2017/2018 OIPC Winter Webinar Series

Ontario's Big 3 Aquatic Invasive Plants

European Water Chestnut, Eurasian Watermilfoil & Water Soldier

Kyle Borrowman, Ducks Unlimited Canada

Amanda Cooper, Trent University

Robert McGowan, Ontario Federation of Anglers & Hunters (ISAP)

24 January 2018

ONTARIO INVASIVE PLANT COUNCIL

OIPC 2017/2018 Winter Webinar Series

Join the OIPC network to learn about the latest developments in invasive plant management, research & related information!

Date	Topic	Presenter
Wed. Dec. 20 2017	Building Invasive Species Awareness at the Community Level with Citizen Science & Volunteer Engagement: Lessons from Across Ontario	**Colin Cassin** ONTARIO INVASIVE PLANT COUNCIL
Wed. Jan. 10 2018	Implementing Biological Control for Invasive Plants in Ontario	**Rob Bourchier** AGRICULTURE & AGRI-FOOD CANADA
Wed. Jan. 24 2018	Approaches for Managing Ontario's 3 Biggest Aquatic Invasive Plants: European Water Chestnut, Eurasian Watermilfoil & Water Soldier	**Kyle Borrowman** DUCKS UNLIMITED **Amanda Cooper** TRENT UNIVERSITY **Robert McGowan** ONTARIO FEDERATION OF ANGLERS & HUNTERS
Wed. Feb. 7 2018	Large-scale Invasive Phragmites Control – Long Point Emergency Use Registration Pilot Project Update	**Eric Cleland** NATURE CONSERVANCY OF CANADA
Wed. Feb. 21 2018	Fighting Invasive Plants with Municipal Frameworks: Lessons from London, Mississauga, York & Other Ontario Municipalities	**Kellie Sherman** ONTARIO INVASIVE PLANT COUNCIL
Wed. March 7 2018	Purple Loosestrife & Biocontrol – an Ontario History	**Donna Mackenzie** ONTARIO BEETLES
Wed. March 21 2018	Implications of Exotic Earthworms for Plant Invasion and Restoration	**Michael McTavish** UNIVERSITY OF WATERLOO

Follow along with *#OIPCwebinar*

Registration & more info available at:
www.ontarioinvasiveplants.ca/webinars

ONTARIO INVASIVE PLANT COUNCIL

European Water Chestnut Management

Kyle Borrowman – European Water Chestnut Program Coordinator
Ducks Unlimited Canada
January 24, 2018

Ontario
Ministry of Natural Resources and Forestry

Ducks Unlimited Canada

Invasive Species Centre

What is Water Chestnut?

Floating leaves (aka Rosette)

- Green sharply-toothed leaves
- Appear in May/June
- Air bladders on leaf stem
- Up to seven rosettes per plant

Underwater leaves

- Fine and feather-like

Flowers (timing of flowering)

- Appear in June
- Four very small (8mm) white petals

Seeds

- Dense, hard nut
- Four barbed spines
- Produced between July/September

Illustration: Dr. Otto Wilhelm Thome;
https://commons.wikimedia.org/wiki/File:Illustration_Trapa_natans0.jpg

Why is it a Problem?

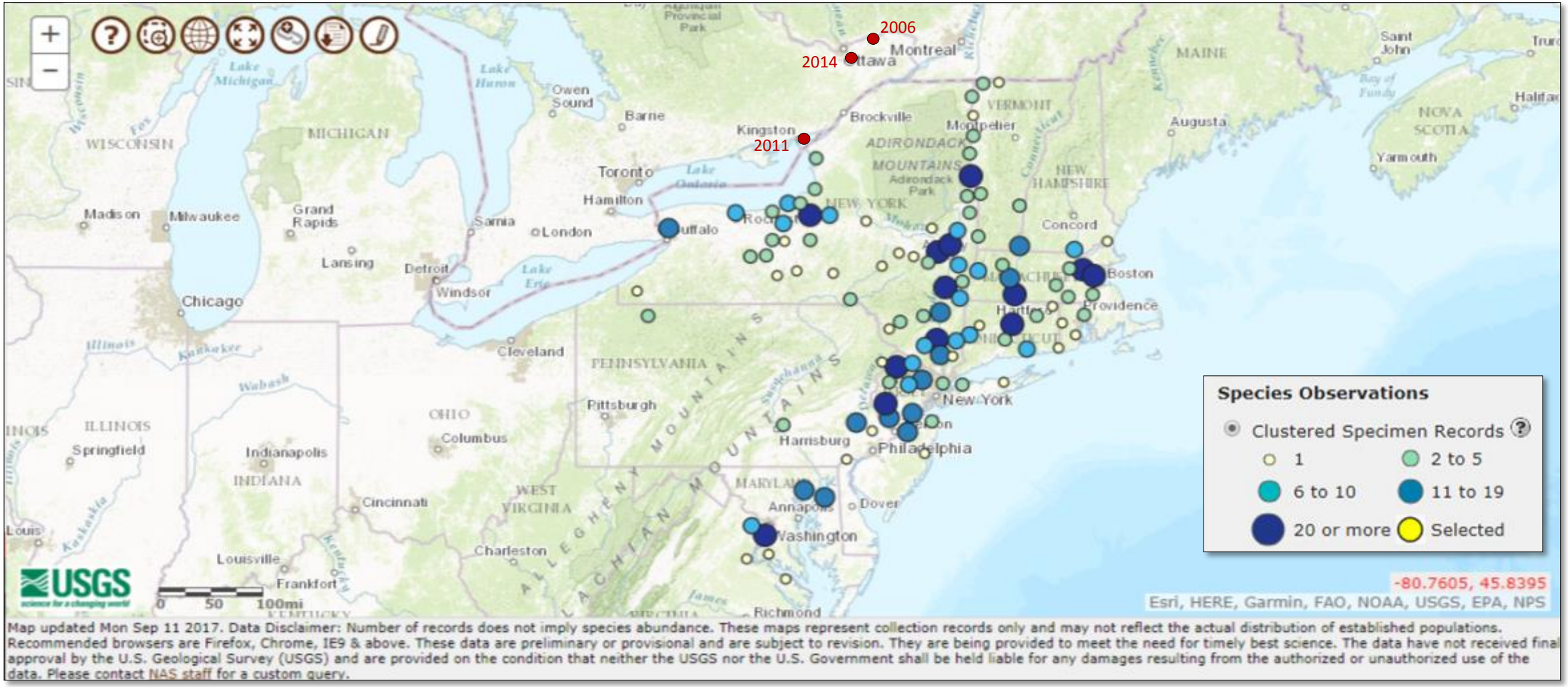
- Quickly form dense, floating mats that outcompete native plants.
- Dense mats of decaying plants lower dissolved oxygen levels and can cause fish kills.
- Negatively impact habitat for fish, waterfowl and other wildlife.
- Can impact navigation and recreational use of waterways.
- Seeds are very sharp and can be a hazard if washed up on shore.
- **Listed as a Prohibited Species under the Invasive Species Act.**

Water chestnut infestation within the western end of the Erie Canal. (Photo Credit: USFWS, 2010)

Introduction and Spread

- Introduced to the U.S. as an ornamental in the late 1800s.
- Historically introduced to Concord River (Massachusetts), Hudson River, Mohawk River and Lake Champlain (New York).
- Spread predominantly by seed, secondarily by dislodged and floating rosettes.
- First observed in Ontario in 2006.

Distribution of Water Chestnut



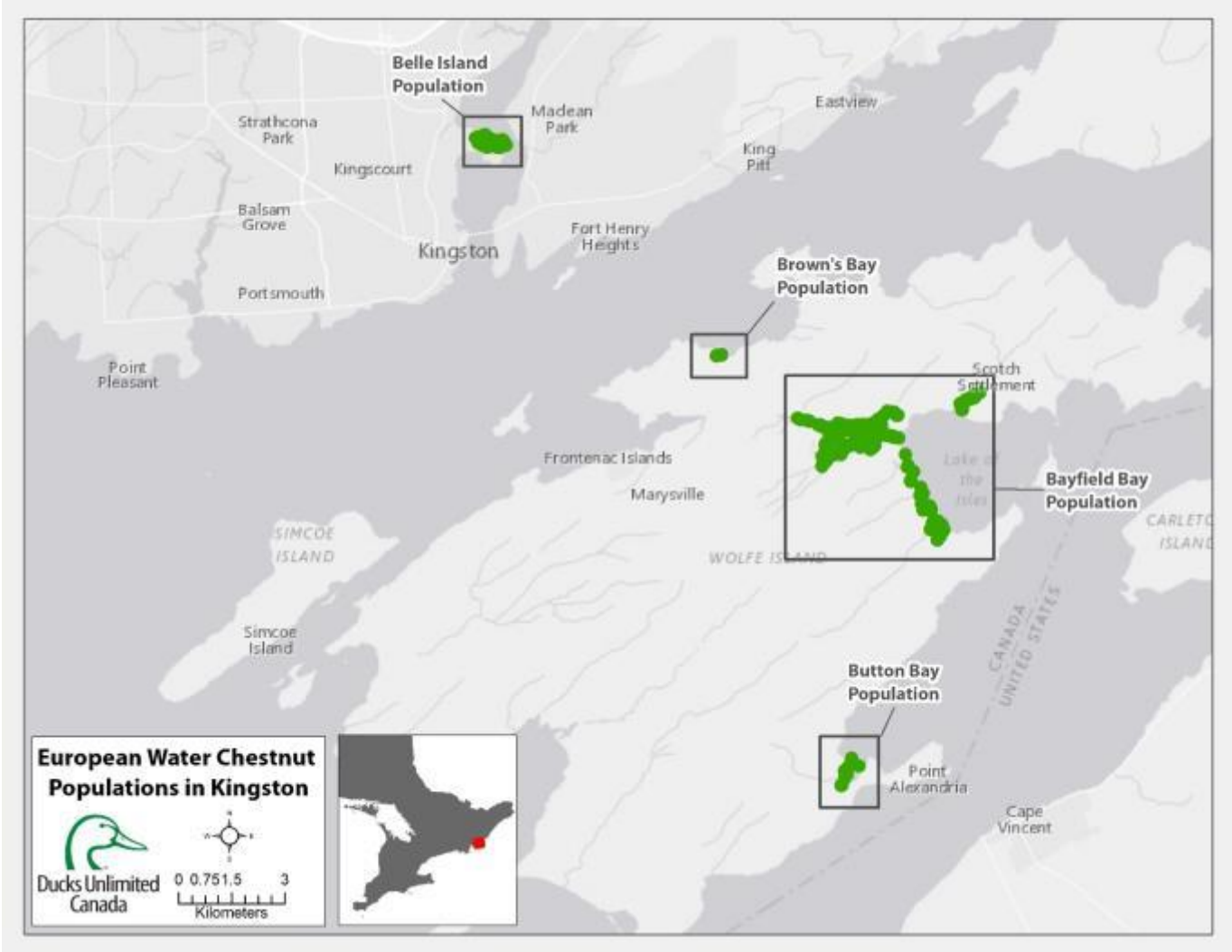
https://nas.er.usgs.gov/viewer/omap.aspx?SpeciesID=263

