

Columbia River Regional Forum Technical Management Team

Annual Review of Lessons Learned

Wednesday, December 6, 2023

Session Summary

The following Facilitator's Summary is intended to provide a brief recap of the 2023 Year End Review presentations. This summary is not intended to be the "record" of the meeting, only a reminder for TMT members. Official minutes can be found on the [TMT website](#).

Welcome

Emily Stranz, DS Consulting Facilitator, welcomed the group to the 2023 Columbia River Technical Management Team (TMT) Year End Review (YER), noting that this is the 25th annual TMT YER. Participants joined the session in-person and virtually; an attendance list is provided on page 6.

The purpose of the TMT YER is to provide an opportunity for TMT members and other interested parties to step out of the regular meeting format, review selected conditions, operations, and information from the year, and consider lessons learned that might enhance choices and decision-making moving forward. The following pages provide brief summaries of the presentations provided during the YER, more details are available in the [presentation slides on the TMT website](#) and in the meeting minutes.

WY 2023 Weather Review

Kyle Dittmer, Columbia River Inter-Tribal Fish Commission, presented a review of [2023 weather conditions](#). Observed temperatures in fall of 2022 were warm and precipitation varied throughout the basin, with some areas, such as southern Idaho, being very dry for the season. Winter 2022-2023 was dry and cold; followed by a cool start to spring and then warmer temperatures later on. Precipitation in Spring 2023 was healthy, especially in southern Idaho, which helped recover areas of the basin that were dry through the fall/winter seasons. Summer was warm and dry. Overall, the water year was good, if not a bit dry. Although 2022-2023 was a La Niña year, it was drier than would be expected, in fact, one of the driest La Niñas on record. In summary, Kyle noted that there was a lot of variability in the weather and precipitation throughout the water year and basin, with a record 26 atmospheric river events.

Winter 2023-2024 Weather Forecast

Kyle also presented an annual [forecast for the 2023-2024 winter season](#). Current model predictions are indicating a strong El Niño and then shifting into ENSO Neutral conditions. Kyle anticipates a borderline strong El Niño, with some shifting between strong and moderate conditions. Precipitation is high for this early in the El Niño season, currently the 7th atmospheric river is passing through the region. Upwelling off the coast of Oregon is increasing, which is not consistent with El Niño conditions. Kyle summarized a few different forecasts for this winter, ranging from near to above normal temperatures, and near normal to dry precipitation levels. Kyle predicted hydrological, snow, and precipitation forecasts all near normal, with a couple of moderate snow events in Portland.

Review of the Water Year and Management Actions

Alexis Mills, US Army Corps of Engineers Northwest Division, presented a review of the [2023 water year and management actions](#). She recapped the water supply, noting that the year most of subbasins were

below average, with the exception of the Snake River basin, which was very close to average for the 2023 water year. As measured at The Dalles, 2023 was the 17th driest on record. Alexis recapped flood risk management, refill, power, spill, temperature, and fish operations at Libby, Albani Falls, Dworshak and Grand Coulee, including chum operations downstream at Bonneville (see slides for details on specific operations). She touched on how the Corps Reservoir Control Center forecasts reservoir operations, including the single trace procedure (STP) and RFC forecasting models. Additionally, Alexis recapped spill operations in the Snake and Lower Columbia and provided a summary of spill reductions as a result of GBT exceedances observed below Ice Harbor in 2023.

Northwest River Forecast Center Updates and Forecast Techniques 101

Steve King, NW River Forecast Center, provided an overview of [forecasting techniques and updates](#), specifically the RFC's STP forecast. He noted a few RFC updates including a new "normal" precipitation dataset, which are used to pit seasonal and monthly observations and forecasts in perspective. Additionally, RFC is recalibrating all 400 basins that they forecast for, using gridded data instead of point data. Steve summarized the Community Hydrologic Prediction System (CHPS), which is the model that RFC uses to prepare a variety of forecasts (including the STP which NWRFC and the Corps co-produce). The CHPS model utilizes observed and forecast forcing inputs, and outputs include a variety of forecasts such as stage height, flow, volume, etc. The model can be run as deterministic or ensemble. Steve provided overviews of the ESP 0 (no deterministic weather forcing for first 10 days), ESP 10 (with deterministic weather), HEFS (uses an ensemble for the first 15 days), and STP forecasts (see slides for details). Regarding the STP, the first 10 days are deterministic, and the remaining 110 days are forecast using historical mean for the 30-year normal. Steve cautioned that the 120-day STP forecast is a reasonable assumption for volume but does not verify well for the peaks and nuances beyond the first 10 days. Steve noted that changes in the STP from week to week are due to changes in inflow forecasts or regulation operations.

Dworshak Summer Operations

Willow Walker, US Army Corps of Engineers Walla Walla District, presented on [Dworshak summer operations and modeling improvements](#), with a brief overview of the Snake River Basin projects and tributaries. Willow noted that the Snake River above Anatone is 85,000 square miles of drainage, the Clearwater is 10,000 square miles, and Dworshak regulates 2,000 square miles, or 2% of the flow that makes its way to Lower Granite. Dworshak is operated to provide cooling water to Lower Granite, much of which comes from snowpack, and some of which originates from carryover, precipitation, and baseflow/soil conditions. Willow provided a summary of the last few years of regional conditions, water supply, and the impacts on short and longer term Dworshak augmentation operations. She also touched on the operational and physical constraints and flexibilities, including ramping rates, water quality requirements, reservoir space, modeling accuracy, and regional coordination on operations. The Walla Walla District has worked over the last few years to increase efficiency and coordination to best utilize Dworshak's cool water (see slides for details).

Small Group Conversations

Following the morning presentations, participants broke into small groups to share thoughts on in-season management given the variability in conditions, as well as additional opportunities to consider.

The following take-aways were noted by individual small groups and will be discussed collectively by TMT in the future as needed.

1. How has TMT adapted in-season management to be responsive to variabilities in climate, precipitation, flow timing and volume?

- Pre-planning responses and improving regular communication.
- Prescribed operations for high and low flows, e.g., spill tables in the FOP.
- Codifying regular/repeated operations, e.g., DWR summer operations for water temperatures.
- Adapting to drought conditions, e.g., DWR summer operations and chum operation.
- Improved team building, not as reactive (better process).
- Increased/improved collaboration and communication.
- Better understanding of reservoir operations, FRM shifts, treaty operations, flow augmentation flexibility.
- Use of observed and forecasted weather data has improved: higher resolution data and improved computing power.

2. What additional opportunities or flexibility should the TMT consider moving forward?

- Data availability and transparency of data.
- Tailoring operation for specific fish populations.
- Potential new operations under a “no-CRT” world, e.g., real time FRM.
- Consider trade-offs/optimal conditions for fish under high flows, e.g., MOP vs. travel time vs. spill levels.
- Maintain network of co-op weather stations in basin.
- Recognize tails of the distribution.
- Balance/recognize things we’d like to know vs. data we have.
- Support data and forecasting improvements, more SNOTEL sites needed.

Estuary PIT Monitoring

Gabriel Brooks, National Oceanic and Atmospheric Administration, provided an overview of [PIT improvements from the Columbia River estuary to McNary Dam](#). He started by pointing out that although the number of PIT tags in the system is decreasing, the number of detections is increasing. There has been a recent decrease in detections at mainstem dams due to more fish passing via spill, however, increased detection instream and at the Lower Granite Spillway Detector have supported overall increases in detection rates. Gabriel focused on recent advancements in the estuary detections using antennas on pile dikes located in the Columbia River Estuary. The pile dike PIT detection sites are capturing adult and juvenile migration. Over the last few years, NOAA has been designing, testing, and adapting their equipment to increase detections and in 2022 two pile dikes detected about a third of the trawl detections. In 2023, results were even better, more detections were captured by the pile dikes than the trawl and flexible arrays. Gabriel provided information on the species composition of the detections, along with the origin of the fish detected (see slides for details). Moving forward, NOAA is increasing the number of pile dike PIT detection antennas, will expand two sites, and evaluate a new site as a test site. Additionally, they are working on installing detectors in the ice and trash sluiceway at

Bonneville and are exploring options for installing additional PIT detection at McNary (spillbay fin antenna, spillbay floating antenna, PIT detection barge, flexible array system, antennas on outfall pipe, etc.).

Juvenile Fish Survival Estimates

Steve Smith, NOAA Fisheries, Northwest Science Center, presented on yearling chinook and steelhead [smolt survival](#) through the hydropower system (see slides for details). NOAA is in the process of incorporating estuary avian PIT recoveries and results presented at the 2023 YER are preliminary. Steve provided detection probabilities in terms of estimated proportion of passing PIT-tagged smolts detected at each dam, noting that higher spill levels have reduced detection rates, as a lower proportion of fish use juvenile bypass systems and other passage routes lack detection capabilities. Exceptions are Bonneville (corner collector) and Lower Granite (spillway detector). 2023 saw an uptick in percentages through the JBS at most dams, although not at McNary (less than 2% of tagged fish detected), especially for steelhead. Steve summarized river conditions, including daily flow, temperatures, spill, percentage spill, and dissolved gas saturation using historical record and 2023 data. In 2023, estimated passage distributions at Lower Granite Dam were close to the historic norms, although Chinook (hatchery especially) showed a more concentrated migration.

