

2008

Yankee Fork Salmon River Chinook Salmon Run Report



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Annual Report



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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 (1,500) and harvest (500) management objectives. In 2008, natural and hatchery Chinook salmon were expected to return to Yankee Fork in sufficient numbers to initiate broodstock collection for the supplementation project. The Tribes obtained and revamped a temporary picket weir which was installed near Pole Flat Campground on July 9; a modified trap box was attached to the weir. The first Chinook salmon was trapped on July 9, indicating the Chinook salmon run was already in progress; the last fish was trapped on September 17. Overall, 228 Chinook salmon were trapped, of which 18.9% were natural and 81.1% were hatchery. Natural adults were released above the weir for natural spawning. A secondary weir was installed near Five Mile Creek on July 29 for hatchery adult outplanting. Hatchery adults trapped at Pole Flat Weir were outplanted above Five Mile Weir to prevent migration into West Fork Yankee Fork where there is an ongoing supplementation study. In addition, 1,438 hatchery adults were obtained from Sawtooth Fish Hatchery and outplanted in upper Yankee Fork for natural spawning beginning July 30 and commencing on September 4. Intensive spawning ground surveys were completed from August 28 – September 19 and approximately 660 redds were observed. This is the largest spawning event ever recorded in the Yankee Fork, dating back to 1952 when surveys were first initiated. Using mark-recapture techniques we estimated an additional 18 natural and 107 hatchery adults passed the Pole Flat Weir undetected; we are unsure how many adult may have passed Five Mile Weir. We observed 49 redds below Pole Flat Weir and 611 above. By expanding redd counts (n=49) below Pole Flat Weir by the fish per redd ratio observed above (2.93) and ratio of hatchery and natural adults trapped, we estimated 27 natural and 117 hatchery adults spawned below the Pole Flat Weir. In summary, we estimate 497 Chinook salmon returned to the Yankee Fork, of which 88 were natural and 409 were hatchery and 1,438 Sawtooth Fish Hatchery adults were outplanted. A total of 1,935 adult Chinook salmon were present in the Yankee Fork. Due to high escapement levels of hatchery adult Chinook salmon in 2008, broodstock collection did not occur in the Yankee Fork as originally planned, but did occur at Sawtooth.

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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 no 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 of 500 adults; (3) the importance of recovering this population and achieving the conservation objective of 1,500 spawners 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

In 2004, the Tribes developed a proposal to supplement the Yankee Fork Chinook salmon population. The Tribes proposal was submitted to the *US v Oregon* parties for consideration and included in the 2005 – 2007 Interim Management Agreement, as a project that required further discussion before being added to the production tables. The Interim Management Agreement provided language for the *US v Oregon* parties to engage in good faith efforts to resolve production proposals. This included addressing technical and policy issues, funding, and ESA permitting for the YFCSS project. Eventually, the Tribes achieved consensus to add the YFCSS project to the production tables in the 2008 *US v Oregon* Management Agreement (*US v Oregon* 2008).

In 2005, an ad hoc Snake Basin Committee (committee) was established to resolve the outstanding production agreements and discuss implementation of the YFCSS project. The committee, consisting of delegates from the Tribes, IDFG, LSRCP, and NOAA-Fisheries met on numerous occasions, either in Portland, Stanley, or Boise, to discuss program objectives and logistics. In Boise at the 2006 LSRCP Annual Meeting, the committee agreed to a conservation program, whereby hatchery fish reared at Sawtooth would be released as smolts in the Yankee Fork. The committee agreed to develop a locally adapted run of Chinook salmon using Sawtooth FH stock and propagate such stock.

Since the production concept was established and there was excess production at Sawtooth FH, IDFG offered to provide BY04 Chinook salmon smolts for release in Yankee Fork in 2006. Of the fourteen production raceways containing 1.5 million smolts, raceway seven was identified for Yankee Fork, which contained approximately 135,934 smolts. All juveniles were adipose fin clipped and 695 (0.51%) were injected with Passive Integrated Transponder (PIT) tags. Juveniles were on average 131 mm fork length. On April 21, two tanker trucks were loaded with smolts and transported to Yankee Fork for release at river kilometer (rkm) 14.6. The arithmetic mean travel time in days from the release site in Yankee Fork to Lower Granite was 19.98 (SE 5.053) with overall survival of 0.64 (SE 0.035).

Age³ hatchery Chinook salmon jacks were expected to return to the Yankee Fork in 2007. The Tribes did not have funding or agreement to trap and enumerate the hatchery or natural return. However, one PIT tagged jack Chinook salmon was detected at Bonneville Dam on April 27 indicating jacks potentially returned to Yankee Fork.

Notwithstanding a funding dilemma to implement the YFCSS Project in 2007, the Tribes reached agreement with the LSRCP for funding and infrastructure to operate and maintain the YFCSS project in 2008. This prompted the Tribes to develop a Memorandum of Agreement (Appendix A) between IDFG and LSRCP to authorize the YFCSS project activities, which further defined the 2008 management objectives described in this report.

Through the MOA, the committee reached consensus to operate two portable picket weirs to trap and collect returning adult Chinook salmon for broodstock to produce up to

400,000 smolts to be raised at Sawtooth. The Tribes and IDFG estimated 214 age⁴ hatchery Chinook salmon adults and 92 natural adults would return to Yankee Fork in 2008. The hatchery estimate was derived from a smolt-to-adult return rate (SAR) to the mouth of Yankee Fork of 0.0016. The natural adult return was estimated from the 25 year average redd count, expanded by 2.5 fish per redd. The production planning escapement estimate for natural and hatchery adults was estimated at 306 fish, which provided the basis for broodstock collection plans as outlined in the MOA.

This report covers the methods and results from the YFCSS Project activities in 2008.

Program Goal and Objectives

The number of adult Chinook salmon returning 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. The goal will provide 1,500 adults to utilize spawning and rearing habitats and 500 adults for harvest opportunities.

Until the Yankee Fork 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 Cernera 1989). The Yankee Fork flows 41.8 kilometers (km) from north to south and enters the upper Salmon River at river rkm 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 km² and includes Yankee Fork proper, 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 precipitation is roughly 68.6 cm, base flows are approximately 1.13 cubic meters per second (m³s), and mean flows are 6.99 m³s.

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, to less than 10 in the 1980's (Konopacky et al. 1986), to zero in the 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 age⁴ to age⁵ 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 10 – 13 cm (Bjornn 1960). The majority of juveniles leave Yankee Fork as fry, parr, and pre-smolt with a smaller percentage leaving as age¹ smolts.

