

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F-21-R-42

Name: Lake Alvin **County:** Lincoln
Legal Description: T100N- R49W-Sec. 33, 34
Location from nearest town: 3 miles east of Harrisburg, SD.

Dates of present survey: June 23-25, 2009 (netting) June 10, 2009 (electrofishing)
Dates of last survey: June 23-25, 2008 (netting);

| Primary Game and Forage Species | Other Species |
|---------------------------------|----------------|
| Largemouth Bass | Yellow Perch |
| Black Crappie | Black Bullhead |
| White Crappie | Common Carp |
| Bluegill | White Sucker |
| Channel Catfish | Green Sunfish |
| Walleye | Northern Pike |
| | Fathead Minnow |

PHYSICAL DATA

Surface area: 105 acres **Watershed area:** 24,564 acres
Maximum depth: 26 feet **Mean depth:** 9 feet
Volume: 930 acre feet **Shoreline length:** 4.3 miles
Contour map available: Yes **Date prepared:** 1997
Lake elevation observed during the survey: Full
Beneficial use classification: (4) warmwater permanent fish propagation, (7) immersion recreation, (8) limited-contact recreation and (9) fish and wildlife propagation and stock watering.

Introduction

Lake Alvin is an artificial impoundment formed by the construction of a dam across the lower end of Nine Mile Creek. It was named for Alvin Dempewolf, the only World War 1 soldier from Harrisburg who died overseas. The construction of the dam was completed in August 1954 and the lake completely filled in 1957. The concrete spillway for the dam was replaced in 1994.

Ownership of Lake and Adjacent Lakeshore Properties

Most of the land inundated by and surrounding Lake Alvin is owned and managed by the South Dakota Department of Game, Fish and Parks (GFP). The Parks Division of GFP manages a State Recreation Area surrounding the southeast, east, and northeast corners of the lake as well as a Lake Access Area on the northwest corner of the lake. The remainder of the shoreline is privately owned.

Fishing Access

The Lake Alvin Recreation Area has a single lane boat ramp with a dock, public toilet, and parking lot as well as several areas accessible to shore fishing. On the southeast corner of the dam there is a handicapped accessible fishing dock and several shorefishing areas. The Lake Access Area on the northwest corner of the lake has a public toilet and a narrow boat ramp with a dock suitable for small boats. There is plenty of shoreline to fish; however, the water is shallow in this area. The entire lake has been designated as a no-wake zone to protect the shoreline from erosion. At no time can boats exceed 5 mph or produce a visible wake.

Field Observations of Water Quality and Aquatic Vegetation

The Secchi depth measurement during the survey was 1 m (39 in) near the east boat ramp. The water was much more turbid in the west end. Small beds of sago pondweed (*Potamogeton pectinatus*) and floating leaf pondweed (*Potamogeton natans*) were scattered along the south shore. Sparse stands of common cattail (*Typha spp.*) are found at the west end of the lake. GFP finished a fencing project in 2009 that excluded cattle from the lake entirely. Interestingly, there were no beach closures due to fecal coliform contamination this year.

BIOLOGICAL DATA

Methods:

Lake Alvin was sampled on June 23-25, 2009 with ten overnight trap-net sets. The trap nets are constructed with 19-mm-bar-mesh ($\frac{3}{4}$ in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. Sampling locations are displayed in Figure 4.

Trap Net Catch

Black bullhead (41.8%), bluegill (27.0%), and black crappie (18.7%) were the most common species sampled in the trap nets (Table 1). Five additional species were also sampled.

Table 1. Total catch from ten overnight trap net sets at Lake Alvin, Lincoln County, June 23-25, 2009.

| Species | Number | Percent | CPUE | 80% C.I. | Mean CPUE* | PSD | RSD-P | Mean Wr |
|------------------------|--------|---------|------|--------------|------------|-----|-------|---------|
| Black Bullhead | 657 | 53.5 | 65.7 | <u>+35.3</u> | 47.2 | 67 | 0 | 93 |
| Bluegill | 275 | 22.4 | 27.5 | <u>+13.1</u> | 95.1 | 84 | 3 | 110 |
| Black Crappie | 167 | 13.6 | 16.7 | <u>+7.2</u> | 42.3 | 38 | 0 | 110 |
| Channel Catfish | 73 | 5.9 | 7.3 | <u>+3.8</u> | 2.1 | 15 | 6 | 80 |
| White Sucker | 26 | 2.1 | 2.6 | <u>+4.4</u> | 5.2 | 100 | 88 | 93 |
| Green Sunfish | 9 | 0.7 | 0.9 | <u>+0.1</u> | 0.2 | -- | -- | -- |
| Northern Pike | 7 | 0.6 | 0.7 | <u>+0.1</u> | 0.1 | -- | -- | -- |
| Freshwater Drum | 6 | 0.5 | 0.6 | <u>+0.1</u> | 0.0 | -- | -- | -- |
| Hybrid Sunfish | 2 | 0.2 | 0.2 | <u>+0.1</u> | 0.4 | -- | -- | -- |
| Yellow Perch | 2 | 0.2 | 0.2 | <u>+0.1</u> | 1.6 | -- | -- | -- |
| Common Carp | 1 | 0.1 | 0.1 | <u>+0.2</u> | 1.8 | -- | -- | -- |
| Largemouth Bass | 1 | 0.1 | 0.1 | <u>+0.1</u> | 0.0 | -- | -- | -- |
| White Crappie | 1 | 0.1 | 0.1 | <u>+0.3</u> | 18.7 | -- | -- | -- |

