THE CHIEF JOSEPH HATCHERY PROGRAM
2013 ANNUAL REPORT

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This report includes both hatchery production/operations and the corresponding monitoring activities completed through April of 2014. It is structured to meet the RM&E technical report formatting requirements for BPA, and therefore the hatchery production portion is included in Appendix A.

Reports, program descriptions, annual review materials and background information, news and contact information can be found on our website at: www.colvilletribes/cjhp

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The list of people responsible for planning, designing, building, funding and implementing the brand new Chief Joseph Hatchery (CJH) is too long to mention here. None of the authors of this report were involved in the initial efforts to convince the federal government to fund this endeavor, but we are grateful for your efforts. As are the Colville Tribal fishermen and other fishermen from Alaska, British Columbia, the Washington Coast, and all through the Columbia River who will benefit from the fish production for many generations to come. We wish to acknowledge Randall Friedlander, CCT Fish & Wildlife Program Director, Kirk Truscott, CCT Anadromous Division Manager, the Colville Business Council and the Natural Resource Committee for their policy direction and program guidance. This hatchery program would not exist today if not for the vision and dedicated efforts of a variety of current and former employees of CCT and BPA, particularly the former CCT Fish and Wildlife Program Manager, Joe Peone and the former CCT Anadromous Division Manager, Jerry Marco. Additionally, expert contributions, counsel, and examples came from a variety of staff from and management agencies (WDFW, USFWS) groups (Mid-C HCP hatchery committees) and contractors to the Colville Tribes. Some of the tables, formatting, and table header text was copied from the CPUD/GPUD 2013 annual report to provide continuity with reporting for other populations in the Upper Columbia and past reporting in the Okanogan.

We want to thank our skilled and dedicated CJHP staff who cared for the fish, collected the data, maintained the equipment and generally did whatever was necessary for the project to be successful. We appreciate their willingness to work long hours under adverse conditions to get the job done.

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ABSTRACT

The Chief Joseph Hatchery is the fourth hatchery obligated under the Grand Coulee Dam/Dry Falls project, originating in the 1940s. Leavenworth, Entiat, and Winthrop National Fish Hatcheries were built and operated as mitigation for salmon blockage at Grand Coulee Dam, but the fourth hatchery was not built, and the obligation was nearly forgotten. After the Colville Tribes successfully collaborated with the United States to resurrect the project, planning of the hatchery began in 2001 and construction was completed in 2013. The monitoring program began in 2012 and adult Chinook Salmon were brought on station for the first time in June 2013. BPA is the primary funding source for CJH, and the Mid-Columbia PUDs (Douglas, Grant and Chelan County) have entered into cost-share agreements with the tribes and BPA in order to meet some of their mitigation obligations.

The CJH production level was set at 60% in 2013 in order to train staff and test hatchery facility systems during the first year of operation. Leavenworth National Fish Hatchery (LNFH) provided 422 Spring Chinook broodstock in June, 2013; representing the official beginning of CJH operations. In July and August the CCT used a purse seine vessel to collect 814 summer/fall Chinook as broodstock that were a continuation and expansion of the previous Similkameen Pond program. In-hatchery survival for most life stages exceeded survival targets and, as of April 2014, the program was on track to exceed the 60% production target for its start-up year.

The CJH monitoring project collected field data to determine Chinook population status, trend, and hatchery effectiveness centered on five major activities; 1) rotary screw traps (juvenile outmigration, natural-origin smolt PIT tagging) 2) beach seine (natural-origin smolt PIT tagging) 3) lower Okanogan adult fish pilot weir (adult escapement, proportion of hatchery-origin spawners [pHOS], broodstock) 4) spawning ground surveys (redd and carcass surveys)(viable salmonid population [VSP] parameters) 5) eDNA collection (VSP parameter—distribution/spatial structure).

Adult summer/fall Chinook spawning escapement in 2013 was estimated to be 8,193, with more than 6,227 natural-origin spawners, which exceeded the recent five year and long term averages. The values for pHOS (0.24) and proportion of natural influence (PNI) (0.79) in 2013 exceeded the objectives (<0.30 and >0.67), but the five year averages fell short of the goals (0.39 and 0.62, respectively).

An Annual Program Review (APR) was held in March, 2014 to share hatchery production and monitoring data, review the salmon forecast for the upcoming year, and develop action plans for the hatchery, selective harvest, and monitoring projects. Based on a strong pre-season forecast of 67,500 Upper Columbia summer/fall Chinook, the plan for 2014 is to operate the hatchery at full program levels of 2 million summer/fall Chinook and 900,000 spring Chinook. To maximize PNI, broodstock for the integrated program should

be 100% natural-origin broodstock (NOB) and CCT should plan to harvest their full allocation with the selective harvest program removing as many adult hatchery Chinook as possible with the purse seine, the weir, and at the hatchery ladder.

INTRODUCTION

Salmon (*Oncorhynchus spp.)* and steelhead (*O. mykiss*) faced many anthropogenic challenges ever since European settlement of the Pacific Northwest. Harvest, hydropower development, and habitat alteration/disconnection have all had a role in reducing productivity or eliminating entire stocks of salmon and steelhead (MacDonald 1894; UCSRB 2007). These losses and reductions in salmon had a profound impact on Native American tribes, including the Confederated Tribes of the Colville Reservation. Hatcheries have been used as a replacement or to supplement the wild production of salmon and steelhead throughout the Pacific Northwest. However, hatcheries and hatchery practices can pose a risk to wild populations (Busack and Currens 1995; Ford 2002; McClure et al. 2008). As more studies lead to a better understanding of hatchery effects and effectiveness, hatchery reform principles were developed (Mobrand et al. 2005; Paquet et al. 2011). The CJHP is one of the first of its kind to be structured using many of the recommendations emanating from Congress's Hatchery Reform Project, the Hatchery Science Review Group (HSRG) and multiple independent science reviews. Principally, the success of the program is not based on the ability to meet the same fixed smolt output or the same escapement goal each year. Instead, the program is managed for variable smolt production and natural escapement. Success is based on meeting targets for abundance and composition of natural escapement and hatchery broodstock (HSRG 2009). Chief Joseph Hatchery Program (CJHP) managers and scientists are accountable for accomplishments and/or failures, and therefore, have well-defined response alternatives that guide annual program decisions. For these reasons, the program is operated in a manner where hundreds of variables are monitored, and activities are routinely and transparently evaluated. Functionally, this means that directed research, monitoring, and evaluation (RM&E) is used to determine status and trends and population dynamics, and is conducted to assess the program's progress in meeting specified biological targets, measure hatchery performance, and in reviewing the key assumptions used to define future actions for the entire CJHP.

The actions being implemented by the Colville Tribes, in coordination with regional management partners, represent an extraordinary effort to recover Okanogan and Columbia River natural-origin Chinook Salmon populations. In particular, the Tribes have embraced hatchery program elements that seek to find a balance between artificial and natural production and address the often conflicting goals of increased harvest and conservation.

Two hatchery genetic management plans (HGMPs) were initially developed for the CJH during the Northwest Power and Conservation Council (NPCC) three-step planning process – one for summer/fall Chinook (CCT 2008a) and one for spring Chinook (CCT 2008b). Each of these plans included an integrated and a segregated component. Integrated hatchery fish have a high proportion of natural origin parents, are released into the Okanogan River system and a proportion of these fish are expected to spawn in the natural environment. Segregated fish have primarily hatchery parents, are to be released from CJH directly into the Columbia River and adult returns are targeted exclusively for harvest.

In 2010 the CCT requested that the National Marine Fisheries Service (NMFS) designate a non-essential experimental population of spring Chinook in the Okanogan utilizing section 10(j) of the Endangered Species Act (ESA). In order to obtain a permit to transfer ESA listed fish from the Methow to the Okanogan, a new HGMP was developed (CCT 2013). Biological Opinions (BiOps) and permits have been issued by NMFS for the 2008 HGMPs, and CCT anticipates a BiOp and permit for the 2013 spring Chinook by late 2014. The program will be guided by all three HGMPs.

At full program the facility will rear up to 2 million summer/fall Chinook and 900,000 spring Chinook. Up to 1.1 million summer/fall Chinook will be released in the Okanogan and Similkameen Rivers as an integrated program and 900,000 will be released from CJH as a segregated program. Up to 700,000 segregated spring Chinook will be released from CJH and up to 200,000 Met Comp spring Chinook from the Winthrop National Fish Hatchery (WNFH) will be used to reintroduce spring Chinook to the Okanogan under section 10(j) of the ESA. In 2013, the summer/fall and spring Chinook program's production level was set at 60% of total production capacity in order to train staff and test hatchery operations.

The CJHP will increase harvest opportunity for all anglers throughout the Columbia River and ocean. Additionally, the Colville Tribes and other salmon co-managers have worked with the mid-Columbia Public Utility Districts to meet some of their hydro-system mitigation through hatchery production (CPUD 2002a; CPUD 2002b; DPUD 2002).

In order to make full use of the best science available the program operates on the following general principles[1]:

1. Monitor, evaluate and adaptively manage hatchery and science programs
2. Manage hatchery broodstock to achieve proper genetic integration with, or segregation from natural populations
3. Promote local adaptation of natural and hatchery populations
4. Minimize adverse ecological interactions between hatchery- and natural-origin fish
5. Minimize effects of hatchery facilities on the ecosystem

[1] Adapted from the Hatchery Reform Project, the Hatchery Science Review Group reports and independent science review.

6. Maximize survival of hatchery fish in integrated and segregated programs
7. Develop clear, specific, quantifiable harvest and conservation goals for natural an hatchery populations within an "All-H" (Hatcheries, Habitat, Harvest and Hydro) context
8. Institutionalize and apply a common analysis, planning, and implementation framework
9. Use the framework to sequence and or prioritize actions
10. Hire, train, and support staff in a manner consistent with successful implementation of the program
11. Conduct annual reviews to include peers, stakeholders, and regional managers, and
12. Develop and maintain database and information systems and a highly functional informational web-presence.

The CJHP annual RM&E activities were focused on five primary field activities to provide data for answering key management questions. These activities included:

1. Rotary screw traps (juvenile outmigration, natural-origin smolt PIT tagging)
2. Beach seine (natural-origin smolt PIT tagging)
3. Lower Okanogan adult fish pilot weir (adult escapement, pHOS, broodstock)
4. Spawning ground surveys (redd and carcass surveys)(VSP parameters)
5. eDNA collection (VSP parameter—distribution/spatial structure)

Additional data compilation activities occurred and were necessary in conjunction with our field efforts to answer the key management questions. These included:

1. Harvest (ocean, lower Columbia, terminal sport, and CCT)
2. Query RMIS for coded wire tag (CWT) recoveries to evaluate strays and stock composition
3. Query PTAGIS for PIT tag returns at mainstem dams and tributaries
4. EDT model estimates for abundance and productivity (from OBMEP)

In-hatchery monitoring/data collection was focused in five areas (see Appendix A):

1. Broodstock collection and bio-sampling
2. Life stage survival
3. Disease monitoring
4. Tagging , marking, and release
5. Ladder surplus / pHOS reduction

Study Area

The primary study area of the CJHP lies within the Okanogan River Subbasin and Columbia River near Chief Joseph Dam in north central Washington State (Figure 1). The Okanogan River measures approximately 185 km long and drains 2,316,019 ha, making it the third-largest subbasin to the Columbia River. Its headwaters are in Okanagan Lake in British

Columbia, from which it flows south through a series of four lakes before crossing into Washington State at Lake Oosoyos. Seventy-six percent of the area lies in Canada. Approximately 14 km south of the border, the Okanogan is joined by its largest tributary, the Similkameen River. The Similkameen River watershed is 510 km long and drains roughly 756,096 ha. The Similkameen contributes approximately 75% of the flow to the Okanogan River. The majority of the Similkameen is located in Canada. However, part of its length within Washington State composes an important study area for CJHP. From Enloe Dam (Similkameen rkm 14) to its confluence with the Okanogan, the Similkameen River contains important Chinook pre-spawn holding and spawning grounds. Downstream of the Similkameen confluence, the Okanogan River continues to flow south until its confluence with the Columbia River at Columbia River km 853, between Chief Joseph and Wells dams, near the town of Brewster, Washington.

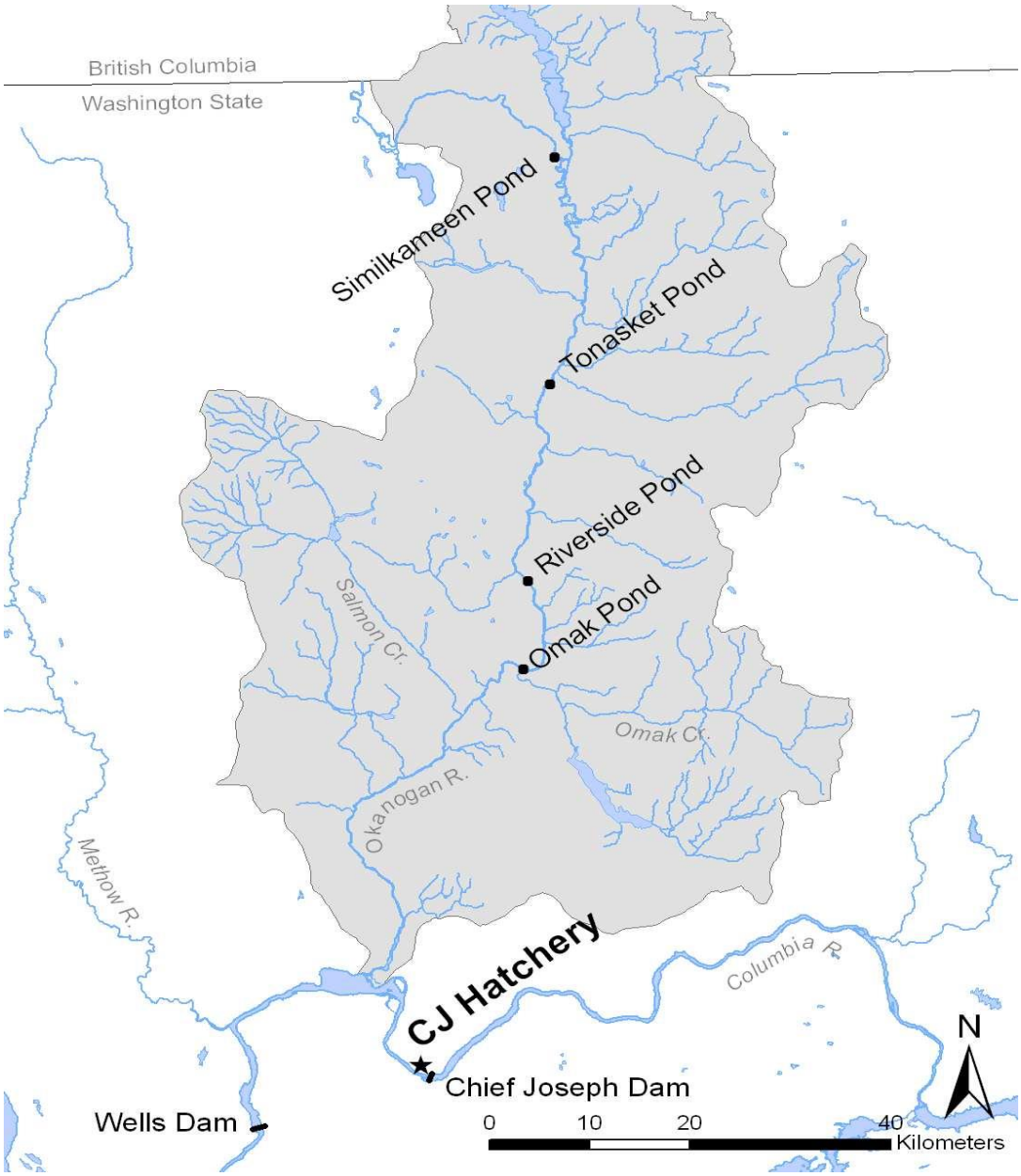


Figure 1. Map of the U.S. portion of the Okanogan River Basin, the Chief Joseph Hatchery, and Chinook Salmon acclimation sites. Tonasket Pond is the primary intended acclimation site for Okanogan spring Chinook.

Similar to many western rivers, the hydrology of the Okanogan River watershed is characterized by high spring runoff and low flows occurring from late summer through winter. Peak flows coincide with spring rains and melting snowpack (Figure 2). Low flows coincide with minimal summer precipitation, compounded by the reduction of mountain snowpack. Irrigation diversions in the lower valley also contribute to low summer flows.

As an example, at the town of Malott, Washington (rkm 27), Okanogan River discharge can fluctuate annually from less than 1,000 cfs to over 30,000 cfs (USGS 2005).

The Okanogan Subbasin experiences a semi-arid climate, with hot, dry summers and cold winters. Water temperature can exceed 25° C in the summer, and the Okanogan River surface usually freezes during the winter months. Precipitation in the watershed ranges from more than 102 cm in the western mountain region to approximately 20 cm at the confluence of the Okanogan and Columbia Rivers (NOAA 1994). About 50% to 75% of annual precipitation falls as snow during the winter months.

For most of its length, the Okanogan River is a broad, shallow, low gradient channel with relatively homogenous habitat. There are few pools and limited large woody debris. Fine sediment levels and substrate embeddedness are high and large woody debris is rare (Miller et al. 2013). Towns, roads, agricultural fields and residential areas are adjacent to the river through most of the U.S. reaches.

Near its mouth, the Okanogan River is affected by the Wells Dam on the Columbia River, which creates a lentic influence to the lowermost 27 km of the Okanogan River. Water level fluctuates frequently because of operational changes (power generation, storage) at Wells Dam.

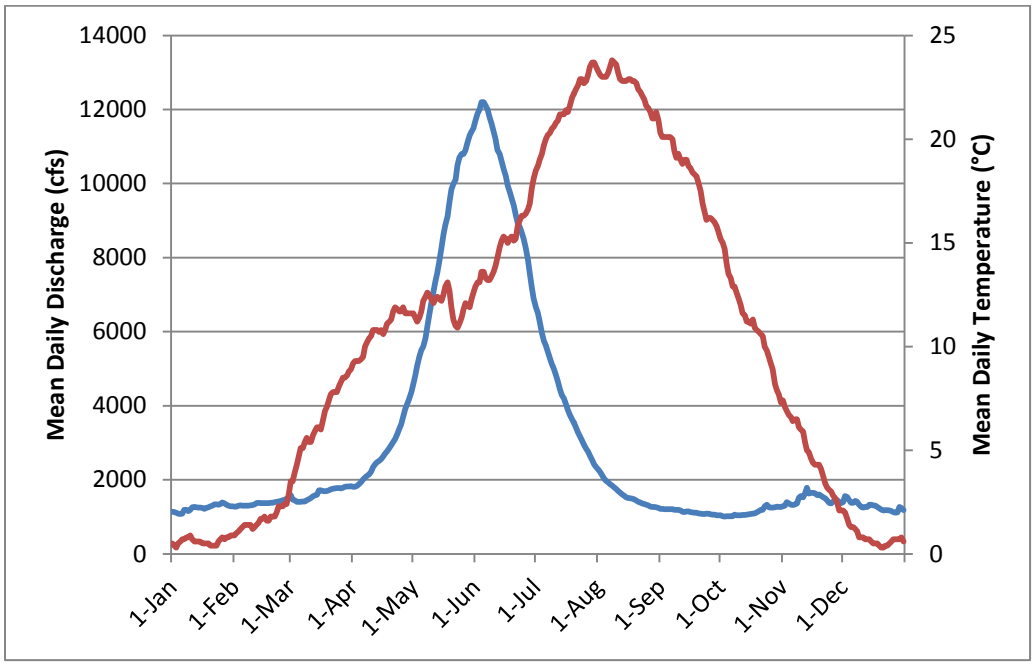


Figure 2. Okanogan River mean daily discharge rate (blue line) and temperature (red line) at Malott, WA.

METHODS

Data Acquisition and Management

Data collection and analysis, combined with structured decision-making, is at the center of specialized monitoring programs such as that of the CJHP. The CJHP and our contractors have designed and implemented a robust information management system to ensure that the reliable, high-quality data is efficiently collected in the field, and that is accessible to inform the annual decision and planning cycle (Figure 3).

Data were recorded in the field using Trimble YUMA® Ruggedized Tablets for the rotary screw trap, the weir, and spawning ground surveys (Figure 4). Data backup occurred both on hard copy and by synchronizing to cloud storage. The YUMA® devices are equipped with integrated GPS, video, photography, and wireless internet capabilities. Use of these tools reduced data entry errors, while increasing the amount of data that can be accurately collected in a rapid fashion.

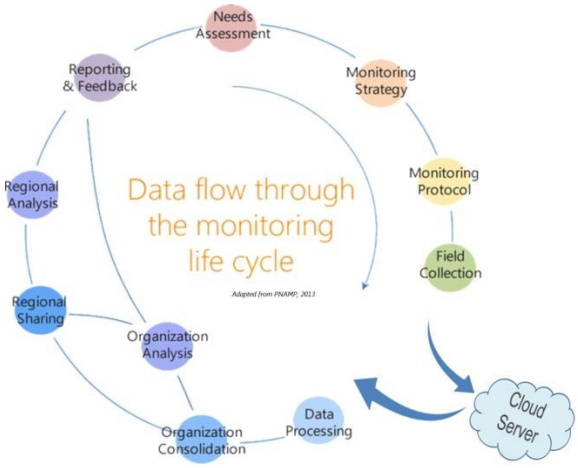


Figure 3. Data flow through the monitoring life cycle (adapted from PNAMP 2012).

Figure 4. Recording data in the field on the YUMA®.

Within the YUMA® units, over 40 detailed, action-specific data forms have been created and stored to accommodate flexible and individualized work. These forms cover the research, monitoring, and evaluation activities. Flexible and scalable database architecture provides the foundation for advanced analytical proficiency, and allows for simplified data sharing with partner Columbia Basin monitoring programs. Within hatchery production, survival, tagging, release and beach seine data were still documented using traditional hard copy data sheets.

The main objectives of the data system development project are to provide the CJHP with a user-friendly, centralized, accurate, and reliable way to input, store, manage, and analyze program data using a similar concept as successfully developed for CCT habitat projects and the Resident Fish Program (Figure 5).

The CJHP confers with the regional Coordinated Assessments (CA) project through the Pacific Northwest Monitoring Partnership's (PNAMP) Data Workgroup. We are currently involved in the CA to develop a standardized data exchange template to obtain readily available estimates and metadata for 'hatchery indicators'. The CA Project is an effort to develop integrated data-sharing of anadromous fish related data between and among the co-managers (i.e., state and federal fish and wildlife agencies and tribes) of the Columbia Basin.

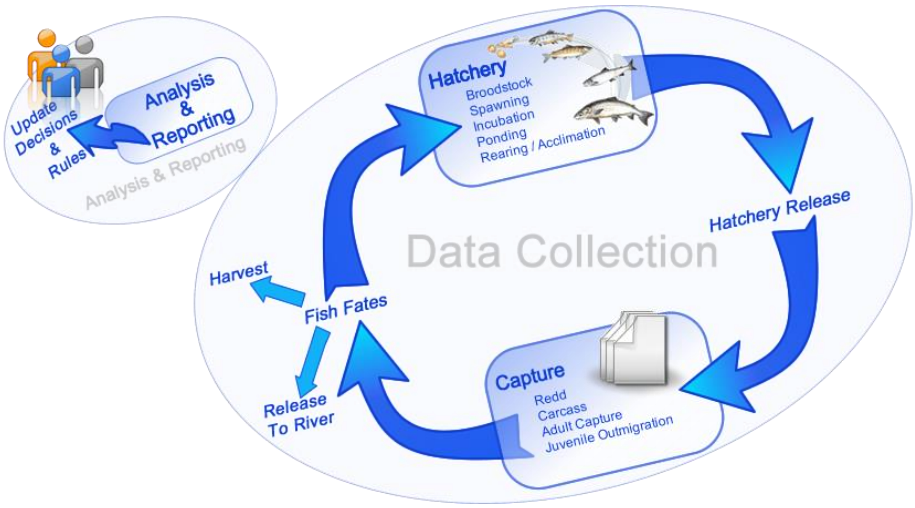


Figure 5. General data flow for the CJHP developed by CJHP and Summit Environmental.

Tag and Mark Plan

HATCHERY SUMMER/FALL CHINOOK.—All summer/fall hatchery-origin Chinook have been/will be marked with an adipose fin clip to ensure differentiation from natural-origin fish in the field and in fisheries. Additionally, all summer/fall Chinook raised for the integrated program have been/will be tagged with a CWT (with distinct codes differentiated by release location), which is inserted into the snout of fish while in residence at the hatchery. A batch of 200,000 summer/fall Chinook in the segregated program will receive a CWT, so the presence or absence of a CWT in adipose-clipped fish is a partial diagnostic as to which program an ad-clipped, hatchery-origin fish belongs (Table 1). This will allow for selective efforts in broodstock collection, purse seining, and hatchery trapping activities to be program specific by determining the presence or absence of a CWT in the field. It was decided that losing some resolution on field differentiation of the segregated and integrated populations was a good tradeoff in order to get the harvest information back from the batch of 200,000 CWT in the segregated program.

Under this strategy, a returning adult from the CJH with an adipose fin clip and CWT would be considered part of the integrated program and either collected for broodstock in the segregated program, allowed to escape to the spawning grounds (if pHOS is within acceptable levels), or removed from the population (for harvest or pHOS management). If a fish has an adipose fin clip but no CWT, then it is assumed from the segregated program (or a stray from another hatchery program) and removed for harvest or pHOS management. In this way, CWTs assist with in-season management of hatchery-origin stocks in the field. The 200,000 segregated fish with a CWT represent about 15% of the combined segregated (900,000) and integrated (1.1 million) hatchery fish with a CWT. If smolt to adult survival and adult holding/migration behaviors are identical, this would mean that 15% of the subsequent generation of segregated fish would have a segregated parent and would not be consistent with the 'stepping stone' approach. However, segregated fish should spend less time holding at the mouth of the Okanogan and therefore have a lower probability of being collected as broodstock in the purse seine. CWT monitoring from broodstock collections during the first several years of returns will provide insight to this tradeoff.

Coded wire tags are also recovered later in the year from salmon carcasses on the spawning grounds within the Okanogan Basin. All recovered CWTs are sent to WDFW for extraction, reading, and data upload to the Regional Mark Processing Center operated by the Pacific States Marine Fisheries Commission (PSMFC)[2] . These data are used to develop estimates of total recruitment, rate of return to point of release (homing), contribution to fisheries, survival rates, mark rate, and other parameters, helping inform future management and production decisions within the CJHP.

[2] website: http://www.psmfc.org/Regional_Mark_Processing_Center_RMPC

Table 1. General mark and tag plan for Chief Joseph Hatchery summer/fall Chinook.

Mark Group	Target max smolt released	Life-stage released	% CWT	Adipose Fin-Clip	PIT tag
Okanogan Integrated	1,100,000				
Similkameen	250,000	Yearling	100%	100%	5,000
Riverside Pond	275,000	Yearling	100%	100%	
Omak Pond	275,000	Yearling	100%	100%	5,000
	300,000	Subyearling	100%	100%	5,000
Chief Joseph Segregated	500,000	Yearling	20%	100%	5,000
	400,000	Subyearling	25%	100%	5,000
Natural-Origin	RST and Confluence Seine	N/A	0%	0%	≤ 25,000

In addition to the adipose fin-clip and CWT, a subset of hatchery-origin fish will be PIT-tagged to further assist with fish monitoring efforts in subsequent years. Table 1 represents the general plan for out years when at full production. 2013 was the first year of broodstock collection so no juvenile hatchery fish were tagged or marked. In 2014, the subyearling summer Chinook will not be PIT tagged because they will not have a corresponding (same migration year) yearling release. PIT tagging BY 2013 yearlings will happen in 2014.

HATCHERY SPRING CHINOOK.—The general tag and mark plan for spring Chinook can be seen in Table 2. In 2013 there was no tagging or marking of spring Chinook because it was the first year of broodstock transfer from LNFH for the segregated program. Additionally, no transfer of 10(j) fish occurred from the WNFH due to delays in permits and federal processes associated with the 10(j) designation.

Table 2. General marking and tagging plan for Okanogan spring Chinook as part of the Chief Joseph Hatchery Program.

Mark Group	Smolt released	Life-stage released	% CWT (#)	Adipose Fin-Clip	PIT tag
Chief Joseph Segregated	700,000	Yearling	29% (200,000)	100%	5,000
Reintroduction (§10(j) fish from Winthrop)					
Tonasket Pond	200,000	Yearling	100%	100%	5,000
Natural-Origin	RST	Yearling	0%	0%	≤ 5,000

NATURAL-ORIGIN FISH TAGGING.—The RM&E plan called for up to 25,000 PIT tags in juvenile natural-origin summer/fall Chinook parr/smolts. PIT tagging of natural-origin summer/fall Chinook occurred at the rotary screw trap and the juvenile beach seine in 2013. Please see those sections for details.

Genetic Analyses

The CJHP has been collecting and archiving genetic samples for future analysis of genotype, allele frequency, and natural and artificial (hatchery) selection for certain genetic traits. The CJHP collected genetic samples (fin clips) from summer Chinook hatchery broodstock in 2013 (n=619), which were provided to Columbia River Inter-tribal Fish Commission (CRITFC) for use in development of a Columbia River Parentage Based Tagging (PBT) program. Genetic samples from outmigrant juvenile Chinook were also collected during operation of the rotary screw trap (n=110), but these juvenile samples were archived within CJHP and not sent to CRITFC. Future analysis of the hatchery broodstock genetic samples for the development of PBT would provide genotype information for CJHP. Currently, however, no funding exists for PBT analysis.

Additionally, through a collaborative agreement with U.S. Geological Survey (USGS), CJHP has received support staff and access to laboratories (FRESC - Snake River Field Station Genetics Laboratory, Boise, ID) capable of genetics analyses for genotyping Okanogan Chinook populations.

Genetic samples will continue to be collected from all hatchery broodstock, as well as outmigrant juvenile Chinook handled at the rotary screw trap and during beach seining (target n=200), and spawned natural- and hatchery-origin Chinook encountered during carcass surveys on the spawning grounds (target n=200 each).

Juvenile Outmigration and PIT tagging

Juvenile outmigration and PIT tagging of natural-origin juvenile Chinook were implemented using two field work efforts, rotary screw traps in the Okanogan River and a juvenile beach seine in the Columbia River near its confluence with the Okanogan River.

Rotary Screw Traps

Two 2.4 m rotary screw traps (RST) were deployed from the Highway 20 bridge near the city of Okanogan (rkm 40). The RST were operated from April 1 to June 28, 2013. Trapping occurred every day for 12 hours, from 2000 to 0800, with the exceptions of May 10 to May 27, when trapping operations were suspended due to high river flow rates and debris load and the Memorial Day weekend. Trapping operations ceased when discharge levels exceeded 15,000 cfs. One trap was rendered inoperable for the remainder of the season after May 10 due to damage from woody debris and high flows.

During operation, the trap location was adjusted in the river to achieve between 6-10 revolutions per minute. The trap was checked every four hours unless a substantial increase in flow (≥ 500 cfs) or debris load occurred, in which case it was checked and cleaned more frequently. All fish were enumerated, identified to species, origin (adipose fin present or absent), and a subsample of natural-origin Chinook were measured. The first 10 unmarked Chinook of each 100 encountered were measured to the nearest mm and released during each trap check. Steelhead smolts were not measured in an attempt to minimize handling and stress of this listed species. Unmarked (adipose fin present) Chinook captured in the RST that were ≥ 65 mm total length received a 12 mm full duplex PIT tag. A small tissue sample was collected from the dorsal fin of PIT tagged fish and any yearling unmarked Chinook for later genetic analysis.

EFFICIENCY TRIALS. — Mark-recapture efficiency trials were used to estimate the total outmigrant population in the Okanogan River. The proportion of marked fish appearing in a random sample estimates the proportion of marked fish in the total population (Rayton and Wagner 2006). Trap efficiency was measured by the rate that marked fish released above the traps were recaptured. Flow, visibility, fish size, and noise are factors that change throughout the season and affect trap efficiency, therefore as many trials as possible were conducted for natural-origin Chinook.

In 2013, mark/recapture efficiency trials were conducted during the trapping season when a minimum of 30 natural-origin subyearling Chinook were captured in a

sample day that were at least 40 mm in length. If the minimum sample size was not captured then hatchery released parr/fry were used as the mark group. The probability of capture was assumed to be the same for hatchery fish as it was for natural-origin fish. After collection, fish were marked with Bismarck Brown dye at a concentration of 0.25 g to 4.5 gallons of water, held for 10-15 minutes with aeration and transported in buckets via a truck for release. Fish were released at night (0000 to 0400) approximately 1.6 river km upriver by the Oak Street bridge. Fish were distributed evenly on both sides of the river to allow for equal distribution across the channel. Trap efficiency was measured by the rate that the marked fish captured and released within the sample period (2000 to 0800) were recaptured.

RST ANALYSIS.—Daily catch was expanded to a daily outmigration estimate based on measured trap efficiency and flow using the Lincoln-Peterson mark-recapture model with a Chapman modifier (Seber 1982) which makes the following assumptions:

1.) All marked fish passed the screw trap or were recaptured during time period *i*
2.) The probability of capturing a marked or unmarked fish is equal
3.) All marked fish recaptured were correctly identified as a marked fish
4.) Marks were not lost or overlooked between time of release and recapture

The Chapman modification is used because it has much better statistical properties when the number of recaptured fish is small (less than 10). The Chapman modification of the Lincoln-Peterson estimate for *N* is

$$\hat{N}_i = \left[\frac{(M_i + 1)(C_i + 1)}{(R_i + 1)} \right] - 1$$

where $\hat{N}_i$ is the population estimate, M_i is the number of fish trapped and marked in the first sample, C_i is the number of fish collected in the second sample, and R_i is the number of fish collected in the second sample that were marked as part of M_i. The approximate variance estimate for $\hat{N}_i$ is

$$V(\hat{N}_i) = \hat{N}_i^2 \frac{(C_i - R_i)}{[(C_i + 1)(R_i + 2)]}$$

Total juvenile production was estimated by the sum of the estimated migrations over discreet periods and the variance of the total production was the sum of the variances. The 95% confidence interval (CI) was ± 1.96 (SD).

Juvenile Beach Seine

Douglas County PUD was the lead agency on beach seining activities in 2013, with additional staff provided by the CJHP for training purposes. However, we are providing a detailed methods section and an abbreviated results section because we will be using the information on returning adults. Additionally, CCT intends to continue with the beach seine effort in the future in order to tag enough wild summer Chinook juveniles. Much of the following text describing the methods was taken directly from a draft DPUD report (DPUD 2014).

Beach seining took place from June 19 to July 11 in the area near the confluence between the Okanogan and Columbia Rivers. The majority of effort and catch was focused on several beaches on river right within 3 km downstream of the mouth of the Okanogan (48° 6'12.46"N, 119°44'35.48"W). In 2013 Washburn Island, Gebber's Landing, and Starr were the areas that were predominately used for collection. These locations provided relatively large numbers of fish, limited bycatch, and provided substrates that prevented the seine from collecting high debris loads or becoming caught on underwater snags. In addition, these three locations were assumed to provide fish from the Methow, Okanogan and Foster Creek delta spawning locations; however this assumption is highly speculative. In the future, efforts will likely focus only in the Gebber's Landing area to increase the likelihood that the majority of tagged fish are of Okanogan origin.

Three beach seines were used to capture fish; one 15.24 m long × 1.83 m deep, another 15.24 m long × 1.22 m deep, and a third 30.49 m long and 3.05 m deep, with a 28.32 cubic-meter "bag" in the center. Seines were made by Memphis Net and Twine (Memphis, Tennessee) and were Delta woven 4.8 mm mesh with "fish-green" treatment. An additional net was used and only differed by 0.635 mm mesh size. This net was relied on in the later weeks of tagging since fish were larger and there was no chance of gill capturing fish. Additional weights of 3-5 kg were added to each end of the seine to help keep it open during retrieval.

To capture fish, one end of the beach seine was anchored on shore, and the other was towed out by a boat until the seine was stretched perpendicular to shore. Then, the vessel would move rapidly upstream and return to shore, causing the seine to form a semi-circle intersected by the shore line (Figure 6). The seine bridal was handed from the boat to a shore crew that would retrieve the net. All Chinook of taggable size (≥65 mm) were transferred to a bucket kept on shore and filled with ambient water for several minutes (generally less than 15) before being transferred to a nearby net pen. Chinook that were obviously smaller than 65 mm were returned to the river. Net pens were approximately five cubic meters and were covered with 4.8-mm mesh; maximizing water exchange while preventing the escape of captured Chinook or the entrance of predators.

Figure 6. Juvenile beach seine being retrieved near the confluence of the Okanogan and Columbia Rivers, with the tagging barge in the background.

Bycatch, most commonly three-spine stickleback (*Gasterosteus aculeatus*) were released immediately onsite without enumeration. Some bycatch were inadvertently transferred to the bucket and net pen and later released from the tagging barge (untagged). Juvenile Chinook were held 24 hours prior to tagging to asses capture effects and 24 hours after tagging to assess tag loss and tag application mortality rates. The following day on the tagging barge Chinook ≥ 65mm were tagged with a full duplex 12 mm PIT tag. Fish were then released into the Wells Pool of the mainstem Columbia River several hundred meters downstream of their capture location.