Current Management Techniques

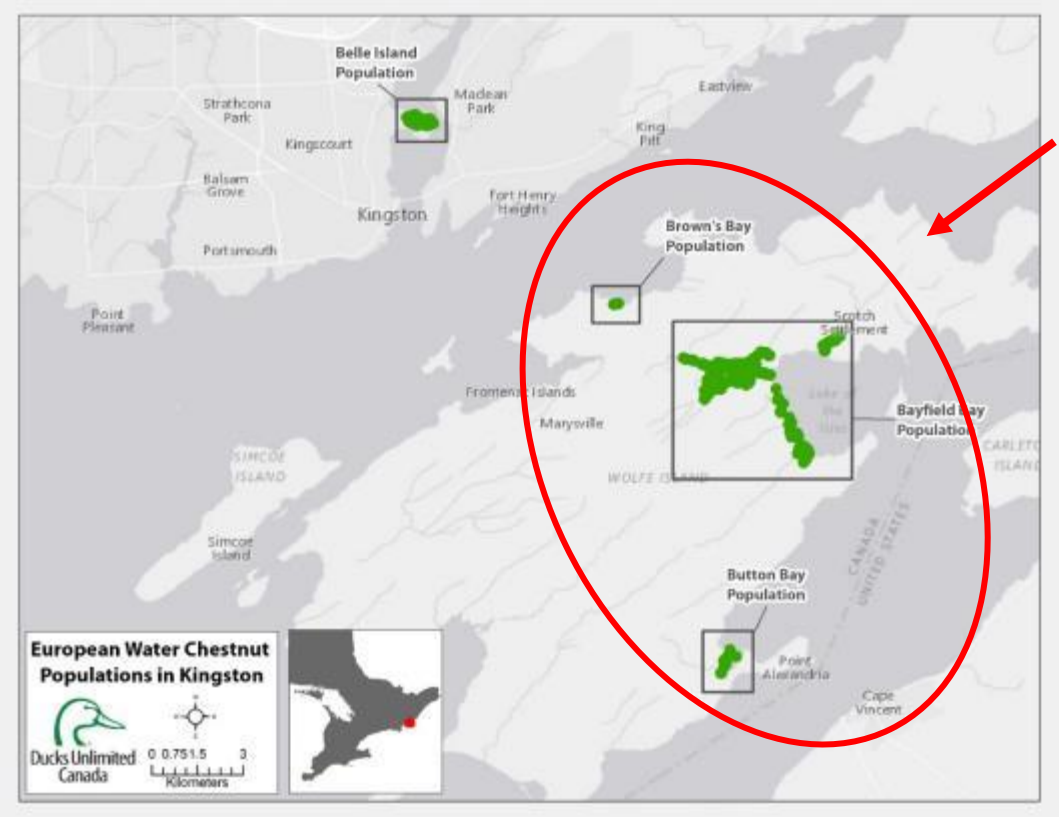
- **Mechanical**
  - Mechanical Harvester – Voyageur Provincial Park.
  - Hand Pulling – Wolfe Island Populations/Black Rapids, Ottawa.
- **Chemical**
  - U.S. – 2-4 D and Triclopyr.
  - Canada – REWARD (Diquat) – Listed on the label, never been treated.
- **Biological**
  - *Galerucella birmanica* – host specificity testing
  - NYS Invasive Species Research Institute – Cornell University.
  - Currently unavailable (needs approval from APHIS/USDA in USA).

Distribution in Lake Ontario/St. Lawrence River

- 2011 – Bayfield Bay, Wolfe Island
- 2014 – Button Bay, Wolfe Island
- 2015 – Belle Island, Kingston
- 2016 – Brown's Bay, Wolfe Island
- 2017 – Lewis Bay, Wolfe Island

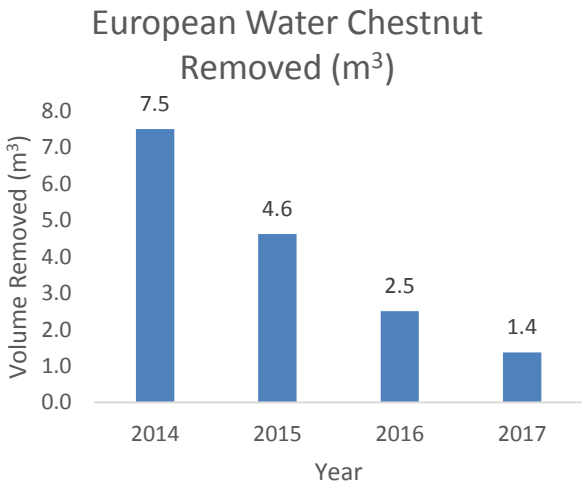


Water Chestnut - Wolfe Island

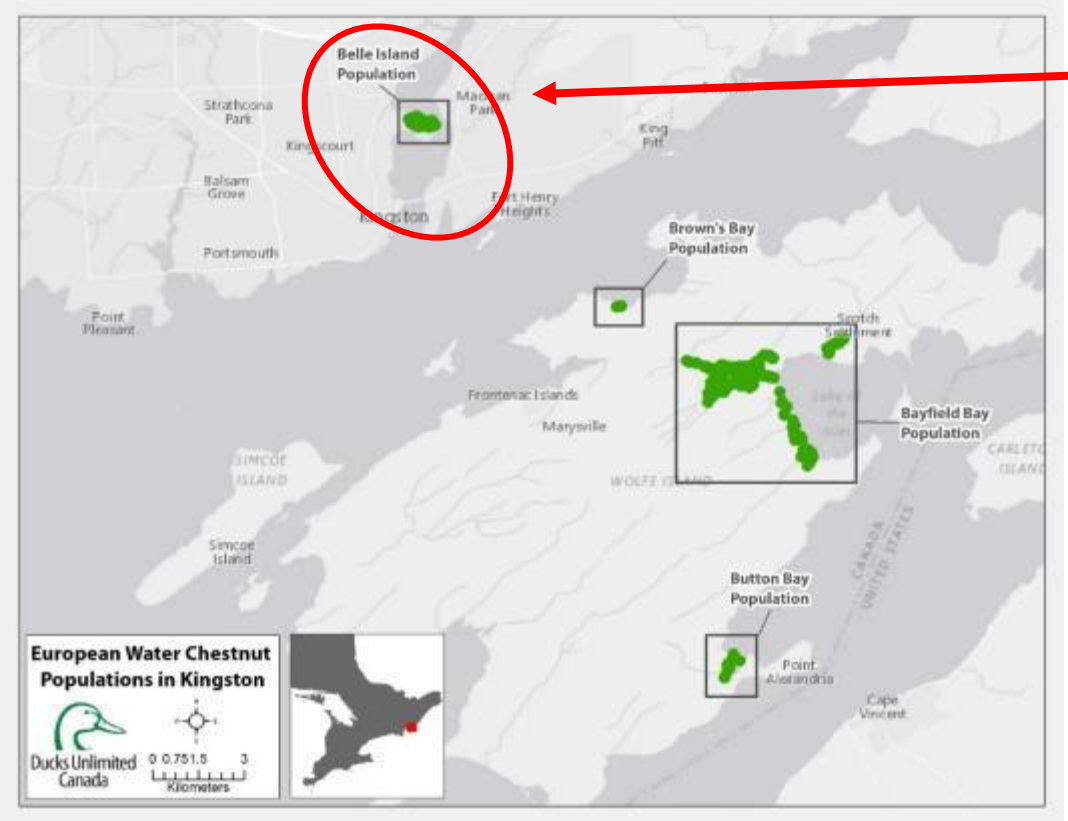


Hand Pulling:

- Performed 2014 – Present
- All plants observed are removed.
- Responding effectively to yearly hand pulling.
- Steady decline in water chestnut removed each year
- 82% decrease over 4 years

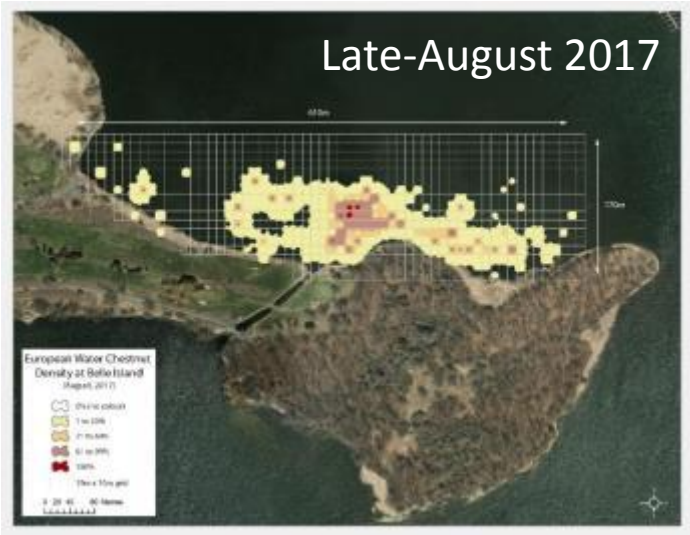


Water Chestnut - Belle Island



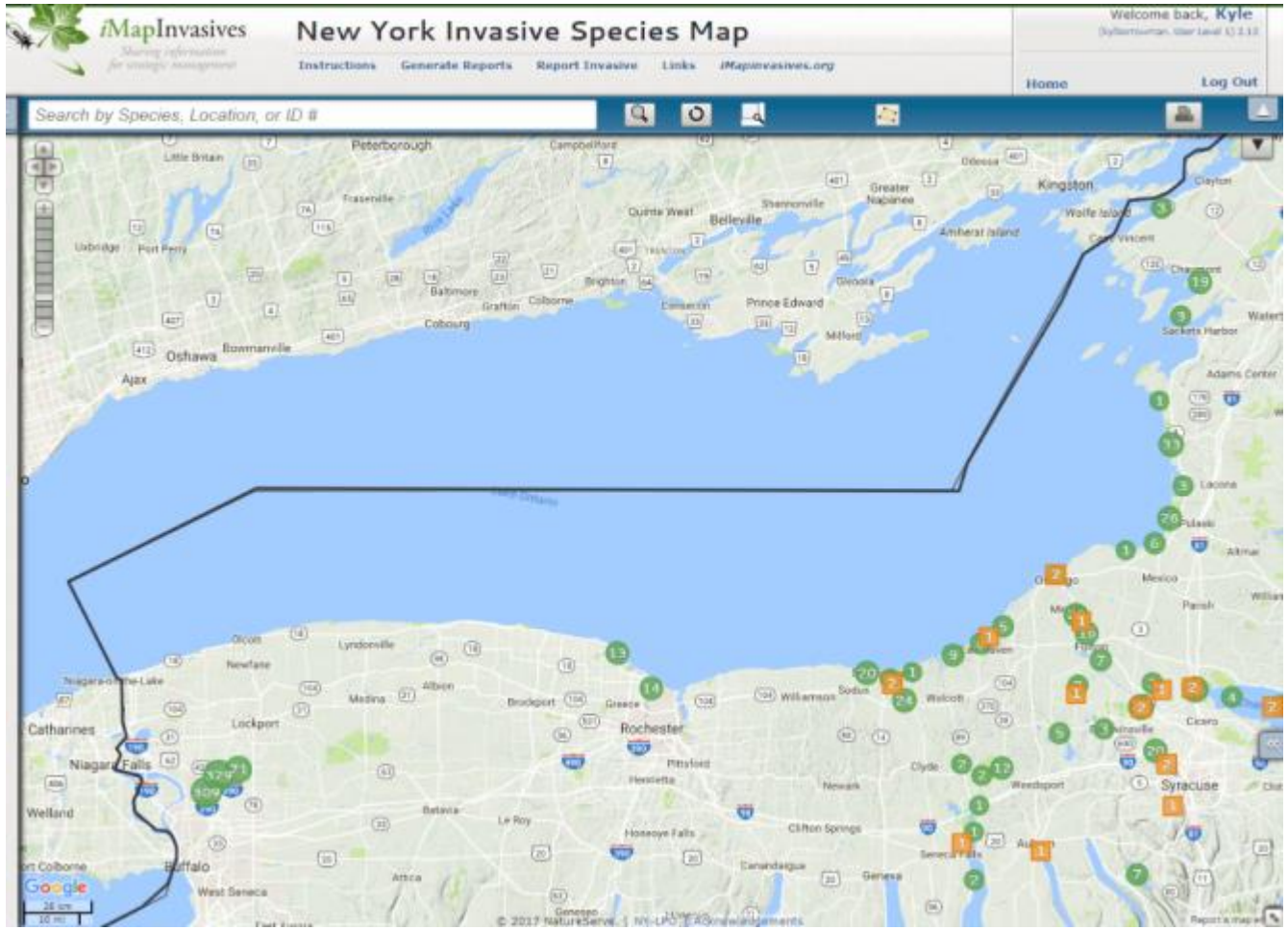
Proposed Herbicide Application

- Located within Greater Cataraqui River – Rideau Canal System.
- Concerns over sediment toxicity and human exposure.
- Reward (Diquat)
- First herbicide application for Water Chestnut in Canada
- Projected treatment in 2018



