Fourteen Island Lake Aquatic Vegetation Survey

Quinte CONSERVATION

www.quinteconservation.ca
http://twitter.com/quinteca

R.R.#2, 2061 Old Highway #2, Belleville, ON K8N 4Z2
Phone: (613) 968-3434

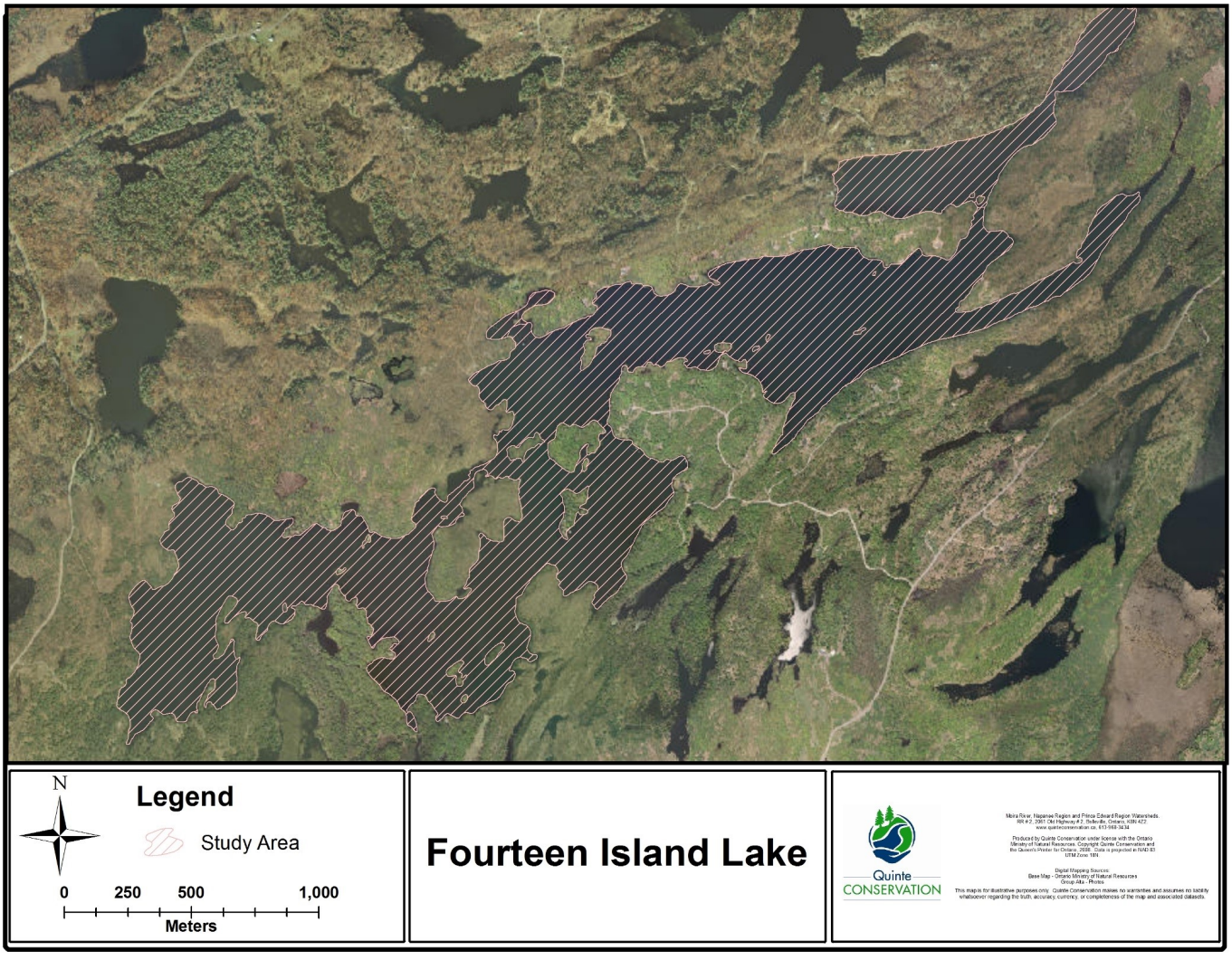
Introduction

Aquatic vegetation is the foundation to a lakes ecosystem, through providing food and shelter to an array of biotic organisms such as fish, waterfowl and benthic-macroinvertebrates. Aquatic plants are responsible for the conversion of energy and nutrients associated with the sun, water and soil into forms that are readily accessible to other biological communities (Environment Canada, 2004). Heavy aquatic plant growth can occur naturally given the correct combination of environmental variables such as light and nutrient availability, but is accelerated due to factors such as nutrient pollution or the introduction of non-native species (Cronk et al., 2008). Excessive plant growth can be detrimental interfering with the natural condition of the lakes ecosystem, particularity if plants are invasive. It is possible for invasive species to outcompete native species leading to decreased diversity and overall less food resources that native biological communities such as fish rely on. Furthermore, an overabundance of aquatic plants can disrupt recreational uses of the lake, such as boating, fishing and swimming (Bromilow et al., 2012).

In partnership with Quinte Conservation and Fourteen Island Lake Association an aquatic vegetation survey was conducted on Fourteen Island Lake on the week of August 12 to 16, 2013. The objective of the survey was to comprehend the aquatic plant community within Fourteen Island Lake through sampling the present biological condition of aquatic macrophtyes, inventorying species and identifying invasive species. This was to determine the biological integrity and overall health of the lake. Furthermore, this study will provide recommendations through best management practices for buffers, water quality and invasive species.

Study Area

Fourteen Island Lake is located in the Township of South Frontenac, Ontario, approximately thirty kilometers North of Kingston. The lake is part of the Napanee river watershed and under Quinte Conservation's jurisdiction. Situated with the Canadian Shield the lake covers 244.8 hectares. Mink Lake is connected on the Northeastern section of the lake and is also included in this survey. The shoreline is dominated by forest with cottages scattered throughout. Portions of the lake with low water levels have an abundance of submerged and emergent aquatic vegetation.



Methodology

The methodology of this survey was loosely based on the Durham Coastal Wetland Protocol. The sampling method design was intended to provide a comprehensive sample of Fourteen Island Lake's aquatic vegetation community.

