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MEMORANDUM

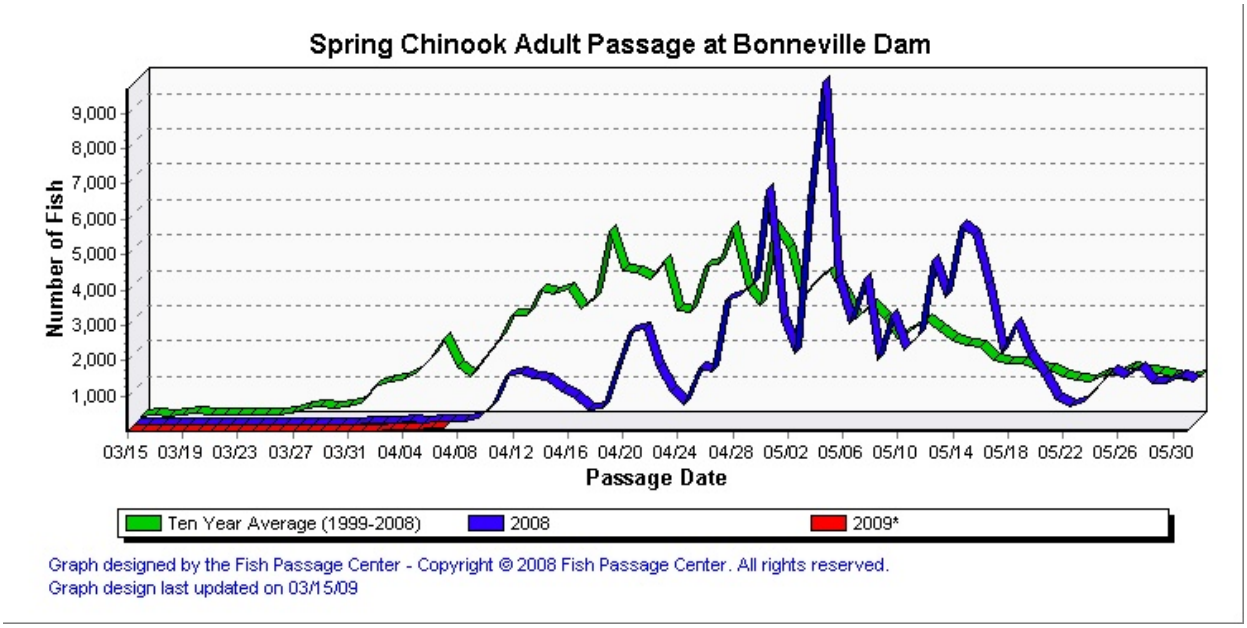
TO: Rob Lothrop
Mike Matylewich

FROM: Michele DeHart

DATE: April 8, 2009

RE: Factors affecting adult passage of spring Chinook

In response to your request, regarding the current concern over the perceived low returns of adult spring Chinook salmon over Bonneville Dam in 2009 we reviewed historic passage data, flow data and water temperature data. The following graph from the FPC web site, at www.fpc.org shows the current passage of spring Chinook adults in 2009 compared with the past ten year average and 2008 passage. The graph indicates that passage thus far is similar to last year but differs is later than the ten year average.



Spring Chinook run timing in the Columbia River appears to be affected by flow (Perry et al. 2003) and/or water temperature (Beer 2007). These studies found that spring Chinook salmon tend to arrive later when river flows are high and water temperatures are low. Given these general findings, we summarized recent run timing, flow and water temperature data to examine how these factors may be affecting run timing in 2009.

We summarized flow and water temperature data collected at Bonneville Dam during March 16-April 30, over years 1995-2009. We then calculated which years had the most similar flow and temperature patterns to those observed in 2009. Compared to the other years examined, flows have been relatively low in 2009 (Figure 1) and are most similar to flows observed in 2004, 2005, and 2008 (Figure 2).

