

Memorandum

To: Wells, Rocky Reach, and Rock Island
HCP Hatchery Committees

Date: November 16, 2017

From: Tracy Hillman, HCP Hatchery Committees Chairman

cc: Sarah Montgomery, Anchor QEA, LLC

Re: Final Minutes of the October 18, 2017 HCP Hatchery Committees Meeting

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plan (HCP) Hatchery Committees meeting was held at the Grant PUD office in Wenatchee, Washington, on Wednesday, October 18, 2017, from 9:00 a.m. to 12:15 p.m. Attendees are listed in Attachment A to these meeting minutes.

Action Item Summary

- Andrew Murdoch (Washington Department of Fish and Wildlife [WDFW]) will write an overview of proposed expanded sampling at the off-ladder fish trap (OLAFT) at Priest Rapids Dam (Item I-A). *(Note: this item is ongoing.)*
- Mike Tonseth will coordinate with Todd Seamons (WDFW) to produce an outline or recommended approach for genetic monitoring (Item I-A). *(Note: this item is ongoing.)*
- Kirk Truscott will discuss internally and coordinate with Keely Murdoch on potential edits to Chelan PUD's Draft Statement of Agreement (SOA) Regarding District's Coho Obligation (Item I-A). *(Note: this item is ongoing.)*
- Sarah Montgomery and Mike Tonseth will coordinate to revise and finalize the September 20, 2017 Hatchery Committees meeting minutes (Item I-A). *(Note: Tonseth provided revisions and Montgomery distributed the final version on October 19, 2017.)*
- Sarah Montgomery will distribute Barry Berejikian's (Northwest Fisheries Science Center [NWFSC]) presentation, "Potential to improve the conservation benefits of steelhead hatcheries," to the Hatchery Committees (Item II-C). *(Note: Montgomery distributed the presentation on October 19, 2017.)*
- Bill Gale, Matt Cooper, Charlie Snow (WDFW), Tom Kahler, and Greg Mackey will develop management alternatives for the Twisp River and Winthrop National Fish Hatchery (NFH) steelhead programs (Item II-C).
- Sarah Montgomery will notify the Hatchery Committees that the Draft Monitoring and Evaluation Plan for PUD Hatchery Programs (2017 Update) will be a decision item at the Hatchery Committees November 15, 2017 meeting (Item III-C). *(Note: Montgomery notified the*

Hatchery Committees on October 19, 2017, and this item is also described below in "Review Items".)

- Tracy Hillman will distribute the draft timelines for Wenatchee and Methow spring Chinook salmon programs for Hatchery Committees review (Item III-D). *(Note: Hillman sent the timelines to Montgomery, who forwarded them to the Hatchery Committees on October 18, 2017.)*

Decision Summary

- There were no decisions approved during today's meeting.

Agreements

- There were no agreements discussed during today's meeting.

Review Items

- Sarah Montgomery sent an email to the Rocky Reach and Rock Island Hatchery Committees on August 15, 2017, notifying them that the Chelan PUD Draft SOA Regarding District's Coho Obligation is available for a 30-day review, with comments due to Catherine Willard by September 14, 2017. Chelan PUD indicated they will request approval of the SOA at the Hatchery Committees September 20, 2017 meeting. *(Note: this item will be discussed at the November 15, 2017 Hatchery Committees meeting.)*
- Sarah Montgomery sent an email to the Hatchery Committees on October 16, 2017, notifying them that the draft plan, *Implementation of Comprehensive Monitoring and Evaluation of Wells Hatchery Complex Programs in 2018*, is available for review with edits and comments due to Greg Mackey by December 1, 2017.
- Sarah Montgomery sent an email to the Hatchery Committees on October 19, 2017, notifying them that the Draft M&E Plan for PUD Hatchery Programs (2017 Update) is available for review and will be a decision item at the November 15, 2017 Hatchery Committees meeting.

Finalized Documents

- Sarah Montgomery sent an email to the Hatchery Committees on September 15, 2017, notifying them the Chelan PUD and Grant PUD 2016 Final M&E Annual Report and Appendices are now available for download from the Hatchery Committees Extranet site.
- Sarah Montgomery sent an email to the Hatchery Committees on October 24, 2017, notifying them the Chelan PUD 2018 Hatchery Monitoring and Evaluation Implementation Plan

(approved on August 18, 2017) is available for download from the Hatchery Committees Extranet site.

I. Welcome

A. Review Agenda, Review Last Meeting Action Items, and Approve the September 20, 2017 Meeting Minutes (Tracy Hillman)

Tracy Hillman welcomed the Hatchery Committees and asked for any additions or changes to the agenda. None were requested.

The Hatchery Committees representatives reviewed the revised draft September 20, 2017 meeting minutes. Sarah Montgomery said there are a few outstanding comments, and representatives revised the meeting minutes. Hatchery Committees representatives present conditionally approved the draft September 20, 2017 meeting minutes, pending further clarification from Mike Tonseth. (Note: Tonseth revised the minutes, and Montgomery distributed the final approved version on October 19, 2017.)

