Herbicide Treatment Analysis

Targeting *Myriophyllum spicatum* (Eurasian watermilfoil)

Cedar Lake

St. Croix County, Wisconsin

August, 2019

Analysis conducted by Ecological Integrity Service
Amery, Wisconsin

Abstract

On June 6, 2019 the herbicide ProcellaCOR (Florpyrauxifen-benzyl) was utilized to reduce *Myriophyllum spicatum* (EWM) in two beds totaling 12.2 acres. The frequency of occurrence (FOO) had a significant reduction ($p<0.0001$ from chi square analysis) with an FOO of 59.5% within the treatment bed before treatment to 0% after treatment. There was one significant reduction in native species (*Potamogeton pusillus*) and three significant increases in native species (based upon chi square analysis before and after treatment).

Introduction

On June 6, 2019 herbicide was applied to target the aquatic invasive species Eurasian water milfoil (EWM)- *Myriophyllum spicatum* on Cedar Lake, St. Croix County, Wisconsin. The treatment was conducted when the water temperature was 66^{o}F with calm winds. The herbicide ProcellaCOR® (Florpyrauxifen-benzyl) was utilized. This treatment covered an area of 12.2 acres in two beds (9.5 acres and 2.7 acres). Figure 2 is a map showing the locations of the two treatment beds.

This analysis is to determine the effectiveness of the herbicide treatment targeting EWM on Cedar Lake, both with the herbicide and the manual removal. The analysis involves surveys conducted in August 2018, April and August 2019 for the herbicide analysis.

Analysis Methods

In August, 2018 a EWM survey was conducted. This survey led to the delineation of EWM beds for potential treatment. The delineated area was then checked in May 2019 to verify EWM coverage and potentially adjust the treatment bed. Treatment then occurred after this survey was completed.

Following treatment, a survey was conducted (post treatment) to evaluate the frequency and density of the EWM after treatment. The post treatment survey was conducted on August 19 , 2019 and involved using the same sampling points at predetermined sample locations within the treatment polygon in the pretreatment survey. A one-meter rake tow was used at each sample point with each species (including EWM) on the rake identified and given a density rating of 1, 2 or 3. The diagram below shows the density standards. The frequency of occurrence is determined within each treatment bed. The frequency of occurrence (FOO)is the % of the sample points that had any particular plant sampled.

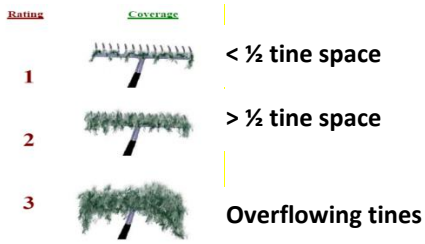

Figure 1: **Density rating graphic.**

After the surveys were completed, a chi-square analysis was conducted on the EWM frequency changes as well as the native plant species frequency changes. This allows for the determination of whether the herbicide treatment possibly reduced the frequency of EWM and whether the native plant species were adversely affected by the herbicide. Typically the pretreatment survey reference is in late summer/fall the year prior to treatment. Table 1 summarizes the bed characteristics, treatment and conditions during treatment.

