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MEMORANDUM

TO: Ed Bowles, ODFW

FROM: FPC Staff

DATE: April 21, 2008

RE: Potential for Bias in NOAA TIR estimate as a result of tagging at LGR

The FPC has prepared the following in response to your questions about data and analyses in the FPC memo (http://www.fpc.org/documents/memos/33-08.pdf) to Russ Kiefer (March 24, 2008). Specifically, FPC staff addressed your questions whether there was evidence of bias in SARs from NOAA tagging studies conducted at Lower Granite Dam (LGR) for in-river and/or transport groups of wild Chinook and steelhead, and whether there was evidence of bias in the TIR (ratios of SAR of transported smolts and in-river smolts) for wild yearling Chinook and steelhead from the NOAA studies. The primary management issue relates to the basis for maximizing transportation of wild steelhead in May as proposed in the draft 2007 Biological Opinion on the FCRPS. For instance, a positive bias in TIR would artificially shift the apparent date of transport benefit to earlier in the season.

Estimation of seasonal TIRs requires knowledge (or an estimate) of the period of time PIT-tagged juvenile in-river migrants pass LGR. Under past management through 2005, untagged smolts that remained in-river below LGR were not collected, and passed LGR via spill or turbine routes only (with few exceptions). In contrast, NOAA transport studies have collected and tagged smolts at LGR, and either bypass or transport the study fish. The NOAA approach, while providing a known date of passage, clearly does not mimic the passage experience of true in-river migrants (see discussion in the Comparative Survival Study Ten Year Report; Schaller et al. 2007). As background, we provide the following definitions:

C_0 = category of smolts migrating through the hydrosystem that were not detected at transport projects (LGR, LGS, LMN)

C_1 = category of smolts migrating through the hydrosystem that were collected and bypassed at one or more of the transport projects

NOAA transport evaluations – in-river smolts collected, tagged and bypassed at LGR

In the following summaries, all data were from tables in the earlier memo (FPC 33-08). Data summaries are preliminary, and include only the point estimates of annual SARs and annual SAR ratios. As future management priorities allow, FPC staff can provide bootstrapped confidence intervals on the estimates using analytical methods developed for CSS. Annual SARs provide the best basis for assessing potential bias because the C_0 category is most representative of the actual in-river experience. The CSS has demonstrated consistently lower SARs for migrants bypassed at one or more transport/collector dams (C_1) compared to the C_0 smolts (Schaller et al. 2007).

Is there evidence of potential bias in SARs from NOAA LGR tagging studies for in-river wild yearling Chinook and steelhead?

Yes. The geometric mean SAR of NOAA in-river migrant was only 53% of the SAR for the C_0 group for wild yearling Chinook (Figure 1). The geometric mean SAR of NOAA in-river migrant was only 60% of the SAR for the C_0 group (Figure 2) for wild steelhead.

It is noteworthy that the NOAA in-river SARs also tended to be lower than those of the C_1 group which were bypassed at one or more Snake River collection/transport dams. SARs for the C_1 group were only 63% and 63% those of the C_0 group for wild Chinook and steelhead (Figures 1 and 2). The NOAA in-river SARs were 70% and 72% those of the C_1 groups for wild Chinook and steelhead, respectively (Figures 1 and 2).

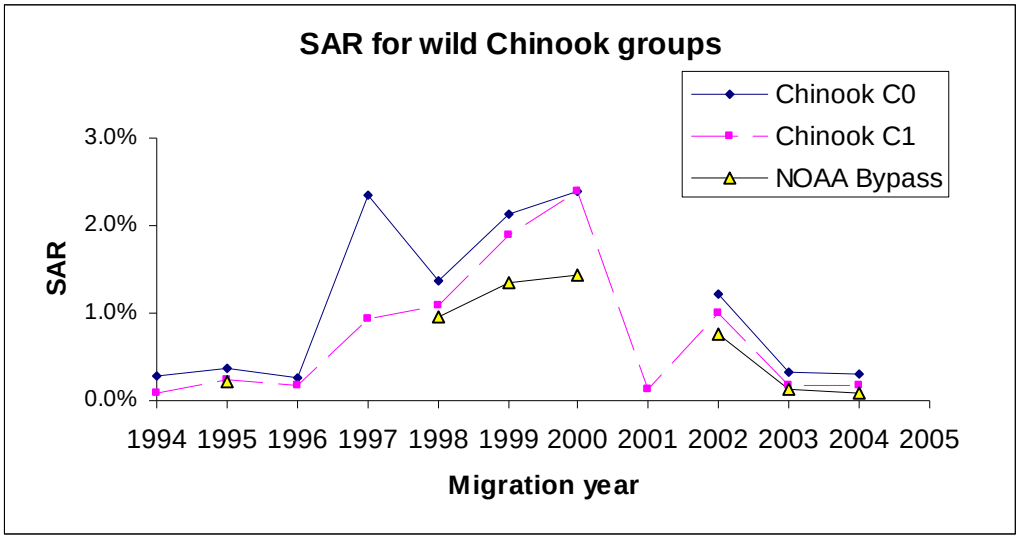

Figure 1. Annual SARs for C_0 and C_1 in-river smolts compared to SARs for NOAA in-river smolts, wild yearling Chinook.

