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Effects of Carp on the Survival and Growth of Aquatic Plants in Rice Lake *(DOW# 27-0116)*

Prepared for the Rice Lake Area Association – December 2010
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Introduction

Aquatic plants play an important role in freshwater lakes, affecting nutrient cycling, water clarity, food-web interactions, and fish productivity (Jeppeson et al. 1998). These effects are particularly apparent in shallow lakes, where much of the lake bottom may receive sufficient light to support plants (Scheffer 2004). However, fertile shallow lakes do not always support abundant plants. Instead, they generally exhibit one of two conditions: a clear water condition dominated by abundant aquatic vegetation, or a turbid, algae-dominated condition with very little aquatic vegetation (Scheffer 2004). In these fertile shallow lakes, destruction of aquatic plants often leads to a persistent algae-dominated state.

Previous studies have shown that common carp (*Cyprinus carpio*) can severely reduce submersed aquatic vegetation through direct uprooting or herbivory (Cahn 1929; Crivelli 1983; Sidorkewicj et al. 1998; Evelsizer and Turner 2006; Miller and Crowl 2006; Bajer et al. 2009). Furthermore, in lakes with super-abundant carp (>100 lbs/acre), these fish can result in nearly total loss of vegetation (Bajer et al. 2009). Such loss of aquatic plants effectively condemns fertile, shallow lakes to a persistent algae-dominated state.

Rice Lake (Hennepin Co., MN) is a classic example of a fertile shallow lake in the algae-dominated state. In recent years, the Rice Lake Area Association (RLAA) has proposed hiring a commercial fisherman to remove adult carp from the lake, with the idea that this would allow greater survival and growth of plants, reduce internal nutrient loading, improve water clarity, and reduce the frequency and severity of summer blue-green algae blooms. Before conducting this large-scale removal of carp, the RLAA wanted to determine if such a removal would increase plant growth, and whether transplantings would be needed to establish plants in some areas. In 2010, the RLAA contracted with Freshwater Scientific Services, LLC to conduct a carp exclosure experiment to determine the effects of carp on plants in the lake, and to assess which plant species would be the best candidates for transplanting to areas devoid of vegetation. This report summarizes the methodology and results from this study.

Study Lake

Rice Lake (45°06’54”N, 93°27”58”W; DOW# 27-0116) is a 315-acre shallow (12 ft max depth), eutrophic, drainage lake in Hennepin County, MN (Figures 1 and 2). The lake’s hydrology is largely driven by Elm Creek, which drains an area of approximately 20 square miles upstream of the lake. Rice Lake typically has low water clarity (2 to 3 ft), high total phosphorus (200 to 300 µg/L), and high chlorophyll-a (50 to 100 µg/L) during the summer months (Figure 3). The lake also experiences frequent, severe blue-green algae blooms. These blooms are most prevalent in mid to late summer, with less severe blooms in the early summer.

