Herbicide Treatment Analysis for *Potamogeton crispus* (CLP)

Big Lake / Round Lake
Polk County, WI

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Abstract

On May 11, 2011there were 14 beds totaling 25.6 acres of curly leaf pondweed (Potamogeton crispus)(CLP) treated with endothall K. The pre and post treatment survey data shows that the reduction in the frequency of was significant (P<0.01). Only 6 of 156 sample points had CLP present in the post treatment survey. There were no beds found within treatment areas and no new beds observed elsewhere. A turion analysis conducted in July 2011 revealed a mean turion density of 44 turions/m^2, ranging from 14/m^2 to 108/m^2. Some native plants had a significant reduction, however this could be due to the need for using the 2009 PI survey data for comparison.

Introduction

On May11, 2011 a total of 25.7 acres of *Potamogeton crispus*-curly leaf pondweed (CLP) beds were treated with herbicide (endothall-K) for the first year. Figure 1 shows the location of the 15 beds.

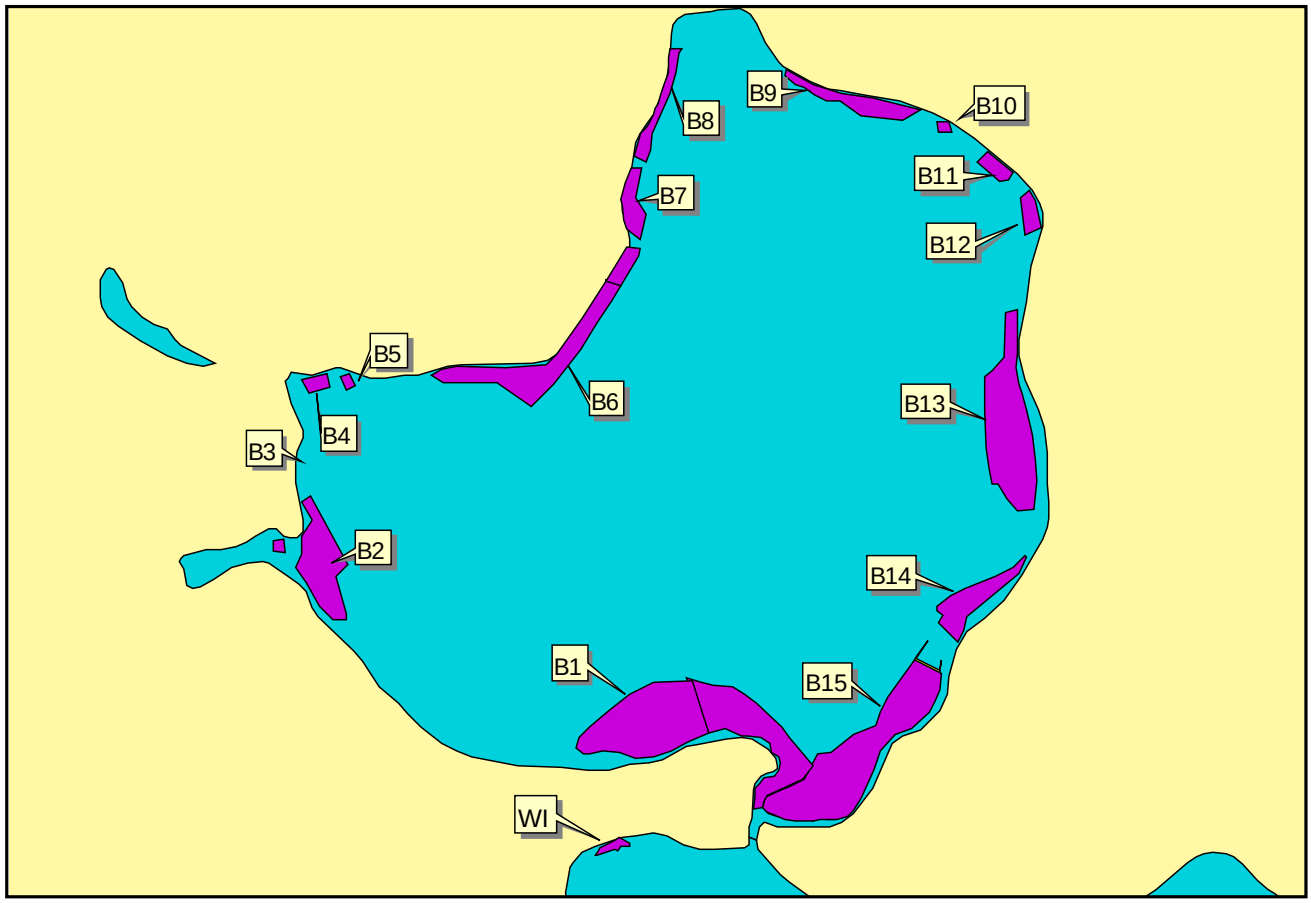

Figure 1: Treatment Beds on Big Lake (labeled "B_") and Round Lake (labeled "W1").

