

COLORADO RIVER RECOVERY PROGRAM
FY 2013 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: 140

I. Project Title: Evaluating effects of non-native predator removal on native fishes in the Yampa River, Colorado

II. Bureau of Reclamation Agreement Number(s): 09-FG-40-2863

Project/Grant Period: Start date (Mo/Day/Yr): 1 Oct. 2008
End date: (Mo/Day/Yr): 30 Sept. 2013
Reporting period end date: 30 Sept. 2013
Is this the final report? Yes _____ No X

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IV. Abstract: Control actions for several non-native fish predators have been implemented in rivers of the Upper Colorado River Basin but effects of those removals on restoration of native fishes is unknown. Understanding the response of the native fish community to predator removal is needed to understand if removal programs are having the desired effect. The objective of this project is to document fish community changes in response to predaceous fish removals in a reach of the Yampa River, Colorado. Native species richness has increased compared to early sampling (2003-2004) conducted in this project, as has native species sampling frequency and abundance, particularly since 2008. Comparison of native fish frequency and abundance in a control and treatment reaches suggested that both non-native predator removals, as well as environmental effects due mostly to higher water, are responsible.

V. Study Schedule: Ongoing as needed, agreement extends through September 2014.

VI. Relationship to RIPRAP:

REDUCE NEGATIVE IMPACTS OF NONNATIVE FISHES AND SPORTFISH
MANAGEMENT ACTIVITIES (NONNATIVE AND SPORTFISH MANAGEMENT)

Green River Action Plan: Yampa and Little Snake Rivers

III.A.1. Implement Yampa Basin aquatic wildlife management plan to develop nonnative fish control programs in reaches of the Yampa River

occupied by endangered fishes. Each control activity will be evaluated for effectiveness and then continued as needed.

Green River Action Plan: Mainstem

III. Reduce negative impacts of nonnative fishes and sportfish management activities (Nonnative and sportfish management)

III.A.2.c Evaluate the effectiveness (e.g., nonnative and native fish response) and develop and implement an integrated, viable active control program.

VII. Accomplishment of FY 2013 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

In 2013, we sampled control and treatment reaches of Little Yampa Canyon and in Lily Park, with an effort similar to 2012 and the past. Many samples were collected in each reach to document native fish response. At time of report submission, we are emerging from field sampling and not all data are input for analysis. As a result, reporting of 2013 results cannot be included in this report. We will however, present a full summary of activities conducted in 2013 at the Non-native fish workshop in early December in Grand Junction, Colorado.

In 2012, 167 samples were collected in the treatment reach of Little Yampa Canyon (where small-bodied smallmouth bass were removed from nearshore habitat) and 90 samples were collected from the control reach (where no small-bodied smallmouth bass were removed). The remainder of samples were scattered throughout South Beach, Juniper, and Lily Park reaches. A total of 13 isolated pool samples were among the total as well.

Number of smallmouth bass sampled and removed in 2012, nearly 8,000, was increased relative to 2011 and about average for most other years (Figure 1). Reduced number collected in 2011 was thought to be due to relatively high water levels that lasted well into summer, and reduced reproductive success and growth of age-0 smallmouth bass in the study area. The increased number in 2012 was likely due to relatively warm water early in the year, caused by lower than normal flow conditions.

Native fishes were again widespread and abundant in samples in 2012, and at higher levels than in 2008-2010, but lower than 2011 (Figure 2). This is compared to 2003-2007, when few native fishes were found, and those mostly only in isolated pools with few predators. In isolated pools, native fishes were most abundant when abundance of smallmouth bass was lowest (Figure 3).

Number of native fish species collected in main channel samples of the Little Yampa Canyon reach of the Yampa River continued to show a positive response through time in the period 2003-2011. In 2003 only a single native fish, speckled dace *Rhinichthys osculus*, was captured (n = 4 individuals). In 2004 the number increased to two species, and from 2005-2007, four species were captured. In 2008, six native fishes were

collected and in 2009 five, the same number captured in 2010; seven native fishes were collected in 2011 including bluehead, mountain, and flannelmouth sucker, mottled sculpin, speckled dace, roundtail chub, and mountain whitefish. In 2012, five native fishes were collected including bluehead and flannelmouth suckers, roundtail chub, speckled dace, and mottled sculpin.