Action items from the Hatchery Committees meeting on September 20, 2017, and follow-up discussions were addressed (*note: italicized text below corresponds to agenda items from the meeting on September 20, 2017*):

- *Andrew Murdoch (Washington Department of Fish and Wildlife [WDFW]) will write an overview of proposed expanded sampling at the off-ladder fish trap (OLAFT) at Priest Rapids Dam (Item I-A).*
This item is ongoing.
- *Mike Tonseth will coordinate with Todd Seamons (WDFW) to produce an outline or recommended approach for genetic monitoring (Item I-A).*
This item is ongoing.
- *Tracy Hillman will distribute the Upper Columbia Salmon Recovery Board's (UCSRB) discussion draft Hatchery Report to the Hatchery Committees when he receives it (Item I-A).*
Hillman sent the report to Montgomery, who distributed it to the Hatchery Committees on October 13, 2017.
- *Tracy Hillman will invite Greer Maier (UCSRB) to an upcoming Hatchery Committees meeting to discuss the Hatchery Report (Item I-A).*
Maier plans to attend the November 15, 2017 Hatchery Committees meeting.
- *Kirk Truscott will discuss internally and coordinate with Keely Murdoch on potential edits to Chelan PUD's Draft Statement of Agreement Regarding the District's Coho Obligation (Item II-A).*

Keely Murdoch said Yakama Nation (YN) and Colville Confederated Tribes (CCT) have met, and Truscott will be discussing this further internally. Mike Tonseth asked when the current agreement expires. Catherine Willard said the agreement expires in October 2017, but a signed agreement is likely not needed until production occurs in 2018.

- *Tom Kahler will send Douglas PUD's Transition Plan Outline to Sarah Montgomery for distribution to the Hatchery Committees (Item III-A).*

Montgomery distributed the outline following the meeting on September 20, 2017.

- *Douglas PUD will provide their Transition Plan to the Hatchery Committees for review (Item III-A).*

Tom Kahler sent the plan to Sarah Montgomery, which she forwarded to the Hatchery Committees on October 16, 2017.

- *Hatchery Committees representatives will review the revised Monitoring and Evaluation (M&E) Plan for PUD Hatchery Programs and discuss it during the October 18, 2017 Hatchery Committees meeting (Item IV-D).*

Sarah Montgomery distributed the latest version of the plan on October 10, 2017, and this item will be discussed today.

- *Tracy Hillman will invite Barry Berejikian (Northwest Fisheries Science Center) to the October 18, 2017 Hatchery Committees meeting to discuss steelhead in the Twisp River (Item V-A).*

Berejikian is present today for this discussion.

II. Douglas PUD

A. Draft 2018 M&E Implementation Plan (Greg Mackey)

Greg Mackey said the draft plan, *Implementation of Comprehensive Monitoring and Evaluation of Wells Hatchery Complex Programs in 2018*, is available for Hatchery Committees review. Mackey shared the plan (Attachment B), which Sarah Montgomery distributed to the Hatchery Committees on October 16, 2017. Mackey said Douglas PUD requests comments by December 1, 2017, to finalize the contract for M&E by January 1, 2018. He said the plan is nearly identical to the previous year, with the following exceptions:

- The Okanogan Safety-Net and Omak Creek Conservation programs are now reported on by Grant PUD (contracted to BioAnalysts) and therefore will not be reported by Douglas PUD to prevent reporting the same results in two reports.
- Language was changed in various sections to improve clarity.

Greg Mackey said the plan includes pilot studies, such as the Twisp River juvenile population estimate study. He said continued implementation of the pilot studies will be determined based on analysis of the approach and results, which Douglas PUD will be working on this winter.

B. Wells Transition Plan (Tom Kahler)

Greg Mackey shared the document, *Draft Transition Plan for Wells and Methow Fish Hatcheries* (Attachment C), which Sarah Montgomery distributed to the Hatchery Committees on September 16, 2017. He said since the last Hatchery Committees meeting, Douglas PUD has been working with WDFW to develop the plan and has also drafted an internal version of the plan with contractual information, internal strategy, and other details. He said Douglas PUD expects more edits from WDFW, but in the meantime wanted to distribute a version to the Committee for review. Tom Kahler said he was hoping the group could discuss WDFW's edits today, but Douglas PUD has not received them yet. He said Douglas PUD and WDFW are working together and coordinating via point people for the transition.

Mackey said the Transition Plan is available for review and requested comments as soon as possible. He said Douglas PUD has hired managers for the Methow Fish Hatchery and Wells Fish Hatchery, and has interviewed candidates for the remaining jobs with offers being made soon. Bill Gale asked if Douglas PUD will hire a Doctor of Veterinary Medicine, and Mackey said Douglas PUD hopes to, but has not confirmed anyone for that position yet.

Tracy Hillman asked if the transition is still planned to occur within a 90-day period. Mackey said yes, but if some tasks require a longer transition time an extension of time for such tasks may be negotiated with WDFW as needed. He said extensions will occur on a case-by-case basis, but there is no plan to employ a blanket extension for the transition. Kahler said so far Douglas PUD expects the transition to be completed in 90 days, by the end of the contract on November 28, 2017.

