

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Beaver Lake, Minnehaha County
2102-F-21-R-48
2015

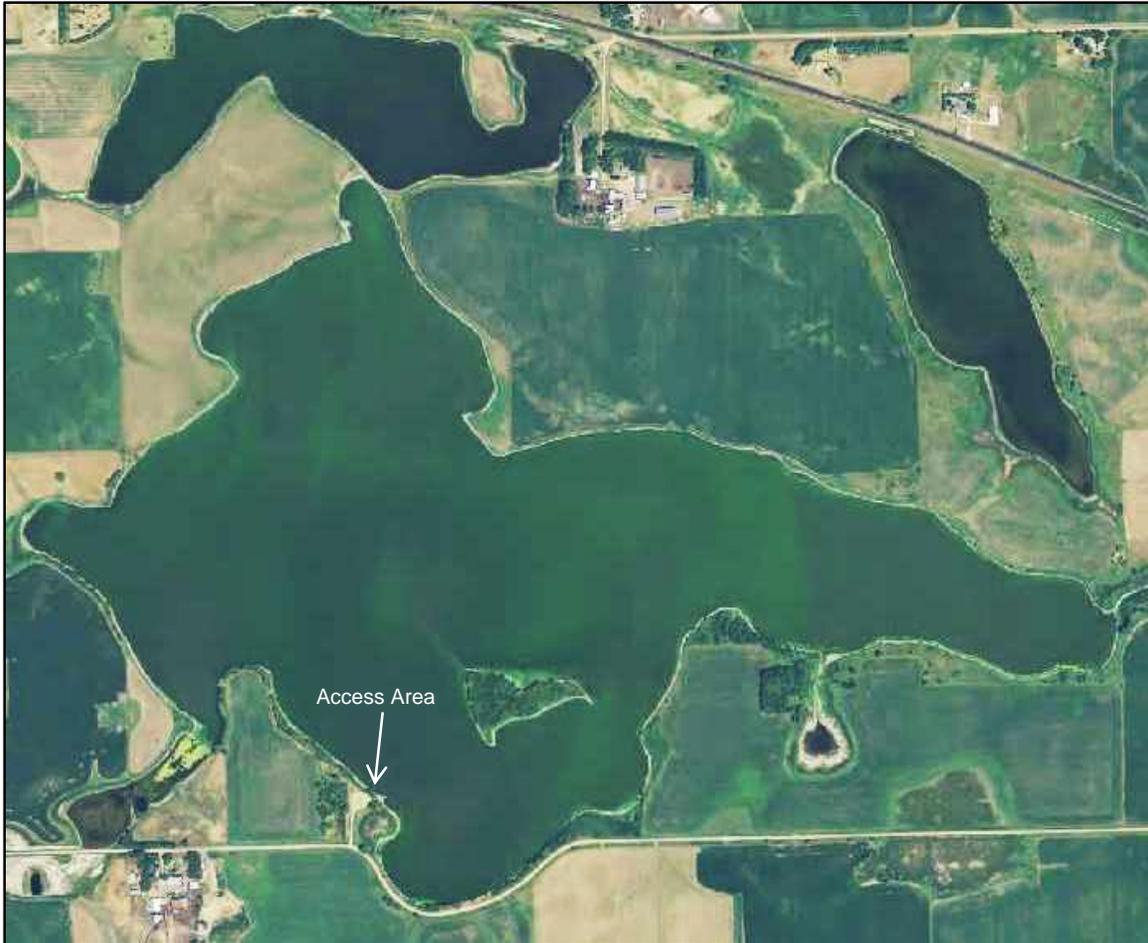


Figure 1. Beaver Lake, Minnehaha County

Legal Description: T102N-R52W-Sec.14-15

Location from nearest town: 1 mile south and $\frac{3}{4}$ miles east of Humboldt, SD

Surface Area: 320 acres

Meandered (Y/N): Yes

OHWM elevation: 1651.6

Outlet elevation: 1651.7

Max. depth at outlet elevation: 11 feet

Observed water level: 4 feet low

Contour map available: Yes

Watershed area: No data available

Shoreline length: No data available

Date set: December, 1988

Date set: December, 1988

Mean depth at outlet elevation: 9 feet

Lake volume: No data available

Date mapped: 2012

DENR beneficial use classifications: (6) warm water marginal fish propagation, (7) immersion recreation, (8) limited-contact recreation, (9) fish and wildlife propagation

Introduction

General

According to historical documents, Beaver Lake was so named because beavers used to be protected on the lake. The lakes' proximity to Sioux Falls makes it an important source of water-based recreation for the area.

Ownership of Lake and Adjacent Lakeshore Properties

Beaver Lake is located just southeast of Humboldt in west central Minnehaha County. It is listed as meandered public water in the State of South Dakota Listing of Meandered Lakes. The South Dakota Department of Game, Fish, and Parks owns and maintains a lake access area on the southwest corner of the lake (Figure 1). The remaining lakeshore is privately owned.

Fishing Access

The lake access area features a concrete boat ramp, boat dock, concrete vault toilet and gravel parking area. Shoreline access is limited to the southwest road right-of-way, especially when the lake is full.

Water Quality and Aquatic Vegetation

Like many shallow lakes, Beaver Lake experiences wide variations in water clarity and aquatic vegetation abundance (Table 1). The exceptional clarity observed in 2009 was produced by the near total fish kill in the winter of 2008-2009 (Table 3).

