



**OTTER CREEK RESERVOIR
2019 TREND NET SURVEY**

**Report prepared by:
Mike Hadley
Regional Sport Fish Biologist**

BACKGROUND: Otter Creek Reservoir is one of southern Utah's most popular fishing destinations and has historically provided a high quality fishery able to sustain a large amount of harvest, as long as water levels remain high enough to maintain the fishery. The fishery is managed with annual stocking quotas of 23,000 sub-catchable rainbow trout (RBT) in the spring and 200,000 in the fall (Table 1). An angler survey conducted at the reservoir in 2016 found that the Otter Creek RBT fishery provides a significant draw to anglers from across Utah, as well as southern Nevada (Hadley et al. 2017). The results of the survey also prompted the designation of Otter Creek Reservoir as one of Utah's Blue Ribbon Fisheries, based on the high quality of the fishery and its value to Utah anglers. In fact, Otter Creek Reservoir can be considered Utah's best RBT sport fishery.

An annual quota of 25,000 Bear Lake cutthroat trout was stocked regularly in Otter Creek Reservoir from the early 1990s through 2017 in an effort to apply predation pressure to Utah chubs. Due to poor returns, this quota was cancelled after 2017 and converted to a quota of 20,000 brown trout. Due to the significant level of angler interest, Otter Creek Reservoir is frequently used as a receptacle for excess trout produced by hatcheries.

Competition between stocked trout and Utah chubs has historically been a chronic problem and Otter Creek Reservoir has been treated periodically with rotenone to reduce chub densities, most recently in 1999. There is no conservation pool in the reservoir but at least a small pool is normally maintained through the year by the Sevier River Water Users in order to sustain a fishery. This effort has been instrumental in preserving the sport fishery during frequent drought conditions over the last 10+ years. The Bear Lake cutthroat trout quota was originally added with the intent that they would utilize chubs as forage and add diversity to the sport fishery. By the same reasoning, a population of smallmouth bass was established in 2005 and a limited population has maintained through natural recruitment since that time.

Due to limited establishment and return, Bear Lake cutthroat trout and smallmouth bass have never been able to exert an appreciable effect on the Utah chub population in Otter Creek Reservoir. Conversely, the introduction of hybrid wipers (white bass x striped bass) to Newcastle and Minersville reservoirs yielded significant reduction of rough fish density and positive responses in survival and condition among stocked trout. Based on these results, the addition of wipers to the Otter Creek Reservoir fishery commenced in 2011. Varying quotas of wiper sac fry and fingerlings have been stocked since that time (Table 2) and the current requested quota is 20,000 fingerlings (2-3 inches). Excess wipers are also stocked in Otter Creek Reservoir when available. Returns of wipers to netting surveys has been limited and variable and return to anglers has been almost negligible (Hadley et al. 2017). Those wipers that have been observed, however, have exhibited exceptional growth and condition. Factors that may have contributed to the low netting returns include poor survival of sac fry, insufficient stocking numbers, and behavioral avoidance of littoral zones where nets are set. Low catch of wipers by anglers is attributed to predominant use of tackle and techniques that target trout and are not favored by wipers.

The fishery at Otter Creek Reservoir is monitored annually through trend net surveys. Since 2011 a new gill net design recommended by the American Fisheries Society (AFS) has been utilized. The random placement of differing mesh sizes is intended to avoid "leading" fish into the net and, thus, reduce bias in the net catch – as opposed to nets previously used for decades ("DWR" nets), which comprised of graduating mesh sizes. As in most waters, catch rate trends observed since 2011 indicate that the AFS nets catch about 50% fewer trout and chubs at

Otter Creek Reservoir than did the DWR nets, though the reduced catches are still sufficient to provide measures of population dynamics.

METHODS: Seven experimental gill nets (four floating and three diving) were set in Otter Creek Reservoir on April 1, 2019, and were allowed to fish overnight. The floating nets and two of the diving nets measured 6 ft x 80 ft, with eight panels of randomly-arranged mesh size (1.5", 2.25", 1", 0.75", 2.5", 1.25", 2") and were set at shoreline locations that have been consistent for more than 30 years of sampling (Figure 1). The additional diving net (NPD) was of the "DWR" design, measuring 6 ft x 125 ft, with five panels of increasing mesh size (0.75", 1", 1.25", 1.5", 2"). This net was set in open water (24 feet bottom depth) in the northern portion of the reservoir (Fig. 1) with the intent of evaluating possible use of the pelagic zone by wipers. Fish caught were removed from nets on the morning of April 2 and all sport fish were measured to the nearest mm (total length) and weighed to the nearest gram. Trout body condition was measured by the calculation of Fulton's K_{TL} (generated from total length [TL]):

$$K_{TL} = (Weight/Length^3) \times 100,000$$

Wiper body condition was measured by relative weight (W_r), given by:

$$W_r = (W/W_s) \times 100$$

where W = the weight of an individual fish and W_s = the standard weight for a fish of similar length. W_s is computed by the equation:

$$\log_{10}(W_s) = a + b(\log_{10}TL)$$

where a and b are constants defined by species-specific length-weight relationships (Anderson and Neumann 1996). Total length was recorded for a subset of Utah chubs, while total batch weight and count was recorded for each net. Results of the 2019 survey were compared with those from historic trend net surveys.

RESULTS: A total of 110 trout was collected at Otter Creek Reservoir on April 2, for a catch rate of 16 trout per net-night (Table 3). This rate was similar to most other years since the AFS nets were first employed in 2011 (Table 4). Although AFS nets yield a lower catch than DWR nets, variability in catch rate has been lower (Fig. 2). Trout made up just 10% of the total catch, but 47% of the total biomass collected (Fig. 3).