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

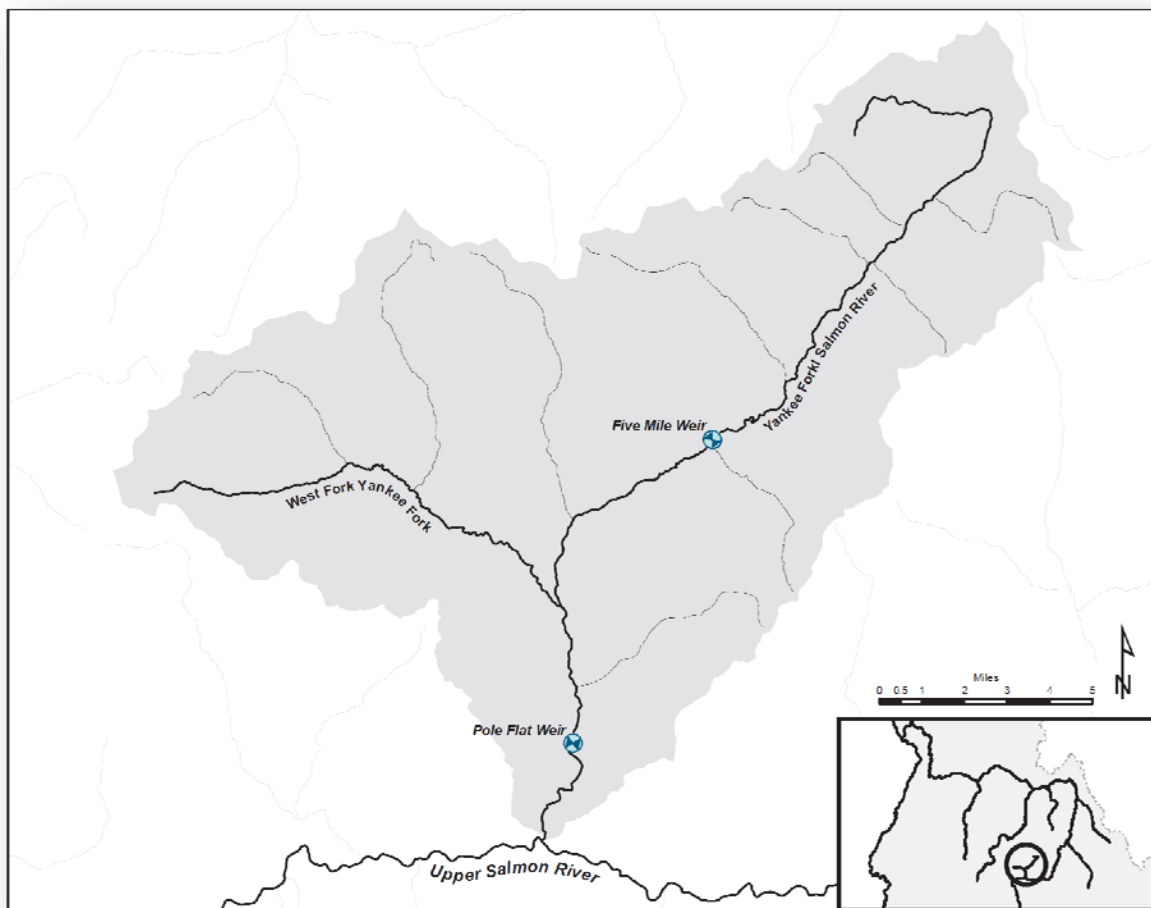


Figure 1. Map of Yankee Fork Salmon River, Idaho.

METHODS

Picket Weirs

The Tribes installed two portable picket weirs in the Yankee Fork in 2008 (Figure 1) for the purposes of enumerating the natural and hatchery return, collecting broodstock, and collecting information for research, monitoring, and evaluation. The Pole Flat Weir was installed on July 9 near Pole Flat Campground approximately 5.2 rkm upstream from the confluence with the Salmon River (Figure 1). The Five Mile Weir was installed on July 27 near Five Mile Creek at rkm 21.5. 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 YFK75.

Pole Flat Weir was installed as soon as flows were considered safe for installation, which was 12 days later than originally scheduled. The weir was set up at a 45° angle (Figure 2) to the roadside bank and a trap box (1.2m × 1.2m × 1.5m) was attached to the upstream side (Figure 3). Due to unsuccessful trapping, as indicated by adults milling below the weir, the initial trap box was dismantled and relocated. We dismantled the trap box on three occasions within the first two weeks of trapping. On each occasion, the trap box was disconnected from the weir during mid-day, relocated, and re-attached. Although moving the trap box did not alleviate the trapping issue, it certainly allowed greater numbers of adults to be trapped. Staff experimented with flow to attract adult Chinook salmon. The small size of the initial trap box was the primary reason adults were able to escape downstream or jump over.



Figure 2. Initial setup of Pole Flat Weir.



Figure 3. Initial trap box used on Pole Flat Weir.

On July 16 the Pole Flat Weir was reconfigured to a v-shaped structure and the initial trap box was opened to cover the weir wings to create a larger box (2.4m × 1.2m × 1.5m) (Figure 4). Although more fish were trapped, the gap in the weir was too large and adults were able to escape downstream or jump over the structure. We did not have the proper lid to cover the trap box and on one occasion an adult was recorded jumping out of the trap box. Again we continued to observe considerable numbers of adult Chinook salmon milling below the weir and each morning very few fish were trapped.



Figure 4. Second modification to Pole Flat Weir and Trap Box.



Figure 5. Final modification to Pole Flat Weir and Trap Box.

On July 24 the left wing of the weir was dismantled, one panel was removed, and the newly fabricated trap box was installed (Figure 5). The left wing of the weir was adjusted to provide a 2.4 m entry way funneled towards a 12.7 cm gap in the new trap box. The weir was operated for the remainder of the season under this successful configuration.

The Pole Flat Weir after our final modification is a temporary structure consisting of v-shaped wings and an in-stream trap box (Figure 6). 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 attached to the pickets, 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 m × 0.6 m panels with 120 – 3.0 m × 1.9 cm pickets. The right wing of the weir consists of nine tripods and six counter weights supporting five 3.0 m × 0.6 m panels and 140 – 3.0 m × 1.9 cm and 160 – 1.5 m × 1.9 cm pickets. The trap box consists of six panels and has a dimension of 3.0 m × 2.4 m × 1.2 m (Figure 6). The panels on the downstream side of the trap box were picketed with 134 – 1.5 m × 1.9 cm pickets, while the panels on the upstream side were made with steel cage to create a flow vortex. The trap box was operated without two pickets in the entry way to allow a 12.7 cm passage way. Upon adult sorting, two pickets were installed to prevent adults from escaping. Under normal trapping operations, the trap box was covered by two pieces of 2.4 m × 1.2 m × 1.9 cm plywood to prevent adults from jumping out.

Five Mile Weir is a temporary structure consisting of v-shaped wings and an in-stream trap box (Figure 7). Each wing consists of two tripods and two counter weights supporting a single 3.0 m x 0.6 m panel and 120 – 1.5 m × 1.9 cm pickets. The trap box consists of six 0.9 m × 1.2 m panels and 1.9 cm pickets of various lengths. As installed, the trap box has an estimated dimension of 1.8 m × 1.8 m × 1.5 m. The weir wings and trap box were sealed with sandbags and 0.6 cm black mesh. The Five Mile Weir was used to trap adult Chinook salmon but further served as a blocking device to prevent outplanted hatchery adults from straying into the West Fork Yankee Fork.



Figure 6. Pole Flat Weir and trap box.



Figure 7. Five Mile Weir.

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. We did not have the equipment necessary to check for internal tags (i.e., PIT, CWT). The following biological data was collected: origin, fork length (cm), scale, and genetic sample (0.5 cm²). Chinook salmon were marked with a right operculum punch for genetic sample and mark-recapture analysis. 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 adult Chinook salmon were either collected for broodstock or outplanted above Five Mile Weir for natural spawning. Hatchery adult Chinook salmon destined for broodstock were injected with 20 mg/kg intra-peritoneal injection of erythromycin to control Renibacterium and transported 78.4 km to the East Fork Salmon River satellite facility for holding. Hatchery adults outplanted for natural spawning were not injected with erythromycin.

All hatchery adults were individually loaded and transported 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 oxygen saturation. 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 near 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.

