

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Brush Lake, Brookings County
2102-F-21-R-47
2014



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: full

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.

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). Contributing factors are likely a very small, closed-basin watershed that has minimal row crop agriculture and no common carp population.

Table 1. Water temperature, Secchi depth and observations/comments on water quality and aquatic vegetation in Brush Lake, Brookings County, 2005-2014.

Year	Water Temp °C (°F)	Secchi Depth cm (in)	Observations/Comments (algae, aquatic vegetation, water quality, etc.)
2006	20 (68)	122 (48)	Algae, sago, clasping leaf, and northern water milfoil
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

Fish Community

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

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

<i>Game Species</i>	<i>Other Species</i>
Walleye	White Sucker
Yellow Perch	Fathead Minnow
Northern Pike	
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 were sampled in 2014 (Table 7).

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

<i>Year</i>	<i>Severity</i>	<i>Comments</i>
		No fish kills have ever been observed or recorded on Brush Lake.

Table 4. Stocking history for Brush Lake, Brookings County, 2005-2014.

<i>Year</i>	<i>Number</i>	<i>Species</i>	<i>Size</i>
2005	38,600	Walleye	Small Fingerling
2006	40,220	Walleye	Small Fingerling
	435	Yellow Perch	Adult
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

Methods

Brush Lake was sampled on July 1-2, 2014 with three overnight gill nets. 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.

Results and Discussion

Net Catch Results

Although black bullheads comprised the majority of the gill net sample, good numbers of yellow perch and walleye were also caught (Table 5). Gill-net CPUE for black bullhead is the highest recorded in 10 years but it's also notable that no common carp have been sampled in that time (Table 7).

Table 5. Total catch from three overnight gill nets set in Brush Lake, Brookings County, July 1-2, 2014.

<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	664	75.6	221.3	+16.3	42.7	19	--	--
Yellow Perch	173	19.7	57.7	+9.9	42.7	64	23	98
Walleye	35	4.0	11.7	+3.5	42.4	97	14	107
Northern Pike	3	0.3	1.0	+1.3	1.0	--	--	--
White Sucker	2	0.2	0.7	+0.9	0.8	--	--	--
O. S. Sunfish	1	0.1	0.3	+0.4	0.0	--	--	--

*10 years (2005-2014)

Table 6. CPUE by length category for selected species sampled with gill nets in Brush Lake, Brookings County, July 1-2, 2014.

<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	--	221.3	179.3	42.0	--	221.3	+16.3
Yellow Perch	3.7	54.0	19.7	21.7	12.6	57.7	+9.9
Walleye	--	11.7	0.3	9.7	1.7	11.7	+3.5
Northern Pike	--	1.0	--	1.0	--	1.0	+1.3
White Sucker	--	0.7	--	--	0.7	0.7	+0.9
O. S. Sunfish*	--	--	--	--	--	0.3	+0.4

*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. Gill-net (GN) and trap-net (TN) CPUE for selected fish species sampled in Brush Lake, Brookings County, 2005-2014.

<i>Species</i>	<i>Gear</i>	<i>2005</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>
Black Bullhead	GN		25.0		1.0		32.0		112.7		221.3
	TN		208.2		13.8		31.8		653.5		
Green Sunfish	GN		--		--		--		--		--
	TN		0.2		0.5		0.2		12.6		
Northern Pike	GN		1.3		--		0.7		2.0		1.0
	TN		3.0		0.5		0.2		1.9		
Walleye	GN		92.7		18.3		24.7		34.0		11.7
	TN		6.0		2.8		2.3		1.4		
White Sucker	GN		1.3		--		1.0		0.7		0.7
	TN		0.8		1.8		1.2		0.6		
Yellow Bullhead	GN		2.0		--		0.7		--		--
	TN		0.8		--		--		1.1		
Yellow Perch	GN		3.3		29.3		51.3		86.7		57.7
	TN		0.8		--		7.2		13.1		

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 100/acre as needed to achieve the management objective

Since 2012, walleye abundance has declined while size structure indices (PSD, RSD-P) have improved (Table 8). Younger year classes are currently missing from the population (Figures 2, 3) indicating poor natural reproduction and/or recruitment from 2011-2013. Small walleye fingerlings were stocked in 2014 and a few age-0 fish were sampled during fall small-mesh gill netting for yellow perch. If survival is good, these fish should appear in the 2015 gill net catch.