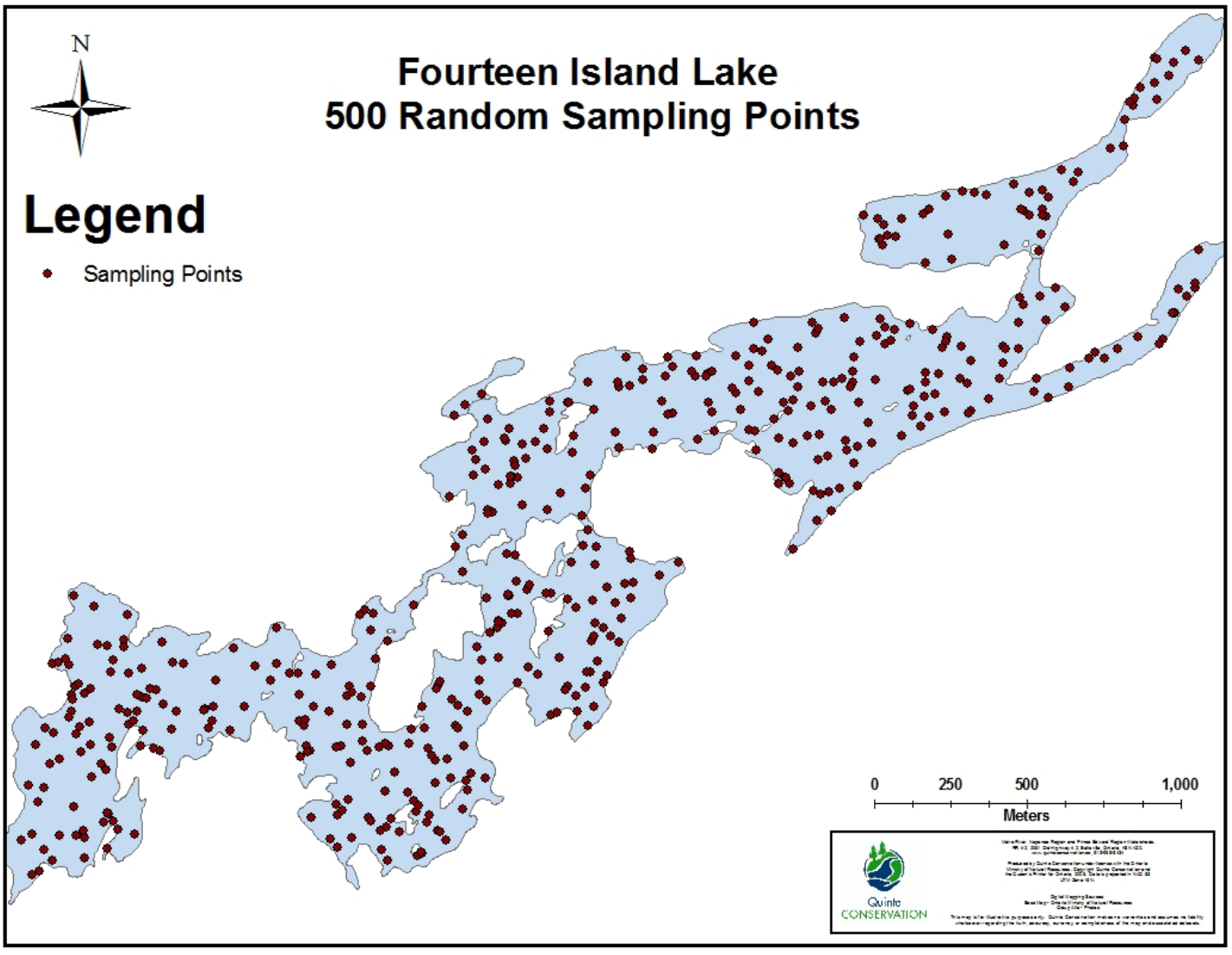
Prior to starting the field work, 500 points were randomly generated using the Software ArcMap and were plotted on a map of Fourteen Island Lake and Mink Lake (see Map 1). The 500 points were generated recognizing that several will be located in areas that cannot be sampled due to water depths. A Garmin GPS was preloaded with the points to access locations during sampling. The GPS accuracy was within -/+3 meters.

The Fourteen Island Lake survey was completed during August when aquatic plants were at maturity. Sampling was completed through accessing the points by boat and canoe. A floating one-meter square quadrat represented the sample area of the randomly generated point. Within each of the quadrats, the vegetation community was thoroughly assessed from the surface to the substrate. Of the 500 points that were randomly generated, the points that had visible aquatic vegetation were sampled. In areas where the depth prevents the vegetation community from being assessed, a few comments were recorded. The point data within the quadrat consists of total coverage, individual plant coverage by species, water depth, sediment type and turbidity which was recorded on a field sheet. Turbidity (NTU) was collected using a turbidity meter and was measured prior to sampling the other parameters to minimize the disturbance of sediments which could skew the results. The water depth was recorded using a weighted rope or a depth finder attached to the boat.

In addition, a visual survey was completed, documenting the vegetation community throughout the entire lake to represent all plants that may not have been found within the quadrat points. The visual survey will be completed by mapping out the dominant and sub-dominant species that are observed throughout the lake as well as any other species that are observed during the field work.


QUI ITE
CONSE VATION

Map 1.


N
Fourteen Island Lake
500 Random Sampling Points
Legend
Sampling Points
0
250
500
1,000
Meters
Quinte
CONSERVATION

Results

Fourteen Island Lake and Mink Lake were completely surveyed for the presence of aquatic vegetation. A total of 138 quadrats of the 500 points, were completed surveying macrophytes from the substrate through to the surface. Overall 27 aquatic plant species were observed within the quadrats. The number of macrophyte found within each quadrat ranged from 1-10 different species. The average number of macrophyte species at each quadrat site was 6. The average amount of total coverage is 88% for the entire quadrat whereas, the average cover of individuals macrophyte species was 30%. The dominant macrophyte found was Water stargrass (*Zosterella dubia*), which composed of 45% of the total species surveyed. Whereas, the subdominant macrophytes were Canada waterweed (*Elodea Canadensis)*, composed of 19% and Eurasian water milfoil (*Myriophyllum spicatum)* at 18% of the total species surveyed. See table 1 for information on individual species occurrences, average percentage covered and the number of sites species were dominant.

Eurasian Water Milfoil (*Myriophyllum spicatum),* European Frog-Bit (*Hydrocharis morsus*-ranae), Curly Pondweed (*Potamogeton crispu),* were invasive species found in the quadrats and submerged aquatic plant communities within Fourteen Island Lake. The overall invasive cover for the sites sampled is 19%. Eurasian water milfoil accounted for 18% total species covered, Curly pondweed occurred much less at 0.30% of species surveyed and European frogbit 0.35% of the total species. Turbidity was also measured at each sampled quadrat. The highest turbidity value was 1.55 NTU, and the lowest value was, 0.01 NTU. The overall average turbidity measured in Fourteen Island Lake was 0.3 NTU.

Map 2.

