

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY
Lake Carthage, Miner County
2102-F-21-R-47
2014



Figure 1. Lake Carthage, Miner County

Legal Description: T108R- R57W- Sec. 4-5, 8

Location from nearest town: ½ mile east of Carthage, SD

Surface Area: 203 acres

Meandered (Y/N): no

OHWM elevation: NA

Outlet elevation: NA

Max. depth at outlet elevation: 14.2 feet

Observed water level: full

Contour map available (Y/N): yes

Watershed area: 94,574 acres

Shoreline length: 4 miles

Date set: NA

Date set: NA

Mean depth at outlet elevation: 6.6 feet

Lake volume: 1,550 acre feet

Date mapped: 2012

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

Introduction

General

Lake Carthage was originally a 38-acre impoundment built on Redstone Creek by the Works Progress Administration (WPA) in 1936. It was named for the nearby town of Carthage. By the early 1960s, erosion from the watershed had silted in the lake, ruining the fishery and the dam and spillway needed repairs. In 1964, a new dam was built downstream that increased the size of the lake to 203 acres.

Ownership of Lake and Adjacent Lakeshore Properties

Lake Carthage is owned and managed by the South Dakota Department of Game, Fish and Parks (GFP). The majority of the lakeshore and surrounding land (430 acres) is owned by GFP. The remainder is privately owned.

Fishing Access

The Lake Carthage Recreation Area, located on the east side of the lake, contains a boat ramp with a dock, public toilet, swimming beach, picnic tables, and primitive camping area. There are many areas accessible to shore fishermen.

Water Quality and Aquatic Vegetation

Water clarity in Lake Carthage is generally low, ranging from 30-53 cm (12-21 in) in the last 10 years (Table 1). Suspended silt from the large, row crop dominated watershed is primary cause for the poor clarity. There were some common cattails observed in the north end of the lake along with a few scattered beds of sago pondweed but the abundance of aquatic vegetation has declined over the years.

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

Year	Water Temp °C (°F)	Secchi Depth cm (in)	Observations/Comments (algae, aquatic vegetation, water quality, etc.)
2014	26 (78)	38 (15)	Cattails and a little sago, water was dirty
2013	24 (75)	53 (21)	Sago and cattails at north end
2011	-- (--)	-- (--)	Sparse sago and cattails
2009	23 (73)	41 (16)	Cattails and sedges
2007	26 (78)	38 (15)	Sago and cattails
2005	25 (77)	30 (12)	Sago and cattails

Fish Community

Lake Carthage contains a combination of typical small impoundment species like largemouth bass and bluegill and large lake species like walleye and yellow perch.

Table 2. Fish species commonly found in Lake Carthage, Miner County.

<i>Game Species</i>	<i>Other Species</i>
Largemouth Bass	White Sucker
Walleye	Common Carp
Northern Pike	
Channel Catfish	
Black Crappie	
Bluegill	
Black Bullhead	
Yellow Perch	

Fish Management

Reduced water depth and poor water clarity has caused the loss of submerged aquatic vegetation and habitat in Lake Carthage, especially in the upper end of the impoundments. This has made it increasingly difficult to maintain a traditional largemouth bass/panfish fishery in the lake. Largemouth bass abundance has declined despite several attempts at stocking adult or juvenile fish (Table 4). Future management efforts will be directed toward walleye, yellow perch, and channel catfish, species better adapted to the type of habitat now available in the lake.

Table 3. Fish kill history for Lake Carthage, Miner County.

<i>Year</i>	<i>Severity</i>	<i>Comments</i>
2010	Light	7/26/10 – angler reported “lots” of dead crappies

Table 4. Stocking history for Lake Carthage, Miner County, 2005-2014.

<i>Year</i>	<i>Number</i>	<i>Species</i>	<i>Size</i>
2005	230	Channel Catfish	Adult
2006	115	Largemouth Bass	Adult
2007	692	Walleye	Adult
2011	2,890	Largemouth Bass	Juvenile
2012	1,739	Largemouth Bass	Juvenile

Methods

Lake Carthage was sampled on July 24-25, 2014 with three overnight gill nets and five overnight trap 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. 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. This report also contains data and information collected in 2013 from 10 overnight trap net sets.

Results and Discussion

Net Catch Results

Black bullheads comprised a significant majority of the gill net and trap net samples (Tables 5-6) and approximately 20% were smaller than stock length (15 cm, 6 in). Decent numbers of channel catfish and walleye were caught, but bluegill and black crappie abundance has been steadily declining (Table 9).

Table 5. Total catch from three overnight gill nets set in Lake Carthage, Miner County, July 24-25, 2014.

