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Basinwide Supplementation Evaluation Project: 2009 Annual Progress Report

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Annual Progress Report

Year #1 (May 1 2009 to April 30 2010)

Basinwide Supplementation Evaluation

Contract No. 42631
Project No. 2009-009-00

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in cooperation with:
Confederated Tribes of the Warm Springs Reservation of Oregon
Yakama Nation
Confederated Tribes of the Umatilla Reservation
Nez Perce Tribe

Prepared for:
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ABSTRACT

This report reviews activities and results for Year #1 (May 1, 2009 to April 30, 2010) of this 10-year project, organized under four primary Project Objectives and summarized briefly for each Objective as follows:

Project Objective #1: A Dual-Frequency Identification Sonar (DIDSON) was operated at the Castile Falls Fishway (rkm 103) on the Klickitat River from May through September 2009. Observation of fish passage events in the recorded video files provided an estimate of 24 ± 4 fish for the 2009 escapement of spring Chinook to the upper basin. The DIDSON will be deployed in a similar manner in Year #2, to obtain a 2010 escapement estimate.

Project Objective #2: The mark-recapture likelihood model (designed to use mark-recapture data of single and double tagged fish, and to incorporate the resulting estimate of tag loss rate into the inference for population abundance) underwent additional modifications. These refinements to the model are still ongoing, which has delayed production of a manuscript suitable submission for journal publication. Finalization of this manuscript is anticipated in Year #2 of the Project.

Project Objective #3: Several different tribal co-managed supplementation programs were considered relative to their need for additional funding of an associated relative reproductive success (RRS) study of natural-origin versus hatchery-origin salmon. Of these, support for the ongoing RRS study of Johnson Creek spring Chinook appeared to be of greatest interest. To present, the Nez Perce Tribe (NPT) has been able to partially fund a RRS study as part of this program, but a quantity of archived samples remain unanalyzed and monies budgeted over the next several years will remain insufficient to fully support the study. In addition, there is need to expand the number of juvenile samples collected, to obtain greater precision in the estimates of juvenile recruits per spawner. Following study of program's history and discussions with NPT biologists and managers associated with the project, CRITFC has offered to provide the needed supplemental funding through the present Project, to finance laboratory analysis of the archived samples, and of the number of samples collected in future years that go beyond the limits of available NPT funding. Analysis of the archived samples and of additional 2010 samples will begin during Year #2 of the Project.

Project Objective #4: Characteristics of several different tribal salmon reintroduction programs were examined relative to the feasibility of initiating a RRS study of natural-origin versus hatchery-origin salmon. The primary objective to performing these RRS studies is to obtain quantified measures information to infer whether the anticipated re-naturalization of the introduced fish is indeed occurring. A RRS study of Hood River spring Chinook was the first program to be chosen for support. This reintroduction program is a collaborative effort of the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) and the Oregon Department of Fish and Wildlife (ODFW). Samples of archived (ODFW/The Dalles) scales for returning adults from the 1992 to 2008 run years were collected, and DNA extraction and microsatellite analyses have been performed. Analysis of the resulting data is as yet incomplete, and sample collection and data analyses for 2009 and 2010 samples will continue through Year #2 of the Project. Additional reintroduction programs chosen for RRS studies include: Lookingglass Creek spring Chinook (Confederated Tribes of the Umatilla Reservation - CTUIR), Newsome Creek (NPT), Lolo Creek spring Chinook (NPT), and upper Wenatchee River coho (Yakama Nation - YN). Discussions on the logistics for obtaining tissue samples have been held with tribal representatives and associated state co-managers. Funding will be provided in Year #2 (2010-2011) of the present Project to support laboratory genetics analyses of archived samples (through 2009) and samples to be collected in 2010. An associated activity supported by the Project was organization of the Tribal Salmon Reintroduction Workshop, held on Feb 2 to 4, 2010 in Pendleton OR. The objective of the workshop was to facilitate an exchange of information between personnel active in the various tribal reintroduction programs. The Workshop was attended by a total of 62 tribal technicians, biologists, managers and policy makers. One outcome of this Workshop was production of a poster (presented at three different scientific conferences) describing the tribal coho reintroduction projects. In addition, drafting of a manuscript summarizing results from these programs was initiated. This manuscript should be ready for submission for publication in Year #2 of the Project.

