

BRIGHT ANGEL CREEK COMPREHENSIVE BROWN TROUT CONTROL PROJECT
October 13, 2015 – February 7, 2016

SEASON REPORT



NPS Photo Rick Jurgen

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Background

In the Colorado River in Grand Canyon, non-native Brown Trout (BNT; *Salmo trutta*) and Rainbow Trout (RBT; *Oncorhynchus mykiss*) may compete with and selectively prey upon native fishes, including Flannelmouth Sucker (FMS; *Catostomus latipinnis*), Bluehead Sucker (BHS; *Catostomus discobolus*), Speckled Dace (SPD; *Rhinichthys osculus*), and the endangered Humpback Chub (HBC; *Gila cypha*) (see Valdez and Ryel 1995, Gloss and Coggins 2005, Yard et al. 2011, Coggins et al. 2011, Whiting et al. 2014, Spurgeon et al. 2015). Bright Angel Creek, a tributary to the Colorado River, and areas nearby historically supported thriving populations of native fishes, and as recently as the 1970s, Brown Trout, a species native to Europe and Asia, were rare in Bright Angel Creek (Minckley 1978, Otis 1994). Since the 1990s, however, Brown Trout have become a predominant component of the fish community in the creek, and a corresponding decline in native fish such as Speckled Dace has been observed (Otis 1994). Bright Angel Creek is now an important spawning site for Brown Trout, and a large aggregation of Brown Trout is found in the Colorado River near the confluence with Bright Angel Creek (Speas 2002, Makinster et al. 2010).

In an attempt to restore the native fish fauna to Bright Angel Creek, and reduce the threat of predation to endangered Humpback Chub in the Colorado River ecosystem, an ambitious program of mechanical removal of nonnative trout has evolved. Current operations under the Bright Angel Creek trout control project were established through the NPS Comprehensive Fisheries Management Plan process (CFMP; NPS 2013), and prior to the completion of the CFMP, operations were guided by the “Bright Angel Creek Trout Reduction Project” Environmental Assessment (EA) and Finding of No Significant Impact (FONSI; NPS 2006) documents. In 2008 and 2011, the U.S. Fish and Wildlife Service issued Final Biological Opinions to the U.S Bureau of Reclamation (BOR) on the Operation of Glen Canyon Dam, which outlined conservation measures to conduct trout reduction efforts in Bright Angel Creek and establish population redundancy of Humpback Chub in tributary refuges in Grand Canyon National Park (USFWS 2008 and 2011). In partial fulfillment of these measures, with funding provided by the BOR, Grand Canyon National Park re-initiated the Bright Angel Creek Trout Reduction Project in 2010 under the 2006 EA, with the primary goals of restoring and enhancing, to the extent feasible, native fish populations that once flourished in Bright Angel Creek, and to benefit Humpback Chub and other native fishes in the Colorado River (NPS 2006; Omana Smith et al 2012).

From 2010-2012, trout reduction efforts included the installation and operation of a weir and backpack electrofishing the lower 2900 meters of the creek (confluence to Phantom Creek; Omana Smith et al 2012). Beginning in the fall of 2012, removal efforts were expanded to encompass the entire length of Bright Angel Creek (approx. 16 kilometers) and Roaring Springs (approx. 1.5 kilometers). The operation of the weir was also extended from October through February to capture greater temporal variability in the trout spawn (Omana Smith et al 2012; NPS 2013). This report summarizes non-native fish removal and native fish monitoring activities in Bright Angel Creek and Roaring Springs for the 2015-16 season: from October 13th, 2015 through February 7th, 2016.

Project Objectives

The goal of this project is to reduce the abundance of nonnative Brown and Rainbow Trout in the Bright Angel Creek drainage to the maximum possible extent in order to restore the native fish community. This report summarizes the fourth season of intensive removal including the following:

1. Installation and operation of a weir and fish trap during the peak Brown and Rainbow Trout spawning period to intercept spawning trout moving between the Colorado River and Bright Angel Creek.
2. Three-pass depletion backpack electrofishing to remove trout from the entire Bright Angel Creek drainage, with a full-pass each winter season.
3. Monitoring of the Bright Angel Creek fish community response to trout removal by estimating relative abundances and population sizes of native and nonnative fishes.

All trout removed from Bright Angel Creek are prepared and distributed for beneficial use (see discussion below), and crews pursue outreach by sharing project objectives and methods with Phantom Ranch staff and park visitors.