TAGGING PROCEDURES.—All tagging was conducted by Biomark using a Biomark mobile tagging station modified for this project. The tagging station consisted of an approximately 1 m^2 aluminum work surface with built in sinks and a trough for holding fish during the tagging process. The station also housed the necessary electronics (computer, digitizer board, tag reader, and antenna) needed for tagging. In 2013 water was pumped from the river directly using a ¼ horsepower pump and radiator system. An anesthetic solution consisting of 100 g Tricare methanosulfonate (MS-222) mixed in 1 L of

water was used to sedate the fish prior to tagging. Approximately 12 ml of anesthetic solution was added to the 45 L of water in the sinks and troughs. The pump and radiator system kept water temperatures ambient with river temperatures. The concentration of MS-222 used would bring the fish to the desired level of stage-2 anesthesia in approximately 3 to 4 minutes. All fish were tagged within 10 minutes of the initial exposure. Recovery time was approximately 1 to 2 minutes.

Each day following seining, the barge would move to the net pen containing the fish captured the previous day. Each tagging location had two net pens: one containing the fish to be tagged, and an empty pen for receiving the tagged fish. Fish to be tagged were collected from the respective net pens using a dip net and placed into an 18.9 L bucket of water. Up to 40 fish at a time were collected from the bucket using a small dip net and placed in one of the tagging-station sinks containing anesthetic solution.

Fish were tagged with 12.5 mm 134.2 kHz ISO PIT tags using pre-loaded, single-use, 12-gauge hypodermic needles (BIO12.BPLT) fitted onto injection devices (MK-25). 12.5 mm PIT tags were used to maximize detection at downstream locations, particularly the Rocky Reach Juvenile Bypass and the Bonneville Dam Corner Collector. However, these tags only allowed tagging to begin once fish were approximately 65 mm fork length. Detection efficiencies at both of the former sites would dramatically suffer when using the smaller PIT tags available. All fish were tagged with a single-use needle to reduce the chance of disease transmission or injuries caused by dull needles. The two or three person Biomark tagging crew consisted of one or two tagger(s) and one tagger/data collector. The data collector interrogated the tag in each tagged fish, recorded its fork length with an electronic wand on a digitizer board, and noted any anomalies. In 2012 and 2013 and PVC pipe was added to the data station so that fish could be immediately recovered in the overnight net pen.

Data collected during tagging were stored using PITTAG3 software (Pacific States Marine Fisheries Commission). After completion of the tagging events, tag files were consolidated, uploaded to PTAGIS, and submitted to Douglas PUD.

FISH RELEASES.—Tagged fish were released the morning after they had been tagged. Prior to release, the net pen was opened and all observed mortalities and moribund fish were removed. Once the mortalities were removed the net pen was tilted to allow the fish to volitionally exit. PIT tags were recovered from dead and moribund fish, the associated tag codes were marked as "Mortalities" in the tag files and the tag codes were deleted. In 2013, a finer mesh was placed at the bases of the net pens to allow for shed PIT tags to be collected. However, despite the modification no shed tags were recovered. Additional focused studies would be required to examine rates of tag shedding.

Lower Okanogan Adult Fish Pilot Weir

The Okanogan adult fish pilot weir (herein referred to as the 'weir') was in its second year of design modifications and testing in 2013. Continued operation and improvements to the weir, are a central part of CCT's strategy for the successful implementation of the CJHP summer/fall Chinook Salmon programs. Pilot weir test results are essential for updating key assumptions, operations and design of the weir.

Objectives for the pilot weir in 2013 included:

1. Install the weir in early August and operate until late September under allowable flow conditions (<3,000 cfs);
2. Document environmental effects of the weir through collection of physical and chemical data in the vicinity of the weir;
3. Test weir trapping operations including live Chinook capture, handling and release;
4. Direct observations and fish counts for estimating species composition, abundance, health, and timing to inform management decisions and future program operations;
5. Measure survival of broodstock collected at the weir.

The lower Okanogan fish weir was installed approximately 1.5 km downstream of Malott, WA (48°16'21.54 N; 119°43'31.98 W). Weir installation began on August 13, 2013 and was complete on August 22. An aluminum trap was installed near the center of the channel at the upstream end of the deep pool in the thalweg of the channel. The trap was 3 m wide, 4.5 m long and 3 m high (Figure 7). The wings of the weir stretched out from either side of the trap towards the river banks. The wings consisted of steel tripods with aluminum rails that supported the 3 m long Acrylonitrile butadiene styrene (ABS) pickets. Each panel was zip-tied to the adjacent panel for strength and stability. Sand bags were placed at the base to support the tripod legs and between panels when needed to fill gaps that exceeded the target picket spacing. Picket spacing ranged from 2.5 to 7.6 cm (1 to 3 in) in 1.2 cm (0.5 in) increments. Pickets were manually forced into the river substrate daily to prevent fish passage under the weir.

The river-right wing consisted entirely of 2.5 cm picket spacing. A 3 m gap between the last panel and the right shoreline remained to allow for portage of small vessels around the weir. This was a very shallow gravelly area and under most flow conditions it did not appear to be a viable path for adult salmon passage. However, a block net was set up from the last panel to the river-right shore to limit escapement via this route. The river left wing had variable picket spacing to accommodate non-Chinook fish passage through the pickets (Figure 8). The primary objective of the wider picket spacing was to allow Sockeye Salmon (*O. nerka*) to pass through the weir and reduce the number of Sockeye that would enter the trap. River left was selected for this spacing to better accommodate observation/data collection regarding successful passage of smaller fish through the panels.

Figure 7. Lower Okanogan adult fish pilot weir, 2013.

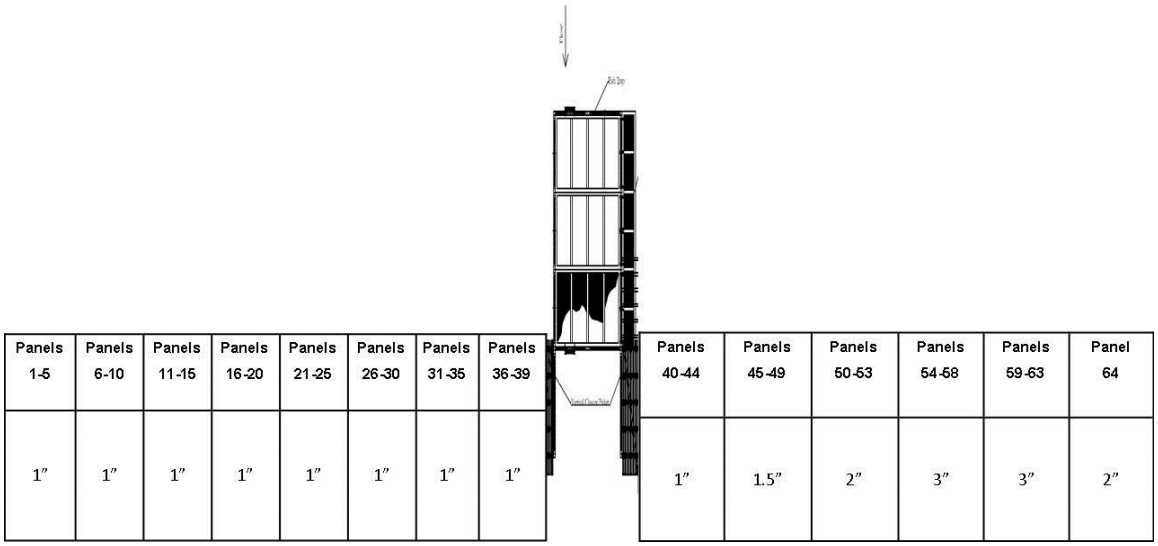


Figure 8. Picket (ABS pipe) spacing within each panel (or set of five panels) at the Lower Okanogan adult fish pilot weir in 2013.

Physical and chemical data were collected in the vicinity of the weir including the water depth (cm) inside the trap, dissolved Oxygen (mg/L), total dissolved solids (TDS)(ppm), turbidity (NTU), temperature (°C), and discharge (cfs). Temperature and discharge were taken from the online data for the USGS gauge at Malott (http://waterdata.usgs.gov/wa/nwis/uv?site_no=12447200). When river temperature exceeded 22.5° C, trapping operations ceased and weir pickets on panels adjacent to the trap on both sides were raised to allow for unrestricted passage by Chinook.

Algae and debris were cleared off of the weir at least once per day, generally in the morning. Dead fish on the upstream side of the weir were enumerated, identified to species and the presence and extent of injuries were noted. The tail was cut off of each mortality before they were tossed downstream of the weir so that they would not be double counted during snorkel surveys.

A 4.6 m high observation tower was placed on the downstream side of the weir on the left bank to better accommodate visual observations of fish behavior. Observations were made for 30 minute intervals one or more times per day. Observers visually estimated the center, left and right thirds of the channel then captured fish observations within those spatial units. Types of behaviors that were documented include searching (spent the majority of time erratically moving up, down, and/or side-to-side in an apparent attempt to pass the weir), stationary (spent the majority of time relatively stationary), contacting (times spent contacting or jumping at the weir panels), guided to the trap

entrance, swam upstream and swam upstream. A single fish had one or a combination of more than one of these behaviors.

Snorkel surveys downstream of the weir occurred five times between August 26 and September 3. Three to four snorkelers surveyed from the weir downstream to Chiliwist Creek (1.5 river km). Observations of live and dead fish were enumerated for each species.

Underwater video cameras were operated outside the trap entrance to determine the number, time of day, and species that passed through the trap, and to calculate weir efficiency and weir effectiveness. Two SeeMate™ Pro underwater video cameras from IAS Products were placed inside the trap from August 23 to August 31 and were moved and operated outside the trap at the entrances from August 31 to September 23 after the trap entrance fykes were installed. The cameras were relocated outside the trap to monitor fish behavior around the redesigned entrance gates. Underwater lights (17 in SeeBrite ™ LED; 325-500 milliamps) were used near each camera to facilitate night time data collection. Video imagery was collected by a DV-IP server, SD Advanced (Dedicated Micros) and reviewed daily on a PC or laptop computer through a wireless network connection and the NetVu Observer software. While reviewing video imagery on shore, hourly species and counts were logged for each day.

Weir efficiency, a measure of the proportion of total spawning escapement encountered by the weir, was calculated by the equation;

$$X = \frac{W_T}{T}$$

where X was weir efficiency, W_T was the number of adult summer/fall Chinook encountered in the weir trap including released fish, and T was the total summer/fall Chinook spawning escapement for the Okanogan River Basin.

Weir effectiveness was a measure of the proportion of the adult hatchery Okanogan summer/fall Chinook run encountered in the weir trap, becoming available for removal from the population as a form of adult fish management. It was calculated by the equation;

$$Y = \frac{W_H}{W_H + HOS}$$

where Y is weir effectiveness, W_H is the number of adult hatchery origin fish encountered in the weir trap, and HOS is the total number of hatchery origin spawners.

Trapping operations were conducted during evening and early morning hours (1600-0600) to test the trap gate design, monitor fish behavior in the trap, and test broodstock collection. From August 21 to August 31 when fish entered the trap during an active trapping session, the downstream gate was closed and fish were identified and

either released, removed for pHOS management, or collected for brood. Five hatchery-origin Chinook were collected from the weir trap on August 28, 2013, transported to shore via a fish boot (rubber tire inner tube) and immediately taken to a 2500 gal hatchery truck. The fish were then transported approximately 32 km to CJH where they were held in the broodstock raceways until the first week of spawning in the first week of October.

Spawning Surveys

The objectives for spawning surveys were to:

1. Estimate total spawning escapement based on the number of Chinook redds per reach
2. Estimate the proportion of natural spawners composed of hatchery-origin recruits (pHOS)
3. Estimate pre-spawn mortality and mean egg retention for wild- and hatchery-origin spawners
4. Determine the origin (rearing/release facility) of hatchery-origin spawners (HOS) in the Okanogan and estimate the spawner composition of out of population and out of ESU strays.
5. Estimate out-of-population stray rate for Okanogan hatchery Chinook and estimate genetic contribution to out-of-basin populations.
6. Determine age composition of returning adults through scale analysis
7. Monitor status and trends of demographic and phenotypic traits of wild- and hatchery-origin spawners (age-at-maturity, length-at-age, run timing, SAR)

Redd Surveys

A primary metric used to monitor the status and trends of salmonid populations is spawning escapement. Estimates of spawning escapement can be calculated based on redd counts and expanded by sex-ratios (Matthews and Waples 1991, Gallagher et al. 2007). This requires intensive visual survey efforts conducted throughout the spawning area and over the course of the entire spawning period. Visual redd surveys were conducted to estimate the number of redds per survey reach from the mouth of the Okanogan River to Zosel Dam (river km 124); the Similkameen River from its confluence with the Okanogan River upstream to Enloe Dam (river km 14); and in the mainstem Columbia River from the mouth of the Okanogan River upstream to Chief Joseph Dam (Table 3). Weekly surveys were timed to coincide with spawning in the basin, generally beginning the last week of September or the first week of October and ending approximately the second week of November. Redds were counted using a combination of fixed-wing aerial flight surveys and inflatable raft float surveys.

Aerial surveys occurred once weekly throughout the spawning season, each covering the entire survey area. Aerial surveys were flown at low elevation and at moderate speeds to accommodate visual identification of redds. From the aircraft, a trained

observer recorded the number and GPS coordinates of all new redds as the plane passes overhead. All data was recorded directly into a YUMA rugged computer tablet (Trimble Navigation, Ltd.). Aerial surveys were primarily used to document redds in areas inaccessible to rafts, or in areas of low redd densities, such that they do not warrant weekly float surveys. All data points were visualized in ArcGIS (ESRI, Inc.), and quality controlled to ensure that redd counts are not duplicated during float surveys. Aerial surveys also served a secondary function of informing research crews where to focus weekly carcass recovery efforts (see below section on Carcass Surveys).

Float surveys occurred once daily, 4 days per week throughout the spawning season. Float surveys consisted of three 2-person teams using inflatable rafts to count redds while floating downstream. Each team was responsible for covering 1/3 of the river width, (1) left bank, (2) center, and (3) right bank. Each individual redd was counted and its position recorded directly into a YUMA rugged computer tablet (Trimble Navigation, Ltd.).

Table 3. Reach names and locations for the Okanogan and Similkameen for summer/fall Chinook Salmon spawning and carcass surveys.

Stream	Code	Reach Description	River km
Okanogan	O1	Mouth to Malott Bridge	0.0-27.0
	O2	Malott Bridge to Okanogan Bridge	27.0-41.8
	O3	Okanogan Bridge to Omak Bridge	41.8-49.1
	O4	Omak Bridge to Riverside Bridge	49.1-65.1
	O5	Riverside Bridge to Tonasket Bridge	65.1-90.9
	O6	Tonasket Bridge to Zosel Dam	90.9-124.0
Similkameen	S1	Mouth to Oroville Bridge	0.0-8.0
	S2	Oroville Bridge to Enloe Dam	8.0-14.0
Canada	C*x*	TBD	TBD

All redds were classified as either a:

1. *Test-redd* (disturbed gravel, indicative of digging by Chinook, but abandoned or without presence of Chinook; generally, this classification is reserved for early

season redd counts, before substantial post-spawn mortalities have occurred as indicated by egg-voidance analysis of recovered carcasses). Test-redds do not contribute to annual redd counts.

2. *Redd* (disturbed gravel, characteristic of successful Chinook redd construction and/or with presence of Chinook).

Redds per reach were calculated for each week as the combined number of new redds counted during aerial- and float-surveys for a given week. Post-season analysis consisted of summing the combined aerial- and float-survey weekly redd totals to calculate annual redd totals per reach, and per total survey area. Estimated total spawning escapement was then calculated by multiplying the total redd count by the sex ratio multiplier for the current year (2.31 for 2013). The sex ratio multiplier = 1 + the ratio of males to females as randomly collected for broodstock at Wells Dam (1:1.31 in 2013, Hillman et al. 2014). Some key assumptions included:

Assumption I –	Each redd was constructed by a single female Chinook, and each female Chinook constructed only one redd
Assumption II –	The ratio of males-to-females on the spawning grounds was the same for wild- and hatchery-origin Chinook and is equal to the male-to-female ratio as randomly collected for broodstock at Wells Dam, or 1.14 males per 1.00 females in 2013 (Hillman et al. 2014)
Assumption III -	Every redd was observable and correctly enumerated

Escapement into Canada

Year-round video systems operated by OBMEP and located in the fishways of Zosel Dam allow observation of salmonids passing over Zosel Dam and potentially into the British Columbia portion of the Okanagan River Basin. For detailed methods within a particular year please see the Okanogan Basin Monitoring and Evaluation Program (OBMEP) annual reports posted at (http://www.colvilletribes.com/obmep_publications.php).

Passage over Zosel Dam can occur via the fishways or through the open dam gates. OBMEP assumes that any gate level greater than 1 foot is high enough for fish to pass upstream through the open gate rather than through the fish ladders and video arrays. In higher water years, a larger proportion of Chinook have the opportunity to pass through the gates rather than through the fishways. The estimates of Chinook escapement past Zosel Dam do not account for fish moving through the gates rather than the fishways. It is currently unclear if summer/fall Chinook are able to fall back below the dam through the

gates, if the gates are open wide enough, creating the potential for one fish to ascend multiple times.

Escapement into Canada was never before reported as part of the Similkameen Pond Hatchery monitoring program. Data and discussion presented herein are intended to begin the process of understanding what is known, what is not known, and what the possibilities are for obtaining a reliable estimate of summer/fall Chinook spawners in the Canadian Okanagan River.

CARCASS SURVEYS

Carcass surveys provide important biological samples for evaluation of hatchery- and natural-origin fish on the spawning grounds, including:

1) Spawner composition [tags (PIT, CWT) and marks (fin clips)]
    a. pHOS
    b. out of population hatchery strays (CWT, PIT)
    c. distribution of within population hatchery fish among spawning reaches
2) Length
3) Sex
4) Age (scales, CWT, PIT)
5) Egg retention

The target annual carcass recovery sample size was 20% of the spawning population (Hillman et al. 2014). Ideally, in order to accurately represent the spawning population within a reach, this sample would be structured such that reaches with higher spawning densities would have proportionately higher carcass recovery rates, while still providing time/resources for recovery efforts in all reaches throughout the mainstem Okanogan, even those with substantially fewer available carcasses. While this is often the case, limitations in staff and resources inevitably dictate carcass recovery strategy.

Summer/fall Chinook carcass recovery efforts occurred simultaneously with redd float surveys. Carcasses were collected during downstream floats using gaff hooks. If a carcass was too degraded to collect or sample for biological data, it was left in the river. Recovered carcasses were transported within inflatable rafts downstream until a suitable beach site was reached for processing. All adipose absent carcasses were assumed to be of hatchery-origin, and all carcasses displaying an intact adipose fin were assumed to be of natural-origin[3]. Biological data collected from carcasses included sex, fork length (FL) and post-orbital hypural length (POH) to the nearest cm, and estimated egg retention for all

[3]There could have been some hatchery-origin fish with an intact adipose fin. Although all summer/fall Chinook hatchery programs in the Upper Columbia clip strive for a 100% adipose fin clip rate, a small percentage (~1%) may not receive the fin clip due to mechanical failure in the marking trailer. Additionally, not all fall Chinook programs, such as Priest Rapids Hatchery, clip the adipose fin of their releases.

females (0 to 5,000 max; visually estimated). All eggs that were not detected within a carcass were assumed to have been deposited. Any female carcass containing an estimated 5,000 eggs were considered a pre-spawn mortality. Forceps were used to remove five scale samples from all natural-origin Chinook. Scales were adhered to desiccant scale cards for preservation and identified by sample number and sample date. At the conclusion of spawning season, scales were sent to WDFW for post-hoc age analysis. Age analysis data was used to assess age-at-return (run-reconstruction), and combined with biological data to assess length-at-age. All Chinook were scanned for passive integrated transponder (PIT) tags and all PIT detections were recorded and later uploaded to PTAGIS. Snouts were taken from all adipose fin clipped Chinook (in 2013 we assumed that all hatchery fish had a CWT to avoid false negatives with the handheld CWT wands). After removal, the snouts were individually bagged and labeled with species, origin, FL, river of recovery and date. At the end of the day they were preserved at -20 °C for future deliver to the WDFW CWT laboratory in Olympia. All data was input directly into a YUMA rugged computer tablet (Trimble Navigation, Ltd.). After sampling each carcass, the caudal fin was removed before being returned to the river to avoid resampling on subsequent surveys. Weekly carcass recovery totals were summed post-season to calculate annual carcass recovery totals per reach and per survey area.

Some key assumptions for carcass surveys included:

Assumption I –	All carcasses had the same probability of being recovered on the spawning grounds (despite differences in sex, origin (wild/hatchery), age at return by origin, size-at-age by origin, jacks, spawn timing, and/or recovery location, habitat type or habitat complexity)`
Assumption II –	The diagnostic unit in which a carcass is recovered is the same as the reach in which the fish spawned
Assumption III –	Sampled carcasses are representative of the overall spawning composition within each reach

pHOS and PNI

pHOS was first calculated using the straightforward method of calculation for the population-level pHOS by simply dividing the number of hatchery-origin spawners by the total spawners, such that:

$$pHOS = \frac{HOS_O}{HOS_O + NOS_O}$$

where HOS_O is the total recovered hatchery-origin carcasses and NOS_O is the total recovered natural-origin carcasses. This simple algorithm does not account for hatchery fish effectiveness (i.e., relative reproductive success) nor does it account for variable pHOS

and unequal sampling effort across reaches. For example, reach S1 tends to have a higher pHOS than other reaches because the Similkameen acclimation site is located in the reach. Likewise, the probability of recovering carcasses in low density spawning reaches is lower than in reaches with high density spawning. For 2013, CJHP attempted to account for each of these factors.

Relative reproductive success has not been measured for summer/fall Chinook in the Okanogan. One of the key assumptions in the In-Season Implementation Tool is that hatchery fish are less fit than wild fish and that fitness will improve with increased PNI. Currently, the hatchery fish effectiveness assumption for the Okanogan population is that hatchery-origin spawners are 80% as effective as natural-origin fish as contributing their genes to the next generation. This assumption is based on research conducted by Reisenbichler and McIntyre (1977) and Williamson et al. (2010). Therefore, the pHOS calculation was amended in 2013 to account for the reduction in hatchery spawner effectiveness, such that:

$$Effective\ pHOS = \frac{0.8\ HOS_O}{0.8\ HOS_O + NOS_O}$$

Further refinement of the pHOS calculation was needed to account for non-random sampling of carcasses and variable pHOS across reaches. This was done by weighting each reach's overall contribution to system-wide pHOS according to the overall proportion of summer/fall Chinook redds that occurred within that reach. First, the proportion of redds that corresponded to each reach was calculated by the equation:

$$redd_{p,r} = \frac{redd_r}{redd_O}$$

where, $redd_r$ is the number of documented redds that occur within reach r, $redd_O$ is the total number of redds documented in the U.S. portion in the Okanogan River Basin, and $redd_{p,r}$ is the proportion of total redds that were documented in reach r.

Next, Effective pHOS was calculated separately for each sampled reach, r, so that:

$$pHOS_r = \frac{0.8HOS_r}{0.8\ HOS_r + NOS_r}$$

where $pHOS_r$ is the Effective pHOS calculation for reach r, and HOS_r *and* NOS_r are the total recovered carcasses of hatchery- and natural-origin within that reach. Finally, Effective pHOS was corrected for the proportion of redds in each reach to determine an Adjusted pHOS, such that:

$$Adjusted\ pHOS = \sum_{i=1}^{n} pHOS_r\ (redd_{p,r})$$

where *n* is the total number of sampled reaches that compose the Okanogan River Basin. These calculations assume that sampled carcasses are representative of the overall spawning composition within each reach; that no carcasses are washed downstream into another reach; that all carcasses have an equal probability of recovery; and that all fish within origin types have equal fecundity. While it is unlikely that all of these assumptions are correct, the modified calculation results in a better representation of the actual pHOS.

PNI was calculated as:

$$PNI = \frac{pNOB}{Adjusted\ pHOS + pNOB}$$

where *pNOB* was the proportion of broodstock that were natural-origin Okanogan returns, and *Adjusted pHOS* was the reach weighted effective pHOS defined previously. To determine an Okanogan specific pNOB, we applied the results of a radio tracking study which estimated that 90% of the natural-origin fish detected near the mouth of the Okanogan River in 2011 and 2012 ended up spawning in the Okanogan Basin (Mann and Snow 2013). Therefore, we assumed that 90% of the NOB collected in the purse seine (2010-2013) was of Okanogan origin.

In years prior to 2010 all of the broodstock for the Similkameen program were collected at Wells Dam. That program strived for 100% pNOB and did achieve >95% pNOB in 7 of the last 8 years (Hillman et al. 2014). However, the Wells Dam broodstock collection efforts composited natural-origin fish from the Okanogan and Methow populations as well as fish originating from downstream populations[4]. We made a correction for non-Okanogan NOB for all years when Wells Dam was used for brood collection using the formula:

$$Adjusted\ Wells\ Dam\ pNOB = Wells\ Dam\ pNOB\ * \left(\frac{Okanogan\ NOS}{Okanogan\ NOS + Methow\ NOS}\right)$$

where the *Adjusted Wells Dam pNOB* was estimated based on the proportion of natural-origin spawners (NOS) that were in the Okanogan compared to the Methow for that particular year. This correction was made for a portion of the broodstock in 2010 and 2011 and all of the broodstock previous to 2010. This correction did not account for stray NORs from downstream populations or NORs that would have remained in the Columbia River above Wells Dam. Although the radio tracking study provides an estimate of this for 2011 and 2012, there was uncertainty regarding the applicability of the radio tracking data for years prior.

[4] A radio tracking study showed that fewer than 50% of the natural-origin fish tagged at Wells Dam ended up in the Okanogan in 2011 and 2012 (Mann and Snow 2013).

Origin of Hatchery Spawners

Snouts from adipose fin clipped fish were removed, individually labeled, frozen, and delivered to the WDFW for CWT extraction and reading. The Regional Mark Information System (RMIS; http://www.rmis.org/rmis) was queried in January 2015 to assess the rearing facility of hatchery-origin Chinook recovered on the Okanogan spawning grounds, the in-to-basin stray rate, and the out-of-basin stray rates. RMIS data query protocols were as follows:

(1) RMIS Data Query Protocol for determining origin (rearing facility) of hatchery-origin spawners (HOS) and estimating out-of-population spawner composition.

RMIS Standard Report:

By 'Release Hatchery' (retrieving only read tags for Chinook collected in spawning grounds in the 'Upper Columbia RMIS Recovery Region'

↓

Choose Data Fields:

Estimated number, recovery location, release location RMIS basin, hatchery location name

↓

Export data to Microsoft Excel

↓

Filter to include only those tags recovered on the 'Okanogan' or 'Similkameen' Rivers

↓

Use Read tag codes to determine Rearing Hatchery Origin and Age Demographics for recovered HOS carcasses

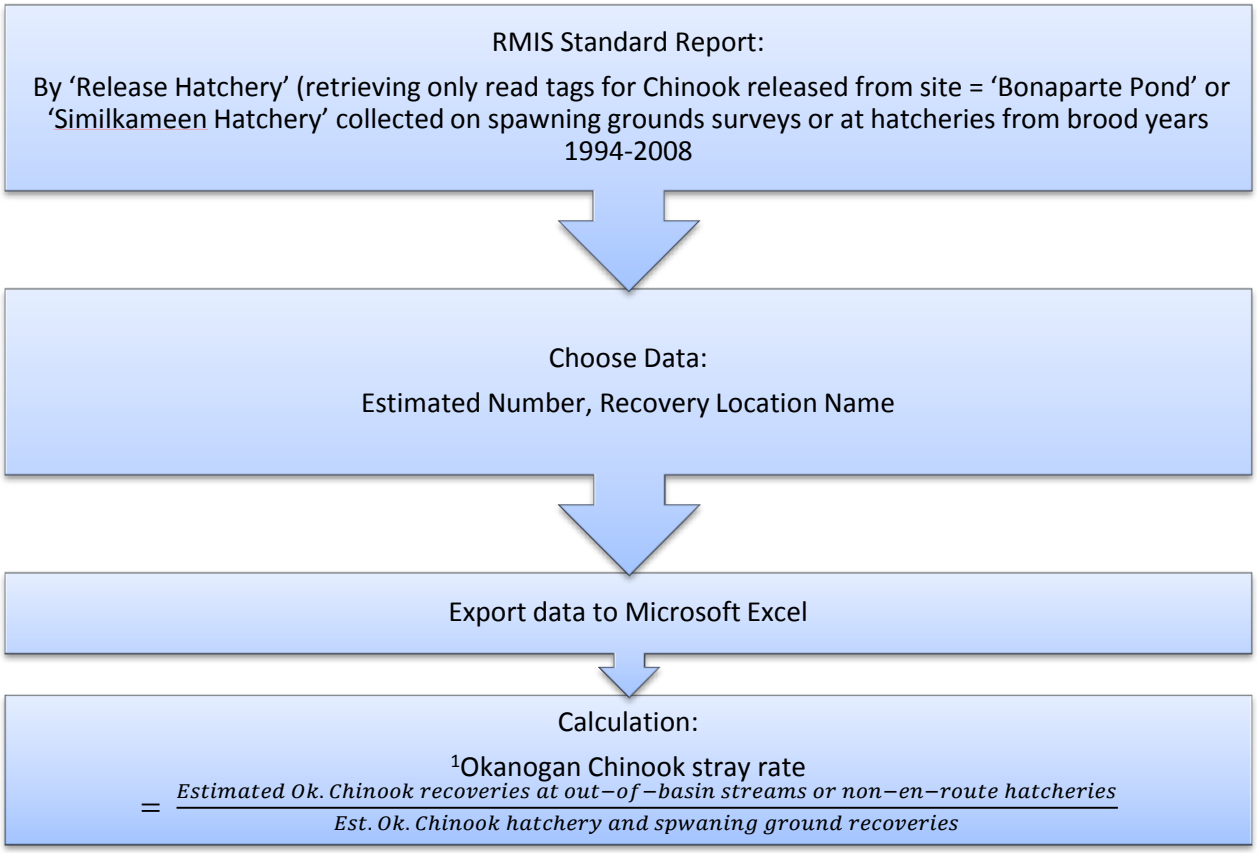
↓

Calculate:

[1]Spawner Composition (%) = $\left(\frac{\text{Estimated non-Ok. origin Chinook recovered on Ok. Spawning grounds}}{\text{Total Estimated Chinook recovered on Ok. Spawning grounds}}\right)\times 100\%$

[1]Calculated individually for each facility or basin that contributed strays to the Okanogan

(2). RMIS Data Query Protocol for estimating out-of-basin stray rates for Similkameen program Chinook



[1]Calculated individually for each brood year, 1994-2008. 2008 represents the most recent brood year that would have returns through age 5.

(3) RMIS Data Query Protocol for estimating genetic contribution of Similkameen program Chinook to out-of-basin populations.

RMIS Standard Report:

By "Release Hatchery" where hatchery location name = Bonaparte Pond AND Similkameen Hatchery; Fishery = 54 (Spawning Grounds Surveys); Recovery year = 2013; Species = Chinook, ;and Tag Status = 1 (Tag read OK).

Choose Data Fields:

Recovery Location Name and Estimated Number

Export data to Microsoft Excel

Calculation for each basin in which Okanogan Chinook were detected:

$$\text{Commposition (\%)} = \left(\frac{\overset{[1]}{\text{Okanogan Origin Spawner}}\ Estimated\ Okanogan\ origin\ Chinook\ detected\ on\ spawning\ grounds}{^{[2]}Estimated\ total\ escapement}\right)\times 100$$

[1]Calculated individually for each subbasin (population) in which Similkameen program Chinook were recovered.

[2]Estimates for total escapement for Chelan, Methow and Wenatchee Basins were taken from Hillman et al. (2014); estimates for total escapement for Entiat Basin was taken from Schmit et al. (2014).

Smolt-to-adult Return

The smolt to adult return rate (SAR) was estimated as:

$$\boldsymbol{SAR = \frac{expanded\ CWT\ recoveries}{CWT\ released}}$$

where expanded CWT recoveries included estimated expanded recoveries on the spawning grounds, at hatcheries and in fisheries. Two expansions were applied. First the number of recoveries was expanded to account for the proportion of the release group that was tagged. For example, with a 99% CWT mark rate the recoveries would be increased by 1%. Second, the recoveries were expanded based on the proportion of the population that was sampled. For example, if carcass surveys recovered 20% of the estimated spawners then the number of CWT recoveries was expanded by 80%. The number of CWT fish released were simply the hatchery release data including all tag codes for CWT released fish (CWT + Ad Clip fish and CWT-only fish).

Spring Chinook Presence and Distribution

A formal monitoring plan for spring Chinook has not been developed with the CJHP because the reintroduction has not yet occurred. However, to the extent that information can be easily gathered from other efforts, we believe it is worthwhile to establish a baseline of presence/absence and distribution. A study of environmental DNA (eDNA) was an important part of this baseline effort (see Appendix C). Monitoring programs throughout the Columbia Basin are implanting PIT tags into both hatchery- and natural-origin spring Chinook as juveniles that might stray to the Okanogan as returning adults. Additionally, the WDFW monitoring program at Wells Dam tags returning adult spring Chinook which greatly increases the probability of detection. For 2013, the presence and distribution of spring Chinook were evaluated by querying the PTAGIS database using an interrogation summary for all PIT detection sites in the Okanogan and Similkameen Rivers, including Canada. Once a list of tag codes was obtained, a second query was run to determine if any of the fish had a final detection outside the Okanogan.

RESULTS

Rotary Screw Traps

The rotary screw traps captured 6,116 Chinook subyearlings, including 2,201 hatchery- and 3,917 natural-origin. The majority of Chinook were captured in early May (before trapping was suspended) and in June (Figure 9. Natural-origin subyearling juvenile outmigration timing measured with two rotary screw traps on the Okanogan River in 2013.). The mean length of Chinook did increase throughout the trapping season, but the number of natural-origin smolts that were large enough (>65 mm) to PIT tag was small (n=110) (Figure 10). Six of these exceeded 115 mm (115 to 150 mm total length) and were likely yearling Chinook. A dorsal fin clip was removed and archived for genetic identification to determine if they were spring or summer/fall Chinook.

The next most abundant species captured in the RST were Mountain Whitefish (*Prosopium williamsoni*), Sockeye, and steelhead (Table 4). Twenty hatchery-origin steelhead and 126 adipose fin present steelhead were removed from the trap and released immediately into the river. There were two juvenile steelhead mortalities (both were adipose fin present) at the trap resulting in a 1.4% handling mortality rate. The encounter of 20 hatchery and 126 adipose present (assumed natural-origin) and mortality of two (2) assumed natural-origin steelhead are within the take limits identified in the authorizing ESA Section 10(a)(1)(A) Permit for the rotary screw trap operation (Permit 16122).

In April and early May, efficiency trials were not conducted because catch rates and fish size were insufficient before high water and debris loads suspended trapping. In June, we were unable to conduct efficiency trials on natural-origin fish because catch rates were insufficient. Eight efficiency trials were conducted between 3940-6170 cfs (Table 5). The low total number of recaptures and the narrow range of flows for the efficiency/flow relationship and the wide variance within the flow levels monitored did not result in a valid expansion of the catch throughout the sampling period (Table 5, Figure 11). Therefore, we were not able to generate a valid estimate of total natural-origin smolt outmigration in 2013.

To explore the possibility of using hatchery-released fish as a surrogate for wild fish, efficiency trials were conducted on April 20-May 3 using hatchery yearlings from the Similkameen Pond. Although 2,201 hatchery fish were recaptured, we believe that using hatchery yearlings as a surrogate for natural subyearlings violates assumption #2 (see methods section).

Efficiency trials were implemented over a fairly narrow range of flows (Figure 11). Even within this narrow range there was not a good predictive relationship between flow and capture efficiency. Therefore, flow could not be used as a predictor of capture efficiency.