ACKNOWLEDGEMENTS

Funding for the present Project was provided by the Bonneville Power Administration under the direction of the Northwest Power and Conservation Council. I sincerely appreciate the administrative support supplied by Barbara Shields, BPA Contracting Officer Technical Representative for this Project, as well as by Kristi Van Leuven, Contracting Office Representative, and Israel Duran, Environmental Compliance Lead. Chris Frederickson and Peter Barber (Yakama Nation - YN) and Saang-Yoon Hyun (Columbia River Inter-Tribal Fish - CRITFC) collaborated on the DIDSON sonar project (Project Objective #1). Saang-Yoon Hyun (CRITFC) and Joel Reynolds (USFWS) collaborated on development of the mark-recapture model (Project Objective #2). Discussions with Craig Rabe and Jay Hesse (Nez Perce Tribe - NPT) and Andrew Matala and Shawn Narum (CRITFC/Hagerman) were critical in the decision to provide supplemental funding from the present Project to the ongoing relative reproductive success (RRS) study of Johnson Creek spring Chinook (Project Objective #3). A great number of representatives from the four Treaty Tribes (YN, NPT, Confederated Tribes of the Umatilla Reservation - CTUIR, and Confederated Tribes of the Warm Springs Reservation of Oregon – CTWSRO) were consulted over this past year, for information on their respective reintroduction programs, which was essential to deciding which programs would be supported with funding for a RRS study through this Project (Project Objective #4). In particular, I would like to recognize the contribution of Chris Brun and Ryan Gerstenberger (CTWSRO), Steve Boe, Carrie Crump and Gary James (CTUIR), Cory Kamphaus, Keely Murdoch and Tom Scribner (YN), and Catherine Bradley, Sherman Sprague, Tom Backman and Jay Hesse (NPT). Additionally, I greatly appreciate the collaboration of the following persons from the state co-managing agencies associated with these programs: Robert Reagan and Megan Heinrich (Oregon Department of Fish and Wildlife), David Venditti, Brett Bowersox and Ryan Banks (Idaho Department of Fish and Game). Finally, in addition to the collaboration of Saang-Yoon Hyun, I would like to acknowledge the administrative support provided by the following CRITFC employees: Douglas Hatch, Phil Roger and Christine Golightly.

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1.0 Introduction

In their 2005 report submitted to the Northwest Power and Conservation Council (NPCC) entitled "Monitoring and Evaluation of Supplementation Projects" (ISRP and ISAB 2005), the Independent Scientific Review Panel (ISRP) and Independent Scientific Advisory Board (ISAB) recommended that an interagency workgroup be formed to design a monitoring and evaluation approach to obtain a basinwide understanding of the critical uncertainties regarding use of hatchery supplementation to rebuild depressed populations. In response, the *Ad Hoc* Supplementation Workgroup (AHSWG) was formed – a group of volunteer scientists and managers associated with tribal, state and federal fisheries agencies, and power companies and other non-governmental agencies. Following a series of workshops and ancillary discussions, the AHSWG recommended a three-pronged approach: 1) conducting treatment/reference (T/R) comparisons of long-term trends in the abundance and productivity of multiple supplemented (treatment) populations relative to un-supplemented (reference) populations, 2) conducting a series of relative reproductive success (RRS) studies to quantify short-term impacts through comparisons of productivity within broodyears of hatchery-origin and natural-origin fish in supplemented populations, and 3) development of a request for proposals to fund several intensive small-scale studies designed to elucidate various biological mechanisms by which introduction of hatchery-produced fish may influence natural population productivity (AHSWG 2008).

The present Project, submitted as part of the Columbia Basin Fish Accords (2008), was designed to implement actions which support the AHSWG recommendations – specifically, actions to 1) improve abundance and productivity estimation procedures used in monitoring supplemented and reference populations (Year #1 Project Objectives #1 and #2), and 2) provide RRS information from supplemented populations and reintroduced/supplemented populations (Year #1 Project Objectives #3 and #4, respectively) – see Project No. 2009-009-00 - Project Narrative, under Attachments within the Project PISCES web site, or http://www.nwcouncil.org/fw/projectselection/accord/Default.asp.

The following report summarizes activities and results obtained during the initial (Year #1, May 2009 through April 2010) for each of these four Project Objectives.

2.0 Project Objective #1: DIDSON Escapement Estimation

The Yakama Nation (YN) is actively involved in management of the anadromous fish populations of the Klickitat River (YN 2008), including escapement of spring Chinook for which they conduct a supplementation program . In a collaborative project between CRITFC and YN, a Dual-Frequency Identification Sonar (DIDSON) was deployed to observe spawning migration of spring Chinook adults through the Castile Falls Fishway (rkm 103) on the Klickitat River. The DIDSON was programmed to continuously record sequential 1-hour files from late May until late September 2009, which encompassed the period anticipated for spring Chinook escapement into the upper basin. "Echograms" were processed from the original DIDSON video files, and upstream passage events observed in the echograms of large fish deemed to be spring Chinook were noted. The resulting data were analyzed to account for periods when DIDSON files were unavailable (occasional periods when operation of the DIDSON was interrupted due to technical problems), producing an estimate for total 2009 spring Chinook escapement to the upper basin of 24 ± 4 fish (95% confidence interval). This estimate is higher than the estimate of 12 fish based on an expansion of the total redd count for the year (4 redds, times an expansion factor of 3 fish per redd). Presuming greater accuracy of the escapement estimate from the direct DIDSON count relative to that from the indirect method based on an expansion of the redd count, reasons for differences between the two methodologies include: 1) that the redd count is underestimated because existent redds were not observed during the surveys (overlooked by the observers, and/or were located in river sections not included within the surveys), and/or 2) that the expansion factor (3 fish per redd) is under-estimated due to greater than expected pre-spawn mortality (from natural causes and/or from fishing mortality).

