Willamette Action Team for Ecosystem Restoration (WATER)
Research, Monitoring and Evaluation (RM&E) Team
Sub-Group Meeting – Middle Fork Pre-Spawn Mortality
October 12, 2016

Facilitator's Summary

The following summary is intended to capture basic discussion, decisions and actions, as well as point out actions or issues that may need further discussion at upcoming meetings. This summary is not intended to be the "record" of the meeting, only a reminder for RM&E members.

ACTION	RESPONSIBLE PARTY	BY WHEN
Identify needed sample size for a potential PSM study in the MF	Cam & Jim	10/26
Provide tagging study to group	Christine	10/26
Continue discussions on MF PSM study	RM&E team	10/27

***Participants at the meeting*:** Stephanie Burchfield (NMFS), Mike Hudson (USFWS), Rich Piaskowski (Corps), Christine Peterson (BPA), Cameron Sharpe (ODFW); Andy Traylor (Corps);

Participants on the phone: Sara Bjork (ODFW), Chris Caudill (University of Idaho), Ryan Couture (ODFW), Lance Kruzic (NMFS), Dave Leonhardt (Corps), George Naughton (University of Idaho), Dan Peck (ODFW), Jim Peterson (OSU), Carl Schreck (OSU);

Facilitator: Emily Plummer, ***Support***: Tory Hines, DS Consulting.

Welcome and Overview of Meeting Purpose

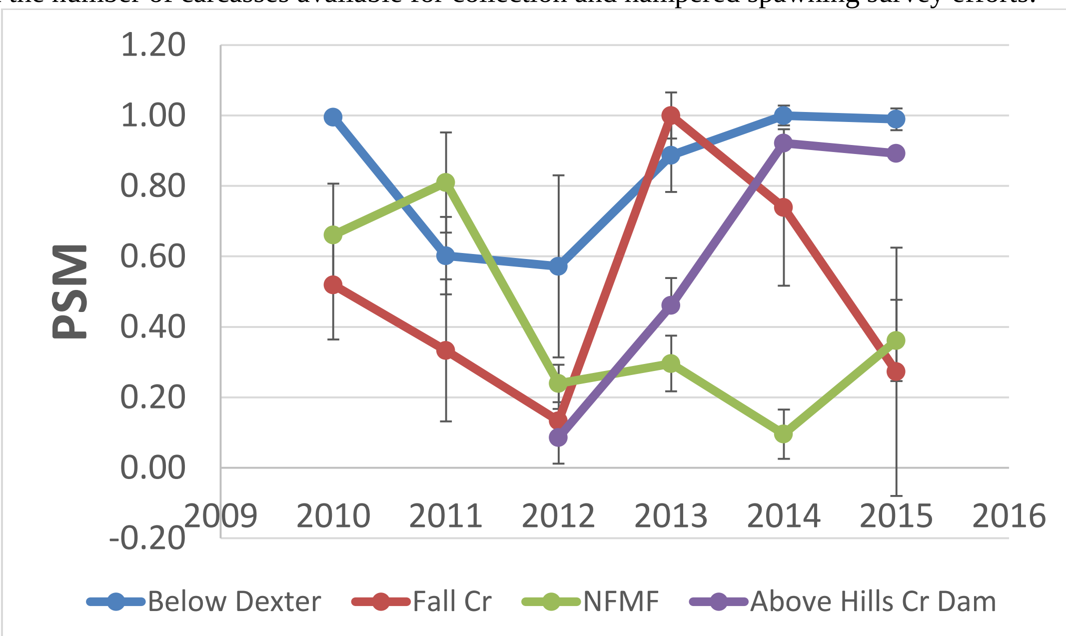
Emily Plummer, DS Consulting, welcomed everyone and stated that the purpose of the sub-group meeting is to clarify technical objectives, study design and potential impacts to the hatchery from a pre-spawn mortality (PSM) study in the Middle Fork. This conversation will help inform the Steering Team in their policy and management discussions on the Middle Fork RM&E Sub-basin Plan. Rich Piaskowski, Corps, recapped concept paper APH 1701 MF, noting that the Corps is interested in more information on the feasibility of effective fish passage, specifically in regards to downstream passage for juveniles and adult PSM. Part of what the Corps is interested in getting at through a study would be to test the level of improvement in adult survival (or reduction in PSM) from changes in protocols at the Dexter adult fish collection facility. He pointed to factors that the Corps is interested in exploring: timing of adult collection, holding times, anesthesia, density and distance of transport, and time of release. Rich noted that the Middle Fork RM&E Sub-basin plan is being discussed at the Steering Team level. Stephanie Burchfield, NMFS, noted that the RM&E Team has discussed PSM studies and does not see eye to eye on the need for further PSM studies; however, she is interested in helping the region understand more clearly what the study would entail and how it impacts operations. She clarified that this session is a technical brainstorming and participation does not signal agreement with the concept. The group coalesced around the idea of a technical brainstorm.

