

# 2011

## Yankee Fork Salmon River Chinook Salmon Run Report



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Annual Report



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# TABLE OF CONTENTS

<b>LIST OF FIGURES.....</b>	<b>3</b>
<b>LIST OF TABLES.....</b>	<b>4</b>
<b>ABSTRACT .....</b>	<b>5</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>6</b>
<b>INTRODUCTION .....</b>	<b>6</b>
BACKGROUND .....	7
PROGRAM GOAL AND OBJECTIVES .....	8
STUDY AREA .....	8
<b>METHODS.....</b>	<b>9</b>
SMOLT RELEASE.....	9
SCREW TRAP .....	10
PICKET WEIRS .....	11
ADULT TRAPPING .....	13
HARVEST MONITORING .....	14
SPAWNING GROUND AND CARCASS SURVEYS .....	15
<b>RESULTS.....</b>	<b>16</b>
SMOLT RELEASE.....	16
JUVENILE TRAPPING .....	18
<i>Broodyear 2010 Juveniles.....</i>	<i>18</i>
<i>Broodyear 2009 Juveniles.....</i>	<i>21</i>
ADULT TRAPPING .....	23
NON-TARGET SPECIES .....	24
RUN-TIMING.....	25
AGE STRUCTURE .....	27
HARVEST MONITORING .....	30
SPAWNING GROUND AND CARCASS SURVEYS.....	30
<i>Spawning Ground Surveys.....</i>	<i>30</i>
<i>Carcass Surveys.....</i>	<i>31</i>
MARK-RECAPTURE EVALUATION.....	32
TOTAL ESCAPEMENT .....	33
<b>DISCUSSION.....</b>	<b>33</b>
<b>RECOMMENDATIONS .....</b>	<b>34</b>
<b>CITATIONS.....</b>	<b>35</b>
<b>APPENDIX A: STANDARDIZED PERFORMANCE MEASURES (GALBREATH ET AL. 2008) FOR THE YANKEE FORK CHINOOK SALMON PROGRAM.....</b>	<b>37</b>
<b>APPENDIX B: REGIONAL PARTICIPATION.....</b>	<b>43</b>

## LIST OF FIGURES

Figure 1. Map of Yankee Fork Salmon River, Idaho, displaying weir locations. ....	9
Figure 2. Yankee Fork smolt release 2011. ....	10
Figure 3. Yankee Fork screw trap and tagging station. ....	11
Figure 4. Pole Flat weir.....	12
Figure 5. Pole Flat weir trap box and work station.....	12
Figure 6. Five Mile weir (upper weir) and trap box. ....	13
Figure 7. Weir, screw trap, redd, and smolt release locations in Yankee Fork, Idaho, 2011. ....	16
Figure 8. Broodyear 2009 hatchery smolt arrival timing to Lower Granite Dam. ....	17
Figure 9. Migration timing of Chinook salmon juveniles during 2011 trapping operations. ....	18
Figure 10. Proportional emigration over time for broodyear 2010 juvenile Chinook salmon past the Yankee Fork screw trap. ....	19
Figure 11. Length-weight relationship for all 2011 juvenile Chinook salmon sampled at the Yankee Fork screw trap. ....	20
Figure 12. Fork length versus date of tagging by emigrant type for juvenile Chinook salmon tagged at the Yankee Fork screw trap. ....	20
Figure 13. Age proportion of broodyear 2009 juveniles estimated past the Yankee Fork screw trap. ....	21
Figure 14. Proportional emigration over time for broodyear 2009 juvenile Chinook salmon past the Yankee Fork screw trap. ....	22
Figure 15. Broodyear 2009 natural juvenile Chinook arrival timing to Lower Granite Dam. ....	22
Figure 16. Daily trapping frequency of natural and hatchery Chinook salmon adults, 2011.....	25
Figure 17. Run-timing of natural and hatchery Chinook salmon to Pole Flat weir, 2011. ....	26
Figure 18. Run-timing of natural and hatchery Chinook salmon to Pole Flat weir, 2008-2011.....	26
Figure 19. Age proportion of natural and hatchery Chinook salmon returns to Yankee Fork, 2011.....	28
Figure 20. Age proportion of natural and hatchery Chinook salmon returns to Yankee Fork, 2008- 2011.....	28
Figure 21. Length frequency diagram for natural and hatchery Chinook salmon returns to Yankee Fork, 2011.....	29
Figure 22. Frequency of returns by age range for natural and hatchery Chinook salmon trapped at the Pole Flat weir, 2008-2011.....	29
Figure 23. Chinook salmon redds in Yankee Fork, 1956 - 2011.....	31

## LIST OF TABLES

Table 1. Broodyear 2009 Chinook salmon smolt release in Yankee Fork. ....	17
Table 2. Broodyear 2009 recruit per spawner calculated by redd, by females trapped at the Pole Flat weir, and by estimated female escapement.....	23
Table 3. Adult Chinook salmon trapping summary for Yankee Fork, 2008 – 2011. ....	23
Table 4. Incidentally trapped bull trout in the Yankee Fork, 2011.....	24
Table 5. Age by length for adjusted natural size classes (Copeland et al. 2008).....	27
Table 6. Age composition of hatchery and natural Chinook salmon, 2008 – 2011.....	27
Table 7. Yankee Fork harvest 2008 – 2011. ....	30
Table 8. Yankee Fork Chinook yearly spawn timing 2008 – 2011. ....	30
Table 9. Number of redds observed by stratum and total in Yankee Fork, 2011. ....	30
Table 10. Date and percent spawned of female carcasses collected in 2011.....	31
Table 11. Yankee Fork production values 2006 – 2011. ....	33

## ABSTRACT

The Shoshone-Bannock Tribes initiated a Chinook salmon (*Oncorhynchus tshawytscha*) supplementation project in Yankee Fork Salmon River, Idaho to assist in returning 2,000 adults for Tribal conservation and harvest management objectives. In 2011, natural and hatchery Chinook salmon were expected to return to Yankee Fork in potentially adequate numbers to initiate broodstock collection for the supplementation project. Prior to initiating trapping operations, Idaho Fish and Game and Tribal staff released 397,828 BY09 smolts in Yankee Fork on April 19 and 20, 2011. The Tribes installed a temporary picket weir near Pole Flat Campground on July 14, six days later than 2010; a modified trap box was attached to the weir. Overall, 128 Chinook salmon were trapped in 2011, 54.7% natural-origin and 45.3% hatchery-origin. Natural adults were released above the weir for natural spawning. A secondary weir was installed upstream of the Jordan Creek confluence on July 7 for potential broodstock collection and hatchery adult outplanting activities. Due to low returns in the Upper Salmon, no hatchery adults were obtained from Sawtooth Fish Hatchery in 2011 for natural spawning in upper Yankee Fork. Intensive spawning ground surveys were completed from August 18 – September 1 and 24 redds were observed. Using mark-recapture techniques we estimated an additional 14 natural and 9 hatchery-origin salmon passed the Pole Flat weir undetected. We observed 8 redds below Pole Flat weir and 16 above. By expanding redd counts (n=8) below Pole Flat weir by the adjusted fish per redd ratio (9.08), we estimated an additional 73 spawners below the Pole Flat weir. In summary, we estimate 220 Chinook salmon, natural and hatchery-origin, returned to the Yankee Fork, with zero adult outplant activities. Due to no escapement of hatchery adult Chinook salmon and limited natural returns to the upper weir in 2011, broodstock collection did not occur in the Yankee Fork as originally planned. In addition, the Tribes installed a rotary screw trap in the Yankee Fork in 2011 to estimate juvenile migrants from program operations. We estimate a total of 31,201 (SE 4,446) juveniles migrated passed the screw trap from April 13 to May 5 and July 13 through November 2, 2011.

## **ACKNOWLEDGEMENTS**

The Shoshone-Bannock Tribes (Tribes) provided the administrative framework for this project to be successful. We especially thank Carlos Lopez for his engineering and welding skills used to reconstruct the trap box structures. We would like to thank all the Tribal employees for their assistance in project operations including Lytle Denny, Paul Kusnierz, Carlos Lopez, Alex Graves, Brock Moss, Skyler Smith, Josh Taryole, Zack Littlejohn, Alyssa Eagle, Jackson Tracy, Otis Osborne, Tyron Bronco, and Hal Hayball. We are especially thankful to Scott Marshall, Chris Starr, Steve Yundt and the Lower Snake River Compensation Plan (LSRCP) – Office for providing funding and support for this project; Idaho Department of Fish and Game (IDFG) personnel including Pete Hassemmer and Sam Sharr for project support and MOA development and Brent Snider and the employees at Sawtooth Fish Hatchery (Sawtooth) for assisting rearing and transporting Yankee Fork Chinook smolts.

## **INTRODUCTION**

The Yankee Fork Salmon River (Yankee Fork) is a traditional Chinook salmon fishery area for Shoshone-Bannock Tribal members, reserved under the Fort Bridger Treaty of 1868. Tribal fishermen have witnessed a significant decline in the number of fish being harvested in the Yankee Fork and this decline has been closely linked to the decline in productivity. One obvious candidate to explain the decline in productivity is the number of dams that smolts (juvenile downstream migrants) and returning adults must pass to survive and complete their life cycle (Schaller et al. 1999; Deriso et al. 2001).

Yankee Fork is one of nine independent populations of Chinook salmon located within the upper Salmon River major population group (MPG) (ICTRT 2007). Yankee Fork historically supported large runs of Chinook salmon (Reiser and Ramey 1987), however in 1992, they were listed as threatened under the Endangered Species Act (ESA) (57 FR14653). In 1995, there were zero redds observed during the Tribes annual spawning ground surveys.

In response to the declining Chinook salmon population in Yankee Fork, the Tribes developed the Yankee Fork Chinook Salmon Supplementation (YFCSS) Project to increase the number of Chinook salmon returning to Yankee Fork. The decision to supplement Yankee Fork Chinook salmon resulted from a number of factors including: (1) an immediate need to prevent local extirpation; (2) the importance of the area as a Tribal subsistence fishery and the need to achieve the Tribal harvest objective; (3) the importance of recovering this population and achieving the conservation objective annually; (4) the long history of introductions of out-of-basin stocks; (5) the proximity of a donor hatchery that could provide broodstock (i.e., Sawtooth) to support a supplementation effort; and (6) regional support for the enhancement effort.

## Background

The YFCSS Project was developed to assist in returning 2,000 adult Chinook salmon to Yankee Fork for Tribal conservation and harvest management objectives. The first juvenile smolt release occurred in April 2006. Juveniles were 100% adipose fin clipped and returned as age<sup>4</sup> adults in 2008 and age<sup>5</sup> adults in 2009.

In 2008 – 2010, natural and hatchery Chinook salmon were expected to return to Yankee Fork in sufficient numbers to initiate broodstock collection for the supplementation project. Overall, 294 Chinook salmon were trapped, of which 30.3% were natural and 69.7% were hatchery (Tardy and Denny 2010). Approximately 2,955 total hatchery adults were obtained from Sawtooth and outplanted in upper Yankee Fork for natural spawning in 2008 and 2009. Intensive spawning ground surveys were completed in all years and 1,101 total redds were observed. In summary, we estimate a total escapement of 3,640 Chinook salmon in the Yankee Fork, 1,935 in 2008, 1,640 in 2009, and 65 in 2010.

The Tribes developed a Memorandum of Agreement (MOA) between IDFG and LSRCP, acquired both an IDFG F-09-06-11 Collection Permit and USFS Special Use Permit YFK-83, and operated under NOAA Section 10 Research Permit 1127-3R to conduct YFCSS activities in 2011. The Tribes planned to operate two portable picket weirs to trap and collect returning adult Chinook salmon for broodstock to produce 200,000 to 400,000 smolts. If excess adults were identified at Sawtooth, YFCSS broodstock could be collected there and any remaining adults would be outplanted. No more than 1,500 adults were planned for outplanting in 2011.

The pre-season forecasted return of natural and hatchery-origin Chinook salmon to the Upper Salmon and Sawtooth was estimated at 1,799 and 502 adults, respectively. This return was expected to be comprised of 425 age<sup>4</sup> Sawtooth fish from BY07 and 77 age<sup>5</sup> Sawtooth fish from BY06.

In 2011, natural-origin adult and hatchery jack Chinook salmon were expected to return to Yankee Fork with potential hatchery-origin adults straying into the watershed. We estimated 317 natural-origin adults would return (prior BY regression estimate to LGD (396) times 80% conversion) to the Yankee Fork in 2011. These two estimates provided the basis for broodstock collection plans as outlined in the MOA.

As part of the YFCSS monitoring and evaluation objectives, the Tribes installed a rotary screw trap in Yankee Fork anticipating capturing BY09 smolts and BY10 fry, parr, and pre-smolts migrating to the ocean. Staff planned to enumerate, tag, and tissue sample juveniles migrating from the Yankee Fork.

This report covers the methods and results from YFCSS Project activities in 2011.



## Program Goal and Objectives

The number of adult Chinook salmon escaping to the Yankee Fork is the basis for determining whether management actions are successful. Through a combination of management activities, including habitat restoration, harvest management, and hatchery supplementation the Tribes are working to achieve the long-term goal of returning 2,000 adult Chinook salmon to the Yankee Fork. Under the Tribe's Hatchery Genetics Management Plan, the goal will provide 1,500 adults to utilize spawning and rearing habitats and 500 adults for harvest opportunities.

Until the Chinook salmon population is self-sustaining, the YFCSS Project will supplement the annual return of Chinook salmon to achieve the long-term adult abundance goal. In addition, the Tribes will continue to manage harvest according to the Tribal Resource Management Plan (Denny et al. 2008).

## Study Area

Yankee Fork is located in the Salmon–Challis National Forest near Stanley, Idaho (Figure 1). The Yankee Fork flows through narrow canyons and moderately wide valleys with forest of lodgepole pine (*Pinus contorta*) (Richards and Cerner 1989). The Yankee Fork flows 41.8 kilometers (km) from north to south and enters the upper Salmon River at river km 590.6. The Yankee Fork headwaters originate at an elevation of 2,500 m and the watershed enters the upper Salmon River at an elevation of 1,880 m. The drainage is composed of 313.8 km<sup>2</sup> and includes Yankee Fork proper and West Fork Yankee Fork (largest tributary), followed by other notable tributaries including Ramey, Cearly, Lightning, Cabin, Jordan, Five Mile, Greylock, and Eight Mile creeks. Average annual precipitation is roughly 68.6 cm, base flows are approximately 1.13 cubic meters per second (m<sup>3</sup>s<sup>-1</sup>), and mean flows are 6.99 m<sup>3</sup>s<sup>-1</sup>. Most of the system is characterized by highly erosive sandy and clay-loam soils.

