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MEMORANDUM

TO: FPAC

FROM: Michele DeHart

DATE: May 28, 2013

RE: Review of NOAA Proposal for Estimating 95% Passage Date at Lower Monumental Dam.

At the May 14, 2013, FPAC meeting, NOAA Fisheries provided a memo proposing that the region base the Lower Monumental Dam transition from the spring to summer spill operation on an estimate of when 95% of the Snake River spring listed ESUs have passed the project. The estimate of the 95% passage date would be made using the Columbia River DART (RealTime) smolt passage predictions based on PIT-tag detections for Snake River stocks. The FPAC requested that the FPC review the proposal and provide comment. In response to your request we are providing the following:

- The PIT-tagged fish used in the DART 95% passage date estimate do not adequately represent the population passing Lower Granite Dam. The DART 95% passage date is biased early.

- Even if the tagged population represented the entire population, the model predictions are too uncertain to inform management decisions on the change date from spring to summer spill.

- Basing passage dates on the PIT-tagged ESU as a whole does not protect late migrating stocks.

- We recommend that if NOAA proceeds with their proposal that they consider early bias in the passage date due to the inadequate representation of late migrating fish, consider the passage of individual stocks within the ESU, and incorporate the variability in the predictions by estimating when the lower confidence band for an estimate would be at 95%.

The PIT-tagged fish used in the DART 95% passage date estimate do not adequately represent the population passing Lower Granite Dam. The DART 95% passage date is biased early.

In order to use a marked population to estimate passage timing of a specific population the marked fish must be representative of that population. If the marking is not representative, then the estimation of passage timing only reflects the passage of the marked subset of the population. This is the case with the DART RealTime prediction, since present marking programs do not mark a known proportion of the population or the entire passage distribution of the population and, therefore, do not provide a sound basis for predicting population passage timing.

The recovery of PIT-tagged fish at Lower Granite Dam is dependent on the fish marking in any given year. Most wild fish (76% to 100%) are marked at traps in the basin (Table 1). If you consider the wild PIT-tagged fish recovered daily at Lower Granite Dam that are used in the RealTime estimation of the 95% passage date, anywhere from 88% to 98% of those tags were from fish marked at traps (Table 2).

Table 1. Proportion of PIT-tagged wild yearling spring/summer Chinook, steelhead, and sockeye that are marked at traps. These are only marks from above Lower Granite Dam.

Species	**Proportion Marked at Traps**
Yearling Chinook	0.76
Steelhead	0.85
Sockeye	1.00

Table 2. Proportion of PIT-tagged wild yearling spring/summer Chinook and steelhead detected at LGR that were marked at traps above LGR. For wild sockeye, 100% were marked at traps.

Date Detected	**Yearling Chinook**	**Steelhead**
May 9	0.89	0.96
May 10	0.93	0.96
May 11	0.89	0.95
May 12	0.89	0.93
May 13	0.89	0.98
May 14	0.93	0.93
May 15	0.91	0.96
May 16	0.89	0.92
May 17	0.94	0.91
May 18	0.92	0.93
May 19	0.91	0.92
May 20	0.93	0.92
May 21	0.88	0.93
May 22	0.88	0.93

The marking of wild Chinook, steelhead, and sockeye is not only dependent on the availability of fish, but also the ability to operate the traps, which can be compromised during periods of high flow and/or high debris. For example, in 2013, the number of traps that were operated to mark wild fish peaked on May 5th at 36 traps. After this date, the number of traps that were operated to mark wild fish steadily decreased. By May 22nd, the number of traps actively marking wild fish in 2013 was down to 14 (Figure 1). This decrease is largely due to the increasing flows and debris loads in the tributaries. For example, the Clearwater and Salmon river traps, which are large traps that are operated as part of the Comparative Survival Study and Smolt Monitoring Program, were taken out of operation on May 7th and May 8th due to high flows and debris. While it is true that the numbers of fish during this time period are declining, the inability to mark this portion of the migration will automatically bias your 95% passage estimate early. Given the reliance of the RealTime estimates on the PIT-tagged marked from traps it becomes apparent why it does not represent the population.