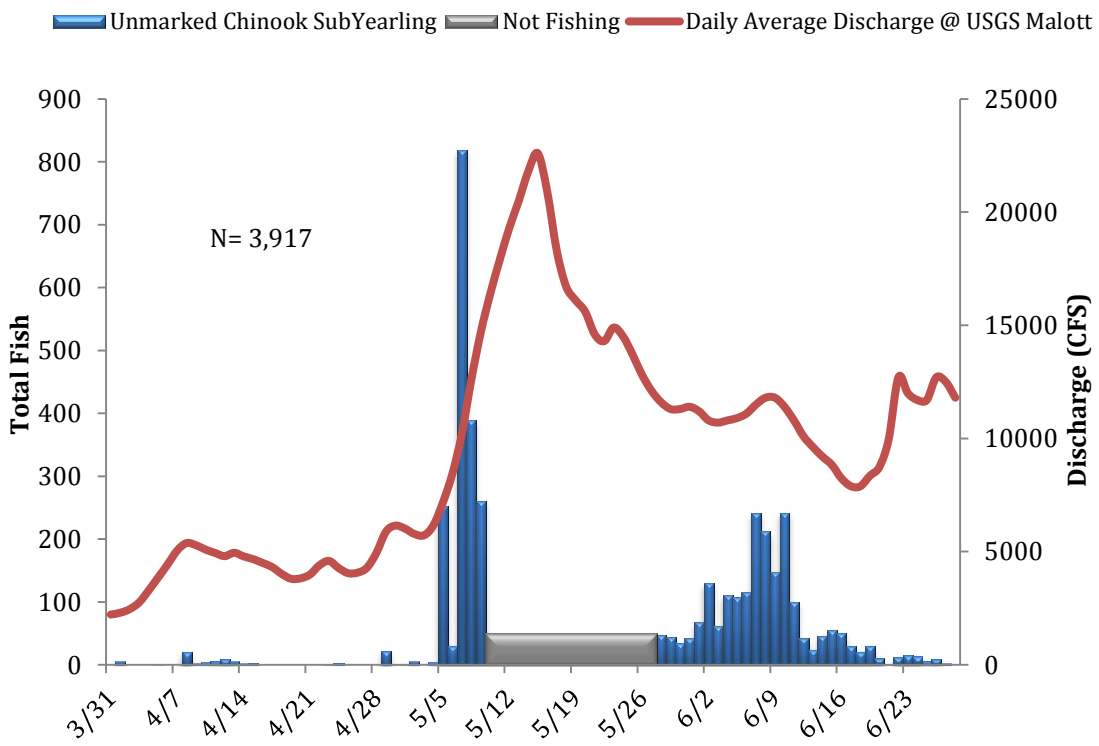


Figure 9. Natural-origin subyearling juvenile outmigration timing measured with two rotary screw traps on the Okanogan River in 2013.

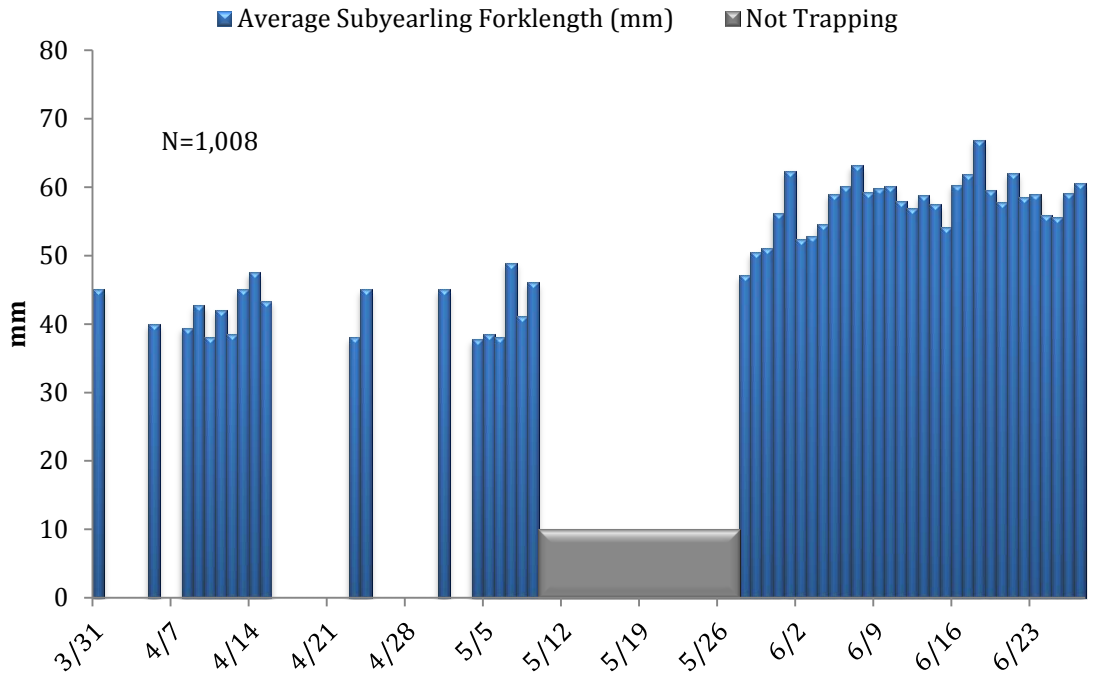


Figure 10. Natural-origin subyearling Chinook size distribution from the rotary screw traps on the Okanogan River in 2013. The first 10 of every 100 fish counted on each trap check were measured.

Table 4. Number of juvenile fish trapped at the Okanogan River rotary screw traps in 2013.

Species	Number Caught
Black Bullhead	14
Bluegill	18
BridgeLip Sucker	7
Brook Trout	1
Brown Bullhead	12
Common Carp	19
Largemouth Bass	2
Longnose Dace	1
Mountain Whitefish	526
Sculpin	4
Yellow Bullhead	1
Yellow Perch	23
Other Species Subtotal	628
Hatchery Chinook Subs	2201
Hatchery Steelhead	20
Sockeye	365
Wild Chinook Subs	3917
Wild Chinook Yearling	7
Wild Steelhead	126
Anadromous Subtotal	6636

Table 5. Efficiency trials conducted on hatchery-origin yearling Chinook smolts at the Okanogan rotary screw traps in April and May, 2013.

Trap Date	River Flow @ USGS Malott	Total Chinook Marked	Total Chinook Released	Total Chinook Recaptured	Trap Efficiency
4/20	3940	48	48	1	0.02
4/22	4620	36	36	0	0.00
4/24	4220	58	58	2	0.03
4/25	4060	66	66	4	0.06
4/26	4150	66	66	1	0.02
4/30	6170	111	111	0	0.00
5/2	5670	60	60	2	0.03
5/3	5760	61	61	4	0.07

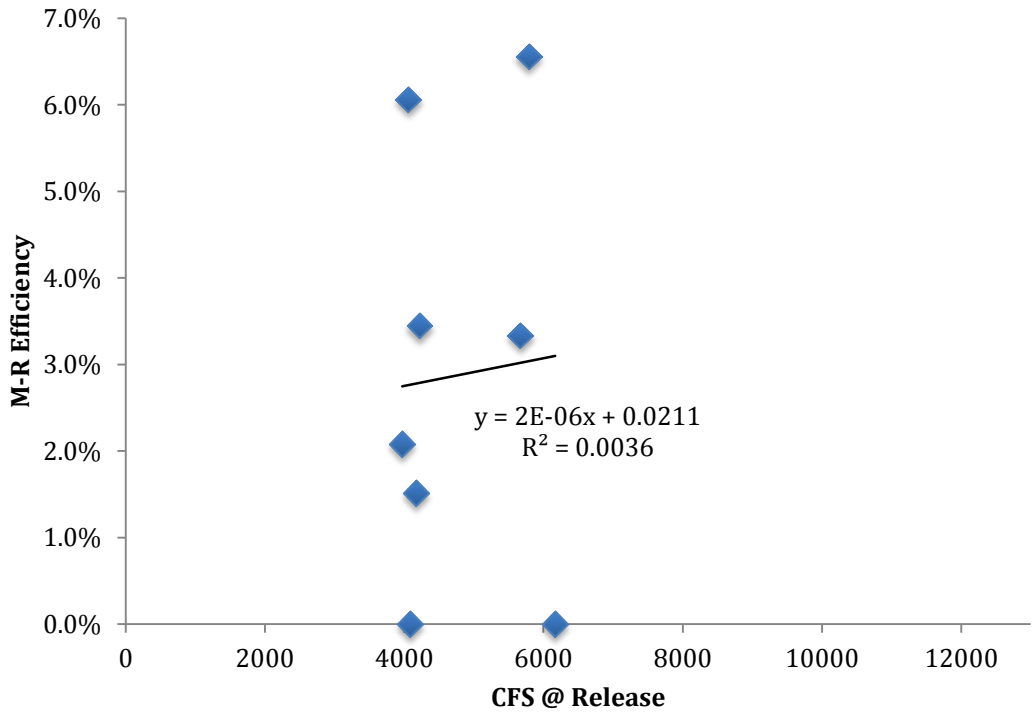


Figure 11. Natural-origin subyearling Chinook mark-recapture efficiency trials from the Okanogan River rotary screw traps in 2013.

Juvenile Beach Seine

In 2013, 17,671 natural-origin juvenile Chinook were PIT tagged and released from the beach seining effort led by DPUD. At the time of this report, DPUD was still finalizing a three-year report on their beach seining and tagging study. To avoid redundancy and the publication of draft material, CJHP will not include results from the DPUD study in this report. Rather, interested parties should contact DPUD for a copy of the report titled: Wells Project Subyearling Chinook Life-History Study, 2011-2013 Report, Wells Hydroelectric Project, FERC No. 2149. Additionally, a web link or copies of the report will be posted on the CJHP website, once the report is finalized and with approval from DPUD.

Lower Okanogan Adult Fish Pilot Weir

The Okanogan River discharge at Malott was higher than normal in 2013, but dropped to 2,000 cfs on August 9, 2013, allowing staff to safely enter the river and begin installation (Figure 12). Discharge continued to drop rapidly throughout the installation period until late August when it increased approximately 500 cfs, presumably due to water management releases from Lake Okanagan designed to improve pre-spawn holding conditions for sockeye in Lake Osoyoos (Figure 12). Rapid increases in discharge were observed beginning September 8, due to thunderstorms that also increased turbidity and eliminated the possibility of observing fish via video, snorkeling, or from the observation tower (Figure 13). Discharge levels near 3,000 cfs nearly overtopped the pickets in the deepest portion of the river (near the trap) and salmon could have jumped over the weir (although this behavior was not observed).

Migration of Sockeye and summer/fall Chinook is generally affected by a thermal barrier that is caused by warm water temperatures (≥~22 °C) in the lower Okanogan River. The thermal barrier is dynamic within and between years, but generally it sets up in mid-July and breaks down in late August. In some years, the Okanogan River will temporarily cool off due to a combination of interrelated weather factors including rainstorms, cool weather, cloud cover or wildfire smoke. This 'break' in the thermal barrier can allow a portion of the fish holding in the Columbia River to enter the Okanogan and migrate up to thermal refuge in the Similkameen River or Lake Osoyoos. In 2013, temperatures were similar to, though often slightly higher than the median daily temperatures from the last 9 years (Figure 14). Temperature surpassed 22.5 °C on July 18 when flow was 4,470 cfs. Temperatures generally stayed above 22.5 °C until mid-August. A steady decrease in temperatures from a high of 25.4 °C to a low 20.3 °C occurred from August 13 to 25.

Dissolved Oxygen varied from 6.2 to 8.4 mg/L, total dissolved solids varied from 82-144 ppm and turbidity varied from 2.4 and 50 NTUs (Table 6).

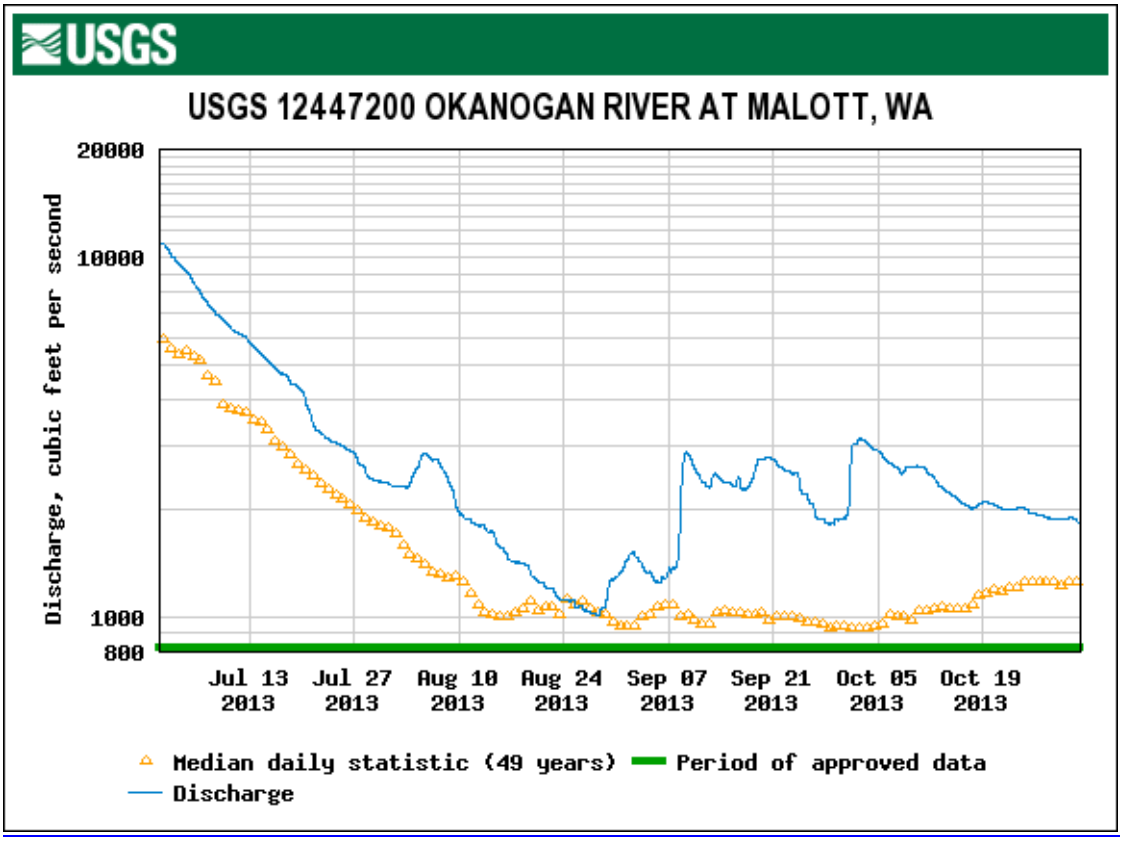


Figure 12. Discharge of the Okanogan River at Malott, WA between July 1 and October 31, 2013. This figure was copied directly from the USGS website (http://nwis.waterdata.usgs.gov/wa).

Figure 13. Photographs of the lower Okanogan fish weir after September 2013 rainstorms increased flow and turbidity.

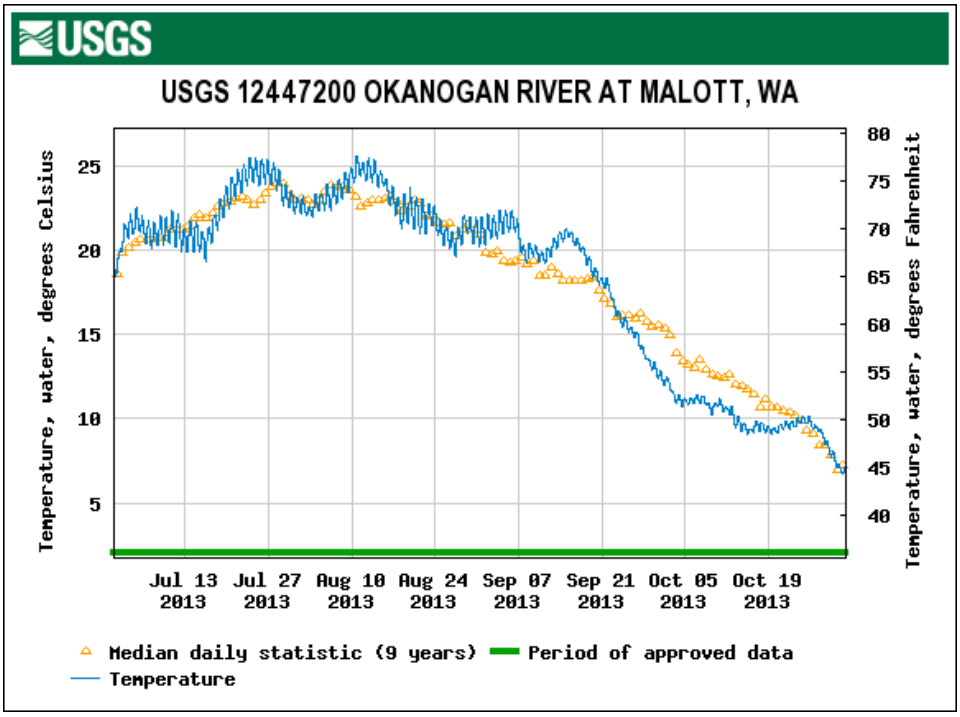


Figure 14. Temperature of the Okanogan River at Malott, WA between July 1 and October 31, 2013. This figure was copied directly from the USGS website (http://nwis.waterdata.usgs.gov/wa).

Table 6. Water quality data at or near the lower Okanogan weir in 2013. Temperature and discharge were taken from the USGS gage at Malott.

Date	Trap Depth (cm)	Dissolved Oxygen (mg/L)	Total Dissolved Solids	Turbidity (NTU)	Temperature (°C)	Discharge (cfs)
08/26/13	55	8.4	144	50	20.1	1,050
08/28/13	50	7.5	138	45	20.5	1,010
08/29/13	55	7.1	140	45	21.1	1,060
09/03/13	70	6.1	125	45	21	1,380
09/04/13	70	6.7	123	45	21.2	1,340
09/05/13	65	6.4	125	2.4	21.1	1,250
09/09/13	120	6.2	114	6	19.7	2,840
09/10/13	115	6.6	85	11.6	19.3	2,570
09/11/13	110	6.8	82	31.3	19.2	2,390
09/12/13	110	6.8	92	16	19.7	2,300
09/13/13	115	7	101	10.1	20.1	2,470
09/16/13	110	7	118	4.3	20.3	2,350
09/17/13	110	7.1	124	4.7	19.9	2,290
09/18/13	120	7.4	118	5.2	19.1	2,560

Twenty-two dead fish were removed from the weir between August 21 and September 18 (Table 7). Mountain Whitefish and Chinook Salmon were the most commonly encountered species. All fish were impinged on the upstream side of weir, indicating that they had most likely died upstream and floated down onto the weir. There were no observations of fish caught between pickets in a head upstream direction, which would have indicated that a fish got stuck and died while trying to push through the pickets.

Table 7. Date and species of fish mortalities observed at the lower Okanogan fish weir in 2013.

Date	Bridgelip Sucker	Chinook	Mountain Whitefish	Sockeye	Steelhead	Unknown Sucker	Total
8/21/13						1	1
8/22/13			1			1	2
8/23/13		1		1			2
8/26/13			1	1		1	3
8/29/13		1					1
8/31/13		1					1
9/3/13			1		1		2
9/9/13			1			1	2
9/11/13			1				1
9/12/13		1	1				2
9/13/13		1					1
9/16/13	1						1
9/17/13			1				1
9/18/13			1				1
Total	**1**	**5**	**8**	**2**	**1**	**4**	**22**

Tower observations revealed a broad array of fish behaviors in the vicinity of the weir (Figure 15). Most observations were of fish in the center third of the channel where observed behaviors were most likely to be contacting the weir, stationary, or searching. Fish approaching on river left were mostly observed being guided towards the trap or searching. The fewest behavioral observations were made on river right which was furthest from the observers, but again searching and guiding toward the trap were the most common behaviors.

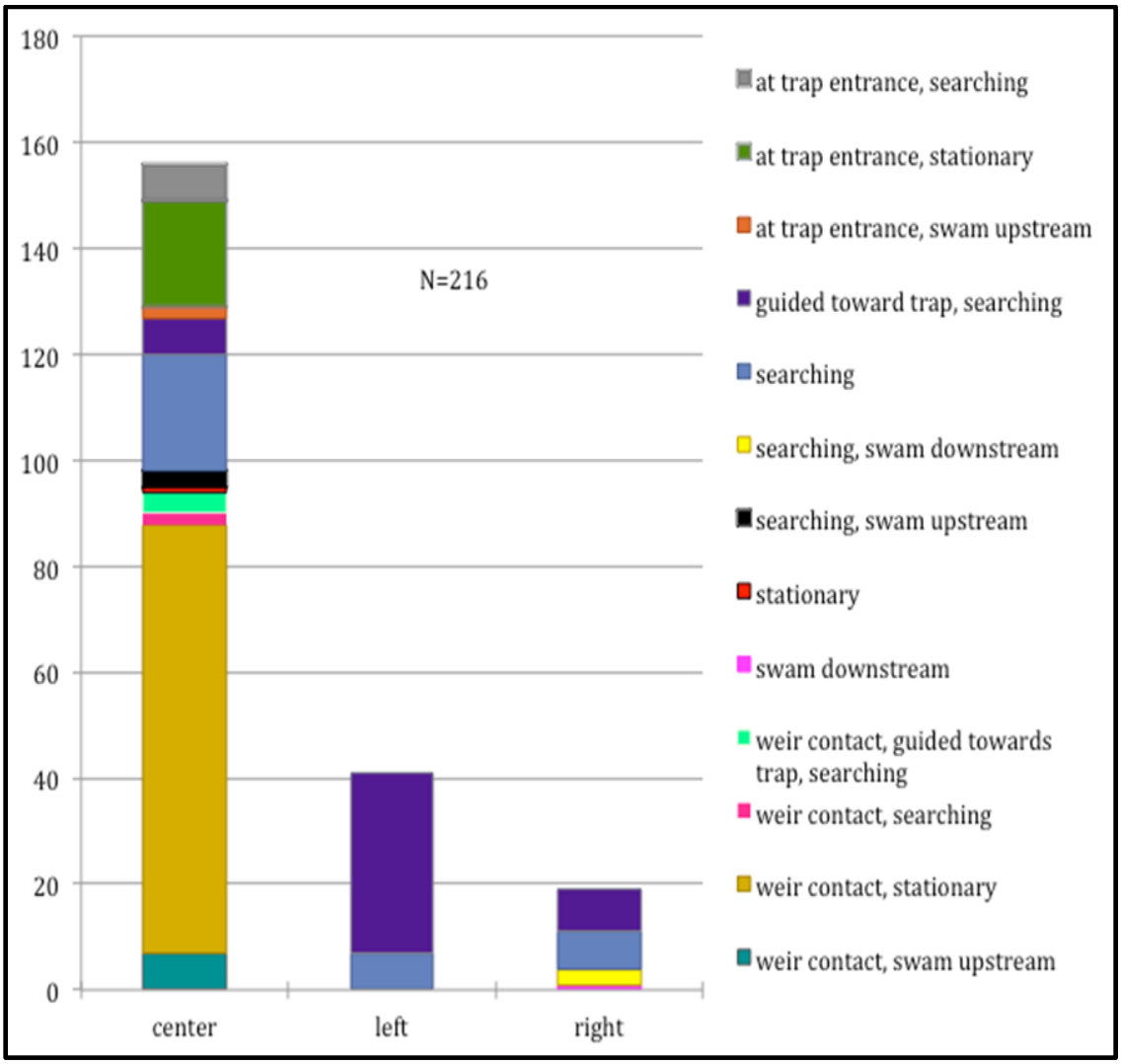


Figure 15. Behavior observations of fish as the encountered the lower Okanogan fish weir in 2013.

Nineteen fish were observed during the snorkel surveys including 15 live Chinook Salmon within the first 300 m downstream of the weir (Figure 16). Only one dead Chinook Salmon was observed during snorkel surveys.

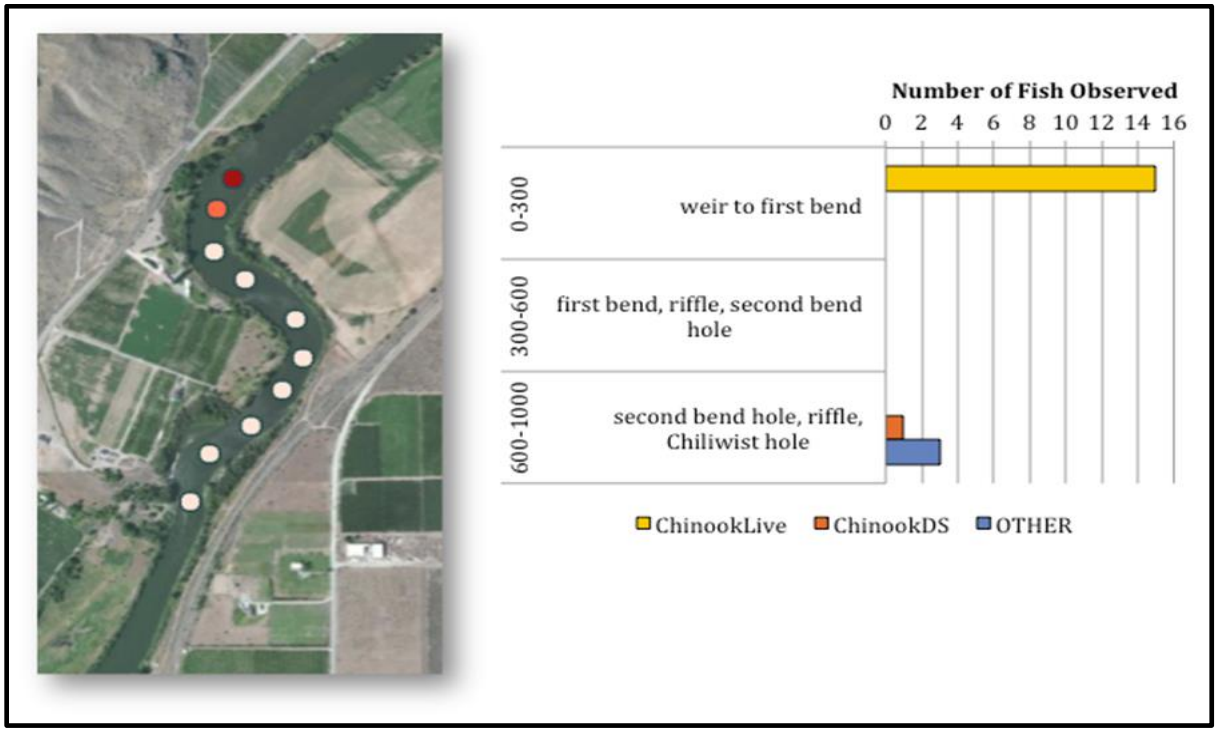


Figure 16. Snorkel survey observations downstream of the lower Okanogan fish weir in 2013. Only one dead Chinook (ChinookDS) was observed. Circles indicate the 100 m transect breaks downstream of the weir.

Video monitoring of passage through the trap encountered 2,115 fish, including 1,485 Chinook, 179 Sockeye, 3 steelhead, and 448 other non-target species (mostly Mountain Whitefish)(Figure 17). Origin was identified on 430 Chinook Salmon and 99 (23%) were hatchery-origin. The majority of Chinook Salmon moved through on August 29 and 30 (Figure 18), when the mean daily temperature at the Malott gauge still exceeded 21 °C. Although Figure 18 shows a comparison with data from 2012, the weir was not fully functional with video monitoring when the big pulse of Chinook Salmon came through after the thermal barrier broke down in 2012. Additionally, the high flows and turbidity prevented effective video monitoring after September 9, 2013.

Figure 17. Video monitoring was used to enumerate and identify species (Sockeye, upper left; steelhead, lower right) passing through the trap of the lower Okanogan fish weir in 2013.

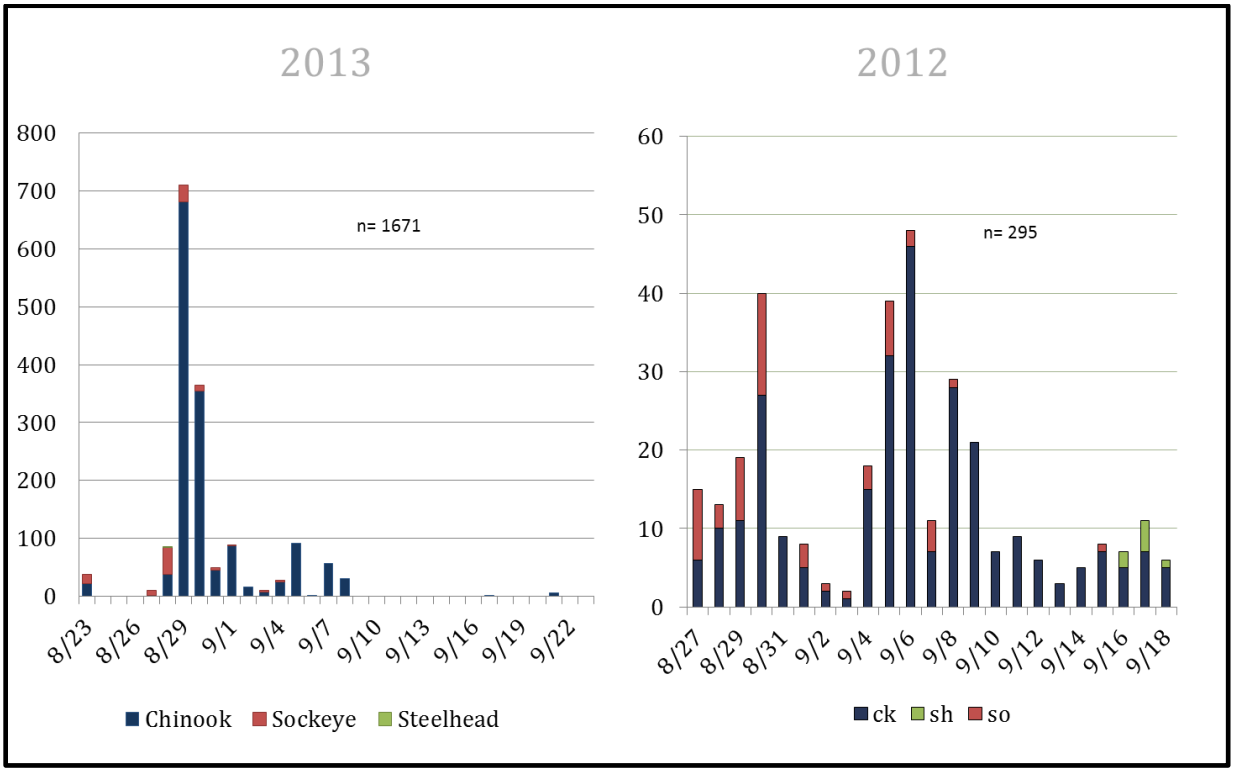


Figure 18. Fish passage through the lower Okanogan fish weir by date in 2012 and 2013.

Passage was observed throughout the day (except 1000) but peaked in the morning (0500 to 0700) and evening (1700 to 2000) (Figure 19). The diel pattern was similar in 2012, though passage throughout the night time hours was more consistent in 2012.

Trapping operations were conducted from August 21 to September 20 to test the trap gate design and monitor fish behavior inside the trap and post release. The total fish trapped at the weir in 2013 was 340 with 26% of them being Chinook salmon (Figure 20). Most of the Chinook trapped were released back into the river (Figure 21). Three adult steelhead were trapped and released and there were no steelhead mortalities or injuries associated with the weir in 2013. Five hatchery-origin Chinook were transported to the hatchery and held in the broodstock ponds concurrently with the fish taken for broodstock from the purse seine. None of the weir collected fish died at the hatchery as of the first spawn in early October.

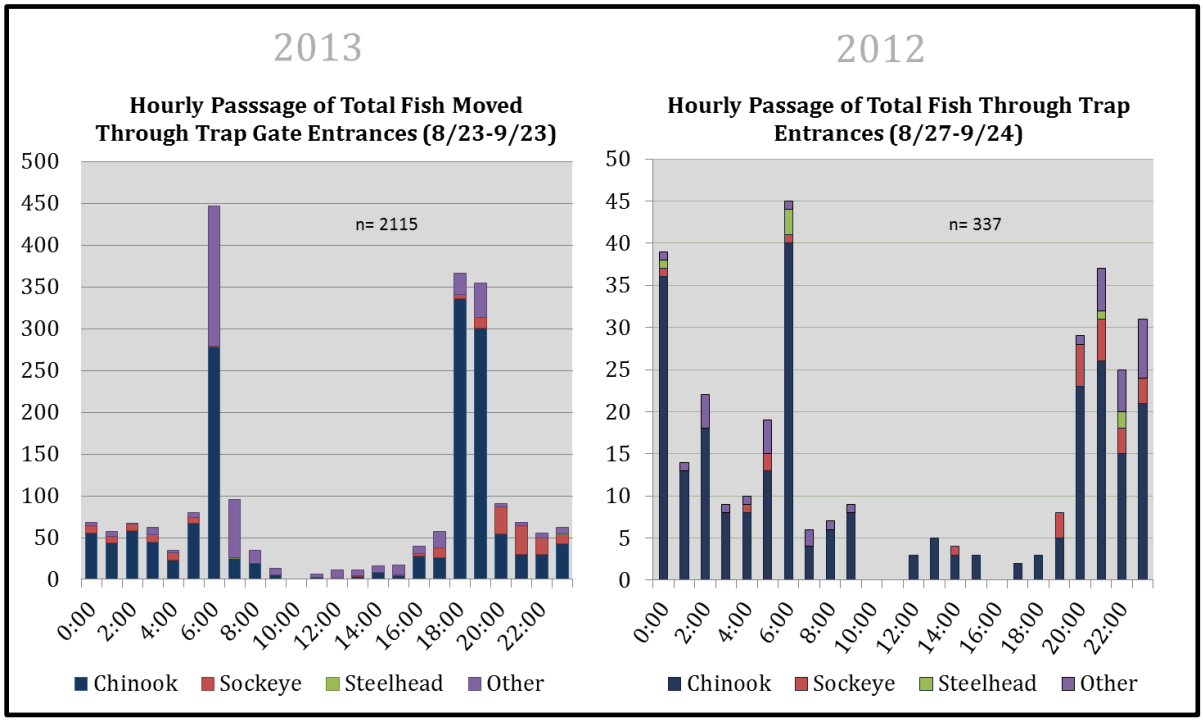


Figure 19. Fish passage through the lower Okanogan weir by hour in 2012 and 2013. 2013 includes fish that were trapped and removed. Comparisons between 2012 and 2013 should be made within the context of different run timing and environmental conditions of each year.

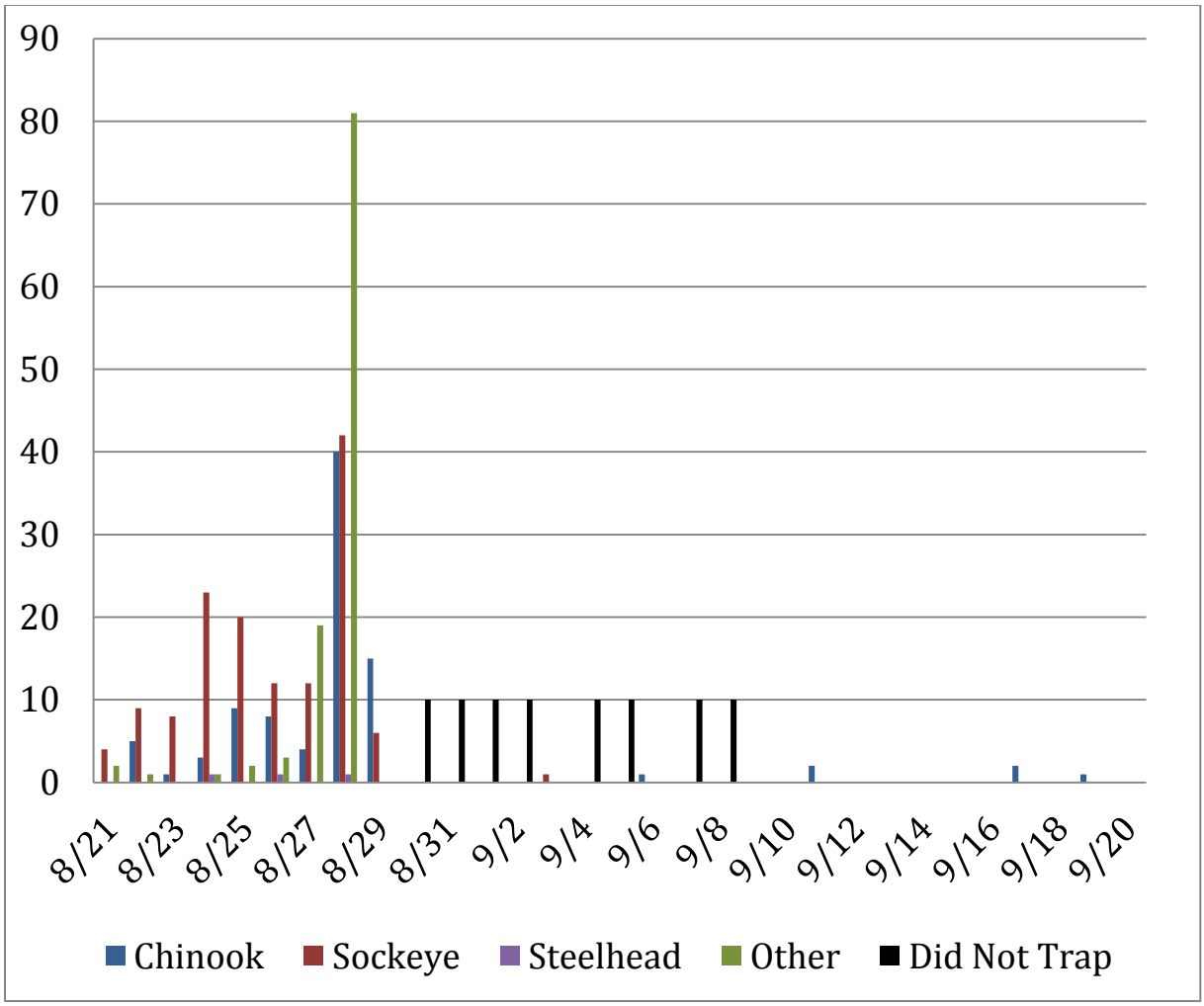


Figure 20. Composition of total fish trapped at the weir in 2013. Trapping generally occurred from 1600-0600.

