3.25 billion to $9.5 billion.[94] However, a DFO witness pointed out that there are other existing vectors for AIS, such as live trade, as well as numerous other possible physical connections. Also, even physical separation might not prevent an invasion of AIS due to extreme flooding conditions, for example.[95]

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90 U.S. Army Corp of Engineers, *Dispersal Barrier Efficacy Study Efficacy Study Interim Report IIA, Chicago Sanitary and Ship Canal Dispersal Barriers – Optimal Operating Parameters Laboratory Research and Safety Tests*, September 2011.

91 David Ullrich, *Evidence*, 18 June 2012.

92 David Burden, Acting Regional Director General, Central and Arctic Region, Department of Fisheries and Oceans, *Evidence*, 2 April 2012.

93 Terry Quinney, *Evidence*, 23 April 2012.

94 David Ullrich, *Evidence*, 18 June 2012.

95 David Burden, *Evidence*, 2 April 2012.

3. Live trade: Implementing and enforcing bans

Some AIS have spread through accidental or intentional releases when food fish are transported live to maintain freshness, or when species imported for the aquarium trade are released into the environment. The presence of live Asian carps and Northern snakeheads for sale in markets in the Great Lakes region represents a significant risk for the spread of these AIS.[96] With respect to the importation of Asian carp, a witness from DFO described the problem of live fish being dewatered and put on ice for transportation, then re-watered and revived once across the border.[97] In fact, the potential for Asian carps to be introduced into the Great Lakes via live trade is believed by some to be equally as important as the CAWS.[98]

In 2005, Ontario passed regulations forbidding the sale or possession of live Asian carps,[99] along with other species such as snakeheads and gobies. Other provinces have also banned the possession or importation of live Asian carps.[100] However, DFO officials noted that the buying and selling of live Asian carps is worth about $5 million a year in the Toronto markets, rendering the small fines, in the order of $20,000 to $50,000, insufficient as a deterrent.[101]

Furthermore, witnesses described a significant gap that exists in the regulatory framework around the import and interprovincial transportation of AIS. At present, there are no regulations at the federal level that would allow the Canadian Border Services Agency (CBSA) to prevent a shipment of live Asian carp or any other AIS from crossing the border.[102] A border agent might observe the possession of live carp but then have to contact Ontario government officials for enforcement. Therefore, at present, only cooperation between the OMNR and CBSA would stop shipments of live Asian carp.[103] DFO scientist Becky Cudmore indicated, however, that the government is actively working to close the gaps in the regulatory framework with respect to import prohibitions, stating that: “draft regulations are in consultation — with the province, so I think they're hoping to have something very soon that they can table.”[104]

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96 David Gillis, *Evidence*, 2 April 2012.

97 David Burden, *Evidence*, 2 April 2012.

98 Anthony Ricciardi, *Evidence*, 26 April 2012.

99 Note that Ontario is contemplating allowing only eviscerated carp in Ontario; see: Government of Ontario, “Protecting Ontario’s Fisheries: Discussion Paper on Tougher Measures to Prevent an Asian Carp Invasion,” Environmental Registry, 7 January 2012.

100 Canada Border Services Agency, “The CBSA assists partner authorities in keeping Canada’s waterways free from Asian carps,” October 2012.

101 David Burden, *Evidence*, 2 April 2012.

102 Anthony Ricciardi, *Evidence*, 25 April 2012.

103 David Gillis, *Evidence*, 2 April 2012.

104 Becky Cudmore, *Evidence*, 30 May 2012.

Recommendation 3

The Committee recommends that the Government of Canada work with provincial and territorial partners to increase enforcement to prevent the illegal live trade of invasive species, such as Asian carps and Northern snakeheads.

The Great Lakes and St. Lawrence Cities Initiative suggested a "law enforcement exchange" between Canada and the U.S., possibly a memorandum of understanding with federal and provincial as well as local authorities, that could help enforcement activities at key border crossings such as Sarnia (Point Edward)–Port Huron or Windsor–Detroit.[105]

Witnesses also drew the Committee's attention to the U.S. *Lacey Act*,[106] which prohibits the interstate movement of harmful injurious species, and which applies to Asian carps. Witnesses felt that this Act is not being adequately enforced in the U.S., and that the Government of Canada should diplomatically encourage the U.S. to enforce its own regulations.[107] The CAWS also falls under U.S. jurisdiction; however, Canada has much at stake and the Canadian government should encourage the U.S. to expand their efforts to address AIS.

