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FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees and Priest Rapids Coordinating Committee	**Date:**	August 30, 2016
From:	John Ferguson, HCP Coordinating Committees Chairman		
Cc:	Kristi Geris		
Re:	Final Notes of the June 21, 2016, Subyearling Chinook Salmon Passage Survival Workshop		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees and Priest Rapids Coordinating Committee (PRCC) convened a Subyearling Chinook Salmon Passage Survival Workshop at the Red Lion Hotel, in SeaTac, Washington, on Tuesday June 21, 2016, from 9:00 a.m. to 4:30 p.m. Attendees are listed in Attachment A to these meeting minutes.

I. Welcome

A. Workshop Introduction: Purpose and Goals (John Ferguson and Denny Rohr)

John Ferguson (HCP Coordinating Committees Chairman) welcomed the HCP Coordinating Committees and PRCC. Ferguson said the purpose of today's workshop is to update information discussed during the last Subyearling Chinook Salmon Workshop, which was held in November 2009. He said Chelan PUD also has a Statement of Agreement (SOA) that maintained subyearling Chinook salmon in Phase III (Additional Juvenile Studies) status until 2016. He said language in the 3-year SOA, which was approved in 2013, requires Chelan PUD to assess improvements in tag technology and survival study designs to evaluate survival study feasibility at the expiration of the SOA. He said information discussed during this workshop will dictate how Chelan PUD moves forward with regard to subyearling Chinook salmon survival studies.

Ferguson said, in January 2016, he and Denny Rohr (PRCC Facilitator; D. Rohr and Associates), and Chelan, Douglas, and Grant PUDs began discussing what to address during

this workshop, and these discussions culminated into today's agenda. He said the HCP Coordinating Committees and PRCC will further discuss today's topics tomorrow and determine a path forward for subyearling Chinook salmon in the Mid-Columbia Basin. Lastly, Ferguson thanked all of the speakers for attending. Rohr added he is looking forward to the day's discussions and also thanked everyone for joining.

II. Fish Passage Survival Model Updates

A. Fish Passage Survival Model Updates (John Skalski)

John Skalski (Columbia Basin Research, University of Washington) provided a presentation titled, Considerations in the Design and Analysis of Subyearling Chinook Salmon Survival Compliance Studies (Attachment B), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris (Anchor QEA, LLC) on June 15, 2016. *(Note: An updated version of Skalski's presentation was distributed following the workshop on June 22, 2016.)*

In this presentation, Skalski reviewed a paired release-recapture study design, including minimal requirements and model assumptions. He reviewed estimating residualization in subyearling Chinook salmon for a single release and paired release. He provided an overview of subyearling studies, including those conducted by U.S. Army Corp of Engineers (USACE) and Grant PUD, and a study conducted at Lower Monumental Dam. Lastly, Skalski discussed passive integrated transponder (PIT)-tag reach survival estimates. Skalski's analyses determined it is not possible to separate active migrants from non-active migrants and provided his opinion that given what is estimable, a statistical solution to addressing subyearling residualization in the survival estimation models does not exist at this time. Instead, Skalski provided recommendations on how best to study active migrants, including what to expect and how to adjust for increased sample size. Additional discussions were as follows.

<u>Assumption #11: No handling or tag effects that could distort survival studies</u> (slide 23)
Bob Rose (Yakama Nation [YN]) asked how much time can pass before these concerns become issues. Skalski said tagger effects are time and distance dependent, as explained on slide 24. Rose said he does not recall studies within the Federal Columbia River Power

System (FCRPS) addressing this. Skalski said, if possible, tagger effects are always addressed. He said, for example, small differences may not be statistically detectable; however, paired releases can account for differences to a small degree. He said, from an agency perspective, this is a favorable approach (negatively biased; also see slides 25 and 26).

Estimating Residualism (slide 30)
Rose asked why not release R_1 to R_3 groups between the dams. Skalski said this is an option; however, this still would not sort out the two pieces.

Overview of the Virtual/Paired-Release Design (slide 41)
Rose asked if the design assumes fish are active migrants, and Skalski said this is correct. Rose asked about size selection, and Skalski said study fish are presumed to be 95 millimeters (mm) in length or more, with no high grading. John Ferguson asked how far downstream are the R_3 paired releases, and Skalski said 20 to 30 kilometers (km). Steve Hemstrom (Chelan PUD) asked if some probability of residualism is built into the design, and Skalski said that is correct.

Recommendations (continued) (slide 57)
Curt Dotson (Grant PUD) questioned how much water can be covered by conducting mobile surveys. Lance Keller (Chelan PUD) also noted that time of year will affect results. Ferguson said, with regard to the shortfalls of PIT-tag studies in estimating residualism, he suggested pairing acoustic-tags with PIT tags to obtain a more robust sample. Skalski said this is possible, and it has been done; however, he asked what can be gleaned with these results. He said this provides confirmation but not correction.

