State of California
The Natural Resources Agency
Department of Fish and Wildlife
North Central Region

Sugar Pine Reservoir, Placer County
General Fish Survey
October 4th, 2017

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Introduction

Sugar Pine Reservoir is located in Placer County, approximately seven miles north of Foresthill, California (Figure 1) and sits amongst dense mixed-conifer forest at an elevation of 3,600 feet above mean sea level. The dam was built in 1979 to impound North Shirttail Creek and Forbes Creek, tributaries to the North Fork American River. When full, the reservoir stores approximately 6,900 acre-feet and has a surface area of 165 acres that services the community of Foresthill. The Tahoe National Forest manages the land and facilities around the reservoir, including a trail system, boat ramp, and two campgrounds to accommodate visitors.

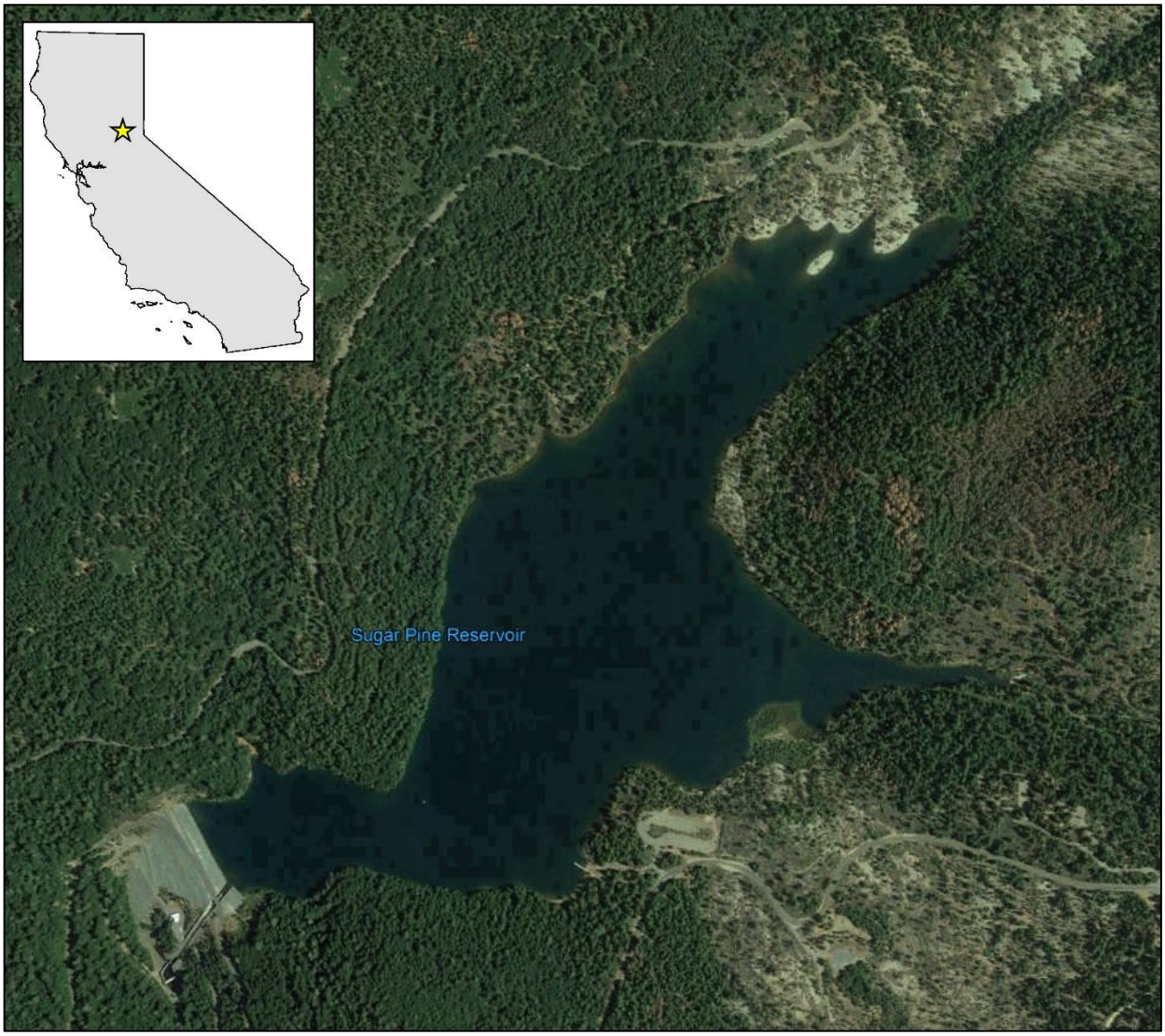


Figure 1: Google Earth overview image of Sugar Pine Reservoir, Placer County, California (retrieved Dec. 2017). The dam face is visible in the lower left corner of the photo. Shirttail Creek is visible in the upper right corner of the image and flows into the northern arm of the reservoir. Forbes Creek flows into the east arm of the reservoir and is visible in the right side of the image.

Fish species known to occur in Sugar Pine Reservoir include: rainbow trout (RT; *Oncorhynchus mykiss*); brown trout (BN; *Salmo trutta*); spotted bass (SPB; *Micropterus punctulatus*); largemouth bass (LMB; *Micropterus salmoides*); smallmouth bass (SMB; *Micropterus dolomieu*); green sunfish (GSF; *Lepomis cyanellus*); bluegill (BG; *Lepomis macrochirus*); and bullhead catfish (BB; *Ameiurus nebulosus*).

CDFW plants approximately 5,000 lbs. of catchable rainbow trout per year to provide a put-and-take fishery during peak recreation season. In 2017, the CDFW North Central Region (NCR) was awarded funding to assess

stocked waters using electrofishing general fish surveys and volunteer angler surveys (SFRA G1798040). This report summarizes the results of the first general fish survey at Sugar Pine Reservoir conducted using these funds.

Survey Effort