All but three of the trout collected were RBT (Fig. 4). Despite the frequent stocking of excess RBT of varying sizes, cohorts of first-year and older fish have typically been simply distinguishable during annual surveys. Cohorts were less distinguishable in 2018 and 2019, however, and the youngest class seemed to be lacking (Fig. 5). This was especially evident in 2019, when no observed fish could be identified as those stocked during the previous fall. Overall, RBT averaged 432 mm (17.0 in) in total length (TL), 888 g (2.0 lbs) in weight, with a mean condition (K_{TL}) of 1.07. Mean length and weight were higher than long-term means for older RBT, while condition was the lowest observed since 2010 (Table 4). The largest RBT observed measured 605 mm (23.8 in) and weighed 2,600 g (5.7 lbs). This fish was much larger than all others observed, however, and the rest ranged in length up to 500 mm (19.7 in) and in weight up to 1,327 g (2.9 lbs). Three cutthroat trout were collected (Fig. 6), ranging from 452 to 526 mm. No brown trout were observed.

A total of 909 Utah chubs was collected in 2019, for a catch rate of 130 fish per net-night. This was the highest catch rate observed since 1995 (Table 4) and marked a nearly sevenfold increase in catch over that observed in 2018 (Fig. 7). Chub catch has historically fluctuated,

usually in response to water level fluctuations and chemical treatments, though the magnitude of increase observed in 2019 is exceedingly rare. The chub catch spanned at least four cohorts and was dominated by smaller fish (Fig. 8). Chubs made up 88% of the total catch, but just 40% of the biomass sampled (Fig. 3).

Sixteen wipers spanning up to five size classes (Fig. 9, 10) were collected during the 2019 trend net survey, for a catch rate of 2.3 fish per net-night. This marked the highest trend net catch rate observed since the introduction of wipers to Otter Creek Reservoir (Table 4). In addition, 2019 marked the first year where all size classes of wipers were represented in the trend net catch. Wipers were caught in each of the nets set, with the pelagic net (NPD, Fig. 1) catching the most, at six. Wipers averaged 423 mm (16.7 in) in TL, 1,376 g (3.0 lbs), with a mean relative weight (W_r) of 105. Relative weight showed a significant positive relationship to total length in 2019 (Fig. 11), indicating improved body condition as wipers grew bigger. Wipers ranged in size up to 594 mm (23.4 in) and 3,780 g (8.3 lbs) (Fig. 12).

DISCUSSION: 2019 trend net survey results indicate that RBT stocked in Otter Creek Reservoir in 2018 experienced reduced survival (Fig. 5), likely due to a combination of factors. Nearly 200,000 excess RBT were stocked throughout 2018 (Table 1), creating elevated competition during a time when environmental conditions were poor due to reduced water level during a severe drought. Koosharem Reservoir, located 30 miles upstream of Otter Creek Reservoir, was drained in fall 2018 for irrigation needs and dam repair. This draining flushed Koosharem's dense chub population downstream into Otter Creek and the 2019 trend net results indicate that a significant portion of those fish traveled down to Otter Creek Reservoir (Fig. 7). The increased abundance of chubs would have further increased competition pressure from fall 2018 to spring 2019. Reduced body condition (Table 4) indicated that these factors also affected adult fish.

Analysis of RBT length distribution from 2017 to 2019 (Fig. 5) indicates that older cohorts may have also contributed to competition with Age 1 RBT. The size structure of 2017 was representative of typical growth rate observed in Otter Creek Reservoir, with RBT stocked the previous fall reaching 230-300 mm (9-12 inches) by the following spring. The larger cohort (400-480 mm; 16-19 in) is typically dominated by fast-growing fish in their second year in the reservoir. Abundance of RBT older than two years is severely reduced by a combination of angler harvest and short life span caused by rapid growth. The 2018 survey found that the RBT catch was dominated by fish in an intermediate size range that is typically empty during the spring. Comparison with 2017 results suggest that this group was the 2016 cohort, which had grown more slowly than is common. The 2019 length distribution shows that the 2016 cohort continued to show good survival, but also continued slow growth, finally reaching after 2.5 years the size range it should have grown to in 1.5 year. Drought conditions and excess RBT stocking could explain this reduced growth rate. Slowed growth rate also can lead to extended lifespan, which would sustain a higher than normal abundance of RBT older than two years. Persistence of a dominant cohort maintained overall RBT abundance from 2017 to 2019 (Fig. 2), despite apparent reduced survival among young fish. The implication of these results is that the availability of larger RBT (16-19 inches) may be reduced in 2020, depending on survival and harvest of the 2016 cohort that dominated the 2019 trend net catch. By contrast, any RBT stocked in 2019 should have experienced excellent survival and growth thanks to the vastly improved water level and conditions resulting from that year's exceptional snowpack.

2019 marked the first year that wipers were distributed evenly among size classes, as well as sampled at all locations throughout the reservoir. The positive relationship between length and

relative weight (Fig. 11) also shows that wipers are experiencing increasing body condition as they grow, indicating that they are successfully utilizing Utah chubs as forage throughout their lifespan. The influx of chubs to Otter Creek Reservoir in 2018, coupled with improved water conditions in 2019, should have further promoted optimal foraging and growth among wipers. In addition to the requested quota of 20,000, an additional 24,000 3- to 4-inch wipers were stocked in 2019.

The pelagic diving net, set to specifically evaluate wiper occupation in the open reservoir, did catch more wipers in 2019 than did the shoreline nets, despite catching no wipers the first time it was deployed in 2018. An additional benefit of the pelagic net was observed in 2018 when two littoral zone nets were fouled by drifting algae. Without the pelagic net, the trend net sample size would have been severely reduced and results may have been less representative of current conditions. For all these reasons, the addition of a pelagic net should continue in trend net surveys.

The significant increase in Utah chub abundance in Otter Creek Reservoir appeared to have had at least a short-term negative impact on the 2018 RBT cohort. It is hoped that improved water conditions, coupled with increased wiper predation, helped mitigate competition between RBT and chubs in 2019. Excess RBT stocking totaled 15,000 fish in spring 2019, while excess quotas of Bear Lake cutthroat and tiger trout were also stocked. Survival and persistence of the latter two species has been variable at best when stocked in Otter Creek Reservoir in the past, but at least 2019 presented the best possible environmental conditions for introduction. Relative biomass of Utah chubs has remained low in Otter Creek Reservoir since 2005 (Fig. 3) even during years when catch rate has been high. This time period corresponds to increased efforts by water users to maintain sufficient water levels by increasing releases from Piute Reservoir to meet water demand during drought years. These conditions have allowed RBT to maintain accelerated growth in Otter Creek Reservoir and gain a competitive advantage over Utah chubs, regardless of performance of various potential chub predators (smallmouth bass, Bear Lake cutthroat trout, brown trout, wipers). Maintenance of minimum water levels will continue to provide the greatest potential in sustaining the state's most successful RBT fishery. Such conditions may be difficult to maintain, however, during extreme drought years like 2018, when reservoir capacity dropped as low as 11%. In those instances, continued efforts to establish populations of wipers and brown trout may aid in depressing increases in Utah chub density that often occur when water levels are drawn low. These species are also more apt to survive low water conditions and provide sport fish opportunity while RBT recover.

