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Aquatic Plant Community of Red Rock Lake: 2015
Hennepin County, MN *(#27-0076-00)*

Point-Intercept Surveys: Jun 2 and Aug 12, 2015
Curlyleaf Turion Survey: Nov 2, 2015

Surveying, Analysis, and Reporting by:
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Funded by:
Riley Purgatory Bluff Creek Watershed District

RILEY PURGATORY BLUFF CREEK
WATERSHED DISTRICT

Survey & Analysis Methods

Point-Intercept Survey

Freshwater Scientific Services, LLC surveyed aquatic plants in Red Rock Lake on Jun 2 and Aug 12, 2015 using the point-intercept method described by Madsen (1999). These surveys incorporated assessments at a total of ~160 sample points arranged in a uniform grid (50-m spacing; Figs 1 and 2). We generated these sample points using desktop GIS software and the MDNR *Random Sample Generator* extension to project a grid of points over aerial images of the lake. We then loaded the selected sample locations onto a handheld GPS unit (Garmin GPSMAP-78) for navigation to each point while in the field.

At each designated sample location, we collected plants using a double-headed, 14-tine rake on a on a rope. For each rake sample, we dragged the rake over the lake bottom for approximately 5 ft before retrieving. Retrieved plants were piled on top of the rake head and assigned density scores from 1 to 4 based upon rake head coverage (Table 1) for each individual species and for all plants collectively.

We calculated the littoral frequency (≤15 ft, % occurrence) and littoral mean density score (plant abundance) for each encountered plant species (Table 2), as well as lake-wide and littoral community metrics (Table 3). We also used desktop GIS software to map the distribution and abundance of plants in the lake (pages 6–14). Additional species that were observed floating or growing in the vicinity of a sample point but not retrieved on the rake were given a rating of zero for that location. These "zero" species were noted as being present on the plant distribution maps (shown as an "X"), but "zero" ratings were excluded from calculations of plant community metrics and statistics (not treated as denoting presence). At each location, we also documented water depth and overall plant height.

Figure 1. Sample locations for the 2015 Red Rock Lake plant surveys; 5-ft contour interval lines. Shaded contour denotes area deeper than 15 ft.

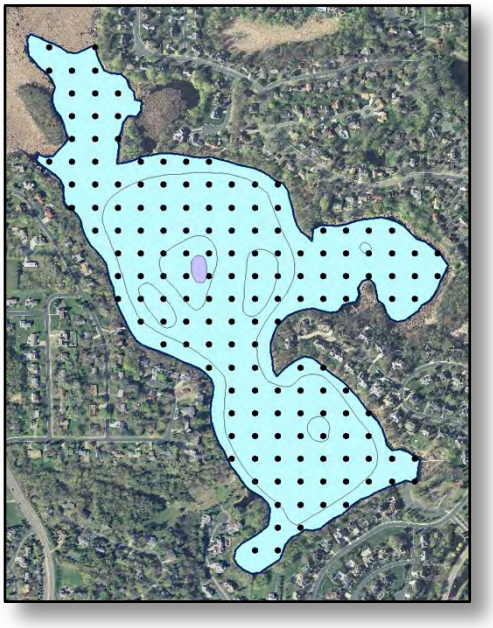


Figure 2. Sampling effort (number of locations sampled) within successive 3-ft depth zones; Red Rock Lake, Aug 2015.

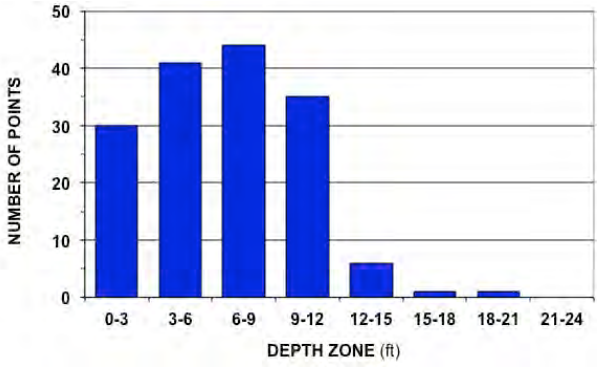


Table 1. Overview of rake density scores used to document plant abundance during point-intercept surveys.

Density Score	Rake Coverage	Description
1		Only a few plants retrieved
2		Full length of rake head covered, but tines only partially covered
3		Plants completely cover the rake head and tines
4		Enough plants to cover rake head and tines multiple times

Sediment Turion Survey

Freshwater Scientific Services, LLC conducted a sediment turion survey for Red Rock Lake on Nov 2, 2015 to assess the abundance and distribution of curlyleaf turions in the lake's sediments. For this survey, we collected sediment samples with a petite Ponar dredge (225 cm^2 basal area, Fig 3) at 40 sites that were randomly selected from the set of points used for the 2015 vegetation surveys (Fig 4). Upon retrieving each sediment sample, we removed any material from the outside of the closed Ponar dredge, emptied its contents into a sifting bucket (1-mm screen), and gently sifted the sample in the field to remove fine sediment. The contents remaining in the bucket after sifting were placed into a labeled plastic bag and stored in a cooler while in the field. In the lab, we manually sorted turions from other debris and recorded total turion counts for each sample. Small turion fragments that did not included a portion of a central turion stem and severely decayed turions that did not retain their shape when lightly squeezed were discarded and were not included in the final turion counts. Turion counts from each sample were divided by the sampled area (0.0225 m^2) to yield sediment turion abundance (turions/m^2) for each sampled site (Table 4, Figs 5-7).

Figure 3. JA Johnson (Freshwater Scientific Services) preparing to collect a sediment sample with the Ponar dredge.

Figure 4. Sample locations for the 2015 Red Rock Lake sediment turion survey; 5-ft contour interval lines shown.

Results

Statistical Summary of Findings

Table 2. Littoral frequency (% occurrence) and abundance (mean density score) of plant species found in Red Rock Lake (Hennepin Co., MN) during the surveys conducted on Jun 2 and Aug 12, 2015. *% Occurrence* and *Mean Density* (0-4 scale) were calculated using all littoral points (water depth ≤15 ft).

PLANT TAXA	COMMON NAME	% OCCURRENCE		MEAN DENSITY	
		JUN	AUG	JUN	AUG
ALL TAXA (combined)		95	79	1.8	2.2
SUBMERSED TAXA					
Ceratophyllum demersum	Coontail	74	71	1.3	1.7
Utricularia vulgaris	Common bladderwort	22	22	0.2	0.2
Potamogeton foliosus	Leafy pondweed	12	17	0.2	0.2
Elodea canadensis	Canadian waterweed	10	13	0.1	0.2
Potamogeton zosteriformis	Flat-stem pondweed	10	4	0.1	<0.1
Zosterella dubia	Water stargrass	4	10	<0.1	0.1
Chara sp.	Muskgrass	7	6	0.1	0.1
*Potamogeton crispus**	Curly-leaf pondweed	5	2 **	0.1	<0.1
Najas flexilis	Slender naiad	–	5	–	0.1
Aquatic Moss	Aquatic moss	3	4	<0.1	<0.1
Stuckenia pectinata	Sago pondweed	3	P	<0.1	–
Myriophyllum sibiricum	Northern watermilfoil	1	1	<0.1	<0.1
FLOATING TAXA					
Lemna trisulca	Star duckweed	74	59	0.8	0.6
Nuphar variegata	Spatterdock	2	43	<0.1	<0.1
Wolffia columbiana	Common watermeal	8	31	0.1	0.3
Lemna minor	Small duckweed	–	22	–	0.2
Spirodela polyrhiza	Large Duckweed	10	17	0.1	0.2
Polygonum amphibium	Water smartweed	6	6	–	–
Nymphaea odorata	White waterlily	6	6	0.1	0.2
Nelumbo lutea	American lotus	P	P	–	–
EMERGENT TAXA					
Iris versicolor	Northern blue flag	P	P	–	–
*Lythrum salicaria**	Purple loosestrife	P	P	–	–
Phragmites australis	Common reed	P	P	–	–
Sagittaria sp.	Arrowhead	P	P	–	–
Typha sp.	Cattail	P	P	–	–

* Invasive, non-native species
** Curlyleaf was treated in May and remaining curlyleaf had senesced and decayed prior to the Aug survey

