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MEMORANDUM

TO: Ed Bowles
Erick Van Dyke

FROM: Michele DeHart

DATE: May 4, 2016

RE: Review of April 2016 Draft of NOAA Fisheries report *2015 Sockeye Salmon Passage Report*

In response to your request, the Fish Passage Center staff reviewed the subject draft report. We offer the following comments for your consideration. The NOAA report addresses the disastrous adult sockeye passage survival in the Columbia and Snake rivers that occurred in 2015. Our overall conclusion is that the report focuses only on a summary of 2015 for sockeye and, by ignoring past years, appears to downplay the long-standing high water temperature issues in the Snake and Columbia rivers and the effects of the FCRPS development and operations on water temperatures and adult and juvenile salmon survival. The approach taken in this summary report of 2015 passage issues obscures the primary lesson from the 2015 experience, which is that under a climate change scenario, the long-recognized and largely unaddressed problem of high water temperatures in the present FCRPS configuration becomes an ever-increasing threat to the survival of salmon in the Columbia River Basin. The recommended actions identified by NOAA in this report are reminiscent of recommendations made over the last 20 years. The problem for migrating adult and juvenile salmon under the present FCRPS configuration, which is significantly different from a free flowing river, is that water temperatures in fishways and forebays routinely exceed the 68°F degree (20°C) level for extended periods of time, over which salmon survival is impaired. NOAA and the action agencies do not address this critical issue in this report.

Our conclusions are summarized in the following points, and later discussed in detail.

- Water temperature in FCRPS fishways has been a long-standing recognized problem for salmon migration, and although recognized, it has been largely unaddressed.
- The 68°F limit for salmon migration corridors is routinely exceeded in FCRPS fishways.
- EPA modelling indicates that the development of the FCRPS increased water temperatures over the natural river.
- NOAA's discussion of water temperatures in the FCRPS obscures the point that 68°F was exceeded in fishways throughout the Columbia Basin. NOAAs discussion of historical exceedances prior to the development of the FCRPS is misleading.
- The management process that was implemented in 2015 did not allow for robust, science-based, decision-making. Actions proceeded on the basis of perception and instincts without scientific evaluation relative to success.
- Survival of adult migrating summer Chinook salmon was also a historical low in 2015 coincident with high water temperatures. This was not addressed in the subject NOAA report.
- We agree with NOAA's statement that sockeye salmon transported as juveniles have a lower adult migration success rate. This is consistent with historical findings for sockeye and other salmon and steelhead. Historical data and the 2015 experience indicate that sockeye salmon should not be transported as juveniles.
- Although continuous cycling of the navigation locks to provide an alternative upstream migration route for sockeye was discussed in the 2015 process, it was not discussed in this report.

Water temperature in FCRPS fishways has been a long-standing recognized problem for salmon migration, although it has been largely unaddressed.

In 1998, NMFS issued a supplemental BiOp for steelhead recommending further actions to the COE. The Corps of Engineers (COE) adopted these recommendations in a 1998 Record of Decision (ROD). The 1998 ROD includes discussion of new information on continuing unresolved issues. They identify water quality standards with respect to total dissolved gas and temperature as one of these issues. And, relative to temperature, they offer (1) the prioritization of cool water releases from Dworshak for juveniles, (2) the development of surface passage routes to decrease forebay delay, and (3) to investigate adult ladder water temperature by collecting more information and evaluating engineering fixes.

It is now 18 years later and NOAA is still recommending that the COE:

> *Improve monitoring and reporting of all mainstem fish ladder temperatures and identify ladders with substantial temperature differentials (>1.0°C).*

The COE has used data loggers to collect temperature in the adult fishways for several years. In spite of this, very little of this information has been made publicly available. The

emphasis recommended by the NOAA/COE Report should not be to "monitor temperatures" and "identify temperature differentials," but should be focused on evaluating the existing information and making immediate modifications to fishways to address the ladder temperatures.

