Snake River Fall Chinook Salmon Workshop

Hosted By U.S. Army Corps of Engineers
May 26-27, 2010

Facilitators' Workshop Summary

DAY 1

Welcome/Introductions
Dean Holecek, COE, welcomed everyone and said the purpose of the workshop was to bring the region together to hear updates on the status of data collection of Snake and Columbia River Fall Chinook, and to begin discussions around methods for analyzing the data. He introduced the Fall Chinook Planning Team (Bill Arnsberg, Nez Perce Tribe; Billy Connor, USFWS; Scott Dunmire, COE; Margaret Filardo, Fish Passage Center; Steve Haeseker, USFWS; Jay Hesse, Nez Perce Tribe; Doug Marsh, NMFS Science Center; and Bill Muir, NMFS Science Center). He thanked the Planning Team for their help developing the workshop and for their commitment to provide leadership for the ongoing effort to develop a "Methods for Analysis Report". He noted that this workshop is one important step in the process.

Holecek then introduced Dave Johnson, Nez Perce Tribe, who shared on behalf of the US v. Oregon parties his hope that the workshop participants remember that the Fall chinook are a significant stock and that the purpose of the fish tagging is to recover this endangered species. As such, the study plan effort is part of US v Oregon settlement negotiations. Johnson noted that he hoped for better inclusion of all regional interests and research as we move forward in the data analysis process. Johnson concluded that the Planning Team might expect a follow up memo from the US v. Oregon parties reflecting these views.

Holecek thanked Johnson for sharing his perspective and encouraged all participants to notify him, as convener of the workshops, of anyone missing who should be included in the ongoing effort. Facilitator Robin Gumpert welcomed and encouraged attendees to stay open as they listened, learned and shared with one another and worked toward the shared goal of recovering the fish.

Session 1 Presentations - Life History of Fall Chinook Salmon

(*PLEASE NOTE:* All presentations from the workshop can be found at the following website: http://www.fpc.org/documents/fallchinook_planningteam_documents.html

Life History Characteristics of Snake River Fall Chinook Salmon Collected off the Oregon/Washington Coast. *(Study by B. Beckman, D. Teel, J. Fisher, C. Morgan, E. Casillas)*

Brian Beckman, NOAA, said the overall goal of his presentation was to help participants better understand ocean effects on survival. His presentation focused on research that has been on-going since 1998, which he said generated a large amount of data, including abundance data. The following bullets summarize highlights from his presentation:

- Abundance: Abundance is set fairly soon after ocean entry. Abundance was high in June and low in September (especially in 2009.) Hatchery production is not correlated with ocean catch, so some other ocean factor in the summer season is affecting marine abundance, which is not set in June. As to whether juvenile catch relates to adult catch, there is no relationship for the June catch; however, there is a significant and positive relation between juvenile and subsequent adult abundance in September.
  - Recommendation: Beckman said that ocean catch by age, adult return by age and year of ocean entry could help provide desired abundance data.
- Size Frequency: For data from 2008-09, Fall Chinook arrive in June and by September are gone. Some fish are spending the winter off the Washington coast and older, larger fish are notably absent in September.
- Life History: A slide showed that 24% of Fall Chinook mature at age 2 and that yearling smolts are relatively large.

Short and Long-term Impacts of PIT Tags on Hatchery Fall and Spring Chinook Salmon
(Study by C. Knudsen, S. Schroeder, M. Johnston, W. Bosch, D. Fast)
Curt Knudsen, Onconh Consulting, reviewed data on impacts of PIT tags on hatchery fish. He noted that his research team was interested in understanding the negative impacts of PIT tags, as early drafts of the YKFP M&E program included use of 810,000 PIT tags annually. Knudsen said they wanted to compare tagged and control group survival rates and that the key to their Fall chinook study was to have a benign mark (otolith mark) to use on untagged control fish. He described the processes for marking, rearing, trucking, trapping and capturing/recapturing the study fish. The following bullets summarize some of the findings:

- The 1995 hatchery Fall Chinook study results showed a 23% reduction in short term (first 3 months after release) survival of PIT tagged fish.

In the second study, published in 2009 and supported by the Yakama Nation and BPA, approximately 40,000 juvenile spring chinook were double-tagged (PIT+CWT) annually over five years; non-PIT tagged fish were also double-marked (CWT+Elatomer). The study estimated that average survival of PIT tagged fish was underestimated by 25% due to a combination of PIT tag effects and tag loss. After correcting for PIT tag loss (mean= 18%), average mortality due to PIT tags was estimated to be 10%.

- PIT tagged fish were smaller on average than non-PIT tagged fish.
- Recovery efficiency of PIT tags at RAMF was estimated to be 99% over a 6 year period.
- The research concluded that PIT tags can have a significant impact on Fall and spring Chinook growth and survival, and it is only by testing for tag effects in the context of actual study conditions that researchers will understand the magnitude and nature of a tag's effects.

When tag-induced mortality and tag loss occur or if growth and behavior are affected by any tagging technique, investigators may not be justified in extrapolating study results to the remainder of the untagged population or other untagged populations.

Review of Snake River fall Chinook salmon spawning and distribution in the Snake River Basin *(Study by B. Arnsberg and P. Groves)*
Bill Arnsberg, Nez Perce Tribe, provided a review of spawning and distribution in the Snake River basin. Highlights from the presentation are summarized in the bullets below:
- Over the last 20 years, the Fall Chinook return rate has trended upward.
- Clearwater River spawn timing is a little sooner than those for the Snake River on average.
- The number of spawning sites on the Snake River has increased, which means habitat is still being used.
- The percent of redds upstream of the Salmon River confluence has also increased; a map of Clearwater River redd spawning site distribution showed that the number of sites has doubled to 50 in the last 10 years.
- 10 year averages of fall Chinook redds counted above Lower Granite showed that most were in the Clearwater and Snake Rivers.
- Redd counts are highly correlated with the adult escapement estimates over Lower Granite Dam.
- Some Clearwater River areas with good spawning gravel are not being used, which is surprising.