Steve presented preliminary annual estimates of survival for various stocks and reaches. The 2023 survival estimate for yearling Chinook from Snake River hatcheries to Lower Granite Dam (LGR) averaged 67%, slightly higher than the long-term average but lower than recent years. Survival for yearling chinook from upper Columbia River hatcheries to McNary Dam averaged 43%, which is the lowest estimate within all years of data. Hatchery steelhead survival from upper Columbia hatcheries to McNary was below average at 34.5%. Estimated survival from the Snake River trap to Lower Granite dam was 87% for yearling Chinook (below average, low confidence) and 94.% for steelhead (near average). Lower Granite to McNary was 63% for Chinook, 71% for steelhead; McNary to Bonneville (fish from Snake) was 75% for Chinook, 89% for steelhead; McNary to Bonneville (fish from upper Columbia) was 78% for Chinook, 100% for steelhead; and Snake River Trap to Bonneville was 42% for Chinook, 58% for steelhead.

Juvenile Fish Transport

Steve also presented on [juvenile transportation](#) through the hydropower system (see slides for details). Yearling Chinook and steelhead data were presented from migration years 2017-2020. Steve summarized that smolt-to-adult-returns (SARs) (LGR-to-LGR) generally remain higher for transported than for bypassed fish. For those that migrated in 2020, SARs were generally higher than for 2017-2019 migrants, with some transported groups exceeded 2% return. SARs for transported fish were higher than for bypassed fish for all stocks in 2020.

Migration year 2020 was the first in which detectors were operational in a spillway at Lower Granite Dam. For all stocks, SARs were greater for spillway-passed fish than for bypassed fish. SARs for spillway-passed wild steelhead also exceeded SARs for transported counterparts. These spillway vs. bypass results are consistent with circumstantial evidence from previous years. They do not resolve whether the cause is a reduction in mortality for spillway-passed fish, either direct or latent, or inherent

differences among fish, such as size or condition, that correlate with both passage-route selection and survival.

Lower Columbia River Chum Salmon: Status, IPM Development, and Habitat Restoration

Todd Hillson, WA Department of Fish and Wildlife, presented on the [Lower Columbia River chum salmon stocks](#), providing an initial historic overview of chum, its decline in the 1940s, and its listing as a threatened species under the Endangered Species Act in 1999. WDFW's approach to chum recovery includes habitat restoration and creation, supplementation and re-introduction, and monitoring. Todd reviewed the status and trends for Grays, Washougal, and upper/lower Columbia River Gorge populations, with only the Grays population reaching above the minimum viability goal 100% over the last 22 years.

WDFW developed an Integrated Population Model (IMP) for lower Columbia chum as part of a three-tiered recovery approach that will help: assess stage and location-specific bottlenecks limiting viability at the population and ESU level, evaluate the role and usefulness of supplementation, and prioritize habitat restorations. Habitat restoration and creation is focused on creating/restoring high-quality off-channel chum spawning habitat with a goal of achieving egg-to-outmigrant survival in the range of 25-50% in spawning channels. See Todd's slides for more information on completed and planned habitat restoration efforts.

Snake River Stocks Status Versus Management Goals

Jay Hesse, Nez Perce Tribe Fisheries, presented on [Snake River salmon stocks status and management goals](#). Historically there have been 7 anadromous fish stocks in the Snake River Basin, with over 2 million fish returning annually, providing a stronghold habitat of spring Chinook and B-run steelhead. Jay emphasized the cultural significance of salmon to the Niimípuu (Nez Perce People) and their way of life, and that their current right to harvest under the 1855 Treaty includes a responsibility to manage their populations. He demonstrated the significant decline of Snake River fish stocks and pointed to the management goals for healthy and abundant populations set via the Columbia River Basin Partnership. For Snake River Basin stocks, Jay noted the following status: spring/summer Chinook, steelhead, and lamprey have a high risk of extinction; sockeye are functionally extinct and are being supported by hatchery production; coho are extinct, have been reintroduced and are now supported by hatchery production; fall Chinook are viable, but the population is not healthy and is hatchery supported; sturgeon are degraded. Jay noted that none of the extant populations are at healthy or harvestable management levels. He highlighted specific stock specific population status for Snake River wild spring/summer Chinook, steelhead, sockeye, fall Chinook, and coho, as well as the Snake Basin salmon and steelhead status relative to historical abundance and CBC management goals. Between 2018-2021, 43% of the Snake River spring/summer Chinook populations were below the Quasi-Extinction Threshold (see slides for details).

Jay described achieving healthy and harvestable goals will require an increase in overall life cycle survival. He showed results from McCann et al 2022 which examined what smolt to adult survival rates would be necessary to achieve adult return goals under four scenarios of freshwater habitat conditions and hatchery influence. That analysis showed populations in the best habitat and without hatchery influence need SARS in 1.6 to 5.0% range, which is consistent with PATH 2 to 6% SAR conclusions. Most of Snake Basin populations will require higher SARs.

Closing

In closing, participants were asked to share something that they will take away from this year's TMT YER and carry forward into the 2024 TMT season. Multiple TMT representatives reflected on the value of having time together in-person to connect and support relationships. There was recognition of the complexity of conditions, operations, and coordination over the last year, and appreciation for the TMT partner's continued engagement in challenging discussions and coordinated decision making. Some participants highlighted that there is still a lot of work to do to support species, and new opportunities for coming in 2024.

With that, Emily thanked everyone for their engagement and the meeting was adjourned.

Participants for all or part of the session (listed in alphabetical order)

Julie Ammann (USACE), Carolina Andes (BPA), Andrea Ausmus (CorSource), Doug Baus (USACE), Grant Bell (?), Scott Bettin (BPA), Gabriel Brooks (NOAA), Chad Brown (WA DOE), Mike Buchko (?), Noah Campbell (?), Trevor Conder (NOAA), Erin Cooper (FPC), Kenneth Curtis (?), Kyle Dittmer (CRITFC), Catherine Dudgeon (USACE), Jonathan Ebel (ID), Karl Eid (?), Matthew Eppard (?), Mike Fee (?), Joel Fenolio (BOR), Shea Frantz (?), Peter Graf (?), George Gardener (?), Ragan Garner (?), Andrew Gingerich (Douglas PUD), David Gruen (?), Ben Hausmann (BPA), Jay Hesse (Nez Perce), Todd Hillson (WDFW), Stacy Horton (?), Steve King (NOAA RFC), Mark Kruzel (West Power Trading), Jody Lando (BPA), Melissa Lesser (?), Tom Lorz (UT/CRITFC), Brian Marotz (MT), Aaron Marshall (USACE), Brandon McCanless (?), K.C. Mehaffey (Clearing Up), Alexis Mills (USACE), Colby Mills (DSC), Dennis Moore (Colville Tribes), Charles Morrill (WA), Keely Murdoch (Yakama Nation), P. Nichols (?), Tony Norris (BPA), Mike O'Bryant (CBB), Christine Petersen (BPA), Shawn Rapp (?), Joshua Rasmussen (EGPS), David Reis (USACE), Jon Roberts (Corps) Chris Runyon (BOR), Jared S. (?), Kate Self (NPCC), Mike Shapley (Snohomish PUD), Donna Silverberg (DSC), Steve Smith (NOAA), Thomas Starkey-Owens (WA DOE), Scott St. John (USACE), Emily Stranz (DSC), Cynthia Studebaker (Corps), Leah Sullivan (BPA), Dave Swank (USFWS), Kelsey Swieca (NOAA), Ashlynn Tate (?), Ian Tattam (?), Brandon Taylor (?), Dan Turner (Corps), Erick Van Dyke (OR), Willow Walker (Corps), John Wasniewski (?), Charles Wiggins (DSC), Lisa Wright (USACE).

**Columbia River Regional Forum
Technical Management Team
OFFICIAL MINUTES
Wednesday, December 6, 2023**

Minutes: Andrea Ausmus, BPA (contractor, CorSource Technology Group)

The goal of the TMT year-end review (YER) is to reflect on operational decisions made throughout the year and to provide a forum to review these decisions, reflect on lessons learned, and discuss ongoing challenges.

2023 YER presentations and discussions focused on Water Year 2023 Weather Review, Winter 2023 – 2024 Weather Forecast, Review of the Water Year and Management Actions, STP and RFC Forecasting Overview, Dworshak Forecasting and Modeling Improvements, Overview of PIT Monitoring from the Estuary to McNary Dam, Juvenile Fish Transport and Survival Estimates, Status Update on Ives Island Chum Population, Snake River Stocks: Status vs. Management Goals.

Today's TMT YER meeting was held both in person at Columbia River Inter-Tribal Fish Commission – Celilo Room and via conference call and webinar facilitated by Emily Stranz, DS Consulting. Notes for this meeting are meant to capture the overall presentation and discussions at TMT YER but are understood not to be a verbatim transcript. Presentations are available on the TMT website.

Stranz introduced the meeting to order as the 25th annual Year End Review. There were a few attendees at the meeting that were participants for the full 25 years, Kyle Dittmer, CRITFC, Scott Bettin, BPA, Donna Silverberg, DS Consulting, and Julie Ammann, Corps, as an intern.

1. WY 2023 Weather Review - Kyle Dittmer, CRITFC

2023

- Autumn was warm going into October and then cooled off as NOAA predicted for temperatures. Precipitation was more chaotic; Washington and S. Idaho saw precipitation while the Upper Columbia stayed dry.
- Winter was colder toward late winter. It was really dry toward mid-winter, January and February were unusually dry. March kicked in to be very moist, especially in S. Idaho.
- Spring was close when it came to the forecasted temperatures being really cold and then jumping to way above normal starting in May. Precipitation was more chaotic, though there were good blasts in the Cascades and S. Idaho received a lot of the moisture.
- Summer was close to the forecast with near normal temperatures and major convective rainstorms in August and September. August blanketed most of the eastside and September focused on S, Idaho.
- WY2023 Seasonal Precipitation showed a really wet year in S. Idaho and a drier year in the Upper Columbia.