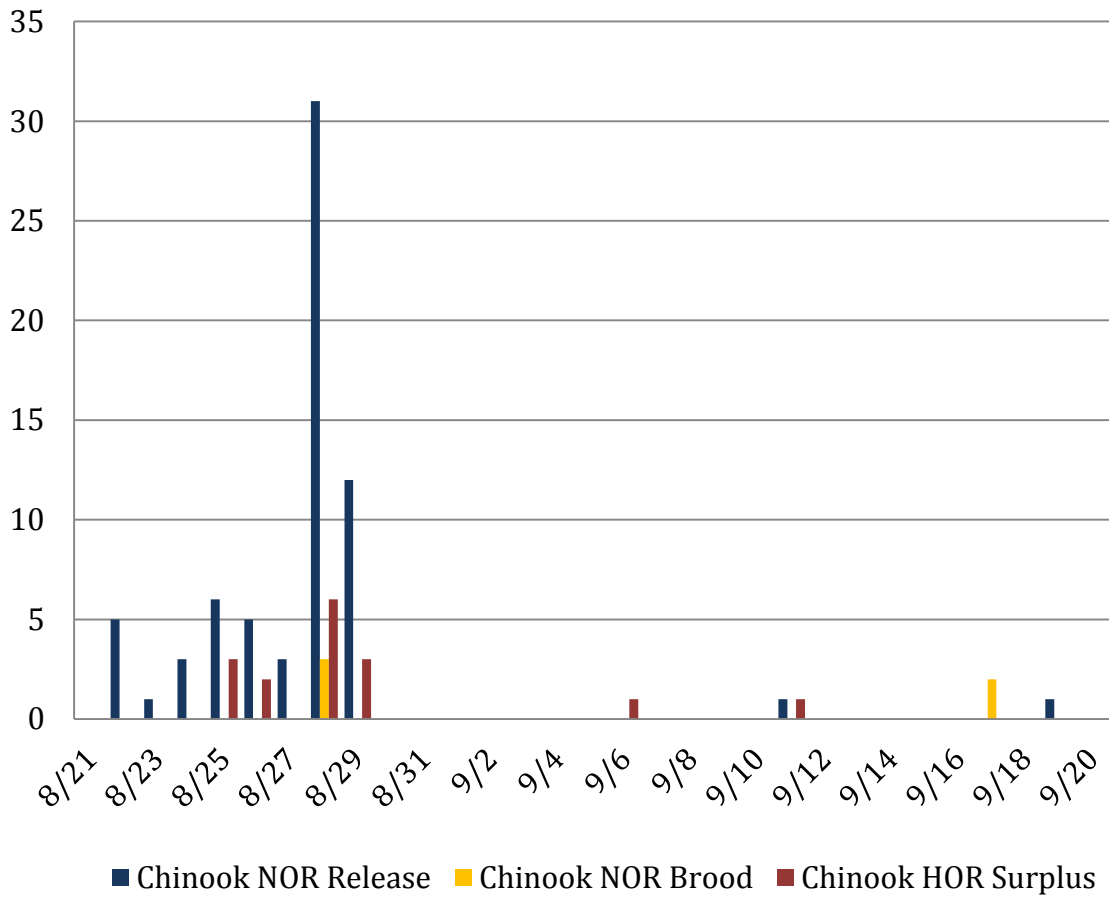


Figure 21. Final destination of Chinook captured in the weir trap during trapping operations in 2013.

Weir efficiency and effectiveness were metrics for evaluating the potential for the weir to contribute to future CJHP population management goals. In 2013, 0.009 of total spawning escapement was detected in the trap (i.e., weir efficiency) (Table 8). The potential weir effectiveness (if we had been removing all of the HOR encountered) was 0.006.

Table 8. The number of hatchery- and natural-origin Chinook Salmon encountered at the lower Okanogan weir in 2013.

Survey Year	Number of summer/fall Chinook carcasses					
	Chinook Adults Encountered in the Weir Trap		Chinook Spawning Escapement Estimates[c]		Weir Metrics	
	Natural Origin (NOR)	Hatchery Origin (HOR)	Natural Origin (NOS)	Hatchery Origin (HOS)	Weir Efficiency[a]	Weir Effectiveness[b]
2013	67	17	5,956	2,237	0.009	0.006

[a] Estimates for weir efficiency are adjusted for prespawn mortality and include Chinook adults that are harvested, released, and collected for brood.

[b] Estimates for weir effectiveness are adjusted for prespawn mortality and include Chinook adults that are harvested or removed for pHOS management.

[c] Estimates do not include Chinook Zosel Dam counts.

Redd Surveys

In 2013, 3,547 summer/fall Chinook redds were counted in the Okanogan and Similkameen rivers using a combination of ground and aerial surveys(Table 9, Figure 22). The number of redds counted in 2013 was considerably higher than the long-term or more recent (5- and 10-year) averages (Table 9). The redd count in the Similkameen was fairly close to the 5- and 10-year averages; however, in the Okanogan the 2013 count was considerably higher than the 5- and 10-year averages (Table 9). The majority of Chinook redds were located in O6 (47%) and S1 (35%), approximately 6% were in O3-O4 (Hwy 20 bridge in Okanogan to Riverside) and less than 1% were found in O1-O2 (downstream of Hwy 20 bridge in Okanogan) (Table 10, Figure 23).

Total spawning escapement in 2013 was 8,194 (3,547 redds × 2.31 fish per redd) (Table 11). During the survey period 1989 through 2013, the summer/fall Chinook spawning escapement within the U.S. portion of the Okanogan River Basin averaged 5,091 and ranged from 473 to 13,857 (Table 11).

The majority of summer/fall Chinook redds were counted in the first week of spawning grounds surveys (Table 12). No new redds were encountered after October 25.

Table 9. Total number of redds counted in the Okanogan River Basin, 1989-2013 and the average for the total time series, the most recent 10 year and 5 year periods.

Survey Year	Number of summer Chinook redds		
	Okanogan River	Similkameen River	Total Count
1989	151	370	521
1990	99	147	246
1991	64	91	155
1992	53	57	110
1993	162	288	450
1994	375*	777	1,152
1995	267*	616	883
1996	116	419	535
1997	158	486	644
1998	88	276	364
1999	369	1,275	1,644
2000	549	993	1,542
2001	1,108	1,540	2,648
2002	2,667	3,358	6,025
2003	1,035	378	1,413
2004	1,327	1,660	2,987
2005	1,611	1,423	3,034
2006	2,592	1,666	4,258
2007	1,301	707	2,008
2008	1,146	1,000	2,146
2009	1,672	1,298	2,970
2010	1,011	1,107	2,118
2011	1,714	1,409	3,123
2012	1,613	1,066	2,679
2013	2,267	1,280	3,547
Average	***994***	***947***	***1,888***
5-yr Average	***1,655***	***1,232***	***2,887***

* Reach-expanded aerial counts.

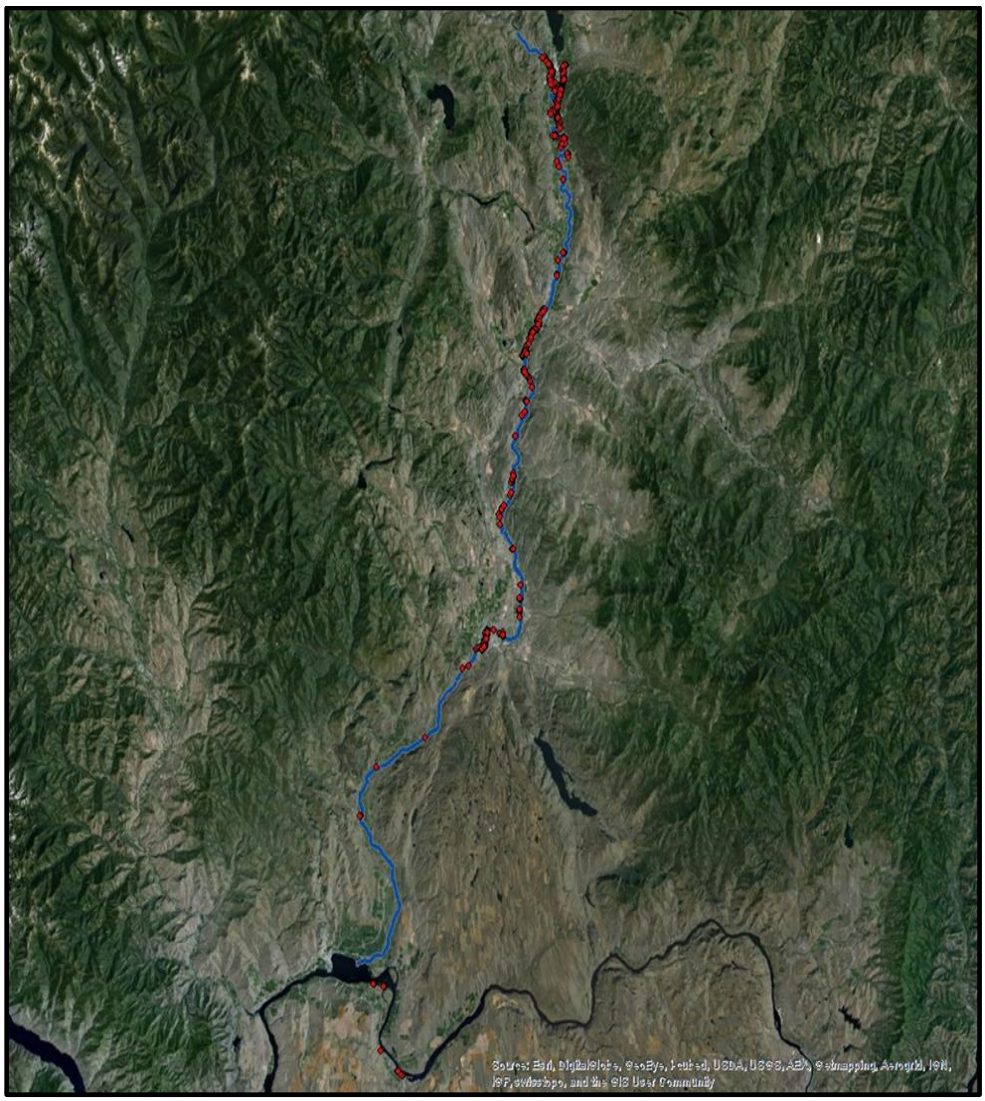


Figure 22. ArcGIS (aerial and ground survey) GPS-located redds of summer/fall Chinook in 2013. Individual redds are identified by red circles. However, this graphic is not intended to accurately represent redd counts in high density areas such as O6 and S1.

Table 10. The number of summer/fall Chinook redds in each reach of the Okanogan (O1-O6) and Similkameen (S1-S2) Rivers from 2006-2013.

Return Year	Number of Summer Chinook Redds								
	Okanogan						Similkameen		Total
	O-1	O-2	O-3	O-4	O-5	O-6	S-1	S-2	
2006	10	56	175	145	840	1366	1277	405	4274
2007	3	16	116	63	549	554	624	86	2011
2008	4	51	59	96	374	561	801	199	2145
2009	3	32	91	138	619	787	1091	207	2968
2010	9	58	67	89	357	431	895	212	2118
2011	3	20	101	55	593	942	1217	192	3123
2012	12	54	159	68	555	765	914	152	2679
2013	3	2	158	46	397	1661	1254	26	3547
Average	***6***	***36***	***116***	***88***	***536***	***883***	***1009***	***185***	***2858***

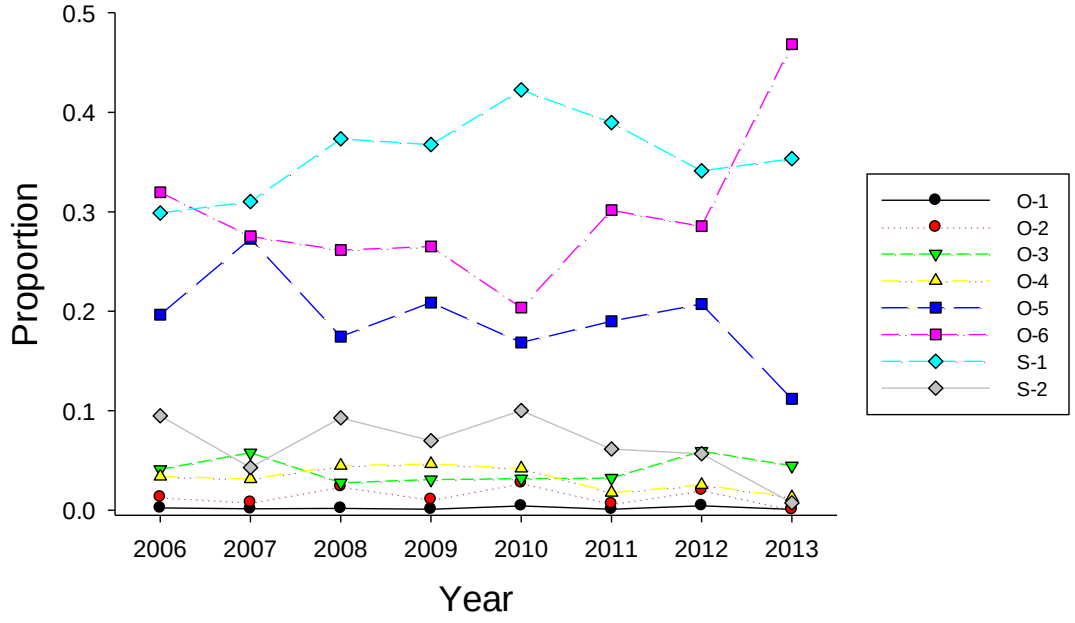


Figure 23. Proportion of redds in each reach of the Okanogan and Similkameen Rivers from 2006 to 2013.

Table 11. Spawning escapements for summer/fall Chinook in the Okanogan and Similkameen Rivers for return years 1989-2013.

Return Year	Fish/Redd Ratio	Spawning Escapement		
		Okanogan	Similkameen	Total
1989*	3.3	498	1,221	1,719
1990*	3.4	337	500	837
1991*	3.7	237	337	574
1992*	4.3	228	245	473
1993*	3.3	535	950	1,485
1994*	3.5	1,313	2,720	4,033
1995*	3.4	908	2,094	3,002
1996*	3.4	394	1,425	1,819
1997*	3.4	537	1,652	2,189
1998	3	264	828	1,092
1999	2.2	812	2,805	3,617
2000	2.4	1,318	2,383	3,701
2001	4.1	4,543	6,314	10,857
2002	2.3	6,134	7,723	13,857
2003	2.42	2,505	915	3,420
2004	2.25	2,986	3,735	6,721
2005	2.93	4,720	4,169	8,889
2006	2.02	5,236	3,365	8,601
2007	2.2	2,862	1,555	4,417
2008	3.25	3,725	3,250	6,975
2009	2.54	4,247	3,297	7,544
2010	2.81	2,841	3,111	5,952
2011	3.1	5,313	4,368	9,681
2012	3.07	4,952	3,273	8,225
2013	2.31	5,237	2,957	8,194
Average	***2.98***	***2,507***	***2,608***	***5,115***
5-Year Average	***2.77***	***4,518***	***3,401***	***7,919***

* Spawning escapement was calculated using the "Modified Meekin Method" (i.e., 3.1 × jack multiplier).

Table 12. Number and timing of new redd counts in reaches of the Okanogan and Similkameen Rivers in 2013.

Reach	Location (Rm)	Day of Month (October 7 to November 1)				Redd Count	Percent
		7-12	14-18	21-25	28- 1		
Okanogan River							
O1	0.0-16.9	0	1	2	0	3	0%
O2	16.9-26.1	2	0	0	0	2	0%
O3	26.1-30.7	46	112	0	0	158	5%
O4	30.7-40.7	6	29	11	0	46	1%
O5	40.7-56.8	257	97	43	0	397	11%
O6	56.8-77.4	1622	5	34	0	1661	47%
Total		**1933**	**244**	**90**	**0**	**2267**	**64%**
Similkameen River							
S1	0.0-1.8	794	354	106	0	1254	35%
S2	1.8-5.7	12	3	11	0	26	1%
Total		**806**	**357**	**117**	**0**	**1280**	**36%**

Escapement into Canada

In 2013 there were 2,275 adult summer/fall Chinook counted in the fishways of Zosel Dam (Table 13). That was the highest count on record and part of a continuing trend showing higher escapements above Zosel. Only 14% of the Chinook observed at Zosel Dam had a clipped adipose fin (i.e., hatchery-origin).

Table 13. Count of run escapement of adult summer/fall Chinook at Zosel Dam using video monitoring in the fishways.

Chinook Passage at Zosel Dam		
Year	**Video Count**	**% Hatchery**
2006	481	1%
2007	455	40%
2008	267	29%
2009	256	17%
2010	359	29%
2011	1415	36%
2012	826	24%
2013	2275	14%
Average	***792***	***24%***

Carcass Surveys

In 2013, 910 carcasses were recovered including 263 ad-clipped and 647 ad-present[5]. The carcass recovery rate was 11% of the total spawning escapement. Carcass recoveries in reaches O3 and O4 or S1 and S2 were recorded together due to the low number of carcasses sampled and a misunderstanding of the protocol. Therefore, a post-hoc estimate of carcasses recovered in those reaches was made such that the number of carcasses assigned to each of the reaches was equal to the relative proportion of redds detected in each reach of the combined sections. No DNA samples were collected from summer/fall Chinook carcasses in 2013. The majority (812; 89%) of carcasses were collected from reach O6 and S1 (Figure 24, also see Appendix D). The proportion of ad-present carcasses recovered in 2013 was noticeably higher in O6 and lower in O5 and S2 than the 10 year average (Figure 24, panel A). The proportion of ad-clipped carcasses recovered in 2013 was noticeably higher in O6 and S1 but lower in O5 and S2 than the 10 year average (Figure 24, panel B).

[5] Coded wire tag data was not available at the time of these analyses, therefore carcasses were not classified as natural- and hatchery-origin, but rather ad-clipped and ad-present.

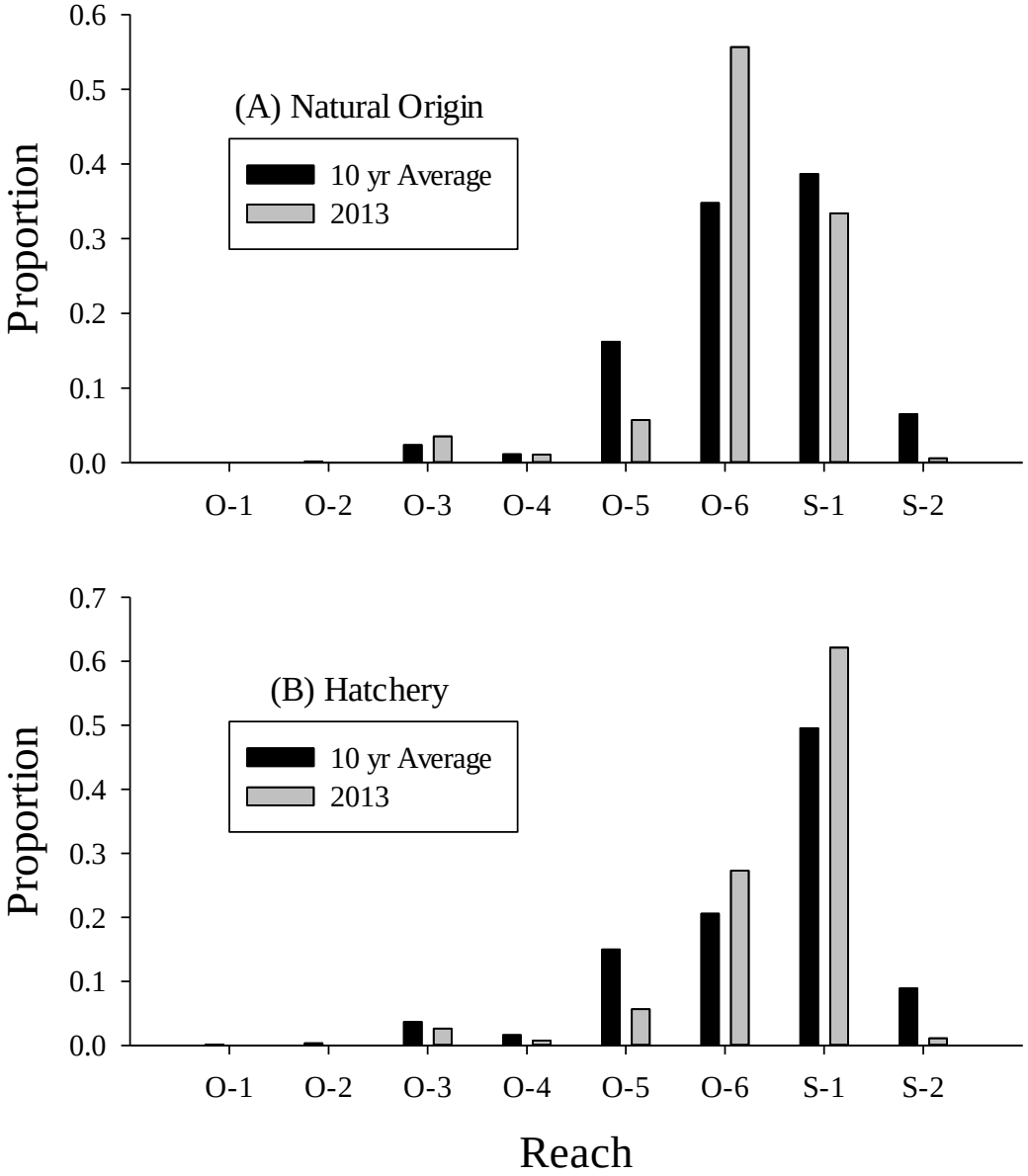


Figure 24. Between-reach proportion of ad-present- (A) and ad-clipped (B) summer/fall Chinook carcasses recovered in the Okanogan (O1-O6) and Similkameen (S1-S2) Rivers in 2013 and the 10 year average (2004-2013).

In the Similkameen River, no female carcasses were sampled with 5,000 eggs, so pre-spawn mortality was estimated to be 0.0%. The egg retention rate for Similkameen spawners was 0.44% (Table 14). In the Okanogan River, no females were sampled with 5,000 eggs, so pre-spawn mortality was estimated to be 0.0%. The egg retention rate for

Okanogan spawners was 0.82%. The egg retention rate for hatchery fish was three times higher than for wild fish (Table 14).

Table 14. Egg retention and pre-spawn mortality of sampled summer/fall Chinook carcasses in the Okanogan Basin in 2013 (*n* = 910).

Survey Area	Adipose	Total Carcasses Sampled	Female Carcasses Sampled	% Female	[1]Egg Retention Rate	Pre-spawn Mortality	% Females w/ >1,000 eggs retained
Okanogan R.	Clipped	96	62	64.58%	1.93%	0	3.23%
Okanogan R.	Present	427	188	44.03%	0.45%	0	0.53%
Okanogan R. Totals		**523**	**250**	**47.80%**	**0.82%**	**0**	**1.20%**
Similkameen R.	Clipped	167	151	90.42%	0.63%	0	0.00%
Similkameen R.	Present	220	162	73.64%	0.26%	0	0.00%
Similkameen R. Totals		**387**	**313**	**80.88%**	**0.44%**	**0**	**0.00%**
[2]Okanogan Basin	Clipped	263	213	80.99%	1.01%	0	0.94%
[2]Okanogan Basin	Present	647	350	54.10%	0.36%	0	0.29%
[2]Okanogan Basin Totals		**910**	**563**	**61.87%**	**0.61%**	**0**	**0.53%**

[1]Assuming fecundity of 5,000 eggs per female, egg retention rate is calculated as: (# eggs estimated remaining in sampled female carcasses) / (# female carcasses sampled * 5,000 eggs each)

[2]Okanogan Basin = Okanogan River and Similkameen River, combined

pHOS AND PNI

There was a decrease in the proportion of hatchery-origin spawners across all reaches in the Okanogan and Similkameen rivers in 2013 compared to the 10-year average (Figure 25). Hatchery-origin spawners comprised 26% of the spawn escapement estimate in the U.S. portion of the Okanogan, which was the lowest (unadjusted) pHOS observed since 2005 (Table 15). After corrections for hatchery fish effectiveness assumptions and reach weighting, the final adjusted pHOS for 2013 was 0.24, which was considerably less than the five year average (0.39) (Table 15). Although the five year average failed to meet the biological objective for pHOS (<0.3), 2012 and 2013 were trending in a positive direction toward the objective (Figure 26).

The overall proportion of natural-origin fish in the broodstock in 2013 was 100% and the pNOB for Okanogan origin was 90% (Table 16). NOB were estimated based on an intact adipose fin and no CWT, scale confirmation is not yet available and the 2013 pNOB estimate will be corrected when the scale data is received from the lab. The resulting PNI for 2013 was 0.78, well above the Biological Objective (0.67). However, the five year average PNI (0.60) failed to meet the objective, but after two consecutive years above 0.67 it is trending in a positive direction toward the objective (Figure 27).

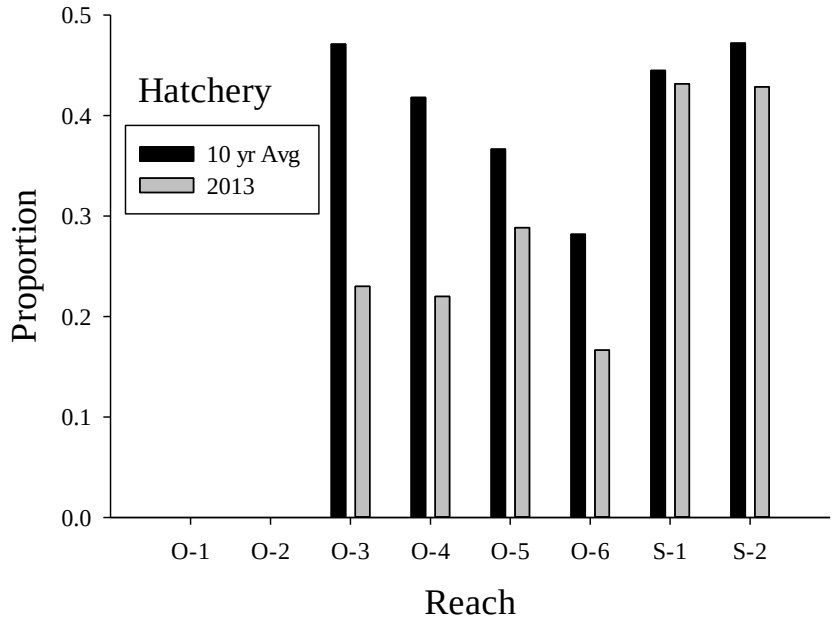


Figure 25. Within-reach pHOS Chinook carcasses recovered in each reach of the Okanogan (O1-O6) and SImilkameen (S1-S2) Rivers in 2013 and the 10 year average (2004-2013).

Table 15. Natural- (NOS) and hatchery- (HOS) origin spawner abundance and composition for the Okanogan River Basin, brood years 1989-2013

Brood Year	Spawners				
	NOS	HOS	pHOS	[1]Effective pHOS	[2]Effective, Reach-weighted pHOS
1989	1,719	0	0	0	-
1990	837	0	0	0	-
1991	574	0	0	0	-
1992	473	0	0	0	-
1993	915	570	0.38	0.33	-
1994	1,323	2,710	0.67	0.62	-
1995	979	2,023	0.67	0.62	-
1996	568	1,251	0.69	0.64	-
1997	862	1,327	0.61	0.55	-
1998	600	492	0.45	0.40	-
1999	1,274	2,343	0.65	0.60	-
2000	1,174	2,527	0.68	0.63	-
2001	4,306	6,551	0.60	0.55	-
2002	4,346	9,511	0.69	0.64	-
2003	1,933	1,487	0.43	0.38	-
2004	5,309	1,412	0.21	0.18	-
2005	6,441	2,448	0.28	0.23	-
2006	5,507	3,094	0.36	0.31	0.18
2007	2,983	1,434	0.32	0.28	0.32
2008	2,998	3,977	0.57	0.51	0.54
2009	4,204	3,340	0.44	0.39	0.40
2010	3,189	2,763	0.46	0.41	0.41
2011	4,642	5,039	0.52	0.46	0.47
2012	4,840	3,385	0.41	0.36	0.40
2013	5,956	2,237	0.27	0.23	0.24
Average	***2,718***	***2,397***	***0.47***	***0.41***	***0.37***
5-yr Avg.	***4,566***	***3,353***	***0.42***	***0.37***	***0.39***

[1]Effective pHOS weighted hatchery spawners at 0.8 per fish as an estimate of relative reproductive success.

[2]The reach-weighted adjustment used the proportion of redds in each reach to correct for carcass sampling bias in the survey design and field efforts. Redds could only be apportioned to the reach in which they were detected back to 2006.

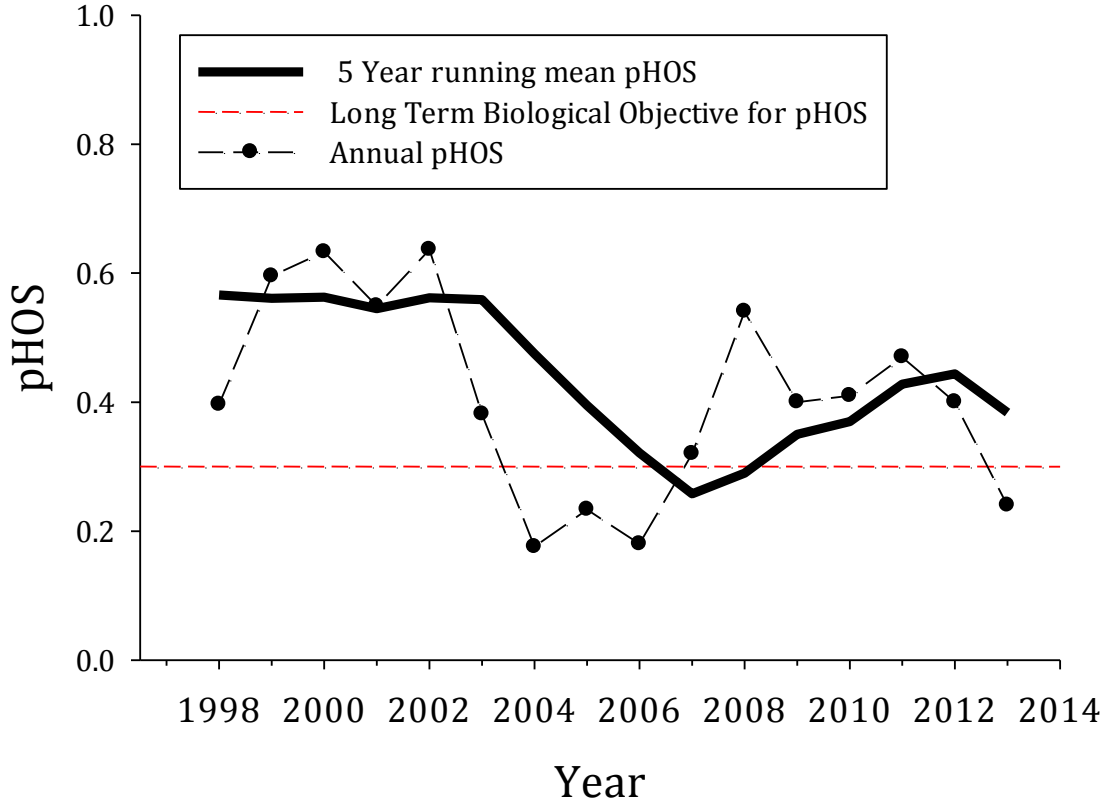


Figure 26. The proportion of hatchery-origin spawners (pHOS) in the Okanogan and Similkameen Rivers from 1998-2013. pHOS was adjusted for the hatchery fish effectiveness assumption (0.8; all years) and the proportion of redds in each reach (2006-2013).

Table 16. Okanogan River summer Chinook spawn escapement and broodstock composition, and calculated pHOS and PNI for Brood Years 1989-2013.

Brood Year	Spawners			Broodstock					PNI	Okan. PNI
	NOS	HOS	pHOS[1]	NOB	Okan. NOB	HOB	pNOB	Okan. pNOB		
1989	1,719	0	0.00	1,297		312	0.81		1.00	
1990	837	0	0.00	828		206	0.80		1.00	
1991	574	0	0.00	924		314	0.75		1.00	
1992	473	0	0.00	297		406	0.42		1.00	
1993	915	570	0.33	681		388	0.64		0.66	
1994	1,323	2,710	0.62	341		244	0.58		0.48	
1995	979	2,023	0.62	173		240	0.42		0.40	
1996	568	1,251	0.64	287		155	0.65		0.50	
1997	862	1,327	0.55	197		265	0.43		0.44	
1998	600	492	0.40	153	77	211	0.42	0.21	0.51	0.35
1999	1,274	2,343	0.60	224	112	289	0.44	0.22	0.42	0.27
2000	1,174	2,527	0.63	164	82	337	0.33	0.16	0.34	0.21
2001	4,306	6,551	0.55	12	46	345	0.03	0.13	0.06	0.19
2002	4,346	9,511	0.64	247	124	241	0.51	0.25	0.44	0.29
2003	1,933	1,487	0.38	381	191	101	0.79	0.40	0.67	0.51
2004	5,309	1,412	0.18	506	253	16	0.97	0.48	0.85	0.73
2005	6,441	2,448	0.23	391	196	9	0.98	0.49	0.81	0.68
2006	5,507	3,094	0.18	500	250	10	0.98	0.49	0.85	0.73
2007	2,983	1,434	0.32	456	228	17	0.96	0.48	0.75	0.60
2008	2,998	3,977	0.54	359	202	86	0.81	0.45	0.60	0.46
2009	4,204	3,340	0.40	503	254	4	0.99	0.50	0.71	0.55
2010	3,189	2,763	0.41	484	242	8	0.98	0.49	0.71	0.54
2011	4,642	5,039	0.47	467	332	26	0.95	0.67	0.67	0.59
2012	4,840	3,385	0.40	107	96	0	1.00	0.90	0.72	0.69
2013	5,956	2,237	0.24	353	318	0	1.00	0.90	0.81	0.79
Average	***2,718***	***2,397***	***0.47***	***413***	***188***	***169***	***0.76***	***0.43***	***0.62***	***0.48***
5-yr Avg.	***4,566***	***3,353***	***0.39***	***383***	***248***	***8***	***0.98***	***0.64***	***0.72***	***0.62***

[1] pHOS values are effective pHOS from 1989-2006 and effective, reach-weighted pHOS from 2006-2013

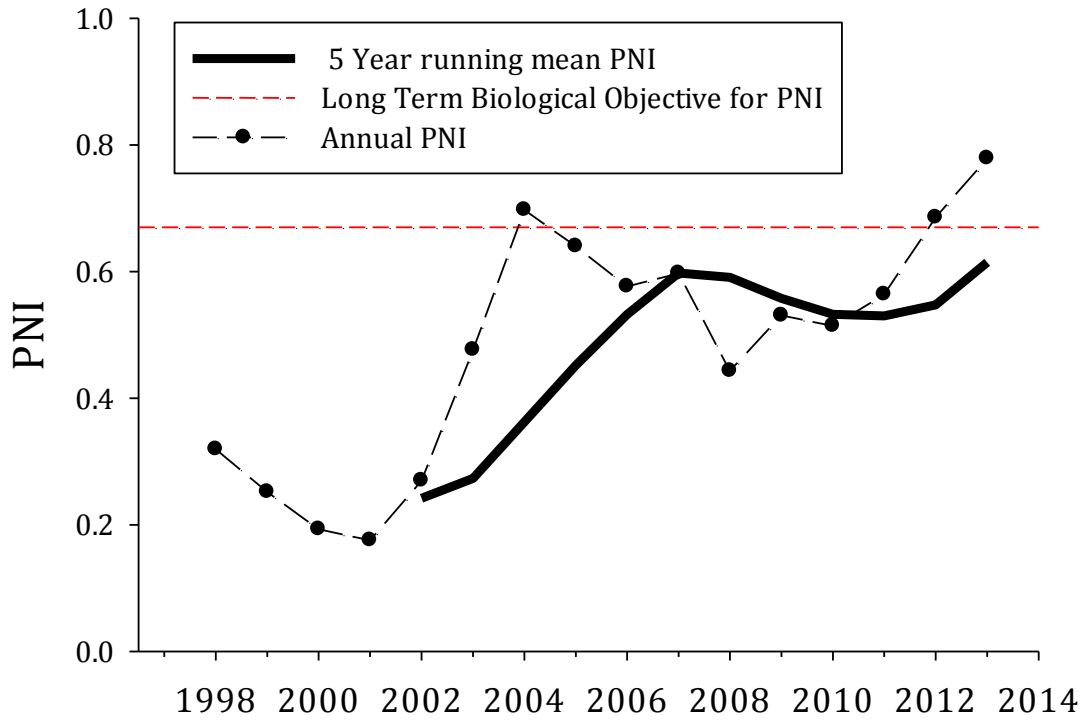


Figure 27. The proportionate natural influence (PNI) in the Okanogan and Similkameen Rivers from 1998 to 2013.

