We Energies
2008 Eurasian Water Milfoil Management Plan

In 2007, We Energies began implementation of a long-term management program for studying the effectiveness of various control methods and implementation of these methods. An experimental project utilizing manual, chemical, and biological controls was conducted in 2007. Manual (hand pulling) controls were found to be ineffective, while chemical controls were found to be relatively effective after a single treatment. Biological controls were implemented on three reservoirs: Brule, Lower Paint, and Twin Falls. Positive trends were immediately observed in both Lower Paint and in Brule. These included a sharp drop in the cover of Eurasian water milfoil, an increase in native diversity and cover, and evidence of successfully reproducing native milfoil weevils (*Euhrychiopsis lecontei)*. While conducting the weevil release, indigenous populations of the native weevils were observed at both Brule and Lower Paint. Conversely, no weevils were observed in or around the release site at Twin Falls pre or post-release, which occurred in Badwater Lake.

In 2006 and 2007, Cowboy Lake in the Kingsford Reservoir exhibited similar characteristics to Badwater Lake. Both water bodies contained the largest extent of Eurasian water milfoil growth as well as the highest densities. Based on the apparent lack of weevils in Badwater Lake, we suspected that one of two factors could be playing a role in why Eurasian water milfoil is growing at such high distribution and densities in these two lakes. We suspected that either significant predation was occurring or weevil reproduction was oppressed by the presence of a hybrid milfoil strain.

The results from 2007 led to the development of a multi-faceted management program that was implemented in 2008. With the discovery of indigenous weevil populations at two reservoirs and the apparent lack of weevils at Twin Falls, the 2008 activities were focused on evaluating the extent to which indigenous populations are present in the system. We also studied how other factors could be affecting the weevil reproduction potential. The 2008 work focused on the following objectives:

- characterizing the indigenous weevil population throughout the system
- determining whether successful weevil reproduction could occur on known hybrid strains of Eurasian waterfoil
- evaluating the extent to which weevil predation is occurring in Twin Falls (i.e. Badwater Lake) and Kingsford (i.e. Cowboy Lake)

Attached is a summary report from EnviroScience, Inc. describing the methods and results from the weevil population conducted in 2008. Indigenous weevil populations were found in each of the nine reservoirs studied. The nine reservoirs were selected as they are the only ones with Eurasian water milfoil present. Weevil populations varied from one reservoir to another, with the highest populations generally occurring in reservoirs with either fewer stands of milfoil or the lowest average densities. Successful consecutive generations of weevils were produced on suspected hybrid milfoil collected from Cowboy and Badwater Lakes. Predation of weevils was observed, but more apparent in Cowboy Lake than in Badwater Lake.

We Energies is currently developing the management program to be carried out in 2009. We intend to replicate certain facets of the program implemented in 2008 to further develop an understanding of indigenous populations, predation on these populations, and the affect indigenous populations are having on the Eurasian water milfoil. Also planned for 2009, are releases of weevils into areas of the system where the milfoil is at higher densities and weevil populations are lower.

September 26, 2008

Mike Grisar
WE Energies
333 W. Everett St.
Milwaukee, WI 53203

Dear Mr. Grisar:

WE Energies contracted with EnviroScience to further investigate the milfoil weevil (*Euhrychiopsis lecontei*) and its potential to control Eurasian watermilfoil (*Myriophllum spicatum*) within the Menominee River watershed during the summer of 2008. Three different components were investigated as part as this year's research: weevil distribution in nine of the twelve reservoirs owned by WE Energies; evaluation of the weevil's ability to utilize hybrid milfoil; and sunfish predation on weevils in two lakes within the system. This is a summary of the results found; a more detailed report will be forthcoming.

1.0 Hybrid Experiment

In recent years, Eurasian watermilfoil (EWM) has been found to hybridize with one or more species of watermilfoils native to North America. Most common among these is a hybrid cross of Eurasian watermilfoil and Northern watermilfoil (*Myriophyllum sibiricum*). During 2004, this hybrid milfoil was identified in Badwater Lake in Twin Falls Reservoir. Although relatively little information exists on the ability of milfoil weevils to utilize hybrid milfoils, EnviroScience's experience indicates that weevils raised on Eurasian watermilfoil have reduced fecundity and generally less impact on hybrid milfoil as compared to Eurasian watermilfoil. The abundance of hybrid milfoil in Badwater and Cowboy lakes raised concern over whether *E. lecontei* could be effective at controlling it, which led to this investigation.

The objective of the hybrid milfoil experiment was to establish cultures of the hybrid from the two lakes, introduce weevils reared on EWM to the hybrid, and track the reproductive success of the weevils. During the first week of June 2008, EnviroScience biologists collected hybrid milfoil from both locations and brought it to the EnviroScience facility in Stow, OH. At that time of year, milfoil is just starting to sprout new, thin meristems from the winter stems that have died back. The plants from the two locations varied with those from Badwater Lake more sparse than those from Cowboy Lake. Importantly, weevils were found on the hybrids in both Badwater Lake and Kingsford Reservoir in Cowboy Lake. Weevils had not been observed during the previous stocking year, but their presence this year indicates that the weevils are already utilizing the hybrid.

