FISHERY MANAGEMENT INVESTIGATIONS

IDAHO DEPARTMENT OF FISH AND GAME

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STATUS OF RAINBOW TROUT IN THE SOUTH FORK BOISE RIVER

ABSTRACT

The South Fork Boise River (SFBR) downstream of Anderson Ranch Dam is a nationally-renowned tailwater trout fishery. Idaho Department of Fish and Game staff has monitored Rainbow Trout *Oncorhynchus mykiss* populations in the SFBR every three years since 1994. These monitoring efforts only effectively sample trout longer than 100 mm. Since 2009, IDFG has conducted annual spring and fall surveys along standardized transects to gain a better understanding of the production of Rainbow Trout (i.e. age-0 juveniles prior to fall and less than 100 mm), over-winter survival, and recruitment to age-1. During the spring survey in 2015, catch of age-1 Rainbow Trout ranged from 0 to 40 fish/site, which equated to a mean density was 0.2 fish/m. Comparing fall and spring fry densities, overwinter survival for 2014-15 was estimated to be 51%. Mean density of age-0 Rainbow Trout during fall 2015 was 1.9 fish/m, which marks a return to near pre-wildfire densities. Fall density estimates in 2013 and 2014 (0.4 fish/m) were approximately 80% lower than the mean 2.3 fish/m estimated for years prior to the wildfire events of 2013. Results from 2015 continue to indicate that overwinter survival or carrying capacity rather than reproduction, determines year class abundance in the South Fork Boise River.

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INTRODUCTION

The South Fork Boise River (SFBR) downstream from Anderson Ranch Dam is a nationally-renowned tailwater-trout fishery and was the first river section in the Southwest Region to be managed under "Trophy Trout" regulations. This fishery is supported by populations of wild Rainbow Trout *Oncorhynchus mykiss* and Mountain Whitefish *Prosopium williamsoni*. Migratory Bull Trout *Salvelinus confluentus* are present at very low densities, and native nongame fish include Largescale Sucker *Catostomus macrocheilus*, Northern Pikeminnow *Ptychocheilus oregonensis* and sculpin *Cottus sp*. are present also.

During the past decade, the Rainbow Trout population in the SFBR has been relatively stable, although the relative paucity of trout in the 200 to 400 mm length range upstream of Danskin Bridge has puzzled anglers and biologists. Concerns over the irregular size structure, evidence of fry mortality during fall stream flow reductions, along with a belief by some anglers that the SFBR lacked spawning habitat led some to conclude that the river was spawning habitat or production limited. To evaluate this notion, IDFG staff began revisiting age-0 trout sampling transects that were established in 1994 during a whirling disease study (Elle 1997 and 1998). Staff began annual sampling of these sites during 2009. However, in 2013, we added 34 additional sites to ensure random site selection, sample a longer river segment, and to develop more precise estimates. From 2009 through 2012, staff sampled high densities of age-0 trout with backpack electrofishing equipment and visually observed many age-0 trout in near-shore habitat throughout the roaded section of the tailwater reach. Our results and observations indicated that reproduction was not limiting the Rainbow Trout population.

The SFBR drainage is still undergoing dramatic changes as a result of the Elk-Pony complex wildfires in August 2013. Following a rainstorm event on September 12, 2013, a number of large debris and sediment flows occurred on at least six tributaries between Anderson Ranch Dam and the Neal Bridge. The loss of vegetation along adjacent hill slopes and tributary riparian areas has created dynamic and unstable conditions. During the first week of August 2014, another series of debris and sediment flows occurred in several south-facing drainages following a series of rainstorms. Notably, Pierce and Granite creeks experienced additional damage, including large sediment flows, further down-cutting and scouring, and the loss of any natural re-vegetation that may have occurred subsequent to the 2013 events. Large debris flows occurred in a few drainages in the canyon section, including Devils Hole, Buffalo and Little Fiddler creeks, and created multiple large rapids. These new rapids are expected to reduce recreational fishing in the canyon because of the technical whitewater expertise now required to safely navigate the section.

