Management of Flowering Rush Using the Contact Herbicide Diquat in Detroit Lakes, Minnesota 2014

A report to the Pelican River Watershed District

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Geosystems Research Institute Report 5065

April 2015

MISSISSIPPI STATE UNIVERSITY

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Executive Summary

Conclusions

- Based on field evaluations, 2014 submersed treatments with the contact herbicide diquat have resulted in a decrease in rhizome bud density of flowering rush for the third year in a row.
- 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 for ongoing assessment to increase the number of cores taken per plot from thirty to forty to reduce variability, and reduce the number of plots for biomass sampling to six –three treated and three reference.

Cite as:

Turnage, G. and J. D. Madsen. 2014. Management of Flowering Rush Using the Contact Herbicide Diquat in Detroit Lakes, Minnesota 2014. Geosystems Research Institute Report 5065, Geosystems Research Institute, Mississippi State University, Mississippi State, MS. March 2015.

Introduction

Flowering rush (*Butomus umbellatus* L.) is an emergent invasive plant that has invaded the Detroit Lakes area, in particular, 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 lake for at least three decades.

Although flowering rush has been in North America for over forty years, very little useful 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. 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.

Materials and Methods

Treatments were made to manage flowering rush populations at designated treatment areas (Tables 1-2; Figures 2-3) 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 were applied; as per the US EPA label (Table 1). The target water column concentration was 0.37 ppm of diquat. Treatments occurred in Big and Little Detroit (Figure 2), Curfman Bay (Figure 2), Sallie (Figure 3), and Melissa Lakes (Figure 3; Tables 1-3). 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, and assessed the impact of submersed applications on aquatic plant communities using a point intercept method.

Biomass estimates. Assessment of both submersed and emergent treatments in this system were done by sampling biomass collected with a 6" diameter biomass coring device to collect both shoots and rhizomes (Figure 4; Madsen et al. 2007). Thirty cores per plot were collected before each proposed treatment, and at the end of the growing season in September (Table 3). After washing to remove sediment, cores were held on ice until returned to campus. Cores 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 50C or greater, and weighed for biomass. Successful applications should reduce rhizome weight and rhizome bud number. Four treatment and three reference plots (Table 3) were sampled for biomass; for a total 210 biomass samples per time. Biomass samples were taken at predetermined points randomly selected from the point intercept points (below) of those plots. For post treatment samples, thirty biomass samples were taken from each plot. Statistical analysis of biomass data was performed using a two-way analysis of variance (ANOVA), with the two factors being treatment (diquat-treated vs. untreated reference) and time of sampling, and the interaction factor being treatment*time. Analysis was done using Statistix (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 one-way ANOVA, testing for a statistically-significant change in frequency between the three sampling dates. Analysis was done using Statistix (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). 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 two best indicators of reduction in long-term growth potential are rhizome abundance , which may be measured by belowground biomass since rhizomes are the dominant constituent of belowground biomass; and rhizome bud density, 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 two constituents indicate long-term control.

Rhizome bud density was significantly reduced in diquat treated plots in 2013, and again in 2014 (Figure 5). The two-way ANOVA was significant ($p<0.0001$) for treatment effect. On average, bud density of diquat treated plots was 78% lower than pre-treatment reference plots after one treatment and 96% less than the pre-treatment reference plot bud densities after two treatments.

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 6). Bud densities in reference plots was not statistically significantly lower than previous years (Figure 6). However, bud densities in diquat treated plots has significantly decreased from 2013 densities (Figure 6).

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 treated plots than untreated plots by the final assessment in September (Tables 4-6; Figure 7). In many individual plots, the frequency of flowering rush was dramatically reduced (Tables 7-30). For instance, frequency of flowering rush in plot C-DIQ-3 was 48% in June, 27% after one treatment in July, and 3.3% after two treatments in September (Table 20). In general, diquat treatments resulted in reduced nuisance from flowering rush growth.

Average species richness per point in diquat treated plots did not decline over the course of the growing season (Figure 8). As in 2013, we assessed plant frequency for all diquat treated (Table 4) and untreated (Table 5) plots, determining which species had a significant change over time.

Diquat-treated plots had four more “increasers” and five more “decreasers” over time than reference plots (Table 6), indicating small to moderate change in frequency with treatments.

Given that there are 24 individual plots, an analysis of each plot will not be discussed. Readers may examine each plot at their leisure (Tables 7-30).

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

Conclusions

- Field evaluations of 2014 treatments with the contact herbicide diquat have resulted in a decrease in rhizome bud density of flowering rush.
- 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 for ongoing assessment to increase the number of cores taken per plot from thirty to forty to reduce variability, and reduce the number of plots for biomass sampling to six –three treated and three reference.

Acknowledgements

This research was supported by the Pelican River Watershed District, with additional support from the Minnesota Department of Natural Resources. Professional Lake Management (PLM) performed the herbicide treatments, and provided information on those treatments. Field and laboratory assistance was provided by Lee Bryant and Mary McGee from Mississippi State University and Brent Alcott, Emily Nelson, and Alex Courneya from the Pelican River Watershed.

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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. Treatment ("DIQ") and reference ("REF") plots for Detroit Lakes, MN, for 2014. To view treatment plots for 2012 and 2013, refer to Madsen et al. 2013 and 2014.

