Big Chapman Lake

Kosciusko County

Fish Management Report – 2005

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EXECUTIVE SUMMARY

Local residents have become increasingly involved in lake management issues at Big and Little Chapman Lakes. In 2004 they hired a consultant to conduct an aquatic plant survey and develop a plant management plan. Based on results of the survey, plans were to treat the entire lake with fluridone in 2005 to control Eurasian water milfoil. The treatment, however, was postponed to allow for additional plant sampling and to obtain data on the status of the fish community. The Division of Fish and Wildlife sampled submersed aquatic plants at 101 random sites on May 16 and August 3, mapped emergent plant beds on August 8, and conducted a standard fish population survey on July 11-13.

Submersed plants were found in nearly all of the littoral zone but generally not at dense levels. Eurasian water milfoil was the dominant plant in May and occurred at 39% of the sites and generated a mean density score of 2.6. By August, Eurasian water milfoil dropped to sixth in abundance and found at 15% of the sites at a mean density of 2.3. Eighteen emergent plant beds, totaling 71 acres, were located. Spatterdock was noted in nine beds and water lilies were noted in 11 beds. Bulrushes were the dominant emergent and found in 13 beds. They varied from 17-100% of the coverage where present.

During the fish survey, 1,382 fish were collected. Bluegills ranked first by number (62%) and second by weight (20%). Northern pike accounted for the largest percentage of the weight (21%). Redear ranked second by number (17%) and third by weight (16%). All other species, including largemouth bass, comprised less than 5% of the number. However, sport fish made up 97% of the total number of fish collected in the survey and 84% of the weight. Bluegills, although abundant, were generally small and grew slowly. Only 56 largemouth bass were captured. They ranged in size from 1¾-20 inches, but only six bass were legal size (14-in or larger).

Based on the survey results, no major changes have occurred in the fish community at Big Chapman Lake over the past 40 years. Overall, current levels of herbicide use appear to be adequately controlling Eurasian water milfoil, although three areas on the eastern half of the lake still contained dense stands in August. By delaying any fluridone treatment, possible adverse impacts on water quality or native plants can be avoided and adequate amounts of cover can be maintained for fish. No fish management recommendations are suggested at this time.

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Big Chapman Lake is a 512-acre natural lake located northeast of Warsaw, Indiana. Public access is available at a Division of Fish and Wildlife site in the southeast corner the lake. It lies in the Tippecanoe watershed and drains approximately 4¼ square miles. The outlet channel empties into Little Chapman Lake and eventually flows to Pike Lake. Hydraulic retention time is over 2 years (783 days) and the water level is generally stable. The earthen levee that serves as part of the water level control structure was rebuilt in 2005 to prevent catastrophic failure and leakage. Crooked Creek, the main inlet, enters the lake on the east side where a sediment delta has developed at its mouth.

Maximum depth of Big Chapman Lake is 39 feet deep and average depth 10½ feet. The lake does not form a sharp temperature gradient. Clarity varies from 5½-12 feet and averages 9 feet (Table 1). Oxygen levels over 3 ppm are normally present at 20-25 feet deep in early summer and 15-20 feet deep later. Water fertility is moderate (mean TSI = 46) compared to other lakes in the area. The bottom consists mostly of sand and marl. Channel bottoms are muck, and as a result, support dense beds of aquatic plants, primarily curly-leaf pondweed and Eurasian water milfoil. Bulrushes and cattails are common in some areas. Spatterdock is rare. Although chara is dense at some locations, many shallow areas are barren. A large part of the shoreline is residential, but a large wetland (nature preserve) is present on the west side of the lake.