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The hybrid plants were sorted and planted into four 50-gallon tanks for each lake within the culturing facility. At the same time, six aquaria with 15 cups of hybrid meristems (10 meristems/cup) were set up. Fifty adult weevils collected from a lake in Michigan's Lower Peninsula were added to one tank for each lake. Soon after, eggs and larvae were found on the meristems.

The plan was to allow these life stages to complete their life cycle on the hybrid with newly emerged adults being transferred to fresh tanks of hybrid milfoil. However, even with added plant fertilizer, the hybrid stems did not develop into the robust stems found in the lakes. Research by Sarah S. Roley and Raymond M. Newman at the University of Minnesota (2006) demonstrated that stem diameter can affect the development of the larvae. If the stems are too thin, they cannot complete their life cycle. The result of the trials was that only one generation of weevils was reared through for both lakes, producing low numbers of adults. In addition to the Michigan weevils, weevils from a Connecticut population were added to separate tanks of hybrid milfoil from Badwater and Cowboy lakes. They also laid eggs on the hybrid stems, which produced larvae that began to feed within the stems.

Discussion

The discovery of weevil populations established in both Badwater and Cowboy lakes, prior to the initiation of the laboratory hybrid experiment, is evidence that the weevils do take to the hybrid naturally. Due to the condition of the plants when collected and the unpredictability of simulating natural conditions for laboratory culturing of the hybrids, we were able to do only a preliminary evaluation of the success of the weevils on the hybrid. We found that weevils reared on pure EWM will lay eggs and larvae will develop to the adult stage on the hybrid. With more robust plants we would have been able to see the culture through more generations.

It should also be noted that during the second week of June, EnviroScience biologists returned to Cowboy Lake to search for adults to supplement the weevil population in the Ohio rearing facility. This population was added to our pure strain of EWM and had comparable reproductive success to our stock culture. Offspring from the population that was taken from the lake in June were restocked in Cowboy Lake in July. The total returned was over 2,000 eggs and larvae, which were stocked in the Northwestern section of the lake. During the second week of August, EnviroScience biologists swam out to the stocking site to collect samples to assess under microscopes back in the Ohio lab. They found one larva and two pupae.

2.0 Weevil Distribution

During the second week of July 2008, approximately one thousand acres of EWM was surveyed within the Menominee River watershed to search for the presence of weevils and to measure the population density in each of the nine reservoirs that are known to contain EWM. Under normal protocol, this would be achieved by collecting pairs of plants along a transect line placed perpendicular to shore by swimming through selected beds of EWM. The tops of two randomly selected plants are removed at five evenly spaced intervals, for a total of ten plants along each line. However, in some locations the protocol had to be modified by running transects parallel to shore, or sometimes a zigzag pattern, due to the sparseness of the EWM found during the time of the survey. A total of 1,411 stems were collected within the entire project area and assessed immediately by EnviroScience biologists. They found weevils in all reservoirs surveyed.

The highest populations of weevils were found in Big Quinnesec, Kingsford, and Peavy Falls reservoirs (Appendix A) while the lowest population was found in Twin Falls, Brule, and Lower Paint Reservoirs. A breakdown for each reservoir with population density will be discussed in the full report.

Discussion

Over the past few years, WE Energies has surveyed the infestation of EWM in the Menominee River watershed evaluating densities of stands from year to year. An obvious oscillation has been witnessed and now can be confirmed that the milfoil weevil is contributing to the patterns seen throughout the system. However, this pattern in density changes readily and should be monitored continuously, possibly re-evaluating the weevil population. For the 2008 season, it seems the weevils got the 'upper hand' on the EWM possibly due to the colder and later spring.

3.0 Sunfish Predation

A review of current literature (Sutter and Newman, 1997) suggests that predation by sunfish may influence the ability of milfoil populations to reach ecologically significant sizes in some lakes and reservoirs. Since weevils were found in both lakes during the early June collection of milfoil for the hybrid experiment, EnviroScience conducted a sunfish survey to evaluate the impact of these fish on weevil populations. This was to be accomplished by analyzing the gut contents of fifty fish obtained by electro fishing. Fifty sunfish were collected in each water body using a Smith-Root® 5.0 Electrofisher. The Electrofisher uses pulsed-direct current from anodes mounted to a boom on the front of a 5.33 m (17'6") boat. Electro fishing was performed at night because of the tendency of fish to rise within four to six feet of the surface at night to feed. When shocked, the fish become temporarily stunned and float to the surface where they are netted. Sampling zones were determined for the areas where weevils were located within the lake. Each sampling zone was approximately 500 m (1640.4 ft.) in length and all available habitats were sampled for approximately 2000 seconds, collecting only *Lepomis spp* (*Lepomis macrochirus,* Bluegill and *Lepomis gibbosus*, Pumpkinseed). All specimens were identified, weighed, and measured in length.