Gale said he has two comments regarding the Transition Plan. He said at U.S. Fish and Wildlife Service (USFWS) fish hatcheries, maintenance staff are identified separately from fish culture staff, and hatchery maintenance expectations are detailed for both groups. Gale suggested that Douglas PUD include information about maintenance responsibilities for the staff that will be maintaining the hatcheries so no maintenance tasks are left undone. Mackey said a landscaping company and cleaning staff will perform some of the maintenance duties in addition to hatchery staff, and more information can be included in the plan based on hatchery staff job descriptions.

Gale said the plan also includes some discussion about coordination with USFWS regarding adult management. He suggested that coordination between Methow Fish Hatchery and Winthrop NFH be clearly identified, especially regarding spring Chinook salmon and steelhead broodstocking. Mackey

said this information can be added under the hatchery supervisor's job description. Mike Tonseth said those details should also be included in the Broodstock Collection Protocols. Gale added he did not see the Broodstock Collection Protocols mentioned in the Transition Plan. Kahler said the Broodstock Collection Protocols are listed in the Transition Plan. Tonseth said the plan should identify how coordination between the hatcheries is laid out and agreed-to. Gale said the Transition Plan is not intended to be a hatchery operations plan. Rather, it is a guiding document for the transition. Gale said for that reason, the plan should at least include a discussion on coordination and how it will be developed. Mackey thanked Gale for his suggestions and encouraged representatives present to review and provide any comments on the plan as soon as possible.

C. Steelhead Presentation and Discussion of Twisp Steelhead Program (Berejikian/Kahler)

Tracy Hillman welcomed Barry Berejikian and said Berejikian has prepared a presentation about his work on steelhead in Hood Canal and a discussion about the Twisp steelhead program will follow the presentation. Berejikian shared the presentation, "Potential to improve the conservation benefits of steelhead hatcheries" (Attachment D), and said the Hood Canal steelhead project has many willing partners such as non-profits and state, tribal and federal governmental entities including the USFWS and NWFSC. He said he has also worked on a project at Winthrop NFH, and those data will be discussed along with the Twisp program. A summary of the presentation and questions and comments are included in the following sections.

Introduction (slides 1-4)

Berejikian said the presentation will include approaches for egg collection, and rearing and release for small steelhead programs similar to the Twisp program. Effects on abundance and genetic diversity, and alternative rearing strategies to improve smolt performance and reduce domestication selection will also be discussed. Lastly, Berejikian said he will talk about developing practical and flexible rearing strategies for conservation and supplementation programs.

To increase diversity, the Hood Canal steelhead project uses hydraulic sampling to extract eggs from redds, thus natural-origin adults are not handled. This project includes captive rearing and release of age-2 (S2) smolts, and the project monitors effects on abundance and genetic diversity of the natural population.

Hydraulic redd sampling (slides 5-8)

Hydraulic extraction of eggs from redds is an alternative to artificial spawning in hatcheries. It includes identifying redds, marking them, triangulating the redds so they can be found again, then using a hydraulic water pump, cage, and seine to work the redd and collect eggs. Collection goals

change as spawning progresses, and this type of sampling allows for sampling the downstream part of a redd and leaving an upstream section undisturbed.

Hydraulic redd sampling produces high proportions of viable eggs (0.93), fish that survive to ponding (0.94), and productive redds (0.76). Berejikian said producing eyed embryos is not a limiting factor. Hydraulic sampling in this study also produced greater genetic diversity among offspring produced than what would be estimated by artificial spawning.

In the Hamma Hamma River, redds were hydraulically sampled and fish were reared and released at age-2. Genetic results of the study show that steelhead mating patterns are complex, females produce on average 1-2 redds, and males service multiple redds.

Keely Murdoch asked if Berejikian has studied the impacts to the remaining eggs in a redd after hydraulic sampling has removed some of the eggs. Berejikian said he does not think there are effects to remaining embryos after hydraulic sampling occurs because a spawning channel study at Manchester Research Station with Chinook salmon measured the egg-to-fry survival of remaining eggs to be about 70%. Greg Mackey asked how many egg pockets on average do steelhead create in one redd. Berejikian said between 6 and 8 on average. Bill Gale asked if female steelhead spawn with different males when they construct a second redd. Berejikian said males can be territorial and follow females to different redds, but it varies and ends up being a combination of the same and different males.

Berejikian said hydraulic sampling works better in rain-driven systems than snow-driven systems (like the Methow basin) due to water-level changes during spring. Todd Pearsons asked about the Chinook salmon spawning channel study—are there significant differences in redd construction that would be affected differently by hydraulic pumping? Berejikian said redd construction for the two species is similar, and Chinook salmon dig deeper redds and cover their redds more entirely.