Adult Outplanting

As mentioned above, hatchery Chinook salmon trapped at Pole Flat or Five Mile weirs were either scheduled for broodstock collection or natural spawning. Hatchery fish scheduled for natural spawning were outplanted in the upper Yankee Fork at rkm 22.6, 25.1, and 31.5 (Figure 8). Hatchery Chinook salmon were directly transported to upper Yankee Fork in the fish tank during the early morning or late evening/night (only on large trapping days) to reduce stress and mortality.

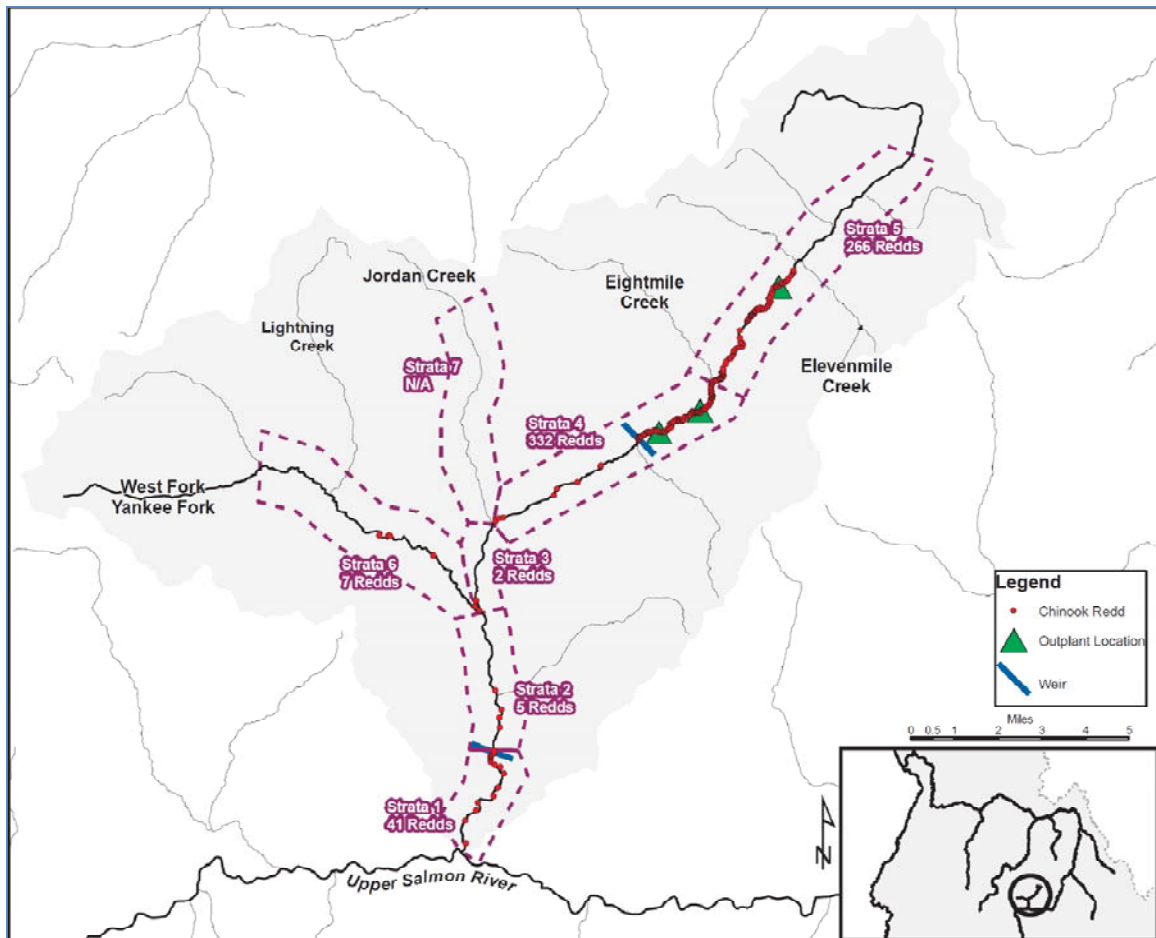


Figure 8. Location map of strata, weirs, adult outplanting locations, and redds.

In addition to outplanting hatchery fish returning to Yankee Fork, the Tribes reached agreement with IDFG to outplant hatchery adults collected at Sawtooth in excess of

broodstock needs. IDFG requested a proposal from the Tribes to determine an appropriate number of adults for outplanting. Prior to outplanting Sawtooth adults, the Tribes' Fish and Game Commission curtailed Tribal hunting for Chinook salmon in the upper Yankee Fork to maximize production benefits and prevent Tribal members from harvesting and consuming fish injected with erythromycin or formalin bath treatments.

Sawtooth adults were transported in tanks mounted on three $\frac{3}{4}$ ton pick-up trucks and one LSRCP tanker truck. On outplanting days, hatchery fish were crowded in the West Pond at Sawtooth following normal protocols and individually netted out. The following biological data was collected from each outplant: fish identification #, gender, length (cm), genetic sample (0.5 cm²), and vial #. Each fish was individually loaded into one of the truck tanks listed above and transported directly to Yankee Fork. Adult fish were either released using nets or funnel tubes (for large tanker truck). In the event of mortality, the caudal fin was removed to prevent duplicate counting during spawning ground surveys.

Spawning Ground Surveys

Intensive spawning ground surveys were conducted in Yankee Fork and its major tributary, West Fork Yankee Fork to determine spawn timing (start, peak, and end), 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 three separate Fish and Wildlife Department projects including: 1) YFCSS, 2) Salmon River Habitat Enhancement (SRHE), and 3) Idaho Supplementation Studies (ISS). IDFG efforts were derived from project staff working under the Captive Rearing Initiative for Salmon River Chinook Salmon.

Yankee Fork was sub-divided into seven distinct stratum (Konapacky 1986), (Figure 8). On a weekly basis, observers walked Yankee Fork (Strata 1–5) during mid-day marking Chinook salmon redds and recovering carcasses; SRHE staff supplemented our efforts within these strata on two occurrences. ISS staff conducted bi-weekly surveys (3 total passes) in Stratum 6, West Fork from Lightning Creek to Cabin Creek, while IDFG staff conducted surveys 2 – 3 times per week covering the section of Stratum 6, from the confluence with Yankee Fork to Lightning Creek. Stratum 7 (Jordan Creek) was not surveyed in 2008.

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 four 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, redd number and this information was linked to the data sheets, scales envelopes, genetic vials, fin ray envelopes, and otolith envelopes.

Carcasses encountered during the surveys were examined for fin clips, operculum punches, and external 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, scale sample, and genetic tissue sample (0.5 cm²). 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.

RESULTS

Adult Trapping

Pole Flat and Five Mile weirs were installed on July 9 and 27, respectively. The first Chinook salmon was trapped at Pole Flat Weir the day of installation, indicating the run was already in progress. The last Chinook salmon was trapped on September 17. The Tribes operated Pole Flat Weir for 79 days and Five Mile Weir for 75 days. Pole Flat and Five Mile weirs were removed on September 25 and October 10, respectively. The Tribes did not trap any Chinook salmon at the Five Mile Weir and therefore results are specific to Pole Flat Weir.

A total of 228 Chinook salmon were trapped at Pole Flat Weir, of which 43 were natural (18.9%) and 185 were hatchery (81.1%) (Table 1). The sex ratio for natural fish was skewed towards males at 65.1%. The sex ratio of hatchery fish was skewed towards females at 51.4%. Of all fish trapped, males represented 51.8% of the run.

Table 1. Adult Chinook salmon trapping summary for Yankee Fork Salmon River.