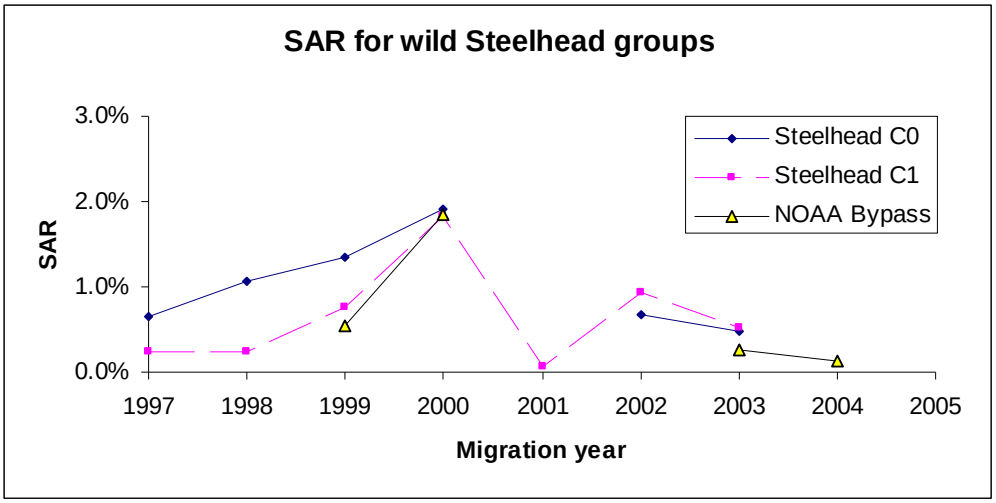

Figure 2. Annual SARs for C_0 and C_1 in-river smolts compared to SARs for NOAA in-river smolts, wild steelhead.

FPC staff further evaluated this potential bias of NOAA in-river SARs by recalculating SARs for a subset of the CSS C_1 group which was detected and bypassed at LGR to more closely mimic the NOAA tagging study. Geometric mean SARs for the NOAA bypass group were 59% those of the CSS bypass group for wild Chinook and 62% those of the CSS bypass group for wild steelhead respectively (Figures 3 and 4).

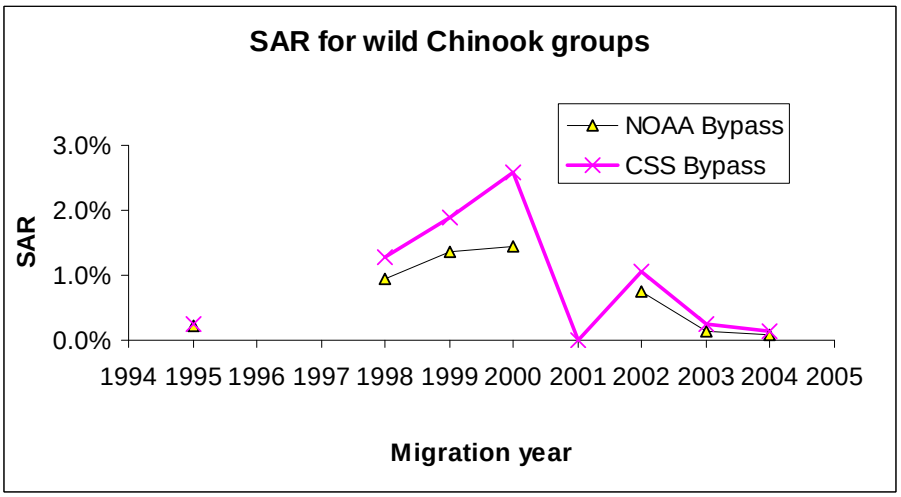

Figure 3. Annual SARs for a subset of C_1 in-river smolts bypassed at LGR compared to SARs for NOAA in-river smolts, wild yearling Chinook.

