

PACTOLA STILLING BASIN POULATION ESTIMATE

PROJECT RESULT SUMMARY

- Estimated Brown Trout population of 623 individuals
- Estimated Brook Trout population of 73 individuals
- Estimated Lake Trout population of 86 individuals
- Estimated Rainbow Trout population of 74 individuals
- Estimated trout assemblage of 940 individuals
- Average W_r values exceeded 100 for all trout species
- Average PSD values exceeded 70 for all trout species

Name: Pactola Stilling Basin

County: Pennington

Legal description: T 1 N, R 5 E, Sec. 2

Location from nearest town: 16.1 km west of Rapid City, SD

Dates tagging study: July 20 thru September 12, 2012

Date last surveyed: June 16, 2005

Most recent lake management plan: None

Management classification: Coldwater Permanent

STUDY AREA

Surface Area: 2.3 ha

Watershed: 82,618 ha

Maximum depth: 3.5 m

Mean depth: Unknown

Lake elevation at survey (from known benchmark): Full

Ownership of lake and adjacent lakeshore property:

The Pactola Stilling Basin is the discharge pool below Pactola Reservoir Dam, which the U.S. Bureau of Reclamation (BOR) operates. The BOR regulates the water flow through the dam as required in order to control the reservoir level and provide water for downstream use.

Fishing Access:

The Pactola Stilling Basin can be accessed via the Pactola Basin Road off South Dakota Highway 385. A parking lot is located adjacent to the water and offers access. Anglers can access the majority of the Pactola Stilling Basin by following a well-worn footpath around the perimeter. A fence directly downstream of the outlet structure prevents access to the concrete flume.

Observations of Water Quality and Aquatic Vegetation:

The majority of the watershed is public timber and grassland administered by the U. S. Forest Service, but there are also significant areas in private ownership. Livestock grazing is widespread on both private and public lands. Much of the public land is under management for production for timber production. Roads and livestock grazing are major sources of sediment into the watershed. There is a heavy silt bed developing within the stilling basin likely derived from the Pactola Reservoir effluent. While water quality is excellent, the huge volume of water moving through the small impoundment contributes to siltation occurring in the discharge pool.

Submergent vegetation is dense throughout the shallow water portion of the pool. Scattered areas of cattail exist in calm littoral sections.

Observations on conditions of structures (i.e. spillway, boat ramps and docks, etc.)

All structures appear to be in good condition. In 1985 and 1986 the crest of the stilling basin was widened and raised 5 m. The rock-cut spillway was widened 30 m to increase safety and capacity in the event of a major flood event. At this time the splash pool below the spillway was also refurbished.

RESEARCH OBJECTIVES

- Objective 1:** To evaluate the population size(s) of salmonid assemblage in the Pactola Stilling Basin.
- Objective 2:** To evaluate the condition of trout species within the Pactola Stilling Basin.
- Objective 3:** Gather baseline data prior to habitat rehabilitation scheduled for Rapid Creek downstream of the Pactola Stilling Basin in 2013.

METHODS

Sampling Effort and Catch:

Fish were collected using nighttime boat electrofishing. Following capture, fish were anesthetized using carbon dioxide and weighed to the nearest g and measured to the nearest mm. Additionally, fish were individually marked using T-bar anchor tags (75 mm, Floy Tag and Mfg. Inc., Seattle, WA). Marking events (N=4) were spaced between one and five weeks to allow adequate recovery time.

Population estimates were calculated using the Schnabel method (Schnabel 1938), which allows for estimating population size from multiple marking and recapturing events over a short period of time. Recapture events were completed within an eight week period following the initial marking event. Sampling occurred in late summer to avoid any potential movement by fall spawning salmonids in the assemblage, which may have resulted in emigration by individuals from the population. Additionally, the Pactola

Stilling Basin is part of the roughly four km stretch of Rapid Creek that is managed as a catch and release area, resulting in little harvest potential between sampling events. Population estimates were derived using the statistical program R v. 2.15.1 (R Development Core Team 2012).

RESULTS AND DISCUSSION

This report summarizes data from the electrofishing survey conducted in the Pactola Stilling Basin in 2012. Additionally, data from the 2012 sampling is compared with previous sampling in Pactola Stilling Basin conducted in 2000, 2002 and 2005. Mean relative weight (W_r) varied from 100.9 to 107.6 for trout species sampled in 2012. These values were similar or higher than W_r values observed in previous years sampling (Table 1). Mean proportional stock density (PSD) varied from 70.0 and 95.2 for trout species sampled in 2012.

Table 1. Species, number (N), relative weight (W_r), proportional stock density (PSD) and for trout sampled from the Pactola Stilling Basin, Pennington County, South Dakota in 2000, 2002, 2005 and 2012.