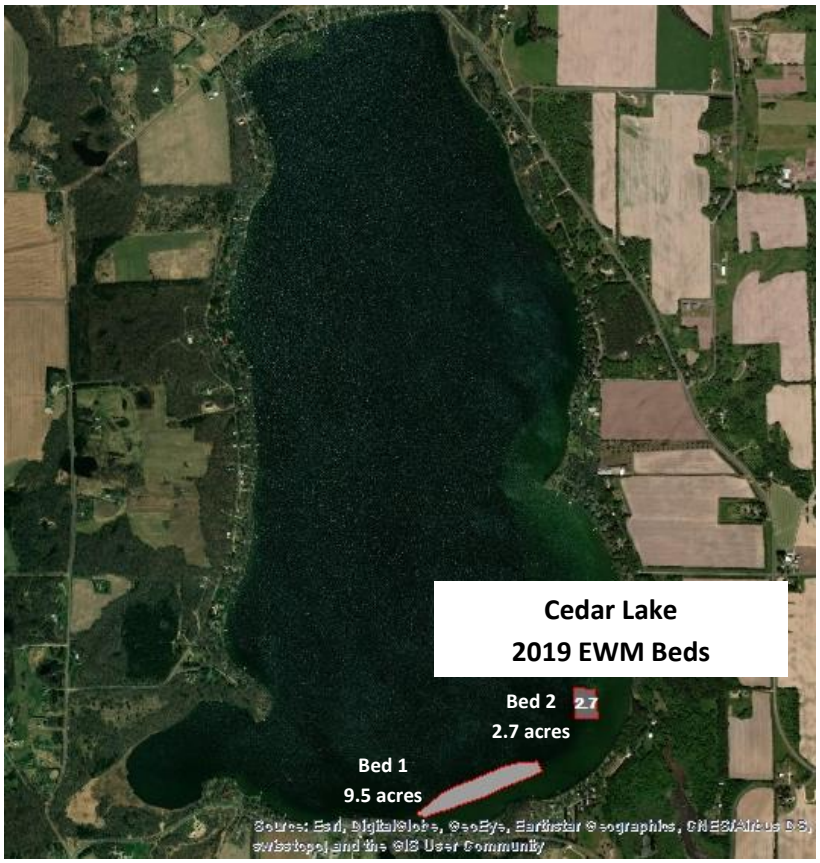

Figure 2: Map of two treatment beds on Cedar Lake, 2019.

Bed	Area (Acres)	Mean depth	Ounces of herbicide applied	Water Temp	Wind speed
1	9.5	4.7 ft	424.6	66	Calm
2	2.7	3.1 ft	106.1	66	Calm
Combined	**12.2**		**530.7**		

Table 1: EWM treatment bed information provided by herbicide applicator

Results

A post treatment survey conducted on August 19, 2019 showed a significant reduction in EWM frequency of occurrence (FOO). In Bed 1 the FOO went from 63.8% before treatment to 0.0% after treatment. In Bed 2 the reduction was from 30.4% to 0.0%. Both beds combined had an FOO reduction from 59.5% to 0.0%. There was no EWM sampled or viewed within the two treatment beds after treatment. The treatment was very effective with FOO reduction being significant based upon the chi-square analysis ($p<0.0001$).

Bed	EWM FOO Before Treat	EWM FOO After Treat	Significant reduction?
Bed 1	63.8	0.00	Yes ($p<0.0001$)
Bed 2	30.4	0.00	Yes ($p<0.001$)
Both beds combined	59.5	0.00	Yes ($p<0.0001$)

Table 2: Frequency of occurrence change before and after treatment and statistical significance data.

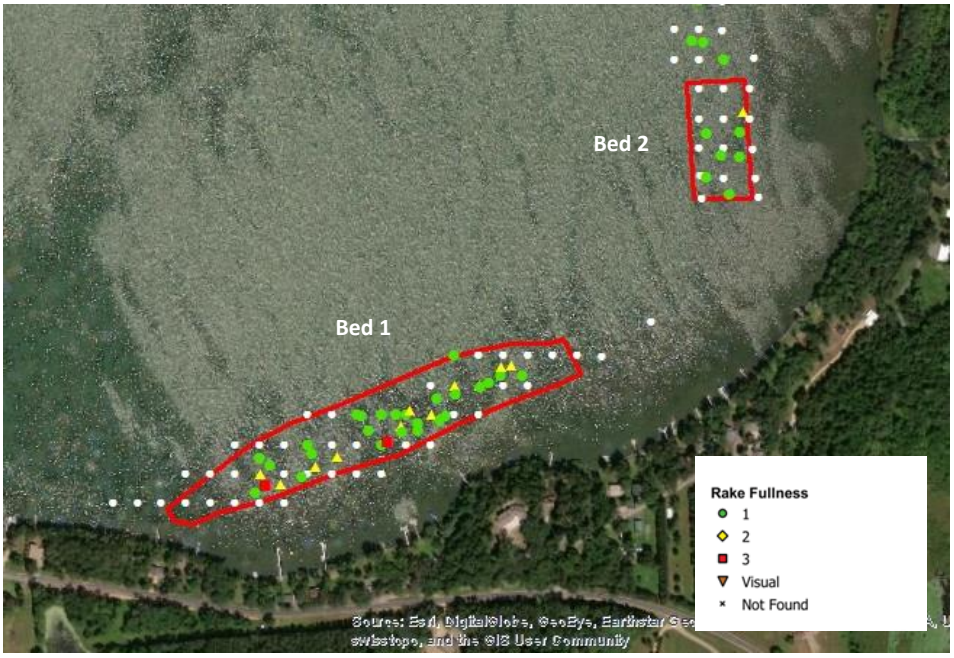

Figure 3: Map of EWM density before herbicide application.