Table 8. CPUE, PSD, RSD-P, and mean *Wr* for all walleyes sampled with gill nets in Brush Lake, Brookings County, 2005-2014. Stocked years are shaded.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CPUE		92.7		18.3		24.7		34.0		11.7
PSD		18		14		56		64		97
RSD-P		1		0		13		8		14
Mean <i>Wr</i>		98		95		101		99		107

Table 9. Walleyes stocked into Brush Lake, Brookings County, 2005-2014.

Year	Number	Size
2005	38,600	Small Fingerling
2006	40,220	Small Fingerling
2009	1,620	Large Fingerling
	6,561	Small Fingerling
2010	39,550	Small Fingerling
2014	40,000	Small Fingerling

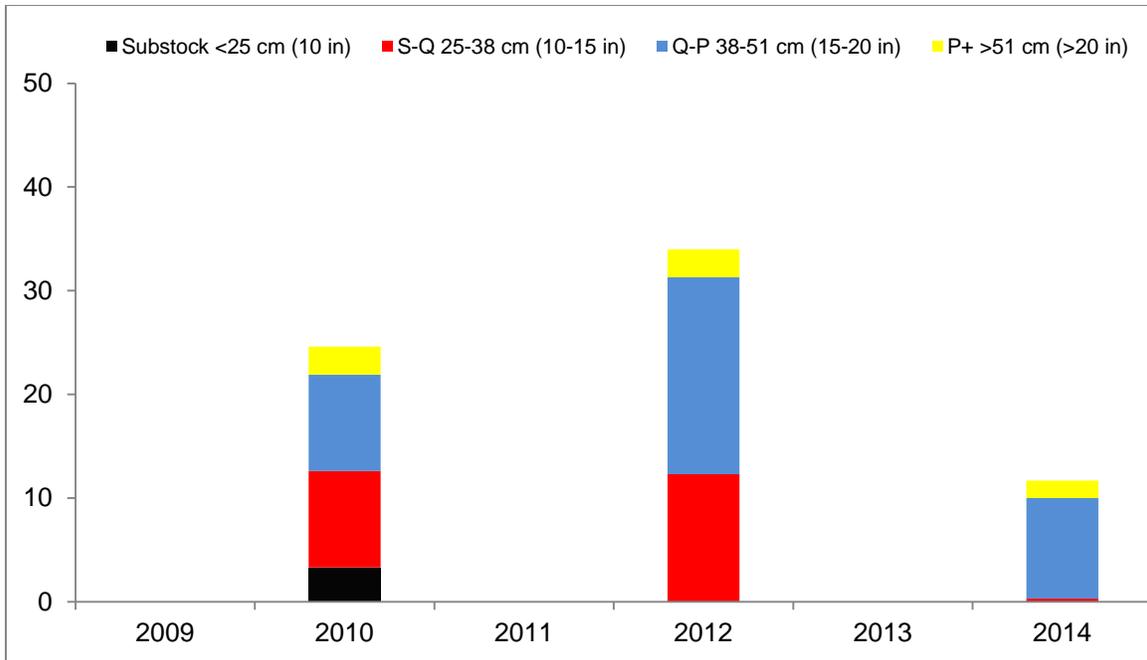


Figure 2. CPUE by length category for walleye sampled with gill nets in Brush Lake, Brookings County, 2009-2014.