Snake River Fall Chinook Salmon Hatchery Production Overview *(Study by M. Shuck and J. Hesse)*
Jay Hesse, Nez Perce Tribe, began his presentation by highlighting the complexity of the Snake River hatchery production program, and the collaborative effort by US v. Oregon parties to prioritize production and marking areas, including PIT tag studies. He commended hatchery staff for their ongoing efforts to keep the program well-coordinated and productive. As further background information, Hesse noted that hatchery programs in the lower Snake River basin have a significant amount of responsibility for returns, as they mitigate losses due to the four Snake River dams, and that they are also responsible for Idaho Power Company, Hells Canyon, and Columbia River Basin Fish and Wildlife Programs. Highlights from his presentation are summarized below:
- The marking strategy requires ongoing management and policy discussions around collection, adult escapement, juvenile rearing, surrogate production, release location, age at release, and changing management goals.
- A map of hatchery facilities and release locations was provided to show the complexity of the program. Some are acclimated and some are direct release sites.
- Collection methods were described; more than half of the total broodstock has been collected at Lower Granite Dam over the last three years.
- The PNI has been fairly low over the last couple of years, but natural origin fish are being incorporated into broodstock.
- Juvenile rearing sites were reviewed, and it was noted that many fish are transported significant distances on land before they are released to the river.
- Over time, there has been a change in timing/release philosophies and an increasing level of subyearlings.

- Natural origin fall Chinook have been just below the ESA minimum viability threshold over the last ten years.
- Overall, abundance has increased, but it is not certain whether this was due to management, or improved ocean conditions.
- Hatchery releases upstream of Lower Granite have increased the amount of spawning habitat utilized.
- While abundance data is clear, questions remain regarding the contribution of hatchery fish, productive capacity of remaining habitat, the long term viability of the fish and the impacts of the production program on the life history of natural Fall Chinook.

Freshwater Life History of Natural Snake River Basin Fall Chinook Salmon Juveniles *(Study by B. Connor and B. Arnsberg)*
Billy Connor, USFWS, described the objectives and methods of his study on freshwater life history of natural Snake River Fall Chinook juveniles, and showed slides of population areas in the basin. He noted that fish habitat areas historically had high variability. During the early 1970's, there was low potential for life history diversity, and spawning was limited to the Snake River. Connor said that overall, the Snake River upstream of the Salmon River is the warmest area for spawning, and the upper Clearwater River and its tributaries are some of the cooler contemporary spawning areas. For those coming from the Snake River, Lower Granite reservoir provides a wide range of space with similar temperature regimes, while the Clearwater River has a relatively narrow range of space. The earliest fish to pass Lower Granite are seen in May/July and are fast growing fish. PIT tag detection systems are dewatered annually in December. Connor said that overall, he has observed many changes in management that have the potential to affect life history diversity; he added that the region has a lot to learn about this diversity and needs to continually develop new tools. He concluded that life history diversity in freshwater is important to recovery and needs to be accounted for in studies of dam passage strategies.

Session 2 Presentations - An Introduction of the History of Evaluating Summer and Fall Transportation and Summer Spill

Winter Passage of Juvenile Fall Chinook Salmon in the Snake River
Ken Tiffan, USGS, presented his study to determine if over wintering juvenile Chinook pass lower Snake River dams. He reviewed sampling and monitoring methods, and showed slides on dates for dewatering over the years 2004-06. Tiffan shared a map of capture locations and described sample sizes for the three years. He noted that fish monitored from November–January were larger, which allowed for a larger tag and longer monitoring. He described the relationship between flow and passage events and showed slides on passage at Lower Granite, Little Goose, Lower Monumental and Ice Harbor by month and year. Tiffan also reviewed residence times by number of days for forebay and reservoirs. **Conclusion**: Tiffan concluded that juvenile winter passage from Lower Snake River dams does occur.

Using Scales from Returning Snake River Fall Chinook Salmon to Better Understand Their Early Life History *(Study by D. Marsh, W. Connor, and W. Muir)*

Doug Marsh, NOAA, reviewed research study objectives and steps in the study of scale samples to understand early life history of Snake River Fall Chinook. He noted that a cooperative study with NOAA, USFWS, and the Nez Perce Tribe began in 2005, and in 2008, a regional consensus study was performed. He also shared that in 2009, the expected 1.4 million returning fish required a new method of handling separation-by-code activities. Also, 2009 activities resulted in the largest number of scales collected to date. He said juvenile PIT-tag data will provide insight into juvenile behavior of both subyearling and yearling ocean entrants. Marsh said the scale results could be grouped a number of ways – by outmigration year, release location, life history or migration history. He showed slides on 2009 data for each of these categories, and clarified that the data was preliminary. Slides on migration pathways and timing for Snake and Clearwater Rivers were also shared and Marsh suggested that there seems to be a difference between the two as far as whether fish entered the ocean as yearlings or subyearlings.

An Overview of Snake River Subyearling Chinook Salmon Transport Studies, 2001-2004 *(Study by D. Marsh and W. Muir)*
Doug Marsh, NOAA, also reviewed Snake River transportation studies and provided detail on the study design, including information on collection and tagging sites. Marsh described the transportation marking method and study design for the 2004 study at Lower Granite and reviewed numbers for tagged fish released each year. For 2002-2004 late season marking at Lower Granite, Marsh said tagging goals were reached and he shared return numbers by age class. He noted problems with the study design that included how to address holdover passage and tagged fish at Lower Granite. **Conclusion**: There is a challenge to using undetected categories – and a need to sort out true data from mortalities.

