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MEMORANDUM

To: Dave Marvin, PEK Ventures

From: Michele DeHart

Date: November 30, 2014

Re: Response to comments on the Draft CSS 2014 Annual Report

Attached, please find the Comparative Survival Study Oversight Committee responses to your comments on the draft 2014 Comparative Survival Study Annual Report. Thank you for reviewing our report and providing comments. Your comments help to keep us on track and aid in clarifying the details of our report. Please note that in the following pages, your original comments are presented in italic font followed by the responses in standard font.

Response to Comments from Dave Marvin

Dear Michele:

I received a copy of the Draft CSS 2014 Annual Report from Curtis Knudsen of Oncorh Consulting. I am pleased to provide you with my comments regarding the review of the PIT Tag Effects Study (PTES) presented in Chapter 6 of that draft report. As a proponent of the appropriate use of PIT tag mark/recapture projects in the Columbia Basin, I am, like Mr. Knudsen, very interested in your efforts to quantify the effects of PIT and coded wire tags on the behavior and survival of spring Chinook.

Before discussing the PTES chapter, I have a suggestion regarding your description of PIT tags on page 10, lines 30-33 of the draft report. The boiler-plate text is outdated, and could be rewritten as: "Wild and hatchery smolts are marked with glass-encapsulated passive integrated transponder (PIT) tags, 2mm in diameter and with a nominal length of 12mm. Each tag has a unique code to identify individual marked fish. PIT tags are implanted into the fish's body cavity using a customized injector or a modified hypodermic needle and syringe. PIT tags have a high retention rate when properly implanted in salmonids, although tags may be expelled by fecund females during or prior to egg deposition. The passive tag has no internal power source and so will normally remain functional throughout the life of the fish, or longer."

CSS Response: We stand by our original description which is generic intentionally and meant to apply to the broad range of analyses contained in the report. Similarly, we generally do not believe the description of tag expulsion from fecund females is appropriate, since all of our SAR analyses, with the exception of Chapter 6 in this annual report, rely on dam detections of actively migrating fish.

General Comments

*Like Mr. Knudsen, I believe the PTES chapter would benefit from more detail and greater clarity provided in the Methods, Results, and Discussion sections. For example, the methods and results sections currently focus on **a)** the numbers of fish marked with each tag type, and **b)** the short term (<30 days) retention of those various tags. There is no similar level of detail in the discussions or provision of data for **a)** the survival (or PIT tag retention/detection) of marks to the Tyee Springs release array; **b)** the estimated survival of the PIT-only and PIT + CW marked smolts to Bonneville Dam, including the methods used to incorporate estuary detection and predation data into those dam passage estimates; **c)** the differential survival of the two PIT-tagged mark groups of Carson NFH Chinook detected as returning adults at Bonneville Dam;**d)** the Smolt-to-Adult Return ratios to Carson NFH for the various mark groups and control, at least for the completed returns from the 2009/2011 brood/release years; and **e)** the post-ponding PIT tag retention rates of adult Chinook detected as they entered the hatchery holding facilities.*

CSS Response: We have provided additional details within the methods, results, and discussion sections, including adult returns by age and SARs for the various tagged and untagged groups. Analyses of adult survival and tag loss within the hatchery will be provided in future reports. We have provided data on tag retention for the dual-tagged group, all of which retained both tags.

*As this is the first year the PTES has been presented in the CSS Annual Report, the methods used to select, collect, and analyze data should be described in considerable detail. However, most of the study methods receive only cursory explanations, or the reader is referred to explanations in other documents. For example, a brief description is provided of the power analyses conducted to determine the sample sizes of the PIT-only, CW-only, and PIT + CW mark groups (2nd paragraph, **Methods** section, pg. 185). The PTES report should reiterate, rather than simply reference, the PIT-tag effect size estimated by Knudsen et al. (2009). In the same paragraph, there is a reference to a report by Brignon and Haeseker (2011) to explain how release sizes were determined. However, when I accessed that document (at http://www.fws.gov/columbiariver/publications/PTES_AR_2011.pdf) I found that the full text of the study proposal (presented as Appendix A), and specifically the calculation of release sizes, is not included in that document or otherwise accessible from the FWS Columbia River FPO Web site. Again,*

this review should reiterate the methods developed by Brignon and Haeseker, along with the adult return rate data used, to determine the appropriate sample sizes for the various test and control release groups.

CSS Response: We have provided additional details on the methods used to collect and analyze the data. Some of those analyses will be provided in future reports. We have stated the effect size that was used in the power calculations and the effect size reported by Knudsen et al. (2009). The link to Brignon and Haeseker (2011) has been fixed and the full document is available. It provides the details on the sample size calculations, and we summarize the power analysis results in the chapter.