A full description of this project - background information and rationale, methods, results (raw data and data analysis) and evaluation of these results - is provided in the CRITFC Technical report (Galbreath et

al. 2010), a copy of which is available at http://maps.critfc.org/tech/10_01report.html, as well as among Attachments in the Project site within PISCES.

3.0 Project Objective #2: Development of a mark-recapture likelihood model

Another methodology for estimating population abundance uses a mark-recapture design. When applied for estimation of spawning escapement of an anadromous population, the technique involves capture and tagging/marking a sample of the adults at an early point during their in-river migration, and subsequent (re)capture/(re)sighting of fish at an upstream barrier or during spawning ground surveys. Information on the number of fish tagged/marked, the number of fish captured/sighted upstream, and the number among the latter which possessed a tag are entered into Peterson estimators to calculate population abundance at the time of tagging, at its associated variance with which to calculate confidence limits (Seber 1973, Everhart et al. 1975).

Portland General Electric, the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) and the Oregon Department of Fish and Wildlife (ODFW) have conducted a collaborative project each year over the past several years, using mark-recapture to estimate escapement of kokanee migrating to their spawning grounds in the Metolius River from Lake Billy Chinook, Jefferson County, Oregon (Lovtang et al. 2008). In these studies, a sample of adults is captured by seining in the lake just prior to their upstream migration, and marked with a brightly colored plastic anchor tags. The fish are then "recaptured" via resighting during walking surveys of the spawning grounds, and the number of tagged and of untagged fish are recorded. However, knowing that some portion of the fish would likely lose their tags during the period between tagging and the spawning surveys, it is expected that the resulting estimation of population abundance would be biased high. To correct for this bias, a presumed tag loss rate of 25% (Smith et al. 1978, Smith and McPherson 1981) was used to adjust downwards the number of originally tagged adults. However, the 25% tag loss rate was estimated from studies of a coastal population of spring Chinook, and would not necessarily be directly applicable to Metolius kokanee. Since 2007, the study design has been modified to provide an estimate of tag loss specific to the Metolius River kokanee. This alteration involves double-tagging a portion of the marked fish with tags of an alternative color. Then, during the spawning surveys the number of double-tagged fish which retain both, or only one of their tags is noted. The ratio of these two values is used to estimate the rate of tag loss, which in turn is used to correct the number of originally single-tagged fish prior to estimating population abundance (Lovtang et al. 2008).

In reviewing of the double-tagging data for the 2007 study of kokanee escapement, however, we noted that a problem remains in the analytical procedure – the uncertainty in the estimate of tag loss rate is not incorporated into the calculation of population abundance. Ignoring this uncertainty results in confidence limits to the abundance estimate that are overly optimistic (narrow). As part of a Pacific Coast Salmon Recovery Fund project (CRITFC Project No. 2007-5-02), we developed a likelihood methodology (the biniomial-hypergeometric likelihood model) to estimate tag loss and its uncertainty based on double-tagging data, which then incorporates both values into the estimation of population abundance, providing a more realistic measure of the combined uncertainty (Galbreath and Hyun 2008).

While the original model is relatively robust, certain questions remained, particularly as concerns a presumption required by the model, that a double-tagged fish would not lose both of its tags. Therefore, it was decided that during the present Project, we would continue development of the model as part of Year #1 activities. To this end, the advice of a biometrician/colleague outside of CRITFC was solicited (Dr. Joel Reynolds, US Fish & Wildlife Service, Anchorage, AK). During Year #1, the model was modified, and the new model run through a series of validation processes with sets of simulated data representing a wide range of input values. Additionally, a draft manuscript was written describing the modified model and the associated validation procedures. Interpretation of the validation results continues, and the original plan to have the manuscript finalized and submitted for publication has been postponed until later in Year #2 of the Project. Likewise, web-posting of the new model is also postponed until this manuscript has been accepted for publication, which we hope to be before the end of Year# 2, or early in Year #3.

4.0 Project Objective #3: Support for an Unfunded/Underfunded RRS Study

As indicated in the Introduction, the AHSWG recommended enacting additional RRS studies within the Columbia basin to examine productivity of natural origin (NO) and hatchery-origin (HO) fish within supplemented populations. A minimum of studies deemed necessary were six per species for stream-type Chinook salmon and for steelhead, two studies of ocean-type Chinook salmon, and three studies of reintroduced salmon populations (AHSWG 2008).

A limited number RRS studies of Columbia basin spring Chinook and steelhead, as well as one for Snake River fall Chinook study, have already been initiated and have ongoing funding. On the other hand, other RRS studies were initiated - tissue samples have been collected and archived - but funding has been insufficient or never allocated to complete the associated laboratory analyses. Examples of supplementation programs in which this has occurred include: Project No. 200303900 - Monitor Reproduction In Wenatchee/Tucannon//Kalama, Project No. 200729900 - Investigation of the Relative Reproductive Success of Stray Hatchery and Wild Steelhead and the Influence of Hatchery Strays on Natural Productivity in the Deschutes River Subbasin, Project Proposal No. 200729900 - Genetic Evaluation of Chinook Salmon Supplementation in Idaho Rivers, Project No. 199604300 - Johnson Creek Artificial Propagation Enhancement Project (JCAPE). In Phase I of present project, CRITFC proposed to identify one such study deemed to be of greatest interest for supplemental funding provided by the present Project.

