COLUMBIA RIVER REGIONAL FORUM TECHNICAL MANAGEMENT TEAM

2018 Year End Review

December 19, 2018

DRAFT FACILITATOR'S SUMMARY

Facilitator: Emily Stranz; Notes: Colby Mills, DS Consulting

The following summary is intended to provide a brief recap of the TMT's Year End Review; however, is not intended to be a "record" of the meeting. Presentations and meeting minutes can be found on the TMT website: http://pweb.crohms.org/tmt/agendas/2018/ .

Welcome and Introductions

DS Consulting facilitator, Emily Stranz, welcomed the group to the Columbia River Technical Management Team's (TMT) 20th annual Year End Review (YER). She reminded the group that the review is an opportunity to step away from in-season management and reflect as a team on conditions, operations, and data from the last year in order to inform process and operations for 2019.

Spring 2018 Flow Conditions

Julie Amman, USACE, began by recapping the spring runoff and water year, to provide context for the 2018 operations review. There was good snowpack setting up for last year's runoff, especially in the northern part of the basin. Weather conditions in April were wet with precipitation above normal and cool temperatures in the headwaters. May experienced well above normal temperatures, triggering rapid snowmelt, with additional precipitation in the Upper Snake River Basin. June was relatively warm and dry, and the snowpack was depleted, thus runoff was low.

The snow water equivalent (SWE) in March was heavy in the Northern Basins in Canada, Montana and Idaho, but not as much in Oregon and Southern Idaho. That water helped to keep flows above normal all the way down to The Dalles. April lost some low elevation snow but still was able to build snowpack in the northern areas.

Julie highlighted 2018 conditions at the Northern Basin projects. Pend Oreille, Hungry Horse and Albeni Falls all had significant runoff. Runoff in May was 206% of normal at Albeni Falls, which caused problems in the Montana basins with active floodplains. Lake Pend Oreille reached peak elevation of 2,064.3 feet on May 30, and had a peak outflow of 119 kcfs. The project operated on a free-flow from April 29 – June 6, with a total runoff of 17.1 MAF, 146% of normal.

At Grand Coulee, runoff in May was 187% of normal, with the April – July total of 121% of normal. The project was drafted to a seasonal minimum elevation of 1221.5 feet in early May for flood risk management. Lower Granite runoff for May was also above normal at 149% while the total runoff for April – July was 116% of normal. She noted that there wasn't the amount of snowpack in the Upper Snake Basin that was present in 2017. Peak inflow at the project was at 176 kcfs. The project was held in the bottom 1 foot operating range from May 7 – June 3 for flood risk management near Lewiston. The Dalles runoff in May was 176% of normal, with a total runoff for April – July at 116% of normal. Peak inflow at the project was 484 kcfs on May 17, with Bonneville Dam peak outflow of 496 kcfs on May 16. The Columbia River at Vancouver peaked at minor flood stage (16 feet). Overall, June, July and August saw below average flows due to the early snowmelt and the lack of spring precipitation.

To conclude, Julie presented a summary hydrograph for Columbia River at The Dalles. It showed that for the 2018 water year, there was a significant amount of runoff in a short amount of time, and then not much more.

Rocks in the Bonneville Spillway

Laurie Ebner, USACE, updated the group on her findings regarding rocks and other hazardous debris in and around the Bonneville spillway. To help the group understand why and how rocks are impacting the spillway, Laurie provided a brief history of the dam, including damages to the spillway from one of the largest floods, in 1948. The 1948 flood pushed materials downstream, but not out of the Bonneville spillway channel. With the subsequent repairs, made in 1954, Flow deflectors were added to reduce the TDG. However, the deflectors cause bizarre hydraulics, and at high velocities actually move flow upstream, bringing rocks up the spillway. The ramps in the spillway also play a role, as they prevent rocks from coming back downstream. Laurie emphasized that having rocks in the spillway is a huge issue because "ball milling" occurs when debris enters a stilling basin and continually churns up the concrete. She noted that this is a major problem at many dams, although it is not likely to cause a failure unless the resulting damage remains unchecked, which is why routine inspections are critical. The past few years have seen many rocks enter the spillway with higher flows, and survey results suggest about 3,000 cubic yards of loose material could continue to move upstream.

2018 Retrospective of Total Dissolved Gas – Lessons Learned

2018 Spring Spill Operations

Dan Turner, USACE, summarized spring spill, state water quality standards, and TDG management at several projects. He began with an overview of the procedure to set spill caps for the gas cap spill operation. The spill season was April 3 – June 20 for lower Snake River projects, and April 10 – June 15 for lower Columbia River projects. 2018 operations were complex and were designed to maximize spill up to, but not to exceed, water quality standards in Oregon and Washington. He provided an outline of the process used daily to set gas caps, which included reviewing TDG data, and looking ahead at flow and weather forecasts. The process relied heavily on the TDG monitoring network, with real time data from each of the projects.

Both Washington and Oregon have an adjustment to their water quality standard, allowing for more TDG in the Columbia River than the Clean Water Act 110% standard. The Corps must operate spill adjustments to the more restrictive state TDG WQS (and most restrictive gauge) in order to maintain TDG within all applicable state standards.

Dan provided a conceptual diagram of the TDG monitoring setup: an upstream forebay gauge, two tailrace gauges (spillway only, and mixed), and a downstream project forebay gauge. He noted that environmental factors significantly influence TDG as flow moves downstream; influential factors include water travel time, wind speed, water temperature, barometric pressure and dispersion (upstream influences downstream). Results of monitoring show that there is still variability in the degassing rate from tailrace to downstream forebay, and that the downstream forebay TDG can be greater to or equal to the upstream tailrace TDG. Dan noted that the downstream forebay gauge is usually the most restrictive gauge. There is also no specific spill cap that meets downstream forebay TDG criteria of 115%. He concluded that every water year, and every week, will look different and present unique challenges to implementation.

Little Goose Adult Salmon Passage

2018 Operations at Little Goose Dam

Doug Baus, USACE, presented on adult passage conditions at Little Goose Dam. He noted operating to 30% spill is an effective tool used to improve passage conditions when adult Chinook salmon are delayed below Little Goose Dam (LGS) due to high spill levels. In 2018, during the 30% spill period, a higher

percentage of tagged adults entered the fish ladder (40% - 65%, compared to less than 20% when spill was higher than 30%). Concerns over the impacts of reduced spill on juveniles were mitigated by reducing to 30% spill during daytime hours, when juveniles are not moving as much. Doug concluded that reducing to 30% spill at Little Goose could be an effective tool in future years to improve passage conditions for adult Chinook salmon.

Erick Van Dyke, OR, discussed a brief history of adult Chinook salmon passage at Little Goose Dam. He pointed to studies conducted in 1976 and 1977 that indicated variability in upstream migration timing of adult salmon and steelhead, with a significantly longer travel time over Little Goose, compared to Lower Granite. The study suggested that spill and turbine operations are regular events at all dams and are not solely responsible for excessive delay. Furthermore, a 2009 study indicated no significant difference in ladder passage rates at Little Goose as a result of different spill operations. In preparation for the 2018 Spring operations, the Fish Passage Center (FPC) identified potential factors that may impact passage at Little Goose, including project configuration, bathymetry, powerhouse and spillbay operations, and operation of the TSWs. In a later memo, FPC added that smolt transport, powerhouse encounter rates, water flow and temperatures, and other factors also impact upstream migration rates. These memos are available on the FPC website.

Paul Wagner, NOAA, reviewed a recent history of Little Goose dam spill. A 2005 court order increased spill to the gas cap at projects, and Little Goose started spilling 40-45%. However, fish stopped passing, and so spill was reduced to 30%. This then became the standard operation, although it was not universally accepted. In 2018, the courts ordered to spill to the gas cap. TMT requested tools to be developed to inform the decision process. Both DART and FPC brought forward tools to inform the passage timing and success of PIT tagged fish that passed Lower Monumental and Little Goose Dams. Paul explained variables considered by the two tools and how the TMT utilized the information in season. He noted that fallback percent by project and year, river environment flow and temperature and effect on spill at the projects were also measures considered in decision making at TMT.

