



**State of Utah
Department of Natural Resources
Division of Wildlife Resources**

**Native Cutthroat Trout (*Oncorhynchus clarkii* ssp.) Conservation
Activities in the Northern Region, 2021**



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Utah Division of Wildlife Resources
1594 West North Temple
Salt Lake City, Utah 84414

J. Shirley, Director

Native Cutthroat Trout (*Oncorhynchus clarkii* ssp.) Conservation Activities in the Northern Region, 2021

by

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INTRODUCTION

BONNEVILLE CUTTHROAT TROUT (*Oncorhynchus clarkii utah*)

The Bonneville Cutthroat Trout (BCT) conservation activities by the UDWR Ogden Office in 2021 included population monitoring in the Woodruff Creek and Otter Creek drainages in the Bear River GMU, population monitoring in the Ogden River and Weber River drainages in the Northern Bonneville GMU, collection of samples for genetic analysis, and stocking of BCT into both Big Creek and Deadman Creek in Summit County. In addition, passive instream arrays (PIA) were placed in lower Weber River tributaries to further assess fish passage improvement projects. Activities conducted during 2021 will help accomplish the objectives for long-term conservation of BCT in Utah (BCT State of Utah Conservation Team 2008) and range-wide (Oplinger and Birdsey 2019).

COLORADO RIVER CUTTHROAT TROUT (*Oncorhynchus clarkii pleuriticus*)

The Colorado River Cutthroat Trout (CRCT) conservation activities conducted in 2021 included population monitoring in Little West Fork Blacks Fork and the rotenone treatment of the West Fork Smiths Fork drainage. The work completed in the Upper Green GMU North Slope subunit will help accomplish the objectives for long-term conservation of CRCT in Utah (Lentsch and Converse 1997).

YELLOWSTONE CUTTHROAT TROUT (*Oncorhynchus clarkii bouvieri*)

Yellowstone Cutthroat Trout (YCT) conservation work in 2021 was limited to population monitoring of select streams in conjunction with nongame species monitoring. As with the other cutthroat trout subspecies, conservation activities involving YCT help accomplish the objectives for long-term conservation of YCT (Range-wide YCT Conservation Team 2009).

METHODS

All stream surveys and monitoring stations were completed at or near base flow conditions. Surveys were completed to determine the extent of the resident cutthroat trout populations in each stream/stream section. When possible, stream survey locations were chosen as closely as possible to previous UDWR or USFS survey locations. Approximately 158 people days were required to complete the native cutthroat trout fieldwork in the Northern Region during 2021.

For surveys on small streams, a 100 m reach, representing habitat conditions throughout the entire stream/section, was identified. For monitoring efforts, the attempt was made to revisit select stations surveyed previously. Stations were measured using a 100 m tape. A natural habitat break (e.g., small waterfall/cascade) was chosen for the upper end of each reach and whenever possible, the lower end. Two to four battery-powered backpack electrofishing units, manufactured by Smith-Root or Halltech, were utilized side-by-side for surveys on larger streams (e.g., streams >2.5-7 m in width). On the remaining surveys, a single battery-powered backpack electrofishing unit was used. Between two and eight personnel were utilized on electrofishing surveys. Electrofishing settings varied depending on stream conductivity. In general, the frequency was set at 60 Hz and the voltage at 250-350V when using a Halltech HT-2000, and 50 Hz, 25% duty cycle, and 250V when using a Smith-Root LR-20B.

All captured fish were transferred to live cages placed in the stream. Fish collected from the first electrofishing pass were kept separate from fish collected on the second electrofishing pass, and so forth. Fish processing and data collection commenced immediately following electrofishing and fish not collected for genetic analyses or health inspections were returned to

the stream. All fish captured were measured to the nearest millimeter (mm) total length (TL) and weighed to the nearest gram (g). Identification of cutthroat trout x rainbow trout hybrids is generally based on examination of phenotypic traits, primarily spotting patterns, fin tips and body coloration.

Population estimates were calculated separately for \geq age-1 salmonids and age-0 salmonids because smaller fish are not immobilized as effectively as larger fish while electrofishing (Reynolds 1989) and consequently, population estimates for age-0 fish are usually not as meaningful. In general, cutthroat trout <50-60 mm TL were considered to be age-0.

Population estimates were based on two-pass electrofishing, unless otherwise noted. A modified Zippin multiple pass depletion electrofishing formula was used to calculate the population estimates and ninety-five percent confidence limits for each site surveyed (Zippin 1958). The formulas used to calculate the estimates were:

$$N = C_1^2 / C_1 - C_2$$
$$SE = [C_1 * C_2 / (C_1 - C_2)^2] * (C_1 + C_2)^{1/2}$$
$$95\% \text{ C.I.} = 2 * SE$$

where,

N = estimated fish population,

C₁ = the number of fish captured from the first pass, and

C₂ = the number of fish captured on the second pass.

Condition factor (K) was calculated using the formula:

$$K = W * 100,000/L^3$$

where,

W = weight in g, and

L = TL in mm.

All cutthroat trout tissue samples retained for genetic analyses were collected according to protocol established by Brigham Young University (BYU). These samples were submitted to the Salt Lake Office during the fall of 2021 and will be analyzed with nuclear DNA and mitochondrial DNA techniques.

Population estimates were not attempted for many of the non-game species because these species are difficult to capture. An estimate of abundance was made for these species as follows: >50 individuals per 100 m - abundant, 10-50 individuals per 100 m station - common, and <10 individuals per 100 m station - sparse. Due to the difficulty of differentiating Mottled Sculpin (*Cottus bairdii*) and Piute Sculpin (*C. beldingii*) in the field, no distinction was attempted for this report and these species are simply referred to as sculpin.

Temperature data collection

Temperature loggers were deployed in various streams/sections in an effort to contribute to various programs and projects, including the development of models to assess future climate scenarios, prioritize habitat restoration opportunities (Oplinger and Birdsey 2019), and evaluate suitability of stream temperatures in select streams for cutthroat trout reintroduction potential. Temperature data will be shared with researchers at Utah State University, Trout Unlimited, and the NorWeST Interagency temperature database.

Methods for Weber River Section 04 and tributary sampling

In the ongoing effort to assess the BCT population in the Weber River and tributaries in Section 04, electrofishing was used to collect BCT. Sampling on the mainstem involved the use of canoe-mounted electrofishing equipment, and backpack electrofishing was used in the tributaries. All BCT captured were measured (TL to nearest mm), weighed (to nearest gram), and inspected for an adipose fin clip. If not clipped, the fish was marked by clipping the adipose fin and injecting a uniquely coded Passive Integrated Transponder (PIT) tag, and released. If clipped, the fish was scanned for a PIT tag and processed accordingly (i.e. if present, PIT code was recorded; if absent, fish was re-marked with a PIT tag in order to collect data in the future). In addition, UTM coordinates were recorded for each tagged fish. Stream distance between UTM coordinates of initial capture and coordinates of recapture was calculated for all recaptured individuals.

In an effort to further evaluate use of specific tributaries by tagged fish during the spawning season, instream antennas were used similar to previous years (see McKell 2014). Two antennas were placed in Strawberry Creek, one downstream of the culvert fish ladder and one upstream, and two antennas were deployed in Jacobs Creek, one downstream of the upper culvert and one upstream. Antennas generally consisted of a flat plate attached to a reader/recorder with a power source (usually 12V deep-cycle battery), that was installed in a location or in a manner that would detect all tagged fish that swam over or near the antenna. Batteries were rotated and recharged twice weekly, and tag data were transferred from readers via the computer software HyperTerminal after the sampling period had ended.

RESULTS AND DISCUSSION
BONNEVILLE CUTTHROAT TROUT

Surveys

Efforts to increase knowledge of the distribution of BCT through inventory of previously un-surveyed streams in the Bonneville Basin are essentially complete.

Monitoring

Multiple-pass electrofishing was completed on 23 streams/sections during 2021 BCT monitoring efforts (Table 1). Eight of the monitored populations appeared to have increased since the previous survey, 13 showed a decline, and two remained essentially flat.

Fish species encountered during stream sampling in 2021 included Bonneville Cutthroat Trout, Brook Trout (BKT; *Salvelinus fontinalis*), Brown Trout, (BNT; *Salmo trutta*), Longnose Dace (LND; *Rhinichthys cataractae*), Mountain Sucker (MTS; *Catostomus platyrhynchus*), Mountain Whitefish (MWF; *Prosopium williamsoni*), Northern Leatherside Chub (NLSC; *Lepidomeda copei*), Rainbow Trout (RBT; *Oncorhynchus mykiss*), Rainbow Trout x Cutthroat Trout hybrids (RTHY), Redside Shiner (RSS; *Richardsonius balteatus*), sculpin (SC; *Cottus* spp.), Speckled Dace (SPD; *Rhinichthys osculus*), Utah Chub (UTC; *Gila atraria*), and Utah Sucker (UTS; *Catostomus ardens*).

Table 1. Results of BCT population monitoring in 2021.

Stream/section	Year	# of ≥age-1 BCT/km	# of ≥age-1 BCT/mile
Bear River GMU, Uinta Mountains/Upper Bear River Subunit			
	2021	58 ± 12	93 ± 19
	2017	196 ± 33	315 ± 53
	2014	72 ± 9	116 ± 14
Mill Creek, border			
	2011	45 ± 131	72 ± 212
	2008	120 ± 8	193 ± 13
	2006	140 ± 7	225 ± 11
	2003	80 ± 37	129 ± 60
Bear River GMU, Rich County Subunit			
South Branch Otter Creek			
	2021	63 ± 15	101 ± 24
	2019	none captured	
Middle Branch Otter Creek, lower			
	2021	303 ± 53	487 ± 86
	2019	110 ± 8	177 ± 13
Middle Branch Otter Creek, upper			
	2021	none captured	
	2019	20 ± 0	32 ± 0

Table 1.—cont.

Stream/section	Year	# of \geq age-1 BCT/km	# of \geq age-1 BCT/mile
Woodruff Creek	2021	229 \pm 13	369 \pm 21
	2016	374 \pm 31	601 \pm 50
	2011	303 \pm 35	488 \pm 56
	2006	610 \pm 50	982 \pm 80
	2000	1087 \pm 439	1749 \pm 706
Birch Creek	2021	516 \pm 19	831 \pm 31
	2016	none captured, age-0 only	
	2011	107 \pm 28	172 \pm 44
	2006	140 \pm 0	225 \pm 0
	2000	701 \pm 41	1128 \pm 65
Sugar Pine Creek (USFS)	2021	529 \pm 24	851 \pm 39
	2016	517 \pm 7	832 \pm 11
	2011	none captured	
	2006	366 \pm 17	589 \pm 27
	2000	729 \pm 45	1174 \pm 72
Wheeler Creek (USFS)	2021	529 \pm 24	851 \pm 39
	2016	none captured, age-0 only	
	2011	107 \pm 28	172 \pm 44
	2006	203 \pm 12	326 \pm 20
	2000	1013 \pm 28	1629 \pm 44
Big Spring Creek (USFS)	2021	1895 \pm 449	3050 \pm 722
	2016	405 \pm 17	652 \pm 28
	2011	180 \pm 372	290 \pm 598
	2006	261 \pm 26	420 \pm 42
	2000	691 \pm 41	1113 \pm 67
Bear River GMU, Cache County Subunit			
Right Hand Fork Logan River	2021	1052 \pm 91	1694 \pm 146
	2018	2488 \pm 74	4005 \pm 119
Northern Bonneville GMU, Ogden River Subunit			
Wheeler Creek (USFS)	2021	141 \pm 7	227 \pm 11
	2016	327 \pm 22	526 \pm 35
	2005	306 \pm 33	493 \pm 53

Table 1.—cont.

Stream/section	Year	# of \geq age-1 BCT/km	# of \geq age-1 BCT/mile
Beaver Creek (South Fork Ogden River Drainage)	2021	322 \pm 32	518 \pm 52
	2016	none captured, station dry	
	2011	219 \pm 12	352 \pm 20
	2006	403 \pm 7	649 \pm 11
Left Fork South Fork Ogden River	2021	249 \pm 50	401 \pm 81
	2013	443 \pm 98	712 \pm 158
	2006	479 \pm 20	772 \pm 32
	1996	688 \pm 129	1107 \pm 208
North Fork Ogden River, Section 03	2021	322 \pm 32	518 \pm 52
	2020	650 \pm 54	1046 \pm 87
	2016	410 \pm 3	660 \pm 5
	2011	439 \pm 34	868 \pm 55
	2006	482 \pm 10	779 \pm 17
	2000	716 \pm 87	1153 \pm 140
Wolf Creek	2021	94 \pm 12	151 \pm 20
	2016	312 \pm 74	502 \pm 120
	2011	240 \pm 61	386 \pm 99
	2006	558 \pm 103	899 \pm 166
	2000	317 \pm 22	510 \pm 36
South Fork Wolf Creek (USFS)	2021	758 \pm 125	1219 \pm 202
	2016	641 \pm 55	1032 \pm 89
	2011	499 \pm 33	803 \pm 52
	2006	615 \pm 38	989 \pm 61
	2000	811 \pm 126	1305 \pm 202
Cold Canyon (USFS)	2021	10 \pm 0	16 \pm 0
	2016	203 \pm 206	326 \pm 332
	2011	216 \pm 22	348 \pm 35
	2006	140 \pm 0	225 \pm 0
	2000	366 \pm 38	588 \pm 61
Cutler Creek (USFS)	2021	245 \pm 19	394 \pm 30
	2016	111 \pm 8	179 \pm 13
	2011	200 \pm 70	323 \pm 113
	2006	197 \pm 24	317 \pm 39
	2000	302 \pm 9	485 \pm 14

Table 1.—cont.

Stream/section	Year	# of \geqage-1 BCT/km	# of \geqage-1 BCT/mile
Northern Bonneville GMU, Weber River Subunit			
	2021	122 \pm 6	197 \pm 9
	2016	234 \pm 19	376 \pm 31
Weber River, Section 10, Cottonwood Site	2010	95 \pm 3	153 \pm 4
	2005	156 \pm 17	251 \pm 27
	1998	302 \pm 9	485 \pm 14
Weber River, Section 11, Aspen Acres	2021	32 \pm 12	52 \pm 19
	2016	93 \pm 7	149 \pm 11
	2005	141 \pm 5	227 \pm 8
	1998	345 \pm 12	554 \pm 19
Weber River, Section 12, headwaters	2021	28 \pm 0	46 \pm 0
	2010	43 \pm 16	69 \pm 25
Echo Creek	2021	141 \pm 7	227 \pm 11
	2018	229 \pm 33	369 \pm 54
	2014	58 \pm 38	93 \pm 61
	2007	85 \pm 11	137 \pm 18
Heiners Creek	2021	two captured, no depletion	
	2007	26 \pm 0	42 \pm 0

BEAR LAKE GMU

Bonneville Cutthroat Trout work in the Bear Lake GMU was coordinated and completed by personnel at Bear Lake Field Station. Results from 2021 activities may be found in reports prepared by the field station.

BEAR RIVER GMU Uinta Mountains/Upper Bear River Subunit

Mill Creek Monitoring

IVAQ230

The Mill Creek “border” station, 200 m in length, was electrofished on July 28, 2021. This is a Northern Leatherside Chub monitoring station currently scheduled for sampling on a 3-year cycle. Results of the current and previous surveys are shown in Table 2 and Figure 1. Based on seven data points for this monitoring station, the BCT population decreased from its largest in 2017 to second lowest in 2021, a numerical reduction of 70%. Estimated BCT biomass also decreased but by a larger margin (85%) (Table 2). In contrast to the observation made in 2017, that Brook Trout were exhibiting a continual increase in the station, 2021 saw a substantial decrease in their number and biomass.

Table 2. Population statistics for species sampled in the Mill Creek border station, 2003, 2006, 2008, 2011, 2014, 2017, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	11	58±12 (93±19)	8 (7)	192	138-290	80	28-223	1.15
	≥age-1 BKT	4	23±15 (36±24)	4 (3)	181	127-240	79	22-160	1.10
	age-0 BKT	14	83±41 (134±66)		65	51-79	3	1-5	
	MWF	3	15±0 (24±0)	<1 (<1)	109	105-116	11	10-12	0.86
	LND		abundant						
	MTS		common						
	NLSC		sparse						
	RSS		sparse						
	SC		abundant						
	SPD		abundant						
	UTC		sparse						
	UTS		sparse						
	2017	≥age-1 BCT	36	196±33 (315±53)	55 (49)	254	162-447	189	36-779
≥age-1 BKT		34	206±70 (331±113)	28 (25)	199	134-261	93	22-190	1.07
age-0 BKT		17	405±3K (652±5K)	3 (3)	78	60-101	5	1-10	
MWF		3	20±34 (32±55)		121	98-165			
FHM			sparse						
LND			abundant						
MTS			common						
NLSC			common						
RSS			sparse						
SC			abundant						
SPD			abundant						
UTS			sparse						

Table 2.—cont.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2014	≥age-1 BCT	14	72±9 (116±14)	18 (16)	260	165-372	176	36-446	0.84
	≥age-1 BKT	29	152±18 (244±28)	22 (19)	195	122-345	100	15-391	0.95
	age-0 BKT	18	106±42 (170±68)	1 (1)	79	63-98	4	2-7	
	MWF	9	46±5 (74±8)	1 (1)	115	73-148	19	2-30	0.81
	FHM		sparse						
	LND		abundant						
	MTS		abundant						
	NLSC		sparse						
	RSS		sparse						
	SC		abundant						
	SPD		abundant						
UTS		sparse							
2011	≥age-1 BCT	5	45±131 (72±212)	14 (12)	264	173-323	218	62-353	1.06
	≥age-1 BKT	33	184±39 (296±63)	39 (35)	185	56-393	154	3-656	1.04
	MWF	27	256±358 (412±577)	21 (19)	168	71-300	61	4-271	0.93
	LND		abundant						
	MTS		common						
	RSS		sparse						
	SC		abundant						
	SPD		common						
UTS		sparse							
2008	≥age-1 BCT	12	120±8 (193±13)	40 (35)	261	163-360	181	17-486	0.92
	≥age-1 BKT	6	60±4 (97±6)	10 (9)	185	100-240	88	11-171	1.14
	age-0 BKT	1	10±0 (16±0)		66		1		
	MWF	14	160±76 (257±122)	5 (4)	112	60-187	16	1-52	0.71
	LND		abundant						
	MTS		common						
	NLSC		sparse						
	RSS		sparse						
	SC		abundant						
	SPD		common						
UTS		sparse							
2006	≥age-1 BCT	14	140±7 (225±11)	33 (30)	211	76-371	131	5-438	1.04
	MWF	5	50±7 (80±11)		79	57-135	6	1-22	0.89
	LND		abundant						
	MTS		common						
	NLSC		common						
	RSS		sparse						
	SC		abundant						
	SPD		common						
UTS		sparse							
2003	≥age-1 BCT	8	80±37 (129±60)	20 (18)	241	189-328	143	55-338	0.94
	≥age-1 BKT	4	40±26 (65±42)	4 (4)	184	177-190	65	55-81	1.03
	age-0 BKT	3	36±61 (57±98)		82	80-84	8	4-10	
	MWF	5	80±235 (129±378)		77	71-82	4	2-6	0.83
	LND		abundant						
	MTS		common						
	NLSC		sparse						
	RSS		common						
	SC		abundant						
	SPD		abundant						
UTS		common							