Bed	Mean Density Prior to Treatment	Mean Density After Treatment
1	0.90	0.00
2	0.50	0.00
Both	0.81	0.00

Table 3: Comparison of mean EWM density before and after treatment.

The density data shows an extensive reduction in mean density, decreasing from 0.81 (scale of 0-3) before treatment to 0.00 after treatment. Figure 3 shows EWM density before treatment and figure 4 shows EMW density after treatment at sample points within the beds.

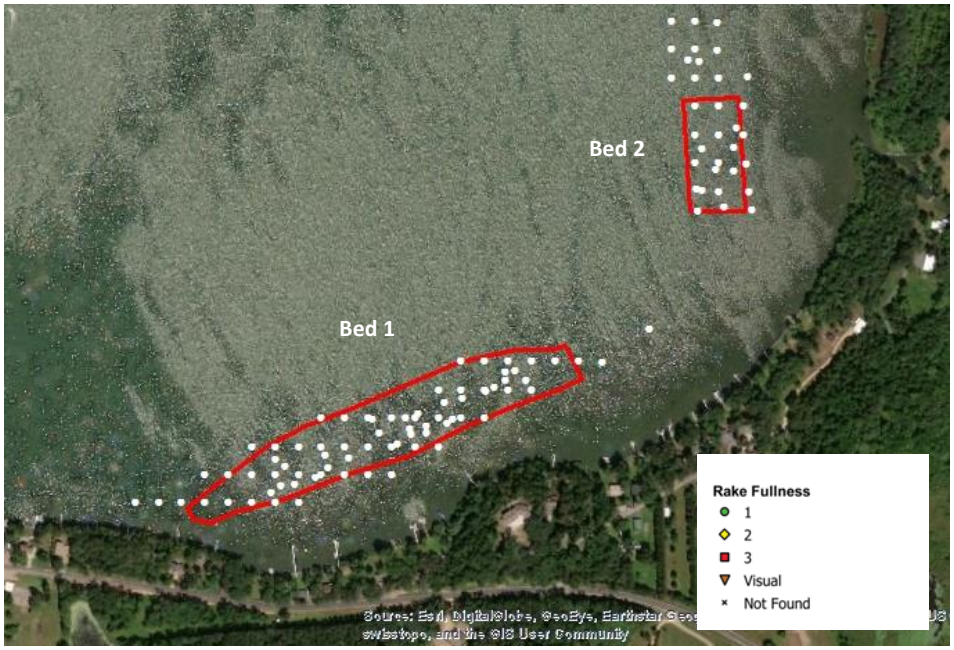

Figure 4: EWM density within treatment beds after treatment.

