2011

Invading Species Watch Program Annual Report

Ontario Federation of Anglers and Hunters

2011

ACKNOWLEDGEMENTS

The *Invading Species Watch* program is an initiative of the *Invading Species Awareness Program*, a partnership of the Ontario Federation of Anglers and Hunters (OFAH) and the Ontario Ministry of Natural Resources (OMNR).

We would like to take this opportunity to introduce and thank some of the program's partners. These new and longstanding partnerships allowed for program expansion into new areas and improved delivery in existing areas in 2011:

- Central Lake Ontario Conservation Authority (CLOCA)
- Community Fish and Wildlife Involvement Program (CFWIP)
- Credit Valley Conservation Authority (CVC)
- Dorset Environmental Science Centre
- Federation of Ontario Cottagers' Associations (FOCA)
- Human Resources and Skills Department Canada's Summer Jobs Program
- Kids For Turtles Environmental Education (KFT)
- Lake of the Woods District Property Owners Association (LOWDPOA)
- Lower Trent Conservation
- Manitoulin and Area Stewardship Council
- Manitoulin Streams Initiative
- Ministry of Environment (MOE)
- Ministry of Natural Resources: Pembroke, Kirkland Lake, Sault Ste Marie, and Aurora Districts
- Mississippi Valley Conservation (MVC)
- Nottawasaga Valley Conservation Authority (NVCA)
- Plenty Canada
- Prince Edward Stewardship Council
- Ontario Streams
- Rideau Valley Conservation Authority (RVCA)
- South Nation Conservation
- South Kenora Rainy River Stewardship Council
- Voyageur Provincial Park

We would also like to extend our gratitude to Terry Rees (Federation of Ontario Cottagers' Associations), Bob Bowles (Kids for Turtles Environmental Education), Susan McLeod (Lake of the Woods District Property Owners Association), Anne Anderson (Lower Trent Conservation), Bob Florean (Manitoulin Area Stewardship Council), Dr. Norman Yan (York University and Ministry of the Environment) and Shelly Arnott (Queens University), Don Lewis and Kirby Punt (Pembroke District MNR), Ilsa Langis and Eden Boyko (Sault Ste. Marie District MNR), Tom Savioja (Nipigon District MNR), Susan Lee (Mississippi Valley Conservation), David Featherstone (Nottawasaga Valley Conservation Authority), Larry McDermott and Paulette Caley (Plenty Canada), Andy Margetson (Prince Edward Stewardship Council), Dayna Laxton (Ontario Streams), Patrick Larson and Sarah McLeod (Rideau Valley Conservation Authority), Michelle Scheerder (South Nation Conservation), Patricia Lowe, Diana Shermet (Central Lake Ontario Conservation Authority), Donna Wales (Biodiversity Section MNR), and Renata Claudi of RNT Consulting for their technical advice and support.

We extend thanks to our summer students Michael Brown, Todd Sarrazin, Alex Ross, Adam Sprott, Connor Steele, Janet Greenhorn, Elauna Boutwell, John Peters, Nikki Moreau, Alana Sargeant, Kaitlin Brady, Kurt Wood, Elisha Persaud, Ian Wolski, Laura Stern, Kara Deloughery, Arron McChesney, Candace Leffler, Megan Williams, Shannon Landovskis, and Shannon Card for their hard work and dedication.

We would also like to take this opportunity to thank many of the OFAH staff for their assistance and support, including Sophie Bull, Terry Quinney, Matt Smith, Fraser Smith, Karen Shier and Philip Shaw.

We extend special thanks to the volunteers participating in the *Invading Species Watch* program. Volunteer involvement in monitoring and raising awareness is fundamental to the success of invasive species prevention efforts.

Finally, thanks are also extended to all individuals and lake and cottage associations who financially assisted the *Invading Species Awareness Program* through monetary donations. The support of these organizations has been essential to the success of this program and is appreciated. Thank you. If you wish to contribute to the *Invading Species Awareness Program,* donations can be made to the:

Ontario Federation of Anglers and Hunters
Invading Species Awareness Program
Box 2800, 4601 Guthrie Drive
Peterborough, Ontario, K9J 8L5

EXECUTIVE SUMMARY

The spring of 2011 marked the beginning of another extremely busy and successful year for the *Invading Species Watch* program. The program is in its thirteenth year of operation and is coordinated by the Ontario Federation of Anglers and Hunters (OFAH) in partnership with the Ontario Ministry of Natural Resources (OMNR). In 2011, the program monitored 122 lakes and waterways for the presence of spiny water flea (*Bythotrephes longimanus)* and zebra mussel veligers (*Dreissena polymorpha).*

The program was delivered through the participation of lake associations and conservation clubs across the province. The Rideau Valley Conservation Authority (RVCA), Mississippi Valley Conservation (MVC), South Nation Conservation (SNC), Lower Trent Conservation, Nottawasaga Valley Conservation Authority (NVCA), Central Lake Ontario Conservation Authority (CLOCA), Credit Valley Conservation (CVC), Manitoulin and Area Stewardship Council, Thunder Bay Stewardship Council, Plenty Canada, Lake of the Woods District Property Owners Association, Kids For Turtles Environmental Education, Ontario Streams and the Pembroke, Nipigon, Kirkland Lake and Sault Ste. Marie District MNR offices, enabled the program's delivery by hosting summer students. These summer students were responsible for the recruitment of volunteers and assisting volunteer monitoring efforts in their respective regions. The Federation of Ontario Cottagers' Associations (FOCA) also assisted by promoting the program to their members. Funding for equipment was also provided by the Community Fish and Wildlife Involvement Program.

The response to these new partnerships and continued dedication of existing partners was outstanding, enabling the program to achieve the following objectives:

1. Establish a provincial volunteer network to track the spread of Zebra Mussels *Dreissena polymorpha*), and spiny water flea (*Bythotrephes longimanus*) in Ontario waters.
2. Update Ontario distribution information and an international database that tracks the spread of aquatic invasive species in North America;
3. Increase the local awareness of aquatic invasive species and encouraged greater public involvement in preventing the spread to inland lakes;
4. Provide participants with early identification of the presence of aquatic invasive species, thus providing an opportunity to initiate protection systems to minimize impacts.

Fourteen monitoring kits containing all the necessary equipment and instructions were circulated to program volunteers. In the fall and winter of 2011, RNT Consulting performed the analysis of water samples from the 122 lakes that were monitored during the summer. **Spiny water fleas were discovered in one lake. Zebra mussel veligers were found in 23 lakes, with three new occurrences.**

The results of the *Invading Species Watch* program were entered into a database of existing *Invading Species Watch* records, which allows users to link with existing OMNR databases and information systems, and provides access to the complete lake history. This database also enables the generation of updated GIS based distribution maps of both the spiny water flea and the zebra mussel, which is critical to the development of awareness initiatives and prevention strategies, to prevent the spread of invasive species into new areas.

THE ONTARIO FEDERATION OF ANGLERS AND HUNTERS

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THE ONTARIO FEDERATION OF ANGLERS AND HUNTERS

SECTION 1:

1.0 THE ONTARIO FEDERATION OF ANGLERS AND HUNTERS: WHO WE ARE

The Ontario Federation of Anglers and Hunters (OFAH) is Ontario's largest, non-profit conservation-based organization, representing 100,000 members, subscribers and supporters, and 670 member clubs. The OFAH's dedication to conservation can be seen through our numerous youth and adult conservation programs, fisheries and wildlife research and restoration initiatives, and the partnerships we have formed with government and conservation organizations across the province.

1.1 THE INVADING SPECIES AWARENESS PROGRAM

In 1992, in response to growing concern over the threat of aquatic invasive species to Ontario's lakes and waterways, the OFAH formed a partnership with the Ontario Ministry of Natural Resources (OMNR) to implement the *Invading Species Awareness Program.* The primary objective of the program is to prevent the spread of aquatic invasive species through accessible, educational hands-on programs and initiatives. Some of the program's successful initiatives include:

- **Invading Species Hotline (1 800-563-7711)** – a toll-free Ontario wide number for the public to report sightings or to obtain information on aquatic invasive species.

- **Invasives Tracking System (www.invasivestrackingsystem.ca)** – a web-based database for the public to report sightings or obtain information on invasive species.

- **Purple Loosestrife Biological Control** – an initiative to control purple loosestrife through the introduction of leaf-eating beetles (*Galerucella spp)* in co-operation with a variety of partners including O.M.N.R, the Ontario Wetland Habitat Fund, Ontario Beetles, the University of Guelph and concerned citizens. Purple loosestrife bio-control has resulted in reductions of purple loosestrife of more than 80% in many areas across the province.

- **Invaders in Our Waters DVD -** An interactive DVD with downloads of educational material in both English and French. The DVD also includes short informative video breaks describing the impacts, pathways of introductions and prevention of invasive species. The DVD is available to schools, libraries, public interest groups and cottage associations for presentations.

