State of California
California Department of Fish and Wildlife
North Central Region

Red Lake, Alpine County

2011-2019 Angler Survey Box Analysis

Photo by J. Hanson

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Introduction

Red Lake is an 85-surface acre reservoir in Alpine County situated at 7,872 feet above mean sea level. Red Lake is located off Highway 88, one mile south of the Carson Pass and 25 miles south of Lake Tahoe (**Figure 1**). Red Lake drains into Red Lake Creek, a five-mile creek that flows into the West Fork Carson River. Red Lake is open all year to the public with a five trout bag limit with a 10 in possession sport-fishing regulation.
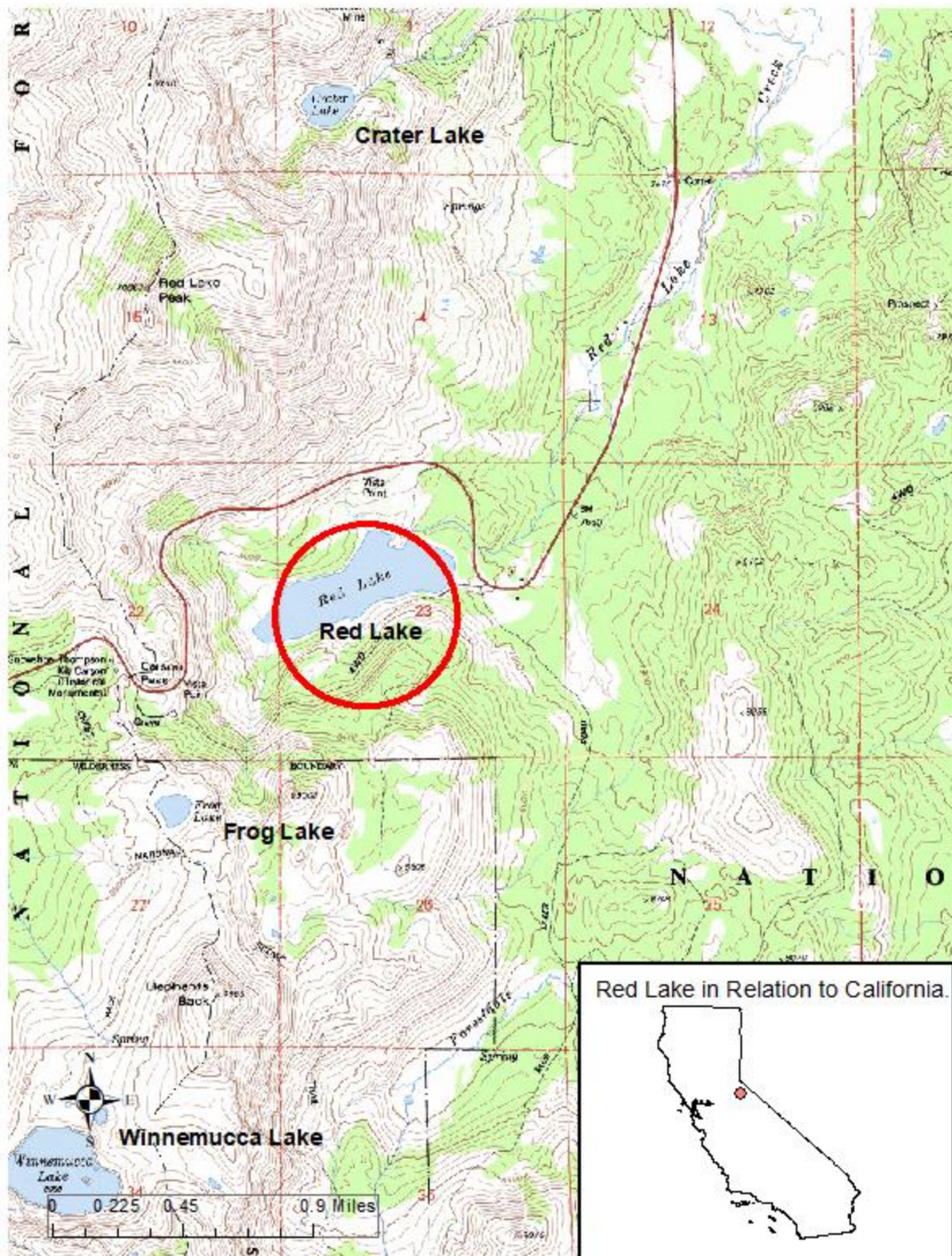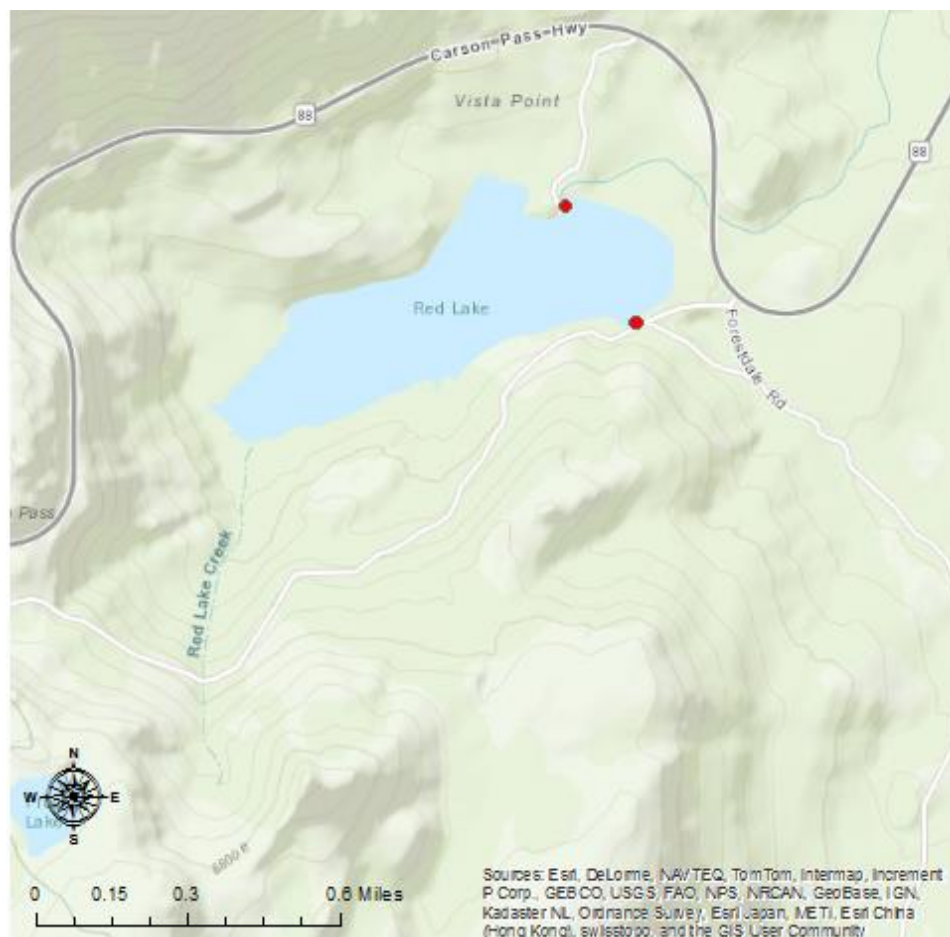
Figure 1. Red Lake, Alpine County.

