FINAL

23 S. Wenatchee Avenue, Suite 220
Wenatchee, Washington 98801
509.888.2070

ANCHOR QEA

Memorandum

To: Wells, Rocky Reach, and Rock Island HCP Hatchery Committees, and Priest Rapids Coordinating Committee Hatchery Subcommittee

Date: January 27, 2022

From: Tracy Hillman, HCP Hatchery Committees Chairman and PRCC Hatchery Subcommittee Facilitator

cc: Larissa Rohrbach, Anchor QEA, LLC

Re: Final Minutes of the December 15, 2021, HCP Hatchery Committees and PRCC Hatchery Subcommittee Meetings

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plan Hatchery Committees (HCP-HCs) and Priest Rapids Coordinating Committee's Hatchery Subcommittee (PRCC HSC) meetings were held by conference call and web-share on Wednesday, December 15, 2021, from 9:00 a.m. to 12:30 p.m. Attendees are listed in Attachment A to these meeting minutes.

Action Item Summary

Joint HCP-HCs and PRCC HSC

Long-term

- Mike Tonseth will distribute the analysis showing feasibility of the Methow Spring Chinook Salmon Outplanting Plan based on historical run size data (Item I-A). (*Note: This item is ongoing; expected completion to be determined.*)
- Kirk Truscott will work with Colville Confederated Tribe (CCT) staff to develop a model that addresses the probability of encountering natural-origin Okanogan River spring Chinook salmon at Wells Dam (Item I-A). (*Note: This item is ongoing; expected completion date to be determined.*)
- Kirk Truscott will determine the number of scales that should be collected from spring Chinook salmon at Wells Dam for elemental signature analysis to discern Okanogan River spring Chinook salmon from Methow River spring Chinook salmon (Item I-A). (*Note: This item is ongoing; completion depends on the outcome of the previous action item.*)
- Keely Murdoch and Mike Tonseth will obtain estimates of pre-spawn mortality from Andrew Murdoch to update the retrospective analysis for Wenatchee spring Chinook salmon (Item I-A). (*Note: This item is ongoing; expected completion date to be determined.*)
- Mike Tonseth and Greg Mackey will solicit input from hatchery managers on effective methods to count surplus fish (Item I-A). (*Note: This item is ongoing; expected completion by early 2022 for incorporation into Broodstock Collection Protocols (BCPs).*)

Near-term (to be completed by next meeting)

- Larissa Rohrbach will file and distribute *10-year Comprehensive Review* chapters and comments to the Committees for review as they are completed (Item III-C). (*Note: This item is ongoing.*)
- Todd Pearsons and Catherine Willard will revise Grant and Chelan PUD's draft Statements of Agreement (SOA) on Sockeye Salmon Obligation for approval in an upcoming meeting (Item I-A). (*Note: This item is ongoing.*)
- Kirk Truscott will develop language for the *Priest Rapids Coordinating Committee's Hatchery Subcommittee Statement of Agreement Regarding Grant PUD's Sockeye Salmon Obligation* on assessing feasibility and implementation of alternative plans in years when environmental conditions are prohibitive for broodstock collection activities (Item I-A). (*Note: This item is ongoing.*)
- PUD representatives will revise the *2024–2033 Recalculation Data Summary (Version 10)* document by end of day Thursday, December 16, 2021, reflecting the following discussions in today's meeting (Item III-A):
  - Update the document to show the preferred method for calculating Wells natural-origin summer Chinook salmon returns.
  - Revise Table 9 to show proportions of mitigation production released from each rearing site.
- All HCP-HCs and PRCC HSC representatives will review the *2024–2033 Recalculation Data Summary (Version 10)* document by January 5, 2022, and send any comments to the PUDs and copy all other representatives (Item III-A).
- The PUDs representatives will review internally the Yakama Nation (YN) request to commit to including summer Chinook salmon inundation mitigation, as shown in Column G of the sensitivity analysis, in the final calculation of mitigation levels (Item III-A).
- All representatives will review internally the Grant PUD request to exclude steelhead inundation mitigation, as shown in Column G of the sensitivity analysis, in the final calculation of mitigation levels (Item III-A).

Rock Island/Rocky Reach HCP-HCs

- None.

Wells HCP-HC

- None.

PRCC HSC

- None.

Decision Summary

- None.

Agreements

- The Rock Island and Rocky Reach HCP Hatchery Committees supported the use of Redd Zone's (fisheries technology company) incubation boxes for Chelan PUD's steelhead production at Chelan Falls Hatchery.

Review Items

- The draft SOA *Regarding the 2023 NNI Hatchery Recalculation Dataset* was distributed by Larissa Rohrbach on December 1, 2021.
- The latest version of the draft *2024–2033 Recalculation Data Summary (Version 10)* was distributed by Larissa Rohrbach on December 21, 2021, for review prior to the January 6, 2022, extra meeting of the HCP-HCs and PRCC HSC.
- The draft *2022 Wells HCP Action Plan* was distributed by Larissa Rohrbach on December 14, 2021, for review and approval in the January 19, 2022, meeting.

Finalized Documents

- Grant PUD's final *Priest Rapids Hatchery Monitoring and Evaluation Annual Report for 2020–2021* was distributed by Larissa Rohrbach on December 10, 2021.
- Douglas PUD's final *Implementation of Comprehensive Monitoring and Evaluation of Wells Hatchery Complex Programs in 2022* was distributed by Larissa Rohrbach on December 21, 2021.
- The final *Monitoring and Evaluation of the Wells Hatchery and Methow Hatchery Programs 2020 Annual Report* was distributed by Larissa Rohrbach on December 21, 2021.
- Chelan PUD's final *Chelan County PUD Hatchery Monitoring and Evaluation Implementation Plan 2022* was distributed by Larissa Rohrbach on January 10, 2022.

I. Welcome

A. Agenda, Announcements, Approve Past Meeting Minutes, Last Meeting's Action Items

Tracy Hillman welcomed the HCP-HCs and PRCC HSC and read the list of attendees (Attachment A). The meeting was held via conference call and web-share because of travel and group meeting restrictions resulting from the coronavirus disease 2019 (COVID-19) pandemic.

All HCP-HCs and PRCC HSC representatives approved the agenda. Revised minutes from the November 17, 2021, meeting were reviewed and approved.

Action items from the HCP-HCs and PRCC HSC meeting on November 17, 2021, were reviewed and discussed *(Note: Italicized text below corresponds to action items from the previous meeting*).

Joint HCP-HCs and PRCC HSC

Long-Term

- *Mike Tonseth will distribute the analysis showing feasibility of the Methow Spring Chinook Salmon Outplanting Plan based on historical run size data. (Note: This item is ongoing; expected completion by 2022.)*
- *Kirk Truscott will work with CCT staff to develop a model that addresses the probability of encountering natural-origin Okanogan River spring Chinook salmon at Wells Dam. (Note: This item is ongoing; expected completion to be determined.)*
- *Kirk Truscott will determine the number of scales that should be collected from spring Chinook salmon at Wells Dam for elemental signature analysis to discern Okanogan River spring Chinook salmon from Methow River spring Chinook salmon. (Note: This item is ongoing; completion depends on the outcome of the previous action item.)*
- *Keely Murdoch and Mike Tonseth will obtain estimates of pre-spawn mortality from Andrew Murdoch to update the retrospective analysis for Wenatchee spring Chinook salmon. (Note: Expected completion to be determined.)*
- *Mike Tonseth and Greg Mackey will solicit input from hatchery managers on effective methods to count surplus fish. (Note: This item is ongoing; expected completion by early 2022 for incorporation into BCPs.)*

Near-Term (to be completed by next meeting)

- *Larissa Rohrbach will file and distribute 10-year Comprehensive Review chapters and comments to the Committees for review as they are completed.*
  This item is ongoing.
- *Todd Pearsons and Catherine Willard will revise Grant and Chelan PUD's draft SOAs on Sockeye Salmon Obligation for approval in a future meeting.*
  This item is ongoing.
- *Kirk Truscott will develop language for the Priest Rapids Coordinating Committee's Hatchery SOA Regarding Grant PUD's Sockeye Salmon Obligation on assessing feasibility and implementation of alternative plans in years when environmental conditions are prohibitive for broodstock collection activities.*
  This item is ongoing.

- *Keely Murdoch will prepare no-net-impact (NNI) mitigation levels calculated using the smolt-to-adult return (SAR) estimation approach used in 2013, compared to the method proposed for the current recalculation effort.*
  A revised comparison of mitigation levels was prepared by Murdoch and distributed by Larissa Rohrbach on December 7, 2021, and presented in the extra conference call on December 9, 2021. Murdoch has continued to refine the spreadsheet in coordination with PUD staff.
- *Catherine Willard will revise the draft* Statement of Agreement Regarding the 2023 NNI Hatchery Recalculation Dataset *(Recalculation Data Sources SOA) to include feedback obtained in today's meeting, for distribution to the HCP-HCs and PRCC HSC next week.*
  This item is complete. A draft SOA was prepared by Chelan PUD and distributed by Larissa Rohrbach along with supporting information on December 1, 2021.
- *All HCP-HCs and PRCC HSC representatives will review the draft Recalculation Data Sources SOA and reply to all with comments via email prior to the additional conference call on December 6, 2021.*
  This item is complete.

II. Rock Island/Rocky Reach HC

A. Piloting Redd Zone Incubation Boxes for Wenatchee Steelhead

Catherine Willard introduced Dave Cox, who is working on a new method for steelhead egg incubation. An overview document was distributed by Larissa Rohrbach on December 14, 2021 (Attachment B).

Redd Zone has miniaturized egg incubation boxes that are modeled after the Kitoi-style incubators used in Alaska since the 1970s. The Chelan Hatchery is currently using the boxes for trout with a capacity of 50,000 eyed eggs, and the hatchery is having good success with incubation and hatching. The hatchery will be receiving boxes for kokanee soon. Cox described how the boxes function, referring to diagrams shown in Attachment B. Eyed eggs are incubated in a substrate, and alevins can volitionally swim up out of the box into a container and then through an outlet drain into an intermediate rearing trough. Advantages of this system are that it saves at least one handling of the fish (or potentially two). Fish don't have to be split into larger rearing vessels until they are approximately 350 to 375 fish per pound and it is a better way to get them on feed with less handling stress.

Greg Mackey noted that a similar incubator was used in an experimental Atlantic Salmon hatchery. When alevins develop in the open trays, the constant muscle twitching to right themselves has an effect on their muscle development, which is avoided by incubating them in an artificial substrate. The egg boxes can also be used to run river water through them for better acclimation. Mackey said he likes the concept for conservation programs where the fish should be reared as similarly to the wild component as possible.

Cox said Washington Department of Fish and Wildlife (WDFW) would like to deploy the boxes for Chelan PUD's steelhead program at the Chelan Hatchery, to benefit steelhead early rearing. The boxes are approximately half the capacity of the heath-style trays but take up approximately half the area. Chelan PUD will need to make some changes to plumbing, but this could be fairly easy to adapt at the Chelan PUD hatchery. There are plenty of boxes available for steelhead at this time. They would only need 3 to 4 boxes based on the size of the program and number of egg-takes.

Willard said she is seeking buy-in from the Rock Island/Rocky Reach HCP Hatchery Committees to deploy the incubation boxes for steelhead.

Matt Cooper agreed with the proposal to use the incubation boxes, noting he used them in Alaska and loved them. Mike Tonseth was supportive with a caveat that there are still some infrastructure changes that would need to take place to accommodate these, and WDFW doesn't have a timeline yet to indicate whether they could be available for this brood year. Kirk Truscott, Brett Farman, and Willard supported the proposal.

Keely Murdoch asked if there are any fish health consequences of incubating a larger number of eggs in a bulk-style basin. For instance, if there is a disease in one of the heath-style incubation trays, that one tray can be isolated or sacrificed. Cox agreed that that is a disadvantage of pooling 50,000 eggs compared to the shallow incubation trays, which hold approximately 15,000 eggs. Redd Zone does make a product that can fit in the boxes to isolate groups of eggs. Murdoch asked if fish health has weighed in on the use of these boxes. Cox said he spoke to Megan Gallagher (WDFW Aquatic Veterinarian) but could not speak for whether she would approve. Tonseth said Chelan Hatchery receives eyed eggs from Eastbank Hatchery, and the fish health profiles from the females would be received during the early incubation stages at Eastbank before the transfer of eggs to Chelan Hatchery, so eggs could be culled before being transferred to the boxes. Cox confirmed that the shallow trays would continue to be used for early incubation at the Chelan Hatchery, then eggs would be placed in the boxes just before hatching.

The Rock Island and Rocky Reach HCP Hatchery Committee supported WDFWs proposal to use Redd Zone incubation boxes for steelhead at Chelan Falls Hatchery. They thanked Cox for his communication with the Committees.

III. Joint HCP-HCs and PRCC HSC

A. Hatchery Production Recalculation: Data Sources

Tracy Hillman summarized the work to date toward approval of data sources for recalculation of hatchery production for NNI mitigation. Hillman reminded the Committees that they are behind schedule on the recalculation process. There is a need to come to an agreement soon in order to move forward on working on the 2022 BCPs, which need to be sent to National Marine Fisheries Service by April 15, 2022.

Catherine Willard summarized the main revisions to the PUDs' *2024–2033 Recalculation Data Summary (Version 10)* (Attachment C), distributed just before today's meeting. Updates included the following:

- Updated SAR data sources based on past meetings discussions.
- Added subyearling Chinook salmon project mortality.
- Confirmed that Chewuch and Twisp spring Chinook salmon SAR data had been included in the original SAR calculations for Methow spring Chinook salmon.
- Included SAR data for the Nason spring Chinook Salmon program for 2013 and 2014
- Ensured that jacks for all Chinook and coho salmon were included for the natural-origin-return count.
- Included data to recalculate Coho salmon, as directed by Chelan PUDs 2017 Coho SOA and needed for Douglas PUD's Coho salmon recalculation.
- Clarified that 1) Wells summer Chinook salmon SARs are based on coded wire tags (CWTs) for yearlings because there are few years with passive integrated transponder (PIT) tags and 2) PIT tags don't work well because virtually all the CWTs are recovered in harvest (they are a heavily harvested stock).
- Obtained total Wells Chinook salmon counts by taking the total Wells Chinook salmon counts shown in DART[1] and subtracting the number of spring Chinook salmon numbers, which are adjusted to account for fallbacks and re-ascension. (Note: The summer Chinook salmon counts using the nadir method were shown in *2024–2033 Recalculation Data Summary* (Version 9) and provides nearly the same number of fish, but Douglas PUD would prefer to use the method that is completely compatible with the spring Chinook salmon counts, and this still needs to be updated in the document. Mike Tonseth said he agrees with Greg Mackey on the preferred method for calculating summer Chinook salmon returns to Wells Dam. He said the modified estimates are used every year to shore up the spring Chinook salmon run escapement. It would be a mistake not to use a similar method, otherwise summer Chinook salmon returns to Wells Dam would be underestimated.)
- Resolved Kirk Truscott's question about the use of survival study fish in the SAR calculations.

[1] Columbia Basin Research (School of Aquatic Fishery and Sciences, University of Washington), 2021. Columbia River DART (Data Access in Real Time). Available from http://www.cbr.washington.edu/dart/.

Coho Salmon

Keely Murdoch said, regarding the Coho salmon data, she has been talking to Tom Kahler about this recalculation for Douglas PUD, who now includes natural-origin Coho salmon in their calculations. This morning, she sent data regarding the proportion of natural-origin fish above Wells Dam that can be used to expand the count above Wells Dam, as well as some SAR data. She asked if there are data needed by Chelan PUD, like the proportion of the NOR in the run and probably Coho salmon PIT-based SARs that Kahler has already prepared. Willard confirmed the numbers shown for Coho salmon in the Methow Basin are from the 2020 Monitoring and Evaluation (M&E) reports for Coho salmon. Murdoch noted she would like to confirm those data match data provided to Kahler. Kahler said it is hard to compare because the M&E Report data are grouped by brood year and the data sent by Murdoch are grouped by return year. Kahler said using data from the M&E report actually resulted in a greater number of adults in the calculations than what Murdoch provided. Murdoch said fortunately, the conversion from brood year to return year is relatively easy because Coho salmon almost all return at age-3.

Priest Rapids Fall Chinook Salmon

Kirk Truscott noted that in Table 5, natural-origin fall Chinook salmon is included with summer Chinook salmon for Wells, Rocky Reach, and Rock Island dams, and asked how mitigation will be counted for those compared to Priest Rapids Dam (PRD), which has separated the summer from fall Chinook salmon. Rod O'Connor said natural-origin fall Chinook salmon counts are handled differently than the other species. Natural-origin spring and summer Chinook salmon are counted at PRD, whereas the fall Chinook salmon are counted at Rock Island Dam, because the PRD Salmon and Steelhead Settlement Agreement accounts for mitigation through the entire project (dam and reservoir). The Priest Rapids fall Chinook salmon count of 11,679 fish is the count at Rock Island Dam. Truscott asked how the fall Chinook salmon that pass PRD but do not pass Rock Island Dam are accounted for. O'Connor said inundation mitigation releases compensate for any losses within the PRD project. Truscott said those inundation mitigation releases are released below PRD, so they don't really benefit those spawning aggregates that move upstream of PRD and Wanapum Dam. Todd Pearsons said yes, though some fish overshoot upstream of PRD. Truscott said he would like to think more about whether the fish released into the tailrace of PRD are adequate mitigation for fall Chinook salmon that spawn in the basin from upstream of PRD to the tailrace of Rock Island Dam. Pearsons said that fish that spawn between PRD and Rock Island Dam are fully mitigated for by inundation mitigation, which assumes there is now zero production between PRD and Rock Island Dam. There are 3 components of fish produced at Priest Rapids Hatchery and released below PRD: 1) inundation mitigation, which is 5 million fish released to make up for any production that would have occurred within that area; 2) 1 million fry in the original agreement to make up for flow fluctuations below PRD in the Hanford Reach, which the Committee converted to approximately 275,000 smolts and agreed to after the last recalculation; and 3) an NNI component that was approximately 325,000 fish. Mike Tonseth confirmed that Section 9.5 of the PRD Salmon and Steelhead Settlement Agreement explains that the release of that 5 million fish accounts for that inundation of the reach above PRD.

