FISH PASSAGE CENTER

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MEMORANDUM

TO: FPAC

FROM: Jerry McCann and Brandon Chockley

DATE: November 19, 2013

RE: Inflated collection estimates at Lower Granite Dam for clipped yearling Chinook, steelhead, and subyearling Chinook due to resampling of PIT-tagged study fish

In 2013, a study was conducted at Lower Granite Dam (LGR) to evaluate the prototype juvenile fish collection channel overflow weir and enlarged orifice. This study involved PIT-tagging clipped yearling Chinook, clipped steelhead, and clipped subyearling Chinook that were sampled as part of the Smolt Monitoring Program (SMP) sample at LGR. Study fish were held overnight, PIT-tagged, and released the second day after collection into gatewell 5A, 5B, or directly into the orifice gallery channel. Occasionally, these PIT-tagged study fish were later detected re-entering the sample tank, which would result in these fish being resampled by the SMP crew. The resampling of these PIT-tagged study fish inflates the daily collection estimates and, therefore, the daily estimates of passage and population indices. In addition, estimates of timing may be impacted by this resampling of study fish. We have reviewed the PIT-tag detections of these study fish at the LGR sample tank in order to investigate to what degree the resampling of PIT-tagged study fish biased collection and passage index estimates and timing. In addition, we explored a method to correct the inflated collection and passage index estimates, based on PIT-tag detections at the LGR sample tank. Below is a brief summary of our findings, followed by a more detailed explanation of these analyses.

- It is important to note that data collected for the SMP are mostly used by the Fish Passage Advisory Committee (FPAC) to inform timing of run-at-large juvenile salmonids as they migrate through the FCRPS. Estimates of collection and the passage index are not intended to serve as population estimates. Furthermore, since many hatchery subyearling Chinook are released unmarked above LGR, the FPC does not typically report separate collections and passage indices for hatchery versus wild subyearling Chinook.

- In all, 146 PIT-tagged clipped yearling Chinook, 158 PIT-tagged clipped steelhead, and 607 PIT-tagged clipped subyearling Chinook from this study were detected at the LGR sample tank PIT-tag detector and, therefore, resampled by the SMP crew.
- The resampling of PIT-tagged study fish had the largest impact on the estimates of collection and passage index for subyearling Chinook. Overall, corrections to the daily collections and passage indices resulted in a 2.3% reduction from the "original" estimate of total collection and total passage index for this species.
    - Corrections to the daily collections and passage indices for hatchery yearling Chinook and hatchery steelhead resulted in a 0.9–1.1% reduction from the "original" estimate of total collection and total passage index for these species.
    - Corrections to the daily collections and passage indices for cumulative yearling Chinook and steelhead resulted in a 0.8% reduction from the "original" estimate of total collection and total passage index for each of these species.
- Passage timing, based on the passage index, was not impacted by the resampling of PIT-tagged study fish.
- Passage timing, based on collection estimates, was impacted only for clipped steelhead and overall subyearling Chinook. However, this impact was small, as only the 90% passage date was impacted and by one day (1 day sooner for clipped steelhead and 1 day later for subyearling Chinook).
- ***Given the minimal impact the resampling of study fish had on timing estimates, we recommend that the 2013 SMP database for LGR be left intact as-is, with no corrections applied.***

Methods

As mentioned above, the FPC staff has reviewed the PIT-tag detection data for PIT-tagged juvenile salmonids from the LGR collection channel and orifice study conducted in 2013 to investigate to what degree the resampling of these PIT-tagged study fish may have had on estimates of collection and the passage index. In particular, we focused on those PIT-tagged study fish that were detected in the LGR sample tank. In addition, we developed a method to correct the biased collection estimates, which, in turn, would correct the estimates of passage indices. In real time, estimates of collection are used by SMP personnel to estimate barge loading during transport operations. However, data collected for the SMP are mostly used by FPAC to inform timing of run-at-large juvenile salmonids as they migrate through the FCRPS. Estimates of collection and the passage index are not meant to serve as population estimates. Furthermore, since many hatchery subyearling Chinook are released above LGR unmarked, the FPC does not typically report separate collections and passage indices for hatchery versus wild subyearling Chinook.

