SOUTH

DAKOTA

FISHERIES

Statewide Fisheries Survey, 2010
Survey of Public Waters
Part 1 - Lakes
Region 1

South Dakota
Department Of
Game, Fish and Parks
Wildlife Division
Joe Foss Building
523 E Capitol Ave
Pierre, South Dakota 57501-3182

Annual Report
No. 13-03

Preface

This is an annual report. Copies of this report and reference to the data is not for publication and can only be made with written permission from the author(s), Director of the Division of Wildlife, or the Secretary of the South Dakota Department of Game, Fish and Parks, Pierre, South Dakota 57501-3182.

Table of Contents

Introduction ……..… 1
Objective ……..… 1
Procedure …….…… 1
Findings ……... 1

LAKE SURVEY RESULTS, Region 1

Butte County
Belle Fourche Reservoir…….. 2
Newell Lake ……. 15

Custer County
Legion Lake …….. 27
Stockade Reservoir…… 32

Fall River County
Angostura Reservoir ……. 49
Cold Brook Reservoir ……. 66
Cottonwood Springs Reservoir …….. 72

Haakon County
Waggoner Lake …….. 80

Jackson County
Belvidere Lake …… 92

Lawrence County
Coxes Lake ……. 97
Dalton Lake …… 100
Iron Creek Lake ……. 106
Upper Mirror ……. 113
Lower Mirror …….. 118
Reausaw Lake ……. 123
Roubaix Lake …….. 128

Meade County
Bandit ……. 134
Bear Butte Lake ……. 139
Curlew Lake …… 146
Durkee Lake …… 155
Opal Lake …… 164

Pennington County
Deerfield Reservoir ……. 170

Gateway Lake……. 183
Horsethief Lake …….. 188
Mitchell Lake …….. 194
New Underwood Lake …… 200
New Wall Dam …….. 208
Pactola Reservoir …… 213
Sheridan Lake ……. 227
Slate Creek Dam …… 241

Perkins County
Coal Springs Lake …….. 246
East Lemmon Lake ……. 252
Flat Creek Lake …….. 259
Owens Lake ……. 266
Shadehill Reservoir ……. 271
Sorum Lake ……. 283
USFS Pasture #9 ……. 290

STATEWIDE FISHERIES SURVEY, 2010

Survey of Public Waters

By

Bill Miller, Michelle Bucholz, and Gene Galinat
South Dakota Department of Game, Fish and Parks
Rapid City, SD 57702

INTRODUCTION

Data gathered from May through October 2010 in State Management Region 1 are contained in this report. The Missouri River System and other State Management Regions are contained in separate reports.

OBJECTIVE

To survey waters where data is not sufficient to complete management plans or where optimum sport fishing yields are not realized under existing management and additional information is needed for plan update and remedial action.

PROCEDURE

Individual waters are surveyed to accumulate and update physical, chemical and biological data. A review of existing information accompanied new data collections. Information collected was recorded in a narrative type form developed for the South Dakota Fisheries Investigations Manual.

FINDINGS

The findings are contained in the following lake survey reports. This reporting method will allow for orderly collecting and recording data, making it available for completing and updating management plans, and evaluating current management practices.

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Belle Fourche Reservoir County: Butte
Legal description: T 9N, R 3E Sec. 1, 2, 3, 7, 11-14, 19, 23-26, 29
Location from nearest town: 9 miles east of Belle Fourche, SD
Dates of present survey: August 2-6, 19, 2010
Date last surveyed: July 28-30, August 3-6, 21, 2009
Most recent lake management plan: F21-R-36 Date: 2004
Management classification: Warmwater permanent
Contour mapped: 1985

Primary Species: (game and forage)	Secondary and other species:
1. Walleye	1. Yellow perch
2. Channel catfish	2. Smallmouth bass
3. Gizzard shad	3. White bass
4. Black crappie	4. Longnose sucker
5.	5. Spottail shiner
6.	6. Common carp
7.	7. Tiger muskie

PHYSICAL CHARACTERISTICS

Surface Area: 8,063 acres; Watershed: 2,867,200 acres
Maximum depth: 55 feet; Mean depth: 25 feet
Lake elevation at survey: approximately 80% of capacity

1. Describe ownership of lake and adjacent lakeshore property:

The U.S. Bureau of Reclamation (BOR) and the Belle Fourche Irrigation District perform the operation and maintenance of Belle Fourche Reservoir. The South Dakota Department of Game, Fish and Parks, Division of Wildlife manages 164 acres of land below the dam grade and the Division of Parks manages 350 acres around the boat ramp (T9N R3E, Sec. 24, 25). The U.S. BOR also manages 6,617 acres around the reservoir as wildlife habitat and for public access although irrigation has priority for water rights.

2. Describe watershed condition and percentages of land use:

The Belle Fourche Reservoir watershed is approximately 4,480 square miles consisting mostly of private land used for livestock grazing.

3. Describe aquatic vegetative condition:

Belle Fourche Reservoir is an irrigation source and often at low levels during the annual survey. In 2010, the reservoir was near 80% capacity during the survey. Belle Fourche Reservoir filled in 2008, leaving a ring of flooded terrestrial vegetation around the lake.

4. Describe pollution problems:

Departmental personnel identified no pollution problems during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

All structures appear to be in excellent condition. Repairs were performed on the outlets to reduce the amount of seepage from the reservoir. The Division of Parks put in a low water ramp, which allows boat access when water levels are below the traditional launching level.

BIOLOGICAL DATA

Methods

Electrofishing

Age-0 gizzard shad were collected using a Smith-Root electrofishing boat during the day on August 19, 2010. Ten, 10-minute runs were made around the lake. During each run, as many age-0 shad were netted as possible and counted. Water temperature was 75 degrees Fahrenheit.

Netting

A net survey was conducted at Belle Fourche Reservoir on August 2-6, 2010 (Figure 1). Trap netting consisted of eight net nights. Four trap nets were set on the August 2 but were not run until the August 4 because of high winds. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (¾ in) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. The gill net survey consisted of eight net nights. All gill nets were monofilament experimental nets 45.7 m (150 ft) long and 1.8 m (6 ft) deep with six 7.6 m (25 ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in).

Collected fish were measured for total length (TL; mm) and weighed (g). Age and growth analysis was accomplished using otoliths or scales collected from individual fish. Otoliths were collected from the first five walleye per centimeter group. For younger fish, typically less than age-4, otoliths were submersed in water in a black dish and viewed whole under a dissecting microscope. Preparation of otoliths of older fish involved “cracking” or breaking the otolith through the nucleus and burning the fractured area under a propane torch. The half-otolith was mounted in putty, cleared with mineral oil, illuminated with a single fiber-optic strand and viewed under a dissecting scope. Aging of other game fish was done with scales. Scale samples were obtained from below the lateral line just behind the pectoral fin. Scales were prepared for reading by pressing them between two acetate slides to make an imprint, then the slides were viewed with a microfiche projector (40X) and distances between scale annuli were recorded on paper strips.

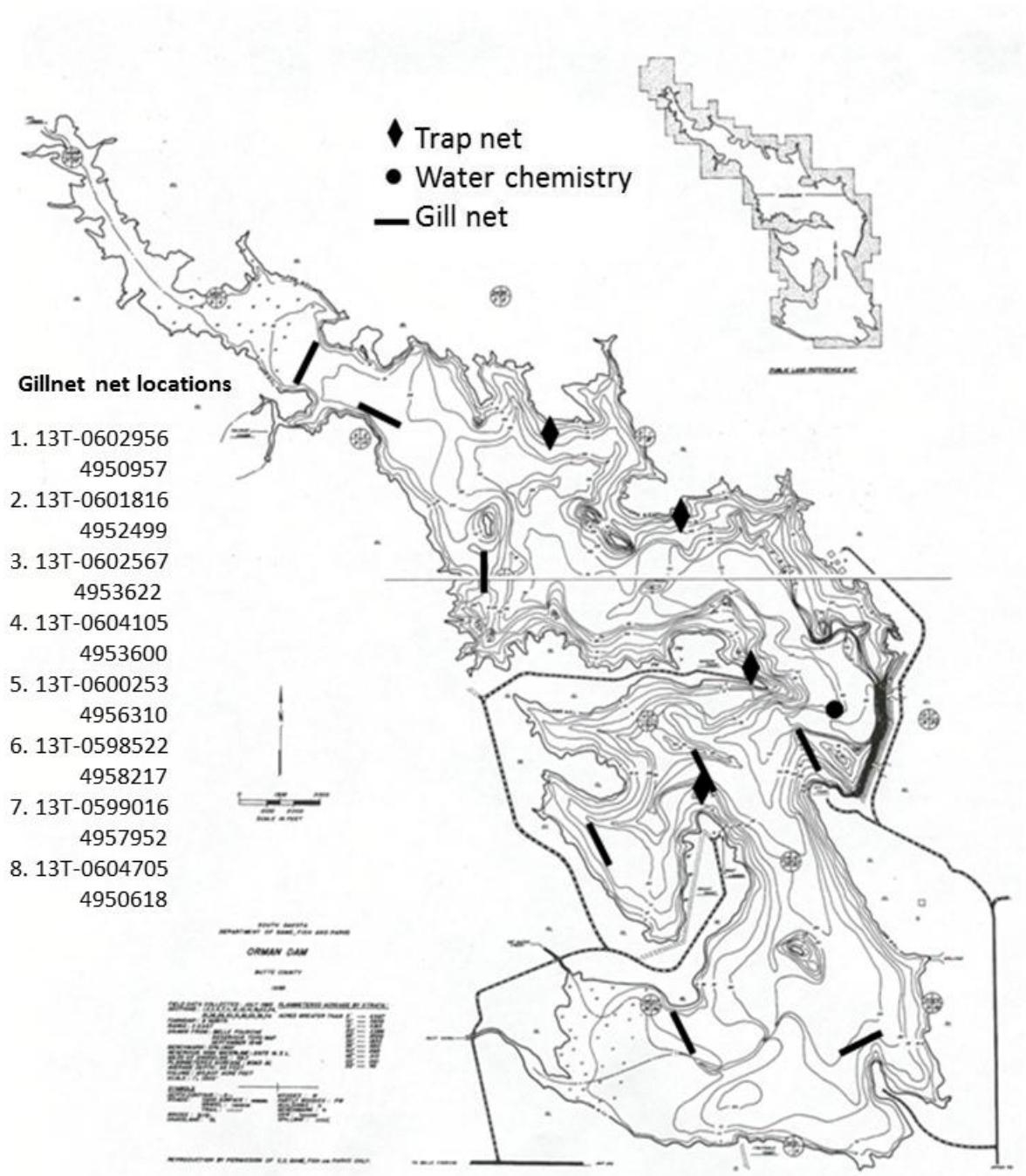


Figure 1. Locations of sampling sites on the Belle Fourche Reservoir, Butte County, 2010.

Data Analysis

Fish population parameters calculated were catch-per-unit-effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean CPUE (number per net night). Population structural characteristics were expressed as length frequency histograms and with PSD and RSD-P values. Fish condition was expressed with mean Wr values.

Results and Discussion

Age-0 Fish Survey

Forty-one young of year shad were captured in 1.7 hours of electrofishing (Table 1). This gave a CPUE of 24.1 shad per hour. In 2009, shad electrofishing yielded a CPUE of 255.2 young of year shad per hour (Table 5).

Table 1. Results for daytime electrofishing catch of age-0 gizzard shad from the Belle Fourche Reservoir, August 19, 2010.

Site	No./Site	Time (sec)	No./hr
#1 Lower-1	0	600	0
#1 Lower-2	0	600	0
#1 Lower-3	0	600	0
#2 Lower-1	0	600	0
#2 Lower-2	26	600	156
#2 Lower-3	0	600	0
Middle-1	6	600	36
Middle-2	0	600	0
Middle-3	1	600	6
Upper-1	8	600	48
Total	**41**	**1.7hrs**	**24.1**

Fish Community Survey

Eleven species totaling 433 fish were collected in gill nets during the 2010 lake survey. Yellow perch dominated the catch, comprising 62.1% of the total. Walleye were the second most common at 18.5%. Spottail shiners were the third most abundant species with 11.5%. Other species collected were black crappie, common carp, freshwater drum, river carpsucker, shorthead redhorse, white bass, white crappie and gizzard shad (Table 2).

Trap nets sampled eleven species for a total of 70 fish (Table 3). Walleye was the most abundant species sampled, comprising 30.0% of the total catch. White bass was second most abundant at 22.9%. Black crappie and yellow perch made up 11.4% each. Other species collected were channel catfish, common carp, freshwater drum, northern pike, river carpsucker, shorthead redhorse, and white crappie.

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD; 90% CI's), and fish condition for fish larger than stock length (Wr>S; 90% CI's) for all fish species collected from eight, 150-ft experimental sinking gill nets in Belle Fourche Reservoir, August 2-6, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr>S
Black crappie	2	0.3 (0.2)	0	--	--	110.5 (--)
Channel catfish	32	4.0 (1.1)	3.9 (1.1)	84 (--)	6 (--)	88.2 (1.7)
Common carp	12	1.5 (0.7)	1.5 (0.7)	100 (--)	33 (26)	82.9 (1.4)
Freshwater drum	5	0.6 (0.4)	0.6 (0.4)	--	--	99.3 (5.0)
Gizzard shad	2	0.3 (0.4)	0.0 (--)	--	--	--
River carpsucker	2	0.3 (0.2)	0.3 (0.2)	--	--	87.2 (--)
Shorthead Redhorse	6	0.8 (0.4)	0.8 (0.4)	--	--	102.3 (2.7)
Spottail shiner	50	6.3 (2.1)	--	--	--	--
Walleye	80	10.0 (4.0)	9.0 (3.7)	68 (9)	1 (3)	76.5 (0.6)
White bass	18	2.3 (1.5)	2.3 (1.5)	100 (--)	83 (16)	82.2 (2.8)
Yellow perch	269	33.6 (17.2)	14.9 (7.7)	45 (8)	6 (4)	95.0 (0.5)
Totals	433					

Table 3. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD; 90% CI's) and fish condition for fish larger than stock-length (Wr>S; 90% CI's) for all fish species collected from four, modified-fyke trap nets in Belle Fourche Reservoir, August 2-6, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr>S
Black Crappie	8	1.0 (0.7)	1.0 (0.7)	25 (31)	13 (23)	105.7 (4.3)
Channel Catfish	3	0.4 (0.6)	0.1 (0.4)	--	--	90.7 (13.6)
Common Carp	2	0.3 (0.2)	0.3 (0.2)	--	--	90.3 (28.4)
Freshwater drum	1	0.1 (0.2)	0.1 (0.2)	--	--	112.7 (--)
Northern pike	1	0.1 (0.2)	0.1 (0.2)	--	--	73.0 (--)
River Carpsucker	3	0.4 (0.4)	0.4 (0.4)	--	--	90.1 (9.3)
Shorthead Redhorse	5	0.6 (0.8)	0.6 (0.8)	--	--	94.3 (5.2)
Walleye	21	2.6 (0.8)	2.6 (0.8)	52 (20)	--	75.5 (1.5)
White Bass	16	2.0 (1.8)	2.0 (1.8)	100	94 (11)	80.4 (2.2)
White crappie	2	0.3 (0.4)	0.3 (0.4)	--	--	91.5 (--)
Yellow Perch	8	1.0 (0.7)	1.0 (0.7)	38 (35)	--	84.9 (2.8)
Totals	70					

Channel Catfish

Channel catfish numbers increased from 1.8 per net in 2009 to 4.0 during in 2010 (Table 4). The proportion of quality fish remained similar between years, indicated by PSD values of 84 in 2010 and 77 in 2009. Percent of larger fish showed an increase indicated by RSD-P increasing from zero in 2009 to six in 2010. Fish condition was about average for this lake at this time of year with a mean Wr for stock length and larger catfish of 88.2. Length frequency shows a good number of fish in the 19 to 21 inch range (Figure 2).

Table 4. Composite listing of sample size (N), catch per gillnet night (CPUE; 80% CI's in parentheses), and proportional stock densities (PSD, RSD; 90% CI's in parentheses) for channel catfish from Belle Fourche Reservoir, 2002-2010.

Year	N	CPUE	PSD	RSD-P	Wr>S
2002	45	22.5 (41.6)	51 (2)	2 (4)	82.5 (1.4)
2003	22	11.0 (12.3)	46 (26)	8 (13)	82.1 (4.5)
2004	69	34.5 (44.6)	63 (22)	0	83.5 (3.6)
2005	30	15.0 (46.2)	7 (9)	0	88.4 (3.3)
2006*	54	13.5 (2.5)	17 (9)	4 (4)	79.4 (0.7)
2007*	44	7.3 (3.9)	49 (14)	0	85.8 (1.0)
2008*	25	4.2 (1.8)	68 (16)	4 (7)	88.4 (3.7)
2009*	14	1.8 (0.9)	77 (22)	0	91.2 (2.7)
2010*	32	4.0 (1.1)	84 (--)	6 (--)	88.2 (1.7)

*150 ft gill nets (300 ft gill nets used prior to 2006)

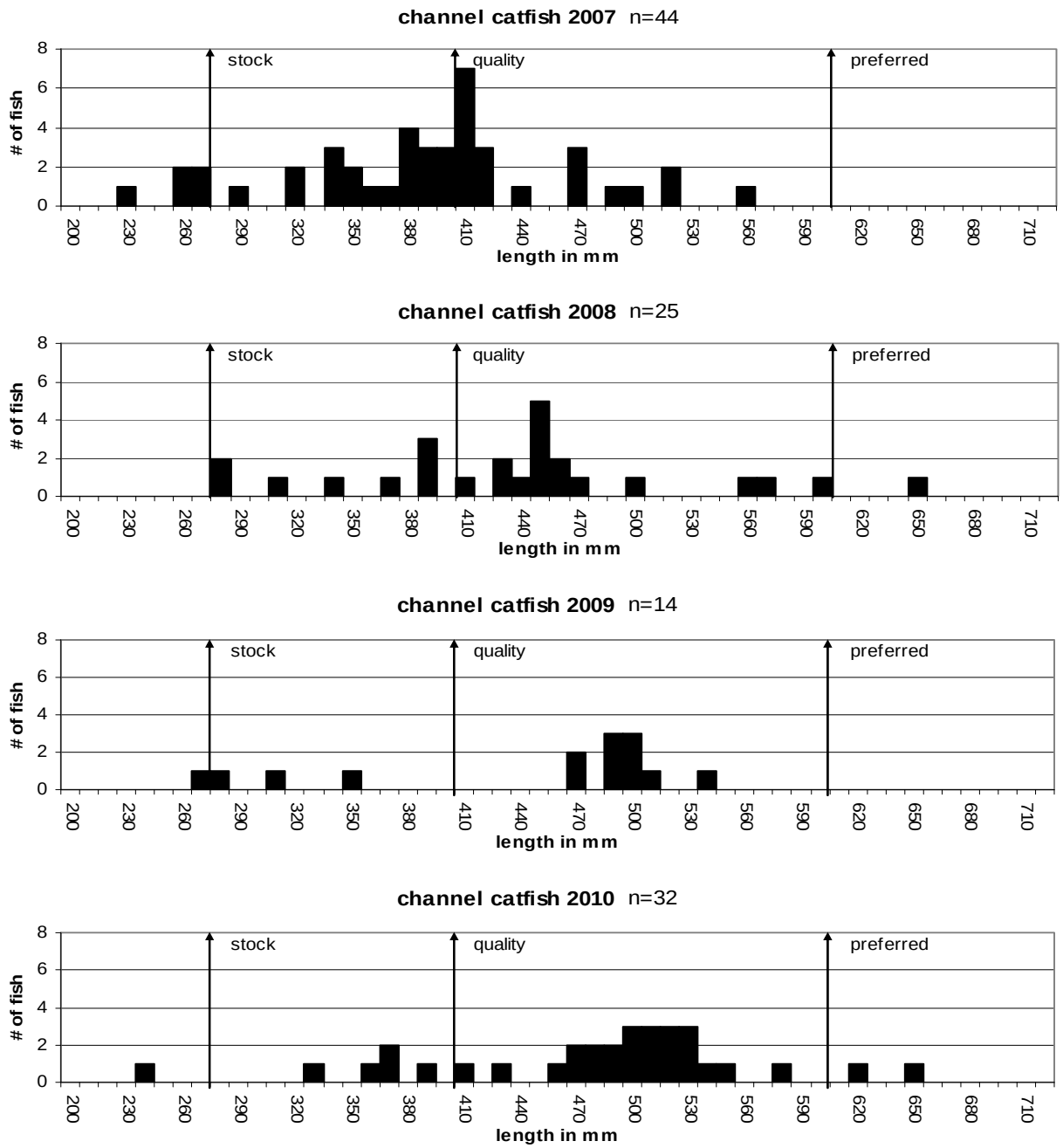


Figure 2. Lengths of channel catfish collected in gill nets from Belle Fourche Reservoir, Butte County 2007-2010.

Gizzard Shad

Gizzard shad are an important prey fish species in the reservoir. Since shad reintroduction in 1997, walleye growth rates have improved dramatically. Adult shad stocking is done annually to ensure adequate reproduction (i.e. forage) in case of a total winterkill.

Age-0 shad are collected through day electrofishing and numbers have been highly variable during sampling (Table 5). Shad numbers dipped sharply this past year. Daytime electrofishing yielded an average CPUE of 24.1 young of year, a substantial decrease from 255.2 last year. In addition, from eight gillnets only two young of year shad were sampled. It appears the long winter may have negatively impacted over winter survival and possibly 2010 reproduction.

Table 5. Results for daytime electrofishing catch of age-0 gizzard shad from the Belle Fourche Reservoir, 2005-2010.

Year	N	Time	CPUE
2005	763	0.83hrs	919.3
2006	3,112	0.83hrs	3,749.4
2007	1,179	0.83hrs	1,420.5
2008	185	1.0hrs	185.0
2009	319	1.3hrs	255.2
2010	41	1.7hrs	24.1

Walleye

Walleye abundance appears to have remained similar from 2009 to 2010. Gillnet catch was 10.0 per night compared to 7.8 per night last year (Table 6). Sizes also have remained similar, indicated by PSD of 68 in 2010 compared to 71 in 2009. The number of fish over twenty inches remains low (i.e. RSD-P = 1). In 2009, no walleye over twenty inches were sampled. The length frequency histogram shows a good number of fish in the 430 to 460 millimeter range, the upper limit of protection offered by the special length regulation (Figure 3). Age data indicates these fish are mostly age 4 (Table 7). These fish should grow beyond the protected sizes next year but anglers can still only harvest one fish per day over 18 inches in length.

Fish condition was low with an average Wr for stock length and larger fish of 76.5, compared to 82.5 last year. This may be a reflection of the poor shad reproduction this year. Walleye growth remained good, however, with mean length at capture averaging 383 millimeters at age 3, compared to 399 last year (Table 8). Future sampling will determine if this age-2 year class can make it through another year of harvest and into the protected length limit over the next couple of years.

Table 6. Composite listing of sample size (N), catch per unit effort (CPUE; 80% confidence intervals are given in parentheses), catch per net night of stock-length fish (CPUE-S; 80%CI's), and proportional stock densities (PSD, RSD; 90% CI's are given in parentheses) for walleye collected by gill net in Belle Fourche Reservoir, 2000-2010.

Year	N	CPUE	CPUE-S	PSD	RSD-P	Wr>S
2000	109	27.3 (17.6)	22.3 (11.1)	65 (9)	0	84.0 (0.4)
2001	283	70.8 (33.2)	63.8 (31.3)	47 (5)	4 (2)	86.1 (0.2)
2002	178	89.0 (40.0)	87.5 (41.6)	38 (6)	3 (2)	84.7 (0.5)
2003	317	158.5 (297.0)	125.0 (255.5)	29 (5)	1 (1)	85.6 (0.1)
2004	227	113.5 (207.8)	95.0 (153.9)	27 (5)	1 (1)	85.3 (0.6)
2005	251	125.5 (185.2)	125.5 (185.2)	40 (5)	0	76.1 (0.2)
2006*	110	27.5 (15.7)	25.3 (14.9)	45 (9)	0	81.5 (0.2)
2007*	114	19.0 (10.5)	14.0 (8.4)	69 (8)	0	80.2 (0.6)
2008*	101	16.8 (6.7)	16.2 (6.1)	46 (9)	1 (2)	79.8 (0.1)
2009*	62	7.8 (2.4)	6.1 (1.9)	71 (11)	0	82.5 (0.8)
2010*	80	10.0 (4.0)	9.0 (3.7)	68 (9)	1 (3)	76.5 (0.6)

*150 foot gillnets used instead of 300 foot pre-2006.

Table 7. Belle Fourche Reservoir walleye length range and weighted mean length (mm) at capture by otolith aged gillnet sample August 2-6, 2010.

Age	Minimum length range @ capture	Weighted mean length @ capture	Maximum length range @ capture	Number of fish in survey
2	227	270	333	23
3	373	383	396	6
4	405	438	470	33
5	419	439	459	2
6	472	477	481	2
7	431	445	462	4
8	440	453	465	2
9	480	499	517	2
10	455	455	455	1

Table 8. Mean condition (Wr) with 90% CI in parenthesis for gillnet walleye by length categories at Belle Fourche Reservoir 2002-2010.

Description	2003	2004	2005	2006	2007	2008	2009	2010
Substock	84.6 (2.8)	92.4 (0.4)	NA	88.3 (--)	80.2 (0.6)	86.3 (4.2)	81.5 (2.2)	82.1 (3.5)
Stock to quality	87.3 (0.1)	87.2 (0.5)	78.5 (0.3)	83.6 (0.4)	83.8 (1.3)	82.7 (0.2)	82.3 (1.8)	78.5 (1.1)
Quality to preferred	81.8 (0.1)	80.9 (0.6)	72.5 (0.5)	78.9 (0.3)	78.6 (0.4)	76.6 (0.7)	82.5 (0.8)	75.8 (0.6)

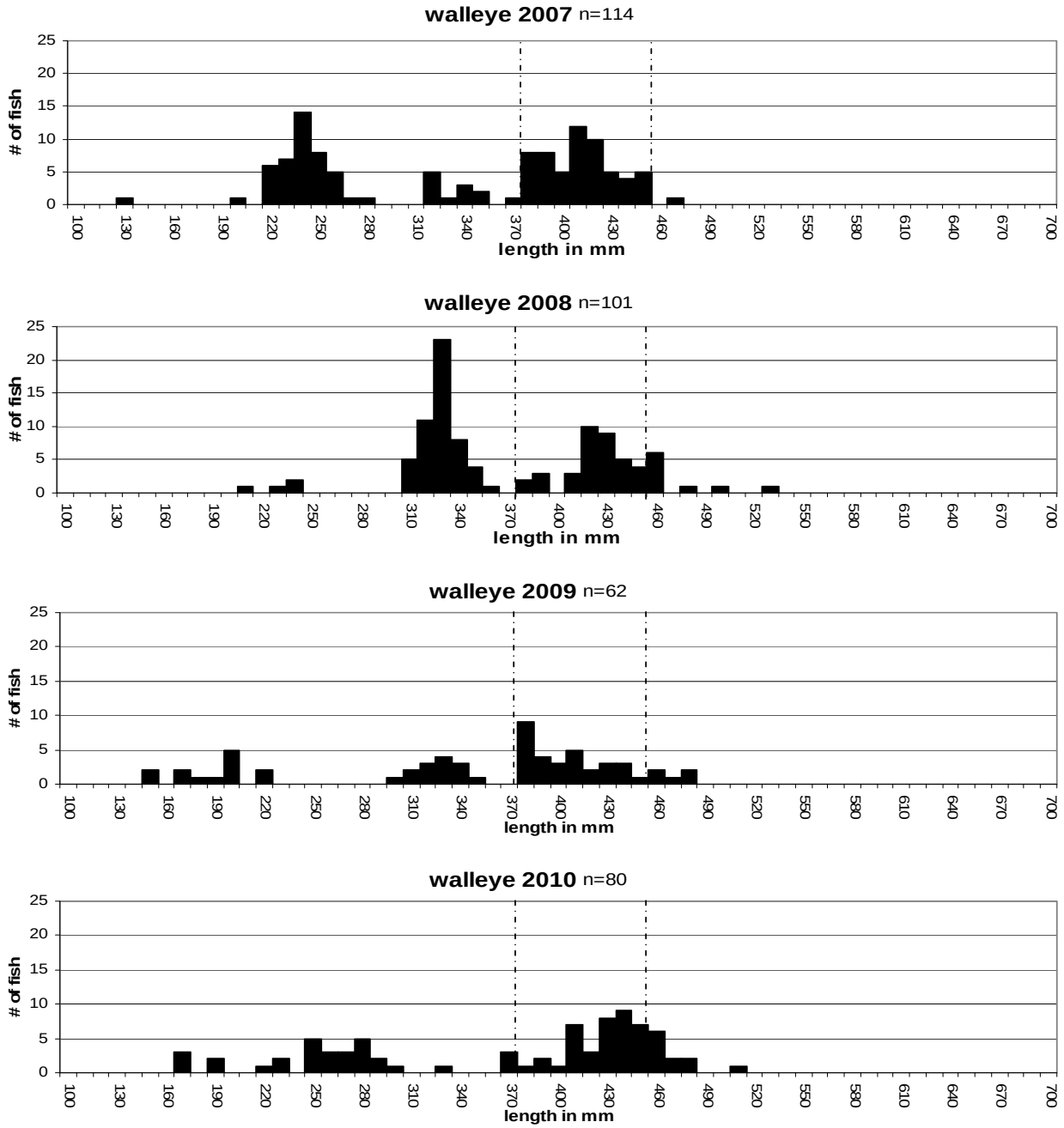


Figure 3. Lengths for gill net walleye from Belle Fourche Reservoir 2007-2010. The dotted line represents 15" to 18" (fish within the protected slot).

Yellow Perch

Spawning structures and adult stockings are being utilized to create an alternative forage base in addition to gizzard shad. High water levels the past two years have helped in these efforts as catch rates increased greatly. Catch rates went from 6.0 per gill net in 2008 to 41.4 last year

(Table 9). This year, CPUE remained high at 33.6 with a CPUE of fish over stock length at 14.9. Length frequency shows a strong 2009-year class (Figure 4).

Abundant water and spawning habitat in 2010 should have helped and reproduction was hopefully good again this year. Sizes are also improving indicated by PSD of 45 and RSD-P of 6 compared to three and zero last year, respectively. At these sizes, perch may become a nice bonus fish for the many anglers visiting Belle Fourche Reservoir.

Table 9. Composite listing of sample size (N), catch per unit effort (CPUE; 80% confidence intervals are given in parentheses), catch per net night of stock-length fish (CPUE-S; 80%CI's), for yellow perch collected by gill net in Belle Fourche Reservoir, 2004-2010.

Year	N	CPUE	CPUE-S
2004	11	5.5 (1.5)	5.5 (1.5)
2005	4	2.0 (6.2)	2.0 (6.2)
2006*	6	1.5 (1.1)	1.5 (1.1)
2007*	56	9.3 (9.2)	0.8 (0.5)
2008*	36	6.0 (4.5)	1.7 (1.4)
2009*	331	41.4 (13.0)	10.9 (3.8)
2010*	269	33.6 (17.2)	14.9 (7.7)

*150 ft gill nets (300 ft gill nets used prior to 2006).

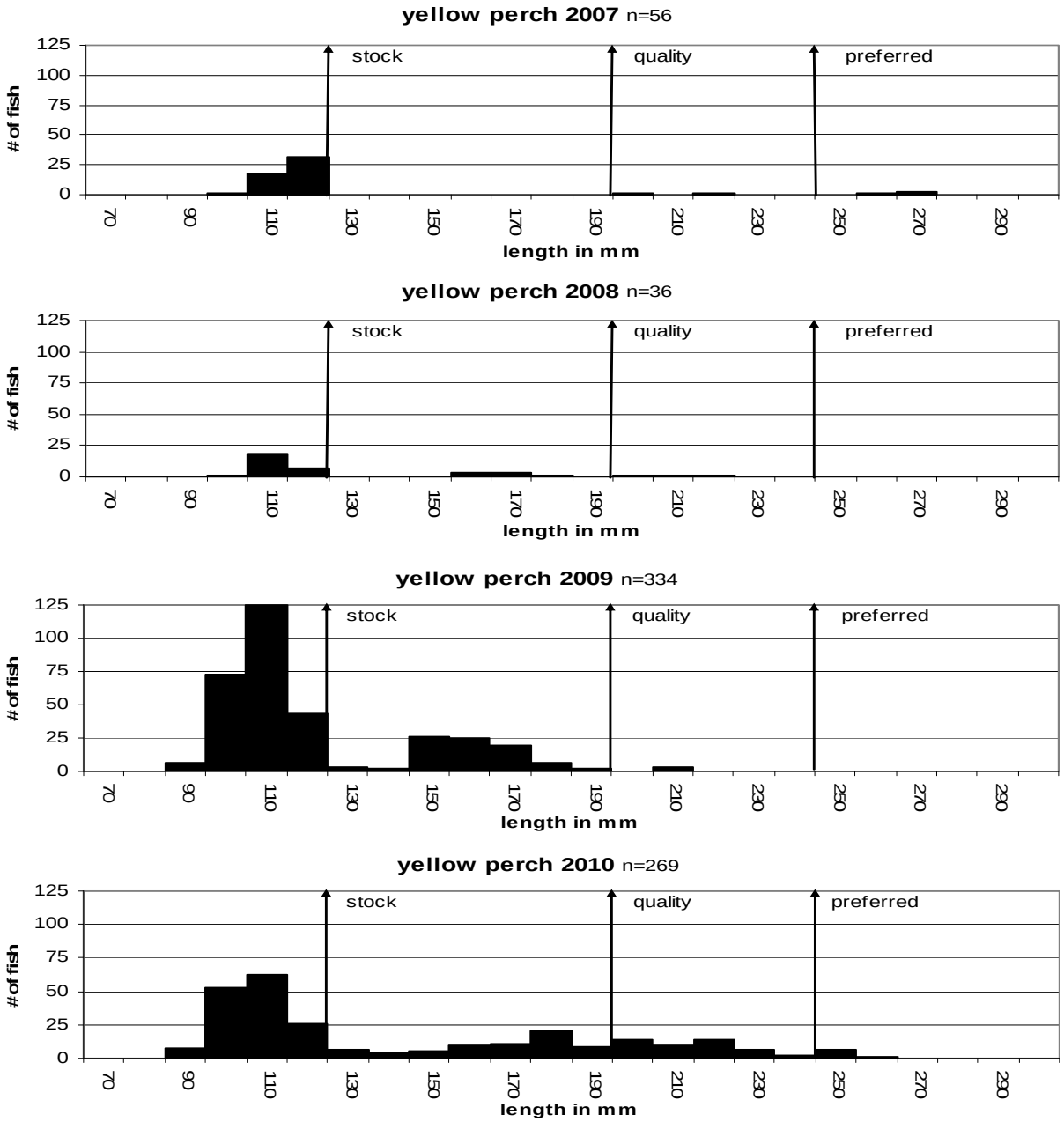


Figure 4. Length histogram of yellow perch collected in gill nets from Belle Fourche Reservoir, Butte County 2007-2010.

RECOMMENDATIONS

1. Continue conducting lake surveys annually to evaluate fish populations.

2. Stock with adult gizzard shad annually to maintain a forage for walleye, as over winter survival of shad is questionable.

3. Take advantage of low water years to place Christmas trees along the shoreline, which will provide habitat to assist crappie (spp.) and yellow perch reproduction and recruitment, this effort may also provide additional forage for walleye.

APPENDICES

Appendix A. Stocking record for Belle Fourche Reservoir, Butte County, 2001-2010.

Year	Number	Species	Size
2001	48	Gizzard shad	Adult
	1,900	Tiger muskie	Large fingerling
2002	2,000	Tiger muskie	Large fingerling
	23	Gizzard shad	Adult
2003	171,893	Walleye	Fingerling
	18,436	Rainbow trout	Fingerling
	1,500	Tiger muskie	Large fingerling
	102	Gizzard shad	Adult
2004	1,605	Tiger muskie	Large fingerling
	120	Gizzard shad	Adult
2005	182	Gizzard shad	Adult
	2,263	Splake trout	Fingerling
2006	96	Yellow perch	Adult
2007	52,800	Rainbow trout	Fingerling
2008	4600	Rainbow trout	Fingerling
	59	Gizzard shad	Adult
2009	74	Gizzard shad	Adult
2010	18	Gizzard shad	Adult
	415,406	Walleye	Fingerling

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Newell Lake County: Butte
Legal description: T 10N, R 6E Sec. 9
Location from nearest town: 8 miles north and 2 miles east of Newell, SD
Dates of present survey: June 14-16, 2010, September 28, 2010
Date last surveyed: June 25-27, October 3, 2007
Most recent lake management plan: F21-R-36 Date: 1997
Management classification: Warm-water permanent
Contour mapped: 1991

Primary Species: (game and forage)	Secondary and other species:
1. Largemouth bass	1. Smallmouth bass
2. Bluegill	2. Rudd
3. Northern pike	3. White sucker
4. Yellow perch	4. Black bullhead
5. Walleye	5.

PHYSICAL CHARACTERISTICS

Surface Area: 183 acres, 74 ha; Watershed: 7,680 acres
Maximum depth: 32 feet; Mean depth: 13.6 feet
Lake elevation at survey (from known benchmark): -1 feet

1. Describe ownership of lake and adjacent lakeshore property:

The Department of Game, Fish and Parks own Newell Lake, as well as the surrounding property. The shoreline is managed as a recreation area and a game production area.

2. Describe watershed condition and percentages of land use:

The Newell Lake watershed is approximately 12 square miles of pasture land. The area has been negatively affected by the recent drought and heavy cattle grazing.

3. Describe aquatic vegetative condition:

Submerged aquatic vegetation in Newell Lake consists of coontail and cattail. Summer months are often characterized as having large amounts of vegetation in the shallow bays and inlets. Emergent vegetation consists of bulrush and cattail.

4. Describe pollution problems:

Siltation occurs in the inlet area and is the primary problem in the lake. Sloughing of banks caused by cattle grazing and cattle excretions within the game production area are other pollution issues.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

In 1998, following the lake survey, major damage occurred to the tubes that required rebuilding the spillway. Work on the spillway was completed in 1999. The spillway and dam are currently in good condition. At the time of the survey, low water made the boat ramp barely useable.

BIOLOGICAL DATA

Methods

A lake survey was conducted at Newell Lake June 14-16, 2010. Sampling consisted of 2 gill net nights and 8 trap net nights (Figure 1). All gill nets were monofilament experimental nets. Each net was 45.7 m (150 ft) long and 1.8 m (6 ft) deep with six 7.6 m (25 ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Trap nets were set at four stations consisting of 2 trap net nights each. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 in) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g). In addition, scale samples for the first five fish per centimeter group were collected from selected fish per gear type for age and growth analysis. Scale samples were pressed onto acetate slides and viewed with a microfiche projector (40X) and the distance between scale annuli were recorded on paper strips.

Night electrofishing was completed at Newell Lake on September 28th. Electrofishing was conducted using a Smith-Root control unit with pulsed-DC. Six, 10-minute sampling runs were completed during the survey. All largemouth bass were collected, measured for total length (TL; mm) and weighed (g). In addition, scale samples were collected from up to 5 fish per centimeter group for largemouth bass for age and growth analysis.

Fish population parameters calculated were catch-per-unit-effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean CPUE (number per net night). Population structural characteristics were expressed as length frequency histograms and with PSD and RSD-P values. Fish condition was expressed with mean Wr values.

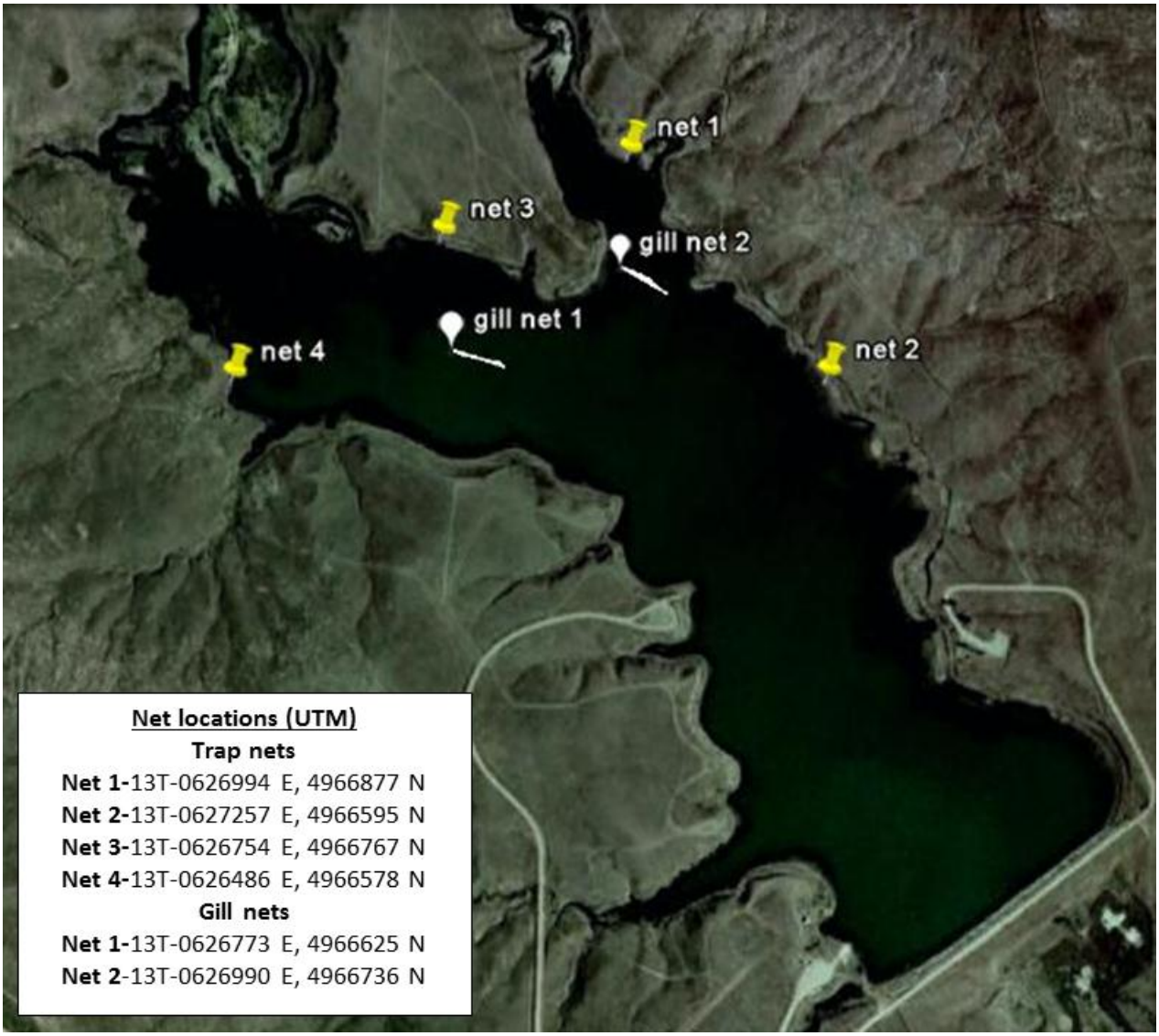


Figure 1. Map of Newell Lake net locations in 2010.

Results and Discussion

The netting portion of the survey was conducted June 14-16, 2010 and boat electrofishing was completed on September 20-8, 2010. Overall, 8 fish species were collected during the netting portion of the fish survey (Tables 1 and 2). Thirty-four fish were collected in gill nets, with walleye being the most abundant at 67.6% by number. Two hundred seventy four fish were collected in trap nets, with European rudd comprising 35.0%, and white sucker 28.1% of the sample. Bluegills were the third most abundant at 24.1%. Fall electrofishing yielded six largemouth bass and 102 walleye (Table 3). Population parameters of dominant game and forage species in Newell Lake are discussed individually below.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock-length; 80%CI's) for all fish species collected from eight, ¾ inch trap nets in Newell Lake, Butte County, June 14-16, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black bullhead	8	1.0 (0.5)	1.0 (0.5)	88 (24)	25 (31)	95.9 (9.1)
Bluegill	66	8.3 (2.4)	8.3 (2.4)	97 (4)	42 (11)	115.6 (1.3)
Golden Shiner	4	0.5 (0.4)	--	--	--	--
Northern pike	4	0.5 (0.4)	0.5 (0.4)	--	--	78.0 (9.6)
European rudd	96	12.0 (6.4)	--	--	--	--
Walleye	19	2.4 (0.8)	2.3 (0.7)	83 (16)	11 (13)	79.6 (2.0)
White sucker	77	9.6 (2.0)	9.6 (2.0)	100 (--)	100	86.1 (2.4)
Total	274					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock-length; 80%CI's) for all fish collected from two, 150-ft experimental sinking gill nets in Newell Lake, June 14-16, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Northern pike	5	2.5 (1.5)	2.5 (1.5)	--	--	76.2 (3.1)
European rudd	4	2.0 (6.2)	--	--	--	--
Walleye	23	11.5 (7.7)	3.5 (7.7)	86 (28)	0	84.5 (3.7)
White sucker	1	0.5 (1.5)	0.5 (1.5)	--	--	--
Yellow perch	1	0.5 (1.5)	0.5 (1.5)	--	--	97.2 (--)
Total	34					

Table 3. Total catch (N), fish per hour (CPUE; 80% CI's in parentheses), fish per hour of stock length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock length; 80%CI's) for largemouth bass and walleye collected from 68.3 minutes of electrofishing at Newell Lake, September 28, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Largemouth bass	6	4.7 (2.7)	4.7 (2.7)	--	--	114.8 (5.2)
Smallmouth bass	1	0.7 (1.0)	0.7 (1.0)	--	--	95.1 (--)
Walleye	102	77.5 (35.7)	18.1 (10.4)	25 (15)	4 (7)	85.2 (1.2)
Total	109					

Bluegill

Bluegill was the most abundant game fish in Newell Lake with a trap net CPUE of 8.3, substantially lower than 57.7 in 2007 (Table 4). Current CPUE was less than half of the management objective of 20 for CPUE of stock length and larger bluegill. Past years have been rather consistently above the objective so this year might be an anomaly. Future sampling will show if this is a trend or numbers return to the objective range.

Sizes of bluegill were good (Figure 2). Stock indices yielded a PSD of 97 with an RSD-P of 42, compared to 53 and 9 in 2007, respectively (Table 4). This suggests Newell Lake should provide an excellent fishery of quality size bluegill. These stock indices are higher than the current management objective for bluegill with PSD between 50 and 80 and RSD-P between 10 and 30. Fish condition of adult bluegill also remains excellent with a mean Wr for stock-length and larger fish of 115.6, higher than the mean Wr in 2007 at 100.6 (Table 4).

Table 4. Composite listing of sample size (N), catch per unit effort (CPUE; 80% confidence intervals are given in parentheses), proportional stock densities (PSD, RSD; 90% CI's in parentheses) and fish condition for fish larger than stock-length (Wr>S; 90% CI's in parentheses) for bluegill collected by trap nets in Newell Lake, 2002, 2004, 2006, 2007, 2010.

Year	N	CPUE-S	PSD	RSD-P	Wr>Stock
2002	192	24.0 (9.7)	76 (5)	16 (5)	92.1 (1.0)
2004	231	33.0 (8.8)	76 (5)	4 (2)	105.3 (0.9)
2006	140	17.5 (8.3)	57 (7)	11 (5)	102.2 (0.6)
2007	404	57.7 (12.3)	53 (5)	9 (3)	100.6 (0.7)
2010	66	8.3 (2.4)	97 (4)	42 (11)	115.6 (1.3)

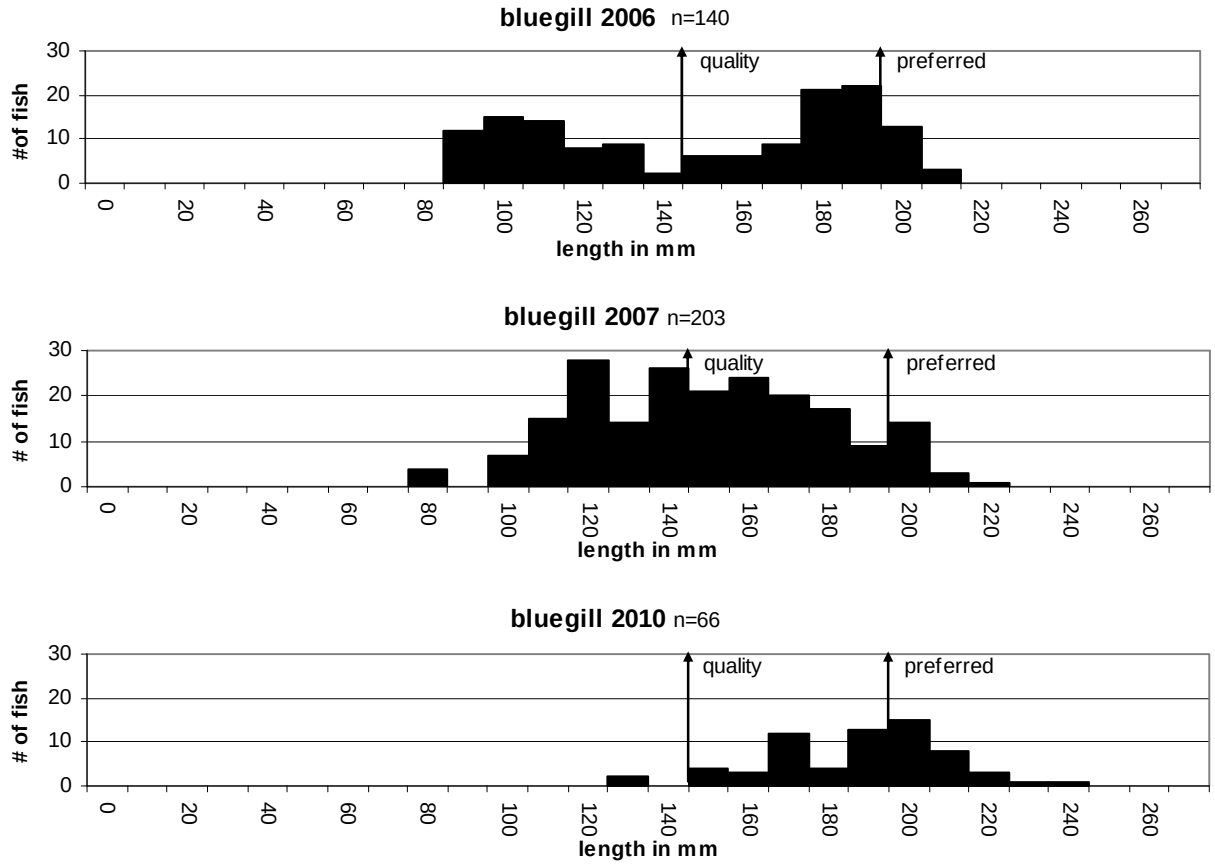


Figure 2. Lengths of bluegill collected by trap nets in Newell Lake, 2006-2007, 2010.

<u>European Rudd</u>

Newell Lake's European Rudd population is doing well and was the most abundant species sampled in the trap nets with a CPUE of 12.0 (Table 1). Catch per net during 2007 was 18.0. Size structure of the rudd population remains relatively similar to that observed in past surveys (Figure 3). Either recruitment is being limited or our gear is adapted to catch fish in the 12 to 15 inch range since fish sampled all appear to be larger fish. A management objective at this lake is to continue management efforts towards high densities of predators (i.e. walleye, largemougth and smallmouth bass) to keep European Rudd densities in check.

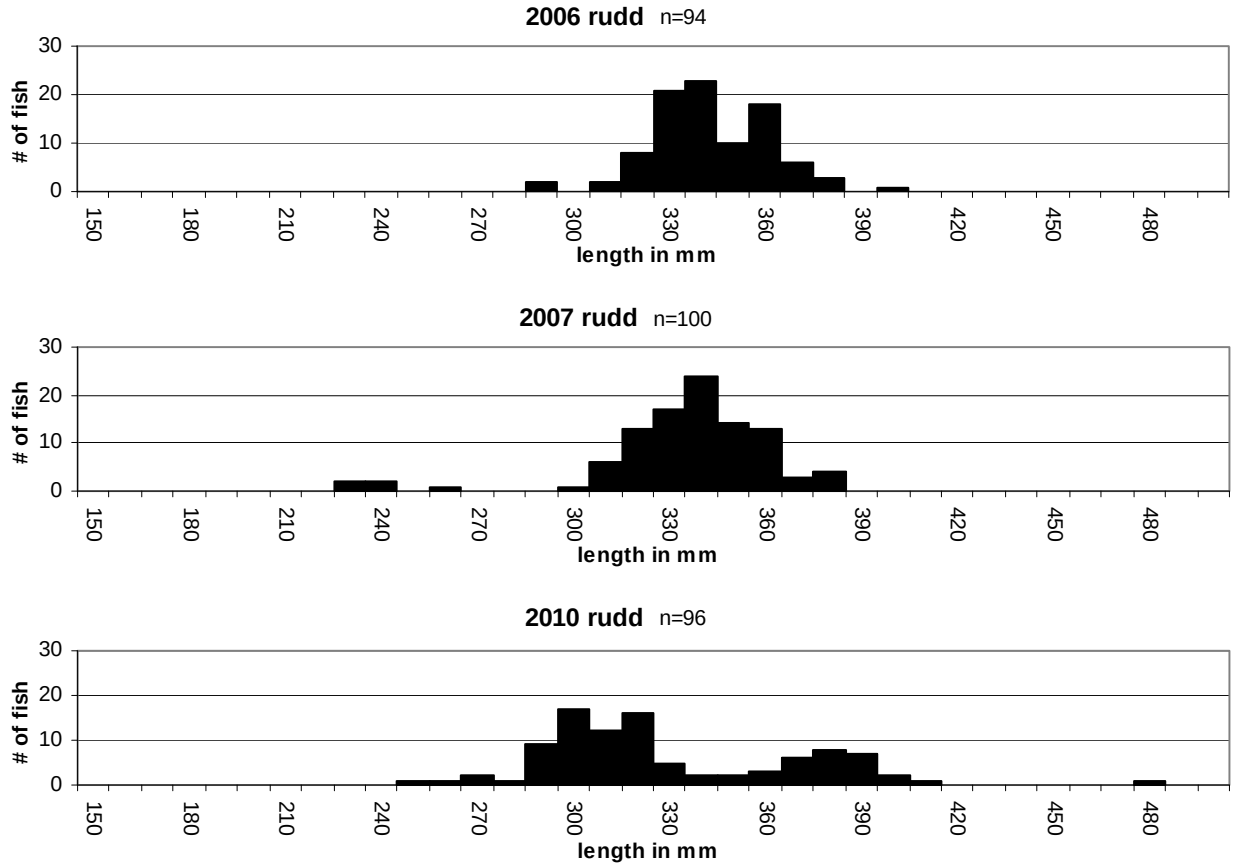


Figure 3. Length frequency histogram of European Rudd collected by trap nets in Newell Lake 2006, 2007, 2010.

Table 5. Composite listing of sample size (N), catch per unit effort (CPUE; 80% confidence intervals are given in parentheses), for European Rudd collected by trap nets in Newell Lake, 2002, 2004, 2006, 2007, 2010.

Year	N	CPUE
2002	144	18.6 (6.4)
2004	53	21.6 (11.9)
2006	173	7.6 (3.4)
2007	130	18.0 (9.2)
2010	96	12.0 (6.4)

Largemouth Bass

A 12 to 16-inch protective length limit with a one bass daily over 16 inches was put in effect for 2004 to increase the numbers of larger bass. Starting January 1, 2010, the protective length limit was raised to protect bass from 14 to 18 inches (i.e. must be released) and only one bass over 18 inches could be kept as part of the daily limit.

The 2007 electrofishing sample had a CPUE for stock-length and larger fish of 55.2 bass per hour, which is the highest recorded in recent history (Table 6). Stock indices were high with a PSD of 73 and an RSD-P of 23. High runoff in 2008 filled the lake and created very turbid water, which prohibited sampling in 2008 and 2009. In 2010, only a few larger bass were caught and catch rates were the lowest recorded since 2000 with a CPUE of 4.7 fish per hour (Figure 4, Table 6). Fish condition remained excellent with a Wr for stock-length and larger fish of 114.8 during this survey.

The 2007 numbers exceeded the current bass management objectives of a minimum CPUE for fish greater than stock length of 20; a PSD between 40 and 70; and RSD-P greater than 20. The 2010 numbers are not within the management objectives and possibly something occurred during the recent flooding of the reservoir that has lowered bass density. In case sample timing or other factors caused the 2010 survey to be a poor representation of the population, this fishery will continue to be sampled annually to determine if this population remains within the management goal.

Table 6. Total catch (N), pedal time (seconds), catch per hour of electrofishing (CPUE), mean total length (TL, standard error is given in parentheses), proportional stock densities (PSD, RSD; 90% confidence intervals are given in parentheses) and condition factor (Wr for fish ≥ stock length; 80%CI's) for largemouth bass collected by electrofishing in Newell Lake, 2000, 2002-2007, 2010.

Year	N	Pedal Time (seconds)	CPUE	CPUE-S	PSD	RSD-P	Wr≥S
2000	3	4,116	2.6	2.6	--	--	--
2002	125	7,200	82.2 (28)	19.2 (7)	50 (16)	0	114.6 (1.3)
2003	77	3,600	77.0 (23)	41.0 (14)	27 (12)	15 (10)	106.7 (1.3)
2004	31	3,600	31.0 (13.4)	28.0 (12.0)	36 (16)	18 (13)	108.1 (1.6)
2005	23	3,894	21.7 (9.1)	18.0 (6.0)	32 (19)	0	101.2 (1.4)
2006	36	3,800	35.5 (16.0)	30.8 (13.8)	42 (--)	16 (--)	114.3 (2.2)
2007	69	3,650	67.9 (15.8)	55.2 (15.1)	73 (10)	23 (10)	117.2 (1.3)
2010	6	4,098	4.7 (2.7)	4.7 (2.7)	--	--	114.8 (5.2)

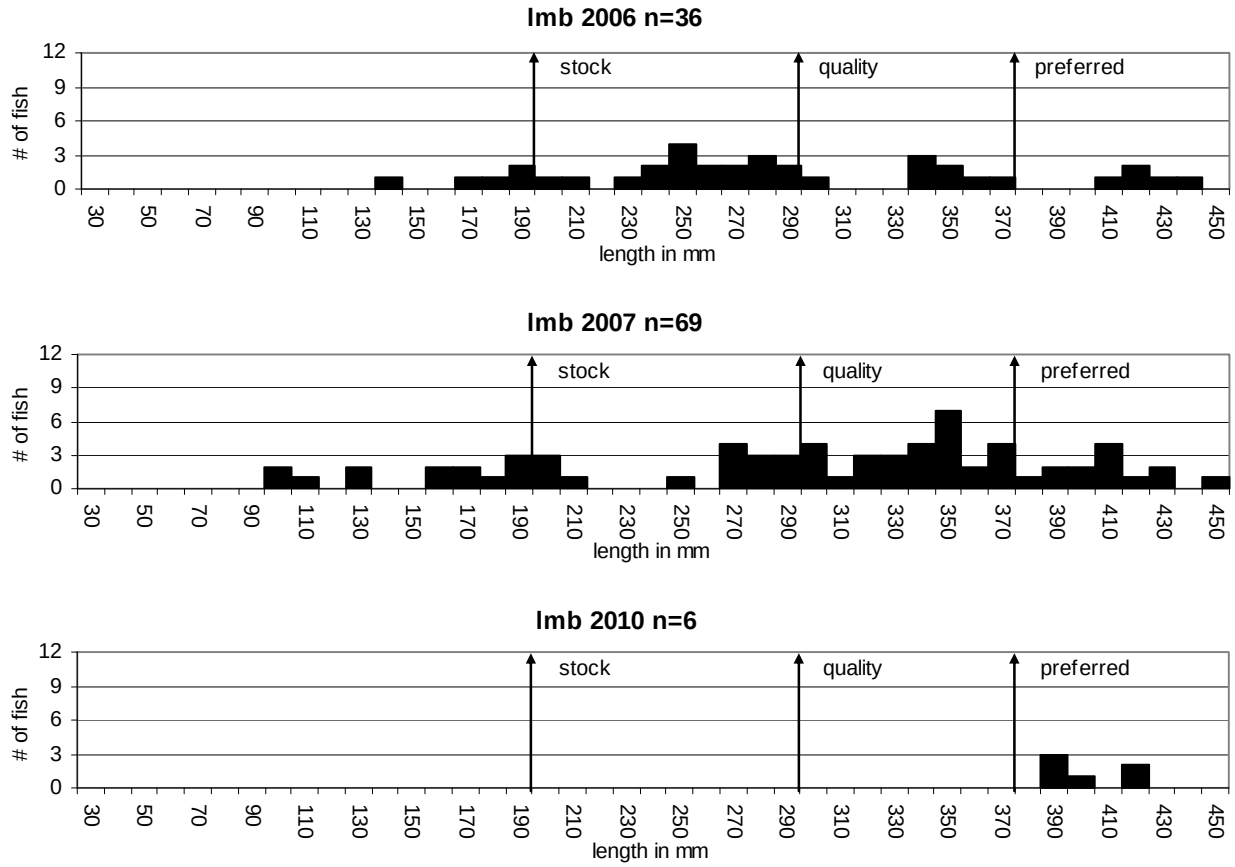


Figure 4. Length frequencies of largemouth bass collected by electrofishing in Newell Lake, Butte County, 2006-2007, 2010.

Walleye

Walleye were the only game fish species to show an increase in numbers since the 2007 survey. In attempt to increase walleye density, a 14-inch minimum length limit for walleye was implemented at Newell Lake on January 1, 2004, which was changed in January of 2010 to a 15-inch minimum with a 2 fish daily limit. In addition to the regulation, 50,000 fingerlings have been stocked annually from 2007-2009. These management efforts were made to increase predator abundance that will provide additional predation on the bluegill and European Rudd populations, as well as, provide a bonus walleye fishery.

During this year's electrofishing survey 102 walleyes were sampled. Of the 102 fish sample, 83 were under stock length of 250 millimeters (Figure 5). This indicates the largest number of young fish sampled in recent years.

It appears the small fingerling stockings have had good survival to date. Mean fish condition was 85.2 for stock length and larger fish during fall electrofishing (Table 8). This is down from 96.1 in the 2007 electrofishing sample. Gillnets numbers also increased while trap net values were very similar to 2007 (Table 7).

Table 7. Composite listing of sample size (N), catch per unit effort (CPUE; 80% confidence intervals are given in parentheses), proportional stock densities (PSD, RSD; 90% CI's in parentheses) and fish condition for fish larger than stock-length (Wr>S; 90% CI's in parentheses) for walleye collected by electrofishing in Newell Lake, 2004-2007, 2010.

Year	N	CPUE	CPUE-S	PSD	RSD-P	Wr>Stock
2004	11	11.0 (5.3)	10.0 (5.9)	80 (24)	0	84.7 (2.2)
2005	16	16.4 (7.5)	14.7 (8.1)	19 (17)	6 (11)	78.9 (1.6)
2006	29	26.8 (5.7)	24.8 (5.5)	33 (16)	4 (6)	87.9 (0.9)
2007	69	67.1 (22.1)	23.9 (17.0)	32 (16)	4 (7)	96.1 (1.6)
2010	102	77.5 (35.7)	18.1 (10.4)	25 (15)	4 (7)	85.2 (1.2)

Table 8. Composite listing of catch-per-unit-effort (CPUE with 80% CI's), for walleye collected by gill nets, trap nets and fall electrofishing in Newell Lake, 2002–2007, 2010.

Year	Gill net	Trap net	Fall electrofishing
2002	2.0 (3.1)	1.1 (0.6)	--
2004	6.0 (9.2)	0.1 (0.2)	11.0 (5.3)
2005	--	--	16.4 (7.5)
2006	0.5 (1.5)	0.4 (0.4)	26.8 (5.7)
2007	2.0 (3.1)	2.6 (1.3)	67.1 (22.1)
2010	11.5 (7.7)	2.4 (0.8)	77.5 (35.7)

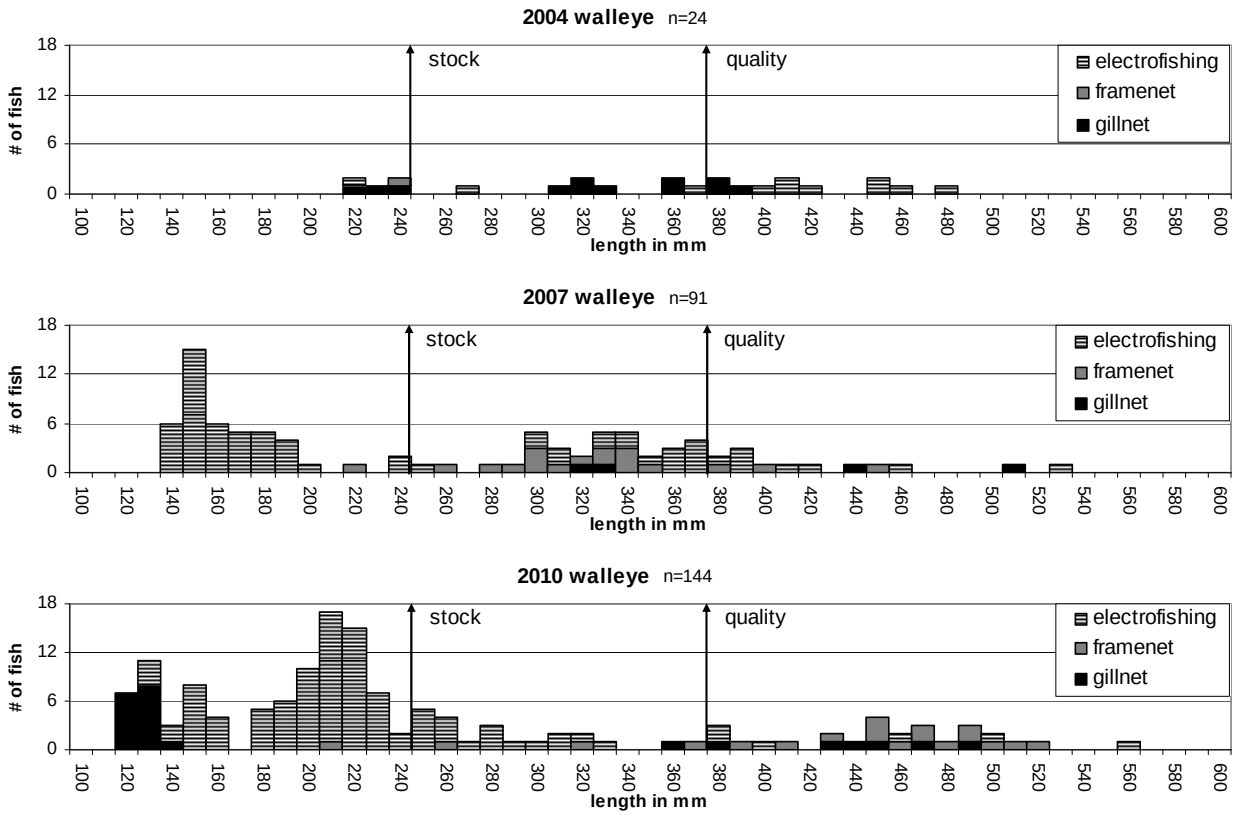


Figure 5. Lengths of walleye collected from Newell Lake, 2004, 2007, 2010.

Yellow Perch

In 2004 and 2006, two- hundred Christmas trees were placed in Newell Lake to provide yellow perch spawning habitat. With high water in 2008 thru 2010 it was expected perch numbers would increase. Our netting survey shows just the opposite. Adult yellow perch numbers remain low in Newell Lake with only one fish sampled out of eight trap nets and two gillnets (Table 9). In 2007, gill nets caught a large number from the 2006 year class with 25.0 per net. These fish didn't show up in 2010. Some perch were observed during fall electrofishing, so it's possible our sampling did not adequately represent the perch population. The fishery is scheduled to be surveyed again in 2011, which should indicate if we missed them with our nets this year.

Table 9. Composite listing of sample size (N), catch-per-unit-effort (CPUE with 80% CI's), for yellow perch collected by gill nets and trap nets in Newell Lake, 2002, 2004, 2006-7 and 2010.

Year	Gill net CPUE	Trap net CPUE
2002	5.0 (3.1)	2.4 (1.5)
2004	4.5 (1.5)	0.7 (0.5)
2006	1.0 (3.1)	0.6 (0.6)
2007	25.0 (77.0)	0.1 (0.2)
2010	0.5 (1.5)	0.0 (--)

RECOMMENDATIONS

1. Conduct standard lake surveys every other year to monitor fish populations.

2. Sample largemouth bass, smallmouth bass and walleye annually with fall night electrofishing to identify population changes and effectiveness of special regulations.

3. Stock small walleye fingerlings biannually at a rate of 200-300 walleye per acre as a secondary predator and bonus fishery.

APPENDICES

Appendix A. Stocking record for Newell Lake, Butte County, 2005-2010.

Year	Number	Species	Size
2005	2,230	Walleye	Large fingerling
2006	180	Largemouth bass	Adult
	187	Walleye	Large fingerling
2007	50,000	Walleye	Small fingerlings
2008	53,975	Walleye	Small fingerlings
2009	54,100	Walleye	Small fingerlings
2010	None		

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Legion Lake County: Custer
Legal description: T3S, R5E, Sec 25
Location from nearest town: 8 Miles East of Custer, SD
Dates of present survey: August 30-31, 2010
Date last surveyed: May 28-30, 1996
Most recent lake management plan: F21-R-28
Management classification: Coldwater Permanent Contour mapped: 1987

Primary Species: (game and forage) Secondary and other species:
1. Rainbow trout 1. Largemouth bass
2. 2. Creek chub

PHYSICAL CHARACTERISTICS

Surface Area: 8.2 ac. (3.3 ha) Watershed: 1,490 acres (603 ha.)
Maximum depth: 22.0 (6.7 m) Mean depth: 9.7 ft. (3.0 m)
Lake elevation at survey (from known benchmark): unknown

1. Describe ownership of lake and adjacent lakeshore property:

Legion Lake, located on Galena Creek in the Battle Creek Watershed, is in Custer State Park. The lake was created after impoundment of Galena Creek as a Works Project Administration job by the Civilian Conservation Corps in 1934. The lake was originally named for the American Legion Club who previously leased the land and owned buildings around the lake. The lake and shoreline is owned and managed by the South Dakota Department of Game, Fish, and Parks (SDGFP).

2. Describe watershed condition and percentages of land use:

The watershed is largely mature ponderosa pine forest administered by SDGFP. The lake and its watershed are used exclusively for recreation and wildlife propagation.

3. Describe aquatic vegetative condition:

Emergent vegetation in the form of cattails line the inlet area of shoreline. Submergent forms were not noted to be excessive.

4. Describe pollution problems:

No pollution problems were evident during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

No apparent structural defects exist with the dam or outlet structure. No boat ramps exist on Legion Lake. A fishing pier, store, restaurant, and paddle boat/canoe rental are located on the northeast shoreline. Another fishing pier is located on the northwest shoreline near the inlet. Both piers appear to be in good condition. Several rental cabins are located a short distance above the lake to the northeast and a campground is across Hwy16A to the northwest. An un-maintained hiking trail is present around the lake and allows for shore fishing for a majority of the shoreline.

BIOLOGICAL DATA

Methods

Legion Lake was surveyed on August 30-31, 2010 with three trap net nights and two gill nets nights (Figure 1). Trap nets were set on August 30th and remained in the water overnight. Two nets had ¾ in mesh and a 1.3 × 23 m (3.9 × 75.5-ft.) lead. One net had ¼ inch mesh and a 50ft lead (baby frame). Leads were pulled on shore for some nets due to water levels and lengths of leads put on shore were not measured. For each survey method, total length (mm) and weight (g) was collected for each fish sampled.

Results and Discussion

Although a few of the earliest stockings have been non-salmonid (bluegill in 1934, bullheads in 1938, and a few occasional largemouth bass stockings), management of Legion Lake has historically been as a trout fishery. Also, while few of the early stockings were fingerling brook trout and a few brown trout, subsequent stockings have primarily been rainbow trout fingerling and catchable (11in) sizes.

The lake has been renovated on three different occasions (early 1940's, 1965 and 1985). In the early 1940's the dam needed maintenance and the lake was dense with aquatic vegetation. The lake was drained while the dam was repaired and the fishery was eliminated and started over. During 1965, the lake was chemically treated with rotenone to eradicate overabundant populations of white suckers, black bullheads, and a smaller population of green sunfish. After the treatment rainbow trout, brook trout, and brown trout were stocked into the lake. By 1985, the fishery was again experiencing high densities of white suckers, black bullheads, and yellow perch. A chemical renovation and silt removal project was performed on Legion Lake in 1985. A lake survey conducted in 1988 detected only one yellow perch among the species targeted for eradication and none of these species were found in the 1996 survey. Rainbow trout catchables have been the primary stockings and management strategy since the 1985 renovation.

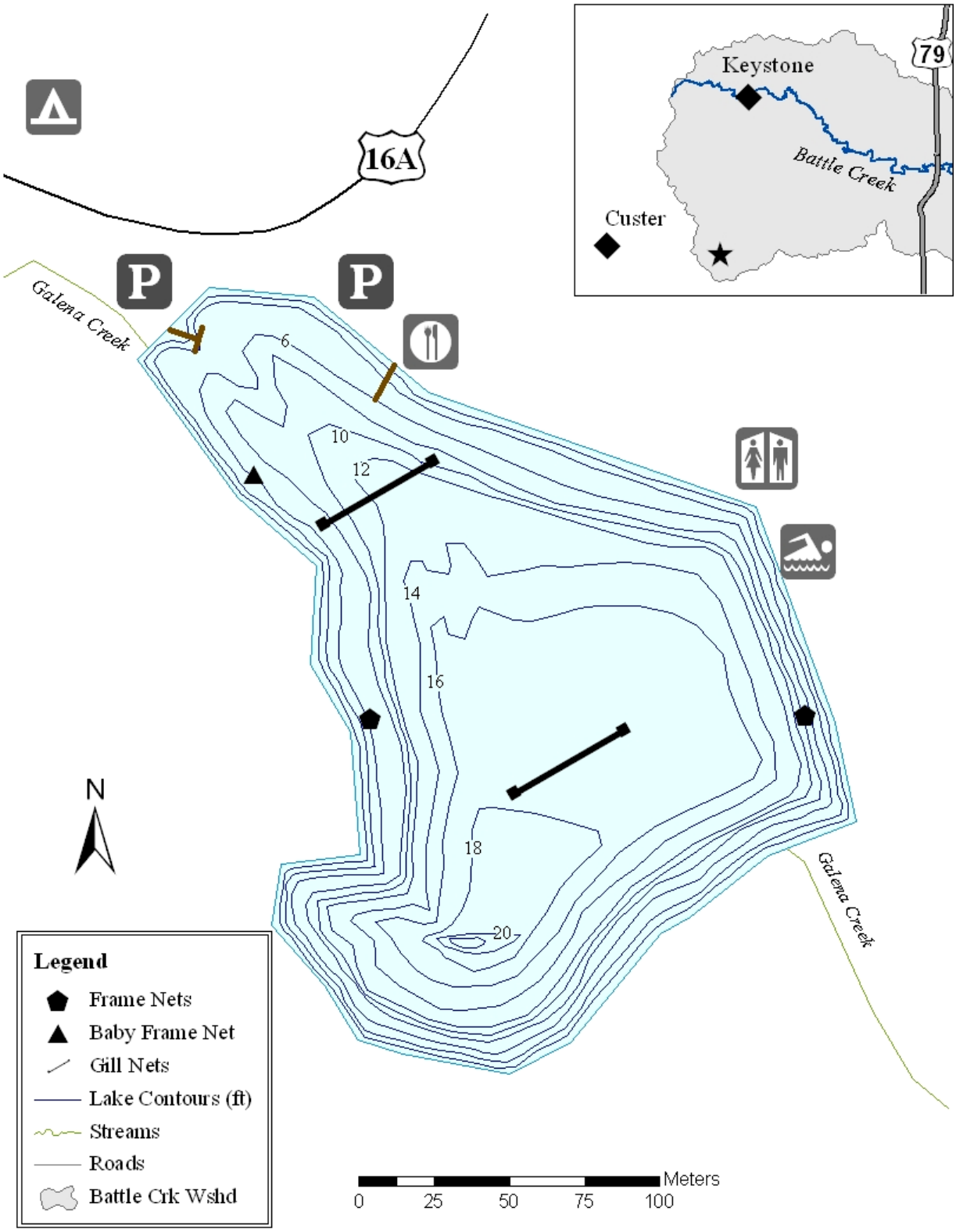


Figure 1. Lake map of sample locations on August 30-31, 2010 at Legion Lake, Custer County, South Dakota.

During the 2010 survey, four species of fish were collected totaling 65 fish (Tables 1 and 2). Largemouth bass were the most abundant species collected followed by rainbow trout. No fish were captured in the ¼ inch trap net. The sampling of a single bluegill and a single black crappie is somewhat surprising. These species have not been recently sampled in Legion Lake and shows that illegal introductions are an ongoing problem within the Black Hills Trout Management Area.

Table 1. Total catch for four, $^{3}/_{4}$ inch modified fyke-nets in Legion Lake, Custer County South Dakota on August 31, 2010. Parameters are reported with confidence intervals.

Species	**N**	**CPUE** (80%)	**CPUE-S** (80%)	**PSD** (90%)	**Wr-S** (90%)
Rainbow trout	2	1 (1)	9.5	0	115(22)
Bluegill	1	0.5 (1.5)	0.5 (1.5)	100	152
Black crappie	1	0.5 (1.5)	0.5 (1.5)	100	101
Total	4				

Table 2. Total catch for two 150ft experimental gill nets in Legion Lake, Custer County South Dakota on August 31, 2010. Parameters are reported with confidence intervals.

Species	**N**	**CPUE** (80%)	**CPUE-S** (80%)	**PSD-S** (90%)	**PSD**	**Wr-S** (90%)	**Mean Length** (mm)
Rainbow trout	27	13.5(11)	13.5(11)	100 (0)	0	121.9(3)	315
Largemouth bass	34	17(43)	7(12)	100 (0)	0	108(4)	202
Total	61						

Rainbow Trout

Rainbow trout are stocked into Legion Lake at a rate of about 2,500 catchable (11 in) and 150 adult (15 in) fish per year. In 2010, 1,500 catchable-size fish and 90 adult fish were stocked prior to the survey (Appendix A). Efforts were made to conduct sampling well after the stocking date to avoid sampling and possibly removing a high proportion of newly stocked fish. Gill nets captured 27 rainbow trout, all 282-381mm (11-15") in length.

Largemouth Bass

Although gill nets are not the ideal way to sample largemouth bass, 34 were captured during the 2010 survey. All of these were stock length (200-300mm) or smaller. In 2003, lengths were recorded on over 200 bass transferred from Legion Lake to Stockade Reservoir. A majority (84%) of these fish were also stock length.

Night electrofishing was accomplished on May 24, 2004 and on June 30, 2008 to capture largemouth bass for transfer to other local waters. Each electrofishing event was one complete trip around the lake. In 2004, over 200 largemouth bass were removed and in 2008 over 250

bass were removed. All bass were less than 15 inches (381mm) and taken to other local waters to supplement low density populations.

Other Species

One bluegill and one black crappie were captured in trap nets and have not been previously caught in lake surveys. During the 1996 survey, one fathead minnow and two creek chub were captured. Neither species was caught in 2010.

RECOMMENDATIONS

1. Continue to manage as a rainbow trout fishery by stocking approximately 2,500 rainbow trout per year.

2. Survey in 2015 to determine species composition, trend of fish population and monitor water quality.

APPENDIX

Appendix A. Stocking record for Legion Lake, Pennington County, 2001-2010.

Year	Species	Number	Size
2001	Rainbow Trout	5,000	Catchable
2002	Rainbow Trout	4,000	Catchable
	Rainbow Trout	2,000	Fingerling
	Rainbow Trout	30	Adult
2003	Rainbow Trout	4,600	Catchable
2004	Rainbow Trout	2,000	Catchable
	Rainbow Trout	150	Adult
2005	Rainbow Trout	2,798	Catchable
	Rainbow Trout	150	Adult
2006	Rainbow Trout	50	Adult
	Rainbow Trout	2,450	Catchable 11”
2007	Rainbow Trout	1,800	Catchable 11”
	Rainbow Trout	29	Catchable 15”
2008	Rainbow Trout	1,800	Catchable 11”
	Rainbow Trout	11	Adult 15”
	Rainbow Trout	52	Catchable 15”
2009	Rainbow Trout	2,750	Catchable 11”
	Rainbow Trout	100	Catchable 15”
2010	Rainbow Trout	2,500	Catchable 11”
	Rainbow Trout	150	Catchable 15”

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Stockade Reservoir County: Custer
Legal description: Sec 21, 22, 27, and 28; R5E; T3S
Location from nearest town: 3 miles east of Custer, SD
Dates of present survey: June 21 & 24, September 7-8 2010
Dates last surveyed: May 19, September 1-3, 2009
Most recent lake management plan: F-21-R-36
Management classification: Coldwater marginal
Contour mapped: June 1986

Primary Species: (game and forage)	Secondary and other species:
1. Largemouth bass	1. Bluegill
2. Smallmouth bass	2. Black bullhead
3. Yellow perch	3. Golden shiner
4. Black crappie	4. White sucker
5. Northern pike	5.

PHYSICAL CHARACTERISTICS

Surface Area: 130 acres Watershed: 42,880 acres
Maximum depth: 13.7 m (45 feet) Mean depth: 4.8 m (15.8 feet)
Lake elevation at survey (from known benchmark): full

1. Describe ownership of lake and adjacent lakeshore property:

Stockade Reservoir is owned by the State of South Dakota and lies within the boundaries of Custer State Park.

2. Describe watershed condition and percentages of land use:

Primary use of the Stockade Reservoir watershed includes timber sales (60%) administered by the U.S. Forest Service (USFS), pastureland (20%), municipal water use (15%), and mining (5%). Livestock grazing occurs on private and USFS land surrounding the lake. Bismarck Lake has a surface area of 25 acres and drains into one of Stockade Reservoir's north bays. Custer Municipal Pond has an estimated surface area of 4 acres and is located on French Creek above Stockade Reservoir on Custer's west edge of town, approximately 5 miles distant.

3. Describe aquatic vegetation condition:

Cattails were present along shorelines with shallow areas and in bays. Submerged vegetation consisted mostly of pondweed in shallow, shoreline areas. Summer algae blooms have sometimes been heavy and contributed to past summer kills.

4. Describe pollution problems:

Siltation and nutrient loading into Stockade Reservoir occurs from highway runoff, grazing, mining, and forestry practices via French Creek and Bismarck Lake Creek. The sewage treatment facility for the city of Custer was upgraded over the years, so city waste no longer enters the lake. From 1987 to 1990, silt removal from the French Creek inlet was accomplished by dredging and construction equipment (i.e. loaders and dump trucks).

5. Describe condition of all structures:

The aeration system, run by a 5-hp Quincy air pump, had no problems in 2010. All other equipment and structures appeared in good condition.

BIOLOGICAL DATA

Gill and trap netting was conducted on September 7-8, 2010. Sampling consisted of 2 gill net nights and 8 trap net nights (Figure 1). All gill nets were monofilament, experimental nets and were 45.7 m (150 ft.) long and 1.8 m (6 ft.) deep with six 7.6 m (25 ft.) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Trap nets were set at eight different stations, one net night each. All trap nets were modified fyke-nets with a 1.3 × 23 m (3.9 × 75.5 ft.) lead, 19.1 mm (¾ in) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. All fish captured were measured (total length, mm) and weighed (g). Otoliths were collected for age analysis from the first five yellow perch of each centimeter group collected from gill nets. Trap net collection was used to complete each size class.

Night electrofishing was conducted at Stockade Reservoir on June 21st and 24th, 2010 to sample largemouth and smallmouth bass. This was conducted using a Smith-Root 18-H electrofishing boat with pulsed-DC current at approximately 150 volts and 6-8 amps. Five ten-minute sites and one nine minute site were completed during the survey (Figure 1). Scales were collected from largemouth and smallmouth bass. These were pressed in acetate slides and aged using a microfiche reader.

Fish population parameters calculated were catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD), and relative weight (Wr) based on length categories. Abundance was expressed as the mean CPUE (mean number per net night or mean number per hour of electrofishing). Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

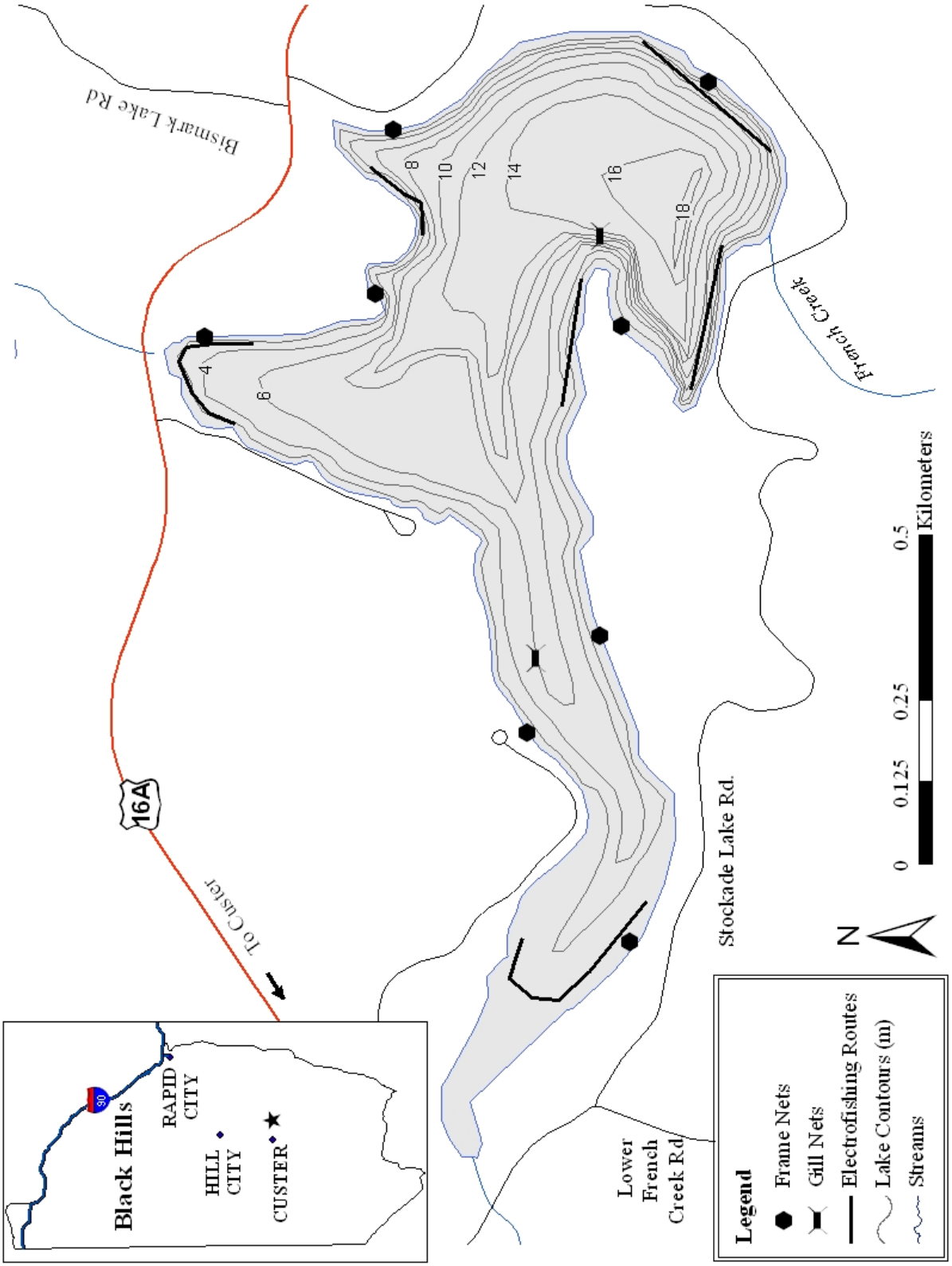


Figure 1. Lake map and 2010 sampling sites at Stockade Reservoir, Custer County, South Dakota.

Results and Discussion

Stockade Reservoir receives a high amount of fishing pressure from area residents, as well as, nonresidents, because of its location in Custer State Park. Largemouth bass, smallmouth bass, northern pike, yellow perch, and black crappie are the primary species in this lake. Bluegill, black bullheads, golden shiners, and white suckers are secondary species in Stockade Reservoir. A 15-inch (381 mm) minimum length limit for largemouth bass was established in 1995 in hopes of improving bass and panfish population structures. Smallmouth bass were added to the minimum length limit in 2004.

Seven different species of fish were caught during the survey (Table). Yellow perch was the most abundant species in gill nets making up 73% of the catch. Bluegill made up 66% of the catch in trap nets and yellow perch made up 23%. Night boat electrofishing was conducted on June 21 and 24, 2010 for largemouth and smallmouth bass with results in Table 3. A summer creel census was completed in 2011 and analysis of this data should tell us more about this fishery.