Committee members generally agreed that the recent revisions appeared acceptable but would like more time to review the dataset in detail.

Hatchery Production Allocation

Regarding Table 9 in the data summary, Murdoch said old data are shown from the 2013 recalculation notebook (*Recalculation of Mid-Columbia River Public Utility District Hatchery Production, 2014–2023, Chelan PUD Supporting Documents*) for the allocation of summer Chinook salmon mitigation among the different release sites used in calculating the Biological Assessment and Management Plan (BAMP) formula. Iin her spreadsheet, she used the proportions of Grant PUD's summer Chinook salmon mitigation allocated to release sites from the Committee-approved 2013 recalculation implementation plan (*Implementation of PUD Hatchery Production, 2014–2023*). In the BAMP formula, an SAR from the hatchery release is used in order to determine the number of smolts that hatchery would need to release to make up for the mortality associated with that particular hatchery. She used the values from the current implementation plan, which reflects how fish have been released for the past 10 years. What was used for Grant PUD in the 2013 recalculation was spawner distribution, which has changed somewhat since then (more fish are allocated to the Okanogan Subbasin, less fish in the Wenatchee Subbasin, and the same amount in Carlton Pond). Across most of the groups in Table 9, that spawner distribution is not what is used in the BAMP formula. For instance, Rocky Reach spring Chinook salmon is allocated 100% to Chiwawa Hatchery, not based on spawner distribution. There were differences between Murdoch's calculation of the BAMP formula results, which were based on the allocations in the 2013 recalculation implementation plan, compared to Grant PUD's results, which were based on allocation according to spawner distribution.

Murdoch reviewed two documents, a draft Joint Fisheries Party (JFP) implementation plan and draft PUD implementation plan that was written for all PUDs because of shared rearing spaces, before the implementation plans were separated out into the final SOAs for each PUD. During the last recalculation effort, it took approximately 3 to 4 months to achieve that implementation plan that went back and forth between the JFP and PUDs before achieving a Committee-approved version. Therefore, the proportions of fish allocated to each hatchery (Table 9) were tweaked during the preparation of the final recalculation implementation plan. To show which hatchery the natural-origin fish were allocated to, Murdoch proposed including an analogous table in this version of the data summary showing what amount of production will be allocated to which hatchery for use in the BAMP formula. The only stock that may need further discussion may be the PRD summer Chinook salmon. The assumptions Murdoch made were not the same as others have made in this calculation, so there is a need to make clear which hatchery the fish are allocated for the BAMP formula.

Pearsons said he sees this slightly differently. That is, there are a number of steps that are needed to get to an implementation plan, which was more of a negotiation process than a technical exercise. There is a need to come up with a best estimate of what that recalculation value is. The first step would be to determine what mitigation is owed. The spawning distribution is a surrogate for the natural production, which is what we are trying to calculate in the BAMP equation. Table 8 shows the percent of the population where the fish spawn so that when the SAR is allocated for these fish, it is done relative to the spawning distribution, because those are the fish that generate the natural production to generate the NNI mitigation (the amount we “owe”). The next step is to use the sensitivity analysis in a negotiation process and determine where the fish would be reared, which is written in the recalculation implementation plan.

Murdoch agrees with the stepwise approach of the process. But in the BAMP formula, first the adult counts and the juvenile project mortality are used to determine the number of natural-origin fish that are missing, then the SAR of the hatchery those fish will be reared at is applied to determine the number of smolts to release from that hatchery. So, it is important to this equation that the SAR of the hatchery from which they would be released is known. In 2013, the only place spawner distribution was used was for PRD summer Chinook salmon because there was no hatchery production. The implementation plan was different from the spawner distribution because of facility capacity (for instance, to reduce the number of fish being reared at Dryden Pond to ensure the Total Maximum Daily Load [a water quality standard] was met). More fish were placed at Carlton Pond and Chief Joseph Hatchery based on the belief that the Methow Basin was under-seeded. Murdoch suggested using the most current information on where fish are planned to be released for use in the BAMP equation to meet the need for that transparency in how the BAMP formula is being calculated. Without an analogous table like the one created in the 2013 recalculation implementation plan, that transparency is missing from this document.

Pearsons said the Committees agreed to an SOA on the approach, then the next step was to come to agreement on the data. The spawning distribution is shown in Table 8. The final step would be the actual calculation. All the relevant data are shown in this dataset. Another SOA could be prepared in addition to this dataset if all felt that was needed. Table 9 provides the historical perspective for context, before there was agreement on where the fish would finally go. Pearsons agreed that different percentages would be used in the final implementation because of priorities of the different Parties, but that part of that is a negotiated outcome.

Murdoch said for Chelan PUD, Table 8 was partially used for the Chief Joseph Hatchery mitigation, which is different from this table because they were negotiating the cost share agreement at the same time as these numbers were evolving. For the Chief Joseph Hatchery mitigation, similar to

Grant PUD, they multiply the project mortality times the number of fish released at Chief Joseph Hatchery to obtain their mitigation number. Per the cost share agreement with the CCT, that mitigation includes the natural-origin fish from the Okanogan Basin specifically, and the hatchery-origin fish from Chief Joseph Hatchery. In that case, we do need that spawner distribution to be able to remove those natural-origin Okanogan Subbasin fish from the BAMP calculation because they are already being covered under their Chief Joseph Hatchery cost share agreement. The BAMP formula was not based on Table 8, it was based on Table 9, as it was calculated prior to the recalculation implementation plan.

Murdoch said as part of this new dataset, there is a need to come to agreement on all the data pieces to be used in the BAMP calculation, including the hatchery program allocation proportion column shown in Table 9. Ultimately, the BAMP can't be calculated until the proportion of fish allocated to each hatchery is known. Whether it's being proposed to use spawner distribution or the current hatchery production allocation in Table 9, that needs to be agreed upon. It's not one or the other, it's both. There are places where spawner distribution does need to be used. Pearsons suggested updating Table 9 without all the other information, to show the proportions associated with the current implementation. Hillman suggested eliminating the "smolts owed" column at this time and adding footnotes that explain how those proportions were calculated. Murdoch said that would be acceptable.

Murdoch said alternatively, the table can show proportions that will be allocated to each hatchery that will be used in the BAMP formula, with the best available information at this time.

Willard said this conversation has helped her to understand the differences between the approaches used in the last recalculation. Willard asked how the proportions will be determined. Pearsons said that information could be provided in two tables to show all the potential data and then, a decision could be made during the sensitivity analysis stage when numbers are generated. O'Connor noted that Table 8 natural-origin spawners gives the opportunity to calculate in-kind, in-place mitigation with the BAMP formula. Table 9 highlights what the programs agreed to after the intense negotiations in the 2013 recalculation effort. Murdoch said she does not necessarily agree with this being characterized as in-kind, in-place mitigation because nowhere in the BAMP formula does it direct you to use proportions of natural-origin spawners. Rather, it directs you to use the proportions allocated to the hatchery where those fish will be raised. That is a management decision. It also tells you to identify populations that need supplementation and to implement supplementation there, which is somewhat the opposite of using spawner distributions, because it makes no sense to put most of your hatchery production in the location that actually has the highest spawner densities versus somewhere that is perhaps under-seeded. There is nowhere else, other than Grant's summer Chinook salmon, that spawner distribution is used. Murdoch said there is now agreement on how to allocate those fish. To use the BAMP properly, the allocation to each hatchery should be used from the previous implementation plan. In the last recalculation, it took 4 months to determine where to put Grant's summer Chinook salmon production, but we already know where it can be allocated this time.

Greg Mackey asked Murdoch to clarify whether she is suggesting that the current allocations to the different rearing locations be used for determining SAR for use in the BAMP. Murdoch said yes, and that's mainly what is shown in Table 9, and she is not suggesting any changes to the allocation to different locations at this time. Mackey said, for the most part, this doesn't affect Douglas PUD's calculation, but he will think more about how this affects different programs. Murdoch gave the example of mitigation for Rocky Reach summer Chinook salmon where 100% was allocated to Chelan Falls Hatchery; it was not divvied up by spawning distribution, and no one is planning on changing that. The one exception that is not clear, and probably had not been agreed to when this table was made, was that the Okanogan Subbasin fish are included in Chief Joseph Hatchery so they would not be included in the Chelan Falls Hatchery number.

Tonseth said Table 9 is a retrospective look at the recalculation but doesn't capture reality. It may be helpful to add columns that represent what was actually produced and released from those facilities. For example, of Grant PUD's summer Chinook salmon, only 31% were allocated to Dryden Pond instead of 65%. What was calculated and what was actually implemented was different. Tonseth also suggested double checking some values in Table 9; proportions shown for Carlton Pond and Chief Joseph Hatchery for Grant PUD's summer Chinook salmon may be switched.

Truscott said it is important to consider how the cost share agreements change the proportions that are actually reared at the various facilities as a starting point for how the newly recalculated mitigation might be allocated. The Parties to the cost share agreements are not contemplating ending the cost share agreements.

Pearsons will revise Table 9 to show the proportional of fish as they are currently allocated to the different facilities. Murdoch said yes, the point is to make sure to come to an agreement on what data are being used in the BAMP formula, to make sure there is agreement on which hatcheries are mitigating for which project. Pearsons said the agreement would come in the next step. At this point, the Committees are agreeing to the data that would be used in the calculation. Murdoch said she disagrees, because the proportions shown in this column are the data needed to calculate the BAMP. Pearsons said he sees it as a sequential process. The first step is determining what is owed based on where those fish are coming from. For instance, if most of the fish that are killed by a project are from the Okanogan Basin, that SAR based on that spawning distribution is what would be used to make up for those fish in the BAMP. If there is a negotiation to move the fish around, that is an additional step, after determining the number of fish that are being killed from a given location based on spawning distribution. Murdoch said in the BAMP formula, what is owed is based on the SAR of the hatchery program from where those fish were released. In the last recalculation, all the information on where fish would be released was not available. If most of the hatchery production is allocated where most of the spawners are, there will be too many fish in those locations and not enough fish in places where they are needed. It may be a vicious cycle that doesn't support recovery and is not consistent with the BAMP formula.

Matt Cooper noted that Entiat summer Chinook salmon should be included in Table 8.

Pearsons said he will prepare an addition to Table 9 showing the proportions based on the current allocation to locations from which fish are being released. The PUDs will review the information in Table 9 for accuracy. Entiat summer Chinook salmon will be added to Table 8. The PUDs will strive to update and distribute the next version of the data summary by end of day tomorrow, December 16, 2021. The Committees will review the data summary by January 5, 2022. Any comments should be provided in an email, copying all Committee members. The objective will be to approve a dataset and an approach to the sensitivity analysis for agreement in the January 19, 2022, regular meeting.

An extra conference call will be held January 6, 2022, from 1 p.m. to 4 p.m.

Hybrid Statement of Agreement and Coded Wire Tag Approach

Murdoch asked Pearsons if it is Grant PUD's position that, by agreeing to this version of the data summary, the Committees are agreeing to the hybrid SAR alternating years using PIT tags and CWT tags (a "hybrid SAR"). Pearsons said yes.

Murdoch said that as she has been updating the summer Chinook salmon mitigation comparison spreadsheet in coordination with others on the Committee and at YN, it is apparent that the summer Chinook salmon mitigation obligation would go down, no matter which way it is calculated (using SARs based on PIT tags, CWTs, or a hybrid). The YN has no issues with that reduction in mitigation if it is being calculated using the original intent of the BAMP mitigation equation, but this reduction is difficult to accept when the YN feels it is not based on the original intent of the BAMP. The YN believes that NNI means replacing all fish that would be killed by the projects, including hatchery-origin fish produced for mitigation. If the original negotiators didn't want to include all groups of fish, they would not have included the BAMP formula. If the hybrid SAR model is used, and the fixed inundation mitigation fish are included in the sensitivity analysis, the mitigation still goes down. Murdoch said, based on discussions with Tom Scribner, David Blodgett and Donella Miller (YN), they could agree to a hybrid SAR in the BAMP if the fixed inundation mitigation fish would be included in the final mitigation numbers, as determined by the sensitivity analysis. It is not NNI without the fixed inundation mitigation included in the sensitivity analysis. Murdoch said she is speaking only for the YN. She has shared that idea with the JFP, though they did not have time to fully vet the idea or to propose something that all are in agreement with.

Cooper said he is not opposed to what Murdoch is suggesting but requested more explanation on what the fixed inundation mitigation is. He asked how the inundation mitigation was determined and whether those numbers stay consistent in this recalculation. Mackey said most of the fixed inundation mitigation numbers were developed a long time ago to mitigate for inundated spawning habitat in the mainstem Columbia River. The numbers are fixed and do not get recalculated, but the unavoidable project mortality would change. The numbers were negotiated lump sums, though the history has been somewhat lost with the retirements of people involved. The numbers included were made large enough to provide for what managers wanted, which was consideration for the entire return, including mortality through the hydrosystem. It's a fixed number that doesn't get recalculated. Mackey said he is uncertain how these numbers were determined, though it was not likely very scientifically rigorous. Kahler said that is certainly the case for steelhead, as there was no mainstem spawning of steelhead upstream of Wells Dam. Willard said the Rock Island and Rocky Reach HCPs state that inundation mitigation compensates for original inundation by the project and is not subject to recalculation and is in addition to mitigation calculated to compensate for unavoidable project mortality. Kahler said in the 1990 Wells Settlement Agreement, the calculations only dealt with passage loss. It may be worth looking at the 1990 agreement and 1987 Rock Island Dam agreement to see how they handled mitigation for inundation for Wells Dam.

Pearsons said the PUDs were not supportive of including fixed inundation mitigation fish in the sensitivity analysis in the 2013 recalculation but allowed for this because 1) there was a lack of agreement among Parties and 2) including the inundation mitigation allowed the Parties to move forward. He does not agree with coupling these two issues together at this time. However, he suggested going forward with approval of the data to be used (including the SARs at this time) and including the fixed inundation mitigation number in the same manner as the 2013 recalculation in the sensitivity analysis, then making the decision about whether they should be included in NNI mitigation at the time when the results of the sensitivity analysis are discussed.

Willard said the fixed inundation mitigation is shown in Column G of the sensitivity analysis. Mackey said the fixed inundation mitigation was included in the high end of the recalculation options, which did not apply to the Douglas PUDs mitigation obligation. Pearsons said that Grant PUD used a high option for spring Chinook salmon, a middle value for summer Chinook salmon, and a low value for steelhead.

Murdoch said the original BAMP formula would have included these fish and so it doesn't sit well with the YN not to include these fish. The PUDs would not be mitigating for their own fixed inundation mitigation fish but would mitigate for other programs' fixed inundation mitigation fish. How Column G of the sensitivity analysis would be calculated, for instance for Chelan PUD, would be to apply Chelan's unavoidable mortality to Douglas PUD's fixed inundation compensation fish. The YN has always understood that NNI is replacing all fish that were killed by the projects. The YN wants to ensure that if we agree to a negotiated hybrid SAR method, that we agree to include the fixed inundation mitigation fish.

Pearsons said it is not being proposed to exclude Column G of the sensitivity analysis in the ranges of mitigation levels that are presented in the sensitivity analysis. Murdoch said she is seeking some agreement that the fixed inundation mitigation will be included all the way through to the recalculation implementation plan.

Willard asked if Murdoch is asking for a commitment to the inundation mitigation for the summer Chinook salmon only. Murdoch said the only other species that has inundation mitigation is steelhead, and the methods for steelhead have changed because we don't have elastomer tags, and the use of PIT tags is not an ideal approach. Murdoch said the YN would accept the approach that the inundation mitigation—at least for summer Chinook salmon—would be included in the calculation.

Cooper said agreeing to this is getting ahead of the steps in the process, but he would agree if it would allow the Committees to move forward through the process. Tonseth said he would restate this as "in order to accept the hybrid SAR method, WDFW would not support any recalculation option that does not include the fixed inundation mitigation shown in Column G of the sensitivity analysis." Truscott said to date, the loss of fixed inundation fish that are killed by those projects has not been mitigated for. He supports Tonseth's phrasing of the agreement. Truscott said, absent an agreement to include Column G of the sensitivity analysis, there would not be agreement on an implementation plan. If Parties can agree to include Column G of the sensitivity analysis in the implementation plan up front, he would support that. Brett Farman said he has nothing to add to the discussion so far.

