SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Lake Alvin, Lincoln County
2102-F-21-R-47
2014

Figure 1. Lake Alvin, Lincoln County

Legal Description: T100N-R49W-Sec.33, 34
Location from nearest town: 3 miles east of Harrisburg, SD

Surface Area: 105 acres
Meandered (Y/N): No
OHWM elevation: NA
Outlet elevation: NA
Max. depth at outlet elevation: 26 feet
Observed water level: Full
Contour map available (Y/N): Yes

Watershed area: 24,564 acres
Shoreline length: 4.3 miles
Date set: NA
Date set: NA
Mean depth at outlet elevation: 9 feet
Lake volume: 930 acre feet
Date mapped: 1997

DENR beneficial use classifications: (4) warmwater permanent fish propagation, (7) immersion recreation, (8) limited-contact recreation and (9) fish and wildlife propagation and stock watering

Introduction

General

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.

Fishing Access

The Lake Alvin Recreation Area on the northeast side of the lake has a single lane boat ramp, boat dock, concrete vault toilet, and parking lot as well as several areas accessible to shore fishing (Figure 1). On the southeast corner of the dam there is a handicapped accessible fishing dock and several additional shore fishing areas. The Northwest Access Area has a public toilet and a narrow boat ramp with a dock suitable for small boats. There is plenty of shoreline to fish but the lake 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.

Water Quality and Aquatic Vegetation

Water clarity varies considerably from year to year depending on the amount of runoff the lake receives from the watershed (Table 1). The abundance of submerged aquatic is directly related to water clarity.

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

Year	*Water Temp °C (°F)*	*Secchi Depth cm (in)*	*Observations/Comments (algae, aquatic vegetation, water quality, etc.)*
2014	26 (79)	52 (20)	Some sago pondweed and cattails
2013	27 (81)	97 (38)	Some sago pondweed, cattails
2012	26 (78)	61 (24)	Small beds of sago pondweed, floating-leaf pondweed
2011	21 (69)	41 (15)	Sago pondweed, cattails, floating-leaf pondweed
2010	24 (75)	41 (16)	--
2009	28 (82)	244 (96)	Scattered beds of sago pondweed and cattails
2008	24 (75)	100 (39)	Small beds of sago pondweed, floating-leaf pondweed
2007	26 (79)	325 (128)	Sago pondweed, floating-leaf pondweed, cattails
2006	-- (--)	162 (64)	Sago pondweed, floating-leaf pondweed, cattails
2005	24(75)	30 (12)	Sago pondweed, floating-leaf pondweed, cattails

Fish Community

Lake Alvin contains a very diverse fish community for a relatively small impoundment (Table 2). Many, like largemouth bass, bluegill and crappie are normally found in small impoundments while river species, like freshwater drum, river carpsucker and bigmouth buffalo likely entered from the Big Sioux River during extreme flood events.

Table 2. Fish species commonly found in Lake Alvin, Lincoln County.

Game Species	***Other Species***
Largemouth Bass	Common Carp
Black Crappie	Freshwater Drum
Walleye	River Carpsucker
Bluegill	White Sucker
Channel Catfish	Bigmouth Buffalo
White Crappie	Golden Shiner
Black Bullhead	
Yellow Bullhead	
Orange-spotted Sunfish	
Green Sunfish	
Northern Pike	
Yellow Perch	

Fish Management

Abundant non-game species compete with game fish for forage and reduce fishing opportunity. In addition, poor water quality and the resulting lack of abundant aquatic vegetation also limit the fishery. Fish kills have also become more common in recent years (Table 3). Stockings of overwintered juvenile largemouth bass and walleye have been attempted to increase fishing opportunity (Table 4).

Table 3. Fish kill history for Lake Alvin, Lincoln County.

Year	***Severity***	***Comments***
2010	Light	Minor summer kills of bluegill and crappie
2004	Moderate	Summer kill of crappie and carp on 6/22/04
2003	Light	9/2/03 – bay W of fishing pier – 90 BLG, 7 LMB, 40 WHS
2001	Light	September fish kill, possible fall turnover

Table 4. Stocking history for Lake Alvin, Lincoln County, 2005-2014.