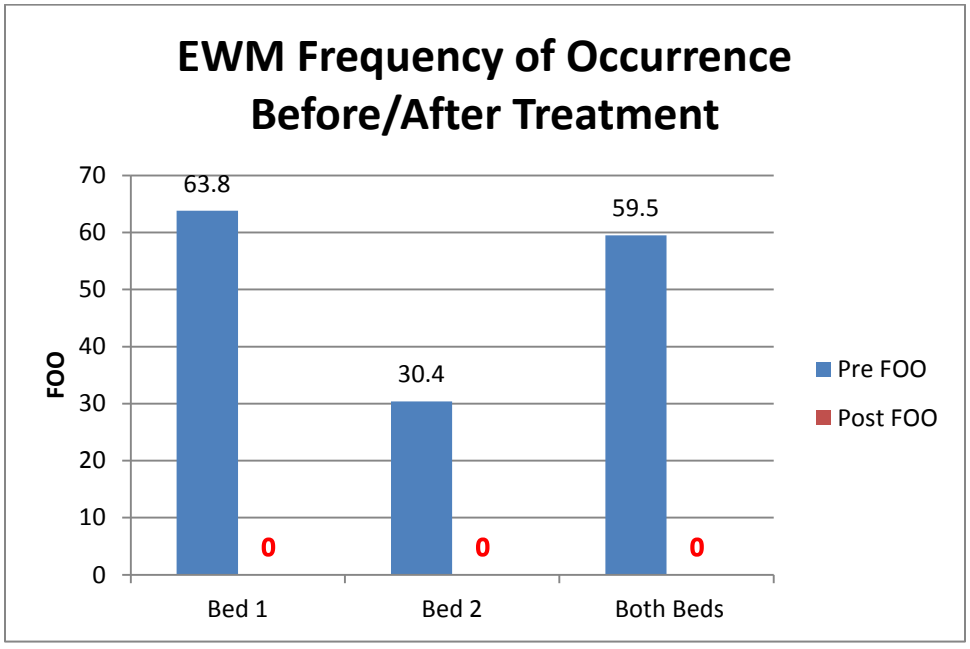

Figure 5: Graph showing frequency of occurrence (FOO) before and after treatment in each bed and both beds combined.

The effect of herbicide on native species was also evaluated using the FOO of each native species before and after treatment in a chi-square analysis. The desire is for no statistically significant reduction in FOO for any native species.

The native species evaluation shows a statistically significant reduction in one species (*Potamogeton pusillus*-small pondweed). This reduction may not be due to herbicide use as earlier in August, the EWM beds were checked but no native data was collected (August 5). During this time, small pondweed was growing widespread and very dense in both beds. However, when the post treatment survey was conducted on August 19, the small pondweed had died off and very little was sampled. It may be that the plant senesced naturally due to other conditions. There were statistically significant increases in three native species. This suggests no negative impact occurred due to herbicide use.

Native Species	Pre-treatment FOO	Post treatment FOO	Change	Significant Increase/ Reduction in species?
Myriophyllum sibircum	0.05	0.00	-	No
Potamogeton pusillus	0.50	0.08	-	Yes (p<0.001)
Potamogeton richardsonii	0.05	0.05	n/c	n/a
Vallisneria americana	0.08	0.44	+	Yes (p<0.001)
Ceratophyllum demersum	0.08	0.67	+	Yes (p<0.001)
Elodea canadensis	0.15	0.08	-	No
Heteranthera dubia	0.00	0.02	+	No
Najas flexilis	0.00	0.28	+	Yes (p<0.001)
Chara sp.	0.08	0.23	+	No
Stuckenia pectinata	0.00	0.02	+	No
Potamogeton praelongus	0.00	0.02	+	No
Potamogeton zosteriformis	0.00	0.02	+	No
Sagittaria sp. (rosette)	0.00	0.02	+	No

Table 4: FOO of each native species sampled before and after treatment with statistical significance.

Long term EWM Changes

In order to evaluate long-term changes in EWM, a sample point grid was established in and around the management beds. This allows not only evaluation of management beds, but if EWM is changing (or spreading) in areas around the management beds.

The long-term EWM survey showed a reduction in EWM within the sampling grid. There was no EWM sampled or viewed in the long-term evaluation sample point grid. The FOO within this grid in August 2018 was 10%. It was 0% in August 2019. However, some EWM was discovered outside of the grid. More points were added to the grid to account for this EWM. This will allow long-term evaluation in future years reflecting this new EWM area. Figures 5 and 6 show the long term sample points with EWM density.