Recommendation 4

The Committee recommends that the Government of Canada continue to work with the Government of the United States to expand their various efforts to restrict the spread of aquatic invasive species, especially Asian carps, into Canada.

C. Slowing the spread

Attempts to prevent species from being introduced are vital, but for a number of reasons may not be successful. Should an introduction occur, decisions have to be made regarding the appropriate response. The longer an introduced species has to establish itself, the greater the risks that it will become invasive. If detected early, attempts can be made to eradicate the introduced population. However, this also requires efficient decision mechanisms followed by swift action. Early detection requires effective monitoring while swift action requires rapid response planning. Similarly, if a population does become established, containing its spread requires monitoring for, and response to, new outbreaks. As stated by Dr. William Taylor:

> I think it is plausible that a harmful species could be discovered at an early stage of its invasion. If we are going to have a chance to do anything about it, we need to have a plan in place. The reality is that without a plan in place, by the time a response is planned and the diverse parties that need to be consulted are consulted and resources are

105 David Ullrich, *Evidence*, 18 June 2012.

106 United States Fish & Wildlife Service, *Lacey Act*, Laws, Treaties & Agreements.

107 Terry Quinney, *Evidence*, 23 April 2012.

obtained and the like, it would be too late. We have a negative example of that already in the history of AIS in the Great Lakes.[108]

1. Monitoring and rapid response

With respect to monitoring, the Committee heard numerous times about the impressive work being carried out by the CEARA in Burlington, Ontario. Witnesses from academia, commercial groups, and the OMNR, expressed the view that monitoring for AIS, for both funding and logistical reasons, needs to be an ongoing program area within DFO. The importance of partnerships in conducting research and monitoring activities was also stressed by witnesses. It was noted that the funding provided to CAISN, for example, has stimulated applied academic research in early detection, rapid response, multiple stressors, and dealing with uncertainty.[109]

Detection of species no longer requires the actual presence of an organism. It relies increasingly on the more sensitive detection of DNA associated with species in the environment. Organisms, like Asian carps, release DNA into the environment in secretions, feces and urine. This environmental DNA (eDNA) can be isolated from water samples, amplified and subsequently sequenced and identified with certain species. As such, eDNA can act as a powerful early detection mechanism. However, the detection of eDNA does not verify the presence of a living organism or population. Sources could be from dead organisms which could be moved by humans or wildlife as carrion or feces, or from water transported from another location (such as bilge water).[110] Professor MacIsaac described an early detection project that uses a new genetic technique called pyrosequencing to assess the presence of alien species using eDNA.[111] The U.S. Army Corps of Engineers has a program to monitor for eDNA from Asian carps in the CAWS area. Work continues to establish the best way to use the information from eDNA monitoring in risk management and response.

Witnesses told the Committee of the importance of having well-established rapid response protocols in place in order to react efficiently if a new AIS is discovered in the Great Lakes. Following early detection, a rapid response protocol requires a risk assessment to determine the threat and coordinated action to contain the species. An example of a rapid response protocol is the provincial plan for Asian carps developed by the OMNR in collaboration with DFO. This plan will guide actions for Ontario if Asian carps are detected in Ontario waters.[112]

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108 William Taylor, *Evidence*, 6 May 2012.

109 Ladd Johnson, Professor, Department of Biology, Laval University, As an Individual, *Evidence*, 25 April 2012.

110 Asian Carp Regional Coordinating Committee, "eDNA."

111 Hugh MacIsaac, *Evidence*, 16 May 2012.

112 Anne Neary, *Evidence*, 7 May 2012.

Such coordination is needed between Canadian jurisdictions. However, the need for a comprehensive, collaborative approach by both the U.S. and Canada in an early detection program was also emphasized.[113] As noted, the new GLWQA includes commitments by both parties to develop and implement an early detection and rapid response initiative by the end of 2014.