       California Department of Fish and Wildlife (CDFW) has stocked Red Lake annually since 1968 for recreational fishing. Historically, Red Lake was a Brook Trout

(*Salvenlinus fontinalis*, BK) fishery. However, in 2011, CDFW shifted the fishery to native Lahontan Cutthroat Trout (*Oncorhynchus clarki henshawi*, LCT). CDFW stocks Red Lake with sub-catchable LCT in addition to catchable brood-stock LCT collected from Heenan Lake (**Appendix 1**). Along with LCT and BK, Red Lake currently supports populations of non-game fish, including Tahoe Sucker (*Catostomus tahoensis*), Mountain Sucker (*Catostomus platyrhynchus*), and Tui Chub (*Gila bicolor*).

To assess the fishery, CDFW installed two angler survey boxes (ASB) at Red Lake approximately 20 years ago (**Figure 2**). Anglers voluntarily complete a survey form after they complete their fishing trip, and deposit it in the box. CDFW uses this data to assess angler satisfaction, species composition, and general angler statistics at Red Lake. This report covers the data collected from Red Lake's ASB from 2011-2019.

Figure 2. Red Lake Angler Survey Box (ASB) locations (Alpine County).

Methods

Participating anglers complete a voluntary survey form about their fishing. The survey asks anglers for information regarding hours fished, type of gear and method used, and the number of landed fish. Anglers are also asked the size and species of the fish landed and whether they kept or released their catch. Finally, anglers are asked three questions, and their answers were recorded on a scale of "-2 to +2 ", with "+2" representing most satisfied and "-2" representing least satisfied. The questions pertain to satisfaction of overall angling experience, fish size, and number of fish caught. The back of the survey form was reserved for anglers who had any additional comments (**Appendix 2**).

Results

In 2019, Red Lake had 36 respondents, which was well below the 2011 – 2019 average of 50 (range: 19 - 116) (**Table 1**). It was also the third lowest angler total in the 2011 - 2019 survey period, but an increase from the previous two years. Cumulatively, 2019 anglers landed 63 fish and fished for 96 hours, which is also below the nine-year average of 135 fish landed and 165.07 hours fished. The catch per angler (1.75) and catch per hour (0.66) in 2019 decreased from the average of 2.94 and 0.91, respectively, over the nine-year period (**Table 1**).

Table 1. Collection of average effort and catch statistics recorded from the ASB 2011 - 2019 at Red Lake.

Year	Respondents	Hours Fished	Fish Landed	Catch per angler	Catch per hour	Hours per angler
2011	37	141.13	98	2.65	0.69	3.81
2012	51	159.75	166	3.25	1.04	3.13
2013	61	181.50	224	3.67	1.23	2.98
2014	41	132.00	136	3.32	1.03	3.22
2015	66	220.25	170	2.58	0.77	3.34
2016	116	423.50	211	1.82	0.50	3.65
2017	19	63.00	105	5.53	1.67	5.53
2018	21	68.50	39	1.86	0.57	3.26
2019	36	96.00	63	1.75	0.66	2.67
Average	50	165.07	135	2.94	0.91	3.51

Five anglers (13.9%) reported fishing from a boat, which resulted in the best success in terms of catch per angler (2.60) in 2019 (**Table 2**). One angler (2.8%) reported using multiple fishing methods (boat and shore), which resulted in the second highest rate in terms of catch per angler (2.00) in 2019. Shore fishing was the most popular method of fishing for a fifth consecutive year (n = 27) and had a 1.70 catch per angler value. One float tube angler had a 0.00 catch per angler value. One angler who did not record their method of fishing had a 1.00 catch per angler value.

Table 2. Number of anglers and catch per angler based on angling method at Red Lake, 2015 - 2019.

	2015		2016		2017	
Method	Number of Anglers (%)	Catch per Angler	Number of Anglers (%)	Catch per Angler	Number of Anglers (%)	Catch per Angler
Boat	2 (3.0%)	1.50	4 (3.4%)	2.50	1 (5.3%)	4.00
Float tube	1 (1.5%)	0.00	1 (1.0%)	0.00	NA	NA
Shore/Wading	58 (87.9%)	2.64	102 (87.9%)	1.81	14 (73.7%)	6.43
Multiple	NA	NA	2 (1.7%)	0.00	1 (5.3%)	0.00
Not recorded	5 (7.6%)	2.80	7(6.0%)	2.29	3 (15.8%)	3.67
Total	66		116		19	

|	2018		2019	
Method	Number of Anglers (%)	Catch per Angler	Number of Anglers (%)	Catch per Angler
Boat	1 (4.8%)	7.00	5 (13.9%)	2.60
Float tube	3 (14.3%)	2.33	1 (2.8%)	0.00
Shore/Wading	15 (71.4%)	1.53	27 (75.0%)	1.70
Multiple	NA	NA	1 (2.8%)	2.00
Not recorded	2 (9.5%)	1.00	2 (5.6%)	1.00
Total	21		36	

Anglers used bait, lures, and flies while fishing at Red Lake (**Table 3**). In 2019, 13 anglers (36.1%) used lures to catch fish, which was an increase from 2017 and 2018. Fly fishing was the least used identified gear used in 2019, similar to previous years, in which three anglers strictly used flies. Lure anglers reported the highest catch rate (2.38 catch per angler) in 2019. Bait anglers reported the second highest identified catch rate in 2019 (1.70 catch per angler), which was a large decrease from 2017 (9.14 catch per angler). Although, it was a decrease from 2017, it was closer to 2011–2014, 2016, and 2018 values (2.38, 2011 – 2014; 1.79, 2016; 2.50, 2018). In 2019, multiple gear anglers (n=10) had a 1.40 catch per angler value while fly anglers had the lowest catch per angler value of 0.33.

