

2011 Lake Ripley Macrophyte Inventory

Methods

Lake Ripley's 2011 aquatic plant (macrophyte) inventory employed the point-intercept sampling method in accordance with protocols approved by the Wisconsin Department of Natural Resources.¹ The inventory was conducted between June 7 and June 28, 2011, with actual sampling dates dictated by weather conditions and field crew scheduling. Samples of the various plant species were pressed, dried and submitted to the Wisconsin State Herbarium in Madison. Patricia Cicero (Water Resource Management Specialist, Jefferson County Land and Water Conservation Department), Paul Dearlove (Lake Manager, Lake Ripley Management District), and Jeanne Scherer (Intern, Lake Ripley Management District) performed the plant inventory, specimen preparation, and data analysis. Plant-distribution maps were prepared by Gerry Kokkonen, GIS Specialist, Jefferson County LWCD.

Results

A total of 21 aquatic plant species were found through point-intercept rake sampling. This number increases to 23 if two visuals are included (common watermeal and floating-leaf pondweed). Plants were found at water depths extending to 21 feet. The six most dominant species documented, in descending order, were: muskgrass (*Chara spp.*), sago pondweed (*Stuckenia pectinata*), coontail (*Ceratophyllum demersum*), northern watermilfoil (*Myriophyllum sibiricum*), Fries' pondweed (*Potamogeton friesii*) and spiny naiad (*Najas marina*). Two native species, Fries' pondweed and northern watermilfoil, moved into dominance for the first time since surveying began in 1976.

The non-native Eurasian watermilfoil (*Myriophyllum spicatum*) declined to a low Relative Frequency of Occurrence of 1.6%, marking an all-time low since its 1989 peak (37.5%). However, a suspected hybrid of Eurasian and northern watermilfoils was documented in both 2006 and 2011, and has shown an increase in frequency. Positive identification by the Wisconsin DNR is pending. While still not a dominant presence, the non-native curly-leaf pondweed (*Potamogeton crispus*) appears to be gaining in prominence, surpassing Eurasian watermilfoil for the first time in terms of Frequency of Occurrence.

Overall species diversity was similar to 2006, but significantly higher compared to earlier surveys. However, as in 2006, data comparisons with earlier surveys may be limited given the change from transect-based to point-intercept-based sampling methods.

¹ Hauxwell, J., S. Knight, K. Wagner, A. Mikulyuk, M. Nault, M. Porzky and S. Chase. 2010. *Recommended baseline monitoring of aquatic plants in Wisconsin: sampling design, field and laboratory procedures, data entry and analysis, and applications*. Wisconsin DNR Bureau of Science Services, PUB-SS-1068 2010. Madison, Wisconsin, USA.

Tables 1-2 and Figure 2 present plant species and statistical relationships from the 2011 inventory. Table 3 and Figure 3 provide analytical comparisons between the 2006 and 2011 point-intercept surveys. Tables 4-6 and Figure 1 provide a comparative analysis among all plant surveys conducted between 1976 and 2011. Factors which may influence results include variations in sampling technique and inter-annual variability in plant growth. Figure 4 represents Lake Ripley's Floristic Quality Index relative to other inventoried lakes in the same eco-region. Finally, maps showing plant distributions and densities are shown as Figures 5-13.

Discussion

Lake Ripley continues to see a gradual increase in aquatic plant community diversity coupled with declines in Eurasian watermilfoil. Fries' pondweed (*Potamogeton friesii*) and northern watermilfoil (*Myriophyllum sibiricum*)—two plants with high Coefficients of Conservatism (8 and 7, respectively)—have become more dominant. Higher Coefficients of Conservatism (on a 0-10 scale) are indicative of native plants that are more intolerant of habitat modification or impaired water quality. Other relatively dominant species include muskgrass (*Chara spp.*), sago pondweed (*Stuckenia pectinata*), coontail (*Ceratophyllum demersum*), and spiny naiad (*Najas marina*). Lake Ripley's Floristic Quality Index of 23.77 continues to rank above the median (21.10) and average (20.00) values for the Southeast Wisconsin Till Plains ecoregion.² In terms of its Aquatic Plant Community Biotic Index, a measure of biological quality of the aquatic plant community, Lake Ripley again scores above the regional mean with a value of 53.³

While the non-native Eurasian watermilfoil has continued to decline in abundance and distribution, the non-native curly-leaf pondweed (*Potamogeton crispus*) appears to be gaining in prominence. Recent increases may be due to a variety of factors, including changes in climate that might favor this early-season weed. Special attention should be paid to this species in future inventories to verify growth trends. Also found was an increase in an unconfirmed species believed to be a hybrid of Eurasian and northern watermilfoils. Because genetic identification of the unknown milfoil found in 2006 was not completed, it is not possible to determine if the 2011 species is the same plant. Samples collected during the 2011 survey were submitted to Wisconsin DNR for identification.

² Median and average FQI for Wisconsin lakes sampled in the SWTP eco-region (updated: August 2011). Statistics provided by Michelle Nault, Wisconsin DNR.

³ Nichols, Stanley, Weber, Steven and Shaw, Byron. (2000) *A Proposed Aquatic Plant Community Biotic Index for Wisconsin Lakes*. Journal of Environmental Management. Volume 26, Number 5, pages 491-502.

Table 1: 2011 plant inventory findings

Species	Frequency of Occurrence (%)	Average Density* (1-3 scale)	Relative Frequency	Importance Value
<i>Ceratophyllum demersum</i> (coontail)	25.3	1.4	10.8	15.1
<i>Chara</i> spp. (muskgrass)	49.6	1.5	21.3	32
<i>Elodea canadensis</i> (waterweed)	9.8	1.4	4.2	5.9
<i>Heteranthera dubia</i> (water stargrass)	1.0	1.0	0.4	0.4
<i>Myriophyllum sibiricum</i> (northern watermilfoil)	24.6	1.1	10.5	11.6
<i>Myriophyllum spicatum</i> (Eurasian watermilfoil)	3.7	1.1	1.6	1.8
<i>Myriophyllum</i> spp. (unknown watermilfoil)	12.3	1.3	5.3	6.8
<i>Lemna minor</i> (small duckweed)	0.2	1.0	0.1	0.1
<i>Najas flexilis</i> (bushy pondweed)	2.0	1.0	0.8	0.8
<i>Najas marina</i> (spiny naiad)	18.7	1.0	8.0	8.0
<i>Nuphar variegata</i> (spatterdock)	1.7	2.1	0.7	1.5
<i>Nymphaea odorata</i> (white water lily)	1.2	1.3	0.5	0.7
<i>Potamogeton crispus</i> (curly-leaf pondweed)	8.9	1.1	3.8	4.2
<i>Potamogeton friesii</i> (Fries' pondweed)	20.1	1.1	8.6	9.5
<i>Potamogeton gramineus</i> (variable pondweed)	0.3	1.0	0.1	0.1
<i>Potamogeton illinoensis</i> (Illinois pondweed)	7.4	1.0	3.2	3.2
<i>Potamogeton pusillus</i> (small pondweed)	0.5	1.0	0.2	0.2
<i>Stuckenia pectinata</i> (Sago pondweed)	32.7	1.0	14.0	14
<i>Potamogeton natans</i> (floating-leaf pondweed)**	--	--	--	--
<i>Potamogeton zosteriformis</i> (flat-stem pondweed)	--	--	--	--
<i>Utricularia vulgaris</i> (bladderwort)	2.7	1.0	1.2	1.2
<i>Vallisneria spiralis</i> (Eel grass)	10.6	1.1	4.5	5.0
<i>Wolffia columbiana</i> (common watermeal)**	--	--	--	--
<i>Zannichellia palustris</i> (horned pondweed)	0.2	1.0	0.1	0.1

* Average Densities and corresponding Importance Values are based on a 1-3 rake-fullness scale, versus a 1-4 scale used in inventories prior to 2006.

