Ocean and Plume Science and Management Forum
March 4, 2016
Northwest Power and Conservation Council
Ocean Forum meeting notes (*draft March 11, 2016*)

Attendees: Phil Rockefeller (Chair), Patty O'Toole, Erik Merrill, Karl Weist, Nancy Leonard, Kerry Berg and Jim Ruff (NPCC), Brian Burke, Laurie Weitcamp, Cheryl Morgan, Kym Jacobson and Jen Gosselin (NOAA-NWFSC), Pete Hassemer and Alan Byrne (IDFG), Jeff Fryer (CRITFC), Tom Rien and Erick Van Dyke (ODFW), Dan Rawding and Mara Zimmerman (WDFW), Lynne Krasnow, Paul Wagner and Jeremy Jording (NMFS), Marc Trudel (DFO), Anne Creason and Bill Maslen (BPA), Doug Olson (USFWS), Catherine Corbett (LCEP), Kate Myers (ISAB),, Tom Iverson (Yakama Tribe rep), and Shane Scott (PPC).

1. Chair Phil Rockefeller welcomed everyone to the meeting and led a round of introductions.

2. The draft notes from the November 2, 2015, meeting were reviewed and approved.

3. Patty O'Toole reviewed the revisions to the OF Charter with the group, which were approved by the Council in December 2015. The changes largely focus on collaboration among OF members and the sharing and utilization of ocean information between researchers and salmon managers. Chair Rockefeller highlighted the need for communication and said that ocean research needs to be relevant and should help inform freshwater management decisions.

4. Discussion of ISAB/ISRP Critical Uncertainties Report – Patty O'Toole said comments are due on the CU report by March 11, with a public meeting at the Council office on March 7 for comment and discussion. Kate Myers summarized the critical uncertainties report in general and said the ocean and plume portion of the report was one of 12 general areas. She said that, while there were only two ocean research projects reviewed, the ISAB report indicated that understanding ocean conditions and collecting ocean research information could be important to other aspects of the F&WL Program and management actions in freshwater. Estuary, plume and ocean are combined into a single theme in the report. She also stressed the importance of forming interdisciplinary teams to conduct research. There is one CU question associated with the ocean theme area, which asks "How much do specific factors impact growth, fish condition, residence time, age at maturation and survival of focal fish species (anadromous salmonids, white sturgeon, Pacific lamprey, eulachon) in the estuary, plume and ocean?"

Erick Van Dyke asked why **green sturgeon** were not mentioned in the list of focal fish species. The ISAB didn't discuss green sturgeon in particular during its deliberations but that species could be added to the list. Lynne Krasnow pointed out that NOAA Fisheries has listed the southern DPU of green sturgeon as threatened under ESA and the northern DPU is a "species of concern." Questions 20-23 in the full CU report cover some of the discussions the OF members have had in past meetings.

Chair Rockefeller asked **which agency or group of agencies** would be most appropriate to pursue particular research questions. This could help the region better coordinate its research efforts and help gain some efficiencies. Where can the Council invest F&WL Program resources toward ocean research? Lynne Krasnow said that NOAA is trying to coordinate with others and contributing ~$1M of agency funds and resources toward ocean research to cost-share with Bonneville funds. Some important research areas that are not being addressed under the Program currently include hypoxia, ocean acidification (OA), sea level rise, etc., all of which have implications to habitat restoration. Brian pointed out that the OF could identify that some funding is needed to move ocean research in these areas forward.

Erick Van Dyke asked whether **ecosystem function**, both in ocean and freshwater, needs to be better addressed in the CU report, which is consistent with the CR Treaty discussions. Bill Maslen suggested this discussion is moving into a policy area and is outside the scope of the OF charter.

5. **Upcoming meetings** of note include the LCEP [Columbia River Estuary Conference](#) on May 24-26, 2016, in Astoria, OR. It will focus on recent anomalous ocean conditions, e.g., "The Blob" of warm ocean water, and how it affects conditions in the estuary. Deadline for abstracts is March 11th. The second meeting will be on June 17 in Vancouver, WA, about the risks of climate change to estuary and near ocean habitats, and how knowledge of these risks can help inform future management actions in estuary. There is also a [Salmon Ocean Ecology meeting](#) in Juneau, Alaska on March 29-31. There will also be a [Salish Sea conference](#) in Vancouver, BC on April 13-15. There is also the annual CSS workshop meeting in Portland on April 20 (Ambridge Event Center, Portland, OR). There will also be a Yakama Nation conference in the Columbia River Gorge on April 19.

