SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Brush Lake, Brookings County
2102-F-21-R-49
2016

Figure 1. Brush Lake, Brookings County

Legal Description: T110N-R52W-Sec. 19, 20, 30
Location from nearest town: 2 miles south, ½ mile east of Arlington, SD

Surface Area: 395 acres
Meandered (Y/N): yes
OHWM elevation: no data
Outlet elevation: no data
Max. depth at outlet elevation: 9.4 feet
Observed water level: 1 ft. low
Contour map available (Y/N): yes

Watershed area: no data
Shoreline length: no data
Date set: no data
Date set: no data
Mean depth at outlet elevation: 7.1 feet
Lake volume: 2,810 acre feet
Date mapped: 2011

DENR beneficial use classifications: (9) fish and wildlife propagation, recreation and stock watering.

Introduction

General

It is believed Brush Lake was so named because of the abundance of brush once found along its shorelines.

Ownership of Lake and Adjacent Lakeshore Properties

Brush Lake is listed as a meandered lake in the State of South Dakota Listing of Meandered Lakes and the fishery is managed by the South Dakota Department of Game, Fish, and Parks (GFP). Most of the east and south shoreline is owned by the United States Fish and Wildlife Service. The north shore is considered a public right-of-way for US Highway 14. The remainder of the shoreline is privately owned. The outlet flows west into the Highway 81 Lake complex.

Fishing Access

There is a grassy shoreline on the south shore of the lake where small boats can be launched with difficulty (Figure 1). There are several areas suitable for shore fishing along Highway 14 and the public properties described above.

Water Quality and Aquatic Vegetation

Overall, Brush Lake usually has pretty good water clarity and abundant submerged aquatic vegetation (Table 1). The Secchi measurement in 2016 was 366 cm (144 in) indicating higher than normal water clarity. A small, closed-basin watershed with minimal row crop agriculture and the absence of common carp, likely contribute to high water clarity.

Table 1. Water temperature, Secchi depth and observations/comments on water quality and aquatic vegetation in Brush Lake, Brookings County, 2007-2016.

Year	*Water Temp ^{o}C (^{o}F)*	*Secchi Depth cm (in)*	*Observations/Comments (algae, aquatic vegetation, water quality, etc.)*
2008	22 (72)	120 (47)	Dense aquatic vegetation
2010	24 (76)	122 (48)	Abundant sago, clasping leaf, and northern water milfoil
2012	26 (79)	33 (13)	No aquatic vegetation observations were recorded
2014	21 (70)	46 (18)	Green water from algae. Sago and clasping leaf observed
2015	24 (76)	81 (32)	Sago, cattails, and clasping leaf observed
2016	25 (78)	366 (144)	Cattails, bulrush, heavy sago, coontail, milfoil, clasping leaf

Fish Community

Brush Lake has a very simple fish community consisting of only nine species (Table 2).

Table 2. Fish species commonly found in Brush Lake, Brookings County.

Game Species	*Other Species*
Walleye	White Sucker
Yellow Perch	Fathead Minnow
Northern Pike	Yellow Bullhead
Green Sunfish	
Orange-spotted Sunfish	
Black Bullhead	

Fish Management

Although shallow, no fish kills have ever been observed on Brush Lake (Table 3). The lake is managed primarily for walleye and yellow perch and these populations are maintained by stocking whenever there are gaps in natural reproduction (Table 4). Black crappies were stocked in 2012 in an attempt to establish a population but none have been sampled (Table 7).

Table 3. Fish kill history for Brush Lake, Brookings County.

Year	*Severity*	*Comments*
		No fish kills have ever been observed or recorded on Brush Lake.

Table 4. Stocking history for Brush Lake, Brookings County, 2007-2016.

Year	*Number*	*Species*	*Size*
2009	1,620	Walleye	Large Fingerling
	6,561	Walleye	Small Fingerling
	244,339	Yellow Perch	Fingerling
2010	39,550	Walleye	Small Fingerling
2011	206,640	Yellow Perch	Fingerling
2012	165,360	Yellow Perch	Fingerling
	770	Black Crappie	Juvenile
2014	40,000	Walleye	Small Fingerling
2015	28,160	Walleye	Small Fingerling

Methods

Brush Lake was sampled on July 6-7, 2016 with three overnight gill nets. The gill nets were 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 (½, ¾, 1, 1¼, 1½, and 2 in) monofilament netting.