Mitch Lockhart, CDFW Environmental Scientist, operated a Smith-Root electrofishing boat (SR-18) during nighttime hours on October 4, 2017 to sample the shallow littoral habitat around the perimeter of Sugar Pine Reservoir. Isaac Chellman, CDFW Environmental Scientist, and one CDFW volunteer worked dip nets to capture stunned fish. The entire shoreline of the reservoir was sampled from 8:00 PM to 12:45 AM using a constant field while maneuvering slowly clockwise around the lake for 4.75 hours. Boat output was generally set between 40%-60% DC Low at 120 pulses per second.

All captured fish were held in a live well and measured to total length (TL) in millimeters (mm). A subset of at least 30 fish from each sport fish species were weighed in grams (g) using a digital scale. Non-game fish species were measured but not weighed. All fish were recovered and released back into the lake.

Analysis Methods

Catch rates for each species were calculated as catch per unit effort (CPUE), by dividing the number of fish captured by the hours sampled.

Length frequency histograms are a visual descriptor of length data. Length frequency data were generated for each species by counting the number of fish sampled whose total lengths fell within twenty-millimeter length intervals or size classes (Anderson and Neumann 1996). The length frequencies are plotted by length interval using Microsoft Excel©. The modal size class was determined by finding the size interval with the greatest frequency of fish.

Stock, quality, preferred, and memorable sizes referenced in this summary are based on standard proportions of world record lengths developed for each species by the American Fisheries Society. The designation of "juvenile size" has been assigned by the author to any fish smaller than stock size.

Relative weight (Wr) is a numerical descriptor of length-weight data that can provide insight into the condition and health of adult fish relative to other adult fish of the same species and size (Anderson and Neumann 1996). The equations are only appropriate for fish that exceed a minimum length dependent upon the species of fish. Wr values of 100 or higher indicate fish of "optimal" condition or health for a given size class compared to national averages. Wr is calculated as follows (Wege and Anderson 1978):