Table 3. The frequency of anglers that used each angling gear and their corresponding catch rates from 2011 - 2019.

Gear Method	2011 - 2014 Catch per Angler (Total Anglers)	2015 Catch per Angler (Total Anglers)	2016 Catch per Angler (Total Anglers)	2017 Catch per Angler (Total Anglers)	2018 Catch per Angler (Total Anglers)	2019 Catch per Angler (Total Anglers)
Bait	2.38 (77)	3.06 (48)	1.79 (61)	9.14 (7)	2.50 (4)	1.70 (10)
Lure	3.63 (54)	1.45 (11)	2.59 (27)	5.00 (5)	2.33 (6)	2.38 (13)
Fly	6.31 (16)	0.00 (1)	0.80 (5)	NA	3.00 (2)	0.33 (3)

|						
Multiple	2.78 (40)	0.75 (4)	1.18 (22)	2.67 (6)	1.00 (8)	1.40 (10)
Not recorded	1.00 (4)	2.00 (2)	2.00 (1)	0.00 (1)	1.00 (1)	NA
Total anglers	191	66	116	19	21	36

In 2019, anglers caught the second fewest fish (n=63) on record (**Table 1** and **Figure 3**). In 2011, 69% (n=68) of trout landed were LCT while only 29% (n=28) were BK. In 2015, 64% of identifiable trout landed were LCT (n=113), 8% were BK (n=14), 24% percent were unidentifiable trout (n=43), and 3% were unknown species (n=6). In 2016, 84% of identifiable trout landed were LCT (n=177), 8% were BK (n=16), and 8% were a combination of unknown species/trout (n=18). In 2017, 68% of identifiable trout landed were LCT (n=71), 18% were unknown species (n=19), 10% were Tui Chubs (n=11), 3% were suckers (n=3), and 1% were BK (n=1). In 2018, 74% of fish landed were LCT (n=29), 10% were unknown species (n=4), 10% were BK (n=4), and 5% were suckers (n=2). In 2019, 62% of fish landed were LCT (n=39), 37% were BK (n=23), and 2% were BN (n=1). It is the first time BN were reported caught since 2011, when anglers reported catching two BN, one in the 10 - 11.9" size class and one in the 14 - 15.9" size class. The number of BK caught was the greatest number of BK caught since 2013, when 123 BK were caught. CDFW last stocked BK in 2010 and has only stocked LCT in Red Lake since 2011.
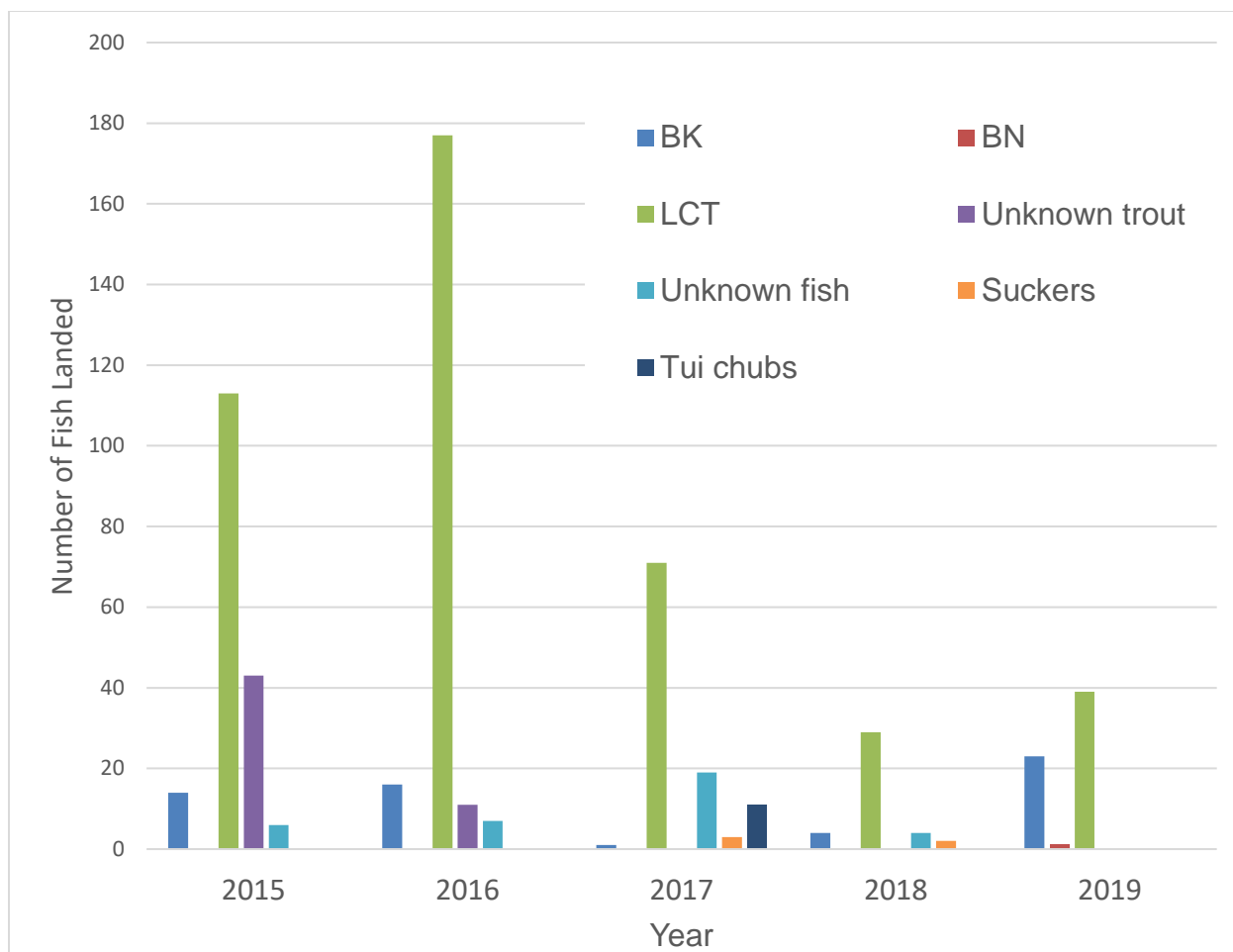
Figure 3. Number of each species of fish caught annually from Red Lake, 2015-2019.

