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MEMORANDUM

TO: FPAC
The Files

FROM: FPC Staff

DATE: October 21, 2005

RE: Timing Estimation of Juvenile Salmonid Migration at Lower Granite Dam

Recently there has been considerable discussion regarding the proportion of the juvenile fall Chinook migration that passed Lower Granite Dam prior to the court ordered spill program. Questions relative to passage timing are raised every year in discussions of fish passage protection measures. The following reiterates the discussions of the issues that have occurred at the Technical Management Team and the Implementation Team of the Federal Regional process.

The application of the fish passage data is generally discussed and invariably the cumulative passage index or the cumulative passage of a single tag group is presented as a basis to end fish protection measures. However, both of these approaches have limitations, and if used as a basis for management decisions alone can lead to a flawed decision. As we have often explained, when considering the timing of juvenile passage the following facts must be incorporated into decision-making:

- The passage index is an index and is not fully expanded for collection efficiency and does not represent a population estimate. These calculations are detailed in the metadata provided on the FPC web site.
- The passage index of the run-at-large primarily reflects the release time and passage of large upstream hatchery releases and obscures the passage of smaller groups of fish with different timing characteristics, which generally migrate in the tails of the migration.
- The timing of large hatchery releases masks the timing of smaller groups of wild/natural fish. In part this can lead to less protection for wild/natural stocks that do not have the same timing as hatchery fish if protection is only based on the timing of the run-at-large.
- The run-at-large passage index does not always reflect passage timing of specific components of a population. For instance, the Snake River fall Chinook ESU is

comprised of two specific migration timing distributions where the wild/natural Clearwater fall Chinook have a later passage timing than Snake River wild/natural fall Chinook

- The passage index is an expansion of a sample of fish passing through the powerhouse system, and is adjusted for spill using a one to one ratio. It is possible that the RSW operation and the recent summer spill are not adequately reflected in the passage index expansions.
- Mark PIT tag groups, in general cannot be used to represent the passage timing of the entire population unless a known specific proportion of the population has been marked. Present PIT tag marking of wild/natural fish is not designed to represent the population. Because PIT tags have a sampling, handling, size and timing limitation, they can represent the earliest components of a particular population. This has been shown in past years for Snake River fall Chinook PIT tag groups.

Passage Indices

The passage index of the migration run-at-large primarily reflects the passage of large groups of hatchery fish. This has been illustrated in many documents and summaries of historical passage data that can be reviewed at www.fpc.org. The passage index of the run-at-large can show an early date of passage timing of a proportion of the migration if large hatchery groups have earlier timing or if the later periods of the migration have very low survival.

PIT tag passage distribution

Each year the limitations of reliance only on passage timing as determined on the basis of wild fall Chinook PIT tag recoveries is discussed. Marking of the wild fall Chinook is limited by two factors, the first is size at time of marking and the second is availability of fish to mark. As fish grow and mature they move from near shore areas and decrease in availability to beach seining techniques used for collection. Consequently, it is difficult to determine the portion of the run that is represented by the wild PIT tagged fall Chinook. Likely, because of the accessibility of early fish the PIT tagged distribution is skewed early. This concern was presented in the earlier years of wild fish tagging, prior to the input of large groups of hatchery fish. In these years the migration timing of the PIT tagged group could be compared to the migration timing of the run at large, since the run at large was all wild fish. In these instances the PIT tag timing often predicted an earlier 95% passage date than did the run at large data. This suggests that the PIT tagged fish timing may be biased towards earlier migrating fish.

2005 Fall Chinook

Both of these issues and considerations apply to issues raised this summer in discussions of the court ordered summer spill program. There have been arguments raised regarding the timing of the summer spill program and the passage of fall Chinook juvenile migrants. These concerns were raised to our attention in Northwest River Partners and Pacific Northwest Generating Group comments regarding the FPC summer spill analysis. The comments did not actually apply to the FPC survival analysis. However, the PNGC and Northwest River partners' comments have prompted us to reiterate discussions that occurred in past years and discuss 2005 specifically in terms of passage proportions.

The status of the juvenile fall Chinook migration was also discussed on August 10, 2005 at the Technical Management Team of the Federal Regional Process. The material discussed along with the presentation slides are posted on the TMT website. During the meeting calculations of juvenile survival, composition of the passage, and timing were discussed.

We reviewed the passage data and reached the following preliminary conclusions regarding fish passage during the Biological Opinion summer migration period.

- Approximately, 40% - 60% of wild /natural Snake River origin fall Chinook passed Lower Granite during the Biological Opinion summer migration period June 20 through August 31.
- In addition, accounting for the 18-day travel time from Lower Granite to McNary dams, fish passing Lower Granite from June 2 through June 19 would have been traveling the reach between Lower Granite and would have some benefit from the summer spill.
- By June 20, only 1% of the Snake River wild/natural migrants had reached McNary Dam.
- These proportions do not include Clearwater origin wild/natural fall Chinook, which migrate later than Snake River wild/natural fall Chinook.
- Large hatchery releases occurred two to three weeks earlier than planned, which shifted the run-at-large passage distribution and the passage index earlier.

Summer spill operations began June 20 in 2005 in the Snake River. This was a significant change in operations during the subyearling Chinook migration and necessitated modifications to the expansion of both collected fish and PIT tag recaptures. The passage index does not capture the full impact of the effect of spill. Cumulative population timing plots for the run-at-large subyearling Chinook and for wild PIT-tagged subyearling Chinook from the Snake River, were developed based upon PIT tag estimates of collection efficiency at Lower Granite Dam. The population timing data presented here is corrected for the changes in collection efficiency that occurred as operations and flows changed at the dam.

