

**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 (2015–2021) at Indian Creek Reservoir**



Photo by B. Ewing

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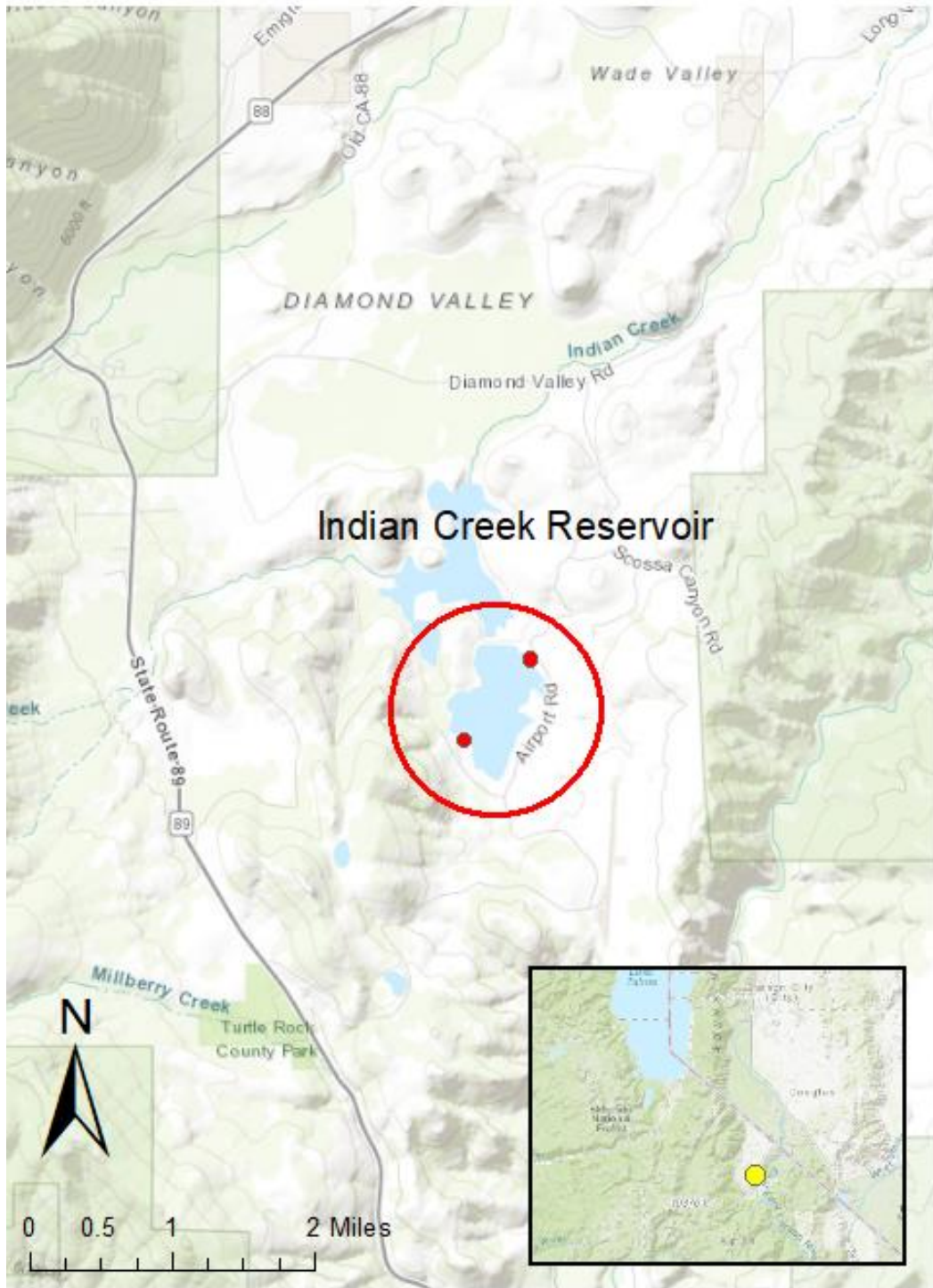
## Introduction

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, delivery of treated wastewater ceased, however, ICR remained 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 clarkii 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 last stocked Brook Trout (*Salvelinus fontinalis*, BK) at ICR in 2002, but BK have not been reported in the last 11 survey years.