Table 1. Water temperature, Secchi depth and observations/comments on water quality and aquatic vegetation in Beaver Lake, Minnehaha County, 2006-2015.

| Year | Water Temp °C (°F) | Secchi Depth cm (in) | Observations/Comments (algae, aquatic vegetation, water quality, etc.) |
|-------------|-------------------------------|---------------------------------|---|
| 2015 | 20 (68) | 86 (34) | Algae and sago |
| 2014 | 22 (72) | 112 (44) | Some sago pondweed was observed |
| 2013 | 25 (77) | 97 (38) | Algae and sago |
| 2009 | 23 (74) | 400 (157) | Sago, clasping leaf, cattail and bulrush abundant |
| 2007 | 26 (78) | 25 (10) | Scattered sago and abundant cattail and bulrush |
| 2006 | -- (--) | 46 (18) | Thick beds of sago pondweed observed |

Fish Community

Beaver Lake contains relatively few species (Table 2) and black bullheads are usually the most abundant.

Table 2. Fish species commonly found in Beaver Lake, Minnehaha County.

| Game Species | Other Species |
|---------------------|----------------------|
| Walleye | Common Carp |
| Yellow Perch | |
| Black Crappie | |
| Northern Pike | |
| Black Bullhead | |

Fish Management

Beaver Lake is very shallow and prone to significant water level fluctuations. This causes frequent fish kills (Table 3) which makes it difficult to maintain consistent fishing opportunity. The lake is primarily managed for walleye, yellow perch and black crappie and frequent stocking is needed to maintain these populations (Table 4).

Table 3. Fish kill history for Beaver Lake, Minnehaha County.

| Year | Severity | Comments |
|-------------|-----------------|--|
| 2013 | Moderate | 4/5/13 - dead BLC around shoreline after ice out. |
| 2008 | Severe | Near total winterkill. Just 7 bullheads sampled. |
| 2006 | Moderate | 7/5/06 – south side – about 75, 4-6 in walleye |
| 1993 | Total | No live fish sampled. |
| 1991 | Moderate | Partial winterkill. A few bullheads and pike survived. |

Table 4. Stocking history for Beaver Lake, Minnehaha County, 2006-2015.

| Year | Number | Species | Size |
|-------------|---------------|----------------|------------------|
| 2006 | 30,250 | Walleye | Fingerling |
| | 6,666 | Walleye | Large Fingerling |
| | 310 | Walleye | Juvenile |
| | 24,700 | Fathead Minnow | Adult |
| 2007 | 825 | Walleye | Large Fingerling |
| 2008 | 3,283 | Black Crappie | Adult |
| | 820 | Northern Pike | Juvenile |
| | 300,000 | Walleye | Fry |
| | 30,340 | Walleye | Fingerling |
| | 37,185 | Yellow Perch | Fingerling |
| 2010 | 500 | Walleye | Juvenile |
| | 27,000 | Walleye | Fingerling |
| 2011 | 29,900 | Walleye | Fingerling |
| 2012 | 60,500 | Walleye | Fingerling |
| | 54,670 | Yellow Perch | Fingerling |
| 2013 | 161,182 | Yellow Perch | Fingerling |
| 2014 | 300,000 | Walleye | Fry |
| 2015 | 21,054 | Walleye | Fingerling |

Methods

Beaver Lake was sampled June 16-17, 2015 with three overnight gill-net sets and five overnight trap-net sets. The gill nets are 45.7 m long x 1.8 m deep (150 ft long x 6 ft deep) with one 7.6 m (25 ft) panel each of 13, 19, 25, 32, 38 and 51-mm-bar-mesh ($\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, and 2 in) monofilament netting. 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.

Results and Discussion

Net Catch Results

Although comprising the majority of the total fish sampled (Tables 5, 7), black bullhead abundance decreased significantly in 2015 (Table 9). Walleye and yellow perch numbers increased for the second year (Table 9.) Black crappies have not yet recovered from the kill in 2013. Common carp numbers are at a 10-year high.

Table 5. Total catch from three overnight gill nets set in Beaver Lake, Minnehaha County, June 16-17, 2015.

| <i>Species</i> | <i>#</i> | <i>%</i> | <i>CPUE</i> ¹ | <i>80% C.I.</i> | <i>Mean CPUE*</i> | <i>PSD</i> | <i>RSD-P</i> | <i>Mean Wr</i> |
|----------------|----------|----------|--------------------------|-----------------|-------------------|------------|--------------|----------------|
| Black Bullhead | 57 | 26.6 | 19.0 | <u>+7.8</u> | 50.1 | 80 | 54 | -- |
| Common Carp | 56 | 26.2 | 18.7 | <u>+7.4</u> | 6.5 | 0 | 0 | -- |
| Walleye | 55 | 25.7 | 18.3 | <u>+8.7</u> | 6.6 | -- | -- | -- |
| Yellow Perch | 43 | 20.1 | 14.3 | <u>+9.4</u> | 4.7 | 93 | 2 | 110 |
| O. S. Sunfish | 2 | 0.9 | 0.7 | <u>+0.9</u> | 0.1 | -- | -- | -- |
| Northern Pike | 1 | 0.5 | 0.3 | <u>+0.4</u> | 2.4 | -- | -- | -- |

*10 years (2006-2015)

Table 6. CPUE by length category for selected species sampled with gill nets in Beaver Lake, Minnehaha County, June 16-17, 2015.

| <i>Species</i> | <i>Substock</i> | <i>Stock</i> | <i>S-Q</i> | <i>Q-P</i> | <i>P+</i> | <i>All sizes</i> | <i>80% C.I.</i> |
|----------------|-----------------|--------------|------------|------------|-----------|------------------|-----------------|
| Black Bullhead | -- | 19.0 | 2.3 | 4.3 | 12.3 | 19.0 | <u>+7.8</u> |
| Common Carp | 14.7 | 4.0 | 4.0 | -- | -- | 18.7 | <u>+7.4</u> |
| Walleye | 16.7 | 1.7 | -- | 1.0 | 0.7 | 18.3 | <u>+8.7</u> |
| Yellow Perch | -- | 14.3 | 1.0 | 13.0 | 0.3 | 14.3 | <u>+9.4</u> |
| O. S. Sunfish* | -- | -- | -- | -- | -- | 0.7 | <u>+0.9</u> |
| Northern Pike | -- | 0.3 | -- | 0.3 | -- | 0.3 | <u>+0.4</u> |

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

¹ See Appendix A for definitions of CPUE, PSD, RSD, RSD-P and mean Wr.

