

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-46

Name: Deerfield Reservoir

County: Pennington

Legal description: Sec. 25 T1N R2E, and Sec. 19-20, 29-30, 32, T1N, R3E

Location from nearest town: 12 miles northwest of Hill City, South Dakota

Dates of present survey: August 12-14, 2013

Date last surveyed: August 13-15, 2012

Most recent lake management plan: F21-R-40

Date: 2008 - 2012

Management classification: Coldwater Permanent

Contour mapped: 1987

Primary Species:

1. Rainbow Trout
2. Splake Trout
3. Brook Trout
4. _____
5. _____
6. _____

Secondary and other species:

1. White Sucker
2. Golden Shiner
3. Rock Bass
4. Yellow Perch
5. Lake Chub

PHYSICAL CHARACTERISTICS

Surface Area: 435 acres

Watershed: 60,800 acres

Maximum depth: 95 feet

Mean depth: 35 feet

Lake elevation at survey 5,907 feet; (97% of full pool) (Bureau of Reclamation)

Ownership of lake and adjacent lakeshore property:

The Bureau of Reclamation (BOR) 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.

Fishing Access

Deerfield Reservoir has boat ramps with docks located on the northeast and southeast sides of the lake. Shore fishing access is available via a walking trail around the lake. Additionally, a campground and picnic area on the southwest shore also allow for fishing access. A no-wake regulation (< 5 mph maximum speed) exists for the reservoir and reduces other boating recreation. All areas require a USFS pass except when parking along the road at the Castle Creek inlet.

Watershed condition and land use:

The Deerfield Reservoir 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.

Observations of Water Quality and Aquatic Vegetation

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. Minor input of silt and nutrients washes into Deerfield Reservoir from Castle/Ditch Creek and Gold Run Creek as well as other smaller drainages. Cattle grazing, a limited amount of agricultural tillage, and cattle feeding contribute to siltation and nutrient loads.

Observations on conditions of structures (i.e. spillway, boat ramps, docks, and roads, 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. The USFS is responsible for management and repair of boat ramps at Deerfield Reservoir. The south boat ramp was replaced in the fall of 2012 and the Rapid City Walleyes Unlimited Chapter donated a new boat dock that was installed in spring 2013.

CURRENT MANAGEMENT OBJECTIVES

- Objective 1.** Maintain a quality Rainbow Trout fishery at Deerfield Reservoir where catch rates exceed 0.50 Rainbow Trout per hour.
- Objective 2.** Annually monitor the White Sucker population, continue White Sucker removals when densities appear high (i.e. gill net CPUE >30).
- Objective 3.** Maintain a secondary fishery of Splake Trout.
- Objective 4.** Continue to work towards reducing Rock Bass density within the reservoir.

BIOLOGICAL DATA

Sampling Effort and Catch

A gill netting survey was conducted on August 12-14, 2013. Gill nets were monofilament experimental type and measured 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). Depths and GPS location were recorded to facilitate similar placement each year (Figure 1). A modified fyke (trap) net survey was also completed on August 12-14, 2013. Trap nets consisted of 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. All nets remained in the water overnight for a total of six trap net and four gill net nights and catch data is displayed in Tables 1 and 2. Collected fish were measured for total length (TL) to the nearest millimeter (mm) and weighed to the nearest gram (g). Discussion on selected fish species follows and completes this report.