Research Presentations

Researchers from Oregon Department of Fish and Wildlife (ODFW), Oregon State University (OSU), and University of Idaho (UofI) presented to the group their findings on PSM in the Middle Fork. Presentations will be made available on the RM&E Team website: http://www.nwd-wc.usace.army.mil/tmt/documents/FPOM/2010/Willamette_Coordination/Willamette%20RME/RME.html

PSM of Spring Chinook salmon in the MF Willamette

Cam Sharpe, ODFW, presented on PSM of Spring Chinook salmon in the Middle Fork Willamette. He noted that there is a great deal of uncertainty surrounding PSM and up to this point there have not been any statistically designed experiments to help understand why PSM occurs at such high numbers. He noted that ODFW estimates PSM by recovery and inspection of female carcasses: if more than 50% of the eggs are remaining in the carcass it is considered PSM; if less than 50% are remaining, it is considered successful spawning. Cam shared that he divides average annual PSM into three categories: low (less than 20% of all females), moderate (20-50%), and high (above 50%). Below Dexter Dam, the PSM average is 84%, causing serious concern regarding reproduction efforts in this area. Cam cautioned that in some instances, PSM estimates are based on small sample sizes which are dictating management decisions. PSM estimates below Dexter are high; at Fall Creek, estimates are highly variable; above Hills Creek Dam estimates were high from 2014-2015. For the North Fork Middle Fork, PSM estimates have declined since 2011; however the 2013 data is questionable due to a deluge at the end of the year, which limited the number of carcasses available for collection and hampered spawning survey efforts.



Cam noted that in all cases there should be an increasing trend of the more females outplanted the more redds, however, that is not the case in the Middle Fork. This is likely due to fallback, poaching, biased low estimates of PSM and biased low redd counts as a result inaccessible reaches of the Middle Fork. A fish that has not spawned may fallback and avoid surveying and carcass collection which leads to biased low estimates for PSM. Fallback may be less of an issue if projects transition to natural origin outplants above the dams. Cam noted that either way, the region should start thinking of what to do with wild fish and create reintroduction plans at each project that address the entire transition from current operations to operations in 5-10 years. Presently, PSM estimates need to be improved in order to influence appropriate management decisions.

Spawning success of spring Chinook salmon in Falls Creek, North Fork Middle Fork and South Santiam 2008-2015