Cowboy Lake

Three sampling zones were shocked in Cowboy Lake. The first of these was the northwest corner, second was northeast corner heading south along the eastern shore, and the final zone was from the boat launch heading west toward the fishing pier. A total of fifty-three sunfish (48 bluegill and five pumpkinseed) were collected for gut analysis. The average length of these fish was 98.04 mm. Twenty-two adult weevils were found in ten fish, one being a pumpkinseed. The majority of the fish feeding on the weevils was found in the last shocking zone in between the boat launch and fishing pier, also the same area where EnviroScience biologists collected adult weevils in June. Snails and chironomid (midge) larvae made up most of the digested material in the stomach contents. It was also noted that parasitic worms were found in the intestinal cavity of the majority of the fish caught from Cowboy Lake.

Badwater Lake

Five sampling zones were shocked in Badwater Lake, collecting a total of fifty-one fish with the average length of 111.67 mm. The first location in the southern area of the lake (milfoil stand #65 from the August 2006 WE Energies EWM Infestation Map) yielded ten bluegills. The second zone in the furthest northern part of the lake (milfoil stand #60) yielded nine fish. The 2007 weevil stocking location was the third shocking zone where eleven fish were collected. The 2007 herbicide treatment site performed by JFNew was the fourth shocking location for a total of ten fish. The analysis of the stomach contents from all four locations consisted of plant material, chironomid and other dipteran (fly) larvae, amphipods, snails, and zooplankton; no adult weevils were found. However, the final shocking location (milfoil stand #57) found two bluegill with ten adult weevils (nine and one, consecutively) in the stomach contents.

Discussion

Overall the diversity of available food resources in Cowboy Lake seemed limited compared to that in Badwater Lake. The higher density of EWM in Cowboy Lake could also contribute to higher predation by sunfish than that found in Badwater Lake. The sunfish found in Badwater Lake were feeding on organisms smaller in size than weevils, even the size class larger than young-of-the-year.

It is interesting to note that the adult weevils found in the stomach contents were completely undigested, along with the empty shells of snails. This suggests that adult weevils are unlikely to be a preferred food choice for the fish. They are similar in size and shape to some smaller snails and may be incidentally ingested while foraging. This is especially probable for Cowboy Lake, where there was a limited diversity of potential food items, as demonstrated by the high percentage of snails found in the gut analysis for fish sampled there.

A more detailed report will be generated during the winter months. Should you have any comments or questions upon reading this summary, please do not hesitate to contact me at 330-688-0111. Thank you for allowing us to perform this work for you and WE Energies.

Sincerely,

Cortney Marquette
Aquatic Biologist/Project Manager

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Appendix A

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Big Quinnesec- 7 Transects

Parameter Measured	Survey July 7, 2008
Total weevils	171.00
Total stems	69.00
Total weevils/stem	**2.48**
Ave. meristems/stem	2.51

Kingsford -15 Transects

Parameter Measured	Survey July 7, 2008
Total weevils	329.00
Total stems	147.00
Total weevils/stem	**2.24**
Ave. meristems/stem	1.99

White Rapids – 10 Transects

Parameter Measured	Survey July 8, 2008
Total weevils	141.00
Total stems	95.00
Total weevils/stem	**1.48**
Ave. meristems/stem	1.72

Chalk Hill – 16 Transects

Parameter Measured	Survey July 8, 2008
Total weevils	243.00
Total stems	158.00
Total weevils/stem	**1.54**
Ave. meristems/stem	2.29

Michigamme Falls -21 Transects

Parameter Measured	Survey July 9, 2008
Total weevils	316.00
Total stems	204.00
Total weevils/stem	**1.55**
Ave. meristems/stem	1.85

Peavy Falls – 30 Transects

Parameter Measured	Survey July 10, 2008
Total weevils	656.00
Total stems	296.00
Total weevils/stem	**2.22**
Ave. meristems/stem	2.32

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Twin Falls – 24 Transects

Parameter Measured	**Survey July 11, 2008**
Total weevils	242.00
Total stems	242.00
Total weevils/stem	**1.00**
Ave. meristems/stem	2.15

Brule – 8 Transects

Parameter Measured	**Survey July 12, 2008**
Total weevils	51.00
Total stems	80.00
Total weevils/stem	**0.64**
Ave. meristems/stem	1.63

Lower Paint – 12 Transects

Parameter Measured	**Survey July 13, 2008**
Total weevils	28.00
Total stems	120.00
Total weevils/stem	**0.23**
Ave. meristems/stem	0.33

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