- **Making Waves! Protecting Aquatic Habitats From Invasive Species -** Curriculum and lesson plans designed to assist grade 4 and grade 6 teachers to introduce students to the concept of healthy habitats and our role in protecting them from invasive species.
- **Invasive Species Workshops** – The invading species workshops are designed to provide training on the proper methods of invasive species collection and identification.
- **Early Detection Network –** The Early Detection Network is comprised of interested citizen scientists and industry professionals dedicated to the early detection of invasive species. The network includes available training on identification and monitoring for invasive species as well as a monthly newsletter sent to every member of the network updating network initiatives. For more information of the Early Detection Network please call the Invading Species Hotline at 1-800-563-7711.

SECTION 2:

2.0 INVADING SPECIES WATCH

2.1 PROJECT GOALS AND OBJECTIVES

In 1998, in response to the need for information on the spread and distribution of invasive species in Ontario waterways, the OFAH created the *Invading Species Watch* program. Since this time, over 600 lakes have been monitored for the presence of zebra mussel and spiny water flea through this volunteer based program. Each year a growing number of cottage associations, conservation organizations, and concerned citizens participate in this important initiative.

The objectives of the program are the following:

1. Establish a volunteer network to track the spread of zebra mussel (*Dreissena polymorpha)* and spiny water flea (*Bythotrephes longimanus)* in Ontario waters;

2. Increase local awareness of the threat of aquatic invasive species and encourage greater public involvement in preventing the spread to Ontario's inland waters;

3. Update Ontario distribution maps and contribute to an international database that tracks the spread of aquatic invasive species in North America;

4. Provide participants with early identification of the presence of aquatic invasive species, thus providing an opportunity to initiate prevention measures to minimize impacts and spread;

5. Expand the monitoring program into regions of the province that have not been monitored extensively, such as northern Ontario.

The program is operated on a partnership basis with a variety of government agencies, non-government organizations, academic institutions and community groups including:

- Central Lake Ontario Conservation Authority (CLOCA)
- Community Fish and Wildlife Involvement Program (CFWIP)
- Credit Valley Conservation Authority (CVC)
- Dorset Environmental Science Centre
- Federation of Ontario Cottagers' Associations (FOCA)
- Georgian Bay Stewardship Council
- Human Resources and Skills Department Canada's Summer Jobs Program
- Kids For Turtles Environmental Education (KFT)
- Lake of the Woods District Property Owners Association (LOWDPOA)
- Lower Trent Conservation
- Manitoulin and Area Stewardship Council
- Manitoulin Streams Initiative
- Ministry of Environment (MOE)
- Ministry of Natural Resources: Pembroke, Kirkland Lake, Sault Ste Marie, and Aurora Districts
- Mississippi Valley Conservation (MVC)

- Nottawasaga Valley Conservation Authority (NVCA)
- Plenty Canada
- Ontario Streams
- Rideau Valley Conservation Authority (RVCA)
- South Nation Conservation
- University of Windsor
- Voyageur Provincial Park

Would your group or organization like a presentation on invading species?

Staff members of the Invading Species Awareness Program are available to give formal presentations at your lake association meetings or community events. Please contact the Invading Species Hotline at **1-800-563-7711** for more information.

SECTION 3:

3.0 METHODS
3.1 VOLUNTEER RECRUITMENT

In 2011, the program was promoted extensively to recruit new volunteers from across the province. Program promotion occurred at 100 events including a variety of major trade shows as well as lake association and stewardship council meetings and local community events including the Toronto Boat Show, the Toronto Sportsmen Show, and the Spring Cottage Life Show.

3.2 MEDIA PROMOTION:

The *Invading Species Awareness Program* was also promoted through a variety of media across the province, including over 80 newspaper, radio, and magazine articles.

3.3 PROGRAM PARTNER PROMOTION:

ISAP program staff promoted the program through the *Invading Species Hotline,* as well as through their attendance at trade shows and conferences. RVCA, SNC, MVC, Manitoulin Area Stewardship Council and LOWDPA also promoted the *Invading Species Watch* program through their community programs and initiatives such as the Watershed Watch program.

3.4 PROGRAM IMPLEMENTATION

The OFAH coordinates the participation of lake associations and volunteers. Volunteers receive an introductory package in the early spring (prior to their sampling date), which includes the sample bottles, forwarding instructions, courier labels and scheduled date to receive the monitoring equipment during the summer.

Twelve students in partnership with the Rideau Valley, South Nation, and Mississippi Valley Conservation Authorities, Pembroke, Kirkland Lake, and Sault Ste. Marie OMNR District Offices, OFAH, and Lake of the Woods District Property Owners Association, and the Georgian Bay Stewardship Council coordinated and facilitated volunteers, as well as lake associations and conservation clubs in their respective areas. These students managed volunteers in their areas, arranged sampling dates and assisted volunteers with actual sampling. In addition, they increased public awareness of invasive species by attending over 100 events throughout the summer.

Figure 2: Summer students with the Invading Species Awareness Program 2010

3.5 PROGRAM MONITORING

Following the protocol in the program manual, participants monitored their lakes once between mid-June and early September; collecting lake samples using plankton haul nets (63 microns) at 3-5 locations on the lake. In total, 341 Samples were collected from 122 lakes averaging 2.8 samples per lake. The participants were responsible for disinfecting the equipment before and after they monitored their lakes. The samples were returned to the OFAH, and then shipped to RNT Consulting for analysis. In total 14 monitoring kits were circulated in the summer of 2011 to volunteers throughout Ontario, sampling 122 lakes.

3.6 PROGRAM ANALYSIS: METHODS

RNT Consulting provided analysis of the plankton samples, following the Schaner protocol using a sugar solution to separate zebra mussel veligers from the sample[1] (Schaner, 1990). The refined sample was then observed under a cross-polarized light, as described by Johnson (Johnson, 1995) to cause the zebra mussel veligers to appear as small glowing 'D' shaped objects with dark crosses. [2] Volunteers were contacted at the end of the program and provided with the results.

[1] Schaner, Ted, 1990. Detection of Zebra Mussel Veligers in Plankton Samples Using Sugar Solution. Ontario Ministry of Natural Resources, Lake Ontario Fisheries Unit 1990 Annual Report, LOA 91.1 (Chapter 6).
[2] Johnson, L.E., 1995. Enhanced Early Detection and Enumeration Of Zebra Mussel (Dreissena spp.) Veligers Using Cross-Polarized Light Microscopy, Williams College-Mystic Seaport.

3.7 RESULTS

Of the 122 lakes or waterways sampled in 2011, spiny waterflea were discovered in one lake. Zebra mussel veligers were found in 23 lakes with three first occurrences.

Spiny Water Flea and Zebra Mussel veligers were discovered in the following lakes:

Zebra Mussel *(Dreissena polymorpha)*

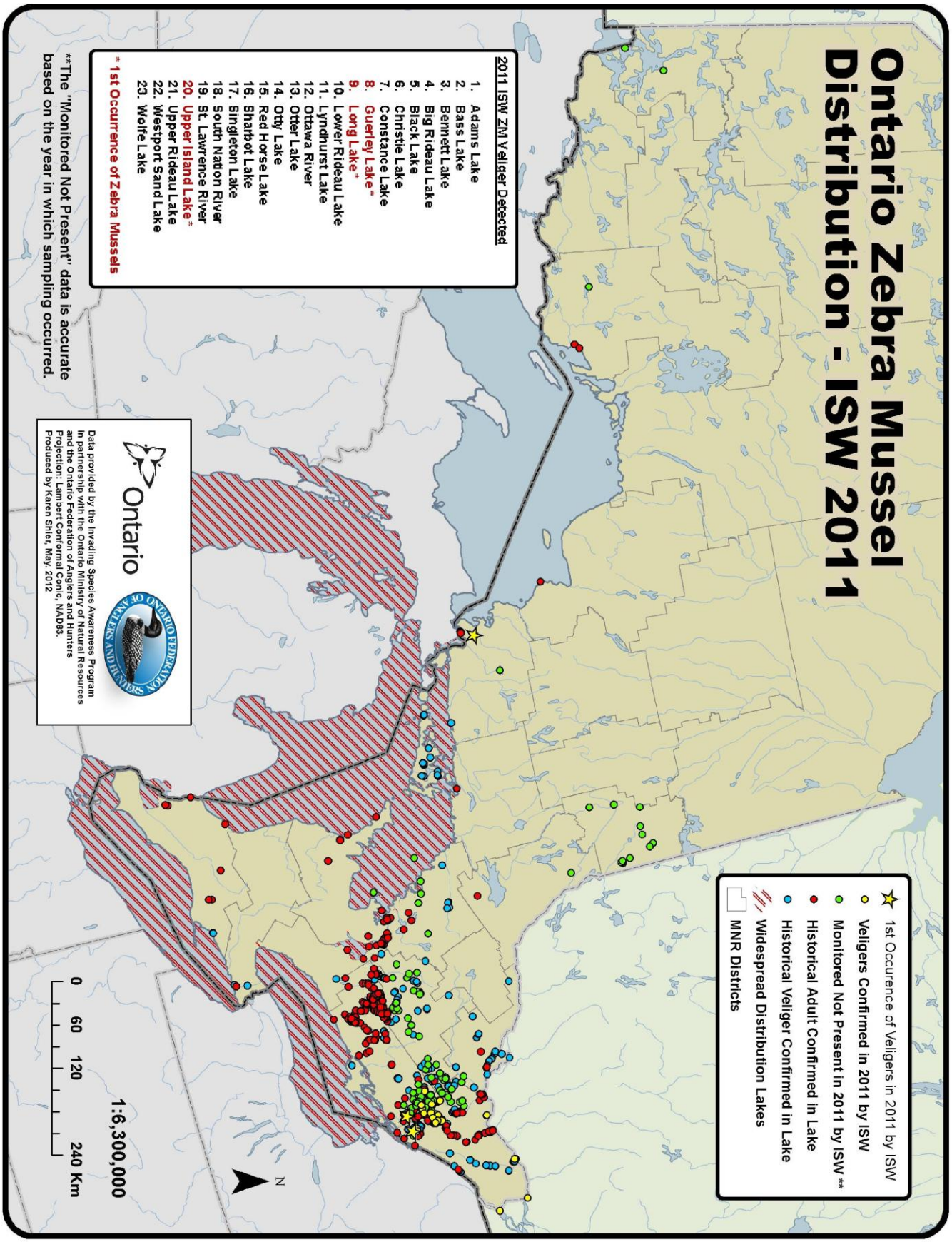
Official Name	County	Township
Adams Lake	Lanark County	Burgess
Bass Lake	Leeds and Greenville	Elmsley
Bennett Lake	Lanark County	Bathurst
Big Rideau Lake	Lanark County	Burgess
Black Lake	Lanark County	Burgess
Christie Lake	Lanark County	South Sherbrooke
Constance Lake	Ottawa Division	March
Guerley Lake	**Frontenac County**	**Pittsburgh**
Long Lake	**Leeds and Greenville**	**Lansdowne**
Lower Rideau Lake	Lanark County	Elmsley
Lyndhurst Lake	Leeds and Greenville	Lansdowne
Ottawa River	Presscot and Russell	East Hawksbury
Otter Lake	Leeds and Greenville	Elmsley
Otty Lake	Lanark County	Burgess
Red Horse Lake	Leeds and Greenville	Lansdowne
Sharbot Lake	Frontenac County	Oso
Singleton Lake	Leeds and Greenville	Lansdowne
South Nation River	Presscot and Russell	Plantagenet
St Lawrence River	Stormont, Dundas, and Glengarry	Lancaster
Upper Island Lake	**Algoma District**	**Aweres**
Upper Rideau Lake	Leeds and Greenville	North Crosby
Westport Sand Lake	Leeds and Greenville	North Crosby
Wolfe Lake	Leeds and Greenville	North Crosby

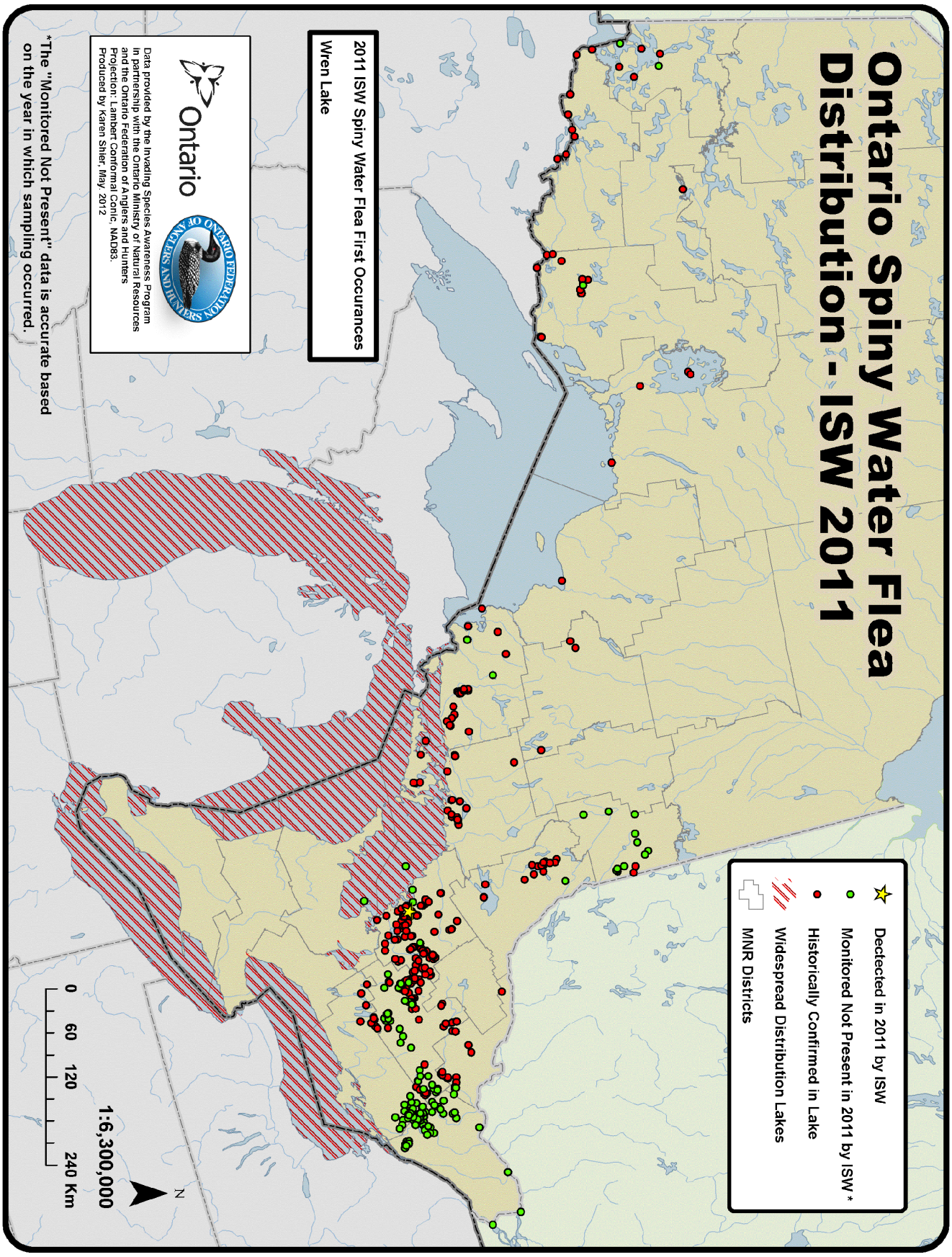
Spiny Waterflea *(Bythotrephes longimanus)*

Official Name	County	Township
Horseshoe Lake	Parry Sound District	Christie

bolded names are first occurrences of reports within the Invading Species Watch database

All participants, regardless of their individual lake results were encouraged to use the extensive resources of the *Invading Species Awareness Program* to raise public awareness of invasive species and to encourage their involvement in prevention measures. A list of available resources and an order form is available on the OFAH website at www.invadingspecies.com.


Ontario Zebra Mussel Distribution - ISW 2011
1st Occurence of Veligers in 2011 by ISW
Veligers Confirmed in 2011 by ISW
Monitored Not Present in 2011 by ISW **
Historical Adult Confirmed in Lake
Historical Veliger Confirmed in Lake
Widespread Distribution Lakes
MNR Districts
2011 ISW ZM Veliger Detected
1. Adams Lake
2. Bass Lake
3. Bennett Lake
4. Big Rideau Lake
5. Black Lake
6. Christie Lake
7. Constance Lake
8. Guerley Lake*
9. Long Lake*
10. Lower Rideau Lake
11. Lyndhurst Lake
12. Ottawa River
13. Otter Lake
14. Otty Lake
15. Red Horse Lake
16. Sharbot Lake
17. Singleton Lake
18. South Nation River
19. St. Lawrence River
20. Upper Island Lake *
21. Upper Rideau Lake
22. Westport Sand Lake
23. Wolfe Lake
* 1st Occurrence of Zebra Mussels
**The "Monitored Not Present" data is accurate based on the year in which sampling occurred.
Ontario
Data provided by the Invading Species Awareness Program in partnership with the Ontario Ministry of Natural Resources and the Ontario Federation of Anglers and Hunters
Projection: Lambert Conformal Conic, NAD83.
Produced by Karen Shier, May, 2012
N
0 60 120 240 Km
1:6,300,000