Mackey said Douglas PUD does not have a large stake in this specific issue, but the arrival at the issue to use a combination of PIT tags and CWTs was a compromise to begin with, and putting conditions on that compromise feels like losing ground. He suspects that the inundation mitigation was originally envisioned as mitigation for adult fish, which would already be baked into the mitigation for the PUDs. Willard said she echoes Mackey's thoughts on the hybrid SAR method as a compromise. This addition of more fish could happen during the sensitivity analysis negotiation, and it does matter if this is for summer Chinook salmon or for steelhead because that would change whether we would agree to the approach. Pearsons said this is jumping ahead of sequence. The Committees are trying to calculate the number of fish that are related to project mortality that are related to NNI. Certain parts of this discussion are technical, and certain parts become more value-based and political and are negotiated. He does not like the concept of pushing a political decision before even coming to agreement on the datasets. Given that this is a policy issue, not a technical issue, he will have to discuss this internally with others at the PUDs to respond to this proposed concept.

Willard asked if the request is to commit to including the fixed inundation mitigation now for summer Chinook salmon or after the sensitivity analysis. Murdoch said at this point this is only being proposed for summer Chinook salmon. She views this as a time saving measure to agree to including Column G of the sensitivity analysis now rather than wait until negotiating this after the sensitivity analyses.

The PUDs will discuss internally the YN's position to include the fixed inundation mitigation fish in the final NNI implementation plan, in preparation for an extra meeting on January 6.

Hillman asked if agreement can't be achieved in January 2022, will we need to engage Coordinating and Policy Committees? If that is the case, we may not have production numbers available for drafting the 2022 BCPs by April 2022.

Murdoch said she saw this as a proposal that would resolve the two disputed issues; the YN would give some on the issue of SARs but then they would not also give on the issue of including fixed inundation mitigation in Column G of the sensitivity analysis. Murdoch said she will have to take this back for discussion internally. If agreement cannot be achieved, perhaps we would have to continue in 2022 with the current release numbers and elevate the issues to other Committees.

Cooper said elevating issues to the policy level should be done to prevent these policy issues from driving a wedge between people in this group. Tonseth said his concern is that the issues that would be addressed by Policy Committees have not been fully identified. This would require a discussion about what the specific questions are and what direction is being sought from the Policy Committees and their individual representatives within each organization, otherwise a gambit of responses will be returned from the Policy Committees and those will not be helpful for moving this process forward. Even with a well-planned request to the Policy Committees, the Hatchery Committees will not receive a timely response. The programs are quickly running out of time to start planning for 2022 production. Recalculation could be put on hiatus until a policy-level response is received. It should be acknowledged that both sides have negotiated and moved closer to a middle ground. Truscott said if all Parties were to agree with the hybrid SAR method and inclusion of fixed inundation mitigation, he would support that. If that is not agreed to now, the discussion of the merits of mitigating for lost mitigation fish will be had at length after the sensitivity analyses are done and the Committees will need to decide on which option to mitigate for at that time. Pearsons said he supports trying to resolve this within this Committee. There is a high probability that if this is elevated to the policy groups, they will return it back to this Committee. This Committee should be able to resolve technical issues, like SAR results. Willard agreed.

Farman said he agrees with the rest of the JFP's position that this is more of a technical issue than a policy issue, and he hopes the Committees can come to agreement without engaging the policy groups. To step back with perspective, some of these changes, like including fixed inundation mitigation, are not going to greatly alter the number of fish released. Conceptually, it makes sense to slow down on technical questions, but the Committees may be getting stuck on things that don't make a huge difference in cost or difficulty of implementation, and overall, there will still be a reduction in mitigation levels.

Pearsons said in the spirit of trying to find a path toward, he doesn't like the approach, but a counterproposal could be to agree to including fixed inundation mitigation in the sensitivity analysis for summer Chinook salmon, but to also agree not to include steelhead fixed inundation mitigation in the sensitivity analysis. That agreement would hardwire including summer Chinook salmon fixed inundation mitigation in the sensitivity analysis, but also hardwire steelhead so they are not part of the sensitivity analysis.

Mackey referred to the SOA *Regarding Methods for 2023 NNI Hatchery Recalculation* from June 16, 2021, which stated that "a sensitivity analysis or some other method that is agreed upon by members will be used to calculate final mitigation numbers to address the lack of consensus on which hatchery programs are subject to NNI." This will not stop forward progress; however, he does feel that it is jumping ahead to include some component of the sensitivity analysis in agreeing to the dataset. The PUDs need to discuss this internally before coming to a final decision on whether to agree to this counterproposal.

Hillman reminded the Committees that they have agreed to identify questions for the Policy Committees once production numbers and the implementation plans are completed. We are under pressure to approve the production numbers so the PUDs can start working on the 2022 BCPs for HCP approval by March 2022, and delivery to National Oceanic and Atmospheric Administration Fisheries by April 2022. The BCPs for the Wells Dam program have to be approved by the Wells HCP Coordinating Committee before they are delivered to National Oceanic and Atmospheric Administration Fisheries.

Murdoch thanked the Committees for having this discussion. She agreed her proposal was jumping ahead in the process but noted that it will save the Committees from having that discussion later.

B. 10-Year Comprehensive Monitoring and Evaluation Report: Review Check-in

Todd Pearsons noted that comments provided to date on the available chapters for the 10-year Comprehensive M&E Report were compiled and distributed, and authors are working on written responses to comments. Two chapters and one report (the sockeye salmon report) have yet to be provided to the Committees for review.

C. 2022 Broodstock Collection Protocols Preparations

Recalculated hatchery production numbers are needed to move forward on the 2022 BCPs.
Todd Pearsons said he hasn't heard of any proposals to change the approaches described in the protocols. Mike Tonseth said as time allows, modifications could be made to those sections where

information changes annually, mainly in the appendices, then implementation numbers can be added when they are finalized.

D. COVID 2019 and Monitoring and Evaluation Activities

Tracy Hillman asked Committees' members to provide their monthly updates on impacts of COVID-19 restrictions on M&E activities. Updates included the following:

- Matt Cooper had no changes since last month at U.S. Fish and Wildlife Service.
- Mike Tonseth and Katy Shelby had no changes since last month at WDFW.
- Brett Farman said National Marine Fisheries Service staff will return to the office by end of January 2022 per a plan at the national level, although this is not likely to occur at the regional level.
- Keely Murdoch had no changes for the YN since last month.
- Todd Pearsons had no changes at Grant PUD since last month.
- Catherine Willard had no changes at Chelan PUD since last month.
- Greg Mackey said the State of Washington mandate for vaccination of state employees did cause some turnover in the WDFW Twisp field office, and some replacements will be necessary.
- Tracy Hillman said Tom Dresser (Grant PUD) would like to see our groups start meeting in person as soon as we can. Dresser will reach out to Douglas PUD representatives to potentially meet at Douglas PUD using safety measures like social distancing and wearing masks. Bill Gale said the U.S. Fish and Wildlife Service policy would be to wear masks at all times, and in-person meetings would only be considered if all people were masked. Gale said he is more comfortable doing a virtual call without having to wear a mask rather than sitting in an auditorium wearing masks.

IV. Administrative Items

A. Next Meetings

The next regular HCP-HCs and PRCC HSC meetings will be Thursday, January 6, 2022, from 1 p.m. to 4 p.m.; Wednesday, January 19, 2022, in the afternoon only; Wednesday, February 16, 2022; and Wednesday, March 16, 2022, held by conference call and web-share until further notice.

V. List of Attachments

Attachment A	List of Attendees
Attachment B	Redd Zone Incubation Box Summary
Attachment C	2024–2033 Recalculation Data Summary (Version 10)

Attachment A
List of Attendees

Name	Organization
Larissa Rohrbach	Anchor QEA, LLC
Tracy Hillman	BioAnalysts, Inc.
Scott Hopkins*	Chelan PUD
Catherine Willard*	Chelan PUD
Kirk Truscott*‡	Colville Confederated Tribes
Tom Kahler*	Douglas PUD
Greg Mackey*	Douglas PUD
Peter Graf‡	Grant PUD
Rod O'Connor	Grant PUD
Todd Pearsons‡	Grant PUD
Brett Farman*‡	National Marine Fisheries Service
Katy Shelby	Washington Department of Fish and Wildlife
Mike Tonseth*‡	Washington Department of Fish and Wildlife
Dave Cox	Washington Department of Fish and Wildlife
Keely Murdoch*‡	Yakama Nation
Matt Cooper*‡	U.S. Fish and Wildlife Service
Bill Gale*‡	U.S. Fish and Wildlife Service

Notes:
* Denotes HCP-HCs member or alternate
‡ Denotes PRCC HSC member or alternate

Attachment B
Redd Zone Incubation Box Summary

Redd Zone Incubation System

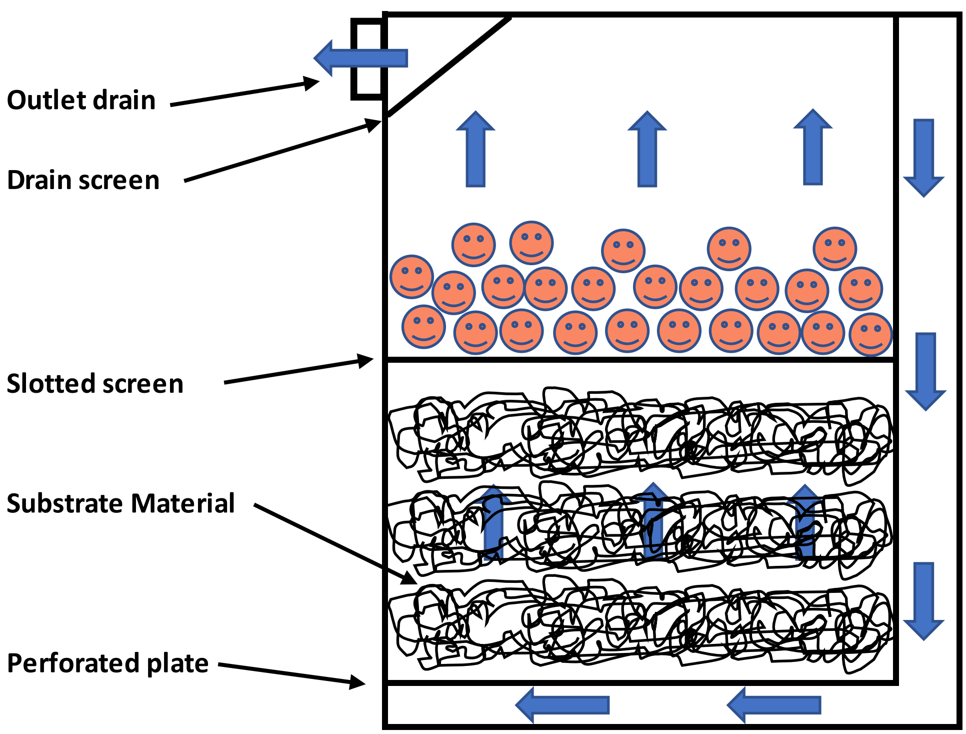
- Redd Zone incubation boxes are modeled after the Kitoi incubators developed and used throughout Alaska since the mid-1970s for Pink, Chum, Chinook, and Sockeye production. Kitoi incubators are currently in use at the Baker Lake and Cedar River hatcheries operated by WDFW. Redd Zones are currently operated at Baker Lake for Sockeye, Eells Springs and Goldendale hatcheries in the production of rainbow trout, and at Reiter Ponds for wild cross summer steelhead.

- The Redd Zone is essentially a box with a perforated plate at the bottom. Water enters the box from the side and upwells through the plate and substrate medium and a slotted screen before exiting the box at a drain in the top of the box wall.

- Eyed eggs are placed on top of the slotted screen. As the eggs hatch, they fall through the screen into the substrate material below. The slotted screen can be removed once all the eggs have hatched.

- Once the alevins have developed sufficiently and begin the "swim up" phase, the screen at the top of box at the drain can be removed. This will allow the fish to volitionally swim out of the box and down a pipe connected to the drain into the intermediate tank below.

Redd Zone Diagram



- The trout sized Redd Zone boxes we are using at Chelan measure 12 inches wide, 15 inches tall, and 18 inches in length. Flow is 5gpm per box. Capacity would be 30000-50000 eyed eggs per box. This is the equivalent of a half stack of heath trays.

- The main advantage to using this system would be less handling(stress) on the fish. Fish can hatch and grow in the darkness of the Redd Zone box instead of exposed under the lights in the shallow trough incubation.

- By hatching directly into the intermediate tanks, we can grow the fish to about 375 fpp before ever having to handle the fish for splitting. This saves at least one handling of the fish.

- Another benefit of hatching into the deeper intermediates would be better initial feeding response. Having a deeper water column would allow the fish more access to feed for longer and help alleviate fish health concerns of eating off the bottom that can be seen with the shallow trough incubation.

- We are currently employing about a dozen of these boxes on the State side of the facility to incubate Brown trout, Brook trout, Tiger trout, Rainbow trout and Kokanee and so far, we have seen good results. Difficulty in removing mortalities from the box once the alevins have entered the substrate is about the only disadvantage seen at this point.

- Minimal modifications would be needed at Chelan to utilize the Redd Zone boxes for steelhead. I would opt for tying into the main line that feeds the intermediates at one point and using hoses from there to reach each box due to their temporary nature. Based on the size of the program of 150,000, we would need to supply four intermediate tanks at most. Hatchery personnel could perform any modifications.

2024-2033 RECALCULATION DATA SUMMARY

Chelan PUD, Douglas PUD, Grant PUD

DECEMBER 2021

Introduction

This document summarizes data used to recalculate hatchery compensation for Douglas, Chelan, and Grant PUDs for future release years 2024-2033. The period of record for this effort includes natural origin adult return years 2011-2020.

Relevant Brood Years

The brood years contributing to this period vary by species and are summarized in Tables 1-4.

Table 1. Chinook Salmon brood years contributing to adult return years 2011-2020.

	Return Year																				
Brood Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2003	RY	A3	A4	A5	A6																
2004		RY	A3	A4	A5	A6															
2005	BY		RY	A3	A4	A5	A6														
2006		BY		RY	A3	A4	A5	A6													
2007			BY		RY	A3	A4	A5	A6												
2008				BY		RY	A3	A4	A5	A6											
2009					BY		RY	A3	A4	A5	A6										
2010						BY		RY	A3	A4	A5	A6									
2011							BY		RY	A3	A4	A5	A6								
2012								BY		RY	A3	A4	A5	A6							
2013									BY		RY	A3	A4	A5	A6						
2014										BY		RY	A3	A4	A5	A6					
2015											BY		RY	A3	A4	A5	A6				
2016												BY		RY	A3	A4	A5	A6			
2017													BY		RY	A3	A4	A5	A6		
2018														BY		RY	A3	A4	A5	A6	
2019															BY		RY	A3	A4	A5	A6
2020																BY		RY	A3	A4	A5
2021																	BY		RY	A3	A4

Notes: Grey background delineates return years 2011-2020. BY = brood year, RY = release year, A = age. 2007 is the first relevant brood year for spring Chinook, and 2006 is the first relevant brood year for summer Chinook.

Table 2. Steelhead brood years contributing to adult return years 2011-2020.

	Return Year																				
Brood Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2005	BY	RY	O1	O2	O3																
2006		BY	RY	O1	O2	O3															
2007			BY	RY	O1	O2	O3														
2008				BY	RY	O1	O2	O3													
2009					BY	RY	O1	O2	O3												
2010						BY	RY	O1	O2	O3											
2011							BY	RY	O1	O2	O3										
2012								BY	RY	O1	O2	O3									
2013									BY	RY	O1	O2	O3								
2014										BY	RY	O1	O2	O3							
2015											BY	RY	O1	O2	O3						
2016												BY	RY	O1	O2	O3					
2017													BY	RY	O1	O2	O3				
2018														BY	RY	O1	O2	O3			
2019															BY	RY	O1	O2	O3		
2020																BY	RY	O1	O2	O3	
2021																	BY	RY	O1	O2	O3

Notes: Grey background delineates return years 2011-2020. BY = brood year, RY = release year, O = ocean year. 2008 is the first relevant brood year for steelhead.

Table 3. Sockeye brood years contributing to adult return years 2011-2020.

Brood Year	Return Year 2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2004		RY	A3	A4	A5	A6															
2005	BY		RY	A3	A4	A5	A6														
2006		BY		RY	A3	A4	A5	A6													
2007			BY		RY	A3	A4	A5	A6												
2008				BY		RY	A3	A4	A5	A6											
2009					BY		RY	A3	A4	A5	A6										
2010						BY		RY	A3	A4	A5	A6									
2011							BY		RY	A3	A4	A5	A6								
2012								BY		RY	A3	A4	A5	A6							
2013									BY		RY	A3	A4	A5	A6						
2014										BY		RY	A3	A4	A5	A6					
2015											BY		RY	A3	A4	A5	A6				
2016												BY		RY	A3	A4	A5	A6			
2017													BY		RY	A3	A4	A5	A6		
2018														BY		RY	A3	A4	A5	A6	
2019															BY		RY	A3	A4	A5	A6
2020																BY		RY	A3	A4	A5
2021																	BY		RY	A3	A4

Notes: Grey background delineates return years 2011-2020. BY = brood year, RY = release year, A = age. 2008 is the first relevant brood year for Sockeye.

Table 4. Coho brood years contributing to adult return years 2011-2020.

Brood Year	Return Year 2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
2004		RY	O1																		
2005	BY		RY	O1																	
2006		BY		RY	O1																
2007			BY		RY	O1															
2008				BY		RY	O1														
2009					BY		RY	O1													
2010						BY		RY	O1												
2011							BY		RY	O1											
2012								BY		RY	O1										
2013									BY		RY	O1									
2014										BY		RY	O1								
2015											BY		RY	O1							
2016												BY		RY	O1						
2017													BY		RY	O1					
2018														BY		RY	O1				
2019															BY		RY	O1			
2020																BY		RY	O1		
2021																	BY		RY	O1	

Notes: Grey background delineates return years 2011-2020. BY = brood year, RY = release year, O = ocean year. 2008 is the first relevant brood year for Coho.