Evaluating the Responses of Snake and Columbia River Fall Chinook Salmon to Dam Passage Strategies and Experiences: Consensus Research Proposal Summary
Jay Hesse provided a brief overview of the Consensus Research Proposal that has served as a foundation for the Fall Chinook study design and subsequent efforts. He noted that the proposal, looking at how operations and strategies affect the behavior and survival of listed Fall Chinook, was developed by a diverse mix of technical and policy level representatives. Jay reviewed background information on what led to the multi-year effort to develop this consensus approach and reported that in October 2007, US v. Oregon approved the study design.

The scope of the study looks at four key areas:
- Whether bypass or transportation of collected fish would result in a higher SAR for the Snake River Fall Chinook population.
- The relative performance of in-river fish vs. transported fish.
- The corresponding SARs under various conditions, FCRPS entry points and routes of passage.
- Juvenile life history approaches impacts on population level trends.

The proposal describes three main analytical approaches: management strategy comparison, passage experience (CSS design), and upriver vs. downriver population level performance comparisons. He reviewed the nine mark/release groups that have been identified for 5 years of tagging (and clarified that these were determined through

 the US v Oregon policy work group as part of Phase 1 of the study design described in the Consensus Proposal). He shared target vs. actual numbers for 2005-2010 data on natural, surrogate, and general production subyearling and yearling populations.

The next step, "Phase 2" workshops, were described as a series of opportunities for the region to test assumptions. The product from these workshops will be a "Methods for Analysis Report". Hesse said the Planning Team hoped to fully engage the region and use Day 2 of this workshop to generate ideas and formulate assignments for developing the report, while staying within the sideboards of the Consensus Proposal. Hesse suggested that Tables 2 and 3 in the Consensus Proposal could provide topics for Day 2 discussions, and that the Planning Team hoped to hear additional ideas on how to think about and adequately assess the data. Finally, he said that "Phase 3" will use the final Methods for Analysis Report to guide actual analysis of the data.

Robin thanked all presenters for providing robust information, and asked participants around the room to introduce themselves. It was noted that the people in the room were reflective of the complex and collaborative effort that has gone in to the Fall Chinook study to date. Day One concluded with questions/answers from participants to presenters:
- Can you clarify for the non-detected groups – are you just looking at those fish that pass over the spillway? Answer: No, they are non-detected irrespective of whether they pass over the top or through the spillway.
- Can you summarize what percentage of the fish are tagged in the Fall? Answer: Do not have exact numbers, but of the fish tagged, we think 50-75% pass undetected during the period when the bypass system is shut down.
- Will the presentation slides be available to us? Answer: Yes, the COE will send an email to all participants regarding the web link for the presentations from the workshop.
- Is the Consensus Proposal available online? Answer: Yes it can be found on the FPC website, and will be added to the list of workshop materials to be shared with workshop participants.
- There was a sudden gap in data from Ken Tiffan's overwintering study in 2004 – what happened? Answer: Some of the radio tags died.
- Regarding PIT tags, are shedding rates the same for spring/summer Chinook? Answer: For Fall Chinook, they are about 4%; for Spring Chinook, the rate is 16-20%.
- Was water temperature for outmigration considered? Answer: No, we did not look at that.
- For the smaller returning adults data, noticed that they were PIT tagged several months before their release - did you notice the size difference when they were released? Answer: No, there was no size difference between tagged and non-tagged fish upon release.
- Do you monitor with hand held devices? Answer: Yes

Day 1 Closing
Workshop attendees and presenters were thanked for taking the time to prepare and participate in the information exchange around Snake and Columbia River Fall Chinook. Dean Holecek said he was pleased to see so many people in attendance today and noted

that Day Two would be the beginning of the dialogue for "Phase 2" as described in the Consensus Proposal. He encouraged participants to add their name to the email distribution list so they can stay connected as the process continues. Jay Hesse added that he knew there were some people in the room that have been very polarized on Fall Chinook issues; he challenged them to come tomorrow ready to listen to each other and prepared to develop solutions for how to help the planning effort move forward.

DAY 2

Session 3 - Presentations on Methods

Welcome and Introductions: Robin Gumpert, facilitator, welcomed the group to the second day of the workshop, and reminded everyone about the discussion protocols that were shared on Day 1. She encouraged everyone to continue their engagement on this very complex issue with an openness to listen, learn and work together to problem solve. She reminded the group that development of the Methods for Analysis Report will continue beyond today, and suggested that the process will be led by the Fall Chinook Planning Team who will seek to recruit the help of those with expertise, resources and/or a willingness to engage in the collaborative effort.

Presentations

Application of the Classic CJS Mark Recapture Model – Successes and Uncertainty. Steve Smith, NOAA, shared information about the CJS Mark-Recapture Model and the use of it to estimate Lower Granite equivalents. The model uses downstream detections as a sample to estimate upstream parameters. He reviewed model assumptions, including consequences of violations and relation to Fall Chinook data. He provided an example of a single release of tagged individuals. He reviewed potential issues with data from PIT tagged Fall Chinook and showed graphs on detection of surrogates at Lower Granite and Little Goose.

Smith discussed the consequence of late passage with Clearwater fish in 2009 and reported that more of these fish were detected in 2010 than in 2009. He reviewed graphs of surrogate data for 2009 for the Snake and Clearwater Rivers, including survival and detection probabilities.