Table 3. Summary of Red Rock Lake plant community metrics from June 2 and Aug 12, 2015 surveys

	RED ROCK LAKE 2015	
WHOLE-LAKE METRICS	**JUN**	**AUG**
Lake Area (acres)	97	97
Total Points Sampled	155	157
% Points Vegetated	94%	78%
% Points Veg. to Surface	14%	32%
Max Depth of Growth (95%)	10.8 ft	9.8 ft
Native Submersed Taxa	10	11
Native Floating/Emergent Taxa	11	12
Non-Native Submersed Taxa	1	1
LITTORAL METRICS *(≤15 ft)*	**2014**	**2015**
Littoral Area (acres)	97	97
Littoral Points Sampled	155	157
% Littoral Points Vegetated	95%	79%
Mean Plant Height (ft)	1.1	1.9
% of Max Littoral Biovolume	18%	34%
Mean Native Taxa / Point	2.5	3.1
Simpson's Diversity	81	88
Floristic Quality (FQI)	18.8	20.4
AMCI Score (Nichols et al. 2000)	49	51

Figure 5. Curlyleaf pondweed turions; Nov 2015

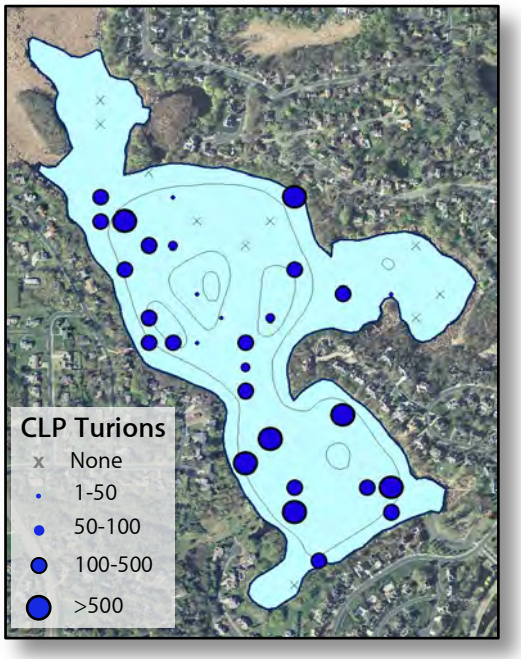


Table 4. Summary of curlyleaf pondweed turion abundance in Red Rock Lake; surveyed Nov 2, 2015

# Samples	40
# Sites with Turions	30
Mean Turions/m^2	269
Std Error	57
Median Turions/m^2	133
Max	1822

Figure 6. General relationship between the abundance of curlyleaf pondweed turions in lake sediments and the potential for recreational impairment within the area of interest (lake-wide or within curlyleaf beds). Ranges for impairment potential were estimated from subjective assessments of nuisance level (Low, Med, High) and turion abundance data from Johnson et al. 2012. Lake-wide mean turion abundance from Red Rock Lake (269 turions/m^2). Although the lake-wide mean indicates only moderate impairment, some areas had substantially higher turion abundance that suggested a high potential for localized severe impairment.

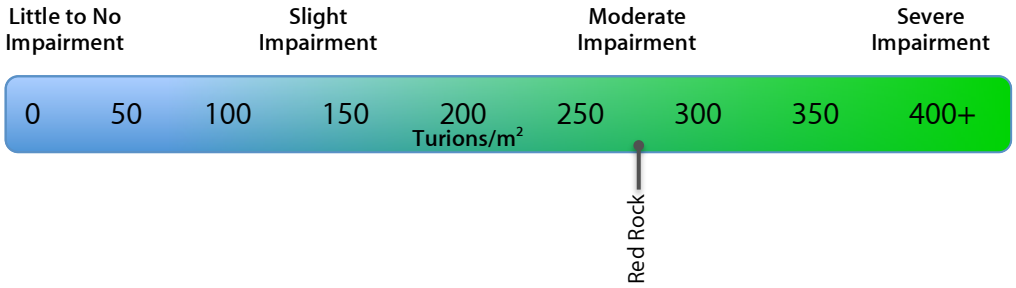
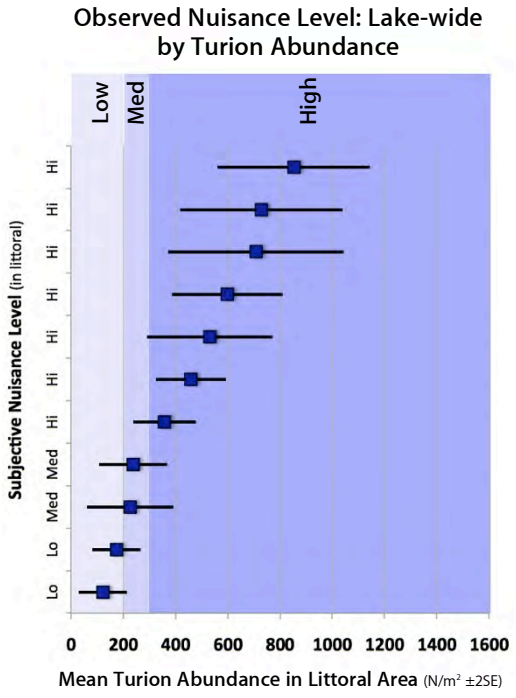
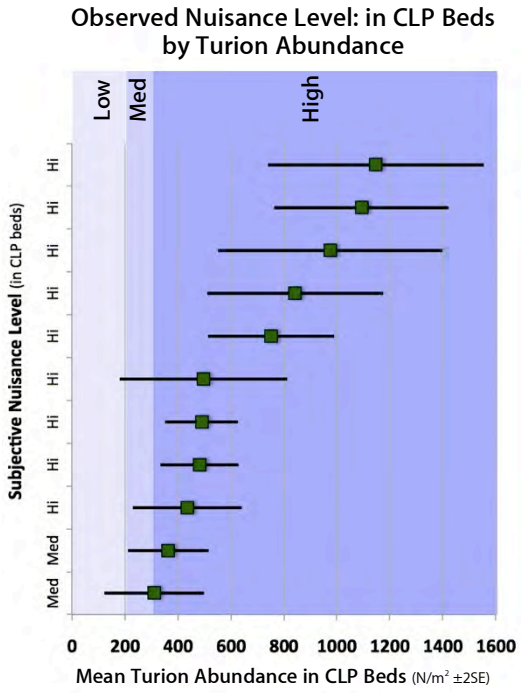
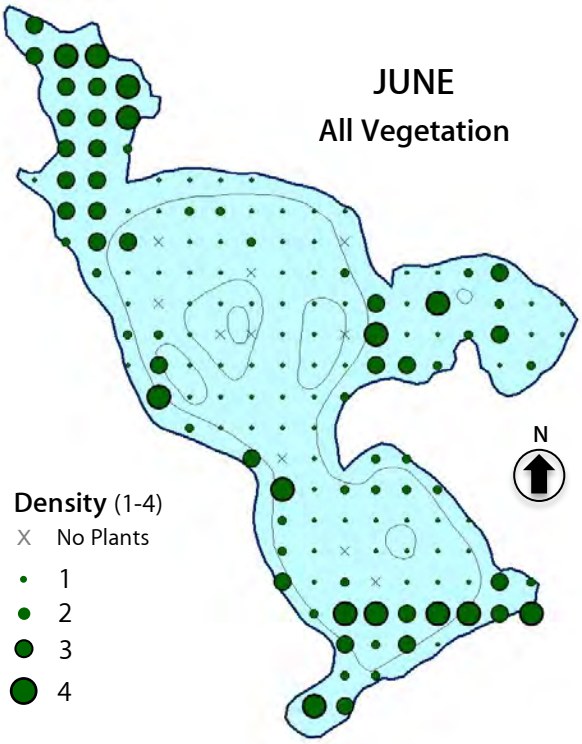


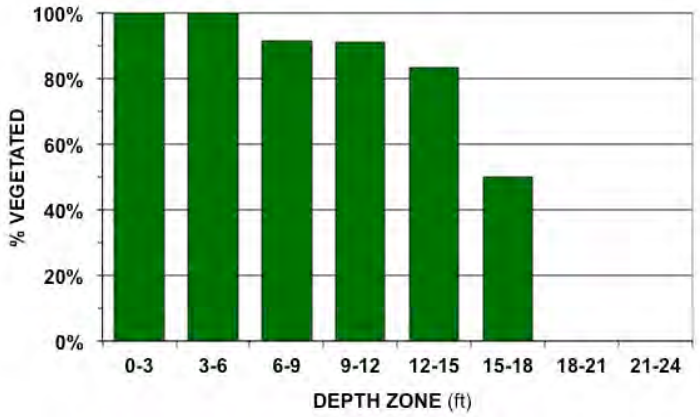
Figure 7. Comparison of observed nuisance level (subjectively rated) of curlyleaf pondweed growth and mean turion abundance throughout the littoral area of lakes (left) and within delineated curlyleaf beds (right). Nuisance level ratings are based upon the degree to which curlyleaf growth would be expected to impair boating in the area of interest indicated (littoral area or in curlyleaf beds). Means and standard errors (SE) of turion abundance were calculated using data collected in previous studies (Johnson et al. 2012; N~40 in each lake). Error bars represent ±2SE.

