2017

Invading Species Watch Program Annual Report

ONTARIO'S INVADING SPECIES AWARENESS PROGRAM

Ontario Federation of Anglers and Hunters

ACKNOWLEDGEMENTS

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

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 2017:

- Cataraqui Region Conservation Authority
- Central Lake Ontario Conservation Authority
- Credit Valley Conservation Authority
- Ducks Unlimited Canada
- EcoSuperior Environmental Programs
- Emily Provincial Park
- Frontenac Provincial Park
- Ganaraska Region Conservation Authority
- Invasive Species Centre
- Kids for Turtles Environmental Education
- Lake of the Woods District Property Owner's Association
- Lake Simcoe Region Conservation Authority
- Lower Trent Conservation Authority
- Manitoulin Streams & MASC
- Mississippi Valley Conservation Authority
- MNRF - Dryden District
- MNRF - Dryden District (Ignace Field Office)
- Muskoka Watershed Council
- Nature Conservancy Canada
- Nottawasaga Valley Conservation Authority
- Ontario Federation of Anglers and Hunters
- Plenty Canada
- Rideau Valley Conservation Authority
- Rondeau Provincial Park
- Sibbald Point Provincial Park
- Sir Sandford Fleming College
- South Nation Conservation Authority
- Township of Scugog
- University of Windsor
- Voyageur Provincial Park
- Wabaseemoong Traditional Land Use Area
- Wasaga Beach Provincial Park
- Wheatley Provincial Park

We would like to extend our gratitude to each of our partners in the delivery of the 2017 ISW season, including Renata Claudi and Bob Prescott of RNT Consulting for their technical advice and support.

We extend thanks to our summer students Alexa Graham, Alyssa Lane, Angela Kuttemperoor, Brent Holmes, Colleen Armstrong, Brady McGlade, Daniel Switzer, Helen Toner, Jacob Timmins-Snoddy, Jennifer McLean, Johnathan Begg, Justin Hunt, Katia McKercher, Kelly Macgillivray, Kristen Tymoshuk, Kylee Neniska, Lauren Negrazis, Lillian Auty, Maggie Stevenson, Megan Dawson, Rebecca Jackson, Rebecca Tigchelaar, Ron Bissonnette, Ryan Kober, Sarah Friesen, and Spencer Leava.

We would also like to take this opportunity to thank many of the OFAH staff for their assistance and support, including Sophie Monfette, Matt DeMille, Alison Morris, Brook Schryer, Kelly Macgillivray, and Robert McGowan.

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 2017 marked the beginning of another extremely busy and successful year for the *Invading Species Watch* program. The program is in its 25th year of operation and is coordinated by the Ontario Federation of Anglers and Hunters (OFAH) in partnership with the Ontario Ministry of Natural Resources and Forestry (MNRF). In 2017, the program monitored 116 lakes and waterways for the presence of spiny waterfleas (*Bythotrephes longimanus)* and zebra mussel veligers (*Dreissena polymorpha).*

The program was delivered through the participation of lake associations and conservation clubs across the province. Mississippi Valley Conservation Authority (MVCA), Voyageur Provincial Park, Muskoka Watershed Council, Dryden District MNRF, South Nation Conservation Authority, Ducks Unlimited Canada, Plenty Canada, Manitoulin Streams, Manitoulin Area Stewardship Council, Rideau Valley Conservation Authority (CVCA), Rondeau Provincial Park, Frontenac Provincial Park, Emily Provincial Park, Kids for Turtles Environmental Education, Wheatley Provincial Park, University of Windsor, Nature Conservancy Canada, Township of Scugog, Invasive Species Centre (ISC), Kawartha Conservation, Sibbald Point Provincial Park, Lake Simcoe Region Conservation Authority, EcoSuperior Environmental Programs, Lower Trent Conservation Authority, Nottawasaga Valley Conservation Authority, Wasaga Beach Provincial Park, Central Lake Ontario Conservation Authority, and the Lakes of the Woods District Property Owners Association 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.

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 and spiny waterfleas in Ontario waters.
2. Update Ontario distribution information (EDDMapS Ontario) 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.

Twenty five monitoring kits containing all the necessary equipment and instructions were circulated to program volunteers. During the fall and winter of 2017, RNT Consulting performed the analysis of water samples from the 116 lakes that were monitored during the summer. **Of the 116 waterbodies sampled in 2017, zebra mussel veligers were found in 32 lakes with 5 first occurrences. Spiny waterflea were discovered in 11 lakes with 3 being new occurrences.**

The results of the 2017 *Invading Species Watch* program will be entered into the EDDMapS Ontario invasive species database (www.EDDMapS.org/Ontario). EDDMapS Ontario was implemented by the Invading Species Awareness Program in 2014 as a tool to document, track and map invasive species throughout the province. This database currently tracks 162 different invasive species within Ontario and is linked to other EDDMapS databases throughout Canada and the United States.

THE ONTARIO FEDERATION OF ANGLERS AND HUNTERS

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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, fish and wildlife conservation-based organization, representing 100,000 members, subscribers and supporters, and 740 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 and Forestry (OMNRF) 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 to date 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 and terrestrial invasive species.

- **EDDMapS Ontario** – EDDMapS Ontario is a web-based mapping system used to depict the distribution of invasive species throughout North America. It is easy to use, open to the public to use, and no knowledge of GIS is required. Reports entered into EDDMapS can be publicly viewed after they have been confirmed by expert verifiers. ISW volunteers will also be able to view the results of their lake each year. Visit www.eddmaps.org/Ontario to sign up and start tracking invasive species today.

