

# SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F-21-R-44

**Name:** Lake Sinai

**County:** Brookings

**Legal Description:** T109N- R52W-Sec 3-4, 8-10

**Location from nearest town:** 1 mile west, 1½ miles north of Sinai, SD

**Dates of present survey:** June 27-29, 2011 (netting); Sept. 22, 2011 (electrofishing)

**Dates of last survey:** June 28-30, 2010 (netting); Sept. 13, 2010 (electrofishing)

Managed Species	Other Species
Walleye	Black Bullhead
Yellow Perch	Common Carp
Smallmouth Bass	Northern Pike
Muskellunge	Bluegill
	Green Sunfish
	Hybrid Sunfish
	Black Crappie

## PHYSICAL DATA

**Surface area:** 1,817 acres

**Maximum depth:** 33 feet

**Volume:** No data

**Contour map available:** Yes

**OHWM elevation:** None set

**Outlet elevation:** None set

**Lake elevation observed during the survey:** Over full

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

**Watershed area:** No data

**Mean depth:** 17 feet

**Shoreline length:** No data

**Date mapped:** 2002

**Date set:** NA

**Date set:** NA

### Introduction

Lake Sinai is a natural glacial lake located just northwest of the town of Sinai in west-central Brookings County. It was named by county commissioners who felt the surrounding land resembled the land around Mount Sinai in the Holy Land. Heavy precipitation in the late 1980s increased the area of the lake to its current size.

### Ownership of Lake and Adjacent Lakeshore Properties

Lake Sinai is listed as meandered public water in the State of South Dakota Listing of Meandered Lakes and the South Dakota Department of Game, Fish, and Parks (GFP) manages the fishery. GFP also owns and manages a Lake Access Area on the north side of the lake. The remainder of the shoreline is privately owned.

## Fishing Access

The North Lake Access Area has a double lane boat ramp, boat dock, large parking area, and public toilet. Shore fishing access around the entire lake is limited.

## Field Observations of Water Quality and Aquatic Vegetation

Water clarity was excellent with a Secchi depth measurement of 0.97 m (38 in). Some small sparse beds of sago pondweed (*Potamogeton pectinatus*) were observed around the lake and there are still considerable areas of flooded trees and brush.

## BIOLOGICAL DATA

### Methods:

Lake Sinai was sampled on June 27-29, 2011 with five overnight gill-net sets and ten overnight trap-net sets. 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. 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. Two hours of nighttime electrofishing were done on September 22, 2011 to evaluate walleye recruitment. Sampling sites are displayed in Figure 3. From the gill-net catch, otoliths were extracted and aged for five walleyes and yellow perch in each 10-mm increment in order to estimate growth rates and age structures of the populations.

### Results and Discussion:

## Gill Net Catch

Yellow perch and walleye comprised 98% gill net catch this year (Table 1). Smallmouth bass and common carp were the only other species sampled.

**Table 1.** Total catch from five overnight gill net sets at Lake Sinai, Brookings County, June 27-29, 2011.

Species	No.	%	CPUE <sup>1</sup>	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
<b>Yellow Perch</b>	227	76.4	45.4	±10.0	47.7	56	9	103
<b>Walleye</b>	64	21.5	12.8	±3.2	13.9	59	0	83
<b>Smallmouth Bass</b>	4	1.3	0.8	±0.5	0.4	--	--	--
<b>Common Carp</b>	2	0.7	0.4	±0.5	1.6	--	--	--

\*10 years (2001-2010)

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

**Table 2.** Catch per unit effort by length category for various fish species captured with gill nets in Lake Sinai June 27-29, 2011.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
<b>Yellow Perch</b>	0.4	45.0	19.6	21.2	4.2	45.4	±10.0
<b>Walleye</b>	8.4	4.4	1.8	2.6	--	12.8	±3.2
<b>Smallmouth Bass</b>	--	0.8	0.4	0.2	0.2	0.8	±0.5
<b>Common Carp</b>	--	0.4	--	0.2	0.2	0.4	±0.5

Length categories can be found in Appendix A.

## Trap Net Catch

Smallmouth bass were the most abundant species in the trap net sample (Table 3). Overall, trap net catches were very low and only five other species were sampled.