III. Snake River Chinook Salmon Life History Patterns

A. Snake River Chinook Salmon Life History Patterns (Billy Connor)

Billy Connor (U.S. Fish and Wildlife Service [USFWS]) provided a presentation titled, An Update on the Migratory Behavior and Trends in Age at Ocean Entry of Natural-origin Chinook Salmon from the Snake River Basin (Attachment C), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Connor reviewed what has been learned about contemporary

movement behaviors and how those behaviors are changing as the abundance of juveniles has increased. He also reviewed the trend in age-at-ocean entry of returning adults because behaviors have changed. A conceptual model based on generalizations from these empirical data indicates density-dependent behaviors, coupled with management actions and ocean conditions, affected a large change in smolt-to-adult return ratios (SARs) for age-0 entrants, whereas the density-dependent decrease in age-1 entrants was compensated for by modest improvements in SARs influenced by management and ocean conditions. Additional discussions were as follows.

Research Hypotheses (H_1 and H_2) (slide 17)
Bob Rose said he would presume if smolt growth decreases with smaller fish, there would be later passage and higher residualism. Connor clarified that smolts from the warmer spawning areas left earlier, and these areas have more fish, more competition, and less space. John Ferguson said, typically, smaller fish residualize longer to grow larger; however, this model indicates the opposite is true due to density dependence. Connor said this is correct.

Conceptual Model (slide 25)
Steve Hemstrom asked if the conceptual model found any correlation to river flow. Connor said there are no data available yet to address this question.

IV. Subyearling Chinook Life History Diversities Observed in the Mid-Columbia

A. Post-Emergent Behavior of Subyearling Chinook in the Wells Reservoir and Implications for the Measurement of Passage Survival through the Wells Project (Tom Kahler)

Tom Kahler (Douglas PUD) provided a presentation titled, Post-emergence Behavior of Subyearling Summer/Fall Chinook in Wells Reservoir and Implications for the Measurement of Passage Survival through the Wells Hydroelectric Project (Attachment D), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Kahler reviewed subyearling studies conducted by Douglas PUD in the Wells Reservoir from 2011 to 2014. He reviewed seining locations, size composition, and emigration to Rocky Reach, McNary, John Day, and Bonneville dams, including reach-specific travel times and travel times sorted by length at tagging. Based on these 4 years of studies, four key findings were concluded. First,

subyearling Chinook salmon are abundant and available to beach seining from early-May through early-July; however, these fish are increasingly difficult to capture with this technique from mid-July on. Second, nearly all subyearlings are too small to PIT-tag in May, and nearly all are large enough to tag by the end of July, if they can be captured. Third, subyearling Chinook salmon exhibit a continuum of migration timing, with passage at downstream projects occurring from spring until termination of bypass operations in mid-November, with few detected as yearlings. Fourth, an examination of travel rates and fish size reveals complex patterns that appear to indicate two classes of fish: 1) emigrants encompassing the full size range of detected individuals; and 2) a rearing class generally comprising the smaller two-thirds of detected fish. Kahler also noted, that during these studies, Douglas PUD was unable to tag a representative sample of the run at large. Additional discussions were as follows.

Size Composition 2011 (slide 11)
John Ferguson asked about the size of the PIT-tags. Kahler said 12-mm tags were used for this study.

Smallest Fish by Capture Date (slide 15)
Kirk Truscott (Colville Confederated Tribes [CCT]) asked if fish size varied by seining location. Kahler said yes, and he noted that fish size also varied at each site by date, as evidenced by the clusters of data points for the 2012 and 2013 tagging efforts. He said, generally, Methow River fish were smaller than Okanogan River fish.

Proportion of Tagged Fish Detected at any Downstream Project during Bypass Operations (slide 32)
Billy Connor asked if there was a difference in dam operations (e.g., period of spill versus no spill). Kahler said, by the time tagging started, Chelan PUD projects were in summer spill. He said Wells Dam is in bypass operations all summer, and the only difference is the number of turbines operating.

General

John Rohrback (CCT) asked about recaptures. Kahler said there were recaptures at different sites. He said, at Gebber's Landing, sampling would occur throughout multiple days. He said sampled fish were held overnight, tagged, and then held overnight again prior to release. He said, after those fish were released, they would return and some would be recaptured again. He said recaptures were also obtained in the Wells Dam forebay, as well as other sites.

Andrew Murdoch (Washington Department of Fish and Wildlife [WDFW]) asked if fish were detected the following spring (as yearlings). Kahler said very few, and he added that detection continued at the FCRPS dams into late-November each year, and even into early December 1 year. He said it is unknown whether any fish migrated as yearlings in late-winter prior to the activation of the bypass systems at those projects.

