

# Warm Water Point-Intercept Macrophyte Survey Red Lake (WBIC: 2492100) Douglas County, Wisconsin



Watershield beds looking toward Red Lake Resort (Berg 2013)



Aerial Photo of Red Lake (2010)

Project Initiated by:  
The Red Lake Association and the  
Wisconsin Department of Natural Resources



Common bladderwort and Robbins' spikerush flowers (Berg 2013)

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## ABSTRACT

Red Lake (WBIC 2492100) is a 253 acre stratified seepage lake located in south-central/southeastern Douglas County, Wisconsin. The lake is mesotrophic in nature with Secchi readings averaging 10.6ft from 1993-2012, and 11.6ft in 2013. A desire to determine if exotic species such as Curly-leaf pondweed (*Potamogeton crispus*) or Eurasian water milfoil (*Myriophyllum spicatum*) had invaded the lake, and to establish baseline data on the richness, diversity, abundance, and distribution of other native aquatic plant populations prompted members of the Red Lake Association and the Wisconsin Department of Natural Resources to authorize a full lake point-intercept macrophyte survey on July 25, 2013. The survey found plants at 423 of 539 survey points (78.5%) and in 93.4% of the 22.5ft littoral zone. Overall plant density was moderate with an average rake fullness value of 2.05 at sites with vegetation. Species richness at individual points averaged a moderate 2.70 species/site, but we identified an exceptionally high total of 67 plants to species growing in and immediately adjacent to the lake. Diversity was also exceptionally high with a Simpson Index value of 0.93. Fern pondweed (*Potamogeton robbinsii*), Common waterweed (*Elodea canadensis*), Muskgrass (*Chara* sp.), and Nitella (*Nitella* sp.) were the most common macrophyte species being found at 36.88%, 32.86%, 28.37%, and 22.22% of survey points with vegetation respectively. Collectively, they accounting for 44.61% of the total relative frequency. The 52 native index species found in the rake produced a mean Coefficient of Conservatism of 6.7 and resulted in a Floristic Quality Index of 48.4. Although the mean C was exactly average, the FQI was nearly double the median FQI of 24.3 for lakes in the Northern Lakes and Forest Ecoregion. A single patch of Narrow-leaved cattails (*Typha angustifolia*) along the north shoreline was the only non-native species found, and they are not likely to become invasive as the organic muck shoreline habitat they prefer is uncommon around the lake. Future management considerations include preserving the lake's native plant communities; working to maintain water clarity and reducing nutrient inputs along the lakeshore by such things as establishing buffer strips of native vegetation, eliminating fertilizer applications, bagging grass clippings, removing pet waste, disposing of fire pit ash away from the lake, and avoiding motor startups in shallow water; continuing the lake's Clean Boats/Clean Waters program; conducting monthly monitoring at the boat landing and at least annual lake-wide meandering littoral zone surveys to look for Aquatic Invasive Species; and developing an Aquatic Plant Management Plan that clarifies a response if a new AIS is introduced into the lake.

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## METHODS:

### July Warm Water Full Point/Intercept Survey:

Using a standard formula that takes into account the shoreline shape and distance, water clarity, depth, and total lake acreage, Michelle Nault (WDNR) generated a 539 point sampling grid for Red Lake (Appendix I). Prior to beginning the July 25<sup>th</sup> point-intercept survey, we conducted a general boat survey of the lake on July 15<sup>th</sup> to gain familiarity with the species present (Appendix II). All plants found were identified (Voss 1996, Boreman et al. 1997; Chadde 2002; Crow and Hellquist 2006, Skawinski 2011), and two vouchers were pressed and mounted for herbarium specimens – one to be retained by the RLA, and one to be sent to the state herbarium in Stevens Point for identification confirmation. During the survey, we located each point using a handheld mapping GPS unit (Garmin 76CSx), recorded a depth reading with a handheld sonar unit (Vexilar – LPS - 1), and used a rake to sample an approximately 2.5ft section of the bottom. All plants on the rake, as well as any that were dislodged by the rake, were identified and assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 2). We also recorded visual sightings of plants within six feet of the sample point not found in the rake. In addition to a rake rating for each species, a total rake fullness rating was also noted. Substrate (lake bottom) type was assigned at each site where the bottom was visible or it could be reliably determined using the rake.

| <u>Rating</u> | <u>Coverage</u>   | <u>Description</u>   |
|---------------|---|--|
| 1             |  | A few plants on rake head                                    |
| 2             |  | Rake head is about ½ full<br>Can easily see top of rake head |
| 3             |  | Overflowing<br>Cannot see top of rake head                   |

Figure 2: Rake Fullness Ratings

## **DATA ANALYSIS:**

We entered all data collected into the standard APM spreadsheet (Appendix II) (UWEX 2010). From this, we calculated the following:

**Total number of sites visited:** This included the total number of points on the lake that were accessible to be surveyed by boat.

**Total number of sites with vegetation:** These included all sites where we found vegetation after doing a rake sample. For example, if 20% of all sample sites have vegetation, it suggests that 20% of the lake has plant coverage.

**Total number of sites shallower than the maximum depth of plants:** This is the number of sites that are in the littoral zone. Because not all sites that are within the littoral zone actually have vegetation, we use this value to estimate how prevalent vegetation is throughout the littoral zone. For example, if 60% of the sites shallower than the maximum depth of plants have vegetation, then we estimate that 60% of the lake's littoral zone has plants.

**Frequency of occurrence:** The frequency of all plants (or individual species) is generally reported as a percentage of occurrences within the littoral zone. It can also be reported as a percentage of occurrences at sample points with vegetation.

Frequency of occurrence example:

Plant A is sampled at 70 out of 700 total littoral points =  $70/700 = .10 = 10\%$

This means that Plant A's frequency of occurrence = 10% when considering the entire littoral zone.

Plant A is sampled at 70 out of 350 total points with vegetation =  $70/350 = .20 = 20\%$

This means that Plant A's frequency of occurrence = 20% when only considering the sites in the littoral zone that have vegetation.

From these frequencies, we can estimate how common each species was at depths where plants were able to grow, and at points where plants actually were growing. Note the second value will be greater as not all the points (in this example, only  $\frac{1}{2}$ ) had plants growing at them.

**Simpson's Diversity Index:** A diversity index allows the entire plant community at one location to be compared to the entire plant community at another location. It also allows the plant community at a single location to be compared over time thus allowing a measure of community degradation or restoration at that site. With Simpson's Diversity Index, the index value represents the probability that two individual plants (randomly selected) will be different species. The index values range from 0 -1 where 0 indicates that all the plants sampled are the same species to 1 where none of the plants sampled are the same species. The greater the index value, the higher the diversity in a given location. Although many natural variables like lake size, depth, dissolved minerals, water clarity, mean temperature, etc. can affect diversity, in general, a more diverse lake indicates a healthier ecosystem. Perhaps most importantly, plant communities with high diversity also tend to be **more resistant** to invasion by exotic species.

**Maximum depth of plants:** This indicates the deepest point that vegetation was sampled. In clear lakes, plants may be found at depths of over 20ft, while in stained or turbid locations, they may only be found in a few feet of water. 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.

**Mean and median depth of plants:** The mean depth of plants indicates the average depth in the water column where plants were sampled. Because a few samples in deep water can skew this data, median depth is also calculated. This tells us that half of the plants sampled were in water shallower than this value, and half were in water deeper than this value.

**Number of sites sampled using rope/pole rake:** This indicates which rake type was used to take a sample. As is standard protocol, we used a 15ft pole rake and a 25ft rope rake for sampling.

**Average number of species per site:** This value is reported using four different considerations. 1) **shallower than maximum depth of plants** indicates the average number of plant species at all sites in the littoral zone. 2) **vegetative sites only** indicate the average number of plants at all sites where plants were found. 3) **native species shallower than maximum depth of plants** and 4) **native species at vegetative sites only** excludes exotic species from consideration.

**Species richness:** This value indicates the number of different plant species found in and directly adjacent to (on the waterline) the lake. Species richness alone only counts those plants found in the rake survey. The other two values include those seen at a sample point during the survey but not found in the rake, and those that were only seen during the initial boat survey or inter-point. **Note: Per DNR protocol, filamentous algae, freshwater sponges, aquatic moss and the aquatic liverworts *Riccia fluitans* and *Ricciocarpus natans* are excluded from these totals.**

**Average rake fullness:** This value is the average rake fullness of all species in the rake. It only takes into account those sites with vegetation (Table 1).

**Relative frequency:** This value shows a species' frequency relative to all other species. It is expressed as a percentage, and the total of all species' relative frequency will add up to 100%. Organizing species from highest to lowest relative frequency value gives us an idea of which species are most important within the macrophyte community (Table 2).

Relative frequency example:

Suppose that we sample 100 points and found 5 species of plants with the following results:

Plant A was located at 70 sites. Its frequency of occurrence is thus  $70/100 = 70\%$

Plant B was located at 50 sites. Its frequency of occurrence is thus  $50/100 = 50\%$

Plant C was located at 20 sites. Its frequency of occurrence is thus  $20/100 = 20\%$

Plant D was located at 10 sites. Its frequency of occurrence is thus  $10/100 = 10\%$

To calculate an individual species' relative frequency, we divide the number of sites a plant is sampled at by the total number of times all plants were sampled. In our example that would be 150 samples ( $70+50+20+10$ ).

Plant A =  $70/150 = .4667$  or 46.67%

Plant B =  $50/150 = .3333$  or 33.33%

Plant C =  $20/150 = .1333$  or 13.33%

Plant D =  $10/150 = .0667$  or 6.67%

This value tells us that 46.67% of all plants sampled were Plant A.

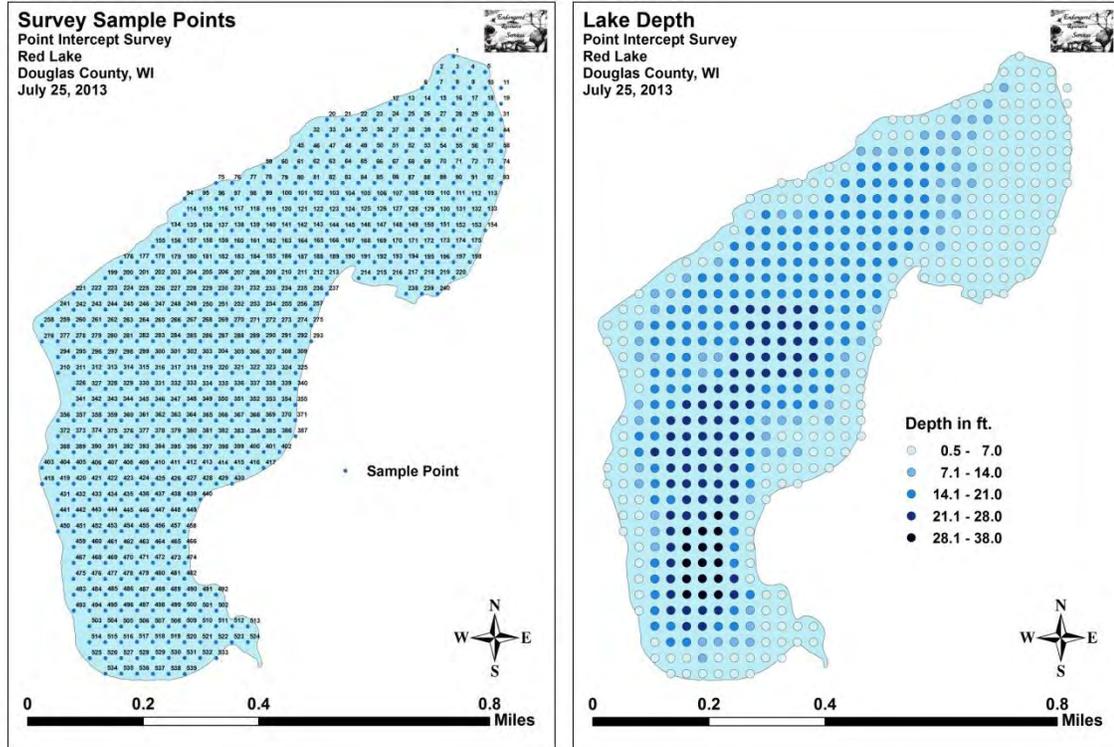
**Floristic Quality Index (FQI):** This index measures the impact of human development on an area's aquatic plants. The 124 species in the index are assigned a Coefficient of Conservatism (C) which ranges from 1-10. The higher the value assigned, the more likely the plant is to be negatively impacted by human activities relating to water quality or habitat modifications. Plants with low values are tolerant of human habitat modifications, and they often exploit these changes to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each native index species found in the lake during the point-intercept survey, and multiplying it by the square root of the total number of plant species (N) in the lake ( $FQI = (\sum(c_1+c_2+c_3+\dots+c_n)/N) * \sqrt{N}$ ). Statistically speaking, the higher the index value, the healthier the lake's macrophyte community is assumed to be. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, Northern Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain. He recommended making comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. Red Lake is in the Northern Lakes and Forests Ecoregion (Table 3).

\*\* Species that were only recorded as visuals or during the boat survey, and species found in the rake that are not included in the index are excluded from FQI analysis.

## RESULTS:

### July Warm-Water Full Point-Intercept Survey:

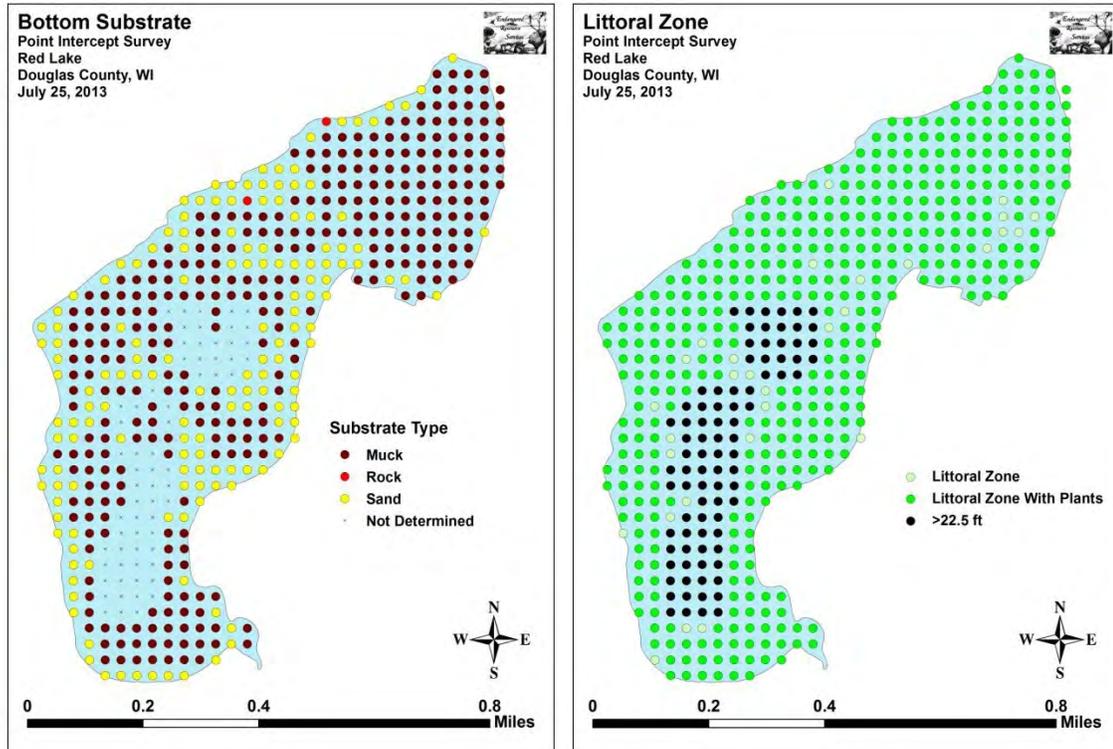
Depth soundings taken at Red Lake's 539 survey sample points revealed the lake is a crescent-shaped trench that grows gradually deeper as the lake curves from the northeast bay to the 37ft deep hole on the south end of the central basin. This crescent is pinched by two gently sloping flats midlake. Other notable features include a sunken island that tops out at 7ft on the north end of the western midlake flat, and a sandy point on the south end of the shallow flat that dominates the northeast bay (Figure 3) (Appendix III).



**Figure 3: Red Lake Survey Points and Lake Depths**

Of the 474 points where we could reliably determine the substrate, sandy areas dominated the shoreline and accounted for 155 (32.7%) of the survey sites. Away from the shore, we found these firm sand substrates transitioned to a nutrient poor sandy muck at most locations over 10ft. The broad northeast bay was dominated by a marly silt, while the small southeast bay and the northern and southern ends of the northeast bay that were adjacent to Tamarack (*Larix laricina*) and Leatherleaf (*Chamaedaphne calyculata*) bogs had the lake's only nutrient-rich organic muck. Collectively, these mucky areas covered 66.9% of the lake's bottom (317 points). We also found two small gravel areas along the north shoreline, but they totaled just 0.4% of the lake bottom (Figure 4) (Appendix III).

The survey located plants growing at 423 sites or on approximately 78.5% of the lake bottom and in 93.4% of the littoral zone. Plants were found at almost all points shallower than 19ft, were patchy to 21ft, and became rare with very low numbers of individuals as we approached the 22.5ft upper littoral limit (Figure 4) (Table 1) (Appendix III).



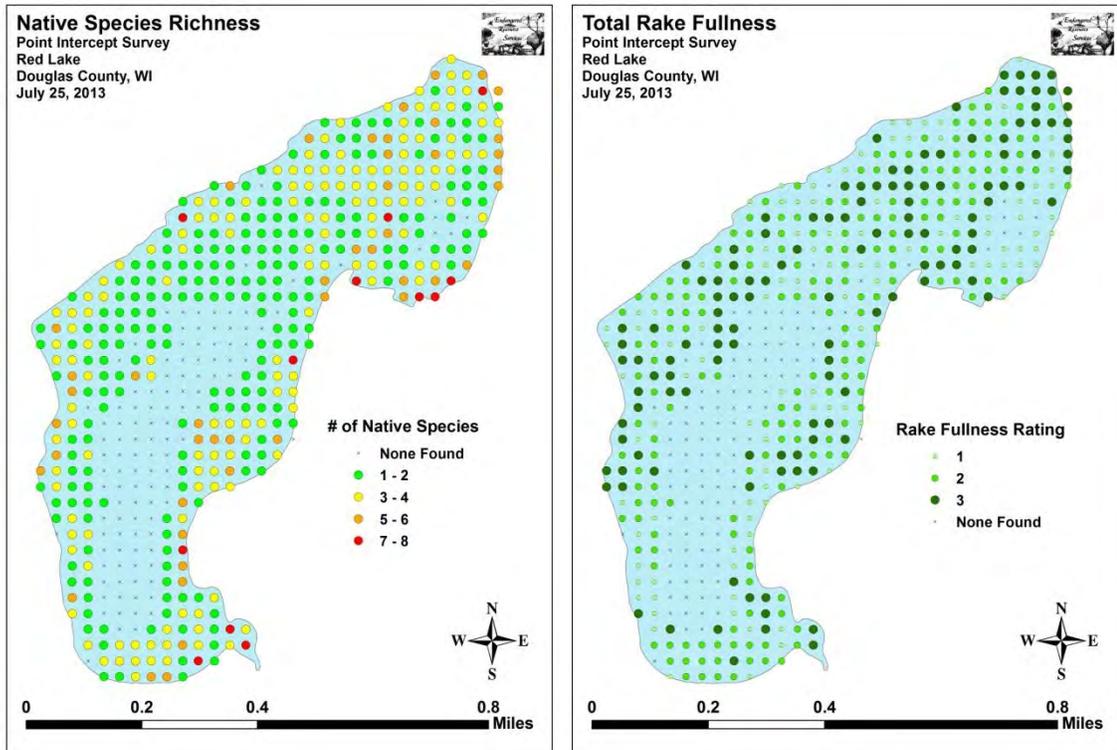
**Figure 4: Bottom Substrate and Littoral Zone**

**Table 1: Aquatic Macrophyte P/I Survey Summary Statistics  
Red Lake, Douglas County  
July 25, 2013**

**Summary Statistics:**

|   |      |
|---|------|
| Total number of points sampled  | 539  |
| Total number of sites with vegetation                                   | 423  |
| Total number of sites shallower than the maximum depth of plants        | 453  |
| Frequency of occurrence at sites shallower than maximum depth of plants | 93.4 |
| Simpson Diversity Index   | 0.93 |
| Maximum depth of plants (ft)  | 22.5 |
| Mean depth of plants (ft)   | 10.1 |
| Median depth of plants (ft)   | 8.5  |
| Number of sites sampled using rope rake (R)                             | 190  |
| Number of sites sampled using pole rake (P)                             | 284  |
| Average number of all species per site (shallower than max depth)       | 2.52 |
| Average number of all species per site (veg. sites only)                | 2.70 |
| Average number of native species per site (shallower than max depth)    | 2.52 |
| Average number of native species per site (veg. sites only)             | 2.70 |
| Species richness  | 57   |
| Species richness (including visuals)                                    | 58   |
| Species richness (including visuals and boat survey)                    | 67   |
| Average rake fullness (veg. sites only)                                 | 2.05 |

Overall diversity was exceptionally high with a Simpson Diversity Index value of 0.93. Species richness was also exceptionally high for a lake of this size with 67 total species found growing in and immediately adjacent to the water. However, localized richness was only moderate with an average of 2.70 native species/vegetative site. A few deep water points skewed the mean depth of plant growth to 10.1ft, while the median depth was only 8.5ft. Total mean rake fullness was moderate averaging 2.05 at sites with vegetation. In general, species richness and diversity declined rapidly at depths below 15ft and total rake biomass at depths beyond 21ft (Figure 5) (Appendix IV).



**Figure 5: Native Species Richness and Total Rake Fullness**

### **Red Lake Plant Community:**

The Red Lake ecosystem is home to a sensitive and rare plant community that is characteristic of pristine, low-nutrient, soft-water, seepage lakes. This community can be subdivided into four distinct zones (emergent, shallow submergent, floating-leaf, and deep submergent) with each zone having its own characteristic functions in the lake ecosystem. Depending on the local bottom type (sand, rock, sandy muck, or nutrient rich organic muck), these zones often had somewhat different species present.

Along sandy shorelines, the lake's emergent plant beds were dominated by Hardstem bulrush (*Schoenoplectus acutus*), Creeping spikerush (*Eleocharis palustris*), and Smooth saw-grass (*Cladium mariscoides*). We also found small numbers of Lake sedge (*Carex lacustris*), Bebb's sedge (*Carex bebbii*), Common yellow lake sedge (*Carex utriculata*), Rice cut-grass (*Leersia oryzoides*), and Softstem bulrush (*Schoenoplectus tabernaemontani*) mixed in along the lake's north shore.



Hardstem bulrush (Per 2002)



Smooth saw-grass (Perlman 2011)



Common yellow lake sedge (Lavin 2011)



Softstem bulrush (Schwarz 2011)

In sandy and organic muck-bottomed areas, these species were replaced by Pickerelweed (*Pontederia cordata*), Water bulrush (*Schoenoplectus subterminalis*), Robbins' spikerush (*Eleocharis robbinsii*), Bald spikerush (*Eleocharis erythropoda*), Wild calla (*Calla palustris*), Marsh cinquefoil (*Comarum palustre*), Three-way sedge (*Dulichium arundinaceum*), Common arrowhead (*Sagittaria latifolia*), Short-stemmed bur-reed (*Sparganium emersum*), and Cattails (*Typha* spp.). Collectively, these emergents work to stabilize the lakeshore, provide a nursery for baitfish and juvenile gamefish, offer shelter for amphibians, and give waterfowl and predatory wading birds like herons a place to hunt.



Pickerelweed (Texas A&M 2012)



Robbins' spikerush on Red Lake's northeast shore (Berg 2013)

Just beyond the emergents in water up to 5ft deep, shallow sugar sand areas tended to have high species richness. They also tended to have low total biomass as these nutrient poor substrates provide habitat most suited to fine leaved “isoetid” turf forming species like Muskgrass (*Chara* sp.), Needle spikerush (*Eleocharis acicularis*), Pipewort (*Eriocaulon aquaticum*), Spiny-spored quillwort (*Isoetes echinospora*), Brown-fruited rush (*Juncus pelocarpus*), Water lobelia (*Lobelia dortmanna*), Dwarf water milfoil (*Myriophyllum tenellum*), Creeping spearwort (*Ranunculus flammula*), and Small purple bladderwort (*Utricularia resupinata*). We also found Narrow-leaved bur-reed (*Sparganium angustifolium*) with its ribbon-like floating leaves growing in these areas. These species are typical of low-nutrient sand-bottomed seepage lakes where they, along with the emergents, work to stabilize the bottom and prevent wave action erosion.



Needle spikerush (Fewless 2005)



Brown-fruited rush (Koshere 2002)



Water lobelia in bloom (Penskar 2011)



Dwarf water milfoil (Koshere 2002)



Small purple bladderwort (Zerr 2008)



Narrow-leaved bur-reed (Schouh 2006)

Shallow organic muck bottomed areas were the rarest habitat in the lake. Because of this, floating-leaf species like White-water lily (*Nymphaea odorata*), Spatterdock (*Nuphar variegata*), Watershield (*Brasenia schreberi*), Water smartweed (*Polygonum amphibium*), and Ribbon-leaf pondweed (*Potamogeton epihydrus*) that require this type of substrate were also uncommon. The protective canopy cover they provide is often utilized by panfish and bass, and mature gamefish like Northern Pike are often found prowling around the edges of these beds.



Spatterdock and White water lily (Falkner, 2009)



Ribbon-leaf pondweed (Petroglyph 2007)



Watershield (Gmelin, 2009)



Water smartweed (Someya 2009)

Growing amongst these floating-leaf species, we also noted the submergent species Coontail (*Ceratophyllum demersum*), Alpine pondweed (*Potamogeton alpinus*), Leafy pondweed (*Potamogeton foliosus*), and Water marigold (*Bidens beckii*). In addition to these rooted plants, a limited number of “duckweeds” and carnivorous bladderworts (*Utricularia* spp.) were observed floating among the lily pads. Rather than drawing nutrients up through roots like other plants, bladderworts trap zooplankton and minute insects in their bladders, digest their prey, and use the nutrients to further their growth.



Keeled nutlets of Leafy pondweed (Kleinman 2009)



Large duckweed (Thomas 2013)





Common bladderwort flowers among lily pads (Hunt 2010)



Bladders for catching plankton and insect larvae (Wontolla 2007)

Sandy muck areas in water from 5-15ft supported a rich collection of generally larger-leaved species including Slender naiad (*Najas flexilis*), Northern water milfoil (*Myriophyllum sibiricum*), Variable pondweed (*Potamogeton gramineus*), Illinois pondweed (*Potamogeton illinoensis*), White-stem pondweed (*Potamogeton praelongus*), Small pondweed (*Potamogeton pusillus*), Claspingleaf pondweed (*Potamogeton richardsonii*), Stiff pondweed (*Potamogeton strictifolius*), Crested arrowhead (*Sagittaria cristata*), and Wild celery (*Vallisneria americana*). The seeds, shoots, roots, and tubers this group provides are heavily utilized by resident and migratory waterfowl. They also provide important habitat for baitfish and juvenile game fish as well as insects like dragonflies and mayflies during the aquatic nymph stages of their lifecycles.



Slender naiad (Cameron 2013)



Northern water milfoil (Berg 2006)



Large-leaf pondweed (Martin 2002)



Variable pondweed (Koshere 2002)



White-stem pondweed (Fewless 2005)



Wild celery (Dalvi 2009)

Areas over 15ft were dominated by just four species: Common waterweed (*Elodea canadensis*), Flat-stem pondweed (*Potamogeton zosteriformis*), Fern pondweed (*Potamogeton robbinsii*), and, growing deeper and at higher densities than any other species, Nitella (*Nitella* sp.). All of these species provide important deep water habitat for mature gamefish.



Common waterweed (Pinkka 2013)



Fern pondweed (Apipp 2011)



Nitella



Rake of Nitella in 20ft. of water off Red Lake's north shore (Berg 2013)

When considering the lake as a whole, Fern pondweed, Common waterweed, Muskgrass, and Nitella were the most common macrophyte species being found at 36.88%, 32.86%, 28.37%, and 22.22% of survey points with vegetation respectively (Table 2) (Figure 6). Together, they accounted for just 44.61% of the total relative frequency indicating a high rate of evenness among the aquatic community (The top four species often account for >50%). White-stem pondweed (4.91), Small pondweed (4.91), Flat-stem pondweed (4.82), and Slender naiad (4.38) were the only other species with a relative frequency over 4.00 (for maps and information on all species, see Appendixes V and VI).

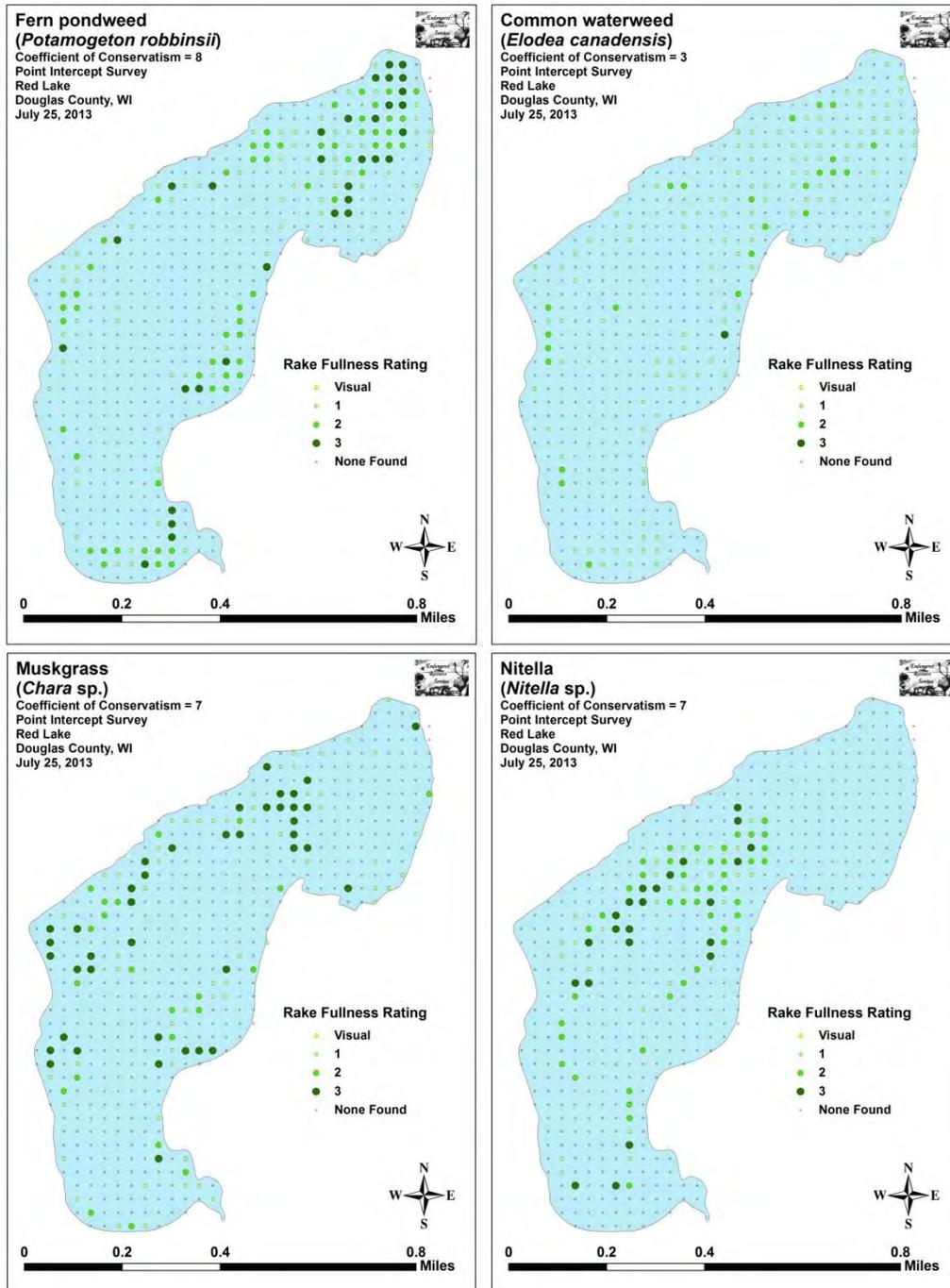


Figure 6: Red Lake's Most Common Macrophyte Species

**Table 2: Frequencies and Mean Rake Sample of Aquatic Macrophytes  
Red Lake, Douglas County  
July 25, 2013**

| Species                          | Common Name              | Total Sites | Relative Freq. | Freq. in Veg. | Freq. in Lit. | Mean Rake | Visual Sight. |
|----------------------------------|--------------------------|-------------|----------------|---------------|---------------|-----------|---------------|
| <i>Potamogeton robbinsii</i>     | Fern pondweed            | 156         | 13.67          | 36.88         | 34.44         | 1.79      | 1             |
| <i>Elodea canadensis</i>         | Common waterweed         | 139         | 12.18          | 32.86         | 30.68         | 1.19      | 0             |
| <i>Chara</i> sp.                 | Muskgrass                | 120         | 10.52          | 28.37         | 26.49         | 1.87      | 0             |
| <i>Nitella</i> sp.               | Nitella                  | 94          | 8.24           | 22.22         | 20.75         | 1.96      | 0             |
| <i>Potamogeton praelongus</i>    | White-stem pondweed      | 56          | 4.91           | 13.24         | 12.36         | 1.29      | 4             |
| <i>Potamogeton pusillus</i>      | Small pondweed           | 56          | 4.91           | 13.24         | 12.36         | 1.29      | 0             |
| <i>Potamogeton zosteriformis</i> | Flat-stem pondweed       | 55          | 4.82           | 13.00         | 12.14         | 1.00      | 0             |
| <i>Najas flexilis</i>            | Slender naiad            | 50          | 4.38           | 11.82         | 11.04         | 1.14      | 1             |
| <i>Potamogeton amplifolius</i>   | Large-leaf pondweed      | 44          | 3.86           | 10.40         | 9.71          | 1.23      | 5             |
| <i>Potamogeton gramineus</i>     | Variable pondweed        | 39          | 3.42           | 9.22          | 8.61          | 1.08      | 6             |
| <i>Myriophyllum tenellum</i>     | Dwarf water-milfoil      | 29          | 2.54           | 6.86          | 6.40          | 1.41      | 0             |
| <i>Vallisneria americana</i>     | Wild celery              | 29          | 2.54           | 6.86          | 6.40          | 1.10      | 1             |
| <i>Potamogeton illinoensis</i>   | Illinois pondweed        | 27          | 2.37           | 6.38          | 5.96          | 1.04      | 31            |
| <i>Utricularia resupinata</i>    | Small purple bladderwort | 26          | 2.28           | 6.15          | 5.74          | 1.54      | 0             |
| <i>Eleocharis acicularis</i>     | Needle spikerush         | 25          | 2.19           | 5.91          | 5.52          | 1.00      | 0             |
| <i>Juncus pelocarpus</i>         | Brown-fruited rush       | 19          | 1.67           | 4.49          | 4.19          | 1.05      | 0             |
| <i>Nymphaea odorata</i>          | White water lily         | 19          | 1.67           | 4.49          | 4.19          | 1.63      | 5             |
| <i>Myriophyllum sibiricum</i>    | Northern water-milfoil   | 16          | 1.40           | 3.78          | 3.53          | 1.00      | 0             |
| <i>Brasenia schreberi</i>        | Watershield              | 14          | 1.23           | 3.31          | 3.09          | 1.36      | 2             |
| <i>Lobelia dortmanna</i>         | Water lobelia            | 14          | 1.23           | 3.31          | 3.09          | 1.50      | 12            |
| <i>Sagittaria cristata</i>       | Crested arrowhead        | 13          | 1.14           | 3.07          | 2.87          | 1.00      | 1             |
| <i>Eriocaulon aquaticum</i>      | Pipewort                 | 9           | 0.79           | 2.13          | 1.99          | 1.33      | 3             |
| <i>Bidens beckii</i>             | Water marigold           | 8           | 0.70           | 1.89          | 1.77          | 1.00      | 0             |
| <i>Pontederia cordata</i>        | Pickerelweed             | 8           | 0.70           | 1.89          | 1.77          | 2.13      | 6             |

**Table 2 (cont’): Frequencies and Mean Rake Sample of Aquatic Macrophytes  
Red Lake, Douglas County  
July 25, 2013**

| Species                             | Common Name              | Total Sites | Relative Freq. | Freq. in Veg. | Freq. in Lit. | Mean Rake | Visual Sight. |
|-------------------------------------|--------------------------|-------------|----------------|---------------|---------------|-----------|---------------|
| <i>Heteranthera dubia</i>           | Water star-grass         | 5           | 0.44           | 1.18          | 1.10          | 1.60      | 0             |
| <i>Sparganium angustifolium</i>     | Narrow-leaved bur-reed   | 5           | 0.44           | 1.18          | 1.10          | 1.00      | 1             |
| <i>Utricularia vulgaris</i>         | Common bladderwort       | 5           | 0.44           | 1.18          | 1.10          | 1.00      | 0             |
| <i>Eleocharis robbinsii</i>         | Robbins' spikerush       | 4           | 0.35           | 0.95          | 0.88          | 2.25      | 0             |
| <i>Potamogeton friesii</i>          | Fries' pondweed          | 4           | 0.35           | 0.95          | 0.88          | 1.50      | 2             |
| <i>Potamogeton richardsonii</i>     | Clasping-leaf pondweed   | 4           | 0.35           | 0.95          | 0.88          | 1.00      | 0             |
| <i>Schoenoplectus acutus</i>        | Hardstem bulrush         | 4           | 0.35           | 0.95          | 0.88          | 2.25      | 5             |
| <i>Ceratophyllum demersum</i>       | Coontail                 | 3           | 0.26           | 0.71          | 0.66          | 1.00      | 0             |
| <i>Dulichium arundinaceum</i>       | Three-way sedge          | 3           | 0.26           | 0.71          | 0.66          | 1.00      | 0             |
| <i>Nuphar variegata</i>             | Spatterdock              | 3           | 0.26           | 0.71          | 0.66          | 1.00      | 1             |
| <i>Potamogeton strictifolius</i>    | Stiff pondweed           | 3           | 0.26           | 0.71          | 0.66          | 1.00      | 0             |
| <i>Schoenoplectus subterminalis</i> | Water bulrush            | 3           | 0.26           | 0.71          | 0.66          | 1.00      | 1             |
| <i>Utricularia minor</i>            | Small bladderwort        | 3           | 0.26           | 0.71          | 0.66          | 1.00      | 0             |
| <i>Eleocharis erythropoda</i>       | Bald spikerush           | 2           | 0.18           | 0.47          | 0.44          | 3.00      | 0             |
| <i>Eleocharis palustris</i>         | Creeping spikerush       | 2           | 0.18           | 0.47          | 0.44          | 1.00      | 1             |
| <i>Lemna minor</i>                  | Small duckweed           | 2           | 0.18           | 0.47          | 0.44          | 1.50      | 0             |
| <i>Potamogeton alpinus</i>          | Alpine pondweed          | 2           | 0.18           | 0.47          | 0.44          | 1.50      | 0             |
| <i>Potamogeton foliosus</i>         | Leafy pondweed           | 2           | 0.18           | 0.47          | 0.44          | 2.00      | 0             |
| <i>Stuckenia pectinata</i>          | Sago pondweed            | 2           | 0.18           | 0.47          | 0.44          | 1.00      | 0             |
| <i>Typha latifolia</i>              | Broad-leaved cattail     | 2           | 0.18           | 0.47          | 0.44          | 1.50      | 1             |
| <i>Calla palustris</i>              | Wild calla               | 1           | 0.09           | 0.24          | 0.22          | 1.00      | 0             |
| <i>Carex comosa</i>                 | Bottle brush sedge       | 1           | 0.09           | 0.24          | 0.22          | 3.00      | 0             |
| <i>Carex utriculata</i>             | Common yellow lake sedge | 1           | 0.09           | 0.24          | 0.22          | 3.00      | 0             |
| <i>Comarum palustre</i>             | Marsh cinquefoil         | 1           | 0.09           | 0.24          | 0.22          | 1.00      | 0             |

**Table 2 (cont’): Frequencies and Mean Rake Sample of Aquatic Macrophytes  
Red Lake, Douglas County  
July 25, 2013**

| Species                               | Common Name            | Total Sites | Relative Freq. | Freq. in Veg. | Freq. in Lit. | Mean Rake | Visual Sight. |
|---------------------------------------|------------------------|-------------|----------------|---------------|---------------|-----------|---------------|
| <i>Eleocharis ovata</i>               | Oval spikerush         | 1           | 0.09           | 0.24          | 0.22          | 1.00      | 0             |
| <i>Isoetes echinospora</i>            | Spiny spored-quillwort | 1           | 0.09           | 0.24          | 0.22          | 1.00      | 0             |
| <i>Myrica gale</i>                    | Sweet gale             | 1           | 0.09           | 0.24          | 0.22          | 3.00      | 0             |
| <i>Potamogeton epihydrus</i>          | Ribbon-leaf pondweed   | 1           | 0.09           | 0.24          | 0.22          | 1.00      | 0             |
| <i>Ranunculus flammula</i>            | Creeping spearwort     | 1           | 0.09           | 0.24          | 0.22          | 1.00      | 0             |
| <i>Sagittaria latifolia</i>           | Common arrowhead       | 1           | 0.09           | 0.24          | 0.22          | 1.00      | 1             |
| <i>Schoenoplectus tabernaemontani</i> | Softstem bulrush       | 1           | 0.09           | 0.24          | 0.22          | 2.00      | 0             |
| <i>Sparganium emersum</i>             | Short-stemmed bur-reed | 1           | 0.09           | 0.24          | 0.22          | 1.00      | 1             |
| <i>Spirodela polyrhiza</i>            | Large duckweed         | 1           | 0.09           | 0.24          | 0.22          | 1.00      | 0             |
|                                       | Filamentous algae      | 1           | *              | 0.24          | 0.22          | 1.00      | 0             |
| <i>Ranunculus aquatilis</i>           | White water crowfoot   | **          | **             | **            | **            | **        | 1             |
| <i>Calamagrostis canadensis</i>       | Bluejoint              | ***         | ***            | ***           | ***           | ***       | ***           |
| <i>Carex bebbii</i>                   | Bebb’s sedge           | ***         | ***            | ***           | ***           | ***       | ***           |
| <i>Carex lacustris</i>                | Lake sedge             | ***         | ***            | ***           | ***           | ***       | ***           |
| <i>Cladium mariscoides</i>            | Smooth sawgrass        | ***         | ***            | ***           | ***           | ***       | ***           |
| <i>Gallium sp.</i>                    | Bedstraw               | ***         | ***            | ***           | ***           | ***       | ***           |
| <i>Leersia oryzoides</i>              | Rice cut-grass         | ***         | ***            | ***           | ***           | ***       | ***           |
| <i>Polygonum amphibium</i>            | Water smartweed        | ***         | ***            | ***           | ***           | ***       | ***           |
| <i>Scirpus atrovirens</i>             | Black bulrush          | ***         | ***            | ***           | ***           | ***       | ***           |
| <i>Typha angustifolia</i>             | Narrow-leaved cattail  | ***         | ***            | ***           | ***           | ***       | ***           |

\* Filamentous algae are not included in the Relative Frequency Calculation

\*\* Visual Only

\*\*\* Boat Survey Only

We identified a total of 52 **native index plants** in the rake during the point-intercept survey. They produced a mean Coefficient of Conservatism of 6.7 and a Floristic Quality Index of 48.4 (Table 3). Nichols (1999) reported an average mean C for the Northern Lakes and Forest Region of 6.7 putting Red Lake exactly average for this part of the state. The FQI was, however, nearly twice the region's median FQI of 24.3 (Nichols 1999). This exceptionally high FQI is likely the result of the many pristine shoreline areas and variety of habitats that Red Lake offers. Specifically, highly sensitive index plants like Wild calla (C = 9), Three-way sedge (C = 9), Pipewort (C = 9), Water lobelia (C = 10), Dwarf water milfoil (C = 10), Alpine pondweed (C = 9), Creeping spearwort (C = 9), Crested arrowhead (C = 9), Water bulrush (C = 9), Narrow-leaved bur-reed (C = 9), Small bladderwort (*Utricularia minor*) (C = 10), and the State Species of Special Concern \*\* Small purple bladderwort (C = 9) would not be present if Red Lake had not enjoyed a history of apparent good water clarity and quality. Other high value species of note not listed in the index included Smooth sawgrass (C = 10), and Robbins' spikerush, another State Species of Special Concern.