Table 1. Total catch for two 150-ft. experimental, sinking, monofilament gill nets in Stockade Reservoir on September 9, 2010. Confidence intervals are also reported.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	RSD-P (90%)	Wr≥S (90%)
Black bullhead	2	1 (3)	1(3)	100 (0)	50 (50)	104.3 (86.2)
Black crappie	8	4 (12.3)	4 (12.3)	88 (24)	0	101.2 (1.8)
Bluegill	1	0.5 (1.5)	0.5 (1.5)	100	100	112.7
Northern pike	1	0.5 (1.5)	0.5 (1.5)	100	100	104.3
Smallmouth bass	1	0.5 (1.5)	0.5 (1.5)	100	100	96.2
White sucker	3	1.5 (4.5)	1.5 (4.5)	100	100	109.8 (6.4)
Yellow perch	44	22 (67.7)	22 (67.7)	48 (13)	0	97.5 (1)
Total	**60**					

Table 2. Total catch of eight overnight trap net sets in Stockade Reservoir, Custer County, South Dakota on September 9, 2010. Confidence intervals are also reported.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	RSD-P (90%)	Wr≥S (90%)
Black bullhead	2	0.1 (0.2)	0.2 (0.2)	100 (0)	0	n/a
Black crappie	65	8.1(2.6)	8.1(2.6)	46 (10)	0	100.2 (1.6)
Bluegill	467	58.4 (37.8)	58.4 (37.8)	93 (3)	2 (1)	114.8 (2.8)
Northern pike	5	0.6 (0.4)	0.6 (0.4)	60 (52)	40 (52)	102.6
Smallmouth bass	1	0.1 (0.2)	0.1 (0.2)	100	100	96
White sucker	2	0.3 (0.2)	0.3 (0.2)	100	100	99.7
Yellow perch	163	20.4(10.0)	20.4(10.0)	50(6)	1(2)	90.2 (1)
Total	**705**					

Table 3. Total catch of six sites of night electrofishing in Stockade Reservoir, Custer County, South Dakota on June 21 and 24, 2010. Confidence intervals are also reported.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	Wr≥S (90%)
Largemouth bass	72	72 (10)	67.7 (8)	73 (9)	24 (9)	97.4 (3.3)
Smallmouth bass	6	6 (3)	6 (3)	33 (43)	0	100 (8.6)
Total	**78**					

Black crappie

Sixty-five black crappies were sampled in trap nets and eight were sampled in gill nets (Tables 1 and 2). Trap net CPUE was 8.1, remaining relatively low as it has been in past years (Table 4). Size structure of the population was very low in 2007 and 2008; however, the proportion of quality length fish (PSD; 200 mm or 8 in) was up this year and seems to be getting better since 2007, although preferred length fish (PSD-P) (250 mm or 10 in) have been absent from the sample since. Condition (Wr) remains high for this species with numbers remaining around 100 or better for the last 11 years. Length frequency histograms show that few fish were detected under 160 mm and a younger year class was not apparent (Figure 2). The management goal is to maintain CPUE-S greater than 10, PSD greater than 20 and PSD-P greater than 5. This goal has not been reached fully within the last few years.

Table 4. Results for black crappie collected in trap nets during surveys of Stockade Reservoir, 2004-2010. Parameters are reported with confidence intervals.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	Wr≥S (90%)
2004	33	4.1 (2.4)	4.0 (2.3)	97 (5)	0	101.7 (10.8)
2005	15	1.9 (0.6)	0.8 (0.5)	100	33 (43)	100.5 (1.5)
2006	44	5.5 (3.0)	5.3 (2.9)	74 (12)	40 (13)	102.0 (0.5)
2007	93	11.6 (8.7)	11.6 (8.7)	1 (2)	1 (2)	97.5 (0.6)
2008	29	3.6 (1.6)	2.3 (0.9)	11 (13)	0	99.4 (--)
2009	77	9.6 (3.5)	8.8 (3.4)	39 (10)	0	101.3 (0.3)
2010	65	8.1	8.1 (2.6)	46 (10)	0	100.2 (1.6)

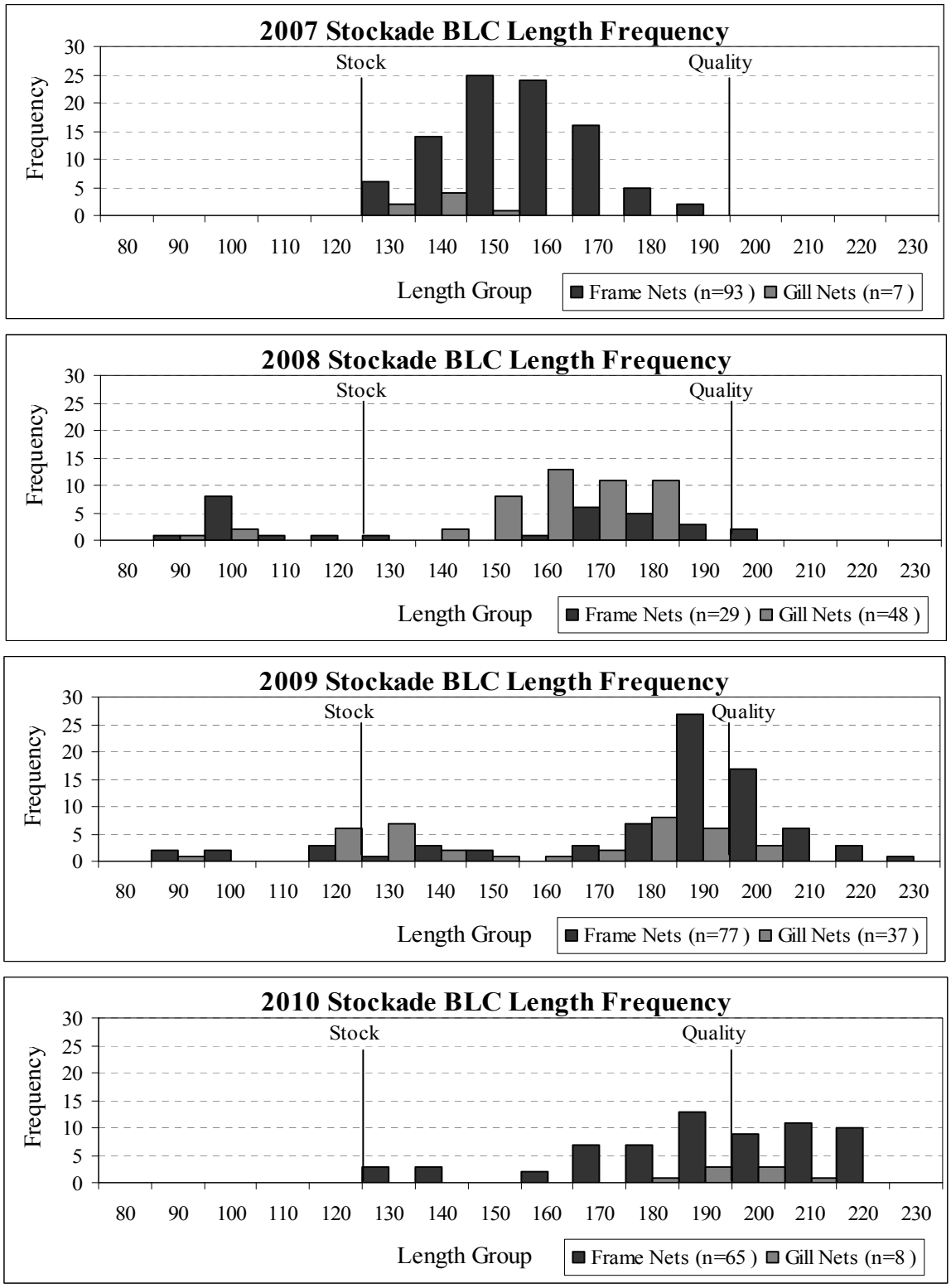


Figure 2. Length frequency histograms for black crappie from surveys at Stockade Reservoir, Custer County, 2007-2010.

Bluegill

Bluegills were first sampled in 2007 and appear to be increasing, making up 66% of the total catch. Abundance (CPUE) is up again this year with a value over three times what it was last year (Table 5). Length frequencies (Figure 3) show the 2007 population and a subsequent second year class in 2008, and change in sizes of those two year classes over a 4-year period. A majority of the fish were quality length (>150 mm or 6 in) with a PSD of 93 and a few even at preferred length (200 mm or 8 in). Fish condition was excellent with an average Wr for stock length and larger fish of 114.8.

It will be interesting to see if anglers begin targeting this species. Additionally, being an illegally stocked species it will also be interesting to watch how this population affects other species, such as the bass and crappie.

Table 5. Results for bluegill collected in trap nets during surveys of Stockade Reservoir, 2007-2010. Parameters are reported with confidence intervals.

Species	**N**	**CPUE** (80%)	**CPUE-S** (80%)	**PSD** (90%)	**PSD-P** (90%)	**Wr≥S** (90%)
2007	26	3.3 (3.1)	3.3 (3.1)	81 (14)	0	96.2 (2.7)
2008	36	4.5 (1.6)	4.5 (1.6)	11 (9)	8 (8)	117.9 (4.5)
2009	126	15.8 (12.2)	15.8 (12.2)	28 (7)	3 (3)	112.4 (1.1)
2010	467	58.4	58.4 (37.8	93 (3)	2 (1)	114.8 (2.8)

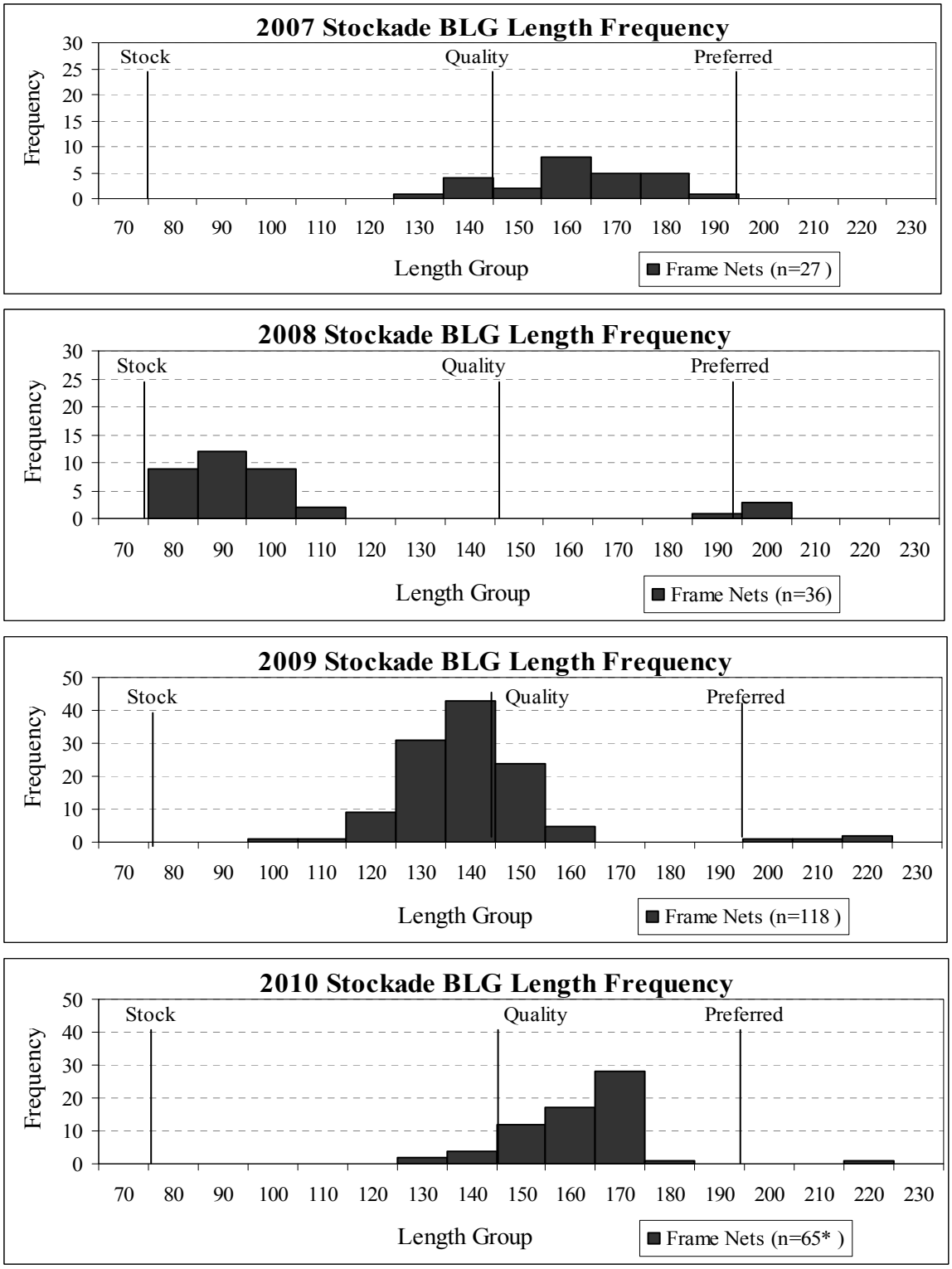


Figure 3. Length frequency histograms for bluegill collected during trap net surveys of Stockade Reservoir in 2007-2010. *only measured fish are included in figure.

Largemouth bass

The bass populations were sampled by electrofishing on the nights of June 21st and 24th, 2010. Largemouth bass CPUE for stock length and larger fish was 72 fish per hour (Tables 3 and 6), half of what the 2009 survey was. This sample yielded a PSD of 73 and a larger percentage of preferred length (380 mm or 15 in) fish than in any other survey year giving a PSD-P of 24 (Figures 4 and 5). Fish condition was lower than previous years with an average Wr for stock length and larger fish of 97. This average was pulled down by the higher percentage of preferred length fish, which had a Wr value of 84.8. This is an impressive population and indicates that the 15-inch minimum on bass likely is producing a quality largemouth bass fishery.

Table 6. Results for largemouth bass collected during night-time electrofishing surveys of Stockade Reservoir, 2004-2010. Parameters are reported with confidence intervals.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	Wr≥S (90%)
*2004	121	121.0 (14.5)	82.0 (6.3)	67 (9)	4 (3)	105.1 (0.9)
*2005	185	185.0 (48.0)	156.0 (38.3)	33 (7)	4 (3)	112.4 (0.6)
2007	214	214.0 (36.1)	210.0 (35.6)	52 (6)	12 (4)	113.0 (0.7)
2009	147	148.2 (49.2)	148.2 (49.2)	76 (6)	19 (6)	109.3 (0.5)
2010	72	72 (10)	67.7 (8)	73 (9)	24 (9)	97.4 (3.3)

*Fall sampling

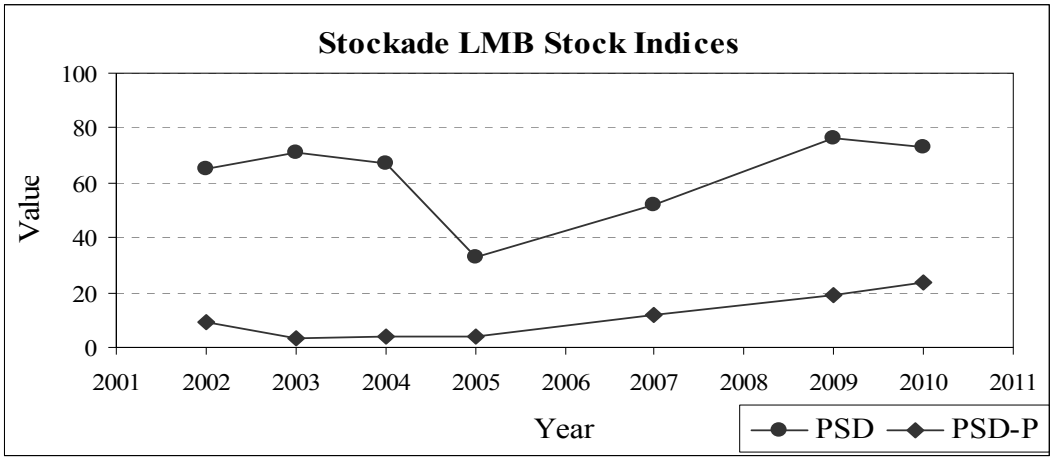


Figure 4. Stock indices for largemouth bass caught electrofishing, Stockade Reservoir 2002-2010.

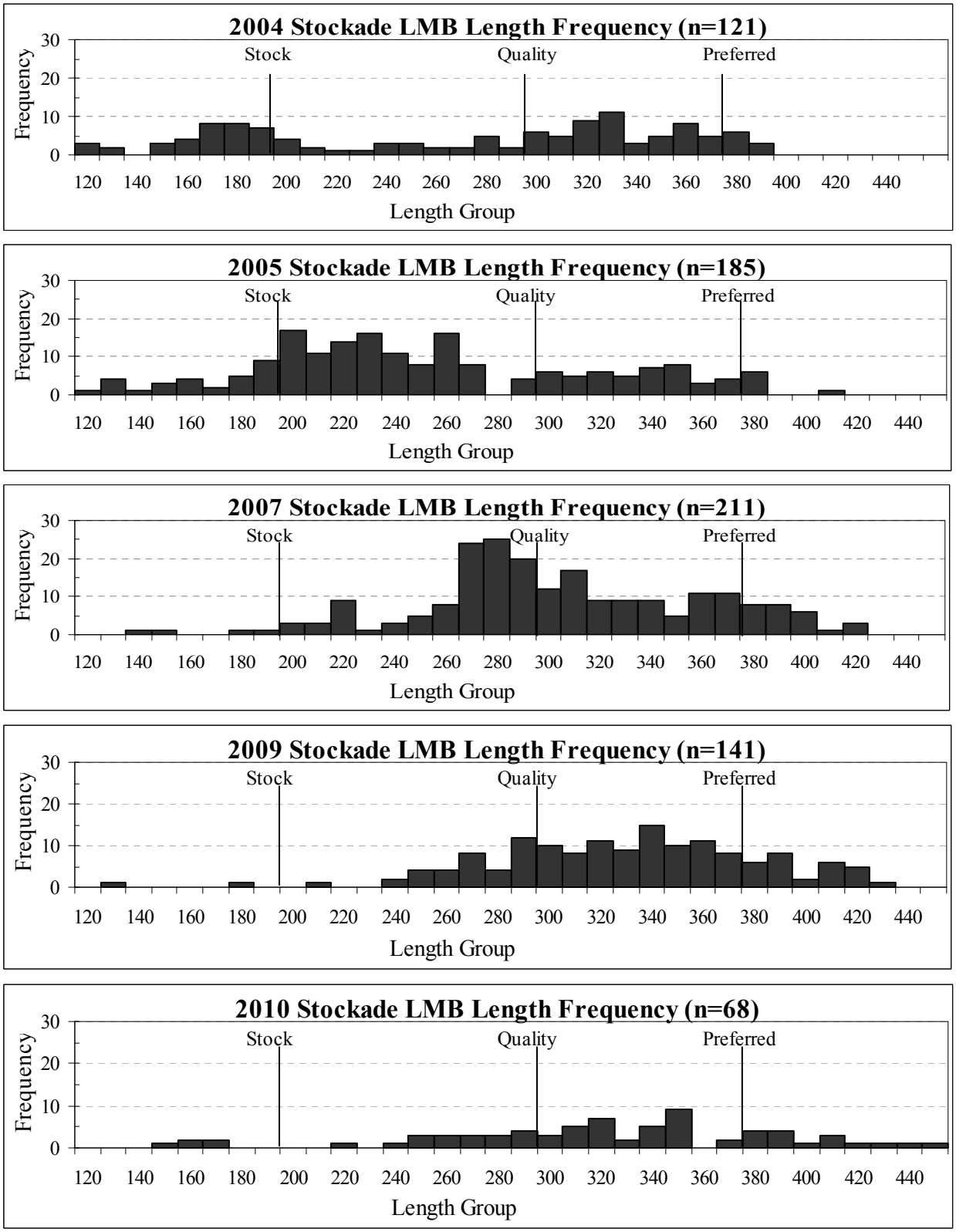


Figure 5. Length frequencies for largemouth bass sampled with spring night electrofishing at Stockade Reservoir, Custer County. 2004-05 surveys were in the fall.

Northern pike

Pike are a highly sought after species, especially during the ice fishing season. Their numbers have remained consistent the past few years; however, catch rates were lower in 2010 (Tables 7 and 8). A greater abundance was captured in June, during the Wildlife Federation Conservation Camp demonstration, but data was not used in this analysis. Length frequency analysis holds little value with only six fish captured, but previous surveys show most pike between quality and preferred length (Figure 6). Condition (Wr) for pike has been excellent for several years with values close to and over 100. With the high number of prey fish available in Stockade Reservoir, pike should continue to have good growth and condition.

Table 7. Results for northern pike captured in gill nets in Stockade Reservoir, on 2003-2010. Parameters are reported with confidence intervals.

Species	**N**	**CPUE** (80%)	**CPUE-S** (80%)	**PSD** (90%)	**PSD-P** (90%)	**Wr≥S** (90%)
2003	4	1.3 (1.3)	1.3 (1.3)	25 (59)	0	89.2 (10)
2004	4	1.3 (0.9)	1.3 (0.9)	75 (0)	0	101.7 (9.0)
2005	10	5.0 (6.2)	5.0 (6.2)	60 (30)	0	99.0 (6.4)
2006	22	11.0 (3.1)	11.0 (3.1)	18 (15)	0	103 (2)
2007	7	7	7	53 (23)	0	100 (4.6)
2008	14	7.0 (9.2)	7.0 (9.2)	100 (--)	7 (13)	98.0 (3.1)
2009	14	7.0 (6.2)	7.0 (6.2)	93 (13)	0	96.1 (2.4)
2010	1	0.5 (1.5)	0.5 (1.5)	100	100	104.3

Table 8. Results for northern pike captured in trap nets in Stockade Reservoir, 2003- 2010. Parameters are reported with confidence intervals.

Species	**N**	**CPUE** (80%)	**CPUE-S** (80%)	**PSD** (90%)	**PSD-P** (90%)	**Wr≥S** (90%)
2003	16	2.0 (0.8)	1.9 (0.8)	13 (16)	7 (11)	85.5 (2.3)
2004	2	0.3 (0.2)	0	0	0	0
2005	12	1.5 (0.6)	1.1 (0.6)	11 (21)	11 (21)	98.0 (3.7)
2006	12	1.5 (1.3)	1.3 (1.3)	70 (28)	20 (24)	99
2007	15	1.9 (1.1)	1.9 (1.1)	86 (28)	0	99 (1.7)
2008	4	0.5 (0.4)	0.5 (0.4)	0	0	not weighed
2009	8	1.0 (0.5)	1.0 (0.5)	88 (24)	13 (23)	91.0 (5.1)
2010	5	0.6 (0.4)	0.6 (0.4)	60 (52)	40 (52)	102.6

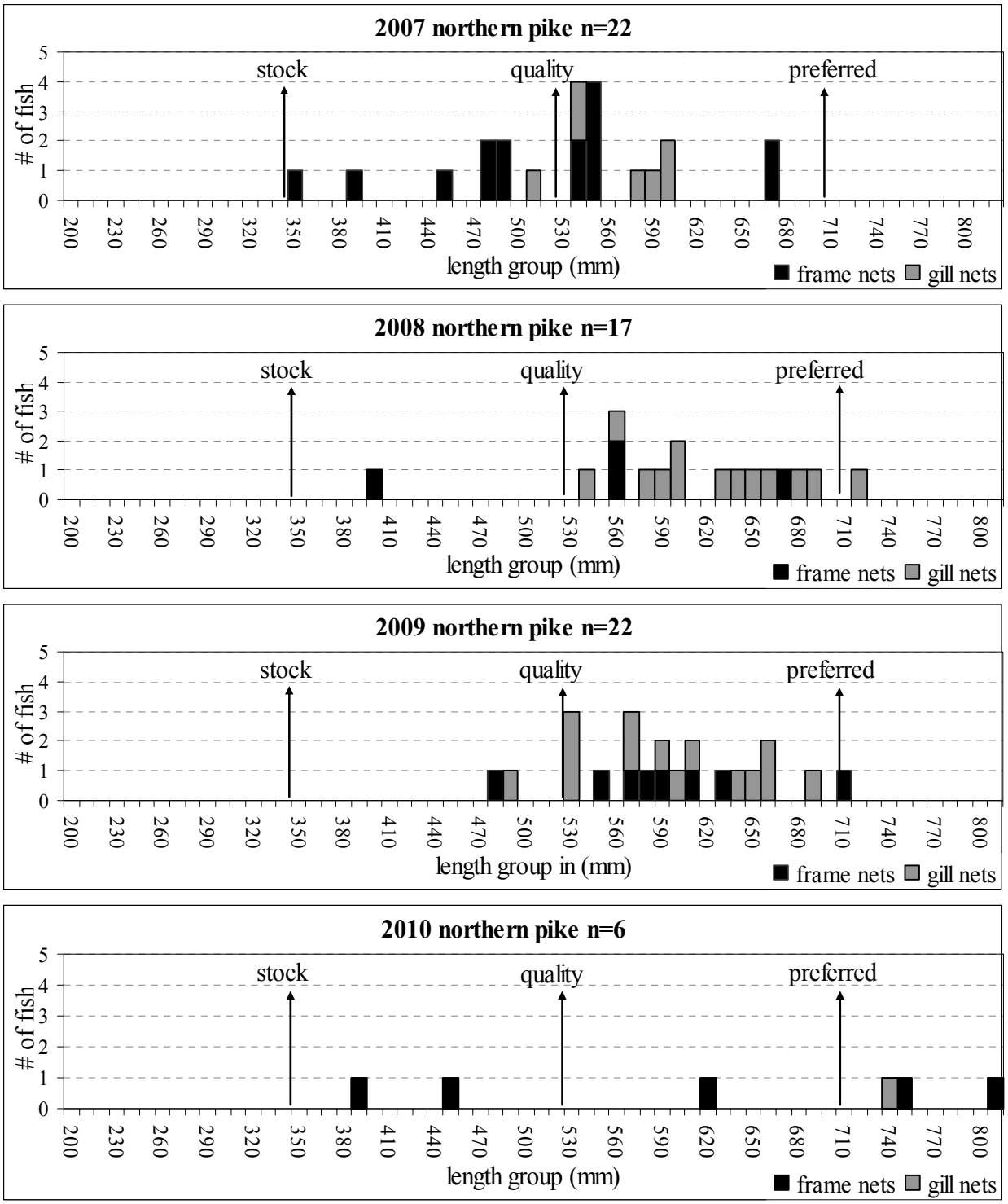


Figure 2. Length frequency for northern pike from gillnets and trap nets at Stockade Reservoir, Custer County 2007-2010.

Smallmouth Bass

Smallmouth bass were stocked into Stockade Reservoir in 1990. The past two years smallmouth bass catch rates (CPUE) have dropped after a large increase in 2007 (Table 9). Fish condition remained high with an average Wr for stock length and longer bass of 100. Surprisingly, smallmouth bass have been maintaining a good population in the presence of a competitive predator like the largemouth bass. The recent drop in CPUE will continue to be monitored to see if densities drop further.

Table 9. Results for smallmouth bass captured trap nets in Stockade Reservoir, 2003-2010. Parameters are reported with confidence intervals.

Species	**N**	**CPUE** (80%)	**CPUE-S** (80%)	**PSD** (90%)	**PSD-P** (90%)	**Wr≥S** (90%)
2003	11	9.4 (7.3)	7.7 (5.2)	100	83 (33)	89.7 (4.1)
2004	8	8.0 (5.4)	6.0 (4.0)	33 (43)	0	94.7 (5.6)
*2007	58	58.0 (22.4)	58.0 (22.4)	98 (3)	52 (11)	105.7 (1.0)
*2009	13	13.2 (8.8)	12.2 (9.0)	92 (15)	42 (27)	96.4 (2.9)
*2010	6	6 (3)	6 (3)	33 (43)	0	100 (8.6)

*Spring sampling

Yellow Perch

Gill net catch rates for stock length perch were at their lowest in 2010, after an all time high in 2009 (Figure 10). However, PSD was over double what it was in 2009 and condition (Wr) also was up and approaching 100. Hopefully size structure will increase next year as a large year class is just below quality length (200mm or 8in) (Figure 7). One possible reason for large variations in abundance is differences in gill net set depths. In the future, depths will be recorded and efforts will be made to set nets at similar depths during each yearly survey. Collecting oxygen and temperature profiles with a YSI sonde may also be beneficial prior to setting nets.

Due to low numbers captured in gills nets, most otoliths were taken from perch captured in trap nets. Aging results are in Tables 11 and 12. This population reaches quality length (200mm or 8in) around age five indicating a slow growing population. Although ages collected by scales vs. otoliths should be cautiously compared, the South Dakota mean for back calculated age with scales has perch reaching quality length around age-3 (Willis, et al. 2001). Perch populations in Sheridan Lake, aged with otoliths in 2010, also reached quality length at around 3 years. Otoliths will be taken from perch in Stockade Reservoir for the next few years before conclusions can be made about the growth of this fishery.

A new regulation went into effect in 2011 that reduced the daily limit for panfish (including perch) from 25 per day to 15 per day. It is unlikely that this will affect the fishery in Stockade Reservoir, but we will continue to monitor this population in light of the reduced limits.

Also of note are yellow grubs found on the perch. The grub occurs naturally in the area and appears to have a successful life cycle through birds and snails at Stockade Lake. They are not harmful to humans either by eating infected fish or by contact with the water. Movement of water and fish from Stockade Lake should be highly restricted to prevent transporting the grub to other lakes. Yellow grubs are also found in yellow perch at Bismarck and Lakota Lakes. Both of these lakes have illegally introduced perch populations that may have originated from Stockade Lake.

Table 10. Results for yellow perch captured in gill nets in Stockade Reservoir, 2004-2010. Parameters are reported with confidence intervals.

Species	**N**	**CPUE** (80%)	**CPUE-S** (80%)	**PSD** (90%)	**PSD-P** (90%)	**Wr≥S** (90%)
2004	113	37.7 (12.0)	37.7 (12.0)	63 (8)	2 (2)	94.8 (1.4)
2005	113	56.5 (47.7)	56.5 (47.7)	79 (7)	16 (6)	93.7 (0.5)
2006	100	50.0 (18.5)	34.5 (4.6)	48 (10)	23 (9)	90.7 (0.9)
2007	56	56.0 (--)	56.0 (--)	2 (3)	0	86.9 (0.6)
2008	86	43.0 (9.2)	32.5 (4.6)	5 (4)	0	86.3 (0.4)
2009	176	88.0 (49.2)	87.5 (50.8)	13 (5)	0	89.2 (1.1)
2010	44	22 (67.7)	22 (67.7)	48 (13)	0	97.5 (1)

Table 11. Stockade Reservoir perch length range and weighted mean length (mm) at capture by otolith aged trap net sample during the 2010 lake survey.

Age	Minimum	Weighted Mean	Maximum	Number surveyed
3	161	167	171	14
4	159	185	210	20
5	166	208	275	73
6	181	200	230	52

Table 12. Stockade Reservoir perch length-at range and weighted mean length (mm) at capture from otoliths by otolith aged gill net sample during the 2010 lake survey.

Age	Minimum	Weighted Mean	Maximum	Number surveyed
3	150	154	165	6
4	163	180	189	10
5	174	207	225	19
6	195	211	225	7

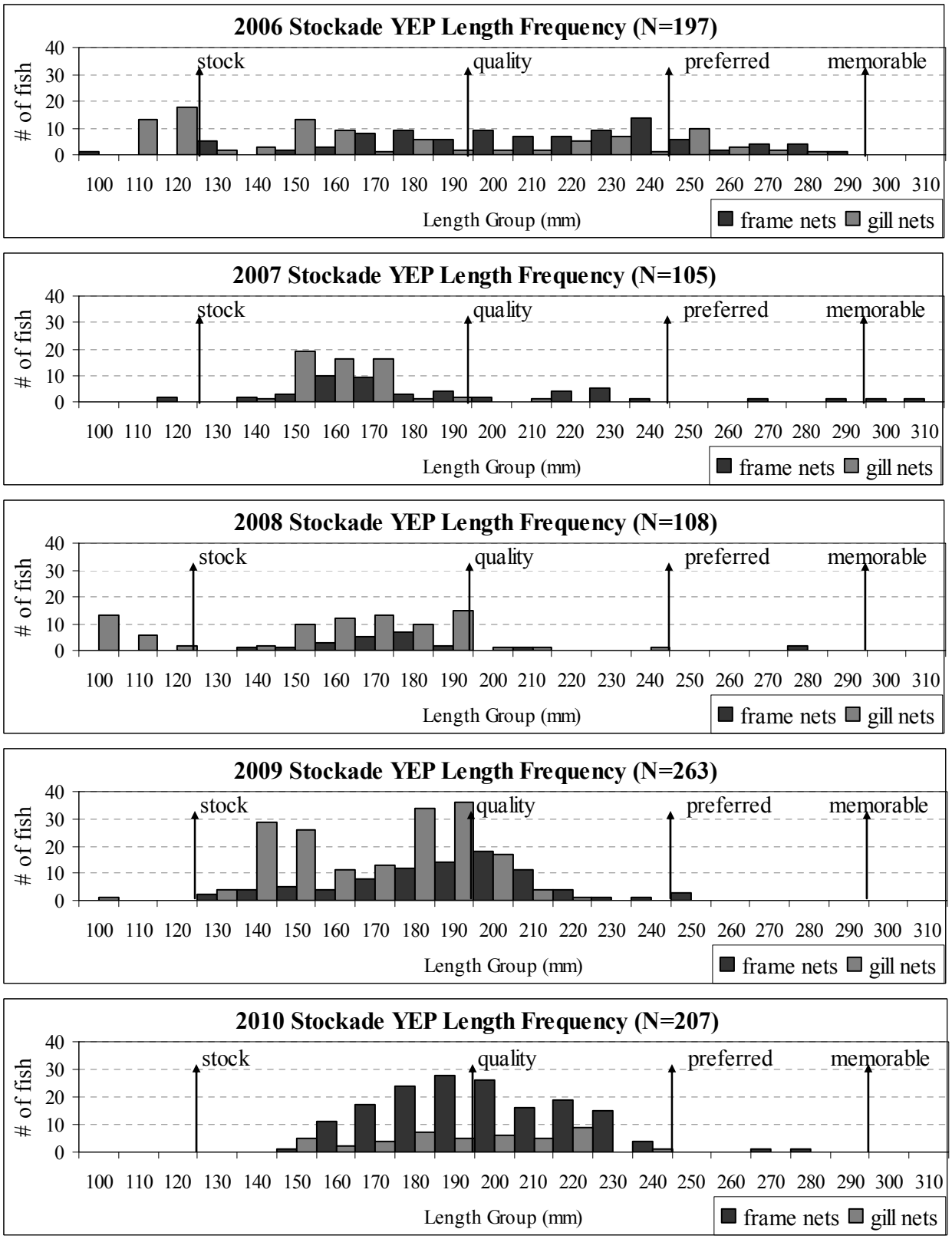


Figure 7. Length frequency for yellow perch from gillnets and trap nets at Stockade Reservoir, Custer County 2006-2010.

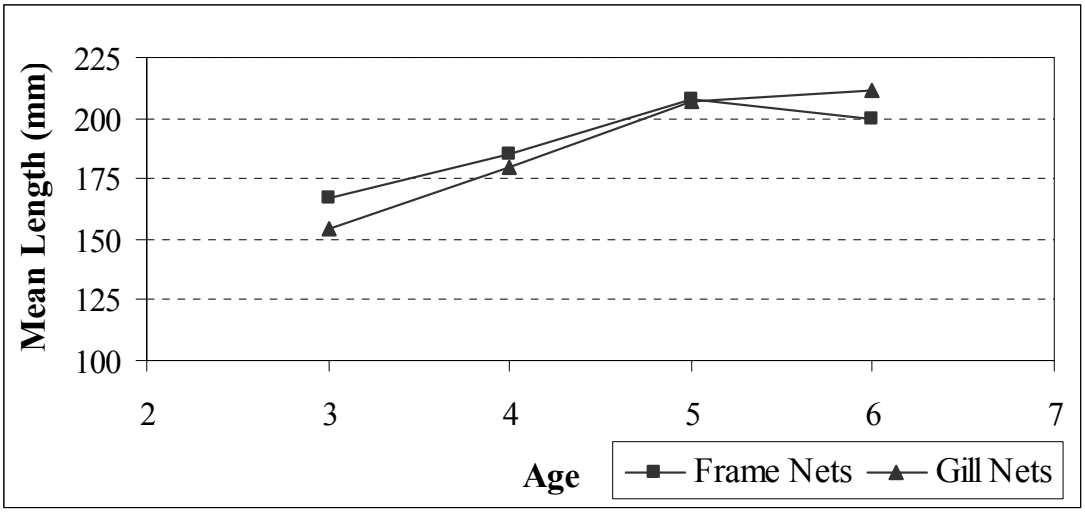


Figure 8. Stockade Reservoir yellow perch weighted mean length (mm) at capture by otolith aged sample during the 2010 lake survey.

Rainbow Trout

Trout stockings were discontinued after 2009. Summer temperatures and oxygen stratification limit the available habitat for trout.

RECOMMENDATIONS

1. Resurvey in 2011 including Spring electrofishing to monitor all fish populations.

2. Collect scales from bass and otoliths from perch to further evaluate growth trends

REFERENCES

Willis, D.W., D.A. Isermann, M.J. Hubers, B.A. Johnson, W.H. Miller, T.R. St. Sauver, J.S. Sorensen, and E.G. Unkenholz. 2001. Growth of South Dakota fishes: a statewide summary with means by region and water type. Special Report. South Dakota Game, Fish, and Parks. Pierre, South Dakota.

APPENDIX

Appendix A. Stocking record for Stockade Reservoir, Custer County, 1999-2010

Year	Number	Species	Size
1999	77,580	Rainbow trout	Fingerling
2000	10	Rainbow trout	Adult
2001	69,844	Rainbow trout	Fingerling
2002	30,000	Rainbow trout	Fingerling
	1,194	Rainbow trout	Catchable
	20	Rainbow trout	Adult
2003	409	Largemouth bass	Adult
	50	Rainbow trout	Adult
2004	3,250	Brown trout	Catchable
2005	3,250	Brown trout	Catchable
2009	1,500	Rainbow trout	Fingerling
2010	None stocked		

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Angostura Reservoir County: Fall River
Legal description: T 8S, R 5,6 E Sec. 1-12,17,19, 20, 21, 28-33
Location from nearest town: 7 miles southeast of Hot Springs, SD.
Dates of present survey: August 8-10, 13, 2010
Date last surveyed: August 10, 17-19, 2009
Most recent lake management plan: F21-R-37 Date: 2005
Management classification: Warmwater permanent Contour mapped: 1985

Primary Species: (game and forage)	Secondary and other species:
1. Walleye	1. Bluegill
2. Channel catfish	2. Common carp
3. Smallmouth bass	3. Green sunfish
4. Gizzard shad	4. Northern pike
5. Largemouth bass	5. Northern redhorse
6. Black crappie	6. River carpsucker
7. Spottail shiner	7. White sucker
8. Emerald shiner	8. Yellow perch
9.	9. Freshwater drum

PHYSICAL CHARACTERISTICS

Surface Area: 4,612 acres; Watershed: 5,824,000 acres
Maximum depth: 70 feet; Mean depth: 29.3 feet
Lake elevation at survey (from known benchmark): unknown

1. Describe ownership of lake and adjacent lakeshore property:

The U.S. Bureau of Reclamation performs the maintenance of Angostura Reservoir and Dam. The South Dakota Department of Game, Fish and Parks manages much of the adjacent land as a recreation/campground area and game production area. The local irrigation district controls the water level and irrigation releases.

2. Describe watershed condition and percentages of land use:

The Angostura Reservoir watershed consists of approximately 9,100 square miles of livestock pastureland. Ownership of the watershed is predominately private with a small portion in Buffalo Gap National Grassland.

3. Describe aquatic vegetative condition:

Higher water levels in 2010 flooded terrestrial vegetation around the lake. Submergent vegetation, mostly Curlyleaf pondweed *Potamogeton crispus*, was observed in the bays and shallow water areas of Angostura.

4. Describe pollution problems:

Department personnel identified no pollution problems during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

No apparent problems were identified on either the dam or spillway. Most of the boat ramps and other facilities were in good condition. Higher water levels in 2010, created access at all boat ramp locations

BIOLOGICAL DATA

Methods

Day Electrofishing

Day electrofishing was completed during August 13, 2010 to index gizzard shad reproduction through presence of age-0 shad. Electrofishing was done using a boat mounted Smith-Root unit with pulsed-DC. Ten sampling runs were made around the lake. Each run was ten minutes in length unless an age-0 shad was captured within the first 5 minutes of sampling, then the run was shortened to 5 minutes to reduce the amount of time spent at the reservoir.

Netting

A lake survey was conducted on Angostura Reservoir August 8-10, 2010. Sampling consisted of 4 gill net nights and 8 trap net nights (Figure 1). All gill nets were monofilament experimental 150 foot nets. A switch in 2006 from 300 ft to 150 ft gill nets was to get better confidence in our catch rate data. The gill nets were monofilament, experimental nets 45.7 m (150 ft) long and 1.8 m (6 ft) deep with six 7.6 m (25 ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Trap nets were set at eight stations consisting of 1 trap net night each. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1-mm (¾ in) mesh and a 1.2 X 23-m (3.9 X 75.5 ft) lead.

Collected fish were measured for total length (mm) and weighed (g). Age and growth analysis was accomplished using otoliths or scales collected from individual fish. Otoliths were collected from the first five walleye per centimeter group. For younger fish, typically less than age-4, otoliths were submersed in water in a black dish and viewed whole under a dissecting microscope. Preparation of otoliths from older fish involved breaking the otolith through the nucleus and burning the fractured area under a propane torch. The half-otolith was mounted in putty, cleared with mineral oil, illuminated with a single fiber-optic strand and viewed under a dissecting scope. Aging of other game fish was done with scales. Scale samples were obtained from below the lateral line just behind the pectoral fin. Scales were prepared for reading by pressing

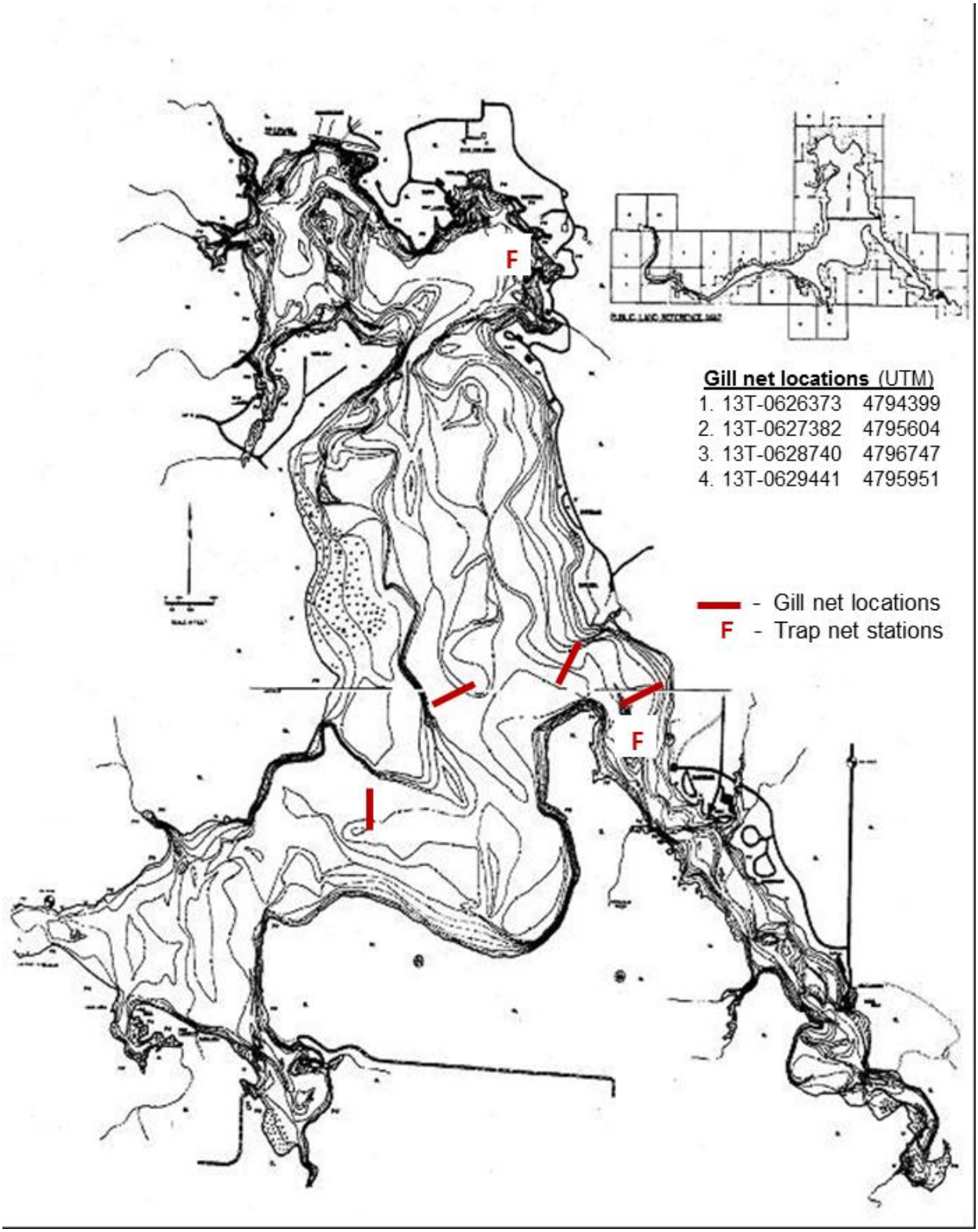


Figure 1. Map of Angostura Reservoir with trap net and gill net locations.

them between two acetate slides to make an imprint, then the slides viewed with a microfiche projector (40X) and distances between scale annuli were recorded on paper strips.

Data Analysis

Fish population parameters calculated were mean catch-per-unit-effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as CPUE (number of fish collected per net night or number of fish collected per hour of electrofishing). Population structural characteristics were expressed as length frequency histograms and with PSD and RSD-P values. Fish condition was expressed with mean Wr values.

Results and Discussion

Age-0 Fish Survey

Day electrofishing was added in 2004 to increase our understanding and sample sizes concerning shad reproduction. Sixty-two young of the year gizzard shad were captured in 1.42 hours of electrofishing and only six of the sites sampled produced shad (Table 1). The low numbers and few sites indicate relatively poor reproduction in 2010, as compared to previous years, such as 2009 when 266 young shad were captured and 2007 when over 2,000 were collected (Figure 2).

Table 1. Daytime electrofishing results from Angostura Reservoir, August 13, 2010.

Site	No./Site	Time (sec)	No./hr
1	0	600	0
2	0	600	0
3	0	600	0
4	0	600	0
5	16	300	192
6	11	300	132
7	16	600	192
8	3	300	36
9	4	600	48
10	12	600	144
Total	**62**	**1.42hours**	**43.7**

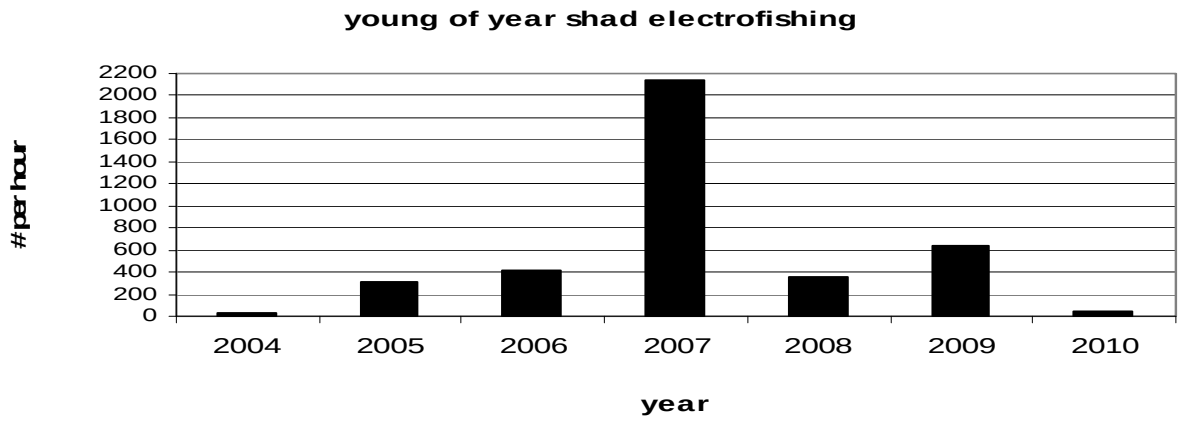


Figure 2. Daytime electrofishing results for young of year gizzard shad from Angostura Reservoir, 2004-2010.

Fish Community Survey

Twelve species were collected in the gill nets and eleven species in the trap nets during the 2010 lake survey of Angostura Reservoir. Three hundred seventy four fish were collected in four experimental gill nets (Table 2). Yellow perch (28.3%) were the most common species collected with walleye (25.1%) being the second most common. Channel catfish were third at (6.2%). Other species collected in gillnets were black crappie, common carp, freshwater drum, gizzard shad, largemouth bass, river carpsucker, shorthead redhorse, smallmouth bass, and spottail shiner.

Eleven species, totaling 214 fish, were collected in trap nets during the 2010 survey (Table 3). Channel catfish (41.6%) were the most common fish collected with bluegill (22.0%) the second most common. Other species collected were black crappie, common carp, freshwater drum, gizzard shad, river carpsucker, smallmouth bass, walleye, white sucker and yellow perch.

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD; 90% CI's), and fish condition for fish larger than stock-length (Wr>S; 90% CI's) for all fish species collected from four, 150-ft experimental sinking gill nets in Angostura Reservoir, August 8-10, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr>S
Black crappie	6	1.5 (1.4)	1.0 (1.2)	--	--	104.0 (14.2)
Channel catfish	60	15.0 (5.3)	13.8 (5.1)	11 (7)	0	81.5 (0.7)
Common carp	42	10.5 (4.8)	10.0 (4.6)	43 (14)	0	86.8 (2.6)
Freshwater drum	6	1.5 (2.0)	1.3 (1.6)	--	--	89.2 (3.0)
Gizzard shad	3	0.8 (0.8)	0.0 (--)	--	--	--
Largemouth bass	6	1.5 (1.1)	1.5 (1.1)	--	--	111.5 (2.1)
River carpsucker	10	2.5 (2.5)	2.5 (2.5)	--	--	93.9 (6.3)
Shorthead redhorse	11	2.8 (1.0)	2.8 (1.0)	--	--	93.3 (4.0)
Smallmouth bass	27	6.8 (5.3)	6.8 (5.3)	44 (17)	7 (9)	98.8 (0.5)
Spottail Shiner	3	0.8 (0.4)	--	--	--	--
Walleye	94	23.5 (6.1)	21.5 (4.8)	53 (9)	6 (4)	83.3 (0.4)
Yellow perch	106	26.5 (27.6)	12.0 (14.8)	19 (10)	0	88.0 (1.3)
Totals	374					

Table 3. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD; 90% CI's) and fish condition for fish larger than stock-length (Wr>S; 90% CI's) for all fish species collected from 8 trap nets in Angostura Reservoir, August 8-10, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr>S
Black crappie	32	4.0 (1.9)	2.9 (1.8)	61 (18)	22 (15)	101.6 (1.5)
Bluegill	47	5.9 (3.7)	5.9 (3.7)	43 (13)	0	100.8 (0.7)
Channel catfish	89	11.1 (7.4)	8.1 (6.2)	6 (5)	0	--
Common carp	10	1.3 (1.3)	1.1 (1.1)	89 (21)	11 (21)	79.9 (2.8)
Freshwater drum	8	1.0 (1.0)	0.9 (0.9)	29 (35)	14 (28)	83.3 (4.0)
Gizzard shad	2	0.3 (0.4)	0.0 (--)	--	--	--
River carpsucker	6	0.8 (0.7)	0.8 (0.7)	--	--	87.2 (4.9)
Shorthead redhorse	4	0.5 (0.5)	0.5 (0.5)	--	--	90.3 (1.8)
Smallmouth bass	6	0.8 (0.6)	0.3 (0.2)	--	--	93.3 (--)
Walleye	9	1.1 (1.4)	1.1 (1.4)	89 (21)	44 (33)	75.2 (--)
White sucker	1	0.1 (0.2)	0.1 (0.2)	--	--	104.0 (14.2)
Totals	214					

Black crappie

Black crappie abundance decreased slightly to 4.0 per trap net, compared to 7.3 last year (Table 4). Size indices were similar to last year with PSD at 61 and RSD-P of 22 this year (Table 4). Mean condition of trap net black crappie greater than stock length was good with a Wr of 101.6 (Table 3). The length frequency histogram for 2010 shows a good number of age-1 and age-2 fish with a few three year olds as well (Figure 3). If water levels continue to stay higher, conditions should be favorable for black crappie.

Table 4. Composite listing of sample size (N), catch per unit effort (CPUE; 80% CI's are given in parentheses), catch per unit effort of stock length fish (CPUE-S; 80% CI's), and proportional stock densities (PSD, RSD; 90% CI's) for black crappie collected by trap nets in Angostura Reservoir, 2003-2010.

Year	N	CPUE	CPUE-S	PSD	RSD-P
2003	30	2.7 (0.9)	2.0 (0.7)	55 (19)	14 (13)
2004	15	1.9 (1.6)	0.6 (0.5)	40 (52)	20 (43)
2005	87	10.9 (7.5)	10.5 (7.3)	69 (8)	6 (4)
2006	40	5.0 (1.9)	4.0 (1.6)	19 (12)	6 (8)
2007	23	2.9 (0.9)	2.3 (0.9)	39 (20)	11 (13)
2008	93	11.6 (3.8)	10.8 (3.5)	43 (9)	9 (6)
2009	58	7.3 (2.4)	5.4 (2.1)	65 (12)	14 (9)
2010	32	4.0 (1.9)	2.9 (1.8)	61 (18)	22 (15)

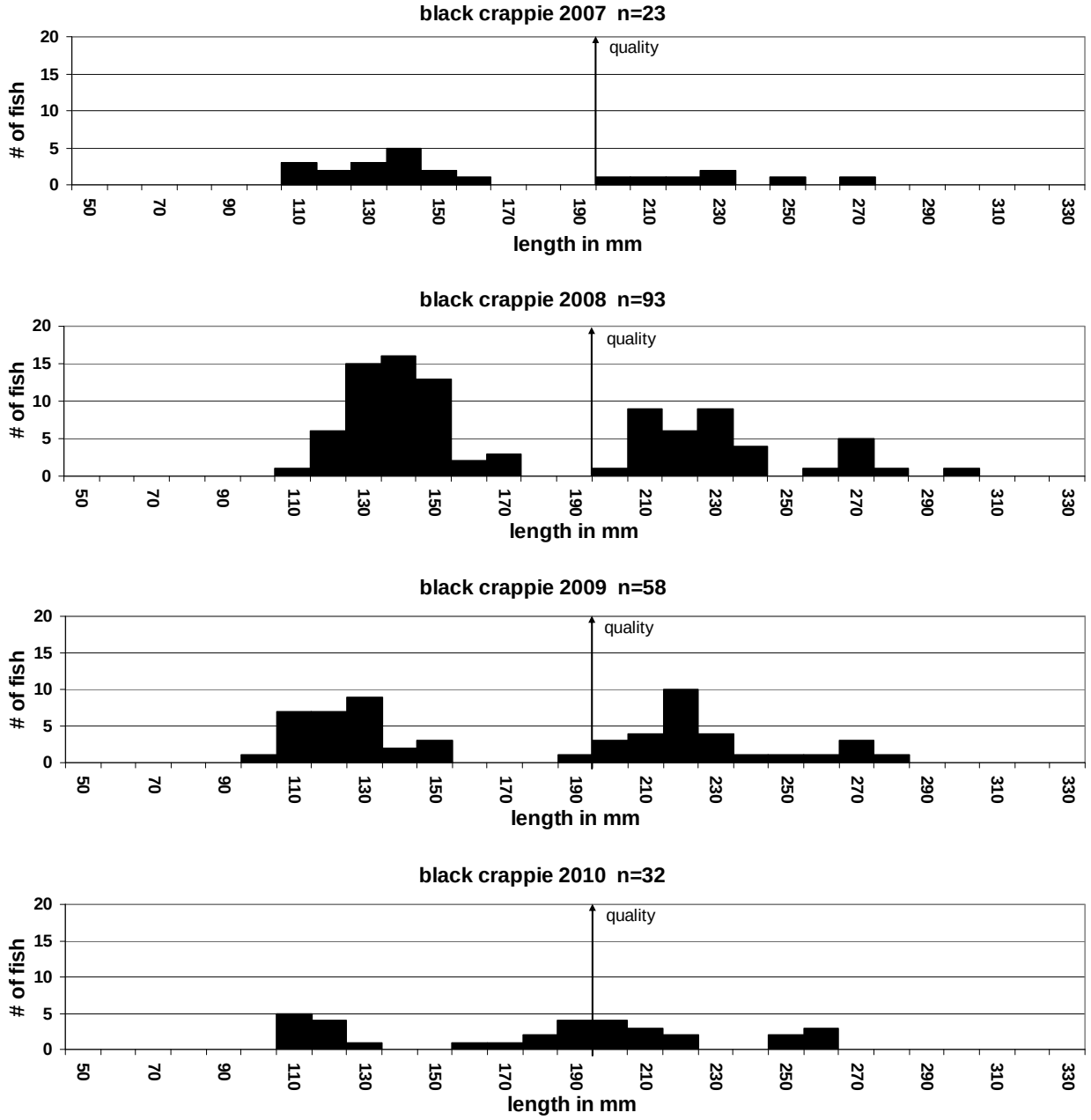


Figure 3. Length histogram of black crappies collected from Angostura Reservoir, Fall River County 2007-2010.

Bluegill

Bluegill numbers decreased since last year with a CPUE of 5.9 compared to 16.3 last year. (Tables 3 and 5). Size structure was higher with a PSD of 43 compared to 15 last year. No fish have been sampled over preferred length in recent history (Figure 4). Fish condition was excellent with a Wr for stock length and larger fish of 100.8. At this point, bluegills are not an

important part of the fishery, but with an increase in size structure, they may become so in the future. Right now, they are probably contributing as a secondary forage species for the many game fish of Angostura.

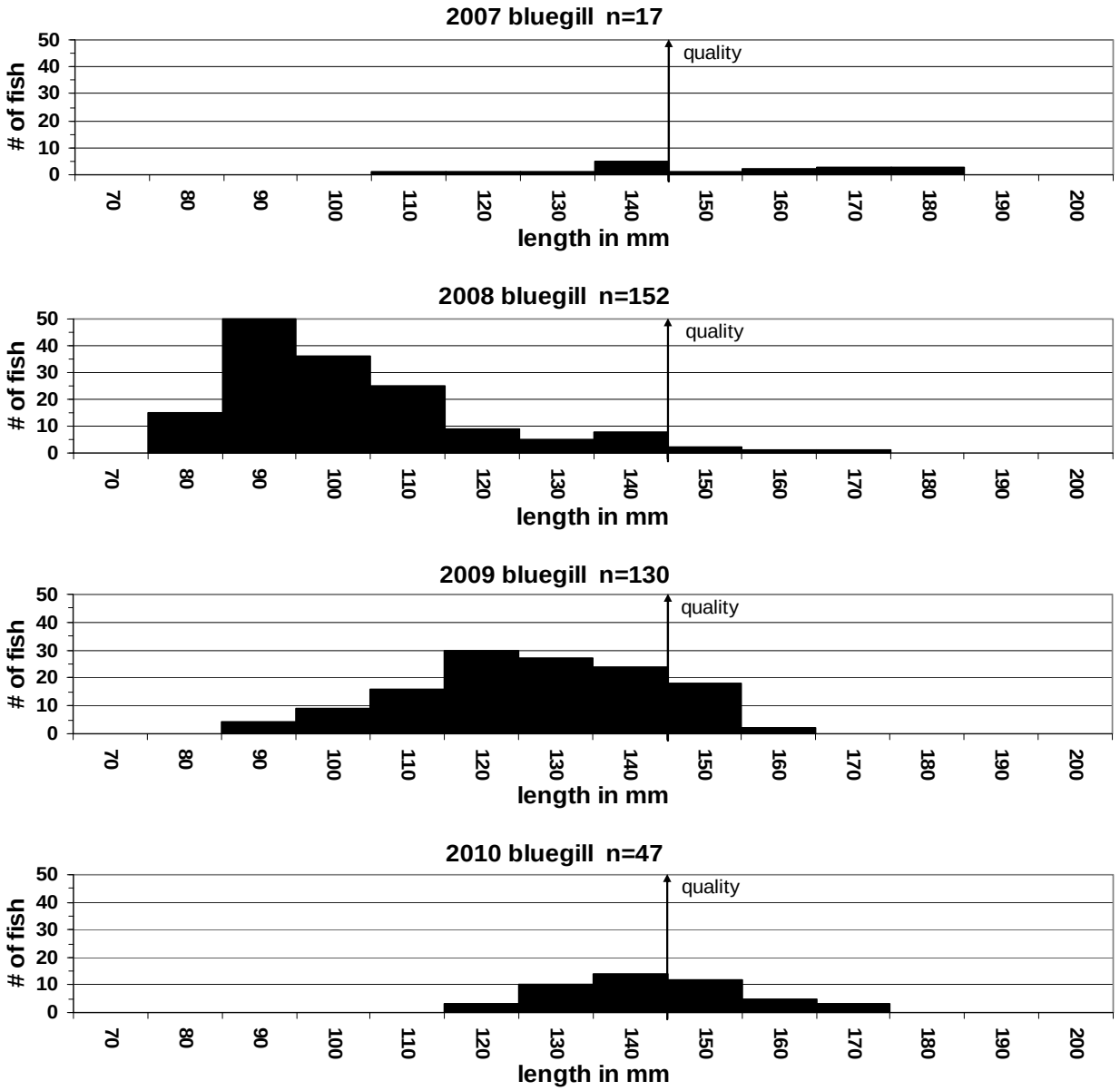


Figure 4. Length histogram of bluegill collected from Angostura Reservoir, Fall River County 2007-2010.

Table 5. Composite listing of sample size (N), catch per unit effort (CPUE; 80% CI's are given in parentheses), catch per unit effort of stock length fish (CPUE-S; 80% CI's), and proportional stock densities (PSD, RSD; 90% CI's) for bluegill collected by 8 trap nets in Angostura Reservoir, 2002-2010.

Year	N	CPUE	CPUE-S	PSD	RSD-P
2002	36	3.3 (2.3)	3.3 (2.3)	31 (14)	0
2003	103	9.4 (5.2)	9.4 (5.2)	39 (8)	0
2004	6	0.8 (0.6)	0.8 (0.6)	33 (43)	0
2005	17	2.1 (1.4)	2.1 (1.4)	41 (21)	0
2006	1	0.1 (0.2)	0.1 (0.2	0	0
2007	17	2.1 (1.6)	2.1 (1.6)	53 (22)	0
2008	152	19.0 (8.3)	19.0 (8.3)	3 (3)	0
2009	130	16.3 (5.7)	16.3 (5.7)	15 (6)	0
2010	47	5.9 (3.7)	5.9 (3.7)	43 (13)	0

Channel Catfish

Channel catfish were the most abundant fish collected in trap nets and third most abundant in gill nets (Tables 2 and 3). Gill net CPUE for all catfish was 15.0, and for fish stock length and greater, CPUE was 13.8 which is about half of last year (Table 6). Condition appears poor with mean Wr for stock length and larger catfish at 81.5 (Table 3). Sizes remain very low (i.e. PSD=11, RSD-P=0; Table 6) and the length frequency histogram (Figure 5) is almost identical to last year with very few fish over 320mm. There appears to be a large year class or two between 290-370mm, which have moved very little over the past five years.

During the springs of 2004-2008, Angostura Reservoir was used as a source for channel catfish and small adult catfish were removed and stocked into other South Dakota waters. Plans are to continue using Angostura Reservoir as a stocking source for other waters over the next couple of years. Whether or not the removals will have an effect on size structure and density of the population will require further investigation.

Table 6. Composite listing of sample size (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's) and proportional stock densities (PSD, RSD; 90% CI's) for channel catfish collected by gillnets in Angostura Reservoir, 2000-2010.

Year	N	CPUE	CPUE-S	PSD	RSD-P
2000	483	96.6 (33.1)	50.8 (17.1)	20 (4)	3 (2)
2001	339	67.8 (49.2)	31.4 (26.3)	20 (6)	2 (2)
2002	351	87.8 (29.8)	15.5 (17.8)	3 (4)	0
2003	233	58.3 (26.4)	16.5 (6.0)	8 (6)	0
2004	462	115.5 (51.7)	38.0 (17.2)	14 (5)	0
2005	171	85.5 (97.0)	21.5 (10.8)	5 (5)	0
2006*	170	42.5 (12.3)	14.3 (4.2)	5 (5)	0
2007*	138	34.5 (7.5)	10.0 (4.6)	10 (8)	3 (4)
2008*	99	33.0 (8.5)	19.0 (10.4)	5 (5)	0
2009*	137	34.3 (16.7)	26.5 (11.4)	2 (2)	0
2010*	60	15.0 (5.3)	13.8 (5.1)	11 (7)	0

*150' gill nets instead of 300' gill nets.

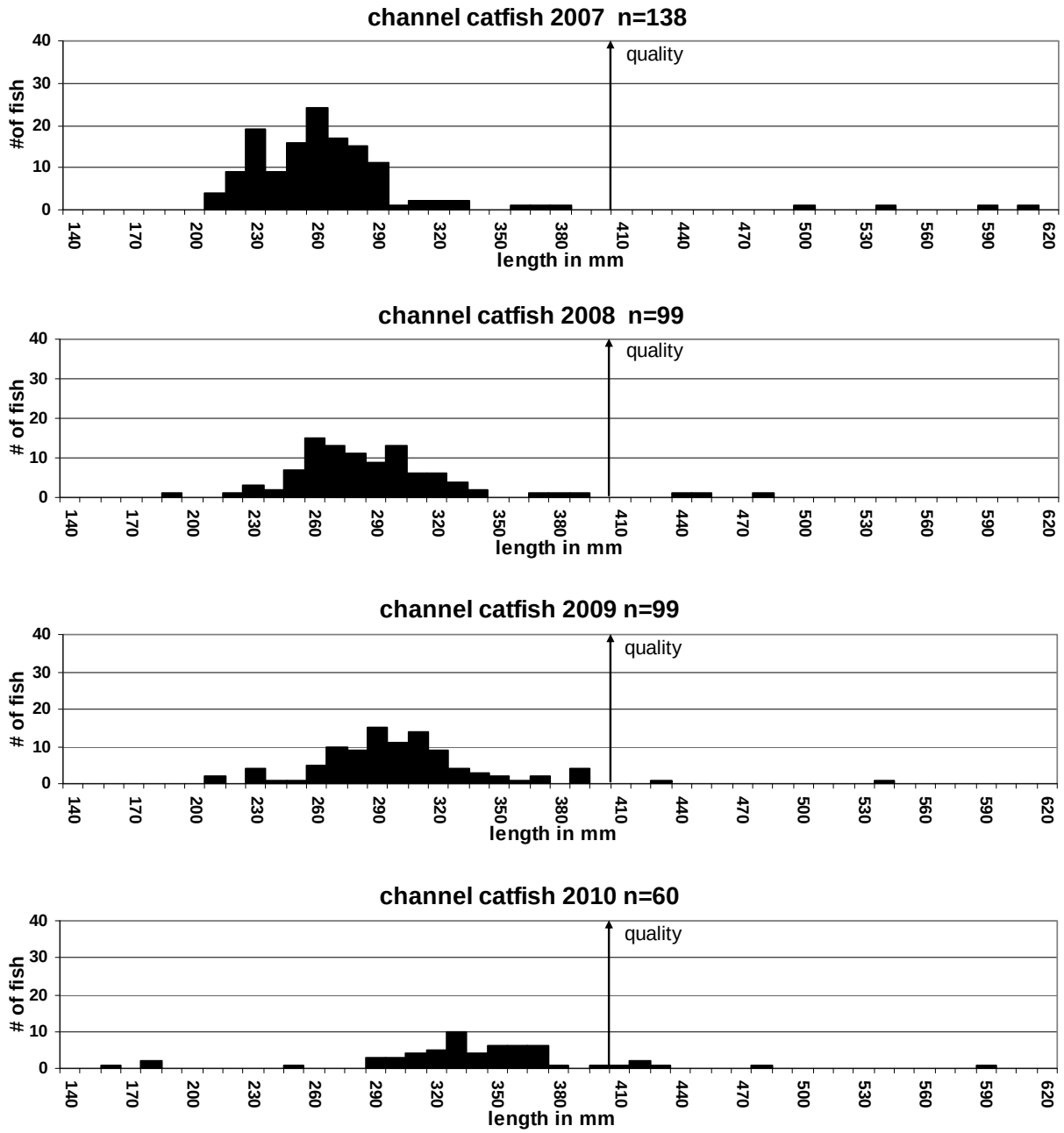


Figure 5. Length frequency histogram of channel catfish collected in gill nets from Angostura Reservoir, Fall River County, 2007-2010.

Gizzard shad

Gizzard shad were introduced to Angostura Reservoir in 1990 to provide forage for game fish, especially walleye, which were experiencing slow growth, poor condition and high mortality. The first age-0 gizzard shad were collected in 1994 during a quarter arc seine survey. No adult gizzard shad have been stocked in Angostura Reservoir since 1994. In recent years, adult shad numbers appear to be down as none have been collected in the past four surveys. August

electrofishing yielded a total of 62 young of the year gizzard shad in 1.42 hours of electrofishing with six of ten sites sampled having shad, indicating poor reproduction in 2010 (Table 1).

The northern latitude of South Dakota and subsequent cold winter water temperatures most likely causes some over-winter mortality of gizzard shad on an annual basis. Limited winter mortality of gizzard shad is desirable to keep densities of adult shad low while maintaining a high reproductive potential. Due to the continued presence of age-0 shad and adults during annual spring shad collection, it is apparent that some survival of shad is occurring and the surviving adult shad can produce large year classes of juveniles.

Walleye

Angostura Reservoir remains one of the most popular walleye fisheries in western South Dakota. Even with high fishing pressure, walleye abundance remains good with a gill net CPUE of 23.5. (Table 7). Last year, CPUE was nearly identical at 22.0. Catch for stock length and longer fish, showed a similar pattern with a CPUE of 21.5 compared to 21.8 last year. The 2005 lake management plan sets the target CPUE for stock length and longer walleye to be at least 20 per gillnet.

Stock density indices indicate an identical proportion of quality walleye to last year with a PSD of 53, (Table 7). The current management goal is a PSD between 30 and 60. Fish over twenty inches decreased slightly with this survey yielding an RSD-P of 6 compared to 8 last year. In efforts to simplify regulations statewide, the minimum length limit for walleye at Angostura Reservoir was increased from 14 inches to 15 inches in January 2010. The walleye length restrictions also still include a one walleye over 20 inches limit. It has been questionable if the "one over" will have any influence on increasing the number of larger walleye since only two percent of the recruited population is making it to 20 inches, however, creel data has shown that anglers do target this segment of the population. Low numbers of 20 inch and larger walleye does make it appear anglers are still keeping numbers of these larger walleye very low. At the very least this regulation will socially place a higher value on these larger walleye.

Walleye condition remained similar to last year when stock-length and larger walleye averaged 86.0. During this survey, fish condition was 83.3. This may be related to the poor shad reproduction this year. Growth continues to look excellent with fish surpassing 15 inches between age two and three (Table 8).

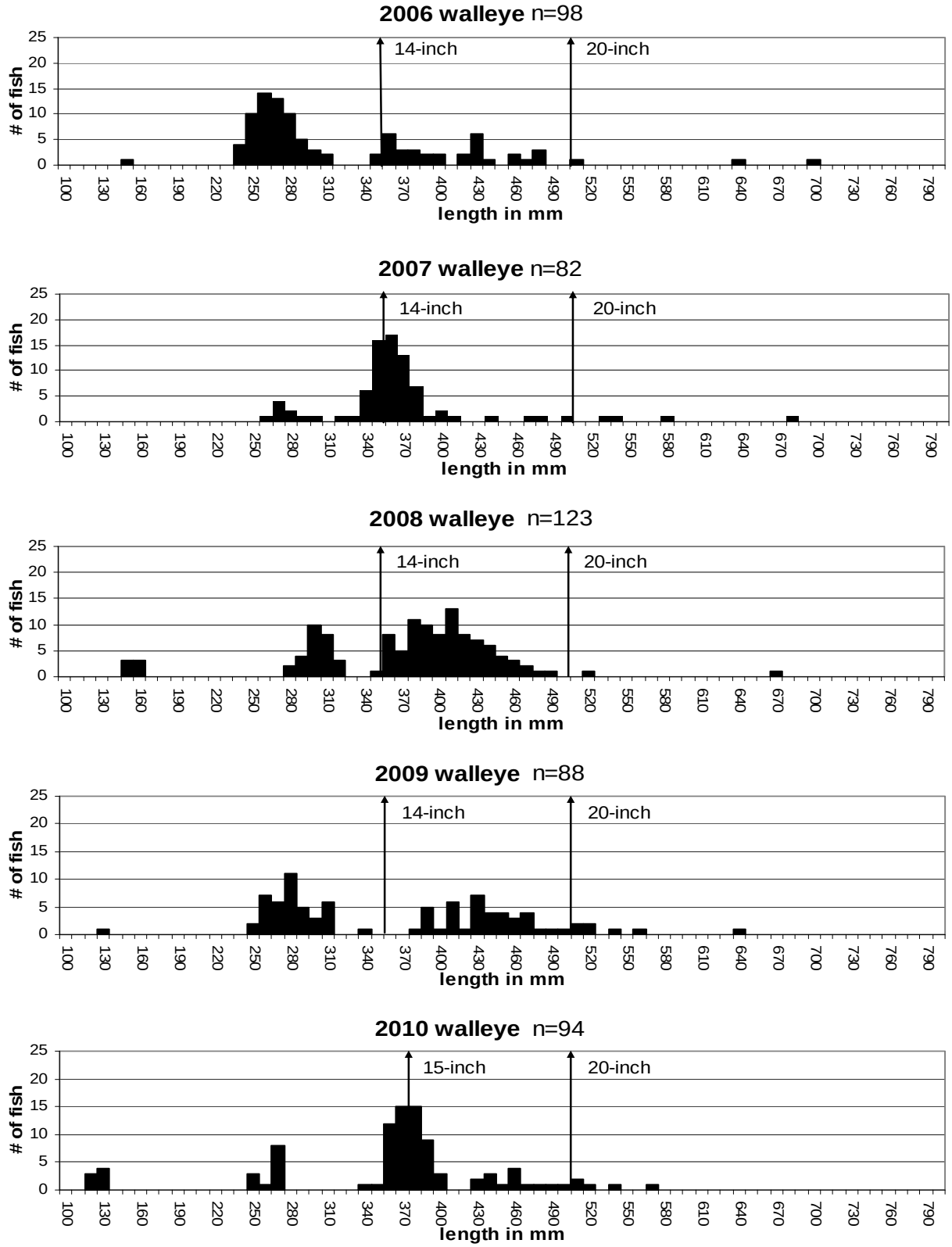


Figure 6. Length frequency histogram of walleye collected in gill nets from Angostura Reservoir, Fall River County, 2006-2010.

Table 7. Composite listing of sample size (N), catch per unit effort (CPUE; standard error is given in parentheses), mean total length (TL; standard error is given in parentheses), and proportional stock densities (PSD, RSD; 90% CI's) for walleye collected by gill net in Angostura Reservoir, 2000-2010.

Year	N	CPUE	CPUE-S	PSD	RSD-P	Wr≥S
2000	249	49.8 (15.5)	39.4 (14.2)	43 (6)	7 (3)	87.8 (0.5)
2001	87	17.4 (11.7)	15.4 (10.9)	31 (9)	8 (5)	87.3 (1.3)
2002	135	33.8 (19.2)	28.3 (19.4)	50 (8)	4 (3)	85.7 (0.0)
2003	117	29.3 (26.2)	23.3 (19.7)	32 (8)	2 (3)	84.6 (0.2)
2004	137	34.3 (14.1)	30.3 (13.0)	57 (8)	6 (4)	82.2 (0.4)
2005	162	81.0 (153.9)	54.5 (100.0)	56 (8)	11 (5)	86.1 (0.6)
2006*	98	24.5 (6.8)	23.3 (6.0)	27 (8)	3 (3)	82.8 (0.1)
2007*	82	20.5 (4.0)	20.5 (4.0)	23 (8)	5 (4)	83.3 (0.7)
2008*	123	41.0 (10.9)	39.0 (10.9)	65 (7)	2 (2)	84.7 (0.1)
2009*	88	22.0 (2.3)	21.8 (2.4)	53 (9)	8 (5)	86.0 (0.7)
2010*	94	23.5 (6.1)	21.5 (4.8)	53 (9)	6 (4)	83.3 (0.4)

*150 foot gillnets instead of 300 footers pre-2006.

Table 8. Angostura Reservoir walleye length range and weighted mean length (mm) at capture by otolith aged gillnet sample August 8-10, 2010.

Age	Minimum length range @ capture	Weighted mean length @ capture	Maximum length range @ capture	Number of fish in survey
1	252	267	275	12
2	346	379	405	55
3	435	444	466	7
4	466	496	540	6
5	469	503	570	3
9	515	520	525	2

Yellow perch

Angostura Reservoir's perch population continues to do well, possibly associated with higher water levels the past two years. Perch were the most numerous species sampled in gillnets this year. During this survey, perch catch was 26.5 per trap net compared to 25.5 last year. Perch condition was average this year with a mean Wr for stock length and larger fish of 88.0, similar to 89.2 last year. Size structure was also similar to last year with a PSD of 19 andRSD-P of 0 versus PSD and RSD-P of 22 and 0 last year, respectively. Continued higher water levels should help the perch population continue to improve.

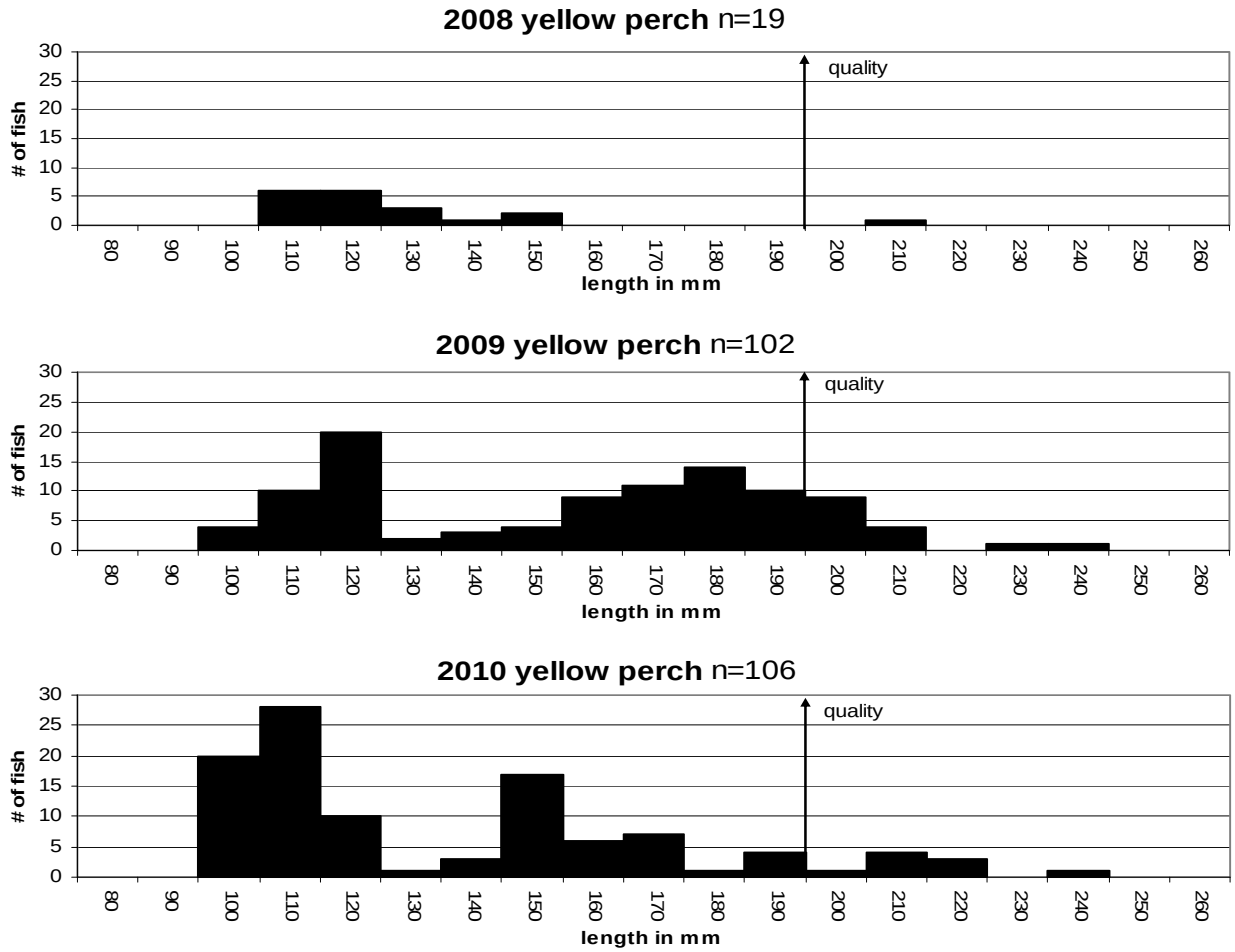


Figure 6. Length frequency histograms for yellow perch collected in gill nets at Angostura Reservoir, 2008-2010.

RECOMMENDATIONS

1. Continue conducting annual lake surveys to evaluate fish populations and regulation success.
2. Monitor the channel catfish population to determine if removal efforts are improving density or growth of this species.

APPENDICES

Appendix A. Stocking record for Angostura Reservoir, Fall River County, 2001-2003, 2005, 2008, and 2010.

Year	Number	Species	Size
2001	12,638	Largemouth bass	Fingerling
	37,000	Rainbow trout	Fingerling
2002	50,100	Walleye	Fingerling
	30,000	Smallmouth bass	Fingerling
2003	218,791	Walleye	Fingerling
	80,000	Rainbow trout	Fingerling
2005	381,045	Walleye	Fingerling
2008	479,900	Walleye	Fingerling
2010	289,340	Walleye	Fingerling

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Cold Brook Reservoir County: Fall River
Legal description: T7S, R5E, Sec.11 & 28
Location from nearest town: 0.5 miles north of Hot Springs, SD
Dates of present survey: July 15-16, 2010
Date last surveyed: October 27, 2007
Most recent lake management plan: F-21-R-38 Date: 2005
Management classification: Coldwater Permanent
Contour mapped: 1992

Primary Species: (game and forage)	Secondary and other species:
1. Rainbow Trout	1. Black Crappie
2. Largemouth Bass	2. Green Sunfish
3.	3. Channel Catfish
4.	4. Common Carp

PHYSICAL CHARACTERISTICS

Surface Area: 34 acres; Watershed: 44,588 acres
Maximum depth: 38 feet; Mean depth: 15 feet
Lake elevation at survey (from known benchmark): unknown (3,585.4 ft on 2-24-2011)

1. Describe ownership of lake and adjacent lakeshore property:

Cold Brook Reservoir is owned by the US Army Corps of Engineers and was constructed in 1950 to reduce flood damages in the Fall River Basin. It is managed for flood control and recreation. Cold Brook Creek in the Fall River Watershed drains into and out of the reservoir. There are camping, picnicking, boating (electric motors only), and swimming facilities located on or adjacent to the reservoir (Figure 1). South Dakota Game, Fish, and Parks manages the fishery.

2. Describe watershed condition and percentages of land use:

The watershed directly above Cold Brook Reservoir is primarily private land used as pasture. The U.S. Forest Service administers 23,784 acres mostly in the northern portion of the watershed. 1,560 acres of the watershed are a part of Wind Cave National Monument and managed by the National Park Service. The remaining 43% (19,244 ac) is comprised of private holdings used mainly for pasture. The land use of the watershed based on ArcGIS layer from 2002 is 51% (23,182 ac) hay pasture or grassland and 46% (20,602ac) forested (combined public and private land).

3. Describe aquatic vegetative condition:

Emergent vegetation in the form of cattail and bulrush exists in the inlet region. Submergent vegetation was evident over much of the bottom to depths of light penetration.

4. Describe pollution problems:

Erosion has contributed a substantial amount of silt at the inlet of the reservoir.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

All structures associated with Cold Brook Reservoir appear adequate and in good condition. The 2007 report indicated that Cold Brook had a new boat ramp at that time.

BIOLOGICAL DATA

Methods

Cold Brook Reservoir was surveyed on July 15-16, 2010 with two gill nets and seven trap nets (Figure 1). The gill nets were set and remained in the water overnight. They were monofilament experimental nets 45.7 m (150 ft) long and 1.8 m (6-ft) deep with six 7.6 m (25-ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Seven trap nets were set (Figure 1) and also remained in the water overnight. Six nets had ¾ in mesh and a 1.3 × 23 m (3.9 × 75.5 ft.) lead. One net had ¼ inch mesh and a 50ft lead (baby frame). Leads were pulled on shore for some nets due to water levels and this was not measured.

Previous surveys of Cold Brook Reservoir in 2002 and 2007 were done by night electrofishing only. The lake was last surveyed with trap nets in 1995. For each survey method, total length (mm) and weight (g) was collected for each fish sampled.

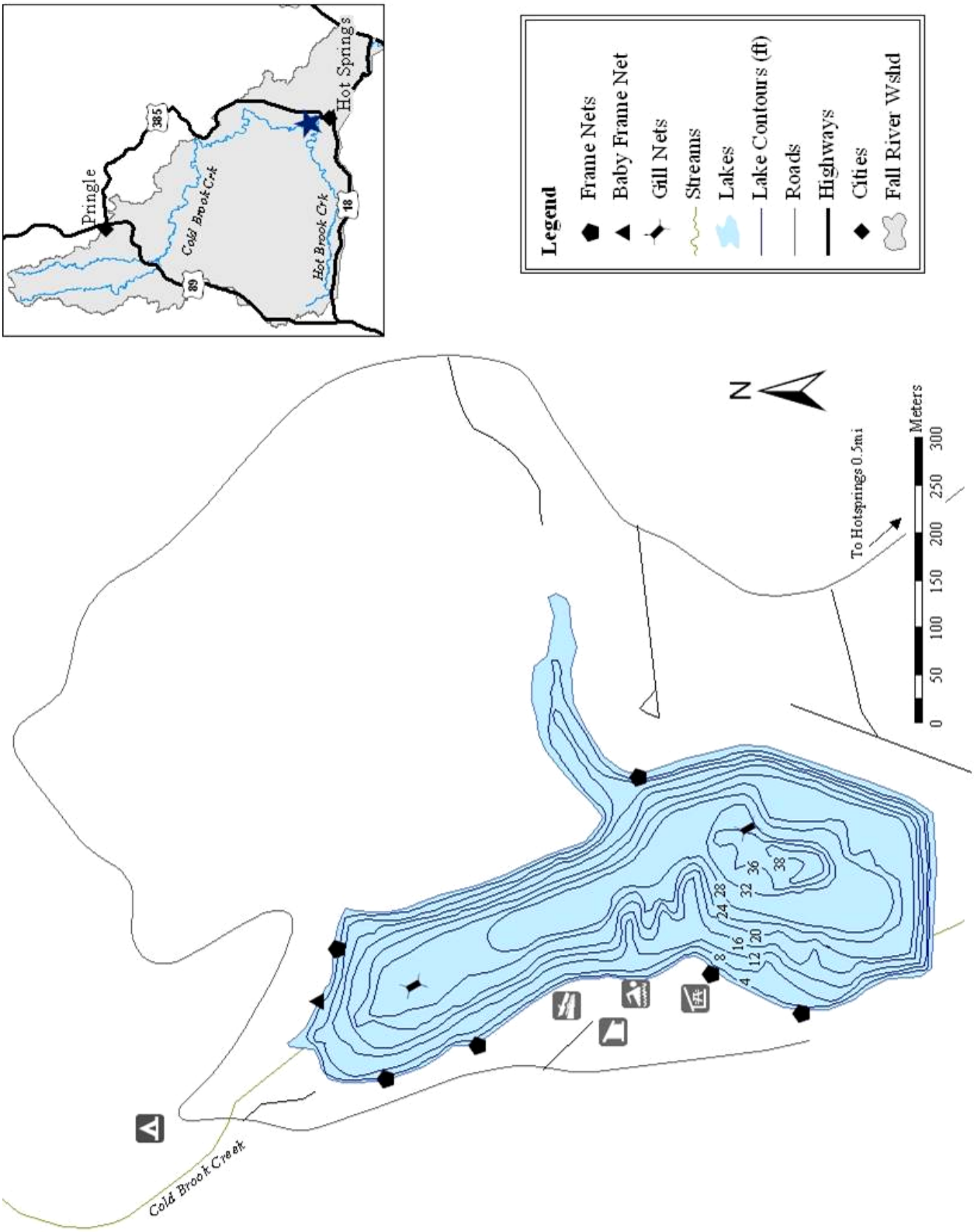


Figure 1. Lake map of sample locations on July 15-16, 2010 at Cold Brook Reservoir, Fall River County, South Dakota.

Results and Discussion

Five species of fish were collected during the survey of Cold Brook Reservoir totaling 129 fish (Tables 1-3).

Table 1. Total catch for six, $^{3}/_{4}$ inch modified fyke-nets in Cold Brook Reservoir, South Dakota on July 16, 2010. Parameters are reported with confidence intervals.

Species	N	CPUE (80%)	CPUE-S	PSD (90%)	Wr-S (90%)	Mean Length (mm)
Green sunfish	54	9 (4.1)	8 (3.3)	37 (11)	96(1)	134
Largemouth bass	7	1 (1.5)	0	100		145
Total	61					

Table 2. Total catch for one ¼ inch modified fyke-net in Cold Brook Reservoir, Fall River, South Dakota on July 16, 2010. Parameters are reported with confidence intervals.

Species	N/CPUE	CPUE-S	PSD (90%)	Wr-S (90%)	Mean Length (mm)
Green sunfish	6	6	33 (43)	100 (5)	155
Total	6				

Table 3. Total catch for two experimental gill nets in Cold Brook Reservoir, South Dakota on July 16, 2010. Parameters are reported with confidence intervals.

Species	N	CPUE	CPUE-S	PSD (90%)	Wr-S (90%)	Mean Length (mm)
Rainbow tout	46	23 (6)	23 (6)	0	91 (0.1)	321
Green sunfish	9	4.5 (1.5)	4.5 (1.5)	22 (28)	102 (7)	132
Black crappie	4	2(3)	0.5 (1.5)	75 (25)	107 (0)	119
Largemouth bass	2	1 (3)	0.5 (1.5)	50 (50)	101 (0)	162
Channel catfish	1	0.5 (1.5)	0.5 (1.5)	100	NA	620
Total	62					

Rainbow Trout

Rainbow trout are stocked into Cold Brook Reservoir at a rate of about 5,880 per year. In 2010, 2,800 catchable sized (11") fish and 120, 15" fish were stocked prior to the survey (Appendix A). They were the most abundant species captured in gill nets and their size and condition was what is expected for hatchery stocked fish.

