

SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F21-R-46

Name: Pactola Reservoir

County: Pennington

Legal description: Sec. 2-5,10-11 T1N R5E; and Sec.31-34 T2N R5E

Location from nearest town: 0.5 miles east of Silver City, S.D.

Dates of present survey: June 5-7 and July 15-18, 2013

Date last surveyed: May 22-24 and July 16-18, 2012

Most recent lake management plan: F21-R-37 **Date:** 2005

Management classification: Coldwater Permanent

Date contour mapped: 1985

Primary Management Species:

1. Rainbow Trout
2. Lake Trout
3. Brown Trout
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____

Secondary species:

1. White Sucker
2. Northern Pike
3. Rock Bass
4. Yellow Perch
5. Largemouth Bass
6. Rainbow Smelt
7. Bluegill
8. Golden Shiner
9. Green Sunfish
10. Black Crappie
11. European Rudd

PHYSICAL CHARACTERISTICS

Surface Area: 785.3 acres

Watershed: 204,154 acres

Maximum depth: 165.8 feet

Mean depth: 62.3 feet

Lake elevation at survey: 4,580 ft (99% full)

Ownership of lake and adjacent lakeshore property

The Bureau of Reclamation (BOR) 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 United States 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.

Fishing Access

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. Boat ramps, parking, and slip docks are located on the north and south ends of the lake. Shore fishing is common along the south shore where there are parking areas, trails, and a floating dock. Jenny Gulch Road provides access to the northwest end of the lake popular for shore and ice fishing.

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. Localized disturbance contributes to increased siltation.

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.

Observations of Water Quality and Aquatic Vegetation

Emergent vegetation is light and grows primarily at the Rapid Creek inlet and in the shallow ends of bays off the main body of the lake. Sediment entering Pactola Reservoir from Rapid Creek seems to be the only apparent pollution concern in the reservoir.

Observations on conditions of structures (i.e. spillway, boat ramps and docks, roads, 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.

MANAGEMENT OBJECTIVES

- Objective 1.** Maintain Pactola Reservoir as a put and take Rainbow Trout fishery through regular stockings of catchable (11 in) fish, where catch rates exceed 0.5 per hour.
- Objective 2.** To maintain a unique trophy Lake Trout population within the reservoir through special regulations (1 daily, 24 in minimum length) and large (15 in) fish stockings when needed.
- Objective 3.** To provide and maintain a Brown Trout population within the reservoir with stockings of catchable (11 in) fish when needed.

BIOLOGICAL DATA

Sampling Effort and Catch

A gill netting survey was conducted on July 15-18, 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). Sampling consisted of 12 gill net nights (Table 1, Figure 1). Depths and GPS location were recorded to facilitate similar placement each year. A modified fyke (trap) net survey consisting of eight net nights was completed on June 5-7, 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.

Twelve species of fish were collected from Pactola Reservoir in 2013 (Tables 2 and 3). Bluegill and Lake Trout were the most abundant fish sampled in gill nets. Bluegill and Rock Bass were the most abundant in trap nets.

Table 1. Gill net dates, location, and depths set in Pactola Reservoir during the 2013 survey.

Set Date	Net #	UTM Lat	UTM Long	Depth (ft)
6/5	Trap 1	4882022	617347	Shore
6/5	Trap 2	4881840	625896	Shore
6/5	Trap 3	4880300	620672	Shore
6/5	Trap 4	4881744	616592	Shore
6/6	Trap 5	4881987	617784	Shore
6/6	Trap 6	4881333	619331	Shore
6/6	Trap 7	4880450	619912	Shore
6/6	Trap 8	4881853	620653	Shore
7/16	Gill 1	4880824	620497	30-50
7/16	Gill 2	4880424	621271	85
7/16	Gill 3	4880503	620396	12-36
7/16	Gill 4	4881708	620670	30-60
7/16	Gill 5	4880821	621123	30-60
7/16	Gill 6	4880610	621299	90-110
7/17	Gill 7	4881280	620116	50-80
7/17	Gill 8	4881319	619297	20-40
7/17	Gill 9	4881390	618958	80
7/17	Gill 10	4882097	618118	60
7/17	Gill 11	4881773	619509	90-100
7/17	Gill 12	4881772	618259	50