Documented records indicate Big Chapman Lake's fish management history began in the 1950s when the Department of Conservation stocked several fish species, including trout, in the lake. Walleyes were added in the 1960s and 1970s by local residents. During the 1980s the Department of Natural Resources stocked additional walleye fry and 2-inch fingerlings in an unsuccessful attempt to establish a walleye fishery. Fish population surveys were conducted at Big Chapman Lake in 1964, 1976, 1991 and 1999. A research study was also conducted from 1982-1987 to evaluate the effects of a 14-inch size limit on largemouth bass. At the time, anglers fished an average of 32 hours per acre each year and took home a total of 2,399 bass. Density of 8-inch and larger bass increased from 13½ to 18 per acre. Electrofishing catch rates rose from 111 to 159 per hour. As the bass population expanded, however, growth declined. By 1987 high exploitation (>50%) of legal-size bass coupled with strong reproduction and slower growth led to a population of numerous 10- to 14-inch bass and few large ones. Another

research project was conducted in fall 2000 through spring 2001 when radio transmitters were inserted into nine northern pike in Big Chapman Lake. Their movements were monitored through mid-April 2001 to identify potential pike spawning locations. The results indicated that pike did not congregate at specific sites and no spawning activity was observed.

Local lake residents have become increasingly involved in lake management issues at Big and Little Chapman Lakes in recent years. In 2001 and 2003, they received public funds through the Department of Natural Resources Lake and River Enhancement (LARE) program to conduct diagnostic studies of watershed problems and implement various improvement projects intended to reduce the input of sediment and nutrients to the lakes. In 2004 local residents also hired a consultant to conduct an aquatic plant survey and develop an aquatic plant management plan, funded in part by LARE. Based on results of the survey, plans were to treat the entire lake with fluridone (Sonar®) in 2005 to control Eurasian water milfoil. The treatment, however, was postponed to allow for additional plant sampling by which the need and effectiveness of the project could be assessed and to obtain current data on the status of the fish community by which the potential long-term impacts of a fluridone treatment on fishing quality could be examined (Workplan #204289). In lieu of the fluridone treatment, a total of 29¼ acres of Eurasian water milfoil and other species were treated on five occasions in 2005 at Big Chapman Lake by three commercial pesticide applicators. Of the total area involved, 2½ acres were located in manmade channels and 27 acres were located within five areas adjacent to developed shorelines. The largest area, 20½ acres, was located at the east shore extending northward from the Crooked Creek inlet. Eurasian water milfoil in this area, as well as three other areas totaling 5 acres, was treated with a 2,4-D formulation (Navigate®).

To obtain additional data on the aquatic plant and fish communities at Big Chapman Lake prior to a proposed fluridone treatment, the Division of Fish and Wildlife sampled submersed aquatic plants on two occasions, mapped emergent floating-leaf and bulrush plant beds, and conducted a standard fish population survey in 2005. Although summary pages of the plant data are presented in this report, more detailed analysis and comparisons with other lakes will be included in the research study report (Workplan #204289). The primary purpose of this report is to summarize the fish survey data.

METHODS

Submersed plants were sampled at 101 random sites in Big Chapman Lake on May 16 and August 3, 2005 using a doubled-head rake according to Division of Fish and Wildlife sampling guidelines. Sites locations on the first occasion were recorded with a GPS unit and then approximately relocated on the second occasion. All sites were located within the littoral zone and varied from 2 to 21½ feet deep in May to 2 to 23 feet deep in August. Channel areas were not included. Plant abundance, including algae, was quantified at each site by stacking the plant biomass evenly across one side of the rake tines. Scores (0-5) were assigned to the amount of plants based on increments marked evenly on the tines. Species were then separated and scored individually at each site.

Emergent plant beds were mapped on August 8, 2005 by boating along the lakeward perimeters of all beds and recording GPS coordinates of their edges. Width of the bed at each GPS point oriented perpendicularly to shore (i.e. visual transect) was measured with a laser rangefinder. Bed size was calculated by summing areas of each polygon created by the linear distance between two consecutive GPS points and their mean width. The presence of various species along each visual transect was recorded, as was the presence of various nearshore wetland plants associated with each transect. Beds were generally defined as areas where emergent plants covered more than 625 square feet and spaces between plants were more than 25 feet. Small emergent stands, defined as isolated patches (<625 sq ft), were also mapped and characterized by species.