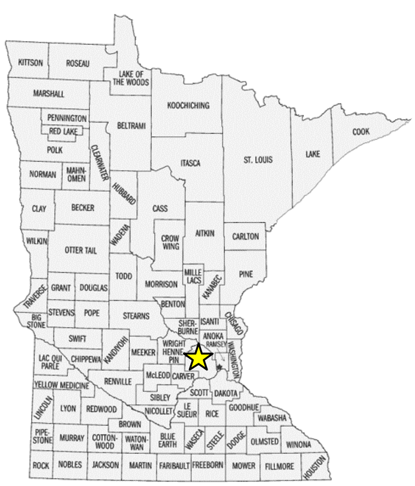

Figure 1. Location of Rice Lake

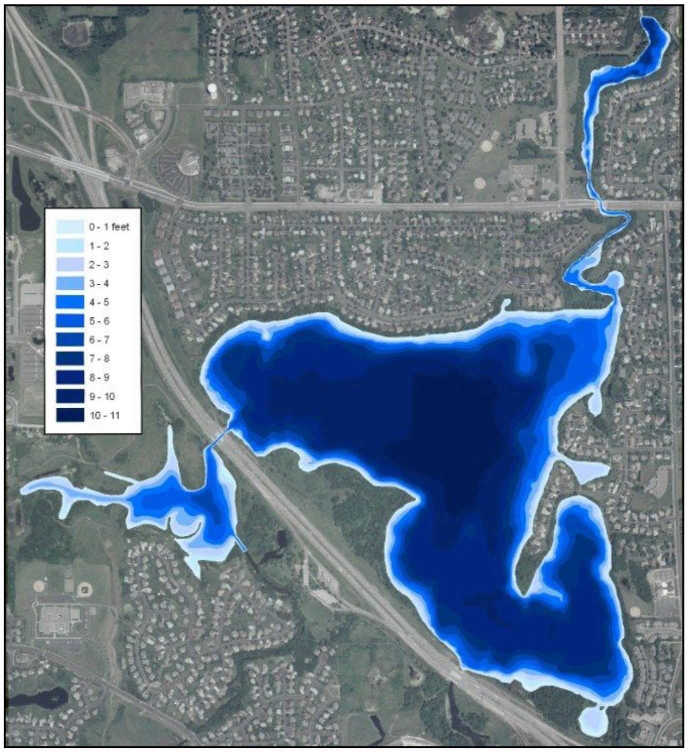

Figure 2. Depth-contour map showing the main basin of Rice Lake (east) and the smaller, isolated western bay.

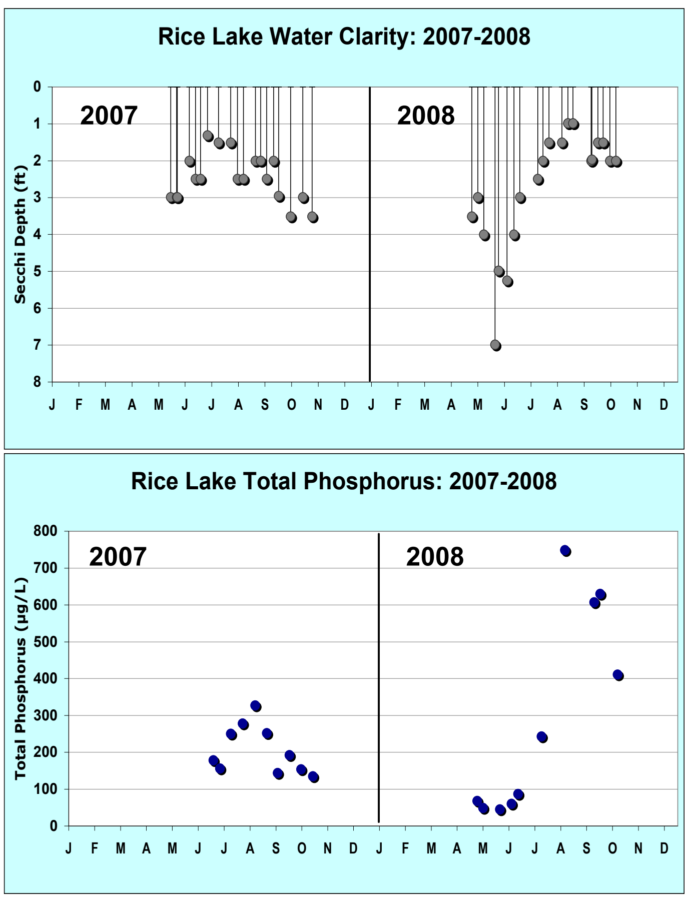

Figure 3. Water clarity (Secchi depth) and total phosphorus in Rice Lake; 2007 and 2008. Samples collected by Blue Water Science and lake volunteers (Minnesota Citizen Lake Monitoring Program)