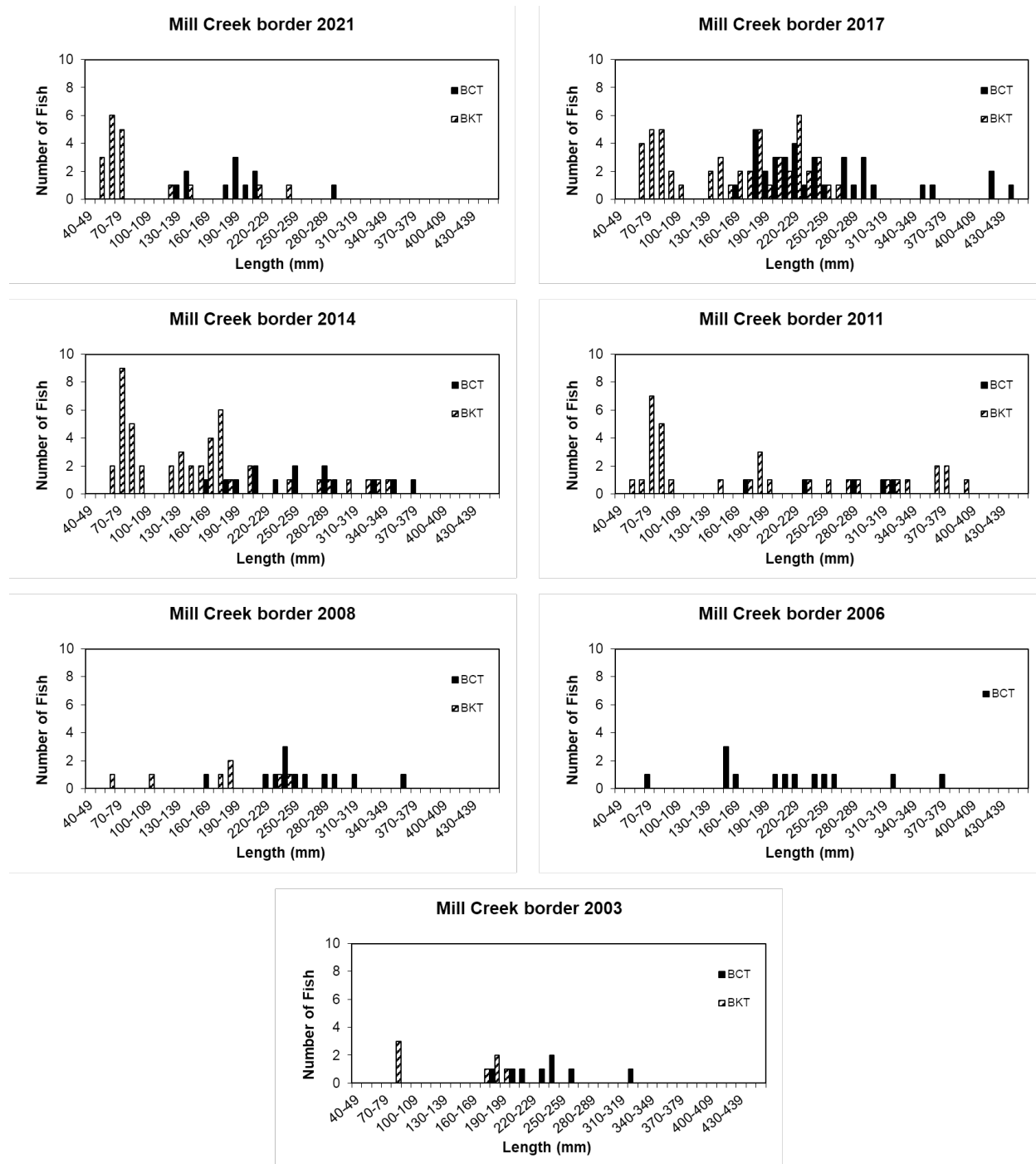


Figure 1. Size distribution of salmonid species sampled in the Mill Creek border monitoring station, 2003, 2006, 2008, 2011, 2014, 2017, and 2021.

Deadman Creek
Chemical Reclamation

IVAQ230B

In an effort to assess the effectiveness of the rotenone treatment conducted in September 2020, a set of water samples were collected on October 22, 2021, from 10 sites in the Deadman

Creek drainage. Sample locations were spread throughout the drainage with some sites selected based on questions regarding rotenone effectiveness. Samples were collected according to lab protocols and will be analyzed for the presence of Brook Trout eDNA by the National Genomics Center for Wildlife and Fish Conservation in Missoula, Montana.

Gold Hill Creek
Monitoring

IVAQ270A

The monitoring station sampled annually between 2010 and 2020 was sampled in 2021, but an equipment issue prevented completion of two-pass depletion sampling. Length frequency data for BCT collected in a single electrofishing pass through the station on June 25, 2021, are shown in Figure 2 along with length-frequency data since 2016. Recruitment has been documented each year, with relatively strong age-1 cohorts present during most years, and consistent age structure from year-to-year (Figure 2).

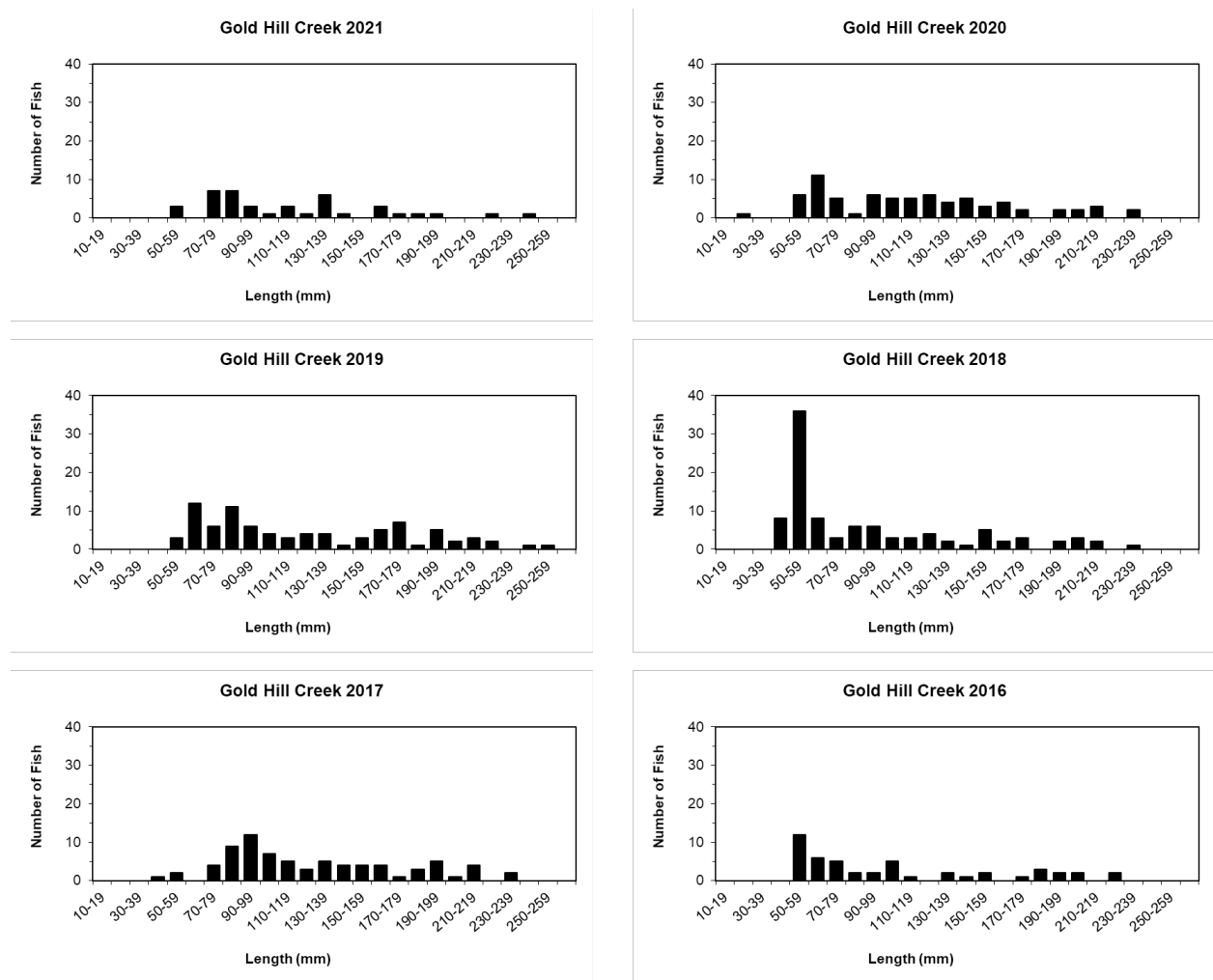


Figure 2. Size distribution of BCT sampled in Gold Hill Creek, 2016-2021.

Rich County Subunit

South Branch Otter Creek

IVAQ170A

Monitoring

This station, 100 m in length, was electrofished on July 9, 2021. This station was surveyed in 2019 to assess BCT population status following rotenone treatments in 2015 and 2016, and although two age-classes of BCT were stocked in the South Branch in October 2016 (McKell 2017), no fish were sampled in the station in 2019 (McKell 2020). Results of the 2021 sampling are shown in Table 3 and Figure 3. Although not as rapid as has occurred post-treatment in other drainages, BCT have begun to repatriate the South Branch, and monitoring will occur on a regular cycle.

Table 3. Population statistics for species sampled in South Branch Otter Creek, 2015-2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	6	63±15 (101±24)	10 (9)	155	109-209	43	12-98	0.99
2019	No fish sampled								
2016	BCT stocked post-treatment								
2015	≥age-1 BKT	1	9±0 (14±0)	2 (2)	168	44-66	46	20-503	0.97
	age-0 BKT	11	present		51	126-361	114		0.99
	≥age-1 BNT	23	206±4 (331±7)	122 (109)	203	35-45			
	age-0 BNT	15	154±61 (248±98)		40	44-90			
	SC	554	abundant		60				

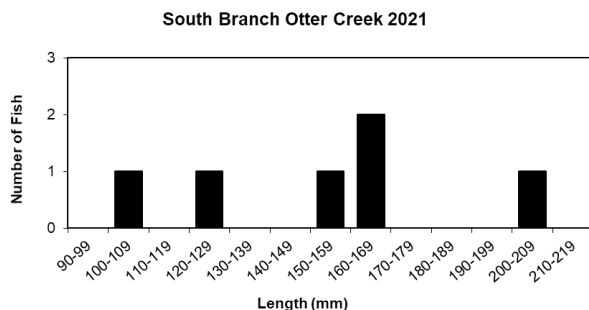


Figure 3. Size distribution of BCT sampled in South Branch Otter Creek monitoring station, 2021.

Middle Branch Otter Creek

IVAQ170A01

Monitoring

In an effort to monitor the restoration of BCT in the Otter Creek drainage, two stations in the Middle Branch were sampled in 2021, replicating sites sampled in 2019 to evaluate post-treatment fish densities. The two sites, both upstream of the Pole Line Road, were electrofished on July 9, 2021. The lower of the two stations was within a BLM riparian enclosure and the other directly upstream and outside of the enclosure. Both stations were 100 m in length.

Lower Station

In contrast to 2019 when only BCT were sampled in this station, the 2021 sampling yielded BCT as well as sculpin. The BCT catch was likely comprised of three age-classes in both 2019 and

2021, although representation of the age-1 cohort was greater in 2021 (Figure 4). The biomass estimate for BCT was good in both years.

Upper Station

This station contained only sculpin in 2021 (Table 4), although BCT were found 30 m upstream of the station via spot electrofishing.

Based on the two data points for these stations, which were spatially contiguous and separated only by a barbed-wire fence, the habitat within the BLM riparian enclosure is more suitable for BCT than the habitat immediately upstream. This is supported by the increased abundance of BCT in the lower station and the absence of BCT in the upstream station (Table 4). This was also apparent in the 2015 BNT population and biomass estimates, the lower station exhibiting double and quadruple, respectively, those of the upper station (Table 4).

Table 4. Population statistics for species sampled in Middle Branch Otter Creek, 2003, 2015, 2019, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
Lower Station									
2021	≥age-1 BCT SC	28	303±53 (487±86) common	92 (82)	159	102-247	46	10-146	0.91
2019	≥age-1 BCT	11	110±8 (177±13)	72 (64)	213	126-297	107	17-245	0.90
2015	≥age-1 BNT age-0 BNT SC	38 4 118	359±3 (577±5) present abundant	283 (253)	215 48	118-332 43-51	126	18-358	1.04
2003	≥age-1 BKT age-0 BKT SC	19 21 226	193±13 (310±21) 216±22 (348±35) abundant	168 (150) 6 (5)	267 85	173-372 61-105	222 7	62-512 3-13	1.12
Upper Station									
2021	SC		common						
2019	≥age-1 BCT	2	20±0 (32±0)	14 (12)	224	203-245	97	82-112	0.87
2015	≥age-1 BNT age-0 BNT SC	18 5 19	198±47 (319±76) present common	71 (64)	155 44	110-270 40-52	48	14-198	1.03

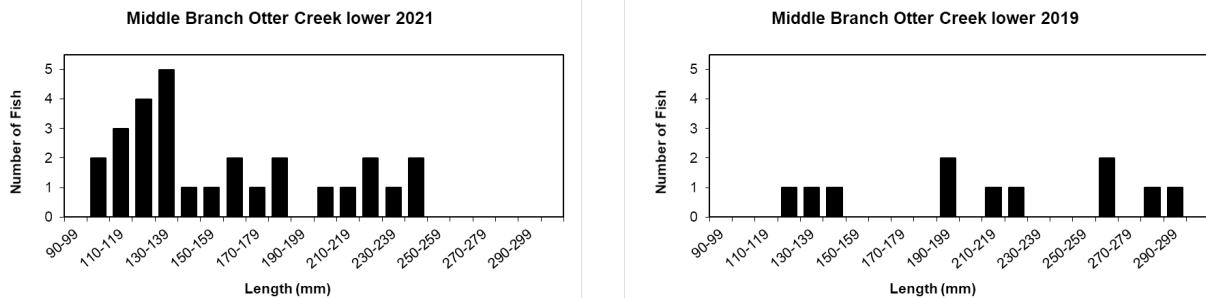


Figure 4. Size distribution of BCT sampled in the Middle Branch Otter Creek lower monitoring station, 2019 and 2021.

Big Creek**IVAQ190***Population Restoration*

Cutthroat trout produced from the Bear Lake brood source at Mantua Hatchery were stocked into Big Creek to aid in the reestablishment of BCT following the rotenone treatments in 2018 and 2019 to remove nonnative trout from the drainage. Approximately 3,360 fingerling with a mean TL of 82 mm were stocked on September 14, 2021.

Woodruff Creek**IVAQ200***Monitoring*

This monitoring station, 124 m in length, was electrofished on August 10, 2021. Results of this and the previous sampling events are shown in Table 5 and Figure 5. Based on the five data points for this station, the size of the BCT population has been on an essentially declining trend since the initial survey in 2000 (Table 5). However, the biomass estimate for 2021 is similar to the estimate for 2000, despite the earlier sample exhibiting a population estimate nearly five times greater than the later sample, an indication of a greater proportion of larger fish in 2021 relative to smaller size-classes, verified in the length-frequency histograms (Figure 5). Mountain Whitefish representing multiple age-classes were again sampled in this station (Table 5), as noted for the first time in 2016 (McKell 2017). Sculpin and Mountain Sucker remain abundant in the station.

Table 5. Population statistics for species sampled during monitoring of Woodruff Creek, 2000, 2006, 2011, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	28	229±13 (369±21)	50 (45)	183	93-395	105	6-530	0.90
	≥age-1 MWF	6	48±0 (78±0)	12 (11)	230	171-272	122	51-200	0.95
	age-0 MWF	30	267±54 (429±88)	3 (2)	80	66-91	5	2-8	
	MTS	323	abundant						
	SC	234	abundant						
2016	≥age-1 BCT	52	367±32 (591±51)	60 (53)	190	102-378	82	6-601	0.93
	age-0 BCT	18	162±112 (261±181)		51	40-62			
	≥age-1 MWF	28	195±17 (313±27)	26 (23)	181	142-330	67	23-415	0.89
	age-0 MWF	31	222±31 (358±49)	3 (3)	91	75-102	7	3-36	
	MTS	563	abundant						
SC	297	abundant							
2011	≥age-1 BCT	29	303±35 (488±56)	71 (63)	170	83-421	113	7-590	0.94
	age-0 MWF	35	356±20 (573±32)	3 (2)	72	58-92	4	1-8	0.94
	MTS	34	common						
	SC		abundant						
2006	≥age-1 BCT	59	610±50 (982±80)	30 (27)	123	81-301	27	4-226	1.18
	age-0 MWF	8			61	55-70	4	2-6	1.58
	MTS	157	abundant						
	SC	70	abundant						
2000	≥age-1 BCT	77	1087±439 (1749±706)	54 (48)	113	71-412	29	1-595	0.86
	age-0 MWF	3			61	48-72	2	1-3	0.99
	MTS		abundant						
	SC		abundant						

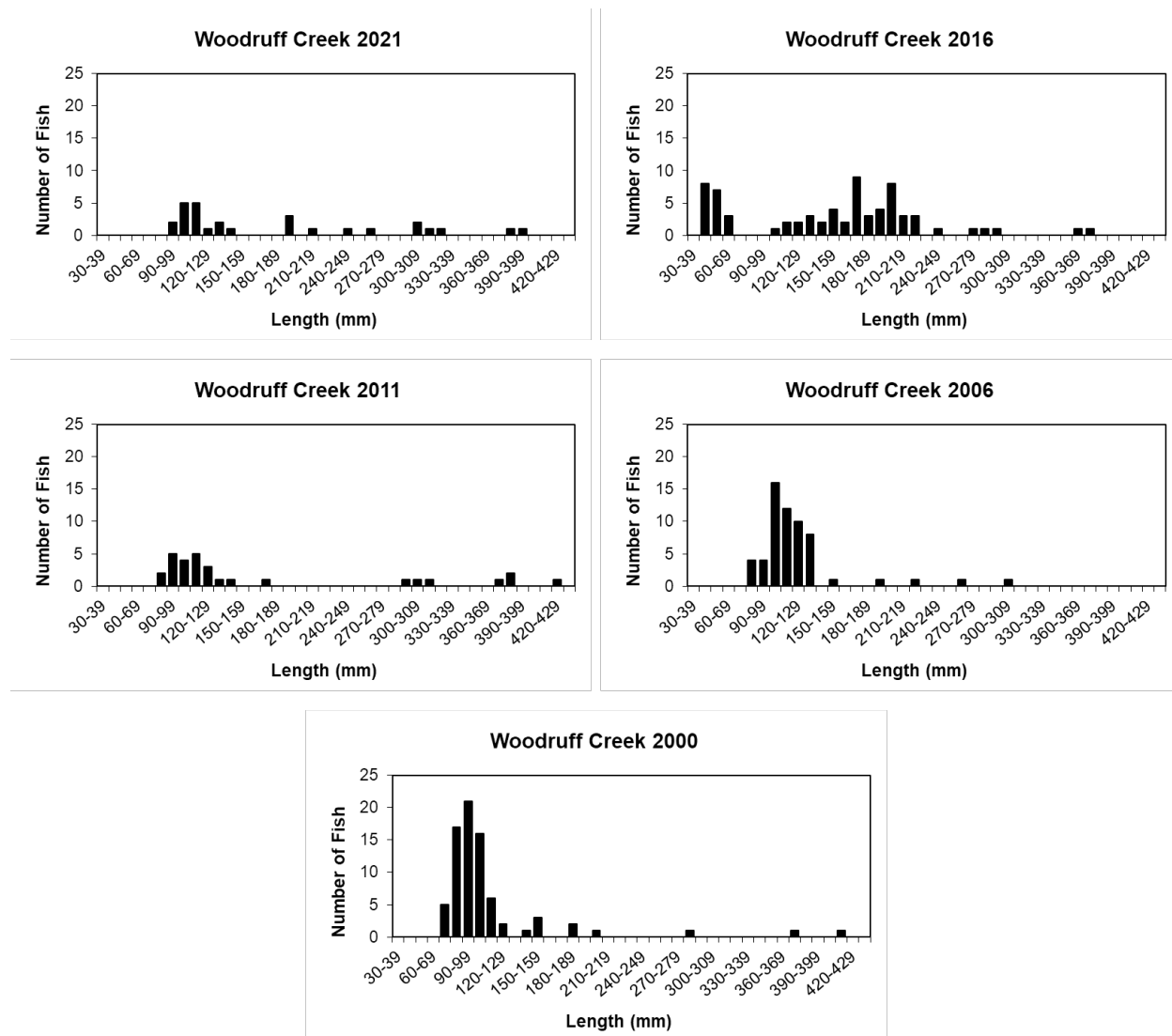


Figure 5. Size distribution of BCT sampled in the Woodruff Creek monitoring station, 2000, 2006, 2011, 2016, and 2021.