** Visual during point-intercept sampling

Table 2: Statistical summary for all plant species documented in the 2011 inventory

Aquatic Plant	Number of Sites Found	FREQ ^a [0-21'] (%)	FREQ ^b [Veg. Sites] (%)	RFREQ ^c (%)	ADEN ^d (1-3 scale)	IV ^e	C ^f
Muskgrass <i>Chara</i> sp.	202	49.6	55.2	21.3	1.5	32	7
Sago pondweed <i>Stuckenia pectinata</i>	133	32.7	36.3	14.0	1.0	14.3	3
Coontail <i>Ceratophyllum demersum</i>	103	25.3	28.1	10.8	1.4	15.2	3
Northern watermilfoil <i>Myriophyllum sibiricum</i>	100	24.6	27.3	10.5	1.1	11.6	7
Fries' pondweed <i>Potamogeton friesii</i>	82	20.1	22.4	8.6	1.1	9.5	8
Spiny naiad	76	18.7	20.8	8.0	1.0	8.0	NA

<i>Najas marina</i>							
Unknown watermilfoil ** <i>Myriophyllum</i> sp.	50	12.3	13.7	5.3	1.3	6.8	NA
Eel grass (Water celery) <i>Vallisneria spiralis</i>	43	10.6	11.7	4.5	1.0	4.5	6
Common waterweed <i>Elodea canadensis</i>	40	9.8	10.9	4.2	1.4	5.9	3
*Curly-leaf pondweed <i>Potamogeton crispus</i>	36	8.9	9.8	3.8	1.1	4.2	NA
Illinois pondweed <i>Potamogeton illinoensis</i>	30	7.4	8.2	3.2	1.0	3.2	6
*Eurasian watermilfoil <i>Myriophyllum spicatum</i>	15	3.7	4.1	1.6	1.1	1.7	NA
Common bladderwort <i>Utricularia vulgaris</i>	11	2.7	3.0	1.2	1.0	1.2	7
Slender naiad, or Bushy pondweed <i>Najas flexilis</i>	8	2.0	2.2	0.8	1.0	0.8	6
Spatterdock <i>Nuphar variegata</i>	7	1.7	1.9	0.7	2.1	1.5	6
White water lily <i>Nymphaea odorata</i>	5	1.2	1.4	0.5	1.3	0.7	6
Water stargrass <i>Heteranthera/Zosterella dubia</i>	4	1.0	1.1	0.4	1.0	0.4	6
Small pondweed <i>Potamogeton pusillus</i>	2	0.5	0.5	0.2	1.0	0.2	7
Small duckweed <i>Lemna minor</i>	1	0.2	0.3	0.1	1.0	0.1	4
Variable pondweed <i>Potamogeton gramineus</i>	1	0.2	0.3	0.1	1.0	0.1	7
Horned pondweed <i>Zannichellia palustris</i>	1	0.2	0.3	0.1	1.0	0.1	7
Sedge <i>Carex</i> spp.	GS	GS	GS	GS	GS	GS	NA
Common watermeal <i>Wolffia columbiana</i>	Visual	Visual	Visual	Visual	Visual	Visual	5
Swamp loosestrife <i>Decodon verticillatus</i>	GS	GS	GS	GS	GS	GS	NA
Southern blue flag <i>Iris virginica</i>	GS	GS	GS	GS	GS	GS	NA
Floating-leaf pondweed <i>Potamogeton natans</i>	Visual	Visual	Visual	Visual	Visual	Visual	5
Bulrush <i>Schoenoplectus/Scirpus</i> sp.	GS	GS	GS	GS	GS	GS	NA
Cattails <i>Typha</i> sp.	GS	GS	GS	GS	GS	GS	1
filamentous algae	162	39.8	44.3	44.3	1.1	48.7	NA

* = Species not native to Wisconsin

**= May be a hybrid of Eurasian watermilfoil and Northern watermilfoil. DNR confirmation pending.

GS = species observed during general boat survey

^aFREQ [0-21'] = Frequency of Occurrence within depth zone defining extent of plant growth. The number of occurrences of a species divided by the number of sampling points in the 0-21' depth range.

^bFREQ [Veg. Sites] = Frequency of Occurrence within sites where plants were collected. The number of occurrences of a species divided by the number of sampling points with documented plant growth.

^cRFREQ = Relative Frequency of Occurrence.

^dADEN = Average Density. The sum of the density ratings for a species (1-3 rake fullness scale) divided by the number of sampling points with vegetation.

^eIV = Importance Value. The product of the relative frequency (RFREQ) and the average density, expressed as a percentage.

^fC = Coefficient of Conservatism. Used to compute Floristic Quality Index. Values range from 0-10, with higher values indicative of plant species intolerant of habitat modification or water quality impairment caused by human disturbance.

Table 3: Statistical descriptions based on all plants inventoried (2006 and 2011)

	<u>2006</u>	<u>2011</u>
^a Total Number of Points Sampled	398	421
^b Number of Points Sampled within Depth Range of Potential Plant Growth (2006: 0-17'; 2011: 0-21')	369	407
^c Number of Points with Vegetation	318	366
^d Maximum Depth of Plant Growth	17 ft	21 ft.
^e Number of Species in Lake	31	28
^f Frequency of Occurrence of Vegetation within Range of Plant Growth (2006: 0-17'; 2011: 0-21')	86	90
^g Simpson Diversity Index	0.85	0.89
^h Species Richness	20	21
ⁱ Floristic Quality Index (FQI)	22.75	23.77
^j Mean Coefficient of Conservatism (C)	5.69	5.76
Average Number of Species Sampled Per Site (2006: 0-17'; 2011: 0-21')	1.76	2.33
Average Number of Species Sampled Per Site (Veg. Sites Only)	2.05	2.60
Average Number of Native Species Sampled Per Site (2006: 0-17'; 2011: 0-21')	1.52	2.02
Average Number of Native Species Sampled Per Site (Veg. Sites Only)	2.00	2.34

^aDoes not include sample points beyond maximum rooting depth where plant growth could not be documented

^bIncludes all sample points within the range of potential plant growth (littoral zone) that was shown to support plant growth

^cIncludes all sample points where vegetation was found after taking a rake sample

^dRepresents deepest point where vegetation was sampled. This depth will fluctuate from year to year depending on changes in water clarity conditions. Plants may be found at depths of over 20 ft. in clear lakes, but only in a few feet of water in stained or turbid lakes. While some species can tolerate very low light conditions, others are only found near the surface. In general, the diversity of the plant community decreases with increased depth.

^eIncludes plant species documented in the lake and along the zero-depth shoreline margin using both the point-intercept method and a general boat survey. Does not include filamentous algae.

^fPercentage of occurrence that vegetation would be sampled within the range of potential plant growth (littoral zone)

^gSimpson Diversity Index: One minus the sum of each of the relative frequencies squared ($SDI = 1 - \sum(RFREQ^2)$). The closer the SDI value is to one, the greater the diversity is between communities being compared. The index allows the plant community at one location to be compared to the plant community at another location. It also allows a single location's plant community to be compared over time. The index value (on a scale of 0-1) represents the probability that two individuals (randomly selected) will be different species. The greater the index value, the higher the diversity in a given location. Plant communities with high diversity are usually representative of healthier lakes, and also tend to be more resistant to invasion by exotic species.

^hIndicates the number of different plant species found in and directly adjacent to the lake (on the waterline). Species richness only counts those plants documented as part of the point-intercept data. It does not include filamentous algae and freshwater sponge. It does include unidentified *Myriophyllum* species.

ⁱMeasures the impact of human development on a lake's aquatic plant community. Species in the index are assigned a Coefficient of Conservatism (C), which ranges from 3.0 to 44.6 in Wisconsin. The higher the value, the more likely the plant is negatively influenced by human activities that affect water quality or habitat. Plants with low values are tolerant of human disturbances, and often exploit these impacts to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each species found in the lake, and then multiplying that value by the square root of the number of species ($FQI = \text{mean}C\sqrt{N}$). Consequently, a higher index value indicates a healthier macrophyte community.

^jMean Coefficient of Conservatism (C) among species documented during point-intercept survey. Does not include species observed during the follow-up boat survey. According to Michelle Nault (Wisconsin DNR), Lake Ripley's 2011 mean C-value of 5.76 compares favorably to a mean C-value of 5.21 for 68 lakes surveyed in our SWTP ecoregion. Individual values ranged from a high of 6.87, to a low of 2.12. Of those, 18 lakes are classified as having physical characteristics similar to Lake Ripley. The average of those C-values is 5.03, with high and low values of 6.02 and 2.12, respectively.