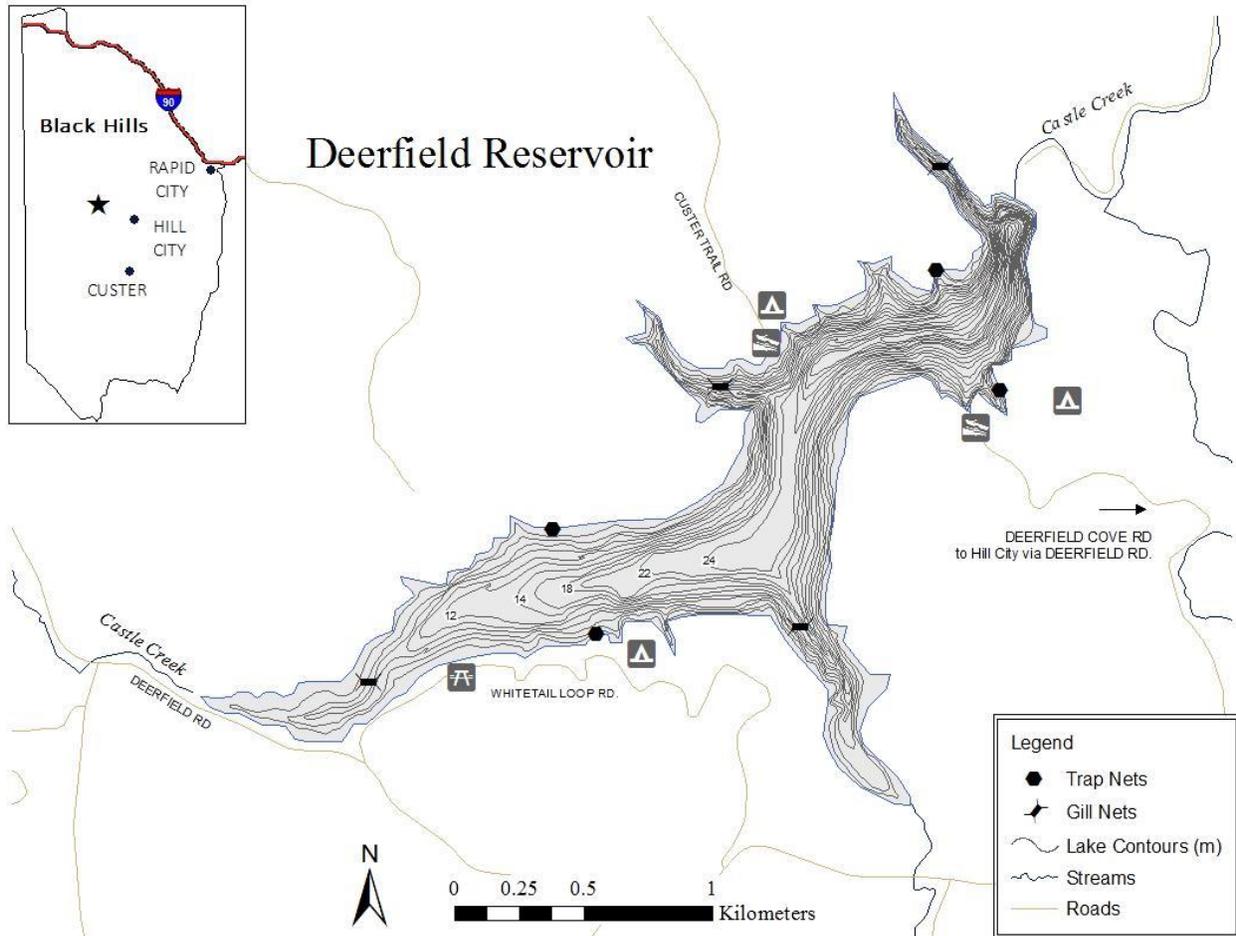


Figure 1. Locations of gill and trap nets during the annual fisheries survey at Deerfield Reservoir, Pennington County, South Dakota, 2013.

Seven fish species were sampled in gill nets and five species in trap nets totaling 479 and 345 fish captured, respectively (Tables 1 and 2). Rock Bass continued to be the most abundant species sampled in trap nets, while Yellow Perch were the most abundant in gill nets.

Table 1. Total catch of twelve 150-foot gill nets set in Deerfield Reservoir, South Dakota on August 12-14, 2013. Parameters are reported with confidence intervals in parenthesis.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	Wr-S (90%)
Brook Trout	37	9.3 (13.5)	6.0 (8.7)	4 (7)	0	85.0 (5.5)
Golden Shiner	1	0.25 (0.4)	-	-	-	-
Rainbow Trout	43	10.8 (4.5)	10.5 (4.1)	0	0	79.8 (0.3)
Splake Trout	13	3.3 (2.7)	-	-	-	-
Rock Bass	34	8.5 (8.5)	8.5 (8.5)	0	0	76.4 (0.2)
White Sucker	24	6.0 (5.7)	6.0 (5.8)	100	92 (10)	95.0 (8.3)
Yellow Perch	327	81.8 (63.4)	81.5 (63.0)	29 (5)	1 (1)	81.9 (1.1)