Year	***Number***	***Species***	***Size***
2014	90,000	Walleye	Fry
2013	1,056	Largemouth Bass	Large Fingerling
	300	Walleye	Adult
2012	259	Largemouth Bass	Adult
2011	2,240	Largemouth Bass	Large Fingerling
2010	1,585	Largemouth Bass	Juvenile
2008	684,610	Fathead Minnow	Adult
2007	430	Walleye	Adult
2005	460	Channel Catfish	Adult

Methods

Lake Alvin was sampled on June 24-25, 2014 with three overnight gill-net sets and ten 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 (½, ¾, 1, 1¼, 1½, and 2 in) monofilament netting. The trap nets are constructed with 19-mm-bar-mesh (¾ 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

Black bullheads comprised about 53% of the gill net sample and 96% of the trap net sample (Tables 4, 6). The majority of bullheads sampled in both gears were smaller than stock length (15 cm, 6 in) (Table 5). Channel catfish and black crappie were the only game species sampled in significant abundance. Bigmouth buffalo, freshwater drum and river carpsucker likely entered the lake from the Big Sioux River during major flood events in 2009, 2011 and 2014 (Table 8).

Table 5. Total catch from three overnight gill nets set in Lake Alvin, Lincoln County, June 24-25, 2014.

Species	***#***	***%***	***CPUE[1]***	***80% C.I.***	***Mean CPUE****	***PSD***	***RSD-P***	***Mean Wr***
Black Bullhead	46	52.9	15.3	±13.6		--	--	--
Channel Catfish	16	18.4	5.3	±1.9		75	6	89
Common Carp	7	8.0	2.3	±1.5		--	--	--
Freshwater Drum	6	6.9	2.0	±1.5		--	--	--
White Sucker	6	6.9	2.0	±1.3		--	--	--
River Carpsucker	4	4.6	1.3	±1.7		--	--	--
Northern Pike	2	2.3	0.7	±0.9		--	--	--

*10 years (2005-2014)

Table 6. CPUE by length category for selected species sampled with gill nets in Lake Alvin, Lincoln County, June 24-25, 2014.

Species	***Substock***	***Stock***	***S-Q***	***Q-P***	***P+***	***All sizes***	***80% C.I.***
Black Bullhead	13.3	2.0	1.0	1.0	--	15.3	±13.6
Channel Catfish	--	5.3	1.3	3.7	0.3	5.3	±1.9
Common Carp	1.3	1.0	0.3	--	0.7	2.3	±1.5
Freshwater Drum	0.3	1.7	1.3	0.3	--	2.0	±1.5
White Sucker	--	2.0	0.7	0.7	0.7	2.0	±1.3
River Carpsucker	--	1.3	1.3	--	--	1.3	±1.7
Northern Pike	--	0.7	--	0.7	--	0.7	±0.9

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 ten overnight trap nets set in Lake Alvin, Lincoln County, June 24-25, 2014.

Species	*#*	*%*	*CPUE*	*80% C.I.*	*Mean CPUE**	*PSD*	*RSD-P*	*Mean Wr*
Black Bullhead	5,356	96.3	535.6	±250.7	103.4	16	0	--
Black Crappie	70	1.3	7.0	±3.6	38.0	77	2	93
White Sucker	35	0.6	3.5	±1.1	4.0	82	67	--
Bluegill	32	0.6	3.2	±1.9	57.2	78	3	100
Common Carp	26	0.5	2.6	±1.1	0.5	--	--	--
Channel Catfish	20	0.4	2.0	±1.0	3.5	42	0	88
White Crappie	8	0.1	0.8	±0.8	0.4	--	--	--
Bigmouth Buffalo	6	0.1	0.6	±0.5	0.1	--	--	--
Yellow Bullhead	6	0.1	0.6	±0.3	0.1	--	--	--
Northern Pike	3	0.1	0.3	±0.2	0.2	--	--	--
River Carpsucker	3	0.1	0.3	±0.2	0.1	--	--	--
Yellow Perch	2	0.0	0.2	±0.2	0.3	--	--	--
Largemouth Bass	1	0.0	0.1	±0.1	0.0	--	--	--
O. S. Sunfish	1	0.0	0.1	±0.1	0.5	--	--	--

*10 years (2005-2014)

Table 8. CPUE by length category for selected species sampled with trap nets in Lake Alvin, Lincoln County, June 24-25, 2014.