Table 4: Number of littoral-zone sample sites where each species was found (1976-2011)

Species	Year						
	1976	1989	1991	1996	2001	2006*	2011*
Muskgrass	47	7	18	23	45	196	202
Eurasian watermilfoil	19	45	48	53	41	25	15
Spiny naiad	--	11	37	46	35	123	76
Eel grass	25	7	7	10	21	11	43
Sago pondweed	12	3	12	18	20	62	133
Bushy pondweed	--	7	8	11	13	4	8
Flatstem pondweed	--	--	--	--	8	--	--
Variable pondweed	--	2	--	--	8	--	1
Coontail	14	3	19	21	5	44	103
Water bulrush	--	--	--	--	4	--	--
Common waterweed	2	--	2	1	3	3	40
Water star grass	--	--	--	--	3	16	4
Curly-leaf pondweed	1	1	--	--	1	5	36
Floating-leaf pondweed	10	8	--	--	1	--	--
Illinois pondweed	--	13	--	1	--	18	30
Small pondweed	--	13	--	--	--	1	2
Northern watermilfoil	--	--	2	1	--	14	100
Common Bladderwort	6	--	2	2	1	--	11
<i>Potamogeton</i> spp.	7	--	5	7	--	--	--
<i>Naiad</i> spp.	3	--	--	--	--	1	--
Leafy pondweed	--	--	--	--	--	3	--
Forked duckweed	--	--	--	--	--	1	--
Small duckweed	--	--	--	--	--	4	1
Fries' pondweed	--	--	--	--	--	27	82
Spatterdock	--	--	--	--	--	7	7
White water lily	--	--	--	--	--	6	5
<i>Myriophyllum</i> sp.**	--	--	--	--	--	--	50
Horned pondweed	--	--	--	--	--	--	1
Common Watermeal	--	--	--	--	--	--	--
Total Number of Species Documented:	11	12	11	12	15	20	21

* 2006 and 2011 had a higher number of sample sites compared to previous years due to use of the point-intercept method

** May be a hybrid of Eurasian watermilfoil and Northern watermilfoil. DNR confirmation pending.

Table 5: Percent frequency of occurrence of aquatic plant species (1976-2011)

Species	Year						
	1976	1989	1991	1996	2001	2006	2011
Muskgrass	69.1	11.7	20.0	25.6	50.0	53.1	49.6
Eurasian watermilfoil	29.9	75.0	53.3	58.9	45.6	6.8	3.7
Spiny naiad	0.0	18.3	41.1	51.1	38.9	33.3	18.7
Eel grass	36.8	11.7	7.8	11.1	23.3	3.0	10.6
Sago pondweed	17.6	5.0	13.3	20.0	22.2	16.8	32.7
Bushy pondweed	--	11.7	8.9	12.2	14.4	1.1	2.0
Flatstem pondweed	--	--	--	--	8.9	--	--
Variable pondweed	--	3.3	--	--	8.9	--	0.2
Coontail	20.6	5.0	21.1	23.3	5.6	12.2	25.3
Water bulrush	--	--	--	--	4.4	--	--
Common waterweed	2.9	--	2.2	1.1	3.3	0.8	9.8
Water stargrass	--	--	--	--	3.3	4.3	1.0
Curly-leaf pondweed	1.5	1.7	--	--	1.1	1.4	8.9
Floating-leaf pondweed	14.7	13.3	--	--	1.1	--	--
Illinois pondweed	--	21.7	--	1.1	--	--	7.4
Small pondweed	--	21.7	--	--	--	0.3	0.5
Northern watermilfoil	--	--	2.2	1.1	--	3.8	24.6
Common Bladderwort	8.8	--	2.2	2.2	1.1	--	2.7
Potamogeton spp.	10.3	--	5.6	7.8	--	--	--
Naiad spp.	4.4	--	--	--	--	0.27	--
Leafy pondweed	--	--	--	--	--	0.8	--
Forked duckweed	--	--	--	--	--	0.3	--
Small duckweed	--	--	--	--	--	1.1	0.2
Fries' pondweed	--	--	--	--	--	7.3	20.1
Spatterdock	--	--	--	--	--	1.9	1.7
White water lily	--	--	--	--	--	1.6	1.2
<i>Myriophyllum sp.</i> *	--	--	--	--	--	--	12.3
Common watermeal	--	--	--	--	--	--	--
Horned pondweed	--	--	--	--	--	--	0.2

* May be a hybrid of Eurasian watermilfoil and Northern watermilfoil. DNR confirmation pending.

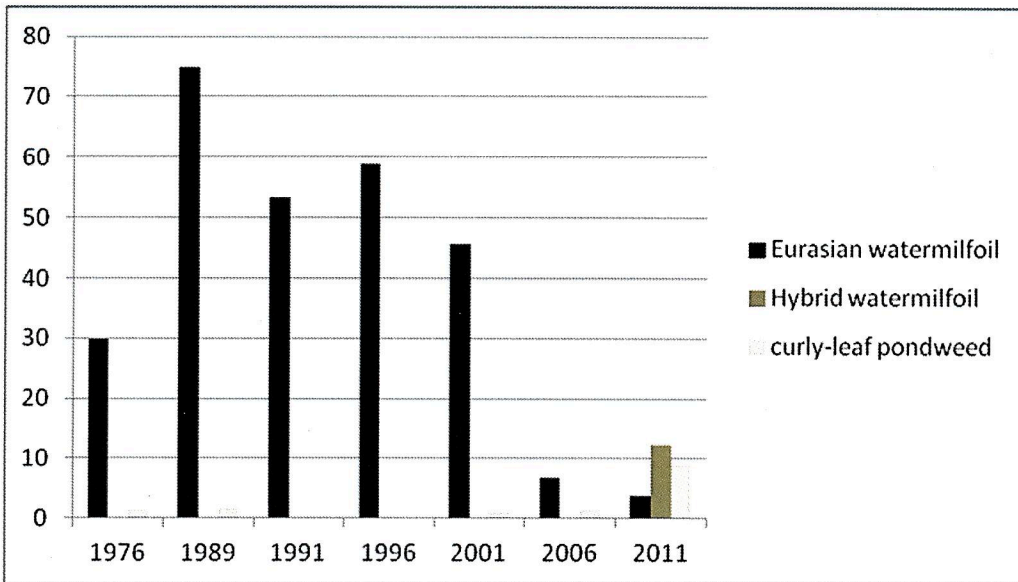


Figure 1: Frequency of Occurrence for Non-Native Aquatic Plant Species Found Among Littoral-Zone Sample Sites (1976-2011*)

Table 6: Percent relative frequency of occurrence of aquatic plant species (1976-2011)

Species	Year						
	1976	1989	1991	1996	2001	2006	2011
Muskgrass	32.2	5.8	11.3	11.9	21.5	30.1	21.3
Eurasian watermilfoil	13.0	37.5	30.0	27.3	19.6	3.8	1.6
Spiny naiad	--	9.2	23.1	23.7	16.7	18.9	8.0
Eel grass	17.1	5.8	4.4	5.2	10.0	1.7	4.5
Sago pondweed	8.2	2.5	7.5	9.3	9.6	9.5	14.0
Bushy pondweed	--	5.8	5.0	5.7	6.2	0.6	0.8
Flatstem pondweed	--	--	--	--	3.8	--	--
Variable pondweed	--	1.7	--	--	3.8	--	0.1
Coontail	9.6	2.5	11.9	10.8	2.4	6.9	10.8
Water bulrush	--	--	--	--	1.9	--	--
Common waterweed	1.4	--	1.3	0.5	1.4	0.5	4.2
Water stargrass	--	--	--	--	1.4	2.5	0.4
Curly-leaf pondweed	0.7	0.8	--	--	0.5	0.8	3.8
Floating-leaf pondweed	6.8	6.7	--	--	0.5	--	--
Illinois pondweed	--	10.8	--	0.5	--	--	3.2
Small pondweed	--	10.8	--	--	--	0.2	0.2
Northern watermilfoil	--	--	1.3	0.5	--	2.2	10.5
Common Bladderwort	4.1	--	1.3	1.0	0.5	--	1.2
Potamogeton spp.	4.8	--	3.1	3.6	--	--	--
Naiad spp.	2.1	--	--	--	--	0.2	--
Leafy pondweed	--	--	--	--	--	0.5	--
Forked duckweed	--	--	--	--	--	0.2	--
Small duckweed	--	--	--	--	--	0.6	0.1

