

## SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-48

**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 10-12, 2015

**Date last surveyed:** August 13-15, 2014

**Most recent lake management plan:** F21-R-46

**Date:** 2014 - 2018

**Management classification:** Coldwater Permanent

**Contour mapped:** 1987

Primary Species:

1. Rainbow trout
2. Lake trout
3. Splake trout
4. Brook trout
5. \_\_\_\_\_

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** 5,906 feet; (93% 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.** Identify factors possibly affecting rainbow trout condition by January 2017.

**Objective 2.** Reduce the density of undesirable fish species, if feasible, by 2019.

**Objective 3.** Investigate introductory stockings of other species or sizes of trout stocked, and if deemed appropriate, complete a written proposal addressing possible introductions and implement as soon as possible.

## **BIOLOGICAL DATA**

### **Sampling Effort and Catch**

A gill netting survey was conducted on August 10-12, 2015. All nets remained in the water overnight for a total of four gill net nights (Figure 1). Collected fish were measured for total length (TL) to the nearest millimeter (mm) and weighed to the nearest gram (g).

During the 2015 annual survey of Deerfield Reservoir, seven fish species were sampled in gill nets totaling 294 fish captured (Table 1). Yellow perch were the most abundant species surveyed.

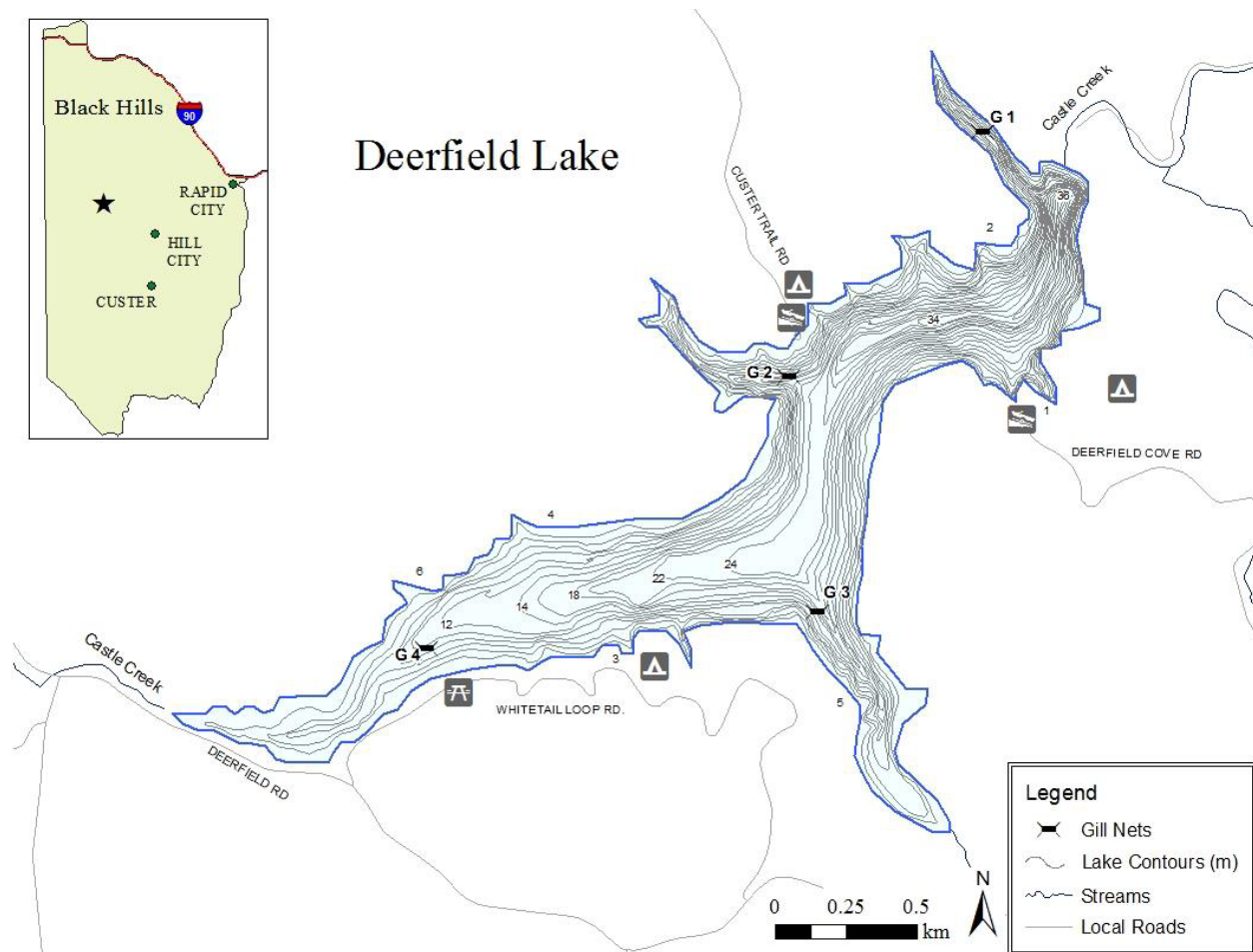


Figure 1. Locations of gill nets during the annual fisheries survey at Deerfield Reservoir, Pennington County, South Dakota, August 10-12, 2015.