Oceanic Nino Index vs. Historic TDA Runoff

- Dittmer showed the graph of the ONI vs. Historic TDA Runoff and pointed out that we were not far off from the -0,6 point of 2001, the second lowest water year in the last 100 years. This is unusual for it being a La Niña year.

Summary

- Weather was highly variable and very unpredictable.
- Atmospheric rivers bands: 26; more mountain snow less valley rain.
- ENSO Forecasts differed from on-the-ground results.
- Mainstem WSFs were much lower than expected.
- This La Niña event was one of the driest on record.

Bettin asked how California was last year.

Dittmer said that he did not look at California in great detail, but he did know that the Sierra Nevada had above normal snowpack and localized flooding. He said when looking at the atmospheric river you need to look at the entire West Coast, not just Oregon and Washington. They filled some of their reservoirs and benefited from the event as much as we did up here.

Dan Turner, Corps, asked what Dittmer thinks about the Drought Index as we see, he asked if they are they representative of dry conditions. He asked when we see that there is an extreme drought in the region how it should be interpreted.

Dittmer said that he looks at the Drought Monitor Index. It is what he uses for the Salmon Managers when they have a week at FPAC. It is a product coordinated between the National Weather Service (NWS) and the University of Nebraska. He said that he thinks that it is very realistic because they look at the ground observation stations of the coop network here and it is updated every week. He said that it has been consistently good product. It appears to be a standard drought product that people like to use because you can definitely see the changes to the levels of dryness each week. It is important for Salmon Managers and Action Agencies to know how much the drought is going to impact the river operations.

Bettin asked how late the runoff was last year. He said it seemed like it was cold and seemed to drop the temperature flows. He asked if it was unusually late for it to start.

Dittmer said that looking at the initial forecast it was going to be around two weeks late. He said that he thinks that it was only one week late because of the very strange patterns with La Niña. With La Niña you expect a delay with the runoff. He said that he thought that it was only five to seven days when compared to the historical norms.

Carolina Andes, BPA, asked about the historical recurrence cycle data (5 years, 10 years, 20 years) being analyzed regarding the weather. She asked if we would be able to anticipate something happening every five years or ten years.

Dittmer said that he is not sure how often those would compute because we need to update the thirty-year normal, which were just recomputed this last year, for the 1991 – 2020 record year. He said as far as recurrence he thinks that is something that the NWS, the Corps, and some other entities here look at.

2. Winter 2023-2024 Weather Forecast - Kyle Dittmer, CRITFC

2023/24 Forecast

- Last Year

- Portland was colder than expected. Precipitation was down 10 percentage points compared on a seasonal basis. There were five forecasted snow events instead there were only two observed, one in December and another in February which was record event. Total of 11 inches of seasonal total snow.
- Government Camp was colder than expected. Precipitation was off by 40 percentage points, but the snow was down only by 8 percentage points. The weather was more active in the mountains. The runoff observed was 80 maf compared to the ~120+ maf predicted.
- Current Model Predictions
 - Average predictions are showing that we will be approaching a sea surface temperature of +2°C which is a definition of a strong El Niño event.
 - As of November 9, 2023, NOAA’s latest modeling shows a 55% chance of Moderate-to-Strong. The model shows that it will be moderate for most of the winter and then pop up to strong from December 1 to after January.
 - Right now, we are having our 7th atmospheric river event for the season, unusual to have that many events that early in the season.
 - NOAA Sea Surface Temperatures show at this moment of time a broad peak between December and January.
 - Upwelling Index has been increasing the last two months pushing the warm waters off the west coast up into Alaska, which is not consistent with an El Niño close to shore. Cautiously could be a good sign for the late migrating salmon going up the coast.
 - NOAA/CPC Winter Forecast shows above normal temperatures and dry for Montana and Idaho.
 - NOAA/NWS Portland shows above normal temperatures and equal chances for either above, below, or near normal precipitation.
 - OSU/Tanis Leach forecasted near normal (maybe a little above normal) temperatures and a snowfall forecast of 0 – 3”.
 - ODA/Pete Parsons forecasted near normal temperature conditions in the Valley and cold elsewhere and precipitation will be dry east of the Cascades. He also forecasted a potential of an Artic outbreak sometime in December.
 - CRITFC Method/Dittmer used the sunspot cycle based on Dr. Theodore Landscheidt’s study to point to a prediction for an El Niño winter. According to the MEI, we have been tracking in El Niño territory since November. The Pacific Decadal Oscillation (PDO) has been negative for the past several years and Dittmer thinks based on that, the effects of the El Niño will not be as devastating to the region. When the PDO is negative and the El Niño is on the positive side it takes the edge off El Niño effects. Dittmer also did a hydrological forecast and he does not think that runoff will be a concern this year.
 - Government Camp
216-inch base / 91% of normal
Below normal snowpack (but not too much below normal)

- Portland

Temperatures on the warmer side

Precipitation below normal

Less variability, hard rain events, longer dry spells, and a few Gorge wind events.

Water Supply Forecast: 96 maf (± 10 maf) / 94% of normal

Snow events: Two snow events (One moderate, one minor); January would be the big month with up to 2.5". Season total: 4.5"

Dave Swank, USFWS, said that Dittmer mentioned the Current Upwelling Index is higher than average. He said that he typically hears about the Spring Upwelling Index which is used in models of juvenile survival when they first hit the ocean. He asked if Dittmer knows how important the index is at this time of year or if it correlates with the Spring Upwelling Index. He said that he has not heard much about it being used at this time of year.

Dittmer said that he tracks the Upwelling Index for his monthly updates at CRITFC. He said that he believes his data comes from NOAA and he will send Swank the link. He said that they track the upwelling in both the winter and summer when the wind can change directions. It is not as important in the winter as in the spring/summer but during an El Niño event it is generally suppressed but instead this year it has increased. This could be local fluctuations so Dittmer said that we will have to watch to see how it plays out.

Kelsey Swieca, NOAA, added that there has been something noticed by the staff that works offshore that when you get winter upwelling it tends to happen in El Niño years and it tends to result in a shift of the forage community. You will get winter spawn anchovy which is not typical for this region. That is a potential implication for the impacts too. It will also impact juvenile salmonids in the spring depending on the forage community.

3. Review of the water year and management actions - Alexis Mills, Corps-NWD

2023 Water Year Summary

- Above the Dalles
 - 87% of normal
 - Started dry and got some water in Spring and Summer
 - Temperatures were $\sim 4^{\circ}\text{F}$ above average (May – September)
- Columbia Basin Snowpack
 - Upper Columbia SWE tracked below normal throughout the snow building season and then had a rapid runoff in May.
 - Kootenai tracked below normal throughout the snow building season but tracked closer to normal with the runoff in May.
 - Pend Oreille also tracked close to average.
 - Lower Snake River had a higher-than-average snow buildup especially in the early spring, and then a slightly more gradual runoff in that sub-basin.

- Water Supply 2023
 - The Dalles had a lot of variability.
 - 74.2 maf / 83% of normal
 - Lower Granite was slightly better but still saw the same fluctuation in the early spring.
 - 19.3 maf / 97% of normal
- Water Supply 2024
 - The Dalles
 - 77 maf / 86% of normal
 - Lower Granite
 - 18 maf / 90% of normal
- Water Supply as compared to period of record, 2023 was 83% of normal and the 17th driest year on record.

Storage Reservoirs

- Libby
 - November through April operated to meet Flood Risk Management (FRM) requirements.
 - Project remained on minimums from February through May with the exception of some water release up to 6.5 kcfs when there was risk of freezing at the Kootenai Tribe fishery.
 - Refill began May 1 because the official April WSF was less than 6.9 maf.
 - Low WSF meant no sturgeon pulse and bull trout minimums were set at 6 kcfs.
 - Libby was able to remain above the bull trout minimum during the summer months.
 - Libby filled to a summer maximum level of 2452.4 ft on July 14 or 6.6 ft below full pool.
 - Libby ended the 2023 WY at elevation 2439.5 ft or 19.5 ft below full pool.
- Albeni
 - Drafted to the winter operating band during kokanee spawning.
 - BPA requested Flexible Winter Power Operations (FWPO) in January, so the project bumped up the to target a higher range from 2052.0 – 2055.0 ft.
 - Switched to freeflow operations from May 4 – May 23.
 - Albeni filled to a summer maximum level of 2062.0 – 2062.5 ft on June 10, continued operating within that range through September.
- Dworshak
 - Remained on minimums through March 26.
 - FRM storage shift to Grand Coulee

- Dworshak filled to a full pool of 1600 ft on June 30.
- SOR 2023-5: Relaxed the temperature target in Lower Granite to 69.5°F from August 6 – 14 to achieve an elevation of 1535 ft on August 31.
 - Summer Flow Augmentation drafted the reservoir to 1536.1 ft by end of August.
- Flows ramped down to release the 200 kaf for the Nez Perce agreement through September to meet 1520 ft,
- Grand Coulee
 - Project filled to 1287.4 ft by end of October.
 - Chum Operation: November 1 – April 10
 - Drum Gate maintenance was required in 2023; two seals were found to be leaking during 2022.
 - FDR below 1255 ft from March 8 to May 5 for the drum gate maintenance.
 - Minimum elevation: 1240 ft
 - Dworshak filled to 1286.6 ft on July 9.
 - Drafted to 1277 ft on August 31 to help with downstream flow objectives.
 - Through September it was operated to meet Bonneville navigation minimums.

Tony Norris, BPA, added that in March we had historically low inflows into Grand Coulee. There was one day where there was only three previous days since 1977 where there was a lower recorded inflow into Grand Coulee. He said that was a significant impact on operations this year.