Fall densities of age-0 Rainbow Trout declined after the fire and subsequent debris slides. From 1996 through 2012, annual fall age-0 Rainbow Trout densities had appeared to be stable. However, following the fires, fall density estimates declined by approximately 80%. The decline in fall age-0 Rainbow Trout densities could be attributed to a number of factors including reduced spawning habitat quality due to higher fine sediment levels, reduced spawning production from adult mortality, poor fry survival due to lack of cover, or direct mortality from extended exposure to suspended sediment and debris (Bozek and Young 1994; Rieman et al. 2012).

Fire restoration efforts are primarily focused on aquatic, terrestrial, and riparian habitats. Access and grazing closures have been in place since November 2013 to minimize disturbance to wildlife and vegetation in the most heavily-burned areas. The majority of terrestrial vegetation plantings are currently scheduled for early spring 2015. Multiple agencies have been involved with damage assessments and restoration plans for the areas affected by the wildfires and landslides, including US Forest Service (USFS), US Bureau of Reclamation (BOR), Trout Unlimited, and IDFG.

Restoration of aquatic habitat has primarily involved addressing the vast amount of fine sediment that has been deposited into the river. Researchers from University of Idaho modeled sediment transport under various flushing flows to determine the amount and duration of flow required to mobilize sediment and improve habitat. Models suggested that a flushing flow of 68 m^3/s or greater for at least 8 d was needed to mobilize fine sediments (Benjankar and Tonina 2014). Traditional increases in spring flows for Rainbow Trout spawning were postponed and stored to provide flushing flows in the summer. Beginning on August 18, 2014 flows were increased from 48 m^3/s to a maximum of 69 m^3/s on August 23, 2014. Flows returned to 45 m^3/s by August 29, 2014 and flows were reduced to 8.5 m^3/s (i.e. typical minimum winter flow) by September 19, 2014. The flushing flow improved the condition of the substrate, particularly upstream of Granite Creek. However, additional rain events during August 2014 caused further deposits of sediment from Granite and Pierce creeks into the main stem SFBR. Currently the erosion of alluvial fans created by these sediment flows are transporting sediment into the river and at least 4 km of river between these tributaries are extremely embedded with sand, fine silt, and mud. A combination of terrestrial stabilization and flushing flows will be required for future rehabilitation efforts.

During the past two years, the primary objective for IDFG regarding SFBR has been to describe the extent of the effects of the sediment flows on fish populations and habitat. In 2015, densities of age-0 and age-1 trout and overwinter survival were evaluated and compared to pre-fire estimates. Finally, IDFG continues to partner with other agencies in planning and prescribing rehabilitation efforts that will take place over the next several years.

METHODS

Production of Age-0 Rainbow Trout has been monitored annually along fixed transects in the fall since 2009 to index abundance in the SFBR. Beginning in 2012, IDFG also began investigating overwinter survival of age-0 Rainbow Trout. Age-0 and age-1 Rainbow Trout were sampled using a Smith-Root Type LR-24 backpack shocker. Thirty-nine fixed trend sites were sampled on March 26-27, 2015 and October 22-23, 2015 (Figure 62). Sites were 33-m long by 4-m wide and located throughout the roaded section between Anderson Ranch Dam and the Danskin Bridge. A single, upstream electrofishing pass was completed at each site. All fish were identified, counted, and measured for total length. Mean linear density of age-0 Rainbow Trout was calculated as described by Elle (1996) and Koenig et al. (2015). Age-0 and age-1 density estimates were compared to those collected in previous years. Overwinter survival S_t was estimated as

$$S_t = \frac{N_t}{N_o}$$

where N_o was the initial abundance in the fall and N_t was the abundance in the spring (Ricker 1975).

RESULTS

During the spring survey, catch of age-1 Rainbow Trout ranged from 0 to 40 fish/site, which equated to a mean density was 0.2 fish/m (Figure 63). Length of Rainbow Trout ranged from 46 to 121 mm with a mean of 74 mm (Figure 64). Using age-0 Rainbow Trout density estimates from the previous October (Koenig et al. 2015), overwinter survival for 2014-15 was estimated to be 51% (Fig 63).

In October 2015, catch of age-0 Rainbow Trout ranged from 0 to 281 fish/site, and total catch equaled 688 trout. Mean length of age-0 Rainbow Trout was 56 mm with a range of 29 to 119 mm (Figure 65). Mean density of age-0 Rainbow Trout during was 1.9 fish/m (Figure 66).