- **Asian Carps Campaign –** The ISAP received funding from Fisheries and Ocean's Canada (DFO) to prevent the introduction of Asian carps to the Canadian Great Lakes as well as build capacity to enhance early detection/warning of Asian Carps in the Canadian Great Lakes. Program staff coordinated the development and distribution of a series of new resources and promotional material with respect to education, awareness, and preventing the introduction of Asian carps. This campaign includes web content, print, stickers, boat launch signage, billboards, and audio/visual public service announcements.

- **Waterfowl Hunters -** ISAP staff continue to promote the targeted campaign for waterfowl hunters focusing on how they can help prevent the introduction/spread of invasive species, such as invasive Phragmites. The ISAP has partnered with over 30 hunting retail outlets across Ontario as part of this project, including two major retail outlets: Bass Pro Shops and Cabela's. To date, ISAP has produced a brochure, a self-directed workshop and both radio and video public service announcements.

- **Clean Boats, Clean Tournaments -** Due to the frequency at which competitive fishing tournament anglers travel between watersheds, their actions at the launch are essential in preventing the spread of aquatic invasive species and preserving fishing opportunities across Ontario. In 2015, program staff implemented the new "Clean Boats, Clean Tournaments" project. This project focused on education and outreach to competitive tournament anglers with the overall goal of engaging anglers in best management practices (e.g. Clean, Drain, Dry) to avoid the spread of aquatic invasive species.

- **Operation Boat Clean -** Program staff continue to work with staff from Aurora District MNRF to deliver Operation Boat Clean within the Lake Simcoe watershed. In 2016, boat wash facilities were operating in two locations along Lake Simcoe in Orillia and Barrie.

- **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 Presentations** – The invading species presentations are designed to provide education on how to identify and report invasive species through the Hotline or EDDMapS Ontario.

Would your lake association or organization like to help spread the word on Asian carps?

The Ontario Federation of Anglers and Hunters in partnership with the Department of Fisheries and Oceans Canada have launched a comprehensive Asian carps Awareness Campaign with the goal of: *Report all potential Asian Carp sightings!*

Free 18”x12” metal signs with mounting posts for outdoors as well as several print resources are available for distribution. Please contact the Invading Species Hotline at 1-800-563-7711 for more information.

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 then, over 600 lakes have been monitored for the presence of zebra mussels and spiny waterfleas through this volunteer-based program. Each year, a growing number of cottage associations, conservation organizations, and concerned citizens participate in this important surveillance initiative.

The objectives of the program are the following:

1. Establish a volunteer network to track the spread of zebra mussels and spiny waterfleas 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's 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; and

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

3.0 METHODS

3.1 VOLUNTEER RECRUITMENT

In 2017, the program was promoted extensively to recruit new volunteers from across the province. Program promotion occurred at more than 150 events, including the Toronto Sportsmen Show, lake association and stewardship council meetings and local community events.

3.2 MEDIA PROMOTION:

The *Invading Species Awareness Program* was also promoted through a variety of media across the province, including website, social media, 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 Streams 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.

During the summer of 2017, the Invading Species Hit Squad consisted of 26 students. In partnership with the **Rideau Valley Conservation Authority (RVCA), Mississippi Valley Conservation (MVCA), South Nation Conservation Authority, Lake of the Woods District Property Owners Association, amongst many others,** some students coordinated and facilitated volunteers, as well as lake associations and conservation clubs in their respective areas. All 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 150 events throughout the summer.

Figure 2: Summer students (Dean Nolan, left and David Ryrie, right) with the Invading Species Awareness Program 2012

3.5 PROGRAM MONITORING

Following the protocol in the program manual, participants monitored their lakes between mid-June and early September. The volunteers collecting lake samples used plankton haul nets (63 microns) at 3-5 locations on the lake. In total, 293 Samples were collected from 116 lakes averaging 2.5 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 37 monitoring kits were circulated in the summer of 2017 to volunteers throughout Ontario.

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.

3.7 RESULTS

Of the 116 lakes or waterways sampled in 2017, zebra mussel veligers were found in 32 lakes with 5 first occurrences. Spiny waterflea were discovered in 11 lakes with 3 being new occurrences.

Zebra mussel veligers were discovered in the following lakes:

Zebra Mussel *(Dreissena polymorpha)*

Waterbody	County	Township
Adams Lake	Lanark	Tay Valley
Bass Lake	Rideau Lakes	Rideau Lakes
Big Rideau Lake	Rideau Lakes	Rideau Lakes
Black Lake	Lanark	Tay Valley
Bob's Lake	Frontenac	South Frontenac
Burridge Lake	Frontenac	South Frontenac
Butterill Lake	Frontenac	South Frontenac
Canonto Lake	Frontenac	North Frontenac
Christie Lake	Lanark	Tay Valley
Collins Lake	Frontenac	South Frontenac
Colonel By Lake	**Frontenac**	**City of Kingston**
Eagle Lake	Frontenac	Central Frontenac
Farren Lake	Lanark	Tay Valley
Goodfellow-Unnamed Pond	**Frontenac**	**Central Frontenac**
Hoggs Bay	Lanark	Tay Valley
Little Silver Lake	Lanark	Tay Valley
Long Lake	Lanark	Drummond North Elmsley
Long Pond	Frontenac	South Frontenac
Loon Lake	Lanark	Tay Valley

[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.

