Eurasian Watermilfoil Strategic Biological Control Program
2011 Progress Report

Prepared for:

Les Cheneaux Islands Watershed Council

Prepared by:

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1.0 Introduction

In 2011, EnviroScience was contracted by Les Cheneaux Islands Watershed Council to supply the Milfoil Solution® (formerly Middfoil®) program to various bays within Lake Huron as part of a Great Lakes Restoration Initiative Grant. This program is specific in that it uses a biological control agent, the milfoil weevil (*E. lecontei*), for an invasive, exotic aquatic plant, Eurasian watermilfoil (*M. spicatum*) (EWM). This program was implemented back in June of 2007 stocking over 15,500 weevils in two areas of Cedarville Bay. An indigenous weevil population was discovered at the time of the stocking. Dramatic reduction of EWM was observed after augmenting to the natural weevil population.

This report summarizes the Milfoil Solution® program that began in late summer of 2011, in which over 55,000 weevils were stocked. It includes qualitative and quantitative data for all the newly established sites as well as the original survey sites from 2007. The table below outlines the program thus far, including site establishment and the number of weevils stocked by location:

Bay	Year	Survey Dates	Sites Established	Number of Weevils
Cedarville Bay	2007	Initial: 6/21 Follow-up: 8/7	S1,S2, MonA	15,500
	2008	Follow-up: 8/6	Survey	0
	2009	Follow-up:8/11	Survey	0
	2011	Initial:8/5 Follow-up:9/12	S3, MonB	15,000
Sheppard's Bay	2011	Initial:8/5 Follow-up:9/12	S1, MonA	30,000
Smith's Bay	2011	Initial:8/5 Follow-up:9/12	S1, MonA	10,000

2.0 Survey Methods

An initial survey is performed prior to weevil stocking and a follow-up survey is conducted six to eight weeks later. These surveys are integral in monitoring changes that occur in both the augmented weevil population and the health of the milfoil over the course of the program in order to make informed management decisions. Qualitative observations in these surveys include the overall density and health of milfoil, identification of native plant species present, and the presence of weevils and weevil-induced damage. Quantitative measurements include milfoil density and weevil population density. Milfoil density is determined by randomly collecting stems throughout the milfoil bed using a quadrat. This sample is then converted to the number of stems per square meter (stems/m^2). Weevil population density (number of weevils per stem) is determined through lab analysis of stems sampled from three transect lines at each site.

3.0 Cedarville Bay

2007-2009 Results

EnviroScience biologists first visited Cedarville Bay in June of 2007. Three sites were established at that time; two weevil stocking sites, S1 and S2, and one monitoring site, Mon1. S1 and S2 are adjacent to one another, located along the western edge of the bay south of the Cedarville Marina. MonA is situated east of the marina in the northern part of the bay (Figure 1). Initial surveys were performed at the sites in order to gather baseline data for each location. The EWM beds were healthy and dense at all of the sites. Weevil adults and weevil damage were observed at each of the sites, indicating the presence of an indigenous population of weevils already existing in the bay. Five species of native plants and one species of algae were found, representing a diverse aquatic plant community. These species include Large leaf pondweed (*Potamogetan amplifolious*), Eel grass (*Vallisneria americana*), Elodea (*Elodea canadensis*), Chara (*Chara* sp.), Northern watermilfoil (*Myriophyllum sibiricum)* and Coontail (*Ceratophyllum demersum*). Once the surveys were completed, 13,500 weevils were stocked in S1 and 2,000 were stocked in S2. By the time of the follow- up survey in August, S1 and S2 experienced decreases in EWM density, and S1 and M1 had an increase in the average number of weevils per stem. Open pockets devoid of plants were beginning to develop in the milfoil beds at all of the sites.

Follow-up surveys were performed in August of 2008 and 2009 for each site utilizing identical methods as previous surveys. The decreasing trend of EWM in S1 and S2 was observed in both years. By late season 2009 the average EWM density at S2 was 0.00 stems/m^2. The three random tosses of the PVC quadrat each came up empty, which illustrates how sparse and widely spaced the milfoil truly was at the site. While the EWM was decreasing the native plant community was increasing. Other species observed included: Naiad (*Najas spp.*), Robbins fern pondweed (*Potamogeton robbinsii*) Water marigold (*Bidens beckii*), Small leaf pondweed (*Potamogeton pusillus*) and Claspingleaf pondweed (*Potamogeton richardsonii*). The EWM at MonA was still considered dense but less than what was observed in 2007; 270 stems/m^2 in 2007 to 74.11 stems/ m^2 in 2009. Additionally, weevil life stages were observed in the field as well as on the stems for the laboratory analysis.