Bob Rose asked Connor, if hatcheries release larger fish, or if fish are released later, could this influence strength and motivation to migrate more quickly. Connor said size and timing of release affect migratory disposition. He added, for example, Lyons Ferry fall Chinook salmon subyearlings are reared under a fast growth regime to produce smolts that are larger in May compared to their natural-origin counterparts. He also said the growth regime influences the migratory behavior of the hatchery smolts; on average, hatchery-origin smolts migrate faster than natural-origin smolts.

B. Juvenile (and Adult) Subyearling Chinook Salmon Life History Information from the Okanogan River and Wells Pool (Casey Baldwin)

Casey Baldwin (CCT) provided a presentation titled, Juvenile and Adult Subyearling Chinook Life History Information from the Okanogan River and Wells Pool (Attachment E), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Baldwin reviewed subyearling studies conducted by the CCT from the Okanogan River and Wells Reservoir from 2014 to 2016. He reviewed rotary screw trap and beach seining locations, tagging constraints (largely due to fish size and water temperature), fish size at tagging, travel times and distribution of detections, and SARs. Based on these data, Baldwin considered whether adult returns can be evaluated to determine if life history characteristics, such as run timing and age structure, are the same. In 2014 and 2015, passage data at Bonneville Dam indicated similar run timing for PIT-tagged and run-at-large summer Chinook salmon (passing Bonneville Dam between

June and August). With regard to age structure, there was too much variance with the limited data to detect a statistical difference, but the age-class proportions of the returns of tagged fish from beach seining generally matched those from the run at-large samples (stock assessment, hatchery broodstock, and carcasses). Furthermore, the question remains whether tagged subyearlings are representative of untagged subyearlings.

C. The Life History of Subyearling Migrants from the Entiat River (Tom Desgroseillier)

Tom Desgroseillier (USFWS) provided a presentation titled, Life-History of Subyearling Chinook Migrants from the Entiat River (Attachment F), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Desgroseillier summarized Entiat River subyearling Chinook salmon out-migration and overwinter rearing within the Columbia River. This included a comparison between summer and spring subyearling Chinook salmon runs and SARs. Overwinter rearing was evaluated based on PIT-tag detections from Entiat River rotary screw traps and at Rocky Reach, McNary, John Day, and Bonneville dams. These data indicate that subyearling Chinook salmon exhibit a high level of plasticity in life history expressions. Among the listed spring run, subyearling Chinook salmon emigrated to the Columbia River from July through November, with the highest proportion observed migrating in October and November. Between 2010 and 2014, subyearling out-migrants represented 55% of the total spring Chinook salmon emigrant production; however, this life history is 3.3 times less likely to contribute to the adult life-stage than yearling migrants. Lastly, both spring- and summer-run subyearling Chinook salmon overwinter within the Columbia River.

D. Comparing the Migration Patterns and Timing of Yearling Spring Chinook Salmon and Subyearling Summer Chinook Salmon through the Mainstem Columbia River Using Available PIT-Tag Data (Peter Graf)

Peter Graf (Grant PUD) provided a presentation titled, Comparing the Migration Patterns of Yearling Spring Chinook and Subyearling Summer Chinook Salmon through the Mainstem Columbia River using Available PIT-Tag Data (Attachment G), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Graf reviewed a comparison of travel times between spring-run yearling and summer-run subyearling Chinook salmon using PIT-tag data

obtained from the PIT-Tag Information System (PTAGIS) in the Upper Columbia River. These data were then evaluated to determine if they fit a 'type,' or migration pattern developed for Snake River summer/fall Chinook salmon juveniles. These types include: ocean-type (enters saltwater as subyearling, first winter in ocean); reservoir-type (delayed seaward migration, overwinter in reservoirs); or stream-type (overwinters in streams, seaward migration, and ocean entry as a yearling). The data indicated that Upper Columbia yearling spring Chinook salmon follow a predictable migration pattern, whereas Upper Columbia subyearling summer Chinook salmon express individual variation in life histories. The latter also appeared to follow three distinct migration 'types' similar to Snake River summer/fall Chinook salmon. The data also indicate there appears to be delayed migration in the Upper Columbia River, and fish size may not be a reliable predictor of 'type.' Additional discussions were as follows.

Travel Rate by 'Type' (slide 39)

Bob Rose suggested translating this travel rate and standardizing by water particle travel time to see what results.

General

Casey Baldwin noted that these data are not as straightforward when studying tributary fish. John Rohrback also noted there can be lower detection efficiency for certain groups, which introduces biases. Graf agreed there could be biases.

