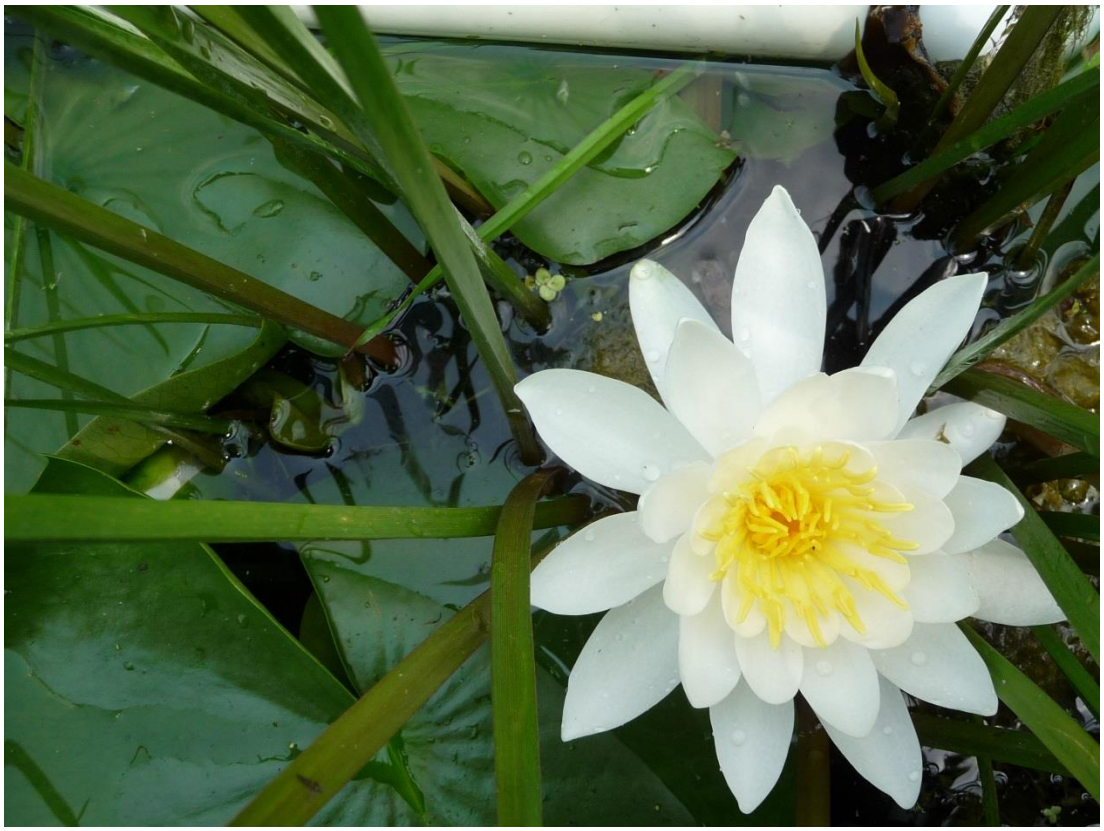
Adaptive Management of Flowering Rush Using the Contact Herbicide Diquat in Detroit Lakes, Minnesota 2016 – Interim Report



A report to the Pelican River Watershed District

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Executive Summary

Conclusions

- Based on field evaluations, 2016 sites receiving two submersed treatments with the contact herbicide diquat have had a continued decrease in rhizome bud density of flowering rush.
- Sites receiving one diquat treatment did not see an increase in rhizome bud density during the growing season.
- Applications of diquat have significantly reduced the nuisance problem and the potential for plants to regrow and spread.
- Diquat treatments do not appear to have a significant effect on species diversity, though some individual species in some plots may have been adversely affected.

Recommendations

- Field evaluations and monitoring of diquat or other herbicides should be continued to determine if reduction in belowground biomass and rhizome bud density is repeatable.
- We recommend that other herbicide active ingredients and use patterns be evaluated under controlled conditions to determine if there are alternatives to diquat treatments, which may be field demonstrated in the future.
- We recommend continued monitoring of all littoral areas for the presence of flowering rush and other AIS.

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Introduction

Flowering rush (*Butomus umbellatus* L.) is an emergent invasive plant that has invaded the Detroit Lakes area, specifically, Detroit Lake (Big Detroit, Little Detroit, and Curfman Lakes), Lake Sallie, Lake Melissa and Mill Pond (Becker County) since the 1960s. It is native to Europe and Asia and first entered the United States in 1928. Flowering rush has continued to be a problem in the Detroit Lakes system for the past three decades. However, applications of the contact herbicide diquat over the last four years have helped to control the spread and density of the plant.

Although flowering rush has been in North America for over forty years, very little information is known about its biology, ecology, and management. Bellaud (2009) reports that it was first observed in North America in St. Lawrence River (Quebec) in 1897. Flowering rush is currently found in all of the southern Canadian provinces except Alberta, and all of the states bordering Canada and the Great Lakes (NRCS 2013). Bellaud (2009) echoes our current state of affairs with flowering rush: "...there is not a wealth of information regarding the management of flowering rush infestations in North America." Bellaud (2009) cites Minnesota Department of Natural Resources research to support the recommendation to use imazapyr on the exposed foliage of flowering rush. Parkinson and others (2010) are also limited in their management recommendations, citing either imazapyr or imazamox foliar applications for management of flowering rush.

The US Army Engineer Research and Development Center (USAERDC) studied the available aquatic herbicides for control of submersed flowering rush plants from Minnesota and Idaho (Poovey et al. 2012). As part of their study, they determined that populations in both Idaho and Minnesota were triploid, as confirmed by ploidy and AFLP (Poovey et al. 2012). Their studies of Minnesota-derived plants used diquat, endothall and flumioxazin at relatively short exposure times. Flumioxazin did not reduce shoot biomass in either treatment. Diquat at the full label rate (0.37 ppm) and at 6 and 12 hours contact time significantly reduced shoot biomass relative to the reference. Endothall treatments at 1.5 and 3 ppm at both 12 and 24 hours exposure time also reduced shoot biomass. No treatments reduced belowground biomass. In contrast, their studies with Idaho-derived plants found flumioxazin at 400ppb and 24 hours exposure time controlled shoot biomass, and endothall at 3 ppm and 24 hour exposure time controlled both aboveground and belowground biomass (Poovey et al. 2012). They also note that repeated treatments with contact herbicides, or integration with systemic herbicides, would be needed to achieve long-term control. Skogerboe (unpub. data) analyzed in lake treatments of endothall in the Detroit Lakes and determined that the adequate concentration exposure times could not be reached to control flowering rush. However data collected on diquat treatments in the Detroit Lakes in 2012 and 2013 showed significant reduction in above and belowground biomass as well as rhizome bud density (Figure 1; Madsen et al. 2013, 2014). The 2012 diquat protocol was repeated in 2013 and 2014 on flowering rush beds in the Detroit Lakes.

In 2015 the protocol was amended such that sites with low density (<20% prevalence) of flowering rush received only one or no (<5% prevalence) diquat treatments instead of two while sites with high densities (>20% prevalence) of flowering rush still received two diquat treatments. The success of this protocol in 2015 (Turnage et al. 2016) led to its continuance in 2016.

The process of geographic range expansion is characterized by three phases once an invasive species reaches new habitat: the lag phase, exponential growth phase, and carrying capacity (Figure 2). The lag phase is seen when invasive species first reach a site; typically invasive plants in this phase are found in very low densities and do not appear to pose a threat as they are not expanding rapidly. The exponential growth phase is seen when plants are actively spreading across a site often doubling in abundance from one year to the next; at this point the species becomes much more noticeable due to its larger geographic range. The carrying capacity phase is achieved when the invasive species has colonized as much available habitat as possible; often this is characterized by large monotypic stands of the invasive where a diverse assemblage of native species had been present historically.

The purpose of amending the 2014 protocol was to decrease resources needed on sites with low flowering rush prevalence so that they could be allocated elsewhere to sites with high prevalence of flowering rush. Sites treated once with diquat were treated in July so as to apply herbicide to the maximum amount of sprouted rhizome buds. Sites receiving two treatments were treated in June and July as in years past. The ultimate goal is conversion of all flowering rush sites to low or no prevalence sites (sites characteristic of the lag phase of the invasion process) in the Detroit Lakes system so that a minimum amount of resources is needed to control the species.

Materials and Methods

Treatments were made to manage flowering rush populations at designated treatment areas (Tables 1-2; Figures 3-4) of submersed or mostly submersed plants with the contact herbicide diquat using drop hoses from a boat, in 4 feet and less of water. From two feet to four feet deep, a rate of two gallons per surface acre were used, and in water depths from shoreline to two feet deep, a rate of one gallon per surface acre was applied; as per the US EPA label. The target water column concentration was 0.37 ppm of diquat. Treatments occurred in Big and Little Detroit (Figure 3), Curfman Bay (Figure 3), Sallie (Figure 4), and Melissa Lakes (Tables 1-2; Figure 4). Diquat formulation used was a 2 lbs. per gallon diquat cation formulation (Tribune, Syngenta Crop Protection, LLC, Greensboro, NC).

Assessment

We assessed the response of flowering rush to herbicide applications using biomass estimates. We assessed the impact of submersed applications on aquatic plant communities using a point intercept method. The initial point intercept survey in June was used to assign the number of diquat applications to each treatment site. Sites with greater than 20% presence of flowering rush

still received two diquat applications, sites with prevalence between 5% and 20% received one diquat application, and sites with less than 5% prevalence received no herbicide treatment (Table 1).