Results and Discussion

Net Catch Results

Usually, black bullheads are the most abundant species in the gill nets (Table 7). However, this year, yellow perch comprised the majority of the gill net sample (Table 5) and CPUE for black bullhead fell below the 10 year mean.

Table 5. Total catch from three overnight gill nets set in Brush Lake, Brookings County, July 6-7, 2016.

Species	*#*	*%*	*CPUE[1]*	*80% C.I.*	*Mean CPUE**	*PSD*	*RSD-P*	*Mean Wr*
Yellow Perch	169	52.2	56.3	±8.8	54.7	17	0	99
Black Bullhead	130	40.1	43.3	±6.7	103.7	71	2	--
Walleye	23	7.1	7.7	±3.0	18.5	59	41	87
Northern Pike	2	0.6	0.7	±0.9	1.0	--	--	--

*10 years (2007-2016)

Table 6. CPUE by length category for selected species sampled with gill nets in Brush Lake, Brookings County, July 6-7, 2016.

Species	*Substock*	*Stock*	*S-Q*	*Q-P*	*P+*	*All sizes*	*80% C.I.*
Yellow Perch	0.3	56.0	46.7	9.3	--	56.3	±8.8
Black Bullhead	--	43.3	12.7	29.7	1.0	43.3	±6.7
Walleye	0.3	7.3	3.0	1.3	3.0	7.7	±3.0
Northern Pike	--	0.7	--	0.3	0.3	0.7	±0.9

Length categories can be found in Appendix A.

Table 7. Gill-net CPUE for selected fish species sampled in Brush Lake, Brookings County, 2007-2016.

Species	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Black Bullhead		1.0		32.0		112.7		221.3	212.0	43.3
Northern Pike		--		0.7		2.0		1.0	1.7	0.7
O. S. Sunfish		--		--		--		--	0.3	--
Walleye		18.3		24.7		34.0		11.7	14.7	7.7
White Sucker		--		1.0		0.7		0.7	--	--
Yellow Bullhead		--		0.7		--		--	--	--
Yellow Perch		29.3		51.3		86.7		57.7	47.0	56.3

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

Walleye

Management Objective

- maintain a walleye population with a total gill-net CPUE of at least 20

Management Strategy

- stock small walleye fingerlings at the rate of 70/acre as needed to achieve the management objective

Although total walleye abundance in 2016 reached a 10-year low, the percentage of preferred-length (51 cm, 20 in) fish was at a10 year high (Table 8). No walleyes were stocked in 2016 (Table 9).

Table 8. CPUE, PSD, RSD-P, and mean Wr for all walleyes sampled with gill nets in Brush Lake, Brookings County, 2007-2016. Stocked years are shaded.

	2007	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***
CPUE		18.3		24.7		34.0		11.7	14.7	7.7
PSD		14		56		64		97	69	59
RSD-P		0		13		8		14	20	41
Mean Wr		95		101		99		107	92	87

Table 9. Walleyes stocked into Brush Lake, Brookings County, 2007-2016.

Year	***Number***	***Size***
2009	1,620	Large Fingerling
	6,561	Small Fingerling
2010	39,550	Small Fingerling
2014	40,000	Small Fingerling
2015	28,160	Small Fingerling