The fish population survey was conducted on July 11-13, 2005. Surface water temperature was 82 degrees and water clarity was 5½ feet. To ensure comparability with previous surveys and reduce mortality of fish (especially northern pike) caught in gill nets, sampling effort included 60 minutes of pulsed DC electrofishing (504V) with two dip-netters, three gill nets set for two days (6 lifts) at six sites, and two trap nets set for two days (4 lifts) at four sites. All captured fish were measured to the nearest tenth-inch when possible. Weights were estimated from standard length-weight formulas generated from data on file from natural lakes fish population surveys in the area. Fish scales were taken from dominant sport fish for age and growth analyses using standard body-length:scale-length relationships.

RESULTS

Plant community

Submersed aquatic plants were found throughout nearly all of the littoral zone but generally not at dense levels. They were present at 93% of the littoral sites in May and 98% in August. Native species were present at 77% and 96% of the sites, respectively. Thirteen species were noted in May and 17 were found in August. Overall mean rake score was slightly higher in August (2.8) compared to May (2.1). Filamentous algae was very sparse and occurred only at 1-2% of the sites.

Eurasian water milfoil was the dominant plant in May and occurred at 39% of the sites and generated a mean density score of 2.6. By August, Eurasian water milfoil dropped to sixth in abundance and was found at 15% of the sites at a mean density of 2.3 (Figure 1). Chara, which ranked second in dominance in May, was the most dominant species in August. It was present on the rake at 48% of the sites in May and 51% in August and its mean density increased from 1.4 to 2.3. Coontail ranked third in dominance on both occasions at 23-25% of the sites and increased in density from 1.6 to 2.4 by August. Curly-leaf pondweed, present at 22% of the sites at a mean density of 1.7 in May (Figure 2), decreased to 3% of the sites and a mean density of 1.3 by August. All other species in May were found at fewer than 7% of the sites. However, four other species were present at 10% or more of the sites in August. Sago pondweed was found at 34% of the sites at a mean density of 1.8. Spiny naiad occurred as 35% of the sites (1.3 mean density), eel grass occurred at 29% (1.5 mean density), and common naiad occurred at 11% of the sites (1.0 mean density).

Eighteen emergent plant beds were located, ranging in size from less than a tenth-acre to 21 acres. Total bed area was 71 acres, or 14% of the lake surface area. Beds were present primarily near and within Nellie's Bay on the north shore and along the entire south shore. Spatterdock was noted in nine beds (50%), varying from 8-100% of the coverage. Water lilies were noted in 11 beds (61%) and varied from 20-100% of the coverage. Bulrushes were the dominant emergent and were found in 13 beds (72%). They varied from 17-100% of the coverage in each bed where present and occupied the largest beds. Other emergent species noted during the sampling included cattails, pickerelweed, purple loosestrife, smartweed, and swamp loosestrife.

Fish community

During the July fish survey, 1,382 fish were collected. Total weight was 310 pounds. Twenty-one species, plus hybrid bluegills, were found. Bluegills ranked first by number (62%) and second by weight (20%). Northern pike accounted for the largest percentage of the weight (21%) but ranked tenth numerically. Redear ranked second by number (17%) and third by weight (16%). All other species, including largemouth bass, comprised less than 5% of the number. However, sport fish made up 97% of the total number of fish collected in the survey and 84% of the weight.

Bluegills, although abundant, were generally small and grew slowly. They ranged in size from 2-7½ inches and were up to seven years old. The number captured by electrofishing (133/15-min) was above average (100/15-min), although the percentage of large bluegills was small. Of all 3-inch and larger bluegills (811), only 13% were 6-inch or larger and only 5% were 7-inch or larger. No 8-inch or larger bluegills were collected. At most area lakes, 6-inch and larger bluegills average 32% of the catch, while 8-inch and larger bluegills average 4%. Bluegills in Big Chapman Lake averaged only 5 inches long by age-4 and 6 inches by age-5. Normally, bluegills reach 6 inches by age-4 and are 7 inches by age-5 at most area lakes.

Only 56 largemouth bass were captured. They ranged in size from 1¾-20 inches, but only six bass were legal size (14-in or larger). The number captured by electrofishing (12/15-min)) was about half the average compared to other northern Indiana natural lakes (25-30/15-min). Most bass were age-3 and age-4. Their growth rate was normal up to age-4. Although not enough older bass were captured to adequately assess growth after age-4, two age-5 bass and one age-6 bass appeared to grow at normal rates.

