# 2015 Milfoil Weevil Survey at Dewart Lake, Kosciusko County, Indiana

Prepared for:

The Dewart Lake Protective Association

Prepared by:

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## 1.0 Introduction

Since its widespread introduction, the exotic-invasive Eurasian watermilfoil (*Myriophyllum spicatum*, herein referred to as milfoil) has become one of the most problematic plants in North American lakes. Rapid growth and reproduction by seed, stolon and fragment allows this plant to create dense, monotypic stands that displace native species. In turn, these dense beds can reduce biodiversity, cause detrimental changes to water quality and impact the aesthetics and recreational use of the water. In 2012, EnviroScience implemented the **Milfoil Solution®** process at Dewart Lake, a 551 acre lake in Kosciusko County, Indiana to combat nuisance populations of milfoil using the milfoil weevil (*Euhrychiopsis lecontei)*.

The milfoil weevil is a native insect to North America that began feeding on Eurasian watermilfoil once it was introduced. This milfoil-specialist completes its entire life cycle on the plant (egg-larvae-pupae-adult) and is capable of producing multiple generations in one growing season. Throughout the fall months, weevils move to shore to overwinter in dry, loose soils and return to the water as the ice recedes in the spring to continue the process. The most significant impacts to milfoil occur during the larval life stage of the insect. During the larval stage, weevils feed on the meristem (growing tip) of the plant and burrow through the stem. This disrupts nutrient flow within the plant and causes the stem to lose buoyancy from air escaping through the damaged plant tissue causing the plant to collapse. This process also leaves the weakened plant susceptible to secondary infection. Over time, milfoil stands become weakened diminishing their ability to compete with native species and prepare for winter months.

Although milfoil weevils are present throughout the northern U.S. states, they are often in small native populations unable to cause significant declines over a noticeable span of time. Milfoil Solution® is implemented to increase weevil populations to aid in reducing nuisance stands of milfoil. This form of biological control is based on a gradual process with significant declines to nuisance populations typically occurring over a three to five year program. This year marked the fourth survey season at Dewart Lake. This report was prepared on behalf of Dewart Lake Protective Association and outlines the progress of the program to date at Dewart Lake.

The table below outlines the milfoil weevil stocking program for Dewart Lake including dates of site establishment and number of weevils stocked:

| Year | Sites Stocked | Total Weevils |
|---|---|---|
| 2012 | S1, S2, S3 | 25,000 |
| 2013 | S1, S3, S4, S5 | 23,500 *(3,500 extra)* |
| 2014 | S6 | 11,000 *(1,000 extra)* |
| 2015 | *Survey only* | *Survey only* |

## 2.0 Survey Methods

The follow-up survey is conducted at the end of the summer season when milfoil has reached peak growth for the year. This survey is 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 0.09$m^2$ 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 30 stems sampled from three transect lines at each site.

## 3.0 Program Summary

The weevil stocking program began June 8, 2012 in which 25,000 weevil eggs and larvae were placed among three dense beds of milfoil named S1, S2 and S3 (Figure 1). It was noted that approximately 75% of the milfoil was growing at the surface and flowering. This growing condition, typical for late season, was observed in lakes all across the Midwest and as early as May. Prior to stocking, a small native weevil population was identified at S2. By August of that season, the only major change observed was a dramatic decrease in milfoil density at S1 (Table 2).