Table 1. Total catch of four 150-foot gill nets set in Deerfield Reservoir, Pennington County, South Dakota on August 10-12, 2015. 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	41	10.25 (8.7)	6.25 (4.8)	0	0	83.3 (2.3)
Splake trout	5	1.25 (1.2)	-	-	-	-
Lake trout	2	0.50 (0.5)	0.50 (0.5)	100	50 (50)	99.3(42.6)
Rainbow trout	33	8.25 (7.8)	7.25 (7.2)	0	0	74.7 (1.8)
Rock bass	22	5.5 (6.3)	5.5 (6.3)	0	0	84.2 (1.0)
White sucker	22	5.5 (5.5)	5.5 (5.5)	100	100	92.2 (7.4)
Yellow perch	169	42.3 (10.6)	41.8 (10.8)	36 (6)	0	81.7 (2.3)

## Rainbow trout

Catchable (~11") rainbow trout are stocked into Deerfield Reservoir at a rate of approximately 3,000 in April, June, August and September (Table 2). Thirty-three were collected from gill nets during the 2015 survey. Mean rainbow trout condition (*Wr*) is always low (74.7). Unlike other systems, reproduction and recruitment to adult fish occurs with rainbow trout in Deerfield Reservoir. Between 2010 and 2014, 47% of surveyed fish were identified as non-hatchery reared fish.

Table 2. Stocking history before August survey (# 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, Pennington County, South Dakota, 2005-2015.

Year	# stocked	N	CPUE (80%CI)	<i>Wr</i> (90% CI)
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)
2014	12,000	11	1.3 (0.7)	75.4 (20.6)
2015	9,000	33	8.3 (7.8)	74.7 (1.8)

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

## Lake trout

Adult lake trout were stocked into Deerfield Lake in 2015 with 60 in April and 763 in November. Two of these individuals were surveyed in gill nets measuring 24 in, 5.4 lbs and 27.4 in, 7.2 lbs (Table 1). Anglers are already successfully targeting these fish and hopefully they will become a good predator of overabundant rock bass as well as providing a trophy fishery. They are currently protected by the Black Hills harvest limit of five combined trout daily, one over 14 inches.

## Rock bass

In 2015, trap nets were not used as a survey method, which is the most effective method to survey rock bass. In 2008-2014, when trap nets were used, they were by far the most abundant species surveyed (CPUE 40-212). Twenty-two were surveyed in gill nets with no fish over quality length (180 mm/7 in). Hopefully the recently stocked large lake trout will reduce their abundance through predation.

## Brook trout and splake trout

Splake trout are a hybrid between brook trout and lake trout. Initial stockings in the 1990s were fingerlings, but recent stockings in 2006 and 2012 have been larger "advanced" fingerlings (~225 mm). In 2012, stocked splake trout were adipose clipped to identify them from other splake trout or brook trout already occurring in the lake.

During the 2015 gill net survey, 41 fish identified as brook trout (no fin clip) and five splake trout were captured (Table 1). Brook trout measured 160-255 mm (6-10 in) in length (Figure 2), and clipped splake trout measured 215-312 mm (8-12in). No larger individuals were collected during this year's survey, but recent year's surveys have produced a few as big as 630 mm (25 in). With large lake trout now in Deerfield identification will be potentially more difficult.