Aquatic Plants in Rice Lake

Recent vegetation surveys have shown that the main basin of Rice Lake generally supports very little plant growth (Table 1). In 2009, the sparse plant community in this basin was dominated by curlyleaf pondweed (*Potamogeton crispus*) and Eurasian watermilfoil (*Myriophyllum spicatum*), with sago pondweed (*Stuckenia pectinata),* coontail (*Ceratophyllum demersum*), Canadian waterweed (*Elodea canadensis)* and horned pondweed (*Zannichellia palustris*) being the only native submersed plants (Table 2). In general, plant growth was very sparse and limited to areas shallower than 4 ft. Furthermore, the percent area vegetated in the main basin decreased from 13% of the lake in June to only 1% in August. Although these surveys found sparse plant growth and low native plant diversity in the main basin, the isolated smaller western basin had dramatically higher plant density and diversity that persisted throughout the summer and supported additional taxa not found in the main basin (Tables 1 and 2).

Table 1. Summary of aquatic plant community metrics in the main basin and western bay of Rice Lake in 2009; point-intercept vegetation surveys conducted by Freshwater Scientific Services, LLC.

	Main Basin		Western Bay	
	Jun	*Aug*	*Jun*	*Aug*
# of Points Sampled	178	178	18	18
% Vegetated *(all littoral)*	13	1	100	100
% Surface Growth	10	1	72	61
Max Depth of Growth *(ft)*	7.5	3.0	6.3	6.6
# of Native Plant Species	5	4	7	8
Avg # of Natives per Point	0.2	<0.1	2.9	3.1
Avg Curlyleaf Density *(0-5)*	0.1	0.0	0.6	0.1
Avg E. Milfoil Density *(0-5)*	<0.1	<0.1	0.0	0.0

Table 2. Littoral frequency (% occurrence) of submersed aquatic plant taxa in the main basin and western bay of Rice Lake in 2009; point-intercept vegetation surveys conducted by Freshwater Scientific Services, LLC.

	Main Basin		Western Bay	
	Jun	*Aug*	*Jun*	*Aug*
Curlyleaf pondweed	7	-	28	11
Eurasian watermilfoil	2	1	-	-
Coontail	9	P	100	100
Sago pondweed	6	-	39	44
Elodea	1	-	39	17
Water star-grass	-	-	33	50
Flat-stem pondweed	-	-	39	11
Horned Pondweed	3	-	-	-

Common Carp in Rice Lake

In 2008, the RLAA contracted with Blue Water Science (St. Paul, MN) to conduct a fish survey in Rice Lake using trap nets. Results from this survey suggested that the abundance of carp (3.8 carp per net) was slightly higher than the typical range reported by the Minnesota DNR (1.0 to 3.6 carp per net). However, trapnets generally do not sample adult carp very well (Dr. Peter Sorenson, Professor, University of Minnesota–Twin Cities, pers. comm.). Furthermore, the trap net method does not provide an estimate of carp biomass in the lake, which is the critical factor for evaluating the potential impact of carp on plants (Bajer et al. 2009). Although, we were not able to determine whether carp were present at low abundance (<30 lbs/acre; little impact to plants), super-abundance (>100 lbs/acre; near total plant removal), or somewhere between, the 2008 fish survey suggests that carp are likely abundant.

The 2008 fish survey also indicated that Rice Lake supported a high abundance of black bullhead (*Ameiurus melas*) and black crappie (*Pomoxis nigromaculatus*), a moderate abundance of bluegill sunfish (*Lepomis macrochirus*), and relatively few predator fish. Although carp are thought to have the largest impact on sediment resuspension and destruction of aquatic plants, the abundant black bullheads in Rice Lake may be adding substantially to total sediment resuspension and plant destruction. Given the near total lack of plants in the main basin, the abundant bullhead population has likely shifted to feeding on invertebrates in the sediment (Steve McComas, Blue Water Science, presentation 71st Midwest Fish & Wildlife Conference, Minneapolis, MN), thus acting like an army of tiny carp. We made no attempt to separate carp and bullhead effects. However, large carp are thought to have a much greater impact on plants than smaller fish (Crivelli 1983).