Lower Beverley Lake	Leeds & Grenville	Rideau Lakes
Lower Rideau Lake	Rideau Lakes	Rideau Lakes
Marble Lake	**Frontenac**	**North Frontenac**
Mississippi Lake	Lanark	Drummond North Elmsley
Otty Lake	Lanark	Tay Valley
Sharbot Lake	Frontenac	North Frontenac
Silver Lake	Frontenac	Central Frontenac
Singleton Lake	Leeds & Grenville	Leeds & Thousand Islands
Skeleton Lake	**Bayly**	**Bayly**
Skeletonpup Lake	**Bayly**	**Bayly**
Sugar Lake	Parry Sound	Seguin
Upper Rideau	Rideau Lakes	Rideau Lakes
Wolfe Lake	Frontenac	South Frontenac

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

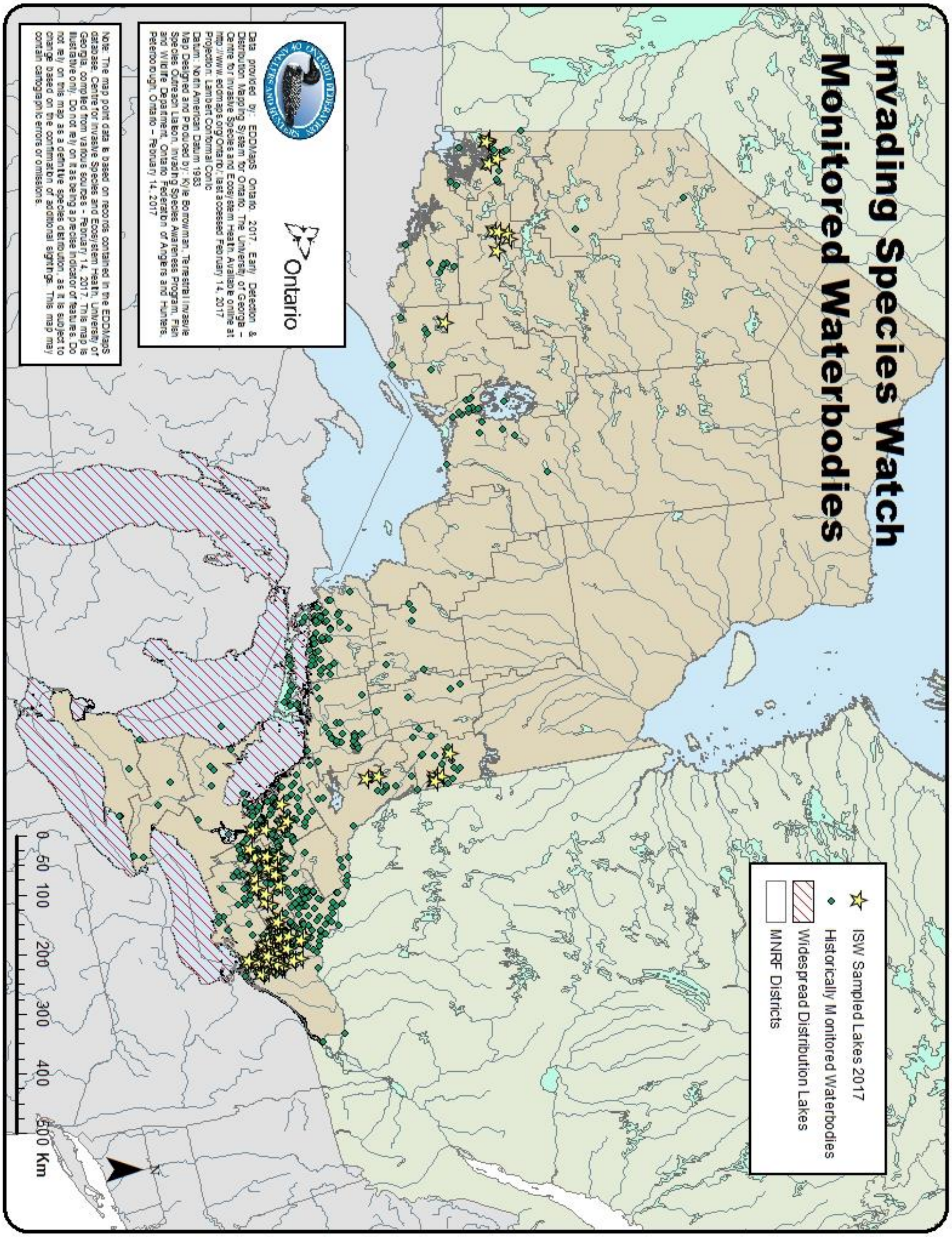
Spiny waterflea were discovered in the following lakes:

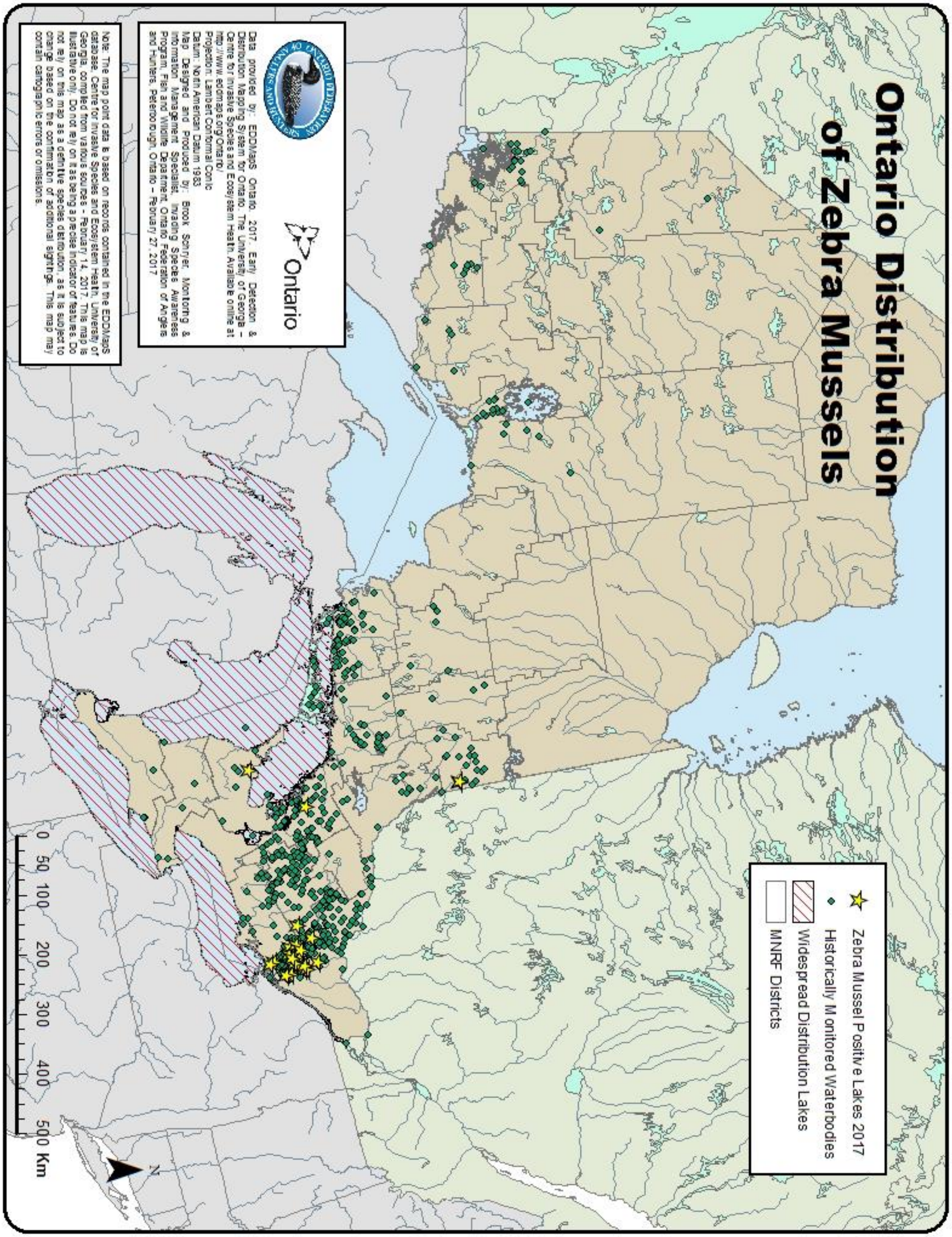
Spiny Waterflea *(Bythotrephes longimanus)*

Waterbody	County	Township
Calabogie Lake	Renfrew	Greater Madawaska
Cavendish Lake	**Peterborough**	**Trent Lakes**
Crotch Lake	Frontenac	North Frontenac
Drag Lake	Haliburton	Dysart et al.
Eagle Lake	**Frontenac**	**Central Frontenac**
Gold Lake	**Peterborough**	**Trent Lakes**
Jack Lake	Peterborough	North Kawartha
Lake Temagami	Nippissing	Phyllis
Lake Vernon	Muskoka	Chaffey
Leonard Lake	Muskoka	Monck
Sugar Lake	Parry Sound	Seguin

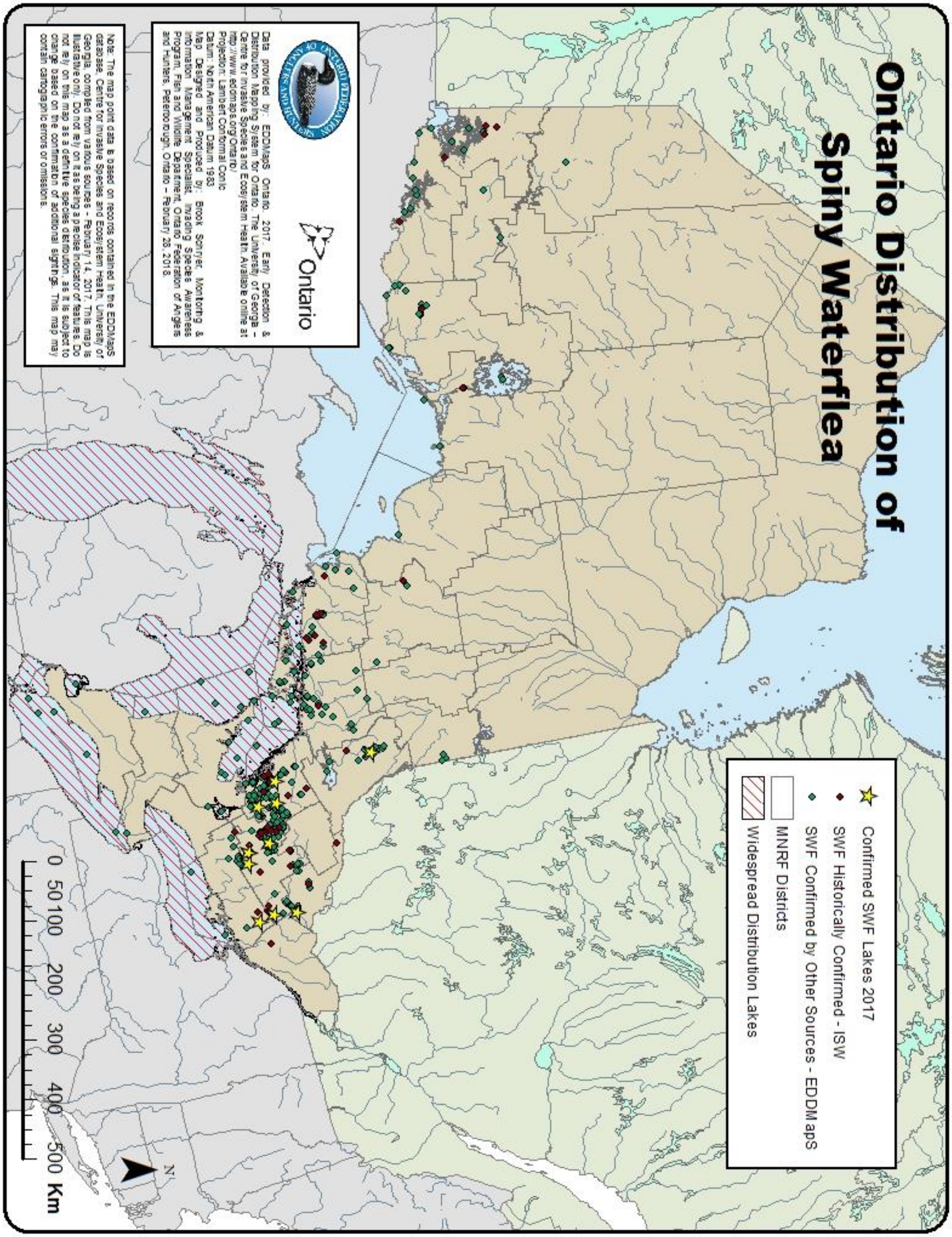
bolded names are first occurrences of reports within the Invading Species Watch database