Grand Coulee (GCL) and Chum Operations (November 2022 – April 2023)

- November 1:
 - Started at 11.3 – 13.0 Bonneville (BON) tailwater.
 - Had late-October precipitation last year which led to a streamflow response and a need to manage for high tailwater.
- Early November:
 - GCL filled to 1287 ft.
- November 12 – 30:
 - Snake and Willamette flows dropped to less than 20 kcfs; BON tailwater ran close to the bottom of range; GCL was drafted to elevation 1279 ft.
- December 1 – 20:
 - GCL passed inflows.
- December 21 – 24:
 - Severe cold snap required a 3 ft. draft at GCL to help meet load; BON tailwater was close to 13.0 ft (day).
- December 25 – January 3:

- Lots of precipitation and warming which lead to peaking in the Willamette River at ~75 kcfs and the Snake River at ~45 kcfs to which BON tailwater responded at about 18 ft.; GCL reduced flows to meet Vernita Bar minimums and filled to ~1284 ft.
- December 31:
 - Switched to the Incubation Phase of a minimum BON tailwater of 11.8 ft.
- January 4 – March 1:
 - GCL drafted for drum gate maintenance.
- February 6 – March 1:
 - The Snake and Willamette Rivers remained well below average; Inflows into GCL averaged ~66 kcfs; Outflow from BON was required to maintain the chum protection tailwater range from 125 to 140 kcfs.
- March 1: GCL forebay elevation: 1258 ft.
- March 2: TMT voted to decrease the chum protection level to 10.2 ft.
 - Inflow to GCL during this period was not sufficient to support chum and not exceed the draft rate limit.
- March 13 – 21: Some streamflow response was seen in the Willamette and Snake rivers which resulted in a BON tailwater elevation of 11.1 ft.
- March 22 – April 10: GCL operated to meet the Vernita Bar minimum of 63 kcfs; Increased streamflow from the Snake and Willamette resulted in a BON tailwater elevation of ~11 ft.

2023 Flood Risk Management

- The Dalles (TDA)
 - TDA would have peaked at 661 kcfs on May 23 if flows were unregulated.
 - Regulated flows peaked at 404 kcfs on May 23.
 - There was no flood fight at the control point this year because Vancouver Stage peaked at 13.7 ft, or 2.3 ft below flood stage, on May 20 during the freshet.
 - Even though it was a below normal runoff year at TDA they did see high outflows in May.

Reservoir Regulation Forecasting

- Mills gave an overview of how the Reservoir Regulation Team does forecasting. She said that weekly they produce a weekly Single Trace Procedure (STP) that is sent out on Mondays. This is coordinated with BPA and the District Offices at least twice a week. They also use the RFC's platform and input regulations for the projects on Thursdays. These can all be done more frequently depending on the need and forecasts are still subject to change.

Spring Spill

- Lower Columbia

- There has been an increase in average spill over the years on the Lower Columbia River. She explained that average spill is not only governed by the forced spill but also the Hydrograph for that year. For 2023, there was a tiny bit of forced spill due to the sharp runoff in May. Otherwise, the FOP and Spring Spill was similar to 2022.
- Lower Snake River
 - There was very little forced spill during Spring 2023. There were higher levels of Spring Spill than 2022 in 2023 even though the Spring Spill was almost identical.

Gas Bubble Trauma (GBT) Monitoring

- In 2023, there was a need to reduce two times on the Lower Snake due to GBT exceedances. There are reductions that happen when there a GBT exceedances of the 125% TDG criterion these are outlined in the 2023 GBT Biological Monitoring Plan.

Spill: GBT Exceedances

- May 9
 - Native non-salmonids below Ice Harbor (IHR) exceeded the GBT criteria at 26%.
- May 10
 - Spill Reduction to 115/120% TDG at all four Lower Snake projects occurred.
- May 11
 - Washington Department of Ecology provided guidance for Lower Granite (LWG) , and it was able to return to 125% gas cap (GC) spill. This was because there was a site-specific sample below the GBT thresholds at LWG.
- May 11 – 16
 - Because LWG returned to 125% GC spill it was impossible to get the forebays with in the 115% TDG water quality standard.
- May 17
 - The three remaining Lower Snake projects (Little Goose (LGS), Lower Monumental (LMN), and ICH returned to 125% GC spill.
- May 18
 - GBT exceedance occurred in native non-salmonids below BON. This occurred during forced spill so there was no spill reduction.
- May 30
 - There was another GBT exceedance below IHR. The three projects: IHR, LGS, and LMN were all reduced to 115/120% TDG.
- June 7
 - There was a clear sample returned and all IHR, LMN, and LGS all returned to 125% TDG.

- All responses to the GBT responses are documented in the Corps' [FOP Implementation Reports](#). They also document in the reports any spill variances from the FOP. These can be found on the TMT website.

Trevor Conder, NOAA, said moving forward with the understanding that it is difficult to meet the forebay 115% criteria for spill reduction and then asked if we are going to modify the criteria to 120% tailrace. He asked what the Corps' process is for moving forward with that.

Mills said that the Corps would not be modifying the water quality standard. She said it would be up to the States.

Condor said that he did not mean the Corps modified it, but they did ignore it last year. He asked if that would be their response moving forward as well.

Dan Turner, Corps, said they did not necessarily ignore it and that was a little harsh. He said that it was a lesson learned that with 125% TDG coming out of LWG they were not able to achieve 115% TDG in the project forebays. Overall, Turner said that it was a successful operation because GBT occurrences went down, but moving forward they will need to get guidance from the State and other policy makers.

Conder said the way that the Corps operated was fine from his perspective. He said that the 120% seems to be reasonable for how much load there is.

Ammann asked if Turner set the spill caps for 120/115%, knowing how long it takes for TDG to dissipate. She said that he was trying to set the spill cap for an operation that may continue for weeks.

Turner said yes. He gave the example of 2018, which was hugely variable, and the forebay WQS made it difficult to set spill caps. In 2023, spill caps would have been very low knowing they were trying to meet 115% in the forebays with LWG at 125%. In retrospect it was impossible.

Chad Brown, WDOE, said that the Rule, Part A and Part B for the spill and the adjusted 125%. The 115% forebay and 125% tailrace water quality standards are not meant to work together and that is one of the reasons why the zone idea was put into the implementation. When they received the request to review the data and consider an allowance for not all the dams to increase spill, it does bring a conflict between A and B. WDOE and the Corps will have to work out an interpretation of that in the future.

Stranz said that is a call for in-season coordination.

Steve Smith, NOAA, said that he will be showing the same data. He said that from what he understood the reduction of spill was in response to GBT exceedances. He said that he did not think that he heard them mention that shortly after resuming the higher spill after that week, there were a few days that approached that highest levels of tailwater gas of the whole season. He asked if there was no accompanying GBT from that.

Mills said that there was some forced spill during that time but did not have accompanying GBT. She asked which time frame he was asking about.

Smith said that according to his data the highest gas in the Snake was around May 24/25 was shortly after the resumption of higher spill but said Mills was right it also corresponds with the peak in flow so it may have been forced spill.

Mills said that was forced spill but there was no GBT exceedance. She said similarly to the Columbia if we had GBT exceedances during that time it would not merit a reduction in spill because it was forced.

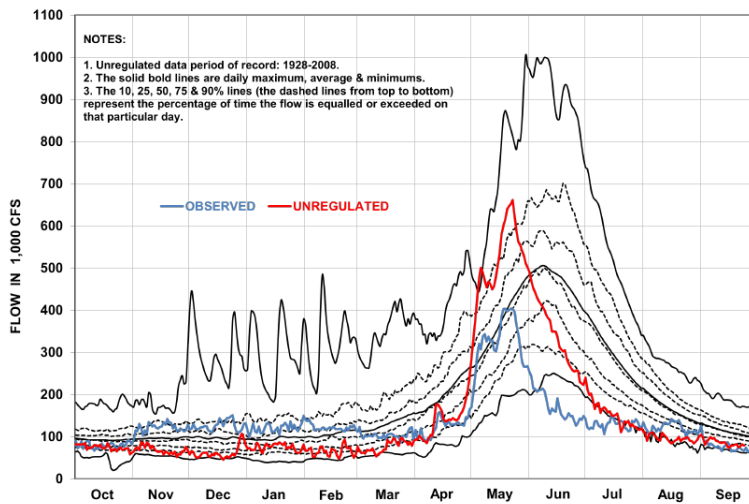
Jonathan Ebel, ID, asked how widespread the GBT exceedance was below ICH. He asked if it was primarily at one site on both exceedances, or one general area of the ICH tailrace.

Mills said Ken Tiffin’s (USGS) emails would be the best source for that. She said that USGS will be publishing a report that includes a lot of that information sometime early in 2024. She said that she does not have that information.

Erick Van Dyke, OR, asked Chad Brown if he has any information that he had summarized or reviewed that can get to Ebel’s question.

Chad said not that he can repeat right now, he has not looked at those emails in a while and does not remember all of the details. He said that Tiffin’s report will provide all of that.

Jay Hesse, Nez Perce, said that the criteria and water quality and fish responses are going to be a continuing discussion. He said that he looks forward to having them before the 2024 operations. Hesse asked Mills about one the graphics on slide 24. He said that it highlighted the unregulated flow projection. He asked if this was for a system wide unregulated condition and is it specific to the conditions in 2023.



Mills said that the red line (unregulated) is specific to conditions in 2023. The black lines are the unregulated historic, ensemble products.

Ammann said that black line is historic unregulated and those can be compared to the 2023 red line. This graphic allows us to compare the last years flows with actual historic flows.