Species	*Substock*	*Stock*	*S-Q*	*Q-P*	*P+*	*All sizes*	*80% C.I.*
Black Bullhead	465.5	70.1	59.1	11.0	--	535.6	±250.7
Black Crappie	0.8	6.2	1.4	4.7	0.1	7.0	±3.6
White Sucker	0.2	3.3	0.6	0.5	2.2	3.5	±1.1
Bluegill	--	3.2	0.7	2.4	0.1	3.2	±1.9
Common Carp	1.7	0.9	0.7	--	0.2	2.6	±1.1
Channel Catfish	0.1	1.9	1.1	0.8	--	2.0	±1.0
White Crappie	--	0.8	--	0.5	0.3	0.8	±0.8
Bigmouth Buffalo	0.1	0.5	0.2	0.2	0.1	0.6	±0.5
Yellow Bullhead	--	0.6	--	--	0.6	0.6	±0.3
Northern Pike	--	0.3	--	0.3	--	0.3	±0.2
River Carpsucker	--	0.3	0.3	--	--	0.3	±0.2
Yellow Perch	--	0.2	0.2	--	--	0.2	±0.2
Largemouth Bass	0.1	--	--	--	--	0.1	±0.1
O. S. Sunfish*	--	--	--	--	--	0.1	±0.1

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

Table 9. Gill-net (GN), or trap-net (TN) CPUE for selected fish species sampled in Lake Alvin, Lincoln County, 2005-2014.

Species	*Gear*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*
Bigmouth	GN										--
Buffalo	TN	--	--	--	--	--	--	0.6	--	0.2	0.6
Black	GN										15.3
Bullhead	TN	11.8	198.2	136.8	39.2	65.7	59.4	31.6	16.5	26.2	535.6
Black	GN										--
Crappie	TN	26.7	17.7	32.1	15.9	16.7	183.7	41.0	13.5	44.5	7.0
	GN										--
Bluegill	TN	186.1	47.5	87.9	26.1	27.5	21.3	6.1	47.5	4.1	3.2
Channel	GN										5.3
Catfish	TN	0.7	2.4	1.2	3.1	7.3	8.4	3.1	5.9	2.6	2.0
Common	GN										2.3
Carp	TN	0.5	--	--	--	0.1	0.4	1.1	--	0.2	2.6
Freshwater	GN										2.0
Drum	TN	--	--	--	--	0.6	--	0.5	0.4	--	--
Golden	GN										--
Shiner	TN	0.1	--	0.1	--	--	--	--	0.2	0.1	--
Green	GN										--
Sunfish	TN	0.2	0.3	0.5	--	0.9	--	--	--	0.2	--
Hybrid	GN										--
Sunfish	TN	--	0.1	0.1	--	0.2	--	--	--	--	--
Largemouth	GN										--
Bass	TN	--	0.1	--	--	0.1	--	--	0.2	--	0.1
Northern	GN										0.7
Pike	TN	0.1	--	0.1	0.1	0.7	--	0.3	0.1	0.1	0.3
O. S.	GN										--
Sunfish	TN	--	--	4.0	0.2	--	--	--	--	--	0.1
River	GN										1.3
Carpsucker	TN	--	--	--	--	--	--	0.2	0.1	--	0.3
White	GN										--
Crappie	TN	0.1	0.8	0.3	0.2	0.1	0.8	--	0.2	0.1	0.8
White	GN										2.0
Sucker	TN	3.8	2.5	4.5	7.1	2.6	4.3	6.7	3.3	1.0	3.5
Yellow	GN										--
Perch	TN	0.4	0.2	0.2	--	0.2	--	--	--	--	0.2

Black Crappie

Management Objective

- Maintain a black crappie population with a total trap-net CPUE of 20-30 and PSD of at least 40.

Management Strategies

- Black crappie growth and maximum size is reduced when population densities become too high. Consider reducing population densities when trap-net CPUE exceeds 30 for more than two years.
- Black crappies seldom exceed 25 cm (10 in) in Lake Alvin. Consider an experimental stocking of gizzard shad to provide supplemental forage.