**Birch Creek
Monitoring**

IVAQ200A

The 2021 station, 100 m in length, was electrofished on July 27, 2021. Results of this and the previous sampling events are shown in Table 6 and Figure 6. Based on the five data points for this station, the BCT population appears to be highly variable exhibiting a large decline between 2000 and 2006 but maintaining a small number through 2011 (Table 6). By 2016, it appeared the monitoring station had become a reach for spawning and rearing only, with no BCT older than age-0 present (Table 6 and Figure 6), although in 2006 only juvenile BCT were sampled. However, age-1+ BCT were present in 2021 in greater numerical abundance than all other events but 2000, and exhibited greater biomass in 2021 than any other sampling event. It is noteworthy that there were no Tiger Trout sampled in 2021. In fact, the 2016 supposition that the Tiger Trout had migrated from Birch Creek Reservoir approximately 8.7 km (5.4 mi) (McKell 2017) was apparently erroneous, as it was later revealed that due to difficulty accessing the

reservoir, hatchery personnel stocked a load of Tiger Trout directly into the creek in 2015 in the vicinity of the monitoring station. Mountain Sucker were sparse in the station in 2021 (Table 6).

Table 6. Population statistics for species sampled during monitoring of Birch Creek, 2000, 2006, 2011, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	51	516±19 (831±31)	78 (69)	123	80-250	23	4-157	0.95
	age-0 BCT	3	30±0 (48±0)		33	27-37			
	MTS	3	sparse						
2016	age-0 BCT	9	90±88 (144±141)	35 (31)	42	38-44	71	55-96	1.16
	≥age-1 TGT	10	75±0 (120±0)		182	165-197			
	MTS	13	common						
2011	≥age-1 BCT	10	107±28 (172±44)	55 (49)	191	100-250	82	10-177	1.02
	age-0 BCT	1	10±0 (16±0)		33				
	MTS	35	common						
2006	≥age-1 BCT	14	140±0 (225±0)	11 (10)	101	84-117	11	5-21	1.05
	MTS	5	sparse						
2000	≥age-1 BCT	68	701±41 (1128±65)	51 (45)	100	55-232	16	1-137	0.97

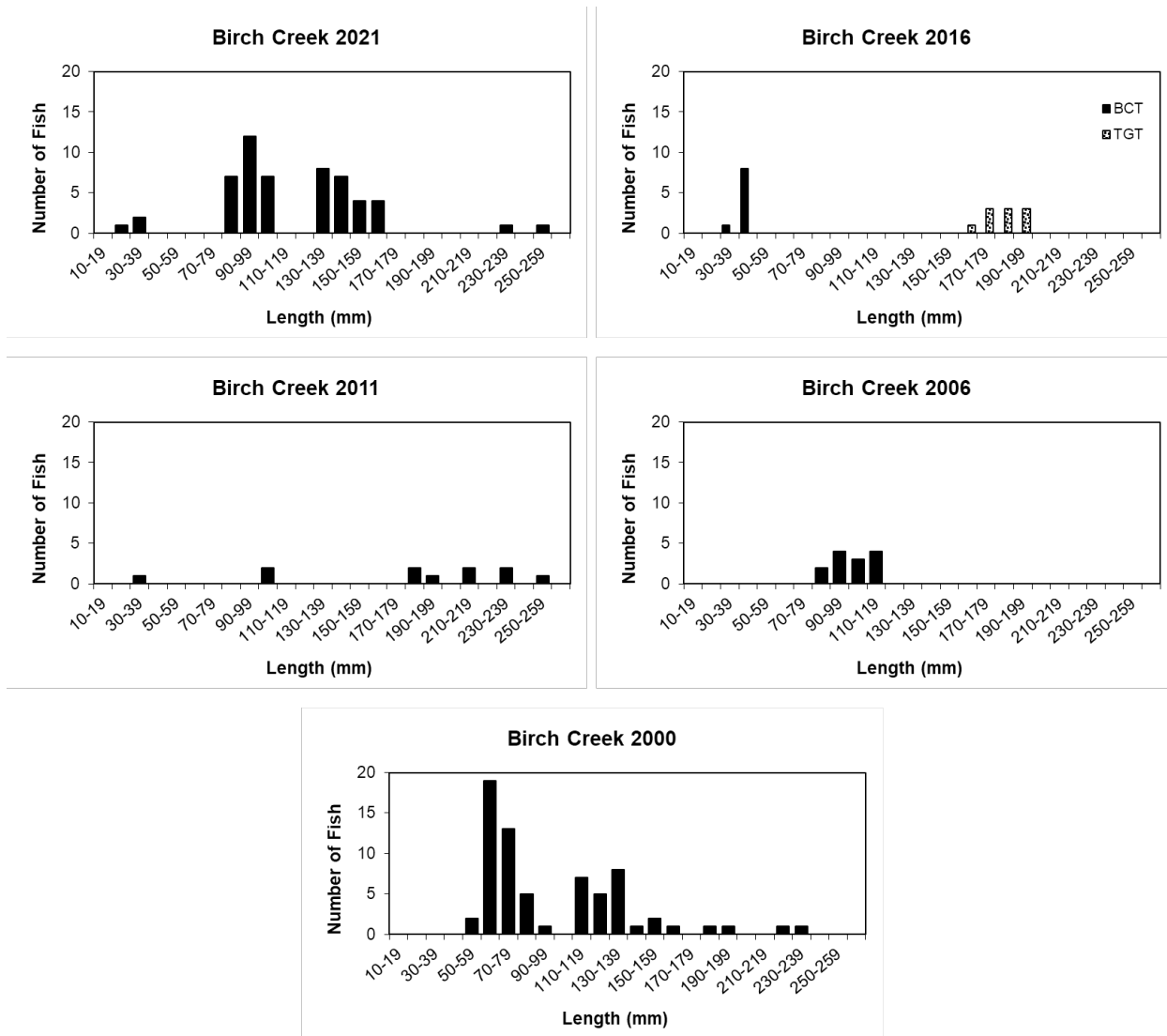


Figure 6. Size distribution of salmonids sampled in the Birch Creek monitoring station, 2000, 2006, 2011, 2016, and 2021.

Sugar Pine Creek
Monitoring

IVAQ200B

The 2021 station, 100 m in length, was electrofished by USFS personnel on July 15, 2021. Results of this and the previous sampling events are shown in Table 7 and Figure 7. Based on the five data points for this station, the BCT population has varied widely through the years, exhibiting a decline between 2000 and 2006, and as a consequence of high spring flows and accompanying scouring in spring of 2011, was greatly depressed, as no fish were sampled in the station in 2011 (Thompson 2012). However, by 2016, the BCT population had rebounded to a moderate density (Table 7) and habitat conditions appeared to be much improved. The abundance of age-1+ BCT in 2021 was similar to 2016 (Table 7), and the distribution of age-classes was similar in 2021 to other sampling events, except 2016 when a large proportion of the BCT sampled represented the age-0 cohort (Table 7, Figure 7). Surprisingly, sculpin were not found in the station in 2021, even though they were abundant in 2016; the reason(s) for their absence is unknown.

Table 7. Population statistics for species sampled during monitoring of Sugar Pine Creek, 2000, 2006, 2011, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	52	529±24 (851±39)	77 (69)	127	74-230	26	4-102	0.94
2016	≥age-1 BCT	66	517±7 (832±11)	97 (86)	158	100-275	48	6-208	0.90
	age-0 BCT	128	1344±359 (2163±578)		45	28-56			
	SC		abundant						
2011	no fish present								
2006	≥age-1 BCT	39	366±17 (589±27)	59 (53)	147	98-285	42	8-222	1.02
	SC		abundant						
2000	≥age-1 BCT	76	729±45 (1174±72)	112 (100)	142	68-271	41	4-235	1.04
	SC		abundant						

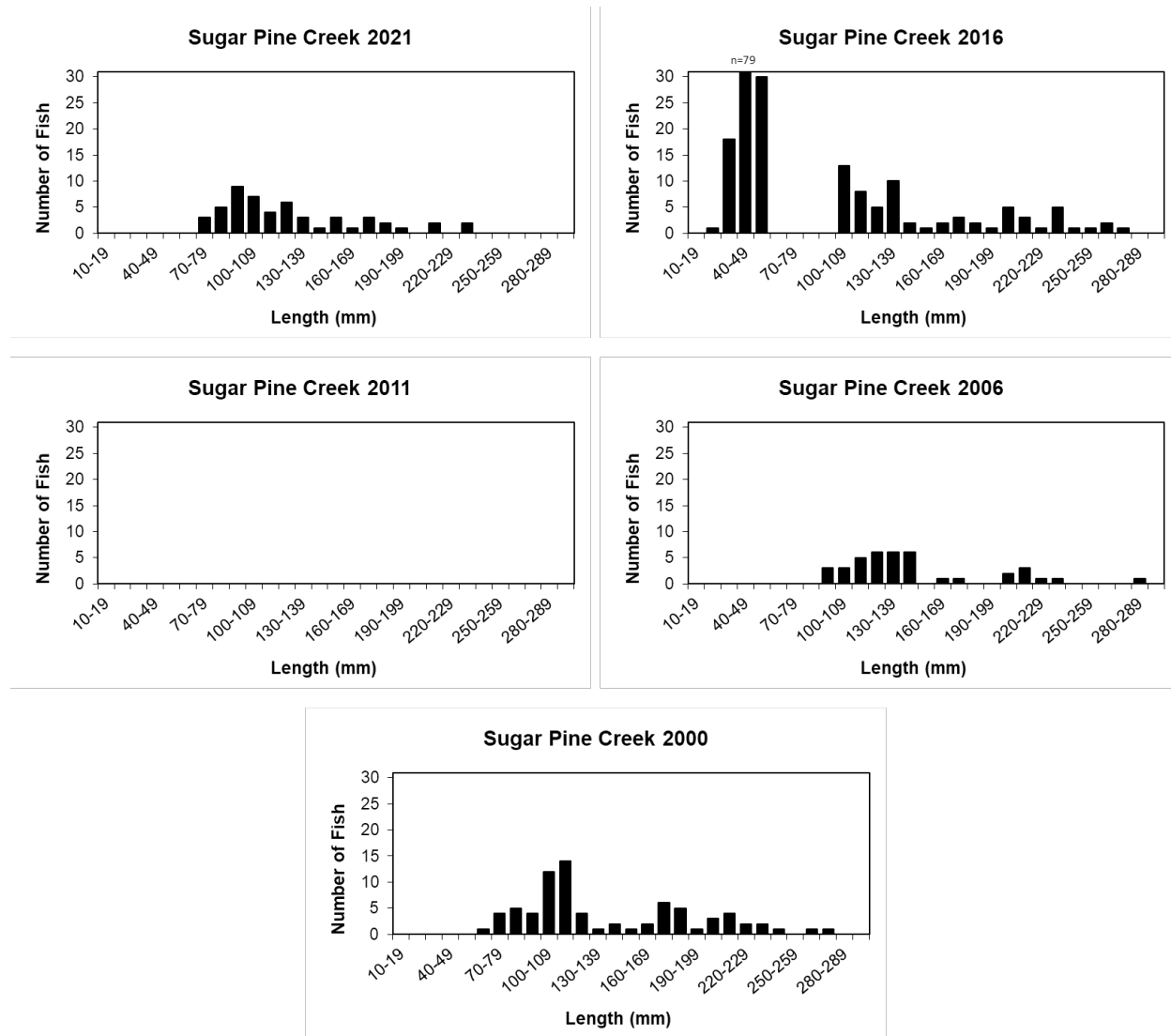


Figure 7. Size distribution of BCT sampled in the Sugar Pine Creek monitoring station, 2000, 2006, 2011, 2016, and 2021.

**Wheeler Creek
Monitoring**

IVAQ200C

The 2021 station, 100 m in length, was electrofished by a USFS crew on July 14, 2021. Unexpectedly, there were no fish sampled in the station; however, BCT were observed in a beaver pond less than 100 m downstream. Results of the previous sampling events are shown in Table 8. Based on the five data points for this station, the BCT population has been in decline, having a high density in 2000 (Table 8) and declining thereafter. By 2016, the monitoring station appeared to have become a reach for spawning and rearing only, with no BCT older than age-0 present (Table 8). Consequently, at the time of sampling in 2021, the monitoring reach contained very low flows (P. Chase, pers. comm.). Absence of all fish, both BCT and sculpin, suggests conditions in the reach may have deteriorated prior to 2021. As has been suspected in other streams with substantial beaver activity (e.g. Right Fork Middle Fork Ogden River and Huff Creek [McKell 2016]), habitat in this portion of Wheeler Creek may no

longer be suitable for spawning or year-round occupancy, or access to the sampled reach may have become limited once fish had vacated the reach.

Table 8. Population statistics for species sampled during monitoring of Wheeler Creek (Woodruff), 2000, 2006, 2011, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	no fish present								
2016	age-0 BCT SC	159 256	1569±66 (2525±107) abundant		35	26-44			
2011	≥age-1 BCT SC	10	107±28 (172±44) sparse	39 (35)	140	60-365	94	3-572	1.23
2006	≥age-1 BCT SC	20	203±12 (326±20) sparse	27 (24)	107	69-203	23	1-100	0.96
2000	≥age-1 BCT SC	100	1013±28 (1629±44) abundant	52 (46)	91	59-199	10	2-76	0.99

Big Spring Creek Monitoring

IVAQ200D

The 2021 station, 114 m in length, was electrofished by a USFS crew on July 14, 2021. Results of this and the previous sampling events are shown in Table 9 and Figure 8. Based on five data points for this station, the BCT population has been in decline, having a high density in 2000 and declining through the subsequent two sampling events but showing a rebound in 2016 (Table 9). The monitoring station appeared to have become more important for spawning and rearing, with a very large number of age-0 BCT present in the station in 2016 and only an age-1 cohort present in 2011 (Table 9 and Figure 8). The 2021 sample contained a very large BCT population represented by several age-classes, including a large spread of adults, as well as strong age-1 and age-2 cohorts (Figure 8). The estimated biomass was extremely high and at more than 500 kg/acre was nearly 20 times greater than the 2016 estimate (Table 9). Incidentally, a beaver dam at the bottom of the reach contained most of the adult BCT and appeared to be an impediment to downstream migration of fluvial BCT from Woodruff Creek that had entered Big Spring Creek to spawn in the spring (P. Chase, pers. comm.).

Table 9. Population statistics for BCT sampled during monitoring of Big Spring Creek, 2000, 2006, 2011, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	161	1895±449 (3050±722)	512 (457)	147	53-380	68	1-466	1.06
2016	≥age-1 BCT age-0 BCT	40 135	405±17 (652±28) 1641±286 (2641±460)	26 (24)	114 39	76-189 28-47	18	5-78	0.95
2011	≥age-1 BCT	10	180±372 (290±598)	2 (1)	57	42-69	2	1-4	1.09
2006	≥age-1 BCT	26	261±26 (420±42)	17 (15)	105	65-191	19	1-86	1.06
2000	≥age-1 BCT	67	691±41 (1113±67)	18 (16)	82	55-178	8	1-156	0.88

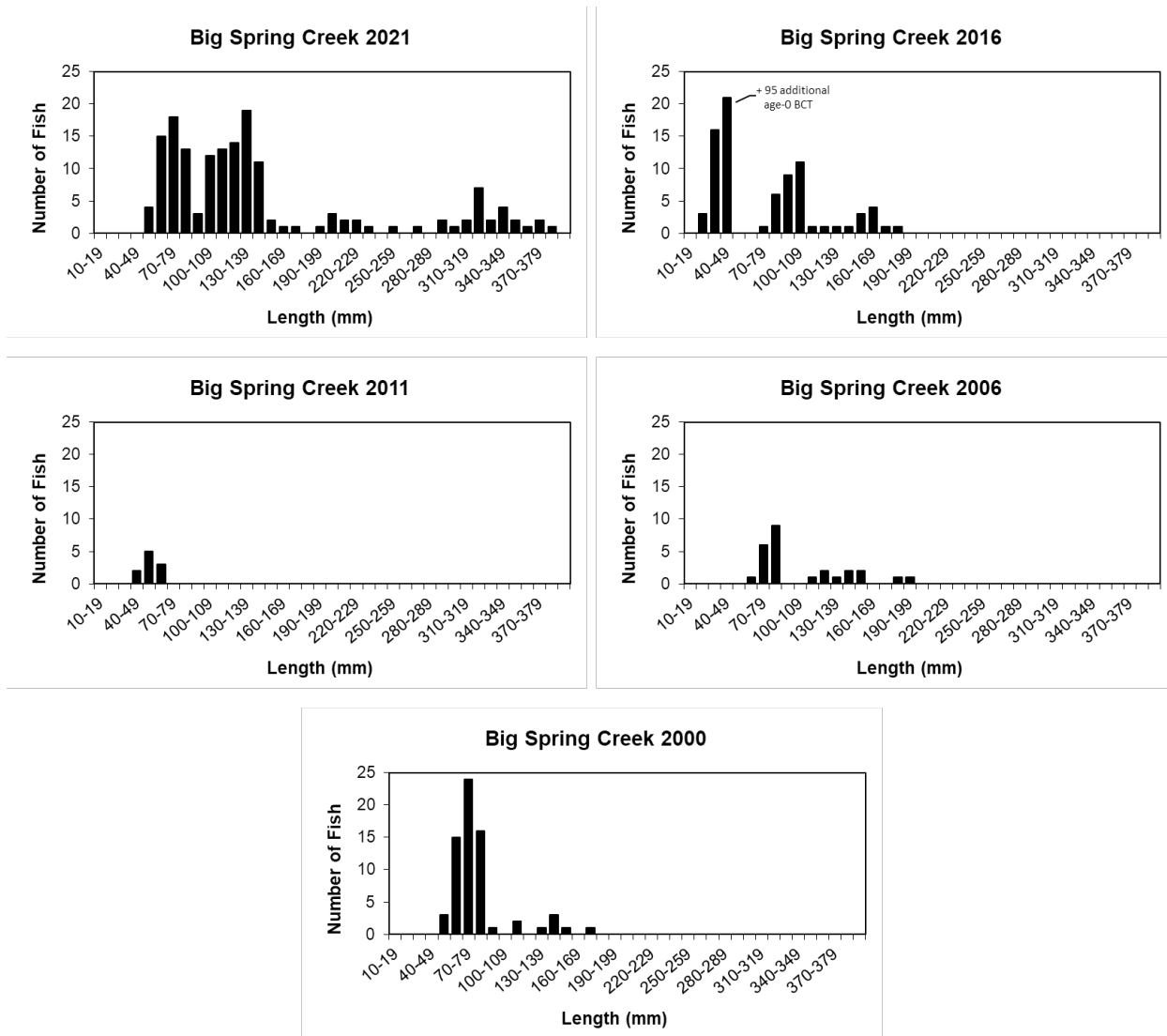


Figure 8. Size distribution of BCT sampled in the Big Spring Creek monitoring station, 2000, 2006, 2011, 2016, and 2021.

Cache County Subunit

Right Hand Fork Logan River Monitoring

IVAQ040A07

This monitoring station, 87 m in length, was electrofished on July 27, 2021. This was the second time this station was sampled following rotenone treatments in 2012 and 2013 to remove Brown Trout. Results of this and the previous sampling are shown in Table 10 and Figure 9. Although the BCT population estimate for 2021 was less than half of the 2018 estimate, the population is doing very well, maintaining excellent abundance, high biomass, consistent recruitment represented by a variety of age-classes (Figure 9), and exhibiting an improvement in mean body condition since 2018 (Table 10). In addition, the 2021 sample contained a greater proportion of adult BCT in the sample relative to all age-classes, especially the age-1 cohort, which was much more prominent in 2018 (Figure 9).