Table 7. Total catch from five overnight trap nets set in Beaver Lake, Minnehaha County, June 16-17, 2015.

| <i>Species</i> | <i>#</i> | <i>%</i> | <i>CPUE</i> | <i>80% C.I.</i> | <i>Mean CPUE*</i> | <i>PSD</i> | <i>RSD-P</i> | <i>Mean Wr</i> |
|----------------|----------|----------|-------------|-----------------|-------------------|------------|--------------|----------------|
| Black Bullhead | 360 | 89.8 | 72.0 | +23.0 | 354.2 | 85 | 65 | -- |
| Common Carp | 38 | 9.5 | 7.6 | +3.0 | 2.2 | -- | -- | -- |
| Black Crappie | 1 | 0.2 | 0.2 | +0.2 | 19.2 | -- | -- | -- |
| Walleye | 1 | 0.2 | 0.2 | +0.2 | 1.5 | -- | -- | -- |
| Yellow Perch | 1 | 0.2 | 0.2 | +0.2 | 0.1 | -- | -- | -- |

*10 years (2006-2015)

Table 8. CPUE by length category for selected species sampled with trap nets in Beaver Lake, Minnehaha County, June 16-17, 2015.

| <i>Species</i> | <i>Substock</i> | <i>Stock</i> | <i>S-Q</i> | <i>Q-P</i> | <i>P+</i> | <i>All sizes</i> | <i>80% C.I.</i> |
|----------------|-----------------|--------------|------------|------------|-----------|------------------|-----------------|
| Black Bullhead | -- | 72.0 | 10.6 | 14.4 | 47.0 | 72.0 | +23.0 |
| Common Carp | 6.6 | 1.0 | 1.0 | -- | -- | 7.6 | +3.0 |
| Black Crappie | 0.2 | -- | -- | -- | -- | 0.2 | +0.2 |
| Walleye | 0.2 | -- | -- | -- | -- | 0.2 | +0.2 |
| Yellow Perch | -- | 0.2 | -- | 0.2 | -- | 0.2 | +0.2 |

Length categories can be found in Appendix A.

Table 9. Gill-net (GN) and trap-net (TN) CPUE for selected fish species sampled in Beaver Lake, Minnehaha County, 2006-2015.

| <i>Species</i> | <i>Gear</i> | <i>2006</i> | <i>2007</i> | <i>2008</i> | <i>2009</i> | <i>2010</i> | <i>2011</i> | <i>2012</i> | <i>2013</i> | <i>2014</i> | <i>2015</i> |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Black Bullhead | GN | 55.7 | 21.0 | | 1.0 | | | | 129.7 | 74.0 | 19.0 |
| | TN | 395.2 | 190.4 | | 38.1 | | | | 689.3 | 740.0 | 72.0 |
| Black Crappie | GN | 2.0 | -- | | 0.3 | | | | -- | -- | -- |
| | TN | 67.6 | 38.9 | | 8.3 | | | | 0.3 | -- | 0.2 |
| Common Carp | GN | 14.7 | 5.7 | | -- | | | | -- | -- | 18.7 |
| | TN | 1.2 | 4.4 | | -- | | | | -- | 0.2 | 7.6 |
| Northern Pike | GN | -- | -- | | 11.0 | | | | 2.0 | 1.0 | 0.3 |
| | TN | 0.1 | 0.1 | | 1.9 | | | | 0.3 | 1.0 | -- |
| Walleye | GN | 0.4 | 5.3 | | 6.7 | | | | 2.7 | 6.3 | 18.3 |
| | TN | 0.1 | 6.8 | | 0.4 | | | | 0.3 | 1.0 | 0.2 |
| Yellow Perch | GN | 0.7 | 0.3 | | 3.3 | | | | 0.3 | 9.3 | 14.3 |
| | TN | 0.1 | 0.4 | | 0.1 | | | | -- | -- | 0.2 |

Walleye

Management Objective

- Maintain a walleye population with a total gill-net CPUE of at least 10 whenever the lake is deep enough to minimize the risk of fish kills.

Management Strategy

- Stock small walleye fingerlings at the rate of 70/acre (32,000) as needed to achieve the management objective.

Walleye abundance increased again in 2015, and is now above the management objective (Table 10). The population is dominated by individuals less than 10 in long (Figures 2, 3) that were likely produced in 2014 by the fry stocking (Table 11). Barring another fish kill, walleye fishing opportunity should continue to improve in the next couple of years.

Table 10. CPUE, PSD, RSD-P, and mean *Wr* for all walleye sampled with gill nets in Beaver Lake, Minnehaha County, 2006-2015. Stocked years are shaded.

