2014-2015 Lower Clark Fork River Salmonid Abundance Monitoring Project Update

Idaho Tributary Habitat Acquisition and Enhancement Program:
Appendix A of the Clark Fork Settlement Agreement

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May 2017

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ABSTRACT

This report documents surveys performed during 2014 and 2015 to estimate abundance of target salmonid species in the Clark Fork River downstream of Cabinet Gorge Dam. An electrofishing survey of approximately 6.6 km of the Clark Fork River was conducted in the fall of 2014 and the spring of 2015 to assess the abundance of salmonid populations in this reach of river. The fall survey was conducted to assess the abundance of resident spring-spawning salmonids (i.e., Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi*, Rainbow Trout *O. mykiss*, and their hybrids), and a spring survey was conducted to assess the population abundance of Brown Trout *Salmo trutta* and Mountain Whitefish *Prosopium williamsoni* using mark-recapture techniques. In addition, the abundance of spring spawners was estimated during the 2015 survey to evaluate the potential magnitude of spring spawning migrations. Abundance of targeted fishes was highest for Mountain Whitefish (3,719; 95% CI range 1,932 to 7,830), while Brown Trout (266; 95% CI range 176 to 423), the fall 2014 estimate of Rainbow Trout and Rainbow Trout x Westslope Cutthroat Trout hybrids (346; 95% CI range 236 to 527), and the fall 2014 estimate of Westslope Cutthroat Trout (306; 95% CI range 200 to 490) were considerably lower. The estimates for spring spawners in 2015 were similar to those derived the prior fall. These data were compared to prior estimates. The point estimate of abundance of Mountain Whitefish in 2014was reduced from 2002-2008 estimates and was most similar to the estimate derived in 2000. The 2015 Brown Trout point estimate was similar to peaks in abundance noted in 2004 and 2008. The fall 2014 Rainbow Trout and Rainbow Trout x Westslope Cutthroat Trout hybrid point estimate was similar to that derived in 1999 and was an increase from those documented in the 2000s. The fall 2014 point estimate of Westslope Cutthroat abundance was substantially higher than those previously calculated.

INTRODUCTION

An agreement reached between Avista Corporation (Avista) and Idaho Department of Fish and Game (IDFG) in 1973 provided for a 84.9 cubic meters per second (cms; 3,000 cubic feet per second; cfs) minimum flow below Cabinet Gorge Dam. That agreement was based on field assessments of the river at varying flows, electrical generating requirements, a review of historic low-flow records, and the earlier recommendation for a minimum flow of the same amount made by the U.S. Fish and Wildlife Service (Service). However, minimum flow in the Clark Fork River below Cabinet Gorge Dam was still one issue of concern to the local stakeholders involved in a collaborative relicensing process conducted by Avista for Cabinet Gorge and Noxon Rapids dams. Avista applied for relicensing of these two hydroelectric facilities on the Clark Fork River in Idaho and Montana in 1999 and the Clark Fork Settlement Agreement (CFSA) was the product of the collaborative relicensing process (Avista 1999). Cabinet Gorge Dam is located just inside the Idaho border and Noxon Rapids Dam is located approximately 32 km upstream in Montana (Figure 1). A new minimum flow was negotiated for Cabinet Gorge Dam as part of the relicensing agreement, which increased the base flow from 84.9 cms (3,000 cfs) to 141.5 cms (5,000 cfs) beginning March1, 1999 (Avista 2001). The objective of the increased minimum flow was to increase the amount of permanently wetted river habitat to benefit the aquatic resources of the Clark Fork River. More specifically, the objectives were to reduce the range of depth and velocity fluctuations in the river, and reduce varial zone and depositional bar dewatering to increase stability of shoreline rearing areas for fish and enhance macroinvertebrate production. Photo documentation was used to estimate the minimum flow needed to provide a meaningful increase in permanently wetted perimeter of the Clark Fork River (Beak 1997).

