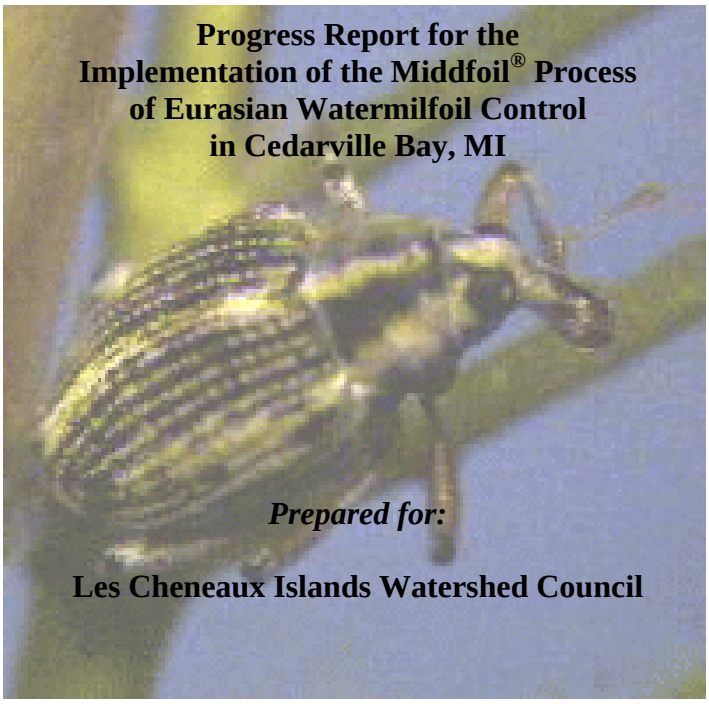

Progress Report for the Implementation of the Middfoil® Process of Eurasian Watermilfoil Control in Cedarville Bay, MI

Prepared for:

Les Cheneaux Islands Watershed Council

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1.0 Description of Lake Characteristics

Cedarville Bay is located within the Les Cheneaux Island Watershed which consists of a 36-island archipelago. Although Cedarville Bay is technically connected to Lake Huron it has more characteristics and functions of an inland lake. There is minimal water movement in the Bay due to the currents, boat traffic and wind. While much of the area surrounding the north and western area of the bay is developed there is also an undeveloped island (La Salle Island) in the eastern and southeastern portion of the Bay. The infestation and excessive growth of Eurasian watermilfoil *(Myriophyllum spicatum)* has become a major concern for property owners surrounding the bay, given its tendency to dominate vegetative communities once it becomes established.

Eurasian watermilfoil (EWM) is an invasive, exotic aquatic plant from Europe and Asia that is thought to have invaded the United States in 1930's. This invasive species tolerates a wide range of growing conditions and out-competes native vegetation which can lead to a monoculture of EWM. Thick beds of EWM limit recreational use, reduce biodiversity, and induce an unbalanced fishery. Furthermore, a severe infestation of milfoil can cause thermal stratification, and lead to a reduction in natural circulation causing dissolved oxygen problems.

2.0 Overall Project Description

Cedarville Bay began a two year MiddFoil® program beginning in the summer of 2007. The stocking event, which included the augmentation of approximately 15,500 weevils in two sites, was conducted on June 21st, 2007. The late-summer follow-up survey was then performed on August 7th, 2007. The final survey to conclude the program will be conducted in late summer of 2008.

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3.0 Methods

In 2007 two basic types of quantitative data collection and one type of qualitative data collection were sampled at the time of the initial and follow-up surveys. The first of these involved collecting plants along three transect lines by swimming through the selected beds of Eurasian watermilfoil perpendicular to shore. The tops of two randomly selected plants were removed at five evenly spaced intervals, for a total of ten plants along each line, and 30 stem samples per site. These plants were analyzed, using a microscope, for the presence of weevils and number of meristems.

Where sufficient EWM stems were found, plant density was determined by collecting all EWM plants within a 0.09 m^2 PVC quadrat. These plants were counted and converted to number of plants per meter squared. These data will serve as an indicator of increases or decreases in EWM density in future survey years.

A qualitative survey of the overall plant community was accomplished by swimming through and around the bed of milfoil noting the presence and density of native species. This sampling technique provides an indication of weevil impact on the EWM beds. We can compare the follow-up survey to the initial survey to determine if the native plants in the lake are becoming more abundant as the weevils damage the EWM stems.