The increase in fry production marked a return to pre-wildfire age-0 density estimates. Mean density of age-0 Rainbow Trout in 2013 and 2014 (0.4 fish/m) were approximately 80% lower than the years prior to the wildfire-related events of 2013 and 2014.) Prior to the wildfires, mean density was approximately 2.0 fish/m and appeared stable from 2009-2012.

DISCUSSION

Fall densities of age-0 Rainbow Trout have returned to levels that were typical prior to the fire and subsequent debris slides. From 1996 through 2012, annual fall age-0 Rainbow Trout densities had appeared to be stable. However, during the two years immediately after the fires, fall density estimates declined by approximately 80% (Butts et al. 2016). The decline in fall densities of age-0 Rainbow Trout could be attributed to a number of factors including reduced spawning habitat quality due to higher fine sediment levels, poor survival, or direct mortality from extended exposure to suspended sediment and debris (Bozek and Young 1994; Rieman et al. 2012).

Spring densities of age-1 Rainbow Trout have been relatively stable, despite widely differing fall densities. This indicates that fall densities of age-0 trout may not be the appropriate index of year-class strength and recruitment. For instance during the 2012-2013 winter, a large number of age-0 Rainbow Trout entered the winter, but mortality was relatively high. In contrast during the 2013-2014 winter, a relatively few age-0 trout entered the winter, but mortality was low. From these limited observations, it appears that year-class-strength may be constrained by the carrying capacity of winter habitat rather than overall abundance of age-0 trout at the start of winter. Also, it appears that overwinter survival favors larger age-0 trout as very few fry <50 mm survived the winter. Length-based differences in mortality were evident in laboratory and field settings where age-0 Rainbow Trout less than 50 mm were unlikely to survive a 150-d winter due to lipid depletion (Biro et al. 2004). A number of studies have implicated the amount of suitable habitat as the primary factor regulating overwinter survival of age-0 salmonids (Cunjak 1996; Mitro et al. 2003; Koenig 2006). IDFG plans to collect one additional year of spring age-1 density information to allow one more calculation of overwinter survival, between fall 2015 and spring 2016.

Delayed negative effects to fish populations from wildfires have been documented in several systems and can occur for a decade or more following wildfires (Meyer and Pierce 2003; Rieman et al 2012). Currently, many hillsides and drainages such as Pierce and Granite creeks are very unstable and prone to additional erosion events. Restoration efforts began in the spring of 2015 and are expected to hasten the recovery and stabilization of many of these areas. In contrast, a number of beneficial effects may occur from the fire and related events, such as increased spawning gravel after fine sediments are flushed, an influx of woody debris, increased delivery of nutrients, and perhaps increased fish growth. Thus far and despite the lack of full recovery of upland, riparian, and aquatic habitats, our data has indicated that the rainbow trout population in the SFBR is resilient as production has rebounded to near pre-fire levels after only two seasons and recruitment to age-1 has been stable throughout.

RECOMMENDATIONS

1. Continue shoreline electrofishing in the spring 2016 to monitor age-1 Rainbow Trout production and overwinter survival; summarize four-year study in 2016 annual report.