Both CDFW and Alpine County historically stocked ICR. However, due to harmful algae blooms (HABs) beginning in 2019, and the Tamarack Fire in July 2021, CDFW decreased the total number of trout stocked at ICR. Alpine County did not stock any trout at ICR in 2020 and 2021 because of the HABs and Tamarack Fire. 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 yellow dot in the inset map in relation to Lake Tahoe. Location of the Angler Survey Boxes are indicated by the red dots.

## Results

Nine anglers responded to the ASB survey in 2021. The 11-year average, including anglers who responded to the 2009 and 2011–2013 roving creel surveys, was 63 (Hood 2013) (**Table 1**). Cumulatively, anglers landed 1,712 fish, for an 11-year average of 156 fish annually and averaged 203.8 hours of fishing (0.80 catch/hour). The 2021 catch per angler average and catch per hour were the highest seen during the 11 survey years.

**Table 1.** Collection of average effort and catch statistics recorded from the roving creel surveys in 2009 and 2011–2013 and the 2015–2021 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
2021	9	31.5	54	1.71	6.00
Average	63	203.8	156	0.80	2.75

In 2021, three fly anglers caught the greatest number of fish ( $n = 31$ ) (**Table 2**). Bait anglers reported the second highest total of identified catch in 2021 ( $n = 14$ ) for a second time in five years, but the smallest percentage of fish caught during the 2017–2021 reporting period. In 2021, lure anglers caught eight fish (14.8%) of the total catch. One angler, who caught one fish did not report the type of gear used. One angler who used multiple types of gear caught zero fish. This is the third time in five years that multiple-gear anglers caught the fewest fish.

**Table 2.** The number of fish landed by the type of gear from 2017–2021.

Year	Number of Fish				
	2017	2018	2019	2020	2021
<b>Angling method</b>					
Bait	94 (49.2%)	67 (38.3%)	156 (64.2%)	9 (40.9%)	14 (25.9%)
Lure	14 (7.3%)	25 (14.3%)	10 (4.1%)	2 (9.1%)	8 (14.8%)
Fly	64 (33.5%)	77 (44.0%)	29 (11.9%)	5 (22.7%)	31 (57.4%)
Multiple	7 (3.7%)	6 (3.4%)	34 (14.0%)	6 (27.3%)	0 (0.0%)
Not recorded	12 (6.3%)	NA	14 (5.8%)	NA	1 (1.9%)
Total	191	175	243	22	54

In 2021, anglers caught the second fewest total fish from ICR (n = 54) from among the last seven years (**Table 1** and **Table 3**). In 2021, 98.1% of fish landed were RT and 1.9% were LCT. The catch rates correspond with stocking records for 2021, since CDFW stocked 300 broodstock LCT and 6,250 RT (**Table 4**). Alpine County did not stock any fish in 2021 due to the Tamarack Fire and water quality concerns from prior harmful algae blooms.

In 2021, anglers caught RT in the greatest numbers for the fifth time in the last six years. Of the 53 RT caught, anglers released 83.0%. The percentage of RT released by anglers was an increase from the number released in 2020 (75.0%). In 2021, anglers released 81.5% of all species caught, compared to 81.8% in 2020, 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 2016–2021.