Hesse said that he does not understand the bullet that says, “unregulated data period of record”. He asked how they get an observed unregulated that does not exist.

Amman said that observed unregulated is computed. She said that they use their models by taking all of the observed inflows and the observed locals, and that is computed into the observed unregulated number.

VanDyke said that he heard Hesse ask if it was local or basin wide. He said that it sounds like it is basin wide.

Ammann said yes, it is all summed up at TDA. TDA is the point that the Corps uses for Flood Risk Management.

Hesse restated that this was assuming that there was no storage and flow manipulation upstream of TDA.

Mills said that was correct.

Hesse asked if it accounts for water withdrawals.

Mills and Ammann were not sure. Ammann said that they should talk offline because they are getting into the technical. She said that it includes natural lakes and lakes stalled by natural constriction, but it tries to remove the project operation piece. She said that she does not know the answer.

Norris said that he does not think that they remove consumptive use. He said that he thinks that is observed use.

Steve King, NWRFC, said that if you use their numbers, they compute naturals for the estimated period, observed period, and the future period using two different methods. The water supply network volumes have storage added back in but not consumptive use. It is a missed bag on TDA on whether other canal withdrawals are added back in. The Snake and Yakama are omitted. The RFC natural forecast all models have the capability of adding back in consumptive use and channel loss; anything manmade.

Ammann said that if Hesse is interested the Corps can get back to him on specific details to that question.

4. STP and Forecast Techniques - Steve King, NWRFC

Current Events/2024 Updates

- King prefaced that he had been working long hours on the major flood event since last Friday with 24/7 operations. There were plenty of floods forecasted but not all of them came in as high as is indicated in the slide.
- NWRFC has just update their PRISM normals.
 - PRISM is used both for United States and for Canada.
 - USA is produced at Oregon State University (OSU) and through a joint contract with BPA, RFC had University of Victoria's Pacific Climate Impacts Consortium (PCIC) produce BC normals, the normals for precipitation and min/max temperature on a graded basis.
 - RFC seams this data together to produce coverage for our domain. This information is available with the new normal on the RFC website.
 - Raw data is only available from [OSU](#) or [PCIC](#).
- Recalibrating all NWRFC basin models.
 - Calibrating against gridded data as opposed to point data.

- They are progressing through the westside and are hoping to finish water year (WY) 2024 and then proceed to the eastside.
- Extension of ESP forcing years to include weather from WY 2023.
 - RFC forces ESP with past weather that is set as of the TMT Year End Meeting goes from 1981 through 2022.
 - Usually is something that RFC is able to transition immediately to but now because they are using gridded information, they are relying on a national center to provide them with QC grids, but they had a glitch. Should have the WY 2023 information by this month. King said it would be nice to have the unusual 2023 WY in the mix.

Single Trace Procedure (STP)

- 120 Extended Forecast
 - Serves the interests of Columbia River basin and into Canada.

Hydrology Model -- Community Hydrological Prediction System (CHPS) Basics

- There are many products but there is one model, CHPS. It is a snow, soil moisture, consumptive use, regulation, routing, and there are different choices to choose from within these depending on what works for a given location.
- King provided several slides that showed different models and model states. He explained that the NWRFC will go in daily and adjust based on antecedent conditions. Most of the following presentation was about “forcing the model”, or what you send into the model. He also said that forcings are in the observed and forecasted information. First you force the model, then you adjust the model, and then you release the output (stage, pool, flow, volume, etc.). These model can handle natural forecasts and/or river forecasts. Ensemble Streamflow Prediction (ESP) is the same as a Single Trace Procedure (STP) deterministic input but instead it is run multiple times.
- STP is a joint product between NWRFC and the Corps because they want to provide the best forecasts to all the stakeholders as possible and also to have the regulation in the models for health and public safety concerns downstream. Though STP is typically run once or twice a week it is able to be run at any time. It is also a legacy product produced independently by NWRFC solely for the Corps. There are times that STP forecasts are not public like the forecasts for Canada which are not publicly available per request.

Brian Marotz, MT, asked King what he felt are the greatest, most notable advances in weather forecasting during the last decade. He said that the reason he asked was he had great hopes for a satellite moisture mapping technology that he since found out ended in 2018. He asked if King uses satellite imagery in his work.

King said one of the major advances is being able to observe the Earth and some things have not advanced as much, like stream flow, getting a good estimate of inflow for a reservoir can be frustrating. The [GHOS](#)t satellite is extremely impressive with its ability to make estimates of water vapor. King said for NWRFC’s precipitation QC they are using a different technique in recent years where they are incorporating satellite and radar information with gage information. He said that it is still heavily based on gages, but they are using other sources to help QC with flood and water supply forecasting. King said for NWRFC to take advantage of tools and data

they need to be available across the domain. He said that there are a lot of one-off projects where people find information on a particular watershed, but it is hard for the NWRFC to take advantage of that technology if it is not available across the baseline, and that includes Canada. King said that there have been other advances; computational power and virtual and real-time coordination.

Ammann shared some of the history of the STP service. She said that the Weather Service used to produce a long-term forecast for the Corps called the SAR model which the Corps would then share with the region. When they went to the Ensemble model in the early-2000s, the Corps looked to how to regulate the number of traces. Ammann said that she thought that STP was the product of that. The Corps has been trying figure out how to regulate the ensembles for the entire river system, Ammann said that it is complicated in the Columbia when you start combining treaty operations, and wheel-based models but they are working on this internally to try to process the ESPs with confidence. Ammann said that she is not sure where it will go in the future; the Technical Management Team was one of the big regional pushes to get a product like STP to look a little further. She said in an ideal world the Corps would be able to apply regulations to the NWRFCs Ensembles and then you would get some statistically based products instead of a single line.

Erin Cooper, FPC, asked from King's presentation, if the first ten days of the STP and ESP10 the same because they are both deterministic from the weather outlook.

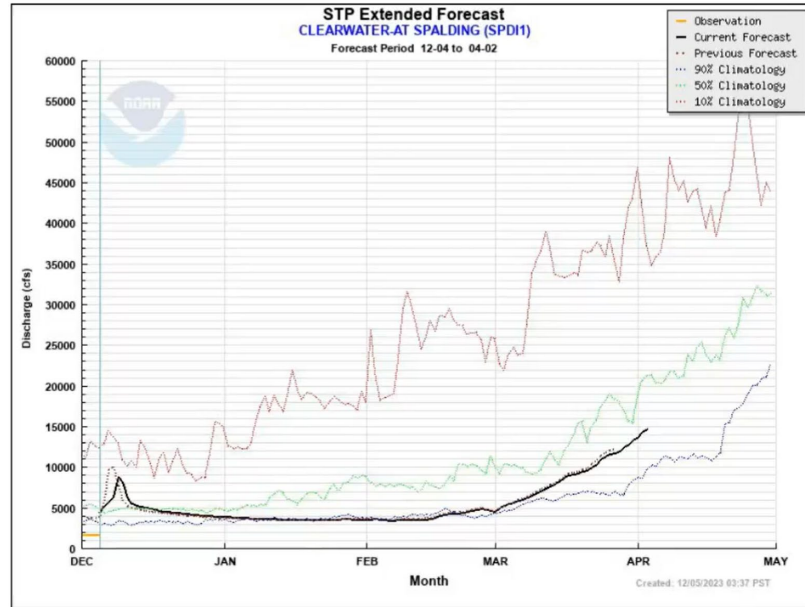
King said yes and no, there are three "flavors" of ESP10, there is *Unadjusted* which most people do not see very often, *Water Supply*, and *Natural*. He said that *Unadjusted* should be equivalent to the STP, but it is not the same for *Water Supply* or *Natural*. He said some locations may be headwaters, in which case everything is the same because there is no regulation.

Cooper asked next about the recalibration of the models that is in progress. She asked if that would affect the STP and the ESP significantly.

King said that he does not think that it will affect it at all. He said that the one thing that will change would be the natural normals which are not used for the STP. The natural runoffs and historical estimates and normals derived from that have a significant simulated component to them. As the model is recalibrated and reconfigured in places it will affect the natural normals but should not affect the STP. King stipulated, other than he hopes to improve the skill that they generally forecast.

Cooper said that they were told by the Corps at TMT that the STP often underestimates inflow to GCL for December. She asked if there has been any historical review of the STP for either what the NWRFC provides for flows or what the Corps provides for operations. She asked if there is ever any retrospective look; can we say routinely if the STP under- or over-estimates flows over a period of time.

King said that does not think that he could speak to that. He said that he had a hunch that many years ago they looked at things when they initially set the procedure up. He said that he does not think they have done anything recently and apologized that he cannot address that currently. He said that it is possible that Ammann or others at the Corps would be able to speak to that question.

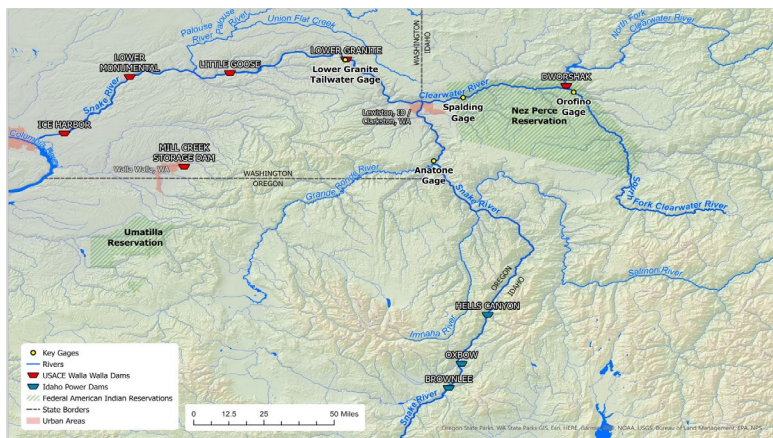


Aaron Marshall, Corps, said that if you look at the STP plot's black line, there is some shape at beginning of the forecast but beyond that there is really no shape and that tells Marshall that they are running the forecast to a historical average. He said if there is no shape from any sort of weather system that might move into the basin and typically this time of year it is difficult to predict the atmospheric river events to give shape to the river traces. He said that we are missing all that shape and variability from the inflows. He said that he thinks that is a big part of what we are seeing in the beginning of November, trying to forecast for operations through the end of December. Coming up with an estimate for GCL operations; they miss out of the storm events in the forecast.