Erick concluded with lessons learned. He noted that having multiple levels of information was helpful when it came to discussion on how to adaptively manage passage. Additionally, both the DART and FPC action tools were useful for identifying when coordination and operational changes were needed. However, more evaluation is needed to verify if the action tools were effective in avoiding unintended consequences, and additional sensitivity analysis could allow for more precision. Additionally, it would be helpful for the TMT to establish agreed upon criteria to help in-season management decisions. Erick reviewed passage rates for PIT tagged adults over Little Goose and Lower Granite and concluded that additional evaluation is needed to identify operations that retain the necessary survival benefits for both juvenile and adult salmon and steelhead traveling through the FCRPS dams.

Adult Spring Chinook Salmon Passage and Migration Behavior through the Lower Snake

Daniel Deng, PNNL, reported on adult spring Chinook salmon passage and migration behavior through the Lower Snake River (gas cap spill evaluation). This study, using acoustic telemetry, evaluated tailrace movements, passage, and fallback of adult Chinook salmon at LGS in relation to increased spill levels, by looking at behavior and movement in the tailrace, behavior in relation to operations and hydraulic conditions, delay into the tailrace locations, and preferred entrances into the adult fish ladder. Daniel concluded that the acoustic telemetry receivers deployed in the LGS tailrace resulted in high detection efficiency and provided good tracking results. Results from the study showed more fallback than two previous studies.

A majority of fish approached the LGS tailrace along the north shore, and more than half of the fish entered using the north shore fish ladder entrance. The study found that with higher spill percentage, fish took more time to enter the LGS fish ladder. Daniel noted that a draft of the final report is expected in February 2019.

Juvenile Salmon Transport & Reach Survival

Smolt Survival and Travel Time

Steve Smith, NOAA, presented data on 2018 spring migration conditions, and travel time and survival of PIT tagged smolts through the hydropower system. He noted that the data looks mostly at yearling Chinook and steelhead with some survival info on sockeye, all of which were left to migrate in-river, as opposed to being transported. 2018 Spring conditions consisted of above average flows, above average spill, and warmer than average water. Tailrace TDGs for Snake River Dams, showed higher than average gas in the Snake River. Travel times for both yearling Chinook and steelhead were among the shortest recorded, as a result, transportation was started a week earlier than previous years and the percent of the smolts transported was higher as well.

Yearling Chinook weekly average travel time for fish leaving Lower Granite Dam was slightly below average, while the average travel time for steelhead from Lower Granite to Bonneville had the shortest travel times, some of the fastest migration observed.

Based on PIT tag counts, it was a fairly average year for survival. The full hydropower system from the Snake River trap to Bonneville had 38.1% survival for yearling Chinook, which was 11% below average, and 52.3% survival for steelhead which was just above the average of 49.1%. 2018 survival estimates for spring Chinook were average in the Snake River and below average in the Lower Columbia River. Steelhead and Sockeye survival estimates were above average in both reaches. Steve provided survival estimates for each species by reach; more data is available on the TMT website. He noted that yearling Chinook survival from McNary to Bonneville was below average for the 4th year in a role, which is of concern. Sockeye from the Snake River had above average survival rates for every reach, which paints a good picture for survival. The Columbia River sockeye had survival estimates at a little above or right at average.

Transport

Steve continued with seasonal analyses of transportation of yearling Chinook and steelhead (migration years 2014 – 2016), and an update of adult returns through December 16, 2018. The purpose of these analyses is to look for patterns in smolt to adult return rates for transported fish versus fish migrating in the river, over a season. To determine patterns within the season, there needs to be a time stamp for when the fish migrated as smolts, thus, the analysis uses tagged fish that went through the juvenile bypass system at Lower Granite, Little Goose, and Lower Monumental.

General observations on passage data show that the results tend to be similar for Lower Granite (LGR) and Little Goose Dams (LGS), both of which combined account for about 75-80% of all transported fish. Things were more variable at Lower Monumental (LMN) due to less data, and generally a lower transport to bypass (T:B) ratio;, transportation from LMN was not as beneficial as from LGR and LGS. In recent years there has been less seasonality in T:B ratios, however higher than average T:B ratios in May 2014 and 2016, and even higher in 2015; which meant very low SARs for bypassed fish. There has also been a trend in recent years of more fish migrating in April, with transportation beginning on April 24 in 2018.

Steve shared that the next steps for this effort include further data reduction and synthesis for multi-year analysis with parameters tied across years, and an updated report completed in 2019.

Lamprey Passage and Counts

Pacific Lamprey Passage in the Lower Columbia and Snake Rivers

Dave Swank, USFWS, reported on Pacific lamprey passage in the Lower Columbia and Snake Rivers, although he noted that not as many studies are done on this species so there's more speculation on data.

He began with a brief summary of escapement, looking at basic counts at the projects on the Lower Columbia and Snake Rivers, concentrating on the recent 1999 – 2018 time period. 2018 was a good year for Pacific lamprey passage with just over 131,000 fish counted (window and Lamprey Passage System (LPS) counts); however, it was not quite as good as 2017, when over 290,000 lamprey were counted. Dave noted that hopefully the past 3 – 4 years represent the new norm for lamprey returns, and not just a spike in the numbers. Comparing the Bonneville Dam counts to upriver Columbia River projects shows a large discrepancy; with a significant drop in lamprey counted at The Dalles Dam and upstream. Dave provided a few theories to explain this drop (perhaps adults are using up more energy going upstream and through the projects?); although there is no firm answer for what is driving the discrepancy.

Historical data show very high returns for Pacific lamprey at Bonneville in the '50s and '60s, and is based on window counts alone (which are not the most accurate due to fallback and re-assention). During the period between 1970 and 1998 lamprey were not counted so there is a gap in the data. Then in 1999 both window and LPS counts started tracking passage.

LPS structures have been very effective at passing lamprey, over the last seven years the average use was 45% of the total adult lamprey run at Bonneville. The Washington shore LPS was recently improved and fish are passing successfully through the new ramps.

Multiple efforts are underway to improve lamprey passage. One potential improvement is reducing entrance velocities at ladders. Preliminary findings suggest mixed results, with increased entrance efficiency during the reduced velocity time period; however, overall passage efficiency was not significantly improved. This could be due to a passage bottleneck at the serpentine section of the ladder. The fishway structures on the Ice Harbor south ladder entrance are being retrofitted for lamprey passage by reducing the total surface area of the entrance and adding holes on the inside of the structure. This is intended to lower velocities and create better entrance efficiency. At Ice Harbor, they have also added orifices to the weir walls as a strategy to get adult lamprey through the troublesome serpentine section of the fish ladder. Another recent experimental improvement is the wetted wall that was installed this past spring, to help get fish out of the ladder.

Juvenile and Adult Sockeye

Juvenile

John Powell, ID, presented an update on the 2018 juvenile and adult migrations for Snake River sockeye. Following the 1991 ESA listing of Snake River sockeye, Idaho initiated a captive brood stock program to support the species population and genetic diversity, as well as to determine appropriate release strategies for recolonization. In the past few years smolt out-migration survival rates have been low from Springfield, Sawtooth and Oxbow hatcheries. Possible contributing factors include gas super-saturation, pumping trauma, de-smoltificaion, water chemistry or stress. Results from the 2017 release suggest that stress factors remain post-release. Upon researching effects of water chemistry differences, results support the working hypothesis that water chemistry is related to the post-release stress on the smolts. In 2018 a study was done to test different water chemistry impacts on the smolts stress levels. Results indicated that acclimation in less hard water was successful at addressing the post-release stress and increasing survival of smolts.

Moving forward in 2019 ID Fish and Game will continue to study stressors on the fish and impacts of acclimation. Additionally they will continue transportation and post-stress sampling during the acclimation and release transports this spring.