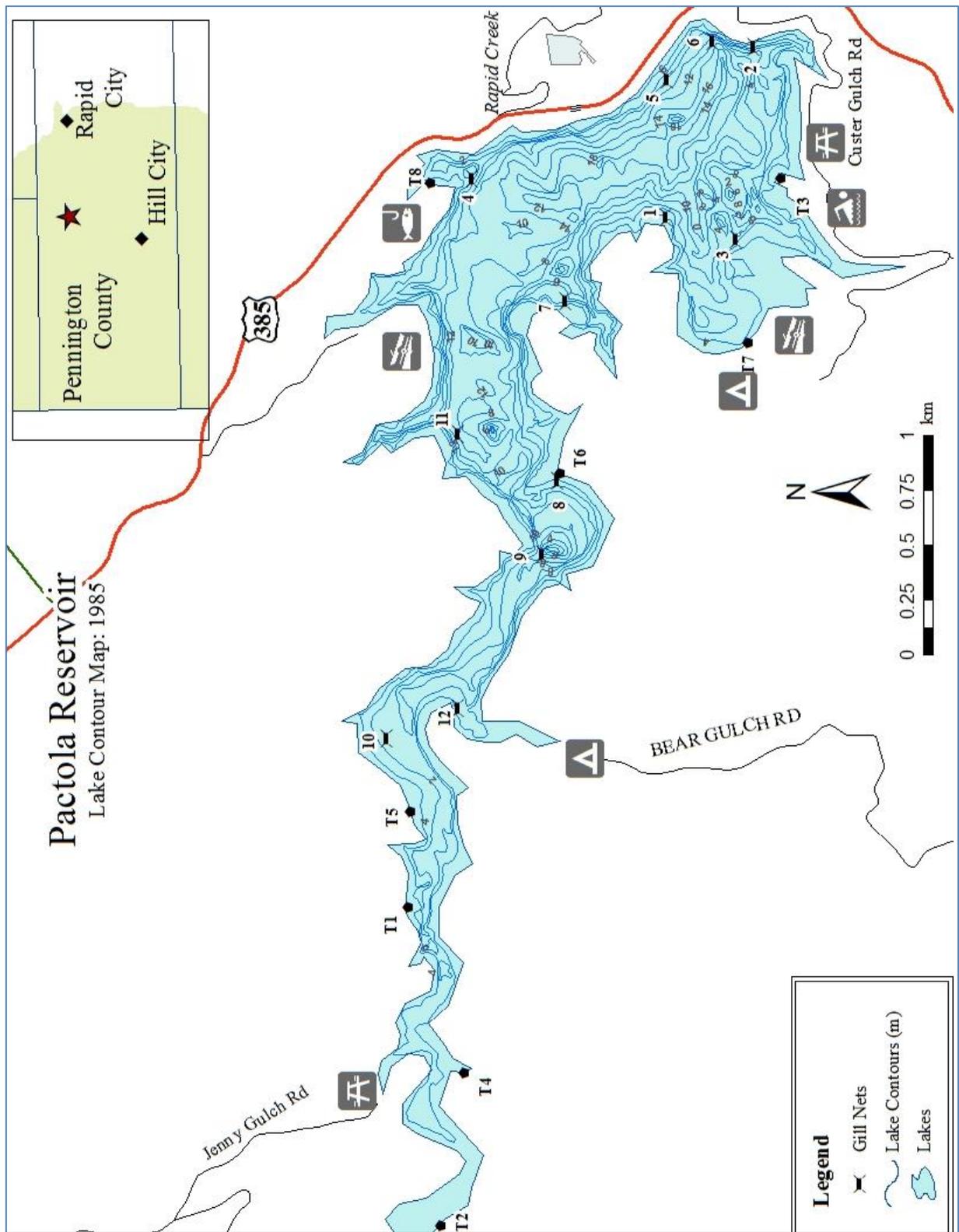


Figure 1. Location of survey nets set on Pactola Reservoir June 5-7 and July 15-18, 2013

Table 2. Total catch of twelve 150-foot gill nets set in Pactola Reservoir on July 15-18, 2013. Parameters are reported with confidence intervals.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	Wr-S (90%)
Bluegill	31	2.6 (3.2)	2.5 (3.2)	59 (14)	0	90.2 (1.9)
Brown Trout	11	0.9 (0.3)	0.9 (0.3)	55 (29)	0	77.4 (3.2)
Lake Trout	46	3.8 (1.0)	3.0 (0.6)	64 (14)	11 (9)	91.7 (2.5)
Northern Pike	3	0.3 (0.2)	0.3 (0.2)	33 (67)	0	93.8 (10.4)
Rainbow Smelt	27	2.0 (2.7)	2.0 (2.7)	-	-	-
Rainbow Trout	12	1.0 (0.8)	1.0 (0.8)	*	0	75.6 (3.6)
Rock Bass	6	0.5 (0.6)	0.3 (0.3)	25 (59)	0	89.4 (15.5)
European Rudd	1	0.1 (0.1)	0.1 (0.1)	100	0	-
White Sucker	4	0.3 (0.3)	0.3 (0.3)	100	100	88.3 (10.0)
Yellow Perch	12	1.0 (1.3)	1.0 (1.3)	67 (26)	25 (23)	89.8 (2.7)

*all stock length fish

Table 3. Total catch of eight trap nets set in Pactola Reservoir on June 5-7, 2013. Parameters are reported with confidence intervals.