* 10 years (1999-2008)

Table 2. Catch per unit effort by length category for various fish species captured with trap nets in Lake Alvin June 23-24, 2009.

| Species | Substock | Stock | S-Q | Q-P | P+ | All sizes | 80% C.I. |
|------------------------|----------|-------|------|------|-----|-----------|--------------|
| Black Bullhead | 3.5 | 62.2 | 20.3 | 41.9 | - | 65.7 | <u>+20.4</u> |
| Bluegill | - | 27.5 | 4.5 | 22.2 | 0.8 | 27.5 | <u>+11.0</u> |
| Black Crappie | 14.6 | 2.1 | 1.3 | 0.8 | - | 16.7 | <u>+9.6</u> |
| Channel Catfish | 0.1 | 7.2 | 6.1 | 0.7 | 0.4 | 7.3 | <u>+4.2</u> |
| White Sucker | - | 2.6 | - | 0.3 | 2.3 | 2.6 | <u>+1.1</u> |
| Green Sunfish | - | 0.9 | 0.4 | 0.5 | - | 0.9 | <u>+0.6</u> |
| Northern Pike | - | 0.7 | 0.7 | - | - | 0.7 | <u>+0.4</u> |
| Freshwater Drum | - | 0.6 | 0.6 | - | - | 0.6 | <u>+0.6</u> |
| Hybrid Sunfish* | | | | | | 0.2 | <u>+0.3</u> |
| Yellow Perch | - | 0.2 | - | 0.2 | - | 0.2 | <u>+0.2</u> |
| Common Carp | - | 0.1 | - | 0.1 | - | 0.1 | <u>+0.1</u> |
| Largemouth Bass | 0.1 | - | - | - | - | 0.1 | <u>+0.1</u> |
| White Crappie | - | 0.1 | - | 0.1 | - | 0.1 | <u>+0.1</u> |

*No length categories established. Length categories can be found in Appendix A.

Largemouth Bass

Management objective: Maintain a largemouth bass fishery with an electrofishing CPUE of at least 20.

Electrofishing CPUE and the population size structure for largemouth bass in Lake Alvin have not varied much over the past 6 years (Table 3). The size structure of the sampled fish was excellent with 23% measuring over 38 cm (15 in) (Table 3). All sampled fish longer than 200 mm (8 in) were PIT tagged. PIT tag loss is a concern since five sampled fish had fin clips from previous tagging but no PIT tags were detected. Fifty-one bass were tagged in 2007 and 35 were tagged this year.

Growth falls between statewide and regional means (Table 4). However, mean Wr was higher than recorded in four previous surveys. This might be explained by the stocking of nearly 700,000 fathead minnows in the fall of 2008.

Table 3. Largemouth bass electrofishing CPUE, PSD, RSD-P and mean Wr for Lake Alvin, Lincoln County, 2000-2009.

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | Mean* |
|---------|------|------|------|------|------|------|------|------|------|------|-------|
| CPUE | | 15.0 | | 31.0 | | 26.0 | | 28.0 | | 30.5 | 25.0 |
| PSD | | 93 | | 58 | | 83 | | 73 | | 89 | 77 |
| RSD-P | | 69 | | 27 | | 37 | | 45 | | 40 | 45 |
| Mean Wr | | 99 | | 100 | | 95 | | 98 | | 104 | 98 |

*4 years (1999, 2001, 2003, 2005)

Table 4. Average back-calculated lengths (mm) for each age class of largemouth bass in Lake Alvin, Lincoln County, 2009.

| Year Class | Age | N | Back-calculation Age | | | | | | | | |
|--------------------|-----|-----------|----------------------|------------|------------|------------|------------|------------|------------|------------|--|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| 2008 | 1 | 24 | 124 | | | | | | | | |
| 2007 | 2 | 2 | 105 | 164 | | | | | | | |
| 2006 | 3 | 4 | 92 | 172 | 263 | | | | | | |
| 2005 | 4 | 5 | 76 | 174 | 240 | 303 | | | | | |
| 2004 | 5 | 8 | 75 | 149 | 252 | 297 | 340 | | | | |
| 2003 | 6 | 9 | 94 | 155 | 230 | 290 | 327 | 360 | | | |
| 2002 | 7 | 6 | 110 | 186 | 253 | 305 | 352 | 389 | 410 | | |
| 2001 | 8 | 3 | 118 | 230 | 307 | 350 | 392 | 420 | 434 | 446 | |
| All Classes | | 61 | 99 | 176 | 257 | 309 | 352 | 389 | 422 | 446 | |
| Statewide Mean | | | | 96 | 182 | 250 | 305 | 342 | | | |
| Region III Mean | | | | 111 | 212 | 287 | 347 | 383 | | | |
| SLI* Mean | | | | 99 | 183 | 246 | 299 | 332 | | | |

*Small Lakes and Impoundments (<150 acres)

Black/White Crappie

Management objective: Maintain a crappie fishery with a trap-net CPUE of at least 20 and PSD of at least 40.