Adult

This year ID Fish and Game estimated a 0% fallback for Redfish Lake sockeye, which is in contrast to what has been observed in the past (John noted that there were a low number of tags available to estimate fallback and ascension). Fish trapped at Lower Granite Dam had genetic samples taken to allow them to be assigned to their genetic stock of origin; those sampled were from Redfish Lake, Osoyoos Lake or Lake Wenatchee populations.

The conversion rate for tagged fish from Lower Granite Dam up to the Stanley basin was 43.1%, which highlights a consistent decreasing trend of conversion across the run over the past five years or so. This was expected, as lower conversions occur with the increasing water temperatures.

In a typical return year for adult Snake River sockeye, the fish swim over 1,400km up to the Stanley Basin, where they're trapped at either Redfish Lake Creek weir or the Sawtooth Hatchery weir. These fish are either trucked to Eagle Hatchery, or if the return is large, some fish are released for spawning into Redfish Lake. Once fish arrive at Eagle Hatchery parentage-based tagging (PBT) is used to select the broodstock. PBT can trace an individual all the way back to the founders of the captive broodstock. Contributions to the broodstock are equalized across the pedigrees; this is a way to use genetics to minimize inbreeding in the captive broodstock. The underrepresented lineages are kept for broodstock, while the overrepresented lineages are destined for release for spawning in Redfish Lake.

For years when trap and haul is instituted, as in 2015, fish are still trapped in the Stanley Basin, so some fish return to Redfish Lake Creek and then are taken to Eagle Hatchery. In addition, adults are trapped at the facility at Lower Granite Dam and trucked directly to Eagle Hatchery, where it proceeds as a normal return year. Once spawning is complete eggs are shipped from Burley Creek and Eagle Hatchery to Springfield Hatchery where they are reared and released as smolts at Redfish Lake Creek. A small number of eyed eggs are selected from each sub-family at Eagle Hatchery that are kept at Eagle with part sent to Burley Creek to continue the captive broodstock.

2019 Forecast & NOAA's Long-Range Forecast

Kyle Dittmer, CRITFC, provided a climate forecast, noting that his prediction is that the 2018-2019 winter will be predominantly enso-neutral conditions with some El Niño "flavor". He does not anticipate that these conditions will have a major impact on salmon survival going into 2019. Although there is a difference of forecasts, as NOAA forecasts a 90% chance for El Niño.

He predicted that the Hood River area will experience near normal temperatures this winter, slightly on the warm side in January and February, with precipitation near to normal or a bit drier than normal. He expects about 121% of normal snowfall from November 2018 through March 2019, with many snow events and a seasonal total of 23 inches. It's looking to be a bit snowier than normal in the Columbia River Gorge. Temperatures in the mountains are expected to be near normal although a bit warmer in January. Colder, wetter, and snowier conditions could appear in late winter and early spring, which might preserve any winter snowpack. Kyle predicted snow events to be 117% of normal, with a base of around 240 inches. Portland can expect near normal temperatures with near to below normal precipitation, and up to 3 snow events for a season total of 5.5 inches.

Group Reflections on 2018 and Aspirations for 2019

Participants were asked to reflect as a group on TMT conversations, coordination, operations and outcomes over the last year and to consider: What lessons would be helpful to carry forward into future years; what did TMT do well; and, what would the group like to do differently in the coming year. The following thoughts were expressed by group members [Note: comments provided below reflect what was heard from individual participants, however, are not reflective of the group as a whole.]:

What lessons would be helpful to carry forward into future years?

- When we work out agreements, we need to make sure we have common understanding and expectations on what will occur. Species and stakeholders throughout the basin need to be considered when making decisions.
- At times there is critically important information, that cannot/is not counted or measured, however, is still important to consider in decision making.
- Learn from the fish: what fish historically/naturally do is what they should do. Recreating natural conditions is necessary for fish to persist in the Snake River.
- There are still quite a few watersheds in Idaho that require a deeper look into the timing delays (for particularly Chinook). There may be some operational adjustments to make if fish are holding back, especially fish that might be from critical areas where the recovery goals are not being reached.
- Tools to evaluate in season are helpful for decision making. If needed, these tools can be refined. Also, it is helpful to talk about differences in interpretations before utilizing the tools; TMT should take time before using tools to clarify differences and seek resolution.
- Going into last year's spill operation the complexity and difficulty of trying to set spill caps was not fully understood. Looking ahead it's important to recognize that next year's operation will be different and will not have been implemented before.
- There are so many variables that go into setting spill caps, including a changing hydrograph.
- Early and frequent coordination between members of TMT is important. For potentially sensitive issues, early notice is appreciated and helps team members better understand what is being proposed, and allows time for consideration of potential benefits and drawbacks.
- Providing proposals ahead of meetings in writing is ideal (even if it is just a few sentences clarifying the proposal).
- There is hope that the Flex Spill agreement and operation will eliminate some of issues from previous year, particularly at Little Goose.
- Trading spill between McNary and John Day, and allowing spill to go up to carry reserves above 1% might be worth revisiting.

What did TMT do well?

- There were sincere efforts made to address issues, concerns and difference in opinions. There are still challenges, however, this last year was good for building trust, understanding and the ability to work together. The process that TMT started and the steps that have been taken hopefully will lead to better teamwork in trying to come to the best solution.
- People worked hard to understand each other's points of views and learned a lot from each other. Difficult conversations that required extra attention and effort did help build trust and understanding.
- The tools that were developed for adult delay were very helpful.
- There were great explanations of different concepts, operations and ideas.
- Lots of Friday afternoon calls! (Could be good or bad).

- TMT acted on issues; things weren't deferred to a future date. Quick reactions and quick responses were great.
- Thank you to Jay Hesse for his hard work on the flex-spill agreement: "atta-fish!"

Emily noted that this list can be revisited later at TMT to determine what next steps should be taken to improve on the upcoming year of coordination. She thanked those who prepared and presented information during the session, noting that it is always helpful to recap the year and to look back to determine what lessons can be carried forward. She also thanked everyone for staying engaged and contributing to meaningful dialogue throughout the day. And with that, the meeting was adjourned.

Present for all or part of the meeting:
Julie Amman (USACE), Leslie Bach (NPCC), Doug Baus (USACE), Scott Bettin (BPA), Jim Chandler (IPC), Brandon Chockley (FPC), Eric Chow (USACE), Trevor Conder (NOAA), Zhiqun (Daniel) Deng (PNNL), Kyle Dittmer (CRITFC), Catherine Dudgeon (USACE), Laurie Ebner (USACE), Steven Hall (USACE), Salina Hart (USACE), Melissa Haskin (Contractor), Laura Hamilton (USACE), Tom Iverson (Yakima Nation), Kim Johnson (BPA), Amit Karki (USACE), Russ Kiefer (ID), Tom Lorz (CRITFC), Amy Lyn (USACE), Regine Maier (USACE), Aaron Marshall (USACE), Sonja Michelsen (USACE), Charles Morrill (WA), Tony Norris (BPA), Michael O'Bryant (CBB), Logan Osgood-Zimmerman (USACE), Alison Pieper (USACE), John Powell (ID), Jon Rocha (BOR), Chris Runyon (BOR), Kristin Scheidt (USACE), Ann Setter (USACE), Steve Smith (NOAA), Leah Sullivan (BPA), Dave Swank USFWS), Dan Turner (USACE), Erick Van Dyke (OR), Paul Wagner (NOAA), Lisa Wright (USACE), Michelle Ewen (USACE);

Colby Mills, Nancy Pionk, Emily Stranz, Donna Silverberg and Charles Wiggins, DS Consulting Facilitation Team.