King said that one of the reasons they are comfortable running with climatology out into the future is what is going on in the soils and the snowpack. He said this time of year there is not much snowpack. He said there is a lot of information in the model that carries over into the future. He said that they have done studies that suggest that there is a soil moisture signal many months in the future. He said although we do not get the weather right, there are some things they can say depending on the time of the year about what is more likely to happen. He said that all of the models have the benefit of doubt, they are dynamically updated. He said that he should also point out that the ESP technique, which throws a lot of weather ensembles at the model, is used to account for the uncertainty in the weather. They do not know what is going to happen, so they throw everything that has happened in recent years. Unfortunately, they are not doing anything to address the model uncertainty calibration. He said that he will be available for follow-up questions at stephen.king@noaa.gov.

5. Dworshak Summer Operations - Willow Walker, Corps-NWW

Dworshak (DWR) Summer Flow Augmentation Overview



- Last dams before LWG: Brownlee, Oxbow, Hells Canyon (Idaho Power (IDP))
- The Snake and the Clearwater confluence at Lewiston, ID.
- DWR is above the confluence on the Nez Perce Reservation.
 - Operated by the Corps
- Scale of Systems
 - Snake River above Anatone gage: 85K square miles of drainage
 - Complete Clearwater System: 10K square miles of drainage
 - N. Fork Clearwater above DWR: 2K square miles of drainage
 - DWR controls about 2% of what is seen at LWG.
- Purpose of DWR Summer Flow Augmentation is to increase fish survival by moderating temperatures in the river and increasing flow (found in the [WMP](#)). The metric for this is by keeping the tailwater temperature of LWG at $\geq 68^{\circ}\text{F}$ with cooling waters from DWR.

Water Supply

- Snowpack, reservoir carryover, precipitation, and baseflow/soil conditions all are water supply drivers.
- DWR is a consistent storage reservoir starting each year ~1520 ft.

Using the Water

- 2015 and 2021 both had poor fish conditions and extreme, record-breaking heatwaves. 2021 had high carryover from 2020, but low precipitation in the fall that led to dry soil conditions and low baseflow. The region had to come together for adaptive management. 2022 had low carryover and continuing dry soils and low base flow.
- 2024 has higher carryover from 2023 but the outcome will still depend on the winter snowpack, summer conditions, and how El Niño comes in.
- Walker overviewed the constraints and flexibilities for DWR: ramping rates, water quality, reservoir space, and model accuracy.

Future Considerations

- Walker showed the improvements over time for DWR based on NOAA's *2015 Adult Sockeye Salmon Passage Report*. She highlighted as the biggest improvement the increased communications with the TMT group, especially the Salmon Managers. She said this communication opened the door for the Corps to then participate in FPAC meetings and have more calls with Salmon Managers which she said was all of our goal at the end of the day.
- Walker shared that she presented at the 2021 YER, and she talked about the commitments that the Corps made at that meeting. She gave an update on those commitments' current statuses.
 - DWR Operations target the earliest fill date possible, when safe and when water supply is available. This is in case they need to implement flow augmentation earlier than anticipated.
 - The Corps implemented a new water supply forecast, adopting the RFC methodology, which allows them to be on the same page as the rest of the region.
 - To help bring down some of the risk from being in the remote basin they have added an additional snow flight. This is to see how much snowpack is in the basin.
 - They have developed better communication with IDP.
 - They also implemented the ramping rates.
- Planned future improvements are potentially new modelling software (HEC Res-Sim)
 - In the next couple years, the Corps plans to use this software for regulation modelling, but it will potentially be used for temperature modelling as well.
- Walker said that over the last couple of years they have found more efficiencies and made improvements. She said that there is always room for improvement, and she appreciates everyone's input. They have just developed a new Water Management Home page that is open to the public.

<https://www.nww.usace.army.mil/Missions/Water-Management>

Contact Information	503-527-7283
Team Lead:	Jon Roberts
Upper Snake System:	Willow Walker
Lower/Middle Snake System:	Grant Bell
Walla Walla System:	David Ries
CWMS Management:	Ashlynn Tate

Walker introduced David Ries, Corps, as their Database Manager. He also regulates Mill Creek. She said that if there is any data information needed, he is the guy to go to.

Dittmer asked if there were any unusual operations from the IDP Company.

Walker said that it happened a lot more in previous years before the Corps made better contact with IDP, where they may generate power unexpectedly. She said what that does is the water

from the IDP releases is warmer than the water coming from DWR and if the Corps does not know that is coming then can be difficult to counteract that temperature. Now that there is a better understanding of what IDP does and why it has been easier to make those predictions and there were not any surprises this year.

Swank said that Walker mentioned the potential for a HEC Res-Sim model in the future. He said that he is curious how it would be different and potentially be an improvement over the model they have been using over the last few years.

Walker said that Turner and Mills, Water Quality, have their own Res-Sim models for longer term operations, and they would have more information to answer those questions.

Mills said that they been building out the ResSim model, starting with Lower Snake temperature in a beta version. They have calibrated the DWR and Lower Snake model. The benefit that they see is being able to run it in a probabilistic platform. So far it is performing similarly to CE-QUALW2- They will be working with Walla Walla on how to best utilize the Res-Sim model. She said that they are also adding Hells Canyon down to IHR so the geographic extent of the model will be larger than the current CE-QUAL-W2 products with a shorter run time.

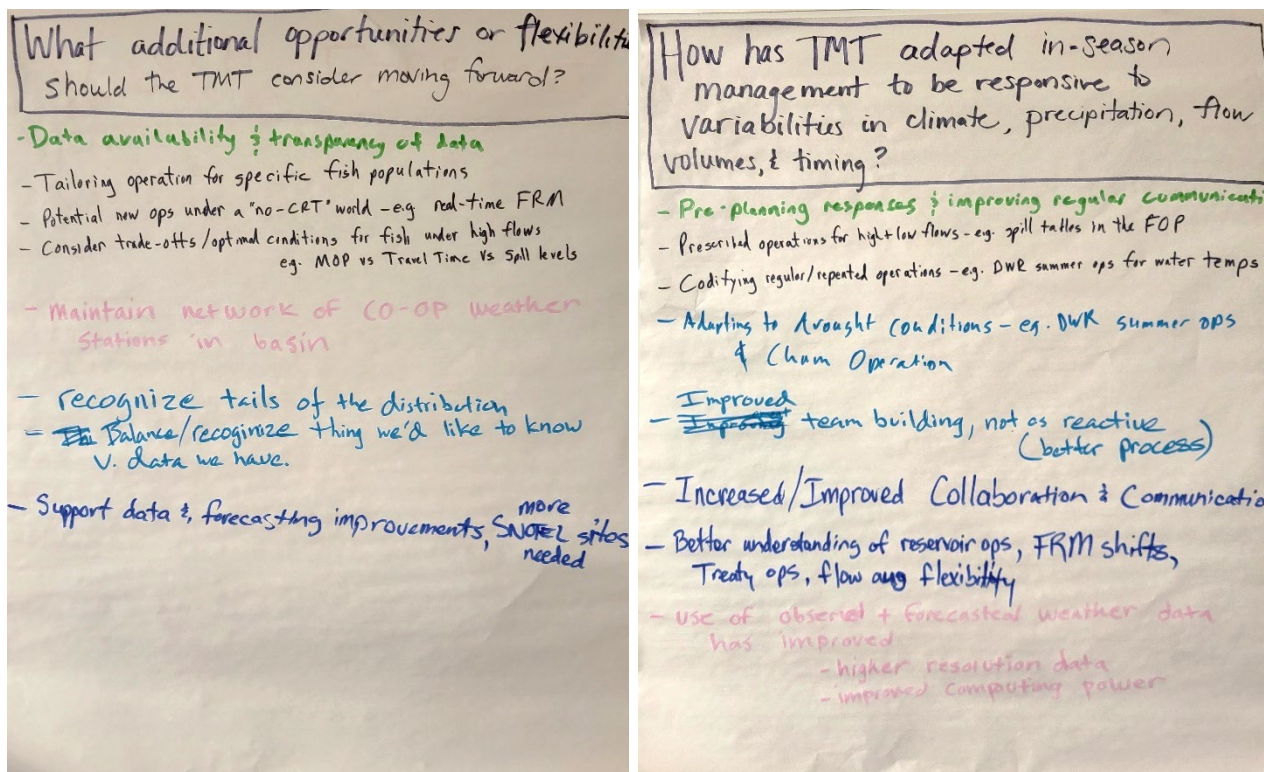
6. 25 Years of YER

Donna Silverberg, DS Consulting, came to celebrate the 25th anniversary of TMT's Year End of Review. The first meeting was held on October 1998 and was intended to have TMT look at their process in a holistic way. She commented about how the technology and data has grown and improved over time.

7. Small group conversations

Meeting attendees split into small groups to talk about the following questions and wrote down their answers on poster paper to contribute collaborative ideas.