Gold was discovered in the area in the 1800s, 1930s, and 1950s which prompted human settlements and as such mining has become part of the rich history in Yankee Fork. Mining activities resulted in the complete re-channeling of lower portions of the Yankee Fork from Jordan Creek to Pole Flat Campground and the deposition of extensive unconsolidated dredge piles. The dredged portion of the Yankee Fork floodplain is sparsely vegetated with long sections containing riparian habitat only near the channel.

Most of the Yankee Fork watershed remains in excellent condition for the production of fish. Within the entire drainage, the number of redds have ranged from over 600 in 1960's (Pollard 1985), to less than 10 in 1980's (Konopacky et al. 1986), to zero in 1995. Chinook salmon destined to the Yankee Fork enter the Columbia River during March through May, with spawning occurring in August and September (Bjornn 1960). Chinook salmon are exceptionally large fish, found to be comprised of primarily age<sup>4</sup> to age<sup>5</sup> adults having fork lengths exceeding 81 cm (Bjornn et al. 1964). Egg incubation extends into December, with emergence occurring in February or March (Reiser and Ramey 1987). Juveniles rear in freshwater until the spring (March-April) of their second year, prior to migrating to the ocean generally at a length of 100-130 mm (Bjornn 1960).

The majority of juveniles leave Yankee Fork as fry, parr, and pre-smolt with a smaller percentage leaving as smolts (Tardy and Denny 2011).

Other fish species present in the Yankee Fork include bull trout (*Salvelinus confluentus*), westslope cutthroat trout (*O. clarki lewisii*), steelhead (*O. mykiss*), mountain whitefish (*Prosopium williamsoni*), shorthead sculpin (*Cottus confuses*), and mountain sucker (*Catostomus platyrhynchus*) (Richards and Cernera 1989; Denny and Tardy 2007).

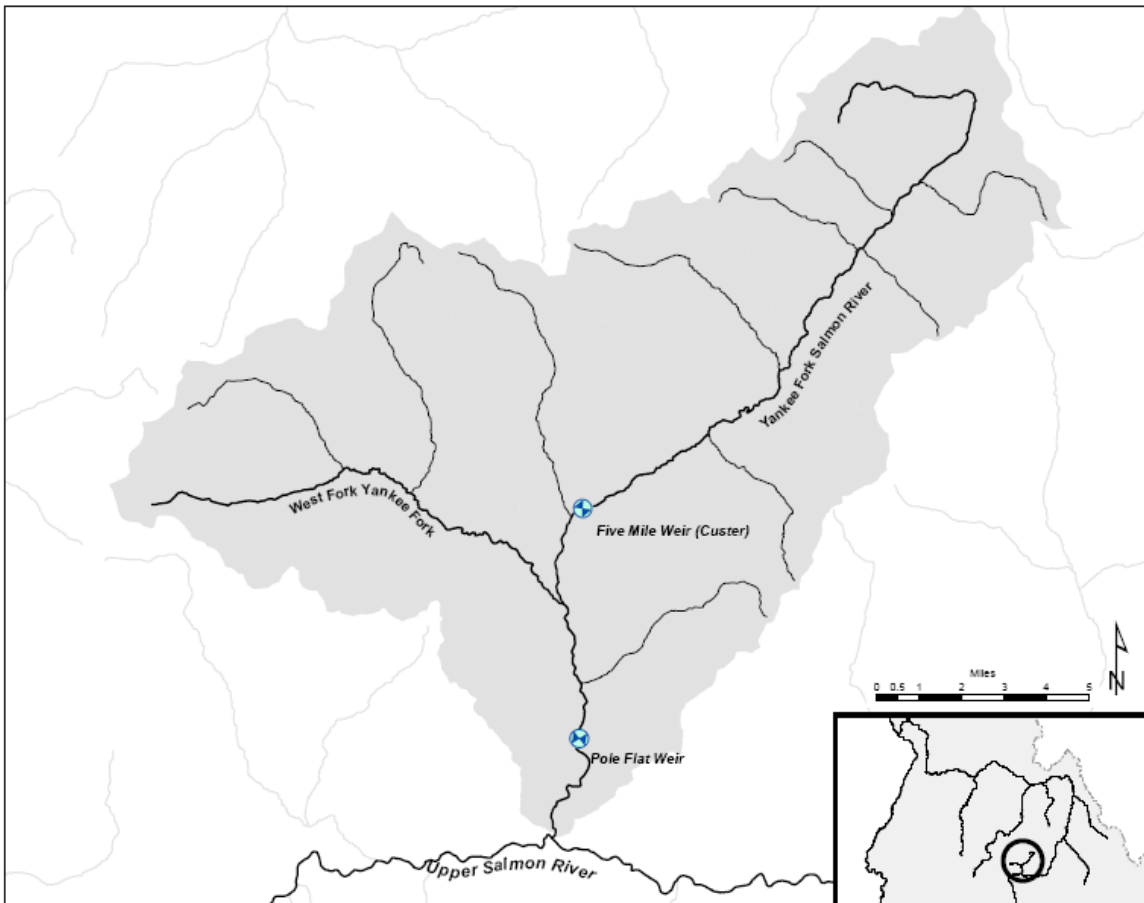


Figure 1. Map of Yankee Fork Salmon River, Idaho, displaying weir locations.

## METHODS

### Smolt Release

Chinook adults for this program were collected, spawned, and sampled by IDFG staff at the Sawtooth Fish Hatchery. Smolts destined for the Yankee Fork program were incubated and reared separately (distinct raceways) from all other hatchery production at Sawtooth. Tribal staff was present at Sawtooth to assist set-up, crowding, loading, transport, and clean up (Figure 2). Two groups, adipose clipped and adipose intact 100% coded wire tag (CWT), were transported to Yankee Fork; releases occurred in Pond Series One and at Jordan Creek confluence to evaluate survival differences between acclimated versus direct stream release (Figure 7).



**Figure 2. Yankee Fork smolt release 2011.**

### **Screw Trap**

The Tribes installed a rotary screw trap in the Yankee Fork in 2011 (Figures 3 and 7) for the purposes of enumerating, tagging, and genetic tissue sampling migrating juveniles for research, monitoring, and evaluation. The screw trap was installed on April 13 downstream of Pole Flat Campground approximately 5.0 rkm upstream from the confluence with the Salmon River. The trap was located within the Salmon–Challis National Forest, and authorized under a U.S. Department of Agriculture Forest Service Temporary Special – Use Permit YFK83.

The screw trap is a temporary structure consisting of two floating pontoons, a rotating cylindrical corkscrew cone, and a live box (Figure 3). Five centimeter braided cable attached to each pontoon islet was connected to a pulley hook on the main cable spanning approximately 20 m across the river allowing the trap to operate in the channel thalweg. High water events and smolt releases resulted in trap removal on May 5. After flows receded, the trap was reinstalled on July 13 in the same location and operated until November 2, 2011.

On a daily basis, the live box on the screw trap was emptied at approximately 1100 hours into one large cooler; evident non-target species were enumerated, recorded, and released directly downstream of the trap with minimal handling. Temperature and staff gauge measurements were recorded prior to transporting fish and additional coolers to the tagging station (Figure 3).

Juveniles  $\leq 69$  mm were stained using Bismark Brown (1.8 L to 18.2 L water) for a minimum of 20 minutes and maximum of 40 minutes. Juveniles  $\geq 70$  mm were injected with a Passive Integrated Transponder Tag (PIT tag) after being anesthetized in a clove oil solution. All marked fish were measured to the nearest 1.0 mm, weighed to the nearest 0.01 g, and tissue sampled. Stained and PIT tagged juveniles were released 1 rkm upstream of the trap at Maternity Hole for mark-recapture analysis to obtain trap efficiency. Recaptures and remaining fish by species were enumerated, recorded, and released downstream of the trap near Pole Camp Creek. Mortalities were recorded as either the result of trapping or handling. If the mortality was a PIT tagged individual, the tag was recollected prior to disposing of the mortality downstream of the trap.



**Figure 3. Yankee Fork screw trap and tagging station.**

### **Picket Weirs**

The Tribes installed two portable picket weirs in the Yankee Fork in 2011 (Figures 1 and 7) for the purposes of enumerating the natural and hatchery return, collecting broodstock, and obtaining information for research, monitoring, and evaluation. The Pole Flat weir was installed on July 14 near Pole Flat Campground approximately 5.2 rkm upstream from the confluence with the Salmon River (Figures 1 and 7). The Five Mile weir (upper weir) was installed on July 7 upstream of the Jordan Creek confluence at rkm 15. Both weirs were located within the Salmon–Challis National Forest, and authorized under a U.S. Department of Agriculture Forest Service Temporary Special – Use Permit YFK83.

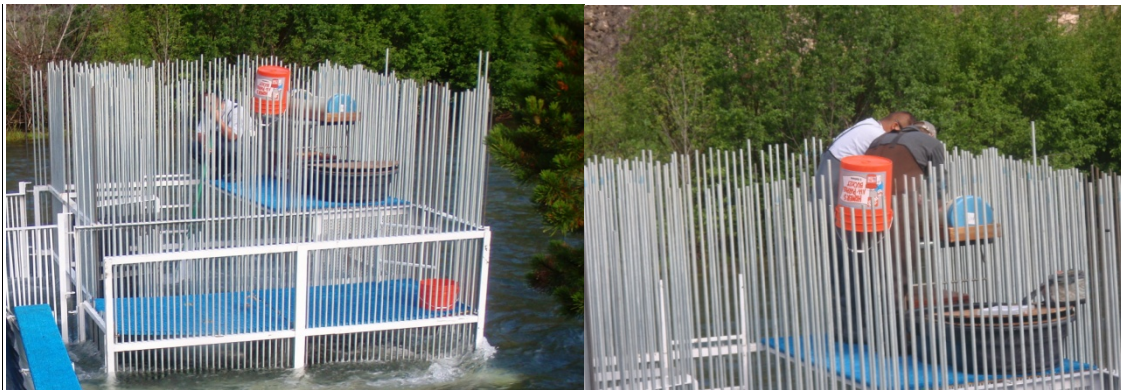
Pole Flat weir was installed as soon as flows were considered safe for installation (approximately  $45.31 \text{ m}^3\text{s}^{-1}$  in the mainstem Salmon River below Yankee Fork). The Pole Flat weir is a temporary structure consisting of v-shaped wings and an in-stream trap box (Figure 4). The v-shaped wings prevent upstream passage and funnel adult Chinook salmon towards the trap box structure. The v-shaped wings are sealed with 0.6 cm black plastic mesh, which prevents adults from jumping through the pickets. We used 4.5 kg sandbags to seal the upstream side of the weir and trap box to prevent adults from getting through or under the pickets. The left wing of the weir consists of four tripods and four counter weights supporting two  $3.0 \text{ m} \times 0.6 \text{ m}$  panels with  $120 - 3.0 \text{ m} \times 1.9 \text{ cm}$  pickets. The right wing of the weir consists of nine tripods and nine counter weights supporting five  $3.0 \text{ m} \times 0.6 \text{ m}$  panels and  $300 - 3.0 \text{ m} \times 1.9 \text{ cm}$  pickets.





**Figure 4. Pole Flat weir.**

During the winter of 2010 – 2011, Tribal staff modified the trap box to accommodate larger Chinook salmon returns and constructed a catwalk. The trap box consists of four panels and has a dimension of 3.0 m × 3.0 m × 1.8 m (Figures 4 and 5). The panels of the trap box were picketed with 248 – 3.0 m × 1.9 cm pickets. The trap box was operated without two pickets in the entry way to allow a 12.7 cm passage way through a funneled proboscis. A recovery and holding box measuring 3.0 m × 1.2 m × 1.8 m was constructed and attached adjacent to the trap box. The recovery box was operated without two pickets on the upstream end to allow a 12.7 cm passage way for natural fish to freely migrate upstream after adequate recovery time. A workstation with all necessary fish processing equipment was constructed on top of the trap box (Figure 5).



**Figure 5. Pole Flat weir trap box and workstation.**



Five Mile weir is a temporary structure consisting of v-shaped wings and an in-stream trap box (Figure 6). The right wing consists of three tripods and three counter weights supporting two 3.0 m × 0.6 m panels and 120 – 3.0 m × 1.9 cm pickets. The left wing consists of ten tripods and ten counter weights supporting five 3.0 m × 0.6 m panels and 60 – 3.0 m × 1.9 cm pickets. The trap box consists of four panels and has a dimension of 3.0 m × 3.0 m × 1.8 m (Figure 6). The panels of the trap box were picketed with 248 – 3.0 m × 1.9 cm pickets. The trap box was operated without two pickets in the entry way to allow a 12.7 cm passage way through a funneled proboscis. A recovery and holding box measuring 3.0 m × 1.2 m × 1.8 m was constructed and attached adjacent to the trap box. The recovery box was operated without two pickets on the upstream end to allow a 12.7 cm passage way for natural fish to freely migrate upstream after adequate recovery time. A workstation with all necessary fish processing equipment was constructed on top of the trap box. The weir wings and trap box were sealed with 4.5 kg sandbags and 0.6 cm black mesh. The Five Mile weir historically served as a blocking mechanism to prevent outplanted hatchery adults from straying into the West Fork Yankee Fork. The weir was relocated downstream in 2011 just above the Jordan Creek confluence in order to increase the ability to collect broodstock for program operations (Figures 1 and 7).



**Figure 6. Five Mile weir (upper weir) and trap box.**

### **Adult Trapping**

On a daily basis, both weirs were checked for newly trapped adult Chinook salmon and non-target species. All Chinook salmon were individually netted and transferred to a 136.4 liter modified Rubbermaid® tote holding freshwater. Fish were not anesthetized prior to handling because the Tribes were actively conducting a Chinook salmon fishery

and the preferred anesthetics are not FDA approved for human consumption. Adult Chinook salmon were visually examined for fin clips, operculum punches, external tags, and injuries as well as scanned for PIT and CWT tags. The following biological data was collected: origin, fork length (cm), and genetic sample (0.5 cm<sup>2</sup>). Chinook salmon were marked with a right operculum punch for genetic sample and mark-recapture analyses. Each fish was visually inspected for key phenotypic characteristics (i.e., kipe jaw, vent) to determine gender.

Natural Chinook salmon were released directly above the weir for natural spawning. Hatchery jack Chinook salmon captures were placed in the holding area attached to the trap box prior to being killed not used (KNU) for Tribal distribution. Hatchery jacks that were released for natural spawning above the Pole Flat weir (5% of return) were not injected with erythromycin.

All transported adults are individually loaded and transferred using a modified fish tank mounted on a ¾ ton pick-up truck. The fish tank has one 1363.8 liter compartment and is supplied with pure oxygen through a stone diffuser. A circulating pump is powered by the ¾ ton pick-up truck to increase oxygenation. The fish tank was filled with water pumped directly from Yankee Fork with a two horsepower pump. IHOT guidelines were followed for transporting adult fish, which is approximately 0.45 kg of fish per 4.5 liters of water.