Columbia River Regional Forum
TECHNICAL MANAGEMENT TEAM
2018 ANNUAL REVIEW OF LESSONS LEARNED
December 19, 2018
Minutes: Melissa Haskin, BPA (contractor, FLUX Resources)

1. Introduction

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 decisions, reflect on lessons learned, and discuss ongoing challenges. This year's presentations included a review of 2018 flow conditions, sockeye passage, and lamprey passage and counts, forecasts for 2019, and more. Presentations were given by representatives of the Corps, Idaho Department of Fish & Game, CRITFC, NOAA, PNNL, and Oregon Department of Fish & Wildlife. Each presentation was followed by a question-and-answer session for clarification. See the end of these minutes for a full list of attendees.

These notes are meant to capture the overall presentations and discussions at the TMT YER but are not to be understood as a verbatim transcript. All presentations are available on the TMT website at: http://pweb.crohms.org/tmt/agendas/2018/1219_Agenda.html

2. Spring 2018 Flow Conditions – Julie Ammann, Corps

http://pweb.crohms.org/tmt/agendas/2018/1219_Ammann_2018_TMT_Year_End_Review.pdf

Julie Ammann, Corps, reported on 2018 flows, snow accumulation, monthly precipitation, and temperature departures. This year was particularly unusual in that above average spring temperatures triggered an early snow melt runoff. This meant high flows in early spring. Meanwhile, summer, particularly in June, was dry and warm. In addition to the snow coming off early in the season, late spring precipitation was below average. The breakdown by month was:

April: Wet and cool. Above normal precipitation and normal to below normal temperatures in headwater basins.
May: Hot. Well above normal temperatures throughout the Columbia Basin, rapid snowmelt.
June: Warm and dry. Snowpack depleted.

Ammann highlighted several projects. At **Albeni Falls**, runoff was 206% of average in May. Active flood fighting measures were taken and the reservoir filled above flood level. The April-July volume was 17.1 MAF, 146% of normal. The project operated on free-flow from April 29-June 6. **Grand Coulee** runoff was 187% of normal in May and the April-July volume was 61.6 MAF (121%). **Lower Granite** runoff was 149% of normal in May and the April-July volume was 23.1 MAF (116%). The project was held in the bottom 1-foot of the normal operating range May 7–June 3 for flood risk management near Lewiston. **The Dalles** runoff was 176% of normal in May and the April-August volume was 101 MAF (116%). In mid-May, the Columbia River at Vancouver was in a minor flood stage at 16 feet.

Ammann showed a graph of observed flows, estimated unregulated flows, and exceedances. The graph really illustrates the early May peak in flows and how quickly the water supply went away this year. Kyle Dittmer, CRITFC, commented that it was a La Niña year. Questions and Comments. None.

3. Rocks in the Bonneville Spillway – Laurie Ebner, Corps
http://pweb.crohms.org/tmt/agendas/2018/1219_Ebner_Bonn_Spillway_and_Rocks.pdf

Laurie Ebner, Corps, updated TMT on rocks that have been moving upstream into the Bonneville spillway tailrace and causing erosion of the stilling basin. Most of the rocks are about the size of a softball up to 12-18 inches, but some are much larger.

The hydraulics of how the rocks get in the spillway stilling basin is complicated. The rocks are local to the spillway and were either debris left after construction or erosion of the rock downstream of the stilling basin. Ebner thinks the rocks may have been pushed downstream nearly to the end of the spillway channel during the flood of 1948. Since then, particularly after the addition of the spillway flow deflectors, the rocks have been moving closer and closer to the dam. Ebner noted the rocks are not simply jumping 30 feet upstream into the stilling basin but are likely being pushed upstream to the stilling basin and then moving laterally towards bays 9 and 10 where they have a small vertical distance to jump to get into the stilling basin.

Over the last few years there have been annual rock removal operations; 2011 was the first year there were significant quantities of rock in the spillway. So far, approximately 1,000 cubic yards of rocks have been removed. Ebner suspects this will continue for the foreseeable future. Survey results suggest there is still about 3,000 cubic yards of loose material on either side (about 6,000 cubic yards total) that could continue to move upstream.

Questions and Comments

Question: Tom Lorz, Umatilla/CRITFC, asked how repairs to spillbays 9, 12, and 14 have held up and if any rebar is being observed in the sediment, which may indicate additional holes. If so, do repairs need to be made immediately to negate a larger scale issue that could be caused by not doing anything now?

Answer: Ebner said repairs have held up fairly well through 2017. She expects repairs held up ok this year as well but has not seen video footage of the inspection of the rock piles yet. Yes, there has been some rebar recovered. However, it is likely coming off the piers. The best solution for the exposed rebar on the piers is to shave the piers is cutting out the rebar smoothing the concrete surface. Structurally the piers can handle this as long as it is not done to all of them. There are currently no holes as big as the hole that was in bay 9, which was 5 to 6 feet in deep. The repair of that hole along with undercutting at bays 2, 3 and 4 seem to be solid.

Question: If 150 kcfs is where we start to pull rocks upstream, would that be helped by a change in the spill pattern, like a crown or reverse crown?

Answer: It is worth investigating, replied Ebner, but such a sharp crown pattern would adversely impact both juveniles and adults. She said it is a possibility that a modified spill patter

could be done part of the time, for instance at night. In particular you want to reduce the flow over the 7 foot deflectors.

Question: Is this an issue at other dams?

Answer: Not at The Dalles or John Day. The Dalles has an apron and then a drop of 250 feet. The material there is also basalt, which is really hard, dense material. John Day has a pile of material that is next to the wall at spillway 1 that has been there forever. Surveys show it is not detrimental to the stilling basin, which is fairly deep.

4. 2018 Retrospective of Total Dissolved Gas – Dan Turner, Corps
http://pweb.crohms.org/tmt/agendas/2018/1219_Turner_USACE_Turner_2018_TMT_WQ_YE_Review.pdf

Dan Turner, Corps, presented on 2018 spring spill operations including flow, spill, and TDG that occurred April 3–June 20 at lower Snake projects and April 10–June 15 at lower Columbia projects.

During periods of voluntary spill, the Corps followed a daily process to set spill caps to meet but not exceed State water quality standards, as follows: 1) Review data and flow/weather forecasts; 2) Run SYSTDG as needed (79 times over 33 days in 2018); 3) Estimate maximum spill levels that meet but do not exceed the gas cap; 4) Coordinate with NOAA; 5) Notify projects and BPA; and 6) Post spill caps on the TMT website. When setting spill caps, the Corps considered the spill and TDG relationship, current and forecasted environmental factors, and travel time. The Corps presented information on a weekly basis at TMT meetings and produced monthly FOP reports that were posted to the website and submitted to the Court.

The Corps set spill caps pursuant to all applicable state standards, which differ between Oregon and Washington as follows:

OREGON	WASHINGTON
Average of 12 highest hours in a day (not consecutive)	Average of most recent 12 consecutive hours (rolling average)
TDG must not exceed 120% in project tailrace on 12-hr average	TDG must not exceed 120% in project tailrace or 115% in next downstream forebay on 12-hr average
Spill must be reduced if TDG exceeds 125% for 2 hours	TDG must not exceed 1-hr average of 125%
Applies to 4 lower Columbia projects (McNary, John Day, The Dalles, and Bonneville)	Applies to all 8 projects

Flows were in the range to achieve spill caps at the lower Snake projects April 3–May 6 and June 3–20, except at Ice Harbor from April 8–May 6 and June 8–10. At the lower Columbia projects, the spill caps were achieved April 10–28 and June 7–15.

Turner discussed the challenges of spill in 2018, sharing that calculating TDG at the downstream forebays is influenced by many factors, including spill rates and patterns, powerhouse flow, travel time, wind speed, water temperature, barometric pressure, and dispersion, as well as TDG in the tailrace and TDG coming in from the upstream project. Turner was surprised to learn that downstream TDG can exceed tailrace TDG and there are times that TDG can actually increase going downstream. Additionally, it takes 7-14 days to de-gas deeper

zones. One of the lessons learned from the 2018 spill season was that environmental factors have a significant and often unpredictable impact on downstream forebay TDG. There is no set of spill caps that can consistently meet the downstream forebay TDG criteria of 115%. Sometimes large changes in spill caps have minimal effect on TDG. He noted that based on current information and models, there is an imperfect understanding of spill and TDG, and how environmental factors impact TDG.