Natural-Origin Adult Returns

The adult return years evaluated for the current recalculation effort cover the period of 2011 to 2020. The average numbers of natural-origin adult returns at each project during this period are summarized in Table 5. Species that are compensated through alternative PUD funding agreements (e.g., Coho, Okanogan Sockeye, Summer Chinook above Wells) are not addressed in this document.

Table 5. Estimated average natural-origin adult passage at Wells, Rocky Reach, Rock Island, Priest Rapids hydroelectric projects during the period of 2011-2020.

Project	Species	Note	Average Count
Wells	Spring Chinook		656
Wells	Steelhead		1,353
Wells	Summer and Fall Chinook		24,849
Wells	Coho		42
Rocky Reach	Spring Chinook		901
Rocky Reach	Steelhead		1,728
Rocky Reach	Summer and Fall Chinook		33,434
Rocky Reach	Coho		58
Rock Island	Sockeye	Wenatchee Only	38,173
Rock Island	Spring Chinook	Nadir Method	1,653
Rock Island	Steelhead		2,632
Rock Island	Summer and Fall Chinook		43,064
Rock Island	Coho		335
Priest Rapids	Fall Chinook		11,679
Priest Rapids	Summer Chinook		32,882
Priest Rapids	Spring Chinook	Nadir Method	1,777
Priest Rapids	Steelhead		3,123

The detailed methods used to calculate adult returns for each species are summarized in Figures 1-17 below and described in Table 6. Annual calculated estimates are bounded by a green outline and the average number of fish from 2011-2020 is highlighted in orange within each figure.

METHOD: WELLS SPRING CHINOOK

Natural Origin SPCH Observed at Wells (1)	
Year	Total
2011	965
2012	663
2013	603
2014	1038
2015	790
2016	658
2017	549
2018	604
2019	386
2020	306
	656

Data Sources

1. Derived from Appendix O (Page 213) of Snow, C., C. Frady, D. Grundy, B. Goodman, and A. Haukenes. 2020. Monitoring and evaluation of the Wells Hatchery and Methow Hatchery programs: 2019 annual report. Report to Douglas PUD, Grant PUD, Chelan PUD, and the Wells and Rocky Reach HCP Hatchery Committees, and the Priest Rapids Hatchery Subcommittees, East Wenatchee, WA.

Figure 1. Annual natural-origin Spring Chinook passage at Wells Dam during 2011-2020.

METHOD: WELLS STEELHEAD

Douglas PUD M&E/WDFW Wells Stock Assessment (1)	
Brood Year	Natural Origin Count (less double counts and fallback)
2011	1770
2012	1395
2013	914
2014	1873
2015	1986
2016	1718
2017	880
2018	817
2019	827
2020	N/A
	1353

Data Sources

1. Derived from Appendix A: Attachment C, Page 228: Snow, C., C. Frady, D. Grundy, B. Goodman, and A. Haukenes. 2020. Monitoring and evaluation of the Wells Hatchery and Methow Hatchery programs: 2019 annual report. Report to Douglas PUD, Grant PUD, Chelan PUD, and the Wells and Rocky Reach HCP Hatchery Committees, and the Priest Rapids Hatchery Subcommittees, East Wenatchee, WA.

Figure 2. Annual natural-origin Steelhead passage at Wells Dam during brood years 2011-2020.

METHOD: WELLS SUMMER CHINOOK

DART Summer Chinook (1)				
Return Year	Summer Chinook Total	Count Adjusted by subtracting Spring Chinook (2)	Percent Natural Origin (3)*	Natural Origin Summer Chinook
2011	51,745	43,524	29%	12,418
2012	52,846	47,559	24%	11,222
2013	82,762	77,261	43%	33,565
2014	83,506	72,960	61%	44,498
2015	103,358	93,366	55%	51,796
2016	65,822	60,611	56%	33,780
2017	43,458	38,516	50%	19,291
2018	34,841	29,881	23%	6,958
2019	38,251	33,358	37%	12,503
2020	64,870	61,262	37%	22,463
				24,849

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.

2. Spring Chinook data from the Monitoring and Evaluation of the Wells Hatchery and Methow Hatchery Programs: 2020 Annual Report. Appendix O.

3. WDFW 14-20 Wells E+W Sum Chinook stock assessment data (Sent by Chris Moran on June 9, 2021)

Figure 3. Annual natural-origin Summer/Fall Chinook passage at Wells Dam during brood years 2011-2020.

METHOD: WELLS COHO

Year	DART Wells Coho Counts (1)	Methow Natural Origin Percent (2)	Methow Natural Origin Estimate
2011	5,796	1.17%	68
2012	2,042	0.00%	0
2013	573	3.38%	19
2014	9,149	0.81%	74
2015	1,173	1.32%	15
2016	423	0.00%	0
2017	3,847	2.30%	89
2018	2,946	0.00%	0
2019	4,088	0.53%	22
2020	12,372	1.06%	131
			42

Natural Origin Calculation

Return Year	Natural-origin Return	Total Return	Percent Natural Origin
2011	69	5885	1.17%
2012	0	2148	0.00%
2013	25	740	3.38%
2014	78	9654	0.81%
2015	22	1666	1.32%
2016	0	536	0.00%
2017	114	4950	2.30%
2018	0	3706	0.00%
2019	28	5282	0.53%
2020		Avg 2011-19	1.06%

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.

2. Table 53 of Yakama Nation Fisheries. 2020. Mid-Columbia Coho Reintroduction Monitoring and Evaluation Report

Figure 4. Annual natural-origin Coho passage at Wells Dam during brood years 2011-2020.

METHOD: RR SPRING CHINOOK

Natural Origin SPCH Observed at Wells (1)		Conversion Rate (2)	Conversion Rate Expanded RR SPCH	Entiat Natural Origin SPCH Returns (3)	Sum of Entiat and Expanded RR SPCH
Year	Total	Natural Origin PIT-Based RR to Wells	Total	Total*	Total
2011	965	100%	965	321	1286
2012	663	100%	663	334	997
2013	603	100%	603	188	791
2014	1038	73.3%	1415	225	1641
2015	790	100.0%	790	417	1207
2016	658	100.0%	658	297	955
2017	549	100.0%	549	64	613
2018	604	100.0%	604	46	650
2019	386	100.0%	386	60	446
2020	306	100.0%	306	120	426
					901

*2020 based on average of 2011-19.

Data Sources

1. Derived from Appendix O (Page 213) of Snow, C., C. Frady, D. Grundy, B. Goodman, and A. Haukenes. 2020. Monitoring and evaluation of the Wells Hatchery and Methow Hatchery programs: 2019 annual report. Report to Douglas PUD, Grant PUD, Chelan PUD, and the Wells and Rocky Reach HCP Hatchery Committees, and the Priest Rapids Hatchery Subcommittees, East Wenatchee, WA.

2. Columbia River DART, Columbia Basin Research, University of Washington. (2021). PIT Tag Adult Returns Conversion Rate. Available from http://www.cbr.washington.edu/dart/query/pitadult_conrate.

3.Fraser, G. S., and M. R. Cooper. 2021. Chinook Salmon spawning ground surveys on the Entiat River, 2020. U. S. Fish and Wildlife Service, Leavenworth, Washington

Figure 5. Annual natural-origin Spring Chinook passage at Rocky Reach Dam during 2011-2020.

METHOD: RR STEELHEAD

DART RR Counts (1)		Fallback Correction (2)	Natural Origin Correction	Entiat Counts (3)		Estimate of Non_Entiat Natural Origin		Sum of Entiat Natural Origin + Non-Entiat Natural Origin
Year	Total	RR_STL FCF	% Natural	Entiat Total	Natural Returns Entiat*	(DART Total*FCF)-Entiat Total	Natural non_Entiat	Total RR Natural Origin
2011	15,280	96.49%	13.98%	465	293	14,279	1,996	2289
2012	13,100	96.34%	12.20%	657	531	11,964	1,460	1991
2013	9,201	98.18%	9.76%	379	245	8,655	845	1090
2014	10,587	98.34%	26.59%	478	433	9,933	2,642	3075
2015	10,894	98.98%	27.53%	647	588	10,136	2,791	3379
2016	5,728	90.41%	19.90%	521	461	4,658	927	1388
2017	3,988	95.11%	19.43%	226	159	3,567	693	852
2018	4,238	96.49%	23.69%	158	113	3,931	931	1044
2019	3,298	96.06%	28.07%	146	109	3,022	848	957
2020	5,398	98.49%	20.13%	218	188	5,098	1,026	1214
								1728

*Assumed prespawn mortality of 10% added to reported value

Wells Stock Assessment WDFW (4)			
BY	Hatchery	Natural	% Natural
2011	10,894	1,770	13.98%
2012	10,040	1,395	12.20%
2013	8,452	914	9.76%
2014	5,170	1,873	26.59%
2015	5,227	1,986	27.53%
2016	6,916	1,718	19.90%
2017	3,649	880	19.43%
2018	2,632	817	23.69%
2019	2,119	827	28.07%
2020	avg 2011-2019		20.13%

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.
2. Buchanan, R.A., and J. R. Skalski. 2012-2020. Detection Efficiencies at Rock Island, Rocky Reach, and Tumwater Dam Adult Ladders (2012-2020). Columbia Basin Research, School
3. https://fortress.wa.gov/dfw/score/score/species/population_details.jsp?stockId=6903
4. Derived from Appendix A: Attachment C, Page 228: Snow, C., C. Frady, D. Grundy, B. Goodman, and A. Haukenes. 2020. Monitoring and evaluation of the Wells Hatchery and Methow Hatchery programs: 2019 annual report. Report to Douglas PUD, Grant PUD, Chelan PUD, and the Wells and Rocky Reach HCP Hatchery Committees, and the Priest Rapids Hatchery Subcommittees, East Wenatchee, WA.

Figure 6. Annual natural-origin Steelhead passage at Rocky Reach Dam during 2011-2020.

METHOD: RR SUMMER CHINOOK

Nadir Apportionment						Fallback Correction % (2)		Natural Origin Correction. CPUD Window Count Data (3)		Adjusted Natural Origin Estimate		
Year	Total SUCH & FACH (1)	Nadir Dates SPCH to SUCH	Nadir Dates SUCH to FACH	SUCH Total	FACH Total	SUCH FCF	FACH FCF	SUCH Natural Origin	FACH Natural Origin	SUCH Total	FACH Total	SUCH+FACH Total
2011	56,516	6/29/2011	9/9/2011	50,274	6,242	89.5%	90.7%	36.66%	83.93%	16,496	4,749	21,245
2012	60,972	6/27/2012	9/16/2012	52,560	8,412	81.6%	78.6%	32.99%	73.84%	14,157	4,880	19,038
2013	122,622	6/6/2013	9/7/2013	73,186	49,436	64.1%	91.4%	45.16%	76.07%	21,175	34,382	55,558
2014	90,401	6/13/2014	9/8/2014	70,657	19,744	92.6%	96.7%	59.15%	81.70%	38,712	15,594	54,307
2015	122,711	5/24/2015	8/24/2015	87,853	34,858	97.8%	88.4%	53.01%	73.52%	45,524	22,661	68,185
2016	80,412	6/5/2016	8/26/2016	66,690	13,722	97.2%	89.3%	49.42%	71.87%	32,028	8,805	40,833
2017	56,685	6/18/2017	9/8/2017	45,981	10,704	95.4%	91.7%	36.90%	79.07%	16,181	7,759	23,939
2018	43,419	6/13/2018	9/7/2018	36,621	6,798	91.2%	100.0%	18.78%	84.34%	6,269	5,733	12,002
2019	50,457	6/10/2019	8/31/2019	42,073	8,384	91.8%	85.7%	18.69%	72.70%	7,221	5,224	12,445
2020	80,663	6/12/2020	9/6/2020	70,335	10,328	94.0%	94.1%	30.16%	70.54%	19,934	6,857	26,791
												33,434

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.
2. Buchanan, R.A., and J. R. Skalski. 2012-2020. Detection Efficiencies at Rock Island, Rocky Reach, and Tumwater Dam Adult Ladders (2012-2020). Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington
3. Chelan PUD adipose clip/raw window count data 2011-2020

Figure 7. Annual natural-origin Summer and Fall Chinook passage at Rocky Reach Dam during 2011-2020.

METHOD: RR COHO

Year	DART RR Coho Counts (1)	Methow Natural Origin Percent (2)	Methow Natural Origin Estimate
2011	7,951	1.17%	93
2012	2,440	0.00%	0
2013	533	3.38%	18
2014	13,170	0.81%	106
2015	2,140	1.32%	28
2016	418	0.00%	0
2017	5,432	2.30%	125
2018	4,424	0.00%	0
2019	6,810	0.53%	36
2020	16,125	1.06%	170
			58

Natural Origin Calculation			
Return Year	Natural-origin Return	Total Return	Percent Natural Origin
2011	69	5885	1.17%
2012	0	2148	0.00%
2013	25	740	3.38%
2014	78	9654	0.81%
2015	22	1666	1.32%
2016	0	536	0.00%
2017	114	4950	2.30%
2018	0	3706	0.00%
2019	28	5282	0.53%
2020		Avg 2011-19	1.06%

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.

2. Table 53 of Yakama Nation Fisheries. 2020. Mid-Columbia Coho Reintroduction Monitoring and Evaluation Report

Figure 8. Annual natural-origin Coho passage at Rocky Reach Dam during 2011-2020

METHOD: RI SOCKEYE (Wenatchee River Only)

DART Counts (1)			Fallback Correction (2)		FCF Adjusted Counts		RI TOTAL Wenatchee Natural Origin
Year	RI	RR	RI_SOCK FCF	RR_SOCK FCF	RI	RR	Delta: Adjusted RI minus RR
2011	146,111	132,096	98%	98%	143,692	129,330	14,363
2012	410,620	363,314	98%	98%	401,801	355,511	46,290
2013	159,208	131,655	98%	97%	156,024	127,811	28,213
2014	581,121	492,892	99%	98%	576,763	484,464	92,299
2015	264,678	216,389	99%	97%	260,999	209,421	51,578
2016	310,341	235,925	99%	99%	307,641	234,085	73,556
2017	73,218	46,701	98%	99%	72,098	46,253	25,845
2018	172,009	162,684	99%	98%	170,599	159,333	11,266
2019	58,562	50,464	97%	98%	57,063	49,485	7,578
2020	280,440	249,521	97%	97%	272,504	241,761	30,743
							38,173

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.
2. Buchanan, R.A., and J. R. Skalski. 2012-2020. Detection Efficiencies at Rock Island, Rocky Reach, and Tumwater Dam Adult Ladders. Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington

Figure 9. Annual natural-origin Wenatchee River Sockeye passage at Rock Island Dam during 2011-2020.