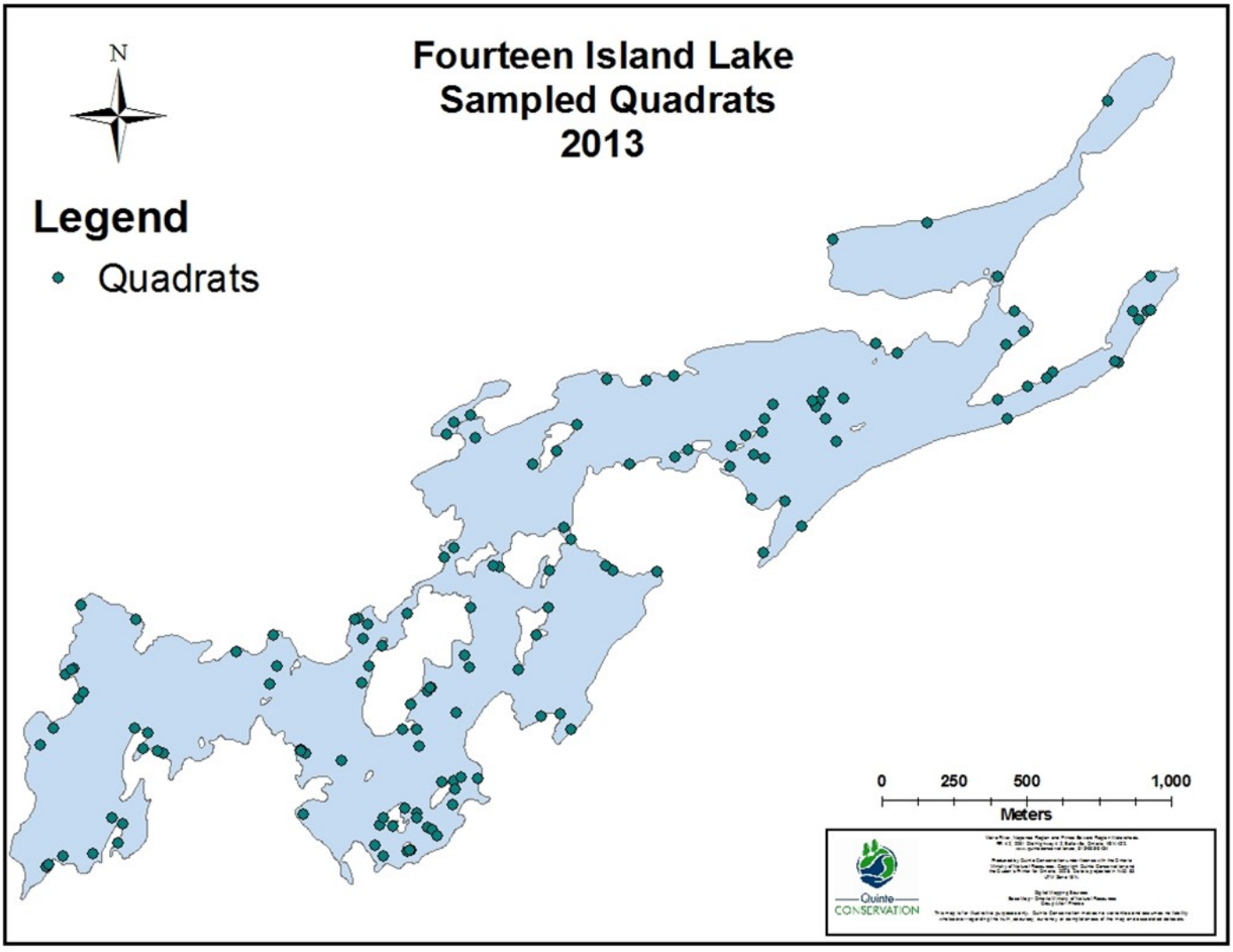
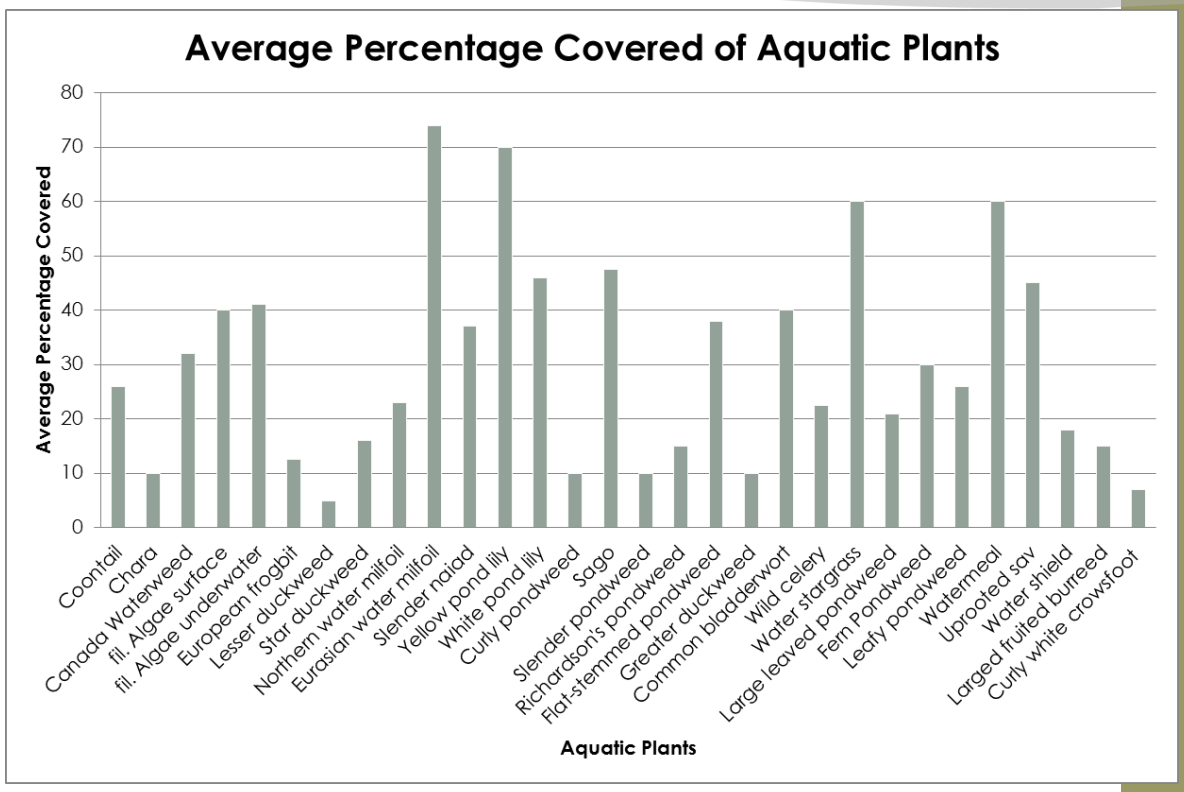
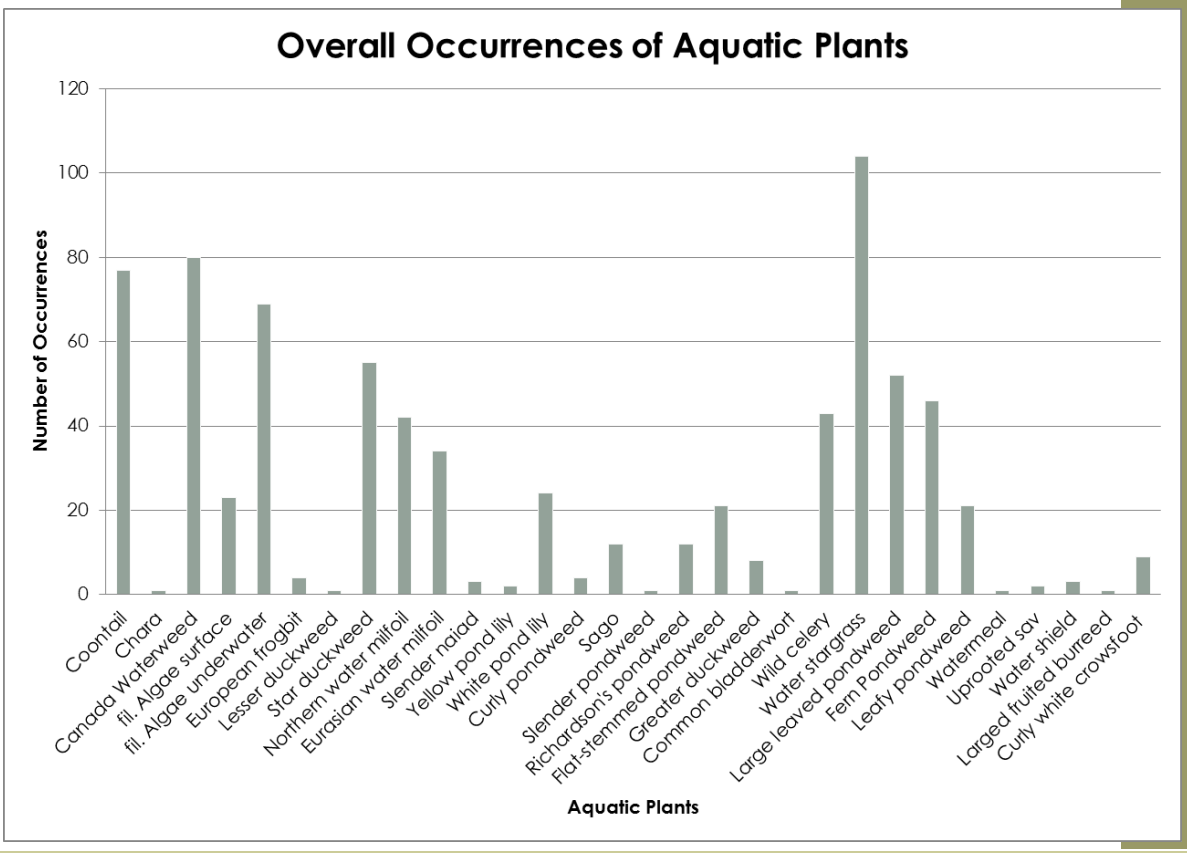