Total trap-net CPUE declined to well below the management objective in 2014 (Table 9). Possible explanations include emigration from the lake during a 2014 flood event or the population may have reached the bottom of the natural abundance cycle. Very few Lake Alvin crappies ever grow fast enough or live long enough to exceed 25 cm (10 in) (Table 11, Figure 3). This is likely caused by inadequate forage fish abundance.

Table 10. CPUE, PSD, RSD-P, and mean Wr for all black crappie sampled with trap nets in Lake Alvin, Lincoln County, 2005-2014. Years in which the management objective was achieved or nearly achieved are shaded.

	2005	***2006***	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***
CPUE	26.7	17.7	32.1	15.9	16.7	183.7	41.0	13.5	44.5	7.0
PSD	10	34	3	13	38	1	68	53	6	77
RSD-23	0	9	1	0	5	0	0	16	1	5
RSD-P	0	7	0	0	0	0	0	1	0	2
Mean Wr	94	102	102	102	110	110	102	103	108	93

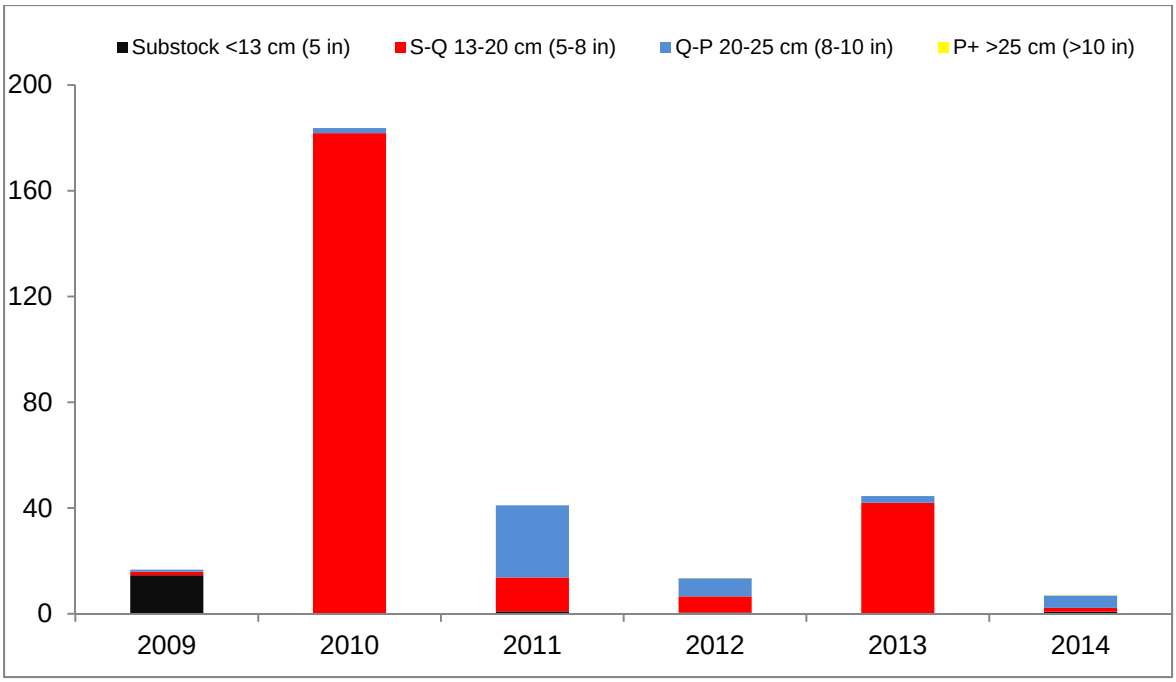

Figure 2. CPUE by length category for black crappie sampled with trap nets in Lake Alvin, Lincoln County, 2009-2014.