In addition to increased minimum flows in the Clark Fork River, Avista and IDFG completed a restoration project in 2001 to provide perennial flow through the approximately 2 km-long Foster Bar side-channel to enhance fish habitat. This involved lowering several hydraulic control points within the side-channel so that water would flow through the side-channel over the range of discharges from Cabinet Gorge Dam. Prior to relicensing, when discharge from Cabinet Gorge Dam dropped below approximately 311.3 cms (11,000 cfs), the side-channel would become a series of un-connected pools. This reconnection was anticipated to provide valuable off-channel spawning and rearing habitat for salmonids, which is in limited supply in the Idaho reach of the Clark Fork River. This project also was intended to improve recreational fishing opportunities for adult salmonids in the side-channel. Subsequent effects of these changes were hypothesized to increase abundance of target fish, increase the proportion of younger age classes of target species, and improve condition of all age classes.

To assess the effectiveness of changes in minimum flow and channel alteration, a ten-year monitoring program was conducted from 1999 through 2008. A report was generated in 2011 summarizing prior monitoring results and recommendations from this required monitoring. Fish populations were monitored between 1999 and 2008 in a 6.6 km reach of the lower Clark Fork River. Targeted species in the monitoring program included Brown Trout *Salmo trutta*, Mountain Whitefish *Prosopium williamsoni*, Rainbow Trout *Oncorhynchus mykiss*, and Westslope Cutthroat Trout *O. clarkii lewisi*. Assessment focused on monitoring changes in abundance, size structure, and condition of fish populations in the affected area. Abundance of target species was estimated during annual monitoring efforts using mark-recapture techniques. No significant changes or trends ($\alpha > 0.05$) in relative abundance were detected for any of the target species over the 10-year period. Native non-game fishes including Northern Pikeminnow *Ptychocheilus oregonensis*, Redside Shiner *Richardsonius balteatus*, Peamouth Chub *Mylocheilus caurinus*, and Largescale Sucker *Catostomus macrocheilus* were the most common fishes sampled. Results over this 10-year period suggested abundance, size structure, and condition of fish populations in the lower Clark Fork River were largely unchanged following increases in minimum flow below Cabinet Gorge Dam (Ryan and Jakubowski 2011).

Our more recent monitoring effort was designed to re-assess these population parameters after approximately 6 additional years had passed. This report provides data on estimated abundance from sampling events conducted in the fall of 2014 targeting spring spawning salmonid species (Westslope Cutthroat Trout and Rainbow Trout, including Rainbow x Westslope Cutthroat Trout hybrids) and the spring of 2015 event, targeting fall spawning salmonids (Brown Trout and Mountain Whitefish). Additional abundance data, as well as a discussion of size and condition information from 2014-15 and from 2017, will be presented following another sampling event scheduled for 2017.

STUDY AREA

The Clark Fork River is the largest tributary to Lake Pend Oreille (LPO), contributing an estimated 92% of the annual inflow (Frenzel 1991) and draining approximately 59,324 km^2 of western Montana (Lee and Lunetta 1990). Four tributaries enter the Clark Fork River downstream of Cabinet Gorge Dam: Twin, Mosquito, Lightning, and Johnson creeks (Figure 1). Peak flows in the Clark Fork River typically occur as a result of snow melt in May or June (PBTAT 1998).

The study area encompasses approximately 6.6 km of river habitat from the USGS gauging station below Cabinet Gorge Dam downstream to the inlet of Foster Bar side-channel (approximately river km 234 – 241, Figure 1). There is approximately 17 km of river habitat between Cabinet Gorge Dam and LPO during winter lake drawdown. Approximately 6 km of the lower river is impacted by elevated LPO water levels during late spring through early fall. Physical habitat in the Clark Fork River below Cabinet Gorge Dam can be characterized as primarily low gradient laminar flow, with three major riffles and several deep pools (to 23 m in depth) (WWP 1995). Riffles are located near the mouths of Twin and Lightning creeks, as well as at Foster Bar side-channel.