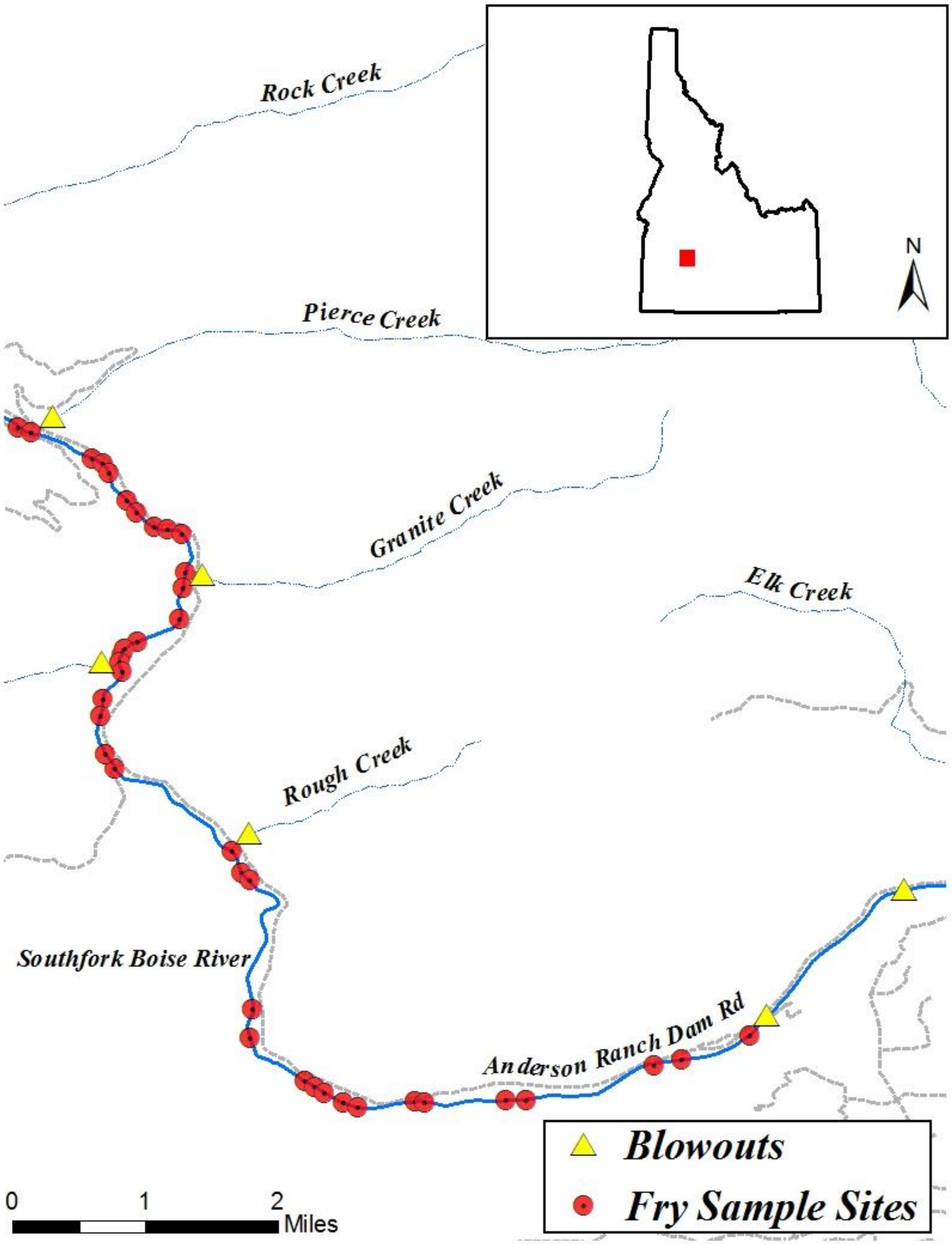

Figure 62. Map of South Fork Boise River, Idaho tailwater section showing location of major debris slides near age-0 Rainbow Trout monitoring sites.