In 2007 and 2008, a total of 5,315 black crappies were transferred from Lake Alvin to other lakes in an attempt to increase the growth and overall size of the remaining fish. Fathead minnows were also stocked in 2008 to supplement the lake's forage base and help improve growth and condition.

Black crappie trap-net CPUE in 2009 was similar to 2008 but lower than the ten year mean (Table 5). Only once in the last ten years have the management objectives for abundance and PSD been attained at the same time. Examining the ten year trend data, it appears that we only come close to achieving the management objectives for size structure when CPUE is 15-20. We may want to modify our objective to reflect this observation.

Young crappie growth is similar to statewide and small impoundments means (Table 6), but slows by age-3. Growth increments for all year classes were higher for the most recent year (Table 6). The 2008 year class dominated this year's catch (Table 6; Figure 1) but the presence of fish from five consecutive year classes indicates consistent natural recruitment. The excellent condition (mean Wr) and improved growth in 2009 (Tables 5 and 6) were likely due to the stocking of fathead minnows and the fish removals.

The white crappie population was decimated by a fish kill in 2004 and has not recovered at this time (Table 7).

Table 5. Stock length black crappie trap-net CPUE, PSD, RSD-P and mean Wr for Lake Alvin, Lincoln County, 2000-2009.

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | Mean* |
|---------|------|------|------|------|------|------|------|------|------|------|-------|
| CPUE | 61.6 | 63.9 | 68.0 | 28.8 | 19.3 | 26.7 | 17.7 | 32.1 | 15.9 | 16.7 | 42.3 |
| PSD | 21 | 14 | 25 | 49 | 29 | 10 | 34 | 3 | 13 | 38 | 22 |
| RSD-P | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 1 |
| Mean Wr | 111 | 106 | 112 | 93 | 90 | 94 | 102 | 102 | 102 | 110 | 103 |

* 10 years (1999-2008)

Table 6. Average back-calculated lengths (mm) for each age class of black crappie in Lake Alvin, Lincoln County, 2009.

| Year Class | Age | N | Back-calculation Age | | | | | | | | |
|--------------------|-----|------------|----------------------|------------|------------|------------|------------|---|---|---|--|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| 2008 | 1 | 153 | 90 | | | | | | | | |
| 2007 | 2 | 4 | 85 | 172 | | | | | | | |
| 2006 | 3 | 3 | 79 | 141 | 207 | | | | | | |
| 2005 | 4 | 6 | 85 | 153 | 185 | 220 | | | | | |
| 2004 | 5 | 1 | 58 | 102 | 145 | 165 | 180 | | | | |
| All Classes | | 167 | 89 | 152 | 188 | 212 | 180 | | | | |
| Statewide Mean | | | 83 | 147 | 195 | 229 | 249 | | | | |
| Region III Mean | | | 95 | 167 | 219 | 253 | 274 | | | | |
| SLI* Mean | | | 78 | 134 | 180 | 209 | 226 | | | | |

*Small Lakes and Impoundments (<150 acres)

Table 7. White crappie trap-net CPUE, PSD, RSD-P and mean relative weight (Wr) for Lake Alvin, Lincoln County, 2000-2009.

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | Mean* |
|---------|------|------|------|------|------|------|------|------|------|------|-------|
| CPUE | 35.5 | 17.1 | 12.4 | 74.8 | 0.9 | 0.1 | 0.8 | 0.3 | 0.2 | 0.1 | 18.7 |
| PSD | 25 | 15 | 17 | 49 | 67 | -- | -- | -- | -- | -- | 32 |
| RSD-P | 2 | 3 | 2 | 0 | 0 | -- | -- | -- | -- | -- | 1 |
| Mean Wr | 100 | 83 | 108 | 88 | 78 | -- | -- | -- | -- | -- | 91 |

*10 years (1998-2007)

Bluegill

Management objective: Maintain a bluegill fishery with a trap-net CPUE of at least 20 and RSD-18 of at least 20.

In 2007, 1,267 bluegills were transferred to other lakes in an attempt to increase the growth of the remaining fish. Stock density indices and relative weight have increased since the removal effort (Table 8).

Bluegill trap net CPUE was the lowest since 1999 (Table 8). The 2005 year class was the most abundant, but fish from six other year classes were also present (Table 9). Growth after age-2 is slower than the statewide, regional and small impoundment means (Table 9). The mean length of the bluegills sampled in Lake Alvin was less than 6 inches (150 mm) prior to 2008, 6.4 inches (162 mm) in 2008 and 6.8 inches in 2009 (173 mm).

For the first time in the last ten years, the management objective for RSD-18 has been achieved. Combined with the growth information above, this suggests bluegill growth in Lake Alvin may be density dependent. The stocking of fathead minnows may have reduced competition with black crappies for invertebrates in the lake.

Table 8. Bluegill trap-net CPUE, PSD, RSD-P and mean Wr for Lake Alvin, Lincoln County, 2000-2009.