6. Patty summarized the **purpose of the meeting today, which** is to draw links between ocean and plume research and management implications. The focus today will be on salmon survival in the ocean and plume and how that information could be better utilized by salmon managers in the CRB.

How does the ocean affect salmon abundance over time?

Brian Burke's presentation addressed salmon modeling, why there are so many models, and purpose of modeling. Examples of model purposes include models for harvest management, hatchery management, scientific exploration, and life cycle modeling. Brian said there are different reasons or purposes for developing different models, but we can try to compare different models or accept the models play different roles.

- Doug Olsen applauded the utility of using multiple models and not focusing on only a single model.

Jen Gosselin presented an example of a forecasting model for ROR, transported fish and PDO. Arrival timing to BON Dam is important; annually, PDO is important to Chinook.

- Paul Wagner said that more of this type of data could help inform the management decision of whether and when to transport juvenile fish.

Laurie Weitcamp presented on observed and expected returns of salmon from Alaska to California in 2015. 2014 had very unusual warm ocean conditions due to "The Blob" in the PNW. We will see the repercussions of those conditions 5 years from now. Warm water can be good in Alaska producing large harvests, but can also have some negative effects. For instance, in 2015 we saw that the sockeye adults were extremely small and the returns of pink salmon was low. Other areas (Fraser River, Puget Sound, Columbia River Basin, Oregon Coast) observed much smaller returns, lower size, lower fecundity, and inriver mortality related to this warm temperature (see slides for details). 2015 drought conditions may impact future returns due to lower smolt migration.

- Chair Rockefeller: is it possible to extrapolate to know what we can expect for 2016?
  - Laurie Weitcamp: current conditions are 1.5 degree above average so the anomalous conditions are still present (blob is reduced but still present) so 2016 runs will be affected negatively. Some debate as to whether "The blob" or El Niño is the cause of the anomalous conditions, e.g. we are seeing pelagic copepods offshore.
  - Brian Burke: "The blob" has morphed into a coastal blob of warm water so the pattern currently being seen is similar to a warm PDO pattern. Some say "The blob" has dissipated but its effect on salmon is still negative since there is a warm PDO pattern offshore.
- Lynne Krasnow: there is a NOAA Science Center-OSU collaboration looking at the stomach content of juvenile chinook comparing warm versus cool years (published paper). We found that in warm years they are eating more and lots of calories are consumed yet fish are of smaller size. So the effect of warm water

on survival may have to do with effect on metabolism rate being higher, so they find food and calories but the metabolic rate is so high they cannot invest in improving their body condition. Still somewhat unclear exactly what is happening.

- o Laurie Weitcamp: it might be that the ecosystem overall has an effect, southern copepods have a lower caloric value and that works up the food web and fish are working more to feed more.
- Kate Myers: any speculations on where the mortality of coho salmon occurs? Is it offshore? In high seas? Or is it delayed entries and predation?
  - o Laurie Weitcamp: I would think it occurs in high seas but we don't know exactly where they are. In 1982/83 Oregon coho experienced high mortality after first summer in ocean and knowing they come from the south you might be able to guess where mortality occurred.
- Chair Rockefeller: if you have small size fish returning – does the small body make them more vulnerable to high temperature mortality?
  - o Mara Zimmerman: Unsure about temperature mortality, but small size is a problem since it means lower fecundity. It's not just the number of fish returning, but size also. Egg quality can be reduced as well.
  - o Chair Rockefeller: so this is one area where ocean conditions are relevant to decisions made upriver. We need adjustments to account for the smaller return and reduced fecundity.
  - o Laurie Weitcamp: It can be hard for managers to react in-season to this type of information but it is worth thinking about.
  - o Chair Rockefeller: so how can we make this information more useful?

- ***{end discussion of this presentation and launch into discussion period}***

GROUP DISCUSSION

HOW FORECAST IS USED AND ROLE OF OCEAN INFORMATION

Alan Byrne: We forecast Columbia River fish returns and this forecast is used by the salmon managers. A forecast is just a forecast, we adjust our management when we see the actual run abundance. Fisheries above BON are managed based on the BON Dam fish count in real time. The use of the run forecast is more to manage people's expectations. I seek to improve our forecast and understanding better how we can use the ocean data and the ocean indicators would be helpful. Perhaps Brian Burke can help me better understand the ocean data. I would like to work with the ocean folks to understand what these ocean indicators are and how to use them (e.g., Brian's slide on what factors are most important on the ocean survival – but it seems that the factors

change a lot; maybe the plume data isn't the most important to the fish, perhaps ocean offshore indicators are the most important data to use).

