



Darrin Fresh Water Institute

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Interim Report on Eradication of Eurasian watermilfoil from selected sites in
Lake George, New York

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1. Background.

Quantitative aquatic plant surveys were undertaken for Dunhams Bay, Elizabeth Island and Sunset Bay in Lake George, New York to obtain pre- and post-treatment data for benthic barrier installations to control Eurasian watermilfoil (*Myriophyllum spicatum* L.). Aquatic plant communities were quantified by both point intercept and line intercept methodologies. Divers recorded the perimeter of dense Eurasian watermilfoil (EWM) growth at each location via GPS. The project deliverables included: a) aquatic plant identification throughout all three locations for compilation of species lists, b) maps of dense growth of Eurasian watermilfoil for each treatment location, c) point intercept frequency of occurrence data for all plant species for points distributed throughout each of the treatment sites, and d) line-intercept transect data for all plant species for each treatment site.

2. Methods

2a. Species List and Herbarium Specimens. As the treatment locations were surveyed, the occurrence of any unknown aquatic plant species observed was recorded and adequate herbarium specimens were collected. The herbarium specimens were returned to the Darrin Fresh Water Institute, where they were identified, pressed, dried, and mounted (Hellquist 1993). The Darrin Fresh Water Institute maintains an extensive herbarium collection for the 59 species of submersed plants reported for Lake George.

2b. Point Intercept. The frequency and diversity of aquatic plant species were evaluated using a point intercept method (Madsen 1999). At each grid point intersection, all species located at that point were recorded, as well as water depth. Species were located by deploying a rake to the bottom, and examining the plants retrieved. A total of 50 points were selected for Dunhams Bay, 40 points for Elizabeth Island, and 40 points for Sunset Bay were evaluated on a 100 m grid. A differential global positioning system (DGPS) was used to navigate to each point for the survey observation. Point intercept plant frequencies were surveyed in July for all locations and in September of 2006 at the sites where benthic barrier installation had occurred.

2c. Line Transects. Macrophyte communities at each treatment site were also surveyed by a line intercept (transect) method employed extensively by DFWI and others to provide data comparable to historical surveys. Transect percent cover characterizes aquatic plant communities by density (percent cover), diversity (species richness) and dominance (relative percent cover). Transects were placed perpendicular to the shoreline and consisted of a polyethylene rope 100 meters in length, with marks every meter to indicate stop or observation points. At each observation point on the transect, a 0.1 m² quadrat is used to quantify percent

cover by species, utilizing the Daubenmire scale (Daubenmire 1959, 1968). Relative percent cover is recorded for each species observed within the quadrat. Physical characteristics including depth, sediment type, and obstructions are also recorded for each quadrat. One transect, to the limit of the littoral zone, or 100 meters was completed for each location. Line intercept plant frequencies and percent cover were surveyed in July for all locations and in September of 2006 at the sites where treatments occurred.

3. Results

3a. Species List. A preliminary list of species observed for each treatment site is provided in Table 1.

3b. Plant Management. Benthic barrier installation was completed in July and August of 2006 by Lycott Environmental Services at two (Dunhams Bay and Elizabeth Island) of the three sites proposed for treatment (see Figures 1 & 2). A total of 1.1 acres of benthic barrier was installed at these two sites to complete initial management efforts. The third site, Sunset Bay, is scheduled for management via benthic barrier in 2007.