$$Wr = (W/Ws) * 100$$

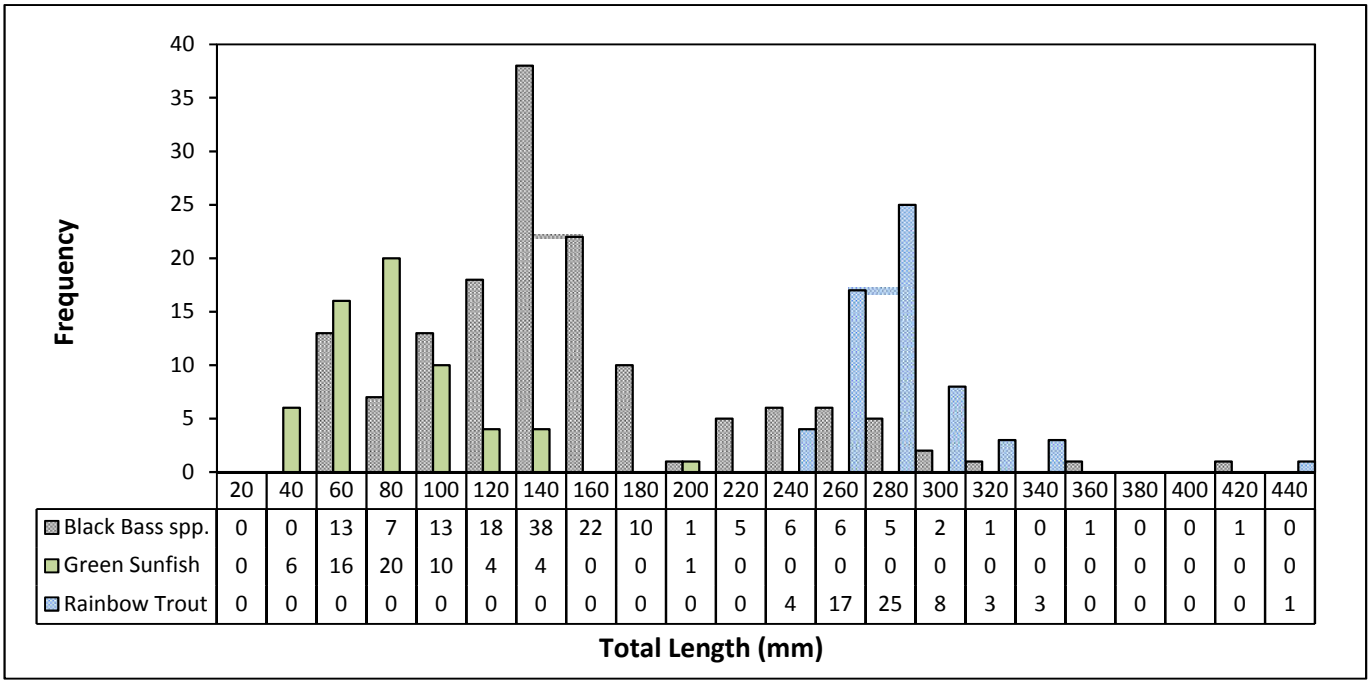
W equals the measured weight of an individual adult fish and Ws is a predicted weight from a length specific regression constructed to represent the species.

Results and Discussion

Catch data are summarized in Table 1 and Figure 2. In total, 291 fish were captured during 4.75 hours of sampling for a catch-per-unit-effort (CPUE) of 61.3 fish per hour. Six species of fish were captured: RT, LMB, SMB, SPB, and GSF.

Table 1: Summary of Electrofishing Catch for Sugar Pine Reservoir, 10.4.2017.

Species	*Number Caught*	*Percent Catch*	*CPUE (catch/hr.)*	*Mean Total Length (mm)*	*Modal Size Class*	*Mean Weight (g)*	*Condition (Mean W_r)*
Total	**291**	**100%**	**61.3**				
Black Bass spp.	149	51%	31.4	145mm (N=149)	121-140mm	78g (N=93)	93 (N=38)
Green Sunfish	61	21%	12.8	73mm (N=61)	61-80mm	-	-
Rainbow Trout	81	28%	17.1	271mm (N=81)	261-280mm	164g (N=63)	66 (N=61)



	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440
Black Bass spp.	0	0	13	7	13	18	38	22	10	1	5	6	6	5	2	1	0	1	0	0	1	0
Green Sunfish	0	6	16	20	10	4	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Rainbow Trout	0	0	0	0	0	0	0	0	0	0	0	4	17	25	8	3	3	0	0	0	0	1

Figure 2: Fish length frequency of electrofishing catch for Sugar Pine Reservoir, 10.4.17. The x-axis displays fish total length divided into 20mm size intervals. The x-axis labels are the upper limit of a particular size interval. For example, the largest fish caught was an RT with a total length between 421 and 440mm. The y-axis displays frequency of a particular size interval. Black bass *spp.* length frequency is displayed in gray. Green sunfish length frequency is displayed in green. While rainbow trout length frequency is displayed in blue.