In all, this study tagged and released approximately 10,916 clipped yearling Chinook (April 15–May 25), 11,014 clipped steelhead (April 15–May 25), and 12,209 clipped subyearling Chinook (May 26–June 21). Of these total PIT-tag releases, approximately 146 clipped yearling Chinook, 158 clipped steelhead, and 607 clipped subyearling Chinook were later detected in the

LGR sample tank, which means they were resampled by SMP crews. To determine the impact of this resampling, we estimated the daily and overall collection counts for each of these species using two methods. The first was to use the collection counts as they were originally reported by SMP personnel, which are overestimates on those days when PIT-tagged study fish were detected in the sample tank. Here-in, we refer to these estimates as the "original" estimates.

The second method was to estimate a new "corrected" daily collection count by reducing the daily sample count by the number of PIT-tagged study fish that were detected at the sample tank for each daily sample. Since only clipped yearling Chinook, clipped steelhead, and clipped subyearling Chinook were tagged for this study, we "corrected" only the sample counts for clipped fish. These "corrected" sample counts were then used to estimate a "corrected" collection count, based on the sample rate that was used for that day's sample. Finally, a "corrected" passage index was calculated from the "corrected" collection estimate.

Finally, we used the "original" and "corrected" estimates of collection and passage indices to estimate timing of yearling Chinook, steelhead, and subyearling Chinook at LGR. Although FPAC typically uses the passage index to estimate timing, we estimated timing from both the daily collections and daily passage indices, to illustrate the potential bias of resampling.

Results

Estimates of Total Collection and Passage Indices

Figures 1 through 3 are provided below to illustrate the impact that the resampling PIT-tagged study fish had on daily estimates of total collection for yearling Chinook, steelhead, and subyearling Chinook. Overall, the resampling of PIT-tagged study fish had the largest impact on estimates of subyearling Chinook total collection and passage index (Table 1). Although the impact was largest on subyearling Chinook, the total "corrected" collection still represented only an estimated 2.3% reduction from the "original" estimate of total collection (Table 1). The "corrected" collections for hatchery yearling Chinook and hatchery steelhead represented a much smaller bias, with only an estimated 0.9–1.1% reduction from the "original" estimates of collection and passage indices for these two groups (Table 1). Finally, the "corrected" collection and passage indices for total yearling Chinook and total steelhead also represented a relatively small bias, with only an estimated 0.8% reduction from the "original" estimates for these two groups (Table 1).

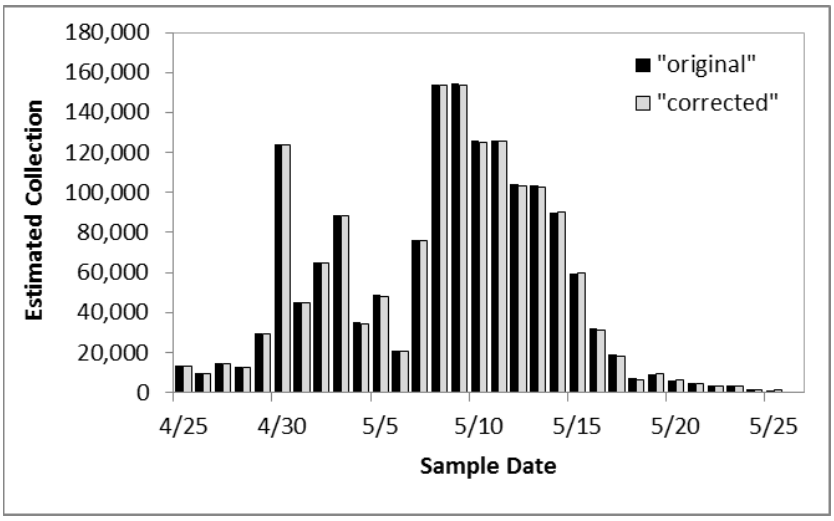

Figure 1. Estimated daily collections ("original" and "corrected") for total yearling Chinook at Lower Granite Dam. The x-axis is intended to focus only on the time period of the study.