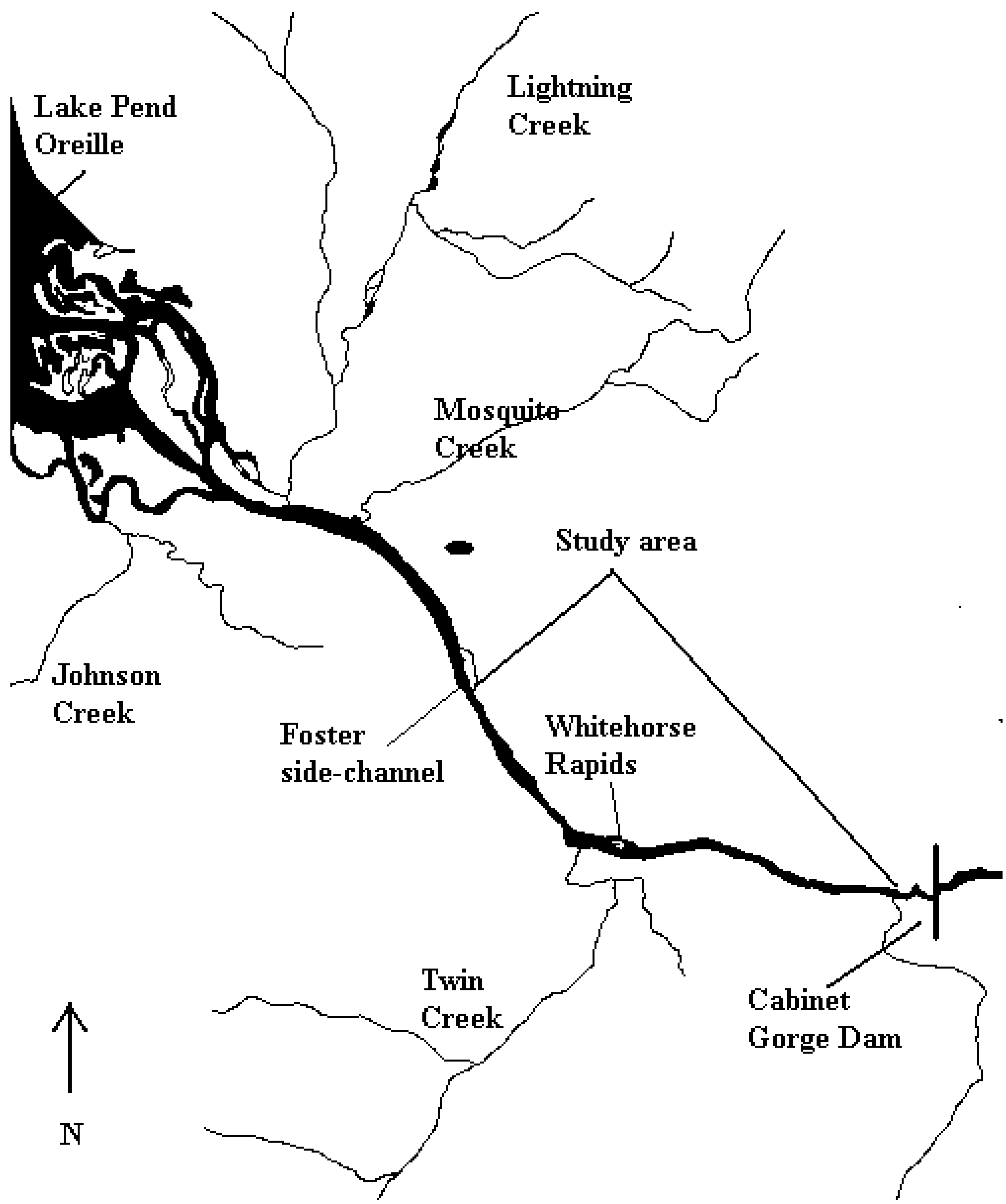

FIGURE 1. Fishery evaluation study area on the lower Clark Fork River, the major tributary to Lake Pend Oreille, Idaho.