The presence of native fishes in samples has also increased since intensive removal of adult and age-0 bass commenced in 2005 (Figure 4). While the total % native fish remains low, the 2008-2010 levels represent a five-fold or more increase over 2007 and before, and the 2011 level has not been realized since sampling began. Presence of native fishes in 2012 samples was high (comparable to 2008-2010), but slightly less than in 2011. Frequency of native fishes in samples has also increased, particularly for roundtail chub *Gila robusta*. Roundtail chub were present in substantially larger numbers in the treatment reach where Age-0 bass are removed compared to the control reach where no Age-0 bass are removed (Figure 5). We interpret these collective patterns as a river-wide response of increased native fish abundance in 2008 and after, perhaps because of higher stream flows and reduced water temperatures. Those same conditions promote later smallmouth bass spawning and slower growth (see below), which may inhibit or reduce predation by that species on native fishes. The larger proportion of native fish in samples in the treatment reach compared to the control is thought a response to removal of large numbers of Age-0 smallmouth bass each year.

An additional aspect of work in FY-2010-2013 was an evaluation of sampling efficiency of our one-pass sampling in specific habitat types. To accomplish that, we sampled in a typical fashion in several locations one or more times. Each time at each site, we sampled with a single pass of electric seine sampling, and then repeated that sampling 1-2 more times to determine removal efficiency of our sampling. In general, in each of the 2010-2012 sampling years, first pass removal constituted about 60-65% of the smallmouth bass present at each site, a relatively high depletion rate. Repeated visits from late summer into autumn will allow us to understand recolonization dynamics of those habitats through the year. As is customary, we plan to report results of 2013 sampling at the December Non-native Fish workshop in Grand Junction or at the Researchers Meeting in January 2014.

We continue to make excellent progress on analysis of otoliths of smallmouth bass collected from the Yampa River. The goal is to better understand effects of streamflow and water temperature on timing and duration of smallmouth bass spawning and hatching dates, and growth rates. Results of otolith analysis show that smallmouth bass in the Yampa River study area first hatched well after spring peak flows declined but the specific calendar date varied from early June to early July across years 2005-2012. A main controlling factor to smallmouth bass reproduction appears to be water temperature. For example, when water temperatures warmed earlier in the lower flow year 2007, smallmouth bass hatching began as early as 4 June. In contrast, first hatching of smallmouth bass in the higher flow year 2008, when water temperatures remained colder later, occurred as late 2 July. Even though timing of hatching varied across years, a

consistent environmental cue to spawning appeared to be the regular onset of water temperatures of 16°C or higher. Peak hatching in the Yampa River occurred about 2-3 weeks after first bass hatched, although in 2009 the peak was only about 10 days after hatching first started. The duration of the spawning season was relatively brief, usually about 4-5 weeks in most years. Results of hatching date distributions related to flow and water temperature regimes was presented at the Non-native Fish Workshop in 2009 as well as at the Upper Colorado River Researchers Meeting (2010, 2011, 2012), the Colorado-Wyoming Chapter of the American Fisheries Society (2009), and the Larval Fish Conference in Santa Fe, New Mexico (2010), and was well-received.

We have also conducted comprehensive analyses of factors affecting growth rates of Age-0 smallmouth bass in the Yampa River. Specifically, we compared intra-annual and inter-annual patterns of bass growth rates and lengths, and related those patterns to thermal and hydrologic characteristics of the Yampa River in the period 2003-2011. Intra-annual cohort growth of smallmouth bass varied from 0.66 mm/day in 2005 to 1.12 mm/day in 2006, both in first cohorts of the year. The shortest length bass were from cohort 3 in 2008 (mean TL = 40 mm) and the largest in cohort 1 in 2007 (102 mm TL). Early cohort growth rates were faster than later ones in all years because they had the benefit of the entire warm summer season to grow. Bass growth ceased when water temperatures declined to about 10°C. General linear model analyses showed that age-0 bass growth rates were highest, and length was greater in September, in years when water temperatures were high and spring runoff flows declined early. Conversely, bass growth rates were lower, and length was shorter in September, in years when water temperatures were cool and runoff was prolonged. Bass from isolated pools usually grew more slowly than those from the mainstem Yampa River. Quantifying factors that affect growth and ecology of age-0 smallmouth bass in the Yampa River will assist with population dynamics investigations that support optimizing strategies for bass removal, and aid recovery efforts for native fishes in the Upper Colorado River Basin. Results of bass growth rate analyses were presented three times in 2010 (all by Angela Hill), at the Upper Colorado River Researchers Meeting, the Colorado-Wyoming Chapter of the American Fisheries Society, and the Larval Fish Conference in Santa Fe, New Mexico, and each was well-received. This information was also incorporated into a population dynamics model for smallmouth bass being developed under Project 161, which allows investigation of year-specific effects on growth and subsequent over-winter survival related to Yampa River flow and water temperature.

