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 – 2017) at Indian Creek Reservoir, Alpine County

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June 2018

Introduction

Indian Creek Reservoir (ICR) lies approximately three miles north of Markleeville off Highway 89 in eastern Alpine County (Figure 1). Indian Creek Reservoir is located within the East Fork Carson River watershed and was originally constructed between 1968-1970 to store tertiary treated wastewater exported from the Lake Tahoe basin by South Tahoe Public Utility District (STPUD). In 1989, the input of this treated wastewater ceased, but the lake is still a recreational sport-fishing destination due to continued stocking efforts from California Department of Fish and Wildlife (CDFW) and the Alpine County Fish and Game Commission (Alpine County). Indian Creek Reservoir has a maximum estimated depth of 50 feet and sits at an elevation of 5600 feet above mean sea level. In average water years ICR has a capacity of 110 surface acres. Indian Creek Reservoir has no major natural tributaries, receiving most of its inflow from a diversion from the West Fork Carson River. Indian Creek Reservoir 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 the only trout native to the eastern Sierra Nevada. Other native fish found in ICR include the Tui chub (Gila bicolor), mountain whitefish (*Prosopium williamsoni*), mountain sucker (*Catostomus platyrhynchus*), Lahontan redside (*Richardsonius egregius*) and the Tahoe sucker (*Catostomus tahoensis*). Brook trout (*Salvelinus fontinalis*, BK) were previously stocked at ICR by CDFW, but have not been reported in any field data covering the last seven survey years. Largemouth bass (Micropterus salmoides, LMB) also occur in ICR.

Methods

In 2017, anglers were asked to complete a voluntary survey form describing their fishing experience at one of the two angler survey boxes (ASB) at ICR. The survey asks 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, anglers were 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, size, and number of fish. The back of the survey form is reserved for anglers who have additional comments. The 2009, 2011-2013 data used for comparison in this report were gathered using the roving creel technique in which a CDFW scientific aide interviewed anglers about their angling experience (Hood 2013).

Figure 1. Indian Creek Reservoir, Alpine County, with Angler Survey Box Locations indicated by green dots.

Results

In 2017, 71 anglers responded to the survey. The seven-year average, including anglers who responded to the 2009 and 2011 – 2013 roving creel surveys was 80 (Hood 2013) (Table 1). Cumulatively, these anglers landed an average of 174 fish annually and averaged 257.2 hours of fishing (0.59 catch/hour). The catch per angler increased from 2016, but was well below the highest catch per angler seen in 2015 (4.78). Likewise, the catch per hour increased from the 0.40 average prior to 2015, but decreased from 1.22 in 2015 to 0.71 in 2017, a 42% decrease of catch per hour.

Table 1. Collection of average effort and catch statistics recorded from the roving creel surveys in 2009 and 2011-2013 and the 2015- 2017 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
Average	80	257.2	174	0.59	2.03

Prior to 2015, the method of take that caught the greatest number of fish was bait (37.8 %) (Table 2). In 2015 and 2016, the method of take that caught the greatest number of fish was flies (49.9 % and 52.2%), which is an increase of 20% and 24% from the previous years. In 2017, bait angling again had the greatest number of fish taken (49.2%). The method that caught the least percentage of fish in 2017 (3.7 %) and prior years was multiple methods, respectively.

Table 2. The number of fish landed by the type of gear from 2009, 2011 - 2013, and 2015 – 2017 at Indian Creek Reservoir, Alpine County.

	Number of Fish			
	2009, 2011 - 2013	2015	2016	2017
Angling Method				
Bait	140 (37.8%)	153 (39.5%)	96 (35.6%)	94 (49.2%)
Lure	17 (4.6%)	5 (1.3%)	8 (3.0%)	14 (7.3%)
Fly	107 (28.9%)	193 (49.9%)	141 (52.2%)	64 (33.5%)
Multiple	106 (28.6%)	15 (3.9%)	6 (2.2%)	7 (3.7%)
Not recorded	0	21 (5.4%)	19 (7.0%)	12 (6.3%)
Total	370	387	270	191

In 2017, anglers managed to catch less trout (n=190) than in 2016 (n=270) and 2015 (n=387). In 2017, anglers reported that 93.7% of trout landed were RT, 3.1% were BN, 2.6% were LCT, and less than 1% were LMB. The reported catch rates correspond with CDFW and Alpine County stocking records as 4,900 lbs. of RT being stocked in ICR in 2017 as compared to 1,147 lbs. of LCT (Table 4).