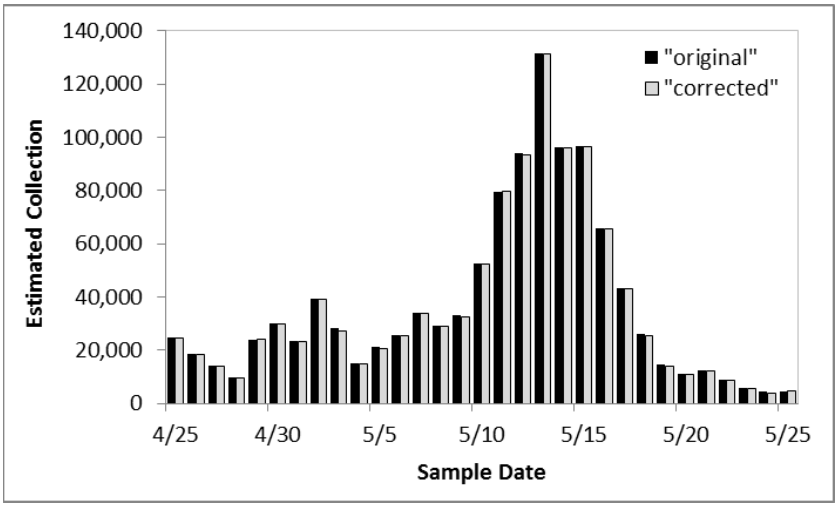

Figure 2. Estimated daily collections ("original" and "corrected") for total steelhead at Lower Granite Dam. The x-axis is intended to focus only on the time period of the study.

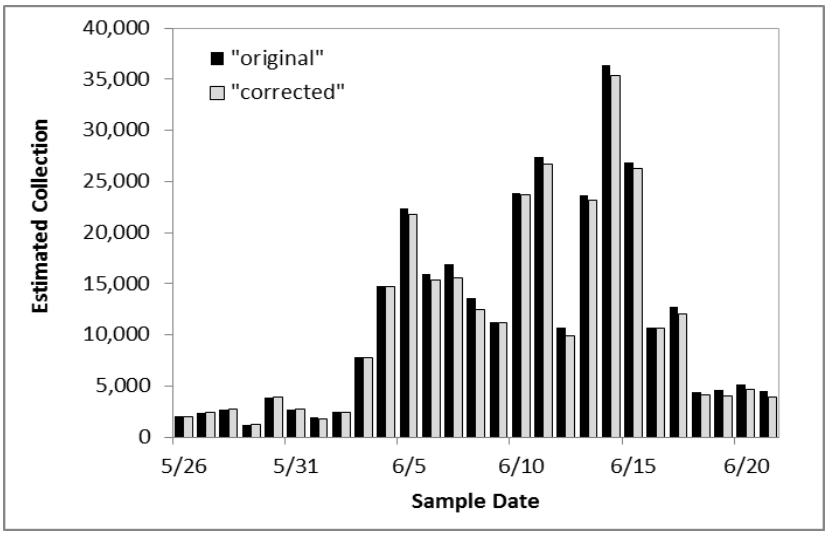

Figure 3. Estimated daily collections ("original" and "corrected") for total subyearling Chinook at Lower Granite Dam. The x-axis is intended to focus only on the time period of the study.

Table 1. "Original" and "Corrected" estimates of total collection and passage index for yearling Chinook (hatchery and total), steelhead (hatchery and total), and subyearling Chinook. Totals presented in this table are for the entire 2013 SMP sampling season.

Species	Run	"Original" Collection	"Corrected" Collection	Percent Reduction	"Original" Passage Index	"Corrected" Passage Index	Percent Reduction
CH1	Hatchery	1,554,702	1,540,304	0.9%	2,176,589	2,156,586	0.9%
	Total	1,865,260	1,850,862	0.8%	2,607,218	2,587,215	0.8%
ST	Hatchery	1,058,689	1,047,002	1.1%	1,515,868	1,498,577	1.1%
	Total	1,444,903	1,433,216	0.8%	2,037,069	2,019,778	0.8%
CH0	Total	493,555	482,185	2.3%	749,071	732,183	2.3%

Estimates of Timing

For other analyses and reports on timing from the SMP, the FPC staff typically focuses on the estimated 10%, 50%, and 90% passage dates, based on the passage index. However, for illustrative purposes, we estimated timing based on both daily collections and the daily passage index.