Methods

Weir and fish trap

On October 1st 2015, a modified resistance board weir with a fish trap was installed approximately 170 meters up Bright Angel Creek from its confluence with the Colorado River, and operated continuously through February 29th, 2016. The weir was checked twice daily, once in the morning and once in the evening, throughout this period. The time and date of each check were recorded as well as the water temperature and the operator's name. During the five months of operation, the water temperature recorded in Bright Angel Creek ranged from 5.3°C – 20.4°C, averaging 10.5°C. Handling and data collection for fish captures followed the Standard Operating Procedures of the Weir at Bright Angel Creek (2015a), including release of native fishes above the weir, and humane euthanization of nonnative fishes followed by preparation for beneficial use (see below). In captured female trout, the weight of the entire egg mass (grams) and the weight of 100 eggs were recorded to the nearest 0.1 gram, allowing for the gravimetric estimation of the total fecundity of the individual.

Electrofishing

The 2015-16 Bright Angel Creek electrofishing season spanned October 15, 2015 – February 9, 2016. (A one-week tour scheduled for January 26 – February 2 was cancelled due to a power and water outage.) Electrofishing activities were guided by the Bright Angel Creek Trout Reduction Project Standard Operating Procedures (2015b). An initial six person crew hiked into the Manzanita bunkhouse via the North Kaibab Trail on October 13, 2015, and received the first helicopter sling load of food and gear on October 14. Once electrofishing had progressed far enough downstream, the base of operations transitioned from Manzanita to the Phantom Ranch bunkhouse on December 15th, 2015. Crew size varied from 6-12 personnel, and included both NPS staff and volunteers. Table 1 below summarizes the electrofishing effort in the Bright Angel

Creek mainstem (BAC) and tributaries including Angel Springs (ASP), Roaring Springs (RIS), Transept Creek (TSP), Wall Creek (WAL), and Phantom Creek (PHA). Additionally, a three-pass depletion was performed on the 170 m of BAC between the Colorado River confluence and the weir on December 14, 2015.

Table 1. Fishing effort across Bright Angel Creek (BAC) reaches and tributaries for the 2015-16 season. Trout hunts (TH) represent additional electrofishing targeting trout when time allowed in reaches where full 3 pass depletion had been completed.

Stream / Reach	Effort
Roaring Springs	3 pass depletion
Angel Springs	3 pass depletion
Transept Creek	3 pass depletion
Wall Creek	single pass
Phantom Creek	single pass
BAC Reach 5: RS/AS confluence to Transept	3 pass depletion + TH
BAC Reach 4: Transept to Ribbon	3 pass depletion + TH
BAC Reach 3: Ribbon to beaver ponds	3 pass depletion + TH
BAC Reach 2: beaver ponds to Phantom Creek	3 pass depletion
BAC Reach 1: Phantom Creek to weir	3 pass depletion
BAC Reach -1: Weir to Colorado River	3 pass depletion
Ribbon Falls	Seined*

*Electrofishing in and near Ribbon Falls Creek was discontinued following consultation with Zuni.

All non-native Brown and Rainbow Trout were humanely euthanized and prepared for human consumption or for use at the Zuni aviary (see *Beneficial Use* below), consistent with a Memorandum of Agreement between the National Park Service and State Historic Preservation Office.

Beneficial Use

As determined through consultation with Traditionally Associated Tribes, trout removed from Bright Angel Creek via the weir or electrofishing are prepared and distributed for beneficial use, to the extent possible. Trout >200mm are prepared for human consumption, and trout <200mm are prepared for eagle consumption at the Zuni aviary. All trout removed from Bright Angel Creek are cleaned and either smoked or placed in vacuum sealed bags and frozen until distributed to employees, volunteers, tribes, the general public, and the aviary for consumption.

Results

Weir

Trout captures at the weir were notably few: only two Rainbow Trout (9/30 and 10/19; 292 mm TL and 233 mm TL, respectively) and one Brown Trout (11/22; 410 mm TL, ripe male) were captured in the weir trap during the entire season. After six consecutive winter seasons of weir operation, this represents the lowest capture of trout yet observed. (The next lowest catch was observed in 2013-14, when 13 Brown and 12 Rainbow Trout were captured.) Captures of native

fishes at the weir were also low, consistent with captures across other seasons of operation, and comprised seven Speckled Dace, two Bluehead Suckers (10/26 and 2/27; 295 and 320 mm TL, respectively), and one Flannelmouth Sucker (12/14; 558 mm TL). Fishes captured during angling by the weir operator in Bright Angel Creek between the mouth and the weir included six Rainbow Trout (caught on 11/24, 1/11, 1/14, 1/16, 1/22; 290-368 mm TL), one Brown Trout (caught on 1/11; 328 mm TL), and one Flannelmouth Sucker (caught on 1/17; 510 mm TL).