EnviroScience biologists returned to the lake on June 20, 2013 with an additional 23,500 weevil eggs and larvae which were stocked among two new sites (S4 and S5) and two 2012 sites (S1 and S3). Positive findings from that initial survey included identifying weevil life stages and damage indicative of a weevil population at all five locations and decreases in milfoil stem

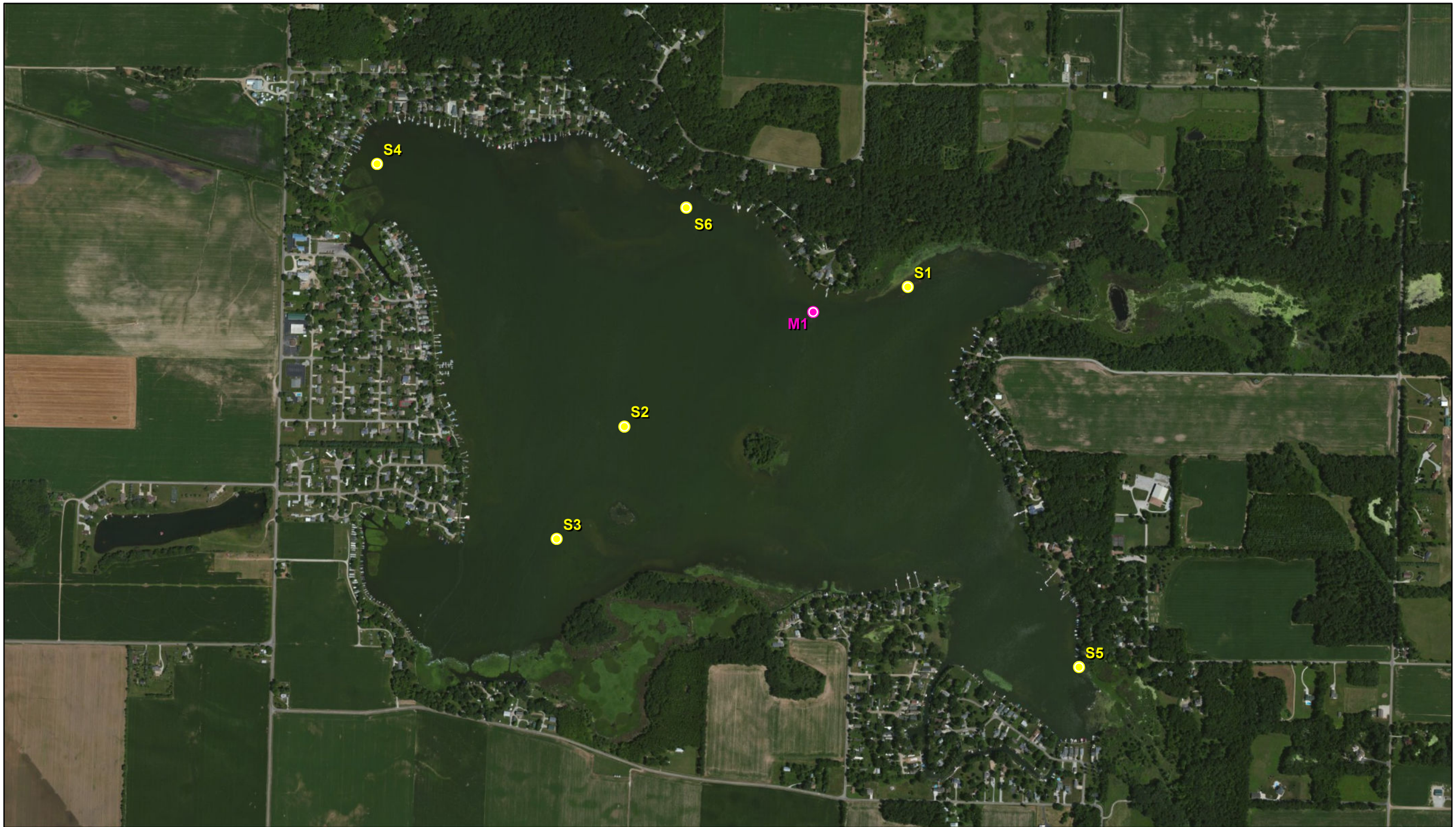


Figure 1. Dewart Lake
Kosciusko County, Indiana

Monitoring Location
Stocking Location

0 500 1,000 2,000 Feet
0 150 300 600 Meters

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Basemap courtesy of Esri.