METHODS

Monitoring indices in 2014-2015 included abundance, size structure, and condition of fish populations in the affected area. Targeted species in the assessment included Brown Trout, Mountain Whitefish, Rainbow Trout and Westslope Cutthroat Trout. To gain sufficient sample sizes, Rainbow Trout and Rainbow x Westslope Cutthroat Trout hybrids were evaluated together as Rainbow Trout. Historically, alternating sample seasons (spring and fall) were used to avoid spawning migration periods of fish from LPO. Spring sample periods were utilized for fall spawning salmonids and fall sampling periods were used for spring spawning salmonids (Ryan and Jakubowski 2011). In this study, Brown Trout and Mountain Whitefish were again targeted in the spring while

Rainbow and Westslope Cutthroat Trout were targeted in the fall. However, the *Oncorhynchus sp*. (Westslope Cutthroat Trout, and Rainbow Trout x Westslope Cutthroat Trout hybrids) population abundances were again estimated during the following spring sampling event to assess the potential magnitude of the spring spawning migration of these species. Fall sampling took place from October 28 through November 6, 2014, and spring sampling took place from March 31 through April 9, 2015.

Boat-mounted, boom-type electrofishing equipment was used to sample fish. Fish sampling was conducted at night, typically using two crews in 6 m-long jet boats. The electrofishing setup in each boat consisted of a Coffelt VVP-15 electroshocker powered by a 5000 watt Honda generator. Smooth DC current was employed to minimize risk of injury to trout (Dalbey et al. 1996). Electrofishing settings were generally set to generate 5 to 8 amps at 200-220 volts. Electrofishing boats floated in fast flow areas, or motored slowly in areas of very slow flow downstream, parallel with the shoreline. While electrofishing, we attempted to keep the anode closest to shore in approximately 0.6 m of water depth. Each boat typically made a single pass down each shoreline, and multiple passes along the shorelines in the Whitehorse Rapids area (to increase sample size in productive areas) each night. The boats alternated banks each night.

Fish stunned in the electrofishing field were netted and placed into a live well for recovery. Captured fish were anesthetized using Tricaine Methanesulfonate (MS-222) for processing. Species and hybrid crosses were identified phenotypically. Characteristics used in identifying Westslope Cutthroat Trout x Rainbow Trout hybrids included throat slashes typically of light intensity or broken in form and exhibiting heavy spotting below the lateral line and toward the anterior end of the fish (Bouwens and Jakubowski 2016). Captured fish were checked for marks (see below) when appropriate. Target species were measured for total length (TL, mm). Fish over approximately 2 kg were weighed to the nearest 40 g and fish less than approximately 2 kg were weighed to the nearest 10 g on top-loading spring scales. Scales were collected from target species for estimation of age. All fish phenotypically identified as pure WCT were implanted with 12-mm PIT tag in the dorsal sinus.

Abundance of target fish species greater than or equal to 200 mm total length (TL) was estimated using mark-recapture techniques. The "marking" period was conducted over a three-night period in the first week of sampling and the "recapture" period was conducted over a three-night period the following week. During the marking period, all target species were marked by punching the lower caudal or anal fin, depending on the event and species. All fish that were previously marked and subsequently recaptured during the marking period were released and not re-counted. All target fish captured during the recapture period were examined for marks and an additional mark (upper caudal) was given to prevent re-counting the same fish during the recapture period. All fish were released near their capture locations, ensuring all fish were released at least 1 km upstream of the bottom of the sampling reach for recovery to lessen the likelihood of fish drifting out of the project area.