Species	N	CPUE (80%)	CPUE-S (80%)	PSD (90%)	PSD-P (90%)	Wr-S (90%)
Bluegill	248	26.4 (13.5)	26.4 (13.5)	38 (5)	1 (2)	94.5 (1.2)
Green Sunfish	2	0.3 (0.6)	0.3 (0.6)	*	0	75.7 (0)
Largemouth Bass	8	1.0 (0.5)	0.1 (0.3)	*	0	104.1 (0)
Northern Pike	1	0.1 (0.3)	0.1 (0.3)	100	0	98.9 (0)
Rainbow Trout	1	0.1 (0.3)	0.1 (0.3)	*	0	81.5 (0)
Rock Bass	114	9.0 (6.3)	8.1 (5.4)	34 (10)	11 (7)	91.6 (1.7)
European Rudd	24	3.0 (4.0)	3.0 (4.0)	96 (7)	4 (7)	-
White Sucker	1	0.1 (0.2)	0.1 (0.2)	100	100	75.9 (0)
Yellow Perch	4	0.5 (0.5)	0.5 (0.5)	*	0	74.0 (2.2)

*all stock length and smaller fish

Rainbow Trout

Pactola Reservoir is managed as a put-and-take fishery and receives over 27,000 Rainbow Trout stocked annually. Explaining numbers caught during sampling is complicated due to a few possible influencing factors. Catch is not normally high for Rainbow Trout in the gill net surveys but has been decreasing since 2006 with 12 caught in 2013 (Table 2). One possible reason for this is increased reservoir volume (Figure 2). Another is better scheduling to complete surveys over a month after stocking to avoid sacrificing stocked fish. A third possible reason for the decrease is the establishment of a population of Northern Pike, an illegally introduced species first observed in 2003. In 2011 SDGFP looked at stomach contents of 70 Northern Pike through the open water season. Results of this small survey indicated that stocked Rainbow Trout were a large part of Northern Pike diets. A graduate study is currently underway to further determine predator food habits in Pactola Reservoir.

It is undetermined yet what actions will be taken if the primary cause of the declining survival of hatchery trout is related to the recently established Northern Pike. Potential solutions are to increase stockings of catchable-size trout, only stock trout during high angling months when trout are targeted, or consider a different strain or species of trout.

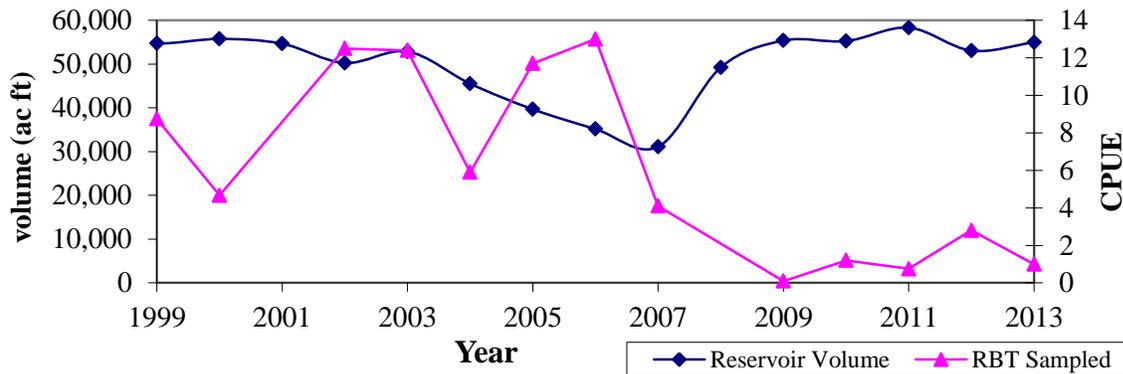


Figure 2. Pactola Reservoir July 31st volume (Bureau of Reclamation) and abundance of Rainbow Trout sampled with gill nets, 1999-2013.

Brown Trout

Numbers of Brown Trout captured in gill nets has generally decreased since 2002 (Figure 3). Brown Trout are not annually stocked into Pactola, but approximately 3,000 and 8,000 Brown Trout were stocked in 2000 and 2002, respectively. Furthermore, 4,700 catchable Brown Trout were stocked in 2007 and likely explains the slightly higher catch prior to 2009. Brown Trout relative abundance (CPUE) was lower in 2009-2013 than any of the past 13 years, with 2013 being the lowest. Similar to Rainbow Trout catch, these results may be confounded by a number of influences such as: the increased volume of water in Pactola Reservoir, which reached 99.9% full in the spring of 2009 (Bureau of Reclamation), increased numbers due to stocking, or the recently established Northern Pike population.

Mean condition (*Wr*) of Brown Trout in Pactola Reservoir has remained fairly low and was 77.4 during the 2013 survey (Table 4). Good condition values (*Wr*) for Brown Trout should be in the low to mid 90s. Mean *Wr* for Brown Trout over 355 mm (14 in) tends to be higher than that of smaller fish (Table 4), but no fish over 340 mm were surveyed in 2013 (Figure 4).