RECOMMENDATIONS:

1. Maintain current stocking quotas for RBT, brown trout, and wipers at Otter Creek Reservoir. Continue stocking of excess RBT and wipers when available.
2. Conduct trend net surveys annually in the spring to monitor trout, wipers, and Utah chubs. Set one to two diving nets in the pelagic zone to assess use by wipers and chubs. Conduct electrofishing when possible in order to more effectively monitor smallmouth bass.
3. Analyze scales or dorsal spines from both wipers and smallmouth bass for age and growth.
4. Develop outreach efforts to promote wiper fishing.

LITERATURE CITED

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 *in* B. R. Murphy and D. W. Willis, editors. Fisheries techniques: second edition. American Fisheries Society, Bethesda, Maryland.

Hadley, M. J., N. R. Braithwaite, and R. D. Hepworth. 2017. 2016 angler survey at Otter Creek Reservoir, Utah. Publication Number 17-02. Utah Department of Natural Resources, Division of Wildlife Resources, Salt Lake City. 26 pp.

Otter Creek Reservoir

Sampling Locations

F=Floating Gill Net

D=Diving Gill Net

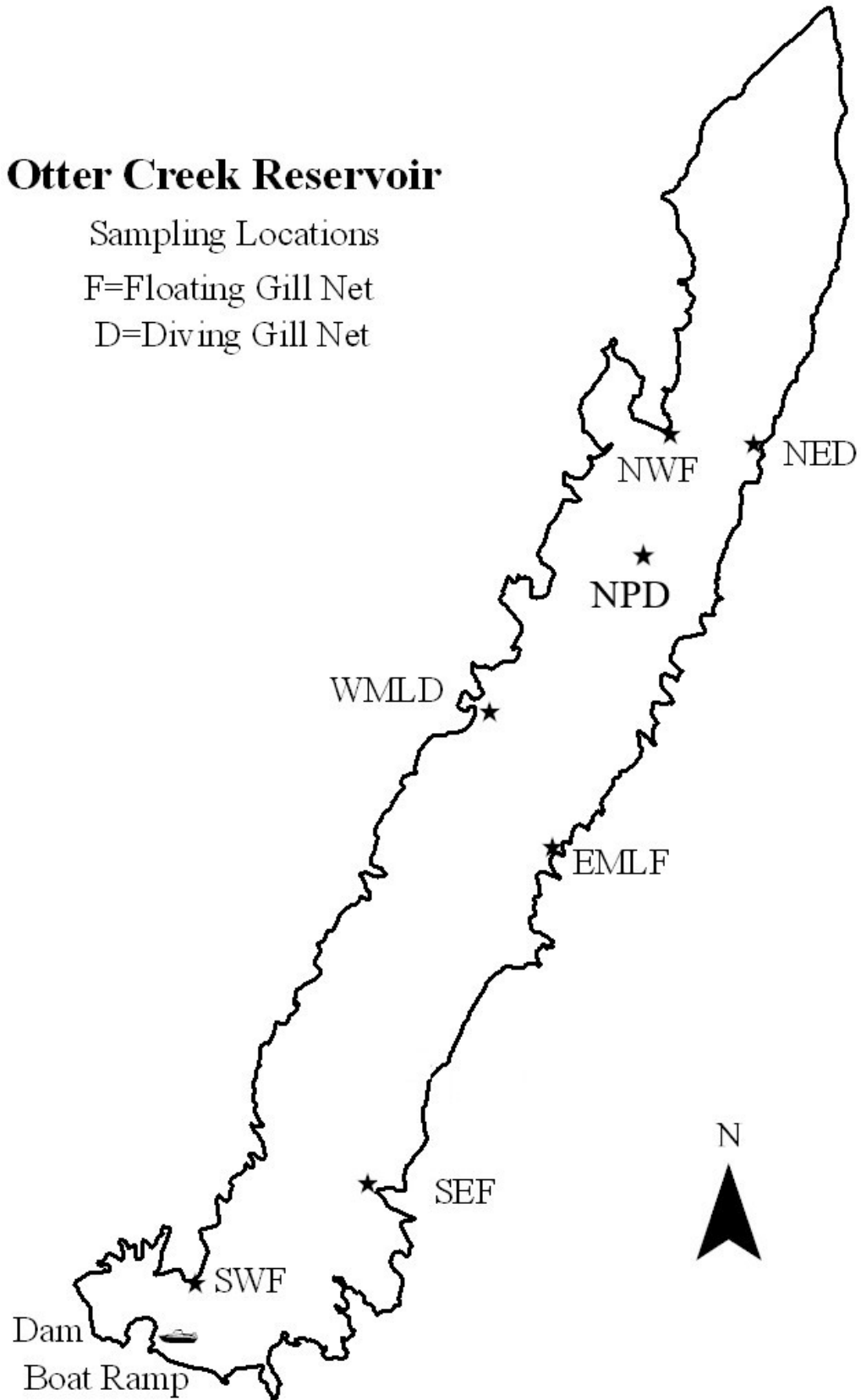


Figure 1. Locations of gill nets set at Otter Creek Reservoir during the 2019 trend net survey.