Table 10. Population statistics for BCT sampled in Right Hand Fork Logan River, 2018 and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	86	1052±91 (1694±146)	126 (113)	180	88-251	63	6-158	0.95
	age-0 BCT	7	96±66 (154±107)		43	40-50			
2018	≥age-1 BCT	211	2488±74 (4005±119)	179 (160)	143	73-285	35	4-226	0.89
	age-0 BCT	17			47	31-57			

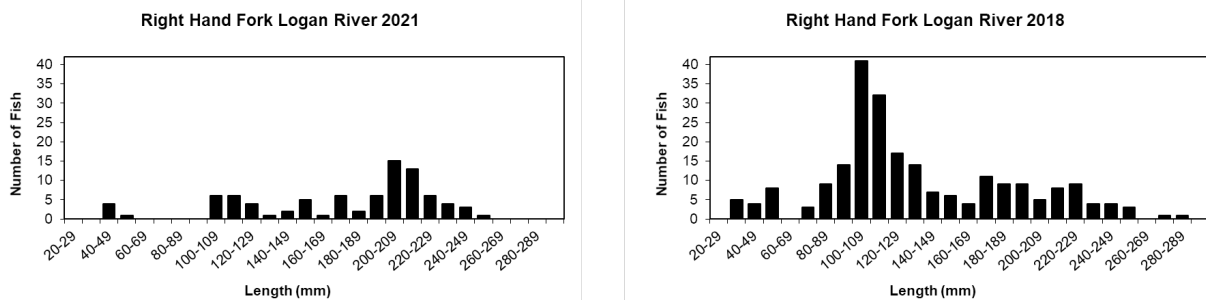


Figure 9. Size distribution of BCT sampled in Right Hand Fork Logan River monitoring station, 2018 and 2021.

NORTHERN BONNEVILLE GMU Ogden River Subunit

Wheeler Creek Monitoring

IVAP030A

The 2021 station, 100 m in length, was electrofished on July 13, 2021, by the USFS. Results of this and the previous sampling events are shown in Table 11 and Figure 10. Based on three data points for this station, the BCT population was similarly sized in 2005 and 2016, exhibiting moderate densities in both years, but was reduced to less than half the previous estimates by

2021 (Table 11). The range of size classes was also reduced in 2021, comprised primarily of yearling individuals (Figure 10). While one Brook Trout was sampled in 2005, none were found in the station in 2016 or 2021 (Table 11 and Figure 10), although Brook Trout dominate the drainage just one kilometer upstream in a large complex of beaver dams.

Table 11. Population statistics for species sampled during monitoring of Wheeler Creek (Ogden), 2005, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	14	141±7 (227±11)	9 (8)	110	82-158	22	6-123	1.24
2016	≥age-1 BCT	32	327±22 (526±35)	61 (55)	150	92-318	64	12-353	1.12
2005	≥age-1 BCT	30	306±33 (493±53)	78 (69)	161	66-280	60	2-249	0.83
	≥age-1 BKT	1	10±0 (16±0)	2 (2)	167		59		1.27

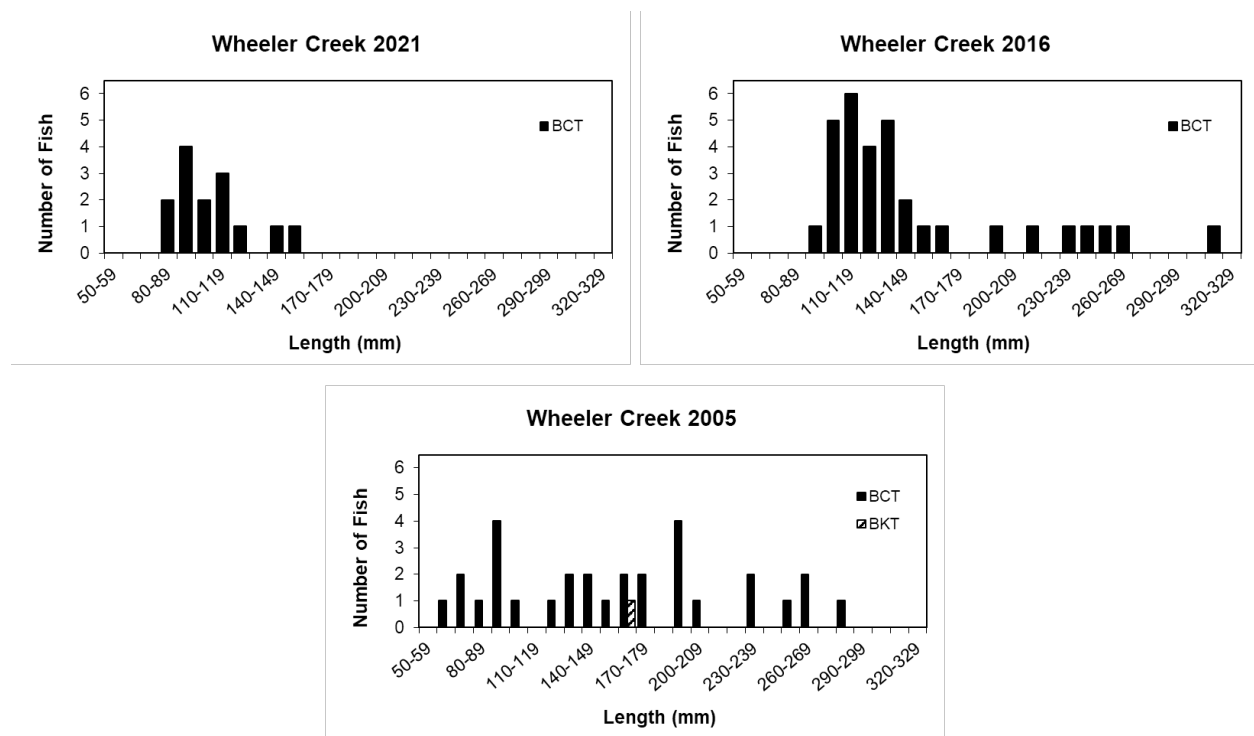


Figure 10. Size distribution of salmonids sampled in the Wheeler Creek (Ogden) monitoring station, 2005, 2016, and 2021.

Beaver Creek Monitoring

IVAP030B02

The monitoring station in Beaver Creek was relocated in 2016 because the previous monitoring station was dry that year. Consequently, an accessible site approximately 6.6 km downstream was sampled but contained only Brown Trout, tiger trout, and sculpin, no BCT. In 2021, a 100 m station roughly 0.8 km upstream of the second 2016 site was electrofished on July 6, 2021. Electrofishing data for both sampling events are shown in Table 12 and Figure 11. The BCT

segment of the population is clearly outnumbered by BNT, and the number of age-0 BNT in the station indicates the utility of this reach for BNT rearing (Table 12, Figure 11). Competition between the two species is likely to continue in this reach in the future. Monitoring of BCT in Beaver Creek should continue on a regular cycle.

Table 12. Population statistics for species sampled during monitoring of Beaver Creek, 2016 and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	8	80±0 (129±0)	7 (6)	143	102-204	30	9-84	0.89
	age-0 BCT	2	no depletion		41	40-41			
	≥age-1 BNT	6	63±15 (101±24)	7 (6)	151	121-190	41	17-87	
	age-0 BNT	33	440±225 (708±362)	3 (2)	61	45-80	2	1-5	
	SC		abundant						
2016	≥age-1 BNT	34	343±14 (552±22)	89 (80)	218	142-361	121	28-460	0.98
	age-0 BNT	19	241±136 (389±216)	3 (3)	85	69-105	6	3-12	
	≥age-1 TGT	2	no depletion		160	155-165	36	33-39	0.88
	SC		abundant						

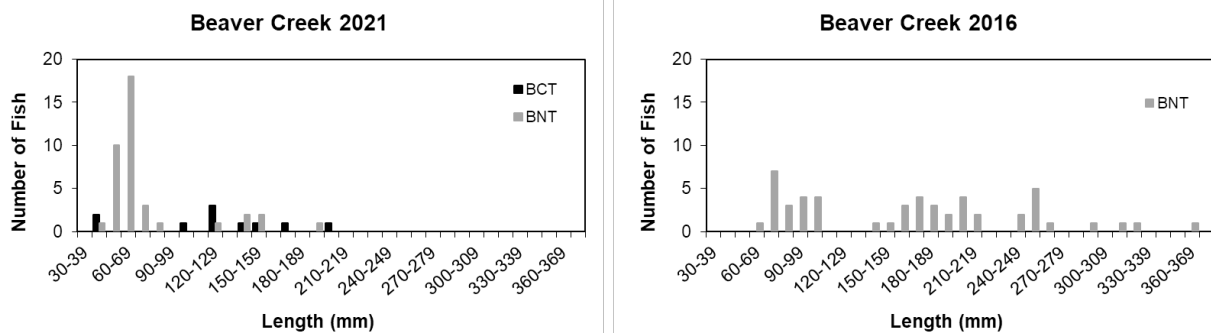


Figure 11. Size distribution of salmonids sampled in the Beaver Creek monitoring station, 2016 and 2021.

**Left Fork South Fork Ogden River
Monitoring**

IVAP030B05

The 2021 station, 100 m in length, was electrofished on July 8, 2021. Results of this and the previous sampling events are shown in Table 13 and Figure 12. Based on four data points for this station, the BCT population decreased by 40% between 2013 and 2021 but remains at a moderate density (Table 13). The range of size classes, minus the age-0 cohort, was similar between years but with fewer adults in 2021 (Figure 12). Rainbow Trout genetic influence has been exhibited among the phenotypes in the sample, though to a fairly limited degree, with only two hybrids identified in the two most recent samplings (Table 13). Sculpin occupy the monitoring reach in limited abundance.

Table 13. Population statistics for species sampled during monitoring of Left Fork South Fork Ogden River, 1996, 2006, 2013, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	23	249±50 (401±81)	no	175	105-325	73	14-390	1.10
	≥age-1 RTHY	2	20±0 (32±0)	width	318	300-335	300	256-343	0.93
	SC		common	data					
2013	≥age-1 BCT	39	443±98 (712±158)	81 (72)	183	112-329	86	14-307	1.30
	age-0 BCT	7	70±0 (113±0)		50	42-56	1		
	≥age-1 RTHY	2	no depletion		233	208-258	120	85-155	0.92
	SC		common						
2006	≥age-1 BCT	48	479±20 (772±32)	70 (63)	175	83-272	68	6-296	0.93
	SC		common	12 (11)	101	81-133	14	6-30	
1996	≥age-1 BCT	61	688±129 (1107±208)	72 (65)	190	95-293	74	8-231	0.92
	≥age-1 RT	1	10±0 (16±0)	2 (2)	260		159		0.90
	SC		sparse						

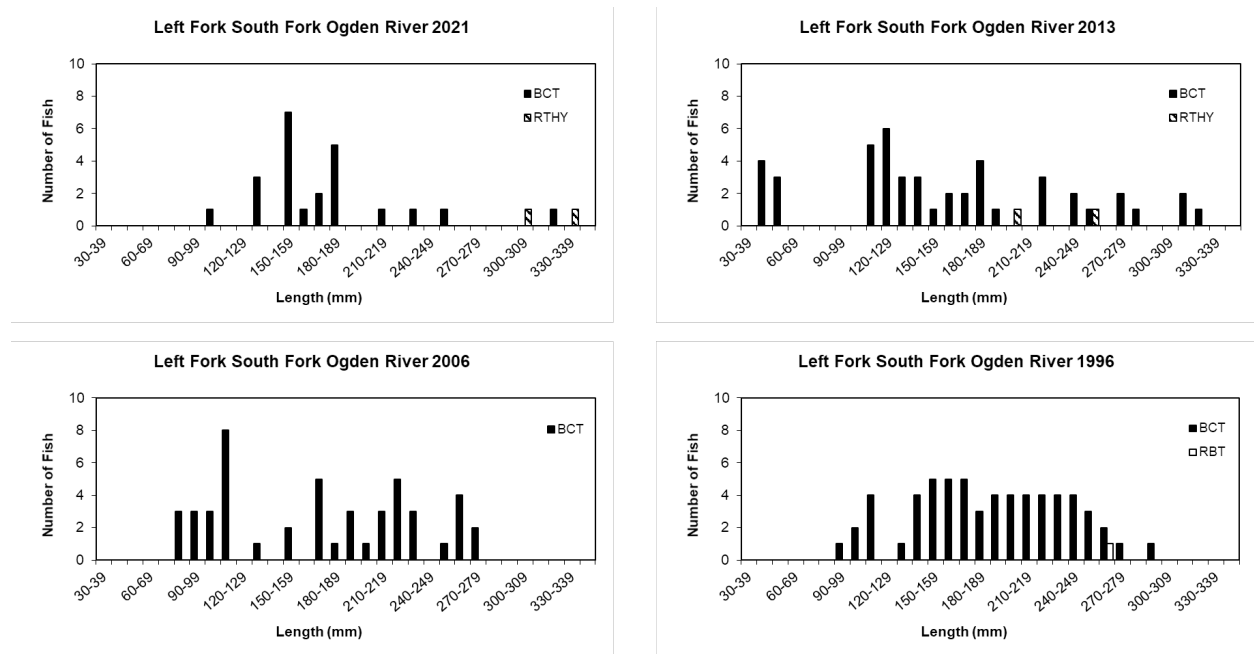


Figure 12. Size distribution of salmonids sampled in the Left Fork South Fork Ogden River monitoring station, 1996, 2006, 2013, and 2021.

North Fork Ogden River

IVAP030D

Monitoring

This monitoring station, an “index site” for BCT in the Northern Bonneville GMU, was electrofished on July 26, 2021. The station was 100 m in length. Results of this and the previous surveys are shown in Table 14 and Figure 13. Based on six data points, the BCT population is maintaining at moderate densities, though decreasing by half between 2020 and 2021 (Table 14). Two noticeable changes in the population, also noted during 2020 (McKell 2021), were a decrease in estimated biomass and apparent truncation of the age (size) structure exhibited by fewer larger individuals and decreased recruitment among the age-1 cohort (Figure 13). Sculpin remain abundant in the sampled reach.

Table 14. Population statistics for species sampled in North Fork Ogden River section 03, 2000, 2006, 2011, 2016, 2020, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT SC	31 168	322±32 (518±52) abundant	26 (23)	124	88-235	23	5-133	0.95
2020	≥age-1 BCT age-0 BCT SC	62 5 140	650±54 (1046±87) present abundant	47 (42)	118 43	73-195 42-44	19 1	4-70	0.97
2016	≥age-1 BCT age-0 BCT SC	41 4 95	410±3 (660±5) present abundant	83 (74)	179 36	80-266 30-39	69	6-219	0.99
2011	≥age-1 BCT age-0 BCT SC	55 13	539±34 (868±55) 128±18 (206±29) common	74 (66)	162 59	88-300 47-67	54 2	6-278 1-3	0.95 0.76
2006	≥age-1 BCT age-0 BCT SC	48	482±10 (776±17) present common	74 (66)	172	75-391	73	4-478	1.03
2000	≥age-1 BCT age-0 BCT SC	45 18	716±87 (1153±140) 358±248 (576±399) abundant	81 (73)	147 43	60-275 36-49	45 1	2-222 1-2	0.99 1.36

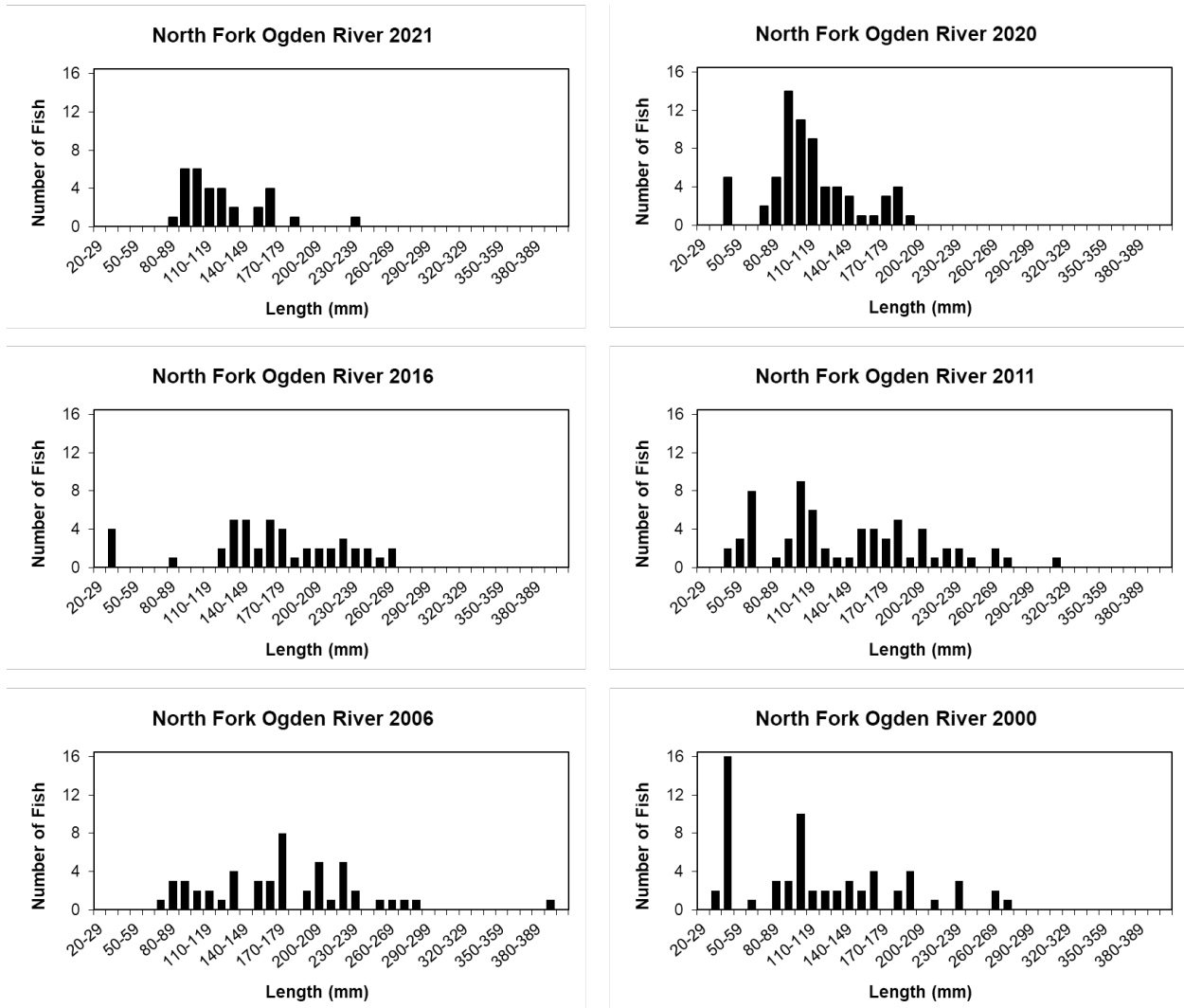


Figure 13. Size distribution of salmonid species sampled in the North Fork Ogden River section 03 monitoring station, 2000, 2006, 2011, 2016, 2020, and 2021.

Wolf Creek

IVAP030D01

Monitoring

The 2021 monitoring station, 87 m in length, was electrofished on July 6, 2021. Results of this and the previous sampling events are shown in Table 15 and Figure 14. Based on five data points for this station, the BCT population has been continually in flux, but 2021 data represent the lowest population estimate yet, less than one-third of the 2016 estimate (Table 15). The estimated biomass was approximately a quarter of the 2016 estimate. The number of age-classes and representation among them were reduced in 2021 (Figure 14). It is noteworthy that although sculpin have not been sampled in this station during any of the recent samplings, they are present at least as close as 1.2 km (0.7 mi) downstream of the station.