**Table 3.** Total catch from nine overnight trap net sets at Lake Sinai, Brookings County, June 27-29, 2011.

Species	No.	%	CPUE	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
<b>Smallmouth Bass</b>	35	46.7	3.5	±1.2	2.3	50	25	99
<b>Yellow Perch</b>	15	20.0	1.5	±0.5	7.4	60	7	100
<b>Bluegill</b>	13	17.3	1.3	±1.3	0.5	85	0	120
<b>Walleye</b>	9	12.0	0.9	±0.4	1.9	--	--	--
<b>Black Crappie</b>	2	2.7	0.2	±0.2	0.2	--	--	--
<b>Common Carp</b>	1	1.3	0.1	±0.1	1.5	--	--	--

\*9 years (2002-2010)

**Table 4.** Catch per unit effort by length category for various fish species captured with trap nets in Lake Sinai, June 27-29, 2011.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
<b>Smallmouth Bass</b>	1.5	2.0	1.0	0.5	0.5	3.5	±1.2
<b>Yellow Perch</b>	--	1.5	0.6	0.8	0.1	1.5	±0.5
<b>Bluegill</b>	--	1.3	0.2	1.1	--	1.3	±1.3
<b>Walleye</b>	0.3	0.6	--	0.5	0.1	0.9	±0.4
<b>Black Crappie</b>	0.2	--	--	--	--	0.2	±0.2
<b>Common Carp</b>	--	0.1	--	0.1	--	0.1	±0.1

Length categories can be found in Appendix A.

## Walleye

**Management objective:** Maintain a walleye population with a gill-net CPUE of at least 15, a PSD range of 30-60, and a growth rate of 14 inches by age-3.

Walleye gill-net CPUE declined to just below the management objective and 10-year average this year (Table 5). Sampled walleyes ranged from 170 mm (6.7 in) to 500 mm (19.7 in) long and fish from the 2010 year class comprised the majority of the sample (Table 6 and Figure 1). Condition (mean Wr) was at the low end of the 10-year range (Table 5).

**Table 5.** Walleye gill-net CPUE, PSD, RSD-P, and mean Wr in Lake Sinai, Brookings County, 2002-2011.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Mean*
CPUE	30.7	14.8	6.0	5.8	6.2	5.5	11.4	10.8	15.2	12.8	13.9
PSD	62	71	64	48	46	46	12	2	28	59	38
RSD-P	1	7	18	10	14	15	7	0	4	0	8
Mean Wr	98	84	84	87	86	89	82	85	84	83	88

\*10 years (2001-2010)

**Table 6.** Weighted mean length at capture (mm) for walleye captured in gill nets in Lake Sinai, Brookings County, 2003-2011. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size in parentheses.

Year	1	2	3	4	5	6	7	8	9	10	11	12
2011 (64)	207 (45)	352 (5)	376 (1)	429 (12)	426 (1)	--	--	--	--	--	--	--
2010 (75)	280 (1)	328 (10)	366 (45)	384 (15)	--	507 (2)	--	--	530 (1)	--	--	645 (1)
2009 (54)	218 (1)	283 (36)	338 (14)	369 (1)	398 (2)	--	--	--	--	--	--	--
2008 (57)	208 (14)	299 (36)	--	404 (4)	--	--	573 (2)	--	--	--	655 (1)	--
2007 (22)	221 (10)	--	345 (5)	--	467 (6)	--	567 (1)	--	--	--	--	--
2006 (37)	--	284 (20)	395 (4)	422 (5)	489 (2)	554 (2)	585 (1)	654 (3)	--	--	--	--
2005 (35)	194 (14)	314 (6)	364 (6)	409 (5)	440 (2)	661 (1)	--	687 (1)	--	--	--	--
2004 (24)	251 (4)	341 (5)	408 (8)	406 (3)	537 (1)	553 (1)	615 (1)	--	704 (1)	--	--	--
2003 (59)	215 (1)	339 (17)	422 (5)	502 (1)	455 (32)	558 (2)	606 (1)	--	--	--	--	--

Fall electrofishing indicated that a large walleye year class was naturally produced in 2011 (Table 7). In contrast, the 2010 year class was a product of fingerling stocking. Age-1 CPH was high indicating reasonably good over-winter survival of 2010 fish. A large increase in mean size (76 cm or 3 in) from early July to September indicated good late-summer growth of age-1 walleyes. High water and flooded terrestrial vegetation likely boosted the productivity of the lake and helped maintain the growth and condition of abundant young walleyes.