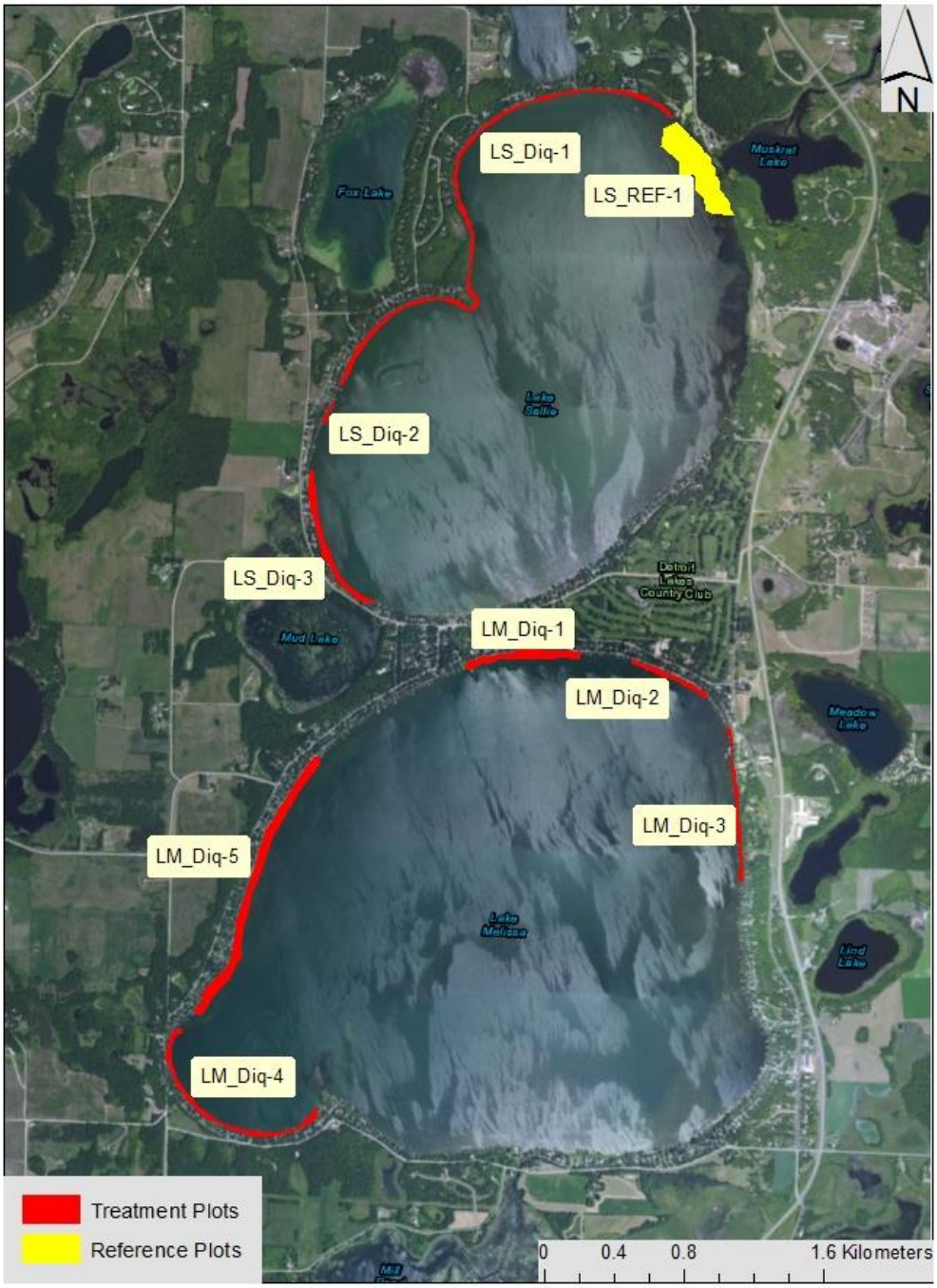

Figure 3. Treatment ("DIQ") and reference ("REF") plots for Lakes Sallie and Melissa, MN, for 2014. To view treatment plots for 2012 and 2013, refer to Madsen et al. 2013 and 2014.

Figure 4. The 6” diameter coring device used to collect aboveground and belowground biomass of flowering rush in the Detroit Lakes.

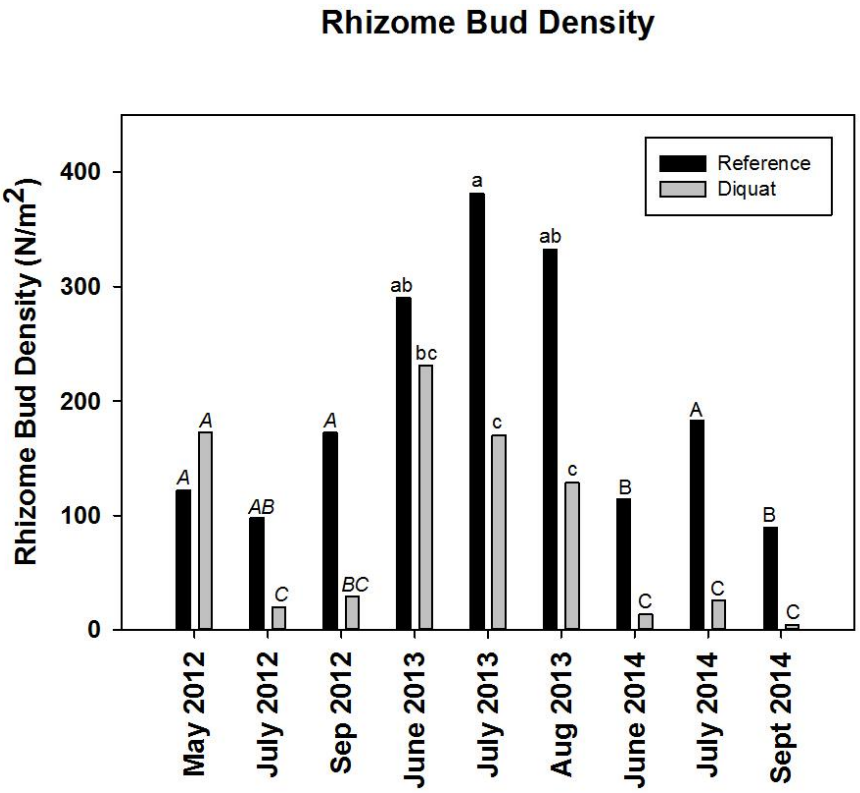

Figure 5. Rhizome bud density (N/m^2) for May, July, and September of 2012; June, July and August of 2013; and June, July, and September 2014; of reference (untreated) and diquat-treated plots in the Detroit Lake Systems. Bars sharing the same letter within a year are not significantly different from one another. Means comparison by LSD, p=0.05, comparing means of treatments and months within a year. Therefore, comparisons for 2012 are capital italics, for 2013 are lower case, and for 2014 are upper case. Plots varied between the three years. Data for 2012 and 2013 are from Madsen et al. 2014. Diquat plots treated after the first two sampling dates each year.

