SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-47

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 13-15, 2014
Date last surveyed: August 12-14, 2013
Most recent lake management plan: F21-R-46 **Date:** 2014 - 2018
Management classification: Coldwater Permanent
Contour mapped: 1987

Primary Species:	Secondary and other species:
1. Rainbow trout	1. White sucker
2. Splake trout	2. Golden shiner
3. Brook trout	3. Rock bass
4.	4. Yellow perch
5.	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. 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 *Wr*itten proposal addressing possible introductions and implement as soon as possible.

BIOLOGICAL DATA

Sampling Effort and Catch

A gill netting survey was conducted on August 13-15, 2014. 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).

During the 2014 annual survey of Deerfield Reservoir, eight fish species were sampled in gill nets and trap nets totaling 460 and 812 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.

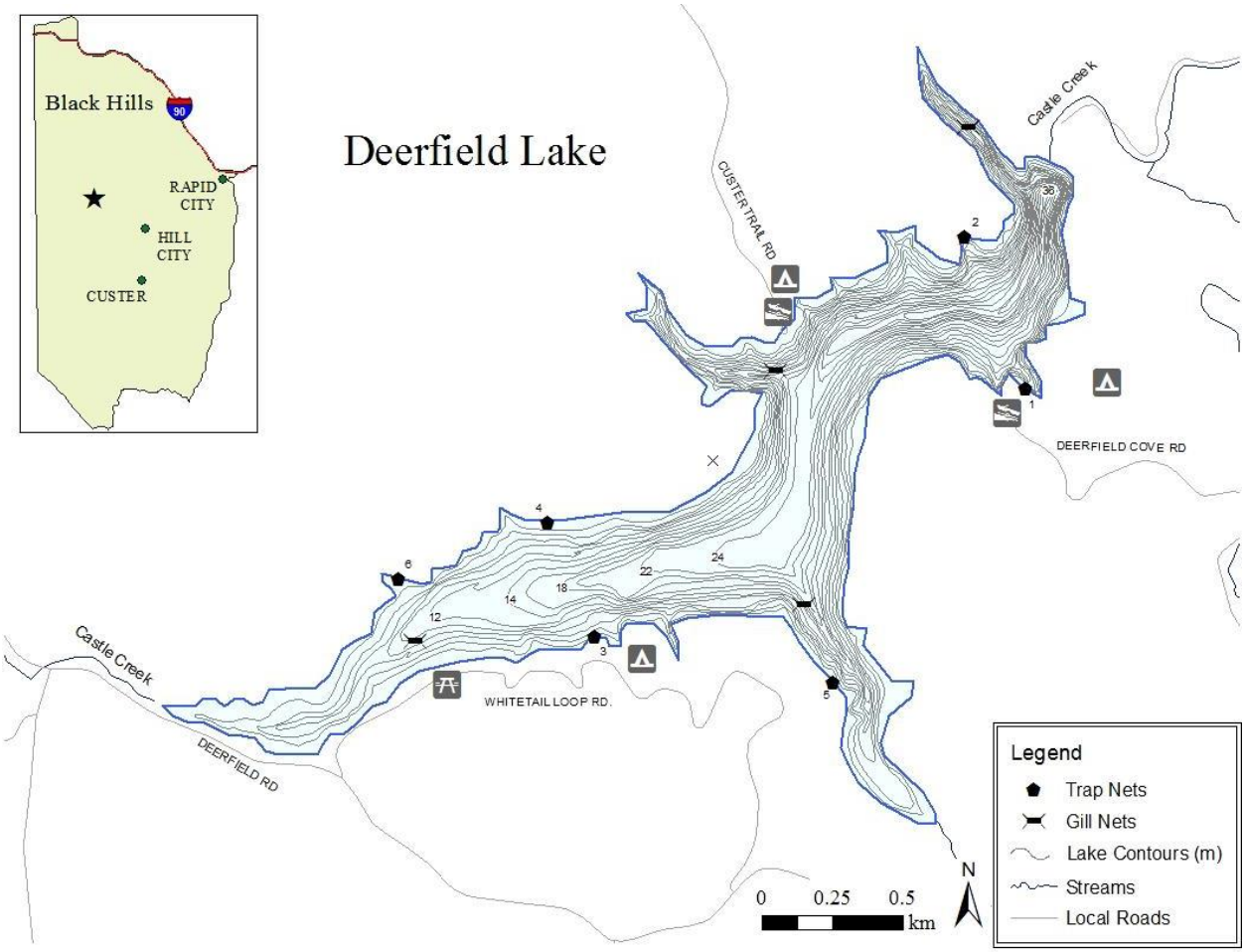

Figure 1. Locations of gill and trap nets during the annual fisheries survey at Deerfield Reservoir, South Dakota, 2014.

Table 1. Total catch of four 150-foot gill nets set in Deerfield Reservoir, South Dakota, on August 13-15, 2014. 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	23	5.8 (4.3)	4.5 (2.80)	0	0	87.1 (5.0)
Rainbow trout	11	2.8 (2.5)	2.2 (1.82)	0	0	75.4 (20.6)
Creek chub	2	1.8 (2.1)	-	-	-	-
Rock bass	30	7.5 (8.1)	7.2 (7.8)	0	0	90.7 (3.0)
Splake trout	10	2.5 (2.0)	-	-	-	-
White sucker	34	8.5 (6.6)	8.5 (6.6)	100	100	103.4 (2.9)
Yellow perch	350	87.2 (96.6)	87.0 (96.6)	18 (4)	0	90.5 (0.2)

Table 2. Total catch of six trap nets set in Deerfield Reservoir, South Dakota on August 13-15, 2014. 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	2	0.3 (0.5)	0.3 (0.5)	0	0	66.2 (0)
Rainbow trout	8	1.3 (0.7)	1.3 (0.7)	0	0	75.4 (20.6)
Creek chub	14	2.3 (2.0)	-	-	-	-
Golden shiner	153	25.5 (8.6)	-	-	-	-
Rock bass	473	78.8 (61.5)	45.3 (36.9)	7 (2)	2 (1)	80.7 (3.0)
White sucker	25	4.1 (2.5)	4.1 (2.5)	100	100	91.4 (2.9)
Yellow perch	137	22.8 (22.4)	22.5 (22.0)	16 (6)	1 (1)	85.2 (1.5)