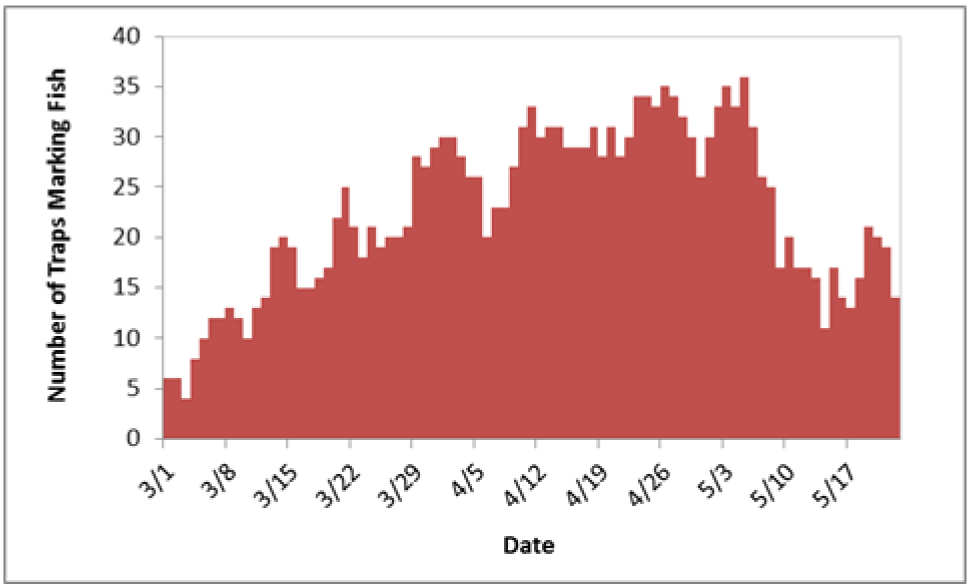

Figure 1. The number of traps actively PIT-tagging wild Chinook, steelhead, and/or sockeye during the period of March 1 to May 22, 2013.

Even if the tagged population represented the entire population, the model predictions are too uncertain to inform management decisions on the change date from spring to summer spill.

Given that terminating spring spill would remove some level of protection for the tails of spring populations of juvenile migrants, a measure of uncertainty must accompany the model predictions of the 95% passage date. We are suggesting using the lower tail of the confidence band around the 95% passage day prediction (e.g. when the model is 95% certain that these runs have passed). This would reduce the risk imparted on spring migrants from reducing spill to meet other research goals and include the uncertainty around the model predictions.

The predictions available on the DART website for 95% passage at Lower Monumental Dam are a combination of Program RealTime (Skalski et al., 1994) predictions of passage at Lower

Granite Dam and COMPASS (Zabel et al., 2008) runs to project this date downstream two dams. Unfortunately, these combined model runs do not express uncertainty around LMN date estimates.

The NOAA proposal uses the passage timing estimates at LGR instead of LMN. The RealTime predictions of the 95% passage date at Lower Granite Dam do include the standard deviation around the stock-specific 95% prediction. Using these dates to inform decisions about LMN would not be conservative but can be used to illustrate the width of uncertainty around these types of predictions.

On June 20th the information provided by the model is too uncertain to say with confidence that 95% of the run as has passed. For example, the June 20th prediction for the run at large for four years is shown in Figure 2. Recent examples of low (2010), medium (2009), and high (2011) flow years along with the most recent calendar year (2012) are shown. The lower end of the confidence interval is always under 95% by June 20th. In other words, it is uncertain based on model predictions that 95% of the run has passed by June 20th in these four years. The low flow year (2010) in the example is particularly uncertain on what percentage has passed by June 20th (potentially as low as ~ 75%). The estimates on June 20th are more precise for the other three years, but never more than 95% certain.