Species	2000			2002			2005			2012		
	N	W_r	PSD									
BNT	364	87.8	73.5	571	90.0	97.5	54	118.9	99.3	294	107.6	70.0
BKT	14	--	78.6	22	--	72.7	13	--	30.8	42	113.0	95.2
TGT	0	--	--	0	--	--	0	--	--	20	--	--
RBT	21	81.9	83.3	45	86.3	63.2	1	99.8	22.7	28	102.9	70.0
SPT	0	--	--	2	--	--	0	--	--	0	--	--
LAT	0	--	--	0	--	--	12	104.7	0	43	100.9	83.3

Brown Trout

The Pactola Stilling Basin supports a robust trout population of 940 fish (Table 2), dominated by Brown Trout *Salmo trutta*. This pattern has been observed in the previous sampling as well. While effort varied between years, Brown Trout were the most prominent species captured in all years. It appears that the numbers and size of trout in the Pactola Stilling Basin have not decreased over the past 12 years. Furthermore, more larger brown trout are present in the Pactola Stilling Basin compared to previous years (Figure 1). Using W_r as an index of condition, as described by Anderson and Nuemann (1996), condition of Brown Trout within the Pactola Stilling Basin has also been improving (Table 1). Over the past 12 years W_r have increased from 87.8, 90.0, 118.9, 107.6 in 2000, 2002, 2005, 2012 respectively. Anderson and Wiethman (1978) determined that a balanced fish population is one with a PSD that is intermediate between the extremes of a large number of small fish and small number of large fish. Mean PSD for Brown Trout sampled in the 2012 was 70.0. While this indicates a quality Brown

Trout population, it also indicates that the population unbalanced as smaller Brown Trout were not present in the surveys.

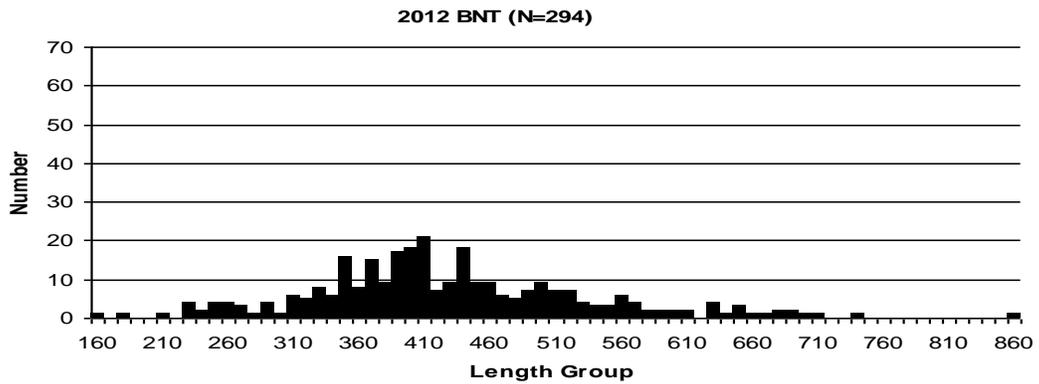
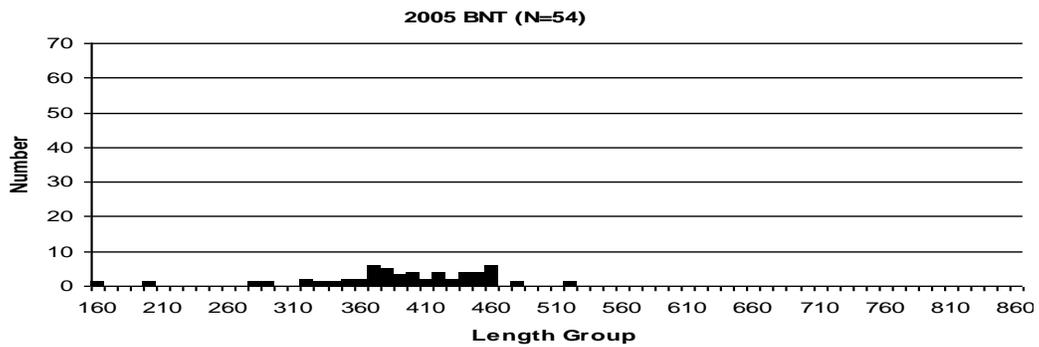
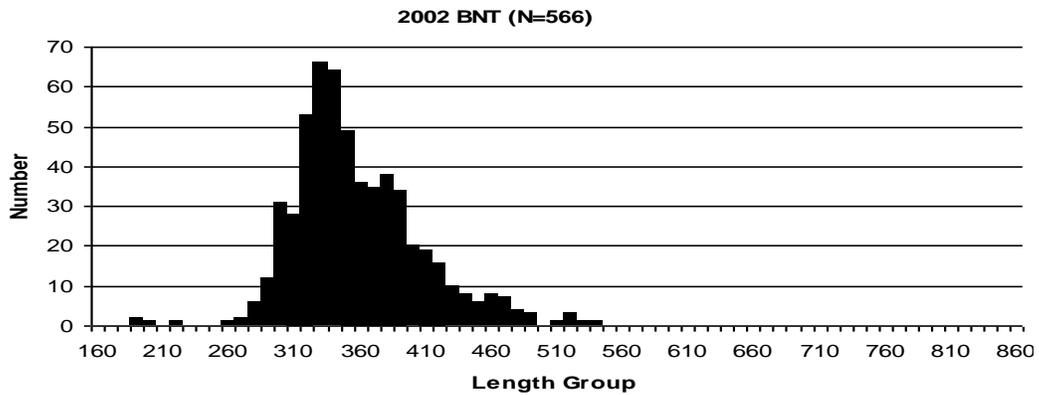
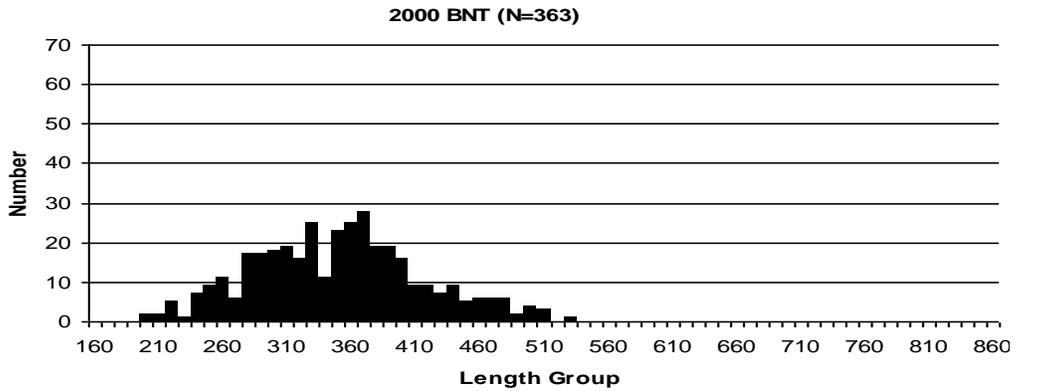