Ontario Spiny Water Flea
Distribution - ISW 2011
Dectected in 2011 by ISW
Monitored Not Present in 2011 by ISW *
Historically Confirmed in Lake
Widespread Distribution Lakes
MNR Districts
2011 ISW Spiny Water Flea First Occurances
Wren Lake
Ontario
Data provided by the Invading Species Awareness Program in partnership with the Ontario Ministry of Natural Resources and the Ontario Federation of Anglers and Hunters
Projection: Lambert Conformal Conic, NAD83.
Produced by Karen Shier, May 2012
*The "Monitored Not Present" data is accurate based on the year in which sampling occurred.
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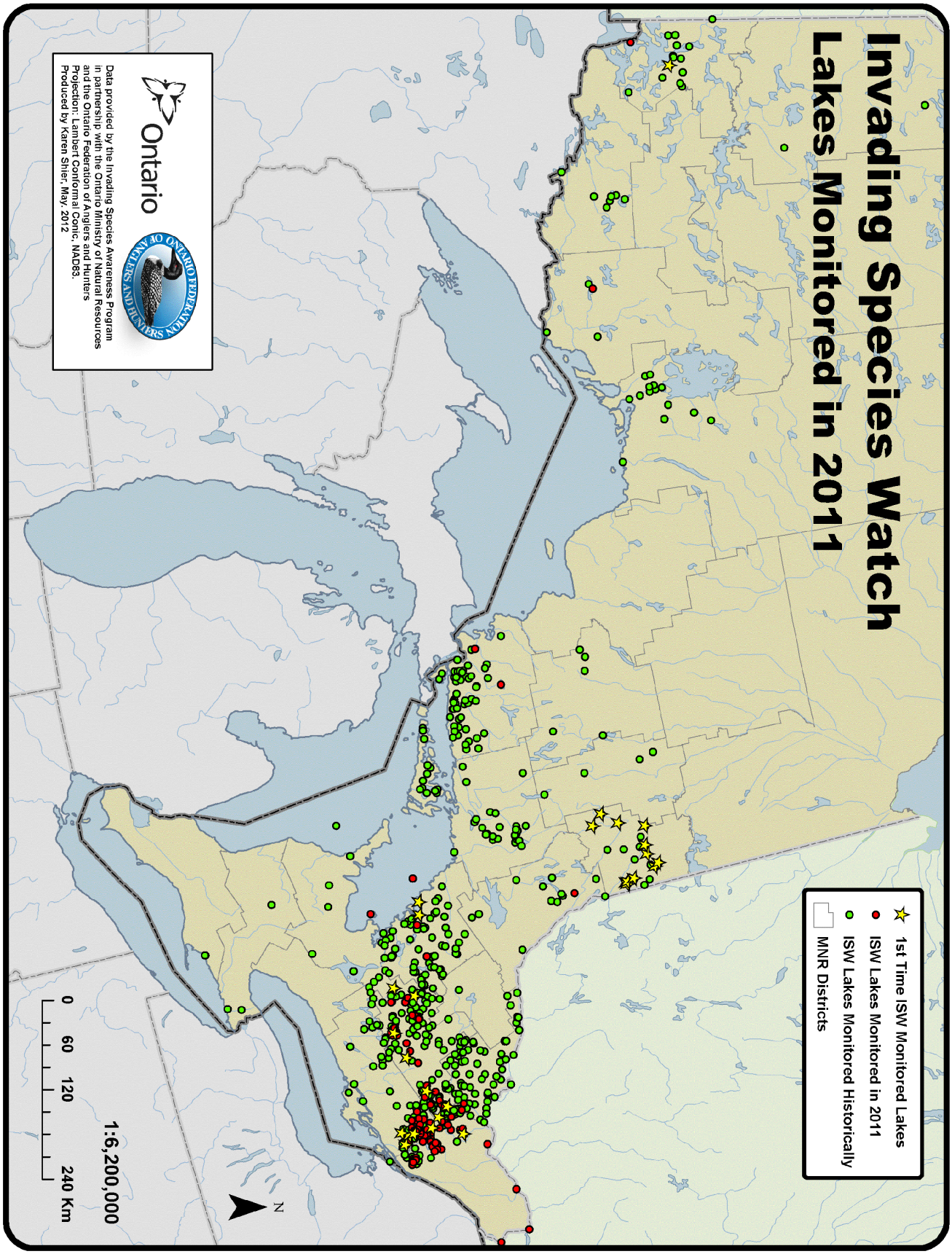

Invading Species Watch
Lakes Monitored in 2011
1st Time ISW Monitored Lakes
ISW Lakes Monitored in 2011
ISW Lakes Monitored Historically
MNR Districts
Ontario
ONTARIO FEDERATION OF ANGLERS AND HUNTERS
Data provided by the Invading Species Awareness Program in partnership with the Ontario Ministry of Natural Resources and the Ontario Federation of Anglers and Hunters
Projection: Lambert Conformal Conic, NAD83.
Produced by Karen Shier, May, 2012
N
0 60 120 240 Km
1:6,200,000

SECTION 4:

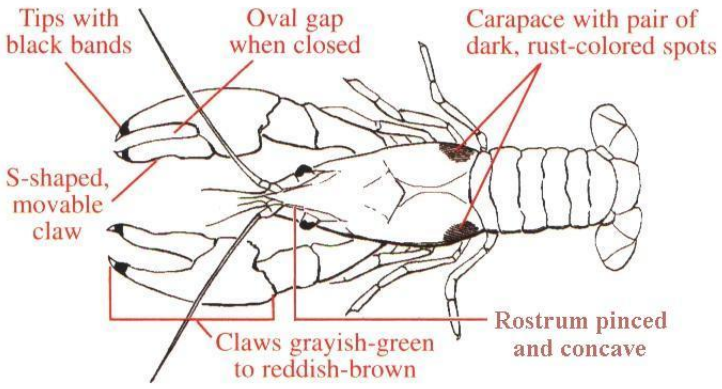
4.0 *INVADING SPECIES WATCH*

4.1 NEW SPECIES

The Invading Species Watch Program has primarily investigated the distribution of the spiny water flea and zebra mussel. However, there are many other invasive species that are also of concern. With that in mind, the OFAH, in cooperation with the OMNR and Dr. Premek Hamr, has developed a new rusty crayfish monitoring protocol. If you would like to assist us by monitoring for rusty crayfish, please contact the Invading Species Hotline at 1-800-563-7711.

Rusty crayfish are native to the United States. They degrade aquatic habitats by feeding heavily on aquatic vegetation and cause harm to native fish populations by feeding on their eggs and fry. Rusty crayfish are very aggressive and often outcompete native crayfish species for food and habitat. In areas of rusty crayfish invasion, native crayfish species have been known to decline or disappear.

General Characteristics of rusty crayfish are the rusty red patches on their body, black tips on their claws and their rostum (the area between the eyes) appears pinched and concave. Use the following illustration as a guide to identify rusty crayfish; please note that some characteristics may be absent in live specimens. If you see a rusty crayfish, keep a sample and report the sighting to the Invading Species Hotline.



In addition to monitoring for rusty crayfish, the *Invading Species Watch* Program will continue to expand the number of lakes it monitors and to make even more presentations to spread awareness of the threat of invasive species. There are many other species such as Eurasian water milfoil, round goby, and European frogbit that pose a threat to Ontario's native species, If you would like to monitor for these or any other invasive species, you can contact the Invading Species for details or feedback.

APPENDIX A: GENERAL INVASIVE SPECIES INFORMATION

INVADING SPECIES: REASONS FOR CONCERN

Invading species create serious ecological and economic problems in Ontario, Canada and the world. The introduction of new invading species occurs on a regular basis through various pathways. There are over 185 non-indigenous species found in the Great Lakes basin alone. Although most species may be benign, or have not been studied, approximately 10% of these species have had significant ecological and/or economic impacts.

Although the details of these impacts are not fully known, there is an agreement among the scientific community that invading species threaten biodiversity. The Committee on the Status of Endangered Wildlife estimated that 25% of Canada's endangered species, 31% of Canada's threatened species and 16% of Canada's vulnerable species are in some way at risk from non-native species (Lee, 2002). Other researchers predict that aquatic invasive species will contribute to extinction rates of 4% per decade, suggesting that fresh water organisms will go extinct 5 times faster than terrestrial organisms and 3 times faster than coastal species (Ricciardi & Rasmussen, 1999).

INVADING SPECIES: PATHWAYS OF INTRODUCTION

Invading species can enter new geographical areas by various means; both natural and human-made. Natural means of introduction include wind, water current, and animal assisted dispersal. Man-made pathways of introduction include shipping and ballast water, canals, the aquarium and horticultural trades, bait buckets and illegal fish transfers.

INVADING SPECIES: PATHWAYS OF SPREAD

Once these non-indigenous species are in Ontario waters, they can spread from waterbody to waterbody by both natural and human made pathways. Animals or water currents can carry and disperse invading species; however, the major pathway of spread involves human activities. Recreational boating and angling can inadvertently spread these invaders to new waterbodies. It is of critical importance to ensure that boats, trailers, motors etc. are properly cleaned and disinfected before leaving a waterbody. For more information regarding this procedure, please contact the Invading Species Hotline at 1-800-563-7711 or visit www.invadingspecies.com.

INVADING SPECIES: WHY DO THEY FLOURISH IN THEIR NEW HOMES?