We also conducted additional smallmouth bass otolith research in spring 2010-2012. The literature is controversial in regards to the number of daily increments and the timing of their deposition in otoliths of smallmouth bass at hatching and swimup. Because this information is critical to our understanding of hatching time and interpretation of hatching date distributions, we raised smallmouth bass embryos in constant and fluctuating temperature regimes at 20°C. Embryos were acquired from the Colorado Division of Wildlife Hatchery at Wray, Colorado. Series of bass from each treatment were preserved through ontogeny to resolve the issue of increment deposition timing and clarity. Those analyses have been completed and the Results were submitted to the North

American Journal of Fish Management.

VIII. Recommendations:

- Present a more complete summary of data regarding the native fish response evaluation at the 2013 Non-native Fish Workshop, and at the 2014 Researchers Meeting (if necessary).
- Continue sampling in 2014 and out years, with similar effort as 2013, to continue to bolster this important data set

IX. Project Status: Our Cooperative Agreement with the Bureau of Reclamation for this project ended on 30 September 2013. The large carryover is the result of that, when we would normally be finishing up fieldwork (October, early-mid November), sample work (October-November), and data analysis and presentation (November-December) for this project. Because this project overlaps fiscal years in terms of field work and obligations, and because we rely on funding received in the prior fiscal year to complete work in any one calendar year (e.g., FY 2013 funding used for work completed in 2013, whether the work is prior to or after 1 October) we are anticipating re-obligation of those funds to us so we can complete this work.

X. FY 2013 Budget Status

- A. Funds Provided: \$85,976
- B. Funds Expended: \$23,418
- C. Difference: \$62,558
- D. Percent of the FY 2013 work completed, and projected costs to complete: <50% of FY13 complete.
- E. Recovery Program funds spent for publication charges: 0

XI. Status of Data Submission (Where applicable):

XII. Signed: Kevin R. Bestgen 19 November 2013
Principal Investigator Date

(Just put name and date here, since you will be submitting the report electronically)

APPENDIX:

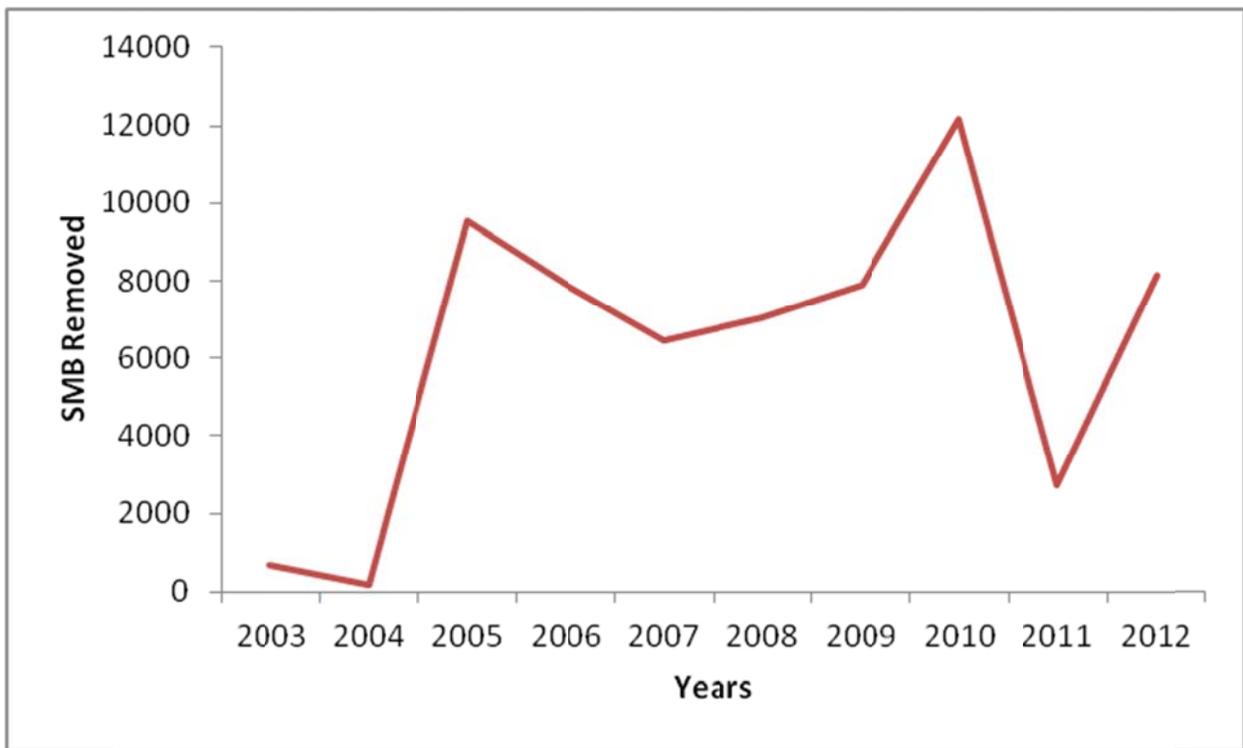


Figure 1. Number of small-bodied (usually < 100 mm total length) smallmouth bass removed from the treatment reach of Little Yampa Canyon, 2003-2012.

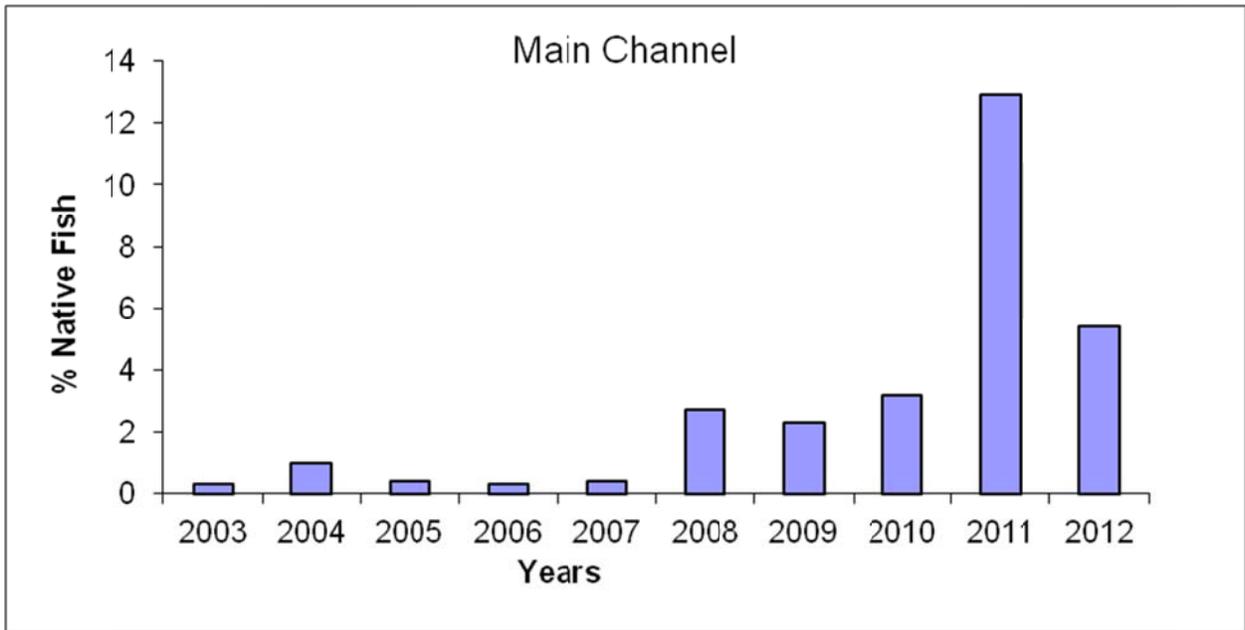


Figure 2. Percent composition of native fishes in the Yampa River, 2003-2012, in samples collected from the main channel in Little Yampa Canyon.