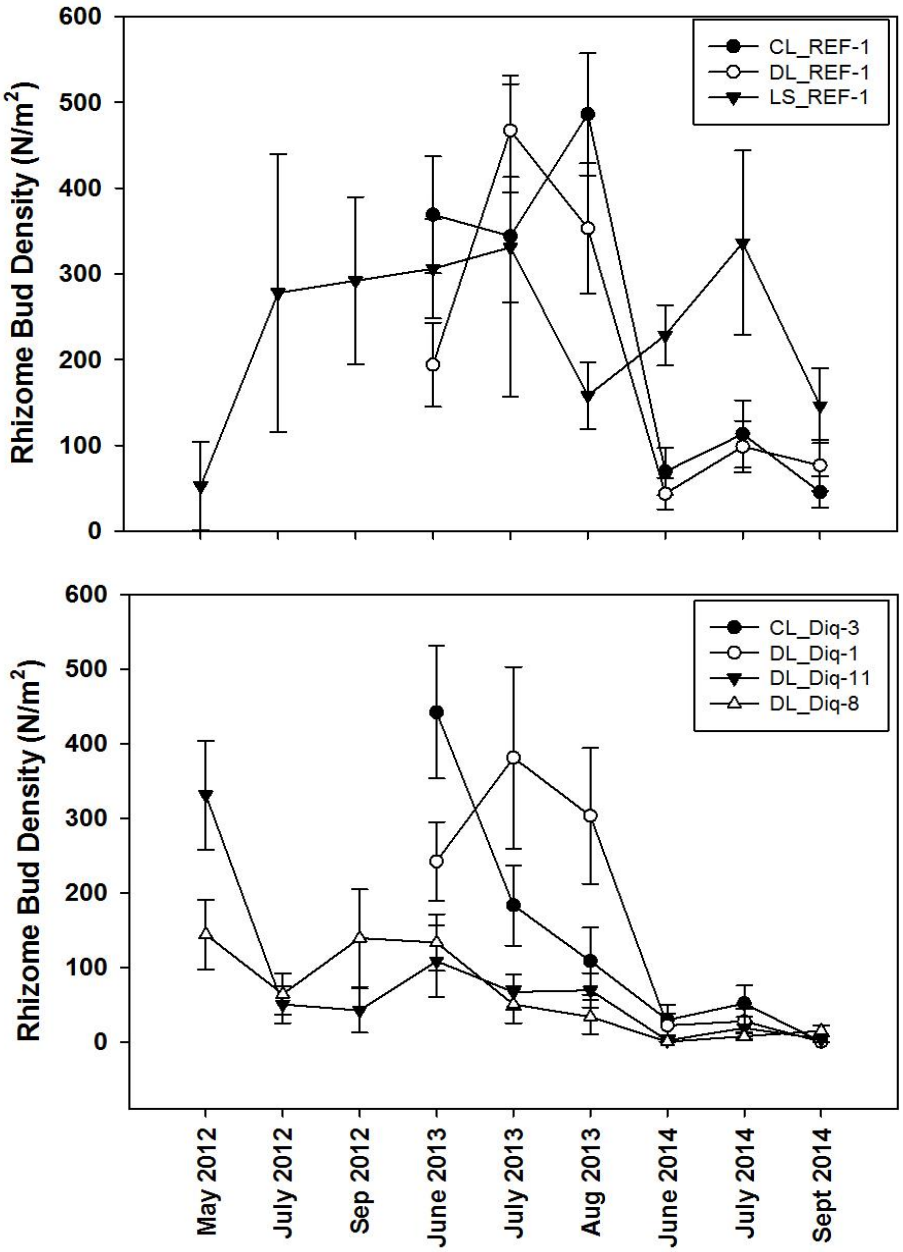

Figure 6. Rhizome bud density (N/m^2) for reference (top) and treatment (bottom) plots in the Detroit Lakes system from 2013 and 2014. See table 2 for a key to plots and their treatments in respective years. Points are the means for twenty samples in 2013 and 30 samples in 2014 per plot per time interval, and the bars indicate one standard error of the mean. Diquat plots treated after the June and July sampling.

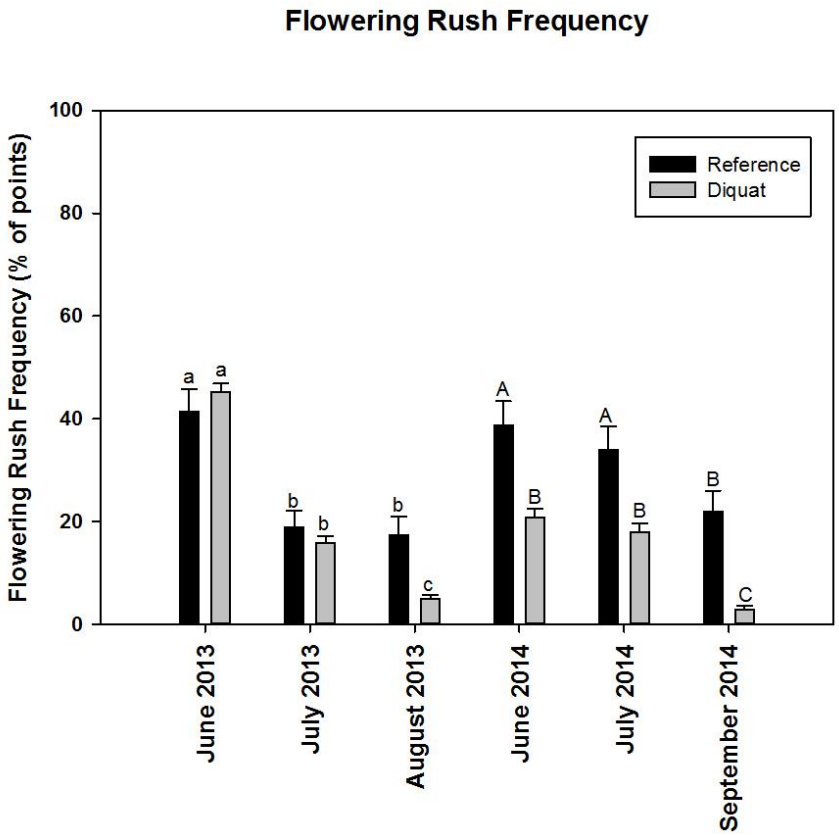

Figure 7. Percent frequency of flowering rush in June, July, and August of 2013 and June, July, and September of 2014 in plots on Detroit Lakes system, MN. Lower case letters are for 2013 data and upper case are for 2014 data. Different letters indicate that the means are different according to ANOVA at the p-0.05 level. Diquat plots treated after the June and July sampling.