Technical reports produced for each of the projects listed above were reviewed. Published information on the JCAPE project supplemented with information shared in discussions with Nez Perce Tribe (NPT) biologists and managers, indicated that support from the present Project of the RRS study within JCAPE would likely be of highest interest. The published reports included a 1998-2005 summary report (Rabe et al. 2006) and an updated monitoring and evaluation plan (Vogel et al. 2006), and slide presentations prepared for the 2009 Symposium on Salmon Supplementation, organized by the NPT Department of Fisheries Resource Management (http://www.nezperce.org/~dfrm/Research/2009%20Symposium.html). In anticipation of performance of a RRS study, JCAPE project biologists have collected tissue samples from adults intercepted at the downstream weir in Johnson Creek each year since 2000, as well as samples from juvenile samples collected with a rotary screw trap operated adjacent to the weir. Since that time, as “year-end” funds became available, they were used to initiate the molecular genetics analyses required for the RRS study. These analyses were performed by CRITFC geneticists at the Hagerman Fish Culture Experiment Station laboratory (HFCES). Preliminary results for analyses of adult samples were summarized in the slide presentation at the 2009 Symposium on Salmon Supplementation: “Evaluation of the Johnson Creek summer Chinook supplementation program using genetic parentage analysis; Do hatchery fish reproduce in the wild?”.

The Nez Perce Tribe has recently made a commitment to provide $60,000 annually from available monitoring and evaluation funds, to support laboratory analyses for this RRS study. This sum will be sufficient to cover laboratory expenses for approximately 1,500 samples. However, in those years of relatively high returns, such as was seen in 2009 and is anticipated in 2010, the total number of samples will likely surpass 2,000. Also, analyses of a backlog of archived adult and juvenile samples remain unfunded. Given the established relationship between CRITFC and the NPT for this study, and the data already available for initial analyses from prior years, supplemental funding from the present Project would assure complete (past and future) analysis of adult and juvenile samples. This support will significantly increase the value of the Johnson Creek RRS study.

Discussions were initiated with NPT biologists and managers during Year #1, regarding establishment of this commitment to provide supplemental financing of the Johnson Creek study. Discussions will continue during Year #2 of the Project, to finalize arrangements for collections and delivery of samples to CRITFC/Hagerman, including agreement on target numbers of juveniles to be sampled annually. Funding will then be transferred to CRITFC/Hagerman to cover expenses incurred during Year #2 for analysis of the backlogged juvenile and adult samples ($n \approx 1{,}400$), and samples collected during 2009 in excess of the approximately 1,500 to be financed by the NPT ($n \approx 1000$).

5.0 Project Objective #4: RRS in Reintroduced/Supplemented Populations

Factors such as overfishing, freshwater habitat loss and degradation, increased mortality within the hydrosystem associated with effects of damming, etc. have been responsible for depressed abundance of essentially all extant natural populations of salmon and steelhead in the Columbia basin. In other cases the effects were even more dramatic, as they lead to extinction of many of these naturally spawning populations. This included extirpation of all populations whose natal streams were above the impassable Chief Joseph and Hells Canyon dams, but also included populations downstream of these dams, e.g., spring Chinook in the Hood, Umatilla, Okanogan and Clearwater River basins, and 100% of the native coho salmon populations within the Columbia basin upstream of Bonneville Dam (Fulton 1968, Mullen 1983; Nehlson et al. 1991, O'Toole et al. 1991).

Efforts have been made to recreate a naturally spawning population in some of the rivers where the original population was extirpated, through stocking of juveniles produced from out-of-basin hatchery stocks (e.g., Bowles and Leitzinger 1991, Phillips et al. 2000, Underwood et al. 2003, Lutch et al. 2005, Murdoch et al. 2006, Bosch et al 2007, Narum et al. 2007). Results from several of these Columbia basin reintroduction programs have been very encouraging. Substantial numbers of the HO juveniles returning as mature adults have been recorded, as well as natural spawning of some portion of these HO fish. Further, NO juveniles at the fry, parr and out-migrating smolt stages have been observed, as have mature NO adults within the subsequent spawning escapement – indicative that a full generation or more of strictly natural production has occurred (Phillips et al. 2000, Underwood et al. 2003, Lutch 2005, Murdoch et al. 2006, Bosch et al 2007, Narum et al. 2007). However, what are the possibilities that these reintroduced fish will successfully establish a population which has the potential for natural self-sustainability? Concern has been expressed regarding the deleterious effects of artificial production on long term natural fitness of a hatchery stock (e.g., Ford 2002, ISRP 2005, Araki et al. 2008) - that these effects may be genetic in nature and not readily reversible. If such is the case, there is reason to question whether an out-of-basin stock which has been hatchery-reared over multiple generations (resulting in genetic selection for characters which are advantageous in the hatchery but disadvantageous in a natural environment) will retain sufficient levels and diversity in the genetic characters needed for the stock to readapt to a new natural environment.