Twelve northern pike were collected, ranging in size from 14-38 inches. All but two were less than 20 inches (legal-size) and four were 30 inches or larger, including three that were larger than 36 inches. Total weight of all pike was estimated to be 65 pounds. All of the pike were caught in gill nets at a rate of 2/lift.

Few other catch-able size sport fish were collected. Although 237 redear were collected, the majority (78%) were 5½-7½ inches long. Only 19 redear (8%) were 8-inch or larger. Trap nets caught all but 31 redear. Fifty-four yellow perch, measuring 5-9 inches long, were collected. They accounted for only 4% of the number of fish in the

survey and 2% of the weight. Forty were caught in gill nets at a rate of 7/lift. Only six were 8-inch or larger. Also collected were 46 rock bass up to 8 inches long, 21 brown bullheads and seven yellow bullheads, several miscellaneous sunfish (longear, warmouth, pumpkinseeds), seven black crappies, and one 15½-inch white bass. The few non-sport fish that were collected included 14 adult gizzard shad, ranging from 11-14½ inches, 10 spotted gar up to 37 inches long, six longnose gar up to 42½ inches, three golden shiners, a lake chubsucker, log perch, and brook silverside.

DISCUSSION

Based on results of the 2005 survey, no major changes have occurred in the fish community at Big Chapman Lake over the past 40 years (Table 2). Bluegills, redear, largemouth bass, and yellow perch have generally comprised the bulk of the catch each year. Crappies have never been especially abundant. A variety of miscellaneous sunfish species have always been present but none have comprised substantial percentages of the catch, except for rock bass in 1999 and longear in 1964 and 1976. Bullheads have also been relatively scarce. Northern pike abundance may have increased in the late 1990s compared to 1964 through 1991 but the latest catch (12) was more comparable to 1976 and 1991. White bass have never been abundant, nor have walleyes, despite previous walleye stocking efforts. In addition, non-sport fish, such as carp and suckers, have never been abundant, although more gizzard shad and lake chubsuckers were caught in 1976. Numbers of gar, both longnose and spotted, have been consistently low. Overall, most of these minor fluctuations in catches of various species probably reflect differences in sampling date, sampling gear and effort, as well as the imprecision of the survey results.

Although Big Chapman Lake is dominated by sport fish, most of them are small. Catchable-size bluegills, those 7-inch or larger, accounted for only 4-13% of the catch of all 3-inch and larger bluegills in each previous survey (Table 3). No 8-inch and larger bluegills were caught in 2005 or 1976 and fewer than 11 were caught in other years. Of 2,930 bluegills caught in all five surveys from 1964 through 2005, only 17 were 8-inch or larger (<1%). Likewise, few large bass have ever been captured at Big Chapman Lake. Of 386 bass captured in all five surveys since 1964, only 20 were 14-inch or larger (5%)

and three (<1%) were 18-inch or larger (Table 4). Percentages of 14-inch and larger bass of all 8-inch and larger bass (i.e. proportional stock densities) varied from 2-13% and averaged 8%. Although very few bass were collected, the percentage of 14-inch and larger bass increased from 2% to 13% following imposition of a 14-inch size limit in 1984, but the percentages remained similar to 1964 and 1976 levels when no size limit was in effect.

Poor size structure of bluegill and largemouth populations in Big Chapman Lake results from poor growth (Tables 3 and 4), although bass growth has not been as comparatively slow. Methods used to calculate growth in 1964 and 1976 were slightly different than methods used later, but bluegill growth has been consistently slow over the past 29 years, a problem also reported even earlier (Ricker 1942). Although the data indicate that growth of young-of-the-year bluegills has gradually increased since 1976, growth after age-3 has generally declined. Too few older bass have been collected to adequately assess their growth, but growth of young bass has fluctuated between marginal and average. Age-2 bass typically average 7 inches at most lakes. Bass in Big Chapman Lake met or exceeded that standard only in 1999. Age-3 and age-4 bass typically average 9½ and 11½ inches at most lakes, but age-3 bass were consistently smaller and age-4 bass were smaller in all years except 1976.

