



# FISH PASSAGE CENTER

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## MEMORANDUM

TO: Paul Wagner (NOAA)

FROM: Michele DeHart

DATE: Amended Date: November 16, 2009  
Original Date: November 5, 2009

RE: Adult spring Chinook timing at Bonneville Dam and environmental factors

In response to your request, the Fish Passage Center staff has reviewed adult count data for spring Chinook at Bonneville and environmental conditions over a 16 year period (1994-2009). Below is a brief summary of our findings, followed by a more detailed explanation of the analyses we conducted.

- The 10% passage date for spring Chinook adults at Bonneville Dam in 2009 was April 29<sup>th</sup>. This is the second latest 10% passage date among the years we analyzed. Return year 2006 had a later 10% passage date of May 2<sup>nd</sup>.
- Linear regression analyses revealed a significant relationship between temperature (Mar. 15-Apr. 1) and the 10% passage date for adult spring Chinook at Bonneville Dam. Later 10% passage dates were associated with lower average temperatures during these times.
- There was not a significant relationship between average flow (Mar. 15-Apr. 1) and the 10% passage date.

### **Methods and Results:**

Fish Passage Center (FPC) staff reviewed the adult count data for spring Chinook adults at Bonneville Dam (BON) over a 16 year period (1994-2009). For this analysis, we relied on the historical count start date of March 15<sup>th</sup>. Therefore, any Chinook passing BON before March 15<sup>th</sup> were not included in this analysis. From March 15<sup>th</sup> to May 31<sup>st</sup>,

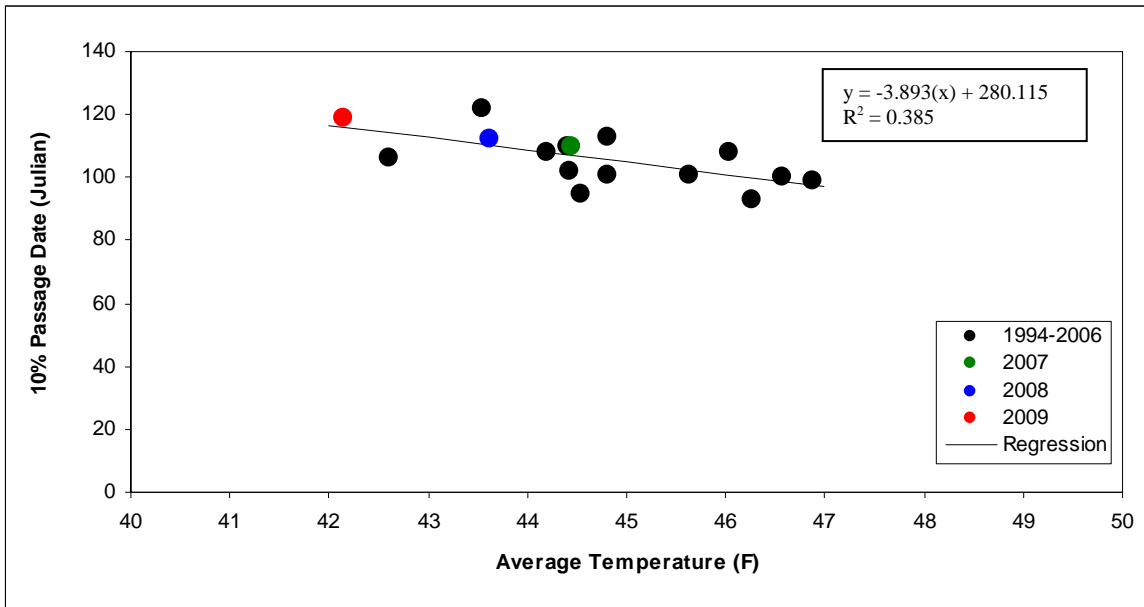
any adult Chinook passing BON are considered spring Chinook. From these counts, we estimated the 10% passage date for each of the return years analyzed. Spring Chinook jacks were included in this analysis. The 10% passage dates were then converted to Julian Dates (i.e., day of the year) for linear regression analyses.

In addition to adult count data, FPC staff also collected temperature data for the period of March 15<sup>th</sup> to May 31<sup>st</sup> for each of the return years we analyzed. For this portion of the analysis, we relied on temperature data that were collected at the Warrendale Total Dissolved Gas gauge, which is found approximately 6 miles downstream of BON. Temperature data from the Warrendale gauge were only available from 1994 to 2009. Flow data from BON were also collected over the same periods of time. In order to describe the temperatures and flow conditions that spring Chinook might encounter in the beginning of the run, we estimated an average temperature and average flow from March 15<sup>th</sup> to April 1<sup>st</sup>. All of the estimates of 10% passage date and each of the environmental variables can be found in Table 1.