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | Mean* |
|---------|------|------|-------|-------|-------|-------|------|------|------|------|-------|
| CPUE | 26.5 | 48.3 | 111.8 | 229.3 | 172.1 | 186.1 | 47.5 | 87.9 | 26.1 | 27.5 | 95.1 |
| PSD | 34 | 26 | 11 | 26 | 47 | 60 | 51 | 37 | 88 | 84 | 41 |
| RSD-18 | 2 | 1 | 0 | 1 | 5 | 0 | 5 | 3 | 8 | 62 | 3 |
| RSD-P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| Mean Wr | 105 | 86 | 119 | 94 | 88 | 95 | 92 | 91 | 99 | 110 | 97 |

*10 years (1999-2008)

Table 9. Average back-calculated lengths (mm) for each age class of bluegills in Lake Alvin, Lincoln County, 2009.

| Year Class | Age | N | Back-calculation Age | | | | | | | | |
|--------------------|-----|------------|----------------------|------------|------------|------------|------------|------------|------------|---|--|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| 2008 | 1 | 8 | 84 | | | | | | | | |
| 2007 | 2 | 31 | 50 | 110 | | | | | | | |
| 2006 | 3 | 13 | 48 | 99 | 156 | | | | | | |
| 2005 | 4 | 167 | 51 | 106 | 152 | 173 | | | | | |
| 2004 | 5 | 36 | 50 | 112 | 145 | 172 | 187 | | | | |
| 2003 | 6 | 8 | 42 | 100 | 118 | 139 | 156 | 168 | | | |
| 2002 | 7 | 3 | 53 | 110 | 164 | 172 | 182 | 188 | 196 | | |
| All Classes | | 266 | 54 | 106 | 147 | 164 | 175 | 178 | 196 | | |
| Statewide Mean | | | 55 | 103 | 141 | 166 | | | | | |
| Region III Mean | | | 60 | 116 | 157 | 180 | | | | | |
| SLI* Mean | | | 53 | 101 | 138 | 163 | | | | | |

*Small Lakes and Impoundments (<150 acres)

All Fish Species

Black bullhead CPUE has been declining since 2006 and is below nuisance level (Table 10). Channel catfish CPUE increased after adult fish from Lake Oahe were stocked in 2004 and 2005. Freshwater drum were sampled for the first time in 2009 and where they came from is unknown. The abundance of most other species remains within previously observed ranges.

Table 10. Trap-net (TN) CPUE for all fish species sampled in Lake Alvin, Lincoln County, 2000-2009.

| Species | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---------|------|------|-------|-------|-------|-------|-------|-------|------|------|
| GOS | -- | 0.1 | -- | -- | -- | 0.1 | -- | 0.1 | -- | -- |
| COC | 0.2 | 0.1 | 0.2 | -- | 0.1 | 0.5 | -- | -- | -- | 0.1 |
| WHS | 9.5 | 9.4 | 4.8 | 2.5 | 4.3 | 3.8 | 2.5 | 4.5 | 7.1 | 2.6 |
| BLB | 3.2 | 0.1 | 1.6 | 8.2 | 16.5 | 11.8 | 198.2 | 136.8 | 39.2 | 65.7 |
| CCF | 0.6 | 1.1 | 2.5 | 0.9 | 1.8 | 0.7 | 2.4 | 1.2 | 3.1 | 7.3 |
| NOP | 0.1 | 0.2 | 0.3 | 0.1 | -- | 0.1 | -- | 0.1 | 0.1 | 0.7 |
| GSF | -- | 0.1 | -- | 0.2 | 0.2 | 0.2 | 0.3 | 0.5 | -- | 0.9 |
| HYB | -- | -- | -- | 3.8 | -- | -- | 0.1 | 0.1 | -- | 0.2 |
| OSF | 0.8 | 6.9 | 2.8 | 1.4 | 0.9 | -- | -- | 4.0 | 0.2 | -- |
| BLG | 26.5 | 48.3 | 111.8 | 229.3 | 172.1 | 186.1 | 47.5 | 87.9 | 26.1 | 27.5 |
| SMB | -- | -- | 0.2 | -- | -- | -- | -- | -- | -- | -- |
| LMB | -- | -- | -- | -- | -- | -- | 0.1 | -- | -- | 0.1 |
| WHC | 35.5 | 17.1 | 12.4 | 74.8 | 0.9 | 0.1 | 0.8 | 0.3 | 0.2 | 0.1 |
| BLC | 61.6 | 63.9 | 68.0 | 26.2 | 19.3 | 26.7 | 17.7 | 32.1 | 15.9 | 16.7 |
| YEP | 1.9 | 5.0 | 3.4 | 2.9 | 1.7 | 0.4 | 0.2 | 0.2 | -- | 0.2 |
| WAE | 0.1 | 0.1 | -- | -- | -- | -- | -- | -- | -- | -- |
| FRD | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.6 |