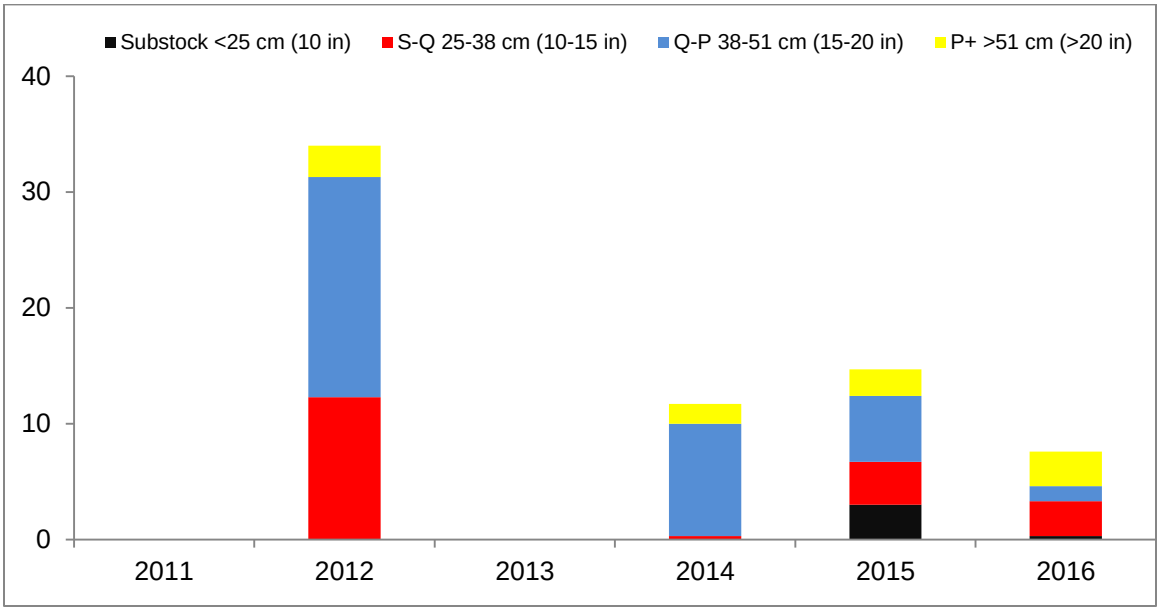

Figure 2. CPUE by length category for walleye sampled with gill nets in Brush Lake, Brookings County, 2011-2016.