\*\* "Special Concern" species are those species about which some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.

**Table 3: Floristic Quality Index of Aquatic Macrophytes  
Red Lake, Douglas County  
July 25, 2013**

| Species                        | Common Name            | C  |
|--------------------------------|------------------------|----|
| <i>Bidens beckii</i>           | Water marigold         | 8  |
| <i>Brasenia schreberi</i>      | Watershield            | 6  |
| <i>Calla palustris</i>         | Wild calla             | 9  |
| <i>Carex comosa</i>            | Bottle brush sedge     | 5  |
| <i>Ceratophyllum demersum</i>  | Coontail               | 3  |
| <i>Chara</i> sp.               | Muskgrass              | 7  |
| <i>Dulichium arundinaceum</i>  | Three-way sedge        | 9  |
| <i>Eleocharis acicularis</i>   | Needle spikerush       | 5  |
| <i>Eleocharis erythropoda</i>  | Bald spikerush         | 3  |
| <i>Eleocharis palustris</i>    | Creeping spikerush     | 6  |
| <i>Elodea canadensis</i>       | Common waterweed       | 3  |
| <i>Eriocaulon aquaticum</i>    | Pipewort               | 9  |
| <i>Heteranthera dubia</i>      | Water star-grass       | 6  |
| <i>Isoetes echinospora</i>     | Spiny-spored quillwort | 8  |
| <i>Juncus pelocarpus</i>       | Brown-fruited rush     | 8  |
| <i>Lemna minor</i>             | Small duckweed         | 4  |
| <i>Lobelia dortmanna</i>       | Water lobelia          | 10 |
| <i>Myriophyllum sibiricum</i>  | Northern water-milfoil | 6  |
| <i>Myriophyllum tenellum</i>   | Dwarf water-milfoil    | 10 |
| <i>Najas flexilis</i>          | Slender naiad          | 6  |
| <i>Nitella</i> sp.             | Nitella                | 7  |
| <i>Nuphar variegata</i>        | Spatterdock            | 6  |
| <i>Nymphaea odorata</i>        | White water lily       | 6  |
| <i>Pontederia cordata</i>      | Pickerelweed           | 8  |
| <i>Potamogeton alpinus</i>     | Alpine pondweed        | 9  |
| <i>Potamogeton amplifolius</i> | Large-leaf pondweed    | 7  |

**Table 3 (cont’): Floristic Quality Index of Aquatic Macrophytes  
Red Lake, Douglas County  
July 25, 2013**

| Species                               | Common Name              | C    |
|---------------------------------------|--------------------------|------|
| <i>Potamogeton epihydrus</i>          | Ribbon-leaf pondweed     | 8    |
| <i>Potamogeton foliosus</i>           | Leafy pondweed           | 6    |
| <i>Potamogeton friesii</i>            | Fries' pondweed          | 8    |
| <i>Potamogeton gramineus</i>          | Variable pondweed        | 7    |
| <i>Potamogeton illinoensis</i>        | Illinois pondweed        | 6    |
| <i>Potamogeton praelongus</i>         | White-stem pondweed      | 8    |
| <i>Potamogeton pusillus</i>           | Small pondweed           | 7    |
| <i>Potamogeton richardsonii</i>       | Clasping-leaf pondweed   | 5    |
| <i>Potamogeton robbinsii</i>          | Fern pondweed            | 8    |
| <i>Potamogeton strictifolius</i>      | Stiff pondweed           | 8    |
| <i>Potamogeton zosteriformis</i>      | Flat-stem pondweed       | 6    |
| <i>Ranunculus flammula</i>            | Creeping spearwort       | 9    |
| <i>Sagittaria cristata</i>            | Crested arrowhead        | 9    |
| <i>Sagittaria latifolia</i>           | Common arrowhead         | 3    |
| <i>Schoenoplectus acutus</i>          | Hardstem bulrush         | 6    |
| <i>Schoenoplectus subterminalis</i>   | Water bulrush            | 9    |
| <i>Schoenoplectus tabernaemontani</i> | Softstem bulrush         | 4    |
| <i>Sparganium emersum</i>             | Short-stemmed bur-reed   | 8    |
| <i>Spirodela polyrhiza</i>            | Large duckweed           | 5    |
| <i>Stuckenia pectinata</i>            | Sago pondweed            | 3    |
| <i>Typha latifolia</i>                | Broad-leaved cattail     | 1    |
| <i>Utricularia minor</i>              | Small bladderwort        | 10   |
| <i>Utricularia resupinata</i>         | Small purple bladderwort | 9    |
| <i>Utricularia vulgaris</i>           | Common bladderwort       | 7    |
| <i>Vallisneria americana</i>          | Wild celery              | 6    |
|                                       |                          |      |
| N                                     |                          | 52   |
| Mean C                                |                          | 6.7  |
| FQI                                   |                          | 48.4 |

**Exotic Species:**

We did **NOT** find any evidence of Curly-leaf pondweed, Eurasian water milfoil, Purple loosestrife (*Lythrum salicaria*), or Reed canary grass (*Phalaris arundinacea*) on Red Lake. A single small stand of Narrow-leaved cattails (*Typha angustifolia*), a species that was historically native to southern but not northern Wisconsin, was found along the north shore during the boat survey. It is potentially invasive in that it often excludes the native Broad-leaved cattail (*Typha latifolia*) from places where the two are found together. As the lake offers little of the organic muck shoreline habitat that cattails prefer, it seems unlikely that either cattail species will become invasive on Red Lake (For more information on exotic invasive aquatic plant species, see Appendix VII).

## **DISCUSSION AND CONSIDERATIONS FOR MANAGEMENT:**

### **Native Aquatic Macrophytes and Algae:**

The Red Lake aquatic ecosystem, based on the many species of rare and sensitive plants present, is in excellent condition. The lake has healthy, rich, and diverse plant communities that appear to be positively affected by water clarity, quality, and chemistry. The presence of so many high index species also suggests a history of conservation and stewardship by lakeshore residents. During our time on the lake, we noted that the majority of residents are employing sound shoreline practices. In fact, many residences could serve as a model for how to minimize human impacts along a lakeshore (Figure 7). We also consistently noticed that property owners that maintained their native shoreline vegetation tended to have healthy populations of these sensitive, desirable, and habitat-producing aquatic plants directly out from their residences, while the few areas with disturbed shorelines often did not. Because so much of the lake's vegetation is in such good condition, the biggest current challenge in management may simply be to maintain the status quo.



**Figure 7: Bulrushes in Front of a Model Natural Shoreline on a Nearby Lake**

Like trees in a forest, these plants support the entire aquatic ecosystem, and preserving them will be critical to maintaining a healthy environment moving forward. As the basis of the food pyramid, they provide habitat for other aquatic organisms, are important food sources for waterfowl and other wildlife, stabilize the shoreline, and work to improve water clarity by absorbing excess nutrients from the water. In lakes without a healthy population of these rooted plants or when nutrients in the water column increase to levels beyond what macrophytes can absorb, filamentous and floating algae tend to proliferate leading to declines in both water clarity and quality.

Over the past 20 years, water quality data collected by Red Lake volunteers shows a history of steady or **increasing** clarity. This trend is probably not a coincidence. Rather, it is likely at least partially tied to the work done by conservation-minded people. Their native vegetation buffers along the majority of the lake's shoreline helps cut down on soil erosion and nutrient runoff into the lake which would otherwise promote algae growth and decrease clarity.

Despite this positive news, the lake's small size means there is no room for complacency as even a small increase in nutrient input could reverse this trend. Residents should continually evaluate how their shoreline practices may be impacting the lake. Simple things like establishing a buffer strip of native vegetation along the lakeshore if one isn't already present, bagging grass clippings, eliminating fertilizer near the lake, collecting pet waste, disposing of ash from fire pits away from the lakeshore, and avoiding stirring up sediments with motor start-ups in shallow water can all significantly reduce the amount of nutrients entering the lake's water column. Hopefully, a greater understanding of how individual property owners can have lake-wide impacts will result in even more people taking appropriate conservation actions thus ensure continued water clarity and quality for all.

### **Aquatic Invasive Species Prevention:**

Aquatic Invasive Species (AIS) such as Eurasian water milfoil are an increasing problem in the lakes of northern Wisconsin in general, and several nearby lakes in Douglas and Washburn Counties in particular. Working to prevent their introduction into Red Lake with proactive measures is strongly encouraged. In 2013, the lake established a Clean Boats/Clean Waters program at the public boat landing. CB/CW monitors offer a layer of protection against AIS by checking incoming watercraft, and providing education, reeducation, and reminders of the potential negative impacts of AIS to lake property owners and visitors alike. Continuing this program, at least on weekends and holidays, is strongly encouraged.

When CB/CW workers are not present, a sign must serve as the "guardian of the lake". The current sign is big, bold, and carries a clear message. However, it has a lot of text and could potentially be overlooked until after people have launched. Adding a secondary sign that is simple, bright, and right at the waterline could increase the chances that visitors will consider their actions carefully before launching (Figure 8).



**Figure 8: Current Sign at Public Landing and Potential Secondary Sign**

In the future, conducting monthly visual inspections around the public boat landing throughout the growing season and at least one annual meandering shoreline survey of the lake's entire visible littoral zone are further suggestions to consider as these surveys can result in early detection if an AIS is introduced into the lake. The sooner an infestation is detected, the greater the chances it can be successfully and economically controlled. Finally, developing an Aquatic Plant Management Plan prior to an infestation would help streamline an appropriate response if/when an infestation of EWM or some other AIS occurs.

### **Management Considerations Summary:**

- Preserve the rare and sensitive native plants on Red Lake and the critical habitat they provide for the whole lake ecosystem.
- Work to maintain water clarity and reduce algal growth by limiting nutrient inputs.
- Specifically, avoid mowing down to the lakeshore and reduce or, if possible, eliminate grass clippings runoff, fertilizer applications, and other sources of nutrients like pet waste and fire pit ashes near the lakeshore.
- Encourage shoreline restoration and the establishment of native vegetation buffer strips along the lakeshore to further prevent runoff and erosion.
- Avoid stirring up sediments with motor start-ups in shallow water as this also promotes algal growth, uproots native plants, and creates barren patches of substrate that exotic species could establish in.
- Continue the Clean Boats/Clean Waters program established in 2013.
- Maintain the signage at the public boat landing and consider adding a second small bright sign at the water line to remind people to clean their boats prior to launching.
- Consider carrying out monthly landing inspections and at least one annual meandering shoreline surveys of the lake's entire visible littoral zone to look for new AIS.
- Complete an Aquatic Plant Management Plan that clarifies a potential response to a new AIS, such as Eurasian water milfoil, if one becomes established in the lake.

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## **Appendix I: Red Lake Survey Sample Points**

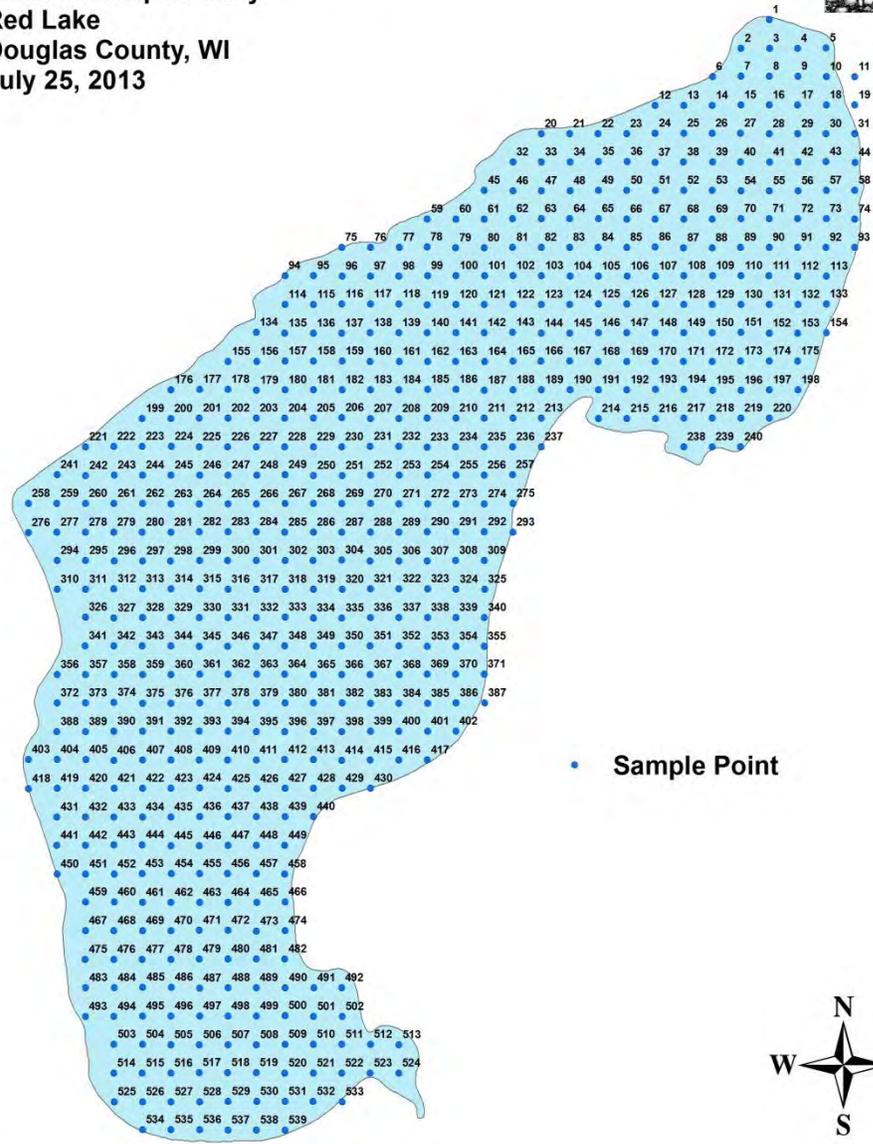
# Survey Sample Points

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



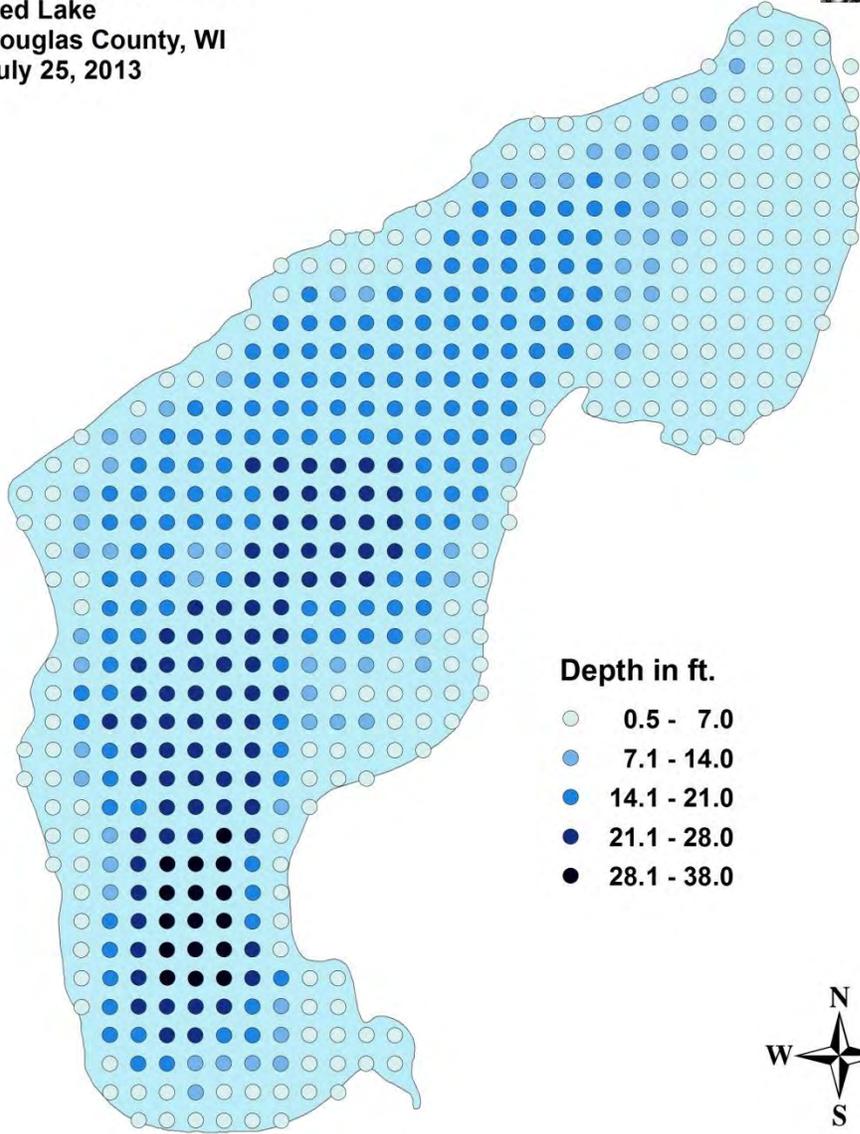
## **Appendix II: Boat and Vegetative Survey Data Sheets**



| Observers for this lake: names and hours worked by each: |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
|--|------------|------------------------------|--------------------------------|---------------------|-----|-----|---|---|---|---|---|--------|---|---|---|----|-------|----|----|----|----|----|----|----|----|--|
| Lake:  |            | WBIC                         |                                |                     |     |     |   |   |   |   |   | County |   |   |   |    | Date: |    |    |    |    |    |    |    |    |  |
| Site #   | Depth (ft) | Muck (M), Sand (S), Rock (R) | Rake pole (P) or rake rope (R) | Total Rake Fullness | EWM | CLP | 1 | 2 | 3 | 4 | 5 | 6      | 7 | 8 | 9 | 10 | 11    | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |  |
| 1  |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 2  |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 3  |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 4  |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 5  |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 6  |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 7  |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 8  |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 9  |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 10   |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 11   |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 12   |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 13   |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 14   |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 15   |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 16   |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 17   |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 18   |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 19   |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |
| 20   |            |                              |                                |                     |     |     |   |   |   |   |   |        |   |   |   |    |       |    |    |    |    |    |    |    |    |  |

## **Appendix III: Habitat Variable Maps**

**Lake Depth**  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

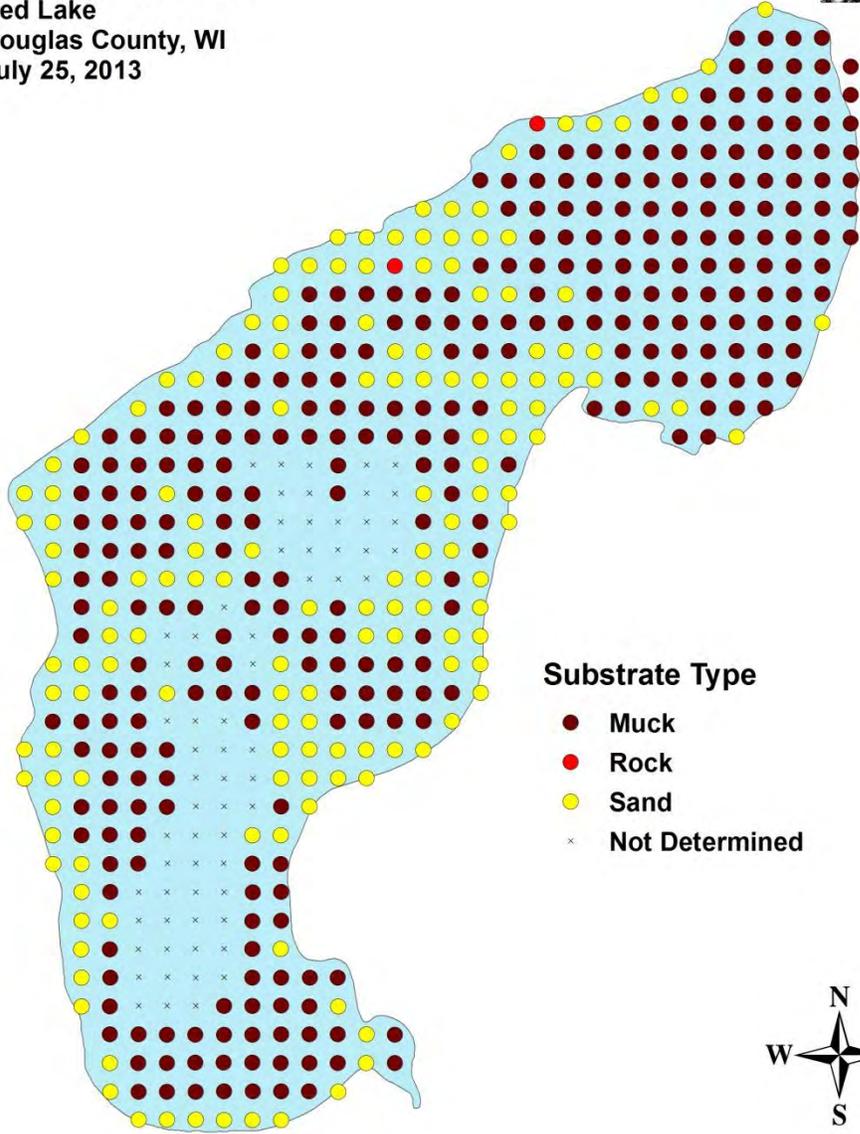


**Depth in ft.**

- 0.5 - 7.0
- 7.1 - 14.0
- 14.1 - 21.0
- 21.1 - 28.0
- 28.1 - 38.0



**Bottom Substrate**  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

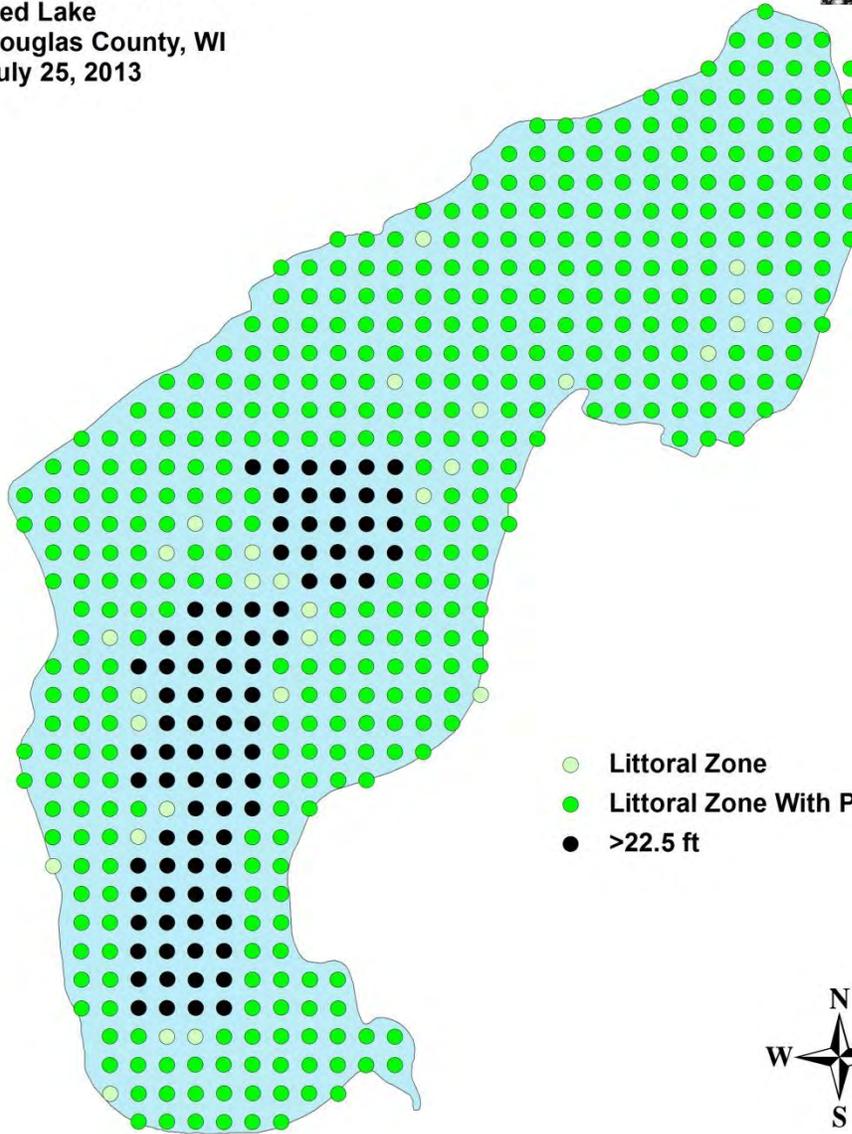


**Substrate Type**

- Muck
- Rock
- Sand
- × Not Determined



**Littoral Zone**  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



- Littoral Zone
- Littoral Zone With Plants
- >22.5 ft



**Appendix IV: Native Species Richness and Total Rake Fullness Maps**

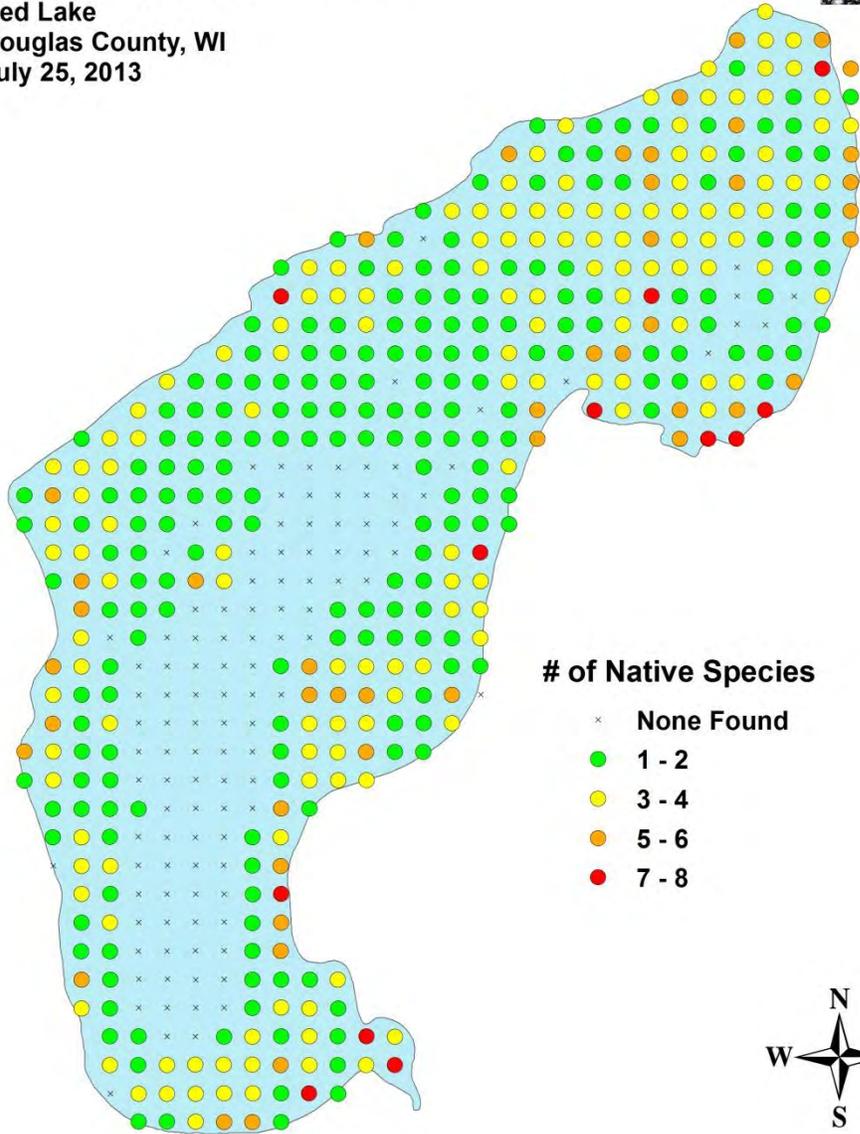
# Native Species Richness

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



## # of Native Species

- x None Found
- 1 - 2
- 3 - 4
- 5 - 6
- 7 - 8



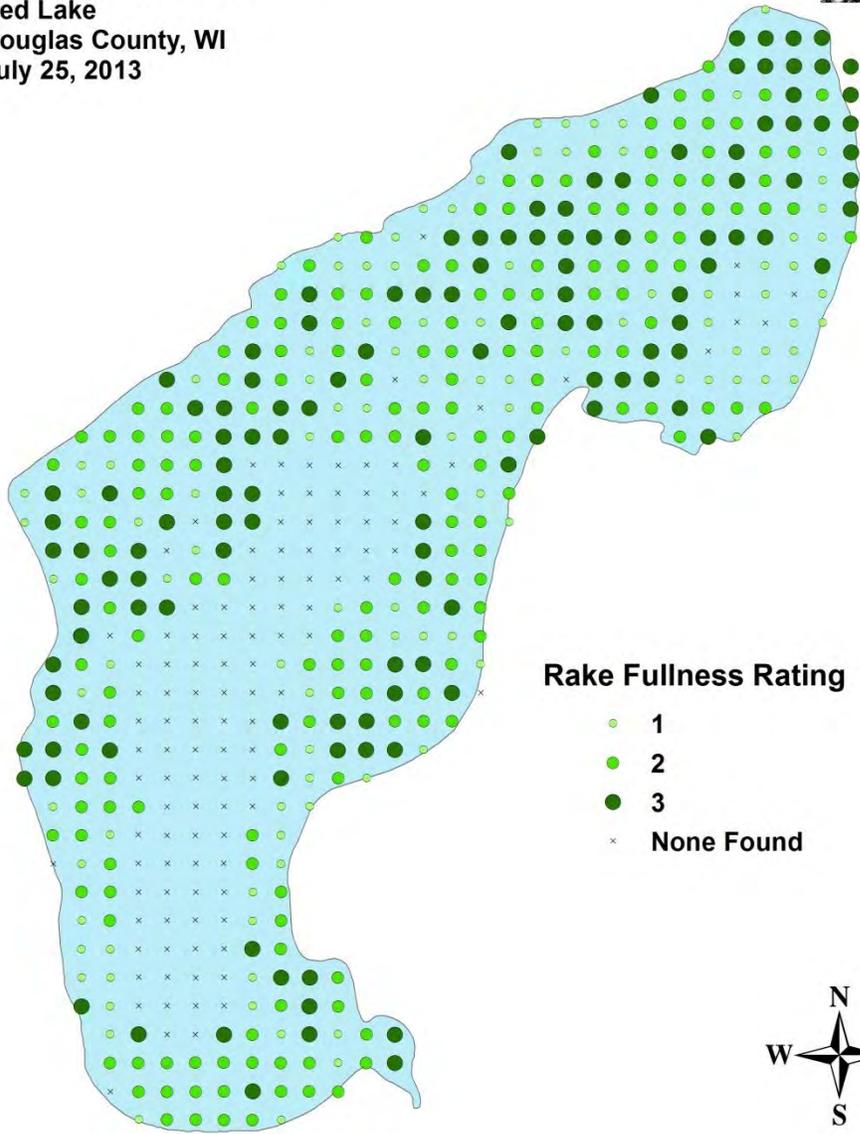
# Total Rake Fullness

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



### Rake Fullness Rating

- 1
- 2
- 3
- × None Found



## **Appendix V: Red Lake Plant Species Accounts**

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Bidens beckii*) **Water marigold**  
**Specimen Location:** Red Lake; N46.17245°, W91.76390°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-039  
**Habitat/Distribution:** Muck bottom in 0-2.5 meters of water. Uncommon, but scattered throughout.  
**Common Associates:** (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton praelongus*) White-stem pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Elodea canadensis*) Common waterweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Brasenia schreberi*) **Watershield**  
**Specimen Location:** Red Lake; N46.17245°, W91.76390°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-040  
**Habitat/Distribution:** Muck and mucky sand bottom in 0.5-1.5 meters. Common to abundant in boggy bays and scattered sheltered shoreline areas.  
**Common Associates:** (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Eleocharis robbinsii*) Robbins' spikerush, (*Pontederia cordata*) Pickerelweed, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia vulgaris*) Common bladderwort

**County/State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Calla palustris*) **Wild calla**  
**Specimen Location:** Red Lake; N46.18605°, W91.75521°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-041  
**Habitat/Distribution:** Muck bottom in 0-0.25 meters. Relatively common in boggy areas of the northeast bays.  
**Common Associates:** (*Myrica gale*) Sweet gale, (*Nymphaea odorata*) White water lily, (*Comarum palustre*) Marsh cinquefoil, (*Pontederia cordata*) Pickerelweed, (*Typha latifolia*) Broad-leaved cattail, (*Sagittaria latifolia*) Common arrowhead, (*Dulichium arundinaceum*) Three-way sedge

**State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Calamagrostis canadensis*) **Blue-joint**  
**Specimen Location:** Red Lake; N46.17238°, W91.77005°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-042  
**Habitat/Distribution:** Firm muck soil at the shoreline. Scattered individuals were located at the public boat landing.  
**Common Associates:** (*Scirpus atrovirens*) Black bulrush

**State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Carex bebbii*) **Bebb's sedge**  
**Specimen Location:** Red Lake; N46.18559°, W91.75919°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-043  
**Habitat/Distribution:** Firm sandy muck at the shoreline. Plants were scattered around the point and mixed with other sedges on the northeast shoreline just west of the Red Lake Resort Bay. Perigynium 3.0-3.2mm X 1.2-1.3 for an approx 2.5 to 1 ratio suggesting *bebbii* and not *scoparia* or *crawfordii*.  
**Common Associates:** (*Typha latifolia*) Broad-leaved cattail, (*Carex utriculata*) Common yellow lake sedge, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Leersia oryzoides*) Rice cut-grass

**State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Carex comosa*) **Bottle brush sedge**  
**Specimen Location:** Red Lake; N46.18526°, W91.75519°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-044  
**Habitat/Distribution:** Muck bottom in 0-0.25 meters. Relatively common in boggy areas of the northeast bays.  
**Common Associates:** (*Myrica gale*) Sweet gale, (*Nymphaea odorata*) White water lily, (*Comarum palustre*) Marsh cinquefoil, (*Pontederia cordata*) Pickerelweed, (*Typha latifolia*) Broad-leaved cattail, (*Sagittaria latifolia*) Common arrowhead, (*Dulichium arundinaceum*) Three-way sedge

**State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Carex lacustris*) **Lake sedge**  
**Specimen Location:** Red Lake; N46.17997°, W91.77180°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-045  
**Habitat/Distribution:** Sandy muck bottom along the shoreline. Rare; only plants found were in one bed near the point in the northwest bay at the shoreline.  
**Common Associates:** (*Typha angustifolia*) Narrow-leaved cattail