The treatment comprised of concentrations ranging from 1.25 ppm to 2 ppm of endothall K. Table 1 shows the statistics for each treatment bed (Bed B-3 was not treated due to limited/no CLP growth at the time of treatment).

Bed	Area (acres)	Mean depth	Acre feet	ppm Endothall
B1	6.79	5.3	35.987	1.25
B2	2.10	4.2	8.82	1.25
B3	Not treated	XXXX	XXXX	XXXX
B4	0.23	7.9	1.817	2
B5	0.08	9.2	0.736	2
B6	2.67	7.2	19.224	1.25
B7	0.66	5.2	3.432	2
B8	0.66	6.0	3.96	2
B9	0.97	5.7	5.529	2
B10	0.08	6.0	0.48	2
B11	0.32	6.7	2.144	2
B12	0.37	8.3	3.071	2
B13	4.00	6.9	27.6	1.25
B14	1.20	7.3	8.76	1.25
B15	5.50	6.2	34.1	1.25
W1	0.10	3.5	0.35	2
	25.73		156.01	

Table 1: Treatment beds and data.

Methods

Prior to treatment, a pre-treatment survey was conducted at 152 predetermined sample points for Big Lake and 4 predetermined sample points for Round Lake. The presence of CLP was recorded at each sample point, along with depth and dominant sediment type. Two treatment beds on Big were adjusted for depth from the previous years CLP mapping. A double tine rake was used and towed 1 meter for each sample.

Approximately 4 weeks after treatment took place, a post-treatment survey was conducted. Each of the sample points used in the pre-treatment survey was used. The CLP density was recorded as well as the density of each native plant species found on the rake after a 1-meter tow (density is not recorded in pre-treatment survey due to such limited plant size).

To examine the effectiveness of an herbicide treatment, data collected one year prior to the treatment is typically compared to the post–treatment survey of the treatment year. However, these data were not collected one year prior, so the survey conducted immediately before treatment was used to compare to the post-treatment survey (survey conducted about 4 weeks after treatment). Statistical analysis is then used to evaluate the effectiveness. A chi-square analysis is completed to evaluate the frequency of occurrence change of CLP in the treatment beds. The native plants present in the full lake PI survey conducted in 2009 were used to see how the native plants responded. Only points that coincide with the treatment beds were used. A chi-square analysis is used to evaluate any changes in the frequency of occurrence of each native plant species surveyed. Since the PI survey was conducted much later in the summer and the post treatment survey was conducted in earlier summer, differences could occur due to the seasonal differences in plant growth.

In addition, CLP mapping was conducted during peak growth. This was to determine the size of any nuisance level beds within the treatment areas as well as any new beds that may be present. No nuisance level CLP that was at or near surface was found. As a result, no new beds were delineated, and only individual plants were observed within the treatment beds.

In July, a turion analysis was conducted. A sediment sampler was used to collect bottom sediment at several randomly selected sample points within the treatment beds. The sample was then filtered with a Wildco filter bucket. The number of turions was counted from the sample and a density was calculated in square meters. Two sediment samples were taken at each sample point (one on each side of the boat). This analysis will allow for the future determination of turion density changes. This data can reflect long-term effectiveness of the CLP treatments. If several years of treatment are successful, resulting in limited CLP plants reaching turion production stages, new CLP growth from turion germination will also be reduced. This will be reflected in reduced turion counts, thus allowing for a more valid decision for continuing or ending treatment in any given bed.

Since this is the first year for this analysis, the 2011 turion data will serve as the baseline.

Results

Frequency changes from pre to post treatment survey

Figure shows the pretreatment frequency data on a map. The **black dots represent sample points where CLP was present, while the white dots represent where CLP was not present**. About 76% of the sample points had CLP present. This frequency was skewed a bit low from deep sample points in Bed 6. The border of this bed was then moved in as a result. Also, bed B3 was eliminated since no CLP was found anywhere in the bed. Also, a small side portion of B2 was also eliminated for the same reason.