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-----------------------|------|------|------|------|------|------|------|------|------|------|
| CPUE | 0.3 | 5.3 | | 6.7 | | | | 2.7 | 6.3 | 18.3 |
| PSD | -- | 0 | | 5 | | | | -- | 79 | -- |
| RSD-P | -- | 0 | | 0 | | | | -- | 11 | -- |
| Mean <i>Wr</i> | -- | 90 | | 99 | | | | -- | 98 | -- |

Table 11. Walleyes stocked into Beaver Lake, Minnehaha County, 2010-2015.

| Year | Number | Size |
|------|---------|------------------|
| 2010 | 500 | Juvenile |
| | 27,000 | Small Fingerling |
| 2011 | 29,900 | Small Fingerling |
| 2012 | 60,500 | Small Fingerling |
| 2014 | 300,000 | Fry |

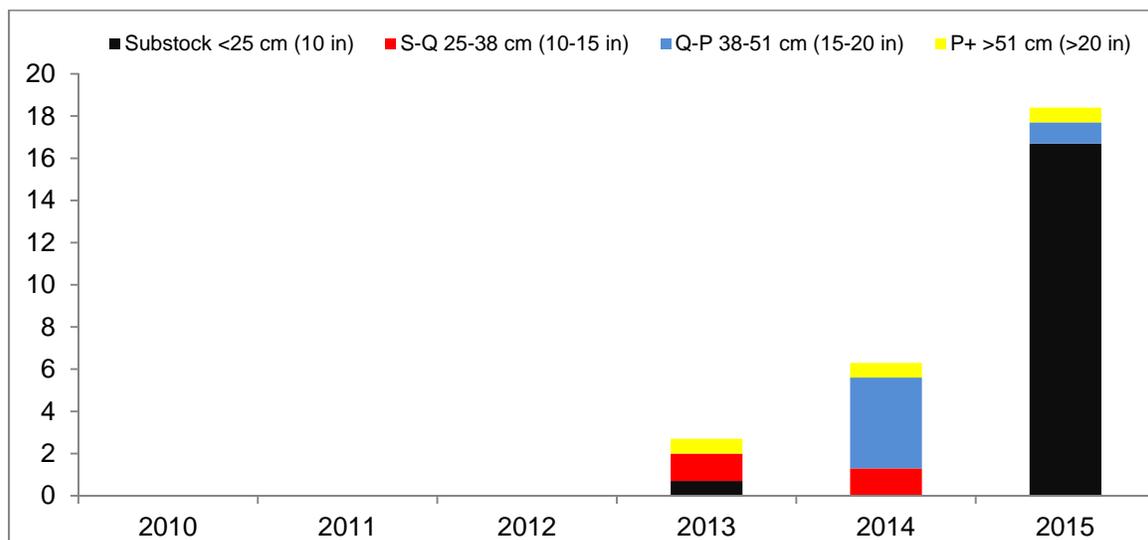
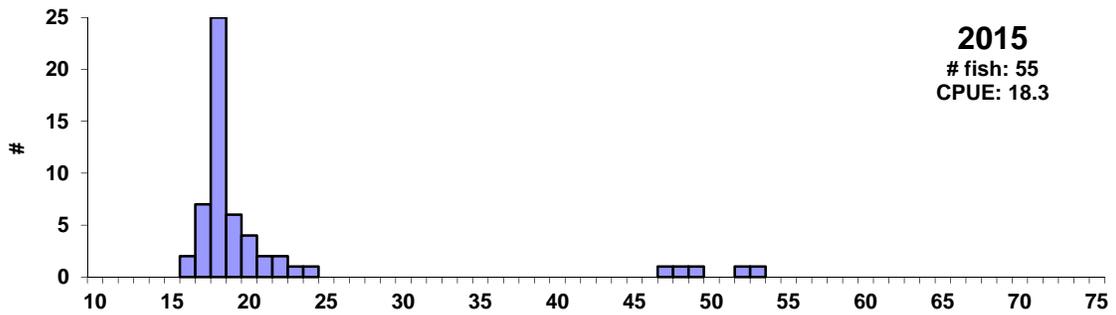
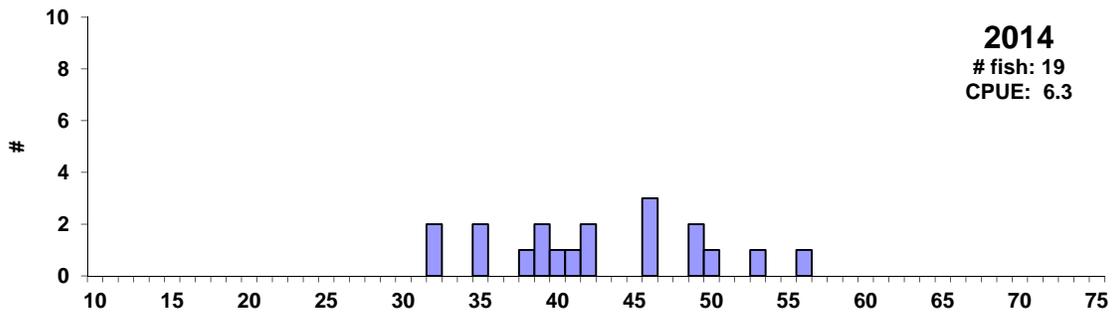
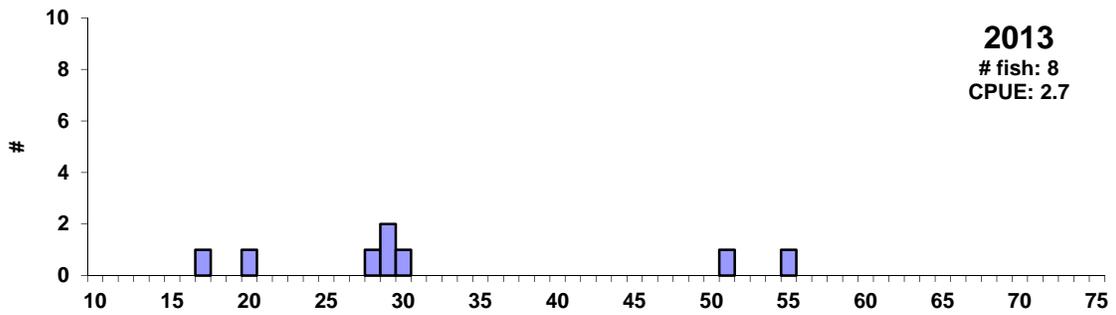
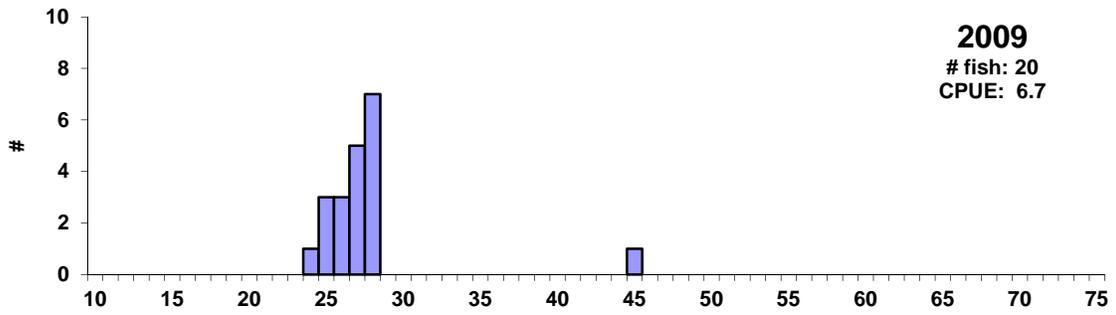