2011 Results

Initial Survey

The original 2007 sites (S1, S2 and Mon A) were surveyed while establishing one new weevil stocking site (S3) on August 5, 2011. The EWM in S1 and S2 was sparse and comparable to what was found in 2009 (Table 2). Native macrophytes made up almost all the plant community within each site; 90% in S1 and 98% in S2. Extensive weevil damage to the plants was observed in both sites and lab analysis revealed life stages in S1 (Table 1). Only 10 stems were

collected from S2 due to the lack of EWM in the survey site. More milfoil was observed in deeper water close to the channel.

The monitoring site, Mon A, was found to be sparse to moderate in density during the August survey. The EWM was sporadic but got more dense heading eastward within the site. The plants within the site consisted of 30% EWM and 70% native species while 40% of the EWM was damaged by weevils. Documented native species included: Northern watermilfoil, Naiad, Eel grass, Water marigold and Chara.

The new site, S3, located along the northeastern shore of La Salle Island adjacent to the channel, was surveyed on August 5th and stocked with 15,000 weevils on August 10th (Figure 1). The weevils were stocked among the approximately 3.25 acre bed of EWM. EnviroScience biologists noted minimal weevil damage to the stems while swimming through the moderately dense bed of plants. No life stages were found on the stems analyzed in the EnviroScience laboratory (Table 1).

Follow-up Survey

The follow-up survey was performed over two days, September 12th and 13th, five weeks after the stocking event. Thirty percent of the whole plant community at S1 was EWM, an increase from what was observed during the August survey, while native species composed the other seventy percent. The EWM was sparse and occurring sporadically. A considerable amount of boat propeller damage was noted throughout the site. Moderate weevil damage was observed in the field while only one life stage was found from the lab analysis (Table 1).

An increase in EWM was also observed in S2 but overall still considered sparsely distributed throughout the site. Minimal weevil damage was noted on the EWM plants while swimming all through the site, however no weevil life stages were observed on the 29 stems collected for lab analysis (Table 1). Although there was a visual increase in the density of the stems within the location, the data showed no change (Table 2).

The EWM at Monitoring site A exhibited the most weevil larval damage of all the sites. At the time of the survey the bed was moderate to dense with more than 30% of the stems damaged however no weevil life stages were found from the lab analysis (Table 1). The density data showed no significant changes between both surveys (Table 2).

According to the data recorded at the time of the survey, the third stocking site, S3, had doubled in stem density however site conditions appeared the same as they were five weeks earlier (Table 2). Native plants observed within the bed included: Naiad, Eel grass, Largeleaf pondweed and Flatstem pondweed (*Potamogeton zosteriformis*).

The stem length of the plants ranged from 7"-20" below the water surface. No evidence of weevils was found in the field or in the lab results (Table 1).

A Monitoring site, Mon B, was established south of the stocking site to watch the movement of the weevils (Figure 1). The EWM within the bed was healthy; no evidence of weevils was observed. The average stem length through the bed was 12.8" under the water surface while the southern edge of the bed was 3' deep. Lab analysis resulted in no weevil life stages found in the site. The density measurements will be used as a comparison for future surveys.

Table 1. Summary Data from Site Transect Analysis of EWM 2011 Initial and Follow-up Surveys of Cedarville Bay

Bay	Site	Parameter measured	Initial Survey 8/5/11	Follow-up Survey 9/12/11
Cedarville	S1	Total weevils	8.00	1.00
		Total stems	30.00	30.00
		Avg. weevils/stem	**0.27**	**0.03**
	S2	Total weevils	0.00	0.00
		Total stems	10.00	29.00
		Avg. weevils/stem	**0.00**	**0.00**
	S3	Total weevils	0.00	0.00
		Total stems	30.00	30.00
		Avg. weevils/stem	**0.00**	**0.00**
	MA	Total weevils	3.00	0.00
		Total stems	30.00	29.00
		Avg. weevils/stem	**0.10**	**0.00**
	MB	Total weevils		0.00
		Total stems	*	30.00
		Avg. weevils/stem		**0.00**

Sites established in 2011
* = site not established

Table 2. Average Density of EWM (stems/m^2) in Cedarville Bay

Bay	Site	Initial Survey 8/5/11	Follow-up Survey 9/12/11
Cedarville	S1	51.9	<10
	S2	<10	<10
	S3	77.8	163.0
	MA	66.7	63.0
	MB	*	144.4

Sites established in 2011
* = site not established

4.0 Sheppard's Bay

Initial Survey
Sheppards Bay is located south of Cedarville Bay. The large EWM bed, approximately 70 acres in size, covered the majority of the bay. On August 5, 2011, over 30,000 weevils were stocked in an area of 1.9 acres within the large bed of S1 (Figure 2). Four buoys marked the stocking location in hopes of keeping boat traffic out. At the time of the survey, the dense EWM ranged in stem length from six inches to three feet below the surface. Very minimal weevil larval damage was observed in the field while no life stages were found during lab analysis (Table 3). The native species observed within the stocking location were: Clasping leaf pondweed, Water merigold, Elodea, Whitestem pondweed (*Potamogeton prealongus*), Naiad, Robbins fern pondweed and other potamogeton spp.