He offered that the information is unbiased only if the downstream sample is representative of all live fish upstream, and noted that this is influenced by operations. He also reviewed size effects on detection at consecutive dams and survival in consecutive reaches. He offered possible remedies to eliminate biases. His findings showed that 10% of the studied fish overwinter in the Lower Granite reservoir and then migrate in the spring. He reviewed comparison graphs of subyearling and yearling data together vs. subyearling data only. The research found that 5% of fish that enter any reservoir as a subyearling remain there until the bypass system is dewatered.

- Participant Question: Can you factor trawl detections and avian predation into your histories? Answer: Yes, but anything below McNary adds only a small effect.

- Participant Question: You talked about "representativeness" – given the classic definition, this would be measured at the point of release, but you implied that it can apply at subsequent release points. Clarify? Answer: The point was that there may be bias with the way the CJS model is estimating. The model should be used as such: using live detections downstream to estimate upstream parameters.

Estimating and Predicting the Probability of Bypassing Subyearling Chinook Salmon at Lower Granite Dam
John Plumb, USGS/University of Idaho, provided an approach to estimating and predicting bypass of subyearling Chinook at Lower Granite dam, and suggested that his presentation was meant to convince participants that accounting for differences in dam operations and sampling effort at the dam may explain observed differences in daily counts at Lower Granite Dam. The objectives of the study were to: 1) Use mark-recapture methods to understand daily passage abundances and annual migration timing at Lower Granite Dam; 2) Apply models to multiple years of data from both radio- and PIT-tagged juvenile Snake River Fall Chinook; and 3) Determine if changes in dam operations may account for variation in abundance and migration timing of the wild population.

Plumb included graphs comparing the observed and adjusted counts of PIT tagged subyearling fall Chinook salmon during 2004 and 2005 data to show migration timing and the rationale of accounting for differences in dam operations (spill) and bypass (capture) probability. He showed a map of release sites, tailrace exits and pit tag detection sites. He showed use of the 'PIT-tag model' and the 'full migration model' which uses radio- and PIT-tagged fish; and suggested that the latter could be applied to adjust PIT-tag counts of wild fall Chinook juveniles, and during annual spill scenarios. He concluded that observed counts under different actual fisheries management scenarios provide an opportunity to learn valuable information about the fish.

- Participant Suggestion: Similar work is being done by the Fish Passage Center – it was suggested that Plumb contact Jerry McCann to discuss his work.

An Overview of the CSS Approach
Steve Haeseker, USFWS, provided an overview of the Comparative Survival Rate Study (CSS) project, which began in 1996 with the objective of 'establishing a long-term dataset of the survival rate of annual generations of salmon from their outmigration as smolts to their return to freshwater as adults to spawn (SAR), and with the goal of evaluating the efficacy of transportation.' Key objectives included: Develop a consistent approach for monitoring SARs, develop more appropriate SARs for in-river migrants, and have a common starting point for comparing SARs of transported and in-river migrants. For the objectives of the study to be met, researchers were challenged to find a way to estimate the number of smolts that were experiencing the same treatment as untagged smolts at transportation collector dams; and to address potential negative bias in SARs introduced by bypass or multiple-bypass.

Haeseker showed three equations that were used to estimate the number of smolts with different passage experiences through the collector dams. The approach seeks to predict the number of undetected smolts based on detected counts at Lower Granite. Haeseker

said that since 2006, there have been management changes that have influenced the amount of fish that are bypassed. He said downstream of the collector projects – whether fish are bypassed or not – is considered representative of the true 'in-river" experience. He described the adjustment calculation for survival rates between dams and noted it is a way to account for survival between projects. He reviewed results of calculations for total populations at Lower Granite. Haeseker said that work is being done to analyze holdover behaviors.

Issue: The research suggests that holdover behaviors downriver of LGR do not appear to affect CSS estimators for the C_0, C_1 and T_0 study categories; however they could affect the Co estimate, depending on the magnitude – which is important to look at in terms of its effect on estimates and also of detection in first vs. second years.

Issue: He described a pattern of fish slowing down as they enter the fall/winter period and noted there are many fish that holdover near Lower Granite – more analysis is needed to understand which fish are slowing down, and why.

Issue: What is an appropriate threshold for 'substantial bias'? More simulation testing of the CSS estimators should be conducted to assess how high the holdover rates would need to be before substantial bias is introduced. Haeseker suggested Clearwater surrogates and naturals should be studied further.

- Participant Question: Why are there big peaks on some of your graphs? Answer: There are variations in the timing of different release groups, and we needed to include some qualifying data.
- Participant Question: I noticed you didn't present 2007 Clearwater River data. Answer: Those were surrogates for the Clearwater.
- Participant Question: On the first slide, you note a goal of a "more appropriate SAR" – do you mean for untagged fish? Answer: An untagged fish would not have been collected, so I am suggesting that an appropriate SAR goal for untagged fish would be in-river migration. Participant response: This does seem important to understand, in order to make the best management decisions. A: Yes, we have to be clear about what kind of question we are trying to answer and the best data to use to answer that question. (For fish that are collected, we want to use the best management strategy, as it will affect how we can collect data.)

Sample Catch Probability, Run and Origin Identification and Life History Terminology
Steve Haeseker, USFWS, shared information about "catchability", defined as the fraction (q) of a fish stock (N) which is caught (C) by a defined unit of the fishing effort (E). His presentation suggested that, while catchability can serve as an index of abundance when q remains constant, when q changes over time or space, then changes in CPUE can be mistaken for changes in abundance. He suggested using linear regression approaches to remove the effects of variable catchability on abundance from the CPEU data.

Haeseker reviewed a graph on distribution of sample surveys, noting that some areas can be over-emphasized, and that the purpose is to understand true distribution. He noted the high amount of PIT-tagged fish released in July 2009, and said the lack of representation of fish in all regions could be a function of a lack of sampling data. Data collected in

2010, with such a low flow year – especially during the June period – could reveal some interesting findings.