Figure 2. CPUE by length category for walleye sampled with gill nets in Beaver Lake, Minnehaha County, 2010-2015.



Length-Centimeters

Figure 3. Length frequency histograms for walleyes sampled with gill nets in Beaver Lake, Minnehaha County, 2009, 2013, 2014, 2015.

Yellow Perch

Management Objective

- Maintain a yellow perch population with a total gill-net CPUE of at least 15 whenever the lake is deep enough to minimize the risk of fish kills.

Management Strategy

- Stock small yellow perch fingerlings at the rate of 500/acre (160,000) as needed to achieve the management objective. Enable the evaluation of these stockings by marking the stocked fingerlings with oxytetracycline (OTC).

Yellow perch abundance also increased for the second consecutive year. CPUE nearly met the management objective (Table 12) and the majority of the fish sampled were 20-25 cm (8-10 in) long (Figures 4, 5). These fish may have originated from the 2012 and 2013 fingerling stockings (Table 13).

Table 12. CPUE, PSD, RSD-P, and mean *Wr* for all yellow perch sampled with gill nets in Beaver Lake, Minnehaha County, 2006-2015. Stocked years are shaded.

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-----------------------|------|------|------|------|------|------|------|------|------|------|
| CPUE | 0.7 | 0.3 | | 3.3 | | | | 0.3 | 9.7 | 14.3 |
| PSD | -- | -- | | -- | | | | -- | 0 | 93 |
| RSD-P | -- | -- | | -- | | | | -- | 0 | 2 |
| Mean <i>Wr</i> | -- | -- | | -- | | | | -- | 97 | 110 |

Table 13. Yellow perch stocked into Beaver Lake, Minnehaha County, 2006-2015.

| Year | Number | Size |
|------|---------|------------|
| 2008 | 37,185 | Fingerling |
| 2012 | 54,670 | Fingerling |
| 2013 | 161,182 | Fingerling |

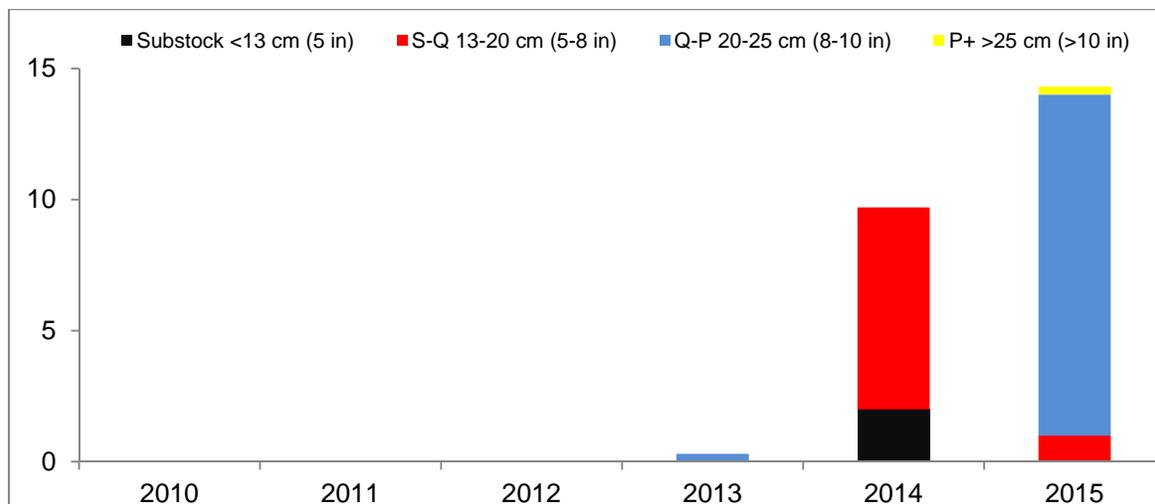


Figure 4. CPUE by length category for yellow perch sampled with gill nets in Beaver Lake, Minnehaha County, 2010-2015.