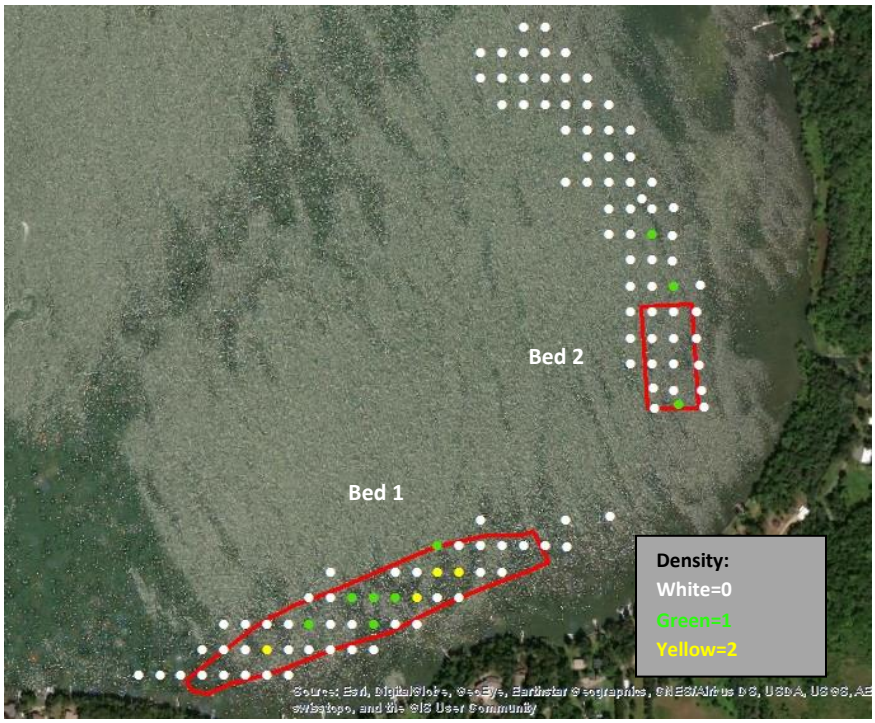

Figure 5: August 2018 EWM density at long term sample grid points.

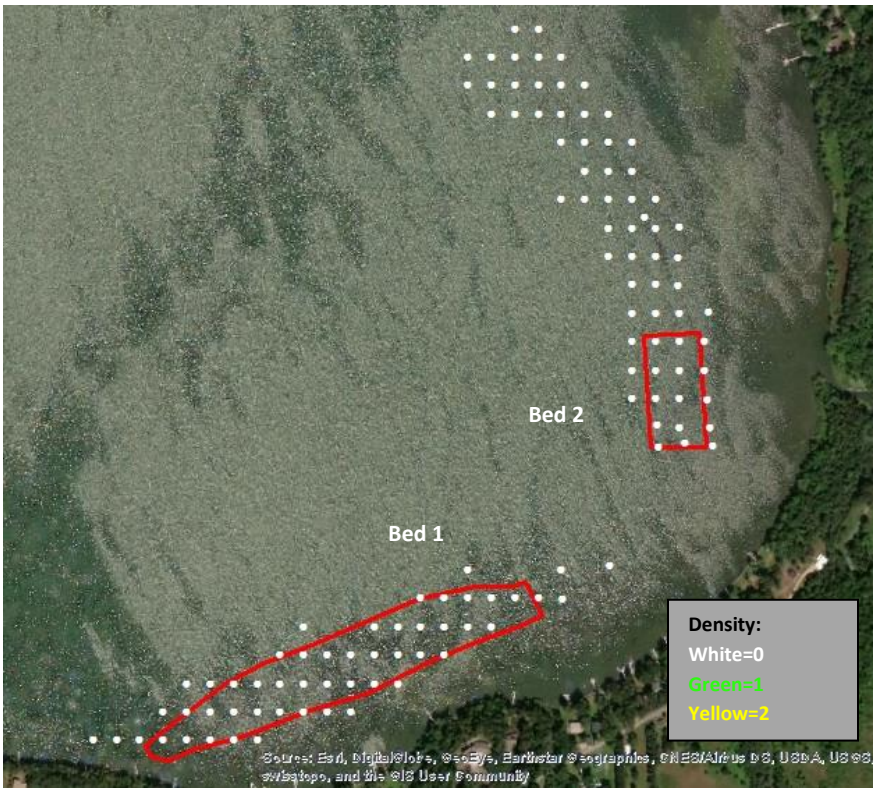

Figure 6: August 2019 EWM density at long term sample grid points.