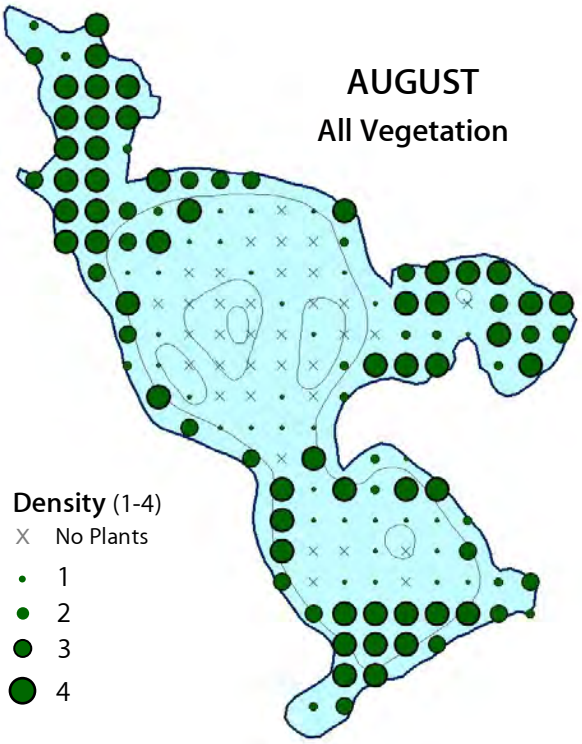


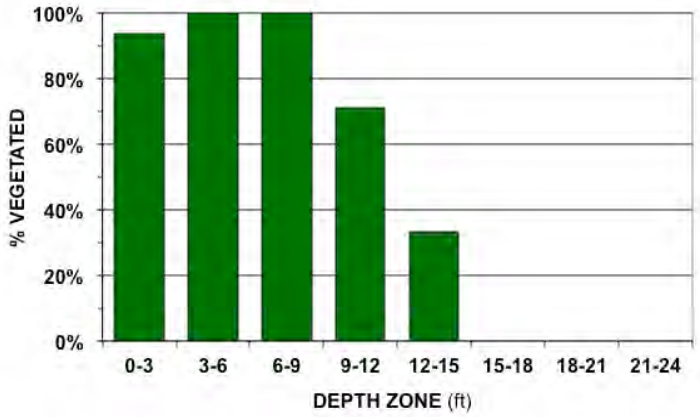


2015 Red Rock Lake – Aquatic Plant Abundance *(all taxa combined)*



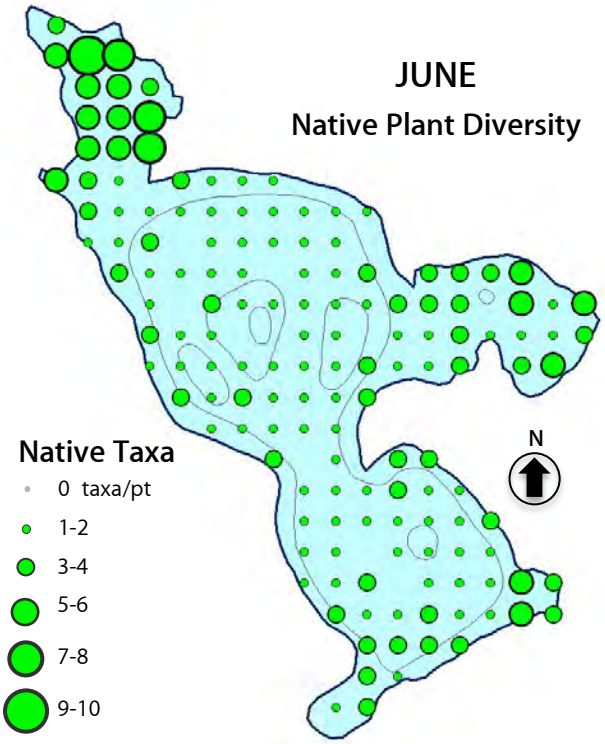


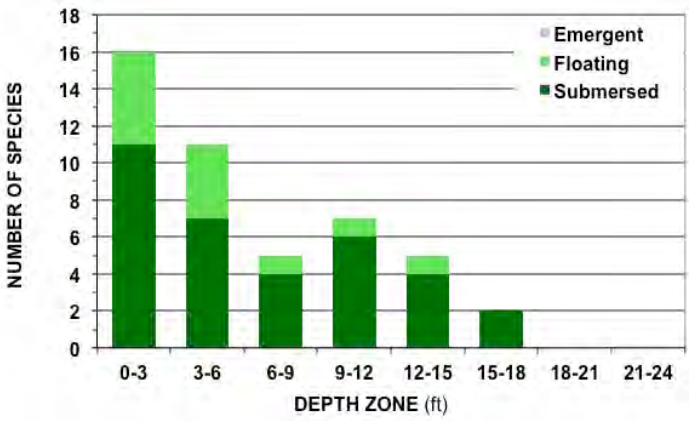


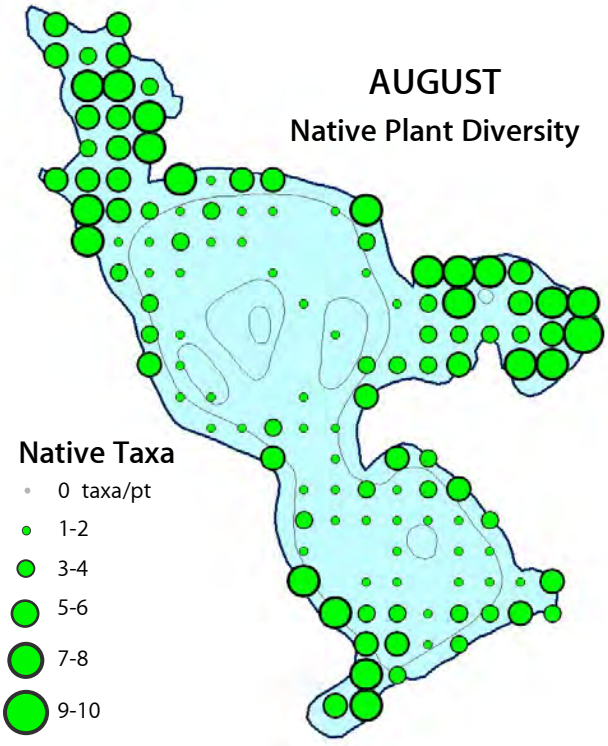


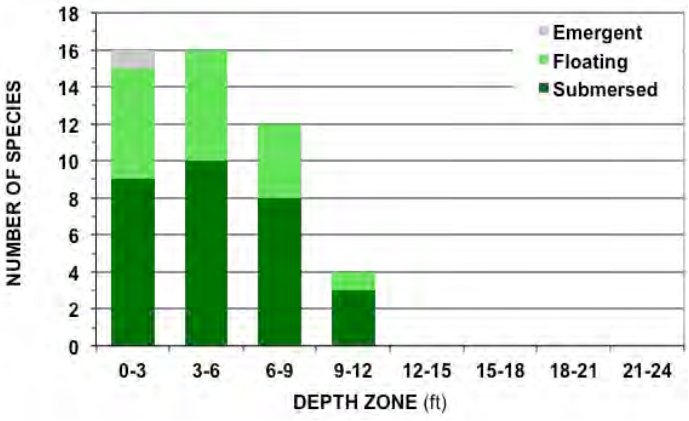
Surveyed: Jun 2 and Aug 12, 2015
Surveyor: JA Johnson
Affiliation: Freshwater Scientific Services, LLC
Methods: Rake, Sonar, Depth Rod