**Table 7.** Age-0 and age-1 walleyes sampled during 2 hours of nighttime electrofishing on Lake Sinai, Brookings County, 2000-2011.

Year	Stocking	Age-0 CPH	80% C.I.	% stocked	Mean length (range; mm)	Wr	Age-1 CPH	80% C.I.	Mean length (range; mm)	Wr
2011	none	262	102-422		159 (125-205)	88	65	49-81	283 (231-330)	90
2010	fingerling	211	160-262	100	154 (135-199)	80	0			
2009	none	29	21-37		185 (156-207)	96	2	1-3	242 (213-275)	90
2008	none	31	21-41		162 (135-185)	100	34	25-43	249 (205-290)	81
2007	none	113	63-139		161 (122-203)	95	17	11-23	282 (251-340)	79
2006	fingerling	291	199-393	96	175 (149-221)	85	0	--	--	--
2005	none	9	5-13		194 (163-212)	90	64	42-84	251 (223-294)	81
2004	fingerling	87	35-139	<sup>1</sup>	134 (110-160)	95	4	1-6	294 (270-314)	90
2003	none	19	12-26		209 (198-223)	101	22	18-26	317 (274-354)	87
2002	none	137	100-174		180 (147-206)	97	19	11-27	282 (200-315)	90
2001	none	59	36-81		169 (138-222)	105	6	3-9	324 (311-339)	97
2000	none	5	2-8		162 (152-174)	80	1	0-2	195	67

<sup>1</sup> Oxymarine killed immersed fingerlings so no marking of stocked fish was done.

## Yellow Perch

**Management objective:** Maintain a yellow perch population with a gill-net CPUE of at least 50 with a PSD range of 30-60.

Although yellow perch gill-net CPUE increased in 2011, it remains below the management objective (Table 8). However, according to angler reports, perch fishing was very good in 2011. The perch sampled represented four consecutive year classes which indicates consistent natural recruitment (Figure 2 and Table 9). Growth is faster than regional, statewide and large lakes means (Table 9) with fish reaching 20 cm (8 in) between age-2 and age-3 and relative weight (Wr) is near the 10-year mean. Older perch (ages 5 and 6) present in surveys from 2003-2006 have been absent in recent surveys. The reasons for this high mortality are not clear at this time.

**Table 8.** Yellow perch gill-net CPUE, PSD, RSD-P and mean Wr in Lake Sinai, Brookings County, 2002-2011.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Mean*
CPUE	127.7	77.3	65.0	40.8	28.0	11.0	13.6	41.8	31.8	45.4	47.7
PSD	70	24	82	85	76	73	52	90	81	56	73
RSD-P	26	1	0	28	23	2	19	0	26	9	14
Mean Wr	111	94	99	107	98	107	101	100	101	103	102

\*10 years (2001-2010)

**Table 9.** Weighted mean length at capture (mm) for yellow perch captured in gill nets in Lake Sinai, Brookings County, 2003-2011. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size in parentheses.

<b>Year</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
2011 (227)	134 (9)	199 (186)	248 (23)	268 (9)	--	--	--	--	--
2010 (159)	107 (42)	206 (76)	259 (41)	--	--	--	--	--	--
2009 (208)	--	208 (188)	251 (17)	276 (3)	--	--	--	--	--
2008 (67)	132 (40)	220 (13)	255 (14)	--	--	--	--	--	--
2007 (44)	146 (12)	221 (29)	247 (3)	--	--	--	--	--	--
2006 (169)	143 (24)	211 (83)	224 (20)	266 (5)	268 (35)	294 (2)	--	--	--
2005 (246)	128 (27)	204 (75)	225 (15)	248 (125)	287 (2)	281 (2)	--	--	--
2004 (261)	127 (39)	194 (34)	226 (182)	247 (6)	--	--	--	--	--
2003 (59)	--	186 (253)	208 (43)	243 (7)	235 (3)	262 (3)	--	--	--

## All Species

Only six species were sampled in Lake Sinai in 2011. CPUE for all species was within previously observed ranges (Table 10). Rough fish and bullhead abundance is currently not a problem. Muskellunge fingerlings were stocked in September 2011 and hopefully will be found in future surveys and angler catches.