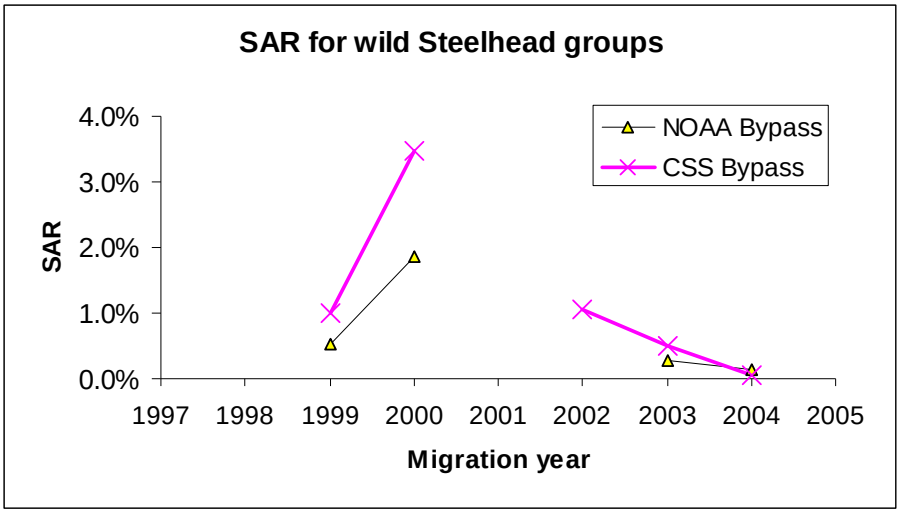

Figure 4. Annual SARs for a subset of C_1 in-river smolts bypassed at LGR compared to SARs for NOAA in-river smolts, wild steelhead.

Given the consistency and magnitude of the SAR differences between the NOAA bypass group and SARs from the CSS (C_0, C_1 and recalculated C_1), for both wild Chinook and steelhead, it appears likely that tagging and bypass at LGR negatively biases SARs of in-river migrants. However, some of the difference may be due to differences in composition of run comprising the CSS and NOAA groups. CSS wild groups represent an aggregate from different Snake River sub basins, whereas NOAA tags at LGR in proportion to the aggregate arrival. We address the issue of how well CSS wild yearling Chinook and steelhead represent overall arrival timing to LGR in a separate memo (Memo to Russ Kiefer dated April 21, 2008). The CSS wild groups do not appear to exhibit different timing than the run at large at Lower Granite Dam.

Is there evidence of potential bias in SARs from NOAA LGR tagging studies for transported wild yearling Chinook and steelhead?

Yes, but the magnitude of SAR difference appears to less than for the in-river group. The geometric mean SAR of NOAA transport was 82% that of CSS transported wild yearling Chinook (Figure 5). The geometric mean SAR of NOAA transport was 75% that of CSS transported wild steelhead (Figure 6).

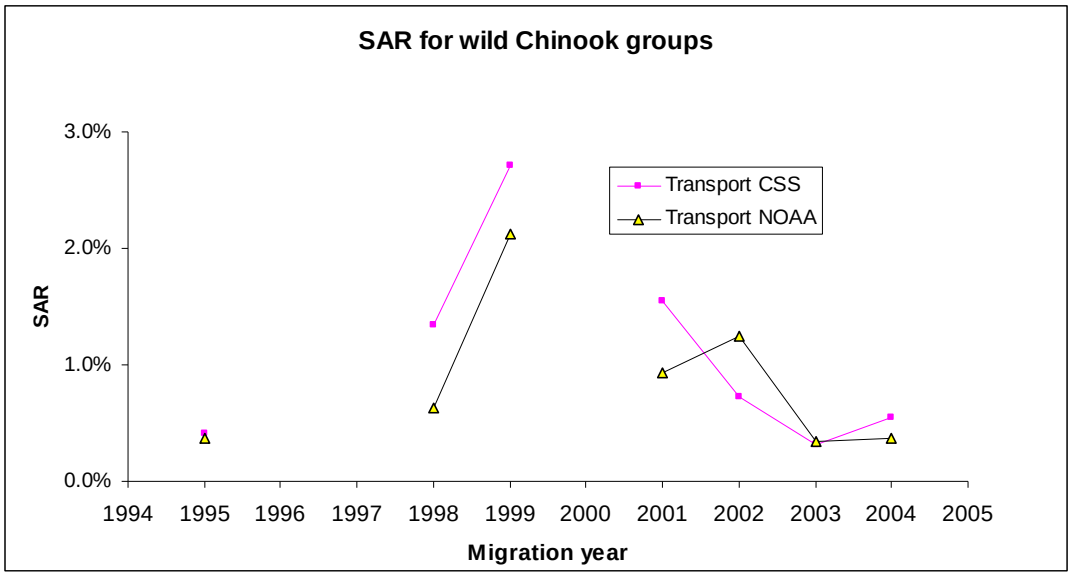

Figure 5. Annual SARs for T_0 transported smolts compared to SARs for NOAA transported smolts, wild yearling Chinook.