Hood Canal project, smolting and rearing (slides 9-24)

The Hood Canal steelhead project includes three facilities, which produced varied numbers of smolts and adults for release. Variation between hatcheries was one potential cause of difference in smolt quality. Murdoch asked if the adult release groups were fully grown steelhead, or if they resembled rainbow trout. Berejikian said those fish were about 520 millimeters long, which is smaller than a natural steelhead, but male maturation was not generally observed until age-3. Berejikian said some of the fish were kept in freshwater, and the Skokomish group of fish was transitioned to seawater before being raised to maturity. Size data are not available yet, but the project will look at the effects of early growth history, and differences in water type on growth, maturation, survival, and reproductive success to inform hatchery planning discussions. Pearsons asked what the project did

with females that matured at age 3. Berejikian said those females were stripped of eggs and held to age-4 to live-spawn.

The Hamma Hamma and Duckabush groups raised at Lilliwaup Hatchery had downstream and early marine survival rates on par with wild fish, while the Skokomish fish raised at McKernan Hatchery had lower survival rates. Density and vessel shape at the hatchery were likely major contributors to the variation in downstream and early marine survival rates.

Numbers of redds in supplemented rivers (slide 14) increased once supplementation began in 2011. Pearsons asked if redd counts include adult outplants. Berejikian said yes. In the Hamma Hamma River, for example, redd counts increased during supplementation from 2002 to 2009. Genetic diversity improved during and after supplementation in the Hamma Hamma River. Allelic richness did not change, heterozygosity increased slightly, and effective population size increased. Berejikian surmised that the addition of more anadromous steelhead spawners may have attracted more natural spawners. Berejikian summarized that conservation programs can increase natural spawning in the short-term and in the generation after supplementation.

Berejikian said fitness loss in steelhead can be genetically or epigenetically heritable and discussed the potential causes for fitness loss.

Berejikian summarized the effects of rearing steelhead to age-2 smolt. Smolting is a threshold trait in steelhead, and hatchery and wild fish vary in their approximate age of smoltification.

Winthrop NFH (slides 25-29)

Berejikian is also working with Winthrop NFH to study how size and age affect migratory performance of steelhead. He said S2 fish travel faster no matter their size. Body size at release explained most of the differences in downstream survival between S1 and S2 smolts. Volitional releases resulted in faster out-migration rates than forced releases, and volitionally released migrants were larger and had higher survival than forced release migrants.

Heritability and body size (slides 30-36)

Berejikian said one study at Manchester Research Station focused on whether heritable size-selective mortality can be avoided, and the study looked at growth rate and body size at smoltification. S1 fish in this study (with smaller fork lengths) had higher seawater mortality than S2 fish (larger fork lengths). There is more heritability in body size with S1 fish than S2 fish, and heritability has a greater affect while fish are younger. Body size and mass varies among families, and mean family body size is correlated with survival.

Pros and cons of S2 programs (slides 37-49)

Berejikian said one negative effect of S2 programs is greater precocious maturation in males than in S1 smolts. He said not all hatcheries should implement S2 programs, but more flexible strategies can be designed for S2 programs. For example, a size sorting experiment shows that growth rate is determined early in life, and early growth rate influences size at smolting. By sorting steelhead in the fall and splitting fish into two groups, an S1 and S2 group can be produced from the same broodstock. He said this is a more proactive approach than trying to grow an S1 or S2 group, and reacting when fish grow too big or too small. Berejikian said programs can take advantage of the current size of fish and propensity to feed in order to sort fish by size and produce higher quality smolts.

Questions and comments

Mackey said one way to make fish self-sort is to place a rack with bar spacing in the raceways, and only small fish can move to the other side of the rack. He said this allows stocking small fish as parr; however, there are some handling issues with this approach.

Gale asked when Berejikian will have more data on juveniles transferred from Winthrop NFH that are segregated. Berejikian said he will have more information in spring 2018, and he will know how the S1s performed. After that, data on S2s will also be available.

Catherine Willard asked why the study sorts juvenile fish at 8 weeks. Berejikian said with previous sorting efforts, research shows size variation at that stage carries through the rearing process. He said the Hood Canal program had success sorting first in October, and again in March for the S2 program. He said sorting twice might be challenging for a large production hatchery.

Pearsons asked if these study results correspond to relative reproductive success (RRS) results. Berejikian said there is no direct comparison between those types of studies. Pearsons asked if there are results from the Hood Canal studies that support RRS studies. Barry responded that it is difficult to compare studies, but since the program started, the effective size of the wild population has increased almost linearly in Hood River (he referred to Table 3 in Christie et al. 2012). He commented that they (Christie et al.) concluded that there was a large Ryman-Laikre effect, but he thinks the data show the opposite effect. Results need to be evaluated in context with abundance and productivity information.