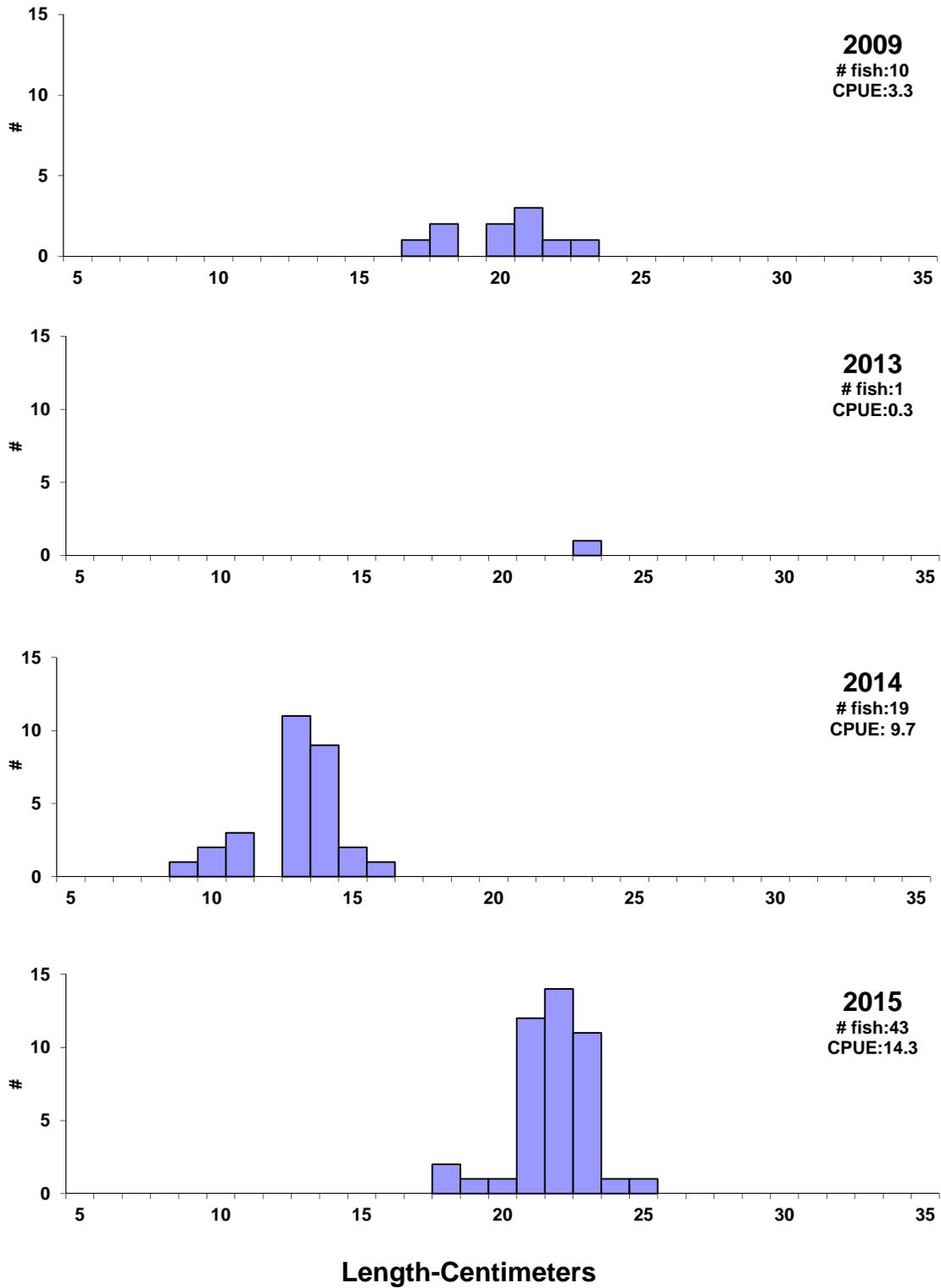


Figure 5. Length frequency histograms for yellow perch sampled with gill nets in Beaver Lake, Minnehaha County, 2009, 2013, 2014, 2015.

Black Crappie

Management Objective

- Maintain fishing opportunity for black crappie.

Management Strategy

- Stock adult or juvenile black crappies at the rate of 10/acre to reestablish a breeding population following a fish kill.

Black crappies have historically been quite abundant in Beaver Lake (Table 14). However, their numbers continue to be very low, with only one fish sampled in 2015 (Table 14). Beaver Lake will be a high priority for stocking should a source of adult or juvenile fish become available.

Table 14. CPUE, PSD, RSD-P, and mean Wr for all black crappies sampled with trap nets in Beaver Lake, Minnehaha County, 2006-2015. Stocked years are shaded.

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|----------------|------|------|------|------|------|------|------|------|------|------|
| CPUE | 67.6 | 38.9 | | 8.3 | | | | 0.3 | 0.0 | 0.2 |
| PSD | 72 | 94 | | 95 | | | | -- | -- | -- |
| RSD-P | 0 | 1 | | 53 | | | | -- | -- | -- |
| Mean Wr | 99 | 103 | | 105 | | | | -- | -- | -- |

Table 15. Black crappies stocked into Beaver Lake, Minnehaha County, 2006-2015.

| Year | Number | Size |
|-------------|---------------|-------------|
| 2008 | 3,283 | Adult |