Table 2. Total catch of six trap nets set in Deerfield Reservoir, South Dakota on August 12-14, 2013. Parameters are reported with confidence intervals in parenthesis.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	Wr-S (90%)
Creek Chub	1	0.17 (0.28)	-	-	-	-
Golden Shiner	5	0.8 (0.7)	-	-	-	-
Rock Bass	286	47.7 (32.9)	33.2 (24.9)	0	0	78.8 (1.1)
White Sucker	23	3.8 (2.4)	3.7 (2.3)	95 (7)	95 (7)	96.0 (1.5)
Yellow Perch	30	5.0 (3.6)	5.0 (3.6)	13 (10)	0	81.9 (0.5)

Rainbow Trout

Catchable (279-381 mm) Rainbow Trout are stocked into Deerfield Reservoir at a rate of approximately 2,000 per month from May through October (Table 3). Survey catch per unit effort (CPUE) and relative weight (*Wr*) are often influenced by the presence of hatchery-reared Rainbow Trout present in the survey. Forty-three Rainbow Trout were collected from gill nets during the 2013 survey. This is the most that has been collected since 2008. Mean Rainbow Trout condition (*Wr*) was up slightly from the past three years with a value of 79.8. Length frequencies (Figure 2) indicated a size structure consistent with the length of hatchery-reared catchable fish, showing that most are between 280 mm and 360 mm (11-14 in); however, one was 150 mm and in recent years a number of rainbow trout smaller than hatchery size have been sampled. Between 2010 and 2012, 50% of surveyed fish were identified as non-hatchery reared fish. Studies are ongoing looking at the contribution of naturally reproduced Rainbow Trout in Deerfield Reservoir and its primary tributary system, Castle Creek.

Table 3. Stocking history (# stocked), number sampled (N), mean catch per unit effort (CPUE), and mean relative weight (*Wr*) from gill net surveys of Rainbow Trout in Deerfield Reservoir, South Dakota, 2004-2013.

Year	# stocked	N	CPUE (80%CI)	Wr (90% CI)
2004	12,010	86	21.5 (9.3)	75.1 (0.1)
2005	12,010	64	16.0 (12.0)	73.3 (0.4)
2006	12,124	77	19.3 (13.6)	70.3 (0.1)
2007	8,400	71	17.8 (8.6)	66.4 (0.1)
2008	12,280	53	13.3 (5.3)	72.1 (0.1)
2009	11,883	17*	8.5 (7.7)	74.4 (0.2)
2010	11,864	30	7.5 (5.4)	70.2 (0.2)
2011	12,000	23	5.7 (6.0)	74.4 (0.2)
2012	12,500	17	4.2 (1.9)	65.8 (0.3)
2013	12,000	43	10.8 (4.5)	79.8 (0.1)

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

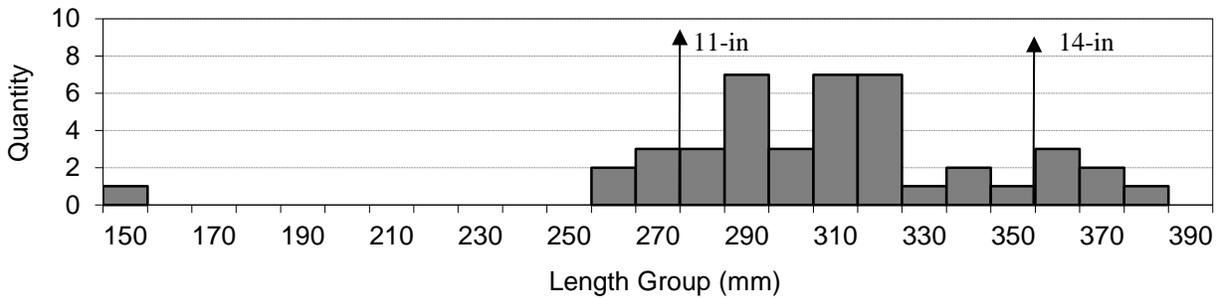


Figure 2. Length frequency histogram for Rainbow Trout collected from Deerfield Reservoir, South Dakota, 2013.

Rock Bass

In 2008, trap nets were added to the annual sampling to more effectively sample the fish assemblage. In 2013, Rock Bass were the most numerous species captured in trap nets comprising 83% of the fish caught. Mean CPUE has been down in 2012 and 2013 compared to years prior (Table 5). Length frequency indicates most of these fish were between 80 mm and 140 mm (3 in - 5 in), putting them at less than quality length (180 mm or 7 in). Mean *Wr* was 74 for gill nets (Table 4) and 77 for trap nets (Table 5), which indicates poor condition and may indicate intraspecific competition. Discussion is ongoing to develop a solution to the overabundance of Rock Bass in Deerfield Reservoir.