In 2016, 22% (n = 43) of the landed trout measured < 10 inches in total length, 43% (n = 31) in 2017, 67% (n = 22) in 2018, and 38% (n = 24) in 2019 (**Figure 4**). Fifty-eight percent (n = 112) of landed trout measured between 12 and 20 inches (in.) in 2016, 21% (n = 15) in 2017, 24% (n = 8) in 2018, and 40% (n = 25) in 2019. Only 4% (n=7) of fish caught were greater than 20 inches in 2016, and increased almost seven-fold to 26% (n = 19) in 2017. Unfortunately, in 2018, this number of fish dropped back down to 3% (n = 1). However, this number rebounded in 2019 to 16% of the total catch (n = 10).
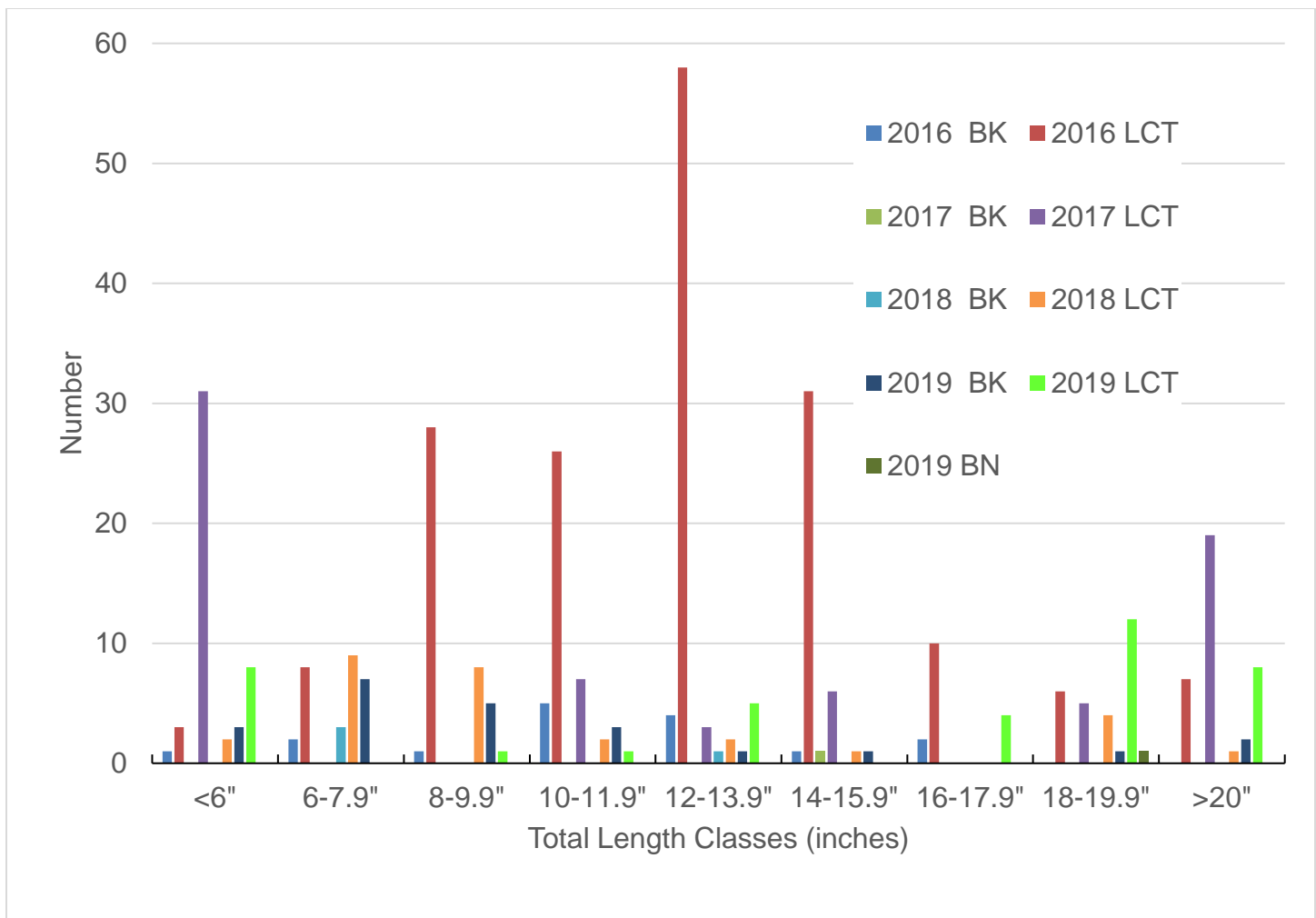
Figure 4. Frequency of identified trout in each size class that anglers reported landing at Red Lake, 2016-2019.