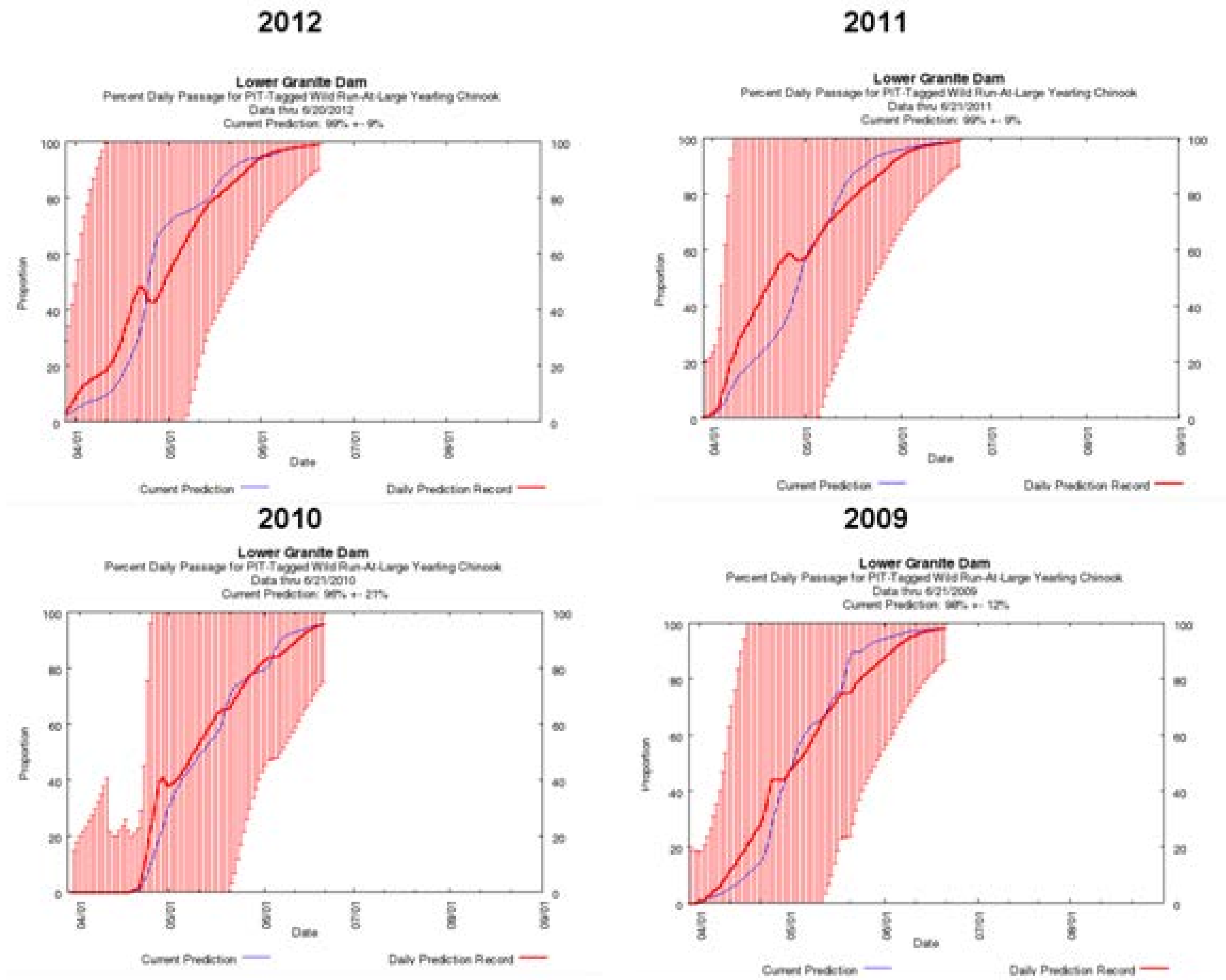

Figure 2. Examples of RealTime predictions of proportion of run-at-large that has passed Lower Granite Dam for 2009–2012. Note the lower confidence interval never exceeds 95% passage. These years were chosen because they were the most recent year (2012) and examples of relatively low (2010), medium (2009), and high (2011) flow years. All RealTime predictions calculated on June 20th for each year.