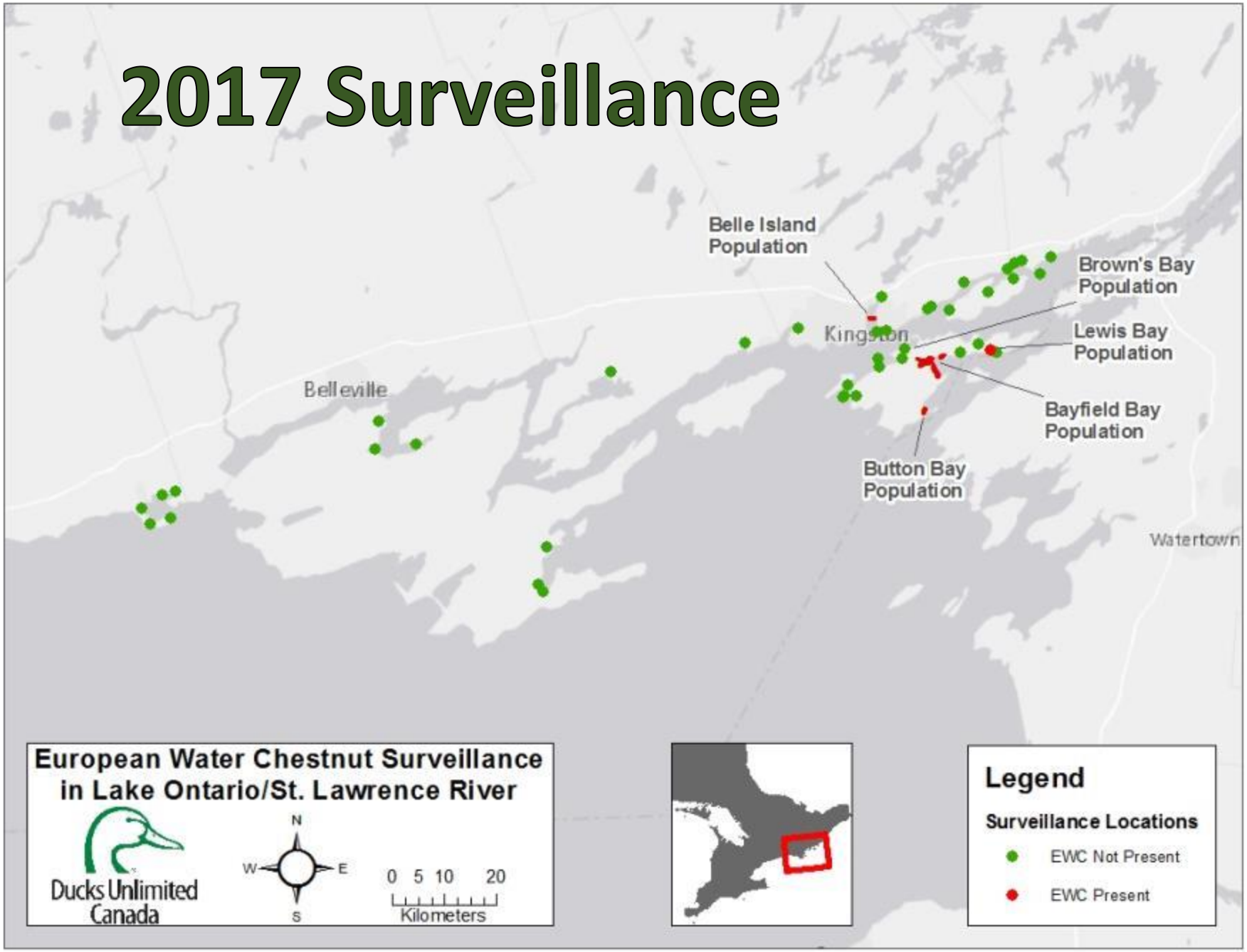
Continued Surveillance

- Water chestnut present in 44 of 62 counties in New York State.
- Observations in 24 Tributaries and Coastal Embayments connected to Lake Ontario/St. Lawrence River.
- DUC identified highly probably areas where water chestnut could occur
- Surveillance performed in late summer/early fall, following management.



https://login.imapinvasives.org/nyimi/map/

2017 Surveillance

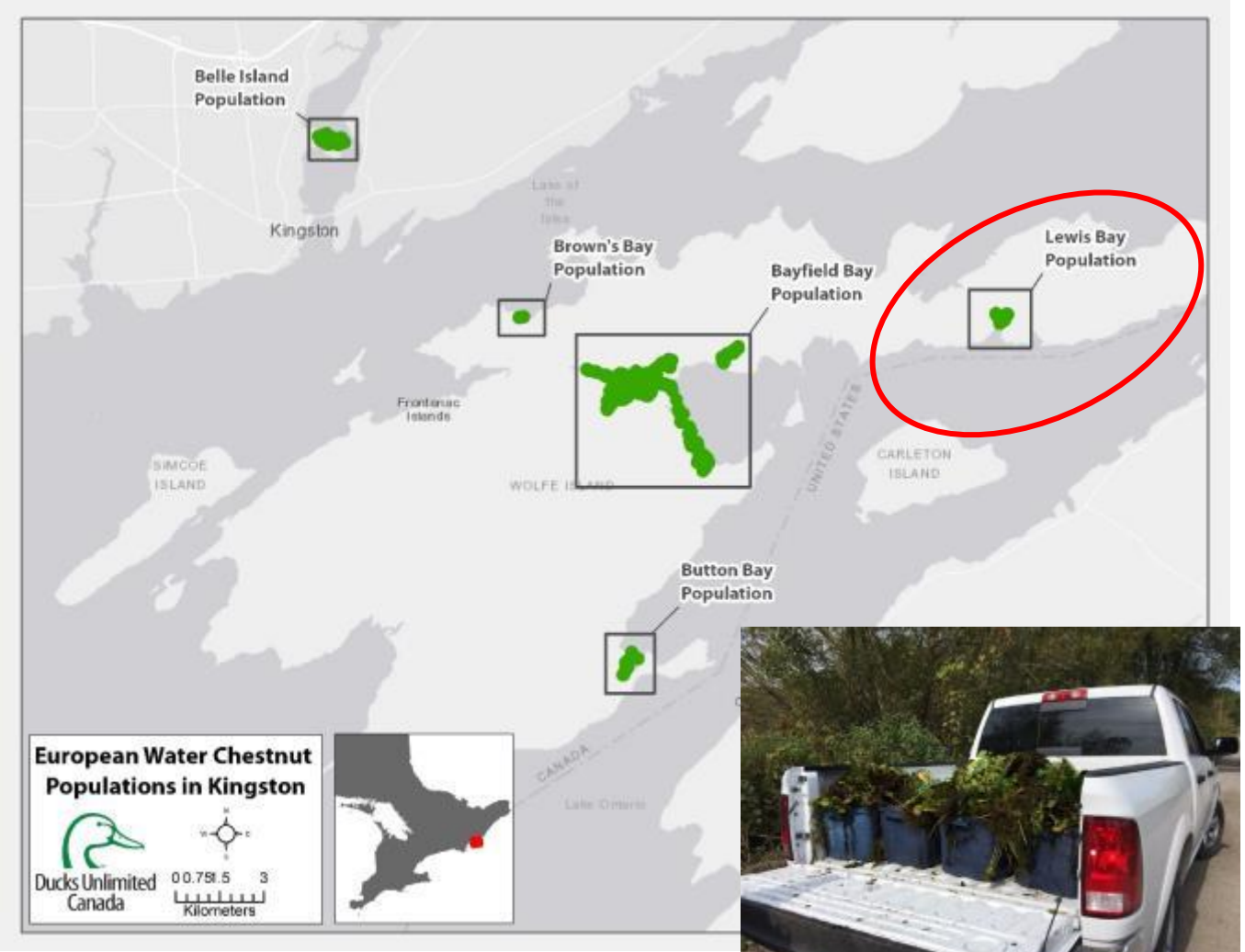


- ~40 Locations visited from August to late October
- Range from Brighton, ON to Ganonoque, ON
- One new population observed on Wolfe Island at Lewis Bay.

Water Chestnut - Continued EDRR

NEW POPULATION – WOLFE ISLAND

- Surveillance work on September 25th, 2017.
- New population observed downstream of known populations on Wolfe Island.
- Chestnut was mapped with a GPS and removed over a three-day period.
- Majority of the plants contained mature seeds.
- Site to be revisited in the 2018 season and consecutive years to follow.



Moving Forward in 2018

WOLFE ISLAND

- Continue removal at Bayfield Bay, Button Bay and Lewis Bay
- Revisit Brown's Bay and other potential locations for new infestations

BELLE ISLAND

- Prepare to apply for permit to treat population with herbicide in 2018

SURVEILLANCE

- Extend surveillance downstream throughout the 1000 Islands and St. Lawrence River
- Continue surveillance upstream along coastal wetlands of Lake Ontario

Thank You!

Kyle Borrowman
European Water Chestnut Program Coordinator
Ducks Unlimited Canada
k_borrowman@ducks.ca
613-389-0418
Ext. 125

Ontario
Ministry of Natural Resources and Forestry

Ducks Unlimited Canada

Invasive Species Centre

Adapting Biological Control for Managing Eurasian watermilfoil (*Myriophyllum spicatum)*

Amanda Cooper
B.Sc. Ecological Restoration
Trent School of the Environment

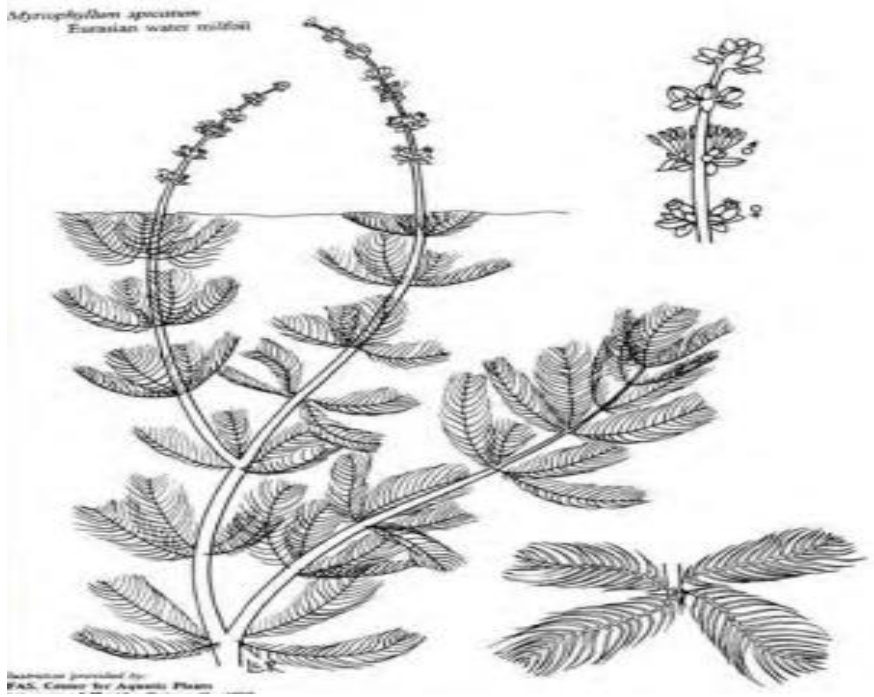
Eurasian watermilfoil

Description

- Invasive rooted submersed perrennial macrophyte
- Whorled leaves on the stem at each node
- Produces small reddish flowers that emerge several inches above the water

Life Cycle

- Successfully colonizes an array of habitats
- Asexual reproduction through root development as dominant method of propagation
- Dies back to root crowns in the late fall
- New shoots grow from the overwintering root crowns in the spring



Dunbar, 2009

Eurasian watermilfoil

History

- Native to Europe, Asia and Northern Africa
- Introduced to North America in the early 1940's

Dispersal

- Aquarium and ornamental pond industries
- Transfer of fragments to new waterbodies