Year	Species	Kept	Released	Unknown whether Kept or Released	Total Caught	Percent of Total Catch	Percent Released
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%
2021	LCT	1	0	NA	1	1.9%	0.0%
	RT	9	44	NA	53	98.1%	83.0%
TOTAL 2021		10	44	0	54		81.5%

**Table 4.** CDFW and Alpine County stocking events from 2009–2021 at Indian Creek Reservoir.

CDFW			Alpine County				
RT		LCT		RT			
Year	lbs.	Number	Year	lbs.	Number	Year	lbs.
2021	1000	1800	2021		300	2021	0
	1500	3300					
	1000	1800					
2020	0		2020	192	9,984	2020	0
				750	300		
2019	2,000	3,800	2019	400	200	2019	1,800
	3,000	6,300		227	1,498		
2018	600	1,020	2018	800	400	2018	3,600
				150	1,110		
2017	300	900	2017	83.3	750	2017	3,600
	900	2,970		83.3	750		
	100	370		300	150		
				90	756		
				90	756		
2016	0	0	2016	500	250		
				320	4,192	2016	3,600
				605	242		
				145	58		
2015	580	1,508	2015	174	87	2015	3,600
	1000	1,500		200	100	2014	3,600
2014	1600	3,040	2014	600	300	2013	3,600
2013	1220	2,806		71.1	1,209	2012	2,800
	610	2,013		2200	6,160	2011	4,950
2012	317.5	6,000	2013	300	150	2010	3,800
	2000	6,000		300	150	2010*	1,000
	625	2,000		1376	14,998	2009	16,800
2011	674	5,999	2012	1149	9,996	2009*	2,200
	1000	2,000		220	110		
	3000	5,400		380	190		
2010	1000	1,500	2011	300	150		
	970	6,014		300	150		
2009	599.7	4,618	2010	600	300		
			2009	300	200		
	<b>25,596</b>	<b>72,658</b>		<b>13,206</b>	<b>55,946</b>		<b>26,195</b>
							<b>54,950</b>