**State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Carex utriculata*) **Common yellow lake sedge**  
**Specimen Location:** Red Lake; N46.18559°, W91.75919°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-046  
**Habitat/Distribution:** Firm sandy muck at the shoreline. Plants were scattered around the point and mixed with other sedges on the northeast shoreline just west of the Red Lake Resort Bay.  
**Common Associates:** (*Typha latifolia*) Broad-leaved cattail, (*Carex bebbii*) Bebb's sedge, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Leersia oryzoides*) Rice cut-grass

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Ceratophyllum demersum*) **Coontail**  
**Specimen Location:** Red Lake; N46.18641°, W91.75750°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-047  
**Habitat/Distribution:** Organic muck bottom in <1m of water. Rare and local; only plants found were in the northeast bay.  
**Common Associates:** (*Lemna minor*) Small duckweed, (*Potamogeton robbinsii*) Fern pondweed, (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Potamogeton alpinus*) Alpine pondweed, (*Spirodela polyrhiza*) Large duckweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Chara* sp. likely *vulgaris*) **Muskgrass**  
**Specimen Location:** Red Lake; N46.17245°, W91.76447°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-048  
**Habitat/Distribution:** Sand bottom areas in water from 0 – 2 meters deep. Common and widely distributed along all sandy lakeshores.  
**Common Associates:** (*Eleocharis acicularis*) Needle spikerush, (*Potamogeton gramineus*) Variable pondweed, (*Najas flexilis*) Slender naiad, (*Utricularia resupinata*) Small purple bladderwort, (*Eriocaulon aquaticum*) Pipewort, (*Myriophyllum tenellum*) Dwarf water milfoil, (*Juncus pelocarpus*) Brown-fruited rush, (*Lobelia dortmanna*) Water lobelia

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Chara* sp.) **Muskgrass**  
**Specimen Location:** Red Lake; N46.17245°, W91.76447°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-049  
**Habitat/Distribution:** Sandy muck in water 4-6.5m. Common, but occurring in much deeper water than the preceding – there was a distinct 2m gap between their distribution, and we suspect it is another species.  
**Common Associates:** (*Nitella* sp.) Nitella, (*Potamogeton robbinsii*) Fern pondweed, (*Elodea canadensis*) Common waterweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Cladium mariscoides*) **Smooth sawgrass**  
**Specimen Location:** Red Lake; N46.17749°, W91.77090°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-050  
**Habitat/Distribution:** Firm sand bottoms along the shoreline. Scattered clusters of plants occurred on the southern half of the lake along undeveloped shoreline areas.  
**Common Associates:** (*Eleocharis palustris*) Creeping spikerush, (*Juncus pelocarpus*) Brown-fruited rush, (*Schoenoplectus acutus*) Hardstem bulrush

**County/State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Comarum palustre*) **Marsh cinquefoil**  
**Specimen Location:** Red Lake; N46.18605°, W91.75521°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-009  
**Habitat/Distribution:** Muck bottom at the shoreline in 0 – 0.25 meters of water. Scattered in boggy areas in the northeast bay.  
**Common Associates:** (*Calla palustris*) Wild calla, (*Myrica gale*) Sweet gale, (*Pontederia cordata*) Pickerelweed, (*Typha latifolia*) Broad-leaved cattail

**County/State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Dulichium arundinaceum*) **Three-way sedge**  
**Specimen Location:** Red Lake; N46.18566°, W91.75520°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-013  
**Habitat/Distribution:** Mucky to firm bottoms in 0-0.25 meters of water. Clusters occurred on floating bog mats scattered along the eastern shoreline of the northeast bay.  
**Common Associates:** (*Typha latifolia*) Broad-leaved cattail, (*Comarum palustre*) Marsh cinquefoil, (*Calla palustris*) Wild calla, (*Carex comosa*) Bottle brush sedge, (*Sagittaria latifolia*) Common arrowhead, (*Eleocharis erythropoda*) Bald spikerush

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Eleocharis acicularis*) **Needle spikerush**  
**Specimen Location:** Red Lake; N46.18559°, W91.75919°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-051  
**Habitat/Distribution:** Moderately common in sand and sandy muck bottoms in water from 0 – 3 meter deep. Occasionally growing as an emergent at the shoreline and on floating muck bogs in the northeast bay.  
**Common Associates:** (*Chara* sp.) Muskgrass, (*Potamogeton gramineus*) Variable pondweed, (*Isoetes echinospora*) Spiny-spored quillwort, (*Najas flexilis*) Slender naiad, (*Myriophyllum tenellum*) Dwarf water milfoil, (*Juncus pelocarpus*) Brown-fruited rush

**County/State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Eleocharis erythropoda*) **Bald spikerush**  
**Specimen Location:** Red Lake; N46.18566°, W91.75520°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-052  
**Habitat/Distribution:** Mucky to firm bottoms in 0-0.25 meters of water. Dense clusters of plants occurred on floating bog mats scattered along the eastern shoreline of the northeast bay.  
**Common Associates:** (*Typha latifolia*) Broad-leaved cattail, (*Comarum palustre*) Marsh cinquefoil, (*Dulichium arundinaceum*) Three-way sedge, (*Carex comosa*) Bottle brush sedge, (*Sagittaria latifolia*) Common arrowhead

**County/State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Eleocharis ovata*) **Oval spikerush**  
**Specimen Location:** Red Lake; N46.18605°, W91.75521°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-053  
**Habitat/Distribution:** Scattered clusters of plants were found growing on floating muck bogs along the eastern shoreline in the lake's northeast bay.  
**Common Associates:** (*Dulichium arundinaceum*) Three-way sedge, (*Carex comosa*) Bottle brush sedge, (*Sagittaria latifolia*) Common arrowhead

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Eleocharis palustris*) **Creeping spikerush**  
**Specimen Location:** Red Lake; N46.18559°, W91.75919°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-054  
**Habitat/Distribution:** Firm sandy bottoms in 0-0.5 meters of water. Uncommon, a few scattered individuals were found growing in Hard and Softstem bulrush beds or in monotypic stands.  
**Common Associates:** (*Schoenoplectus acutus*) Hardstem bulrush, (*Eleocharis acicularis*) Needle spikerush, (*Chara* sp.) Muskgrass, (*Myriophyllum tenellum*) Dwarf water milfoil, (*Juncus pelocarpus*) Brown-fruited rush, (*Utricularia resupinata*) Small purple bladderwort, (*Schoenoplectus tabernaemontani*) Softstem bulrush

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Eleocharis robbinsii*) **Robbins' spikerush**  
**Specimen Location:** Red Lake; N46.17245°, W91.76390°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-055  
**Habitat/Distribution:** Organic and silty muck in 0.5-1.0 meter of water. Locally common in a few boggy bays on the northeast and southeast corners of the lake.  
**Common Associates:** (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield, (*Pontederia cordata*) Pickerelweed, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia vulgaris*) Common bladderwort

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Elodea canadensis*) **Common waterweed**  
**Specimen Location:** Red Lake; N46.18368°, W91.75514°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-056  
**Habitat/Distribution:** Muck bottom in 0-6.5 meters of water.  
Rarely abundant, but found almost everywhere within the littoral zone except over pure sand.  
**Common Associates:** (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton praelongus*) White-stem pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Potamogeton illinoensis*) Illinois pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Eriocaulon aquaticum*) **Pipewort**  
**Specimen Location:** Red Lake; N46.17245°, W91.76447°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-057  
**Habitat/Distribution:** Sand bottom areas in water from 0 – 1 meter deep. Common and widely distributed along most sandy lakeshores.  
**Common Associates:** (*Eleocharis acicularis*) Needle spikerush, (*Chara* sp.) Muskgrass, (*Myriophyllum tenellum*) Dwarf water milfoil, (*Juncus pelocarpus*) Brown-fruited rush, (*Utricularia resupinata*) Small purple bladderwort, (*Ranunculus flammula*) Creeping spearwort, (*Lobelia dortmanna*) Water lobelia

**County/State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Gallium* sp.) **Bedstraw**  
**Specimen Location:** Red Lake; N46.18122°, W91.76019°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-058  
**Habitat/Distribution:** Soft muck bottoms in water <1 meter deep. Only plants found were in the southwest corner of the northeast bay.  
**Common Associates:** (*Nymphaea odorata*) White water lily, (*Utricularia vulgaris*) Common bladderwort, (*Pontederia cordata*) Pickerelweed, (*Brasenia schreberi*) Watershield, (*Utricularia minor*) Small bladderwort

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Heteranthera dubia*) **Water star-grass**  
**Specimen Location:** Red Lake; N46.18368°, W91.75514°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-059  
**Habitat/Distribution:** Silty and sandy muck in 0.5-2.5m of water. Almost all plants were located along the eastern shore of the northeast bay.  
**Common Associates:** (*Stuckenia pectinata*) Sago pondweed, (*Najas flexilis*) Slender naiad, (*Pontederia cordata*) Pickerelweed, (*Potamogeton friesii*) Fries' pondweed, (*Najas flexilis*) Slender naiad

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Isoetes echinospora*) **Spiny-spored quillwort**  
**Specimen Location:** Red Lake; N46.17245°, W91.76447°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-060  
**Habitat/Distribution:** Sand in 1 meter of water. A single individual was found at the point – not seen anywhere else in the lake  
**Common Associates:** (*Eleocharis acicularis*) Needle spikerush, (*Chara* sp.) Muskgrass, (*Myriophyllum tenellum*) Dwarf water milfoil, (*Eriocaulon aquaticum*) Pipewort, (*Utricularia resupinata*) Small purple bladderwort, (*Juncus pelocarpus*) Brown-fruited rush, (*Schoenoplectus acutus*) Hardstem bulrush

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Juncus pelocarpus*) **Brown-fruited rush**  
**Specimen Location:** Red Lake; N46.17245°, W91.76447°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-061  
**Habitat/Distribution:** Sand bottom areas in water from 0 – 1 meter deep. Common and widely distributed along all sandy shorelines.  
**Common Associates:** (*Eleocharis acicularis*) Needle spikerush, (*Chara* sp.) Muskgrass, (*Myriophyllum tenellum*) Dwarf water milfoil, (*Eriocaulon aquaticum*) Pipewort, (*Utricularia resupinata*) Small purple bladderwort, (*Ranunculus flammula*) Creeping spearwort, (*Lobelia dortmanna*) Water lobelia

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Leersia oryzoides*) **Rice cut-grass**  
**Specimen Location:** Red Lake; N46.18559°, W91.75919°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-062  
**Habitat/Distribution:** Firm sandy muck at the shoreline. Plants were scattered around the point and mixed with sedges on the northeast shoreline just west of the Red Lake Resort Bay.  
**Common Associates:** (*Typha latifolia*) Broad-leaved cattail, (*Carex utriculata*) Common yellow lake sedge, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Carex bebbii*) Bebb's sedge

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Lemna minor*) **Small duckweed**  
**Specimen Location:** Red Lake; N46.18641°, W91.75750°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-063  
**Habitat/Distribution:** Located floating at or just under the surface in sheltered areas over nutrient rich organic muck. Rare; a few scattered individuals were found in the northeast bays.  
**Common Associates:** (*Nymphaea odorata*) White water lily, (*Nuphar variegata*) Spatterdock, (*Spirodela polyrhiza*) Large duckweed, (*Ceratophyllum demersum*) Coontail, (*Potamogeton robbinsii*) Fern pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Lobelia dortmanna*) **Water lobelia**  
**Specimen Location:** Red Lake; N46.17245°, W91.76447°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-064  
**Habitat/Distribution:** Sand bottom areas in water from 0 – 1 meter deep. Common and widely distributed along all sandy lakeshores.  
**Common Associates:** (*Eleocharis acicularis*) Needle spikerush, (*Chara* sp.) Muskgrass, (*Myriophyllum tenellum*) Dwarf water milfoil, (*Juncus pelocarpus*) Brown-fruited rush, (*Utricularia resupinata*) Small purple bladderwort, (*Ranunculus flammula*) Creeping spearwort, (*Eriocaulon aquaticum*) Pipewort

**County/State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Myrica gale*) **Sweet gale**  
**Specimen Location:** Red Lake; N46.18605°, W91.75521°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-065  
**Habitat/Distribution:** Muck bottom at the shoreline. The dominant brush species adjacent to the bay.  
**Common Associates:** (*Calla palustris*) Wild calla, (*Comarum palustre*) Marsh cinquefoil, (*Pontederia cordata*) Pickerelweed, (*Typha latifolia*) Broad-leaved cattail

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Myriophyllum sibiricum*) **Northern water milfoil**  
**Specimen Location:** Red Lake; N46.17830°, W91.77036°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-066  
**Habitat/Distribution:** Found over sandy muck bottoms in water 1-6m deep. Relatively common but seldom abundant. Widespread around the central basin and in the broad flat in the northeast bay.  
**Common Associates:** (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Elodea canadensis*) Common waterweed, (*Potamogeton illinoensis*) Illinois pondweed, (*Potamogeton robbinsii*) Fern pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Myriophyllum tenellum*) **Dwarf water milfoil**  
**Specimen Location:** Red Lake; N46.17245°, W91.76447°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-067  
**Habitat/Distribution:** Sand bottom areas in water from 0 – 1.5 meters deep. Common and widely distributed along most sandy lakeshores.  
**Common Associates:** (*Eleocharis acicularis*) Needle spikerush, (*Chara* sp.) Muskgrass, (*Eriocaulon aquaticum*) Pipewort, (*Juncus pelocarpus*) Brown-fruited rush, (*Utricularia resupinata*) Small purple bladderwort, (*Ranunculus flammula*) Creeping spearwort, (*Lobelia dortmanna*) Water lobelia

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Najas flexilis*) **Slender naiad**  
**Specimen Location:** Red Lake; N46.18368°, W91.75514°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-068  
**Habitat/Distribution:** Sand, sandy muck, and marly muck in 0.5-3 meters of water. Relatively common and widely distributed throughout.  
**Common Associates:** (*Chara* sp.) Muskgrass, (*Potamogeton gramineus*) Variable pondweed, (*Vallisneria americana*) Wild celery, (*Eleocharis acicularis*) Needle spikerush, (*Potamogeton amplifolius*) Large-leaf pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Nitella* sp. likely *flexilis*) **Nitella**  
**Specimen Location:** Red Lake; N46.17951°, W91.76869°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-069  
**Habitat/Distribution:** Sandy muck bottom areas in water generally over 3 meters deep and up to 7 meters. Common to abundant in the 4.5-5.5m bathymetric ring around the southern basin.  
**Common Associates:** (*Elodea canadensis*) Common waterweed, (*Potamogeton pusillus*) Small pondweed, (*Myriophyllum sibiricum*) Northern water milfoil, (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Nuphar variegata*) **Spatterdock**  
**Specimen Location:** Red Lake; N46.18641°, W91.75750°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-070  
**Habitat/Distribution:** Muck bottom in <1m of water. Uncommon, a few small patches occurred in the north and south ends of the northeast bay.  
**Common Associates:** (*Nymphaea odorata*) White water lily, (*Utricularia vulgaris*) Common bladderwort, (*Pontederia cordata*) Pickerelweed, (*Brasenia schreberi*) Watershield

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Nymphaea odorata*) **White water lily**  
**Specimen Location:** Red Lake; N46.18641°, W91.75750°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-071  
**Habitat/Distribution:** Muck bottom in 0-1.5 meters. Restricted to the northeast and southeast bays where it was the dominant floating-leaf species.  
**Common Associates:** (*Nuphar variegata*) Spatterdock, (*Brasenia schreberi*) Watershield, (*Potamogeton robbinsii*) Fern pondweed, (*Utricularia vulgaris*) Common bladderwort, (*Schoenoplectus subterminalis*) Water bulrush, (*Eleocharis robbinsii*) Robbins' spikerush

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Polygonum amphibium*) **Water smartweed**  
**Specimen Location:** Red Lake; N46.18644°, W91.75580°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-072  
**Habitat/Distribution:** Found in sandy muck bottom conditions in shallow water 0.5-1 meter deep. Rare; a few 10's of plants were growing just east of the docks at Red Lake Resort in the lake's northeast bay.  
**Common Associates:** (*Ceratophyllum demersum*) Coontail, (*Potamogeton robbinsii*) Fern pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Pontederia cordata*) **Pickernelweed**  
**Specimen Location:** Red Lake; N46.17245°, W91.76390°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-073  
**Habitat/Distribution:** Silt to muck bottom over firm substrate in 0-1 meter of water. Common in emergent beds in sheltered areas of the northeast and southeast bays – much more scattered over sand on the western shoreline.  
**Common Associates:** (*Schoenoplectus acutus*) Hardstem bulrush, (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia vulgaris*) Common bladderwort, (*Eleocharis robbinsii*) Robbins' spikerush

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Pontederia cordata*) **Pickernelweed**  
**Specimen Location:** Red Lake; N46.17245°, W91.76390°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-073  
**Habitat/Distribution:** Silt to muck bottom over firm substrate in 0-1 meter of water. Common in emergent beds in sheltered areas of the northeast and southeast bays – much more scattered over sand on the western shoreline.  
**Common Associates:** (*Schoenoplectus acutus*) Hardstem bulrush, (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia vulgaris*) Common bladderwort, (*Eleocharis robbinsii*) Robbins' spikerush

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Potamogeton amplifolius*) **Large-leaf pondweed**  
**Specimen Location:** Red Lake; N46.17197°, W91.76959°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-075  
**Habitat/Distribution:** Sandy muck in .water 1-5m deep. Common and widespread, but seldom abundant. Scattered around the central basin, and in the broad flat in the northeast bay.  
**Common Associates:** (*Potamogeton illinoensis*) Illinois pondweed, (*Potamogeton praelongus*) White-stem pondweed, (*Potamogeton pusillus*) Small pondweed, (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Potamogeton robbinsii*) Fern pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Potamogeton epihydrus*) **Ribbon-leaf pondweed**  
**Specimen Location:** Red Lake; N46.18644°, W91.75580°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-076  
**Habitat/Distribution:** Found in mucky bottom conditions in shallow water 0.5-1 meter deep. Rare; a few 10's of plants were found just east of the Red Lake Resort in the lake's northeast bay.  
**Common Associates:** (*Potamogeton foliosus*) Leafy pondweed, (*Ceratophyllum demersum*) Coontail, (*Sparganium emersum*) Short-stemmed bur-reed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton alpinus*) Alpine pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Potamogeton foliosus*) **Leafy pondweed**  
**Specimen Location:** Red Lake; N46.18604°, W91.75578°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-077  
**Habitat/Distribution:** Found in mucky bottom conditions in shallow water 0.5-1 meter deep. Rare; a few scattered locations occurred just east of the Red Lake Resort in the lake's northeast bay.  
**Common Associates:** (*Utricularia minor*) Small bladderwort, (*Ceratophyllum demersum*) Coontail, (*Sparganium emersum*) Short-stemmed bur-reed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton alpinus*) Alpine pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Potamogeton friesii*) **Fries' pondweed**  
**Specimen Location:** Red Lake; N46.18368°, W91.75514°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-078  
**Habitat/Distribution:** Silty muck in <1m of water. Located along the eastern shoreline of the northeast bay – not seen anywhere else.  
**Common Associates:** (*Stuckenia pectinata*) Sago pondweed, (*Heteranthera dubia*) Water star-grass, (*Pontederia cordata*) Pickerelweed, (*Ranunculus aquatilis*) White water crowfoot, (*Najas flexilis*) Slender naiad

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Potamogeton gramineus*) **Variable pondweed**  
**Specimen Location:** Red Lake; N46.17245°, W91.76447°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-079  
**Habitat/Distribution:** Compact morph only form found on the lake. They were most common in sandy/muck bottom conditions in water 0.5-4 meters deep. Common and widespread.  
**Common Associates:** (*Najas flexilis*) Slender naiad, (*Chara* sp.) Muskgrass, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Sagittaria cristata*) Crested arrowhead, (*Eleocharis acicularis*) Needle spikerush, (*Myriophyllum tenellum*) Dwarf water milfoil, (*Juncus pelocarpus*) Brown-fruited rush

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Potamogeton illinoensis*) **Illinois pondweed**  
**Specimen Location:** Red Lake; N46.17197°, W91.76959°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-080  
**Habitat/Distribution:** Sandy muck in water 1-2.5m deep. Relatively common in a bathymetric ring at this depth around the central basin and in the broad flat in the northeast bay.  
**Common Associates:** (*Potamogeton amplifolius*) Large-leaf pondweed, (*Potamogeton praelongus*) White-stem pondweed, (*Potamogeton pusillus*) Small pondweed, (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Potamogeton robbinsii*) Fern pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Potamogeton praelongus*) **White-stem pondweed**  
**Specimen Location:** Red Lake; N46.17830°, W91.77036°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-081  
**Habitat/Distribution:** Sandy muck bottom conditions in water 1.5-5m deep. Common and widespread around the central basin, and in the broad flat in the northeast bay.  
**Common Associates:** (*Myriophyllum sibiricum*) Northern water milfoil, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Nitella* sp.) Nitella, (*Elodea canadensis*) Common waterweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Potamogeton pusillus pusillus*) **Small pondweed**  
**Specimen Location:** Red Lake; N46.18437°, W91.76143°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-082  
**Habitat/Distribution:** Common and widespread over sandy and organic muck in water from 0.5-7 meters deep. Most individuals were in fruit - nutlets with offset beak confirmed ID.  
**Common Associates:** (*Potamogeton robbinsii*) Fern pondweed, (*Myriophyllum sibiricum*) Northern water milfoil, (*Potamogeton praelongus*) White-stem pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Nitella* sp.) Nitella, (*Elodea canadensis*) Common waterweed, (*Potamogeton illinoensis*) Illinois pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Potamogeton richardsonii*) **Clasping-leaf pondweed**  
**Specimen Location:** Red Lake; N46.18368°, W91.75514°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-083  
**Habitat/Distribution:** Found in sandy muck bottom conditions in shallow water 1-2 meters deep. Rare, but widespread throughout the lake.  
**Common Associates:** (*Potamogeton praelongus*) White-stem pondweed, (*Potamogeton gramineus*) Variable pondweed, (*Najas flexilis*) Slender naiad, (*Chara* sp.) Muskgrass, (*Potamogeton robbinsii*) Fern pondweed, (*Heteranthera dubia*) Water star-grass, (*Potamogeton friesii*) Fries' pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Potamogeton robbinsii*) **Fern pondweed**  
**Specimen Location:** Red Lake; N46.17830°, W91.77036°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-084  
**Habitat/Distribution:** Found over sandy and organic muck bottom s in water 0.5-6m deep. Common and widespread around the central basin and in the broad flat in the northeast bay.  
**Common Associates:** (*Myriophyllum sibiricum*) Northern water milfoil, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Nitella* sp.) Nitella, (*Elodea canadensis*) Common waterweed, (*Potamogeton illinoensis*) Illinois pondweed, (*Potamogeton zosteriformis*) Flat-stem pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Potamogeton strictifolius*) **Stiff pondweed**  
**Specimen Location:** Red Lake; N46.17197°, W91.76959°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-085  
**Habitat/Distribution:** Rare over sandy marl in water from 1-2m deep. A few small patches occurred in the south bay with a single individual found along the north shore.  
**Common Associates:** (*Potamogeton pusillus*) Small pondweed, (*Chara* sp.) Muskgrass, (*Elodea canadensis*) Common waterweed, (*Potamogeton robbinsii*) Fern pondweed, (*Potamogeton gramineus*) Variable pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Potamogeton zosteriformis*) **Flat-stem pondweed**  
**Specimen Location:** Red Lake; N46.17830°, W91.77036°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-086  
**Habitat/Distribution:** Found over sandy and organic muck bottoms in water 0.5-6m deep. Common and widespread, but seldom abundant around the central basin and in the broad flat in the northeast bay.  
**Common Associates:** (*Myriophyllum sibiricum*) Northern water milfoil, (*Potamogeton pusillus*) Small pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Nitella* sp.) Nitella, (*Elodea canadensis*) Common waterweed, (*Potamogeton illinoensis*) Illinois pondweed, (*Potamogeton robbinsii*) Fern pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Ranunculus aquatilis*) **White water crowfoot**  
**Specimen Location:** Red Lake; N46.18368°, W91.75514°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-087  
**Habitat/Distribution:** Silty muck in <1m of water. A small bed occurred around the point; not seen anywhere else on the lake.  
**Common Associates:** (*Stuckenia pectinata*) Sago pondweed, (*Heteranthera dubia*) Water star-grass, (*Pontederia cordata*) Pickerelweed, (*Potamogeton friesii*) Fries' pondweed, (*Najas flexilis*) Slender naiad

**County/State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Ranunculus flammula*) **Creeping spearwort**  
**Specimen Location:** Red Lake; N46.18353°, W91.76482°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-088  
**Habitat/Distribution:** Sand bottom in water <1m deep. Rare; only plants found were in the rake at the point.  
**Common Associates:** (*Eleocharis acicularis*) Needle spikerush, (*Chara* sp.) Muskgrass, (*Myriophyllum tenellum*) Dwarf water milfoil, (*Juncus pelocarpus*) Brown-fruited rush, (*Utricularia resupinata*) Small purple bladderwort, (*Eriocaulon aquaticum*) Pipewort

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Sagittaria cristata*) **Crested arrowhead**  
**Specimen Location:** Red Lake; N46.18126°, W91.75791°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-089  
**Habitat/Distribution:** Submergent form was uncommon over sand and silt bottoms. A few individuals were emergent, but none were in bloom. Relatively common in the silt flats of the northeast bay.  
**Common Associates:** (*Najas flexilis*) Slender naiad, (*Chara* sp.) Muskgrass, (*Vallisneria americana*) Wild celery, (*Potamogeton amplifolius*) Large-leaf pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Sagittaria latifolia*) **Common arrowhead**  
**Specimen Location:** Red Lake; N46.18526°, W91.75519°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-090  
**Habitat/Distribution:** Muck bottom in 0-0.25m of water. Relatively common in undeveloped shoreline areas of the northeast bay.  
**Common Associates:** (*Typha latifolia*) Broad-leaved cattail, (*Eleocharis erythropoda*) Bald spikerush, (*Dulichium arundinaceum*) Three-way sedge, (*Schoenoplectus tabernaemontani*) Softstem bulrush

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Schoenoplectus acutus*) **Hardstem bulrush**  
**Specimen Location:** Red Lake; N46.17245°, W91.76447°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-091  
**Habitat/Distribution:** Firm sand bottoms in 0-1 meter of water. The dominant reed on the lake, beds were common along most undisturbed sandy shorelines.  
**Common Associates:** (*Eleocharis palustris*) Creeping spikerush, (*Chara* sp.) Muskgrass, (*Myriophyllum tenellum*) Dwarf water milfoil, (*Juncus pelocarpus*) Brown-fruited rush, (*Eriocaulon aquaticum*) Pipewort, (*Utricularia resupinata*) Small purple bladderwort

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Schoenoplectus subterminalis*) **Water bulrush**  
**Specimen Location:** Red Lake; N46.17245°, W91.76390°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-092  
**Habitat/Distribution:** Organic muck bottoms in 0-0.5 meter of water. Scattered locations in the bays on the lake's east side – especially adjacent to the bog in the tiny southeast bay.  
**Common Associates:** (*Brasenia schreberi*) Watershield, (*Eleocharis robbinsii*) Robbins' spikerush, (*Pontederia cordata*) Pickerelweed, (*Nymphaea odorata*) White water lily, (*Utricularia vulgaris*) Common bladderwort

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Schoenoplectus tabernaemontani*) **Softstem bulrush**  
**Specimen Location:** Red Lake; N46.18559°, W91.75919°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-093  
**Habitat/Distribution:** Firm sandy muck to organic muck bottoms in 0-0.25 meter of water. A single large bed was found surrounding the point on the northeast shoreline just west of the Red Lake Resort Bay. Scattered clusters occurred at a few points elsewhere along the eastern shore in the northeast bay.  
**Common Associates:** (*Typha latifolia*) Broad-leaved cattail, (*Carex utriculata*) Common yellow lake sedge, (*Sagittaria latifolia*) Common arrowhead, (*Carex bebbii*) Bebb's sedge

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Scirpus atrovirens*) **Black bulrush**  
**Specimen Location:** Red Lake; N46.17238°, W91.77005°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-094  
**Habitat/Distribution:** Firm muck soil at the shoreline. Scattered individuals were located at the public boat landing.  
**Common Associates:** (*Calamagrostis canadensis*) Blue-joint

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Sparganium angustifolium*) **Narrow-leaved bur-reed**  
**Specimen Location:** Red Lake; N46.17221°, W91.77003°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-095  
**Habitat/Distribution:** Located over sandy muck in 0.5-1m of water. More common than the survey indicated - small patches of plants were scattered in a narrow band around the shore of much of the lake.  
**Common Associates:** (*Nymphaea odorata*) White water lily, (*Najas flexilis*) Slender naiad, (*Sagittaria cristata*) Crested arrowhead, (*Vallisneria americana*) Wild celery, (*Potamogeton gramineus*) Variable pondweed, (*Chara* sp.) Muskgrass

**County/State:** Douglas County, Wisconsin      **Date:** 7/25/13  
**Species:** (*Sparganium emersum*) **Short-stemmed bur-reed**  
**Specimen Location:** Red Lake; N46.18644°, W91.75580°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-096  
**Habitat/Distribution:** Only plants found were near the point in the northeast bay over thick organic muck in water <1m deep.  
**Common Associates:** (*Potamogeton zosteriformis*) Flat-stem pondweed, (*Nuphar variegata*) Spatterdock, (*Potamogeton epihydrus*) Ribbon-leaf pondweed, (*Potamogeton foliosus*) Leafy pondweed, (*Brasenia schreberi*) Watershield, (*Nymphaea odorata*) White water lily, (*Ceratophyllum demersum*) Coontail

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Spirodela polyrhiza*) **Large duckweed**  
**Specimen Location:** Red Lake; N46.18641°, W91.75750°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-097  
**Habitat/Distribution:** Located floating at or just under the surface in sheltered areas. Rare; a few scattered individuals occurred interspersed between the lily pads in the northeast bay near the Red Lake Resort.  
**Common Associates:** (*Nymphaea odorata*) White water lily, (*Nuphar variegata*) Spatterdock, (*Lemna minor*) Small duckweed, (*Potamogeton friesii*) Fries' pondweed

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Stuckenia pectinata*) **Sago pondweed**  
**Specimen Location:** Red Lake; N46.18368°, W91.75514°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-098  
**Habitat/Distribution:** Silty muck in <1m of water. Rare; seen at only two locations in the northeast bay.  
**Common Associates:** (*Ranunculus aquatilis*) White water crowfoot, (*Heteranthera dubia*) Water star-grass, (*Pontederia cordata*) Pickerelweed, (*Potamogeton friesii*) Fries' pondweed, (*Najas flexilis*) Slender naiad

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Typha angustifolia*) **Narrow-leaved cattail**  
**Specimen Location:** Red Lake; N46.17997°, W91.77180°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-099  
**Habitat/Distribution:** Firm sand/sandy muck bottoms in 0-0.5 meter of water. A single small bed was found on the northwest shoreline in a small muck pocket.  
**Common Associates:** (*Carex lacustris*) Lake sedge

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Typha latifolia*) **Broad-leaved cattail**  
**Specimen Location:** Red Lake; N46.18559°, W91.75919°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-100  
**Habitat/Distribution:** Firm sand and muck bottoms in 0-0.5 meter of water. Scattered patches were found primarily along the northeast shoreline adjacent to bog areas.  
**Common Associates:** (*Carex utriculata*) Common yellow lake sedge, (*Sagittaria latifolia*) Common arrowhead, (*Carex bebbii*) Bebb's sedge, (*Schoenoplectus tabernaemontani*) Softstem bulrush, (*Eleocharis erythropoda*) Bald spikerush

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Utricularia minor*) **Small bladderwort**  
**Specimen Location:** Red Lake; N46.18604°, W91.75578°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-101  
**Habitat/Distribution:** Muck bottom in shallow water <1 meter deep. Rare; scattered locations in mucky areas of the northeast bays.  
**Common Associates:** (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield, (*Pontederia cordata*) Pickerelweed, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia vulgaris*) Common bladderwort, (*Eleocharis robbinsii*) Robbins' spikerush

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Utricularia resupinata*) **Small purple bladderwort**  
**Specimen Location:** Red Lake; N46.17245°, W91.76447°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-102  
**Habitat/Distribution:** Sand bottom areas in water from 0 – 1 meter deep. Common and widely distributed along all sandy lakeshores.  
**Common Associates:** (*Chara* sp.) Muskgrass, (*Myriophyllum tenellum*) Dwarf water milfoil, (*Juncus pelocarpus*) Brown-fruited rush, (*Eriocaulon aquaticum*) Pipewort, (*Ranunculus flammula*) Creeping spearwort, (*Lobelia dortmanna*) Water lobelia

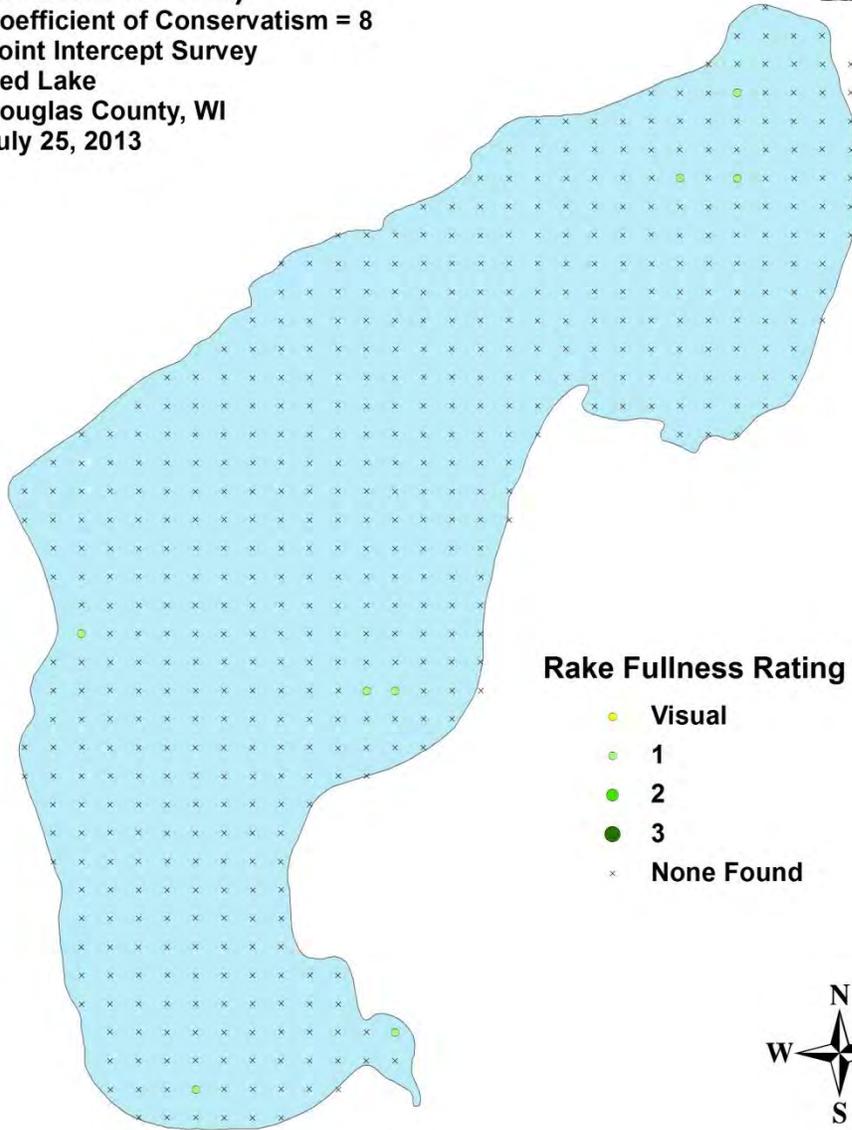
**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Utricularia vulgaris*) **Common bladderwort**  
**Specimen Location:** Red Lake; N46.18604°, W91.75578°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-103  
**Habitat/Distribution:** Muck bottom in shallow water <1meter deep. Rare; scattered locations in mucky areas of the northeast bays.  
**Common Associates:** (*Nuphar variegata*) Spatterdock, (*Nymphaea odorata*) White water lily, (*Brasenia schreberi*) Watershield, (*Pontederia cordata*) Pickerelweed, (*Schoenoplectus subterminalis*) Water bulrush, (*Utricularia minor*) Small bladderwort, (*Eleocharis robbinsii*) Robbins' spikerush

**County/State:** Douglas County, Wisconsin      **Date:** 7/15/13  
**Species:** (*Vallisneria americana*) **Wild celery**  
**Specimen Location:** Red Lake; N46.17245°, W91.76447°  
**Collected/Identified by:** **Matthew S. Berg** **Col. #:** MSB-2013-104  
**Habitat/Distribution:** Found over sandy and organic muck bottoms in water 0.5-4m deep. Common and widespread, but seldom abundant around the central basin and in the broad flat in the northeast bay.  
**Common Associates:** (*Najas flexilis*) Slender naiad, (*Potamogeton gramineus*) Variable pondweed, (*Potamogeton amplifolius*) Large-leaf pondweed, (*Elodea canadensis*) Common waterweed, (*Potamogeton illinoensis*) Illinois pondweed, (*Potamogeton robbinsii*) Fern pondweed

**Appendix VI: Red Lake P/I Density and Distribution Maps**

**Water marigold  
(*Bidens beckii*)**

Coefficient of Conservatism = 8  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

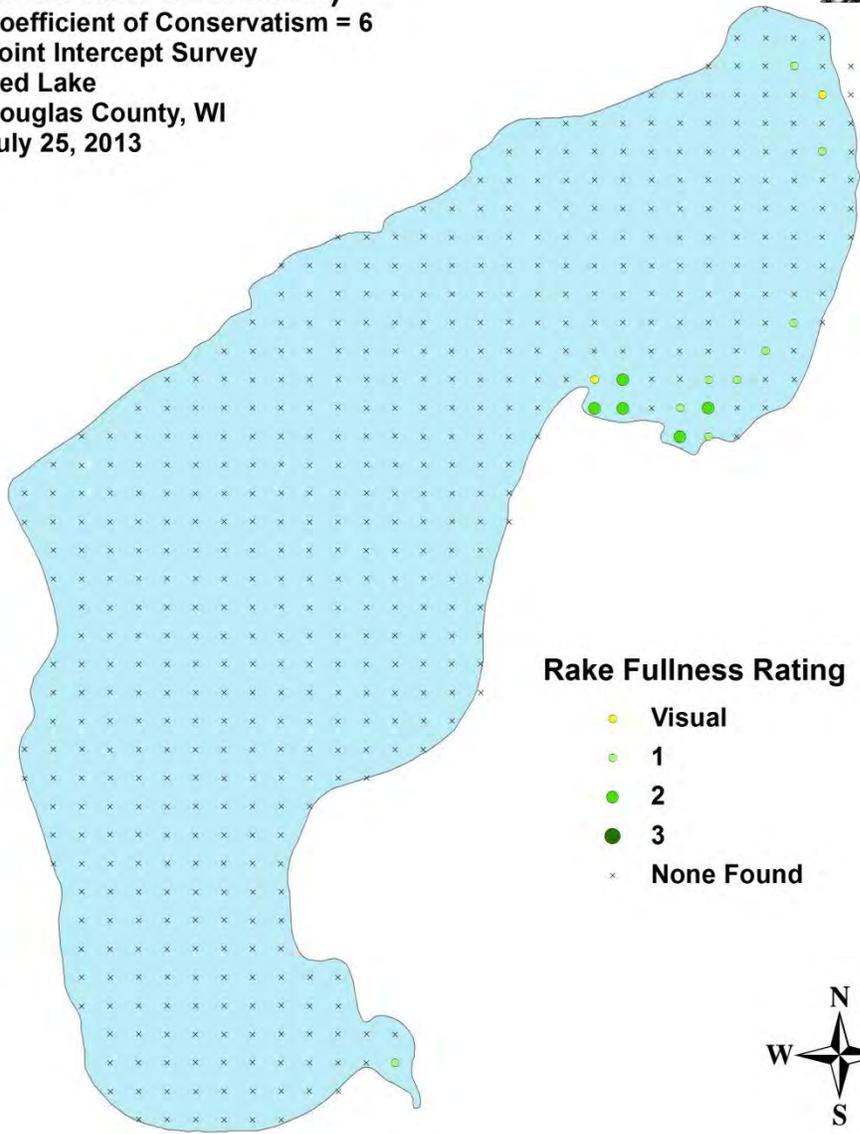


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Watershield**  
**(*Brasenia schreberi*)**  
Coefficient of Conservatism = 6  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