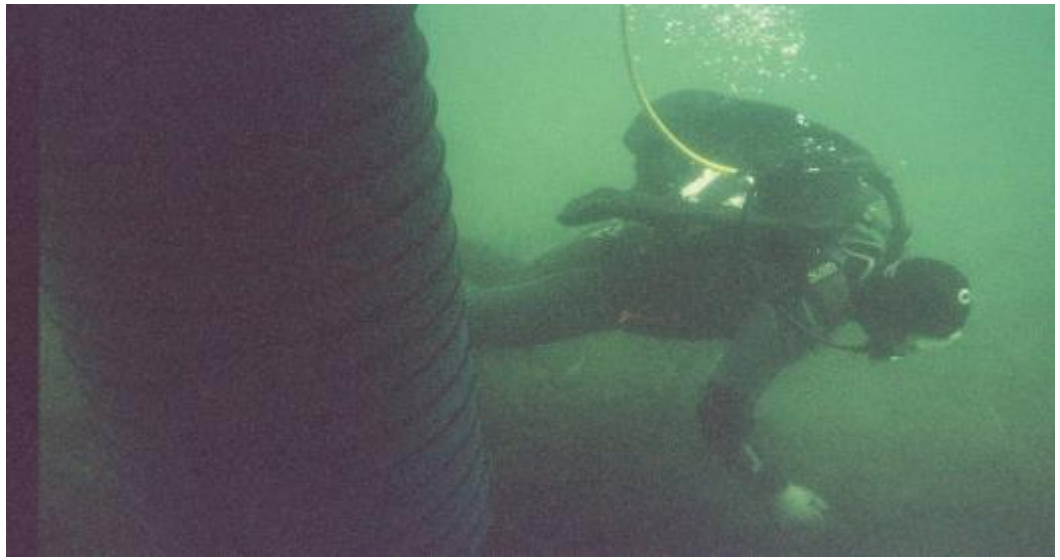
Risks/Impacts

- Dense canopies shade out native vegetation
- Complicates recreational activities
- Reduces property values

EWM Control Options

Physical (Dredging)

- Longer-term
- Selective
- Very limited areas
- Slow
- Expensive
- Increases water depth



AE Commercial Diving Services, 2015

Physical (Harvesters)

- Direct relief
- Immediate efficacy
- Moderately inexpensive
- Sediment disturbance
- Harvests indirect plants, fish and macroinvertebrates
- Aid in spreading some *spp.*

Dunbar, 2009

EWM Control Options

Chemical

- Ie. Diquat
- Requires only a short exposure time
- Broad spectrum
- Fast action
- Inexpensive
- Non-selective
- Not effective in turbid waters
- Requires more treatments per year
- Negative public perception

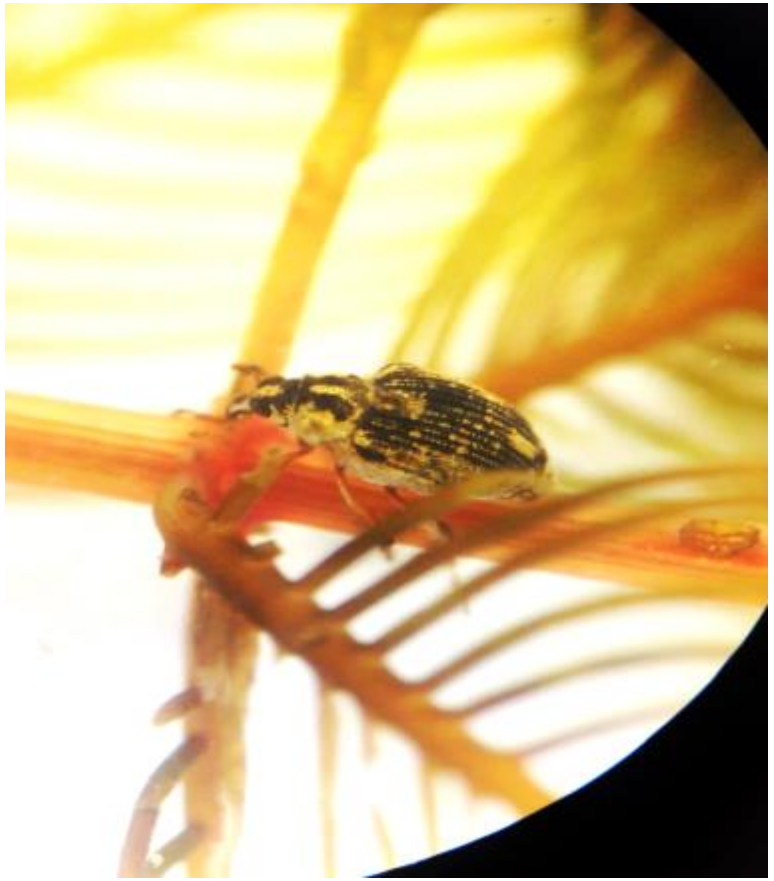
Wisconsin Department of Natural Resources, 2013

EWM Control Options

Biological

- Long-term
- Effective
- Positive public perception
- Several apparent successes through natural problems
- Requires a large amount of control agents
- Unpredictability of results
- Costly