- o Laurie Weitcamp: Salmon survival ocean indicators, the red-green table, 2015 was all red so it was one of the worst years for fish in the ocean, so I would suggest you pay attention to that table.
- o Alan Byrne: we do pay attention to that table but I don't know how to use it to inform our forecasts.

Jeremy Jording: based on my experience, I see ocean information included along with the Oregon and Washington coast forecasts. But this isn't occurring in the Columbia River forecasts. We use a static forecast to inform the AK and Canadian fisheries. But in river, we use real time information to manage the fisheries.

Patty O'Toole: We know that forecasts are used for harvest and that managers consider forecasts for hatchery broodstock collection planning. Anything else we use these run forecasts for?

- Lynne Krasnow: we don't call it forecasting but we have a similar function we use to predict how the ocean informs lifecycle model.
- Dan Rawding: forecasts are really about conservation. So if we have supplementation programs that are at high risk, the forecast will help with those. When we had no spring chinook fisheries in 2012 that was a conservation measure, not just a harvest measure. So I encourage everyone to look at forecasts from conservation perspective.
- Patty O'Toole: That is helpful feedback that will help communicate the value of this information to the program
- Jeremy Jording: has anyone investigated which forecast are currently using this information and whether those forecast were improved by incorporating this information?
- Bill Bosch: I developed a Yakima spring chinook forecast for TAC and we included the NOAA ocean conditions. To incorporate the NOAA ocean indicators we ranked these (a way to summarize all the ocean indicators) and used the mean of the ranking. There are 5 -10 different methods that incorporate that info. We try to use the best data while trying to not over-predict.
- Mara Zimmerman: for our WDFW coho forecast we use a sibling regression, or jack-based prediction that is derived from available data on hatchery coho. I have been providing a coho forecast that is using the ocean indicators (the data presented today). There is a tight correlation between WA coast survival and ocean indicators. For wild coho the sibling regression falls apart over time perhaps due to the variable ocean environment condition; whereas hatchery coho sibling regression holds up better, perhaps due to hatchery conditions. Am interested in using the ocean information to help with wild coho.

- Laurie Weitcamp: Oregon uses jack sibling regression and an environmental based model. They expected 200K coho and got 70K back.
- Erick Van Dyke: yeah, our forecasts are not always on the mark.

Catherine Corbett: we compile a dataset in the estuary (we have about 10 years of data) that might be useful at some point; perhaps it could inform run forecasting. I would be interested in learning what we could provide and how it could be used.

DESCRIPTION OF 2015 FISH RETURNS

Jeff Fryer: I'm involved in sockeye forecast for TAC. High mortality for Okanagan run between BON and spawning grounds during 2015. We didn't notice a small size at BON Dam of the fish we sampled. [later added] However, the 2015 sockeye size is similar by age but smaller than those fish of the same age measured a few years ago. I'm just getting into the data analysis now.

Doug Olson: For our coho hatchery production we had to collect broodstock from other areas during 2015. Coho were smaller and fecundity was lower in 2015. Even for a particular size of fish the fecundity was lower than expected for that size. For spring Chinook, we observed an effect of temperature in the tributaries with more pre-spawning mortality and lower egg quality, both in hatchery and wild fish.

OCEAN and HATCHERY

Doug Olson: I think it would be helpful for hatchery management folks to be able to use the ocean data from a perspective of providing information about the environmental conditions, being able to combine information about conditions in the tributaries, estuary, and ocean. This might inform us about when it would be a better time to release juvenile fish from hatcheries within a year. For out-years, having an indication that there is a poor ocean condition period coming up might help inform hatcheries to use a lower rearing density, since that appears to result in a higher SAR (so sometimes raising fewer fish results in higher adult returns). Informing hatchery management in this manner would be a huge paradigm change given that hatchery production numbers are pretty much set in advance right now. If we had a 2-year advance notice about ocean conditions, then we could adjust our hatchery rearing density.

- Patty O'Toole: when hatchery managers are planning brood stock collections what type of prediction/forecasting do you make and how are these made?
- Alan Byrne: we use the prediction from the TAC and our own data for anticipated brood stock returns to individual facilities (we make our predictions based on cohort analysis, etc.), and we make in-season adjustments based on PIT-TAG detection at BON Dam.