Green Sunfish

During the 2010 survey, 69 green sunfish were captured in Cold Brook Reservoir (Tables 1-3) with a CPUE of nine, making them the most abundant species caught in trap nets. This is a slight increase from the CPUE of 6.5 for green sunfish captured in ¾ inch trap nets during the

1995 survey. A majority of the fish were of stock length or greater (<80mm) (Figure 2). Condition for this species was high with a Wr value of 96.

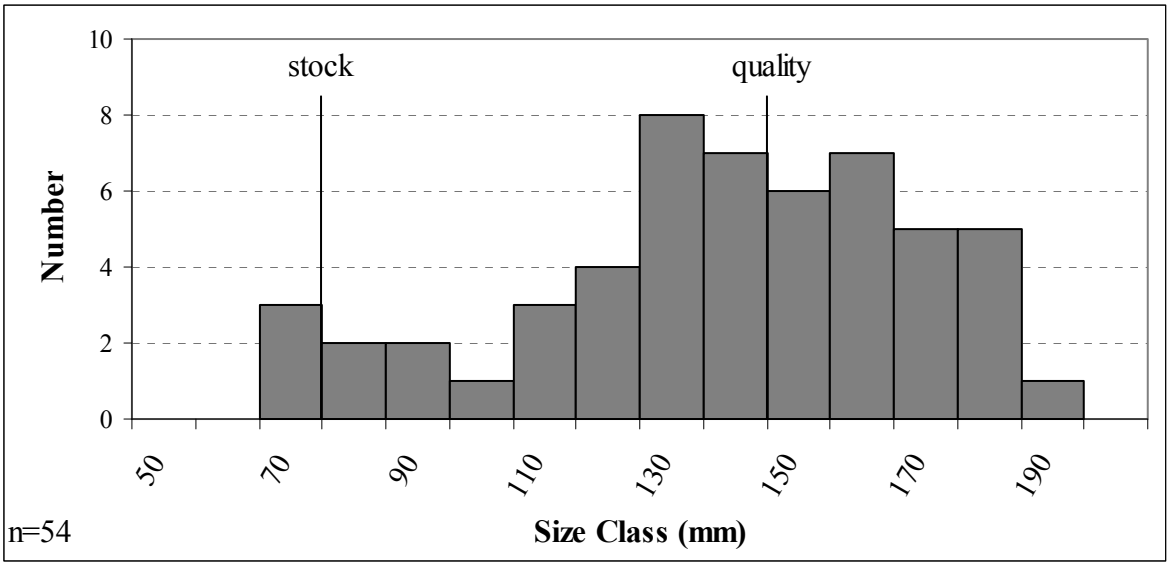


Figure 2. Length frequency histogram of green sunfish captured in ¾ inch modified fyke trap nets at Cold Brook Reservoir on July 16, 2010.

Largemouth bass

Cold Brook was not electrofished as part of the 2010 survey; therefore, largemouth bass were not effectively sampled. Seven were caught in ¾ in trap nets and two in gill nets. Trap net fish were all substock (< 200mm) and gill net fish were one stock and one substock length.

Other Species

Black crappie and channel catfish were also captured during the survey (Tables 1-3) in low abundances.

RECOMMENDATIONS

1. Conduct a night electrofishing survey to gather information on the largemouth bass populations. If population characteristics are indicative of high abundance then consider using Cold Brook as an adult largemouth bass source for other lakes.

2. Evaluate success of the rainbow trout fishery and stocking program in the presence of a high density largemouth bass population.

APPENDICES

Appendix A. Stocking record for Cold Brook Reservoir, Fall River County, 2001-2010.

Year	Species	Number	Size
2001	Rainbow Trout	6,730	Catchable
	Rainbow Trout	25	Adult
2002	Rainbow Trout	5,272	Catchable
	Rainbow Trout	70	Adult
2003	Rainbow Trout	5,250	Catchable
	Rainbow Trout	11	Adult
2004	Rainbow Trout	4,680	Catchable
	Rainbow Trout	214	Adult
2005	Rainbow Trout	5,060	Catchable
2006	Rainbow Trout	9,500	Catchable
	Rainbow Trout	300	Adult
2007	Rainbow Trout	6,800	Catchable
	Rainbow Trout	70	Adult
2008	Rainbow Trout	8,350	Catchable
	Rainbow Trout	56	15”
2009	Rainbow Trout	6,400	Catchable
	Rainbow Trout	280	15”
2010	Rainbow Trout	5,600	Catchable
	Rainbow Trout	240	15”

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Cottonwood Springs Reservoir County: Fall River
Legal description: Sec 18, T 7 S, R 5E
Location from nearest town: 3 miles W, 1 mile N. of Hot Springs, SD
Dates of present survey: July 8-9, 2010
Date last surveyed: July 6, 2006
Most recent lake management plan: NA
Management classification: Warmwater permanent
Contour mapped: 1994

Primary Species: (game and forage)
1. Largemouth bass
2. Rainbow trout

Secondary and other species:
1. Black crappie
2. Green sunfish
3. Smallmouth bass

PHYSCIAL CHARATERISTICS

Surface Area: 12 acres
Watershed: 16,641 acres
Maximum depth: 25 feet;
Mean depth: 16 feet
Lake elevation at survey: 3,871 feet

1. Describe ownership of lake and adjacent lakeshore property:

Cottonwood Springs Dam was constructed to reduce flood damages in the Fall River Basin. The dam, reservoir and surrounding land are owned and managed by the U.S. Army Corps of Engineers. The Corps also maintains a picnic area and an 18 site campground, bathrooms and a playground.

2. Describe watershed condition and percentages of land use:

The U.S. Forest Service administers 2,631 acres on the east central portion of the watershed and the remaining 84% is comprised of private holdings. The land use of the watershed is 84% (14,046 ac) hay pasture or grassland and 13% (2,201 ac) forested (combined public and private land).

3. Describe aquatic vegetative condition:

Emergent vegetation was found in the inlet and on the entire edge of the lake. Submergent vegetation was present throughout the lake.

4. Describe pollution problems:

No pollution problems were identified. The lake was clear all the way to the bottom.

5. Describe condition of all structures, (i.e. spillway, level regulators, boat ramps, etc.):

All structures associated with Cottonwood Springs Reservoir appear to be in good condition. An extended boat ramp was built in 2006 to accommodate low water levels. During the 2010 survey, this ramp was a long distance and big drop off from the water. No boat access was available and the shoreline is too shallow for anything more than a two person boat. Fishing access was a several hundred yard walk from the parking lot near the boat ramp. Reports in March 2010, after this survey, indicate the lake has recently refilled and water levels are again up to the ramp.

CHEMICAL DATA

A temperature and pH profile was collected at Cottonwood Springs Reservoir during the survey in the deepest part of the lake this year using a YSI 6820 unit (Table 1). A temperature probe was also placed in the lake during 2003. A surface water high temperature of 80°F and a mid lake high temperature of 79°F was recorded on July 24.

Table 1. Temperature and pH profile of Cottonwood Springs Reservoir on July 8, 2010.

Depth (m)	Temp ^{o}C	pH
0.5	23.8	8.33
2.5	22.9	8.49
5	22.5	8.49
7.5	21.8	8.79
bottom	20.9	6.85

BIOLOGICAL DATA

Methods

The Cottonwood Springs Reservoir fishery was surveyed on July 8-9, 2010 with 1 gill net night and 4 trap net nights (Figure 1). The gill net was a monofilament experimental net and was 45.7 m (150-ft) long and 1.8 m (6-ft) deep with six 7.6 m (25-ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Four trap nets were set and remained in the water overnight. Three nets had ¾ in mesh and a 1.3 × 23 m (3.9 × 75.5-ft.) lead. To sample smaller fish, one net had ¼ inch mesh with a 50ft lead. Leads were pulled on shore for some nets due to water levels or lake size and this length was not measured.

For each survey method, total length (mm) and weight (g) was collected for each fish sampled. Data was entered into WinFin 4.4 and analysis was completed using WinFin Analysis 2.3.

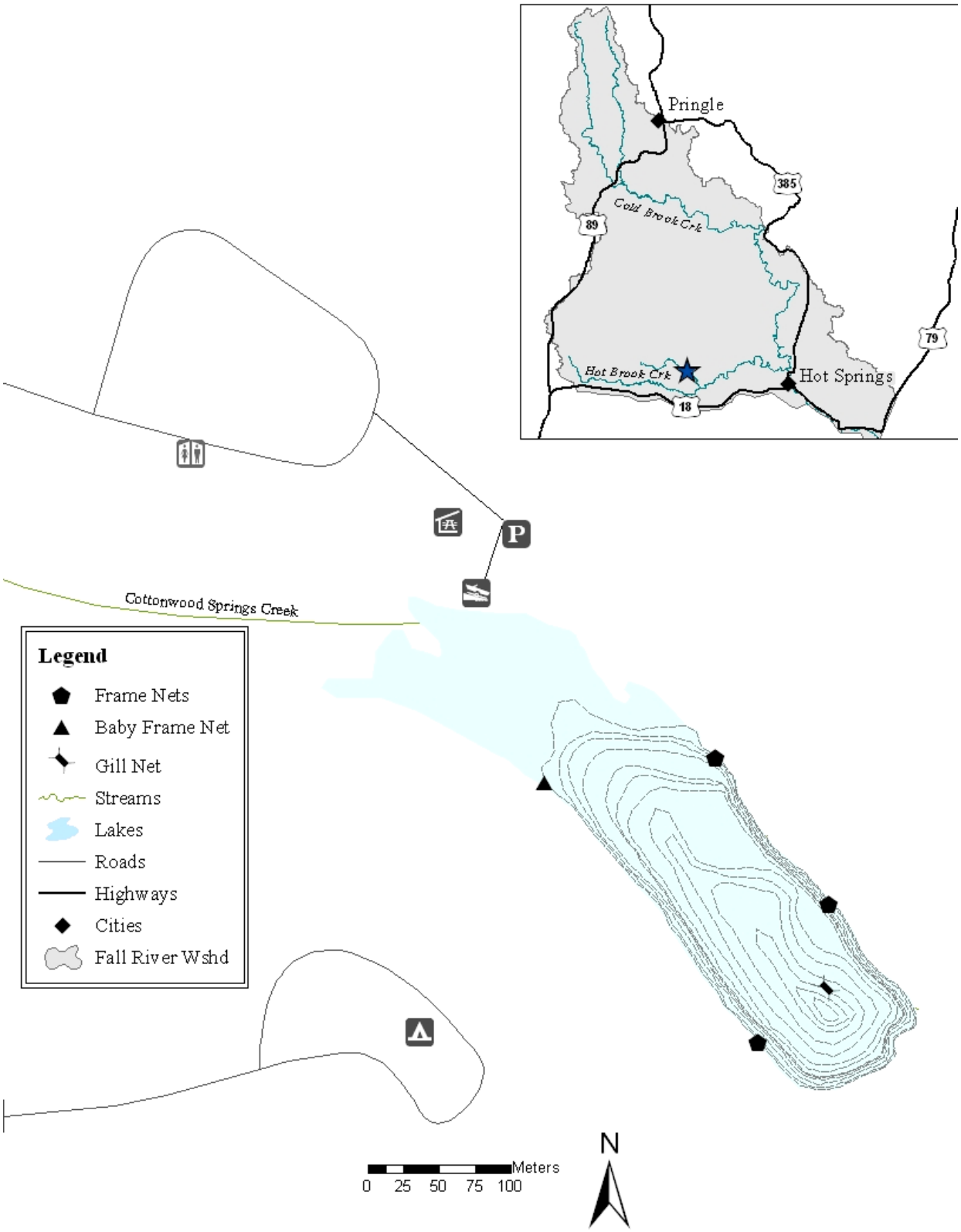


Figure 1. Lake map of sampling sites on July 8-9, 2010 at Cottonwood Springs Reservoir, Fall River County, South Dakota.

Results and Discussion

Only black crappie and green sunfish were collected during the survey of Cottonwood Springs Reservoir totaling 440 fish (Tables 2-4). Green sunfish was the most abundant species sampled. Largemouth bass were seen, but not captured.

Table 2. Total catch for three, $^{3}/_{4}$ inch modified fyke-nets in Cottonwood Springs Reservoir, Fall River County, South Dakota on July 9, 2010. Parameters are reported with confidence intervals.

Species	**N**	**CPUE/CPUE-S** (80%)	**PSD** (90%)	**Wr-S** (90%)
Black crappie	38	13(17.7)	95 (5)	97 (0.7)
Green sunfish	253	84.3(90.3)	not measured	
Total	291			

Table 3. Total catch for one ¼ inch modified fyke-net in Cottonwood Springs Reservoir, Fall River, South Dakota on July 9, 2010. Parameters are reported with confidence intervals.

Species	**N/CPUE**	**CPUE-S**	**PSD** (90%)	**Wr-S** (90%)	**Mean Length** (mm)
Black crappie	21	21	76 (17)	97 (1.4)	209
Green sunfish	83	83	27 (8)	114 (1.7)	147
Total	104				

Table 4. Total catch for one experimental gill net in Cottonwood Springs Reservoir, Fall River County, South Dakota on July 9, 2010. Confidence intervals are also reported.

Species	**N/CPUE**	**CPUE-S**	**PSD** (90%)	**Wr-S** (90%)	**WR-P**
Black crappie	22	22	95 (5)	98 (2.2)	na
Green sunfish	23	23	13 (12)	118 (3)	93
Total	45				

Black Crappie

Eighty-one black crappies were captured during the 2010 survey. CPUE increased 84% in 2010 for trap nets compared to the 2006 survey. A majority of the crappie in this survey were quality length (≥200mm), and none were preferred length (≥250mm), a similar result to the 2006 survey (Figure 3). Condition of adult crappie has also remained high (Figures 2-4). It would appear the Cottonwood Springs Reservoir population is doing well. Mean indices were reported by Guy and Willis (1995) for black crappies sampled in ten South Dakota small impoundments less than 40ha. This report indicated a PSD of 27, much lower than the value for Cottonwood Springs at

95. Mean condition (Wr-S) for Cottonwood Springs Reservoir crappie was 97, only slightly lower than that for Guy and Willis (1995) lakes at a value of 99. In addition, Gabelhouse (1984) found that in small Midwestern impoundments, crappie PSD was inversely correlated with largemouth bass PSD and PSD-P. Therefore, the high PSD of crappies in Cottonwood Springs Reservoir could indicate low stock density indices for bass. The bass population will be sampled by using night electrofishing in 2011.

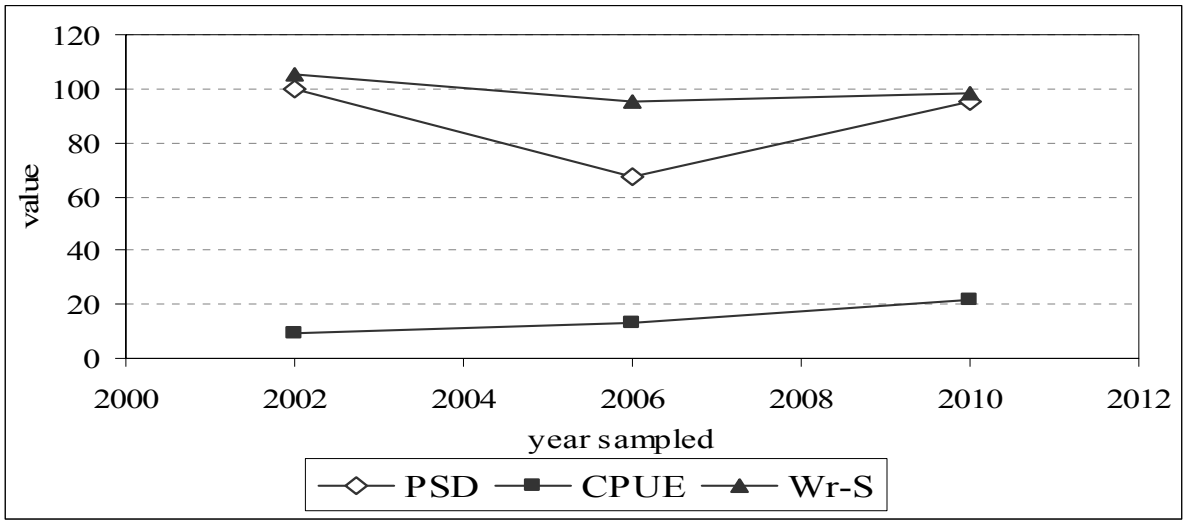


Figure 2. Indices for black crappie sampled in gill nets at Cottonwood Springs Reservoir, Fall River County, South Dakota.

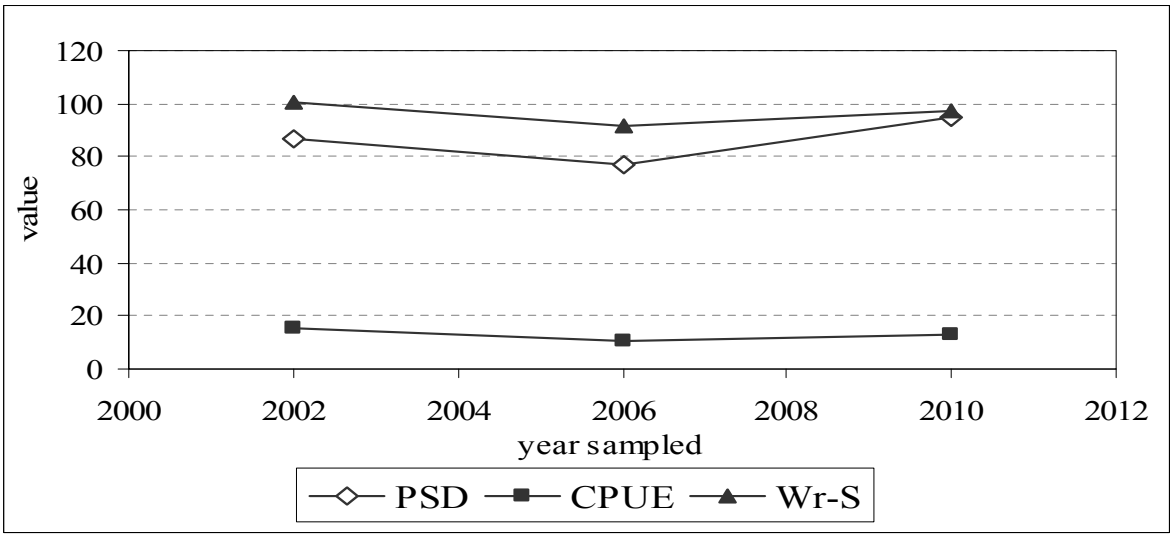


Figure 3. Indices for black crappie sampled in $^{3}/_{4}$inch trap nets at Cottonwood Springs Reservoir, Fall River County, South Dakota.

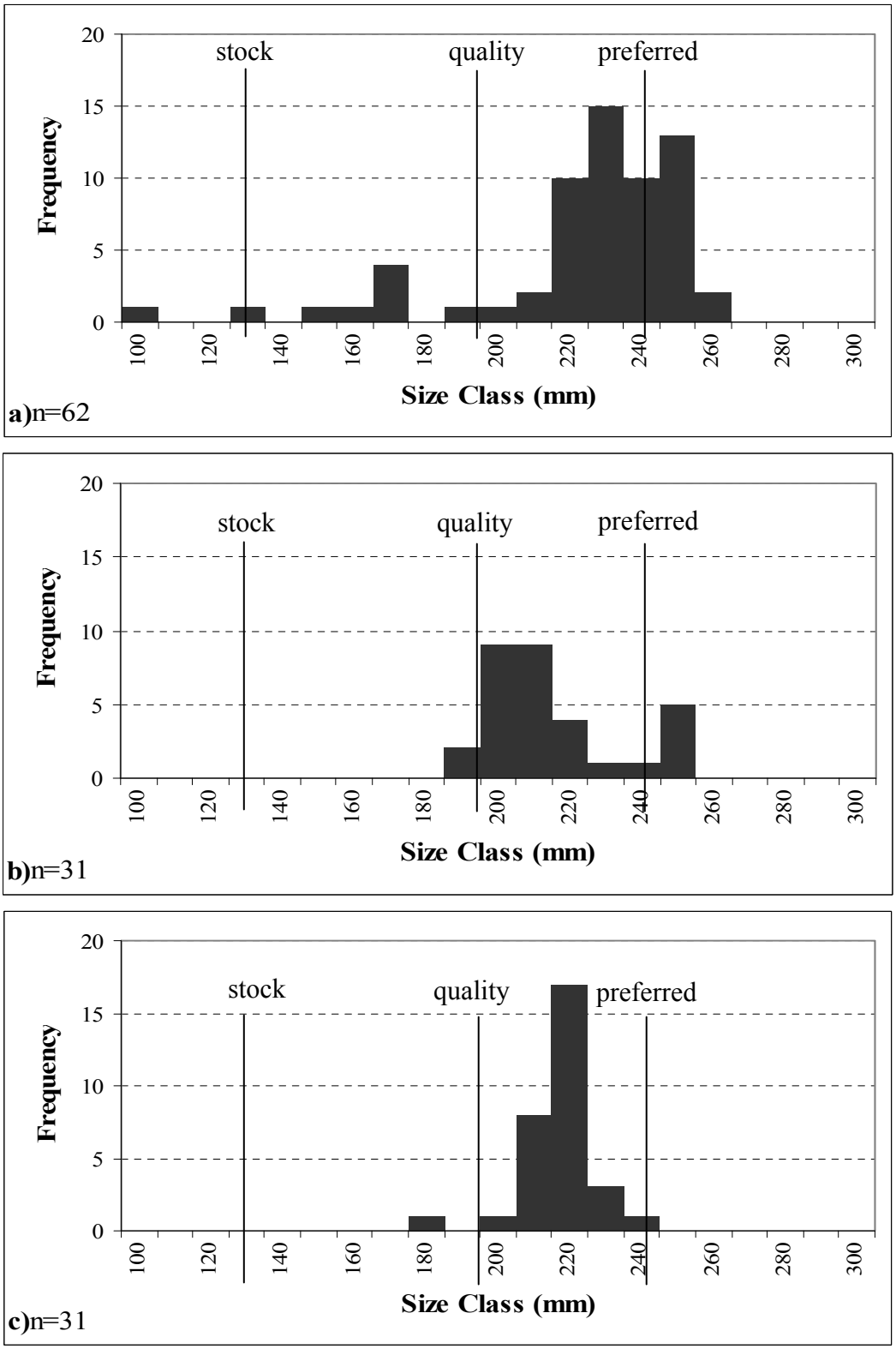


Figure 4. Length frequency histogram for black crappie captured in ¾ inch trap nets in Cottonwood Springs Reservoir, South Dakota: a)2002 b)2006 c)2010

Green Sunfish

During the 2010 survey, 359 green sunfish were captured in Cottonwood Springs Reservoir (Tables 2-4), which was an 80% increase in CPUE from the 2006 survey, which first detected the species. Five fish were capture in this previous survey. A majority of the fish were stock length (80-150mm) (Figure 5) with low PSD values of 27, and 13 for ¼ inch trap nets and gill nets, respectively. Condition for this species was high with Wr values of 114 and 118 for ¼ inch trap nets and gill nets, respectively. Lengths and weights were not taken for fish in ¾ inch trap nets.

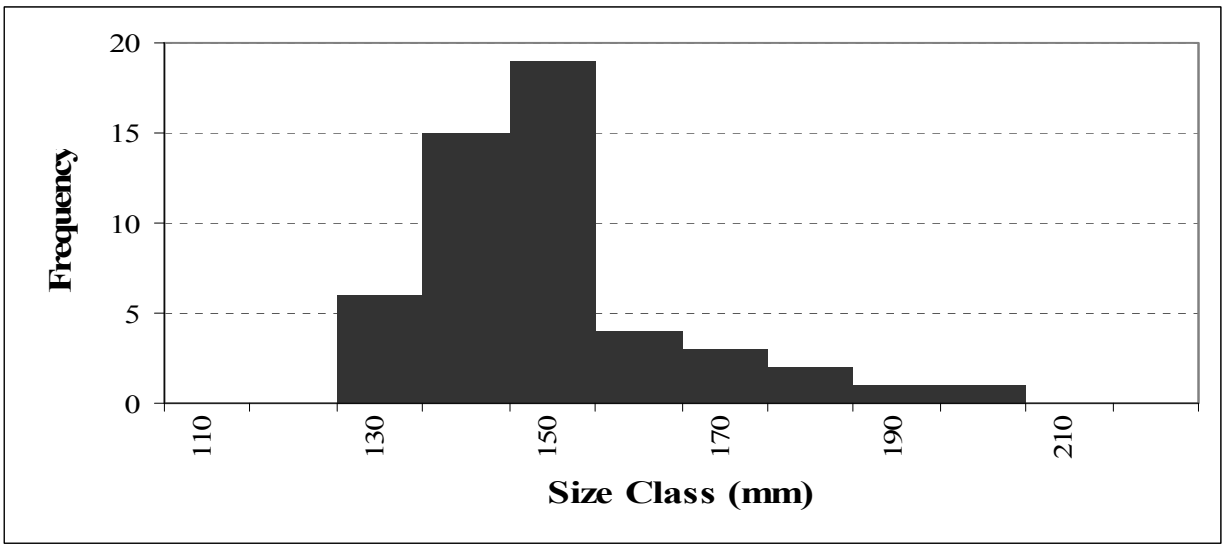


Figure 5. Length frequency histogram for green sunfish captured in ¼ inch modified fyke nets Cottonwood Springs Reservoir, Fall River, South Dakota on July 9, 2010.

Other species

Electrofishing was not conducted in 2010 so largemouth and smallmouth bass were not sampled effectively. During the 2006 survey, 12 largemouth bass and seven smallmouth bass were captured in ¾ inch trap nets for CPUE values of 4 and 2.3, respectively. Trout species were not detected and were last stocked in 2007 (Appendix A).

RECOMMENDATIONS

1. Manage for largemouth bass and black crappie.
2. Consider regular stocking of rainbow trout when water levels increase to near full.
3. Conduct electrofishing to evaluate bass population when water levels permit putting a boat in the lake.
4. Conduct annual lake survey in 2015.

LITERATURE CITED

Gabelhouse, D.W. Jr. (1984). An assessment of crappie stocks in small Midwestern private impoundments. North American Journal of Fisheries Management. 4:371-38

Guy, C.S., and D.W. Willis. 1995. Population Characteristics of Black Crappies in South Dakota Waters: A Case for Ecosystem-Specific Management. North American Journal of Fisheries Management. 15:754-765.

APPENDICES

Appendix A. Stocking record for Cottonwood Springs Dam, South Dakota, 2000-2010

Year	Number	Species	Size
2000	7,800	rainbow trout	fingerling
	188	rainbow trout	catchable
2001	1,200	rainbow trout	catchable
2002	7,000	rainbow trout	fingerling
	2,150	rainbow trout	catchable
2003	800	rainbow trout	catchable
	45	rainbow trout	adult
2004	725	brown trout	catchable
	1,500	rainbow trout	catchable
2005	725	brown trout	catchable
	1,499	rainbow trout	catchable
2006	1,500	rainbow trout	catchable
2007	450	rainbow trout	catchable

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Waggoner Lake County: Haakon
Legal description: T 1N, R 20E Sec. 1 and T 1N, R 21E Sec. 6
Location from nearest town: 3 miles north of Philip, SD
Dates of present survey: July 6-8, 2010; September 30, 2010
Date last surveyed: September 30, 2008
Most recent lake management plan: F21-R-32 Date: 1998
Management classification: Warmwater permanent
Contour mapped: 1995

Primary Species: (game and forage)	Secondary and other species:
1. Largemouth bass	1. Black crappie
2. Bluegill	2. Northern pike
3.	3. Yellow perch
4.	4. Green sunfish
5.	5. Walleye
6.	6. Channel catfish
7.	7. Smallmouth bass
8.	8. White sucker

PHYSICAL CHARACTERISTICS

Surface Area: 107 acres (43 ha); Watershed: 16,600 acres
Maximum depth: 21 feet; Mean depth: 10 feet
Lake elevation at survey (from known benchmark): full

1. Describe ownership of lake and adjacent lakeshore property:

The State of South Dakota has an easement for public access up to 12 feet above the high water mark. A majority of the lakeshore property is privately owned with small portions owned by the city of Philip and Haakon County.

2. Describe watershed condition and percentages of land use:

Approximately 90% of the watershed consists of livestock grazing. An increasing portion of the watershed has been tilled for small grain row crops. The increased tillage has accelerated siltation of the lake. The primary source of water for Waggoner Lake is a city owned hot water well and Grindstone Creek. A continual water supply is rare for lakes in western South Dakota and this lake generally doesn't experience fluctuations but, the well water is also used by a nearby golf course which can affect input into the reservoir. The hot water well provides some benefit to fish in the winter months; however, it makes ice conditions near the inlet unpredictable.

3. Describe aquatic vegetative condition:

Emergent vegetation is limited to bulrushes and cattails, which are abundant in the bays and inlet areas of the lake. Submerged vegetation is a problem annually in mid-summer. Approximately 50% of the shoreline was covered by submergent vegetation.

4. Describe pollution problems:

There is moderate siltation from run-off. Currently department personnel have detected no pollution problems during lake surveys.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

A new boat ramp was installed in 2004.

BIOLOGICAL DATA

Methods

A lake survey was conducted on Waggoner Lake June 6-8, 2010. Sampling consisted of 1 gill net night and 7 trap net nights (Figure 1). All gill nets were monofilament experimental nets. Each net was 45.7 m (150 ft) long and 1.8 m (6 ft) deep with six 7.6 m (25 ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Trap nets were set at four stations consisting of 2 trap net nights each. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 inch) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g). In addition, scale samples for the first five fish per centimeter group were collected from selected fish per gear type for age and growth analysis. Scale samples were pressed onto acetate slides and viewed with a microfiche projector (40X) and the distance between scale annuli were recorded on paper strips.

Night electrofishing was conducted at Waggoner Lake on September 30, 2010. Electrofishing was conducted using a Smith-Root control unit with pulsed-DC. Six, ten-minute runs were completed. All smallmouth bass and largemouth bass collected were measured for total length (TL; mm) and weighed (g). Age and growth was not calculated due to recent adult stockings.

Fish population parameters calculated were catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean catch per unit effort (CPUE; mean number per net night or mean number per hour of electrofishing). Actual pedal time (time the electrofishing unit produced current) was recorded from the digital display on the Smith-Root control box and used to calculate electrofishing CPUE. Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

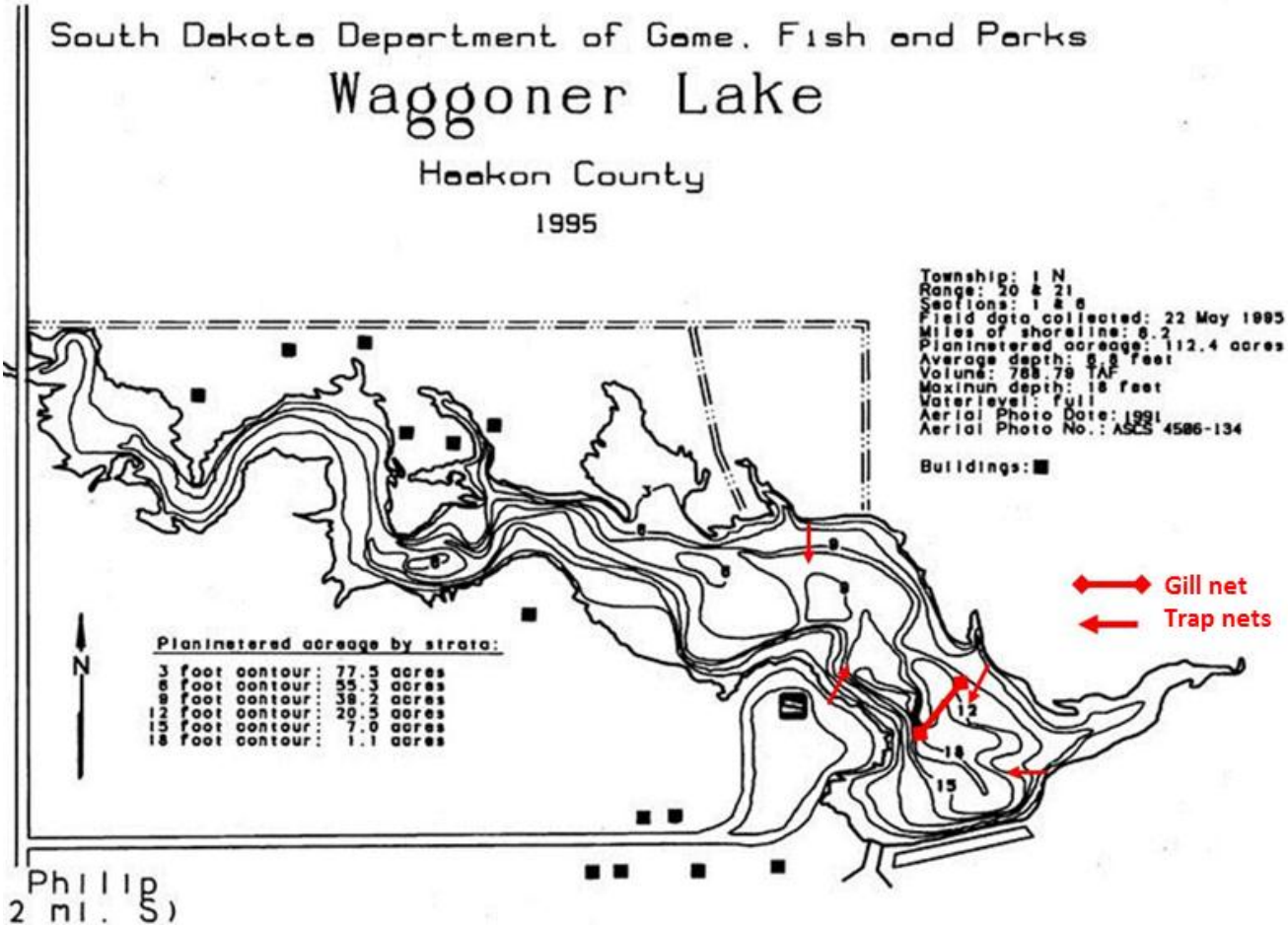


Figure 1. Map of Waggoner Lake and net locations in 2010.

Results and Discussion

Eight species were collected during the 2010 survey of Waggoner Lake. Seven species, totaling 82 fish, were collected in the experimental gill net (Table 1). Black crappie was the most abundant species sampled, comprising 35.4% of the total sample. Yellow perch were second at 28.0%, followed by golden shiners, black bullhead and bluegill, respectively.

Seven species, totaling 338 fish, were collected in the trap nets during the 2010 survey (Table 2). Black crappie was the most common comprising 43.8% of the total. Bluegill was second at 34.9% and yellow perch were third, comprising 15.1% of the trap net sample by number.

Table 1. Total catch (N), catch per net night, catch per net night of stock length fish, and proportional stock densities (PSD, RSD; 90% CI's in parentheses) for all fish species collected from one 150-ft experimental sinking gill net in Waggoner Lake, Haakon County, July 6-8, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr > S
Black bullhead	9	9.0 (--)	9.0 (--)	78 (28)	22 (28)	96.8 (4.9)
Black crappie	29	29.0 (--)	28.0 (--)	0	0	104.4 (0.8)
Bluegill	6	6.0 (--)	6.0 (--)	17 (33)	0)	107.4 (6.5)
Golden shiner	12	12.0 (--)	--	--	--	--
Largemouth bass	1	1.0 (--)	1.0 (--)	--	--	106.0 (--)
Northern pike	2	2.0 (--)	2.0 (--)	--	--	84.7 (7.0)
Yellow perch	23	23.0 (--)	22.0 (--)	73 (17)	0	91.2 (1.1)
Total	82					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80%CI's), and proportional stock densities (PSD, RSD; 90% CI's in parentheses) for all fish species collected from 7 trap nets in Waggoner Lake, Haakon County, July 6-8, 2010 .

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr > S
Black Bullhead	6	0.9 (0.9)	0.9 (0.9)	50 (45)	17 (33)	90.9 (8.2)
Black crappie	148	21.1 (12.7)	21.0 (12.6)	2 (2)	0	97.5 (0.6)
Bluegill	118	16.9 (7.3)	16.9 (7.3)	64 (8)	0	105.6 (0.7)
Golden Shiner	5	0.7 (0.8)	--	--	--	--
Northern pike	7	1.0 (0.4)	0.9 (0.4)	67 (43)	0	85.5 (4.9)
White sucker	3	0.4 (0.4)	0.4 (0.4)	--	--	88.8 (5.5)
Yellow perch	51	7.3 (5.2)	7.1 (5.2)	82 (9)	22 (10)	92.6 (0.9)
Total	338					

Black bullheads

Waggoner Lake remains a low density bullhead population with a mean trap net CPUE of 0.9 in 2010, compared to 2.3 in 2006. Gill net catch for bullheads was the same in 2006 and 2010. Condition was good with a Wr for stock length and larger fish of 90.9 in the trap nets and 96.8 in the gill net. It appears that bass and pike may be having an effect on bullheads and keeping density down.

Black crappies

Abundance of black crappies was similar to 2006 with a mean CPUE in trap nets of 21.1, compared to 27.0 in the last survey (Table 2). Sizes of black crappies were small indicated by low stock density indices (i.e. PSD equal to 2 and an RSD-P of 0; Table 2) and shown in the length frequency histogram (Figure 2). The small sizes are a substantial change from 2004 when PSD was 76 and RSD-P 9 and from 2006 when PSD was 11 and RSD-P 4. The young year classes should reach quality length by next survey. Mean condition of stock length and larger black crappies this year was 97.5 compared to 98.8 in 2006. Growth was near the regional average (Table 4).

Table 4. Waggoner Lake black crappie year class, age in 2010, sample size (N), mean back-calculated total length-at-age, the Region 1 mean length-at-age, and the South Dakota state-wide black crappie mean length-at-age (Willis et al 2001). Standard errors are in parentheses.

Year Class	**Age**	**N**	**Age 1**	**2**	**3**	**4**	**5**
2008	2	95	84	128			
2007	3	51	89	142	164		
2005	5	1	64	129	167	197	221
Pop. mean (SE)		**147**	**79 (7)**	**133 (4)**	**165 (1)**	**197 (0)**	**221 (0)**
Region 1			74(3)	122(7)	158(9)	197(13)	217(16)
South Dakota			83(2)	147(4)	195(5)	229 (6)	249 (6)

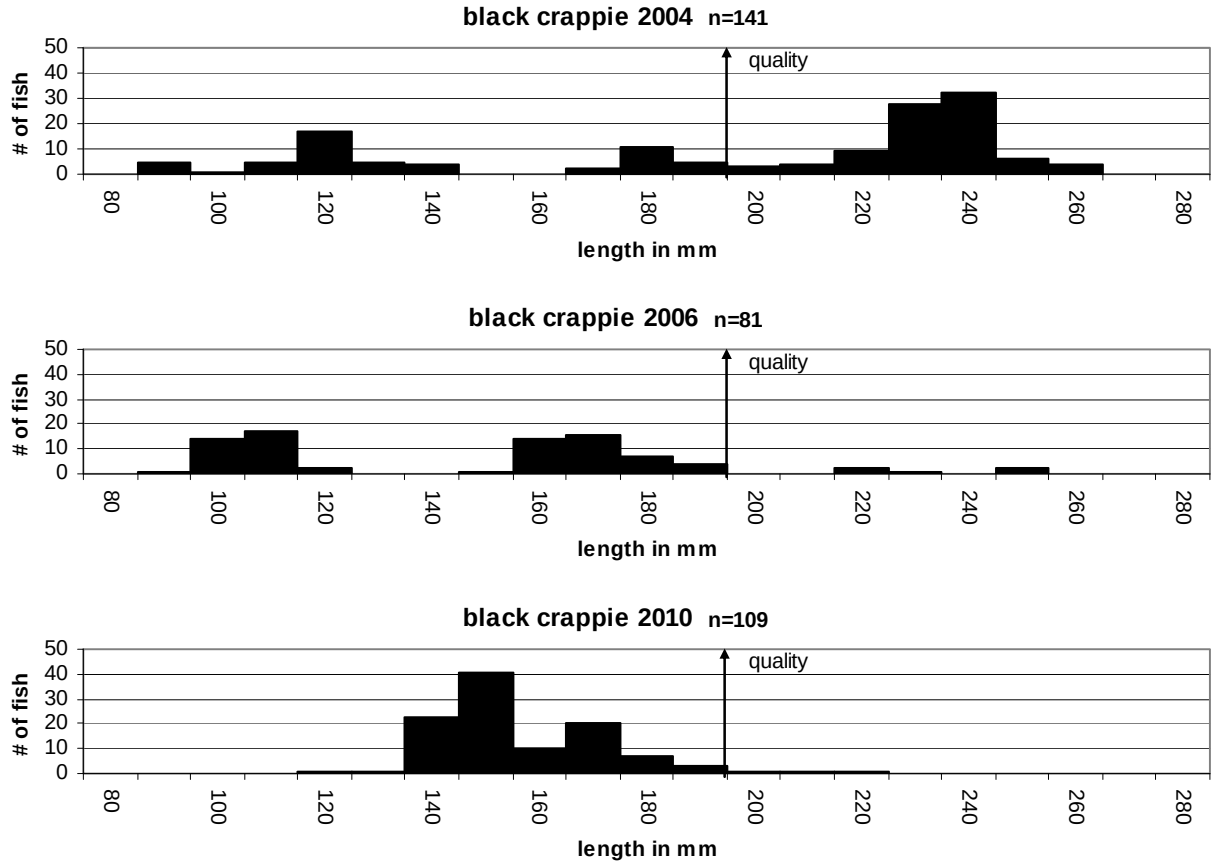


Figure 2. Length histogram of black crappies collected in trap nets from Waggoner Lake, Haakon County, 2004, 2006, 2010.

Bluegill

Bluegills were the second most abundant fish captured in trap nets in 2010 with a CPUE of 16.9 (Table 3). Size structure was good with a PSD value of 64, however, very few fish over 8 inches were sampled (Table 3, Figure 3). Bluegill mean condition was high with a Wr of 105.6 for stock length and larger fish. Growth was slightly higher than the regional mean (Table 5). More preferred length fish should show up in the next couple years as the high number of quality length fish continue to grow. The bluegill population appears to be doing very well. Our data indicates the population is maintaining quality sizes in the presence of a very diverse fishery.

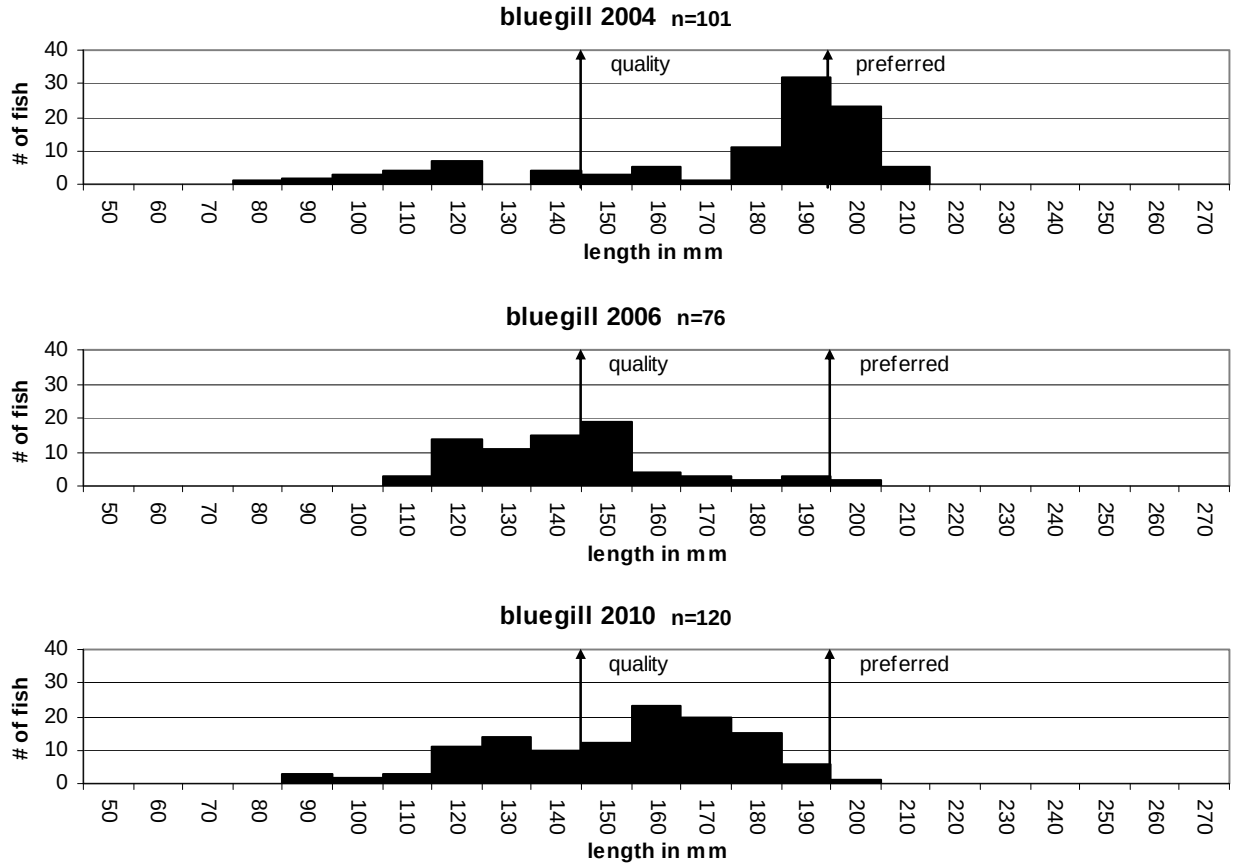


Figure 3. Length frequency histogram of bluegill collected in trap nets from Waggoner Lake, Haakon County, 2004, 2006, 2010.

Table 5. Waggoner Lake bluegill year class, age in 2010, sample size (N), mean back-calculated total length-at-age, the Region 1 mean length-at-age, and the South Dakota state-wide bluegill mean length-at-age (Willis et al 2001). Standard errors in parentheses.

Year Class	Age	N	Age 1	2	3	4	5	6
2008	2	16	77	114				
2007	3	46	58	101	132			
2006	4	25	52	92	130	157		
2005	5	19	52	99	129	155	173	
2004	6	5	52	91	129	148	171	184
Pop. mean (SE)		**111**	**58 (5)**	**99 (4)**	**130 (1)**	**153 (3)**	**172 (1)**	**184 (0)**
Region 1			52 (5)	92 (6)	123 (5)	146 (5)	166 (5)	
South Dakota			55 (2)	103 (3)	141 (3)	166 (4)	180 (4)	

Largemouth bass

One hundred fourteen largemouth bass were captured during night electrofishing (Table 6). Mean CPUE was 113.1 for all largemouth bass and mean CPUE for largemouth bass stock length or greater was 71.4. Sizes of most fish collected ranged from 150 mm to 260 mm (Figure 4). Stock density indices indicate a population of small fish with a few large individuals (i.e. PSD of 6 and RSD-P of 6).

Over the years, the largemouth bass population has been variable. Density and size structure were high from 1996-1999, but number declined dramatically in 2000. Adult stockings appear to have helped the population recover. Currently, this population resembles a high density population with poor size structure. GF&P management objectives for this fishery is a CPUE of adult bass greater than 20, a PSD range of 50-80 and an RSD-P of greater than 30. Our current survey dropped in these values but past surveys have indicated these objectives are very reasonable for this fishery.

Table 6. Total catch (N), pedal time (seconds), catch per hour of electrofishing (CPUE), proportional stock densities (PSD, RSD; 90% confidence intervals are given in parentheses) for largemouth bass collected by electrofishing in Waggoner Lake, Haakon County, 2005-2008, 2010.

Year	N	Pedal Time (sec)	CPUE	CPUE-S	PSD	RSD-P
2005	77	3,898	71.0 (12.0)	59.7 (10.2)	58 (11)	32 (10)
2006	57	3,000	68.4 (11.9)	48.0 (10.9)	63 (14)	25 (12)
2007	68	2,828	90.5 (40.7)	86.6 (38.9)	69 (10)	41 (11)
2008	42	3,600	42.0 (7.9)	38.0 (7.4)	79 (11)	41 (14)
2010	114	3,839	113.1 (51.4)	71.4 (30.1)	6 (5)	6 (5)

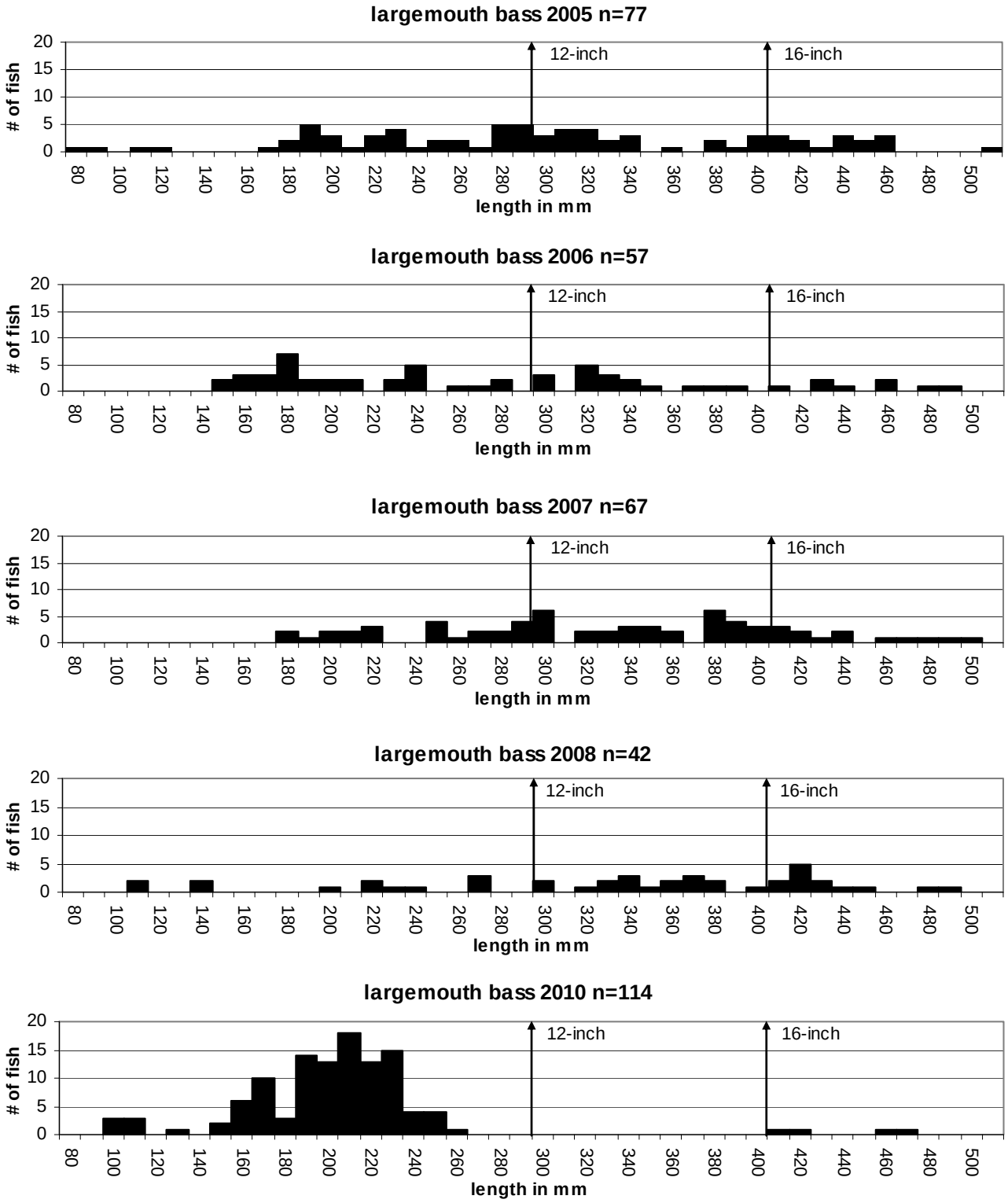


Figure 4. Length histogram of largemouth bass collected during night electrofishing from Waggoner Lake, Haakon County, 2005-2008, 2010.

Northern pike

Waggoner Lake appears to have a low density northern pike population. One gill net caught 2 pike, and the three trap nets sampled 7 more (Tables 1 and 2). This is a substantial decrease from 2004 when two gillnets and eight trap nets caught a total of 31 northern pike and a catch of 29 fish in 2006. Mean condition of northern pike was fairly poor with the gill net sample yielding a Wr for stock length and larger fish of 85.5. Length frequency of the combined sample indicates most of the northern pike in the 2010 population range from 480 to 660 mm (Figure 5).

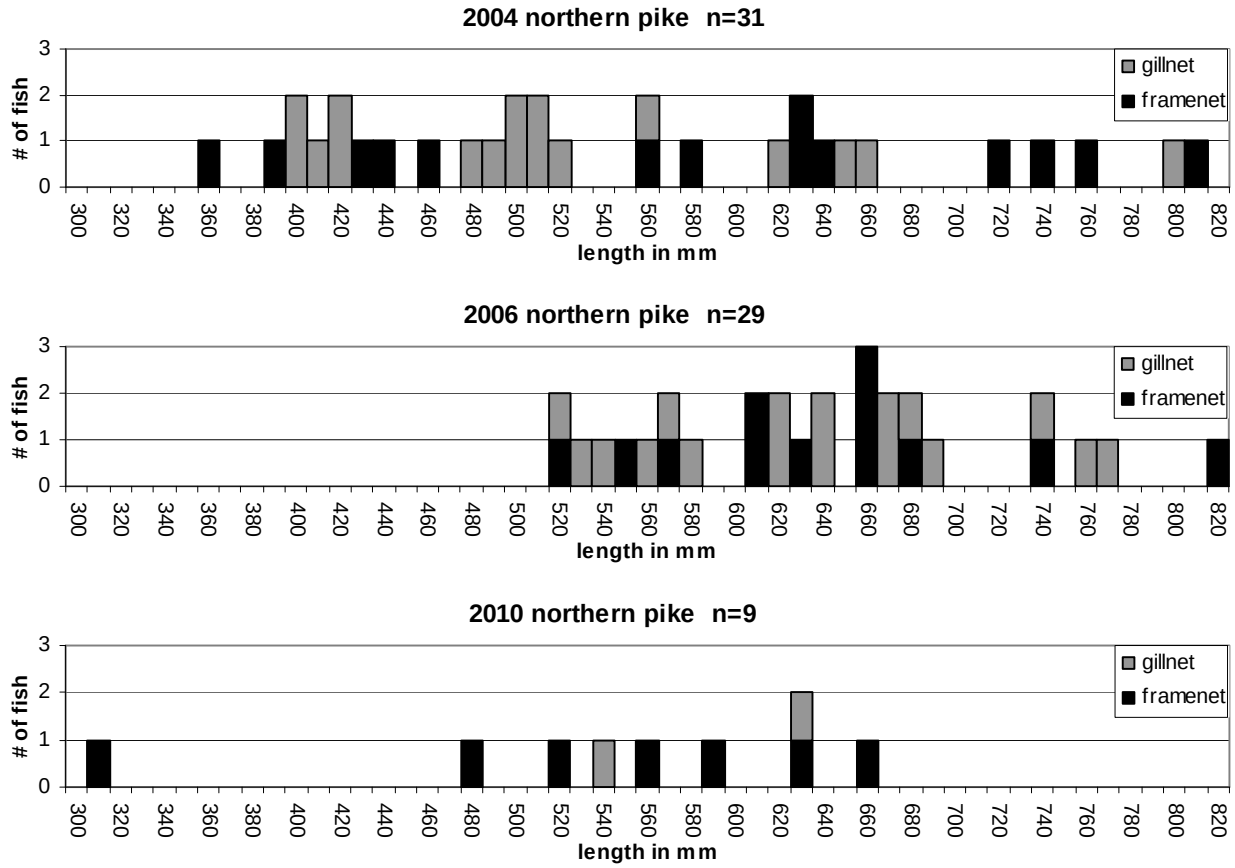


Figure 5. Length histogram of northern pike collected in trap nets and gill nets from Waggoner Lake, Haakon County, 2004, 2006, 2010.

Yellow Perch

The yellow perch population has remained stable since 2004, when a total of 82 perch were sampled from two gillnets and eight trap nets. In 2010, one gill net caught 24 perch and three trap nets caught sixteen. Stock indices were similar between gear types (Tables 1 and 2). Gillnet PSD was 40 with an RSD-P of 15, while trap net sampled larger fish for a PSD of 44 and an RSD-P of 6. Both these samples fall within the current management objectives for this fishery.

Fish condition was also good with a mean Wr for stock length and larger fish of 89.3 for the gillnet sample and 88 for the trap net sample. The combined 74 fish sample shows only a few younger fish and a good proportion of the fish over 8 inches (Figure 6). Growth was good, faster than the regional mean (Table 7).

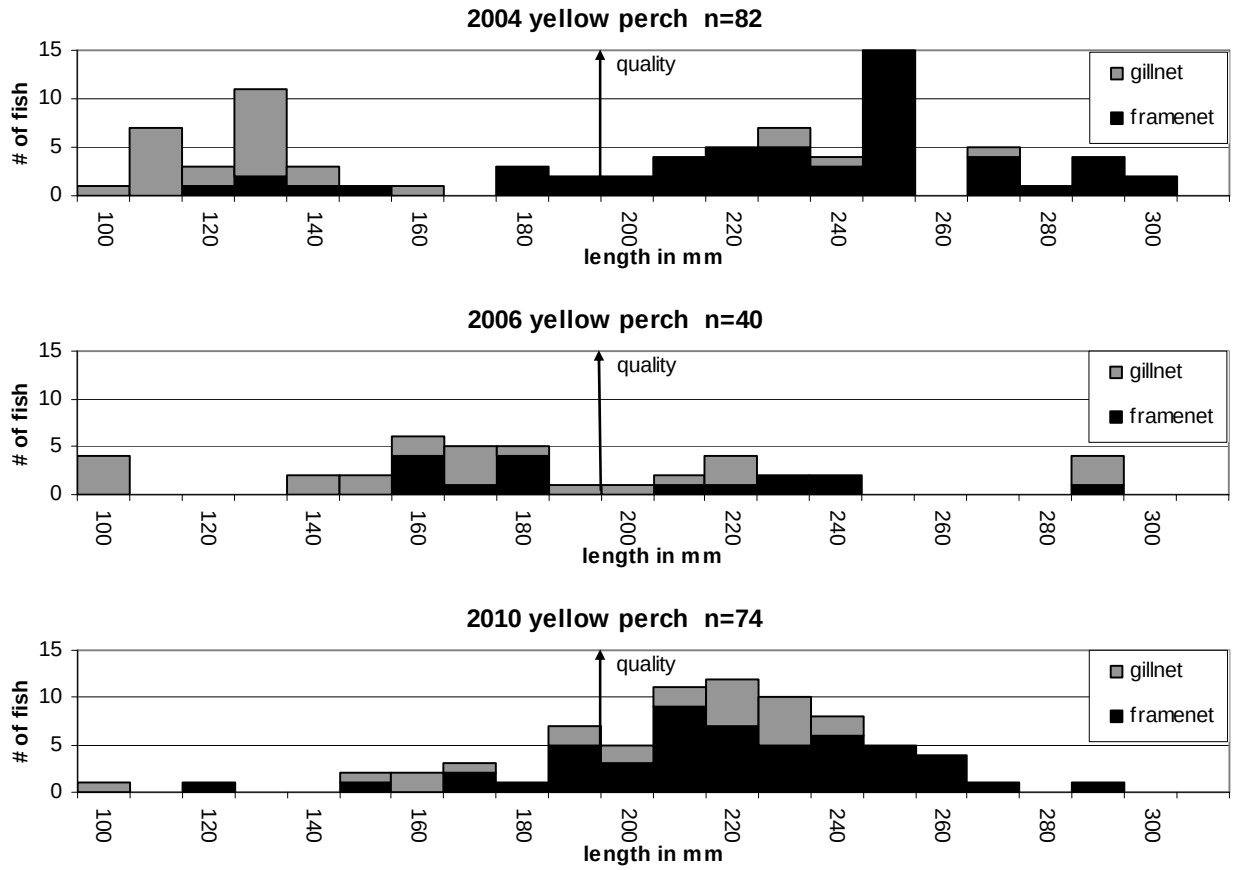


Figure 6. Length histogram of yellow perch collected from gill nets and trap net at Waggoner Lake, Haakon County, 2004, 2006, 2010.

Table 7. Waggoner Lake yellow perch year class, age in 2010, sample size (N), mean back-calculated total length-at-age, the Region 1 mean length-at-age, and the South Dakota state-wide yellow perch mean length-at-age (Willis et al 2001). Standard errors are in parentheses.

Year Class	Age	N	Age 1	2	3	4	5	6
2009	1	1	73					
2008	2	3	91	143				
2007	3	5	94	146	181			
2006	4	5	83	133	178	202		
2005	5	7	78	121	155	190	215	
2004	6	2	81	129	156	181	207	222
Pop. mean (SE)		**23**	**83 (3)**	**134 (5)**	**167 (7)**	**191 (6)**	**211 (4)**	**222 (0)**
Region 1			70 (3)	117 (6)	158 (6)	186 (6)	208 (8)	
South Dakota			86 (2)	145 (4)	190 (5)	220 (5)	242 (8)	

LITERATURE CITED

Willis, D.W., D.A. Isermann, M.J. Hubers, B.A. Johnson, W.H. Miller, T.R. St. Sauver, J.S. Sorenson, E.G. Unkenholz, and G.A. Wickstrom. 2001. Growth of South Dakota Fishes: A Statewide Summary with means by region and Water Type. Special Report. South Dakota Department of Game, Fish and Parks. Pierre, South Dakota.

RECOMMENDATIONS

1. Continue conducting lake surveys once every 2 years to evaluate fish populations and stocking success as well as seeing if management objectives are being met.

2. Continue annual fall night electrofishing to develop long-term trend data of largemouth bass and continue monitoring the smallmouth bass population.

APPENDIX

Appendix A. Stocking record for Waggoner Lake, Haakon County, 1999-2010.

Year	Number	Species	Size
1999	6,000	Largemouth bass	Fingerling
2000	12,000	Largemouth bass	Fingerling
2001	905	Largemouth bass	Adults
	12,620	Largemouth bass	Fingerling
2001 – 2010	None Stocked		

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Belvidere Lake County: Jackson
Legal description: Section 32, Township 2S, Range 24E
Location from nearest town: City Limits of Belvidere
Dates of present survey: July 28-29, 2010
Date last surveyed: June 16-17, 1999
Most recent lake management plan: F21-R-29 Date: 1996
Management classification: Warmwater permanent
Contour mapped: Date 1989

Primary Species: (game and forage)	Secondary and other species:
1. Largemouth bass	1. Yellow perch
2. Bluegill	2. Green sunfish
3. Black bullhead	3.

PHYSICAL CHARACTERISTICS

Surface Area: 42.3 acres (17 ha); Watershed: 5800 acres
Maximum depth: 8 feet; Mean depth: 4 feet
Lake elevation at survey (from known benchmark): full feet

1. Describe ownership of lake and adjacent lakeshore property:

Belvidere Lake is located on the east edge of the City of Belvidere, SD. The lake is owned by the city and there are no developed recreational facilities located around the lake.

2. Describe watershed condition and percentages of land use:

The watershed of Belvidere Lake is privately owned. It is used primarily for agricultural purposes including livestock grazing and small grain farming. In recent years about half of the watershed use is small grain farming and half is livestock grazing.

3. Describe aquatic vegetative condition:

Belvidere Lake was infested with extremely heavy blooms of coontail and pondweed. In mid-summer access was limited to boats. Emergent vegetation consists of cattail and bulrushes. Approximately 10% of the surface area was covered with emergent vegetation.

4. Describe pollution problems:

No pollution problems were detected by department personal during lake surveys in 2010.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

Belvidere has no boat ramp. Other structures were not investigated for condition.

BIOLOGICAL DATA

Methods

Netting Survey

A lake survey was conducted on Belvidere Lake on July 28-29, 2010. Sampling consisted of 4 trap net nights (Figure 1). All trap nets were modified fyke-nets with a 1.3 X 1.5-m frame, 19.1 mm (0.75 inch) mesh and a 1.2- X 23-m (3.9- X 75.5-ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g).

Data Analysis

All data was entered into WinFin 2.95. Fish population parameters, confidence intervals and standard errors were computed using WinFin Analysis. Parameters calculated were catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean CPUE (number per net night). Population structural characteristics were expressed as length frequency histograms and with PSD and RSD-P values. Fish condition was expressed as mean Wr.

Results and Discussion

Belvidere Lake was completely dry prior to 2008. It was stocked with largemouth bass and bluegill fingerlings in 2008 and bass again in 2009. Black bullheads and yellow perch were also present in this survey (Table 1).

Fish Community Survey

Overall, 383 fish were collected during the 2010 fishery survey at Belvidere Lake (Table 1). Black bullhead was the most common species sampled making up 80.7% of the total catch. Bluegill were the second most abundant at 14.9%. Largemouth bass and yellow perch were the other two species present in the lake.

Figure 1. Map with trap net locations (white arrows) at Belvidere Lake, 2010**.**

Table 1. Total catch (N), catch per net night (CPUE), catch per net night of stock-length fish (CPUE-S), proportional stock-densities (PSD, RSD; 90% CI's in parentheses) and condition factor (mean Wr for stock length and larger fish) for all fish species from four trap net in Belvidere Lake, Meade County, July 28-29, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr>S
Black bullhead	309	77.3 (36.2)	76.5 (36.1)	0	0	86.8 (1.7)
Bluegill	57	14.3 (21.7)	14.3 (21.7)	100	0	113.2 (0.6)
Largemouth bass	16	4.0 (6.6)	0.3 (0.4)	0	0	112.9 (0.2)
Yellow perch	1	0.3 (0.4)	0.3 (0.4)	0	0	103.8 (--)
Total	383					

Black Bullhead

Black bullheads were the most abundant species sampled, even though none were stocked after the lake refilled in 2008. Trap net CPUE was 77.3 fish per net (Table 1). The length frequency histogram and stock indices showed a population dominated by small fish (Figure 2, Table 1). Both RSD-P and PSD were 0. Fish condition for stock length and larger fish was 86.8. Age and growth analysis were not completed, making it difficult to determine if this is a young population just developing after the drought or an overabundant, slowed growth population.

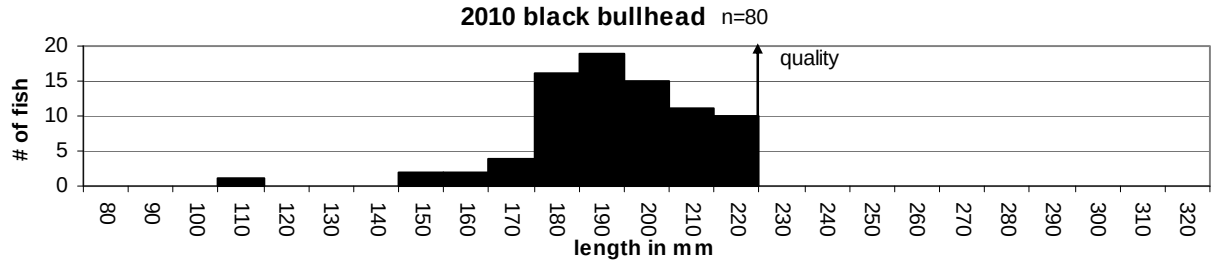


Figure 2. Length frequency histogram for black bullheads from trap net in Belvidere Lake, Meade County, July 28-29, 2010.

Bluegill

After the lake refilled in 2008, fifteen thousand bluegill fingerlings were stocked to establish a panfish fishery. They appear to have done well with a CPUE of 14.3 (Table 1). Growth appears to be excellent as all the fish sampled were over quality length (Figure 2). Some of these two year old fish were just less than 8 inches. Fish condition was also excellent with a mean Wr for stock length and larger fish at 113.2.

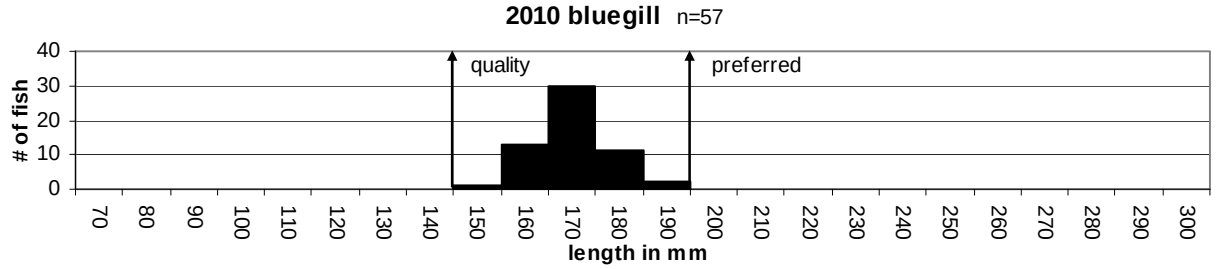


Figure 2. Length frequency histogram for bluegill from trap nets in Belvidere Lake, Meade County, July 28-29, 2010.

Largemouth Bass

Largemouth bass fingerlings were stocked in 2008 and 2009. Due to no boat ramp on Belvidere Lake, electrofishing was not done. However, 16 bass were sampled among the four trap nets and ranged in sizes from 140 mm to 260 mm (Table 1 and Figure 3). Fish condition was good at 112.9 for stock length and larger bass. It would appear that the fingerlings are doing well at this point.

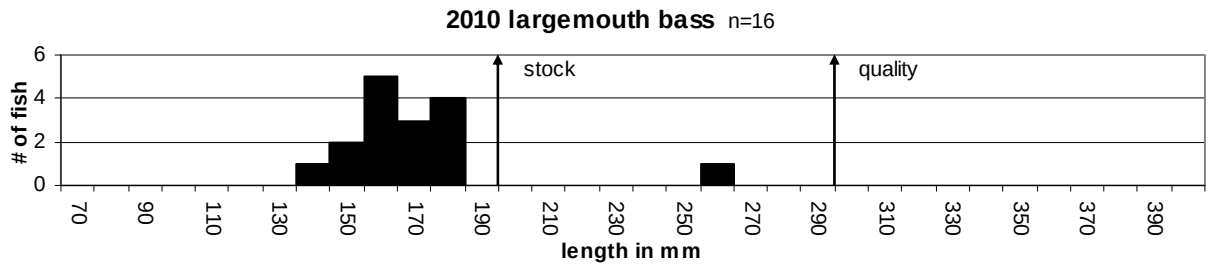


Figure 3. Length frequency histogram for largemouth bass from trap nets in Belvidere Lake, Meade County, July 28-29, 2010.

RECOMENDATIONS

1. Conduct a lake survey in 2012 to determine the progression of the fishery.

APPENDIX

Appendix A. Stocking record for Belvidere Lake, Jackson County, 2008-2009.

Year	Number	Species	Size
2008	15,000	Bluegill	Fingerling
	2,000	Largemouth bass	Fingerling
2009	5,000	Largemouth bass	Fingerling

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Coxes Lake County: Lawrence
Legal description: T7N, R1E, Sec 16, SE 1/4
Location from nearest town: 8W, 1N and 1/2E of Spearfish
Dates of present survey: August 23-24, 2010
Date last surveyed: May 20-21, 1996
Most recent lake management plan: F21-R-30 Date: 1997
Management classification: Coldwater Permanent
Contour mapped: No

Primary Species: (game and forage)	Secondary and other species:
1. Rainbow trout	1. Fathead Minnow
2. Finescale Dace	2.

PHYSICAL CHARATERISTICS

Surface Area: 4.0 ac. Watershed: <1.0 mi.^{2}
Maximum depth: 80.0 (24.4 m) Mean depth: 92% <2 ft., 8% 80 ft.
Lake elevation at survey (from known benchmark): 3,424 ft.(1,044 m)

1. Describe ownership of lake and adjacent lakeshore property:

Coxes Lake was constructed in the mid 1930's. The lake and its shoreline are owned and managed by the South Dakota Department of Game, Fish and Parks (SDGFP).

2. Describe watershed condition and percentages of land use:

The watershed is largely public grassland administered by SDGFP. A small portion of the watershed is in private ownership and is used for livestock grazing.

3. Describe aquatic vegetative condition:

Emergent vegetation in the form of cattails lined the entire shoreline.

4. Describe pollution problems:

Heavy soil loads within the lake and some sedimentation from runoff covers approximately 92 percent of Coxes Lake's bottom area resulting in an average water depth of <2 feet with the exception of a "Morning Glory" spring hole which is the lake's source. The spring located at the west end of the lake, measures approximately 100' x 150' and has a depth of approximately 80 feet. Water clarity in Coxes Lake is good and water quality parameters indicate water chemistry not detrimental to fish life.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

No apparent structural defects exist with the dam or outlet structure. One dock is located on the west end of the lake and provides the only access for shore fishing. A vault toilet is also located adjacent to the west shore. No boat ramps exist on Coxes Lake.

BIOLOCIAL DATA

Methods

Coxes Lake was surveyed on August 23-24, 2010 with one trap net night and two 3-hour minnow traps (Figure 1). A trap net was set on August 23rd and remained in the water overnight. The trap net had ¾ in mesh and a 1.3 × 23 m (3.9 × 75.5-ft.) lead. Some of the lead was pulled on shore and this distance was not measured. The two minnow traps were baited with two pieces of wheat bread and retrieved on August 23rd.
Fish were identified and counted.

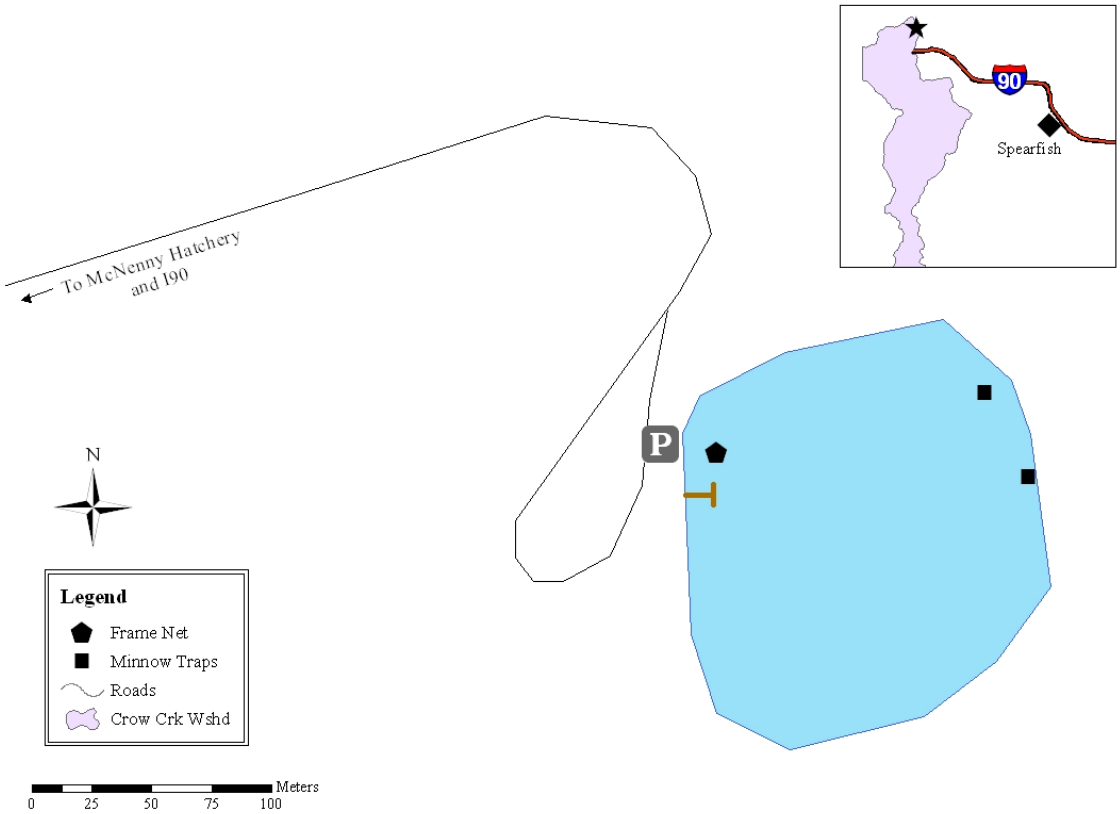


Figure 1. Map of net locations during fisheries survey on August 23-24, 2010 of Coxes Lake, Lawrence County, SD.

Results and Discussion

Finescale dace

Finescale dace are a state endangered species in South Dakota and were the only species collected during the survey with 18 total in minnow traps. The fyke net had human tampering with during the survey and was not effective. Approximately 50 finescale dace were in the net.

Rainbow Trout

Rainbow trout are stocked into Coxes Lake at a rate of about 2,000 fish per year. None were captured during the survey, however, these fish would likely reside in the deep hole of the lake and the extremely steep slope did not allow for sampling.

RECOMMENDATIONS

1. Manage as a rainbow trout fishery by the stocking of approximately 2,000 catchables as per annual coldwater fish stocking schedule.

2. Survey again in 2015 to determine species composition and status of finescale dace population.

APPENDIX

Appendix A. Stocking record for Coxes Lake, Lawrence Co. 1999-2010.

Year	Species	Number	Size
1999	Rainbow Trout	2,832	Catchable
2000	Rainbow Trout	2,531	Catchable
2001	Rainbow Trout	2,991	Catchable
2002	Rainbow Trout	3,153	Catchable
2003	Rainbow Trout	1,600	Catchable
2004	Rainbow Trout	1,897	Catchable
2005	Rainbow Trout	2,200	Catchable
2006	Rainbow Trout	2,100	Catchable
2007	Rainbow Trout	1,260	Catchable 11”
	Rainbow Trout	200	Catchable 15”
2008	Rainbow Trout	1,395	Catchable 11”
	Rainbow Trout	45	Catchable 15”
2009	Rainbow Trout	2,475	Catchable 11”
	Rainbow Trout	10	Catchable 15”
2010	Rainbow Trout	2,075	Catchable 11”

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Dalton Lake County: Meade

Legal description: R5E; T3N, Sec. 11, SE1/4
Location from nearest town: 6 miles NE of Nemo on FS Rd 224
Dates of present survey: June 21-22, 2010
Date last surveyed: August 3-4, 1994
Most recent lake management plan: F-21-R-37 Date: 2005
Management classification: Coldwater Permanent

Primary Species: (game and forage)	Secondary and other species:
1. Brook trout	1. White sucker
2. Rainbow trout	2. Finescale dace
3. Golden shiner	3.

PHYSICAL CHARACTERISTICS

Surface Area: 3 acres (1.2 ha) Watershed: 6,339 acres
Maximum depth: 9 feet Mean depth: 6 feet
Lake elevation at survey (from known benchmark): NA

1. Describe ownership of lake and adjacent lakeshore property:

Dalton Lake and lakeshore are located on public land administered by the US Forest Service. The dam was constructed in 1935 by the Civilian Conservation Corps. A campground exists on the south shoreline and receives moderate to heavy use during the summer months. Both the campground and recreational use of the lake require a fee.

2. Describe watershed condition and percentages of land use:

The U.S. Forest Service administers 90% of the watershed and the remaining is interspersed with private holdings. The land use of the watershed is 91% forest and 7% grassland (combined public and private land). Grazing occurs over much of the watershed.

3. Describe aquatic vegetative condition:

Emergent forms become excessive during late summer. Shoreline angling is greatly restricted at that time.

4. Describe pollution problems:

Siltation caused by road building, grazing, and timber harvest has reduced maximum depth to around 9.5 feet

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

Structures were not inspected during this survey.

CHEMICAL DATA

Only temperature data was collected in 2010, by using a YSI 6820 sonde. Temperatures ranged from 52°F (11.04°C) on the bottom to 60°F (15.75°C) at the surface (Table 1).

Table 1. Temperatures (°C)

Location	West end	Middle	East end
Surface ˚C	15.75	15.19	14.38
1m ˚C	14.9	12.53	11.85
2m ˚C	n/a	11.25	11.04

BIOLOGICAL DATA

Methods

Four trap nets were set in standardized locations (Figure 1) on June 21, 2010 and remained in the water overnight. Three trap nets were modified fyke-nets with ¾ inch mesh and a lead. The fourth trap net was a ¼ inch modified fyke-net with a lead. Much of the leads were pulled on shore for all nets and this was not measured.

For each survey method, total length (mm) and weight (g) was collected for each fish sampled. Data was entered into WinFin 4.4 and analysis was completed using WinFin Analysis 2.3.

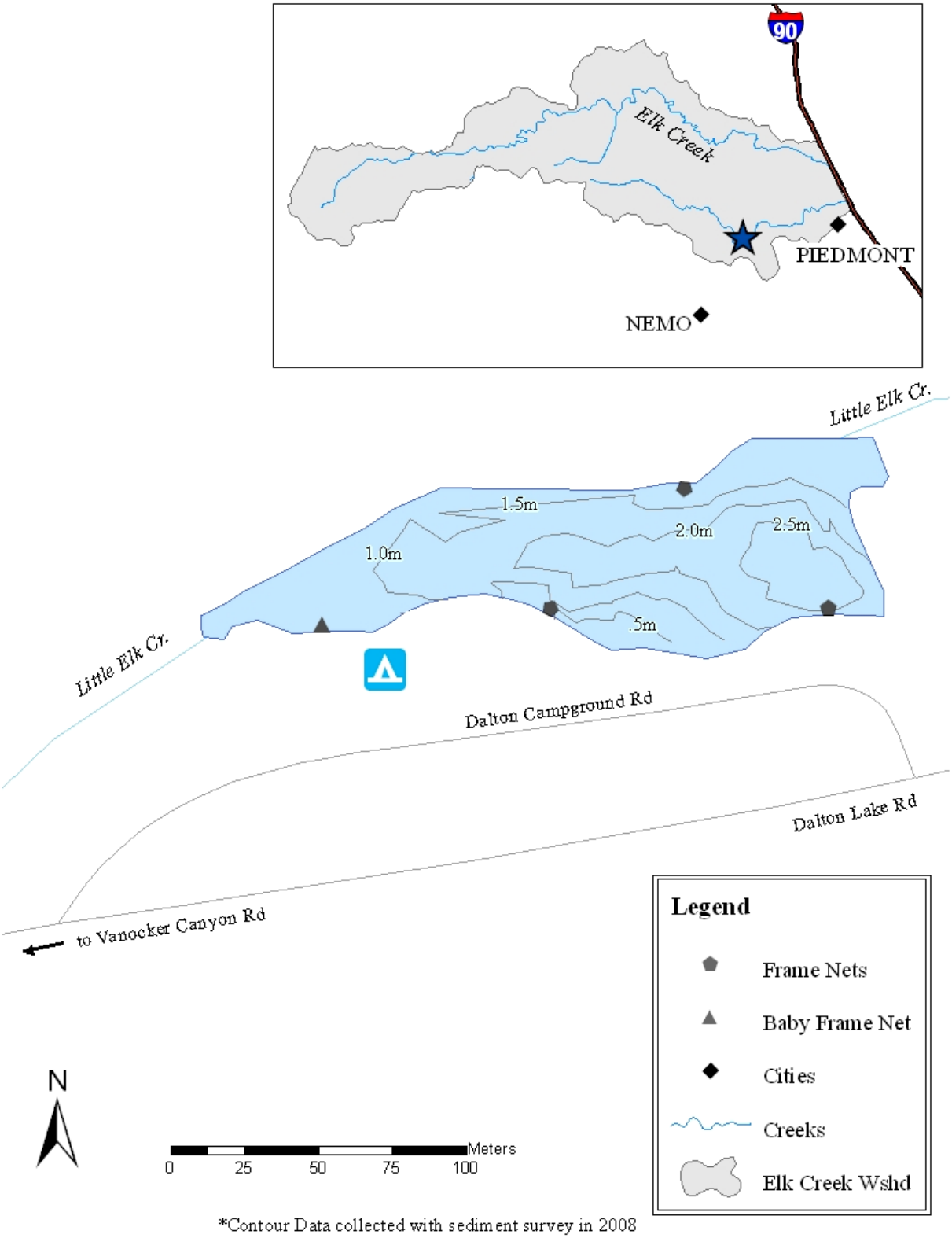


Figure 1. Lake map and location of trap nets during the June 21-22, 2010 survey of Dalton Lake, Lawrence Co.

Results and Discussion

Four fish species were caught in the fyke nets totaling 825 fish (Tables 2 and 3). Golden shiners were the most numerous species sampled followed by brook trout.

Table 2. Total catch for three $^{3}/_{4}$ inch trap nets in Dalton Lake, Lawrence County, South Dakota on June 22, 2010. Confidence intervals are in parentheses.

Species	N	CPUE (80% CI)	CPUE-S (80% CI)	PSD (90% CI)	Wr	Wr-S	Mean Length (mm)
Brook trout	34	11.3(15.8)	11.3(15.8)	65	88	88	169
Golden shiner	177	59(66.6)	--	--	118	--	122
Total	211						

Table 3. Total catch for one ¼ inch trap net in Dalton Lake, Lawrence County, South Dakota on June 22, 2010.

Species	N/CPUE	CPUE-S	PSD	Wr	Wr-S	Mean Length (mm)
Brook trout	20	13	100	150	92	250
Golden shiner	587	--	--	--	--	--
White sucker	1	1	100	--	--	--
Finescale dace	6	--	--	--	--	--
Total	614					

Brook Trout

Brook trout populations in Dalton Lake had increased since the last survey in 2004. Out of the 54 brook trout sampled, all but 13 were 200 mm or greater (Figure 2). Condition (Wr) for these fish also was higher than in most Black Hills lakes and streams (citation?). Only two individuals were sampled in 1994.

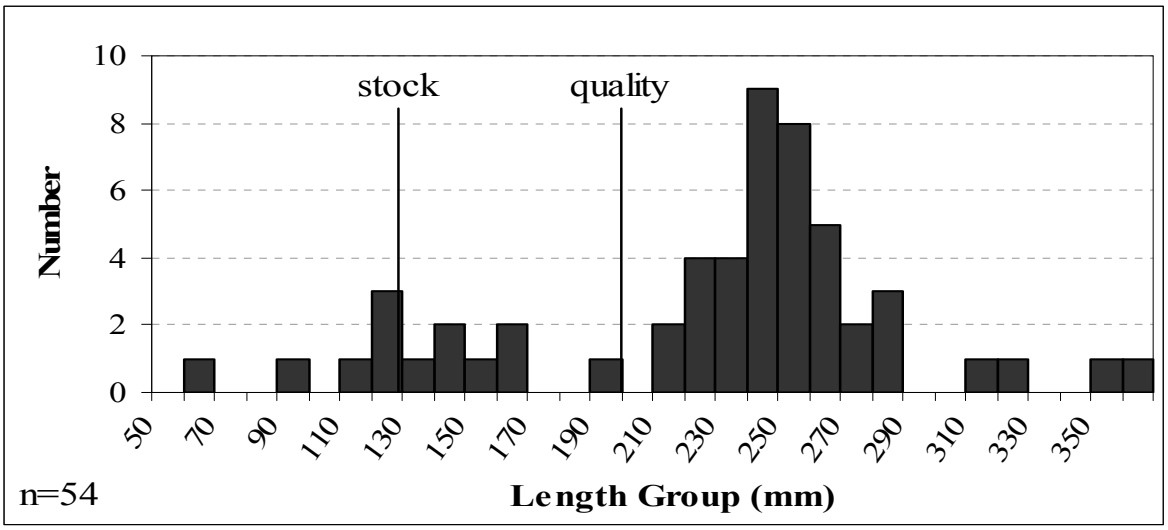


Figure 2. Length frequency histogram for all brook trout caught in modified fyke-nets on June 22, 2010.

Golden Shiner

A high abundance of golden shiners was observed during this survey with 764 sampled (Tables 2 and 3). During the 1994 survey 383 fish were captured with a CPUE of 150 and 79 for ¼ inch and ¾ inch nets, respectively.

White Sucker

Only one white sucker was sampled during the survey. None were detected in 1994.

Finescale Dace

Finescale dace were detected for the first time in Dalton Lake during the June 2010 survey (Table 3). The finescale dace is a state species of concern. Other individuals have been sampled below Dalton Lake as recently as the 2008 stream survey of Little Elk Creek.

Rainbow Trout

Although 150, 11" rainbow trout were stocked in to Dalton Lake in 2010 a couple weeks prior to this survey none were captured in trap nets.

RECOMMENDATIONS

1. Continue stocking rainbow trout at current stocking rate.

2. The US Forest Service plans to draw down this lake, fix structures, and dredge in fall-winter 2011. Reduce rainbow trout stocking and consider conducting brook trout and finescale dace removal/transfer prior to this.

3. Consider Dalton Lake as a possible source for trap and transfer of golden shiner.

4. Conduct annual lake survey in 2015.

APPENDIX

Appendix A. Recent stockings for Dalton Lake.

Year	Species (Strain)	Size	Stockings	Number
2008	Rainbow Trout (Shasta)	Catchable 11”	1	15
2009	Rainbow Trout (Shasta)	Catchable 11”	3	250
2010	Rainbow Trout (Shasta)	Catchable 11”	2	150
2010	Rainbow Trout (Erwin)	Catchable 15”	1	10

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Iron Creek Lake County: Lawrence
Legal description: Sec. 27 and 29, T5N, R1E
Location from nearest town: Approximately 10 mi. W. and 2 mi. N. of Lead, S.D.
Dates of present survey: September 1-2 and September 8, 2010
Date last surveyed: July 22, 2002 and August 6, 2002
Most recent lake management plan: F-21-R-37 Date: 2005
Management classification: Coldwater permanent
Contour mapped: 1986

Primary Species: (game and forage)	Secondary and other species:
1. Hatchery rainbow trout	1. Green sunfish
2. Largemouth bass	2. Yellow perch
3. Brown trout	3. Emerald shiner
4.	4. Black crappie
5.	5. Golden shiner

PHYSICAL CHARACTERISTICS

Surface Area: 21.6 ac, (8.7 ha) Watershed: 960 ac.,
Maximum depth: 10.4 m (34.0 ft.) Mean depth: 4.4 m (14.4 ft.)
Lake elevation at survey (from known benchmark): elevation unknown

1. Describe ownership of lake and adjacent lakeshore property:

Iron Creek Lake is an artificial lake formed by the impoundment of Iron Creek in 1936 by the Works Progress Administration and the Civilian Conservation Corps. The lake and shoreline (120 feet wide around the lake) was deeded by a private individual to Lawrence County then sold to the Department of Game, Fish and Parks in 1969 for the sum of $1.00. Only the lake proper and shoreline belongs to the GF&P. The dam is in Forest Service ownership and land around and above the lake is mostly in private ownership along with a campground, store, and restaurant.