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. Eleven were collected from gill nets during the 2014 survey. Mean rainbow trout condition (*Wr)* is always low and was only 75.4 during this survey (Table 3).

Since 2010, hatchery reared fish stocked into Deerfield have received a fin clip in order to differentiate from wild fish. Between 2010 and 2014, 47% 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, 2004-2014.

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)
2014	12,000	11	1.3 (0.7)	75.4 (20.6)

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

Rock bass

In 2008, trap nets were added to more effectively sample the fish assemblage. In 2014, rock bass were again the most numerous species captured in trap nets comprising 58% of the fish caught. Mean CPUE was up again after two years of lower results (Table 4). Lengths of measured rock bass 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 91 for gill nets (Table 1) and 81 for trap nets (Tables 2 and 4).

Table 4. Parameters of rock bass surveyed with trap nets set in Deerfield Reservoir, South Dakota in 2008-2014. Values are reported with confidence intervals in parentheses.

Year	N	CPUE (80%)	PSD (90%)	*Wr*≥S (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)
2014	473	78.8 (61.5)	7 (2)	80.7 (3.0)

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. 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 the annual survey have been difficult to differentiate between the two species. The small size, appearance and lack of fin clips suggest that splake trout may be reproducing naturally or crossing with brook trout. Morphological characteristics and meristic counts are not definitive enough to distinguishing between the types of fish. A research study including genetics identification was begun to determine the reproductive contribution of the species. This will help determine if either brook trout or splake trout are naturally adding to the fishery, as well as correctly identifying state record individuals.

During the 2014 gill net survey, 23 fish identified as brook trout (no fin clip) and ten splake trout were captured (Table 1). Most brook trout measured 180-280 mm (7-11 in) in length, with clipped splake trout measuring 230-280 mm (9-11in). 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).