In the event of a mortality, staff recorded detailed information on the carcasses following normal trapping procedures described above, including the cause of death. Carcasses were distributed below the Pole Flat weir for nutrient enrichment and the caudal fin was removed to prevent duplicate counting.

Once all fish were enumerated, the weir structures were cleaned and checked to ensure proper function. Staff snorkeled and/or walked the upstream and downstream sides of the weirs to ensure the structures were sealed and functioning properly. If mortalities were found while cleaning the weir, staff followed normal procedures described above.

### **Harvest Monitoring**

Harvest guidelines were developed for each Fishery Management Area (FMA) as per the Tribal Resource Management Plan and include the number of natural and hatchery-origin Chinook salmon available for harvest. Chinook salmon fisheries were managed to achieve escapement or broodstock goals as the first priority. The harvest framework for natural-origin populations incorporates the Viable Population Thresholds (VPT) defined by the Interior Columbia-basin Technical Recovery Team (ICTRT) for basic, intermediate, and large populations. Using the pre-season forecast, the Tribes developed a harvest guideline in 2011 for Yankee Fork based upon population specific abundance estimates developed by co-managers in Idaho. The Tribes harvest guidelines were considered maximum harvest rates for Snake River spring/summer Chinook salmon.

The goal of harvest monitoring is to provide accurate and precise estimates of Chinook salmon harvest in all areas open to Chinook salmon fishing. This is accomplished by

obtaining catch per unit effort (CPUE) data. Fishery monitors covered Yankee Fork on a daily basis from June 23 to August 11, 2011, gathering data in the field from fisherman on the amount of time fished, number of fish caught, released, type of gear used (spear, snag, hook and line), origin, mark, and length from fish harvested. Where applicable, fishery personnel collected tissue samples from harvested Chinook salmon for later verification of genetic identity.

### **Spawning Ground and Carcass Surveys**

Intensive spawning ground surveys were conducted in Yankee Fork and its major tributary, West Fork Yankee Fork, to determine spawn timing, redd enumeration and distribution, abundance of live fish and to collect carcasses for biological information. Spawning ground survey procedures were developed by the YFCSS Project for hatchery effectiveness monitoring and coordinated with the various programs and/or agencies conducting field work in the Yankee Fork.

Tribal efforts were derived from two separate Fish and Wildlife Department projects including: 1) YFCSS and 2) Idaho Supplementation Studies (ISS). Yankee Fork was sub-divided into eight distinct strata (Konapacky 1986) (Figure 7). On a weekly basis, observers walked Yankee Fork (Strata 1–5) during mid-day marking Chinook salmon redds and recovering carcasses. ISS staff conducted bi-weekly surveys (3 total passes) in West Fork from Lightning Creek to Cabin Creek (Stratum 6). Jordan Creek (Stratum 7) and Eightmile Creek (Stratum 8) were not surveyed in 2011.

Observers were provided standard gear (i.e., polarized sunglasses, data sheets, gps unit, ribbon, permanent markers, backpack, and genetic sampling kit) and covered the same area over a three week period to increase the accuracy and precision of data collected. Chinook salmon redds were identified, recorded, and marked with an iridescent ribbon directly lateral to the apex of the redd. Observers recorded the following information on the ribbon: date, agency, observer initials, and redd number; this information was linked to the data sheets, scale envelopes, genetic vials, fin ray envelopes, and otolith envelopes.

Carcasses encountered during the surveys were examined for fin clips, operculum punches, and external/internal tags following standard trapping protocols. We identified three categories for processing carcasses: (1) operculum punched, (2) not operculum punched, and (3) natural-origin. If the carcass showed a pre-existing operculum punch, staff recorded gender, origin, fork length (cm), and percent spawned. If the carcass was not marked with a pre-existing operculum punch, the following biological data was collected: gender, origin, fork length (cm), percent spawned, and genetic tissue sample (0.5 cm<sup>2</sup>). If the carcass was a naturally produced Chinook salmon, biological data was collected as prescribed under categories one or two, with the addition of a fin ray and otolith sample, as requested by IDFG. The caudal fin was removed from all sampled carcasses and the carcass was placed back in the stream for nutrient enrichment.



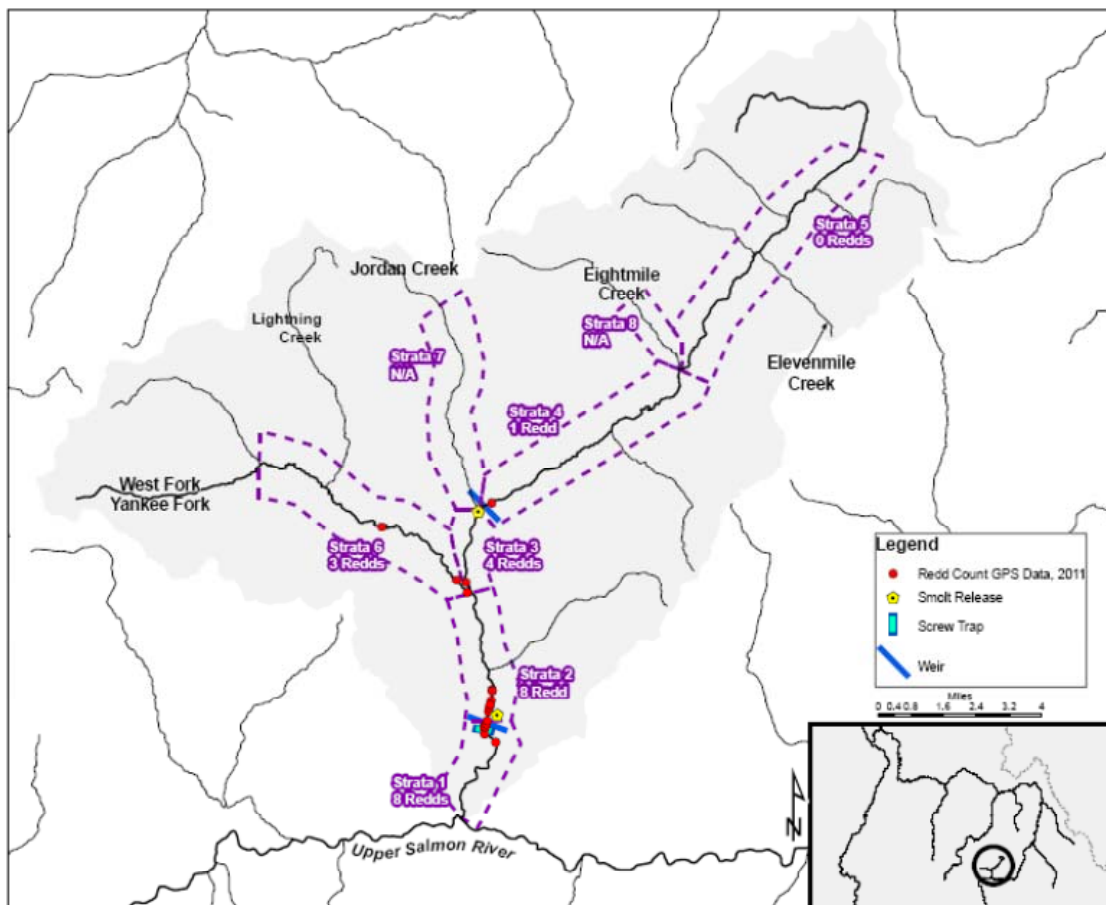


Figure 7. Weir, screw trap, redd, and smolt release locations in Yankee Fork, Idaho, 2011.

## RESULTS

All Yankee Fork Performance Measures established by the Collaborative Systemwide Monitoring and Evaluation Project (CSMEP) and ADHOC Supplementation Workgroup are reported in Appendix A and with specific 2011 YFCSS in-season scientific tasks and objectives highlighted within the results. Regional participation in LSRCP and other fishery activities are presented in Appendix B. Broodyear reports will be developed starting in 2014 with final returns from broodyear 2008.

### Smolt Release

Broodyear (BY) 2009 Chinook salmon smolts reared at the Sawtooth Fish Hatchery for the Yankee Fork program were isolated in two separate raceways by indentifying mark. Raceway five initially contained 199,237 coded wire tagged (CWT) only juveniles; raceway six held approximately 198,640 adipose fin clipped only juveniles. Each group was tagged with 1,200 PIT tags for a total of 2,400.

Prior to transport and release, the Tribes determined to compare direct stream versus acclimated smolt releases in Yankee Fork. Staff utilized Pond Series One (PS1) as the acclimation location by constructing a block net to ensure no migration from the pond.

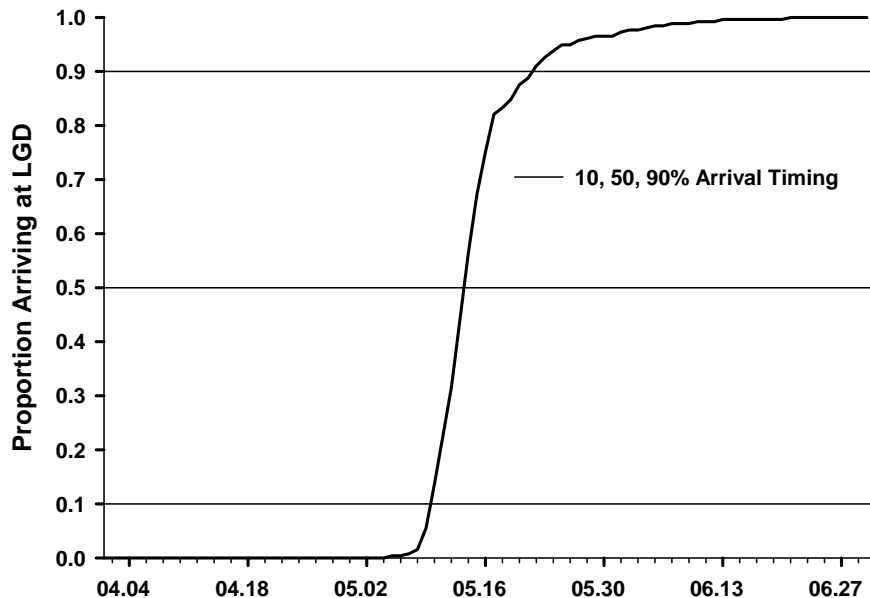
Direct stream release occurred in the mainstem Yankee Fork just below the Jordan Creek confluence. To compare direct release and acclimated survival, adipose clipped individuals were released at Jordan Creek confluence as the direct stream group and CWT only juveniles were treated as the acclimation group in PS1.

Tribal and IDFG staff transported the BY09 smolts to the Yankee Fork on April 19 and 20. There were 199,188 CWT only released into PS1 and 198,640 adipose clipped only direct stream released at the confluence for a total of 397,828 (2,339 PITs) smolts released in the Yankee Fork in 2011 (Table 1). The CWT only acclimation group was allowed to volitionally emigrate 48 hours later after block net removal on April 21.

**Table 1. Broodyear 2009 Chinook salmon smolt release in Yankee Fork.**

Mark	Initial # Smolts (PITs)	Release Date	Location	Final Releases (PITs)
<i>Ad Clip Only</i>	198,640 (1,200)	4/20/11	Mainstem	198,640 (1,151)
<i>CWT Only</i>	199,237 (1,200)	4/19/11	PS1	199,188 (1,188)
<i>Total</i>	397,828 (2,400)			<b>397,828 (2,339)</b>

Cormack/Jolly-Seber survival estimate for the 2011 hatchery Chinook salmon smolt release in Yankee Fork equaled 0.319 (0.0372) to Lower Granite Dam. By group, the acclimated CWT only juveniles showed higher survival at 0.374 (0.0645) as compared to the direct stream adipose clipped group, 0.266 (0.0404). Staff estimates of the 397,828 total smolts released into Yankee Fork, 74,496 (61,649 – 87,344) CWT smolts and 52,838 (44,813 – 60,863) adipose clipped smolts survived to Lower Granite Dam. Based on PIT tag detections from both release groups, arrival timing occurred between May 5 and June 21, 2011, with 10%, 50%, and 90% detection dates on May 8, May 14, and May 22, respectively (Figure 8). Peak detections occurred on May 13 and 14 (n=32).



**Figure 8. Broodyear 2009 hatchery smolt arrival timing to Lower Granite Dam.**

## Juvenile Trapping

### Broodyear 2010 Juveniles

The Yankee Fork screw trap was installed on April 13 and operated for 23 days until trap removal on May 5 in response to high water and smolt releases. The trap was re-installed after flows receded on July 13 and operated for an additional 113 days until removal on November 2. Staff trapped and handled a total of 2,248 juvenile individuals. Non-target species including steelhead (233), bull trout (82), cutthroat trout (23), rainbow trout (48), and mountain whitefish (237) resulted in 623 captures.

In 2011, there were 1,625 juvenile Chinook salmon captured in screw trap operations with 7 (0.0043) mortalities recorded. Staff marked a total of 676 juveniles and collected 621 genetic samples for parentage analysis under monitor and evaluation activities. There were a total of 42 recaptures for an overall trap efficiency of  $0.06 \pm 0.021$ .

Using the methods and data collected by the ISS, staff stratified time periods by juvenile life stage and significant changes in the hydrograph to calculate a Gauss population estimate of the number of juvenile Chinook migrating past the trap (Figure 9). ISS has classified March 1, June 1, and September 1 as arbitrary dates for fry, parr, and pre-smolt life stages, respectively, and, therefore, separate periods.

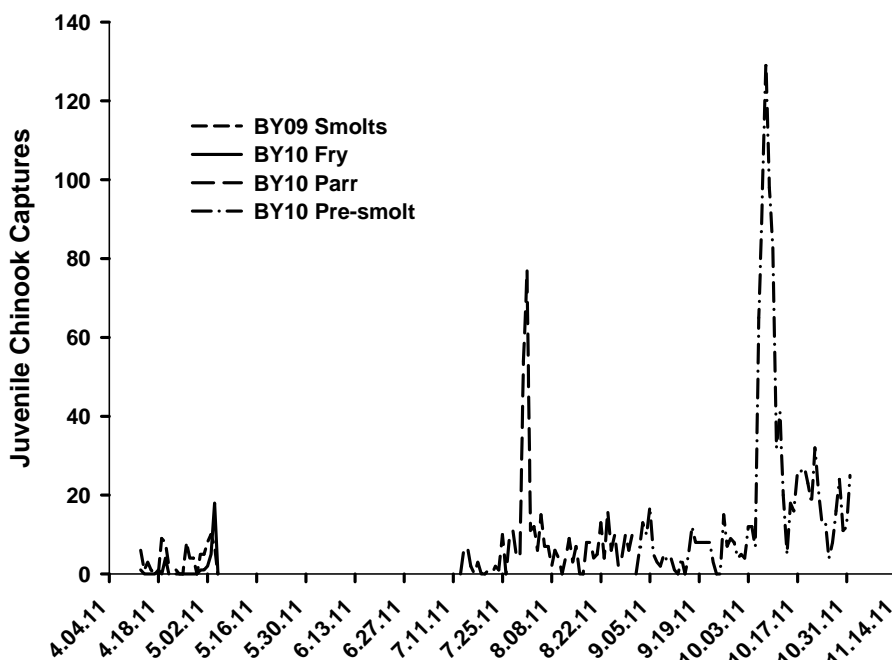


Figure 9. Migration timing of Chinook salmon juveniles during 2011 trapping operations.