Study Objectives

The RLAA is currently considering management options to reduce the abundance of carp and possibly bullheads in Rice Lake. However, given the uncertainty as to the current abundance of carp, the lake association wanted to determine whether carp were directly impacting plants through herbivory and uprooting, or if indirect effects (high turbidity and low light) were responsible for the lack of plants in the main basin of the lake. If direct carp effects are found to be responsible for the lack of plants, then carp removal may be an attractive strategy to improve the lake. Alternatively, if water clarity is found to be the main factor limiting plants and direct carp effects are minimal, then management would be better focused on nutrient reduction rather than carp removal. In addition to determining the relative importance of direct carp effects and indirect effects, the RLAA was interested in evaluating whether the plant species found in the isolated western bay would fare well in the main basin if direct carp effects were reduced. The specific objectives of the study were:

(1) Evaluate the importance of direct carp effects (herbivory and uprooting) vs. indirect carp effects (increased turbidity) in preventing plant growth in Rice Lake

(2) Evaluate whether the survival and growth of selected plant taxa is enhanced in study plots where carp are not present

(3) Assess whether natural sprouting and survival of plants (not planted) from lake sediments is increased in study plots where carp are not present

(4) Evaluate likely colonizers (native plants from western bay) for nuisance potential

Overall, the aim of this study was to assess the impacts that carp removal may have on plants in Rice Lake. This information will help guide future management decisions and foster realistic expectations among lake users.

Methods

Study Plots

We selected two study locations in shallow (2 to 3 ft), near-shore areas of Rice Lake (Figure 4). At each location, we installed one fenced plot (carp excluded) and one open plot (carp permitted). The two plots at each study location were installed side by side along shore (spaced about 15 ft apart) in areas with uniform water depth and sediment texture (Figure 5; Table 3). Fenced plots (8×16-ft) were constructed with vinyl-coated, welded wire fence (2×4-in mesh) attached to 6-ft metal fence posts (Figure 6). The fence extended 2 to 3 ft above the surface of the water to prevent carp from jumping into the fenced plots. In addition, we added a layer of plastic fence with 1-in openings to the outside of the fenced plots to further limit larger fish from entering the fenced area (Figure 6). After installation, we pounded the fence posts into the sediment to drive the bottom edge of the fence 4 to 6 inches below the surface of the sediment. Open plots (8×16-ft) were delineated using four 6-ft fence posts placed at the corners of each plot (Figure 7). Within each of these fenced and open study plots, we set up a grid of 10 cells and marked the center of each cell with a labeled PVC post (Figures 5 and 6).

Figure 4. Location of two study sites

Figure 5. Diagram showing plot orientation, and placement of open and planted cells within each plot

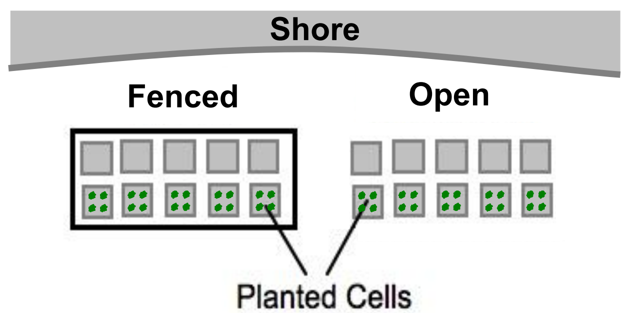

Table 3. Study plot descriptions and characteristics. "Fetch" is the maximum length of open water over which wind can blow toward each study plot (indicates exposure to waves)