The 68°F limit for salmon migration corridors is routinely exceeded in FCRPS fishways

During the 2015 adult sockeye passage season, it became clear that critical temperature data from the adult fishways were not readily available to the fisheries managers. Without these data, managers were unable to evaluate ladder temperature differentials during the period when sockeye passage was of dire concern in the Snake River. Since this time, the FPC has been working with the COE to obtain ladder temperature data so these data can be made available to the fisheries managers. As part of this process, the COE has stated that the temperatures from the forebay monitors generally track the temperatures at the adult fishway monitors (Tammy Mackey, personal communication). With this in mind, the FPC staff summarized daily average temperatures at the Bonneville and Ice Harbor forebay monitors over the last 18 years (1998–2015) for the period of May 1 to up to the point that the monitor is removed (or September 30, whichever occurred first). While 2015 had the highest proportion of days exceeding the 68°F limit for salmon, it is clear from these data that this limit has been routinely exceeded over the last 18 years (Figure 1). For example, in 1998 the 68°F limit was exceeded 48% of the days at Bonneville and 54% of the days at Ice Harbor. Furthermore, even the years with the lowest proportion of days exceeding the 68°F limit still exceeded the limit approximately 20% of the time (1999, 2008, and 2012 at BON; 2008 and 2011 at IHR).

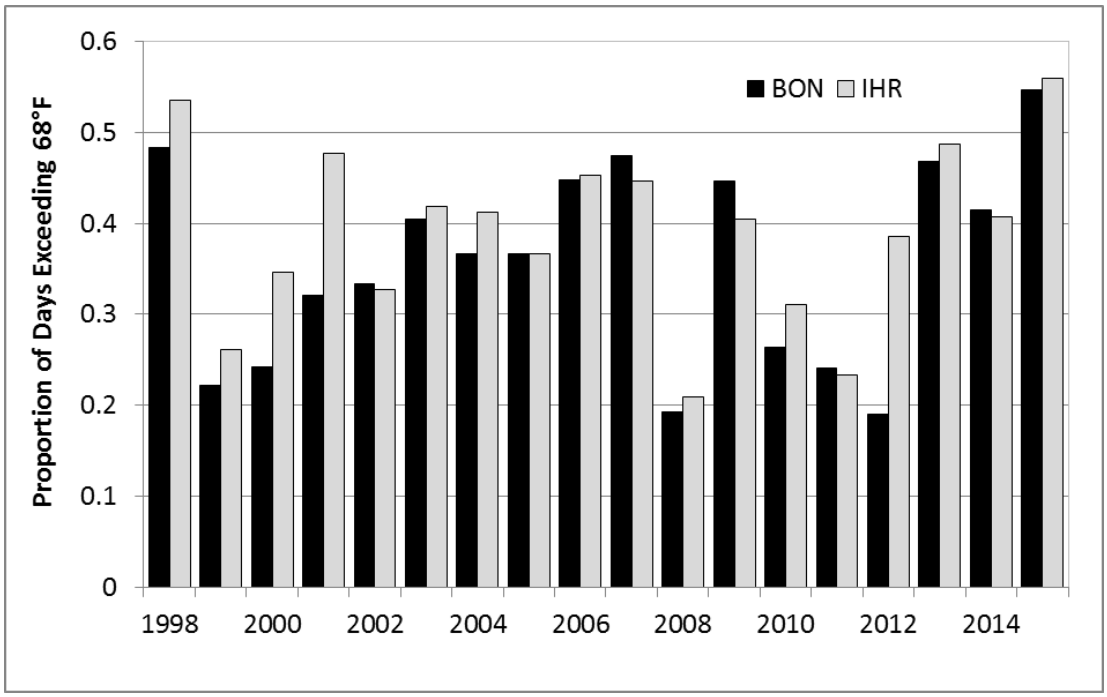

Figure 1. Proportion of days (May 1–~Sept 30) that the forebay monitor at Bonneville or Ice Harbor exceeded the 68°F limit for salmon migration corridors (1998–2015).

EPA modeling indicates that the development of the FCRPS increased water temperatures over the natural river.