2. Describe watershed condition and percentages of land use:

The U.S. Forest Service (USFS) manages approximately 80% of the watershed while the remaining 20% is privately owned. A privately managed campground and store along with approximately 20 summer homes are located adjacent to the lake.

3. Describe aquatic vegetative condition:

The inlet area and much of the upper shoreline of Iron Creek Lake has dense emergent vegetation in the form of cattails and bulrush. The lake also has large amounts of submergent vegetation.

4. Describe pollution problems:

Siltation from various sources has been a problem since construction of the lake in 1936, although no known measurements of accumulated sediments have been taken.

5. Describe condition of all structures (i.e. spillway, level regulators, boat ramps, etc.):

All structures appeared to be in good condition at the time of the survey.

BIOLOGICAL DATA

Iron Creek Lake was surveyed on September 1-2, 2010 with one gill net night and four trap net nights (Figure 1). All nets were set and remained in the water overnight. The gill net was a monofilament experimental net measuring 45.7 m (150 ft) long and 1.8 m (6 ft) deep with six 7.6 m (25 ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Four trap nets were set and remained in the water overnight. Three nets had ¾ inch mesh and a 1.3 × 23 m (3.9 × 75.5-ft.) lead. One net had ¼ inch mesh and a 50ft lead (baby frame).

Night electrofishing was conducted at Iron Creek Lake on Sept. 8, 2010 to sample largemouth bass using a Smith-Root 18-H electrofishing boat with pulsed-DC current.
Sampling started at the boat launch area and the entire shoreline was fished. Three, ten minute sites were completed during the survey.

For each survey method, total length (mm), and weight (g) was collected for each fish sampled.

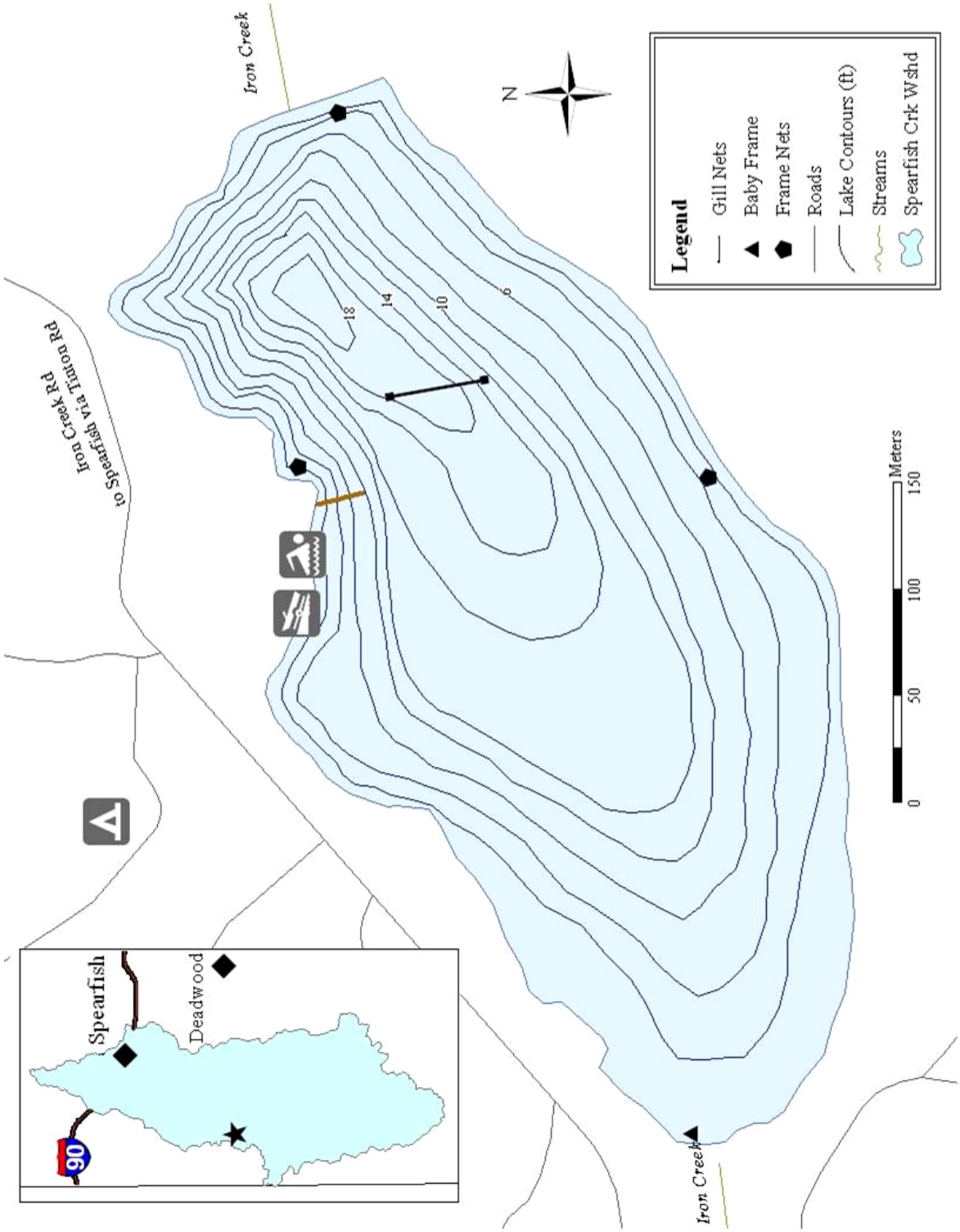


Figure 1. Map of net locations for fisheries survey on September 1-2, 2010 at Iron Creek Lake, Lawrence County, South Dakota.

Results and Discussion

Five species of fish were collected during the survey of Iron Creek Lake totaling 159 fish (Tables 1-3). Not many fish were captured in trap nets and none in the gill net. It is possible that water temperatures were starting to get too cold for effective sampling.

Table 1. Total catch for three $^{3}/_{4}$ inch trap nets in Iron Creek Lake, Lawrence County, South Dakota on September 2, 2010. Confidence intervals are in parentheses.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	Wr-S (90%)	Mean Length (mm)
Green sunfish	5	1.7 (0.6)	1.7 (0.6)	20 (43)	102 (2)	135
Largemouth bass	2	0.6 (0.6)	0	0	97 (23)	
Total	7					

Table 2. Total catch for one ¼ inch trap net in Iron Creek Lake, Lawrence County, South Dakota on September 2, 2010. Confidence intervals are in parentheses.

Species	N/CPUE	CPUE-S	PSD	Wr-S (90%)
Brown trout	3	3	100	66
Rainbow trout	1	1	0	110
Green sunfish	2	2	50	110 (41)
Yellow perch	1	1	0	95
Total	7			

Table 3. Total catch of 3, 10-minute night electrofishing passes on Iron Creek Lake, Lawrence County, South Dakota on September 8, 2010. Parameters are reported with confidence intervals.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	Wr-S (90%)	Mean Length (mm)
Largemouth bass	145	290 (224)	218 (160)	15 (6)	95 (1)	224

<u>Largemouth Bass</u>

Illegal introductions of largemouth bass have provided a limited warm water fishery at Iron Creek Lake. Largemouth bass collected from night electrofishing were generally of stock length (200-300 mm) with the size structure increasing since it was last sampled in 2002 (Table 3; Figure 2). CPUE almost doubled since the last survey which had a value of 112, however, electrofishing in 2002 consisted of two-20 minute passes as opposed to three 10 minute passes in 2010. Condition (Wr) was slightly lower in 2010 with a value of 95 as compared to 101 in 2002.

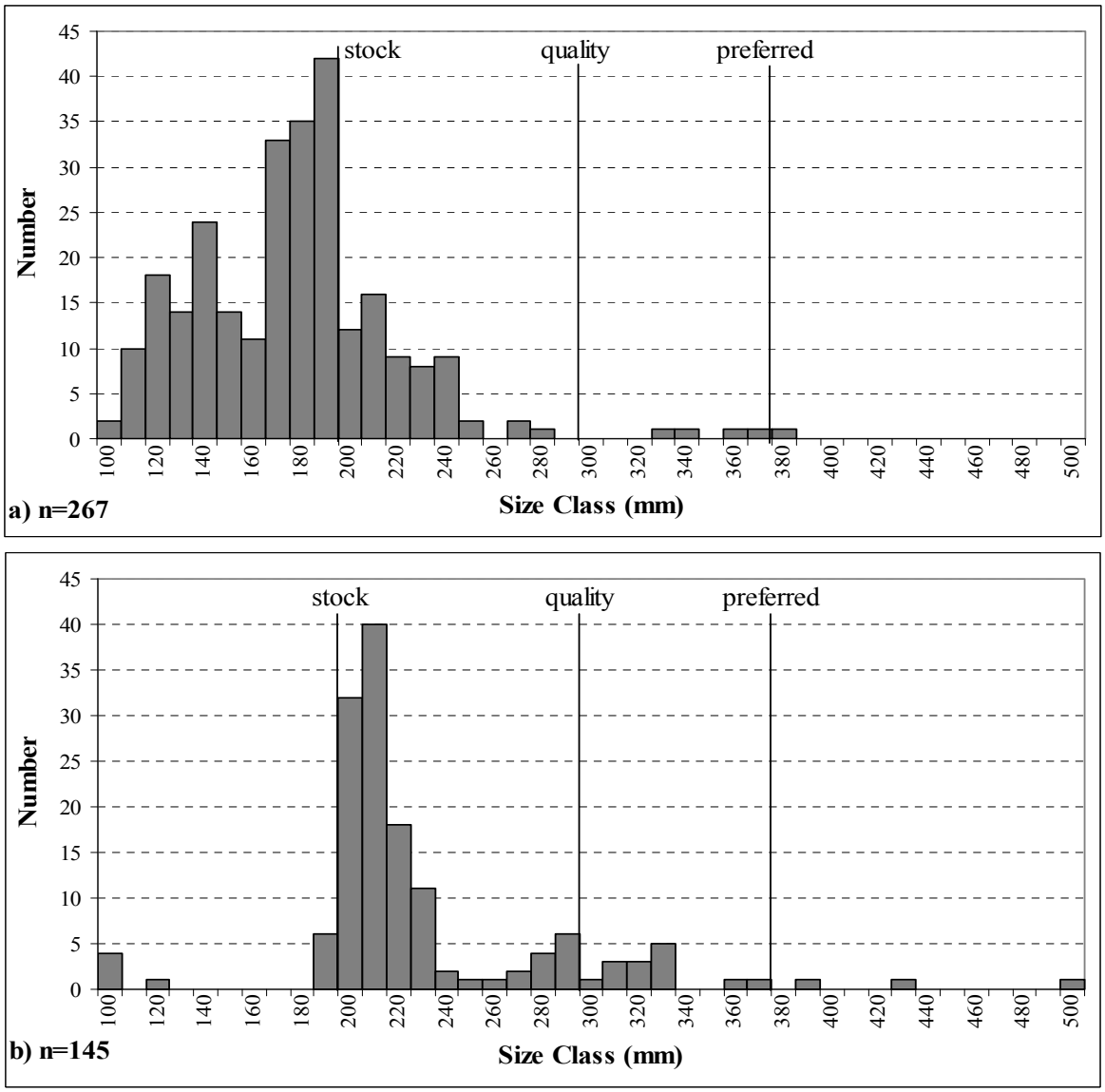


Figure 2. Length frequency histogram and size class distinctions for largemouth bass captured during night electrofishing surveys in a) Aug 2002, and b) Sept 2010.

Rainbow Trout

Rainbow trout are stocked into Iron Creek Lake at a rate of about 6,800 fish per year. In 2010, 5,144 catchable sized fish and 225, 15" fish were stocked prior to the survey. Efforts were made to conduct the sample the furthest date from any previous stocking date as not to kill stocked fish. One was captured during the survey (Table 2); however, several were seen during the night electrofishing survey. Age-0 rainbow trout were collected in Iron Creek above the lake during the 2008 stream survey, indicating that this species does spawn in this system. It is not known

what effect, if any, natural reproduction may have on the rainbow trout fishery in Iron Creek Lake.

Brown Trout

Three brown trout were captured during the survey (Table 2) and several were seen during the night electrofishing survey. Age-0 brown trout were also collected in Iron Creek above the lake during the 2008 stream survey. Since no brown trout have been stocked in Iron Creek Lake or Iron Creek recently, the presence of adult brown trout in the lake and age-0 trout in the stream indicates this species does spawn in this system and contributes to the fishery.

Green Sunfish

Green sunfish have not been stocked by the department within the Black Hills Trout Management Area and are considered nuisance introductions to any lake within the Black Hills. Seven were collected in trap nets during the 2010 survey (Tables 1 and 2). During the 2002 survey green sunfish made up 45.3% of the fish sampled by trap nets with a CPUE of 22. Overpopulation of green sunfish and white suckers caused high levels of competition with rainbow trout for available food and habitat, which necessitated total eradication of fish in the lake in 1950, 1960, 1967, and 1983.

Yellow Perch

Yellow perch have also been illegally introduced within the Black Hills Trout Management Area. One was captured during the 2010 survey, however, 32 were captured in trap nets during 2002 with a CPUE of 8 (Table 1).

Black Crappie

Black crappie is another illegally introduced species to lakes within the Black Hills Trout Management Area. None were captured during the survey; however, reports from the Iron Lake store employees indicate that local anglers target this species with some success. Twelve were captured in trap nets in 2002 with a CPUE of 3.

Other Species

Emerald shiner, golden shiner, and black bullhead were collected during the 2002 survey, but not in 2010. White suckers, a species targeted for eradication in 1950, 1960, 1967, and 1983, were also not detected during the 2010 or 2002 lake survey or the 2008 stream survey.

RECOMMENDATIONS

1. Continue stocking with catchable rainbow trout as scheduled in the annual Coldwater Fish Stocking Schedule.

2. Survey with trap nets, gill nets, and night electrofishing in 2015. Nets should be set prior to September to avoid colder water conditions and resulting lower catches.

APPENDIX

Appendix A. Stocking record for Iron Creek Lake, Pennington Co. 2003-2010.

Year	Species	Number	Size
2003	Rainbow Trout	6,400	Catchable
2004	Rainbow Trout	8,425	Catchable
2005	Rainbow Trout	7,035	Catchable
2006	Rainbow Trout	420	Adult
	Rainbow Trout	7,020	Catchable 11”
2007	Rainbow Trout	5,140	Catchable 11”
	Rainbow Trout	107	Catchable 15”
2008	Rainbow Trout	6,030	Catchable
	Rainbow Trout	48	Adult
	Rainbow Trout	561	Catchable 15”
2009	Rainbow Trout	15,050	Catchable
	Rainbow Trout	450	Catchable 15”
2010	Rainbow Trout	6,344	Catchable
	Rainbow Trout	300	Catchable 15”

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Upper Mirror Lake County: Lawrence
Legal description: S20, R1E, T7N
Location from nearest town: 3 miles north and 7 miles west of Spearfish
Date of present survey: Aug 11-12, 2010
Date last surveyed: May 20-21, 1996
Most recent lake management plan: F21-R-42 Date: 1 January 2010
Management classification: Coldwater permanent

Primary Species: (game and forage)
1. Hatchery rainbow trout

Secondary and other species:
1. Green sunfish

PHYSICAL CHARACTERISTICS

Surface Area: 7 acres; Watershed: 0
Maximum depth: 6.7 m (22 ft) ; Mean depth: 0.9 m (3.0 ft)
Lake elevation at survey (from known benchmark): full

1. Describe ownership of lake and adjacent lakeshore property:

The Mirror Lakes are located on the McNenny GPA in the Crow Creek Watershed. Upper Mirror Lake was created in the mid 1930's on land owned by James and Kate McNenny. The lake and surrounding land was purchased between 1942 and 1944 and is now owned by the South Dakota Game, Fish and Parks.

2. Describe watershed condition and percentages of land use:

The lake was built on a spring and no streams feed the lake. The portion of the watershed owned by the S.D. Department of Game, Fish and Parks is a wildlife management area. This area has abundant vegetation and brush and works as a buffer area to grazed land within the watershed. The watershed is not important as a water source and there are several springs within Upper Mirror Lake which provide a constant water level and turnover.

3. Describe aquatic vegetative condition:

Submergent vegetation covers the entire lake except for a deep area on the northern end of the lake and small areas where upwellings of the Madison Aquifer erupt from the lake bed. Emergent vegetation is present extending from a few feet to several feet into the water and covering all but a small portion of the shoreline.

4. Describe pollution problems:

Large amounts of soil loads have been identified as early as 1971 and was calculated to occupy over 50% of the lake capacity. Additional small amounts of silt loading occurs from natural erosion and from a dirt trail along the lake shore. No other pollution problems were apparent.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

Metal fishing nodes were put in place during spring 2009 to allow for better shoreline fishing access. The existing wooden pier appeared to be in good condition. The outlet was not examined.

CHEMICAL DATA

Chemical data was not collected during the 2010 survey.

BIOLOGICAL DATA

Methods

Mirror Lake was surveyed on August 11-12, 2010 with four modified-fyke trap nets (Figure 1). The trap nets were set on August 11th and remained in the water overnight. Three nets had ¾ in mesh and a 1.3 × 23 m (3.9 × 75.5-ft.) lead. One net had ¼ inch mesh and a 50ft lead (a.k.a. baby frame). Leads were pulled on shore for some nets due to water levels and this was not measured.

For each survey method, total length (mm) and weight (g) was collected for each fish sampled. Data was entered into WinFin 4.4 and analysis was completed using WinFin Analysis 2.3.

Results and Discussion

Upper Mirror Lake has been managed as a trout fishery since the first recorded stockings in 1944. Initial stockings were fingerling rainbow trout, however, sizes of fish stocked changed primarily to catchable (9") and longer trout in 1953. Brook trout fingerlings and adults were stocked in the 1950's. While other fish species have been sampled in the lake, the only other recorded stockings were multiple years of brown trout. Most recently stockings continue to be rainbow trout.

Past management recommendations have been to remove sediment from the lake and to treat the lake with chemicals to remove the green sunfish population. Neither recommendation has been completed. Concerns of rupturing the lakebed and possibly draining the lake has been a limiting factor towards habitat improvement efforts. Due to continuous flow into the lake from springs, a complete kill likely could not be accomplished and a chemical treatment impractical.

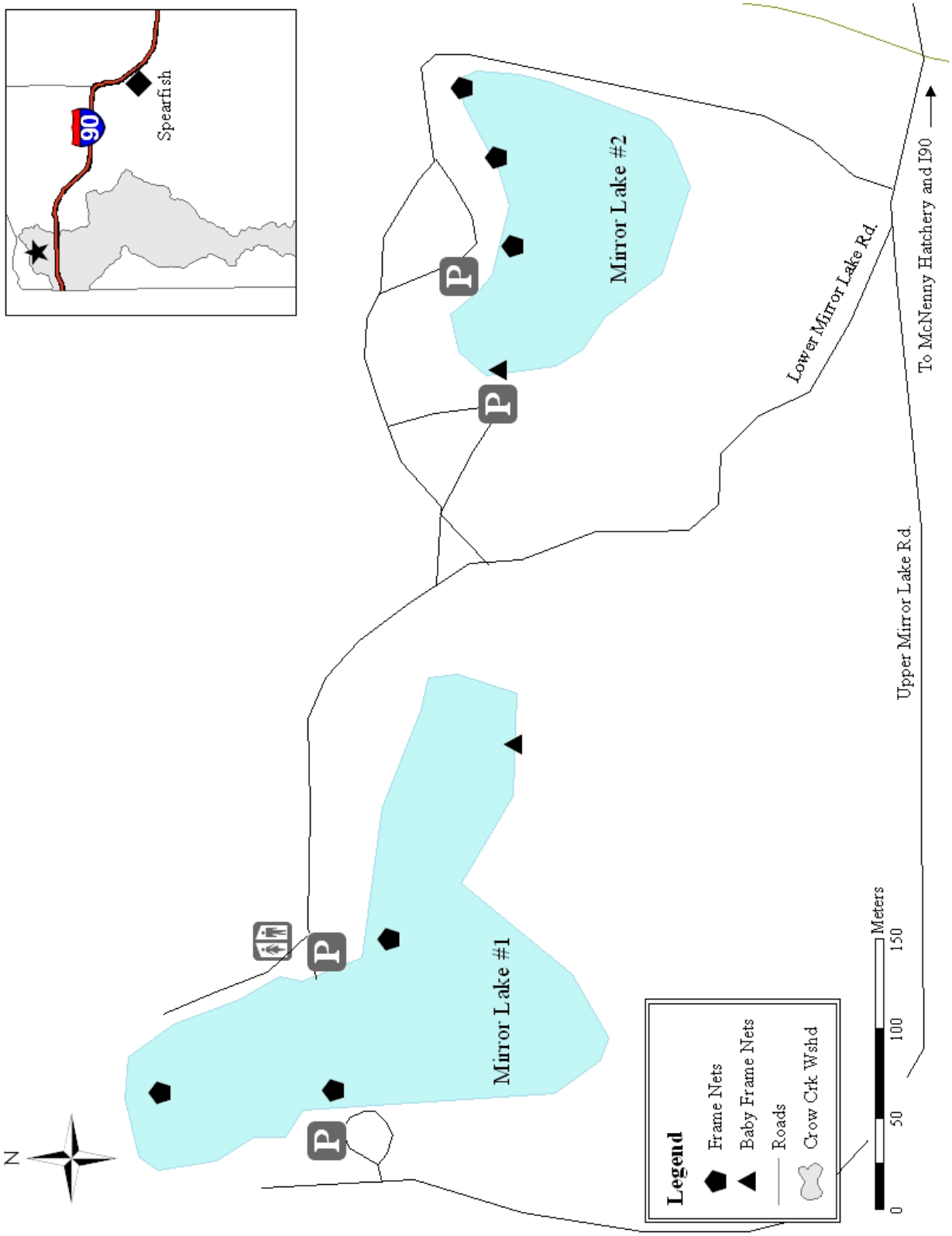


Figure 1. Map of net locations during fisheries survey on August 11-12, 2010 of Upper Mirror Lake (#1) and Lower Mirror Lake (#2), Lawrence County, SD.

Survey Results

Green sunfish was the only species collected during the survey.

Table 1. Total catch for one, $^{1}/_{4}$ inch modified fyke-nets in Mirror Lake #1, Lawrence County, South Dakota on August 12, 2010. Confidence intervals are in parentheses.

Species	**N/CPUE**	**CPUE-S**	**PSD-S**	**Wr-S** (90%)	**Mean Length** (mm)
Green sunfish	713	403	100	85 (4)	84

Table 2. Total catch for three, $^{3}/_{4}$ inch modified fyke-nets in Mirror Lake #1, Lawrence County, South Dakota on August 12, 2010. Confidence intervals are in parentheses.

Species	**N**	**CPUE** (80%)	**CPUE-S** (80%)	**PSD**
Green sunfish	533	178 (58)	101 (34)	not measured

Rainbow Trout

Rainbow trout are stocked into Mirror Lake #1 at a rate of about 1,500 fish per year. None were captured during the survey; however, these fish would likely reside in the deep hole of the lake and the extremely steep slope did not allow for a trap net to be set in this location.

Green Sunfish

Green sunfish are an illegal introduced nuisance species to any lake within the Black Hills Trout Management Area. They were the only species detected and had high abundances of substock and stock length (≥80mm) fish. Families with young children have expressed enjoyment fishing here due to very high catch rates of this species; however, trout fishing for other species can be difficult at times due to these high catch rates of green sunfish.

RECOMMENDATIONS

1. Continue to manage as a put and take fishery and stock hatchery rainbow trout at current rate.

2. Conduct lake survey in 2015 with trap nets.

APPENDIX

Appendix A. Stocking record for Mirror Lake #1, Pennington Co. 2001-2010.

Year	Species	Number	Size
2001	Rainbow Trout	3,262	Catchable
2002	Rainbow Trout	3,065	Catchable
2003	Rainbow Trout	2,475	Catchable
2004	Rainbow Trout	1605	Catchable
2005	Rainbow Trout	1,865	Catchable
2006	Rainbow Trout	1,735	Catchable
	Rainbow Trout	15	Adult
2007	Rainbow Trout	902	Catchable 11”
	Rainbow Trout	249	Catchable 15”
2008	Rainbow Trout	1,230	Catchable 11”
	Rainbow Trout	46	Catchable 15”
	Rainbow Trout	20	Adult
2009	Rainbow Trout	2,440	Catchable 11”
	Rainbow Trout	145	Catchable 15”
2010	Rainbow Trout	1,375	Catchable 11”
	Rainbow Trout	115	Catchable 15”

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Lower Mirror Lake County: Lawrence
Legal description: S20, R1E, T7N
Location from nearest town: 3 miles north and 7 miles west of Spearfish
Date of present survey: August 11-12, 2010
Date last surveyed: May 20-21, 1996
Most recent lake management plan: F21-R-25 Date: 24 January 1992*
Management classification: Coldwater permanent

Primary Species: (game and forage)
1. Hatchery rainbow trout

Secondary and other species:
1. Green sunfish

PHYSICAL CHARACTERISTICS

Surface Area: 3.6 acres
Watershed: 0
Maximum depth: 2.5 m (8.2 ft.)
Mean depth: unknown
Lake elevation at survey : full

1. Describe ownership of lake and adjacent lakeshore property:

The Mirror Lakes are located on the McNenny GPA in the Crow Creek Watershed. The South Dakota Department of Game, Fish and Parks own Lower Mirror Lake and all adjacent land.

2. Describe watershed condition and percentages of land use:

Lower Mirror Lake lies approximately 185 yards below Upper Mirror Lake #1. The portion of the watershed owned by the S.D. Department of Game, Fish, and Parks is a wildlife management. This area has abundant vegetation and brush and works as a buffer area to grazed land within the watershed. Lower Mirror Lake is a popular fishing lake for local anglers.

3. Describe aquatic vegetative condition:

Sporadic clumps of cattails covered an estimated 15-20 percent of the shoreline and extended 6 to 10 feet into the lake. Submergent vegetation was not identified at the time of the survey.

4. Describe pollution problems:

The parking area, the highly used fishing areas, and the dirt trails near the waters edge contribute to siltation entering the lake. Upper Mirror Lake acts as a sediment basin for most of the water entering Lower Mirror Lake.

5. Describe condition of all structures, i.e. spillway, level regulators, boatramps, etc.:

Metal fishing nodes were put in place during spring 2009 to allow for better shoreline fishing access. At the time of the survey, runoff had caused the gravel walking path down to the western most fishing pier to wash away creating large ruts in the path and stairs. The outlet was not examined.

CHEMICAL DATA

Chemical data was not collected in 2010

BIOLOGICAL DATA

Methods

Lower Mirror Lake was surveyed on August 11-12, 2010 with four trap net nights (Figure 1). Trap nets were set on August 11th and remained in the water overnight. Three nets had ¾ in mesh and a 1.3 × 23 m (3.9 × 75.5 ft.) lead. One net had ¼ inch mesh and a 50 ft lead.

Leads were pulled on shore for some nets due to water levels. Lengths of leads were not measured. For each survey method, total length (mm) and weight (g) was collected for each fish sampled.

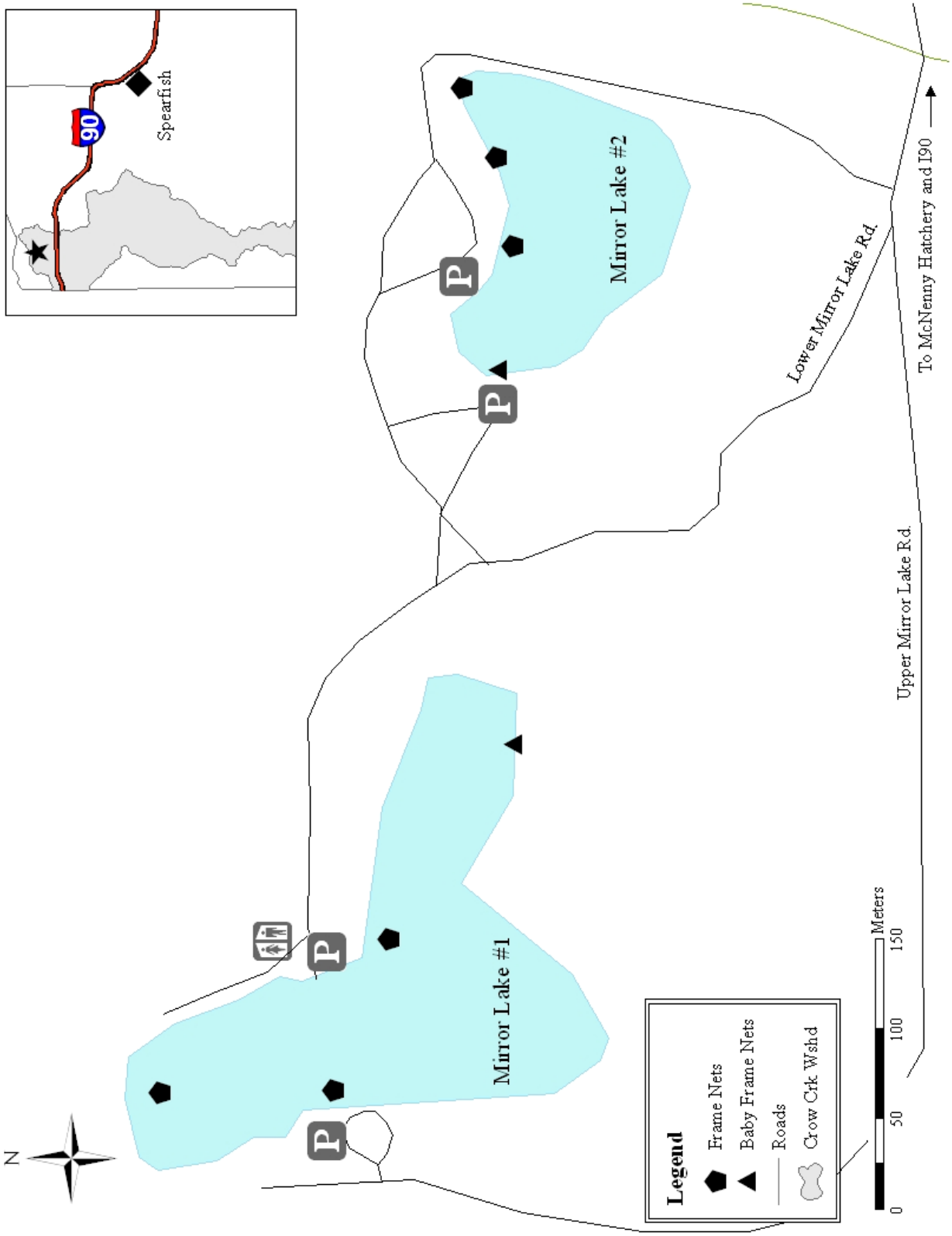
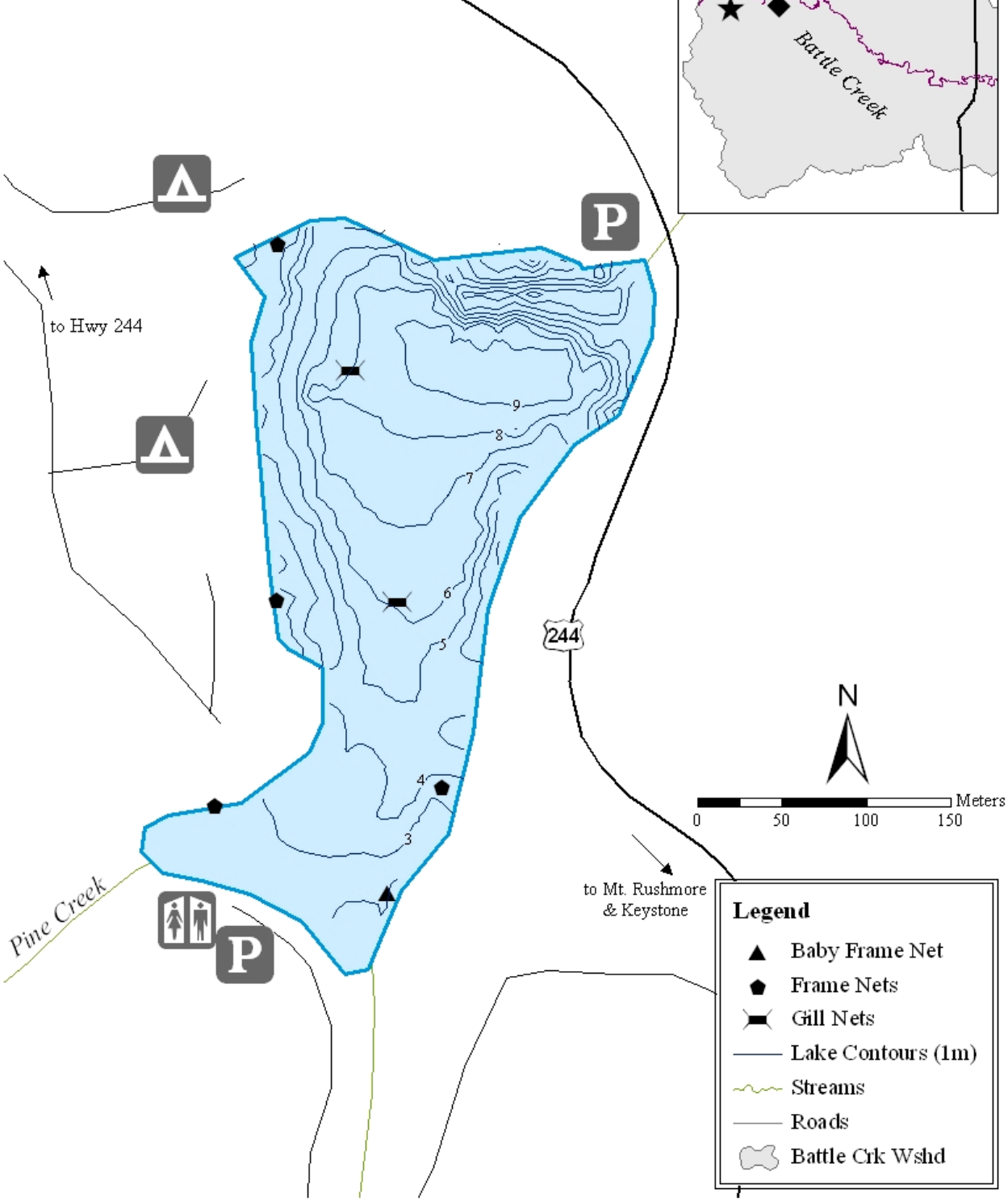


Figure 1. Map of net locations during fisheries survey on August 11-12, 2010 of Mirror Lakes, Lawrence County, SD.



RECOMMENDATIONS

1. Continue to manage as a put and take fishery and stock hatchery rainbow trout at current rate.

2. Conduct lake survey in 2015 with trap nets.

APPENDIX

Appendix A. Stocking record for Lower Mirror Lake, Lawrence Co. 2001-2010.

Year	Species	Number	Size
2001	Rainbow Trout	2,127	Catchable
2002	Rainbow Trout	1,944	Catchable
2003	Rainbow Trout	1,824	Catchable
2004	Rainbow Trout	1,305	Catchable
2005	Rainbow Trout	1,135	Catchable
2006	Rainbow Trout	1,230	Catchable
	Rainbow Trout	10	Adult
	Brown Trout	62	Adult
2007	Rainbow Trout	30,000	Fry
	Rainbow Trout	400	Catchable 11”
	Rainbow Trout	80	Catchable 15”
	Brown trout	42	Adult
	Brown trout	150	Catchable
2008	Rainbow Trout	570	Catchable 11”
	Rainbow Trout	25	Catchable 15”
	Rainbow Trout	14	Adult
2009	Rainbow Trout	4,000	Fingerling
	Rainbow Trout	2,378	Catchable 11”
	Rainbow Trout	143	Catchable 15”
2010	Rainbow Trout	1,005	Catchable 11”
	Rainbow Trout	70	Catchable 15”

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Reausaw Lake County: Lawrence
Legal description: Sec. 2 and 3; R4E; T3N
Location from nearest town: 5 miles west and 4 miles north of Nemo, SD
Dates of present survey: June 24-25, 2010
Date last surveyed: May 24-25, 1993
Most recent lake management plan: F21-R-7 Date: 4 October 1973
Management classification: Coldwater permanent

Primary Species: (game and forage)
1. Hatchery rainbow trout
2. Brook trout

Secondary and other species:
1. Green sunfish
2. White sucker

PHYSICAL CHARACTERISTICS

Surface Area: 4 acres Watershed: 1,670 acres
Maximum depth: not measured-likely around 3m Mean depth: unknown
Lake elevation at survey (from known benchmark): N/A

1. Describe ownership of lake and adjacent lakeshore property:

Reausaw Lake and surrounding shoreline is owned and maintained by S.D. Department of Game, Fish and Parks.

2. Describe watershed condition and percentages of land use:

The watershed is comprised of approximately 34% private land (65% forested, 21% grassland), and 65% public land administered by the U.S. Forest Service (93% forested, 3.5% grassland). Hay Creek runs through the watershed and is the main water source for Reausaw Lake.

3. Describe aquatic vegetative condition:

Submergent aquatic vegetation has been abundant over much of the lake by late summer in most years. The Hay Creek inlet and upper end of the lake has dense growth of cattails. During this survey at the end of June vegetation consisted of cattails on the north end and east corner. Submergent forms were not abundant.

4. Describe pollution problems:

The lake had heavy siltation from agricultural, highway, and natural causes. The 1973 lake survey indicated that silt had filled 32% of the total capacity of the lake. Sediment removal was completed

with dam embankment repair in 2000-2001. Unrestricted grazing along Hay Creek still adds to silt and nutrient loads entering the lake.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

The lake was impounded in 1928. Dam embankment repair and rebuilding of the outlet structure was completed in 2000-2001 along with installation of a pit toilet, small parking area, and dry fire hydrant. An aeration tower was installed in 1998. The 1993 survey report indicated that on occasion beaver blocked the spillway causing water to spill over the dam grade and cause erosion.

CHEMICAL DATA

No chemical data was collected in 2010. A surface temperature probe in place from May to Oct 2004 indicated temperatures as high as 26°C (79°F) in mid to late July of that year.

BIOLOGICAL DATA

Survey Methods

Four trap nets were set on June 24, 2010 and remained in the water overnight (Figure 1). The three trap nets were modified fyke-nets with ¾ inch mesh and a 1.3 × 23 m (3.9 × 75.5 ft.) lead. The fourth trap net was a ¼ inch mesh modified fyke-net with a 50 ft lead. Leads were pulled on shore for some nets and this was not measured.

For each survey method, total length (mm) and weight (g) was collected for each fish sampled.

Results and Discussion

Four fish species were caught in the fyke nets totaling 378 fish (Tables 1 and 2). White sucker was the most numerous species sampled followed by green sunfish .

Table 1. Total catch for three trap nets with $^{3}/_{4}$ inch mesh in Reausaw Lake, Lawrence County, South Dakota on June 22, 2010.

Species	N	CPUE (80% CI)	CPUE-S (80% CI)	PSD (90% CI)	Wr	Wr-S	Mean Length (mm)
Brook trout	1	0.33 (0.6)	0.33 (0.6)	100	124	124	226
Green sunfish	20	6.7 (12.6)	6.7 (12.6)	0	99	99	108
Rainbow trout	19	6.3 (0.6)	4	0	85	77	281
White sucker	147	49 (50)	--	--	--	--	--
Total	187						

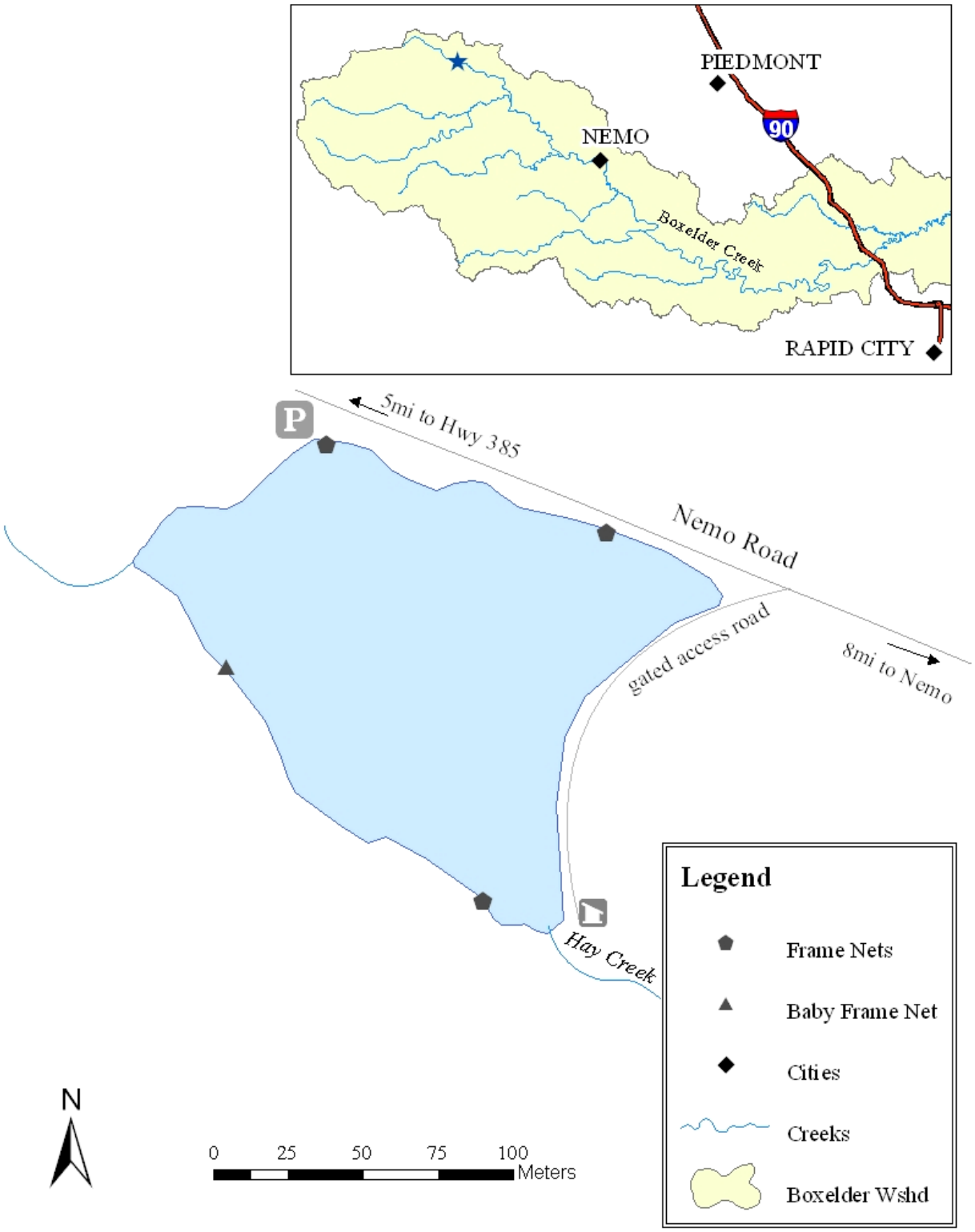


Figure 1. Reausaw Lake and net locations for the June 24-25, 2010 fisheries survey.

Table 2. Total catch for one ¼ inch modified fyke-net in Reausaw Lake, Lawrence County, South Dakota on June 22, 2010.

Species	N/CPUE	CPUE-S	PSD	Wr	Wr-S	Mean Length (mm)
Brook trout	2	2	100	96	96	283
Green sunfish	29	29	0	92	92	108
Rainbow trout	3	3	0	67	67	292
White sucker	157	148	7	74	79	206
Total	191					

Brook Trout

Three brook trout (Tables 1 and 2) were captured during the June 2010 survey. All three were greater than quality length (200mm). None were detected in the 1993 survey.

Green Sunfish

Forty-nine green sunfish were captured during the 2010 survey of Reausaw Lake, all between stock (80mm) and quality (150mm) length. Condition for this species was good with Wr values of 99 and 92 for ¾ and ¼ inch mesh nets, respectively. CPUE during the 1993 survey was higher with values of 250 and 82 for ¾ and ¼ inch mesh nets, respectively (Tables 1 and 2). When the lake was drained for dredging in 2000-2001, a pipe was installed for creek bypass. It is possible that fish survived in the creek during the drawdown, otherwise they were re-introduced into the lake after that time. Although abundance was low, anglers during the survey and on two other occasions complained about high catch rates of this species hindering their trout fishing.

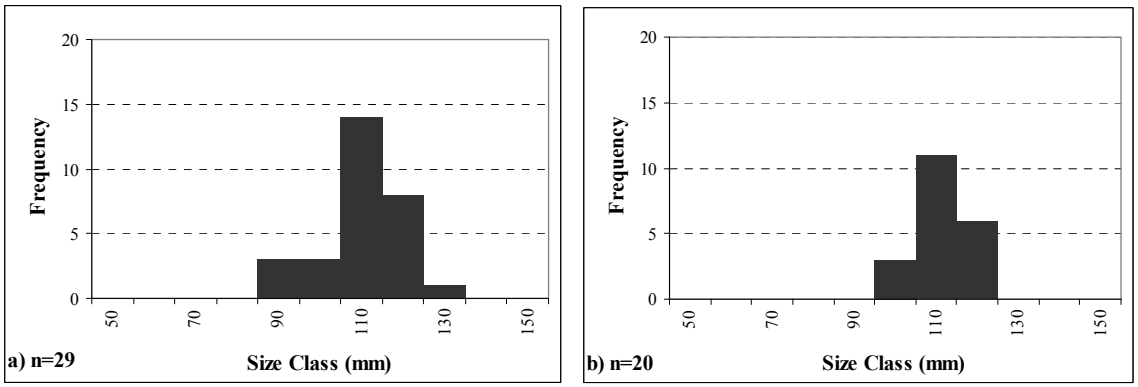


Figure 2. Length frequency histogram for green sunfish captured in ¼ (a) and ¾ (b) inch trap nets during a June 24-25, 2010 fisheries survey.

White Sucker

White suckers were the most abundant species captured during the survey with a total of 304 sampled and CPUE values of 49 and 157 for ¾ and ¼ inch nets, respectively (Tables 1 and 2). During the 1993 survey CPUE was 183 and 5 for ¾ and ¼ inch nets, respectively.

Rainbow Trout

Twenty two rainbow trout were captured in trap nets during the 2010 survey (Tables 1 and 2). Five-hundred-fifty, 11", and 60, 15" rainbow trout were stocked into Reausaw Lake in 2010 prior to this survey.

Other species

Fathead minnow and yellow perch were detected during the 1993 survey; however, none were captured in 2010.

RECOMMENDATIONS

1. Continue stocking rainbow trout at current stocking rate.

2. Conduct annual lake survey in 2015.

APPENDICES

Appendix A. Stocking record for Reausaw Lake, Lawrence County, South Dakota.

Year	Species (Strain)	Size	Stockings	Number
2008	Rainbow Trout (Shasta)	Catchable 11"	2	420
	Rainbow Trout (Utah)	Catchable	1	300
	Rainbow Trout (Erwin)	Catchable 15"	1	20
2009	Rainbow Trout (Shasta)	Catchable 11"	4	1100
	Rainbow Trout (Erwin)	Catchable 11"	2	675
	Rainbow Trout (Utah)	Catchable 15"	4	80
2010	Rainbow Trout (Shasta)	Catchable 11"	3	825
	Rainbow Trout (Erwin)	Catchable 15"	4	80

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Roubaix Lake County(ies): Lawrence
Legal description: Sec. 20, 29 T3N, R4E
Location from nearest town: 4 miles east and 10 miles south of Deadwood
Dates of present survey: June 29-30, 2010
Date last surveyed: September 1, 1972
Most recent lake management plan: F-21-R-42 Date: January 2010
Management classification: Coldwater permanent
Contour mapped: 1988 (prior to dredging)

Primary Species: (game and forage)	Secondary and other species:
1. Rainbow Trout	1. Fathead minnow
2. Brook Trout	2. Green Sunfish
3.	3. White Sucker

PHYSICAL CHARATERISTICS

Surface Area: 6 ac (2.4 ha) Watershed: 5,485 ac (2,220 ha)
Maximum depth: around 14 ft (4.2m) Mean depth: unknown-around 7 ft
Lake elevation at survey (from known benchmark): unknown

1. Describe ownership of lake and adjacent lakeshore property.

Roubaix Lake is an artificial lake built on Middle Fork Boxelder Creek by the Civilian Conservation Corps in 1936. The lake and surrounding shoreline is owned by the U.S. Forest Service.

2. Describe watershed condition and percentages of land use.

The U.S. Forest Service administers 93% (5,127 ac) of the watershed and the remaining is interspersed with private holdings. The land use of the watershed is 89% (4,883 ac) forest and 9.5% (522 ac) grassland (combined public and private land). The bulk of the grassland meadows are used for grazing or haying.

There is a 57 site campground managed by the USFS with outhouses, and a large changing building near the swim beach. Access to the lake is excellent but does require a day use fee or park sticker. The campground and swimming beach are used heavily during the summer months and the lake access remains open year round.

3. Describe aquatic vegetative condition.

The inlet of the lake has dense emergent vegetation in the form of cattail and bulrush and has submergent vegetation beyond that. The shoreline around the dam, swimming beach, and south side are nearly free of rooted aquatic plants. Prior to dredging it was estimated that 50-60% of the lake was covered with aquatic plants, hindering fishing activities. Currently this is much less with a majority of the lake accessible for fishing.

4. Describe pollution problems.

The watershed is approximately 8.6 square miles in a mixture of shallow to moderately deep loamy to clay soils, stony high rock ridges, rolling plateaus, and narrow stream valleys. The lake covers approximately six acres and the bottom of the lake is primarily silt and broken shale from its surrounding Precambrian metamorphic strata. Unfenced grazing has contributed to heavy siltation entering Roubaix Lake. Roubaix Lake Road and Rocky Johnson Road follow Middle Boxelder Creek and likely contribute to siltation and logging occurs throughout much of the watershed as well. The campground consists of paved roads, and gravel parking spots. A low retaining wall has been erected a short distance from the shoreline along the southeast side of the lake to prevent direct erosion from the steep slope.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

No apparent structural defects exist with the dam or outlet structure. During winter 2007-2008, a project to renovate the lake was done in cooperation with the Northern Hills USFS Ranger District. Renovation included spillway reconstruction, outlet replacement, sediment removal from the pond and construction of a pedestrian access bridge across the spillway. Construction costs were $347,704. During the renovation the inlet stream, Middle Boxelder Cr., was diverted through 8" pressure pipe and the lake was completely drawn down. No boat ramps exist on Roubaix Lake.

CHEMICAL DATA

No chemical data was collected in 2010.

BIOLOGICAL DATA

Survey Methods

Four trap nets were set in standardized locations (Figure 1) on June 29, 2010 and remained in the water overnight. Three nets were modified fyke-nets with ¾ in mesh and a 1.3 × 23 m (3.9 × 75.5-ft.) lead. The fourth trap net was a ¼ in modified fyke-net with a 50ft lead. Leads were pulled on shore for some nets due to water levels or lake size and this length was not measured.

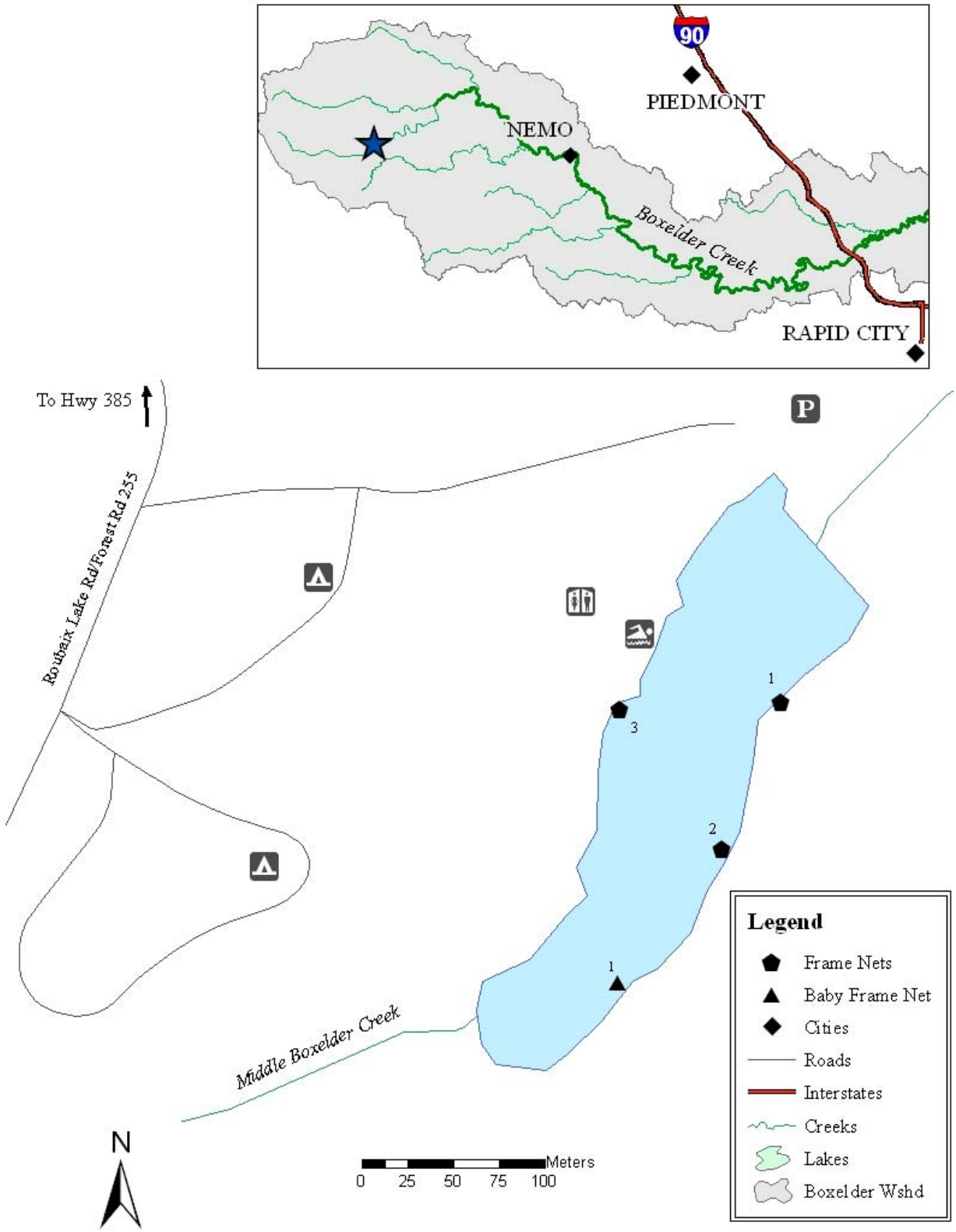


Figure 1. Map of Roubaix Lake with net locations during the fish survey on June 29-30, 2010.

For each survey method, total length (mm) and weight (g) was collected for each fish sampled. Data was entered into WinFin 4.4 and analysis was completed using WinFin Analysis 2.3.

Results and Discussion

Five fish species were caught in the fyke nets totaling 197 fish (Tables 1 and 2). White sucker was the most numerous species sampled followed by rainbow trout.

Table 1. Total catch for three, $^{3}/_{4}$ inch modified fyke-nets in Roubaix Lake, Lawrence County, South Dakota on July 1, 2010. Parameters are reported with confidence intervals.

Species	N	N/CPUE (80%)	CPUE-S (80%)	PSD (90%)	Wr-S (90%)	Mean Length (mm)
Brook trout	6	2 (1.5)	2 (1.5)	67	89 (4)	208
Rainbow trout	16	5.3 (4.5)	5 (4.1)	0	72 (3.6)	282
White sucker	37	12.3 (17.9)	12 (17.3)	22 (12)	81 (1)	225
Total	59					

Table 2. Total catch for one ¼ inch modified fyke-net in Roubaix Lake, Lawrence County, South Dakota on July 2, 2010. Parameters are reported with confidence intervals.

Species	N/CPUE	CPUE-S	PSD (90%)	Wr-S (90%)	Mean Length (mm)
Brook trout	3	3	100	100 (15)	214
Rainbow trout	4	4	0	86 (10)	283
Green sunfish	18	18	0	106 (1.4)	125
White sucker	107	58	2 (3)	81 (3.4)	161
Fathead minnow	6	--	--	--	--
Total	138				

Brook trout

Eight brook trout were captured during the survey (Tables 1 and 2). Six of these fish were quality length or greater (200 mm) and the rest were stock length (130-200 mm). One brook trout was captured during the 1994 survey during daytime electrofishing.

Rainbow trout

Twenty rainbow trout were sampled during the 2010 survey (Tables 1 and 2). Roubaix Lake is managed as a "put and take" rainbow trout fishery with approximately 2,480 fish stocked yearly. It was stocked with 1,200 catchable (11") fish and sixty-five 15" fish prior to this survey. Fish were of expected lengths for stocked fish (~11inches), but did have rather low mean condition with Wr-S values of 72 and 86.

White sucker

White sucker was the most abundant fish sampled during the 2010 survey of Roubaix Lake with 107 and 37 captured in ¼ and ¾ in nets, respectively.

Green Sunfish

Green sunfish have been illegally introduced into Roubaix Lake. Eighteen were captured during the survey in the ¼" mesh net. When the lake was drained for dredging in 2007-2008 a pipe was installed for creek bypass. It is possible that fish survived in the creek during the drawdown; otherwise they were re-introduced into the lake after that time.

Fathead minnow

Six fathead minnows were captured in the ¼" net during the 2010 survey. Dozens were observed near the northwest shore hiding under rocks and other debris. During the 1994 survey, two were captured via electrofishing and 13 by two quarter arc seine hauls.

Other species

Two largemouth bass and 43 golden shiner were detected during the 1994 survey. None were captured in 2010.

RECOMMENDATIONS

1. Manage as a rainbow trout fishery by stocking catchable rainbow trout at the current rate.

2. Conduct lake survey in 2015 to determine species composition and trend of fish populations.

APPENDICES

Appendix A. Stocking record for Roubaix Lake, Lawrence Co. 2003-2010.

Year	Species	Number	Size
2003	Rainbow Trout	3,200	Catchable
	Rainbow Trout	3,600	Catchable
2004	Rainbow Trout	1,455	Catchable
2005	Rainbow Trout	1,430	Catchable
2006	Rainbow Trout	1,480	Catchable
	Rainbow Trout	25	Adult
2007	Rainbow Trout	349	Catchable 11”
	Rainbow Trout	7	Catchable 15”
2008	Rainbow Trout	825	Catchable 11”
	Rainbow Trout	40	Catchable 15”
2009	Rainbow Trout	25	Adult
	Rainbow Trout	2,975	Catchable 11”
	Rainbow Trout	65	Catchable 15”
2010	Rainbow Trout	2,400	Catchable 11”
	Rainbow Trout	85	Catchable 15”

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Bandit Lake County: Meade
Legal description: T 2N, R9E, Sec 7
Location from nearest town: inside Ellsworth Airforce Base
Dates of present survey: June 5-6, 2010
Date last surveyed: This is the first survey completed on this dam.
Most recent lake management plan: NA
Management classification: Warm-water permanent

Primary Species: (game and forage)
1. Largemouth bass
2. Redear sunfish

Secondary and other species:
1. Bluegill
2. Green sunfish

PHYSICAL CHARACTERISTICS

Surface Area: 2.8 acres
Watershed: NA acres
Maximum depth: NA feet
Mean depth: NA feet
Lake elevation at survey (from known benchmark): full

1. Describe ownership of lake and adjacent lakeshore property:

The dam structure and surrounding property lies within Ellsworth Air Force Base and is owned by the United States Air Force.

2. Describe watershed condition and percentages of land use:

The watershed above and surrounding Bandit Lake is developed municipal land. Areas immediately around the lake are grassy with no developments on the shorelines.

3. Describe aquatic vegetative condition:

Submergent vegetation was noted in shallow areas (under 5 feet), mostly in and near the inlet. Less than 30% of the shoreline had emergent vegetation.

4. Describe pollution problems:

No pollution problems were identified during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

The Air Force funded removal of trees on the dam, a rebuild of the dam and outlet structure, and dredging of the lake in 2006 and 2007. During construction, the lake was drained to a very low

level. It is unknown by GFP staff how much sediment was removed. All structures associated with the lake are in good condition.

BIOLOGICAL DATA

Methods

A lake survey was conducted at Bandit Lake June 5-6, 2010. Sampling consisted of two trap net nights. Trap nets were set at two stations consisting of 1 trap net night each. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 in) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g).

Fish population parameters calculated were catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean catch per unit effort (CPUE; mean number per net night). Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

Results and Discussion

Overall, 5 fish species were collected from trap nets during the lake survey conducted June 5-6, 2010 (Table 1). A total of 267 fish were collected with green sunfish comprising 52.1%, and bluegill comprising 39.7% of the sample. Redear sunfish comprised 7.5% of the sample. Black crappie was the only other species sampled. Population parameters of dominant game and forage species in Bandit Lake are discussed individually below. A single baby trap net was set to sample any minnow species present. Thirty fathead minnows were sampled along with numerous bluegill and green sunfish.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock-length; 80% CI's) for all fish species collected from two, ¾ inch trap nets in Bandit Lake, Pennington County, June 5-6, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black crappie	2	1.0 (0.0)	0.5 (1.5)	--	--	115.8 (--)
Bluegill	106	53.0 (55.4)	52.0 (52.3)	13 (6)	11 (5)	107.0 (1.1)
Green sunfish	139	69.5 (115.4)	69.5 (115.4)	18 (5)	0	--
Redear sunfish	20	10.0 (24.6)	10.0 (24.6)	95 (9)	5 (9)	109.9 (2.3)
Total	267					

Bluegill

During the renovation in 2006 and 2007, the lake was not completely drained and most likely a number of fish survived. However, a few adult bluegills were transferred from Gateway Lake into Bandit Lake soon after the renovation. Since the lake refilled in 2007, the bluegill have done very well. Trap net CPUE of stock length (3 inches) and longer fish was 52.0 (Table 1) indicating a good density of fish. The length frequency and size indicies show a population of small fish with a PSD of only 13 (Figure 1; Table 1). Indices also show a good portion of larger fish with an RSD-P of 11. The absence of medium sized fish is most likely due to loss of the fishery during drawdown when the lake was dredged.

Fish body conditions were excellent with an average Wr for stock length and larger of 107.0.

The growing numbers of bluegill is a concern. It will be important to maintain a good bass population to keep bluegill abundance low and a quality size structure.

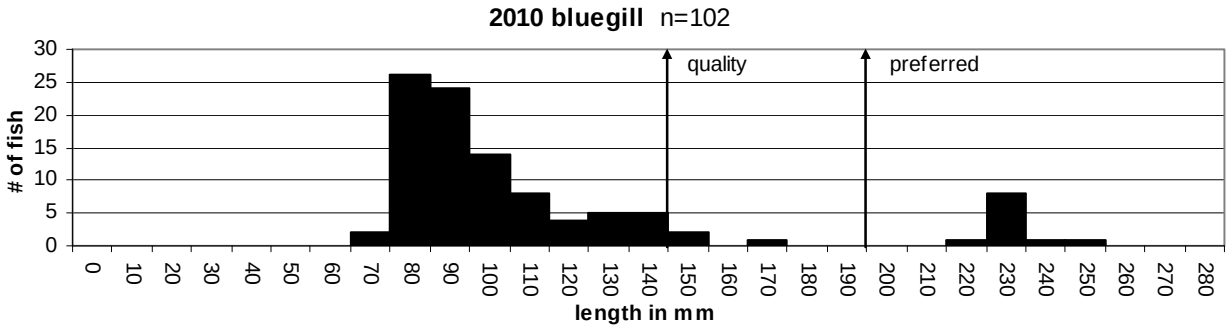


Figure 1. Length frequency histogram of measured bluegills collected by trap nets from Bandit Lake, 2010.

Green Sunfish

Green sunfish were the most abundant species sampled in our lake survey with a catch per net of 69.5 (Table 1). Size structure of the population appears composed of small adult fish a PSD of 18 and RSD-P of 0. The length frequency also shows most fish are less than 6 inches in length (Figure 2). Similar to the bluegill sample, these numbers suggest the bass abundance may be low.

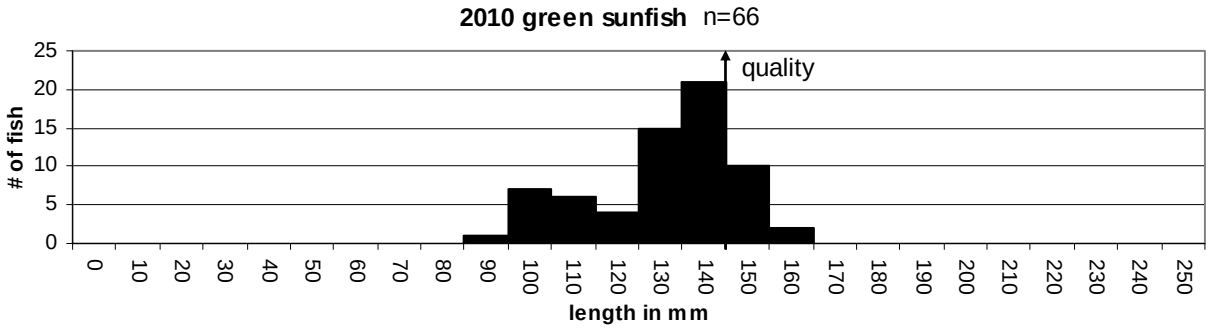


Figure 2. Length frequency histogram of measured green sunfish collected by trap nets in Bandit Lake, 2010.

Redear sunfish

Along with the bluegills, redear sunfish were transferred from Gateway Lake into Bandit Lake after the lake refilled in 2007. Redears were not a part of the fishery prior to the renovation. These fish showed up in the trap net with a CPUE of 10.0 (Table 1). One small fish was sampled showing recruitment is occurring (Figure 3). Fish condition was excellent with a Wr for stock length and larger of 109.9

Without intensive management, it is doubtful that these fish will be able to compete with the abundant bluegill and green sunfish. Redear sunfish reproduction is not as plentiful as bluegill and since these two species do crossbreed with each other, redear genetics will probably be carried on in bluegill/redear hybrids unless a source of adult redear can be established elsewhere and used for supplemental stockings.

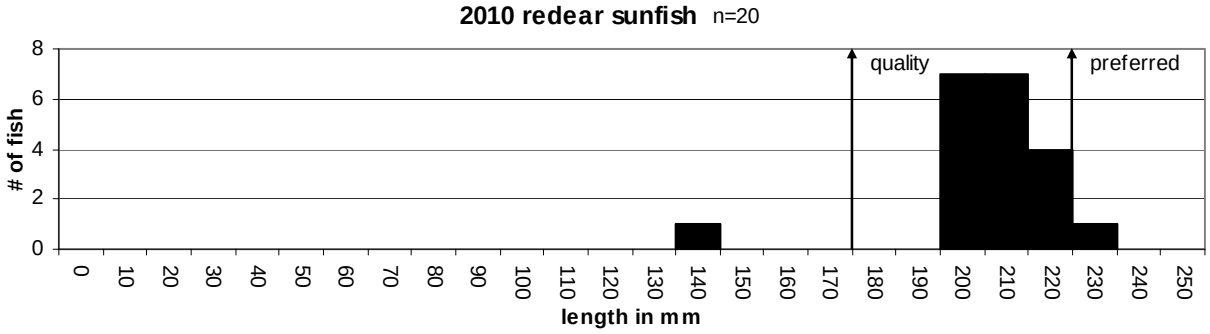


Figure 3. Length frequency histogram of redear sunfish collected by trap nets in Bandit Lake, 2010.

RECOMMENDATIONS

1. Conduct standard lake surveys once every three to five years to monitor fish populations.

2. Sample the largemouth bass population as soon as possible. If numbers of largemouth bass are low or nonexistent, stock adult largemouth at around 3 to 5 lbs per acre (i.e. 30 to 50 ten inch bass).

APPENDIX

Appendix A. Stocking record for Bandit Lake, Pennington County, 2007-2010.

Year	**Number**	**Species**	Size
2007	35	bluegill	Adult
2007	108	redear sunfish	Adult

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Bear Butte Lake County: Meade
Legal description: T 6 N, R 7 E, Sec. 25 & 30
Location from nearest town: 4 mi. W, 2.5 mi. N of Sturgis, SD
Dates of present survey: June 14-16, 2010, September 23, 2010
Date last surveyed: May 21-22, 2003
Most recent lake management plan: F21-R-31 Date: 1998
Management classification: Warmwater semi-permanent
Contour mapped: 2002

Primary Species:(game and forage)	Secondary and other species:
1. Largemouth bass	1. Green sunfish
2. Yellow perch	2. Fathead minnow
3. Black crappie	3. Rock bass
4. Northern pike	4. Black Bullhead

PHYSICAL CHARACTERISTICS

Surface Area: 180 acres; Watershed: 2,000 acres
Maximum depth: 13 feet; Mean depth: 7 feet
Lake elevation at survey (from known benchmark): full feet

1. Describe ownership of lake and adjacent lakeshore property:

The South Dakota Game, Fish and Parks owns the lake and surrounding lakeshore. Bear Butte State Park manages the lakeshore property adjacent to the lake.

2. Describe watershed condition and percentages of land use:

The Bear Butte Lake watershed is predominately grassland.

3. Describe aquatic vegetative condition:

No emergent vegetation was present at the time of this survey, due to falling water levels. Submerged vegetation is excessive from midsummer to freeze up.

4. Describe pollution problems:

No pollution problems were identified by departmental personnel during the survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

The boat ramp is an older concrete plank ramp, very rough and shallow, and showing signs of age and wear. No other structures were inspected for condition.

BIOLOGICAL DATA

Methods

Sampling at Bear Butte Lake consisted of four 3/4 inch trap nets and one 150 foot experimental gill net set for one night on June 14 and followed up with three trap nets reset on June 15. The gill net was a monofilament experimental net 45.7 m (150 ft) long and 1.8-m (6 ft) deep with six 7.6 m (25 ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1-mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Trap nets were set at four stations and ran overnight. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 in) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g). Only fish from the gill net were weighed. In addition, scale samples for the first five fish per centimeter group were collected from selected fish per gear type for age and growth analysis. Scale samples were pressed onto acetate slides and viewed with a microfiche projector (40X) and the distance between scale annuli were recorded on paper strips.

Fish population parameters calculated were catch-per-unit-effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean catch-per-unit-effort (CPUE; mean number per net night or mean number per hour of electrofishing). Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

Results and Discussion

Bear Butte Lake was nearly dry for a two-year period prior to filling in the spring of 2008. The spring run-off brought more than just water as black bullheads are present in high numbers. Bullheads dominated both gear types during our survey. They comprised 90.2% of the trap net catch, with black crappie second most abundant with 8.9%. Bullheads also made up over 78% of the gillnet sample and channel catfish were second at 12.2%. The most commonly collected fish species during the survey are discussed further in this report.

Net Locations (UTM)

Net 1-623083.91E, 4923628.71N
Net 2-623486.76E, 4923203.71N
Net 3-623693.99E, 4923311.99N
Net 4-623989.36E, 4923597.06N
Gillnet-623563.54E, 4923418.87N

Figure 1. Map of Bear Butte Lake, Meade County, with net locations and GPS coordinates.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock length; 80%CI's) for fish species collected from seven, ¾ inch trap nets in Bear Butte Lake, Meade County, June 14-16, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black bullhead	6,435	919.3 (583.8)	260.4 (165.4)	14 (2)	0	--
Black crappie	632	90.3 (30.0)	90.3 (30.0)	4 (1)	0	113.0 (3.4)
Channel catfish	2	0.3 (0.4)	0.3 (0.4)	--	--	97.7 (24.0)
Golden shiner	1	0.1 (0.2)	--	--	--	--
Yellow perch	64	9.1 (6.5)	9.1 (6.5)	56 (11)	11 (7)	87.6 (0.7)
Total	7,134					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock length; 80%CI's) for all fish species collected from one, 150-ft experimental sinking gill net in Bear Butte Lake, Meade County, June 14-15, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black bullhead	148	148.0 (--)	42.0 (--)	14 (9)	0	90.1 (4.0)
Black crappie	14	14.0 (--)	13.0 (--)	8 (13)	0	110.4 (1.2)
Channel catfish	23	23.0 (--)	23.0 (--)	65 (18)	0	108.2 (6.6)
Yellow perch	4	4.0 (--)	4.0 (--)	25 (59)	0	88.9 (4.3)
Total	189					

Table 3. Total catch (N), fish per hour (CPUE; 80% CI's in parentheses), fish per hour of stock-length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock length; 80%CI's) for largemouth bass collected from 60 minutes of electrofishing at Bear Butte Lake, Meade County, September 23, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Largemouth bass	35	42.0 (31.5)	6.0 (4.1)	40 (52)	0	108.8 (16.8)
Total	35					

Black Bullhead

Black bullheads were the dominate species sampled even though none were stocked after being completely dry. Seven trap nets sampled 6,435 bullheads for a CPUE of 919.3 (Table 1). The single gillnet caught 148 bullheads and most were less than 8 inches in length (Table 2; Figure 2). Stock indices were identical between gear types with a PSD of 14. All fish sampled were removed from the lake. Hopefully, the recent bass, channel catfish, walleye and northern pike stockings will provide enough predation on the already abundant population to decrease density and help increase size structure.

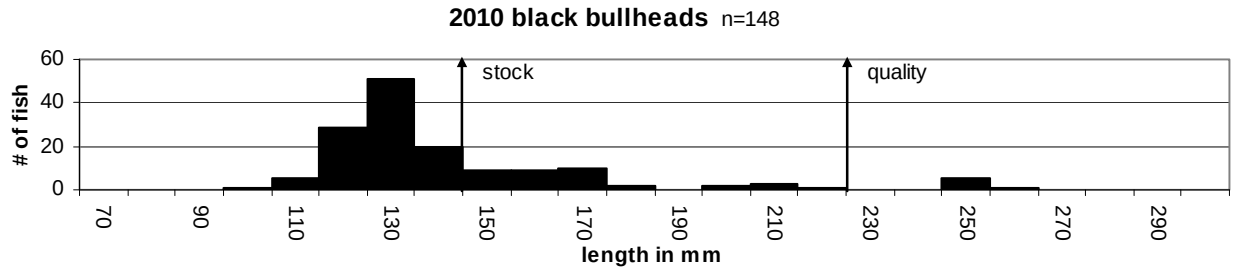


Figure 2. Length frequency histogram for black bullheads sampled from the gillnets in Bear Butte Lake, 2010.

Black Crappie

After the lake refilled in 2008, 230 adult black crappies were stocked to reintroduce them to the lake. It appears crappie are doing just fine with a trap net CPUE of 90.3 (Table 1). Fish condition was good with a Wr for stock length and larger fish of 113.0. No fish were sampled over 220 millimeters (Figure 3).

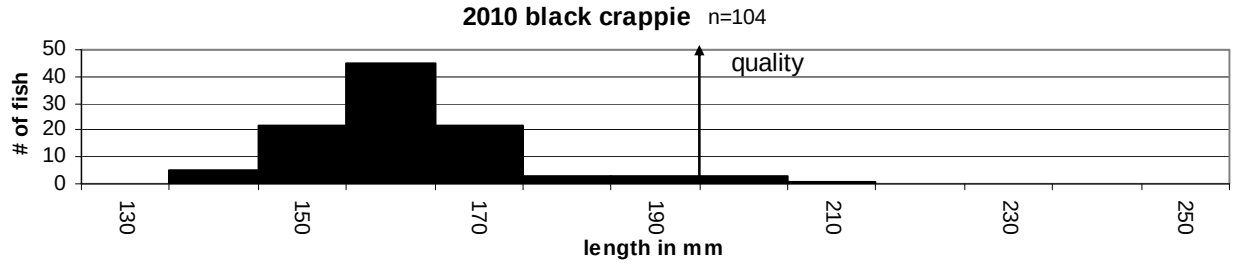


Figure 3. Length frequency histogram for black crappie sampled from Bear Butte Lake, 2010.

Largemouth Bass

Bear Butte Lake was restocked with 5,620 small fingerling largemouth bass in the fall of 2008 and again in 2009, with another 13,000 fingerlings (Appendix A). The intent is for these fish to recruit and become a control on the abundant bullhead population. Fall electrofishing yielded a CPUE of 35.0 fish per hour (Table 3). The original stocked fish were over 320mm (Figure 4).

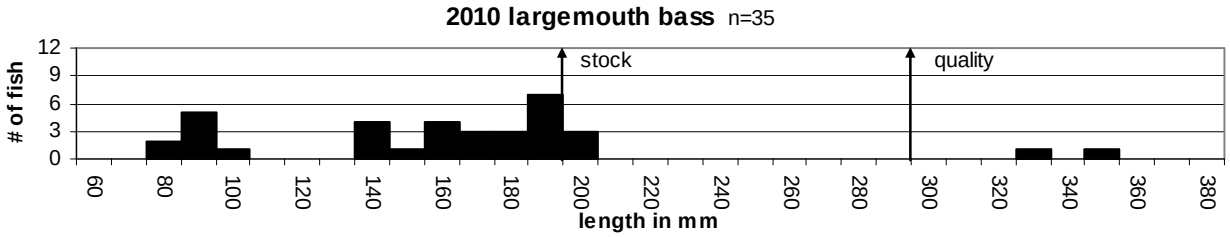


Figure 4. Length frequency histogram for largemouth bass sampled from Bear Butte Lake, September 23, 2010.

Yellow Perch

Yellow perch numbers have increased since the adult stockings in 2009. Since refilling in 2008, fourteen hundred prespawn perch have been stocked (Appendix A). One gill net caught four yellow perch (Table 2). Gillnet catch may have been influenced by high numbers of bullheads entangled in the net, therefore there was no additional gillnet effort during this sampling period. Seven trap nets caught 64 perch over stock length (Figure 5). Stock indices for the trap net sample had a PSD of 56 and an RSD-P of 11 (Table 1).

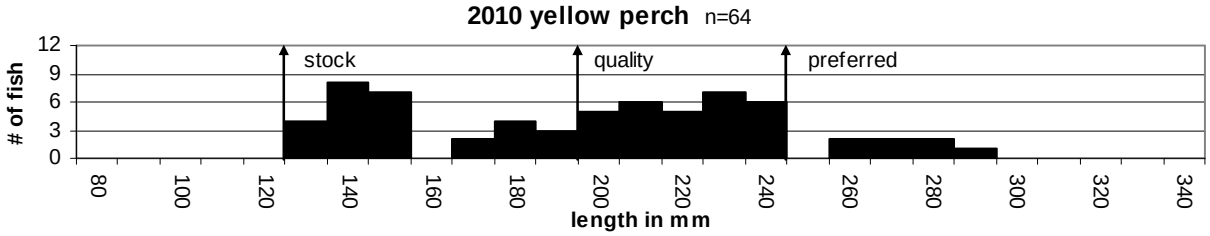


Figure 5. Length frequency histogram for yellow perch sampled from the trap nets in Bear Butte Lake, June 14-16, 2010.

RECOMMENDATIONS

1. Manage primarily as a northern pike/yellow perch/black crappie fishery.

2. Work to reduce the overabundant bullhead population (e.g. trap net removals and stocking largemouth bass)

3. To continue having strong year classes of yellow perch, the placement of Christmas tree structures in the lake to improve yellow perch spawning habitat should occur.

APPENDICES

Appendix A. Stocking record for Bear Butte Lake, Meade County, 2008-2010.

Year	Number	Species	Size
2008	230	Black crappie	ADT
	2,400	Fathead minnow	ADT
	5,620	Largemouth bass	FGL
2009	500	Yellow perch	ADT
	570	Channel catfish	ADT
	13,000	Largemouth bass	FGL
2010	50	Golden shiner	ADT
	900	Yellow perch	ADT
	20,000	Walleye	FGL
	110	Northern pike	ADT

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Curlew Lake County: Meade
Legal description: T 3N, R 11E Sec. 2, 10, 11
Location from nearest town: 8 mi. N, 4 mi. E, 1.5 mi. N of New Underwood, SD
Dates of present survey: June 23-25, 2010
Date last surveyed: June 24-26, 2009
Most recent lake management plan: F21-R-36 Date: 2004
Management classification: Warmwater permanent
Contour mapped: July 1994

Primary Species: (game and forage)	Secondary and other species:
1. Black crappie	1. Bluegill
2. Largemouth bass	2. Yellow perch
3. Northern pike	3. Black bullhead
4. Walleye	4. White sucker

PHYSICAL CHARACTERISTICS

Surface Area: 136 acres; Watershed: 12,800 acres
Maximum depth: 22 feet; Mean depth: 10.2 feet
Lake elevation at survey (from known benchmark): full

1. Describe ownership of lake and adjacent lakeshore property:

Curlew Lake is owned and managed by the South Dakota Department of Game, Fish and Parks. All land bordering the immediate shoreline, excluding three quarter sections in Section 2 and a small tract of land comprising 10 acres in Section 11, are owned by the Department of Game, Fish and Parks. The 10-acre tract in Section 11 has a written access agreement with the landowner; the three quarter sections in Section 2 do not have active access agreements. There is no record of problems regarding public access across this section of land.

2. Describe watershed condition and percentages of land use:

Curlew Lake watershed is comprised of 80% range and pasture lands and 20% cropland.

3. Describe aquatic vegetative condition:

Rooted aquatic vegetation appears along most of the shoreline. Bulrush is the primary emergent plant species associated with the lake. Coontail and grassy pondweed are abundant submersed vegetative species in the lake.

4. Describe pollution problems:

Siltation at inlets and shorelines due to natural erosion around the reservoir and cattle grazing on the private tract and its shoreline has decreased depth and area within the lake. No other pollution problems were identified by department personnel during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.

All access and regulatory structures appear to be in adequate condition. A new boat ramp was installed in 2005. Also, in 2009 a boat dock was reconditioned by the Rapid City Area Chapter of Walleyes Unlimited and installed with an MOU between them and the SD GF&P.

BIOLOGICAL DATA

Netting Survey

A lake survey was conducted on June 23-25. Sampling consisted of two overnight sets for three trap net locations and two 150 ft gill nets (Figure 1). All gill nets were monofilament experimental nets. Each trap net was 45.7 m (150 ft) long and 1.8 m (6 ft) deep with six 7.6 m (25 ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 inch) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g). In addition, scale samples for the first five fish per centimeter group were collected from selected fish species per gear type for age and growth analysis. Scale samples were pressed onto acetate slides and viewed with a microfiche projector (40X) and the distance between annuli were recorded on paper strips.

Data Analysis

Fish population parameters calculated were catch-per-unit-effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean CPUE (mean number per net night or mean number per hour of electrofishing). Population structural characteristics were expressed as length frequency histograms and PSD and RSD-P values. Fish condition was expressed as mean Wr.

Results and Discussion

Curlew Lake is an important fishery located about thirty minutes from Rapid City. It is a favorite location for many Rapid City anglers in search of walleye, largemouth bass, black crappie and other panfish species. Low water levels and a resulting partial winterkill in 2007-2008, lead to a large decrease in all fish populations. Recently, Curlew Lake has had a high density, low quality black bullhead population. This might be due to low density walleye and bass populations. In an attempt to improve panfish quality and walleye catch rates, a 14-inch minimum length limit was imposed on walleye starting in 2004. In 2007, a 15-inch minimum was imposed on largemouth bass to further improve predator density. Starting January 1st, 2010, the 14-inch minimum four walleye daily limit was changed to a 15-inch minimum length limit with a two walleye daily limit.

Fish Community Survey

Eleven fish species were collected during the lake survey conducted June 23-25, 2010 in Curlew (Table 1). Six hundred and eighty three fish were collected in trap nets, with black bullhead comprising 77.9% of the total. Black crappie was a distant second at 17.4%. Other species sampled were channel catfish, common carp, golden shiner, green sunfish, largemouth bass, northern pike, walleye, white sucker, and yellow perch. Only five fish were sampled in two, 150 foot gill net sets (Table 2). One black bullhead, three walleye, one yellow perch made up the total gill net catch.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock length; 80% CI's) for fish collected from six, ¾ inch trap nets in Curlew Lake, June 23-25, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black Bullhead	532	88.7 (62.8)	37.2 (27.0)	5 (3)	0	75.4 (2.2)
Black Crappie	119	19.8 (10.7)	19.7 (10.6)	34 (7)	2 (2)	93.3 (1.0)
Channel Catfish	1	0.2 (0.2)	0.2 (0.2)	--	--	88.9 (--)
Common Carp	15	2.5 (1.6)	2.5 (1.6)	33 (23)	20 (19)	86.9 (7.2)
Golden Shiner	1	0.2 (0.2)	0.2 (0.2)	--	--	--
Green Sunfish	1	0.2 (0.2)	0.2 (0.2)	--	--	--
Largemouth bass	1	0.2 (0.2)	0.2 (0.2)	--	--	103.9 (--)
Northern Pike	6	1.0 (1.0)	0.5 (0.5)	--	--	83.9 (5.6)
Walleye	3	0.5 (0.3)	0.0 (--)	--	--	--
White Sucker	2	0.3 (0.3)	0.3 (0.3)	--	--	80.4 (11.8)
Yellow Perch	2	0.3 (0.3)	0.3 (0.3)	--	--	77.5 (--)
Total	**683**					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock length; 80% CI's) for all species collected from two gill nets in Curlew Lake, June 23-25, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black Bullhead	1	0.5 (1.5)	0.5 (1.5)	--	--	73.0 (--)
Walleye	3	1.5 (4.6)	0 (--)	--	--	--
Yellow Perch	1	0.5 (1.5)	0.5 (1.5)	--	--	78.3 (--)
Total	**5**					

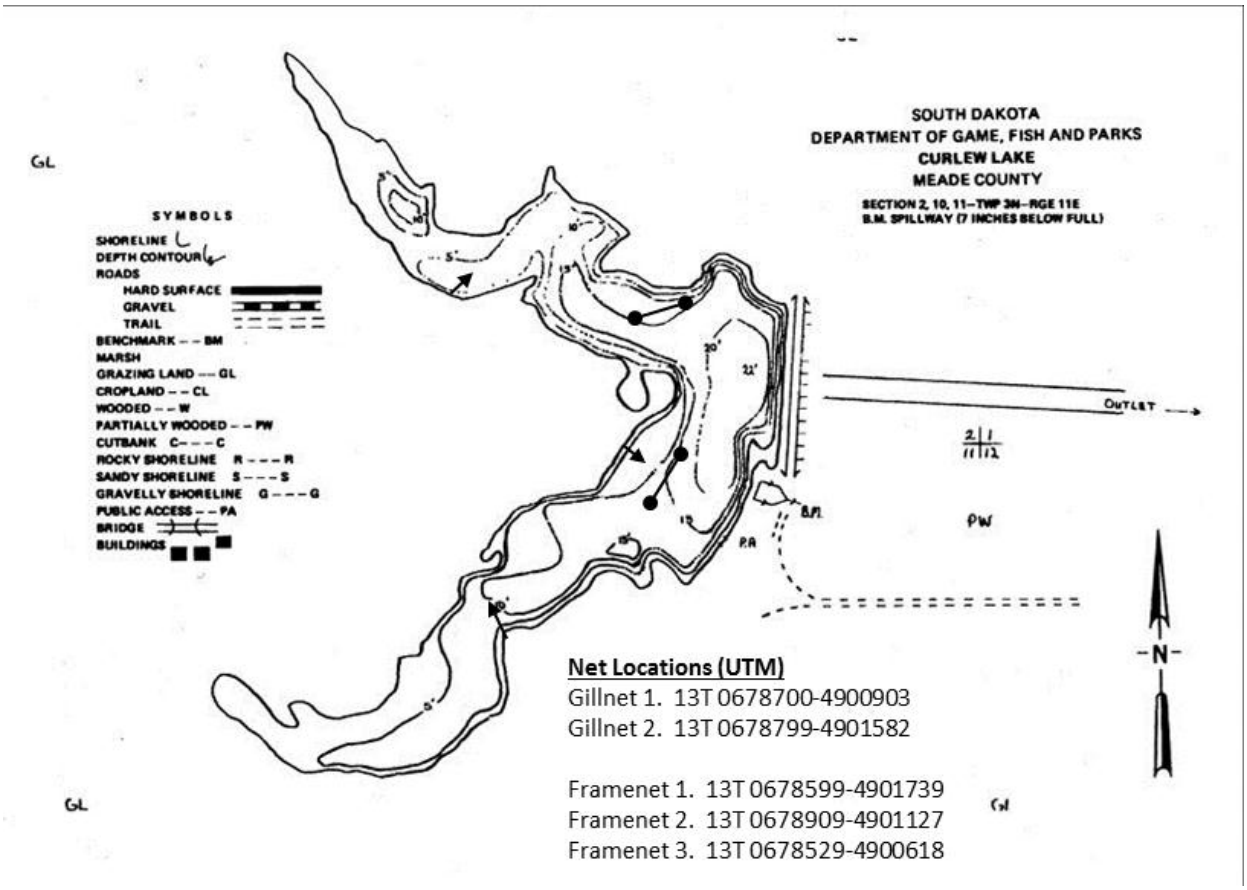


Figure 1. Map of Curlew Lake and 2010 net locations.

Black bullhead

Bullhead numbers showed a sharp increase in abundance from past years. Frame net CPUE was 88.7, compared to 17.5 last year (Table 1). Stock density values indicate a population of small fish with a PSD value of only 5 and RSD-P at 0. Mean condition (Wr) for stock length and larger bullheads was poor at 75.4 (Table 1). Although no age or length-at-age data was collected, length frequencies suggest a strong year class or two under quality length (Figure 2).

Trend data (Table 3) indicates this is a redeveloping population with little current predator influence (i.e. high density, small size structure and poor condition) and is reaching an overabundance. Managers feel that by increasing the walleye and bass populations will result in a more balanced, low density bullhead population.