3c. Species Frequency. Species richness at all locations was quite high, with a large number of species occurring in more than 5% of survey points (Table 2). In Dunhams Bay, duck celery, *Vallisneria americana* was the most common species (39% of survey points) both pre and post-treatment. For Elizabeth Island, Robbins pondweed, *Potamogeton robbinsii* was the most common species (38% of survey points) pre-treatment but declined to fourth post-treatment. Eurasian watermilfoil frequency of occurrence remained stable in Dunhams Bay (11% of survey points pre-treatment and 13% post-treatment). At the Elizabeth Island site, EWM frequency of occurrence declined from 5% pre-treatment to absent post-treatment. Common native species for Dunhams Bay prior to benthic barrier installation included *Vallisneria americana* (39% of survey points), *Potamogeton robbinsii* (30%), *P. praelongus* (22%), *Sphagnum* (13%), *Elodea canadensis* (11%), *P. zosteriformis* (9%), *P. gramineus* (7%), and *Ranunculus longirostris* (7%). Comparable results were observed post-treatment in Dunhams Bay, with native species including *Vallisneria americana* (39% of survey points), *Potamogeton robbinsii* (26%), *P. praelongus* (26%), *Sphagnum* (17%), *Elodea canadensis* (15%), *P. gramineus* (4%), and *Ranunculus longirostris* (2%). For Elizabeth Island, common native species prior to benthic barrier installation included *Potamogeton robbinsii* (38%), *P. gramineus* (28%), *P. amplifolius* (25%), *P. perfoliatus* (23%), *V. americana* (23%), *Najas flexilis* (23%), *N. guadalupensis* (18%), *P. foliosus* (18%) and *P. praelongus* (10%). Comparable results were observed post-treatment for Elizabeth Island, where common native species included *V. americana* (48%), *P. robbinsii* (23%), *P. gramineus* (25%), *P. amplifolius* (25%), *P. praelongus* (10%), *P. perfoliatus* (8%), *Najas flexilis* (3%), and *N. guadalupensis* (3%). The decline in the naiads is a normal seasonal phenomena resulting from early fall senescence in this genera.

3d. Line Intercept Transects. Line intercept results differed from point intercept, although many individual species were represented in both (Tables 2 & 3). In Dunhams Bay, the most common species pre-treatment were *Vallisneria americana* (82%), *Potamogeton robbinsii* (46%), *Myriophyllum spicatum* (38%), *P. praelongus* (31%), *Elodea canadensis* (17%), *Najas*

flexilis (15%), and *Isoetes echinospora* (11%). Post-treatment, Dunhams Bay was dominated by *Vallisneria americana* (28%), *Potamogeton robbinsii* (47%), *P. gramineus* (12%), *Myriophyllum spicatum* (10%), *P. praelongus* (19%), *Elodea canadensis* (13%), *Najas flexilis* (14%), and *Isoetes echinospora* (2%). In the Elizabeth Island area, the most common species pre-treatment were *Chara sp.* (46%), *Myriophyllum spicatum* (13%), *Isoetes lacustris* (11%), *Elodea canadensis* (8%), *Vallisneria americana* (6%), and *Najas flexilis* (6%).

4. References

- King, R. W, and L. Lyman. 2006. Lake George Integrated Aquatic Plant Management Program, Lake George Park Commission. Prepared by Lycott Environmental Inc. Southbridge, MA. USA.
- Hellquist, C.B. 1993. Taxonomic considerations in aquatic vegetation assessments. *Lake and Reserv. Manage.* 7:175-183.
- Madsen, J.D. 1999. Point intercept and line intercept methods for aquatic plant management. US Army Engineer Waterways Experiment Station Aquatic Plant Control Research Program Technical Note CC-02, Vicksburg, MS.

Table 1. Species list for Lake George Treatment Sites.