He shared a graph on incubation temperature units on the Clearwater vs. the Snake River and said emergence of the surrogates tends to be earlier on the Clearwater. He shared data on run-type proportions based on adult detections and said he has concerns about the results from 1991 and 1993 – he suspects the data set may be contaminated.

Conclusions: Catchability appears to vary with flow in both the Clearwater and Snake River. Ignoring the influences of catchability on CPUE (and the resulting tag-release distribution) can lead to inaccuracies in characterizing the sampled population. The "instant peak" CPUE observations for the Clearwater are problematic. A substantial portion of the population may not be vulnerable to sampling due to high flows. As a result, the Clearwater surrogate releases may not be reflecting the size and migration timing of the Clearwater population.

Next Haeseker discussed issues around run identification; noting a need to examine whether different run types exhibit different migration timetables and asking whether location, length or tagging date can be used to reliably determine run type. He looked at Clearwater and Snake River releases, tagging at Lower Granite and run timing.

Conclusions: Length, tagging location and release appear inadequate to definitively determine run-type. Substantial numbers of spring/summer Chinook are tagged at Lower Granite during late summer/fall. Without genetic samples, there is a need for caution in declaring Chinook as belonging to a particular run-type among samples collected in the wild. Large releases of untagged, unmarked hatchery-origin fish can contaminate "wild" samples, even under high classification accuracy. However, recent increases in redd counts may reduce the potential for hatchery misidentification.

Finally, Haeseker suggested a need for consensus on definitions of 'tactics' and 'strategies'. He quoted the following: "The Chinook, like all *Oncorhynchus* species, is anadromous and semelparous. Within this general life history strategy, however, chinook display a broad array of tactics, including length of freshwater, estuarine, and oceanic residence, variation in ocean distribution and ocean migratory patterns, and variation in age and season of spawning migration." Healey (1991)

He concluded with the following suggestions for steps moving forward:
- Recognize (and exploit) the conditioning inherent in the PIT-tag data
- Explicitly incorporate known factors into analyses: release location, length, release date, rear-type across multiple releases
- Quantify how known factors affect observed demographic processes in an effort to improve understanding of sources of variation
- More attention should be directed at examining the sampling (fishing) processes that work to directly (13W, 15W) or indirectly (surrogate) create release distributions
- Clearly state uncertainties in run-type, rear-type and catchability constraints when apparent

Effect of Extended Water on the PIT-tag Detection System and Overwintering on Estimates of Lower Granite Equivalents

Rebecca Buchanan, University of Washington, reviewed various study groups and Lower Granite equivalents -- estimated as functions of estimates of detection and survival probabilities. In her study, the CJS model was used on subyearling detections. She also discussed complications from overwintering or winter passage during juvenile migration, shared an analysis of 2006 PIT-tag data and provided alternative analysis approaches for consideration.

Conclusion: The research suggests that if there is overwintering or late passage, detection methods are violated. She reviewed calculations for SAR and TIR and provided detailed examples for SAR for Fall Chinook in-river population. Buchanan also reviewed 2006 analysis methods for each weekly release group and results for each group. Again, if there is overwintering, the data can have a bias. She reviewed possible solutions to address the mismatch between adults and juveniles: use a fixed count of adults, restricting to those that migrated as subyearlings; or fix the juvenile counts by including both winter and spring migrants. She suggested an alternative approach – estimating SAR from a release point.

Conclusions:
o   Overwintering or winter passage introduces bias in SAR of the Co group and the transport-inriver ratio using the Co group
o   Adjustment for overwintering requires much more data and more modeling assumptions
o   Focus on the Co group is misguided for Fall Chinook salmon that overwinter
o   An unbiased, simple and robust approach is available for estimating TIR
  •   Participant Question: How does overwintering affect the ratio? Answer: It is not possible to identify which adult pass through the hydraulic bypass as yearling vs. subyearling.

Rebecca closed by acknowledging the work of her colleagues Billy Connor (USFWS), Doug Marsh (NOAA), and BPA.

Inclusion of Down River Releases from other Studies

Steve Haeseker, USFWS, presented ideas on the value of monitoring demographic rates for other upriver bright fall Chinook populations using PIT tags. He suggested the following areas be considered: Hanford Reach, Little White Salmon NFT, and Yakima. Monitoring these populations would provide key information valuable for characterizing migration timing, survival rates, migration rates and SARs. Each population experiences a different portion of the FCRPS, and may respond differently (or similarly) to the environmental and management factors experienced within the FCRPS. Monitoring SARs over time provides key information for improving understanding of the effects of environmental conditions and management strategies within and outside the FCRPS on life-cycle survival rates of Snake Basin and Columbia River fall Chinook.

To do this, Haeseker suggested using blocking techniques to compare demographic rates of interest, and then investigate the hypotheses; he shared ideas for how this might be done.

<u>Similarity Indices Comparison of Natural, Surrogate, and Production Release Groups</u>
Billy Connor, USFWS, reviewed post-release attributes of natural and hatchery groups
released into the Snake and Clearwater Rivers, with the objective to compare selected
post-release attributes between PIT-tagged natural subyearlings and two PIT-tagged
groups of hatchery subyearling released in 2005, 2006, and 2008.

He reviewed definitions of surrogate, hatchery and wild fish and showed a graph of
various weeks of catch in the Snake and in the Clearwater in 2006. He also shared graphs
of mean travel times, detections at Lower Granite and the joint probability of migration
and survival to the Lower Granite tailrace. He then showed the mean similarity indices
across dams, comparing natural and surrogates and natural and production fish from the
Snake and Clearwater Rivers.