Electrofishing

Total captures of Brown Trout this season (n=5558) were the lowest since BAC drainage-wide removal efforts were initiated in 2012-13. The population exhibits a bimodal length-frequency distribution after several seasons of removal (Fig. 1; 79-521 mm TL, mean 173.6 mm TL). Rainbow Trout captures were also the lowest observed yet over four seasons (n=1177), following a (possibly compensatory) increase in numbers of age-0 Rainbows in the third season of removal, 2014-15. This population now exhibits a unimodal length-frequency distribution (Fig. 2; 101-400 mm TL, mean 188.9 mm TL).

Coincident with declining nonnative trout populations as a result of targeted removal, the native fauna shows signs of a positive response in BAC. Captures in 2015-16 provided the first evidence of more than incidental recruitment in Bluehead Suckers since intensive trout removal began; 63 Blueheads of <105 mm TL were observed, compared to three in that size class in 2014-15 (see Fig. 3; 56-378 mm TL, mean 218.8 mm TL). Juvenile Flannelmouth Suckers (n=15) were also sampled in reaches 1 and 2, the first time since initiation of intensive trout removal that they have been detected upstream of the weir. Finally, Speckled Dace captures have increased nearly four-fold since 2012-13, and the population shows signs of expanding upstream into reaches 2 and 3, where captures were formerly incidental (Table 2; Figure 5; 32-189 mm TL, mean 76.1 mm TL).

Table 2. Total electrofishing captures by species across Bright Angel Creek (BAC) reaches and tributaries for the 2015-16 season. BNT = Brown Trout, RBT = Rainbow Trout, BHS = Bluehead Sucker, FMS = Flannelmouth Sucker, and SPD = Speckled Dace.

	BNT	RBT	BHS	FMS	SPD
Roaring Springs	14	0	0	0	0
Angel Springs	176	587	0	0	0
Transept Creek	53	0	0	0	0
Wall Creek	5	0	0	0	0
Phantom Creek	16	3	5	0	111
BAC Reach 5: RS/AS confluence to Transept	1528	144	0	0	0
BAC Reach 4: Transept to Ribbon	1626	33	1	0	0
BAC Reach 3: Ribbon to beaver ponds	1384	144	49	0	39
BAC Reach 2: beaver ponds to Phantom Creek	700	213	141	7	2380
BAC Reach 1: Phantom Creek to Weir	53	47	165	8	8815
BAC Reach -1: Weir to Colorado River	3	6	0	0	84
TOTAL:	5558	1177	361	15	11429