Euhrychiopsis lecontei – native milfoil weevil

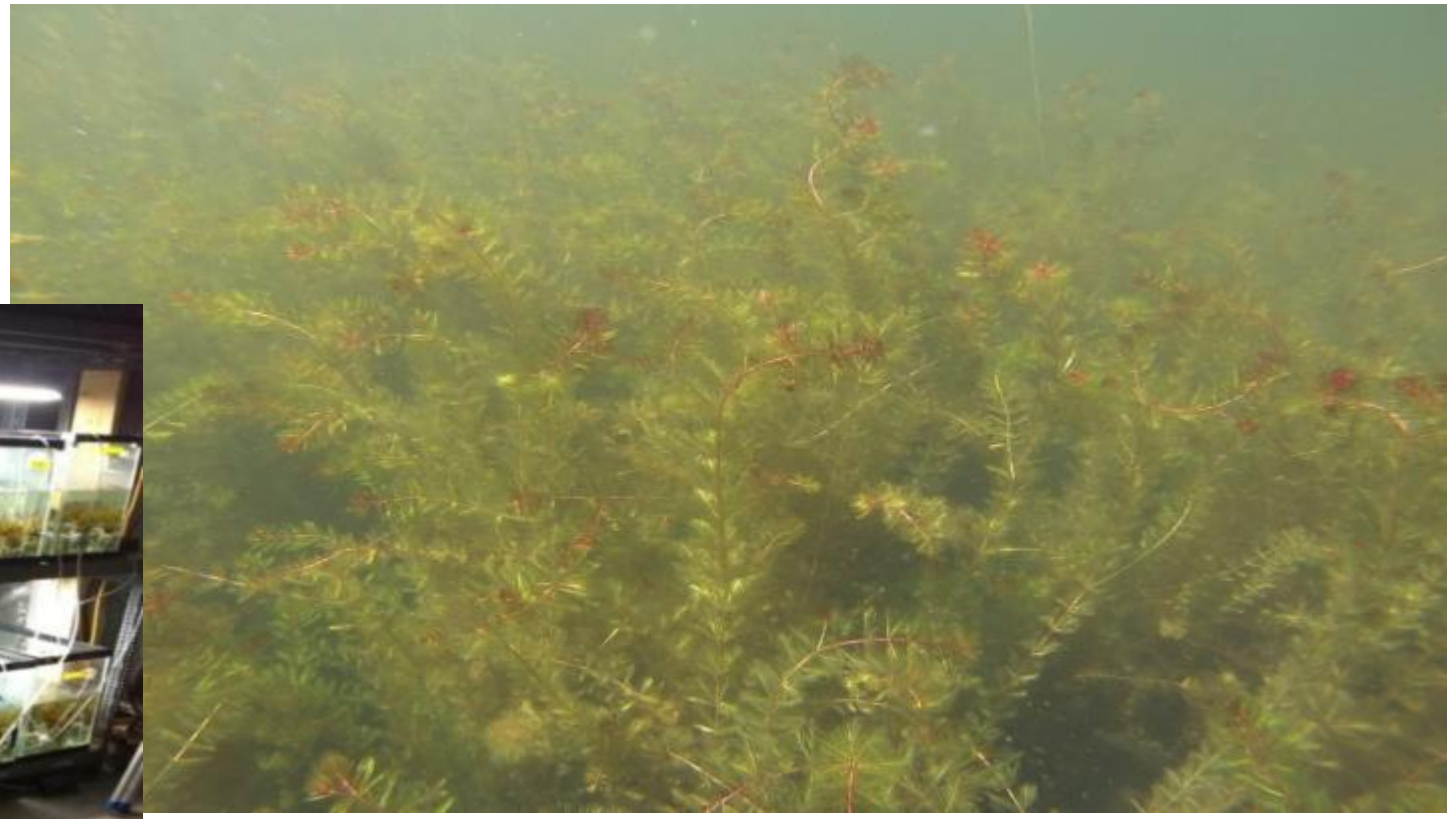


Cooper, 2014

Biocontrol of EWM at Big Cedar Lake, Ontario

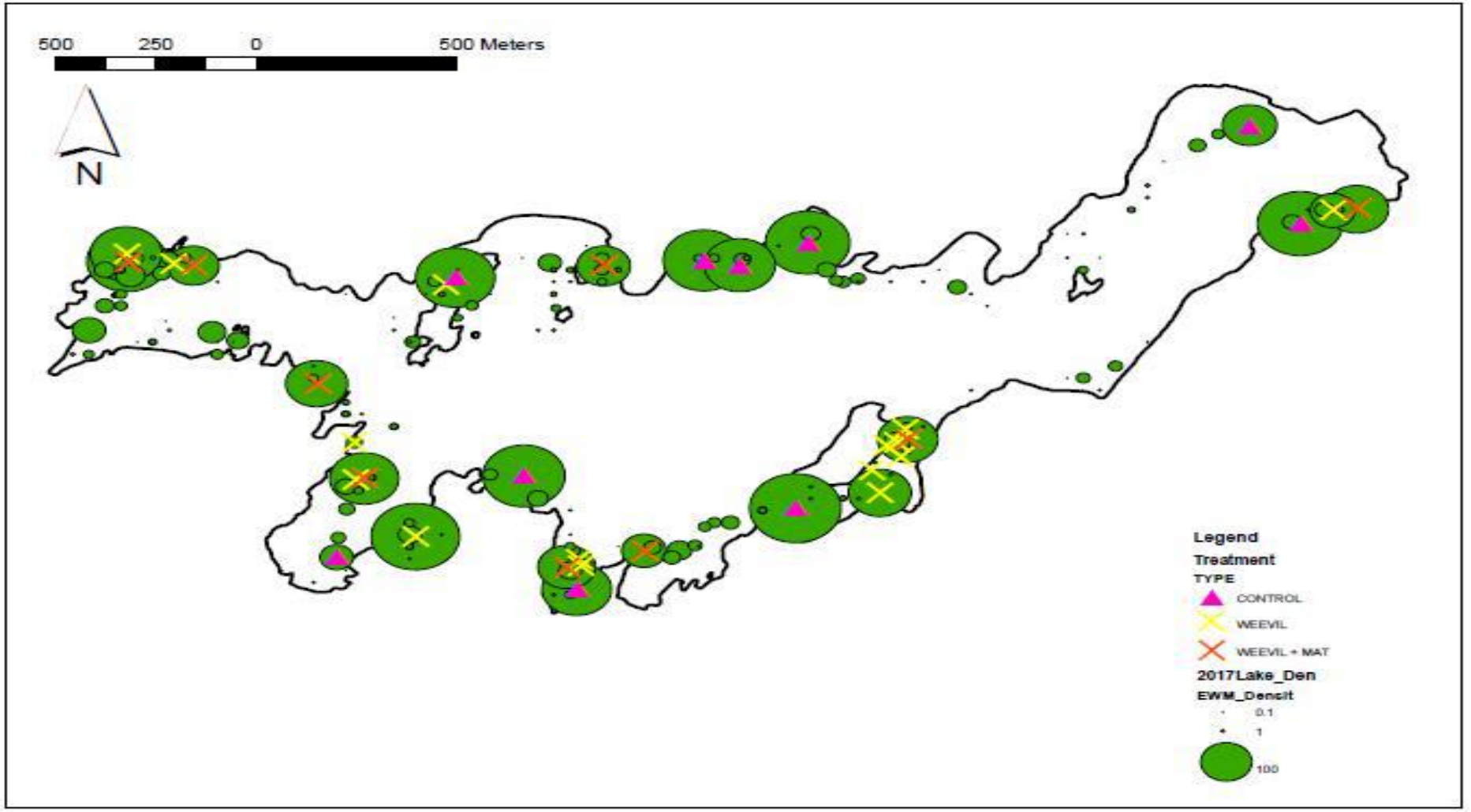
Lab Culture & Weevil Stocking

Cooper, 2015



Cooper, 2016

Biocontrol of EWM at Big Cedar Lake, Ontario

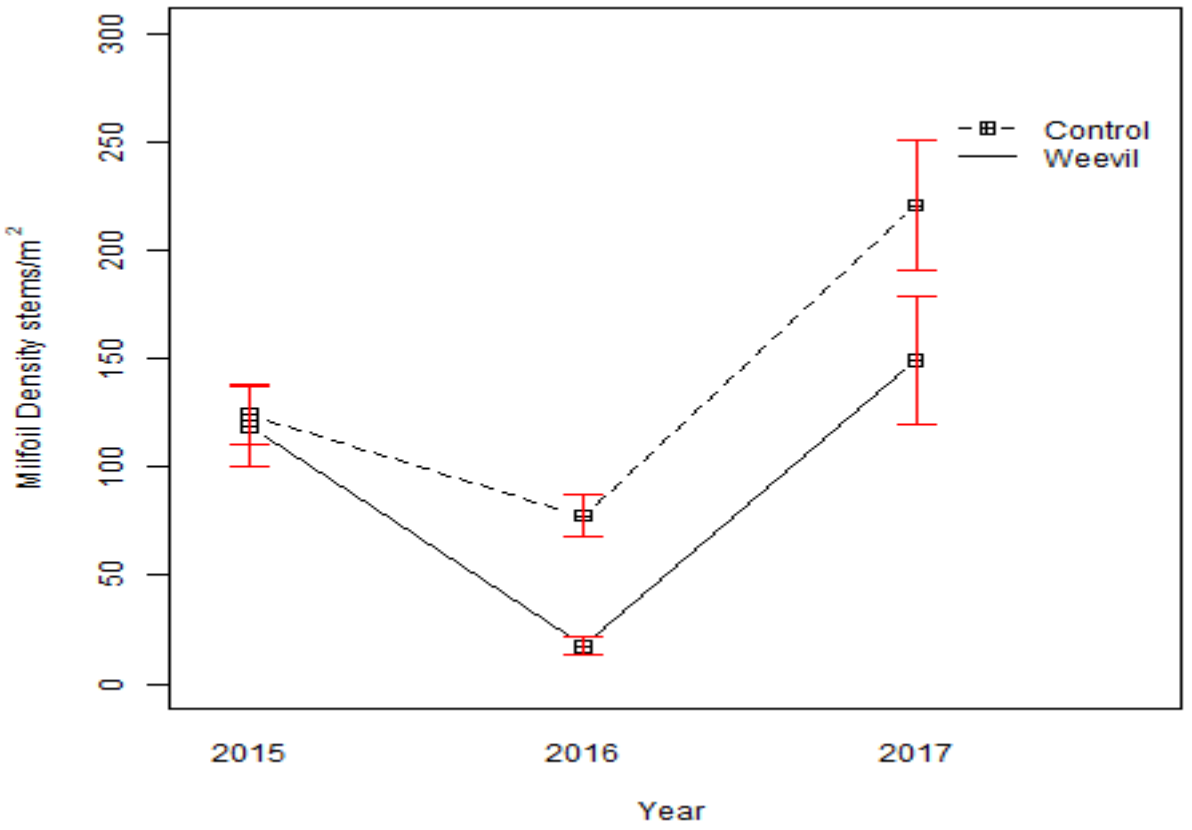


Map of all sites surveyed for milfoil density at the end of summer 2017. Density (green circles) is proportionate to the highest value (stems/m2).

Biocontrol of EWM at Big Cedar Lake, Ontario

2015 Experiment

- 25,000 weevils were stocked across 4 sites
- EWM was nearly or completely eradicated from these sites in 2016 but has since returned in 2017

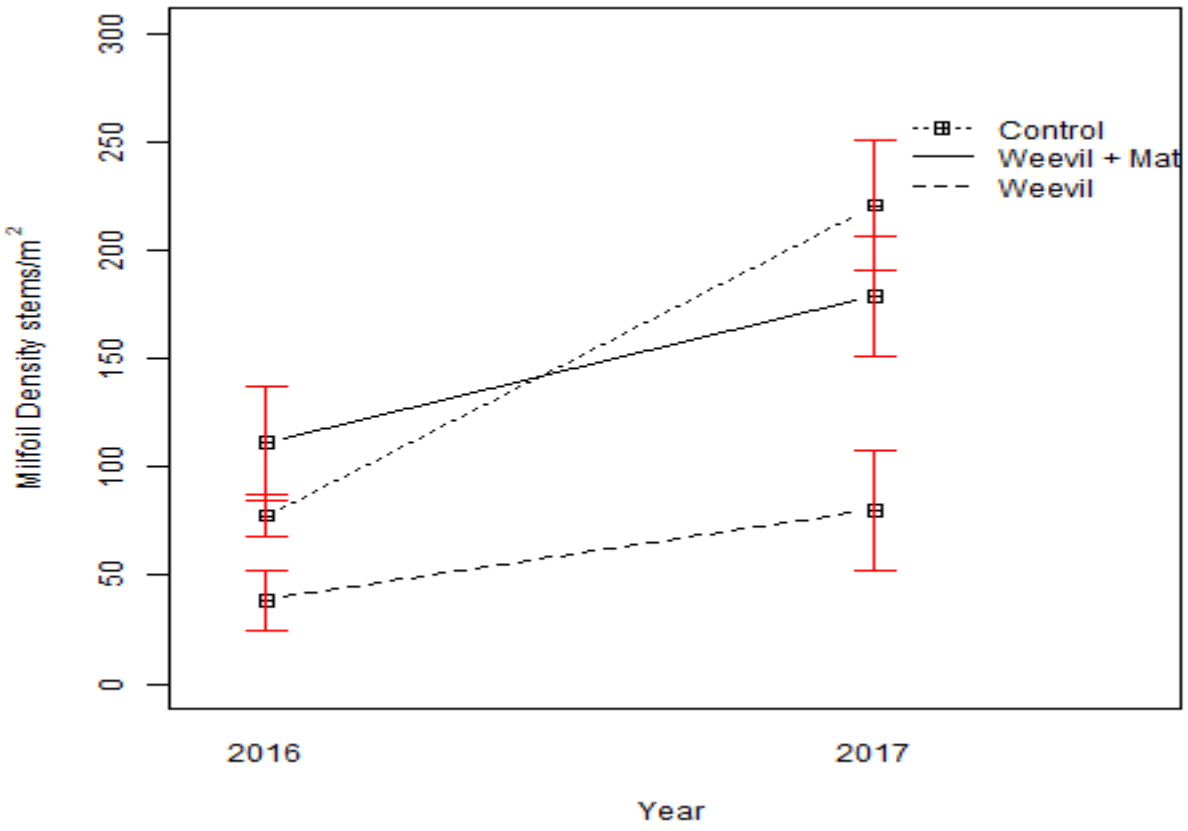


Milfoil density for the 2015 treatment season and observed for two years. This year had 4 control sites and 4 weevil sites.

Biocontrol of EWM at Big Cedar Lake, Ontario

2016 Experiment

- 40,000 weevils were stocked across 5 sites
- Additionally, in 3 of these sites, a vegetated benthic mat was installed

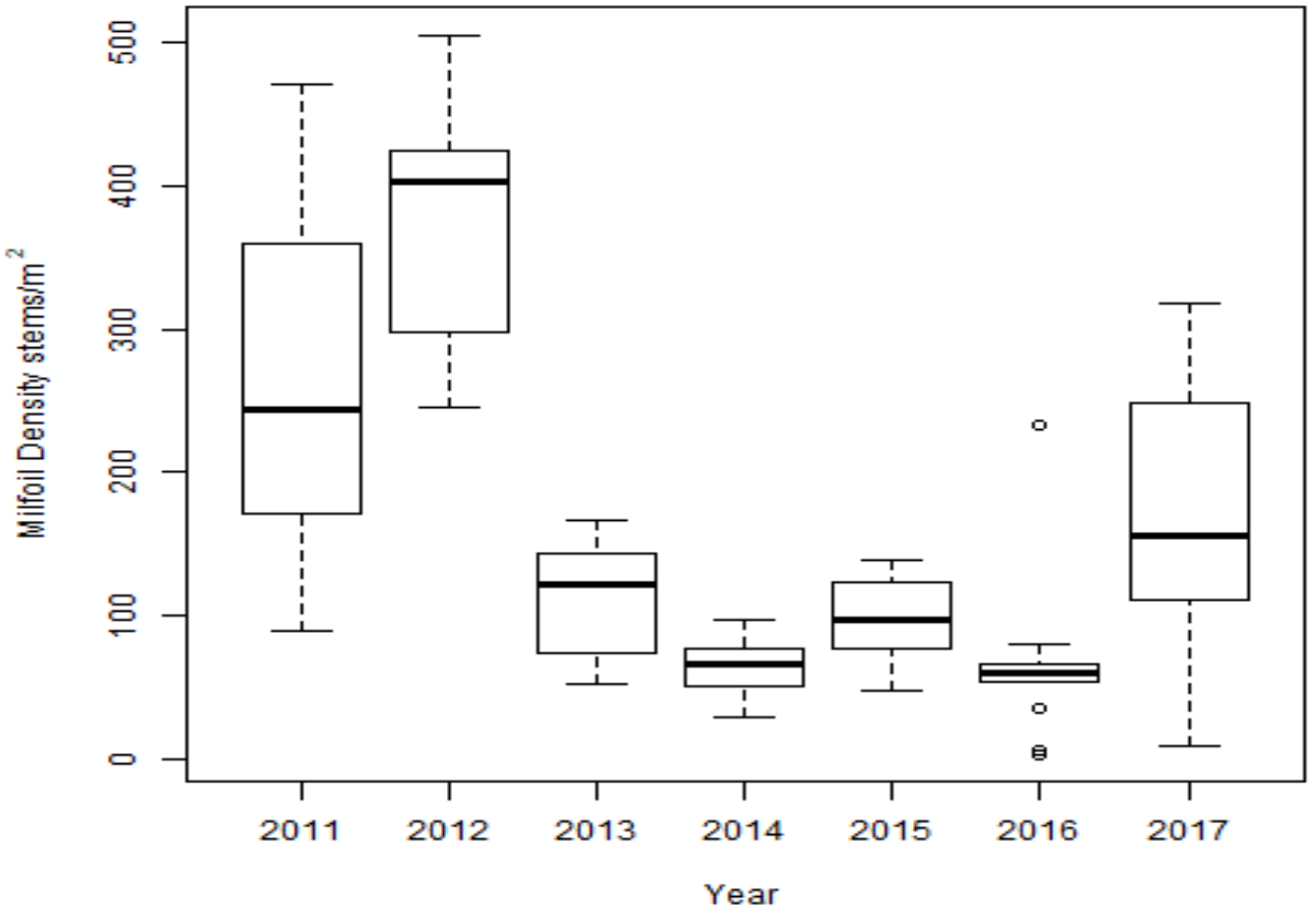


Milfoil density for the 2016 treatment season and observed for a year. This year had 4 control sites, 3 weevil + mat sites and 2 weevil sites.

Biocontrol of EWM at Big Cedar Lake, Ontario

Long-term Trends in EWM Density

1. Possibility of Diminishing Returns on Weevil Stocking
2. EWM Re-colonization in 2015 Experiment Sites
3. Continued Evidence of Weevil Saturation



Historical changes in the average stem densities of milfoil patches in Big Cedar Lake from 2011-2017.