Site/Plot	*Water Depth (inches)*	*Sediment Texture*	*Maximum Fetch (mi.)*
Site 1 (west)			
Fenced Plot	26–30	Fine sand	0.65
Open Plot	*28–31*	Fine sand	0.65
Site 2 (southeast)			
Fenced Plot	20–23	Fine sand/muck	0.35
Open Plot	19–21	Fine sand/muck	0.35

Figure 6. Installed fenced plot with PVC cell markers (left), and close-up of fencing (right)

Figure 7. Installed plots (site 2) showing placement of fenced plot (left), open plot (right), PVC markers, and reflective marker buoys at outer corners of the study site

Plantings

We selected 6 native submersed aquatic plant species for transplanting into the study plots (Table 4). These plant species were selected based upon their tolerance of turbid water, ability to form a dense meadow of plants in shallow areas, and their habitat value for fish and wildlife. None of these plant species were found growing in the main basin of Rice Lake during the 2009 plant survey. However, 4 of the species (Canadian waterweed, flat-stem pondweed, water star-grass, and wild celery) were fairly abundant in the small, isolated western basin. The remaining 2 selected plant species (muskgrass and bushy pondweed) were not observed growing in Rice Lake in 2009, but grew well in nearby Weaver Lake and Fish Lake.

On June 18, 2010, we manually harvested 20 to 30 specimens of each species from the small western basin of Rice Lake and from Weaver Lake (1 mile southeast of Rice Lake). Within 2 hours of harvesting, the collected specimens were transplanted into the Rice Lake study plots. Within each plot, we randomly selected one of the 5 lake-ward cells for each species (flat-stem pondweed and wild celery shared a cell in each plot). Within each cell, we anchored 4 plants (all the same species, except in cells with flat-stem pondweed and wild celery) within 6 inches of the PVC marker, anchoring the base of each plant to the sediment with 4-inch wire sod staples.

Monitoring and Data Analysis

We assessed plant survival, height, and condition in all study plots three weeks after transplanting (July 8) to assess initial plant survival, and again after 2 months (August 26) to assess growth and survival over the summer months. In addition to assessing the planted cells, we also assessed unplanted cells in fenced and open plots to determine whether natural plant recruitment and survival were affected by carp.

Table 4. Description of aquatic plant species transplanted to study plots

Common Name	*Taxonomic Name*	*Growth Form*	*Food/Habitat Value*	*Tolerance of Turbitity*
Bushy pondweed	*Najas flexilis*	Shrub	Med–High	Med
Canadian waterweed	*Elodea canadensis*	Shrub	Med	Med
Flat-stem pondweed	*Potamogeton zosteriformis*	Vertical	Med	Med–High
Muskgrass	*Chara* sp.	Meadow	High	Med
Water star-grass	*Zosterella dubia*	Shrub	Med–High	High
Wild celery	*Vallisneria americana*	Vertical	Med–High	Med–High

During each survey, we measured the water depth within each cell and assessed whether each transplanted specimen survived (recorded as present or absent). We measured the total height of each plant, from the sediment to the tip of the longest stem when pulled vertically, and noted the overall condition of each plant using a 0 to 3 scale: 0=dead, 1=poor, 2=fair (persisting), 3=excellent (active growth). For the unplanted cells, we noted the species present and measured the height of any plants. While surveying within each plot, we were careful to walk only within the space between the two rows of cells to avoid damaging the plants.

For each type of plot (fenced or open), we calculated the % survival for each of the transplanted species by dividing the number plants remaining by the total number of specimens originally transplanted. Similarly, we calculated the average plant height and average plant condition for each species within the fenced and open plots. We did not observe a substantial difference between the two sites, so we chose to pool all of the plantings for each species within each type of plot (fenced or open). We used a chi-square test to evaluate differences in % survival, and Welch's t-test to evaluate differences in average plant height and condition (Zar 2010).