2015 Red Rock Lake – Native Plant Diversity









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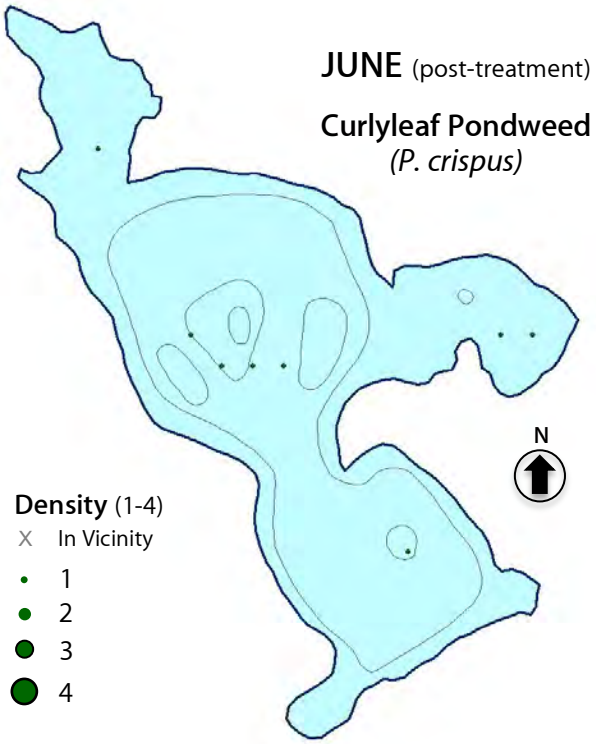
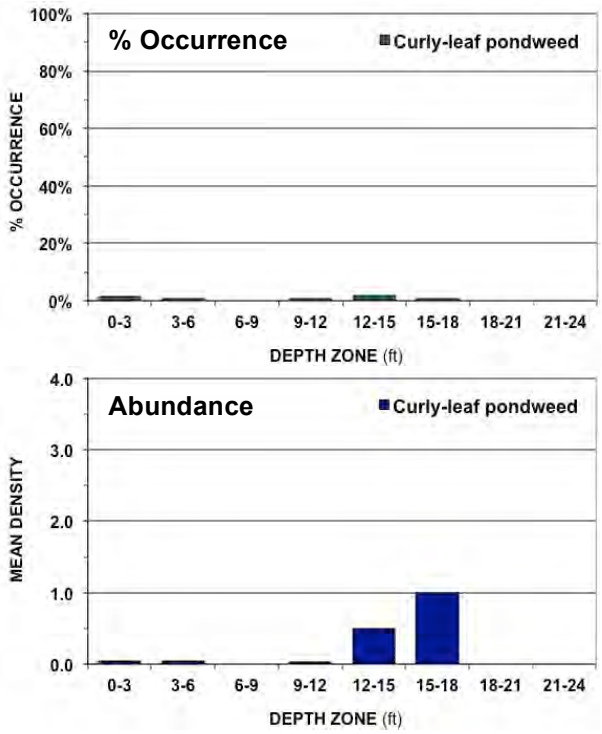
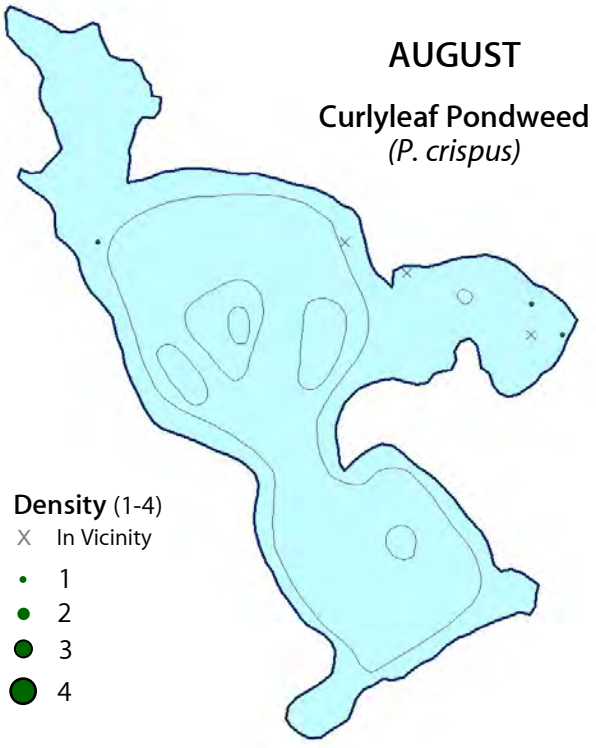
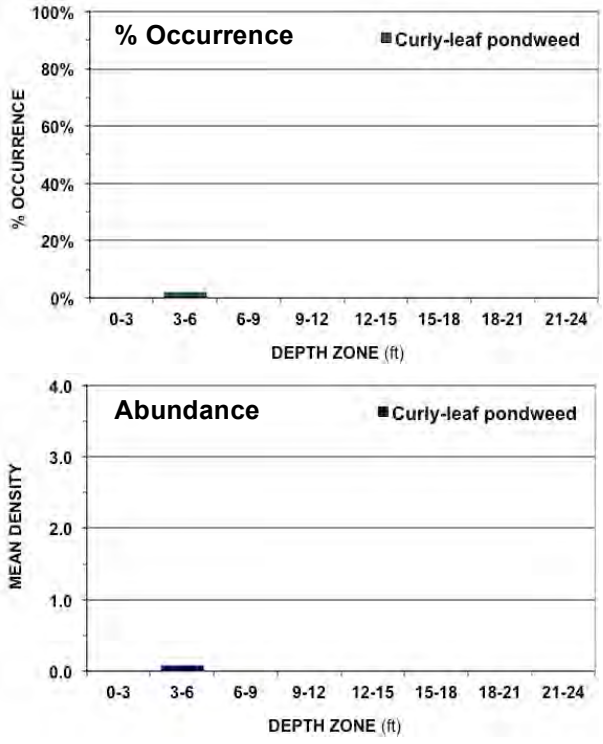
2015 Red Rock Lake – Curlyleaf Pondweed