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%	

On July 16, the Tribes and IDFG agreed that hatchery returns to Sawtooth were sufficient to meet Sawtooth and YFCSS project broodstock goals, which were established at 1.3 million and 400,000 Chinook salmon smolts, respectively. Prior to this agreement, the Tribes transported 15 hatchery adults to the East Fork Salmon River (East Fork) satellite facility for holding. After this conclusion, all hatchery adults encountered at the Pole Flat Weir were transported above Five Mile Weir for natural spawning.

There were eight Chinook salmon and three bull trout mortalities recorded. All Chinook salmon mortalities were hatchery-origin and recorded from circulator failures during transport. The three bull trout mortalities were from fish caught between trap box pickets.

On August 2, the fifteen hatchery adults that were transported to East Fork satellite facility for broodstock were transported back to Yankee Fork and released. All transferred fish were healthy and appeared to be in good physical condition upon release.

One fish was recaptured at Pole Flat Weir on August 15. This natural fish was identified by the presence of a pre-existing right operculum punch.

Non-Target Species

Bull trout were the only non-target species captured during the eleven weeks of trapping. The first bull trout was trapped on July 16 and the last fish was trapped on September 17. Bull trout ranged from 21 to 58 (cm) fork length with an average length of 47.9 cm. Gender or age structure was not determined, however all 12 individuals were genetically sampled, as requested by IDFG Salmon Regional Office. 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.

Run-Timing

Chinook salmon migration occurred over a 71 day period from July 9 – September 17 (Figure 9). Natural fish migration occurred over a 62 day period from July 9 – September 7. Of the 185 hatchery fish trapped (Table 1), migration occurred over a 69 day period from July 11 – September 17. Natural and hatchery Chinook salmon exhibited bi-modal run-timing distribution. The first peak occurred during late July and the second peak occurred during early September, with the majority of fish being trapped during the second peak. Daily trapping frequency was highest on August 28 for both natural and hatchery adults with 26 fish trapped (4 natural and 22 hatchery).

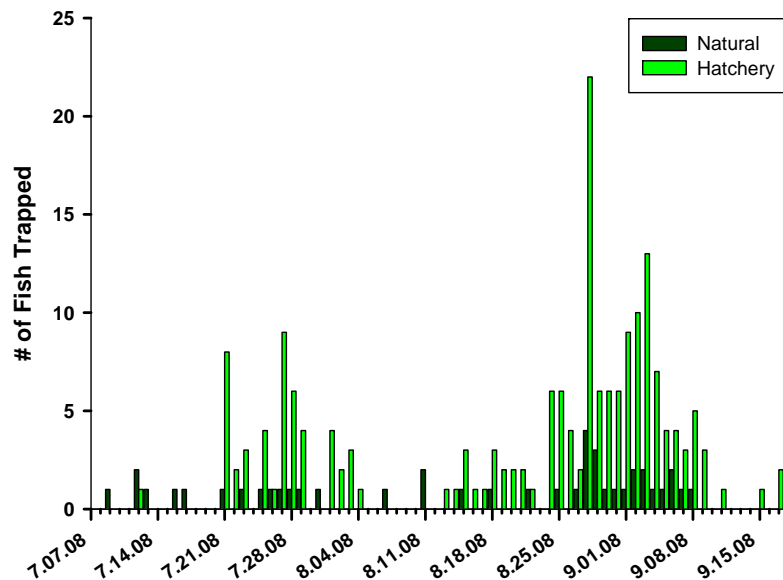


Figure 9. Daily trapping frequency of natural and hatchery Chinook salmon adults.

The return timing of natural and hatchery fish was similar with 50% of the adults enumerated on August 25 and 28, respectively (Figure 10). After 50% of the return entered Yankee Fork, the remaining components of both runs entered in a surprisingly rapid period of time.

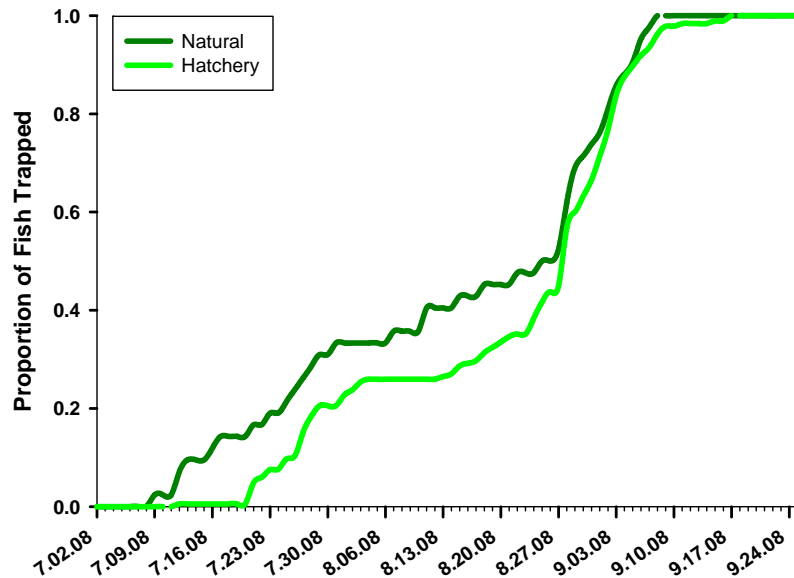


Figure 10. Run-timing of natural and hatchery Chinook salmon.

Age Structure

The Tribes used two methods to determine age structure of natural and hatchery fish returning to Yankee Fork, both based on fork length (cm). Age categories as defined by Copeland et al. (2008) were used to estimate age at return for natural fish (Table 2). The following length categories developed for use at Sawtooth were adopted for hatchery fish ($\text{age}^3 \leq 64 \text{ cm} \leq \text{age}^4 \leq 82 \text{ cm} \leq \text{age}^5$) returning to Yankee Fork. These methodologies will be utilized until we develop age structure categories for Yankee Fork.

Table 2. Age by length for adjusted size classes (Copeland et. al 2008).

Size Class	Age ³	Age ⁴	Age ⁵
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 methodologies listed above, 71% of the fish trapped were age⁴ adults, followed by 27% age⁵, and 2% age³ (Table 3, Figure 11). Four age³ and 33 age⁵ hatchery adults likely strayed into the Yankee Fork. From fish trapped at Pole Flat Weir approximately 148 were age⁴ hatchery adults from the BY 04 smolt release.

Of the natural fish trapped, one was considered an age³ adult, with 14 age⁴ and 28 age⁵ adults (Table 3). There were fewer age⁴ natural fish than hatchery fish and more age⁵ natural fish than hatchery fish.

Table 3. Age composition of hatchery and natural Chinook salmon.

Year	Age ³			Age ⁴			Age ⁵		
	Natural	Hatchery	Total	Natural	Hatchery	Total	Natural	Hatchery	Total
2008	1	4 ¹	5	14	148	162	28	33 ¹	61
Percent	20%	80%	2%	8%	92%	71%	46%	54%	27%

^{1/} hatchery strays.