Species	#	%	CPUE¹	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Black Bullhead	719	86.9	239.7	<u>+85.1</u>		23	0	--
Channel Catfish	40	4.8	13.3	<u>+3.1</u>		42	5	84
Walleye	36	4.4	12.0	<u>+4.9</u>		0	0	94
Common Carp	18	2.2	6.0	<u>+3.0</u>		81	25	--
White Sucker	6	0.7	2.0	<u>+1.5</u>		--	--	--
Northern Pike	5	0.6	1.7	<u>+0.7</u>		--	--	--
Yellow Perch	3	0.4	1.0	<u>+0.7</u>		--	--	--

*10 years (2005-2014)

Table 6. CPUE by length category for selected species sampled with gill nets in Lake Carthage, Miner County, July 24-25, 2014.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Black Bullhead	50.3	189.3	146.0	43.3	--	239.7	<u>+85.1</u>
Channel Catfish	7.0	6.3	3.7	2.3	0.3	13.3	<u>+3.1</u>
Walleye	--	12.0	12.0	--	--	12.0	<u>+4.9</u>
Common Carp	0.7	5.3	1.0	3.0	1.3	6.0	<u>+3.0</u>
White Sucker	--	2.0	--	0.3	1.7	2.0	<u>+1.5</u>
Northern Pike	--	1.7	0.3	1.0	0.3	1.7	<u>+0.7</u>
Yellow Perch	--	1.0	--	--	1.0	1.0	<u>+0.7</u>

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 Lake Carthage, Miner County, July 24-25, 2014.

<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	1,910	87.1	382.0	+87.8	470.5	23	0	--
White Sucker	190	8.7	38.0	+19.2	12.6	100	100	--
Channel Catfish	50	2.3	10.0	+6.8	13.9	11	5	90
Common Carp	14	0.6	2.8	+1.3	12.2	100	33	--
Black Crappie	13	0.6	2.6	+1.4	6.5	46	31	121
Northern Pike	10	0.5	2.0	+1.3	1.3	90	10	90
Bluegill	5	0.2	1.0	+0.7	13.8	--	--	--
Walleye	1	0.0	0.2	+0.3	0.1	--	--	--

*10 years (2005-2014)

Table 8. CPUE by length category for selected species sampled with trap nets in Lake Carthage, Miner County, July 24-25, 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	281.6	100.4	96.0	23.4	--	382.0	+87.8
White Sucker	--	38.0	--	--	38.0	38.0	+19.2
Channel Catfish	6.2	3.8	3.4	0.2	0.2	10.0	+6.8
Common Carp	1.0	1.8	--	1.2	0.6	2.8	+1.3
Black Crappie	--	2.6	1.4	0.4	0.8	2.6	+1.4
Northern Pike	--	2.0	0.2	1.6	0.2	2.0	+1.3
Bluegill	--	1.0	0.2	0.6	0.2	1.0	+0.7
Walleye	--	0.2	0.2	--	--	0.2	+0.3

Length categories can be found in Appendix A.

Table 9. Gill-net (GN) and trap-net (TN) CPUE for selected fish species sampled in Lake Carthage, Miner 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										239.7
	TN	34.1		366.5		684.9		501.9		853.4	382.0
Black Crappie	GN										--
	TN	7.4		18.5		9.2		1.1		0.1	2.6
Bluegill	GN										--
	TN	65.1		9.0		3.6		3.8		--	1.0
Channel Catfish	GN										13.3
	TN	32.3		29.7		2.6		3.3		5.5	10.0
Common Carp	GN										6.0
	TN	17.3		22.4		3.9		25.0		1.6	2.8
Hybrid Sunfish	GN										--
	TN	0.3		1.0		0.2		0.1		--	--
Northern Pike	GN										1.7
	TN	0.1		0.8		1.5		3.0		0.4	2.0
Walleye	GN										12.0
	TN	--		0.1		0.1		0.1		--	0.2
White Sucker	GN										2.0
	TN	10.4		14.6		1.2		3.1		8.4	38.0
Yellow Perch	GN										1.0
	TN	4.0		0.7		--		0.2		0.1	--

Walleye

Management Objective

- maintain a walleye population with a total gill-net CPUE of at least 10

Management Strategy

- stock small walleye fingerlings at the rate of 100/acre (20,300) as needed to achieve the management objective

Since no walleyes have been stocked in Lake Carthage since 2007 (Table 11), the fish sampled in 2014 (Table 10) must have been produced naturally by a remnant adult population. Walleye will now be the primary predator managed in Lake Carthage due to a change in habitat that is no longer favorable for largemouth bass.

Table 10. CPUE, PSD, RSD-P, and mean Wr for all walleyes sampled with gill nets in Lake Carthage, Miner County, 2005-2014. Stocked years are shaded.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CPUE										12.0
PSD										0
RSD-P										0
Mean Wr										94

Table 11. Walleyes stocked into Lake Carthage, Miner County, 2005-2014.