Population estimates were calculated using the modified Petersen method for sampling without replacement (any individual was only counted once, Krebs 1989) as:

$$N = [(M+1)(C+1)/(R+1)] - 1$$

Where N = Estimated population

M = Number of individuals marked in the marking period

C = Total number of individuals captured in the recapture period

R = Number of individuals encountered during the recapture period that were marked during the marking period.

Confidence intervals (95%) around population estimates were estimated using a Poisson distribution to account for small recapture sample size (Chapman 1948, Seber 1982) and were calculated using tabled values provided in Ricker (1975).

RESULTS

Abundance of targeted fishes described by population estimates was dominated by Mountain Whitefish, with Brown Trout, Rainbow Trout and Rainbow Trout x Westslope Cutthroat Trout hybrids, and Westslope Cutthroat Trout present in considerably lower abundance. Population estimates of Rainbow Trout and Rainbow Trout x Westslope Cutthroat Trout hybrids and Westslope Cutthroat Trout were similar between the fall 2014 and spring 2015 sampling events (Table 1).

TABLE 1. Population estimates of fish ≥200 mm TL by year, species, and season for Mountain Whitefish (MWF) Brown Trout (BRN), Rainbow Trout and Westslope x Rainbow hybrids (RBT + WRHY), and Westslope Cutthroat Trout (WCT), from the approximately 6.6 km study area in the lower Clark Fork River, Idaho. Sample sizes for number of fish marked during the marking period (M), number captured during the recapture period (C), and number of fish marked in the mark period subsequently recaptured in the recapture period (R), as well as associated 95% confidence intervals are included.

							95 % CI	
Year	Species	Season	M	C	R	Estimate	Lower	Upper
2015	MWF	Spring	170	173	7	3,719	1,932	7,830
2015	BRN	Spring	85	64	20	266	176	423
2014	RBT+WRHY	Fall	119	71	24	346	236	527
2015	RBT+WRHY	Spring	74	72	13	391	235	693
2014	WCT	Fall	101	59	19	306	200	490
2015	WCT	Spring	67	65	13	321	193	568

When compared to prior data (Ryan and Jakubowski 2011), the 2015 point estimate of spring abundance of Mountain Whitefish was lower than 2002-2008 estimates, and was most similar to the estimate derived in 2000 (Figure 2). The spring 2015 Brown Trout point estimate of 266 fish was similar to peaks in abundance noted in 2004 and 2008 (Figure 3). The fall 2014 and spring 2015 Rainbow Trout and Rainbow Trout x Westslope Cutthroat Trout hybrid point estimates were similar to that derived in 1999, and was an increase from those documented in the 2000s (Figure 4). The fall 2014 and spring 2015 point estimates of Westslope Cutthroat abundance was higher than the average abundance previously calculated (Figure 5).