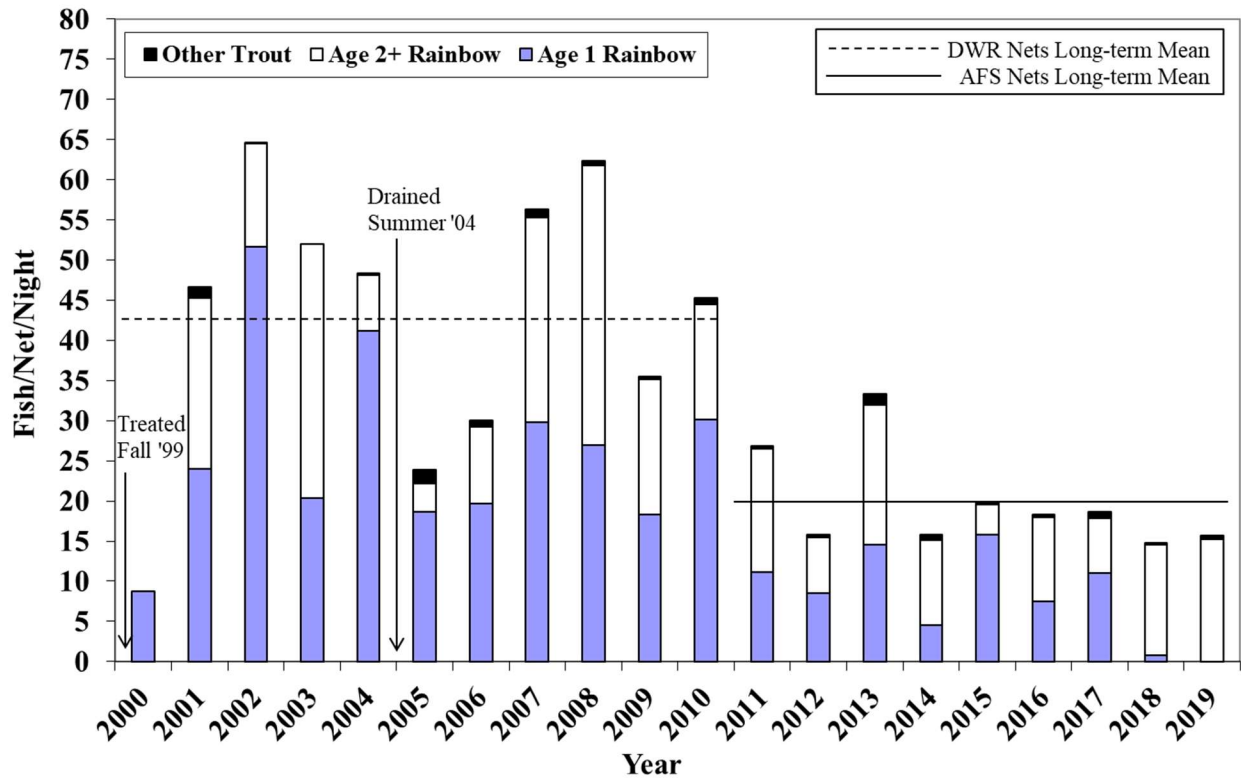


Figure 2. Trout catch rate during trend net surveys at Otter Creek Reservoir, 2000-2019.

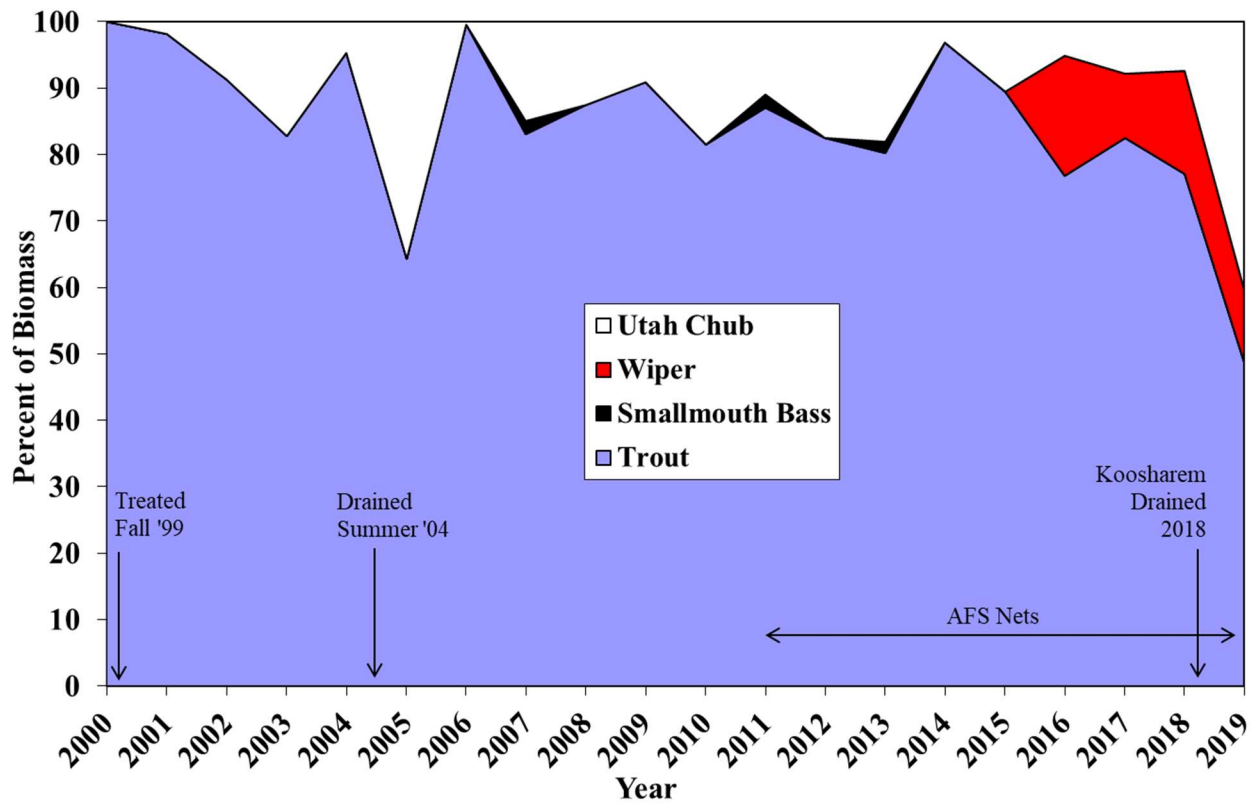


Figure 3. Relative biomass of fish species collected during trend net surveys at Otter Creek Reservoir, 2000-2019.