Fries' pondweed	--	--	--	--	--	4.1	8.6
Spatterdock	--	--	--	--	--	1.1	0.7
White water lily	--	--	--	--	--	0.9	0.5
<i>Myriophyllum sp.*</i>	--	--	--	--	--	--	5.3
Common watermeal	--	--	--	--	--	--	--
Horned pondweed	--	--	--	--	--	--	0.1

** May be a hybrid of Eurasian watermilfoil and Northern watermilfoil. DNR confirmation pending.

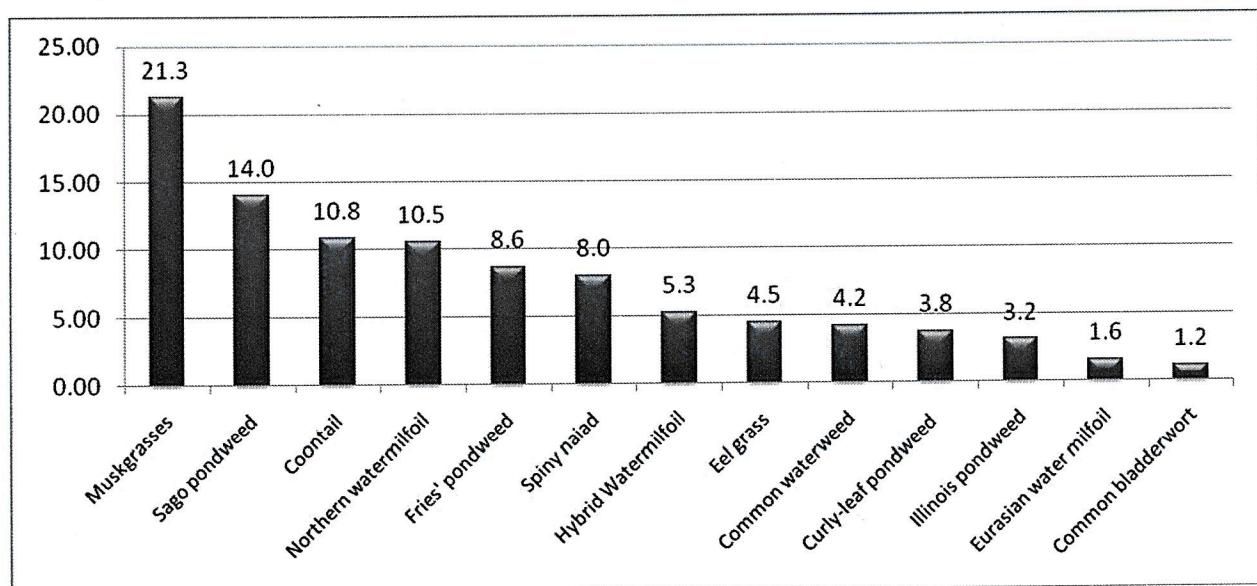


Figure 2: 2011 Species with a Relative Frequency (%) of 1.0 or greater.

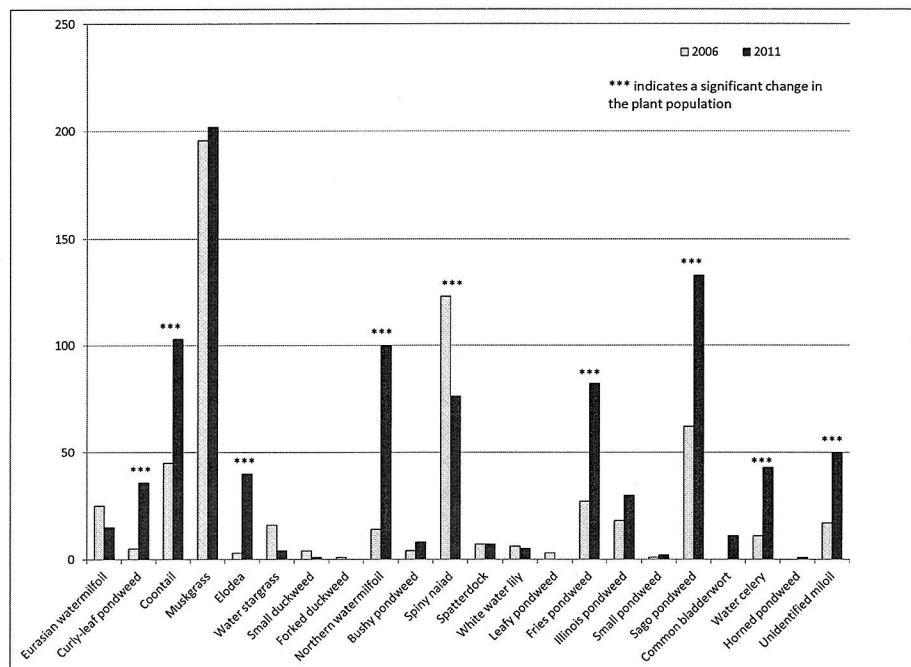


Figure 3: 2006 and 2011 comparison of total number of sample points where each species was found.

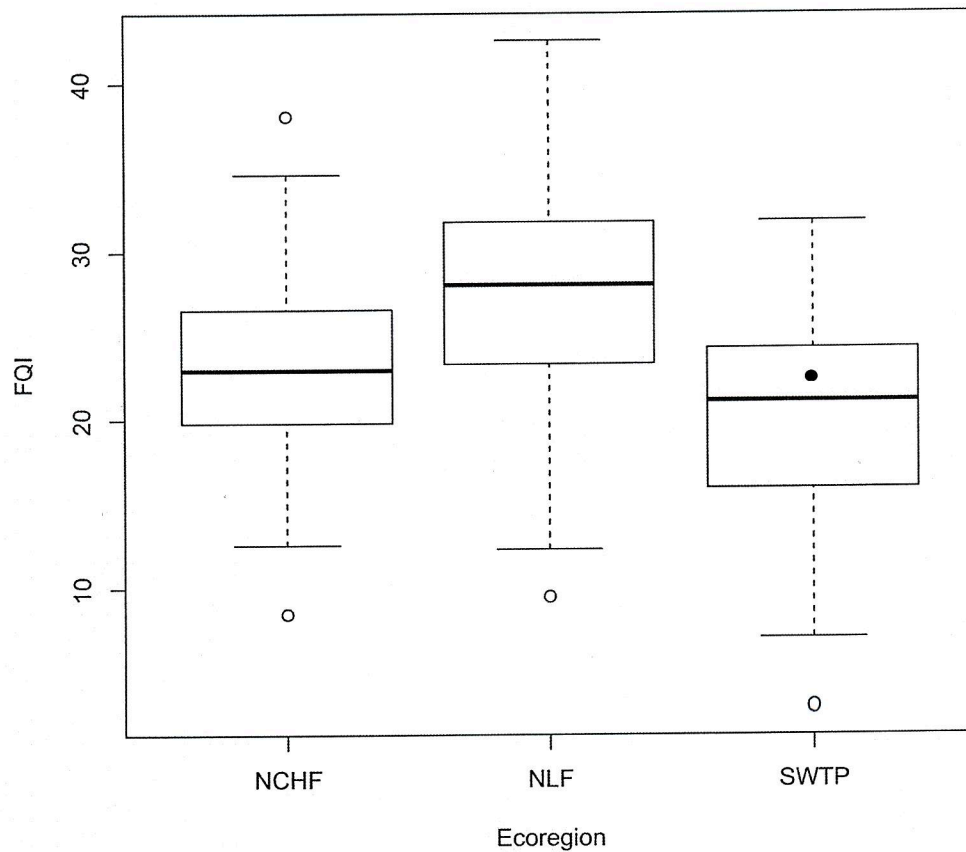


Figure 4: Box plot showing variation in Floristic Quality Index (FQI) by ecoregion across 233 Wisconsin lakes sampled with the Wisconsin standardized baseline aquatic plant monitoring protocol over six years (2005-2011). Mean is center, box covers 50% of the data, whiskers indicate range, circles indicate outliers, solid dot is Lake Ripley. NCHF = North Central Hardwood Forests, NLF = Northern Lakes and Forests, SWTP = Southeastern Wisconsin Till Plains.