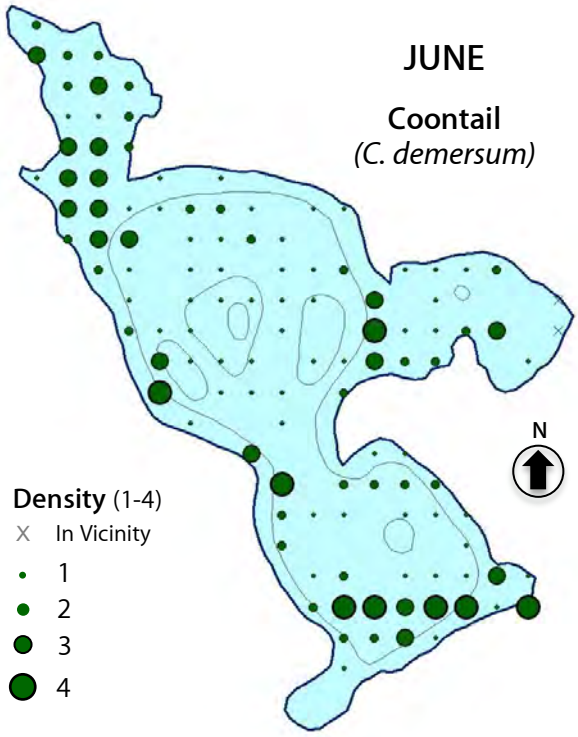


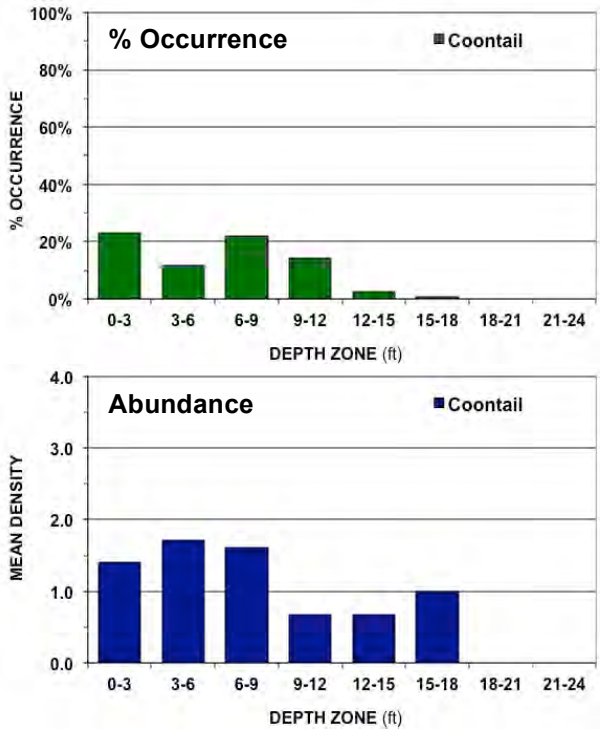


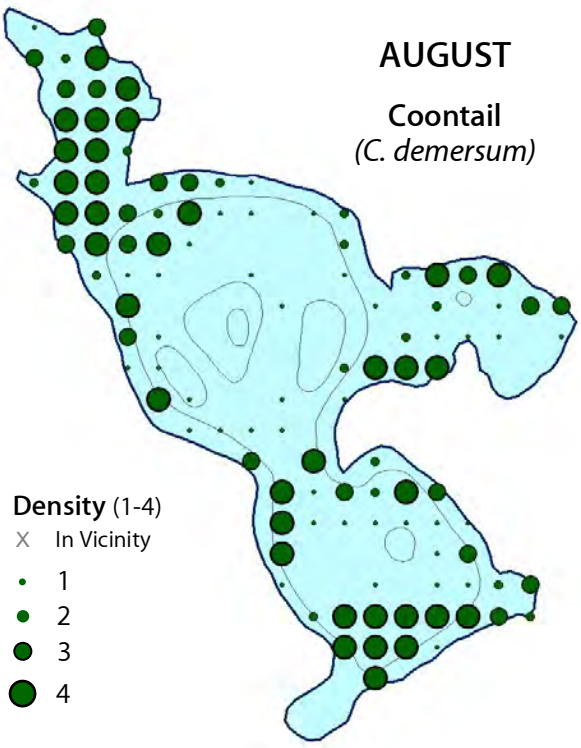


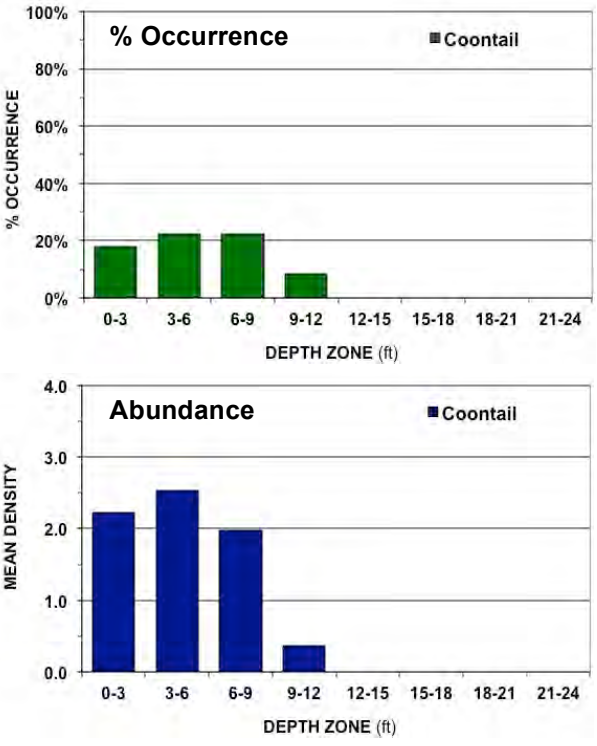


2015 Red Rock Lake – Coontail

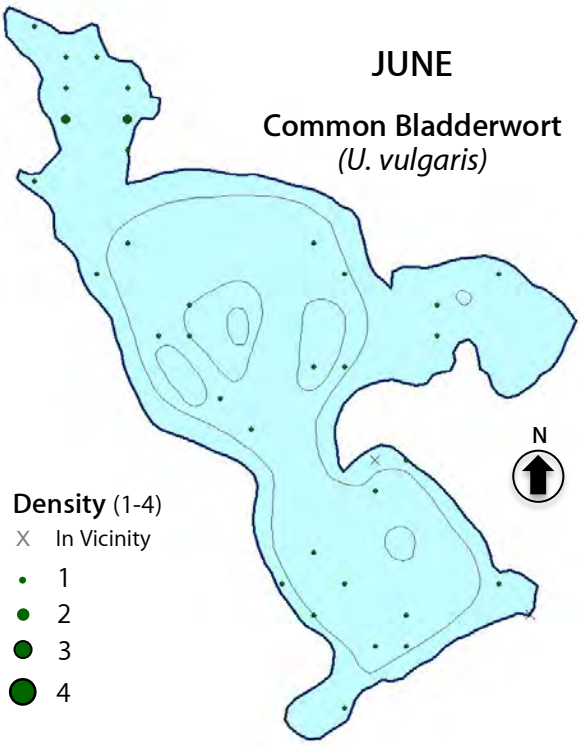


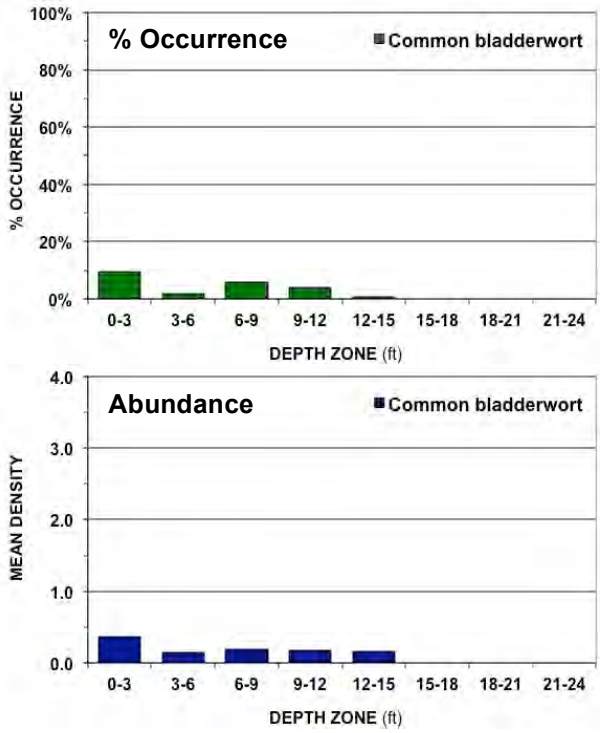


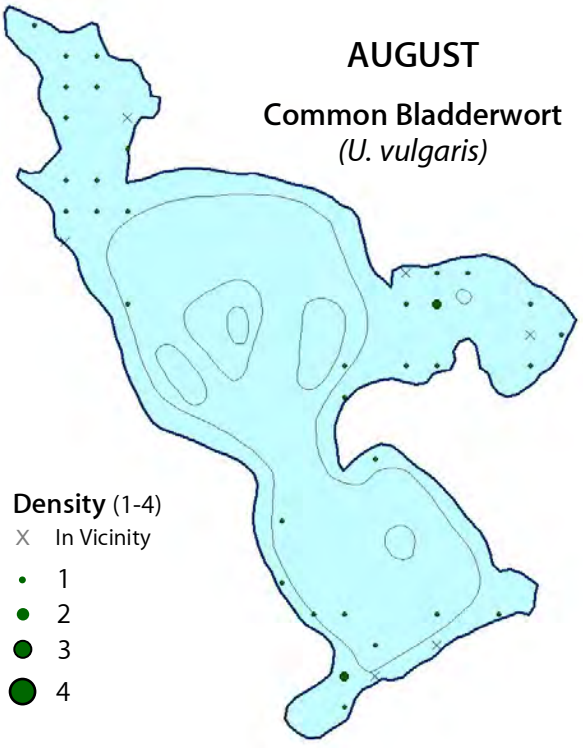


