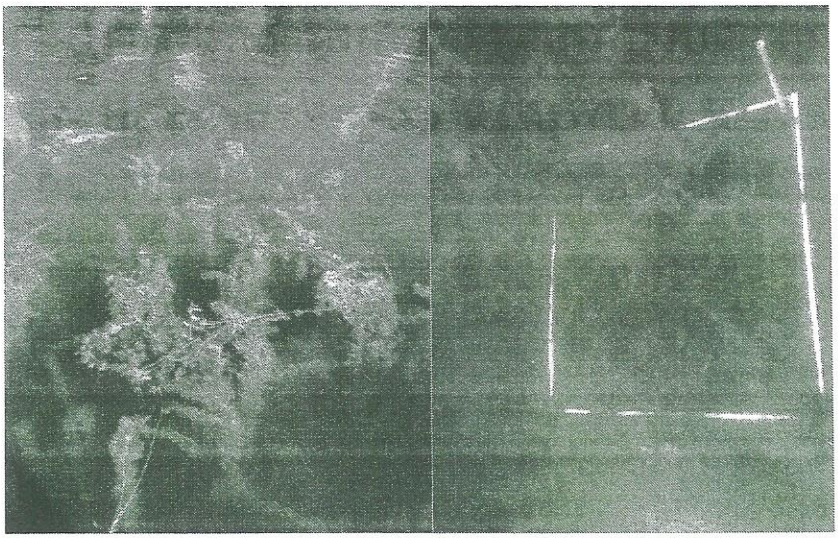
Pre- Eurasian Milfoil Treatment Aquatic Vegetation Survey, St. Lawrence River, Goose Bay, New York



Submitted to:

Goose Bay Reclamation Corporation

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Alexandria Bay, NY 13607

November 7, 2014

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Images: Eurasian Milfoil (left) and vegetation plot with quadrat (right) in Goose Bay Summer 2014 (photos P. Zimmer)

Executive Summary

The purpose of this survey was to collect baseline, pre-treatment data, of Goose Bay, St. Lawrence River aquatic vegetation within the proposed treatment area and a nearby control area (outside the influence of the proposed treatment). Percent cover for each vegetative species within $1m^2$ plots were recorded along 150 m transects (three plots per transect) within the treatment area (n=10 transects) and control sites (n=5 transects). An additional 5 transects were erected in the treatment area where native broadleaved submersed aquatic vegetation (SAV) was located to examine post-treatment response for this native vegetation. Temperature and dissolved oxygen were also recorded for the surface, mid-level, and bottom of each plot. Survey results show no significant difference in the cover of Eurasian water milfoil (*Myriophyllum spicatum*) between the treatment area (28.9%) and the control area (20.7%) or the native broad-leaved area (28.4%). This data will be used to as a pre-treatment comparison to evaluate the efficacy of the application of Renovate OTF.

Introduction

Eurasian water milfoil (*Myriophyllum spicatum*) is an invasive aquatic plant species that was considered a nuisance since the early 1800s and was first officially described in the Potomac River (Ward 1881). Its presence in the Great Lakes watershed in was first described in 1882 in Paddy's Lake near Oswego New York (Mills et al. 1991) and has since spread across North America (USDA Plants Database). This plant is considered a nuisance species because its rapid growth and high density adversely affects recreation use of waterways including swimming, boating, sport fishing and degrading the aesthetic appeal (Smith, 1990). *M. spicatum* also has a negative effect on the biotic quality of water by lowering dissolved oxygen concentrations (Smith 1990) and outcompeting native vegetation (Madsen 1991). Dominance of Eurasian Milfoil may alter the composition of aquatic macroinvertebrates and have negative impacts on ecological functions such as fish spawning (Madsen 1991). A study of prevalence of Eurasian Milfoil in relation to limnological characteristics indicated a relationship of its greater abundance with higher total phosphorus (TP) and trophic status. The upper St. Lawrence River, however, has lower TP levels and is considered oligotrophic (Mills and Forney 1981, Farrell et al. 2010). Trophic state and productivity, however is greater in St. Lawrence River embayments, and Eurasian Milfoil commonly reaches high densities, especially in protected geomorphic types of bays, such as Goose Bay, New York (Figure 1).

A paleontology study from a deep core (10m) indicated presence of *Myriophyllum* within Goose Bay c. 7,000 years before present (Rippke et al. 2010). Surveys of aquatic macrophytes in Goose Bay in 1976 documented no occurrence of *M. spicatum*, but native *M. exalbescens* (*M. sibiricum*) was documented (Mills and Forney 1977). These species are known to hybridize, but *M. spicatum* now predominates and has reached nuisance levels. In an effort to control *M. spicatum* in the bay, the Goose Bay Reclamation Corporation (GBRC) is considering applying the herbicide Renovate OTF to a 25 acre treatment area in the bay (Figure 2). This herbicide is approved for quiescent waters, which according to the water flow study done earlier in the year, Goose Bay is considered a wind driven system that is without substantial current when winds are low (Parkes 2014). In order to assess the efficacy of the treatment, a pre-treatment assessment was done to establish a baseline of the plant community composition. The purpose of this aquatic vegetation survey was to determine pre-treatment density of Eurasian water milfoil and other aquatic vegetation in the treatment area as well as in an outside control area.