Conclusions: Connor offered the following thoughts to close his presentation:
- We knew when developing the consensus proposal that it would not be possible
  during this study to PIT-tag the sample size of natural subyearlings required for
  precise SARs.
- The method of surrogate releases provides an approach to obtain precise SARs for
  a group of subyearlings that exhibit the protracted migration and relatively low
  survival of PIT-tagged natural subyearlings.
- As intended when the production program was developed, the population of
  production subyearlings does not share the protracted migration and relatively low
  juvenile survival of PIT-tagged natural subyearlings.
- The similarity is greater between natural and surrogate subyearlings than between
  natural and production subyearlings.

- <u>Participant Question:</u> Are there traits that resemble one another, but in actuality
  have different survival rates? <u>Answer:</u> Yes – and this is important to note.
- <u>Participant Question:</u> How has the methodology changed since the change to
  using smaller tags? <u>Answer:</u> Generally, not much change to the methodology, but
  we think it will have an effect on survival, once the 8.5mm tags become widely
  available.

<u>Announcement</u>: *There will be a PIT tag workshop next January at the Skamania Lodge –
If participants have any suggestions for topics, please email: Dave Marvin at
Dave.marvin@ptagis.org.*

Session 4 - Small Group Discussion and Next Steps

Jay Hesse reviewed the three analytical approaches described in the Consensus Proposal
and reminded the group that the goal is to collaboratively develop a summary of
approaches for analyzing the data collected on Fall Chinook. He said the purpose of the
collaborative effort and development of the Methods for Analysis Report is to address
and reduce conflicts that could arise later on how to analyze the data – and the planning
group wants to understand as many views as possible on the strengths and weaknesses of
methods before they get to the analysis stage. He noted that there are management

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strategy comparisons and analysis of passage routes that need to be considered, as well as Columbia River vs. Snake River population performance. Hesse reminded participants that the Consensus Proposal is available online and noted that within that document, there are a set of specific questions the group is trying to answer.

- Participant Question: Is there analytical framework language in the proposal?
  Answer: There is some, but not in great detail. Steve Haeseker touched on that in his presentations.
- Participant Question: I heard Dave Johnson say that the goal is to recover fish.
  Answer: Yes, we can't lose sight of why hatchery production is occurring – it is not just for research.

Small Group Discussions

Facilitator Robin Gumpert turned to the small group tables and said that a Planning Team member was seated at each table and would help facilitate the discussion and serve as a scribe. The groups spent time discussing the following questions (developed by the Planning Team) and then reporting out to the large group. The following bullets reflect comments shared back to the large group from each of the tables. (**Appendix 1** of the workshop summary includes the notes gathered from the small groups.)

Question 1: What 'x's in Tables 2 & 3 have potential bias? In what ways? What analysis should be done to quantify the magnitude of bias?
Reporting out:
- Clearwater Basin focuses on post-release attributes and related SARs. If there's a bias here, x's in the Snake basin are also biased.
- Given the differences in survival of various fish, compare hatchery to hatchery and surrogate to surrogate.
- Further explore the Co group per the information presented at this workshop.
- For passage timing in Clearwater – there are still uncertainties and potential bias.
- There is a PIT tag bias if it is not uniform across fish groups; new technology (new types of PIT tags) need to be considered.
- Ask: Are we tagging the right fish?
- There is a potential bias in To:C1.
- In the consistency of x's across years – look at descriptive statistics on each one.
- Break out population and sub-population level and determine bias/magnitude of bias.
- For data, include a description of transportation periods and types and criteria to go from 'X' to 'x' or 'A' to 'a'.

Question 2: What A's have been demonstrated to be unbiased? What analysis should be done to quantify this?
Reporting Out:
- None – but we could look at various levels of over-wintering / holdover fish to see the magnitude of bias.
- Snake River surrogates survival could move from an A to an x.
- None – until we can demonstrate no overwintering.
- We need matching estimates of juvenile and adult information.

- The Snake River sub-population is not heavily influenced by holdovers, but in general, the Snake River population is.
- To inform use of Snake River data, use University of Idaho information, including native origin, and utility chemical signature.
- For the Snake River population surrogate group – the entire column could be considered an x.
- Natural origin survival estimates could be changed too, if the time period changed.
- Would like to see year round monitoring.
- What factors/variables need to be considered, relative to operations?
- Winter spill affects the study analysis.
- Spillway detectors would improve our ability to be less biased (e.g. at Ice Harbor.)
- Opportunities exist for additional PIT-tag detection if we work with existing facilities/operations.

Question 3: What population level performance measures can be used to compare upriver/downriver fish? What analysis should be done to quantify the comparison?
Reporting out:
- Comparisons can be made but are very difficult to explain even if observed.
- Use caution in comparisons: hatchery to hatchery is ok, but maybe not hatchery to wild, or wild to other natural groups – however, it is still worthwhile to study upriver vs. downriver fish.
  o Caveat – Consider survival relative to distance, particularly the Hanford Reach vs. Snake River down to John Day.
- Concerned for timing of marked fish – link technologies as a solution.
- Why have no Umatilla or Priest Rapids fish been considered?
- Ocean fishery impacts are important.
- PIT tag effects are important.
- All performance measures should be considered for absolute survival comparisons, and their impacts on the results.
- No direct comparisons, but could look at overwintering and other factors impacting other fish, and compare that to Snake River populations.
- Question appropriateness of comparing the two – but may still be worthwhile, e.g. in making management strategy decisions.