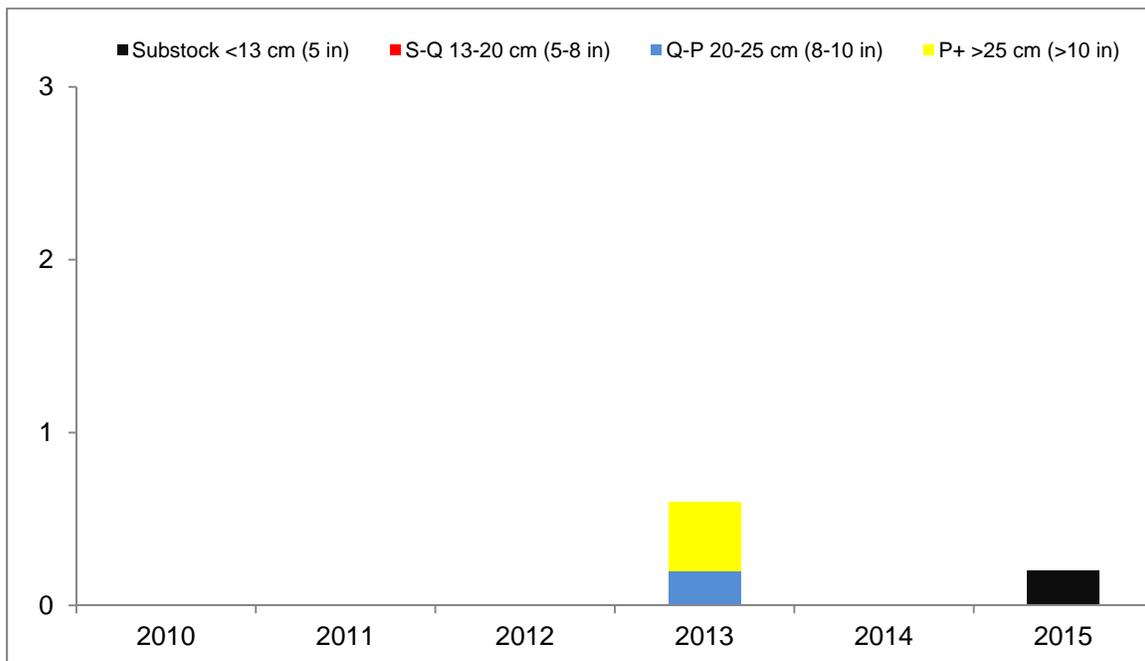
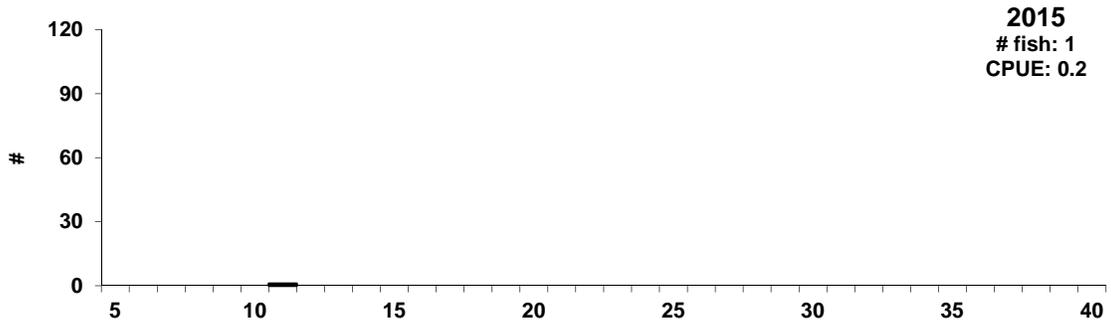
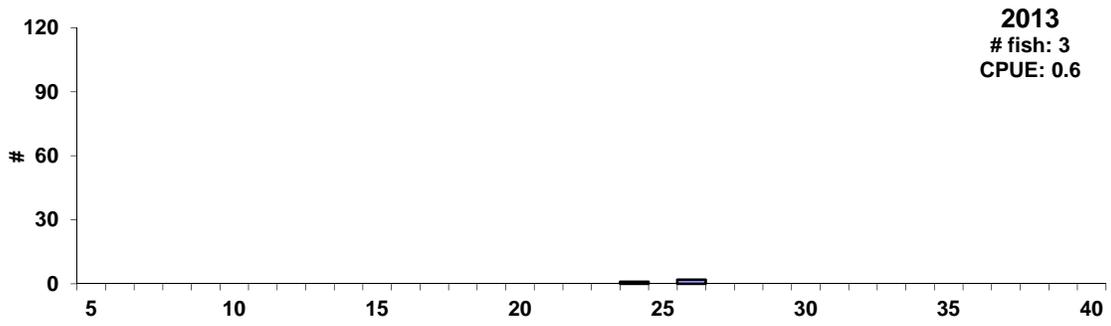
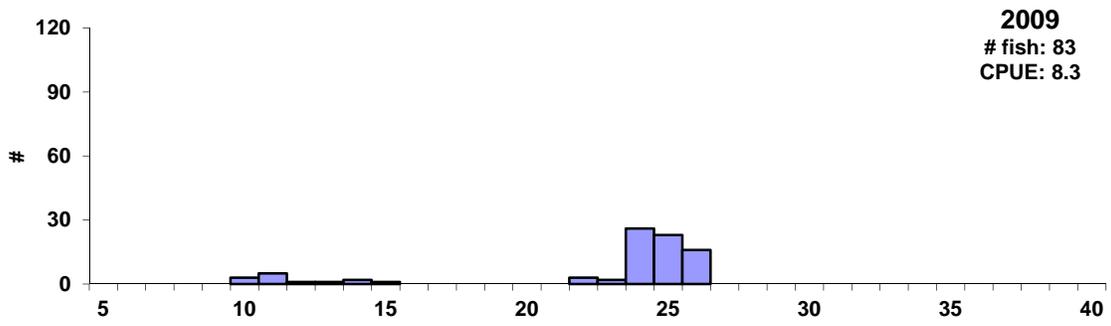
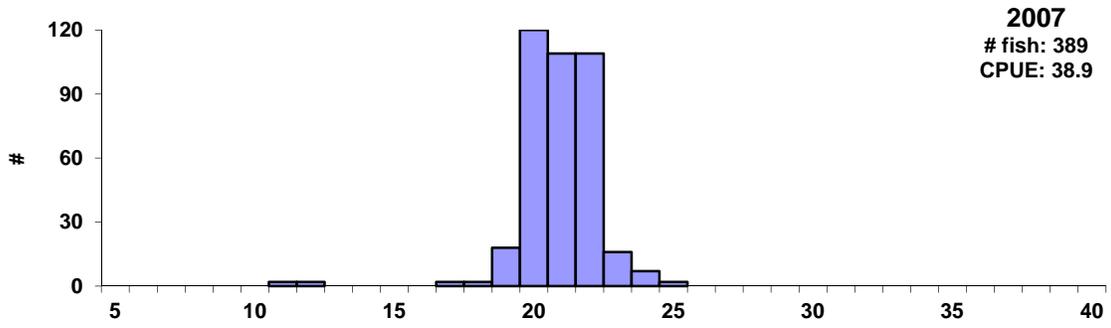