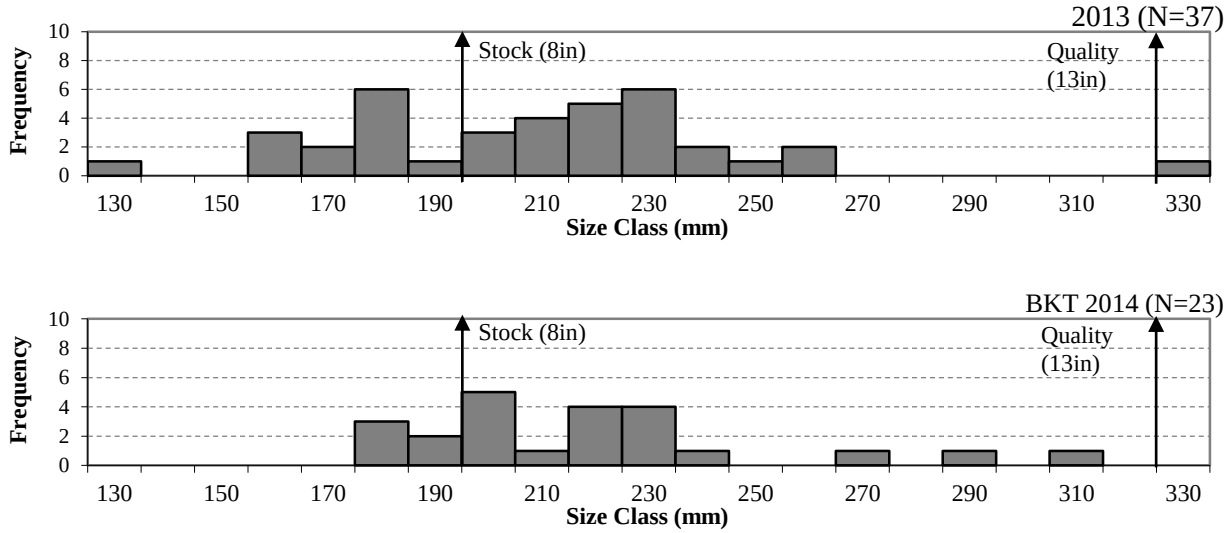

Figure 2. Length frequency histogram for brook trout captured during gill net survey of Deerfield Reservoir, South Dakota in 2013 and 2014.

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 5). The removals appeared to lower densities as gill net catch did decrease following removals. Values from the past three surveys indicate 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 age-0 and juvenile white suckers. 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 during any future yellow perch trap and transfers and rock bass removals.

Size structure of white suckers appears to have increased in recent years with mean PSD-P values of 40 in 2001 to around 100 since 2008. In 2014, the majority of fish were over memorable length (410 mm or 16 in) with a PSD-M value of 91 and a mean total length of 443 mm (17.4 in). Condition (*Wr*) has remained around 100 since 2009, with the highest level during the 2014 survey (Table 5).

Table 5. Summary of white suckers removed by trap nets and parameters for fish collected during gill net surveys from Deerfield Reservoir, South Dakota, 2004-2014.

Year	Number Removed	Pounds Removed	CPUE (80%)	PSD (90%)	*Wr*≥S (90%)
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)
2014	0	0	8.5 (6.6)	100	103.4 (2.9)

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 (Table 6). The decrease in 2011 is likely due to a change of location and depth of nets that year. Condition was high in 2014, however the continued low PSD value likely indicates 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 are 150 mm to 210 mm (6 to 8 in) in length (Figure 3). Deerfield Reservoir has been a source for yellow perch trap and transfer, in recent years. Over 6,650 were relocated to other aquatic systems in May 2014.