Biomass estimates. Assessment of both submersed and emergent treatments in this system were done by sampling plant tissues (biomass) collected with a 6" diameter biomass coring device to collect both shoots and rhizomes (Figure 5; Madsen et al. 2007) in nine plots (Table 2): three reference, three receiving one diquat treatment, and three receiving two diquat treatments. Forty cores per plot were collected before each proposed treatment, and at the end of the growing season in September (Table 2). After washing to remove sediment, biomass specimens were held on ice and shipped overnight to Mississippi State University. Specimens were separated into aboveground and belowground biomass. Rhizome buds (Figure 1) were counted, but not separated from the remainder of belowground biomass. Plants were dried for 72 hours at 70C or greater in a forced air over and then dried biomass was weighed. Successful applications should reduce biomass weight and rhizome bud number. Biomass samples were taken at predetermined points randomly selected from the point intercept survey points (below) of those plots.

Statistical analysis of mean rhizome bud count was performed using an analysis of variance (ANOVA) procedure. Any differences in means were further separated using a mean separation test. Statistical analysis was done using Statistix 9.0 (Analytical Software, Tallahassee, FL).

Point Intercept. To assess the community impact of submersed diquat treatments, point intercept sampling (Madsen 1999) was done on all treated plots and reference plots (Table 2). The grid interval was no less than 25 m. There were not an equal number of points per plot. Statistical analysis was performed using a Kruskal-Wallice analysis, testing for a statistically-significant change in frequency between the three sampling dates. Analysis was done using Statistix 9.0 (Analytical Software, Tallahassee, FL).

Results and Discussion

Biomass. The measurement of abundance, such as biomass, is the best method to evaluate the effectiveness of control (Madsen 1993; Madsen and Bloomfield 1993; Madsen and Wersal 2017). Since the aboveground biomass often causes the nuisance problem, reduction in biomass may measure the reduction in nuisance potential. While reduction of the nuisance potential is important to resource user perception, it is also important to contribute to the long-term management of the invasive plant species. For flowering rush, the best indicator of reduction in long-term growth potential is rhizome bud number (or density). Rhizome bud density is important since buds appear to be the perennating and regrowth propagule (Marko et al. 2012; Madsen et al. 2012). Rhizomes are the main location to store carbohydrates, essential for overwintering and for regrowth from management. Rhizome buds are the individual growing

points from which new ramets or leaves regrow. Reductions in these tissues should result in long-term control.

Rhizome bud density was significantly reduced ($p<0.0001$) in 2013, 2014, and again in 2015 in sites receiving two diquat applications (Figures 6 and 7). As in 2015, those sites receiving one diquat application did not have an increase in rhizome bud density in 2016 (Figure 6). This suggests that sites with low flowering rush density can be effectively controlled with just one diquat application per growing season.

Biomass plots examined for bud density over time illustrate a general trend for reference site bud density to increase during the growing season, and treatment plot density to decline (Figure 7). Bud densities in reference plots were not statistically significantly lower than previous years (Figure 7). However, bud densities in diquat treated plots have significantly decreased from peak (2013) densities (Figure 7).

Point Intercept. While decreasing the nuisance growth and reducing the long-term potential to spread and regrow is important for managing invasive plants, this benefit must be weighed against possible damage to the native plant community. A point intercept study was performed to evaluate the impact on native plant species and the overall community. This sampling did not detect a decrease in the abundance of native plants, but rather if plants survived and continued at the same frequency.

Flowering rush frequency was significantly lower in all plots by the final assessment in September (Tables 3-5; Figure 8). At this time it is unkown why flowering rush declined in reference plots; however it is possible that the species had started to senescence by the final sampling. In many individual plots, the frequency of flowering rush was dramatically reduced (Tables 7-35). For instance, frequency of flowering rush in plot C-DIQ-3 was 63.6% in June, 3% after one treatment in July, and 0% after two treatments in September (Table 23). In general, diquat treatments resulted in reduced nuisance from flowering rush growth.

Average species richness (no. per point) in reference plots did not decrease over the 2016 growing season (Figure 9). Average species richness in diquat treated plots decreased in all one diquat treated plots (Figure 9); this represents a decline of 0.54 species per point in sites receiving one diquat treatment and 1.39 species per point sites receiving two diquat treatments. This decline in species richness is expected in treatment plots as flowering rush was being reduced in these plots due to diquat treatments. Interestingly, sites receiving one diquat application had a reduction in mean species richness in 2016 but not in 2015 (Turnage et al. 2016). This suggests that one diquat application per year may be sufficient to reduce flowering rush biomass long term. As in 2014, we assessed plant frequency for all diquat treated (Table 3 and 4) and untreated (Table 5) plots, determining which species had a significant change over time. Of the 34 species found in previous years, 30 were found in the 2016 survey sites. There were 16 species that had no change regardless of site location or time, four of which were not

found (*Heteranthera dubia* – water stargrass, *Juncus pelocarpus* – brownfruit rush, *Typha angustifolia* – narrrowleaf cattail, and *Wolffia* sp. - watermeal) in the 2016 surveys (Table 6). There were three species (*Ceratophyllum demersum* – coontail, *Najas flexilis* – bushy naiad, and *Vallisneria Americana* – water celery) that increased in all sites (Table 6). There were two species (*Butomus umbellatus* – flowering rush, *Potamogeton crispus* – curlyleaf pondweed) that decreased in all 2016 plots (Table 6), both of which are invasive species; however, curlyleaf pondweed behaves as a winter annual in northern states and thus its decline in summer months is due to its life cycle rather than diquat treatments. There remaining species showed various types of change between survey efforts (Table 6), indicating small to moderate change in frequency with treatments.

Given that there are 29 individual plots, an analysis of each plot will not be discussed.

Diquat treatments do not appear to have a significant effect on species diversity, though some individual species in some plots may have been adversely affected.

Conclusions and Recommendations

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Recommendations

- Field evaluations and monitoring of diquat or other herbicides should be continued to determine if reduction in belowground biomass and rhizome bud density is repeatable.
- We recommend that other herbicide active ingredients and use patterns be evaluated under controlled conditions to determine if there are alternatives to diquat treatments, which may be field demonstrated in the future.
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Acknowledgements

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Literature Cited

Bellaud, M. 2009. Chapter 13.10: Flowering Rush, pp. 141-144. In: Biology and control of aquatic plants: a best management practices handbook (Gettys LA, WT Haller and M Bellaud, eds.). Aquatic Ecosystem Restoration Foundation, Marietta GA. 210 pages.

Madsen, J.D. 1999. Point intercept and line intercept methods for aquatic plant management. US Army Engineer Waterways Experiment Station Aquatic Plant Control Research Program Technical Note CC-02, Vicksburg, MS.

Madsen, J.D. 1993. Biomass techniques for monitoring and assessing control of aquatic vegetation. Lake and Reservoir Management 7:141-154.

Madsen, J.D., G. Turnage, and B. T. Sartain. 2014. Management of Flowering Rush Using the Contact Herbicide Diquat in Detroit Lakes, Minnesota 2013. Geosystems Research Institute Report 5063, Geosystems Research Institute, Mississippi State University, Mississippi State, MS. May 2014.

Madsen, J.D., B. Sartain, G. Turnage, and M. Marko. 2013. Herbicide Trials for Management of Flowering Rush in Detroit Lakes, Minnesota for 2012. Geosystems Research Institute Report 5059, Geosystems Research Institute, Mississippi State University, Mississippi State, MS. April 2013.

Madsen, J.D., and J.A. Bloomfield. 1993. Aquatic vegetation quantification symposium: An overview. Lake and Reservoir Management 7:137-140.

Madsen, J. D. and R. M. Wersal. 2017. A review of aquatic plant monitoring and assessment methods. Journal of Aquatic Plant Management 55: 1 – 12.

Madsen, J. D., Wersal, R. M., Marko, M. D., and Skogerboe, J. G. 2012. Ecology and Management of Flowering Rush (*Butomus umbellatus*) in the Detroit Lakes, Minnesota. GRI Report #5054. Mississippi State University: Geosystems Research Institute.

Madsen, J. D., Wersal, R. M., & Woolf, T. E. 2007. A New Core Sampler for Estimating Biomass of Submersed Aquatic Macrophytes. Journal of Aquatic Plant Management. 45: 31-34.

Marko, M., J. Madsen, C. Olsen, and R. Smith. 2012. Ecology of Flowering Rush (*Butomus umbellatus*) in Detroit Lakes, Becker County, Minnesota. Letter report, Concordia College, Moorhead, MN. August 2012.

NRCS 2013. Plants Database, US Department of Agriculture, Natural Resources Conservation Service (NRCS). http://plants.usda.gov. Access March 2013.

Parkinson, H., J. Mangold, V. Dupuis, and P. Rice. 2010. Biology, Ecology, and Management of Flowering Rush (*Butomus umbellatus*). Montana State University Extension, EB0201, December 2010. 7pp.

Poovey, A.G., C.R. Mudge, R.A. Thum, C. James, and K.D. Getsinger. 2012. Evaluations of contact herbicides for controlling two populations of submersed flowering rush. Journal of Aquatic Plant Management 50:48-54.

Turnage, G., B. Alcott, and T. Guetter. 2016. Adaptive Management of Flowering Rush Using the Contact Herbicide Diquat in Detroit Lakes, Minnesota 2015. Geosytems Research Institute Report 5067, Geosystems Research Institute, Mississippi State University, Mississippi State, MS. April 2016.