Figure 4. Rainbow trout collected at Otter Creek Reservoir on April 2, 2019.

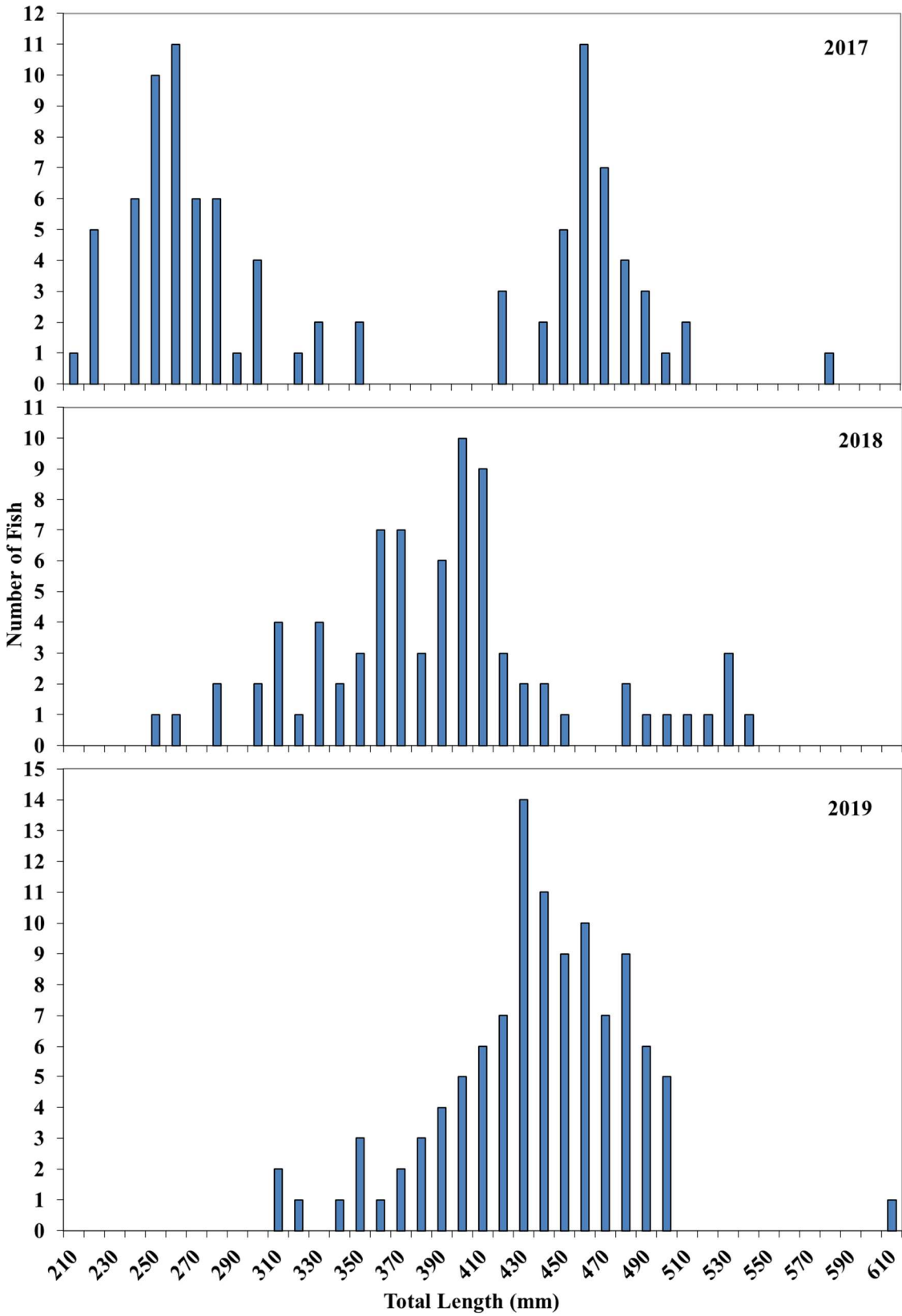


Figure 5. Length distribution of rainbow trout collected during trend net surveys at Otter Creek Reservoir, 2017 to 2019.



Figure 6. Cutthroat trout collected at Otter Creek Reservoir on April 2, 2019.