- Lynne Krasnow: would one year in advance suffice to adjust rearing densities or is that too late?
- Alan Byrne: for subyearling releases like fall salmon that might be OK. Traditional spring chinook program that has a 2 year rearing process would need a strong reason to change those 2-year programs one year into the process.
- Jennifer Gosselin: what about changing up the approach so the hatchery fish are more heterogeneous? Have the hatchery rear some fish under low density, other under high density, or a different fish size, etc. so you end up releasing a heterogeneous group of fish with a given year? Is that possible?
- Alan Byrne: well anything is possible. Some hatchery facilities test that sort of thing. I think there is value to having a diverse program. First thing we need to do is articulate what we are trying to achieve, do we want a specific type of age composition in return, or matching diversity of wild fish, or are we maximizing fish put out for future harvest. So depends on the type of program. If we can keep funding hatchery research programs we can get a better answer to your questions.

DENSITY DEPENDENCE

Patty O'Toole: our science panel talks a lot about density and its impacts. So it might be something worthy of more discussion. Providing ocean condition information 2 years in advance can make changes in hatchery operations, but shorter term changes will be harder.

- Doug Olson: I think there should be some research program to address specific questions and to get at some of these questions. All hatchery programs in the basin won't go in one particular direction just because it might be a good idea. But there might be some facilities that can address these uncertainties.
- Laurie Weitcamp: as an ocean researcher, we have the challenge that all hatchery fish are competing together. We would like to see hatchery numbers decrease a lot so we could see the resulting impact on wild fish. So we would need an entire basinwide effort to reduce the overall number of hatchery fish released, because a reduction at a few facilities is not a large enough change.

Paul Wagner: Is there evidence of density dependence in the ocean?

- Brian Burke: we are not collecting enough data to talk about food limitations. We need to know more about forage fish. Forage fish are not uniformly distributed so they can influence variability. We need to incorporate more data about those forage fish.
- Kym Jacobson: In response to Paul, there are a number of us that used to look at fish densities and initially we didn't think there was a density effect. But looking at fish condition and adult returns, and having a long history looking at variability

in the ocean, I think we now believe we need to look at this issue more closely. We haven't had adequate resources to look at this issue in-depth, but there are indications that it could be happening so we are moving in that direction.

- Brian Burke: in good ocean years perhaps there is enough food available and density is not an issue. We don't have a good handle on the forage fish base. We only have indicators of their abundance. That is a key data gap.

ESTUARY RME FOR BIOP

Lynne Krasnow: I want to mention that starting this spring NOAA Fisheries is focusing on estuary RME for the FCRPS BiOp. We are going to collect longitudinal data – taking fish from the Smolt Monitoring Program and sampling from 4 different spots in the river. So we will have data on what fish are eating, their body condition, etc. throughout the lower river and estuary. So we may get more data about what happens to the fish as they migrate through lower Columbia River and estuary.

- Brian Burke: Given the new sampling and given that some hatcheries have the ability to do experimental treatments, is there an opportunity to address specific questions such as, if a hatchery releases fish of a different condition or at a different release time, and then we collect data longitudinally in the lower Columbia River and plume, is there anything more we can learn here?
- Erick Van Dyke: How does ocean prey availability affect fish eating and how it metabolizes the prey – since that may impact what you observe. BRIAN B: how we interpreted fish condition influences fish survival; we compare juvenile fish condition across survivors; it would be good to take a more direct approach using the data we have.
- Laurie Weitcamp: In this new effort in the estuary we will be taking insect samples to know about prey composition/availability, assuming juvenile fish eat the insect. There are two sister projects going at the same time as the longitudinal study, one that looks at the production of insects and fluctuation (export) of insects to the river, and the other looking at fish stomach content to identify the insect source (isotope etc).
- Catherine Corbett: we look at Chinook stomach content and we see insects in the lower river and we are finding full stomachs. We are also trying to find the origin/basis of the foodweb and whether it has shifted in some fashion.
- Brian Burke: there is an opportunity with the data collected this year to look at fish condition factors at BON Dam and in the lower Columbia River. Managers might be interested to know how fish condition changes, mortality, etc. We could use the data we will collect in 2016 and share that with you all.