METHOD: RI SPRING CHINOOK

	Nadir Apportionment		Fallback Correction % (2)		Adjusted SPCH Counts		Total WEN River Count	WEN River Natural Origin	Adjusted "WEN River Only" Count	RR SPCH converting from RI	Total RI SPCH: Sum of WEN River and RR
Year	Nadir RR SPCH	Nadir RI SPCH	RR_SPCH FCF	RI_SPCH FCF	RR SPCH	RI SPCH	Delta: Adjusted RI SPCH Minus RR SPCH	% Natural	Natural Origin	Natural Origin	Natural Origin
2011	12,026	18,927	91.45%	95.68%	10,997	18,110	7,112	10.34%	736	1286	2022
2012	7,087	22,709	89.77%	89.77%	6,362	20,386	14,024	13.46%	1888	997	2885
2013	6,538	14,119	90.50%	96.25%	5,917	13,590	7,673	10.40%	798	791	1589
2014	12,767	23,549	71.12%	91.47%	9,080	21,540	12,460	11.33%	1411	1641	3052
2015	8,391	21,807	97.65%	98.30%	8,194	21,436	13,242	6.99%	926	1207	2133
2016	5,840	13,062	98.67%	98.90%	5,762	12,918	7,156	11.01%	788	1041	1829
2017	6,157	8,175	92.42%	99.30%	5,690	8,118	2,427	14.19%	344	613	957
2018	5,754	7,694	91.28%	97.42%	5,252	7,495	2,243	12.27%	275	650	925
2019	5,177	5,801	100.00%	97.79%	5,177	5,673	496	8.43%	42	446	488
2020	3,851	7,563	91.60%	91.93%	3,528	6,953	3,425	6.43%	220	426	646
											1,653

Wenatchee SPCH

	Non-LNFH Wenatchee Spawning Escapement (3)		Estimated Natural-origin SPCH Escapement	Natural-origin Broodstock Collected (4)	Estimated Natural-origin Return	Hatchery-origin Escapement and Broodstock (4)	Sum of Hatchery and Natural Origin	LNFH Return To Icicle Creek (5)	Total Wenatchee Return	
Year	Total	Natural Origin Percentage	Total	Total	Total	Total	Total	Total	Total	Estimated Natural Origin Percentage
2011	3,376	29.94%	1011	80	1,091	2,466	3,557	6,990	10,547	10.34%
2012	2,845	45.10%	1283	68	1,351	1,611	2,962	7,074	10,036	13.46%
2013	2,242	20.25%	454	180	634	2,152	2,786	3,309	6,095	10.40%
2014	1,761	54.38%	958	85	1,043	2,157	3,200	6,005	9,205	11.33%
2015	1,657	40.25%	667	51	718	1,402	2,120	8,149	10,269	6.99%
2016	975	69.31%	676	128	804	1,221	2,025	5,277	7,302	11.01%
2017	705	38.43%	271	121	392	953	1,345	1,417	2,762	14.19%
2018	890	21.36%	190	90	280	1,026	1,306	976	2,282	12.27%
2019	888	16.46%	146	77	223	1,020	1,243	1,404	2,647	8.43%
2020	806	31.76%	256	115	371	885	1,256	4,511	5,767	6.43%

Non-Wenatchee Natural-origin SPCH Converting from RI to RR

RR SPCH Estimate	Conversion Rate (6)	Conversion Rate Expanded RI SPCH
Total	Natural Origin PIT-Based RI to RR	Total
1,286	100.00%	1,286
997	100.00%	997
791	100.00%	791
1,641	100.00%	1,641
1,207	100.00%	1,207
955	91.67%	1,041
613	100.00%	613
650	100.00%	650
446	100.00%	446
426	100.00%	426

Caracass Survey Data (7)

Year	Natural Origin	Hatchery Origin	% Natural Origin
2011	100	234	29.94%
2012	253	308	45.10%
2013	131	516	20.25%
2014	211	177	54.38%
2015	128	190	40.25%
2016	210	93	69.31%
2017	83	133	38.43%
2018	66	243	21.36%
2019	66	335	16.46%
2020	108	232	31.76%

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.
2. Buchanan, R.A., and J. R. Skalski. 2014-2020. Detection Efficiencies at Rock Island, Rocky Reach, and Tumwater Dam Adult Ladders (2014-2020). Columbia Basin Research, School of Aquatic and Fishery Sciences, University of
3. Derived from Table 6.25a in Hillman, T., M. Miller, M. Hughes, C. Moran, J. Williams, M. Tonseth, C. Willard, S. Hopkins, J. Caisman, T. Pearsons, and P. Graf. 2021. Monitoring and evaluation of the Chelan and Grant County PUDs
4. Derived from Tables 5.1 and 6.4 in Hillman, T., M. Miller, M. Hughes, C. Moran, J. Williams, M. Tonseth, C. Willard, S. Hopkins, J. Caisman, T. Pearsons, and P. Graf. 2021. Monitoring and evaluation of the Chelan and Grant County PUDs
5. USFWS 2019 Monitoring and Evaluation of the Leavenworth National Fish Hatchery Spring Chinook Salmon Program, 2019.
6. Columbia River DART, Columbia Basin Research, University of Washington. (2021). PIT Tag Adult Returns Conversion Rate. Available from http://www.cbr.washington.edu/dart/query/pitadult_conrate.
7. Derived from Tables 5.32 and 6.26 in Hillman, T., M. Miller, M. Hughes, C. Moran, J. Williams, M. Tonseth, C. Willard, S. Hopkins, J. Caisman, T. Pearsons, and P. Graf. 2021. Monitoring and evaluation of the Chelan and Grant County

Figure 10. Annual natural-origin Spring Chinook passage at Rock Island Dam during 2011-2020 (Nadir Method).

METHOD: RI STEELHEAD

	DART RI Counts (1)	DART RR Counts (1)	Fallback Correction (2)	Fallback Correction (2)	FCF Adujsted Subtotal		Delta RI-RR (WEN River Only)	Natural Origin Correction	WEN River Only	Expanded PIT from RI to RR	Sum of WEN River Only and Total RR Natural Origin
Year	Total	Total	RI_STL FCF	RR_STL FCF	RI_STL	RR_STL	Total	% Natural	Natural Origin Total	Total RR Natural Origin	Total RI Natural Origin
2011	19,024	15,280	95.43%	96.49%	18,154	14,744	3,411	36.40%	1185	2,289	3473
2012	15,454	13,100	96.34%	96.34%	14,889	12,621	2,268	27.90%	610	1,991	2600
2013	11,505	9,201	96.31%	98.18%	11,081	9,034	2,047	53.50%	1055	1,090	2144
2014	15,037	10,587	95.59%	98.34%	14,374	10,411	3,963	47.30%	1792	3,075	4866
2015	14,041	10,894	97.63%	98.98%	13,708	10,783	2,925	39.90%	1140	3,446	4586
2016	7,166	5,728	96.07%	90.41%	6,884	5,179	1,706	52.50%	860	1,441	2301
2017	5,265	3,988	93.52%	95.11%	4,924	3,793	1,131	58.10%	614	852	1467
2018	5,229	4,238	94.34%	96.49%	4,933	4,089	844	50.00%	398	1,044	1442
2019	4,360	3,298	96.59%	96.06%	4,211	3,168	1,043	67.60%	681	1,003	1684
2020	6,753	5,398	92.47%	98.49%	6,244	5,316	928	62.70%	538	1,214	1752
											2632

Dryden Stock Assessment Percent Natural Origin (3)

Year	Hatchery	Natural	Percent Natural Origin
2011	143	82	36%
2012	191	74	28%
2013	53	61	54%
2014	106	95	47%
2015	86	57	40%
2016	29	32	52%
2017	49	68	58%
2018	47	47	50%
2019	48	100	68%
2020	25	42	63%

	RR (4)	Conversion Rate (5)	Expanded PIT from RI to RR
Year	Total Natural Origin	Natural Origin PIT: RI to RR	Total RR Natural Origin
2011	2289	1.00	2,289
2012	1991	1.00	1,991
2013	1090	1.00	1,090
2014	3075	1.00	3,075
2015	3379	0.98	3,446
2016	1388	0.96	1,441
2017	852	1.00	852
2018	1044	1.00	1,044
2019	957	0.95	1,003
2020	1214	1.00	1,214

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.
2. Buchanan, R.A., and J. R. Skalski. 2012-2020. Detection Efficiencies at Rock Island, Rocky Reach, and Tumwater Dam Adult Ladders (2012-2020). Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington
3. WDFW stock assessment data; "2011-2020 Dryden Steelhead Origins.xlsx" Provided 8/5/2021
4. See RR Steelhead Method
5. Columbia River DART, Columbia Basin Research, University of Washington. (2021). PIT Tag Adult Returns Conversion Rate. Available from http://www.cbr.washington.edu/dart/query/pitadult_conrate.

Figure 11. Annual natural-origin Steelhead passage at Rock Island Dam during 2011-2020.

METHOD: RI SUMMER CHINOOK

	Nadir Apportionment					Fallback Correction % (2)		Ad-present Correction. CPUD Window Count Data (3)		Natural Origin Subtotal		FACH PRH Overshoot	Adjusted Natural Origin Estimate		
Year	DART (1) Total SUCH & FACH	Nadir Dates SPCH to SUCH	Nadir Dates SUCH to FACH	SUCH Total	FACH Total	SUCH FCF	FACH FCF	SUCH Natural Origin	FACH Natural Origin	SUCH Natural Origin	FACH Natural Origin	Ad-Present Natural Origin Fish	SUCH Total	FACH Total	SUCH+FACH Total
2011	75,563	6/11/2011	9/11/2011	67,356	8,207	91.9%	81.6%	47.22%	92.20%	29,237	6,174	85.96%	29,237	5,307	34,544
2012	69,365	6/26/2012	9/7/2012	57,694	11,671	81.6%	78.6%	30.12%	77.30%	14,186	7,089	85.96%	14,186	6,093	20,280
2013	144,102	6/14/2013	9/6/2013	85,452	58,650	75.8%	89.2%	51.07%	77.26%	33,058	40,398	85.96%	33,058	34,725	67,783
2014	121,555	6/14/2014	9/13/2014	95,253	26,302	96.4%	90.9%	66.67%	85.84%	61,225	20,525	85.96%	61,225	17,643	78,868
2015	146,196	5/25/2015	8/27/2015	107,039	39,157	97.7%	97.9%	54.36%	75.32%	56,838	28,865	85.96%	56,838	24,812	81,650
2016	109,215	6/1/2016	9/1/2016	92,314	16,901	99.0%	92.3%	55.25%	75.87%	50,482	11,836	85.96%	50,482	10,174	60,656
2017	73,895	6/14/2017	8/19/2017	58,325	15,570	96.6%	68.8%	45.47%	61.52%	25,611	6,585	85.96%	25,611	5,660	31,272
2018	52,247	6/12/2018	8/25/2018	42,208	10,039	98.5%	83.3%	24.83%	83.46%	10,328	6,982	85.96%	10,328	6,001	16,329
2019	60,186	5/31/2019	8/22/2019	47,027	13,159	92.1%	61.5%	23.87%	75.19%	10,340	6,089	85.96%	10,340	5,234	15,574
2020	89,322	6/12/2020	8/24/2020	75,156	14,166	89.7%	71.9%	33.44%	13.03%	22,541	1,327	85.96%	22,541	1,141	23,681
															43,064

	Fall Chinook Natural Origin Correction. Average PRH overshoot using PIT estimate and ad-present releases from PRH (4)		Apportionment of ad-present Fall Chinook	
Year	PIT estimate PRH-origin at RI	Ad-present PRH-origin releases	Ad-present PRH Overshoots	Ad-Present Natural Origin Fish
2011	30.20%	46.50%	14.04%	85.96%
2012	30.20%	46.50%	14.04%	85.96%
2013	30.20%	46.50%	14.04%	85.96%
2014	30.20%	46.50%	14.04%	85.96%
2015	30.20%	46.50%	14.04%	85.96%
2016	30.20%	46.50%	14.04%	85.96%
2017	30.20%	46.50%	14.04%	85.96%
2018	30.20%	46.50%	14.04%	85.96%
2019	30.20%	46.50%	14.04%	85.96%
2020	30.20%	46.50%	14.04%	85.96%

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.
2. Buchanan, R.A., and J. R. Skalski. 2012-2020. Detection Efficiencies at Rock Island, Rocky Reach, and Tumwater Dam Adult Ladders. Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington
3. Chelan PUD adipose clip/raw window count data 2011-2020
4. Richards, S. and T. Pearsons. 2021. Priest Rapids Hatchery Monitoring and Evaluation Annual Report for 2019-2020. The average value of PIT-tagged PRH-origin fall Chinook Salmon detected at Rock Island Dam was derived from Table 52 and included BY's 2010-2013. The average value of ad-present releases was derived from Table 15 and included BY's 2010-2013.

Figure 12. Annual natural-origin Summer and Fall Chinook passage at Rock Island during 2011-2020.

METHOD: RI COHO

Year	DART RI Coho Counts (1)	Percent Wenatchee	Percent Methow	Wenatchee Count Estimate	Methow Count Estimate	Wenatchee Natural Origin Percent (2)	Methow Natural Origin Percent (3)	Wenatchee Natural Origin Estimate	Methow Natural Origin Estimate	Total RI (Sum of Wenatchee & Methow)
2011	31,045	80.20%	19.80%	24,897	6,148	2.24%	1.17%	557	72	629
2012	8,277	73.10%	26.90%	6,050	2,227	5.09%	0.00%	308	-	308
2013	2,611	72.90%	27.10%	1,904	707	0.95%	3.38%	18	24	42
2014	47,587	78.14%	21.86%	37,183	10,404	3.15%	0.81%	1,170	84	1254
2015	4,499	60.17%	39.83%	2,707	1,792	2.58%	1.32%	70	24	94
2016	2,489	79.48%	20.52%	1,978	511	0.24%	0.00%	5	-	5
2017	13,200	62.01%	37.99%	8,185	5,015	3.86%	2.30%	316	115	432
2018	8,391	51.76%	48.24%	4,343	4,048	0.23%	0.00%	10	-	10
2019	13,594	56.25%	43.75%	7,646	5,948	0.09%	0.53%	7	32	38
2020	30,973	68.22%	31.78%	21,131	9,842	2.05%	1.06%	433	104	537
										335

Relative Run Size

Return Year	Wenatchee Total Return	Methow Total Return	Percent Wenatchee	Percent Methow
2011	23833	5885	80.20%	19.80%
2012	5837	2148	73.10%	26.90%
2013	1991	740	72.90%	27.10%
2014	34501	9654	78.14%	21.86%
2015	2517	1666	60.17%	39.83%
2016	2076	536	79.48%	20.52%
2017	8080	4950	62.01%	37.99%
2018	3976	3706	51.76%	48.24%
2019	6790	5282	56.25%	43.75%

Natural Origin Calculation Wenatchee

Return Year	Natural-origin Return	Total Return	Percent Natural Origin
2011	533	23833	2.24%
2012	297	5837	5.09%
2013	19	1991	0.95%
2014	1086	34501	3.15%
2015	65	2517	2.58%
2016	5	2076	0.24%
2017	312	8080	3.86%
2018	9	3976	0.23%
2019	6	6790	0.09%
2020	Avg 2014-19		2.05%

Natural Origin Calculation Methow

Return Year	Natural-origin Return	Total Return	Percent Natural Origin
2011	69	5885	1.17%
2012	0	2148	0.00%
2013	25	740	3.38%
2014	78	9654	0.81%
2015	22	1666	1.32%
2016	0	536	0.00%
2017	114	4950	2.30%
2018	0	3706	0.00%
2019	28	5282	0.53%
2020	Avg 2014-19		1.06%

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.
2. Table 27 of Yakama Nation Fisheries. 2020. Mid-Columbia Coho Reintroduction Monitoring and Evaluation Report
3. Table 53 of Yakama Nation Fisheries. 2020. Mid-Columbia Coho Reintroduction Monitoring and Evaluation Report

Figure 13. Annual natural-origin Coho passage at Rock Island during 2011-2020.

METHOD: PR FALL CHINOOK

Year	Total SUCH & FACH (1)	RI Nadir Dates SUCH to FACH	RI FACH Total	Reascension Correction Factor RI FACH RCF	% Ad-present (3)	FACH PRH Overshoot adjustment Ad-Present Natural Origin Fish	RI FACH Total
	Nadir Apportionment (1)			Natural Origin Correction Factors			Adjusted Natural Origin Estimate
2011	54,276	9/11/2011	8,207	81.59%	92.20%	85.96%	5,307
2012	60,488	9/7/2012	11,671	78.57%	77.30%	85.96%	6,093
2013	127,869	9/6/2013	58,650	89.16%	77.26%	85.96%	34,725
2014	107,688	9/13/2014	26,302	90.91%	85.84%	85.96%	17,643
2015	140,216	8/27/2015	39,157	97.87%	75.32%	85.96%	24,812
2016	103,517	9/1/2016	16,901	92.31%	75.87%	85.96%	10,174
2017	71,122	8/19/2017	15,570	68.75%	61.52%	85.96%	5,660
2018	49,289	8/25/2018	10,039	83.33%	83.46%	85.96%	6,001
2019	57,187	8/22/2019	13,159	61.54%	75.19%	85.96%	5,234
2020	85,361	8/24/2020	14,166	71.87%	13.03%	85.96%	1,141
							11,679

Year	PIT estimate PRH-origin at RI	Ad-present PRH-origin releases	Ad-present PRH Overshoots	Ad-Present Natural Origin Fish
	Fall Chinook Natural Origin Correction. Average PRH overshoot using PIT estimate and ad-present releases from PRH (4)		Apportionment of ad-present Fall Chinook	
2011	30.20%	46.50%	14.04%	85.96%
2012	30.20%	46.50%	14.04%	85.96%
2013	30.20%	46.50%	14.04%	85.96%
2014	30.20%	46.50%	14.04%	85.96%
2015	30.20%	46.50%	14.04%	85.96%
2016	30.20%	46.50%	14.04%	85.96%
2017	30.20%	46.50%	14.04%	85.96%
2018	30.20%	46.50%	14.04%	85.96%
2019	30.20%	46.50%	14.04%	85.96%
2020	30.20%	46.50%	14.04%	85.96%

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.
2. Buchanan, R.A., and J. R. Skalski. 2012-2020. Detection Efficiencies at Rock Island, Rocky Reach, and Tumwater
3. CPUD raw window count data
4. Richards, S. and T. Pearsons. 2021. Priest Rapids Hatchery Monitoring and Evaluation Annual Report for 2019-2020. The average value of PIT-tagged PRH-origin fall Chinook Salmon detected at Rock Island Dam was derived from Table 52 and included BY's 2010-2013. The average value of ad-present releases was derived from Table 15 and included BY's 2010-2013.

Figure 14. Annual natural-origin Fall Chinook passage at Rock Island during 2011-2020 for GPUD mitigation.