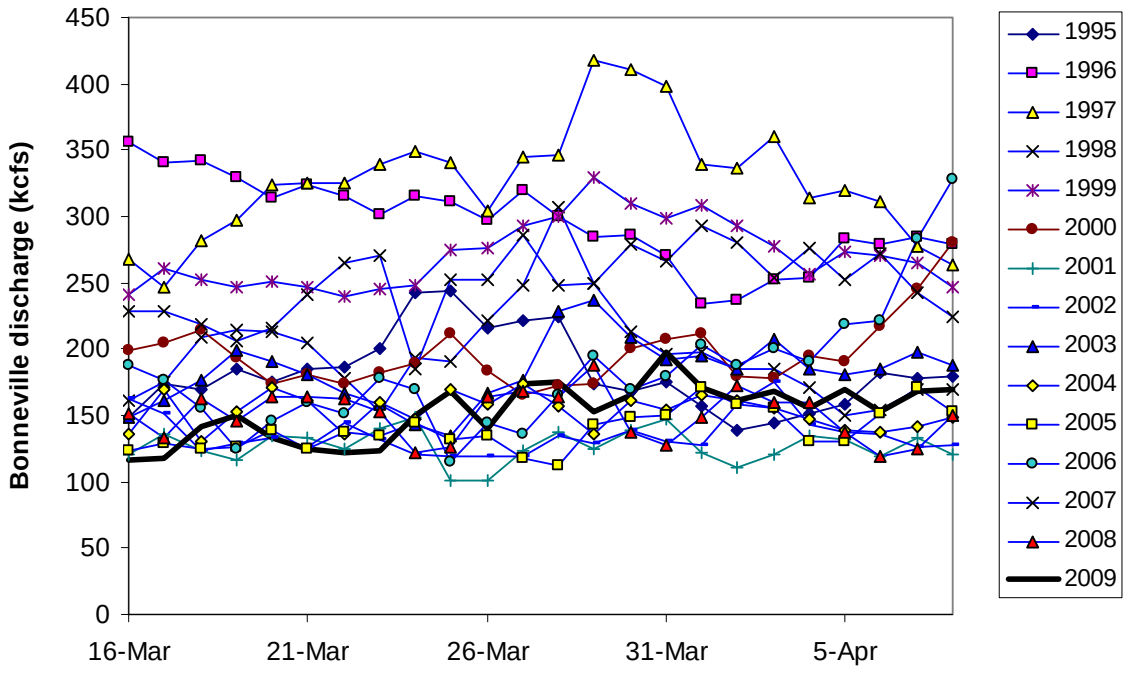


Figure 1. Bonneville flows during March 16-April 8, over years 1995-2009.

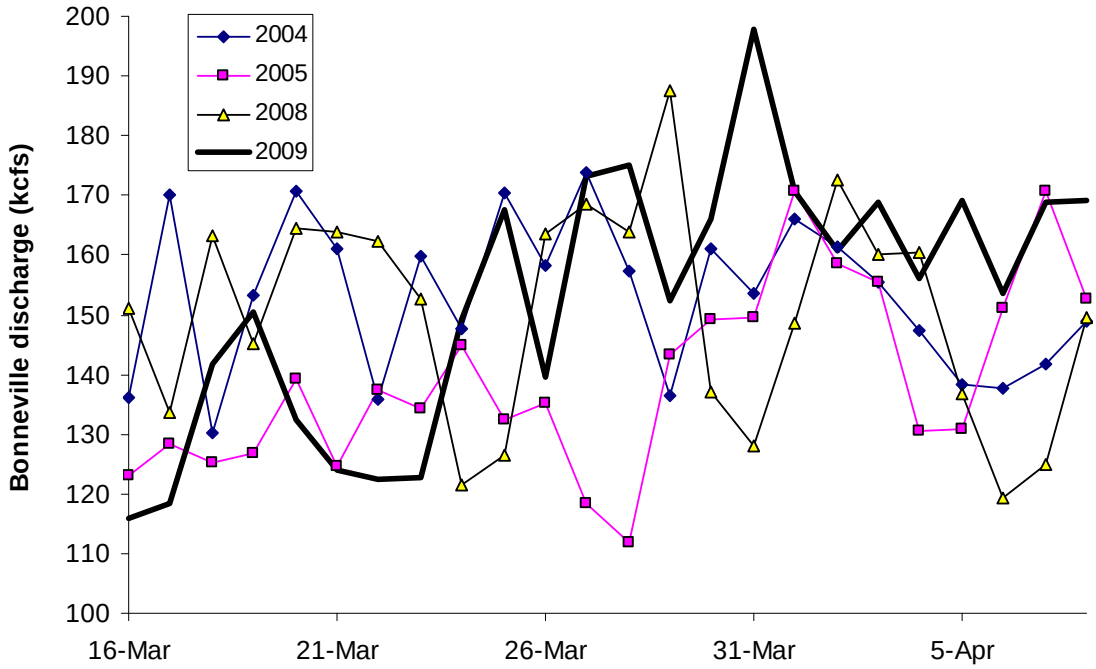


Figure 2. Bonneville flows during March 16-April 8 in years 2004, 2005, 2008 and 2009.

Water temperatures in 2009 have been some of the lowest observed over years 1995-2008 (Figure 3). The 2009 water temperatures are most similar to water temperatures observed in 2004, 2006 and 2008 (Figure 4), though 2009 temperatures were lower during late March and were similar to 2008 in late March through April 8th.