N
Fourteen Island Lake
Sampled Quadrats
2013
Legend
Quadrats
0
250
500
1,000
Meters
Quinte
CONSERVATION

Table 1.

Common Name	Latin Name	Occurrences	Percent covered	Number of sites where dominant
Coontail	*Ceratophyllum demersum*	77	26	8
Chara	*Chara spp*	1	10	0
Canada Waterweed	*Elodea canadensis*	80	32	14
fil. Algae surface		23	40	
fil. Algae underwater		69	41	
European frogbit	*Hydrocharis morsus-ranae*	4	12.5	0
Lesser duckweed	*Lemna minor*	1	5	0
Star duckweed	*Lemna trisulca*	55	16	6
Northern water milfoil	*Myriophyllum sibiricum*	42	23	5
Eurasian water milfoil	*Myriophyllum spicatum*	34	74	21
Slender naiad	*Najas flexilis*	3	37	0
Yellow pond lily	*Nuphar variegata*	2	70	1
White pond lily	*Nymphaea odorata*	24	46	6
Curly pondweed	*Potamogeton crispus*	4	10	1
Sago	*Potamogeton pectinatus*	12	47.5	4
Slender pondweed	*Potamogeton pusillus*	1	10	0
Richardson's pondweed	*Potamogeton richardsonii*	12	15	0
Flat-stemmed pondweed	*Potamogeton zosteriformis*	21	38	8
Greater duckweed	*Spirodela polyrhiza*	8	10	0
Common bladderwort	*Utricularia vulgaris*	1	40	0
Wild celery	*Vallisneria americana*	43	22.5	3
Water stargrass	*Zosterella dubia*	104	60	65
Large leaved pondweed	*Potamogeton amplifolius*	52	21	1
Fern Pondweed	*Potamogeton robbinsii*	46	30	5
Leafy pondweed	*Potamogeton foliosus*	21	26	3
Watermeal	*Wolffia Sp.*	1	60	0
Uprooted sav		2	45	0
Water shield	*Brasenia schreberi*	3	18	0
Larged fruited burreed	*Sparganium eurycarpum*	1	15	0
Curly white crowsfoot	*Ranunculus longirostris*	9	7	0



Graph 1.



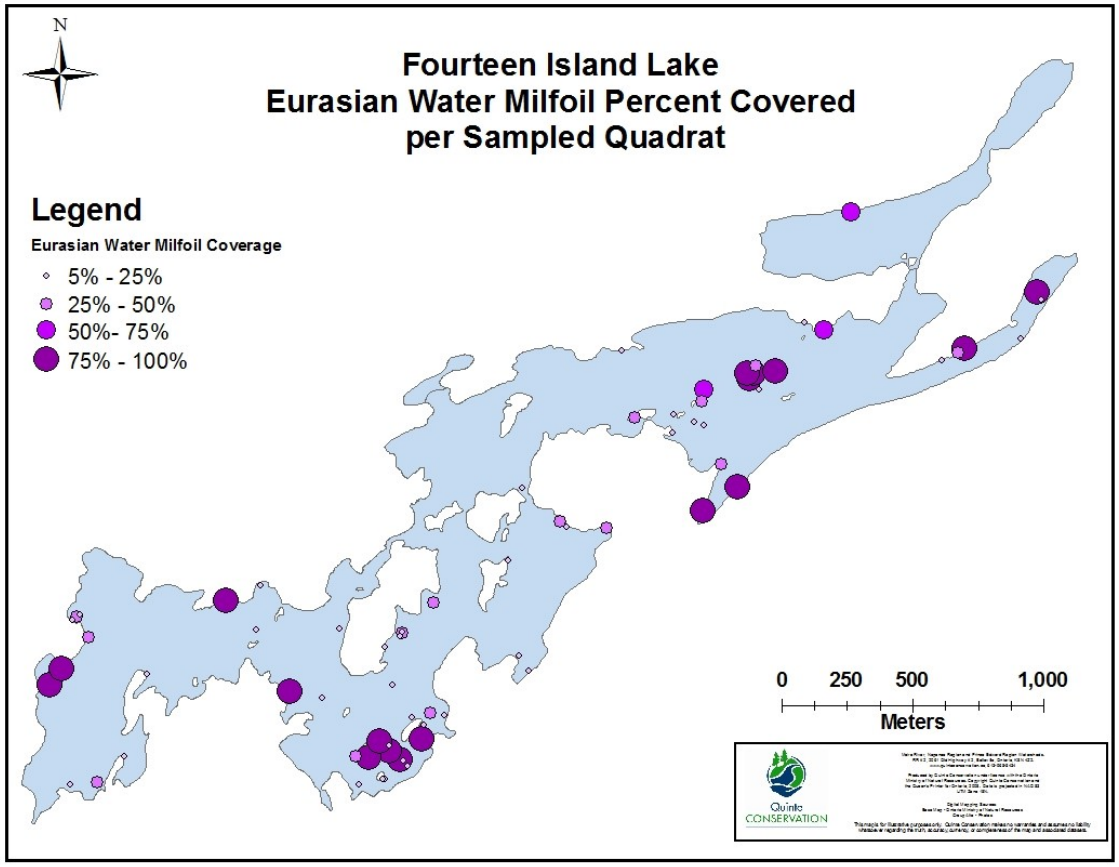
Graph 2.