Collection efficiency – In order to capture the potential range of passage proportions, two methods were used to estimate the collection efficiency based on different PIT-tag groups. The first method used a combination of PIT-tag wild, hatchery, and acclimation releases of subyearling Chinook. The method used a large pool of released fish so that daily collection efficiency estimates could be calculated over a large portion of the season. The collection efficiency was plotted against spill proportion at Lower Granite Dam (Figure 1). From that relationship, daily estimates of collection efficiency were developed for the entire migration season based on the daily spill percentage. The daily collection numbers from the Smolt Monitoring Program (SMP) sampling were expanded based on these daily estimates of collection efficiency, as were the daily PIT-tag detections of Snake River wild PIT tags. From these daily estimates plots of cumulative passage timing estimates were generated for the run-at-large and for wild PIT-tagged Snake River subyearlings.

The first method of calculating collection efficiency relied on a broad group of marks and largely represents hatchery origin or acclimation released fish, since these made up the great majority of marks. A second estimate was developed using only the wild PIT-tag marks released

in the Snake River. Because of the relatively smaller number of detections from this population, collection efficiency was only calculated for two time periods, prior to June 20 and after June 20. These estimates were then used to expand daily detections to daily PIT-tag population estimates.

The resulting cumulative passage timing curves for the run-at-large and wild PIT-tagged Snake River subyearlings in 2005 are plotted in Figure 2.

- The Snake River origin PIT-tagged wild subyearling fall Chinook showed a later timing distribution compared to the run-at-large, which was predominated by hatchery fish. The wild Snake River fish, based on PIT-tagged fish timing, reached about 50% passage on June 20 (43% to 60% based on the two different methods of estimating CE)
- Approximately 90% of the run-at-large subyearling population, comprised primarily of large hatchery releases, passed Lower Granite Dam by June 20.
- The Snake River fall Chinook ESU is defined by two very different segments of the population, Snake River wild fall Chinook and Clearwater River wild fall Chinook, the passage timing of the Clearwater fish must also be considered. The Clearwater wild fish continue to pass Lower Granite Dam at the time of this writing. As of October 5, of the 1,872 fish marked this summer, 20 have been detected at Lower Granite Dam. As was described earlier in this memo, the population that has passed Lower Granite is likely much higher than that number. There were 8 detections prior to spill beginning, 10 detections during summer spill operations and 2 since the end of August (one each in September and October).

The estimated 90% passage date for the Snake River wild/natural PIT-tags was reached between July 2 and July 5. Based on travel time to McNary Dam the Snake River wild/natural subyearling fall Chinook would have been passing through the lower Snake River through July. The median travel time from Lower Granite to McNary Dam, prior to June 20, was estimated at 17.8 days. After June 20 the median travel time was calculated at about 15.5 days, but was based on only 4 fish that were detected at both sites. The 90% passage date for the wild/natural Snake River subyearling fall Chinook at McNary Dam was July 25th. After that time, based on PIT-tag detections and mark data from SMP, the run at Lower Granite was likely predominated by wild/natural subyearling fall Chinook from the Clearwater River. The Clearwater wild/natural subyearling fall Chinook are also part of the ESU.

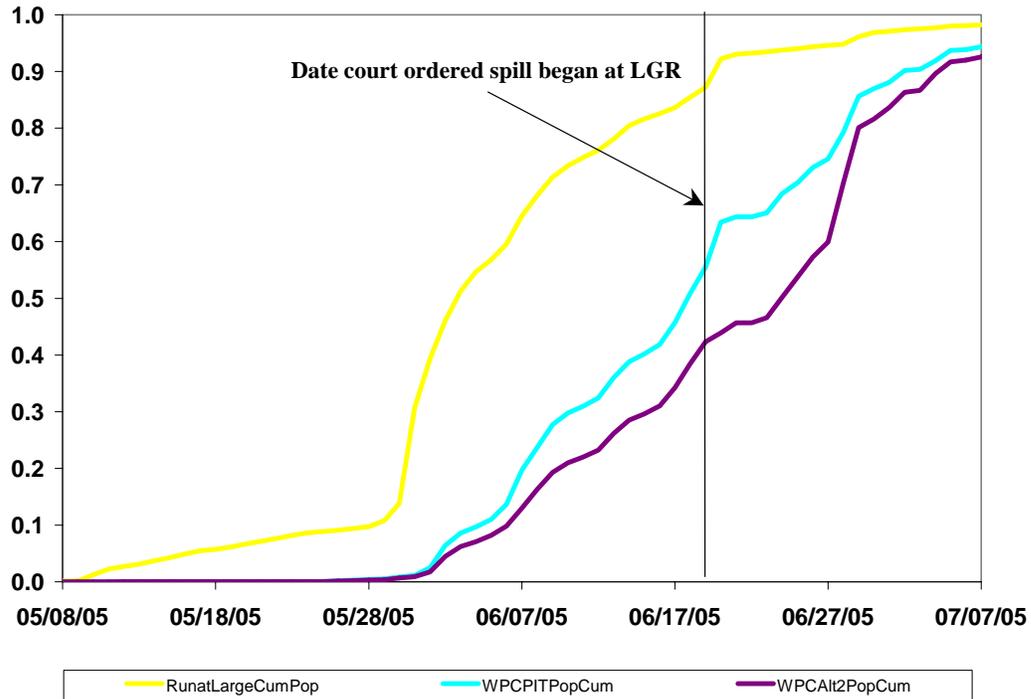


Figure 2. Estimated cumulative passage timing of run-at-large subyearling Chinook in 2005 at Lower Granite Dam compared to two estimates of timing for wild PIT-tag marks from the Snake River.