Table 3. Composite listing of catch per net night for stock-length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD; 90% CI's) and condition factor (Wr for fish ≥ stock length; 80%CI's) for black bullheads collected from trap nets in Curlew Lake, 2005-2010.

Year	N	CPUE	CPUE-S	PSD	RSD-P	Wr≥S
2005	7	0.9 (0.7)	0.9 (0.7)	100	0	88.6 (1.8)
2006	4	0.6 (0.6)	0.6 (0.6)	100	50 (50)	103.6 (5.0)
2007	1	0.1 (0.2)	0.1 (0.2)	0	0	77.6 (--)
2008	25	3.1 (1.2)	2.9 (1.3)	13 (12)	0	105.6 (3.6)
2009	105	17.5 (11.0)	13.5 (10.3)	9 (6)	0	82.8 (9.4)
2010	532	88.7 (62.8)	37.2 (27.0)	5 (3)	0	75.4 (2.2)

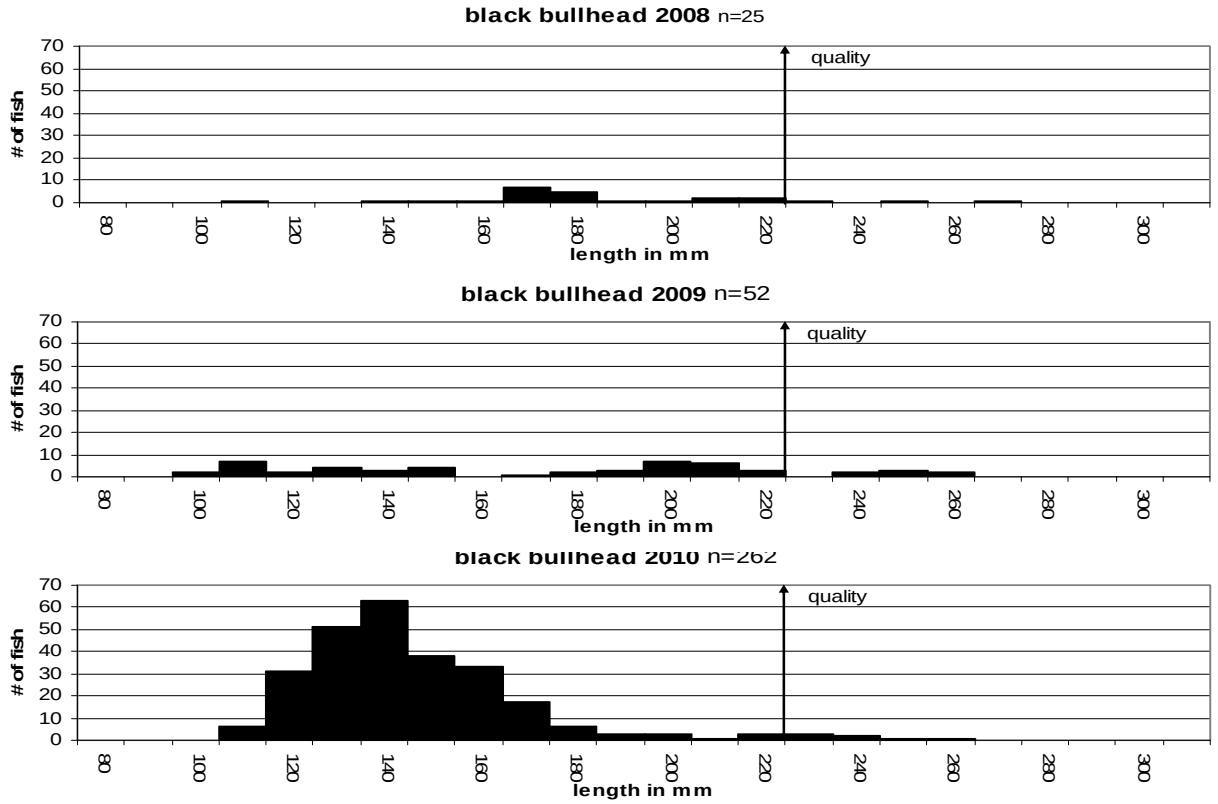


Figure 2. Length frequency histogram for black bullheads from trap net in Curlew Lake, 2008-2010.

Black Crappie

Black crappie trap net catch was similar to last year (Table 4; Figure 3). Trap net CPUE was 19.8 compared to 18.0 last year. The decline in abundance from 2008 is probably due to a partial winterkill observed in 2007/2008 and in addition, the lake recently filling may have compounded the lower catch rates. Stock indices were similar to last year with a PSD of 34, compared to 38

last year (Table 4). Proportion of 10 inch crappie (RSD-P) stayed the same at a value of 2. Fish condition was average with a Wr for stock length and larger fish of 93.3.

The walleye and bass stockings and regulations haven't had much time to influence the size structure and growth of black crappie in Curlew Lake but it seems reasonable that predator numbers need to be higher to move the crappie population towards management objectives. If the black crappie objectives are to be met, predator densities need to increase. Even with the minimum length limits in place, it will take time after the winterkill for predator populations to rebound and influence the crappie population.

Table 4. Composite listing of catch per net night for stock-length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD; 90% CI's) and condition factor (Wr for fish ≥ stock length; 80%CI's) for black crappie collected from trap nets in Curlew Lake, 2005-2010.

Year	CPUE	CPUE-S	PSD	RSD-P	Wr≥S
2005	22.3 (6.5)	22.3 (6.5)	75 (6)	0	89.7 (1.0)
2006	178.3 (97.8)	12.3 (9.2)	91 (6)	0	84.5 (0.2)
2007	353.1 (111.7)	216.4 (68.7)	17 (2)	0	100.7 (1.3)
2008	54.6 (15.9)	48.9 (14.3)	9 (3)	2 (1)	107.4 (1.1)
2009	18.0 (10.1)	**16.3 (9.0)**	38 (8)	2 (2)	101.5 (0.7)
2010	19.8 (10.7)	19.7 (10.6)	34 (7)	2 (2)	93.3 (1.0)

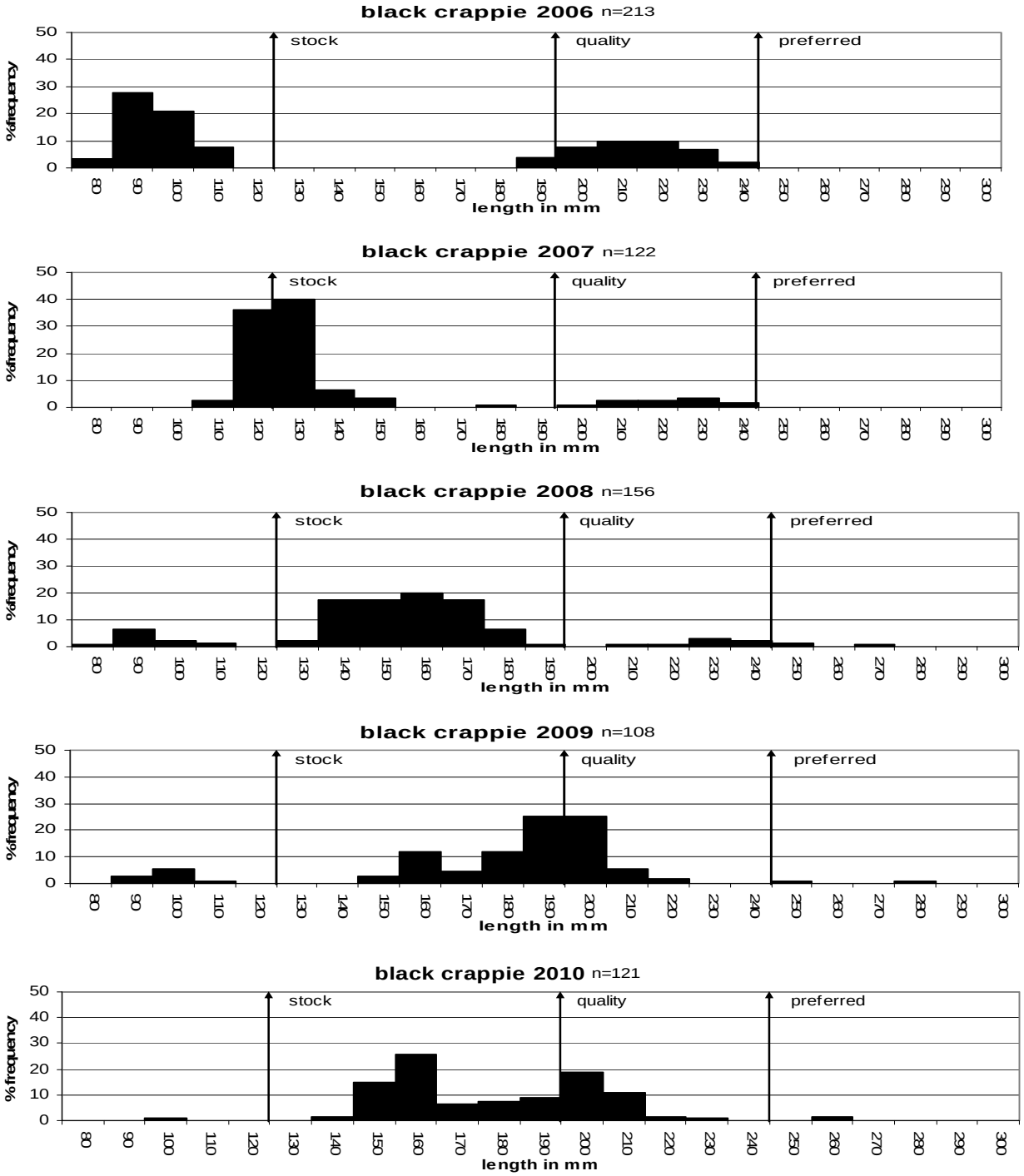


Figure 3. Length frequency histogram of black crappie from trap nets at Curlew Lake from 2006-2010.

Walleye

Since the winterkill, 107,000 small walleye fingerlings have been stocked in hopes of getting the predator base ahead of the bullheads and black crappies. Two gillnets caught a total of three walleye for a CPUE of 1.5 (Table 1). Last year, the gillnet CPUE was 5.5 (Figure 4). All fish were under stock length. Poor water clarity in the fall of 2010 caused fall electrofishing to be canceled. Electrofishing will be done as soon as conditions allow sampling of the walleye and largemouth bass population.

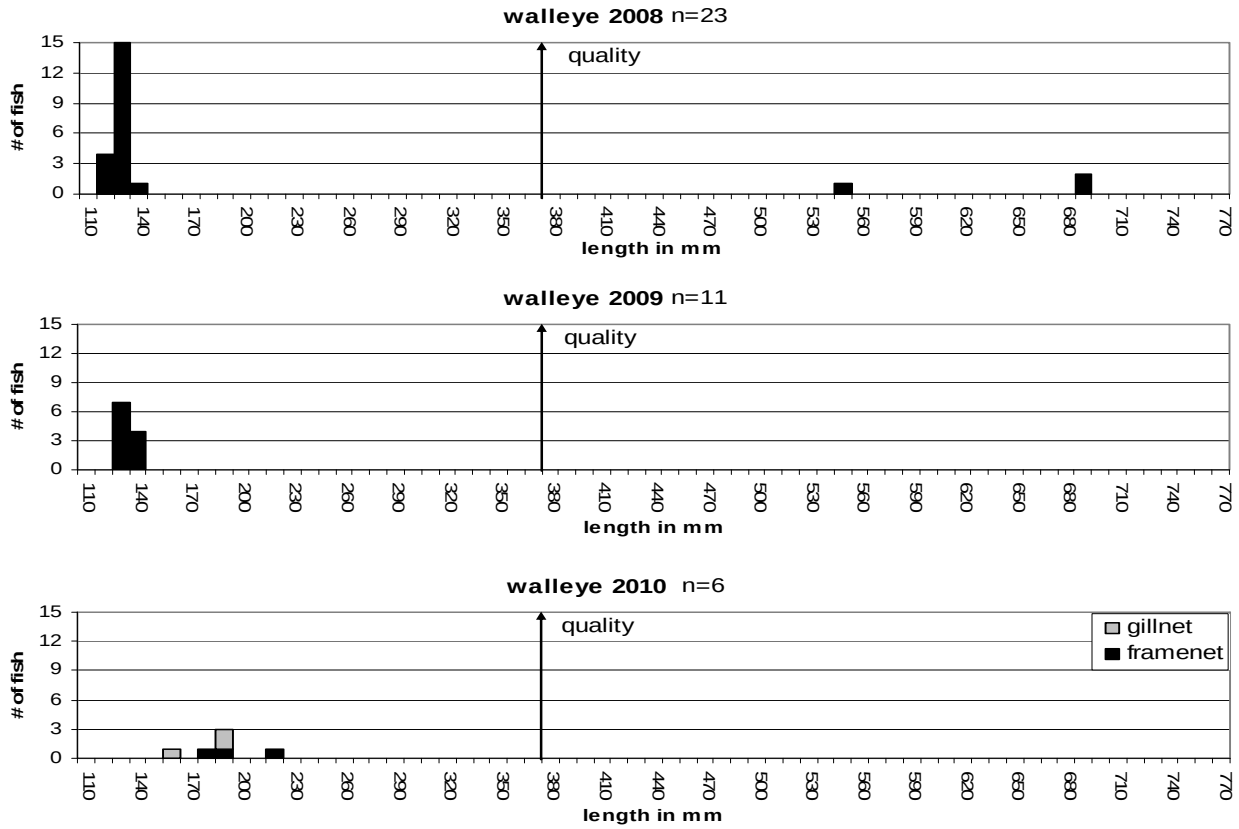


Figure 4. Length frequency histogram for walleye from electrofishing at Curlew Lake, October 16, 2008, gill nets on June 24-26, 2009 and framenet and gillnets on June 23-25, 2010.

RECOMMENDATIONS

1. Stock large walleye fingerling and adult largemouth bass to get predator densities up to influence panfish populations and help reach panfish management objectives.

2. Electrofish annually to get better data sets on walleye and largemouth bass.

3. Survey panfish populations every other year to document effects of the new management strategies.

APPENDICES

Appendix A. Stocking record for Curlew Lake, Meade County, 2001-2010.

Year	Number	Species	Size
2001	10,920	Largemouth bass	Fingerling
	4,760	Walleye	Fingerling
2002	13,600	Largemouth bass	Fingerling
2003	2,174	Walleye	Lg. Fingerling
2004	1,956	Walleye	Lg. Fingerling
2005 – 2007		Not stocked	
2008	46,990	Walleye	Fingerling
	13,000	Largemouth bass	Fingerling
2009	70	Channel catfish	Adult
	400	Yellow perch	Adult
	150	Largemouth bass	Adult
	23,960	Largemouth bass	Fingerling
	46,260	Walleye	Fingerling
2010	250	Golden shiner	Adult
	14,000	Walleye	Fingerling
	8,420	Largemouth bass	Fingerling

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Durkee Lake County: Meade
Legal description: Sec. 21 & 28, Twn. 12 N, R 17 E
Location from nearest town: 3 miles south of Faith, SD
Dates of present survey: June 29-30, 2010
Date last surveyed: June 23-24, 2008
Most recent lake management plan: F21-R-36 Date: 2004 - 2008
Management classification: Warmwater permanent
Contour mapped: 1993

Primary Species:(game and forage)	Secondary and other species:
1. Largemouth bass	1. Northern pike
2. Yellow perch	2. Channel catfish
3. Bluegill	3. Black bullhead
4. Black Crappie	4. Golden shiner

PHYSICAL CHARACTERISTICS

Surface Area: 70 acres; Watershed: 6,400 acres
Maximum depth: 20 feet; Mean depth: 15 feet
Lake elevation at survey (from known benchmark): full

1. Describe ownership of lake and adjacent lakeshore property:

The City of Faith owns Durkee Lake and the SD Department of Game, Fish and Parks manages the fishery in the lake. Hunting is illegal in or around Durkee Lake by city ordinance. A city-administered golf course is located adjacent to the lake.

2. Describe watershed condition and percentages of land use:

The inlet to Durkee Lake is Spook Creek. Most of the watershed is pasture land. Overgrazing contributes to moderate siltation.

3. Describe aquatic vegetative condition:

Rooted aquatic vegetation consists of bulrushes and cattails. The vegetation covers approximately 90% of the shoreline. Submerged vegetation is excessive from mid-summer until freeze up in all water under 8 feet.

4. Describe pollution problems:

Siltation due to natural erosion and cattle grazing has decreased depth and area of the lake. No other pollution problems were identified by department personnel during the 2010 survey.

5. Describe condition of all structures, (i.e. spillway, level regulators, boat ramps, etc.):

The dam grade was repaired in 1997 and is in good condition.

BIOLOGICAL DATA

Methods

Netting

A lake survey was conducted at Durkee Lake on June 29-30, 2010. Sampling consisted of 1 gillnet night and 4 trap net nights (Figure 1). The gillnet was a monofilament experimental net measuring 45.7 m (150ft) long and 1.8 m (6ft) deep with six 7.6 m (25ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Trap nets were set at four stations consisting of 4 trap-net nights each. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 inch) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g). In addition, scale samples for the first five fish per centimeter group were collected from selected fish species per gear type for age and growth analysis. Scale samples were pressed onto acetate slides and viewed with a microfiche projector (40X) and the distances of annuli from scale focus were recorded on paper strips.

Data Analysis

Fish population parameters calculated were catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean CPUE (number per net night). Population structural characteristics were expressed as length frequency histograms and PSD and RSD-P values. Fish condition was expressed as mean Wr.

Results and Discussion

Fish Community Survey

Six fish species were collected during the lake survey conducted June 29-30 at Durkee Lake (Tables 1 and 2). A total of 3,026 fish were sampled in the trap net survey with black bullhead comprising 97.8%. Bluegill (1.6%) was the second most abundant species in the trap net. The gillnet catch showed similar results with 42 of the 57 fish caught being bullheads. Northern pike were second at 1.1%. Other species collected in survey include black crappie, largemouth bass and yellow perch.

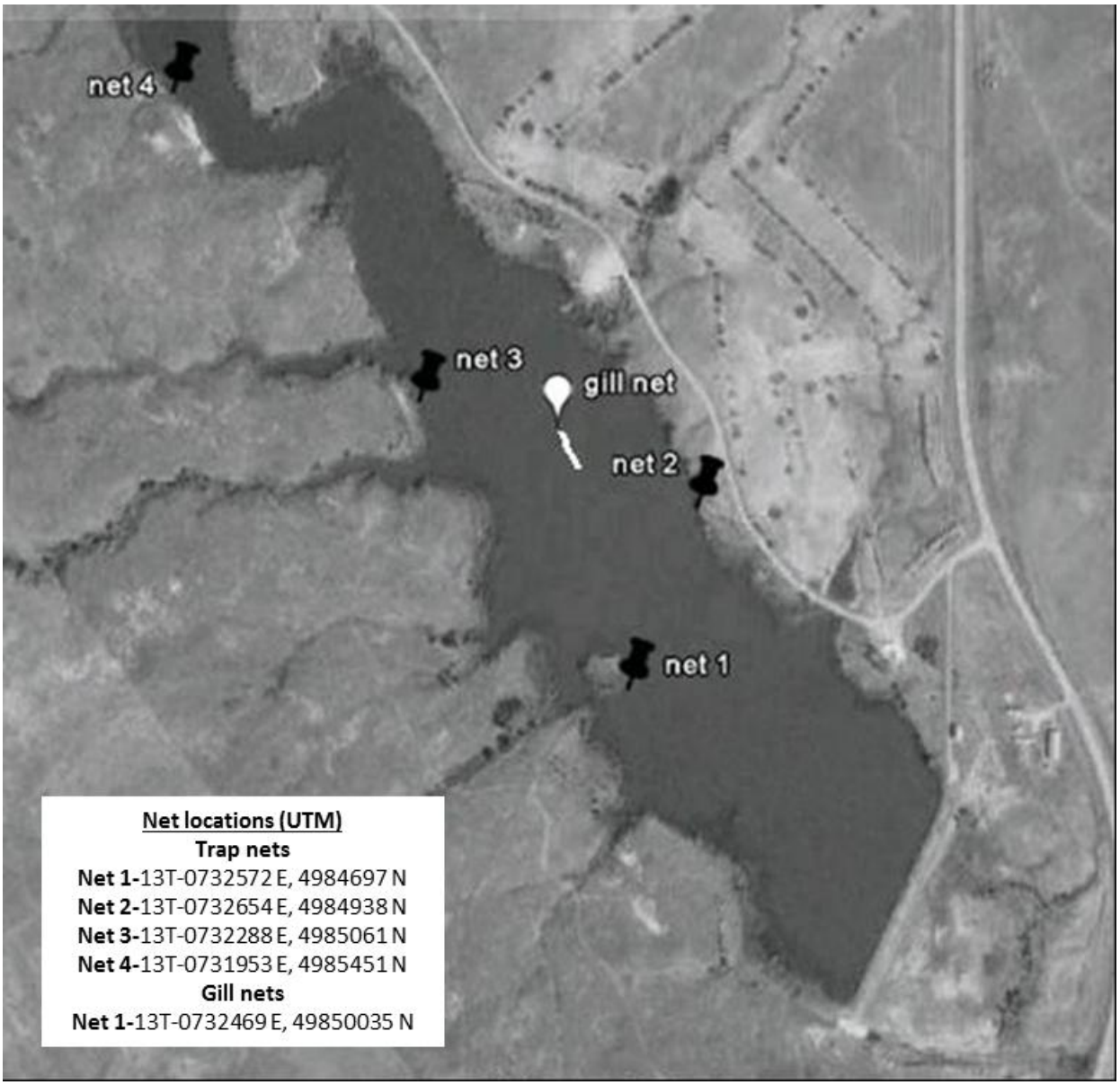


Figure 1. Map of Durkee Lake and net locations during 2010 survey.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock length; 80% CI's) for all fish species collected from four, ¾ inch trap nets in Durkee Lake, Meade County, June 29-30, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black bullhead	2,959	739.8 (352.3)	490.5 (724.1)	54 (2)	5 (1)	91.0 (2.8)
Black crappie	1	0.3 (0.4)	0.3 (0.4)	--	--	82.5 (--)
Bluegill	49	12.3 (8.0)	12.3 (8.0)	49 (12)	16 (9)	108.8 (1.5)
Largemouth bass	1	0.3 (0.4)	0.3 (0.4)	--	--	98.3 (--)
Northern pike	2	1.8 (1.0)	1.8 (1.0)	--	--	85.7 (5.6)
Yellow perch	14	3.5 (1.7)	3.5 (1.7)	43 (39)	29 (35)	94.8 (1.0)
Total	3,026					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock length; 80% CI's) for all fish species collected from one 150-ft experimental sinking gill net in Durkee Lake, Meade County, June 29-30, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black bullhead	42	42.0 (--)	5.0 (--)	20 (43)	0	102.1 (6.4)
Black crappie	2	2.0 (--)	0.0 (--)	--	--	132.5 (--)
Bluegill	2	2.0 (--)	2.0 (--)	--	--	106.7 (0.0)
Northern pike	6	6.0 (--)	6.0 (--)	--	--	97.9 (3.4)
Yellow perch	5	5.0 (--)	0.0 (--)	--	--	--
Total	57					

Bluegill

Bluegills were again present in the 2010 survey after none were sampled in 2008. Efforts were made to reestablish bluegill by stocking 50 adult and 22,000 fingerlings during the summer of 2008. Trap net CPUE was 12.3 (Table 1). All fish sampled were over stock length (Figure 2). Size structure was good with a PSD of 46 and an RSD-P of 16. Condition was also good with a mean Wr for stock length and larger fish at 108.8.

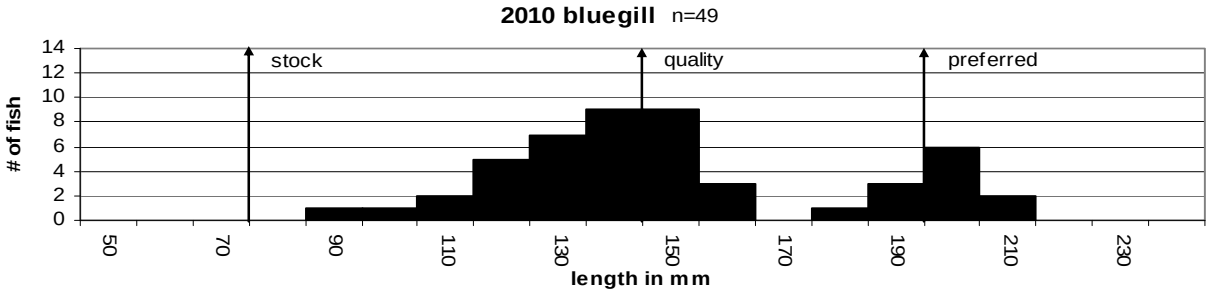


Figure 2. Length frequency histogram of bluegill collected in Durkee Lake 2010.

Black Bullhead

Black bullheads are overabundant in Durkee Lake. Black bullhead was the most prevalent species sampled during this survey as it was in the 2008 survey. In 2008, trap net CPUE was 74.0 and gillnet CPUE was 13.0. In 2010, abundance was higher with a trap net CPUE of 739.8 and a gill net CPUE of 42. Size structure was similar to that of the last survey with a PSD of 54 and a RSD-P of 5 this year, compared to PSD of 58 and RSD-P of 1 in 2008. Not surprisingly, fish condition dropped with a mean Wr for stock length and larger fish of 91.0 down from 99.3 in the last survey. The length frequency indicates two large year classes dominating the lake right now (Figure 3).

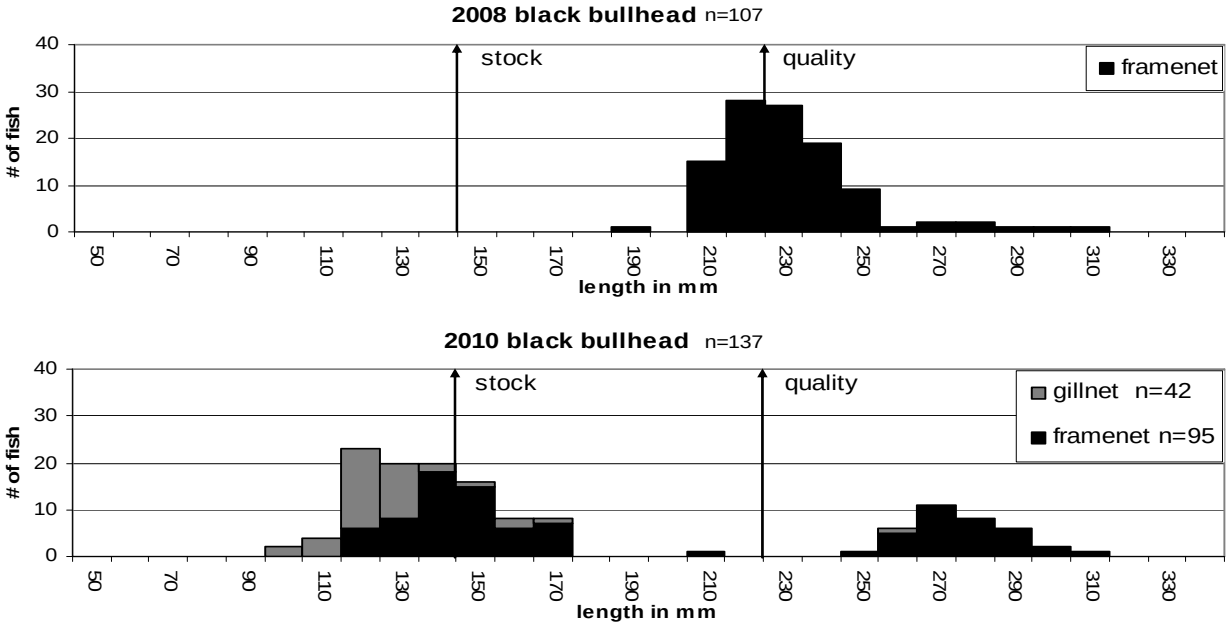


Figure 3. Length frequency histogram of black bullhead collected in Durkee Lake, 2008, 2010.

Northern Pike

The pike population seems to be about the same density as in the survey in 2008 when trap net CPUE was 2.6 and gillnet CPUE was 6.0. During this survey, trap net CPUE was 1.8 with a gillnet CPUE of 6 (Tables 1 and 2). The six pike sampled in the trap nets yielded an average Wr for stock length and larger fish of 97.9, which is excellent for a small impoundment in western South Dakota (citation?). Sizes of sampled northern pike ranged from 370mm to 720mm (Figure 4).

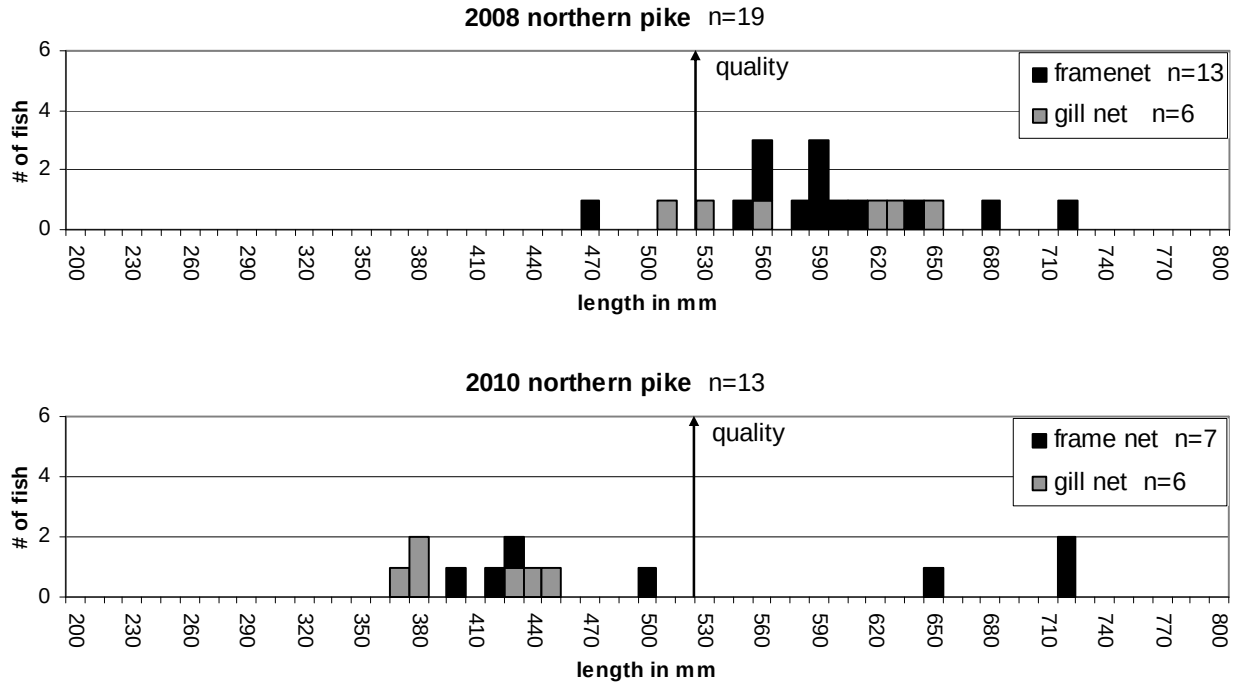


Figure 4. Length frequency histogram of northern pike collected by trap nets and gill nets in Durkee Lake, 2008, 2010.

Yellow Perch

The perch population also remained similar to 2008 when gill net CPUE was 6.0 and trap net CPUE was 2.2. During this survey, gill net CPUE was 5.0 and trap net CPUE was 3.5 (Tables 1 and 2). Fish condition was good with a Wr for 5 inch and longer fish of 94.8. The length frequency shows a low density population with recruitment occurring (Figure 5). The improved water conditions should allow the perch population to grow and provide a quality fishery and forage for bass.

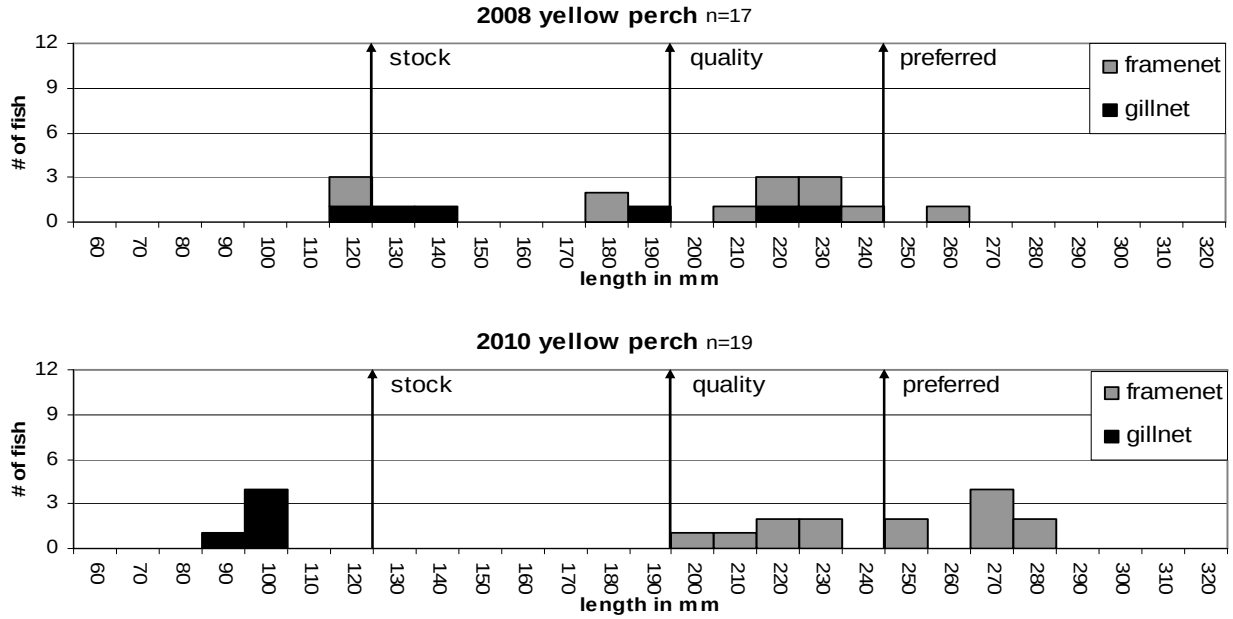


Figure 5. Length frequency histogram of yellow perch collected in Durkee Lake, 2008, 2010.

Largemouth Bass

During the 2008 largemouth bass abundance was extremely low. During late summer and early fall, 200 adult bass and 10,000 fingerlings were stocked. The fall 2008 electrofishing survey showed a low density population with ten adult bass in sixty minutes of electrofishing. Eleven hundred fifty five juvenile bass were stocked in 2009. The 2009 fall electrofishing sample yielded 182 bass. The 2009 length frequency shows most of the fish were probably age-1 fish and in good density (Figure 6).

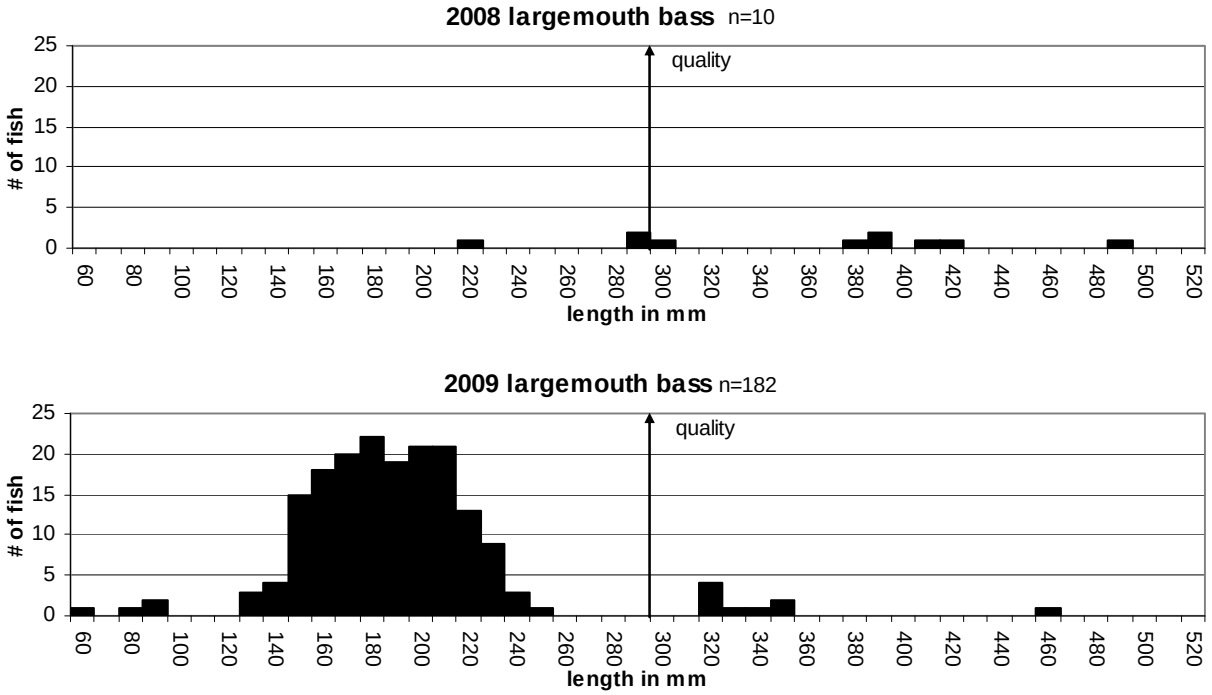


Figure 6. Length frequency histogram of largemouth bass collected by electrofishing in Durkee Lake, October 7, 2008 and September 24, 2009.

RECOMMENDATIONS

1. Continue conducting electrofishing surveys on an annual basis to monitor the largemouth bass population in Durkee Lake.

2. Evaluate panfish and bullhead populations in 2011 with a netting survey along with bullhead removal.

APPENDIX

Appendix A. Stocking record for Durkee Lake, Meade County, 2000, 2002, 2008 and 2009.

Year	Number	Species	Size
2000	500	Black crappie	Adult
	8500	Largemouth bass	Fingerling
2002	7700	Largemouth bass	Fingerling
	589	Largemouth bass	Adult
	100	Smallmouth bass	Adult
2008	192,500	Northern pike	Fry
	50	Bluegill	Adult
	22,000	Bluegill	Fingerling
	200	Largemouth bass	Adult
	10,000	Largemouth bass	Fingerling
2009	1,155	Largemouth bass	Juvenile
	150	Black crappie	Adult

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Opal Lake County: Meade
Legal description: Sec. 16, Twn. 11 N, R 14 E
Location from nearest town: 17 miles west, 9 miles south of Faith, SD
Dates of present survey: June 28-29, 2010
Date last surveyed: May 24-25, 2005
Most recent lake management plan: F21-R-38 Date: 2006
Management classification: Warmwater permanent
Contour mapped: 1995

Primary Species:(game and forage)	Secondary and other species:
1. Yellow perch	1. Largemouth bass
2. Northern pike	2. Black bullhead
3. Bluegill	3.

PHYSICAL CHARACTERISTICS

Surface Area: 31.3 acres (12.7 ha); Watershed: 4,500 acres
Maximum depth: 18 feet; Mean depth: 7.5 feet
Lake elevation at survey (from known benchmark): full

1. Describe ownership of lake and adjacent lakeshore property:

Opal Dam is situated on 200 acres of Game Production Area owned and managed by the South Dakota Department of Game, Fish and Parks. The entire acreage is fenced with an autogate for access. Access to the GPA is provided along a section line trail. Access is restricted to fair weather; the road is very limited for travel during wet periods.

2. Describe watershed condition and percentages of land use:

The watershed of Opal Dam is almost entirely used for livestock grazing, some of the watershed is planted into small grain. Part of the GPA does have tree rows planted for habitat enhancement of wildlife.

3. Describe aquatic vegetative condition:

During the summer, vast areas of submergent vegetation (coontail, buttercup, potamogeton) are along the shoreline. Except for the riprap of the dam, emergent vegetation (cattails and reeds) surrounds much of the lake. Shoreline angling is hampered in midsummer to late fall because of vegetation.

4. Describe pollution problems:

Department personnel identified no pollution problems during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

Opal Dam has a new spillway (installed in 1994) and a boat ramp was installed in 2005.

BIOLOGICAL DATA

Methods

Netting Survey

A lake survey was conducted on Opal Lake on June 28-29, 2010. Sampling consisted of one gill net night and 4 trap net nights (Figure 1). The gill net was a monofilament experimental net 45.7 m (150-ft) long and 1.8 m (6-ft) deep with six 7.6 m (25-ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). All trap nets were modified fyke-nets with a 1.3 X 1.5-m frame, 19.1 mm (0.75 inch) mesh and a 1.2- X 23-m (3.9- X 75.5-ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g). In addition, scale samples for the first five fish per centimeter group were collected from selected fish per gear type for age and growth analysis. Scale samples were pressed onto acetate slides and viewed with a microfiche projector (40X) and the distance between scale annuli were recorded on paper strips.

Data Analysis

Fish population parameters calculated were catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as mean catch per unit effort (CPUE; mean number per net night or mean number per hour of electrofishing). Actual pedal time (time the electrofishing unit produced current) was recorded from the digital display on the control box and used to calculate electrofishing CPUE. Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

Results and Discussion

Opal Lake was dry in 2007 and refilled in 2008. Since it refilled it has been stocked with northern pike, bluegill and yellow perch. All three were sampled in this survey (Tables 1 and 2). In addition to the stocked fish, black bullhead showed up in the nets.

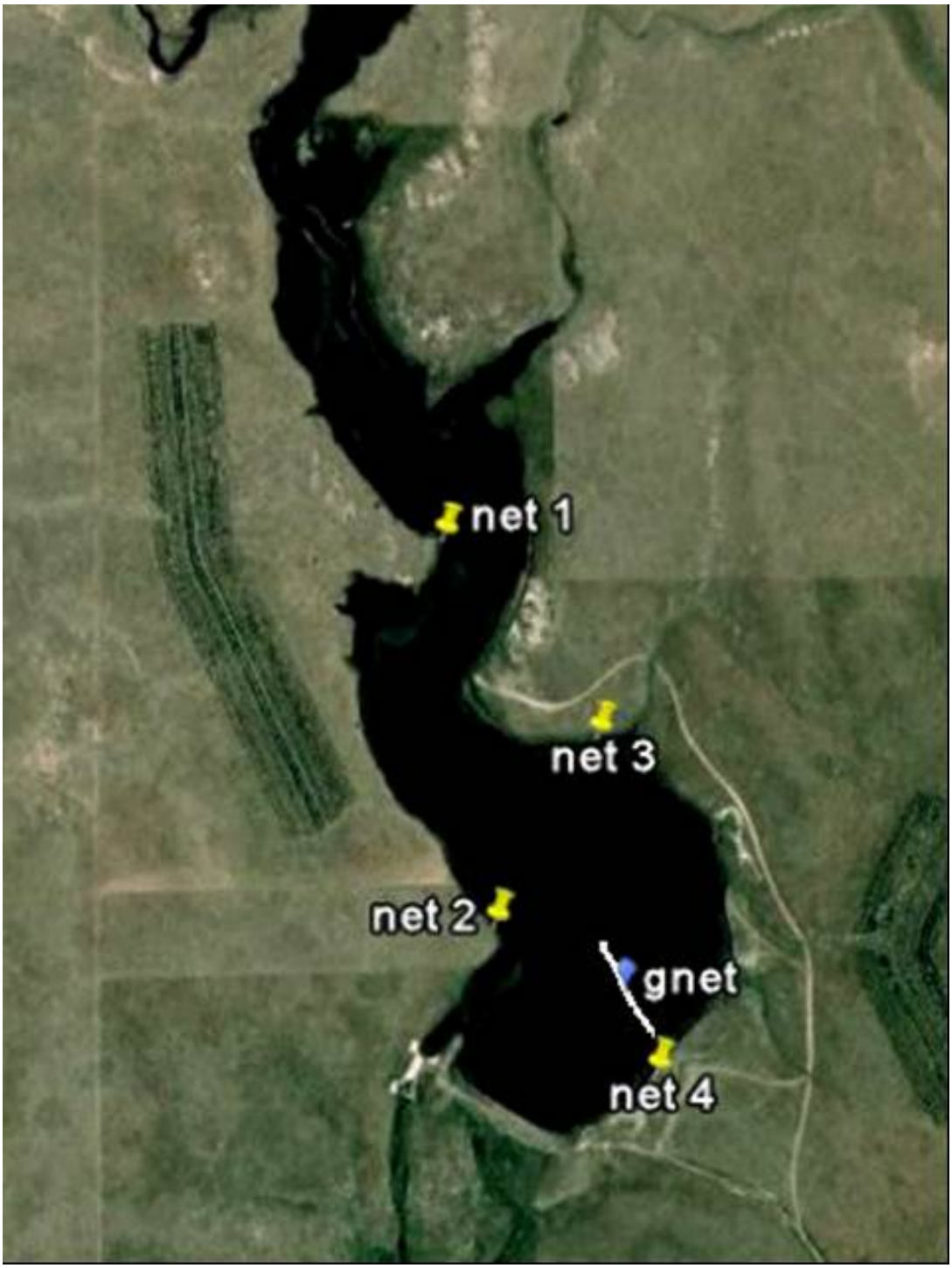


Figure 1. Aerial view of Opal Lake and location of net sites during 2010.

Table 1. Total catch (N), catch per net night (CPUE), catch per net night of stock-length fish (CPUE-S), proportional stock-densities (PSD, RSD; 90% CI's in parentheses) and condition factor (mean Wr for stock length and larger fish) for all fish species from four trap nets in Opal Lake, Meade County, June 28-29, 2010.

Species		CPUE	CPUE-S	PSD	RSD-P	Wr>S
Black bullhead	20	5.0 (5.0)	4.5 (4.1)	0	0	82.5 (0.6)
Bluegill	2	0.5 (0.5)	0.5 (0.5)	--	--	112.0 (--)
Northern pike	4	1.0 (0.7)	0.5 (0.5)	--	--	86.3 (--)
Yellow perch	2	0.5 (0.5)	0.3 (0.4)	--	--	103.9 (--)
Totals	28					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's in parentheses), proportional stock densities (PSD, RSD; 90% CI's in parentheses) and condition factor (mean Wr for stock-length and larger fish) for all fish species from one experimental gill net in Opal Lake, June 28-29, 2010.

Species		CPUE	CPUE-S	PSD	RSD-P	Wr>S
Black bullhead	2	2.0 (--)	2.0 (--)	--	--	106.8 (9.6)
Northern pike	10	10.0 (--)	5.0 (--)	40 (52)	0	92.2 (3.6)
Yellow perch	16	16.0 (--)	0.0 (--)	0	0	--
Totals	28					

Bluegill

Before Opal went dry it had a very high quality bluegill fishery with some fish in the 1.5 pound range. Bluegills were reintroduced in 2008 after the lake refilled. During this survey, only two bluegill were sampled in the four trap net sample (Table 1).

Black Bullhead

Black bullhead was most abundant species sampled in the trap net. Trap net CPUE was 5.0 with none of the fish being over quality length (Table 1; Figure 2). Plans to reduce and keep bullhead density down are to build predator populations (i.e. northern pike and largemouth bass). Bullheads were not stocked since the lake went dry. It is believed that bullheads washed in from a dam further up the watershed during high water.

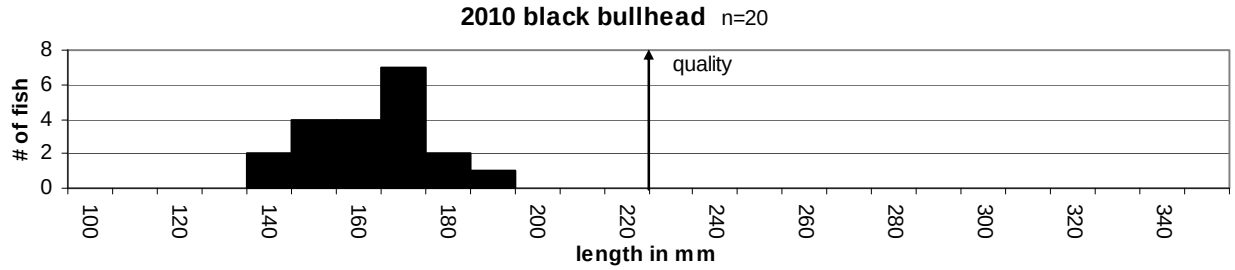


Figure 2. Length frequency histogram for black bullheads from trap nets at Opal Lake, 2010.

Northern Pike

Northern pike fry were stocked in 2008 to reestablish them after the lake went dry during the recent drought. One gill net night caught ten northern pike while the trap nets averaged one per night (Tables 1 and 2). The length frequency histogram shows at least two separate year classes (Figure 3). Pike are the only predator fish currently being established in the lake.

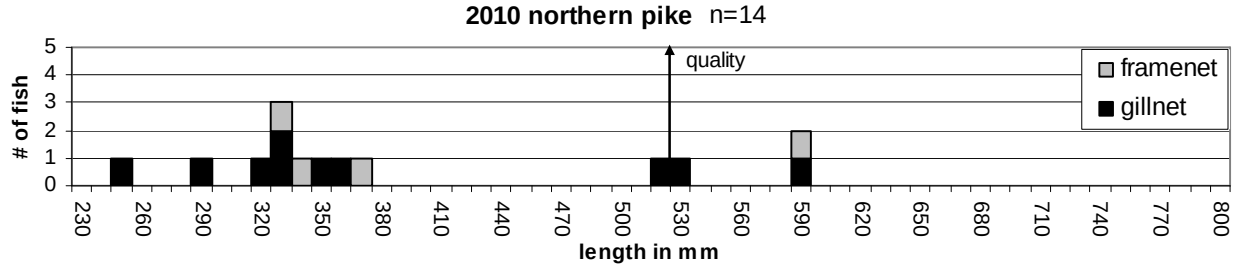


Figure 3. Length frequency histogram for northern pike from gill nets and trap nets at Opal Lake, 2010.

Yellow Perch

Two perch were sampled in the trap nets and 16 were caught in the gill net (Tables 1 and 2). Before the lake went dry Opal Lake had large perch. Two perch sampled in 2003 were over 13 inches. Stocked adults should provide enough brood fish to reestablish this fishery. The majority of the fish sampled appear to be one year olds ranging from 90 mm to 100 mm (Figure 4).

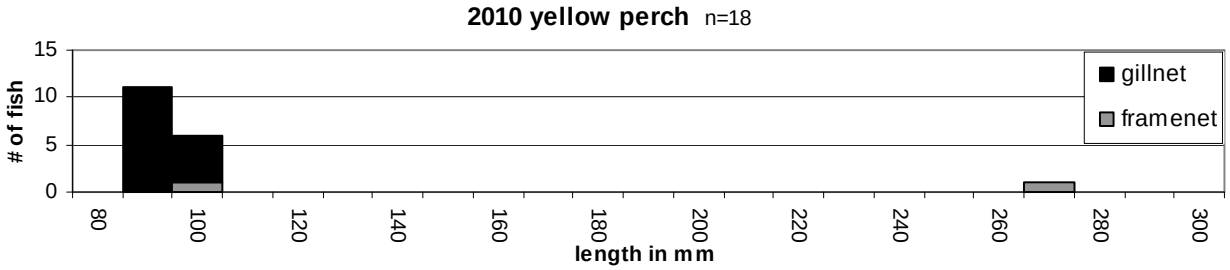


Figure 4. Length frequency histogram for yellow perch from gill nets and trap nets at Opal Lake, 2010

RECOMMENDATIONS

1. Continue conducting surveys on a biannual basis to monitor the fish population in Opal Lake. Include night electrofishing in the standard survey to monitor the largemouth bass population.

2. Stock largemouth bass fingerlings or adults when available to reestablish bass since lake went dry in 2007.

APPENDICES

Appendix A. Stocking record for Opal Lake, Meade County, 2008-2010.

Year	Number	Species	Size
2008	192,500	Northern pike	Fry
	20	Bluegill	Adult
	200	Bluegill	Juvenile
	10,000	Bluegill	Fingerling
	200	Yellow perch	Adult
2010	200	Yellow perch	Adult

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Deerfield Reservoir County: Pennington
Legal description: Sec. 25,R2E,T1N and Sec 19, 20, 29, 30, 32,R3E,T1N
Location from nearest town: 12 miles northwest of Hill City, South Dakota
Dates of present survey: August 18-20, 2010
Date last surveyed: August 24-25, 2009
Most recent lake management plan: F21-R-40 Date: 2008 - 2012
Management classification: Coldwater Permanent
Contour mapped: 1987

Primary Species: (game and forage)
1. Hatchery rainbow trout
2. Splake trout
3. Lake chub

Secondary and other species:
1. White sucker
2. Golden shiner
3. Rock bass
4. Yellow perch

PHYSICAL CHARACTERISTICS

Surface Area: 435 acres (176 ha); Watershed: 60,800 acres
Maximum depth: 29 m (95 ft.); Mean depth: 10.7 m (35 ft.)
Lake elevation at survey (from known benchmark): 99 % full

1. Describe ownership of lake and adjacent lakeshore property:

The Bureau of Reclamation maintains and operates Deerfield Reservoir and dam. The United States Forest Service (USFS) maintains and operates the campground and boat launch facilities at Deerfield Reservoir.

2. Describe watershed condition and land use:

The Deerfield watershed consists of approximately 95 square miles of forested land located within the Black Hills National Forest. The USFS has management authority on approximately 75% of the watershed and the remaining 25% is controlled by private landowners. A small portion of the privately owned land is cultivated and most of the remaining private land is open meadowland used for grazing or haying interspersed with coniferous forest.

3. Describe aquatic vegetative condition:

Vegetation density in most of the reservoir is low. In the shallow ends of most bays and at the inlet of Castle Creek and Gold Run Creek, small concentrations of heavy vegetation were present.

4. Describe pollution problems:

Minor pollution occurs from silt and nutrients washing into Deerfield Reservoir from Castle/Ditch Creek and Gold Run Creek as well as other smaller drainages flowing into the lake. Cattle grazing on the entire watershed, a limited amount of agricultural tillage, and cattle feeding contribute to siltation and nutrient loads. Silt deposits and weed growth in the upper portions of bays reflects these activities.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

The dam and spillway were reconstructed in 1986. A new valve at the outlet of Deerfield Reservoir was installed in December of 1995 allowing more precise control of flows into Castle Creek, which improved habitat for trout in the stream. The USFS is responsible for management and repair of boat ramps at Deerfield Reservoir. The south boat launch was renovated with concrete blocks in 2005.

BIOLOGICAL DATA

Methods

Four gill nets and two trap nets were set in standardized locations on August 17, 2010 and two trap nets were set on August 19, 2010 (Figure 1). All nets remained in the water overnight for a total of four trap net and four gill net nights. Trap nets were modified fyke-nets with a 1.3 × 23 m (3.9 × 75.5-ft.) lead. The gill nets were monofilament experimental nets 45.7m (150-ft) long and 1.8m (6-ft) deep with six 7.6m (25-ft) panels of bar mesh sizes: 12.7mm (0.5 in), 19.1mm (0.75 in), 25.4mm (1.0 in), 31.8mm (1.25 in), 38.1mm (1.5 in), and 50.8mm (2.0 in).

Results and Discussion

Seven fish species were caught in both gill nets and trap nets totaling 659 and 603 fish respectively (Tables 1 and 2). In gill nets yellow perch were the most abundant comprising 45.5% of the total. Rock bass were the second most abundant with 30.5% and white sucker being third at 14%. Rock bass were the most abundant in trap nets at 73.8% of the total.

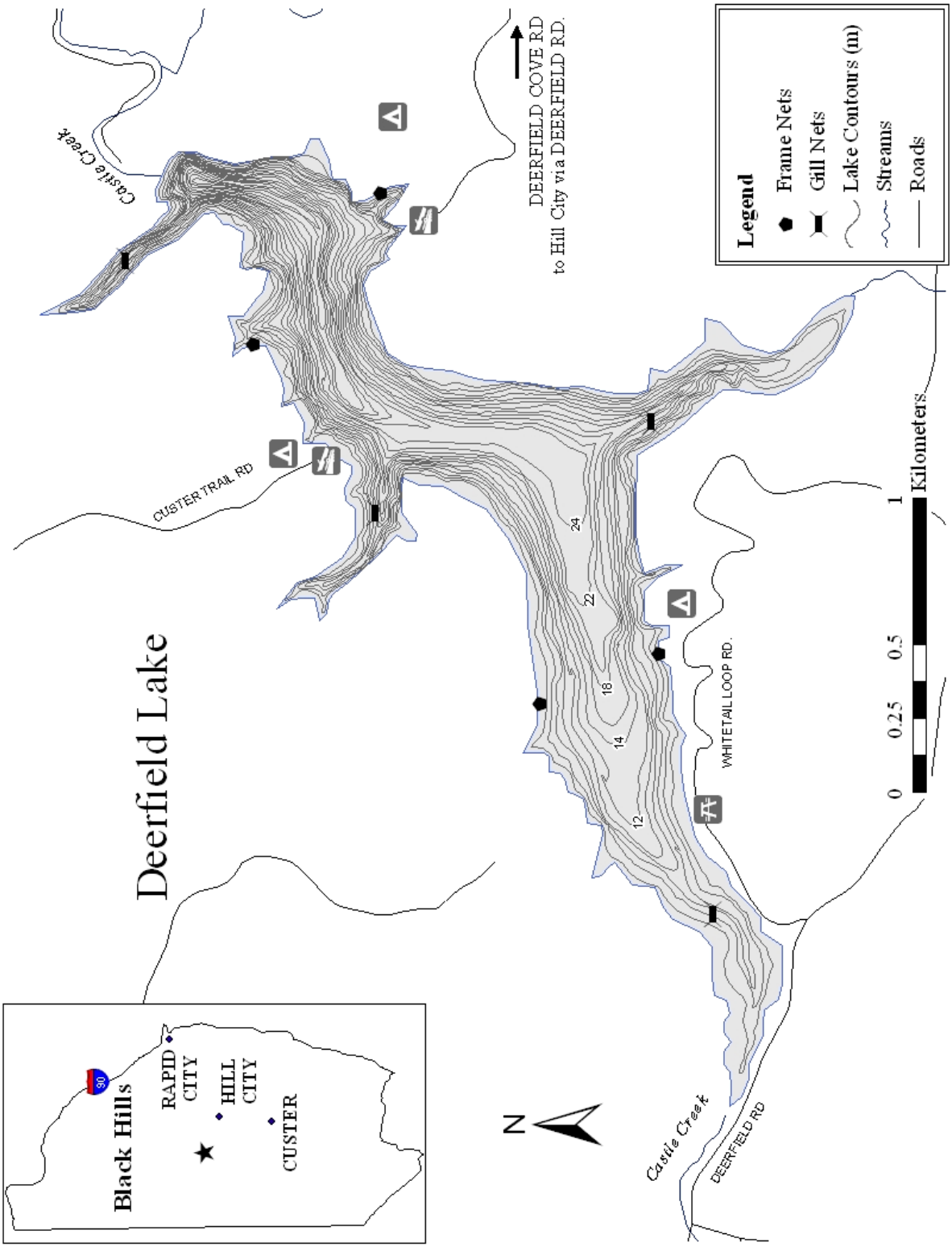


Figure 1. Map of net locations for fisheries survey on August 17-20, 2010 of Deerfield Reservoir, Pennington County, South Dakota

Table 1. Total catch for four experimental gill nets in Deerfield Reservoir, Pennington County, South Dakota on July 18-19, 2010. Parameters are reported with confidence intervals.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	Wr≥S (90%)
Brook trout	15	3.8 (4.6)	3.75	93	--	98.7
Splake trout	2	0.5 (0.8)	--	--	--	--
Golden shiner	16	4 (3.5)	--	-	--	--
Rainbow trout	30	7.5 (5.4)	7.5 (5.4)	0	0	69
Rock bass	201	50.2 (62.2)	48 (59.5)	14 (4)	9 (3)	86 (2.2)
White sucker	95	23.8 (22)	23.8 (22)	100	96 (3)	100 (4)
Yellow perch	300	75 (76)	66.7 (66.3)	39 (5)	0	92 (2)
Total	659					

Table 2. Total catch for four trap nets in Deerfield Reservoir, Pennington County, South Dakota on July 17-20, 2010. Parameters are reported with confidence intervals.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	Wr≥S (90%)
Brook trout	31	7.8 (11.6)	4	55	0	90
Splake trout	1	0.25 (0.4)	--	--	--	--
Golden shiner	22	5.5 (6)	--	--	--	--
Rainbow trout	18	4.5 (3.3)	4.5 (3.3)	0	0	59.7
Rock bass	445	111 (54.7)	87.8 (41.6)	0	0	84 (2)
White sucker	26	6.5 (8)	6.5(8)	100	100	91 (1)
Yellow perch	60	15 (11.7)	14 (10)	25 (10)	0	88 (4)
Total	603					

Rainbow Trout

Rainbow trout are currently stocked into Deerfield Reservoir at a rate of about 2,000 per month, May through October (Appendix A). Survey catch rates (CPUE) and condition (Wr) are heavily influenced by stocking dates and condition from the hatchery. All rainbows stocked into Deerfield Reservoir are around 279 mm (11 inches). Thirty rainbow trout were collected during the survey out of four gill nets in 2010 for a CPUE of 7.5 (Table 1). Fish condition measured by Wr was 69. Table 3 shows number of trout stocked, catch rates, and fish condition from the last six years. Length frequencies (Figure 2) are consistent with stocked fish, showing that most are between 280 and 350 mm.

A study is currently underway looking at the potential contribution of naturally reproduced rainbow trout in Deerfield Reservoir and Castle Creek above the dam. Stocked rainbow trout have been clipped since August 2008. During the 2010 survey, ten of the 30 fish captured in gill

nets and 11 of the 18 in trap nets were not clipped. This indicates that they were either stocked prior to Aug 2008, regenerated their clipped fins, or are from natural reproduction.

Table 3. Number of catchable rainbow trout stocked, (N) number sampled, number caught per gill net (CPUE), and average condition (Wr) for Deerfield Reservoir, 2004-2010.

Year	# Stocked	N	CPUE (80%CI)	Mean Wr
2004	12,010	86	21.5 (9.3)	75.6
2005	12,010	64	16.0 (12.0)	74.2
2006	12,124	77	19.3 (13.6)	74.2
2007	8,400	71	17.8 (8.6)	67.0
2008	12,280	53	13.3 (5.3)	79.1
2009	11,883	17*	8.5 (7.7)	81.9
2010	11,864	30	7.5 (5.4)	69.1

*Only 2 nets were set and in different locations than previous years.

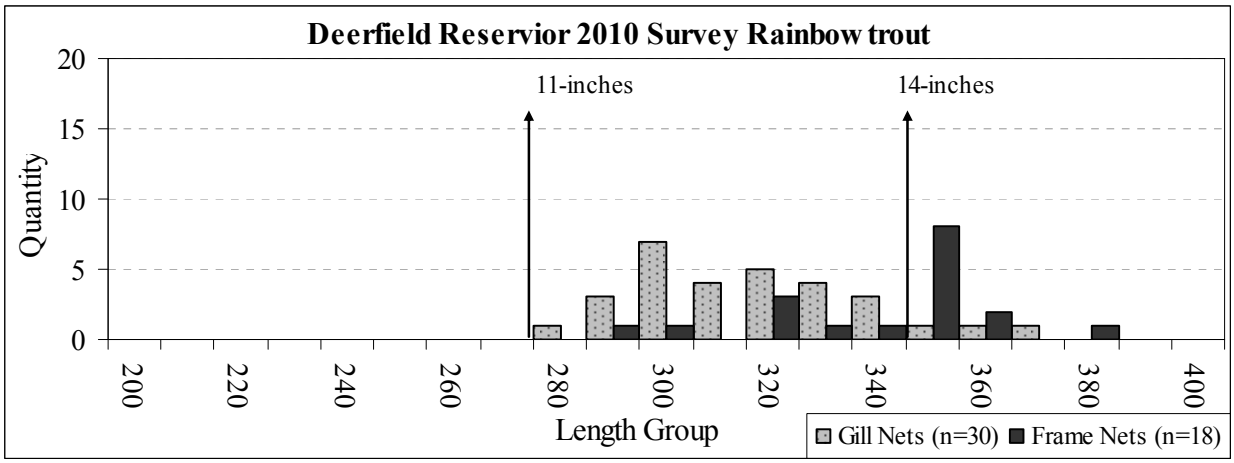


Figure 2. Length frequency histogram for rainbow trout collected from Deerfield Reservoir, Pennington County, South Dakota in 2010.

Rock Bass

In 2008, trap nets were added to the annual sampling. In 2010, rock bass were the most abundant species captured, comprising 30% and 74% of the fish caught in gill nets and trap nets, respectively. CPUE for trap nets was 111, compared to 112 and 212 in 2008 and 2009, respectively. Size structure indicated most of these fish were in the 100-150 mm range (Figure 3). Fish condition was low at 86 for gill nets and 84 for trap nets, which would be expected with an overabundance of small fish. Many anglers have complained that high catches of small rock bass hinder their ability to catch sought after species such as trout. Rock bass removal may be necessary during the spring and could coincide with white sucker removal and/or perch trap and transfer.

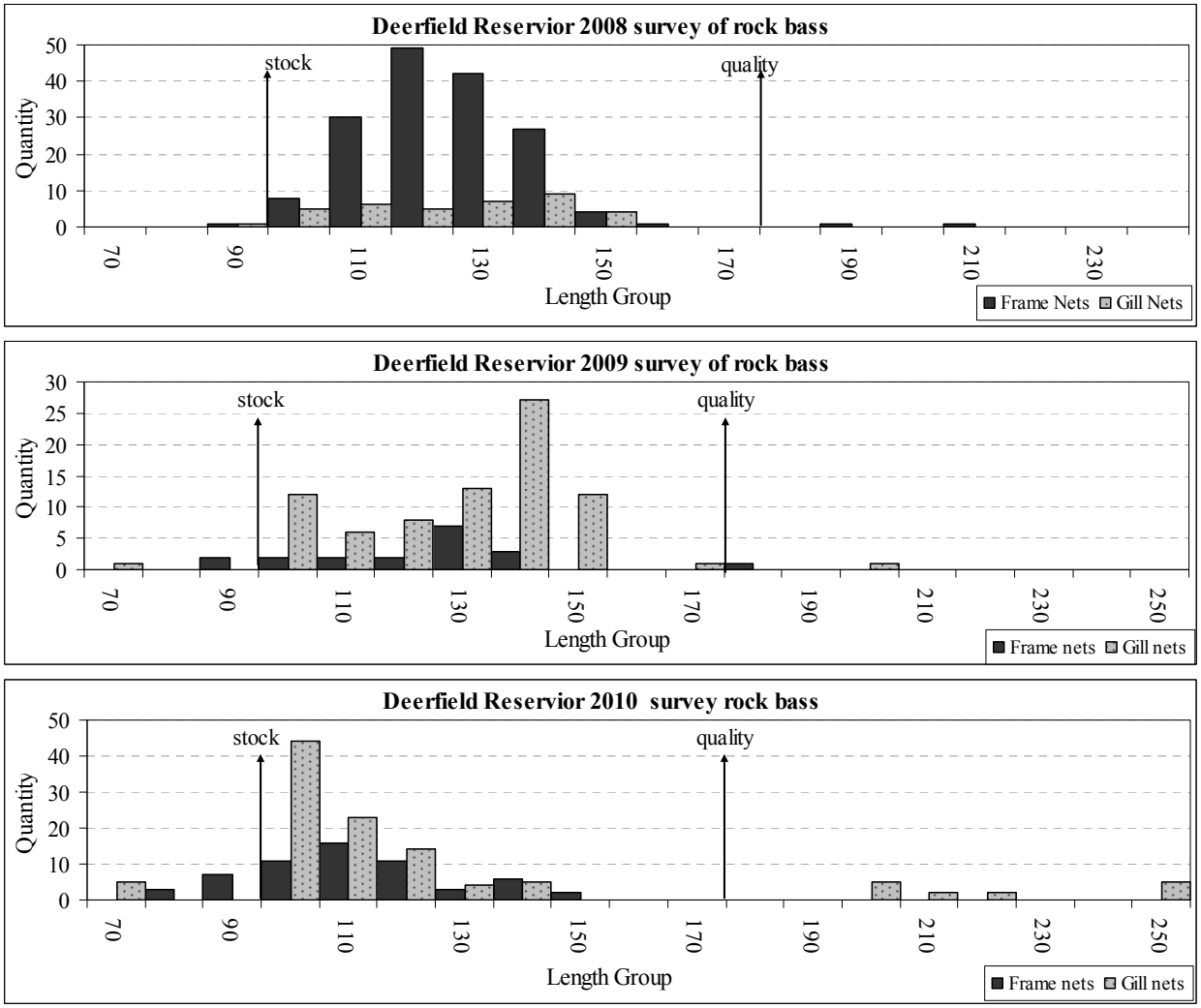


Figure 3. Length frequency histogram for rock bass captured during surveys of Deerfield Reservoir in 2008-2010. Only measured fish are shown.

Splake Trout

Splake trout are a cross between a brook trout and lake trout. Catchable splake (11-inches) were stocked in Deerfield Reservoir for the first time in 2006. In the 1990s, fingerlings or medium sized fish were stocked. The 2006 stocked fish were adipose clipped to identify them from other splake already occurring in the lake. Only three fish were captured during the 2010 survey, two in gill nets and one in trap nets. This is a substantial difference from previous years (Tables 1 and 2). No clips were observed from the 2006 stocking during the 2009 or 2010 survey. Condition has also been low for splake captured during surveys with values in the 70's, however, late winter ice angling has produced record and near record splake in the last couple of years.

Table 4. Number of catchable splake trout stocked, (N) number sampled, number caught per gillnet (CPUE), and average fish condition (Wr) for Deerfield Reservoir, 2004-2010.

Year	# Stocked	N	CPUE (80%CI)	Wr
2004	0	44	11.0 (6.3)	77.2
2005	0	26	6.5 (2.2)	78.1
2006	7,164	78	19.5 (10.8)	79.2
2007	0	48	12.0 (6.0)	72.9
2008	0	84	21.0 (5.5)	79.7
2009	0	16	8.0 (12.3)	73.1
2010	0	2	0.5 (0.8)	71.3

White Sucker

White suckers were sampled in 1993, 11 years after a 1982 chemical renovation. White sucker density appeared to increase dramatically in the late 1990's. Due to this increasing number of white suckers, removal efforts were conducted from 1999 to 2001 (Table 5). Trap nets with ¾ inch mesh were used to catch white suckers during their spawning period. The collected suckers were removed from Deerfield Reservoir in an attempt to reduce the overall density of white suckers in the lake and prevent some reproduction. From 2000-2002, a decline in the CPUE of white suckers occurred, but an increase in CPUE was observed again in 2003 and 2004 (Table 5; Figure 4). Removals were again initiated in 2006 with an estimated seven tons of suckers removed that year (Table 5). The CPUE value was lower in 2006 compared to 2005 suggesting a small impact may have been made. The CPUE again dropped by 10 fish per net in 2007 and another 4.8 decrease in 2008. Suckers were not removed in 2010 due to the rainbow trout study and that substantially fewer were caught in the spring removal in 2009. Abundance (CPUE) was back up to around 24 in 2009 and 2010, similar to 2006.

In 2009, only two nets were set in different locations and confidence intervals were very high. Sucker condition was high in 2009 and 2010 with a mean Wr for stock length and larger fish of around 100. This is the highest recorded in recent years.

Size structure of white suckers appears to have increased in recent years with a majority of fish over preferred length (330 mm or 13 inches)(Figures 5 and 6). This is an increase in PSD-P from 40 in 2001 to almost 100 in 2010. Also the proportion of memorable PSD-M length fish (410mm or 16in) has increased from near zero in 2001 to almost 60 in 2010. White sucker removal may be necessary to keep numbers down; however it is uncertain what impact a high density of suckers has on the Deerfield Reservoir sport (trout) fishery.

Table 5. Summary of white suckers removed by trap nets and parameters are for fish collected during gillnet surveys from Deerfield Reservoir, South Dakota, 1999-2010.

Year	N Removed	Pounds Removed	Mean Weight (lbs)	CPUE	Wr≥S
1999	3,136	4,504	1.4	85.5 (--)	
2000	9,571	13,400	1.4	52.8 (--)	
2001	4,355	5,401	1.2	46.5 (29.0)	
2002	0	0	--	22.3 (14.0)	
2003	0	0	--	26.8 (23.1)	
2004	0	0	--	36.3 (14.0)	89.8
2005	0	0	--	35.0 (18.3)	90.7
2006	9,020	14,432	1.6	25.8 (13.5)	89.3
2007	1,064	1,809	1.7	15.8 (13.5)	93.4
2008	4,706	8,000	1.7	11.0 (7.8)	94.7
2009	1,500	2,600	1.7	24.0 (49.2)	101.0
2010	0	0	--	23.8 (22)	100.0

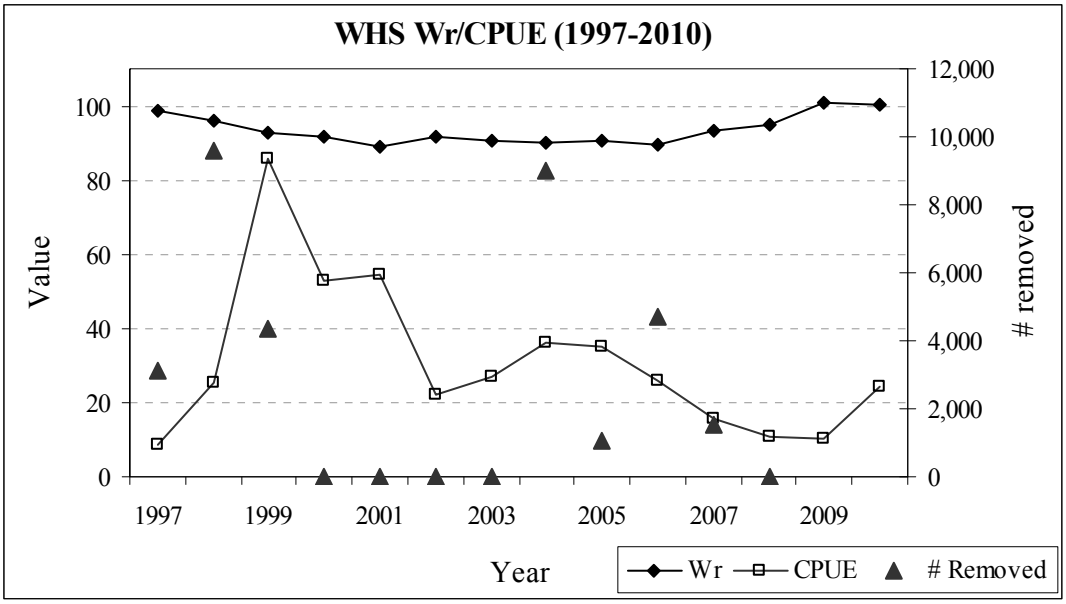


Figure 4. Catch rate and condition (Wr) for white suckers surveyed with gill nets from Deerfield Reservoir in 1997-2010. Number removed in spring netting is also included.

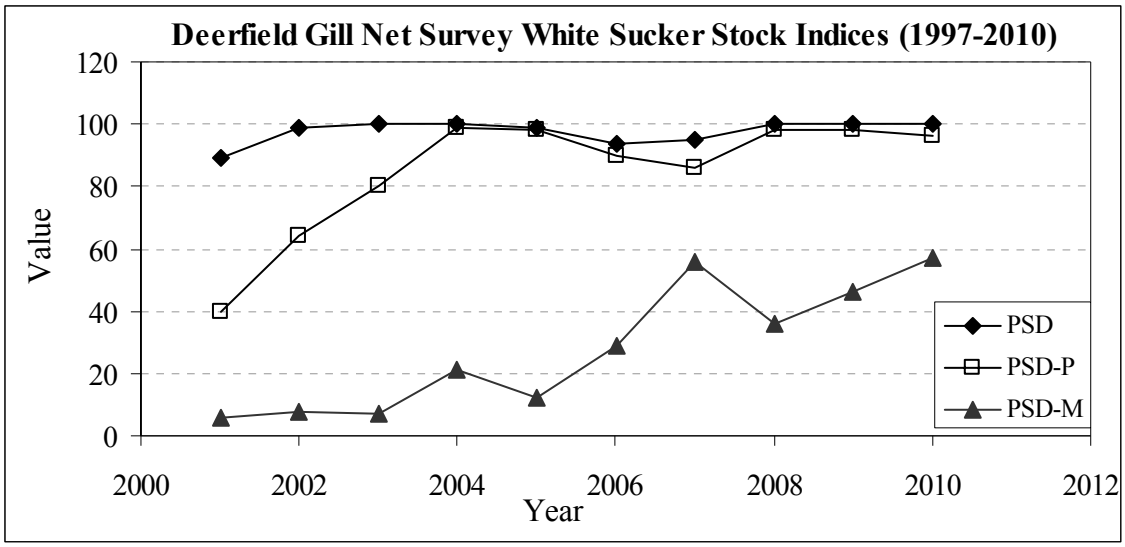


Figure 5. Stock indices for white suckers captured during gill net surveys of Deerfield Lake 2001-2010.

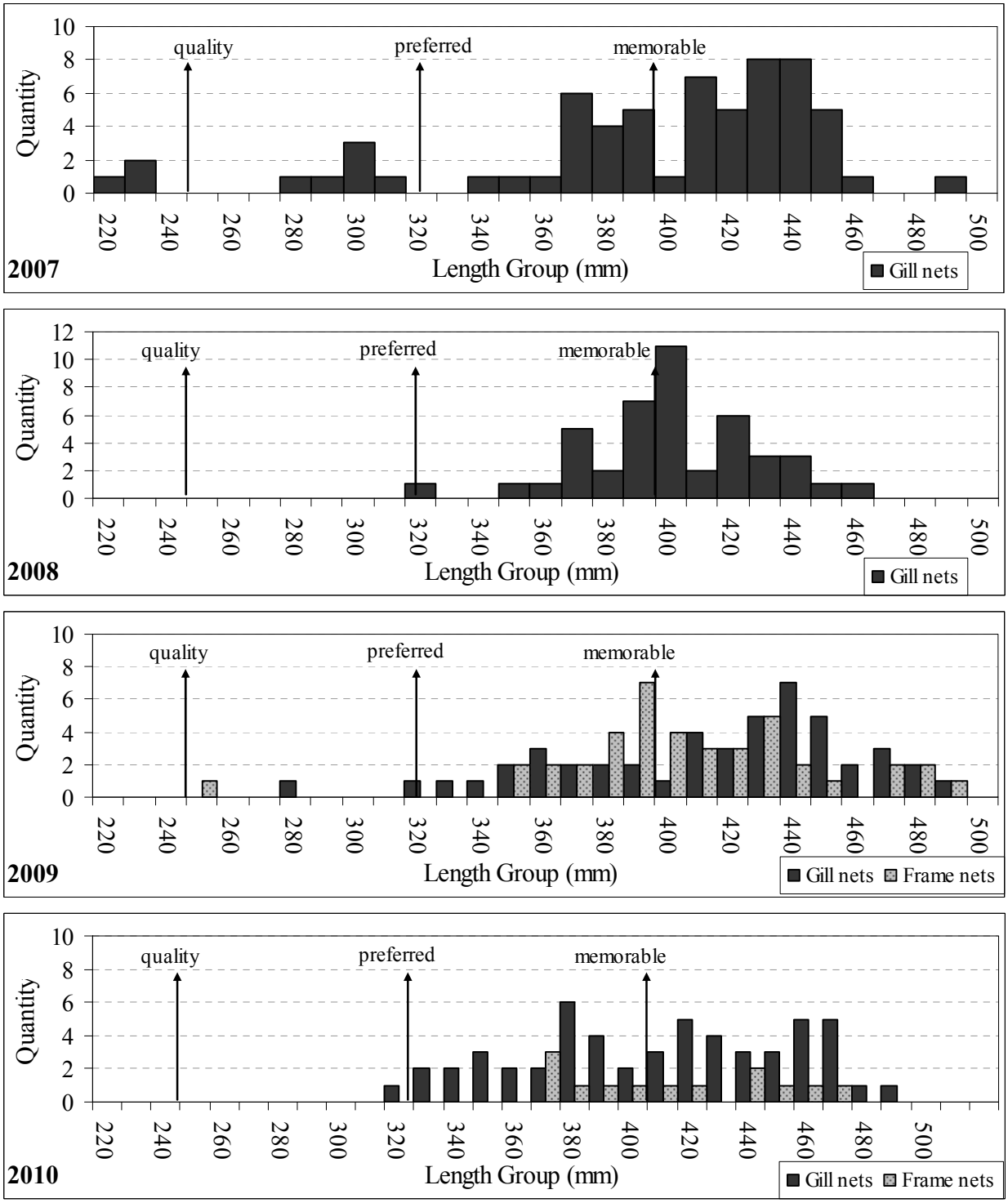


Figure 6. Length frequency histograms for white suckers collected in gill nets from Deerfield Reservoir, Pennington County, South Dakota 2007-20010.

Yellow Perch

The yellow perch population continues to increase in Deerfield Reservoir. CPUE for gill nets has increased from 3.0 in 2003 to 75 in 2010 (Table 6). Average fish condition (Wr>S) this year was 92.0 and appears to be increasing slightly each year. PSD almost doubled in 2009, but was slightly higher in 2010 to previous values. This may be because the 2009 nets were set in different locations and at a reduced effort.

It would appear the perch have established themselves and are providing another fishery in Deerfield Reservoir. Size structure shows a good number of fish between 8 and 10 inches with a year class at 4 to 5 inches showing some good recruitment. The past couple years Deerfield Reservoir has also been a source for perch trap and transfer to other waters.

Table 6. Results of yellow perch from gill nets in Deerfield Reservoir, 2003-2010.

Year	**N**	**CPUE** (80%)	**PSD** (90%)	**Wr>S** (90%)
2003	12	3.0 (4.9)	33 (26)	83.7 (2.2)
2004	2	0.5 (0.8)	--	80.3 (19.9)
2005	24	6.0 (3.9)	38 (18)	86.7 (1.7)
2006	31	7.8 (6.3)	35 (--)	88.4 (2.0)
2007	155	38.8 (38.0)	20 (6)	90.0 (1.4)
2008	241	60.3 (59.0)	23 (5)	92.4 (0.1)
2009	125	62.5 (81.6)	55 (10)	91.0 (1.1)
2010	300	75.0 (76)	39(5)	92.0 (2.0)

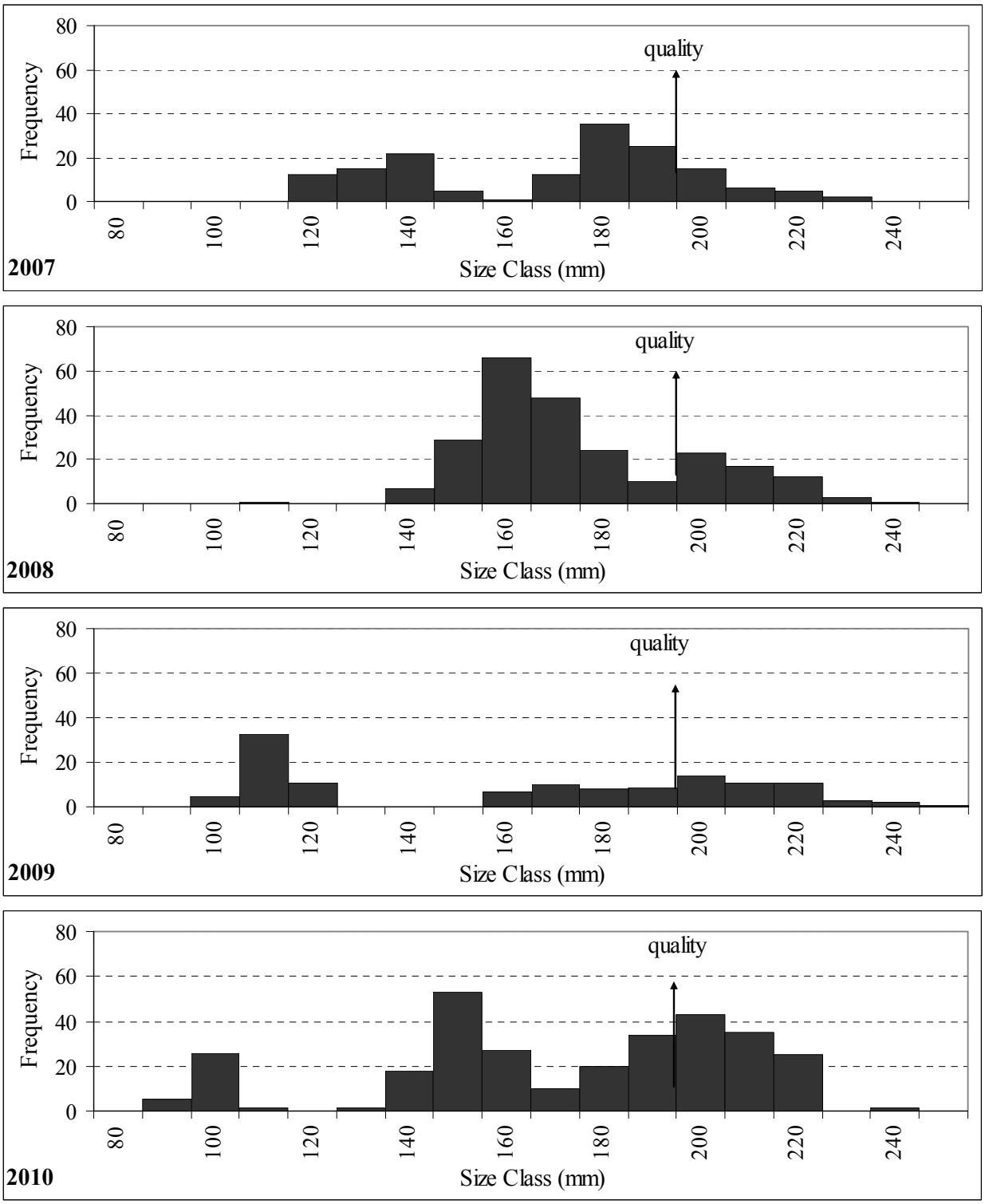


Figure 7. Length frequency histogram for yellow perch collected in gill net surveys of Deerfield Reservoir, 2007-2010.

RECOMMENDATIONS

1. Stock catchable (11”) rainbow trout to provide anglers with favorable size fish. .

2. Complete standard lake surveys annually to continue monitoring rock bass, yellow perch, splake and white sucker numbers, condition, and size structure, and monitor trout sizes and clipped fins for hatchery fish vs. natural fish.

3. Sucker CPUE trends seem to decrease with removals. Consider annual spring removal of white suckers, if time and personnel are available.

4. Due to angler complaints, attempt rockbass removals in 2011 by electrofishing and/or trap netting.

APPENDICES

Appendix A. Stocking record for Deerfield Reservoir, South Dakota 2002-2010.

Year	Number	Species	Size
2002	60,000	rainbow trout	fingerling
	10,164	rainbow trout	catchable
	307	rainbow trout	adult
2003	350	rainbow trout	adult
	8,409	rainbow trout	catchable
	60,625	rainbow trout	fingerling
2004	10	rainbow trout	adult
	12,000	rainbow trout	catchable
2005	12,000	rainbow trout	catchable
2006	12,124	rainbow trout	catchable
	7,124	splake trout	catchable
2007	8,400	rainbow trout	catchable
2008	12,280	rainbow trout	catchable
2009	11,883	rainbow trout	catchable
2010	11,864	rainbow trout	catchable

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Gateway Lake County: Pennington
Legal description: T2N, R9E, Section 18
Location from nearest town: inside Ellsworth Airforce Base
Dates of present survey: June 5-6, 2010
Date last surveyed: June 25-27, October 3, 2007
Most recent lake management plan: NA
Management classification: Warm-water permanent

Primary Species: (game and forage)	Secondary and other species:
1. Largemouth bass	1. Yellow perch
2. Redear sunfish	2. Golden shiner
3. Bluegill	3. Black crappie
4.	4. Rockbass

PHYSICAL CHARACTERISTICS

Surface Area: 5.5 acres (2.2 ha) Watershed: NA acres
Maximum depth: NA feet Mean depth: NA feet
Lake elevation at survey (from known benchmark): full

1. Describe ownership of lake and adjacent lakeshore property:

The entire lake and surrounding property is owned by Ellsworth Air Force Base.

2. Describe watershed condition and percentages of land use:

The watershed above and surrounding Bandit Lake is developed municipal land. Areas immediately around the lake are grassy with no developments on the shorelines.

3. Describe aquatic vegetative condition:

Gateway Lake contains a lot of submergent vegetation, especially in water less than 5 feet deep. About 50% of the shoreline had emergent vegetation (i.e. cattails)

4. Describe pollution problems:

No pollution problems were identified during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

All structures are in excellent condition. The lake was drained in 2003/2004 and new outlet structures were added along with tree removal across the dam face.

BIOLOGICAL DATA

Methods

A lake survey was conducted at Gateway Lake June 5-6, 2010. Sampling consisted of 2 trap net nights. Trap nets were set at two stations consisting of 1 trap net night each. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 in) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g).

Fish population parameters calculated were catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean catch per unit effort (CPUE; mean number per net night). Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

Results and Discussion

Overall, 8 fish species were collected from trap nets during the lake survey (Table 1). A large number of bluegill (n = 462) were collected, comprising 81.6%, and redear sunfish comprising 8.7% of the sample. Black crappie, bluegill/redear hybrids, bluegill/green sunfish hybrids, golden shiner, rock bass and yellow perch were also sampled in smaller numbers. Population parameters of dominant game and forage species in Gateway Lake are discussed individually below. A single baby trap net was set to sample any minnow species present. No minnows were sample but species sampled were bluegill, largemouth bass, redear sunfish, golden shiner and bluegill x redear sunfish hybrids.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock-length; 80% CI's) for all fish species collected from two, ¾ inch trap nets in Gateway Lake, June 5-6, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black crappie	8	4.0 (9.2)	4.0 (9.2)	0	0	93.5 (3.9)
Bluegill	377	188.5 (257.0)	188.5 (257.0)	66 (8)	0	97.8 (0.8)
Bluegill x GSF	1	0.5 (1.5)	--	--	--	--
Bluegill x RES	19	9.5 (4.6)	--	--	--	--
Golden shiner	8	4.0 (3.1)	--	--	--	--
Redear sunfish	40	20.0 (46.2)	20.0 (46.2)	55 (13)	0	113.1 (1.3)
Rock bass	1	0.5 (1.5)	0.5 (1.5)	--	--	--
Yellow perch	8	4.0 (3.1)	4.0 (3.1)	88 (24)	25 (31)	100.2 (21.3)
Total	462					

Bluegill

Bluegill numbers have greatly increased since the survey in 2007 when trap net CPUE was 25.0. Bluegill were the most abundant panfish in Gateway Lake with a trap net CPUE of 188.5 (Table 1). Stock density indices yielded a PSD of 66 with an RSD-P of 0 compared to 47 and 2 last survey, respectively. These numbers suggest Gateway Lake is becoming a high density bluegill fishery as bluegill composed 81.6% of all the fish sampled. Fish condition was good with a Wr for stock length and larger fish of 97.8. Length frequency shows a good number of fish between 140 and 160 mm, which is similar to sizes seen in 2007 (Figure 1).