Discussion

Aquatic plants

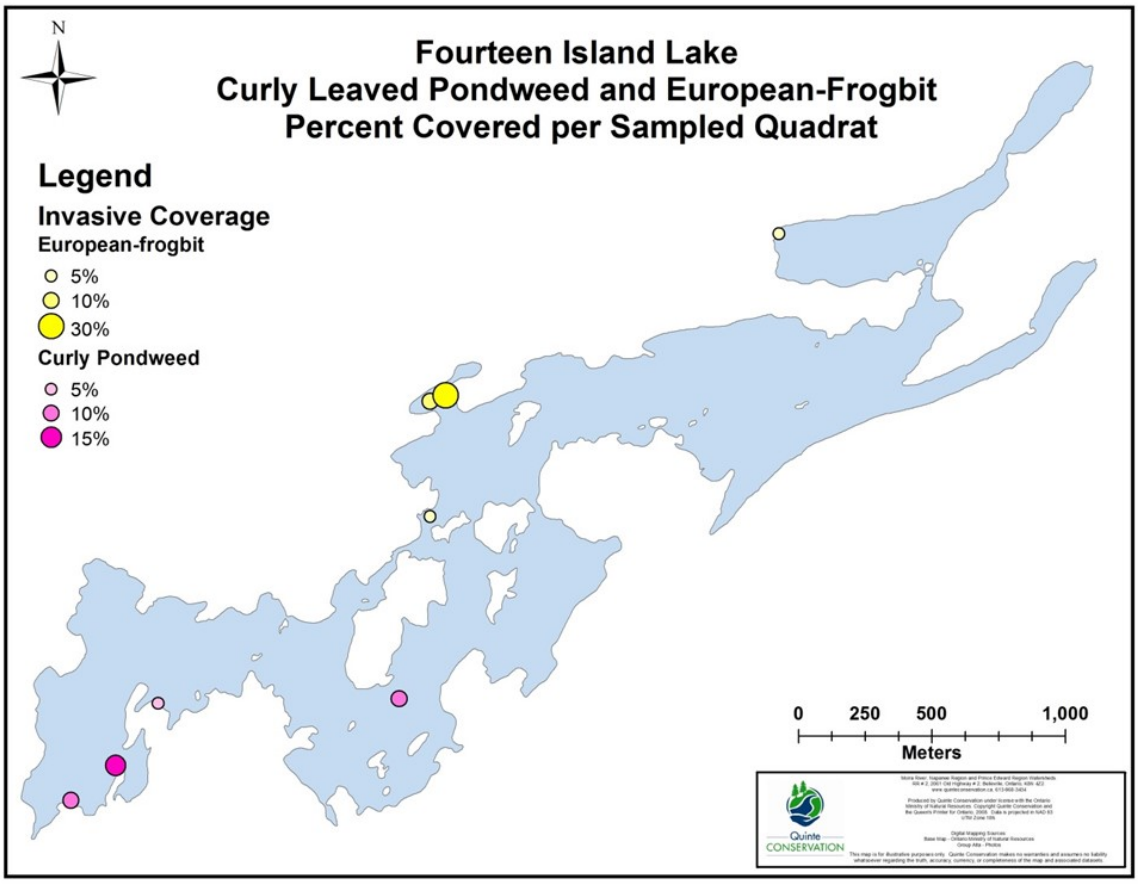
Fourteen Island Lake's aquatic vegetation community appears to have a healthy and diverse presence of aquatic plants, other than a small percentage of invasive species comprising mainly of Eurasian water milfoil. The overall invasive cover for the points sampled was 19%, indicating that the aquatic vegetation diversity could be compromised if the invasive plants spread further. Eurasian water milfoil only occurred in the sampled quadrats 35 times but of those occurrences it was the dominant species for 21 quadrats. This indicates that where Eurasian water milfoil is present it is tends to outcompete native plants leading to less diversity. Maps 3 and 4 show the distribution and percent coverage of these invasive species within the quadrat data.

Water stargrass was the most frequently sampled and overall was the most dominant aquatic plant sampled. Water stargrass is also a turbidity in-tolerant species, which is an indicator of a high quality ecosystem. Future monitoring is recommended as a long-term management plan to document changes in the biological condition of the lake and distributions of invasive species.



Map 3.

Map 4.



Turbidity

Turbidity is a measure of the suspended particles such as silt, clay, organic matter, plankton, and microscopic organism in the water (McNeely et al., 1979). As an indicator of water quality, turbidity is important to measure in as it has a direct association of marcophyte growth. Fourteen Island Lake exhibits excellent water clarity that allows aquatic organisms to thrive. The turbidity was very low with an average NTU of 0.3724. To compare, Ontario drinking water standards recommend an NTU of 5 or less (McNeely et al., 1979), and the turbidity of Fourteen Island Lake is sufficiently lower than that standard. However, it is not recommended to drink from the lake without treatment. The low turbidity could be the result of the abundant zebra mussels found within the lake.

Recommendations

Proper stewardship of the lake will maintain the biological integrity, well being able to enjoy the many recreational activities Fourteen Island Lake has to offer. To maintain this balance best management practices are listed below;

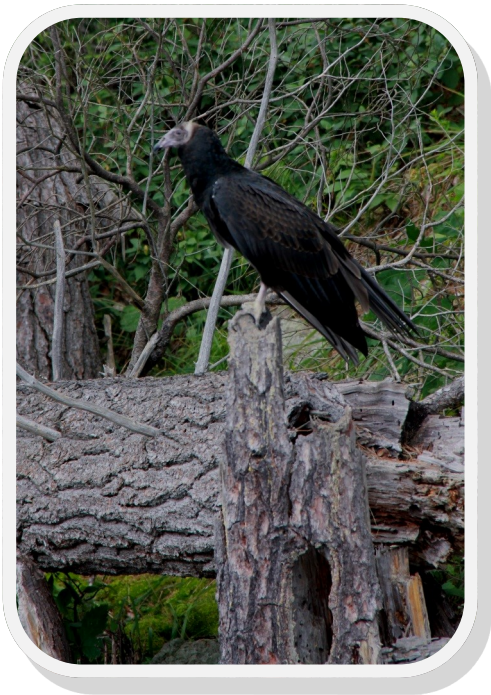
1. Natural buffers

Overall Fourteen Island Lake shoreline is natural. Nonetheless, as part of best management practices maintaining buffer strips will assist on mitigating detrimental effects of shoreline living on the lake. A natural shoreline with a vegetated buffer provides habitat for fish, amphibians, birds and mammals. Vegetation buffer strips can help control erosion, protect and enhance water quality through removing sediment, nutrients and other contaminants from runoff and also, protect habitat (Norman, 2005). The loss of vegetation on the shoreline can cause erosion because the roots of the plants act as anchors holding the soil in place. Furthermore, buffers act as natural filters for runoff of potential pollutants before reaching water (Ford, 2008). Do not cut the grass to the edge of shoreline. Allow for at least a 3-5 meter buffer from the water's edge to protect the bank from erosion, a 10 meter buffer to provide habitat for edge species and the most commonly recommended widths are 15 to 30m for water quality improvement (Norman, 2005). Enjoy the benefits that a natural shoreline with a well vegetated buffer can offer.