density throughout the stocking sites. Milfoil density decreased at all sites from June to August (except for new site S4 where little change occurred), a pattern which does not follow the typical trend as the summer progresses and milfoil reaches peak growth. Data collected to this point are encouraging since initial survey sites from 2012 to 2013 have all experienced reduction in stem density by approximately 40 to 50%. Additionally, the increase in native aquatic vegetation as observed from 2012 to 2013 is highly preferred over the contiguous growth of one species. However, some native species such as Coontail (*Ceratophyllum demersum*) can grow to nuisance levels as observed in the southeast bay of the lake in 2013.

In 2014, a total of 11,000 weevils were stocked at S6. At the time of the follow-up survey in August, milfoil density decreased at three sites and remained the same two sites (one of those being the monitoring site). Weevils were observed on stem samples from three sites with the remainder containing varying degrees of weevil-specific activity.

## 4.0 2015 Results

*Final Follow-up Survey – August 12, 2015*

At the time of the final follow-up survey in August of 2015, milfoil at all of the survey locations dramatically decreased in stem density and several sites were completely absent with too few stems to collect the required thirty along the sampling transects (S1, S2, S5, S6). The monitoring site was the densest (163 stems/$m^2$) compared to the only other two survey sites where milfoil was present (20 to 33 stems/$m^2$ at S4 and S3). Sample analysis revealed weevil life stages and damage at all of the sites where stems were collected.

A diverse population of aquatic vegetation was observed with seventeen individual species identified: Cattail, Chara/Muskgrass, Coontail, Curly-leaf pondweed, Eelgrass, Elodea, Flat-stem pondweed, Fries pondweed, Illinois pondweed, Large-leaf pondweed, Naiad (bushy and spiny), Nitella, Sago pondweed, Variable pondweed, Water stargrass, and Water lily.

## 5.0 Discussion

Milfoil was growing deep below the surface in 2015 due to both measured weevil activity and precipitation levels the previous spring. Wherever milfoil was found, it was low growing, far from surface sunlight, and appeared unhealthy. The boat launch is the exception as this is a high

traffic area in which new fragments are being introduced and propagated regularly in a shallow, warmer environment.

The diverse native plant community at Dewart Lake is an important factor in maintaining long-term control of milfoil as it can compete for light, growing space, and available nutrients. Considering the relatively shallow depths in the littoral zones of Dewart Lake, aquatic vegetation (native and/or exotic) will continue to be present with variation each year as a response to growing conditions. Controlling invasive species (as eradication is typically not possible) is a gradual process that will require ongoing effort and support from the residents of Dewart Lake.

When working with a biocontrol such as the milfoil weevil, 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. Goals of milfoil management using the weevil include: reduction of milfoil at the stocking locations, increase in desirable native plant community and continuing to observe weevils throughout the existing milfoil beds. It appears that the weevil population is successfully overwintering along the shoreline and returning to the lake each spring based on data from stem analysis. The weevil population will respond each year to changes in the plant community. As milfoil decreases, so too will the weevil population to adjust for decreased habitat. Should milfoil increase due to seasonal conditions (such as a mild winter or warmer summer) the weevil population will gradually catch up with plant growth and remain in Dewart Lake to varying degrees as long as there is some milfoil.

## 5.0 Recommendations

It is the recommendation of EnviroScience that an aquatic vegetation survey is conducted annually at Dewart Lake to monitor invasive plant growth and assist in lake management decisions. This survey should be performed towards the end of each summer (late July to early September). Although vegetation surveys can be conducted in spring and early summer, they will not accurately represent peak plant growth occurring later in the summer season.

Milfoil can propagate from small fragments so it is recommended that boat operators avoid navigating directly through dense beds of aquatic vegetation in order to hinder the spread of unwanted invasive plants. Additionally, removing plant fragments from boats and trailers before and after launching will help this cause.