The Twisp Steelhead Program

Tom Kahler said this discussion will inform the future of the Twisp program, and said the Hatchery Committees should carefully consider a wide range of alternatives. He said Berejikian is

knowledgeable about issues affecting the Twisp program, and Kahler asked him to attend today to provide input on the future of the program. Mackey summarized the steelhead programs in the Methow basin and said Douglas PUD operates the Twisp program, which uses wild-by-wild brood collected in the Twisp River. He said fish from this program are released in the Twisp River as S1s, and the Winthrop NFH program releases S2s. He said the Hatchery Committees have been discussing the potential to combine the programs, and need to collectively decide how to rear and release the 248,000 conservation fish available. Gale added that the discussion is about steelhead conservation programs in the Methow basin, not just the Twisp River, and some decisions about the programs will need to be made soon.

Gale said Winthrop NFH has one group of steelhead that could be released in the Twisp River in spring 2018, and a consensus needs to be reached about how, when, and where to release these fish. He said the Hatchery Committees also need to discuss whether and how to composite the programs before broodstock is collected. He said longer-term decisions include how to mix age-at-release groups throughout the basin, and whether to transition to a phase where different release strategies are used.

Kahler said an additional item of concern is that not many families are represented in the Twisp steelhead program, so what is the best way to increase genetic diversity without mining wild stock? Mike Tonseth said the relative reproductive success study in the Twisp River indicated that there may be a Ryman-Laikre effect occurring in this population. Tonseth asked if negative genetic effects are occurring, what is the best way to improve the situation? Tonseth said the Twisp Weir only provides access to about half of the steelhead population in the Twisp River due to its location, limiting genetic diversity in broodstock collected at that location. He said an additional piece to consider is that the relatedness of individuals being collected at the Weir is unknown, and understanding the relatedness may also guide discussions moving forward.

Kahler asked if YN has tried partially live-spawning steelhead. Murdoch said no, but the Columbia River Inter-tribal Fish Commission staff may have information about that from their kelt reconditioning programs. Berejikian said he is not aware of any programs using partial live-spawning, but it was discussed as an option for the Tucannon River. Murdoch said in order to partially live-spawn fish, post-release survival and success would have to be studied. She said after being partially spawned and released, female fish would have to select a site and partner before continuing to spawn. Gale asked if partially spawning male fish would help genetic diversity. Murdoch said she does not think that would increase diversity. Tonseth said it would be similar to using reconditioned kelt. Murdoch agreed and said reconditioned kelt spawn in a subsequent year outside of the hatchery, which increases lifetime fecundity, but does not provide more diversity to the hatchery program.

Gale said there are many possible options for the future of the Twisp and Winthrop NFH programs, and the first decisions should focus on whether to composite broodstock. If the programs are not going to be composited, options are more limited. This first decision will set the stage for future decisions. Murdoch said combining programs should be considered as an option so that there are more overall options available to discuss. She said keeping the Twisp program separate may not be a viable option because there are signs of a Ryman-Laikre effect occurring, which is a concern for the future of natural fish. She said the genetic issues occurring in the Twisp River are exacerbated because it is a subset of the population. She said because it is not a unique spawning aggregate, combining the programs is not necessarily a "composite" approach because they are not genetically distinct. She said implementing hydraulic redd sampling to improve diversity would be difficult in the Twisp River because of spawn timing. Eggs are in the gravel by June, which is also peak runoff for the system, and high water and flow levels would likely prevent access to redds for sampling. She said another concern with using hydraulic sampling for the Twisp program is that it is a mitigation program, not a research program. She said removing eyed eggs from natural-origin fish that are in the wild may not even meet the mitigation requirement. She said with in-gravel mortality, and an eye-up rate likely lower than in hatcheries, it would require much effort for maybe not enough eggs. She said there is also likely less impact on the population overall by collecting adults rather than eggs to meet the mitigation number. She said she favors combining broodstock for the Twisp and Winthrop programs, and releasing fish in the Twisp River and other areas could be part of a comprehensive reworking of steelhead supplementation in the Methow basin.

Tonseth said the hydraulic approach likely will not work in the Methow basin because it is a snow-fed system. Even if it were attempted though, he said there is uncertainty about additional take associated with hydraulically removing eggs from redds, and it may be difficult to permit. He said assessing the permitting feasibility as well as the physical feasibility of different options should be considered as discussions move forward. Gale said one positive aspect of sampling directly from redds is that it allows natural mate choice and redd site selection. He said using spawning channels may be a substitute to redd sampling in the natural environment, and has been successful at Winthrop NFH. He said if, as a group, the Hatchery Committees think that natural mate selection and sorting are important program components, using spawning channels could be a viable way to achieve those priorities. Mackey asked if using spawning channels is a feasible way to achieve the production levels needed for the Twisp program. Gale said more broodstock would probably be needed, and Tonseth said it would require collecting nearly 100% of the eggs produced in the channels.

Gale said he is not opposed to combining the programs, and said he is not too alarmed by the Ryman-Laikre effects occurring in the Twisp River. He said if the Twisp program were kept separate from the Winthrop NFH program, one option would be to take adults from the 48,000 fish Twisp

program to Methow Fish Hatchery to spawn, and then remove a percentage of the fish that are smallest and use them in a 2-year program at Methow Fish Hatchery. The other fish would then be sent to Wells Fish Hatchery for release into the Twisp River. Gale said a 2-year program at Methow Fish Hatchery would add an additional brood year each year to the basin.