Table 3. Data on kept and released trout at Indian Creek Reservoir in 2009, 2011-2013, and 2015 - 2017.

Year	Species	Kept	Released	Unknown whether Kept or Released	Total Caught	Percent of Total Catch	Percent Released
2009, 2011 - 2013	BN	7	10	NA	17	4.6%	58.8%
	LCT	8	14	NA	22	5.9%	63.6%
	RT	136	193	NA	329	88.9%	58.7%
	Unknown	0	2	NA	2	0.5%	100.0%
TOTAL		151	219		370		
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%
TOTAL 2015		153	234		387		
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%	64.7%
	Unknown	0	1	NA	1	0.4%	100.0%
TOTAL 2016		82	187	1	270		
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		

* Unknown trout species

Table 4. CDFW and Alpine County stocking events from 2009 - 2017.

CDFW						Alpine County	
RT			LCT			RT	
Year	lbs.	Number	Year	lbs.	Number	Year	lbs.
2017	300	900	2017	83.3	750	2017	3600
	900	2970		83.3	750		
	100	370		300	150		
				90	756		
				90	756		
				500	250		
2016	0	0	2016	320	4192	2016	3600
				605	242		
				145	58		
2015	580	1508	2015	174	87	2015	3600
	1000	1500		200	100	2014	3600
2014	1600	3040	2014	600	300	2013	3600
2013	1220	2806		71.1	1209	2012	2800
	610	2013		2200	6160	2011	4950
2012	317.5	6000	2013	300	150	2010	3800
	2000	6000		300	150	2010*	1000
	625	2000		1376	14998	2009	16800
2011	674	5999	2012	1149	9996	2009*	2200
	1000	2000		220	110		
	3000	5400		380	190		
2010	1000	1500	2011	300	150		
	970	6014		300	150		
2009	599.7	4618	2010	600	300		
			2009	300	200		
	16496.2	54638		10686.7	42154		49550

*Denotes brown trout plant

Six anglers (8.5%) reported fishing from a boat, which resulted in the best success in terms of catch per angler (5.50 catch/angler) in 2017 (Table 5). Seven anglers (9.9%) reported no angling method, which resulted in the second best success rate in terms of catch per angler (3.43 catch/angler) in 2017. Twenty-eight anglers (39.4%) reported fishing by float tube, resulting in a 2.32 catch per angler success rate. Thirty anglers reported fishing from shore/wading and had a 2.30 catch per angler success rate.

Table 5. The Number of Anglers and Catch per Angler Based on Angling Method at Indian Creek Reservoir.

	Year			
	2016		2017	
Method	Number of Anglers	Catch per Angler	Number of Anglers	Catch per Angler
Boat	7	1.86	6	5.50
Float Tube	10	5.30	28	2.32
Shore or Wading	4	0.75	30	2.30
Not recorded	94	2.14	7	3.43

In 2017, the greatest percentage (32%) of landed RT (n = 57) that were measured were in the 12.0 – 13.9 in. length class (Figure 2), the same exact percentage from 2016. For LCT, 60% (n = 3) of the landed and measured fish were in the 18.0 – 19.9 in. length class. For BN, 67% (n = 4) of the landed and measured fish were in the 6.0 – 7.9 in. length class. One LMB was caught in the less than 6.0 in. length class.