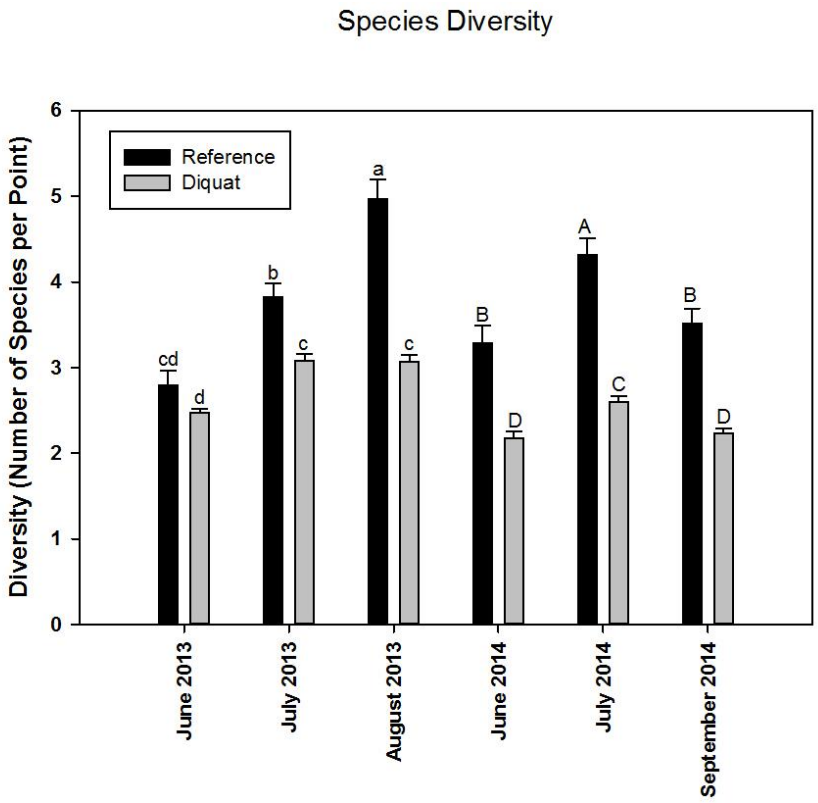

Figure 8. Species diversity (as average number of species per point) in reference and diquat-treated plots in the Detroit Lake system in 2013 and 2014. Diquat plots treated after the June and July sampling. Lower case letters are for 2013 data and upper case are for 2014 data. Different letters indicate that the means are statistically different according to ANOVA at the p-0.05 level.

Table 1. Diquat[1] treatment dates, areas, and volumes along with application conditions. Weather data from application records (PLM Lake and Land Management Corporation, unpubl. records) for herbicide treatments in Detroit Lakes in 2014.

Basins	Area (acres)	Volume of Formulated Herbicide (gallons)	Rate (gal./acre-ft)	Wind Direction (cardinal)	Wind Speed (mph)
First diquat application, June 21, 2014					
Detroit and Little Detroit	171.9	343.8	0.5	NNW	5-10
Curfman	13.2	26.4	0.5	NNW	0-5
Melissa	19.8	39.6	0.5	NNW	0-5
Sallie	23.5	47	0.5	NNW	0-5
Second diquat application, August 1, 2014					
Detroit and Little Detroit	171.9	343.8	0.5	NW	5-10
Curfman	13.2	26.4	0.5	NW	5-10
Melissa	19.8	39.6	0.5	NW	5-10
Sallie	23.5	47	0.5	NW	0-5

[1]Tribune, Syngenta Crop Protection, Greensboro, NC

Table 2. Treatment and reference plot names for Detroit Lakes basins for 2014, with the 2013 plot designation, plot area, approximate amount of diquat applied per treatment, total treatment amount, and other notes. All diquat numbers are approximations as exact values is unknown.

Lake	2014 Plot Designation	2013 Plot Designation	Area (acres)	Diquat (gal) per trt time	Total Diquat (gal)	Notes
Curfman	CL_Diq-1	CL_Diq-1	1.4	0	0	Untreated
Curfman	CL_REF-1	CL_Diq-2	2.2	NA	NA	Reference
Curfman	CF_Diq-3	CL_Diq-3	13.3	13.2	26.4	
Little Detroit	DL_Diq-1	DL_Diq-1	4.0	8.0	16.0	
Little Detroit	DL_Diq-2	DL_Diq-2	5.6	11.2	22.4	
Little Detroit	DL_Diq-3	DL_Diq-3	9.5	19.0	38.0	
Big Detroit	DL_Diq-4	DL_Diq-4	6.9	13.8	27.6	
Big Detroit	DL_Diq-5	DL_Diq-5	11.0	22.0	44.0	
Big Detroit	DL_Diq-6	DL_Diq-6	19.3	38.7	77.4	
Big Detroit	DL_Diq-7	None	5.4	10.7	21.4	
Big Detroit	DL_Diq-8	DL_Diq-8	83.4	166.8	333.6	
Big Detroit	DL_Diq-9 (Part)	DL_Diq-9	4.2	8.5	17.0	
Big Detroit	DL_Diq-10 (Part)	DL_Diq-10	8.3	16.5	33.0	
Big Detroit	DL_Diq-11	DL_Diq-7	14.7	29.5	58.9	
Big Detroit	DL_REF-1	DL_Diq-11_REF	6.4	NA	NA	Reference
Melissa	LM_Diq-1	LM_Diq-1	7.4	14.8	29.6	
Melissa	LM_Diq-2	LM_Diq-2	3.4	6.7	13.4	
Melissa	LM_Diq-3	LM_Diq-3 (Part)	4.1	1.0	2.0	
Melissa	LM_Diq-4	LM_Diq-7 (Part)	7.9	4.0	8.0	
Melissa	LM_Diq-5	LM_Diq-8	20.1	0	0	Untreated
Sallie	LS_REF-1	LS_REF-1	21.0	NA	NA	Reference
Sallie	LS_Diq-1	LS_Diq-1	16.5	32.9	65.8	
Sallie	LS_Diq-2	LS_Diq-2	0.8	1.5	3.0	
Sallie	LS_Diq-3	LS_Diq-3	7.7	15.4	30.8	
TOTAL			284.5	434.2	868.4	

Table 3. Seven sites at which thirty biomass samples were collected in June, July, and September of 2014.

Lake	2014 Plot Designation	2013 Plot Designation	Area (acres)	Notes
Curfman	CL_REF-1	CL_Diq-2	2.20	Reference
Curfman	CL_Diq-3	DL_Diq-3	13.27	Treatment
Little Detroit	DL_Diq-1	DL_Diq-1	4.00	Treatment
Big Detroit	DL_Diq-11	DL_Diq-7	14.73	Treatment
Big Detroit	DL_Diq-8	DL_Diq-8	83.40	Treatment
Big Detroit	DL_REF-1	DL_Ref_1	6.41	Reference
Sallie	LS_REF-1	LS_Ref-1	21.01	Reference

Table 4. Point intercept frequency of species in all diquat-treated plots in the Detroit Lakes system, 2014 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= 491, 493, 490; respectively.