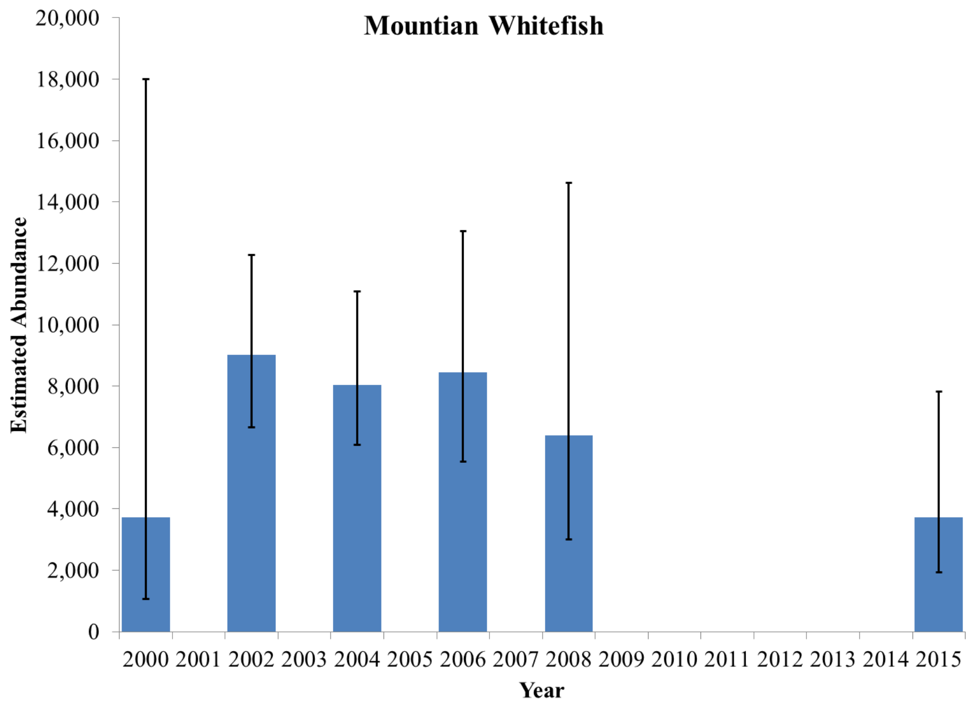

FIGURE 2. Estimated abundance of Mountain Whitefish ≥ 200 mm by study year captured in the 6.6 km study reach of the lower Clark Fork River, Idaho. Error bars represent 95% confidence intervals.

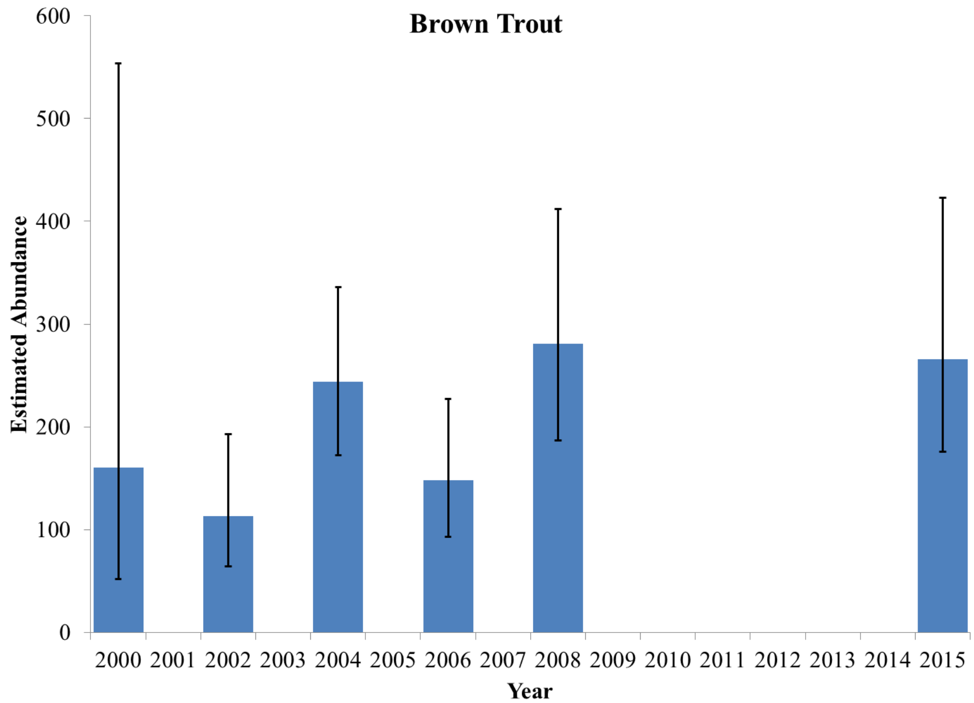

FIGURE 3. Estimated abundance of Brown Trout ≥ 200 mm by study year captured in the 6.6 km study reach of the lower Clark Fork River, Idaho. Error bars represent 95% confidence intervals.