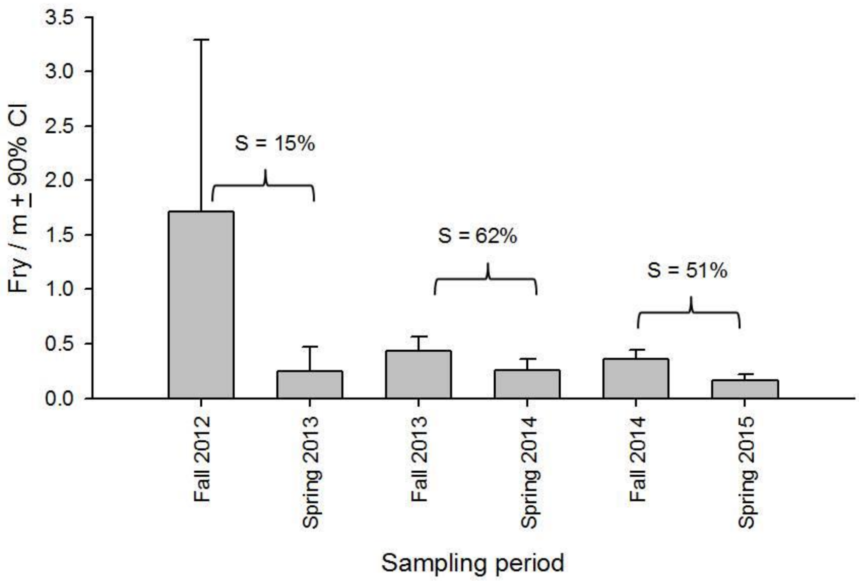

Figure 63. Comparison of mean densities age-0 and age-1 Rainbow Trout collected at 39 3-m long shoreline trend sections between fall and spring for three years at the South Fork Boise River, Idaho. Overwinter survival was estimated from comparing fall and spring age-0 trout densities.

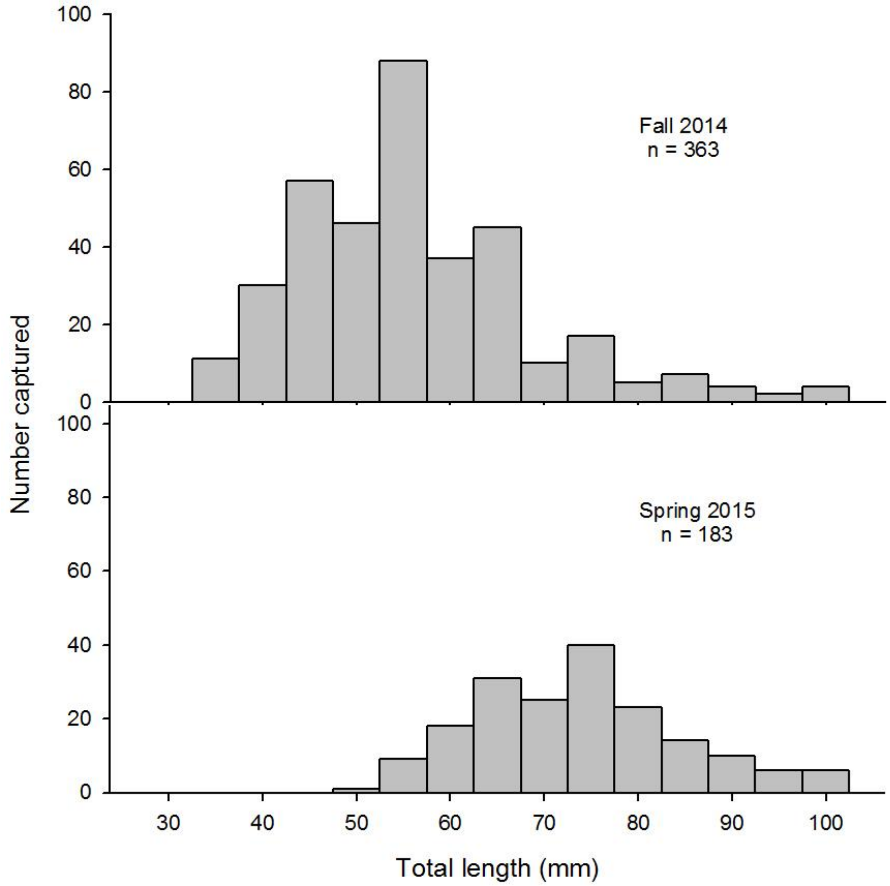

Figure 64. Length distributions of age-0 and age-1 Rainbow Trout, sampled during fry surveys during October 2014 and March 2015 in the South Fork Boise River downstream of Anderson Ranch Dam.