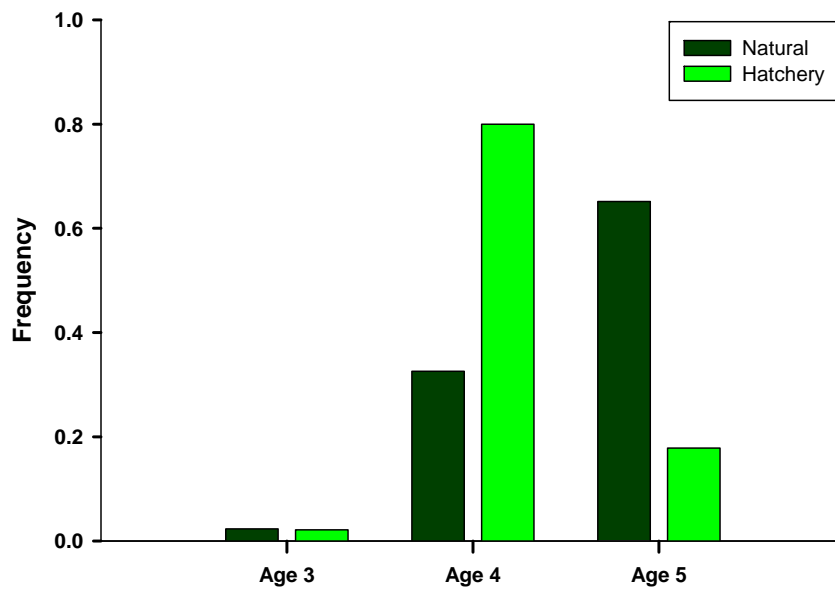


Figure 11. Age frequency of natural and hatchery Chinook salmon.

Of the fish trapped at Pole Flat Weir, fork length averaged 78.9 cm (range 50 – 102). Natural Chinook salmon ranged from 50 to 102 cm fork length with an average length of 82.5 cm, while hatchery Chinook salmon ranged from 61 to 90 cm fork length with an average length of 78 cm (Figure 12).

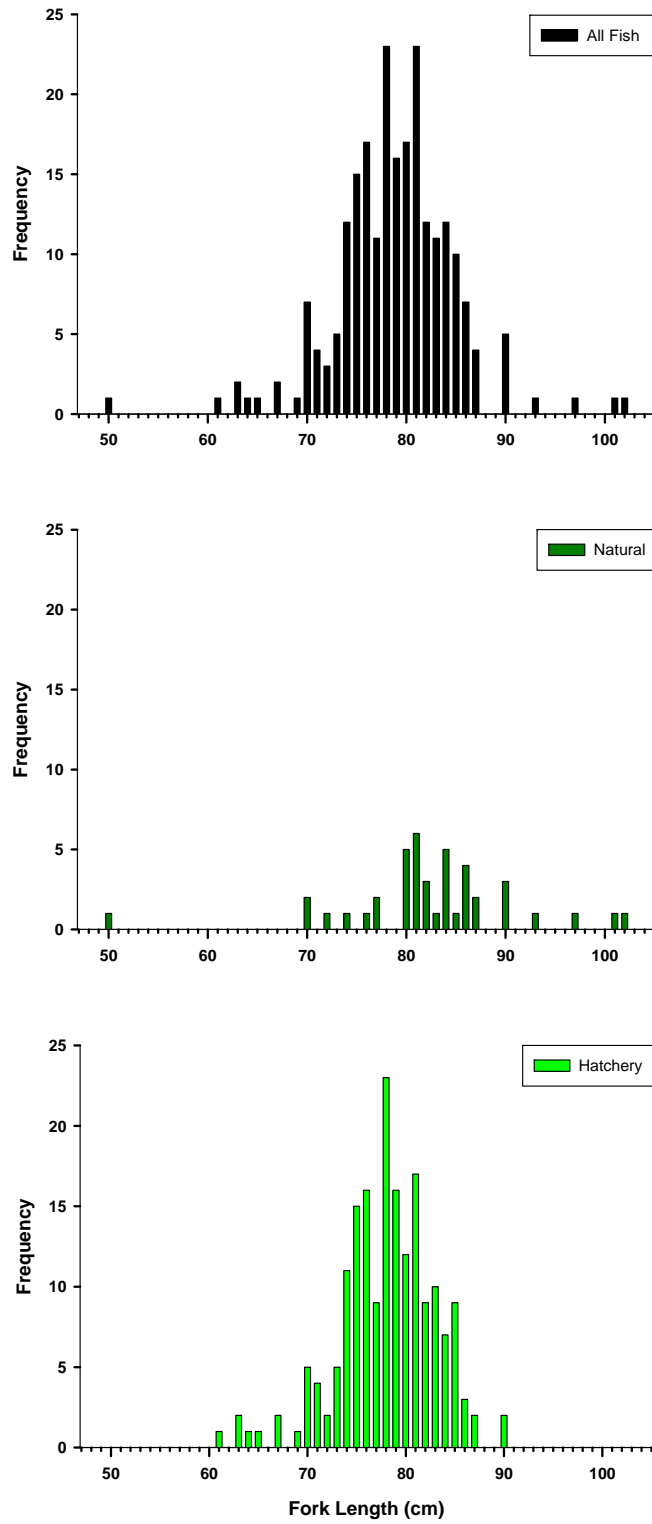


Figure 12. Length frequency of all fish, natural fish, and hatchery fish.

Adult Outplanting

Yankee Fork has an estimated spawning potential to accommodate 7,117 adult Chinook salmon. For adult outplanting activities in the upper Yankee Fork (Five Mile Creek to McKay Creek), we estimated the spawning area could sustain approximately 2,980 spawners (Table 4). This estimate was based on a habitat model, usable spawning habitat (length of stream and width), area of an average Chinook salmon redd, and 2.5 fish per redd. The Tribes requested to outplant 1,500 adults to seed ~50% of the spawning area carrying capacity estimate. Of the 1,500 adults scheduled for outplanting, approximately 40% were proposed to be females and 60% males, of which 5% of the males could be jacks.

Table 4. Estimated Chinook salmon spawning area, redd numbers, and adult escapement estimate for the Yankee Fork Salmon River.

Yankee Fork Stream/ Segment	Length (Miles)	Length (Feet)	Measured Flow (cfs)	Habitat Model Used ^a	Estimated Total Spawning Area (ft ²)	Estimated Usable Area (ft ²) ^b	Estimated Number of Redds ^c	Estimated Adult ^d
Yankee Fork								
Mouth to Polecamp Creek	2.8	14784	45	YF-2 (adjusted)	24300	2430	61	91
Polecamp Creek to West Fork	4	21120	104	YF-4	111725	11172	279	419
West Fork to Jordan Creek	2.3	12144	50	YF-3	92662	9266	232	347
Jordan Creek to Fivemile Creek	4	21120	45	YF-2	43487	4349	109	163
Fivemile Creek to Ninemile Creek	5.3	27984	31	YF-1	153328	76664	1917	2875
Ninemile Creek to McKay Creek	4.5	23760	45	YF-2 (adjusted)	27896	2789	70	105
<i>sub-total</i>	22.9	120912			453398	106670	2667	4000
West Fork								
Mouth to Cabin Creek	8	42240	44	WF-1	299198	74799	1870	2805
Cabin Creek to Divide	4	21120	44	WF-1 (adjusted)	83289	8329	208	312
<i>sub-total</i>	12	63360			382487	83128	2078	3117
Total	34.9	184272			835885	189798	4745	7117
a	Adjusted models applied to unmodeled reach - models adjusted for width and total area							
b	Areas adjusted by percentage of total spawning area thought usable in the reach, assuming redd aerial requirements must be contiguous							
c	Numbers derived from Chinook redd area estimate of 40 ft ² /redd							
d	Assumes 2.5 fish/redd or 1.5 males/female							

Beginning July 30 and ending September 4, YFCSS and IDFG personnel transported and released 1,438 Sawtooth hatchery Chinook salmon (Table 5) above Five Mile Weir for natural spawning. Sawtooth adult outplants were marked with a left operculum punch for genetic evaluations and identification during spawning ground surveys. In total 842 males (58.6%) and 596 females (41.4%) were released to spawn naturally; this included

87 jacks. There were a few mortalities associated with fish transportation, but the cause of death is unknown.

