

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

**Indian Creek Reservoir, Alpine County**

**Summary Report of Roving Creel Surveys (2009, 2011–2013) and Angler Survey  
Box Analysis (2015–2020) at Indian Creek Reservoir**



Photo by B. Ewing

Ben Ewing

District Fisheries Biologist: Alpine, Amador, Calaveras, and Lake Counties

April 2021

## Introduction

Indian Creek Reservoir (ICR) is approximately three miles north of Markleeville, off Highway 89, in eastern Alpine County (**Figure 1**). ICR is within the East Fork Carson River watershed and was originally constructed by South Tahoe Public Utility District (STPUD) between 1968 and 1970 to store tertiary treated wastewater exported from the Lake Tahoe basin (STPUD website). In 1989, the input of this treated wastewater ceased, but ICR is still a recreational sport-fishing destination due to continued stocking efforts by California Department of Fish and Wildlife (CDFW) and the Alpine County Fish and Game Commission (Alpine County). ICR has a maximum estimated depth of 50 feet and sits at an elevation of 5,600 feet above mean sea level. In average water years, ICR has a surface area of 110 surface acres. ICR has no large, natural tributaries, receiving most of its inflow from a diversion from the West Fork Carson River. ICR supports various fish species, including non-native Rainbow Trout (*Oncorhynchus mykiss*, RT) and Brown Trout (*Salmo trutta*, BN), as well as Lahontan Cutthroat Trout (*Oncorhynchus clarki henshawi*, LCT), which are native to the eastern Sierra. Other native fish found in ICR include the Tui Chub (*Gila bicolor*, TC), Mountain Whitefish (*Prosopium williamsoni*, MWF), Mountain Sucker (*Catostomus platyrhynchus*), Lahontan Redside (*Richardsonius egregius*), and the Tahoe Sucker (*Catostomus tahoensis*). Largemouth Bass (*Micropterus salmoides*, LMB) also occur in ICR. CDFW stocked Brook Trout (*Salvelinus fontinalis*, BK) at ICR in 2002, but BK have not been reported in the last 10 survey years.

Both CDFW and Alpine County historically stocked ICR. However, due to harmful algae blooms (HABs) beginning in 2019, CDFW recently decreased the total number of trout stocked at ICR. Alpine County did not stock any trout at ICR in 2020 because of the HABs. Although both entities stock RT, only CDFW stocks LCT. Stocked sizes include fingerling (< 5 inches (in)), sub-catchable (~ 7 in.), catchable (~12 in.), and super-catchable (trophy) (19 in.) and greater-size fish. Fingerling and sub-catchable trout are stocked under a put and grow management strategy, while catchable and trophy trout are stocked under a put and take management strategy. CDFW is implementing a put and grow strategy with the fingerling and sub-catchable LCT. Rapid growth is expected from the fingerling and sub-catchable size trout due to the high productivity of ICR.

## Methods

Anglers were asked to complete a voluntary survey form about their fishing experience at one of the two angler survey boxes (ASB) at ICR. The survey asked

anglers for information regarding hours fished, type of gear used, angling method, and the number of landed fish. Anglers were also asked the size and species of the fish landed and whether they kept or released their catch. Finally, the survey asked three questions about angler's satisfaction of overall angling experience, size, and number of fish. Anglers recorded their answers on a scale of -2 to +2, with "+2" representing most satisfied and "-2" representing least satisfied. The back of the survey form was reserved for anglers who had additional comments. The 2009, 2011–2013 data used for comparison in this report were gathered using the roving creel survey, in which a CDFW scientific aide interviewed anglers about their angling experience (Hood 2013).



**Figure 1.** Indian Creek Reservoir, Alpine County. Indian Creek Reservoir is also indicated by a beige dot in the inset map in relation to California.

## Results

Fifteen anglers responded to the ASB survey in 2020. The 10-year average, including anglers who responded to the 2009 and 2011–2013 roving creel surveys was 68 (Hood 2013) (**Table 1**). Cumulatively, anglers landed 1658 fish for a 10-year average of 166 fish annually and averaged 221.1 hours of fishing (0.71 catch/hour). The 2020 catch per angler average and catch per hour were the lowest seen in the last six years.

**Table 1.** Collection of average effort and catch statistics recorded from the roving creel surveys in 2009 and 2011–2013 and the 2015–2020 angler survey box (ASB) at Indian Creek Reservoir.