METHOD: PR SPRING CHINOOK

	Nadir Apportionment (1)		Reascension Correction % (2), (3)		Adjusted SPCH Counts for Reascension		Total WEN River Count	WEN River Natural Origin Correction	Adjusted WEN River Count	RR SPCH converting from PR	Total PR SPCH: Sum of WEN River and RR
Year	Nadir RR SPCH	Nadir PR SPCH	RR_SPCH RCF	PR_SPCH RCF	RR SPCH	PR SPCH	Delta: Adjusted PR SPCH Minus RR SPCH	% Natural	Natural Origin	Natural Origin	Natural Origin
2011	8,046	20,312	91.45%	98.33%	7,358	19,973	12,616	10.34%	1305	1,286	2591
2012	6,619	25,897	89.77%	98.28%	5,942	25,451	19,509	13.46%	2626	997	3623
2013	4,601	14,471	90.50%	100.00%	4,164	14,471	10,307	10.40%	1072	791	1863
2014	10,487	19,523	71.12%	98.75%	7,458	19,279	11,821	11.33%	1339	1,641	2980
2015	8,137	20,388	97.65%	98.99%	7,946	20,182	12,236	6.99%	856	1,207	2063
2016	5,553	12,592	98.67%	100.00%	5,479	12,592	7,113	11.01%	783	1,015	1798
2017	5,754	7,734	92.42%	98.04%	5,318	7,582	2,265	14.19%	321	613	934
2018	4,975	6,315	91.28%	100.00%	4,541	6,315	1,774	12.27%	218	650	868
2019	4,819	6,071	100.00%	100.00%	4,819	6,071	1,252	8.43%	106	446	552
2020	3,444	4,348	91.60%	98.00%	3,155	4,261	1,106	6.43%	71	426	497
											1777

Caracass Survey Data (8)			
Year	Natural Origin	Hatchery Origin	% Natural Origin
2011	100	234	29.94%
2012	253	308	45.10%
2013	131	516	20.25%
2014	211	177	54.38%
2015	128	190	40.25%
2016	210	93	69.31%
2017	83	133	38.43%
2018	66	243	21.36%
2019	66	335	16.46%
2020	108	232	31.76%

Wenatchee SPCH										
	Non-LNFH Wenatchee Spawning Escapement (4)		Estimated Natural-origin SPCH Escapement	Natural-origin Broodstock Collected (5)	Estimated Natural-origin Return	Hatchery-origin Escapement and Broodstock (5)	Sum of Hatchery and Natural Origin	LNFH Return To Icicle Creek (6)	Total Wenatchee Return	
Year	Total	Natural Origin Percentage	Total	Total	Total	Total	Total	Total	Total	Estimated Natural Origin Percentage
2011	3,376	29.94%	1011	80	1,091	2,466	3,557	6,990	10,547	10.34%
2012	2,845	45.10%	1283	68	1,351	1,611	2,962	7,074	10,036	13.46%
2013	2,242	20.25%	454	180	634	2,152	2,786	3,309	6,095	10.40%
2014	1,761	54.38%	958	85	1,043	2,157	3,200	6,005	9,205	11.33%
2015	1,657	40.25%	667	51	718	1,402	2,120	8,149	10,269	6.99%
2016	975	69.31%	676	128	804	1,221	2,025	5,277	7,302	11.01%
2017	705	38.43%	271	121	392	953	1,345	1,417	2,762	14.19%
2018	890	21.36%	190	90	280	1,026	1,306	976	2,282	12.27%
2019	888	16.46%	146	77	223	1,020	1,243	1,404	2,647	8.43%
2020	806	31.76%	256	115	371	885	1,256	4,511	5,767	6.43%

*2020 based on avg 2014-19

Non-Wenatchee Natural-origin SPCH Converting from PR to RR		
RR SPCH Estimate	Conversion Rate (7)	Conversion Rate Expanded PR SPCH
Total	Natural Origin PIT-Based PRD to RR	Total
1,286	100.00%	1,286
997	100.00%	997
791	100.00%	791
1,641	100.00%	1,641
1,207	100.00%	1,207
955	94.00%	1,015
613	100.00%	613
650	100.00%	650
446	100.00%	446
426	100.00%	426

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.
2. GPUD unpublished data
3. Buchanan, R.A., and J. R. Skalski. 2014-2020. Detection Efficiencies at Rock Island, Rocky Reach, and Tumwater Dam Adult Ladders (2014-2020). Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington
4. Derived from Table 6.25a in Hillman, T., M. Miller, M. Hughes, C. Moran, J. Williams, M. Tonseth, C. Willard, S. Hopkins, J. Caisman, T. Pearsons, and P. Graf. 2021. Monitoring and evaluation of the Chelan and Grant County
5. Derived from Table 5.1 and 6.4 in Hillman, T., M. Miller, M. Hughes, C. Moran, J. Williams, M. Tonseth, C. Willard, S. Hopkins, J. Caisman, T. Pearsons, and P. Graf. 2021. Monitoring and evaluation of the Chelan and Grant County PUDs hatchery programs: 2020 annual report.
6. USFWS. 2019. Monitoring and Evaluation of the Leavenworth National Fish Hatchery Spring Chinook Salmon Program, 2019.
7. Columbia River DART, Columbia Basin Research, University of Washington. (2021). PIT Tag Adult Returns Conversion Rate. Available from http://www.cbr.washington.edu/dart/query/pitadult_conrate.
8. Derived from Tables 5.32 and 6.26 in Hillman, T., M. Miller, M. Hughes, C. Moran, J. Williams, M. Tonseth, C. Willard, S. Hopkins, J. Caisman, T. Pearsons, and P. Graf. 2021. Monitoring and evaluation of the Chelan and Grant County PUDs hatchery programs: 2020 annual report.

Figure 15. Annual natural-origin Spring Chinook passage at Priest Rapids during 2011-2020 (Nadir Method).

METHOD: PR STEELHEAD

Year	DART PR Counts (1) Total	DART RR Count (1) Total	Reascension Correction % (2) PR STL RCF	Reascension Correction % (3) RR STL RCF	RCF Adjusted Subtotal PR_STL	RCF Adjusted Subtotal RR_STL	Delta PR-RR ("WEN ONLY") Total	Natural Origin Correction % Natural	WEN River Only Natural Origin Total	Expanded PIT from PR to RR Total RR Natural Origin	Sum of WEN River Only and Total RR Natural Origin Total PR Natural Origin
2011	20,757	15,280	96.33%	96.49%	19,995	14,744	5,252	36.44%	1914	2,373	4287
2012	17,230	13,100	95.99%	96.34%	16,539	12,621	3,919	27.92%	1094	1,991	3085
2013	15,011	9,201	94.99%	98.18%	14,260	9,034	5,226	53.51%	2796	1,090	3886
2014	19,843	10,587	97.65%	98.34%	19,377	10,411	8,966	47.26%	4238	2,816	7054
2015	14,316	10,894	97.65%	98.98%	13,980	10,783	3,197	39.86%	1274	3,105	4380
2016	6,498	5,728	96.36%	90.41%	6,262	5,179	1,083	52.46%	568	1,118	1686
2017	5,804	3,988	97.70%	95.11%	5,671	3,793	1,878	58.12%	1091	950	2042
2018	4,918	4,238	98.25%	96.49%	4,832	4,089	742	50.00%	371	1,080	1452
2019	3,924	3,298	97.67%	96.06%	3,833	3,168	664	67.57%	449	917	1366
2020	6,506	5,398	98.00%	98.49%	6,376	5,316	1,059	62.69%	664	1,330	1994
											3123

Dryden Stock Assessment Percent Natural Origin (4)			
Year	Hatchery	Natural	Percent Natural Origin
2011	143	82	36%
2012	191	74	28%
2013	53	61	54%
2014	106	95	47%
2015	86	57	40%
2016	29	32	52%
2017	49	68	58%
2018	47	47	50%
2019	48	100	68%
2020	25	42	63%

Year	RR (5) Total Natural Origin	Conversion Rate (6) Natural Origin PIT: PR to RR	Expanded PIT from PR to RR Total RR Natural Origin
2011	2,289	0.96	2,373
2012	1,991	1.00	1,991
2013	1,090	1.00	1,090
2014	2,816	1.00	2,816
2015	3,047	0.98	3,105
2016	1,080	0.97	1,118
2017	760	0.80	950
2018	982	0.91	1,080
2019	917	1.00	917
2020	1,330	1.00	1,330

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.
2. GPUD unpublished data
3. Buchanan, R.A., and J. R. Skalski. 2012-2020. Detection Efficiencies at Rock Island, Rocky Reach, and Tumwater Dam Adult Ladders (2012-2020). Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington
4. WDFW stock assessment data; "2011-2020 Dryden Steelhead Origins.xlsx" Provided 8/5/2021
5. See RR Steelhead Method
6. Columbia River DART, Columbia Basin Research, University of Washington. (2021). PIT Tag Adult Returns Conversion Rate. Available from http://www.cbr.washington.edu/dart/query/pitadult_conrate.

Figure 16. Annual natural-origin Steelhead passage at Priest Rapids during 2011-2020.

METHOD: PR SUMMER CHINOOK

	Nadir Apportionment (1)			Reascention Correction % (2)	Natural Origin Correction. GPUD Window Count Data (3)	Adjusted Natural Origin Estimate
Year	SPCH to SUCH	SUCH to FACH	PR SUCH	PR SUCH RCF	SUCH Natural Origin	PR SUCH Total
2011	6/10/2011	8/31/2011	61,773	100.0%	43.34%	26,773
2012	6/27/2012	8/27/2012	51,761	100.0%	38.36%	19,858
2013	6/12/2013	8/26/2013	80,814	100.0%	50.95%	41,175
2014	5/29/2014	8/26/2014	94,152	100.0%	66.46%	62,570
2015	5/26/2015	8/25/2015	96,402	98.8%	54.49%	51,908
2016	5/29/2016	8/20/2016	92,542	100.0%	57.30%	53,028
2017	6/12/2017	8/16/2017	55,277	100.0%	47.08%	26,024
2018	6/6/2018	8/21/2018	44,611	100.0%	26.80%	11,957
2019	6/3/2019	8/18/2019	44,286	100.0%	21.66%	9,592
2020	5/31/2020	8/30/2020	76,735	100.0%	33.80%	25,935
						32,882

Data Sources

1. Columbia River DART, Columbia Basin Research, University of Washington. (2021). Adult Passage Daily Counts. Available from http://www.cbr.washington.edu/dart/query/adult_daily.
2. GPUD unpublished data.
3. Grant PUD raw window count data 2011-2020

Figure 17. Annual natural-origin Summer Chinook passage at Priest Rapids during 2011-2020.

Comparison Between Natural-origin Adult Enumeration Methods for 2013 and 2023 Recalculation Efforts

Table 6. Summary and comparison of methods used during 2013 and 2023 recalculation efforts

Project	Species	2013 Method Summary	2023 Method Summary
Wells	Spring Chinook	Natural-origin spring Chinook returns at Wells were calculated using stock assessment data provided by WDFW. Returns were adjusted for broodstock removals, fallback, and double counts.	Same
Wells	Steelhead	Natural-origin steelhead returns at Wells were calculated using Wells stock assessment data provided by WDFW. Returns were adjusted for broodstock removals, fallback, and double counts.	Same
Wells	Summer Chinook	Funding for CJH. Recalculation was not used	Summer Chinook adults were enumerated at Wells using total Chinook counts from DART and then subtracting spring-Chinook based on stock assessments at Wells by WDFW. The proportion of natural-origin summer Chinook were also obtained from stock assessments at Wells and then applied to the remainder to estimate total natural-origin summer Chinook passage.
Wells	Coho	N/A	Hatchery- and natural-origin proportions were applied to annual DART counts at Wells. Hatchery- and natural-origin proportions were provided by the Yakama Nation through M&E reporting on Methow program (Caisman et al. 2020).
Rocky Reach	Spring Chinook	Natural-origin spring Chinook returns at Rocky Reach were calculated by first apportioning spring Chinook by average nadir date and then subtracting unmarked hatchery fish based on 1) Wells/WDFW stock assessment data and 2) PIT expansion of HORs using conversion rate from RR to Wells. The availability of PIT data was limited to HORs and only a	Natural-origin spring Chinook returns at Rocky Reach were calculated based on the conversion rate of NORs from RR to Wells and Entiat escapement. Specifically, the availability of 1) PIT data for natural origin fish and all return years (2011-2020) allowed for the direct calculation of natural origin spring Chinook at Rocky Reach using 1) Wells/WDFW stock assessment data for NORs and 2) PIT expansion of NORs using conversion rate from Wells. NORs returning

Project	Species	2013 Method Summary	2023 Method Summary
		fraction of return years, therefore it was only possible to remove unmarked hatchery fish for 2006-2010 return years.	to the Entiat (USFWS data) were subsequently added to the expanded RR count. This method directly solves for NORs and reflects data that were not previously available during the earlier recalculation. In addition, this approach uses 10 return years (instead of 5 return years) because of the availability of NOR PIT data for all return years.
Rocky Reach	Steelhead	Natural-origin steelhead returns at Rocky Reach were calculated by adjusting RR window counts by NOR percentage using data obtained from Wells stock assessment efforts.	Natural-origin steelhead returns at Rocky Reach were calculated by adjusting window counts by 1) NOR percentage using Wells stock assessment data, and 2) fallback correction factor[1] data for 2012-2020 return years were used to correct window counts for multiple ascension attempts. Entiat steelhead were considered separately because they do not convert to Wells dam and therefore may influence the hatchery to natural-origin ratio. The estimated number of Entiat NORs were subsequently added to the total for Rocky Reach. The previous recalculation method did not account for the Entiat River specifically and therefore may have had additional error associated with the hatchery to natural-origin ratio
Rocky Reach	Summer and Fall Chinook	Natural-origin summer/fall Chinook counts were based on window counts with stock apportionment by nadir date as adjusted by the percentage of NORs. Nadir apportionment was based on the average nadir date of all return years. Hatchery and natural-origin percentages were determined using adipose fin observations from fish counting windows and the percent NOR was applied to the nadir count. Clipped and unclipped adult data records were only available in 2002 and thereafter.	Natural-origin summer/fall Chinook counts were based on window counts with stock apportionment by nadir date as adjusted by 1) the percentage of NORs, and 2) fallback correction factor[1] data. Nadir apportionment was based on 1) individual return years and 2) summer and fall runs within each year. Hatchery and natural-origin percentages were determined using adipose fin observations from fish counting windows for all return years. The estimates for the current recalculation effort are likely to be more accurate than the previous recalculation effort because the individual nadir year approach was used instead of the "average" to capture annual variability in run timing. In addition, fallback correction factor[1] data were available and used to correct window counts for multiple ascension attempts for both summer and fall Chinook.
Rocky Reach	Coho	N/A	Hatchery- and natural-origin proportions were applied to annual DART counts at Rocky Reach. Hatchery- and natural-origin proportions were provided by the Yakama Nation through M&E reporting on Methow program (Caisman et al. 2020).
Rock Island	Sockeye	Wenatchee natural-origin sockeye returns at Rock Island were calculated by 1) subtracting window counts at Rock	Wenatchee natural-origin sockeye returns at Rock Island were calculated by 1) subtracting window counts at Rock Island from

Project	Species	2013 Method Summary	2023 Method Summary
		Island from window counts at Rocky Reach and 2) applying NOR percentage data obtained from PRD stock assessment efforts.	window counts at Rocky Reach and 2) applying fallback correction factor[1] data to correct window counts for multiple ascension attempts. There was no hatchery program in the Wenatchee during the period of record so NOR percentage was not considered.
Rock Island	Spring Chinook	Natural-origin spring Chinook returns at Rock Island were calculated by first apportioning spring Chinook by average nadir date and then subtracting unmarked hatchery fish based on 1) Wells/WDFW stock assessment data and 2) PIT expansion of HORs using conversion rate from RI to Wells. The availability of PIT data was limited to HORs and only a fraction of return years, therefore it was only possible to remove unmarked hatchery fish for 2006-2010 return years.	The nadir method first apportioned spring Chinook from window counts using the nadir date for each return year. For the Wenatchee River, spring Chinook counts were subsequently adjusted by 1) the percentage of NORs observed in the Wenatchee River, and 2) fallback correction factor[1] data. NORs upstream of Rock Island were estimated using a PIT tag-based expansion derived from the RI to RR conversion rate of NORs. This method is an improvement over the previous recalculation approach because it solves for NORs directly. In addition, the nadir method used uses new data sources that were not previously available during the earlier recalculation (e.g., NOR PIT data) and expand the period of record from 5 years (2006-2010) to 10 years (2011-2020).
Rock Island	Steelhead	Natural-origin steelhead returns at Rock Island were calculated by adjusting RI window counts by NOR percentage obtained from PRD stock assessment. The PRD stock assessment historically relied on visual assessments of elastomer tags to identify unclipped hatchery fish (up to brood year 2010 and return year 2014). However, elastomer tag loss was not corrected for and therefore PRD estimates likely inflated the number of NORs present. In addition, PRD stock assessment results include significant numbers of hatchery origin returns from Ringold and other unidentified hatchery locations. As a result, hatchery-origin to natural-origin ratios derived from PRD stock assessment data are not expected to be reflective of ratios expected for upstream tributaries.	Natural-origin steelhead returns at Rock Island were calculated by 1) estimating Wenatchee origin NORs and adding these to 2) PIT expanded NORs calculated for RR. The Wenatchee NOR component was calculated by subtracting RR window counts from RI window counts (after applying fallback correction factor[1] data to correct window counts for multiple ascension attempts) and then applying the percentage NOR obtained from Dryden stock assessment activities. The PIT expanded NOR calculation for RR was based on the conversion rate for NORs from RI to RR. This method uses natural origin return PIT data that were not previously available and uses stock assessment data from WDFW collected at two sources (Dryden and Wells). The use of Dryden and Wells stock assessment data allows for comparison with other M&E tributary data to verify count accuracy. For example, the estimated average Dryden-based count of Wenatchee steelhead is 887 for return years 2011-2020 which is higher but similar to the average Wenatchee NORs for contributing brood years (Avg = 865; BY =