**Aquatic Plant Survey
Lake Ripley - Jefferson County - June 2011
Total Rake Fullness Rating**

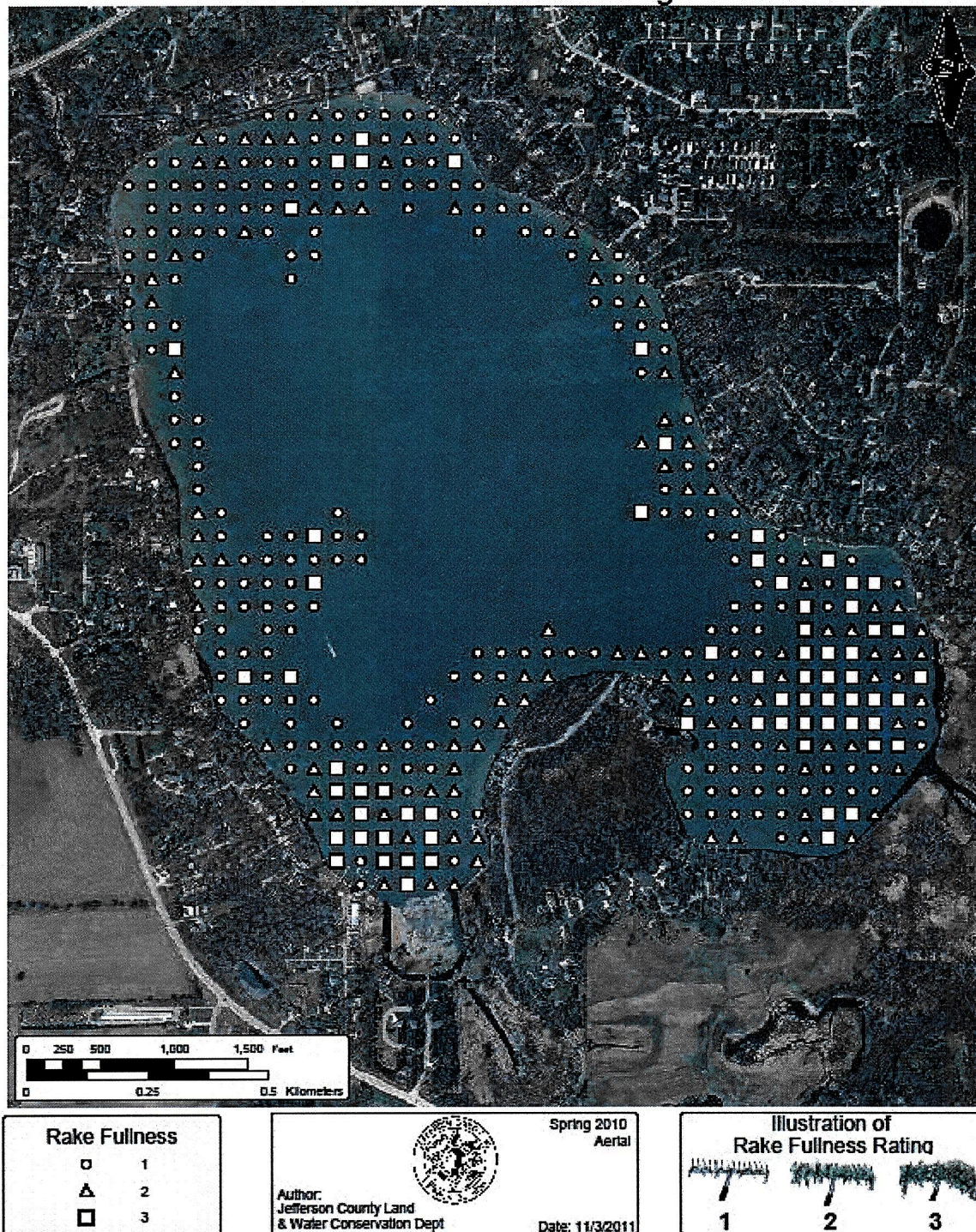


Figure 5: Total Rake Fullness Ratings for Each Point Sampled

**Aquatic Plant Survey
Lake Ripley - Jefferson County - June 2011
Native and Exotic Plants**

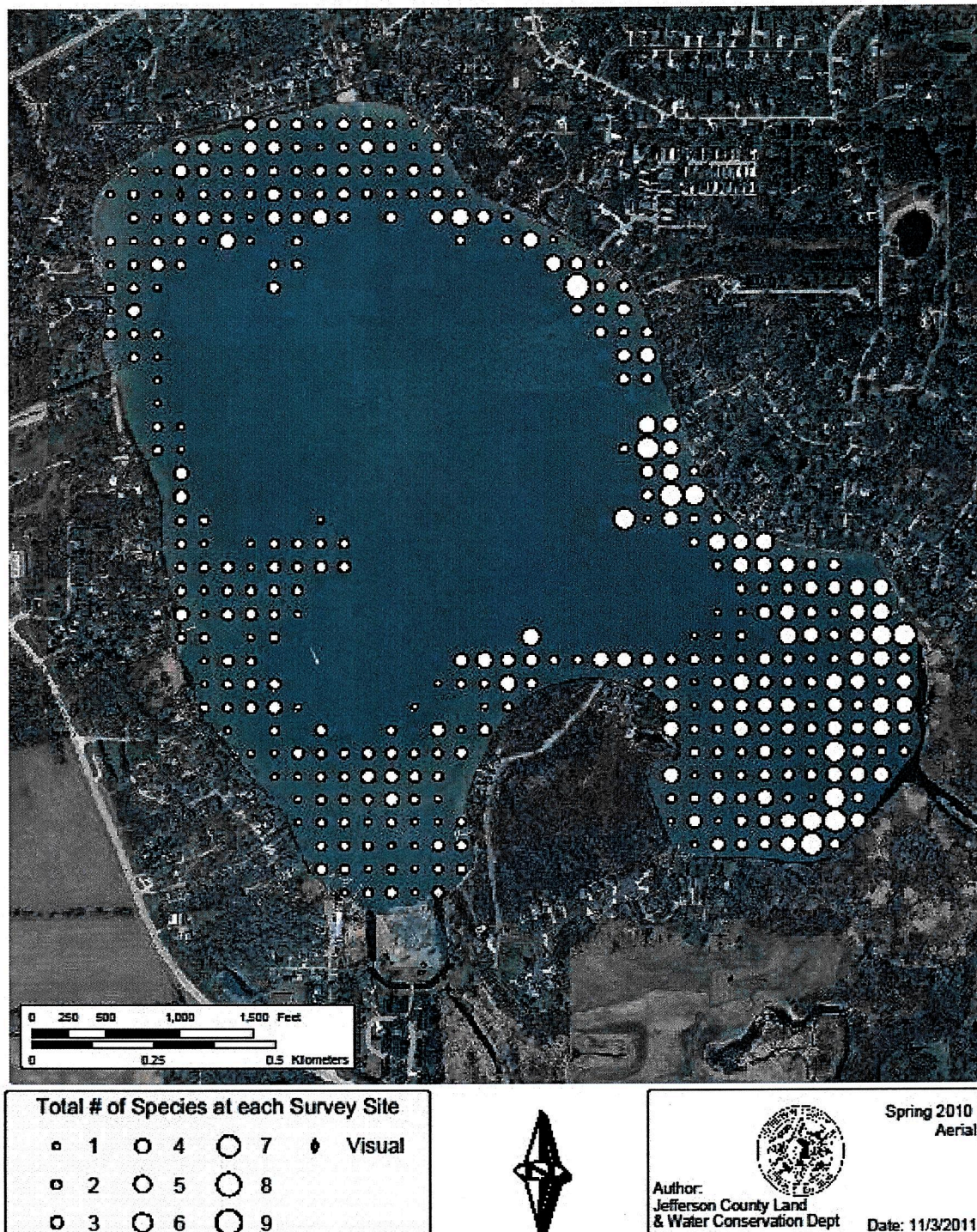


Figure 6: Total Number of Species Found at Each Point Sampled

Aquatic Plant Survey **Lake Ripley - Jefferson County - June 2011** **Native Plants**