Biocontrol of EWM at Big Cedar Lake, Ontario

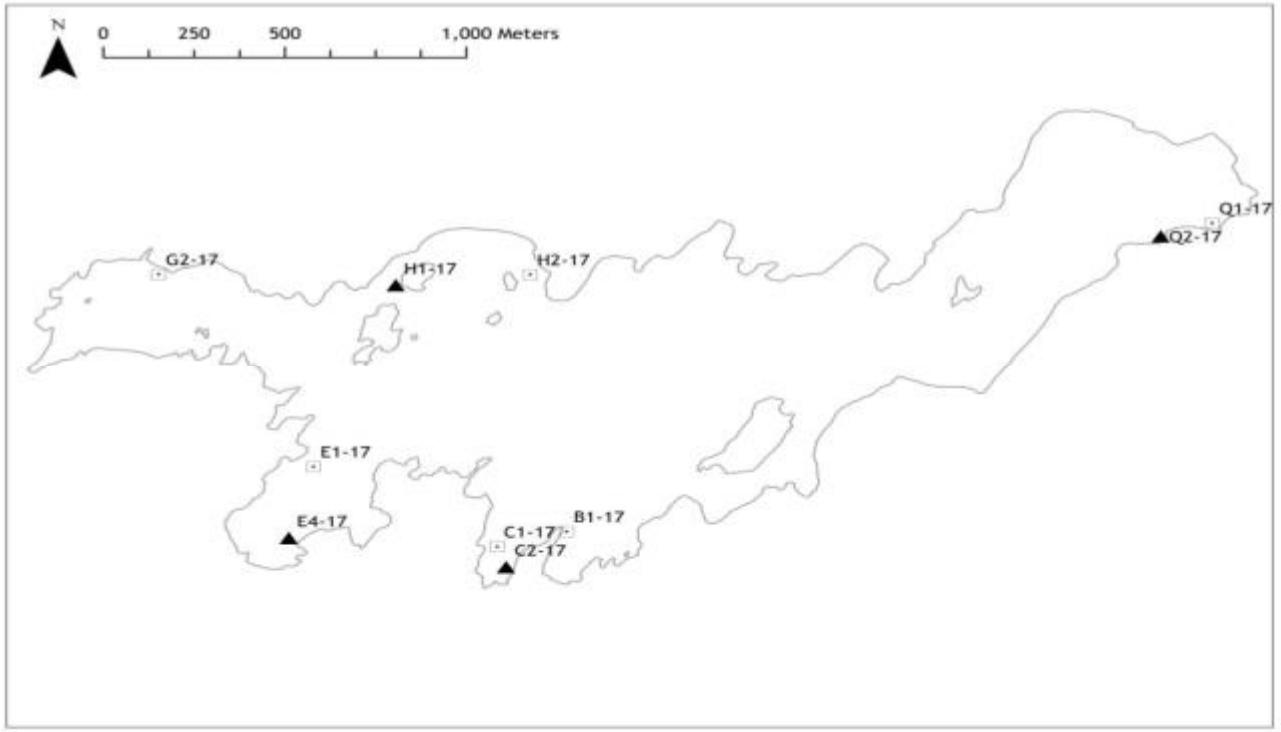
Conclusions

- Since 2013, average EWM densities have altered from higher to lower each year
- It is unlikely that EWM will be completely eradicated from Big Cedar Lake by milfoil weevils alone

Biocontrol of EWM at Big Cedar Lake, Ontario

2017 Experiment

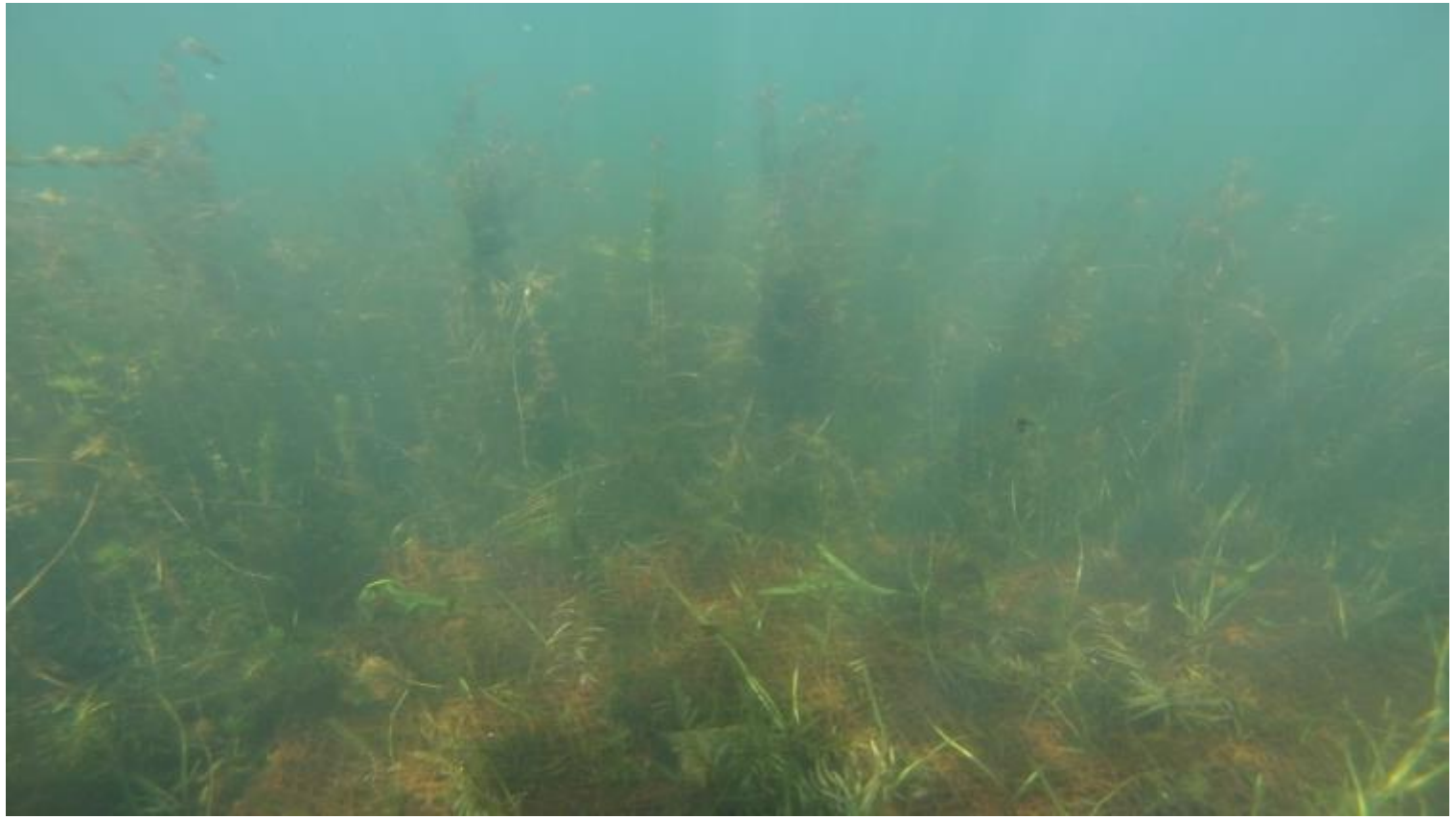
- 40,000 weevils were stocked across 6 sites
- Additionally, a vegetated benthic mat was installed at each of the 6 sites
- Full-lake survey of EWM density was conducted



Locations of 2017 sites at Big Cedar. Triangles represent control sites and squares represent treatment sites with mats and weevils.

Biocontrol of EWM at Big Cedar Lake, Ontario

Vegetated Biodegradable Benthic Mats



Cooper, 2016

Cooper, 2017

Biocontrol of EWM at Big Cedar Lake, Ontario

Recommendations for Future EWM Management

- Primarily focus on encouraging native plants to compete with EWM
- Continue monitoring experimental patches (2015-present) and full-lake survey points
- Select material that can prevent EWM growth while allowing adequate spacing for native transplants
- Install vegetated benthic mats when EWM density is low

Literature Cited

AE Commercial Diving Services. (2015). Suction Harvesting. Retrieved from http://aquaticinvasivecontrol.com/diveservices/aquatic-species-control/

Boylen, C. W., Eichler, L. W., & Sutherland, J. W. (1996). Physical control of Eurasian watermilfoil in an oligotrphic lake. *Hydrobiolgia*, 340: 213-218.

Dunbar, G. (2009). Okanagan Basin Water Board. *Management Plan for Eurasian Watermilfoil (Myriophyllum Spicatum) in the Okanagan, British Columbia*.

Hamel, C. (2014). *Non-native Invasive Freshwater Plants: Myriophyllum spicatum*. Retrieved from State of Washington Department of Ecology: http://www.ecy.wa.gov/programs/wq/plants/weeds/aqua004.html

Harrahy, E. A., Edwards, D. S., & Hedman, C. J. (2014). Persistence of 2,4-D and its effects on benthic macroinvertebrates following spring treatment of Eurasian watermilfoil, myriophyllum spicatum L. in Two Lakes in Southeastern Wisconsin, USA. *Bulletin of Environmental Contamination and Toxicology* , 92: 404-409.

Jester, L. L., Bozek, M. A., Helsel, D. R., & Sheldon, S. P. (2000). Euhrychiopsis lecontei distribution, abundance, and experimental augmentations for Eurasian

Kawartha Lake Stewards Association (2009). Aquatic Plants Guide.

Li F, Lianlian Z, Xie Y, Jiang L, Chen X, Deng Z, Pan B. 2015. Colonization by fragments of the submerged macrophyte *Myriophyllum spicatum* under different sediment type and density conditions. Sci Rep. 5: 11821.

Madsen, J. D., Wersal, R. M., & Woolf, T. E. (2015). Operation control of Eurasian watermilfoil (Myriophyllum spicatum) and Impacts to the Native Submersed Aquatic Macrophyte Community in Lake Pend Oreille, Idaho. *Invasive Plant Science and Management*, 8(2): 219-232.

Miller, J.K., L. Roketenetz, & H. Garris. (2011). Modelling the interaction between the exotic invasive aquatic macrophyte *Myriophyllum spicatum* and the native biological control agent *Euhrychiopsis lecontei* to improve augmented management programs. *Biological Control,* 56(6): 935-945.

Newman, R. M. (2004). Invited review: Biological control of Eurasian watermilfoil by aquatic insects: basic insights from an applied problem. *Archiv fuer hydrobiologie*, *159*(2), 145-184.

Nichols, S. A. (1975). Identification and management of Eurasian watermilfoil in Wisconsin. *Wisconsin Academy of Science, Arts, and Letters*, *63*, 116-128.

Smith CS, Barko JW. 1990. Ecology of Eurasian watermilfoil. J Aquat Plant Manage. 28: 55-64.

Management Of Water Soldier (*Stratiotes aloides*) In Ontario

OIPC Winter Webinar Series

Robert McGowan

Ontario Federation of Anglers and Hunters

Invading Species Awareness Program

Wednesday January 24, 2018

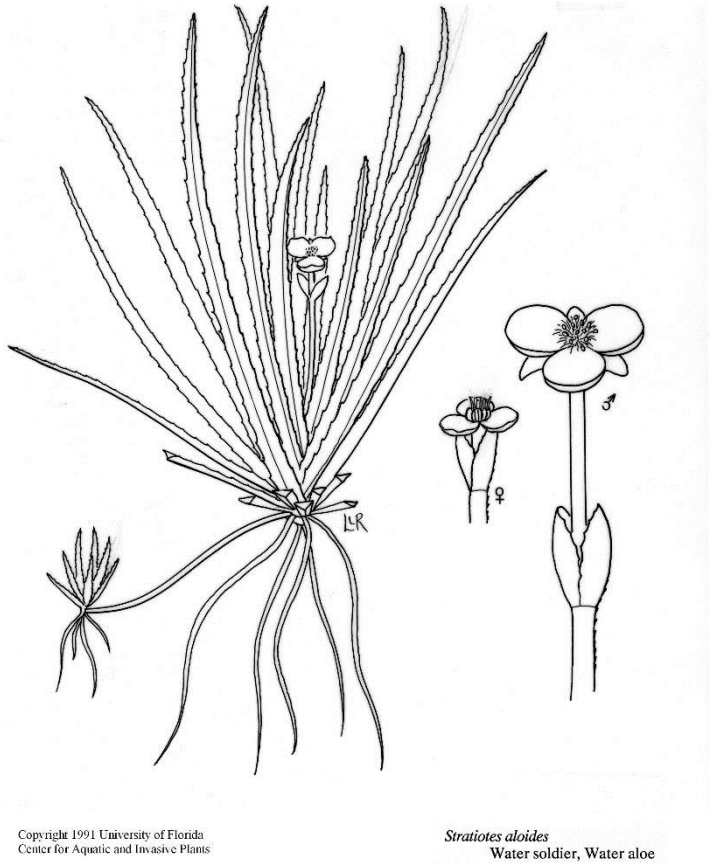
Overview

- What is Water Soldier
- Morphology
- Water Soldier in Ontario
- Past Management
- Herbicide