Length frequency analysis in 2013 is difficult because only 11 individuals were captured (Figure 4). The 2011 and 2012 surveys yielded some of the largest Brown Trout ever captured during a survey of Pactola Reservoir with lengths of 695 mm (27 in) and 640 mm (25 in), respectively.

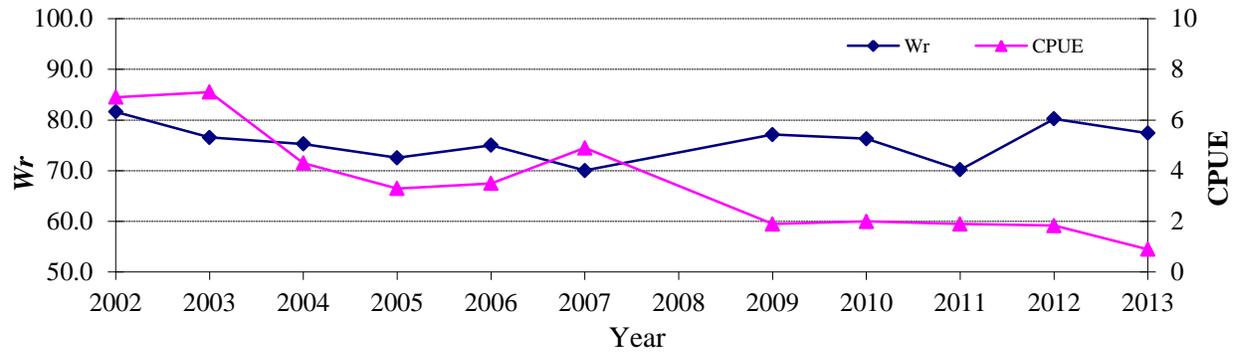


Figure 3. Trends in mean relative weight (Wr) and catch per unit effort (CPUE) for Brown Trout sampled with gill nets from Pactola Reservoir, 2002-2013.

Table 4. Catch per unit effort (CPUE), and mean relative weight (Wr) values for Brown Trout collected during gill net surveys in Pactola Reservoir, South Dakota, 2002-2007 and 2009-2013. Confidence intervals are presented in parenthesis.

Year	N	CPUE (80%)	Mean Wr (90%)	$Wr < 355$ mm (90%)	$Wr > 355$ mm (90%)
2002	97	6.9 (0.5)	81.6 (0.1)	81.2 (0.1)	85.3 (0.3)
2003	85	7.1 (2.4)	76.6 (0.1)	74.7 (0.1)	101.0 (1.0)
2004	52	4.3 (1.2)	75.3 (0.2)	72.2 (0.1)	88.1 (0.5)
2005	40	3.5 (1.2)	72.5 (0.2)	70.5 (0.1)	84.0 (0.6)
2006	42	3.5 (1.3)	75.0 (0.1)	74.9 (0.1)	76.2 (0.6)
2007	59	4.9 (1.9)	70.0 (0.1)	69.1 (0.1)	76.8 (0.5)
2009	23	1.9 (1.2)	77.1 (0.2)	76.5 (0.1)	81.4 (0.8)
2010	29	2.4 (1.0)	76.3 (0.1)	75.9 (0.2)	79.0 (0.1)
2011	25	2.1 (0.9)	70.2 (0.3)	68.0 (0.2)	81.7 (1.3)
2012	22	1.8 (0.8)	80.2 (0.2)	77.6 (0.3)	84.2 (0.5)
2013	11	0.9 (0.4)	77.4 (0.3)	77.4 (0.1)	-