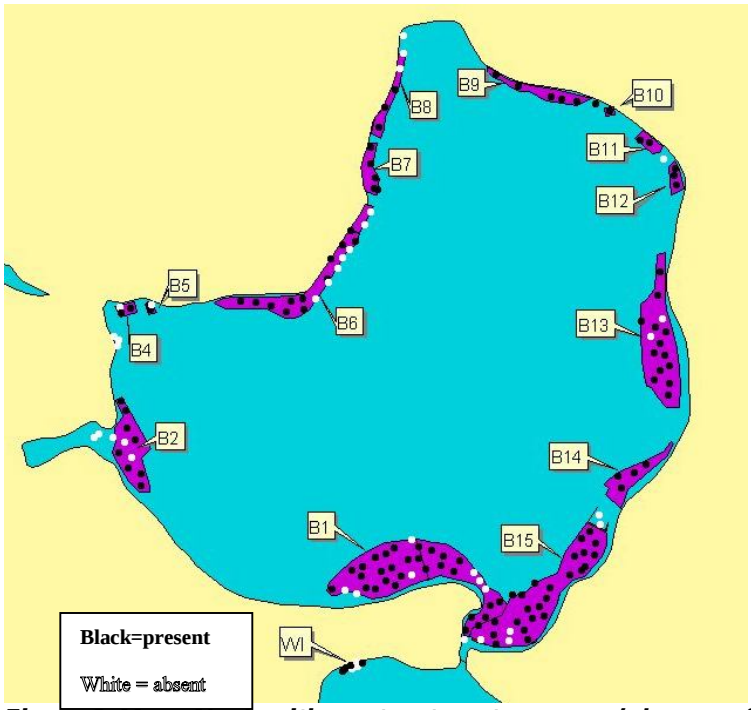

Figure 2: Map of beds with pre-treatment presence/absence of CLP.

Figure 3 shows the frequency map of the beds after treatment occurred. As can be seen, the number of points with CLP sampled was only 6 or 3.8% of the sample points. This demonstrates a dramatic reduction in CLP frequency.

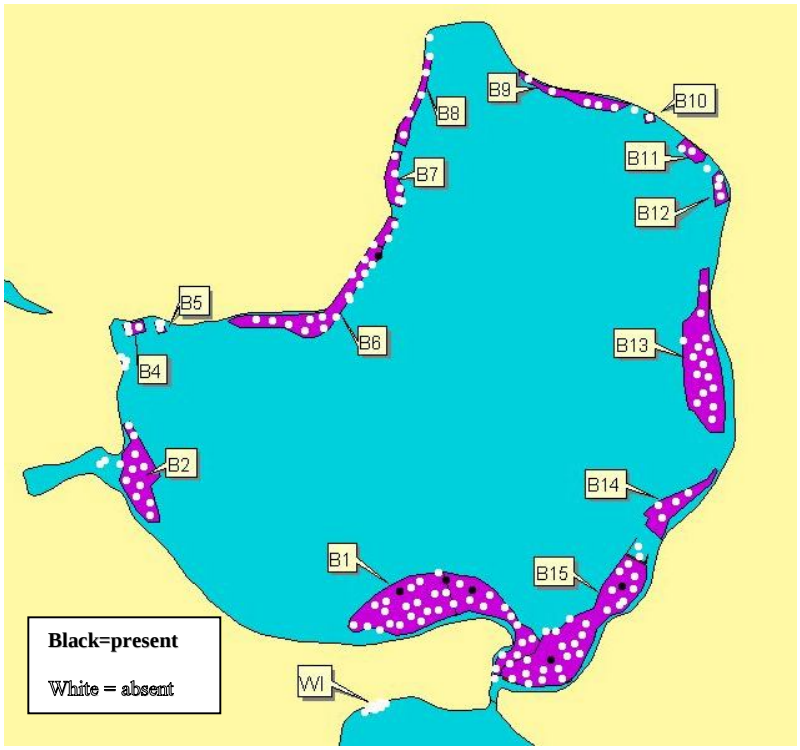

Figure 3: Map of beds with post-treatment presence/absence of CLP.

Table 2 summarizes the frequency reduction. The reduction was found to be significant based upon the chi-square analysis (P<0.05).

CLP Data	*Measured*
Pre-treatment	0.76
Post-treatment	0.04
Change	Reduced (-0.72)
Significant	Yes ($P=2.1 \times 10^{-38}$)

Table 2: Frequency change data before and after treatment.