Common	Scientific	CODE	June	July	Sep	P-value
Water marigold	*Bidens beckii*	BBEC	0	0	0	M
Flowering rush	*Butomus umbellatus*	BUMB	102	88	14	**<0.0001**
Coontail	*Ceratophyllum demersum*	CDEM	21	14	47	**<0.0001**
Chara	*Chara*	chara	318	422	402	**<0.0001**
Water moss	*Drepanocladus*	DREP	54	45	73	**0.0161**
Elodea	*Elodea canadensis*	ECAN	0	0	0	M
Water stargrass	*Heteranthera dubia*	HDUB	7	0	0	**0.0009**
Brownfruit rush	*Juncus pelocarpus*	JPEL	0	0	0	M
Common duckweed	*Lemna minor*	LMIN	0	1	0	0.3697
Star duckweed	*Lemna trisulca*	LTRI	62	17	33	**<0.0001**
Northern watermilfoil	*Myriophyllum sibiricum*	MSIB	31	26	9	**0.0019**
Bushy naiad	*Najas flexilis*	NFLEX	0	50	17	**<0.0001**
Nitella	*Nitella*	NITEL	6	0	1	**0.0116**
White waterlily	*Nymphaea odorata*	NODOR	2	11	9	**0.0461**
Yellow pondlily	*Nuphar lutea*	NVARI	23	25	26	0.9036
Curlyleaf pondweed	*Potamogeton crispus*	PCRI	45	0	1	**<0.0001**
Leafy pondweed	*Potamogeton foliosus*	PFOL	27	8	2	**<0.0001**
Variable pondweed	*Potamogeton gramineus*	PGRAM	0	0	0	M
Illinois pondweed	*Potamogeton illinoensis*	PILL	82	93	32	**<0.0001**
Floating pondweed	*Potamogeton nataus*	PNAT	0	1	4	0.0729
Whitestem pondweed	*Potamogeton praelongus*	PPRA	3	0	2	0.2444
Richardson's pondweed	*Potamogeton richardsonii*	PRICH	102	119	98	0.2458
Robbin's pondweed	*Potamogeton robbbinsii*	PROBB	0	0	0	M
Flatstem pondweed	*Potamogeton zosteriformis*	PZOS	90	87	40	**<0.0001**
Widgeongrass	*Ruppia cirrhosa*	RCIRR	0	0	0	M
White water buttercup	*Ranunculus longirostris*	RLON	12	4	5	0.0633
Hardstem bulrush	*Schoenoplectus acutus*	SACU	28	25	26	0.9559
Arumleaf arrowhead	*Sagittaria cuneata*	SCUN	0	0	0	M
Sago pondweed	*Stuckenia pectinata*	SPEC	12	5	0	**0.0015**
Narrowleaf cattail	*Typha angustifolia*	TANG	0	4	0	**0.0185**
Broadleaf cattail	*Typha latifolia*	TLAT	4	1	2	0.3649
Common bladderwort	*Utricularia macrorhiza*	UMAC	1	0	0	0.3675
Watercelery	*Vallisneria americana*	VAME	39	233	246	**<0.0001**
Watermeal	*Wolffia*	WOOLF	0	0	4	**0.0179**
Total species richness		SPP	22	21	22	
Native species richness		NATSPP	20	20	20	

Table 5. Point intercept frequency of species in all untreated reference plots in the Detroit Lakes system, 2014 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= 106, 109, 109; respectively.

Common	Scientific	CODE	June	July	Sep	P-value
Water marigold	*Bidens beckii*	BBEC	0	0	0	M
Flowering rush	*Butomus umbellatus*	BUMB	41	37	24	**0.0253**
Coontail	*Ceratophyllum demersum*	CDEM	23	36	45	**0.0087**
Chara	*Chara*	chara	45	63	54	0.0797
Water moss	*Drepanocladus*	DREP	5	4	9	0.3028
Elodea	*Elodea canadensis*	ECAN	0	6	4	0.0604
Water stargrass	*Heteranthera dubia*	HDUB	1	0	0	0.3576
Brownfruit rush	*Juncus pelocarpus*	JPEL	0	0	0	M
Common duckweed	*Lemna minor*	LMIN	0	2	2	0.3747
Star duckweed	*Lemna trisulca*	LTRI	21	24	29	0.4805
Northern watermilfoil	*Myriophyllum sibiricum*	MSIB	13	30	27	**0.0155**
Bushy naiad	*Najas flexilis*	NFLEX	0	13	6	**0.0010**
Nitella	*Nitella*	NITEL	1	0	1	0.6012
White waterlily	*Nymphaea odorata*	NODOR	9	12	9	0.7407
Yellow pondlily	*Nuphar lutea*	NVARI	18	25	19	0.4641
Curlyleaf pondweed	*Potamogeton crispus*	PCRI	31	0	1	**<0.0001**
Leafy pondweed	*Potamogeton foliosus*	PFOL	6	6	0	**0.0428**
Variable pondweed	*Potamogeton gramineus*	PGRAM	0	0	0	M
Illinois pondweed	*Potamogeton illinoensis*	PILL	17	32	29	0.0557
Floating pondweed	*Potamogeton natans*	PNAT	1	1	1	0.9997
Whitestem pondweed	*Potamogeton praelongus*	PPRA	8	2	0	**0.0040**
Richardson's pondweed	*Potamogeton richardsonii*	PRICH	16	29	12	**0.0071**
Robbin's pondweed	*Potamogeton robbbinsii*	PROBB	0	0	0	M
Flatstem pondweed	*Potamogeton zosteriformis*	PZOS	38	30	23	**<0.0001**
Widgeongrass	*Ruppia cirrhosa*	RCIRR	0	0	0	M
White water buttercup	*Ranunculus longirostris*	RLON	11	13	5	0.1365
Hardstem bulrush	*Schoenoplectus acutus*	SACU	17	19	19	0.9522
Arumleaf arrowhead	*Sagittaria cuneata*	SCUN	0	0	0	M
Sago pondweed	*Stuckenia pectinata*	SPEC	5	9	2	0.0912
Narrowleaf cattail	*Typha angustifolia*	TANG	1	1	0	0.6012
Broadleaf cattail	*Typha latifolia*	TLAT	6	11	8	0.4788
Common bladderwort	*Utricularia macrorhiza*	UMAC	0	2	0	0.1383
Watercelery	*Vallisneria americana*	VAME	14	34	54	**<0.0001**
Watermeal	*Wolffia*	WOOLF	0	0	0	M
Total species richness		SPP	23	24	22	
Native species richness		NATSPP	21	23	20	

Table 6. Dynamics of species in diquat-treated and untreated reference plots in the Detroit Lake system across three months in 2013; where a "+" indicates species that statistically increased, a "0" indicate species with no significant change, and a "-" indicates species with a significant decrease in frequency at points.