Questions and Comments

Question: Charles Morrill, WA asked if it would be possible for Turner to add some numbers into the illustrations in his presentation that would show the difference between a downstream forebay and an upstream forebay as an example. For instance, could Dan show one specific set of numbers for Lower Granite to Little Goose?

Answer: Turner said that was a great idea, especially because it is another way to look at the situation. He said that maybe WA and Corps could work together to find this information.

Question: Russ Kiefer, ID, asked, "Should we go back and look at the location of tailwater TDG monitors and consider moving some?" He was specifically wondering if gauges that pick up TDG from powerhouses should be moved.

Answer: That would require significant regional negotiation and studies, which have already been completed for their current locations. Most gauges are designed to pick up TDG produced by water passing over the spillway but a couple are also influenced by flow through the powerhouse, which is essentially TDG passed from upstream. Each gauge has its own unique set of conditions and is detecting TDG accurately at that point. The location of each gauge was selected based on extensive studies and regional negotiations. In certain places, the elevation can play a key part in where a gauge is placed. Installation is expensive and to move a gauge would take considerable money, research, regional coordination, and effort.

5. Little Goose Dam Adult Salmon Passage

5a. Little Goose 2018 Operations – Doug Baus, Corps; Erick Van Dyke, ODFW, and Paul Wagner, NOAA
http://pweb.crohms.org/tmt/agendas/2018/1219_VanDyke_Wagner_Baus_Little_Goose_Spill_2018_combined_TMT_4.pdf

- ***LGS Forebay Storage to Improve Adult Passage Conditions – Doug Baus, Corps***

Doug Baus, Corps, reported on passage at Little Goose Dam and how forebay storage may be used to temporarily reduce high levels of spill in order to improve passage conditions for adult Chinook salmon. In 2018, the operation was implemented to reduce spill to 30% for 8 hours in the morning to target peak adult passage. During all remaining hours, spill was increased to the gas cap for the benefit of downstream-migrating juveniles. The forebay will be an effective tool in the future if necessary to improve passage conditions for adult Chinook salmon, reported Baus.

New tools this year developed by DART and Fish Passage Center (FPC) allowed agencies to see delays in real time. At the May 29 TMT meeting, there was a differential in adult fish counts of about 6,000-7,000 between Lower Monumental and Little Goose, and both tools indicated adult fish were being delayed below Little Goose. In an effort to improve adult fish passage at Little Goose Dam the TMT coordinated the following operation:

1) 4 AM -12 PM -Operate to maintain 30% spill. Store remaining inflow in the LGS pool above the 1-foot Minimum Operation Pool (MOP) range of 633.0 -634.0 feet as necessary depending on inflows.
2) 12 PM –4 PM –Increase spill to pass inflow. LGS may be above MOP.
3) 4 PM -4 AM -Increase spill as necessary to draft back to MOP while remaining under 130% TDG (approximately 125 kcfs spill).

The operation was implemented for 4 days from May 30 through June 2.. During the 30% spill period, a higher percentage of the tagged adults present in the tailwater entered the fish ladder (40% -65%) than during previous days (below 20% from May 25 to May 29) **Martinez et al., (2018).

Baus provided the following table that may be used to calculate forebay storage at LGS. The storage capacity of the Little Goose pool is approximately 5 kcfs-days/foot. Generally, the relationship between the inflow/outflow differential and change in forebay elevation is linear; therefore the following table may be used when estimating a spill reduction and associated change in forebay. For example, the first row indicates that if reducing spill to 30% results in inflow being 5 kcfs greater than outflow, the forebay would fill 1 foot over the day. These are approximations and should not be taken as exact:

LGS Storage Capacity of 5 kcfs-days/foot		
Project Inflow vs Outflow Differential (kcfs)	Delta (+/-) in Forebay Elevation (feet)	Period (day)
5	1	1
10	2	1
15	3	1
20	4	1
25	5	1

Baus mentioned that using forebay storage is a tool that could be used in future years if there is a delay in adult passage due to high rates of spill.

Using the LGS FBE to target 30% spill has been an effective tool to increase passage of adult Chinook salmon. During the 30% spill period, a higher percentage of the tagged adults present in the tailwater entered the fish ladder (40% -65%) than during previous days (below 20% from May 25 to May 29). This operation addressed concerns regarding impacts on juveniles Chinook salmon by limiting the duration of the 30% spill operation. In the event there is the delay of adult Chinook salmon in periods of high spill in 2019 going to 30% spill in a more timely manner and storing above MOP would likely reduce the delay of adult Chinook salmon in the LGS tailrace.

- ***History of Little Goose Adult Chinook Salmon Passage – Erick Van Dyke, ODFW***

Erick Van Dyke, ODFW, provided a brief history of Little Goose adult Chinook salmon passage. Many studies have shown that dams delay fish passage. One instance of this is at Little Goose Dam. The same fish take longer to pass Little Goose than they do Lower Granite (Haynes and Gray, 1980). One study showed that involuntary spill is influential in explaining fish counts between Lower Monumental and Little Goose. While the authors pointed out the relationship, they did not identify a specific condition that is best. No studies have been done to assess the general and frequent use of the North powerhouse entrance. Van Dyke says this has been overlooked in setting operational patterns and criteria.

Van Dyke reported that involuntary operations played a role in the variation of adult fish counts with fish counts rapidly rebounding following a change in higher river discharge. Overall, Jepson et al. (2009) imply that ultimate success of adult Chinook to the spawning grounds was influenced by passage conditions created by dam operations. The time that spring Chinook spend in the Lower Monumental to Little Goose river reach does not affect their upstream migration success to or above their hatchery of origin. Little evidence of negative effects on adult upstream survival has been found for Snake River spring Chinook relative to the time spent in the Ice Harbor to Lower Granite reach or the Lower Monumental to Little Goose reach.

In preparation for 2018 spring operations, the Fish Passage Center wrote a series of memos that looked at unintended consequences and factors that could be important to consider before making operational changes. A full write up of the findings is available in his presentation, including:

1) Project configuration and tailrace bathymetry are a primary source for tailrace conditions that affect adults.

2) The spillway weir can have negative impacts on adult passage. In 2010, the spillway weir was closed on two separate occasions, once for 8 hours and once for nearly two days, while maintaining a uniform spill pattern and spill percent. During each of these occasions, adult passage increased dramatically compared to the days that the spillway weir was operating. Among operational variables, the operation of the spillway weir had the largest effect on adult passage rates at Little Goose when analyzing hourly project operations and adult passage.

3) Adult salmon and steelhead that were transported as smolts have slower upstream migration, lower upstream migration success, and higher dam re-ascension rates, all contributing to delay.

4) Each juvenile powerhouse encounter reduces SARs by a 9-13%.

- ***Recent History of LGS Spill – Paul Wagner, NOAA***

Paul Wagner, NOAA, spoke about recent history of Little Goose as well as monitoring. In 2005 during the court-ordered spill to gas cap, Little Goose spill was around 45% and fish passage slowed down. There was grave concern. Spill was dialed back incrementally until fish started passing at 30%, which became the new standard. Salmon managers have wondered if this the right spill proportion that balances benefits for both adults and juveniles.

In 2017, spill and flows were high and adult delay was observed. In response, spill was reduced to 30% during morning hours and inflow was stored in the forebay as necessary, which resulted in increased adult passage.

This year, salmon managers used PIT-tag data to populate tools created by DART and FPC to track passage timing and success at Little Goose and Lower Monumental. The two tools were similar in that they both reported projected counts and expected conversions. An FPC analysis speculated that fish that took up to 20 days to pass the lower Snake River projects showed no reduction in survival to tributary detection locations.