Table 15. Population statistics for species sampled during monitoring of Wolf Creek, 2000, 2006, 2011, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	8	94±12 (151±20)	22 (19)	139	101-205	30	9-91	0.93
2016	≥age-1 BCT	25	312±74 (502±120)	85 (76)	158	98-245	49	9-157	0.97
	age-0 BCT	3	34±0 (54±0)		37	35-41			
2011	≥age-1 BCT	21	240±61 (386±99)	72 (64)	160	90-269	61	12-247	1.17
2006	≥age-1 BCT	45	558±103 (899±166)	142 (127)	163	66-302	57	1-256	0.97
	≥age-1 RTHY	5	56±0 (89±0)	26 (23)	214	161-268	104	38-194	0.98
2000	≥age-1 BCT	31	317±22 (510±36)		113	73-175	19	3-62	1.24
	age-0 BCT	39	568±354 (914±570)		42	36-48			

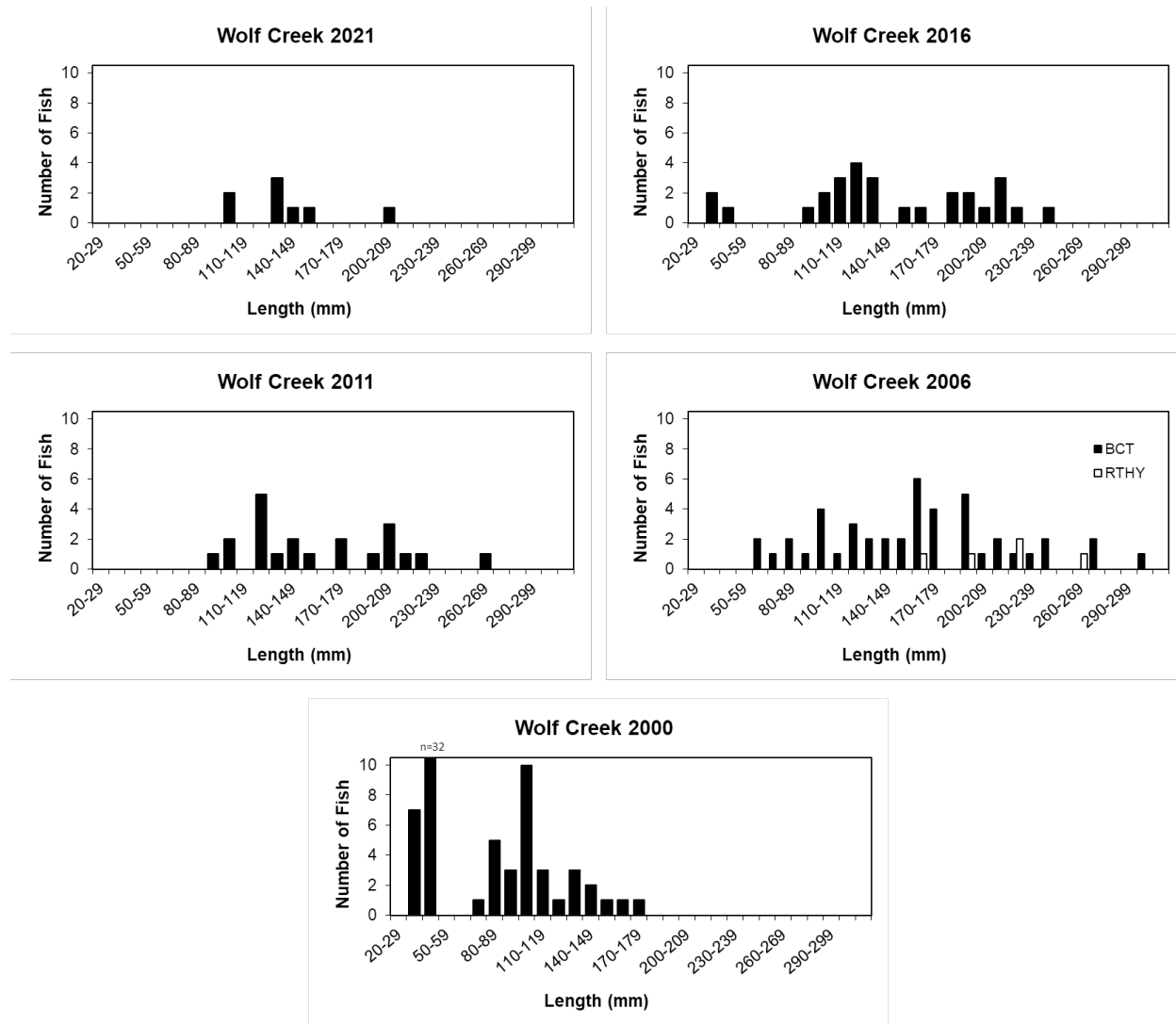


Figure 14. Size distribution of BCT sampled in the Wolf Creek monitoring station, 2000, 2006, 2011, 2016, and 2021.

South Fork Wolf Creek**IVAP030D01A***Monitoring*

The 2021 monitoring station, 100 m in length, was electrofished on July 13, 2021, by the USFS. Results of this and the previous sampling events are shown in Table 16 and Figure 15. Based on five data points for this station, the BCT population appears to have remained relatively stable through all sampling events, and even exhibited an increase in 2021 to its second highest estimates both numerically and in terms of biomass (Table 16). The length-frequency distribution in 2021 was similar to previous years (Figure 15).

Table 16. Population statistics for species sampled during monitoring of South Fork Wolf Creek, 2000, 2006, 2011, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	67	758±125 (1219±202)	110 (98)	159	73-251	53	4-157	1.07
2016	≥age-1 BCT	61	641±55 (1032±89)	87 (77)	153	77-253	48	4-147	1.08
2011	≥age-1 BCT	49	499±33 (803±52)	81 (72)	183	59-278	77	5-262	1.10
2006	≥age-1 BCT	45	615±38 (989±61)	117 (104)	174	70-312	72	2-302	1.04
2000	≥age-1 BCT	55	811±126 (1305±202)	106 (94)	136	64-260	44	2-190	1.10

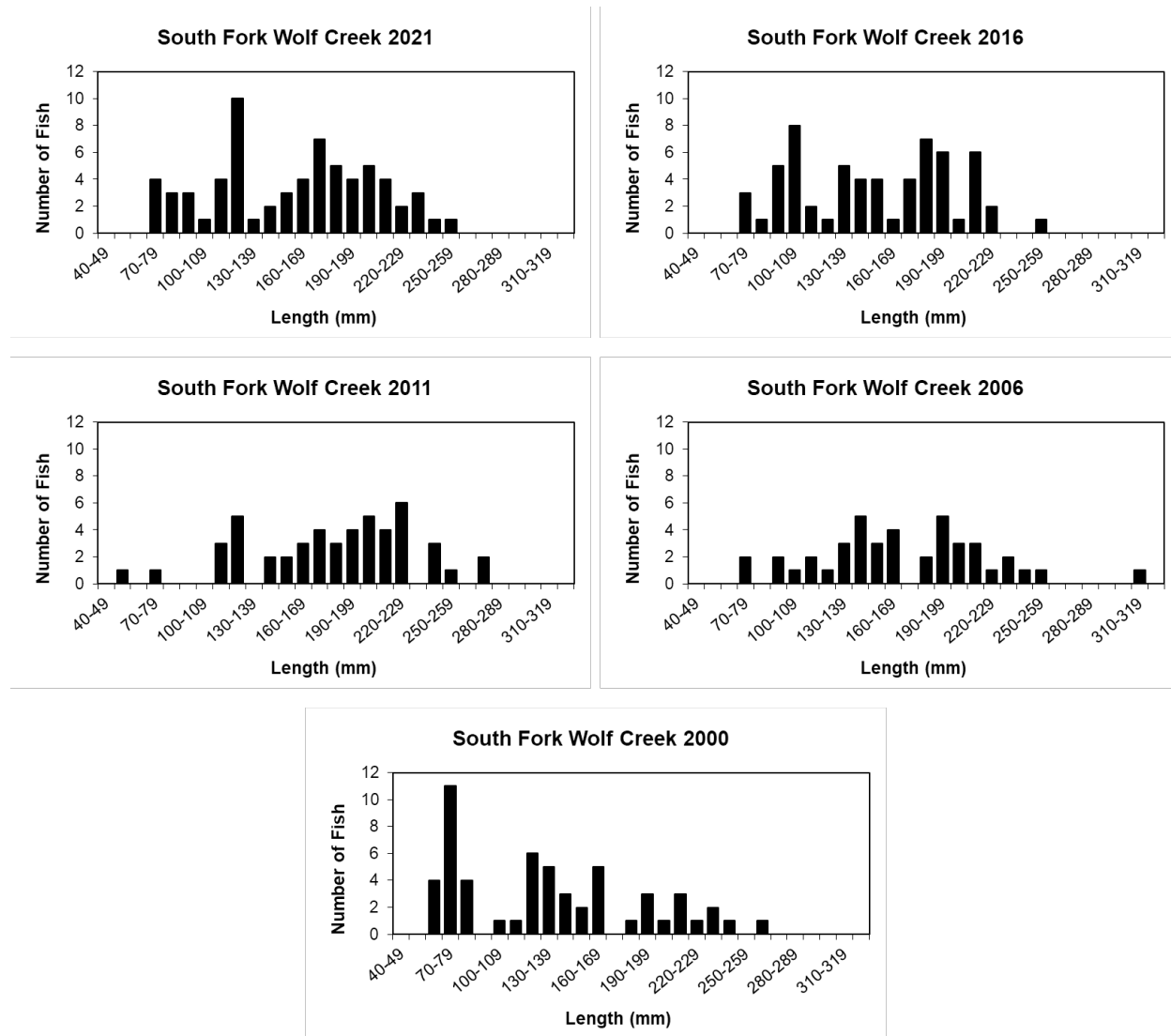


Figure 15. Size distribution of BCT sampled in the South Fork Wolf Creek monitoring station, 2000, 2006, 2011, 2016, and 2021.

**Cold Canyon
Monitoring**

IVAP030D04

The 2021 monitoring station, 100 m in length, was electrofished on July 13, 2021, by the USFS. Results of this and the previous sampling events are shown in Table 17 and Figure 16. Based on five data points for this station, the BCT population appears to have reached a very low level in the monitoring reach, after maintaining relatively stable densities through all previous sampling events (Table 17). The disappearance of all but a single adult BCT is alarming and indicates recruitment has not occurred in the last few years (Figure 16). Observations made at the time of sampling were that stream habitat looked good, but it appeared that high flows had flushed through the station in the last couple years, and flows in 2021 were very low (P. Chase, pers. comm.), all of which appeared to result in a sharp decline in the BCT population.

Table 17. Population statistics for species sampled during monitoring of Cold Canyon, 2000, 2006, 2011, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	1	10±0 (16±0)	2 (2)	178		58	0	1.03
2016	≥age-1 BCT	14	203±206 (326±332)	32 (29)	134	75-199	31	5-93	1.07
2011	≥age-1 BCT	21	216±22 (348±35)	11 (10)	104	54-187	17	1-74	0.93
2006	≥age-1 BCT	14	140±0 (225±0)	9 (8)	78	47-191	14	1-87	1.00
2000	≥age-1 BCT	35	366±38 (588±61)	20 (18)	86	53-230	12	1-125	0.97
	age-0 BCT	1							

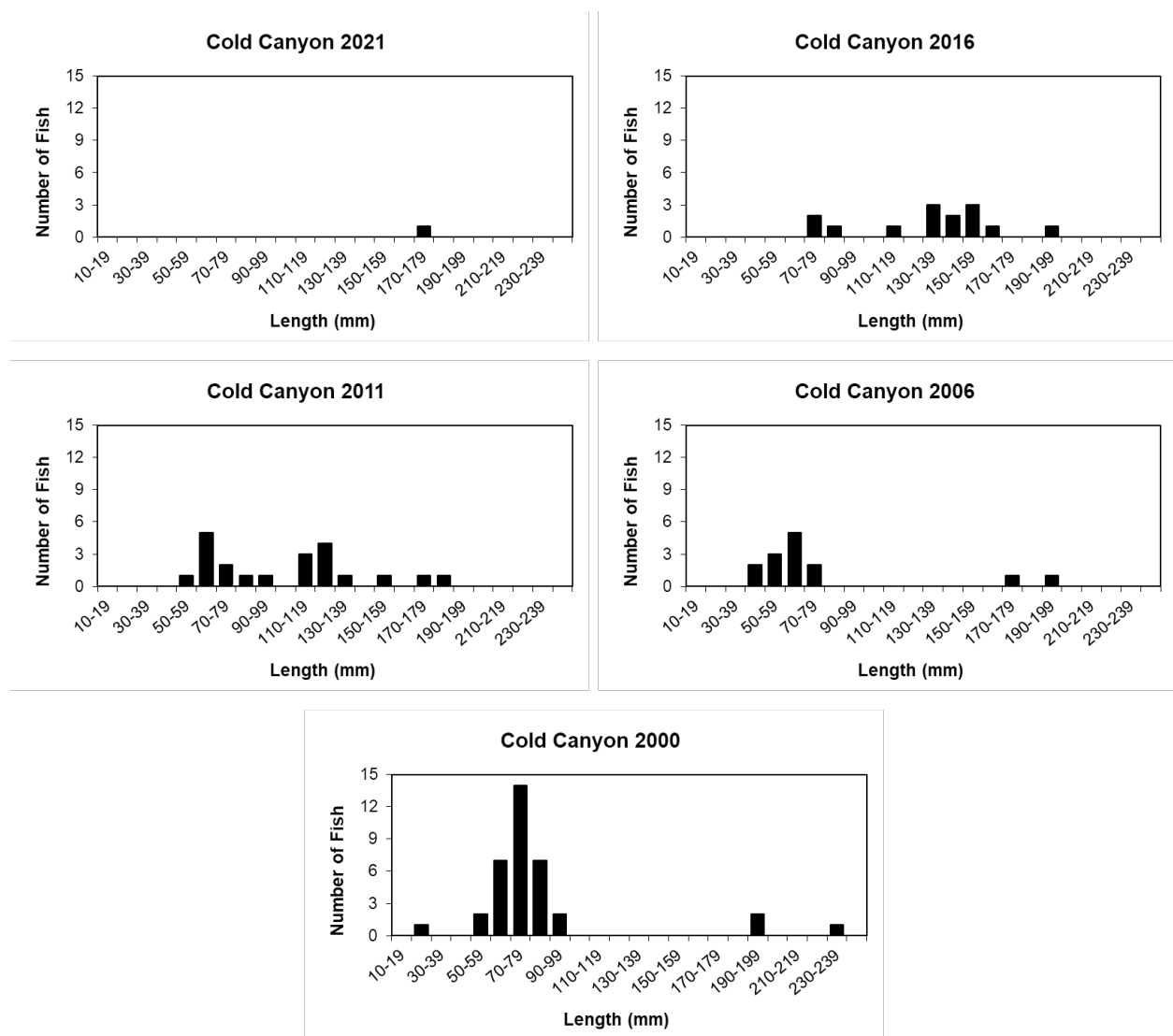


Figure 16. Size distribution of BCT sampled in the Cold Canyon monitoring station, 2000, 2006, 2011, 2016, and 2021.

Cutler Creek**IVAP030D06***Monitoring*

The 2021 monitoring station, 100 m in length, was electrofished on July 12, 2021, by the USFS. Results of this and the previous sampling events are shown in Table 18 and Figure 17. Based on five data points for this station, the BCT population appears to fluctuate constantly, and currently sits at a moderate level numerically (second only to 2000), but the population was at its lowest in 2021 in terms of biomass (Table 18). The length-frequency distribution in 2021 shows a relatively strong age-1 cohort along with a handful of adults (Figure 17). Sculpin have been abundant during all sampling efforts (Table 18).

Table 18. Population statistics for species sampled during monitoring of Cutler Creek, 2000, 2006, 2011, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT SC	24	245±19 (394±30) abundant	9 (8)	107	76-196	15	4-79	0.97
2016	≥age-1 BCT SC	11	111±8 (179±13) abundant	18 (16)	163	106-254	70	15-210	1.22
2011	≥age-1 BCT SC	20	200±70 (323±113) abundant	36 (32)	164	71-276	69	4-254	1.17
2006	≥age-1 BCT SC	19	197±24 (317±39) abundant	38 (34)	182	61-299	88	1-286	0.93
2000	≥age-1 BCT age-0 BCT SC	30 1	302±9 (485±14) present abundant	27 (24)	127 35	69-275	33	2-188	0.97

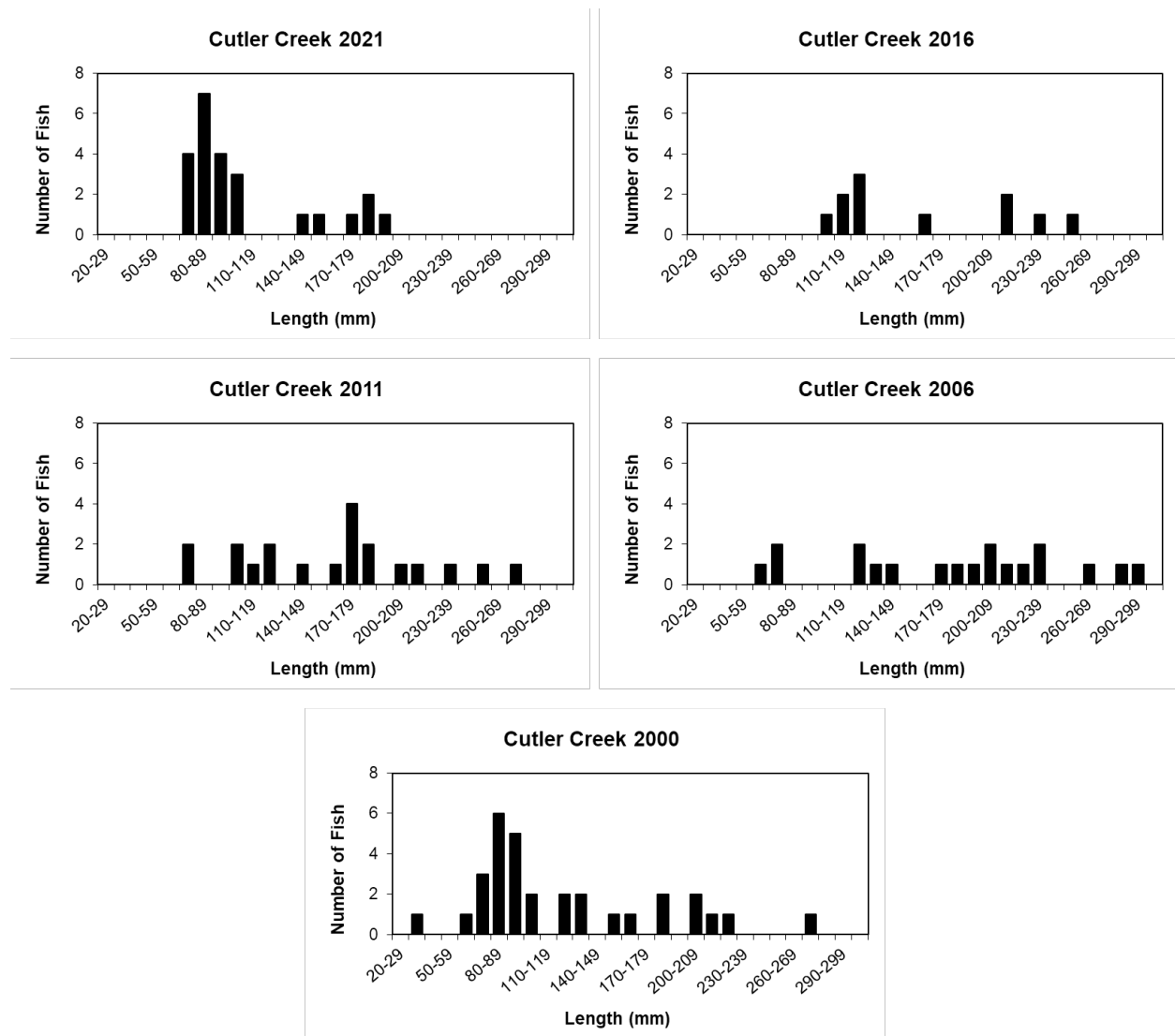


Figure 17. Size distribution of BCT sampled in the Cutler Creek monitoring station, 2000, 2006, 2011, 2016, and 2021.