Hydrosystem development has had a significant effect on temperature in the mainstem Columbia and Snake rivers. This impact goes beyond the effect caused by naturally high temperatures that may have historically occurred in the mainstem and the tributaries (Note: while naturally high temperatures are often cited to have occurred, there is little consistent water temperature data available to document pre-development river temperatures). By slowing water flow and increasing surface area for solar radiation, dams increase water temperatures in the reservoirs created. The major impact on the daily average, cross-section, water temperature is due to the increase in width and depth resulting from the construction and operation of the impoundments (Yearsley et al., 2001).

In 1995, the National Marine Fisheries Service (NMFS) issued a Biological Opinion (1995 BiOp) concluding that modifications to FCRPS operations were needed to ensure long-term survival of salmon stocks in the Snake River that were protected by the Endangered Species Act (ESA) (NMFS, 1995). The inability to meet water quality standards with respect to temperature was identified as an issue. A temperature of 20°C (68°F) was established as a reference temperature, considered the upper incipient lethal limit for salmon. Focus was on the prioritization of cool water releases from Dworshak and Brownlee dams for juveniles, evaluation and improvement of water prediction temperature models, the development of surface passage routes to decrease forebay delay, and the provision of water temperature control in fish ladders. At that time the COE agreed to coordinate with the Environmental Protection Agency (EPA) regarding their concerns on water temperature.

In October 2000, the states of Oregon, Washington and Idaho signed a Memorandum of Understanding with the EPA-Region 10 that established EPA as the lead agency for the development of a Columbia/Snake mainstem temperature Total Maximum Daily Load (TMDL). TMDL development is usually a state responsibility, but considering (1) the interstate and international nature of the waters, (2) EPA's technical expertise in the modeling effort, and (3) EPA's Tribal Trust responsibilities, EPA agreed to take responsibility for the technical development of this TMDL. Once the EPA developed the TMDL, it was to be up to the states to develop a plan to implement the TMDL.

The EPA modeled the Columbia system using RBM10 (a peer reviewed, one dimensional energy budget model) (Yearsley et al., 2001) and assessed the impacts on natural water temperature (no human-caused pollution or alterations) of point sources, tributary inputs, and dams. They determined that:

1. The effect of existing point sources is very small and does not lead to water quality exceedances when averaged in with the total river flow.
2. Most of the tributaries have a negligible effect on the cross-sectional average temperatures, with exception of the Spokane, Snake, and Willamette, which are large enough to affect the temperature of the Columbia River; and only the Grande Ronde, Salmon, and Clearwater are large enough to potentially alter the Snake River. The magnitude of the effect is a function of temperature differential and flow volume.

3. Dams do have an effect on temperature in the mainstem. The maximum impact ranges from negligible to large, depending on the dam.

The TMDL was to provide a total increase within each reach within target sites to develop waste load allocations. However, the draft TMDL was never finalized and all activity on the TMDL ceased at this time. According to the WA Department of Ecology website (http://www.ecy.wa.gov/programs/wq/tmdl/TMDLsbyWria/tmdlColumbiaRvr.html), the status of the TMDL is "Delayed to allow necessary discussions and information exchange."

NOAAs discussion of water temperatures in the FCRPS obscures the point that 68°F was exceeded in fishways throughout the Columbia Basin. NOAA's discussion of historical exceedances prior to the development of the FCRPS is misleading

Although initially supportive of developing the TMDL and also addressing adult ladder temperatures, the COE moderated their stance regarding the role of the hydrosystem in temperature occurrences above the States' criteria, or the 20°C (68°F) salmon reference temperature, after the development of the feasibility report. This was subsequent to the COE's development of their *Lower Snake River Juvenile Salmon Migration Feasibility Report/ Environmental Impact Statement, Appendix C Water Quality* (USACE 2002).

The COE's official position was included as an appendix to the WQP that was part of the Proposed Actions of the 2004 BiOp remand (NMFS, 2004). The COE's position asserted that high mainstem temperatures occurred both pre- and post-impoundment and that, while the hydrosystem development and operation bore some responsibility for increasing mainstem water temperatures, they also wanted to recognize upstream influences (including the construction and operation of upstream dams, point source returns, agriculture practices, forestry practices, and urban development) as well as climate change.