Tonseth said assessing the relatedness of adults being collected for broodstock in the Twisp River would still be helpful to determine how many families are represented. Murdoch said the Weir might pick up a small proportion of the families in the river. Tonseth said even by adding diversity with factorial mating at the hatchery, there might not be enough diversity to increase the effective population size. Tonseth said hook-and-line broodstock collection might be one way to increase genetic diversity. Mackey said the genetic [relatedness] distance between fish could be used to determine a mating scheme for fish. Gale said another option for increasing diversity is releasing 1- and 2-year old fish in the Twisp River for a few years, then changing the release location and rotating a mixed-smolt-age release group of fish throughout the basin.

Mackey said there are some additional factors to consider when assessing whether to combine broodstock. He said there may be no genetic difference detected between the Twisp River and other areas, but there could be a difference that was not detected. He said there may be selective pressures effecting local adaptation in the Twisp River that, by combining programs, would be precluded. Murdoch said at a larger scale, keeping the Methow population separate from the Okanogan population provides opportunity for local adaptation. Mackey said genetic diversity is not necessarily a step-wise process; if diversity can be increased immediately with local adaptation, it should not be precluded. He said separate spawning aggregates are identified as part of recovery for steelhead. Tonseth said the recovery criteria look at the distinct population segment (DPS) level, and do not identify individual spawning aggregates. He said current actions should focus on DPS-level diversity criteria. Murdoch said local adaptation is important, but in this case, there may be greater concerns for diversity at a higher level. Mackey said a small population with closely related individuals that are more fit for that environment could quickly amplify genetic adaptation to the local environment, and local adaptation should be considered as alternatives are developed. He said a do-no-harm approach could include managing the Methow basin as one population, so if severe bottlenecking is occurring in the Twisp River, it could be mitigated by the rest of the population. He said assessing the Twisp River in isolation is not entirely appropriate for determining whether a Ryman-Laikre effect is occurring. He said if there is genetic divergance in the Twisp River it should not be precluded from continuing; homogenizing the population could even be a greater threat to recovery than a perceived Ryman-Laikre effect. Tonseth said he does not necessarily advocate homogenizing the populations. Mackey said he advocates diversification.

Gale said one option is to combine broodstocks and have mixed-age release groups spread into different areas over time. He said that way, after the release into the Twisp River is stopped, for example, the natural population can adapt locally. He said a basin-wide perspective should include a 20-year plan that all parties agree to.

Hillman said that within-population structure and diversity is a requirement for recovery within the Upper Columbia Recovery Plan. He said this is assessed at the population scale, and the Plan requires steelhead spawning within certain spawning areas or tributaries. He asked if the National Marine Fisheries Service (NMFS) has in the past weighed in on whether spawning aggregates can be combined. Murdoch said NMFS previously indicated that this would be okay, and included language for that possibility in the draft Methow steelhead BiOp.

Hillman asked for volunteers to start drafting management alternatives for steelhead in the Methow basin, so it will be easier to discuss this with NMFS and to inform Broodstock Collection Protocols. USFWS and Douglas PUD representatives volunteered to continue this discussion and develop alternatives. Gale said he, Matt Cooper, Charlie Snow, Kahler, and Mackey will develop management alternatives for the Twisp River and Winthrop NFH steelhead programs.

Berejikian said coming up with a list of alternatives is a good plan. Regarding the uncertainty about a Ryman-Laikre effect occurring with Twisp River steelhead, he asked what the trend is, and suggested fully understanding the effects and variables then checking with Craig Busack (NMFS) about intended approaches to address the issues. He said there is an opportunity to consider multiple combined approaches. He said, for example, spawning channels have been mentioned. He said in his own study, the number of fry acquired from one channel (35,000 to 40,000 fry) was nearly equal to the fecundity of the female fish put into the channel, in one out of two channels used in the study. Tonseth suggested testing the spawning channel approach using hatchery fish before putting wild broodstock in it. He also asked what the genetic effects would be if one male fertilizes multiple redds in the spawning channel. Berejikian said he has data he could share with the group on the numbers of males and females placed into the channels in his study, their individual relative reproductive success, and effective population size. Tonseth said those data could help determine if using spawning channels would improve genetic diversity. Berejikian summarized that there are many tradeoffs to consider when thinking about the future of steelhead programs in the Methow basin.

Tonseth asked if a one-year smolt can be produced from a spawning channel. Berejikian said yes, and also suggested working with the WDFW regional office to coordinate on fish health issues. Pearsons asked if there were any fish health issues with using spawning channels in Berejikian's studies. Berejikian said no, because in the Hood Canal study, adults are not handled. The study takes eyed eggs from the natural environment and puts them into a quarantine system. Mackey said in his

previous work in the northeast United States, he collected parr by electrofishing natural spawning areas. He said electrofishing has been used in the Twisp River to collect age-0 fish (parr) in September. He said collecting fry could help improve genetic diversity. Tonseth said electrofishing for fry would hopefully result in a mix of families, and Mackey said it can be performed throughout the whole river in contrast to using the Twisp Weir, which only collects a subset of the population. Mackey noted that it would be difficult or impossible to collect an entire program this way. Berejikian said one program in Oregon was collecting juvenile steelhead, and they had skewed sex ratios, disease issues in the hatchery, and eventually switched to an egg collection approach due to successful egg collection in other programs. Representatives present thanked Berejikian for his presentation and input.