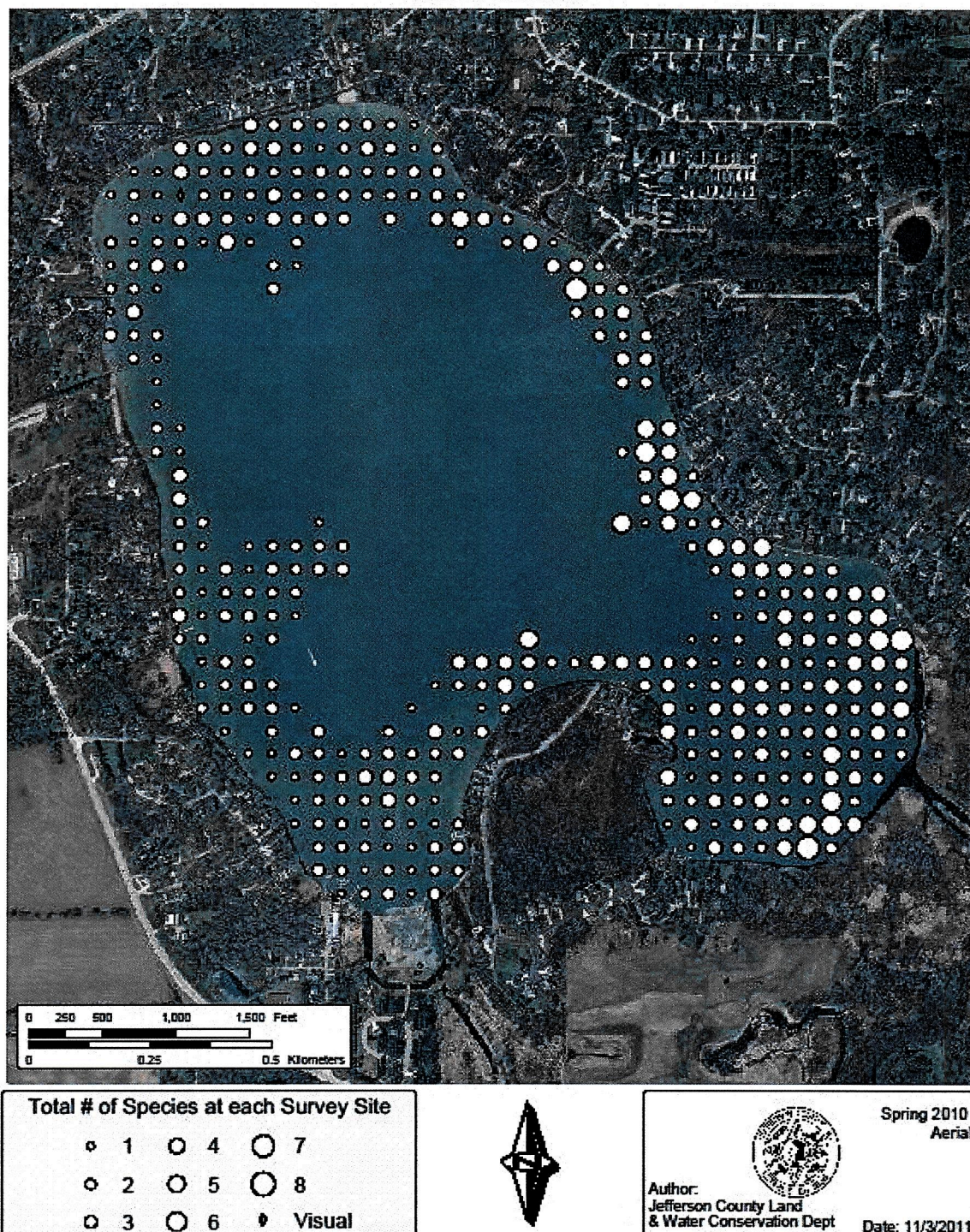


Figure 7: Total Number of Native Species Found at Each Point Sampled

Total Rake Fullness Rating				
○	1	□	3	
△	2	◆	Visual	

Lake Ripley - Jefferson County June, 2011

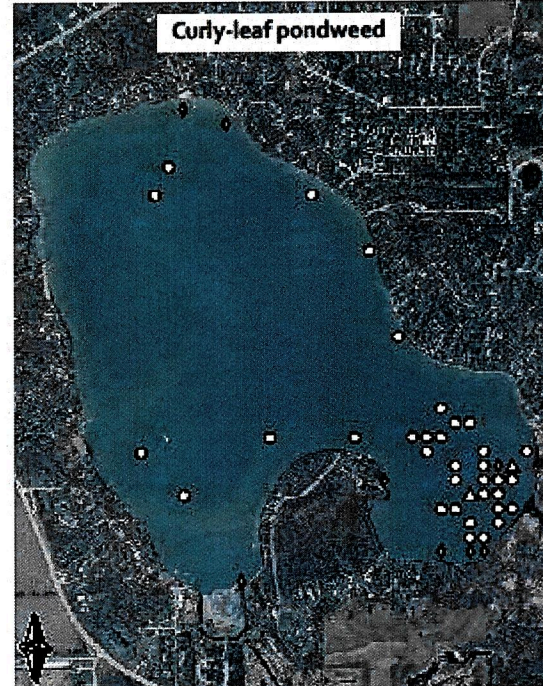
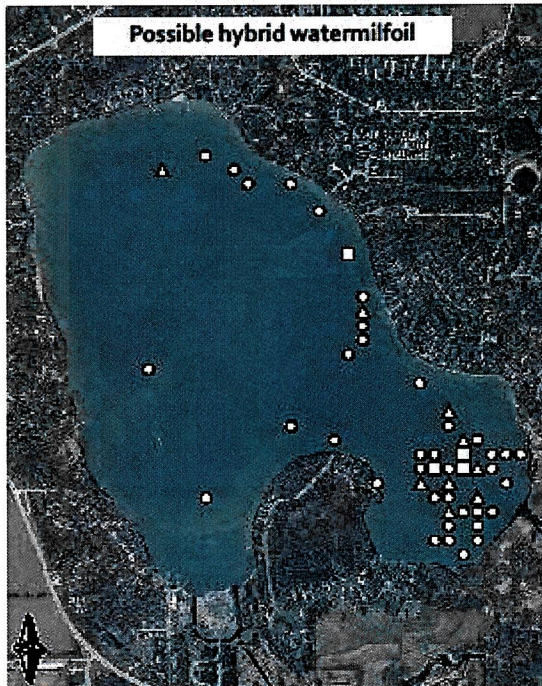
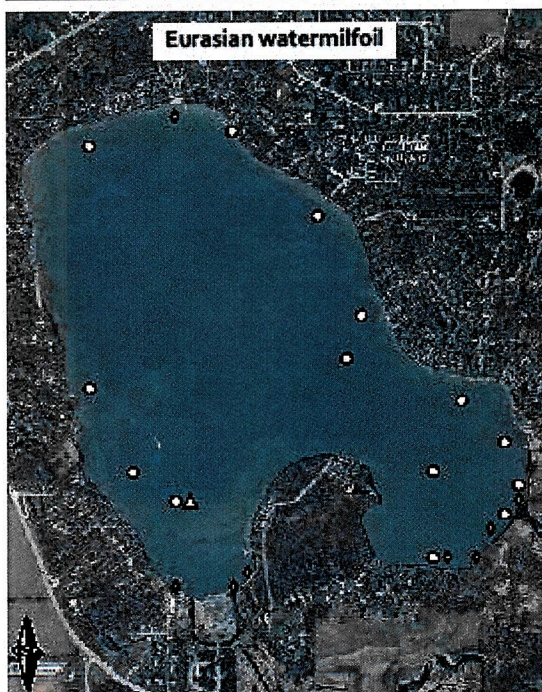
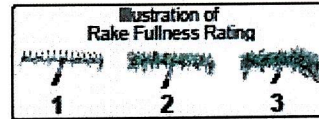