Figure 1. Rhizome of flowering rush (*Butomus umbellatus*) with two rhizome buds visible. This is the major propagule or growing point of the triploid biotype.

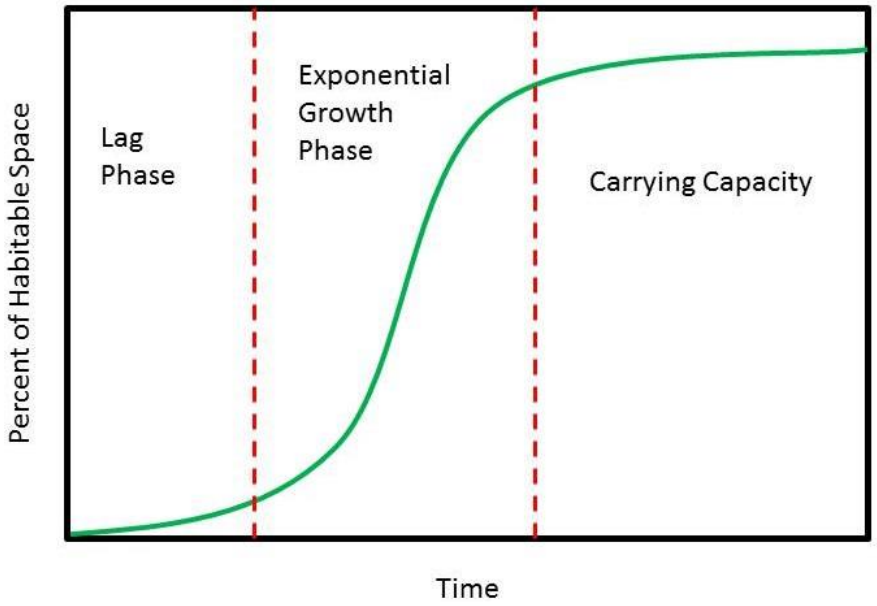

Figure 2. Figure showing the different phases of spread after a site has been invaded.

Figure 3. Sites receiving one diquat treatment, two diquat treatments, and reference plots in Detroit Lake, MN, in 2016.

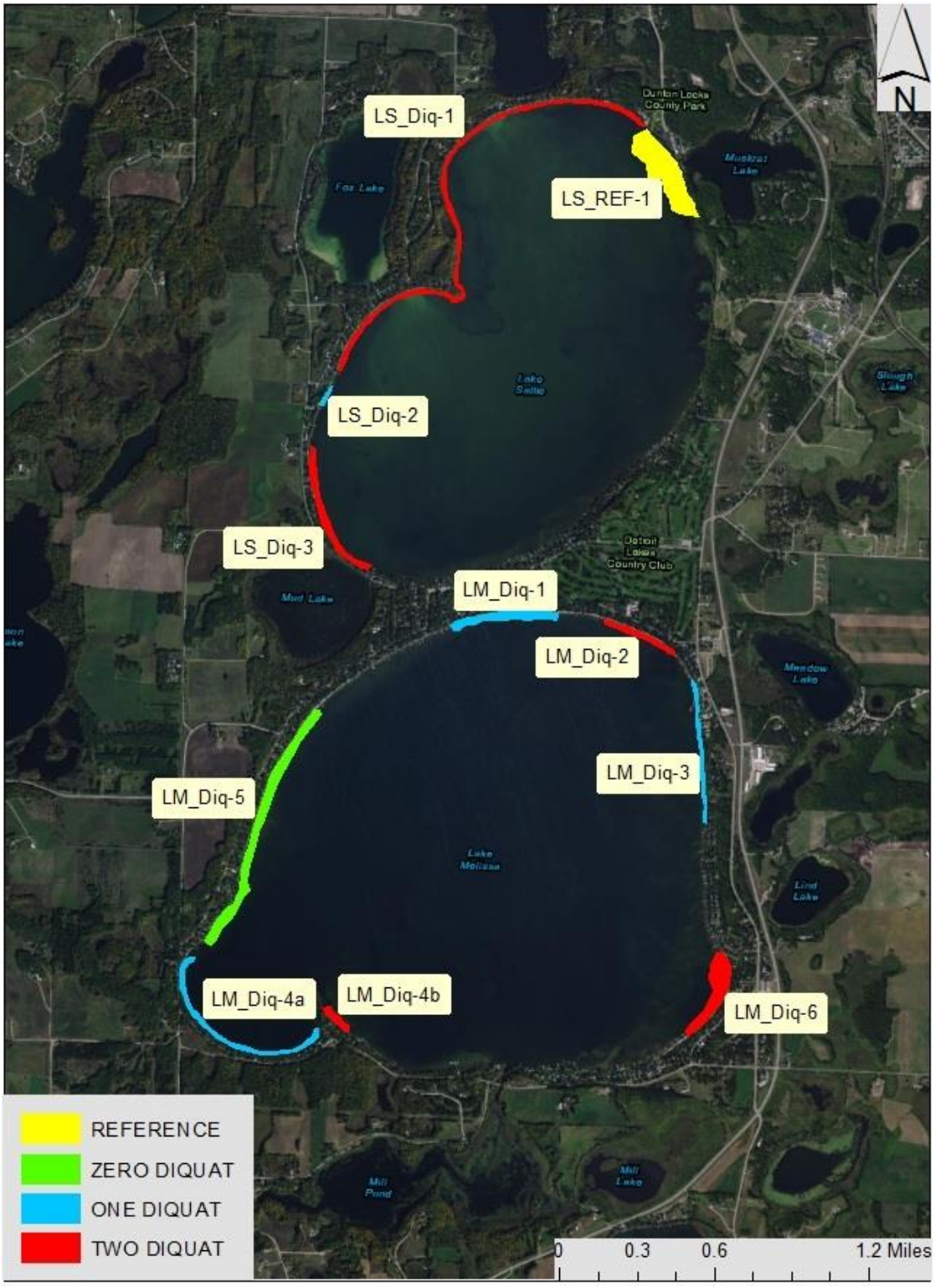

Figure 4. Sites receiving zero diquat treatments, one diquat treatment, two diquat treatments, and reference plots in Lakes Sallie and Melissa, MN, in 2014.

Figure 5. The 6” diameter coring device used to collect aboveground and belowground biomass of flowering rush in the Detroit Lakes.

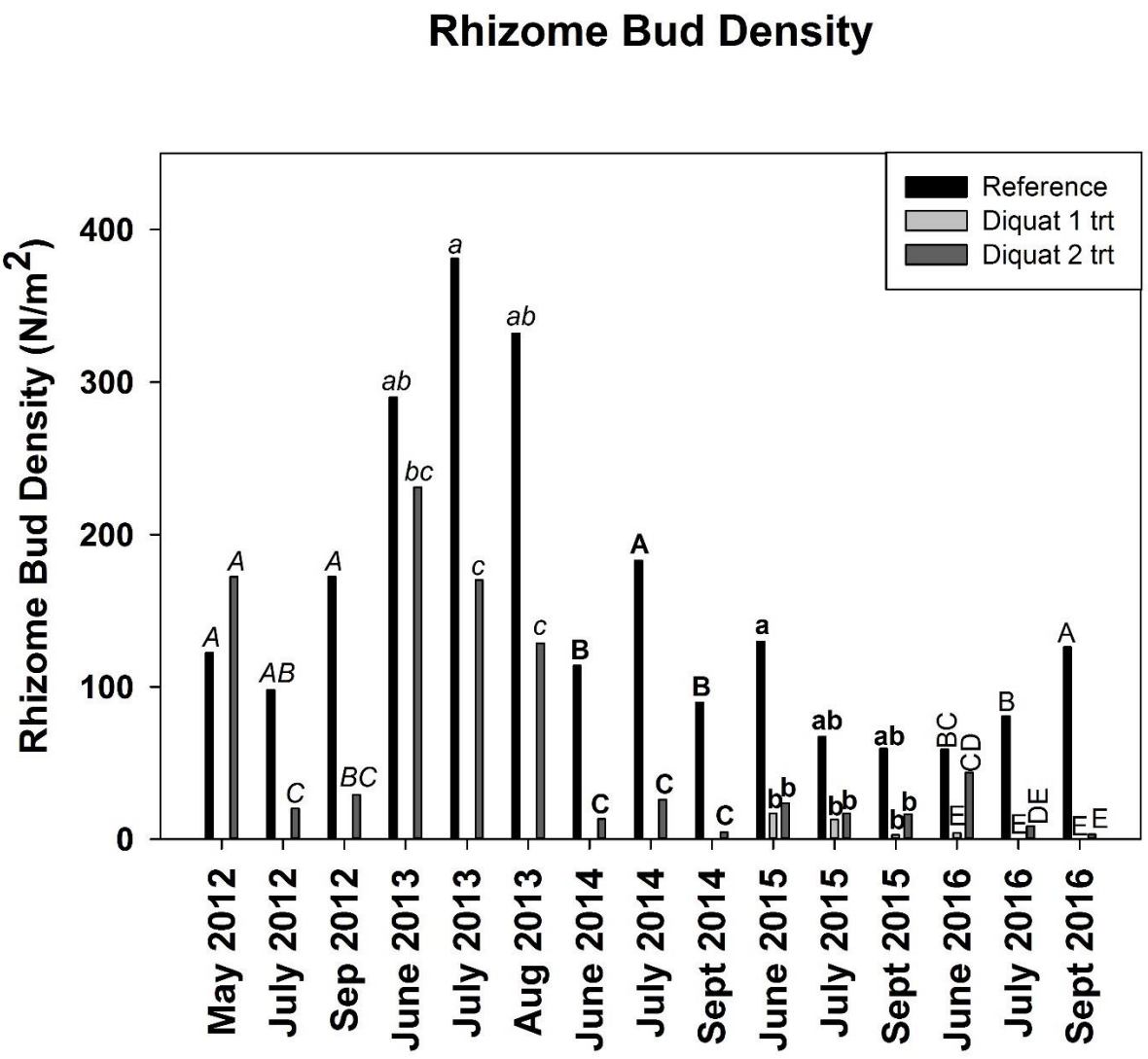

Figure 6. Rhizome bud density (N/m^2) for May, July, and September of 2012; June, July and August of 2013; June, July, and September 2014; and June, July, and September of 2015 of reference (untreated) and diquat-treated plots in the Detroit Lake Systems. Diquat 1 trt bars represent those sites that received one diquat treatment (2015 and 2016 only) while those designated diquat 2 trt received two herbicide treatments. Bars sharing the same letter within a year are not significantly different from one another. Means comparison by homogenous groups, p=0.05, comparing means of treatments and months within a year. Therefore, comparisons for 2012 are capital italics, for 2013 are lower case italics, for 2014 are upper case bold type, for 2015 are lower case normal type, and for 2016 are uppercase normal type. Plots varied between the five years.