While some witnesses pointed to weaknesses in early detection and response in the Great Lakes Basin, others also noted countries that have exemplary planning. In particular, Australia's focussed monitoring and rapid response was noted. In one case, the Australian government took just one month to identify the problem (in a marina monitored for just this purpose), and to develop and implement a plan to cordon off the harbour and eradicate the invasive species.[114] Focussed monitoring and very rapid response led to the eradication of the problem. Such focussed monitoring was suggested for the Great Lakes. Professor MacIsaac recommended a periodic, systematic sampling of key ports perceived to have the highest risk of new invaders.[115] As noted previously, other countries such as Australia have also put in place various successful mechanisms to prevent the entry of invasive species.

Recommendation 5

The Committee recommends that the Government of Canada network with international partners to determine best practices for the management of aquatic invasive species.

Despite the need for monitoring and rapid response, it was noted, that for the Great Lakes, some scientists believe that by the time any species is detected in a system as large as this, it will be too late. Rapid response will be ineffective and programs will quickly evolve into control. Such a point of view emphasizes that preventing entry of organisms into the Great Lakes is far more important than early detection and rapid response.[116]

2. Unintentional movement

Recreational fishing and boating can serve as another critical pathway, particularly between the Great Lakes and other inland lakes, which may be even more vulnerable due to their smaller size and lower species diversity. For example, while the round goby is believed to have entered the Great Lakes through ballast water, it is believed to have spread through its use as a bait fish.[117] As noted by a DFO witness:

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113 Hugh MacIsaac, *Evidence*, 16 May 2012.

114 Anthony Ricciardi, *Evidence*, 25 April 2012.

115 Hugh MacIsaac, *Evidence*, 16 May 2012.

116 William Taylor, *Evidence*, 6 May 2012.

117 David Gillis, *Evidence*, 2 April 2012.

> Live trade is another interesting vector, and it can be expressed in several ways. Fishermen use live bait. They may want to move it from one area to another, and then when they're done, they release the bait, maybe without thinking that it could be an invasive species in that ecosystem. There's also the aquarium trade, the water garden trade, where live plants and animals are brought in for ornamental purposes, and live food fish in markets in our major cities.[118]

A number of witnesses emphasized the importance of citizen education in preventing the spread of AIS through such unintentional movement. As an example, the important work done by the OFAH through their Invading Species Awareness Program (ISAP) was commended. Operated in partnership with the OMNR, ISAP focuses on public education and awareness, and includes an invading species hotline that receives thousands of calls per year.[119]

Despite witnesses' positive appraisal of the ISAP program, the OFAH testified that the program was underfunded at the federal level, and cited a recent Environment Canada termination of what had been years 2 and 3 of a $50,000 per year funding agreement.[120]

In addition, the OFAH reiterated its recommendation, originally accepted by the Committee in 2003 and 2005, that the federal government provide it with funding in order to establish a national public education and awareness program.[121] The newly amended *Fisheries Act* perhaps signals a willingness for the Government to enter into partnerships by clarifying that the Minister may enter into agreements and make grants, contributions and loans to facilitate the implementation of a program or project.[122]

An OMNR witness stressed the need to communicate broadly, particularly with communities for whom certain problematic species are of special cultural importance.

> We are concerned about certain practices among different communities. Some communities, for cultural reasons and ceremonial purposes, will release live fish into waterways. It takes an inordinate amount of effort to reach out to the different communities and address the practices they have, the views and beliefs they hold close. Our work is not going to be done, by any stretch, through an agreement with one stakeholder community. It really is broad societal awareness that we need to promote to change practices.[123]

Most witnesses strongly supported investments in citizen education, while noting that they must always be evaluated for effectiveness.[124] In particular, increased awareness

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118 Ibid.

119 Greg Farrant, *Evidence*, 23 April 2012.

120 Ibid.

121 Ontario Federation of Anglers and Hunters, *Written Brief*, 23 April 2012.

122 *Fisheries Act*, R.S.C. 1985, c. F-14.

123 Ala Boyd, Manager, Biodiversity Branch, Biodiversity Policy Section, Ontario Ministry of Natural Resources, *Evidence*, 7 May 2012.

124 See for instance: Ladd Johnson, *Evidence*, 25 April 2012.

of the severe economic impact of AIS helps to alter behaviour and therefore prevent unintentional introductions as well as facilitating strong planning and action to address the problem.[125]

D. Control

Despite all efforts to prevent entry and spread of AIS, they can become established. Historically many such species have done so in the Great Lakes. After a species becomes established, controlling the impact of the species on ecosystems and fisheries may become the only option. The best known of these species is the sea lamprey.