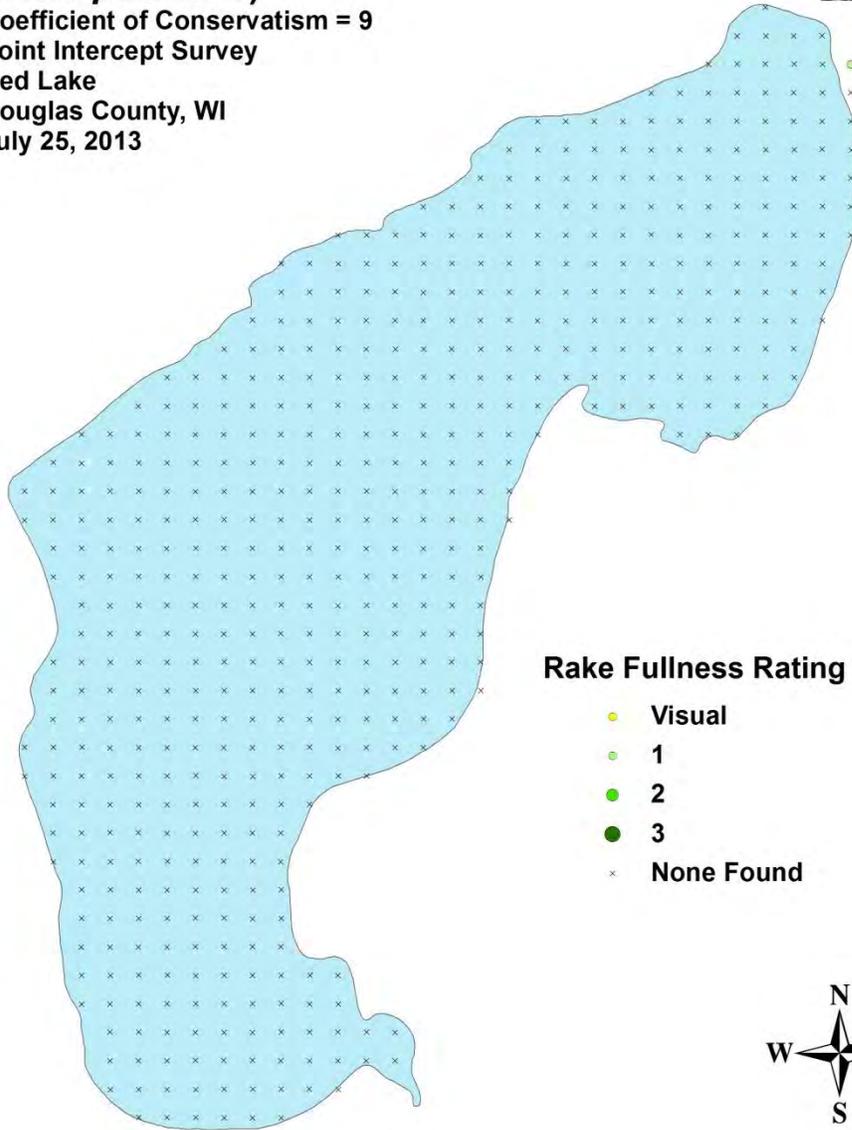


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Wild calla**  
**(*Calla palustris*)**  
Coefficient of Conservatism = 9  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



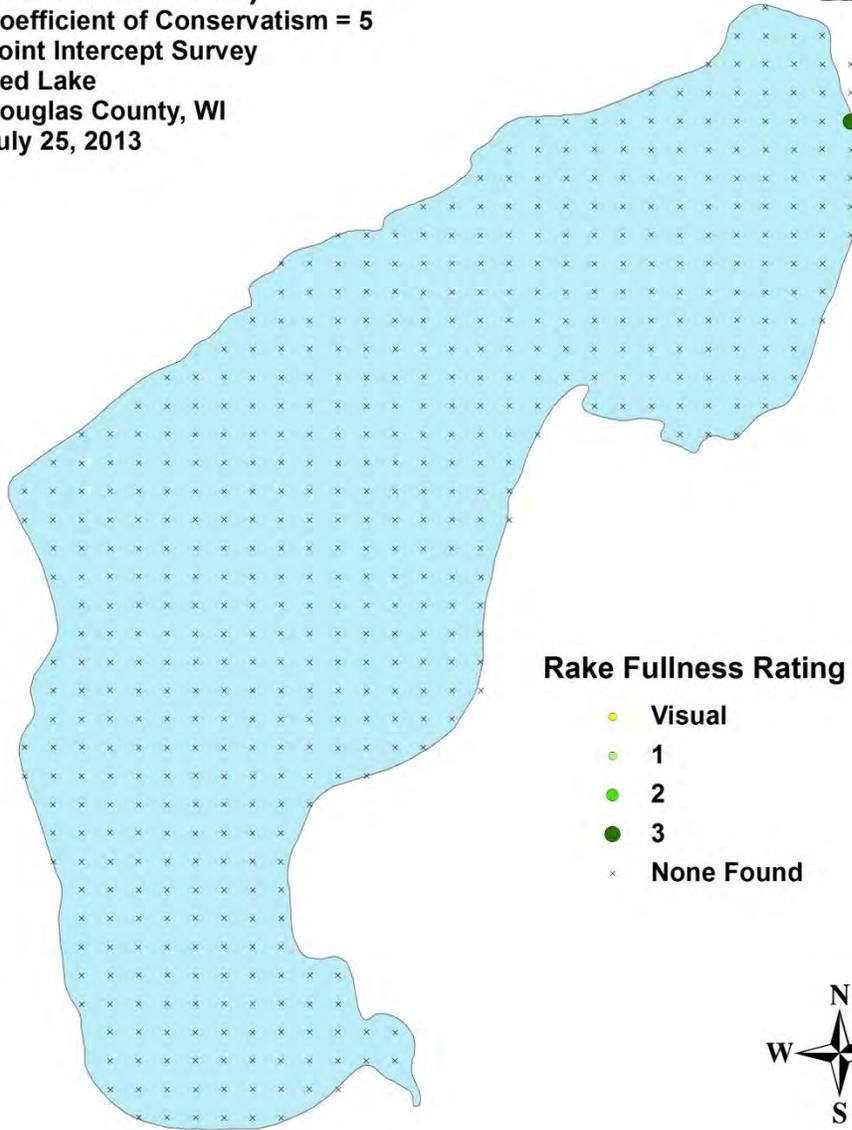
**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Bottle brush sedge  
(*Carex comosa*)**

Coefficient of Conservatism = 5  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Common yellow lake sedge  
(*Carex utriculata*)**

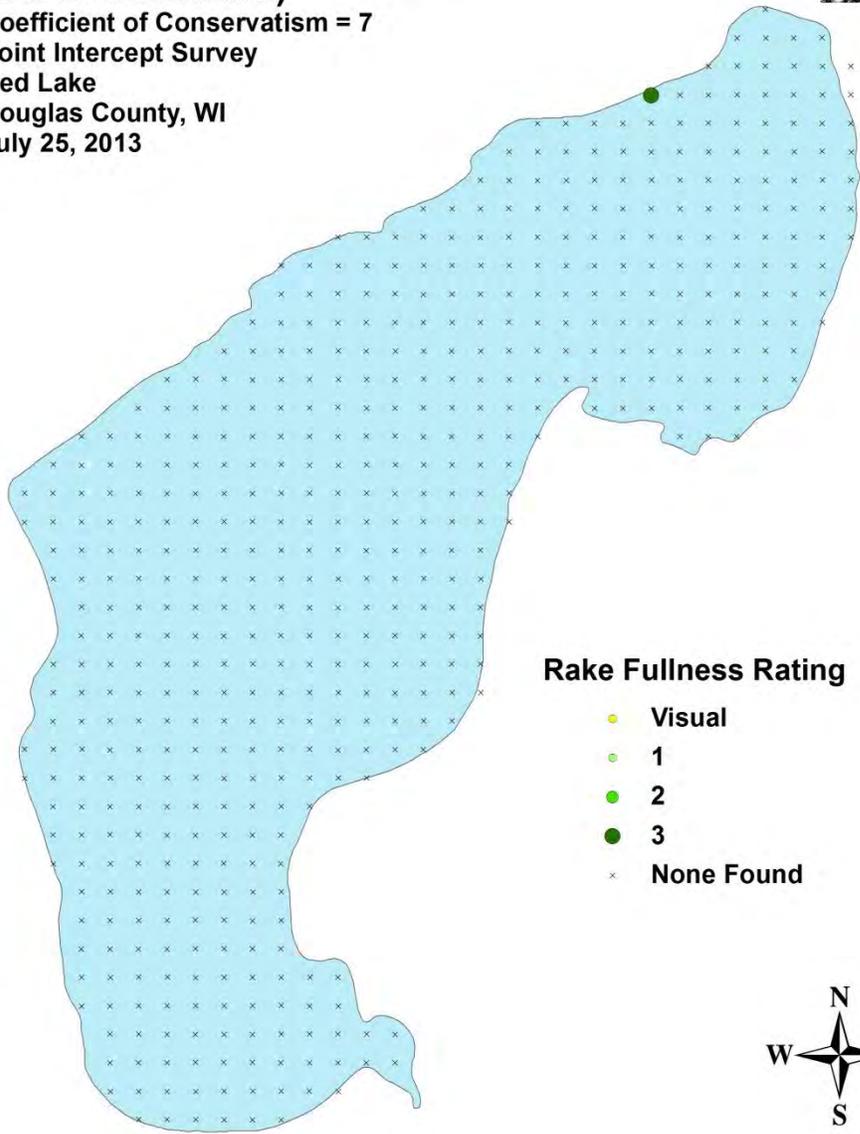
Coefficient of Conservatism = 7

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Coontail**  
**(*Ceratophyllum demersum*)**

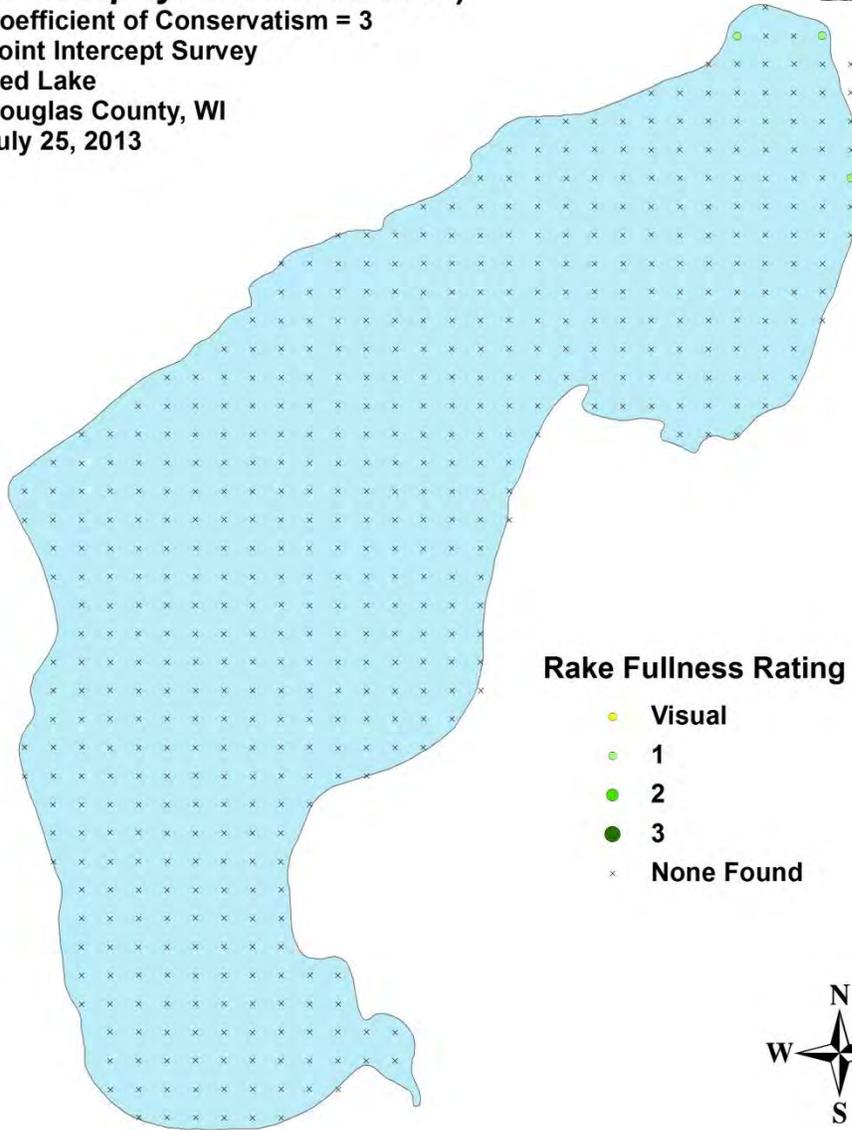
Coefficient of Conservatism = 3

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



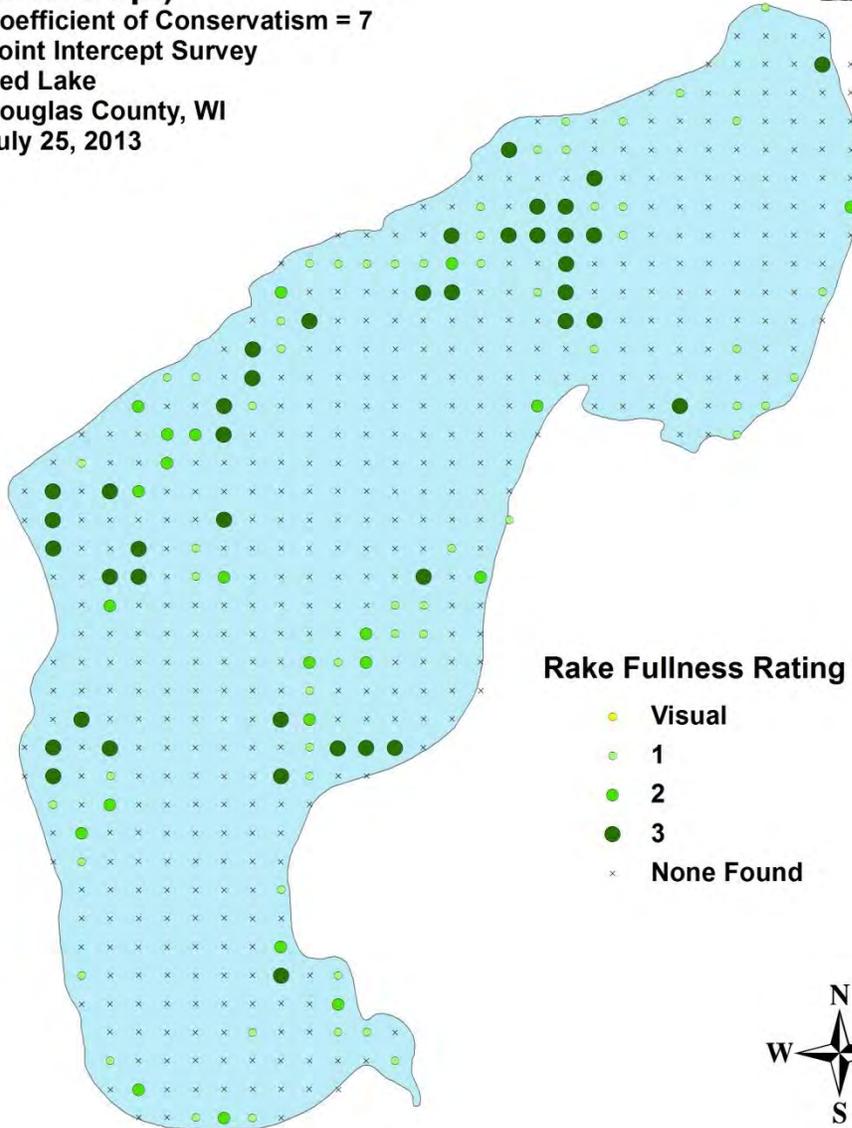
**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found

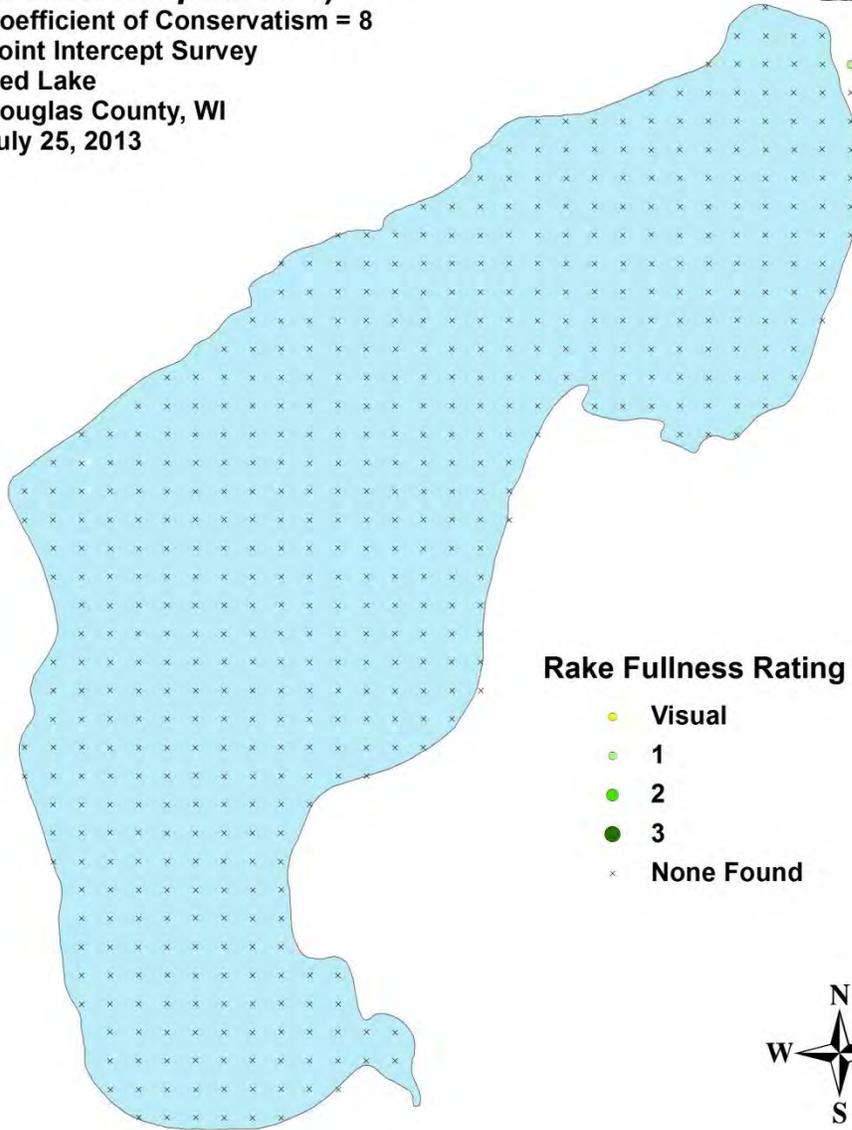


# Muskgrass (*Chara sp.*)

Coefficient of Conservatism = 7  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Marsh cinquefoil**  
**(*Comarum palustre*)**  
Coefficient of Conservatism = 8  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Three-way sedge  
(*Dulichium arundinaceum*)**

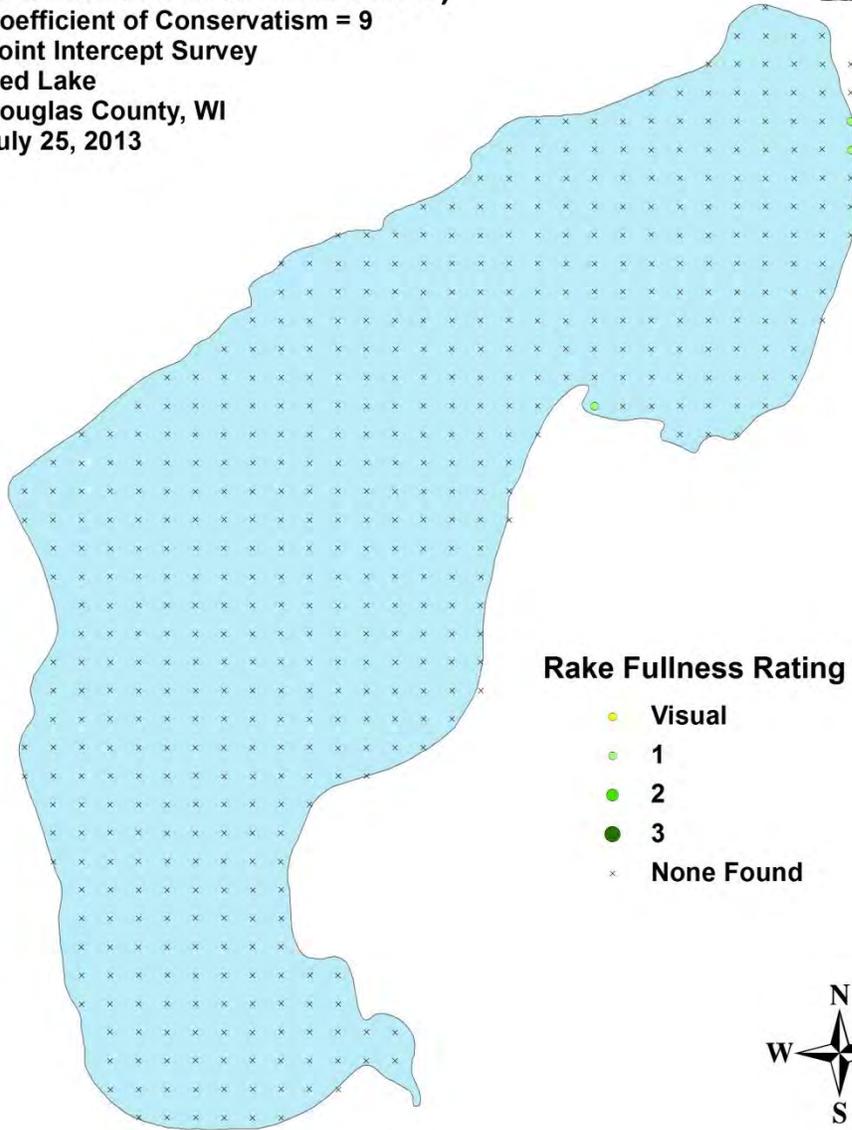
Coefficient of Conservatism = 9

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Needle spikerush  
(*Eleocharis acicularis*)**

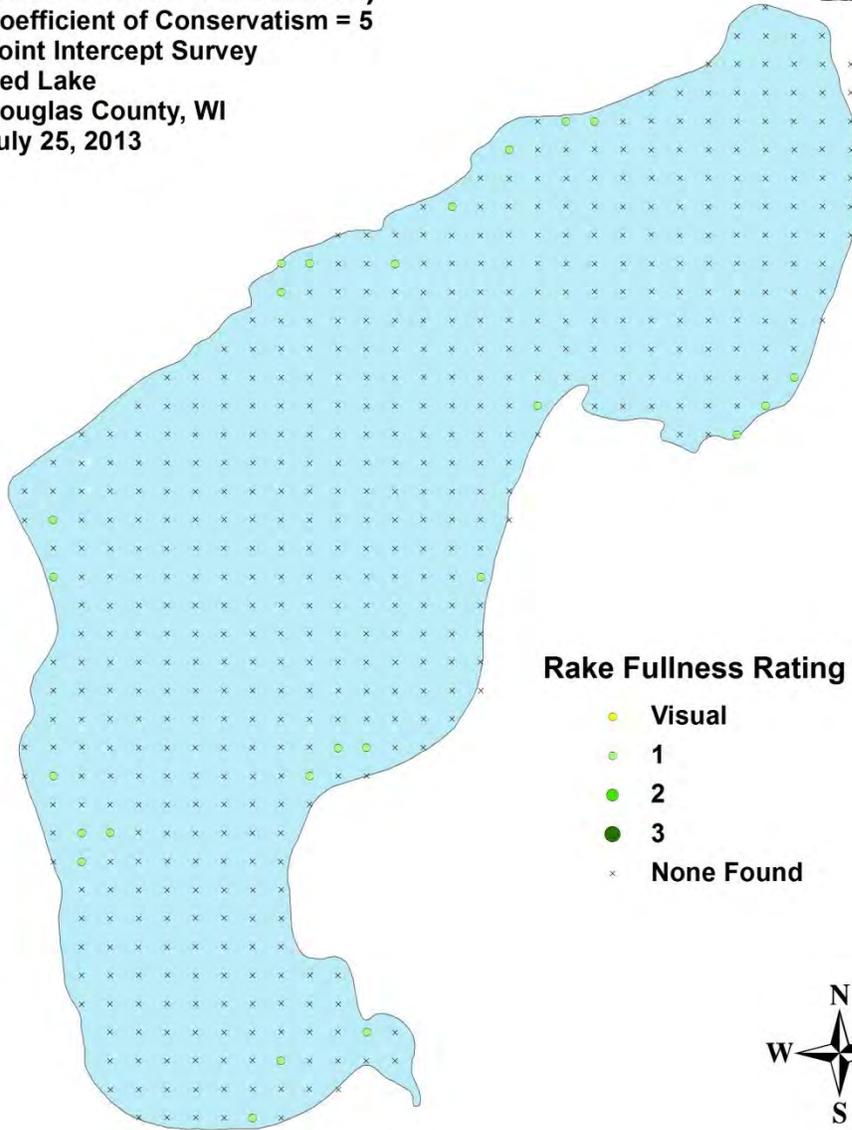
Coefficient of Conservatism = 5

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Bald spikerush**  
**(*Eleocharis erythropoda*)**

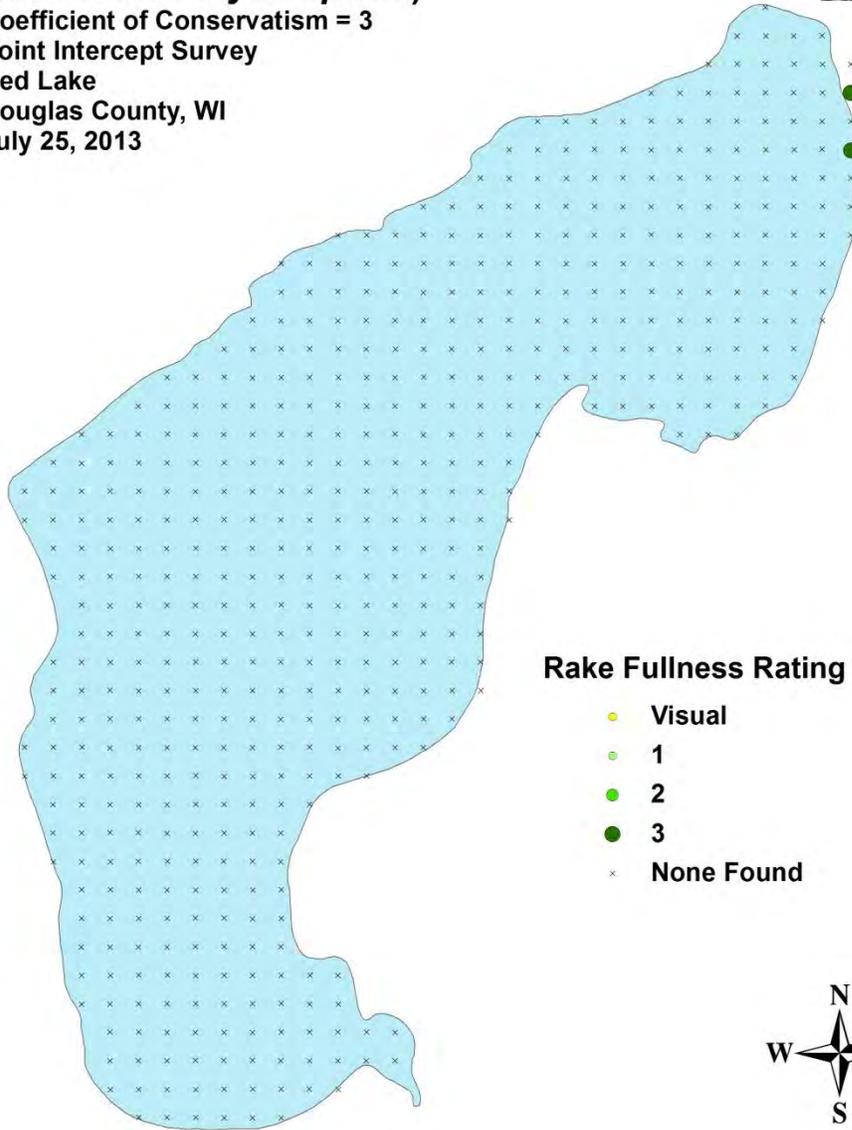
Coefficient of Conservatism = 3

Point Intercept Survey

Red Lake

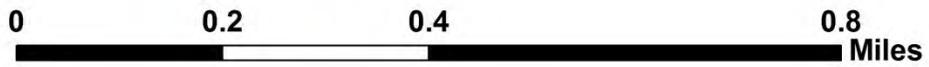
Douglas County, WI

July 25, 2013

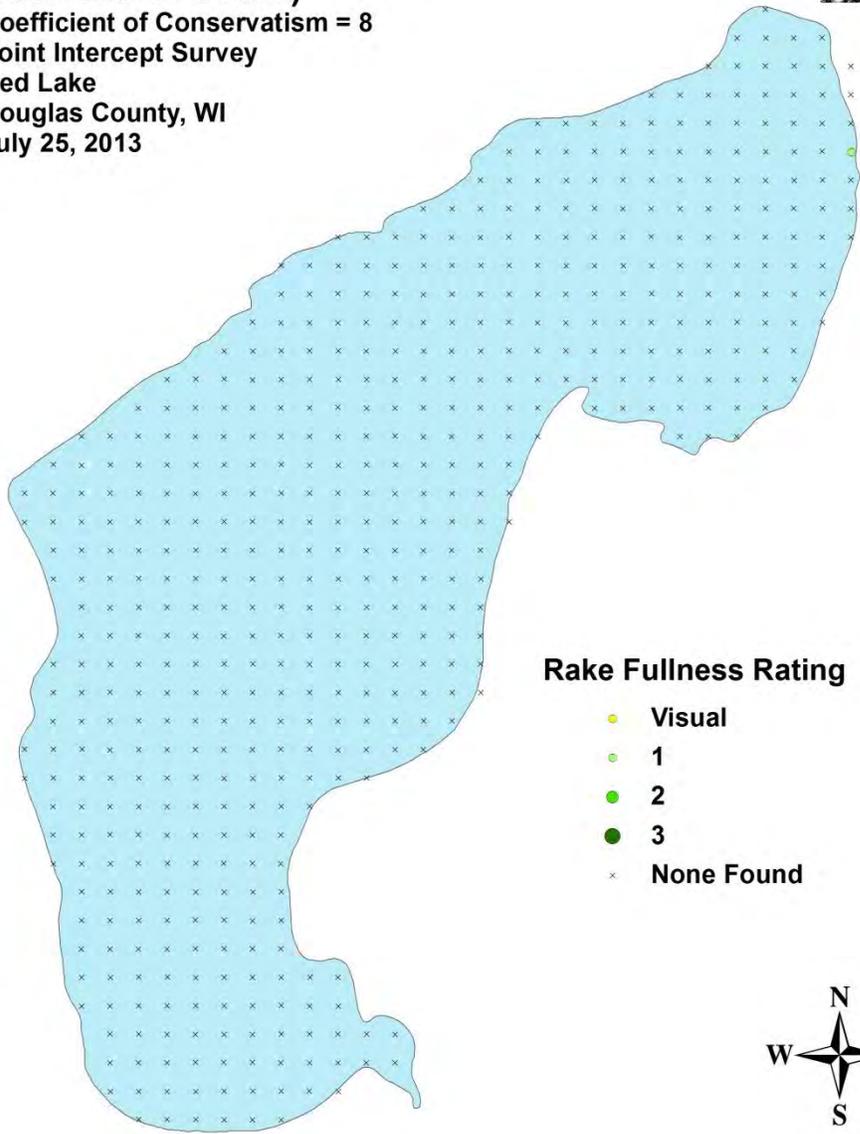


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Oval spikerush**  
**(*Eleocharis ovata*)**  
Coefficient of Conservatism = 8  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Creeping spikerush  
(*Eleocharis palustris*)**

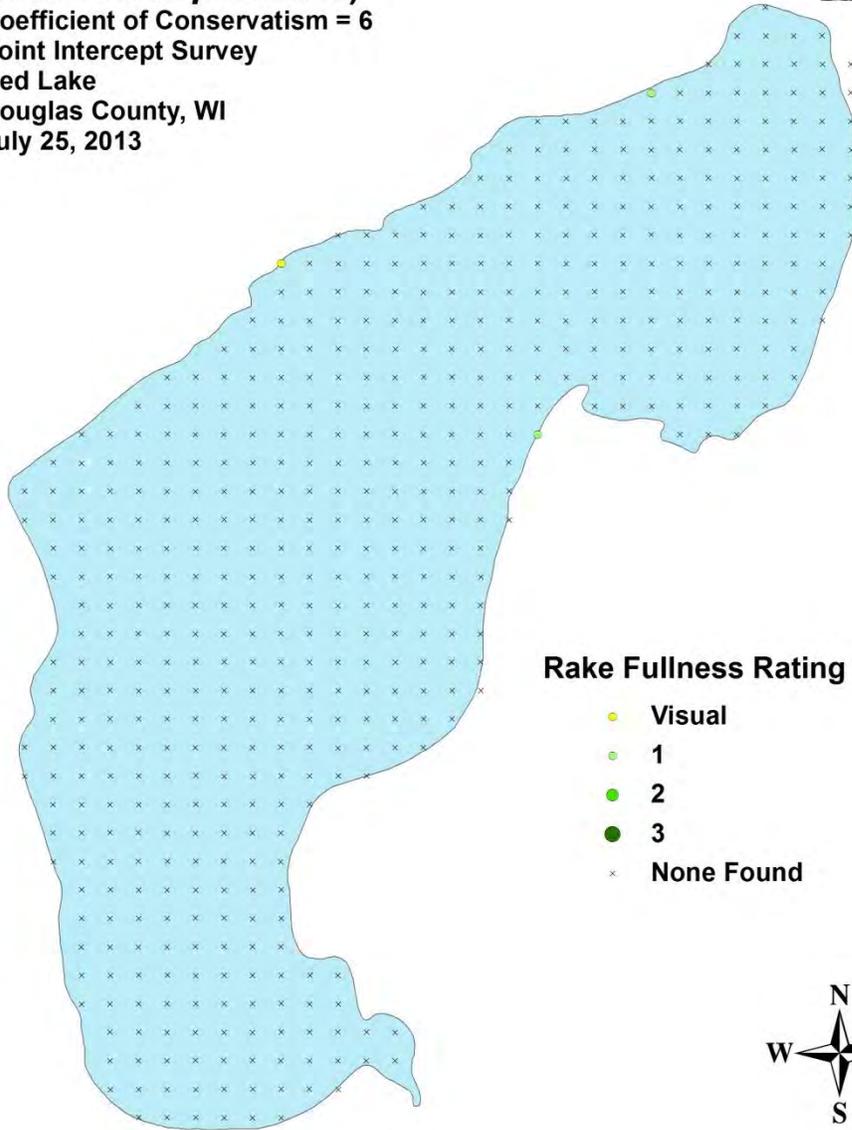
Coefficient of Conservatism = 6

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013

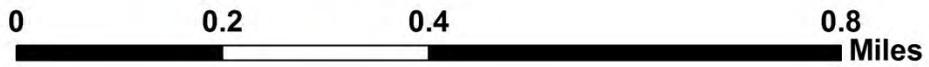
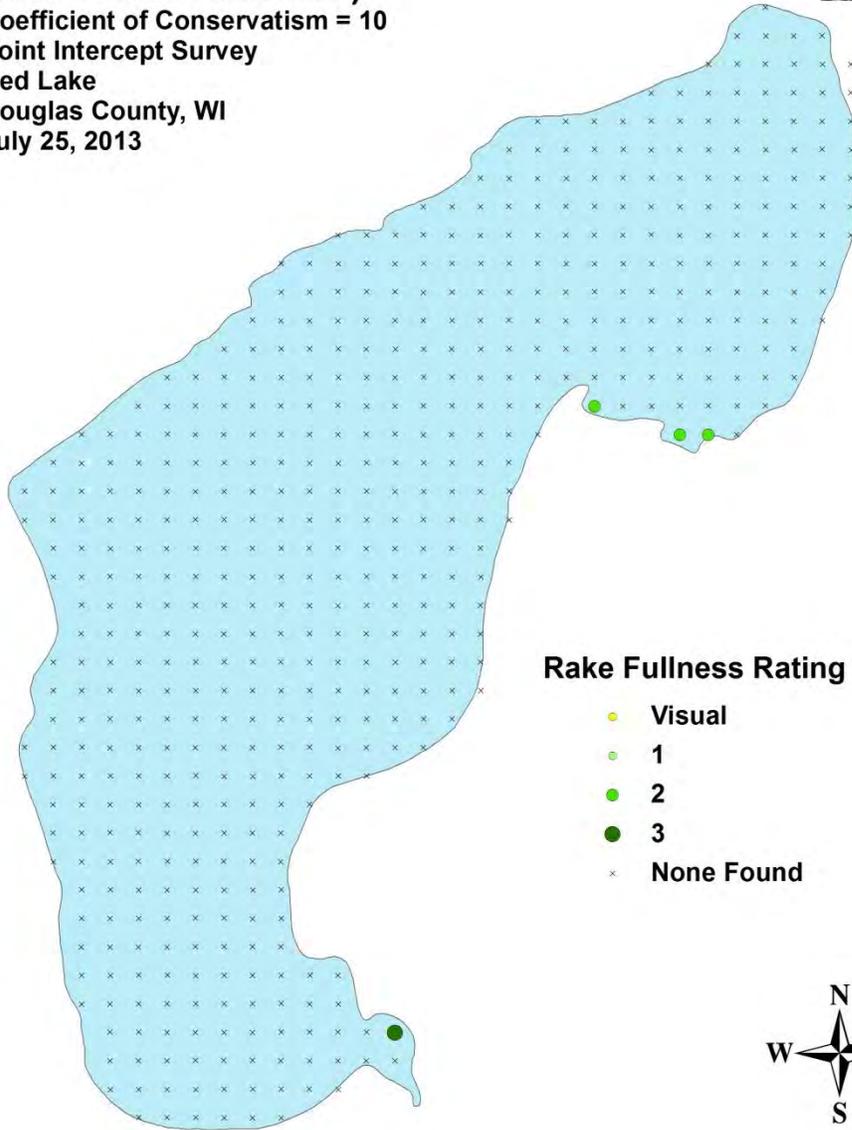