In a recent meta-analysis, Fraser (2008) reviewed published reports for 31 different salmonid reintroduction programs, including several of the Columbia basin programs cited above. For many of these programs, particularly those for which effects of hydrosystem blockages and habitat degradation which contributed to the extirpation of the original populations have been substantially reversed, a self-sustaining population appears to be re-establishing itself. However, hatchery supplementation continues to a greater or lesser degree in each of these programs, and uncertainty therefore remains whether the natural production observed is supported by spawning of a progressively better adapted naturalized population, as opposed simply to natural production of some number of returning adults from the supplementation program juveniles stocked annually into the river. Under this Project Objective, we are initiating RRS studies in several of these reintroduction/supplementation programs, so as to obtain empirical data with which to better assess their relative success.

Broodstock management protocols for these programs generally involve the progressive phasing out of the original out-of-basin hatchery broodstock. In their place, returning adults are collected in-basin for use as broodfish to produce the juveniles with which to continue supplementation of the newly reintroduced population. The initial generations of this "local origin" broodstock are comprised of mature hatchery origin (HO) adults. In subsequent generations, as the number of adults of natural origin (NO) in the return run grows, NO fish can be incorporated into the hatchery broodstock in increasing proportions. The rationale for this strategy is based on the presumption that the genetic characters which facilitated successful return and natural spawning of the original HO fish will be passed on to their progeny, and that over generations a population which is progressively better adapted to the local environment will be established and become increasingly abundant and productive.

While it will not be possible to make a definitive determination whether or not a reintroduced population is self-sustainable prior to monitoring of population abundance over several years following cessation of the

supplementation project, RRS information can infer that the process of adaptation might, or might not, be occurring. An out-of-basin stock, particularly one which has been hatchery-reared over multiple generations, can be presumed to be (far) less than ideally adapted to a given natural environment. A low level of adaptation of the introduced stock will be reflected by a low level of productivity (recruits per spawner, R/S). If, however, the reintroduced fish go through a process of naturalization/adaptation to the new environment over successive generations of reintroduction/supplementation, it will be illustrated by a trend for increasing productivity. Unfortunately, because of year-to-year environmental variability, observation of a significant trend requires long term data sets. On the other hand, the need for multiple years of data with which to estimate a trend can be circumvented if one can compare natural productivity within generations among parental types, categorized by the management protocols and the number of generations of hatchery influence. That is, if the process of naturalization is occurring, one would expect measures of R/S to be higher for naturally spawning in-basin HO adults relative to out-of-basin HO fish, for in-basin NO fish relative to in-basin HO fish, and for second generation in-basin NO fish relative to first generation in-basin NO fish, etc. The RRS studies to be established through this Project will provide data to illustrate whether or not this process of naturalization is indeed occurring.

The goal in Year #1 for Project Objective #4 Year #1 was to examine information from multiple tribal reintroduction programs in order to chose 5-6 programs where a RRS study is not just feasible but could yield valuable results for comparing productivity of NO versus HO fish, taking into consideration other relevant characters – sex, run-timing, size and age, etc. Reports were reviewed and discussions were held with managers and biologists associated the following reintroduction programs:

spring Chinook
- Hood River
- Umatilla River
- Walla Walla River
- Lookingglass Creek (Grande Ronde River)
- Lolo Creek (Clearwater River)
- Newsome Creek, Crooked River, and Red River (South Fork of the Clearwater River)

coho salmon
- Yakima River
- Wenatchee River
- Methow River
- Umatilla River
- Clearwater River

Characteristics of a reintroduction program which were considered to positively influence its inclusion among those chosen for financial support included:

- The river has a weir/dam at which returning adults may be trapped and sampled
- The trap is highly efficient (collects at least the large majority of the adults)
- The adults can be identified to origin (HO vs NO), and other ancillary data is collected – sex, run-timing, size, age, etc.
- The trap is located downstream of all or the large majority of the (sub)population's spawning habitat
- The program is funded on an ongoing basis to trap and sample the adults
- The program is funded on an ongoing basis to trap and sample juveniles (identifiable as natural-origin), and juvenile sampling is performed in a sufficiently representative manner
- Adult and juvenile samples have been collected in previous years and the samples are archived
- A RRS study has already been initiated, but lacks sufficient funding for completion
- Willingness of the associated co-managers to collaborate in a RRS study

5.1 Hood River spring Chinook reintroduction program

The first reintroduction program to be chosen for financing of a RRS study under the present Project was the Hood River spring Chinook program – a program co-managed by the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) and the Oregon Department of Fish and Wildlife