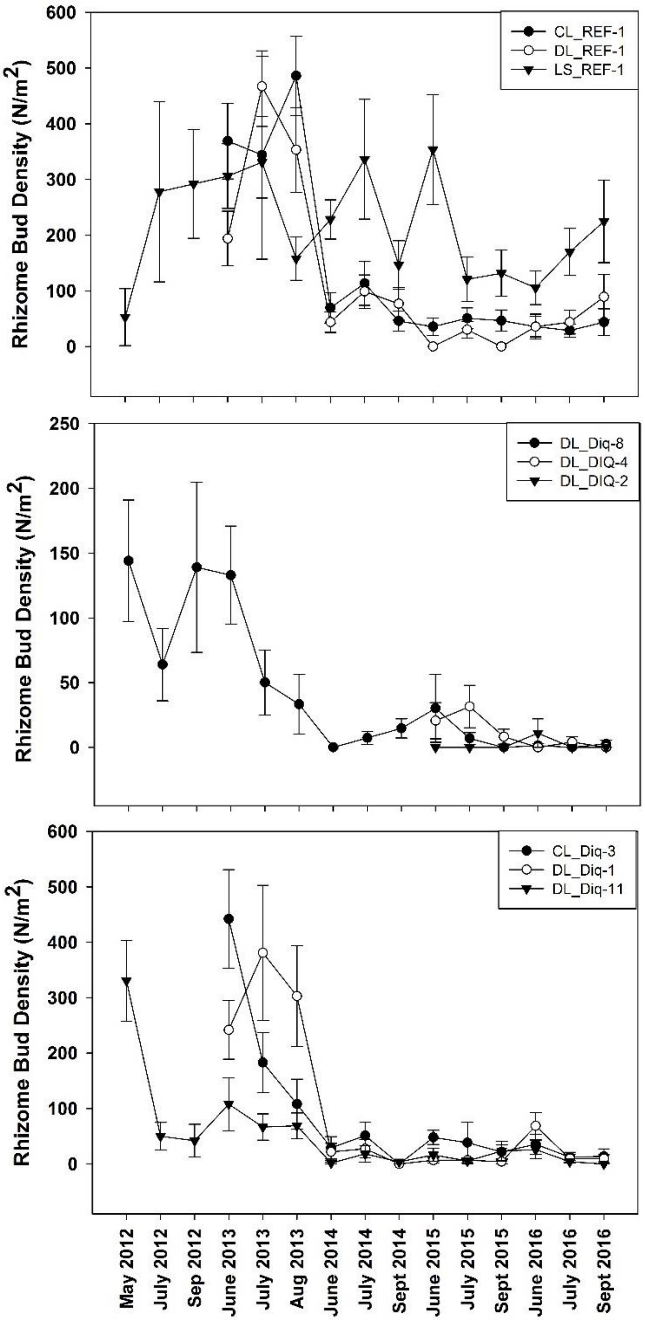

Figure 7. Rhizome bud density (N/m^2) for reference sites (top), sites receiving one diquat treatment (middle), and sites receiving two treatments (bottom) in the Detroit Lakes system from 2012 through 2016. Points are the means for twenty samples in 2012 and 2013, 30 samples in 2014, and 40 samples in 2015 and 2016 per plot per time interval. Error bars represent one standard error of the mean.

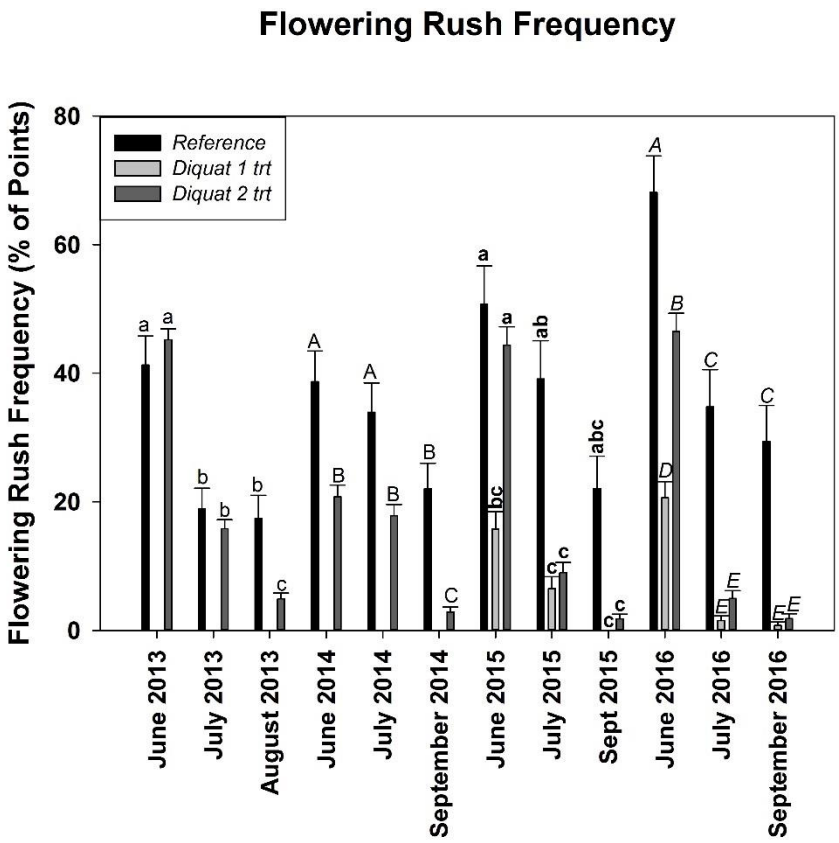

Figure 8. Percent frequency of flowering rush in June, July, and August of 2013 and June, July, and September of 2014, 2015, and 2016 in plots on Detroit Lakes system, MN. Lower case letters are for 2013 data, upper case are for 2014, lower case bold type are for 2015 data, and uppercase italics are for 2016 data. Bars sharing the same letter within years are not significantly different from one another. Error bars represent one standard error of the mean.

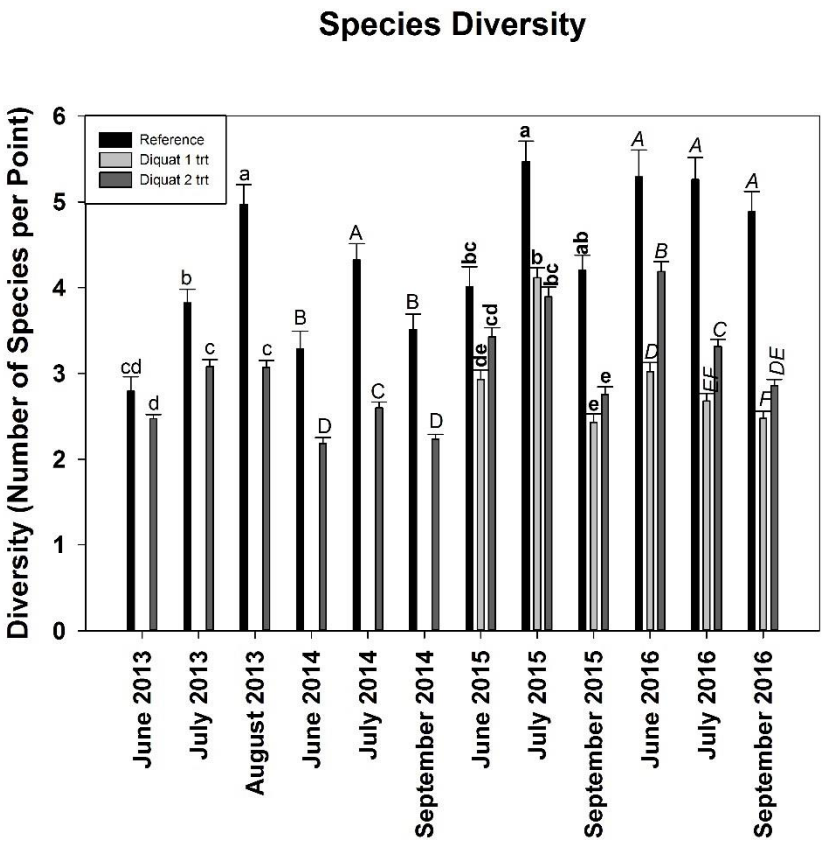

Figure 9. Species diversity (as average number of species per point) in reference and diquat-treated plots in the Detroit Lakes system in 2013, 2014, 2015, and 2016. Lower case letters are for 2013 data, upper case are for 2014 data, lower case bold type are for 2015, and uppercase italics are for 2016 data. Bars sharing a letter within a year are not significantly different from one another. Error bars represent one standard error of the mean.