Year	Respondents	Hours Fished	Fish Landed	Catch per Hour	Catch per Angler
2009	143	361.5	242	0.67	1.69
2011	45	134.0	11	0.08	0.24
2012	10	32.5	14	0.43	1.40
2013	98	248.0	103	0.42	1.05
2015	81	318.5	387	1.22	4.78
2016	115	436.5	270	0.62	2.35
2017	71	269.5	191	0.71	2.69
2018	56	207.3	175	0.84	3.13
2019	45	144.5	243	1.68	5.40
2020	15	58.5	22	0.38	1.47
Average	68	221.1	166	0.71	2.42

Like 2017 and 2019, five bait anglers caught the greatest number of fish ( $n = 9$ ) in 2020 (**Table 2**). Multiple-gear anglers reported the second highest total of identified catch in 2020 ( $n = 6$ ) for a second consecutive year, and a large percentage increase from the prior four years. In 2020, fly anglers caught five fish (22.7%) of the total catch. Lure anglers caught two fish, the lowest number of fish in 2020 (9.1%). This is the second straight year that lure anglers caught the least number of fish.

**Table 2.** The number of fish landed by the type of gear from 2016–2020.

Year	Number of Fish				
	2016	2017	2018	2019	2020
<b>Angling method</b>					
Bait	96 (35.6%)	94 (49.2%)	67 (38.3%)	156 (64.2%)	9 (40.9%)
Lure	8 (3.0%)	14 (7.3%)	25 (14.3%)	10 (4.1%)	2 (9.1%)
Fly	141 (52.2%)	64 (33.5%)	77 (44.0%)	29 (11.9%)	5 (22.7%)
Multiple	6 (2.2%)	7 (3.7%)	6 (3.4%)	34 (14.0%)	6 (27.3%)
Not recorded	19 (7.0%)	12 (6.3%)	NA	14 (5.8%)	NA
<b>Total</b>	<b>270</b>	<b>191</b>	<b>175</b>	<b>243</b>	<b>22</b>

In 2020, anglers caught the least number of fish ( $n = 22$ ) in the last six years (**Table 3**). In 2020, 50.0% of fish landed were LCT, 22.7% were TC, 18.2% were RT, and 4.5% were for LMB and MWF each, respectively. The catch rates correspond with stocking records for 2020, since no RT were stocked by either CDFW or Alpine County. In 2020, 942 lbs. of LCT were stocked into ICR. This stocking event is likely the reason more LCT than RT were caught in 2020 (**Table 4**).

In 2020, LCT were caught in the greatest numbers for the first time in the last five years. Of the 11 LCT caught, 72.7% were released. The percentage of LCT released was consistent with the number released in 2019 (71.4%). In 2020, anglers released 81.8% of all species caught, compared to 58.8% in 2019, 75.2% in 2018, 51.8% in 2017, and 69.5% in 2016.

**Table 3.** Kept and released fish at Indian Creek Reservoir from 2015–2020.

Year	Species	Kept	Released	Unknown whether Kept or Released	Total Caught	Percent of Total Catch	Percent Released
2015	BN	6	2	NA	8	2.1%	25.0%
	LCT	52	160	NA	212	54.8%	75.5%
	RT	95	71	NA	166	42.9%	42.8%
	Unknown*	0	1	NA	1	0.3%	100.0%
<b>TOTAL</b>							
2015		153	234		387		60.5%

2016	BN	2	0	NA	2	0.7%	0.0%
	LCT	4	45	NA	49	18.1%	91.8%
	RT	76	141	1	218	80.7%	65.0%
	Unknown	0	1	NA	1	0.4%	100.0%
TOTAL 2016		82	187	1	270		69.5%
2017	BN	2	4	NA	6	3.1%	66.7%
	LCT	2	3	NA	5	2.6%	60.0%
	RT	88	91	NA	179	93.7%	50.8%
	LMB	0	1	NA	1	< 1.0%	100.0%
TOTAL 2017		92	99	0	191		51.8%
2018	BN	1	15	NA	16	9.1%	93.8%
	LCT	5	24	NA	29	16.6%	82.8%
	RT	35	84	NA	119	68.0%	70.6%
	SKR	0	0	10	10	5.7%	NA
	Unknown	0	1	NA	1	0.6%	100.0%
TOTAL 2018		41	124	10	175		75.2%
2019	MWF	0	2	NA	2	0.1%	100.0%
	LCT	4	10	NA	14	5.8%	71.4%
	RT	92	84	NA	176	72.4%	47.7%
	LMB	0	1	NA	1	0.0%	100.0%
	TC	3	13	NA	16	6.6%	81.3%
	Unknown	1	33	NA	34	14.0%	97.1%
TOTAL 2019		100	143	0	243		58.8%
2020	MWF	0	1	NA	1	4.5%	100.0%
	LCT	3	8	NA	11	50.0%	72.7%
	RT	1	3	NA	4	18.2%	75.0%
	LMB	0	1	NA	1	4.5%	100.0%
	TC	0	5	NA	5	22.7%	100.0%
TOTAL 2020		4	18	0	22		81.8%