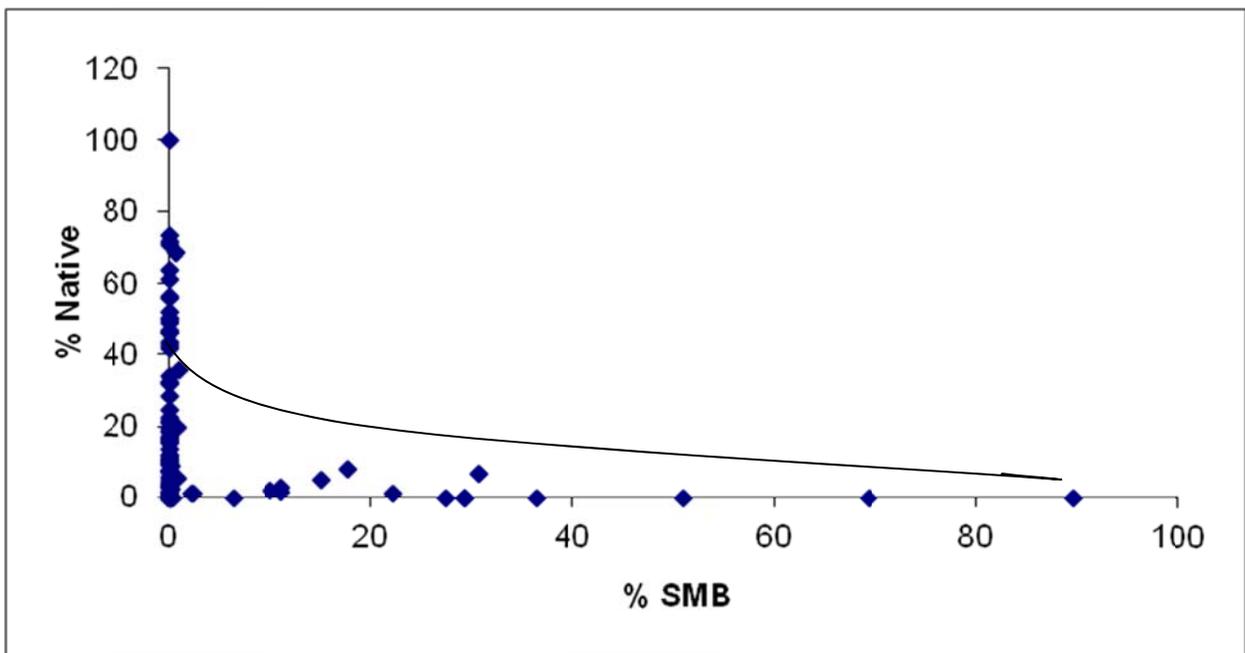


Figure 3. Percent native fishes as a function of percent smallmouth bass in samples collected from isolated pools in the Little Yampa Canyon reach of the Yampa River 2003-2012.