Table 5. Parameters of Rock Bass surveyed with trap nets set in Deerfield Reservoir, South Dakota in 2008-2013. Values are reported with confidence intervals in parentheses.

Year	N	CPUE (80%)	PSD (90%)	<i>Wr</i> ≥ <i>S</i> (90%)
2008	1,060	212.0 (126.3)	1 (2)	80.2 (0.4)
2009	449	112.3 (57.6)	6 (10)	79.9 (1.5)
2010	445	111.0 (54.7)	0	82.0 (2)
2011	915	152.5 (47)	2 (1)	78.5 (1)
2012	251	41.8 (23.2)	3 (2)	76.7(1.0)
2013	286	47.7 (32.9)	0	78.8 (1.1)

Brook Trout and Splake Trout

Splake Trout are a hybrid between Brook Trout and Lake Trout. Initial stockings in the 1990s involved fingerlings, but recent stockings in 2006 and 2012 have utilized advanced fingerlings. In 2012, stocked Splake Trout were adipose clipped to identify them from other Splake Trout or Brook Trout already occurring in the lake. In recent years, some fish caught in gill nets have been difficult to differentiate between Brook Trout and are possibly naturally produced crosses of Brook Trout and Splake Trout. Morphological characteristics, as well as meristic counts, have made distinguishing between the two fish difficult. The small size of individuals and lack of fin clips seems to suggest that Splake Trout may be crossing back with Brook Trout or naturally reproducing with other Splake Trout in the system. A research study including genetics identification has begun to determine the reproductive contribution of the species. This would be important in correctly identifying fish in annual surveys to determine if either Brook Trout or

Splake Trout are naturally adding to the fishery, as well as correctly identifying state record individuals.

During the 2013 gill net survey, thirty-seven fish identified as Brook Trout (no clipped fin) and 13 Splake Trout were captured (Table 1). Most Brook Trout and Splake Trout measured 130-280 mm (5-11 in) in length, with two larger individuals. One fish at 330 mm was identified as a Brook Trout and one at 620 mm was identified as a Splake Trout.

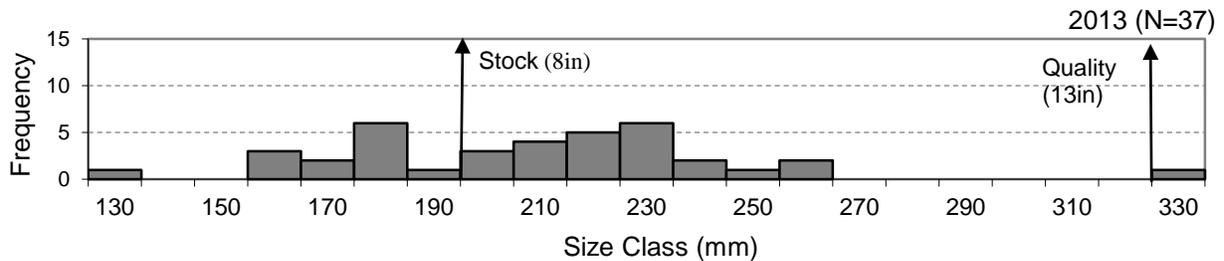


Figure 3. Length frequency histogram for Brook Trout captured during gill net survey of Deerfield Reservoir, South Dakota in 2013.

White Sucker

White Sucker densities were high in the late 1990s. To reduce the density of White Suckers, removal efforts were conducted from 1999 to 2001, 2006-2009, and 2012 using trap nets during the spring spawning period (Table 6). The removals appeared to lower densities, as gill net catch did decrease following removals. White Suckers will not be targeted for removals next year as catch rates were less than 30 individuals per net, however, individuals caught will be removed during any future Yellow Perch trap and transfer and Rock Bass removals.

Size structure of White Suckers appears to have increased in recent years with mean proportional stock density of preferred length fish (PSD-P) values of 40 in 2001 to almost 100 since 2008. In 2012, the majority of fish were over memorable length (410 mm or 16 in) with a proportional stock density of memorable sized fish (PSD-M) value of 83 and a mean total length of 425 mm (17 in). Condition (*Wr*) has remained around 100 since 2009 (Table 6).