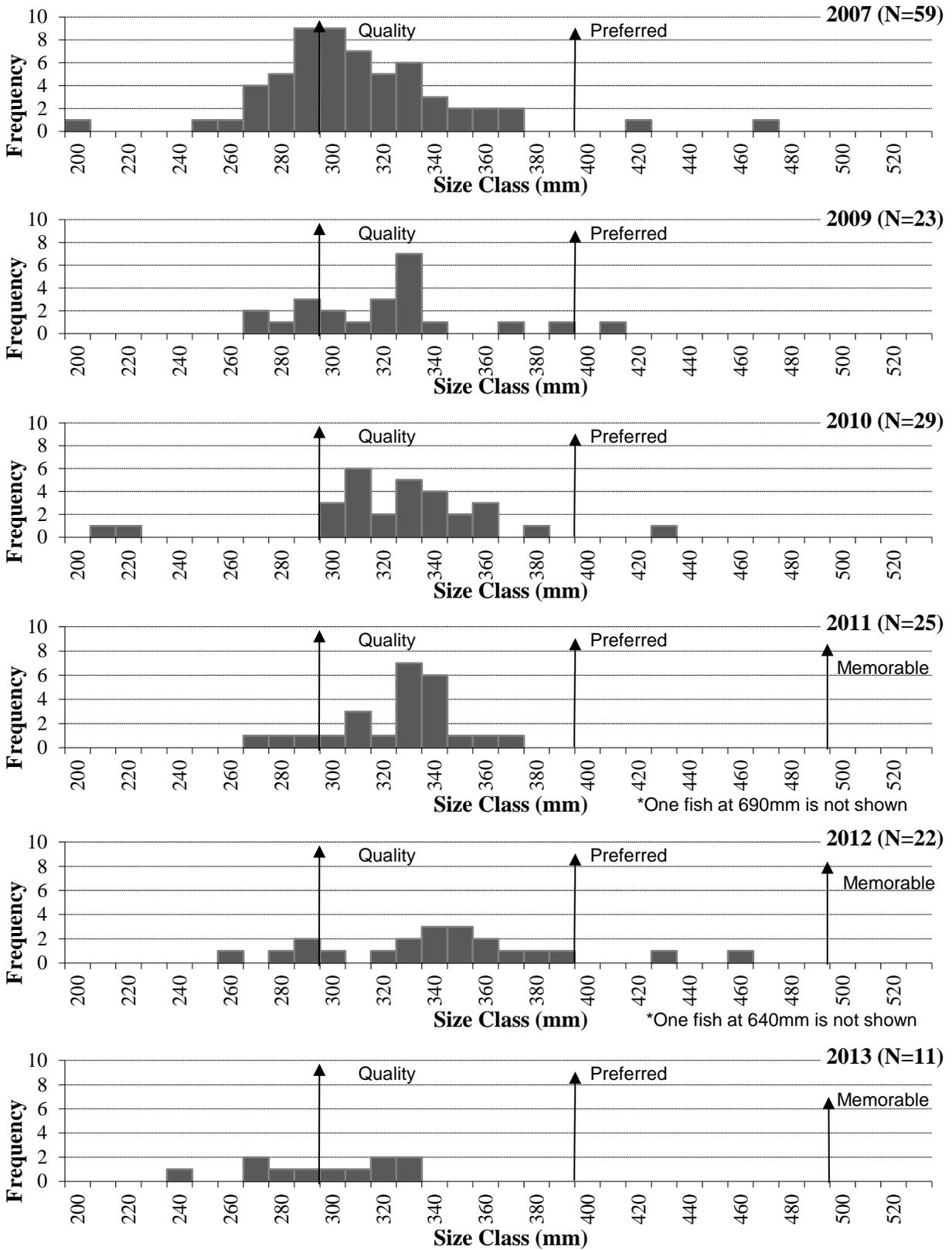


Figure 4. Length frequency histograms for Brown Trout sampled in gill nets from Pactola Reservoir, South Dakota, 2007, 2009-2013.

Lake Trout

Relative abundance of surveyed Lake Trout in 2013 was higher than it has been since 2007 (Table 5). Lake Trout (N= 9,955) were stocked in spring 2003 at an average total length of 292 mm (11.5 in) and again (N= 7,451) in the fall of 2005 at an average total length of 355 mm (14 in). These fish were differentially marked by fin clips to identify the two stockings. Nonclipped fish are assumed to be naturally reproduced or wild. During the 2012 survey, only Lake Trout stocked in 2003 (N=4) and wild fish (N=42) were captured. This is a similar composition to the past three years. The abundance of naturally reproduced “wild” Lake Trout caught during the annual survey has increased to 91% of the sample.

Pactola Reservoir currently has a minimum length restriction of 610 mm (24 in) for Lake Trout. In 2013 the size range for surveyed fish was 251-1,005 mm. (Figure 5). Mean length of wild Lake Trout dropped greatly in 2011 (Table 5); however a larger number (N=14) of fish less than 300 mm were captured which lowered the average (Figure 5). The average increased in 2012 and 2013 to its highest levels. Also, the presence of smaller fish indicates reproduction and recruitment continues to add to the “wild” population (Figure 5). Size structure of Lake Trout has varied greatly since 2003 with the highest value during this year’s survey (PSD=64). Six of these were over the 24 inch minimum, the most ever caught in annual surveys, with one measuring at 1,005 mm (39.5 in) and around 13,154 g (30 lbs). Several fish over the 24 inch (610 mm) minimum are caught by anglers in the winter and spring. The hook and line record was surpassed in Jan 2013 with a 30 lb fish. Mean condition (*Wr*) of Lake Trout over 12 inches has been in the 80s since 2004, but was in the 90s in 2012 and 2013. This increase is likely a factor of seeing proportionally higher numbers of larger fish in the sample, as these larger Lake Trout appear in better condition during sampling. For example, as PSD values increase, mean condition of stock length and longer fish increases as well (Figure 6).

Table 5. Parameters of Lake Trout surveyed from gill nets set in Pactola Reservoir including number surveyed over the 24 inch (610 mm) angler harvest minimum. Confidence intervals are presented in parenthesis.