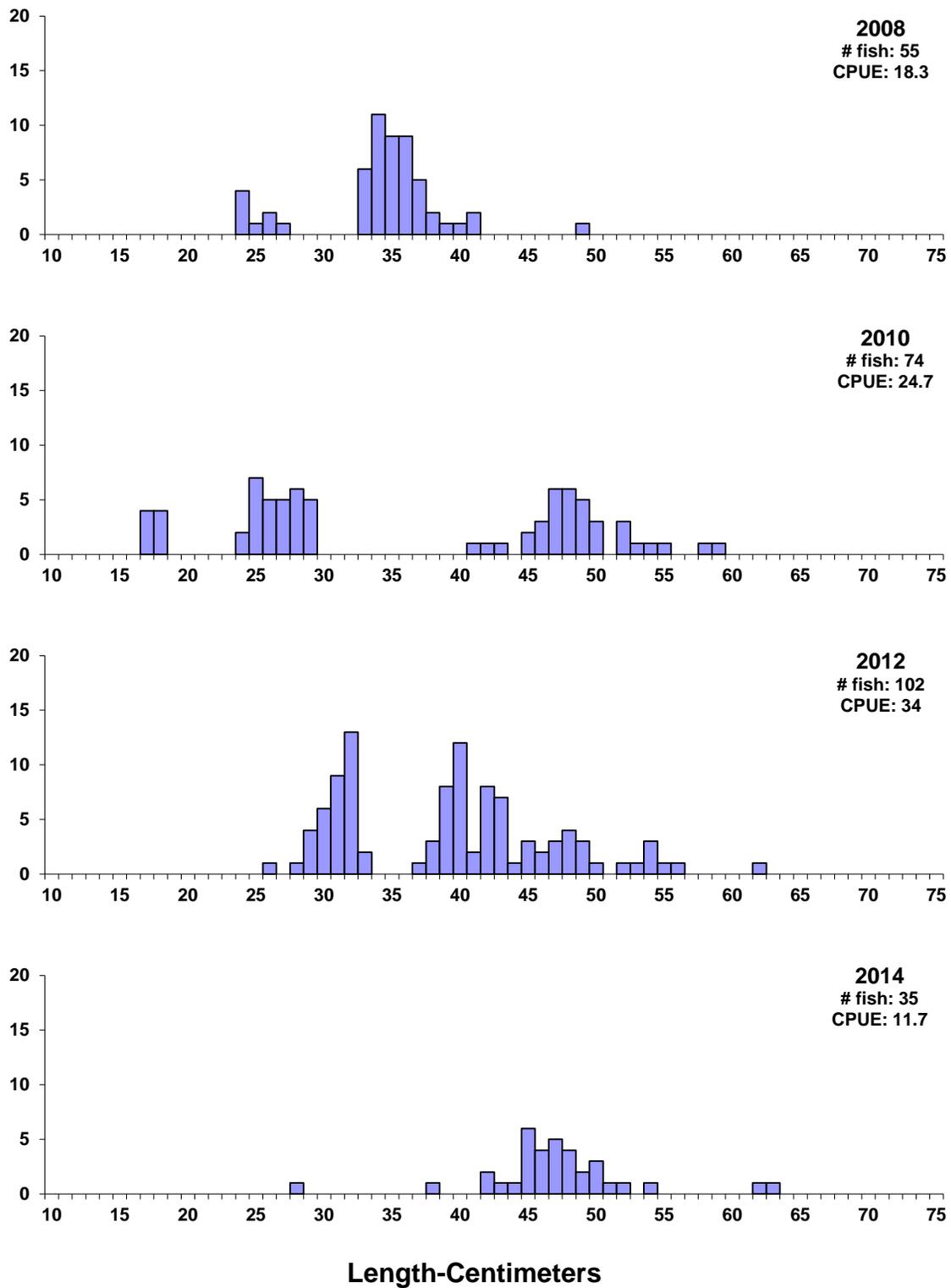


Figure 3. Length frequency histograms for walleyes sampled in Brush Lake, Brookings County, 2008, 2010, 2012, 2014.

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 declined in 2014 but the population contains a greater proportion of larger fish (RSD-P) than it did in 2012 (Table 10). Figures 4 and 5 also indicate the presence of a young year class that was likely produced naturally in 2013 and age-0 yellow perch were sampled in cloverleaf traps set this fall.

Table 10. CPUE, PSD, RSD-P, and mean Wr for all yellow perch sampled with gill nets in Brush Lake, Brookings County, 2005-2014. Stocked years are shaded.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CPUE		3.3		29.3		51.3		86.7		57.7
PSD		30		4		7		73		64
RSD-P		30		2		7		8		23
Mean Wr		97		94		103		93		98

Table 11. Yellow perch stocked into Brush Lake, Brookings County, 2005-2014.

Year	Number	Size
2006	435	Adult
2009	244,339	Fingerling
2011	206,640	Fingerling
2012	165,360	Fingerling

Table 12. Weighted mean length at capture (mm) for yellow perch sampled with gill nets in Brush Lake, Brookings County, 2014. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size is in parentheses.

Year	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10
2014	139	210	245	287	--	--				
(173)	(53)	(59)	(41)	(20)						