While future White Sucker removals may be necessary to keep numbers down, values from this survey suggest the population is maintaining a lower density with reduced recruitment. It is possible this is a result of Rock Bass and Yellow Perch populations displaying a predatory pressure on juvenile White Suckers.

Table 6. Summary of White Suckers removed by trap nets and parameters for fish collected during gill net surveys from Deerfield Reservoir, South Dakota, 2000-2013.

Year	Number Removed	Pounds Removed	CPUE (80%)	PSD (90%)	$Wr_{\geq S}$ (90%)
2000	9,571	13,400	52.8 (--)	-	-
2001	4,355	5,401	54.5 (14.6)	89 (3)	88.9 (0.1)
2002	0	0	22.3 (14.0)	99 (1)	91.7 (0.5)
2003	0	0	26.8 (23.1)	100	90.4 (0.5)
2004	0	0	36.3 (14.0)	100	89.8 (0.5)
2005	0	0	35.0 (18.3)	99 (1)	90.7 (0.4)
2006	9,020	14,432	25.8 (13.5)	94 (4)	89.3 (0.1)
2007	1,064	1,809	15.8 (13.5)	95 (4)	93.4 (1.6)
2008	4,706	8,000	11.0 (7.8)	100	94.7 (0.9)
2009	1,500	2,600	24.0 (49.2)	100	101.0 (1.6)
2010	0	0	23.8 (2.25)	100	99.8 (3.8)
2011	0	0	7.0 (5.2)	96 (6)	99.6 (1.7)
2012	~500	NA	7.3 (6.4)	100	99.1 (1.6)
2013	0	0	6.0 (5.8)	100	101.0 (1.7)

Yellow Perch

Yellow Perch density continues to increase in Deerfield Reservoir. Gill net CPUE has increased from three in 2003 to 81.8 in 2013 (Table 7). The decrease in 2011 could be due to placement of nets, specifically a change in depth. The low PSD value of 26 and decreasing Wr of 81.9 likely indicate a population experiencing slow growth due to overabundance or competition with other species (i.e. Rock Bass and Rainbow Trout).

Length-frequency indicates most fish 150 mm to 200 mm (six to eight inches) with few larger than that and possibly three or more year classes (Figure 4). In recent years, Deerfield Reservoir has been a source for Yellow Perch trap and transfer. A few hundred Yellow Perch were relocated to other aquatic systems in May 2013.

Table 7. Parameters of Yellow Perch surveyed with gill nets in Deerfield Reservoir, South Dakota in 2003-2013. Values are reported with confidence intervals in parentheses.

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 (76.0)	39 (5)	92.0 (2.0)
2011	31	7.8 (8.8)	39 (0)	89.7 (2.4)
2012	227	56.8 (92.9)	26 (5)	83.3 (0.5)
2013	327	81.8 (63.4)	29 (5)	81.9 (1.1)