Please contact EnviroScience at (800) 940-4025, or swalters@EnviroScienceInc.com with questions regarding this report.

**Table 1. Weevil population analysis (weevils/stem), 2012-2015.**

| Site | Parameter measured | 6/8/12 | 8/8/12 | 6/20/13 | 8/1/13 | 6/3/14 | 8/13/14 | 8/12/15 |
|---|---|---|---|---|---|---|---|---|
| **S1** | Total weevils | 0.00 | 0.00 | 5.00 | 0.00 | 0.00 | 5.00 | ** |
| | Total stems | 30.00 | 30.00 | 30.00 | 30.00 | 30.00 | 30.00 | |
| | Avg. weevils/stem | 0.00 | 0.00 | **0.17** | 0.00 | 0.00 | **0.17** | |
| **S2** | Total weevils | 7.00 | 8.00 | 3.00 | 0.00 | 0.00 | 0.00 | ** |
| | Total stems | 27.00 | 29.00 | 30.00 | 30.00 | 30.00 | 30.00 | |
| | Avg. weevils/stem | **0.26** | **0.28** | **0.10** | 0.00 | 0.00 | 0.00 | |
| **S3** | Total weevils | 0.00 | 0.00 | 11.00 | 0.00 | 0.00 | 0.00 | 10.00 |
| | Total stems | 29.00 | 29.00 | 30.00 | 30.00 | 30.00 | 30.00 | 30.00 |
| | Avg. weevils/stem | 0.00 | 0.00 | **0.33** | 0.00 | 0.00 | 0.00 | **0.33** |
| **S4** | Total weevils | *** | *** | 2.00 | 0.00 | 1.00 | 3.00 | 3.00 |
| | Total stems | | | 30.00 | 30.00 | 30.00 | 28.00 | 28.00 |
| | Avg. weevils/stem | | | **0.07** | 0.00 | **0.03** | **0.11** | **0.11** |
| **S5** | Total weevils | *** | *** | 1.00 | 0.00 | 0.00 | 0.00 | ** |
| | Total stems | | | 25.00 | 30.00 | 30.00 | 30.00 | |
| | Avg. weevils/stem | | | **0.03** | 0.00 | 0.00 | 0.00 | |
| **S6** | Total weevils | *** | *** | *** | *** | 0.00 | 1.00 | ** |
| | Total stems | | | | | 30.00 | 30.00 | |
| | Avg. weevils/stem | | | | | 0.00 | **0.03** | |
| **M1** | Total weevils | *** | *** | 0.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| | Total stems | | | 30.00 | 30.00 | 30.00 | 30.00 | 30.00 |
| | Avg. weevils/stem | | | 0.00 | 0.00 | 0.00 | 0.00 | **0.10** |

***Site too sparse to collect 30 stem samples*
****Site not established*

**Table 2. Average Eurasian watermilfoil density (stems/m$^2$), 2012-2015.**

| Site | 6/8/12 | 8/8/12 | 6/20/13 | 8/1/13 | 6/3/14 | 8/13/14 | 8/12/15 |
|---|---|---|---|---|---|---|---|
| **S1** | 161.11 | 38.89 | 83.33 | 40.74 | 85.18 | 55.56 | 0.0 |
| **S2** | 158.33 | 172.22 | 61.11 | 35.19 | 92.59 | 53.70 | 0.0 |
| **S3** | 94.44 | 80.56 | 42.59 | 38.89 | 120.37 | 57.41 | 33.3 |
| **S4** | *** | *** | 38.89 | 40.74 | 177.78 | 53.71 | 20.3 |
| **S5** | *** | *** | 25.93 | 25.93 | 55.56 | 55.56 | 0.0 |
| **S6** | *** | *** | *** | *** | 116.67 | 57.41 | 0.0 |
| **M1** | *** | *** | 59.26 | 24.07 | 101.85 | 109.26 | 163.0 |

****Site not established*