ORIGIN OF HATCHERY SPAWNERS

Strays Within the Okanogan.—The majority (95%) of hatchery-origin spawners recovered on the spawning grounds in 2013 were from Similkameen (81%) and Bonaparte (14%) pond releases (Table 17). This was very similar to the average (94%) of recent years (2006-2013). Strays from outside the Okanogan but within the Upper Columbia summer/fall Chinook ESU were most commonly from the mainstem Columbia River releases (e.g., Wells Hatchery and Turtle Rock). Strays from outside the ESU were very rare. Stray hatchery fish comprised 1.0% of total spawner composition (i.e., stray pHOS) (Table 18). This was less than the recent (2006-2013) average and well under the biological target of < 5%.

Strays Outside the Okanogan.—The most recent brood year that could be fully assessed (through age 5) for stray rate of Okanogan fish to areas outside the Okanogan was 2008. The 2008 brood year had a stray rate of less than 1%, which was less than the long term and recent five year averages (Table 19). The RMIS query did not reveal any Okanogan hatchery-origin CWT codes from spawning ground recoveries in non-target spawning areas. It was unclear if that was a real outcome or if the 2013 CWT results were just not yet available in RMIS for the other tributaries. Subsequent analysis for future

reports will reassess 2013 spawner composition in those areas. In general, stray hatchery fish from the Okanogan Basin hatchery programs have been less than 1% of the other tributary population's spawner composition and less than 3% for the Entiat and Chelan River spawning aggregates[6] (Table 20).

SMOLT-TO-ADULT RETURN

The most recent brood year that could be fully assessed (through age 5) for SAR was 2008. Based on expanded CWTs, the 2008 brood year had a SAR of 2.7%, which was considerably better than the long-term (1.4%) and 5 year (1.8%) averages (Table 21).

[6] The Entiat and Chelan River are evaluated separately here because they were not classified as independent populations within the ESU (Peven et al. 2010) and therefore may not be subject to the same biological targets as the Methow and Wenatchee populations.

Table 17. Estimated number (and percent of annual total) of hatchery-origin spawners from different release basins recovered on the Okanogan/Similkameen spawning grounds, based on CWT recoveries and expansions, for return years 2006-2013. For specific hatchery program releases contributing to strays in the Okanogan Basin see Appendix D.

Return Year	Release Site								
	Summer Chinook Run						Fall Chinook Run		
	Homing Fish		Straying Fish						
	Okanogan River Basin		Within ESU Stray					Out of ESU Stray	
	Okanogan River	Similkameen River	Methow River	Wenatchee River	Chelan River	Mainstem Columbia River	Mainstem Columbia River	Snake River	Other
2006	0 (0%)	709 (87%)	12 (2%)	12 (2%)	0 (0%)	81 (10%)	0 (0%)	0 (0%)	0 (0%)
2007	0 (0%)	1121 (95%)	17 (1%)	5 (0%)	0 (0%)	42 (4%)	0 (0%)	0 (0%)	0 (0%)
2008	0 (0%)	3224 (95%)	11 (0%)	24 (1%)	4 (0%)	133 (4%)	3 (0%)	0 (0%)	0 (0%)
2009	0 (0%)	2733 (95%)	14 (0%)	14 (0%)	9 (0%)	99 (3%)	0 (0%)	5 (0%)	4 (0%)
2010	4 (0%)	2165 (89%)	44 (2%)	35 (1%)	110 (5%)	75 (3%)	0 (0%)	4 (0%)	0 (0%)
2011	219 (5%)	4196 (93%)	44 (1%)	5 (0%)	34 (1%)	22 (0%)	0 (0%)	6 (0%)	0 (0%)
2012	379 (13%)	2397 (83%)	29 (1%)	23 (1%)	17 (1%)	52 (2%)	0 (0%)	0 (0%)	0 (0%)
2013	254 (14%)	1437 (81%)	10 (1%)	54 (3%)	0 (0%)	10 (1%)	0 (0%)	0 (0%)	0 (0%)
Average	107 (4%)	2248 (90%)	23 (1%)	21 (1%)	22 (1%)	64 (3%)	0 (0%)	2 (0%)	1 (0%)

Table 18. Estimated percent of spawner composition of hatchery-origin spawners from different release basins recovered on the Okanogan/Similkameen spawning grounds, based on CWT recoveries and expansions, for return years 2006-2013. For specific hatchery program releases contributing to strays in the Okanogan Basin see Appendix D

Return Year	Release Site									Stray pHOS	Total pHOS
	Summer Chinook Run						Fall Chinook Run				
	Homing Fish		Straying Fish								
	Okanogan River Basin		Within ESU Stray					Out of ESU Stray			
	Okanogan River	Similkameen River	Methow River	Wenatchee River	Chelan River	Mainstem Columbia River	Mainstem Columbia River	Snake River	Other		
2006	0.0%	15.6%	0.3%	0.3%	0.0%	1.8%	0.0%	0.0%	0.0%	2.3%	18.0%
2007	0.0%	30.0%	0.5%	0.1%	0.0%	1.1%	0.0%	0.0%	0.0%	1.7%	31.7%
2008	0.0%	51.5%	0.2%	0.4%	0.1%	2.1%	0.1%	0.0%	0.0%	2.8%	54.3%
2009	0.0%	38.4%	0.2%	0.2%	0.1%	1.4%	0.0%	0.1%	0.1%	2.0%	40.4%
2010	0.1%	36.5%	0.7%	0.6%	1.9%	1.3%	0.0%	0.1%	0.0%	4.5%	41.1%
2011	2.3%	43.9%	0.5%	0.1%	0.4%	0.2%	0.0%	0.1%	0.0%	1.2%	47.4%
2012	5.2%	32.9%	0.4%	0.3%	0.2%	0.7%	0.0%	0.0%	0.0%	1.7%	39.7%
2013	3.4%	19.5%	0.1%	0.7%	0.0%	0.1%	0.0%	0.0%	0.0%	1.0%	23.9%
Average	1.4%	33.5%	0.4%	0.3%	0.3%	1.1%	0.0%	0.0%	0.0%	2.2%	37.1%

Table 19. Number (n) and percent of hatchery-origin Okanogan summer/fall Chinook that homed to target spawning areas and in route hatcheries (Wells and Chief Joseph Hatchery), and number and percent that strayed to non-target spawning areas and non-target hatchery programs, brood years 1989-2008.

Brood Year	Homing				Straying			
	Okan. /Similk.		In Route Hatchery		Non-target Streams		Non-target Hatchery	
	n	%	n	%	n	%	n	%
1989	3,132	69.7%	1,328	29.6%	2	0.0%	31	0.7%
1990	729	71.4%	291	28.5%	0	0.0%	1	0.1%
1991	1,125	71.3%	453	28.7%	0	0.0%	0	0.0%
1992	1,264	68.5%	572	31.0%	8	0.4%	1	0.1%
1993	54	62.1%	32	36.8%	0	0.0%	1	1.1%
1994	924	80.8%	203	17.7%	16	1.4%	1	0.1%
1995	1,883	85.4%	271	12.3%	52	2.4%	0	0.0%
1996	27	100.0%	0	0.0%	0	0.0%	0	0.0%
1997	11,659	97.1%	309	2.6%	35	0.3%	2	0.0%
1998	2,784	95.4%	102	3.5%	31	1.1%	2	0.1%
1999	828	96.7%	18	2.1%	10	1.2%	0	0.0%
2000	2,091	93.8%	29	1.3%	94	4.2%	15	0.7%
2001	105	98.1%	2	1.9%	0	0.0%	0	0.0%
2002	702	96.2%	17	2.3%	11	1.5%	0	0.0%
2003	1,580	96.2%	47	2.9%	16	1.0%	0	0.0%
2004	4,947	94.4%	206	3.9%	85	1.6%	2	0.0%
2005	606	93.2%	22	3.4%	22	3.4%	0	0.0%
2006	5,210	97.6%	60	1.1%	68	1.3%	0	0.0%
2007	1,330	97.9%	19	1.4%	10	0.7%	0	0.0%
2008	3,559	98.3%	34	1.0%	22	0.6%	4	0.1%
Total	***44,539***	***90.7%***	***4,015***	***8.2%***	***482***	***1.0%***	***60***	***0.1%***
5-yr Total	***15,652***	***96.6%***	***341***	***2.1%***	***207***	***1.3%***	***6***	***0.0%***

Table 20. Number (n) and percent of spawning escapements that consisted of hatchery-origin Okanogan summer/fall Chinook within other non-target basins, return years 1994-2013.

Return Year	Wenatchee		Methow		Chelan		Entiat	
	n	%	n	%	n	%	n	%
1994	0	0.0%	0	0.0%	-	-	-	-
1995	0	0.0%	0	0.0%	-	-	-	-
1996	0	0.0%	0	0.0%	-	-	-	-
1997	0	0.0%	0	0.0%	-	-	-	-
1998	0	0.0%	0	0.0%	0	0.0%	0	0.0%
1999	0	0.0%	0	0.0%	0	0.0%	0	0.0%
2000	0	0.0%	6	0.5%	30	4.5%	0	0.0%
2001	12	0.1%	0	0.0%	10	1.0%	0	0.0%
2002	0	0.0%	3	0.1%	4	0.7%	5	1.0%
2003	0	0.0%	8	0.2%	22	5.3%	14	2.0%
2004	0	0.0%	0	0.0%	5	1.2%	0	0.0%
2005	5	0.1%	27	1.1%	36	6.9%	7	1.9%
2006	0	0.0%	5	0.2%	4	1.0%	2	30.0%
2007	0	0.0%	3	0.2%	4	2.1%	0	0.0%
2008	0	0.0%	9	0.5%	46	9.3%	4	1.3%
2009	15	0.2%	3	0.2%	11	1.8%	18	7.2%
2010	6	0.1%	0	0.0%	33	3.0%	0	0.0%
2011	0	0.0%	0	0.0%	45	7.3%	0	0.0%
2012	6	0.1%	5	0.2%	18	2.1%	0	0.0%
2013*	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	***44***	***0.0%***	***69***	***0.2%***	***268***	***2.9%***	***50***	***2.7%***
5-yr Total	***27***	***0.1%***	***8***	***0.1%***	***107***	***2.8%***	***18***	***1.4%***

* It was uncertain if none were detected or if the data had not yet been uploaded to the Regional Mark Information System database.

Table 21. Smolt-to-adult return rate (SARs) for Okanogan/Similkameen summer/fall Chinook, brood years 1989-2008.

Brood Year	Number of tagged smolts released[a]	Estimated adult captures[b]	SAR
1989	202,125	4,293	2.1%
1990	367,207	972	0.3%
1991	360,380	975	0.3%
1992	537,190	2,282	0.4%
1993	379,139	117	0.0%
1994	212,818	1,528	0.7%
1995	574,197	2,851	0.5%
1996	487,776	31	0.0%
1997	572,531	18,600	3.2%
1998	287,948	7,687	2.7%
1999	610,868	2,776	0.5%
2000	528,639	6,762	1.3%
2001	26,315	424	1.6%
2002	245,997	1,975	0.8%
2003	574,908	3,489	0.6%
2004	676,222	12,896	1.9%
2005	273,512	1,660	0.6%
2006	597,276	13,626	2.3%
2007	610,379	4,758	0.8%
2008	516,524	14,008	2.7%
Total	***4,948,588***	***70,061***	***1.4%***
5-yr Total	***2,673,913***	***46,948***	***1.8%***

[a] Includes all tag codes and CWT released fish (CWT + Ad Clip fish and CWT-only fish).

[b] Includes estimated recoveries (spawning grounds, hatcheries, harvest, etc.) and observed recoveries if estimated recoveries were unavailable.

Spring Chinook Presence and Distribution

Fourteen spring Chinook with a PIT tag were detected in the Okanogan Basin in 2013 (Table 22). However, two were likely summer Chinook based on adult run timing and one migrated over from the Methow as a juvenile in October. One of the 11 remaining spring Chinook adult returns left Salmon Creek on June 15 and was detected in the Methow Basin (at Spring Creek Acclimation Pond) on September 3. The final detection sites for the remaining adult spring Chinook in the Okanogan were Omak Creek (4), Salmon Creek (2), Canada/VDS3 (2), Antoine Creek (1) and Loup Loup Creek (1). Only one of the 10 fish was wild and the remaining nine were hatchery-origin (Table 22). Only one of the 9 hatchery fish had been tagged as a juvenile (at Mid-Valley Acclimation Pond in the Methow), the other eight were tagged as an adult at Wells Dam.

Table 22. PIT tag detections of spring Chinook in the Okanogan Basin in 2013. (H= Hatchery, U = Unknown, W = Wild). Although classified as spring Chinook in PTAGIS due to run timing when marked, the fish with adult detections after October 1 (grey shaded cells) were likely summer Chinook that were mis-classified at the time of tagging.

Tag Code	Origin	Release Site Name	Release Date	Mark Length mm	Recapture Date	Recapture Site Name
384.36F2B4DADB	H	Wells Dam	6/12/2013	590	6/12/2013	WEA - Wells Dam, DCPUD Adult Ladders
					6/15/2013	SA1 - Salmon Creek Instream Array
					9/3/2013	SCP - Spring Creek Acclimation Pond
3D9.1C2D77D892	H	Wells Dam	5/15/2013	720	5/15/2013	WEA - Wells Dam, DCPUD Adult Ladders
					6/24/2013	SA1 - Salmon Creek Instream Array
3D9.1C2D7ACDF3	H	Wells Dam	5/22/2013	780	5/31/2013	WEA - Wells Dam, DCPUD Adult Ladders
					7/23/2013	LLC - Loup Loup Creek Instream Array
3D9.1C2D83646A	H	Wells Dam	5/23/2013	520	5/23/2013	WEA - Wells Dam, DCPUD Adult Ladders
					6/22/2013	OMK - Omak Creek Instream Array

3D9.1C2D838D2D	H	Wells Dam	5/22/2013	690	5/22/2013	WEA - Wells Dam, DCPUD Adult Ladders
					6/15/2013	OKC - Okanagan Channel at VDS-3
3D9.1C2D83D325	H	Wells Dam	5/22/2013	490	5/22/2013	WEA - Wells Dam, DCPUD Adult Ladders
					6/15/2013	OMK - Omak Creek Instream Array
3D9.1C2D92542B	H	Wells Dam	6/4/2013	660	7/4/2013	WEA - Wells Dam, DCPUD Adult Ladders
					7/30/2013	OMK - Omak Creek Instream Array
3D9.1C2D92B1C3	H	Wells Dam	5/31/2013	530	5/31/2013	WEA - Wells Dam, DCPUD Adult Ladders
					8/5/2013	OMK - Omak Creek Instream Array
3D9.1C2DAD9CEC	H	Mid-Valley Acclimation Pond, Methow	4/23/2012	116	4/30/2012	MVP - Mid-Valley Acclimation Pond
					5/11/2012	RRJ - Rocky Reach Dam Juvenile
					5/4/2013	BO4 - Bonneville WA Ladder Slots
					5/6/2013	TD1 - The Dalles East Fish Ladder
					5/10/2013	MC1 - McNary Oregon Shore Ladder
					5/18/2013	PRA - Priest Rapids Adult
					5/24/2013	RIA - Rock Island Adult
					5/25/2013	RRF - Rocky Reach Fishways
					5/27/2013	WEA - Wells Dam, DCPUD Adult Ladders
					6/20/2013	ANT - Antoine Creek Instream Array
3D9.1C2DDC6754	H	Wells Dam	6/3/2013	730	6/3/2013	WEA - Wells Dam, DCPUD Adult Ladders
					6/7/2013	SA1 - Salmon Creek

						Instream Array
3D9.1C2DDC9E09	H	Wells Dam	6/17/2013	670	6/17/2013	WEA - Wells Dam, DCPUD Adult Ladders
					10/1/2013	ZSL - Zosel Dam Adult Fishways
3D9.1C2D3FCACE	U	Rock Island Dam	5/13/2010	150	5/29/2010	MCJ - McNary Dam Juvenile
					8/4/2013	BO3 - Bonneville WA Shore Ladder/AFF
					9/15/2013	TD1 - The Dalles East Fish Ladder
					9/22/2013	MC1 - McNary Oregon Shore Ladder
					9/29/2013	PRA - Priest Rapids Adult
					10/6/2013	RRF - Rocky Reach Fishways
					10/9/2013	WEA - Wells Dam, DCPUD Adult Ladders
					10/12/2013	OKL - Lower Okanogan Instream Array
3D9.1BF1CEB9FF	W	Wells Dam	5/16/2013	800	5/25/2013	WEA - Wells Dam, DCPUD Adult Ladders
					8/21/2013	OKC - Okanagan Channel at VDS-3
3D9.1C2DD9F9E7	W	Methow River	10/7/2013	115	10/15/2013	OKL - Lower Okanogan Instream Array

DISCUSSION

Rotary Smolt Traps (RST)

The RST captured over 7,000 fish, including nearly 4,000 natural-origin subyearling Chinook. Unfortunately, high flows resulted in 17 non-trapping days, and a drifting tree took out one of the smolt traps for the remainder of the season. Additionally, fish size and low capture rates at the highest and lowest flow levels only allowed for capture efficiency trials over a fairly narrow range of flows. These factors resulted in low confidence in the expanded estimate of total out-migrating smolts.

NOAA Fisheries suggested a goal for precision of juvenile outmigration monitoring was to achieve a coefficient of variation (CV) of 15% or less (Crawford and Rumsey 2009). It is not clear that this level of precision is attainable in any large river system using conventional sampling methods such as a rotary screw trap. However, general premise of improving precision as much as possible so that management decisions can be made with confidence is the goal for the CJHP. An attempt was made in 2013 to collect the data necessary to use a new flow regression model that may be capable of a lower CV that meets the NOAA recommendation of 15% or less (Murdoch et al. 2012). However, because of the inability of river flow to explain variance in trap efficiency (r^2 = .0036), we were unable to use the flow-based regression model. The CJHP will continue to improve capture techniques to increase the precision of juvenile production estimates. Environmental factors such as river discharge, configuration, and trap size influenced the efficiencies of these trials. In 2013 and previous years, CJHP performed mark-recapture trials using a pooled Peterson estimator with a Chapman modification to produce population estimates of natural-origin chinook fry and smolts (Rayton and Wagner 2006). Because of high and variable flows that affected trapping efficiency, resulting estimates of production have had a relatively wide confidence interval (CJHP 2009).

Additional recommendations for the future (2014) include the use of a 1.5 m RST in place of one of the 2.4 m traps to increase the capture rate of target fish along the margin. The 1.5 m trap can be fished closer to shore at lower flows which will expand the range of flow conditions that can be trapped.

Juvenile Beach Seine

Discussion regarding the beach seining and tagging will be limited due to the draft status of the DPUD report. Primarily, the objective of including beach seining effort in this 2013 annual report was to document the methods used by Douglas County and Biomark, and to set up the project for CJHP to take over in 2014. Given the low catch rate of taggable summer/fall Chinook from the RST, beach seining appears to be a more reliable opportunity to capture large numbers of taggable summer/fall Chinook juveniles.

Although capture locations in 2013 were limited, fish were captured in areas that could also be used by juveniles originating from Methow and Columbia River spawning areas. Therefore, future analyses of returning adults will need to take this into account by recognizing that some fish may not be destined for the Okanogan. Perhaps releases from areas other than immediately downstream of the Okanogan confluence can be filtered out. However, the information in the draft DPUD report did not articulate tag files by catch location. To improve and standardize future reporting efforts, CJHP staff should work with DPUD study implementers to gain a better understanding of the data and how best to evaluate it for returning adults.

Lower Okanogan Adult Fish Pilot Weir

Temperature and discharge conditions on the Okanagan River in 2013 were fairly typical, allowing for installation and operation of the weir in August and capture and observation of many Chinook and Sockeye. The thermal barrier did not appear to break down very abruptly in 2013. Temperature slowly dropped below 22.5 °C in late August and the mode of fish passage occurred about four days after the mean daily temperature dropped below 22.0 °C. With only one year of data, further speculation regarding the relationship between temperature at Malott and the post thermal barrier passage of mid-late arriving summer Chinook is not merited. However, continued monitoring of Chinook passage through the weir with respect to temperatures should continue in order to better refine weir operations and future expectations for weir effectiveness.

None of the water quality parameters monitored were at a level that would cause concern regarding an environmental effect of the weir on water quality. However, due to the rainstorms in early September, discharge and ambient turbidity increased to a level that prohibited effective observations, video, and trap operation.

The small number (22) of dead fish at the weir was encouraging, but the reality was that dead 'wash ups' were not a good indicator of weir effects. A fish kill upstream that had nothing to do with the weir could cause many fish to wash up on the upstream side of the weir. Conversely, any adverse effects of the weir would not have been detected if fish carcasses were stranded on shore or taken by scavengers before washing up on the weir. However, behavioral observations and the lack of fish impinged between pickets (head upstream) were good indicators that this weir configuration and picket spacing were not a major cause of direct mortality. No data were collected to assess indirect mortality.

Tower observations were limited to daylight hours and their quality and accuracy was affected by wind, cloud cover, and time of day (sunlight and shadows differentially affected river left in the morning). These effects were not quantified. The broad array of behavior types and the similarities between some of them limited the utility of the tower observation data. Tower observations were thought to be an important component of the fish monitoring data for weir effects and effectiveness, and perhaps they would have been if

fish had responded differently to the weir. However, given the qualitative nature of the observations there is not much that can be said about the results. It seems intuitive that staff on site ought to be observing and recording data regarding fish presence/absence and activity when the weir is in active fishing mode, but this qualitative information may never prove to be very useful in a post-hoc assessment.

Snorkel surveys revealed relatively few fish observations. With only three to four snorkelers in such a large river there was not 100% lateral coverage. Additionally, turbid water limited visibility to approximately two to three meters, so snorkelers did not have a continuous view of the river bottom in the deep pools. It was also possible that fish dissuaded by the weir could have moved further downstream before dying. However, we believe that coverage was sufficient to detect a major mortality event below the weir, if one had occurred. We recommend that alternatives to snorkeling be pursued in the future to better capture downstream fish observations. It is possible that bank observations or raft floats could provide adequate downstream information regarding fish activity and carcasses more efficiently than snorkeling.

The video monitoring provided a good estimate of fish moving through the trap until September 9, 2013 when rainstorms increased flow and turbidity. Video counts suggested that we did observe the post thermal barrier movement of Chinook Salmon into the Okanogan River in 2013. In 2012, staff observed many Chinook passing the weir before construction was complete and video monitoring was in place. Therefore, direct comparisons between 2012 and 2013 passage timing and behavior cannot be made.

Weir trapping and fish handling commenced for the first time in 2013. Natural-origin Chinook were successfully trapped and released into the river. A test on hatchery-origin broodstock was successfully implemented and there was 100% survival to spawning. Similar to 2012, many sockeye were observed swimming through the 2.5 to 3.0 inch picket spacing that was intended for that purpose. Unfortunately, there was no way to quantify the number of Sockeye that swam through the weir panels versus those that entered the trap. Certainly, many jack and perhaps small adult Chinook also escaped through the weir panels that were intended to allow Sockeye passage. We recommend continued testing of picket spacing configurations to increase the efficiency of Chinook trapping without causing too many Sockeye to also use the trap.

There was no way to know how many fish escaped past the weir before it was installed or how many fish swam through, around or jumped over the wings after it was installed. However, we were able to relate observations at the weir to estimates of total spawners and evaluate efficiency and effectiveness of the weir. The potential weir effectiveness measure of 15% shows high potential for using the weir as an important tool for pHOS management. Only 29% of the Chinook that were counted on video were positively identified as adipose fin present or absent. It was unclear if there was bias in that

estimate towards or against hatchery fish when using video to try to identify the presence or absence of an adipose fin. Continuing these evaluations in future years will be critical to determining the long-term viability of the weir as a fish management tool for summer Chinook.

The test of survival for broodstock collected at the weir was successful. However, because the fish were not spawned, egg viability was not evaluated. Regardless, the high survival rate provided confidence that the weir can be used for broodstock collection in the future. We recommend a continued risk-averse approach to broodstock collection at the weir in 2014, particularly if natural-origin broodstock are collected. The effects on survival and egg viability due to prolonged prespawn holding in the Columbia River and late migration into the relatively warm Okanogan have not been evaluated.

Recommended Weir and Trap Changes for 2014.—In January and February of 2014, CJHP staff convened a post-season review to discuss data, operations and recommendations for improvements/changes to the weir and weir operations. A summary of the 2013 weir operations was also presented at the 4th Annual Chief Joseph Hatchery APR. The following recommendations are derived from the 2013 post-season analysis and discussions at the APR:

1. Install walkway and grating;
2. Install additional walkway access point section;
3. Live box(s)/ transport carts for broodstock;
4. New power drop located near upstream access point;
5. Move trap ~5 m upstream;
6. Add 4.6 m^2 (50 ft^2)of trap space (one additional section);
7. Add two more sections of 'catwalk' on the trap;
8. Streambed sealing apron;
9. Leveling lift system;
10. Trap ingress/egress ladder;
11. Recessed video and light housings;
12. Positive pressure gate operating system;
13. Adjusting entry and crowder gate alignment;
14. Install PIT detection arrays on both entry doors;
15. Continue third year of pilot testing to refine the weir configuration that is effective at entraining and trapping targeted fish;
16. Establish and publish protocols and methods for live capture/live release of native non-target fish and lethal removal of non-native fish;
17. Establish and publish protocols and methods for capture and removal of hatchery-origin summer/fall Chinook to meet adult fish management goals (i.e., biological targets for pHOS and PNI).

18. Establish and publish protocols and methods for capture and transport of summer/fall Chinook for broodstock. Initial target discussed at the APR was 15% of NOR to be collected from the weir after the post thermal barrier passage;
19. More closely evaluate the 7.6 cm (3 in) picket spacing as it relates to Chinook passage;
20. Explore alternative methods (besides snorkeling) for evaluating fish presence/absence below the weir.
21. Evaluate "effectiveness" of the weir at contributing to CJHP program goals (pHOS reduction and NOR broodstock collection).
22. Collect biological, physical and environmental data sufficient to assess the "effects" of the weir and for environmental compliance reviews.

Redd Surveys

Overall spawning activity was high in 2013, with the third highest redd counts observed in the Okanogan River Basin since redd surveys began (Table 10). The spawn cycle was characterized by an all-time high redd count in reach O6, higher than average redd counts in reach S1, and a reduction in spawning activity in reach S2 (Table 10).

In addition to the redd count, the overall percent of natural-origin carcasses recovered in reach O6 was also the highest on record. Summer/fall Chinook may be responding to seasonal increased flow in reach O6 that is likely due to the cross-channel instream structure that was installed in 2010. Conversely, it was unclear why there were substantially fewer redds in S2 when compared to recent or long term averages. One objective of the new CJHP is to increase spawning distribution in the lower reaches of the Okanogan where a low proportion of the spawning activity has traditionally occurred. Continued monitoring of redd and carcass distribution will be critical to evaluation of this metric.

Although aerial surveys contributed a relatively small portion of the observed redds, they were very important for documenting that no spawning is occurring in areas not surveyed with a ground crew, and for enumerating redds in non-floated, low density spawning areas. We recommend that future aerial surveys extend into the second week in November to begin looking for late (i.e., November) spawning Chinook redds. Traditionally, there has been no documented effort with ground or aerial surveys to document or quantify late spawning Chinook.

Redd surveys should have started earlier because the majority of redds were counted in the first week of surveys. Ideally, redd surveys should begin at the onset of spawning. However, given that there was no turbidity or sediment deposition at that time of year, redd life was likely long enough that we did not miss redds.

The fish per redd expansion was based on the sex ratio at Wells Dam. This method has been used since at least 1998 (Hillman et al. 2014) and is still being applied to both the Methow and Okanogan populations. However, we are not confident that the combined sex ratio of hatchery and wild summer Chinook at Wells Dam is representative of the Okanogan population because it includes Methow returns as well as mainstem released hatchery fish and downstream hatchery and wild fish. If the Okanogan has fewer precocial males (jacks), then the Okanogan abundance estimate would be biased high. We recommend exploring other approaches to estimating the number of fish per redd in the Okanogan and Similkameen Rivers.

ESCAPEMENT INTO CANADA

Escapement of summer/fall Chinook into Canada had been largely overlooked until recently, when the video counts of Chinook passing over Zosel Dam increased to a level where OBMEP staff brought the results to the attention of CJHP staff. Spawning escapement in Canada is still unknown, as the video counts represent run escapement and the relationship between run escapement and spawn escapement is not clear. Informal discussions with Canadian biologists indicate that small numbers (i.e., substantially fewer than the Zosel Dam video counts) of Chinook spawners have been detected building redds in the Canadian portion of the Okanogan River (R. Bussanich, ONA, pers. comm., 2014). This discrepancy has at least three possible explanations that need to be further explored in the coming years.

1) Chinook can migrate downstream through Zosel Dam without being detected in the fishways video monitoring system (currently not thought to be a possibility because Zosel Dam floodgates were not opened wide enough to allow for Chinook passage during times of summer/fall Chinook presence in 2013; Sonya Schaller, CCT, pers. comm., 2013).
2) Chinook are making it to spawning areas in the Canadian Okanogan and not being detected by Canadian spawning ground surveys. These surveys currently target sockeye, but the spawn timing and potential spawning areas are similar.
3) High pre-spawn mortality kills fish between passage at Zosel Dam and potential spawning grounds somewhere in Canada.

Some possible solutions to exploring these explanations include:

a) Evaluate PIT tag results for fish that might ascend through the fishways multiple times (this will not account for fish that fall back once and don't re-ascend).
b) Conduct more extensive surveys in Canadian Okanagan River of larger substrate areas during peak summer Chinook spawning (mid-late October). It is not clear where, when, or if there are gaps in time and space that would allow Chinook spawning to go undetected.

c) Conduct carcass surveys above Zosel Dam, throughout Lake Osoyoos and the Canadian Okanogan looking for pre-spawn mortality.
d) Capture and radio tag fish in the Zosel fishways.

Until a definitive method is developed for estimating spawn escapement in Canada, the CJHP will continue to monitor and report run escapement via video monitoring. However, we will not add run escapement past Zosel Dam to spawn escapement in the U.S. because this could overestimate total spawners if explanation 1 or 3 (see list above) are true.

Carcass Surveys

The carcass recovery effort fell short of the target sample rate (12% rather than 20%). Although there were several contributing factors, the bottom line is we fell short of the goal and have plans to remedy that in the future. It is not clear what the ramifications are to the analyses from having a sample rate lower than 20%.

It was likely that some of the assumptions were not met, due to possible carcass recovery biases. Zhou (2002) reported fish length as a significant factor in carcass recovery probability, with larger fish recovered at a higher rate than smaller fish. This is especially important as it relates to precocious males, or jacks, which are expected to occur with higher frequencies in hatchery-origin Chinook. Failing to assess and correct for biases and population discrepancies could lead to potential underestimation of hatchery-origin Chinook survival (resulting in inflated hatchery production) or over-estimation of wild-origin Chinook survival (masking potentially negative effects of the hatchery program), according to Murdoch et al. (2010).

Egg retention and pre-spawn mortality results should be interpreted cautiously. Carcass collection for examination did not begin in 2013 until October 10. Redd surveys show this date to be later than the onset of spawning activity. The carcasses of fish that died prior to the onset of spawning and before sampling began may have been carried downstream of recovery floats, consumed by scavengers, or covered with sediment, making them unavailable for sampling or harder to detect and collect. This could result in an underestimation of pre-spawn mortality. The protocol in 2013 assumed that each fish should have 5,000 eggs and were only considered pre-spawn mortality if they retained all 5,000 eggs. A static fecundity assumption may not be the best approach because younger and smaller females will likely have fewer eggs. Additionally, the current assumption used by the CJH during spawning activities for average fecundity is 4,600 eggs. We expanded the assessment to include an evaluation of fish that retained greater than 1,000 eggs as an attempt to capture some of the variability in fecundity and situations where fish died before depositing a biologically important portion of their eggs. We are not sure that 1,000 eggs is biologically important, but clearly there should be some amount of egg retention that matters besides 100%. Past efforts have focused the egg retention evaluation on the

Okanogan and Similkameen Rivers separately. We repeated that assessment in this report for consistency, but question the utility of analyzing these two rivers individually because they are one continuous spawning population. We added a hatchery- versus natural-origin assessment of egg retention and propose that is the meaningful metric that should be continued in the future. We recommend a review and modification of the egg retention estimation methods/protocol.

pHOS and PNI

The biological target for the program was to have a five year average pHOS less than 0.3. Although the five year mean failed to meet this objective, pHOS was less than 0.3 for the first time since 2006 and was on a positive trend towards the objective. The program met the biological target for PNI (>0.67) for the second year in a row. Although the five-year rolling mean failed to meet the objective, PNI is on a positive trend towards the objective. In the future, continued aggressive removal of hatchery fish through selective fisheries and adult management at the weir and hatchery ladder will be important for the program to meet the biological targets for pHOS and PNI.

Origin of Hatchery Spawners

Hatchery-origin fish recovered on the spawning grounds in the Okanogan Basin were predominantly (95%) from the Okanogan Basin releases. Stray hatchery fish from outside the Okanogan made up a very small percentage (<1%) of total spawners. Likewise, Okanogan Basin hatchery fish strayed to other areas at a low rate and were a small percentage (<3%) of the spawner composition in other Upper Columbia tributaries. Stray rates and hatchery spawner composition were within the target levels for the program both within and outside the Okanogan Basin.

Smolt-to-adult Return

In 2013, SAR was considerably above average for the most recent brood year available (2008). It is likely that the SAR estimate is biased low because some recovery efforts were not expanded within RMIS. We had no way to obtain information necessary to do these expansions or to even speculate as the magnitude of the potential error introduced because of it. In the future, we recommend also using PIT tags as an independent, additional estimate of SAR.

ADAPTIVE MANAGEMENT AND LESSONS LEARNED

The Annual Program Review (APR)

Each year the CJHP hosts a workshop to review and present findings from the previous year and plan for the upcoming fish production and science monitoring cycle. The APR was convened in March 2014 with the purpose of reviewing data collection efforts and results from 2013 and developing the hatchery implementation and monitoring plan for 2014 (Figure 28). This effort is focused on using adaptive management to guide the program. After a series of presentations highlighting the data collection activities and results, the group (CJHP staff and invited guests from federal, state, PUD, and other organizations) used the In-Season Implementation Tool (ISIT) during the "Analysis" step (Figure 29). The group reviewed the ISIT input parameters for key assumptions, status and trends and decision rules to be sure that the best available information was included in the model. ISIT then used the pre-season Upper Columbia summer/fall Chinook Salmon forecast to provide an estimate of how the program should be implemented with respect to broodstock collection, harvest, weir and hatchery ladder operations to achieve biological targets for 2014. APR materials with more details than what is provided within this report can be found at www.colvilletribes.com/cjhp.php.

Key Management Questions

Answering key management questions is an essential function of the CJHP and is central to the analysis and reporting steps in both the APR and this annual report. Management questions inform the development of the RM&E activities, the CJHPs Key Management Questions (KMQs) are:

1. What is the current status and recent historical trend of the naturally-spawning population in terms of Viable Salmonid Population (VSP) parameters[7]
2. What is the current status and recent historical trends for hatchery returns and harvest?
3. Is the hatchery program meeting target in-hatchery performance standards?
4. Are the hatchery post-release targets met for survival, catch contribution and straying?
5. Are targets for total catch contribution and selectivity for HORs met?
6. Are there negative effects of the hatchery on the natural population?
7. Are assumptions about natural production potential valid?
8. How should the program be operated in the coming year?

[7] From McElhany, 2000 (NOAA), a viable salmonid population is an independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100-year time frame. The four VSP parameters are abundance, productivity, spatial structure and diversity.

Figure 28. The Chief Joseph Hatchery's annual planning process and work flow.

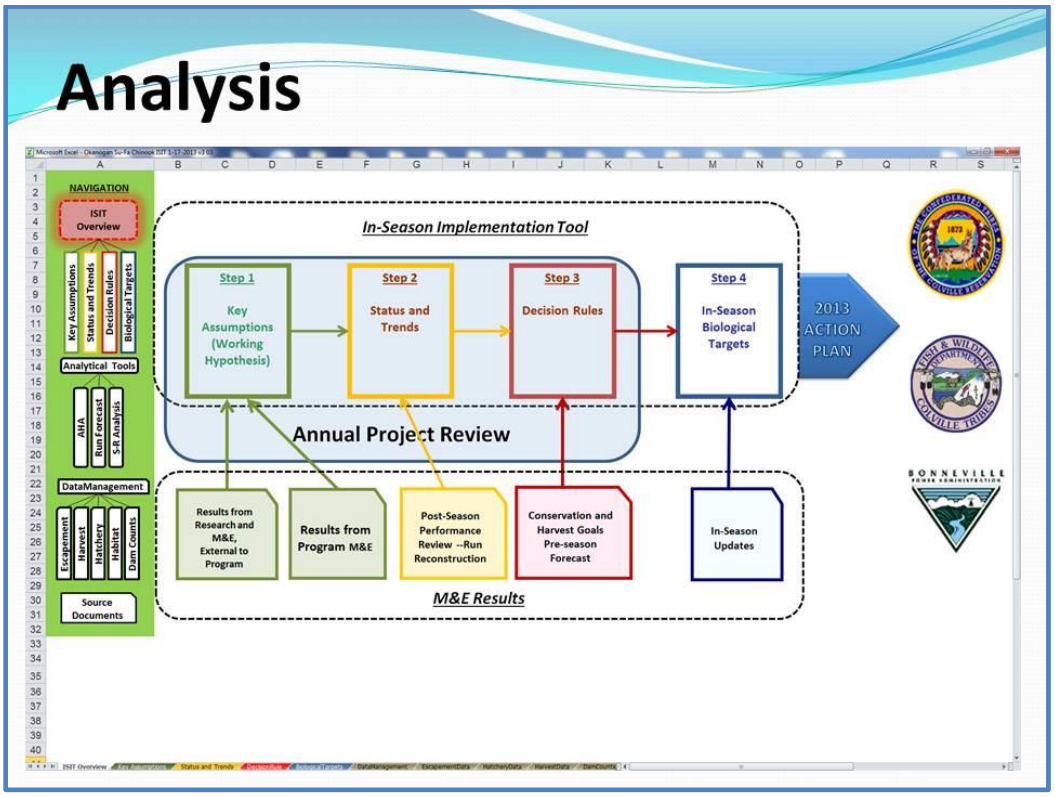


Figure 29. The Chief Joseph Hatchery's analytical work flow.