Figure 6. CPUE by length category for black crappies sampled with trap nets in Beaver Lake, Minnehaha County, 2010-2015.



Length-Centimeters

Figure 7. Length frequency histograms for black crappies sampled with trap nets in Beaver Lake, Minnehaha County, 2007, 2009, 2013, 2015.

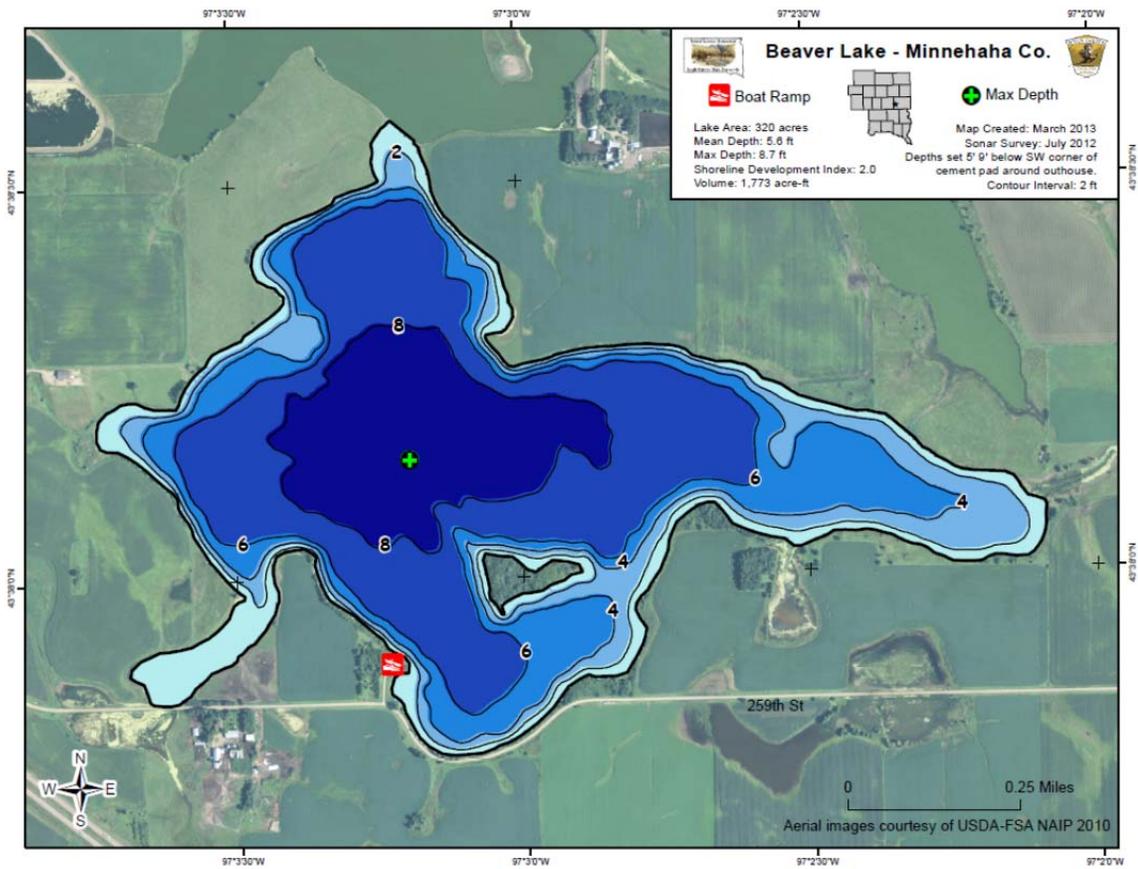


Figure 8. Contour map of Beaver Lake, Minnehaha County.

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 |
|------------------|-------|---------|-----------|-----------|--------|
| Common carp | 28 | 41 | 53 | 66 | 84 |
| White Sucker | 15 | 25 | 33 | 41 | 51 |
| Bigmouth buffalo | 28 | 41 | 53 | 66 | 84 |
| Black bullhead | 15 | 23 | 30 | 38 | 46 |
| Channel catfish | 28 | 41 | 61 | 71 | 91 |
| Northern pike | 35 | 53 | 71 | 86 | 112 |
| White Bass | 15 | 23 | 30 | 38 | 46 |
| Green Sunfish | 8 | 15 | 20 | 25 | 30 |
| Bluegill | 8 | 15 | 20 | 25 | 30 |
| Smallmouth bass | 18 | 28 | 35 | 43 | 51 |
| Largemouth bass | 20 | 30 | 38 | 51 | 63 |
| White crappie | 13 | 20 | 25 | 30 | 38 |
| Black crappie | 13 | 20 | 25 | 30 | 38 |
| Yellow perch | 13 | 20 | 25 | 30 | 38 |
| Walleye | 25 | 38 | 51 | 63 | 76 |
| Freshwater Drum | 20 | 30 | 38 | 51 | 63 |

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.x