In all, staff estimates, 3,054 (SE 608) BY10 parr and 28,147 (SE 6,145) BY10 pre-smolt juveniles migrated past the trap in 2011. Due to insufficient mark/recapture data, an overall estimate for BY10 fry migrants could not be calculated. During the period of

April 13 – May 5 and July 13 – November 2, 31,201 (SE 4,446) BY10 Chinook salmon juveniles were estimated to have migrated downstream past the screw trap (Figure 10).

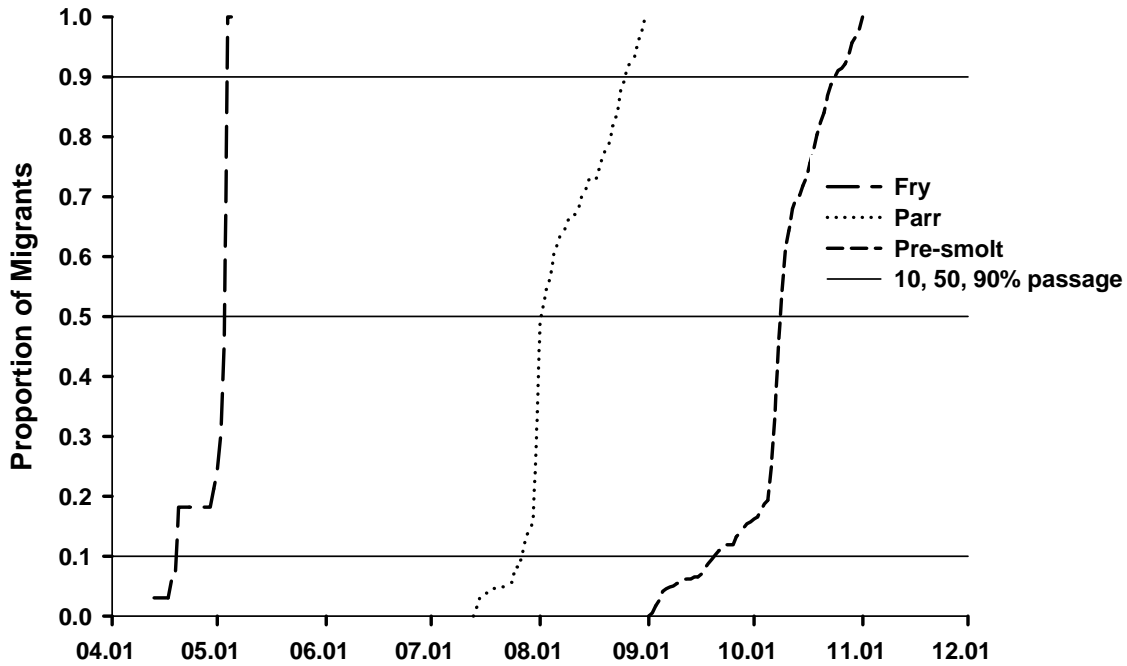


Figure 10. Proportional emigration over time for broodyear 2010 juvenile Chinook salmon past the Yankee Fork screw trap.

Length-weight relationships were derived for total (Figure 11) and life stage specific (Appendix A) BY10 migrating Chinook juveniles in 2011. The relationships were determined according to a polynomial quadratic model. The  $b$  value was used to evaluate the growth curve relationship. When  $b$  values are not significantly deviant from 3.0, growth is typically isometric, whereas values skewed from 3.0 indicate either positive or negative allometric growth (Ricker 1975).

The length-weight relationships for total migrants and by life stage were significant ( $p < 0.05$ ,  $R^2 > 0.90$ ). The variations in  $b$  values around 3.0 were not significant and indicated isometric growth for BY10 fry, parr, pre-smolt, and the total 2011 migrants. These results demonstrate that environmental conditions (water temperature, food availability, habitat access) in Yankee Fork do not appear to alter normal isometric growth.

All life history types (BY09 smolts and BY10 fry, parr, and pre-smolt) were present during 2011 screw trap operations (Figure 12). Emigration pattern was consistent to other tributaries in the Upper Salmon as previous BY smolts and current BY fry migrate in early spring followed by parr and pre-smolt in late summer, early fall. Mean lengths, weights, and condition factors for all life history types in Figure 12 are presented in Appendix A. There was no significant difference in mean length between BY09 smolts, BY10 parr, and BY10 pre-smolts.

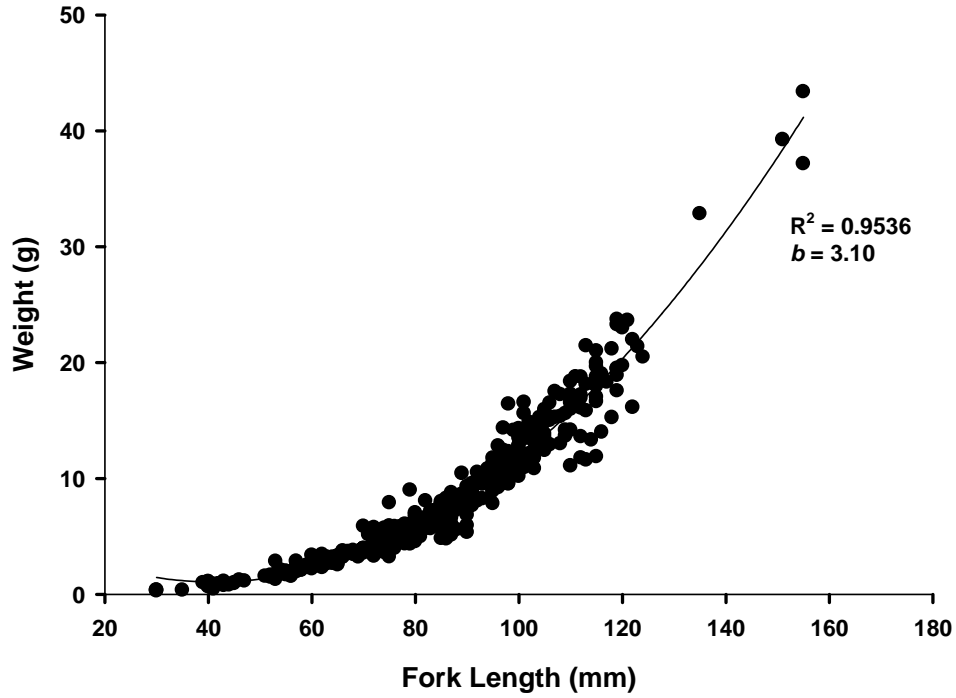


Figure 11. Length-weight relationship for all 2011 juvenile Chinook salmon sampled at the Yankee Fork screw trap.

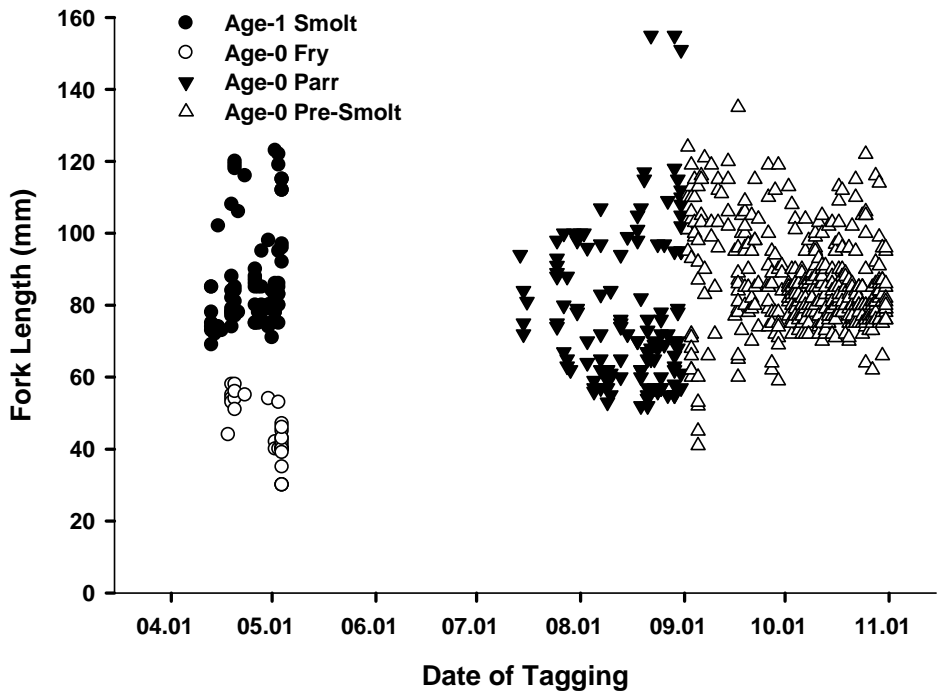
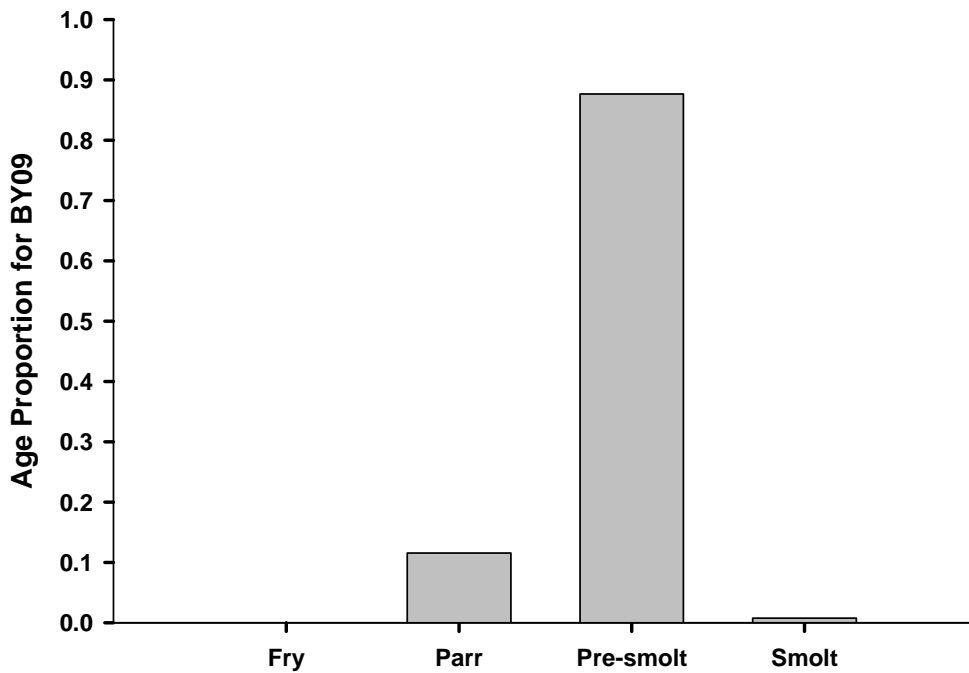


Figure 12. Fork length versus date of tagging by emigrant type for juvenile Chinook salmon tagged at the Yankee Fork screw trap.

### Broodyear 2009 Juveniles

In 2010, the Yankee Fork screw trap was installed on April 27 and operated for 37 days until high water events spurred the loss of the trap on June 3. A new trap was installed on August 21 and operated for an additional 88 days until removal on November 16. During this period, 46 (SE 10) fry, 15,114 (SE 3,369) parr, and 114,501 (SE 7,627) pre-smolt BY09 juveniles were estimated migrating past the screw trap (Figure 13). BY09 smolts were captured in the spring of 2011 and staff estimates 972 individuals passed the trap between April 13 and May 5. Staff estimates a total of 130,633 (SE 5,649) BY09 juveniles passed the Yankee Fork screw trap between April 27 – June 3, August 21 – November 16, 2010, and April 13 – May 5, 2011 (Figure 14).



**Figure 13. Age proportion of broodyear 2009 juveniles estimated past the Yankee Fork screw trap.**

Cormack/Jolly-Seber minimum survival estimate for BY09 natural Chinook salmon parr and pre-smolt migrating from Yankee Fork equaled 0.143 (0.0159) to Lower Granite Dam. There were no observations for BY09 tagged smolts, insufficient detections to determine parr survival separately, and therefore parr and pre-smolt tags were grouped to generate a survival estimate. Assuming this survival as the minimum, 18,535 (16,474 – 20,596) natural parr and pre-smolt juveniles survived to Lower Granite Dam. Based on PIT tag detections from both groups, arrival timing occurred between April 9 and June 10, 2011, with 10%, 50%, and 90% detection dates on April 27, May 10, and May 17, respectively (Figure 15). Peak detections at Lower Granite Dam occurred on May 14 (n=6), four days after the 50<sup>th</sup> passage percentile. Larger tagged juveniles tended to arrive earlier at Lower Granite, however with weak correlation (n=58,  $R^2=0.0143$ ). Mean travel time for all parr and pre-smolt detections (n=58) equaled 213.5 days (SE 3.7).

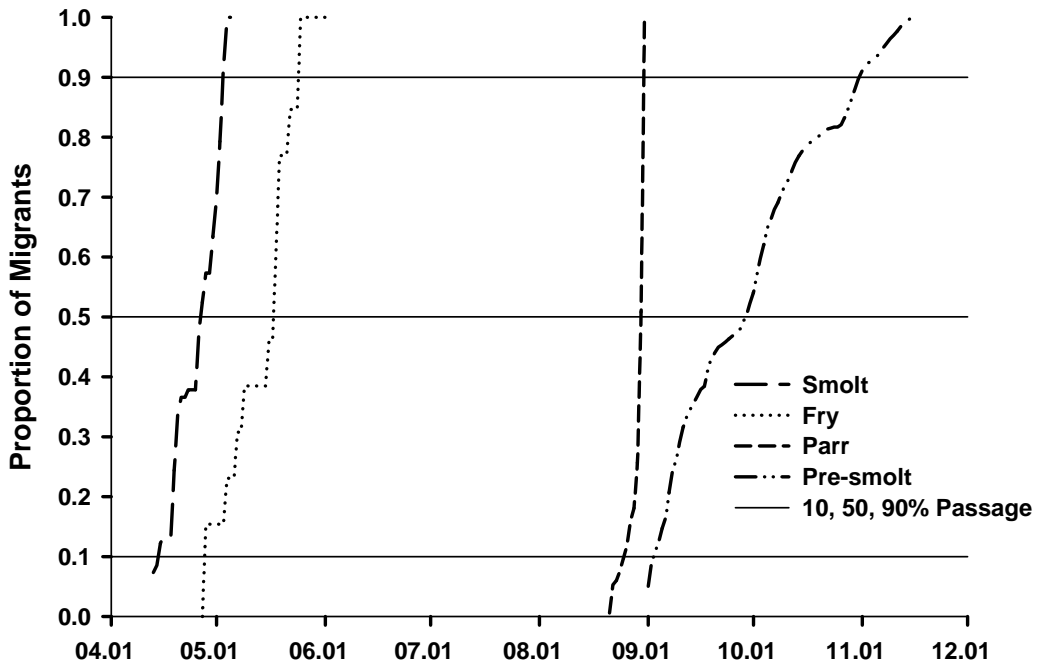


Figure 14. Proportional emigration over time for broodyear 2009 juvenile Chinook salmon past the Yankee Fork screw trap.