Table 11. Weighted mean length at capture (mm) for black crappie sampled with trap nets in Lake Alvin, Lincoln County, 2005-2014. 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	125 (11)	207 (56)	--	248 (2)	239 (1)	--	--	--	--	--
2013	--	174 (420)	212 (4)	228 (17)	227 (4)	--	--	--	--	--
2012	87 (44)	154 (24)	204 (3)	217 (42)	220 (21)	--	317 (1)	--	--	--
2011	120 (13)	198 (159)	209 (237)	--	--	--	--	--	--	--
2010	130 (19)	177 (1819)	--	--	--	--	--	--	--	--
2009	118 (154)	189 (4)	215 (3)	224 (6)	192 (1)	--	--	--	--	--
2008	119 (22)	158 (61)	189 (58)	205 (4)	195 (18)	--	--	--	--	--
2007	109 (4)	179 (307)	205 (7)	222 (5)	220 (2)	--	--	--	--	--
2006	129 (226)	185 (27)	210 (14)	213 (32)	246 (16)	267 (8)	--	--	--	--
2005	111 (56)	171 (131)	188 (112)	197 (15)	210 (7)	--	--	--	--	--

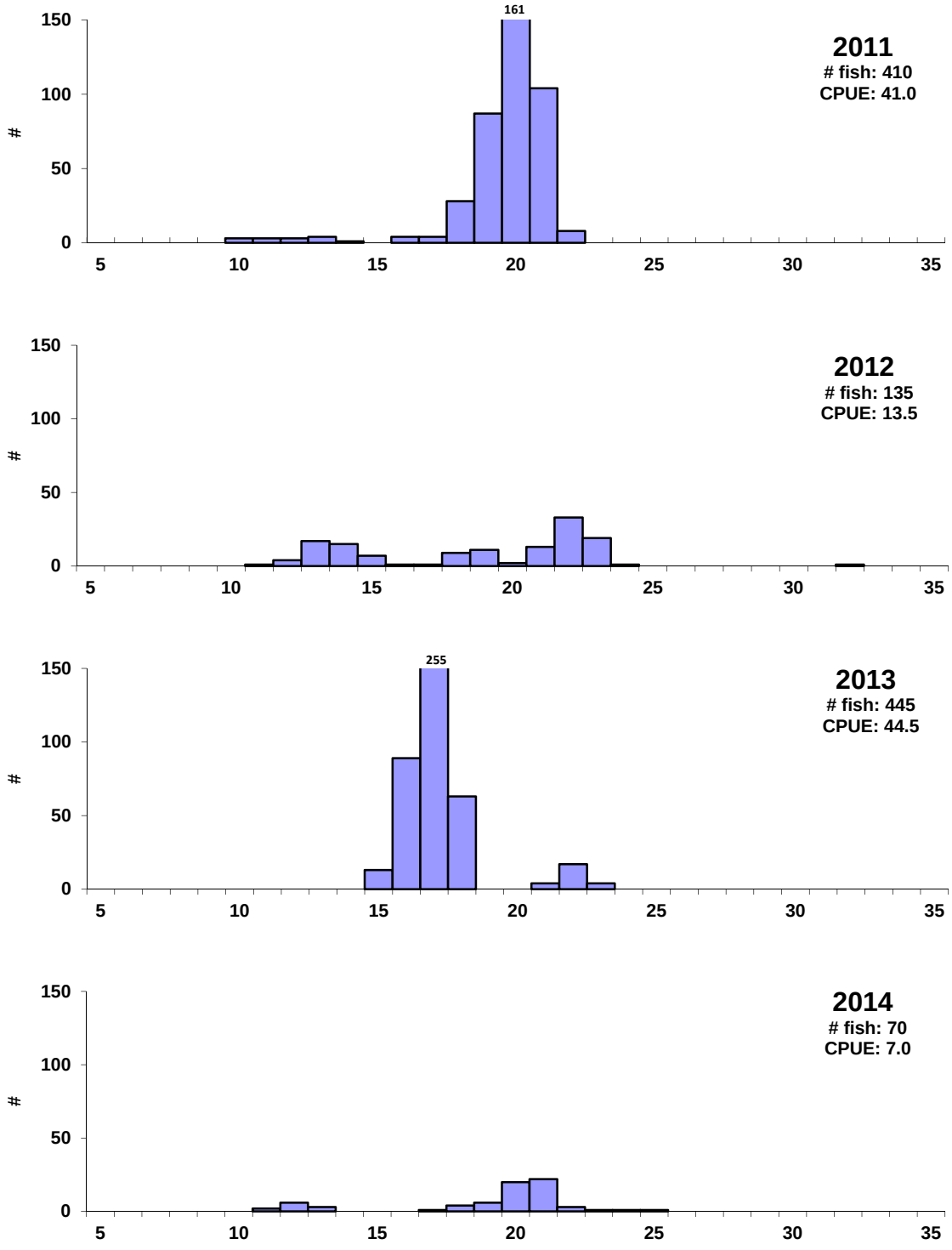

Figure 3. Length frequency histograms for black crappies sampled with trap nets in Lake Alvin, Lincoln County, 2011, 2012, 2013, 2014.