2014 Run Size Forecast and Biological Targets for 2014

Run-size forecasts and updates are an early indicator for the biological targets for the coming season, through the Decision Rules outlined in the ISIT. The preseason forecast is based on brood year escapement and juvenile survival indicators and is generated through the Technical Advisory Committee (TAC) to the *U.S. v. Oregon* fish management agreement. As the season nears, this information is supplemented with return data from downstream dam counts. The pre-season forecast for Upper Columbia summer Chinook Salmon was 67,500. The pre-season forecast, and subsequent run updates from early dam counts, were used to predict the NOR and HOR run size for the Okanogan population. Hatchery broodstock and selective harvest targets are determined based on these estimates and the objectives for pHOS (<0.30) and PNI (>0.67). A regression analysis conducted within ISIT in preparation for the APR predicted that the pre-season forecast of 67,500 upper Columbia would yield 5,112 NORs and 3,889 HORs (Figure 30). The harvest and broodstock collection goals were established from this prediction. With a NOR run size over 5,000 the broodstock collection recommendation for the integrated program was full production (643 NOB) with 100% pNOB (Figure 30). Likewise, the segregated program should achieve full production with 520 HOB. The model predicted that 1,887 HORs would be captured in the terminal (above Wells Dam) fisheries and that 961 HORs could be removed at the weir. These efforts would result in 3,699 NOS and 961 HOS for a pHOS of 17% and a PNI of 0.85. Under this modeling scenario the biological targets would be met in 2014. As run size updates become available (through TAC) the ISIT outputs will be double checked until the final in-season check point on July 15, 2014. At that time the run size at Wells Dam will be input into ISIT and the final plan for broodstock and harvest will be updated. If the July 15 update includes more hatchery and natural fish than predicted then harvest and removal of surplus fish at the weir and the hatchery ladder will be implemented by CCT and WDFW (through their mark-selective sport fishery).

BIOLOGICAL TARGETS	2013	<-- most recent year included in running averages

Use	5	-year running averages to calculate prior-cumulatives		
Recent History:			**Biological Targets:**	
Prior-cumulative NOB	924	Harvest	HORs retained in Fisheries	1,867
Prior-cumulative HOB	675		Incidental Loss of NORs	770
Prior-cumulative pNOB	58%		*↑partial source of broodstock*	
		Hatchery and Weir	Return of HORs to Hatchery	101
Prior-cumulative NOS	22,262		HORs retained at Weir	961
Prior-cumulative HOS	13,426		*↑partial source of broodstock*	
Prior cumulative pHOS	38%	Integrated Hatchery Program	Natural Origin Brood (NOB)	643
Prior cumulative PNI	0.61		Hatch. Origin Brood (HOB) -Okan	0
			Projected Annual pNOB-Okan	100%
			Cum pNOB	76%
Expected Returns to Wells Dam (most recent update):			Smolt Release-Okanogan	1,100,000
NOR Return	5,112			
Return from Integrated Program	3,889	Segregated Hatchery	Hatch. Origin Brood (HOB) -CJH	520
Return from Segregated Program	-		Smolt Release-CJH	900,000
Runsize Prediction for:	2014	Natural Spawning Escapement	Nat. Origin Spawners (NOS)	3,699
Preseason forecast (Columbia)	67,500		Hat. Origin Spawners (HOS)	961
Applies until:	7/15		Total Number of Spawners	4,659
Wells Dam Count thru 7/15			pHOS	17%
Okanogan NOR Forecast:	5,112		PNI	0.85
HOR Forecast:	3,889		Projected	
			Cum pHOS	35%
			Cum PNI	0.69
			Est. Natural Smolts	597,357

Figure 30. The in-season updates management worksheet used to set biological targets for the upcoming year in the In-Season Implementation Tool.

2014 Key Assumptions

The CJHP reviews the key assumptions (working hypothesis) each year at the APR workshop. These assumptions directly affect the decision rules used to guide in-season management decisions. The program documents the changes and uses this information for future review and analysis (Figure 31).

Okanogan-Similkimeen Summer Chinook

		Biological	Integrated Program			
Natural Production	**Current**		**Trans. 1**	**Trans 2**	**Long Term**	**Segregated Prog**
Productivity (Smolts/Spawner)	969		969	969	969	
Capacity (Smolts)	807,784		807,784	807,784	807,784	
Juv Passage Survival	27.00%		27.00%	27.00%	27.00%	
Ocean survival	4.10%		4.10%	4.10%	4.10%	
Adult Passage Survival	83.00%		83.00%	83.00%	83.00%	
Fitness	0.76		0.88	0.99	0.99	
PNI	0.63	> 0.67	0.75	0.93	0.94	
Total pHOS	35%	< 30%	33%	2%	2%	
Segr. pHOS	2%	< 5%	2%	0%	1%	
Ocean Harvest Rate	43%		43%	30%	30%	
Lower Columbia Harvest Rate (Zones 1-6, Mouth to MCN)	5%		5%	5%	5%	
Upper Columbia Harvest Rate (MCN to Wells)	10%		10%	10%	10%	
Terminal Harvest Rate (Post Wells)	3%		16%	14%	15%	
Natural Origin Spawners	2,347	> 5,000	1,510	3,048	3,000	
Hatchery Production						
Local Brood	344		644	596	596	358
Yearling Release	576,000		800,000	1,000,000	1,000,000	500,000
sub-yearling Release	-		300,000	0	0	400,000
SAR (yearling)	0.69%		0.69%	0.69%	0.69%	0.69%
SAR (sub-yearling)	0.30%		0.30%	0.30%	0.30%	0.30%
Stray Rate (into Okanogan)	95%		95%	70%	70%	20%
pNOB	50%		100%	30%	30%	
NOB	172		644	179	179	
Relative Reproductive Success	80%		80%	80%	80%	80%
Ocean Harvest Rate	43%		43%	40%	40%	40%
Lower Columbia Harvest Rate (Zones 1-6, Mouth to MCN)	10%		10%	9%	9%	9%
Upper Columbia Harvest Rate (MCN to Wells)	2%		2%	23%	23%	23%
Pre-terminal Harvest Rate (Ocean to Wells)	50%		50%	58%	58%	58%
Terminal Harvest Rate (Post Wells)	30%		48%	70%	75%	90%
Hatchery Surplus	3		962	492	340	456
Average Terminal HOR Run	2,009		2,791	2,924	2,924	1,462
Expected HOS	1,337		689	61	51	23
Fisheries and Weirs						
Weir Factor	0%		50%	90%	90%	
Relative Induced Terminal NOR Mortality	10%		1%	20%	20%	

Figure 31. The key assumptions worksheet used in the 2014 In-Season Implementation Tool for the CJHP planning at the Annual Program Review.

2014 Status and Trends

The recent performance of the population is a primary driver for determining how the hatchery program should be operated in the future. This was accomplished by updating and reviewing the status and trend information within five categories: (1) natural production, (2) hatchery production, (3) harvest, (4) migration, and (5) habitat (Figure 32).

				PUD Counts at Wells Dam		Estimated Return of Okanogan Origin Fish		Harvest Above Wells								Broodstock				Okanogan Natural Spawning Escapement			
								Tribal Harvest				Recreational Harvest				Okanog./Similk Integrated Program							
Return year		FPC Reported Dam Count at Wells	% of final count	NOR All Origins	HOR All Origins	**Okan. NORs**	Okan. HORs	**Total Tribal Harvest**	Total NORs	Okan. NORs	Okan. HORs	**Total Rec. Harvest**	Total NORs	Okan. NORs	Okan HORs	Total NORs	Okan. NORs	Total HORs	Total Brood	NOS	HOS	pHOS	PNI
1998	3	**1,060**	0.25	970	5,519	**677**	492	**-**	0	-	-	**-**	-	-	-	153	77	211	364	600	492	45%	32%
1999	4	**999**	0.11	2,708	4,580	**1,386**	2,343	**-**	0	-	-	**-**	-	-	-	224	112	289	513	1,274	2,343	65%	25%
2000	5	**2,266**	0.26	2,726	7,398	**1,256**	2,527	**-**	0	-	-	**-**	-	-	-	164	82	339	503	1,174	2,527	68%	19%
2001	6	**9,766**	0.24	10,266	19,195	**4,352**	6,551	**-**	0	-	-	**-**	-	-	-	91	46	266	357	4,306	6,551	60%	17%
2002	7	**23,221**	0.34	24,138	42,035	**4,587**	10,501	**1,753**	653	118	990	**-**	-	-	-	247	124	241	488	4,346	9,511	69%	27%
2003	8	**20,564**	0.40	9,194	7,373	**2,265**	2,698	**2,130**	785	141	1,211	**-**	-	-	-	381	191	101	482	1,933	1,487	43%	48%
2004	9	**14,762**	0.40	23,227	13,989	**7,268**	1,630	**242**	0	-	218	**2,803**	1,895	1,706	817	506	253	16	522	5,309	1,412	21%	70%
2005	10	**14,449**	0.42	18,911	15,164	**7,630**	2,801	**784**	392	71	353	**1,419**	1,025	923	355	391	196	9	400	6,441	2,448	28%	64%
2006	11	**12,563**	0.43	20,262	8,730	**7,486**	3,837	**1,389**	563	101	743	**2,119**	1,809	1,628	54	500	250	10	510	5,507	3,094	36%	58%
2007	12	**5,532**	0.37	7,088	7,789	**4,093**	1,984	**1,078**	467	84	550	**1,803**	887	798	726	456	228	17	473	2,983	1,434	32%	60%
2008	13	**8,838**	0.35	11,244	13,779	**3,934**	5,517	**2,299**	588	106	1,540	**1,665**	698	628	561	404	202	41	445	2,998	3,977	57%	44%
2009	14	**13,753**	0.46	15,184	14,187	**5,106**	5,352	**2,598**	363	65	2,012	**1,062**	648	583	244	507	254	-	507	4,204	3,340	44%	53%
2010	15	**12,264**	0.41	5,671	7,167	**4,046**	4,937	**2,912**	354	64	2,174	**1,019**	612	551	204	484	242	8	492	3,189	2,763	46%	51%
2011	16	**3,912**	0.12	12,139	19,164	**5,235**	5,616	**1,097**	449	81	577	**1,017**	200	180	556	467	332	26	493	4,642	5,039	52%	56%
2012	17	**10,082**	0.24	14,424	27,716	**5,800**	5,635	**3,184**	656	118	2,250	**2,470**	829	746	1,264	107	96	-	107	4,840	3,385	41%	69%
2013	18	**25,571**	0.38	34,965	30,179	**8,797**	5,665	**4,621**	832	3,410	3,410	**2,107**	179	-	1,735	184	-	303	487	5,387	2,255	30%	
2014	19	**-**		-																			
2015	20	**-**		-																			
2016	21	**-**		-																			

Figure 32. The status and trends worksheet in the In-Season Implementation Tool for CJHP planning at the Annual Program Review.

2014 Decision Rules

The decision rules determine the targeted size of the hatchery program and the management of natural escapement abundance and composition. The purpose of the Decision Rules are to assure that the CJHP manages the hatchery, terminal fisheries and weir to meet the guidelines for abundance, spawner composition, and distribution of the natural spawning escapement (Figure 33).

DECISION RULES

Select a Scenario: Transition 1

	Minimum NOR escapement	800		800	
	Smallest viable hatchery program	100,000		100,000	
	Max % of NOR used for Broodstock	30%		30%	
Integrated Program	Max Nmbr Yearlings	800,000		800,000	
	Max Nmbr Sub-yearlings	300,000		300,000	
	pNOB Trigger (NOR run)	1,100		1,100	
	pNOB	100%		100%	
Segregated Program	Max Nmbr Yearlings	500,000		500,000	
	Max Nmbr Sub-yearlings	400,000		400,000	
	Backfill w/ HORs (y,n)	n		n	

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Criteria for transition	Transition	Transition 2	Long Term
Current	2014-Facilties completed and tested, full brood available		
Transition 1		2019 or 5000 NORs (5-year rolling average)	
Transition 2			2027-

pHOS

Return of CJH HORs to Wells: 0

NOR Return \ Return of Okanogan HORs	1,000	2,500	3,889	6,000	7,000	8,000
600	28%	49%	60%	70%	73%	76%
800	22%	42%	53%	63%	67%	70%
1,000	19%	37%	47%	58%	62%	65%
1,100	20%	38%	49%	60%	63%	66%
1,200	20%	38%	49%	60%	63%	66%
1,300	20%	38%	49%	60%	63%	66%
2,000	15%	31%	41%	52%	56%	59%
2,500	12%	25%	34%	44%	48%	52%
3,500	8%	17%	25%	34%	37%	40%
5,112	5%	12%	17%	24%	27%	30%
6,000	4%	10%	15%	21%	24%	26%
8,000	3%	7%	11%	16%	18%	20%
10,000	2%	6%	9%	13%	15%	17%

Natural Origin Brood (NOB)

NOR Return	1,000	2,500	3,889	6,000	7,000	8,000
600	-	-	-	-	-	-
800	-	-	-	-	-	-
1,000	-	-	-	-	-	-
1,100	134	134	134	134	134	134
1,200	219	219	219	219	219	219
1,300	219	304	304	304	304	304
2,000	600	600	600	600	600	600
2,500	643	643	643	643	643	643
3,500	643	643	643	643	643	643
5,112	643	643	643	643	643	643
6,000	643	643	643	643	643	643
8,000	643	643	643	643	643	643
10,000	643	643	643	643	643	643

Figure 33. Screen shot of the decision rules in the In-Season Implementation Tool for CJHP planning at the Annual Program Review.

The Annual Program Planning Tool (APPT)

In 2013 and 2014, the CJHP, in consultation with regional partners and experts, initiated an effort to systematize the CJHP's annual planning workshops. The result is a set of tools used to improve efficiency and coordination of integrated, all H-planning processes. The Annual Program Planning Tool (APPT) tools help link activities across the CJHP and the CCT's Anadromous Fish Division to management decisions, and bring the relationship to resource goals into focus.

The APPT tool consists of interconnected modules contained in an Excel-based environment and workbook. The completed APPT spreadsheet can be found in APPENDIX E. The purpose of the APPT is to:

- Link CJHP activities to Key Management Questions, hypotheses, indicators and variables;
- Identify the specific data necessary for use in the All-H Analyzer (AHA) and In-season Implementation Tool (ISIT) and other analyses;
- Schedule annual Chief Joseph Hatchery Program (CJHP), production and science program activities;
- Identify specific and integrated data input deliverables from harvest, hatchery, hydro and habitat Programs ("All-H" integration);
- Assign staff responsible for leading each activity, and
- Produce output suitable for developing budgets, work and implementation plans, staffing levels, activity schedules and identification and linkages to BPA's Pisces work elements.

Data Gaps and Research Needs

In a partnership with USGS, WDFW and the ONA, the CJHP is working to identify data gaps and applied research needs within the Okanogan Basin that would better inform hatchery management, increase available data for resource management decision making, and benefit overall salmonid recovery in the greater Columbia River basin. The tasks identified should be considered for future funding as they would directly inform CJHP and other natural resource managers and aid in the decision making process. Some of the data gaps and applied research needs that have been identified include:

1. Refined estimates (extent, fate, timing and location) of summer/fall Chinook using the mainstem Columbia River above Wells Dam for spawning (i.e. straying), rather than returning to their natal Okanogan River using radio or acoustic telemetry.
2. Extent, fate, timing and location of spawning Chinook in the Canadian portion of the Okanogan Basin.
3. Development and testing of a panel of microsatellites and/or single nucleotide polymorphisms (SNP's) for genotyping genetic stocks of Chinook salmon in the Okanogan Basin and upper-Columbia River, upstream of Wells dam, to identify and differentiate Okanogan summer- vs. fall- vs. spring-Chinook, as well as hatchery × hatchery, hatchery × wild, and wild × wild crosses of these various life-history types.
4. Utilization of advancements in thermal imaging/LiDAR or other remote sensing technologies combined with in-stream temperature loggers and ArcGIS/R Statistical Program (STARS & FLoWs toolsets & SSN package) to map current thermal refugia in the Okanogan basin and model potential changes resulting from climate change scenarios.
5. Development and/or adaptation of existing methods for better estimation of fine sediment loads per reach length in the Okanogan River to quantify effects on Chinook salmon spawning redds and productivity.

6. Implementation and comparisons of the R-based flow regression method for juvenile outmigration estimation compared to traditional mark-recapture estimates.
7. Design for testing fish tagging rate assumptions. PIT, radio and genetic tagging emphasis.
8. Post-release mortality for various capture techniques including the purse seine, hatchery ladder, sport fishing, the weir, etc.
9. Origin of summer/fall Chinook at the CJH ladder.
10. Abundance of Priest Rapids Hatchery fish at the Okanogan weir and CJH ladder.

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APPENDIX A

Hatchery operations and production

The CJH's central facility is a 15 acre facility located immediately below Chief Joseph Dam along the right bank of the Columbia River at rkm 872 near Bridgeport, WA. There are two CJH acclimation facilities on the Okanogan River, Omak (rkm 51) and Riverside (rkm 64) acclimation ponds. There is an additional acclimation facility on the Similkameen River (rkm 6.4) that is part of the CJH program but is operated by WDFW and funded by the CPUD.

Construction of the hatchery was completed in 2013 and broodstock were brought on station for the first time. The goal of the CJHP is to contribute to the increased abundance, productivity, temporal-spatial diversity, re-colonization of Chinook in the Okanogan Basin, and provide increased harvest for all fishers.

Production Objectives

Full program production totals 2.9 million Chinook Salmon, including 2 million summer/fall Chinook and 900,000 spring Chinook. The summer/fall Chinook program incorporates both an integrated program (1.1 million smolts) supported by Okanogan River natural-origin broodstock and a segregated program (900,000 smolts) supported by hatchery-origin adults returning from the integrated program. The spring Chinook program includes a segregated program (700,000 smolts) supported by Leavenworth National Fish Hatchery (LNFH) broodstock and a re-introduction program (200,000 smolts) supported by WNFH broodstock (Met Comp stock) will be used (once permits are obtained) to reintroduce spring Chinook to the Okanogan under section 10(j) of the ESA.

In 2013, the summer/fall and spring Chinook program's production level was set at 60% of total production capacity (excluding 10(j) spring Chinook reintroduction program) in order to train staff and test hatchery operations.

Spring Chinook Salmon

Brood Collection

The segregated spring Chinook production goal for the 2013 brood is a release of 420,000 yearlings in April of 2015. The calculated number of brood needed to meet this production was 402 adults, based on a 50/50 ratio of males and females. This includes 10% pre-spawn mortality, up to 20% culling for Bacterial Kidney Disease (BKD) management, 10% egg loss, and rearing mortality of 15%. The mortality per life stage estimates were

based on LNFH data. As with any new facility, baseline data collected during initial production years will be the basis for adjusting broodstock requirements in future years.

A total of 422 spring Chinook broodstock were transferred from LNFH to CJH between June 18 and June 19, 2013; including 211 females, 171 males and 40 jacks (Table A 1). The 422 spring Chinook transferred represents 105% of the collection objective and was partially a result of an attempt to reduce the proportion of jacks in the broodstock. Due to logistics at LNFH on the day(s) of transfer, a total of 10 females over the required female equivalents for the program were also transferred and contributed to the 5% overage in total broodstock transferred.

Transport water was obtained from LNFH to fill the transport trucks, at a temperature of 51° F and the adult holding pond temperature, at LNFH, was 48° F. Transport densities ranged from 0.20 and 0.50 lbs. /gal. (Table 1) All transport included Vita Life, a calming agent superior to salt, at a rate of 500 ml per 2,000 gal., and supplemental oxygen at 8 L/min. There were no mortalities associated with the transport.

Broodstock were off loaded, via water-to-water transfer, into adult ponds #5 and #6, at CJH. The receiving water was 54.5° F. The adult pond had a flow rate of 380 gpm and an exchange rate of 60 minutes, representing a Flow Index (FI) of 0.42 and 0.20 for pond #5 and #6, respectively (Table A 2). The Density Index (DI) was 0.04 and 0.02 for ponds #5 and #6, respectively. Both adult ponds were a mixture of well water and reservoir water, but as the reservoir water warmed, ground water was gradually increased to maintain proper temperature profiles. Both ponds were treated a minimum of 3 days per week with formalin to control fungus, at a rate of 1:6000, for one exchange.

On July 24, 2013 and again on August 30, 2013, USFWS DVM Joy Evered assisted hatchery staff with inoculations for all spring Chinook brood. Each female was inoculated with Gallimycin – 100 at a rate of .50 ml per 10 lbs. / fish IP, for reduction of BKD, and Vetrimycin – 200 (Oxytetracycline) IP, at the same dosages, for reduction of pre-spawn mortality due to furunculosis. Survival was 90% for females, 96% for males and 95% for jacks with a combined survival of 92.9% (Table A 3). This survival was higher than the standard (90%).

Table A 1. Chief Joseph Hatchery spring Chinook broodstock transfer summary for 2013.

			Males							
Date	**Trapping site**	**Receiving Facility**	**Adult**	**Jack**	**Total**	**Females**	**Total Broodstock**	**Holding Temp (°F)**	**Transport Temp. (°F)**	**Transport Density (lbs./gal)**
6/18/2013	LNFH	CJH	108	40	148	132	280	48	51	0.50
6/19/2013	LNFH	CJH	63	0	63	79	142	48	51	0.2
Total			**171**	**40**	**211**	**211**	**422**			

Table A 2. Spring Chinook broodstock adult holding conditions for 2013.

		Males								
Transfer Date	**Adult Pond**	**Adult**	**Jack**	**Total**	**Females**	**Total Broodstock**	**Transport Temp (°F)**	**Holding Temp. (°F)**	**Flow Index**	**Density Index**
6/18/2013	#5	108	40	148	132	280	54.5	51	0.42	0.04
6/19/2013	#6	63	0	63	79	142	54.5	51	0.20	0.02

Table A 3. Chief Joseph Hatchery spring Chinook broodstock holding and survival summary for 2013. (M= adult males, J = jacks, and F = adult females). The survival standard for this life stage was 90%.

Beginning			**Ending**			**Mortality**			**Cumulative Survival (%)**		
M	**J**	**F**	**M**	**J**	**F**	**M**	**J**	**F**	**M**	**J**	**F**
171	40	211	164	38	190	7	2	21	95.9%	95.0%	90.0%

SPAWNING

Spring Chinook spawning occurred between August 19 and September 10, 2013 (Table A 4). The spawn consisted of 198 females and 200 males, with four non-viable (green) females killed resulting in a green egg take of approximately 752,000 (Table A 4).

Spawning occurred inside the spawning shed adjacent to the adult holding raceways, and gametes were then transported to the main facilities egg entry room for processing. Each individually numbered female was fertilized with a primary male initially, and then a backup male was added to ensure fertilization. Each female's eggs were then placed in the corresponding numbered trey. The eggs from 20 females were culled due to high or moderate ELISA results (culled eggs from Elisa results are not included in Table A 4). This was approximately 10% of the females collected and was less than planned for (up to 20%).

INCUBATION

Each female's eggs were initially incubated separately to facilitate culling based on ELISA results. Once eyed, egg mortality was removed and eggs were combined for hatching. All spring Chinook eggs were placed on varying degrees of chilled water. The water temperature was gradually dropped, on the first egg take, to 40° F degrees. This process was done over a several hour period the day after spawning. The second egg take was left on well water (54° F) until such time as the total numbers of temperature units (TUs) were earned to equal the first egg take, then the same procedure was used to lower water temperature to 40° F. This process provided the ability to control when, and how many, fish are brought out of the incubators and placed into early rearing.

Green egg to eyed egg survival varied from 83% to 95% per group, with a cumulative average of 89% (Table A 4). This survival was lower than the standard (90%).

REARING

The first group of spring Chinook was brought out of incubation and transferred into early rearing troughs on March 3, 2014. During March, this group was introduced to feed in the early rearing troughs, and reared for a period of two weeks. After the initial rearing period inside, this group was transferred outside to the standard raceways via the fry transfer line. No inventory was taken at this time to prevent excess handling stress. On March 18, the second group was brought out of incubation and transferred to the early rearing vessels. Survival from early rearing fry to ponding was 97% which exceeded the standard (95%) for this life stage (Table A 5).

Table A 4. Chief Joseph Hatchery spring Chinook spawning and survival summary for 2013 (M = adult males, J = jacks and F = adult females). The target survival standard for this life stage was 90%.

	Total Adults Spawned			Green Egg Take	Eyed Egg	Mortality (Pick off)	Cumulative Survival (%)
Month	**M**	**J**	**F**	**Total**	**Total**	**Total**	**Total**
Aug. 19	38	3	40	152,000	126,454	20,540	86.0
Aug. 26	80	6	85	323,000	256,987	13,202	95.1
Sept. 4	54	9	63	239,400	157,038	31,286	83.4
Sept. 10	8	2	10	38,000	26,375	3,749	87.6
Total	180	20	198	752,400	566,854	68,777	89.2

Table A 5. Chief Joseph Hatchery spring Chinook ponding summary for brood year 2013. The standard survival for this life stage was 95%.

	Total Fry on hand	Ponding Mortality	Monthly Feed/lbs.	Monthly Mortality	Ponding Loss (%)	Cumulative Survival (%)
Prod. Group	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
LVNH						
3/3/14	383,441	5,119	309	1,295	1.3%	98.4%
3/18/14	183,413	11,345	28	1,382	6.1%	93.1%
Total	566,854	16,464	337	2,677	2.9%	97.1%

Spring Chinook were fed BioVita diet, and converted at an average of 0.65:1. Post ponding rearing is on schedule, with no fish health issues and minimal mortality to date (

Table A **6**). Survival for this life stage will be reported in subsequent annual reports once all release information is available.

Table A 6. Chief Joseph Hatchery BY 2013 spring Chinook rearing summary as of April 2014.

Production Group	Total on hand	Rearing Mortality	Total Feed (lbs.)	Conv. Rate	Rearing Survival (%)	BY Cumulative Survival (%)
	Total	Total	Total	Total	Total	Total
LVNH						
3/31/14	549,205	1,185	343	0.80:1	99.2%	96.9%
4/30/14	547,045	2,160	1,169	0.83:1	96.1%	96.5%
YTD	547,045	3,345	1,512	0.815:1	96.1%	96.5%

CUMULATIVE EGG TO SMOLT SURVIVAL

This metric cannot be reported for the 2013 brood year until 2015 when the yearlings are released. This overall survival metric will be a critical assessment of the hatchery's performance. The target egg to smolt survival identified in the original spring Chinook HGMP was 77% (CCT 2008a).

Summer/Fall Chinook Salmon

BROODSTOCK COLLECTION

Collection of summer/fall Chinook for BY 2013 occurred between July 10 and August 26, 2013 via the CCT purse seine operation at the mouth of the Okanogan River. Both hatchery- and natural-origin brood were collected to supply the integrated and segregated production programs at CJH. As the seine was being pursed, 9 m transport barges approached the seine vessel and tied off on the opposite side. The broodstock transport barges have two transport tanks; a 300 gallon for HORs and a 600 gallon for NORs. Brood fish were removed from the seine and placed headfirst in a rubber tube, or boot, containing some water and handed to the staff on the barges for placement in the holding tanks. A maximum of 14 HOR and 28 NOR brood could be loaded per barge. Once full, or at the commencement of the purse seine haul, the barges returned to the offload area at Mosquito Park approximately 2 km away. The brood was then removed from the tanks by hand, placed into a boot, then delivered to one of two 2500 gallon tanker trucks and transported 16 km to the hatchery.

Water temperatures were of major concern during these operations and monitored to minimize trauma to the adult brood. Okanogan River temperatures during July ranged from 66° F (19° C) to 78° F (25.5° C). In order to limit the effects of the temperature changes we monitored the temperature of all transport vessels and strived to not expose brood to changes greater than 8° F. We accomplish this by utilizing both well water and surface water when filling the barges and transport tankers, and monitoring our raceway temperatures.

A weekly quota was developed to ensure that brood collections occurred across as much of the summer run timing as possible (Table A 7). If brood collection failed to meet the weekly quota it was adjusted the following week. The purse seine is only effective when there is a thermal barrier at the mouth of the Okanogan, therefore broodstock can only be collected there until late August or early September. Additional efforts to collect late run timing brood were initiated in 2013 at the pilot weir. Those efforts were reported in the weir evaluation section of the 2013 M&E report.

Broodstock were off loaded, via water-to-water transfer, into adult ponds at CJH. The receiving water was approximately 57° F. The adult ponds had a flow rate of 380 gpm, and an exchange rate of 60 minutes, representing a Flow Index (FI) of 0.15 and a Density Index (DI) of 0.02. Upon arrival, adult ponds were on a mixture of well water and reservoir water, but as the reservoir water warmed, the ground water contribution was gradually increased to maintain proper temperature profiles. All adult ponds were treated a minimum of five days per week with formalin to control fungus at a rate of 1:6000, for one exchange. On July 24 and August 30, USFW DVM Joy Evered assisted hatchery staff with inoculations for all summer/fall Chinook brood. Each female was inoculated with Gallimycin – 100 at a rate of .50 ml per 10 lb. / fish IP, for reduction of BKD, and Vetrimycin – 200 (Oxytetracycline) IP, at the same dosages, for reduction of pre-spawn mortality to furunculosis. A total of 337 HOB were collected including 170 females, 162 adult males and five jacks (Table A 8). A total of 477 NOB were collected including 231 females, 234 adult males, and 12 jacks (Table A 9). No steelhead or Bull trout were encountered during broodstock collection efforts.

Table A 7. Chief Joseph Hatchery summer/fall Chinook weekly broodstock collection objectives and results for brood year 2013.

Week	Weekly Quota[1] Natural Origin[2]	Weekly Quota[1] Hatchery Origin[3]	Cumulative Proportion	Cumulative Collection Natural Origin	Cumulative Collection Hatchery Origin
July 8 - July 14	16	14	0.04	16	14
July 15 - July 21	16	14	0.08	33	28
July 22 - July 28	78	64	0.27	111	92
July 29 - Aug. 4	78	64	0.46	190	156
Aug. 5 - Aug.11	95	79	0.69	284	235
Aug. 12 - Aug. 18	95	79	0.92	379	314
Aug. 19 - Aug. 25	26	19	0.98	404	333
Aug. 26 - Sept. 1	8	7	1.00	412	340

[1]Weekly collection short-fall to be added to following week's collection
[2]Combined collection strategies in priority order (purse seine, tangle-net, Okanogan weir beach seine and CJH ladder
[3]Combined collection strategies in priority order: purse seine, tangle-net, CJH ladder, Okanogan weir and beach seine

Table A 8. Chief Joseph Hatchery summer/fall Chinook Hatchery-Origin Broodstock (HOB) transfer summary for brood year 2013.

Date	Trapping site	Receiving Facility	Male	Female	Jack	Total Brood stock	River Temp (°F)	Barge Temp (°F)	Transport Temp. (°F)	Adult Pond Temp (°F)
7/10/2013	SEINE	CJH	1	9	0	10	68	62	58	57
7/11/2013	SEINE	CJH	2	0	0	2	68	62	58	57
7/15/2013	SEINE	CJH	5	6	0	11	70	62	58	57
7/24/2013	SEINE	CJH	20	33	2	55	74	66	60	57
7/29/2013	SEINE	CJH	20	36	1	57	72	64	59	57
7/30/2013	SEINE	CJH	6	0	0	6	72	64	59	57
8/5/2013	SEINE	CJH	3	6	0	9	72	64	59	57
8/6/2013	SEINE	CJH	35	38	2	75	72	64	59	57
8/12/2013	SEINE	CJH	11	20	0	31	73	64	60	57
8/13/2013	SEINE	CJH	41	11	0	52	74	66	60	57
8/20/2013	SEINE	CJH	15	7	0	13	72	64	59	57
8/26/2013	SEINE	CJH	3	4	0	7	72	64	59	57
Total			**162**	**170**	**5**	**337**				

Table A 9. Chief Joseph Hatchery summer/fall Chinook Natural-Origin Broodstock (NOB) transfer summary for brood year 2013.

Date	Trapping site	Receiving Facility	Males	Females	Jacks	Total Broodstock	River Temp (°F)	Barge Temp (°F)	Trans Temp. (°F)	Adult Pond Temp (°F)
7/10/2013	SEINE	CJH	11	3	0	14	68	62	58	57
7/11/2013	SEINE	CJH	2	0	0	2	68	62	58	57
7/15/2013	SEINE	CJH	4	12	0	16	70	62	58	57
7/24/2013	SEINE	CJH	32	39	0	71	74	66	60	57
7/29/2013	SEINE	CJH	34	42	3	79	72	64	59	57
7/30/2013	SEINE	CJH	22	0	0	22	72	64	59	57
8/6/2013	SEINE	CJH	7	15	3	70	72	64	59	57
8/6/2013	SEINE	CJH	38	32	0	70	72	64	59	57
8/12/2013	SEINE	CJH	23	21	0	44	73	64	60	57
8/13/2013	SEINE	CJH	24	25	0	49	74	66	60	57
8/20/2013	SEINE	CJH	31	40	6	77	72	64	59	57
8/26/2013	SEINE	CJH	6	2	0	8	72	64	59	57
Total			**234**	**231**	**12**	**477**				

Five hatchery Chinook were collected from the weir trap on August 28, 2013, transported to shore via a fish boot (rubber tire inner tube) and placed into a 2500 gallon hatchery truck. The fish were then transported approximately 32 km to Chief Joseph Hatchery where they were held in the broodstock raceways until the first spawn date the first week in October. There was zero mortality on these five fish. They were not used as broodstock so no further evaluation of egg viability or overall spawning success for weir collected brood could be conducted. This effort was simply to test the collection and pre-spawn holding survival of weir collection brood.

The cumulative pre spawn holding survival was 96% for HOB and 84% for NOB (Table A 10). The HOB survival met the standard (90%) but the NOB survival did not. The majority of loss for NOB occurred with females in late October and November. Spawn timing of NOB was protracted when compared to HOB (approximately 14 days) and as a result, NOB were held longer and were subject to additional handling, which may have contributed to the HOB/NOB differential survival.

Table A 10. Chief Joseph Hatchery summer/fall Chinook Hatchery (HOB) and Natural (NOB) origin broodstock holding survival summary for brood year 2013. (M = adult males, J = jacks and F = adult females). The survival standard for this life stage was 90%.

	Brood Total			**Ending Month**			**Mortality**			**Monthly Survival (%)**			**Cumulative Survival (%)**		
Month	**M**	**J**	**F**	**M**	**J**	**F**	**M**	**J**	**F**	**M**	**J**	**F**	**M**	**J**	**F**
HOB															
July	54	3	84	52	3	81	2	0	3	96.3	100.	96.4	96.3	100	96.4
August	160	5	167	157	5	166	3	0	1	98.1	100.	99.4	96.9	100	97.6
Sept.	157	5	166	157	5	165	0	0	1	100.0	100.	99.3	96.9	100	97.1
Oct	157	5	165	156	5	163	1	0	2	99.3	100.	98.7	96.2	100	95.8
Nov.	156	5	163	155	5	163	1	0	0	99.3	100.	100.0	95.6	100	95.8
NOB															
July	105	3	96	103	3	95	2	0	1	98.1	100	99.0	98.1	100	99.0
August	211	12	209	209	12	206	2	0	3	99.1	100.	99.0	98.1	100	98.1
Sept.	209	12	206	208	12	202	1	0	4	99.5	100.	98.1	97.7	100	96.2
Oct.	208	12	202	206	12	188	2	0	14	99.0	100.	93.1	96.7	100	90.0
Nov.	206	12	188	198	12	176	8	0	12	96.1	100.	93.6	92.9	100	83.8

SPAWNING

Summer/fall Chinook spawning began October 9 and continued weekly through November 20. Total NOB spawned included 177 males, five jacks, and 173 females. (Table A 11) Total HOR spawn included 149 males, five jacks, and 160 females. In addition, five non-viable NOR females and two non-viable HOR females were spawned. These were not green killed, but were eggs discarded for fish health reasons. Total green egg take for the season was 1,698,699. Egg survival from green egg to eyed egg for NOB ranged from 87.5 to 98.8 and averaged 94.1 (Table A 11). Egg survival for HOB ranged from 90.0 to 98.5 and averaged 93.9. Survival was higher than the standard (90%) for this life stage.