Process Next Steps
Gumpert asked each member of the Planning Team to stand and be recognized. She summarized the team's suggested process moving forward from this workshop:

June-September 2010:	Fall 2010:	Winter 2010-2011:
Planning team leads effort to develop Methods for Analysis Report: • Meet every two weeks	Draft Methods for Analysis Report: • Includes ideas presented during this workshop	Data analysis begins Work continues to complete the Methods Report

• Enlist the help of workshop attendees and others – through work sessions; assignments; and/or feedback on iterative drafts of the report • Seek agreement on how to analyze data (by Winter 2010 – perhaps agreement on a set of data, not all)	• Includes information gathered post-workshop via work sessions; assignments; and feedback on iterative drafts • Will be reviewed by an independent review panel (e.g. ISAB)	COE convenes a follow-up public workshop to roll out the Methods Report

(*Note: The planning team held a debrief conference call after the workshop and discussed the timeframe outlined above. While it was a shared interest to scope out a path forward, the group expressed some concerns that this timeframe might be too limiting, given the amount of work that needs to go in to developing a robust Methods for Analysis Report. The planning team will continue their efforts and provide updates on the process and timelines in the coming weeks.)

Index cards were available at each table for those willing to offer support (resources, research, data, etc.) in the next step of the process and were invited to add their name, contact information and area of expertise or interest on the cards, which were passed on to the planning group after the workshop.

Workshop Wrap Up:
Robin thanked workshop attendees for their participation and turned to the Planning Team for closing remarks. Dean Holecek said he heard more agreement in small groups than he had anticipated and said that he was impressed by the number of folks willing to stay through the afternoon session and engage in the discussion. Jay Hesse said that the time spent in the workshop reminded him of the reasons why it was hard to put the consensus proposal together: people are passionate about how to do management and research around these fish and the effort is complex. He added that it was a good experience to sit down and talk face to face with others in the region. He said he was excited about the data that has been presented and it was good clarification for the Planning Team to spend the time here to share information and listen to others' perspectives. Bill Muir, NOAA, thanked DS Consulting for their facilitation assistance.

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Appendix 1: Small Group Discussion Notes from Planning Team Members

(One table suggested the following points be considered relative to all the questions):
- Wild/natural recovery – surrogate applicability of hatchery fish equals bias/or error
  - How to take into account – study animals must have consistency
  - How do you determine how representative they are
  - SAR's are different by virtue of origin – hatchery, wild, H x W, 1° generation progeny
    Hatchery production/hatchery production – also has issues
  - Two surrogates
  - Try to define if you can compare subgroup vs. subgroup

Question 1:
- PIT-tag bias – is it uniform across the groups or is it differential across groups (e.g. surrogates, natural, production)?
- Curt Knudsen results statistically significant but perhaps not biologically significant. Concerns about the specific tags used in Knudsen's study. O/A extrapolating results of Knudsen study may not be appropriate.
- Evaluate FACH groups (surrogate, production, natural) for comparative tag loss, tag effects. Use existing data from returning adults that were CWT/PIT tagged.
- Hard to address concern about natural vs. surrogate because of differences in tagging conditions, monitoring, etc.
- Need to use 8.5 mm tags for all fish regardless of fish size so tag effects are consistent (8.5 mm tags used since 2008, in combination with 12 mm tags).
- Surrogate vs. natural? Imperfect but acceptable
- To plus C[1] potentially biased
- Given what you know about difference in survivals of hatchery, natural, surrogate, first generation supplementation progeny, second generation supplementation progeny, how can that be incorporated into the study design – e.g. can you compare hatchery vs. hatchery, natural vs. natural, surrogate vs. surrogate? Can you discern if there are differences in survival
- Collection at key dams – year round PIT tag detection (winter). Year round detection system would be nice
- There is potential for bias in all the mark groups.
- Continue to look into Steve Haeseker presentation analysis and options.
- Weight samples to reflect catchability /tagability.
- Incorporation/quantification of fish too small to tag – consider behavior and subsequent tagability/recruitment to tag groups.
- Origin determination – increase attribute marking of hatchery fish or removal of hatchery origin fish.
- Surrogate performance is quantified year by year. How do differences in annual surrogate performance groups affect across year comparisons?
- Randomness is inherit as such represents variability natural bias.
- 5 years of replication may be too short.
- ***Include descriptive stats on all release groups. Flag groups with issues. This always involves clarity of data being used for management decisions.

- How do we handle CLWR production in a transportation study given limited exposure to summer spill? Lack of management actions for CLWR fish. What is the study design for this group?
- Disconnect between summer spill and subpopulations.
- Need to describe transportation periods and types (barge vs. trucks vs. nothing).
- In discussing travel time, we should focus on the rate not total time.
- Regarding passage time, we should consider changing them from an "X" to an "A"
-

Question 2:
- Snake River subpopulations magnitude of winter movement low. Look at winter movement.
- Concern exists for bias in comparisons between surrogates and a biased assessment of natural component.
- Side comment – Better detection ability/equipment in spill ways will increase precisions and provide route specific quantification.
- Fish that overwinter upstream of LGD create problems. Fish that overwinter downstream of LDG but in rivers may not be an issue.
- Current C0 analysis is based on joint probability of migrating and surviving. Does not include yearling emigrants.
- Maybe the Snake River subpopulation Co group have been demonstrated to be unbiased (because of lower holdover rates).
- Use otolith microchemistry to identify where Co groups are overwintering (ocean, Lower Granite reservoir, etc.)
- No A's should be changed.
- Undetected Co unbiased – no; needs more analysis
- Age structure now compared to historic
- SAR Co is potentially biased until we are sure that we have matching, unbiased estimates of both juvenile and adult numbers
- Which A's are unbiased – none if there is overwintering
- Snake not affected by holdover population – however, Clearwater can't – additional chemical signature data – considered as well – should not affect Co estimatation
- UI: Three years data – Lower Granite or swim in – wild/returning adult/non-clipped scales; two analyzed: natural origin, rearing location, juvenile overwintering, growth. Clearwater – overwintering; Snake – lower percentage overwintering
- Need to address some of the sample issues identified – marking of hatchery or natural fish or subyearling spring chinook
- What management applications are you looking for Clearwater fish, since they are migrating outside of transportation?
- Do you need to address transportation if these fish migrate outside transport time?
- We could run a CJS model with varying overwinter/holdover percentages to look at changes in bias