Basing passage dates on the PIT-tagged ESU as a whole does not protect late migrating stocks.

The FPC staff reviewed PIT-tag detections of wild yearling spring/summer Chinook at LGR to investigate to what degree different stocks arrive at different times. We did this for seven years of PIT-tag detections (2006–2012). For this analysis, PIT-tagged wild yearling spring/summer Chinook were categorized by the basin they originated from. The basins we used included: Clearwater River, Grande Ronde River, Imnaha River, Salmon River, and Combined, where combined was a combination of all wild yearling spring/summer Chinook that were PIT-tagged above Lower Granite Dam. Wild Chinook that were tagged and released at LGR were not included in these analyses, nor were wild Chinook that were part of acoustic-tag studies. We then summarized the juvenile PIT-tag detections at the juvenile PIT-tag detector at LGR to determine the passage timing of the various PIT-tag groups. To account for daily fluctuations in operations, and therefore detection probabilities, daily PIT-tag detections were expanded for the daily proportion of water that was routed through the powerhouse.

These PIT-tag analyses indicate that an earlier start date for the initiation of summer spill would have an impact on at least one stock of wild yearling spring/summer Chinook in almost every year over the last seven years (Table 3). This analysis also indicates that wild spring Chinook from the Clearwater River are routinely the latest stock to migrate past Lower Granite Dam (Table 2). While this stock of spring Chinook is not currently listed under the ESA, it is still of critical importance. Clearwater wild spring Chinook is not the only wild stock that would have been impacted by an earlier start date to summer spill volumes. In five of the seven years we analyzed, there was at least one other stock of wild spring/summer Chinook that had a 95% passage date at LGR that was later than June 4th (Table 3).

Table 3. Estimated 95% passage date for specific stocks of PIT-tagged wild yearling spring/summer Chinook tagged above Lower Granite Dam. The latest 95% passage date for each migration year is in ***Bold-Italic*** font.

	Migration Year						
Stock	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Clearwater Wild	***6/13***	***6/2***	***6/19***	***6/18***	***6/21***	***6/22***	***6/23***
Grande Ronde Wild	5/28	5/20	6/6	5/31	6/7	6/12	6/5
Imnaha Wild	5/16	5/26	5/19	5/22	6/3	5/16	5/21
Salmon Wild	6/7	5/20	5/25	5/26	6/6	5/28	5/23
Combined Wild	6/6	5/22	5/29	5/28	6/11	6/2	5/28

In summary, we recommend that if NOAA proceeds with their proposal that they consider early bias in the passage date due to the inadequate representation of late migrating fish, consider the passage of individual stocks within the ESU, and incorporate the variability in the predictions by estimating when the lower confidence bound for an estimate would be at 95%.

References

Skalski, J. R., G. Tartakovsky, S. G. Smith and P. Westhagen. 1994. Pre-1994 Season Projection of Run-Timing Capabilities Using PIT-tag Databases. Center for Quantitative Science, School of Fisheries, University of Washington, Seattle, Washington. Technical Report (DOE/BP-35885-7) to Bonneville Power Administration, Portland, Oregon, Project 91-051, Contract DEBI79-87BP35885. 67 pp. (Available from Bonneville Power Administration, Division of Fish and Wildlife, P.O. Box 3621, Portland, OR 97283-3621.)

Zabel, R. W., J. Faulkner, S. G. Smith, J. J. Anderson, C. Van Holmes, N. Beer, S. Iltis, J. Krinke, G. Fredicks, B. Bellerud, J. Sweet, and A. Giorgi. 2008. Comprehensive Passage (COMPASS) Model: a model of downstream migration and survival of juvenile salmonids through a hydropower system. Hydrobiologia 609(1):289-300.