Typically, invading species flourish in new waterbodies for a number of reasons. Most have few or no predators and or diseases in their new habitats to keep their populations in balance. Further these species reproduce quickly and in some cases more often than native species. Additionally, invading species often have an ability to adapt to various ecosystems

and environmental conditions. These characteristics, combined with numerous mechanisms for spread, enable invasive species to rapidly become established when introduced to new locations.

Unfortunately, once an invading species becomes established there is often little that can be done to eradicate them from a waterbody. This reaffirms the importance of prevention efforts.

APPENDIX B: ZEBRA MUSSEL INFORMATION

THE ZEBRA MUSSEL: BIOLOGY OF INVASION

The zebra mussel was originally native to the Caspian Sea and Ural River in Asia. In the nineteenth century, it spread west and now occurs in most of Europe, the western portion of the Commonwealth of Independent States (formally the Soviet Union) and Turkey. In the mid 1980's, a Eurasian vessel released ballast water into the Great Lakes region that contained either adult or larval forms of the zebra mussel (*Dreissena polymorpha)*. Zebra mussels were first discovered in water intake pipes in industrial and municipal water plants in Lake St. Clair near Detroit in 1988. Today, zebra mussels have successfully invaded all of the Great Lakes, the Rideau and Trent Severn waterways and a number of inland waterbodies in Ontario.

The most notable traits attributing to the rapid spread of the zebra mussel are its prolific reproductive capabilities and methods of dispersal by natural or human induced means. The microscopic zebra mussel larva (veligers) are free swimming and rely on water currents and wave action to transport them to new locations downstream. Due to their microscopic size, veligers can be transferred to new waterbodies via the bilge water and bait buckets of unsuspecting boaters or anglers. Additionally, adult zebra mussels can attach to any hard surface and can be easily transferred to new waters via boat hulls as well as attached to aquatic plants on boat trailers. Recreational boating is generally recognized as being the main facilitator in the dispersal of zebra mussels to new locations within connected lakes or waterways (upstream systems) and inland lakes.

THE ZEBRA MUSSEL: BIOLOGY

Figure 2: Zebra Mussel
Source: The O.F.A.H.

The zebra mussel (*Dreissena polymorpha)* is a freshwater clam (mollusc) that can be distinguished from native clams by its brown and cream to yellow stripes and flat to concave shell bottom. These free-swimming microscopic planktonic veliger, also distinguish zebra mussels from the two families of native clams, *Unioniidea* and *Sphaeriidae*, which do not produce free-swimming larval forms.

Male and female zebra mussels participate in either one or two spawning events per year typically between May to September and possibly as late as October. Zebra mussels normally begin to reproduce when water temperatures reach 12° Celsius (Table 1). One female zebra mussel can produce between 40,000 and 1 million eggs per season. Microscopic eggs hatch and release veligers. Over a period of 3 weeks veligers grow a thin "D" shaped transparent shell and slowly settle to the bottom of the lake or waterway. They then attach to any firm surface using byssal (sticky) threads. "An individual zebra mussel can attach to an object with more than 100 byssal threads that are secreted from a gland at the base of its foot."[3] These byssal threads also distinguish the zebra mussel from native

[3] US Army Corps of Engineers: Zebra Mussels: Biology, Ecology and Recommended Control Strategies. Technical Note ZMR-1-01

North American fresh water clams that only have a single thread that is present only in the juvenile stage. Development from the egg stage to the settling stage is highly variable and is largely influenced by temperature, the warmer the water the faster the development.

After an immature mussel settles it can remain attached to a hard substrate for life. However, if conditions become unsuitable, from physical disturbance, poor water quality or water temperature changes, zebra mussels can release from their byssal threads. Individuals can then be carried passively, with the assistance of water currents, attach to new surfaces by secreting new byssal threads. Additionally, zebra mussels can crawl by extending a foot-like structure, anchoring it to substrate with mucus and then contracting the muscles to pull the body forward. Small individuals are more mobile than large mussels.

Will Zebra Mussels Survive In My Lake?

	No Survival		**Poor Growth**		**Mod. Growth**		**Good Growth**		**Best Growth**
Criteria	**From**	**To**	**From**	**To**	**From**	**To**	**From**	**To**	
Alkalinity (mg $CaCO_{3/l}$)	0	17	18	35	36	87	88	122	>122
Calcium (mg/l)	5	6	10	11	25	26	35	>35	
Total Hardness (mg $CaCO_{3/l}$)	0	22	23	41	43	90	91	125	>125
Conductivity (μ Siemens)	0	21	22	36	37	82	83	110	>110
PH	0	6.8	6.9	7.4	7.5	7.8	7.9	8.0	>8.0
Temperature (°C)[a]	<-2	>40	0-8	28-30	9-12	25-27	13-17	21-24	18-20

Table 1: Approximate Growth Performance of Zebra Mussels in Relation to Alkalinity, Calcium, Total Hardness, Conductivity and pH. [4]

Note: Temperature should be interpreted with caution here because it affects mussels at both high and low values. For example there is no survival at temperatures below –2 or above 40°C but there is survival between these temperatures; there is poor growth both between 0-8°C and 28-30°C but moderate to best growth between these extremes.

Zebra Mussels Under The Microscope!

One of the simplest and most efficient methods for analyzing the *Invading Species Watch* Program water samples involves the use of cross-polarized light. Zebra mussel larvae are one of the few reflective objects found in the samples. Larvae are reflected due to the calcium structure of the larval shell and they glow as bright spots under polarized light. Because of the arrangement of the calcium particles, portions of the shell do not reflect the light and thus the veligers appear with small glowing "Maltese" crosses. Under the polarized light zebra mussels can be confused with ostracods and are distinguished based on size, shape, or other features. However cross-polarized light provides a simple way to narrow the range of possibilities from hundreds of aquatic species captured in a plankton haul.

[4] Claudi, Renata and Mackie Gerald, L. 1994. Practical Manual for Zebra Mussel Monitoring and Control. Lewis Publishers: Boca Raton, Florida USA.

THE ZEBRA MUSSEL: IMPACTS OF THE INVASION IN ONTARIO

ECOLOGICAL IMPACTS

Aquatic ecosystems that have established zebra mussel populations can experience significant alterations from their natural state including food, habitat and biodiversity-related alterations.

Food Related Alterations

Zebra mussels are filter feeders, removing microscopic plant and animal matter from water as a source of food. Each mussel can filter about one litre of lake water per day. However, not all of what they consume is digested. What they don't eat is combined with mucus as "pseudo-feces" and is discharged onto the lake bottom where it accumulates.

A consequence of their filtering capabilities includes the reduction of phytoplankton (algae) diversity and numbers from the water column. Zebra mussels also remove, through filtering, small animals (i.e. rotifers, immature copepods). As phytoplankton and zooplankton are a source of food for larval fish and young fish, they may compete with zebra mussels for this important food source.

The zebra mussel has also been linked to the decline of diporeia, a tiny shrimp-like amphipod, in the Great Lakes, which is an important food source for many fish species. Since the early 1990's, populations of diporeia have either disappeared or dramatically declined in many areas of the Great Lakes. For example, in the Kingston basin of Lake Ontario, diporeia abundance has fallen to near zero, from a previous level of 14,000 per square meter.[5] Diporeia is an organism that formerly represented up to 70% of the Great Lakes biomass of bottom-dwelling invertebrates. Diporeia's decline has caused a major food chain disruption, affecting fish species such as whitefish.

Habitat Related Alterations

When zebra mussels filter water organisms, matter is removed from the water and as a result water clarity increases. Sunlight can then penetrate further into the water column, causing an increase in plant growth. This increase in sunlight is detrimental to light sensitive fish such as walleye and could force these fish to re-locate to darker and deeper areas of the lake or waterway. However, this increased light penetration can have positive effects for certain species including bass and pike, which flourish in high light environments.

Fish spawning habitats may also be altered by the colonization of zebra mussels on rocks. Many fish species depend on rocky or cobble surfaces and the crevices between them for suitable spawning habitat. Once the zebra mussel colonizes an area, these crevices disappear. In a typical zebra mussel infestation, adult zebra mussels can reach densities in the thousands per square metre. These high densities negatively impact both fish spawning habitats and smaller native aquatic organisms, which, feed on fine particles from the water, and have to compete with the zebra mussel for food. Additionally the sedimentation that

[5] Lozano, S.J., Scharold, J.V., and Nalepa, T.F. 2001. Recent declines in benthic macroinvertebrate densities in Lake Ontario. Can. J. Fish. Aquat. Sci. **58**: 518-529.

results from the excretion of pseudo-feces and feces fills the preferred spawning areas and crevices between them that fish depend upon.