*The survival and detection probability methods alluded to in the 2nd paragraph of the **Methods** section on pg. 187 should also be explained in greater detail. In the absence of such documentation, the reader must rely, as I have, on obtaining the raw detection event numbers accessible from the PTAGIS database for fish detected as smolts and/or adults at Bonneville Dam or as smolts downstream in the PIT trawl operated by NOAA Fisheries, or from avian mortality events recorded in the Columbia River Estuary, and employing our own methods to compute detection probabilities and survival rates.*

CSS Response: We have provided additional details on the methods and detection sites used to estimate apparent survival rates and detection probabilities.

*Additionally, the discussions of reach and site survival estimates (and the accompanying graphs) in the **Results** section should include numbers of observed marks from which the estimates are derived. The SAR for 2009 BY PIT-only marked returns to Carson NFH is computed from only 20 fish[1], while the SAR for 2009 BY PIT + CW returns is derived from only six (6) hatchery returns. Your results describe and illustrate a more than three-fold decrease in the survival of 2009 BY PIT + CW tagged adult returns relative to the PIT-only mark group; without some provision of precautions and caveats regarding the use of these sparse data sets, I would agree with Mr. Knudsen that your results argue for the immediate cessation of marking hatchery fish with both PIT and coded wire tags.*

CSS Response: We have provided a table with the adult returns by age of each of the tagged and untagged groups. The results on dual-tagged fish are very preliminary this early in the study and should be considered with caution before application to other studies.

Specific Comments

*The first paragraph of the **Methods** section (pg. 185) focuses on the type(s) of rearing vessel(s) at Carson NFH used in this study. What were the densities of tagged and untagged fish in these various vessels?*

CSS Response: We have provided details on the number of tagged and untagged fish in each of the rearing vessels.

*In the second paragraph of the **Methods** section (pg. 185), please specify the expected PIT-tag effect size, and the smolt-to-adult return ratio (SAR), used to initially determine the appropriate study sample sizes. I can not easily locate SAR values back to Carson NFH, but historic SARs computed from release back to Bonneville Dam are presented earlier in this draft report (Table 4.45, pg. 130). Those Release-to-BOA SARs (excluding jack returns) range from 0.23 to 2.85, with a geometric mean of 0.71. Are those Release-to-BOA SARs consistent with, or proportional to, the release-to-raceway SARs used to determine the release sizes in this study?*

CSS Response: We have stated the PIT-tag effect that is detectable with the study design and the PIT-tag effect reported by Knudsen et al. (2009).

*In the third paragraph of the **Methods** section (pg. 186), please describe the protocols for the collection, handling, anesthetizing, marking, and recovery of the three mark groups (CWT only, PIT tag only, and CW + PIT tag). Was the dual-tag mark group anesthetized twice, or anesthetized for a longer duration, than the CW- or PIT-only tag groups? Were there protocols in place to test for tagger effects within and between the various mark groups? Were there any differences between raceways (e.g., holding*

densities, water temperature, predation removals), or between years, that might influence the results of this study?

CSS Response: We have provided additional details on the handling, anesthetizing, and tagging of the three groups. The dual-tag group was anesthetized twice. There were no protocols in place to test for tagger effects, but the same, highly-experienced individuals participated in all of the tagging events. Previous data has shown that there are no significant differences in SARs between rearing vessels. There were no apparent differences in the handling, density, water temperature, or predation removals between raceways.

*Please clarify why tag retention rates were assessed after only 30 days, rather than conducting the assessment when the marked cohort was released the following April. Also clarify why it was necessary to euthanize the dual-tagged group in order to determine the tag retention rate for each mark. You state (fourth paragraph of the **Methods** section, pg. 186) that you estimated the precision of retention rates from 0.90 to 0.99, but display only rates from 0.95 to 0.99 in Figure 6.1; please revise the text or include more data. Is there a more rigorous test for precision than "opting" to sample ~300 fish per mark group?*

CSS Response: The 30-day period is the standard tag retention protocol used at USFWS hatcheries. The CJS model is used to estimate survival/retention of PIT-tagged fish from the point of tagging until the time of hatchery release, and those estimates showed that survival/retention of PIT-tagged fish were estimated to be 100%. We have provided additional details on why the dual-tagged individuals were euthanized. The choice to select 300 individuals is based on the desire to minimize the number of fish used for retention sampling while still achieving adequate precision.