Results

% Survival

Overall, the survival of transplanted vegetation (all species collectively) was substantially greater (P<0.001, chi-square) in the fenced plots than in the open plots (Table 5). In July, plant survival was greater (P<0.001) in fenced plots (90%) than in open plots (50%). By the end of August, the difference in plant survival between fenced (70%) and open plots (10%) was even more pronounced (P<0.001). These results strongly suggest that carp were negatively impacting vegetation directly through herbivory or uprooting. However, not all of the evaluated plant species showed the same level of survival during the course of the study. Bushy pondweed and flat-stem pondweed both showed trends of decreasing survival in fenced plots between July and August, while water star-grass and wild celery maintained high % survival throughout the study. In the open plots, all of the evaluated taxa showed decreased survival between July and August, however, Canadian waterweed (30%), water star-grass (30%), and wild celery (30%) appeared to fare somewhat better in the open plots than the other taxa, which all had 0% survival by August.

Table 5. % Survival of vegetation transplanted in fenced and open study plots; evaluated in July and August; results rounded to nearest 10%.

			% Survival *	
		N	*No Carp (fenced plot)*	*Carp (open plot)*
July				
All Vegetation	-	40	90 %	50 %
Bushy pondweed	*N. flexilis*	8	100	10
Muskgrass	*Chara* sp.	8	90	30
Canadian waterweed	*E. canadensis*	8	100	50
Flat-stem pondweed	*P. zosteriformis*	4	100	80
Water star-grass	*Z. dubia*	8	100	60
Wild celery	*V. americana*	4	50	50
August				
All Vegetation	-	40	70	10
Bushy pondweed	*N. flexilis*	8	30	0
Muskgrass	*Chara* sp.	8	80	0
Canadian waterweed	*E. canadensis*	8	80	30
Flat-stem pondweed	*P. zosteriformis*	4	50	0
Water star-grass	*Z. dubia*	8	100	30
Wild celery	*V. americana*	4	100	30

* Plants were counted as "surviving" if any portion of a plant remained rooted in the transplanted cell.

Plant Height

Overall, the average height of the surviving transplanted vegetation (all species collectively) was substantially greater (P≤0.006, Welch's t-test) in the fenced plots than in the open plots (Table 6). In July, the average height of the surviving vegetation was greater (P=0.006) in fenced plots (23 ±2 in) than in open plots (11 ±3 in). By the end of August, the difference between fenced (24 ±3 in) and open plots (2 ± 1 in) was even more pronounced (P<0.001). Again, these results strongly suggest that carp were negatively impacting vegetation directly through herbivory or incidental damage to plants while foraging in sediments. However, not all of the evaluated plant species showed the same patterns in plant height during the course of the study. Although most of the evaluated plant species maintained their height in the fenced plots over the course of the study, bushy pondweed and muskgrass both showed trends of decreasing height in fenced plots. Conversely, in the open plots, all of the evaluated plant species decreased in average height between July and August. However, water star-grass appeared to fare better in the open plots than the other taxa, decreasing only slightly from an average height of 24 inches in July to 17 inches in August.

Table 6. Average height of plants that were transplanted in fenced and open study plots (only surviving plants were measured); evaluated in July and August; results rounded to nearest inch.

			Average Plant Height	
		N	*No Carp (fenced plot)*	*Carp (open plot)*
July				
All Vegetation	-	40	23 in.	11 in.
Bushy pondweed	*N. flexilis*	8	17	6
Muskgrass	*Chara* sp.	8	21	10
Canadian waterweed	*E. canadensis*	8	21	6
Flat-stem pondweed	*P. zosteriformis*	4	37	22
Water star-grass	*Z. dubia*	8	28	24
Wild celery	*V. americana*	4	17	14
August				
All Vegetation	-	40	24	2
Bushy pondweed	*N. flexilis*	8	11	0
Muskgrass	*Chara* sp.	8	11	0
Canadian waterweed	*E. canadensis*	8	24	4
Flat-stem pondweed	*P. zosteriformis*	4	33	0
Water star-grass	*Z. dubia*	8	30	17
Wild celery	*V. americana*	4	36	4