Table 1. Treatment and reference plot names for the Detroit Lakes basins in 2016 with the 2015 plot designation, plot area, and number of diquat treatments per plot. In '# of Diquat Treatments' those numbers that are underlined are sites used for biomass analysis.

Lake	2016 Plot Designation	2015 Plot Designation	Area (acres)	# of Diquat Treatments
Curfman	CL_Diq-1	CL_Diq-1	1.4	2
Curfman	CL_REF-1	CL_REF-1	2.2	Reference
Curfman	CF_Diq-3	CF_Diq-3	13.3	2
Little Detroit	DL_Diq-1	DL_Diq-1	4.0	2
Little Detroit	DL_Diq-2	DL_Diq-2	5.6	1
Little Detroit	DL_Diq-3	DL_Diq-3	9.5	2
Big Detroit	DL_Diq-4	DL_Diq-4	6.9	1
Big Detroit	DL_Diq-5	DL_Diq-5	11.0	2
Big Detroit	DL_Diq-6	DL_Diq-6	19.3	1
Big Detroit	DL_Diq-7	DL_Diq-7	5.4	1
Big Detroit	DL_Diq-8	DL_Diq-8	83.4	1
Big Detroit	DL_Diq-9	DL_Diq-9	4.2	1
Big Detroit	DL_Diq-10	DL_Diq-10	8.3	2
Big Detroit	DL_Diq-11	DL_Diq-11	14.7	2
Big Detroit	DL_Diq-12	-	13.7	2
Big Detroit	DL_Diq-13	-	3.5	2
Big Detroit	DL_Diq-14	-	1.2	2
Big Detroit	DL_REF-1	DL_REF-1	6.4	Reference
Melissa	LM_Diq-1	LM_Diq-1	7.4	1
Melissa	LM_Diq-2	LM_Diq-2	3.4	2
Melissa	LM_Diq-3	LM_Diq-3	4.1	1
Melissa	LM_Diq-4a	LM_Diq-4	7.9	1
Melissa	LM_Diq-4b	-	2.1	2
Melissa	LM_Diq-5	LM_Diq-5	20.1	0
Melissa	LM_Diq-6	Dakotah Beach	11.6	2
Sallie	LS_REF-1	LS_REF-1	21.0	Reference
Sallie	LS_Diq-1	LS_Diq-1	16.5	2
Sallie	LS_Diq-2	LS_Diq-2	0.8	1
Sallie	LS_Diq-3	LS_Diq-3	7.7	2
TOTAL			373.2	

Table 2. Nine sites at which forty biomass samples per site were collected in June, July, and September of 2016.

Lake	2016 Plot Designation	2015 Plot Designation	Area (acres)	Notes
Curfman	CL_REF-1	CL_REF-1	2.20	Reference
Big Detroit	DL_REF-1	DL_REF-1	6.41	Reference
Sallie	LS_REF-1	LS_REF-1	21.01	Reference
Little Detroit	DL_Diq-2	DL_Diq-2	3.37	One Treatment
Big Detroit	DL_Diq-4	DL_Diq-4	6.92	One Treatment
Big Detroit	DL_Diq-8	DL_Diq-8	83.40	One Treatment
Little Detroit	DL_Diq-1	DL_Diq-1	4.00	Two Treatment
Curfman	CL_Diq-3	CL_Diq-3	13.27	Two Treatment
Big Detroit	DL_Diq-11	DL_Diq-11	14.73	Two Treatment

Table 3. Point intercept frequency of species in all plots receiving one diquat treatment in the Detroit Lakes system, 2016 for three months. P-value is based on a Kruskal-Wallis test, with month as the variable. A p-value of "M" indicates insufficient presence while p-values in bold type indicate a statistically significant difference. N= 213, 212, 208; respectively.

Common	Scientific	CODE	June	July	Sep	P-value
Water marigold	*Bidens beckii*	BBEC	0	0	0	M
Flowering rush	*Butomus umbellatus*	BUMB	42	24	2	**<0.0001**
Coontail	*Ceratophyllum demersum*	CDEM	3	41	21	**0.0001**
Chara	*Chara*	chara	188	30	194	0.0539
Water moss	*Drepanocladus*	DREP	38	13	16	**0.0014**
Elodea	*Elodea canadensis*	ECAN	6	5	2	0.1567
Water stargrass	*Heteranthera dubia*	HDUB	0	0	0	M
Brownfruit rush	*Juncus pelocarpus*	JPEL	0	0	0	M
Common duckweed	*Lemna minor*	LMIN	0	3	0	M
Star duckweed	*Lemna trisulca*	LTRI	11	52	15	0.2517
Northern watermilfoil	*Myriophyllum sibiricum*	MSIB	29	25	20	0.1297
Bushy naiad	*Najas flexilis*	NFLEX	0	15	21	**<0.0001**
Nitella	*Nitella*	NITEL	3	0	0	0.1286
White waterlily	*Nymphaea odorata*	NODOR	2	12	4	0.3315
Yellow pondlily	*Nuphar lutea*	NVARI	2	14	3	0.4888
Curlyleaf pondweed	*Potamogeton crispus*	PCRI	47	1	2	**<0.0001**
Leafy pondweed	*Potamogeton foliosus*	PFOL	12	2	2	**0.0065**
Variable pondweed	*Potamogeton gramineus*	PGRAM	0	0	3	0.1197
Illinois pondweed	*Potamogeton illinoensis*	PILL	48	8	38	0.1674
Floating pondweed	*Potamogeton nataus*	PNAT	1	0	1	0.7446
Whitestem pondweed	*Potamogeton praelongus*	PPRA	2	5	1	0.5089
Richardson's pondweed	*Potamogeton richardsonii*	PRICH	53	12	48	0.3748
Robbin's pondweed	*Potamogeton robbbinsii*	PROBB	0	1	3	0.1197
Flatstem pondweed	*Potamogeton zosteriformis*	PZOS	21	11	18	0.3984
Widgeongrass	*Ruppia cirrhosa*	RCIRR	0	1	0	M
White water buttercup	*Ranunculus longirostris*	RLON	0	1	0	M
Hardstem bulrush	*Schoenoplectus acutus*	SACU	12	17	14	0.3955
Arumleaf arrowhead	*Sagittaria cuneata*	SCUN	0	0	0	M
Sago pondweed	*Stuckenia pectinata*	SPEC	56	5	4	**<0.0001**
Narrowleaf cattail	*Typha angustifolia*	TANG	0	0	0	M
Broadleaf cattail	*Typha latifolia*	TLAT	0	3	0	M
Common bladderwort	*Utricularia macrorhiza*	UMAC	5	33	5	0.6097
Watercelery	*Vallisneria americana*	VAME	73	29	103	**0.0010**
Watermeal	*Wolffia*	WOOLF	0	0	0	M
Total species richness		SPP	21	25	23	
Native species richness		NATSPP	19	23	21	

Table 4. Point intercept frequency of species in all plots receiving two diquat treatments in the Detroit Lakes system, 2016 for three months. P-value is based on a Kruskal-Wallis test, with month as the variable. A p-value of "M" indicates insufficient presence while p-values in bold type indicate a statistically significant difference. N= 376, 376, 377; respectively.

Common	Scientific	CODE	June	July	Sep	P-value
Water marigold	*Bidens beckii*	BBEC	0	0	0	M
Flowering rush	*Butomus umbellatus*	BUMB	164	13	6	**<0.0001**
Coontail	*Ceratophyllum demersum*	CDEM	26	40	55	**0.0007**
Chara	*Chara*	chara	300	330	323	**0.0325**
Water moss	*Drepanocladus*	DREP	23	48	22	0.8696
Elodea	*Elodea canadensis*	ECAN	19	8	2	**0.0002**
Water stargrass	*Heteranthera dubia*	HDUB	0	0	0	M
Brownfruit rush	*Juncus pelocarpus*	JPEL	0	0	0	M
Common duckweed	*Lemna minor*	LMIN	4	0	0	**0.0446**
Star duckweed	*Lemna trisulca*	LTRI	44	98	107	**<0.0001**
Northern watermilfoil	*Myriophyllum sibiricum*	MSIB	105	30	23	**<0.0001**
Bushy naiad	*Najas flexilis*	NFLEX	0	12	17	**<0.0001**
Nitella	*Nitella*	NITEL	0	0	0	M
White waterlily	*Nymphaea odorata*	NODOR	4	8	8	0.2463
Yellow pondlily	*Nuphar lutea*	NVARI	27	33	34	0.3554
Curlyleaf pondweed	*Potamogeton crispus*	PCRI	98	0	1	**<0.0001**
Leafy pondweed	*Potamogeton foliosus*	PFOL	5	3	3	0.4748
Variable pondweed	*Potamogeton gramineus*	PGRAM	0	0	0	M
Illinois pondweed	*Potamogeton illinoensis*	PILL	92	62	53	**0.0003**
Floating pondweed	*Potamogeton nataus*	PNAT	0	0	2	0.1573
Whitestem pondweed	*Potamogeton praelongus*	PPRA	31	23	3	**<0.0001**
Richardson's pondweed	*Potamogeton richardsonii*	PRICH	135	113	85	**<0.0001**
Robbin's pondweed	*Potamogeton robbbinsii*	PROBB	0	0	0	M
Flatstem pondweed	*Potamogeton zosteriformis*	PZOS	91	63	33	**<0.0001**
Widgeongrass	*Ruppia cirrhosa*	RCIRR	0	0	0	M
White water buttercup	*Ranunculus longirostris*	RLON	6	1	0	0.0138
Hardstem bulrush	*Schoenoplectus acutus*	SACU	11	10	12	0.8373
Arumleaf arrowhead	*Sagittaria cuneata*	SCUN	0	0	0	M
Sago pondweed	*Stuckenia pectinata*	SPEC	127	5	0	**<0.0001**
Narrowleaf cattail	*Typha angustifolia*	TANG	0	0	0	M
Broadleaf cattail	*Typha latifolia*	TLAT	4	4	5	0.7404
Common bladderwort	*Utricularia macrorhiza*	UMAC	14	21	14	0.9943
Watercelery	*Vallisneria americana*	VAME	176	224	220	**0.0015**
Watermeal	*Wolffia*	WOOLF	0	0	0	M
Total species richness		SPP	22	21	21	
Native species richness		NATSPP	20	20	19	