E. The Life-History Strategies of Upper Columbia Summer/Fall Chinook as Determined by Scale Analysis of Returning Adults (Andrew Murdoch)

Andrew Murdoch provided a presentation about Life-History Strategies of Upper Columbia Summer/Fall Chinook as Determined by Scale Analysis of Returning Adults (Attachment H), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Murdoch reviewed 2013 to 2015 data for Wenatchee River subyearling Chinook salmon. Based on cumulative emigration timing and mean size at capture, the data indicate that, in general, fish are too small to PIT-tag. Graphs were also reviewed depicting natural spawners by juvenile life history in the Wenatchee, Methow, and Okanogan rivers (based on carcass data). Wenatchee and Methow river data indicate a general increasing trend in subyearlings, some

variation in yearlings, and a big decrease in reservoir-reared fish, which dominated the returns through return-year 2000. Murdoch said he does not know if this shift is a result of increased or decreased survival of one group or the other. Okanogan River data are slightly different, showing a more pronounced dominance of subyearlings beginning in 2001 and more variability between the three types in prior years. Lastly, the data indicate no significant trends in the last 10 years. Additional discussions were as follows.

General

Steve Hemstrom noted that summer/fall Chinook salmon in the Upper Columbia River travel the same distance as yearlings and seem to be dealing with conditions much better. He questioned, from an Endangered Species Act perspective, how are they accomplishing this. Murdoch said, because those fish cannot be tagged, there are no data to make this comparison. He said there could be something happening in the hydrosystem; however, there is no way of knowing. He said tools are limited; however, there are options to conduct a more in-depth investigation, such as mass marking or Strontium marks. He also suggested using different marks through time, and then examining otoliths to evaluate ocean entry. He said these methods are currently being discussed.

Casey Baldwin noted the high percentage of ocean-type fish taking weeks to months to migrate, particularly in the Okanogan River, and asked if those fish might be reservoir-reared or subyearlings. Murdoch said Lance Campbell (WDFW) is investigating when these fish truly enter salt water by analyzing calcium in otiliths. Baldwin said there are two groups of reservoir-reared fish: 1) those that are slowly moving downstream; and 2) those that overwinter. Murdoch said a subyearling can be a mover or slower mover, but does not overwinter in fresh water. Peter Graf said, based on the PIT-tag data he presented, a substantial number of fish move in December, which would be ocean-type in terms of adults, because they are not migrating the following year. Murdoch said any reservoir-reared fish will be a year-1 something.

BREAK FOR LUNCH

V. Discussion

A. Discussion (John Ferguson and Denny Rohr)

John Ferguson opened the floor for discussion and comments.

Billy Connor said he appreciated the discussions so far. He said, regarding compliance (with the respective PUD agreements and licenses), if this means meeting specific project goals (e.g., use acoustic tags and evaluate project-by-project survival), he believes this is the correct direction to head. He said travel times have always been a big topic and added he believes the graphs Tom Kahler shared depicting two distinct groups of migraters are completely accurate. Connor said he is unsure about the effects of flow on migration. He said the Independent Scientific Advisory Board conducted studies on travel times, which indicated it is not how fast fish move through the reservoirs, it is more about the conditions they experience that effect SARs. He suggested to instead focus on smaller tag sizes and evaluate big-picture concepts for parr, fry, and smolts.

Steve Hemstrom questioned whether a difference in survival can be assessed against project effects. Tom Desgroseillier said SARs are much lower for subyearlings, which was the impetus to evaluate overwintering. He suggested reviewing known fish overwintering in the reservoir compared to yearling out-migrants to identify more information about fish overwintering in the reservoir.

Andrew Murdoch said he is interested in smolt trap operations, noting that from the spawning tributaries, the vast majority of subyearlings enter the Columbia River as fry. He said he is interested in determining the size distribution for subyearlings in the hydrosystem. He said he understands how PIT-tag data can be useful; however, he also thinks these data may not be representative of the entire population. He suggested gaining a better understanding of the characteristics of sub-populations in each project, and then determining the unknowns.

Bob Rose said sometimes the correct answers are not found because the correct questions are not being asked. He asked if there are other questions needing to be answered before the compliance question can realistically be asked. He also noted the population seems to be

doing quite well, which allows more time to address these questions. Murdoch agreed the subyearling populations are doing well and suggested taking advantage of the abundance of fish.

Jeff Korth (WDFW) suggested considering what effects snowpack and the amount and timing of discharge in the tributaries may have on conditions for subyearlings that may prompt them to migrate into the reservoirs in the first place. He added that ocean conditions and survival are among other possible questions. Connor said runoff level and timing affect movement from riverine habitat into reservoirs by affecting temperature. He explained that water temperature can become warm early during years with little snowpack. He said subyearlings will typically respond to such warming by moving downstream into reservoirs earlier than would be the case during high-snowpack years. He said low flow years can correspond with low rates of freshwater survival and with El Niño conditions that reduce survival in saltwater.