2. Protect water quality

Anthropogenic practices inevitably impair water quality however, through stewardship the residents of Fourteen Island Lake can mitigate these impacts. As stated before buffers protect water quality and help stop excess sediment, nutrients and contaminates from runoff but there are other management practices that protect water quality. This includes avoiding the use of fertilizers as they have a direct effect on the lake. Human development of the landscape and activity in near shore areas invariably leads to unnaturally elevated nutrient inputs into the lake, which contribute to excessive aquatic plant growth (Cronk et al., 2008). Furthermore, once these nutrients are introduced into the system, they can lead to an explosive growth in algae, preventing light from reaching photosynthetic organisms (Bromilow, 2012). Eliminate potential pollutants by being careful, avoiding the use of fertilizers and pesticides, and maintaining septic systems (Ford, 2008). In addition, hardening of surfaces such as asphalt driveways or rooftops can be detrimental to the lake as it aids in sediment and nutrient loading. Harden surfaces do not allow for natural filtering of water before it enters the lake. Opt for softer or more permeable surfaces such as gravel or wood chips rather than concrete and asphalts (Ford, 2008).

3. Invasive species



Invasive species were a major concern for the residents of Fourteen Island Lake and several have been identified within the lake. The presence of the invasive species does require some measures to ensure that the plants are being controlled. The concern is that invasive species outcompete native plants, are more adaptable to different environmental conditions, reproduce aggressively, have less natural predators and disrupt the natural biological balance. Whereas, native plants occur naturally, part of a balanced ecosystem and are low maintenance. The invasive species found within the lake include; Eurasian Water Milfoil (*Myriophyllum spicatum)*, European Frog-Bit (*Hydrocharis morsus-ranae)*, Curly-Leaved Pondweed (*Potamogeton crispu),* and Purple-Loosestrife (*Lythrum salicari)*. Common Reed (*Pharagmities)* was not identified on the shoreline of the lake, however, was seen within the vicinity.

The spread of invasive species, both flora and fauna can be minimized by preventing them from getting into the system in the first place. These control measures include; ensuring that boats and trailers are properly cleaned before launching between water systems. Invasive species are often transported between aquatic systems after becoming caught on boat propellers and trailers (Bromilow, 2012). Avoid planting non-native plants in gardens and never dump unwanted bait into waterways, always discard in trash bins.

Once established there are individual control measures for different species as certain removal methods will aid plant reproduction. It is also important to remember that interfering with the plant community can have adverse consequences on the ecosystem. Once established, it can be extremely difficult and costly to attempt to eradicate introduced species, and control measures are usually very expensive and may be harmful to the environment (Lui et al., 2010).

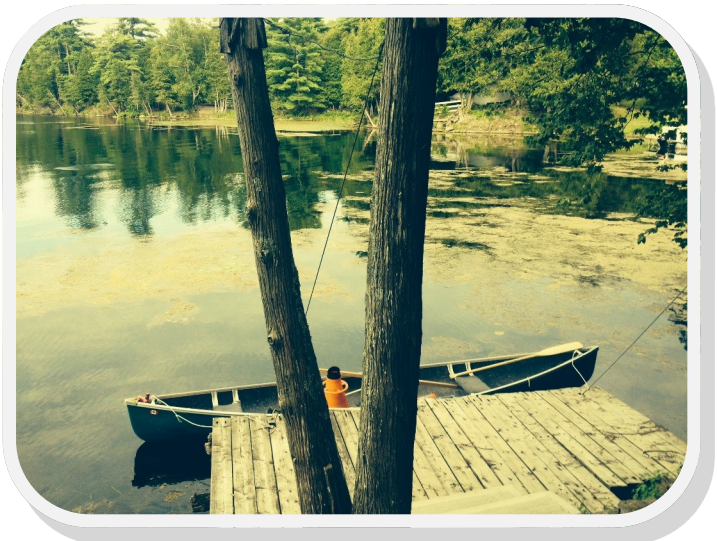
Eurasian Water Milfoil (Myriophyllum spicatum)

Eurasian water milfoil (*Myriophyllum spicatum)* has been established and is the most commonly seen invasive macrophyte in Fourteen Island Lake. Northern water milfoil (*Myriophyllum Sibiricum)* was also observed in the lake and is native to the region. The two milfoils are difficult to distinguish from one another and it is also possible that they can hybridize with one another.

Eurasian water milfoil is detrimental to a lakes ecosystem because it forms a dense canopy where other plants are outcompeted, these stands can reduce oxygen levels within the lake, creates stagnant water and can impede on recreational activities (Lui et al., 2010). Once in a system it can be extremely difficult to control. Eurasian water milfoil spreads by fragmentation, meaning that when a part of the plant breaks off the fragment is able to form a new plant, which easily spreads the plant through the aquatic system. There is no known method that is recommended to eradicate Eurasian water milfoil. Avoid boating in areas that this plant is growing because a boat propeller will disperse the plant further. Hand removal is not recommended as it can aid in fragmentation of the plant resulting in reproduction as well.

Curly-Leaved Pondweed (Potamogeton crispu)

Curly-leaved pondweed (*Potamogeton crispu)* can spread between water bodies via plant material such as plant fragments or fruit that are transported with boats, boat trailers and other equipment (Lui et al., 2010). Currently, curly-leaved pondweed is not a major concern in Fourteen Island Lake, although has the potential for invasion. The macrophyte grows throughout the winter and gains an immediate advantage over other native species that cannot grow during this time (Bromilow, 2012). It has the potential to form dense stands which cover and dominate large areas, crowding out other species, impeding water flow, restricting recreational activities in the water, and potentially altering oxygen levels with impacts on fish (Lui et al., 2010). Manual removal is recommended because it is adequate for controlling small infestations and has minimal impacts on the lake ecosystem (Cronk, 2008). Further monitoring is recommended.



European Frog-Bit (Hydrocharis morsus-ranae)

European frog-bit (*Hydrocharis morsus-ranae)* was observed in Fourteen Island Lake, however is not a major concern because of its minimal presence. It was introduced as an ornamental plant and has since spread. European frog-bit can form large, dense, floating mats of intertwining plants, reducing native submerged plant cover by diminishing light and competing for gases and nutrients, it also can impede on water flow and recreational activities (Lui et al., 2010). European Frog-bit is dispersed by fragmentation of the plant. Reduce speed and avoid boating around European Frog-bit because the wake can displace plants and the propeller can break up the plants allowing them to spread.