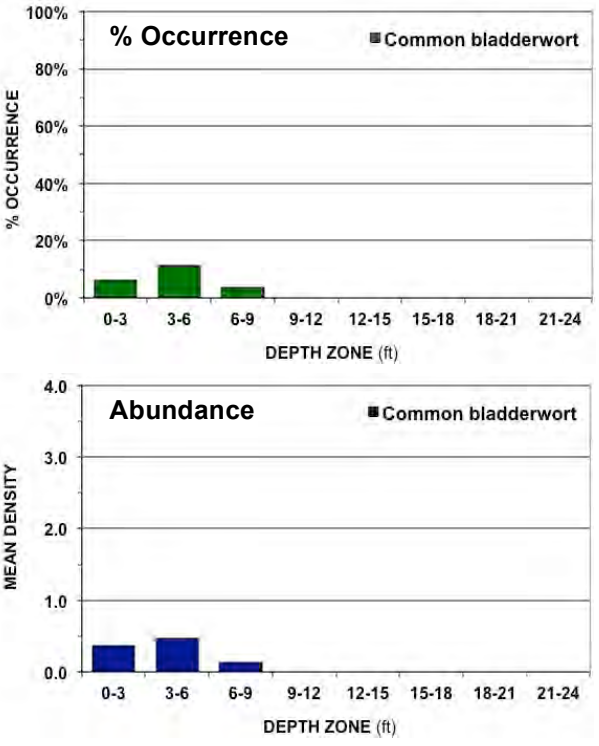


2015 Red Rock Lake – Common Bladderwort

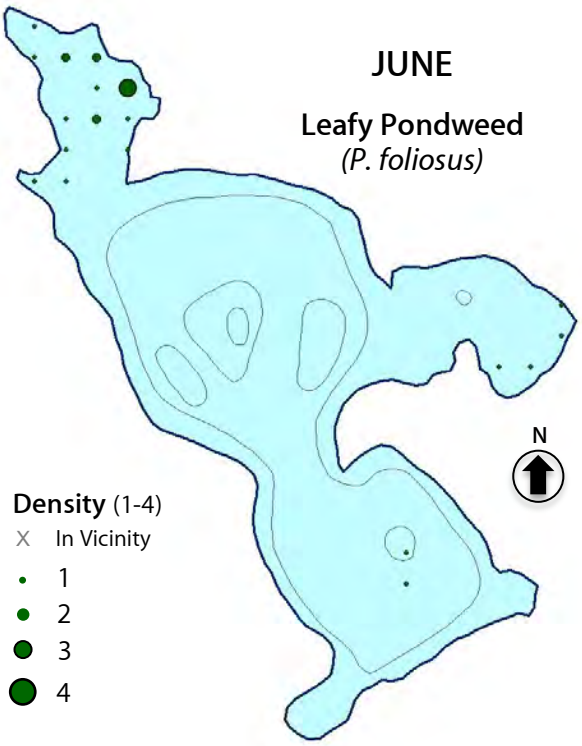


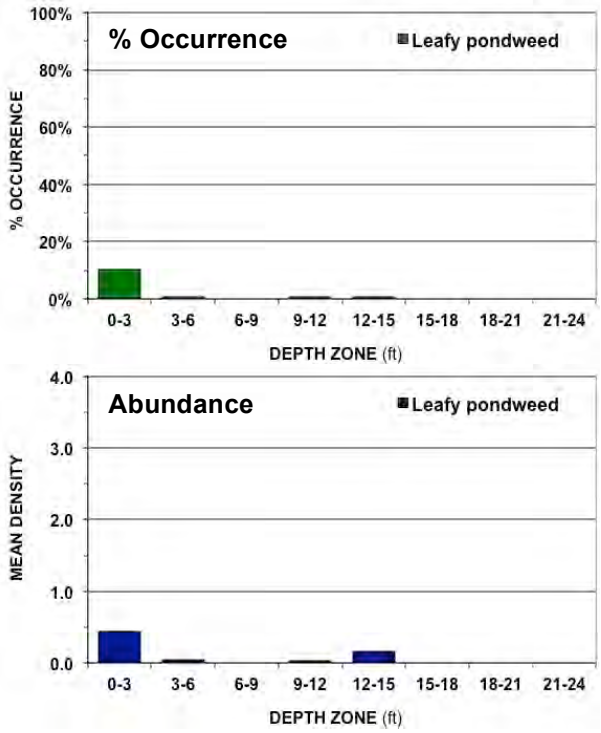


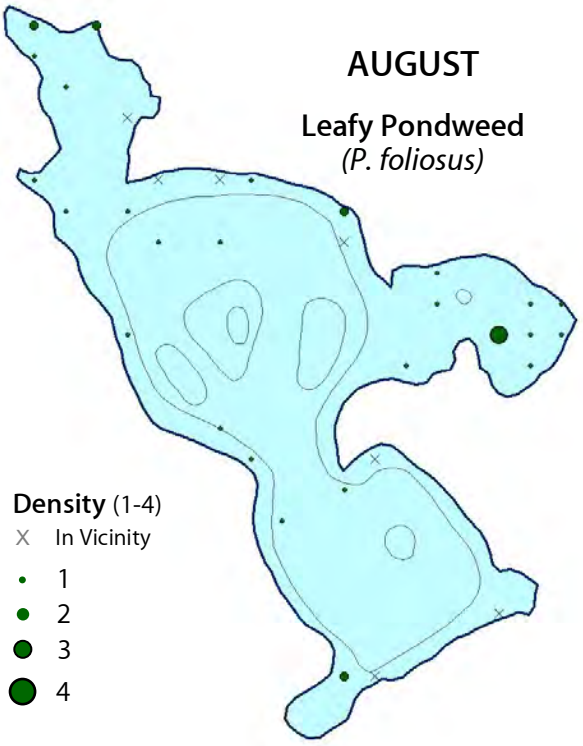


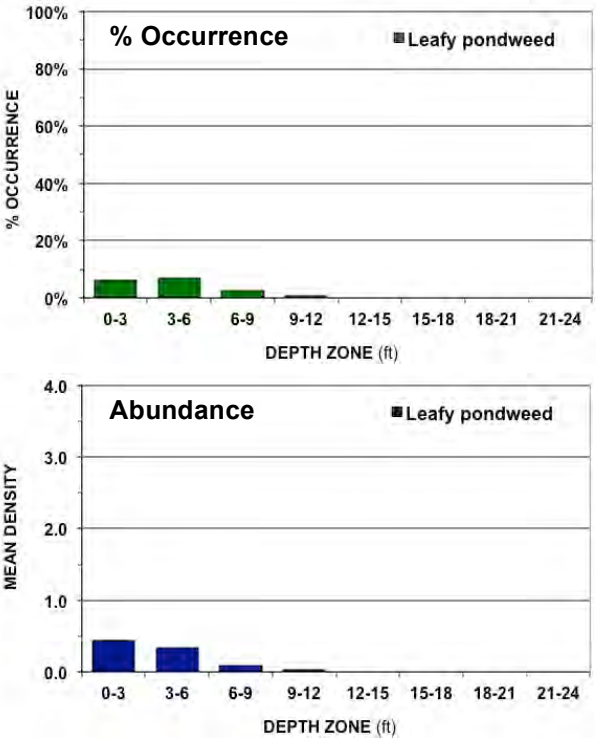


2015 Red Rock Lake – Leafy Pondweed

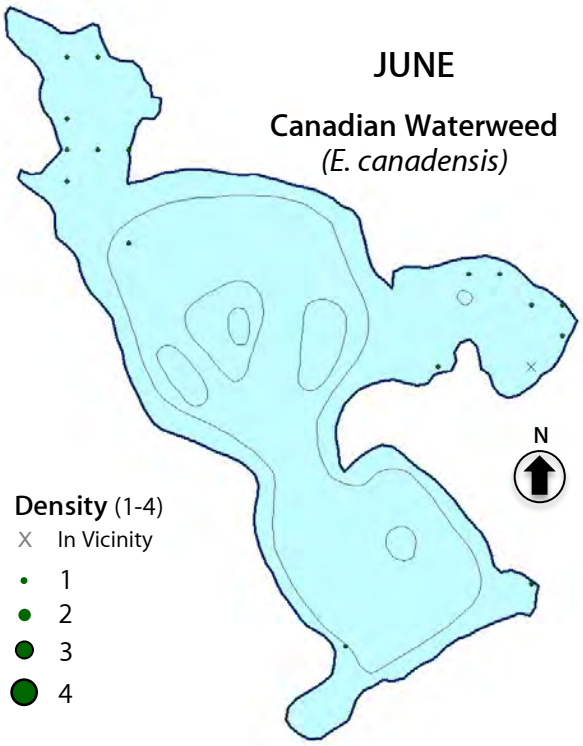