Figure 1. Length frequency histograms for Brown Trout sampled from the Pactola Stilling Basin in 2000, 2002, 2005 and 2012.

Rainbow Trout

Rainbow Trout *Oncorhynchus mykiss* numbers were consistent with previous sampling (Table 1). The Schnabel method estimated a Rainbow Trout population of 74. No prior population estimates were made on individual species other than Brown Trout, thus no comparisons can be made to previous population estimates. Rainbow Trout W_r has increased over the last 12 years from an average of 81.9 in 2000 to 102.9 in 2012. Proportional stock densities varied in previous samples from 83.3 in 2000 to 22.7 in 2005. Mean PSD for Rainbow Trout in the 2012 sample was 70.0. Similar to Brown Trout, smaller size classes were missing in the 2012 sample.

Lake Trout

Lake Trout *Salvelinus namaycush* were not detected in the Pactola Stilling Basin until 2005. Lake Trout were introduced into Pactola Reservoir in the mid 1970's, 2003 and 2005. Natural reproduction by introduced Lake Trout has been detected in the reservoir and it is likely that young-of-the-year or juvenile Lake Trout emigrated into the Pactola Stilling Basin through the outlet structure. Alternatively, adults could have also passed through the structure. Twelve Lake Trout were sampled in 2005. In 2012, a total of 43 Lake Trout were captured, potentially indicating that they have become more established within the system. In 2012, an estimated 86 individuals with 95% confidence intervals of 41 and 220 are present in the Pactola Stilling Basin. Their presence may explain the slight decrease in Brown Trout numbers. Similar to Brown Trout, Lake Trout are highly piscivorous (Morbey et al. 2007), which may increase interspecific competition within the system. Lake Trout condition remained high from 2005 through 2012 with a W_r over 100 in both 2005 and 2012. Mean PSD for Lake Trout captured in the 2012 sample was 83.3. Similar to Brown Trout PSD, this value is higher than what is generally considered a balanced population as the smaller size classes are missing in the sample. It is unknown if a reproducing population of Lake Trout exists in the Pactola Stilling Basin or if all reproduction occurs above in Pactola Reservoir and individuals emigrate into the Pactola Stilling Basin.