4.0 2007 Initial Survey and Stocking Event

The initial survey and stocking event was conducted on June 21st, 2007. A total of approximately 15,500 weevil eggs and larvae were stocked in two sites that exhibited favorable, life-sustaining factors necessary for weevil survival. The sites established for weevil implantation (S1 and S2) were located along the western edge of the Bay south of the Cedarville Marina (Figure 1) in one continuous milfoil bed. Location S1 was stocked with approximately 13,500 weevils while the remaining 2,000 was stocked at S2 near

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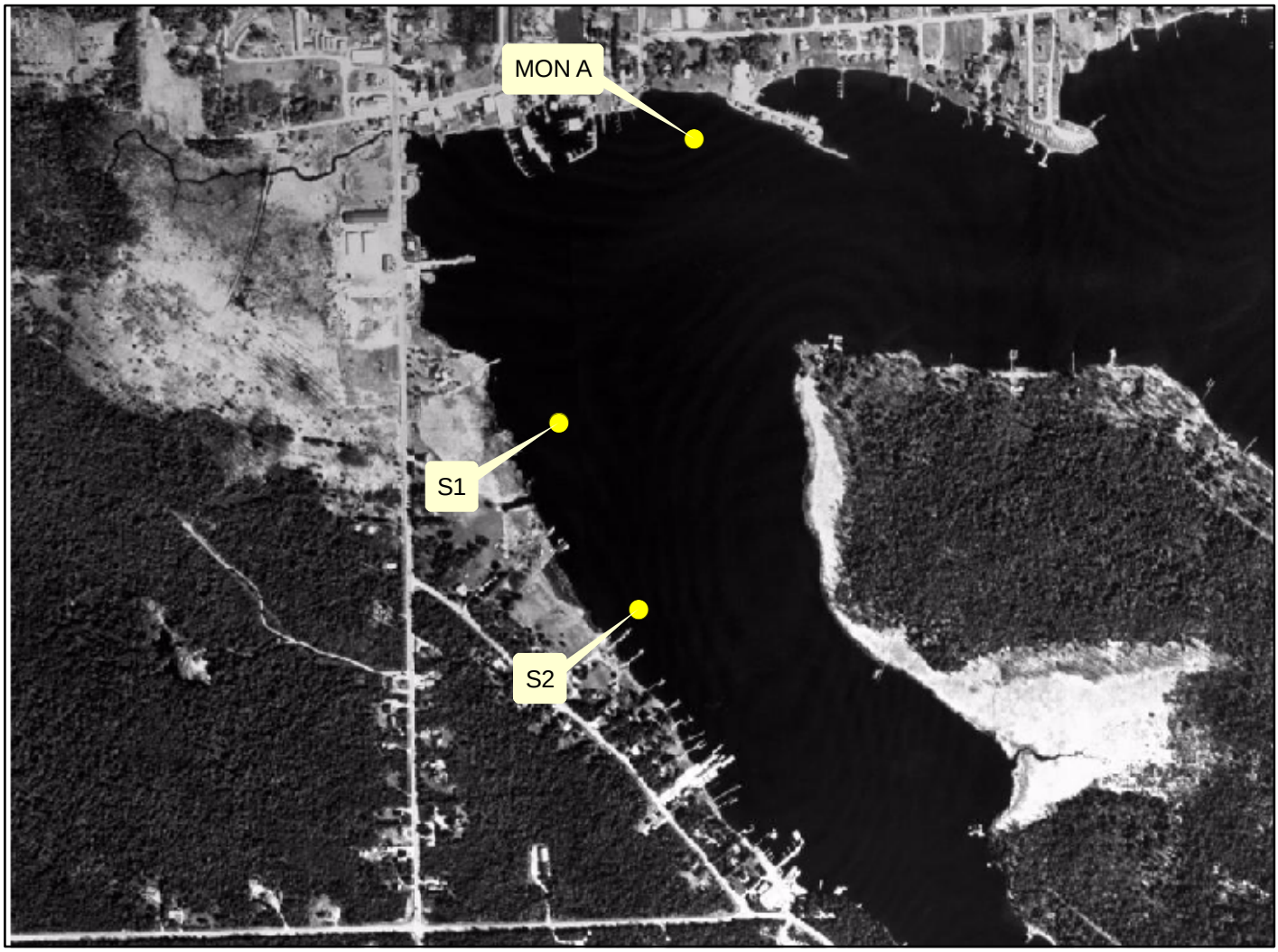
Cedarville Bay, Lake Huron, MI

MiddFoil® Stocking and Monitoring Site Locations



Data projected to NAD83 UTM Zone 16N.

0 0.125 0.25 0.5 Miles

2007 Site Location

N

Figure 1. Cedarville Bay Stocking and Monitoring Locations

the Shoberg residence. The monitoring site (Mon A), not stocked with weevils, was established as a control plot to help track the movement of weevils throughout the Bay. This monitoring location was established east of the Cedarville Marina in the northern portion of the Bay.