Year	N	N _{>610} mm	CPUE (80%)	CPUE-S (80%)	PSD (90%)	Wr-S (90%)	Mean Length (mm)
2003	16	3	1.3 (1.1)	0.8 (0.7)	33 (31)	102.1 (14.4)	303
2004	51	1	4.3 (1.3)	1.1 (0.4)	8 (13)	84.3 (7.5)	293
2005	16	3	1.3 (0.8)	0.8 (0.5)	30 (28)	86.3 (8.9)	389
2006	56	2	4.7 (1.6)	4.0 (1.3)	4 (5)	78.6 (1.8)	379
2007	65	0	5.4 (1.7)	5.1 (1.6)	0	82.7 (1.1)	370
2009	22	0	1.8 (0.9)	1.8 (0.9)	5 (7)	85.8 (2.1)	410
2010	40	0	3.3 (1.0)	3.1 (1.0)	24 (12)	87.1 (2.1)	437
2011	40	1	3.3 (1.5)	2.2 (0.8)	23 (14)	83.3 (2.8)	383
2012	30	1	2.5 (1.3)	2.3 (1.1)	48 (17)	92.7 (1.7)	466
2013	46	6	3.8 (1.0)	3.0 (0.6)	64 (14)	91.7 (2.5)	466

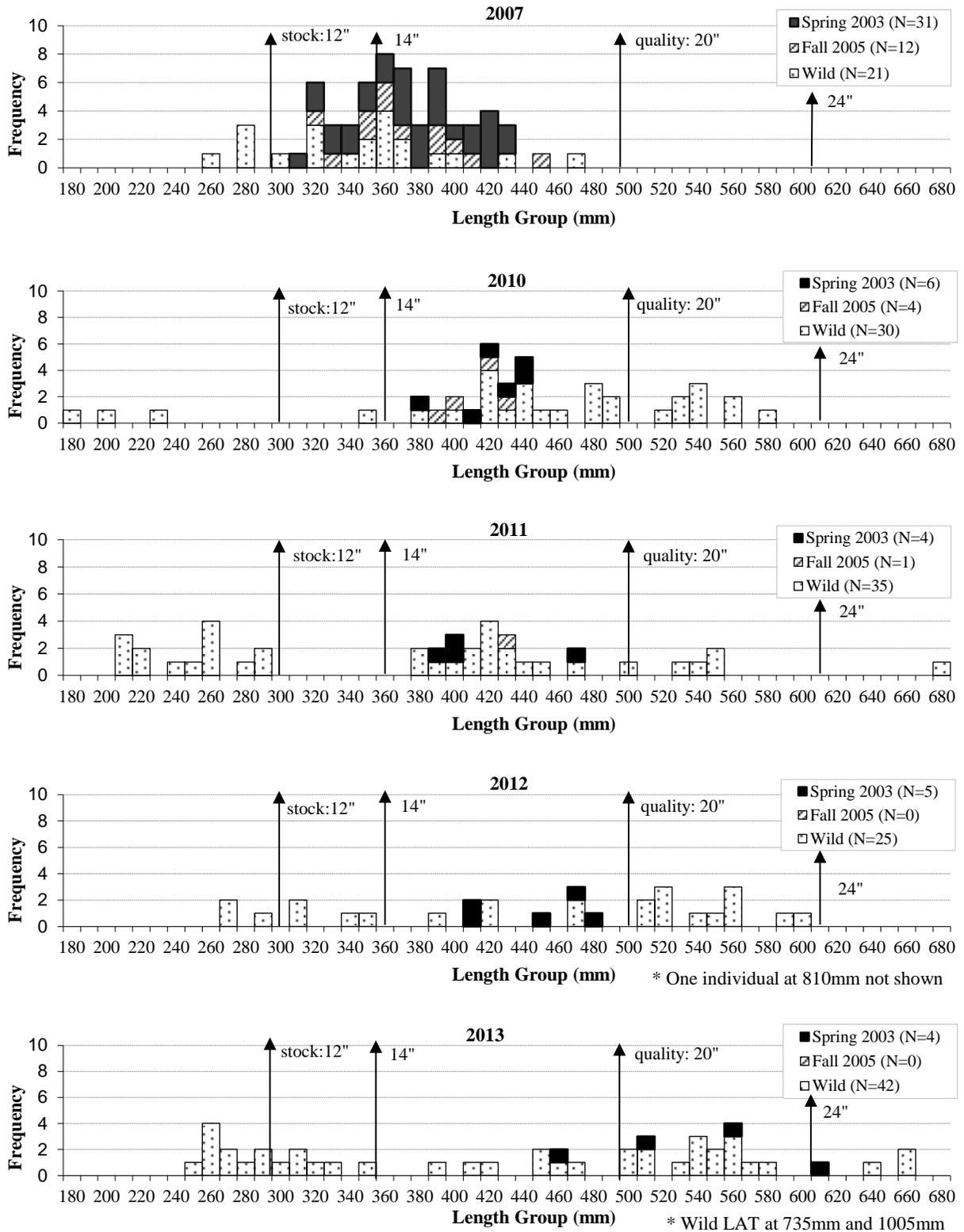


Figure 5. Length-frequency histograms for Lake Trout sampled with gill nets in Pactola Reservoir, 2007, 2010-2013.