Figure 8: Rake Fullness Ratings for Watermilfoils and Curly-Leaf Pondweed

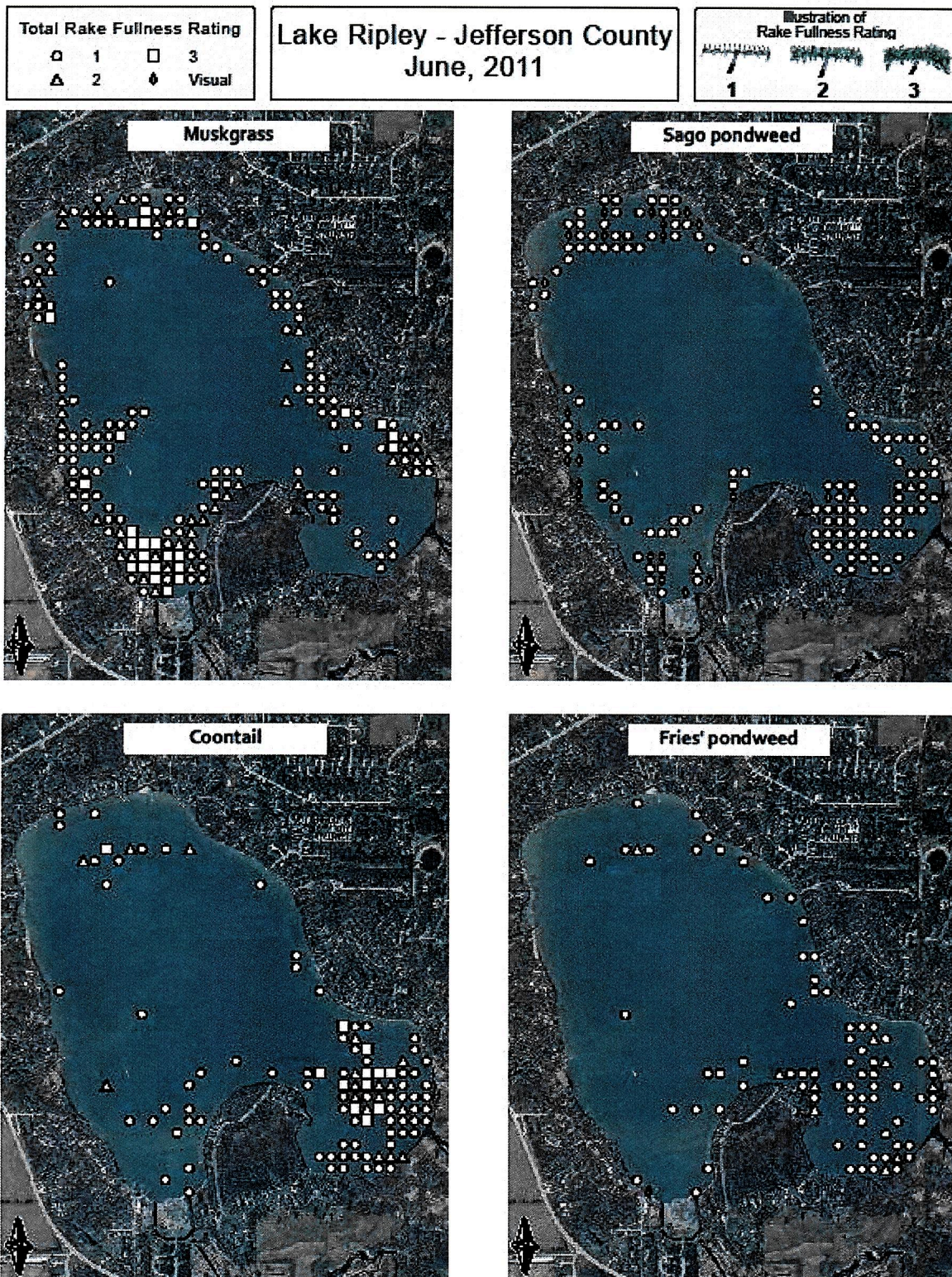


Figure 9: Rake Fullness Ratings for Muskgrass, Sago Pondweed, Coontail and Fries' Pondweed

Total Rake Fullness Rating			
□	1	□	3
△	2	◆	Visual

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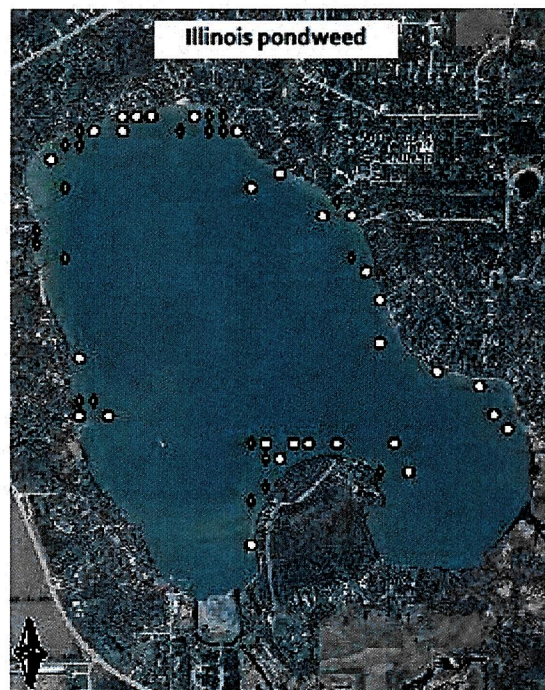
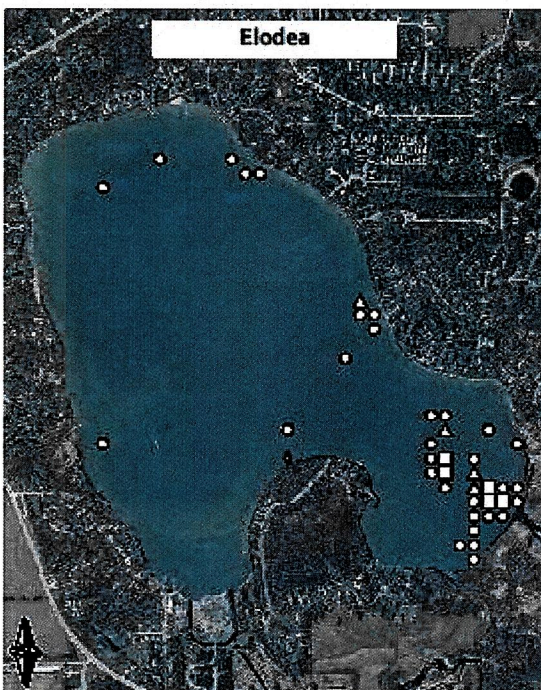
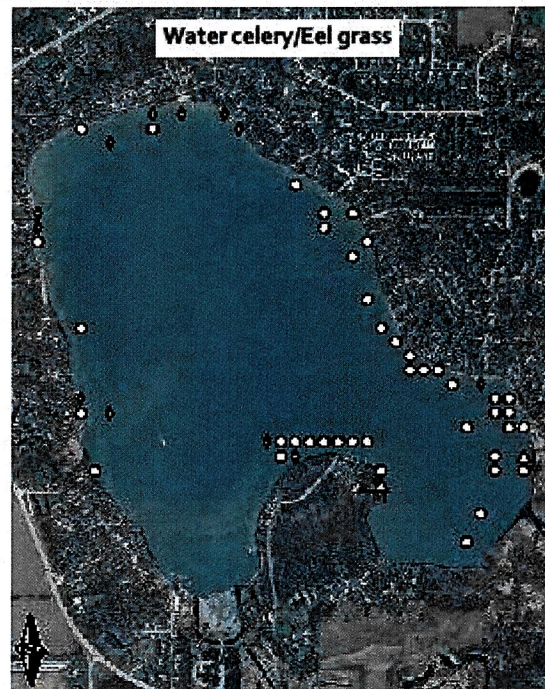
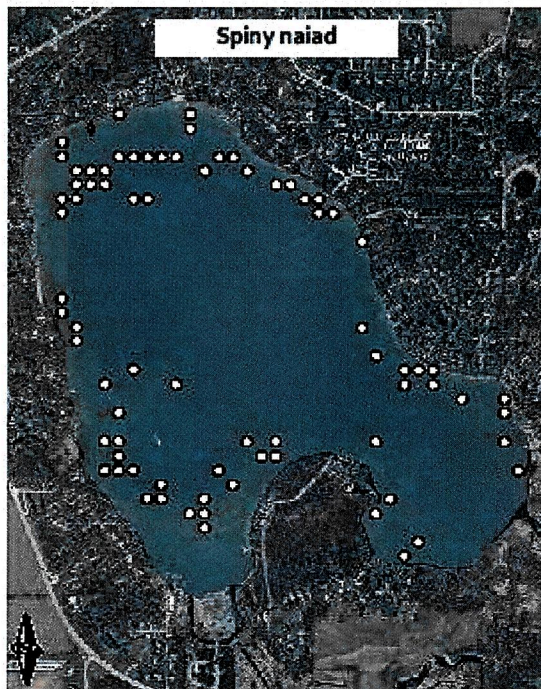