Rose asked about an effective method to collect those fish after they are in the reservoir. Connor suggested using a lampara net, so long as velocities are not too high. He said USFWS owns a lampara net, if anyone is interested in borrowing it. He said USFWS also owns a large boat specially equipped to use this net. He explained that the net is deployed in a circle between two boats, with a rope attached to the stern of the first boat. Then a hydraulic winch is used to bring the net in. He said a lampara net is more fish-friendly than a purse sein. He said the USFWS boat is located in Cook, Washington. Marty Leidtke (U.S. Geological Survey [USGS]) added that USGS also has a smaller boat equipped for lampara nets.

Kirk Truscott said about 100,000 subyearlings are needed to conduct paired-release survival studies, and the likelihood of obtaining that many subyearlings is low. Kahler said the HCPs indicate compliance is passage survival; however, he asked how passage versus non-passage should be defined. Kirk Truscott suggested that passage should be defined as when fish are in the tributary and not in the project area. Kahler asked about fish using the project area for rearing, but not migrating. Curt Dotson agreed and asked for clarification on an active migrant versus a non-active migrant. Hemstrom also noted predation as a project effect and

asked how to address that. *(Note: Hemstrom later clarified that his statement was an observation more than a question. He said no other juvenile HCP Plan Species requires the amount of time to outmigrate, and spring outmigrants are also much more certain to migrate. He said the more time a tagged subyearling Chinook salmon spends in a reservoir due to natural behavior of "longer rearing periods," the more likely for predation to have a larger survival effect on that fish, and hence the resulting Project Survival Estimate. He explained that the way the HCPs are set up to measure Project survival, Project effect, subyearling studies will incorporate reservoir predation mortality as a "Project effect," which occurs on subyearlings during their longer rearing in reservoirs. He said the HCPs assume historical survival in the river reaches, which are now reservoirs, should have been 100%. He said No-Net-Impact must provide for net 100% survival, which means historically, before dams were constructed, no predation mortality would have occurred on subyearling summer run Chinook salmon rearing for longer periods in riverine locations in the mainstem Columbia River. He said in reality, even historically, these "non-active" or slow migrant fish because of their behavior, likely historically suffered some natural predation mortality from native predators (e.g., pikeminnow, sturgeon, bull trout). He said mortality is now assumed to be a Project-related mortality effect. He said predation is likely reduced for faster migrating sockeye salmon, steelhead, and yearling Chinook salmon. He said secondly, there is no precise way to determine for a rearing tagged subyearling that is not acoustically detected at a dam, whether or not it suffered predation in a reservoir or whether the tag battery expired prior to detection.)*

VI. Availability of Study Fish

A. Grant PUD Subyearling Survival and Behavior Pilot Studies: Application of Age-0 Fall Chinook Salmon (Peter Graf)

Peter Graf provided a presentation titled, Grant PUD Subyearling Survival Pilot Studies: Application of Age-0 Fall Chinook (Attachment I), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Graf reviewed pilot studies from 2001 to 2003 that were focused on dam passage survival using PIT tags in the Priest Rapids and Wanapum reservoirs. He also reviewed a study from 2008 that focused on survival estimates for Priest Rapids Dam and Reservoir using HTI acoustic tags in the Priest Rapids Reservoir. Lastly, he reviewed a

study from 2009 focused on migration estimates and mortality using Juvenile Salmon Acoustic Telemetry System (JSATS) tags in the Priest Rapids Reservoir. In summary, the pilot studies found that subyearlings traveled slower than other species, and reservoir delay was observed in all studies. Delay in reservoir forebays often resulted in violations of the assumption of downstream mixing and releases from Priest Rapids Hatchery displayed ocean-type behavior. Additional discussions were as follows.

General

Curt Dotson said, although subyearlings traveled slower than other species of salmonids studied within the Priest Rapids Project, the difference is not as dramatic as observed in other studies. He asked if this might be relative to size, because Grant PUD's study fish were larger than most of the fish tagged upstream. Graf said the authors of the studies described this as two behaviors. Dotson asked if this might be equivalent to the two observed behaviors (emigrants and rearing fish) depicted in Tom Kahler's presentation, and Graf said that is correct. Graf added that the sockeye salmon used in this study were comparable in size to the subyearlings used in this study; however, the sockeye salmon migration times were much faster.