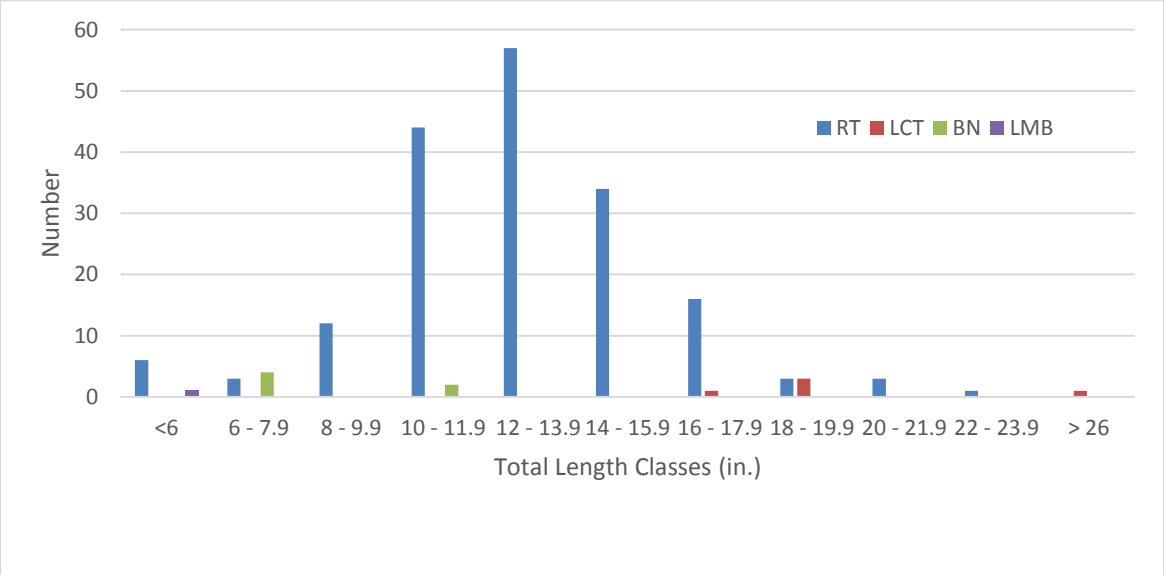

Figure 2. Frequency of identified fish in each size class that anglers reported landing at Indian Creek Reservoir in 2017.

In 2017, RT were caught in the greatest numbers for a second consecutive year, but of the 179 caught, 50.8% were released. In 2017, 51% of fish caught were released in comparison to 69% in 2016.

In 2017, anglers reported being more satisfied with their overall angling experience than the previous two years (Tables 6). Anglers have only had a negative average angling experience response once in seven years' of surveys, which is an indication that the fishery has provided a satisfactory experience for a large majority of the time surveys have been conducted. Anglers were satisfied with the size of fish over the seven-year sampling period with the 2017 value (1.00) similar to previous years' averages. Anglers were satisfied with the number of fish caught in 2017 (0.38) which was higher than the 2016 average (0.00), but lower than 2015 and before.

Table 6. Angler satisfaction response averages for the Indian Creek Reservoir fishery from 2009, 2011-2013, and 2015 - 2017.

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

Discussion

Data gathered from the ICR ASB shows anglers catching over two fish on average per trip for a third consecutive year, which is successful. Overall catch and CPUE in 2017 was the fourth and third highest in seven years (n=191) (0.71 fish/hour). The decrease could be attributed to the decrease of respondents from 2016 and 2015.

The greatest number of RT caught in 2017 were in the 12.0– 13.9 in. size class for a second consecutive year. This corresponds with anglers being satisfied with the size of their catch for a seventh consecutive sampling year. It is possible that there is a sustainable balance between number of fish and available resources in ICR, thus allowing the trout that are in ICR to grow to larger sizes. Anglers were satisfied with the numbers of fish caught in 2017. This is an increase from last year, but down from 2015 and prior. This could be due to the lack of any catchable RT planted in 2016 because of the drought.

Very few LCT were caught in 2017 compared to 2016 (Ewing 2016). This could be due to the approximately 1200 fingerlings planted in 2014 and no fingerling plants in 2015. CDFW has been stocking allotments of broodstock (2lbs) LCT from Heenan Lake (Alpine County) into ICR in recent years. However, anglers are not reporting catching many of these larger fish, as only one LCT over 20 inches was caught and reported in 2017, none in 2016, and only three in 2015. The broodstock LCT could potentially be swimming downstream into the Afterbay once being stocked, because they were stocked during their spawning season. CDFW may move the ICR broodstock allotment for 2019 to the East and

West Carson River in hopes of giving the public an opportunity to catch a trophy-size fish because the Afterbay is on private property.