Project	Species	2013 Method Summary	2023 Method Summary
			2008-2014) and more than the average of the combined harvest, escapement, and brood collection of NORs for return years 2011-2020 (Avg = 547). In short, the calculated adult returns numbers are likely higher than the actual number of NORs present.
Rock Island	Summer and Fall Chinook	Natural-origin summer/fall Chinook counts were based on window counts with stock apportionment by nadir date as adjusted by the percentage of NORs. Nadir apportionment was based on the average nadir date of all return years. Hatchery and natural-origin percentages were determined using adipose fin observations from fish counting windows and the percent NOR was applied to the nadir count. Clipped and unclipped adult data records were only available in 2002 and thereafter. Fall Chinook overshoots from PRD were corrected for by using PIT detections at RI and juvenile fall Chinook marking data from PRD	Natural-origin summer/fall Chinook counts were based on window counts with stock apportionment by nadir date as adjusted by 1) the percentage of NORs, and 2) fallback correction factor[1] data. Nadir apportionment was based on 1) individual return years and 2) summer and fall runs within each year. Adipose-present hatchery-origin fall Chinook from PR hatchery were corrected for by using PIT detections at RI and juvenile fall Chinook marking data from PR hatchery. Hatchery and natural-origin percentages were determined using adipose fin observations from fish counting windows for all return years. The estimates for the current recalculation effort are likely to be more accurate than the previous recalculation effort because the individual nadir year approach was used instead of the "average" to capture annual variability in run timing. In addition, fallback correction factor[1] data were available and used to correct window counts for multiple ascension attempts for both summer and fall Chinook.
Rock Island	Coho	N/A	Hatchery- and natural-origin proportions were applied to annual DART counts at Rock Island. Hatchery- and natural-origin proportions were provided by the Yakama Nation through M&E reporting on Methow and Wenatchee programs (Caisman et al. 2020).
Priest Rapids	Fall Chinook	Natural-origin fall Chinook counts were based on window counts at Rock Island and stock apportionment by nadir date as adjusted by the percentage of NORs. Nadir apportionment was based on the average nadir date of all return years. Hatchery and natural-origin percentages were determined using adipose fin observations from fish counting windows and the percent NOR was applied to the nadir count. Clipped and unclipped adult data records were only available between 2007 and 2010, and therefore limited the period of record to 4 years.	Natural-origin fall Chinook counts were based on window counts at Rock Island with stock apportionment by nadir date as adjusted by 1) the percentage of NORs, and 2) reascension correction factor[2] data. Nadir apportionment was based on 1) individual return years and 2) summer and fall runs within each year. Adipose-present hatchery-origin fall Chinook from PR hatchery were corrected for by using PIT detections at RI and juvenile fall Chinook marking data from PR hatchery. Hatchery and natural-origin percentages were determined using adipose fin observations from fish counting windows for all return years. The estimates for the current recalculation effort are likely to be more accurate than the previous recalculation effort

Project	Species	2013 Method Summary	2023 Method Summary
			because the individual nadir year approach was used instead of the "average" to capture annual variability in run timing. In addition, reascension correction factor[2] data were available and used to correct window counts for multiple ascension attempts for both summer and fall Chinook.
Priest Rapids	Spring Chinook	Natural-origin spring Chinook counts were based on window counts at Priest Rapids and stock apportionment by nadir date as adjusted by the percentage of NORs. Nadir apportionment was based on the average nadir date of all return years. Natural-origin spring Chinook salmon were estimated as unclipped fish at Priest Rapids Dam minus unclipped hatchery fish at Wells adjusted by conversion rates between Priest Rapids Dam and Wells Dam. Clipped and unclipped adult data records were only available between 2007 and 2010, and therefore limited the period of record to 4 years.	Natural-origin spring Chinook counts at Priest Rapids use similar method as Rock Island spring Chinook except the counting location and PIT tag expansion uses Priest Rapids as the control point (not Rock Island). See Rock Island 2023 spring Chinook method. The new method is an improvement over the previous recalculation approach because NORs are calculated directly and new data sources expand the period of record from 4 years (2007-2010) to 10 years (2011-2020).
Priest Rapids	Steelhead	Natural origin steelhead counts were based on window counts at Priest Rapids Dam as adjusted by NOR percentage. NOR percentage was calculated using stock assessment data collected from PRD.	Natural-origin steelhead counts at Priest Rapids use similar method as Rock Island steelhead except the counting location and PIT tag expansion uses Priest Rapids as control point (not Rock Island). See Rock Island 2023 steelhead method.
Priest Rapids	Summer Chinook	Natural-origin Summer Chinook counts were based on window counts at Priest Rapids and stock apportionment by nadir date as adjusted by the percentage of NORs. Nadir apportionment was based on the average nadir date of all return years. Hatchery and natural-origin percentages were determined using adipose fin observations from fish counting windows and the percent NOR was applied to the nadir count. Clipped and unclipped adult data records were only available between 2007 and 2010, and therefore limited the period of record to 4 years.	Natural-origin Summer Chinook counts were based on window counts at Priest Rapids and stock apportionment by nadir date as adjusted by 1) the percentage of NORs and 2) reascension correction[2] factor. Nadir apportionment was based on the individual nadir date for each return year. Hatchery and natural-origin percentages were determined using adipose fin observations from fish counting windows and the percent NOR was applied to the nadir count. Clipped and unclipped adult data records were available for all return years. The estimates for the current recalculation effort are likely to be more accurate than the previous recalculation effort because the individual nadir year approach was used instead of the "average" to capture annual variability in run timing. In addition, window counts were corrected for multiple ascension attempts and counts for all return years have been included.

Notes

1. The fallback correction factor is used to adjust window counts for multiple ascension attempts or fallback to attain estimates of run size. The fallback correction factor is estimated based on observed PIT-tag detections in the adult ladders and reflect the ratio of number of unique fish to number of passage attempts. Fallback correction factors were calculated by Columbia Basin Research: *Buchanan, R.A., and J. R. Skalski. 2012-2020. Detection Efficiencies at Rock Island, Rocky Reach, and Tumwater Dam Adult Ladders (2012-2020). Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington*

2. Fallback Correction Factor = Reascension Correction Factor

Project Survival and Unavoidable Project Mortality Data

Project survival and associated unavoidable project mortality values are summarized in Table 7. Updated values for Rock Island yearling Chinook are anticipated upon completion of a project survival study in 2021.

Table 7. Summary of project survival and unavoidable project mortality data based on completed survival studies or other agreements.

Project	Species	Project Survival	UPM
Wells	Spring Chinook	96.04%	3.96%
Wells	Summer/Fall Chinook Subyearling	93.00%	7.00%
Wells	Summer/Fall Chinook Yearling	96.04%	3.96%
Wells	Steelhead	96.04%	3.96%
Wells	Sockeye	93.00%	7.00%
Wells	Coho	96.04%	3.96%
Rock Island	Spring Chinook	93.75%	6.25%
Rock Island	Summer/Fall Chinook Subyearling	93.00%	7.00%
Rock Island	Summer/Fall Chinook Yearling	93.75%	6.25%
Rock Island	Steelhead	96.75%	3.25%
Rock Island	Sockeye	93.27%	6.73%
Rock Island	Coho	93.00%	7.00%
Rocky Reach	Spring Chinook	93.00%	7.00%
Rocky Reach	Summer/Fall Chinook Subyearling	93.00%	7.00%
Rocky Reach	Summer/Fall Chinook	93.00%	7.00%
Rocky Reach	Steelhead	95.79%	4.21%
Rocky Reach	Sockeye	93.59%	6.41%
Rocky Reach	Coho	93.00%	7.00%
PRD/WAN	Spring Chinook	86.59%	13.41%
PRD/WAN	Summer/Fall Chinook Subyearling	86.49%	13.51%
PRD/WAN	Summer/Fall Chinook Yearling	86.59%	13.41%
PRD/WAN	Steelhead	87.03%	12.97%
PRD/WAN	Sockeye	91.70%	8.30%

Natural-origin Spawner Distribution

The average number and relative distribution of natural-origin spawners is summarized in Table 8. Data were compiled from the Washington State Department of Fish and Wildlife "SCORE" website[1] and hatchery monitoring and evaluation annual reports[2]. During the previous recalculation effort, natural-origin spawner distributions contributed to the apportionment of hatchery production among facilities. Specifically, the spawner data (and other factors) were used to populate the "proportion" of hatchery compensation allocated to individual facilities in developing the sensitivity analysis (Table 8).

Table 8. Natural-origin spawner distribution for the period of 2011-2020

Species	Stock_Tributary	Average NOS (2011-2020)	Percent Distribution Above RI	Percent Distribution Above RR	Percent Distribution Above Wells
Spring Chinook	SPCH_METH	341	28%	62%	100%
Spring Chinook	SPCH_ENTI	209	17%	38%	
Spring Chinook	SPCH_WEN	673	55%		
		Species Total (N)	1223	550	341
Steelhead	STL_METH	677	40%	56%	75%
Steelhead	STL_OKAN	224	13%	18%	25%
Steelhead	STL_ENTI	314	19%	26%	
Steelhead	STL_WEN	471	28%		
		Species Total (N)	1687	1215	901
Summer Chinook	SUCH_METH	1,367	10%	16%	18%
Summer Chinook	SUCH_OKAN	6,357	46%	76%	82%
Summer Chinook	SUCH_ENTI	225	2%	3%	
Summer Chinook	SUCH_CHEL	468	3%	6%	
Summer Chinook	SUCH_WEN	5,508	40%		
		Species Total (N)	13924	8417	7723
Sockeye	SOCK_OKAN	170,143	82%	100%	100%
Sockeye	SOCK_WEN	38,173	18%		
		Species Total (N)	208316	170143	170143
Coho	COHO_METH	45	13%	100%	100%
Coho	COHO_ WEN	289	87%		
		Species Total (N)	334	45	45

1 https://fortress.wa.gov/dfw/score/

2 Hillman, T., M. Miller, M. Hughes, C. Moran, J. Williams, M. Tonseth, C. Willard, S. Hopkins, J. Caisman, T. Pearsons, and P. Graf. 2021. Monitoring and evaluation of the Chelan and Grant County PUDs hatchery programs: 2020 annual report.

Snow, C., C. Frady, D. Grundy, B. Goodman, G. Mackey, and A. Haukenes. 2021. Monitoring and evaluation of the Wells Hatchery and Methow Hatchery programs: 2020 annual report. Report to Douglas PUD, Grant PUD, Chelan PUD, and the Wells and Rocky Reach HCP Hatchery Committees, and the Priest Rapids Hatchery Subcommittees, East Wenatchee, WA.

Table 9. Historic calculated hatchery compensation rates for natural-origin returns at mid-Columbia projects for 2013-2024 illustrating the proportion (orange highlight) of hatchery compensation allocated to specific hatcheries.

Project	Species	Ave. wild returns	Project survival	Less adults	Hatchery	Proportion	SAR	Smolts owed
WEL	SpCH	568	0.9630	21.8	Methow	100%	0.234%	9,326
	SuCH	15,531	0.9630	596.7	Wells	25%	1.236%	12,066
					Chief Joe	75%	1.227%	36,475
	StHD	992	0.9630	38.1	Wells	100%	1.137%	3,352
RRH	SpCH	717	0.9300	54.0	Methow	100%	0.234%	23,063
	SuCH	25,991	0.9300	1,956.3	Chelan Falls	100%	1.320%	148,205
					Similkameen	0%	1.227%	-
	StHD	1,310	0.9579	57.6	Chiwawa	100%	1.262%	4,562
RIS	SpCH	1,534	0.9375	102.3	Chiwawa	100%	0.540%	18,938
					Methow	0%	0.234%	-
	SuCH	43,990	0.9375	2,932.7	Dryden	60%	0.632%	278,418
					Carlton	0%	0.205%	-
					Similkameen	40%	1.227%	95,604
	StHD	3,606	0.9675	121.1	Chiwawa	100%	1.262%	9,598
PRD	SpCH	1,885	0.8659	291.9	White/Nason	50%	0.540%	27,030
					Methow	50%	0.234%	62,377
	SuCH	22,739	0.8659	3,521.5	Dryden	65%	0.632%	362,184
					Carlton	9%	0.205%	154,604
					Chief Joe	26%	1.227%	74,621
	FaCH	8,619	0.8659	1,334.7	Priest Rapids	100%	0.410%	325,543
	StHD	4,003	0.8105	935.9	Wells	100%	1.137%	82,281

SAR Data

Smolt to adult return (SAR) rates were calculated for individual public utility district hatchery programs. The brood years included in the calculations represent those brood years that are expected to contribute to the adult return years of 2011-2020 (see Tables 1-4). This approach uses a 10-year adult return window and maximizes the number of relevant brood year SARs that are included. It should be noted that if the brood year SARs are not linked with their associated adult return years, changes in hatchery performance will be muted by variability in ocean productivity and the resultant hatchery compensation values will primarily reflect the extent of the mismatch between the ocean productivity experienced by adult returns and the decoupled brood years (as opposed to hatchery performance). For the current recalculation effort, complete brood year SARs from the previous recalculation were not used. However, because a single brood year may span multiple adult return years, it is impossible to generate continuous brood year SARs that do not overlap recalculation periods (Figure 19). Therefore, an incomplete brood year from one recalculation period may contribute to and remain relevant in the next recalculation period as it is updated with additional returns.

Adult Returns Recalculation Period 1 (2006–2010) | Adult Returns Recalculation Period 2 (2011–2015)

Adult Return Year

	Brood Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	2004	Age 3	Age 4	Age5							
	2005		Age 3	Age 4	Age5						
	2006			Age 3	Age 4	Age5					
Overlapping Brood Years	2007				Age 3	Age 4	Age5				
	2008					Age 3	Age 4	Age5			
	2009						Age 3	Age 4	Age5		
	2010							Age 3	Age 4	Age5	
	2011								Age 3	Age 4	Age5
	2012									Age 3	Age 4

Figure 18. Illustration of brood years overlapping recalculation periods

The following sections provide an overview of the SAR calculation method for individual species and stocks. For Chinook stocks, the proposed method for calculating SARs includes: Alternating between 1) PIT data from Project or upstream detection locations plus CWT data from downstream harvest ["PIT + CWT harvest"]; and 2) CWT-based SARs obtained directly from annual reports ["CWT"; e.g., Hillman et al. 2021].

The alternation sequence begins with the first brood year populated with a PIT + CWT harvest value followed by the second brood year populated with a CWT value and continues thereafter for all relevant brood years (e.g., BY1 = PIT + CWT harvest; BY2 = CWT; BY3 = PIT + CWT harvest; BY 4 = CWT; etc.). For spring and fall Chinook with 8 relevant brood years, SAR data includes 4 brood years populated with PIT + CWT harvest data and 4 brood years populated with CWT data. For summer Chinook with 9 relevant brood years, SAR data includes 5 brood years populated with PIT + CWT harvest data and 4 brood years populated with CWT data. In instances where an initial relevant brood year lacked PIT data, the inclusion of PIT + CWT harvest values began at the first brood year where PIT data became available and alternated thereafter with CWT values. Where PIT data were available for less than the target number of brood years (i.e., 4 years for spring and fall Chinook and 5 years for summer Chinook), all available PIT + CWT harvest data were used regardless of sequence with CWT data. After selecting the SAR data for the relevant brood years (e.g., PIT + CWT harvest or CWT), the arithmetic mean of all values was calculated for each stock.

The mixing of two different SAR data sets for Chinook Salmon has been proposed as a compromise to facilitate continued progress with the current hatchery recalculation process as there is disagreement among the Hatchery Committee members on how SARs should be calculated to support hatchery recalculation.

Spring Chinook

For Spring Chinook, PIT + CWT harvest data were obtained from the following sources: 1) PIT tag data from release to detection at individual hydroprojects or upstream location, and 2) CWT harvest data for downstream ocean, Zone 1-5 commercial, recreational, and Tribal fisheries. CWT data were obtained from annual reports (e.g., Hillman et al. 2021; Snow et al. 2021)

Summer Chinook

For Summer Chinook, PIT + CWT harvest data were obtained from the following sources: 1) PIT tag data from release to adult detection at individual hydroprojects or upstream locations, and 2) CWT harvest data for downstream ocean, Zone 1-5 commercial, and Zone 6 Tribal fisheries. CWT data were obtained from annual reports (e.g., Hillman et al. 2021; Snow et al. 2021)

Fall Chinook

For Fall Chinook PIT + CWT harvest were obtained from the following sources: 1) PIT tag data from release to adult detection at McNary Dam, and 2) CWT data obtained from downstream ocean, Zone 1-5 commercial, recreational, and Tribal fisheries. McNary Dam was used as a control point because significant numbers of adult fall Chinook spawners use the Hanford Reach. CWT data were obtained from annual reports (e.g., Richards and Pearsons 2021)

Steelhead

Summer Steelhead SARs were calculated using 1) PIT tag data from release to detection at Bonneville Dam or 2) stock assessment data if PIT tags were not available for a given brood year.

Sockeye

Hatchery production did not occur in the Wenatchee basin and hatchery SARs were not calculated. Therefore, natural-origin SARs were calculated based on run reconstruction using smolt production and adult return estimates from Hillman et al. 2021.

Table 10 summarizes the calculated SARs for the PUD hatchery facilities and includes the brood years that were considered (based on Tables 1-3). Table 11 provides specific detail for individual brood year SARs.

Coho

Coho SARs were obtained from the Yakama Nation Mid-Columbia Coho Reintroduction Monitoring and Evaluation Report for 2019 for the Wenatchee and Methow programs. Pit data were also obtained from the WINT and WINTBC programs to support SAR estimates to Wells for the Twisp program.