Year	Number	Size
2007	692	Adult

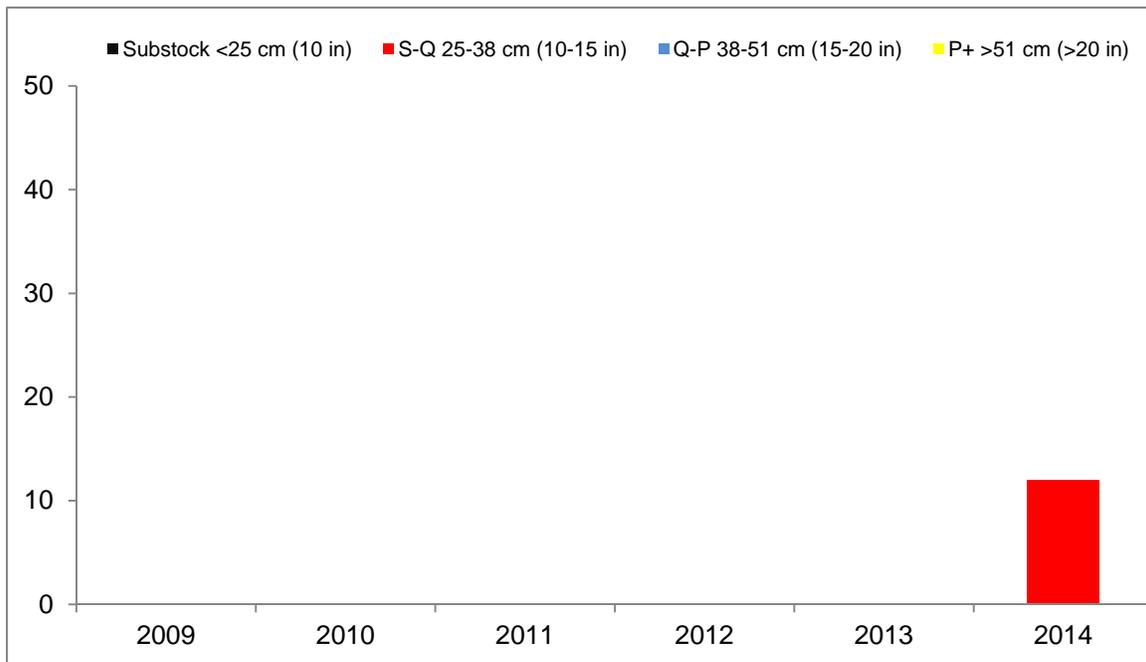


Figure 2. CPUE by length category for walleye sampled with gill nets in Lake Carthage, Miner County, 2009-2014.

Black Crappie

Management Objective

- None

Management Strategy

- Monitor the black crappie population during annual lake surveys and report the results.

After several years of decline, black crappie abundance rose slightly in 2014 (Table 12). The population contains multiple year classes with fish up to 25 cm (10 in) in length (Figures 3, 4).

Table 12. CPUE, PSD, RSD-P, and mean Wr for all black crappies sampled with trap nets in Lake Carthage, Miner County, 2005-2014. Stocked years are shaded.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CPUE	7.4	18.5			9.2		1.1		0.1	2.6
PSD	66	13			18		9		--	46
RSD-P	34	4			1		0		--	31
Mean Wr	118	128			112		115		--	121

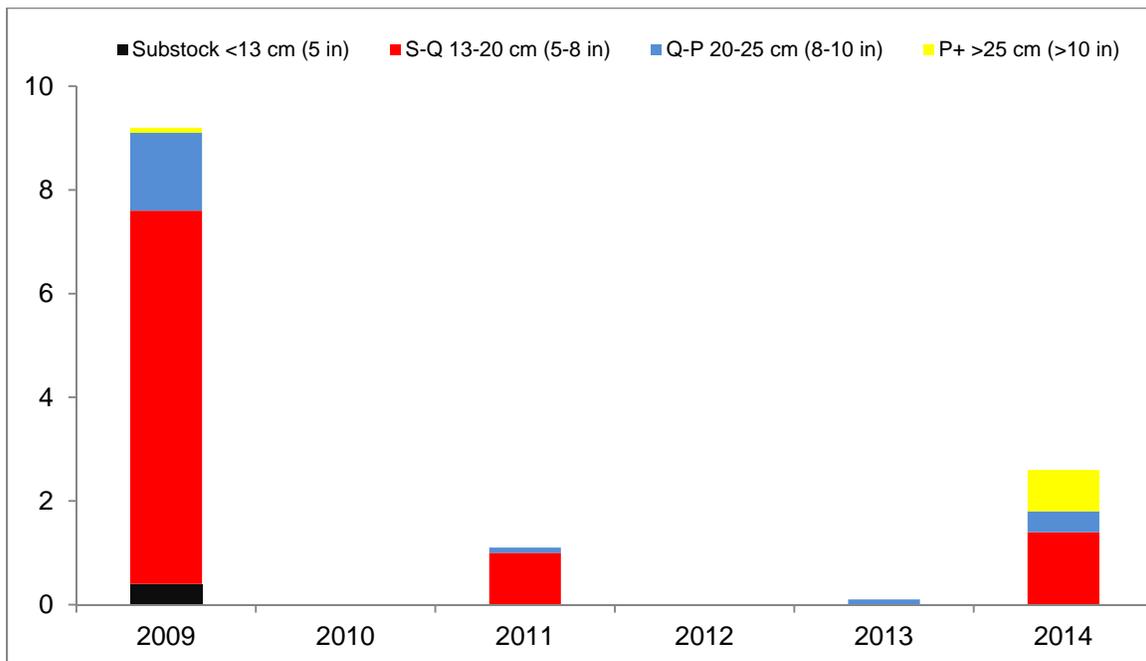


Figure 3. CPUE by length category for black crappies sampled with trap nets in Lake Carthage, Miner County, 2009-2014.