It is often difficult to manage a fishery to satisfy both high catch rates and large size of fish caught; arguably ICR has provided both large fish and high catch rates over the seven years of this study.

Prior to 2015, the percentage of released species were very similar, ranging from 58.7% - 63.6%, but in 2015, 75.5% of the LCT were released compared to only 42.8% and 25.0% of RT and BN released, respectively. In 2016, 91.8% of LCT were released. In 2017, 50.8% of RT caught were released. In 2017, the greatest number of RT kept were in the 10.0 – 11.9 in. length class, while the greatest number of RT released were in the 12.0 – 13.9 in. length class. It is unclear as to why anglers preferred keeping certain sizes of trout. Mortal hook wounds in smaller fish may persuade some anglers in keeping smaller-sized rather than releasing them. Every year's ASB survey shows that LCT are being released at a higher percentage than RT. Alpine County stocks RT from a private aquaculturist in which the RT's meat is a pink color and has been an angler favorite according to Alpine County (T. Sadaro, Pers. Communication).

Indian Creek Reservoir also has a LMB population (Figure 3) where anglers have caught LMB over five pounds, with one LMB less than six inches recorded caught in 2017. It is possible that LMB could be predating on RT and LCT, but the actual percentage is unknown.

In 2017, shore angling was the greatest method of angling recorded, while in 2016 float tube angling was the greatest. This may be a result of the increased area of quality shoreline access after a record 2016/2017 winter rain/snowfall.

Figure 3. CDFW staff with LMB caught at ICR (M. Mamola).

The overall fishing experience for anglers in 2017 was positive at ICR for the second time in three years. It is possible the overall angling experience was positive in 2017 since neither the number of fish or size of the fish had a negative average value.

The number of respondents in the 2017 survey was 71, which is a fair number for an ASB, but the lowest for ICR's ASB.

Both CDFW and Alpine County stock ICR. Rainbow trout are stocked by both entities while LCT are stocked only by CDFW. The sizes of fish stocked include fingerling, sub-catchable, catchable, and super-catchable (trophy) 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 sub-catchable LCT, and it appears that the fish can grow out to a catchable size, and have showed up in large numbers. The lack of stocked LCT in 2015 may explain the decrease in LCT caught in 2017 compared to 2016. Rapid growth is expected from the fingerling and sub-catchable size trout due to the high productivity of ICR.

ICR is a very productive reservoir that has large amounts of aquatic vegetation covering the water surface during the summer months. This vegetative cover may have impeded fishing success for shore anglers when compared to float tube anglers in 2016. Although in 2017, the majority of anglers fished from shore compared to float tube anglers. With better shoreline access in 2017 due to the increased lake capacity, it may explain why more anglers reported shore fishing than tube fishing in

2017 compared to 2016. It is difficult to identify any overlying trends for angling method since the 2016 survey was the first allowing the angler to indicate the method of fishing used.

Largemouth bass are present in ICR but only one has shown up in the surveys. Largemouth bass have the potential to alter the fishery drastically, but it is hard to identify their effects without further studies. Electrofishing ICR by boat would help get a better understanding of the size of the LMB fishery and the possible presence of other warm water species.

Recommendations

- Broodstock LCT are not being reported in the ASB surveys in high numbers. Transfer broodstock allotment to the East and West Carson Rivers and monitor.
- Conduct a general fish survey to determine the relative population size of the LMB at ICR.
- Continue stocking efforts for RT and LCT.

References

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

2. Ewing, B. 2016. Indian Creek Reservoir, Alpine County Summary Report of Roving Creel Surveys (2009, 2011 – 2013) and 2015 - 2016 Angler Survey Box Analysis at Indian Creek Reservoir, Alpine County. http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=155185