No CLP density was observed in any of the treatment areas that would constitute a bed. Furthermore, no new beds were observed to delineate for future treatments (in addition to the treatment areas in 2011) in any other locations.

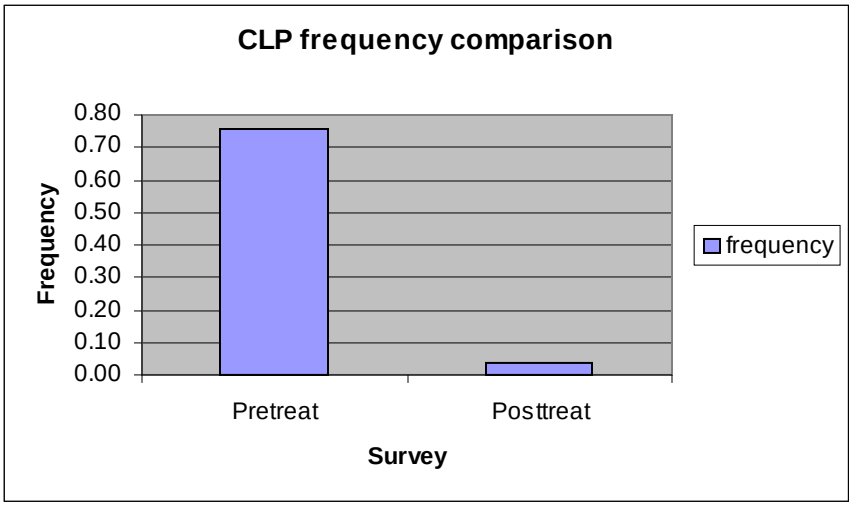

Figure 4: Graph showing frequency reduction in all CLP beds-2011.

Another important part of the treatment analysis is the evaluation of any negative response in the native plant community. The potential frequency changes are analyzed to assure that the target species (CLP) was the only plant affected by the herbicide treatment. Since no native plant data was collected at the treatment survey points prior to this year's treatment, the only possible data to use for comparison is the 2009 full lake PI survey. This data should be used with caution as seasonal differences in survey timing could account for differences. However, in future treatments there will be native plant data at the survey sample points for treatment.

Table 3 summarizes the native plant frequency data any potentially significant changes. There are some reductions that are statistically significant. These species include: *Potamogeton zosteriformis* (flat-stem pondweed), *Vallesnaria americana* (wild celery), *Stuckenia pectinatus* (sago pondweed), and *Potamogeton amplifolius* (large-leaf pondweed) (other apparent significant reductions had low value warnings and will not be considered valid). However, the comparisons of the two surveys (conducted at different times in the summer) may not be valid. Native plant frequencies need to be carefully monitored in future treatments and now a more valid database exists.

Species	Freq PI	Freq Post	Change	Significant
filamentous algae	0.22	0.15	-	NO
Chara sp.	0.02	0.01	-	NO
Elodea canadensis	0.16	0.29	+	YES
Heteranthera dubia	0.09	0.19	+	NO
Potamogeton zosteriformis	0.44	0.15	-	YES
Vallesnaria americana	0.42	0.01	-	YES
Ceratophyllum demersum	0.78	0.72	-	NO
Lemna triscula	0.18	0.21	+	NO
Bidens beckii	0.04	0.00	-	YES*
Potamogeton richardsonii	0.13	0.05	-	NO
Potamogeton robbinsii	0.04	0.06	+	NO
Potamogeton praelongus	0.09	0.10	+	NO
Myriophyllum sibiricum	0.24	0.13	-	NO
Potamogeton pusillus	0.02	0.01	-	NO
Stuckenia pectinatus	0.07	0.01	-	YES
Nymphae odorata	0.05	0.06	+	NO
Potamogeton foliosus	0.04	0.00	-	YES*
Potamogeton illinoensis	0.05	0.03	-	NO
Potamogeton amplifolius	0.07	0.01	-	YES
Najas flexilus	0.04	0.00	-	YES*
Ranunculus aquatilis	0.04	0.00	-	YES*
Eleocharis acicularis	0.02	0.00	-	NO
Nitella sp.	0.00	0.01	+	NO
Lemna minor	0.00	0.01	+	NO
***Expected Value Too Small-Use with caution.**				

Table 3: Native species frequency data. Shows comparison between 2009 PI survey (within treatment beds) and 2011 post-treatment survey.