Table 5. Point intercept frequency of species in all untreated reference plots in the Detroit Lakes system, 2016 for three months. P-value is based on a Kruskal-Wallis test, with month as the variable. A p-value of "M" indicates insufficient presence while p-values in bold type indicate a statistically significant difference. N= 69, 69, 68; respectively.

Common	Scientific	CODE	June	July	Sep	P-value
Water marigold	*Bidens beckii*	BBEC	0	0	3	0.1195
Flowering rush	*Butomus umbellatus*	BUMB	47	24	20	**<0.0001**
Coontail	*Ceratophyllum demersum*	CDEM	26	41	43	**0.0023**
Chara	*Chara*	chara	43	30	21	**0.0002**
Water moss	*Drepanocladus*	DREP	7	13	0	**0.0070**
Elodea	*Elodea canadensis*	ECAN	10	5	3	**0.0408**
Water stargrass	*Heteranthera dubia*	HDUB	0	0	0	M
Brownfruit rush	*Juncus pelocarpus*	JPEL	0	0	0	M
Common duckweed	*Lemna minor*	LMIN	0	3	1	0.4964
Star duckweed	*Lemna trisulca*	LTRI	32	52	50	**0.0010**
Northern watermilfoil	*Myriophyllum sibiricum*	MSIB	23	25	30	0.1312
Bushy naiad	*Najas flexilis*	NFLEX	0	15	5	**0.0279**
Nitella	*Nitella*	NITEL	3	0	1	0.3152
White waterlily	*Nymphaea odorata*	NODOR	9	12	13	0.2313
Yellow pondlily	*Nuphar lutea*	NVARI	17	14	12	0.2143
Curlyleaf pondweed	*Potamogeton crispus*	PCRI	25	1	0	**<0.0001**
Leafy pondweed	*Potamogeton foliosus*	PFOL	0	2	0	M
Variable pondweed	*Potamogeton gramineus*	PGRAM	0	0	0	M
Illinois pondweed	*Potamogeton illinoensis*	PILL	9	8	14	0.1705
Floating pondweed	*Potamogeton natans*	PNAT	0	0	1	0.4964
Whitestem pondweed	*Potamogeton praelongus*	PPRA	15	5	7	0.0549
Richardson's pondweed	*Potamogeton richardsonii*	PRICH	13	12	6	0.0729
Robbin's pondweed	*Potamogeton robbbinsii*	PROBB	0	1	0	M
Flatstem pondweed	*Potamogeton zosteriformis*	PZOS	17	11	13	0.2987
Widgeongrass	*Ruppia cirrhosa*	RCIRR	0	1	0	M
White water buttercup	*Ranunculus longirostris*	RLON	6	1	1	0.0600
Hardstem bulrush	*Schoenoplectus acutus*	SACU	18	17	16	0.4411
Arumleaf arrowhead	*Sagittaria cuneata*	SCUN	0	0	1	0.4964
Sago pondweed	*Stuckenia pectinata*	SPEC	16	5	2	**0.0003**
Narrowleaf cattail	*Typha angustifolia*	TANG	0	0	0	M
Broadleaf cattail	*Typha latifolia*	TLAT	5	3	6	0.4897
Common bladderwort	*Utricularia macrorhiza*	UMAC	24	33	30	0.1728
Watercelery	*Vallisneria americana*	VAME	20	29	33	**0.0147**
Watermeal	*Wolffia*	WOOLF	0	0	0	M
Total species richness		SPP	21	25	24	
Native species richness		NATSPP	19	23	23	

Table 6. Dynamics of species in diquat-treated and untreated reference plots in the Detroit Lake system across three months in 2016; where a "+" indicates species that statistically increased, a "0" indicates species with no significant change, and a "-" indicates species with a significant decrease in frequency at points.

Common	Scientific	CODE	1 Diquat	2 Diquat	Reference
Water marigold	*Bidens beckii*	BBEC	0	0	0
Flowering rush	*Butomus umbellatus*	BUMB	-	-	-
Coontail	*Ceratophyllum demersum*	CDEM	+	+	+
Chara	*Chara*	chara	0	+	-
Water moss	*Drepanocladus*	DREP	-	0	-
Elodea	*Elodea canadensis*	ECAN	0	-	-
Water stargrass	*Heteranthera dubia*	HDUB	0	0	0
Brownfruit rush	*Juncus pelocarpus*	JPEL	0	0	0
Common duckweed	*Lemna minor*	LMIN	0	-	0
Star duckweed	*Lemna trisulca*	LTRI	0	+	+
Northern watermilfoil	*Myriophyllum sibiricum*	MSIB	0	-	0
Bushy naiad	*Najas flexilis*	NFLEX	+	+	+
Nitella	*Nitella*	NITEL	0	0	0
White waterlily	*Nymphaea odorata*	NODOR	0	0	0
Yellow pondlily	*Nuphar lutea*	NVARI	0	0	0
Curlyleaf pondweed	*Potamogeton crispus*	PCRI	-	-	-
Leafy pondweed	*Potamogeton foliosus*	PFOL	-	0	0
Variable pondweed	*Potamogeton gramineus*	PGRAM	0	0	0
Illinois pondweed	*Potamogeton illinoensis*	PILL	0	-	0
Floating pondweed	*Potamogeton natans*	PNAT	0	0	0
Whitestem pondweed	*Potamogeton praelongus*	PPRA	0	-	0
Richardson's pondweed	*Potamogeton richardsonii*	PRICH	0	-	0
Robbin's pondweed	*Potamogeton robbbinsii*	PROBB	0	0	0
Flatstem pondweed	*Potamogeton zosteriformis*	PZOS	0	-	0
Widgeongrass	*Ruppia cirrhosa*	RCIRR	0	0	0
White water buttercup	*Ranunculus longirostris*	RLON	0	0	0
Hardstem bulrush	*Schoenoplectus acutus*	SACU	0	0	0
Arumleaf arrowhead	*Sagittaria cuneata*	SCUN	0	0	0
Sago pondweed	*Stuckenia pectinata*	SPEC	-	0	-
Narrowleaf cattail	*Typha angustifolia*	TANG	0	0	0
Broadleaf cattail	*Typha latifolia*	TLAT	0	0	0
Common bladderwort	*Utricularia macrorhiza*	UMAC	0	-	0
Watercelery	*Vallisneria americana*	VAME	+	+	+
Watermeal	*Wolffia*	WOOLF	0	0	0
	Increasers		3	5	4
	No change		26	19	24
	Decreasers		4	10	6

Table 7. Species prevalence at survey points in site DL-DIQ-1 in 2016.

SITE	DL-DIQ-1		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	13	21	23
POINTS	20	20	20
Bidens beckii	0	0	0
Butomus umbellatus	13	5	0
Ceratophyllum demersum	0	0	0
Chara	20	20	20
Drepanocladus	1	0	0
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	2	0	0
Myriophyllum sibiricum	7	1	0
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	4	4	4
Potamogeton crispus	10	0	0
Potamogeton foliosus	0	0	1
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	7	8	4
Potamogeton natans	0	0	0
Potamogeton praelongus	2	0	0
Potamogeton richardsonii	14	14	12
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	0	7	5
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	8	7	8
Sagittaria cuneata	0	0	0
Stuckenia pectinata	12	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	1	1	1
Vallisneria americana	8	11	14
Wolffia	0	0	0

Table 8. Species prevalence at survey points in site DL-DIQ-2 in 2016.

SITE	DL-DIQ-2		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	13	21	23
POINTS	24	24	24
Bidens beckii	0	0	0
Butomus umbellatus	8	0	0
Ceratophyllum demersum	0	0	0
Chara	22	22	23
Drepanocladus	0	1	0
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	3	0	0
Myriophyllum sibiricum	8	0	0
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	1	1
Potamogeton crispus	1	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	6	6	7
Potamogeton natans	0	0	0
Potamogeton praelongus	4	2	0
Potamogeton richardsonii	8	8	8
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	6	3	1
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	1
Sagittaria cuneata	0	0	0
Stuckenia pectinata	10	1	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	5	8	5
Wolffia	0	0	0

Table 9. Species prevalence at survey points in site DL-DIQ-3 in 2016.