OCEAN and FW PROGRAM MITIGATION

Lynne Krasnow: I want the Council to understand the value of the ocean to the success of mitigation for FCRPS. So we want to draw attention to how Brian Burke uses this ocean information for in-river management.

- Jeremy Jording: The current areas affected by the plume are modified any given year based on volume of water flowing out of the Columbia River. So some of the coastal forecasting uses, especially ocean fishing which impacts the adult return to the CRB, there is a component there that ties the two together.
- Brian Burke: To address Lynne's question, for forecasting how many fish return in a given year, it's not really important what predictor is used as long as they exist and they can forecast accurately.
- Dan Rawding: Regarding lifecycle models, we ran a scenario under different levels of productivity. He also noted that looking at predation vulnerability to marine mammals, different stocks fared differently when ocean conditions varied. When modeling the whole lifecycle, the ocean becomes very important since most of their life and mortality occurs there.
- Lynne Krasnow: Both the ocean and ocean model are important to mitigation under the program.
- Patty O'Toole: It's impressive that we are getting so much information now. We now have information on many variables.
- Jennifer Gosselin: How much can we tease apart the various factors? We have a lot of data collected but we need to figure out what data to use to tease out the important factors.

OCEAN, LAMPREY and EULACHON

Patty O'Toole (on behalf of Tom Rien): Are there any interesting ocean condition effects on lamprey and eulachon?

- Laurie Weitcamp: we know almost nothing about ocean conditions and lamprey, not even where they go in the ocean. I've asked our ocean survey samplers to keep an eye out for them. We don't know what effects them since we don't know where they go. We think they may go south since hake have signs of lamprey bites. The Bering Sea shelf surveys catch Pacific lamprey in their surveys, but there are no Pacific lamprey populations in Alaska. Jon Hess (CRITFC) is working on lamprey genetics to determine the origin of the Pacific lamprey caught in the Bering Sea surveys. The tiny Pacific lamprey return in huge size and it is all ocean growth, so we need to figure this out. The pink shrimp harvest are seeing more eulachon, so eulachon may be hanging out with the pink shrimp. But we have no idea where the eulachon go in the Pacific Ocean.
- Dan Rawding: our ability to get robust estimates of eulachon when they return to spawning is not great. Without grounding what is happening on the spawning

grounds, it might be hard to tease out how their abundance relates to ocean indicators. So if we want to better understand eulachon, would help to understand where they go off shore, but we also need to improve our knowledge of their spawning abundance.

WRAP UP

Patty O'Toole: any additional comments?

- Jeremy Jording: Thanks, I appreciated the interactions today, it's been very beneficial.
- Patty O'Toole: Thank you to all the TAC folks for engaging with us today.

Chair Rockefeller: It's been a delightful conversation and I enjoyed listing to the scientists and have nothing but the greatest admiration of your work and the ability to distill your work and share it with people like myself. I look forward to our next OF meeting. Hope you can also engage in our meeting on Monday on our research plan and submit comments to Patty O'Toole.

NEXT MEETING

Patty O'Toole: Potential topics of our next meeting might include juvenile fish timing, e.g., when to release hatchery fish. Any other ideas from the group? You can email me potential topics. We are thinking of late summer or fall 2016 for our next OF meeting.

- Dan Rawding: how can we follow up and try to address the collaboration opportunities instead of working off a laundry list of possible uses of ocean data.
- Lynne Krasnow: I agree.
- Mara Zimmerman: I also agree.
- Patty O'Toole: What works best to achieve this opportunity to collaborate?
- Jeremy Jording: Perhaps small work group meeting one-on-one.
- Perhaps TAC members would be interested to meet with the ocean research folks to better understand these ocean variables and what they mean and where they are. I don't want to use an ocean variable that might be meant for CA – we need lots of back and forth discussion. For this it may be more efficient to work in a small group situation than in a formal meeting like this.
- Brian Burke: I agree with meeting in a small group especially when we are going into the details of the research and fish populations. So I'm not sure where or how we should land on that.
- Dan Rawding: Perhaps one opportunity is to have Bill Bosch discuss his use of an environmental factor and learn from him what he learned so we can have a learning opportunity and an information exchange occurs.
- Patty O'Toole: So what can we do that is most helpful? I'll provide his contact information to everyone here.

- Lynne Krasnow: Perhaps we should let a few people engage one-on-one and during the next Ocean Forum meeting. They can then share with us how that went, including discussing how they used environmental factors in their work.

END

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