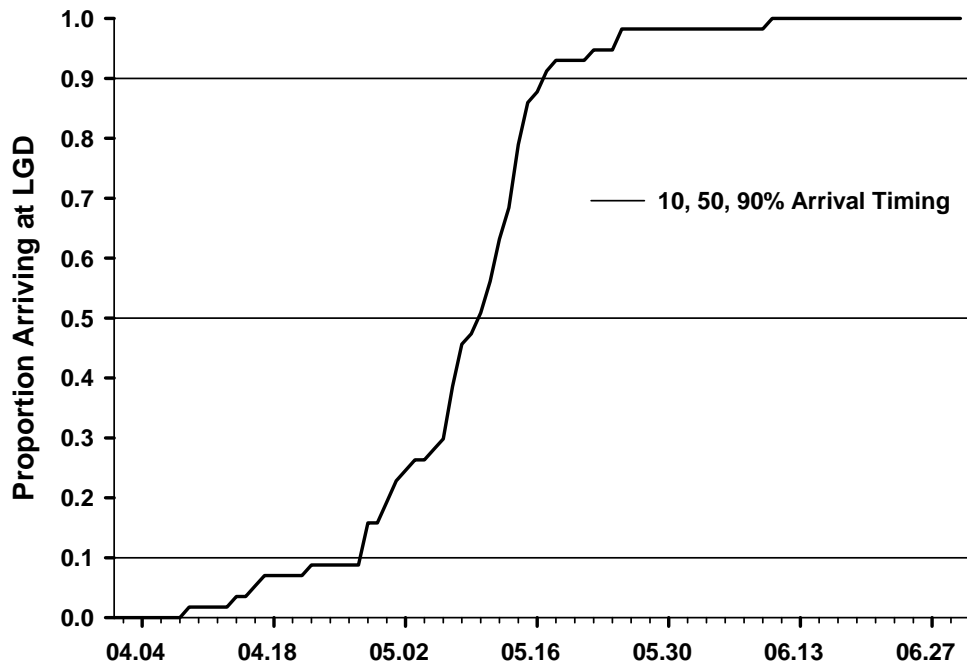


Figure 15. Broodyear 2009 natural juvenile Chinook arrival timing to Lower Granite Dam.

Broodyear 2009 juvenile estimates were finalized with the emigration of BY09 smolts in the spring of 2011. Recruit per spawner calculations were analyzed by redds in 2009, numbers of females trapped in 2009, and number of estimated females escaped in 2009 (Table 2). There were 414 redds identified, 24 returning females trapped at the Pole Flat weir, and a total escapement of 838 females with hatchery adult outplanting activities. In all measures, pre-smolts per spawner were highest versus no fry migrants per spawner. These recruit per spawner estimates are considered minimal estimates: 1.) the screw trap was installed late in the season missing the fry migration, and 2.) the screw trap was lost in high flows and re-installed during mid parr migration.

**Table 2. Broodyear 2009 recruit per spawner calculated by redd, by females trapped at the Pole Flat weir, and by estimated female escapement.**

Life Stage	Migrants	Redds	Females Trapped	Female Escapement	Recruit/ Redd	Recruit/ Female Trapped	Recruit/ Female Escaped
Fry	46	414	24	838	0	2	0
Parr	15,114				37	630	18
Pre-smolt	114,501				277	4,771	137
Smolt	972				2	41	1
Overall	130,633				316	5,443	157

### Adult Trapping

Pole Flat and Five Mile weirs were installed on July 14 and July 7, respectively. The first Chinook salmon was trapped at Pole Flat weir on July 15, one day after installation and the last fish was trapped on September 7. The Tribes operated Pole Flat weir for 62 days and Five Mile weir for 68 days. Pole Flat and Five Mile weirs were removed on September 13 and September 12, respectively.

A total of 122 Chinook salmon were trapped at Pole Flat and 6 at Five Mile with an additional 17 recaptures (Table 3). The overall natural male: female ratio was skewed towards males likely the result of late trap installation. All hatchery trapped Chinook salmon were male jacks, the product of the BY08 hatchery smolt release.

**Table 3. Adult Chinook salmon trapping summary for Yankee Fork, 2008 – 2011.**

Year	Natural			Hatchery			Total		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
2008	28	15	43	90	95	185	118	110	228
Percent	65.1%	34.9%	18.9%	48.6%	51.4%	81.1%	51.8%	48.2%	
2009	16	13	29	9	11	20	25	24	49
Percent	55.2%	44.8%	59.2%	45.0%	55.0%	40.8%	51.0%	49.0%	
2010	13	4	17	0	0	0	13	4	17
Percent	76.5%	23.5%	100%	0%	0%	0%	76.5%	23.5%	
2011	53	17	70	58	0	58	111	17	128
Percent	75.7%	24.3%	54.7%	100%	0.0%	45.3%	86.7%	13.3%	



Due to low returns in the Upper Salmon and Yankee Fork, no broodstock was collected in Yankee Fork and zero hatchery strays and/or adult outplants occurred above Five Mile weir for natural spawning. There were initially seven males transported from the Five Mile weir to Sawtooth for broodstock, but were soon transferred back to Yankee Fork proper after no females could be collected. There was zero total mortality at either the Pole Flat or Five Mile weirs from trapping operations. However, four of the transferred males died in holding at Sawtooth prior to re-release in Yankee Fork.

### **Non-Target Species**

Bull trout individuals were the only non-target species captured at the weir during the nine weeks of trapping. Bull trout were measured, tissue sampled for IDFG analysis, and released immediately above the weirs. There were a total of 38 individuals (6 recaps) with an average length of 50 cm (Table 4). There were two recorded mortalities. Bull trout captures and metrics have been appropriately reported to Scott Grunder, IDFG Native Species Coordinator. All other non-target species including mountain whitefish, rainbow trout, and cutthroat trout were small enough to freely pass between the pickets in the weir or trap box.

**Table 4. Incidentally trapped bull trout in the Yankee Fork, 2011.**

<b>Date</b>	<b>Gender</b>	<b>Length (cm)</b>	<b>Disposition</b>
11-Jul	M	55	Released Above
16-Jul	M	53	Released Above
16-Jul	M	56	Released Above
16-Jul	M	43	Released Above
19-Jul	M	42	Released Above
19-Jul	M	50	Released Above
20-Jul	M	53	Released Above
20-Jul	M	52	Released Above
21-Jul	M	55	Released Above
23-Jul	M	53	Released Above
23-Jul	M	60	Released Above
25-Jul	M	59	Released Above
26-Jul	M	52	Released Above
28-Jul	M	47	Released Above
31-Jul	F	45	Mortality
31-Jul	M	41	Released Above
31-Jul	M	40	Released Above
1-Aug	F	45	Released Above
1-Aug	M	44	Mortality
1-Aug	M	54	Released Above
1-Aug	F	56	Released Above
1-Aug	M	45	Released Above
2-Aug	M	49	Released Above

3-Aug	M	38	Released Above
3-Aug	M	41	Released Above
4-Aug	M	53	Released Above
7-Aug	M	54	Released Above*
10-Aug	F	49	Released Above
10-Aug	M	45	Released Above
10-Aug	M	48	Released Above
14-Aug	M	61	Released Above
15-Aug	M	55	Released Above*
15-Aug	M	56	Released Above*
15-Aug	M	54	Released Above*
18-Aug	M	45	Released Above*
25-Aug	F	52	Released Above
25-Aug	M	59	Released Above
30-Aug	M	52	Released Above*

\*indicates recapture at Five Mile weir

### Run-Timing

Chinook salmon migration occurred over a 55 day period from July 15 – September 7 (Figure 16). Returning Chinook salmon exhibited bi-modal run-timing distribution. Daily trapping frequency was highest on July 26 and August 22, with eight total (natural and hatchery) fish being trapped.

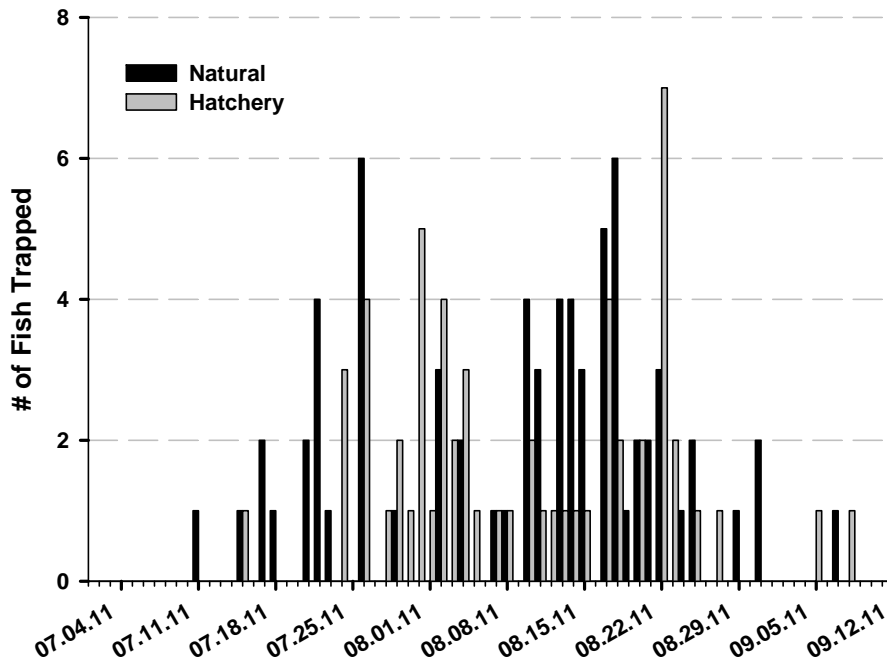


Figure 16. Daily trapping frequency of natural and hatchery Chinook salmon adults, 2011.

Return timing of natural fish was earlier at the 10% margin, but six days later as compared to the 50% hatchery return passage date (8/8/11) (Figure 17). Cumulative run-timing of natural and hatchery fish since 2008 (Figure 18) indicates natural fish arrive approximately two weeks earlier.

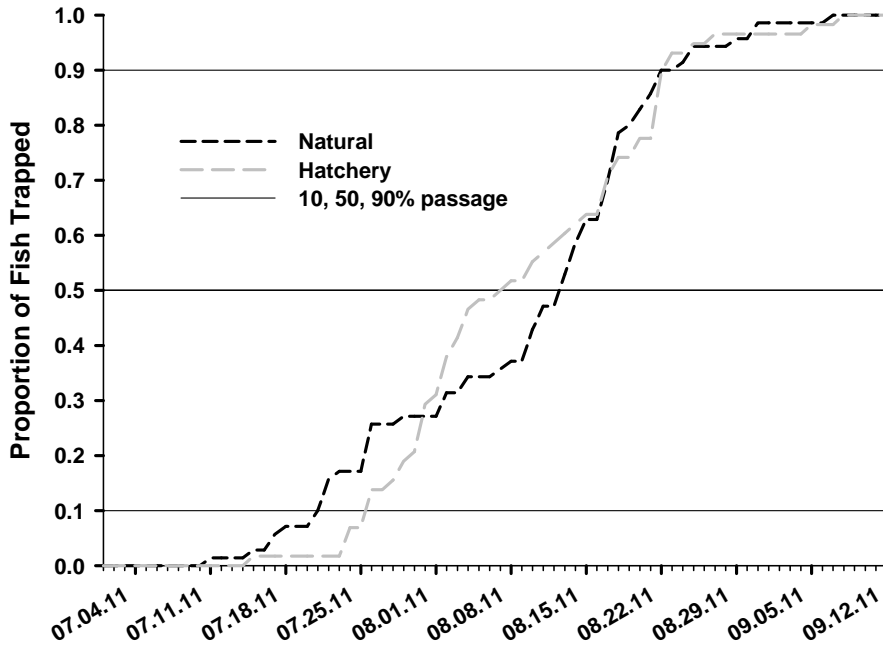


Figure 17. Run-timing of natural and hatchery Chinook salmon to Pole Flat weir, 2011.

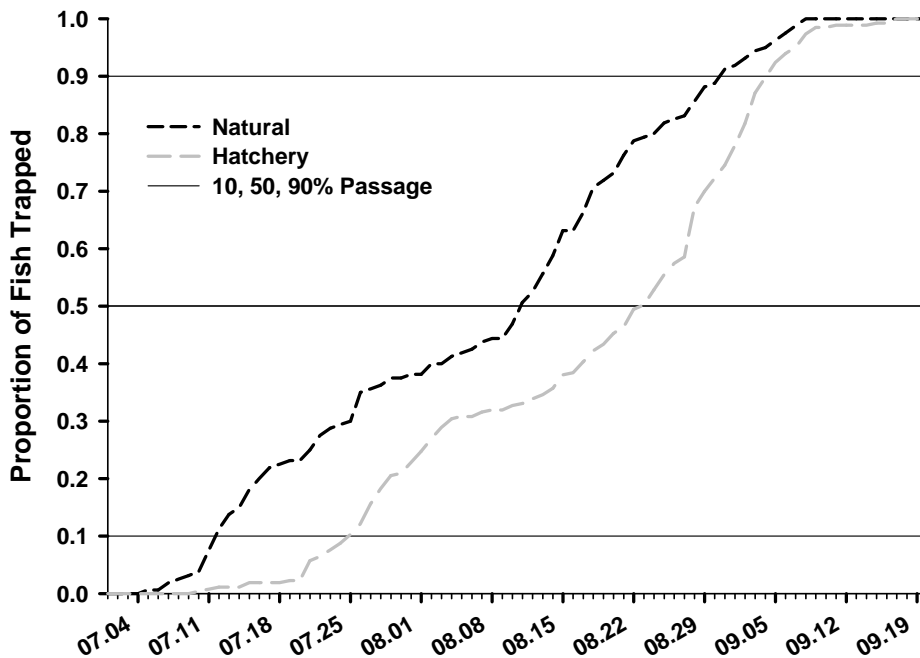


Figure 18. Run-timing of natural and hatchery Chinook salmon to Pole Flat weir, 2008-2011.