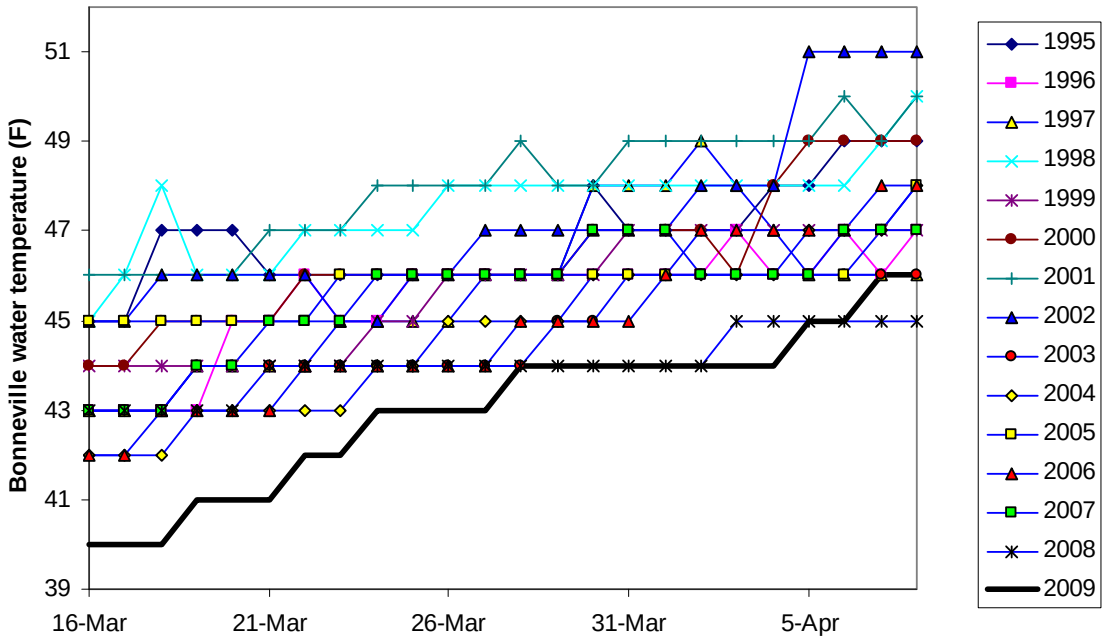


Figure 3. Bonneville water temperatures during March 16-April 8 over years 1995-2009.

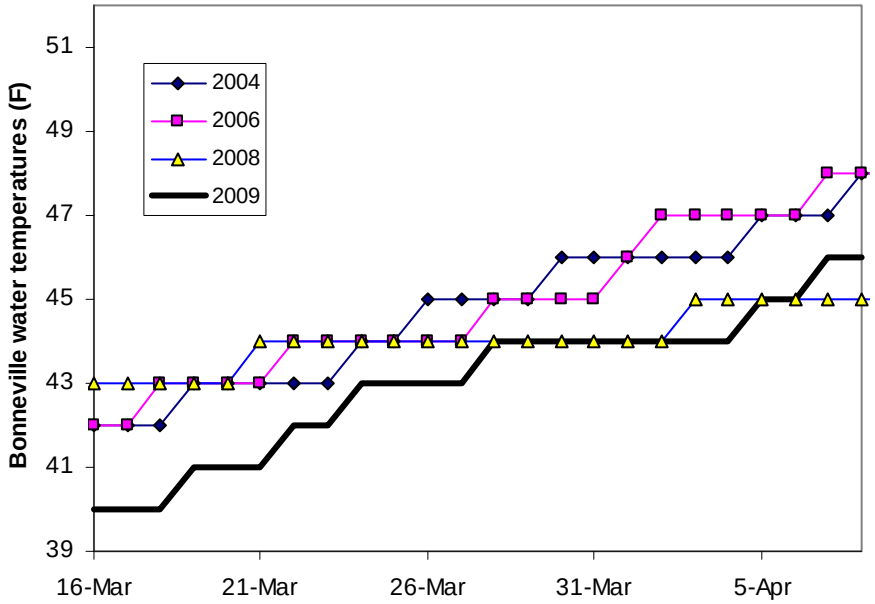


Figure 4. Bonneville water temperatures during March 16-April 8 in years 2004, 2006, 2008 and 2009.