- How has TMT adapted in-season management to be responsive to variabilities in climate, precipitation, flow timing and volume?
- What additional opportunities or flexibilities should the TMT consider moving forward?



8. NOAA – PIT Detection System Improvements from the Estuary to McNary – Gabe Brooks, NOAA

Brooks gave an update on the PIT tag detection systems. The overview he provided showed that the annual tagged fish released in the system peaked in 2010 with ~2.8M tags; recent years have been ~2M. Unique detections across all the systems that report to PTAGIS also peaks in 2010 but have picked up recently. This could be due to a few factors: increased detections from instream sites due to improve technology and LGR GRS detector. The GRS detector is designed with antennas that have a five-foot read range and allow for an average of ~200k unique detection per year.

PIT Detection in the Estuary was split into three methods for 2023: Pair Trawl (TWX), Flexible Array (FLX), and Pile Dikes. TWX was historically the best method and this year it was upgraded with a new multiplexer. FLX had improvement made for 2023, specifically a reel was added to assist pulling the array back into the boat. FLX was also operated with a focus on steelhead detections, while the Pile Dikes focused a bias for chinook.

Pile Dikes (PD) were the greatest focus for 2023 and NOAA, with BPA and WDFW, expanded the into four sites:

- PD7 (RM 43.30)
- PD5 (RM 38.26)
- PD6 (RM 42.93)
- PD8 (RM 51.10)

Brooks outlined NOAA’s 2024 season proposal. He said that they have received additional funding from BPA to improve the PD sites to eventually replace TWX as it is expensive to operate in manpower and is getting long in the tooth. They plan to permanently install and expand PD5 and PD6. Then install a new test site, PDX, using a new floating equipment panel that can be used in the future to test additional sites. Finally, they are going to complete

BON ITS Development, they have sent in the 1B Fixed Open proposal to the Corps, and they are in the process of evaluating. It may be possible for them to install next year.

Tom Lorz, Umatilla/CRITFC, asked about whether we have resolved the issue with the anchoring system on the barge. He said that the anchoring system used was setting up a very large bow wave which was going to impact fish. He asked if we have addressed the issue of trying a different system to see if it was bad anchors or bad PIT detection.

Brooks said that they have not addressed it but they have considered it. He said when they looked at the data in 2020, when it was deployed below Bonneville, there were more detections on the outside of the fins than on the inside fins. It appears that there was some kind of avoidance. They considered that with an 11 ft/sec mooring ball out in front of the barge was creating surface disturbance. He said that was one possible reason for the possible avoidance. He said to answer Lorz' question, they have not been funded to put the barge out again, so they have not addressed that specifically. They have not tried to moor it 100 m from the floating ball.

Conder said in the graphics showing the distributions of species detected on the pile dikes compared to the trawl. He asked if anyone has done an estimation of the distribution of PIT tags that would be available for detection. He said that the trawl could potentially be biased one way or the other itself.

Brooks said that Steve Smith, NOAA, would be a better resource to answer that question.

9. Juvenile Fish Transport and Survival Estimates - Steve Smith, NOAA Science Center

Smith qualified that the fish in this presentation are only those that were allowed to migrate in the river. He also said that the PIT tag detections downstream of BON are critical to estimating survival to BON. Models require data from downstream of the last site for which you can estimate survival.

The reduction in detection probabilities that has occurred in the last four years especially at the dams that only had detection in the juvenile bypass systems, far fewer fish are using those systems with the higher spill. There are two locations that have remained closer to their typical detection and those are LGR and BON.

Smith presented a few graphs:

- The average daily spill at LGS for April through mid-June.
- The daily average temperatures at LGS for April through mid-June.
- Daily Spill 2006 – 2023 Mean LGR, LGS, LMN in terms of volume (kcfs)
 - This showed the reaction of the Corps to GBT exceedances and then the forced spill after due to the rush in May.
- Daily Percentage of Spill 2006 – 2023 Mean LGR, LGS, LMN
 - 2020 – 2022 showed historically high spill
 - 2023 was different because of the high flows in May keeping the volumes how they were kept a lower percentage of spill.
- Daily Dissolved Gas Saturation

Passage timing for 2023 all four stocks were close to the median as far as to where the peak was and overall timing. For hatchery chinook in 2023 the migration was a more concentrated

peak, this may have been a consequence of the big rush of water in May. Chinook and steelhead both had longer travel times despite the greater spill in 2023.

In terms of survival 2023:

- Snake River Basin Hatcheries: 67% on average
- Upper Columbia River Hatcheries: 43.1% on average
 - Lowest we have had.
 - Third year in a row that it was below average.
 - Smith has not looked at it yet to try to diagnose.
- Hatchery Steelhead – Upper Columbia: 34.5% on average

Snake River Trap to Lower Granite is important because this is the first reservoir that Snake River fish traverse.

- Snake to LWG – Yearling Chinook 87.6% on average
 - Below average 5 out of the 6 last years
 - Number of fish tagged there has been decreasing so the confidence has been decreasing.
- Snake to LWG – Steelhead 94.2% on average
- LWG to MCN – Chinook 62.8% on average (below)
- LWG to MCN – Steelhead 71.1% on average
- MCN to BON – Chinook (Snake) 74.9% on average (above)
- MCN to BON – Steelhead (Snake) 89.3% on average (well above)
- MCN to BON – Chinook (U. Columbia) 78.2% on average (above)
- MCN to BON – Steelhead (U. Columbia) 100.3% on average (well above)
- Snake to BON – Chinook 42.3% on average (below)
- Snake to BON – Steelhead 58.4% on average (above)

Migrating smolts transported at collector dams, because there were not a lot of fish before April 24, a good population was subject to collection and transportation. About a third of steelhead and chinook were transported and about 40% of sockeye.

10. Smolt Transportation – Yearling Chinook and Steelhead Data from Migration Years 2017 – 2020 - Steve Smith, NOAA Science Center

Smith presented about yearling chinook and steelhead starting as smolts at LWG for fish returning as adults through December 31, 2022. In a head-to-head comparison transported smolt-to-adult return ratio (SAR) continued to return in higher rates than bypassed fish. The annual estimated ratio of transported vs. bypassed showed that in 2020 that they were all above 1.0, for steelhead for the last five years it has been closer to 2 and 5 times the return rate.

Smith then added in the LWG spilled fish for wild chinook and steelhead, and hatchery chinook and steelhead. The data showed that the return rate was higher for the spilled fish than the bypassed in all years. Indications show that for chinook from the beginning of the transportation period at LWG, April 24, that wild fish were returning 50% higher rate for transported than bypassed. It was 29% for spilled vs. bypassed. There appears to be a case for spill outperforming transport, but the data is still young at one year.

Lorz said that in 2021 NOAA did Appendix D on survivals where they did a Bayesian model. He asked if they are still doing Bayesian modelling.

Smith said that model is still under development and NOAA has not used it yet for any of their official reports or memos. Lorz happened to catch the one estimate that went above 100 in the CGS model. He said NOAA's version of that model and how they are going to implement it is not ready for primetime.

Lorz asked once NOAA adds in the avian detections in the estuary does Smith think that that survival will go up.

Smith said not necessarily because it does not move survival estimates predictably in either direction it just provides more data to estimate the detection probability at BON which increases precision. Because it is a statistical sample it can change the estimate and it can change it either direction. Conder had asked a question earlier about the bias, and this is where the bias potentially comes in. The statistical model assumes that fish that were detected at BON and fish not detected at BON are equally likely to show up in the sample downstream, in the same proportions. NOAA has a different number of sampling mechanisms in the estuary that are all sampling differently and might have their own biases but because the estuary samples are the last sample in the line their ability to test is severely hampered. They are stuck with making that assumption and hope that whatever biases there are all balance out.

Ebel asked for Smith's spillway estimates if he removed individuals that were subsequently detected at LGS or LMN, or if he accounted for any post-LGR spillway detection history.

Smith said that the numbers that he showed are just looking at fish bypassed at LGR versus fish spilled at LGR and count them up and look to see how many returned as adults. He did not make any adjustments for what happened to them downstream. He assumed that some fish end up getting transported elsewhere, that is part of their experience.

11. Lower Columbia River Chum Salmon: Status, IPM Development, and Habitat Restoration - Todd Hillson, WA Department of Fish & Wildlife

Hillson provided an overview of the Evolutionarily Significant Unit (ESU) on the Washington side of the Lower Columbia. Currently there are 1,000 – 10,000s of chum returning to annually to the ESU and it is divided into 17 historical populations.

Washington's approach to recovery has been habitat restoration and creation, supplementation and reintroduction, and monitoring. A large part of their program is monitoring specifically the Viable Salmonid Population (VSP) parameter monitoring program. Hillson described this in full in the presentation.

Hillson provided the status and trends:

- Grays River
 - Minimum Viability: 1600 spawners

- Above Minimum Viability Goal 100% last 22 years
- Washougal Basin includes two mainstem Columbia River spawning locations.
 - Minimum Viability: 1300 spawners
 - Above Minimum Viability Goal 16 of last 21 years
- Lower Gorge includes Ives Population
 - Minimum Viability: 1000 spawners
 - Above Minimum Viability Goal 19 of last 23 years
 - 4 mainstem sites (Ives, Horsetail, Multnomah, St. Cloud)
 - 3 tributaries (Hamilton Creek, Hardy Creek, Duncan)
- Upper Gorge (Above Bonneville)
 - Minimum Viability: 450 spawners
 - Last time above Minimum Viability Goal was 1966.
 - USFWS did radio telemetry work in early-00s and a significant portion of the chum that ascend past BON eventually fall back through BON and spawn below.
- Elochoman and Skamokawa Population
 - Minimum Viability: 1300 spawners
 - Above Minimum Viability Goal two or three times
 - Have not calculated a peak count estimation yet.