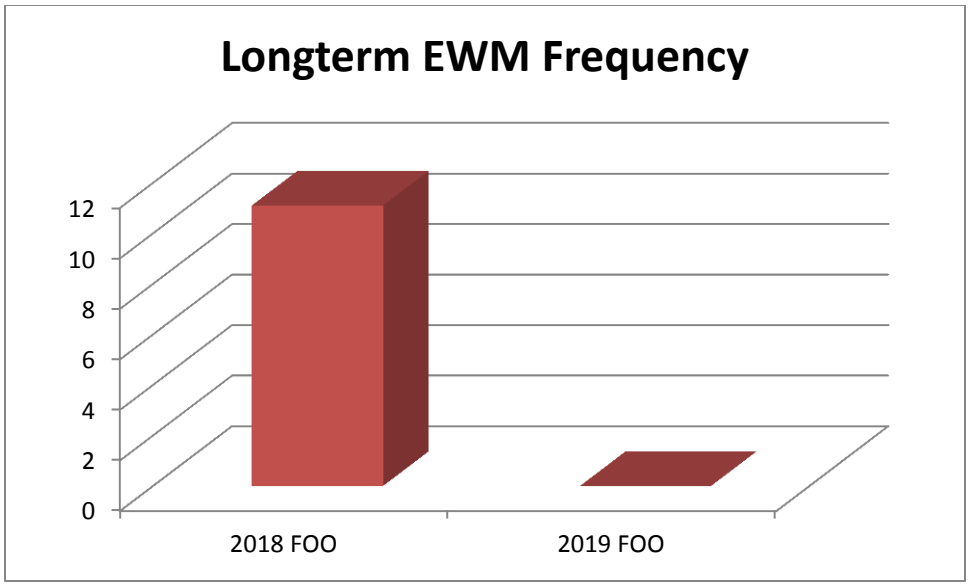

Figure 7: Comparison of EWM FOO at long term sample points 2018 and 2019.

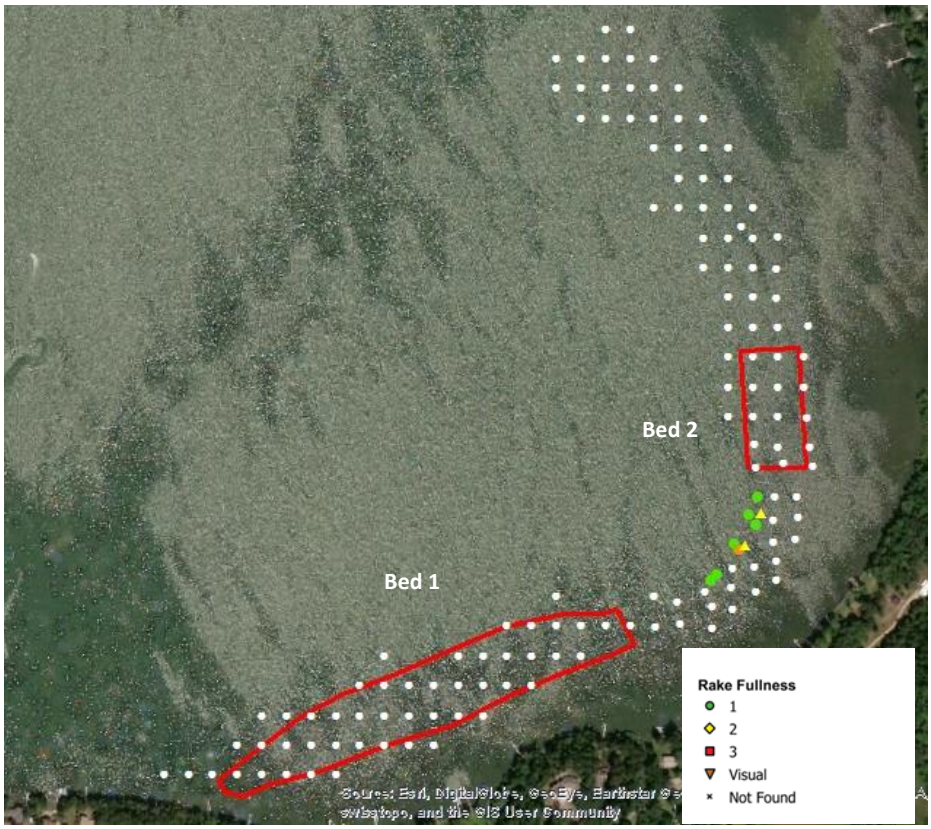

Figure 8: EWM density at added long term sample points August 2019.

Discussion

The 2019 herbicide treatment was successful on the two EWM beds in Cedar Lake. In 2015 the herbicide 2,4-D was utilized with some success in reduction. In 2016, 2,4-D was used again and was not effective. A mixture of endothall and diquat was used in 2017 as an alternative to 2,4-D and that was not effective in reduction in EWM. Diver Assisted Suction Harvest (DASH) was utilized in 2018 due to limited herbicide effectiveness. However, the density increased and the new herbicide ProcellaCOR was used in 2019 with the hope it would be more effective. There was no EWM sampled or viewed within the treatment beds after treatment. The data shows one native species had a significant reduction. However, that reduction may not have been due to herbicide use since it was present in high density and coverage two weeks prior to the post treatment survey and several weeks after treatment.

It appears that the change in herbicide was effective and reduced EWM immensely.

References

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http://www4.uwsp.edu/cnr/uwexlakes/ecology/apmguide.asp appendix d.