Table 6. Parameters of yellow perch surveyed with gill nets in Deerfield Reservoir, South Dakota in 2003-2014. 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)
2014	350	87.2 (96.6)	18 (4)	90.5 (0.2)

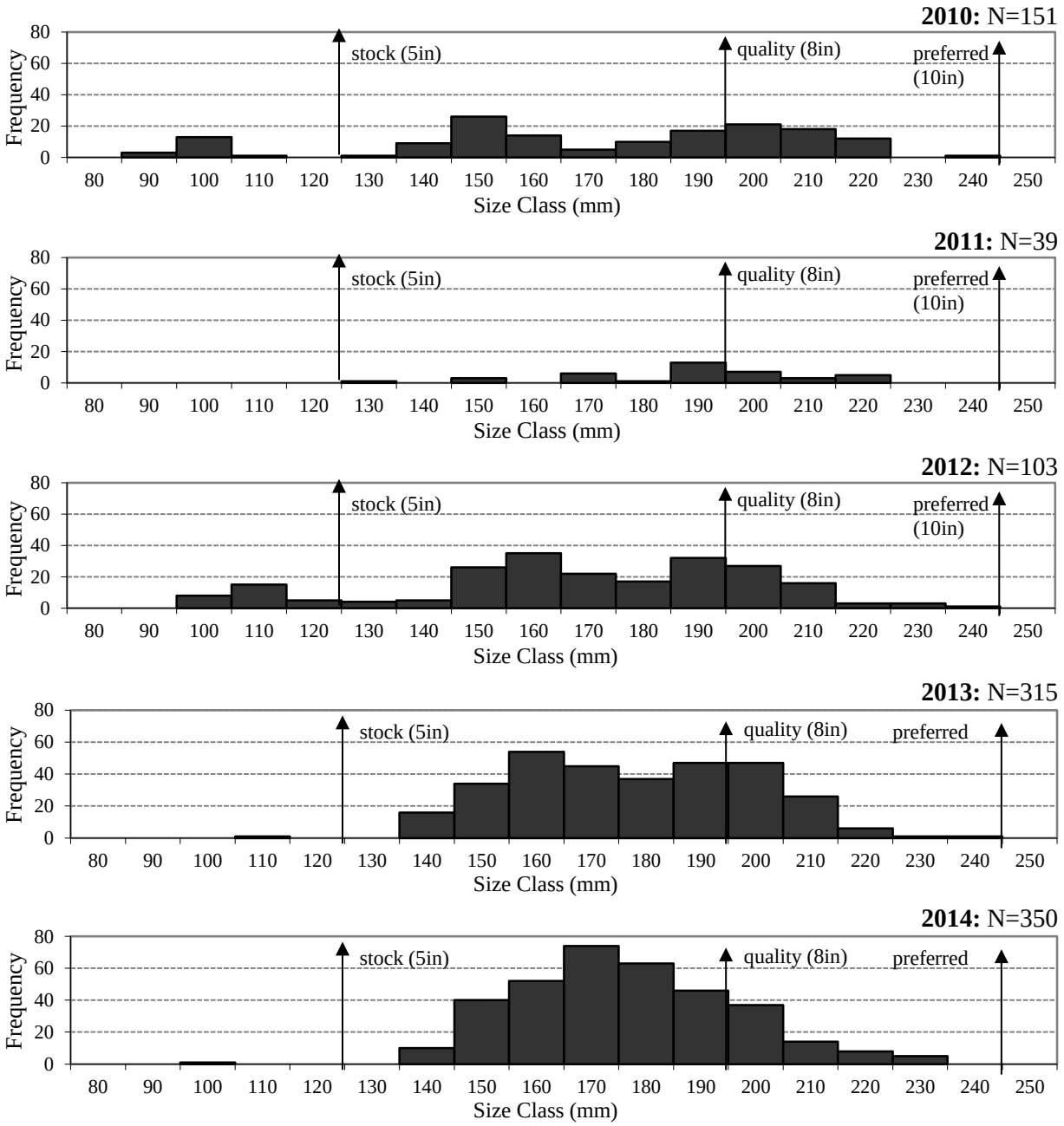

Figure 3. Length frequency histograms for yellow perch collected in August gill net surveys from Deerfield Reservoir 2010-2014.

LITERATURE CITED

Bureau of Reclamation, U.S. Department of the Interior. Current Reservoir Data for Deerfield Reservoir, SD. 10 Dec 2014. <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. 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, 1999-2014. 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