Black Bass: One hundred and forty-nine black bass were captured comprising 51% of the catch. Unfortunately, due to inconsistencies in species identification and recording techniques throughout the sampling effort, it was not possible to separate the bass data by species. As a result, all bass will be referred to as black bass *spp.* (BAS) for the remainder of the report.

Despite the data recording errors, it was possible to determine some species-specific details even if discrete numbers were not attainable. Namely, the majority of BAS captured were LMB. SPB made up the smallest portion of the catch. The largest bass captured was a SMB (404mm, 854g). The modal size class for BAS was relatively small at 121-140mm but fish were in good condition as evidenced by a mean W_r of 93.

Figure 2 and Table 2 summarize the black bass catch by size class and clearly show the majority of BAS captured (82%) were of juvenile size (TL <200mm). Of 149 BAS captured only 27 (18%) were mature, stock-size fish (≥ 200mm), while five fish (3%) were of quality size. Given the time of year, it was expected that large numbers of juvenile BAS, yearlings from the spring spawn, would be found in shallow sections of the lake.

Table 2: Summary of Black Bass Catch by Size Category at Sugar Pine Reservoir, 10.4.2017.

Size	*Length*	*Number*	*Percent BAS catch*	*CPUE (catch/hr)*	*RSD*	*Mean Total Length (mm)*	*Mean Weight (g)*	*Condition (Mean W_r)*
Total		**149**	**100%**	**31.4**				
Juvenile size	≤ 199mm	122	82%	25.7	-	120mm (N=122)	29g (N=73)	94 (N=18)
Stock size	≥ 200mm	27	18%	5.7	-	258mm (N=27)	260g (N=20)	92 (N=20)
Quality size	≥ 300mm	5	3%	1.1	19	331mm (N=5)	507g (N=5)	91 (N=5)
Preferred size	≥ 380mm	1	1%	0.2	4	404mm (N=1)	854g (N=1)	85 (N=1)
Memorable size	≥ 510mm	0	0%	0.0	0	-	-	-
Trophy size	≥ 630mm	0	0%	0.0	0	-	-	-

Condition (mean W_r) was high for juvenile, stock, and quality size categories (>90) indicating these fish were in good condition compared to national data (Brouder 2009). Good condition suggests the population is neither

stunted nor over-abundant, and have ample forage. Prey items appropriate for small BAS and present in Sugar Pine Reservoir include GSF, crayfish, and other juvenile bass, all of which were abundant in the shallows.

Figure 3 compares the percentage of adult BAS catch per size category to the national average of spring nighttime electrofishing catch for small impoundments (Brouder et al. 2009). It is clear the adult BAS sample has a higher percentage of stock-size fish relative to national averages. In addition, the proportion of quality, preferred and memorable size fish is less than the national averages. The national averages of LMB and SMB are included to demonstrate that the aforementioned misidentification mistakes are not responsible for the skew. Analyzing relative stock densities (RSD) would help clarify the situation but too few stock, quality and memorable size BAS were captured.

The small sample of adult BAS could be due to a number of reasons. In general, adult BAS are easier to sample during spring when fish are in the shallows to get ready to spawn. Fall BAS surveys, on the other hand, target juvenile fish and yearlings. To account for this, ideally, the timing of fall BAS surveys should coincide with dropping water temperatures which encourage adult fish into the shallows to feed before winter. Water temperature measurements were not recorded during the night of October 4, 2017 due to a broken onboard sensor and therefore it is unclear if the survey was timed appropriately.

The next survey event should be conducted in spring when increasing surface water temperatures exceed 55 °F and adult bass move into the shallows to prepare for spawning. In addition, springtime surveys are more comparable to national datasets as opposed to fall surveys. Lastly, additional survey data is necessary to capture a larger sample of adult fish and determine differences between SMB, SPB, and LMB populations within the lake.