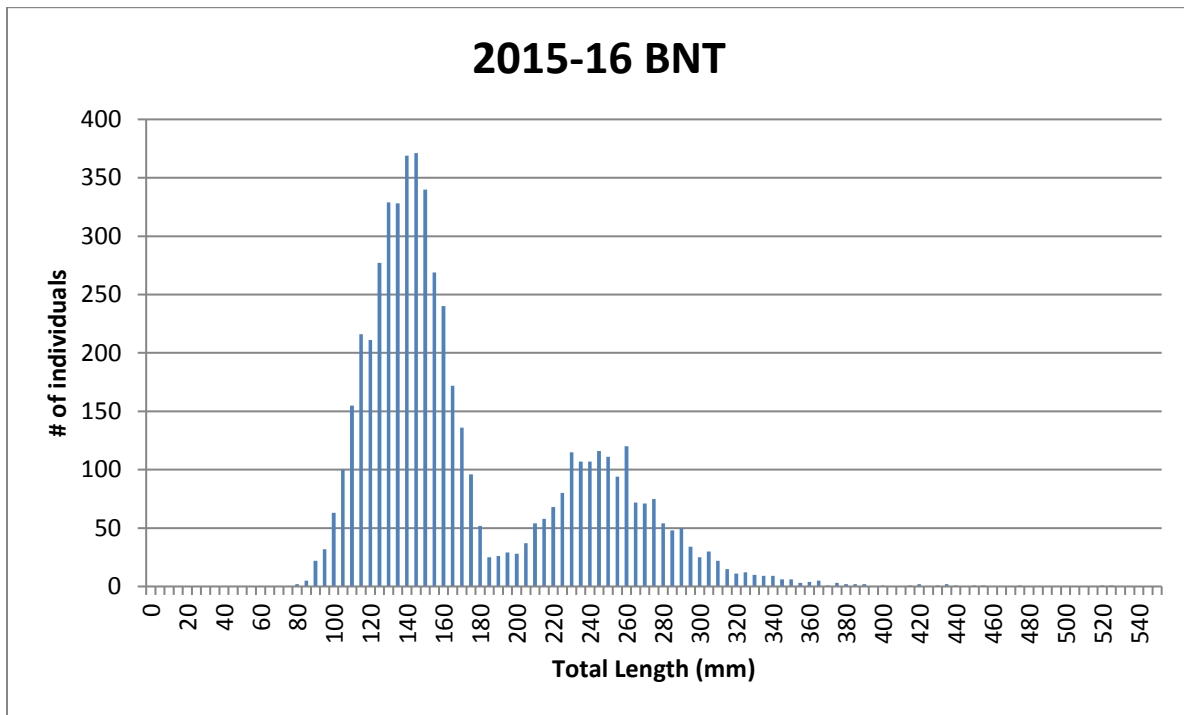


Figure 1. Length-frequency of Brown Trout captured via electrofishing during the 2015-2016 season.

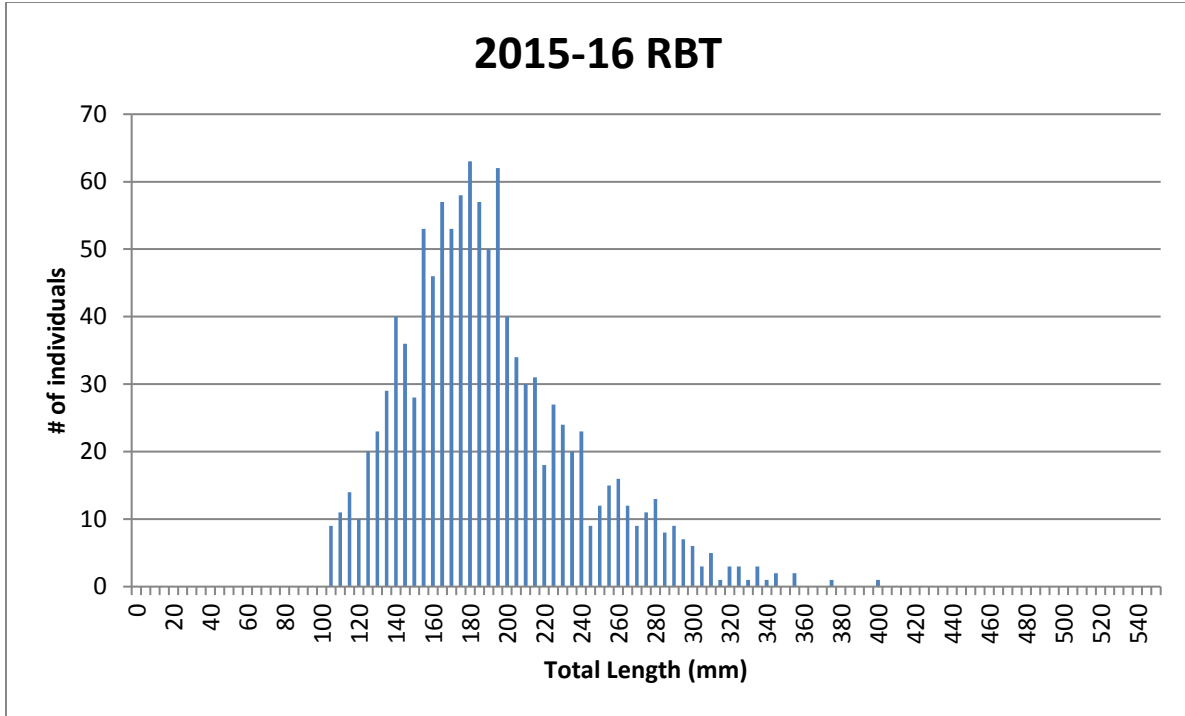


Figure 2. Length-frequency of Rainbow Trout captured via electrofishing during the 2015-2016 season.