Overall the milfoil beds located within Cedarville Bay were relatively healthy, with the exception that epiphyton (algae) was noted on some of the milfoil plants in locations S1 and S2. During the initial survey (pre-treatment) weevils and damage indicative to weevils was observed in all three locations. This indicated that an indigenous population of weevils was present in the lake prior to the initiation of the MiddFoil® treatment. This observation was confirmed by an analysis of stems that were brought back to the EnviroScience laboratory for examination under a microscope. As shown on Table 1 (Appendix A), a total of 26 weevils were identified on 90 milfoil stems during the initial survey (8 weevils at S1, 16 weevils at S2 and 2 weevils at Mon A). In addition to the EWM, several other native plant species were observed. These species include: largeleaf pondweed (*Potamogetan amplifolious*), eel grass (*Vallisneria americana*), elodea (*Elodea canadensis*), chara (*Chara* spp.), northern watermilfoil (*Myriophyllum sibiricum)* and coontail (*Ceratophyllum demersum*). A healthy and established population of native vegetation will not only compete for essential light and nutrients but is expected to replace the EWM, preventing future re-establishment of the milfoil.

5.0 2007 Follow-up Survey

The follow-up survey was performed on August 7, 2007. At the time of this survey the milfoil at locations S1 and S2 was still dense; however there were areas of open pockets where milfoil had fallen out of the water column. Although the monitoring site was not stocked with bugs it visually appear to have the best results. The milfoil in this area was not topped out at the surface but instead falling over. This may have been a result of the indigenous weevil population affecting the density of the milfoil. A large population of eel grass and also some coontail plants were observed throughout stocking locations S1

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and S2. As shown on Table 1 (Appendix A) the average number of weevils per stem increased in S1 and the monitoring location while decreasing at S2. However, with the high density of milfoil in the stocking locations, the number of weevils found is a great representation of the population at the time of the follow-up survey. Stem analysis results in other lakes with the same high milfoil density are usually substantially lower.

Discussion and Conclusion

Since weevil damage does not typically cause a change in total EWM biomass over the course of one growing season (Newman et al., 1996), initial and final densities for the stocking sites established in 2007 were averaged to obtain a single value that will be used in comparisons of EWM density in future years (Appendix A, Table 2). Mean values are expected to decline each year as weevil damage results in reduced numbers of plants surviving through the winter months. A native aquatic plant community was also observed to be increasing within the stocking locations. The presence and percentage of native aquatic plant species are expected to increase and continue competing for essential light and nutrients, and eventually replace the EWM.

When working with a biocontrol such as the milfoil weevil, it is important to remember that the rate in which "control" is achieved can vary greatly from lake to lake. Many factors play an important role including the size of the lake, shoreline habitat, amount and health of the EWM, amount of weevils stocked, and how much recreation occurs on the lake. The Bay of Cedarville maintains the necessary requirements to sustain a population of weevils throughout the summer, as well as having the critical required shoreline habitat for overwintering survival. This was evident by finding an indigenous population. As the EWM begins to decrease overtime, so will the population of weevils until the two reach a state of equilibrium and sustain each others presence within the lake at low levels. Density oscillations observed between weevils and EWM are expected and are not surprising due to the fact that the milfoil has the potential to grow faster than the weevils can reproduce. It may take the population of weevils a season to "catch up" with the

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density of EWM before they can bring the milfoil levels back down. We have been witnessing this very event happening in many lakes in Michigan that utilizes the MiddFoil® program.

In conclusion, by artificially augmenting the 15,500 weevils to the indigenous population, the weevils appear to have not only been able to sustain and thrive throughout the summer, but to have some initial impacts on the milfoil population within the stocking and monitoring locations. These positive results can be expected to accelerate should the Les Cheneaux Islands Watershed decide to continue with future weevil stockings throughout Cedarville Bay.

6.0 Literature Cited

Newman, R.M., K.L Holmberg, D.D Biesboer and B.G Penner. 1996. Effects of a potential biocontrol agent, *Euhrychiopsis lecontei*, on Eurasian watermilfoil in experimental tanks. *Aquat. Bot*. 53:131-150.

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Appendix A

2007 Progress Report Data
Tables for Cedarville Bay

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Table 1. Summary Data from Site Transect Analysis of EWM During 2007 Initial and Follow-up Surveys of Cedarville Bay

Site #	Parameter Measured	Initial Survey (June 22, 2007)	Follow-up Survey (August 7, 2007)
S1	Total weevils	8.00	11.00
	Total stems	30.00	30.00
	Average weevils/stem	**0.27**	**0.37**
	Avg. meristems/stem	3.25	2.17
S2	Total weevils	16.00	7.00
	Total stems	30.00	30.00
	Average weevils/stem	**0.53**	**0.23**
	Avg. meristems/stem	2.00	1.97
M1	Total weevils	2.00	9.00
	Total stems	30.00	30.00
	Average weevils/stem	**0.07**	**0.30**
	Avg. meristems/stem	2.87	1.43

Table 2. Average Density of Eurasian Watermilfoil Collected During 2007 Initial and Follow-up Surveys of Cedarville Bay

Site #	Species	Common Name	2007 Average Density (stem/m^2)
S1	*Myriophyllum spicatum*	Eurasian watermilfoil	341.67
S2	*Myriophyllum spicatum*	Eurasian watermilfoil	355.00
M1	*Myriophyllum spicatum*	Eurasian watermilfoil	361.67