Plant Condition

Overall, the average condition of the transplanted vegetation (all species collectively) was substantially greater (P<0.001, Welch's t-test) in the fenced plots than in the open plots (Table 7). In July, the average condition of vegetation was greater (P<0.001) in fenced plots (2.2 ±0.1) than in open plots (0.9 ±0.3). By the end of August, the difference between fenced (1.9 ±0.3) and open plots (0.2 ± 0.1) was even more pronounced (P<0.001). These results further suggest that carp were negatively impacting vegetation directly through herbivory or incidental damage to plants while foraging in sediments. However, some of the evaluated plant species fared better than others during the course of the study. Although most of the evaluated plant species in fenced plots maintained an average condition around 2 (fair condition) over the course of the study, water star-grass and wild celery were stand-outs, both showing very active growth, strong reproduction, and spreading within the immediate vicinity of the plantings in fenced plots (Figure 8). Conversely, in the open plots, all of the evaluated plant species experienced decreases in their average condition between July and August, with no clear standouts.

Table 7. Average condition of vegetation (0-3 rating) transplanted in fenced and open study plots; evaluated in July and August. Plant condition scoring: 0=gone, 1=poor, 2=good (persisting), 3=excellent (active growth and/or reproduction).

			Average Plant Condition	
		N	*No Carp (fenced plot)*	*Carp (open plot)*
July				
All Vegetation	-	40	2.2	0.9
Bushy pondweed	*N. flexilis*	8	2.1	0.3
Muskgrass	*Chara* sp.	8	1.8	0.5
Canadian waterweed	*E. canadensis*	8	2.3	0.6
Flat-stem pondweed	*P. zosteriformis*	4	2	1.5
Water star-grass	*Z. dubia*	8	2.9	1.8
Wild celery	*V. americana*	4	2.3	1.0
August				
All Vegetation	-	40	1.9	0.2
Bushy pondweed	*N. flexilis*	8	0.5	0.0
Muskgrass	*Chara* sp.	8	0.8	0.0
Canadian waterweed	*E. canadensis*	8	2.0	0.3
Flat-stem pondweed	*P. zosteriformis*	4	2.3	0.0
Water star-grass	*Z. dubia*	8	3.0	0.5
Wild celery	*V. americana*	4	3.0	0.3

Figure 8. Active growth and spreading of water star-grass (left; *Zosterella dubia*) and wild celery (right; *Vallisneria americana*) within one of the fenced plots (August, 2010).

Natural Sprouting in Unplanted Cells

Sprouting and survival of other native plants (species not transplanted) were substantially greater in the fenced plots than in the open plots. In July, we found native plants in 80% of the unplanted cells in fenced plots, but in only 40% of the unplanted cells in open plots. By the end of August, this difference was even more pronounced between fenced plots (100% unplanted cells vegetated) and open plots (0% unplanted cells vegetated). The vegetation that sprouted and survived in the unplanted cells was predominantly sago pondweed (*Stuckenia pectinata*), with some coontail, horned pondweed (*Zannichellia palustris*), and narrow-leaf pondweed (*Potamogeton pusillus*).

In addition to these unplanted native plant species, we found that one of the transplanted species, Canadian waterweed, spread into several of the unplanted cells. Although it is possible that Canadian waterweed sprouted from propagules in the lake sediments, we suspect that the specimens of this species found in the unplanted cells came from fragments of the transplanted specimens in the study plots. This suggests that although Canadian waterweed did not show the greatest survival or growth in the study plots, it may spread more easily than the other evaluated plants (spread by fragmentation). We did not find Eurasian watermilfoil or curlyleaf pondweed in the unplanted cells, however, these invasive plants would likely respond similarly to native plants, growing more densely and expanding in Rice Lake if carp abundance was reduced.

Figure 9. Sago pondweed (*Stuckenia pectinata*) growing in a fenced plot.