Table 5. Sawtooth hatchery adult Chinook salmon outplanting summary.

Date	Males	Females	Jacks	Total
30-Jul	14	14	0	28
31-Jul	50	50	0	100
1-Aug	36	40	4	80
6-Aug	29	20	11	60
7-Aug	40	40	0	80
8-Aug	132	127	1	260
13-Aug	267	274	0	541
14-Aug	67	31	71	169
4-Sep	120	0	0	120
Total	755	596	87	1438

Spawning Ground Surveys

Spawning ground surveys were conducted from August 28 – September 19. Four total passes were conducted in the six identified strata by the same monitoring group to detect newly completed redds. Superimposition of redds within the outplanted area was minimal indicating that sufficient spawning habitat was available. There were 660 total redds (Figure 13) identified (includes eight from West Fork Yankee Fork).

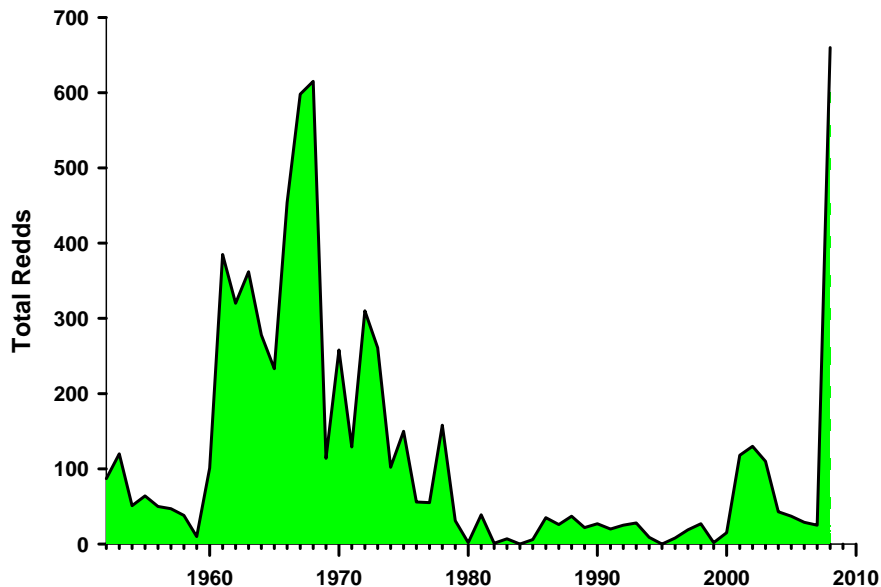


Figure 13. Chinook salmon redds in Yankee Fork, 1956 - 2008.

In stratum two, 35 of the 40 redds identified were recorded just below the weir in excellent spawning habitat. The majority of the identified redds (589) were located in

strata 4 and 5 (above Five Mile Weir) obviously due to outplants of hatchery adults. Data suggests that natural production in strata 1 and 3 is low due to a depressed natural adult return.

Female hatchery fish, from Yankee Fork and those outplanted contained less remaining gametes in the body cavity than did natural females indicating successful spawning. The percent spawned for natural females was 83.3%, Sawtooth hatchery females 93.4%, and Yankee Fork hatchery females 94.2% (± 5.5 ; 95% CI) (Figure 14). We did not visually witness any predation or poaching on live salmon within the Yankee Fork. However, after spawning was completed, salmon carcasses were spread throughout the river and forest areas, primarily a result of observed black bears (*Ursus americanus*), river otters (*Lontra canadensis*), and bald eagles (*Haliaeetus leucocephalus*).

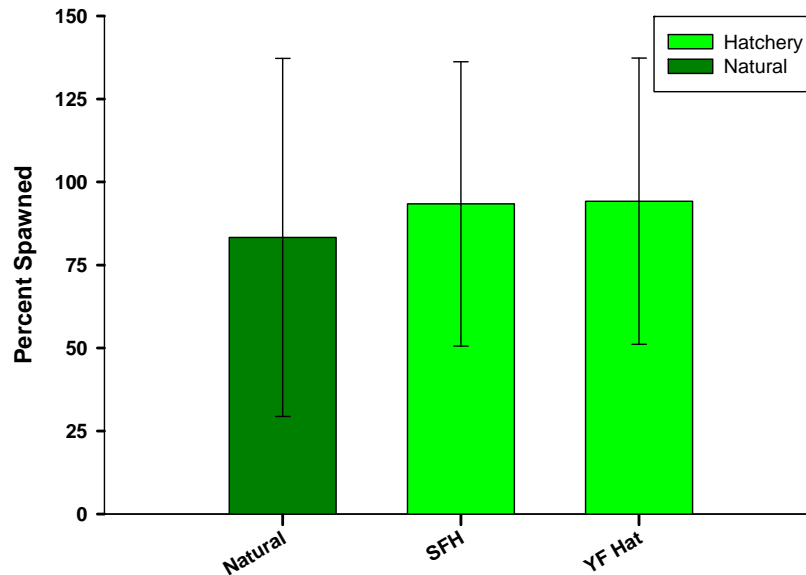


Figure 14. Estimated female adult Chinook salmon percent spawned for natural, Sawtooth hatchery, and Yankee Fork groups, 2008.

Mark-Recapture Evaluation

Due to late installation of the weir, structural modifications, and high water events shifting the weir during trapping, the Tribes acknowledge the presence of 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 number.

The mark-recapture study was conducted with natural-origin adults between the lower and upper weir. There were 43 natural adults released above Pole Flat Weir, of which 21 operculum punched adults were recovered in spawning ground surveys for an efficiency of 48.8%. Field crews recovered 9 natural and 52 hatchery carcasses that were not

operculum punched. Dividing the number of unmarked carcasses by the efficiency rate (0.488), resulted in an additional estimated 18 natural and 107 hatchery adults missed at the lower weir. Combining the trapped and estimated values, the Tribes estimate 353 adults escaped above the weir; 61 natural and 292 hatchery. Overall trapping efficiency therefore equaled 65% (228/353).

To estimate the number of adults below the weir, the Tribes applied a fish per redd value obtained from dividing the total number of adults above the weir (353) plus the number of adults outplanted from Sawtooth (1,438) by 611 total redds above the weir ($1,791/611 = 2.93$ fish/redd). There were 49 redds identified below the weir multiplied by 2.93 fish per redd for an estimated total of 144 adults below the lower weir. Applying the natural (0.19) and hatchery (0.81) return ratios at the trap to the estimated 144 adults results in 27 natural and 117 hatchery adults below the weir.

We estimate 27 natural adults spawned below the Pole Flat Weir and 61 escaped above for a total return of 88 natural-origin adults. We further estimate 117 hatchery adults spawned below Pole Flat Weir and 292 escaped above for a total return of 409 hatchery adults. Combining both origins, the Tribes estimate a total return of 497 adults to the Yankee Fork in 2008.

Total Escapement

Overall, we estimate 497 natural and hatchery adults returned to Yankee Fork in 2008 and an additional 1,438 Sawtooth hatchery adults were outplanted. Of the adults that returned naturally, 409 were hatchery (82.3%) and 88 were natural (17.7%). Yankee Fork natural fish were comprised of 56 males (63.6%) and 32 females (36.4%). Yankee Fork hatchery fish were comprised of 184 males (45%) and 225 females (55%). The total spawning aggregate comprised 1,935 adults with 1,847 hatchery (95.5%) and 88 natural (4.5%) creating 660 redds.