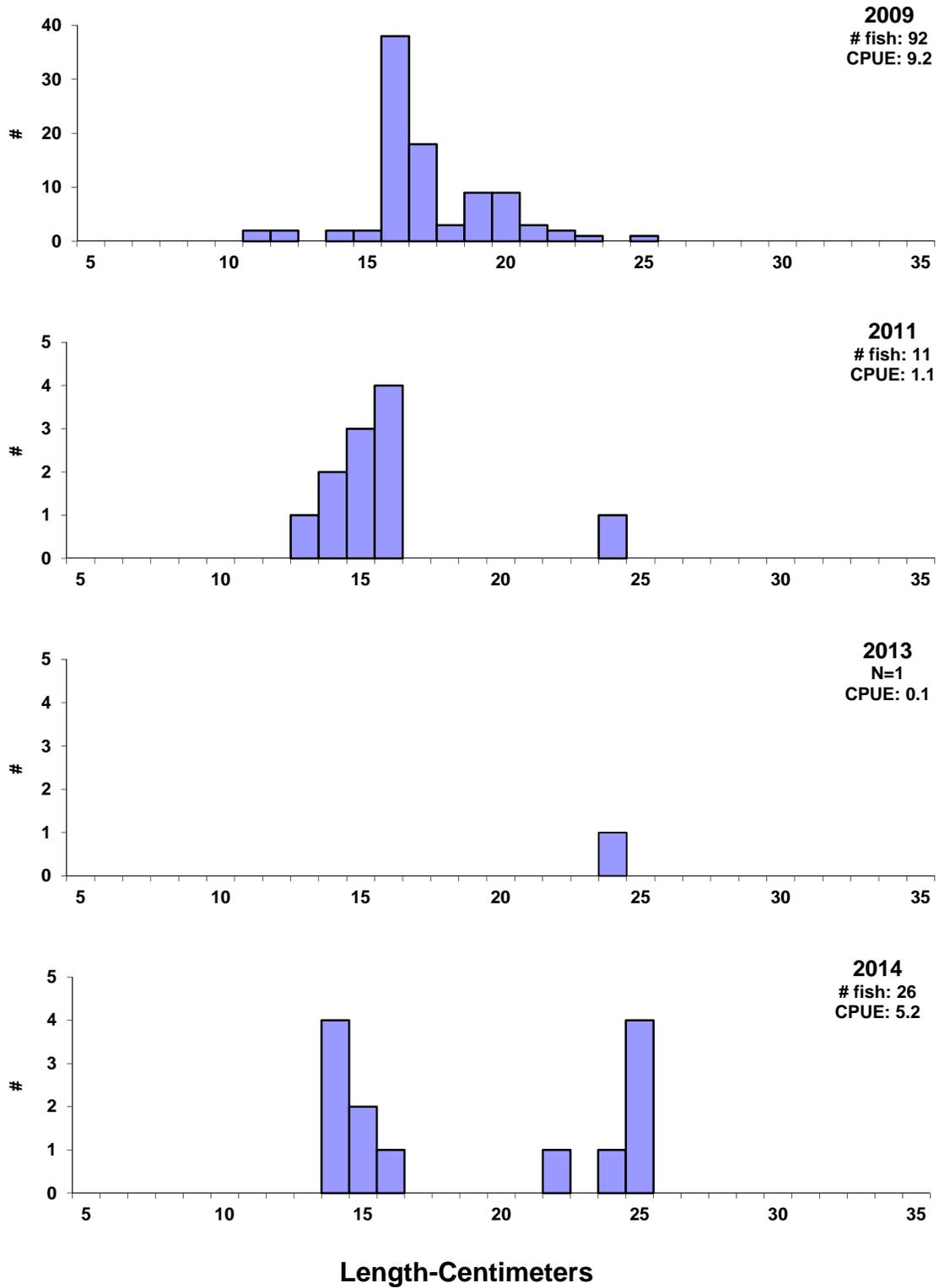


Figure 4. Length frequency histograms for black crappies sampled with trap nets in Lake Carthage, Miner County, 2005, 2007, 2009, and 2011.

Bluegill

Management Objective

- None

Management Strategy

- Monitor the bluegill population during lake surveys and report the results.

Similar to black crappie, bluegill abundance rebounded slightly following years of decline (Table 13). The population contains fish large enough to interest anglers (Figures 5, 6) but there is little fishing opportunity due to low abundance.