Slow growth of bluegills, as well as marginal growth of bass, coupled with exploitation by anglers may explain the scarcity of these two most popular fish in Big Chapman Lake. The reasons why bluegill growth is slow, however, are not known. A research study is currently in progress (Workplan #202201) at several northeast Indiana natural lakes to examine factors that may limit bluegill quality, including aquatic plant distribution and abundance, food resources, water chemistry, and predator abundance. Another study is underway (Workplan #202068) to examine the impacts of bass fishing on bass density and size in large lakes. Results of these projects may have application to Big Chapman Lake and may ultimately provide insight into ways to improve fishing.

Meanwhile, Big Chapman Lake also provides an opportunity to more closely evaluate and better understand the impacts of aquatic plant management efforts at Indiana lakes. Based on comparisons with data initially available from other lakes, Eurasian water milfoil is not unusually abundant nor does it restrict recreational access except in some

specific nearshore riparian areas. For example, Eurasian water milfoil in nearby Dewart Lake was found at 56% of littoral sites in May 2005 and 60% in August 2005 with density scores averaging 2.5 and 3.0, respectively. In contrast, at Big Chapman Lake it was found at 39% and 15% of littoral sites with density scores of 2.6 and 2.3.

Overall, current levels of herbicide use appear to be adequately controlling Eurasian water milfoil, although three areas on the eastern half of the lake still contained dense stands in August (as depicted in Figure 1). By limiting control to current levels for the next several years, the assumption that Eurasian water milfoil is an aggressive invader and will likely expand throughout the lake can be tested. By delaying any fluridone treatment, possible adverse impacts on water quality or native plants can be avoided and adequate amounts of cover can be maintained for fish. At Big Chapman Lake, where northern pike are an important component of the fish community, current Division of Fish and Wildlife guidelines suggest vegetation should cover up to 80% or more of the littoral zone. At Big Chapman Lake, native plant species were detected at 77% of the sites in May and 96% in August, although chara, a low-growing plant that provides little ambush cover for pike, was dominant.

Additional management interest at Big Chapman Lake should be directed at protecting the remaining sections of undeveloped shoreline and adjacent wetlands, as well as continuing to reduce the input of sediment and nutrients to the lake. Once all erodable areas within the Crooked Creek watershed are addressed, the sediment delta at its mouth should be removed. Similar deltas exist off other inlets. Likewise, efforts are needed to protect offshore areas of bulrush beds by curtailing use of motorized watercraft within them. The Division of Fish and Wildlife should also continue to work with local agencies, conservation organizations, recreational user-groups, and landowners to preserve the natural character of the lake through on-going watershed management programs, land acquisition, permit review and regulatory compliance, zoning ordinances, strategic planning, and environmental education.

NOTE: *For additional information aquatic plant management at Big Chapman Lake, the reader is referred to Workplan #204289 of the Division of Fish and Wildlife*.

RECOMMENDATIONS

1. No fish management recommendations are suggested at this time.

REFERENCES

Ricker, W. E. 1942. The rate of growth of bluegill sunfish in lakes of northern Indiana. *In* Investigations of Indiana Lakes and Streams 2:161-214.

Workplan 202068. Natural lakes largemouth bass investigations. Division of Fish and Wildlife, Indiana Department of Natural Resources, Indianapolis, IN.

Workplan 202201. Understanding the relationship between zooplankton abundance and bluegill growth. Division of Fish and Wildlife, Indiana Department of Natural Resources, Indianapolis, IN.

Workplan 204289. Whole-lake fluridone effects. Division of Fish and Wildlife, Indiana Department of Natural Resources, Indianapolis, IN.

Submitted by: Jed Pearson, fisheries biologist
December 2, 2005

Approved by: _____
Stu Shipman, regional supervisor
December 22, 2005

Table 1. Historic oxygen levels (ppm) and water clarity (secchi depth) at Big Chapman Lake, 1965 through 2005 (source - Division of Fish and Wildlife files).