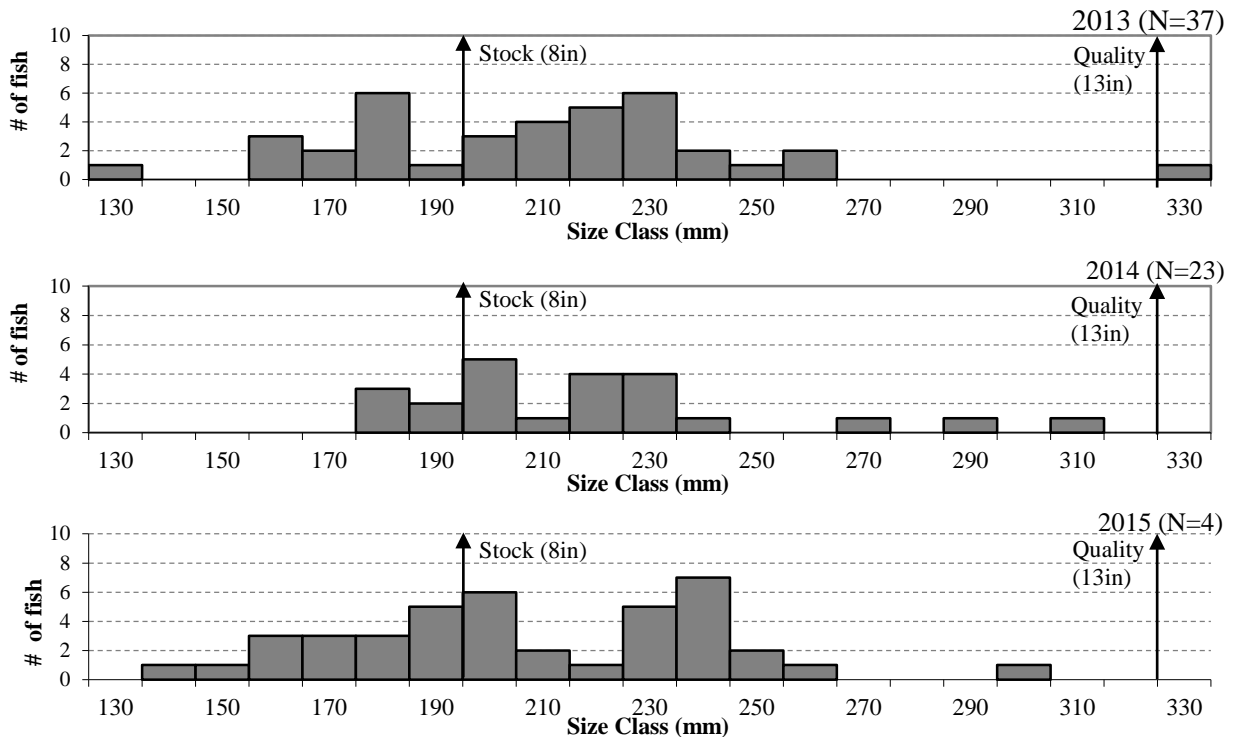


Figure 2. Length frequency histogram for brook trout captured during gill net survey of Deerfield Reservoir, Pennington County, South Dakota in 2013-2015.

### 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 3). The removals appeared to lower densities as gill net catch did decrease following removals. Values from 2011-2015 indicate the population is maintaining a lower density with reduced recruitment. White suckers will not be targeted for removals next year as catch rates were less than 20 individuals per net, however, individuals caught will be removed whenever possible.

Size structure of white sucker appears to have increased in recent years with mean proportional stock density of preferred length fish (PSD-P) values of 40 in 2001 to 100 since 2008. In 2015, all of fish were over memorable length (410 mm or 16 in) with a mean total length of 453 mm (17.8 in). Condition (*Wr*) has remained around 100 since 2009, with the highest level during the 2014 survey (Table 3).

Table 3. Summary of white suckers removed by trap nets and parameters for fish collected during gill net surveys from Deerfield Reservoir, South Dakota, 2005-2015.

Year	Number Removed	Pounds Removed	CPUE (80%)	PSD (90%)	$W_{r \geq S}$ (90%)
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)
2014	0	0	8.5 (6.6)	100	103.4 (2.9)
2015	0	0	5.5 (5.5)	100	92.7 (7.4)

### Yellow perch

Yellow perch density continues to increase in Deerfield Reservoir. Gill net CPUE has increased from 3 in 2003 to 87.2 in 2014 and back down to 42 in 2015 (Table 4). The decrease in 2011 is potentially due to a change of location and depth of nets that year. Relative weight decreased in 2015, and the continued low PSD value likely indicates a population experiencing slow growth due to potential overabundance or competition with other species (i.e. rock bass and rainbow trout).

Length-frequency indicates most fish 160 mm to 210 mm (6 to 8 in). Year classes are not apparent in 2014 or 2015 as they have been in previous years (Figure 3), which is also a possible indication of low recruitment. Deerfield Reservoir has been a source for yellow perch trap and transfer in recent years. Over 2,320 were relocated to other aquatic systems in May 2015.

Table 4. Parameters of yellow perch surveyed with gill nets in Deerfield Reservoir, South Dakota in 2005-2015. Values are reported with confidence intervals in parentheses.