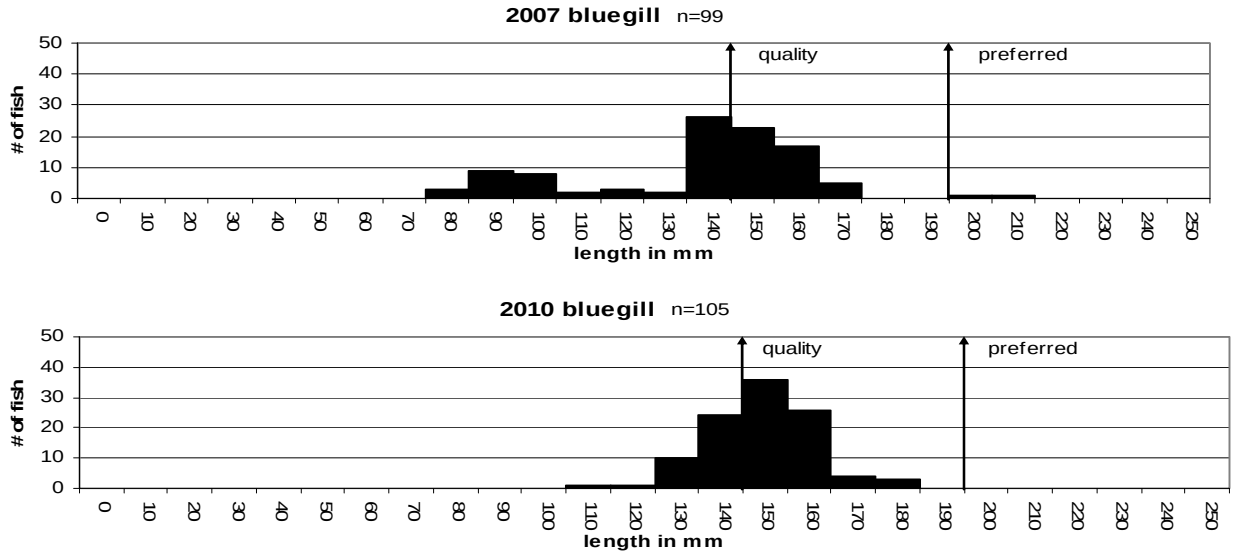


Figure 1. Length frequencies of bluegill collected by trap nets in Gateway Lake 2007, 2010.

Redear/Bluegill Hybrids

The 2007 survey had no hybrids but in 2010 the largest panfish sampled was an apparent hybrid at 280 mm. Trap net CPUE was 9.5 per net. While no age and growth analysis was done, it appears these hybrids are fast growing, as these fish are as long, and even longer, than any of the parent fish species sampled.

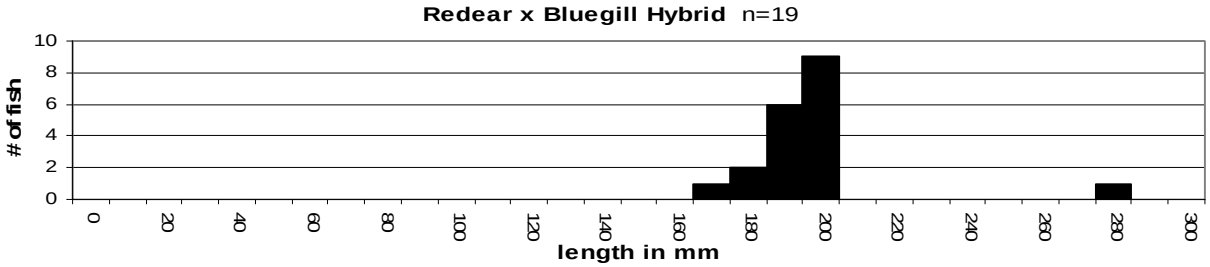


Figure 2. Length frequencies of bluegill X redear collected by trap nets in Gateway Lake, 2010.

Redear sunfish

In 2004, one hundred fifty adult redear sunfish were stocked after receiving them from the Nebraska Game and Parks. The 2005 length frequency shows the adults caught the next year in a trap net survey (Figure 3). In 2007, the length frequency shows good numbers of fish in the population of various sizes, indicating good natural recruitment. Redear were actually the most abundant species present in the 2007 survey with a trap net CPUE of 42.8. During this survey, CPUE has dropped to 20.0 (Table 1). PSD was 55 with no fish reaching preferred length. Condition was excellent with a Wr for stock length and larger fish of 113.1.

In spite of the abundant bluegill, the redear sunfish still seem to be recruiting, growing and in great condition. However, density trends suggest in time the bluegill population will dominate the fishery and redear sunfish might disappear.

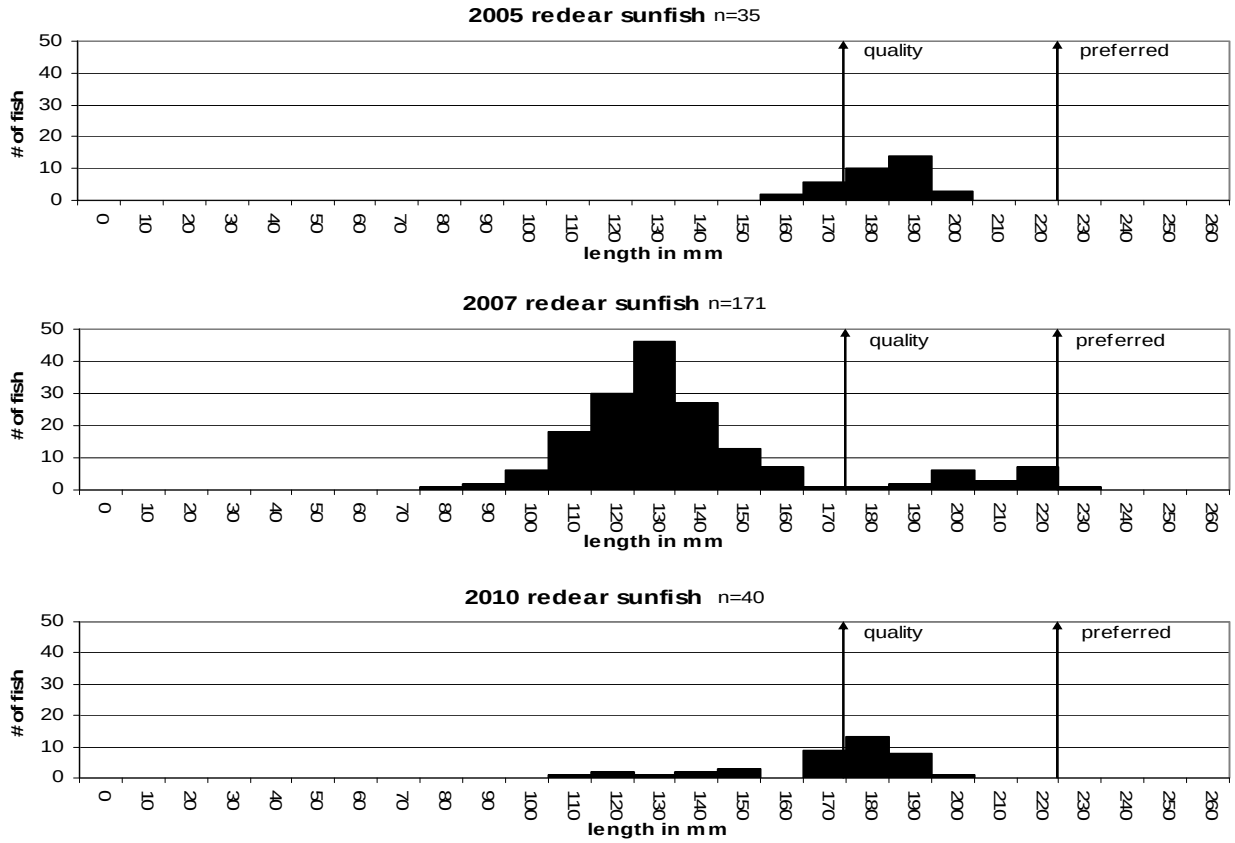


Figure 3. Length frequency histogram of redear sunfish collected by trap nets in Gateway Lake 2005, 2007, 2010.

RECOMMENDATIONS

1. Conduct standard lake surveys at least once every three years to monitor fish populations.
2. Sample the largemouth bass population as soon as possible.
3. Use as a bluegill source if this species are needed for stocking elsewhere.

APPENDICES

Appendix A. Stocking record for Gateway Lake, Pennington County, 2004-2010.

Year	Number	Species	Size
2004	150	Redear sunfish	Adult
2004	860	Largemouth bass	Fingerling

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Horsethief Lake County: Pennington
Legal description: Northeast 1/4 of section 11, R5E, T2S
Location from nearest town: 3 miles west of Keystone, SD
Dates of present survey: August 2-3, 2010
Date last surveyed: June 3, 1996
Most recent lake management plan: F21-R-37 Date: 1 January 2005
Management classification: Coldwater permanent

Primary Species:	Secondary and other species:
1. Hatchery rainbow trout	1. Yellow perch
2.	2. Golden shiner
3.	3. Green Sunfish
4.	4. Black crappie

PHYSICAL CHARACTERISTICS

Surface Area: 16.4 acres (6.6 ha); Watershed: 1,862 acres
Maximum depth: 9.5 m (31 ft) Mean depth: 3.8 m (12.6 ft)
Lake elevation at survey (from known benchmark): unknown

1. Describe ownership of lake and adjacent lakeshore property:

Horsethief Lake and the adjacent land are owned by the U.S. Forest Service. The lake was created by a dam placed on Pine Creek during the mid-1930's. A U.S. Forest Service campground is immediately adjacent to the south edge of the lake.

2. Describe watershed condition and percentages of land use:

The watershed is owned and administered by the U.S. Forest Service with most of it lying within the Norbeck Wildlife Preserve and Black Elk Wilderness. Geology of the area consists of Precambrian granite formation which is exposed in many places. Slopes are very steep. There is no commercial or residential development other than the USFS campground adjacent to the south shore of the lake. The entire area lies within 2.5 miles of Mount Rushmore and is a popular area for hiking. No motorized traffic beyond the campground is permitted within the watershed.

3. Describe aquatic vegetative condition:

At the time of the survey, there was emergent vegetation in the inlet area and western shoreline.

4. Describe pollution problems:

Due to the lack of extensive development, the pollution is from natural erosion of the steep slopes within the watershed. The campground adjacent to the south shore and the highway next to the northeast shore contribute to the siltation. A sediment survey was done by GF&P fisheries staff in January 2010 indicating sediment depths of at least one meter in the north west and south east corners of the lake. Horsethief Lake is scheduled by the U.S. Forest Service for sediment removal and dam repairs within the next couple years along with Bismarck and Lakota Lakes.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

All structures appeared to be in good condition. Fishing piers are located at various places along the east shoreline as well as along most of the south shoreline. All appear to be in good condition. Day use access is limited to a parking area along the highway and a small parking lot on the south shore that is difficult for large vehicle navigation.. Launching a small boat or raft is difficult due to stairs, railings, and cattails unless done from the campground area.

BIOLOGICAL DATA

Methods

Horsethief Lake was surveyed on August 2-3, 2010 with two gill net nights and seven trap net nights (Figure 1). The gill nets were set and remained in the water overnight. They were monofilament experimental nets 45.7m (150ft) long and 1.8m (6ft) deep with six 7.6m (25ft) panels of bar mesh sizes: 12.7mm (0.5in), 19.1mm (0.75in), 25.4mm (1.0in), 31.8mm (1.25in), 38.1mm (1.5in), and 50.8mm (2.0in). Seven trap nets were set (Figure 1) and remained in the water overnight. Six nets had ¾ in mesh and a 1.3 × 23m (3.9 × 75.5ft.) lead. One net had ¼in mesh and a 50ft lead (baby frame). Leads were pulled on shore for some nets due to water levels and this was not measured.

A previous survey of Horsethief Lake in 1996 was done by setting four gill nets for one hour each, one baby trap net for 30 minutes, and one trap net for 2 hours. Fish from the baby trap net were not counted or measured and only nine of the larger yellow perch from the trap net were measured. Therefore, comparisons other than species presence will not be made between the 1996 and 2010 surveys

For each survey method, total length (mm) and weight (g) was collected for each fish sampled.

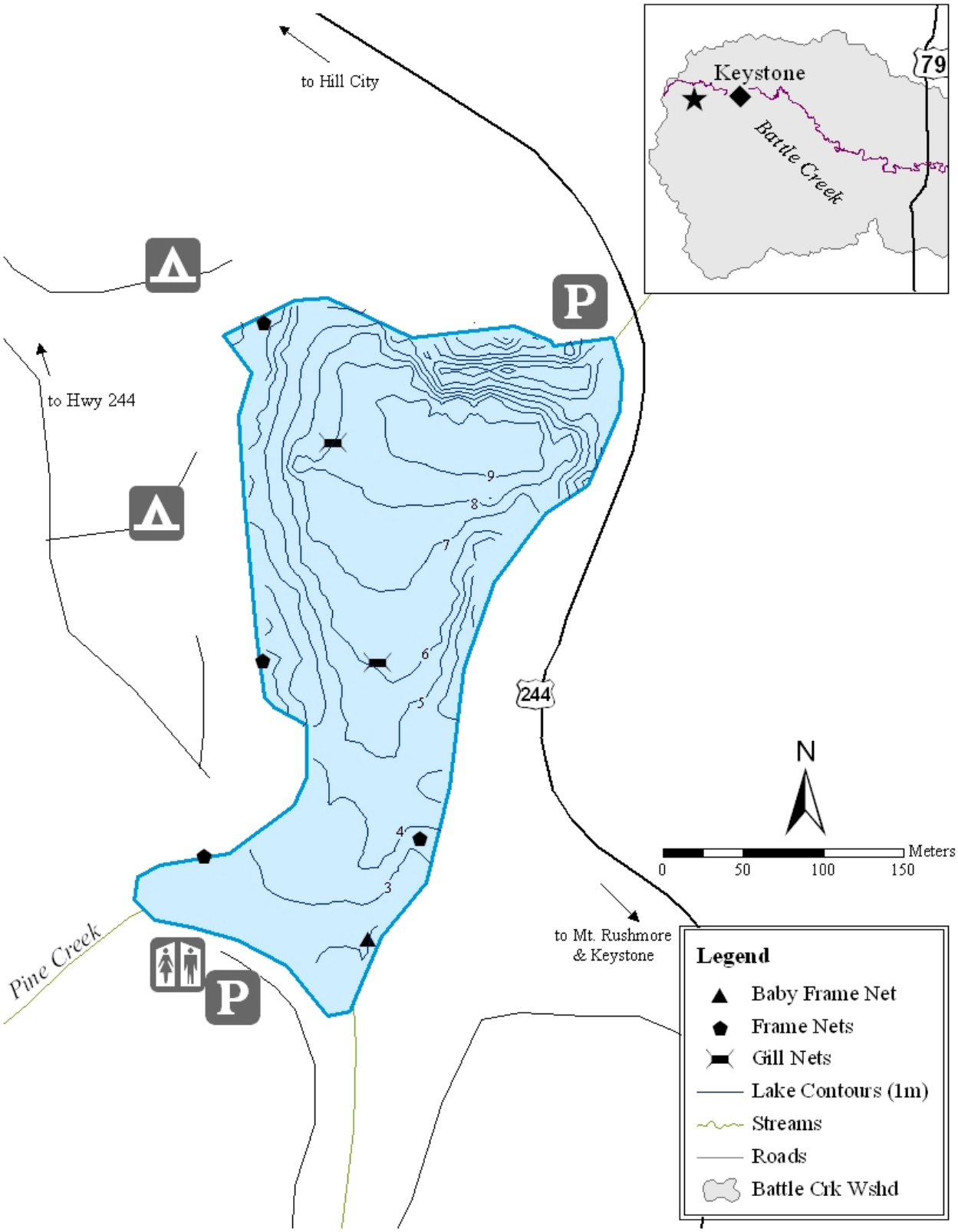


Figure 1. Lake map of sample locations on August 2- 3, 2010 at Horsethief Lake, Pennington County, South Dakota.

Results and Discussion

Four species of fish were collected during the survey of Horsethief Lake totaling 1,090 fish (Tables 1 and 2). Green sunfish were by far the most abundant species detected, followed by yellow perch. Gill nets captured one green sunfish and, therefore, will not be reported in a table. Gill nets were set at approximately 20 feet deep and, in hindsight, it is likely this was deeper than many fish would inhabit due to habitat, oxygen, or temperature constraints. It would be beneficial to conduct lake profile sampling of DO and temperature prior to setting nets. This lake likely experiences oxygen and temperature stratification in the summer.

Table 1. Total catch for four, $^{3}/_{4}$ inch modified fyke-nets in Horsethief Lake, Pennington County, South Dakota on August 3, 2010. Confidence intervals are also included.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	Wr-S (90%)	Mean Length (mm)
Green sunfish	398	99.5 (88)	99.5 (88)	0	113(9)	109
Yellow perch	163	41 (38)	40 (38)	16 (5)	93 (1.6)	177
Golden shiner	70	17.5 (19)	n/a			
Black crappie	46	11.5 (12)	11.2 (12)	18 (9)	101(0.2)	179
Total	677					

Table 2. Total catch for one ¼ inch modified fyke-net in Horsethief Lake on August 3, 2010. Bulk counts were collected and fish were not measured in this net

Species	N/CPUE	CPUE-S
Green sunfish	397	397
Golden shiner	8	8
Yellow perch	7	7
Black crappie	1	1
Total	413	

Rainbow Trout

Rainbow trout are stocked into Horsethief Lake at a rate of about 6,900 fish per year. In 2010, 4,000 catchable (~11 inches) fish and 200 adult (~15 inches) fish were stocked prior to the survey. Efforts were made to conduct the sample the furthest date away from any previous stocking date as not to kill stocked fish. None were captured during the survey.

Green Sunfish

Green sunfish have not been stocked by the department within the Black Hills Trout Management Area and are considered nuisance introductions to any lake within this management area. During the 2010 survey, 796 green sunfish were captured in Horsethief Lake with a CPUE of 99.5 and 397 for ¾ and ¼ inch nets, respectively (Tables 1 and 2). All of the fish were of stock length (80-150mm) with all but five between 100 and 130mm. Condition for this species

was high with a Wr value of 113, which was surprising for the high abundance. The local conservation officer indicated that anglers are frustrated with only being able to catch this species as abundances and densities near shore are extremely high. Green sunfish were not detected during the 1996 survey.

Yellow Perch

Yellow perch have also been illegally introduced within the Black Hills Trout Management Area. They were the second most abundant species captured during the 2010 survey with a CPUE of 41 for ¾ inch trap nets (Tables 1 and 2). A majority of the fish were between 140mm and 230mm (stock to preferred length) with two each of preferred and memorable lengths (PSD-S=84, PSD-P=3, PSD-M= 1) (Figure 2). Condition for perch was average with a Wr of 93.

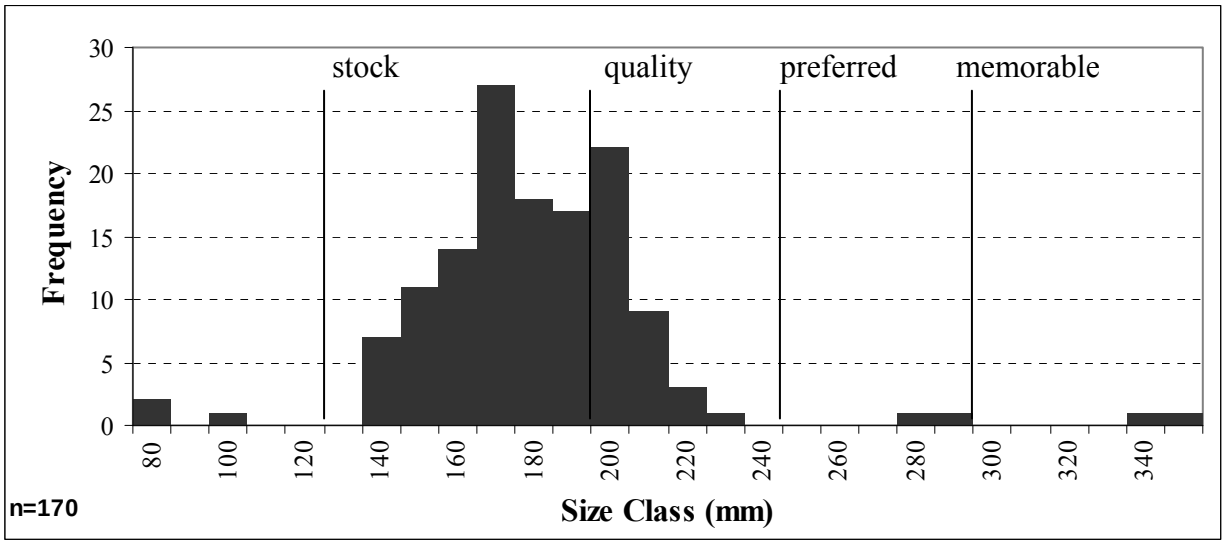


Figure 2. Length frequency histogram for yellow perch captured in trap nets on August 3, 2010 during a survey of Horsethief Lake, Pennington Co., South Dakota.

Black Crappie

Black crappie is another illegally introduced species to lakes within the Black Hills Trout Management Area. Forty-six were captured in ¾ inch trap nets during the survey with a CPUE of 11.5 (Table 1). All but six fish in ¾ inch trap nets were of stock length (130-200mm) with one substock and five of quality length (200-250mm). The one crappie caught in the baby trap net was over preferred length at 305mm. A few angler reports indicated black crappie in Horsethief Lake over ten inches (254mm). Black crappies were not detected during the 1996 survey.

Golden Shiner

Golden Shiner were also caught during the survey with 78 total captured for a CPUE of 17.5 for ¾ inch trap nets (Tables 1 and 2).

Other Species

One white sucker was caught during the 1996 survey and none were collected in 2010.

RECOMMENDATIONS

1. Continue to manage as a put and take fishery and stock hatchery rainbow trout at current rate.

2. Conduct lake survey in 2015 with trap and gill nets and possible DO and temperature profile. Utilize the DO and temperature profiles to make sure nets are not set below areas suitable for fish presence.

APPENDIX

Appendix A. Recent department stockings for Horsethief Lake, Pennington Co., 2001-2010.

Year	Species	Number	Size
2001	Rainbow Trout	7,635	Catchable
2002	Rainbow Trout	5,000	Catchable
2003	Rainbow Trout	3,000	Catchable
2004	Rainbow Trout	849	Catchable
2005	Rainbow Trout	6,817	Catchable
	Rainbow Trout	375	Adult
2006	Rainbow Trout	7,000	Catchable
	Rainbow Trout	150	Adult
2007	Rainbow Trout	4,700	Catchable 11”
	Rainbow Trout	72	Catchable 15”
2008	Rainbow Trout	5,480	Catchable
	Rainbow Trout	154	Catchable 15”
2009	Rainbow Trout	8,000	Catchable
	Rainbow Trout	300	Catchable 15”
2010	Rainbow Trout	6,671	Catchable
	Rainbow Trout	300	Catchable 15”

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Mitchell Lake County: Pennington
Legal description: T1S, R5E, Sections 28 and 29
Location from nearest town: 2 mi. NE Hill City
Dates of present survey: June 28-29, 2010
Date last surveyed: May 14-15, 1996
Most recent lake management plan: N/A
Management classification: Coldwater Permanent

Primary Species: (game and forage)	Secondary and other species:
1. Rainbow Trout	1. Brook Trout
2.	2. Fathead Minnow
3.	3. Golden Shiner
4.	4. Green Sunfish
5.	5. Yellow Perch
6.	6. Rock Bass
7.	7. White Sucker

PHISICAL CHARACTERISTICS

Surface Area: 6.7 ac. Watershed: 65850 ac
Maximum depth: 11.8 ft. Mean depth: 9.5 ft.
Lake elevation at survey (from known benchmark): unknown

1. Describe ownership of lake and adjacent lakeshore property:

Mitchell Lake was constructed in the mid 1930's. The lake and its shoreline are public land managed by the U.S. Forest Service (USFS).

2. Describe watershed condition and percentages of land use:

The U.S. Forest Service administers 85% (55,771 ac) of the watershed and the remaining is interspersed with private or city holdings. The land use of the watershed is 90% forest and 6% grassland (combined public and private land). Hill City, a community of approximately 780 people is located about two miles upstream along Spring Creek, which is the source of water for Mitchell Lake. Private dwellings, livestock grazing, and timber production account for most of the watershed usage.

3. Describe aquatic vegetative condition:

Emergent vegetation in the form of cattail lined most of the inlet area and manmade waterfowl nesting islands. Submergent vegetation was not abundant at the time of this survey. Algae growth along the dam shoreline was very high during the survey, effectively reducing the appeal of fishing activity.

4. Describe pollution problems:

Heavy sedimentation occurring from roads, logging, and grazing combine to create high turbidity. Sedimentation has all but eliminated the availability for fishing from the northwest parking area. Sediment was removed from the lake in 1984 to increase water depth and provide top soil for a road construction project in the immediate area.

According to the 1996 survey report, historically, low oxygen levels occurred during the winter months at depths below one foot under the ice. This condition was likely due to pollutants from Hill City's wastewater treatment facility and livestock grazing within the watershed.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

No boat ramps exist on Mitchell Lake. Mitchell Lake and Major Lake are scheduled for construction projects in FY2012 in an existing agreement with the USFS. USFS, GFP and USFWS Sport Fish Restoration funds will be used to make structural repairs to the outlet and spillway. Sediment removal to restore reservoir volume and improve fish habitat has also been proposed. These projects were originally scheduled for FY2008. Access includes a small parking area and steps leading to a path over the dam.

CHEMICAL DATA

No chemical data was collected in 2010. A temperature monitor was in place from July 10 to October 6, 2003. That datum indicated that the surface temperature reached 26°C (79°F) during mid-August of that year and mid lake temperatures exceeded 24 ^{o}C (75 ^{o}F) in mid-July and mid-August.

BIOLOGICAL DATA

Methods

Four trap nets were set in standardized locations on June 28, 2010 and remained in the water overnight (Figure 1). Three trap nets were modified fyke-nets with ¾ in mesh and a 1.3 × 23 m (3.9 × 75.5-ft.) lead. The southwest net was damaged by beaver and, therefore, was not counted in the survey results. The fourth trap net was a ¼ in modified fyke-net with a 50ft lead. Leads were shortened on shore for some nets due to water levels and this length was not measured.

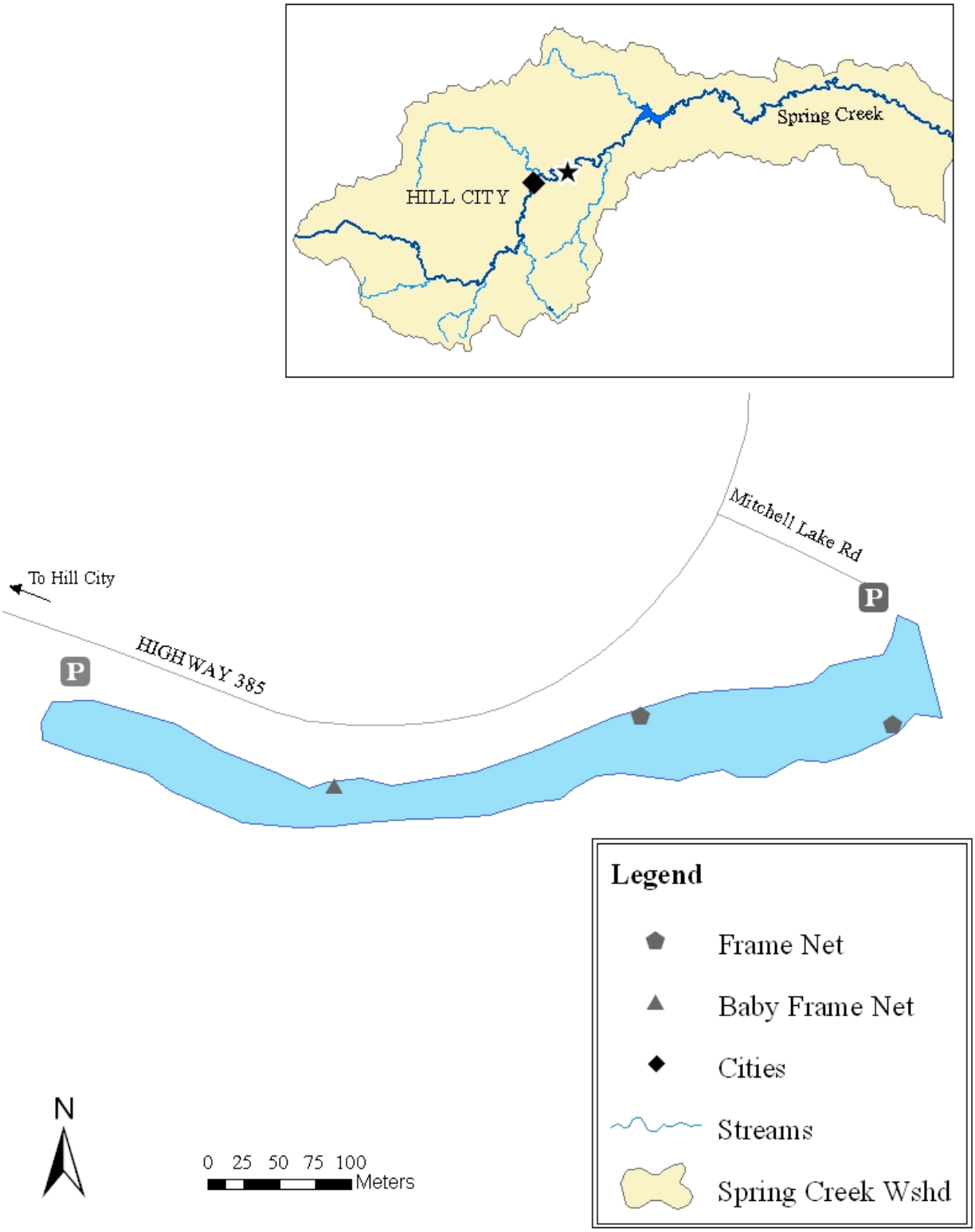


Figure 1. Map of Mitchell Lake with net locations during the fish survey on June 28-29, 2010.

Results and Discussion

Six fish species were caught in the trap nets totaling 66 fish (Tables 1 and 2). White sucker was the most numerous species sampled followed by black crappie.

Table 1. Total catch for two, $^{3}/_{4}$ inch modified fyke-nets in Mitchell Lake, Pennington County, South Dakota on June 29, 2010. Confidence intervals are also included.

Species	**N**	**CPUE** (80%)	**CPUE-S** (80%)	**PSD** (90%)	**PSD-P** (90%)	**Wr-S** (90%)	**Mean Length (mm)**
Black crappie	18	9 (3)	4.5 (1.5)	0	0	93 (0.2)	131
Rainbow trout	5	2.5 (4.6)	2.5 (4.6)	0	0	81 (4.2)	308
Yellow perch	11	5.5 (1.5)	5.5 (1.5)	45 (29)	36 (27)	97 (6.9)	221
White sucker	26	13 (0)	13 (0)	81 (13)	23 (14)	79 (4.9)	295
Total	60						

Table 2. Total catch for one ¼ inch modified fyke-net in Mitchell Lake, Pennington County, on June 22, 2010. Parameters are reported with confidence intervals.

Species	**N/CPUE**	**CPUE-S**	**PSD**	**Wr-S** (90%)
Green sunfish	4	4	50	103 (4)
Rock bass	1	1	100	99 (0)
White sucker	1	1	100	77 (0)
Total	6			

Rainbow Trout

Five-hundred catchable rainbow trout were stocked into Mitchell Lake in 2010 prior to this survey. Five rainbow trout were captured in trap nets during the 2010 survey (Tables 1 and 2). Due to the high probability that these were recently stocked fish, lengths and weights were not recorded.

Green Sunfish

Green sunfish are considered a nuisance species within the Black Hills Trout Management Area and have been illegally introduced to Mitchell Lake. Four were captured in the baby trap net with two under and two over quality length (150mm). Three green sunfish were captured during the previous survey in May 1996 indicating that abundance has not likely increased in this lake as it has in other Black Hills locations.

White Sucker

White suckers were the most abundant species captured during the survey with a total of 27 sampled, only one of which was in the baby frame net. All but five fish were over quality length (250mm). This species had CPUE values of 13 and one for ¾ and ¼ inch nets, respectively (Tables 1 and 2). During the 1996 survey, CPUE was 43 and 11 for ¾ and ¼ inch nets, respectively, therefore, abundance seems to have decreased.

Black Crappie

Black crappies have also been illegally introduced into Mitchell Lake. Eighteen individuals were captured during the June 2010 survey, while none were present in the 1996 fisheries survey. All of the fish were between 120 and 150mm. These fish had an average body condition with a Wr-S of 93 (Table 1). None have been captured in Spring Creek above Sheridan Lake, but a few individuals are present in Sheridan Lake. It's most likely these fish were moved by anglers from Sheridan Lake.

Yellow perch

Yellow perch are also an illegally introduced species. Eleven were captured in ¾ in trap nets during the 2010 survey with a CPUE of 5.5 (Table 1). Although few fish were captured sizes were favorable with two of preferred (<250mm) and two of memorable (300mm) length. Condition was good with a value of 97 (Table 1).

Other species

Brook trout, fathead minnow, mountain sucker, and golden shiner were detected during the 1996 survey; however, none were captured in 2010.

RECOMMENDATIONS

1. Manage as a rainbow trout fishery by stocking catchable rainbow trout at the current rate (Appendix A).

2. Conduct lake survey in 2015 to determine species composition and trend of fish populations.

APPENDIX

Appendix A. Stocking records for Mitchell Lake, Pennington Co. South Dakota.

Year	Species (Strain)	Size	Stockings	Number
2007	Rainbow Trout (Shasta)	Catchable	3	152
	Rainbow Trout (Erwin)	Catchable	1	40
2008	Rainbow Trout (Shasta)	Catchable 11”	2	152
2009	Rainbow Trout (Shasta)	Catchable 11”	5	625
	Rainbow Trout (Sand Creek)	Catchable	1	125
2010	Rainbow Trout (Shasta)	Catchable	3	550
	Rainbow Trout (Erwin X Arlee)	Catchable	2	300

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: New Underwood Dam County: Pennington
Legal description: NM ¼ Sec 30, T2N, R11E
Location from nearest town: ½ mile N, ½ mile W of New Underwood, SD
Dates of present survey: June 22-23, 2010
Date last surveyed: June 1-2, September 23, 2009
Most recent lake management plan: F21-R-28 Date: 1994
Management classification: Warmwater semi-permanent

Primary Species:(game and forage)	Secondary and other species:
1. Black crappie	1. Black bullhead
2. Bluegill	2. Golden shiner
3. Largemouth bass	3. Channel catfish

PHYSICAL CHARACTERISTICS

Surface Area: 20 acres; Watershed: 1,920 acres
Lake elevation at survey (from known benchmark): -0.5 feet

1. Describe ownership of lake and adjacent lakeshore property:

The lakeshore is owned by the South Dakota Department of Game, Fish and Parks and managed as a lake access area.

2. Describe watershed condition and percentages of land use:

The watershed is privately owned, except for the immediate lakeshore. Most of the area is planted with small grain crops.

3. Describe aquatic vegetative condition:

Cattails surround much of the lake. Submerged vegetation can be troublesome in mid to late summer and is found in water less than 6 feet.

4. Describe pollution problems:

Siltation is decreasing depth and leading to increased amounts of emergent and submergent aquatic vegetation. No other pollution problems were identified by department personnel during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

All structures associated with New Underwood Dam appeared to be in good condition. No problems were identified by department personnel.

BIOLOGICAL DATA

Methods

A lake survey was conducted at New Underwood Dam on June 22-23, 2010. Sampling consisted of 3 trap net nights. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 inch) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed to the nearest gram.

Data Analysis

Fish population parameters calculated were catch-per-unit-effort (CPUE; mean number per net night or mean number per hour of electrofishing)), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean CPUE. Actual pedal time (time the electrofishing unit produced current) was recorded from the digital display on the Smith-Root control box and used to calculate electrofishing CPUE. Population structural characteristics were expressed as length frequency histograms, PSD and RSD-P. Fish condition was expressed as mean Wr.

Results and Discussion

Overall, six fish species were collected during the lake survey conducted June 22-23, 2010 at New Underwood Dam (Table 1). The lake has suffered from low water the past few years and refilled in 2008. It was stocked heavily last year with bass, crappie, catfish and bluegill. It appears there was a substantial winterkill in winter of 2007, but was not complete as large numbers of bullheads still exist, as well as, yellow perch, neither of which were stocked after the winterkill. Bluegills were the most abundant fish sampled comprising 69.9% of the total. Green sunfish were a distant second at 13.1%, and black crappie third at 8.3%. Channel catfish, black bullhead and yellow perch were also sampled.

Figure 1. Aerial view of New Underwood Lake and net locations.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock-length; 80% CI's) for all fish species from three, ¾ inch trap nets in New Underwood Dam, Pennington County, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr≤S
Black bullhead	15	5.0 (3.9)	5.0 (3.9)	60 (23)	0	103.6 (1.8)
Black crappie	17	5.7 (2.7)	3.3 (2.3)	80 (24)	80 (24)	93.1 (5.7)
Bluegill	144	48.0 (47.9)	48.0 (47.9)	60 (7)	1 (1)	117.6 (1.3)
Channel catfish	1	0.3 (0.6)	0.3 (0.6)	--	--	78.9 (--)
Green sunfish	27	9.0 (12.6)	9.0 (12.6)	4 (6)	0	97.0 (0.9)
Yellow perch	2	0.7 (0.6)	0.7 (0.6)	--	--	91.8 (43.8)
Total	206					

Black Bullhead

The black bullhead population changed drastically since last year. Last year, CPUE was 68.8 with a PSD of 1 (Table 2). This survey CPUE was much lower at 5.0 with a PSD of 60. Fish condition was excellent with a Wr for stock length and larger of 103.6. The length frequency histogram shows excellent growth as last year's fish grew around 70 mm (Figure 2).

Table 2. Composite listing of sample size (N), catch-per-unit-effort (CPUE; 80% CI's in parentheses), proportional stock density indices (PSD, RSD-P; 90% CI's) and fish condition for fish larger than stock-length (Wr>S; 90% CI's) for black bullhead collected by trap nets in New Underwood Dam, 2002, 2004-2005, 2009, 2010.

Year	N	CPUE-S	PSD	RSD-P	Wr>S
2002	234	58.5 (26.9)	100	57 (6)	98.1 (1.3)
2004	201	67.0 (22.9)	100	41 (6)	--
2005	76	19.0 (10.9)	93 (5)	70 (9)	97.7 (1.9)
2009	279	68.8 (46.7)	1 (2)	1 (2)	105.2 (2.1)
2010	15	5.0 (3.9)	60 (23)	0	103.6 (1.8)

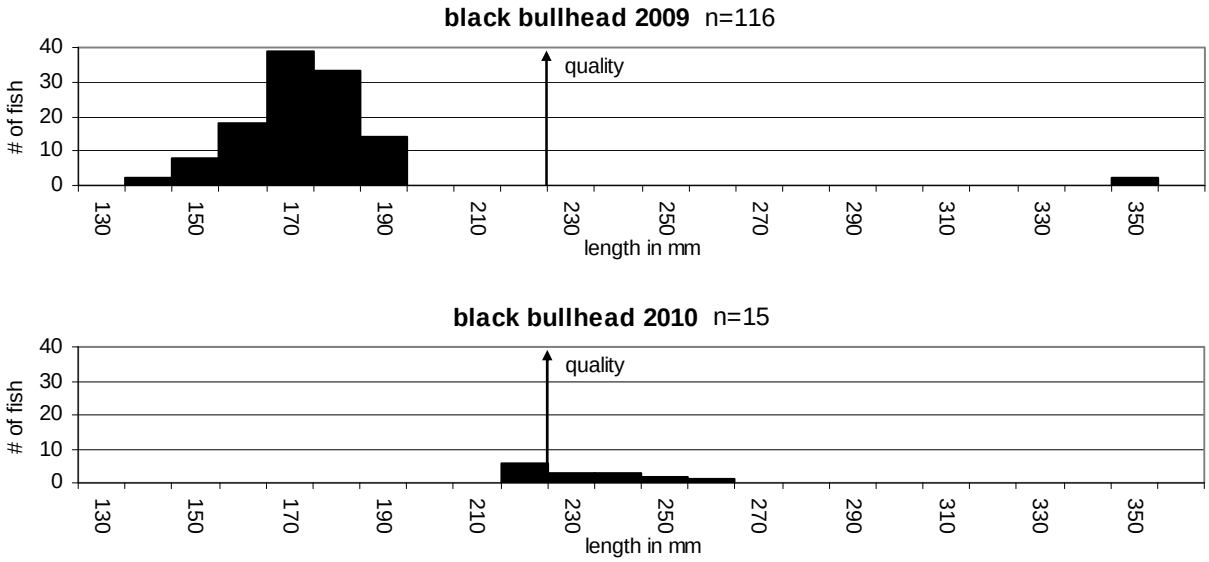


Figure 2. Length frequency histogram of black bullhead collected by trap nets in New Underwood Dam, 2009-2010.

Black Crappie

Black crappie abundance was less than 2009but shows signs of recruitment (Figure 3). This year trap net CPUE was 3.3, compared to 10.3 in 2009 (Tables 1 and 3). Stock indices were extremely high, PSD of 80 and a RSD-P of 80, suggesting few medium size fish. Fish condition was average with a Wr for stock and larger fish of 93.1. This lake is fished heavily and it may be a good place to stock additional adult crappies if a source becomes available.

Table 3. Composite listing of sample size (N), catch per unit effort (CPUE; 80% confidence intervals are given in parentheses), proportional stock densities (PSD, RSD; 90% CI's) and fish condition for fish larger than stock-length (Wr>S; 90% CI's) for black crappie collected by trap nets in New Underwood Dam, 2002-2010.

Year	N	CPUE-S	PSD	RSD-P	Wr>Stock
2002	163	40.8 (50.5)	53 (6)	0	99.0 (0.9)
2004	197	64.3 (32.7)	--	--	--
2005	73	18.3 (17.8)	21 (8)	0	91.0 (0.9)
2009	41	10.3 (7.9)	98 (5)	24 (12)	105.2 (0.4)
2010	17	3.3 (2.3)	80 (24)	80 (24)	93.1 (5.7)

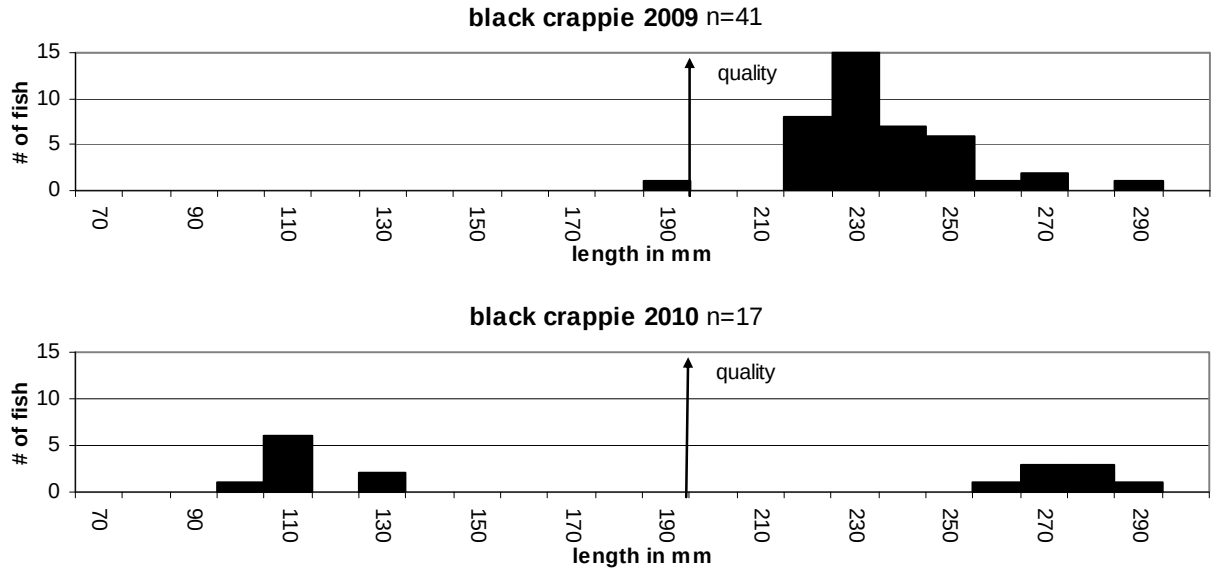


Figure 3. Length frequency histogram of black crappie collected by trap nets in New Underwood Dam, 2009-2010.

Bluegill

Bluegill were the most abundant species sampled in trap nets with a CPUE of 48.0 (Tables 1 and 4). This is a substantial increase from 2009, when CPUE was 9.5. Stock indices were also up from last year with a PSD of 60 and an RSD-P of 1. Last year the 38 fish sample had a PSD of 8 with a RSD-P of 0. Fish condition was excellent with a Wr for stock length and larger fish of 117.6. The length frequency histogram shows a big year class between 160mm-180mm (Figure 4). These fish should help provide a good fishery as perch and crappie numbers are decreasing.

Table 4. Composite listing of sample size (N), catch per unit effort (CPUE; 80% confidence intervals are given in parentheses), proportional stock densities (PSD, RSD; 90% CI's) and fish condition for fish larger than stock-length (Wr>S; 90% CI's) for bluegill collected by trap nets in New Underwood Dam, 2002-2010.

Year	N	CPUE-S	PSD	RSD-P	Wr>Stock
2002	74	18.5 (9.9)	73 (9)	0	89.8 (0.3)
2004	320	106.7 (96.5)	88 (3)	0	
2005	68	17.0 (11.2)	90 (6)	1 (3)	99.1 (0.2)
2009	38	9.5 (7.8)	8 (8)	0	122.9 (1.6)
2010	144	48.0 (47.9)	60 (7)	1 (1)	117.6 (1.3)

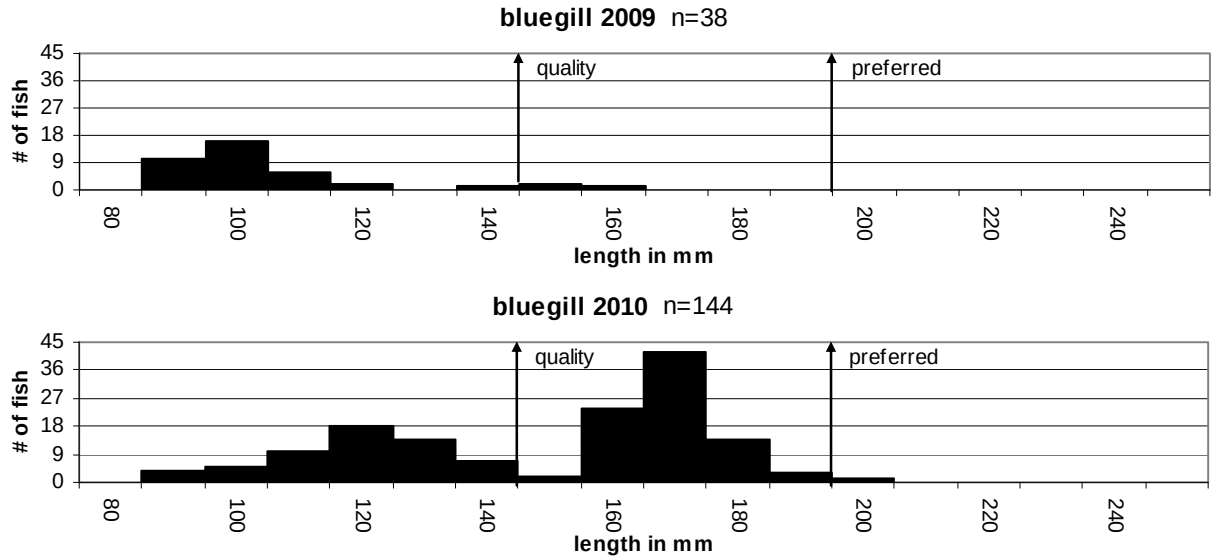


Figure 4. Length frequency histogram of bluegill collected by trap nets in New Underwood Dam, 2009-2010.

Yellow Perch

Yellow perch abundance was high last year considering none were stocked after a winterkill in 2007. In 2010, only two larger perch were sampled (Figure 5). Fish condition was excellent with a Wr of 109.7. Due to the popularity of New Underwood Dam, this year's sample suggests this fish population requires adult stockings to maintain a quality fishery.

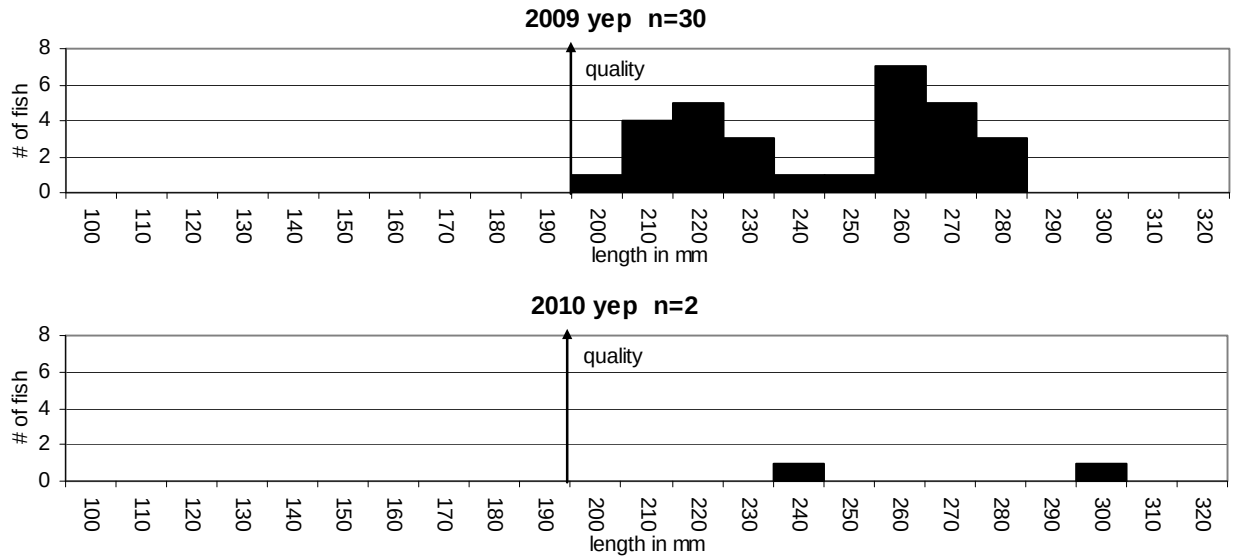


Figure 5. Length frequency histogram of yellow perch collected by trap nets in New Underwood Dam, 2009-2010.

RECOMMENDATIONS

1. Continue conducting lake surveys biennially to monitor bass and panfish populations and to evaluate the 15-inch minimum bass regulation.

2. Continue to stock channel catfish when available to provide a unique angling opportunity at this well-utilized fishery.

3. Stock adult yellow perch and black crappie when available to provide more angling opportunity.

APPENDIX

Appendix A. Stocking record for New Underwood Dam, Pennington County, 2001-2010.

Year	Number	Species	Size
2001	2,040	Largemouth bass	Fingerling
2002	2,680	Largemouth bass	Fingerling
2003	200	Largemouth bass	Adult
	30	Channel catfish	Adult
2004	336	Channel catfish	Adult
2006	217	Channel catfish	Adult
2008	300	Black crappie	Adult
	90	Largemouth bass	Adult
	1,500	Largemouth bass	Fingerling
	40	Bluegill	Adult
	8,000	Bluegill	Fingerling
2009	200	Channel catfish	Adult
	300	Largemouth bass	Juvenile
2010	23	Channel catfish	Adult

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: New Wall Lake County: Pennington
Legal description: T 1 S, R 15 E; Sec 1-2, 11-12
Location from nearest town: 1.5 mi. S and 1.5 mi. W of Wall, SD
Dates of present survey: September 21, 2010
Date last surveyed: October 2, 2008
Most recent lake management plan: F21-R-38 Date: 2006 - 2010
Management classification: Warm water permanent
Contour mapped: 1985

Primary Species: (game and forage)	Secondary and other species:
1. Largemouth bass	1. White crappie
2. Bluegill	2. Black bullhead
3.	3. Walleye
4.	4. Northern Pike
5.	5. White sucker
6.	6. Yellow perch

PHYSICAL CHARACTERISTICS

Surface Area: 42 acres, (17 ha); Watershed: 3,780 acres
Maximum depth: 24 feet; Mean depth: 12.9 feet
Lake elevation at survey (from known benchmark): - 1 feet

1. Describe ownership of lake and adjacent lakeshore property:

New Wall Dam was built by and is maintained by the South Dakota Department of Game, Fish and Parks (SDGFP). New Wall Lake is owned by the SDGFP manages the fishery.

2. Describe watershed condition and percentages of land use:

The ownership of the watershed of New Wall Lake consists of: 10% state, 50% private, and 40% federal. Of the total 3,780 acres, 40% are agricultural (winter wheat) and 60% are short grass prairie.

3. Describe aquatic vegetative condition:

Low water has left some cattails out of the water, but on the steeper gradients some still enter the lake. Submergent vegetation is plentiful in the shallow, upper ends of the lake in water under five feet.

4. Describe pollution problems:

No pollution problems were identified by departmental personnel during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

The spillway was not inspected by fisheries personnel, however all other structures associated with New Wall Lake appear to be in good condition. A new boat ramp was installed in the late 1990's and access to the lake was also improved through addition of more gravel as a road improvement to the boat ramp in 2001. Low water levels in 2004 made the ramp unusable, therefore gravel was added at the end of the ramp as an extension. In winter 2009-2010, the local chapter of Walleye Unlimited refurbished an old boat dock with new wood, bunkers and reinforced the steel structure. The boat dock was installed during Spring 2010 and remains on the boat dock for angler use. Fisheries personnel with the Game, Fish and Parks are responsible for annual dock movement into and out of the lake.

BIOLOGICAL DATA

Methods

Night electrofishing was conducted at New Wall Lake on September 21, 2010, with a water temp of 61.5 degrees Fahrenheit. Electrofishing was conducted using a Smith-Root unit with pulsed-DC. Six, 10-minute sights were completed during the survey. All largemouth bass were collected, measured for total length (TL; mm) and weighed (g). In addition, scale samples were collected from up to 5 fish per centimeter group for age and growth analysis.

Fish population parameters calculated were catch per unit effort (CPUE; mean number per net night or mean number per hour of electrofishing), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean CPUE. Actual pedal time (time the electrofishing unit produced current) was recorded from the digital display on the Smith-Root control box and used to calculate electrofishing CPUE. Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

Results and Discussion

New Wall Lake is an important public water body in Eastern Pennington County. Currently, largemouth bass and bluegill are managed as the primary game fish in New Wall Lake while white crappie and yellow perch are managed as secondary game fish. In efforts to improve bass size structure, a 12-inch to 16-inch slot with only one fish over 16 inches included in a daily limit of 5 was implemented January 1, 2003. The slot was changed on January 1, 2010 to a 14 inch to 18 inch protective length limit in which only one bass over 18 inches can be included in the daily limit of 5.

Largemouth bass

Night electrofishing is done annually to evaluate the bass population and the slot regulation imposed on the bass in New Wall Lake. During night electrofishing only largemouth bass were netted. Higher water levels in 2010 increased our sample to 55 minutes of electrofishing, compared to 50 minutes last year, which was the amount of time it took to make a complete trip around the lake.

Ninety-two largemouth bass were captured this year (Table 1). Mean catch per hour was 103.5 for all largemouth bass. Catch of largemouth bass stock length and longer was 76.4 per hour. Sixty-eight fish over stock length (200 mm) were sampled, compared to 35 during the last survey in 2008. Size structure numbers dropped since last survey with a PSD of 18 and a RSD-P of 10 versus PSD 49 and RSD-P 26 in 2008. This is due to a large year class of age-2 fish just over stock length. Fish condition for stock length and larger was 105.1. Length frequency shows a year class from 2008 (Figure 1). Future sampling will help determine if this year class will persist as large year classes are often no longer sampled in New Wall Lake by age 4. Growth rates of bass in New Wall appear good. Mean lengths of year classes through age-5 are similar to means across the state (Table 2). For example, back-calculations of age-3 bass showed an average length of 240 mm (9.4 inches), very close to the statewide mean of 250 mm (9.8 inches).

Overall the bass population seems to be doing very well. The population appears to be recovering nicely after a few years of low water conditions at New Wall Lake and a strong class of age-2 fish are recruiting to the population.

Table 1. Total catch (N), pedal time (seconds), catch per hour of electrofishing (CPUE), mean total length (TL, standard error is given in parentheses), proportional stock densities (PSD, RSD; 90% CI's) and condition factor (Wr for fish ≥ stock length; 80% CI's) for largemouth bass collected by electrofishing in New Wall Lake, 2000-2010.

Year	N	Pedal Time (sec)	CPUE	CPUE-S	PSD	RSD-P	Wr≥S
2000	105	5,612	67.4 (na)	59.0 (na)	50 (9)	7 (5)	125.5 (1.8)
2001	206	6,960	106 (20.2)	57.7 (12.4)	76 (7)	8 (4)	100.9 (0.1)
2002	204	3,950	184.8 (34.8)	91.4 (16.5)	37 (8)	1 (2)	97.8 (1.1)
2003	172	3,600	172.0 (25.6)	160.0 (24.4)	49 (7)	3 (2)	99.6 (0.4)
2004	96	3,146	108.5 (20.9)	72.8 (10.7)	73 (9)	5 (4)	108.5 (0.2)
2005	45	3,484	45.9 (15.8)	43.7 (15.3)	79 (11)	28(12)	103.0 (1.4)
2006	16	1,700	34.8 (22.0)	13.2 (8.6)	50 (45)	17 (33)	106.1 (5.1)
2007	68	1,719	146.3 (79.6)	23.6 (16.8)	55 (28)	9 (17)	103.3 (5.0)
2008	43	3,000	51.6 (11.1)	42.0 (12.7)	49 (15)	26 (13)	103.3 (2.0)
2010	92	3,283	103.5 (21.8)	76.4 (17.7)	18 (8)	10 (7)	105.1 (0.2)

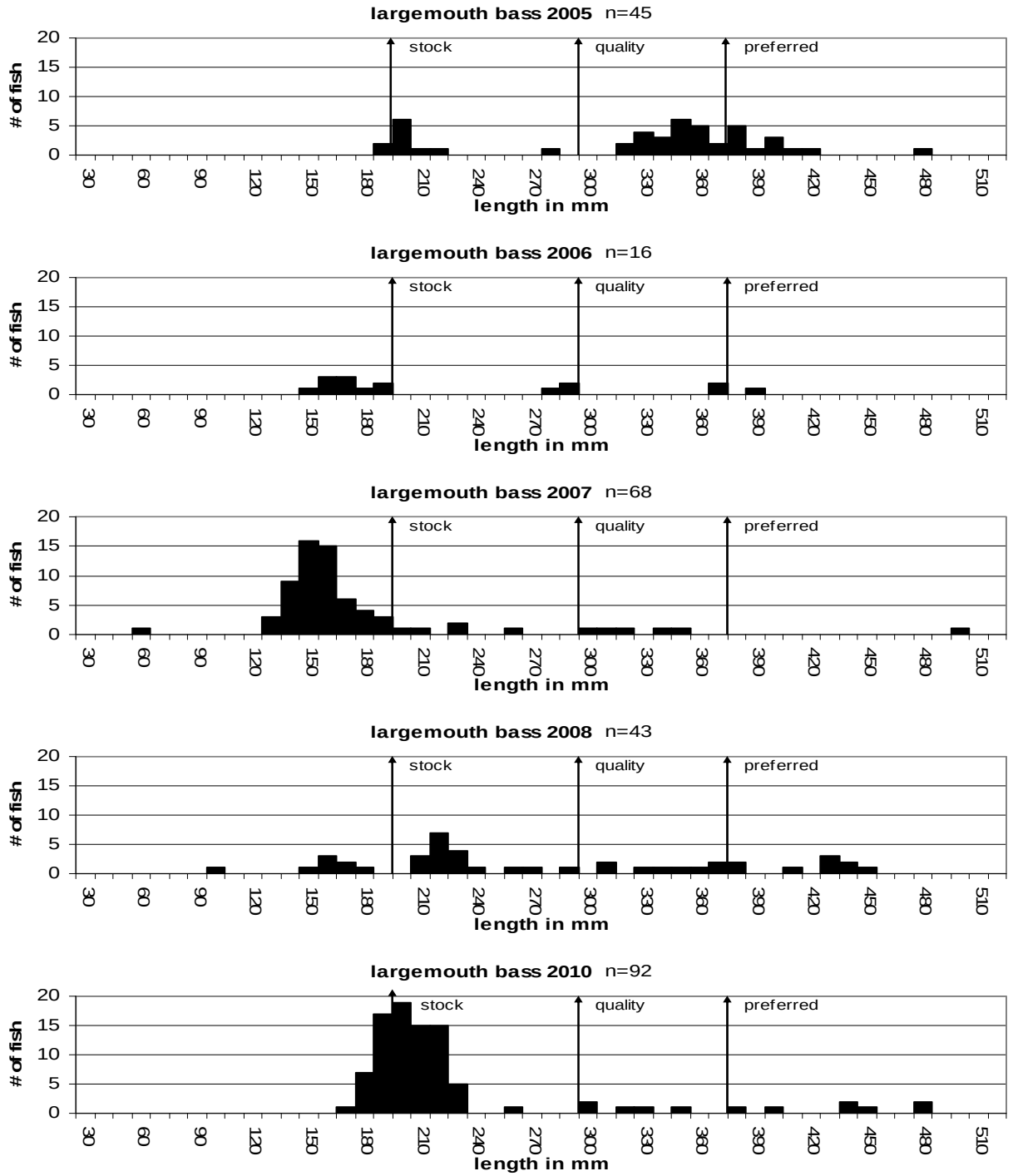


Figure 1. Length frequency histogram from electrofishing for largemouth bass at New Wall Lake for 2005-2010.

Table 2. New Wall Lake largemouth bass age in 2010 from electrofishing, sample size (N), mean back-calculated total length-at-age, mean SD length-at-age (Willis et al. 2001), and population standard errors (SE).

Year Class	Age	N	Age 1	2	3	4	5	6	7	8
2008	2	71	85	145						
2007	3	3	80	166	230					
2006	4	1	69	123	199	254				
2005	5	4	91	200	269	324	363			
2003	7	1	94	180	254	302	361	416	453	
2002	8	2	113	184	250	298	348	387	418	446
Total		**82**								
2010 Mean			**89**	**166**	**240**	**296**	**357**	**401**	**436**	**446**
(SE)			**(6)**	**(11)**	**(12)**	**(14)**	**(5)**	**(15)**	**(18)**	**(0)**
SD Mean			96	182	250	305	342			
(SE)			(3)	(6)	(7)	(8)	(8)			

LITERATURE CITED

Willis, D.W., D.A. Isermann, M.J. Hubers, B.A. Johnson, W.H. Miller, T.R. St. Sauver, J.S. Sorenson, E.G. Unkenholz, and G.A. Wickstrom. 2001. Growth of South Dakota Fishes: A Statewide Summary with means by region and Water Type. Special Report. South Dakota Department of Game, Fish and Parks. Pierre, South Dakota.

RECOMMENDATIONS

1. Continue to conduct netting surveys in New Wall Lake on an as needed basis.

2. Conduct electrofishing surveys annually to assess the largemouth bass population.

APPENDIX

Appendix A. Stocking record for New Wall Lake, Pennington County, 2001-2010.

Year	Number	Species	Size
2001	18	Black crappie	Adult
	50	Bluegill	Adult
2002 – 2006		None stocked	
2007	150	Largemouth bass	Adult
2008		None stocked	
2009	3,700	Largemouth bass	Fingerling

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Pactola Reservoir County: Pennington
Legal description: Sec. 2,3,4,5,10,11; R5E, T1N and Sec.31,32,33,34;R5E,T2N
Location from nearest town: 0.5 miles east of Silver City, S.D.
Dates of present survey: July 28-30, 2010
Date last surveyed: July 21-22, 2009
Most recent lake management plan: F21-R-37 Date: 2005
Management classification: Coldwater Permanent
Date contour mapped: 1985

Primary Management Species:	Secondary species:
1. Rainbow trout	1. White sucker
2. Lake trout	2. Northern pike
3. Brown trout	3. Rock bass
4.	4. Yellow perch
5.	5. Largemouth bass
6.	6. Rainbow smelt
7.	7. Bluegill
8.	8. Golden shiner
9.	9. Green sunfish
10.	10. Black crappie

PHYSICAL CHARACTERISTICS

Surface Area: 785 acres; Watershed: 204,154 acres
Maximum depth: 165.8 feet; Mean depth: 62.3 feet
Lake elevation at survey: 102% full (55,306 ft)

1. Describe ownership of lake and adjacent lakeshore property:

The Bureau of Reclamation (BOR), an agency of the U.S. Department of Interior, operates Pactola Dam and Reservoir in accordance with the needs dictated by downstream water demands such as irrigation, domestic water supply, regulation of Pactola Reservoir levels, and maintenance of minimum flows in Rapid Creek below the reservoir. The U.S. Forest Service (USFS) has jurisdiction over campgrounds, picnic areas, boat launches, access areas, and shoreline use. Private enterprises lease control of camping, marinas, and concession operations at various sites around the reservoir. A USFS visitor center, three parking lots, and some overlook areas are located on the dam. Veteran's Point, a handicap parking lot with fishing access piers, is located at the north end of the dam.

2. Describe watershed condition and percentages of land use:

The majority of the watershed is public timber and grassland administered by the USFS. However, substantial areas of private ownership exist. Much of the land immediately adjacent to the Rapid Creek watershed streams is privately owned with a small portion under tillage. Livestock grazing is widespread on both private and public lands. Much of the public land is under management for production of salable timber products. Extensive thinning of ponderosa pine on public land has taken place or is under way to enhance water yield. Roads and livestock grazing are major sources of sediment in the streams. Mountain slopes vary from moderate to extreme steepness on the lake shore as well as on the watershed.

Deerfield Reservoir is located on the upper portion of the Rapid Creek watershed above Pactola Reservoir. Slate Creek Dam, Dumont Pond, and many small, unnamed ponds are also located within the Rapid Creek watershed above Pactola. In addition, Silver City, Rochford, and several small developments exist in the upper Rapid Creek watershed.

3. Describe aquatic vegetative condition:

Shorelines are steep and emergent vegetative density is light, growing only at the Rapid Creek inlet and in the littoral areas of bays off the main body of the lake.

4. Describe pollution problems:

Sediment entering Pactola from Rapid Creek seems to be the only apparent pollution concern in the reservoir.

5. Describe condition of all structures such as the spillway, boat ramps, etc.:

All structures appear to be in good condition. In 1985-1986 the crest of the dam was widened and raised 15 feet. The rock-cut spillway was widened 150 feet to increase safety and capacity in the event of a major flood. At this time the splash pool below the spillway was also revamped. A low water boat ramp was installed at the north marina in 2005-2006 and a pathway to a gravel ramp was installed at the same time.

CHEMICAL DATA

Water chemistry was not conducted at Pactola in 2010 by GF&P staff. DENR conducted water chemistry samples on 6-17 and 7-28. Coincidentally, their second sample was at the same time as the fishery survey. A thermocline was present near 10 meters during the July 28th sample, but oxygen levels remained high below this (Figure 1).

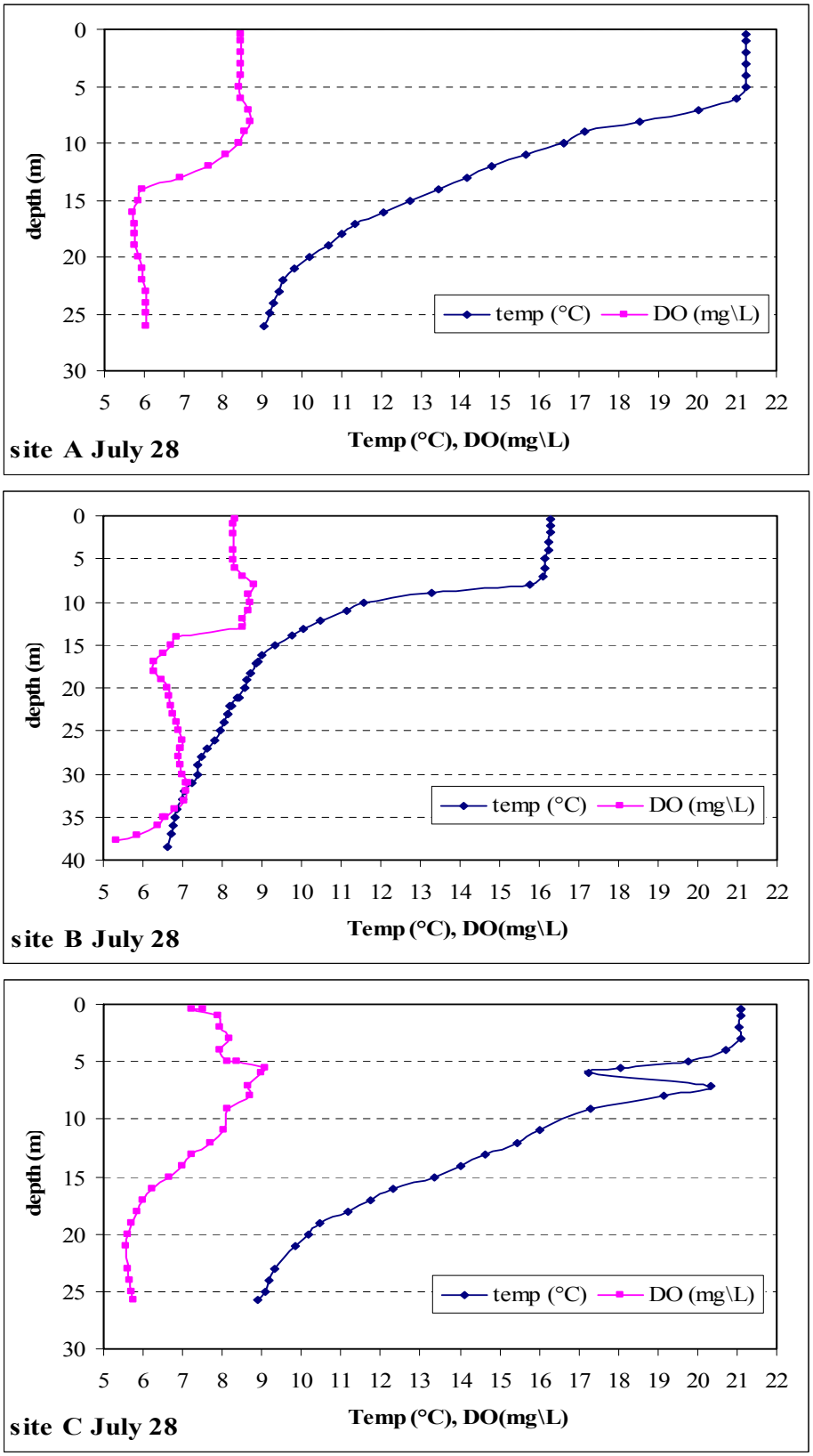


Figure 1. Lake chemistry profile data collected by SD DENR on July 28, 2010 at Pactola Reservoir from three sites (see Figure 2).

BIOLOGICAL DATA

Methods

Gill netting was conducted on July 28-30, 2010. Sampling consisted of 12 gill net nights with six set each day and run the next (Table 1, Figure 2). Each net was set perpendicular to the shoreline (or island) and depth and GPS location was recorded for each end of the net. All gill nets were monofilament, experimental nets 45.7 m (150 ft.) long and 1.8 m (6 ft.) deep with six 7.6 m (25 ft.) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). All fish captured were measured (total length, mm) and weighed (g).

Fish population parameters calculated were catch per unit effort (CPUE) and relative weight (Wr). Relative abundance was expressed as the mean CPUE (mean number of fish captured per net night). Fish condition was expressed as mean Wr.

Lake trout were evaluated based on their differential clippings. Fish stocked in 2003 were marked with an adipose fin clip while the 2005 stocked fish were marked with an adipose and right pelvic clip. Fish sampled with no clip are assumed to be naturally reproduced or 'wild' fish.

Reservoir elevation and content was obtained from the Bureau of Reclamation web site. (available at http://www.usbr.gov/gp-bin/arcweb_ptr.pl)

Table 1. Gill net dates, locations, and depths set in Pactola Reservoir during the 2010 survey.

Set Date	Net #	UTM Lat	UTM Long	Depth (ft)
7/28	Pac 1	4880824.2	620497.8	unknown
7/28	Pac 2	4880424.2	621271.8	66
7/28	Pac 3	4880503.2	620396.8	23
7/28	Pac 4	4881708.2	620670.8	40-86
7/28	Pac 5	4880821.2	621123.8	50-60
7/28	Pac 6	4880610.2	621299.8	70-110
7/29	Pac 7	4881280.2	620116.8	90
7/29	Pac 8	4881318.3	619297.1	15-25
7/29	Pac 9	4881390.2	618958.8	50-90
7/29	Pac 10	4882098.2	618118.8	60
7/29	Pac 11	4881831.2	619509.8	60-100
7/29	Pac 12	4881773.8	618260.7	50-53

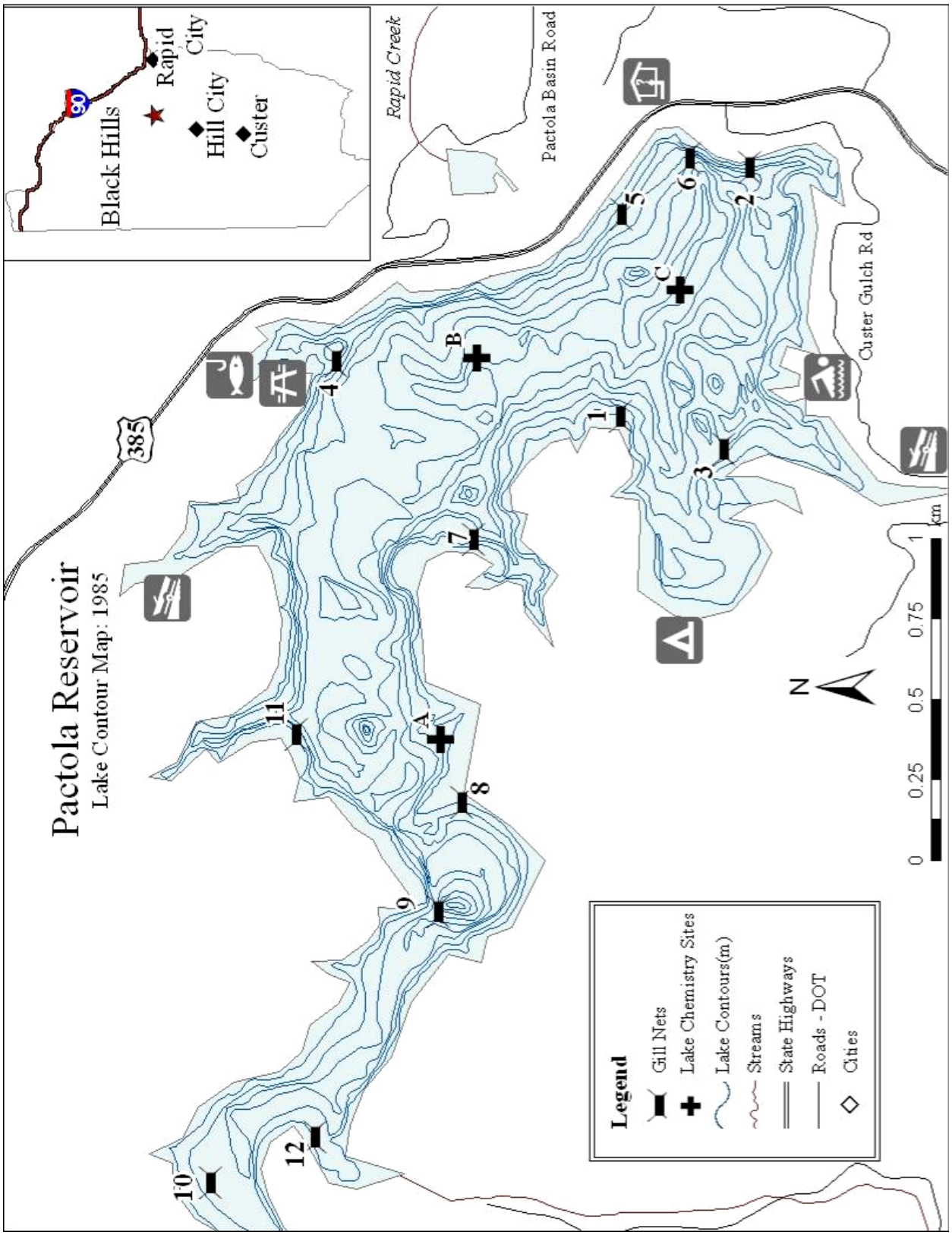


Figure 2. Location of gill nets set on Pactola Reservoir July 28-30, 2010 and water chemistry sites on July 28, 2010.

Results and Discussion

Eleven species of fish were collected from Pactola in 2010 (Table 2). Bluegill, lake trout, and yellow perch were the most abundant fish sampled.

Table 2. Total catch of twelve 150-foot, experimental, sinking, monofilament gill nets set in Pactola Reservoir on July 28-30,2010. Parameters are reported with confidence intervals.

Species	**N**	**CPUE** (80%)	**CPUE-S** (80%)	**PSD** (90%)	**RSD-P** (90%)	**Wr-S** (90%)
Bluegill	99	8 (7.7)	6 (6)	26 (7)	0	94 (.8)
Brown trout	29	2 (1)	2 (1)	n/a	n/a	81.8
Rainbow trout	14	1.2 (0.7)	1.2 (0.7)	0	0	77.6
Lake trout	40	3 (1)	3 (1)	23	0	88.5
Largemouth bass	10	0.8 (0.9)	0	0	0	95 (substock)
Northern pike	10	0.8 (0.5)	0.7 (0.5)	50 (36)	13 (23)	87 (3.7)
Rainbow smelt	10	0.8 (0.8)	n/a	n/a	n/a	n/a
Rock bass	9	0.8 (0.5)	0	0	0	95 (1.8)
White sucker	7	0.6 (0.5)	0.6 (.5)	100	100	78 (25)
Golden shiner	7	0.5 (0.6)	n/a	n/a	n/a	n/a
Yellow perch	38	3 (2.5)	3 (2.4)	31 (14)	3 (4)	88 (1.5)
Totals	273					

Rainbow Trout

Fourteen rainbow trout were caught in gill nets in 2010 (Table 2). CPUE for rainbow trout has decreased since 2006 to their lowest levels during the last three surveys. This is possibly due to increased reservoir volume (Figure 3), however, surveys are typically done over a month after stocking has occurred. Approximately 19,425 hatchery rainbow trout were stocked in 2010 prior to the survey with the last stocking on June 29th.

Another likely reason for the decrease in trout numbers is the increasing presence of northern pike. This year, a study was undertaken to determine if pike predation could influence trout numbers. Preliminary results suggest the growing pike population may be having an impact on trout survival. It is undetermined what actions will be taken if the primary cause of the declining survival of hatchery trout is pike related. Potential solutions would be increased stocking, ceasing late fall trout stocking, and/or attempting annual pike removals.

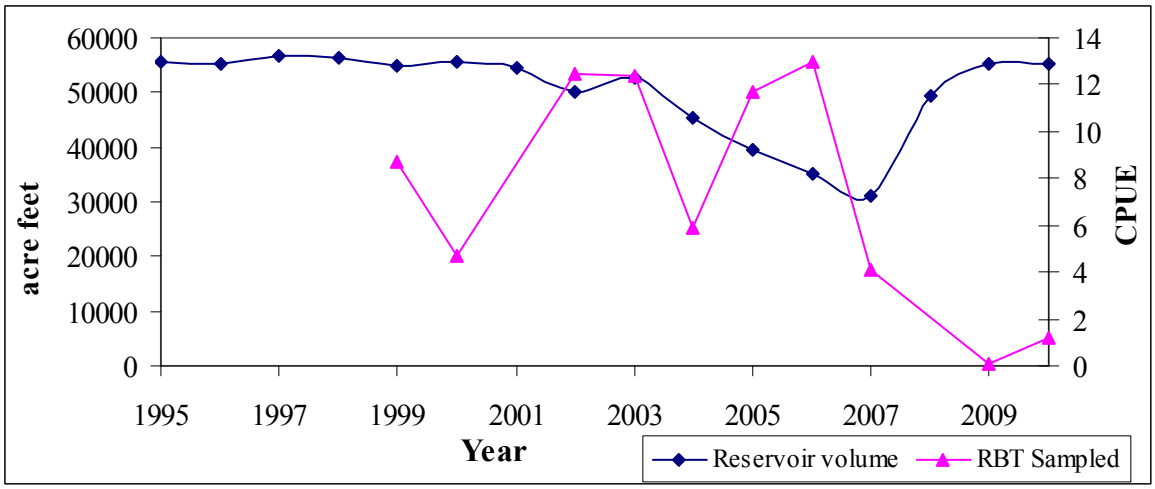


Figure 3. Pactola Reservoir volume (July 31st) and abundance of RBT sampled with experimental gill nets each year.

Brown Trout

Numbers of brown trout captured in gill nets has generally decreased since 2002 (Figure 4). Brown trout are only occasionally stocked into Pactola. In 2000 and 2002, there were 3,000 and 8,000 brown trout were stocked into Pactola Resevoir, respectively. These stockings may explain the high net catch rates in the 2002 survey. Furthermore, 4,700 catchable brown trout were stocked in 2007 and most likely explains the increased catch that year. Brown trout relative abundance was lower in 2009 and 2010 than any of the past 13 years. However, these results may be confounded by the increased volume of water in Pactola Reservoir, which reached 99.9% full in the spring of 2009 and was over full at 102% during the survey (Figure 5).

Condition of brown trout has been fluctuating. Mean condition (Wr) of brown trout during the 2009 survey was at its highest since 2002, but went down during the 2010 survey (Figure 4). Mean Wr in fish less than 350 mm (14 in) in length has been poor with values below average to good condition values of 95 to 105 (Table 3) (Guy and, Brown 2007). This could indicate problems in food or feeding conditions (Murphy and Willis 1996). Conversely, brown trout >350 mm generally have had higher Wr values, but decreased in 2010 to the lowest it has ever been.

Length frequency analysis indicated that the size structure of brown trout has increased in the last few years, but low sample sizes make meaningful size structure comparisons inconclusive.

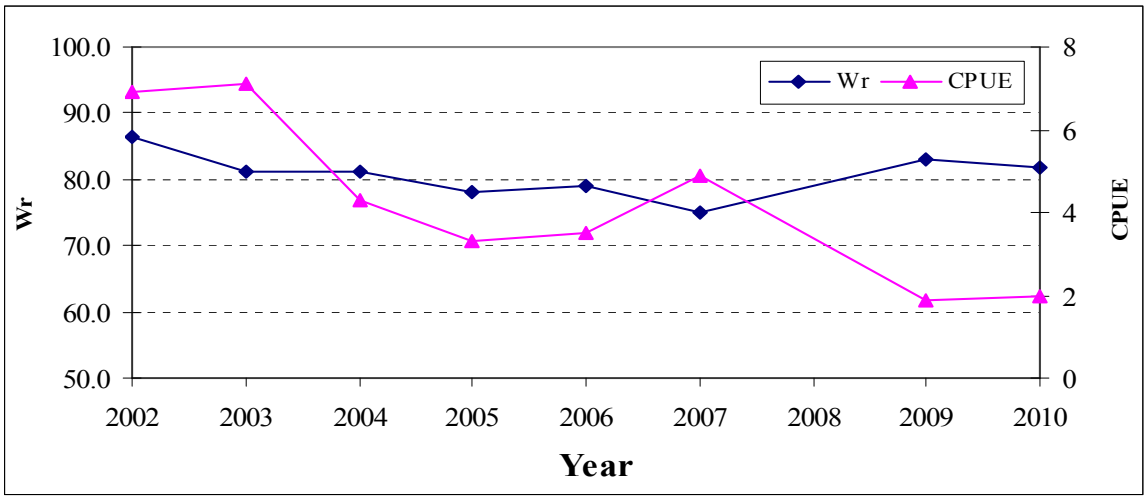


Figure 4. Condition (Wr) and CPUE for brown trout sampled with gill nets from 2002-2010.

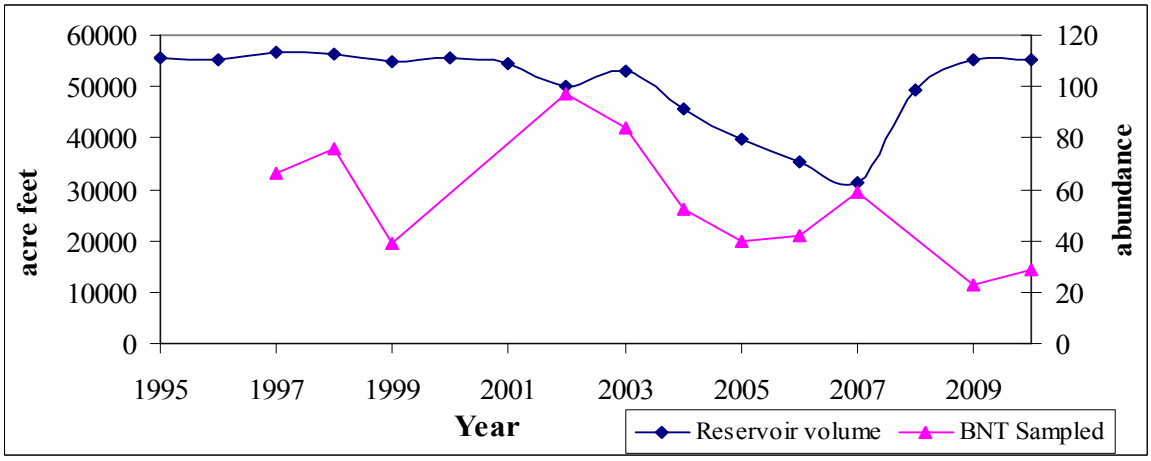


Figure 5. Pactola Reservoir July 31st volume and abundance of BNT sampled with experimental gill nets. Reservoir volume obtained from <http://www.usbr.gov/gp-bin/arcweb_ptr.pl>

Table 3. Wr values for brown trout from Pactola Reservoir, Pennington County.

Year	Mean Wr	Wr < 350 mm	Wr > 350 mm
2002	86.3	84.8	96.9
2003	81.1	78.3	118.3
2004	81.2	75.7	99.4
2005	78.0	74.6	97.4
2006	79.0	78.5	85.5
2007	74.9	73.3	85.2
2009	83.1	81.7	91.9
2010	81.8	81.1	83.7

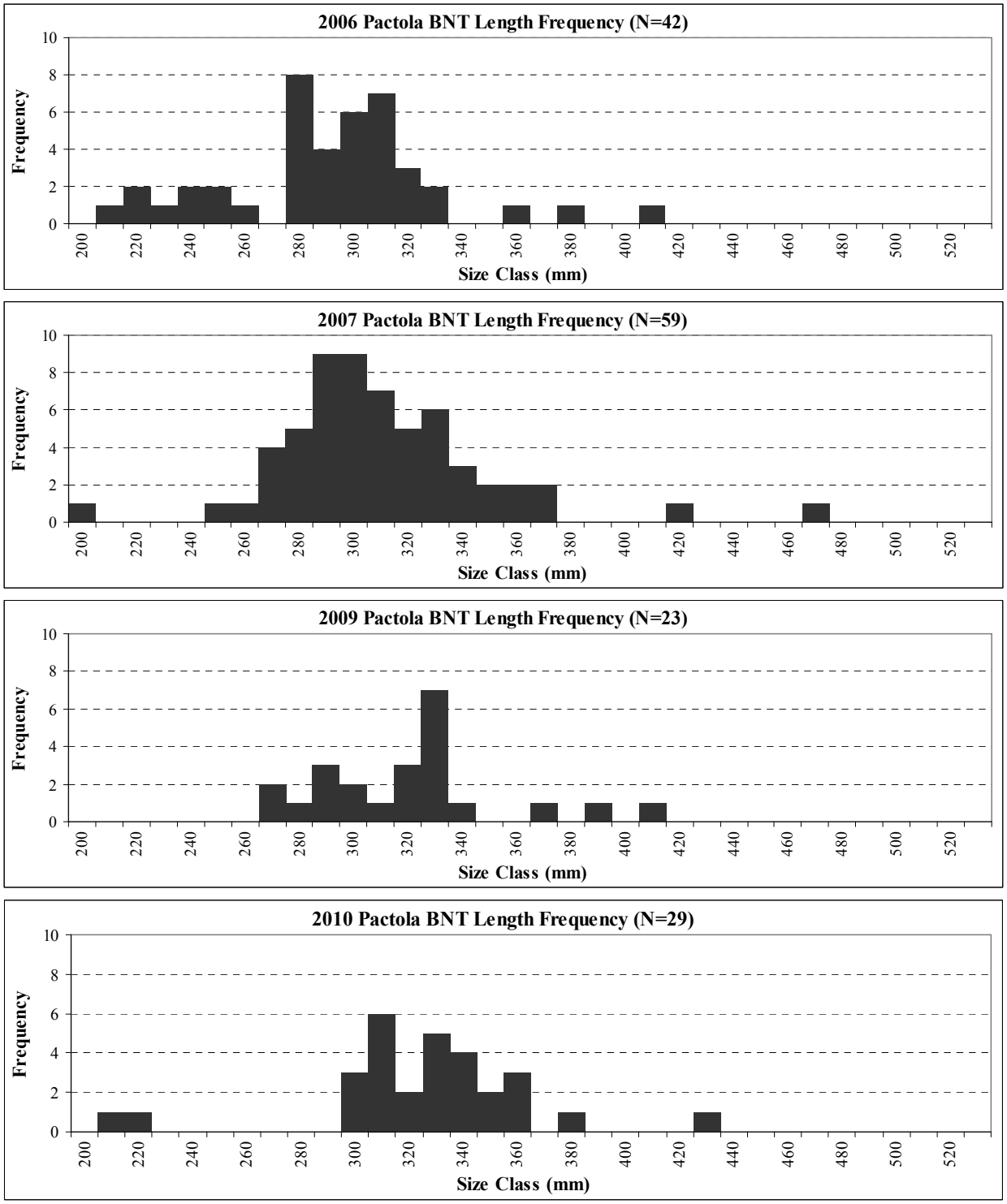


Figure 6. Length frequencies for brown trout sampled in gill nets from Pactola Reservoir.