**Rake Fullness Rating**

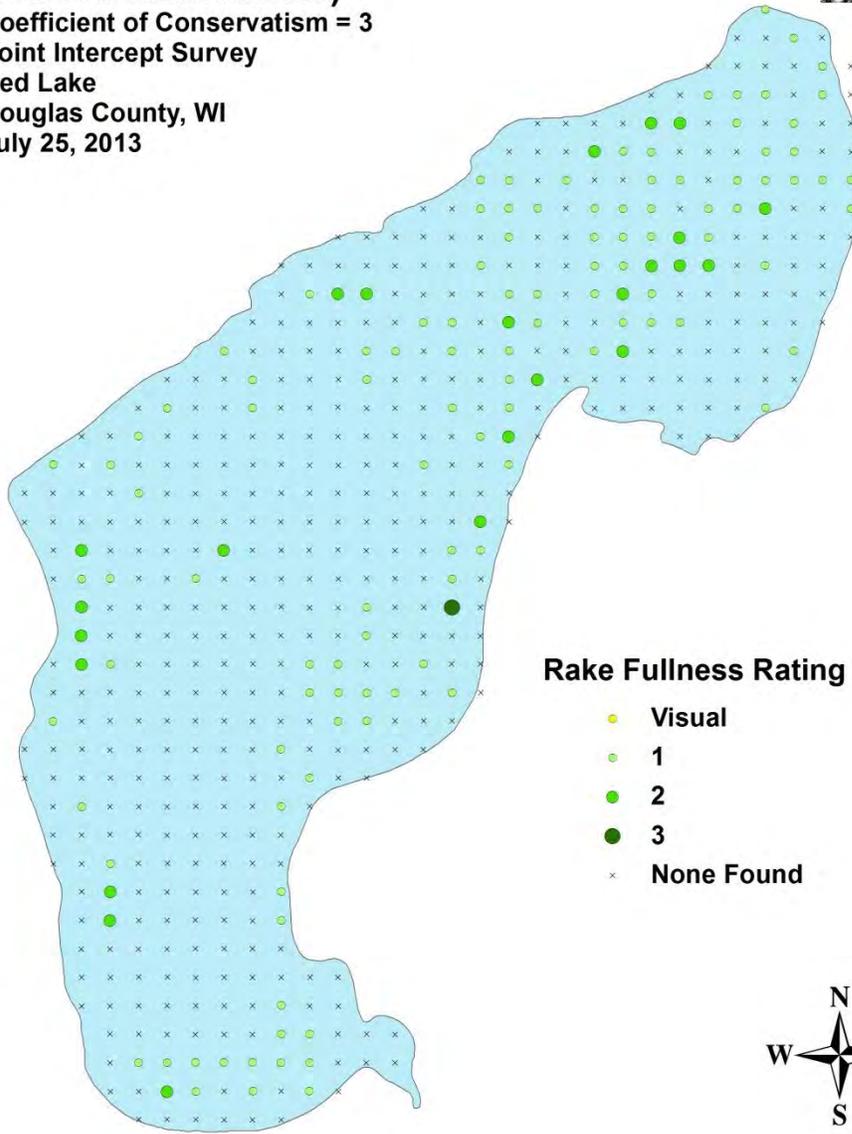
- Visual
- 1
- 2
- 3
- × None Found



**Robbins spikerush**  
**(*Eleocharis Robbinsii*)**  
Coefficient of Conservatism = 10  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Common waterweed**  
**(*Elodea canadensis*)**  
Coefficient of Conservatism = 3  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

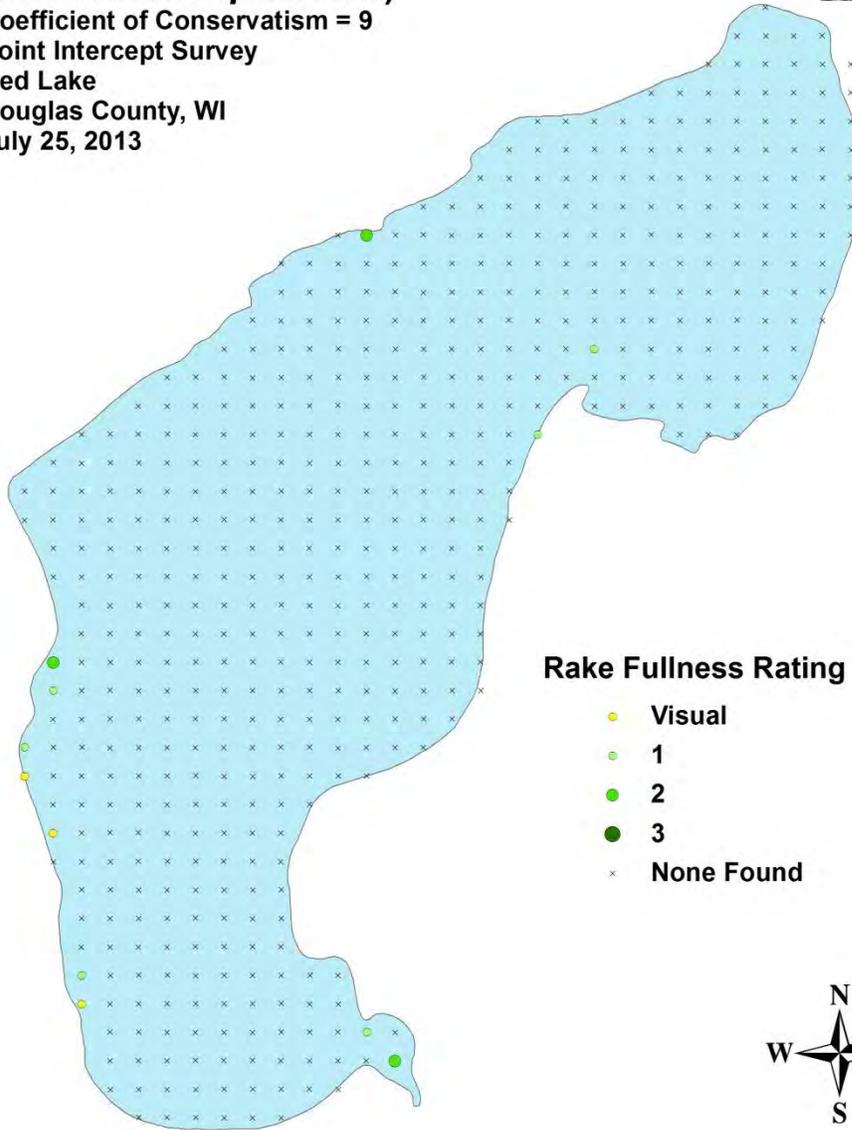


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Pipewort**  
**(*Eriocaulon aquaticum*)**  
Coefficient of Conservatism = 9  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



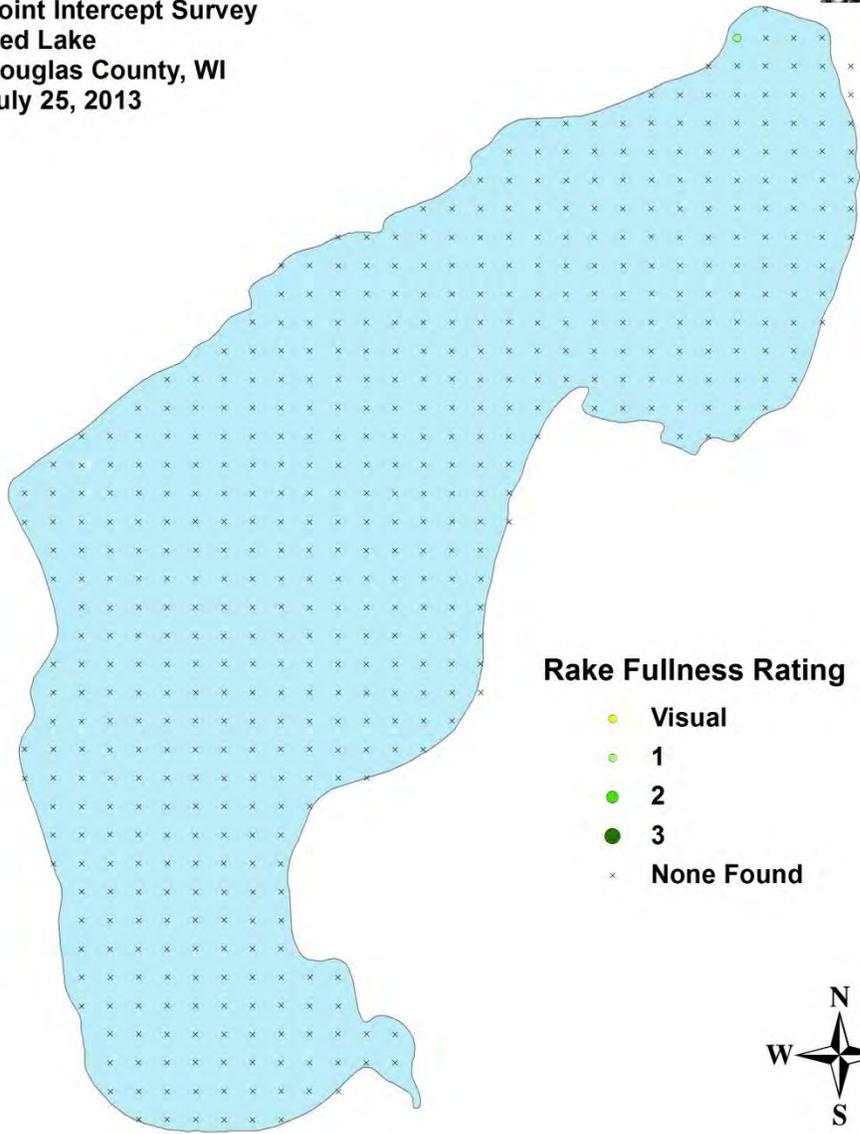
**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



# Filamentous algae

Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



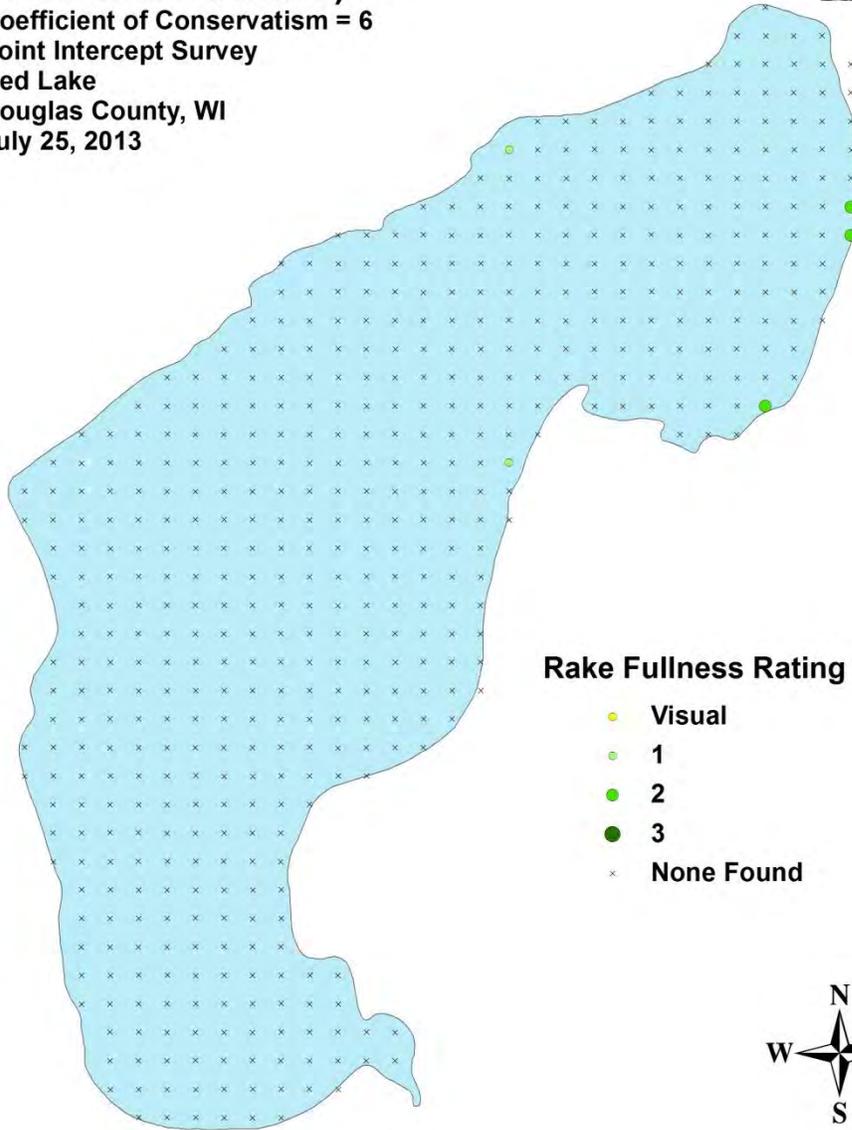
### Rake Fullness Rating

- Visual
- 1
- 2
- 3
- × None Found



**Water star-grass  
(*Heteranthera dubia*)**

Coefficient of Conservatism = 6  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Spiny-spored quillwort  
(*Isoetes echinospora*)**

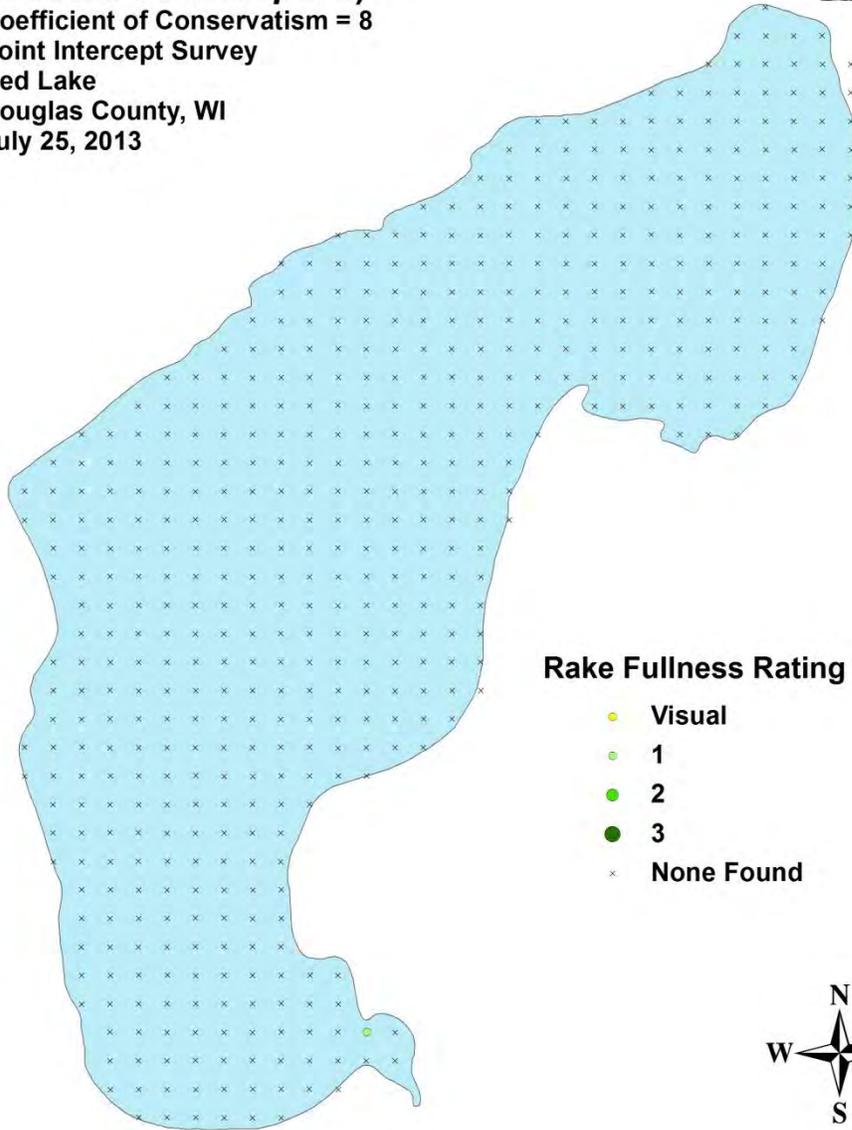
Coefficient of Conservatism = 8

Point Intercept Survey

Red Lake

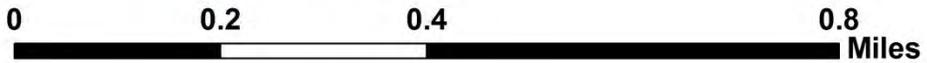
Douglas County, WI

July 25, 2013

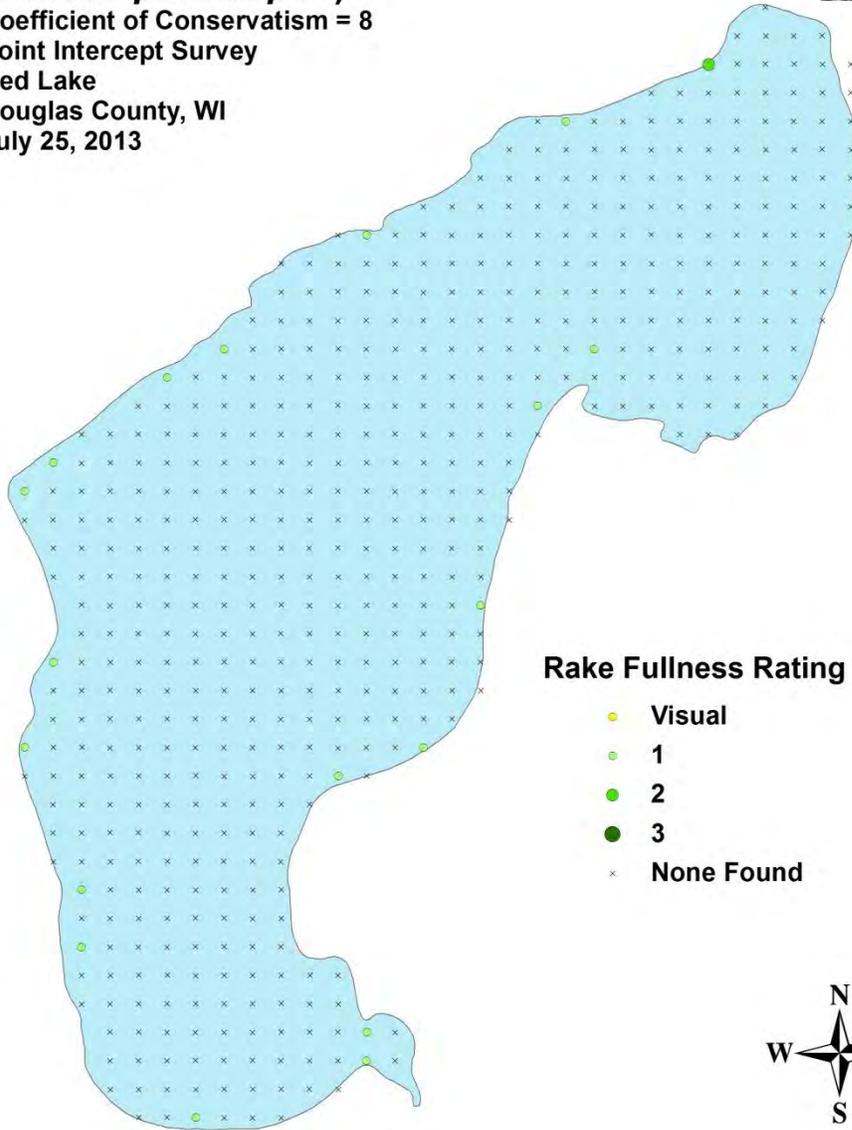


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Brown-fruited rush**  
**(*Juncus pelocarpus*)**  
Coefficient of Conservatism = 8  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

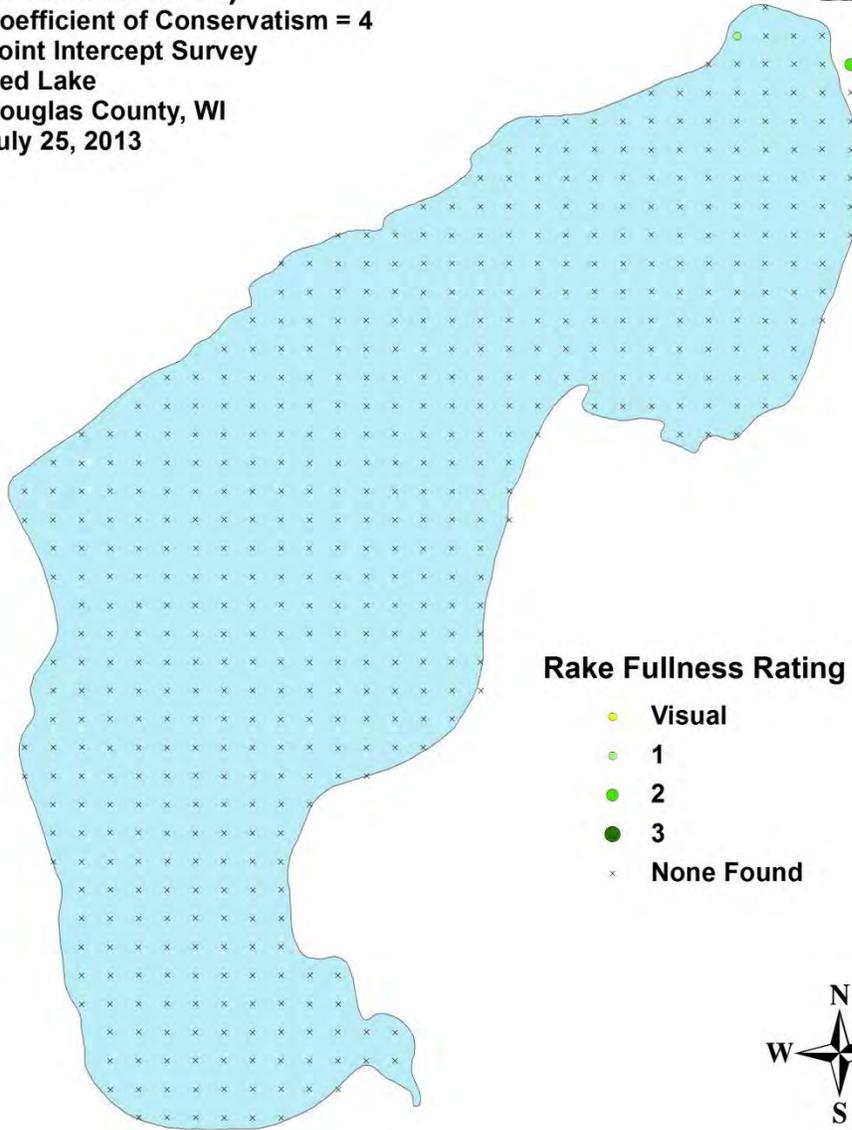


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Small duckweed**  
**(*Lemna minor*)**  
Coefficient of Conservatism = 4  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

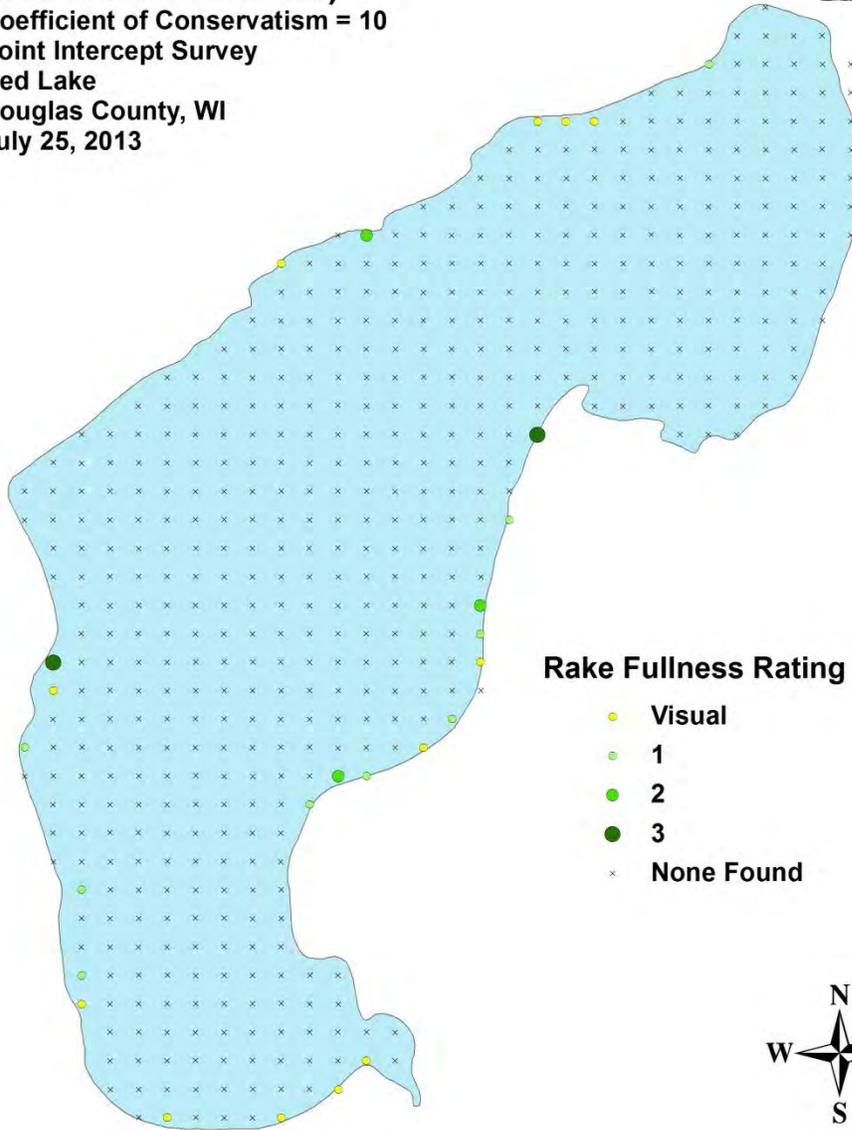


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Water lobelia**  
**(*Lobelia dortmanna*)**  
Coefficient of Conservatism = 10  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

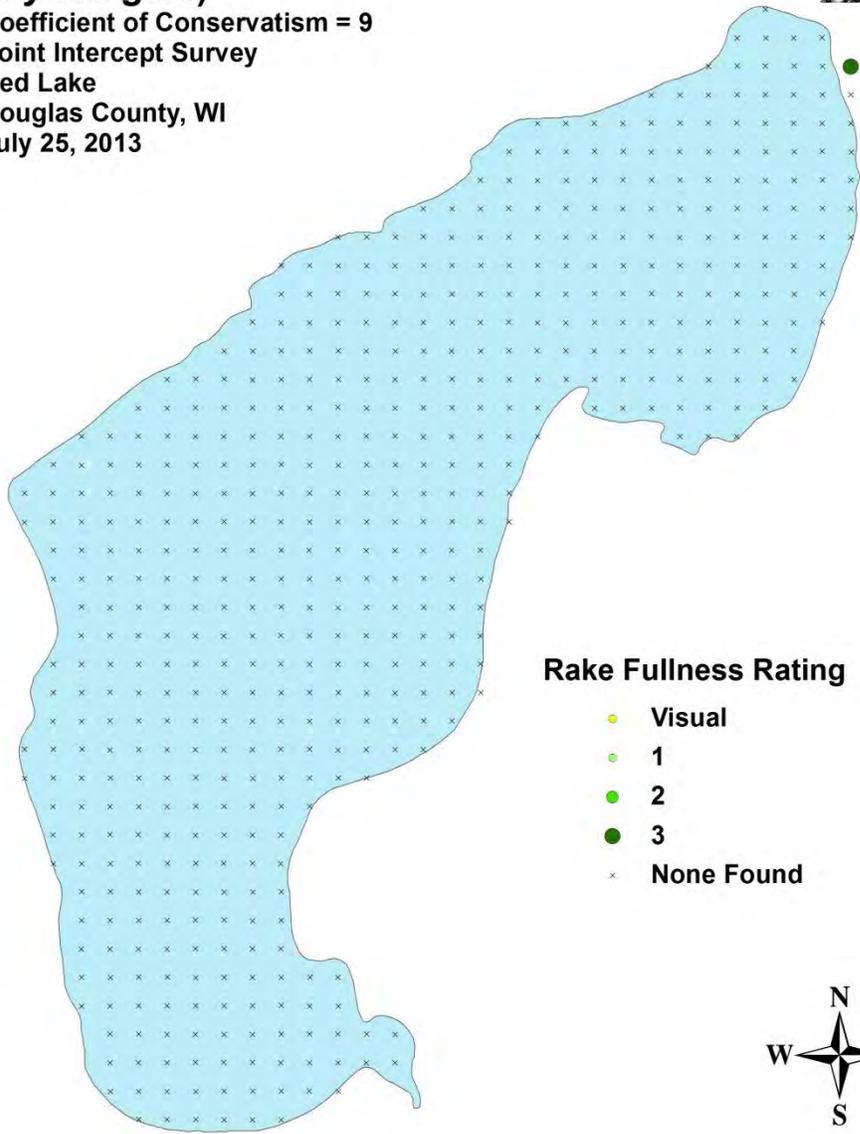


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Sweet gale**  
**(*Myrica gale*)**  
Coefficient of Conservatism = 9  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Northern water milfoil**  
**(*Myriophyllum sibiricum*)**

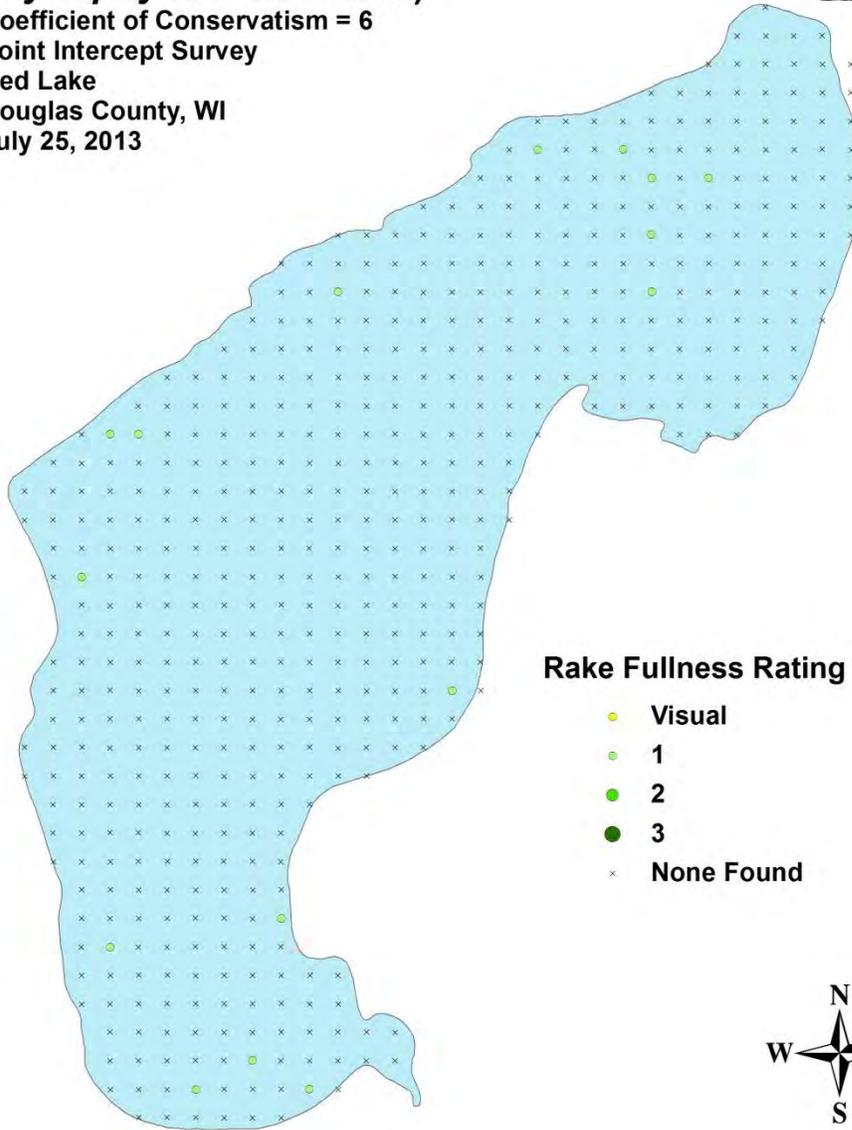
Coefficient of Conservatism = 6

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Dwarf water milfoil**  
**(*Myriophyllum tenellum*)**

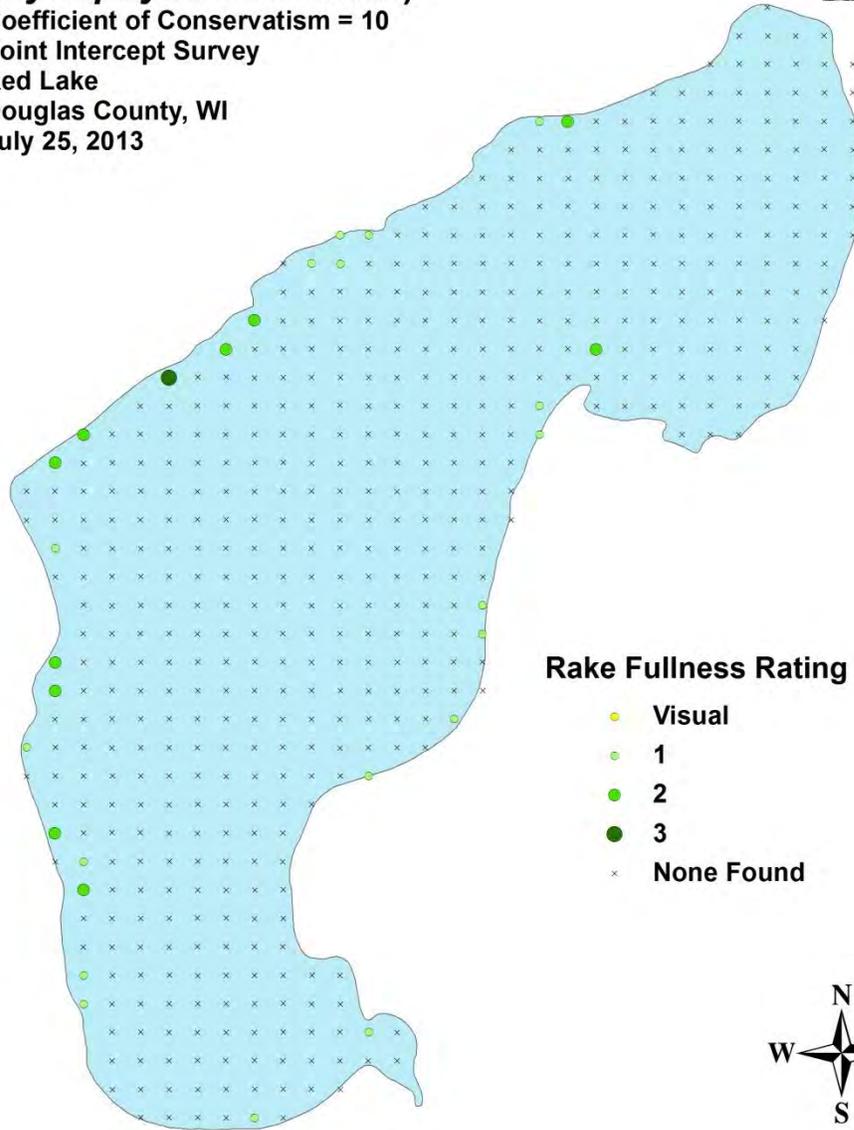
Coefficient of Conservatism = 10

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



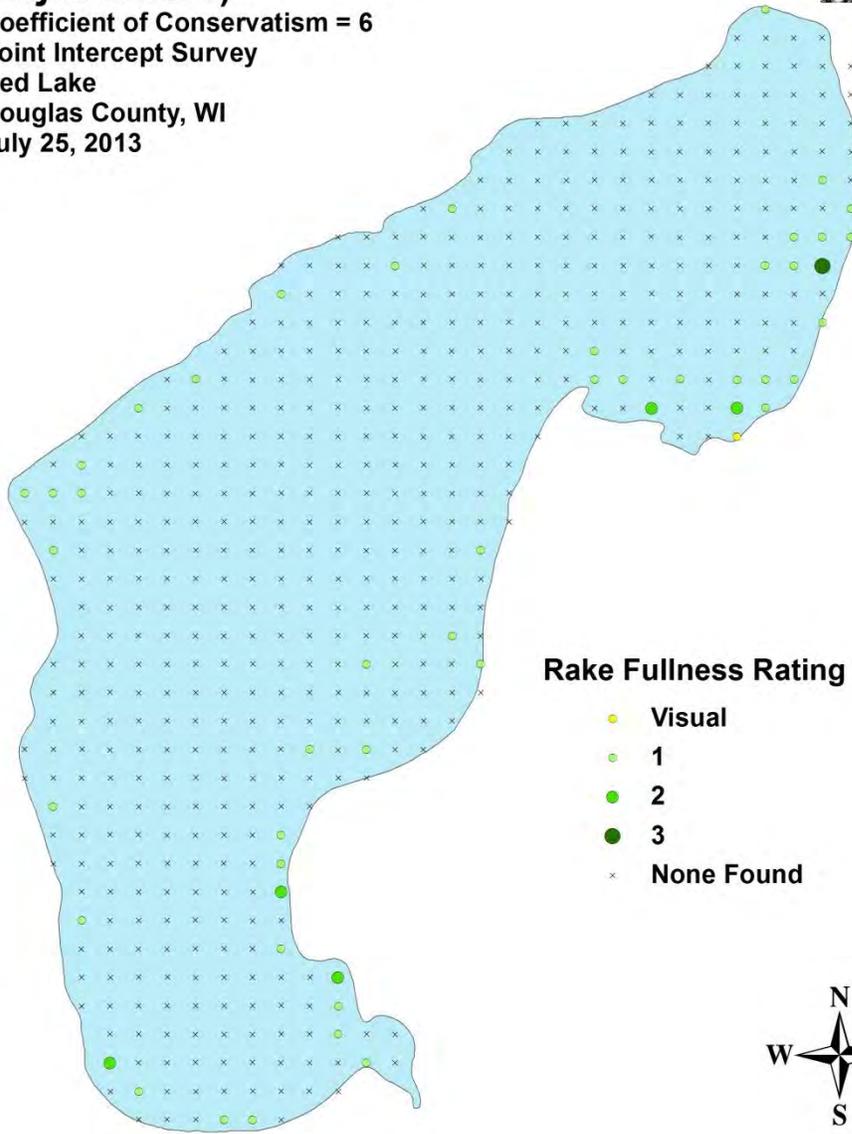
**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Slender naiad  
(*Najas flexilis*)**

Coefficient of Conservatism = 6  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