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Appendix A

Memorandum of Agreement 2008 Broodstock Management Plan for Sawtooth Hatchery & Yankee Fork

Introduction

The Shoshone-Bannock Tribes (SBT), Idaho Department of Fish and Game (IDFG), and Lower Snake River Compensation Plan (LSRCP) office plan to collect ad-clipped hatchery Chinook salmon (*Oncorhynchus tshawytscha*) in the Yankee Fork Salmon River (Yankee Fork) in 2008. This Memorandum of Agreement (MOA) describes collection and disposition of those Chinook. This MOA applies only to operation of weirs and collection of Chinook in Yankee Fork Salmon River in 2008.

The court-approved United States vs. Oregon (US v Oregon) ten-year Management Agreement identifies implementation of a Chinook program in Yankee Fork starting in 2009, with planning and development (i.e. Hatchery Genetics Management Plan) completed in 2008. Notwithstanding the US v Oregon agreement, nor prejudicing development of a long term plan, the expected return of hatchery-origin Chinook salmon to Sawtooth Fish Hatchery (Sawtooth) and Yankee Fork Salmon River in 2008 and anticipated in 2009 provides options that that were not available in previous years.

Background

In 2006, 1.42 million BY '04 Sawtooth hatchery-origin Chinook salmon smolts were released on station and an additional 135,934 BY '04 smolts were released into Yankee Fork near Jordan Creek confluence (approximately 9 miles upstream from the mouth). In 2008, the pre-season forecasted return of hatchery Chinook salmon to Sawtooth is 2,370 adults. This return is expected to be comprised of 2,232 four year old Sawtooth fish from BY '04. This translates to an expected smolt-to-adult return rate (SAR) of 0.16%. If we assume the same SAR for smolts released in the Yankee Fork as is forecasted for Sawtooth, we can expect about 214 four year old adults, with an additional 92 natural-origin adults (25 year average redd count expansion estimate assuming 2.5 spawners/redd; Matthews and Wapels 1991), for total escapement of 306 adults in Yankee Fork. In-season updates during mid-June indicate the actual return may in the range of 50% - 60% of the pre-season forecast.

At the Salmon River Annual Operating Plan (AOP) meeting in Boise on February 4, 2008, the Parties discussed the number of adult Chinook salmon spawned for broodstock at Sawtooth. The current target at Sawtooth is listed as 1.0 million smolts in US vs. Oregon to 1.3 million in the Salmon River AOP. General agreement was reached to increase the egg take, since the adult return is expected to be relatively large, to achieve at least a 1.3 million smolt release at Sawtooth Hatchery.

On April 28, 2008, SBT, IDFG, and LSRCPC met via conference call to facilitate discussion to develop a Broodstock Management Plan for Sawtooth and Yankee Fork. At that meeting IDFG, SBT, and LSRCPC agreed that:

- 1) The upper limit for smolt rearing at Sawtooth Hatchery given existing raceway space, water availability and winter icing conditions would be 1.7 million smolts.
- 2) The minimum brood year 2008 smolt release objective at Sawtooth Hatchery would be 1.3 million smolts.
- 3) The 2008 Upper Salmon River fishery would be managed to provide adult escapement capable of providing eggs to produce 1.3 million smolts based on expected fecundity and average prespawning mortality.
- 4) Brood year 2008 production greater than 1.3 million smolts up to the hatchery capacity of 1.7 million smolts will be negotiated between IDFG, SBT, and LSRCPC prior to the 2010 release, and will incorporate agreements contained in US. v. Oregon and the Salmon River AOP.
- 5) In 2008, the SBT will operate two weirs (within 5 miles of the mouth of Yankee Fork and above the confluence with Jordan Creek) in the Yankee Fork to: a) trap first generation Sawtooth hatchery-origin Chinook salmon returning from the BY '04 smolt release in lower Yankee Fork; b) transport those hatchery-origin Chinook salmon to the East Fork Salmon River satellite facility for potential broodstock; and c) trap and pass all natural-origin Chinook salmon and all other species at both weirs. Disposition of Yankee Fork collected Chinook is discussed below (Broodstock Collection).
- 6) Signatories below acknowledge, this agreement serves as a mechanism to provide ESA take coverage under IDFG's ESA Section 6 bull trout agreement, and IDFG'S Section 10 Idaho Supplementation Studies research permit
- 7) NOAA and USFWS consultation, and acquisition of USFS special use and IDFG fish collection and fish transportation permits will all be necessary to install and operate the weir and transport adult Chinook.

Broodstock Collection

The broodstock target for 2008 will be up to 1.7 million smolt production at Sawtooth Hatchery, contingent on managing the fishery to escape adults to provide eggs for at least 1.3 million smolts and adults escaping to the Yankee Fork and Sawtooth Hatchery to provide eggs for up to an additional 400,000 smolts. The disposition of smolts above 1.3 million at Sawtooth Hatchery will be determined prior to releasing any broodyear 2008 eggs or fish and will be included in the Yankee Fork HGMP. The SBT will ensure broodstock collection in Yankee Fork follows standard Integrated Hatchery Operations Team (IHOT) guidelines.

If sufficient adults return to Sawtooth to produce 1.7 million smolts, all eggs will be taken from Sawtooth Hatchery returns. Yankee Fork hatchery-origin adults will provide

a contingency back-up plan to provide eggs to produce 1.7 million smolts if that objective cannot be met with fish returning to Sawtooth Hatchery. Broodyear 2008 Chinook releases in the Yankee Fork will occur according to the Yankee Fork HGMP distribution schedule (to be developed and agreed to by all parties).

To achieve the 1.7 million smolt goal, approximately 450 females and 450 males will be spawned (n = 900) to achieve 1.935 million green eggs (4,300 eggs/female; average of 88% eyed egg-to-smolt survival). The Yankee Fork weir operation is intended to provide additional adults for broodstock, as necessary, up to the total hatchery-origin adult return to accommodate 1.7 million smolts.

The SBT anticipate resident and anadromous rainbow trout (*O. mykiss*), mountain whitefish (*Prosopium williamsoni*), cutthroat trout (*O. clarki*), and bull trout (*Salvelinus confluentus*) may be incidentally captured at the Yankee Fork weir. Non-target captures will be recorded and fish will be immediately released either upstream or downstream of the weir with minimal handling.

The LSRCF will fund the SBT to operate two portable picket style weirs with trap boxes on the Yankee Fork in 2008 with an objective of collecting all hatchery-origin chinook salmon for broodstock. Assuming adult Chinook run-timing is similar to Sawtooth and East Fork, weir operations will occur from June 16 (pending water conditions) until seven consecutive days of no trapping in late August to account for bi-modal run distribution. The first weir will be constructed in the lower Yankee Fork (stratum 2) and the second weir in upper Yankee Fork in stratum 4 (Figure 1), both located on US Forest Service lands.

Location of the first weir should allow trapping of 98% of all Chinook salmon entering Yankee Fork, as annually there is less than 2% of the total redds in the downstream canyon (stratum 1). SBT staff will be present 24 hours a day to trap, transfer, monitor, and evaluate adults collected at the weirs. All natural-origin adults will be immediately passed above both weirs with minimal handling. All mortalities will be removed and data will be collected on date, time, sex, cause of death (if known), and body condition. Biological samples will be collected and placed in proper containers for later analysis.

Hatchery-origin adults will be transported by SBT using a 300 gallon tank mounted on a truck to the East Fork satellite facility for holding. The tank has one compartment of 300 gallon capacity and is modified to include oxygen (tank and diffuser) and circulating pump. The tank will be filled with water pumped directly from Yankee Fork. Normal hauling guidelines will be followed for adult fish, which is approximately one pound of fish per gallon of water.