III. Joint HCP-HC/PRCC HSC

A. NMFS Consultation Update (Emi Kondo)

Emi Kondo provided an update on consultation for the unlisted programs in the upper Columbia River. She said she requested an initiation of consultation from Chelan PUD, Grant PUD, and WDFW, which would serve as their official request to NMFS to begin consultation. Bill Gale asked if the parties sent a letter initiating consultation when they submitted Hatchery and Genetic Management Plans (HGMPs). Kondo said HGMPs were submitted in 2010, and recalculation for No Net Impact occurred since then, so it is appropriate for the PUDs to submit initiation requests for current programs. She said Chelan PUD and Grant PUD should submit requests, but Douglas PUD should not, as their program has not changed since the HGMPs were submitted. Deanne Pavlik-Kunkle (Grant PUD) said Grant PUD is drafting their request. Kondo said the next step after NMFS receives requests is to respond with a letter of sufficiency. Regarding the Biological Opinion (BiOp) for the unlisted programs, Kondo said the draft will be finished soon and will go to internal review, then comanager review.

B. USFWS Bull Trout Consultation Update (Matt Cooper)

Matt Cooper said Karl Halupka provided him an update on USFWS bull trout consultations, which he summarized as follows:

- Halupka is working to get the BiOp for the batch of Wenatchee subbasin programs signed this week.
- USFWS is continuing regular coordination with NMFS (Emi Kondo and Charlene Hurst) and Mike Tonseth on the Methow steelhead consultation, the consultation for the batch of hatchery programs for unlisted Chinook salmon stocks in the Columbia River, and reinitiation

of Mitchell Act consultation for the Ringold fall Chinook salmon program with the U.S. Army Corps of Engineers. NMFS may initiate consultation on the upper Columbia batch next week.

- USFWS completed expedited consultation on Nason Creek Acclimation Facility intake maintenance and are discussing consultation options for covering future intake maintenance with NMFS and Grant PUD.

Todd Pearsons asked if the signed BiOp for the batch of Wenatchee subbasin programs will be distributed to all Hatchery Committees and PRCC HSC parties. Tonseth said National Oceanic and Atmospheric Administration (NOAA) is the action agency and is consulting with USFWS, so the signed BiOp will be directly transmitted to NOAA and the applicants will likely also be notified. Tonseth said he heard that comments are still being incorporated into the BiOp, and may not be signed this week.

C. M&E Plan for PUD Hatchery Programs 2017 Update (Hillman)

Tracy Hillman said he revised the M&E Plan for PUD Hatchery Programs to reflect changes discussed during the September 20, 2017 Hatchery Committees meeting and distributed it (Attachment E). Hillman reviewed the new information in Section 7.2 (Non-target Taxa of Concern), and Section 8 (Adaptive Management).

He said he also added Appendix 1, Estimation of Carrying Capacity, which Andrew Murdoch (WDFW) is reviewing. Hillman defined two types of carrying capacity as follows:

- Population equilibrium capacity—the maximum number or biomass of a species that can occur based on density dependent mechanisms that reduce population growth rates as population size increases
- Habitat capacity—the maximum number or biomass of a species that habitat can support

He said the appendix includes an example of how carrying capacity is estimated for spring Chinook salmon in the Chiwawa River watershed and the entire Wenatchee River basin. He described methods for assessing density dependence in juvenile spring Chinook salmon and described the importance of having large contrast in spawner abundances in identifying the presence of density dependence and estimating carrying capacity. Keely Murdoch asked if there is a way to discuss the geospatial component to capacity related to the graphs in Appendix 1. She said spring Chinook salmon in the Chiwawa River watershed are a hatchery-driven population, and in years with big escapement, the proportion of hatchery origin spawners is very high. She added that the reproductive success study shows unequal spawner distributions, and a reduction in productivity (parr production) is related to distribution. Hillman agreed and indicated that calculation of habitat capacity, which is based on fish-habitat data and not just fish data, which are used to estimate

population equilibrium capacity, should not be affected by hatchery production within the watershed. He said he calculated both habitat and population equilibrium capacities and compared those results in the appendix. Hillman then described the different models used to calculate carrying capacity and their associated assumptions. He said capacity estimates can be standardized by dividing the estimates by watershed area, intrinsic potential, or other watershed-scale metrics. This allows comparisons among different basins or watersheds.

Hillman said for spring Chinook salmon in the Chiwawa River, models produced a range of estimates for parr and smolt capacities. He said the smolt capacity estimates are about half of the parr capacity estimates, and these estimates can be extrapolated to the entire Wenatchee River basin using intrinsic potential. He then compared extrapolated capacity estimates based on intrinsic potential to actual capacity estimates based on data collected at the lower Wenatchee smolt trap. The actual and extrapolated estimates did not differ greatly.