John Ferguson asked about the fish size of subyearlings passing through the Wanapum and Priest Rapids bypass systems. Tom Dresser (Grant PUD) said one study conducted by Battelle in the Priest Rapids project area, which evaluated habitat use of subyearlings in the Wanapum Dam tailrace from April to July, found fish size to be between 50 to low-90s mm. He said this is consistent with what Kahler found in the Wells Pool. Dresser also said he believes these fish were fall subyearlings because fall Chinook salmon spawn in the Wanapum Dam tailrace.

Kirk Truscott asked if subyearlings are ever captured during gatewell dipping, and if so, were they sampled. Dotson said this has occurred in the past during summer months; however, gatewell dipping is strictly salvage (i.e., no sampling). Kirk Truscott asked if there have been any active tag studies informing whether these subyearlings are mid reservoir or shoreline oriented in migration. Dotson said this information may be available in raw data; however, not in a report. Kirk Truscott said, if subyearlings are shoreline-orientated, this may cause

issues because there are a lot of backwater areas and complex habitat, which may result in longer migration times.

B. Subyearling Data from the Rocky Reach Juvenile Bypass System (Lance Keller)

Lance Keller provided a presentation titled, Subyearling Chinook Data Collected from the Rocky Reach Juvenile Bypass System (Attachment J), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Keller reviewed an overview of the Rocky Reach Juvenile Fish Bypass System (RRJFBS) and a summary of available subyearling Chinook salmon data, including abundance, run composition, run timing, and fish size. These data reveal high variability in the daily index counts at the RRJFBS and two runs of subyearlings past Rocky Reach Dam (hatchery and unknown). The hatchery group consisted of fish migrating past Rocky Reach Dam in late-May to early-July and a large number of fish in an initial passage pulse. This group also consisted of larger fish sizes compared to the unknown group. The unknown group consisted of fish migrating past Rocky Reach Dam in late-June through August, with variable elongated passage. This group consisted of smaller fish sizes than the hatchery group; however, fish size did increase later in the passage season. Graphs throughout the presentation included a horizontal orange line at 95 mm, signifying a possible minimum fork length for subyearlings, should an active tag survival study be carried out. A vertical purple line was also present in each graph signifying when 18°C water temperatures were observed in the Rocky Reach Reservoir, which exceed the temperature threshold for conducting fish surgeries. The graphs depicted that with varying abundance numbers, size variation in hatchery and unknown fish, and the annual date at which 18°C water temperature is achieved, the ability to collect and tag a representative sample of juvenile subyearling Chinook salmon for a project survival study becomes increasingly difficult. Additional discussions were as follows.

<u>2010 Counts and Run Timing / 2010 Average Length Based on Origin</u> (slide 6)

Andrew Murdoch asked if Chelan PUD collects fish smaller than 80 mm before May. Keller said Chelan PUD collects fry prior to May; however, these fish are currently not identified to the species level. Mike Tonseth (WDFW) noted on the '2010 Average Length Based on Origin' graph, at the front end of the unknown group, a large amount of those fish are

dominated by releases from Turtle Rock, which is why there is a huge peak at that time. Alene Underwood (Chelan PUD) noted that the last Turtle Rock release was in 2011.

2011 Counts and Run Timing / 2011 Average Length Based on Origin (slide 7)
Casey Baldwin asked what fish length is considered a fry. Keller said 75 mm, so the fish depicted in the graphs are greater than 75 mm.

C. Results of Wells Reservoir Fish Collection Studies (Tom Kahler)

Tom Kahler provided a presentation titled, A Draft Review of Historic and Recent Data on Subyearling Chinook Availability in Wells Reservoir (Attachment K), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Kahler reviewed several pieces of historical subyearling data ranging from 1969 through the 1980s, including purse seine, beach seine, and fyke net data. Based on these various data, subyearlings begin passing Wells Dam when they are approximately 40 to 50 mm in length. The data cannot tell us whether fish are entrained or actively migrating; regardless, fish of this size range pass Wells Dam starting around the beginning May. The beach seine data are not necessarily representative of what fish are passing Wells Dam; however, these data may reflect what may be observed in the tributaries. The data indicate all size classes are migrating (or at least entrained). Finally, data from the Hanford Reach corroborate the data from the Wells Reservoir indicating that a very small proportion of the subyearling Chinook salmon use the shoreline from April through June. The size distribution of those captured in the nearshore matches that of those captured offshore in April and May; however, in June, the offshore catches lack the smaller size classes still present in nearshore catches, and the nearshore catches lack the largest size classes that dominate offshore catches. Additional discussions were as follows.

April 12 to 23, McGee et al. 1983 (slide 9)
Kahler said this slide shows a distribution from purse seining. Jim Craig (USFWS) asked if this includes night and day catches, and Kahler said this includes only night catches.