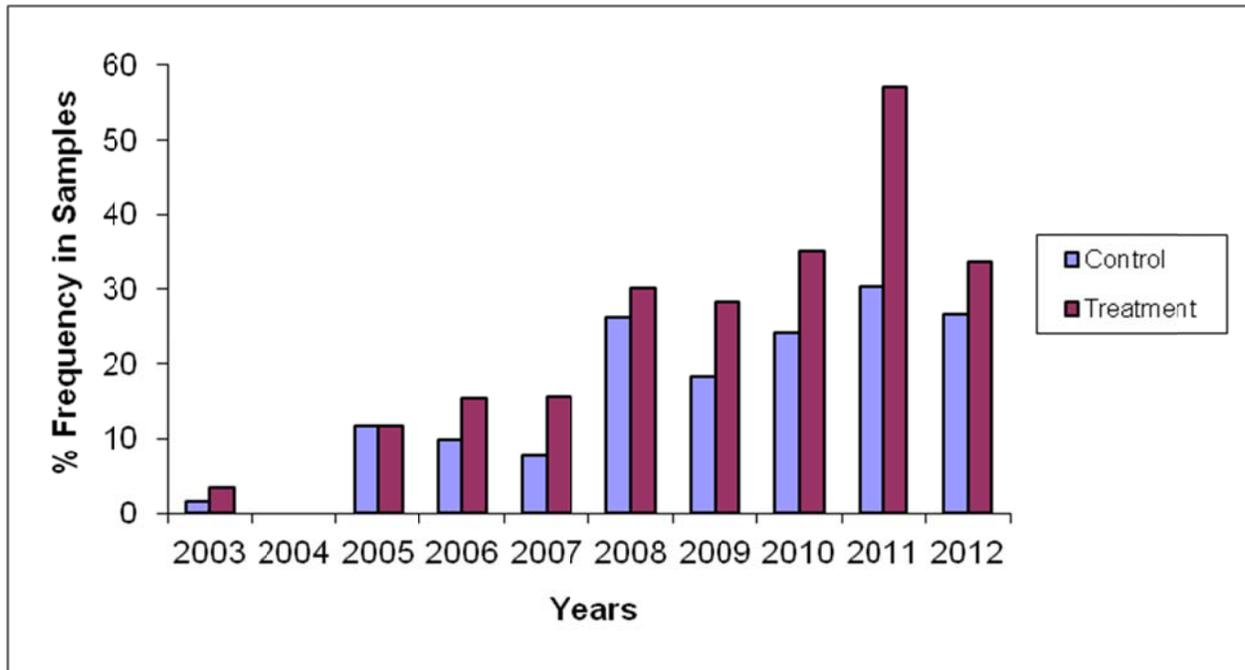


Figure 4. Presence of native fishes (any species) in samples collected in the main channel of the Yampa River in control (no age-0 smallmouth bass removal) and treatment (intensive age-0 smallmouth bass removal) reaches in Little Yampa Canyon, 2003-2012.

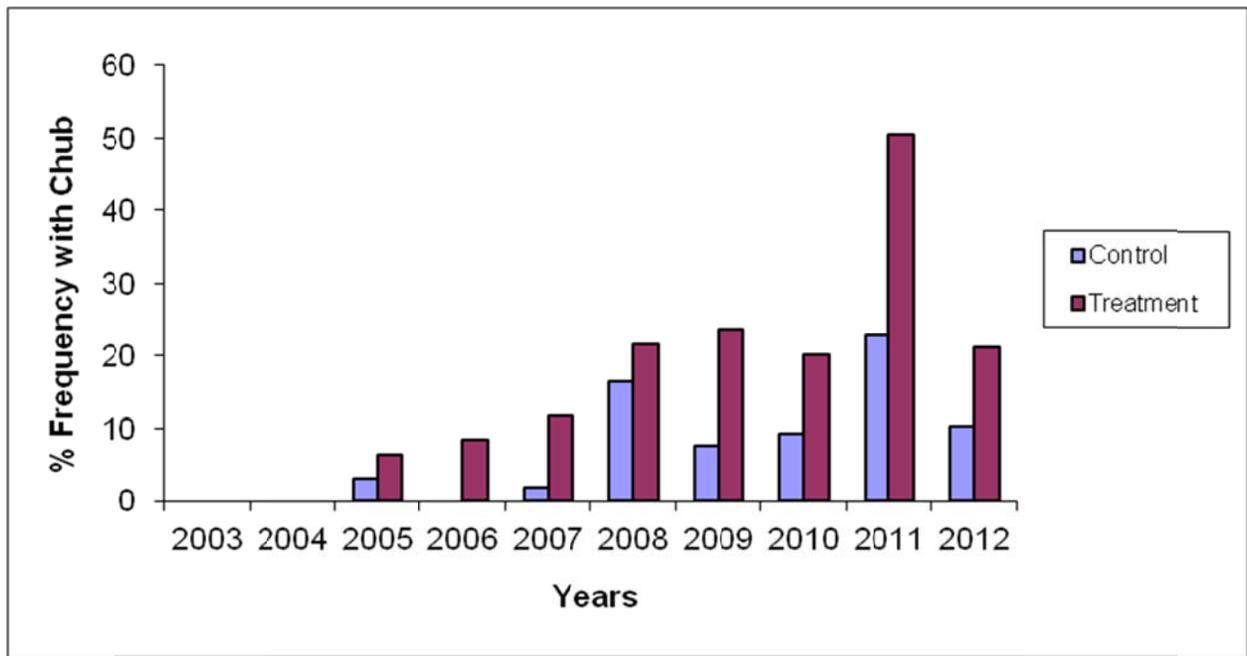


Figure 5. Frequency of roundtail chub in samples collected in the main channel Yampa River in the control (no age-0 smallmouth bass removal) and treatment (intensive age-0 smallmouth bass removal) reaches in Little Yampa Canyon, 2003-2012.