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.


Invading Species Watch
Monitored Waterbodies
ISW Sampled Lakes 2017
Historically Monitored Waterbodies
Widespread Distribution Lakes
MNRF Districts
0 50 100 200 300 400 500 Km
N
Ontario
Data provided by: EDDMapS Ontario. 2017. Early Detection & Distribution Mapping System for Ontario. The University of Georgia – Centre for Invasive Species and Ecosystem Health. Available online at http://www.eddmaps.org/Ontario/; last accessed February 14, 2017
Projection: Lambert Conformal Conic
Datum: North American Datum 1983
Map Designed and Produced by: Kyle Borrowman, Terrestrial Invasive Species Outreach Liaison, Invading Species Awareness Program, Fish and Wildlife Department, Ontario Federation of Anglers and Hunters, Peterborough, Ontario – February 14, 2017
Note: The map point data is based on records contained in the EDDMapS database, Centre for Invasive Species and Ecosystem Health, University of Georgia, compiled from various sources - February 14, 2017. This map is illustrative only. Do not rely on it as being a precise indicator of features. Do not rely on this map as a definitive species distribution, as it is subject to change based on the confirmation of additional sightings. This map may contain cartographic errors or omissions.



Ontario Distribution of Zebra Mussels
Zebra Mussel Positive Lakes 2017
Historically Monitored Waterbodies
Widespread Distribution Lakes
MNRF Districts
Ontario Federation of Anglers and Hunters
Ontario
Data provided by: EDDMapS Ontario. 2017. Early Detection & Distribution Mapping System for Ontario. The University of Georgia – Centre for Invasive Species and Ecosystem Health. Available online at http://www.eddmaps.org/Ontario/
Projection: Lambert Conformal Conic
Datum: North American Datum 1983
Map Designed and Produced by: Brook Schryer, Monitoring & Information Management Specialist, Invading Species Awareness Program, Fish and Wildlife Department, Ontario Federation of Anglers and Hunters, Peterborough, Ontario – February 27, 2017
Note: The map point data is based on records contained in the EDDMapS database, Centre for Invasive Species and Ecosystem Health, University of Georgia, compiled from various sources - February 14, 2017. This map is illustrative only. Do not rely on it as being a precise indicator of features. Do not rely on this map as a definitive species distribution, as it is subject to change based on the confirmation of additional sightings. This map may contain cartographic errors or omissions.
0 50 100 200 300 400 500 Km
N



Ontario Distribution of Spiny Waterflea
Confirmed SWF Lakes 2017
SWF Historically Confirmed - ISW
SWF Confirmed by Other Sources - EDDMapS
MNRF Districts
Widespread Distribution Lakes
0 50 100 200 300 400 500 Km
N
Ontario
Data provided by: EDDMapS Ontario. 2017. Early Detection & Distribution Mapping System for Ontario. The University of Georgia – Centre for Invasive Species and Ecosystem Health. Available online at http://www.eddmaps.org/Ontario/
Projection: Lambert Conformal Conic
Datum: North American Datum 1983
Map Designed and Produced by: Brook Schryer, Monitoring & Information Management Specialist, Invading Species Awareness Program, Fish and Wildlife Department, Ontario Federation of Anglers and Hunters, Peterborough, Ontario – February 28, 2018.
Note: The map point data is based on records contained in the EDDMapS database, Centre for Invasive Species and Ecosystem Health, University of Georgia, compiled from various sources - February 14, 2017. This map is illustrative only. Do not rely on it as being a precise indicator of features. Do not rely on this map as a definitive species distribution, as it is subject to change based on the confirmation of additional sightings. This map may contain cartographic errors or omissions.

4.0 CHANGES TO ISW MOVING FORWARD

On behalf of the Ontario Federation of Anglers and Hunters (OFAH), its 100,000 members, subscribers and supporters, and 740 member clubs, I would like to thank you for your continued interest and support of the Invading Species Awareness Program (ISAP) through your participation in our Invading Species Watch (ISW) program. As you know, the program has been monitoring Ontario's lakes for aquatic invasive species (AIS) through the dedication of its volunteers for many years. Over these years, we have been able to better understand the distribution of zebra mussels (*Dreissena polymorpha*) and spiny waterfleas (*Bythotrephes longimanus*) as a result of the contributions made by our volunteers.