Contaminant Bioaccumulation

Recent studies in North America have demonstrated high levels of contaminant bioaccumulation in zebra mussels (Bioaccumulation is described as the accumulation of contaminants by aquatic organisms from sources such as water, food and in the case of zebra mussels, suspended sediment particles in the water column). These toxins may become available to zebra mussel predators higher in the food chain. Contaminants found in zebra mussel populations include hexachlorobenzene and pentachlorophenol. In the Netherlands, analysis of zebra mussels indicated that they had accumulated cadmium, mercury, lead, PCB's, pesticides, and petroleum hydrocarbons (Reeders and Bij de Vaate 1992). Not only does the zebra mussel absorb these deadly contaminants in their body tissues, but they can also release them into the sediment through their pseudo-feces.

Since zebra mussels have invaded the Great lakes, scientists have noted a decline in greater and lesser scaup duck populations. These waterfowl feed on zebra mussels and scientists are concerned that they may accumulate selenium in their tissue, possibly affecting lesser scaup reproductive ability. (Petrie, 2002)

Biodiversity Alterations

Zebra mussels have also severely affected native clam populations in the Great Lakes by interfering with their ability to feed, grow, move, and reproduce. Nine species of clams have disappeared or declined in Lake Erie since the introduction of zebra mussels. Data from Lake St. Clair indicated that in 1990, 100% of the clams were encrusted with zebra mussels with an average of 638 zebra mussels per clam. Many clams had between 1,000 and 2,000 zebra mussels. In 1991 the density of living clams was only one eightieth of 1990 levels and the number of living clam species had decreased from 11 to 4. (Gillis and Mackie 1992)

ECONOMIC IMPACTS

The most visible and dramatic effects of zebra mussels occur in industrial and municipal facilities. Intake pipes and screens of facilities i.e. power plants, factories, municipal drinking water facilities become clogged with large colonies of zebra mussels. The economic impacts of zebra mussels in Ontario are staggering. While exact figures are difficult to generate, the following figures are known:

Figure 2. A pipe clogged by zebra mussels (provided by Peter Yates)

- Ontario Power Generation spends approximately $20 million per year for zebra mussel control; and
- Canada spends an estimated $500 million annually on alien species control efforts in the Great Lakes (Commissioner of the Environment and Sustainable Development 2001).

In the Great Lakes region, industrial plants and public utilities have been shut down periodically to deal with damage caused by zebra mussels. This costs millions of dollars in repair costs and lost production.

Socio-economic impacts can occur on public and private beaches, which become littered with thousands of zebra mussels, which produce an unpleasant odour and zebra mussel shells are sharp which render beaches painful to walk on. The habitat changes caused by zebra mussels such as the promotion of aquatic weed growth can also restrict recreational boating and swimming activities.

Due to the ecological and economic impacts of the zebra mussel, it is recognized as one of the world's worst invaders. The zebra mussel has spread throughout the Great Lakes and numerous inland lakes in southern Ontario within a mere 15 years. This is an astounding fact considering this range spans across 3 different eco-zones, each with markedly different climates, geography and lake or waterways. There continues to be many unanswered questions about zebra mussels regarding their impacts and potential distribution in Ontario. The *Invading Species Watch* program is contributing to answering these critical questions by documenting the distribution of zebra mussels and providing resource managers with critical information about the dispersal and lake conditions necessary for invasion.

APPENDIX C: SPINY WATER FLEA INFORMATION

THE SPINY WATER FLEA: BIOLOGY OF INVASION

It is likely that the spiny water flea (*Bythotrephes longimanus)*, like the zebra mussel, was introduced to the Great Lakes from the discharge of ship ballast water. The first recorded occurrence of the spiny water flea in North America was in Lake Ontario in 1982, and by 1987 it was present in all of the Great Lakes. Now you can also find spiny water flea in many inland lakes and waterways throughout Ontario.

Due to their small size, eggs and adults are easily transferred to new lakes or waterways as stowaways in the bilge, and transom wells of boats and other personal watercraft, or spread through infested angling or boating equipment such as fishing lines, downrigger cables and anchor ropes.

THE SPINY WATER FLEA: BIOLOGY

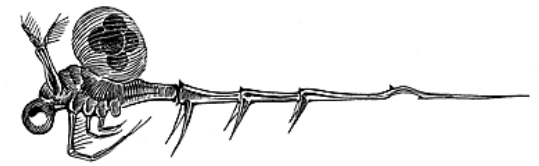


Figure 4: The Spiny Water Flea
Source: Bell Museum, University of Minnesota

The spiny water flea belongs to the class Crustacea, a group of animals such as crabs and shrimps that possess a hard exoskeleton (outer shell). This Eurasian animal is approximately 1 cm in length, and as its name suggests, has a long barbed tail spine that accounts for 80% of its length. The spine contains from one to four pairs of barbs, which can be used to determine the age of the animal (US Sea Grant, 2005). Like all other Crustacea, its exoskeleton moults in order to grow. The spiny water flea is unique because it sheds only the exoskeleton that covers its body, retaining the exoskeleton that covers the tail spine. The animal is never without its long, stout spine, which suggests that the tail serves a vital protective function. (US Sea Grant, 2005)

The head has a large black eye and a pair of swimming antennae. Also present are a pair of jaws which are used to pierce and shred its prey. This animal has four pairs of legs; the first, longer pair is used for catching prey, whereas the other pairs of limbs are designed for grasping prey while they are being consumed. Spiny water flea is a voracious predator and can eat up to 20 organisms of zooplankton daily.

SPINY WATER FLEA: IMPACTS OF THE INVASION IN ONTARIO

ECOLOGICAL IMPACTS

Like the zebra mussel, the spiny water flea can have significant and rapid impacts on lake ecosystems, many of which still remain unknown. However recent research initiatives have identified several impacts including native zooplankton species reduction, food chain disruptions, and water clarity reductions

Spiny water flea consumes up to three times as much as native species of zooplankton. Spiny water flea consumes smaller species of native zooplankton such as *Daphnia,* which is an important food source for juvenile fish species. As a result the spiny water flea competes directly with these juvenile fish for food. When populations of this invader are high,

consumption is significant, and the amount of food available to native species of predatory zooplankton, smaller forage fish, and juvenile fish is largely reduced.

Planktivorous fish such as whitefish and lake herring feed on spiny water flea. However, studies have indicated that juvenile fish smaller than 10 cm in length are unable to use the spiny water flea as a source of food due to the long tail spine, which prevents them from swallowing it. Research by Rae Barnhisel of Michigan Technological University found that young yellow perch cough up the spiny water flea because of the long tail spine, which prevents that fish from swallowing it.

APPENDIX D: 2010 INVADING SPECIES WATCH RESULTS

Results from the *Invading Species Watch* in 2011:

Waterbody	County	Township	Spiny Water Flea	Zebra Mussel
Adams Lake	Lanark County	Burgess	N	Y
Adams Lake	Lanark County	Burgess	N	Y
Adams Lake	Lanark County	Burgess	N	Y
Adams Lake	Lanark County	Burgess	N	Y
Adams Lake	Lanark County	Burgess	N	Y
Amikougami Lake	Timiskaming District	Teck	N	N
Amikougami Lake	Timiskaming District	Teck	N	N
Amikougami Lake	Timiskaming District	Teck	N	N
Amikougami Lake	Timiskaming District	Teck	N	N
Bagot Long Lake	Renfrew County	Bagot	N	N
Bagot Long Lake	Renfrew County	Bagot	N	N
Bagot Long Lake	Renfrew County	Bagot	N	N
Bass Lake	Leeds and Grenville United Counties	Elmsley	N	N
Bass Lake	Leeds and Grenville United Counties	Elmsley	N	Y
Bass Lake	Leeds and Grenville United Counties	Elmsley	N	N
Beaver Lake	Peterborough County	Cavendish	N	N
Beech Lake	Haliburton County	Stanhope	N	N
Beech Lake	Haliburton County	Stanhope	N	N
Beech Lake	Haliburton County	Stanhope	N	N
Bennett Lake	Lanark County	Bathurst	N	Y
Bennett Lake	Lanark County	Bathurst	N	Y
Big Rideau Lake	Lanark County	Burgess	N	Y
Big Rideau Lake	Lanark County	Burgess	N	Y
Big Rideau Lake	Lanark County	Burgess	N	Y
Black Lake	Lanark County	Burgess	N	Y
Black Lake	Frontenac County	Bedford	N	N
Black Lake	Frontenac County	Bedford	N	N
Black Lake	Frontenac County	Bedford	N	N
Blue Lake	Frontenac County	Loughborough	N	N
Blue Lake	Frontenac County	Loughborough	N	N
Bobs Lake	Frontenac County	South Canonto	N	N
Bobs Lake	Frontenac County	South Canonto	N	N