Adult holding ponds at East Fork will be checked on a daily basis by trap tenders. Mortalities will be removed and data will be collected on date, time, sex, cause of death (if known), and body condition. Biological samples will be collected and placed in proper containers for later analysis. All mortalities will be spread across the upper Yankee Fork spawning habitat to replenish depleted marine nutrients in the system.

Recognizing that pre-season forecasts are subject to a high degree of uncertainty, the Parties will contact each other daily to discuss progress towards achieving the broodstock target necessary to produce up to 1.7 million smolts. Should enough adults return to Sawtooth to achieve the target egg take, then hatchery origin fish that were trapped in the Yankee Fork will be transported back to the Yankee Fork above the second weir (above Jordan Creek) to spawn naturally.

Critical Habitat

The NMFS published a final rule designating critical habitat for Snake River spring summer Chinook salmon October 25, 1999. Both weirs will be constructed in ESA listed critical habitat located in Yankee Fork. The SBT weir operations is not likely to adversely impact critical habitat, since it is a temporary structure that will be removed in the fall. The Tribes will conduct an assessment of the habitat prior to implementation of the weirs and include the impacts in the final report.

Fish Health

The SBT and IDFG will follow the best fish health practices proposed by the IHOT. Brood fish trapped at Yankee Fork will be examined for pathogens during routine collection. Adults will be injected with a 20 mg/kg intra-peritoneal injection of erythromycin to control *Renibacterium*. To reduce prespawning mortality due to *Ichthyophthirius multifiliis*, holding water will be treated with 167 mg/l formalin for up to 7 days per week. When water temperatures exceed 18.3 °C, an extended formalin treatment of 40 mg/l for 6 hours will be implemented if *I. multifiliis* is detected. Natural-origin and hatchery-origin adults released above the weir for natural spawning will not be injected with erythromycin.

General Monitor and Evaluation

As part of the long-term monitoring and evaluation (M&E) program, the SBT are prepared to assess the success of hatchery supplementation activities in the Yankee Fork. All trapped adult Chinook salmon in 2008 will be sampled for genetic analysis. DNA samples will be obtained through a operculum punch which can be used later to verify if the adult was captured at the weirs. Scale samples will be obtained for age and life history determination as a contingency to tissue samples. All samples will be stored in 95% ethanol for later analysis. Additional Yankee Fork monitoring and evaluation activities will be identified and agreed to between the parties prior to release of any Chinook in the Yankee fork in 2010.

The SBT will conduct creel surveys using PCSRF funds and estimate total Chinook and bull trout catch in Yankee Fork. If possible, staff will obtain tissue samples, fork length, gender, CWT, or PIT tag information from harvested Chinook. Shoshone-Bannock tribal fisherman will be provided with scale envelopes to preserve scales from harvested fish not surveyed and sampled. Total fish harvested, pressure, and CPUE estimated yearly.

Under the ISS program, the SBT will conduct intensive redd surveys in the West Fork Yankee Fork and operate a rotary screw trap near the confluence with Yankee Fork. The Salmon River Habitat Enhancement Project will conduct intensive redd surveys in the Yankee Fork, conduct snorkel surveys to continue the long-term parr trend dataset, and assess habitat enhancement actions.

The SBT will provide a detailed report of the Yankee Fork project by December 31, 2008 to the LSRCF office and NOAA-Fisheries as part of the FY-2008 SBT Annual Report.

Authorization

Signatories below indicate support for the 2008 broodstock management plan for Sawtooth Hatchery and Yankee Fork Salmon River.

Cal Groen
Director, IDFG

Scott Marshall
Administrator, LSRCF

Alonzo Coby
Chairman, Shoshone-
Bannock Tribes

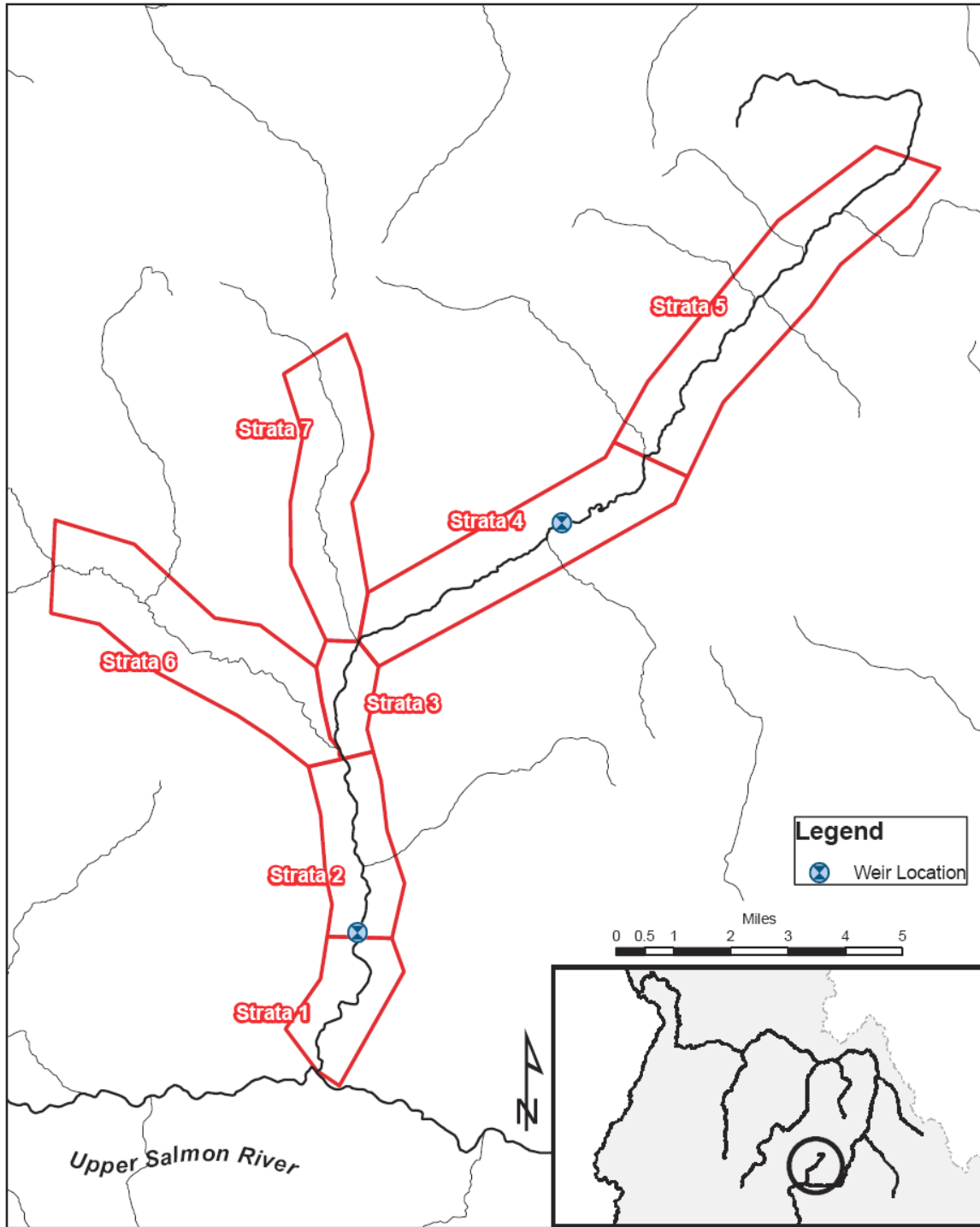


Figure 1. Locations of the two portable picket weirs in Yankee Fork Salmon River, Idaho.