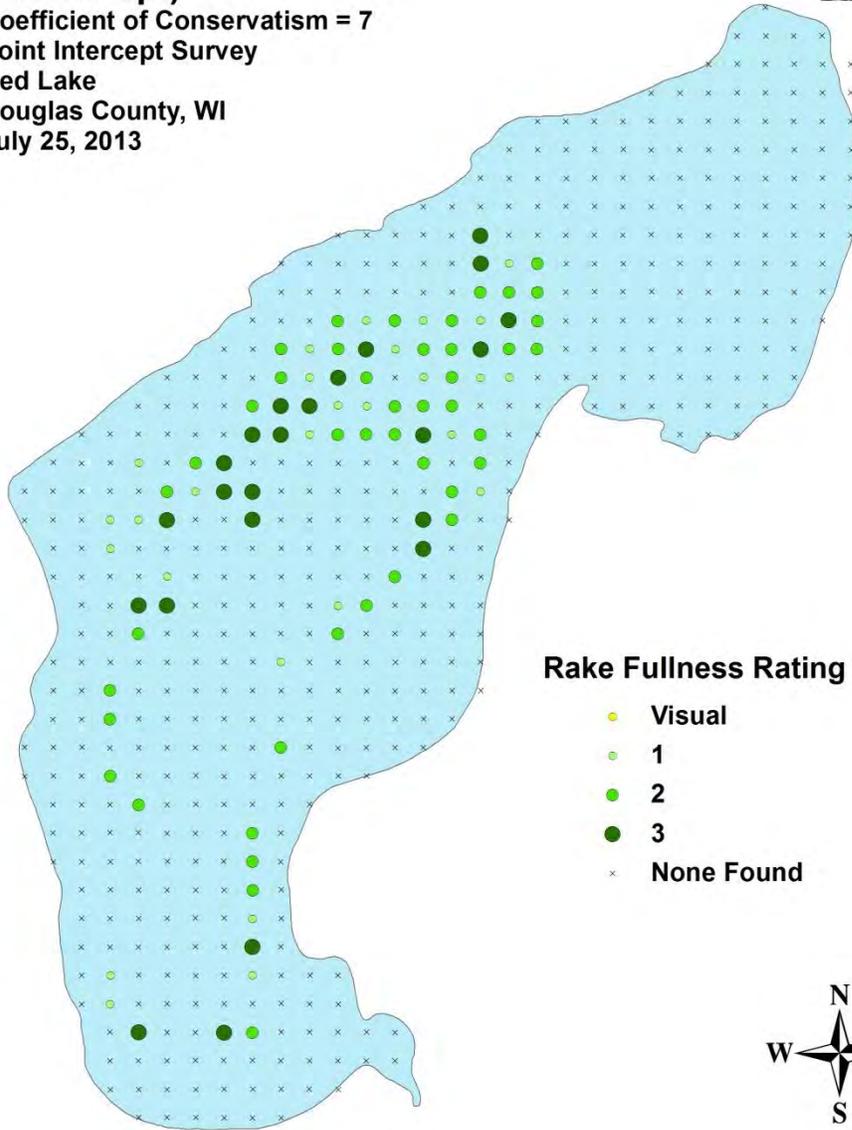
**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Nitella**  
**(*Nitella* sp.)**

Coefficient of Conservatism = 7  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

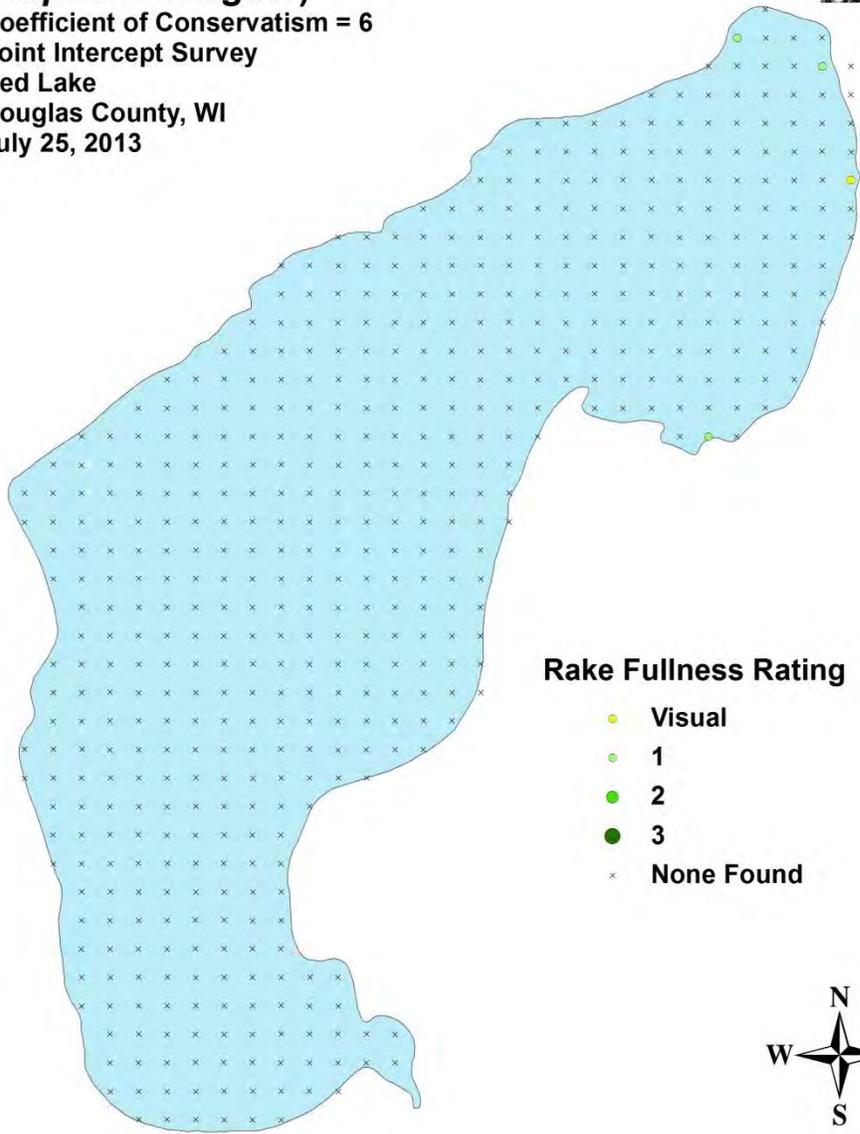


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Spatterdock**  
**(*Nuphar variegata*)**  
Coefficient of Conservatism = 6  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

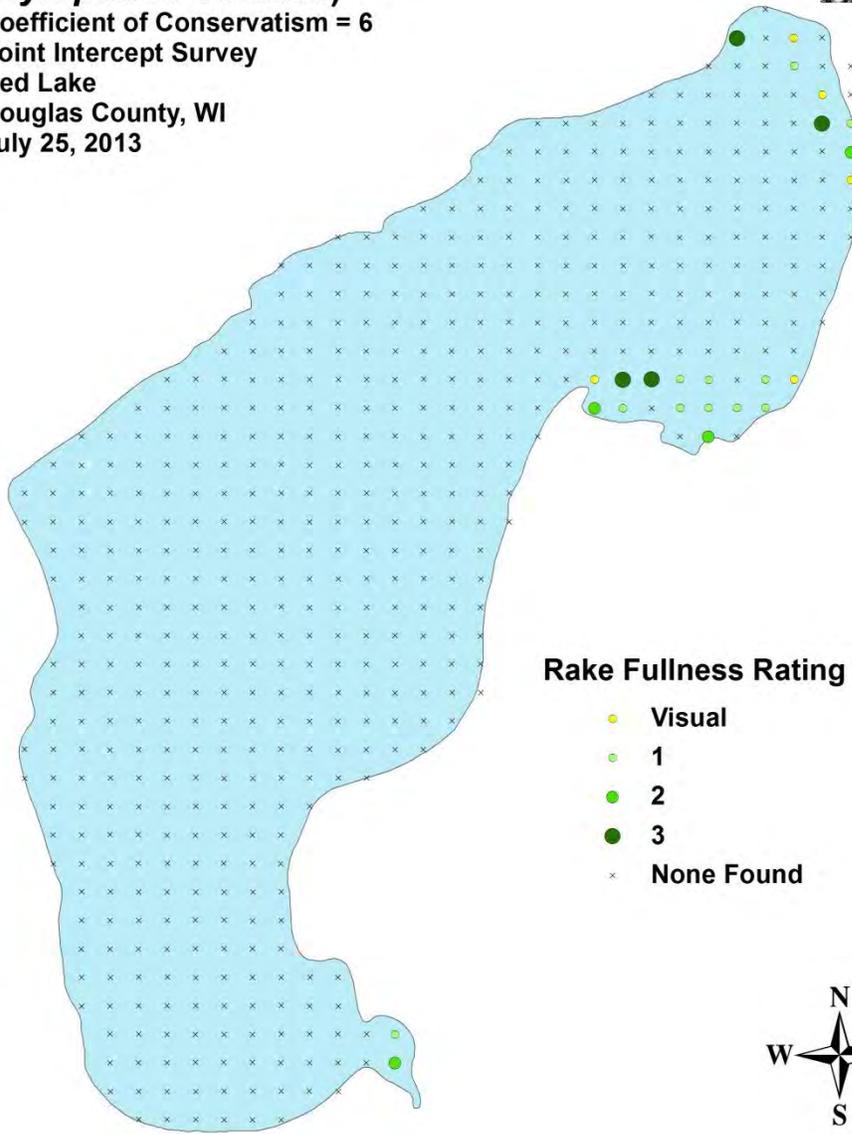


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**White water lily**  
**(*Nymphaea odorata*)**  
Coefficient of Conservatism = 6  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

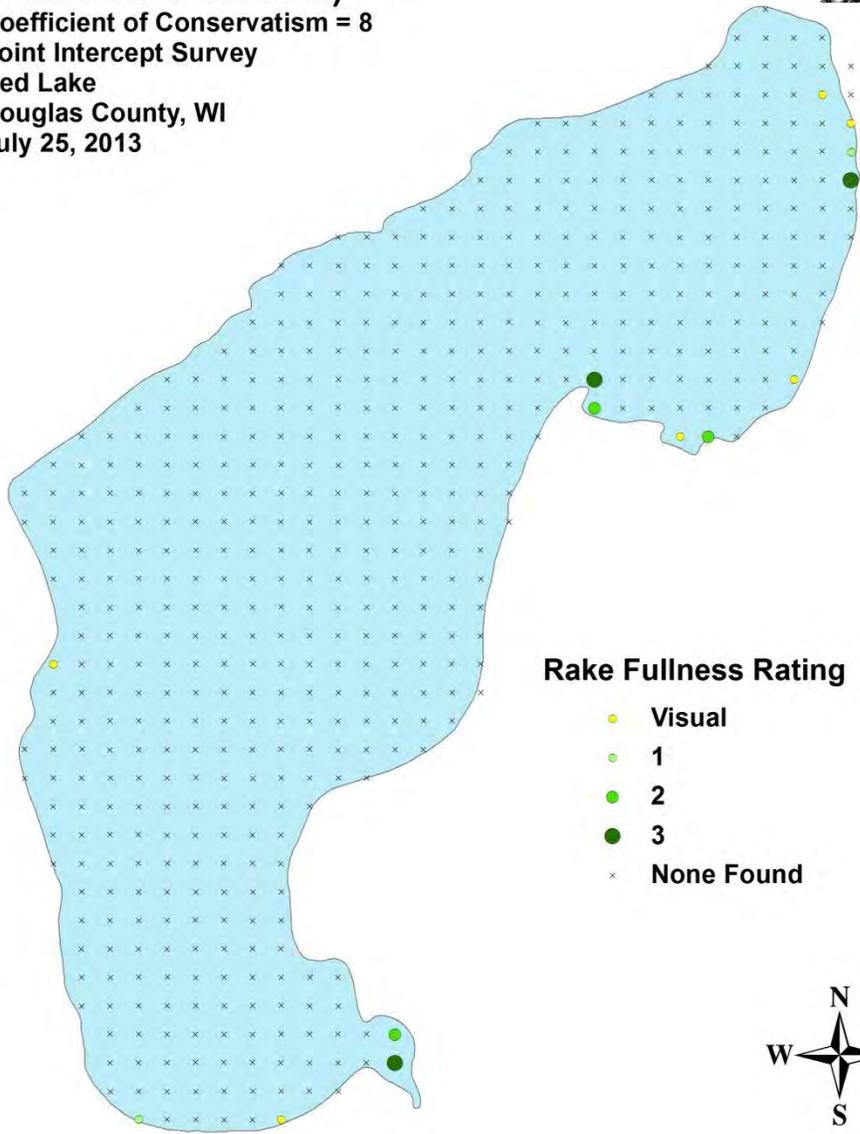


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Pickerelweed**  
**(*Pontederia cordata*)**  
Coefficient of Conservatism = 8  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

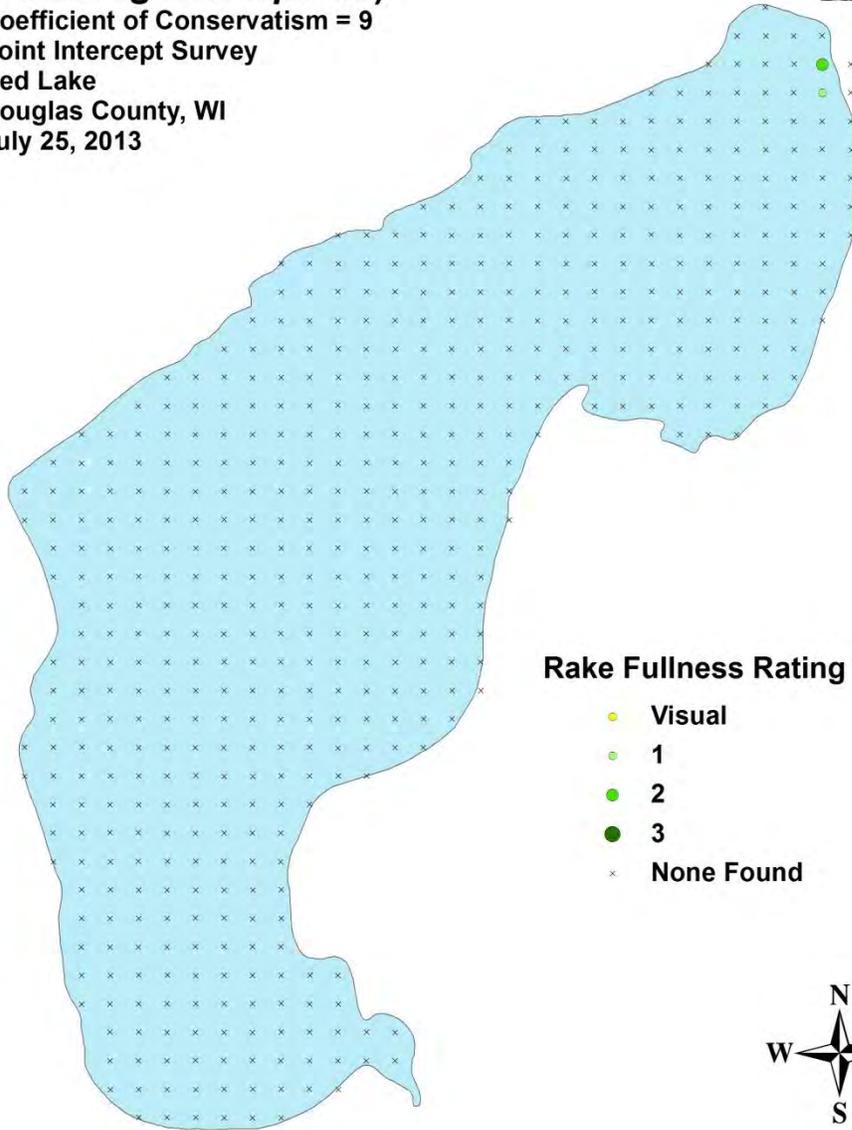


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found

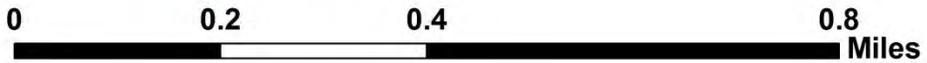


**Alpine pondweed**  
**(*Potamogeton alpinus*)**  
Coefficient of Conservatism = 9  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Large-leaf pondweed**  
**(*Potamogeton amplifolius*)**

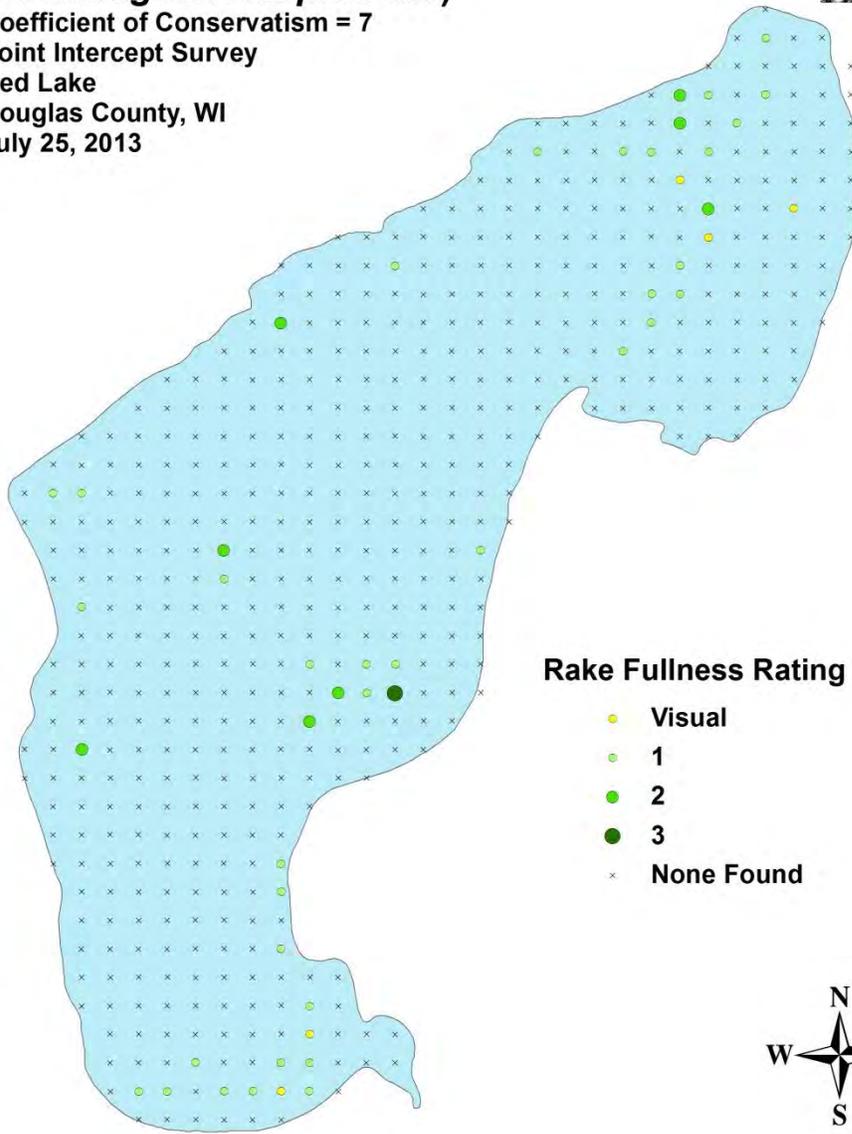
Coefficient of Conservatism = 7

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Ribbon-leaf pondweed**  
**(*Potamogeton epihydrus*)**

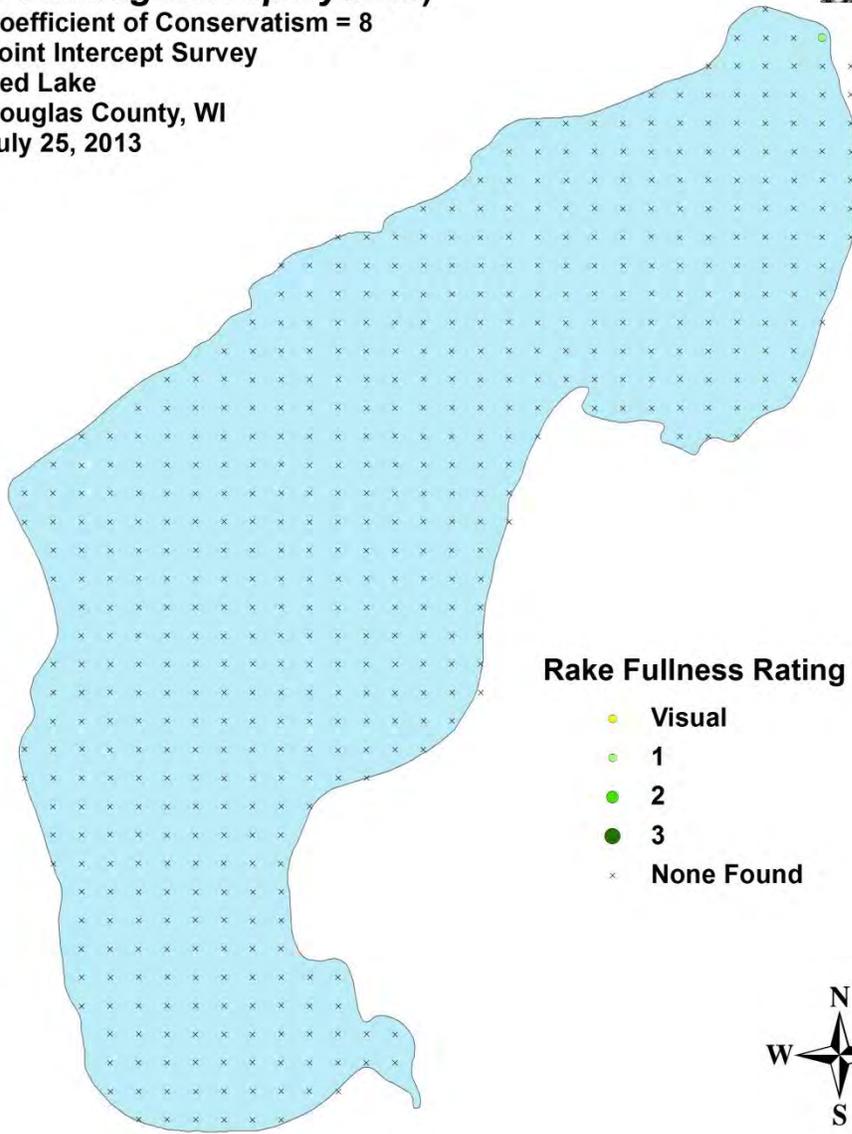
Coefficient of Conservatism = 8

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013

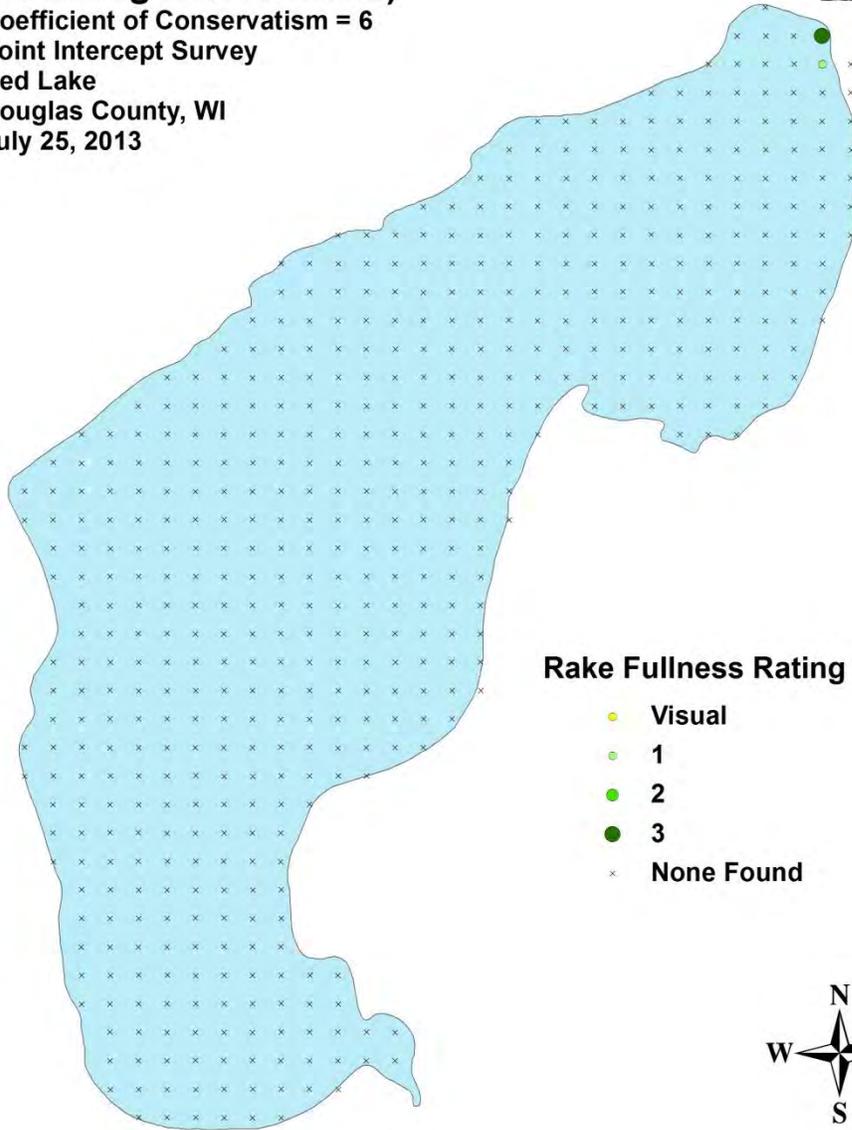


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Leafy pondweed**  
**(*Potamogeton foliosus*)**  
Coefficient of Conservatism = 6  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

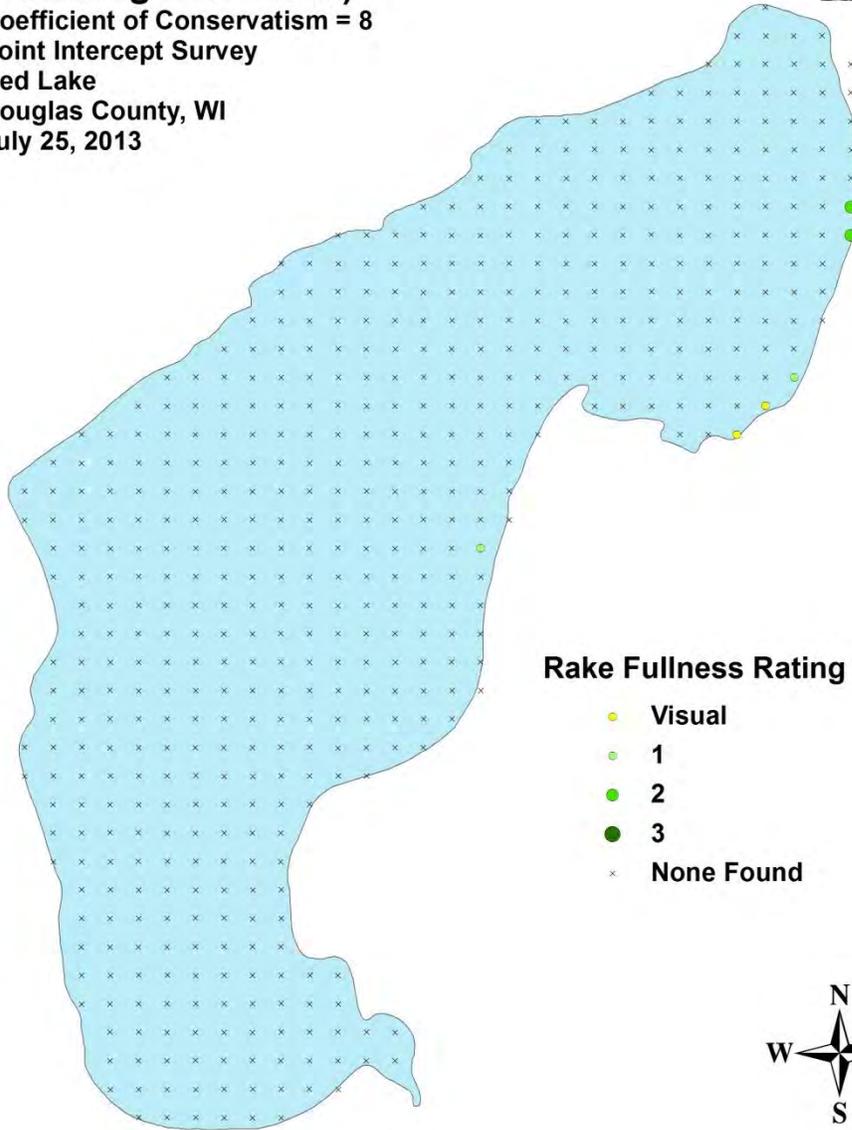


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Fries' pondweed**  
**(*Potamogeton friesii*)**  
Coefficient of Conservatism = 8  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Variable pondweed  
(*Potamogeton gramineus*)**

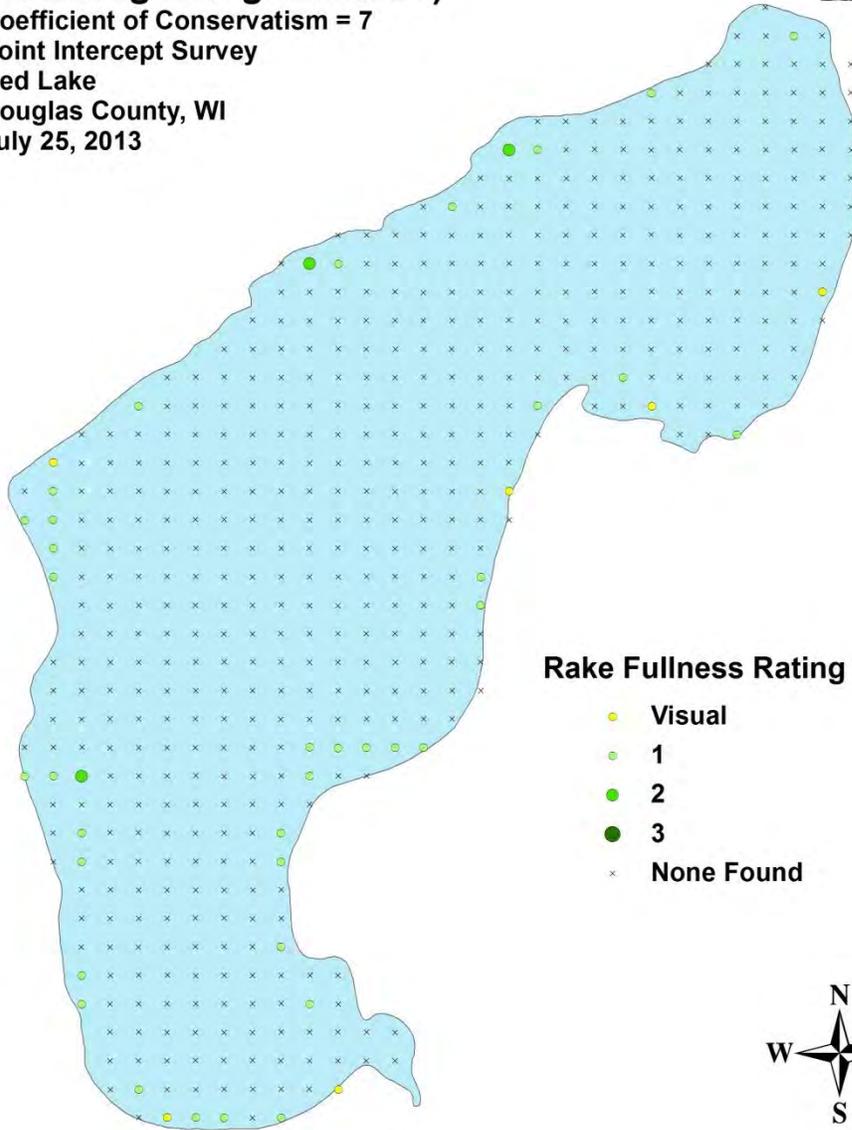
Coefficient of Conservatism = 7

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Illinois pondweed  
(*Potamogeton illinoensis*)**

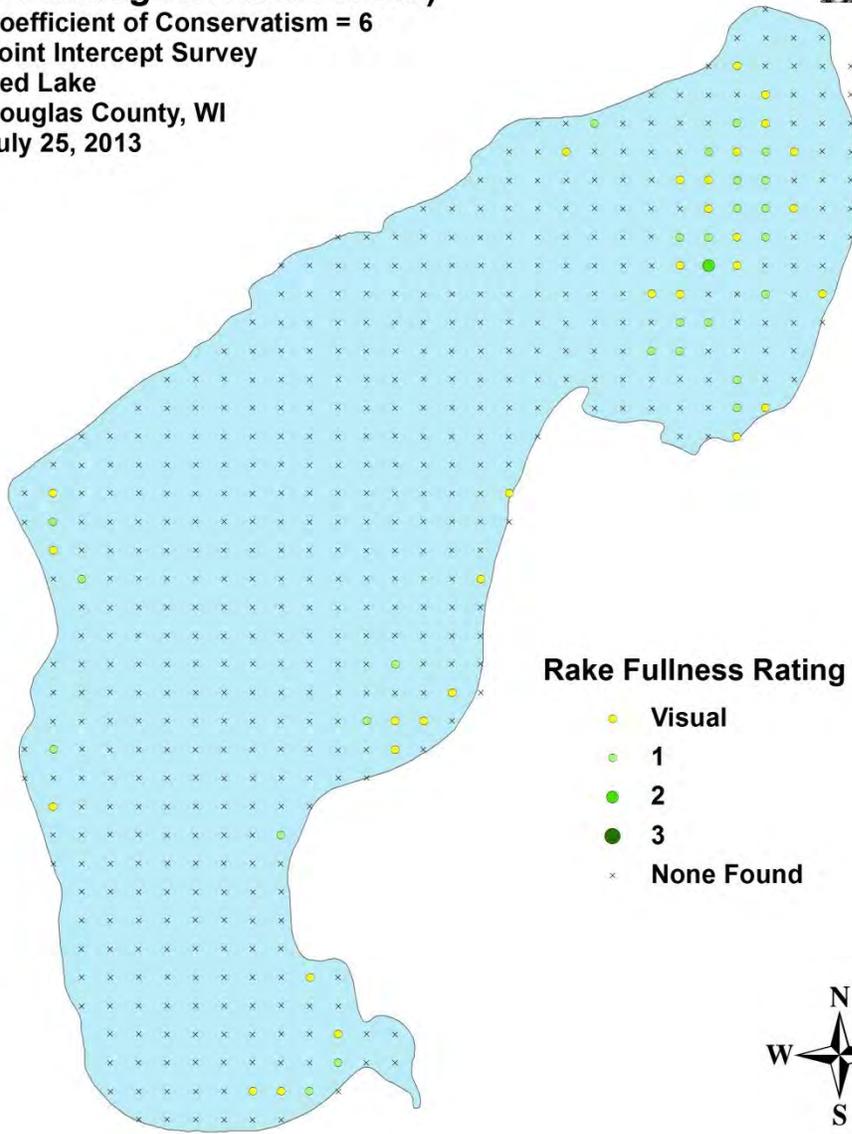
Coefficient of Conservatism = 6

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**White-stem pondweed**  
**(*Potamogeton praelongus*)**

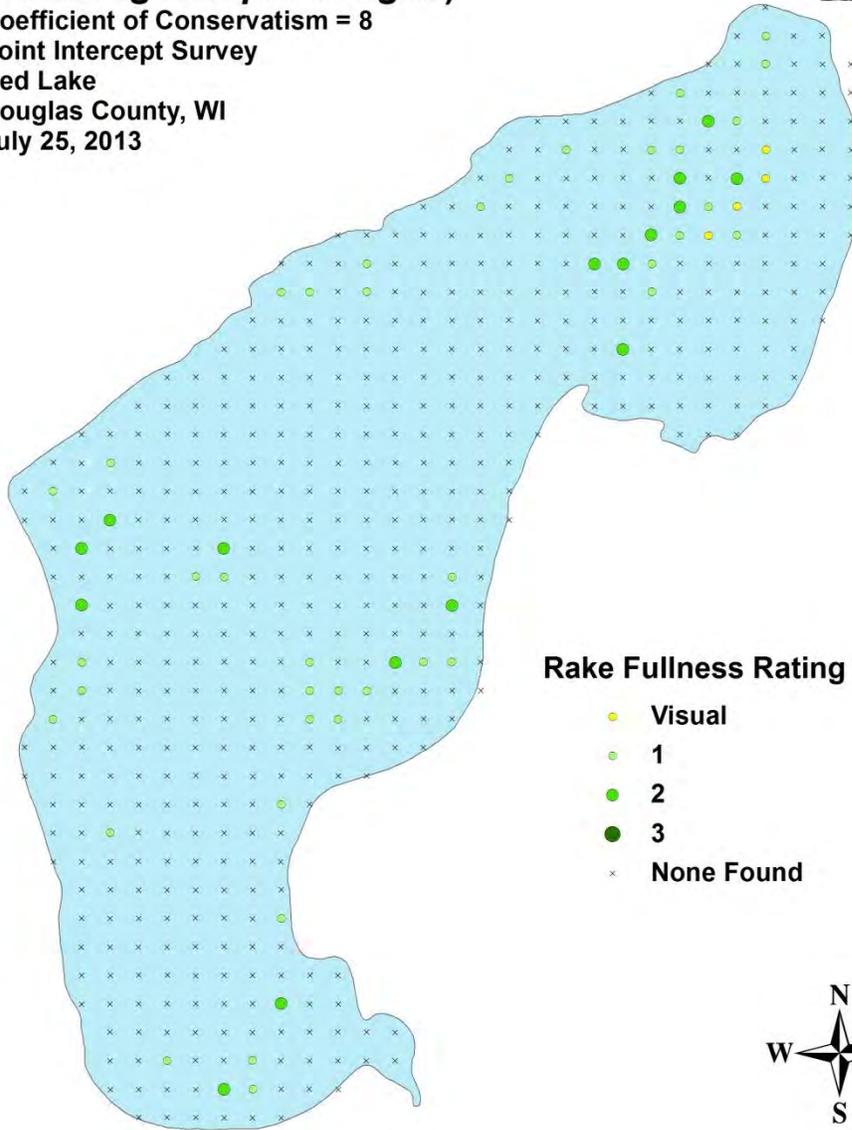
Coefficient of Conservatism = 8

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013

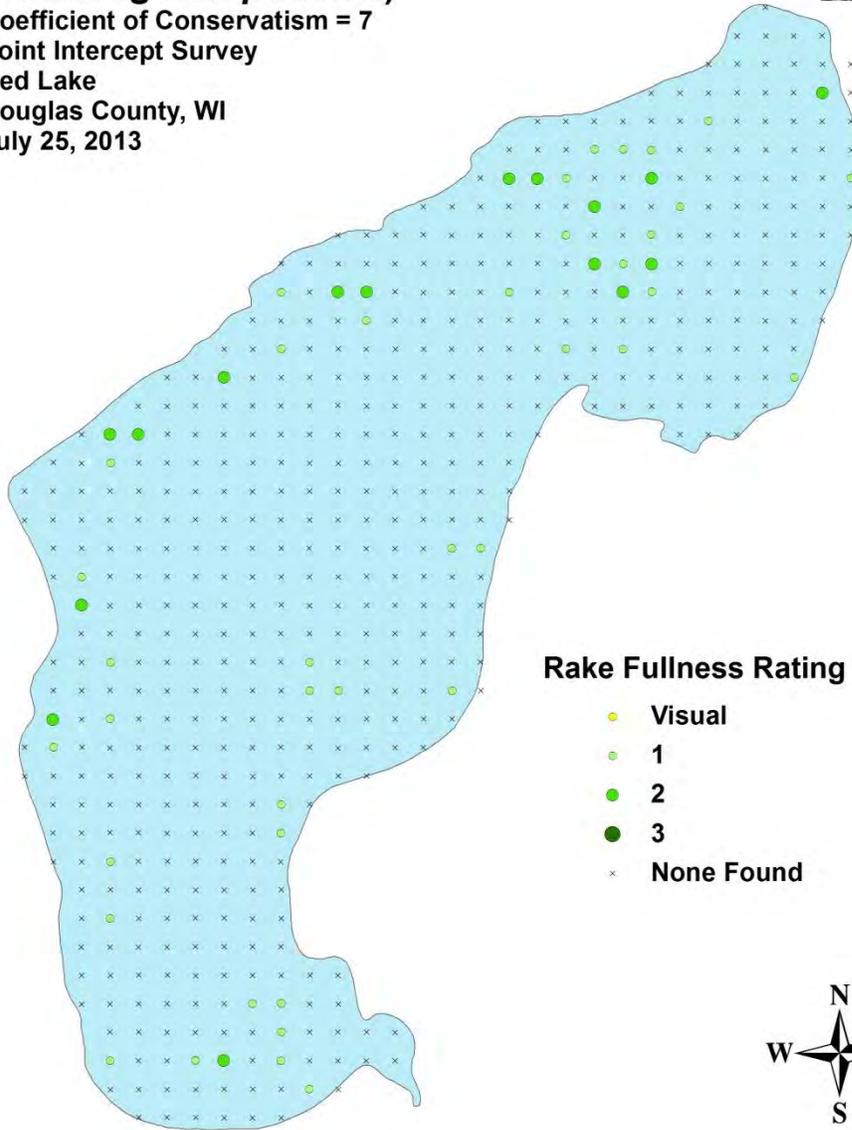


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Small pondweed**  
**(*Potamogeton pusillus*)**  
Coefficient of Conservatism = 7  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Clasping-leaf pondweed  
(*Potamogeton richardsonii*)**