GOS (Golden Shiner), COC (Common Carp), WHS (White Sucker), BLB (Black Bullhead), CCF (Channel Catfish), NOP (Northern Pike), GSF (Green Sunfish), HYB (Hybrid Sunfish), OSF (Orange-spotted Sunfish), BLG (Bluegill), LMB (Largemouth Bass), SMB (Smallmouth Bass), WHC (White Crappie), BLC (Black Crappie), YEP (Yellow Perch), WAE (Walleye), FRD (Freshwater Drum)

MANAGEMENT RECOMMENDATIONS

1. Funding has been approved to build a silt retention dam on Nine Mile Creek above Lake Alvin. This dam will prevent sediment and other pollutants from entering the lake, resulting in better water quality and aquatic habitat. Construction is tentatively scheduled to begin in 2010.
2. A project to install a water level control structure is under consideration. The structure will allow occasional lowering of water levels to dry and compact loose sediment in the upper portion of the lake, to establish terrestrial and wetland vegetation for short-term habitat improvement and to allow nutrients trapped in the sediments to be released and used for increased fish production.
3. Suspend efforts to improve crappie and bluegill growth and population size structure through fish removals and supplemental forage stocking. These activities may affect our ability to successfully evaluate the effects of the silt retention dam and water level manipulation.
4. Evaluate the 2008 efforts to improve crappie and bluegill growth by stocking supplemental forage and fish removals.

5. Plan and implement a monitoring program designed to evaluate the effects of the silt retention dam and water level manipulation on water quality, aquatic vegetation, sediment depths, invertebrate populations, fish populations, and recreational use.
6. Stock walleye when surplus fish are available to increase angler use and diversify fishing opportunity.

Table 11. Stocking record for Lake Alvin, Lincoln County, 1991-2009.

| Year | Number | Species | Size |
|-------------|---------------|-----------------|-----------------|
| 1991 | 525,000 | Fathead Minnow | Adult |
| | 3,000 | Walleye | Lrg. Fingerling |
| 1992 | 30,000 | Black Crappie | Fingerling |
| | 12,000 | Channel Catfish | Fingerling |
| | 3,212 | Walleye | Lrg. Fingerling |
| | 29,500 | Yellow Perch | Fingerling |
| 1993 | 3,355 | Walleye | Lrg. Fingerling |
| 1994 | 9,036 | Black Crappie | Lrg. Fingerling |
| 1996 | 1,203 | Black Crappie | Adult |
| 1997 | 9,000 | Largemouth Bass | Fingerling |
| 2002 | 195 | Largemouth Bass | Adult |
| 2003 | 201 | Largemouth Bass | Adult |
| 2004 | 358 | Channel Catfish | Adult |
| | 220 | Largemouth Bass | Adult |
| 2005 | 460 | Channel Catfish | Adult |
| 2007 | 430 | Walleye | Adult |
| 2008 | 684,610 | Fathead Minnow | Adult |