Table 13. CPUE, PSD, RSD-P, and mean Wr for all bluegills sampled with trap nets in Lake Carthage, Miner County, 2005-2014. Stocked years are shaded.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CPUE	65.1		9.0		3.6		3.8		0.0	1.0
PSD	32		22		62		84		--	--
RSD-P	8		1		0		11		--	--
Mean Wr	122		104		109		110		--	--

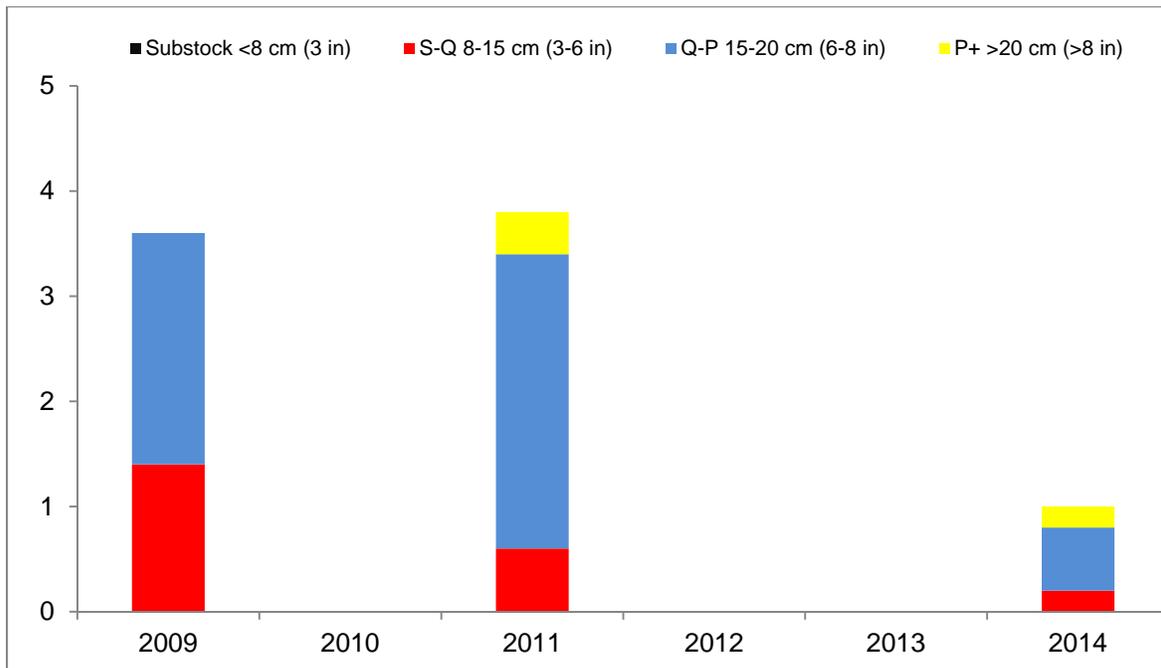


Figure 5. CPUE by length category for bluegill sampled with trap nets in Lake Carthage, Miner County, 2009-2014.