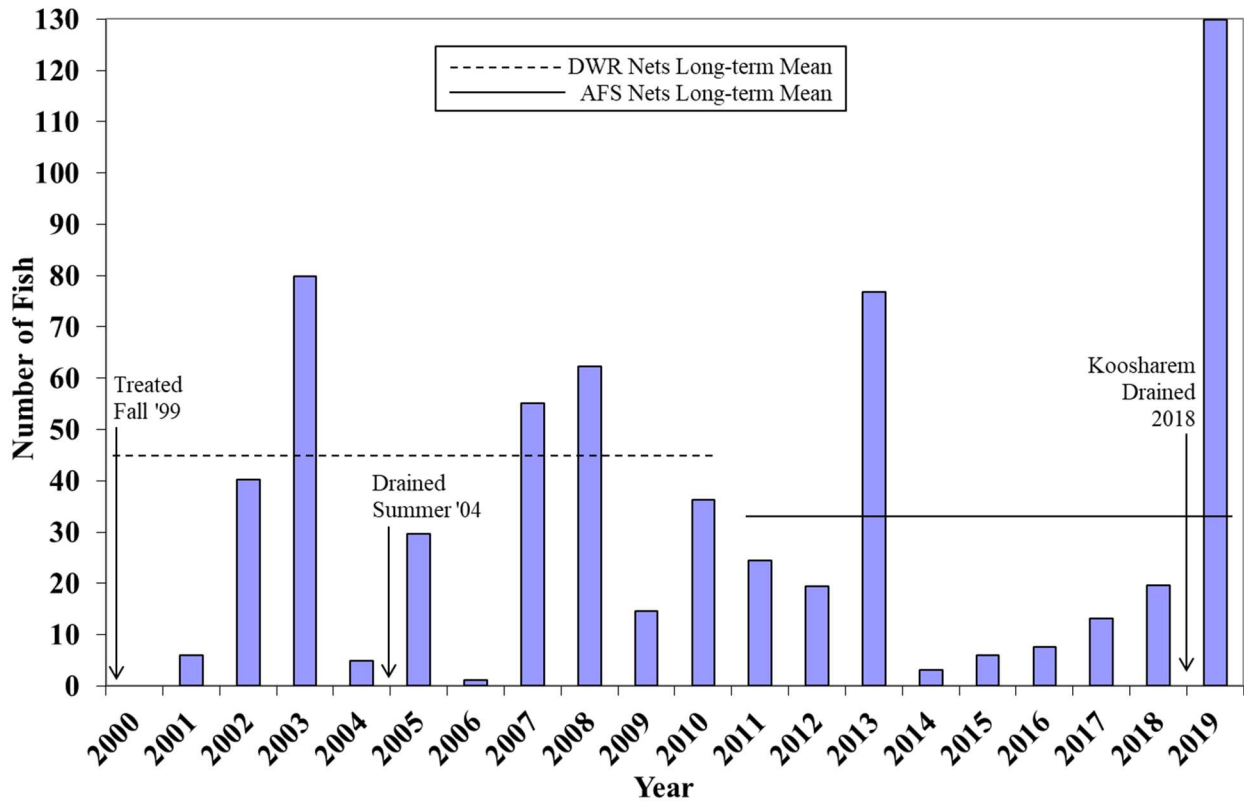


Figure 7. Utah chub catch rate during trend net surveys at Otter Creek Reservoir, 2000-2019.

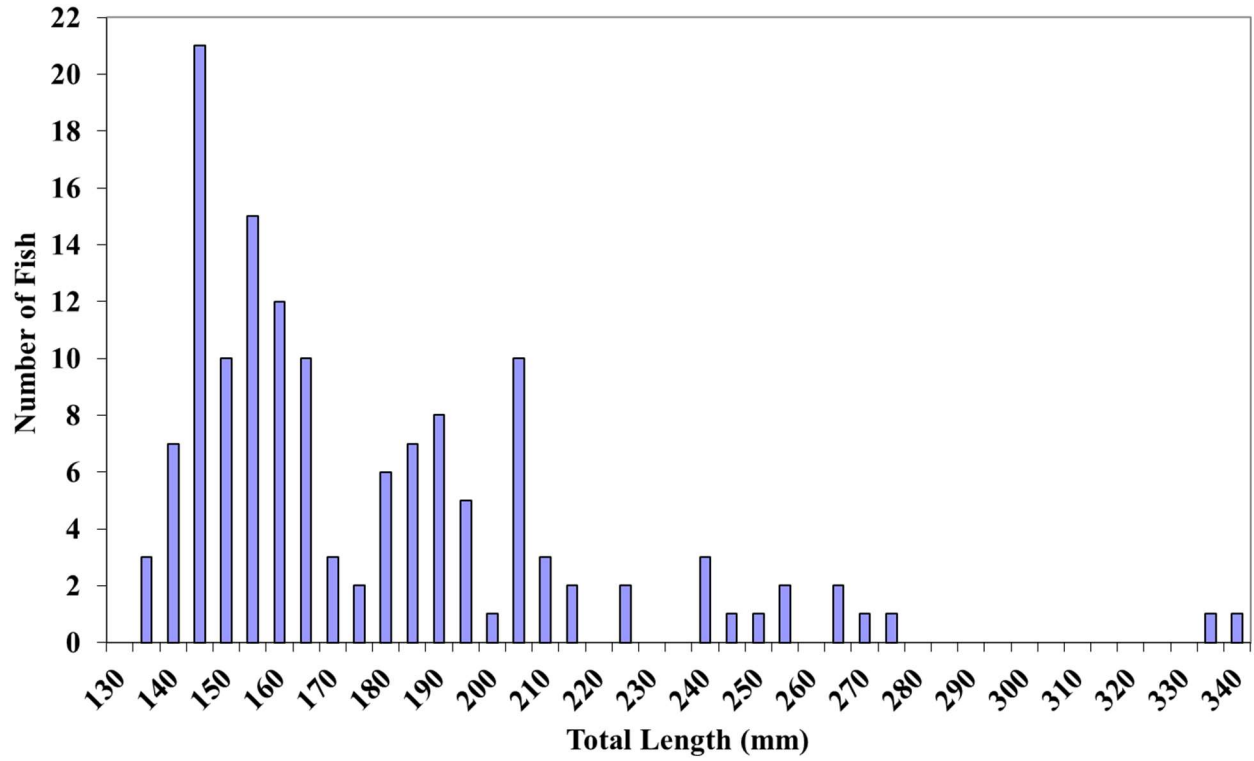


Figure 8. Length distribution of Utah chubs collected at Otter Creek Reservoir on April 2, 2019.

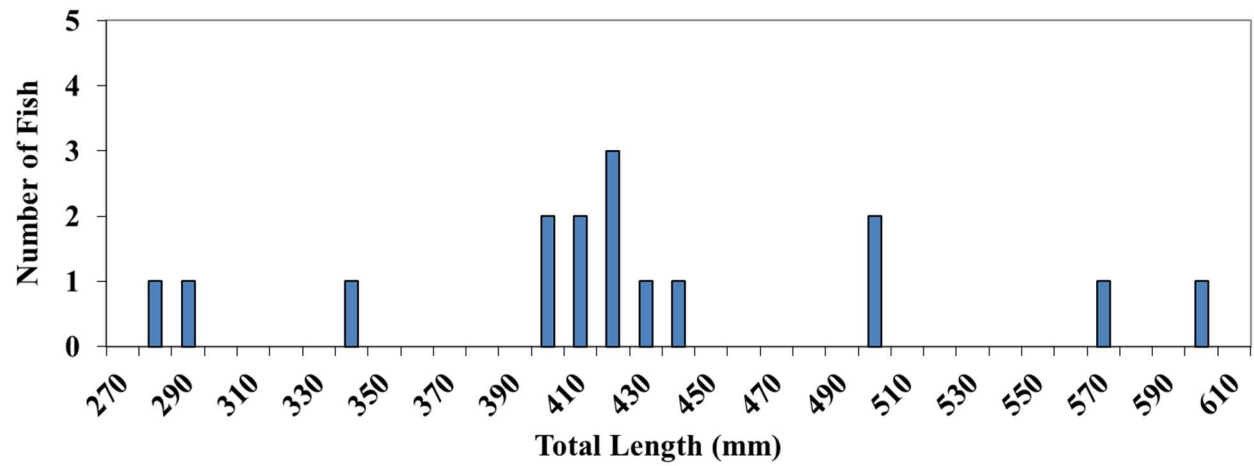


Figure 9. Length distribution of wipers collected at Otter Creek Reservoir on April 2, 2019.