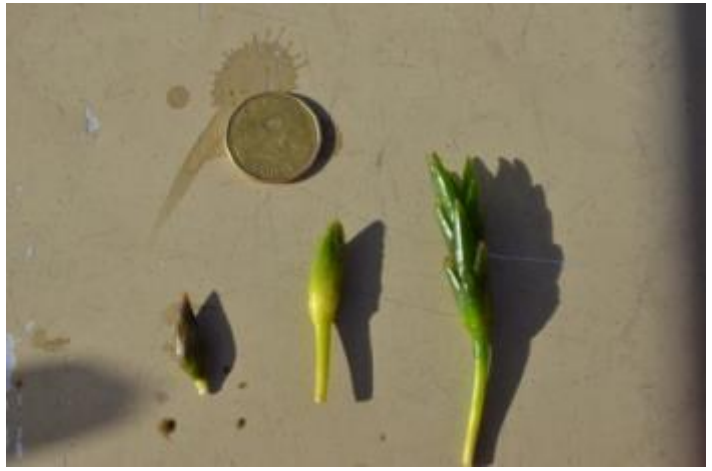
What is Water Soldier

- Native to Europe and Northwest Asia
- First wild population in NA located in Trent River
- Asexual reproduction by way of offsets and turions
- Forms dense mats of floating and submerged vegetation

Morphology

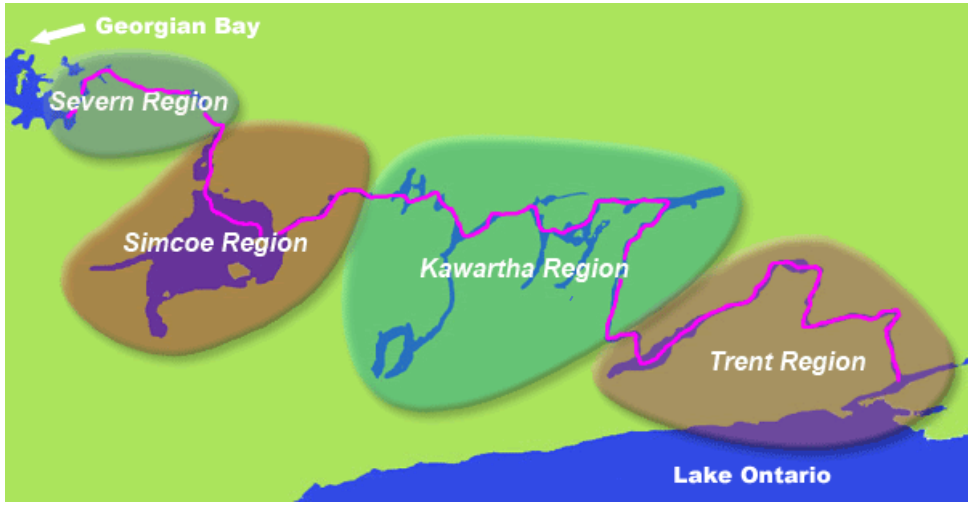


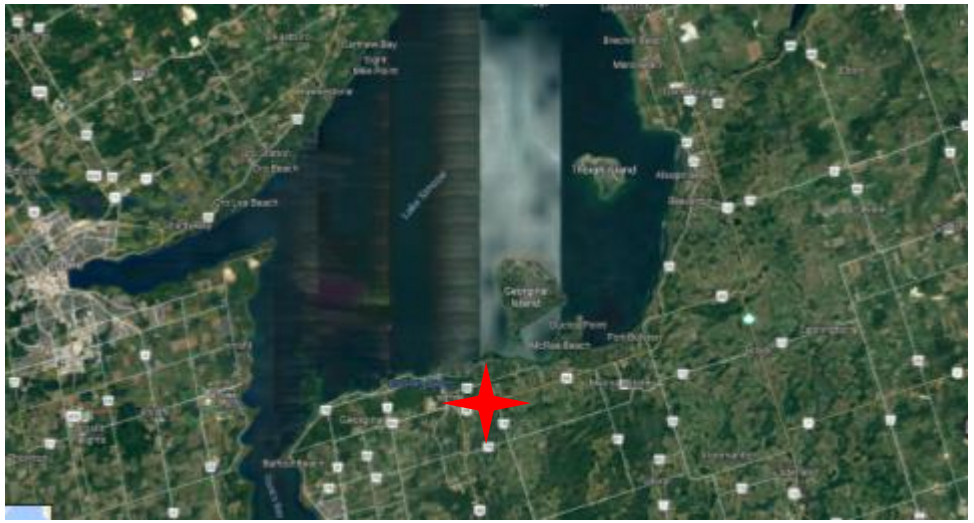
(Commons Wikipedia,2016)



ONTARIO'S INVADING SPECIES AWARENESS PROGRAM

Water Soldier in Ontario





Working Group

Ontario Invasive Plant Council

Ontario

TRENT UNIVERSITY

US Army Corps of Engineers

LOWER TRENT CONSERVATION

Canada

ONTARIO FEDERATION OF ANGLERS AND HUNTERS

Ontario MINISTRY OF THE ENVIRONMENT

Hand Removal

Mechanical Harvester

Mechanical harvester
˜One hectare of surface area covered
190 cubic yards removed
40 cubic yards taken to Bio digester

Shade Cloth Enclosures 2016

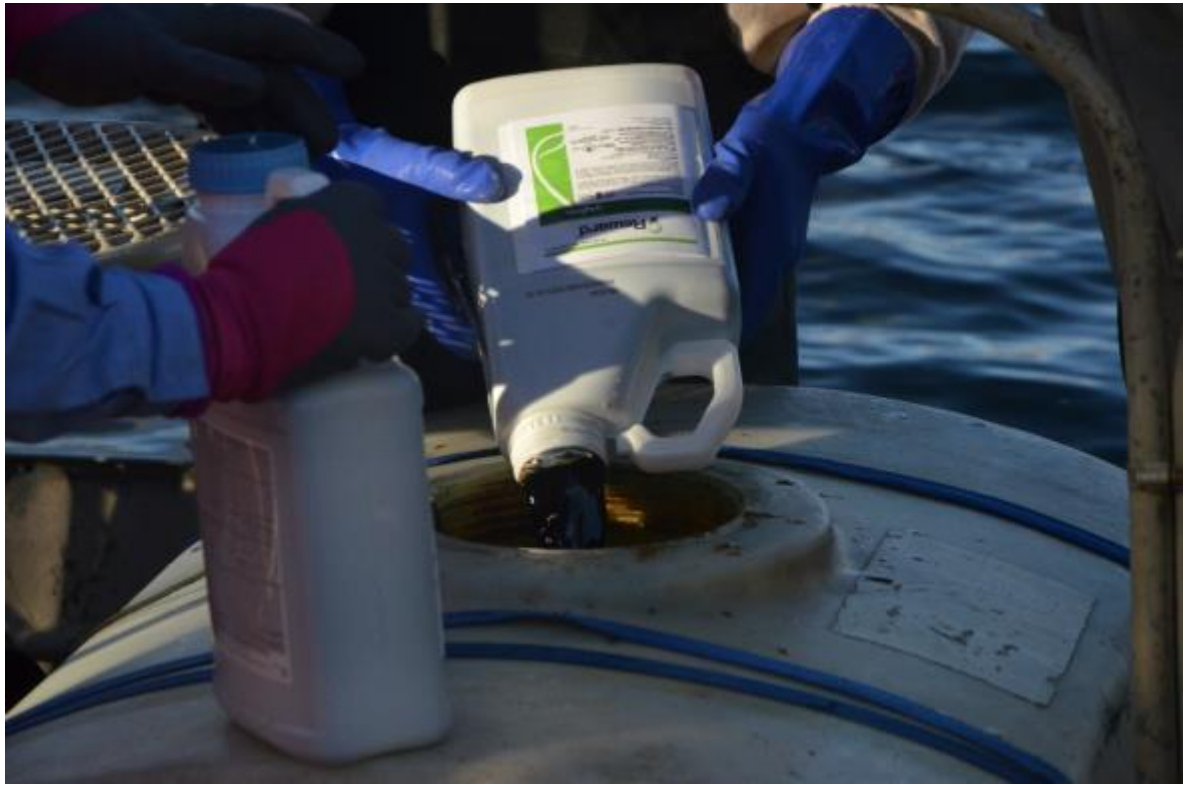
Shade Cloth Enclosures Pilot Project with Trent University

Three 10 ft X 10 ft enclosures Crowe Bay and Percy Reach

All three enclosures had a 100% reduction in water soldier

Great management for small populations, constraints with larger populations.

Reward (Diquat dibromide)



Herbicide

Herbicide Application

(MacDonald, 2016)

(Schryer, 2016)