The tools show last year there was some decrease in conversion. Overall conversion was pretty good from project to project. During low flow years, like 2014-2015, passage is fast. During high flow years, passage is slower. Overall conversion is near 100% in high flow years, it just takes longer for fish to make the trip. One might ask, if all the fish made it, does delay matter? Fish that did not make it on time experienced rapidly changing conditions.

- ***Overall Lessons Learned - Erick Van Dyke, ODFW***

Overall, this season was different in that multiple information sources (DART, FPC) were available to inform in-season management. These tools will continue to be honed and should provide good information for future discussion during spill season.

Both of the actions implemented during spill season this year worked well. Adult cumulative passage at Lower Granite exceeded 96% with ≤ 1.7% spread 2014–2018. Little Goose operational changes meant to address adult passage concerns increased juvenile PIT PH at more than Little Goose Dam. Each juvenile powerhouse encounter reduces subsequent SAR by a relative 9-13%.

One question on salmon managers mind is: *Do the tools provide early warning of unintended consequences?* There is consensus that in general, they would benefit from a sensitivity evaluation.

Russ Kiefer reported that the FPC is reviewing this season and will have additional information available in the future.

Questions and Comments

Question: Julie Ammann, Corps, asked if based on the information Erick Van Dyke provided, does he believe that closing the spillway weir should be a tool to improve adult passage?

Answer: Van Dyke said it is worth additional consideration and discussion, in his opinion.

Question: What is the DART threshold for delay?

Answer: Wagner replied that the DART tool threshold for delay was 3 days. The rule of thumb is that it should take fish 1 day to pass the pool and 1 day at the project. DART uses a black dot to indicate delay when passage takes 3 or more days. Paul said this threshold can certainly be revisited and discussed further. The nice thing about DART is that if the salmon

managers choose to set a different threshold, they can simply plug that into DART. The tool can incorporate changes such as the minimum amount of days to be considered delay.

5b. Adult Spring Chinook Salmon Passage and Migration Behavior through the Lower Snake River (gas cap spill evaluation) - Daniel Deng, PNNL
http://pweb.crohms.org/tmt/agendas/2018/1219_Deng_LGS_Adult_Chinook_Passage_FINAL_12192018.pptx

Daniel Deng, PNNL, presented on adult spring Chinook passage and migration behavior through the lower Snake River. This year's study was completed using both acoustic and PIT-tags, as opposed to past studies that used radio-telemetry. The goal of the study was to evaluate tailrace movements, passage, and fallback of adult Chinook salmon at Little Goose in relation to increased spill levels, and also included a post-construction analysis of the new adult ladder temperature reduction system.

During this year's study, 400 fish were tagged and released between April 26 and June 6. Of those, 369 were detected. The results of this year's study show the following:

- May 21–24, spill 35-40% = 30-50% of fish in the tailrace entered the ladder.
- May 25–29, spill ≥ 45% = less than 20% of fish in the tailrace entered the ladder.
- May 30–June 3, special 30% spill operation for 8 hours each morning = 40-65% of fish in the tailrace entered the ladder during 30% spill over these 4 days.
- A majority (62%) of fish were first detected approaching the tailrace along the north shore.
- Slightly over half of the fish utilized the north shore fish ladder entrance, and just under half used the south powerhouse entrance. Only 3 (1%) used the north powerhouse entrance.
- 95% of fish enter the ladder between 4am and 7pm. Fish prefer to enter the ladder during the day time.
- No difference in travel time from being PIT detected to exiting into the forebay with the temperature reduction system pump on vs. off.
- As spill increases, fish tend to not move around as much.

More results are available in Deng's presentation. A full report will be available in February (Derek Fryer, Corps Walla Walla, is the POC).

Questions and Comments

Question: Erick Van Dyke: Can Deng provide the same information for fish that did not fall back as what was provided for fish that did, especially as it relates to tracking in the forebay?

Answer: Yes, Deng can check and send this information to Van Dyke through USACE POC.

Question: Can Deng provide information on the tailrace depth? This may provide information on if fish have the ability to compensate for higher TDG levels.

Answer: It would be tough on a large scale. Deng can pull the information for a small sample. It will not be as accurate.

Question: Is there a change in detection efficiency at higher spill levels?

Answer: Once spill levels increase, so do noise levels so that definitely affects detections.

6. Juvenile Salmon Transport & Reach Survival - Steve Smith, NMFS Science Center
http://pweb.crohms.org/tmt/agendas/2018/1219_Smith_Smolt_Survival%20and%20Transportation%20-%202018%20TMT%20Year-End.pdf

Steve Smith, NOAA NW Fisheries Science Center, presented on 2018 migration conditions, travel time, and survival of PIT-tagged smolts transported vs migrated in-river. Juvenile passage timing is affected by multiple factors including flow, temperature, and spill.

In spring of 2018, flows were above average throughout the season and spill was slightly above average (vs 2006-2017). Water temperature was warmer than average, particularly in April and late May. Travel times for yearling Chinook and steelhead were some of the shortest observed.

For 2018, PIT-tag survival estimates for yearling Chinook was average in the Snake River and below average in the lower Columbia River. Steelhead and sockeye survival were above average in both reaches.

Questions and Comments:

Question: Brandon Chockley, FPC: Why did the transportation proportions for sockeye increase this year?

Answer: In every year for which I've estimated transportation percentage for sockeye (2013-2018), hatchery sockeye have passed all collection dams in May, while transportation was occurring. The 2018 increase in percent transported for hatchery sockeye was entirely because they were more likely to enter collection systems (bypass/detection probabilities were higher) at Lower Granite and Little Goose. For wild sockeye, the 2018 increase was the result of a combination of the earlier start date of transportation and higher probability of entering collection systems.

Russ Kiefer, ID, also noted there seems to be an issue in which fish detected at McNary appear to have lower survival than those that pass McNary by other routes without being detected. He said this is a violation of one of the model assumptions they have. He also said that the Lower River can be challenging with PIT-tags.

Trevor Condor, NOAA, voiced concern that with a new operation he wants to be able to be certain he is improving conditions in the river. He said the Harnish et al. paper showed higher estimates of survival and wondered if a new study is necessary or if estimates should be reconfigured. He mentioned that one thing agencies could look into moving forward is studying survival from Lower Granite Dam to John Day Dam and John Day Dam to Bonneville Dam (as opposed to doing Lower Granite to McNary Dam and McNary to Bonneville Dam as studies have done in the past). McNary data may possibly be biased due to the bypass and show lower

survival numbers than reality or may be less precise. Using Lower Granite fish all the way down to Bonneville Dam could curtail imprecision, he suggested.

Smith said he would take that into consideration. He said similar work had been done, not consistently for all years though. He said that is how the issue with the fish detector at McNary was identified.

Tom Lorz, Umatilla/CRTIFC, asked why NMFS has not considered using PIT-tag detection below Bonneville at the bird islands. He said this would help true up the numbers since the fish made it to Bonneville.

Smith said he was not as confident as Tom that they would increase the accuracy of the numbers. He said that the islands sample fish differently than the PIT trawl does. He suggested this become part of the larger group, NOAA/FPAC discussion such as the spring meeting where folks get together and talk about issues.

Lorz said that that his agency had done a study to see if sampling was different and the answer was no.

Both parties agreed it was something to look into.

Smolt Transportation Seasonal Analyses

Smith also presented on smolt transportation. He presented on Yearling Chinook and steelhead using data from 2014-2016 updated with adult returns through December 16, 2018. He focused on smolt-to-adult return ratios for transported vs. in-river fish at the three Snake River collector dams, Lower Granite, Little Goose and Lower Monumental.

Looking at the three years used in the analysis, 2014 was a year with average flow, average spill and slightly below average temperatures. 2015 was a year with low flow, high spill and above average temperatures. 2016 was a year with above average flow, average spill and warm temperatures.