(ODFW). Following extirpation of the native stock no later than the mid-1970s, spring Chinook were reintroduced into the Hood River with the stocking of Carson Hatchery juveniles in 1986. Stocking has continued annually, although in 1992 the co-managers switched to use of Deschutes River stock from Round Butte Hatchery, with occasional input from Warm Springs River Hatchery (Underwood et al. 2003). Beginning in 1992, scales and ancillary information (sex, size, date, etc.) were collected annually on every adult salmon intercepted at the Powerdale Dam fish trap (Hood River rkm 6), along with information as to whether the fish was passed upstream for natural spawning, collected for hatchery broodstock, or recycled downstream to the sport fishery. Reports of the Hood River Monitoring and Evaluation Project which summarize information over the history of the project related to releases of hatchery-produced spring Chinook juveniles, of natural spawning and production of spring Chinook juveniles, and of adult escapement include: Underwood et al. 2003, Olsen 2003 and 2007, Vaivoda et al. 2005a and b, McCanna et al. 2006. An updated version of the monitoring and evaluation program associated with the Hood River Production Program, which includes a description of the genetics study of the spring Chinook is available in ODFW and CTWSRO 2008.

During Year #1 of the present Project, samples of available archived scales (Run Years 1992 to 2008) collected from returning adults captured at Powerdale Dam were obtained for all fish passed upstream for natural spawning, and sent to the CRITFC/Hagerman genetics laboratory (n ≈ 6750). DNA was extracted for each individual, and analyses performed for a standardized suite of 15 microsatellite loci. While still incomplete, some preliminary analyses of the resulting genetics data have been performed. Summary information from these analyses is available in the slide presentation file "HoodR CHS_Provisional Summary_May2010.pdf", and in the file: "poster Coastwide Genetics 2010.pdf" (a poster prepared for the Coastwide Salmonid Genetics meeting, Boise ID June 2-4, 2010) within the Attachments section of the Project's site in PISCES. One finding of note was the identification of a portion of the NO fish with a genotype characteristic of Lower Columbia/Willamette River Chinook, which persists across run years (1992 to 2007; average ≈ 16%). Additionally, capture date at Powerdale Dam for these fish was on average 37 days later than fish of the upper Columbia stream-type lineage to which the remaining fish assign (similar to that of Carson and Deschutes stocks). These fish of the Lower Columbia lineage likely represent strays, or progeny of strays, which recolonized the Hood River in the years following extirpation of the indigenous stock. Parentage information is still too preliminary to make any statements regarding relative productivity of the fish.

Activities projected for Year #2 for this portion of the Project include:

- collection and analysis of samples for which scales were missing in the archived scale envelopes examined in the first round of sample collection, but which might be obtained from the corresponding scale cards (used for determining fish age), which have also been archived at the ODFW office in The Dalles OR.
- collection and analysis of samples for natural origin adults collected in 2009 and 2010
- quality control of the laboratory analyses
- performance of parentage analyses once the full data set is complete
- confirmation of concordance of results from the parentage analyses with data on fish age determined from scale reading
- development of a statistical model which incorporates information on sex, age, size, and return date into the analyses for relative productivity differences between natural and hatchery origin adults within broodyears

5.2 Other Reintroduction Programs

Monies budgeted in Project Year #1 for laboratory analyses of samples from reintroduction programs were used entirely for processing of archived scales of Hood River spring Chinook. Meanwhile, information from other tribal reintroduction programs was assessed, and the choice was made to undertake RRS studies in four additional programs:

5.2.1 Lookingglass Creek (Grande Ronde River) spring Chinook

Spring Chinook populations within the Grande Ronde system declined dramatically in abundance by the 1980s. As part of the Lower Snake River Compensation Plan (LSRCP), a hatchery was constructed at rkm 3 on Lookingglass Creek (a tributary to the Grande Ronde at rkm 136) for the purpose of rearing fish with which to supplement these populations in Grande Ronde and Imnaha systems. However, for the population in Lookingglass Creek itself, it was too late – this population had already become extinct. Reintroduction of spring Chinook from the hatchery into Lookingglass Creek occurred over the following 20 years (initially using Wind River, then Carson NFH, then Rapid River stocks) but had very limited success in terms of reestablishing a naturally spawning population. Managers later decided to cease use of these out-of-basin stocks, and re-reintroduction was attempted again in 2001, this time using Catherine Creek (also a tributary to the Grande Ronde). Since 2004, in anticipation of eventual genetics studies to help assess the relative success of this effort, tissue samples from all adults passed upstream of the Lookingglass weir (½ km upstream of the hatchery), as well as samples from juveniles captured in a screw trap (¼ km downstream of the weir), have been collected (n ≈ 1,400). The samples were sent to CRITFC/Hagerman, where they have been archived and currently await funding to cover the cost of laboratory analysis. Annual project reports (1989 to present) which summarize juvenile stocking and population monitoring information for Lookingglass Creek spring Chinook are available within the Confederated Tribes of the Umatilla Indian Reservation - Reports and Publications section of the LSRCP/US Fish and Wildlife web site: http://www.fws.gov/lsnakecomplan/Reports/CTUIRreports.html.

