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MEMORANDUM

TO: Fish Passage Advisory Committee

FROM: Michele DeHart

DATE: January 26, 1999

RE: Review of Muir et al presentation to the Northwest Power Planning Council

In response to the January 19, 1999 FPAC request, the Fish Passage Center staff reviewed the materials presented by Bill Muir and Whitt Anderson at the January 13, 1999 meeting of the Northwest Power Planning Council. The NPPC staff provided copies of the overheads presented at the meeting. In addition, we reviewed the report on the presentation in the Columbia Basin Bulletin, the January 13, 1999 Oregonian Editorial entitled "Surviving the Dams", and the News Release issued on January 13, 1999 by the Northwest Power Planning Council. We also reviewed The Dalles 1997 spillway survival study and the 1998 preliminary summary of results. We did not attend the Muir/Anderson presentation so we can not attribute specific conclusions to the presenters. However, the news releases, articles and editorials attribute specific conclusions to Bill Muir. The FPC review addresses the actual data presented by Muir and whether or not the conclusions are supported by the data, regardless of whom the conclusion is attributed to in these documents.

The widely distributed conclusions are:

1. "Survival of juvenile salmon and steelhead migrating past the four federal dams on the lower Snake River is as high today or higher than it was in the early 1960s before the dams were in place".
2. "Since juvenile survival is as high today as it was before three of the four Snake River dams were built, there is little reason to consider the dam breaching option".
3. "Muir's statistics contradict PATH's".

None of the above conclusions can be directly obtained or supported by the data that was presented by Muir.

General Comments

The data presented by Muir is not new and has been presented previously in several other forums. The following FPC comments present the conclusions that we believe can be

supported by the data presented by Muir and a discussion of why the conclusions in the subject documents are not supported by the Muir data. The Muir data does not tell us very much and is not surprising. The results are expected. The data have been collected under high flow and spill conditions, which we would expect to result in higher survival rates.

The Dalles Spillway Survival Study

The discussion regarding The Dalles Spillway survival study results was included in the Muir presentation. There are significant technical concerns regarding that study and the experimental design. Those have been documented in written comments to National Marine Fisheries Service. The study and appropriate application and interpretation of the results and future study designs are presently under discussion. We do not believe that the study provides a basis for modification of the Biological Opinion spill measure at The Dalles Dam.

Improvements at COE facilities

The discussion of improvements at COE facilities over the years omitted any discussion of delayed mortality and cumulative stress. There is a growing body of evidence and analysis, which indicates that passage through COE facilities, particularly multiple passage, is a primary contributor to delayed mortality and lower adult returns.

Transportation

Although the Muir presentation did not discuss transportation, review of the graphics presented raise an obvious issue. The presentation emphasizes that juvenile survival has increased but adult returns continue to decrease. One obvious action that has been taken over the years that was discussed, is the smolt transportation program. An increasing proportion of the downstream migrant population has been transported over those years in which juvenile survival has increased and adult returns have decreased.

The Muir data shows that:

- There is a clear flow travel time relationship even in short river reaches.
- Flows averaging greater than 100 kcfs, combined with spill levels exceeding an average 45 kcfs in the spring (as occurred in 1998), will result in high juvenile survival of hatchery fish in the short river reach. Hatchery groups of fish exhibited a high juvenile in-river survival under these conditions. Most of the test groups that are represented in the calculations of survival are hatchery groups.
- Breaching the four Lower Snake River dams would increase juvenile survival to McNary Dam at least 30%, under conditions of high flow and high spill as has occurred in all but one year of the data presented. Breaching the four Lower Snake River dams might have a greater increase on juvenile survival through the reach in low flow conditions. However, none of the Muir data reflects lower flow conditions.
- There exists a flow survival relationship and flow travel time relationship for summer migrant fall chinook juveniles. Flow augmentation is important for fall chinook.
- Juvenile survival estimates in short river reaches are not a good indicator of smolt to adult returns and only provide an index of survival annually.

The Muir data does not show:

- Juvenile survivals in low flow conditions.
- That the benefits of dam breaching are insignificant.
- Anything regarding survival in longer river reaches to below Bonneville Dam.
- Anything regarding smolt to adult returns.
- Any conflict with the PATH analysis, since the data was fully incorporated into PATH.
- Anything unexpected regarding flow survival relationships. The methodology was not expected to develop within year flow survival relationships. In addition, a relationship can not be expected to emerge if flows do not change significantly.

Specific Comments

“Survival of juvenile salmon and steelhead migrating past the four federal dams on the lower Snake River is as high today or higher than it was in the early 1960s before the dams were in place”.

- Our extrapolated survival to Ice Harbor Dam for wild chinook from the Salmon River (Whitebird) trap is 69% with Lower Monumental, Little Goose and Lower Granite dams in place and 90% survival to Ice Harbor without the three dams. This represents an approximate 30 % increase in juvenile survival with the three dams removed.
- Pre-dam survival of wild chinook from the Whitebird trap to Ice Harbor Dam (river mile 9) averaged 89%. Survival of wild chinook from the Whitebird Trap to Lower Granite Dam (river mile 107.5) in 1998 averaged 94%. Survival is not the same as it was in pre-dam conditions.
- Removing the three Snake River dams would increase survival to below Bonneville by 15%.