SITE	DL-DIQ-3		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	13	21	23
POINTS	25	25	25
Bidens beckii	0	0	0
Butomus umbellatus	13	2	0
Ceratophyllum demersum	0	0	0
Chara	25	24	25
Drepanocladus	0	0	0
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	1	0	1
Myriophyllum sibiricum	1	0	0
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	9	0	0
Potamogeton foliosus	0	1	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	6	4	2
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	8	12	7
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	1	9	1
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	11	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	14	17	14
Wolffia	0	0	0

Table 10. Species prevalence at survey points in site DL-DIQ-4 in 2016.

SITE	DL-DIQ-4		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	21	23
POINTS	31	31	31
Bidens beckii	0	0	0
Butomus umbellatus	8	0	0
Ceratophyllum demersum	0	0	0
Chara	30	31	31
Drepanocladus	0	4	1
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	12	23
Myriophyllum sibiricum	6	0	3
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	6	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	12	6	2
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	1	0	1
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	4	1	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	8	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	10	18	11
Wolffia	0	0	0

Table 11. Species prevalence at survey points in site DL-DIQ-5 in 2016.

SITE	DL-DIQ-5		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	21	23
POINTS	20	20	20
Bidens beckii	0	0	0
Butomus umbellatus	6	1	3
Ceratophyllum demersum	0	0	0
Chara	17	20	18
Drepanocladus	5	9	1
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	1
Myriophyllum sibiricum	0	0	0
Najas flexilis	0	1	1
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	0	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	3	0	1
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	5	0	4
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	0	0	1
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	1	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	5	11	15
Wolffia	0	0	0

Table 12. Species prevalence at survey points in site DL-DIQ-6 in 2016.

SITE	DL-DIQ-6		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	21	23
POINTS	34	34	34
Bidens beckii	0	0	0
Butomus umbellatus	3	2	0
Ceratophyllum demersum	0	1	1
Chara	31	33	31
Drepanocladus	15	6	3
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	1	7	0
Myriophyllum sibiricum	0	1	2
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	2	3	2
Potamogeton crispus	10	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	0	0	1
Potamogeton natans	0	0	0
Potamogeton praelongus	0	1	1
Potamogeton richardsonii	3	4	6
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	1	0	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	12	1	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	5	18	20
Wolffia	0	0	0

Table 13. Species prevalence at survey points in site DL-DIQ-7 in 2016.

SITE	DL-DIQ-7		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	21	23
POINTS	25	25	25
Bidens beckii	0	0	0
Butomus umbellatus	4	0	1
Ceratophyllum demersum	1	1	4
Chara	6	24	24
Drepanocladus	6	7	2
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	3	8	10
Myriophyllum sibiricum	3	0	3
Najas flexilis	0	0	8
Nitella	2	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	0	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	0	0	3
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	0	0	3
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	2	0	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	1	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	13	20	21
Wolffia	0	0	0

Table 14. Species prevalence at survey points in site DL-DIQ-8 in 2016.

SITE	DL-DIQ-8		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	21	23
POINTS	44	44	44
Bidens beckii	0	0	0
Butomus umbellatus	11	1	0
Ceratophyllum demersum	0	0	1
Chara	44	44	43
Drepanocladus	13	5	7
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	1	0	0
Myriophyllum sibiricum	5	1	0
Najas flexilis	0	0	3
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	26	0	0
Potamogeton foliosus	1	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	0	1	1
Potamogeton natans	0	0	0
Potamogeton praelongus	2	0	0
Potamogeton richardsonii	8	3	5
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	0	0	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	26	6	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	13	37	24
Wolffia	0	0	0

Table 15. Species prevalence at survey points in site DL-DIQ-9 in 2016.

SITE	DL-DIQ-9		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	21	23
POINTS	20	19	20
Bidens beckii	0	0	0
Butomus umbellatus	2	0	0
Ceratophyllum demersum	0	0	0
Chara	20	19	20
Drepanocladus	3	6	1
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	3	15	0
Myriophyllum sibiricum	2	0	1
Najas flexilis	0	2	3
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	1	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	7	0	7
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	4	3	4
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	1	0	2
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	1	0
Stuckenia pectinata	3	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	3	0	1
Vallisneria americana	8	5	11
Wolffia	0	0	0

Table 16. Species prevalence at survey points in site DL-DIQ-10 in 2016.

SITE	DL-DIQ-10		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	21	23
POINTS	26	26	27
Bidens beckii	0	0	0
Butomus umbellatus	8	1	3
Ceratophyllum demersum	9	10	10
Chara	2	8	0
Drepanocladus	5	13	10
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	18	21	27
Myriophyllum sibiricum	3	3	2
Najas flexilis	0	0	1
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	8	0	1
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	0	0	1
Potamogeton natans	0	0	0
Potamogeton praelongus	3	1	1
Potamogeton richardsonii	1	0	0
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	5	0	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	0	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	9	7	5
Vallisneria americana	2	11	16
Wolffia	0	0	0

Table 17. Species prevalence at survey points in site DL-DIQ-11 in 2016.

SITE	DL-DIQ-11		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	21	23
POINTS	23	23	23
Bidens beckii	0	0	0
Butomus umbellatus	8	1	0
Ceratophyllum demersum	0	0	0
Chara	22	23	21
Drepanocladus	10	13	8
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	1	0	0
Myriophyllum sibiricum	1	0	0
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	4	6	6
Potamogeton crispus	6	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	0	1	0
Potamogeton natans	0	0	1
Potamogeton praelongus	1	1	0
Potamogeton richardsonii	1	1	0
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	0	0	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	13	1	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	6	23	18
Wolffia	0	0	0

Table 18. Species prevalence at survey points in site DL-DIQ-12 in 2016.

SITE	DL-DIQ-12		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	13	21	23
POINTS	25	25	25
Bidens beckii	0	0	0
Butomus umbellatus	14	0	0
Ceratophyllum demersum	0	1	1
Chara	25	25	25
Drepanocladus	0	0	0
Elodea canadensis	4	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	18	0	0
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	11	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	12	5	4
Potamogeton natans	0	0	0
Potamogeton praelongus	0	1	0
Potamogeton richardsonii	24	16	6
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	20	4	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	23	2	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	25	25	23
Wolffia	0	0	0

Table 19. Species prevalence at survey points in site DL-DIQ-13 in 2016.

SITE	DL-DIQ-13		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	21	23
POINTS	12	12	12
Bidens beckii	0	0	0
Butomus umbellatus	5	0	0
Ceratophyllum demersum	0	0	0
Chara	3	12	12
Drepanocladus	0	1	1
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	3	0	0
Lemna trisulca	1	7	2
Myriophyllum sibiricum	0	0	0
Najas flexilis	0	4	7
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	1	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	3	0	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	2	0	2
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	0	0	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	3	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	2	4	3
Wolffia	0	0	0

Table 20. Species prevalence at survey points in site DL-DIQ-14 in 2016.

SITE	DL-DIQ-14		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	21	23
POINTS	5	5	5
Bidens beckii	0	0	0
Butomus umbellatus	3	0	0
Ceratophyllum demersum	0	0	0
Chara	5	5	5
Drepanocladus	0	2	0
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	1	0
Myriophyllum sibiricum	0	0	0
Najas flexilis	0	0	1
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	0	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	3	2	1
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	0	0	1
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	0	0	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	4	1	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	5	1	1
Wolffia	0	0	0

Table 21. Species prevalence at survey points in site DL-REF-1 in 2016.

SITE	DL-REF-1		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	21	23
POINTS	21	21	19
Bidens beckii	0	0	0
Butomus umbellatus	7	0	1
Ceratophyllum demersum	11	14	17
Chara	2	7	3
Drepanocladus	1	7	0
Elodea canadensis	1	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	12	20	19
Myriophyllum sibiricum	7	6	15
Najas flexilis	0	1	0
Nitella	3	0	1
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	12	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	2	2	5
Potamogeton natans	0	0	0
Potamogeton praelongus	10	5	5
Potamogeton richardsonii	2	3	3
Potamogeton robbinsii	0	1	0
Potamogeton zosteriformis	4	2	9
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	0	1	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	5	9	0
Vallisneria americana	4	12	10
Wolffia	0	0	0

Table 22. Species prevalence at survey points in site C-DIQ-1 in 2016.

SITE	C-DIQ-1		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	13	22	23
POINTS	9	9	9
Bidens beckii	0	0	0
Butomus umbellatus	8	0	0
Ceratophyllum demersum	2	5	5
Chara	9	9	9
Drepanocladus	0	0	0
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	3	1	4
Myriophyllum sibiricum	6	0	0
Najas flexilis	0	2	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	8	8	8
Potamogeton crispus	1	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	0	0	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	3	3	1
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	0	0	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	3	0	0
Typha angustifolia	0	0	4
Typha latifolia	4	4	0
Utricularia macrorhiza	0	0	2
Vallisneria americana	7	9	9
Wolffia	0	0	0

Table 23. Species prevalence at survey points in site C-DIQ-3 in 2016.

SITE	C-DIQ-3		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	13	22	23
POINTS	33	33	33
Bidens beckii	0	0	0
Butomus umbellatus	21	1	0
Ceratophyllum demersum	5	0	1
Chara	33	33	33
Drepanocladus	0	1	0
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	3	2	6
Myriophyllum sibiricum	8	0	0
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	9	12	12
Potamogeton crispus	14	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	1	2	0
Potamogeton natans	0	0	0
Potamogeton praelongus	4	3	0
Potamogeton richardsonii	10	10	0
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	0	1	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	3	3	3
Sagittaria cuneata	0	0	0
Stuckenia pectinata	20	0	0
Typha angustifolia	0	0	1
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	12	20	22
Wolffia	0	0	0

Table 24. Species prevalence at survey points in site C-REF-1 in 2016.