## Age Structure

Age categories as defined by Copeland et al. (2008) were used to estimate age at return for natural fish (Table 5). This methodology will be utilized until developing age structure categories specific to Yankee Fork.

**Table 5. Age by length for adjusted natural size classes (Copeland et al. 2008).**

Size Class	Age <sup>3</sup>	Age <sup>4</sup>	Age <sup>5</sup>
50-59	0.93	0.07	0.00
60-69	0.20	0.80	0.00
70-79	0.00	0.96	0.04
80-89	0.00	0.25	0.75
90-99	0.00	0.02	0.98
100-109	0.00	0.00	1.00

Using the methodology listed above, 35 of the natural fish trapped were age<sup>4</sup> adults, followed by 26 age<sup>3</sup>, and 9 age<sup>5</sup> (Table 6, Figure 19). All hatchery returns to the Yankee Fork in 2011 were age<sup>3</sup> jacks from the BY08 smolt release. There were no hatchery strays either trapped at the Pole Flat weir or identified in mark/recapture analyses during spawning ground surveys. Age<sup>4</sup> returns were proportionally similar to the cumulative returns in 2008-2011 (Figure 20); however age<sup>3</sup> returns were higher in 2011 possibly indicating a larger age<sup>4</sup> run size in 2012.

**Table 6. Age composition of hatchery and natural Chinook salmon, 2008 – 2011.**

Year	Age <sup>3</sup>			Age <sup>4</sup>			Age <sup>5</sup>		
	Natural	Hatchery	Total	Natural	Hatchery	Total	Natural	Hatchery	Total
2008	1	4 <sup>1</sup>	5	14	148	162	28	33 <sup>1</sup>	61
Percent	20%	80%	2%	8%	92%	71%	46%	54%	27%
2009	6	1 <sup>1</sup>	7	15	8 <sup>1</sup>	23	8	11	19
Percent	85.7%	14.3%	14%	65.2%	35.8%	47%	42.1%	57.9%	39%
2010	1	0	1	13	0	13	4	0	4
Percent	100%	0%	6%	100%	0%	72%	100%	0%	22%
2011	26	58	84	35	0	35	9	0	9
Percent	31.0%	69.0%	66%	100%	0%	27%	100%	0%	7%
<i>Total</i>	34	63	97	77	156	233	49	44	93
<i>Percent</i>	35.1%	64.9%	23%	33.0%	67.0%	55%	52.7%	47.3%	22%

<sup>1</sup>/ hatchery strays

<sup>A</sup>/ 2008 adult outplants: 87 age<sup>3</sup> males; 755 age<sup>4</sup> and age<sup>5</sup> males combined and 596 age<sup>4</sup> and age<sup>5</sup> females combined

<sup>B</sup>/ 2009 adult outplants: 81 age<sup>3</sup> males; 614 age<sup>4</sup> males; 55 age<sup>5</sup> males and 5 age<sup>3</sup> females; 621 age<sup>4</sup> females; 141 age<sup>5</sup> females

Of the natural fish trapped at Pole Flat weir, fork length ranged from 44 to 98 cm with an average length of 67 cm; hatchery lengths ranged from 43 to 61 cm averaging 50 cm (Figure 21). Size at return (Figure 22) since 2008 for both natural and hatchery fish is greatest between 70-79 cm (age<sup>4</sup>) followed by 80-89 cm (0.25 age<sup>4</sup>, 0.75 age<sup>5</sup>).

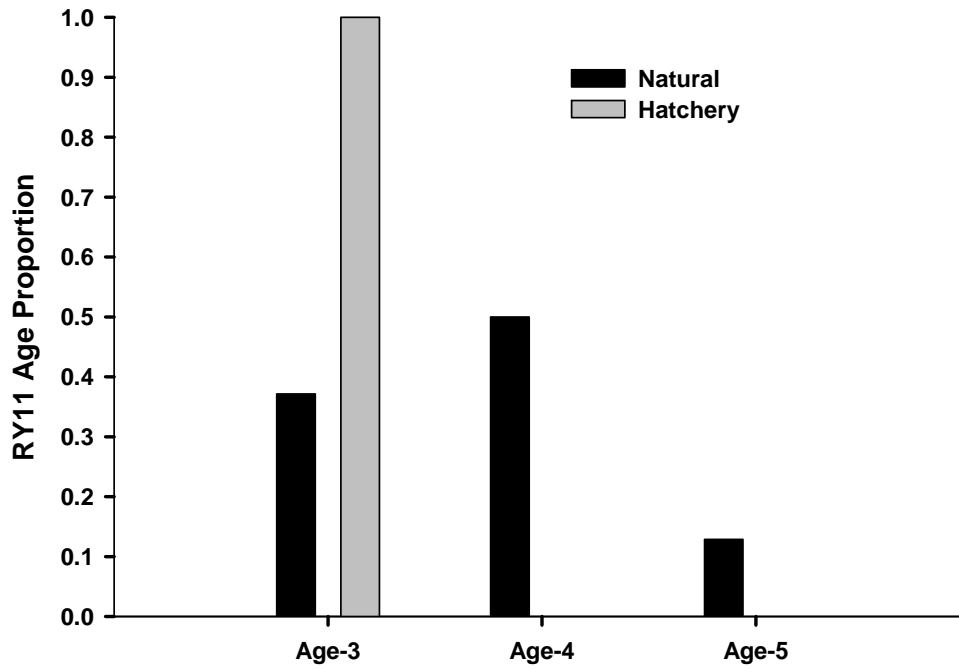


Figure 19. Age proportion of natural and hatchery Chinook salmon returns to Yankee Fork, 2011.

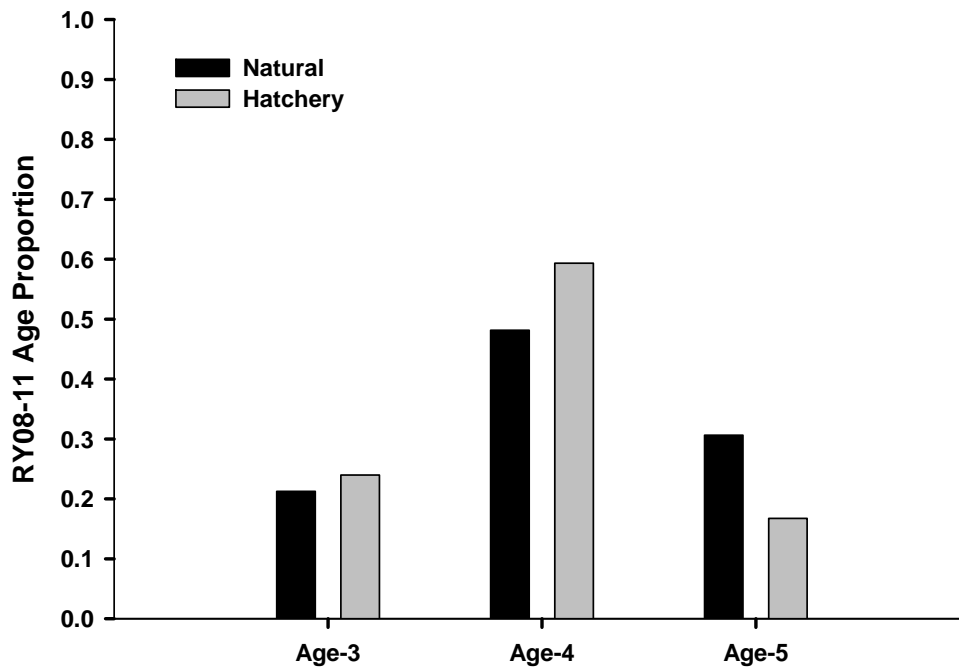


Figure 20. Age proportion of natural and hatchery Chinook salmon returns to Yankee Fork, 2008-2011.

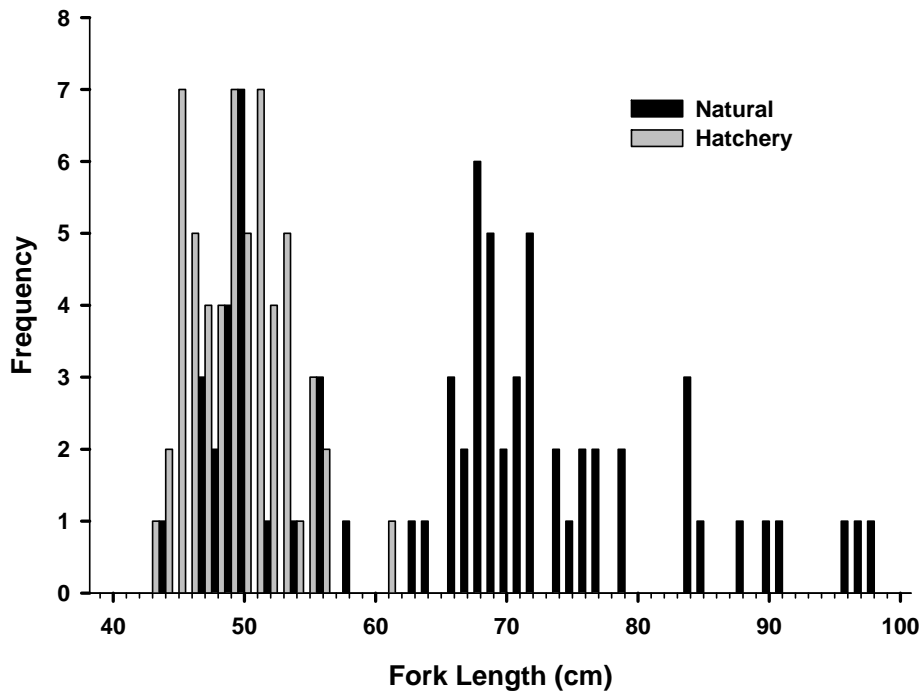


Figure 21. Length frequency diagram for natural and hatchery Chinook salmon returns to Yankee Fork, 2011.

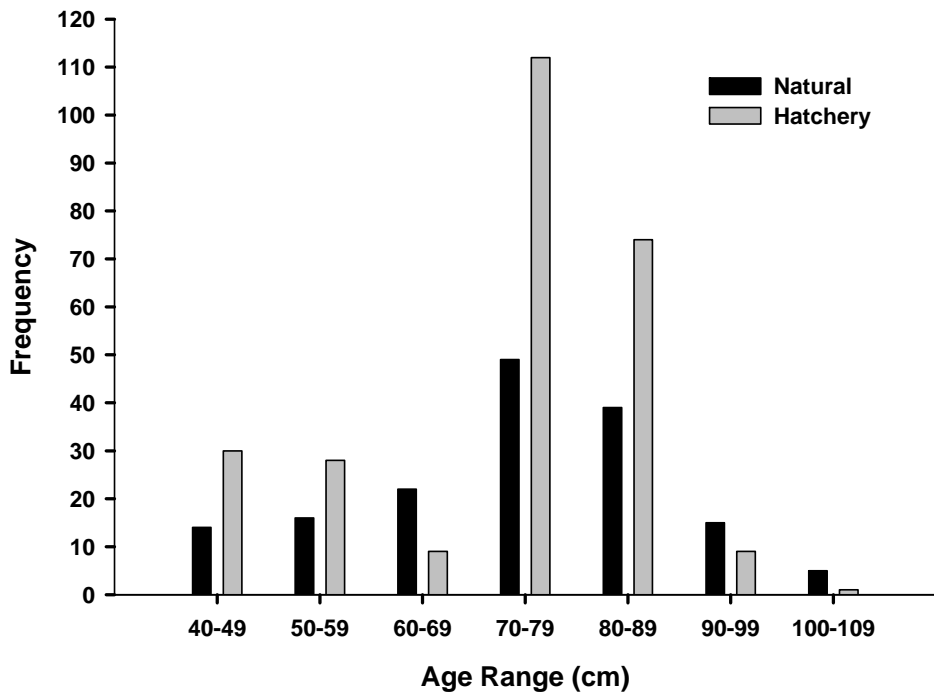


Figure 22. Frequency of returns by age range for natural and hatchery Chinook salmon trapped at the Pole Flat weir, 2008-2011.

## Harvest Monitoring

Tribal staff conducted harvest monitoring on a daily basis while performing Yankee Fork production activities to interview fishermen and obtain a catch per unit effort (CPUE). Log book data indicates staff completed 19 random harvest surveys in Yankee Fork. In sum, there were 4 efforts and 4 fishing days observed, zero adult fish harvested (Table 7), equaling a season total of zero CPUE per day. Three natural and zero hatchery adults have been harvested in Yankee Fork since initiating the program in 2008.

**Table 7. Yankee Fork harvest 2008 – 2011.**

<b>Year</b>	<b>Natural Adult Harvest</b>	<b>Hatchery Adult Harvest</b>
2008	1	0
2009	1	0
2010	1	0
2011	0	0
<b>Total</b>	<b>3</b>	<b>0</b>

## Spawning Ground and Carcass Surveys

### Spawning Ground Surveys

Spawning ground surveys were conducted from August 18 – September 1 in correlation with past observed spawn timing in Yankee Fork (Table 8). Three total passes were conducted in the six identified strata by the same monitoring group to detect newly completed redds. There were 24 total redds identified in 56 Yankee Fork stream kilometers (km) resulting in 0.43 redds/km (Table 9; Figures 7 and 23).