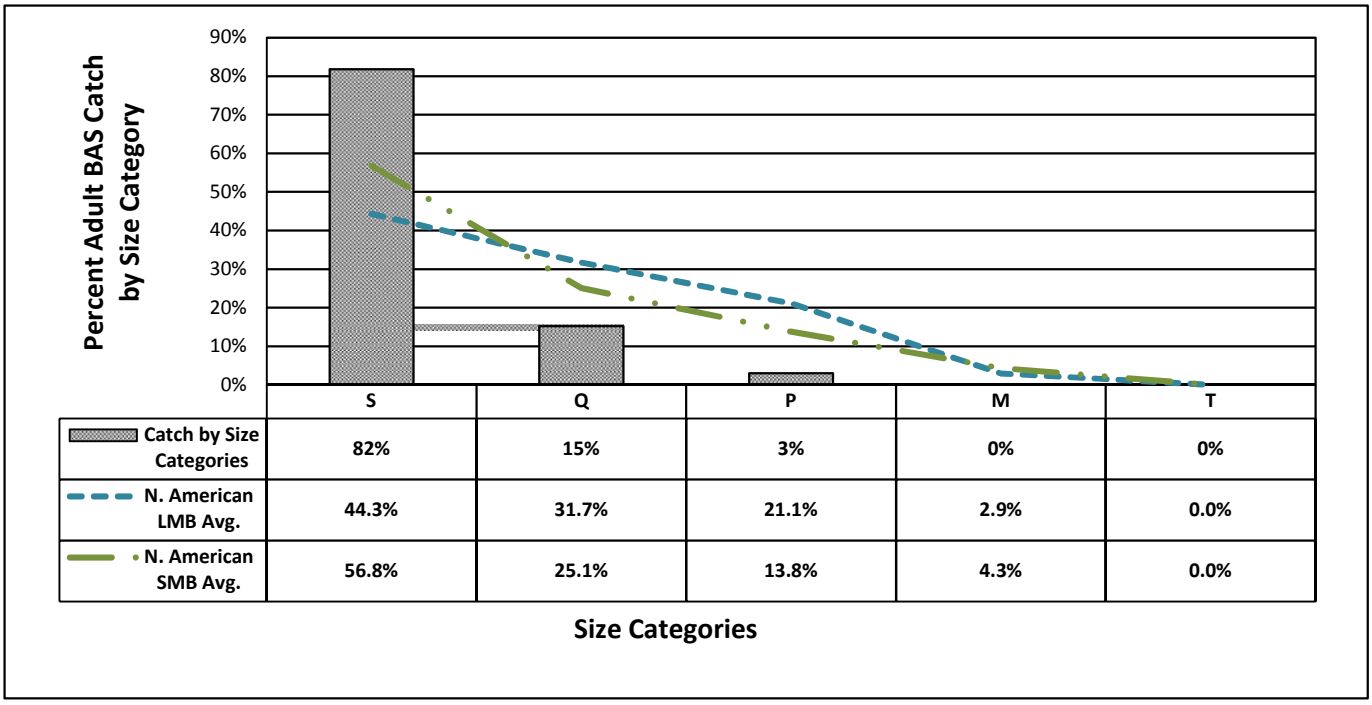


Figure 3: Percentage adult BAS catch by size categories (S=stock; Q=quality; P= preferred; M=memorable; T=trophy). The adult BAS sample from Sugar Pine Reservoir is displayed in gray. National averages for nighttime spring electrofishing samples on small impoundments are displayed for LMB in blue and SMB in green (Brouder et al. 2009).

Rainbow Trout

Sugar Pine Reservoir is planted regularly by CDFW with catchable rainbow trout. Table 3 summarizes rainbow trout plants since 2007. Variations in stocking levels over the past ten years have been driven by outside forces, such as hatchery production issues, rather than fisheries management decisions (Figure 4).

Table 3: Recent CDFW Stocking History at Sugar Pine Reservoir (retrieved Jan 2018).

Date	*Species*	*Pounds*	*Number*	*Fish/Lb.*
Total		**48,197**	**163,367**	
1/28/2018	RT	800	1,440	3.0
10/23/2017	ELT*	2,000	6,000	3.0
7/6/2017	RT	2,000	7,200	3.6
6/14/2016	RT	800	2,560	3.2
3/30/2016	RT	500	950	1.9
4/22/2015	RT	1,000	1,800	1.8
3/24/2015	RT	800	1,520	1.9
2/24/2015	RT	800	1,520	1.9
5/12/2014	RT	1,000	2,100	2.1
10/16/2013	RT	1,600	3,360	2.1
10/9/2013	RT	2,000	4,000	2.0
5/2/2013	RT	2,000	4,430	2.2
11/7/2012	RT	2,000	3,400	1.7
10/24/2012	RT	2,000	3,400	1.7
7/2/2012	RT	2,000	4,600	2.3
5/21/2012	RT	2,000	3,600	1.8
10/21/2011	RT	3,000	6,300	2.1
6/27/2011	RT	1,000	2,000	2.0
6/10/2011	RT	1,000	1,800	1.8
5/19/2011	RT	1,000	2,000	2.0
6/30/2010	RT-F*	49	20,384	416.0
6/29/2010	RT	1,500	3,000	2.0
6/15/2010	RT	1,000	2,000	2.0
5/12/2010	RT	1,000	1,500	1.5
4/26/2010	RT	1,000	1,500	1.5
4/9/2010	RT	1,000	2,100	2.1
3/17/2010	RT	2,000	3,200	1.6
7/22/2008	RT-F*	53	19,928	376.0
6/12/2008	RT	3,000	6,000	2.0
4/29/2008	RT	3,000	6,000	2.0
8/14/2007	RT-F*	295	25,075	85.0
6/11/2007	RT	1,000	1,900	1.9
5/11/2007	RT	2,000	3,200	1.6
4/11/2007	RT	2,000	3,600	1.8