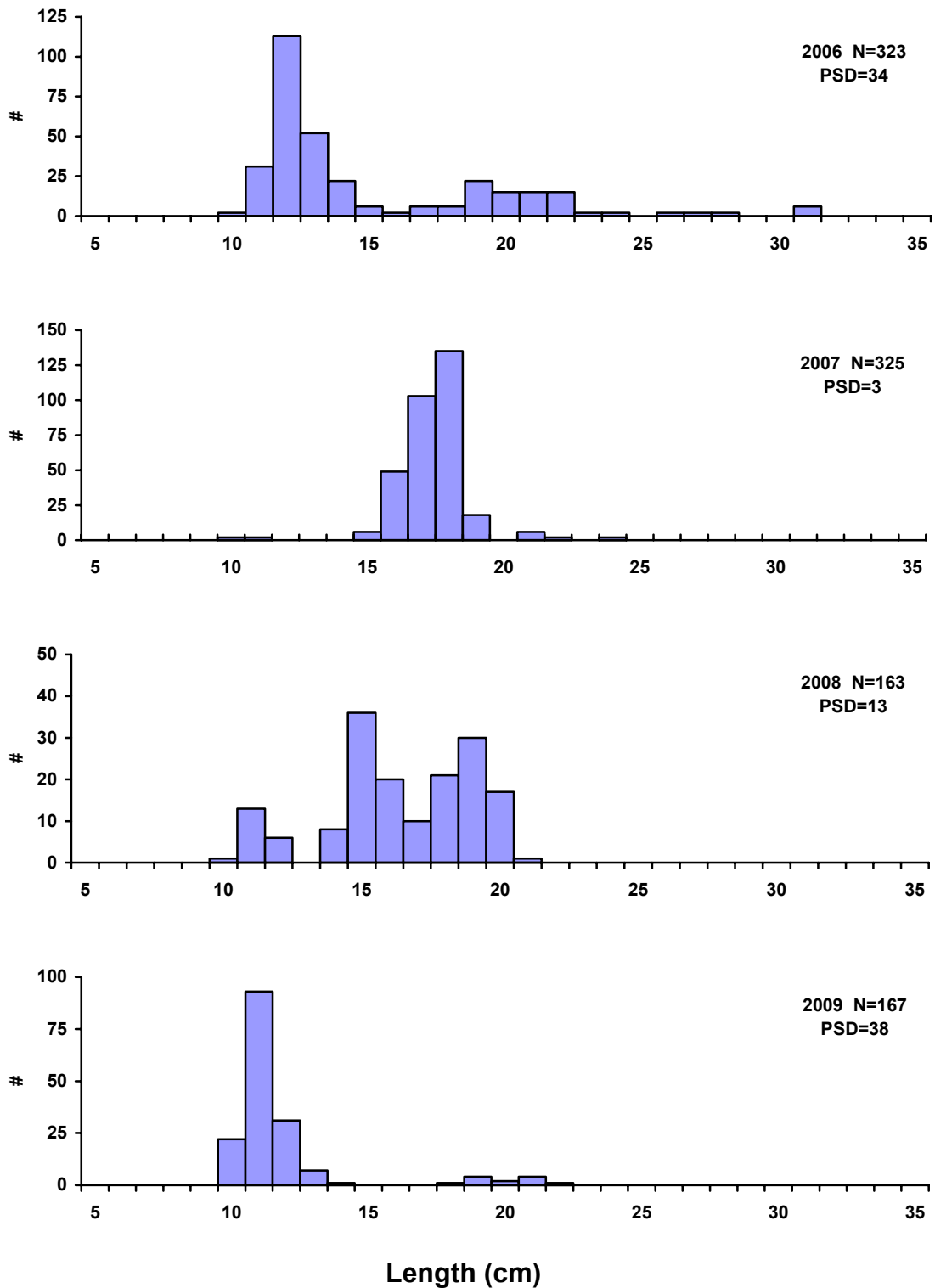


Figure 1. Length-frequency histograms for black crappies sampled with trap nets in Lake Alvin, Lincoln County, 2006-2009. Length frequency of the total catch was extrapolated from a sample of 100 measured fish.

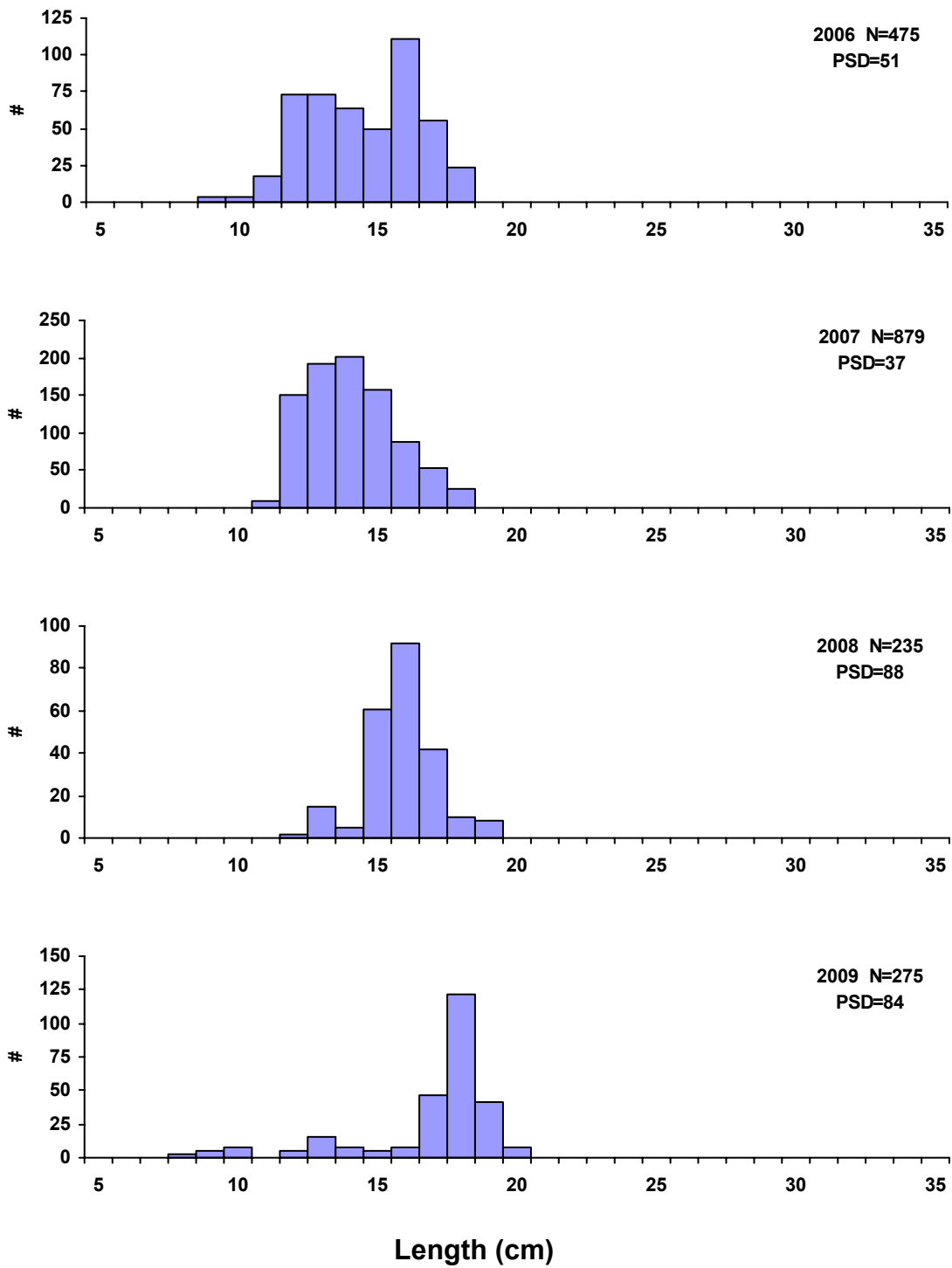


Figure 2. Length-frequency histograms for bluegill sampled with trap nets in Lake Alvin, Lincoln County, 2006-2009.