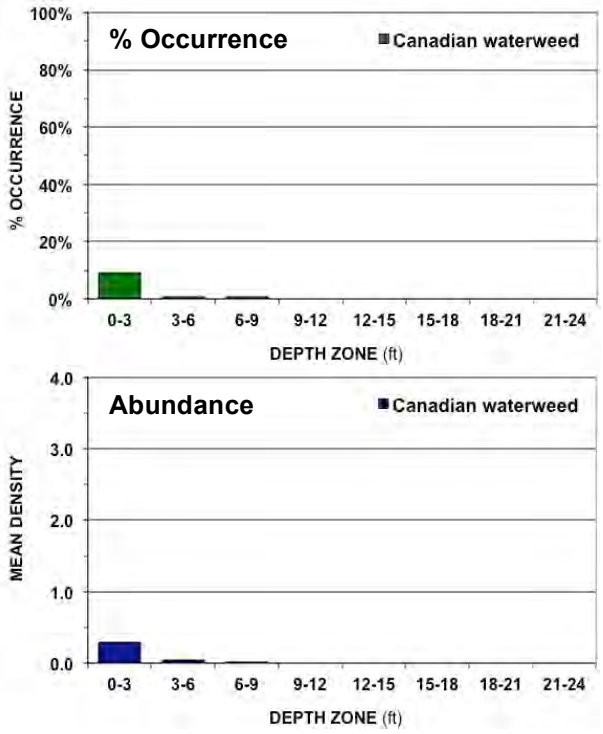


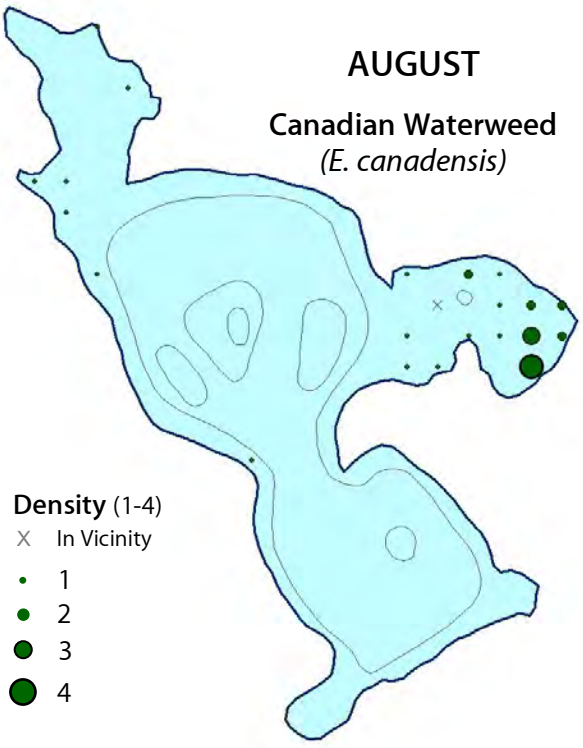


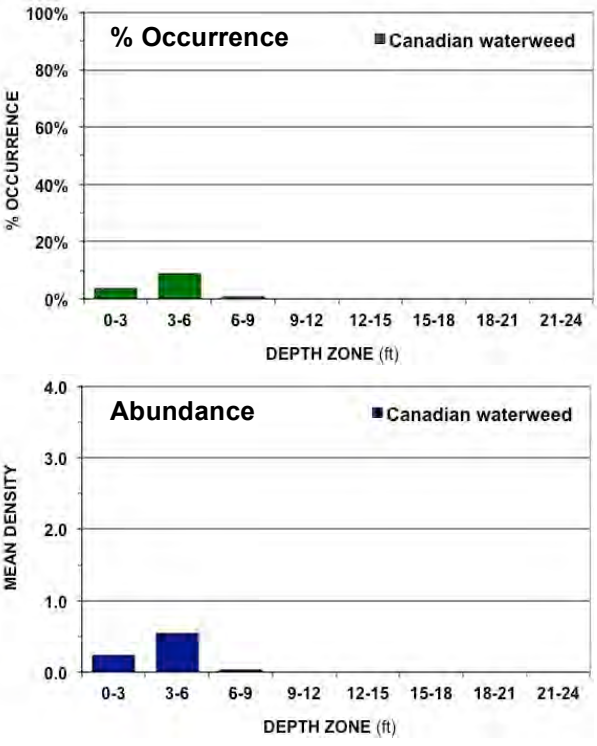


2015 Red Rock Lake – Canadian Waterweed (Elodea)

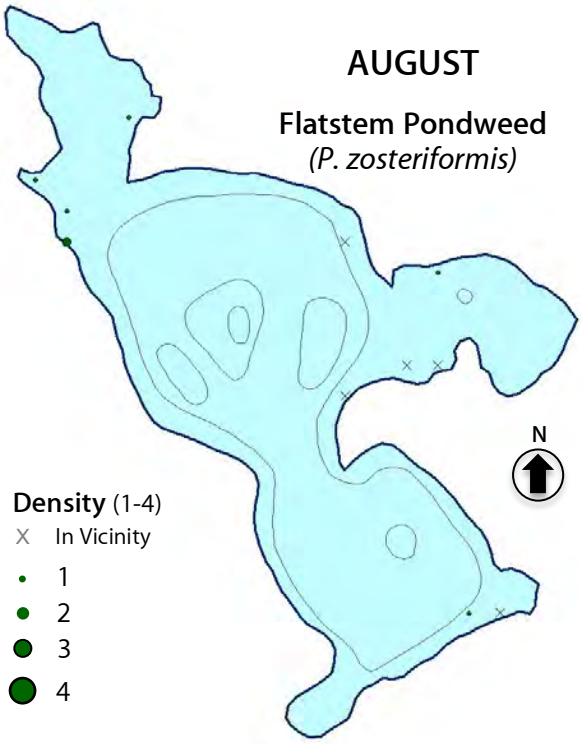


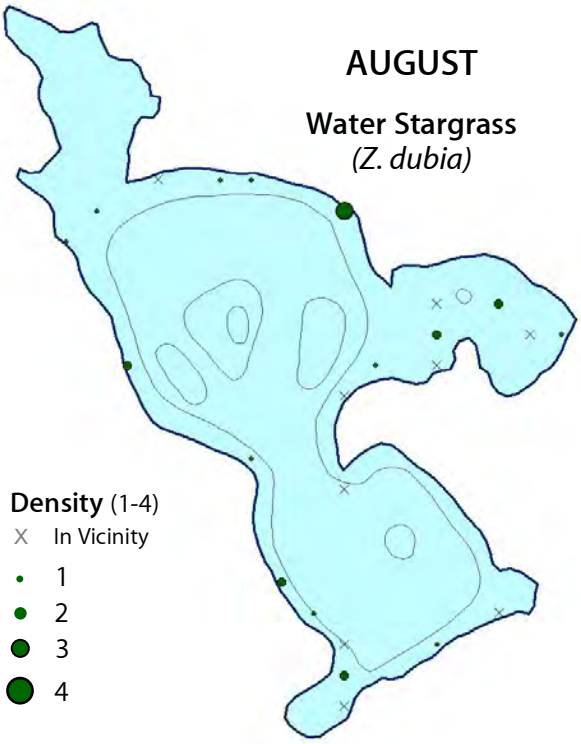


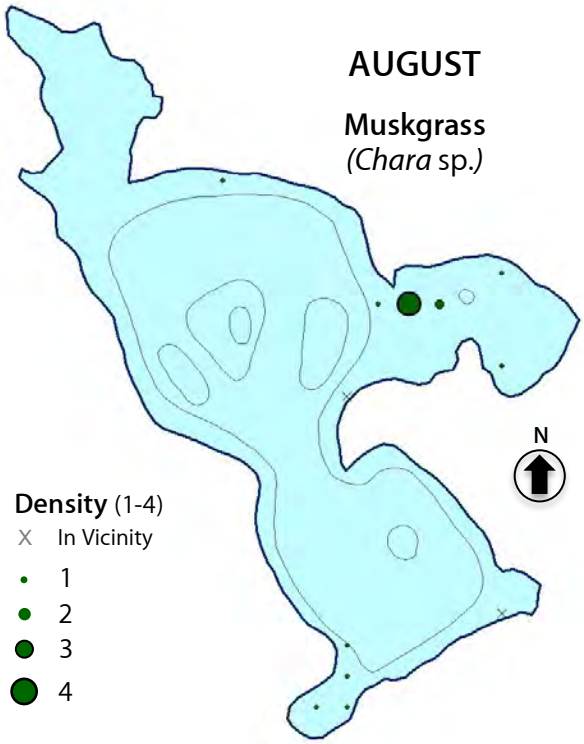


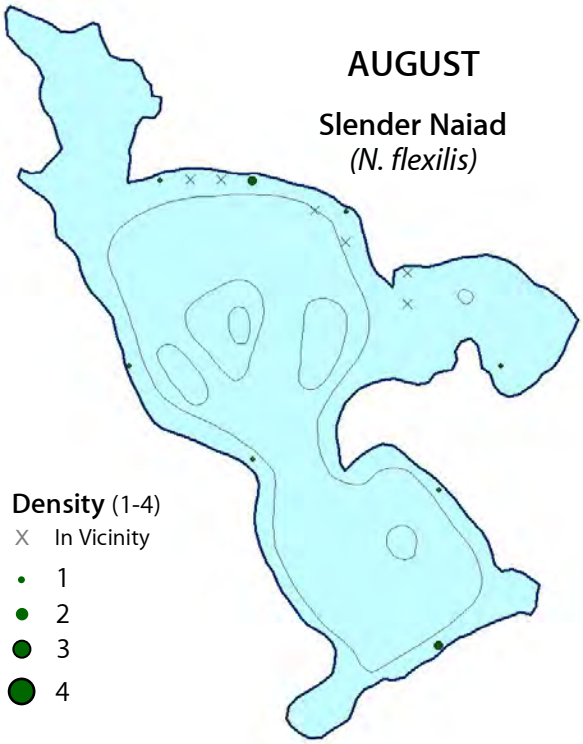