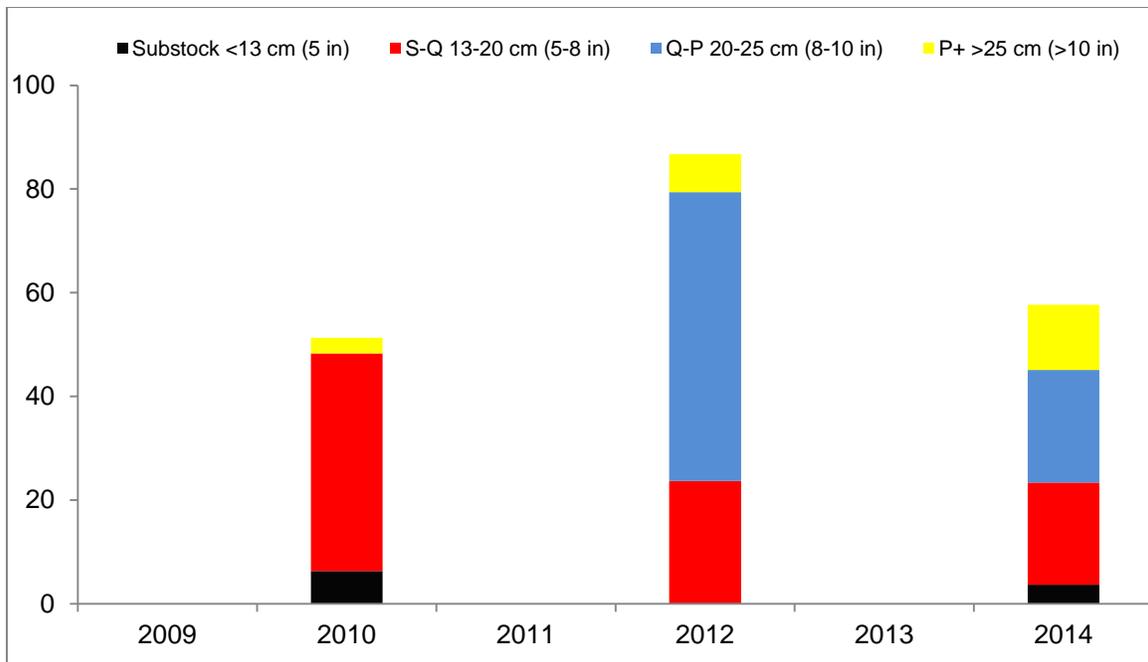


Figure 4. CPUE by length category for yellow perch sampled with gill nets in Brush Lake, Brookings, County, 2009-2014.