May 16 to 29, Purse Seine versus Beach Seine (slide 25)

Curt Dotson asked about the mesh size on the purse seine and where the beach seine was deployed in the water column. Kahler said the beach seine was shoreline oriented, and the purse seine was not specifically set up to capture subyearlings.

General

Dotson said once a certain water temperature is reached, subyearlings tend to move offshore into deeper water. Bob Rose asked if deeper water is synonymous with cooler water, and Kahler said this is not true in the Wells Reservoir.

VII. Discussion

A. Discussion (John Ferguson and Denny Rohr)

John Ferguson suggested considering the effects of climate change on differential run timing, fish numbers, growth, and conducting a compliance test. No other comments were discussed at this time.

VIII. Tagging Effects and Available Tags and Detection Equipment

A. Barotrauma (Alison Colotelo)

Alison Colotelo (Pacific Northwest National Laboratory [PNNL]) provided a presentation titled, Understanding Barotrauma in Fish Passing Hydro Structures (Attachment L), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Colotelo reviewed barotrauma due to rapid decompression, simulating rapid decompression, laboratory testing, probability of mortality or injury, acclimation depth effects on barotrauma, identification of acclimation depth of subyearlings, and effects of transmitters on barotrauma. In summary, barotrauma is primarily caused by the expansion and rupture of the swim bladder during rapid decompression. The ratio of acclimation to nadir pressure is the most important factor in determining the likelihood of barotrauma for juvenile Chinook salmon. Fish acclimated deeper in the water column are more susceptible to barotrauma. Tagged fish are more susceptible to barotrauma. Additional discussions were as follows.

Probability of Mortality or Injury (slide 11)

John Ferguson said 20.9% expected mortality seems high, noting that field studies indicate only 10 to 15% expected mortality. He asked if this percentage is regarding unburdened fish. Colotelo replied, if fish acclimated to the surface are directly injected into the water, there is a lower rate of pressure change. Therefore, there will be a lower susceptibility to injury than the untagged population of subyearlings migrating through the system, which reside deeper in the water column. Ferguson noted that some papers indicate fish can self-adjust. Colotelo said those papers may have assumed those fish were acclimated to a deep depth when passing through the turbine. She said fish have the ability to burp to reduce susceptibility to barotrauma; however, the physiological state of the fish and depth of natural buoyance is unknown. She said the worst-case scenario is assumed in the lab.

General

Steve Hemstrom asked if the underside of the turbine blade is the area of greatest pressure, and Colotelo said that is correct. Colotelo added that assumptions are made where fish are passing, until it is known exactly where fish pass.

Denny Rohr asked if subyearlings tend to acclimate deeper in the water column before passing turbines, and Colotelo said that is what was found in the Snake River.

Bob Rose asked if the bubbles found in the eyes and gills are related to the swim bladder. Colotelo said Battelle conducted studies and found when the swim bladder explodes, it pushes gas through the vasculature. Ferguson suggested that fish can regulate their swim bladder through their vascular system. Colotelo said younger fish have less developed system for regulating the size of the swim bladder through their vascular system.

Casey Baldwin asked whether there are changes to growth or survival for fish subjected to barotrauma in which the swim bladder does not explode. Colotelo said, in lab tests, fish have been euthanized after a couple of days, so Battelle has not evaluated delayed effects. She said fish can recover from small ruptures; however, no work has been conducted on long-term effects.

Lance Keller asked if tag expulsion has been observed in the lab. Colotelo said tag loss is not common with the standard USACE tag and suture practices; however, with future injectable transmitters, Battelle will evaluate tag expulsion. She said it is important to consider whether a fish died from passing the turbine or if the tag was just expelled.

B. Tag Hardware (Curt Dotson)

Curt Dotson provided a presentation titled, Types of Tags that are Presently on the Market (Attachment M), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Dotson reviewed five different tag vendors and their tag technology available to date. He noted that battery life is dependent on ping rate, and the larger the tag, the longer the battery life. He said PNNL is now working to release injectable tags.

C. Tagging Effects (Marty Leidtke)

Marty Leidtke provided a presentation titled, Tagging and Tag Effects in Subyearling Chinook Salmon (Attachment N), which was distributed to the HCP Coordinating Committees and PRCC by Kristi Geris following the workshop on June 22, 2016. In this presentation, Leidtke reviewed potential issues with tagging and tagging-related impacts to subyearling Chinook salmon, including elevated water temperatures, disease, tag effects, and tag operations and tagger effects. In summary, Leidtke said tagging subyearlings for telemetry studies can be challenging; however, mitigation can be executed at several levels. Small tags for small fish will not resolve all concerns. Lastly, studies can be executed reliably with a well-planned and executed approach to tagging. Leidtke recommended using prophylactic treatments immediately after tagging to control disease and fungal risk. She also recommended removing sutures from tagged fish prior to release. Additional discussions were as follows.