Purple-Loosestrife (Lythrum salicari)

Low densities of Purple loosestrife (*Lythrum salicari*) were found along the shorelines of Fourteen Island Lake. This species rapidly forms mono-specific stands, displacing native plant species that provide food, cover, and breeding areas for a number of wildlife species (Henne et al., 2005). Due to how sparse Purple loosestife was found throughout the lake, the best management practice to eradicate it is to pull the plant by hand. When removing by hand ensure that no root fragments remain, broken roots will form a new plant. Furthermore, cutting the flower is also an effective method of removal. Cutting can reduce stem densities however, repeated cuts are necessary, and purple loosestrife may never be eliminated from a site using this technique (Henne et al., 2005). Nonetheless, cutting mature purple loosestrife plants has been shown to decrease plant vigor and retard seed production, but does not destroy the perennial rootstock (Henne et al., 2005).

Common Reed (Pharagmities)

As previously mentioned, Common reed (*Pharagmities)* was only seen in the vicinity of Fourteen Island Lake. Nonetheless, is considered to be the most aggressive invasive species of marsh ecosystems in North America (Bains et al., 2009). Continual monitoring of the species is recommended to ensure it does not spread into the lakes system. The plant forms large monocultural stands, displacing native wetland vegetation, reducing plant species richness, and threatening habitat of rare species, species at risk and other wetland species (Lui et al., 2010). Common reed releases toxins from its roots into the surrounding soil which impedes the growth of and even kills off neighbouring plants (Ontario Ministry of Natural Resources, 2011).

The best management practices for invasive pharagmites control in Ontario according to the Ontario Ministry of Natural Resources (Ontario Ministry of Natural Resources, 2011).

In *Phragmites* stands where there is standing water present:

- Herbicides CANNOT be applied.
- Cut/mow the stalks as low as possible.
- Tarping/solarization is another option, but may not be as effective in standing water.

In *Phragmites* stands where the water level can be controlled:

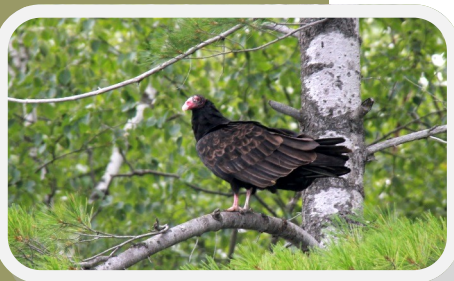
- Cut/mow the stalks as low a height as possible.
- Maintain the water level so that it remains a minimum of 1.5 m taller than the entire stand for a period of at least 6 weeks.

In *Phragmites* stands where there is no standing water present:

- Perform wildlife assessments.
- Time herbicide application appropriately.
- If necessary, mow or roll the stand to compact the dead biomass.
- If appropriate, perform a prescribed burn in the area.
- Monitor and perform follow-up treatments as necessary.

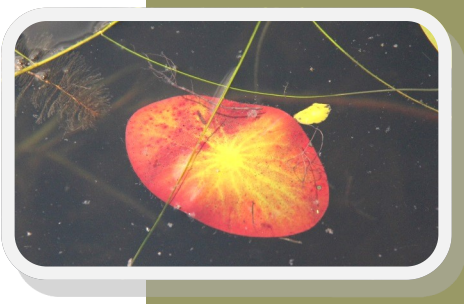
Inventory of all Aquatic Vegetation

- Stiff arrowhead (*Sagittria rigida)*
- Coontail (*Ceratophyllum demersum*)
- Large-leaved pondweed (*Potamogeton amplifolius)*
- Chara (*Chara Sp.*)
- Floating arrowhead (*Sagittaria cuneata)*
- Sago (*Potamogeton pectinatus*)
- Fern pondweed (*Potamogeton robbinsii*)
- Northern water milfoil (*Myriophyllum sibiricum)*
- Eurasian water milfoil (*Myriophyllum spicatum)*
- Richardson's pondweed *(Potamogeton richardsonii)*
- Curly pondweed (*Potamogeton crispus)*
- White pond lily (*Nymphaea odorata)*
- Yellowpond lily (*Nuphar variegate*)
- Wild celery (*Vallisneria Americana*)
- Star duckweed (*Lemna trisulca)*
- Lesser duckweed (*Lemna minor)*
- Canada Waterweed (*Elodea Canadensis)*
- Flat-stemmed pondweed (*Potamogeton zosteriformis)*
- Pickerelweed (*Pontederia cordata*)



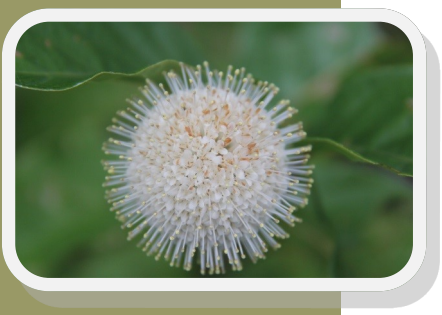
- Watermeal (*Wolffia)*
- Water shield (*Brasenia schreberi)*
- Slender naiad (*Najas flexilis)*
- Water stargrass (*Zosterella dubia)*
- Leafy pondweed (*Potamogeton foliosus)*
- Greater duckweed (*Spirodela polyrhiza)*
- Floating-leaved pondweed (*Potamogeton natans)*
- European frogbit *(Hyrocharis morsus-ranae)*
- Bladderwort (*Utricularia vulgaris*)
- Large-fruited burreed (*Sparganium eurycarpum)*
- Water shield (*Brasenia schreberi*)
- Water marigold (*Megalodonta beckii*)
- Floating arrowhead (*Sagittaria cuneata*)
- Softstem bullrush (*Scirpus acutus*)
- Water smartweed (*Polygonum amphibium)*
- Broad-leaved arrowhead (*Sagittaria latifolia)*

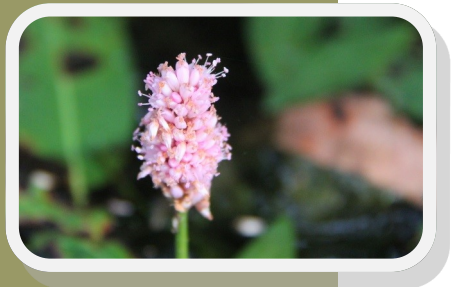
Aquatic Vegetation Found in Quadrats



- Water shield (*Brasenia schreberi)*
- Coontail (*Ceratophyllum demersum)*
- Chara (*Chara sp.)*
- Canada Waterweed (*Elodea Canadensis)*
- European Frogbit (*Hydrocharis morsus-fanae)*
- Lesser duckweed (*Lemna minor)*
- Star duckweed (*Lemna trisulca)*
- Norther water milfoil (*Myriophyllum sibiricum)*
- Eurasian water milfoil (*Myriophyllum spicatum)*
- Slender naiad (*Najas flexilis)*
- Yellow pond lily (*Nuphar variegate)*
- White pond lily (*Nymphaea odorata)*
- Large leaved ponweed (*Potamogeton amplifolius*)
- Curly pondweed (*Potamogeton crispus)*
- Leafy pondweed (*Potamogeton foliosus)*
- Sago (*Potamogeton pectinatus)*
- Slender pondweed (*Potamogeton pusillus)*
- Richardson's pondweed (*Potamogeton richardsonii)*
- Fern pondweed (*Potamogeton robbinsii)*
- Flat-stemmed pondweed (*Potamogeton zosteriformis)*
- Curly white crowsfoot (*Ranunculus longirostris)*
- Large-fruited burreed (*Sparganium eurycarpum)*
- Greater duckweed (*Spirodela polyrhiza)*
- Common bladderwort (*Utricularia vulgaris)*
- Wild celery (*Vallisneria Americana)*
- Water meal (*wolfia sp.)*
- Water stargrass (*Zosterella dubia)*