**Table 10.** Gill-net (GN) and trap-net (TN) CPUE for all fish species sampled in Lake Sinai, Brookings County, 2002-2011.

<b>Species</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>
<b>COC (GN)</b>	5.2	3.0	4.8	1.2	1.2	--	0.2	0.8	--	0.4
<b>COC (TN)</b>	2.0	5.2	1.7	0.9	0.1	1.0	0.3	0.3	1.6	0.1
<b>BLB (GN)</b>	49.5	32.3	5.3	0.2	0.2	0.5	--	--	--	--
<b>BLB (TN)</b>	634.0	45.5	9.9	3.9	2.5	1.8	0.3	0.6	--	--
<b>NOP (GN)</b>	0.5	1.5	0.3	0.7	0.8	--	0.2	--	0.2	--
<b>NOP (TN)</b>	--	0.1	0.1	0.4	--	0.3	--	0.1	--	--
<b>GSF (GN)</b>	--	--	--	--	--	--	--	--	--	--
<b>GSF (TN)</b>	1.1	--	--	0.1	--	0.3	0.2	0.1	0.1	--
<b>HYB (GN)</b>	--	--	--	--	--	--	--	--	--	--
<b>HYB (TN)</b>	0.4	0.1	0.1	--	--	0.1	--	--	0.1	--
<b>BLG (GN)</b>	--	--	--	--	--	--	--	--	--	--
<b>BLG (TN)</b>	0.4	0.2	0.2	0.2	0.8	1.9	0.4	--	0.4	1.3
<b>SMB (GN)</b>	--	--	--	0.3	0.2	1.0	1.0	1.2	0.6	0.8
<b>SMB (TN)</b>	--	--	0.2	0.9	2.0	5.2	4.6	1.2	6.7	3.5
<b>BLC (GN)</b>	--	--	--	--	0.2	--	--	--	--	--
<b>BLC (TN)</b>	--	--	--	--	0.9	0.2	--	0.4	0.4	0.2
<b>YEP (GN)</b>	127.7	77.3	65.0	40.8	28.0	11.0	13.6	41.8	31.8	45.4
<b>YEP (TN)</b>	42.8	6.6	2.6	6.4	1.8	1.5	2.0	2.2	1.0	1.5
<b>WAE (GN)</b>	30.7	14.8	6.0	5.8	6.2	5.5	11.4	10.8	15.2	12.8
<b>WAE (TN)</b>	0.5	1.4	0.8	1.1	1.8	5.6	3.2	0.8	1.9	0.9