Bluegill

Management Objective

- Maintain a bluegill population with a total trap-net CPUE of 25-50 and RSD-18 of at least 20.

Management Strategy

- Bluegill growth and maximum size is reduced when population densities become too high. Consider reducing population densities when trap-net CPUE exceeds 50 for more than two years.

Although bluegill abundance continues to decline (Table 12), the population size structure has increased since 2013 (Table 12). Similar to crappies, bluegill growth and maximum size seems to be limited by available forage, in this case, zooplankton and aquatic invertebrates. Population densities within the management objective range tend to produce higher quality fish.

Table 12. CPUE, PSD, RSD-P, and mean Wr for all bluegills sampled with trap nets in Lake Alvin, Lincoln County, 2005-2014. Years in which the management objective was achieved or nearly achieved are shaded.

	2005	***2006***	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***
CPUE	186.1	47.5	87.9	26.1	27.5	21.3	6.1	47.5	4.1	3.2
PSD	60	51	37	88	84	61	89	73	34	78
RSD-18	0	5	3	8	62	19	8	44	0	7
RSD-P	0	0	0	0	3	4	3	3	0	3
Mean Wr	95	92	91	99	110	91	95	97	104	100

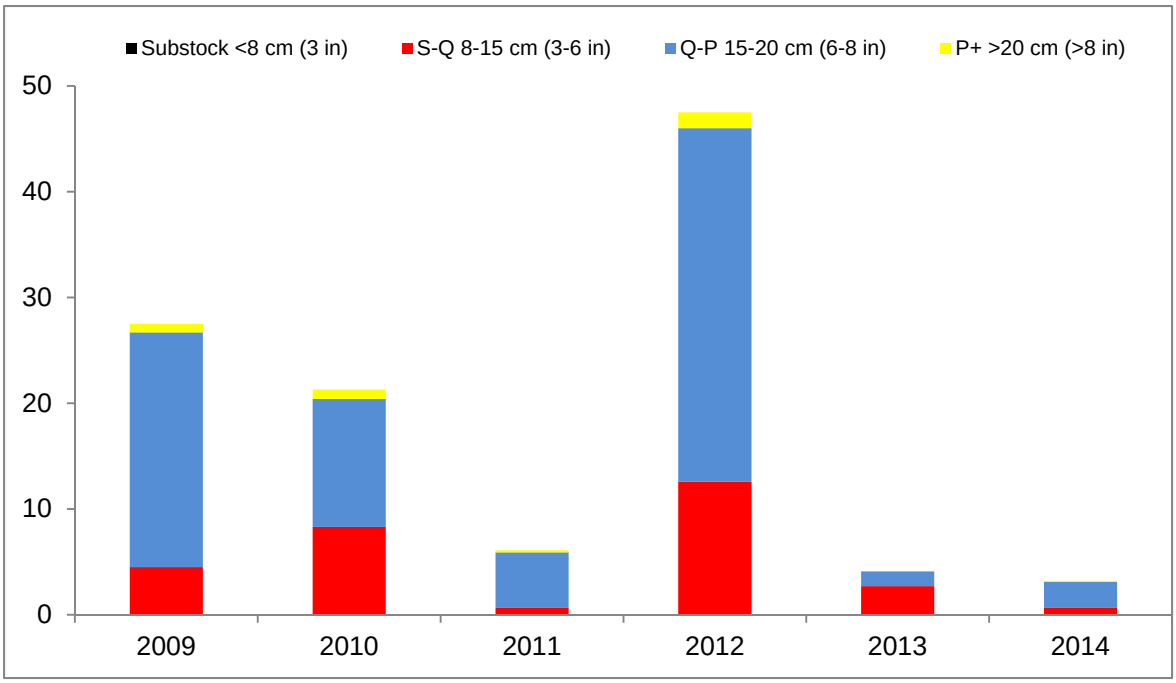

Figure 4. CPUE by length category for bluegills sampled with trap nets in Lake Alvin, Lincoln County, 2009-2014.