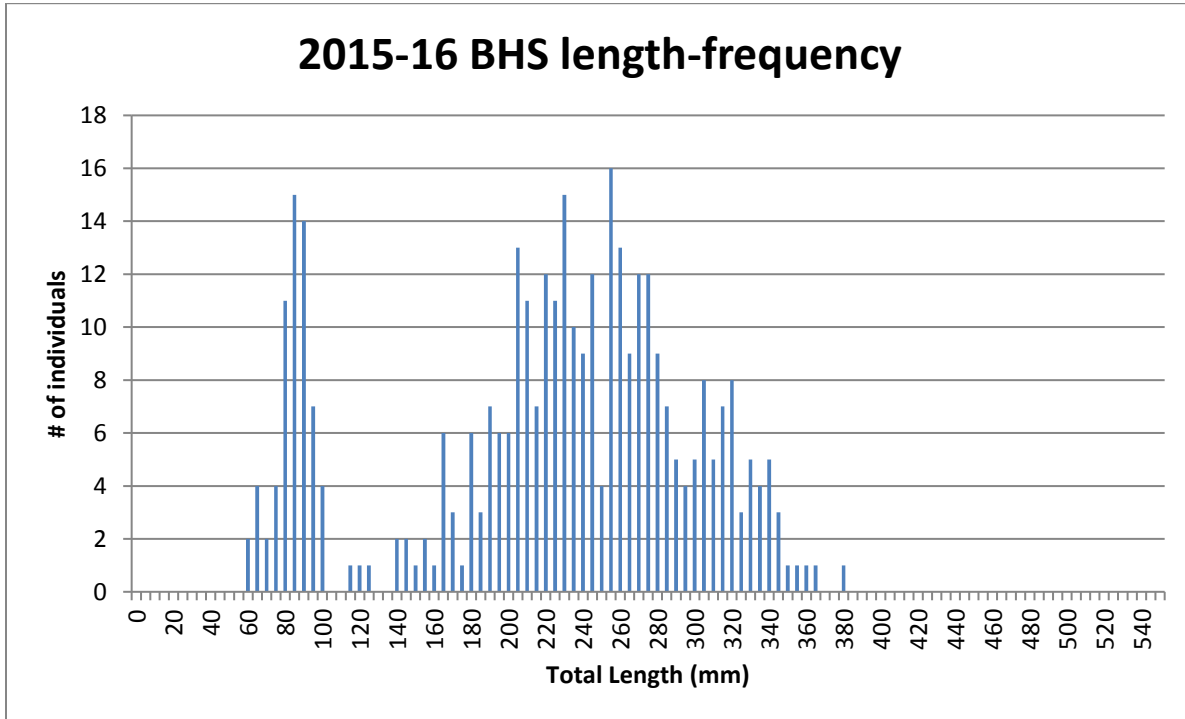


Figure 3. Length-frequency of Bluehead Suckers captured via electrofishing during the 2015-16 season (same-season recaptures removed).