Weber River Subunit

Weber River Section 04 (and tributaries)

IVAP

Research/Surveys

In 2021, biologists from the UDWR NRO continued collecting data on fluvial BCT in the lower Weber River (Section 04) and two of its tributaries: Strawberry Creek (IVAP060) and Jacobs Creek (IVAP060A). A study was formally initiated in 2011, with the objective of clarifying the interaction of the mainstem Weber River BCT population in Sections 02-04 with the tributaries in the vicinity of Mountain Green to determine the connectedness of these populations and to identify barriers to fish movement within the project area. Since results of the work completed during the period 2011-2017 were published in a peer-reviewed journal article (see Budy et al. 2020), and additional work completed in 2018 was reported previously (see McKell 2019), the data are only coarsely summarized below and in Table 19.

One objective of the study was to characterize the life history of the BCT population in this portion of the Weber River and determine whether the tributaries served as spawning habitat for the mainstem population. To increase the opportunity of meeting this objective, as many cutthroat trout as possible were sampled and marked with a PIT tag, utilizing various methods of sampling. This resulted in the tagging of 2,792 cutthroat trout throughout the study area, including the mainstem and tributaries. In addition, 58 Rainbow Trout or trout identified as rainbow-cutthroat hybrids were tagged. Of the cutthroat trout tagged, 948 (34%) were re-sampled (i.e. recaptured via active sampling or resighted passively on an instream antenna) on at least one occasion. Of those, 198 were re-sampled two or more times. Of the 58 Rainbow Trout (plus hybrids) tagged, 24 (41%) were re-sampled at least once, and six of those were re-sampled two or more times.

The number of unique resights or “hits” on tributary antennas by year is illustrated in Figure 18. The differences between years are due to a number of factors: the number of detections in 2013 and 2014 were in most cases much higher than the number in 2012, presumably due to the increased numbers of tagged fish in the system; the number and placement of antennas were not consistent between years (e.g. no antennas were deployed in Jacobs, Strawberry, or Cottonwood in 2016); equipment malfunctions in some streams during some years (e.g. Strawberry in 2012, Cottonwood in 2015).

Table 19. Summary of BCT PIT tagging for the Weber River and tributaries, 2011-2021. Note: “Re-sampled” is defined as any recapture or resight of a tagged fish; “# Tagged in Weber and Re-sampled” is a count of fish tagged in any section of the Weber River mainstem and later re-sampled in the corresponding stream or section (no Total since multiple individuals were re-sampled at multiple sites).

Stream/Section	# of BCT Tagged	TL (mm) at Tagging		# (%) ≥ 300 mm TL	# (%) Re-sampled	# Tagged in Weber and Re-sampled
		Mean	Range			
Weber R Sec 02	79	306	148-486	47 (59)	9 (11)	8
Weber R Sec 03	327	271	109-460	118 (36)	87 (27)	61
Weber R Sec 04	1526	312	124-549	845 (55)	617 (40)	194
Strawberry Cr	185	268	123-463	75 (41)	77 (42)	125
Jacobs Cr	197	213	105-512	44 (22)	74 (38)	249
Gordon Cr	127	213	110-398	12 (9)	21 (17)	17
Dry Cr	0					1
Cottonwood Cr	173	196	123-405	8 (5)	25 (14)	49
Peterson Cr	153	177	120-470	9 (6)	26 (17)	107
Dalton Cr	25	297	182-431	10 (40)	12 (48)	31
Smith Cr	0					11
TOTAL	2792	278	105-549	1168 (42)	948 (34)	---

The total number of cutthroat trout tagged in the Weber River mainstem was 1,932. Of those, 713 (37%) were re-sampled later in the mainstem and/or a tributary, while the remaining 1,219 were not re-sampled. One hundred sixty of the re-sampled cutthroat trout were re-sampled more than once. A large majority (n=553; 78%) of the 713 re-sampled cutthroat trout were re-sampled outside of the Weber River mainstem. Section 04 of the Weber River is discussed in detail below, as well as a brief summary for Strawberry Creek and Jacobs Creek; data for the other mainstem sections and tributaries were summarized previously (McKell 2017).

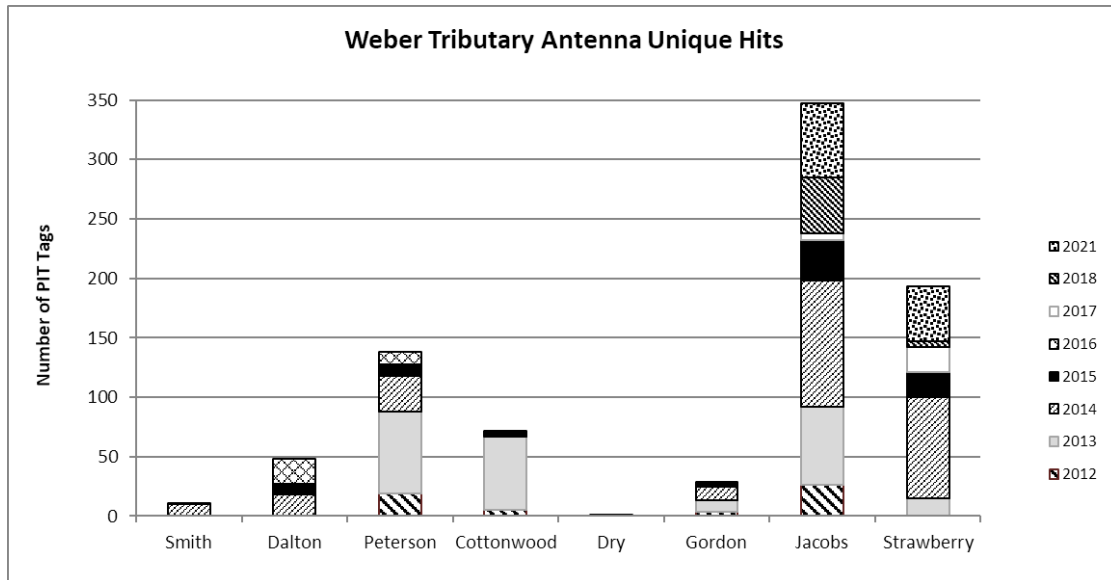


Figure 18. Number of different individual trout PIT tag resights on instream antennas in Weber River tributaries, 2012-2021.

Weber River Section 04

More cutthroat trout were tagged in Section 04 of the Weber River than any other section or stream, totaling 1,526. A total of 617 (40%) were re-sampled in the Weber River mainstem and/or in a tributary. The number tagged in this section and later re-sampled in a tributary was 531, some of which were also re-sampled in the Weber mainstem. Twenty-seven of these were each resighted in two separate tributaries, and 19 were resighted in two different tributaries in the same year. Forty-four of the fish tagged in Section 04 were re-sampled in a tributary in two different years. The remaining 86 (= 617 - 531) BCT tagged in Section 04 and later re-sampled were re-sampled only in the mainstem.

Tributaries

Cutthroat trout were tagged in six of the eight tributaries listed above, totaling 860 individuals. Approximately 27% (n=235) were re-sampled, a much lower rate of re-sampling than observed in the mainstem (37%). Note that re-sampling in the tributaries was accomplished primarily through the use of instream antennas (“resight”), deployed in the spring during the cutthroat trout spawning period. Of the 235 individuals re-sampled, 200 were re-sampled in the same tributary only, and 35 were re-sampled outside of the tributary in which they were tagged, either in a different tributary or in the Weber River. The majority (n=702; 82%) of the cutthroat trout tagged in tributaries were less than 300 mm TL, and 142 (20%) of them were re-sampled, but only 15 (11%) of those re-sampled were re-sampled outside of the tributary in which they were tagged. Ninety-three (59%) of the 158 cutthroat trout 300 mm TL or greater were re-sampled, and 20 (22%) of those re-sampled were re-sampled in another tributary or the Weber River mainstem. Twenty-three of the cutthroat trout tagged in a tributary were resighted in multiple years. Six cutthroat trout tagged in a tributary were later resighted in a different tributary in the same year, five of them moving from Strawberry to Jacobs and one from Jacobs to Gordon. Four others were re-sampled in a tributary different from the one they were tagged in during a subsequent year. Thirty-one tributary-tagged cutthroat trout were re-sampled two or more times. Data summaries for Strawberry and Jacobs creeks are provided below.

Strawberry Creek: 185 cutthroat trout were tagged and 77 of them were re-sampled at some point in time later for a 42% re-sample rate. Fifty-eight of the re-sampled fish were re-sampled only in Strawberry. Of the 19 tagged in Strawberry and re-sampled elsewhere, 13 were re-sampled in Jacobs Creek and six in the Weber, three of which were re-sampled in both the Weber and Jacobs. Of the cutthroat trout tagged in the Weber, 125 of them were re-sampled in Strawberry Creek, eight in 2013, 60 in 2014, 10 in 2015, three in 2016 (all recaptures, as no antenna was deployed in 2016), three in 2017, three in 2018, and 45 in 2021. There were 46 unique tags (i.e. different individuals) resighted in Strawberry Creek in 2021, five in 2018, 21 in 2017, 21 in 2015, 85 in 2014, and 15 in 2013 (eight tagged in the Weber, six from Strawberry, and one from Jacobs) (Figure 18). There were no resightings in 2012, as the antenna deployed that year likely malfunctioned, and none in 2016 since no antenna was deployed.

Two antennas were deployed in Strawberry Creek in 2021 to continue evaluating the fish ladder installed in September 2016 within the Interstate-84 culvert. The lower antenna was deployed downstream of I-84 near the railroad crossing and the upper antenna was placed less than 100 m upstream of the fish ladder. Out of 46 unique BCT tags recorded in Strawberry Creek in 2021, 38 of them were detected by both antennas; the other eight were detected by the lower antenna only. In 2018, two out of five unique tags were detected by the antenna upstream of the ladder; the other three were detected by the lower antenna only. Compared with ladder use by tagged BCT in 2021 and 2017 (see McKell 2018), 2018 was relatively light, likely the result of flows that dropped to very low levels earlier than usual in the late spring.

Jacobs Creek: 197 cutthroat trout were tagged and 74 (38%) were re-sampled later. Of the 74 re-sampled, 68 were re-sampled only in Jacobs, one was resighted in Gordon Creek (in 2012 and also resighted in Jacobs in both 2012 and 2013), two were resighted in Strawberry (one in 2014, and the other in 2013, which was also resighted in Jacobs in 2012), and three were recaptured in the Weber (and also resighted in Jacobs). Ten of the cutthroat trout tagged in Jacobs were resighted in Jacobs in multiple years, and 13 of the fish tagged in Jacobs Creek were re-sampled two or more times. Jacobs Creek was the most heavily utilized tributary by fluvial cutthroat trout, with 249 of the cutthroat tagged in the Weber later detected moving about in Jacobs Creek during 2012-2021, including several individuals tagged below the rest stop dam in Section 03. There were 62 unique tags resighted in Jacobs Creek in 2021, 47 in 2018, six in 2017, 34 in 2015, 106 in 2014, 65 in 2013, and 26 in 2012 (Figure 18). Incidentally, two of the largest BCT sampled during this study were captured in Jacobs Creek, both measured 512 mm TL; one was a female sampled in June 2011 and the other a male captured in May 2012.

Two antennas were deployed in Jacobs Creek in 2021 to further evaluate a fish passage project completed in late 2017 that was intended to make the upper culvert more accessible to fish. One antenna was placed immediately downstream of the step-pool project, and the other was placed a short distance upstream of the culvert. Out of 62 tagged BCT detected in Jacobs Creek in 2021, a total of 43 (69%) were presumably resighted by the antenna upstream of the culvert, based on the dates the tags were resighted by the lower antenna and the number of "hits" recorded at the upper antenna, as tag data from the upstream reader were not accessible. In contrast, 45 out of 47 tagged BCT detected in Jacobs Creek in 2018 were resighted by the antenna upstream of the culvert, a 96% passage rate. Previous barrier assessments verified the culvert was not a complete barrier to all fish, as 62% of tagged BCT achieved passage through the culvert in 2013, and only 25% passed the culvert in 2014.

Weber River Section 10

IVAP

Monitoring

This station, located adjacent to the USFS Cottonwood Picnic Area in Weber Canyon, was 115 m in length and was electrofished on September 9, 2021. Based on five data points for this station, the BCT population has maintained relatively low densities and in 2021 the population was at the second lowest density observed during the five sampling events (Table 20). The length-frequency distribution indicates consistent recruitment across all sampling events, though successful recruitment has apparently been limited in recent years (Figure 19). Other species sampled in 2021 were Mountain Whitefish, Longnose Dace, sculpin, and Brown Trout.

Table 20. Population statistics for species sampled in Weber River Section 10, 1998, 2005, 2010, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	14	122±6 (197±9)	7 (6)	172	107-300	67	11-227	0.87
	≥age-1 BNT	1	9±0 (14±0)	2 (2)	305		344		1.21
	MWF	13	114±6 (183±10)	48 (43)	362	219-421	532	122-803	1.06
	LND		sparse						
	SC		abundant						
2016	≥age-1 BCT	33	227±20 (366±32)	20 (17)	186	97-400	90	8-567	0.86
	age-0 BCT	1	7±0 (11±0)		62		2		
	≥age-1 BKT	4	27±0 (43±0)	2 (2)	185	109-221	76	12-112	1.01
	≥age-1 BNT	1	7±0 (11±0)	1 (1)	281		207		0.93
	MWF	30	201±6 (324±10)	27 (24)	215	82-327	139	4-384	0.97
	LND		sparse						
	MTS SC		sparse abundant						
2010	≥age-1 BCT	19	95±3 (153±4)	8 (7)	219	75-330	116	6-340	0.92
	age-0 BCT	2			60	55-65	3	2-4	
	≥age-1 BKT	1	5±0 (8±0)	1 (1)	250		176		1.13
	≥age-1 RBT	4	23±15 (36±24)	3 (3)	274	227-327	214	120-354	0.98
	≥age-1 CTxRB	4	20±0 (32±0)	4 (3)	284	227-311	255	110-336	1.04
	MWF	52	263±9 (423±15)	80 (71)	348	250-417	437	160-706	1.00
	SC		abundant						
2005	≥age-1 BCT	30	156±17 (251±27)	2 (1)	224	114-351	132	17-426	1.09
	age-0 BCT	3	15±0 (24±0)		70	68-72	1		
	MWF	23	120±16 (194±26)	3 (2)	278	102-432	292	12-856	1.15
	SC		abundant						
1998	≥age-1 BCT	27	302±9 (485±14)	2 (2)	244	108-331	172	12-372	0.89
	age-0 BCT	3			63	59-70	1	1-2	
	≥age-1 BKT	3	20±34 (32±55)		289	254-347	229	146-350	0.91
	≥age-1 RBT	1			307		290		1.00
	MWF	9	49±16 (79±26)	2 (2)	340	86-452	508	6-926	0.91
	SC		abundant						

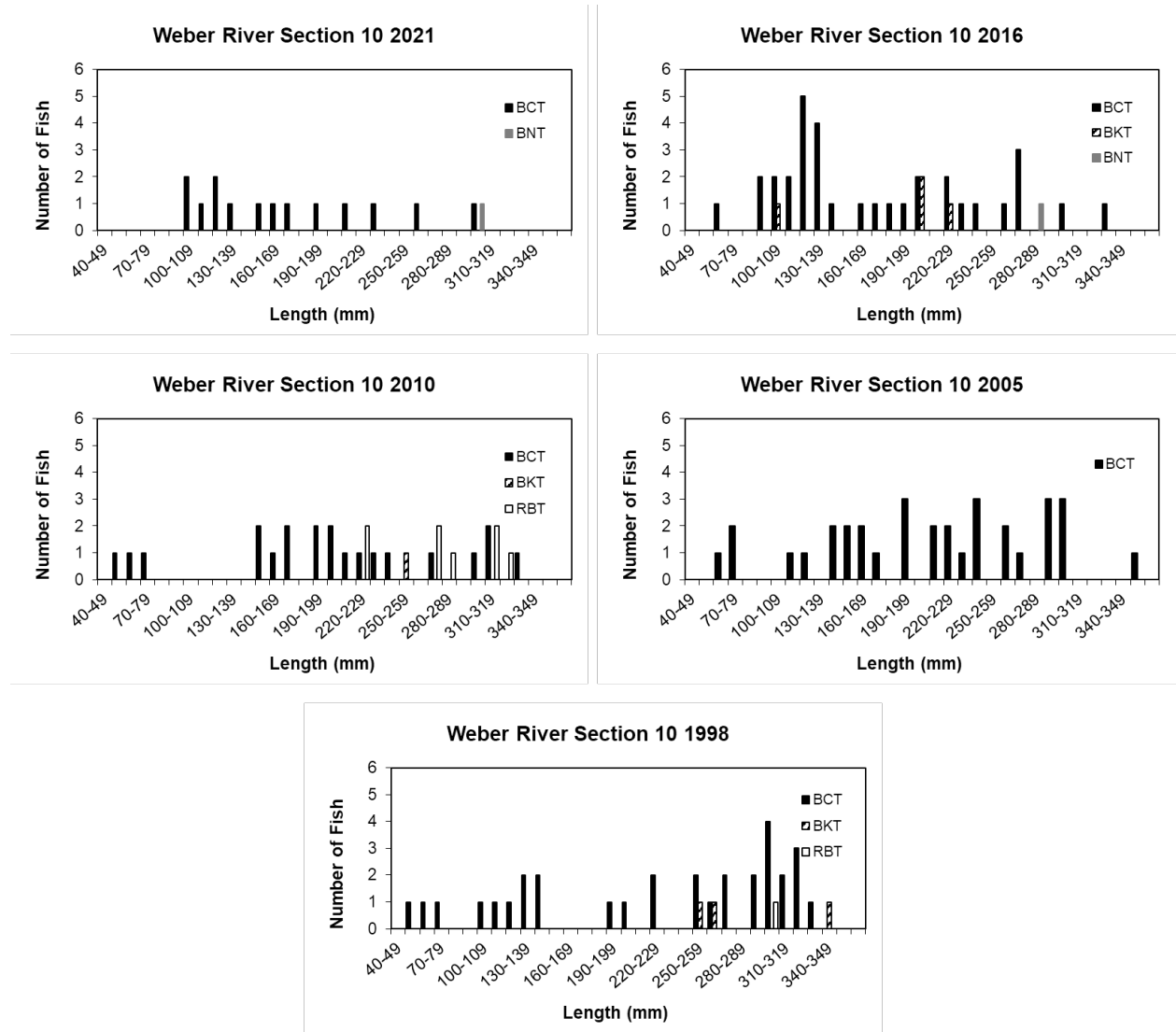


Figure 19. Size distribution of trout sampled in Weber River Section 10, 1998, 2005, 2010, 2016, and 2021.

Weber River Section 11

IVAP

Monitoring

This station, located adjacent to the Aspen Acres Subdivision in Weber Canyon, was 165 m in length and was electrofished on September 9, 2021. Based on four data points for this station, the BCT population declined from moderate density in 1998 to approximately one-fourth of that size in 2016, to one-tenth the 1998 estimate in 2021 (Table 21). The length-frequency distribution for 2021 shows a decreased and limited range of size-classes and indicates inconsistent recruitment in recent years (Figure 20). The diversity of fishes in the station in 2021 was similar to 2016 and 1998, with the same five species represented in each sample (Table 21); in addition to BCT, native species included Mountain Whitefish and sculpin. The other two species were non-native Brook Trout and Rainbow Trout (Table 21). Similar to 2016, the Rainbow Trout sampled in 2021 likely resulted from stocking. The Brook Trout population exhibited a decrease in 2021 to estimates more similar to the 2005 and 1998 estimates (Table 21); the same pattern was observed in the Mountain Whitefish population. Sculpin were abundant during all sampling events.