Bobs Lake	Frontenac County	South Canonto	N	N
Bobs Lake	Frontenac County	South Canonto	N	N
Bobs Lake	Frontenac County	South Canonto	N	N
Bobs Lake	Frontenac County	South Canonto	N	N
Bobs Lake	Frontenac County	Bedford	N	N
Bobs Lake	Frontenac County	Bedford	N	N
Bobs Lake	Frontenac County	Bedford	N	N
Bowley Lake	Lanark County	Ramsay	N	N
Bowley Lake	Lanark County	Ramsay	N	N
Bowley Lake	Lanark County	Ramsay	N	N
Buckshot Lake	Frontenac County	Miller	N	N
Buckshot Lake	Frontenac County	Miller	N	N
Buckshot Lake	Frontenac County	Miller	N	N
Burridge Lake	Frontenac County	Bedford	N	N
Burridge Lake	Frontenac County	Bedford	N	N
Butterill Lake	Frontenac County	Bedford	N	N
Calabogie Lake	Renfrew County	Bagot	N	N
Calabogie Lake	Renfrew County	Bagot	N	N
Calabogie Lake	Renfrew County	Bagot	N	N
Canning Lake	Haliburton County	Minden	N	N
Canning Lake	Haliburton County	Minden	N	N
Canning Lake	Haliburton County	Minden	N	N
Canonto Lake	Frontenac County	South Canonto	N	N
Canonto Lake	Frontenac County	South Canonto	N	N
Canonto Lake	Frontenac County	South Canonto	N	N
Carnahan Lake	Frontenac County	Olden	N	N
Carnahan Lake	Frontenac County	Olden	N	N
Cavendish Lake	Peterborough County	Cavendish	N	N
Chandos Lake	Peterborough County	Chandos	N	N
Chandos Lake	Peterborough County	Chandos	N	N
Chandos Lake	Peterborough County	Chandos	N	N
Christie Lake	Lanark County	South Sherbrooke	N	Y
Christie Lake	Lanark County	South Sherbrooke	N	Y
Christie Lake	Lanark County	South Sherbrooke	N	Y
Clayton Lake	Lanark County	Lanark	N	N

Clayton Lake	Lanark County	Lanark	N	N
Clayton Lake	Lanark County	Lanark	N	N
Clear Lake	Timiskaming District	Bayly	N	N
Clear Lake	Timiskaming District	Bayly	N	N
Clear Lake	Lanark County	South Sherbrooke	N	N
Constance Lake	Ottawa Division	March	N	N
Constance Lake	Ottawa Division	March	N	Y
Crab Lake	Peterborough County	Burleigh	N	N
Crego Lake	Kawartha Lakes Division	Somerville	N	N
Crosby Lake	Leeds and Grenville United Counties	North Crosby	N	N
Crosby Lake	Leeds and Grenville United Counties	North Crosby	N	N
Crow Lake	Frontenac County	Bedford	N	N
Crow Lake	Frontenac County	Bedford	N	N
Crow Lake	Frontenac County	Bedford	N	N
Dalhousie Lake	Lanark County	Dalhousie	N	N
Dalhousie Lake	Lanark County	Dalhousie	N	N
Davern Lake	Lanark County	South Sherbrooke	N	N
Davern Lake	Lanark County	South Sherbrooke	N	N
Deep Bay	Parry Sound District	Carling	N	N
Deep Bay	Parry Sound District	Carling	N	N
Deep Bay	Parry Sound District	Carling	N	N
Dickey Lake	Hastings County	Lake	N	N
Dickey Lake	Hastings County	Lake	N	N
Duncan Lake	Timiskaming District	Raymond	N	N
Duncan Lake	Timiskaming District	Raymond	N	N
Duncan Lake	Timiskaming District	Raymond	N	N
Eagle Lake	Frontenac County	Hinchinbrooke	N	N
Eagle Lake	Frontenac County	Hinchinbrooke	N	N
Elbow Lake	Frontenac County	Pittsburgh	N	N
Elbow Lake	Frontenac County	Pittsburgh	N	N
Elbow Lake	Frontenac County	Pittsburgh	N	N
Elbow Lake	Frontenac County	Hinchinbrooke	N	N
Elbow Lake	Frontenac County	Hinchinbrooke	N	N
Elbow Lake	Frontenac County	Hinchinbrooke	N	N

Farren Lake	Lanark County	South Sherbrooke	N	N
Farren Lake	Lanark County	South Sherbrooke	N	N
Fermoy Lake	Frontenac County	Bedford	N	N
Georgian Bay	Bruce County	null	N	N
Georgian Bay	Bruce County	null	N	N
Georgian Bay	Bruce County	null	N	N
Gold Lake	Peterborough County	Cavendish	N	N
Gowganda Lake	Timiskaming District	Nicol	N	N
Gowganda Lake	Timiskaming District	Nicol	N	N
Gowganda Lake	Timiskaming District	Nicol	N	N
Green Lake	Frontenac County	Barrie	N	N
Guerley Lake	Frontenac County	Pittsburgh	N	Y
Guerley Lake	Frontenac County	Pittsburgh	N	N
Guerley Lake	Frontenac County	Pittsburgh	N	N
Hoggs Bay	Lanark County	Burgess	N	N
Hoggs Bay	Lanark County	Burgess	N	N
Horseshoe Lake	Parry Sound District	Christie	N	N
Horseshoe Lake	Parry Sound District	Christie	Y	N
Horseshoe Lake	Parry Sound District	Christie	Y	N
Howard Lake	Timiskaming District	Arnold	N	N
Howard Lake	Timiskaming District	Arnold	N	N
Howard Lake	Timiskaming District	Arnold	N	N
Kangaroo Lake	Lanark County	Dalhousie	N	N
Kangaroo Lake	Lanark County	Dalhousie	N	N
Kashwakamak Lake	Frontenac County	Barrie	N	N
Kashwakamak Lake	Frontenac County	Barrie	N	N
Kashwakamak Lake	Frontenac County	Barrie	N	N
Kerr Lake	Lanark County	Lanark	N	N
Killenbeck Lake	Leeds and Grenville United Counties	Lansdowne	N	N
Killenbeck Lake	Leeds and Grenville United Counties	Lansdowne	N	N
Killenbeck Lake	Leeds and Grenville United Counties	Lansdowne	N	N
Lake of the Woods	Rainy River District		N	N
Lake of the Woods	Rainy River District		N	N
Lake of the Woods	Rainy River District		N	N

Lake of the Woods	Rainy River District		N	N
Lake of the Woods	Rainy River District		N	N
Lake of the Woods	Rainy River District		N	N
Lake of the Woods	Rainy River District		N	N
Lake of the Woods	Rainy River District		N	N
Lake of the Woods	Rainy River District		N	N
Lake of the Woods	Rainy River District		N	N
Lake Vernon	Muskoka District Municipality	Stisted	N	N
Lake Vernon	Muskoka District Municipality	Stisted	N	N
Lake Vernon	Muskoka District Municipality	Stisted	N	N
Lake Vernon	Muskoka District Municipality	Stisted	N	N
Leggat Lake	Frontenac County	Olden	N	N
Leggat Lake	Frontenac County	Olden	N	N
Leggat Lake	Frontenac County	Olden	N	N
Limerick Lake	Hastings County	Limerick	N	N
Limerick Lake	Hastings County	Limerick	N	N
Limerick Lake	Hastings County	Limerick	N	N
Little Crosby Lake	Leeds and Grenville United Counties	North Crosby	N	N
Little Dudmon Lake	Haliburton County	Dudley	N	N
Little Dudmon Lake	Haliburton County	Dudley	N	N
Little Silver Lake	Lanark County	South Sherbrooke	N	N
Little Silver Lake	Lanark County	South Sherbrooke	N	N
Long Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
Long Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
Long Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
Long Lake	Frontenac County	Pittsburgh	N	N
Long Lake	Frontenac County	Pittsburgh	N	N
Long Lake	Frontenac County	Pittsburgh	N	N
Long Lake	Peterborough County	Burleigh	N	N
Long Lake	Peterborough County	Burleigh	N	N
Long Lake	Peterborough County	Burleigh	N	N
Long Lake	Haliburton County	Dudley	N	N
Long Lake	Haliburton County	Dudley	N	N
Long Lake	Leeds and Grenville United	Lansdowne	N	N

	Counties			
Long Lake	Leeds and Grenville United Counties	Lansdowne	N	N
Long Lake	Leeds and Grenville United Counties	Lansdowne	N	N
Long Pond Lake	Frontenac County	Bedford	N	N
Longbow Lake	Kenora District	Kirkup	N	N
Longbow Lake	Kenora District	Kirkup	N	N
Longbow Lake	Kenora District	Kirkup	N	N
Loon Call Lake	Peterborough County	Anstruther	N	N
Loon Call Lake	Peterborough County	Anstruther	N	N
Loon Call Lake	Peterborough County	Anstruther	N	N
Loon Lake	Lanark County	Burgess	N	N
Loon Lake	Haliburton County	Dudley	N	N
Loon Lake	Haliburton County	Dudley	N	N
Loon Lake	Haliburton County	Dudley	N	N
Loucks Lake	Peterborough County	Burleigh	N	N
Loucks Lake	Peterborough County	Burleigh	N	N
Loucks Lake	Peterborough County	Burleigh	N	N
Lower Rideau Lake	Lanark County	Elmsley	N	Y
Lower Rideau Lake	Lanark County	Elmsley	N	Y
Lower Rideau Lake	Lanark County	Elmsley	N	Y
Lyndhurst Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
Lyndhurst Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
Lyndhurst Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
McGowan Lake	Lanark County	South Sherbrooke	N	N
McGowan Lake	Lanark County	South Sherbrooke	N	N
McLaren Lake	Lanark County	Burgess	N	N
Mill Pond Bay	Parry Sound District	McDougall	N	N
Mill Pond Bay	Parry Sound District	McDougall	N	N
Mill Pond Bay	Parry Sound District	McDougall	N	N
Miskwabi Lake	Haliburton County	Dudley	N	N
Miskwabi Lake	Haliburton County	Dudley	N	N
Mistinikon Lake	Timiskaming District	Powell	N	N
Mistinikon Lake	Timiskaming District	Powell	N	N