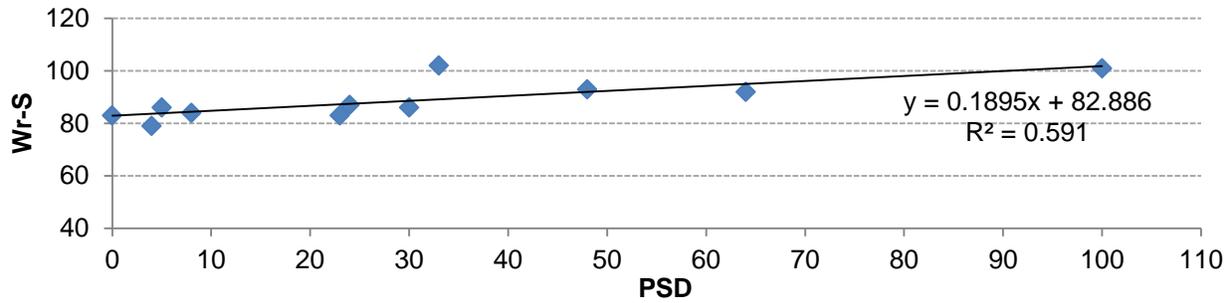


Figure 6. Lake Trout size structure (PSD) and mean condition (*Wr-S*) for fish longer than 12 inches in Pactola Reservoir, 2002-2013.

Bluegill

Increased water levels the past three years, allowed for trap net surveys where steep shorelines usually do not allow for such sampling. Bluegills were the most abundant fish in trap nets and second most abundant in gill nets in 2013 making up 62% and 20% of the catch, respectively (Tables 2 and 3). Bluegill condition has remained relatively steady with *Wr* values in the upper 80s and 90s, with the highest value in 2013 (Table 6). Most Bluegill caught in trap nets were between 100 and 200 mm (4-8 in), with a decreasing size structure (PSD=38) since 2011 (Table 6). Length frequencies do not clearly indicate different age classes and suggest overabundance and slowed growth rates (Figure 7).

Table 6. Parameters of Bluegill captured during trap net surveys of Pactola Reservoir.

Year	N	CPUE	PSD	PSD-P	Wr-S
2011	264	32.9 (15.4)	81 (4)	15 (3)	89.9 (2.7)
2012	242	30.3 (10.5)	48 (5)	5 (3)	88.1 (1.2)
2013	248	26.4 (12.2)	38 (5)	1 (1)	94.3 (1.6)