*** ELT = Eagle Lake trout; RT-F= fingerling rainbow trout**

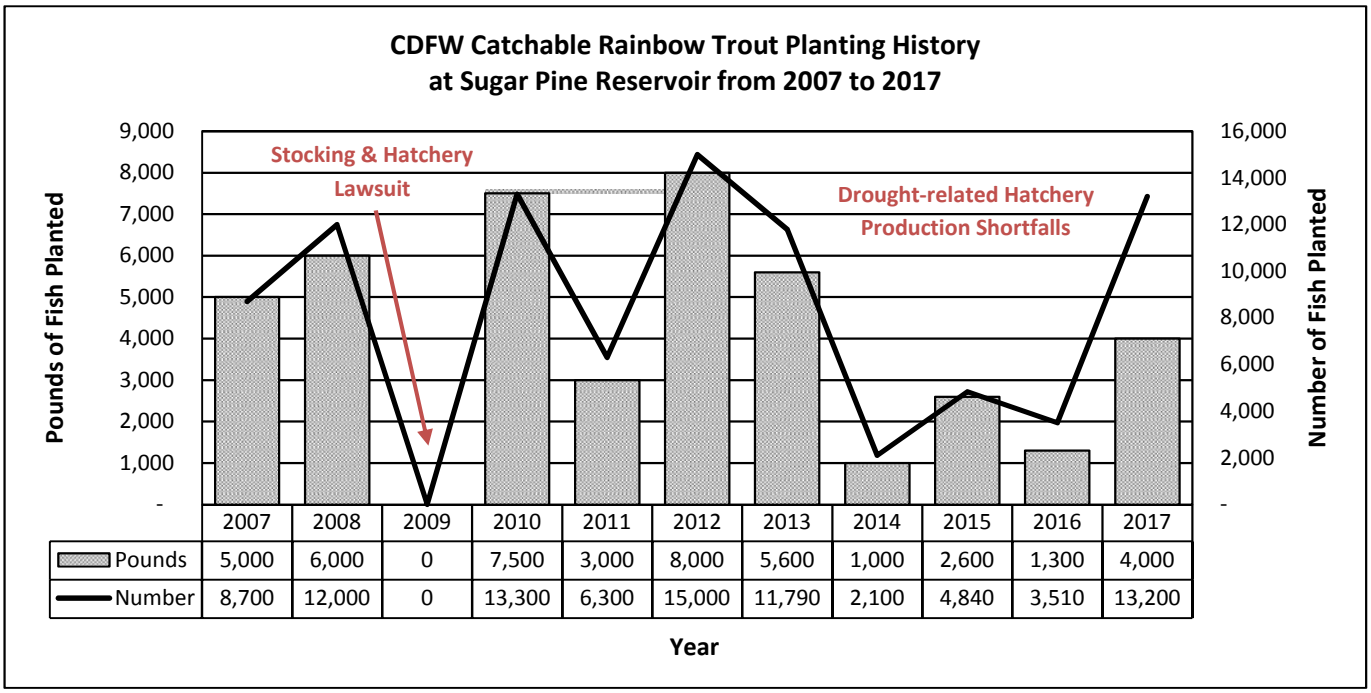


Figure 4: Summary of CDFW catchable rainbow trout plants at Sugar Pine Reservoir from 2007 to 2017 (retrieved Jan 2018). Pounds of catchable rainbow trout planted per year is displayed with gray bars. Number of catchable rainbow trout planted per year is displayed with a black line. Planting year is displayed along the X-axis.