Mistinikon Lake	Timiskaming District	Powell	N	N
Mistinikon Lake	Timiskaming District	Powell	N	N
Mistinikon Lake	Timiskaming District	Powell	N	N
Mosque Lake	Frontenac County	Miller	N	N
Mosque Lake	Frontenac County	Miller	N	N
Mosque Lake	Frontenac County	Miller	N	N
Mountain Lake	Haliburton County	Minden	N	N
Mountain Lake	Haliburton County	Minden	N	N
Mountain Lake	Haliburton County	Minden	N	N
Negaunee Lake	Haliburton County	Dudley	N	N
Negaunee Lake	Haliburton County	Dudley	N	N
OBrien Lake	Lanark County	South Sherbrooke	N	N
Ottawa River	Prescott and Russell United Counties	East Hawkesbury	N	Y
Otter Lake	Leeds and Grenville United Counties	Elmsley	N	Y
Otter Lake	Leeds and Grenville United Counties	Elmsley	N	Y
Otter Lake	Leeds and Grenville United Counties	Elmsley	N	Y
Otty Lake	Lanark County	Burgess	N	Y
Otty Lake	Lanark County	Burgess	N	Y
Otty Lake	Lanark County	Burgess	N	Y
Palmerston Lake	Frontenac County	Palmerston	N	N
Palmerston Lake	Frontenac County	Palmerston	N	N
Palmerston Lake	Frontenac County	Palmerston	N	N
Panagapka Lake	Cochrane District	Clifford	N	N
Panagapka Lake	Cochrane District	Clifford	N	N
Panagapka Lake	Cochrane District	Clifford	N	N
Patterson Lake	Lanark County	Dalhousie	N	N
Pike Lake	Lanark County	Burgess	N	N
Pike Lake	Lanark County	Burgess	N	N
Pike Lake	Lanark County	Burgess	N	N
Pine Lake	Frontenac County	Clarendon	N	N
Pine Lake	Frontenac County	Clarendon	N	N
Pine Lake	Frontenac County	Clarendon	N	N
Rainbow Lake	Lanark County	South Sherbrooke	N	N
Ranger Lake	Algoma District	Reilly	N	N

Ranger Lake	Algoma District	Reilly	N	N
Ranger Lake	Algoma District	Reilly	N	N
Red Horse Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
Red Horse Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
Red Horse Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
Rib Lake	Timiskaming District	Gillies Limit	N	N
Rib Lake	Timiskaming District	Gillies Limit	N	N
Rib Lake	Timiskaming District	Gillies Limit	N	N
Rock Lake	Frontenac County	Bedford	N	N
Round Lake	Lanark County	Burgess	N	N
Round Lake	Lanark County	Burgess	N	N
Sesekinika Lake	Timiskaming District	Grenfell	N	N
Sesekinika Lake	Timiskaming District	Grenfell	N	N
Sesekinika Lake	Timiskaming District	Grenfell	N	N
Sharbot Lake	Frontenac County	Oso	N	Y
Sharbot Lake	Frontenac County	Oso	N	Y
Sharbot Lake	Frontenac County	Oso	N	Y
Shebandowan Lakes	Thunder Bay District	Haines	N	N
Shebandowan Lakes	Thunder Bay District	Haines	N	N
Shebandowan Lakes	Thunder Bay District	Haines	N	N
Shebandowan Lakes	Thunder Bay District	Haines	N	N
Shebandowan Lakes	Thunder Bay District	Haines	N	N
Silver Lake	Frontenac County	Oso	N	N
Singleton Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
Singleton Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
Singleton Lake	Leeds and Grenville United Counties	Lansdowne	N	Y
Skeleton Lake	Timiskaming District	Bayly	N	N
Skeleton Lake	Timiskaming District	Bayly	N	N
Skeleton Lake	Timiskaming District	Bayly	N	N
Skeletonpup Lake	Timiskaming District	Bayly	N	N

Skeletonpup Lake	Timiskaming District	Bayly	N	N
South Nation River	Prescott and Russell United Counties	Plantagenet	N	N
South Nation River	Prescott and Russell United Counties	Plantagenet	N	N
South Nation River	Prescott and Russell United Counties	Plantagenet	N	N
South Nation River	Prescott and Russell United Counties	Plantagenet	N	Y
South Nation River	Prescott and Russell United Counties	Plantagenet	N	Y
South Nation River	Prescott and Russell United Counties	Plantagenet	N	Y
South Nation River	Prescott and Russell United Counties	Plantagenet	N	Y
South Nation River	Prescott and Russell United Counties	Plantagenet	N	Y
South Nation River	Prescott and Russell United Counties	Plantagenet	N	Y
Spectacle Lake	Leeds and Grenville United Counties	North Crosby	N	N
St. Anthony Lake	Timiskaming District	Skead	N	N
St. Anthony Lake	Timiskaming District	Skead	N	N
St. Anthony Lake	Timiskaming District	Skead	N	N
St. Lawrence River	Stormont, Dundas and Glengarry	Lancaster	N	Y
St. Lawrence River	Stormont, Dundas and Glengarry	Lancaster	N	Y
St. Lawrence River	Stormont, Dundas and Glengarry	Lancaster	N	Y
St. Lawrence River	Stormont, Dundas and Glengarry	Lancaster	N	Y
St. Lawrence River	Stormont, Dundas and Glengarry	Lancaster	N	Y
Stormy Lake	Haliburton County	Glamorgan	N	N
Stormy Lake	Haliburton County	Glamorgan	N	N
Stormy Lake	Haliburton County	Glamorgan	N	N
Stump Lake	Lanark County	North Sherbrooke	N	N
Stump Lake	Lanark County	North Sherbrooke	N	N
Sunday Lake	Frontenac County	Palmerston	N	N
Sunday Lake	Frontenac County	Palmerston	N	N
Taylor Lake	Lanark County	Lanark	N	N
Taylor Lake	Lanark County	Lanark	N	N
Taylor Lake	Lanark County	Lanark	N	N
Tommy Lake	Leeds and Grenville United	North Crosby	N	N

	Counties			
Upper Island Lake	Algoma District	Aweres	N	Y
Upper Island Lake	Algoma District	Aweres	N	N
Upper Island Lake	Algoma District	Aweres	N	N
Upper Mazinaw Lake	Frontenac County	Barrie	N	N
Upper Mazinaw Lake	Frontenac County	Barrie	N	N
Upper Mazinaw Lake	Frontenac County	Barrie	N	N
Upper Rideau Lake	Leeds and Grenville United Counties	North Crosby	N	N
Upper Rideau Lake	Leeds and Grenville United Counties	North Crosby	N	Y
Upper Rideau Lake	Leeds and Grenville United Counties	North Crosby	N	N
Upper Rideau Lake	Leeds and Grenville United Counties	North Crosby	N	Y
Watabeag Lake	Timiskaming District	Nordica	N	N
Watabeag Lake	Timiskaming District	Nordica	N	N
Watabeag Lake	Timiskaming District	Nordica	N	N
Watabeag Lake	Timiskaming District	Nordica	N	N
Watabeag Lake	Timiskaming District	Nordica	N	N
Wendigo Lake	Timiskaming District	Bayly	N	N
Wendigo Lake	Timiskaming District	Bayly	N	N
Wendigo Lake	Timiskaming District	Bayly	N	N
Wendigo Lake	Timiskaming District	Bayly	N	N
Westport Sand Lake	Leeds and Grenville United Counties	North Crosby	N	N
Westport Sand Lake	Leeds and Grenville United Counties	North Crosby	N	Y
Westport Sand Lake	Leeds and Grenville United Counties	North Crosby	N	N
White Lake	Frontenac County	Bedford	N	N
White Lake	Frontenac County	Bedford	N	N
Wolf Lake	Kawartha Lakes Division	Digby	N	N
Wolf Lake	Kawartha Lakes Division	Digby	N	N
Wolfe Lake	Leeds and Grenville United Counties	North Crosby	N	N
Wolfe Lake	Leeds and Grenville United Counties	North Crosby	N	Y
Wollaston Lake	Hastings County	Wollaston	N	N

Wollaston Lake	Hastings County	Wollaston	N	N
Wollaston Lake	Hastings County	Wollaston	N	N

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