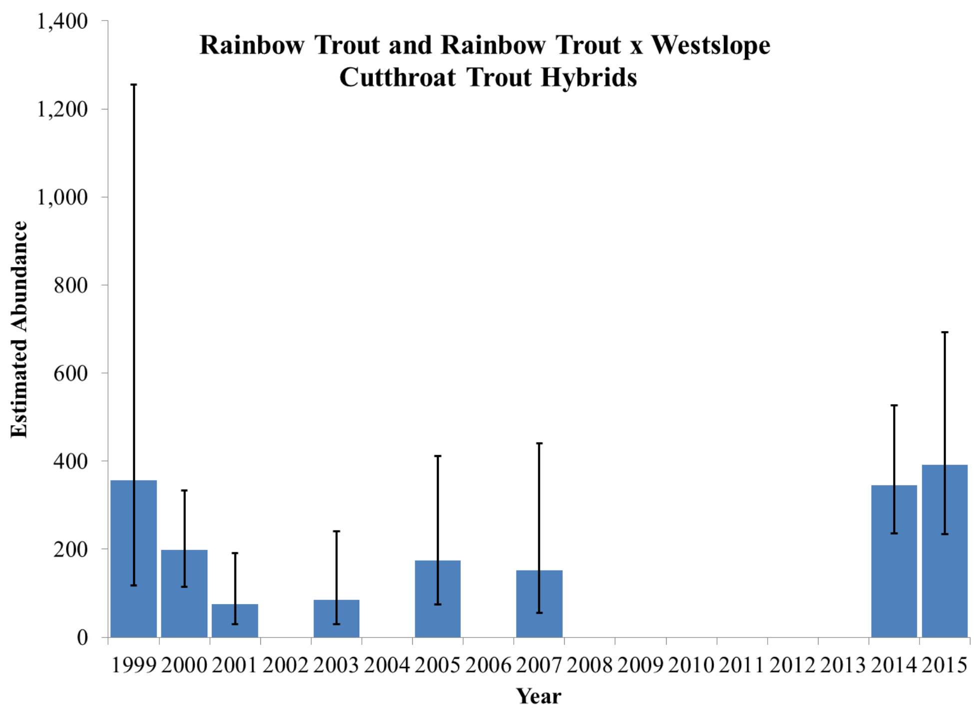

FIGURE 4. Estimated abundance of Rainbow Trout and Rainbow Trout x Westslope Cutthroat Trout Hybrids ≥ 200 mm by study year captured in the 6.6 km study reach of the lower Clark Fork River, Idaho. Error bars represent 95% confidence intervals.