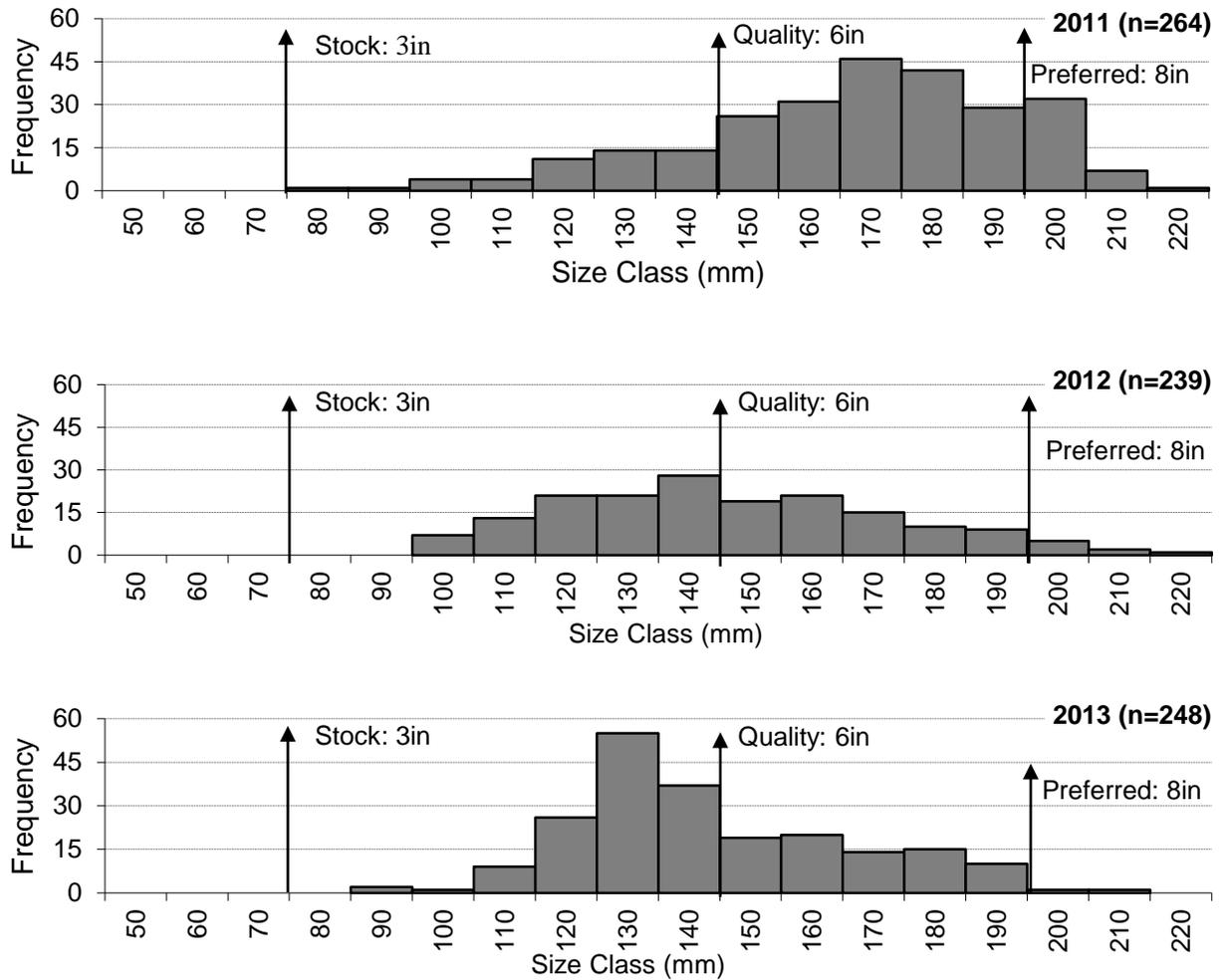


Figure 7. Length frequencies of Bluegill captured during surveys of Pactola Reservoir.

Northern Pike

Although deep set gill nets are not the preferred method for sampling northern pike, gill net catch (CPUE) indicates an established population. Catch decreased this year with only three captured during the 2013 survey (Table 7). Size structure (PSD) increased in 2011 and 2012, but no larger fish were caught in this survey. There is recent concern that this illegally introduced species may be affecting the trout fishery in Pactola Reservoir.

Table 7. Abundance, condition, and stock indices for Northern Pike captured during gill net surveys of Pactola Reservoir in 2003-2012.

Year	N	CPUE	PSD 90% CI	PSD-P 90% CI	PSD-M 90% CI	Wr-S 90% CI	Mean length (mm)
2003	1	0.19	100	0	0	97	576
2004	0	0	-	-	-	-	-
2005	0	0	-	-	-	-	-
2006	4	0.3	100	0	0	100 (3)	575
2007	4	0.3	75 (59)	25 (59)	0	99 (9)	621
2009	5	0.4	60 (52)	40 (52)	0	86 (8)	583
2010	10	0.8	50 (36)	13 (23)	0	87 (4)	497
2011	14	0.9	77 (22)	31 (24)	8 (13)	95 (5)	595
2012	11	0.5	82 (22)	45 (28)	27 (25)	100 (6)	679
2013	3	0.3	33 (67)	0	0	93 (10)	458

Secondary Species

Yellow Perch are also an illegally introduced species to Pactola Reservoir. In 2011 they were the most abundant species captured in gill nets with 91 fish, but 31 were surveyed in 2012 and 12 in 2013 (Tables 2 and 3). Size structure (PSD) went up from zero in 2012 to 67 in 2013.

Largemouth Bass, Rainbow Smelt, Rock Bass, White Sucker, European Rudd, and Golden Shiner were captured in low abundance (Tables 2 and 3).

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 and growth rates.
3. Re-evaluate trout and Northern Pike management based on graduate study results.

REFERENCES

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>

APPENDIX

Appendix 1. Stocking record for Pactola Reservoir, South Dakota, 2005-2013.

Year	Species (Strain)	Size	Stockings	Number of fish
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	1	2,800
2008	Rainbow Trout (McConaughy)	Catchable	1	2,125
	Rainbow Trout (Shasta)	Catchable	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	9	22,699
	Rainbow Trout (Shasta)	Fingerling	2	4,603
	Rainbow Trout (Shasta)	Small Fingerling	1	12,420
2010	Rainbow Trout (Erwin X Arlee)	Catchable	2	9,619
	Rainbow Trout (Shasta)	Catchable	5	19,425
2011	Rainbow Trout (Erwin X Arlee)	Catchable	2	8,905
	Rainbow Trout (Shasta)	Catchable	4	19,837
2012	Rainbow Trout (Erwin X Arlee)	Catchable	2	9,450
	Rainbow Trout (Shasta)	Catchable	5	19,484
2013	Rainbow Trout (Shasta)	Catchable 11"	5	17,400
	Rainbow Trout (Shasta)	Catchable 15"	1	125
	Rainbow Trout (McConaughy)	Catchable 11"	4	13,324