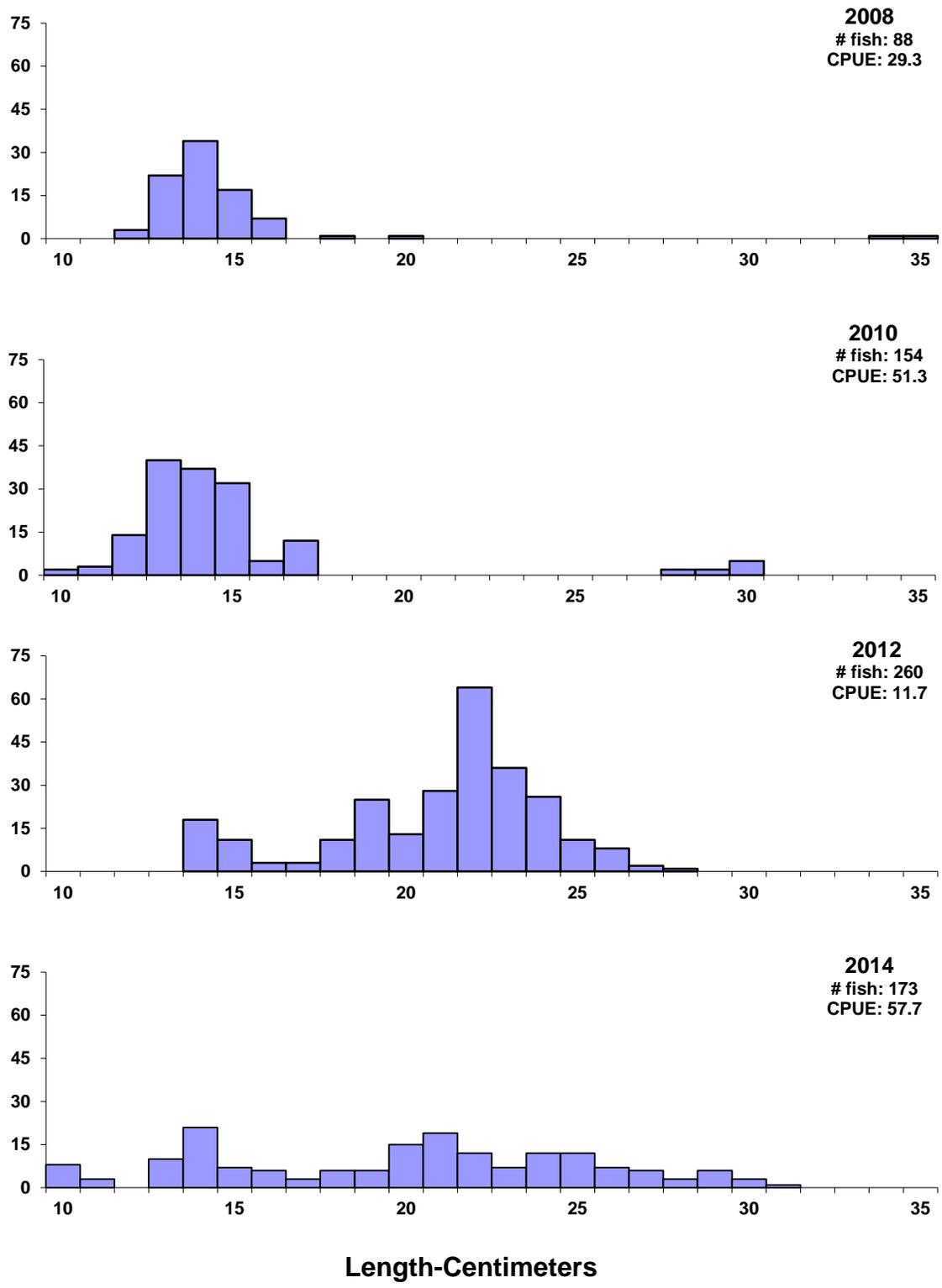


Figure 5. Length frequency histograms for yellow perch sampled with gill-nets in Brush Lake, Brookings County, 2008, 2010, 2012, 2014.

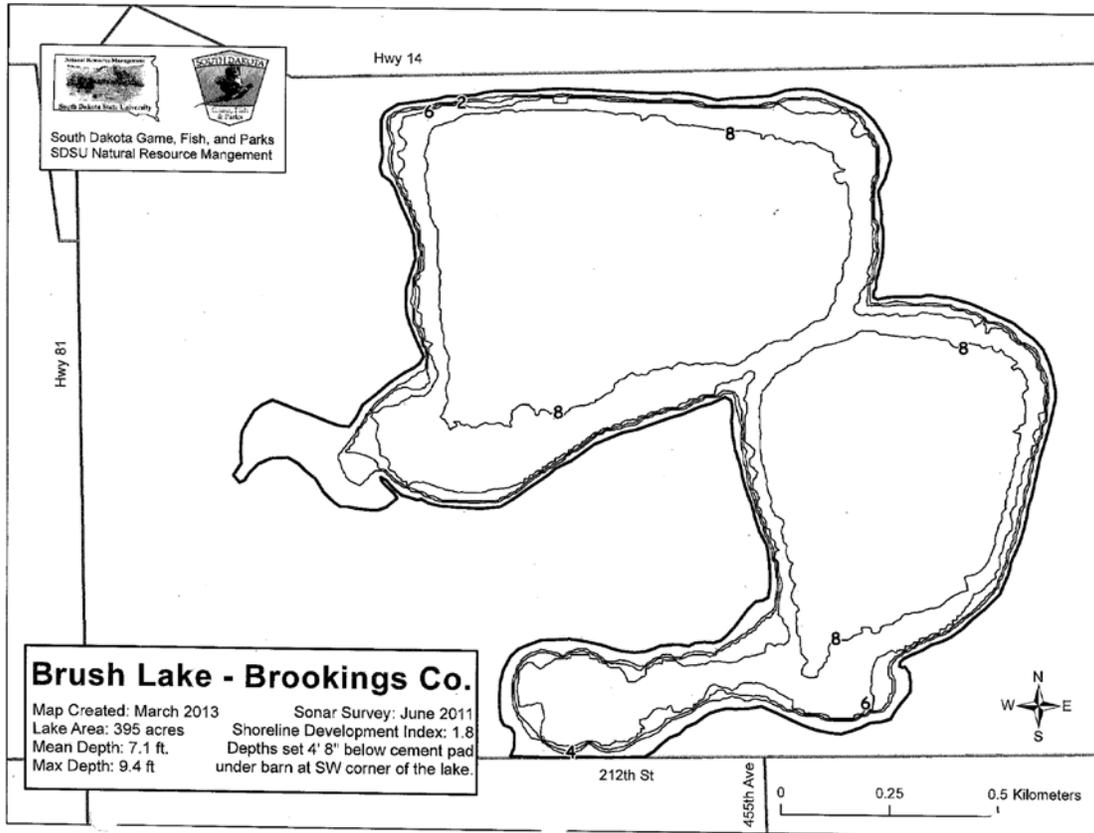


Figure 6. Contour map of Brush Lake, Brookings County.

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:

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

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 (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.