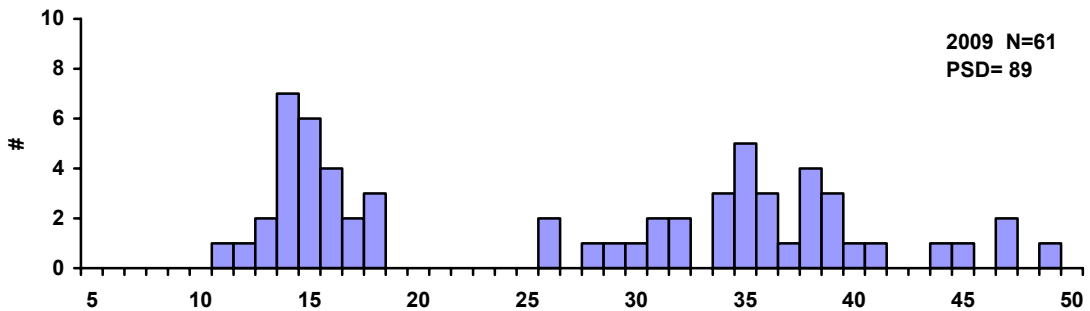
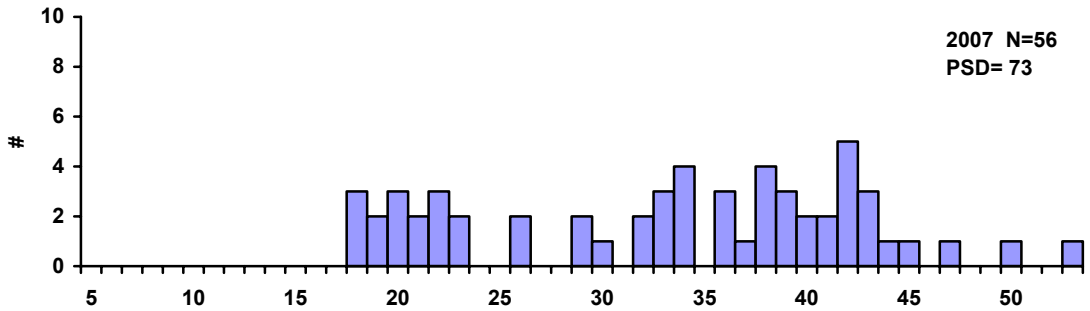
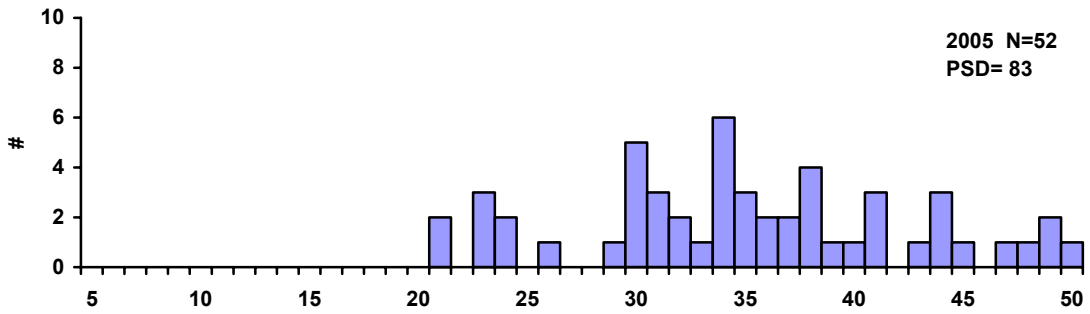
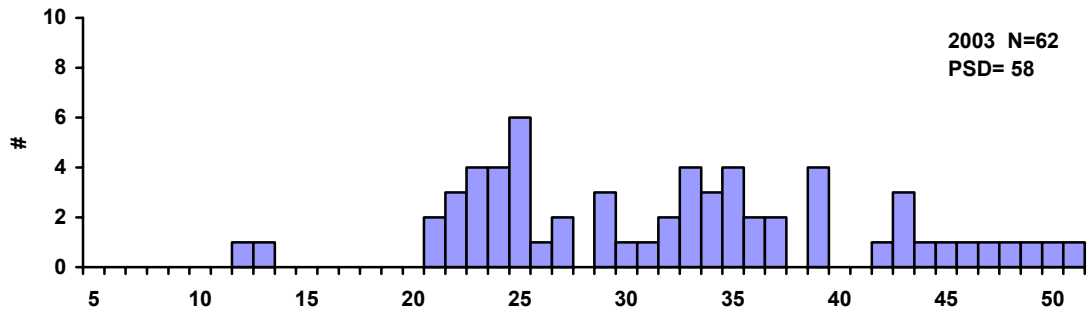


Figure 3. Length-frequency histograms for largemouth bass sampled by electrofishing in Lake Alvin, Lincoln County, 2003, 2005, 2007, and 2009.