Species	Common Name	Dunhams Bay	Elizabeth Island	Sunset Bay
<i>Brasenia schreberi</i> J.F. Gmel	Water shield	X		
<i>Ceratophyllum demersum</i> L.	coontail	X		
<i>Chara</i> sp.	muskgrass, chara	X	X	X
<i>Elatine minima</i> (Nutt.) Fisch. & C.A. Mey.	small waterwort	X	X	X
<i>Eleocharis acicularis</i> (L.) Roemer & Schultes	needle spike-rush	X	X	X
<i>Elodea canadensis</i> Michx.	elodea	X	X	X
<i>Eriocaulon septangulare</i> With.	pipewort		X	
<i>Isoetes echinospora</i> Dur.	quillwort	X	X	
<i>Isoetes lacustris</i> L.	large spore quillwort		X	
<i>Juncus pelocarpus</i> Mey.	rush			X
<i>Lobelia dortmanna</i> L.	water lobelia		X	
<i>Megalodonta (Bidens) beckii</i> Torr.	water marigold	X	X	X
<i>Myriophyllum sibiricum</i> Kom.	northern watermilfoil			
<i>Myriophyllum spicatum</i> L.	Eurasian watermilfoil	X	X	X
<i>Myriophyllum tenellum</i> Bigel.	leafless milfoil	X	X	X
<i>Najas flexilis</i> (Willd.) Rostk. & Schmidt.	bushy pondweed	X	X	X
<i>Najas guadalupensis</i> (Spreng.) Magnus	southern naiad		X	
<i>Nuphar advena</i> (Ait.) Ait. f.	yellow pondlily		X	
<i>Nymphaea odorata</i> Ait.	white waterlily	X		
<i>Pontederia cordata</i> L.	pickerelweed	X		X
<i>Potamogeton amplifolius</i> Tuckerm.	largeleaf pondweed	X	X	X
<i>Potamogeton epihydrus</i> Raf.	ribbon-leaf pondweed		X	
<i>Potamogeton foliosus</i> Raf.	leafy pondweed			X
<i>Potamogeton gramineus</i> L.	variable-leaf pondweed	X	X	X
<i>Potamogeton perfoliatus</i> L.	clasping-leaf pondweed	X	X	X
<i>Potamogeton praelongus</i> Wulfen	white-stem pondweed	X	X	X
<i>Potamogeton pusillus</i> L.	small pondweed	X	X	X
<i>Potamogeton richardsonii</i> (Ar. Benn.) Rydb.	Richardson's pondweed		X	
<i>Potamogeton robbinsii</i> Oakes	Robbins' pondweed	X	X	X
<i>Potamogeton spirillus</i> Tuckerm.	narrow leaf pondweed	X	X	X
<i>Potamogeton vaseyii</i> Robbins	narrow leaf pondweed			X
<i>Potamogeton zosteriformis</i> Fern.	flat-stem pondweed		X	X
<i>Ranunculus longirostris</i> Godron	white watercrowfoot	X	X	X
<i>Ranunculus reptans</i> L.	creeping spearwort	X		
<i>Sagittaria cuneata</i> Sheldon (S. arifolia)	arumleaf arrowhead		X	
<i>Sagittaria graminea</i> Michx.	grassy arrowhead	X	X	
<i>Scirpus</i> sp.	bulrush	X		
<i>Sparganium</i> sp.	burreed	X	X	
<i>Sphagnum</i> sp.	sphagnum	X		
<i>Typha</i> sp.	cattail	X		
<i>Utricularia resupinata</i> B.D. Greene	bladderwort		X	
<i>Utricularia vulgaris</i> L.	great bladderwort	X		
<i>Vallisneria americana</i> L.	wild celery	X	X	X
<i>Zosterella (Heteranthera) dubia</i> Jacq.	water stargrass	X	X	X

Table 2. Point intercept aquatic plant percent frequency by species for pre-treatment and post-treatment.