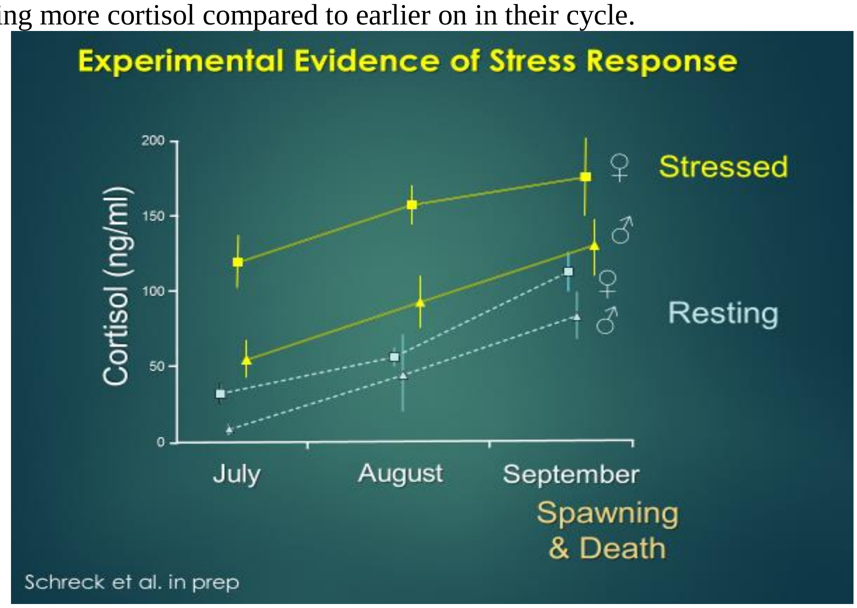
Chris Caudill, University of Idaho, noted that PSM is a regional issue and on average rates of PSM are higher in the Willamette than other basins. Biological growth rates decline for PSM rates above 50%. From 2008-2015, spawning surveys were conducted to assess PSM at Fall Creek, North Fork Middle Fork and South Santiam. Covariates examined included fish traits (sex, size, condition, migration timing, energetics), temperature exposure, toxin loads and disease. Release site temperatures at Fall Creek (FC) were on average much warmer (exceeding 20˚C in the summer months) compared to the North Fork Middle Fork (NFMF). For FC and NFMF, stream temperature appears to be a primary driver in PSM rates. At FC, PSM also increased for later migrants and larger fish. In the NFMF there were no significant predictors of PSM, other than temperature. Statistical tests by tributary, year by year and by toxin provided no clear connection between various toxins and PSM (toxins assessed included Ni, Cd, Pb, DDT, PCB). For carcass recovery from 2013-2015, less than 25% of carcasses recovered were in acceptable condition to be used in PSM estimates; sample sizes for PSM estimates were often small. Chris also noted that tagging effects showed that double tagged fish were negatively impacted by tagging, increasing PSM. One way to improve carcass detection is to radio tag fish prior to outplanting, there is only a slight increase in PSM for fish only radio tagged. Christine Peterson, BPA, noted a study that provided additional insight on the effects of tags. She will provide that study to the group.

- **ACTION: Christine Peterson, BPA, will e-mail the group the study on impacts of tags.**

Additionally, conducting spawning surveys as soon as fish are outplanted may improve PSM estimates (data suggests that across both basins PSM occurred prior to the first redd being observed). Rich asked what conclusions can be drawn from temperature exposure throughout the run. Chris stated that there is not enough data on fish below the collection facilities to conclude that warmer conditions during migration will lead to PSM.

PSM of MF Willamette Chinook salmon: improving trap, transport and release operations

Carl Schreck, Oregon State University, stated that the process of trapping, transport and release operations can be continually improved as part of a reintroduction plan. Salmon die when they can no longer regulate stress responses (as measured by cortisol levels). After spawning, a salmon's energy is depleted leaving them vulnerable to diseases. Additionally, migrating salmon endure numerous stressors like warm temperatures, pathogens, and trap/transport. With PSM, death shifts earlier in the salmon's lifecycle. Numerous variables could cause PSM, like lack of nutrition in the ocean as well as holding in pools below the dams. Carl explained a recent study in which fish were PIT-tagged at Willamette Falls and sampled monthly to monitor their resting condition, then they are exposed to stress (by lowering water levels) and sampled again. This study examined the quality of stress as the fish are maturing and preparing to spawn. As fish approach spawning, the study suggested that when stressed, they were capable of creating more cortisol compared to earlier on in their cycle.



As fish experience stress prior to spawning, rapid energy drain results in the immune system failing to fight off pathogens/disease and can lead to an enhanced probability of PSM.