Figure 10. Wipers collected at Otter Creek Reservoir on April 2, 2019.

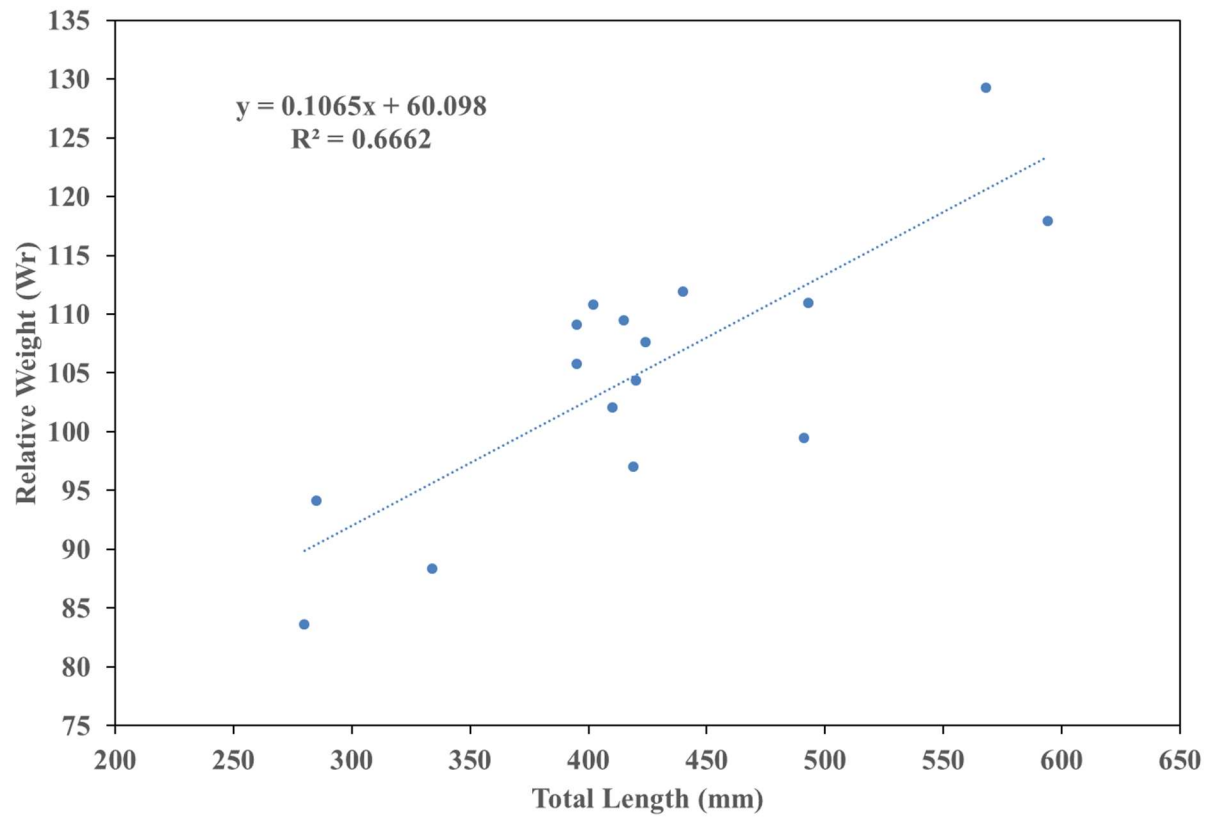


Figure 11. Relationship between total length (mm) and relative weight (W_r) among wipers observed in Otter Creek Reservoir on April 2, 2019.



Figure 12. Large wiper observed at Otter Creek Reservoir on April 2, 2019.

Table 1. Record of trout stocking in Otter Creek Reservoir for the five years prior to the 2019 trend net survey.

<u>Year</u>	<u>Rainbow Trout</u>			<u>Cutthroat Trout</u>		<u>Brown Trout</u>		<u>Total Excess</u>	
	<u>Number</u>	<u>Size (in)</u>	<u>Timing</u>	<u>Number</u>	<u>Size (in)</u>	<u>Number</u>	<u>Size (in)</u>	<u>Rainbow</u>	<u>Cutthroat</u>
2014	197,905 ^a	8.2	Fall	21,996 ^b	8.2	18,490	3.1		75,966
2015	216,955 ^a	7.9	Fall	75,966 ^c	2.4				
	44,715	6.9	Spring	23,930 ^b	7.3				
	36,125	3.1	Spring	10,091 ^d	3.5	5,612 ^a	3.7	106,490	117,523
	25,650	3.0	Fall	107,432 ^c	1.6-3.3				
2016	211,625 ^a	7.4	Fall	25,977 ^b	7.9				
	62,726	2.1	Spring	80,907 ^d	4.3	5,083 ^a	4.1	162,731	178,765
	100,005	7.8	Summer	97,858 ^c	1.7-2.4				
2017	891	15-21	Spring						
	59,709 ^a	7.5	Summer						
	9,100 ^a	9.6	Summer	25,090 ^b	7.6	133	15.3		
	30,659 ^a	6.1	Fall			5,288 ^a	3.3	891	---
	19,795 ^a	7.4	Fall			5,535	4.6		
	21,221 ^a	10.0	Fall						
2018	8,157	10.8	Spring						
	24,878 ^a	6.6	Spring						
	137,779	3-4	Summer	---	---	20,808 ^a	3.1	196,623	---
	50,667	7.0	Fall						
	198,275 ^a	6.8	Fall						
2019	23,000	7.0	Spring						
Quota	200,000	7.0	Fall	---	---	20,000	3.0	---	---

^a – Requested quota.

^b – Requested Bear Lake cutthroat trout quota.

^c – Excess Bonneville cutthroat trout from Manning Meadow brood production.