A monitoring site, Mon A, was established west of the stocking location. The site consisted of sporadic patches of EWM (estimated at 40% of the plant community) while the remaining 60% were the same native species identified in S1. Larval damage was noted on approximately 40% of the EWM stems in the field. Weevil eggs and larvae were found on three of the stems collected for lab analysis revealing an indigenous weevil population established within the site (Table 3).

Follow-up Survey
By September 12th the EWM within the stocking location at S1 more than doubled in density (Table 4). Although dense, the plants were still below the surface. Weevil induced damage was observed to the rooted stems that were stocked five weeks prior. However, no evidence of weevils was found on the stems that were collected throughout the entire stocking location for analysis (Table 3). EnviroScience biologists noted that some of the stems within the site were starting to auto-fragment, in which segments were developing roots before separation from the

plant. This is a type of asexual reproduction that the plant undergoes in early spring/ late summer.

The density of EWM in the monitoring site, Mon A, had decreased slightly and composed 30% of the overall plant community. Eel grass and Naiad were the dominant plant species within the site. Although weevil life stages were not found as a result of the lab analysis, moderate damage to 20% of the stems was observed in the field (Table 3).

Table 3. Summary Data from Site Transect Analysis of EWM 2011 Initial and Follow-up Surveys of Sheppard's Bay

Bay	Site	Parameter measured	Initial Survey 8/5/11	Follow-up Survey 9/12/11
Sheppard's	S1	Total weevils	0.00	0.00
		Total stems	30.00	60.00
		Avg. weevils/stem	**0.00**	**0.00**
	MA	Total weevils	5.00	0.00
		Total stems	30.00	30.00
		Avg. weevils/stem	**0.17**	**0.00**

Table 4. Average Density of EWM (stems/m^2) in Sheppard's Bay

Bay	Site	Initial Survey 8/5/11	Follow-up Survey 9/12/11
Sheppard's	S1	74.1	211.1
	MA	37.0	31.5

5.0 Smith's Bay

Initial Survey

The new stocking site, S1, was located south of Hessel Bay, on the northeast corner of Marquette Island (Figure 3). The moderately, dense bed of EWM was located in 1'-3' of water and stem length ranged from 7"-24" below the surface of the water. Adult weevils were observed on the stems in the field suggesting a native population of weevils present prior to the stocking event. Five weevils were found on two of the thirty stems collected for analysis (Table 5). After the survey was completed, over 10,000 weevil eggs and larvae were stocked in the approximately 3 acre bed. A healthy mix of native plant species was present within the site: Eel grass, Elodea,

Clasping leaf pondweed, Coontail, Variable pondweed (*Potamogeton diversifolius*) and Stonewort (*Nitella sp*.).

Follow-up Survey

The EWM was dense and only inches below the water surface by the time of the follow-up survey. EWM was the dominant species making up 98% of the plant community. Less than five percent of the plants were starting to flower. Although visually dense, the density data reflect a decrease from the initial survey (Table 6). Minimal larval damage to the plants was observed throughout the stocking area while the stem analysis revealed two weevils in total (Table 5).

During the September survey, EnviroScience biologists established a monitoring site (Mon A) outside of the small bay stocked with weevils to better monitor the movement of the weevils. A few homeowners in the area managed the EWM near their boat docks by hiring a mechanical harvester, but this new site was not harvested. A healthy native plant community included: Northern watermilfoil, Clasping leaf pondweed, Robbins pondweed, Eel grass, Stonewort, Elodea, Chara, Largeleaf pondweed, Flatstem pondweed and Peacock moss (*Taxiphyllum sp*.). The density data will be used as a comparison in the upcoming seasons (Table 6). Weevils were not found on the stems analyzed at the lab, but larval damage was observed in the field.