Table A 11. Chief Joseph Hatchery brood year 2013 summer/fall Chinook spawning results. The survival standard for this life stage was 90%.

	Total Adults Spawned			Green Egg Take	Eyed Egg	Mortality (Pick Off)	Cumulative Survival (%)	
Month	**M**	**J**	**F**	**Total**	**Total**		**Total**	**Total**
NOB								
Oct. 9	1	0	1	5,432	5,117		315	94.2
Oct. 16	3	0	3	14,746	14,574		172	98.8
Oct. 23	15	0	15	69,618	67,439		2,179	96.9
Oct. 30	63	3	62	281,474	268,688		2,786	95.5
Nov. 6	50	2	50	237,780	227,253		10,527	95.6
Nov. 13	29	1	29	124,570	109,008		15,562	87.5
Nov. 20	13	0	13	54,865	49,614		5,251	90.4
Sub-total	174	6	173	788,485	741,693		46,792	94.1
HOB								
Oct. 9	7	0	7	32,303	31,803		500	98.5
Oct. 16	27	0	24	116,485	112,362		3,853	96.7
Oct. 23	17	0	17	68,636	62,410		6,226	90.9
Oct. 30	76	1	88	414,247	391,388		22,859	94.5
Nov. 6	29	2	32	148,350	133,526		14,824	90.0
Sub-total	156	3	168	780,021	731,489		48,262	93.8
Total	340	9	341	1,568,506	1,473,182		95,054	93.9

INCUBATION

Eggs from each female summer/fall Chinook were placed in individual incubators (Heath Trays) and remained individually incubated until ELISA results were obtained. Once eye-up occurred, eggs from moderate and high ELISA results would have been destroyed; however, all females came back as low ELISA. This cull rate exceeded expectations as the production plan accounted for a cull rate 5% for segregated and 3% for integrated. After eye-up, egg mortality was removed and the eggs were inventoried and put into incubators at 5,800 eggs per tray for hatching. Incubation water temperatures were manipulated to the level necessary to synchronize the hatching and ponding of the spawn takes throughout October and November 2013 and to achieve the size-at-release target for both yearling and subyearling summer Chinook programs. On the day of spawning and over a several hour period, the incubation water temperatures were gradually reduced on yearling egg takes to a temperature of 40° F. Subyearling groups were not chilled until each take achieved 230 Temperature Units (TU). Once each take achieved 230 TUs, incubation temperatures were, manipulated to either advance or delay maturation. Variable incubation water temperatures were required to synchronize hatching dates associated with variable spawn dates throughout the spawn period within yearling and subyearling production groups and to achieve target hatching date associated with size-at-release targets, based on projected growth rates and release dates for the respective production groups.

REARING

The first group of integrated yearlings was brought out of incubation and transferred into early rearing troughs on March 18, 2014. During the month of March, this group was introduced to feed in the early rearing troughs, and remained in early rearing for a period of two weeks. After the initial rearing period inside, this group was transferred outside to the standard raceways via the fry transfer line. Ponding survival ranged from 96% to 98% and averaged 97% across all groups which exceeded the survival standard (95%) for this life stage (Table A 12).

Post ponding rearing was on schedule as of April 2014, with no fish health issues to date with very (<1%) little mortality (Table A 13). Summer/fall Chinook were fed BioVita diet, and were converting at an average of 0.65:1 to date.

Table A 12. Chief Joseph Hatchery brood year 2013 summer/fall Chinook ponding summary. The survival standard for this life stage was 95%.

Production Group	Total Fry on hand	Ponding Mortality	Monthly Feed/lbs.	Monthly Mortality	Ponding Loss (%)	Cumulative Survival (%)
	Total	Total	Total	Total	Tota	Total
NOB						
Subs	208,462	8,570	459	572	4.1%	95.9%
Yrlng	533,231	20,921	19	1,942	3.9%	96.1%
Sub-total	741,693	29,491	478	2,514	4.0%	96.0%
HOB						
Subs	280,704	5,782	848	730	2.0%	98.0%
Yrlng	450,788	9,675	180	180	2.1%	97.9%
Sub-total	731,492	15,457	848	730	2.1%	97.9
Total	1,473,185	44,948	1,326	3,244	3.1%	97.0%

Table A 13. Chief Joseph Hatchery brood year 2013 summer/fall Chinook rearing summary.

Production Group	Total on hand	Rearing Mortality	Total Feed	onv. Rate	Rearing Survival (%)	BY Cumulative Survival (%)
	Total	Total	Total	Total	Tota	Total
NOR						
Subs	197,516	992	2,189	0.96:1	99.5%	94.7%
Yrlng	510,818	1,492	554	0.75:1	97.1%	95.8%
HOR						
Subs	265,893	2,502	2,486	0.81:1	99.0%	94.7%
Yrlng	440,933	180	180	0.71:1	99.9%	97.8%

YTD	1,415,160	5,166	5,409	0.807:1	99.7%	96.1%

Omak Acclimation Pond

On October 24, Chief Joseph Hatchery staff transferred 44,821 BY 2012 summer/fall Chinook from Wells Fish Hatchery to the Omak Acclimation Pond (Table A 14). At the time of transfer, the fish were approximately 16.7 fpp, and were programmed for over winter acclimation, with a target size at release of 10 fpp. These fish began volitional release April 15, 2014 with an end release date of April 30. Cumulative transfer-to-release survival was high (98.7%), exceeding the program standard of 95%.

Riverside Acclimation Pond

Riverside Acclimation Pond was not used to rear BY 2012 summer/fall Chinook and therefore was vacant during 2013.

Similkameen Acclimation Pond

Similkameen pond was used to rear yearling summer Chinook per the WDFW program funded by CPUD. Adult broodstock used to generate the juveniles from BY 2012 were collected via the CCT purse seine as part of the transition to the new collaborative CJH program. Starting with BY 2013 juveniles, the fish going to Similkameen Pond will have completed their early rearing at CJH. However, for purposes of continuity we are reporting egg take and release information for the Similkameen program starting with brood year 2011 (when CCT purse seine contributed to the brood collection). The Similkameen Pond program released 627,978 yearling summer/fall Chinook in April and May of 2013 (Hillman et al. 2014). WDFW and CCT collected 201,295 eggs for the Similkameen Pond program for BY 2012 (Hillman et al. 2014) and released 114,000 yearlings in April and May of 2014 (Hillman et al. 2014).

Cumulative egg to smolt survival

This metric cannot be reported for the 2013 brood year until 2015 when the yearlings are released. This overall survival metric will be a critical assessment of the hatchery's performance. The target egg to smolt survival identified in the original summer/fall Chinook HGMP was 77.5% for subyearlings and 73.5% for yearlings (CCT 2008b).

Table A 14. Omak Acclimation Pond, brood year 2012 NOR summer/fall Chinook rearing summary, October 2013 - April 2014.

	Total on hand	Mortality	Feed (lbs.)	Fish per pound	Cumulative Survival (%)
Month	**Total**	**Total**	**Total**	**Total**	**Total**
Oct. 31	44,821	15	218	15.2	99.96
Nov. 30	44,390	431	74	14.6	99.00
Dec. 31	44,354	36	0	14.6	98.92
Jan. 31	44,266	88	0	14.6	98.72
Feb. 28	44,246	20	5	14.6	98.68
Mar. 31	44,232	14	594	11.7	98.65
April 18	44,232	0	132	10.2	98.65
Cumulative	**44,232**	**604**	**1,023**	**12.5**	**98.73**

CHIEF JOSEPH HATCHERY LADDER

The CJH fish ladder began operation late in July 2013, with the first adult management activities occurring on August 1, 2013. The intention of the CJH ladder operation was to facilitate adult management by removing hatchery-origin fish, and thereby reduce pHOS in the Okanogan River and Columbia River above the confluence of the Okanogan River.

From August thru November 2013, a total of 1,998 hatchery-origin summer/fall Chinook and 10 sockeye were removed at the CJH ladder and utilized for tribal subsistence purposes, and 718 natural-origin summer/fall Chinook, and 41 steelhead were trapped, handled and released back to the Columbia River during CJH ladder operations (Table A 15). The encounter/handling and release of 41 steelhead represents 3.7 percent of the allowable incidental take provided in the Biological Opinion (BiOp) for Chief Joseph Hatchery collection facilities. (NMFS 2008). There were no observed steelhead mortalities during the ladder operations in 2013.

The ladder was closed and dewatered on November 5, 2013, for the season. The protocol was to sample 20% (one of five) of the adipose-clipped summer/fall Chinook for code-wire tags (CWT). Snouts with positive CWT detection were sent to the WDFW laboratory in Olympia for CWT extraction and reading. Results are not available yet but will be included in the M&E section of future reports.

Table A 15. Chief Joseph Hatchery adult ladder operations from August to November, 2013.

Date	Trapping site	HOR Males Removed	HOR Females Removed	HOR Jack (1) Removed	NOR Male RTS	NOR Female RTS	NOR Jack RTS	Sockeye Removed	Male Steelhead RTS	Female Steelhead RTS
8/5/2013	Ladder	64	80	15	5	4	7	1	1	2
8/12/2013	Ladder	117	77	44	17	6	8	1	1	1
8/16/2013	Ladder	18	17	21	4	5	1	3	0	2
8/21/2013	Ladder	62	40	51	8	2	2	4	2	4
8/27/2013	Ladder	89	55	118	8	6	2	0	1	2
Aug. Sub-total		***350***	***269***	***249***	***42***	***23***	***20***	***9***	***5***	***11***
9/3/2013	Ladder	86	40	193	5	4	4	0	0	2
9/9/2013	Ladder	75	58	32	10	7	5	0	0	0
9/12/2013	Ladder	18	15	2	4	3	3	0	0	7
9/18/2013	Ladder	33	32	9	0	0	0	0	0	0
9/25/2013	Ladder	18	10	15	17	5	9	1	0	2
Sept. Sub-total		***230***	***155***	***251***	***36***	***19***	***21***	***1***	***0***	***11***
10/2/2013	Ladder	0	1	1	12	1	9	0	1	1
10/10/2013	Ladder	43	22	3	0	0	0	0	0	0
10/14/2013	Ladder	43	37	11	31	12	7	0	0	6
10/22/2013	Ladder	37	28	3	19	6	4	0	0	2
10/28/2013	Ladder	29	19	5	40	6	8	0	1	0
Oct. Sub-total		***152***	***107***	***23***	***102***	***25***	***28***	***0***	***2***	***9***
11/1/2013	Ladder	63	25	2	138	31	14	0	2	1
11/5/2013	Ladder	69	25	1	175	29	25	0	0	0
Nov. Sub-total		***132***	***50***	***3***	***313***	***60***	***39***	***0***	***2***	***1***
Total		***864***	***581***	***526***	***493***	***127***	***108***	***10***	***9***	***32***

(1) Includes mini-jacks

(2) RTS= Return to stream

APPENDIX A

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APPENDIX B
2014 PRODUCTION PLAN

Summer Chinook Early - Integrated Program (Similkameen Release)

Chief Joseph Hatchery Production Plan

Brood Year:	2014						**Planting Goal:**	267,000		
Species:	Summer Chinook - Early						**Pounds:**	26,700		
Stock:	Okanogan									
Origin:	Wild									
Program:	Integrated									
Egg Take Goal:	360,000						**Adult Goal:**	158		
Estimated Release Data:										
Start Date:	**End Date:**	**Num Release**	**fish per lb.**	**Wt. grams**	**otal weight (lb**	**Total weight (kg**	**Life Stage**	**Release Site**	**Mark Typ**	**Tagged**
04/01/16	04/15/16	267,000	10	45	26,700	12,015	yearlings	Similkameen	Ad Clippe	CWT
Notes:	Egg take goal includes 3% for culling.									
	Adult Goal includes 10% pre-spawn mortality									
	10% Green to Eyed egg mortality									
	Rearing mortality is 16.7%									
Rearing Summary:										

Species	Source	Date	Number Green Eggs	Number Eyed Eggs	Number Ponded	Fed Fry	Released	Location
EA SU Chinook YR	Okanogan	April	349,200	314,280	298,566	283,638	267,000	Similkameen

Summer Chinook Late - Integrated Program (Omak Acclimation Pond Release)

Chief Joseph Hatchery Production Plan

Brood Year:	2014						**Planting Goal:**	566,000		
Species:	Summer Chinook - Late						**Pounds:**	32,600		
Stock:	Okanogan									
Origin:	Wild									
Program:	Integrated									
Egg Take Goal:	765,000						**Adult Goal:**	340		
Estimated Release Data:										
Start Date:	**End Date:**	**Num Release**	**fish per lb.**	**Wt. grams**	**otal weight (lb**	**Total weight (kg**	**Life Stage**	**Release Site**	**Mark Typ**	**Tagged**
04/01/16	04/15/16	266,000	10	45	26,600	11,970	yearlings	Omak	Ad Clippe	CWT
05/15/15	06/01/15	300,000	50	11	6,000	3,300	sub-yearling	Omak	Ad Clippe	CWT

Notes: Egg take goal includes 3% for culling.
Adult Goal includes 10% pre-spawn mortality
10% Green to Eyed egg mortality
Rearing mortality is 15.7% for yearlings, 16.2% for subs.

Rearing Summary:

Species	Source	Date	Number Green Eggs	Number Eyed Eggs	Number Ponded	Fed Fry	Released	Location
EA SU Chinook YR	Okanogan	April	348,764	313,887	298,193	283,283	266,000	Omak
EA SU Chinook Sub	Okanogan	June	393,287	353,958	336,260	319,447	300,000	Omak

Summer Chinook Late – Segregated Program (CJH Site Release)

Chief Joseph Hatchery Production Plan

Brood Year:	2014	**Planting Goal:**	450,000
Species:	Summer Chinook - Late	**Pounds:**	29,000
Stock:	Okanogan		
Origin:	Hatchery		
Program:	Segregated		
Egg Take Goal:	620,000	**Adult Goal:**	275

Estimated Release Data:

Start Date:	End Date:	Num Release	fish per lb.	Wt. grams	otal weight (lb	Total weight (kg	Life Stage	Release Site	Mark Typ	Tagged
04/01/16	04/15/16	250,000	10	45	25,000	11,250	yearlings	CJ hatchery	Ad Clipped	
05/15/15	06/01/15	200,000	50	11	4,000	2,200	sub-yearling	CJ hatchery	Ad Clipped	

Notes: Egg take goal includes 5% for culling.
Adult Goal includes 10% pre-spawn mortality
10% Green to Eyed egg mortality
Rearing mortality is 14.4% for yearlings, 16.5% for subs.

Rearing Summary:

Species	Source	Date	Number Green Eggs	Number Eyed Eggs	Number Ponded	Fed Fry	Released	Location
EA SU Chinook YR	Okanogan	April	323,950	291,555	276,977	263,128	250,000	CJ Hatchery
EA SU Chinook Sub	Okanogan	June	265,050	238,545	226,618	215,287	200,000	CJ Hatchery

Summer Chinook Early – Integrated Program (Riverside Acclimation Pond Release)

Chief Joseph Hatchery Production Plan

Brood Year:	2014						**Planting Goal:**	266,000		
Species:	Summer Chinook - Early						**Pounds:**	26,600		
Stock:	Okanogan									
Origin:	Wild									
Program:	Integrated									
Egg Take Goal:	360,000						**Adult Goal:**	158		
Estimated Release Data:										
Start Date:	**End Date:**	**Num Release**	**fish per lb.**	**Wt. grams**	**otal weight (lb**	**Total weight (kg**	**Life Stage**	**Release Site**	**Mark Typ**	**Tagged**
04/01/16	04/15/16	266,000	10	45	26,600	11,970	yearlings	Riverside	Ad Clippe	CWT

Notes: Egg take goal includes 3% for culling.
Adult Goal includes 10% pre-spawn mortality
10% Green to Eyed egg mortality
Rearing mortality is 16.7%

Rearing Summary:

Species	Source	Date	Number Green Eggs	Number Eyed Eggs	Number Ponded	Fed Fry	Released	Location
EA SU Chinook YR	Okanogan	April	349,200	314,280	298,566	283,638	266,000	Riverside

Summer Chinook Early – Segregated Program (CJH Release Site)

Chief Joseph Hatchery Production Plan

Brood Year:	2014	**Planting Goal:**	450,000
Species:	Summer Chinook - Early	**Pounds:**	29,000
Stock:	Okanogan		
Origin:	Hatchery		
Program:	Segregated		
Egg Take Goal:	620,000	**Adult Goal:**	275

Estimated Release Data:

Start Date:	End Date:	Num Release	fish per lb.	Wt. grams	otal weight (lb	Total weight (kg	Life Stage	Release Site	Mark Typ	Tagged
04/01/16	04/15/16	250,000	10	45	25,000	11,250	yearlings	CJ hatchery	Ad Clipped	
05/15/15	06/01/15	200,000	50	9	4,000	1,800	sub-yearling	CJ hatchery	Ad Clipped	

Notes: Egg take goal includes 5% for culling.
Adult Goal includes 10% pre-spawn mortality
10% Green to Eyed egg mortality
Rearing mortality is 14.4% for yearlings, 16.5% for subs.

Rearing Summary:

Species	Source	Date	Number Green Eggs	Number Eyed Eggs	Number Ponded	Fed fry	Released	Location
EA SU Chinook YR	Okanogan	April	323,950	291,555	276,977	263,128	250,000	CJ Hatchery
EA SU Chinook Sub	Okanogan	June	265,050	238,545	226,618	215,287	200,000	CJ Hatchery

Spring Chinook - Leavenworth (CJH Release)

Chief Joseph Hatchery Production Plan

Brood Year:	2014						**Planting Goal:**	700,000		
Species:	Spring Chinook						**Pounds:**	46,667		
Stock:	Leavenworth									
Origin:	Hatchery									
Egg Take Goal:	1,094,400						**Adult Goal:**	640		
Estimated Release Data:										
Start Date:	**End Date:**	**Num Release**	**fish per lb.**	**Wt. grams**	**otal weight (lb**	**Total weight (kg**	**Life Stage**	**Release Site**	**Mark Typ**	**Tagged**
04/01/16	04/15/16	700,000	15	30	46,667	21,000	yearlings	CJ hatchery	Ad Clipped	
Notes:	Egg take goal includes 20% for culling.									
	Adult Goal includes 10% pre-spawn mortality									
	10% Green to Eyed egg mortality									
	Rearing mortality is 15.5%									
Rearing Summary:										

Species	Source	Date	Number Green Eggs	Number Eyed Eggs	Number Ponded	Fed Fry	Released	Location
Spring Chinook	Leavenworth	April	875,520	787,968	748,570	711,141	700,000	CJ Hatchery

Spring Chinook - Met Comp (Tonasket Acclimation Pond Release)

Chief Joseph Hatchery Production Plan

Brood Year:	TBD	Pending NOAA approval on 10-J					**Planting Goal:**	200,000		
Species:	Spring Chinook						**Pounds:**	13,333		
Stock:	Met Comp									
Origin:	Hatchery/Wild									
Egg Take Goal:	326,800						**Adult Goal:**	190		
Estimated Release Data:										
Start Date:	**End Date:**	**Num Release**	**fish per lb.**	**Wt. grams**	**otal weight (lb**	**Total weight (kg**	**Life Stage**	**Release Site**	**Mark Typ**	**Tagged**
04/01/13	04/15/13	200,000	15	30	13,333	6,000	yearlings	Tonasket Pond	Ad Clippe	CWT
Notes:	Egg take goal includes 20% for culling.									
	Adult Goal includes 10% pre-spawn mortality									
	10% Green to Eyed egg mortality									
	Rearing mortality is 15.8%									
Rearing Summary:										

Species	Source	Date	Number Green Eggs	Number Eyed Eggs	Number Ponded	Fed Fry	Released	Location
Spring Chinook	Met Comp	April	261,440	235,296	223,531	212,355	200,000	Tonasket

APPENDIX C

Environmental DNA

An assessment of Environmental DNA (eDNA) analysis for detection of Chinook salmon in Upper-Columbia River subbasins, including the Okanogan Subbasin (USA and Canada) was implemented in cooperation with the USGS. Goals of this pilot study were to (1) develop a molecular assay capable of detecting Chinook DNA in water samples, (2) collect baseline data to characterize the distribution of Chinook in the Okanogan Subbasin, prior to the proposed release of a non-essential experimental population of spring-Chinook under section 10(j) of the ESA, and (3) to assess the effectiveness of eDNA analysis as a monitoring tool for implementation into the CJHP monitoring program. The focus of this monitoring tool was to identify presence/absence of Chinook in tributaries to the Okanogan River, habitat that would more likely be utilized by spring Chinook, following the release of the experimental population. Collection of water samples for eDNA analysis took place in 2012 at 48 sites in the Methow and Okanogan Subbasins. Results of these initial surveys were published as a thesis study with Boise State University (Laramie, 2013) and are available at: http://scholarworks.boisestate.edu/td/780.

The study abstract (reprinted from Laramie, 2013):

> "Determining accurate species distribution is crucial to conservation and management strategies for imperiled species, but challenging for small populations that are approaching extinction or being reestablished. We evaluated the efficacy of environmental DNA (eDNA) analysis for improving detection and thus known distribution of Chinook salmon in the Methow and Okanogan Sub-basins of the Upper-Columbia River, Washington, USA. We developed an assay to target a 90 base pair sequence of Chinook DNA and used quantitative polymerase chain reaction (qPCR) to quantify the amount of Chinook eDNA in 1-L water samples collected at 48 sites in the sub-basins. We collected samples once during high flows in June and again during low flows in August 2012. Results from eDNA surveys were compared to the current known distribution of Chinook. Using eDNA methods, the probability of detecting Chinook given that they were present was 0.83. Detection probability was lower ($p = 0.69$) in June during high flows and at the beginning of spring-Chinook migration than during base flows in August ($p = 0.98$). Based on our triplicate sampling, we had a false-negative rate of 0.07, suggesting that fewer replicates could be collected at a site while maintaining reasonable detection. Of sites that tested positive

during both sampling events, there was a higher mean concentration of eDNA in August than in June, probably because of reduced discharge, more fish, or both. As expected eDNA concentration increased from upstream to downstream, but only in one tributary and this pattern varied considerably among streams suggesting that other factors influence the spatial pattern of eDNA concentrations. For example, highest eDNA concentrations were found at sites with water temperatures centered around the optimal rearing temperature for Chinook and decreased rapidly around the approximate lethal temperature for the species. These results demonstrate the potential effectiveness of eDNA detection methods for determining landscape-level distribution of anadromous salmonids in large river systems."

During the 2012 pilot study, Chinook eDNA was detected in three tributaries in the U. S. portion of the basin and three in British Columbia based on the (Figure 1).

In June 2013, eight additional sites in the Okanogan subbasin (Antoine Creek, Loup Loup Cr., Siwash Cr., Tunk Cr., Tonasket Cr., Aeneas Cr., Wanacut Cr. and Similkameen River) were surveyed for eDNA. Samples were collected, extracted and analyzed using the same protocols as described in Laramie 2013 for the 2012 pilot study. Results of qPCR analysis for the 8 sites sampled in 2013 were not available at the time of this publication but will be included in the 2014 CJHP Annual Report.

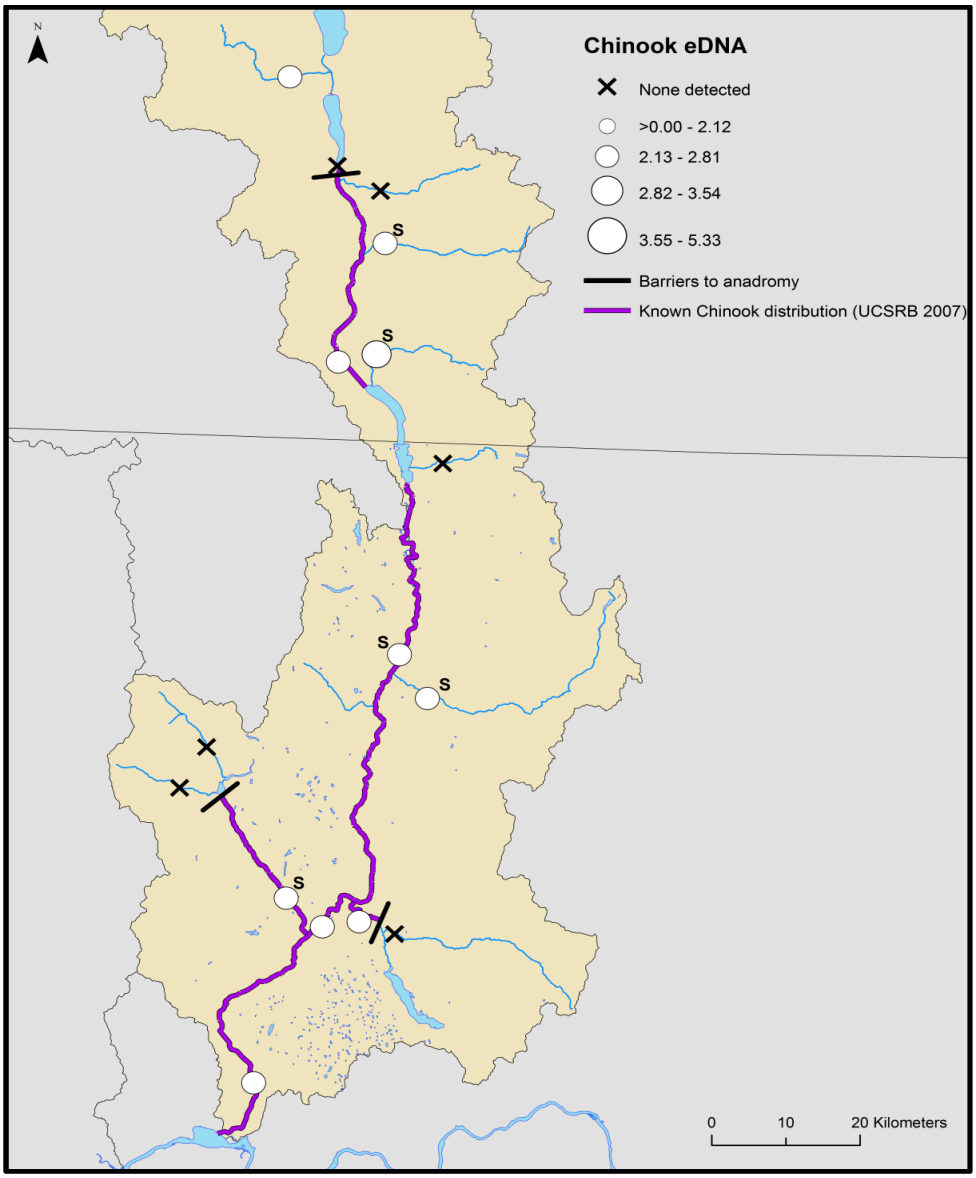

Figure C 1. eDNA sample sites in the Okanogan Subbasin collected in August 2012. 'S' represents samples that were sequenced to further confirm presence of Chinook at the sample site (Laramie 2013).

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APPENDIX D

Reach Weighted Effective pHOS

Table D 1. pHOS information for adjustments based on hatchery fish effectiveness (relative reproductive success assumption) and the reach weighting based on the proportion of redds in each reach in the Okanogan River from 2006 to 2013.

Brood Year		Number of Summer Chinook Redds and Spawners								Total	Effective Reach Weighted pHOS[1]
		Okanogan						Similkameen			
		O-1	O-2	O-3	O-4	O-5	O-6	S-1	S-2		
2006	NOS	2	2	22	10	105	247	370	73	831	18.0%
	HOS	2	1	9	6	15	44	138	33	248	
	Effective pHOS[2]	44.4%	28.6%	24.7%	32.4%	10.3%	12.5%	23.0%	26.6%		
	% Redds	0.2%	1.3%	4.1%	3.4%	19.7%	32.0%	29.9%	9.5%	100%	
2007	NOS	1	0	30	1	284	322	405	20	1063	31.7%
	HOS	1	0	25	0	169	197	253	9	654	
	Effective pHOS[2]	44.4%	0.0%	40.0%	0.0%	32.3%	32.9%	33.3%	26.5%		
	% Redds	0.2%	0.8%	5.8%	3.1%	27.3%	27.6%	31.0%	4.3%	100%	
2008	NOS	2	1	14	11	107	324	347	41	847	54.3%
	HOS	2	9	26	25	141	341	512	116	1172	
	Effective pHOS[2]	44.4%	87.8%	59.8%	64.5%	51.3%	45.7%	54.1%	69.4%		
	% Redds	0.2%	2.4%	2.8%	4.5%	17.4%	26.2%	37.3%	9.3%	100%	
2009	NOS	2	3	13	14	189	347	330	75	973	40.4%

	HOS	0	4	18	18	159	153	373	75	800	
	Effective pHOS[2]	0.0%	51.6%	52.6%	50.7%	40.2%	26.1%	47.5%	44.4%		
	% Redds	0.1%	1.1%	3.1%	4.7%	20.9%	26.5%	36.8%	7.0%	100%	
2010	NOS	1	5	19	18	154	180	329	69	775	41.1%
	HOS	2	5	11	24	87	172	296	79	676	
	Effective pHOS[2]	61.5%	44.4%	31.7%	51.6%	31.1%	43.3%	41.9%	47.8%		
	% Redds	0.1%	0.1%	4.5%	1.3%	11.2%	46.8%	35.4%	0.7%	100%	
2011	NOS	0	0	21	4	201	362	216	19	823	47.4%
	HOS	0	0	34	10	160	116	537	95	952	
	Effective pHOS[2]	0.0%	0.0%	56.4%	66.7%	38.9%	20.4%	66.5%	80.0%		
	% Redds	0.1%	0.6%	3.2%	1.8%	19.0%	30.2%	39.0%	6.1%	100%	
2012	NOS	0	0	18	9	133	427	206	23	816	39.7%
	HOS	1	0	38	6	123	110	288	31	597	
	Effective pHOS[2]	100.0%	0.0%	62.8%	34.8%	42.5%	17.1%	52.8%	51.9%		
	% Redds	0.4%	2.0%	5.9%	2.5%	20.7%	28.6%	34.1%	5.7%	100%	
2013	NOS	0	0	23	7	37	360	216	4	647	23.9%
	HOS	0	0	7	2	15	72	164	3	263	
	Effective pHOS[2]	0.0%	0.0%	19.6%	18.6%	24.5%	13.8%	37.8%	37.5%		
	% Redds	0.1%	0.1%	4.5%	1.3%	11.2%	46.8%	35.4%	0.7%	100%	
Average % Redds		***0.2%***	***1.3%***	***4.0%***	***3.1%***	***18.7%***	***30.9%***	***35.3%***	***6.5%***		
Average Effective pHOS		***44.4%***	***58.0%***	***45.7%***	***49.6%***	***36.5%***	***27.3%***	***45.9%***	***52.1%***		

Average Reach Weighted Effective pHOS =	***37.1%***

Table D 2. Number of hatchery- and natural-origin (wild) summer Chinook carcasses collected in each reach of the Okanogan (O1-O6) and Similkameen rivers from 1993 to 2013.

Survey year	Origin	Survey reach								Total
		O-1	O-2	O-3	O-4	O-5	O-6	S-1	S-2	
1993[a]	Wild	0	0	3	0	13	4	48	1	69
	Hatchery	0	2	0	0	10	9	25	0	46
1994[b]	Wild	0	0	1	0	7	1	113	22	144
	Hatchery	0	4	3	0	20	4	205	38	274
1995	Wild	0	0	1	0	10	0	66	4	81
	Hatchery	0	0	1	0	20	0	173	11	205
1996	Wild	0	0	0	1	3	1	53	0	58
	Hatchery	0	0	0	1	2	1	173	0	177
1997	Wild	0	0	1	0	0	3	83	0	87
	Hatchery	0	0	1	0	9	0	142	1	153
1998	Wild	0	1	3	1	6	5	162	4	182
	Hatchery	0	0	5	0	1	2	178	0	186
1999	Wild	0	0	0	0	9	23	293	9	334
	Hatchery	0	0	3	2	14	30	473	39	561
2000	Wild	0	0	8	8	24	11	189	4	244
	Hatchery	0	2	12	7	23	5	538	37	624
2001	Wild	0	10	23	5	67	42	390	54	591
	Hatchery	0	16	52	5	60	70	751	51	1,005
2002	Wild	6	14	20	10	81	212	340	72	755
	Hatchery	4	18	63	25	123	360	925	187	1,705

2003[c]	Wild	0	0	13	0	12	152	231	124	532
	Hatchery	0	0	15	0	5	91	365	257	733
2004	Wild	0	2	19	19	108	225	1,125	260	1,758
	Hatchery	0	2	12	5	38	58	267	38	420
2005	Wild	0	5	51	21	256	364	531	176	1,404
	Hatchery	0	3	42	16	115	70	200	100	546
2006	Wild	2	2	22	10	105	247	370	73	831
	Hatchery	2	1	9	6	15	44	138	33	248
2007	Wild	1	0	30	1	284	322	405	20	1,063
	Hatchery	1	0	25	0	169	197	253	9	654
2008	Wild	2	1	14	11	107	324	347	41	847
	Hatchery	2	9	26	25	141	341	512	116	1,172
2009	Wild	2	3	13	14	189	347	330	75	973
	Hatchery	0	4	18	18	159	153	373	75	800
2010	Wild	1	5	19	18	154	180	329	69	775
	Hatchery	2	5	11	24	87	172	296	79	676
2011	Wild	0	0	21	4	201	362	216	19	823
	Hatchery	0	0	34	10	160	116	537	95	952
2012	Wild	0	0	18	9	133	427	206	23	816
	Hatchery	1	0	38	6	123	110	288	31	597
2013[d]	Wild	0	0	23	7	37	360	216	4	647
	Hatchery	0	0	7	2	15	72	164	3	263
Average	***Wild***	***1***	***2***	***15***	***7***	***90***	***181***	***299***	***53***	***647***
	Hatchery	***1***	***3***	***19***	***8***	***64***	***95***	***340***	***59***	***590***

[a] 25 additional carcasses were sampled on the Similkameen and 46 on the Okanogan without any reach designation.

[b] One additional carcass was sampled on the Similkameen without any reach designation.

[c] 793 carcasses were sampled on the Similkameen before initiation of spawning (pre-spawn mortality) and an additional 40 carcasses were sampled on the Okanogan. The cause of the high mortality (*Ichthyophthirius multifilis* and *Flavobacterium columnarae*) was exacerbated by high river temperatures.

[d] In 2013, carcass recoveries were combined in reaches O-3 and O-4, and S-1 and S-2. Then re-apportioned based on redd counts within each reach.

Table D 3. Estimated number (and percent of annual total) of hatchery-origin spawners from different hatcheries recovered on the Okanogan/Similkameen spawning grounds, based on CWT recoveries and expansions, for return years 2006-2013.

Return Year	RMIS Release Basin														Total
	Homing Fish		Within ESU Stray[1]										Out of ESU Stray		
	Okanogan River Basin		Methow	Wen.	Chelan			Columbia R. Summer Chinook				Fall Chinook			
	Bonpte. Pond	Simil. Pond	Carlton Acl. Pond	Dryden Pond	Chelan River Net Pen	CCPUD Hat.	Chelan Hat.	Wells Hat.	Turt. Rock Hat.	East-bank Hat.	GCPUD Hat.	PRD Hat.	Glnwd. Spring Hat.	Oxbow Hat.	
2006	0 (0%)	709 (87%)	12 (2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	12 (2%)	56 (7%)	12 (2%)	12 (2%)	0 (0%)	0 (0%)	0 (0%)	814
2007	0 (0%)	1121 (95%)	17 (1%)	3 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (0%)	37 (3%)	2 (0%)	3 (0%)	0 (0%)	0 (0%)	0 (0%)	1,186
2008	0 (0%)	3224 (95%)	11 (0%)	24 (1%)	0 (0%)	4 (0%)	0 (0%)	75 (2%)	59 (2%)	0 (0%)	0 (0%)	3 (0%)	0 (0%)	0 (0%)	3,404
2009	0 (0%)	2733 (95%)	14 (0%)	4 (0%)	0 (0%)	9 (0%)	0 (0%)	76 (3%)	23 (1%)	9 (0%)	0 (0%)	0 (0%)	4 (0%)	5 (0%)	2,869
2010	4 (0%)	2165 (89%)	44 (2%)	4 (0%)	0 (0%)	75 (3%)	35 (1%)	75 (3%)	0 (0%)	31 (1%)	0 (0%)	0 (0%)	0 (0%)	4 (0%)	2,434
2011	219 (5%)	4196 (93%)	44 (1%)	0 (0%)	0 (0%)	6 (0%)	28 (1%)	17 (0%)	5 (0%)	5 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (0%)	4,520
2012	379 (13%)	2397 (83%)	29 (1%)	23 (1%)	6 (0%)	6 (0%)	6 (0%)	29 (1%)	23 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2,897
2013	254 (14%)	1437 (81%)	10 (1%)	54 (3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	10 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1,763
Avg.	**107 (4%)**	**2248 (90%)**	**23 (1%)**	**14 (1%)**	**1 (0%)**	**13 (0%)**	**9 (0%)**	**36 (1%)**	**26 (2%)**	**8 (0%)**	**2 (0%)**	**0 (0%)**	**1 (0%)**	**2 (0%)**	**2,486**

[1] Three spring Chinook recovered in 2008 were excluded from analysis. They were reared at Entiat NFH and released from Omak Creek in 2005.