The NOAA/COE Report uses the same logic and mostly the same data to imply little implication for the hydrosystem in affecting temperature. They use a dataset from 1955–1958 for temperatures from an undeveloped Snake River. There is no recognition that these data (taken from a 1963 publication and converted from °F to °C) are 6-day averages of daily maximum water temperatures. These data may represent a 1-hour or few hours' peak temperature exceedances of the 68°F standard for salmon migration. NOAA misrepresents these data as comparable to the recent data that show daily average temperatures exceed the 68°F standard for most of July and August and, in 2015, the last week of June. In addition, NOAA fails to recognize that, in a natural river, migrating adult salmon can escape to cool deep pools to wait until hourly peak temperatures or short-term peak temperatures dissipate. In the developed FCRPS there is no potential to escape because daily average temperatures exceed 68°F for months at a time. The historical dataset used by NOAA in this report to argue that the FCRPS did not affect salmon migration water temperatures is not comparable or relevant to the present daily average water temperature dataset, given the increased period of thermal exposure adult migrating salmon currently experience. In addition, NOAA fails to recognize that substantial construction work, including the building of a coffer dam, was initiated at Ice Harbor Dam in 1955 which could have affected water temperature at that location.

There were certainly issues with high temperatures and potential mortality to sockeye salmon associated with high river temperatures historically. The issue relative to the present hydrosystem is the magnitude of the exposure and the magnitude of the mortality response due to the delay and concentration of fish in reservoirs and adult fishways. The same 1963 publication warns of the exacerbation of the mortality issue due to the presence and future construction of dams.

In addition, the NOAA/COE Report minimizes the importance of the1°C increase in temperature between McNary and Bonneville dams, while wholly ignoring the extreme temperatures in the Snake River, despite cold water released from Dworshak Dam. It appears that the cooling effect of cold water releases from Dworshak appears to be lost by the time water gets beyond Little Goose Dam. For example, cold water releases from Dworshak are operated in a manner to prevent temperatures at the Lower Granite Dam (LGR) tailrace from exceeding 20°C. Despite the fact that temperatures at the LGR tailrace were mostly below 20°C in 2015, temperatures at the Ice Harbor (IHR) tailrace exceeded 22°C for a total of 24 days in 2015 (Figure 2). In fact, the temperature differentials between LGR and IGR were as high as 3–4°C for 17 days in 2015, mostly in July (June 30–July 2 and July 14–27). These high temperature differentials between LGR and IHR suggest that the reservoirs created by the FCRPS projects on the mainstem Snake River do have an effect on mainstem temperatures, as there is very little input from tributaries between LGR and IHR.