Sea Lamprey: A case history

The sea lamprey is one of the most notorious species to have invaded the Great Lakes. It is believed to have spread to Lake Erie with the construction of the Welland Canal, and to have spread throughout the Great Lakes by the 1930s.[126] The sea lamprey's arrival and its subsequent population explosion between the 1930s and the 1950s decimated the commercial lake trout fishery and caused other significant changes to the ecosystem of the Great Lakes.[127]

The Sea Lamprey Control Program is the only mitigation, control and management program for any AIS that is funded on a continuous basis.[128] The Great Lakes Fishery Commission works with DFO, the U.S. Fish and Wildlife Service, and the U.S. Army Corps of Engineers to undertake sea lamprey control.[129] In Canada, the Sea Lamprey Control Centre is based in Sault Ste. Marie, Ontario and is the Canadian agent of the Commission responsible for keeping sea lamprey populations in the Great Lakes basin at a minimum.[130]

The share of funding for the Sea Lamprey Control Program was, pursuant to the Convention, recommended by the Commission to be 31% by Canada and 69% by the United States. Currently Canada and the U.S. spend $8.1 million and $22 million respectively (27% and 73%). Witnesses such as the Bluewater Anglers and the OFAH noted that, in addition to the fact that lamprey fish-wounding rates are up, they also felt that Canada is under-funding the binational control program by approximately $2.5 to $3 million per year, as DFO funding has not changed since 2004.[131] The Great Lakes Fishery Commissioner also mentioned that, according to the funding formula agreed to for

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125 Anthony Ricciardi, *Evidence*, 25 April 2012.

126 Department of Fisheries and Oceans, "Fighting Sea Lamprey with Science," March 2011.

127 Michelle Wheatley, Regional Director, Science, Central and Arctic Region, Department of Fisheries and Oceans, *Evidence*, 2 April 2012.

128 David Gillis, *Evidence*, 2 April 2012.

129 Great Lakes Fishery Commission, "How are Sea Lamprey Controlled," Sea Lamprey Control.

130 Department of Fisheries and Oceans, "Sea Lamprey Control."

131 John Van Rooyen, *Evidence*, 23 April 2012.

implementing the binational treaty, Canada should be providing $15.9 million in fiscal year 2013 to the control effort. In fact, because Canada is behind in its commitment to this program, the U.S. actually subsidized it about $360,000 for the operations of the Sea Lamprey Control Centre, located in Ontario.[132]

Sea lamprey populations are controlled with measures such as lampricides, physical barriers and trapping. The sterile male release program was recently discontinued as it was determined that it was not cost effective.[133] According to DFO, a 90% reduction in sea lamprey populations has been achieved in many areas through these control efforts.[134] However, the Committee also heard that in certain areas, such as the St. Mary's River, sea lamprey numbers remain significantly above target levels. The depth and current of the river have made traditional lampricide treatment ineffective for the St. Mary's River.[135] The OFAH noted that the success of the control program must be looked at on a lake-by-lake basis, and, for Lake Erie, the sea lamprey spawner abundance remains at a pre-control level.[136] The Commission also concurred by stating that "we are above targets in many other areas, including Lake Superior, Lake Huron, and Lake Erie. That means that fishery losses are still occurring."[137]

The use of lampricides has generated some amount of controversy. While DFO officials told the Committee that lampricides do not cause harm to other species, or have very limited impacts,[138] other witnesses explained that there is evidence that lampricides can cause harm to other native lampreys, as well as to the endangered lake sturgeon.[139] New research is continuing into alternatives to lampricides, which includes such approaches as using pheromones to attract lampreys to traps, and using repellents to deter lampreys from entering such areas as spawning grounds.[140] Witnesses noted that without the DFO, NSERC or Commission funding, this research could not take place.[141]

Recommendation 6

The Committee recommends that the Government of Canada support the development of new methods to eradicate sea lamprey from the Great Lakes.

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132 Robert Lambe, *Evidence*, 11 June 2012.