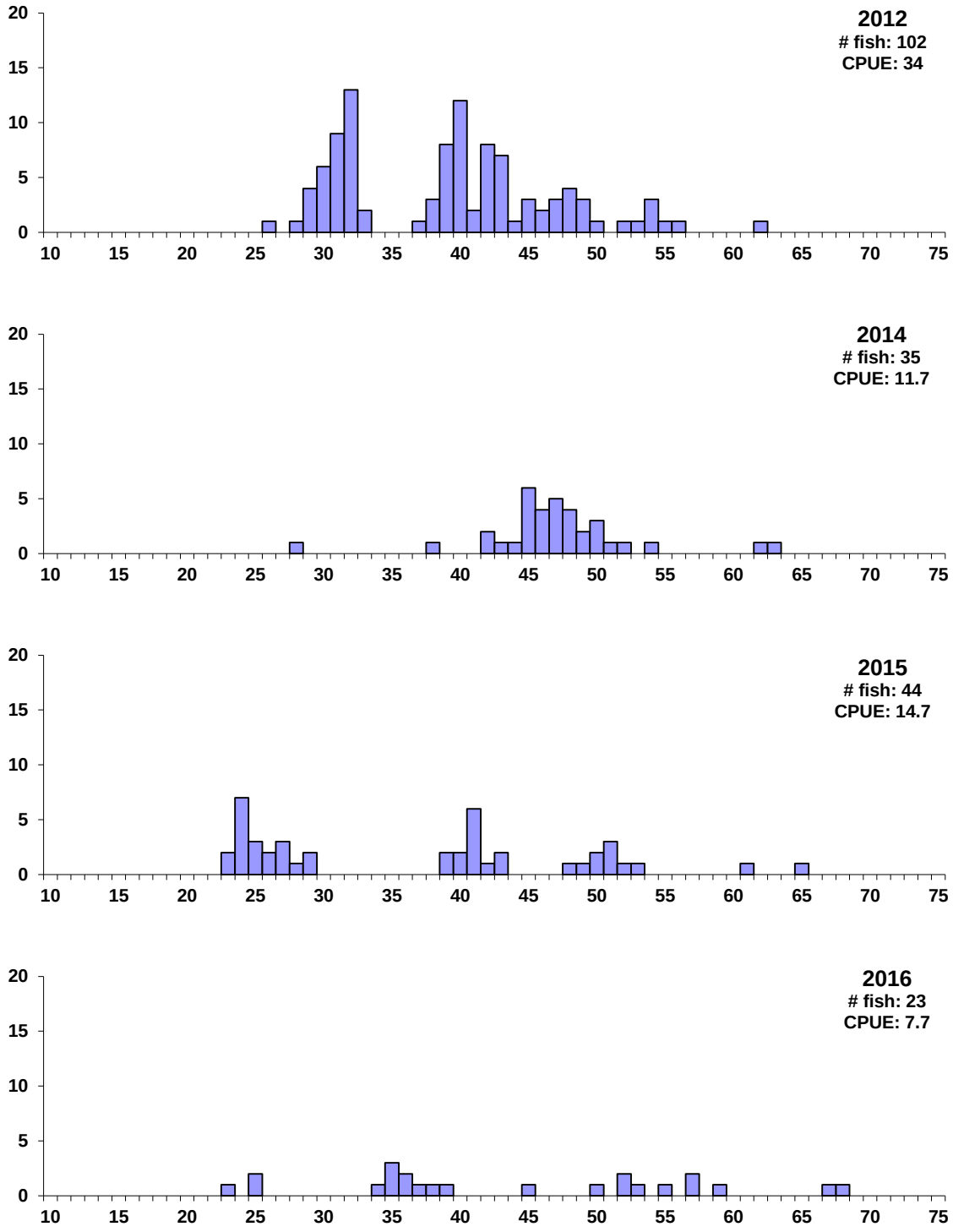

Figure 3. Length frequency histograms for walleyes sampled in Brush Lake, Brookings County, 2012, 2014, 2015, 2016.

Yellow Perch

Management Objective

- maintain a yellow perch population with a total gill-net CPUE of at least 50

Management Strategy

- stock small yellow perch fingerlings as needed to achieve the management objective

Yellow perch abundance has remained relatively stable for several years (Table 10). The population is now comprised of smaller fish (lower PSD and RSD-P) than sampled in 2014 or 2015. This is due to the abundance of young yellow perch naturally produced in 2014-15 (Figures 4 and 5). No fish over 25 cm (10 in.) were netted in 2016.

Table 10. CPUE, PSD, RSD-P, and mean Wr for all yellow perch sampled with gill nets in Brush Lake, Brookings County, 2007-2016. Stocked years are shaded.

	2007	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***
CPUE		29.3		51.3		86.7		57.7	47.0	56.3
PSD		4		7		73		64	26	17
RSD-P		2		7		8		23	5	0
Mean Wr		94		103		93		98	92	99

Table 11. Yellow perch stocked into Brush Lake, Brookings County, 2007-2016.

Year	***Number***	***Size***
2009	244,339	Fingerling
2011	206,640	Fingerling
2012	165,360	Fingerling

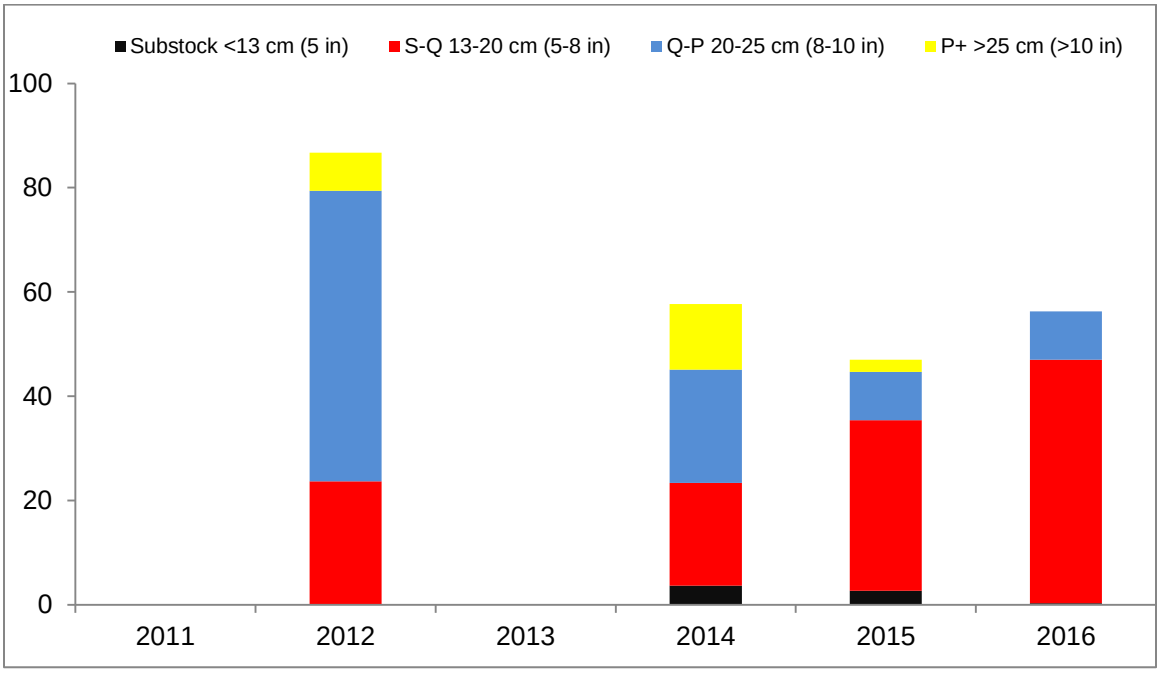

Figure 4. CPUE by length category for yellow perch sampled with gill nets in Brush Lake, Brookings, County, 2011-2016.