In 2015, anglers released 50% of BK caught compared to only 12% of LCT released (**Table 4**). In 2016, anglers released 50% of BK while releasing 38% of LCT. In 2017, anglers kept all BK while releasing 37% of LCT. Anglers released 11% of unknown fish, 100% of suckers, but kept all Tui Chubs in 2017. In 2018, anglers released 75% of BK and 83% of LCT. In 2018, anglers released all unknown fish and no suckers. In 2019, anglers released 83% of BK and 59% of LCT. The one BN caught in 2019 was released.

Table 4. Kept and released fish in Red Lake from 2015 - 2019.

Year	Species	Kept	Released	Total Caught	Percent of Total Catch	Percent Released
2015	BK	7	7	14	8.0	50.0

Year	Species					
	LCT	99	14	113	64.2	12.4
	Unknown trout	43	0	43	24.4	0.0
	Other	NA	NA	6	3.4	NA
		149	21	176		
2016	BK	8	8	16	7.8	50.0
	LCT	109	68	177	85.9	38.4
	Unknown fish	11	2	13	6.3	15.4
		128	78	206		
2017	BK	1	0	1	1.0	0.0
	LCT	45	26	71	67.6	36.6
	Unknown fish	17	2	19	18.1	10.5
	Suckers	0	3	3	2.9	100.0
	Tui Chub	11	0	11	10.5	0.0
		74	31	105		
2018	BK	1	3	4	10.3	75.0
	LCT	5	24	29	74.4	82.8
	Unknown fish	0	4	4	10.3	100.0
	Suckers	2	0	2	5.1	0.0
		8	31	39		
2019	BK	4	19	23	36.5	82.6
	LCT	16	23	39	61.9	59.0
	BN	0	1	1	1.6	100.0
		20	43	63		

*In 2016, the disposition of 5 fish caught was not recorded.