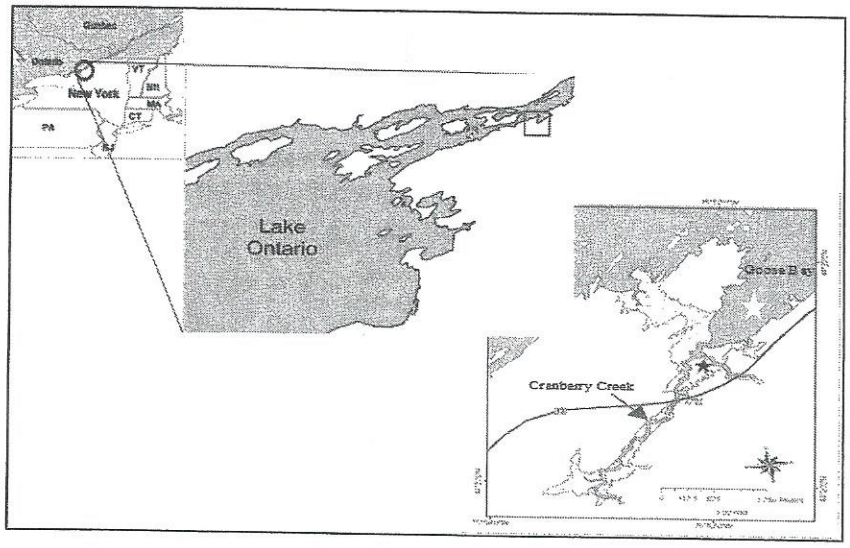

Figure 1. Goose Bay Eurasian Milfoil proposed treatment area (star).

Methods

Ten, evenly spaced, transects were set along the length of the treatment area, perpendicular to the shoreline, with three sample plots per transect (Figure 2). Sample plots were approximately 50 meters apart, but some distances were reduced in order to maintain the sample plot in an aquatic environment. Plots were marked with GPS and PVC pipe with painted orange tips to ensure identification of the same plot location for the post-treatment survey. Five control transects, with three sample plots each (n=15 plots) were erected perpendicular to the shoreline outside of the treatment area (control). The area for the control site was chosen based on its relatively similar density of milfoil and composition of other plants. Sample plots in the control site were also placed 50 meters apart and were marked in a similar manner. An additional five transects were set in an area within the treatment area that showed a relatively high density of broadleaved native plant species. Renovate OTF is known to be effective against other species of plants that are native to New York (FDA MSDA sheet), and the extra transects were added to assess impacts to native, beneficial plants.

All 60 plots were sampled from July 9th 2014 to July 11th 2014. The identity and percent cover of each species present within the 1 meter square quadrant was recorded by visual assessment. All floating and submersed vegetation was identified to the lowest possible taxon, typically species level.

The average percent cover of *M. spicatum* was compared among treatment, control, and native plots using a one-way ANOVA. Descriptive statistics were also reported for *M. spicatum*. We also compared the average percent cover of each species present among the three groups. This was done by averaging the percent cover of each species in all the treatment plots and all

the control plots as well as the reference plots. These averages were then used to create a stacked column chart showing the relative proportions of each species in each of the transect areas.

Figure 2. Vegetation survey study design showing vegetation sampling plot locations in the treatment area (blue), control area (green) and native area (yellow). Proposed treatment area is outlined in black.

Results

The average percent cover of *M. spicatum* was similar for the treatment (28.9%), control (20.7%) and broadleaved reference plots (28.4%; Table 1). Cover of *M. spicatum* was not statistically different between the treatment, control, and reference area (P=0.6865; Table 2).

Table 1. Descriptive statistics for *M. spicatum* sampled within study plots for all 3 treatment types (treatment, control, and broadleaved reference) in Goose Bay, NY.

Myriophyllum Cover: Descriptive Statistics							
Variable	**N**	**Mean**	**Median**	**SD**	**SE**	**Min**	**Max**
Treatment	30	28.93	20	34.26	6.25	0	100
Control	15	20.73	10	31.26	8.07	0	100
Reference	15	28.40	24	22.34	5.77	0	80

Table 2. One-way ANOVA results comparing mean cover of *M. spicatum* among treatment, control, and native plots. Statistical analysis was run in PAST and significance level was set at α=0.05.