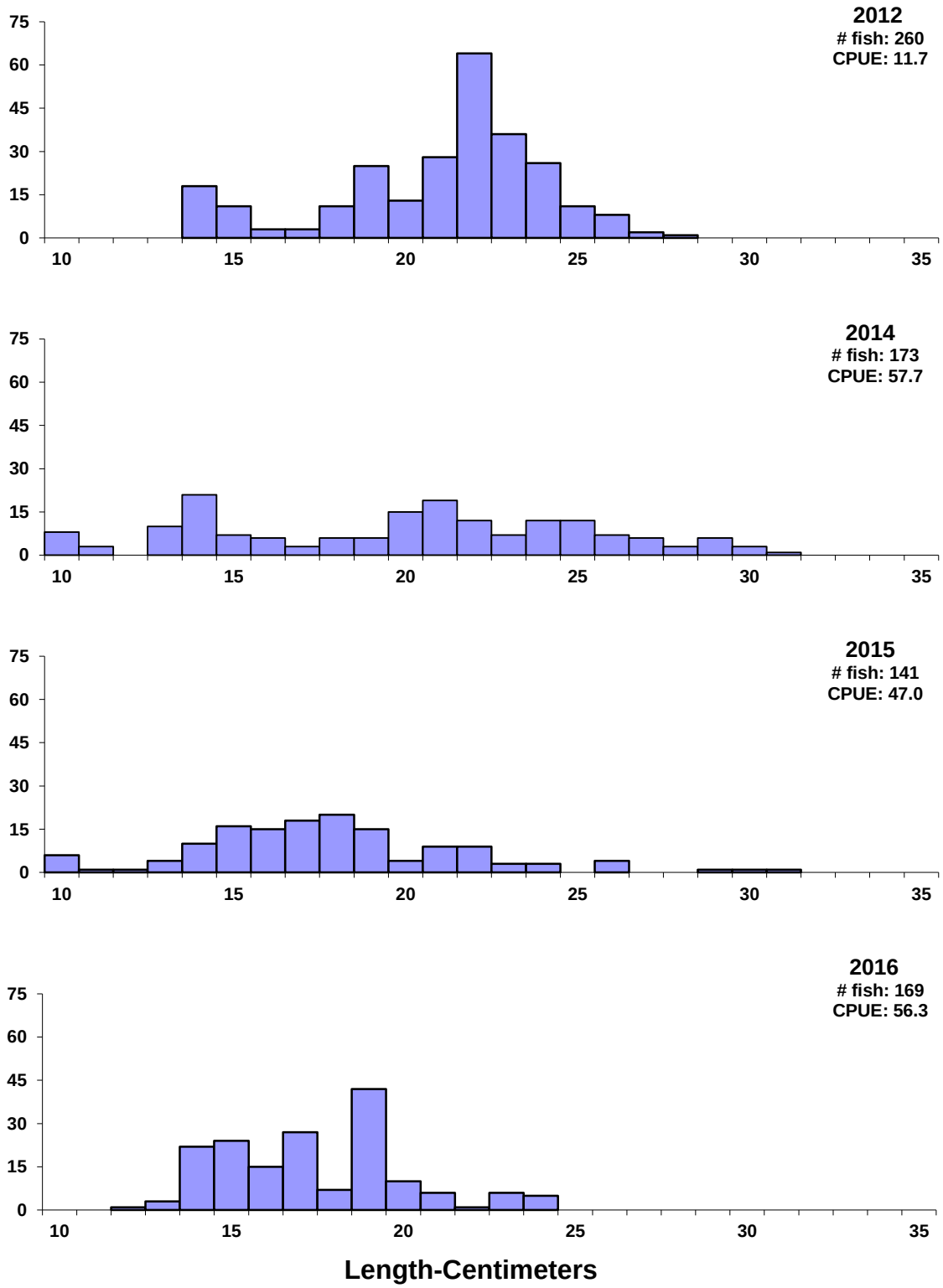

Figure 5. Length frequency histograms for yellow perch sampled with gill-nets in Brush Lake, Brookings County, 2012, 2014, 2015, 2016.