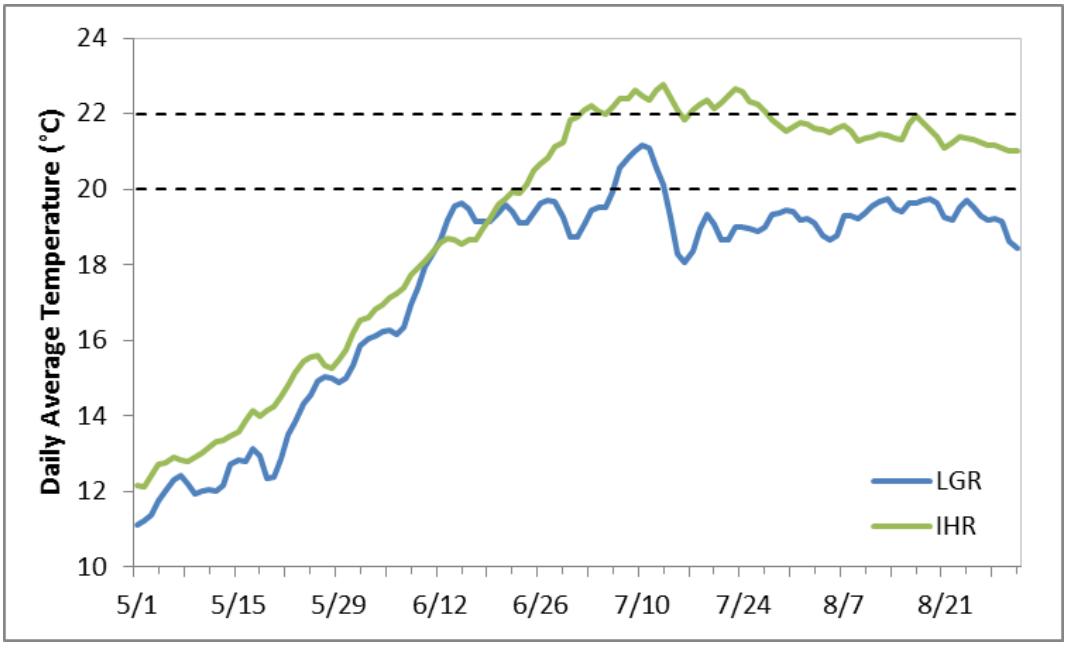

Figure 2. Daily average temperature at the tailrace monitors at Lower Granite and Ice Harbor dams (May 1–August 31, 2015).

As previously discussed, a 1°C temperature differential has been found to be sufficient enough to affect upstream salmon migration in fishways. The 1°C temperature differential between Bonneville and McNary is offered by NOAA as evidence that the FCRPS does not affect water temperature, which clearly discounts the known effect of a similar differential in the fishways.

The management process that was implemented in 2015, did not allow for robust, science-based, decision-making. Actions proceeded on the basis of perception and instincts without scientific evaluation relative to success.

The NOAA/COE Report discusses project-specific operations that were implemented in 2015. They provide in their recommendations to:

> *Develop water temperature models, or similar tools, to assess the effect of alternative project operations at Lower Granite and Little Goose dams on ladder and tailrace temperatures or implement a study to empirically assess the effect of proposed operations.*

This NOAA/COE Report notes that regional disagreement exists regarding the efficacy of changes in project operations and its impacts on adult passage success. The report fails to recognize that regional discussion took into consideration that the actions proposed by NOAA in 2015 at Lower Granite and Little Goose Dam were associated with detrimental impacts to juvenile migrants. NOAA characterizes the juvenile passage as "relatively few juvenile migrants" implying that there would be little impact to juveniles. This view was not regionally accepted in terms of "trading off" operations without having clearly established goals, objectives and criteria for determining success.

Additionally, in spite of over twenty years of recognizing the impact of adult ladders and temperature, there has been a complete stalling of the development of viable alternatives to address the issue. This led to the consideration of actions that had an associated cost in juvenile and adult mortality including: emergency trapping and hauling at high water temperatures, and changing spill operations that decreased juvenile passage protection. It was the cost to juvenile and adult survival and the lack of a plan for evaluation of operations that led to differences in recommendations among the salmon managers.

The issue of adult ladder temperature differentials and passage delay must be addressed, and it must go beyond investigating those recommendations made in this NOAA/COE Report. Once again, a selective water withdrawal capability at Brownlee Dam is overlooked while making recommendations.

References

NMFS (National Marine Fisheries Service). 1995. Endangered Species Act Section 7(a)(2) Biological Opinion on the Reinitiation of consultation on the 1994–1998 Operation of the Federal Columbia River Power System. NMFS, Northwest Region, Portland, Oregon. March 1995.

NMFS (National Marine Fisheries Service). 2004. Endangered Species Act Section 7(a)(2) Biological Opinion Consultation on the Operation of the Federal Columbia River Power System. NMFS, Northwest Region, Portland, Oregon. November 2004.

USACE (U.S. Army Corps of Engineers). 2002. Lower Snake River Juvenile Salmon Migration Feasibility Report/Environmental Impact Statement, Appendix C: Water Quality. February 2002.

Yearsley, J.D., D. Karna, S. Peene and B. Watson. 2001. Application of a 1-D heat budget model to the Columbia River system. Final report 901-R-01-001 by the U.S. Environmental Protection Agency, Region 10, Seattle, Washington.