Herbicide Applications 2014

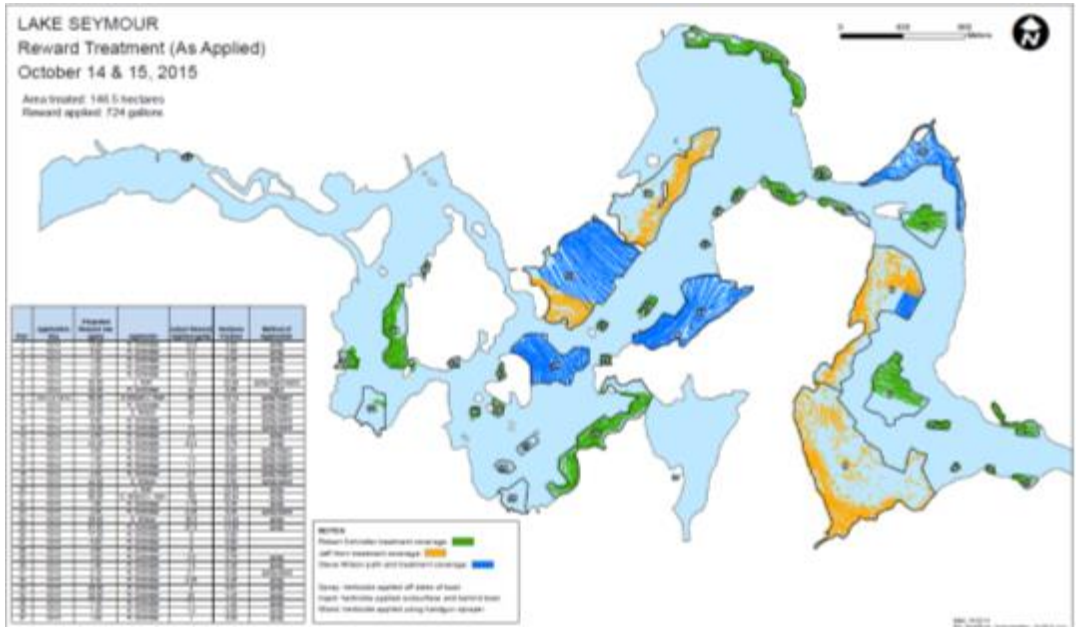
Herbicide Applications 2015

2015

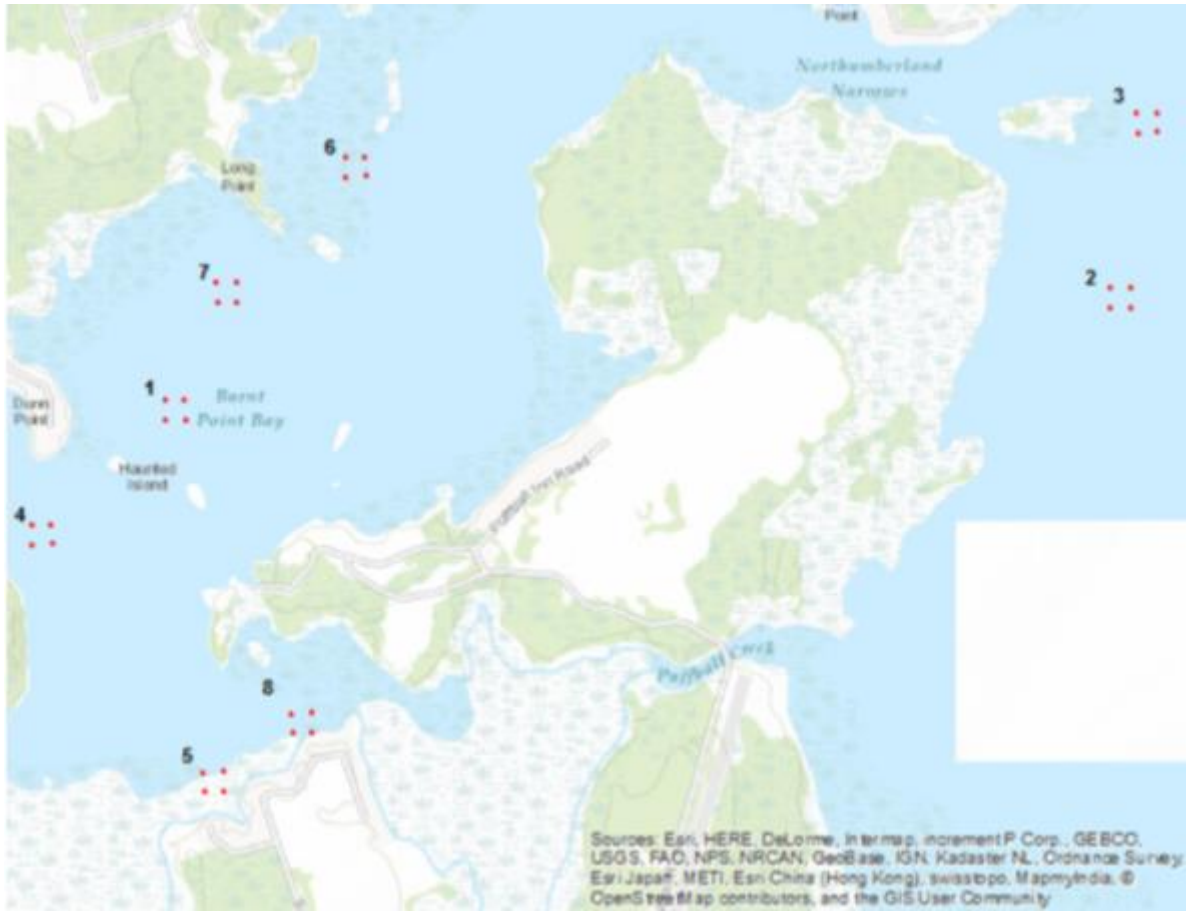
(McCulloch, 2015)

2016

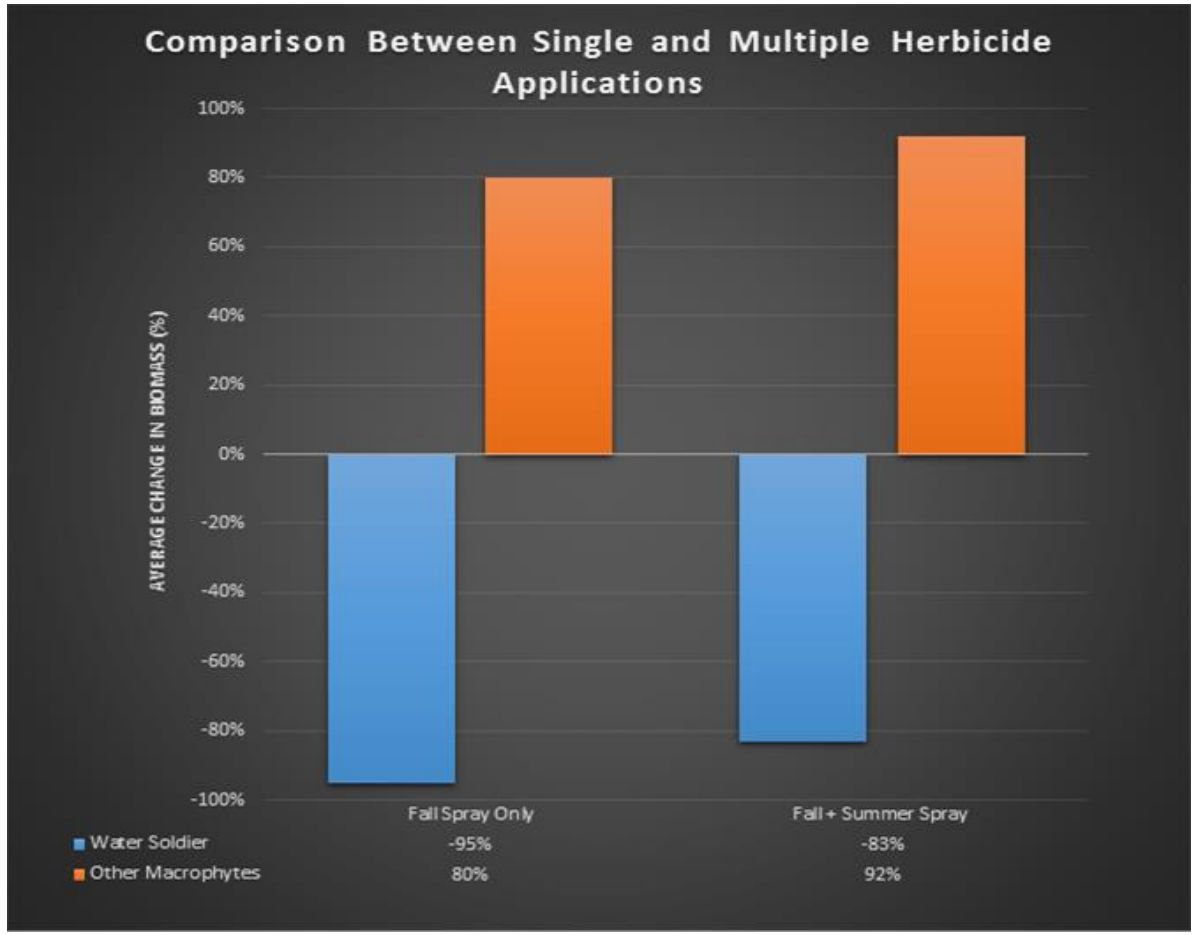
(McCulloch, 2016)



Trent University Research

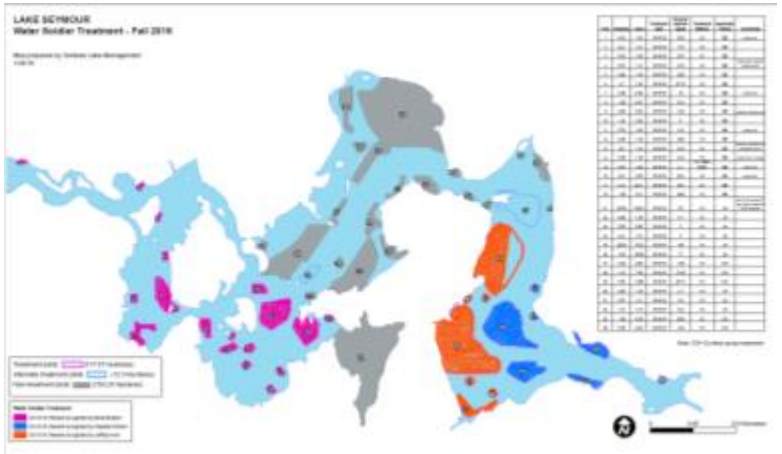


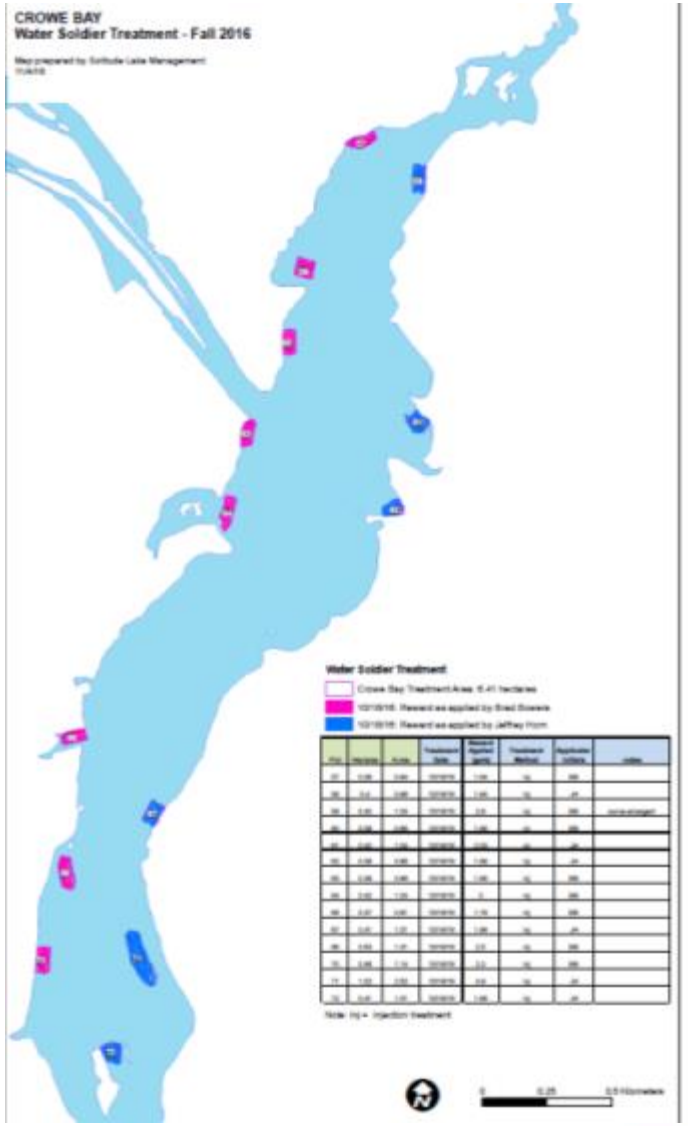
(Trent University, 2016)



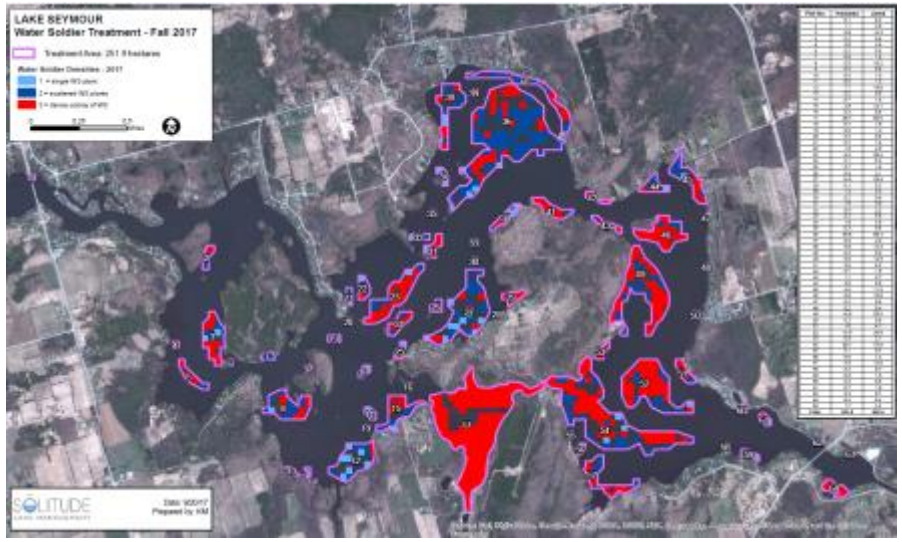
(Trent University, 2016)

Herbicide Applications 2016





Herbicide Applications 2017



Thank you

Robert McGowan
Water Soldier Management Technician
Ontario Federation of Anglers and Hunters

705-748-6324 ext. 242
robert_mcgowan@ofah.org

Canning, Robert and Eric Sager. 2015. Risk Assessment for Water Soldier (*Stratiotes aloides*) in Ontario Waters. Prepared for the Ontario Ministry of Natural Resources and Forestry. 34 pp.

Weissflog, N. and E. Sager. 2016. An investigation of the reproductive ecology of crab's-claw in the Trent River, Ontario, Canada. J. Aquat. Plant. Manage. 54:72-77.

OMNRF, 2017, An Integrated Management Plan for the Eradication of Water Soldier in Ontario, Canada First Draft

2017/2018 OIPC Winter Webinar Series

Question Period

1) ***For short questions:*** *please use the Chat Feature on the side of your screen*
2) ***For more detailed questions:*** *please type "UNMUTE <Name>" into the Chat Feature and we'll open your audio line*

ONTARIO INVASIVE PLANT COUNCIL