\*Denotes BN plant

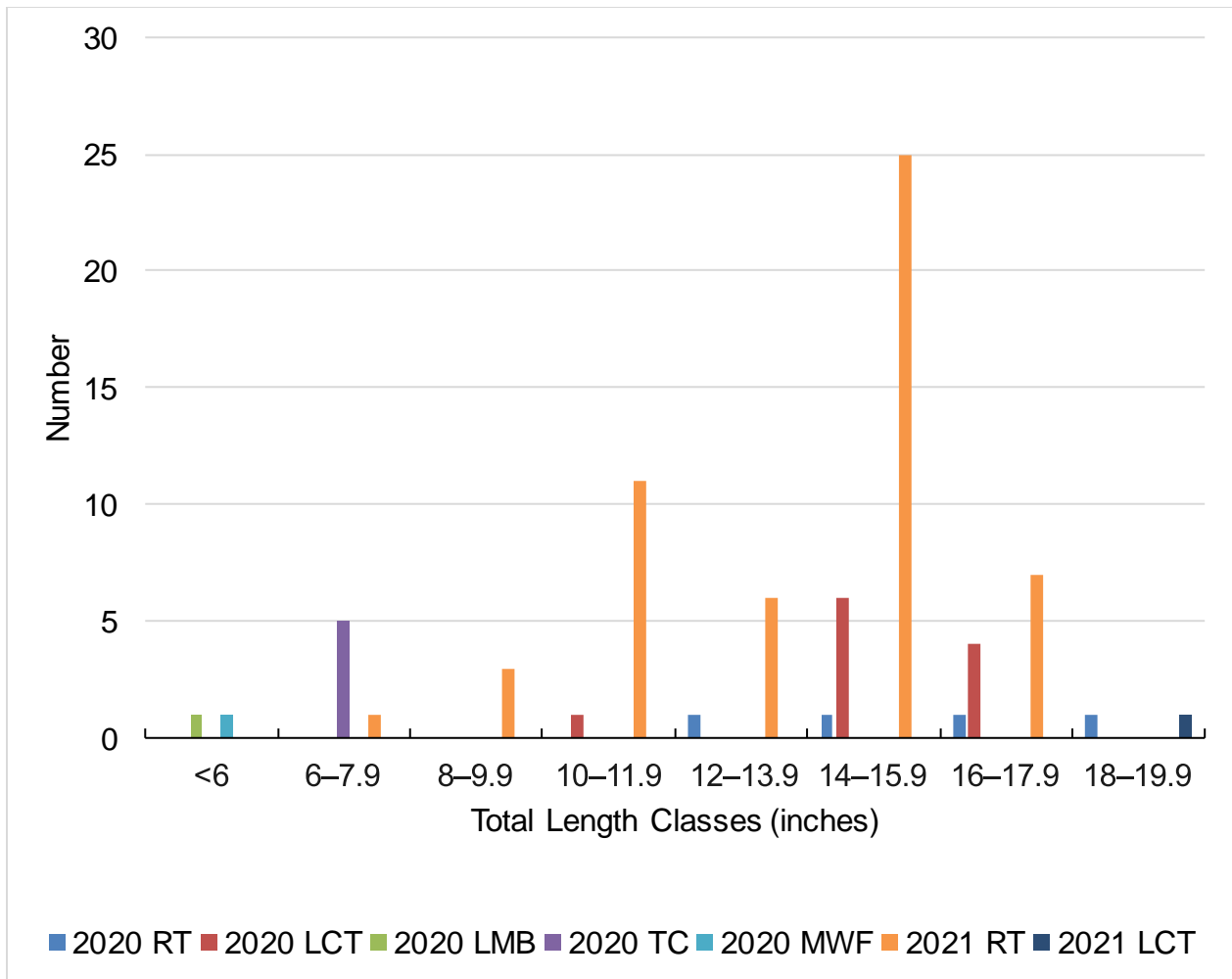


In 2021, float tube anglers (who comprised 22.2% of all anglers in 2021) had the highest catch per angler average (15.00) (**Table 5**). Five shore/wading anglers (55.6%) had the second highest catch per angler average (4.40 catch/angler). Lastly, one boat angler and one angler that did not record their angling method each had a 1.00 catch per angler value.

**Table 5.** The number of anglers and catch per angler based on angling method at Indian Creek Reservoir from 2018–2021.

Method	Year							
	2018		2019		2020		2021	
	Number of Anglers	Catch per Angler	Number of Anglers	Catch per Angler	Number of Anglers	Catch per Angler	Number of Anglers	Catch per Angler
Boat	1	1.00	4	13.00	2	1.00	1	1.00
Float tube	23	3.35	8	3.63	4	0.75	2	15.00
Shore or Wading	27	3.07	27	5.15	9	1.89	5	4.40
Multiple	1	3.00	NA	NA	NA	NA	NA	NA
Not recorded	4	2.75	6	3.83	NA	NA	1	1.00

In 2021, the modal length class for RT was 14.0–15.9 in. (n = 25) (**Figure 2**). Anglers caught RT in each of the six length classes between 6.0 and 17.9 in. In 2020, there was no modal length class for RT. In 2021, the modal length class for LCT was 18.0–19.9 in. (n = 1). In 2020, the modal length class for LCT was 14.0–15.9 in. (n = 6). Anglers did not report catching any other fish species in 2021. In 2020, the modal length class for TC was 6.0–7.9 in. (n = 5) and < 6.0 in. for both MWF and LMB.



**Figure 2.** Frequency of identified fish in each length class that anglers reported landing at Indian Creek Reservoir in 2020 and 2021.

In 2021, anglers reported being satisfied with their overall angling experience for the fifth consecutive year (**Table 6**). This is an increase from 2020, which was the second lowest average value on record (0.31). Anglers were satisfied with the size of fish over the entire eleven-year sampling period, with 2021 being the highest value on record (1.57) (**Table 6**). Anglers had the second highest satisfaction average response with the number of fish caught in 2021 (1.14).

**Table 6.** Angler satisfaction response averages for the Indian Creek Reservoir fishery from 2009, 2011–2013, and 2015–2021.