Jim Peterson, Oregon State University, discussed statistical relationships of factors that lead to PSM. Some of those factors included transport (loading, time, degree day, truck, trip of the day, and Willamette discharge) and outplanting (outplant site, timing/density in the truck and time of the year they are outplanted). He noted that there is unexplained variation in transport mortalities as well as remaining uncertainties for outplant mortalities. Jim suggested that the goals and objectives of the reintroduction plan should be to: 1) develop tactics to ensure spawner success, 2) develop decision tools for managers that minimize PSM and negative sub-lethal effects and, 3) integrate decision tools and monitoring to create adaptive management strategies.

Data Gaps and Study Implementation Discussion

The group discussed data gaps relating to PSM in the Middle Fork, potential study designs to fill the gaps, as well as impacts to the hatchery and ideas on how to mitigate impacts. The results of this technical brainstorm are below.

Data Gaps	Potential studies to fill data gaps?	How/will study impact hatchery operations?	Alternative ways to get info w/o impacting hatchery operations?
Interaction between factors – temperature, fish conditions, transport, etc., and how to relate the multiple factors. Relationship between temperature, cushings syndrome, pathogens, and energetics. Outplanting – seasonal start/stop times/no outplanting, time of day, distance of transport and location, condition of location, condition of fish. Sub-lethal effects – delayed effect between mainstem & tailrace. Facility - arrival of adults, holding time, trap ops, fish sedation, density.	Study needs: • 2,000 fish; • roughly 30% probability of recovery of carcasses (double the current rate); • 5 treatments • most (all?) immediate release Study handling events: multiple vs. single event at capture facility. Increase the frequency of trap operations. Genetic sampling (2018 juvenile study): use genetics to determine who spawned and who did not. Utilize info from other basins? Look across basins at generalities & specifics to the basin: what factors are very different between the Willamette and McKenzie? Focus on these for experimental design, example: are fish in the Mck handled less, lower densities and transport distance, holing time? Look at mgmt. protocols and implementation (have been outplanting since 1995 with changes every 2 years, however, haven’t	Open trap earlier (already opening as early as possible due to the need to disinfect after juveniles are released in April). The rate of fish processing slows, if sorting by tags and recording marks. Additional staff would be needed in order to operate DEX – new hires need to have CDLs. There may be additional trucking needs. ODFW has one truck, not sure of availability of others. The Corps truck used for outplanting once a week for each FC, DEX, and Cougar.	Use large enough sample size so that sampling can be randomized. Do not sort fish by tags: analyze if and when fish passed Willamette Falls.? New brood pond at Willamette Hatchery would help w/holding and brood needs. Increase the number of trucks and staff.

	seen changes in PSM - could it be below the project?) Look at time series - see what we can pull out from the years of data. Add more PIT detectors throughout basin - use PIT data to learn more about the fishes' experience downstream of the project. Look at PIT data from Willamette Falls – when do the fish get to DEX? Have 1 treatment group – track it and use it as the experimental design. Reverse NF/MF & MF protocols to see what changes in the MF. Design a suite of best management practices considering variety of factors – active adaptive management. Develop mgmt. tools to use in multiple basins.		

Next Steps
The group noted that more information is needed regarding the potential study needs, including how many fish would be needed and if they are available this year. This information will help the RM&E Team know if they should move forward on a proposal for FY17. Rich noted that a proposal will have to be drafted and reviewed by the RM&E team. If there is a need for fish beyond the normal available amount, then managers will have to weigh in on the decision. Cam and Jim agreed to review data and determine the sample size needed. They will bring this information back to the RM&E Team by October 26th.

- **ACTION: Cam and Jim will identify the needed sample size by October 26th.**
- **ACTION: The RM&E Team will discuss at their October 27th meeting to better assess the impact on the hatchery.**

Emily thanked the group for their efforts in the brainstorming session and with that the meeting was adjourned.

The next RM&E Team meeting is October 27th from 9:00-12:00 at the DS Consulting Office.

This summary is respectfully submitted to you by DS Consulting. Suggested edits are welcome and can be submitted to Emily at emily@dsconsult.co.