\* Unknown trout species

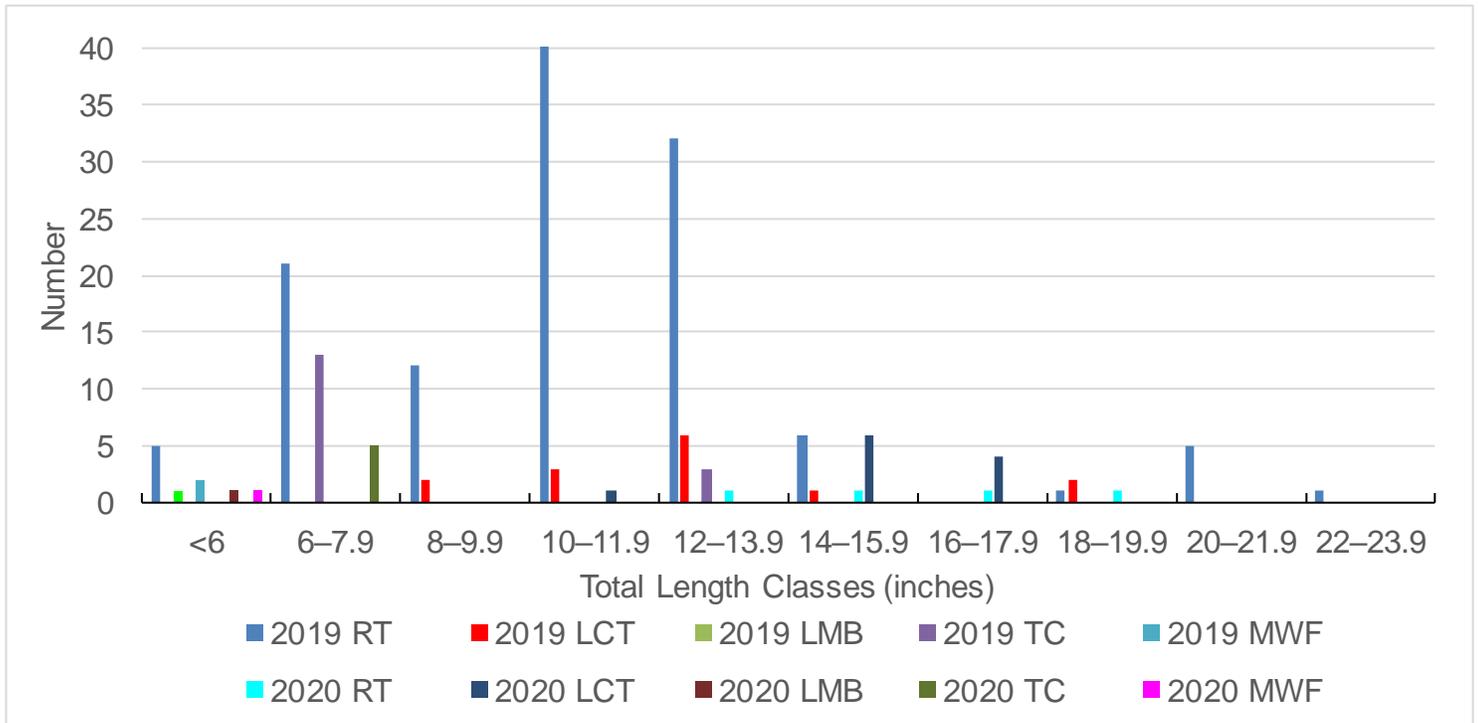


In 2020, shore/wading anglers (60.0%) had the highest catch per angler average (1.89) (**Table 5**). Two boat anglers (13.3%) had the second highest catch per angler average (1.00 catch/angler). Lastly, four float tube anglers had a 0.75 catch per angler value.

**Table 5.** The number of anglers and catch per angler based on angling method at Indian Creek Reservoir from 2017–2020.

Method	Year							
	2017		2018		2019		2020	
	Number of Anglers	Catch per Angler						
Boat	6	5.50	1	1.00	4	13.00	2	1.00
Float tube	28	2.32	23	3.35	8	3.63	4	0.75
Shore or Wading	30	2.30	27	3.07	27	5.15	9	1.89
Multiple	NA	NA	1	3.00	NA	NA	NA	NA
Not recorded	7	3.43	4	2.75	6	3.83	NA	NA

In 2020, there was no single modal length class for RT. One RT was caught in each of the four length classes between 12.0 and 19.9 inches. In 2019, the modal length class for RT was 10.0–11.9 inch (in.) (n = 93). In 2020, the modal length class for LCT was 14.0–15.9 in. (n = 6). In 2019, the modal length class for LCT was 12.0–13.9 in. (n = 6) (**Figure 2**). The modal length class for TC was 6.0–7.9 in. for a second consecutive year (2020, n = 5; 2019, n = 13). The modal length class for both MWF and LMB was < 6.0 in. for a second consecutive year.