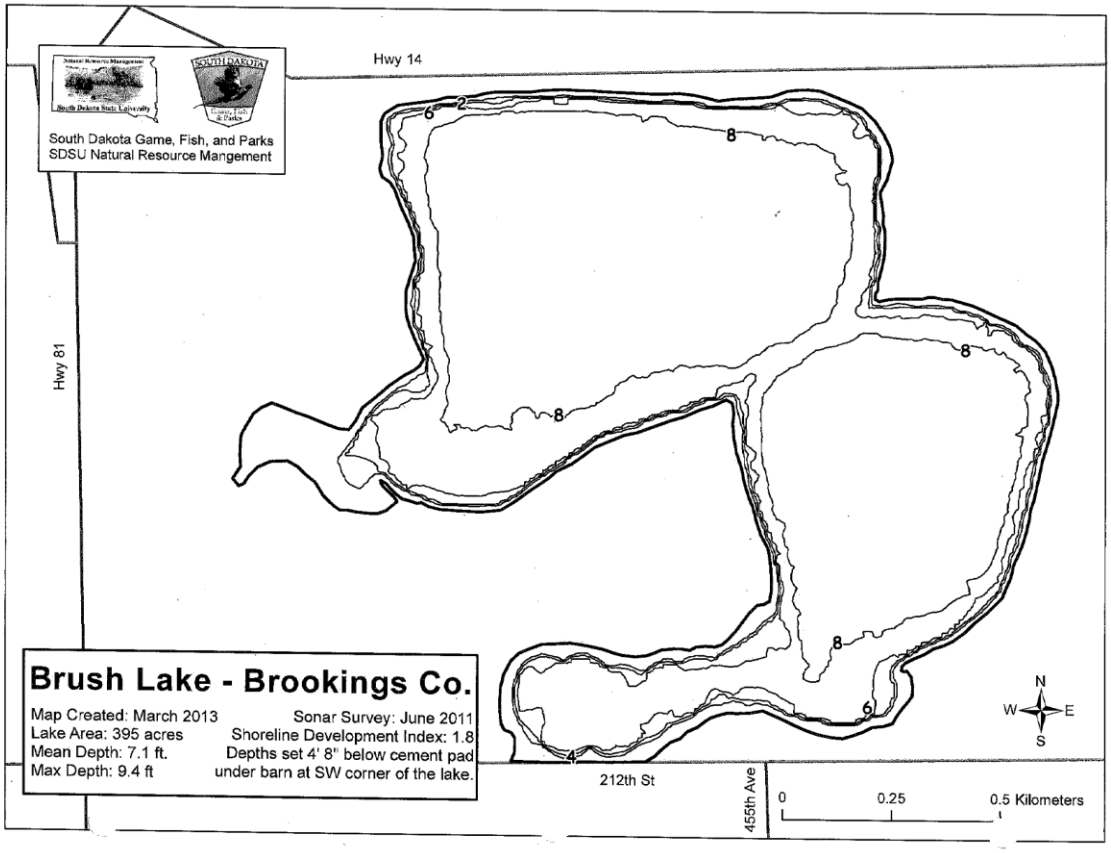

Figure 6. Contour map of Brush Lake, Brookings County.

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:

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

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

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

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 (inches in parenthesis).

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25 (10)	38 (15)	51 (20)	63 (25)	76 (30)
Yellow perch	13 (5)	20 (8)	25 (10)	30 (12)	38 (15)
Black crappie	13 (5)	20 (8)	25(10)	30 (12)	38 (15)
White crappie	13 (5)	20 (8)	25(10)	30 (12)	38 (15)
Bluegill	8 (3)	15 (6)	20 (8)	25 (10)	30 (12)
Largemouth bass	20 (8)	30 (12)	38 (15)	51 (20)	63 (25)
Smallmouth bass	18 (7)	28 (11)	35(14)	43 (17)	51 (20)
Northern pike	35 (14)	53 (21)	71 (28)	86 (34)	112 (44)
Channel catfish	28 (11)	41 (16)	61 (24)	71 (28)	91 (36)
Black bullhead	15 (6)	23 (9)	30 (12)	38 (15)	46 (18)
Common carp	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)
Bigmouth buffalo	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)

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.