Table 21. Population statistics for species sampled in Weber River Section 11, 1998, 2005, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	5	32±12 (52±19)	1 (1)	155	132-178	42	22-70	1.07
	age-0 BCT	1	no depletion		56		2		
	≥age-1 BKT	5	32±12 (52±19)	2 (2)	179	149-231	71	33-157	1.09
	age-0 BKT	17	114±31 (183±51)		89	69-111	7	3-12	
	≥age-1 RBT	44	281±29 (451±47)	45 (40)	262	205-322	186	77-341	0.99
	MWF	22	140±20 (226±33)	25 (23)	238	92-397	211	6-580	1.01
	SC		abundant						
2016	≥age-1 BCT	18	93±7 (149±11)	10 (9)	226	76-321	134	5-330	0.94
	age-0 BCT	1			41				
	≥age-1 BKT	25	135±22 (218±36)	11 (10)	204	126-278	100	22-229	1.07
	age-0 BKT	6			88	75-102	7	4-11	
	≥age-1 RBT	32	164±7 (264±12)	32 (28)	292	237-349	236	119-388	0.93
	MWF	42	222±20 (357±32)	40 (35)	263	102-387	218	9-588	0.97
	SC		abundant						
2005	≥age-1 BCT	28	141±5 (227±8)	2 (1)	238	112-396	165	10-401	0.92
	age-0 BCT	1			46		1		
	≥age-1 BKT	5	25±0 (40±0)		190	103-283	118	12-283	1.22
	age-0 BKT	1			80				
	MWF	27	137±8 (221±13)	3 (2)	262	73-380	259	5-580	1.24
		SC		abundant					
1998	≥age-1 BCT	69	349±12 (562±19)	4 (3)	227	111-368	132	10-468	0.88
	age-0 BCT	1			49		1		
	≥age-1 BKT	4	23±15 (36±24)		187	150-226	61	28-92	0.87
	≥age-1 RBT	34	170±2 (274±3)	2 (2)	258	157-298	178	36-272	1.00
	MWF	10	50±0 (80±0)	1 (1)	313	182-383	329	52-586	0.96
		SC		abundant					

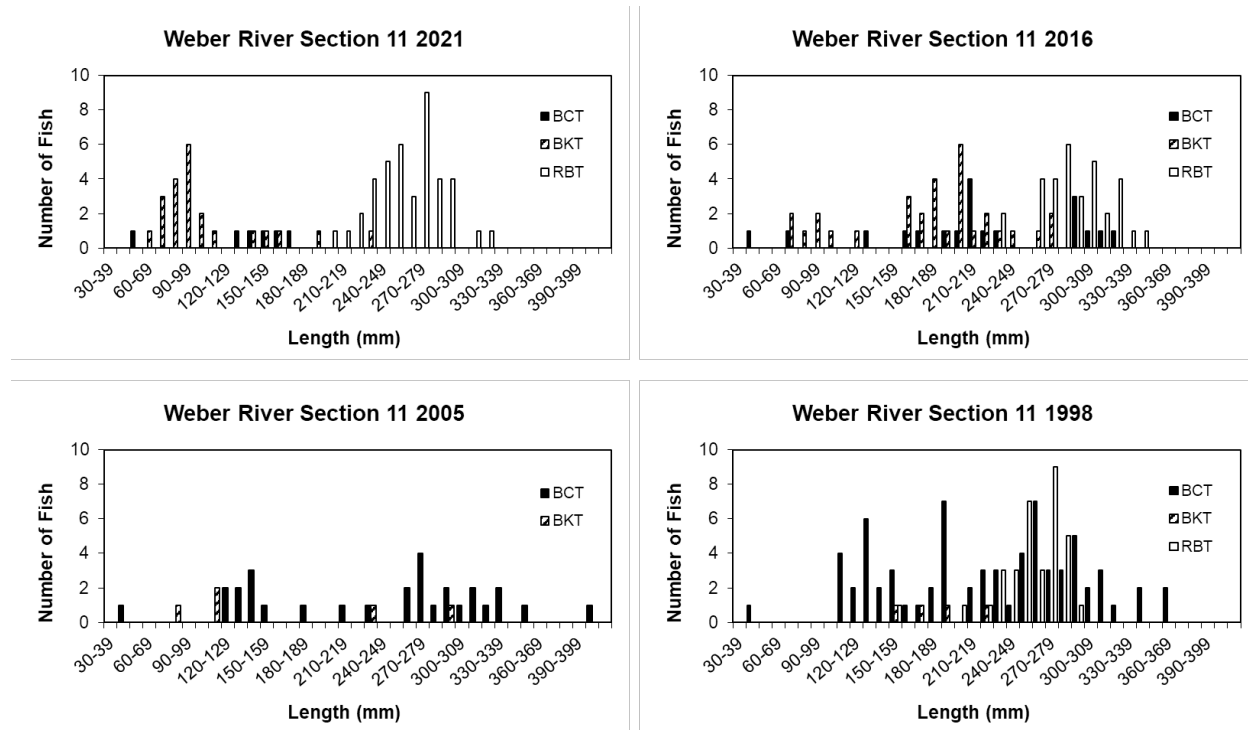


Figure 20. Size distribution of trout sampled in Weber River Section 11, 1998, 2005, 2016, and 2021.

Weber River Section 12 Monitoring

IVAP

This station, located in the Weber River headwaters west of Mirror Lake Highway, was 106 m in length and was electrofished on September 23, 2021. Based on the two data points for this station, the BCT population in this portion of the Weber drainage is small (Table 22) but apparently dynamic, with a shift from primarily adults in 2010 to all juveniles in 2021 (Figure 21), suggesting at least a degree of recruitment success in the recent past.

Table 22. Population statistics for species sampled in Weber River Section 12, 2010 and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT	3	28±0 (46±0)	0.5 (0.4)	93	86-98	7	6-8	0.84
	age-0 BCT	1	9±0 (15±0)		45				
2010	≥age-1 BCT	5	43±16 (69±25)	7 (6)	173	126-202	55	18-82	0.98

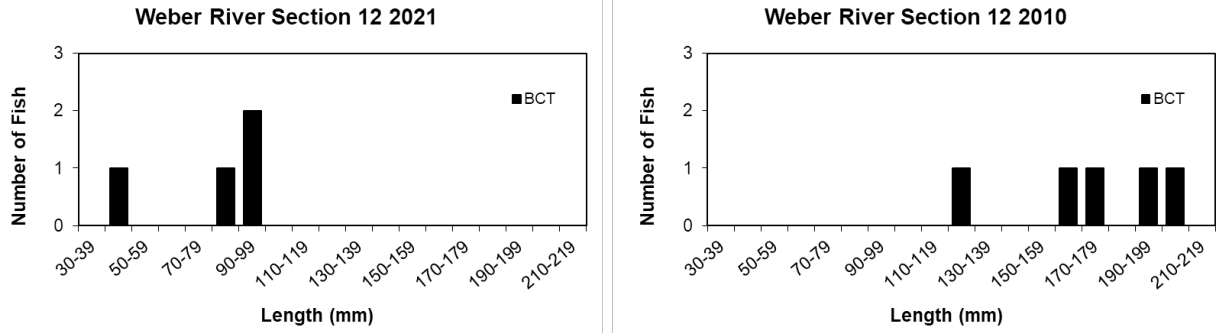


Figure 21. Size distribution of BCT sampled in Weber River Section 12, 2010 and 2021.

Echo Creek
Monitoring

IVAP210

The monitoring station in Echo Creek, 100 m in length, was electrofished on July 7, 2021. Results of this and previous samplings are shown in Table 23 and Figure 22. Based on the four data points for this station the BCT population experienced a roughly 40% decrease between 2018 and 2021, following a four-fold increase in abundance between 2014 and 2018 (Table 23). The length-frequency distribution for 2021 shows a range of sizes similar to 2018, and indicates that although recruitment has been limited it was more consistent leading up to 2018 and 2021 than it was preceding the other sampling years (Figure 22). Multiple species of native nongame fish have been present at varying densities in this stream reach during the sampling events.

Table 23. Population statistics for species sampled in the Echo Creek monitoring station, 2007, 2014, 2018, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT MTS SC SPD	14	141±7 (227±11) sparse abundant abundant	60 (54)	204	115-332	89	14-281	0.86
2018	≥age-1 BCT MTS RSS SC SPD	22	229±33 (369±54) sparse common abundant abundant	77 (69)	182	109-285	73	13-210	1.08
2014	≥age-1 BCT MTS SC SPD	4	58±38 (93±61) common abundant common	13 (12)	239	222-255	119	98-139	0.87
2007	≥age-1 BCT MTS SC SPD	8	85±11 (137±18) sparse abundant common	36 (32)	178	85-284	84	6-242	0.99

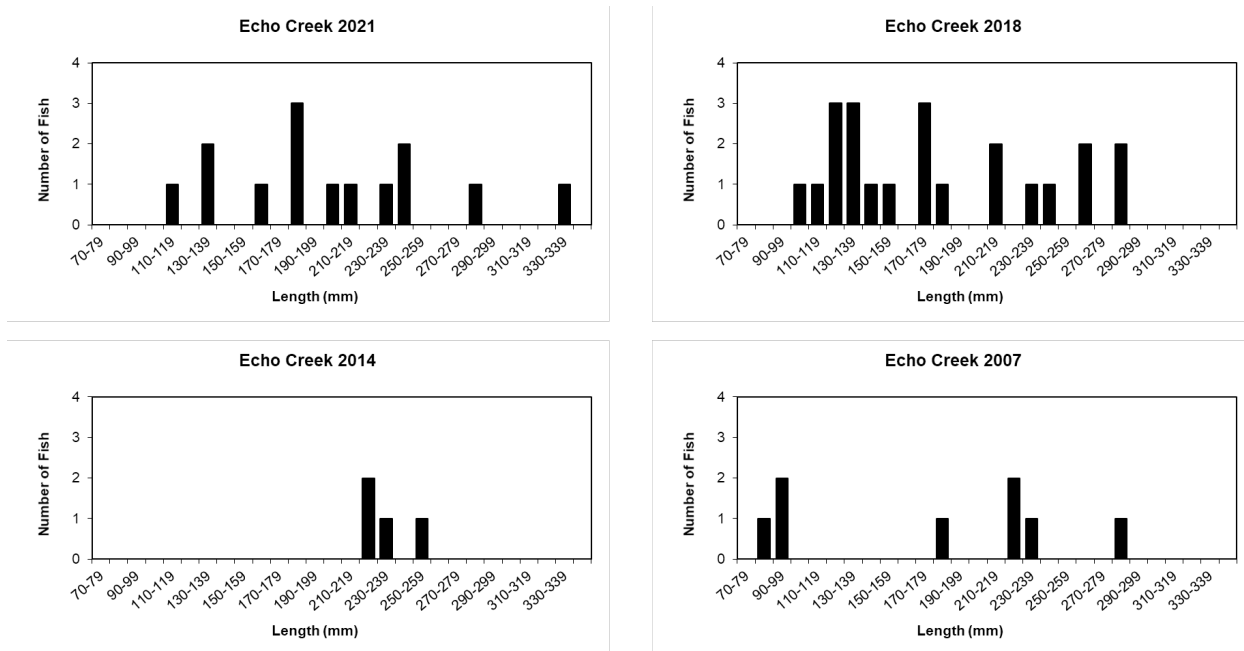


Figure 22. Size distribution of BCT sampled in the Echo Creek monitoring station, 2007, 2014, 2018, and 2021.

Heiners Creek Monitoring

IVAP210B

The station in Heiners Creek, 100 m in length, was electrofished on July 7, 2021. Results of this and the previous sampling event are shown in Table 24 and Figure 23. Based on the two data points for this station the BCT population is small and limited (Table 24). The length-frequency distribution for 2021 shows a juvenile and a probable adult, while the 2007 sample was comprised of at least two adults and one suspected sub-adult (Figure 23). The habitat in this portion of Heiners Creek, composed of a narrow, low gradient, meandering channel with low flows, and the resultant warm water temperatures (21°C [70°F] at the time of sampling), suggest it is marginal for sustaining a resident BCT population. Incidentally, multiple species of native nongame fish occupy Heiners Creek.

Table 24. Population statistics for species sampled in the Heiners Creek monitoring station, 2007 and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 BCT RSS SPD	2	no depletion sparse abundant		146	120-172	34	13-55	0.92
2007	≥age-1 BCT MTS SPD	3	26±0 (42±0) common common	36 (32)	255	152-341	209	38-377	1.03

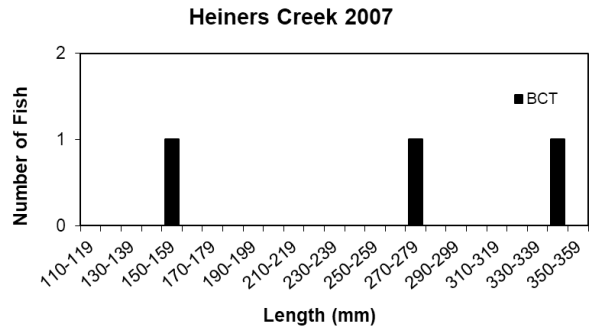
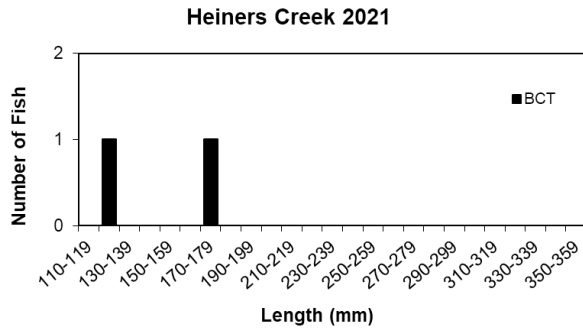


Figure 23. Size distribution of BCT sampled in the Heiners Creek monitoring station, 2007 and 2021.

Provo River Subunit

Boulder Creek

VAF200A

Genetic Collection

A partial set of BCT fin clips was collected in 2020, and the remainder were collected on June 30, 2021. The 30 samples were preserved according to established protocols.

COLORADO RIVER CUTTHROAT TROUT

Monitoring

Multiple-pass electrofishing was completed at two sites during 2021 (Table 25). Both of the monitored populations appeared to have decreased since the previous surveys.

Fish species encountered during population monitoring in 2021 included Colorado River Cutthroat Trout and Mountain Sucker.

Chemical Reclamation

During 2021, the UDWR with assistance from USFS personnel executed a chemical treatment in the West Fork Smiths Fork drainage in Summit County.

Table 25. Results of CRCT population monitoring in 2021.

Stream/section	Year	# of \geq age-1 CRCT/km	# of \geq age-1 CRCT/mile
Upper Green GMU, North Slope of the Uinta Mountains Subunit			
	2021	60 \pm 0	97 \pm 0
Little West Fork Blacks Fork, lower station	2016	161 \pm 6	259 \pm 10
	2011	101 \pm 9	163 \pm 14
	2008	252 \pm 18	406 \pm 29
Little West Fork Blacks Fork, upper station	2021	82 \pm 11	131 \pm 17
	2016	196 \pm 20	316 \pm 32
	2011	327 \pm 13	526 \pm 21
	2005	542 \pm 60	873 \pm 86

UPPER GREEN GMU North Slope of the Uinta Mountains subunit

West Fork Smiths Fork

IICK020B

Chemical Reclamation

A large crew of personnel from UDWR and USFS applied rotenone to the West Fork Smiths Fork drainage over a three-day period, August 30-September 1, 2021. Treated water was neutralized a short distance upstream of the Wyoming border at the migration barrier installed by UDWR in 2006. The mainstem, as well as all tributaries and spring inputs upstream of the barrier to the headwaters, totaling approximately 32.0 km of stream, plus Lake G-64 (1.44 ha) and a small unnamed pond (0.26 ha) were targeted. However, the headwater portions of two tributaries were excluded from the treatment because genetic analyses showed their CRCT populations to be genetically pure (see Evans and Shiozawa 2016).

Little West Fork Blacks Fork

IICK030

Monitoring

Two stations in the Little West Fork Blacks Fork were monitored in 2021, one just upstream of the old road crossing (lower) and the other in the meadow upstream of the pole fence (upper). Both stations were electrofished on August 2, 2021, and both stations were monitored previously in 2016 and 2011.

Lower Station

The fish community in this 100 m station was comprised of a small population of CRCT and Mountain Sucker (Table 26). The CRCT population estimate for 2021 was smaller than all other previous estimates (Table 26). The length-frequency histograms show a similar range of size-classes of CRCT, except for 2021, which exhibits a loss of the older age-classes (Figure 24). Mountain Sucker have continually maintained a moderate population in this reach (Table 26).

Upper Station

This 100 m station also contained a small population of CRCT, which was less than half the density and half the biomass found in 2016 (Table 26); incidentally, this population has been on a declining trend since the initial survey in 2005. The length-frequency distribution for this station has shown a good range of size-classes of CRCT during each sampling event (Figure 25), although few adults were sampled in 2021. As with the lower station, Mountain Sucker have maintained a moderate population in this reach (Table 26).

Table 26. Population statistics for species sampled in the Little West Fork Blacks Fork, 2005, 2008, 2011, 2016, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
Lower Station									
2021	≥age-1 CRCT	6	60±0 (97±0)	5 (4)	115	90-135	16	6-24	0.96
	MTS	26	361±239 (581±385)						
2016	≥age-1 CRCT	16	161±6 (259±10)	28 (25)	146	97-200	34	9-79	1.01
	MTS	39	461±100 (742±210)						
2011	≥age-1 CRCT	10	101±9 (163±14)		158	117-198			
	MTS	23	249±50 (401±81)						
2008	≥age-1 CRCT	25	252±18 (406±29)	38 (34)	153	111-206	35	15-71	0.92
	MTS	29	319±72 (514±115)						
Upper Station									
2021	≥age-1 CRCT	8	82±11 (131±17)	9 (8)	123	83-170	21	6-46	0.98
	MTS	59	616±49 (991±78)						
2016	≥age-1 CRCT	21	196±20 (316±32)	20 (18)	122	85-181	23	6-63	1.02
	age-0 CRCT	4	36±0 (59±0)		44	41-47			
	MTS	34	401±183 (645±294)						
2011	≥age-1 CRCT	34	327±13 (526±21)	38 (34)	133	68-243	29	2-143	0.94
	MTS	22	215±19 (346±31)						
2005	≥age-1 CRCT	51	542±60 (873±86)	86 (77)	144	67-204	31	2-81	0.88
	MTS	21	338±374 (544±601)						

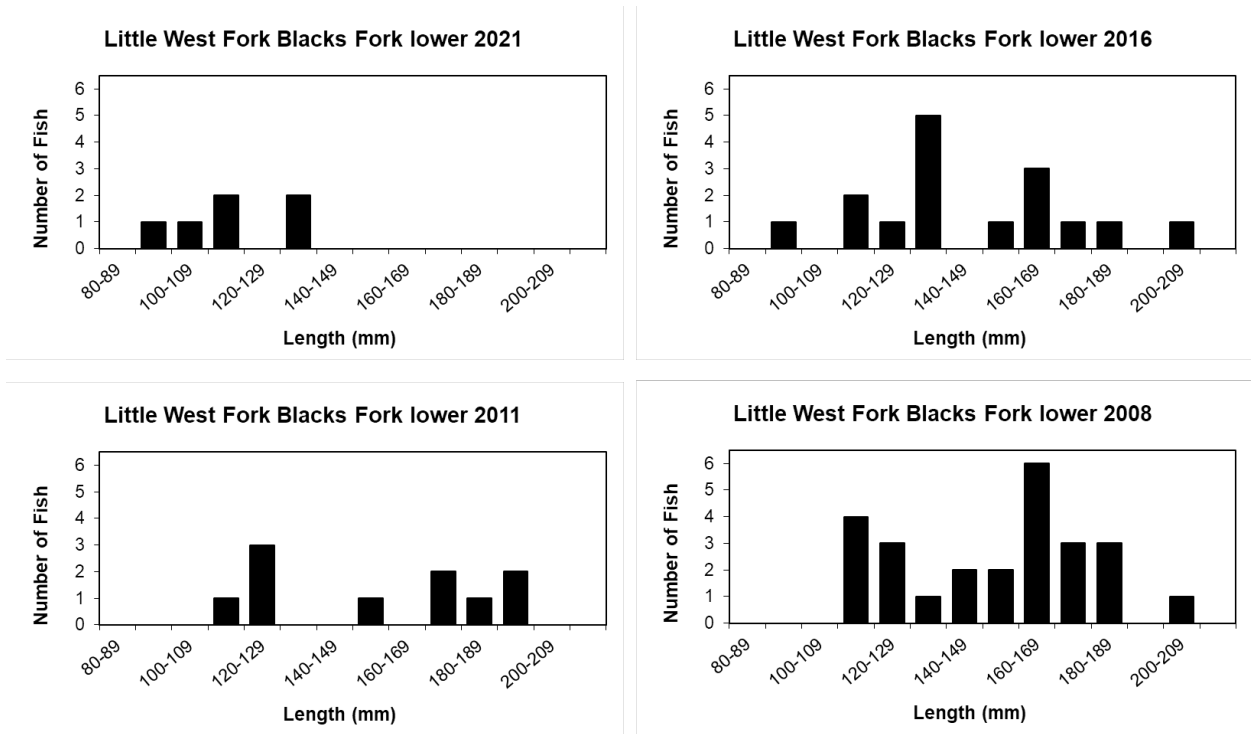


Figure 24. Size distribution of CRCT sampled in the Little West Fork Blacks Fork lower monitoring station, 2008, 2011, 2016, and 2021.