WDFW have taken all the data and put it into an Integrated Population Model (IPM) to support their three-tiered recovery approach. The model allows WDFW to use sparse data to generate point estimates and variance.

Hillson described WDFW's habitat restoration and creation projects with a focus on sizing the off-channel habitat for ~500 spawning pairs. The goal for the channels is to achieve an egg to fry survival of 25 – 50%. So far, they have completed Duncan Creek, Hamilton Springs, two smaller channels in the Skamokawa Basin, and Crazy Johnson. WDFW has Elochoman Hatchery site in planning, the final design was completed in 2016 but the site is on hold until they get a full restoration plan and funding. The Eagle Island Spawning Channel is in an old channel scar. They have funding, final designs but the permits have expired and has needed to go back in permitting. Hillson is hoping for construction to begin in 2024/25.

Stranz shared that there was a chat from Christine Peterson, BPA, that she is glad to hear Eagle Island might happen.

Swank said that he was curious about Duncan Creek spawning channel. He said that it was his understanding that is where WDFW is sometimes transporting captured adults to that channel and using it to estimate some type of spawn or recruit relationship. He asked if that is still ongoing and what has been learned from that, if there has been a bottle neck or an environmental condition, or what drives the recruits coming out of that channel. He said that it was his understanding that the Duncan Creek channel allows WDFW to do that estimate. He asked if WDFW has teased out what is driving the number of smolts being produced each year based on the research there.

Hillson said that they did a lot of environmental monitoring in the first several years of the project, but they have not tied that into a model or anything. He said that the egg to fry survival is pretty consistent at 40 – 55% range. He said that they have got what he considers ideal conditions in there. Duncan Creek and Hamilton Springs have similar egg to fry survival rates. Both have good gravel with low amounts of fines, good upwelling, warmer water, no flooding, and no scour. He said maybe once we have Crazy Johnson Creek, we will have more natural off-channel spawning area to compare rates and environmental conditions with.

Swank asked if that consistent egg to fry survival natural or unusual based on the fact that it is a controlled environment.

Hillson said that it is a controlled environment for the egg to fry survival. They have teased that out by making multiple juvenile trapping locations down in the Gray's River basin where they have been looking at what they consider high quality off-channel spawning area in Crazy Johnson versus the West Fork and the Main Stem Grays. Crazy Johnson consistently has higher egg to fry survivals in the same year as the estimates for the West Fork and Grays populations. Hillson said that they think that it is tied to the winter flow events, how much scour, how much flow we have.

Bettin asked how many fish WDFW got in the Duncan Creek Trap this year.

Hillson said they have 110.

Bettin asked if they plan to clean out the trap.

Hillson said yes, the plan is not to be there permanently.

Morrill told Hillson thank you and that it was a great presentation.

Bettin asked if there was any preliminary information on the late start or the 10.2' start. He asked if WDFW has learned anything.

Hillson said that he talked to the guys doing the surveying work and the numbers seem to be low and they were not in the accustomed areas. He said that once we got into the more normal tailwater elevations fish moved in to where they have been historically. Hillson said that appears that Hamilton Slough has had some gravel movement, and the fish are using a different side than they have in the past.

Conder said that he was curious with the over 600 going over BON this year. He asked if any indication of where they might be spawning and if they have been successful.

Hillson said that they have not done any monitoring. They picked some up in their fall chinook work, up in Wind River, Drano, and White Salmon occasionally. Chris, WDFW, has done some DNA work up there for one or two years that showed some spawning possibly happening in Hood, but they are not there in big numbers. Hillson said that he has not heard of anyone seeing them in big numbers in surveys above BON.

Van Dyke asked how WDFW treats the artificial spawning channel.

Hillson said that production out of a spawning channel is considered a Natural Origin Recruit (NOR).

Swieca asked how the sites being selected for the additional artificial spawning channels that are in the works. She asked if there is some criteria used for the selection of those locations.

Hillson said for Elocaman, Skamokawa, and Ives WDFW started out with a basin-wide survey, looking at Lidar, side channel scars, and historical information trying to find old channels and side channels that may have disconnected. Then they go out and do boots on the ground surveys, looking at those areas and talk to landowners. One of the biggest hurdles is getting landowner buy-in. They will then pick 3 or 4 of the top sites and then do pit pump tests for ground water for amount and levels. Then they will go in and do drive pisometers, hobo monitors for a season or two while chum would be in there.

12. Snake River stocks: Status versus Management Goals - Jay Hesse, Nez Perce Tribe

Underpinning of a Fish Managers Thought Process of 8 Steps of Management

1. What is the condition of the resource that you want to have?
2. What is the status relative to the desired condition?
3. What are the limiting factors?
4. What options do you have to address those limiting factors?
5. ...

What we do at TMT addresses one of the limiting factors.

Hesse gave a presentation using an object lesson with pitchers of liquid representing historical abundance, wild abundance, and hatchery abundance. The historic pitcher representing the historical 1855 Treaty signing was about 1M or more Spring/Summer Chinook coming back to the Snake Basin. The comparison Hesse gave was 1 milliliter was equal to 1 thousand chinook returning. A full pitcher represented the number of fish returning at the time of the Treaty.

There was a process lead by NOAA Fisheries called the Columbia Basin partnership. In the document there was a goal put out for an abundance-based criteria for natural origin fish for the Snake Basin, 235,000 fish. As the hydro system was developed hatcheries were used to mitigate to replace the lost production from the construction of those they expected to return 90,000 fish.



Current day, 2023 estimates of Spring/Summer Chinook are 7,500 natural origin fish and 4,500 hatchery fish.

Hesse shared historical context from the Niimiipuu's perspective of the right to harvest, and responsibility to manage. He shared two resources [Nez Perce Tribe Department of Fisheries Resources Management Plan](#) and [Phase 2 Report of the Columbia Basin Partnership Task Force](#).

Hesse provided some graphics that reiterated the lesson from above in the PowerPoint, explaining the grade levels of the fish in the river basin and what are the goals for the future for getting to healthy and harvestable. For the last three generations there have been more progeny than their parents. Hesse also gave an update on the Quasi-Extinction.

Hesse explained what has been identified as goals, based specifically the Smolt to Adult survival rate to replace the fisheries study found in the *CSS Report 2022*, Chapter 6. To achieve these goals, it will take some changes in how we operate the hydro system.

Carolina Andes, BPA, thanked Hesse and asked him if he considered for resources for the future restorations.

Fish managers and the Nez Perce Tribe are highly engaged in habitat restoration throughout the Snake Basin and are actively seeking resources to do that work, both on the ground restoration to improve quality (over-wintering habitat, removing of barriers, habitat restoration) as well as protective-type aspects (litigation to minimize increased mining activity in S. Fork Salmon Basin). He said they are now engaged in how to prioritize. Hesse said that their Nez Perce thought process is all of the habitats will be ultimately important and they did not put all of their eggs into one population, it was spread out. They are now rethinking that given the growing list of threats from the climate change models and they are asking how to hang on to growing populations in the short term while the larger term issues are addressed.

Andes was also interested if the food sources with the increase of population was considered.

Hesse said that they have analyzed the carrying capacity. He said there is analysis that population of density effects even at these very low levels. He said that it is not inconsistent with the thought process where primary marine drive nutrients cycling has been broken and highly limited. One of the project that they have proposed as part of one of the quasi-extinction thresholds is nutrient enhancement. He said whether that is with salmon analog, nutrient carcasses, which was experimented with 20 years ago, but they are taking actions not to maximize the distribution of fall hatchery brood stock carcasses back into the habitat, refocusing this into certain populations. They have also proposed the exploitation of shad carcasses as a surrogate for the salmon carcasses but there are some questions about the nutrient value and suitability of those. There are also concerns about thiaminase and other things they need to figure out first. He said that it is something that they are concerned about; it is one of those factors of having low abundance over time.

Swank said that he was intrigued by Hesse's plot of the generational spawner to recruits for the last three years showing progress. He asked how the number of progeny are measured and does Hesse have any thoughts on what might be driving that.

Hesse said that is a generational growth index and for all of the detailed modelers that collect all of the data. He said that there are many people who collect this data across every one of our agencies, funding sources are diverse, a bunch of it comes from the Fish and Wildlife program and is funded by BPA. Hesse said that these are LWG numbers, IDFG has a huge part of that amongst others. Hesse said that the generational growth rate is a basin coming back at LWG. It is broad, non-age specific. He picked the predominant age of return, in this case for chinook: 4/5

years. The majority of the progeny coming back in that one year. He said that it is not exact, and it is not the true Parent : Progeny ratios. He has not been able to do that yet for steelhead given all the diversity. The reasons Hesse thinks it is positive are the good ocean conditions, looking at the NOAA stop light chart. Aligning it with the outmigration with the high spill programs, Hesse said that the results are consistent with modeling outcomes of high spill operations in good ocean conditions, they are not a statistical proof of the outcomes of either one of those conditions.

Morrill said that he appreciated what Hesse shared. He said one of the things that has improved in TMT is the ability to share and to understand the positions that we have. It is tough and hard to see any significant progress in the recovery of salmon and steelhead.

13. Group reflection

TMT reflected on the following question:

What has stood out to you from today's presentations and how will you use that information moving forward in your role at the TMT?

Generally, the group said that they found that open communication made making decision making easier. They mentioned that operations worked far better when they looked to the past to learn from it and worked together adaptively. Looking at forecasts have allowed TMT to make smarter and wiser decisions. Overall, TMT showed that they can be a place to come to with concerns and they were willing to work them out to the best of their ability.