**Figure 2.** Frequency of identified fish in each length class that anglers reported landing at Indian Creek Reservoir in 2019 and 2020. The number of RT in the 10–11.9 inch total length–class in 2019 was an outlier above the y-axis scale.

In 2020, anglers were satisfied with their overall angling experience for the fourth consecutive year (**Table 6**). However, 2020 was the second lowest average value on record (0.31). Anglers were satisfied with the size of fish over the entire ten-year sampling period, showing little variation across response years (**Table 6**). Anglers had a neutral satisfaction average response with the number of fish caught in 2020 (0.00 average), which was also the lowest value recorded in the last four years.

**Table 6.** Angler satisfaction response averages for the Indian Creek Reservoir fishery from 2009, 2011–2013, and 2015–2020.

Year	Overall angling experience	Size of the fish	Number of fish
2009, 2011–2013	1.43	1.03	1.01
2015	0.66	0.94	0.76
2016	-0.30	1.05	0.00
2017	0.77	1.00	0.38
2018	0.64	1.00	0.41
2019	0.91	0.88	1.25
2020	0.31	1.00	0.00
Average	0.63	0.98	0.54

## Discussion

Anglers caught less than two fish per trip, the first time catch per angler was less than two fish since 2013. The 2020 CPUE (0.38) was also the lowest seen since 2013. The 2020 overall catch (n = 22) was the lowest total since 2012, when only 14 fish were landed. The cyanobacteria issues that occurred at ICR in 2019 and 2020 may have deterred many anglers from fishing as well as the COVID–19 Pandemic. In 2019, the water quality was poor, had a green color, and was a hazard to humans, pets, and wildlife. Cyanobacteria blooms caused by eutrophication lead to serious impacts on aquatic ecosystems and human health (Jin et al. 2015). During bloom events, signs were displayed around the lake advising the public of the health hazards that were present to humans and their pets. Although there were no new harmful algae blooms in 2020, toxins from 2019 still lingered, forcing South Tahoe Public Utility District to keep health advisory signs posted (D. Arce, pers. comm.). With the water quality issues and sign requirements, Alpine County and CDFW decided to not stock RT into ICR in 2020, which is reflected in both the number and species of fish caught. In 2020, the Bureau of Land Management, who operates the campground at ICR, closed the campground due to concerns over COVID-19. This closure also likely contributed to a decrease in anglers at ICR.

There was no single length class with the greatest number of RT caught in 2020. One RT was caught in each size class from the 12.0–13.9 in. class to 18.0–19.9 in. class. However, this corresponds with anglers being satisfied with the size of their catch for a tenth consecutive sampling year. Anglers were neutral on their satisfaction with the

number of fish caught in 2020. This is a decrease from the previous three years. The decrease likely occurred because of the large decrease in trout stocked in 2020.

Fewer LCT were caught in 2020 than 2019 (Ewing 2020). In recent years, CDFW has stocked broodstock ( $\geq 2$  lbs.) LCT from Heenan Lake (Alpine County) into ICR. However, other than in 2018, anglers did not report catching many of these larger fish. For example, only one LCT over 20 in. was reported caught in 2017, none in 2016, and only three in 2015. In 2018, eight LCT over 20 in. were caught, but none in 2019 and 2020. In 2018, some of the broodstock may have still been in spring spawning mode. During early spring and early summer of 2018, LCT gathered in large numbers by the inlet to ICR, which allowed shore anglers easier access to the congregating LCT. These consistent inlet flows may have contributed to angler catch success compared to the lack of flows during earlier drought conditions. In 2019 and 2020, high flows were not present at the inlet, thus providing less of an opportunity for shore anglers to catch these large LCT, although some were still caught (**Figure 3**).



**Figure 3.** Craig Witt with LCT caught near inlet at ICR in 2020. (Photo courtesy of D. Kaffer)

Due to the low flow conditions at ICR in 2019 and 2020, many of the LCT may have been out in the middle of the lake. With the water quality issues at ICR in 2019 and 2020, many anglers may have been hesitant to come into body contact with the lake, thus fewer boat anglers were able to target the LCT occupying deeper water.