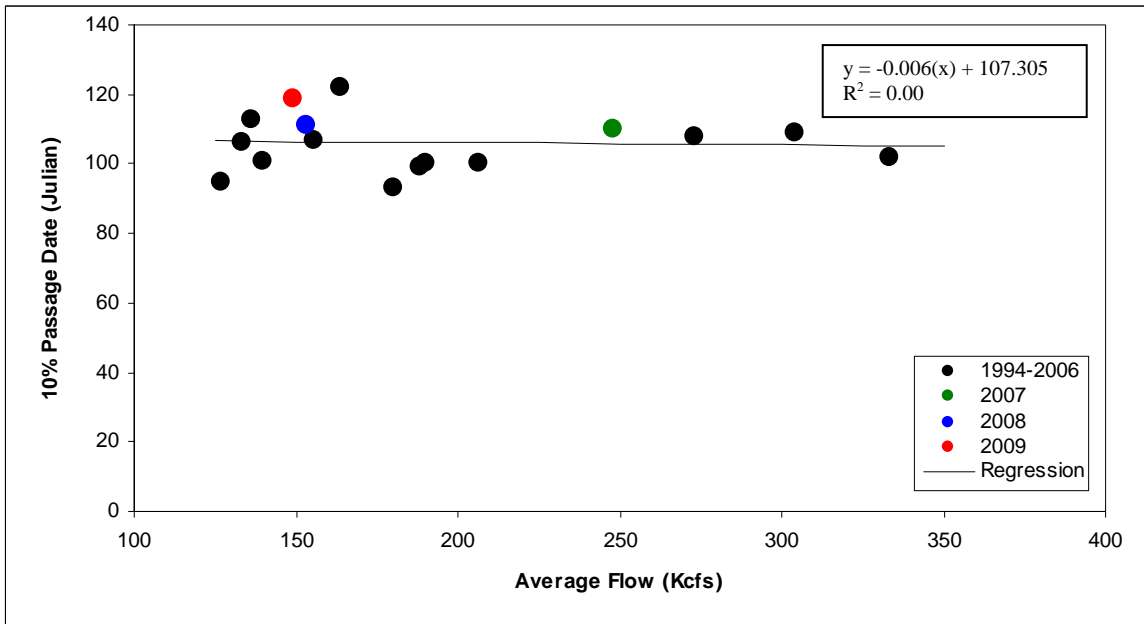
**Table 1.** Estimated 10% passage date for spring Chinook at Bonneville Dam from 1994 to 2009. Average temperature, cumulative degree days, and average flow are for the period of March 15<sup>th</sup> to April 1<sup>st</sup> of each year.

| <b>Return Year</b> | <b>10% Passage Date</b> | <b>10% Passage Date (Julian)</b> | <b>Average Temperature (°F)</b> | <b>Average Flow (Kcfs)</b> |
|--------------------|-------------------------|----------------------------------|---------------------------------|----------------------------|
| 1994               | 11-Apr                  | 101                              | 45.6                            | 139.6                      |
| 1995               | 9-Apr                   | 99                               | 46.9                            | 188.1                      |
| 1996               | 19-Apr                  | 110                              | 44.4                            | 304.3                      |
| 1997               | 12-Apr                  | 102                              | 44.4                            | 333.1                      |
| 1998               | 10-Apr                  | 100                              | 46.6                            | 206.3                      |
| 1999               | 18-Apr                  | 108                              | 44.2                            | 273.1                      |
| 2000               | 10-Apr                  | 101                              | 44.8                            | 190.0                      |
| 2001               | 5-Apr                   | 95                               | 44.5                            | 126.8                      |
| 2002               | 16-Apr                  | 106                              | 42.6                            | 133.2                      |
| 2003               | 3-Apr                   | 93                               | 46.3                            | 180.3                      |
| 2004               | 17-Apr                  | 108                              | 46.0                            | 155.7                      |
| 2005               | 23-Apr                  | 113                              | 44.8                            | 136.3                      |
| 2006               | 2-May                   | 122                              | 43.5                            | 163.7                      |
| 2007               | 20-Apr                  | 110                              | 44.5                            | 247.9                      |
| 2008               | 21-Apr                  | 112                              | 43.6                            | 153.0                      |
| 2009               | 29-Apr                  | 119                              | 42.1                            | 148.9                      |

The relationship between 10% passage date (Julian) and each of these environmental variables was investigated using linear regression analyses. Linear regression analysis revealed a significant relationship between average temperature (Mar. 15-Apr. 1) and 10% passage date ( $p = 0.006$ ) (Figure 1). Later 10% passage dates were associated with lower average temperatures during the period of March 15<sup>th</sup> and April 1<sup>st</sup>. There was no significant relationship between average flow (Mar. 15-Apr. 1) and 10% passage date ( $p = 0.886$ ) (Figure 2).



**Figure 1.** Linear regression of average temperature (°F) (Mar. 15-Apr. 1) and estimated 10% passage date for spring Chinook adults at BON.



**Figure 2.** Linear regression of average flow (Kcfs) (Mar. 15-Apr. 1) and estimated 10% passage date for spring Chinook adults at BON.