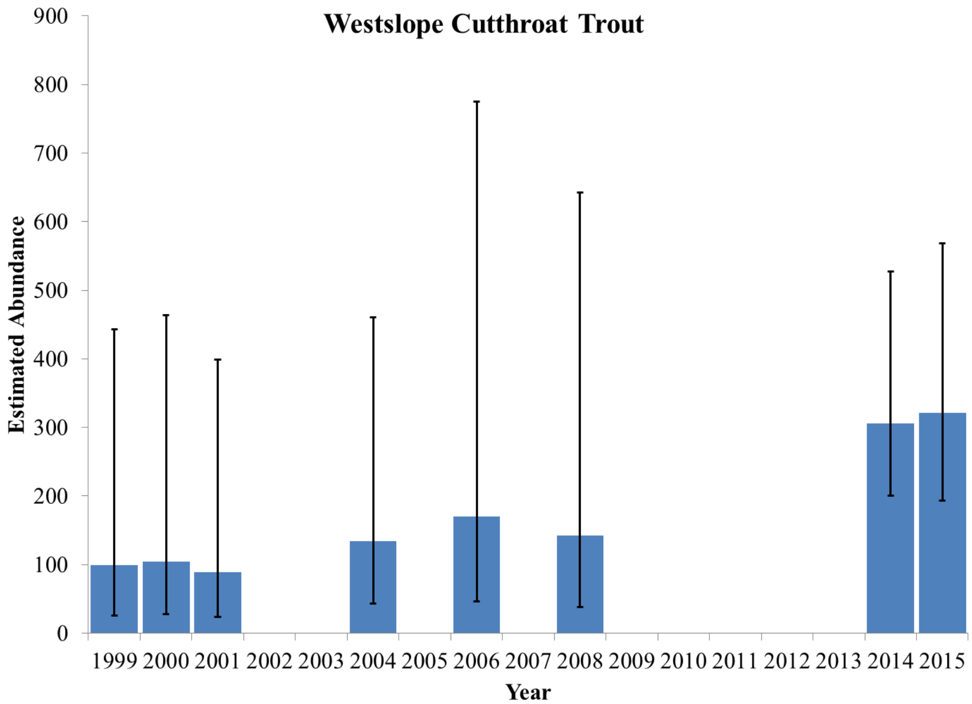

FIGURE 5. Estimated abundance of Westslope Cutthroat Trout ≥ 200 mm by study year captured in the 6.6 km study reach of the lower Clark Fork River, Idaho. Error bars represent 95% confidence intervals.

DISCUSSION

The purpose of this report was to document the 2014-2015 abundance estimates of target species in the Clark Fork River. Collected length, weight, and age data, along with a comprehensive analysis of trends, are not reported in this document, but will be further discussed following additional sampling planned for 2017. These new data points are insufficient to fully characterize the trends associated with the lower Clark Fork River salmonid populations. Further work planned in 2017 will help elucidate whether the higher *Oncorhynchus sp.* and reduced Mountain Whitefish estimates were anomalous or are truly an indicator of changing abundance levels. If these estimates indicate a changing trend, then causal agents will need to be explored.

An interesting component to the 2014-2015 sampling involved deriving a population size estimate of spring spawners both in the fall of 2014, when it was expected that only resident fish were in the river, and in the spring of 2015, when migratory Westslope Cutthroat Trout and Rainbow Trout were expected to be beginning their spawning migrations. We were unable to detect a large increase in total abundance in the spring in our sampling reach. Supporting telemetry data inferred that a component of the populations below Cabinet Gorge Dam is comprised of fish that originated upstream of Cabinet Gorge Dam, passed downstream of the dam, and are then blocked in the spring during their upstream spawning migrations (Bernall and Johnson 2016). Further examination of data (size, age, and potentially microchemical analysis) collected from the fish sampled during both periods may help define whether it is possible to detect a change in the composition of fish populations below Cabinet Gorge Dam depending on season. This information may be helpful when making determinations and recommendations regarding the implementation of full-scale Westslope Cutthroat Trout passage over Cabinet Gorge Dam.

RECOMMENDATIONS

1) Perform a comprehensive analysis similar to that performed by Ryan and Jakubowski (2011) assessing long-term trends in population size, age, and size structure indices with relation to flow and other pertinent variables. This information will be used to better understand the long-term impacts of changing river conditions on lower Clark Fork River salmonid populations.
2) Further explore the possibility of using microchemical analysis to determine the origin and life-history of salmonids found in the Clark Fork River below Cabinet Gorge Dam. This information may be important when determining future passage protocols over Cabinet Gorge Dam.

ACKNOWLEDGEMENTS

The authors would like to thank IDFG staff Will Demien and Avista staff Kevin Duffy, Tanner Mitchell, John Suhfras, Rex Philpott, Josh Storaasli, and Shaun Lacy for help with sample collection. We would also like to thank Sean Moran and Paul Kusnierz (Avista), Jason Blakney (MWFP), Wade Fredenberg (USFWS), and Andy Dux (IDFG) for their review of previous versions of this report. We would also like to thank Avista employees Tim Swant, Paul Kusnierz, Shana Bernall and Heide Evans, for their oversight and administrative support. This project was funded through Appendix A of the Clark Fork Settlement Agreement.

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