Figure 10: Rake Fullness Ratings for Spiny Naiad, Eel Grass, Elodea and Illinois Pondweed

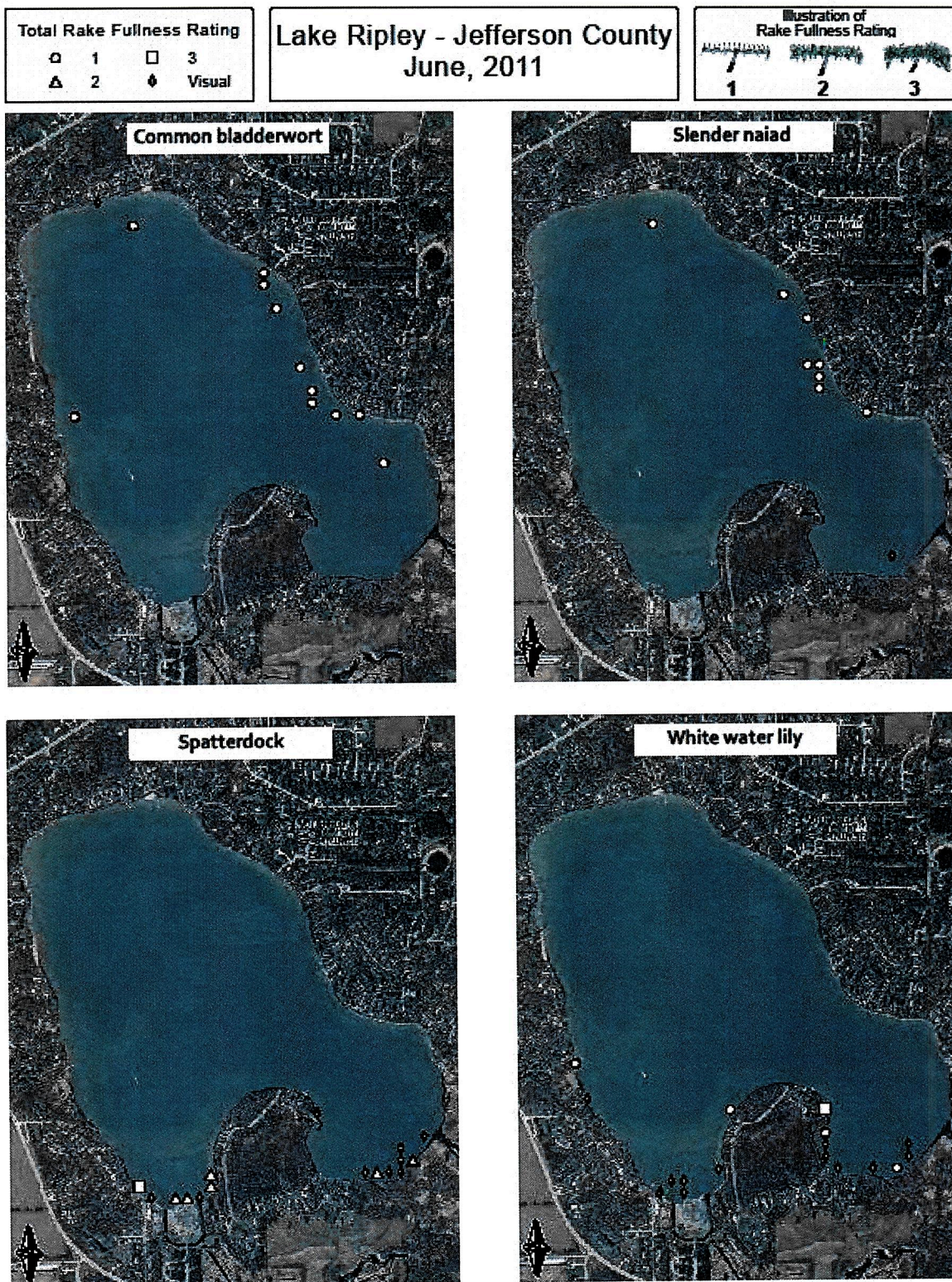


Figure 11: Rake Fullness Ratings for Common Bladderwort, Slender Naiad, Spatterdock and White Water Lily

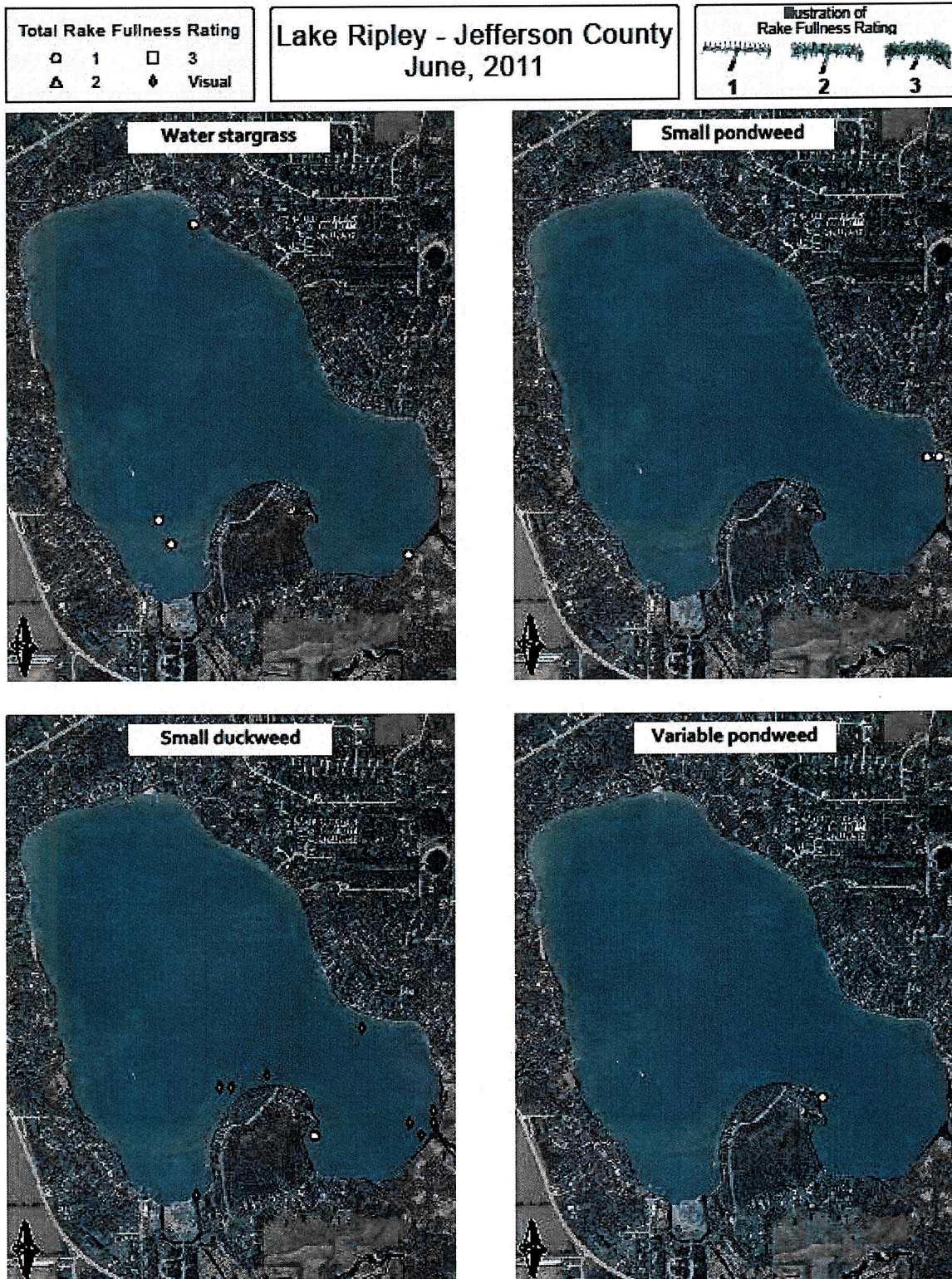


Figure 12: Rake Fullness Ratings for Water Stargrass, Small Pondweed, Small Duckweed and Variable Pondweed