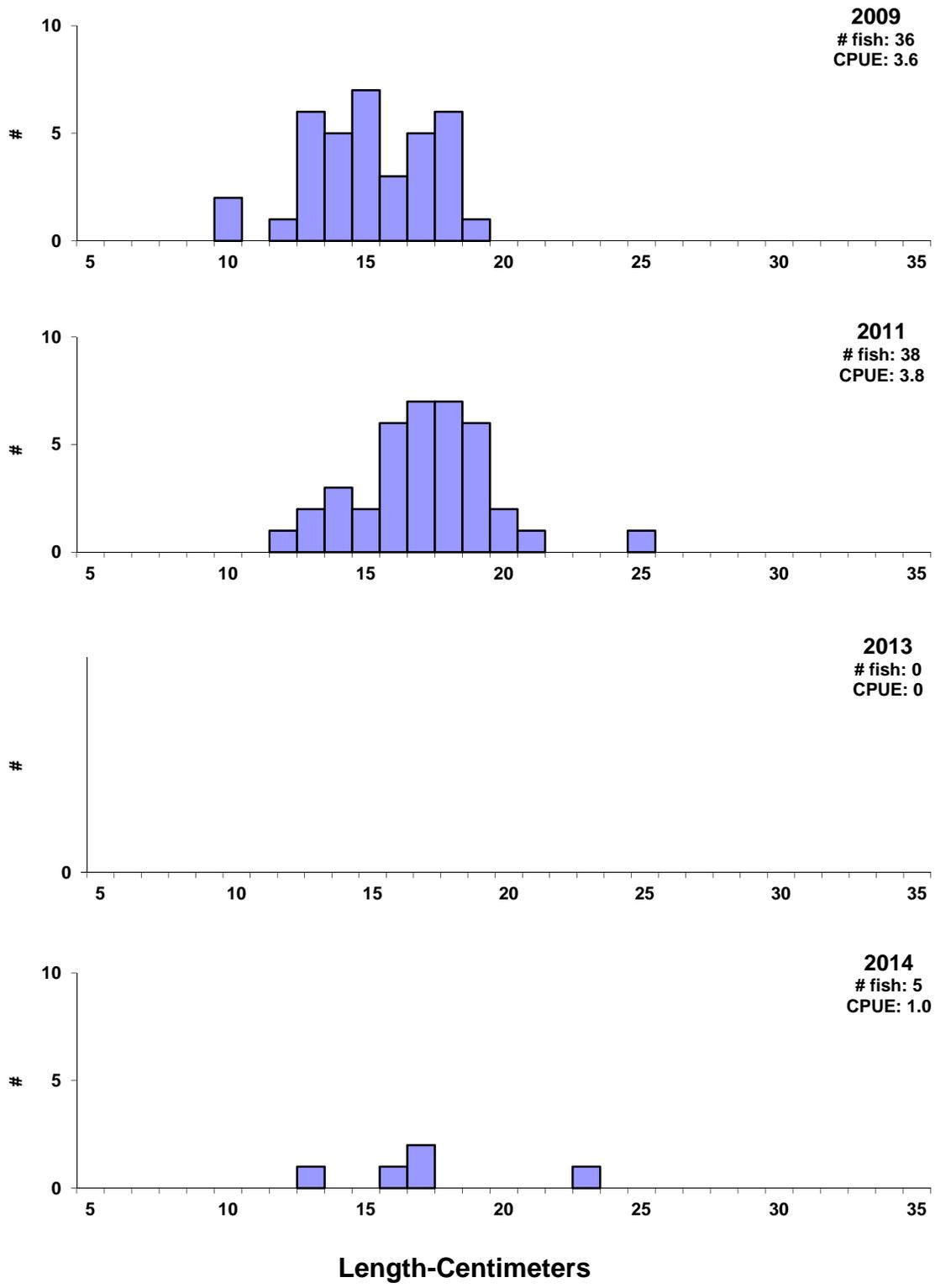


Figure 6. Length frequency histograms for bluegill sampled with trap nets in Lake Carthage, Miner County, 2009, 2011, 2013, and 2014.

Channel Catfish

Management Objective

- maintain a channel catfish population with a total trap-net CPUE of at least 10

Management Strategies

- stock juvenile channel catfish at the rate of 10/acre (2,030) as needed to achieve the management objective
 - evaluate the use of baited hoop nets to more accurately assess the size structure, abundance and recruitment of channel catfish and to determine whether there is a consistent relationship between hoop net and trap net catches
- Insert narrative

Channel catfish trap-net CPUE has been increasing since 2009 and is now at the management objective (Table 14). No channel catfish have been stocked since 2005 (Table 15) so the increase in abundance can be attributed to natural reproduction and recruitment. This is further supported by the abundance of small fish present in the population the last two years (Figures 7, 8).

Table 14. CPUE, PSD, RSD-P, and mean W_r for all channel catfish sampled with trap nets in Lake Carthage, Miner County, 2005-2014. Stocked years are shaded.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CPUE	32.3		29.7		2.6		3.3		5.5	10.0
PSD	34		80		14		36		14	11
RSD-P	0		0		14		7		0	5
Mean W_r	91		93		82		83		87	90

Table 15. Channel catfish stocked into Lake Carthage, Miner County, 2005-2014.