^d – Excess Bear Lake cutthroat trout.

Table 2. Record of wiper stocking in Otter Creek Reservoir for the five years prior to the 2019 trend net survey.

<u>Year</u>	<u>Number Stocked</u>	<u>Size (in)</u>	<u>Fish/acre</u>
2014	44,843	1.3	18
2015	29,835	1.7-2.1	12
2016	23,469	1.5	9
2017	26,999	2.1	11
2018	6,970	1.5	2.8
2019	20,000	2.0	8
Quota			

Table 3. Summary of the results from the 2019 trend net survey at Otter Creek Reservoir.

Water:	Otter Creek Reservoir			Catalog #:	VI 403													
Date Set:	4/1/2019	Time:	15:00	Weather:	Cloudy, calm													
Date Pulled:	4/2/2019	Time:	10:00	Water Temp:	48 F													
# Nets:	AFS - 4 Floaters, 2 Divers			Collectors:	M. Hadley, R. Hepworth, S. Beckstrom, J. Gleave, Snow College NR Club													
	DWR - 1 Diver																	
Summary for Sport Fish																		
Species	N	Total Weight (kg)	fish per net/night	Total Length (mm)			Weight (g)			Condition (Ktl)			% total catch	% total biomass	% total trout	% trout biomass		
				Mean	SE	Range	Mean	SE	Range	Mean	SE	Range						
Rainbow Trout	107	94.98	15.29	432	4.45	301-605	888	28.5	322-2600	1.07	0.01	0.86-1.36	10.34	47.16	97.27	96.66		
Cutthroat Trout	3	3.28	0.43	479	23.4	452-526	1095	216	829-1523	0.97	0.04	0.90-1.05	0.29	1.63	2.73	3.34		
Trout	110	98.27	15.71	434	4.42	301-605	893	28.3	322-2600	1.06	0.01	0.86-1.36	10.63	48.79	---	---		
Summary for Warmwater Sportfish																		
Species	N	Total Weight (kg)	fish per net/night	Total Length (mm)			Weight (g)			Relative wt. (Wr)			% total catch	% total biomass				
				Mean	SE	Range	Mean	SE	Range	Mean	SE	Range						
Wiper	16	22.02	2.29	423	21.4	280-594	1376	253	253-3780	105	2.79	84-129	1.55	10.93				
Summary for Non-Sport Fish																		
Species	N	Total Weight (kg)	fish per net/night	% total catch	% total biomass	Total Length Range (mm)												
Utah Chub	909	81.11	129.86	87.83	40.27	135-339												
Comment:	- NPD (north pelagic diver) was a DWR net set in 24 feet to the south of NEF.																	

Table 4. Trend net survey results at Otter Creek Reservoir, 1974-2019.

Date	Nets Set		Total Trout	Trout per net-night	Rainbow trout stocked 2 yrs. or more			Rainbow trout stocked previous year			Growth (mm/day)	Wiper per Net-Night	Wiper all ages			Total Nongame per net-night	Comments
	Flo	Div			Mean TL (mm)	Mean W (g)	Ktl	Mean TL (mm)	Mean W (g)	Ktl			Mean TL (mm)	Mean W (g)	Wr		
8-May-74	0	1	124	124											0	TREATED 1971	
1-May-75	1	1	107	54											4.5		
21-Apr-76	1	1	35	18											6.5		
29-Apr-77	1	1	25	13											24	TREATED 1977	
10-Apr-79	1	2	80	27											0		
6-May-80	2	1	69	23											0		
24-Apr-81	2	1	46	15											1.33		
22-Apr-82	2	1	23	8											5		
12-May-83	6	1	175	25											65		
5-Apr-84	6	0	312	52	392	722	1.20	303	351						47		
10-Apr-85	6	0	299	50	424	966	1.26	245	183	1.20	0.48				93		
10-Apr-86	6	0	370	62	496	1300	1.06	322	463	1.30	0.69				115		
23-Apr-87	5	0	395	79	448	1010	1.13	302	348	1.22	0.77				244		
21-Apr-88	3	0	303	101	448	993	1.10	284	275	1.20	0.60				70		
19-Apr-89	4	0	57	14	471	1148	1.08	257	213	1.22	0.47				188	TREATED 1989	
12-Apr-90	4	0	32	8				272	221	1.07	0.61				0		
15-Apr-91	3	0	116	39	409	878	1.22	244	163	1.10	0.35				1.33		
16-Apr-92	4	0	50	13	423	880	1.15	260	221	1.25	0.60				0.5		
15-Apr-93	6	0	336	56	397	802	1.26	275	250	1.18					12		
18-Apr-94	6	0	211	35	468	1343	1.30	298	359	1.30	0.65				65		
3-Apr-95	5	0	319	64	410	725	1.04	241	140	0.98	0.34				195		
26-Mar-96	6	0	321	54	390	654	1.09	272	241	1.18	0.56				6.7		
3-Mar-97	6	0	345	58	347	380	0.89	207	86	0.95	0.23				31	Earlier netting	
26-Mar-98	4	0	51	13	406	766	1.13	271	184	0.90	0.52				45	4 nets instead of 6	
23-Mar-00	4	0	35	9				259	188	1.02	0.43				0	TREATED 1999	
27-Mar-01	6	0	280	47	408	848	1.24	252	202	1.24	0.46				6		
2-Apr-02	6	0	388	65	417	890	1.21	275	239	1.13	0.57				40		
8-Apr-03	6	0	312	52	388	652	1.12	248	175	1.12	0.34				80		
6-Apr-04	6	0	290	48	416	816	1.12	264	215	1.15	0.43				4.8	Drained Fall 04	
6-Apr-05	6	0	143	24				226	121	1.03	0.30				30		
13-Apr-06	6	0	180	30	390	775	1.26	294	337	1.30					1.2		
4-Apr-07	5	1	338	56	415	832	1.19	252	200	1.21	0.50				55		
11-Apr-08	5	1	374	62	386	609	1.08	254	190	1.13	0.47				62		
8-Apr-09	4	2	213	36	416	855	1.18	312	346	1.13	0.73				15		
7-Apr-10	4	2	272	45	449	977	1.07	264	204	1.07	0.47				36		