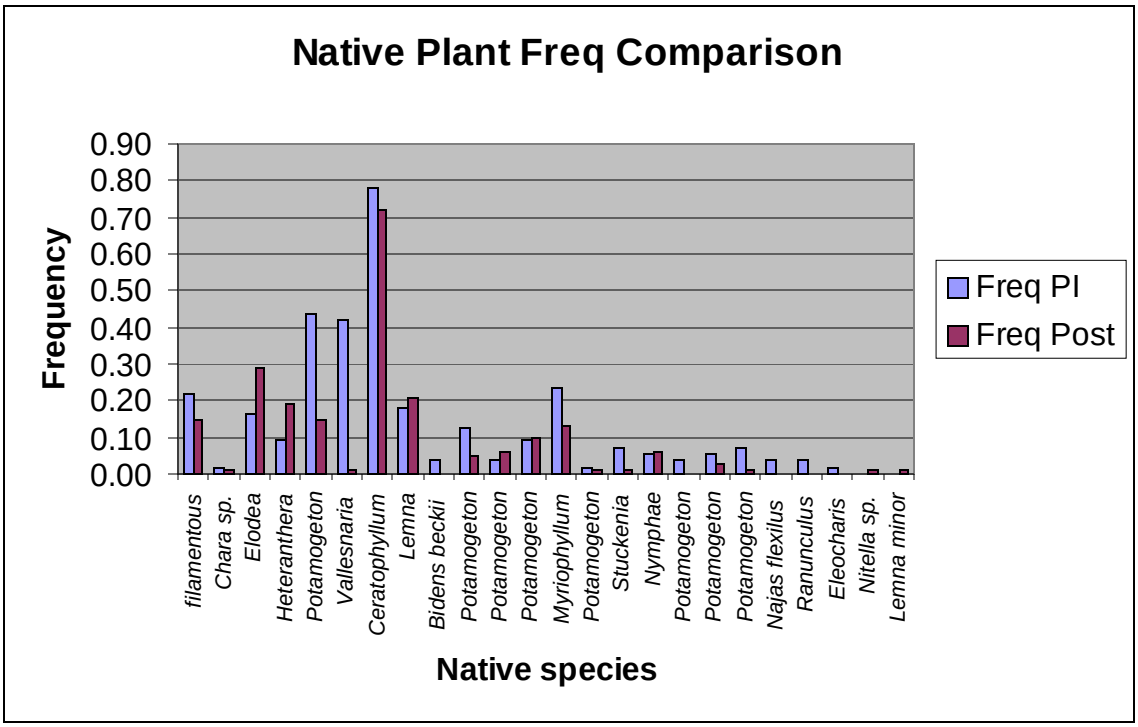

Figure 5: Graph showing the frequency difference in native species from 2009 PI survey and 2011 post-treatment survey.

Turion data was collected and is summarized in Table 4. This data will be used in future treatment years in order to help determine long-term effectiveness and then help determine when treatment should cease in various beds. See appendix for individual bed data.

Turion data	*Mean Turions sampled*	*Density(per m^2)*
Mean all beds	2.05	44
Highest (B9)	5	108
Lowest (B13)	0.67	14

Table 4: Turion survey data-2011

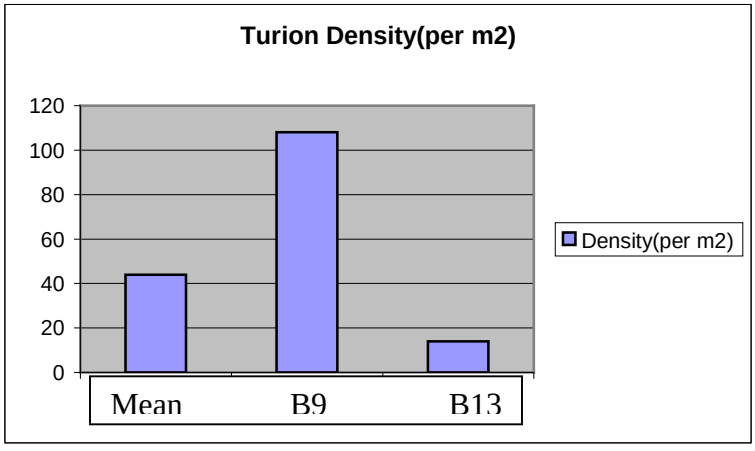

Figure 6: Graph showing turion density-mean all beds, highest bed and lowest bed.