In 2019, anglers reported being satisfied with their overall angling experience (**Table 5**). Anglers have experienced a positive average angling experience response all nine years, which indicates that the fishery provides a satisfactory experience. Anglers were satisfied with the size of trout for the fifth consecutive year. The 2019 1.06 "size" value is the highest of any previous year. Anglers were satisfied with the number of fish caught for a seventh consecutive year.

Table 5. Angler satisfaction response averages for the Red Lake fishery from 2011 through 2019.

Year	Overall Angling Experience	Size of the Fish	Number of Fish
2011	0.28	-0.33	-0.14
2012	0.34	-0.42	-0.15
2013	0.73	-0.16	0.49
2014	0.54	-0.16	0.38
2015	0.50	0.52	0.50
2016	0.08	0.43	0.10
2017	1.06	0.87	0.93

| 2018 | 0.53 | 0.75 | 0.42 |
| 2019 | 0.64 | 1.06 | 0.82 |

Discussion

Red Lake anglers average almost three fish caught per day in the last nine years. However, overall catch in 2019 was the second lowest in nine years. Catch per hour and catch per angler were the third lowest and lowest values in the nine years of surveys. It is possible the lower overall catch per angler and catch per hour were a function of the large cyanobacteria blooms that happened in Red Lake in 2019. Cyanobacteria blooms caused by eutrophication lead to serious impacts on aquatic ecosystems and human health (Jin et al. 2015). The water quality was poor, had a green color, and was a hazard to humans, pets, and wildlife. During bloom events, signs around the lake notified the public of the health hazards of cyanobacteria to humans and their pets. This likely deterred many potential anglers from recreating at Red Lake.

Although CDFW stocked the same amount of LCT brood stock in 2019 as in 2018, anglers reported landing more ≥ 20.0 in. LCT in 2019. According to local CDFW game warden Erick Elliott (Pers. Comm.), the word that Red Lake receives super-catchable LCT has spread, with many anglers from the central valley, driving up to Red Lake for the opportunity to catch large trout.

In 2019, five anglers fished from a boat. These anglers also had the greatest catch per angler value. It is possible these anglers were able to reach areas of the lake with better water quality compared to the dam area, which is where most anglers fish. Unfortunately for those anglers fishing the dam, this area has the highest concentration of algae due to Red Lake's wind direction.

For the first time, the greatest number of fish caught in 2019 were in the 18.0 in. – 19.9 in. size class. The majority of these fish were caught within five days of the final 2019 LCT super-catchable stocking. It is possible anglers caught LCT brood-stock from the recent LCT stocking.

Before 2013, anglers were unsatisfied with the number of trout they were catching. For seven straight years, anglers have been satisfied with the number of trout caught. It is possible that the decrease in fish stockings over the years has decreased competition for food, increased LCT survivability and growth rates in Red Lake. This likely contributed to LCT in Red Lake to grow to more, larger-sized LCT, not previously available to anglers. The large number of angler-released fish may also contribute to fish growing to a larger size. During the last five years, anglers have been satisfied with

the size of trout caught. It is often difficult to manage a fishery to satisfy both high catch rates and large size of fish caught, but from 2015-2019 it was accomplished.

Similar to 2018, anglers released most trout caught in 2019. In recent years, fishing clubs and many outdoor writers have promoted the idea of catch and release fishing. Anglers are encouraged to release fish they catch, even though the fish may be large enough to keep under the prevailing fishing regulations (Clark Jr. 1983). However, the number of LCT released decreased to 59% in 2019, compared to 83% in 2018. Since 24% of the trout caught were between 12 and 20 in. in 2018, it is possible anglers released these fish, hoping to catch larger trout. In 2019, this value increased to 40%, increasing the likelihood of an angler keeping his catch.