The ISW program is one part of a joint-partnership program between the OFAH and the Ontario Ministry of Natural Resources and Forestry (MNRF). Through the ISW program, we have garnered many successes, including the establishment of a provincial volunteer network to track the spread of zebra mussels and spiny waterfleas, increased local awareness of AIS, and garnered greater public involvement in preventing the introduction and spread of AIS to inland lakes.

This year, we are excited to offer a new experience for Ontario's citizen scientists that have been involved with ISW in the past. We have recognized the importance of surveying for other aquatic invasive species that may or may not be currently present in Ontario. As such, the ISW program will no longer function as it has in the past, but will be focused on building capacity for the surveillance of a broader list of AIS.

As we begin this transition, we are looking to coordinate THREE separate AIS workshops in Ontario that will focus on the identification and reporting tools available for AIS in Ontario. We are looking to our existing volunteer network to help us in deciding when and where to host these workshops. If you are interested in participating in a workshop, please email me at **brook_schryer@ofah.org**, or call (705) 748-6324, ext. 227 and include your name, address, and contact information as we hope to select locations based on the feedback we receive. The ISAP is incredibly appreciative of our volunteers and their years of dedication to the ISW program and we look forward to continuing to work with you as we move forward with enhancing Ontario's capacity for early warning of AIS.

4.1 NEW SPECIES

The Invading Species Watch Program has primarily investigated the distribution of the spiny water flea and zebra mussels since its inception. However, there are many other invasive species that are also of concern for Ontario's biodiversity, economy, and society, including human health. With that in mind, the OFAH, in partnership with the MNRF and the Ontario Invasive Plant Council (OIPC) are beginning a new Early Detection and Rapid Response (EDRR) program in 2018. This new program will not be fully operational until 2019, but will aim to monitor for a number of different AIS in your watersheds and will help facilitate early detection and rapid response of high-risk species. The species list that this new program aims to identify has not been finalized at this time and will depend on the feedback received from volunteers at the AIS workshops that will be planned for the summer-fall of 2018.

APPENDIX A: GENERAL INVASIVE SPECIES INFORMATION

INVADING SPECIES: REASONS FOR CONCERN

Invasive species create serious ecological and economic problems in Ontario, Canada, and the rest of the world. The introduction of new invasive species occurs on a regular basis through various pathways. Currently, 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 and are listed as 'invasive.'

Although the details of these impacts are not fully known, there is an agreement among the scientific community that invading species threaten Ontario's biodiversity. The Committee on the Status of Endangered Wildlife estimates 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 five times faster than terrestrial organisms and three times faster than coastal species (Ricciardi & Rasmussen, 1999).

INVADING SPECIES: PATHWAYS OF INTRODUCTION

Invasive 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 invasive 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, drained, and dried before leaving a waterbody. For more information regarding this procedure, please contact the Invading Species Hotline at 1-800-563-7711 or visit http://www.invadingspecies.com/boating/.

INVADING SPECIES: WHY DO THEY SUCCEED SO WELL?

Typically, invasive 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 as they would in their native range. Furthermore, these species typically reproduce quickly either through multiple reproductive cycles in a single year or by having high fecundity. Additionally, invasive 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, reproduce, and spread when introduced to new environments.

Unfortunately, once an invasive 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

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. The 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.

Figure 2: Zebra Mussel
Source: The OFAH

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 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 and 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 larger individuals.

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	>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, pH[4] and temperature.

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.

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

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

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.

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.

[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.

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 farther 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 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 scaups’ 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 and many had between 1,000 and 2,000 zebra mussels attached to them. 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, and 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. This abundance of shells produce an unpleasant odour and 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 25 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 has contributed 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 WATERFLEA: BIOLOGY OF INVASION

It is likely that the spiny waterflea (*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 waterflea 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. They can also be spread through infested angling or boating equipment such as fishing lines, downrigger cables, and anchor ropes.

THE SPINY WATERFLEA: BIOLOGY

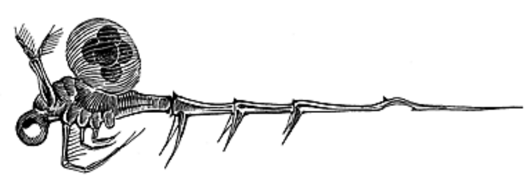


Figure 4: The Spiny Water Flea
Source: Bell Museum, University of Minnesota

The spiny waterflea 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 of the spiny waterflea 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 waterflea 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 waterflea 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 waterflea consumes up to three times as much as native species of zooplankton. Spiny waterfleas consume smaller species of native zooplankton such as *Daphnia*, which is an important food source for juvenile fish species. As a result, the spiny waterflea 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 waterflea; however, studies have indicated that juvenile fish smaller than 10 cm in length are unable to use the spiny waterflea 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 waterflea because of the long tail spine, which prevents that fish from swallowing it.