Tiger Trout

Tiger Trout *Salmo trutta* X *Salvelinus fontinalis* were captured in the 2012 sample; however, low numbers no recaptures precluded a population estimate. Additionally, W_r and PSD were not calculated due to the small sample sizes. While Tiger Trout have been stocked within the Black Hills Management Area, they have not been stocked within the Rapid Creek watershed. Thus, their presence is likely due to natural hybridizing between female Brown Trout and male Brook Trout. These hybrids often exhibit poor survival but good growth rates (Blanc and Poisson 1983; Scheerer et al. 1987) which provide an

additional opportunity for anglers. While no individuals were captured over 174 mm in the 2012 sample, anecdotal evidence indicates that adults do exist within the fishery, though likely in low numbers.

Splake Trout

Only two Splake Trout *Salvelinus namaycush* X *Salvelinus fontinalis* have been captured (2002) in the Pactola Stilling Basin since the study began. No Splake Trout were captured in 2012. If they do persist within the fishery it is likely at numbers undetectable by current fish sampling methods.

Brook Trout

The 2012 sampling provided a population estimate of 73 Brook Trout *Salvelinus fontinalis* with 95% confidence intervals of 37 and 169. Due to small sample sizes in previous years, no population estimates, measures of condition or PSD are available for comparisons. Brook Trout in the Pactola Stilling Basin are of good condition with a mean W_r of 113.0. Brook Trout size structure was high with a PSD of 95.2 and was the highest PSD observed for any of the previous samples. Similar to the other trout species, Brook Trout PSD indicated a large number of quality fish with an absence of smaller fish in the population.

Table 2. Population estimates for the trout population in the Pactola Stilling Basin, Pennington County, including 95% confidence intervals.

Species	Population Estimate	Lower Confidence Interval	Upper Confidence Interval
Rainbow Trout	74	23	420
Lake Trout	86	41	220
Brown Trout	623	506	809
Brook Trout	73	37	169
Total Assemblage	940	786	1,169

Data from the overall trout assemblage within the Pactola Stilling Basin indicates a healthy population of large, adult fish. In all cases, trout condition was good to excellent, with mean W_r values exceeding 100. All trout populations had above average population quality with high PSD's. Despite the absence of smaller size classes, this fishery has remained relatively stable. Several scenarios exist that may partially explain the observed size structure in this unique fishery. Gear selectivity could be causing the apparent lack of smaller fish. During electrofishing, larger fish are generally easier to immobilize than smaller ones due to their increased body length (Adams et al. 1972) and greater total surface area (Emery 1984). Smaller fish generally require more peak power than larger fish to be immobilized (Reynolds and Simpson 1978). Peak output used during electrofishing may not have reached the threshold to allow for immobilization of small fish. Alternatively, smaller fish may not recruit to the fishery until juvenile or adult sizes. Adult trout may move downstream of the Stilling Basin into Rapid Creek to find

more suitable (i.e. lotic) habitat. Spawning movements by salmonids is well documented (Kwain 1983; McCutcheon et al. 1994; Mellina et al. 2005) and has been observed in the Black Hills Trout Management Area (James 2011). While no attempt to identify movement patterns by individuals in the Pactola Stilling Basin, increased numbers of adults have been observed immediately downstream in Rapid Creek during typical spawning times, including multiple individuals from this study, identified by the presence of floy tags in their dorsal musculature (Davis pers. Comm.). Offspring may then move back into the stilling basin as part of their life-history strategy, similar to smolts leaving a tributary. Alternately, emigration by adult Lake Trout from Pactola Reservoir through the deepwater outlet may explain the high size structure observed in the 2012 sample. It is unknown if any reproduction by Lake Trout occurs in the Pactola Stilling Basin or if natural reproduction is limited to the lucustrine environment above Pactola Dam. Lastly, the large numbers of adult predators may deter the recruitment of smaller fish through direct predation.

The 2012 survey was conducted as part of a baseline assessment of the section Rapid Creek scheduled for habitat rehabilitation in 2012-2013. Approximately 4,000 m section of Rapid Creek will undergo habitat improvements such as production of overhead cover and in-stream structures. Although this section of Rapid Creek is downstream of the Pactola Stilling Basin, this may impact the trout as movement in and out of the system is possible. In conjunction with the population estimate in the stilling basin, a mark/recapture study is being conducted within the section of Rapid Creek scheduled for habitat improvements. These two studies will help evaluate any potential impacts this management strategy may have on the fishery.

Management Recommendations

1. Continue to manage the Pactola Stilling Basin as a catch and release only pond with artificial lures only and no organic bait within 100 feet restrictions.
2. Conduct an additional population estimate within five years of completion of the habitat rehabilitation project to evaluate any potential changes in the fishery.

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