**Table 8. Yankee Fork Chinook yearly spawn timing 2008 – 2011.**

<b>Year</b>	<b>Observed Spawn Timing</b>
2008	8.28 – 9.19.08
2009	8.13 – 9.10.09
2010	8.18 – 9.01.10
2011	8.18 – 9.01.11

**Table 9. Number of redds observed by stratum and total in Yankee Fork, 2011.**

<b>Location</b>	<b>Redds Observed</b>
Stratum 1	8
Stratum 2	8
Stratum 3	4
Stratum 4	1
Stratum 5	0
Stratum 6	3
Stratum 7	N/A
Stratum 8	N/A
<b>Total</b>	<b>24</b>

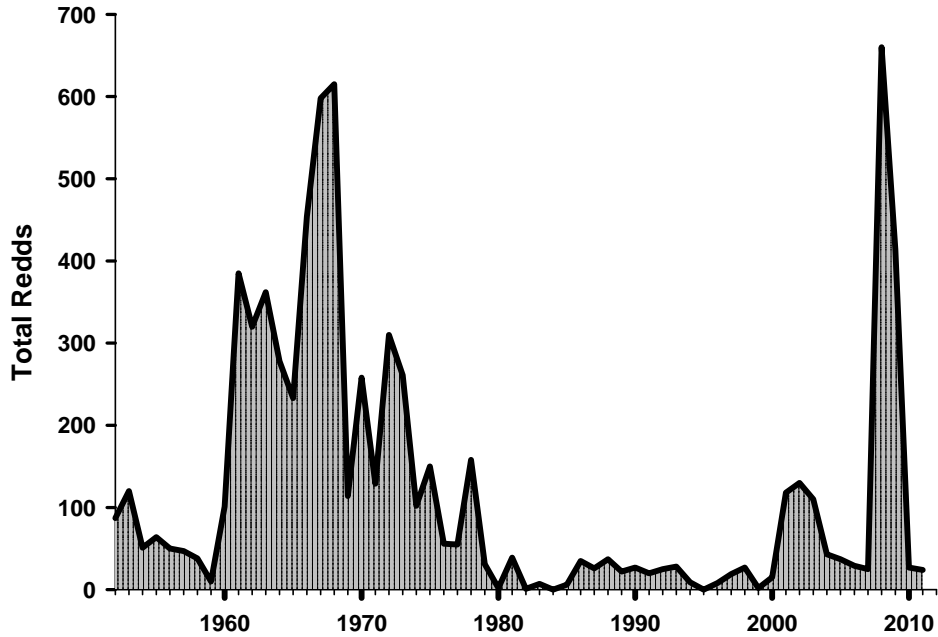


Figure 23. Chinook salmon redds in Yankee Fork, 1956 - 2011.

Carcass Surveys

Carcass surveys were completed concurrently during the three pass spawning ground surveys from August 18 – September 1. Staff collected a total of 41 carcasses from the confluence to the headwaters of Yankee Fork. There were 36 natural carcasses (32 punched; 4 un-punched) and 3 hatchery carcasses (1 punched; 2 un-punched) recovered between the Pole Flat weir and the headwaters. Zero strays (0.0% stray rate) were identified at the Pole Flat weir or during carcass surveys. There were seven carcasses collected containing PIT tags (5 QCI, 1 CRITFC, and 1 NMFS). All were tagged at Lower Granite as returning adults, except for the NMFS which was tagged as a juvenile in 2009 migrating to the ocean.

Of the 41 carcasses collected, eight were female. None of the carcasses were  $\leq 25\%$  spawned indicating 0.0% pre-spawn mortality in 2011 (Table 10).

Table 10. Date and percent spawned of female carcasses collected in 2011.

Date	% Spawn
18-Aug	98.8
18-Aug	97.1
1-Sep	100.0
1-Sep	99.9
1-Sep	100.0
6-Sep	100.0
6-Sep	100.0
6-Sep	100.0



## Mark-Recapture Evaluation

The Tribes acknowledge the presence of potential un-trapped returning adults in Yankee Fork. To determine the total escapement to Yankee Fork, the Tribes utilized a mark-recapture study to apply an efficiency rate to recovered unmarked adults to estimate a total escapement number.

The mark-recapture study was conducted with natural-origin returns between the lower weir and Twelve Mile Creek. There were 64 natural salmon released above Pole Flat weir and three above Five Mile weir, of which 32 operculum punched carcasses were recovered in spawning ground surveys for an efficiency of 47.8%. Field crews recovered four natural and two hatchery carcasses that were not operculum punched. Using the Peterson Estimator (Chapman 1951):

$$\hat{W}_{M/R} = [(M+1)(C+1)/R+1] - 1$$

Where M is marked released above, C is total carcass recoveries including marked and unmarked, and R is marked carcass recoveries, staff estimated total escapement above the weir.

This results in a total of 53 estimated natural-origin adults and 25 jacks above the weir with a variance of 10 fish. Two unmarked hatchery carcasses were recovered above the weir resulting in a total of nine expanded for past the Pole Flat weir. Overall trapping efficiency therefore equaled 84.1% (122 trapped ÷ 145 estimated escaped above).

Using an adjusted fish per redd value (Peterson Addition method) obtained between the Pole Flat and Yankee Fork headwaters, the Tribes were able to estimate escapement below the Pole Flat weir. In order to obtain the adjusted value, female:red and male:red ratios were first calculated. The adjusted female:red estimate (1.19) was calculated by dividing the total (including Peterson estimator fish) number of females (19) above Pole Flat by the number of above-weir redds (16). The male:red estimate (7.89) was calculated by multiplying the female:red estimate (1.19) by the original (pre-removal) male:female sex ratio (6.63) at the weir. The sum of the female:red and male:red ratios provided the “adjusted” fish per redd.

The Tribes applied the adjusted fish per redd value (9.08) to the 8 redds identified below the weir; resulting in 73 fish. Applying the ratio of natural (0.525) and hatchery (0.475) individuals trapped at the weir, we estimate 38 natural and 35 hatchery salmon spawned below the weir. The overall female spawner per redd including above and below weir production resulted in 1.17 females/redd.

We estimate 38 natural-origin spawned below the Pole Flat weir and 78 escaped above for a total return of 116 natural-origin individuals (82 adults; 34 jacks). We further estimate 35 hatchery jacks spawned below Pole Flat weir, 9 escaped above, 58 were KNU at the weir, and 2 harvested for a total return of 104 hatchery jacks. Combining both origins, the Tribes estimate a total return of 220 Chinook salmon to the Yankee Fork in 2011.

## Total Escapement

Overall, we estimate 220 natural and hatchery salmon returned to Yankee Fork in 2011. Of the 220 returns, 116 were natural (52.7%) and 104 were hatchery jacks (47.3%). Yankee Fork natural fish were comprised of 88 males (75.9%) and 28 females (24.1%). Yankee Fork hatchery fish were comprised entirely of 104 male jacks. The total spawning aggregate comprised 160 Chinook salmon with 116 natural (72.5%) and 44 hatchery (27.5%) creating 24 redds (Table 11).

**Table 11. Yankee Fork production values 2006 – 2011.**

Year	Releases	Trapped HOR	Trapped NOR	Est. Escapement	Redds Produced
2006	135,934 smolts				21
2007					18
2008	1,438 adults	185	43	1,935	660
2009	1,517 adults	20	29	1,640	414
2010	211,833 fry <sup>1</sup> & 398,544 smolts	0	18	65	27
2011	397,828 smolts	58	70	220 <sup>2</sup>	24

<sup>1</sup>Fry produced from 481,717 excess eyed eggs from SFH outplanted in YF ponds.

<sup>2</sup>Indicates total escapement to Yankee Fork. Spawner abundance equals 160 (116 natural, 44 hatchery); 58 hatchery jacks KNU at weir and 2 harvested.

## DISCUSSION

The Yankee Fork Chinook Salmon Supplementation program is designed to incorporate habitat restoration, harvest management, and hatchery supplementation to achieve the long term goal of returning 2,000 adults and is annually operated to identify adaptive management strategies within and between seasons.

Hatchery smolt releases were conducted to investigate survival differences between direct stream and acclimated releases. Overall survival for the entire group was 0.319 (0.0372) to Lower Granite Dam. Between groups, the acclimated release (CWT) showed higher survival than the direct stream release (ad-clipped). These results were similar to the BY08 smolt release, however, the BY08 acclimated group (ad-clipped) did not return as age<sup>3</sup> adults (n=3) while the CWT direct stream group, which showed lower survival to Lower Granite Dam, returned 101 jacks to Yankee Fork.

There were significant BY08 CWT adult strays (373 of 474; 78.7%) to Sawtooth in 2011. Due to non-differential marking of the ad-clipped juveniles released at Sawtooth and Yankee Fork, stray rate could not be determined for this group. Results indicate natural-origin juveniles arrive at Lower Granite approximately two weeks prior to the released hatchery smolts. Staff will need to evaluate the possibility of releasing BY10 hatchery smolts earlier in April to ensure Yankee Fork imprinting, mimic natural life history, and reduce stray rates.

Tribal staff is collecting high quality juvenile Chinook salmon emigration data, when the trap is operational. Staff has been unable to collect accurate data for emigrating smolts and fry due to late trap installation and insufficient mark-recapture data. Early parr

emigration data (June 1 – 14) has also been limited due to high flows. That said, results from screw trap operations indicate that the majority of juveniles are migrating from Yankee Fork as pre-smolts and a smaller proportion as parr.

Weir operations have improved dramatically since initiating the program in 2008. Staff has continually completed structural modifications to the weir and trap box, improving the ability to trap, capture, handle, and process returning Chinook salmon adults. High proportion of trapped natural-origin males versus females is a clear indication that late trap installation is consistently missing the front portion of the run.

## **RECOMMENDATIONS**

The Tribes will continue to operate the Yankee Fork Chinook Salmon Supplementation program to collect monitor and evaluation data to improve operations through adaptive management. We anticipate age<sup>4</sup> supplementation returns in 2012 from BY08 adult outplants and BY08 hatchery smolt releases, in addition to age<sup>3</sup> returns from the BY09 hatchery smolt release. Increased returns in 2012 should, for the first time in program history, allow the program to collect localized broodstock from Yankee Fork. Contingent on Yankee Fork flow, staff expects to install the Pole Flat and Five Mile weirs the third week of June, or as soon as possible, to ensure capturing the entire returning salmon run. The program will focus on collecting as many natural-origin carcasses as possible for IDFG production monitoring to develop a specific age at length for Yankee Fork adult returns.

The screw trap will be installed in March with proper retrieval equipment for high spring flows in order to collect sufficient smolt and fry emigration data. The Tribes will expand screw trap protocols to develop a permanent site (i.e., cable anchors and bridge) to ensure full seasonal operation for more accurate and precise emigration data. Longer trapping operation will result in increased tagging to accurately characterize natural juvenile emigration metrics.

The YFCSS program will continue to study acclimated versus direct stream survival rates to Lower Granite Dam with future Chinook salmon smolt releases. Given the new information on the difference between natural and hatchery arrival timing to Lower Granite Dam, staff will evaluate the ability (i.e., transport schedules, cost, and environmental conditions) to release BY10 hatchery smolts earlier in April to mimic natural life history patterns and reduce stray rates to Sawtooth Fish Hatchery. The Tribes will seek additional PIT tags for the smolt release groups to accurately estimate survival through the hydrosystem and forecast returning adults to the Yankee Fork.

Currently, the YFCSS program is developing a statement of work with Abernathy Fish Technology Center to analyze genetic tissue samples collected from migrating juveniles and returning adults. These genetic analyses including genetic diversity and relative reproductive success will be used as one tool within the monitor and evaluation plan to determine the efficacy of supplementation activities in the Yankee Fork.

With potential help from the LSRCF, the Tribes plan to support increased infrastructure in Yankee Fork by designing and implementing a permanent trapping structure and adult holding facility to support increased supplementation returns and program operations in the near future.

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**APPENDIX A: Standardized Performance Measures (Galbreath et al. 2008) for the Yankee Fork Chinook Salmon Program**

	<b>Performance Measure</b>	<b>Evaluation Specific to Yankee Fork</b>
<b>Abundance</b>	Adult Escapement to Tributary	220 (116 natural; 104 hatchery)
	Fish per Redd	9.08 fish/redd (adjusted)
	Female Spawner per Redd	1.17 females/redd
	Redd Counts	24 redds; 0.43 redds/km ( <i>See Table 9</i> )
	Spawner Abundance	160 (116 natural; 44 hatchery)
	Hatchery Fraction	27.5%
	Harvest	2 hatchery jacks
	Juvenile Emigrant Abundance	<i>See Juvenile Trapping Results</i>
	Smolts	18,535 (16,474 – 20,596) BY09 NOR
	Run Prediction	2011: 396 NOR and 393 HOR
<b>Survival</b>	Smolt-Adult Return Rate	NOR BY09 in 2014; HOR BY08 in 2013
	Recruit per Spawner	<i>See Table 2</i>
	Pre-spawn Mortality	0.0%
	Juvenile Survival to LGD	<i>See Smolt Release and Juvenile Trapping Results</i>
	Post-release Survival	<i>See Smolt Release and Juvenile Trapping Results</i>
<b>Distribution</b>	Adult Spawner Distribution	<i>See Figure 7 and Table 9</i>
	Stray Rate (percentage)	0.0% to YF; 78.7% BY08 to SFH
<b>Genetic</b>	Genetic Diversity	<i>See Table A1 below</i>
	Relative Reproductive Success	To be determined with Abernathy Fish Technology Center Statement of Work in 2012
<b>Life History</b>	Age Structure	<i>See Figures 19 and 20</i>
	Age-at-Return	<i>See Table 6</i>
	Age-at-Emigration	<i>See Figures 12 and 13</i>
	Size-at-Return	<i>See Figures 21 and 22</i>
	Size-at-Emigration	<i>See Table A2 below</i>
	Juvenile Emigration Condition	<i>See Table A2 below</i>
	Percent Females (adults)	<i>See Table A3 below</i>
	Adult Run-timing	<i>See Figures 17 and 18</i>
	Spawn-timing	<i>See Table 8</i>
	Juvenile Emigration Timing	<i>See Figures 8, 10, 14, and 15</i>
Juvenile Arrival Timing (LGD)	<i>See Figures 8 and 15</i>	

Habitat	Instream Flow	<i>See Figure A1 below</i>
	Water Temperature	<i>See Figures A2 and A3 below</i>
	Fish Assemblage	<i>See Juvenile Trapping Results</i>
In-Hatchery Measures	Hatchery Production Abundance	<i>See Table 11</i>
	In-hatchery Life Stage Survival	BY09 Chinook green egg to eyed egg = 94%; Green egg to smolt = 71.4%
	Size-at-Release	256 mm FL; 17.5 g
	Juvenile Condition Factor	Average CF = 0.0000334
	Fecundity by Age	Mean = 4,958 eggs/female
	Spawn Timing	8.13 – 9.16.09; 8 spawning days
	Hatchery Broodstock Fraction	100%
	Hatchery Pre-spawn Mortality	1.03% (11/1067)
	Female Spawner ELISA Values	High ELISA levels (odv>0.25) of Renibacterium salmoninarum were detected in 14 disease samples of the brood Chinook salmon. This resulted in the eggs from 28/518 (0.54%) females being culled (two females per incubation tray).
	In-hatchery Disease Monitoring	This brood year received a feeding of oxytetracycline for coldwater disease and two prophylactic feedings of Aquaflor to reduce the risk of a bacterial kidney disease (BKD) epizootic. Pre-liberation sampling in March 2010 had one pool of 12 positive for Renibacterium (low optical) and two pools of 12 positive for Myxobolus cerebralis. BY09 fingerlings were treated with formalin in various large raceways from 6/16/10 through 9/21/10 to keep Ichthyophthirius in check. Each raceway received 6 gal. of formalin over an hour flush, 3 times per week. At 660 gpm/raceway, this works out to a 167 ppm treatment rate.
	Broodstock Spawner Length (mm)	Males: age <sup>3</sup> = 538, age <sup>4</sup> = 760, age <sup>5</sup> = 883 Females: age <sup>3</sup> = 616, age <sup>4</sup> = 771, age <sup>5</sup> = 885
	Pre-release Mark Retention	260 fin clipped fish checked in raceway 6; 97% ad-clipped, 3% mis-clipped
	Pre-release Tag Retention	97% CWT retention (raceway 5 only), 97.5% PIT-tag retention (raceway 5&6)
	Hatchery Release Timing	4.19 (CWT) and 4.20.11 (ad-clipped)
	Chemical Water Quality	<i>See Table A4 below</i>
Water Temperature	<i>See Figure A4 below; 9.7°C at release</i>	