Depth (ft)	5/1965	8/1976	6/1980	6/1991	6/1999	7/2005
0	9.0	9.0	8.0	11.0	7.0	8.9
5	9.0	8.4	8.0	11.0	7.0	8.7
10	9.0	8.4	8.0	10.0	7.0	8.1
15	9.0	7.8	6.0	8.0	7.0	4.3
20	8.6	7.2	2.0	4.0	7.0	1.4
25	8.4	4.6	0.0	2.0	6.0	0.5
30	---	0.0	---	1.2	1.5	0.4
35	—	0.0	—	0.2	0.4	0.3
secchi depth (ft)	12	6	9	9	12	5½

Table 2. Number of fish collected in fish population surveys at Big Chapman Lake, 1964 through 2005.

Species	Jun 1964	Aug 1976	Jun 1991	Jun 1999	Jul 2005
Banded killifish	0	0	2	1	0
Black crappie	36	10	1	27	7
Blackside darter	0	0	0	1	0
Bluegill	180	362	321	1,214	853
Bluntnose minnow	0	0	12	12	9
Bowfin	5	0	1	2	0
Brook silversides	0	0	36	5	1
Brown bullhead	8	7	15	10	21
Carp	1	6	0	2	0
Central mudminnow	0	0	1	0	0
Channel catfish	0	0	0	1	0
Grass pickerel	19	8	3	3	0
Gizzard shad	65	139	12	0	14
Golden redhorse	1	0	0	1	0
Golden shiner	6	4	11	7	3
Green sunfish	7	0	0	1	0
Hybrid sunfish	0	0	0	2	1
Johnny darter	0	0	1	0	0
Lake chubsucker	9	41	6	29	1
Largemouth bass	91	53	123	63	56
Log perch	0	9	15	1	1
Longear	76	86	3	26	19
Longnose gar	10	4	7	1	6
Northern pike	3	11	7	37	12
Pumpkinseed	9	14	0	3	7
Redear	196	67	26	57	237
Rock bass	7	8	11	101	46
Spotted gar	20	5	21	10	10
Spotted sucker	1	1	0	0	0
Steelcolor shiner	0	0	11	0	0
Walleye	12	2	4	0	0
Warmouth	46	21	50	91	16
White bass	0	1	1	2	1
White catfish	0	1	0	0	0
White crappie	0	1	0	0	0
White sucker	3	3	1	0	0
Yellow bullhead	72	5	10	16	7
Yellow perch	79	77	127	69	54
TOTAL	962	946	839	1,795	1,382
SAMPLING EFFORT					
Electrofishing hours	8 AC	3 AC	1 DC	1 DC	1 DC
Gill net lifts	6	12	6	4	6
Trap net lifts	0	0	8	6	4

Wire traps	27	0	0	0	0

Table 3. Size and growth rate of bluegills at Big Chapman Lake, 1964 through 2005.

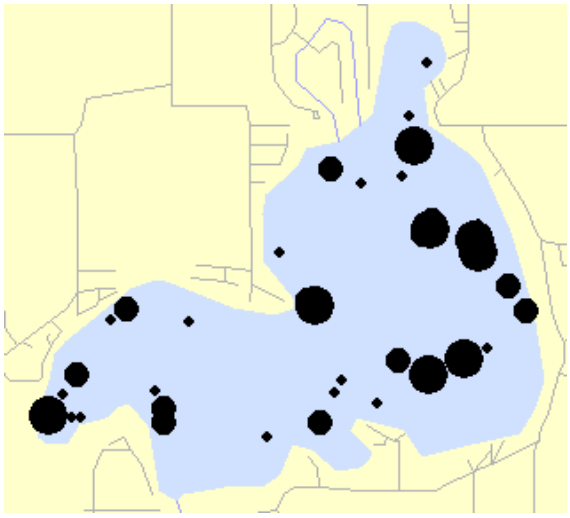
Inches	Jun 1964	Aug 1976	Jun 1991	Jun 1999	Jul 2005
Number of bluegills					
<3	7	7	62	100	42
3-5½	86	290	195	1,029	704
6-6½	65	43	33	39	63
7-7½	18	22	21	43	44
∃8	4	0	10	3	0
Back-calculated mean length (inches) at various ages					
Age-1	---	1.0	1.5	1.6	1.8
Age-2	3.3	2.3	2.6	2.5	2.5
Age-3	5.7	3.9	4.1	3.6	3.7
Age-4	6.4	5.4	6.0	5.0	4.8
Age-5	7.2	6.4	7.0	6.3	6.1
Age-6	---	7.0	7.6	—	6.8