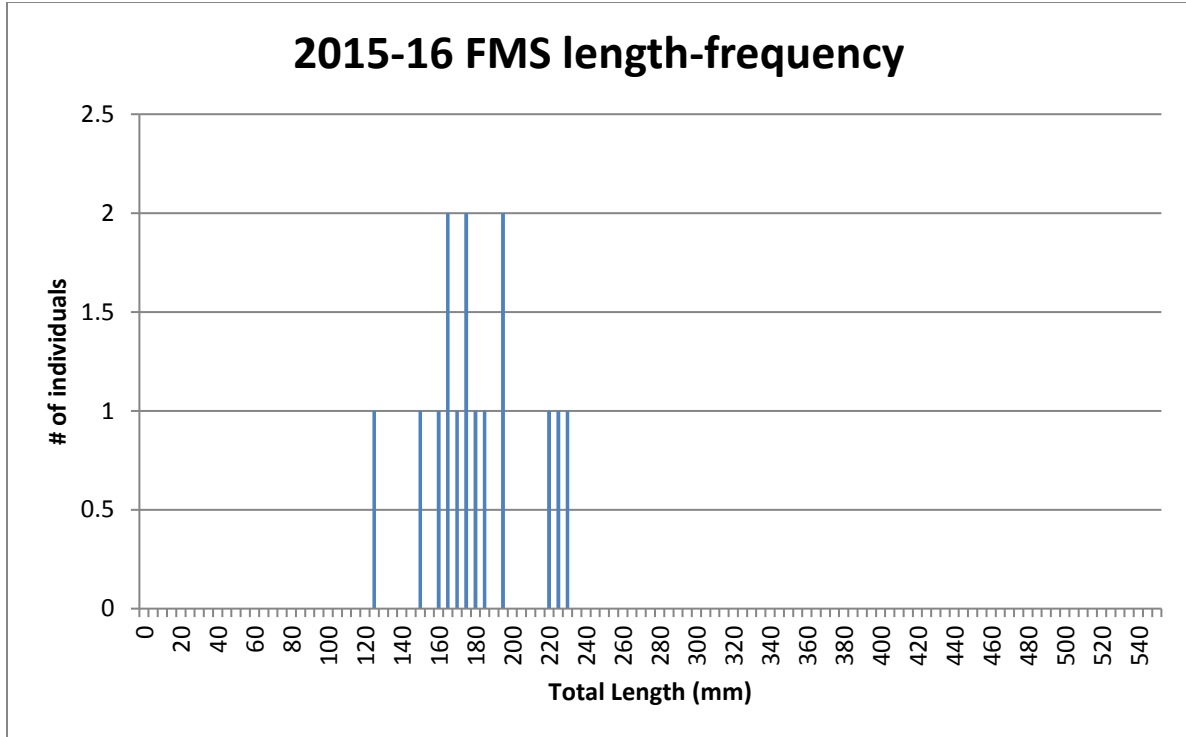


Figure 4. Length-frequency of Flannemouth Suckers captured via electrofishing during the 2015-16 season (same-season recaptures removed).

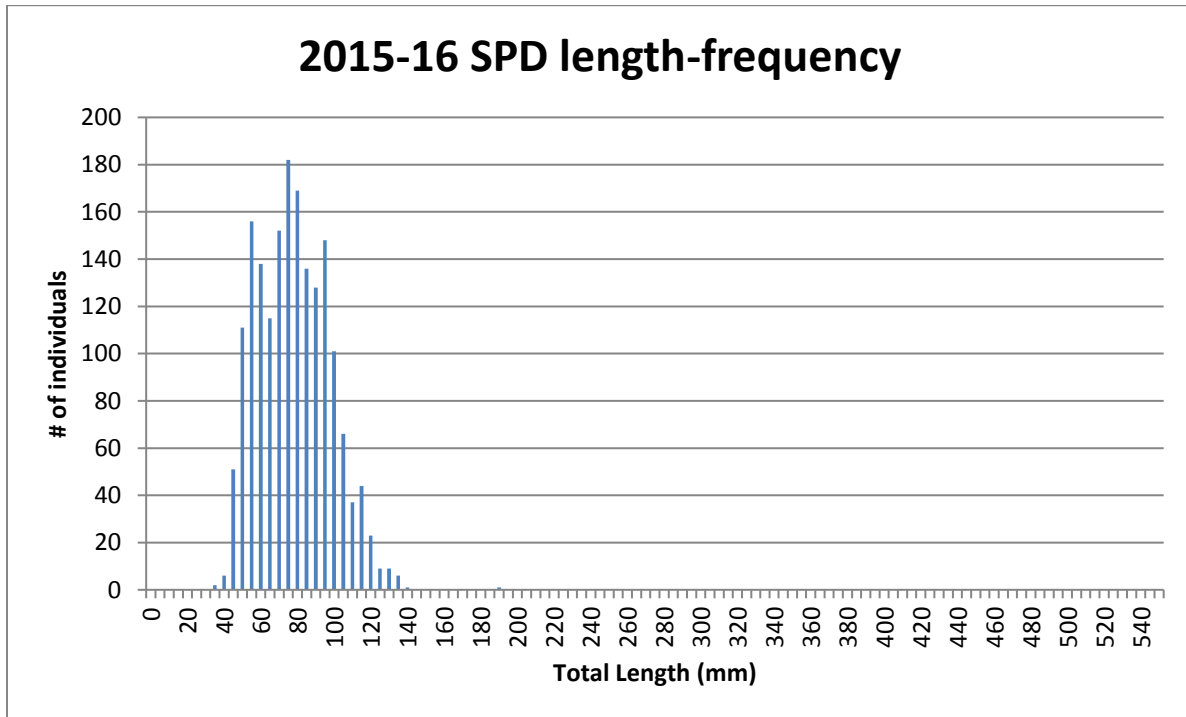


Figure 5. Length-frequency of Speckled Dace captured via electrofishing during the 2015-16 season. N=1791 measured individuals.

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