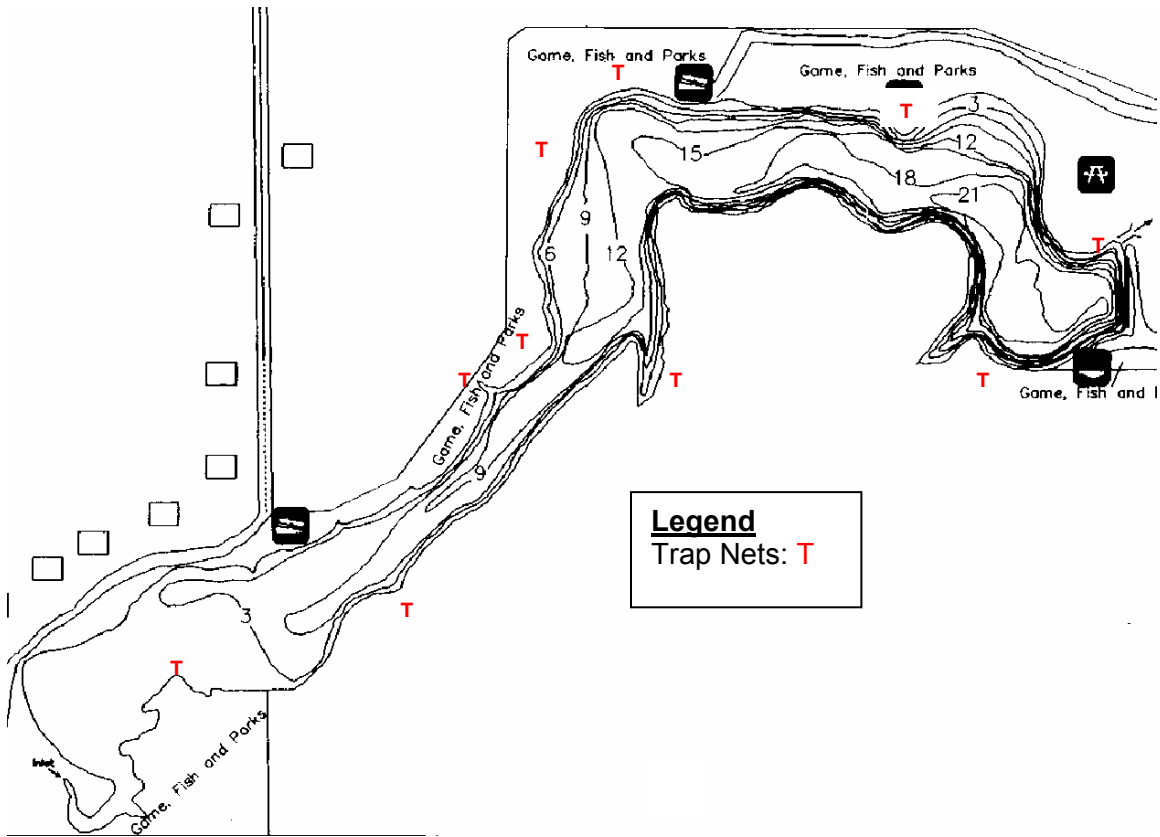


Figure 4. Sampling locations on Lake Alvin, Lincoln County, 2009.

Appendix A. A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

Catch per Unit Effort (CPUE) is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill net nights of effort, catch per hour of electrofishing, etc.

Proportional Stock Density (PSD) is calculated by the following formula:

$$\text{PSD} = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

Relative Stock Density (RSD-P) is calculated by the following formula:

$$\text{RSD-P} = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters.

| Species | Stock | Quality | Preferred | Memorable | Trophy |
|--------------------|-------|---------|-----------|-----------|--------|
| Walleye | 25 | 38 | 51 | 63 | 76 |
| Sauger | 20 | 30 | 38 | 51 | 63 |
| Yellow perch | 13 | 20 | 25 | 30 | 38 |
| Black crappie | 13 | 20 | 25 | 30 | 38 |
| White crappie | 13 | 20 | 25 | 30 | 38 |
| Bluegill | 8 | 15 | 20 | 25 | 30 |
| Largemouth bass | 20 | 30 | 38 | 51 | 63 |
| Smallmouth bass | 18 | 28 | 35 | 43 | 51 |
| Northern pike | 35 | 53 | 71 | 86 | 112 |
| Channel catfish | 28 | 41 | 61 | 71 | 91 |
| Black bullhead | 15 | 23 | 30 | 38 | 46 |
| Common carp | 28 | 41 | 53 | 66 | 84 |
| Bigmouth buffalo | 28 | 41 | 53 | 66 | 84 |
| Smallmouth buffalo | 28 | 41 | 53 | 66 | 84 |

For most fish, 30-60 or 40-70 are typical objective ranges for “balanced” populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

Relative weight (Wr) is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.