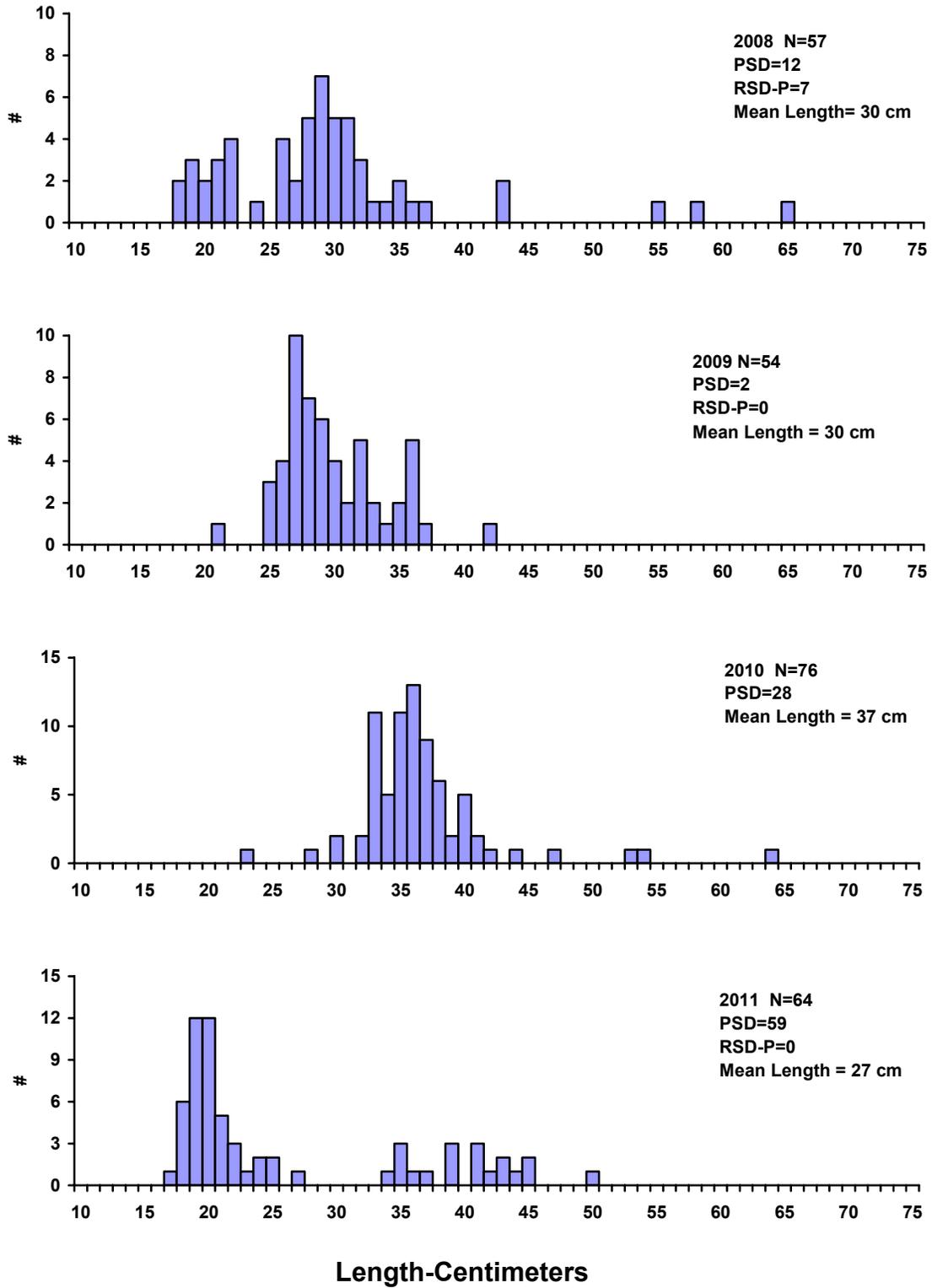
COC (Common Carp), BLB (Black Bullhead), NOP (Northern Pike), GSF (Green Sunfish), HYB (Hybrid Sunfish), BLG (Bluegill), SMB (Smallmouth Bass), BLC (Black Crappie), YEP (Yellow Perch), WAE (Walleye)