*In the fifth paragraph of the **Methods** section (pg. 187), please describe the protocols used to allow the calculation pre-release mortality, such as the collection of dead or moribund fish, and the retrieval of shed tags from the raceways. Why were these protocols not employed for the 2011 releases? What was the detection rate of the Tyee Springs PIT tag detection array in each of the four years of the study, and what were the adjusted release numbers? These adjusted release numbers should be reported here and in Table 6.1, "Preliminary estimates of the number of tagged fish released by release year, tag group, and rearing vessel."*

CSS Response: We have elected to use the numbers tagged as our starting population rather than make adjustments due to tag loss or mortality because it is not possible to collect shed tags or mortalities within the earthen ponds. Detection probabilities at the Carson juvenile array were estimated to be 0.1% in 2011, 6% in 2012, 18% in 2013, and 15% in 2014. These preliminary estimates will change over time as additional fish are recovered.

Earlier in this report (Table 4.45, pg. 130) you note that the number of Carson NFH smolts surviving to Bonneville Dam is based on the "[e]stimated population of tagged study fish alive to BON tailrace (includes fish detected at the dam and those estimated to pass undetected). CJS estimation of S1 uses PIT-tags detected on bird colonies in the Columbia River estuary and adult detects to augment the NOAA Trawl detections below BON." As this is the first report for the PIT Tag Effects Study, please describe in detail the methods used to employ CJS models, detections of marked smolts at BON and the estuary trawl, and the in situ detection of tags on East Sand Island to estimate juvenile reach survival and site detection probabilities for the PIT-only and PIT+CW mark groups.

CSS Response: We have provided additional details and a figure to describe the application of the CJS model on the PIT-only and dual-tag groups.

*In the sixth paragraph of the **Methods** section (pg. 187), you state that adult spring Chinook return to Carson NFH up to three years after release, but then caution that the survival estimates for the 2011 release year are preliminary. Please explain why the return total through the summer of 2014 for the 2009/2011 Brood/Release year is considered to be "preliminary".*

CSS Response: It is preliminary because we had not analyzed the age-5 returns at the time of writing.

*In the description of the post-ponding identification and enumeration of marked fish (seventh paragraph of the **Methods** section, pg. 188), please provide details on the protocols used. In particular, how were CWTs identified in surplussed fish? Since late-stage PIT tag detection may be sex-linked, was the sex of each sampled fish recorded and reported along with the presence/absence of a PIT and/or CW tag? Also, please clarify how you will "correct for tag loss" when estimating SARs for untagged fish.*

CSS Response: Surplus fish with CWTs were identified using the same stationary CWT detector used in spawning operations. However, sex could not be determined on surplus fish because of technical and logistical constraints. We have provided additional details on the CJS model that will be used to estimate tag loss after hatchery entry. We have provided additional details on how we will estimate and correct for tag loss using the dual-tag group.

*The reported numbers of tagged fish released (Table 6.1, referenced in the first paragraph of the **Results** section on pg. 188) need to be clarified. Is the "Number tagged for release" different from the estimate of the actual release size? If so, please provide both values. From the observed SARs for the 2011 release groups, were the "prescribed sample sizes" sufficient to address the study objectives? Please provide a table of survival estimates from "the time of tagging until detection at the juvenile release array". In addition, please re-scale the y-axis in Figure 6.2 to a minimum value of 60% to (barely) encompass the confidence interval around the 2011 dual-tagged survival estimate; this will provide more detail for the individual point estimates.*

CSS Response: We have provided a table with the numbers of fish tagged, which will be the starting population numbers for the study and these will not be adjusted for tag loss or mortality (see response above). The numbers tagged were similar to the numbers specified in the sample size power analyses. We have provided a table with the survival estimates from tagging until detection at the Carson juvenile array. Because the table contains the same information, we have deleted the figure with those same estimates.

*Please provide a table of the survival estimates from release to Bonneville Dam, to complement the data displayed in Figure 6.3. In addition, please re-scale the y-axis in Figure 6.3 to a minimum value of 40% to (barely) encompass the confidence interval around the 2014 dual-tagged survival estimate. In the second paragraph of the **Results** section, at the bottom of pg. 190, clarify that the preliminary SAR estimates presented in figure 6.4 are for the 2011 test/control groups only. Are the estimated SARs (0.04% - 0.16%) for the various mark and control groups consistent with the historic and expected return rates? Since the observed SAR for the untagged fish is pooled from the three rearing vessel types, is there historic hatchery data to document the expected SARs for each vessel type?*

CSS Response: We have elected to provide a graph of the survival estimates to Bonneville Dam because we feel it is easier to interpret, and have scaled the graph as suggested. A table with the same information would be redundant. We have provided a table with the age-specific adult returns for each of the tagged and untagged groups. Analyses have shown that there are no significant differences in SARs among rearing vessels, and the returns from 2011 are consistent with previous return assumptions used in the sample size power analyses.