Year	N	CPUE (80%)	PSD (90%)	$W_{r > S}$ (90%)
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)
2014	350	87.2 (96.6)	18 (4)	90.5 (0.2)
2015	169	42.3 (10.6)	36 (6)	81.7 (2.3)

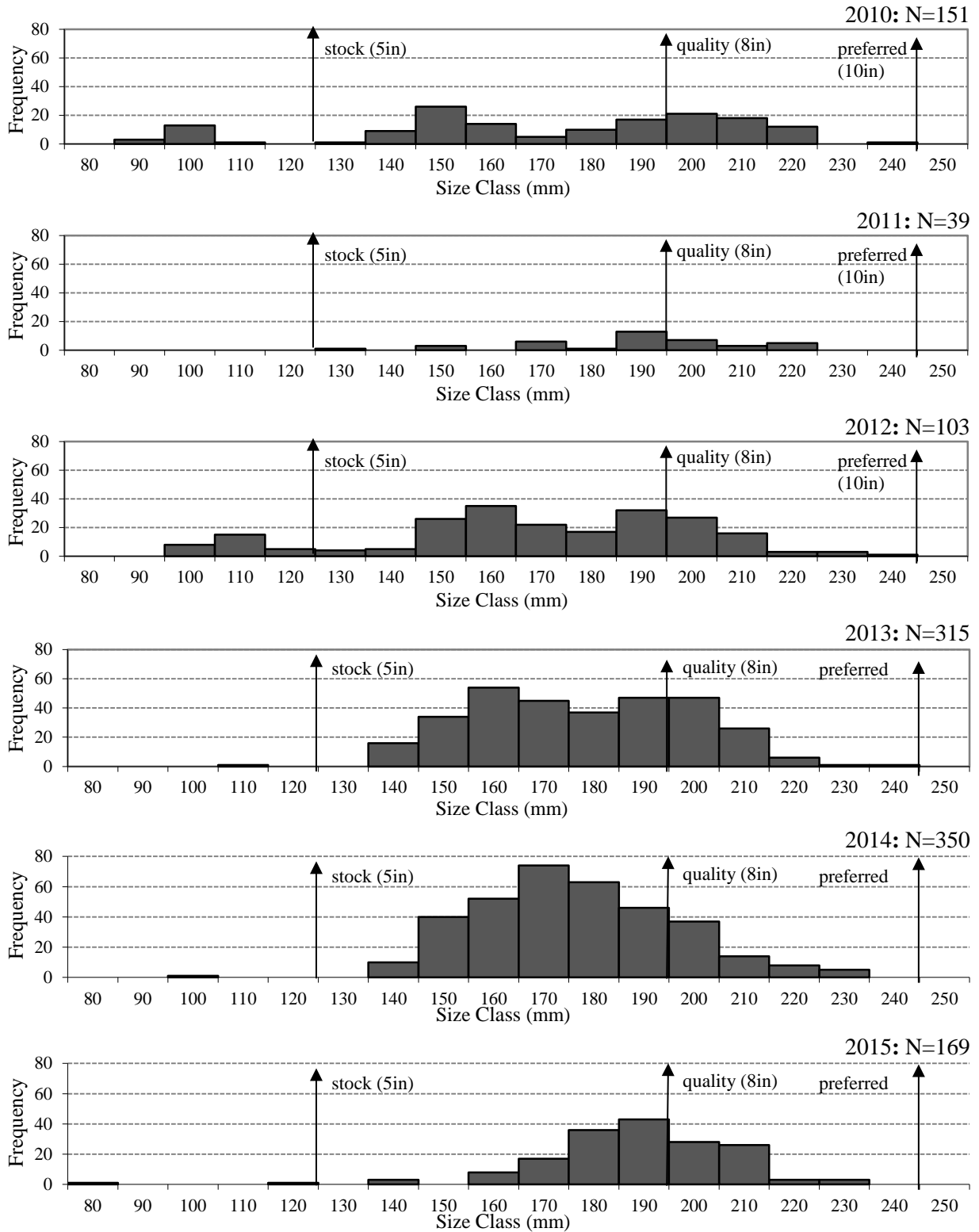


Figure 3. Length frequency histograms for yellow perch collected in August gill net surveys from Deerfield Reservoir, Pennington County, 2010-2015.

## **LITERATURE CITED**

Bureau of Reclamation, U.S. Department of the Interior. Current Reservoir Data for Deerfield Reservoir, SD. 18 Dec 2015. <[http://www.usbr.gov/gp-bin/arcweb\\_dfr.pl](http://www.usbr.gov/gp-bin/arcweb_dfr.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 20.
4. Evaluate the effect of stocking lake trout on other species.



## APPENDIX

Appendix A. Stocking history, including year, number stocked, species and size of fish stocked for Deerfield Reservoir, Pennington County, South Dakota, 1999-2015. 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
2014	12,000	rainbow trout	catchable
2015	12,000	rainbow trout	catchable
	823	lake trout	adult