Common	Scientific	CODE	Diquat	Reference
Water marigold	*Bidens beckii*	BBEC	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	0
Water stargrass	*Heteranthera dubia*	HDUB	-	0
Brownfruit rush	*Juncus pelocarpus*	JPEL	0	0
Common duckweed	*Lemna minor*	LMIN	0	0
Star duckweed	*Lemna trisulca*	LTRI	-	0
Northern watermilfoil	*Myriophyllum sibiricum*	MSIB	-	+
Bushy naiad	*Najas flexilis*	NFLEX	+	+
Nitella	*Nitella*	NITEL	-	0
White waterlily	*Nymphaea odorata*	NODOR	+	0
Yellow pondlily	*Nuphar lutea*	NVARI	0	0
Curlyleaf pondweed	*Potamogeton crispus*	PCRI	-	-
Leafy pondweed	*Potamogeton foliosus*	PFOL	-	-
Variable pondweed	*Potamogeton gramineus*	PGRAM	0	0
Illinois pondweed	*Potamogeton illinoensis*	PILL	-	0
Floating pondweed	*Potamogeton natans*	PNAT	0	0
Whitestem pondweed	*Potamogeton praelongus*	PPRA	0	-
Richardson's pondweed	*Potamogeton richardsonii*	PRICH	0	-
Robbin's pondweed	*Potamogeton robbbinsii*	PROBB	0	0
Flatstem pondweed	*Potamogeton zosteriformis*	PZOS	-	-
Widgeongrass	*Ruppia cirrhosa*	RCIRR	0	0
White water buttercup	*Ranunculus longirostris*	RLON	0	0
Hardstem bulrush	*Schoenoplectus acutus*	SACU	0	0
Arumleaf arrowhead	*Sagittaria cuneata*	SCUN	0	0
Sago pondweed	*Stuckenia pectinata*	SPEC	-	0
Narrowleaf cattail	*Typha angustifolia*	TANG	+	0
Broadleaf cattail	*Typha latifolia*	TLAT	0	0
Common bladderwort	*Utricularia macrorhiza*	UMAC	0	0
Watercelery	*Vallisneria americana*	VAME	+	+
Watermeal	*Wolffia*	WOOLF	+	0
	Increasers		8	4
	No change		16	24
	Decreasers		11	6

Table 7. Species prevalence at survey points in site DL-DIQ-1 in 2014.

SITE	DL-DIQ-1		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	17	28	11
POINTS	20	20	20
Bidens beckii	0	0	0
Butomus umbellatus	12	7	2
Ceratophyllum demersum	0	0	1
Chara	17	17	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	1	1
Myriophyllum sibiricum	0	0	0
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	3	2	5
Potamogeton crispus	0	0	0
Potamogeton foliosus	0	1	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	9	9	5
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	6	10	8
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	5	5	1
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	9	7	8
Sagittaria cuneata	0	0	0
Stuckenia pectinata	0	0	0
Typha angustifolia	0	0	0
Typha latifolia	0	1	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	2	13	16
Wolffia	0	0	0

Table 8. Species prevalence at survey points in site DL-DIQ-2 in 2014.

SITE	DL-DIQ-2		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	28	11
POINTS	24	24	24
Bidens beckii	0	0	0
Butomus umbellatus	0	1	0
Ceratophyllum demersum	0	0	1
Chara	22	21	20
Drepanocladus	0	0	0
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	0	0	0
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	1	1	1
Potamogeton crispus	1	0	0
Potamogeton foliosus	2	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	4	8	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	6	8	4
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	3	4	1
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	0	0
Vallisneria americana	0	9	2
Wolffia	0	0	0

Table 9. Species prevalence at survey points in site DL-DIQ-3 in 2014.

SITE	DL-DIQ-3		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	28	11
POINTS	25	25	25
Bidens beckii	0	0	0
Butomus umbellatus	10	15	5
Ceratophyllum demersum	3	0	0
Chara	15	22	24
Drepanocladus	0	0	0
Elodea canadensis	0	0	0
H eteranthera dubia	1	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	2	0	0
Myriophyllum sibiricum	5	2	0
Najas flexilis	0	2	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	0	0	0
Potamogeton foliosus	7	1	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	3	5	1
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	8	16	11
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	1	11	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	2	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	4	12	14
Wolffia	0	0	0

Table 10. Species prevalence at survey points in site DL-DIQ-4 in 2014.

SITE	DL-DIQ-4		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	29	11
POINTS	31	31	31
Bidens beckii	0	0	0
Butomus umbellatus	8	2	0
Ceratophyllum demersum	0	0	2
Chara	29	31	31
Drepanocladus	0	2	1
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	0	0	0
Najas flexilis	0	2	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	0	0	0
Potamogeton foliosus	1	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	6	10	4
Potamogeton natans	0	0	1
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	2	1	0
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	2	2	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	0	0	0
Vallisneria americana	0	12	8
Wolffia	0	0	0

Table 11. Species prevalence at survey points in site DL-DIQ-5 in 2014.

SITE	DL-DIQ-5		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	17	28	11
POINTS	20	20	20
Bidens beckii	0	0	0
Butomus umbellatus	8	3	1
Ceratophyllum demersum	0	0	0
Chara	8	19	18
Drepanocladus	3	7	5
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	2	0	0
Myriophyllum sibiricum	1	1	0
Najas flexilis	0	2	0
Nitella	2	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	0	0	0
Potamogeton foliosus	1	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	6	1	2
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	3	1	2
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	2	1	2
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	0	0
Vallisneria americana	2	7	9
Wolffia	0	0	0

Table 12. Species prevalence at survey points in site DL-DIQ-6 in 2014.

SITE	DL-DIQ-6		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	17	28	11
POINTS	34	34	34
Bidens beckii	0	0	0
Butomus umbellatus	3	9	1
Ceratophyllum demersum	0	0	0
Chara	29	34	34
Drepanocladus	5	5	5
Elodea canadensis	0	0	0
H eteranthera dubia	2	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	4	0	0
Myriophyllum sibiricum	0	0	0
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	1	1	1
Potamogeton crispus	2	0	0
Potamogeton foliosus	4	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	0	2	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	8	0	2
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	9	1	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	6	19	14
Wolffia	0	0	0

Table 13. Species prevalence at survey points in site DL-DIQ-7 in 2014.

SITE	DL-DIQ-7		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	29	11
POINTS	25	25	25
Bidens beckii	0	0	0
Butomus umbellatus	3	1	0
Ceratophyllum demersum	1	1	1
Chara	9	23	14
Drepanocladus	12	3	19
Elodea canadensis	0	0	0
H eteranthera dubia	1	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	1	0
Lemna trisulca	6	3	2
Myriophyllum sibiricum	0	2	0
Najas flexilis	0	2	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	0	0	0
Potamogeton foliosus	1	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	4	5	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	1	7	7
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	2	4	2
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	25	21
Wolffia	0	0	0

Table 14. Species prevalence at survey points in site DL-DIQ-8 in 2014.