Table 5. Summary Data from Site Transect Analysis of EWM 2011 Initial and Follow-up Surveys of Smith's Bay

Bay	Site	Parameter measured	Initial Survey 8/5/11	Follow-up Survey 9/12/11
Smith's	S1	Total weevils	5.00	2.00
		Total stems	30.00	30.00
		Avg. weevils/stem	**0.17**	**0.07**
	MA	Total weevils	*	0.00
		Total stems		30.00
		Avg. weevils/stem		**0.00**

* = site not established

Table 6. Average Density of EWM (stems/m^2) in Smith's Bay

Bay	Site	Initial Survey 8/5/11	Follow-up Survey 9/12/11
Smith's	S1	137.0	113.9
	MA	*	85.2

* = site not established

6.0 Discussion

The focus of the Milfoil Solution® treatment program is to control the growth of EWM using the milfoil weevil. When working with a biocontrol such as the milfoil weevil, it is important to remember that the rate at which "control" is achieved can vary greatly among water bodies. Many factors play an important role, including the size of the water body, shoreline habitat, amount and health of the EWM, amount of weevils stocked, and the level of recreation occurring on the lake. Although a high number of weevils were stocked in each location, they were stocked later in the growing season than preferred. EnviroScience biologists were not expecting drastic changes to the EWM by the time of the follow-up survey considering that the weevils had only been implemented five weeks earlier. The purpose of the survey was to visually examine the establishment of the weevils.

Damage to the rooted stems was observed in the immediate stocking areas in Sheppards Bay and Smiths Bay. Although some samples analyzed from the follow-up surveys did not contain weevil life stages, they did exhibit damage unique to a weevil population such as areas where larvae have burrowed down the stem and holes where pupae have emerged. Weevil generations may appear to occur less frequently as milfoil density increases during peak growth later in the season, so these measurements are best viewed over multiple years to observe long-term trends.

The stem biomass in two of the sites (S3 of Cedarville Bay and S1 of Sheppard Bay) had doubled at the time of the follow-up survey but is expected to decrease as the augmented weevil population grows. Successful milfoil suppression as part of a biological control strategy includes reduction in density of the milfoil, maintenance of the stems below the lake surface at a non-nuisance level, and open areas within the stocking site. These exact characteristics have been observed in the 2007 stocking areas in prior years and EnviroScience biologists anticipate positive results in the upcoming season based on results from the 2011 survey.

Should you have any questions or comments, please do not hesitate to contact EnviroScience at (800) 940-4025 or at cmarquette@enviroscienceinc.com.

Figure 1. Cedarville Bay 2011 Stocking and Monitoring Locations.

2007 Stocking and Monitoring Locations

2011 Monitoring and Stocking Locations

1,600 800 0 1,600 Feet

400 200 0 400 Meters

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Figure 2. Sheppard's Bay 2011 Stocking and Monitoring Locations.

2011 Monitoring Location

2011 Stocking Location

1,600 800 0 1,600 Feet

400 200 0 400 Meters

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Figure 3. Smith's Bay 2011 Stocking and Monitoring Locations.

2011 Monitoring and Stocking Locations

1,600 800 0 1,600 Feet

400 200 0 400 Meters

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Milfoil Weevil Private Purchase Program for Lake Huron Residents Within the Les Cheneaux Islands

Milfoil Solution®, offered exclusively by EnviroScience, utilizes a native weevil as the biological control agent for managing the exotic Eurasian watermilfoil (EWM) in an environmentally-friendly and sustainable manner. Twelve years of experience enables EnviroScience's Lake Management Team to customize effective programs for lakes and ponds of all sizes.

In 2011, The Les Cheneaux Watershed Council began a two-year **Milfoil Solution®** program on several bays of the lake. The watershed council is scheduled to receive more milfoil weevils in June, 2012 for specific sites with noticeable control and reduction of milfoil expected in the stocked sites and limited adjacent areas by 2013.

A number of lake-front property owners have expressed interest in stocking additional milfoil weevils along their shoreline through private or group purchases. Because these efforts will promote more rapid and effective lake-wide EWM control, EnviroScience is pleased to offer a special program for Lake Huron property owners that make it more affordable than ever to stock larger numbers of weevils. This is important because the more weevils you can stock, the faster the process works. The following table outlines the 2012 pricing structure. Note: the cost includes weevils and labor for stocking.

Weevil Units	No. of Weevils	Total
1	1,000	$1,200.00
2	2,000	$1,800.00
3	3,000	$2,400.00
4	4,000	$3,000.00
5	5,000	$3,500.00
6	6,000	$4,000.00

Weevil culturing will begin in early June with weevil stocking throughout the month. Please contact Cortney Marquette, cmarquette@enviroscienceinc.com or Rebecca McMenamin, rmcmenamin@enviroscienceinc.com), for a proposal or for more information.

Sincerely,

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