*In the one and only paragraph of the **Discussion** section (pg. 192), you state that you "were successful in achieving the initial study objectives." However, the objectives you discuss are tangential to those described in the Introduction, to wit: "(1) to evaluate the effects of PIT tags and CWTs on spring Chinook salmon SARs and (2) to quantify PIT and coded-wire tag loss rates prior to hatchery release and following adult hatchery return." You state that you tagged and released the target sample sizes but fail to discuss if those target sizes were sufficient to allow an evaluation of the impacts of the various marks on SARs. While you have thoroughly documented the short-term (<30 day) loss of CW and PIT tags following tagging, you have shared no data for subsequent tag loss prior to release or following adult returns to the hatchery. With a small (20) number of PIT-only returns from the 2011 release, respectively, and unreported numbers of CWT-only and untagged fish, I'm not fully convinced that the "preliminary results*

suggest" that PIT tags and CWTs provide similar SAR estimates, which in turn are similar to the SAR for untagged Carson NFH spring Chinook. And, with only six PIT + CW tag returns, I am dubious of your suggestion that dual-tagged fish have a lower SAR than fish marked with only a PIT tag or CWT. I do not disagree with your suggestion, but simply do not believe there are sufficient data to support the claim.

CSS Response: The initial study objectives were to tag 15K PIT-only, 15K dual-tag, and 75K CWT-only fish. Subsequent reports will cover the remaining study objectives. The sample size power analyses indicate that these release numbers will have 80% power to detect a 20% reduction in SARs of PIT-tagged fish relative to CWT fish. The survival estimates to the Carson juvenile array represent mortality/tag loss from the point of tagging until hatchery release. We have provided a table with the age-specific number of adult returns for each of the tagged and untagged groups. We believe that the numbers support our initial claims.

Since the returns are complete to Carson NFH for PIT-tagged fish released in 2011, I queried PTAGIS for the release, detection, and mortality data. The release files provided to PTAGIS do not break out the 306 PIT-only tags held separately for the tag retention evaluation and then released with the general population, so I could not match exactly the PIT-only release group used in your evaluation. Neither was I able to use the detections at the NOAA-Fisheries estuary PIT trawl (TWX) and the mortality recoveries at East Sand Island to match the FPC estimate of smolt survival for the PIT-only group to the Bonneville Dam tailrace, as reported in Table 4.45 (pg. 130). However, the raw numbers of tagged smolts detected at BON (table A below) are similar for the two PIT tag mark groups, as are the numbers and proportions of detections and mortalities downstream (tables B & C). It is only as the tag groups return to BON (table D) and Carson NFH (table E) that we begin to see a substantial difference in the proportional representation. I hope that your discussion will investigate and elaborate on these observations, and provide a thoughtful assessment of the preliminary data and its utility in addressing your study objectives.

CSS Response: Future reports will include analyses of adult survival and tag loss from Bonneville Dam to Carson NFH as well as within the hatchery. Age-5 returns to the hatchery were not available at the time of writing, and therefore we have not reported those estimates. We have provided age-specific adult returns by tag group. It is very early in the study to begin assessing possible reasons for the low return of the dual-tag group from 2011, but the analyses you present are similar to the ones we will conduct in future reports.

A) 2011 Releases of PIT-only and PIT + CWT tags, and smolts detected at Bonneville Dam.

	Releases	***Smolt Detections at BON (2011)***	
PIT-only	*14,953*[2]	*1480*	*9.90%*
PIT + CWT	*14,595*	*1488*	*10.20%*
Total	*29,548*	*2968*	*10.04%*

B) 2011 Releases of PIT-only and PIT + CWT tags detected at the NOAA-Fisheries PIT trawl (TWX).

	Detected at BON	***Not Detected at BON***	***% Detected at BON***
PIT-only	*9*	*62*	*12.68%*
PIT + CWT	*13*	*69*	*15.85%*
Total	*22*	*131*	*14.38%*

C) 2011 Releases of PIT-only and PIT + CWT tags detected from mortality events on East Sand Island (ESANIS).

	Detected at BON	Not Detected at BON	% Detected at BON
PIT-only	43	254	14.48%
PIT + CWT	42	239	14.95%
Total	85	493	14.71%

D) 2011 Releases of PIT-only and PIT + CWT tags detected at BOA after 2011.

	Detected as Smolts	Not Detected as Smolts	% Detected as Smolts
PIT-only	6	46	11.54%
PIT + CWT	6	29	17.14%
Total	12	75	13.79%

E) 2011 Releases of PIT-only and PIT + CWT tags detected at Carson NFH.

	Detections at Carson	BON to CAL Conversion	SAR
PIT-only	20	38.5%	0.13%
PIT + CWT	6	17.1%	0.04%

I appreciate the opportunity to comment on this preliminary report of the PIT Tag Effects Study. I hope you find these comments useful in preparing your final report for 2014, as well as in your analyses and updates in the remaining years of the study.

Regards,
Dave Marvin