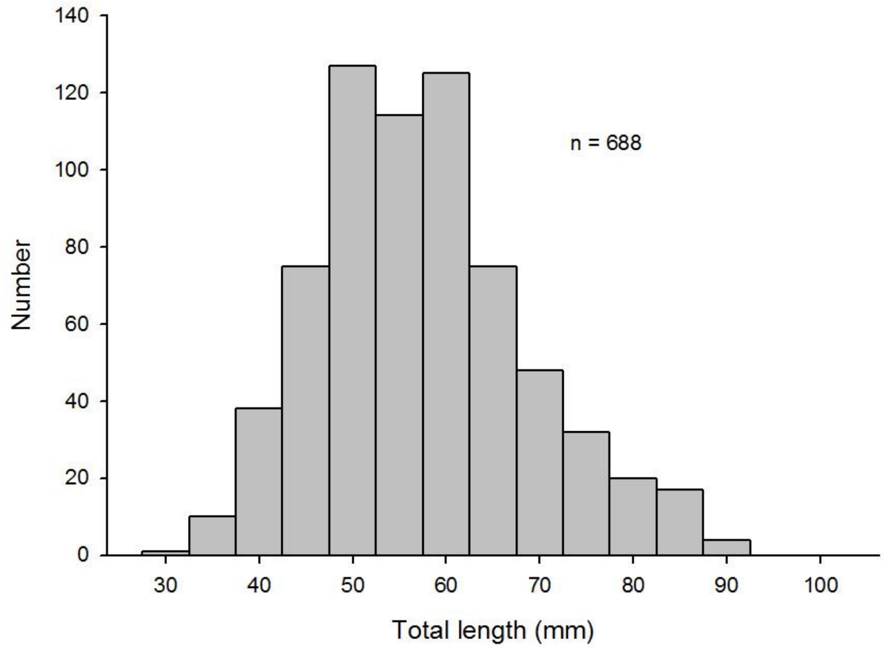

Figure 65. Length distributions of age-0 and Rainbow Trout, sampled during fry surveys during October 2015 in the South Fork Boise River downstream of Anderson Ranch Dam.

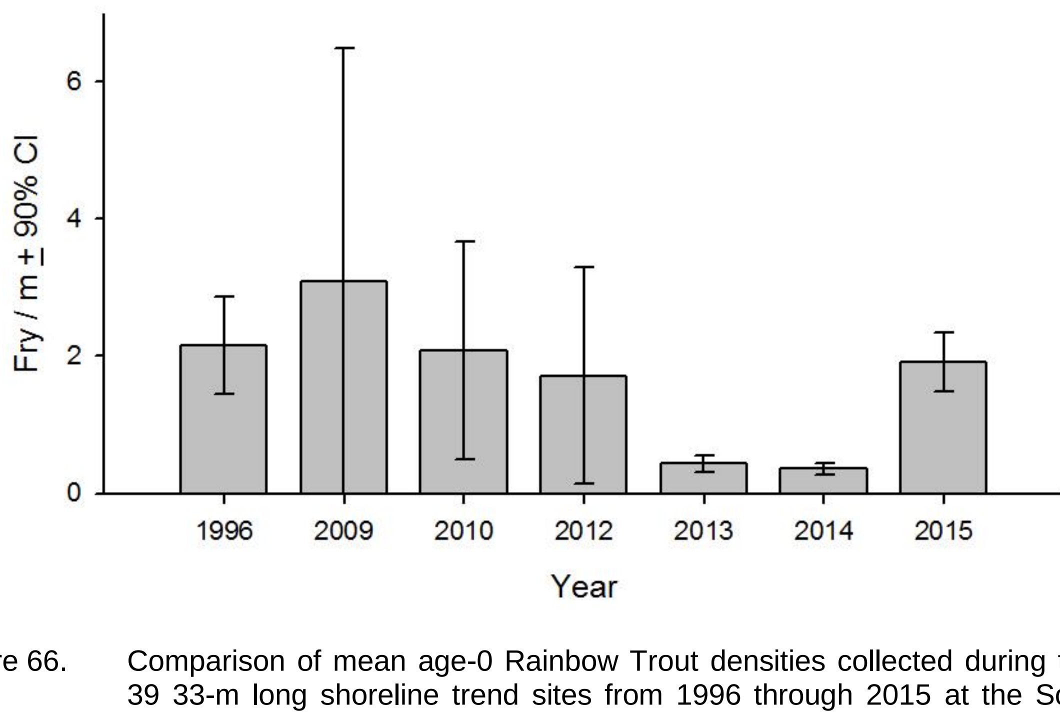

Figure 66. Comparison of mean age-0 Rainbow Trout densities collected during the fall at 39 33-m long shoreline trend sites from 1996 through 2015 at the South Fork Boise River, Idaho.