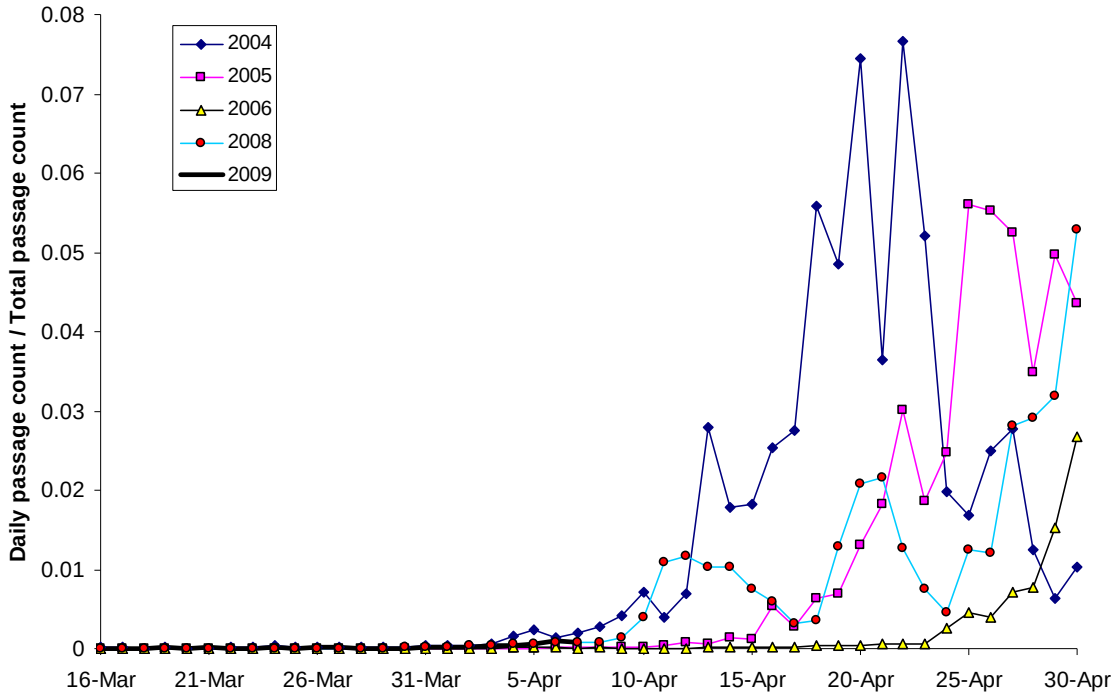
These data summaries indicate that flows and/or water temperatures observed in 2009 are most similar to those observed in 2004, 2005, 2006 and 2008. Given that these years had similar flow

and temperature conditions, it is reasonable to expect that run timing in 2009 may be similar to run timing in those years.

Next, we examined run timing in 2004, 2005, 2006, 2008 and 2009. The total number of spring Chinook passing Bonneville Dam differs among years. To standardize these differences in run magnitude, we divided the daily passage counts by the total run count at Bonneville Dam. These statistics represent the proportion of the total run count that passed each day. For 2009, we used an assumed total run count of 250,000 (assumed total run counts of 100,000 to 300,000 gave similar results).

It is evident that 2009 passage-to-date is similar to that observed in 2004, 2005, 2006 and 2008 (Figure 5). In each of these years, passage counts through April 10th were low. For these years with similar flow and water temperature conditions, the run did not begin to substantially increase until April 13th (2004), April 11th (2005), April 29th (2006) and April 21st (2008). Applying these historical passage indices and assuming a total passage count of 250,000 will occur in 2009, the first day that we would expect a daily passage count over 1,000 would be April 9th (2004), April 16th (2005), April 25th (2006) and April 10th (2008). However, 2009 is unique in that it is a year with both low flow and low water temperatures. The low flow would tend to favor an earlier migration, while the low temperatures would tend to favor a later migration. It is unclear whether one factor is more important than the other or whether both factors are important. In most years, low flows are associated with high temperatures and high flows are associated with low temperatures. Again, 2009 is unique in that it is a low flow year with low water temperatures and it is unclear how the salmon will balance these conflicting signals.

Based on these flow and water temperature data, the passage count-to-date is not unusual. Given the low flows and low water temperatures, it seems likely that the run will be somewhat delayed, and at this point is appears that passage counts will not likely increase substantially until mid-to-late April.



References:

Beer, W.N. 2007. Run timing of adult Chinook salmon passing Bonneville dam on the Columbia River. White Paper, Columbia Basin Research, University of Washington.

Keefer, M.L., C.A. Peery, M.A. Jepson, K.R. Tolotti, T.C. Bjornn, L.C. Stuehrenberg. 2004. Stock-specific migration timing of adult spring–summer Chinook salmon in the Columbia River Basin. North American Journal of Fisheries Management 24:1145–1162.