Appendix E

Annual Program Planning Tool Spreadsheet

Table E 1. Annual tasks, subtasks, milestones for the CJHP.

Task-->	**1.1 Manage information and support the adaptive management process**				
Subtasks-->	**1.1.1 Ensure quality, timeliness and access all information needed to support decision making (maintenance/update of ISIT/AHA)**				
Milestone	**Activity/Description**	**Begin Date**	**Due Date**	**WE Deliverable**	**Lead**
Budget, schedule, scope and assignments for RM&E program completed	Plan for, administer and coordinate CJHP RM&E Program activities.	May 1, 2014	October 1, 2014	Updated APR data set	Keith Wolf
Data entered correctly to the OBMEP database	Data for ISIT that comes from OBMEP is entered into the OBMEP database prior to updating ISIT	1-Apr-14	Feb. 2015 (tentative; as available)	Updated APR data set	John Arterburn/ Lars Mobrand/ ICFI & Keith Wolf for Spring CK
Track and report progress toward biological goals	HARVEST (OK): In coordination with the harvest program, evaluate data on Colville Tribal C&S fisheries (Chief Joseph Dam Tailrace, platform and Okanogan River) to determine annual total effort, catch per unit of effort, and harvest of CJHP and other stocks (compilation of last season and previous year)	1-Apr-14	Nov. 1 2014	Updated APR data set	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff
Ensure that information is disseminated to fisheries managers and field crews as needed	Compile, analyze, and disseminate Project information, data, and findings via APR.	Nov. 2014	1-Mar-15	Updated APR data set	Keith Wolf
Task-->	**1.2 RM&E Activities required to: make annual production adjustments (in-season run-size prediction and updating)**				
Subtasks-->	**1.2.1 Update run-size projections**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Report TAC fish counts and run timing at Bonneville, Priest Rapids, and passing Wells Dams	Report TAC fish counts and run timing at mainstem hydro projects	Dec. 1 2014	Jul 31 2015	Annual Report on forecasting and disposition of returning adults	Mike Rayton
Update forecast in ISIT based on TAC 50% run size, timing and composition (NOR v HOR) at Bonneville in June	Estimate fraction of Okanogan-origin fish arriving at mainstem hydro projects. ISIT and AHA input. Regression.	Dec. 1 2014	Jul 15 2015	Annual Report on forecasting and disposition of returning adults	Andrea Pearl

Analyze accuracy/precision and future alternatives.	Regression analysis for prediction of NORs in the Okanogan from escapement at Wells	June 1 2014	Feb. 28 2015	Annual Report on forecasting and disposition of returning adults	Casey Baldwin
Query CJH PIT tag data and report preliminary results	Upload and data management for SAR Analysis	Jan. 1 2014	Feb. 28 2015	Annual Report on forecasting and disposition of returning adults	Andrea Pearl, Casey Baldwin
Subtasks-->	**1.2.2 Reporting/recording (how is information brought into ISIT/AHA)**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Update and document Key Assumptions	Active step to populate CJHP database. QA/QC in CJHP registered database and begin analysis	Nov. 1 2014	Mar. 31 2015	Annual Report on forecasting and disposition of returning adults	Andrea Pearl, Keith Wolf
Update estimates of SAR based on PIT tagging and Juvenile sampling	Upload and data management. Analysis	Nov. 1 2014	Mar. 31 2015	Annual Report on forecasting and disposition of returning adults	Andrea Pearl, Casey Baldwin
Update EDT	Upload and data management. Analysis	Jan. 31, 2015	Mar. 31 2015	Annual Report on forecasting and disposition of returning adults	John Arterburn, Keith Wolf (EDT), Andrea (ISIT)
Update and report in-hatchery survival parameters	Upload and data management. Analysis	Mar. 1 2014	Feb. 28 2015	Annual Report on forecasting and disposition of returning adults	Pat Phillips, Andrea Pearl
Update Status and Trend Information—both analytical results and documentation	Upload and data management. Analysis	Dec. 1 2014	Feb. 28 2015	Annual Report on forecasting and disposition of returning adults	Andrea Pearl, John Rohrback, Matt Laramie
Run CJH database queries	Maintain and manage the CHJP Database. SQL or other regional standards (Juvenile trapping, weir operations, redd and carcass survey database queries, Hatchery, Harvest, Spawning Escapement)	Nov. 1 2014	Feb. 28 2015	Annual Report on forecasting and disposition of returning adults	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff
Development of CJH database reports	Maintain and manage the CHJP Database. SQL or other regional standards	May 1 2014	Nov. 1 2014	Annual Report on forecasting and disposition of returning adults	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff
Move reports into ISIT/AHA	Maintain and manage the CHJP Database. SQL or other regional standards	Dec. 1 2014	Feb. 28 2015	Annual Report on forecasting and disposition of returning adults	Andrea Pearl, , John Rohrback, Matt Laramie and CJHP staff
Task-->	**1.3 RM&E activities required to: effectively implement the Program in terms of adult fish management: harvest, weir operations, broodstock collection**				
Subtasks-->	**1.3.1 Set Adult Management Targets**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**

Establish Biological Targets and report to Mike and Pat	Upload and data management. Analysis	Mar. 1 2014	15-Jul-14	Annual Report on forecasting and disposition of returning adults	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff
Review pre-season forecast from TAC then apply US v. OR and WDFW agreements to obtain a harvest allocation for Chinook.	data used for WE to estimate harvest allocation	Dec. 1 2014	Dec. 15 2014	Annual Report on forecasting and disposition of returning adults	Mike Rayton
Reconcile biological targets with harvest allocation; communications with co-managers	coordinated process with co-managers to disseminate information regarding harvest and biological targets	Mar. 15, 2014	Oct. 31, 2014	Annual Report on forecasting and disposition of returning adults	Kirk Truscott
Subtasks-->	**1.3.2 Deploy Selective Gear**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Establish efficiency parameters and effect monitoring	Conduct test of Weir	15-Jul-14	Oct. 31, 2014	Summary at APR/Final Report in 2015	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff
Establish efficiency parameters and effect monitoring	Conduct test of Tangle net	1-Jul-14	Sept. 30, 2014	Summary at APR	Mike Rayton
Establish efficiency parameters and effect monitoring	Conduct test of floating trap	NA 2014	NA 2014	0	NA 2014
Establish efficiency parameters and effect monitoring	Conduct test of beach seines	1-Jul-14	31-Oct-14	Summary at APR	Keith, Mike
Establish efficiency parameters and effect monitoring	Conduct test of scaffold	TBD	TBD	Summary at APR	TBD
Establish efficiency parameters and effect monitoring	Conduct test of hoop and dip net	TBD	TBD	Summary at APR	TBD
Establish efficiency parameters and effect monitoring	Conduct test of purse seine	11-Jun-14	Oct. 15, 2014	Summary at APR	Mike Rayton
Subtasks-->	**1.3.3 Fishing gear effect and effectiveness**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Interrogate NOR Chinook on purse and beach seine for PIT tags	Data will be uploaded to PTAGIS frequently enough during tagging/release operations that the PIT tag data will be in the database before the tagged fish are likely to be detected [specify appropriate intervals, perhaps by season if variable].	15-Oct-14	30-Nov-14	Annual Report on forecasting and disposition of returning adults	Andrea Pearl
Interrogate NOR Chinook at weir for PIT tags	Data will be uploaded to PTAGIS frequently enough during tagging/release operations that the PIT tag data will be in the database before the tagged fish are likely to be detected [specify appropriate intervals, perhaps by season if variable].	15-Jul-14	30-Nov-14	Annual Report on forecasting and disposition of returning adults	Andrea Pearl

Examine feasibility and outline study design to assess delayed mortality	Develop a study to analyze delayed mortality.	1-Apr-14	Aug. 31, 2014	Annual Report on forecasting and disposition of returning adults	Casey Baldwin
Estimate harvest rate based on catch data (Mike, July-Oct), CPUE, Feasibility/Cost Effectiveness	Data analysis to determine an estimated harvest rate. Calculate annual cost of program operations and compare to sum of ex-vessel value of commercial catches and monetary value of recreational fisheries for Chinook	TBD	TBD	Annual Report on forecasting and disposition of returning adults	TBD
Address jacks	Compile age composition for various gear types; summarize similarities and differences	15-Jul-14	Mar. 1, 2015	Annual Report on forecasting and disposition of returning adults	Casey Baldwin
Subtasks-->	**1.3.4 Monitor and record catch information-update status and trends**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Summarize and report Tribal harvest data, and recreational catch data received from WDFW to Andrea	Coordinated process with CCT staff to disseminate and share information for decision making	15-Oct-14	31-Jan-15	Annual Report on forecasting and disposition of returning adults	Mike Rayton
Tribal Creel surveys and upload of data into harvest database	Data collection on Tribal Creel fishing.	1-Jul-14	15-Nov-14	Annual Report on forecasting and disposition of returning adults	Mike Rayton
Subtasks-->	**1.3.5 Access catch information-update status and trends**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Retrieve CWT data (RMIS and DART)	query database for analysis	1-Jan-15	28-Feb-15	Annual Report on forecasting and disposition of returning adults	Casey Baldwin, Mike Rayton
Estimate number of Okanogan-origin HOR and NOR fish harvested in selective and non-selective fisheries state and tribal fisheries	Data analysis to determine an estimate of Okanogan HOR and NOR harvested by fishery	1-Nov-14	28-Feb-15	Annual Report on forecasting and disposition of returning adults	Mike Rayton, Casey Baldwin
Estimate contribution rate of Okanogan HORs to out-of-basin populations	data analysis to determine an estimate of hatchery returns to out-of-basin populations	1-Jul-14	15-Dec-14	Annual Report on forecasting and disposition of returning adults	Mike Rayton, Casey Baldwin
Estimate stray rate of Okanogan released HORs into Okanogan	data analysis to determine Okanogan releases to spawner composition	1-Jul-14	15-Dec-14	Annual Report on forecasting and disposition of returning adults	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff and Casey Baldwin
Subtasks-->	**1.3.6 Mark & tag recovery activities and/or development of future use of tags & marks**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**

Collect snouts and submit to WDFW for analysis	Collect snouts and submit to WDFW for analysis	1-Jul-14	28-Nov-14	Annual Report on forecasting and disposition of returning adults; study plans where applicable	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff, Pat Phillips, Mike Rayton
Analysis of tag recoveries	Query regional mark information system (RMIS) to determine # of recoveries of Okanogan-origin fish: in fisheries; at weir; on the spawning grounds; hatchery broodstock, hatchery ladder	15-Dec-14	28-Feb-15	Annual Report on forecasting and disposition of returning adults; study plans where applicable	Casey Baldwin, Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff
Analysis of tag recoveries	PIT tag activities and summary	15-Dec-14	28-Feb-15	Annual Report on forecasting and disposition of returning adults; study plans where applicable	Andrea Pearl
Future analysis of tag recoveries	Development of key management questions to be addressed through genetic analysis, and study design for use of genetic tags for CJH analysis. Continue archiving PBT information at CJH	April 1 2014	Feb. 28, 2015	Annual Report on forecasting and disposition of returning adults; study plans where applicable	Matt Laramie, Casey Baldwin, Kirk Truscott
Analysis of tag recoveries	Where available, access data. 1) Development of key management questions to be addressed through radio tag analysis, and 2) study design for use of radio tags for CJH analysis.	April 1 2014	Feb. 28, 2015	Annual Report on forecasting and disposition of returning adults; study plans where applicable	Matt Laramie, Casey Baldwin, Kirk Truscott, Jennifer Miller
Analysis of tag recoveries	where available, access data. 1) Development of key management questions to be addressed through acoustic tag analysis, and 2) study design for use of acoustic tags for CJH analysis.	April 1 2014	Feb. 28, 2015	Annual Report on forecasting and disposition of returning adults; study plans where applicable	Keith Wolf, Andrea Pearl, Casey Baldwin
Analysis of tag recoveries	Regional Coordination	1-Apr-14	15-Dec-14	Annual Report on forecasting and disposition of returning adults; study plans where applicable	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff, Pat Phillips, Casey Baldwin
Subtasks-->	**1.3.7 Plan and conduct Annual Project Review (APR)**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Planning and Logistics: three APR workgroups (policy, technical, logistics)	Plan, prepare for, coordinate and communicate with CCT and support staff for implementing the Annual Program Review.	Nov. 1 2014	30-Apr-15	Conduct APR and produce Annual Plans and Report	Keith Wolf, Kirk Truscott
Task-->	**1.4 Activities required to: effectively implement hatchery operations to meet production targets and contribution to CJHP RM&E**				
Subtasks-->	**1.4.1 Brood Collection**				

Milestone	Activity	Begin Date	Due Date	Deliverable	Lead
Collect BY 14 Summer/Fall Chinook Broodstock	Off-Site Brood Collection: Purse Seine and Transport/Weir	15-Jul-14	Oct. 31, 2014	Production Report and weekly collection schedule	Pat Phillips, Tony Cleveland, Mike Rayton
Develop Broodstock collection quota	Update collection quota based on APR Biological Targets	15-Mar-14	1-Apr-14	Production Report and weekly collection schedule	Kirk Truscott
Collect BY 14 Spring Chinook Broodstock	Collect and transport Leavenworth broodstock to CJH	1-Jun-14	30-Jun-14	Production Report and weekly collection schedule	Pat Phillips
BY 14 Summer/Fall Chinook Adult Management	On-Site Fish Ladder Operation, Brood Collection and Surplus Fish Handling	1-Jul-14	30-Nov-14	Production Report and weekly collection schedule	Pat Phillips
Broodstock composition NOR, HOR for Spring Chinook	Summarize Leavenworth and Winthrop NFH transfer information (Critical Data and information)	1-Jun-14	31-Dec-14	Production Report and weekly collection schedule	Pat Phillips
Broodstock composition NOR, HOR for S/Fall Chinook	Collect data at spawn and surplussing (length, sex, CWT, PBT, PIT tag, etc.)	1-Oct-14	30-Nov-14	Production Report and weekly collection schedule	Pat Phillips, Matt Laramie
Surplussed Fish for Spring Chinook	Surplus fish as needed	NA 2014	NA 2014	Production Report and weekly collection schedule	NA 2014
Surplussed Fish for S/Fall Chinook	Remove hatchery fish from the ladder.	1-Jul-14	30-Nov-14	Production Report and weekly collection schedule	Pat Phillips
Subtasks-->	**1.4.2 On-Site Brood Holding and Egg-Take**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Within hatchery life-stage survival	Data collection of hatchery pre-spawn mortality (Spring and S/F Chinook)	1-Jun-14	30-Nov-14	Hatchery Production Report	Pat Phillips
Within hatchery life-stage survival	Data collection of spawned broodstock which includes M/F, jack and estimated green egg take (SP/Su/F)	1-Aug-14	30-Nov-14	Hatchery Production Report	Pat Phillips
Within hatchery life-stage survival	Data collection of fecundity(Spring and S/F Chinook)	1-Nov-14	31-Jan-15	Hatchery Production Report	Pat Phillips
Subtasks-->	**1.4.3 Incubation and Ponding**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Within hatchery life-stage survival	Data collection of green egg to eyed egg survival (Spring and S/F Chinook)	1-Nov-14	31-Jan-15	Hatchery Production Report	Pat Phillips
Within hatchery life-stage survival	Data collection of eyed egg to emergence survival (Spring and S/F Chinook)	1-Dec-14	30-Apr-14	Hatchery Production Report	Pat Phillips
Within hatchery life-stage survival	Data collection of number of fry ponded to indoor rearing (Spring and S/F Chinook)	1-Dec-14	30-Apr-14	Hatchery Production Report	Pat Phillips
Subtasks-->	**1.4.4 Chinook Start-up Indoor Rearing at the Hatchery**				
Milestone	**Activity**	**Begin**	**Due**	**Deliverable**	**Lead**

		Date	Date		
Within hatchery life-stage survival	Short term rearing (Spring and S/F Chinook)	1-Jan-14	31-May-14	Hatchery Production Report	Pat Phillips
Within hatchery life-stage survival	Number of fry transferred to outdoor raceways (Spring and S/F Chinook)	1-Feb-14	31-May-14	Hatchery Production Report	Pat Phillips
Subtasks-->	**1.4.5 Juvenile Fish Marking and Tagging**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Uniquely mark individual production groups	Mark reintroduction 10j Spring Chinook with 100% CWT-Ad (USFWS) and 5,000 PIT tag (CCT) --Spring Chinook	1-Jun-14	31-Aug-14	Hatchery Production Report	Pat Phillips
Uniquely mark individual production groups	Mark integrated Summer Chinook with 100% CWT-Ad and 10,000 PIT tag (CCT) -Sum/Fall Chinook	1-Jul-14	30-Apr-15	Hatchery Production Report	Pat Phillips
Uniquely mark individual production groups	Mark segregated Spring Chinook with 200k CWT and 100% Ad-Clip --Spring Chinook	1-Jul-14	31-Aug-14	Hatchery Production Report	Pat Phillips
Uniquely mark individual production groups	Mark segregated Summer Chinook with 200k CWT and 100% Ad-Clip and 10,000 PIT tag (CCT) --Sum/Fall Chinook	1-Jul-14	30-Apr-15	Hatchery Production Report	Pat Phillips
Uniquely mark individual production groups	Perform pre-release tag retention evaluation of CWT's and PIT tags. Captures mark efficiency-proportion of fish released that were successfully marked. --Spring Chinook	15-Mar-14	15-Apr-14	Hatchery Production Report	Pat Phillips, Tony Cleveland, Andrea Pearl
Uniquely mark individual production groups	Perform pre-release tag retention evaluation of CWT's and PIT tags. Captures mark efficiency-proportion of fish released that were successfully marked. --S/Fall Chinook	15-Mar-14	15-Jun-14	Hatchery Production Report	Pat Phillips, Tony Cleveland, Andrea Pearl
Subtasks-->	**1.4.6 Chinook Outdoor Rearing in Raceways and Ponds at the Hatchery**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Within hatchery life-stage survival	Outdoor rearing and release of segregated fish at the hatchery --Spring Chinook	1-May-14	30-Apr-15	Report sections for Production and Annual Report	Pat Phillips
Within hatchery life-stage survival	Outdoor rearing and release of segregated fish at the hatchery --S/Fall Chinook	1-Feb-14	30-Apr-15	Report sections for Production and Annual Report	Pat Phillips
Within hatchery life-stage survival	Outdoor rearing and release of10j reintroduction fish at the hatchery --Spring Chinook	1-May-14	31-Oct-14	Report sections for Production and Annual Report	Pat Phillips
Within hatchery life-stage survival	Outdoor rearing and release of integrated fish at the hatchery --S/Fall Chinook	1-Feb-14	30-Apr-15	Report sections for Production and Annual Report	Pat Phillips

Subtasks-->	1.4.7 Chinook Outdoor Rearing in Ponds at the Hatchery				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
	No of segregated fish released at the hatchery --Spring Chinook	1-Feb-14	30-Apr-15	Report sections for Production and Annual Report	Pat Phillips
	No of segregated fish released at the hatchery --S/Fall Chinook	1-Feb-14	30-Apr-15	Report sections for Production and Annual Report	Pat Phillips
Subtasks-->	**1.4.8 Chinook Transport to Acclimation Ponds**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Juvenile transfers	200k 10j reintroduction juvenile fish transferred to Acclimation ponds --Spring Chinook	15-Oct-14	15-Nov-14	Hatchery Production Report	Pat Phillips, Tony Cleveland
Juvenile transfers	660k Integrated fish transferred to Acclimation ponds --S/Fall Chinook	15-Apr-14	15-Nov-14	Hatchery Production Report	Pat Phillips, Tony Cleveland
Subtasks-->	**1.4.9 Chinook Rearing at Acclimation Ponds**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Within hatchery life stage survival	Outdoor rearing and release of 10j reintroduction fish at the acclimation pond --Spring Chinook	1-Nov-14	30-Apr-15	Hatchery Production Report	Pat Phillips, Tony Cleveland
Within hatchery life stage survival	Outdoor rearing and release of integrated fish at the acclimation pond --S/Fall Chinook	15-Apr-14	30-Apr-15	Hatchery Production Report	Pat Phillips, Tony Cleveland
Task-->	**1.5 RM&E activities required to: test key program assumptions related to habitat and natural production**				
Subtasks-->	**1.5.1 Spawning habitat survey**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Empirical measurements at spawning locations	data collection and upload into database. Data analysis as needed	NA 2014	NA 2014	NA 2014	NA 2014
Subtasks-->	**1.5.2 Habitat status and trend monitoring**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Habitat surveys	Update habitat data	1-Jan-14	31-Dec-14	Updated productivity and capacity at defined intervals (four years)	John Arterburn
Subtasks-->	**1.5.3 Redd/carcass surveys**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Map redd locations	Data collection and entry on where redds are located into ArcGIS for Okanogan and Similkameen rivers	1-Oct-14	28-Feb-15	APR Presentation and Annual Report	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie

					and CJHP staff
Conduct spawning ground and carcass surveys in Okanogan and Similkameen rivers	data collection and entry for spawning ground, carcass recoveries, and egg retention in the Okanogan and Similkameen rivers	1-Oct-14	15-Nov-14	APR Presentation and Annual Report	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff
Inclusion of Zosel video and Redd surveys	Obtain Zosel video, pit and spawning ground data in Canada to integrate into CJHP databases	15-Nov-14	31-Jan-15		Casey Baldwin, Andrea Pearl, ONA
Upload existing data into CJH database	Uploading data from data collections	1-Oct-14	30-Nov-14	#REF!	Andrea Pearl, Keith Wolf
Analysis to meet objectives above	QA/QC on the dashboard, run query reports and data summaries. Analyze data in ArcGIS. Input data into ISIT	20-Nov-14	28-Feb-15		Andrea Pearl, Matt Laramie
Subtasks-->	**1.5.4 juvenile emigration monitoring**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Beach seining and tagging up to 25k NOR CK	Pit Tag subyearling juvenile Chinook fish >65mm	15-Jun-14	30-Jul-14	APR Presentation and Annual Report	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff
Screw trapping on the Okanogan River	Operate Rotary Screw Trap to conduct Juvenile abundance estimates, tagging, trap efficiency, and run timing	1-Apr-14	31-Jul-14	APR Presentation and Annual Report	Keith Wolf, Andrea Pearl
Review protocols in MM.org.	Adopt, modify or create CJH protocols	1-May-14	30-Apr-15	APR Presentation and Annual Report	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff
Analysis to meet objectives above	QA/QC on the dashboard, run query reports and data summaries. Analyze data in ArcGIS. Input data into ISIT	20-Nov-14	February 28th	APR Presentation and Annual Report	Keith Wolf, Andrea Pearl
Subtasks-->	**1.5.5 monitoring at wells dam**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Retrieve data from stock monitoring at Wells Dam east and west ladders (WDFW)	Coordinate with WDFW to obtain data into existing CJHP database	1-Dec-14	31-Jan-15	ISIT Status and Trends	Andrea Pearl
Retrieve data from ladder counts at Wells (DCPUD)	Coordinate with DCPUD to obtain data into existing CJHP database	1-Jul-14	30-Nov-14	ISIT Status and Trends	Andrea Pearl
Tagging and Marking at Wells	Tagging activities to include radio, acoustic and pit tags	NA 2014	NA 2014	ISIT Status and Trends	Keith Wolf, Casey Baldwin, Matt Laramie and John Rohrback
Subtasks-->	**1.5.6 Habitat restoration planning and implementation**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**

Provide implementation schedule and project description	Implement habitat restoration projects	15-Mar-14	14-Mar-15	APR Presentation and Annual Report	Chris Fisher
Subtasks-->	**1.5.7 Monitor and record annual variables and events affecting summer/fall Chinook**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Review last year's events and summarize	Document environmental anomalies	1-May-14	30-Apr-15	ISIT/AHA input, APR and Annual Report	Keith Wolf
Subtasks-->	**1.5.8 Implementation**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Were assumptions met? Review last year's events and summarize	Summarize all collection efforts at APR and adapt plans as necessary	1-Nov-14	30-Apr-15	ISIT/AHA input, APR and Annual Report	Keith Wolf
Subtasks-->	**1.5.9 All-H integration**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
		1-Nov-14	30-Apr-15	ISIT/AHA input, APR and Annual Report	Keith Wolf, Kirk Truscott
Task-->	**1.6 Activities required for RM&E-logistics and tool development**				
Subtasks-->	**1.6.1 Planning, scheduling and coordination of field work**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Work with Keith to integrate Action Plan into M&E Plan	Summarize all data collection and analysis and adapt plans as necessary.	1-Nov-14	30-Apr-15	ISIT/AHA input, APR and Annual Report	Keith, DJW
Subtasks-->	**1.6.2 Tool Development**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Set of models and other tools for use in analysis and planning. Includes other statistical and qualitative/qualitative analysis for use in annual process.	AHA/ISIT/APPT etc. data and database management	1-May-14	30-Apr-15	ISIT/AHA input, APR and Annual Report	Keith Wolf
Regression and other analyses for reporting and the APR process	ISIT/AHA data analysis, data and database management	1-May-14	30-Apr-15	ISIT/AHA input, APR and Annual Report	Andrea Pearl
	APPT Planning Tool	1-May-14	30-Apr-15	ISIT/AHA input, APR and Annual Report	Keith Wolf, Andrea Pearl, Matt Laramie, Casey Baldwin
The CJH database includes coordinating and integrating multiple data sets from different locations (WDFW, DCPUD, EDT, PNAMP, OBMEP, ISIT, AHA)	CJH Database	1-May-14	30-Apr-15	ISIT/AHA input, APR and Annual Report	Keith Wolf, Andrea Pearl, John Rohrback
	Website development and management	1-May-14	30-Apr-15	ISIT/AHA input, APR and Annual	Andrea Pearl, Brenda

				Report	Schmidt, Keith Wolf, Pat Phillips
Task-->	**1.7 Activities required to: manage and administer RM&E program**				
Subtasks-->	**1.7.1 Manage and Administer RM&E Activities**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Provide accrual reporting for FY 2014	Provide BPA with an estimate of contract work that will occur prior to April 30 but will not be billed until April 30 or later. Data must be input in to Pisces by March.	1-Jan-15	1-Mar-15	Record of communications	Keith Wolf
Provide development of FY 2015 budget and SOW	develop out year budget and SOW for 2015 for all CJHP activities and provide in Pisces format to BPA on time and with all required attachments	1-Jul-14	30-Sep-14	Record of communications	Keith Wolf
Provide requested budget modifications and information	Monitor budgets (not development as outlined in Manage and Administer Projects)	1-May-14	30-Apr-15	Record of communications	Keith Wolf
Subtasks-->	**1.7.2 Address Policy Issues**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Participate in meetings, communications, workshops, APR etc.	Identify key stakeholders and policy makers. Identify potential decisions and/or influence that stakeholder(s) could impose that could affect the CJHP. Provide information to Colville Tribal decision-makers	1-May-14	30-Apr-15	Record of communications	DJW and Kirk Truscott will collaborate on this list w/ Chuck Brushwood
Subtasks-->	**1.7.3 Prepare budgets**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
FY Budget Approval	Develop Budgets in BPA and Tribal Formats. Process though federal and CCT administrative steps. Incorporate into PISCES	1-Jul-14	1-Feb-15	Contract "offer"	Keith Wolf
Subtasks-->	**1.7.4 Administer agreements with contractors, PUDs, etc.**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Development of Cost Share Agreements and annual review	Coordinate with BPA and the Cost Share Agreement Partners. Financial review each month to approve/correct charges and approve for submission to BPA.	1-May-14	30-Apr-15	Review and approval for Cost Share Agreements	Keith Wolf
Subtasks-->	**1.7.5 Monthly reviews of all accounting, purchasing and invoicing**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Monthly review and corrections if necessary to CCT accounting reports. Approval of subsequent invoices prior to submittal to BPA	Coordinate with BPA and the Cost Share Agreement Partners. Financial review each month to approve/correct charges and approve for submission to BPA.	1-May-14	30-Apr-15	Monthly invoices	Keith Wolf

Subtasks-->	1.7.6 Procurement and inventory control				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Approved purchases consistent with budgets	Coordination with CCT A/P, vendor communications Preparation of applicable documents	1-May-14	30-Apr-15	Receipt of purchased items	Andrea Pearl, Brenda Schmidt with approvals from Keith Wolf, Pat Phillips
Subtasks-->	**1.7.7 Publications and conferences**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
As deemed contributory to progression of program, reduction is error, improvement data collection, analysis, data management and overall science rigor.	Project Manager to assess opportunities and or requirements for attendance, presentation, training.	1-May-14	30-Apr-15	Attendance reports	Keith Wolf & Pat Phillips
Subtasks-->	**1.7.8 Training**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Completion of employee and or program development plans	Development of employee and or program development plans	May 1, 2014	April 30, 2014	Documentation of attendance, APR presentation.	Keith Wolf
Task-->	**1.8 Activities required to: produce Project Status Reports**				
Subtasks-->	**1.8.1 Prepare Project Status Report 1**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Oct-Dec 2013 (10/1/2013 - 12/31/2013)	Status reports entered on time and correctly	1-May-14	1-Jul-14	Pisces Status Reports	Keith Wolf & Pat Phillips
Jan-Mar 2014 (1/1/2014 - 3/31/2014)	Status reports entered on time and correctly	1-Aug-14	1-Oct-14	Pisces Status Reports	Keith Wolf & Pat Phillips
Apr-Jun 2014 (4/1/2014 - 6/30/2014)	Status reports entered on time and correctly	Nov. 1 2014	1-Jan-15	Pisces Status Reports	Keith Wolf & Pat Phillips
Jul-Sep 2014 (7/1/2014 - 9/30/2014)	Status reports entered on time and correctly	1-Feb-15	30-Apr-15	Pisces Status Reports	Keith Wolf & Pat Phillips
Task-->	**1.9 Annual Program Report**				
Subtasks-->	**1.9.1 Draft and finalize Annual Program Report**				
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**
Reporting Period	entered on time and correctly with appropriate attachments	1-Nov-14	30-Apr-15	Annual Progress Report	Keith Wolf, Pat Phillips
Category-->	**2.0 Environmental Compliance**				
Task-->	**2.1 Permitting activities for RM&E activities**				
Subtasks-->					
Milestone	**Activity**	**Begin Date**	**Due Date**	**Deliverable**	**Lead**

Obtain all environmental compliance permits	On-the-ground work associated with this work element cannot proceed until this milestone is complete. Milestone is complete when final documentation is received from BPA environmental compliance staff (completion can be based on pre-existing environmental documentation from BPA).	1-May-14	30-Apr-15	Environmental compliance documents and Agreements	Keith Wolf, Andrea Pearl
Obtain all environmental compliance permits	Perform data collections and analysis for use in environmental review and permit applications.	1-May-14	30-Apr-15	Environmental compliance documents and Agreements	Keith Wolf with Andrea Pearl, John Rohrback, Matt Laramie and CJHP staff
Obtain all environmental compliance permits from NOAA	Perform data collections and analysis for use in environmental review and permit application	1-May-14	30-Apr-15	Environmental compliance documents and Agreements	Charles Brushwood, Casey Baldwin, Keith Wolf
Obtain all environmental compliance permits	Perform data collections and analysis for use in environmental review and permit application	1-May-14	30-Apr-15	Environmental compliance documents and Agreements	Charles Brushwood, Casey Baldwin, Keith Wolf
Obtain all environmental compliance permits	Perform data collections and analysis for use in environmental review and permit application	1-May-14	30-Apr-15	Environmental compliance documents and Agreements	Casey Baldwin
Obtain all environmental compliance permits and agreements	Perform data collections and analysis for use in environmental review and permit application	1-May-14	30-Apr-15	Environmental compliance documents and Agreements	Charles Brushwood, Casey Baldwin

APPENDIX F

Glossary of Terms, Acronyms, and Abbreviations

The following is a list of key terms and variables used in the Chief Joseph Hatchery Program and in this Annual Report. This is not a complete list, but provides many of the main terms used in this report or that will likely be used in future CJHP Annual Report.

Accord/MOA = A ten-year agreement (2008 – 2018) between BPA and the CCT whereas BPA agreed to fund pre-determined fish and wildlife projects and CCT agreed not to sue the Action Agencies regarding the BiOp for the FCRPS.

CJHP Master Plan = A three-step development and review process required for all new hatcheries funded by BPA in the Columbia Basin.

eDNA = environmental DNA; dissolved or cell-bound DNA that persists in the environment.

Escapement Target = Number of fish of all origins targeted to pass upstream of the Okanogan Adult Fish weir

HOB = the number of hatchery-origin fish used as hatchery broodstock.

HOR = hatchery-origin recruit. The number of HOR's equals the sum of HOS + HOB + hatchery-origin fish intercepted in fisheries.

HOR Terminal Run Size = Number of Chief Joseph Hatchery HOR's returning to Wells Dam

HOS = the number of hatchery-origin fish spawning naturally.

Juvenile Abundance = annual abundance of out-migrant juveniles estimated by expanding data from juveniles captured at the rotary screw trap.

Met Comp = Methow composite Spring Chinook. These fish are part of the Winthrop NFH program and are intended to be used for the Okanogan reintroduction pending approval under section 10(j) of the ESA.

NOB = the number of natural-origin fish used as hatchery broodstock.

NOR = natural-origin recruit. The number of NOR's equals the sum of NOB, + NOS + natural-origin fish intercepted in fisheries.

NOR Terminal Run Size = Number of Okanogan (and Similkameen, combined) NOR's returning to Wells Dam.

NOS = the number of natural-origin fish spawning naturally.

pHOS = proportion of natural spawners composed of HOR's. Equals HOS/ (NOS + HOS).

PNI = proportion of natural influence on a composite hatchery-/natural-origin population. Can also be thought of as the percentage of time the genes of a composite population spend in the natural environment. Equals 1 - pNOB/ (pNOB + pHOS).

pNOB = proportion of hatchery broodstock composed of NOR's. Equals NOB/ (HOB + NOB).

SAR = smolt to adult return.

Recovery Plans = Federally-required plans under the Endangered Species Act that describe species status, recovery criteria and expected restoration actions.

Relative Reproductive Success = The probability that an HOR produce adult offspring and summer/fall expressed as a fraction of the same probability for a NOR

Spatial Distribution = Geographic spawning distribution of adult salmon.

Spawner Abundance = Total number of adult spawners each year**.**

Subbasin Plans = Plans developed in the early 2000s for the NPCC project funding process describing "limiting factors" used for development of regional recovery and protection strategies.

Total NOR Recruitment = Annual number of adult recruits (catch plus escapement)

AHA = All H Analyzer

APPT = Annual Program Planning Tool

APR = Annual Program Review

BiOp = Biological Opinion

BKD = Bacterial Kidney Disease

BPA = Bonneville Power Administration

CA = Coordinated Assessments

CBFWA = Columbia Basin Fish and Wildlife Authority

CCT = Confederated Tribes of the Colville Indian Reservation

cfs = Cubic feet per second

CJH = Chief Joseph Hatchery

CJHP = Chief Joseph Hatchery Program

Colville Tribes = Confederated Tribes of the Colville Reservation

CTFWP = Colville Tribes Fish &Wildlife Program

CRITFC = Columbia River Inter-Tribal Fish Commission

CWT = Coded Wire Tag

DI = Density Index

DPS = Distinct Population Segment

EDT = Ecosystem Diagnostic & Treatment

ELISA = Enzyme-Linked Immunosorbent Assay

ESA = Endangered Species Act

ESU = Evolutionarily Significant Unit

FCRPS = Federal Columbia River Power System

FI = Flow Index

FPP = Fish per pound

FWS = US Fish and Wildlife Service

GIS = Geographic Information System

gpm = gallons per minute

GPS = Global Positioning System

HCP = Habitat Conservation Plan(s)

HGMP = Hatchery Genetic Management Plan(s)

HSRG = Hatchery Science Review Group

ISIT = In-season Implementation Tool

ISRP = Independent Scientific Review Panel

KMQ = Key Management Questions

LNFH = Leavenworth National Fish Hatchery

NEPA = National Environmental Policy Act

NMFS = National Marine Fisheries Service

NOAA = National Oceanic and Atmospheric Administration

NPCC = Northwest Power and Conservation Council

ODFW = Oregon Department of Fish and Wildlife

ONA = Okanagan Nation Alliance

PBT = Parental Based Tagging

PIT = Passive Integrated Transponder

PNAMP = Pacific Northwest Aquatic Monitoring Partnership

PSMFC = Pacific States Marine Fisheries Commission

PTAGIS = PIT Tag Information System

PUD = Public Utility District

RKM= River Kilometer

RM = River Mile

RMIS = Regional Mark Information System

RM&E = Research, Monitoring, and Evaluation

RST = Rotary Screw Trap

SNP = Single Nucleotide Polymorphism

TAC = Technical Advisory Committee

TRMP = Tribal Resources Management Plan

TU = Temperature Unit

UCSRB = Upper Columbia Salmon Recovery Board

USGS = United States Geological Survey

WDFW = Washington Department of Fish and Wildlife

WNFH = Winthrop National Fish Hatchery