5.2.2 Lolo Creek (Clearwater River) spring Chinook

Reintroduction of spring Chinook in the Clearwater basin began with the removal of the Lewiston Dam and the annual stocking of hatchery juveniles in the early 1970s. In Lolo Creek - a tributary to the Clearwater River at rkm 87 - the NPT began reintroduction with outplants of Dworshak NFH adults in 1997. Juveniles from the adjacent Clearwater Anadromous Fish Hatchery were released into Lolo in 1999. And since 2004, Lolo Creek has been stocked annually with juveniles produced at the Nez Perce Tribal Fish Hatchery, using adults collected in Lolo Creek. Recent information on spring Chinook juvenile stocking, on natural spawning and juvenile production, and on adult escapement is available in annual reports for the Nez Perce Tribal Hatchery Monitoring and Evaluation Project – Spring Chinook Supplementation in the Clearwater Subbasin (Backman et al. 2009 and Bradley et al. 2009). Escapement into Lolo Creek is monitored at 2 weirs: a lower weir at rkm 21 and an upper weir at rkm 51. The upper weir can generally be installed 1-2 weeks before the lower weir, and captures the near totality of spring Chinook accessing the upper basin. The lower weir is downstream of essentially 100% of the spawning area, however it typically cannot be installed until a week or two after the upper weir, by which time a substantial portion of the adult migration past this location has already occurred. While only a portion of the adult run has been interrogated at these weirs, tissue samples have been collected, and archived, from the adults chosen for use as broodstock and from a sample of the fish passed upstream. Tissue samples have also been collected annually and archived, from a sample of out-migrating juveniles collected in a screw-trap operated near the lower weir. To present, genetics analyses of these samples has not been performed. In Year #2 we will look further in detail relative to the number of samples, and the timing of these collections to determine to what extent genetics/parentage analysis of these samples would yield valuable information.

A project to construct a permanent weir at the lower site was recently submitted and approved (see FY2010 Fast Track BiOp Review proposal submitted to the Northwest Power and Conservation Council "Lolo Creek Permanent Weir Construction", http://www.nwcouncil.org/fw/budget/2010/rme/proposal.asp?id=1653). Following its installation (foreseen in 2011 or 2012), essentially all in-migrating adults will be intercepted and tissue-sampled. In consequence, we have proposed to finance a RRS study through the present Project, based on both juvenile and adult R/S. In the meantime, we propose to a) perform genetics analyses on archived samples for hatchery broodstock and out-migrating hatchery origin juveniles, and b) to perform beginning in 2010, a juvenile recruits per spawner RRS study of NO versus HO adults limited to those sampled at the upstream weir and which spawned naturally in the upper portion of the basin. Tissue samples from

adults sampled at the upper weir will begin in 2010, and samples of their progeny (parr) will be collected by electroshocking in summer 2011 – Project Year #3.

5.2.3 Newsome Creek (South Fork of the Clearwater River) spring Chinook

Supplementation of reintroduced spring Chinook has also been performed by the NPT in Newsome Creek, a tributary to the South Fork of the Clearwater River at rkm 84. Similar to Lolo Creek, information on juvenile stocking and on juvenile and adult monitoring is available in the annual reports Backman et al. 2009 and Bradley et al. 2009. Unlike Lolo Creek, however, the NPT has systematically tissue sampled returning adults annually beginning in run year 2005. The adults are intercepted at a weir located approximately 100 m upstream of the Creek's confluence with the South Fork, in principle therefore, collecting essentially 100% of the run. Samples from out-migrating juveniles have been collected beginning fall 2007, in a screw-trap located just downstream of the weir site, operated both in the fall and the spring. Using "year end" monies, NPT has been able to finance analysis of all adult samples (released upstream for natural spawning, and collected for use as hatchery broodstock) and a portion of their corresponding juvenile progeny for run years 2005-2007. Results are summarized in the report "Genetic pedigree analysis to evaluate natural productivity between natural-, and stray-origin Chinook salmon (*Oncorhynchus tshawytscha*) in Newsome Creek, ID by Matala et al., which is included as Appendix C in Bradley et al. 2009. Beginning in Year #2, it has been agreed that the present Project will take on responsibility for the cost of laboratory analysis for all remaining juvenile samples, and all samples (juvenile and adult) to be collected from 2010 onward.

Consideration is also being given to pairing the Newsome Creek study with a RRS of spring Chinook in the Crooked River. The confluence of Crooked River with the South Fork is only 2 km upstream that of Newsome Creek, and has a spring Chinook population of similar size and life history as that in Newsome Creek. Inclusion of productivity information from Crooked River could provide interesting comparisons with neighboring Newsome Creek. Since the early 1990s, Crooked River was annually supplemented with Clearwater stock reintroduced spring Chinook juveniles as part of the Idaho Supplementation Study (ISS; Bowles and Leitzinger 1991). However, the ISS design prescribed cessation of supplementation in many of the treatment streams, including Crooked River, after several years. As such, 2004 was the last year of supplementation stocking in the Crooked River, after which only natural origin adults have been passed upstream for natural spawning. Of note, performance of RRS studies in several of the supplementation treatment streams, including the Crooked River, was later proposed as an addition to the ISS design (Lutch et al. 2005), and tissue samples from all adults and from a limited number of natural origin juveniles have been collected and archived. However, funding to perform the RRS studies was not forthcoming. Discussions are still underway with the Idaho Department of Fish and Game regarding CRITFC taking on the financing of a Crooked River RRS study through the present Project, with a decision expected in the first half of Project Year #2, and with the possibility of analyzing the archived samples by the end of Year #2.