There were only two instances when the estimated passage dates differed between the "original" and "corrected" data and both occurred when estimating timing from the daily collection counts (Table 2). For hatchery steelhead, the estimated 90% passage date for the "corrected" collections was one day later than that for the "original" collections (Table 2). However, the estimated passage dates for total steelhead were not affected. For total subyearling Chinook, the estimated 90% passage date for the "corrected" collections was one day later than that for the "original" collections. When based on the passage index, the estimated 10%, 50%, and 90% passage dates were the same for the "original" and "corrected" datasets for all three species (Table 3).

Finally, we constructed cumulative passage curves for each of these groups. We chose not to display them in this memorandum because the curves for the "original" and "corrected" datasets were indistinguishable for all curves constructed.

Table 2. Estimated 10%, 50%, and 90% passage dates for yearling Chinook (hatchery and total), steelhead (hatchery and total), and subyearling Chinook based on "original" daily collections and "corrected" daily collections. Shaded boxed indicate where the "corrected" collections resulted in a change in estimated passage date.

		"Original" Collections			**"Corrected" Collections**		
Species	**Run**	**10%**	**50%**	**90%**	**10%**	**50%**	**90%**
CH1	Hatchery	21-Apr	8-May	14-May	21-Apr	8-May	14-May
	Total	19-Apr	8-May	14-May	19-Apr	8-May	14-May
ST	Hatchery	20-Apr	9-May	17-May	20-Apr	9-May	16-May
	Total	20-Apr	11-May	17-May	20-Apr	11-May	17-May
CH0	Total	30-May	9-Jun	1-Aug	30-May	9-Jun	2-Aug

Table 3. Estimated 10%, 50%, and 90% passage dates for yearling Chinook (hatchery and total), steelhead (hatchery and total), and subyearling Chinook based on "original" daily passage indices and "corrected" daily passage indices.

		"Original" Passage Index			**"Corrected" Passage Index**		
Species	**Run**	**10%**	**50%**	**90%**	**10%**	**50%**	**90%**
CH1	Hatchery	20-Apr	7-May	13-May	20-Apr	7-May	13-May
	Total	19-Apr	8-May	14-May	19-Apr	8-May	14-May
ST	Hatchery	19-Apr	6-May	16-May	19-Apr	6-May	16-May
	Total	19-Apr	9-May	17-May	19-Apr	9-May	17-May
CH0	Total	30-May	9-Jun	27-Jul	30-May	9-Jun	27-Jul

Conclusions

Overall, there was minimal impact from the resampling of PIT-tagged study fish on the daily and overall estimates of collection and passage index for yearling Chinook, steelhead, and subyearling Chinook in 2013. In addition, the resampling of PIT-tagged study fish had no impact on estimates of timing at LGR, when considering the passage index, and very little impact on timing when considering collections. Given these results, we recommend that the 2013 SMP database for LGR be left intact as-is, with no corrections applied.

To: Brandon Chockley

From: Paul Wagner – FPAC co chairman

Date: November 21, 2013

Subject: Significance of bias in collection estimates and passage indices at Lower Granite Dam due to the influence of recollecting study fish in 2013.

On November 19, 2013 the Fish Passage Advisory Committee (FPAC) met at the Fish Passage Center office in Portland, OR for its monthly face-to-face meeting. One of the agenda items for this meeting was to discuss a November 19, 2013 memo to FPAC from the FPC entitled: "Inflated collection estimates at Lower Granite Dam for clipped yearling Chinook, steelhead, and subyearling Chinook due to resampling of PIT-tagged study fish" (document #132-13). The memo discusses the impact of resampling PIT-tagged study fish at LGR on daily and total estimates of collection and passage indices as well as impacts on estimates of juvenile timing. Based on the analyses presented in the memo, the FPC staff recommended that the impact of resampling was not significant enough to warrant changing the SMP database for LGR in 2013. After discussion of the memo, the FPAC was in agreement with the FPC recommendation.