Table 4. Size and growth rate of largemouth bass at Big Chapman Lake, 1964 through 2005.

Inches	Jun 1964	Aug 1976	Jun 1991	Jun 1999	Jul 2005
Number of bass					
<8	44	26	13	7	11
8-11½	33	17	93	34	31
12-13½	9	8	15	17	8
14-17½	5	2	2	3	5
∃18	0	0	0	2	1
Back-calculated mean length (inches) at various ages					
Age-1	3.2	2.9	3.8	2.9	4.5
Age-2	6.4	6.5	6.7	7.4	6.3
Age-3	8.9	9.3	8.7	9.3	8.5
Age-4	11.4	13.3	10.0	10.5	11.4
Age-5	14.4	---	11.5	11.9	---
Age-6	16.1	---	12.9	13.8	---

Figure 1. Locations where Eurasian water milfoil was detected out of 101 random sites during aquatic plant sampling at Big Chapman Lake on May 16 and August 3, 2005. Dot sizes represent relative abundance scores: small dots depict sites with Eurasian water milfoil rake scores of 1 or 2, medium dots presents scores of 3 or 4, and large dots represent scores of 5.

May 16, 2005



August 3, 2005

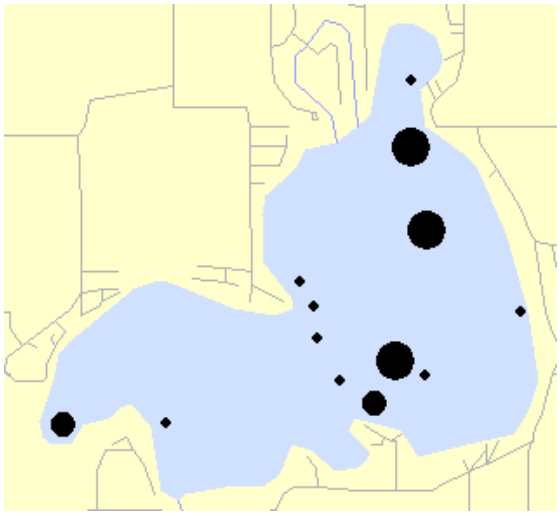
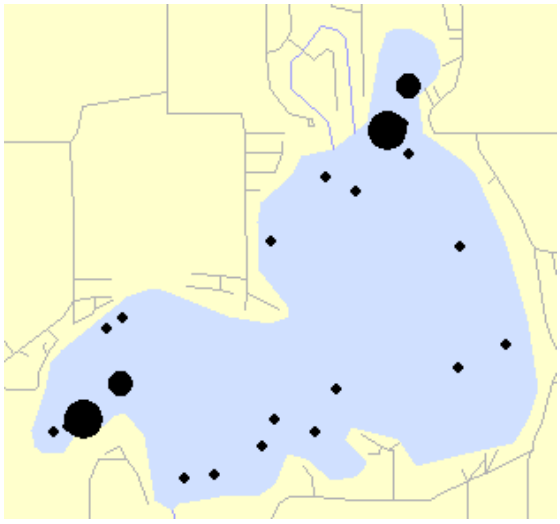


Figure 2. Locations where curly-leaf pondweed was detected out of 101 random sites during aquatic plant sampling at Big Chapman Lake on May 16 and August 3, 2005. Dot sizes represent relative abundance scores: small dots depict sites with curly-leaf pondweed rake scores of 1 or 2, medium dots presents scores of 3 or 4, and large dots represent scores of 5.

May 16, 2005



August 3, 2005