Raymond et al (1979) estimated wild chinook juvenile survival from the Whitebird trap site to Ice Harbor Dam in 1966, 1967 and 1968 before the upper three Snake River dams were completed. The weighted mean survival of three release groups of wild chinook from the Salmon River trap to Lower Granite Dam was 94% in 1998. Converting this to a mortality per mile of 0.00045 and extending this mortality rate 231.5 miles to Ice Harbor Dam, we estimate that the 1998 survival to Ice Harbor Dam, in the absence of the three other Snake River dams, would be approximately 90%. This is similar to the 3-year average of 89% obtained in the late 60's by Raymond (1979). As additional dams began to operate in the Snake River (Lower Monumental 1969, Little Goose 1970, and Lower Granite 1975), the estimates of survival from the lower Salmon River trap to Ice Harbor Dam dropped to between 10 and 50% during 1970 to 1975, and averaged only 33% for that six-year period (Raymond 1979). Consideration of historical survival estimates must recognize that those estimated were developed using a different methodology than recent survival estimates. In 1998, the weighted mean survival from the Salmon River trap to Lower Monumental Dam tailrace was estimated at 76%. On a per-project basis, the current wild chinook survival is averaging 91% per dam over three dams. Improved flow and spill conditions were expected to increase juvenile survival. However, survival is still not as high as the level that would be occurring if the dams were not present. Our extrapolated survival to Ice Harbor Dam for wild chinook from the Salmon River trap is 69% with the three dams in place, and 90% without the three dams. This is

approximately a 30% increase in survival with three dams removed, and with four dams removed it would be expected to be even higher. Extrapolating the 91% per dam survival to all eight dams the wild chinook from the Salmon River must cross, we estimate a 47% survival to below Bonneville Dam, which is within the range of survival being reported by NMFS. Without the Snake River dams, we would expect this survival to increase 15 percentage points or more. These expected improvements reflect the data being collected under present above average flow conditions. Improvement could be greater when compared to low flow conditions.

“Since juvenile survival is as high today as it was before three of the four Snake River dams were built, there is little reason to consider the dam breaching option”.

- Removal of the four Lower Snake River dams relates to more than direct project mortality at the concrete. Removal of the four Lower Snake river dams is in large part discussed as an alternative to additional flow augmentation to increase water velocity through the Lower Snake River.
- The Muir data confirms that there is a significant flow/travel time relationship for all stocks of juvenile salmon.
- Petrosky et al (1998) estimated smolt to adult return for Snake River wild chinook and steelhead. This analysis (**Figure B. 4-2**) indicates that total adult recruitment increases with faster water particle travel times (higher flows) during the juvenile out migration. An analysis by Deriso et.al. (1996) supports these findings. Deriso analyzed the differential survival among upstream and downstream populations, finding that water particle travel time, i.e. flow during the juvenile migration explained over 50% of the differential survival.
- Regardless of direct juvenile mortality estimates, the four Lower Snake River dams have a significant impact on water particle and fish travel time. Fish travel time can be decreased by increasing flow augmentation or decreasing cross sectional area of the river.

The time it takes smolts to migrate from above Lower Granite to below Bonneville Dam would be reduced with the removal of the lower Snake River dams. Figure B.4-4 from the PATH FY989 Final Report shows “water travel time” from Lewiston to Bonneville Dam would be cut in half with the removal of the lower Snake River dams (and cut in half again without John Day Dam). Smolt travel time relations with flow or with water travel time have been documented in PATH and FPC documents, along with results from NMFS reports. Raymond (1979) estimated that under moderate flows (71-106 kcfs in the Snake River and 212-318 kcfs in the lower Columbia River) smolts would migrate at a rate of 40 miles/day. From Whitebird on the Salmon River to the mouth of the Columbia River is 566 miles. Therefore, in a free-flowing river, the smolts could have made this journey in about 14 days. Raymond also estimated the impounded waters reduced the smolts migration rate to about one-third of its free-flowing level. With 56% of this distance now impounded, and at about 13 miles/day at moderate flows in impounded stretches, we project that smolts now take about 31 days to cover this distance using Raymond’s estimates of smolt migration rates. This would place the smolts in the estuary about two and one-half weeks later than under free-flowing conditions. PIT tagged data for wild chinook released from the Salmon River trap showed median travel times

to Bonneville Dam ranging from 26 days (releases from trap between April 16 and 28) to 45 days (releases between March 18 and 31). If we add four additional days to travel the 146 miles from Bonneville Dam to the mouth, the total travel time from the Salmon River trap to mouth of Columbia River would range between 30 days for late migrants and 49 days for early migrants. The late migrating wild chinook's travel time was very similar to Raymond's estimate under moderate flows (monthly average flows in May of 1998 was 320 kcfs at McNary Dam). The early and late migrating wild chinook passed Bonneville Dam during May with nine days separating the median passage date of each group. So a two and one-half week delay due to the impoundments under moderate flows seems reasonable with the 1998 data as well.

In summary, the Muir presentation has generated significant reaction by the press, the Northwest Power Planning Council members and others. However, upon review of the data there are no significant changes to the existing hypothesis on fish passage and fish passage mitigation that can be made based upon Muir's presentation.

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