SITE	C-REF-1		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	13	22	23
POINTS	14	14	15
Bidens beckii	0	0	0
Butomus umbellatus	12	0	0
Ceratophyllum demersum	0	4	3
Chara	13	14	15
Drepanocladus	0	3	0
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	1	1	3
Myriophyllum sibiricum	6	2	0
Najas flexilis	0	10	4
Nitella	0	0	0
Nymphaea odorata	1	0	0
Nuphar lutea	6	2	6
Potamogeton crispus	3	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	1	1	1
Potamogeton natans	0	0	0
Potamogeton praelongus	1	0	0
Potamogeton richardsonii	4	1	1
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	0	0	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	2	1	1
Sagittaria cuneata	0	0	0
Stuckenia pectinata	10	4	0
Typha angustifolia	0	0	6
Typha latifolia	5	3	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	7	11	14
Wolffia	0	0	0

Table 25. Species prevalence at survey points in site S-DIQ-1 in 2016.

SITE	S-DIQ-1		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	15	25	24
POINTS	42	42	42
Bidens beckii	0	0	0
Butomus umbellatus	15	0	0
Ceratophyllum demersum	2	4	17
Chara	27	39	42
Drepanocladus	1	2	1
Elodea canadensis	0	1	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	7	30	31
Myriophyllum sibiricum	6	6	3
Najas flexilis	0	3	6
Nitella	0	0	0
Nymphaea odorata	4	8	8
Nuphar lutea	2	1	2
Potamogeton crispus	13	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	7	2	4
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	26	20	22
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	7	11	11
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	1	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	5	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	2	4	0
Vallisneria americana	32	30	33
Wolffia	0	0	0

Table 26. Species prevalence at survey points in site S-DIQ-2 in 2016.

SITE	S-DIQ-2		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	15	24	24
POINTS	5	5	5
Bidens beckii	0	0	0
Butomus umbellatus	1	1	0
Ceratophyllum demersum	0	0	0
Chara	5	5	5
Drepanocladus	0	0	0
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	2	1	1
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	1	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	0	1	1
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	5	4	5
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	1	0	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	1	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	5	5	5
Wolffia	0	0	0

Table 27. Species prevalence at survey points in site S-DIQ-3 in 2016.

SITE	S-DIQ-3		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	15	24	24
POINTS	25	25	25
Bidens beckii	0	0	0
Butomus umbellatus	9	0	0
Ceratophyllum demersum	1	0	1
Chara	25	25	25
Drepanocladus	0	0	0
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	1	3
Myriophyllum sibiricum	14	5	0
Najas flexilis	0	1	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	7	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	1	2	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	11	14	4
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	0	3	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	8	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	1	1	0
Vallisneria americana	20	12	15
Wolffia	0	0	0

Table 28. Species prevalence at survey points in site S-REF-1 in 2016.

SITE	S-REF-1		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	14	24	24
POINTS	34	34	34
Bidens beckii	0	0	3
Butomus umbellatus	28	24	19
Ceratophyllum demersum	15	23	23
Chara	8	9	3
Drepanocladus	6	3	0
Elodea canadensis	9	5	3
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	3	1
Lemna trisulca	19	31	28
Myriophyllum sibiricum	10	17	15
Najas flexilis	0	4	1
Nitella	0	0	0
Nymphaea odorata	8	12	12
Nuphar lutea	11	12	6
Potamogeton crispus	10	1	0
Potamogeton foliosus	0	2	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	6	5	8
Potamogeton natans	0	0	1
Potamogeton praelongus	4	0	2
Potamogeton richardsonii	7	8	2
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	13	9	4
Ruppia cirrhosa	0	1	0
Ranunculus longirostris	6	1	1
Schoenoplectus acutus	16	16	15
Sagittaria cuneata	0	0	1
Stuckenia pectinata	6	0	2
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	19	24	28
Vallisneria americana	9	6	9
Wolffia	0	0	0

Table 29. Species prevalence at survey points in site M-DIQ-1 in 2016.

SITE	M-DIQ-1		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	15	25	25
POINTS	20	20	20
Bidens beckii	0	0	0
Butomus umbellatus	3	0	0
Ceratophyllum demersum	0	0	1
Chara	19	19	20
Drepanocladus	0	0	0
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	1	0	0
Najas flexilis	0	0	1
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	1	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	4	7	3
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	6	10	11
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	1	3	1
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	2	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	5	5	6
Wolffia	0	0	0

Table 30. Species prevalence at survey points in site M-DIQ-2 in 2016.

SITE	M-DIQ-2		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	15	24	24
POINTS	20	20	20
Bidens beckii	0	0	0
Butomus umbellatus	7	0	0
Ceratophyllum demersum	0	1	1
Chara	20	19	20
Drepanocladus	0	10	0
Elodea canadensis	1	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	10	1	1
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	8	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	12	10	8
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	6	8	4
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	15	7	1
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	1	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	1	0	0
Vallisneria americana	14	8	8
Wolffia	0	0	0

Table 31. Species prevalence at survey points in site M-DIQ-3 in 2016.

SITE	M-DIQ-3		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	15	24	24
POINTS	32	32	32
Bidens beckii	0	0	0
Butomus umbellatus	8	0	0
Ceratophyllum demersum	1	4	9
Chara	30	31	25
Drepanocladus	0	0	2
Elodea canadensis	6	5	1
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	2	5
Myriophyllum sibiricum	14	15	5
Najas flexilis	0	1	2
Nitella	1	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	5	0	0
Potamogeton foliosus	11	10	0
Potamogeton gramineus	0	0	3
Potamogeton illinoensis	18	22	10
Potamogeton natans	1	2	1
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	8	14	5
Potamogeton robbinsii	0	0	3
Potamogeton zosteriformis	10	5	6
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	12	11	14
Sagittaria cuneata	0	0	0
Stuckenia pectinata	6	0	1
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	2	7	2
Vallisneria americana	7	18	8
Wolffia	0	0	0

Table 32. Species prevalence at survey points in site M-DIQ-4a in 2016.

SITE	M-DIQ-4a		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	15	25	25
POINTS	27	27	27
Bidens beckii	0	0	0
Butomus umbellatus	6	3	1
Ceratophyllum demersum	0	4	5
Chara	27	27	25
Drepanocladus	1	0	0
Elodea canadensis	0	0	1
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	2	0	0
Myriophyllum sibiricum	4	8	7
Najas flexilis	0	0	3
Nitella	0	0	0
Nymphaea odorata	1	2	1
Nuphar lutea	0	0	1
Potamogeton crispus	2	0	2
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	16	18	12
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	14	16	8
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	4	12	6
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	0	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	3	2
Vallisneria americana	15	17	14
Wolffia	0	0	0

Table 33. Species prevalence at survey points in site M-DIQ-4b in 2016.

SITE	M-DIQ-4b		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	15	25	25
POINTS	6	6	6
Bidens beckii	0	0	0
Butomus umbellatus	4	0	0
Ceratophyllum demersum	0	0	0
Chara	6	6	6
Drepanocladus	0	0	1
Elodea canadensis	0	0	0
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	1	0	2
Najas flexilis	0	1	1
Nitella	0	0	0
Nymphaea odorata	1	1	3
Nuphar lutea	0	3	0
Potamogeton crispus	1	0	0
Potamogeton foliosus	0	0	2
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	3	1	1
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	5	6	6
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	1	3	3
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	5	4	3
Typha angustifolia	0	1	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	1	0	0
Wolffia	0	0	0

Table 34. Species prevalence at survey points in site M-DIQ-5 in 2016.

SITE	M-DIQ-5		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	15	25	25
POINTS	31	31	31
Bidens beckii	0	0	0
Butomus umbellatus	1	6	8
Ceratophyllum demersum	0	7	13
Chara	31	31	31
Drepanocladus	0	1	0
Elodea canadensis	0	4	2
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	4	11	15
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	2	0
Nuphar lutea	0	1	0
Potamogeton crispus	4	1	0
Potamogeton foliosus	1	8	1
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	22	25	21
Potamogeton natans	0	1	0
Potamogeton praelongus	0	0	1
Potamogeton richardsonii	11	15	21
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	1	7	10
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	1	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	5	9	18
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	2	0
Vallisneria americana	9	13	17
Wolffia	0	0	0

Table 35. Species prevalence at survey points in site M-DIQ-6 in 2016.

SITE	M-DIQ-6		
YEAR	2016	2016	2016
MONTH	JUNE	JULY	AUG
DAY	15	25	25
POINTS	36	36	36
Bidens beckii	0	0	0
Butomus umbellatus	16	2	0
Ceratophyllum demersum	7	18	17
Chara	15	15	14
Drepanocladus	0	1	0
Elodea canadensis	14	7	2
Heteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	1	0	0
Lemna trisulca	5	22	9
Myriophyllum sibiricum	16	14	14
Najas flexilis	0	1	1
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	1	0
Potamogeton crispus	3	0	0
Potamogeton foliosus	5	2	2
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	19	13	19
Potamogeton natans	0	0	1
Potamogeton praelongus	17	15	2
Potamogeton richardsonii	15	7	13
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	28	17	13
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	6	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	5	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	8	5
Vallisneria americana	9	16	13
Wolffia	0	0	0