Myriophyllum Cover: One-way ANOVA					
Source	DF	Sum of Squares	Mean Square	F Value	P Value
Between Group	2	726.85	363.425	0.3787	0.6865
Within Group	57	54702.4	959.691		
Total	59	55429.3			

Species composition for each treatment type, treatment (n=14 species), control (n=15 species) and broadleaved reference (n=14 species) were similar (Figure 3). The percent vegetation coverage by species, scaled to 100%, shows dominance by *M. spicatum*, but a diversity of other, mostly native species for each treatment category. Important species in addition to Eurasian Milfoil were three native species, coontail (*Ceratophyllum demersum*), water celery (*Vallisneria americana*), and waterweed (*Elodea canadensis*). The macrophytic algae, *Nitella* and *Cladophora*, were also found in abundance, mostly in the control and broadleaved reference areas.

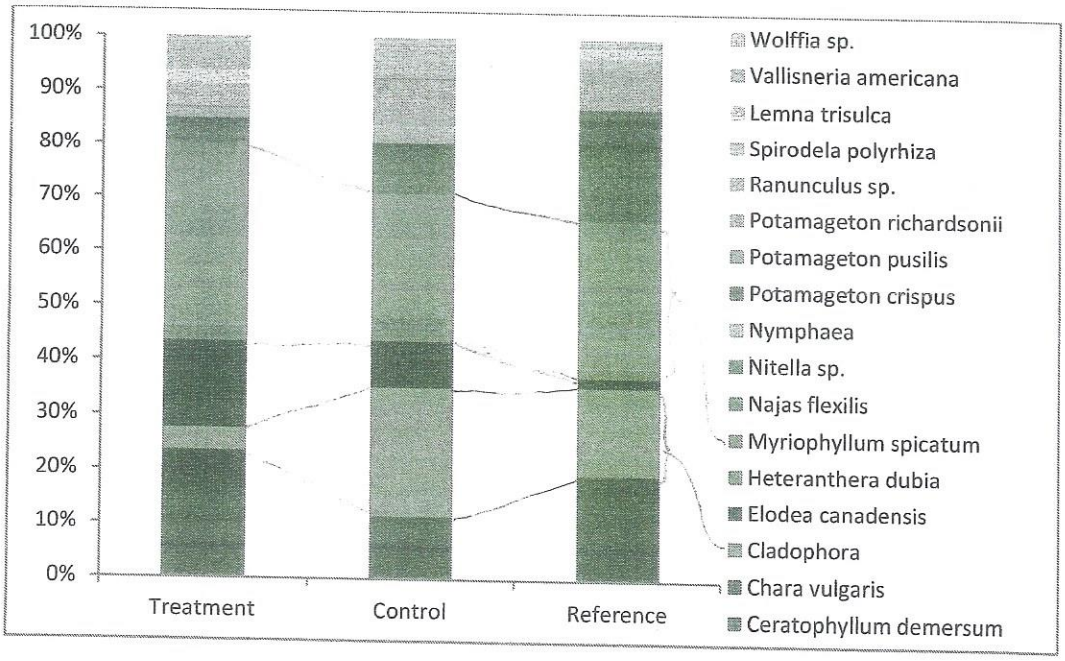

Figure 3. Percent abundance (scaled to 100%) of all species present in each of the transect areas.

Summary

Transects and vegetation plots were established to collect baseline data used for comparison of herbicide treatment effects. The control and the treatment area were not statistically different indicating they would serve as a useful comparison for post-treatment responses. Eurasian water milfoil was the dominant aquatic plant for all transect comparisons, but a diversity of native macrophytes were also present. Because other broadleaved vegetation was present and well represented, the effect of the Renovate OTF on those community elements in relation to its effectiveness for controlling *M. spicatum* should be apparent. Renovate is known for having lethal effects on certain dicots including broadleaved SAV, but many of these species will exist as propagules in the seed bank and re-germination of more favorable plants may re-colonize post-treatment. The effect of reductions of *M. spicatum* on native SAV will also be able to be assessed using post-treatment plot comparisons.

References

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Gmail by Google

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Weed Mapping

John M. Farrell <jmfarrell@esf.edu> Mon, Jun 30, 2014 at 5:21 PM
To: Robert Lamoureux <bclamour@gmail.com>
Cc: Stewart Davey <sandkdavey@earthlink.net>

Hi Bob,

We're on it and will begin next week. Can you send a google map with your dock location? We're going to leave a boat for the duration of the sampling (less than two weeks). Peter Zimmer is the ESF undergraduate student I mentioned. We really won't need any additional manpower. If volunteers want to help with seining in Goose Bay let me know.

John

Sent from my iPhone
[Quoted text hidden]

Peter Zimmer
Andrew Miano

Gmail by Google

Robert Lamoureux <bclamour@gmail.com>

Weed Mapping

John M. Farrell <jmfarrell@esf.edu> Wed, Jul 9, 2014 at 9:45 AM
To: Robert Lamoureux <bclamour@gmail.com>

Bob,

Got it...crew has been out there the last three days.

John

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From: Robert Lamoureux [bclamour@gmail.com]
Sent: Tuesday, July 08, 2014 7:33 PM
To: John M. Farrell
Subject: Re: Weed Mapping

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