Hillman also reviewed the calculation of habitat capacity using a fish-habitat model (Quantile Regression Forest Model) and using quantile regression to estimate the 90% reference interval for the stock-recruitment functions. He then compared results from all the different models. Todd Pearsons asked why there is a difference in number of spawners needed to reach parr habitat capacity between the Chiwawa River and Wenatchee River. Hillman said the Chiwawa River has higher quality habitat, so one unit of intrinsic potential in the Chiwawa produces more fish than say a unit of intrinsic potential in another area within the Wenatchee.

Hillman suggested that the Hatchery Committees review the recommendations included in Appendix 1. He said one item not included in the appendix is if abundance and productivity data should be normalized using population equilibrium capacity estimates or habitat capacity estimates. Catherine Willard suggested providing the estimate with associated levels of error. Hillman said appendices in annual reports provide error bars for stock-recruitment data, and the Chiwawa River data have less error in their estimates than other areas. Hillman said another item that will need to be decided is how to calculate carrying capacity for summer Chinook salmon.

Pearsons said in order for this document to be useful to the Independent Scientific Advisory Board (ISAB), the Hatchery Committees and PRCC HSC should try to approve it in November 2017. He said the ISAB hopes to finish their assessment by December 2017, but may continue into 2018. Hillman asked representatives present if approving this document in November would be reasonable, and they agreed. Sarah Montgomery said she will distribute the draft again as a decision item for the November 15, 2017 Hatchery Committees meeting.

D. Timeline of Changes in Spring Chinook Salmon Programs (Tracy Hillman)

Tracy Hillman said he drafted timelines for the Wenatchee and Methow spring Chinook salmon programs to determine interruptions for statistical analysis. Hillman shared a document, *Draft Hatchery Program Timelines* (Attachment F), and representatives present reviewed the timelines.

Hillman said he reviewed reports, permitting documents, and other items and picked events or changes he thought might interrupt the time series in a statistically important way. He requested that the Hatchery Committees review the timelines and suggest additions. Catherine Willard said these timelines might also be useful to the ISAB, and suggested adding adult management to the timeline. Keely Murdoch asked if the timelines should just have hatchery program information, or should also include other effects to populations. Hillman said as a minimum, the timelines should include anything that would potentially affect statistical analyses. Todd Pearsons agreed and suggested making a timeline with all suggested events as the first step. Mike Tonseth said the Hatchery Committees should compile one set of timelines with all suggested events, then a subset of timelines including just the major events to be used for statistical analysis. Pearsons suggested checking the timeline included in the UCSRB's Draft Hatchery Report for comparison. Hillman said he did this and found some discrepancies between his version and the draft report. In one example, Matt Cooper explained the difference is due to stating the brood year a hatchery program began, as opposed to the release year. Hillman summarized that the Hatchery Committees will review the timelines, and provide comments and suggestions to him via email. He said he will distribute the draft timelines for review.

IV. HCP Administration

A. Next Meetings

The next Hatchery Committees meetings are on November 15, 2017 (Grant PUD), December 20, 2017 (TBD), and January 17, 2018 (Grant PUD).

V. List of Attachments

Attachment A List of Attendees

Attachment B Implementation of Comprehensive Monitoring and Evaluation of Wells Hatchery Complex Programs in 2018 - Draft

Attachment C Draft Transition Plan for Wells and Methow Fish Hatcheries

Attachment D Potential to improve the conservation benefits of steelhead hatcheries

Attachment E Draft 2017 Update - M&E Plan for PUD Hatchery Programs

Attachment F Draft Hatchery Program Timelines

Attachment A
List of Attendees

| Name | Organization |
|-----------------------|--|
| Tracy Hillman | BioAnalysts, Inc. |
| Sarah Montgomery | Anchor QEA, LLC |
| Catherine Willard* | Chelan PUD |
| Greg Mackey* | Douglas PUD |
| Tom Kahler* | Douglas PUD |
| Todd Pearsons‡ | Grant PUD |
| Peter Graf‡ | Grant PUD |
| Deanne Pavlik-Kunkel‡ | Grant PUD |
| Mike Tonseth* | Washington Department of Fish and Wildlife |
| Alf Haukenest | Washington Department of Fish and Wildlife |
| Matt Cooper* | U.S. Fish and Wildlife Service |
| Bill Gale* | U.S. Fish and Wildlife Service |
| Michael Humling† | U.S. Fish and Wildlife Service |
| Chris Pasley† | U.S. Fish and Wildlife Service |
| Emi Kondo† | National Marine Fisheries Service |
| Barry Berejikian | Northwest Fisheries Science Center |
| Keely Murdoch* | Yakama Nation |

Notes:

* Denotes Hatchery Committees member or alternate

† Joined by phone

‡ Joined for the joint HCP-HC/PRCC HSC discussion