Inventory of shoreline plants



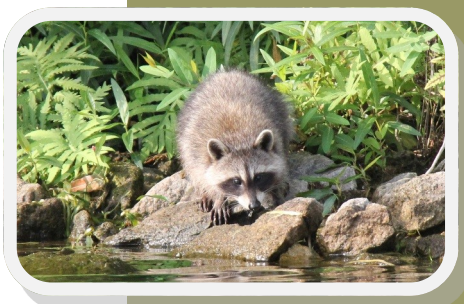


- Swamp milkweed (*Asclepias incarnate)*
- Square-stemmed monkey flower (Mimulus ringens)
- Cattail (*Typha latifolia)*
- Marsh fern *(Thelypteris palustris)*
- Sensitive fern (*Onoclea sensibilis)*
- Jewelweed (*Impatiens capensis*)
- Bittersweet night shade *(Solanum dulcamara)*
- Purple loosestrife (*Lythrum salicaria)*
- Elderberry (Sambucus nigra)
- Common juniper (*Juniperus communis)*
- Cardinal flower (*Lobelia cardinalis)*
- Common strawberry (*Fragaria virginiana)*
- Marsh cinquefoil (*Potentilla palustris)*
- Wild mint (*Mentha arvensis)*
- Dolls eye (*Actaea pachypoda)*
- Dodder (*Cuscuta)*
- Lambs ear (*Stachys byzantine)*
- Northern blue flag (*Iris versicolor)*
- Harebell (*Campanula rotundifolia)*
- Canada goldenrod (*Solidago canadensis)*
- Buttonbush (*Cephalanthus occidentalis)*
- Marsh bellflower (*Campanula aparinoides)*
- Common Buckthorn (*Rhamnus cathartica)*
- Green sedge (*Carex viridula)*
- Water-willow (*Decodon verticillatus)*
- Reed canary grass (*Phalaris arundinacea)*
- Canada mayflower (Maianthemum canadense)
- Common skullcap (*Scutellaria galericulata)*
- Bedstraw (*Galium sp.)*
- Hedge Bindweed (*Calystegia sepium)*

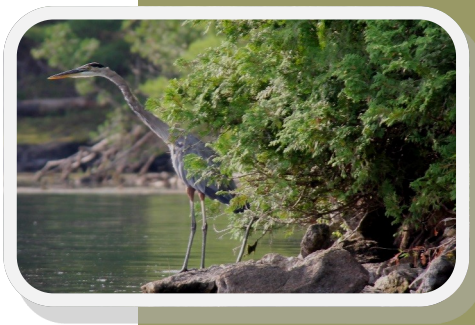
Invasive Aquatic Vegetation;

- Eurasian Water Milfoil (*Myriophyllum spicatum)*
- European Frog-Bit (*Hydrocharis morsus-ranae*)
- Curly-Leaved Pondweed (*Potamogeton crispus)*
- Purple Loosestrife (*Lythrum salicaria)*

Wildlife sightings;



- Common loon (*Gavia immer)*
- Green heron (*Butorides virescens)*
- Great blue heron (*Ardea Herodias)*
- Raccoon (*Procyon lotor)*
- Turkey vulture (*Cathartes aura)*
- Map turtle (Graptemys geographica)
- Painted turtle (*Chrysemys picta marginata)*
- Common tern (*Sterna hirundo)*
- Muskrat (*Ondatra zibethicus)*



Control Measures

Remember that controlling aquatic plants may require permits from organizations such as:

-Ministry of Natural Resources
-Ontario Ministry of the Environment
-Department of Fisheries and Oceans
-Conservation Authorities

Resources

Albert, D., & Burton, T. M. (2008). Vegetation Community Indicators. *Great Lakes coastal wetlands monitoring plan* (pp. 32-58). Ann Arbor, Michigan: Great Lakes Commission.

Bains, G., Kumar, A., Rudrappa, T., Alff, E., Hanson, T., & Bais, H. (2009). Native Plant and Microbial Contribut ions to a Negative Plant-Plant Interaction. *Plant Physiology*, *4* (151), 2145 –2151.

Bromilow, M., Diem, T., Fellbaum, S., Fortino, S., & Parsons, C. (2012). University of Michgan Biological Station. *Aquatic Vegetation Survey 2012 for Douglas Lake*, 1-17.

Cronk, K. (2008). Aquatic vegetation survey 2008 for Crooked and Pickeral Lakes . *Tip of the Mitt Watershed*, 1 - 34.

Environment Canada. (2004). Durham Region Coastal Wetland Monitoring Project; Year 2 Technical Report. *Canadian Wildlife Service*, *2*, 1-286.

Ford, R. (2008). *The shore primer a cottager's guide to a healthy waterfront.* (Ontario ed.). Burlington, Ont.: Fisheries and Oceans Canada.

Henne, D., Lindgren, C., Gabor, T., Murkin, H., & Roughley, R. (2005). An Integrated Management Strategy For The Control Of Purple Loosestrife Lythrum Salicaria L. (Lythraceae) In The Netley-Libau Marsh, South ern Manitoba. *Biological Control*, *32* (2), 319-325.

Lui, K., Butler, M., Allen, M., Synder, E., Silva, J. d., Brownson, B., et al. (2010). *Field guide to aquatic invasive species: identification, collection and reporting of aquatic invasive species in Ontario waters*. Toronto: Ministry of Natural Resources.

McNeely, R. N., Neimanis, V. P., & Dwyer, L. (1979). *Water quality sourcebook: a guide to water quality pa rameters*. Ottawa: Inland Waters Directorate, Water Quality Branch.

Norman, A. (2005). The Use of Vegetative Buffers to Protect Wetlands. *Ontario Ministry of Natural Resources*, *12*, 1-5.

Ontario Ministry of Natural Resources. (2011). Invasive Phargmites-Best Management Practices. Ontario Min istry of Natural Resources, 15p.

Quinte
CONSERVATION

www.quinteconservation.ca
http://twitter.com/quinteca

R.R.#2, 2061 Old Highway #2,
Belleville, ON K8N 4Z2
Phone: (613) 968-3434

For more information please contact:
Christine Jennings 613-968-3434 extension 106 OR
Brad McNevin 613-968-3434 extension 107