Lake Trout

Relative abundance of lake trout surveyed in 2010 was almost double that of 2009. Lake trout were stocked in spring 2003 at 292 mm TL (11.5 in) and in the fall of 2005 at 355 mm TL (14 in) with 9,955 and 7,451 fish, respectively. Lake trout stocked in 2003 currently range from 375-440 mm (14-17 in) with a mean of 414 mm (16 in) (Figure 7). These fish appear to have grown slowly until reaching about 375 mm where growth slows even more. Condition (Wr) for 2003 stocked lake trout has remained relatively constant since 2003 ranging between 81 and 89 (Figure 8). They have had greater Wr than 2005 stocked fish in previous surveys, but condition in 2009 did not differ between these two groups and in 2010 was lower than that of 2005 stocked fish. It should be understood inferences to the stocked classes and wild lake trout are based on small sample sizes with no statistical analysis.

Known from differential fin clipping, four lake trout from the 2005 stocking were sampled in 2010 with a mean length of 403 mm (15 inches), a slight increase from the 2005 stocked fish collected in 2007 (Figure 7). Condition, however, has increased substantially since the 2007 survey (Figure 8). Again, these analyses are based on small sample sizes.

Naturally reproduced "wild" lake trout accounted for 33%, 55%, and 75% of the gill net catch in 2007, 2009, and 2010, respectively. Wild lake trout appeared to have greater growth rates than clipped fish for all years sampled but age data must be collected to determine if growth rate is truly higher than for stocked fish. Based on the 2010 length data, growth has not slowed for wild fish over 400 mm like it has for stocked fish (Figure 7). This year, unclipped fish Wr was lower than stocked fish and has been decreasing since 2006 (Figure 8).

Length-frequency analysis also shows an overall increase in the size structure of lake trout over the last few years with the greatest number of large fish captured in 2010 than any year (Figure 9). Nine of these were over quality length (500 mm) which has not been seen prior to this survey. None captured were greater than the 24" (609 mm) minimum length limit, although a few anglers have reported catching these fish.

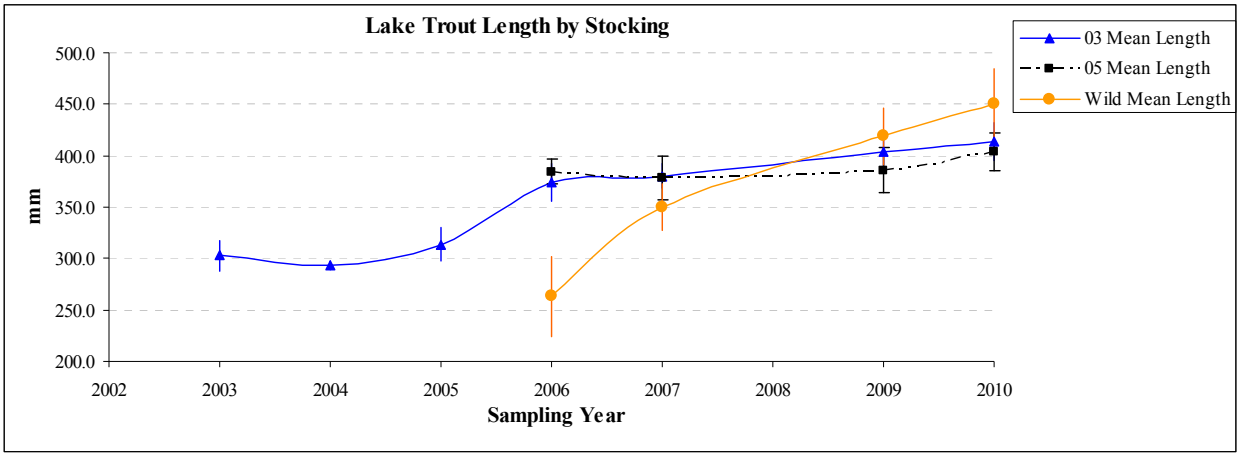


Figure 7. Lake trout mean length during gill net sampling separated by year fish were stocked and lake trout produced within the lake (i.e. wild).

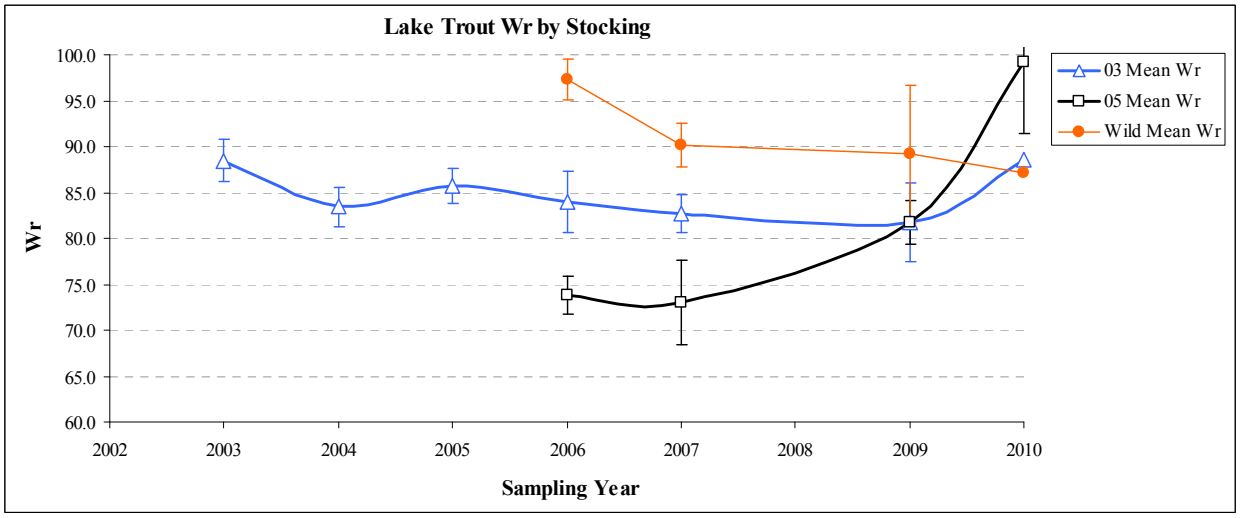


Figure 8. Lake trout mean length during gill net sampling separated by year fish were stocked.

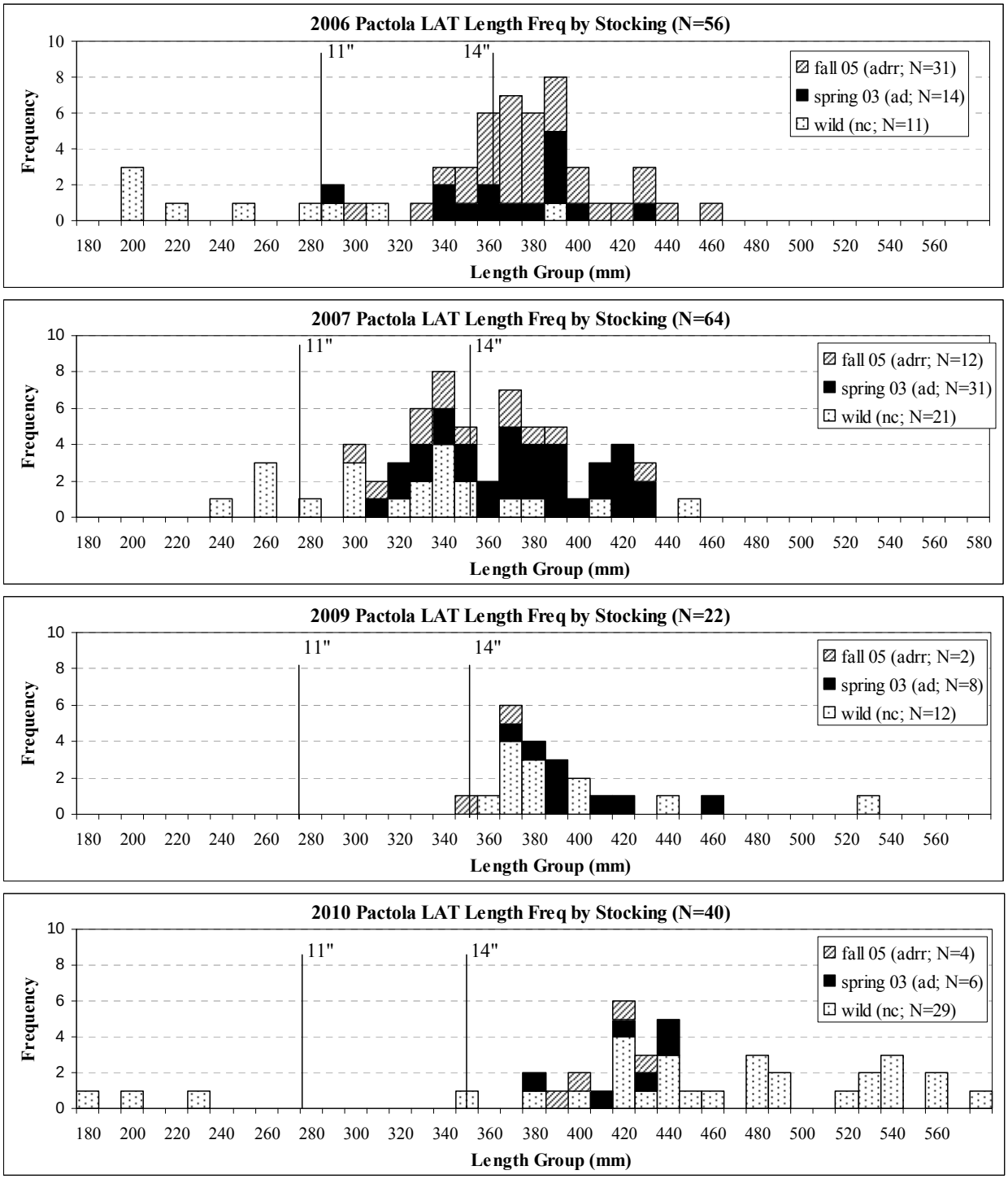


Figure 9. Length frequency histograms for lake trout sampled in Pactola Reservoir from 2006 - 2010.

Other Species

Bluegills were the most numerous species captured in 2010, accounting for about 36% of the total catch (Table 1). Bluegill condition has remained relatively steady with mean Wr values between 90 and 102 for every year sampled since 2002.

Yellow perch were also captured in abundant numbers with 38 in 2010, over double what was sampled in 2009. With a mean length of 172 mm (6 in) and PSD of 31, these individuals are still small.

Although deep set gill nets are not the preferred method for sampling northern pike, CPUE doubled from 2009 to 2010. There is recent concern that this illegally introduced species may be affecting the trout fishery in Pactola Reservoir. A diet study will be conducted in 2011 on northern pike to examine this further. Anglers have been targeting this species for the last few years, especially during winter, and reportedly catch large individuals.

Largemouth bass, rainbow smelt, rock bass, white sucker, and golden shiner were captured in low abundance.

RECOMMENDATIONS

1. Conduct a lake survey every one to two years to update information on fish populations and evaluate management strategies.

2. Collect otoliths from lake trout captured in gill nets to obtain information on population dynamics including age structure, growth rates, and mortality.

3. Propose research evaluating trophic structure and relationships of fish inhabiting Pactola Reservoir.

REFERECNES

Guy, C.S., M.L. Brown. 2007. Analysis and Interpretation of Freshwater Fisheries Data. American Fisheries Society, Bethesda, Maryland. pp.440.

Murphy, B.R. and Willis, D.W. 1996. Fisheries Techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland. pp 457

APPENDIX

Appendix A. Stocking record for Pactola Reservoir, South Dakota 2004-2010.

Year	Species (Strain)	Size	Stockings	Number of Fish
2004				
	Rainbow Trout	Adult	1	180
	Rainbow trout	Catchable	1	15,000
	Rainbow trout (Ennis)	Catchable	2	4,593
	Rainbow trout (McConaughy)	Catchable	1	10,000
2005				
	Lake Trout	Catchable	1	7,451
	Rainbow trout (Shasta)	Catchable	3	14,997
2006				
	Rainbow trout (Erwin)	Catchable	8	22,366
	Rainbow trout (Shasta)	Catchable	1	4,000
2007				
	Brown Trout (Soda Lake)	Catchable	1	4,700
	Rainbow trout (Erwin)	Catchable	1	3,000
	Rainbow trout (Shasta)	Catchable 11"	1	2,800
2008				
	Rainbow trout (McConaughy)	Catchable 11"	1	2,125
	Rainbow trout (Shasta)	Catchable 11"	2	4,963
	Rainbow trout (Utah)	Catchable	1	7,975
2009				
	Rainbow trout (Erwin)	Catchable	1	3,300
	Rainbow trout (McConaughy)	Catchable	1	2,400
	Rainbow trout (McConaughy)	Fingerling	2	7,420
	Rainbow trout (Shasta)	Catchable 11"	9	22,699
	Rainbow trout (Shasta)	Fingerling	2	4,603
	Rainbow trout (Shasta)	Small Fingerling	1	12,420
2010				
	Rainbow trout (ErwinXArlee)	Catchable 11”	2	9,619
	Rainbow trout (Shasta)	Catchable 11”	5	19,425

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Sheridan Lake County: Pennington
Legal description: Sec. 11,12,13,14; R5E; T1S and Sec. 7; R4E; T1S
Location from nearest town: 5 miles east and 2 miles north of Hill City, SD
Dates of present survey: July 19-20, August 9-10 and September 7, 2010
Date last surveyed: July 27-28, 2008 and September 22, 2009
Most recent lake management plan: F21-R-38 Date: 2006
Management classification: Warmwater permanent
Contour mapped: June 1986

Primary Species: (game and forage)	Secondary and other species:
1. Rainbow trout	1. Northern pike
2. Yellow perch	2. Golden shiner
3. Black crappie	3. Green sunfish
4. Largemouth bass	4. White sucker
5. Brown trout	5. European rudd
6.	6. Black bullhead
7.	7. Rock bass

PHYSICAL CHARACTERISTICS

Surface Area: 383 acres (155 ha); Watershed: 95,311 acres
Maximum depth: 96 feet Mean depth: 30 feet
Lake elevation at survey (from known benchmark): 4,624 ft. (full)

1. Describe ownership of lake and adjacent lakeshore property:

Sheridan Lake was constructed for recreational purposes in 1939. Sheridan Lake and its dam are maintained and operated by the U.S. Forest Service. The operation and maintenance of campgrounds, picnic areas, parking lots, and boat launch facilities are managed under a special use permit by non-government entities. These entities also cooperate with the U.S. Forest Service during major maintenance and improvement in the off season. The marina and concession operations are leased to private enterprise under other long-term use permits (Personal communication with Amy Ballard, USFS, 1995).

2. Describe watershed condition and percentages of land use:

The ownership of the Sheridan Lake watershed is 85.8% U.S. Forest Service (81,818 a or 31,111 ha) and 14.2% private (13,493 a or 5,461 ha) (Personal communication Jon Macy, USFS, 1994). The bulk of U.S. Forest Service land is managed for timber production, but is also grazed through a permit process. Most of this land is covered by pine or spruce forest interspersed with

meadows. Logging, thinning, and other timber management practices are ongoing. All of these activities contribute to the sediment load into Sheridan Lake carried by Spring and Horse creeks. Private land is less often forested and more often used as horse pasture, cattle grazing land, home sites, or campgrounds. The watershed also contains the town of Hill City and several other small developments. Small reservoirs including Mitchell Lake, Major Lake, Newton Fork Dam, Sunday Gulch and several unnamed farm ponds are located within the watershed. Most of the watershed consists of hills with moderate to steep inclines. Roads and trails are prevalent throughout the watershed.

3. Describe aquatic vegetative condition:

Abundant emergent vegetation, primarily cattails, is present in the shallow ends of bays, along shallow shoreline areas, and near the inlets of Spring and Horse Creeks. Submergent vegetation is abundant throughout the lake at depths of six to eight feet. Algae blooms sometimes occur during the summer months and filamentous algae is found at times along the shoreline. Sheridan Lake is also infested with the invasive curly leaf pondweed.

4. Describe pollution problems:

Siltation occurs at all inlets, especially the Spring and Horse Creek inlets, and is heavy due to agricultural use (grazing), timber/logging operations, highway runoff, and natural erosion. Moderate to heavy nutrient loads are entering the system.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

A faulty valve in the dam prevented controllable water releases from Sheridan Lake into Spring Creek during 2003. This valve was repaired in late 2004, but is not operational at this time.

CHEMICAL DATA

No chemical data was collected in 2010, however, South Dakota Department of Natural Resources collected water quality parameters for Sheridan Lake in 2009 on June 23 and August 18 (Figure 1). Their results show that Sheridan Lake does exhibit oxygen and temperature stratification. DO levels likely limit the habitat of fish species to the shallower reaches of the lake. This may be why gill nets have not caught many trout or yellow perch in the last few surveys.

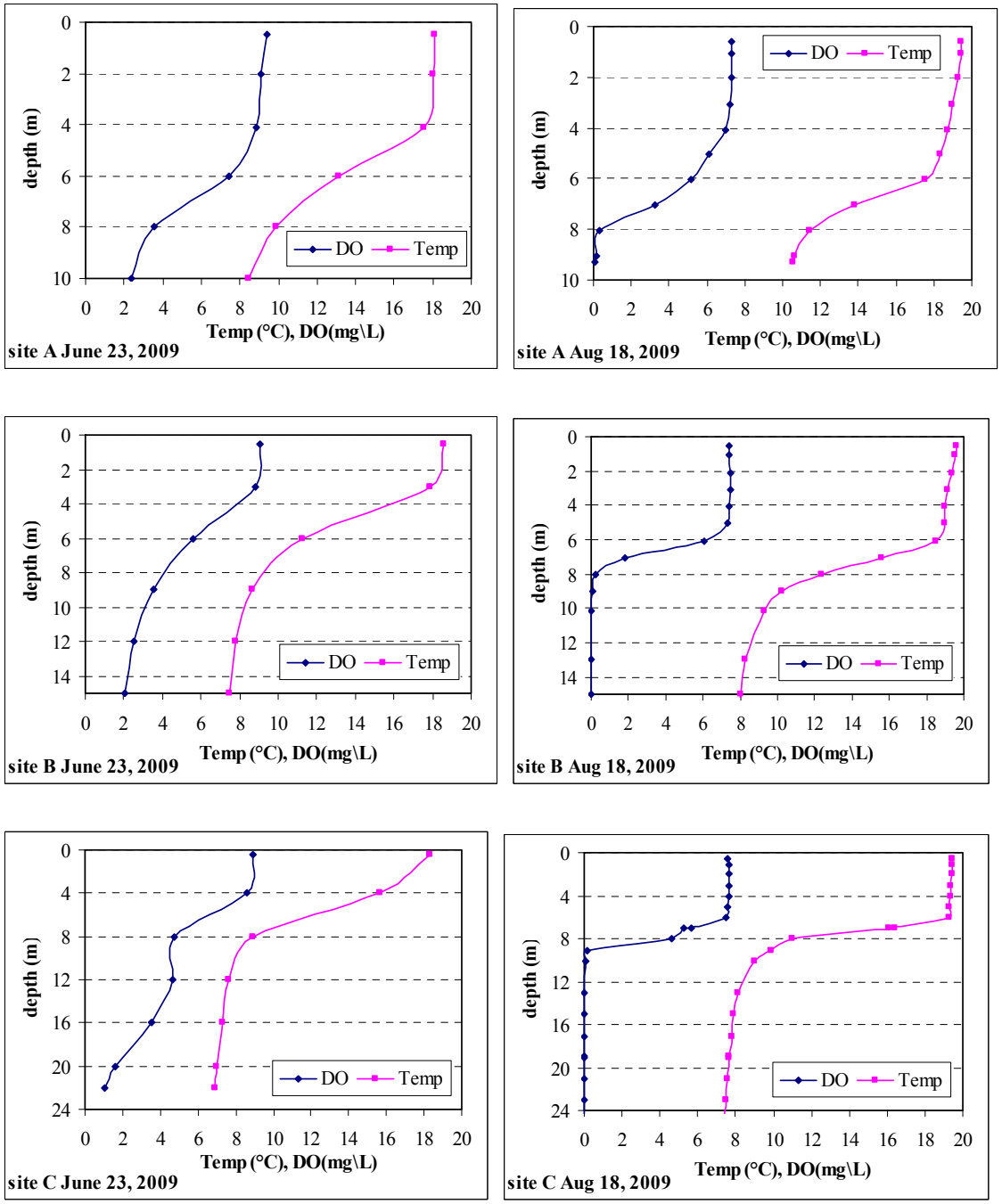


Figure 1. Lake water chemistry profiles for Sheridan Lake at three sites and two dates in 2009. Data was collected by S.D Dept of Environment and Natural Resources.

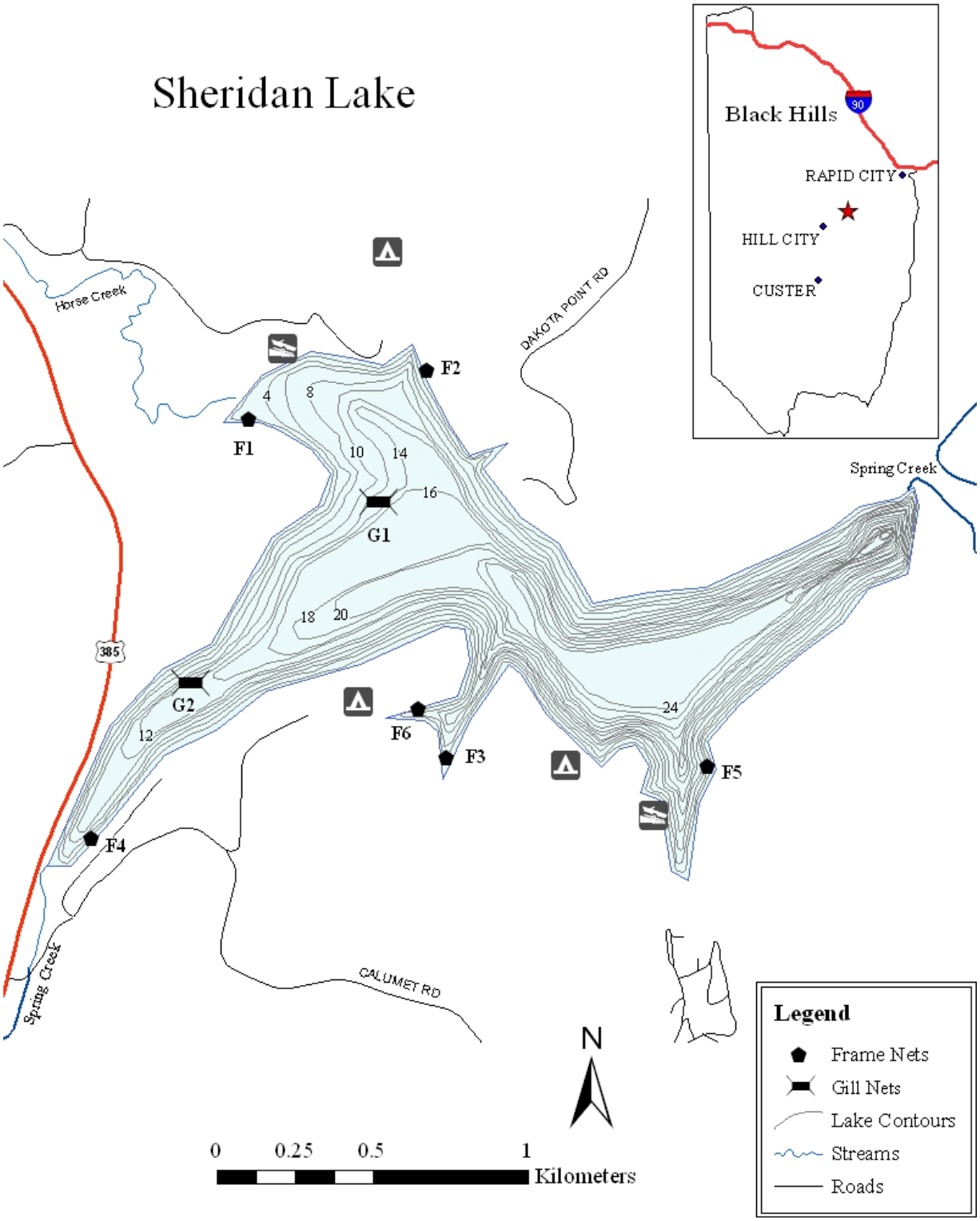


Figure 2. Lake map and 2010 sampling sites for Sheridan Lake, Pennington County, SD.

Methods

Two gill nets and six trap nets were set in standardized locations on July 19, 2010 (Figure 2, Table 1). Due to low catch rate, gill nets were set again on August 9, 2010. All nets remained in the water overnight for a total of six trap net and four gill net nights. Trap nets were modified fyke-nets with a 1.3 × 23 m (3.9 × 75.5 ft.) lead. Gill nets were monofilament experimental nets 45.7m (150 ft) long and 1.8m (6 ft) deep with six 7.6m (25 ft) panels of bar mesh sizes: 12.7mm (0.5 in), 19.1mm (0.75 in), 25.4mm (1.0 in), 31.8mm (1.25 in), 38.1mm (1.5 in), and 50.8mm (2.0 in).

Table 1. Net locations for 2010 fisheries survey of Sheridan Lake, South Dakota.

Set Date	Net #	UTM Lat	UTM Long
7/19	Gill 1	4870349	622427
7/19	Gill 2	4869797	621963
7/19	Frame 1	4870673	622126
7/19	Frame 2	4870831	622699
7/19	Frame 3	4869589	622762
7/19	Frame 4	4869333	621623
7/19	Frame 5	4869564	623598
7/19	Frame 6	4869745	622673

Night electrofishing was conducted at Sheridan Lake on September 7, 2010 to sample largemouth bass using a Smith-Root 18-H electrofishing boat with pulsed-DC current at approximately 150 volts and 6-8 amps. Five ten-minute sites and one nine-minute site was completed during the survey.

For each survey method, total length (mm) and weight (g) was collected for each fish sampled.

Results and Discussion

Nine fish species were caught in trap nets totaling 126 fish (Table 2). Rock Bass were the most numerous species sampled followed by yellow perch. Three species were caught with gill nets totaling 18 fish (Table 3).

Table 2. Total catch for six trap nets in Sheridan Lake, Pennington County, on July 20, 2010. Parameters are reported with confidence intervals.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	Wr≥S (90%)
Black bullhead	16	2.7 (2.8)	2.7 (2.8)	100	38 (22)	86.5 (2.1)
Black crappie	12	2 (2.4)	2.4 (2.4)	100	0	94.0 (1.3)
Rainbow trout	1	0.16	0.16	0	0	85.7
Largemouth bass	1	0.2	0.2 (0.3)	0	0	100.4
Rock bass	36	6 (3.9)	5.8 (3.9)	100	0	87.6 (1.5)
European rudd	25	4.2 (3.9)	n/a	n/a	n/a	n/a
White sucker	1	0.16	0.16	100	100	87.5
Yellow perch	33	5.5 (3.4)	5.3 (3.3)	61 (0)	10 (0)	92.5 (1.3)
Total	126					

Table 3. Total catch for two 150ft experimental gill nets set in Sheridan Lake on July 20, 2010 and set again on August 10, 2010. Confidence intervals are also included.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	Wr≥S (90%)
Rainbow trout	3	0.75	0.75	66	0	91.9
Northern pike	1	0.16	0.16	100	0	>106.4
Yellow perch	14	3.5 (3.1)	3.5 (3.1)	100	14 (17)	103.5 (2.5)
Total	18					

Largemouth bass

Night boat electrofishing captured 62 largemouth bass on September 7, 2010 resulting in a catch per unit effort (CPUE) of 62 fish per hour (Table 4). Abundance of largemouth bass has remained relatively constant except in 2007 where values were almost twice as high as the previous survey. The CPUE of stock length fish (200 mm) in 2010 was slightly lower than in 2009, but has also remained relatively constant except for the 2007 sample.

These fish have had good to excellent condition over the past few years with a Wr ranging from 99 to 105 (Table 4).

The proportion of quality length fish (PSD ≥300 mm) decreased in 2010 and that of preferred length fish (380 mm) increased slightly. Length frequency histograms (Figure 4) show few fish are above 380 mm (15 in) with highest abundances between 200 and 300 mm (8-12 in). Currently, Sheridan Lake is under a 15-inch minimum angling regulation for largemouth bass.

Largemouth bass growth in 2010 was similar to the past surveys, but still range one to two inches per year slower than the SD mean (Figure 5). Bass are reaching stock length (200 mm or 8 in) at about 3 years of age.

Table 4. Results of largemouth bass captured during night electrofishing surveys of Sheridan Lake, Pennington County, South Dakota.

Year	N	Effort (sec)	CPUE	CPUE-S	PSD	PSD-P	Wr≥S
2003	82	3,600	82	69	20	7	102
2004	57	3,600	57	38	37	3	102
2005	57	3,488	58	33	39	0	99
2007	111	3,450	115	102	26	1	104
2008	54	3,600	54	46	61	9	105
2009	50	3,550	50	51	43	0	104
2010	62	3,600	62	42	31	7	101

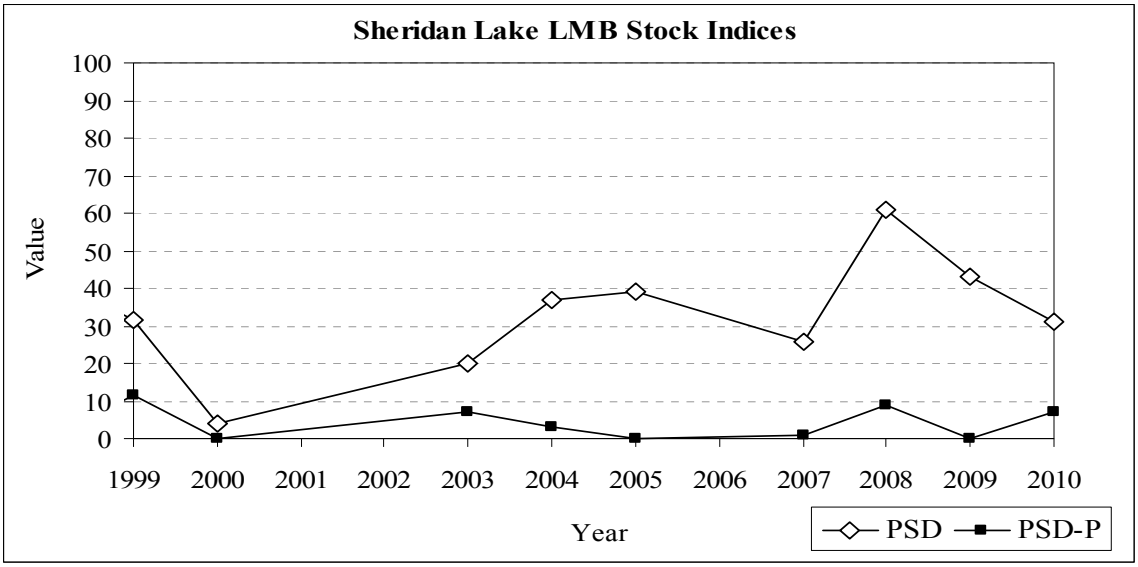


Figure 3. Stock indices for largemouth bass captured during night electrofishing surveys of Sheridan Lake, Pennington Co., South Dakota.

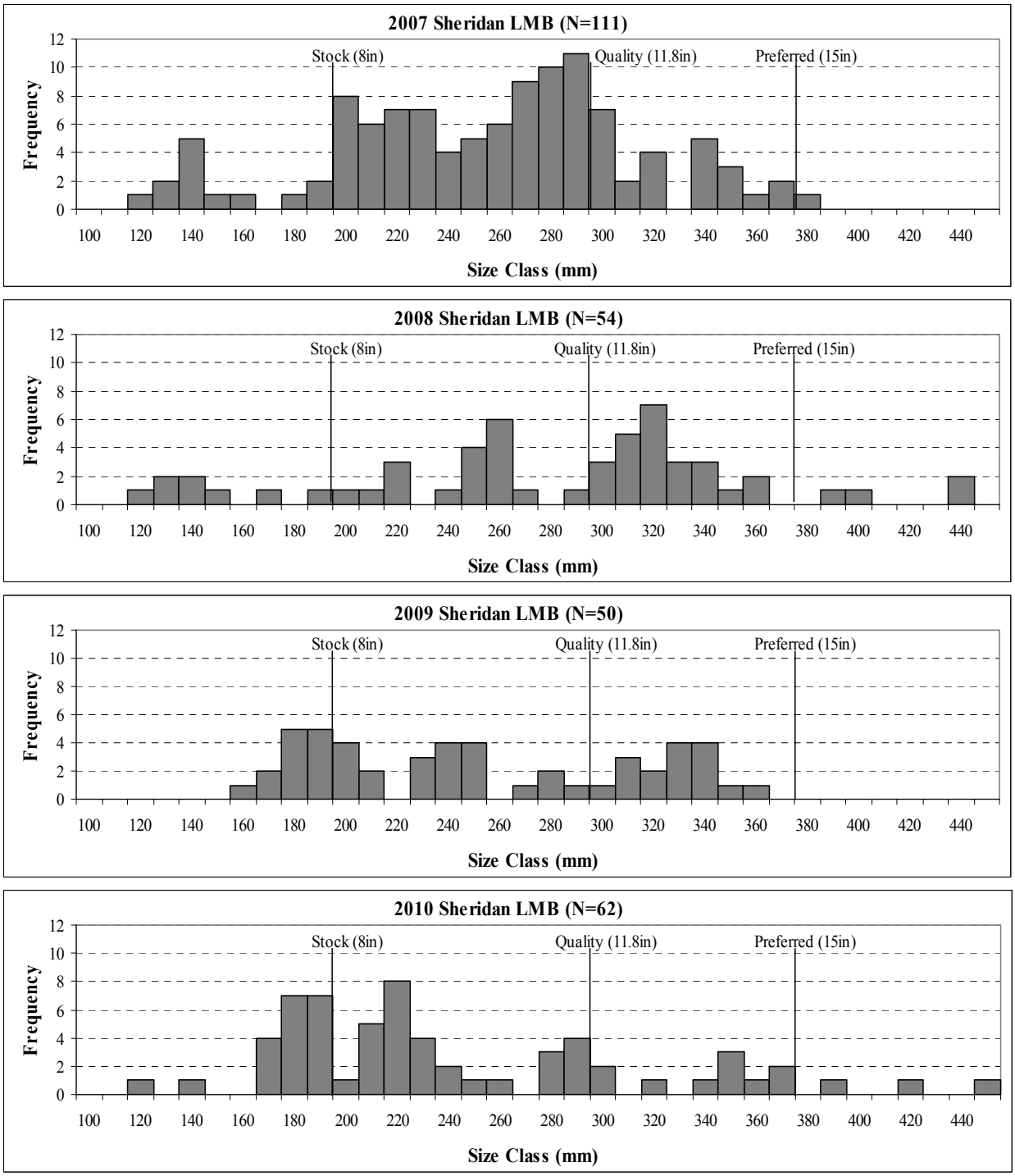


Figure 4. Length frequency histograms for largemouth bass collected by night electrofishing from Sheridan Lake, Pennington County, South Dakota.

Figure 5. Length-at-age for largemouth bass captured in Sheridan Lake by night electrofishing.

Yellow Perch

Catch per unit effort has shown an overall decrease during surveys of Sheridan Lake since 2003 (Figure 6). It is possible that abundance is down, but a more likely reason is that nets have been set deeper than the optimal oxygen levels for yellow perch. Plans for 2011 include increasing gill net effort and taking a closer look at net location, depth and oxygen levels to optimize the survey.

Since 2007, sizes of yellow perch have increased, indicated by the greater proportions of quality (PSD) and preferred (PSD-P) length fish (Table 5). Length frequencies indicate that most yellow perch in Sheridan Lake are between quality and preferred length with a peak around 270 mm (9.8in) (Figure 7). Few yellow perch in Sheridan Lake exceed 10 inches.

Condition (Wr) for yellow perch captured in gill nets has been excellent and remained relatively constant with values around 100. During the 2010 survey values were at their greatest (Table 6), although with a small number captured this value and those for stock density should be viewed cautiously.

Due to low numbers captured in gills nets, most otoliths were taken from yellow perch captured in trap nets. Otolith aging indicated that one of these fish was 14 years old at 230 mm (9 in) and one was 12 at 247 mm (9.7 in) (Tables 7 and 8). Some Sheridan Lake yellow perch do exhibit faster growth reaching quality length (200 mm or 8 in) around age-3. However, the lack of larger fish may suggest it is likely that high energy food is unavailable for perch to grow past lengths of about 10 to 11 inches. Unless a different, high energy food source becomes available, yellow perch in Sheridan Lake may not reach sizes greater than currently observed. High fishing

pressure and harvest may also be contributing to the perch population being "cropped off" when they reach a certain size. Yellow perch may grow slow due to the high harvest rates.

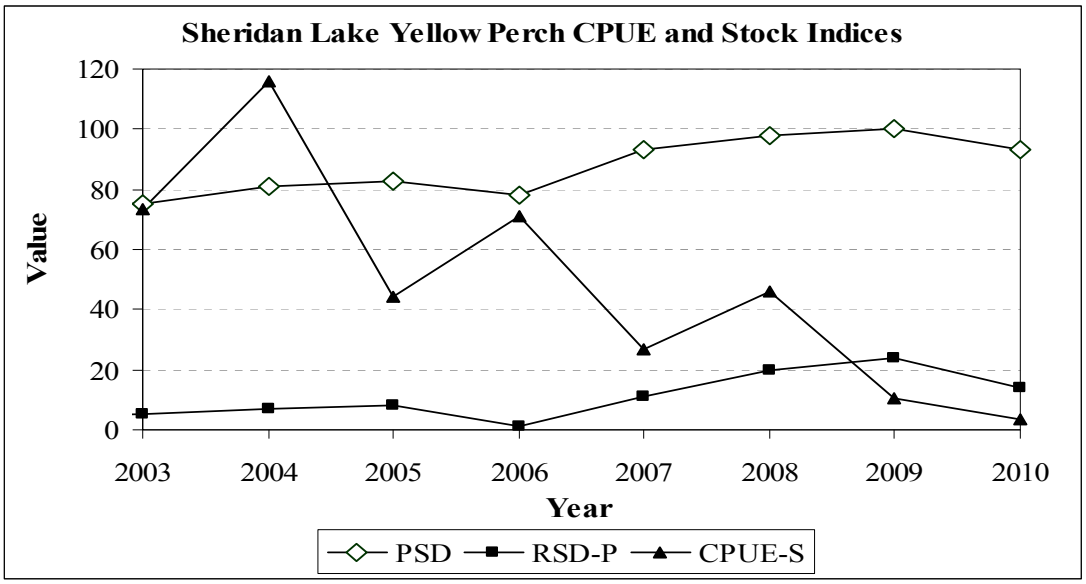


Figure 6. Stock indices and condition for yellow perch captured with gill nets in Sheridan Lake, Pennington County, South Dakota**.**

Table 5. Stock indices and condition for yellow perch captured with gill nets in Sheridan Lake, Pennington County, South Dakota.

Year	N	Effort	CPUE	CPUE-S	PSD	PSD-P	Wr-S
2004	231	2	116	116	81	7	98
2005	89	2	44.5	44.5	83	8	97.4
2006	193	2	96.5	71	78	1	98.8
2007	54	2	27	27	93	11	96
2008	92	2	46	46	98	20	100
2009	21	2	10.5	10.5	100	24	100
2010	14	4	3.5	3.5	93	14	104

Table 6. Stock indices and condition for yellow perch captured with trap nets in Sheridan Lake, Pennington Co., South Dakota.

Year	N	Effort	CPUE	CPUE-S	PSD	RSD-P	Wr-S
2003	44	8	6.2		66	5	95
2006	55	6	9.1		45	0	n/a
2009	56	6	9.3	9.1	44	7	95
2010	33	6	5.5	5.3	72	9	92

Table 7. Sheridan Lake yellow perch length range and weighted mean length (mm) at capture by otolith aged experimental gill net sample during the 2010 lake survey.

Age	Minimum	Weighted mean	Maximum	Number surveyed
1	145	145	145	1
4	231	231	231	1
5	211	231	260	8
6	276	276	276	1
7	215	215	215	1
9	235	235	235	1
12	247	247	247	1

Table 8. Sheridan Lake yellow perch length range and weighted mean length (mm) at capture by otolith aged trap net sample during the 2010 lake survey.

Age	Minimum	Weighted Mean	Maximum	Number surveyed
1	128	128	128	1
2	130	131	133	4
3	185	199	214	7
4	190	220	255	14
5	216	218	220	2
6	238	238	238	1
7	278	278	278	1
8	272	272	272	1
14	232	232	232	1

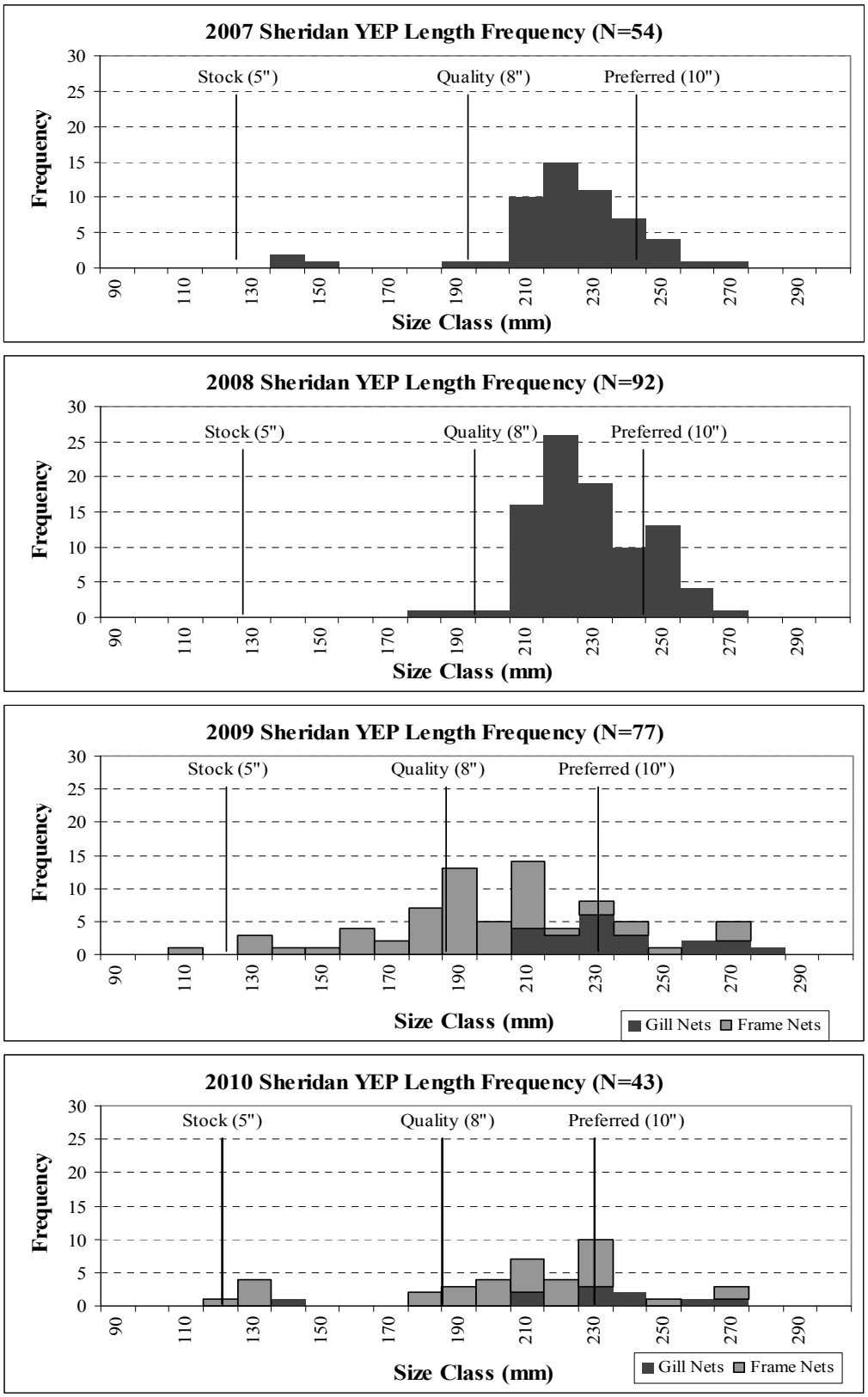


Figure 7. Length frequency histogram for yellow perch captured during surveys in 2007-2010.

Rainbow Trout

Although over 18,630 rainbow trout were stocked into Sheridan Lake in 2010, only one was captured in trap nets and three in gill nets during the 2009 survey. See discussion in water chemistry section on oxygen and temperature during summer stratification.

Rock Bass

Rock bass were the most abundant species captured during the survey with 36. This is the lowest number caught since 2003 with the greatest being in 2004 with 207 surveyed. They are an illegally introduced species to any water body within the Black Hills Trout Management Area. Other reservoirs have experienced angler complaints about rock bass catch hindering their ability to catch other species.

European Rudd

European rudd, an introduced species, remains abundant in Sheridan Lake with 25 captured in 2010, slightly less than the 36 captured in 2009 and 42 in 2006. In 2003 only one was sampled. Eropean rudd may pose a threat to the Sheridan Lake system because of their omnivorous habits, which may result in predation on other fishes and competition for resources (Howells et al. 1991).

Smallmouth Bass

Seventy-eight hundred smallmouth bass fingerlings were stocked into Sheidan Lake in late August 2010. Future surveys or angler comments should determine if these stockings were successful.

Northern Pike

Northern pike, an illegally introduced species to Black Hills lakes, are a popular winter fishery for Sheridan lake anglers. Only one was caught during the 2010 survey (Table 2).

Other Species

Black bullhead and black crappie were also trapped during the survey in moderate numbers (Tables 1 and 2).

RECOMMENDATIONS

1. Continue stocking rainbow trout at current stocking rate.

2. Conduct annual lake survey in 2011.

a. Trap netting to be conducted in early summer at a time better suited for panfish catches.
b. Gill net sampling should be completed during late summer. Increased netting effort and YSI water chemistry profiles should be taken prior to net placement.
c. Conduct night electrofishing during the spring for largemouth bass and smallmouth bass.

LITERATURE CITED

Howells, R. G., R. W. Luebke, B. T. Hysmith, J. H. Moczygemba. 1991. Field Collections of Rudd, *Scardinius erythrophthalmus* (Cyprinidae), in Texas. The Southwestern Naturalist, 36:244-245

APPENDICES

Appendix A. Stocking record for Sheridan Lake, South Dakota, 2005-2010.

Year	Species (Strain)	Size	Stockings	Number
2005	Brown Trout (Soda Lake)	Catchable	1	2,664
	Rainbow Trout (Ennis)	Catchable	2	5,000
	Rainbow Trout (McConaughy)	Catchable	2	10,700
2006	Rainbow Trout (Erwin)	Catchable	2	5,000
	Rainbow Trout (Shasta)	Catchable	2	10,789
2007	Brown Trout (Soda Lake)	Catchable	1	726
	Rainbow Trout (Erwin)	Catchable 11”	2	4,100
	Rainbow Trout (Shasta)	Catchable	2	7,490
2008	Rainbow Trout (Shasta)	Catchable 11"	1	3,582
	Rainbow Trout (Utah)	Catchable	1	5,000
2009	Brown Trout (Utah)	Catchable 11"	1	1,000
	Rainbow Trout (Erwin)	Catchable	1	10,000
	Rainbow Trout (McConaughy)	Catchable	3	10,637
	Rainbow Trout (McConaughy)	Fingerling	1	6,000
2010	Brown Trout (Soda Lake)	Catchable 11"	1	900
	Rainbow Trout (Erwin X Arlee)	Catchable	1	9,000
	Rainbow Trout (McConaughy)	Catchable	2	9,630
	Smallmouth Bass	Fingerling	1	7,800

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-3943

Name: Slate Creek Dam County: Pennington
Legal description: T1N, R4E, Sections 22
Location from nearest town: 4 mi. South of Mystic
Dates of present survey: June 29-30, 2010
Date last surveyed: Aug 3, 1994
Most recent lake management plan: F21-R-28
Management classification: Coldwater Permanent

Primary Species: (game and forage)	Secondary and other species:
1. Rainbow Trout	1. Creek Chub
2. Brook Trout	2. White Sucker
3. Brown Trout	3.

PHYSICAL CHARACTERISTICS

Surface Area: 3.1 ac. (1.3 ha) Watershed: 20,310 ac (8,219 ha)
Maximum depth: 6.6 ft (2.0 m) Mean depth: 3.6 ft. (1.1 m)
Lake elevation at survey: unknown

1. Describe ownership of lake and adjacent lakeshore property:

Slate Creek Dam Lake was constructed in 1936 by the Civilian Conservation Corps. The lake and its shoreline are public land managed by the U.S. Forest Service (USFS). The Forest Service gate is locked from October through late May, but can be accessed by foot or bike.

2. Describe watershed condition and percentages of land use:

The U.S. Forest Service administers 77% (15,710 ac) of the watershed and the remaining is interspersed with private or city holdings. The land use of the watershed is 76% (15,474 ac) forest and 19% (3,885 ac) grassland (combined public and private land). Cattle grazing and timber harvest occurs over much of the 30.6 sq. mi. of the watershed. Grazing is very heavy at the dam itself. The area is also used heavily for slate rock collection during the spring and summer months.

3. Describe aquatic vegetative condition:

Emergent vegetation covered approximately 60% of the lake surface acreage, while submergent forms comprised about 10% of the surface area.

4. Describe pollution problems:

Sedimentation from roads and heavy grazing has reduced average depth to <4 ft, thus limiting trout habitat and creating the potential for lethal summer water temperatures.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

No apparent structural defects exist with the dam or outlet structure.

BIOLOGICAL DATA

Survey Methods

Two trap nets were set in standardized locations on June 29, 2010 and remained in the water overnight (Figure 1). Monofilament experimental gill nets were 45.7 m (150-ft.) in length and 1.8 m (6 ft.) in depth. Each net consisted of six 7.6 m (25 ft.) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). One net was a modified fyke-net with ¾ in mesh and a 1.3 × 23 m (3.9 × 75.5 ft.) lead. The second net was a ¼ in modified fyke-net with a 50 ft lead. Leads were pulled on shore for some nets due to water levels or lake size and this length was not measured. For each survey method, total length (mm) and weight (g) was collected for each fish sampled.

Results and Discussion

Four fish species were caught in the trap nets totaling 253 fish (Tables 1 and 2). Creek chub was the most numerous species sampled followed by white sucker.

Table 1. Total catch for one ¼ inch mesh trap net in Slate Creek Dam, Pennington County, on June 22, 2010. Parameters are reported with confidence intervals.

Species	**N/CPUE**	**CPUE-S**	**PSD**	**Wr**	**Mean Length** (mm)
Brook trout	2	1	50	108 (31)	271
Creek chub	138	n/a	n/a	n/a	
White sucker	53	43	91 (8)	73 (1.8)	189
Total	193				

Table 2. Total catch for one, $^{3}/_{4}$ inch mesh trap net in Slate Creek Dam, Pennington County, South Dakota on June 29, 2010. Parameters are reported with confidence intervals.

Species	**N/CPUE**	**CPUE-S**	**PSD**	**Wr** (90%)	**Mean Length (mm)**
Brown trout	2	2	100	126 (14)	439
White sucker	58	46	not measured in $^{3}/_{4}$ in net		
Total	60				

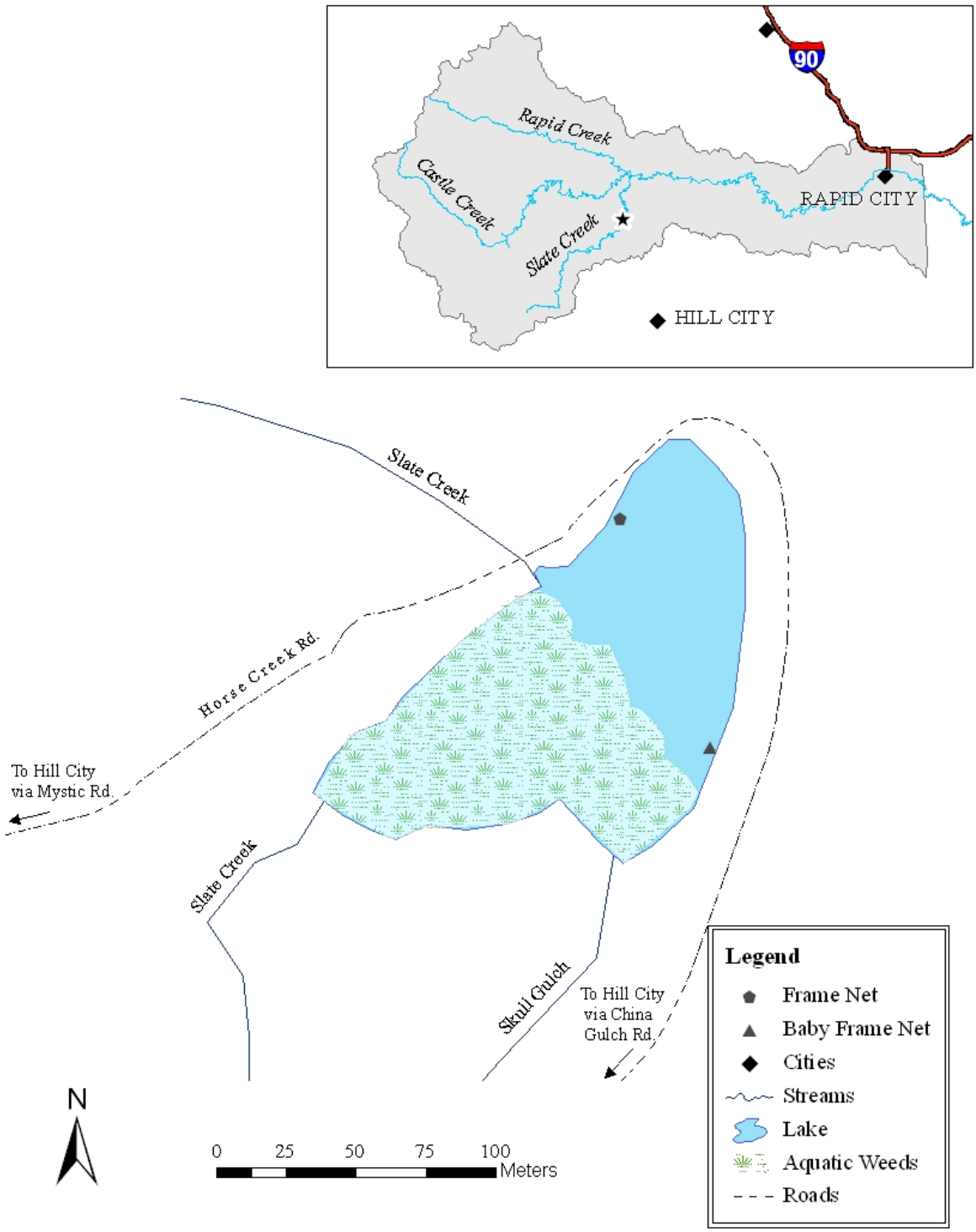


Figure 1. Slate Creek Dam with net locations during the fish survey on June 29-30, 2010.

Brook trout

Two brook trout were captured during the survey in the ¼ inch mesh net (Table 1). These fish were 176 mm (6.9 in) and 366 mm (14.4 in) long, both greater than stock (130 mm), and one over quality (200 mm) length. No brook trout were captured during the 1994 survey; however, that survey was accomplished with a rowboat and backpack electrofisher near the shore. Individuals have been collected in the creek during stream surveys below and above the dam.

Brown trout

Two brown trout were captured in the ¾ inch mesh net at Slate Creek Dam (Table 2). Both fish were greater than preferred length (300 mm) and one was over trophy length (460 mm) at 506 mm (19.9 in). No brown trout were collected during the 1994 electrofishing survey. Individuals have been found in the creek during stream surveys below and above the dam.

White sucker

Slate Creek Dam appears to be home to a large number of white suckers. One hundred-eleven were captured in trap nets during the survey (Tables 1 and 2). A majority of those measured were over quality length.

Creek Chub

Creek chubs were captured in the ¼ in mesh net and revealed a large number of creek chubs also inhabit Slate Creek Dam. The high density is likely indicative of the recent drought and low numbers of brown trout and brook trout. No creek chubs were caught during the 1994 survey, however they were collected during the stream survey below the dam in 2008.

Rainbow trout

No rainbow trout were sampled during the 2010 survey. Slate Creek Dam was last stocked in 2000 with catchable rainbow trout. During the 1990's this dam received between 500 and 600 catchable size fish per year. Several anglers have commented that they used to love fishing this dam for trout, and would love to see it come back as a fishery.

Other species

Fathead minnow, mountain sucker, and one unidentified cyprinid were collected during the 1994 survey done with a backpack electrofishing unit from a rowboat around the shoreline. None were captured in 2010.

RECOMMENDATIONS

1. Resume stocking Slate Creek Dam with catchable rainbow trout now that water levels have increased.

2. Manage as a rainbow trout fishery by stocking catchable rainbow trout at the previous rate of 500 annually (Appendix A).

3. Deploy a temperature monitor to determine if adequate water temperatures exist during the summer months.

4. Conduct lake survey in 2015 to determine species composition and trend of fish populations.

APPENDIX

Appendix A. Stocking records for Slate Creek Dam, Pennington Co. South Dakota.

Year	Species (Strain)	Size	Stockings	Number
1997	Rainbow Trout	Catchable	3	375
1998	Rainbow Trout	Catchable	4	500
1999	Rainbow Trout	Catchable	4	500
2000	Rainbow Trout	Catchable	4	500

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Coal Springs Lake County: Perkins
Legal description: Sec. 24, T. 17N, R. 16E
Location from nearest town: 3 mi. E, 6 mi. S, 3 mi. E, 1½ mi. S, and ½ mi. E of Meadow
Dates of present survey: July 12-13, 2010
Date last surveyed: July 1-2, 2003
Most recent lake management plan: F21-R-31 Date: 1998
Management classification: Warmwater permanent

Primary Species:(game and forage)	Secondary and other species:
1. Largemouth bass	1. Northern pike
2. Walleye	2. Yellow perch
3.	3. Black bullheads

PHYSICAL CHARACTERISTICS

Surface Area: 90.3 acres Watershed: 6,400 acres
Maximum depth: 23 feet Mean depth: 12.1 feet
Lake elevation at survey (from known benchmark): (full) feet

1. Describe ownership of lake and adjacent lakeshore property:

A portion of Coal Springs Lake lies within the southeast quarter of Section 24, which is owned by Perkins County. The remainder of the lake is located on private property. There is a 12-foot public easement along the lake.

2. Describe watershed condition and percentages of land use:

The Coal Springs Lake watershed is comprised of approximately 60% cropland, 39% rangeland, and the remaining 1% as woodland.

3. Describe aquatic vegetative condition:

Cattails surround much of the shoreline. Submergent vegetation was extremely heavy in areas where light penetrated to the bottom.

4. Describe pollution problems:

Department personnel identified no pollution problems during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

Structures seemed in good condition. Coal Springs Lake does not have a boat ramp.

BIOLOGICAL DATA

Methods

A lake survey was conducted on Coal Springs Lake on July 12-13, 2010. Sampling consisted of two gill net nights and 4 trap net nights (Figure 1). The gill nets were monofilament experimental nets 45.7 m (150 ft) long and 1.8 m (6 ft) deep with six 7.6 m (25 ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Trap nets were set at four stations consisting of 4 trap net efforts each day. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 in) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g). In addition, scale samples for the first five fish per centimeter group were collected from selected fish per gear type for age and growth analysis. Scale samples were pressed onto acetate slides and viewed with a microfiche projector (40X) and the distance between scale annuli were recorded on paper strips.

Fish population parameters calculated were catch-per-unit-effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean catch-per-unit-effort (CPUE; mean number per net night or mean number per hour of electrofishing). Actual pedal time (time the electrofishing unit produced current) was recorded from the digital display on the control box and used to calculate electrofishing CPUE. Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

Results and Discussion

Coal Springs Lake refilled in 2009 after an extended drought. The four trap nets caught a total of 35 fish (Table 1). Northern pike comprised 91.4% of the total catch. Two yellow perch and one black bullhead were also sampled in the trap net. The one gill net captured five northern pike (Table 2).

Figure 1. Map of Coal Springs Lake with net locations and GPS coordinates.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD; 90% CI's) and condition factor (mean Wr for stock length and larger fish) for all fish species from four trap nets in Coal Springs Lake, Perkins County, July 12-13, 2010.

Species		CPUE	CPUE-S	PSD	RSD-P	Wr>S
Black bullhead	1	0.3 (0.4)	0.3 (0.4)	--	--	106.3 (--)
Northern pike	32	8.0 (1.5)	7.8 (1.2)	3 (--)	0	80.5 (1.8)
Yellow perch	2	0.5 (0.5)	0.5 (0.5)	--	--	115.4 (--)
Totals	35					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD; 90% CI's) and condition factor (mean Wr for stock length and larger fish) for all fish species from two experimental gillnets in Coal Springs Lake, July 12-13, 2010.

Species		CPUE	CPUE-S	PSD	RSD-P	Wr>S
Northern pike	5	5.0 (--)	4.0 (--)	0	0	81.1 (6.8)
Totals	5					

Black Bullhead

In 2003, black bullheads dominated the trap net and gill net catch with a CPUE of 65.5 and 126.0, respectively. Stock indices were high with each gear type yielding a PSD of 94. During this survey one bullhead was caught in the trap net sample (Table 1). That individual bullhead was extremely large (370 mm) and may have survived the low water years (Figure 2).

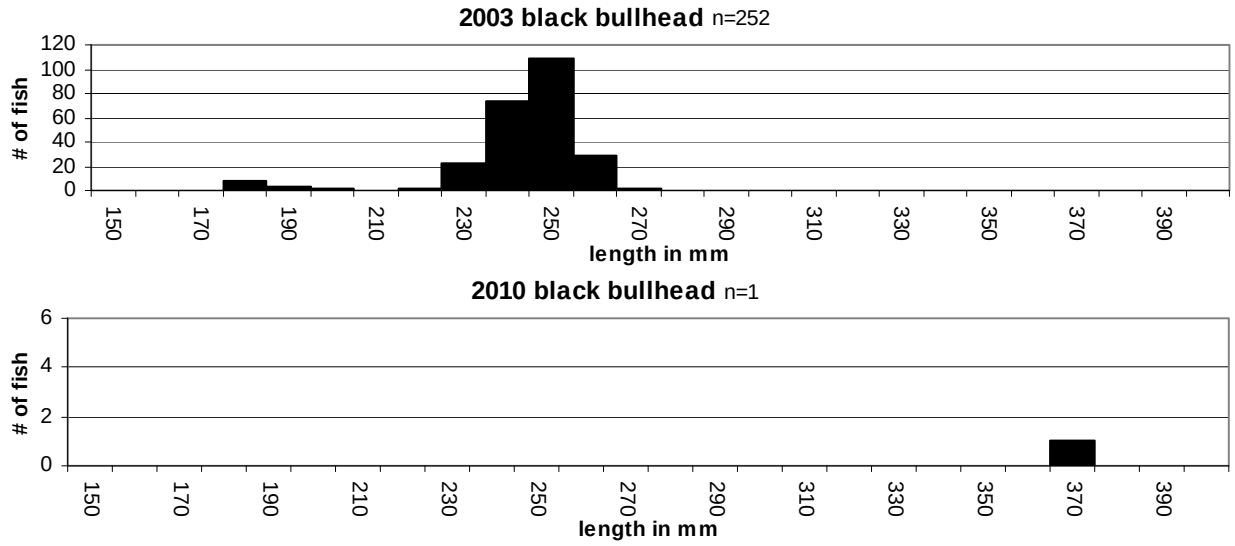


Figure 2. Length frequency histogram for black bullheads at Coal Springs Lake, 2003-2010.

Northern Pike

The northern pike were an unexpected catch during the 2010 survey with a trap net CPUE of 8.0. The single gill net caught five northern pike. No northern pike were stocked since the winterkill of 2008, so these fish may be naturally produced from some surviving adults. In 2003, two pike were sampled from two gill nets and none from the trap net. These fish appear to be one year olds born in the spring of 2009 when the lake refilled (Figure 2).

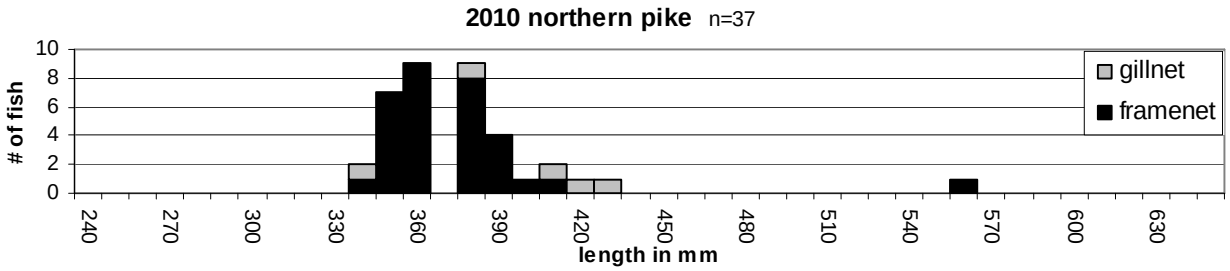


Figure 3. Length frequency histogram for northern pike from Coal Springs Lake, July 12-13, 2010.

Yellow Perch

One thousand yellow perch were stocked in 2009 when the lake refilled. During this survey, two small yellow perch were caught in the four trap nets. In 2003, only one perch was sampled. Coal Springs is scheduled to be resurveyed in 2011. If available, more adult yellow perch should be stocked in Coal Springs to establish a fishery.

RECOMMENDATIONS

1. Stock more adult yellow perch when available to reestablish the population.

2. Resurvey in 2011 to check for success of walleye and yellow perch stockings.

APPENDIX

Appendix A. Stocking record for Coal Springs Lake, Perkins County, 2001-2010.

Year	Number	Species	Size
2001	Not Stocked		
2002	8,200	Largemouth bass	Fingerling
2003	Not Stocked		
2004	430	Yellow perch	Adult
2005-2008	Not Stocked		
2009	350	Yellow perch	Adult
	650	Yellow perch	Adult
	40,100	Walleye	Fingerling
2010	8,200	Walleye	Fingerling
	5,000	Largemouth bass	Fingerling

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: East Lemmon Lake (Lemmon State Lake) County: Perkins
Legal description: T 21 N, R 17 E Sec. 16, 21
Location from nearest town: 11 mi. S. 7 mi. E Lemmon, SD
Dates of present survey: July 12-13, 2010
Date last surveyed: June 12-13, 2006
Most recent lake management plan: F21-R-29 Date: 1996
Management classification: Warmwater semi-permanent
Contour mapped: 1994

Primary Species: (game and forage)	Secondary and other species:
1. Largemouth bass	1. Tiger Muskie
2. Yellow perch	2. White sucker
3.	3. Black bullhead
4.	4. Channel catfish
5.	5. Golden shiner

PHYSICAL CHARACTERISTICS

Surface Area: 165 ac; Watershed: 49,500 acres
Maximum depth: 16 feet; Mean depth: 8.5 feet
Lake elevation at survey (from known benchmark): -3 feet

1. Describe ownership of lake and adjacent lakeshore property:

East Lemmon Lake is owned and managed by the South Dakota Department of Game, Fish and Parks. The dam structure and a small portion of the lake are located on private land.

2. Describe watershed condition and percentages of land use:

Ninety percent of the East Lemmon Lake watershed is privately owned agricultural land; the remainder is part of the Grand River National Grassland. The privately owned land is predominantly pasture and row crops, while the National Grassland is exclusively grazing land.

3. Describe aquatic vegetative condition:

Cattails and bulrush comprise much of the shoreline and littoral areas. During mid to late summer large mats of submergent vegetation are present throughout the lake.

4. Describe pollution problems:

No pollution problems were identified by department personnel during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

The spillway at East Lemmon Lake developed a cavity during the spring of 1995. A temporary repair of the badly damaged structure occurred in the fall of 1997. In the fall of 2000, a full repair of the dam including intakes, tubes and spillway was completed. The cost of the project at completion was $147,198. A boat ramp to provide public access was planned for the 2002 fiscal year, but has yet to be completed.

BIOLOGICAL DATA

Methods

A lake survey was conducted on East Lemmon Lake July 12-13, 2010. Sampling consisted of one gill net night and 4 trap net nights (Figure 1). The gill net was a monofilament experimental net 45.7 m (150 ft) long and 1.8 m (6 ft) deep with six 7.6 m (25 ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Trap nets were set at four stations for one night. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 inch) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g). In addition, scale samples for the first five fish per centimeter group were collected from selected fish per gear type for age and growth analysis. Scale samples were pressed onto acetate slides and viewed with a microfiche projector (40X) and the distance between scale annuli were recorded on paper strips.

Fish population parameters calculated were catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean catch per unit effort (CPUE; mean number per net night or mean number per hour of electrofishing). Actual pedal time (time the electrofishing unit produced current) was recorded from the digital display on the control box and used to calculate electrofishing CPUE. Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

Results and Discussion

East Lemmon Lake is a shallow lake and frequently experiences fish die offs due to oxygen depletions. These oxygen depletions have decimated entire year classes of yellow perch and largemouth bass. Sampling has shown that some fish have survived these events and remain in high enough numbers to repopulate the lake on their own. If lake levels will remain high this would reduce chances of more fish losses. Dominant fish species are discussed individually below.

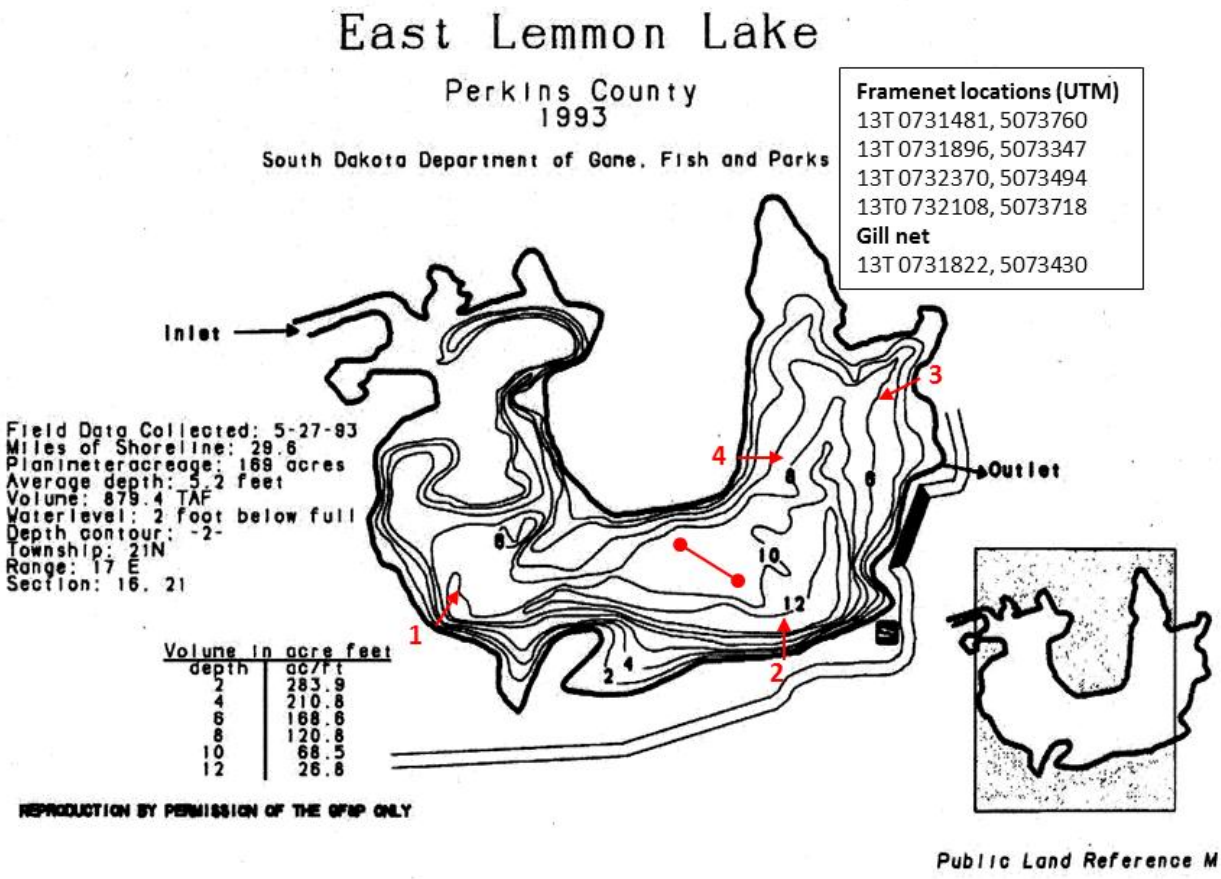


Figure1. Map of East Lemmon Lake and net locations during the 2010 survey.

Fish Community Survey

Gill and Trap Net Catch

Four species were collected in trap nets, totaling 188 fish. Black bullheads were the most common fish sampled, making up 72% of the total number captured (Table 1). White sucker were the second most common at 22%. Five age-0 northern pike and six adult yellow perch were also sampled in the trap nets.

Two species, totaling 6 fish, were collected in the experimental gill net (Table 2). The five white suckers and one yellow perch were the only fish captured in the gill net.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD; 90% CI's) and condition factor (mean Wr for stock length and larger fish) for all fish species from four trap nets in East Lemmon Lake, Perkins County, July 12-13, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr>S
Black bullhead	135	33.8 (24.0)	26.3 (18.3)	32 (8)	0	97.5 (1.5)
Northern pike	5	1.3 (1.6)	--	--	--	
White sucker	42	10.5 (15.6)	10.5 (15.6)	98 (4)	5 (5)	84.6 (0.3)
Yellow perch	6	1.5 (0.8)	1.5 (0.8)	100	17 (33)	101.3 (2.4)
Totals	188					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD; 90% CI's) and condition factor (mean Wr for stock length and larger fish) for all fish species from one experimental gill net in East Lemmon Lake, Perkins County, July 12-13, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr>S
White sucker	5	5.0 (--)	5.0 (--)	100	20 (43)	93.3 (2.1)
Yellow perch	1	1.0 (--)	1.0 (--)	--	--	101.4 (--)
Totals	6					

Black bullheads

Black bullheads were the most abundant fish captured in the trap nets. Mean CPUE in trap nets was 33.8 (Table 1). In 2006, CPUE was 9.3 indicating an increasing density. This is likely due to a winterkill event reducing the largemouth bass and tiger muskie populations. Bullheads ranged in size from 110 mm to 280 mm (Figure 2). Stock density indices were low with a PSD of 32 and an RSD-P of 0 from the trap net sample. In 2006, PSD was 73 with an RSD-P of 61. Mean condition for stock length and larger fish was 97.5. It appears the large bullheads have died off and a large number of young fish are replacing them.

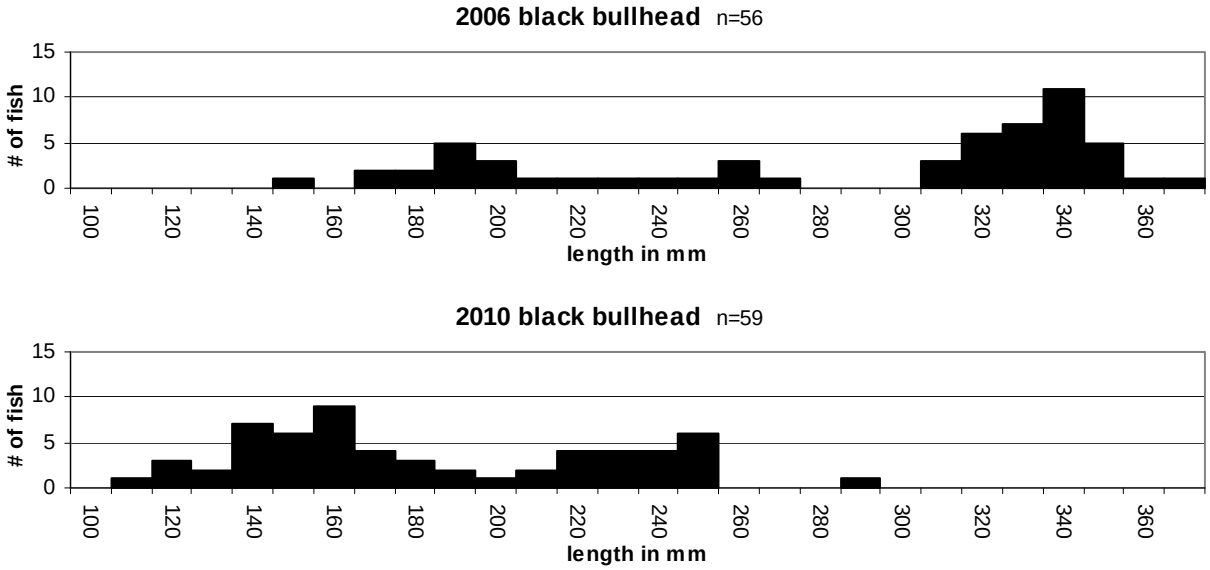


Figure 2. Length histogram of black bullheads collected in trap nets from East Lemmon Lake, Perkins County, 2006, 2010.

Northern Pike

East Lemmon Lake experiences frequent winterkills, therefore northern pike fry were stocked in the spring of 2010 to establish a fast growing fish to create a fishery before the next winterkill. Five of the fry were of a size large enough to be sampled in our four trap nets (Figure 3). Next year these fish will be larger and more likely to recruit to our gear and give a better idea on success of the fry stocking.

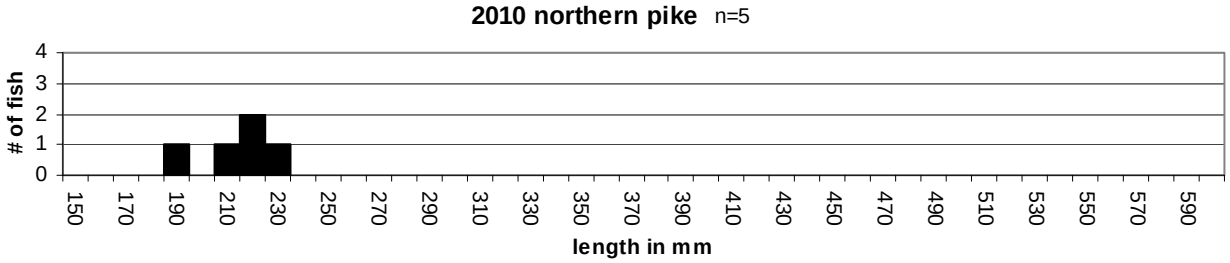


Figure 3. Length histogram of northern pike collected in trap nets from East Lemmon Lake, Perkins County, 2010.

White suckers

A current management objective for East Lemmon Lake is to reduce the white sucker density. Sucker density has gone down, but white suckers were still the most numerous fish collected in gill nets and second most in trap nets. In 2006, CPUE for gill nets was 23.0 and for trap nets 31.7. In 2003, CPUE was 40.5 and 37.5, respectively. This year CPUE decreased to 5.0 for gill nets and 10.5 for trap nets. Numbers are down due to the winterkills but, as with the bullheads, a

good number of young fish between 260 mm and 310 mm recruited to the population (Figure 4). It appears this population is increasing and if largemouth bass or northern pike populations decline, stockings will be done when the lake levels is near full.

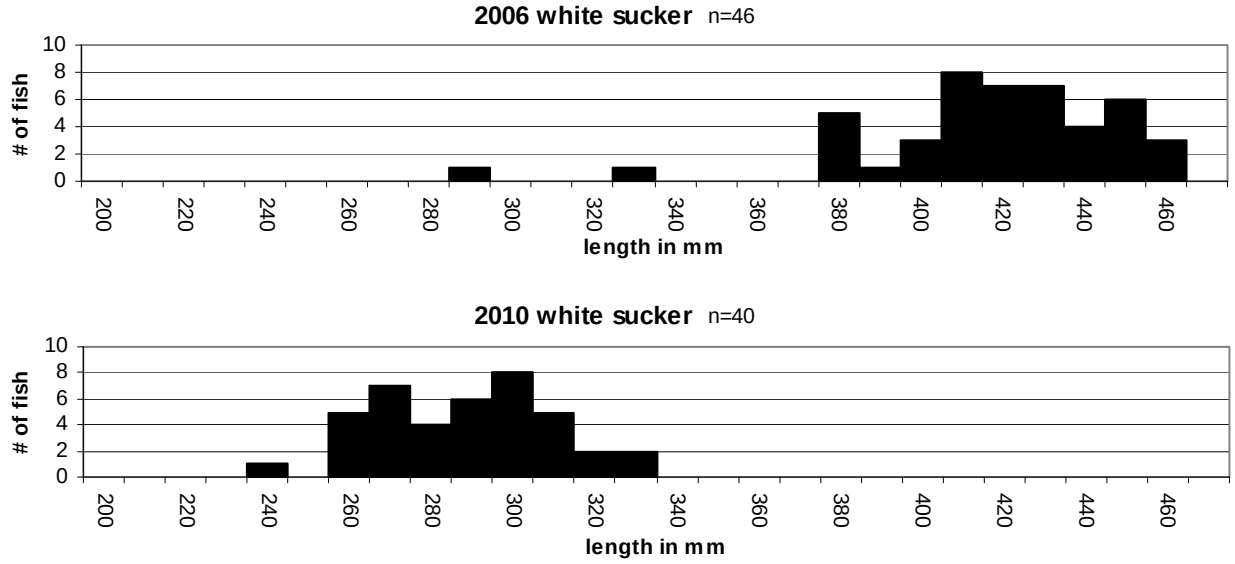


Figure 4. Length histogram of white sucker collected by gill nets from East Lemmon Lake, Perkins County, 2006, 2010.

Yellow perch

The current management objective is to increase and maintain yellow perch gill net CPUE at 25 or greater for stock-length and larger fish and maintain PSD between 20 and 40. Recent winterkills have decreased the population of yellow perch. CPUE was 1.5 for trap nets and 1.0 for gill nets in 2010. Four hundred prespawn adults were stocked to reestablish the population. Seven adults were sampled during the survey between the two gear types (Figure 5). Next year's survey should show if stocking these fish prespawn was successful.

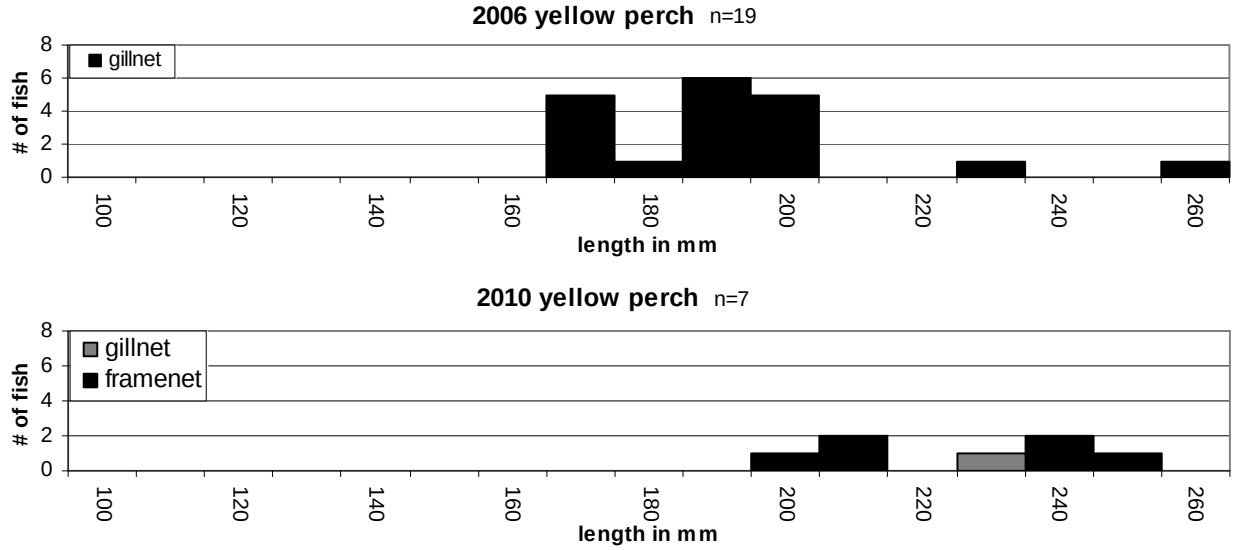


Figure 5. Length frequencies of yellow perch from East Lemmon Lake, Perkins County, 2006, 2010.

RECOMMENDATIONS

1. Conduct a lake survey next year to evaluate fish populations and stocking success.

2. Stock adult golden shiners, yellow perch and largemouth bass to help reestablish populations since the winterkills.

APPENDICES

Appendix A. Stocking record for East Lemmon Lake, Perkins County, 2002-2010.

Year	Number	Species	Size
2002	13,525	Largemouth bass	Fingerling
2003		Not Stocked	
2004	500	Yellow perch	Adult
2005	884	Tiger muskie	Fingerling
2006	500	Tiger muskie	Fingerling
2007-2009		Not Stocked	
2010	166,000	Northern pike	fry
	400	Yellow perch	Adult
	6,000	Largemouth bass	Fingerling

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Flat Creek Lake County: Perkins
Legal description: T21 N, R16 E, Sec. 20 & 21
Location from nearest town: 0.5,mi. west, 10 mi. south of Lemmon, SD
Dates of present survey: July 10-11, 2010
Date last surveyed: May 30-June 1, 2005
Most recent lake management plan: F21-R-29 Date: 1996
Management classification: Warmwater semi-permanent

Primary Species: (game and forage)	Secondary and other species:
1. Black bullhead	1. Channel catfish
2. Black crappie	2. Common carp
3. Bluegill	3. Golden shiner
4. Northern pike	4.
5. Yellow perch	5.

PHYSICAL CHARACTERISTICS

Surface Area: 203.4 acres (82 ha); Watershed: 102,400 acres
Maximum depth: 24 feet; Mean depth: 7.9 feet
Lake elevation at survey (from known benchmark): full

1. Describe ownership of lake and adjacent lakeshore property:

Flat Creek Lake was constructed as a WPA dam in the 1930's. Flat Creek Lake is divided by Highway 73 and has excellent access from the highway. Access on the east half is limited due to private ownership.

2. Describe watershed condition and percentages of land use:

The Flat Creek Lake watershed consists of approximately 102,400 acres. Approximately 50% of this acreage is cropland, 49% rangeland and 1% woodland.

3. Describe aquatic vegetative condition:

Cattails and bullrush surround most of the shoreline areas on both sides of the highway.

4. Describe pollution problems:

Department personnel identified no pollution problems during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

All structures appeared to be in good condition during the 2010 lake survey. Currently, small boats can be launched just off SD Hwy 73 in the southwest corner with four-wheel drive vehicles.

BIOLOGICAL DATA

Methods

Netting Survey

The fish population in Flat Creek Lake was sampled with the use of one experimental gill net and four trap nets (Figure 1). Total effort was overnight totaling one gill net night and four trap net nights. The gill net measured 150 ft X 6 ft with 6 mesh panels each measuring 25 ft in length and having mesh sizes of 0.5 in, 0.75 in, 1.25 in, 1.5 in, and 2.0 in (bar measure). The trap nets consisted of a 4 ft X 5 ft frame, 4 ft X 75 ft lead and 0.75 in bar mesh. Collected fish were measured for total length (TL; mm) and weighed (g). No growth analysis was done due to winterkills and recent stockings.

Data Analysis

Fish population parameters calculated were mean catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD), and relative weight (Wr) based on length categories. Abundance of individual fish species was expressed as CPUE, mean number of fish collected per net night.

Results and Discussion

Eight species, totaling 535 fish, were collected during the present survey (Tables 1 and 2). Black bullheads were the most abundant fish collected in trap nets making up 62.9% of the catch. Common carp were second most abundant with 27.7%. Gill nets were also dominated by carp at 72.4% of the total. This lake experiences frequent low water and winterkill events. Since refilling of the lake in 2008, carp and bullheads have had some successful year classes. Stockings of walleye, northern pike and largemouth bass should help build the predator populations and possibly reduce densities of carp and black bullheads.