Year	Number	Size
2005	230	Adult

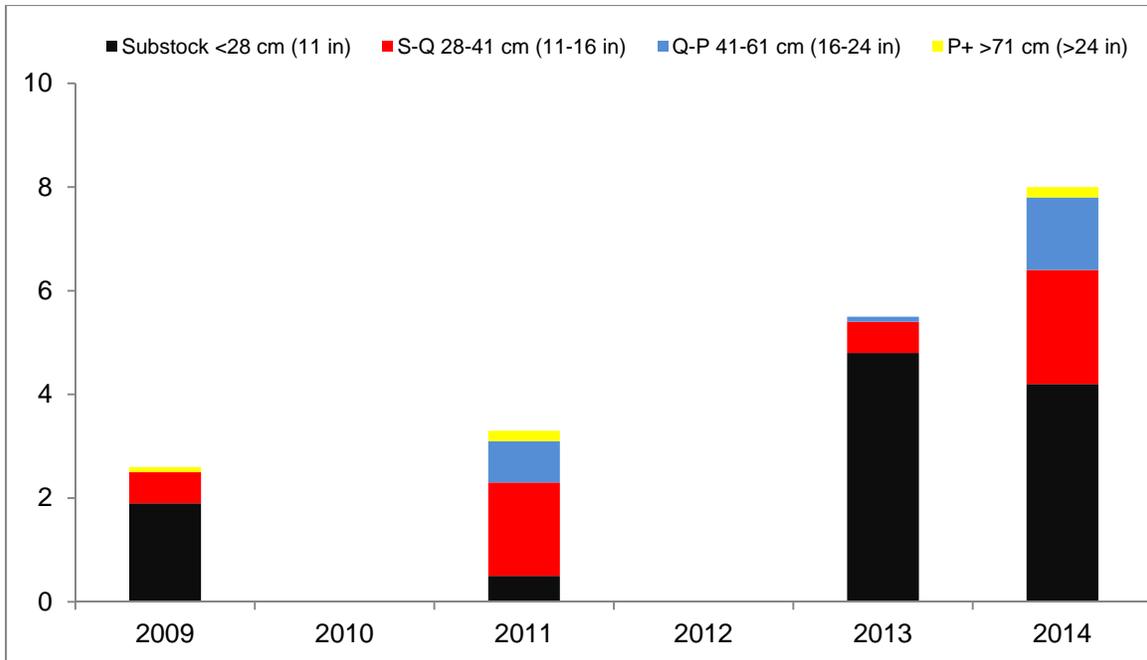
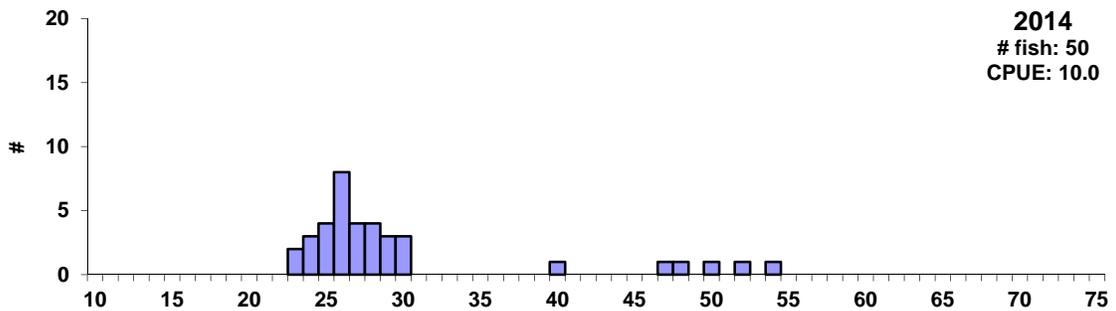
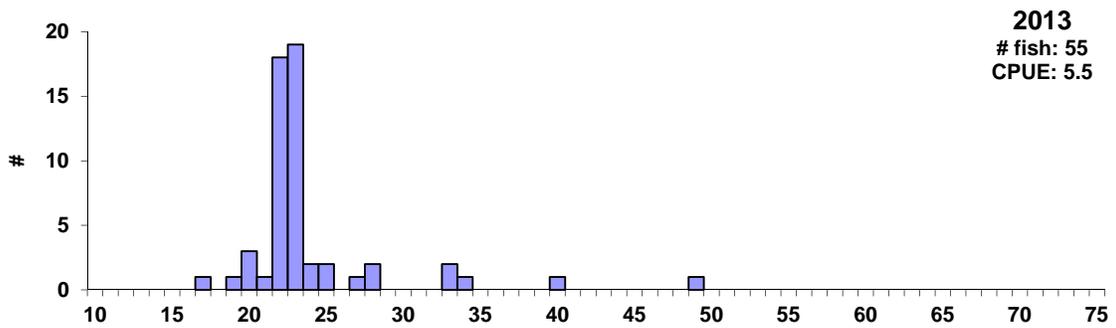
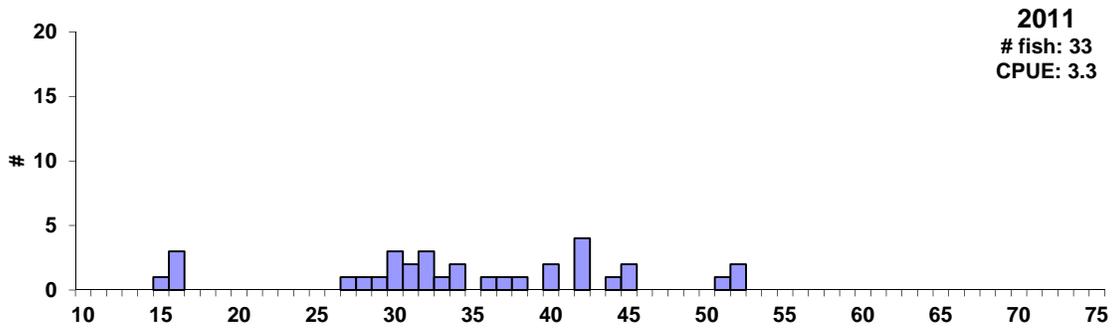
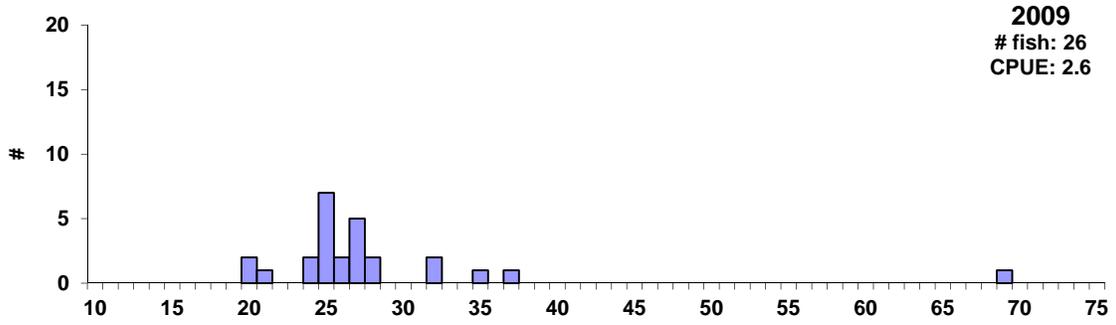