	Dunham		Elizabeth	
	Pre	Post	Pre	Post
<i>Ceratophyllum demersum</i>	6.5%	2.2%	2.5%	
<i>Chara sp.</i>		2.2%	30.0%	2.5%
<i>Eleocharis acicularis</i>			7.5%	17.5%
<i>Elodea canadensis.</i>	10.9%	15.2%	7.5%	2.5%
<i>Elatine minima</i>			2.5%	2.5%
<i>Eriocaulon septangulare</i>			2.5%	2.5%
<i>Isoetes echinospora</i>		2.2%	2.5%	
<i>Isoetes lacustris</i>			7.5%	7.5%
<i>Juncus pelocarpus</i>			5.0%	
<i>Megalodonta beckii (Bidens beckii)</i>	2.2%	2.2%	10.0%	20.0%
<i>Myriophyllum alterniflorum</i>			5.0%	
<i>Myriophyllum spicatum</i>	10.9%	13.0%	5.0%	
<i>Myriophyllum tenellum</i>			2.5%	5.0%
<i>Najas flexilis</i>	4.3%		22.5%	2.5%
<i>Najas guadalupensis</i>			17.5%	2.5%
<i>Nuphar advena</i>			10.0%	
<i>Nymphaea odorata</i>			2.5%	
<i>Potamogeton amplifolius</i>	2.2%	4.3%	25.0%	25.0%
<i>Potamogeton ephedrus</i>		2.2%	2.5%	
<i>Potamogeton foliosus</i>			17.5%	
<i>Potamogeton friesii</i>			5.0%	
<i>Potamogeton gramineus</i>	6.5%	4.3%	27.5%	25.0%
<i>Potamogeton perfoliatus</i>	2.2%		22.5%	7.5%
<i>Potamogeton praelongus</i>	21.7%	26.1%	10.0%	10.0%
<i>Potamogeton pusillus</i>	2.2%		7.5%	
<i>Potamogeton robbinsii</i>	30.4%	26.1%	37.5%	22.5%
<i>Potamogeton vaseyii</i>			2.5%	7.5%
<i>Potamogeton zosteriformis</i>	8.7%		5.0%	
<i>Ranunculus longirostris</i>	6.5%	2.2%	5.0%	
<i>Ranunculus reptans</i>			2.5%	2.5%
<i>Sphagnum</i>	13.0%	17.4%		
<i>Utricularia vulgaris</i>			2.5%	
<i>Vallisneria americana</i>	39.1%	39.1%	22.5%	47.5%
<i>Zosterella dubia (Heteranthera dubia)</i>	2.2%	2.2%	2.5%	

Table 3. Aquatic plant percent frequency by species for the line intercept transects.

Species	Dunhams Bay		Elizabeth Island	
	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
<i>Ceratophyllum demersum</i>	4.0	3.0		
<i>Chara species</i>	2.0	5.0	46.0	16.0
<i>Elatine minima</i>	2.0	2.0		10.0
<i>Eleocharis acicularis</i>	1.0	3.0		
<i>Elodea canadensis</i>	17.0	13.0	8.0	
<i>Eriocaulon septangulare</i>				6.0
<i>Isoetes echinospora</i>	11.0	2.0	3.0	
<i>Isoetes lacustris</i>			11.0	35.0
<i>Lobelia dortmanna</i>				1.0
<i>Megalodonta beckii</i>	6.0	7.0		
<i>Myriophyllum sibiricum</i>	1.0			
<i>Myriophyllum spicatum</i>	38.0	10.0	13.0	
<i>Myriophyllum tenellum</i>				17.0
<i>Najas flexilis</i>	15.0	14.0	6.0	26.0
<i>Najas guadalupensis</i>			2.0	5.0
<i>Potamogeton gramineus</i>	3.0	12.0	4.0	13.0
<i>Potamogeton perfoliatus</i>	5.0	6.0		5.0
<i>Potamogeton praelongus</i>	31.0	19.0		
<i>Potamogeton pusillus</i>	1.0	1.0	1.0	5.0
<i>Potamogeton robbinsii</i>	46.0	47.0	1.0	21.0
<i>Potamogeton spirillus</i>	3.0	3.0	1.0	
<i>Potamogeton zosteriformis</i>	5.0	4.0		
<i>Ranunculus longirostris</i>	6.0	4.0		
<i>Ranunculus reptans</i>		2.0		1.0
<i>Sagittaria graminea</i>	2.0			
<i>Utricularia resupinata</i>				2.0
<i>Utricularia vulgaris</i>	5.0	2.0		
<i>Vallisneria americana</i>	82.0	28.0	6.0	50.0
<i>Zosterella dubia</i>	5.0	5.0		

Figure 1. Dunhams Bay EWM dense growth, pre-treatment (top) and post-treatment (bottom).