Discussion

This study clearly showed that the growth and survival of aquatic plants in Rice Lake was dramatically enhanced in the absence of direct carp effects. This suggests that if the abundance of carp in the lake could be reduced substantially (to <30 lbs/acre), plants would likely flourish in shallow, near-shore areas of the lake. Given that sago pondweed and coontail were the most abundant native plants in the unplanted cells, these two species would likely dominate near-shore areas shortly after carp removal. Previous work has shown that carp do not like to eat coontail or sago pondweed (Miller and Provenza 2007), so it is not surprising that these two taxa were the dominant native plants remaining in the main basin of Rice Lake.

Our results also clearly showed that transplanted specimens of muskgrass and Canadian waterweed did not do well in the lake. This suggests that these plant species may not fare well in Rice Lake, however it is possible that they were merely more sensitive to transplanting than the other taxa. Conversely, water star-grass and wild celery appeared to survive transplanting very well and flourished in the absence of carp. These two species would be very good candidates for transplanting in the main basin of Rice Lake to increase the diversity of plants and improve the quality of fish habitat after carp removal. Both species could be easily harvested from nearby waters; water star-grass from the western basin of Rice Lake and wild celery from nearby Weaver Lake. Furthermore, neither of these species typically form dense nuisance growth.

Possible Next Steps

Based upon the results of this study, the RLAA should consider the following actions to increase native plant growth, improve water clarity, and reduce the frequency and duration of blue-green algae blooms.

(1) Determine the abundance (lbs/acre) and age-length distribution of carp remaining in Rice Lake (capture/recapture) following carp removal. This could be done before a removal to estimate the amount of removal needed, and/or after a removal to determine whether additional removal is necessary to achieve or maintain carp density <30 lbs/acre.

(2) Conduct a large-scale carp/bullhead removal

(3) Transplant water star-grass and wild celery to strategically placed "nursery plots" in near-shore areas of Rice Lake. Although limited plantings could be tried without carp removal, any major transplanting activities should be delayed until carp have been reduced. In addition, species of emergent vegetation should be included in transplantings.

(4) Monitor changes to the aquatic plant community in the lake annually in August for three to five years after carp removal, and periodically thereafter (every 3 to 5 years).

(5) Conduct follow-up assessments of carp abundance and age structure periodically after any removal to determine whether the carp population remains suppressed or is rebounding. This will be vital for evaluating whether carp removals are an effective and sustainable management strategy for Rice Lake.

(6) Survey the bluegill population and explore options to maintain a large, healthy population of bluegills. Recent studies at the University of Minnesota have indicated that bluegills are voracious predators of carp eggs and newly-hatched carp (Bajer and Sorenson 2010).

Final Statements

Although direct carp effects appear to be the main factor limiting plant abundance in shallow areas of Rice Lake, carp removal will not be a cure-all for the lake. Given the high nutrient load from Elm Creek and the high internal loading of phosphorus from lake sediments, the lake will likely still be sufficiently fertile, even after carp removal, to maintain a persistent algae-dominated state. However, reductions of carp to <30 lbs/acre would likely promote plant growth in shallow, near-shore areas. This would improve fish habitat and reduce sediment resuspension in shallow near-shore areas, possibly leading to improved water clarity, a more desirable fishery, and modest reductions in the frequency and severity of blue-green algae blooms.

Before conducting a carp removal, the RLAA should ensure that its members have realistic expectations and that they understand the trade-offs involved with such activities (e.g. increased plant density in near-shore areas, possible nuisance plant growth in some areas). Although Rice Lake will likely persist in an algae-dominated state until nutrients are reduced substantially, shoreline homeowners and RLAA members need to consider how a carp removal and the possible subsequent increases in plant growth may impact current lake uses (e.g. impaired boating or swimming in near-shore areas due to dense plants, improved fishing, improved water clarity, etc.).

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