SITE	DL-DIQ-8		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	17	28	11
POINTS	44	44	44
Bidens beckii	0	0	0
Butomus umbellatus	4	4	0
Ceratophyllum demersum	0	0	0
Chara	42	44	44
Drepanocladus	6	3	0
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
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	2	2	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	4	2	0
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	16	1	2
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	0	0	0
Vallisneria americana	3	28	26
Wolffia	0	0	0

Table 15. Species prevalence at survey points in site DL-DIQ-9 in 2014.

SITE	DL-DIQ-9		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	29	11
POINTS	20	20	20
Bidens beckii	0	0	0
Butomus umbellatus	0	0	0
Ceratophyllum demersum	0	0	0
Chara	11	19	15
Drepanocladus	4	1	12
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	2	0	0
Myriophyllum sibiricum	0	0	0
Najas flexilis	0	5	4
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	2	12	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	0	5	3
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	0	5	0
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	0	0	0
Vallisneria americana	0	13	10
Wolffia	0	0	0

Table 16. Species prevalence at survey points in site DL-DIQ-10 in 2014.

SITE	DL-DIQ-10		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	29	11
POINTS	25	26	25
Bidens beckii	0	0	0
Butomus umbellatus	7	5	0
Ceratophyllum demersum	9	9	13
Chara	0	18	6
Drepanocladus	4	4	10
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	13	11	13
Myriophyllum sibiricum	9	4	2
Najas flexilis	0	1	4
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	14	0	0
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	5	11	2
Potamogeton natans	0	0	0
Potamogeton praelongus	3	0	2
Potamogeton richardsonii	1	8	0
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	3	16	10
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	5	1	4
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	1	20	10
Wolffia	0	0	0

Table 17. Species prevalence at survey points in site DL-DIQ-11 in 2014.

SITE	DL-DIQ-11		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	17	28	11
POINTS	23	23	23
Bidens beckii	0	0	0
Butomus umbellatus	10	4	3
Ceratophyllum demersum	0	0	0
Chara	17	22	22
Drepanocladus	13	11	14
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	7	0	2
Myriophyllum sibiricum	0	0	0
Najas flexilis	0	8	0
Nitella	0	0	1
Nymphaea odorata	0	0	0
Nuphar lutea	4	4	5
Potamogeton crispus	0	0	0
Potamogeton foliosus	0	1	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	1	1	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	5	2	0
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	11	1	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	1	0
Typha latifolia	1	0	1
Utricularia macrorhiza	0	0	0
Vallisneria americana	7	16	16
Wolffia	0	0	0

Table 18. Species prevalence at survey points in site DL-REF-1 in 2014.

SITE	DL-REF-1		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	29	11
POINTS	21	21	21
Bidens beckii	0	0	0
Butomus umbellatus	4	3	0
Ceratophyllum demersum	7	13	9
Chara	4	6	3
Drepanocladus	1	1	7
Elodea canadensis	0	0	0
H eteranthera dubia	1	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	4	8	9
Myriophyllum sibiricum	4	7	0
Najas flexilis	0	0	1
Nitella	0	0	0
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	9	12	9
Potamogeton natans	0	0	0
Potamogeton praelongus	7	2	0
Potamogeton richardsonii	4	4	0
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	14	19	10
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	2	6	1
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	1	1	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	3	8	13
Wolffia	0	0	0

Table 19. Species prevalence at survey points in site C-DIQ-1 in 2014.

SITE	C-DIQ-1		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	17	28	11
POINTS	8	9	9
Bidens beckii	0	0	0
Butomus umbellatus	5	3	1
Ceratophyllum demersum	3	1	1
Chara	5	8	9
Drepanocladus	0	0	1
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	1	0
Lemna trisulca	5	4	0
Myriophyllum sibiricum	0	2	7
Najas flexilis	0	0	2
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	8	7	8
Potamogeton crispus	3	0	1
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	0	1	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	1	3	1
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	4	3	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	1	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	2	0	0
Typha angustifolia	1	0	0
Typha latifolia	1	4	2
Utricularia macrorhiza	0	0	0
Vallisneria americana	3	5	8
Wolffia	0	0	0

Table 20. Species prevalence at survey points in site C-DIQ-3 in 2014.

SITE	C-DIQ-3		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	17	28	11
POINTS	33	33	30
Bidens beckii	0	0	0
Butomus umbellatus	16	9	1
Ceratophyllum demersum	3	0	4
Chara	30	30	28
Drepanocladus	2	0	1
Elodea canadensis	0	0	0
H eteranthera dubia	2	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	15	0	4
Myriophyllum sibiricum	8	3	3
Najas flexilis	0	6	3
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	9	16	13
Potamogeton crispus	11	0	1
Potamogeton foliosus	0	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	5	3	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	5	5	0
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	11	3	1
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	2	1	1
Schoenoplectus acutus	4	4	2
Sagittaria cuneata	0	0	0
Stuckenia pectinata	3	1	0
Typha angustifolia	0	2	0
Typha latifolia	3	0	1
Utricularia macrorhiza	1	0	0
Vallisneria americana	4	18	16
Wolffia	0	0	0

Table 21. Species prevalence at survey points in site C-REF-1 in 2014.

SITE	C-REF-1		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	17	28	11
POINTS	14	14	14
Bidens beckii	0	0	0
Butomus umbellatus	10	4	1
Ceratophyllum demersum	0	0	5
Chara	11	13	11
Drepanocladus	2	0	0
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	4	0	1
Myriophyllum sibiricum	0	1	1
Najas flexilis	0	0	1
Nitella	0	0	0
Nymphaea odorata	0	1	0
Nuphar lutea	4	8	4
Potamogeton crispus	2	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	1	1	1
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	8	1	0
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	0	0	0
Schoenoplectus acutus	0	4	3
Sagittaria cuneata	0	0	0
Stuckenia pectinata	1	0	0
Typha angustifolia	0	1	0
Typha latifolia	5	7	6
Utricularia macrorhiza	0	0	0
Vallisneria americana	6	11	12
Wolffia	0	0	0

Table 22. Species prevalence at survey points in site S-DIQ-1 in 2014.

SITE	S-DIQ-1		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	28	10
POINTS	42	42	42
Bidens beckii	0	0	0
Butomus umbellatus	9	19	0
Ceratophyllum demersum	1	2	9
Chara	7	26	17
Drepanocladus	1	2	1
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	4	1	9
Myriophyllum sibiricum	4	7	0
Najas flexilis	0	10	2
Nitella	3	0	0
Nymphaea odorata	2	10	9
Nuphar lutea	5	1	1
Potamogeton crispus	7	1	0
Potamogeton foliosus	3	2	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	4	5	2
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	21	25	21
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	9	15	7
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	1	1	3
Schoenoplectus acutus	2	2	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	0	1	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	4	18	33
Wolffia	0	0	0

Table 23. Species prevalence at survey points in site S-DIQ-2 in 2014.