<u>General</u>

Bob Rose asked if USGS has evaluated implications of injectable acoustic tags, and Leidtke said not specifically. Leidtke said the USGS parent facility has worked with PIT-tag injection needles.

Andrew Murdoch asked about the new suture location. Leidtke said the new position is parallel and adjacent to the old position, off the mid-ventral line by a couple of millimeters.

Alison Colotelo said Battelle is considering, for fish less than 90 mm, a small incision to inject a tag and not using sutures to close it, and then testing the fish through a swim chamber to determine whether the tags stay in. She said these tests should be ready this winter. Leidtke suggested monitoring that closely. She said a good tagger can have a fish off the surgery table in 1.5 minutes and questioned whether injecting the tag is much faster. She said, if one suture ensures a tag will not be expelled, this may be worth considering. Colotelo said the injectable tag is already developed. She said the tag has a battery capability to last more than 120 days, and PNNL is considering sending the tag out to manufacturers. She said USACE also is producing a 20-day injectable, and another tag in development will be smaller than 12 mm, with a battery life of 20 days. She said more information on the latter should be available in July 2016.

IX. Conclusions and Discussion

A. Conclusions and Discussion (John Ferguson and Denny Rohr)

John Ferguson and Denny Rohr thanked the speakers for their time and presentations. Ferguson asked HCP Coordinating Committees and PRCC members to think about a path forward to discuss during tomorrow's HCP and PRCC meetings.

X. List of Attachments

Attachment A	List of Attendees
Attachment B	Considerations in the Design and Analysis of Subyearling Chinook Salmon Survival Compliance Studies (Skalski)
Attachment C	An Update on the Migratory Behavior and Trends in Age at Ocean Entry of Natural-origin Chinook Salmon from the Snake River Basin (Connor)
Attachment D	Post-emergence Behavior of Subyearling Summer/Fall Chinook in Wells Reservoir and Implications for the Measurement of Passage Survival through the Wells Hydroelectric Project (Kahler et al.)
Attachment E	Juvenile and Adult Subyearling Chinook Life History Information from the Okanogan River and Wells Pool (Baldwin et al.)
Attachment F	Life-History of Subyearling Chinook Migrants from the Entiat River (Desgroseillier)
Attachment G	Comparing the Migration Patterns of Yearling Spring Chinook and Subyearling Summer Chinook Salmon through the Mainstem Columbia River using Available PIT-Tag Data (Graf)
Attachment H	Life-History Strategies of Upper Columbia Summer/Fall Chinook as Determined by Scale Analysis of Returning Adults (Murdoch)
Attachment I	Grant PUD Subyearling Survival Pilot Studies: Application of Age-0 Fall Chinook (Graf)
Attachment J	Subyearling Chinook Data Collected from the Rocky Reach Juvenile Bypass System (Keller)
Attachment K	A Draft Review of Historic and Recent Data on Subyearling Chinook Availability in Wells Reservoir (Kahler and McGee)
Attachment L	Understanding Barotrauma in Fish Passing Hydro Structures (Colotelo)
Attachment M	Types of Tags that are Presently on the Market (Dotson)
Attachment N	Tagging and Tag Effects in Subyearling Chinook Salmon (Leidtke)

Attachment A
List of Attendees

Name	Organization
John Ferguson	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Denny Rohr	D. Rohr and Associates
Lance Keller*	Chelan PUD
Steve Hemstrom*	Chelan PUD
Keith Truscott	Chelan PUD
Alene Underwood	Chelan PUD
Tom Kahler*	Douglas PUD
Peter Graf	Grant PUD
Tom Dresser†	Grant PUD
Curt Dotson†	Grant PUD
Scott Carlon*†	National Marine Fisheries Service
Jim Craig*†	U.S. Fish and Wildlife Service
Billy Connor	U.S. Fish and Wildlife Service
Tom Desgroseillier	U.S. Fish and Wildlife Service
Jeff Korth*†	Washington Department of Fish and Wildlife
Mike Tonseth	Washington Department of Fish and Wildlife
Andrew Murdoch	Washington Department of Fish and Wildlife
Kirk Truscott*†	Colville Confederated Tribes
Casey Baldwin	Colville Confederated Tribes
John Rohrback	Colville Confederated Tribes
Tom Skiles†	Columbia River Inter-Tribal Fish Commission
Bob Rose*†	Yakama Nation
Marty Leidtke	U.S. Geological Survey
John Skalski	University of Washington, Columbia Basin Research
Alison Colotelo	Pacific Northwest National Laboratory

Notes:

* Denotes Coordinating Committees member or alternate

† Denotes Priest Rapids Coordinating Committee member or alternate