Figure 7. CPUE by length category for channel catfish sampled with trap nets in Lake Carthage, Miner County, 2009-2014.



Length-Centimeters

Figure 8. Length frequency histograms for channel catfish sampled with trap nets in Lake Carthage, Miner County, 2009, 2011, 2013, and 2014.

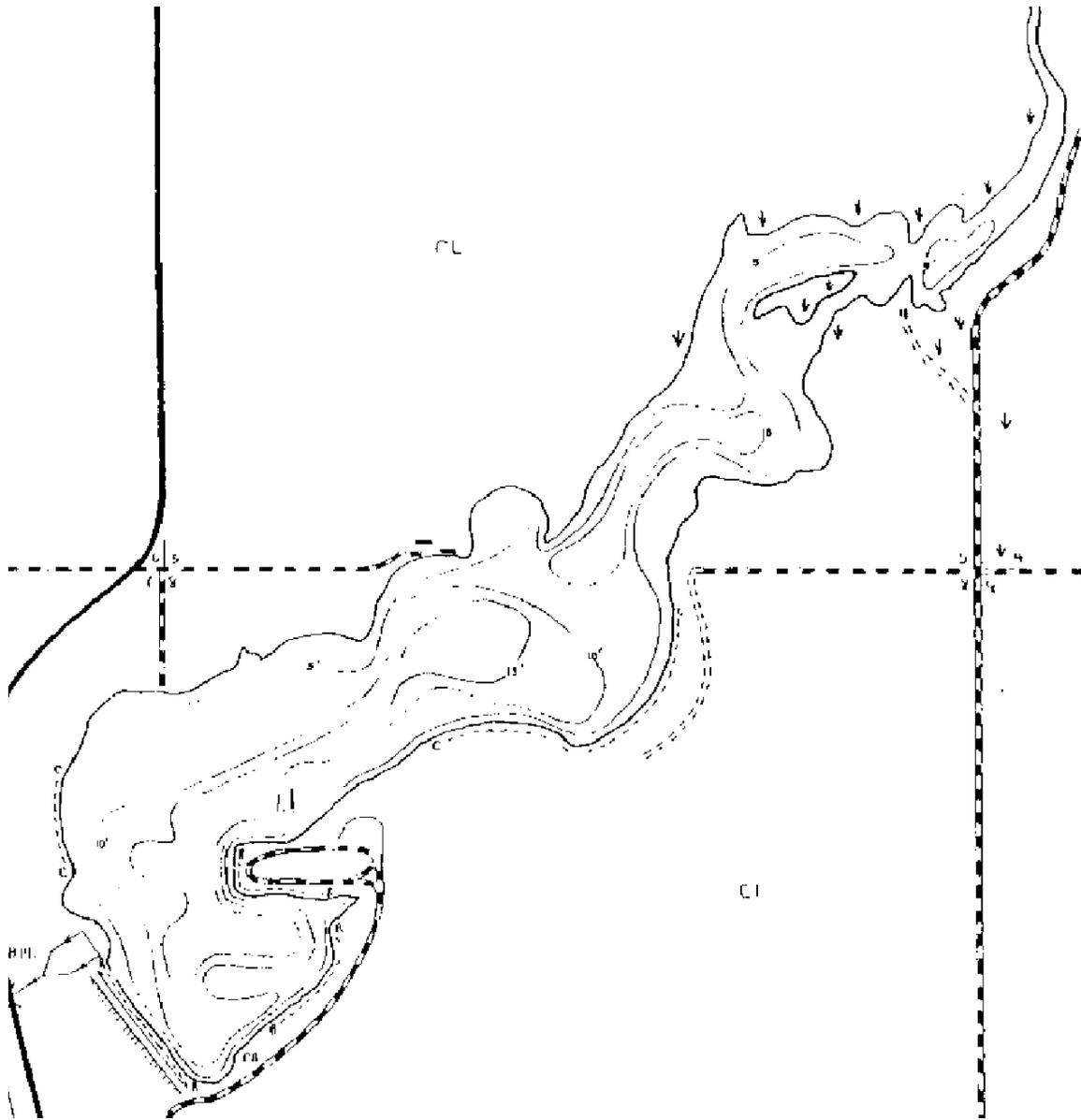


Figure 9. Contour map of Lake Carthage, Miner County.

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
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.