- For information, winter spill does occur at dams, generally for days to weeks; therefore, turbine passage isn't the only available way for fish to pass a dam during the winter. In fact, winter spill may be very important for moving fish from one dam to another.
-

Question 3:
- Down river transportation limited to McNary.
- SARs
- Juvenile Arrival timing at each dam (BON and JohnDay)
- ***Ocean fishery impacts and CWT data (number and ocean distribution)
- Include Yakima group
- Account for factors that may be difference between populations.
- Adult return timing.
- Focus on all groups.
- ***CWT SAR comparisons to PIT tag SARS equal???
- ***PIT tag effects may differ between our tag groups due to differences in size at tagging and release.
- Need to identify measure that we are quantifying – absolute SARs based on PIT tags and the potential for effects on results.
- Not directly but other applications may be useful: overwintering behavior, ocean entry/travel time, effects of supplementation
- Bad question
- Exploring differences (Steve's) in candidate populations to better understand how Snake River fish are doing compared to other similar Fall chinook stocks.
- Filtering of candidate populations for similarity/differences in factors that might affect survival (besides the Snake River dams)
- SAR – use multiple groups of downriver: hatchery vs. hatchery – Lyons Ferry vs. BVL brights
- Deschutes/Sandy wild vs. Snake wild? (Very difficult due to stock difference, effects of supplementation, etc.)
- Try not to mix hatchery vs. wild together since they behave very differently?
- Review SARs for both based on CWT
- Perhaps add PRD to the hatchery comparison
- Historic SAR in the Snake run resonstruction/data – was it lower just due to distance
- Still worthwhile to look at hatchery comparison, since fish are being marked and have been for a long time.
- USGS data shows no difference between mid-Columbia River spring and Snake River spring/summer Chinook (i.e., stream-type salmon)
- A major problem exist if there are timing differences.
- Could potentially look at survival vs. distance for mid-Columbia, Snake, and Little White Salmon fish
- Could try and link different tag technologies
- One could potentially add Umatilla River and Priest Rapids Fall Chinook to the comparison groups

Appendix 2: List of Workshop Attendees

Name	From
Jason Achziger	USACE
Rich Alldredge	ISAB
Bill Arnsberg	Nez Perce Tribe
Gordon Axel	NOAA
Brian Beckman	NOAA
Brian Bellgraph	Pacific Northwest National Laboratory
Rebecca Buchanan	University of Washington
Chris Caudill	University of Idaho
Jim Chandler	Idaho Power Company
Brandon Chockley	Fish Passage Center
David Clugston	USACE
Jim Congleton	ISAB
Billy Connor	USFWS
Tom Cooney	Northwest Pacific Fisheries Council
Adam Daniel	USACE
Tim Dalton	ODFW
Earl Dawley	Fisheries Consultant, Astoria
Michele Dehart	Fish Passage Center
Scott Dunmire	USACE
Peter Dygert	NOAA
Tim Dykstra	USACE
Scott English	USACE
Margaret Filardo	Fish Passage Center
Derek Fryer	USACE
Ritchie Graves	NOAA
Robin Gumpert	DS Consulting
Steve Haeseker	USFWS
Erin Halton	DS Consulting
Jens Hegg	University of Idaho
Jay Hesse	Nez Perce Tribe
John Hesse	Citizen
Martha Hesse	Citizen
Kent Hills	Oxbow Fish Hatchery
Dean Holecek	USACE
Eric Hockersmith	NOAA
Carla Hurlbert	USACE
Dave Johnson	Nez Perce Tribe
Chris Karchesky	Normandeau Associates
Russ Kiefer	IDFG
Bernard Klatte	USACE
Curt Knudsen	Oncorh Consulting
Kathryn Kostow	ODFW
Rick Kruger	ODFW
Richard Ledgerwood	NOAA
Jon Lovrak	WDFW

Bob Magie	Pacific States Marine Fisheries Commission
Doug Marsh	NOAA
Dave Marvin	Pacific States Marine Fisheries Commission
Scott McCutcheson	Biomark
Geoff McMichael	Pacific Northwest National Laboratory
Fred Mensik	Pacific States Marine Fisheries Commission
Rosanna Mensik	Pacific States Marine Fisheries Commission
Debbie Milks	WDFW
Christine Moffitt	USGS - Idaho
Gregory Moody	USACE
Charles Morrill	WDFW
Bill Muir	NOAA
Enrique Patino	NOAA
Charles Paulsen	Paulsen Environmental Research
Chris Pinney	USACE
John Plumb	USGS/University of Idaho
Erin Rechisky	Kintama
Tom Rien	ODFW
Bob Rose	Yakama Nation Fisheries
Stuart Rosenberger	Idaho Power Company
Ben Sandford	NOAA
Mark Schuck	WDFW
Shane Scott	Public Power Council
Marvin Shutters	USACE
Steve Smtih	NOAA
Jason Sweet	BPA
David Teel	NOAA
Eric Volkman	BPA
Paul Wagner	NOAA
John Williams	NOAA
Dave Wills	USFWS
Bill Young	Nez Perce Tribe
Brian Zimmerman	Confederated Tribes of the Umatilla Indian Reservation