Eighty-one RT were captured ranging from 236mm to 435mm in total length with a modal size class of 261-280mm. Figure 2 and Table 4 summarize the RT catch by size class and clearly show the majority of rainbow captured (83%) were stock-size adult fish (TL ≥250mm; Anderson & Neumann 1996). Fourteen (17%) RT captured were juvenile-size fish (TL<250mm) but were at the upper limit of that size class with a mean TL of 240mm. These two size classes of RT are likely from the planting event on July 6, 2017, three months before the survey (Table 3).

Only one fish captured was of quality-size (TL ≥400mm), therefore no stock density proportions can be calculated. This fish is likely a holdover from a stocking event prior to July 2017. The next most recent stocking event was June 14, 2016 (Table 3).

Table 4: Summary of Rainbow Trout Catch by Size Category at Sugar Pine Reservoir, 10.4.2017.

Size	*Length*	*Number*	*Percent RT catch*	*CPUE (catch/hr.)*	*RSD*	*Mean Total Length (mm)*	*Mean Weight (g)*	*Condition (Mean W_r)*
Total		**81**	**100%**	**17.1**				
Juvenile size	≤ 249mm	14	17%	2.9	-	240mm (N=14)	107g (N=10)	66 (N=8)
Stock size	≥ 250mm	67	83%	14.1	-	278mm (N=67)	175g (N=53)	66 (N=53)
Quality size	≥ 400mm	1	1%	0.2	1	435mm (N=1)	665g (N=1)	68 (N=1)
Preferred size	≥ 500mm	0	0%	0.0	0	-	-	-
Memorable size	≥ 650mm	0	0%	0.0	0	-	-	-
Trophy size	≥ 800mm	0	0%	0.0	0	-	-	-

RT weight varied between 84g to 665g with a mean weight of 164g. The RT sampled were in poor body condition with a mean relative weight (W_r) of 66. Heavy infestations of small white worms were visible on the outside of nearly all RT captured. The parasites were observed on the skin of the fish, generally above the lateral line, and between the dorsal fin and peduncle. The parasites may be *Salmincola californiensis* (M. Adkison, pers. comm., Jan. 18, 2018), a parasitic copepod that infects *Oncorhynchus spp.* and is common in California waters. Unfortunately, no vouchers or photos were collected to verify. The two largest RT captured (435mm, 665g, W_r 68; 333mm, 302g, W_r 69) were visibly in better condition than the majority of the catch (mean W_r 66). Moreover, parasites were not visible on the exterior of the fish. This may indicate that RT planted in mid-summer at Sugar Pine Reservoir are prone to parasitism, poor health, and slow growth rates.

Additional springtime surveys are necessary to determine if RT from these stocking events successfully hold over into the 2018 season. Moreover, with a large enough RT sample, there may be measurable differences in hold over success between RT from summer vs winter planting events.

It is suspected that RT spawning habitat is extremely limited and that RT are not self-sustaining at Sugar Pine Reservoir. This assumption is supported by the absence of yearling or young-of-year size classes from the catch. In addition, Mitch Lockhart visually surveyed the first 200 meters of Shirttail Creek and Forbes Creek in June 2017 and did not observe fish in the creeks nor spawning habitat suitable for RT. Additional surveys are necessary to lend confidence to this conclusion.

Green Sunfish

Sixty-one GSF were captured ranging from 34mm to 192mm total length. The modal size class was 71-80mm. Of the 61 GSF captured, 20 (33%) were stock-size (TL≥80mm) while 41 were juvenile-size (TL<80mm). A single (2%) fish was of quality-size (TL≥150mm). GSF were not weighed, therefore mean condition cannot be calculated. Too few adult BAS and adult GSF were captured to conduct a relative stock density analysis between BAS and GSF. As a result, no further analysis of the GSF catch has been conducted for this report.

Recommendations

- Repeat the survey during spring using water surface temperature data to help time the survey when adult bass are in the shallows and available for capture by an electrofishing boat.
- Repair temperature sensor.
- Compare RT results from fall to spring to determine holdover success of RT planted in 2017.
- Analyze Angler Survey Box data for Sugar Pine Reservoir.
- Consider timing of plants in hold over success
- Collect voucher of parasitized RT for analysis at the CDFW Fish Health Laboratory.

Literature Cited

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