**Table 11.** Stocking record for Lake Sinai, Brookings County, 1991-2011.

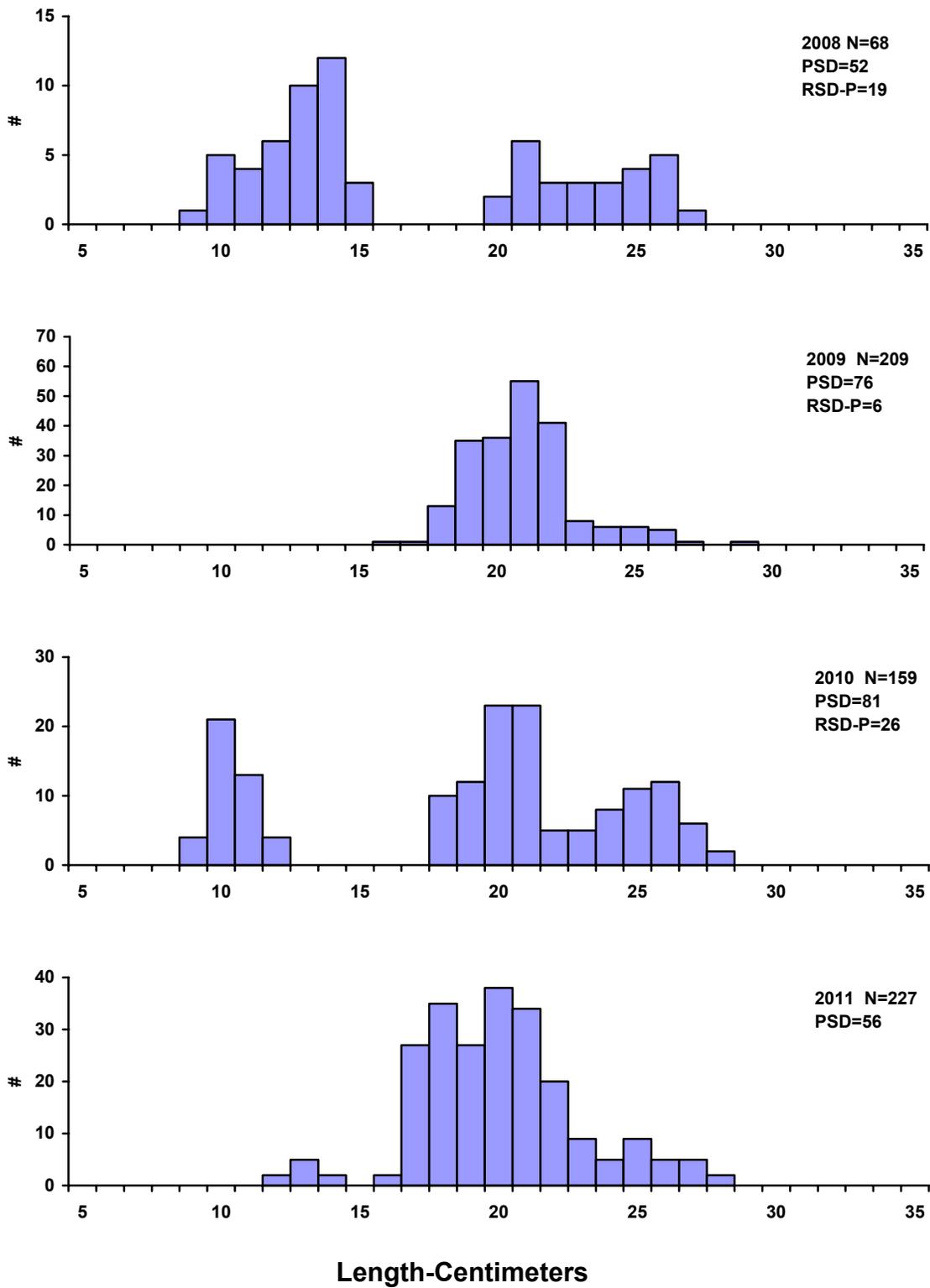
<b>Year</b>	<b>Number</b>	<b>Species</b>	<b>Size</b>
1991	32,115	Yellow Perch	Fingerling
1992	30,399	Yellow Perch	Fingerling
	22,480	Walleye	Lrg. Fingerling
1993	19,644	Walleye	Lrg. Fingerling
1994	30,950	Bluegill	Fingerling
	19,268	Walleye	Lrg. Fingerling
1995	32,000	Bluegill	Fingerling
	60,000	Largemouth Bass	Fingerling
1996	1,994	Bluegill	Fingerling
	192,540	Walleye	Fingerling
1998	2,400,000	Walleye	Fry
1999	11,689	Yellow Perch	Adult
2002	65	Smallmouth Bass	Adult
2003	57,470	Smallmouth Bass	Fingerling
2004	170,200	Walleye	Fingerling
	13,440	Smallmouth Bass	Fingerling
2005	58,340	Smallmouth Bass	Fingerling
2006	173,060	Walleye	Fingerling
2010	172,480	Walleye	Fingerling
2011	1,223	Muskellunge	Lrg. Fingerling