The basic question addressed by his research is the difference over time in the rate of adult return for fish that were transported vs. bypassed (T:B ratio) after entering juvenile bypass systems (JBS) as smolts. This requires a time stamp that identifies when a smolt was detected in juvenile bypass system. These analyses use fish that entered JBS at LWG, LGS, or LMN, including those tagged upstream of, or at Lower Granite. The data provide a seasonal analysis of smolt to adult return rates (SARs) through the season. Note that analyses are subject to confounding of mortality and straying.

One challenge in the data is that there are groups of smolts that have 0 adult returns. Traditional methods give the same estimated SAR of 0% in this case regardless of the number of smolts in the group. An alternative method known as “median unbiased estimation” preserves the information carried in the sample size: 0 adults returning from a large number of smolts gives a lot more information about the true SAR than 0 adults from a very small sample.

Overall, for Wild Chinook, estimated T:B ratios have been high in the last three years; transported fish have returned at higher rates than bypassed fish. At LGR and LGS, estimated T:B ratios were at least 3 for migration years 2014-16.

Results tend to be similar for Lower Granite Dams and Little Goose Dams. Together, they account for about 75-80% of all transported fish. Things tend to be more variable at Lower Monumental due to less available data. Typically, Lower Monumental has a lower T:B ratio, meaning transportation is not as beneficial from Lower Monumental as it is from Lower Granite and Little Goose.

In recent years, there has been less seasonality. The data also shows that fish are migrating earlier. More fish are migrating in April. For about 10 years there was not much data for transport fish in April. In 2018, data began to come in on April 24. This should provide information for future analyses.

Moving forward, Smith would like to further summarize data using a multi-year analysis with parameters tied across years. He is working on a updated contract report to USACE, which will be available in 2019, to be followed by a journal article

Questions and Comments

Question: Paul Wagner, NOAA, wondered what the threshold was for a "very warm" year such as 2015.

Answer: Steve is not sure, he said all he know was it was too warm in 2015.

Question: The benefit for wild Chinook seemed to increase over the last few years relative to what it was, do you know why?

Answer: No. Until 2014 wild Chinook had shown some of least benefit of the 4 groups. Smith asked Russ Kiefer if he knew. Russ said he has not looked into it.

7. Lamprey Passage and Counts – Dave Swank, US Fish & Wildlife
http://pweb.crohms.org/tmt/agendas/2018/1219_Swank_Pacific_Lamprey_Returns_to_the_Columbia_River.pdf

Dave Swank, USFWS presented on lamprey passage and counts. Total lamprey counts have increased dramatically since 2014. Last year was a banner year for returns of pacific lamprey, with over 290,000 counted. This year was also a good year with 131,000 returns.

Swank said he is hoping the numbers the last few years are the new normal as opposed to a deviation. At this point, it is hard to know.

Swank pointed out that the high counts in 2017 are still less than older counts from 1950s and 60s (four years >150k, two of which were > 300k).

An unknown this year is why there is such a difference in the number of lamprey counted at Bonneville and the number counted at the Dalles.

Swank said there are lots of theories – maybe some fish spawning in the main stem; maybe some fish are spawning in the tributaries. Swank said that Mary Mosier, thinks the latter is not possible because there is not enough fish that do that to explain this drastic drop. It is hard to say what is causing the discrepancy.

When it comes to Fishway vs. LPS Passage the proportion of lampreys using LPS's has been around 45% since 2013 (it was 57% in 2015).

The Dalles had a nice run this year but that have been holdover from 2017 at Bonneville.

This year was the first year the Wetted Wall at Bonneville Bradford Island was used. It was installed in 2018, the idea behind the wall is that lamprey can climb up it easier. Counters observed about 350 adults using it this past summer. Based on the small amount of video footage they were able to review, they extrapolated estimates that 3,500 probably used the wall last summer. Swank believes it was a very successful first year.

As far as "run timing," "Peak" of the adult run is typically June through early August, but this year started in May (at TDA and BON) and tail extended into September.

Swank's wish list for next year to improve counts is optical sensors.

Questions and Comments. None.

8. Juvenile and Adult Sockeye Update – John Powell, ID Fish & Game
http://pweb.crohms.org/tmt/agendas/2018/1219_Powell_Redfish_Sockeye.pdf

John Powell, ID Fish & Game presented on juvenile and adult sockeye. The work ID Fish and Game does is to protect the Broodstock Collection of fish from extinction and help them maintain their genetic diversity. The initial Broodstock collection included:

Returning adult Sockeye (n = 16)

Out-migrating smolts (several hundred from 1991 – 1993)

Residual Sockeye (26 from 1993 – 1995)

ID's goal is to increase the size of the population and determine appropriate release strategies for recolonization.

Powell went over releases from 2015 on.

During the 2015 Springfield Release, 214K+ smolts were released. There was 31.3% survival from release to Lower Granite Dam. 135K Sawtooth smolts were also released. Survival was 48.5% from release to Lower Granite Dam. 77K Oxbow smolts were released of which survival was 42.5% from release to Lower Granite Dam. There was some gas bubble trauma so ID wonders if gas super saturation affected the survival rates of these fish.

In 2016 there was a new transportation route using a lower elevation summit. ID also focused on water quality during transportation. Again there was bruising and descaling. Survival

from release to Lower Granite was low. 540K+ smolts released from Springfield with 31.2% survival from release to Lower Granite Dam; 94K smolts released at Oxbow with 51.8% survival from release to Lower Granite Dam. Efforts were made to address degassing at Springfield. ID began to wonder if water chemistry was an issue.

In 2017, a new larger 6" fish pump was purchased. At Springfield, fish earlier was stocked earlier and salt was added to the water as ID tried to evaluate water chemistry differences. At Springfield 730K+ smolts were released and survival from release to Lower Granite Dam was 16.4%.

ID wondered if low survival was stress related so it began hormone testing. It found that stress remained after release and post-release. It also wondered about the alkalinity of the soft water at Redfish Lake and the effect that could have on fish.

ID designed a controlled experiment in fall of 2017. It focused on 3 water sources (Springfield, Redfish Lake, and the Salmon River) tested at Eagle Fish hatchery. Teams sampled the blood chemistry of fish before and after transport and release to these three areas. For Springfield well water, cortisol, the hormone that measures stress, decreased over time after the fish were released. In Salmon River water there was an initial spike on release and then a decrease 24 hours later. However, fish released into Redfish Lake Creek water experienced increasing cortisol levels in the time following release. This supports the idea that water chemistry is leading to post-release stress on smolts.

In 2018, ~600K smolts acclimated at Sawtooth Hatchery, half were released in Redfish Lake Creek and half were released in the Salmon River. ~40K smolts were released directly from Springfield Hatchery to Redfish Lake Creek as a control. Release survival is estimated to be much higher than it has been in years past.

In 2019, the plan is to have 560K Springfield reared/Sawtooth acclimated smolts and release them into Redfish Lake Creek. 330K Sawtooth reared smolts will be released into Redfish Lake Creek. 3K Springfield reared smolts will be released directly into Redfish Lake Creek as a control. Cortisol and blood glucose will be monitored during acclimation and release transports.

Powell also discussed fallback, which was estimated to be 0% for Redfish Lake Sockeye Salmon in 2019, this is much different than what has been observed in prior years. This 0% observed fallback rate may be due to a lack of tags at Redfish lake. Unfortunately, Lake Wenatchee Sockeye had high fallback rates (115%).

Conversion rates from Lower Granite Dam to Stanley basin are about 43%. Those that converted in the first quarter of the season (6/20 - 7/03) experienced the highest survival rates (71.4%) and those that converted later were more likely not to make it, with conversion numbers dropping to 16.6% in the fourth quarter of the season (7/12 - 10/18).

Questions and Comments

Comment: Russ Kiefer, ID, asked that fish not be referred to as "surplus," noting "*we want even more!*"

Question: Paul Wagner, NOAA, asked if the Wenatchee fish are natural origin or if they just show up and if there is any reason why they pick the Snake River.