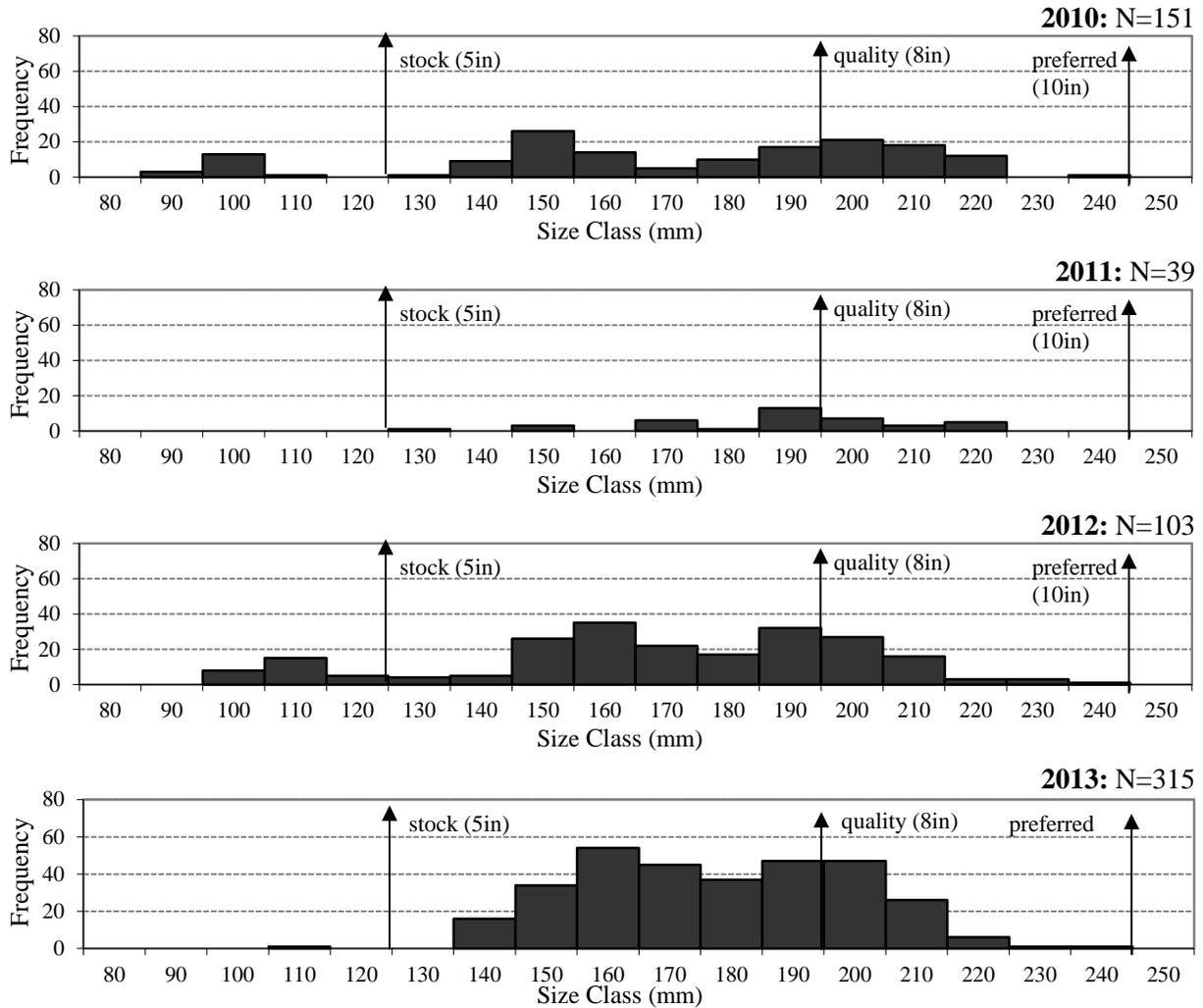


Figure 4. Length frequency histograms for Yellow Perch collected in gill net surveys from Deerfield Reservoir, South Dakota, 2010-2013.

LITERATURE CITED

Bureau of Reclamation, U.S. Department of the Interior. Current Reservoir Data for Pactola Reservoir, SD. 10 Nov 2011. <http://www.usbr.gov/gp-bin/arcweb_ptr.pl>

RECOMMENDATIONS

1. Continue current catchable Rainbow Trout stockings.
2. Complete standard lake surveys annually to continue monitoring fish indices.
3. White Sucker CPUE trends seem to decrease with removals. Consider annual spring removal of White Suckers when gill net CPUE exceeds 30.

4. Attempt Rock Bass removals by electrofishing and/or trap netting.

APPENDIX

Appendix A. Stocking history, including year, number stocked, species and size of fish stocked for Deerfield Reservoir, Pennington County, South Dakota, 1999-2013. Catchable size fish are around 279 mm (11 in).

Year	Number	Species	Size
1999	120,000	Rainbow Trout	fingerling
	2,538	Rainbow Trout	catchable
	23,373	Splake Trout	fingerling
2000	120,000	Rainbow Trout	fingerling
	2,335	Rainbow Trout	catchable
2001	60,612	Rainbow Trout	fingerling
	7,219	Rainbow Trout	catchable
2002	60,000	Rainbow Trout	fingerling
	10,471	Rainbow Trout	catchable
2003	8,759	Rainbow Trout	catchable
	60,625	Rainbow Trout	fingerling
2004	12,010	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
2011	12,000	Rainbow Trout	catchable
2012	12,500	Rainbow Trout	catchable
	5,853	Splake Trout	advanced fingerling
2013	12,000	Rainbow Trout	catchable