## **MANAGEMENT RECOMMENDATIONS**

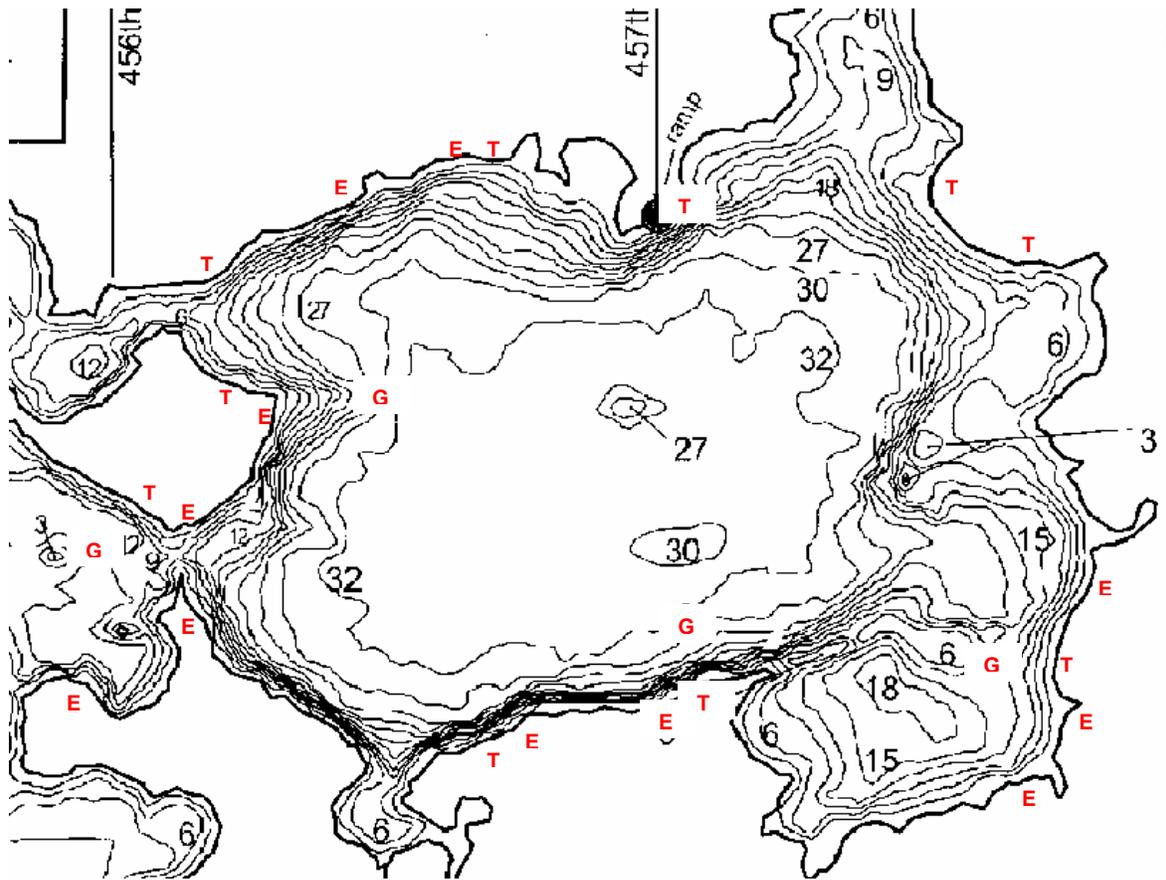
1. Monitor the fishery by conducting annual summer netting surveys to assess the fish population and fall electrofishing surveys to assess walleye recruitment.
2. Achieve the walleye management objective by stocking fry or fingerlings into voids of natural reproduction as determined by fall electrofishing surveys.
3. Consider stocking fry, fingerling, or adult yellow perch if natural reproduction fails to maintain population density at objective levels.
4. Stock muskellunge fingerlings at the rate of one/acre every other year to establish and maintain a low-density population.



**Figure 1.** Length frequency histograms for walleyes sampled with gill nets in Lake Sinai, Brookings County, 2008-2011.



**Figure 2.** Length frequency histograms for yellow perch sampled with gill nets in Lake Sinai, Brookings County, 2008-2011.



**Legend**

Gill Net Sites: G

Trap Net Sites: T

Electrofishing Sites: E

**Figure 3.** Sampling locations on Lake Sinai, Brookings County, 2011.

**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).

<b>Species</b>	<b>Stock</b>	<b>Quality</b>	<b>Preferred</b>	<b>Memorable</b>	<b>Trophy</b>
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.