APPENDIX D: 2017 INVADING SPECIES WATCH RESULTS

Results from the *Invading Species Watch* in 2017

Sighting WaterBody	Sample #	ZM Veligers (Present Y/ Absent N)	Spiny Water Flea (Present Y/ Absent N)
Adam Lake	IS-1	Y	N
Adam Lake	IS-3	Y	N
Adam Lake	IS-2	Y	N
Anstruther Lake	1	N	N
Anstruther Lake	2	N	N
Anstruther Lake	3	N	N
Bagot Long Lake	1	N	N
Bagot Long Lake	2	N	N
Bagot Long Lake	3	N	N
Baptiste Lake	1	N	N
Baptiste Lake	2	N	N
Baptiste Lake	3	N	N
Bass Lake	IS-1	Y	N
Bennett Lake	1	N	N
Bennett Lake	2	N	N
Big Rideau Lake	IS-2	Y	N
Big Rideau Lake	IS-1	N	N
Black Lake	IS-1	N	N
Black Lake	IS-2	Y	N
Black Sturgeon Lake	1	N	N
Black Sturgeon Lake	2	N	N
Black Sturgeon Lake	3	N	N
Bobs Lake- Central Narrows	IS-1	N	N
Bobs Lake- East Basin	IS-1	N	N
Bobs Lake- Green Bay	IS-1	N	N
Bobs Lake- Green Bay	IS-2	N	N
Bobs Lake- Green Bay	IS-3	N	N
Bobs Lake- Long Bay	IS-2	Y	N
Bobs Lake- Mud Bay	IS-1	Y	N
Bobs Lake- Norris Bay	IS-1	Y	N
Bobs Lake- West Basin	IS-1	N	N
Bobs Lake-Buck Bay	IS-1	N	N
Bowley Lake	1	N	N
Bowley Lake	2	N	N
Bowley Lake	3	N	N
Buck Bay	1	N	N
Buck Bay	2	N	N
Buck Bay	3	N	N
Buck Lake	1	N	N
Buck Lake	2	N	N
Buck Lake	IS-3	N	N

Buckshot Lake	1	N	N
Buckshot Lake	2	N	N
Buckshot Lake	3	N	N
Burridge Lake	IS-2	Y	N
Burridge Lake	IS-1	Y	N
Butterill Lake	IS-2	Y	N
Butterill Lake	IS-1	N	N
Calabogie Lake	1	N	Y
Calabogie Lake	2	N	Y
Calabogie Lake	3	N	Y
Canning Lake	1	N	N
Canning Lake	2	N	N
Canning Lake	3	N	N
Canonto Lake	1	Y	N
Canonto Lake	2	N	N
Canonto Lake	3	N	N
Carnahan Lake	IS-1	N	N
Cavendish Lake	1	N	Y
Cavendish Lake	2	N	N
Cavendish Lake	3	N	N
Centrefire	1	N	N
Centrefire	2	N	N
Centrefire	3	N	N
Christie Lake	IS-2	Y	N
Christie Lake	IS-3	Y	N
Christie Lake	IS-1	Y	N
Collins Lake	1	Y	N
Collins Lake	2	N	N
Collins Lake	3	Y	N
Colonel By Lake	1	Y	Y
Colonel By Lake	2	Y	Y
Colonel By Lake	3	Y	Y
Crego Lake	1	N	N
Crego Lake	2	N	N
Crosby Lake	IS-1	N	N
Cross Lake	1	N	N
Cross Lake	2	N	N
Cross Lake	3	N	N
Crotch Lake	1	N	N
Crotch Lake	2	N	Y
Crotch Lake	3	N	N
Crow Lake	IS-2	N	N
Crow Lake	IS-3	N	N
Crow Lake	IS-1	N	N
Cushing Lake	1	N	N
Cushing Lake	2	N	N

Dalhousie Lake	1	N	N
Dalhousie Lake	2	N	N
Dalhousie Lake	3	N	N
Davern Lake	IS-1	N	N
Davis Lake	1	N	N
Davis Lake	2	N	N
Drag Lake	1	N	Y
Drag Lake	2	N	Y
Drag Lake	3	N	N
Eagle Lake	IS-1	Y	Y
Eagle Lake	IS-3	N	N
Eagle Lake	IS-2	N	N
Elbow Lake	IS-2	N	N
Elbow Lake	IS-3	N	N
Elbow Lake	IS-1	N	N
Engineer Lake	1	N	N
Farquhar Lake	1	N	N
Farquhar Lake	2	N	N
Farquhar Lake	3	N	N
Farren Lake	IS-1	Y	N
Farren Lake	IS-2	Y	N
Fawn Lake	3	N	N
Fermoy Lake	IS-1	N	N
Fox Lake	1	N	N
Fox Lake	2	N	N
Fox Lake	3	N	N
Ghost Lake	1	N	N
Ghost Lake	2	N	N
Ghost Lake	3	N	N
Gilbert Lake	1	N	N
Gilbert Lake	2	N	N
Gilbert Lake	3	N	N
Glamor Lake	1	N	N
Glamor Lake	2	N	N
Glamor Lake	3	N	N
Gold Lake	1	N	Y
Gold Lake	2	N	N
Gold Lake	3	N	Y
Goodfellow-Unnamed Pond	1	N	N
Goodfellow-Unnamed Pond	2	N	N
Goodfellow-Unnamed Pond	3	Y	N
Grace Lake	1	N	N
Grace Lake	2	N	N
Grace Lake	3	N	N
Granite Lake	1	N	N
Grawler/Bat/Bear Lake	1	N	N