**Table A1. Genetic tissue samples collected from YFCSS program operations.**

<b>Broodyear</b>	<b>Samples</b>	<b>Life Stage</b>	<b>Origin</b>	<b>Activity</b>	<b>Location</b>
2006	181	Juvenile	Natural	Electrofishing	CRITFC
2007	125	Juvenile	Natural	Electrofishing	Fort Hall
2008	298	Adult	Natural/Hatchery	Weir Trapping	Fort Hall
2008	1,438	Adult	Hatchery	Outplants	Fort Hall
2008	518	Juvenile	Natural	Screw Trap	Fort Hall
2008	240	Adult	Hatchery	Smolt Release	IDFG
2009	73	Adult	Natural/Hatchery	Weir Trapping	Fort Hall
2009	1,517	Adult	Hatchery	Outplants	Fort Hall
2009	912	Adult	Hatchery	Egg Outplants	IDFG
2008/2009	1,206	Juvenile	Natural	Screw Trap	Fort Hall
2009	240	Adult	Hatchery	Smolt Release	IDFG
2010	34	Adult	Natural	Weir Trapping	Fort Hall
2009/2010	621	Juvenile	Natural	Screw Trap	Fort Hall
2011	139	Adult	Natural/Hatchery	Weir Trapping	Fort Hall
<b>Total</b>	<b>7,542</b>				

**Table A2. Mean size and condition at emigration.**

<b>Life Stage</b>	<b>Mean FL (mm)</b>	<b>Mean Weight (g)</b>	<b>Mean Condition</b>
BY09 Smolts	86.8 (1.58)	7.42 (0.46)	0.11 (0.001)
BY10 Fry	44.8 (1.42)	1.16 (0.10)	0.12 (0.004)
BY10 Parr	78.3 (1.93)	7.21 (0.64)	0.12 (0.001)
BY10 Pre-smolts	85.9 (0.65)	7.86 (0.22)	0.14 (0.028)

**Table A3. Percent females by origin and year for YF spawning population.**

<b>Year</b>	<b>Natural %</b>	<b>Hatchery %</b>	<b>Total %</b>
2008	36	44	44
2009	56	51	51
2010	25	0	25
2011	24	0	19
<b>Total</b>	<b>34</b>	<b>47</b>	<b>46</b>

**Table A4. Sawtooth Fish Hatchery water quality analysis of wells 1, 2, 6, & 7.**

<b>Well Number</b>	<b>1</b>	<b>6 and 7</b>	<b>1 and 2</b>	<b>1 and 2</b>
<b>Year</b>	<b>2011</b>	<b>2008</b>	<b>2005</b>	<b>2002</b>
<b>Nutrients (mg/L)</b>				
T. Ammonia as N	<0.01	<0.04	<0.01	<0.01
T. Kjeldahl N as N	0.12	*	*	*
T. Phosphorus as P	0.016	<0.05	0.017	0.012
Ortho Phosphate as P	0.005	*	*	*
<b>Minerals (mg/L)</b>				
Sp. Conductance (umhos/cm)	173	*	*	*
Hardness as CaCO <sub>3</sub>	80.3	78.3	78.3	81
T. Alkalinity as CaCO <sub>3</sub>	83.2	70.4	79.8	79
Bicarbonate Alk. As CaCO <sub>3</sub>	83.2	70.4	79.8	79
Calcium	28.8	27.9	26.3	27.9
Magnesium	2.05	2.29	2.11	1.93



Sodium	5.33	4.81	4.7	4.69
Potassium	0.48	<0.05	0.75	0.53
Fluoride	0.76	0.67	0.82	0.83
<b>Total Metals (ug/L) and Miscellaneous</b>				
Arsenic, Total	0.001	<0.005	0.9003	0.005
Cadmium, Total	<0.0007	<0.0005	<0.0005	0.005
Chloride	*	<1.0	0.93	0.72
Cobalt	*	<0.02	NR	<0.01
Copper	<0.01	<0.01	<0.01	<0.01
Lead	0.0022	<0.005	<0.002	<0.002
Mercury	<0.002	<0.0002	<0.0002	<0.002
Selenium	<0.005	<0.005	0.005	0.013
Cyanide (mg/L)	*	<0.005	<0.005	<0.005
pH (SU)	7.73	*	*	*
Turbidity (ntu)	0.11	*	*	*

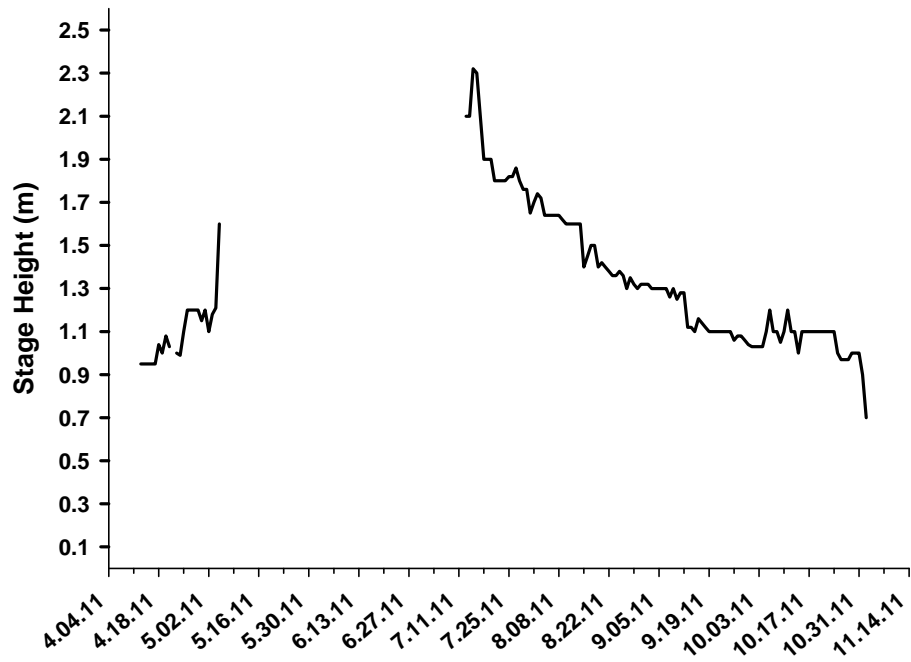


Figure A1. Yankee Fork hydrograph during screw trap and weir operations, 2011.

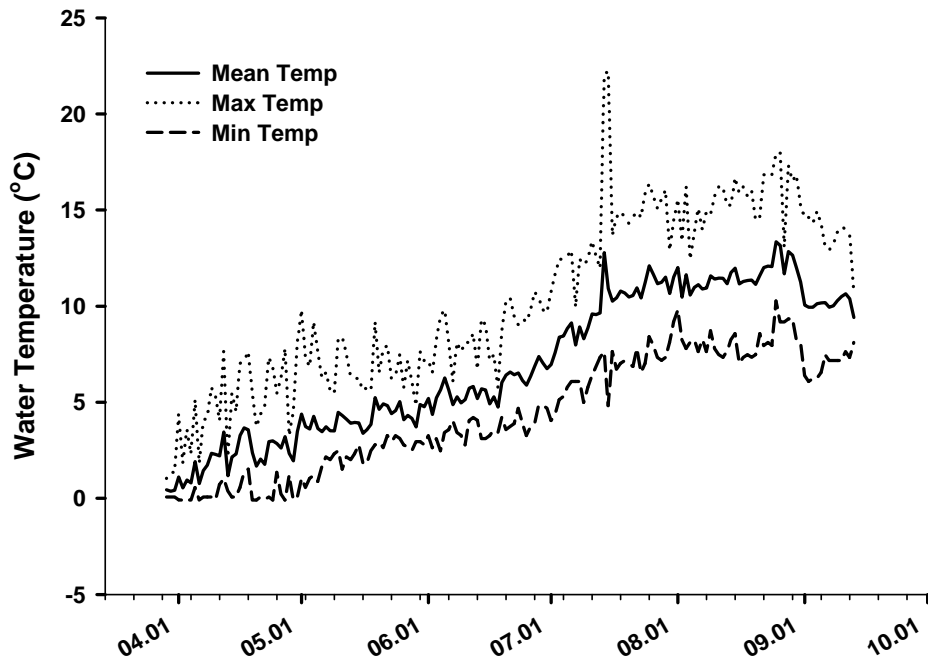


Figure A2. Temperature profile recorded at the Pole Flat weir and screw trap, 2011.

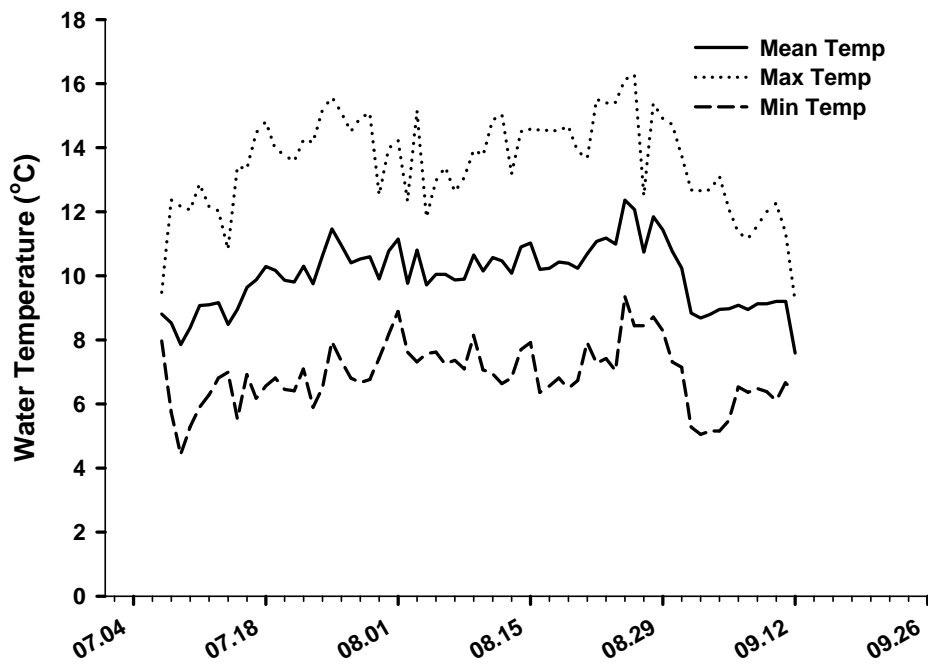


Figure A3. Temperature profile recorded at the Five Mile (upper) weir, 2011.

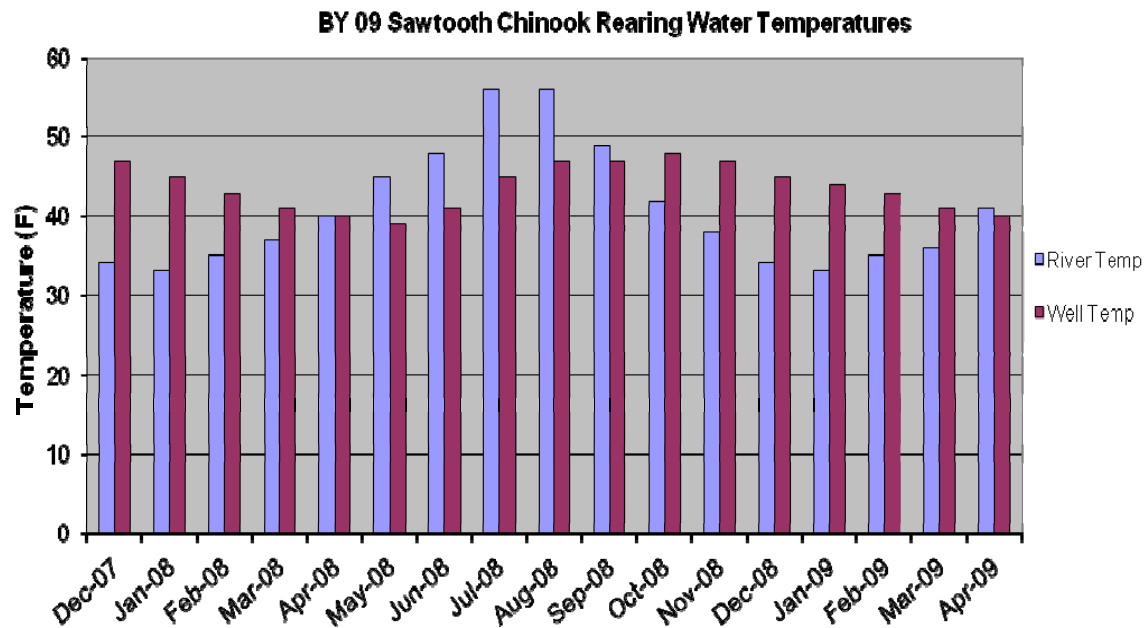


Figure A4. Broodyear 2009 Sawtooth Chinook rearing temperatures.

## APPENDIX B: Regional Participation

<b>Meeting</b>	<b>Location</b>	<b>Dates</b>	<b>Personnel</b>
Surph Workshop	Boise, ID	11/17 – 11/18/10	L. Denny, K. Tardy, C. Lopez
LSRCP Review Symposium	Boise, ID	11/30 – 12/2/10	L. Denny, K. Tardy, C. Lopez, A. Graves
B-run Steelhead Coordination	Stanley, ID	1/12/11	K. Tardy
Salmon Challis Nat. Forest	Challis, ID	1/13/11	K. Tardy
PSMFC PIT-tag Workshop	Skamania, WA	1/24 – 1/28/11	L. Denny, K. Tardy, C. Lopez, A. Graves
Columbia River Compact	Oregon City, OR	2/7 – 2/9/11	K. Tardy, A. Graves
ICAFS Annual Meeting	Boise, ID	3/1 – 3/4/11	L. Denny, K. Tardy, C. Lopez, A. Graves
Salmon River AOP	Boise, ID	3/15/11	L. Denny, K. Tardy
LSRCP Production	Boise, ID	3/16 – 3/17/11	L. Denny, K. Tardy
SBT/IDFG Coordination	Boise, ID	3/18/11	L. Denny, K. Tardy