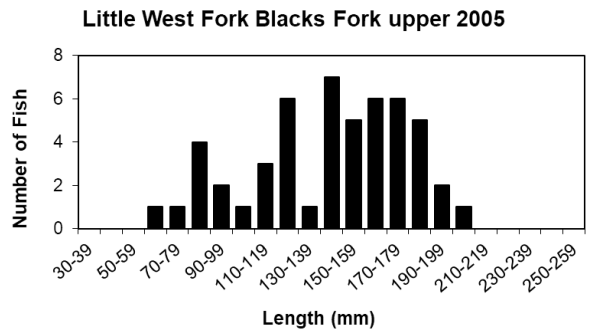
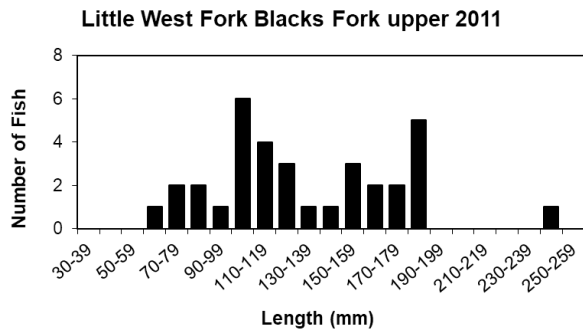
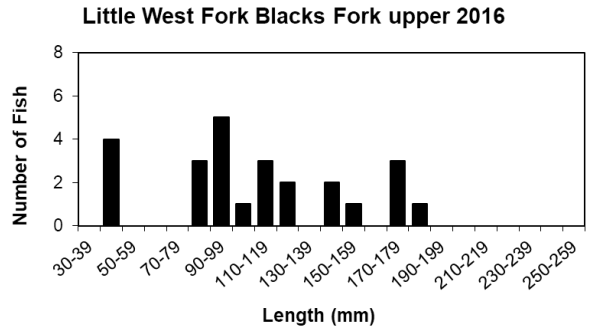
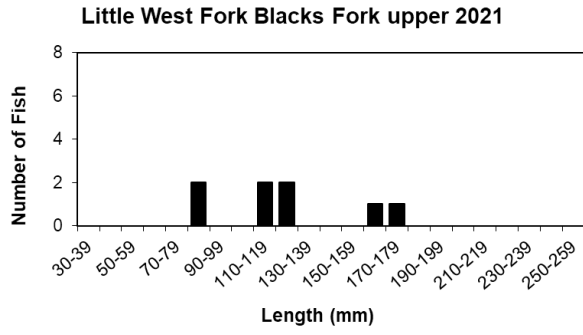


Figure 25. Size distribution of CRCT sampled in the Little West Fork Blacks Fork upper monitoring station, 2005, 2011, 2016, and 2021.

YELLOWSTONE CUTTHROAT TROUT

Monitoring

Multiple-pass electrofishing was completed in two streams during 2021 (Table 27). One of the monitored populations appeared to have decreased since the previous sampling, while the other was similar between samplings.

Fish species encountered during population monitoring in 2021 included Yellowstone Cutthroat Trout, Bluehead Sucker (BHS; *Catostomus discobolus*), sculpin, and Speckled Dace.

Table 27. Results of YCT population monitoring in 2021.

Stream/section	Year	# of \geq age-1 YCT/km	# of \geq age-1 YCT/mile
Lower Snake GMU, North Slope of the Raft River Mountains			
	2021	171 \pm 14	276 \pm 23
	2018	665 \pm 621	1070 \pm 999
	2017	634 \pm 46	1021 \pm 75
Basin Creek	2016	116 \pm 192	186 \pm 310
	2012	127 \pm 7	205 \pm 11
	2006	232 \pm 52	373 \pm 84
	2001	303 \pm 20	489 \pm 33
South Fork Junction Creek	2021	168 \pm 208	271 \pm 336
	2012	141 \pm 9	226 \pm 14
	2001	68 \pm 12	109 \pm 19

LOWER SNAKE GMU North Slope Raft River Mountains

South Fork Junction Creek

IIIAA060

Monitoring

One station in this stream, surveyed previously in 2012, was electrofished on June 28, 2021, to monitor the YCT population. This station, 97 m in length, was located at the confluence with Basin Creek. Results of this and the previous surveys are shown in Table 28 and Figure 26. The abundance of the YCT population appeared essentially flat between 2012 and 2021, although estimated biomass was approximately 50% higher in 2021 (Table 28). The length-frequency distribution for 2021 and 2012 are similar, except for age-0 YCT, which were represented during 2012 and not sampled in 2021 (Figure 26).

Table 28. Population statistics for species sampled in South Fork Junction Creek, 2001, 2012, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 YCT	11	168±208 (271±336)	125 (111)	223	130-343	139	18-349	1.04
	SC		abundant						
	SPD		sparse						
2012	≥age-1 YCT	12	141±9 (226±14)	79 (70)	239	155-320	149	33-312	0.94
	age-0 YCT	5			49	42-53			
	RSS		common						
	SC		abundant						
	SPD		common						
2001	≥age-1 YCT	7	68±12 (109±19)	23 (21)	181	91-320	75	5-307	0.90
	SC		common						
	SPD		abundant						

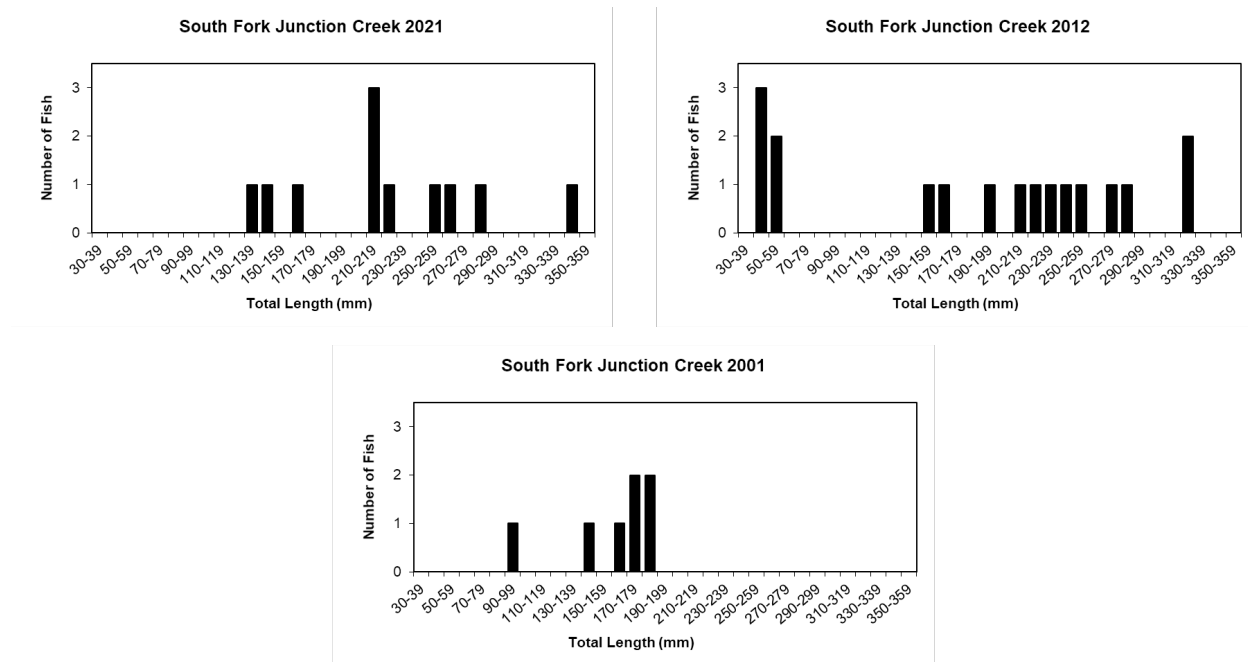


Figure 26. Size distribution of YCT sampled in the South Fork Junction Creek monitoring station, 2001, 2012, and 2021.

**Basin Creek
Monitoring**

IIIAA06011

The monitoring station in Basin Creek was sampled in 2021 as part of Bluehead Sucker population monitoring. The station was 101 m in length, located a short distance upstream of the road crossing at the lower end of Cotton Thomas Basin, and was electrofished on June 30, 2021. Results of this and previous sampling efforts are shown in Table 29 and Figure 27. The YCT population appeared to have experienced a sharp 70% decline in abundance since 2018, coupled with a greater than 80% decrease in estimated biomass (Table 29). The length-

frequency distribution for 2021 shows an array similar to 2018, with a relatively strong age-1 cohort but decreased representation among the older age-classes (Figure 27).

Table 29. Population statistics for species sampled in Basin Creek, 2001, 2006, 2012, 2016, 2017, 2018, and 2021.

Year	Species	Total Catch	#/km ± 95% C.I. (#/mi ± 95% C.I.)	kg/ha (lb/ac)	TL (mm)		WT (g)		Mean K
					Mean	Range	Mean	Range	
2021	≥age-1 YCT BHS SPD	17	171±14 (276±23) common abundant	21 (18)	134	97-195	28	8-84	0.96
2018	≥age-1 YCT BHS SPD	43 5 88	665±621 (1070±999) sparse abundant	131 (117)	142	94-365	39	8-394	0.98
2017	≥age-1 YCT BHS SPD	61 3 48	634±46 (1021±75) sparse common	124 (111)	160	112-269	50	14-237	1.10
2016	≥age-1 YCT BHS SPD	8 1 36	116±192 (186±310) sparse common	59 (53)	193 117 65	126-252 50-86	84	19-151	0.97
2012	≥age-1 YCT BHS SPD	13 1 16	127±7 (205±11) sparse common	77 (69)	213 60 72	98-289	108 2 5	9-229 1-9	0.91
2006	≥age-1 YCT SPD	22	232±52 (378±84) common	43 (38)	147	98-285	56	10-274	1.23
2001	≥age-1 YCT SPD	30	489±33 (303±20) sparse	42 (38)	137	77-244	34	6-156	1.14

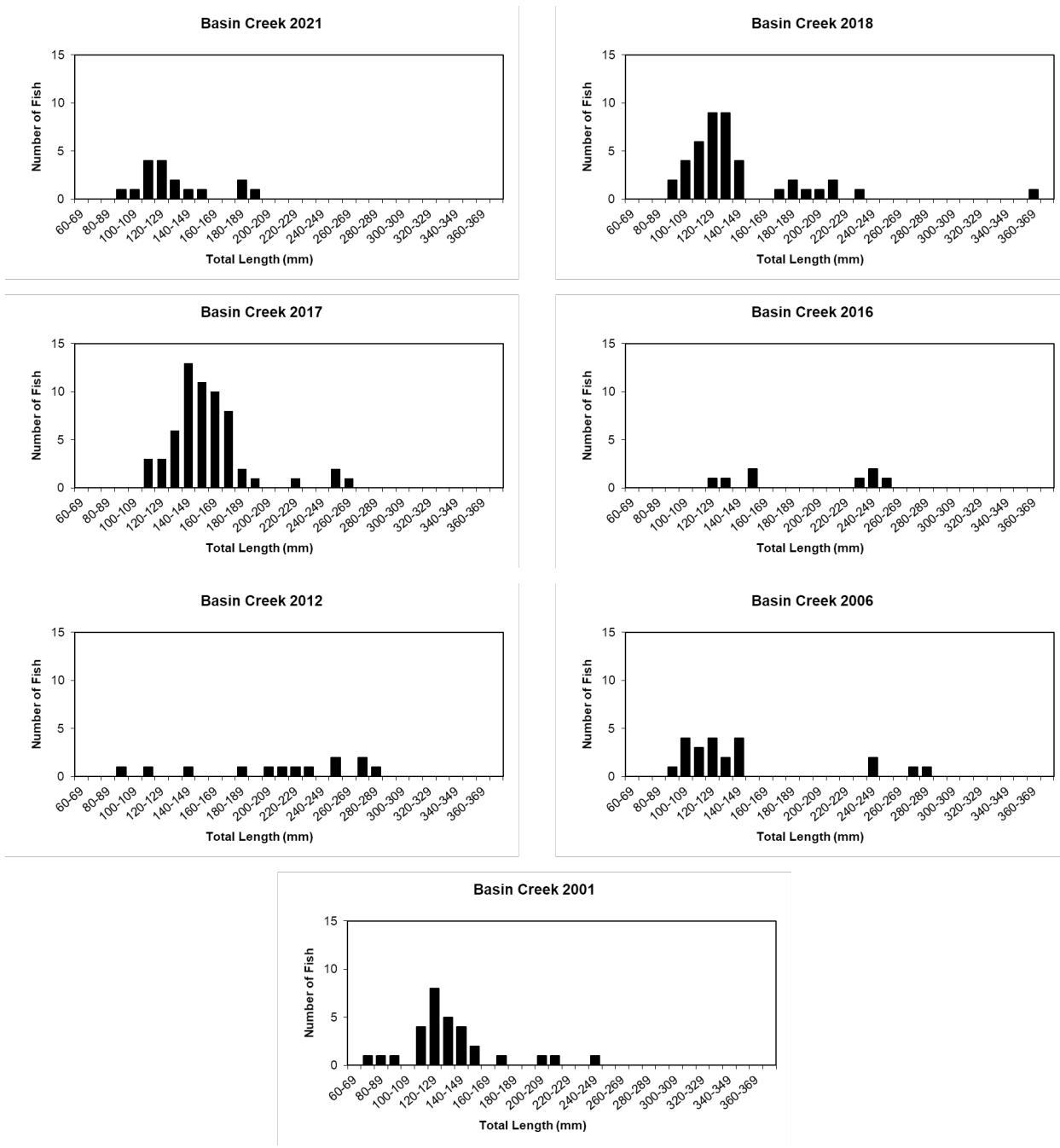


Figure 27. Size distribution of YCT sampled in the Basin Creek monitoring station, 2001, 2006, 2012, 2016, 2017, 2018, and 2021.

RECOMMENDATIONS

BONNEVILLE CUTTHROAT TROUT

Surveys

The majority of surveys to determine BCT distribution in the Northern Region have been completed. Small, un-surveyed streams/stream reaches may be discovered and additional work would be required to determine BCT distribution within them.

Monitoring

Overall, BCT populations monitored in 2021 showed some variation in numbers compared to previous surveys, some populations up in number, some down, and some flat. Overall, populations appeared to be stable, with consistent recruitment in most populations indicated by multiple age-classes in most of the samples.

As noted for some streams surveyed twice during 2008 (see McKell and Thompson 2009), timing of surveys or monitoring may produce varying results—results that may not accurately characterize the long-term status of a population. Unless monitoring is conducted during the same month in the field season as the previous survey, the results may reflect seasonal variation instead of actual trends. Tracking trends is ultimately the purpose of monitoring, which is an important part of efforts to conserve native trout. Monitoring should continue as populations of BCT representative of each GMU/subunit are revisited on an approximate five-year cycle. Specifically for 2022, monitoring is planned for streams in Rich County, as well as the Northern Bonneville GMU index sites.

Efforts toward increasing our understanding of the fluvial BCT population in the lower Weber River and tributaries should continue, including additional electrofishing and PIT-tagging, and antenna deployment in select tributaries where passage has been restored.

Restoration

Opportunities for BCT expansion and enhancement, including barrier construction and chemical treatments, will continue to be explored on an opportunistic basis. Finalization of the EA in August 2012 (USFWS 2012) signaled the commencement of treatment project implementation in 2012 in the Right Hand Fork of Logan River, continued with the second chemical treatment of the Right Hand Fork in September 2013 and stocking of BCT fingerling (produced from Temple Fork gametes) in October 2013 and September 2014, and the small-scale chemical treatment between the barriers in 2015. The chemical treatment of the Otter Creek drainage in Rich County was initiated with the first treatment in September 2015, continued with the second treatment in October 2016, and reintroduction of BCT in October 2016. The first treatment of Big Creek was conducted in September 2018 and the second in September 2019. The chemical treatment of Deadman Creek in the upper Bear River drainage was conducted in 2020. With the Deadman Creek treatment concluded, the Northern Region will be decreasing efforts to restore BCT and increasing focus on population monitoring.

Identifying opportunities to repatriate fishless streams along the Wasatch Front should continue to be a priority. This will add to cutthroat trout reintroduction efforts for Holmes and Willard creeks in 2011 and 2012, Mill and Steed creeks in 2013 and 2014, upper Willard Creek and Stone Creek in 2015, upper Stone Creek in 2016, Ricks, Barnard, and Stone creeks in 2017, North Fork Kays Creek in 2018, and Mill, Stone, Barnard, Ricks, and Holmes creeks in 2019. Opportunities that should be explored further include the headwater portions of Barnard, Ricks, and Parrish creeks in Davis County, and Waterfall and Beus canyons in Weber County.

COLORADO RIVER CUTTHROAT TROUT

Surveys

Colorado River Cutthroat Trout surveys have essentially been completed in the Northern Region. However, small, un-surveyed streams/stream reaches may be discovered and would require additional surveys to determine CRCT distribution within them.

Monitoring

Populations monitored in 2021 showed declines in abundance since the previous sampling in 2016. The monitoring of CRCT populations should follow the timeline established by the UDWR and USFS, and should remain a high priority. Monitoring is scheduled for most of the CRCT drainages on the North Slope in 2022.

Restoration

Opportunities for CRCT expansion and enhancement in North Slope drainages should continue to be explored. With the chemical treatment of the West Fork Smiths Fork drainage in 2021, effort will be made to re-establish CRCT throughout the drainage beginning in 2022. Opportunities to enhance CRCT habitat should also be explored.

YELLOWSTONE CUTTHROAT TROUT

Monitoring

One of the two populations monitored in 2021 exhibited a decrease in abundance, and the other was essentially flat. Monitoring of all YCT populations is scheduled for 2022.

Restoration

Opportunities for YCT restoration and enhancement in Raft River tributaries should continue to be explored, particularly for the population in the headwaters of George Creek.

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