In 2021, CDFW will continue to stock ICR with LCT broodstock and return to stocking RT. If the inlet at ICR maintains adequate flow into the reservoir throughout spring 2021, as observed two and three years ago, more trophy-sized LCT may become available for anglers. During drought years, the inlet flows minimally, which may cause

LCT to go into the afterbay, which is on private property and does not provide angler access.

It is often difficult to manage a fishery to satisfy both high catch rates and large fish size. This is because large-sized fish demand a greater amount of food than smaller-sized fish. With a certain amount of available food, either the fishery can hold many, smaller-sized fish or fewer, larger-sized fish. ICR has provided both large fish and high catch rates over most years of this study. The long growing season, large amounts of baitfish, and large allotments may be some of the reasons why ICR has been able to satisfy anglers in both numbers and sizes for most of the years surveyed.

Anglers released most of the fish caught at ICR in 2020. For the first time in 2020, LCT were released at a lower percentage than RT. This may be the result of just fewer RT stocked into IVR in 2020, decreasing overall RT caught. Overall, anglers continued to release a large percentage of fish species caught at ICR. In recent years, fishing clubs and many outdoor writers have promoted the idea of catch and release fishing. They argue that catching a fish is the most valuable component of the recreational fishing experience, and if fish are released unharmed, they might be available for recapture on a future fishing trip (Clark 1983). Mortal hook wounds in smaller fish may persuade some anglers to keep smaller-sized fish rather than releasing them. Anglers may also release smaller fish in hopes of catching a larger fish to harvest.

ICR also has a LMB population (**Figure 4**) where anglers have caught LMB over five pounds, but only three have been reported in the last six years. Predation is one of the factors influencing the yield of stocked salmonids (Larsson 1985; Blackwell and Juanes 1998; Dieperink et al. 2001). LMB may be predating on RT and LCT, especially the fingerling-sizes, but the level of affect potential LMB predation may be having on stocked trout populations is unknown.



**Figure 4.** John Hanson with LMB caught at ICR.  
(Photo courtesy of M. Mamola)

For a fourth consecutive year, shore angling was the most frequent method reported. This may be a result of anglers hesitant to launch their boat in a reservoir with poor water quality issues present.

In 2020, the overall fishing experience for anglers at ICR was positive for the fifth time in six years. One explanation for the overall positive angling experience could be that anglers were satisfied with the size of the fish caught. Anglers have only had a negative average angling experience response once in ten years of surveys at ICR. This suggests that the fishery has provided a satisfactory experience for a majority of the survey period.

Fifteen anglers responded to the 2020 survey, below the ICR average of 68. In 2019, ICR endured very poor water quality, which resulted in multiple poor water quality postings across the reservoir, discouraging water contact for both humans and pets. These conditions likely deterred anglers, many of whom probably decided to fish

elsewhere. Although water conditions improved in 2020, anglers may have still been discouraged to fish ICR due to the water quality signage around the lake.

## Recommendations

- Keep ASBs at ICR for one more year.
- Continue pre-2020 stocking allotments of RT and LCT.

## References

Blackwell, B. F., and F. Juanes. 1998. Predation on Atlantic salmon smolts by striped bass after dam passage. *North American Journal of Fisheries Management* 18:936–939.

Clark, R. D. 1983. Potential effects of voluntary catch and release of fish on recreational fisheries. *North American Journal of Fisheries Management* 3:306–314.

Dieperink, C., S. Pedersen, and M. I. Pedersen. 2001. Estuarine predation on radio-tagged wild and domesticated sea trout (*Salmo trutta L.*) smolts. *Ecology of Freshwater Fish* 10: 177–183.

Ewing, B. 2020. Summary Report of Roving Creel Surveys (2009, 2011–2013) and 2015–2019 Angler Survey Box Analysis at Indian Creek Reservoir, Alpine County. California Department of Fish and Wildlife. Available from: <http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=177872>

Hood, N. 2013. Indian Creek Reservoir Creel Report. California Department of Fish and Wildlife. <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=85751>

Jin C., Y. Liang, S. Liu, S. Wu, X. Qian and X. Zhou. 2015. The pulmonata snail *Lymnaea* is a potential biomanipulation species for use against cyanobacteria blooms, *Journal of Freshwater Ecology* 30: 479—490, DOI: [10.1080/02705060.2014.979377](https://doi.org/10.1080/02705060.2014.979377)

Larsson, P. O. 1985. Predation on migrating smolts as a regulating factor in Baltic salmon. *Salmo salar L.*, populations. *Journal of Fish Biology* 26:391–397.

South Tahoe Public Utility website. <https://stpud.us/about/>