Table 10. Summary of average hatchery smolt to adult return data for public utility district hatchery programs

Species	Program	Brood Years Included (Current Recalculation)	Brood Years included (Previous Recalculation)	Avg. SAR[1]	Project-based SAR: Avg. Priest Rapids SAR	Project-based SAR: Avg. Rock Island SAR	Project-based SAR: Avg. Wells SAR	Data Used
Spring Chinook								
	Chiwawa	2007-2014; N = 8	2002-2004, 2007[2], 2008[2]			0.525%[3]		Project/Upstream PIT + Downstream CWT harvest: 2007, 2009, 2011, 2013; M&E CWT only: 2008, 2010, 2012, 2014
	Nason	2013-2014	N/A		0.480%			Nason data were available for 2 brood years: 2013 and 2014
	Methow	2007-2014; N = 8	2001-2005		0.527%	0.527%	0.527%	Project/Upstream PIT + Downstream CWT harvest: 2008, 2010, 2012, 2014; M&E CWT only: 2007, 2009, 2011, 2013
Summer Chinook								
	Carlton	2006-2014; N = 9	2000-2004		0.827%			Project/Upstream PIT + Downstream CWT harvest: 2008, 2009, 2012, 2013, 2014; M&E CWT only: 2006, 2007, 2010, 2011
	Chelan Falls	2006-2014; N = 9	2000-2004		1.879%	1.789%[3]		Project/Upstream PIT + Downstream CWT harvest: 2007, 2010, 2012, 2013, 2014; M&E CWT only: 2006, 2008, 2009, 2011
	Dryden	2006-2014; N = 9	2000-2004		0.800%	0.782%[3]		Project/Upstream PIT + Downstream CWT harvest: 2008, 2011, 2012, 2013, 2014; M&E CWT only: 2006, 2007, 2009, 2010
	Similkameen	2006-2014; N = 9	2000-2004		2.076%	1.993%[3]		Project/Upstream PIT + Downstream CWT harvest: 2008, 2009, 2011; M&E CWT only: 2006, 2007, 2010, 2012, 2013, 2014
	Wells	2006-2014; N = 9	N/A				1.412%	CWT data used for all years
Fall Chinook								
	Priest Rapids Hatchery	2006-2013; N = 8	2001-2005		1.433%			Project/Upstream PIT + Downstream CWT harvest: 2007, 2009, 2011, 2013; M&E CWT only: 2006, 2008, 2010, 2012
Steelhead								
	Chiwawa/Wenatchee	2008-2015; N = 8	2001-2003, 2006, 2007	0.581%				PIT release to BON: 2008-2015
	Okanogan	2008-2015; N = 8		0.609%				PIT release to BON: 2008-2015

	Wells & Methow	2008-2015; N = 8	2002-2006	0.869%		M&E Report 2008; PIT release to BON: 2009-2015
Sockeye						
	Wenatchee	2007-2015; N = 8	2002, 2003, 2006-2008[2]	6.31%[4]		No hatchery program (natural-origin run reconstruction from M&E Report)
Coho						
	Wenatchee	2008-2016: N = 9	N/A	0.413%		YN M&E Data from2019 Mid-C Coho Reintroduction and Monitoring Report
	Methow	2008-2016: N = 9	N/A	0.268%		YN M&E Data from2019 Mid-C Coho Reintroduction and Monitoring Report
	Twisp	2008-2018: N=11	N/A		0.915%	PIT data from WINT and WINTBC programs

Notes:

1. A single average SAR estimate was calculated for steelhead and Sockeye Salmon.
2. Incomplete brood years previously calculated with PIT Data
3. PIT data corrected for detection efficiency: (Spring Chinook Avg = 0.9135, Summer Chinook Avg = 0.9179; Buchanan, R.A., and J. R. Skalski. 2012-2020. Detection Efficiencies at Rock Island, Rocky Reach, and Tumwater Dam Adult Ladders (2012-2020). Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington
4. Natural-origin SAR. No hatchery program.

Table 11. Smolt to adult return data for individual public utility hatcheries.

				Project SAR based on Alternating PIT and CWT Data			
Species	**Program**	**Brood Year**	**Single SAR**	**SAR PRD**	**SAR RI**	**SAR Wells**	**SAR Data Notes**
SPCH	Chiwawa	2007		0.71%	0.65%		PIT + CWT harvest, detections at or upstream of project
SPCH	Chiwawa	2008		0.64%	0.64%		CWT
SPCH	Chiwawa	2009		0.59%	0.61%		PIT + CWT harvest, detections at or upstream of project
SPCH	Chiwawa	2010		0.62%	0.62%		CWT
SPCH	Chiwawa	2011		0.99%	0.73%		PIT + CWT harvest, detections at or upstream of project
SPCH	Chiwawa	2012		0.37%	0.37%		CWT
SPCH	Chiwawa	2013			0.33%		PIT + CWT harvest, detections at or upstream of project
SPCH	Chiwawa	2014			0.26%		CWT
SPCH	Nason (PRD)	2013		0.480%			PIT + CWT harvest, detections at or upstream of project
SPCH	Nason (PRD)	2014		0.480%			CWT
SPCH	Methow	2007		0.46%	0.46%	0.46%	CWT
SPCH	Methow	2008		1.32%	1.32%	1.32%	PIT + CWT harvest, detections at or upstream of project; first PIT data year
SPCH	Methow	2009		0.22%	0.22%	0.22%	CWT
SPCH	Methow	2010		0.88%	0.88%	0.88%	PIT + CWT harvest, detections at or upstream of project
SPCH	Methow	2011		0.83%	0.83%	0.83%	CWT
SPCH	Methow	2012		0.17%	0.17%	0.17%	PIT + CWT harvest, detections at or upstream of project
SPCH	Methow	2013		0.14%	0.14%	0.14%	CWT
SPCH	Methow	2014		0.20%	0.20%	0.20%	PIT + CWT harvest, detections at or upstream of project
SUCH	Carlton	2006		0.91%			CWT
SUCH	Carlton	2007		0.12%			CWT
SUCH	Carlton	2008		2.45%			PIT + CWT harvest, detections at or upstream of project; first PIT data year
SUCH	Carlton	2009		0.18%			PIT + CWT harvest, detections at or upstream of project
SUCH	Carlton	2010		0.41%			CWT
SUCH	Carlton	2011		1.10%			CWT
SUCH	Carlton	2012		0.14%			PIT + CWT harvest, detections at or upstream of project
SUCH	Carlton	2013		0.69%			PIT + CWT harvest, detections at or upstream of project
SUCH	Carlton	2014		1.45%			PIT + CWT harvest, detections at or upstream of project
SUCH	Dryden	2006		1.13%	1.13%		CWT
SUCH	Dryden	2007		0.11%	0.11%		CWT
SUCH	Dryden	2008		1.99%	2.00%		PIT + CWT harvest, detections at or upstream of project; first PIT data year
SUCH	Dryden	2009		0.51%	0.51%		CWT
SUCH	Dryden	2010		0.38%	0.38%		CWT

				Project SAR based on Alternating PIT and CWT Data			
Species	**Program**	**Brood Year**	**Single SAR**	**SAR PRD**	**SAR RI**	**SAR Wells**	**SAR Data Notes**
SUCH	Dryden	2011		1.30%	1.22%		PIT + CWT harvest, detections at or upstream of project
SUCH	Dryden	2012		0.51%	0.50%		PIT + CWT harvest, detections at or upstream of project
SUCH	Dryden	2013		0.82%	0.77%		PIT + CWT harvest, detections at or upstream of project
SUCH	Dryden	2014		0.45%	0.43%		PIT + CWT harvest, detections at or upstream of project
SUCH	Chelan Falls	2006		2.82%	2.82%		CWT
SUCH	Chelan Falls	2007		1.73%	1.75%		PIT + CWT harvest, detections at or upstream of project; first PIT data year
SUCH	Chelan Falls	2008		2.07%	2.07%		CWT
SUCH	Chelan Falls	2009		1.13%	1.13%		CWT
SUCH	Chelan Falls	2010		2.99%	2.58%		PIT + CWT harvest, detections at or upstream of project
SUCH	Chelan Falls	2011		1.81%	1.81%		CWT
SUCH	Chelan Falls	2012		1.44%	1.42%		PIT + CWT harvest, detections at or upstream of project
SUCH	Chelan Falls	2013		1.17%	0.94%		PIT + CWT harvest, detections at or upstream of project
SUCH	Chelan Falls	2014		1.76%	1.59%		PIT + CWT harvest, detections at or upstream of project
SUCH	Similkameen	2006		2.28%	2.28%		CWT
SUCH	Similkameen	2007		0.81%	0.81%		CWT
SUCH	Similkameen	2008		2.99%	3.04%		PIT + CWT harvest, detections at or upstream of project; first PIT data year
SUCH	Similkameen	2009		1.89%	1.52%		PIT + CWT harvest, detections at or upstream of project
SUCH	Similkameen	2010		1.75%	1.75%		CWT
SUCH	Similkameen	2011		3.77%	3.35%		PIT + CWT harvest, detections at or upstream of project
SUCH	Similkameen	2012		2.50%	2.50%		CWT
SUCH	Similkameen	2013		0.90%	0.90%		CWT; data source Andrea Pearl CCT-Harvest included
SUCH	Similkameen	2014		1.79%	1.79%		CWT; data source Andrea Pearl CCT-Harvest included
SUCH	Wells	2006				2.169%	CWT
SUCH	Wells	2007				0.442%	CWT
SUCH	Wells	2008				1.609%	CWT
SUCH	Wells	2009				1.647%	CWT
SUCH	Wells	2010				0.895%	CWT
SUCH	Wells	2011				2.619%	CWT
SUCH	Wells	2012				1.112%	CWT
SUCH	Wells	2013				1.034%	CWT
SUCH	Wells	2014				1.180%	CWT
FACH	Priest Rapids Hatchery	2006		0.05%			CWT
FACH	Priest Rapids Hatchery	2007		1.72%			PIT + CWT harvest, detections at McNary; first PIT data year
FACH	Priest Rapids Hatchery	2008		0.33%			CWT

				Project SAR based on Alternating PIT and CWT Data			
Species	Program	Brood Year	Single SAR	SAR PRD	SAR RI	SAR Wells	SAR Data Notes
FACH	Priest Rapids Hatchery	2009		1.95%			PIT + CWT harvest, detections at McNary
FACH	Priest Rapids Hatchery	2010		3.10%			CWT
FACH	Priest Rapids Hatchery	2011		1.94%			PIT + CWT harvest, detections at McNary
FACH	Priest Rapids Hatchery	2012		1.75%			CWT
FACH	Priest Rapids Hatchery	2013		0.62%			PIT + CWT harvest, detections at McNary
STLHD	Chiwawa/Wenatchee	2008	0.95%				PIT SAR (Release to BON)
STLHD	Chiwawa/Wenatchee	2009	1.18%				PIT SAR (Release to BON)
STLHD	Chiwawa/Wenatchee	2010	0.50%				PIT SAR (Release to BON)
STLHD	Chiwawa/Wenatchee	2011	0.56%				PIT SAR (Release to BON)
STLHD	Chiwawa/Wenatchee	2012	0.76%				PIT SAR (Release to BON)
STLHD	Chiwawa/Wenatchee	2013	0.43%				PIT SAR (Release to BON)
STLHD	Chiwawa/Wenatchee	2014	0.01%				PIT SAR (Release to BON)
STLHD	Chiwawa/Wenatchee	2015	0.26%				PIT SAR (Release to BON)
STLHD	Okanogan	2008	0.07%				PIT SAR (Release to BON)
STLHD	Okanogan	2009	1.30%				PIT SAR (Release to BON)
STLHD	Okanogan	2010	0.54%				PIT SAR (Release to BON)
STLHD	Okanogan	2011	0.92%				PIT SAR (Release to BON)
STLHD	Okanogan	2012	0.44%				PIT SAR (Release to BON)
STLHD	Okanogan	2013	0.98%				PIT SAR (Release to BON)
STLHD	Okanogan	2014	0.07%				PIT SAR (Release to BON)
STLHD	Okanogan	2015	0.55%				PIT SAR (Release to BON)
STLHD	Wells & Methow	2008	1.32%				DPUD M&E Report
STLHD	Wells & Methow	2009	1.22%				PIT SAR (Release to BON)
STLHD	Wells & Methow	2010	0.57%				PIT SAR (Release to BON)
STLHD	Wells & Methow	2011	1.24%				PIT SAR (Release to BON)
STLHD	Wells & Methow	2012	0.99%				PIT SAR (Release to BON)
STLHD	Wells & Methow	2013	1.11%				PIT SAR (Release to BON)
STLHD	Wells & Methow	2014	0.01%				PIT SAR (Release to BON)
STLHD	Wells & Methow	2015	0.49%				PIT SAR (Release to BON)
SOCK	Wenatchee	2007	3.46%				Run reconstruction SAR using smolt trap data and adult returns Chelan PUD M&E
SOCK	Wenatchee	2008	1.39%				Run reconstruction SAR using smolt trap data and adult returns Chelan PUD M&E
SOCK	Wenatchee	2009	2.33%				Run reconstruction SAR using smolt trap data and adult returns Chelan PUD M&E
SOCK	Wenatchee	2010	12.97%				Run reconstruction SAR using smolt trap data and adult returns Chelan PUD M&E
SOCK	Wenatchee	2011	7.43%				Run reconstruction SAR using smolt trap data and adult returns Chelan PUD M&E

				Project SAR based on Alternating PIT and CWT Data			
Species	**Program**	**Brood Year**	**Single SAR**	**SAR PRD**	**SAR RI**	**SAR Wells**	**SAR Data Notes**
SOCK	Wenatchee	2012	5.00%				Run reconstruction SAR using smolt trap data and adult returns Chelan PUD M&E
SOCK	Wenatchee	2013	2.15%				Run reconstruction SAR using smolt trap data and adult returns Chelan PUD M&E
SOCK	Wenatchee	2014	9.01%				Run reconstruction SAR using smolt trap data and adult returns Chelan PUD M&E
SOCK	Wenatchee	2015	13.06%				Run reconstruction SAR using smolt trap data and adult returns Chelan PUD M&E
COHO	Wenatchee	2008	0.720%				CWT and PBT from YN M&E
COHO	Wenatchee	2009	0.300%				CWT and PBT from YN M&E
COHO	Wenatchee	2010	0.120%				CWT and PBT from YN M&E
COHO	Wenatchee	2011	0.930%				CWT and PBT from YN M&E
COHO	Wenatchee	2012	0.140%				CWT and PBT from YN M&E
COHO	Wenatchee	2013	0.260%				CWT and PBT from YN M&E
COHO	Wenatchee	2014	0.420%				CWT and PBT from YN M&E
COHO	Wenatchee	2015	0.510%				CWT and PBT from YN M&E
COHO	Wenatchee	2016	0.320%				CWT and PBT from YN M&E
COHO	Methow	2008	0.250%				CWT and PBT from YN M&E
COHO	Methow	2009	0.150%				CWT and PBT from YN M&E
COHO	Methow	2010	0.060%				CWT and PBT from YN M&E
COHO	Methow	2011	0.320%				CWT and PBT from YN M&E
COHO	Methow	2012	0.140%				CWT and PBT from YN M&E
COHO	Methow	2013	0.040%				CWT and PBT from YN M&E
COHO	Methow	2014	0.520%				CWT and PBT from YN M&E
COHO	Methow	2015	0.440%				CWT and PBT from YN M&E
COHO	Methow	2016	0.480%				CWT and PBT from YN M&E
COHO	Twisp	2008				1.213%	PIT data from WINT and WINTBC programs
COHO	Twisp	2009				0.329%	PIT data from WINT and WINTBC programs
COHO	Twisp	2010				0.058%	PIT data from WINT and WINTBC programs
COHO	Twisp	2011				2.012%	PIT data from WINT and WINTBC programs
COHO	Twisp	2012				0.201%	PIT data from WINT and WINTBC programs
COHO	Twisp	2013				0.103%	PIT data from WINT and WINTBC programs
COHO	Twisp	2014				0.973%	PIT data from WINT and WINTBC programs
COHO	Twisp	2015				0.600%	PIT data from WINT and WINTBC programs
COHO	Twisp	2016				1.105%	PIT data from WINT and WINTBC programs
COHO	Twisp	2017				1.125%	PIT data from WINT and WINTBC programs
COHO	Twisp	2018				2.349%	PIT data from WINT and WINTBC programs

References

Caisman, J., R. Alford, T. Jeffris, C. Kamphaus, K. Mott, and G. Wolfe. 2020. Mid-Columbia Coho Reintroduction Monitoring and Evaluation. Project # 1996-040-00. Yakama Nation Fisheries. August 2020.

Hillman, T., M. Miller, K. Shelby, M. Hughes, C. Moran, J. Williams, M. Tonseth, C. Willard, S. Hopkins, J. Caisman, T. Pearsons, and P. Graf. 2021. Monitoring and evaluation of the Chelan and Grant County PUDs hatchery programs: 2020 annual report. Report to the HCP and PRCC Hatchery Committees, Wenatchee and Ephrata, WA.

Richards, S.P. and T.N. Pearsons. 2021. Priest Rapids Hatchery Monitoring and Evaluation Annual Report for 2019-2020. Public Utility District No. 2 of Grant County, Ephrata, Washington.

Snow, C., C. Frady, D. Grundy, B. Goodman, G. Mackey, and A. Haukenes. 2021. Monitoring and evaluation of the Wells Hatchery and Methow Hatchery programs: 2020 annual report. Report to Douglas PUD, Grant PUD, Chelan PUD, and the Wells and Rocky Reach HCP Hatchery Committees, and the Priest Rapids Hatchery Subcommittees, East Wenatchee, WA.