133 Istvan Imre, Assistant Professor, Department of Biology, Algoma University, *Evidence*, 30 April 2012.

134 David Burden, *Evidence*, 2 April 2012.

135 Istvan Imre, *Evidence*, 30 April 2012.

136 Greg Farrant, *Evidence*, 23 April 2012.

137 Robert Lambe, *Evidence*, 11 June 2012.

138 David Gillis, *Evidence*, 2 April 2012.

139 Istvan Imre, *Evidence*, 30 April 2012.

140 Ibid.

141 Hugh MacIsaac, *Evidence*, 16 May 2012.

Conclusion

Because the Great Lakes region is one of the most ecologically sensitive watersheds in the world, it faces significant threats from AIS. Consequently, direct actions to combat AIS have been a priority since the 1950s sea lamprey response. The fight against invasive species has required scientists and officials to find new methods to prevent and control AIS in the Great Lakes. In recent years, for example, enhanced ballast water regulations have been introduced that appear to be effective in limiting the introduction of new AIS. Also, a growing understanding of the seriousness of the threat posed by AIS has resulted in a new emphasis on cooperation among governmental and non-governmental organizations. The GLWQA and the binational risk assessment on Asian carp are important outcomes.

The Government of Canada recently provided an investment of $17.5 million over five years for implementing the Asian Carp Initiative to protect Canada's Great Lakes.[142] Currently, strategies are being developed to enhance prevention measures and to design a plan to mitigate and control the impacts of Asian carps if they should make it into the Great Lakes watershed. The Minister of Fisheries and Oceans has also committed to developing new regulations under the amended *Fisheries Act* to prohibit the import, transport and possession of live AIS such as Asian carps. Because prevention measures depend on the containment effort of our American partners, continued cooperation is essential. Both countries must continue to be fully committed to developing and implementing an effective long-term program to respond to the threat of the Great Lakes posed by AIS.

While these agreements and investments are encouraging, invasive species are an ongoing concern, and not restricted to particular species, however much they may be identified as a current threat. It is necessary for the federal government to develop a comprehensive long-term framework, including funding, with a focus on prevention, to properly address the serious threat that AIS pose to the Great Lakes.

Recommendation 7

The Committee recommends that the Government of Canada develop a comprehensive long-term framework and funding strategy for the management of aquatic invasive species.

142 Government of Canada, *Supplementary Estimates (C) 2012-13*.

GLOSSARY

Common and scientific names for Great Lakes Area fish and aquatic invasive species

Common name	Scientific name
Alewife	*Alosa pseudoharengus*
Bighead carp	*Hypophthalmichthys nobilis*
Fish-hook waterflea	*Cercopagis pengoi*
Lake herring	*Coregonus artedi*
Lake sturgeon	*Acipenser fulvescens*
Lake trout	*Salvelinus namaycush*
Lake whitefish	*Coregonus clupeaformis*
Northern snakehead	*Channa argus*
Pacific salmon	*Oncorhynchus* spp.
Quagga mussel	*Dreissena bugensis*
Rainbow trout	*Oncorhynchus mykiss*
Round goby	*Neogobius melanostomus*
Sea lamprey	*Petromyzon marinus*
Silver carp	*Hypophthalmichthys molitrix*
Spiny waterflea	*Bythotrephes longimanus*
Walleye	*Stizostedion vitreum*
Yellow perch	*Perca flavescens*
Zebra mussel	*Dreissena polymorpha*

LIST OF RECOMMENDATIONS

Recommendation 1

The Committee recommends that the Government of Canada continue to explore the feasibility of regulating ballast water for lake ships internal to the Great Lakes St. Lawrence basin and that any potential regulations be harmonized with those of the United States. 14

Recommendation 2

The Committee recommends that the Government of Canada develop a hull fouling policy. 14

Recommendation 3

The Committee recommends that the Government of Canada work with provincial and territorial partners to increase enforcement to prevent the illegal live trade of invasive species, such as Asian carps and Northern snakeheads..... 19

Recommendation 4

The Committee recommends that the Government of Canada continue to work with the Government of the United States to expand their various efforts to restrict the spread of aquatic invasive species, especially Asian carps, into Canada..... 19

Recommendation 5

The Committee recommends that the Government of Canada network with international partners to determine best practices for the management of aquatic invasive species. 21

Recommendation 6

The Committee recommends that the Government of Canada support the development of new methods to eradicate sea lamprey from the Great Lakes. 24

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APPENDIX A
LIST OF WITNESSES