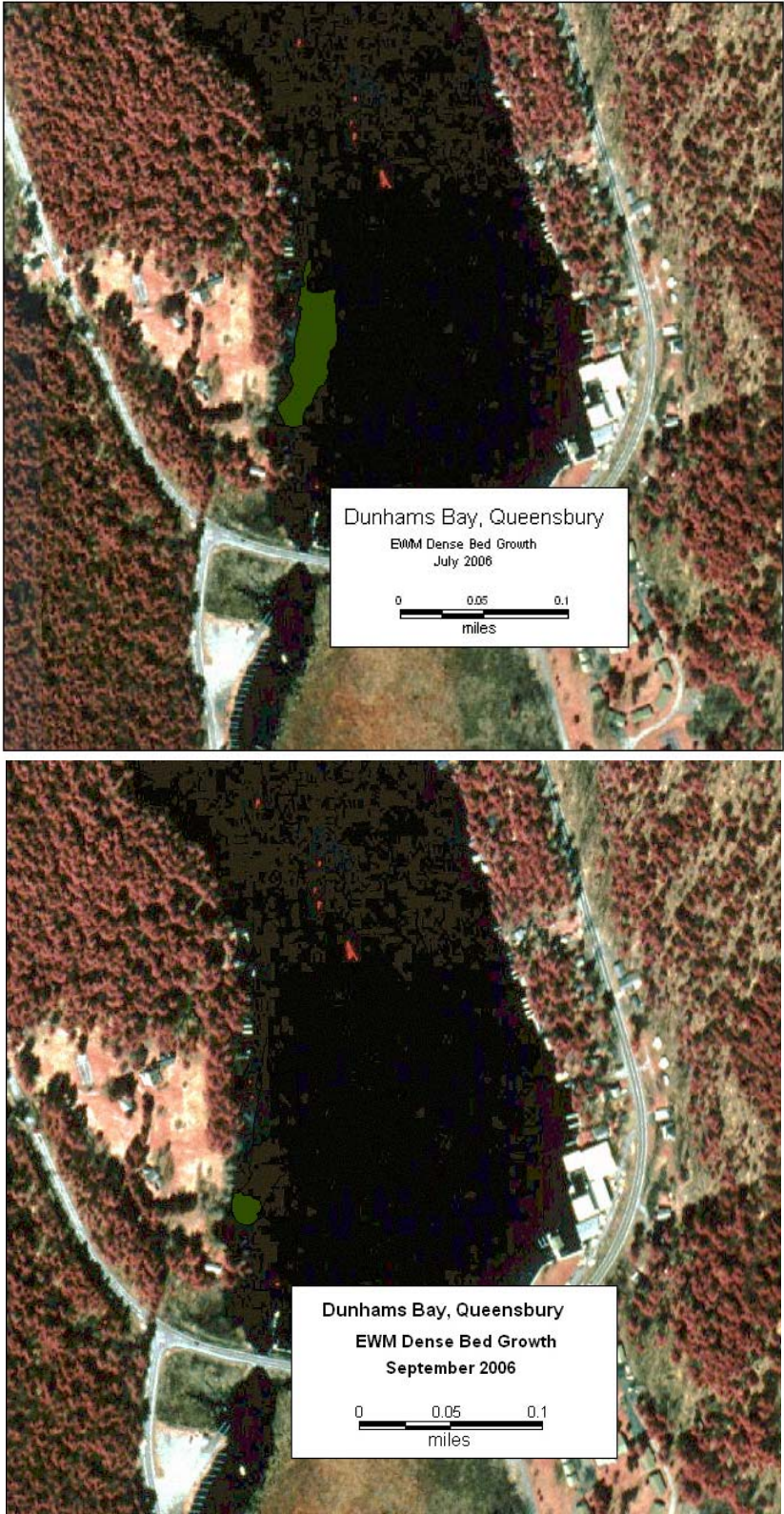


Figure 2. Elizabeth Island EWM dense growth, pre-treatment. All dense EWM growth was removed by a combination of benthic barrier and hand pulling in 2006.