Grawler/Bat/Bear Lake	2	N	N
Grawler/Bat/Bear Lake	3	N	N
Green Lake	IS-1	N	N
Guerley Lake	1	N	N
Guerley Lake	2	N	N
Guerley Lake	3	N	N
Head Lake	1	N	N
Head Lake	2	N	N
Head Lake	3	N	N
Hoggs Bay	IS-2	Y	N
Hoggs Bay	IS-1	N	N
Horseshoe Lake	1	N	N
Horseshoe Lake	2	N	N
Horseshoe Lake	3	N	N
Jack Lake	1	N	N
Jack Lake	2	N	N
Jack Lake	3	N	Y
Kahshe Lake	1	N	N
Kahshe Lake	2	N	N
Kahshe Lake	3	N	N
Kahshe Lake	4	N	N
Kahshe Lake	5	N	N
Kahshe Lake	6	N	N
Keikewabik	1	N	N
Keikewabik		N	N
Kishkebus Lake	1	N	N
Kishkebus Lake	2	N	N
Lake of the Woods	1	N	N
Lake of the Woods	2	N	N
Lake of the Woods	3	N	N
Lake of the Woods	4	N	N
Lake of the Woods	5	N	N
Lake of the Woods	6	N	N
Lake Temagami	1	N	N
Lake Temagami	2	N	N
Lake Temagami	3	N	Y
Lake Vernon	1	N	Y
Lake Vernon	2	N	Y
Lake Vernon	3	N	Y
Lake Winnetka	1	N	N
Leggat Lake	IS-2	N	N
Leggat Lake	IS-1	N	N
Leonard Lake	1	N	N
Leonard Lake	2	N	Y
Leonard Lake	3	N	N
Limerick Lake	1	N	N

Limerick Lake	2	N	N
Limerick Lake	3	N	N
Little Crosby	IS-1	N	N
Little Silver Lake	IS-1	Y	N
Little Silver Lake	IS-2	Y	N
Long Lake	1	N	N
Long Lake	2	N	N
Long Lake	3	N	N
Long Lake East	IS-1	Y	N
Long Lake East	IS-2	Y	N
Long Lake West	IS-2	Y	N
Long Lake West	IS-1	Y	N
Long Pond	IS-1	N	N
Long Pond	IS-2	Y	N
Longbow Lake	1	N	N
Longbow Lake	2	N	N
Loon Call Lake	1	N	N
Loon Call Lake	2	N	N
Loon Call Lake	3	N	N
Loon Lake	IS-1	Y	N
Lower Beverley Lake	1	Y	N
Lower Beverley Lake	2	Y	N
Lower Beverley Lake	3	Y	N
Lower Rideau Lake	IS-2	Y	N
Lower Rideau Lake	IS-1	Y	N
Lower Rideau Lake	IS-3	Y	N
Lower Rock Lake	1	N	N
MackAvoy Lake	1	N	N
MackAvoy Lake	2	N	N
MackAvoy Lake	3	N	N
Marble Lake	1	N	N
Marble Lake	2	Y	N
Marble Lake	3	Y	N
Mazinaw	1	N	N
Mazinaw	2	N	N
Mazinaw	3	N	N
McLaren Lake	IS-1	N	N
Miskwabi Lake	1	N	N
Miskwabi Lake	2	N	N
Miskwabi Lake	3	N	N
Mississippi Lake	1	Y	N
Mississippi Lake	2	Y	N
Mississippi Lake	3	Y	N
Mountain Lake	1	N	N
Mountain Lake	2	N	N
Mountain Lake	3	N	N

O'Brien Lake	IS-1	N	N
O'Brien Lake	IS-2	N	N
Oomen-Unnamed Pond	1	N	N
Oomen-Unnamed Pond	2	N	N
Oomen-Unnamed Pond	3	N	N
Otty Lake	IS-2	Y	N
Otty Lake	IS-3	N	N
Otty Lake	IS-1	Y	N
Patterson Lake	1	N	N
Patterson Lake	2	N	N
Patterson Lake	3	N	N
Pike Lake	IS-1	N	N
Rainbow Lake	IS-2	N	N
Rock Lake	IS-1	N	N
Round Lake	IS-1	N	N
Sesekinika Lake	1	N	N
Sesekinika Lake	2	N	N
Sesekinika Lake	3	N	N
Shabomeka Lake	1	N	N
Shabomeka Lake	2	N	N
Shabomeka Lake	3	N	N
Sharbot Lake	1	Y	N
Sharbot Lake	2	Y	N
Sharbot Lake	3	Y	N
Silver Lake	1	Y	N
Silver Lake	2	Y	N
Silver Lake	3	Y	N
Singleton Lake	1	Y	N
Singleton Lake	2	N	N
Skeleton Lake	1	N	N
Skeleton Lake	2	Y	N
Skeletonpup Lake	1	Y	N
Skeletonpup Lake	2	N	N
Spectacle Lake	IS-1	N	N
St. Anthony Lake	1	N	N
St. Anthony Lake	2	N	N
St. Anthony Lake	3	N	N
Steenburg Lake	1	N	N
Steenburg Lake	2	N	N
Steenburg Lake	3	N	N
Stormy Lake	1	N	N
Stormy Lake	2	N	N
Stormy Lake	3	N	N
Sugar Lake	1	Y	N
Sugar Lake	2	Y	N
Sugar Lake	3	Y	Y

Thunder Lake	1	N	N
Thunder Lake	2	N	N
Thunder Lake	3	N	N
Tommy Lake	IS-1	N	N
Upper Rideau	IS-1	Y	N
Upper Rideau	IS-2	N	N
Upper Rideau	IS-3	N	N
Upper Rock Lake	1	N	N
Upper Rock Lake	2	N	N
Upper Rock Lake	3	N	N
Wendigo Lake	1	N	N
Wendigo Lake	2	N	N
Wenona Lake	1	N	N
Wenona Lake	2	N	N
Whitefish Lake	1	N	N
Whitefish Lake	2	N	N
Whitefish Lake	3	N	N
Whitefish Lake	4	N	N
Wolfe Lake	IS-3	Y	N
Wolfe Lake	IS-2	Y	N
Wolfe Lake	IS-1	N	N
Wollaston Lake	1	N	N
Wollaston Lake	2	N	N
Wollaston Lake	3	N	N

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