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
2021	0.63	1.57	1.14
Average	0.63	1.06	0.62

## Discussion

Anglers caught six fish per trip, the highest on record in 11 years of surveys. The 2021 CPUE (1.71) was also the highest on record. The 2021 overall catch (n = 54) was the second lowest total in the last eight years. Although the overall catch total was low in 2021, the few anglers at ICR caught many fish. The cyanobacteria issues that occurred at ICR in 2019 and 2020 may have deterred many anglers from fishing in 2021. 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 and 2021, 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 and Alpine County also did not stock any RT in 2021. The limited stocking affected both the number and species of fish caught, and likely contributed to the reduced number of anglers who fished ICR the last two years. In 2020, the Bureau of Land Management, who operates the campground at ICR, closed the campground due to concerns over COVID-19. In 2021, the campground was burned in the Tamarack Fire (**Figure 3**). The Tamarack Fire not only burned down the campground and ASB located on the northern section of ICR, but also forced closure of the reservoir to public access for many weeks. With ICR closed off to the public for part of 2021, loss of the campground, lack of trout stocking by the County, and previous water quality concerns, it is clear why fewer anglers fished ICR in 2021.



**Figure 3.** Indian Creek Reservoir bathroom and northern Angler Survey Box Location on January 28, 2022. (Photo by B. Ewing)

The length class with the greatest number of RT caught in 2021 was 14.0–15.9 in. This corresponds with anglers being satisfied with the size of their catch for an eleventh consecutive sampling year including the highest satisfaction-with-size value. Anglers were satisfied with the number of fish caught in 2021. Like the “size” average value, anglers also reported the highest “Number” value on record. The increase may have occurred because of the number of trout stocked to angler ratio in 2021 (i.e., few anglers given the number of trout stocked).

Anglers only reported one LCT caught in 2021. 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, anglers only reported one LCT over 20 in. caught in 2017, none in 2016, and only three in 2015. In 2018, anglers reported eight LCT over 20 in. caught, but none in 2019, 2020, and 2021. 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. From 2019–2021, high flows were not present at the inlet, thus providing less of an opportunity for shore anglers to catch these large LCT. However, anglers still caught some large LCT in 2020, but these captures were not reported in the ASB (**Figure 4**).



**Figure 4.** Chris Michael with LCT caught near inlet at ICR in 2020. (Photo courtesy of D. Kaffer)

Due to low flow conditions at ICR from 2019–2021, 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 in 2021, thus fewer boat anglers were able to target the LCT occupying deeper water. Even though water quality improved in 2021, the Tamarack Fire, which began in July 2021, prevented many anglers from accessing ICR for much of the summer and early fall.

In 2022, CDFW will continue stocking ICR with LCT broodstock and will attempt to stock RT, if available. If the inlet at ICR maintains adequate flow into the reservoir throughout spring 2022, as observed three and four 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 surveyed years.

Anglers released most of the fish caught at ICR in 2021. Overall, anglers continued to release a large percentage of fish species caught at ICR. In recent years, catch and release fishing has become a popular practice (Grambsch and Fisher 1991). Additionally, catch and release fishing can allow an increased number of anglers to benefit from a fishing experience (Walmo and Gentner 2008). Anglers may also release smaller fish in hopes of catching a larger fish to harvest.

ICR also has a LMB population (**Figure 5**), and anglers have caught LMB over five pounds, but only three have been reported in the last seven 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 preying on RT and LCT, especially the fingerling-sizes, but the level of LMB predation on stocked trout populations is unknown.



**Figure 5.** John Hanson with LMB caught at ICR. (Photo Courtesy of M. Mamola)

For a fifth consecutive year, shore angling was the most frequent method reported (Ewing 2020). This may be a result of anglers hesitant to launch their boat in a reservoir with prior poor water quality issues, as well as the paved public launch ramp being closed indefinitely due to the Tamarack Fire.

In 2021, the overall fishing experience for anglers at ICR was positive for the sixth time in seven years. Two reasons for the overall positive angling experience could be that anglers were satisfied with both the size and number of fish caught. Anglers have reported negative average angling experience only once in 11 years of surveys at ICR. This suggests that the fishery has provided a satisfactory experience for a majority of the survey period.

## Recommendations

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

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