SITE	S-DIQ-2		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	28	10
POINTS	5	5	5
Bidens beckii	0	0	0
Butomus umbellatus	1	4	0
Ceratophyllum demersum	1	0	0
Chara	2	5	5
Drepanocladus	0	0	0
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	0	0	0
Najas flexilis	0	3	0
Nitella	1	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	2	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	1	5	3
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	1	1	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	0	0	0
Vallisneria americana	0	5	5
Wolffia	0	0	0

Table 24. Species prevalence at survey points in site S-DIQ-3 in 2014.

SITE	S-DIQ-3		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	28	10
POINTS	25	25	25
Bidens beckii	0	0	0
Butomus umbellatus	5	4	1
Ceratophyllum demersum	0	1	1
Chara	14	24	23
Drepanocladus	1	1	0
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	1	0	1
Myriophyllum sibiricum	2	0	0
Najas flexilis	0	3	0
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	2	0	0
Potamogeton foliosus	3	0	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	4	1	0
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	6	8	8
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	4	5	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	0	0	0
Vallisneria americana	0	8	17
Wolffia	0	0	4

Table 25. Species prevalence at survey points in site S-REF-1 in 2014.

SITE	S-REF-1		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	28	10
POINTS	34	34	34
Bidens beckii	0	0	0
Butomus umbellatus	22	19	20
Ceratophyllum demersum	12	22	22
Chara	6	6	1
Drepanocladus	1	3	1
Elodea canadensis	0	6	4
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	1	3
Lemna trisulca	8	12	19
Myriophyllum sibiricum	9	19	19
Najas flexilis	0	9	1
Nitella	1	0	1
Nymphaea odorata	9	10	9
Nuphar lutea	6	10	7
Potamogeton crispus	14	0	0
Potamogeton foliosus	6	5	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	5	6	9
Potamogeton natans	1	0	1
Potamogeton praelongus	1	0	0
Potamogeton richardsonii	7	12	3
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	11	23	6
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	8	7	4
Schoenoplectus acutus	16	15	16
Sagittaria cuneata	0	0	0
Stuckenia pectinata	1	5	2
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	2	0
Vallisneria americana	2	8	17
Wolffia	0	0	0

Table 26. Species prevalence at survey points in site M-DIQ-1 in 2014.

SITE	M-DIQ-1		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	27	10
POINTS	17	20	20
Bidens beckii	0	0	0
Butomus umbellatus	0	0	0
Ceratophyllum demersum	0	0	4
Chara	8	14	16
Drepanocladus	1	1	0
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	0	1	0
Najas flexilis	0	2	0
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	0	1	1
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	2	4	3
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	1	1	1
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	0	0
Vallisneria americana	0	1	4
Wolffia	0	0	0

Table 27. Species prevalence at survey points in site M-DIQ-2 in 2014.

SITE	M-DIQ-2		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	27	10
POINTS	20	20	20
Bidens beckii	0	0	0
Butomus umbellatus	1	0	0
Ceratophyllum demersum	0	0	2
Chara	19	18	18
Drepanocladus	0	2	0
Elodea canadensis	0	0	0
H eteranthera 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	2
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	7	4	3
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	7	2	3
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	5	4	1
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	0	0
Vallisneria americana	3	5	7
Wolffia	0	0	0

Table 28. Species prevalence at survey points in site M-DIQ-3 in 2014.

SITE	M-DIQ-3		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	27	10
POINTS	30	28	30
Bidens beckii	0	0	0
Butomus umbellatus	1	0	0
Ceratophyllum demersum	1	1	6
Chara	24	17	28
Drepanocladus	0	1	0
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	0	4	4
Najas flexilis	0	3	1
Nitella	0	0	0
Nymphaea odorata	0	0	0
Nuphar lutea	0	0	0
Potamogeton crispus	5	0	0
Potamogeton foliosus	4	2	1
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	13	8	9
Potamogeton natans	0	1	3
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	9	4	15
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	2	2	6
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	1	0	0
Schoenoplectus acutus	12	12	13
Sagittaria cuneata	0	0	0
Stuckenia pectinata	0	0	0
Typha angustifolia	0	1	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	0	1	3
Wolffia	0	0	0

Table 29. Species prevalence at survey points in site M-DIQ-4 in 2014.

SITE	M-DIQ-4		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	27	10
POINTS	27	27	27
Bidens beckii	0	0	0
Butomus umbellatus	3	1	0
Ceratophyllum demersum	2	0	3
Chara	15	18	19
Drepanocladus	1	2	5
Elodea canadensis	0	0	0
H eteranthera dubia	1	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	4	1	1
Myriophyllum sibiricum	1	2	0
Najas flexilis	0	0	0
Nitella	0	0	0
Nymphaea odorata	0	1	0
Nuphar lutea	0	0	0
Potamogeton crispus	2	0	0
Potamogeton foliosus	1	0	1
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	7	3	3
Potamogeton natans	0	0	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	7	6	6
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	3	5	6
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	1	1	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	0	0
Vallisneria americana	1	3	15
Wolffia	0	0	0

Table 30. Species prevalence at survey points in site M-DIQ-5 in 2014.

SITE	M-DIQ-5		
YEAR	2014	2014	2014
MONTH	JUNE	JULY	SEPT
DAY	18	27	10
POINTS	29	31	31
Bidens beckii	0	0	0
Butomus umbellatus	0	8	2
Ceratophyllum demersum	1	0	8
Chara	19	30	30
Drepanocladus	1	0	0
Elodea canadensis	0	0	0
H eteranthera dubia	0	0	0
Juncus pelocarpus	0	0	0
Lemna minor	0	0	0
Lemna trisulca	0	0	0
Myriophyllum sibiricum	0	1	0
Najas flexilis	0	4	1
Nitella	0	0	0
Nymphaea odorata	0	1	0
Nuphar lutea	0	0	0
Potamogeton crispus	0	0	0
Potamogeton foliosus	0	1	0
Potamogeton gramineus	0	0	0
Potamogeton illinoensis	0	13	11
Potamogeton natans	0	1	0
Potamogeton praelongus	0	0	0
Potamogeton richardsonii	3	15	7
Potamogeton robbinsii	0	0	0
Potamogeton zosteriformis	1	14	7
Ruppia cirrhosa	0	0	0
Ranunculus longirostris	1	0	0
Schoenoplectus acutus	0	0	0
Sagittaria cuneata	0	0	0
Stuckenia pectinata	0	3	0
Typha angustifolia	0	0	0
Typha latifolia	0	0	0
Utricularia macrorhiza	0	0	0
Vallisneria americana	0	2	4
Wolffia	0	0	0