Answer: John is not sure. In 2015, some fish picked up in the trap and haul were of Columbia River origin. This year's fish showed up at the tail end of the run. In 2016 and 2017 a small number was sampled but in years prior to 2015 sampling didn't occur near the end of the run because of ladder temperature at the adult trap. Because of this, it is unknown if it is something that happens every year or if there is something special about this year and 2015.

The indication John has after talking to CRTIFC is that it is somewhat typical.

9. Forecast for 2019 - Kyle Dittmer, CRITFC
http://pweb.crohms.org/tmt/agendas/2018/1219_Dittmer_Winter_wx2018-2019_TMT.pdf

Kyle Dittmer, CRITFC, gave weather and climate predictions for 2019. Dittmer does forecasting based on regression analysis of historic TDA runoff and the MEI index for 20 past analog years. He includes solar forcing and NOAA's Sea-Surface Temperature Departure Forecasts in his forecast.

CRITFC's forecast for Hood River is many snow events or 121% of normal (NOV-MAR) with seasonal total 23-inches of snow.

At Government Camp, CRTIFC is calling for a seasonal total of: 240-inches or 117% of normal (NOV-MAY).

Dittmer is predicating intense rain events, floods, fog, wind storms, gorge wind, freezing rain, etc. in Portland.

His water supply forecast is 97 maf (±10 maf) or 96% of average at the Dalles whereas the NWRFC January – July forecast is currently 91 maf.

Overall he expects the region to see above average temperatures and near normal precipitation.

10. Large Group Reflection

Participants shared their observations of hydro system operations over the past year. Several commented that TMT members gained valuable experience in working together.

Russ Kiefer, ID, shared 4 areas of concern ID had with Little Goose operations last year.

Kiefer voiced some concern about the 2018 spill and decision process noting challenges in communication. He shared that ID and other voiced concern over a specific operation (the 30% spill operation at Little Goose for 8 hours at a time to avoid spill during adult passage). He said that with two technical groups available, he asked that the groups develop method to track adult passage and only reduce spill when delay was actually happening. He believed this was what would happen and what ID agreed to. He said he was disappointed when during the season

the data indicated adult delays and some members objected to implementing what he though was the agreement for the 2018 operation.

He also took issue with the statistical analysis used to justify the objection noted above. As the ID technical representative, he maintains that an alpha of .05 is appropriate for looking at differences in juvenile conditions because samples size aren't large enough that alpha 0.05 won't avoid significant errors the opposite way. He recommended an alpha of .10 for adult analysis because of the lower amount of data available.

ID is also concerned that the Snake River contains many populations of wild spring Chinook, which have difference in migration timing. Timing has been selected through natural selection, he noted, which means it is a survival advantage. These fish getting their eggs in the gravel at the right time is currently something that cannot be measured. However, just because it can not be counted does not mean it is not critically important. When we delay fish, we are not just delaying fish that are counted, we are also delaying uncounted species. Some uncounted fish, as some that Kiefer recently found, may not be able to make it to their spawning grounds if they are delayed and will not produce as well as they do.

Kiefer expressed that having tribal and sport anglers not considered in decisions to us is a concern to ID.

It is very concerning to ID that they have to prove an impact before they can convince folks that what fish historically and naturally do is what they should do. "We need to focus on recreating natural conditions if we want wild natural fish to persist in the Snake," he said.

Overall, Kiefer concluded that when we work out agreements we need to make sure have we have a common understanding and expectations for what will occur.

Ann Setter, Corps, said there are still a number of water sheds for Chinook that have a long ways to go. She noted that it is important that timing of operations be considered carefully and that agencies do what they can to take into account if they are holding back fish from critical areas where recovery is being observed. She supported Russ's idea that it may well be early time to remote areas that plays a role.

Paul Wagner, NOAA, said it is nice to have the tools to be able evaluate issues. They may need to be refined and folks can talk about that. If there is a difference in interpretation, as Kiefer noted in his thoughts above, they should be discussed prior to use, noted Paul. "We should take the time before to work it out and talk it out and see if a resolution can be reached before the moment of need," he said.

Charles Morrill, WA, agreed that agencies should learn from Russ's concern about communication and that he hopes agencies and representatives are better informed for this coming year.

Russ Kiefer, ID, complimented the two technical groups that put together good tools for TMT. Members agreed that these tools were very useful during the spill season for in-season decisions.

Julie Ammann, Corps, shared that the Corps did not understand how complex and hard is would be to try to set spill caps going into spill season last year. She said that her team had to adjust on the fly, which is challenging, but that they did a good job. Looking ahead she thinks it is important to recognize that next year's operation will also be different and will not be anything like what has been implemented before. This may pose new challenges that will be addressed as the season progresses.

Tools that would help in 2019 would be better water temperature forecasts and better barometric forecasts for the 5- 7-day range.

Dan Turner, Corps, noted that there is still a lot of work to do in understanding the uncertainty of forecasts.

Dave Swank, said that early and frequent coordination with TMT members even prior to FPAC is critical and appreciated. He said early notices on proposed operations to give him time to understand and think about potential benefits/drawbacks of operations. Trying to make decisions on fly at meeting is challenging and he likes to see proposals in writing, even if they are just a few sentences.

Dave Swank, USFWS, is hopeful that flex spill will help with the Little Goose spring run delay observed last year. Because there is a difference of opinion on how cautious to be, Dave advocated that members bring their information to TMT and FPAC and make a decision before spill season so that before the situation occurs again, there is a consensus on what will be done about it if it happens.

Charles Morrill, WA, applauded efforts at Dworshak Dam. Last winter and spring there were some issues at Dworshak and Morrill complimented the team on their willingness to understand different points of view. He was pleased with the efforts to resolve and address concerns.

Scott Bettin, BPA, said that setting spill cap changes depending the hydrograph going up or down. Hopefully it won't make a difference in 2019 but it was a critical change in 2018. He noted that on the way up there is a tendency to underestimate and on way down there is a tendency to overestimate.

Paul Wagner, NOAA, said that carrying reserves over 1% may be worth revisiting as a group since it is complicated. It would be beneficial to learn that again before the moment of need.

Members also gave "props" to Jay Hesse for his work with the 2019 flex spill agreement. TMT members applauded his efforts in coordinating with TMT members and pushing things forward.

Today's Attendees:

TMT Members:

Agency	TMT Representative
Army Corps of Engineers	Doug Baus, Julie Ammann, Lisa Wright
Bonneville Power Administration	Tony Norris, Scott Bettin
Bureau of Reclamation	Chris Runyan
NOAA Fisheries	Paul Wagner, Trevor Condor
US Fish & Wildlife Service	Dave Swank
Washington	Charles Morrill
Oregon	Erick Van Dyke
Idaho	Russ Kiefer
Montana	Jim Litchfield
Nez Perce Tribe	Jay Hesse
Umatilla Tribe	Tom Lorz
Colville Tribe	Sheri Sears
Warm Springs Tribe	N/A
Kootenai Tribe	N/A
Spokane Tribe	N/A

Other Attendees (non-TMT members):

Corps – Eric Chow, Catherine Dudgeon, Laurie Ebner, Steve Hall, Salina Hart, Laura Hamilton, Amit Karki, Amy Lyn, Regine Maier, Aaron Marshall, Sonja Michelsen, Logan Osgood-Zimmerman, Alison Pieper, Kristin Scheidt, Ann Setter, Dan Turner, Michelle Yuen

BPA – Kim Johnson, Leah Sullivan

Reclamation – John Roache

NOAA NW Fisheries Science Center – Steve Smith

Yakama Nation Fisheries – Tom Iverson

Fish Passage Center – Brandon Chockley, Erin Cooper

Pacific Northwest National Laboratories – Zhiqun (Daniel) Deng

Northwest Power and Conservation Council – Leslie Bach

Idaho Power – Jim Chandler

Columbia Basin Bulletin – Mike O'Bryant

DS Consulting – Emily Stranz (Facilitator), Colby Mills, Nancy Pionk, Donna Silverberg, Charles Wiggins

FLUX Resources – Melissa Haskin (Note taker)