2015 Red Rock Lake – Additional Native Aquatic Plants

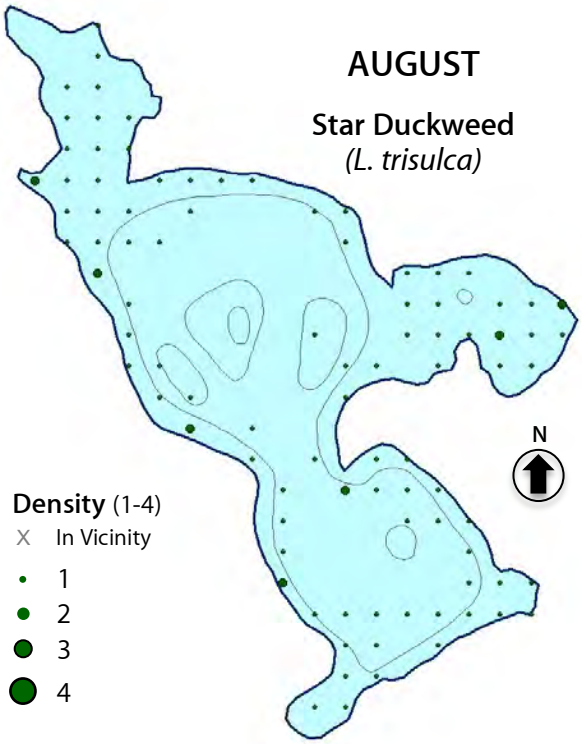


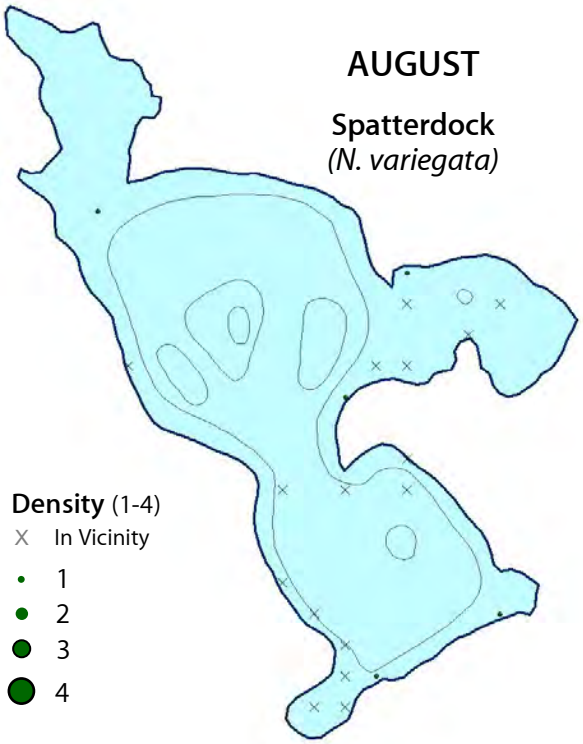


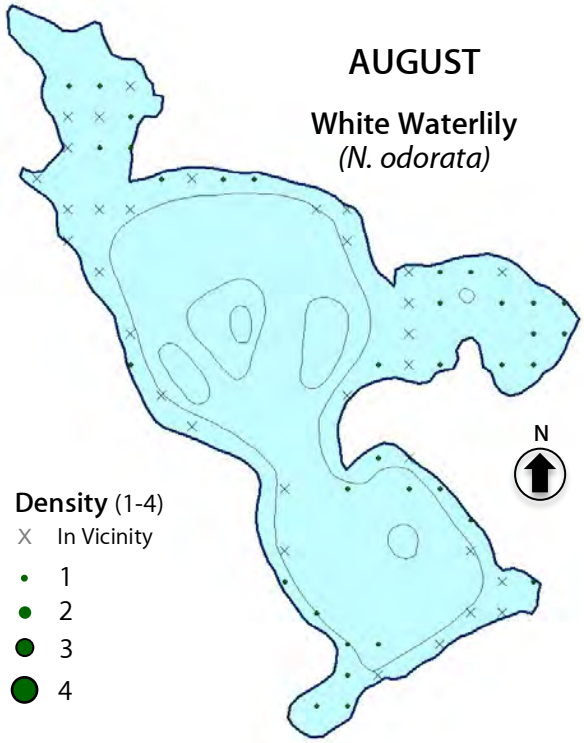


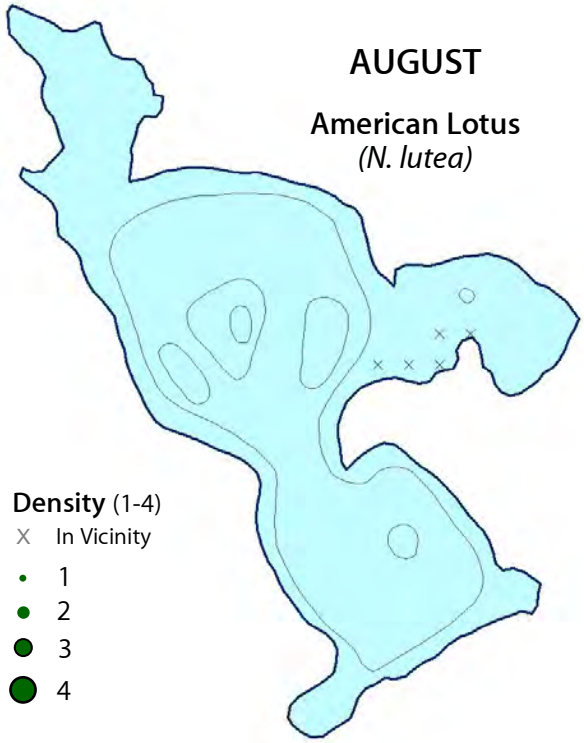


2015 Red Rock Lake – Native Aquatic Plants









References

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