Unlike creel surveys, ASB surveys have shown more LCT caught than BK. Historically, Red Lake was a BK fishery, but CDFW has not stocked BK into Red Lake since 2010. Red Lake has and continues to receive both sub-catchable LCT (when available) and Heenan Lake LCT brood-stock. The continued stockings of LCT and discontinuation of BK stocking may explain the increase of LCT caught when compared to BK. However, in 2019, anglers caught 23 BK, which was more than the previous three years combined. It is possible the last three winters' above normal precipitation enhanced the spawning opportunities for BK, not present before a five-year drought (2012-2016). It is also possible increased outflows gave BK in Red Lake Creek more incentive and/or opportunity to migrate into the lake.

The overall fishing experience for anglers has been positive at Red Lake every year surveyed. This is consistent with a roving creel survey conducted by CDFW in 2014 (Onanian 2014). One reason anglers are likely satisfied is because anglers are catching fish. Several studies have shown that angler satisfaction is positively related to fishing success (Hicks et al. 1983; Graefe and Fedler 1986; McMichael and Kaya 1991; Spencer 1993; Mostegl 2007; Hunt et al. 2012).

The number of respondents in the 2019 survey was the highest in three years, which is positive to see, especially considering the poor water quality that Red Lake had in 2019. However, it was a decrease from the average. Ideally, the more respondents, the more feedback it provides CDFW regarding angler satisfaction. Angler feedback is useful for making more informed management decisions at popular recreational fisheries. Overall, it appears the anglers who responded to the ASB in 2019 had a satisfactory time at Red Lake.

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Appendix 1. Stocking history at Red Lake since 2011.

Date	Species	Weight (lbs.)	Number	Size
7/18/2011	LCT	201	3015	Sub-catchable
5/18/2012	LCT	378	189	Super-catchable
5/22/2012	LCT	322	161	Super-catchable
6/4/2012	LCT	785	6672	Sub-catchable
6/5/2012	LCT	1,532	13328	Sub-catchable
5/13/2013	LCT	460	5014	Sub-catchable
5/21/2013	LCT	360	180	Super-catchable
5/22/2013	LCT	304	152	Super-catchable

Date	Species	Number	Count	Size Class
5/29/2014	LCT	218	109	Super-catchable
6/5/2014	LCT	218	109	Super-catchable
6/23/2014	LCT	100	1600	Sub-catchable
5/19/2015	LCT	300	150	Super-catchable
5/20/2016	LCT	375	150	Super-catchable
5/31/2016	LCT	150	1005	Sub-catchable
6/4/2017	LCT	290	145	Super-catchable
6/6/2017	LCT	430	215	Super-catchable
6/13/2017	LCT	125	1000	Sub-catchable
5/24/2018	LCT	720	360	Super-catchable
6/15/2018	LCT	134.14	1100	Sub-catchable
5/31/2019	LCT	524	262	Super-catchable
6/5/2019	LCT	138.79	569	Sub-catchable
6/5/2019	LCT	40.78	369	Sub-catchable
6/5/2019	LCT	196	98	Super-catchable

Appendix 2.

Red Lake

The California Department of Fish and Wildlife is conducting an evaluation of the trout fishery on Red Lake. We request your help in this evaluation by providing the following information in this survey. Please use this form for **one** day's fishing on Red Lake by **one** angler only.

Date Fished: _____   # Hours Fished: _____
                            mm/dd/yyyy

Primary gear type used (check one):

☐   Bait   ☐   Lure   ☐   Fly

Primary method or location fished (check one):

☐   Shore or Wading   ☐   Float Tube   ☐   Boat

Enter the total number of fish caught by species and size class:

Size	brook trout		Lahontan cutthroat trout		Other:	
	Kept	Released	Kept	Released	Kept	Released
Less than 6"						
6"-7.9"						
8"-9.9"						
10"-11.9"						
12"-13.9"						

14"-15.9"						
16"-17.9"						
18"-19.9"						
20" and greater						

Please indicate your level of satisfaction with the following statements regarding your fishing experience today:

	Least satisfied		Neutral		Most satisfied	
Overall angling experience today:	-2	-1	0	+1	+2
Size of fish:	-2	-1	0	+1	+2
Number of fish:	-2	-1	0	+1	+2

Please use the back of this form for any additional comments. Thank you for taking the time to fill out this form.