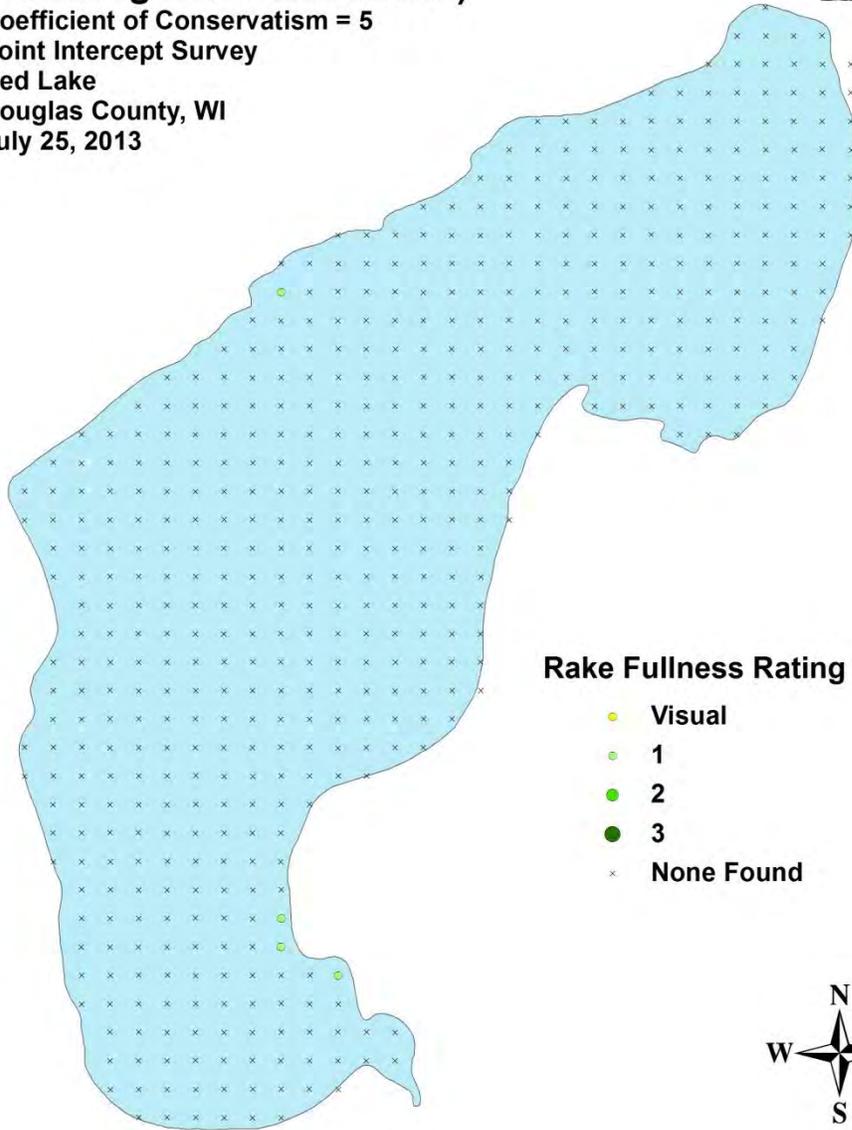
Coefficient of Conservatism = 5

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013

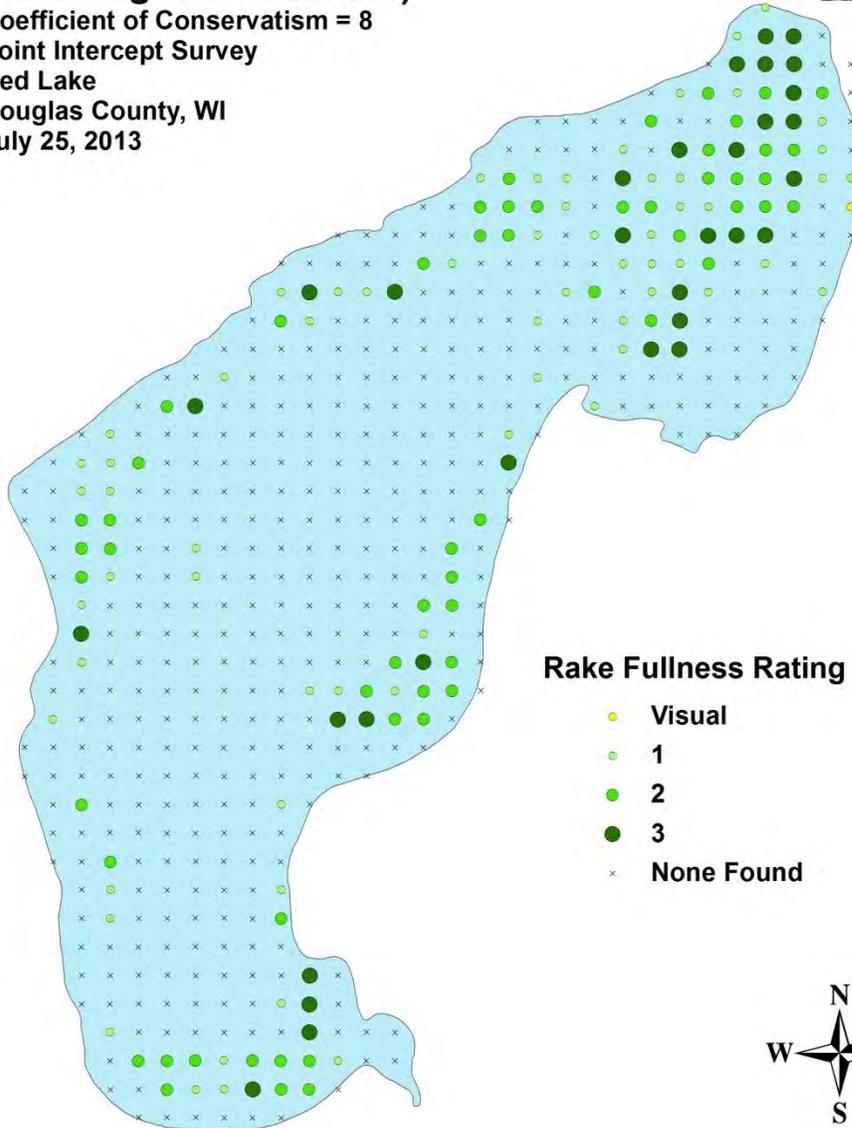


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Fern pondweed**  
**(*Potamogeton robbinsii*)**  
Coefficient of Conservatism = 8  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Stiff pondweed**  
**(*Potamogeton strictifolius*)**

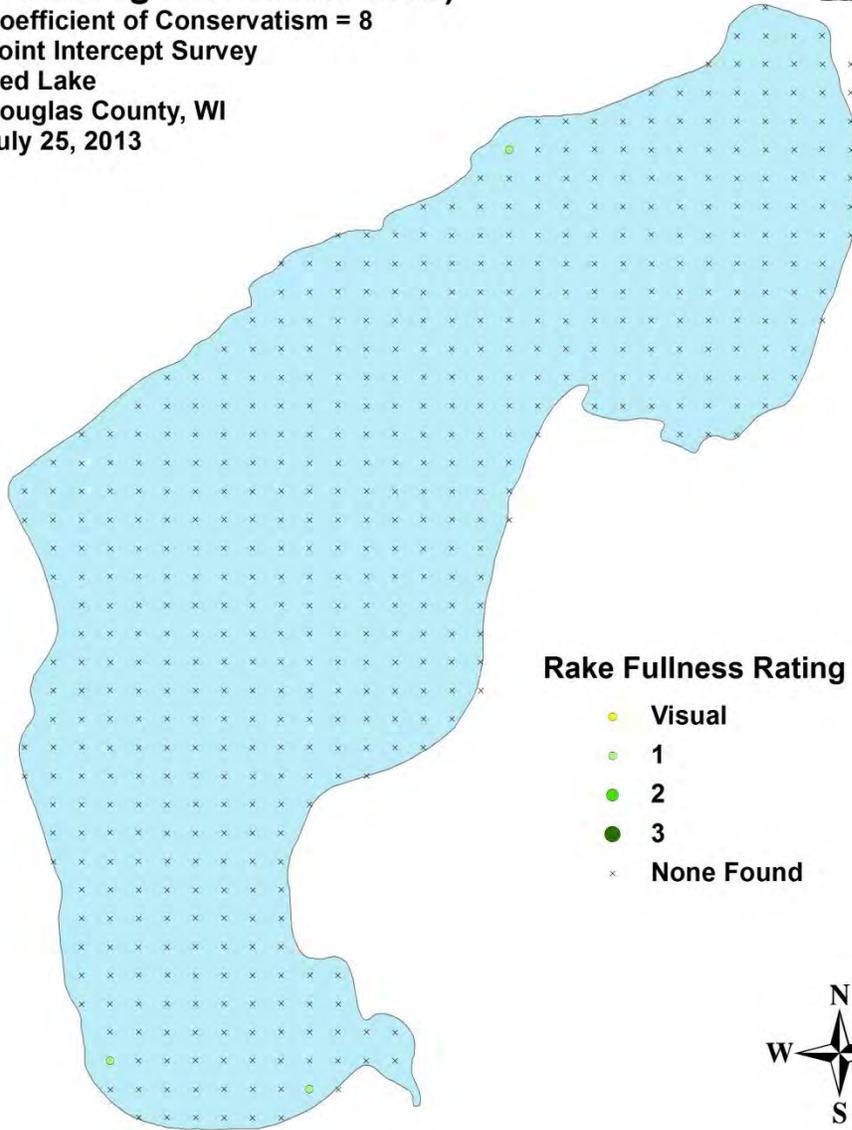
Coefficient of Conservatism = 8

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Flat-stem pondweed  
(*Potamogeton zosteriformis*)**

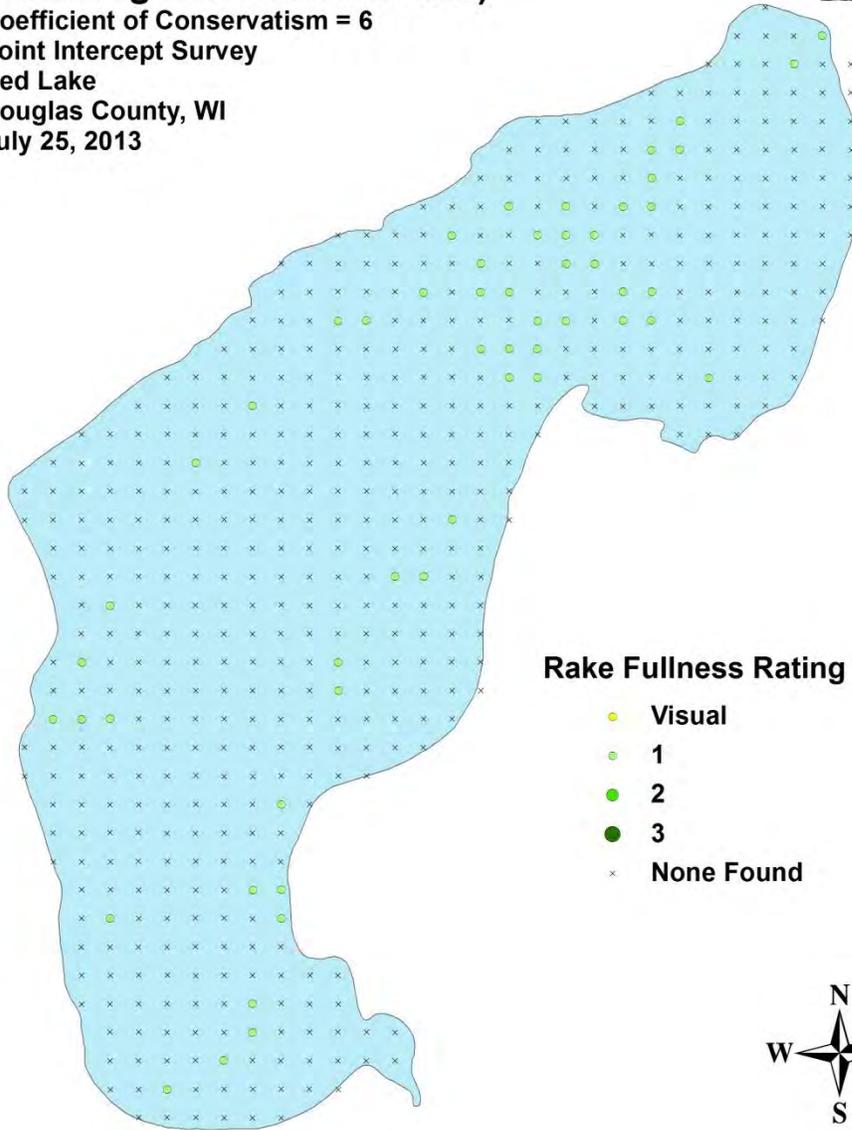
Coefficient of Conservatism = 6

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**White water crowfoot  
(*Ranunculus aquatilis*)**

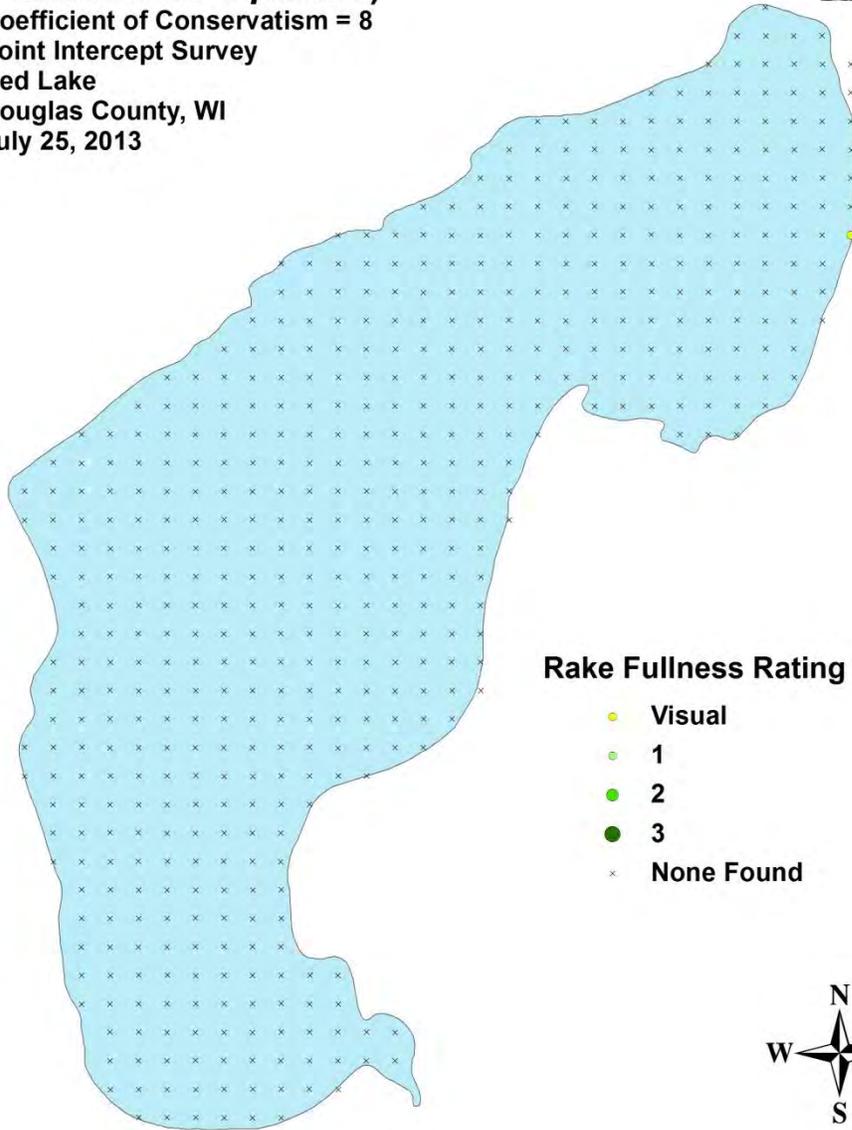
Coefficient of Conservatism = 8

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Creeping spearwort  
(*Ranunculus flammula*)**

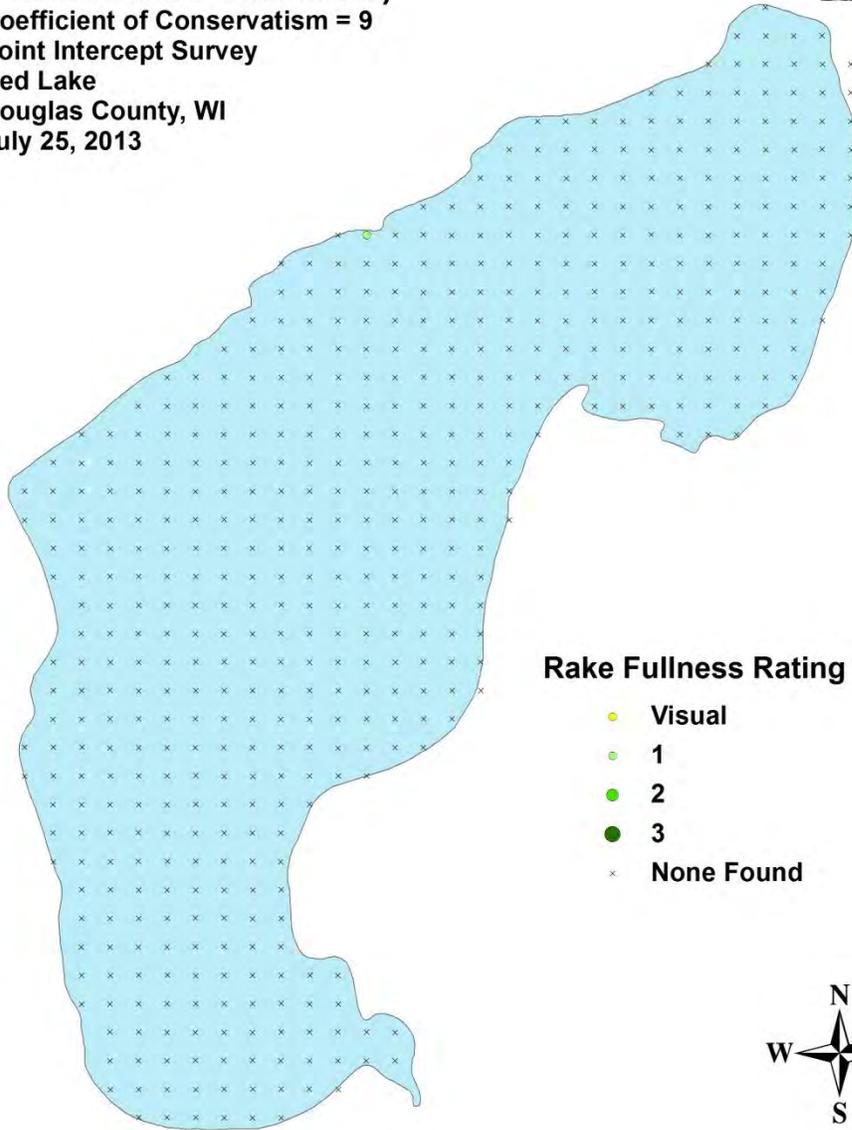
Coefficient of Conservatism = 9

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013

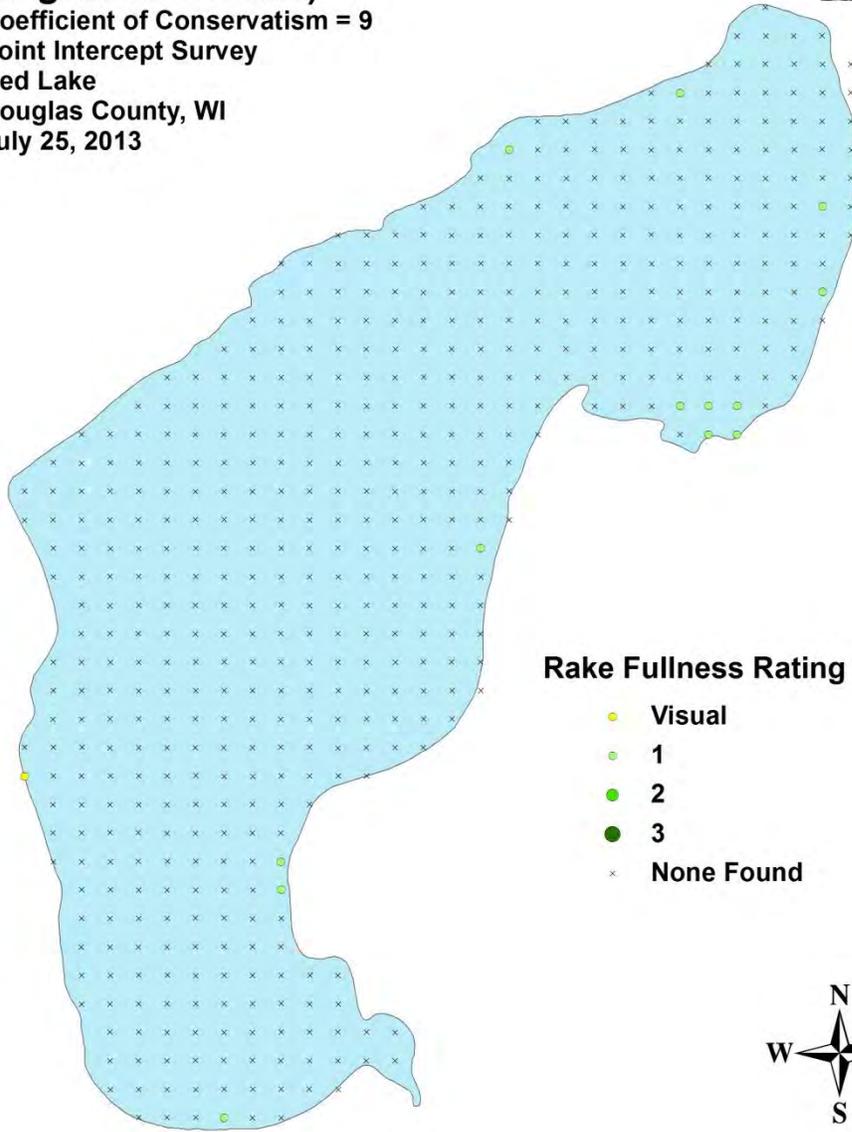


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Crested arrowhead**  
**(*Sagittaria cristata*)**  
Coefficient of Conservatism = 9  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



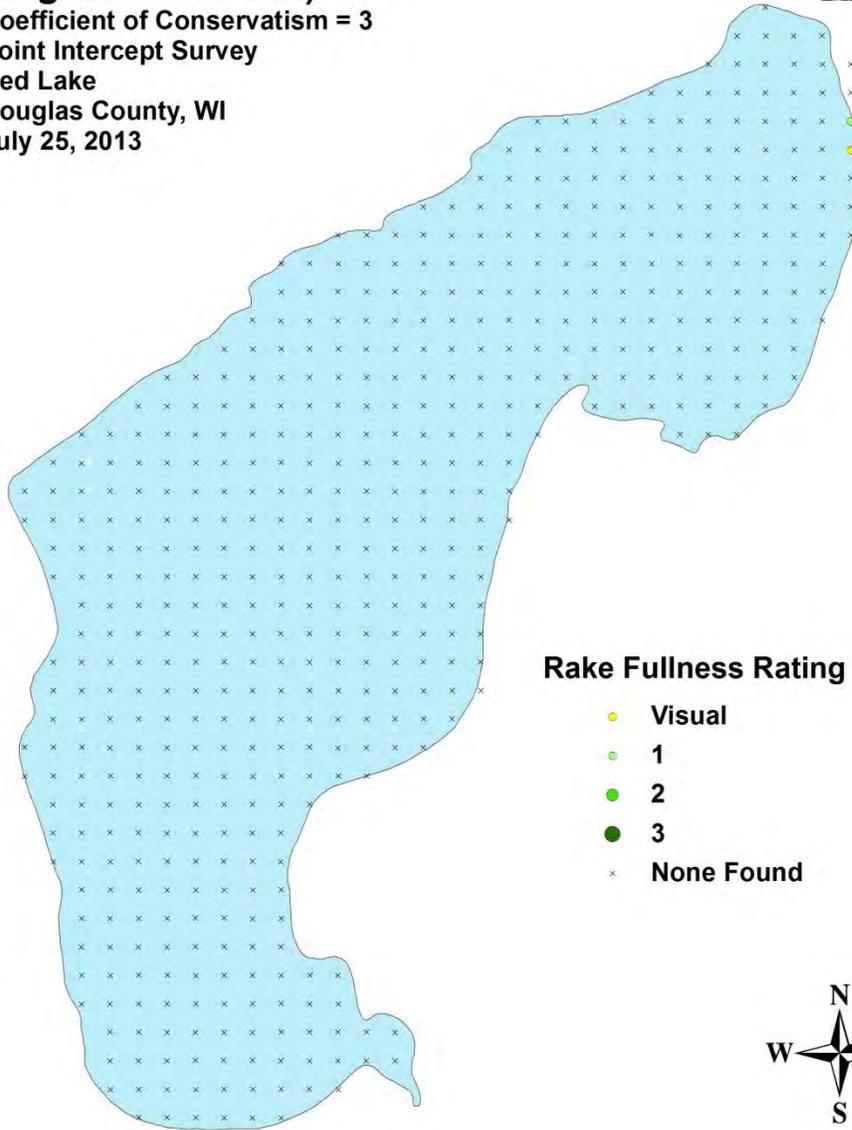
**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Common arrowhead  
(*Sagittaria latifolia*)**

Coefficient of Conservatism = 3  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Hardstem bulrush  
(*Schoenoplectus acutus*)**

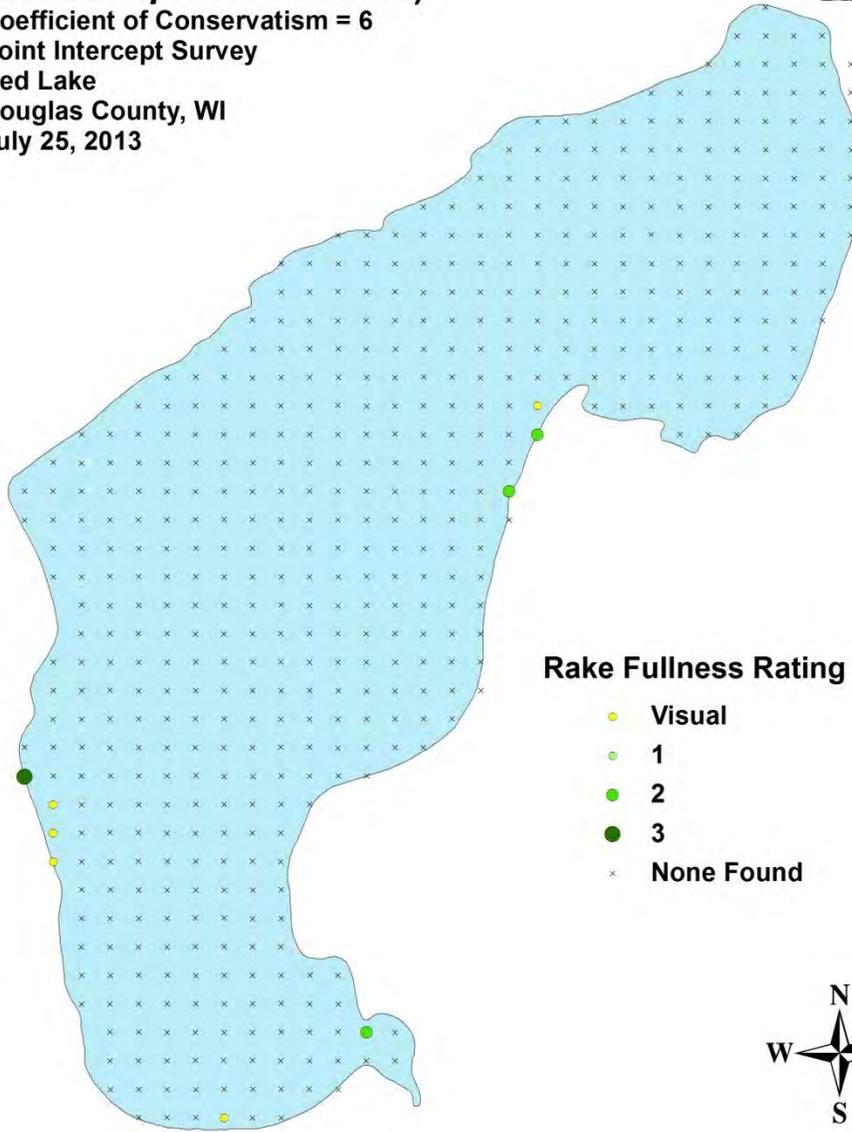
Coefficient of Conservatism = 6

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Water bulrush**  
**(*Schoenoplectus subterminalis*)**

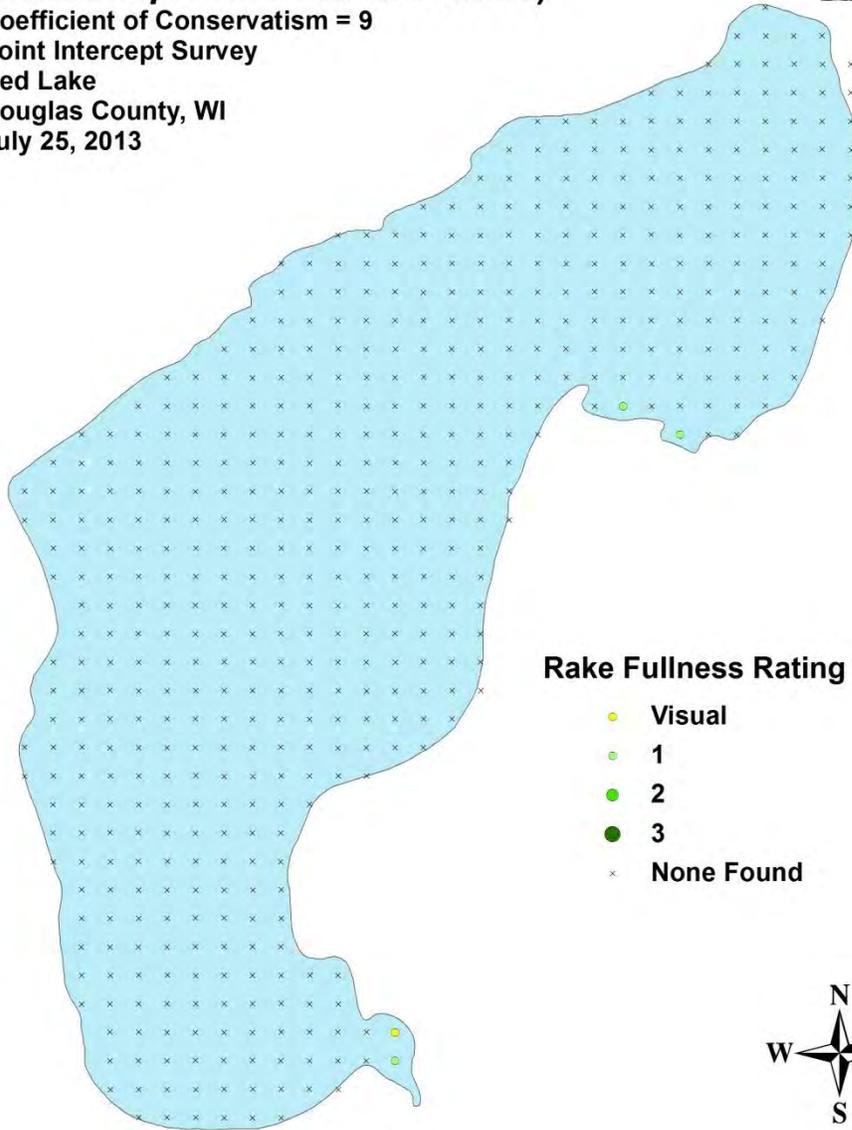
Coefficient of Conservatism = 9

Point Intercept Survey

Red Lake

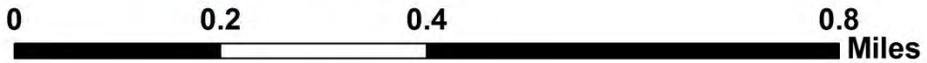
Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Softstem bulrush**  
**(*Schoenoplectus tabernaemontani*)**

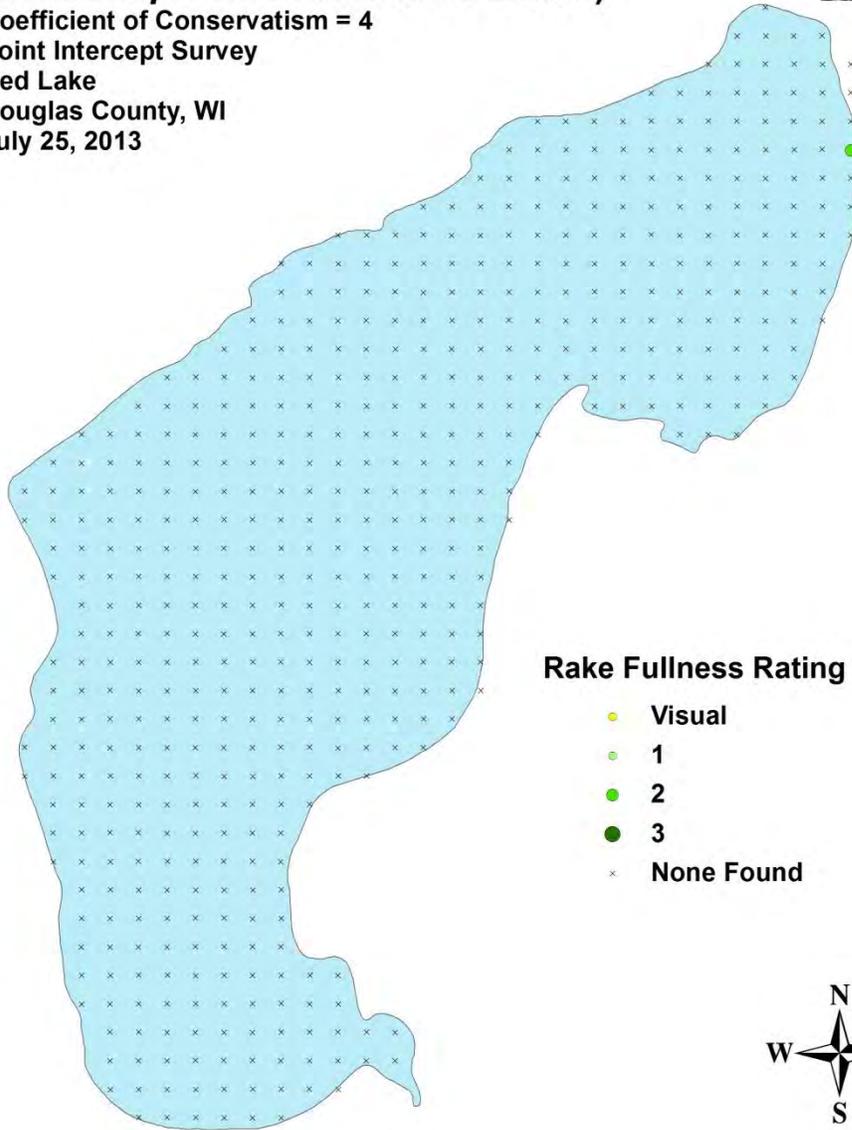
Coefficient of Conservatism = 4

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Narrow-leaved bur-reed  
(*Sparganium angustifolium*)**

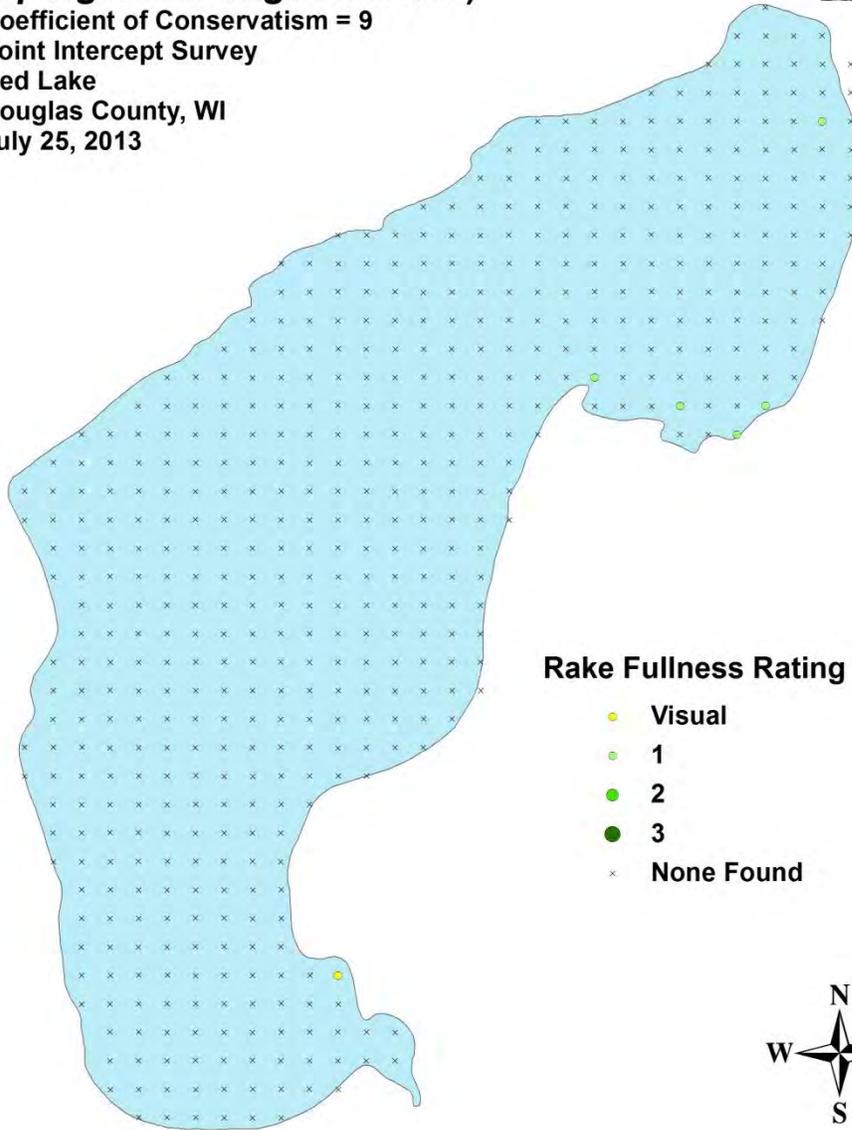
Coefficient of Conservatism = 9

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Short-stemmed bur-reed  
(*Sparganium emersum*)**