5.2.4 Upper Wenatchee River (above Tumwater Dam) coho salmon

Coho salmon were extirpated in the entire Mid-Columbia basin by the mid-1990s. Reintroduction of the species in the Wenatchee River began in 1999 with annual stocking of out-of-basin hatchery origin coho juveniles (a stock created from multiple lower Columbia sources, which had undergone 15 or more generations of hatchery rearing). Adult returns from the initial years of reintroduction were sufficiently abundant that by 2003, 100% of the broodfish for the supplementation program were collected in-basin. Additionally, an increasing proportion of the broodfish collected each year since are of natural origin – progeny of hatchery origin fish which returned and spawned naturally. This program is described in detail in Murdoch et al. 2006.

A large portion of the supplementation juveniles released into the Wenatchee were from sites in Icicle Creek, in the lower Wenatchee, and to present the majority of the adults have returned to the lower river. Dryden Dam is located at rkm 26, below almost 100% of the coho spawning area, however, the trap can intercept only a portion of the returning adults, compromising its use for sampling in a RRS study. Currently, the YN is currently shifting more of the juvenile releases to acclimation sites in the upper basin,

and they intend to operate the trap at Tumwater Dam (rkm 52) where they will be able to interrogate upwards of 100% of the adults returning to the upper basin of the Wenatchee. They also operate a smolt trap just upstream of Tumwater Dam, which provides a means to sample natural origin juveniles from spawning in the upper basin. A provisional agreement has also been reached to institute a RRS study of reintroduced coho salmon in the upper basin (above Tumwater Dam) of the Wenatchee River. Beginning in 2010, all adult coho intercepted at the Tumwater trap will be tissue sampled, as will be a representative sample of the NO progeny from each brood year out-migrating from the upper basin. Additionally, tissue samples will be collected from broodfish used to produce the HO juveniles with which the river is supplemented each year, which can be used later for parentage assignment to their adult progeny that escape to the upper basin. Beginning in Year #2, tissue samples from these fish will be sent to the CRITFC molecular genetics laboratory in Hagerman. Laboratory analysis of these samples with a suite of coho-specific microsatellite DNA markers will begin in Year #3 of the Project, with subsequent parentage analysis to quantify relative numbers of recruits per spawner for each brood year.

5.3 Budget for molecular genetics analyses

The Project is currently budgeted to cover the costs for analysis of a total of 8,000 tissue samples per year for the RRS studies under Project Objectives #3 and #4. The table below provides approximate numbers of samples that will be analyzed in Year #2 of the Project, which includes samples that will be collected in 2010, as well as samples collected previously but which were not analyzed. If the number of samples to be analyzed in Year #2 exceeds 8,000, we intend to request a budget modification to have unspent/unallocated monies from Years #1 and #2 transferred into the budget to cover the difference. Also, if it appears that in coming years the total numbers of samples for the 7 identified programs will not surpass the 8,000 annually, adding an 8th study will be considered.

Population	Species	Estimated Number of Samples Year #2
Johnson Creek	spring Chinook	2,400
Hood River	spring Chinook	1,750
Lookingglass Creek	spring Chinook	2,000
Lolo Creek	spring Chinook	500
Newsome Creek	spring Chinook	400
Crooked River	spring Chinook	1,200
Wenatchee River	coho	0
Total		8,250

5.4 Tribal Salmon Reintroduction Workshop

An associated activity supported in Year #1 by the Project was organization of the Tribal Salmon Reintroduction Workshop, held on Feb 2 to 4, 2010 in Pendleton OR. The objective of the workshop was to facilitate an exchange of information between personnel active in the various tribal reintroduction programs in the Columbia basin. The workshop consisted of a series of oral slide presentations covering reintroduction programs from all four tribes, focused primarily on coho and Chinook salmon. Additionally, a field trip was organized to visit a weir site, an acclimation site and a hatchery operated by the CTUIR. The Workshop was attended by a total of 62 tribal technicians, biologists, managers and policy makers. Opportunities such as provided by this Workshop to meet and share information amongst tribal representatives are rare, and the reaction to the Workshop was most positive and many participants expressed the desire that similar opportunities be organized on a more regular basis. One specific outcome of the Workshop was production of a poster on the tribal coho reintroduction programs (presented at three different scientific conferences). Additionally, drafting of a written manuscript summarizing results from the coho programs, in a format suitable for publication in a scientific journal (e.g., Fisheries) was initiated in Year #1. This manuscript should be ready for submission in Year #2 of the Project.

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