Figure 1, Aerial view of Flat Creek Lake and net locations during 2010.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), condition factor (Wr for fish ≥ stock length; 80%CI's) for all fish species collected from four, ¾ inch mesh trap nets in Flat Creek Lake, Perkins County July 10-11, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black bullhead	259	64.8 (20.3)	0.0 (--)	0	0	--
Common carp	114	28.5 (21.8)	0.3 (0.4)	--	--	--
Walleye	19	4.8 (3.1)	2.3 (2.7)	0	0	86.3 (3.5)
Yellow perch	20	5.0 (2.4)	4.3 (2.6)	12 (14)	6 (10)	97.5 (9.1)
Total	412					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD-P; 90% CI's in parentheses), and condition factor (Wr for fish ≥ stock length; 80% CI's) for all fish species collected from one, 150-ft experimental sinking gill nets in Flat Creek Lake, Perkins County, July 10-11, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black bullhead	4	4.0 (--)	1.0 (--)	--	--	--
Common carp	89	89.0 (--)	1.0 (--)	--	--	--
Northern pike	10	10.0 (--)	10.0 (--)	--	--	103.2 (2.3)
Walleye	9	9.0 (--)	3.0 (--)	--	--	84.4 (--)
Yellow perch	11	11.0 (--)	9.0 (--)	--	--	--
Total	123					

Black bullheads

Black bullhead abundance has increased in Flat Creek Lake since the 2005 survey. While winterkill events appear to have negatively affected other species, bullheads have produced a high density, small-sized structure population. CPUE from trap nets this survey was 64.8 with all fish being under stock length of 6 inches (Table 1). The gill net caught four bullheads with one fish over stock length. In 2005, trap nets had a CPUE of 8.9 (Table 3). Size structure seen in surveys over the past ten years seems to confirm recurring fish kill events as sizes have been poor with no bullheads sampled over 9 inches (Figure 2).

Table 3. Composite listing catch-per-unit-effort (CPUE; 80% CI's are given in parentheses), proportional stock densities (PSD, RSD; 90% CI's in parentheses) and fish condition for fish larger than stock-length (Wr>S; 90% CI's in parentheses) for black bullhead collected by trap nets in Flat Creek Lake, 2000, 2003, 2005 and 2010.

Year	CPUE	PSD	RSD-P	Wr ≥ S
2000	142.6 (89.0)	0	0	83.3 (0.8)
2003	112.9 (30.3)	0	0	87.6 (1.4)
2005	8.9 (5.3)	0	0	83.2 (1.4)
2010	64.8 (20.3)	0	0	--

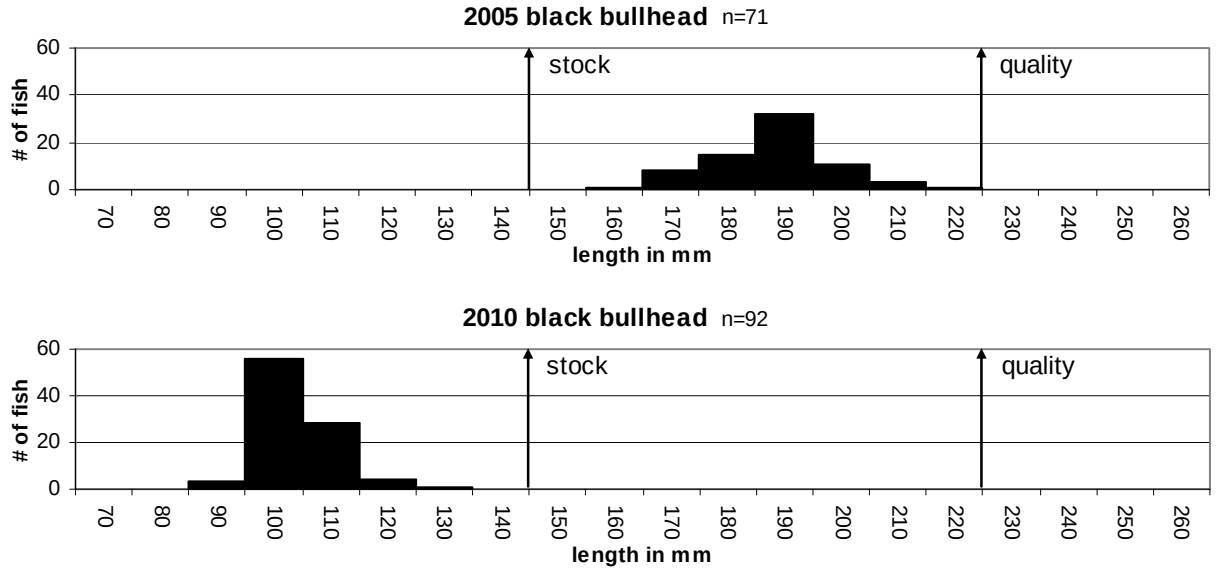


Figure 2. Length frequency histograms for black bullheads from Flat Creek Lake 2005, 2010.

Common carp

The common carp population follows a similar trend to the black bullheads, i.e. a large year class of substock fish (Figure 3). Gillnet CPUE was 89.0 and trap net CPUE was 28.5 (Tables 1 and 2). Only two carp in the sample were over stock length.

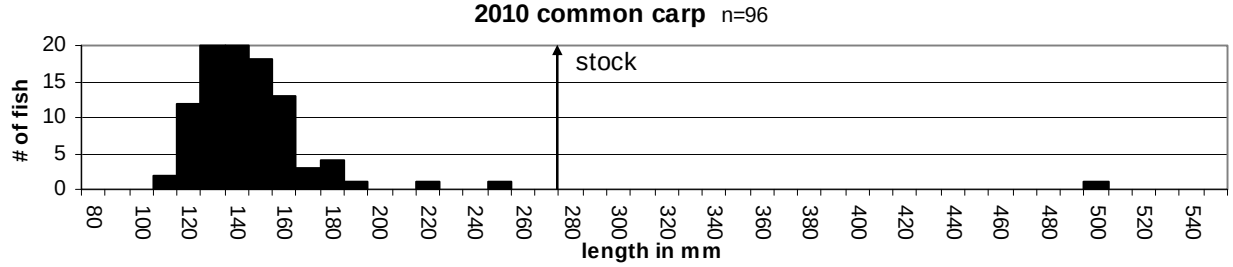


Figure 3. Length frequency histogram for common carp from trap nets in Flat Creek Lake, Perkins County, July 10-11, 2010.

Northern pike

Northern pike numbers were unexpected. Northern pike fry were stocked the spring of 2010 after what was believed to be a complete winterkill, but gill net catch shows that some had survived and produced a good year class (Figure 4). One gill net caught ten pike while the four trap nets didn't catch any. The large forage base of carp and bullhead should provide northern pike with good forage and grow.

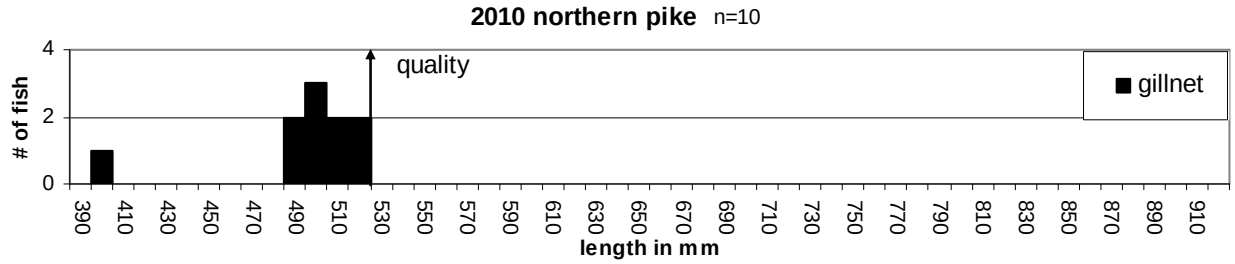


Figure 4. Length frequency histogram for northern pike from the gill net in Flat Creek Lake, Perkins County, July 10-11, 2010.

Walleye

Since the low water and winterkill in 2008, 66,625 small walleye fingerlings have been stocked. Trap net catch yielded a CPUE of 4.8 (Table 1). One gill net caught nine walleye (Table 2). Fish ranged from 170 to 320 millimeters (Figure 5). As these fish get larger, they should also be able to use the abundant bullhead and carp production as a forage base.

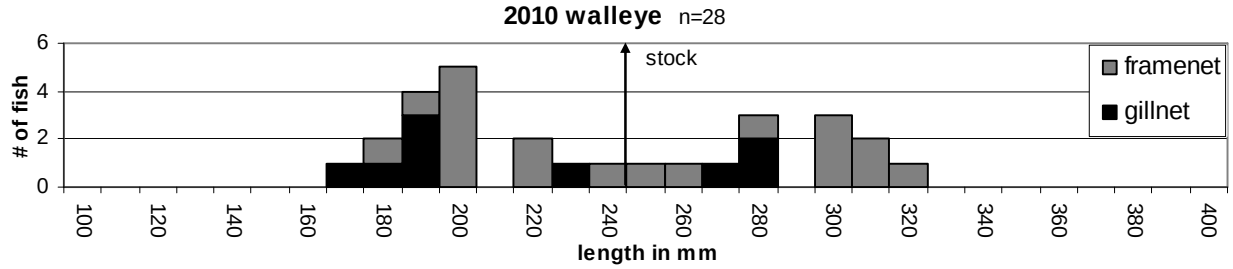


Figure 5. Length frequency histogram for walleye from trap nets and gillnet in Flat Creek Lake, Perkins County, July 10-11, 2010.

Yellow Perch

The yellow perch population seems to have followed a similar pattern as the northern pike. Catch of a good number just over stock length (5 inches) indicates previous reproduction before the adults were stocked in Spring of 2010. Trap net CPUE was 5.0 with one gill net catching 11 yellow perch (Tables 1 and 2). Most of these fish were just over stock length (Figure 6).

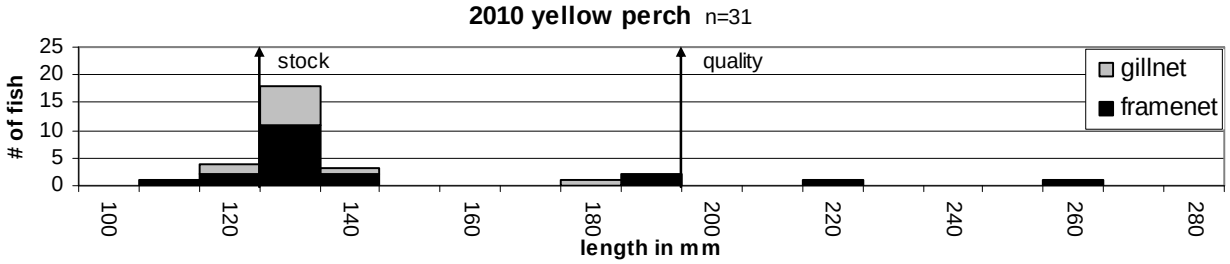


Figure 6. Length frequency histogram for yellow perch from trap nets and a gill net in Flat Creek Lake, Perkins County, July 10-11, 2010.

RECOMMENDATIONS

1. Stock adult largemouth bass at a rate of 10 per acre to increase bass density to help reduce bullhead numbers and improve panfish quality.

2. Stock large, fall walleye fingerlings at a rate of 10 per acre, every other year if good lake levels persist, as a secondary predator to help reduce bullhead and carp numbers and provide a popular sportfish.

APPENDIX

Appendix A. Stocking record for Flat Creek Lake, Perkins County, 2007-2010.

Year	Number	Species	Size
Winterkill 2007-2008		None stocked	
2009	46,625	Walleye	Fingerling
	1,000	Largemouth bass	Fingerling
2010	680	Yellow perch	Adult
	191,200	Northern pike	Fry
	20,000	Walleye	Fingerling
	1,000	Largemouth bass	Fingerling

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Owens Lake County: Perkins
Legal description: Twn. 17 N, Rge. 14 E, Sec. 4
Location from nearest town: 3 miles east, 4 miles south of Bison, SD
Dates of present survey: July 12-13, 2010
Date last surveyed: May 30-31, 2005
Most recent lake management plan: F21-R-29 Date: 1996
Management classification: Warmwater semi-permanent
Contour mapped: Date 1985

Primary Species: (game and forage)	Secondary and other species:
1. Black bullhead	1.
2. Northern pike	2.
3. Largemouth bass	3.
4. Yellow perch	4.

PHYSICAL CHARACTERISTICS

Surface Area: 96 acres (39 ha); Watershed: 57,000 acres
Maximum depth: 15 feet; Mean depth: 6.3 feet
Lake elevation at survey (from known benchmark): full feet

1. Describe ownership of lake and adjacent lakeshore property:

Most all of the land around Owens Lake is owned by the Department of Game, Fish and Parks and is managed as a Game Production Area.

2. Describe watershed condition and percentages of land use:

The Owens Lake watershed is primarily grasses and used as pastureland for livestock.

3. Describe aquatic vegetative condition:

Emergent vegetation was present in the extremely clear water in depths under 7 feet deep. Seventy percent of the shoreline is covered by cattails or reeds.

4. Describe pollution problems:

Department personnel identified no pollution problems during the 2010 survey. Owens Lake is relatively shallow and the fish population does experience winterkill occasionally.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

The dam and spillway appeared in good condition. The boat ramp is a rough concrete plank ramp which is starting to be undercut by wave action in spots.

BIOLOGICAL DATA

Methods

Netting Survey

A lake survey was conducted on Owens Lake during July 12-13, 2010. Sampling consisted of one gill net night and 4 trap net nights (Figure 1). The gill net was a monofilament experimental net 45.7 m (150 ft) long and 1.8 m (6 ft) deep with six 7.6 m (25 ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 inch) mesh and a 1.2 X 23-m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g). In addition, scale samples for the first five fish per centimeter group were collected from selected fish per gear type for age and growth analysis. Scale samples were pressed onto acetate slides and viewed with a microfiche projector (40X) and the distance between scale annuli were recorded on paper strips.

Data Analysis

Fish population parameters calculated were catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean catch per unit effort (CPUE; mean number per net night). Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

Results and Discussion

One gill net and four trap nets were set over night in Owens Lake on July 12, 2010. Black bullheads were the most abundant fish collected in both gill nets and trap nets (Tables 1 and 2). A single northern pike was caught in the trap nets. The northern pike was not aged but was substock length and most likely an age-1 fish. During the 2005 survey, only black bullhead and northern pike were collected. In the spring of 2005, three hundred sixty eight prespawn yellow perch were stocked to establish a yellow perch fishery as the water levels in Owen Lake had risen over previous years. Despite this stocking, no yellow perch were sampled during this survey, which may be due to the use of only one gill net.

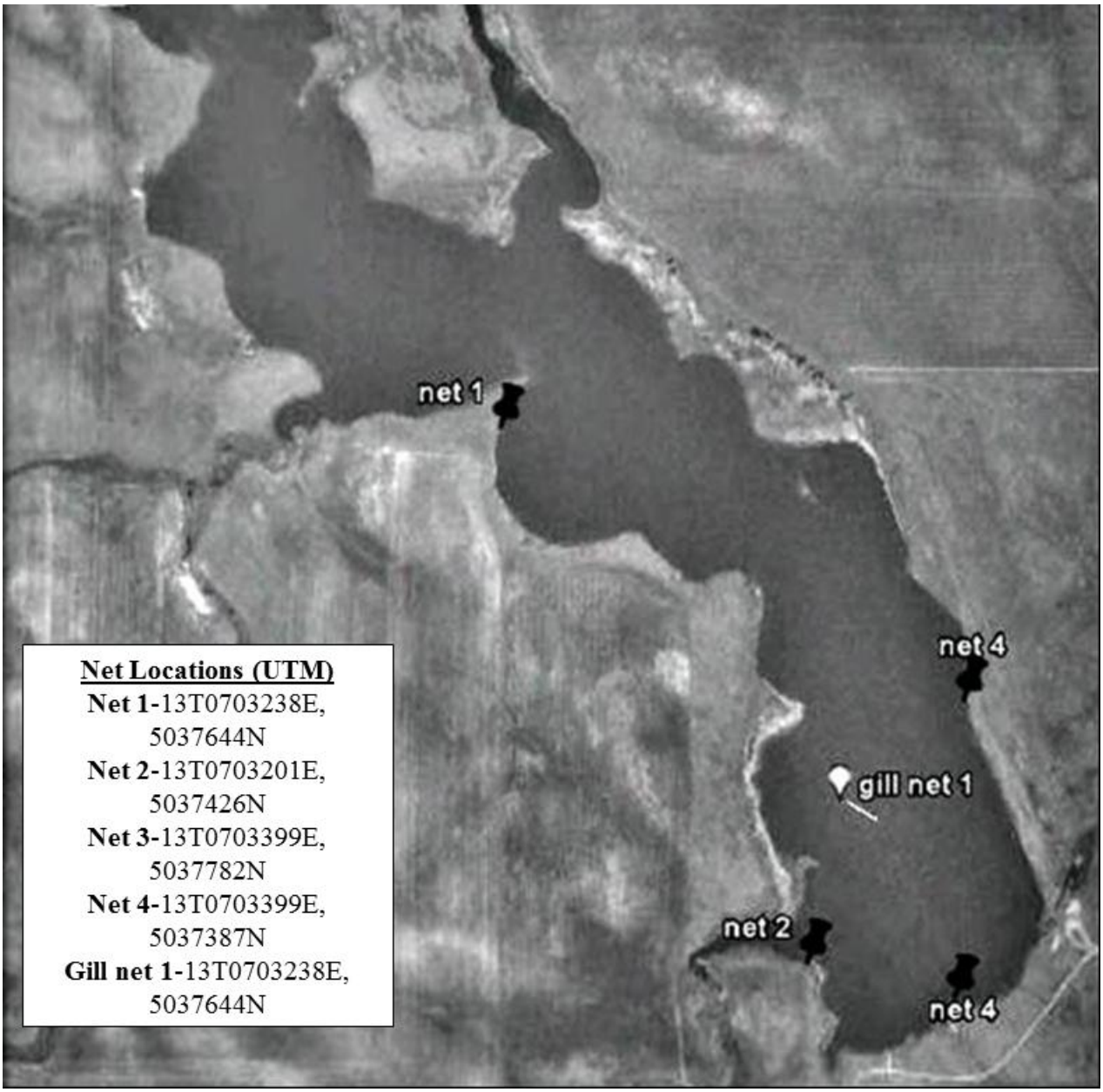


Figure 1. Aerial view of Owens Lake and net locations during sampling in 2010.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD; 90% CI's), and fish condition for fish larger than stock-length (Wr>S; 90% CI's) for all fish species collected from one gill net in Owens Lake, July 12-13, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr≥S
Northern pike	8	8.0 (--)	8.0 (--)	0	0	91.7 (1.8)
Yellow perch	2	2.0 (--)	2.0 (--)	0	0	92.2 (--)
Totals	10					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD; 90% CI's), and fish condition for fish larger than stock-length (Wr>S; 90% CI's) for all fish species collected from four trap nets in Owens Lake, July 12-13, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr≥S
Black bullhead	6	1.5 (2.0)	1.5 (2.0)	100	17 (33)	106.4 (7.5)
Northern pike	44	11.0 (7.1)	10.8 (6.8)	0	0	88.8 (2.2)
Yellow perch	1	0.5 (0.2)	0.5 (0.2)	--	--	101.6 (--)
Totals	51					

Black bullheads

Black bullheads were abundant in Owens Lake in 2005, when mean CPUE in gill nets was 37 fish and mean CPUE in trap nets was 8.0. All fish were over quality length at that time and fish caught during this survey were also over quality length (Figure 2). This year, six adult black bullheads were caught in the four trap nets and none were caught in the gill net (Tables 1 and 2).

Although few black bullheads were sampled in July, of concern is the appearance of large numbers in the fall. During a trap and transfer effort for northern pike, large numbers of substock black bullheads were observed in the trap nets. It appears they likely were too small to be sampled during the July survey, but had grown enough to be caught during September.

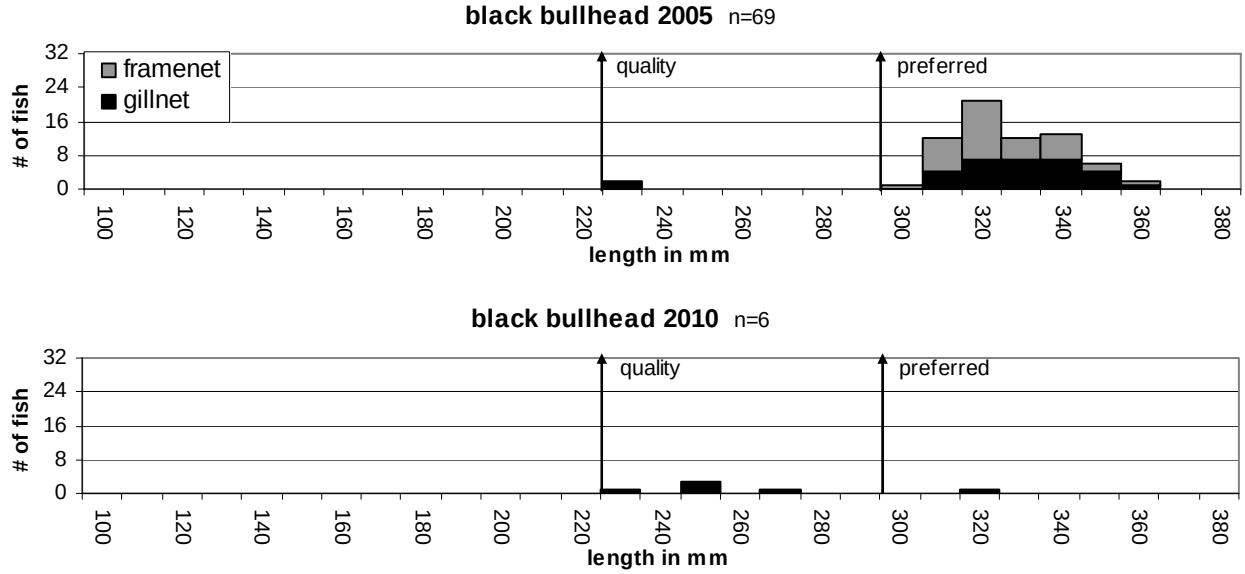


Figure 2. Length frequency histograms for black bullheads from Owens Lake, Perkins County, 2005, 2010.

Northern pike

Northern pike numbers were a surprise as Owens Lake was just stocked with fry in the spring of 2010 after a winterkill in 2008. As seen in the length frequency histogram (Figure 3), the northern pike population has been reproducing, indicating some had survived what was thought to be complete winterkill (Figure 3). The gill net caught eight pike while trap net CPUE was 11.0 per net (Tables 1 and 2). All fish sampled were under quality length. Mean Wr for stock length and larger fish was around 90 between the gear types.

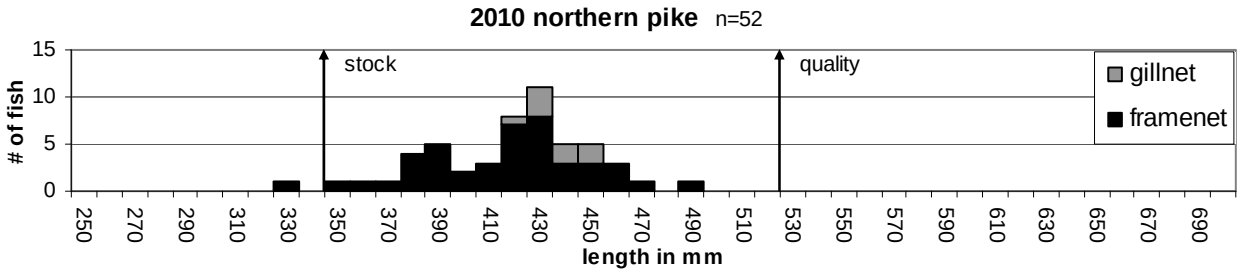


Figure 3. Length frequency histograms for northern pike from Owens Lake, Perkins County, July 12-13, 2010.

RECOMMENDATIONS

1. Sample again in 2012 to check for fish recruitment since water levels have returned.

2. Continue to manage as a yellow perch/northern pike fishery as this lake is marginal and these species grow rapid enough to provide good periodic fisheries.

APPENDIX

Appendix A. Stocking record for Owens Lake, 1995- 2010.

Year	Number	Species	Size
1995	197	Northern pike	Adult
1996	16,230	Northern pike	Adult
1997	32,000	Northern pike	Fingerling
2005	368	Yellow perch	Adult
2009	250	Yellow perch	Adult
2010	97,600	Northern pike	Fry
	5,560	Largemouth bass	Fingerling

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Shadehill Reservoir County: Perkins
Legal description: T 21N, R 15E Sec. 1-4,8-10,15-17,20-23,26,27,34,35
Location from nearest town: 12 miles south of Lemmon, SD
Dates of present survey: August 16-18, 2010
Date last surveyed: August 11-13, 25, 2009
Most recent lake management plan: F21-R-36 Date: 2004 - 2008
Management classification: Warmwater permanent
Contour mapped: July 1985

Primary Species: (game and forage)	Secondary and other species:
1. Walleye	1. Northern pike
2. Smallmouth bass	2. Bluegill
3. Channel catfish	3. White bass
4. Black crappie	4. Spottail shiner
5. Yellow perch	5. Common Carp
6. Emerald shiner	6. River carpsucker
7. Gizzard shad	7. Northern redhorse
8.	8. White sucker

PHYSICAL CHARACTERISTICS

Surface Area: 4,693 ac (1,899 ha); Watershed: 2,176,000 acres
Maximum depth: 62 feet; Mean depth: 21.8 feet
Lake elevation at survey (from known benchmark): unknown

1. Describe ownership of lake and adjacent lakeshore property:

Shadehill Reservoir is maintained and operated by the U.S. Bureau of Reclamation. South Dakota Department of Game, Fish and Parks maintains a recreation area/campground and game production area along much of the shoreline.

Describe watershed condition and percentages of land use:

The Shadehill Reservoir watershed is approximately 3,400 square miles, 75% of which is pasture and grassland, 20% agricultural cropland, and 5% forest and park land.

3. Describe aquatic vegetative condition:

Due in part to its contour and yearly water level fluctuations, Shadehill Reservoir has limited emergent and submergent vegetation. After low water years, Shadehill refilled in 2009 and a ring of flooded vegetation could be found around the lake.

4. Describe pollution problems:

Department personnel identified no pollution problems during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

All access and regulatory structures are in excellent condition. A state park at the reservoir provides excellent facilities for visitors to Shadehill Reservoir.

BIOLOGICAL DATA

Methods

Netting Survey

A lake survey was conducted on Shadehill Reservoir August 16-18, 2010. Sampling consisted of 6 gill net nights and 8 trap net nights (Figure 1). Gill nets were monofilament experimental nets 45.7 m (150 ft) long and 1.8 m (6 ft) deep with six 7.6 m (25 ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Trap nets were set at eight stations consisting of 1 trap net night each. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (¾ in) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead.

Day Electrofishing

Day electrofishing was conducted using a Smith-Root unit with pulsed-DC on August 16, 2010 at Shadehill Reservoir. Ten sites around the lake were completed during daylight hours and only age-0 shad were targeted. If shad were caught within the first five minutes then the station was limited to only five minutes. If, however, no age-0 shad were caught then the station was extended to 10 minutes.

Data Collection and Analysis

Collected fish were measured for total length (mm) and weighed (g). Age and growth analysis was accomplished using otoliths or scales collected from individual fish. Otoliths were collected from the first five walleye per centimeter group. For younger fish, typically less than age-4, otoliths were submersed in water in a black dish and viewed whole under a dissecting microscope. Preparation of otoliths from older fish involved breaking the otolith through the nucleus and burning the fractured area under a propane torch. The half-otolith was mounted in putty, cleared with mineral oil, illuminated with a single fiber-optic strand and viewed under a dissecting scope. Aging of other game fish was done with scales. Scale samples were obtained from below the lateral line just behind the pectoral fin. Scales were prepared for reading by pressing them between two acetate slides to make an imprint, then the slides viewed with a microfiche projector (40X) and distances between scale annuli were recorded on paper strips.

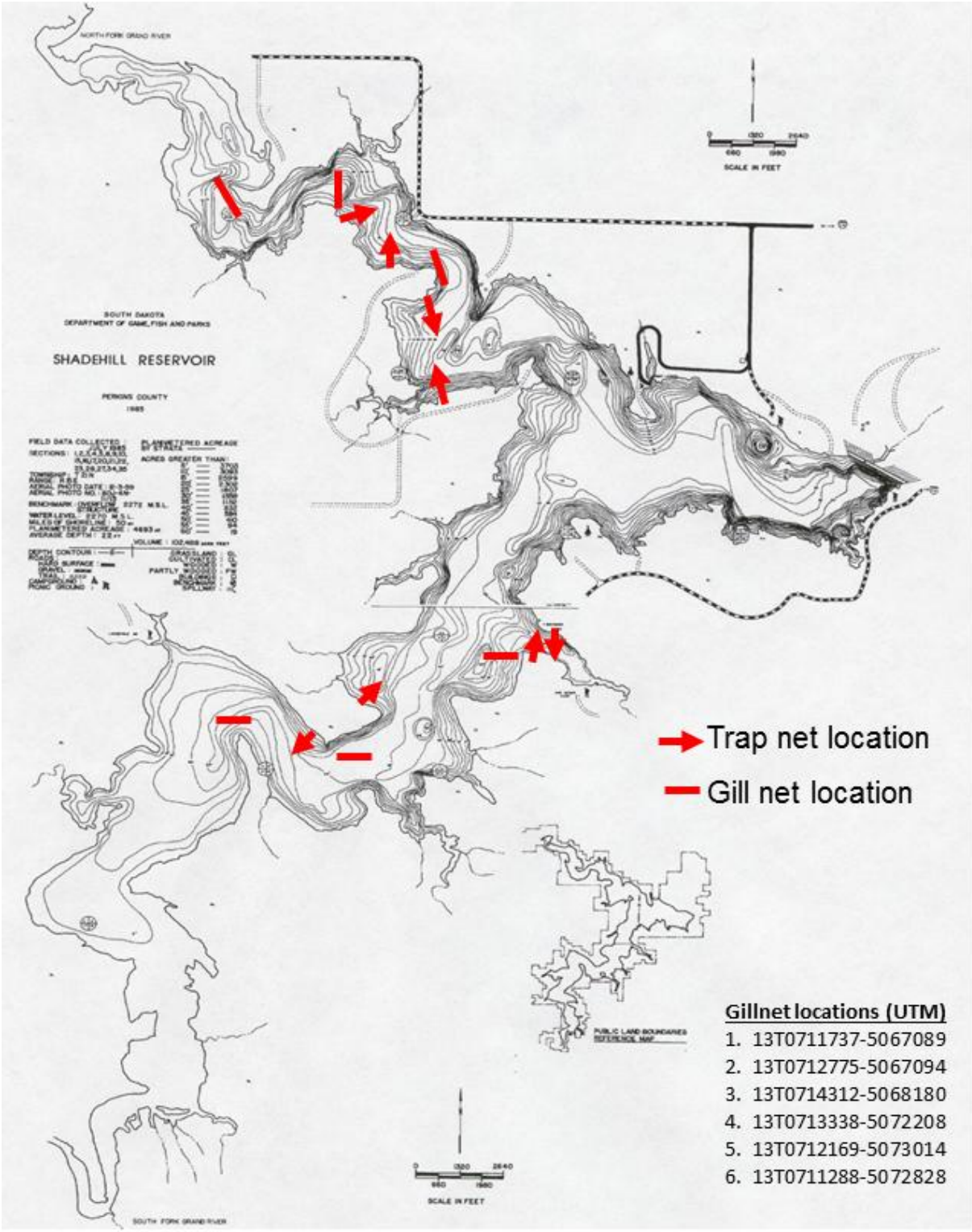


Figure 1. Map of Shadehill with trap net and gill net locations during sampling in 2010.

Fish population parameters calculated were mean catch-per-unit-effort (CPUE; number of fish collected per net night or number of fish collected per hour of electrofishing), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as CPUE. Population structural characteristics were expressed as length frequency histograms and with PSD and RSD-P values. Fish condition was expressed with mean Wr values.

Results and Discussion

Thirteen species were collected in the six gill nets during the 2010 lake survey of Shadehill Reservoir, totaling 288 fish (Table 1). Channel catfish were the most abundant species comprising 28% of the total, while white bass at 24% were second most abundant. Walleye were third at 22%. Other species captured in the gill nets are listed in Table 1.

Eight trap nets sampled twelve species for a total of 125 fish in 2010 (Table 2). Black crappies were most abundant making up 39% of the sample. Smallmouth bass was the second most numerous caught, comprising 16% of the catch. Other species captured are listed in Table 2.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's), and fish condition for fish larger than stock length (Wr>S; 90% CI's) for all fish species collected from six gill nets in Shadehill Reservoir, August 16-18, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr>S
Black crappie	4	0.7 (0.6)	0.7 (0.6)	--	--	112.4 (2.6)
Channel catfish	81	13.5 (4.9)	13.2 (4.5)	67 (9)	0	82.6 (0.2)
Common carp	4	0.7 (0.5)	0.3 (0.3)	--	--	82.6 (33.4)
Freshwater drum	9	1.5 (1.1)	1.5 (1.1)	--	--	100.9 (2.7)
Goldeye	1	0.2 (0.2)	0.2 (0.2)	--	--	--
Northern pike	14	2.3 (1.4)	2.2 (1.2)	38 (25)	0	83.5 (4.8)
River carpsucker	8	1.3 (0.9)	1.3 (0.9)	--	--	91.8 (4.5)
Shorthead redhorse	8	1.3 (1.1)	1.3 (1.1)	--	--	94.8 (3.0)
Walleye	64	10.7 (3.1)	5.8 (1.7)	34 (14)	0	80.9 (0.7)
White bass	69	11.5 (5.0)	11.5 (5.0)	74 (9)	68 (9)	90.4 (0.2)
White crappie	5	0.8 (0.6)	0.8 (0.6)	--	--	106.1 (11.0)
White sucker	1	0.2 (0.2)	0.2 (0.2)	--	--	88.8 (--)
Yellow perch	20	3.3 (2.3)	3.3 (2.3)	30 (18)	0	99.3 (1.3)
Totals	288					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's) and fish condition for fish larger than stock-length (Wr>S; 90% CI's in parentheses) for all fish species collected from 8 trap nets in Shadehill Reservoir, August 16-18, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr>S
Black crappie	49	6.1 (2.3)	6.1 (2.3)	31 (12)	16 (9)	106.7 (1.9)
Bluegill	6	0.8 (0.9)	0.8 (0.9)	--	--	120.7 (5.9)
Channel catfish	13	1.6 (0.9)	1.6 (0.9)	31 (24)	0	82.0 (2.2)
Common carp	5	0.6 (0.4)	0.6 (0.4)	--	--	83.8 (9.8)
Freshwater drum	1	0.1 (0.2)	0.1 (0.2)	--	--	111.0 (--)
River carpsucker	7	0.9 (0.7)	0.9 (0.7)	--	--	94.8 (6.8)
Shorthead redhorse	1	0.1 (0.2)	0.1 (0.2)	--	--	93.2 (--)
Smallmouth bass	20	2.5 (1.5)	1.3 (0.8)	20 (24)	0	101.6 (2.5)
Walleye	12	1.5 (0.7)	1.4 (0.6)	82 (22)	9 (17)	78.3 (3.2)
White bass	6	0.8 (0.7)	0.8 (0.7)	--	--	85.0 (5.0)
White crappie	1	0.1 (0.2)	0.1 (0.2)	--	--	98.2 (--)
Yellow perch	4	0.5 (0.3)	0.5 (0.3)	--	--	94.6 (1.6)
Totals	125					

Black crappie

Black crappie density increased with a trap net CPUE of 6.1 compared to 2.0 last year (Table 3). Stock indices were lower with a PSD of 33 and an RSD-P of 16, compared to 93 and 57 last year, respectively. Although only 49 black crappies were caught in trap nets, lengths appear to show a balanced population (Figure 2). The lower proportional stock density is result of a large age-1 year class entering the population. Crappie condition remained excellent and was even higher this year with a mean Wr for stock-length and larger fish of 106.7, compared to 102.3 last survey.

Table 3. Composite listing of sample size (N), catch-per-unit-effort (CPUE; 80% confidence intervals are given in parentheses), proportional stock densities (PSD, RSD; 90% CI's) and fish condition for fish larger than stock-length (Wr>S; 90% CI's) for black crappie collected from trap nets in Shadehill Reservoir, 2006-2010.

Year	N	CPUE	PSD	RSD-P	Wr > Stock
2006	11	1.4 (0.7)	83 (33)	67 (43)	91.8 (3.1)
2007	12	1.5 (0.9)	73 (26)	18 (22)	92.9 (2.6)
2008	5	0.6 (0.3)	40 (52)	0	95.1 (3.6)
2009	14	2.0 (1.0)	93 (13)	57 (24)	102.3 (4.2)
2010	49	6.1 (2.3)	31 (12)	16 (9)	106.7 (1.9)

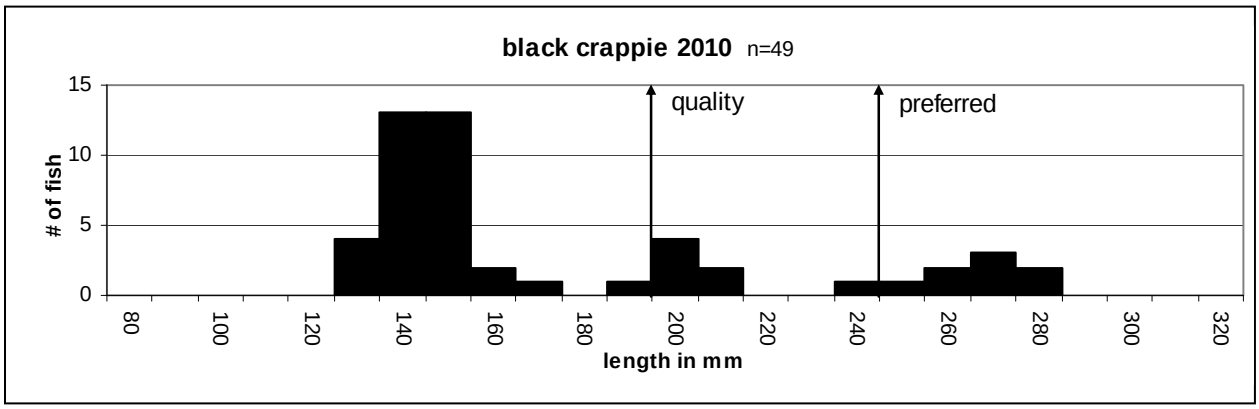


Figure 2. Length frequencies for black crappie from trap nets on August 16-18, 2010.

Channel Catfish

Channel catfish numbers increased to 13.5 per gill net, an increase from 4.8 last year. Size structure was also higher, with PSD from 41 last year to 67 this year (Table 4). Few of these abundant catfish ever reach larger sizes. Possibly, our gear does not sample the larger fish. In 2011, catfish spines will be taken to get age and growth data. Past data shows very few catfish reaching preferred-length (Figure 3). Fish condition for stock length and larger fish was 82.6, down considerably from 97.1 last year.

Table 4. Composite listing of sample size (N), catch-per-unit-effort (CPUE; 80% confidence intervals are given in parentheses), proportional stock densities (PSD, RSD; 90% CI's) and fish condition for fish larger than stock-length (Wr>S; 90% CI's) for channel catfish collected by gill nets in Shadehill Reservoir, 2006-2010.

Year	N	CPUE	PSD	RSD-P	Wr >Stock
2006	199	24.9 (6.6)	36 (6)	0	78.9 (0.7)
2007	116	19.3 (4.0)	38 (8)	1 (1)	76.5 (0.7)
2008	196	32.7 (9.7)	26 (5)	1 (--)	75.1 (0.8)
2009	29	4.8 (1.4)	41 (16)	0	97.1 (3.5)
2010	81	13.5 (4.9)	67 (9)	0	82.6 (0.2)

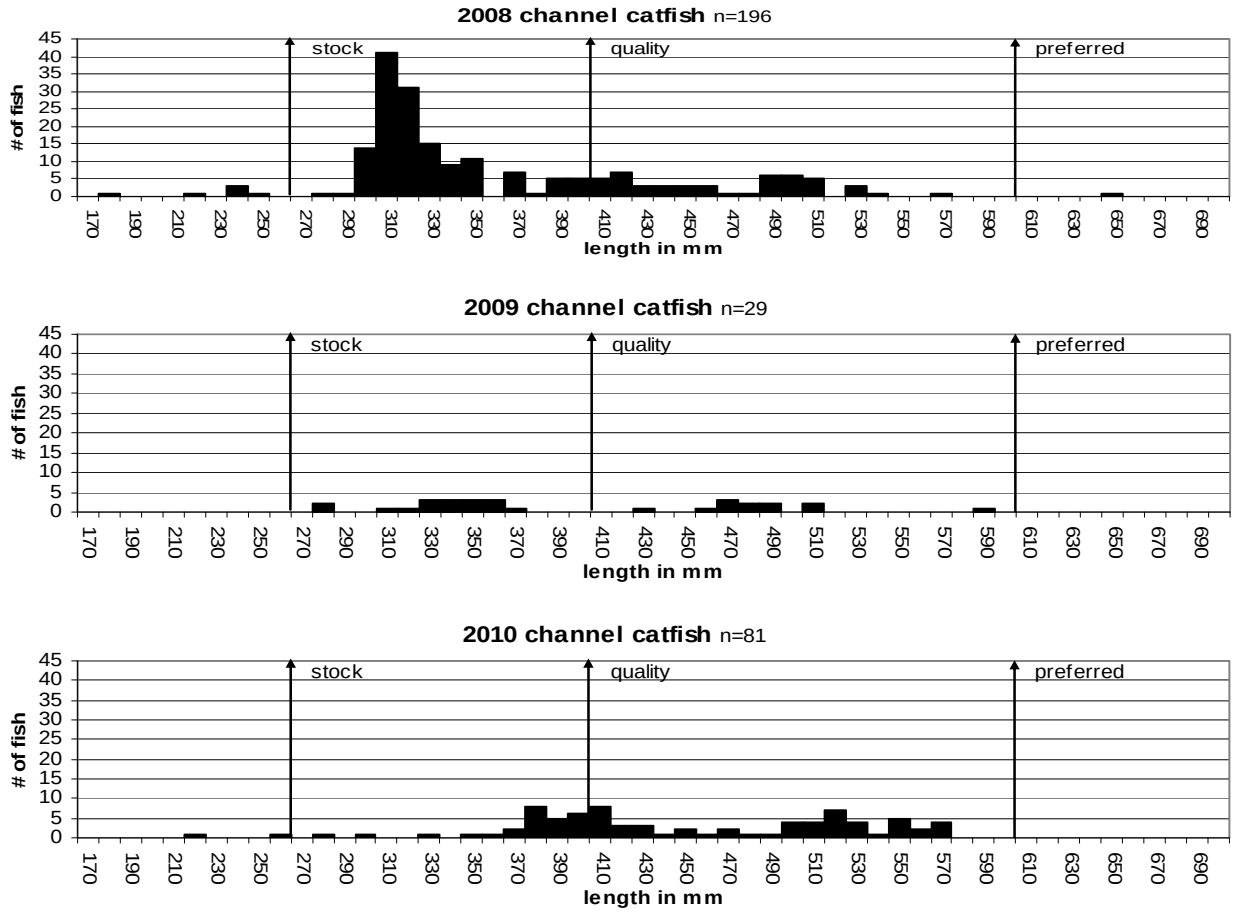


Figure 3. Channel catfish length frequencies from fish caught in gill nets at Shadehill Reservoir, 2008-2010.

Gizzard Shad

Gizzard shad numbers have declined sharply, presumably from two consecutive hard winters. No adult shad have been sampled in gill nets since 2008. No age-0 were sampled during the summer electrofishing survey for the first time since the survey was started in 2004 (Figure 4). It should be noted that some young of year shad were observed during the fall age-0 walleye survey. Ninety adult shad were stocked in the spring to add brood fish to the lake after the cold winter. In 2011, attempts will be made to stock as many adult shad as possible to get numbers back up to keep this forage population at higher levels.

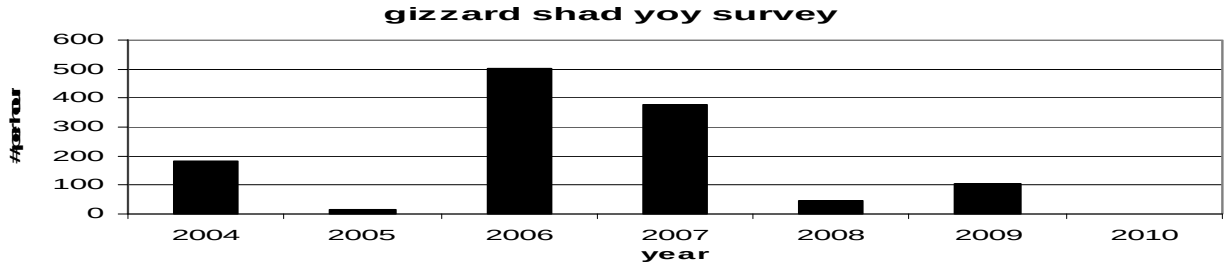


Figure 4. Daytime electrofishing results for young of year gizzard shad, Shadehill Reservoir, 2004-2010.

Walleye

Our walleye sample showed a decrease in abundance compared to last year's sample. Gill net CPUE was 10.7, versus 16.7 last year (Table 5). Catch for stock length and larger fish showed an even sharper decline with CPUE going from 13.5 to 5.8. PSD for this sample was 34, which is up from 19 last year. Fish over 20 inches continue to remain scarce in the gill net sample (Figure 5). It will be interesting to see if the change from a 14-inch to 15-inch minimum will increase the proportion and densities of stock size and greater fish in the future. Aging data showed age-3 fish averaged just shorter than 15 inches (Table 6). Fish condition was below average with stock length and larger fish having a mean Wr of 80.9, a bit lower than last year's mean of 86.0.

Current walleye management objectives for the Shadehill Reservoir walleye fishery is to maintain a minimum gill net CPUE for stock length and larger walleye of 10 with a PSD of 30-60, and increase RSD-P to 10 or greater, and increase growth rates to near or at the regional mean. At this point, values are a just below, but close to meeting all the objectives. Managers are expecting that additional walleye stockings and an increase in the shad population will push the fishery into our objective ranges.

Table 5. Catch data for walleye collected by gill net in Shadehill Reservoir, 2006-2010.

Year	N	CPUE	CPUE-S	PSD	RSD-P	Wr >Stock
2006	57	7.1 (1.8)	6.1 (1.7)	27(10)	4 (5)	84.0 (1.0)
2007	56	9.3 (2.8)	8.2 (3.1)	33 (12)	2 (3)	80.1 (0.8)
2008	57	9.5 (3.0)	7.5 (2.3)	27 (11)	2 (4)	81.9 (0.7)
2009	100	16.7 (8.3)	13.5 (6.7)	19 (8)	1 (2)	86.0 (0.1)
2010	64	10.7 (3.1)	5.8 (1.7)	34 (14)	0	80.9 (0.7)

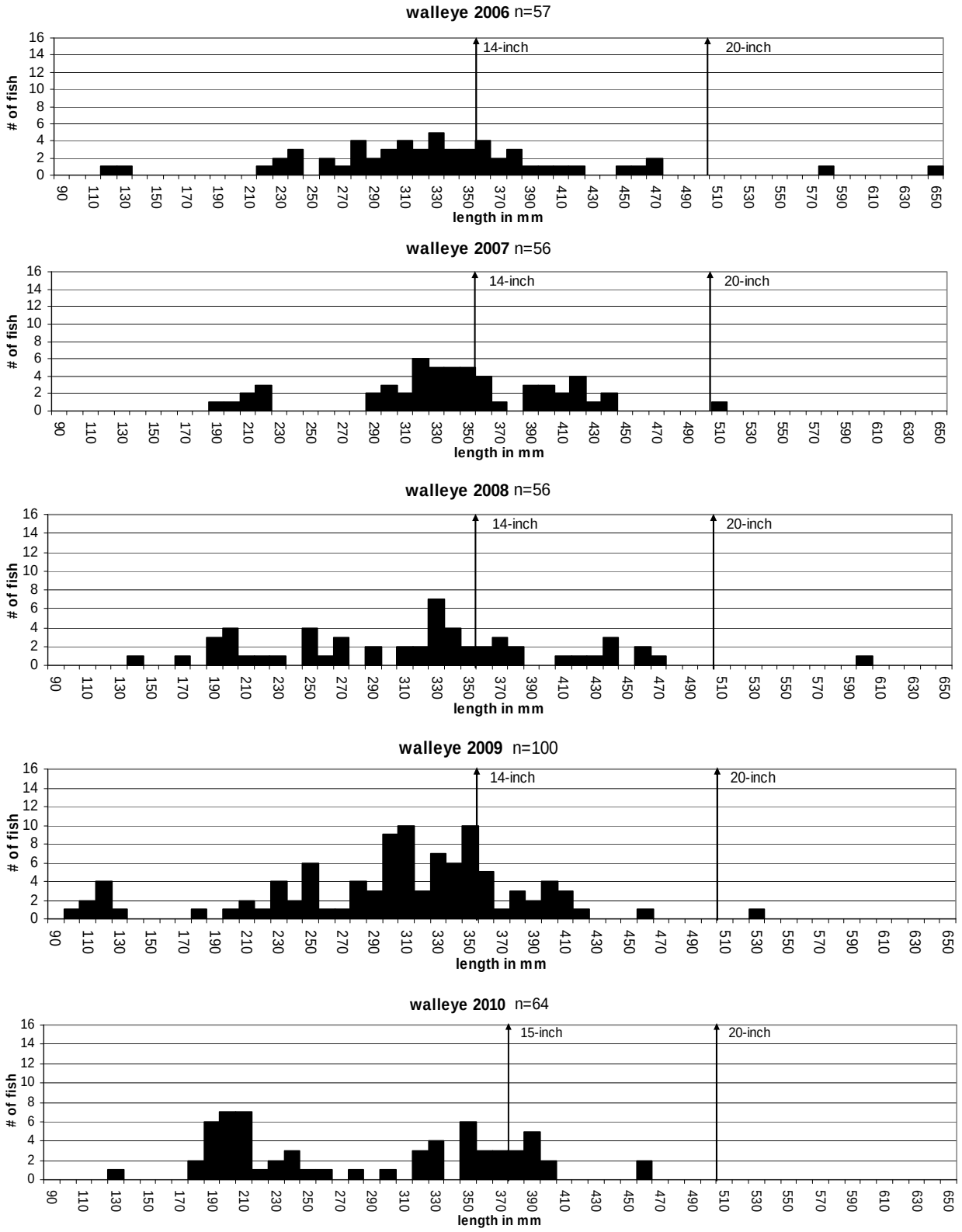


Figure 5. Length frequencies for walleye caught in gill nets at Shadehill Reservoir, 2006-2010.

Table 6. Shadehill Reservoir walleye minimum, maximum and weighted mean lengths (mm) at capture by age (determined from otoliths) from gill net catch, August 16-18, 2010.

Age	Minimum length @ capture	Weighted mean length @ capture	Maximum length @ capture	Number of fish in survey
1	204	218	250	20
2	285	341	390	17
3	357	377	396	9
4	367	404	460	6
9	463	463	463	1

White Bass

White bass abundance has remained steady since 2006, when gill net catch was 10.6 fish per net for stock length and larger white bass (Table 8). This year's gill net CPUE was 11.5 compared to 7.8 last year. Stock density indices have also remained similar over the past few years. PSD, for example, was 100 and RSD-P of 69 in 2009, compared to PSD of 74 and RSD-P of 68 in this survey. Fish condition decreased slightly from a mean Wr for stock length and larger fish at 92.1 last year to 90.4 this year. Most fish appear to be from the 2001 year class and growing about 10 to 20 millimeters per year (Figure 5). The length frequency histogram, however, shows a 2009 year class entering the population indicating a good recruitment during the high water conditions.

Table 8. Composite listing of sample size (N), catch-per-unit-effort (CPUE; 80% CI's are given in parentheses), mean total length (TL; standard error in parentheses), proportional stock densities (PSD, RSD; 90% CI's) and fish condition for fish larger than stock-length (Wr>S; 90% CI's) for white bass collected by gill net in Shadehill Reservoir, 2000-2010.

Year	N	CPUE	CPUE-S	PSD	RSD-P	Wr > Stock
2000	44	7.3 (7.0)	7.3 (7.0)	98 (4)	23 (11)	83.0 (0.8)
2001	93	18.6 (22.9)	4.6 (4.4)	91 (10)	74 (16)	88.0 (2.0)
2002	51	12.8 (8.9)	12.8 (8.9)	63 (12)	35 (12)	85.6 (1.1)
2003	293	73.3 (72.9)	73.3 (72.9)	91 (3)	1 (1)	87.6 (0.6)
2004	176	44.0 (45.0)	44.0 (45.0)	100	7 (4)	90.0 (1.9)
2005	242	60.5 (42.6)	60.5 (42.6)	100	2 (2)	85.5 (0.0)
2006*	85	10.6 (5.8)	10.6 (5.8)	99 (2)	9 (6)	84.3 (0.2)
2007*	73	12.2 (7.1)	12.2 (7.1)	100	18 (8)	81.5 (0.1)
2008*	53	8.8 (5.0)	8.8 (5.0)	96 (4)	30 (11)	82.1 (1.0)
2009*	47	7.8 (3.7)	5.3 (3.8)	100	69 (14)	92.1 (0.8)
2010*	69	11.5 (5.0)	11.5 (5.0)	74 (9)	68 (9)	90.4 (0.2)

*150 foot gill net (300 foot gill nets used prior to 2006)

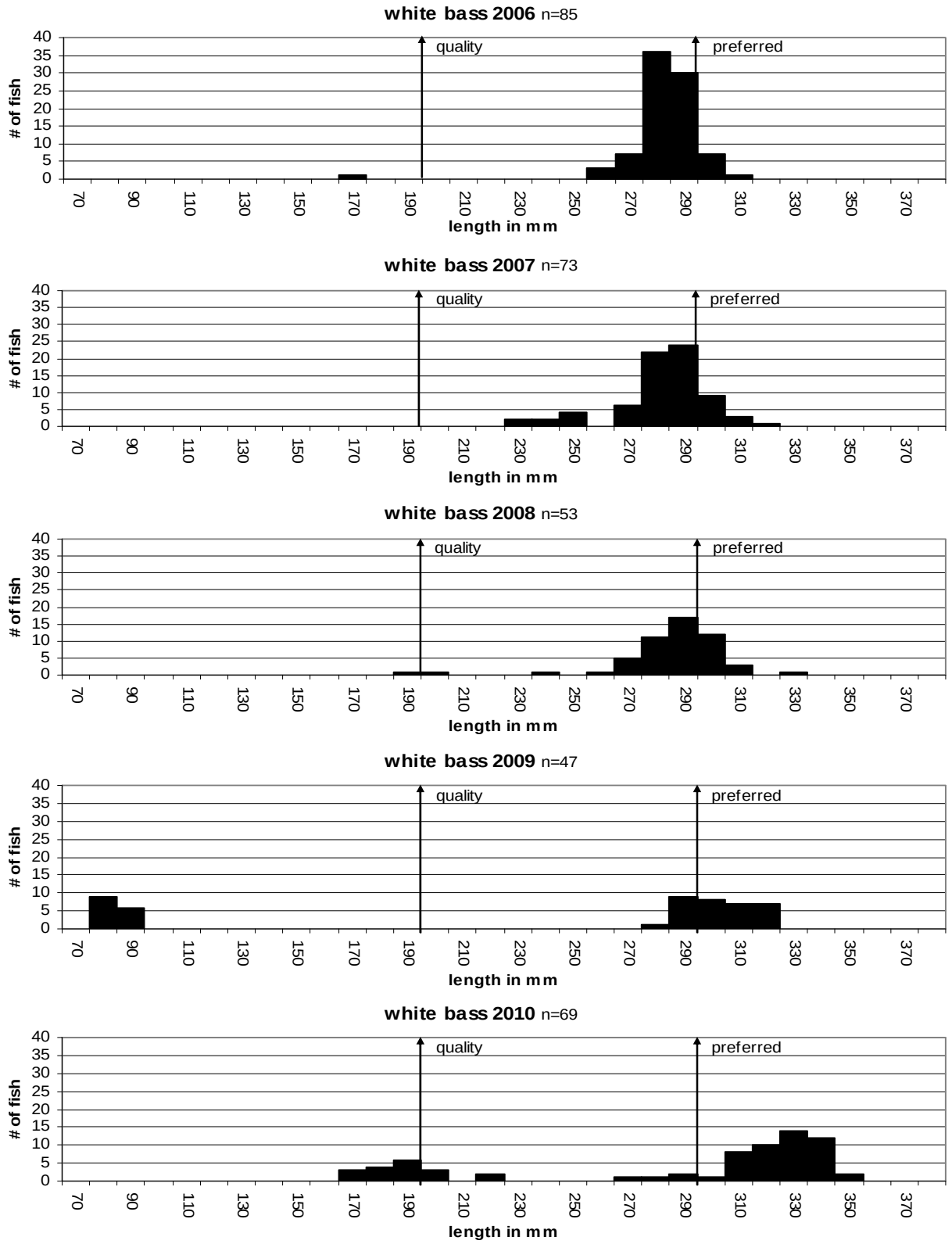


Figure 5. Length frequency histograms of white bass collected by gillnet in Shadehill Reservoir from 2006-2010.

Other fish species

Nine other fish species were collected during the annual lake survey: bluegill, common carp, freshwater drum, gizzard shad, goldeye, northern pike, river carpsucker, shorthead redhorse, and yellow perch. These other species had low catch rates (Tables 2 and 3). According to past surveys, this is normally the case with these species.

RECOMMENDATIONS

1. Continue conducting annual surveys of the fishery to evaluate populations and stocking success (i.e. gizzard shad introductions, walleye, and smallmouth bass).

2. Stock adult gizzard shad annually to ensure adequate forage for the walleye and other predatory fish.

3. Stock small walleye fingerlings at 1 pound per acre to try to increase walleye density.

APPENDIX

Appendix A. Stocking record for Shadehill Reservoir, Perkins County, 2002-2010.

Year	Number	Species	Size
2002	50,000	Walleye	Fingerlings
2003	251	Gizzard shad	Adult
2004	233	Gizzard shad	Adult
	162,700	Walleye	Fingerlings
2005	250	Gizzard shad	Adult
	200,300	Walleye	Fingerlings
2006	65	Gizzard shad	Adult
	166,698	Walleye	Fingerlings
2007	192,953	Walleye	Fingerlings
2008	409,235	Walleye	Fingerlings
2009	420,652	Walleye	Fingerlings
	85	Gizzard shad	Adult
2010	90	Gizzard shad	Adult
	385,829	Walleye	Fingerlings

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: Sorum Lake County: Perkins
Legal description: Sec. 16, Twn. 17 N, R 10 E
Location from nearest town: 1 miles east and 1 mile south of Sorum, SD
Dates of present survey: June 21-22; October 13, 2010
Date last surveyed: June 29-July 1,1998
Most recent lake management plan: F21-R-42 Date: Jan 2010
Management classification: Warmwater permanent
Contour mapped: 1993

Primary Species:(game and forage)	Secondary and other species:
1. Largemouth bass	1. Black Bullhead
2. Walleye	2. Green Sunfish
3. Yellow Perch	3. Golden shiner
4. Black Crappie	4.

PHYSICAL CHARACTERISTICS

Surface Area: 88 ac (35.6 ha); Watershed: 54,000 acres
Maximum depth: 17 feet; Mean depth: 5.5 feet
Lake elevation at survey (from known benchmark): full

1. Describe ownership of lake and adjacent lakeshore property:

Sorum Dam is a state owned dam and the South Dakota Department of Game, Fish and Parks manages the fishery. The terrestrial area around the lake and dam is managed as a Game Production Area (GPA).

2. Describe watershed condition and percentages of land use:

Sorum Lake is an impoundment on Rabbit Creek. Over half of the watershed is pasture and the rest is cropland (mainly wheat). The eastern side of the Slim Buttes is within the watershed and soil types here contribute to increasing silt within the lake.

3. Describe aquatic vegetative condition:

Rooted aquatic vegetation consists of bulrushes and cattails. The vegetation covers approximately 75% of the shoreline. Submerged vegetation is excessive from midsummer until freeze up in water depths under 5 feet.

4. Describe pollution problems:

Siltation due to natural erosion and cattle grazing has decreased depth and area of the lake. No other pollution problems were identified by department personnel during the 2010 survey.

5. Describe condition of all structures, (i.e. spillway, level regulators, boat ramps, etc.):

The dam is seeping and the boat ramp is in poor condition.

BIOLOGICAL DATA

Methods

Netting

A lake survey was conducted at Sorum Lake on June 21-22, 2010. Sampling consisted of 2 gill net nights and 5 trap net nights (Figure 1). All gill nets were monofilament experimental nets. Each net was 45.7 m (150 ft) long and 1.8 m (6ft) deep with six 7.6 m (25ft) panels of bar mesh sizes: 12.7 mm (0.5 in), 19.1 mm (0.75 in), 25.4 mm (1.0 in), 31.8 mm (1.25 in), 38.1 mm (1.5 in), and 50.8 mm (2.0 in). Trap nets were set at five stations consisting of 1 trap net night each. All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 inch) mesh and a 1.2 X 23-m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g). In addition, scale samples for the first five fish per centimeter group were collected from selected fish per gear type for age and growth analysis. Scale samples were pressed onto acetate slides and viewed with a microfiche projector (40X) and the distance between scale annuli were recorded on paper strips.

Electrofishing

Night electrofishing was conducted at Sorum Lake on October 13, 2010. Electrofishing was conducted using a Smith-Root control unit with pulsed-DC. Six, ten-minute runs were completed. Age and growth was not calculated due to lake just being stocked since being dry.

Data Analysis

Fish population parameters calculated were catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean catch per unit effort (CPUE; mean number per net night). Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

Results and Discussion

Sorum Lake filled in the spring of 2009 from heavy winter snow after being dry from 2004 thru 2008. In 2009, the lake was stocked with prespawn yellow perch and adult black crappie, largemouth bass fingerlings, and walleye fingerlings. This year it was again stocked with adult yellow perch, golden shiners and walleye fingerlings. It appears these fish are doing well as five trap nets caught 1,874 fish (Table 1).

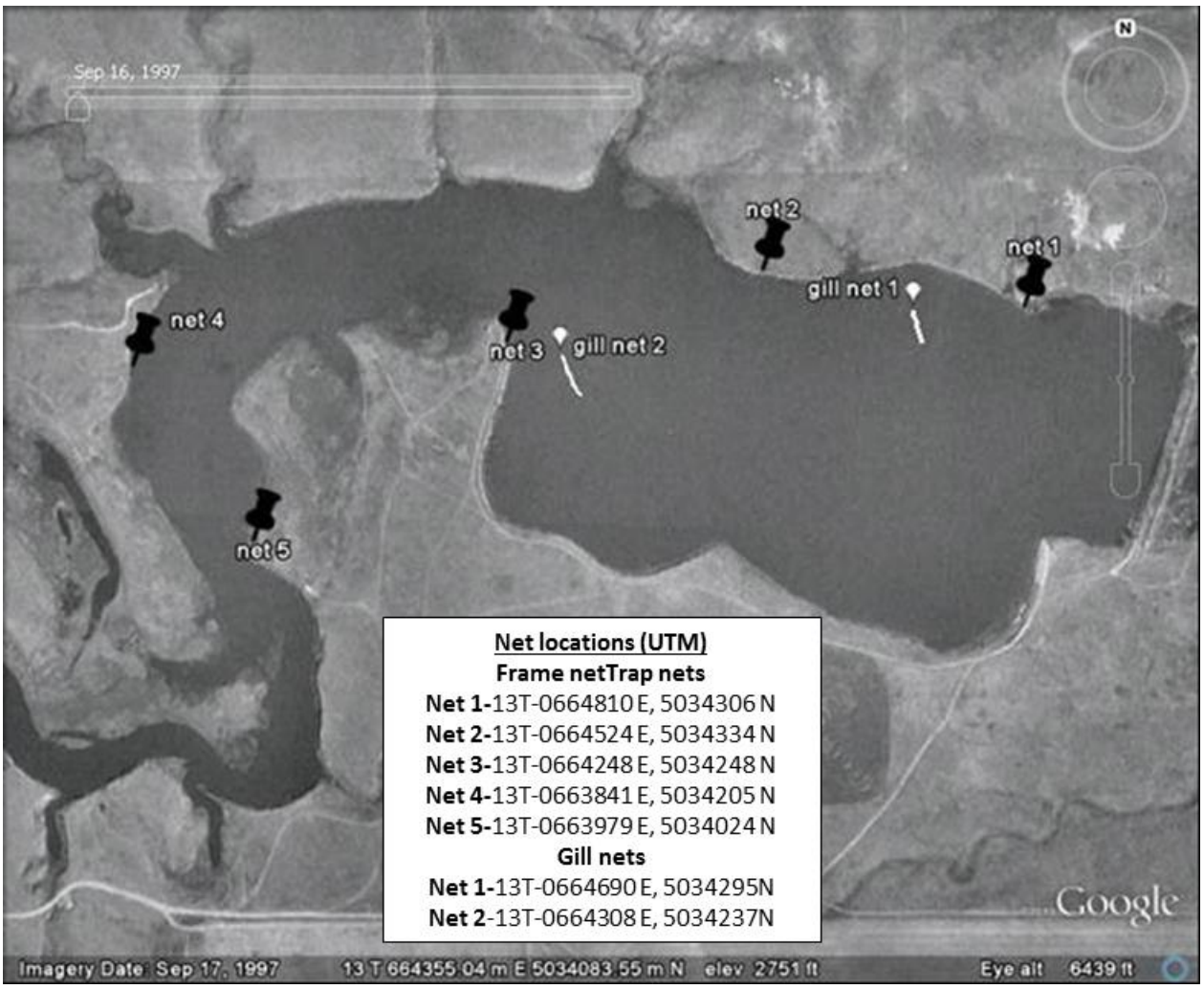


Figure 1. Map of Sorum Lake and net locations during the 2010 fish survey.

Yellow perch dominated the catch at 57.2%. Green sunfish were second at 24.0% and black bullhead third at 13.6%. Bullhead and green sunfish most likely came from upstream dams with runoff since these fish species were not stocked by GFP. Yellow perch dominated the gill net catch, comprising 91.8 % of the 392 fish sample (Table 2). Walleye were second at 5.1%.

Fall electrofishing captured 202 fish in one hour with 171 walleye and 31 largemouth bass (Table 3). These were the only fish targeted during the electrofishing survey.

Table 1. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's), and condition factor (Wr for fish ≥ stock length; 80% CI's) for all fish species collected from five, ¾ inch trap nets in Sorum Lake, June 21-22, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black bullhead	259	51.8 (17.2)	33.6 (8.9)	8 (3)	0	107.4 (6.6)
Black crappie	2	0.4 (0.4)	0.0 (--)	--	--	--
Golden shiner	62	12.4 (9.0)	--	--	--	--
Green sunfish	456	91.2 (41.3)	91.2 (41.3)	21 (5)	0	104.2 (5.6)
Largemouth bass	1	0.2 (0.3)	0.0 (--)	--	--	82.9 (--)
Walleye	45	9.0 (5.0)	0.0 (--)	0	0	96.7 (8.0)
Yellow perch	1,072	214.4 (138.4)	156.4 (100.8)	--	--	--
Total	1,897					

Table 2. Total catch (N), catch per net night (CPUE; 80% CI's in parentheses), catch per net night of stock-length fish (CPUE-S; 80%CI's), proportional stock densities (PSD, RSD-P; 90% CI's), and condition factor (Wr for fish ≥ stock length; 80%CI's) for all species collected from two, 150-ft experimental sinking gill nets in Sorum Lake, June 21-22, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Black bullhead	4	2.0 (0.0)	1.5 (1.5)	--	--	103.2 (--)
Black crappie	6	3.0 (9.2)	0.0 (--)	--	--	--
Golden shiner	7	3.5 (4.6)	--	--	--	--
Green sunfish	2	1.0 (0.0)	1.0 (0.0)	--	--	--
Walleye	20	10.0 (9.2)	0.0 (--)	0	0	91.6 (2.1)
Yellow perch	360	180.0 (126.2)	131.0 (92.3)	1 (1)	0	108.1 (2.1)
Total	399					

Table 3. Total catch (N), fish per hour (CPUE; 80% CI's in parentheses), fish per hour of stock-length fish (CPUE-S; 80% CI's), proportional stock densities (PSD, RSD-P; 90% CI's), and condition factor (Wr for fish ≥ stock length; 80% CI's) for largemouth bass and walleye collected from 60 minutes of electrofishing at Sorum Lake, October 13, 2010.

Species	N	CPUE	CPUE-S	PSD	RSD-P	Wr ≥ S
Largemouth bass	31	31.0 (9.0)	28.0 (8.1)	0	0	107.8 (2.5)
Walleye	171	171.0 (34.4)	40.0 (21.3)	0	0	79.8 (0.7)
Total	202					

Black Bullhead

Black bullheads may have entered the lake from higher in the watershed as none were stocked by the Game, Fish and Parks. Trap nets yielded a CPUE of 51.8 of which 33.6 were over stock length (Table 1). Numbers of quality length fish were relatively low (Figure 2). Condition of

adult fish, however, was good with a Wr for stock length and over fish at 107.4. While trap nets caught numerous bullheads, the two gill nets only captured four (Table 2).

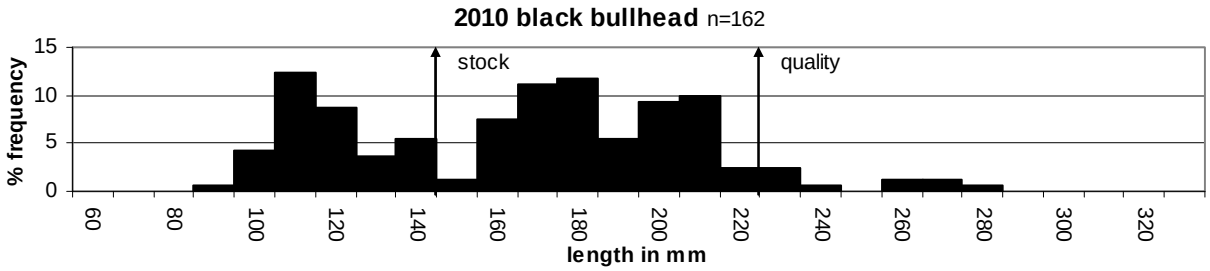


Figure 2. Length frequency histogram for black bullheads from trap nets in Sorum Lake, Perkins County, June 21-22, 2010.

Green Sunfish

Along with the black bullheads, green sunfish have been found in Sorum Lake and are prevalent, evidenced by a trap net CPUE of 91.2. Size structure of the population tended to be composed of smaller fish with a green sunfish PSD of 21 with an RSD-P of 0 (Table 1, Figure 3). It is expected that the size structure will improve as largemouth bass and walleye populations build and, in turn, reduce sunfish density.

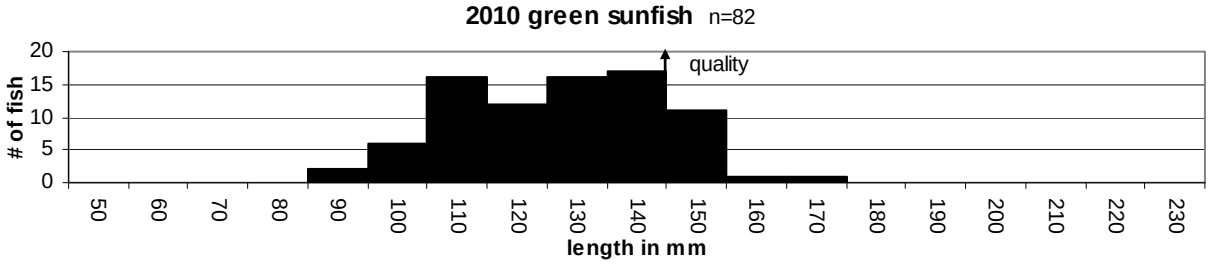


Figure 3. Length frequency histogram for green sunfish from trap nets in Sorum Lake, Perkins County, June 21-22, 2010.

Largemouth Bass

Over 7,300 largemouth bass fingerlings were stocked in fall of 2009. Fall electrofishing yielded a CPUE of 31.0 fish per hour (Table 3). The fingerlings were around an inch and a half long when stocked. In one year, some of these fish had reached 290 mm, showing tremendous growth (Figure 4). The apparent good source of prey should keep largemouth bass growth rates high while this fishery is becoming established.

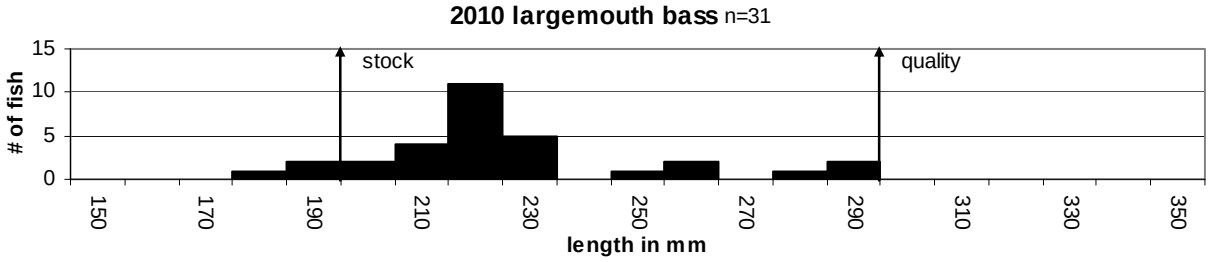


Figure 4. Length frequency histogram for largemouth bass from electrofishing in Sorum Lake, Perkins County, June 21-22, 2010.

Walleye

Walleye stockings appear to have been very successful. Gill net CPUE was 10.0 and trap net CPUE was 9.0 (Tables 1 and 2). Also, one hour of fall electrofishing yielded 171 walleye (Table 3). The length frequency histogram shows excellent growth with a good portion of the age-1 fish surpassing stock length of 10 inches (Figures 5 and 6).

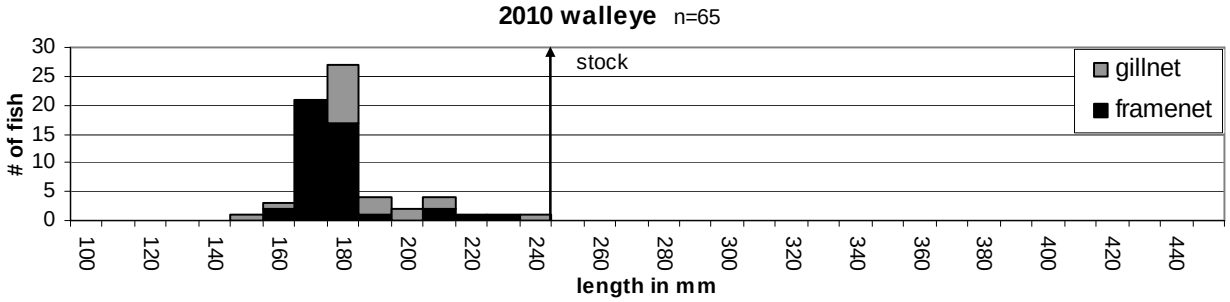


Figure 5. Length frequency histogram for walleye from gill and trap nets at Sorum Lake, Perkins County, June 21-22, 2010.

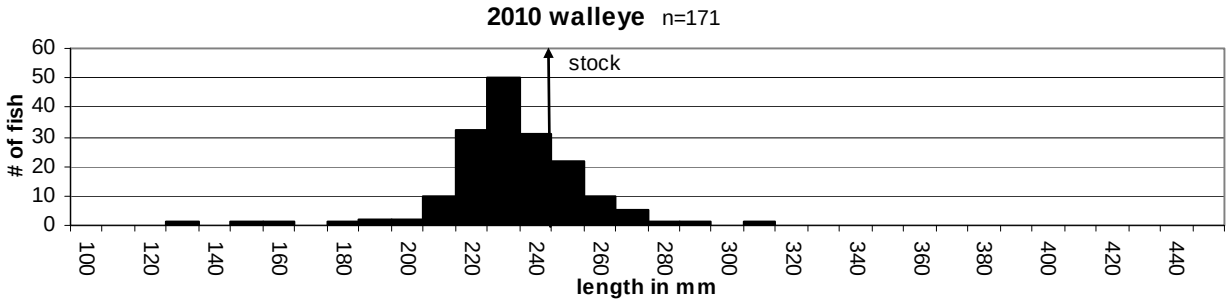


Figure 6. Length frequency histogram for walleye from electrofishing at Sorum Lake, Perkins County, October 13, 2010.

Yellow Perch

Prespawn perch stocked in 2009 appear to have done well with a gill net CPUE of 180 fish per net (Table 2) and trap net CPUE over 214 (Table 1). These fish are only one year old but some are already up to 6 inches (Figure 7). If this growth continues, Sorum should provide an excellent fishery by next winter. Fish condition was excellent with stock length and larger fish having an average Wr of over 108.

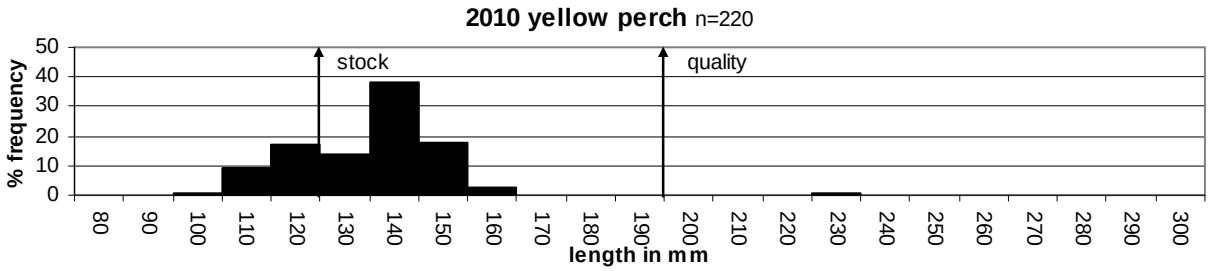


Figure 7. Length frequency histogram for yellow perch from gill nets at Sorum Lake, Perkins County, June 21-22, 2010.

RECOMMENDATIONS

1. Continue conducting electrofishing surveys on a yearly basis to monitor the largemouth bass and walleye populations in Sorum Lake.

2. Continue conducting netting surveys annually or biannually to monitor yellow perch and other fish populations.

APPENDIX

Appendix A. Stocking record for Sorum Lake, Perkins County, 2009-2010.

Year	Number	Species	Size
During 2004 to 2009 Sorum Lake was dry or too low to support a fishery			
2009	550	Yellow perch	Adult
	200	Black crappie	Adult
	43,800	Walleye	Fingerling
	7,320	Largemouth	Fingerling
2010	490	Yellow perch	Adult
	250	Golden shiner	Adult
	9,000	Walleye	Fingerling

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-43

Name: USFS Pasture # 9 County: Perkins
Legal description: Sec. 4 & 9, Twn. 20 N, R 16 E
Location from nearest town: 1 mile west, 15 miles south, ½ mile east of Lemmon, SD
Dates of present survey: July 12-13, 2010
Date last surveyed: October 16, 2001
Most recent lake management plan: N/A
Management classification: N/A

Primary Species:(game and forage)	Secondary and other species:
1. Largemouth bass	1. Green sunfish
2. Yellow perch	2.
3. Rainbow trout	3.

PHYSICAL CHARACTERISTICS

Surface Area: 19 ac (7.7 ha); Watershed: Approximately 450 acres
Maximum depth: NA feet; Mean depth: NA feet
Lake elevation at survey (from known benchmark): full feet

1. Describe ownership of lake and adjacent lakeshore property:

The USFS owns the land surrounding the dam in Pasture #9.

2. Describe watershed condition and percentages of land use:

The watershed is primarily used as pastureland.

3. Describe aquatic vegetative condition:

Rooted aquatic vegetation consists of bulrushes and cattails and was primarily observed only in shallow bay areas during sampling.

4. Describe pollution problems:

Department personnel identified no pollution problems during the 2010 survey.

5. Describe condition of all structures, i.e. spillway, level regulators, boat ramps, etc.:

No boat ramp exists at the dam in USFS Pastue #9. The condition of the dam grade and any other structures associated with the dam were not inspected by department personnel during the 2010 survey. The USFS has developed a recreation area on the west side of the lake with

parking area, picnicking area and out house. The access road to the lake has also been improved to a good gravel road instead of a two track trail.

BIOLOGICAL DATA

Methods

A lake survey was conducted on USFS #9 on July 12-13, 2010. Sampling consisted of four trap net nights (Figure 1). All trap nets were modified fyke-nets with a 1.3 X 1.5 m frame, 19.1 mm (0.75 in) mesh and a 1.2 X 23 m (3.9 X 75.5 ft) lead. Collected fish were measured for total length (TL; mm) and weighed (g).

Fish population parameters calculated were catch-per-unit-effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr) based on length categories. Abundance was expressed as the mean catch-per-unit-effort (CPUE; mean number per net night or mean number per hour of electrofishing). Population structural characteristics were expressed as length frequency histograms and stock density indices (PSD and RSD-P). Fish condition was expressed as mean Wr.

Results and Discussion

Fifty-six fish were captured in the four trap net sample (Table 1). Green sunfish were the dominant species comprising 85.7% of the sample. Yellow perch were the second most abundant species at 12.5%. One rainbow trout was caught in a trap net. No bass were sampled or targeted by our gear type, but have been stocked regularly in recent years.

Table 1. Total catch (N), catch per net night (CPUE), catch per net night of stock length fish (CPUE-S), proportional stock densities (PSD, RSD; 90% CI's in parentheses) and condition factor (mean Wr for stock length and larger fish) for all fish species from four trap nets in USFS #9, Perkins County, July 12-13, 2010.

Species		CPUE	CPUE-S	PSD	RSD-P	Wr>S
Green sunfish	48	12.0 (8.5)	12.0 (8.5)	0	0	100.4 (1.9)
Rainbow trout	1	0.3 (0.4)	--	--	--	--
Yellow perch	7	1.8 (2.4)	1.5 (2.5)	67 (43)	50 (45)	84.8 (9.5)
Totals	56					

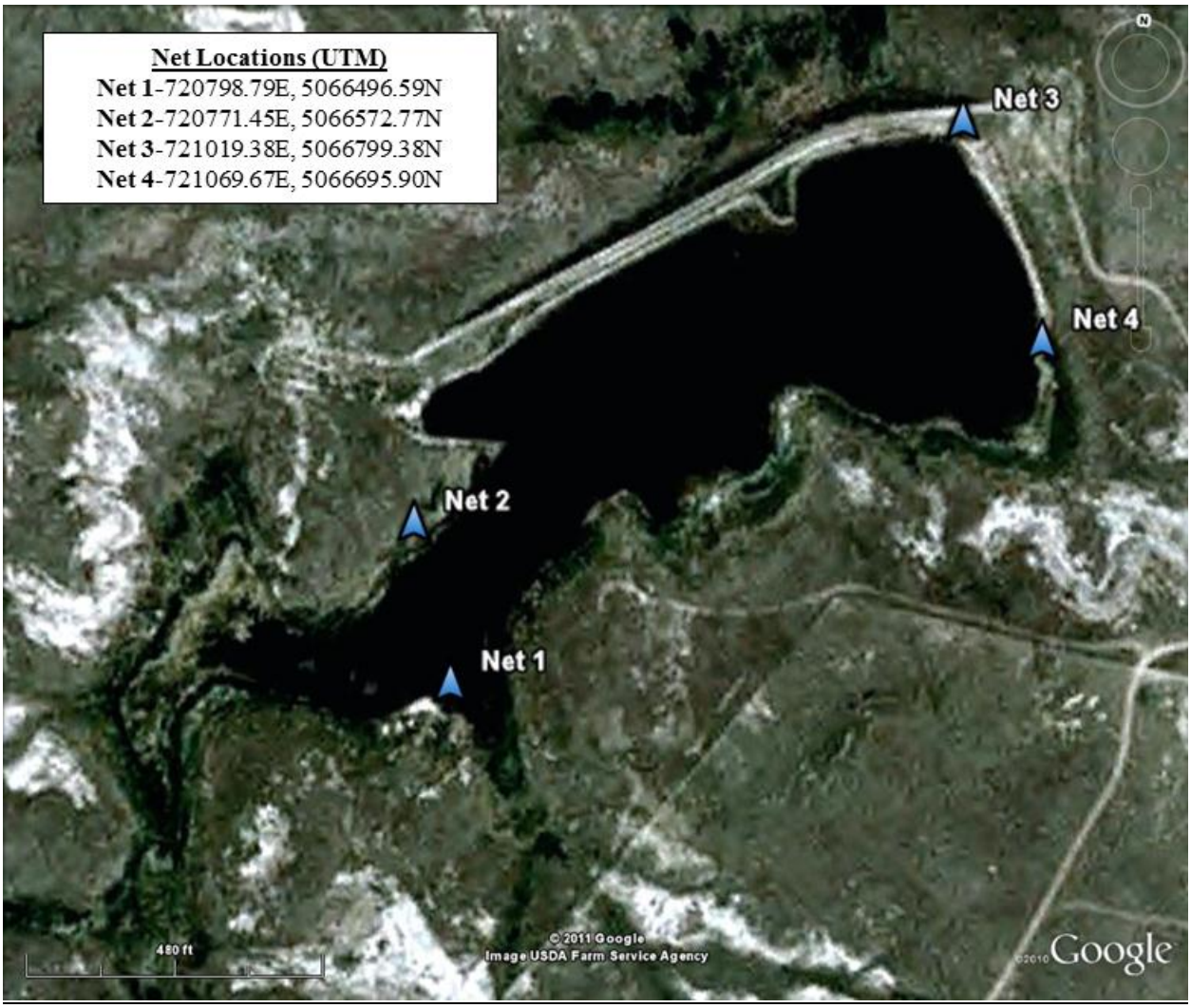


Figure 1. Map of USFS Pasture #9 Pond and net locations during the 2010 survey.

Green Sunfish

Green sunfish were the most numerous species caught during the 2010 survey with a trap net with a CPUE of 12.0. (Table 1) No fish sampled were over quality length but all were over stock length (i.e. 80 mm, Figure 2). Fish condition was excellent with an average Wr of 100.4.

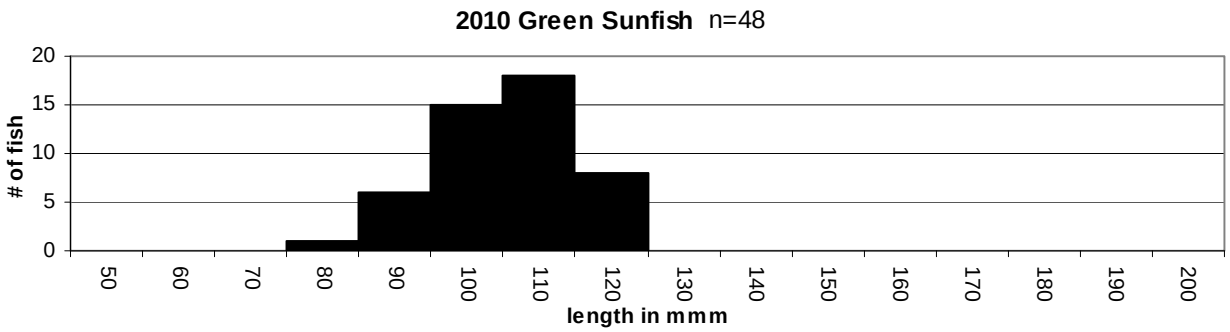


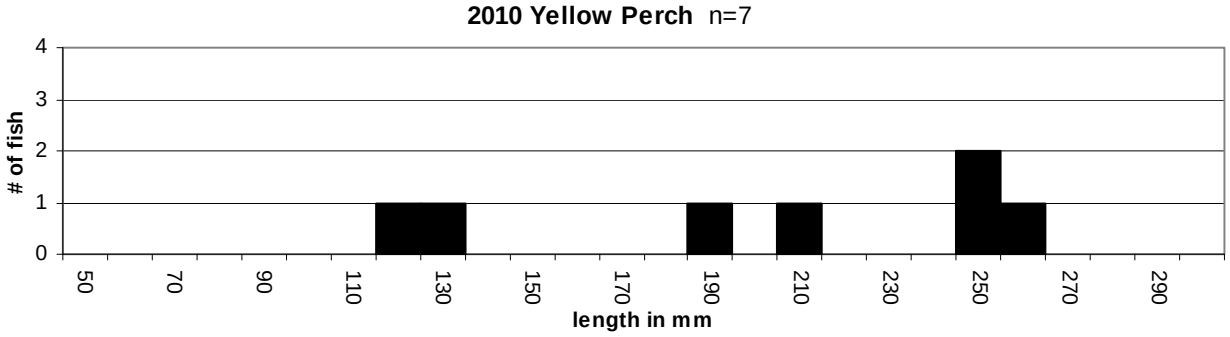
Figure 2. Length frequency histogram of green sunfish from trap nets at USFS #9 on July 13, 2010.

Rainbow Trout

Catchable size (11 inch) rainbow trout are stocked twice a year, once in the spring and once in the fall, at 600 fish per stocking. Communications with local anglers indicate this has proven to be a popular fishery. During this survey, one trout was sampled (Table 1). The survey was in mid-July and only trap nets were used, therefore, deeper, colder waters were not sampled. The one fish sample is not a concern since sampling was not directed towards catching trout and the rainbow trout stockings are meant to be seasonal, providing high catch rates of nice size fish in spring, fall and winter.

Yellow Perch

Yellow perch were stocked after the lake recovered from low water conditions during the recent drought. In Spring of 2009, six hundred-fifty adult yellow perch were stocked. During our sampling, seven yellow perch were caught giving a CPUE of 1.8 per trap net (Table 1) and ranging from 120-260 mm (Figure 3). These fish should find suitable habitat to reestablish the lake with a quality panfish population.



F**igure 3.** Length frequency histogram of yellow perch from trap nets at USFS #9 on July 13, 2010.

RECOMMENDATIONS

1. Stock adult largemouth bass at a rate of at least 5 per acre to reestablish a predator population.

2. Survey every five years, including largemouth bass sampling.

APPENDIX

Appendix A. Stocking record for USFS Pasture #9, Perkins County, 2000, 2002, 2004-2006, 2009 and 2010.

Year	Number	Species	Size
2000	2,500	Largemouth bass	Fingerling
2002	400	Largemouth bass	Fingerling
2004	860	Largemouth bass	Fingerling
2005	2,040	Largemouth bass	Fingerling
2006	145	Channel catfish	Adult
	4,500	Largemouth bass	Fingerling
2009	650	Yellow perch	Adult
	1200	Rainbow trout	Catchables (11in)
2010	1200	Rainbow trout	Catchables (11in)