Organizations and Individuals	Date	Meeting
Department of Fisheries and Oceans	2012/04/02	32
David Burden, Acting Regional Director General, Central and Arctic Region		
David Gillis, Director General, Ecosystems and Oceans Science Sector		
Michelle Wheatley, Regional Director, Science, Central and Arctic Region		
Bluewater Anglers	2012/04/23	33
John Van Rooyen, Hatchery Manager and Board of Directors		
Ontario Federation of Anglers and Hunters		
Greg Farrant, Manager, Government Affairs and Policy		
Terry Quinney, Provincial Manager, Fish and Wildlife Services		
As individuals	2012/04/25	34
Ladd Erik Johnson, Professor, Department of Biology, Laval University		
Anthony Ricciardi, Associate Professor, McGill University		
As an individual	2012/04/30	35
Istvan Imre, Assistant Professor, Department of Biology, Algoma University		
Georgian Bay Association		
Robert Duncanson, Executive Director		
John Wilson, Director and Chair, Fisheries Committee		
Ontario Commercial Fisheries' Association	2012/05/02	36
Peter Meisenheimer, Executive Director		
Purdy Fisheries Limited		
Tim Purdy, Vice-President		
Leigha Purdy, Associate		
Josiah Purdy		
Ontario Ministry of Natural Resources	2012/05/07	37
Ala Boyd, Manager, Biodiversity Branch, Biodiversity Policy Section		

Organizations and Individuals	Date	Meeting
Ontario Ministry of Natural Resources	2012/05/07	37
Tim Johnson, Research Scientist, Applied Research and Development Branch, Aquatic Research		
Francine MacDonald, Senior Invasive Species Biologist, Biodiversity Branch, Biodiversity Policy Section		
Anne Neary, Director, Applied Research and Development Branch		
Canadian Aquatic Invasive Species Network	2012/05/16	39
Hugh MacIsaac, Director, Professor at the Great Lakes Institute for Environmental Research, University of Windsor		
Department of Fisheries and Oceans	2012/05/30	40
Sarah Bailey, Research Scientist, Central and Arctic Region, Great Lakes Laboratory for Fisheries and Aquatics Sciences, Burlington		
Becky Cudmore, Senior Science Advisor, Central and Arctic Region, Great Lakes Laboratory for Fisheries and Aquatics Sciences, Burlington		
Nick Mandrak, Research Scientist, Central and Arctic Region, Great Lakes Laboratory for Fisheries and Aquatics Sciences, Burlington		
International Joint Commission	2012/06/06	41
Joe Comuzzi, Canadian Chair		
Camille Mageau, Secretary		
William D. Taylor, Co-Chair, Science Advisory Board, Work Group on Aquatic Invasive Species Rapid Response		
Great Lakes Fishery Commission	2012/06/11	42
Marc Gaden, Communications Director and Legislative Liaison		
Chris Goddard, Executive Secretary		
Robert Lambe, Commissioner		
Great Lakes and St. Lawrence Cities Initiative	2012/06/18	43
David A. Ullrich, Executive Director		
Department of Fisheries and Oceans	2012/10/16	46
David Burden, Acting Regional Director General, Central and Arctic Region		
Becky Cudmore, Senior Science Advisor, Central and Arctic Region, Great Lakes Laboratory for Fisheries and Aquatics Sciences, Burlington	2012/10/16	46

Organizations and Individuals	Date	Meeting
Department of Fisheries and Oceans	2012/10/16	46
Nick Mandrak, Research Scientist, Central and Arctic Region, Great Lakes Laboratory for Fisheries and Aquatics Sciences, Burlington		

APPENDIX B
LIST OF BRIEFS

Organizations and Individuals
Canadian Chamber of Commerce
Department of Fisheries and Oceans
Georgian Bay Association
Imre, Istvan
Ontario Federation of Anglers and Hunters
RNT Consulting Inc.
Sarnia Lambton Chamber of Commerce

REQUEST FOR GOVERNMENT RESPONSE

Pursuant to Standing Order 109, the Committee requests that the government table a comprehensive response to this Report.

A copy of the relevant *Minutes of Proceedings* (Meetings Nos. 32 to 37, 39 to 43, 46, 65, and 69 to 72) is tabled.

Respectfully submitted,

Rodney Weston

Chair