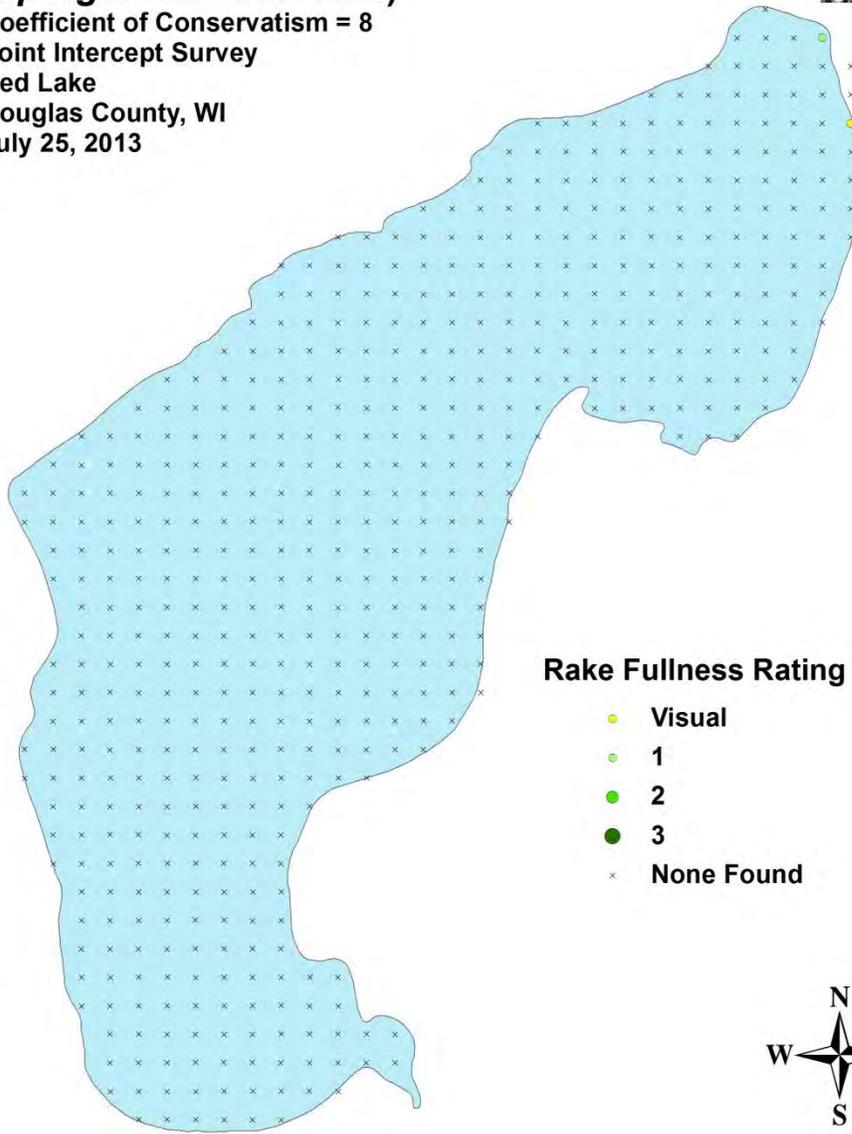
Coefficient of Conservatism = 8

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013

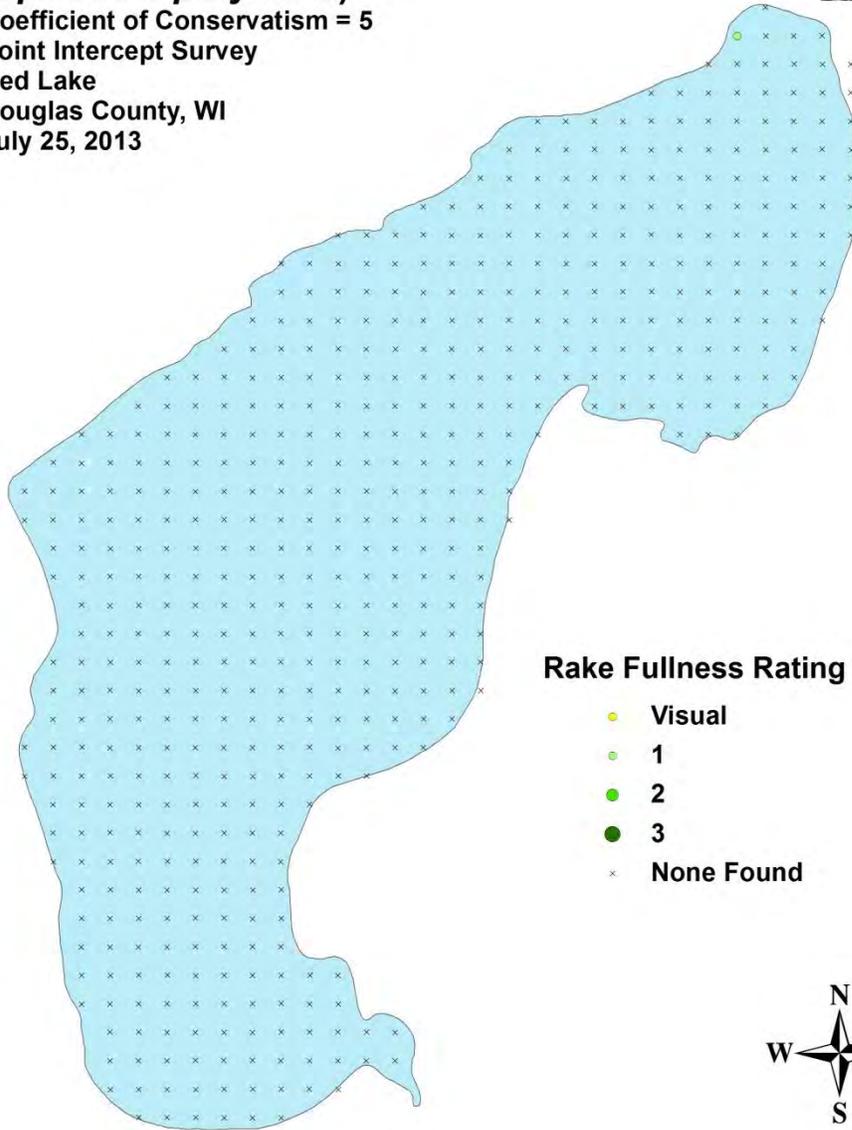


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Large duckweed**  
**(*Spirodela polyrhiza*)**  
Coefficient of Conservatism = 5  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

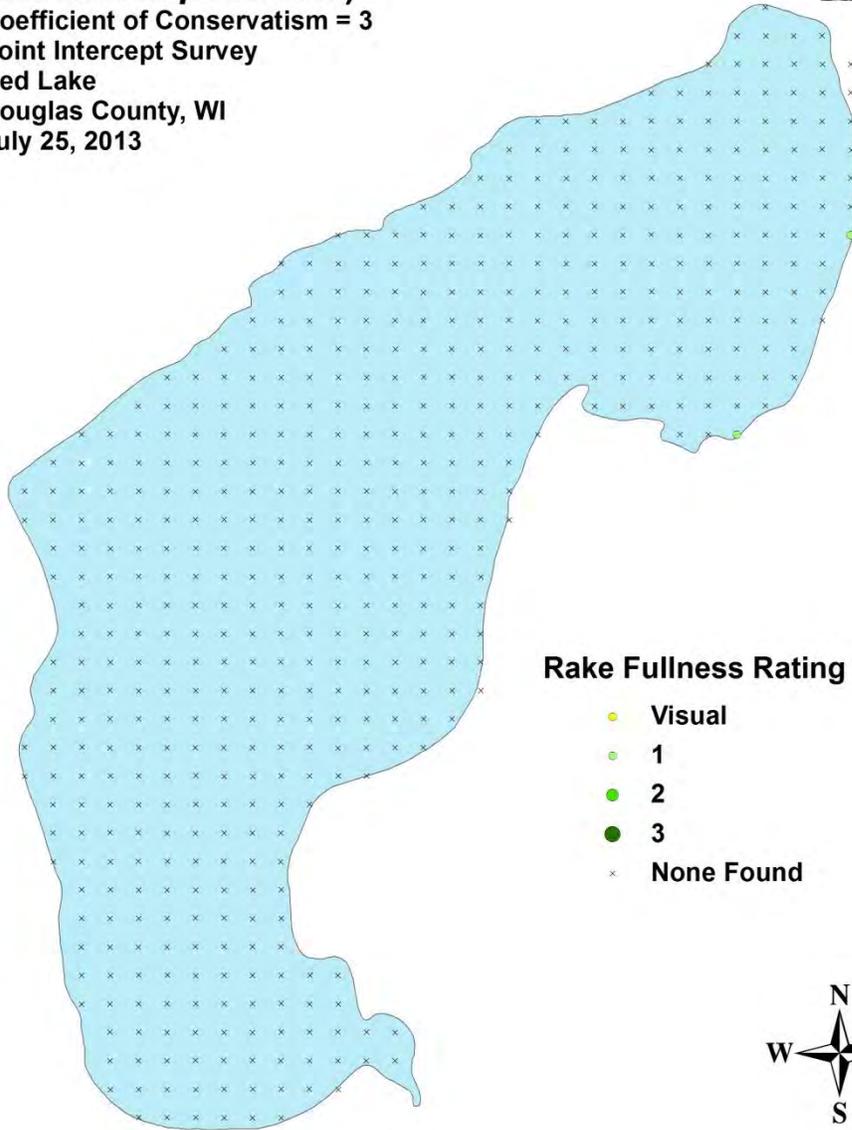


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Sago pondweed**  
**(*Stuckenia pectinata*)**  
Coefficient of Conservatism = 3  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



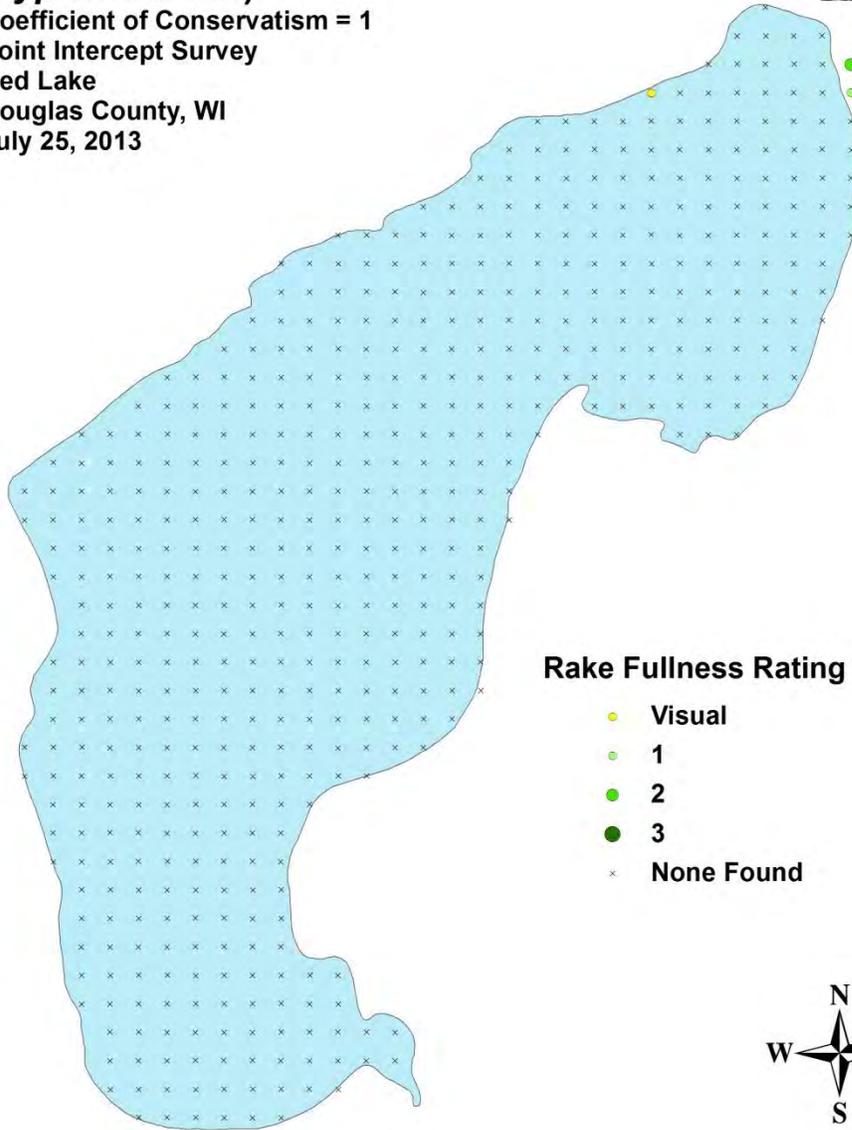
**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Broad-leaved cattail**  
**(*Typha latifolia*)**

Coefficient of Conservatism = 1  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

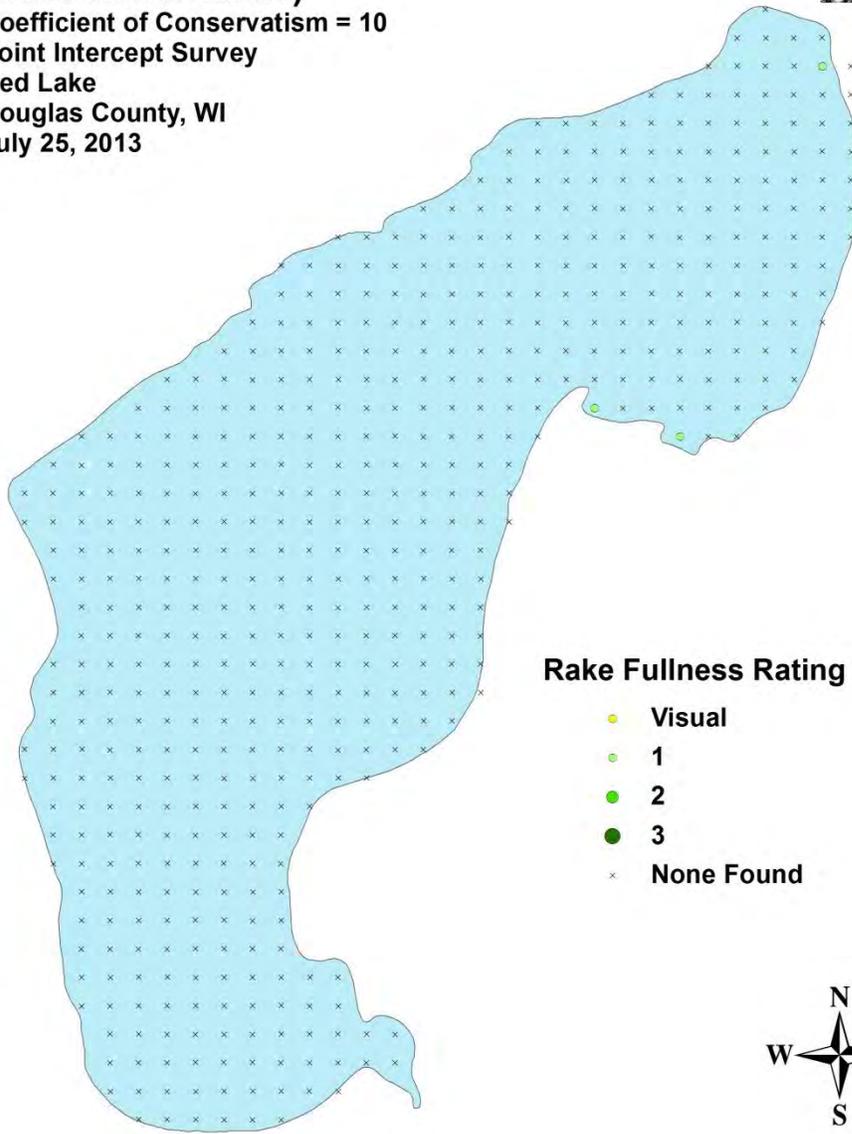


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Small bladderwort**  
**(*Utricularia minor*)**  
Coefficient of Conservatism = 10  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Small purple bladderwort  
(*Utricularia resupinata*)**

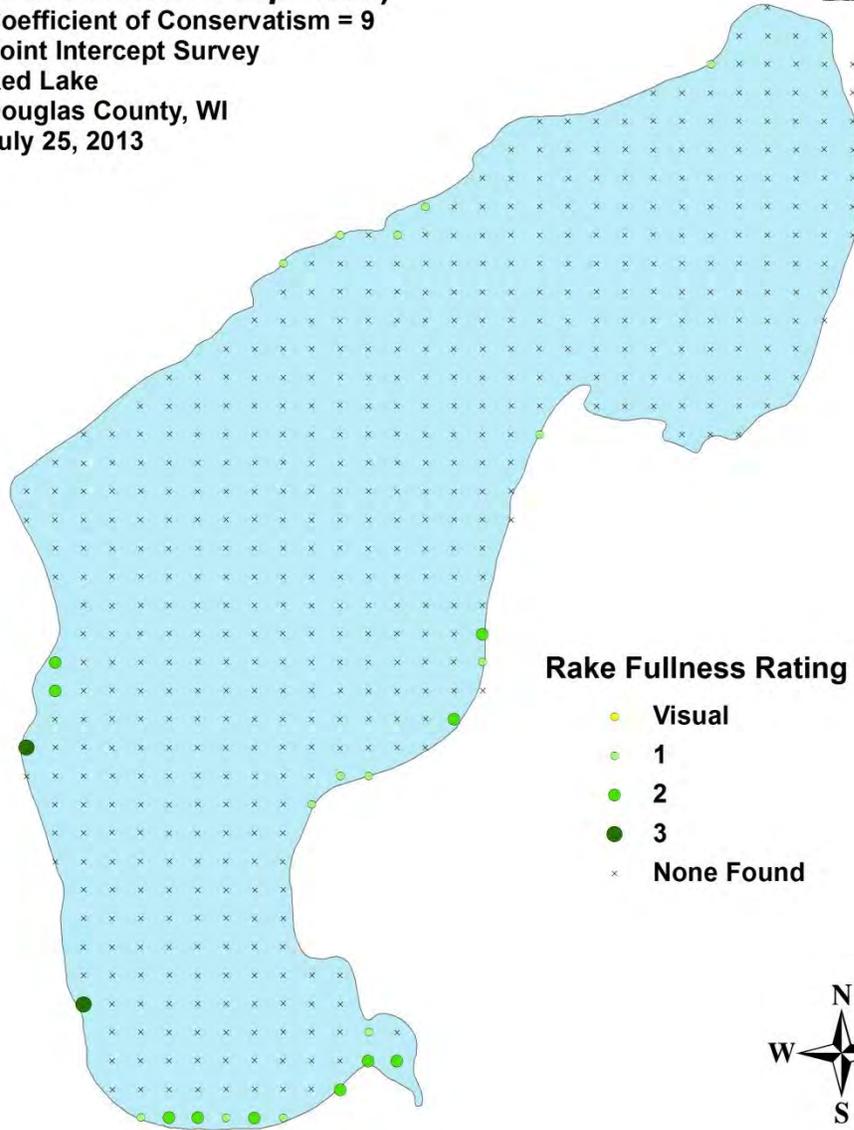
Coefficient of Conservatism = 9

Point Intercept Survey

Red Lake

Douglas County, WI

July 25, 2013



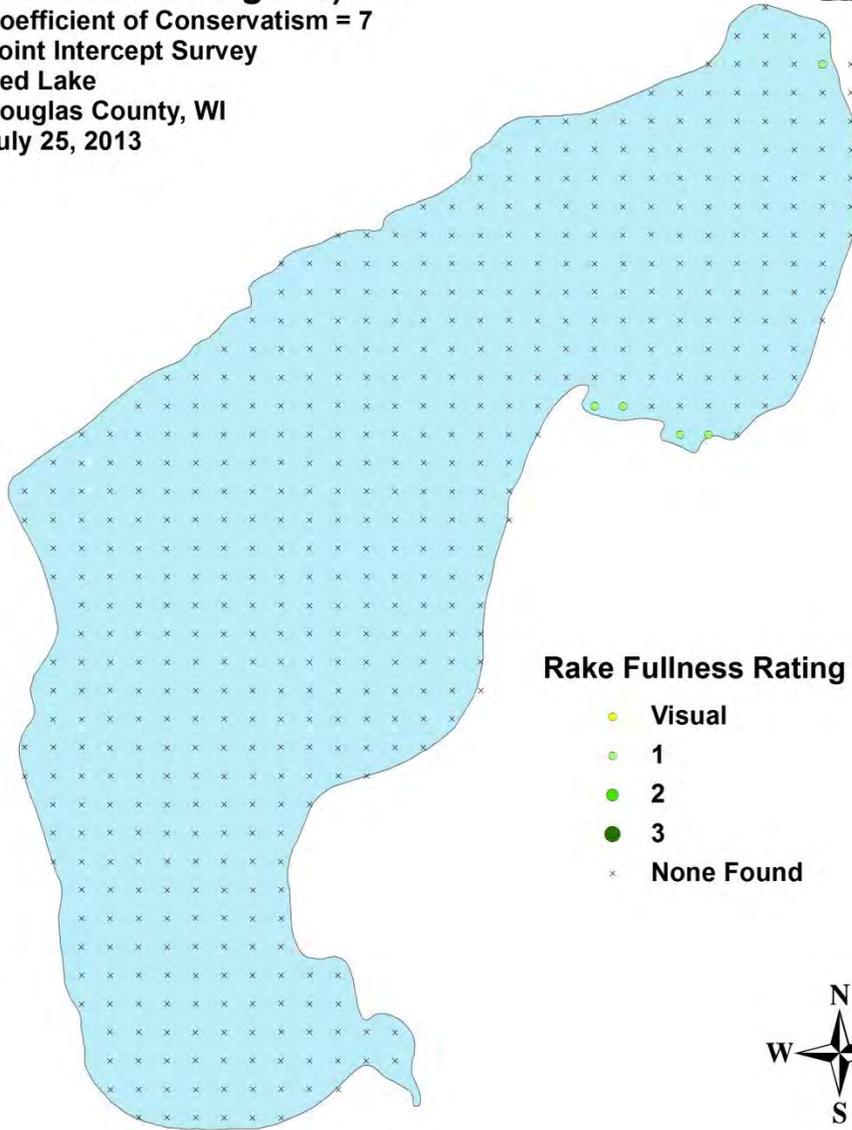
**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found

0 0.2 0.4 0.8 Miles

**Common bladderwort  
(*Utricularia vulgaris*)**

Coefficient of Conservatism = 7  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013

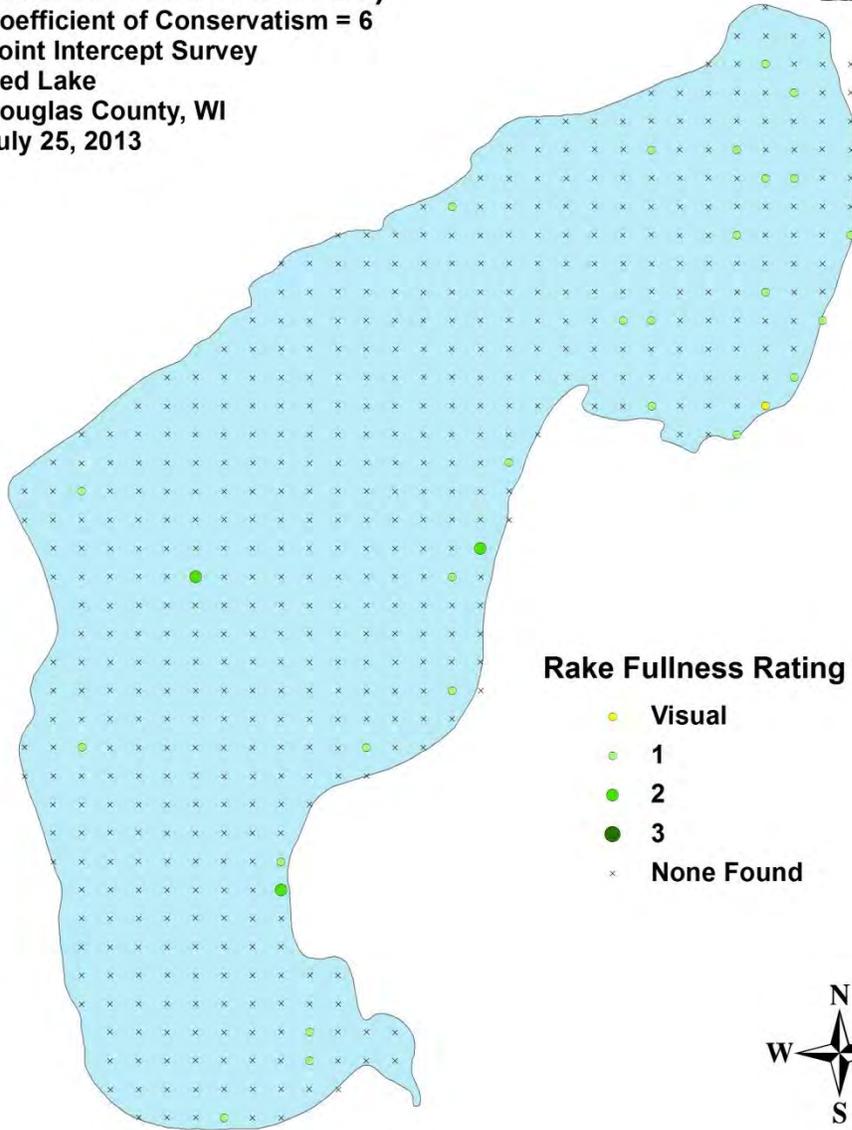


**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



**Wild celery**  
**(*Vallisneria americana*)**  
Coefficient of Conservatism = 6  
Point Intercept Survey  
Red Lake  
Douglas County, WI  
July 25, 2013



**Rake Fullness Rating**

- Visual
- 1
- 2
- 3
- × None Found



## **Appendix VII: Aquatic Exotic Invasive Plant Species Information**



**Curly-leaf pondweed**

**DESCRIPTION:** Curly-leaf pondweed is an invasive aquatic perennial that is native to Eurasia, Africa, and Australia. It was accidentally introduced to United States waters in the mid-1880s by hobbyists who used it as an aquarium plant. The leaves are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. The plant usually drops to the lake bottom by early August

**DISTRIBUTION AND HABITAT:** Curly-leaf pondweed is commonly found in alkaline and high nutrient waters, preferring soft substrate and shallow water depths. It tolerates low light and low water temperatures. It has been reported in all states but Maine

**LIFE HISTORY AND EFFECTS OF INVASION:** Curly-leaf pondweed spreads through burr-like winter buds (turions), which are moved among waterways. These plants can also reproduce by seed, but this plays a relatively small role compared to the vegetative reproduction through turions. New plants form under the ice in winter, making curly-leaf pondweed one of the first nuisance aquatic plants to emerge in the spring.

It becomes invasive in some areas because of its tolerance for low light and low water temperatures. These tolerances allow it to get a head start on and out compete native plants in the spring. In mid-summer, when most aquatic plants are growing, curly-leaf pondweed plants are dying off. Plant die-offs may result in a critical loss of dissolved oxygen. Furthermore, the decaying plants can increase nutrients which contribute to algal blooms, as well as create unpleasant stinking messes on beaches. Curly-leaf pondweed forms surface mats that interfere with aquatic recreation. (Taken in its entirety from WDNR, 2013 <http://dnr.wi.gov/topic/Invasives/fact/CurlyLeafPondweed.html>)



**Eurasian water milfoil**

**DESCRIPTION:** Eurasian water milfoil is a submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts, and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles its width further down, often curving to lie parallel with the water surface. The fruits are four-jointed nut-like bodies. Without flowers or fruits, Eurasian water milfoil is nearly impossible to distinguish from Northern water milfoil. Eurasian water milfoil has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets. Coontail is often mistaken for the milfoils, but does not have individual leaflets.

**DISTRIBUTION AND HABITAT:** Eurasian milfoil first arrived in Wisconsin in the 1960's. During the 1980's, it began to move from several counties in southern Wisconsin to lakes and waterways in the northern half of the state. As of 1993, Eurasian milfoil was common in 39 Wisconsin counties (54%) and at least 75 of its lakes, including shallow bays in Lakes Michigan and Superior and Mississippi River pools.

Eurasian water milfoil grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes. Optimal growth occurs in alkaline systems with a high concentration of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.

**LIFE HISTORY AND EFFECTS OF INVASION:** Unlike many other plants, Eurasian water milfoil does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. Milfoil is readily dispersed by boats, motors, trailers, bilges, live wells, or bait buckets, and can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, Eurasian water milfoil is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of Eurasian milfoil provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl.

Dense stands of Eurasian water milfoil also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by Eurasian water milfoil may lead to deteriorating water quality and algae blooms of infested lakes. (Taken in its entirety from WDNR, 2013 <http://dnr.wi.gov/topic/Invasives/fact/EurasianWatermilfoil.html>)



### **Reed canary grass**

**DESCRIPTION:** Reed canary grass is a large, coarse grass that reaches 2 to 9 feet in height. It has an erect, hairless stem with gradually tapering leaf blades 3 1/2 to 10 inches long and 1/4 to 3/4 inch in width. Blades are flat and have a rough texture on both surfaces. The leaf ligule is membranous and long. The compact panicles are erect or slightly spreading (depending on the plant's reproductive stage), and range from 3 to 16 inches long with branches 2 to 12 inches in length. Single flowers occur in dense clusters in May to mid-June. They are green to purple at first and change to beige over time. This grass is one of the first to sprout in spring, and forms a thick rhizome system that dominates the subsurface soil. Seeds are shiny brown in color.

Both Eurasian and native ecotypes of reed canary grass are thought to exist in the U.S. The Eurasian variety is considered more aggressive, but no reliable method exists to tell the ecotypes apart. It is believed that the vast majority of our reed canary grass is derived from the Eurasian ecotype. Agricultural cultivars of the grass are widely planted.

Reed canary grass also resembles non-native orchard grass (*Dactylis glomerata*), but can be distinguished by its wider blades, narrower, more pointed inflorescence, and the lack of hairs on glumes and lemmas (the spikelet scales). Additionally, bluejoint grass (*Calamagrostis canadensis*) may be mistaken for reed canary in areas where orchard grass is rare, especially in the spring. The highly transparent ligule on reed canary grass is helpful in distinguishing it from the others. Ensure positive identification before attempting control.

**DISTRIBUTION AND HABITAT:** Reed canary grass is a cool-season, sod-forming, perennial wetland grass native to temperate regions of Europe, Asia, and North America. The Eurasian ecotype has been selected for its vigor and has been planted throughout the U.S. since the 1800's for forage and erosion control. It has become naturalized in much of the northern half of the U.S., and is still being planted on steep slopes and banks of ponds and created wetlands.

Reed canary grass can grow on dry soils in upland habitats and in the partial shade of oak woodlands, but does best on fertile, moist organic soils in full sun. This species can invade most types of wetlands, including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas; it also grows in disturbed areas such as berms and spoil piles.

**LIFE HISTORY AND EFFECTS OF INVASION:** Reed canary grass reproduces by seed or creeping rhizomes. It spreads aggressively. The plant produces leaves and flower stalks for 5 to 7 weeks after germination in early spring, then spreads laterally. Growth peaks in mid-June and declines in mid-August. A second growth spurt occurs in the fall. The shoots collapse in mid to late summer, forming a dense, impenetrable mat of stems and leaves. The seeds ripen in late June and shatter when ripe. Seeds may be dispersed from one wetland to another by waterways, animals, humans, or machines.

This species prefers disturbed areas, but can easily move into native wetlands. Reed canary grass can invade a disturbed wetland in less than twelve years. Invasion is associated with disturbances including ditching of wetlands, stream channelization, deforestation of swamp forests, sedimentation, and intentional planting. The difficulty of selective control makes reed canary grass invasion of particular concern. Over time, it forms large, monotypic stands that harbor few other plant species and are subsequently of little use to wildlife. Once established, reed canary grass dominates an area by building up a tremendous seed bank that can eventually erupt, germinate, and recolonize treated sites. (Taken in its entirety from WDNR, 2013  
<http://dnr.wi.gov/topic/Invasives/fact/ReedCanaryGrass.html>)



### **Purple loosestrife**

(Photo Courtesy Brian M. Collins)

**DESCRIPTION:** Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. Showy flowers vary from purple to magenta, possess 5-6 petals aggregated into numerous long spikes, and bloom from August to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat.

This species may be confused with the native wing-angled loosestrife (*Lythrum alatum*) found in moist prairies or wet meadows. The latter has a winged, square stem and solitary paired flowers in the leaf axils. It is generally a smaller plant than the Eurasian loosestrife. By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

**Distribution and Habitat:** Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe during the 1800's. It is still promoted by some horticulturists for its beauty as a landscape plant, and by beekeepers for its nectar-producing capability. Currently, about 24 states have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. It has since extended its range to include most temperate parts of the United States and Canada. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators, like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America.

Purple loosestrife was first detected in Wisconsin in the early 1930's, but remained uncommon until the 1970's. It is now widely dispersed in the state, and has been recorded in 70 of Wisconsin's 72 counties. Low densities in most areas of the state suggest that the plant is still in the pioneering stage of establishment. Areas of heaviest infestation are sections of the Wisconsin River, the extreme southeastern part of the state, and the Wolf and Fox River drainage systems.

This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers.

**Life History and Effects of Invasion:** Purple loosestrife can germinate successfully on substrates with a wide range of pH. Optimum substrates for growth are moist soils of neutral to slightly acidic pH, but it can exist in a wide range of soil types. Most seedling establishment occurs in late spring and early summer when temperatures are high.

Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Mature plants with up to 50 shoots grow over 2 meters high and produce more than two million seeds a year. Germination is restricted to open, wet soils and requires high temperatures, but seeds remain viable in the soil for many years. Even seeds submerged in water can live for approximately 20 months. Most of the seeds fall near the parent plant, but water, animals, boats, and humans can transport the seeds long distances. Vegetative spread through local perturbation is also characteristic of loosestrife; clipped, trampled, or buried stems of established plants may produce shoots and roots. Plants may be quite large and several years old before they begin flowering. It is often very difficult to locate non-flowering plants, so monitoring for new invasions should be done at the beginning of the flowering period in mid-summer.

Any sunny or partly shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances such as water drawdown or exposed soil accelerate the process by providing ideal conditions for seed germination. Invasion usually begins with a few pioneering plants that build up a large seed bank in the soil for several years. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire wetland. The plant can also make morphological adjustments to accommodate changes in the immediate environment; for example, a decrease in light level will trigger a change in leaf morphology. The plant's ability to adjust to a wide range of environmental conditions gives it a competitive advantage; coupled with its reproductive strategy, purple loosestrife tends to create monotypic stands that reduce biotic diversity.

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways. (Taken in its entirety from WDNR, 2013 <http://dnr.wi.gov/topic/Invasives/fact/PurpleLoosestrife.html>)

**Appendix VIII: Glossary of Biological Terms  
(Adapted from UWEX 2010)**

Aquatic:

organisms that live in or frequent water.

Cultural Eutrophication:

accelerated eutrophication that occurs as a result of human activities in the watershed that increase nutrient loads in runoff water that drains into lakes.

Dissolved Oxygen (DO):

the amount of free oxygen absorbed by the water and available to aquatic organisms for respiration; amount of oxygen dissolved in a certain amount of water at a particular temperature and pressure, often expressed as a concentration in parts of oxygen per million parts of water.

Diversity:

number and evenness of species in a particular community or habitat.

Drainage lakes:

Lakes fed primarily by streams and with outlets into streams or rivers. They are more subject to surface runoff problems but generally have shorter residence times than seepage lakes. Watershed protection is usually needed to manage lake water quality.

Ecosystem:

a system formed by the interaction of a community of organisms with each other and with the chemical and physical factors making up their environment.

Eutrophication:

the process by which lakes and streams are enriched by nutrients, and the resulting increase in plant and algae growth. This process includes physical, chemical, and biological changes that take place after a lake receives inputs for plant nutrients--mostly nitrates and phosphates--from natural erosion and runoff from the surrounding land basin. The extent to which this process has occurred is reflected in a lake's trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile).

Exotic:

a non-native species of plant or animal that has been introduced.

Habitat:

the place where an organism lives that provides an organism's needs for water, food, and shelter. It includes all living and non-living components with which the organism interacts.

Limnology:

the study of inland lakes and waters.

Littoral:

the near shore shallow water zone of a lake, where aquatic plants grow.

Macrophytes:

Refers to higher (multi-celled) plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects. Overabundance of such plants, especially problem species, is related to shallow water depth and high nutrient levels.

Nutrients:

elements or substances such as nitrogen and phosphorus that are necessary for plant growth. Large amounts of these substances can become a nuisance by promoting excessive aquatic plant growth.

Organic Matter:

elements or material containing carbon, a basic component of all living matter.

Photosynthesis:

the process by which green plants convert carbon dioxide (CO<sub>2</sub>) dissolved in water to sugar and oxygen using sunlight for energy. Photosynthesis is essential in producing a lake's food base, and is an important source of oxygen for many lakes.

Phytoplankton:

microscopic plants found in the water. Algae or one-celled (phytoplankton) or multicellular plants either suspended in water (Plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll a (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Numerous species occur. Algae are an essential part of the lake ecosystem and provides the food base for most lake organisms, including fish. Phytoplankton populations vary widely from day to day, as life cycles are short.

Plankton:

small plant organisms (phytoplankton and nanoplankton) and animal organisms (zooplankton) that float or swim weakly through the water.

ppm:

parts per million; units per equivalent million units; equal to milligrams per liter (mg/l)

**Richness:**

number of species in a particular community or habitat.

**Rooted Aquatic Plants:**

(macrophytes) Refers to higher (multi-celled) plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects. Overabundance of such plants, especially problem species, is related to shallow water depth and high nutrient levels.

**Runoff:**

water that flows over the surface of the land because the ground surface is impermeable or unable to absorb the water.

**Secchi Disc:**

An 8-inch diameter plate with alternating quadrants painted black and white that is used to measure water clarity (light penetration). The disc is lowered into water until it disappears from view. It is then raised until just visible. An average of the two depths, taken from the shaded side of the boat, is recorded as the Secchi disc reading. For best results, the readings should be taken on sunny, calm days.

**Seepage lakes:**

Lakes without a significant inlet or outlet, fed by rainfall and groundwater. Seepage lakes lose water through evaporation and groundwater moving on a down gradient. Lakes with little groundwater inflow tend to be naturally acidic and most susceptible to the effects of acid rain. Seepage lakes often have long, residence times, and lake levels fluctuate with local groundwater levels. Water quality is affected by groundwater quality and the use of land on the shoreline.

**Turbidity:**

degree to which light is blocked because water is muddy or cloudy.

**Turion:**

hardened vegetative structure that many lake plants (especially the *Potamogeton* “pondweeds” use as an overwintering bud.

**Watershed:**

the land area draining into a specific stream, river, lake or other body of water. These areas are divided by ridges of high land.

**Zooplankton:**

Microscopic or barely visible animals that eat algae. These suspended plankton are an important component of the lake food chain and ecosystem. For many fish, they are the primary source of food.

## **Appendix IX: Raw Data Spreadsheets**