Table 13. Weighted mean length at capture (mm) for bluegills sampled with trap nets in Lake Alvin, Lincoln County, 2005-2014. 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	97 (4)	150 (7)	168 (16)	176 (4)	207 (1)	--	--	--	--	--
2013	--	141 (35)	157 (6)	--	--	--	---	--	--	--
2012	71 (119)	123 (100)	154 (38)	175 (111)	180 (102)	210 (5)	--	--	--	--
2011	--	138 (6)	166 (52)	191 (1)	--	205 (2)	--	--	--	--
2010	--	149 (165)	181 (8)	189 (10)	190 (29)	201 (2)	--	--	--	--
2009	114 (8)	133 (31)	173 (13)	183 (167)	194 (36)	173 (8)	--	--	--	--
2008	--	135 (5)	155 (44)	163 (168)	174 (9)	193 (8)	--	--	--	--
2007	--	133 (325)	149 (400)	160 (123)	178 (21)	184 (9)	--	--	--	--
2006	119 (50)	138 (204)	160 (43)	164 (77)	170 (91)	181 (10)	--	--	--	--
2005	91 (17)	121 (55)	148 (479)	155 (1310)	--	--	--	--	--	--

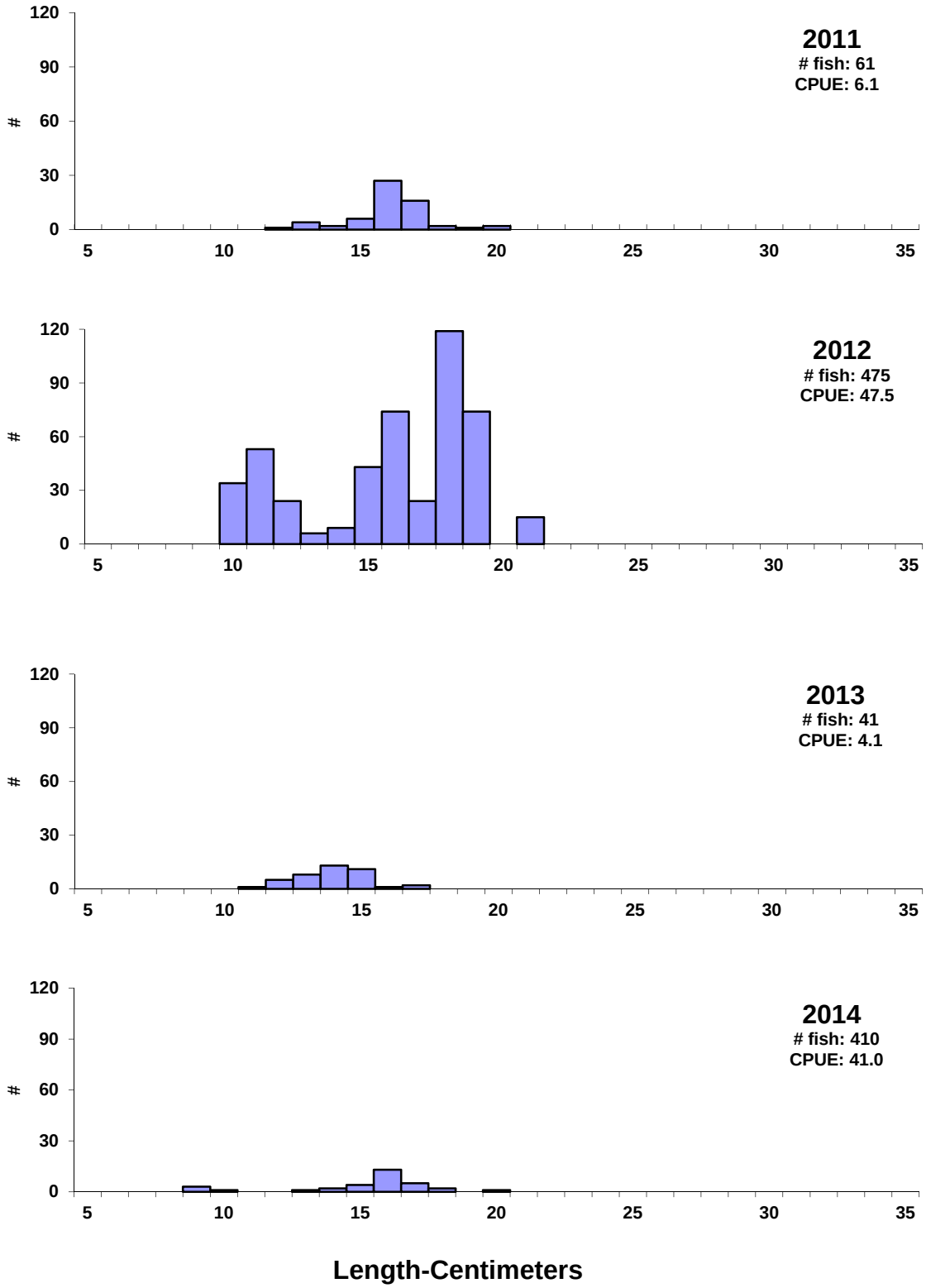

Figure 5. Length frequency histograms for bluegills sampled with trap nets in Lake Alvin, Lincoln County, 2011, 2012, 2013, 2014.

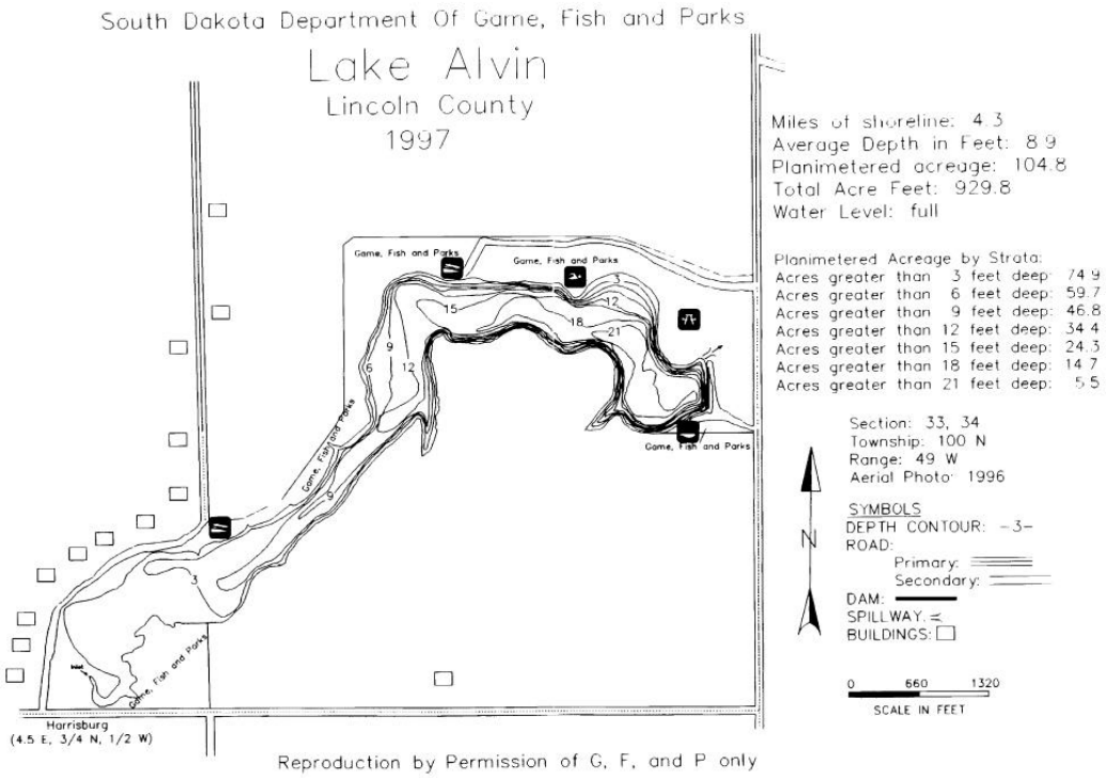

Figure 6. Contour map of Lake Alvin, Lincoln County.

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.