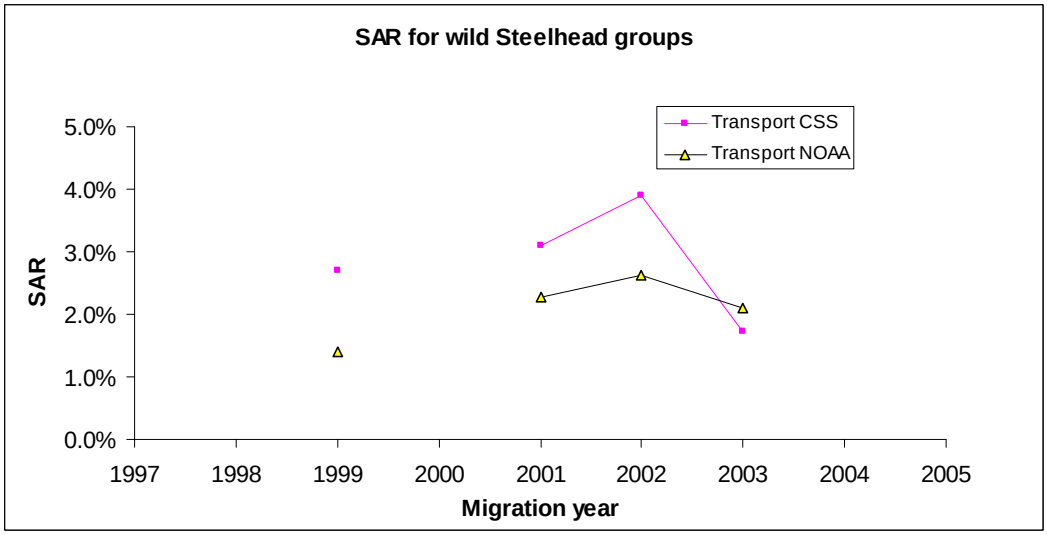

Figure 6. Annual SARs for T_0 transported smolts compared to SARs for NOAA transported smolts, wild steelhead.

Is there evidence of potential bias in TIRs from NOAA LGR tagging studies for wild yearling Chinook and steelhead?

Yes. Annual TIRs from the NOAA study were considerably higher than those from the CSS for wild yearling Chinook, and to some extent, for wild steelhead. Wild Chinook geometric mean TIR from the NOAA transport study was nearly twice as high (191%) as that from CSS based on the most representative in-river group (C_0; Figure 7). Wild steelhead geometric mean TIR from the NOAA transport study was 120% that from CSS (Figure 8). These contrasts at present do

not capture the uncertainty (wide CI) inherent in the SAR and TIR estimates of wild steelhead in the CSS study prior to 2003 (Schaller et al. 2003).

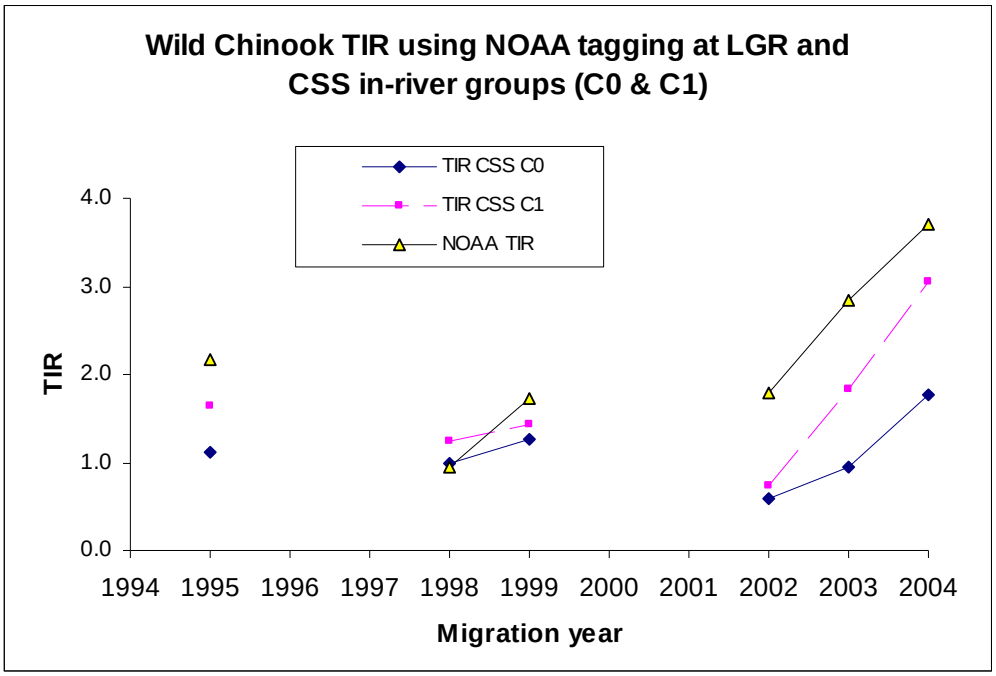

Figure 7. Annual TIRs for NOAA transport study compared to TIRs from CSS smolts using C_0 and C_1 in-river groups, wild yearling Chinook.

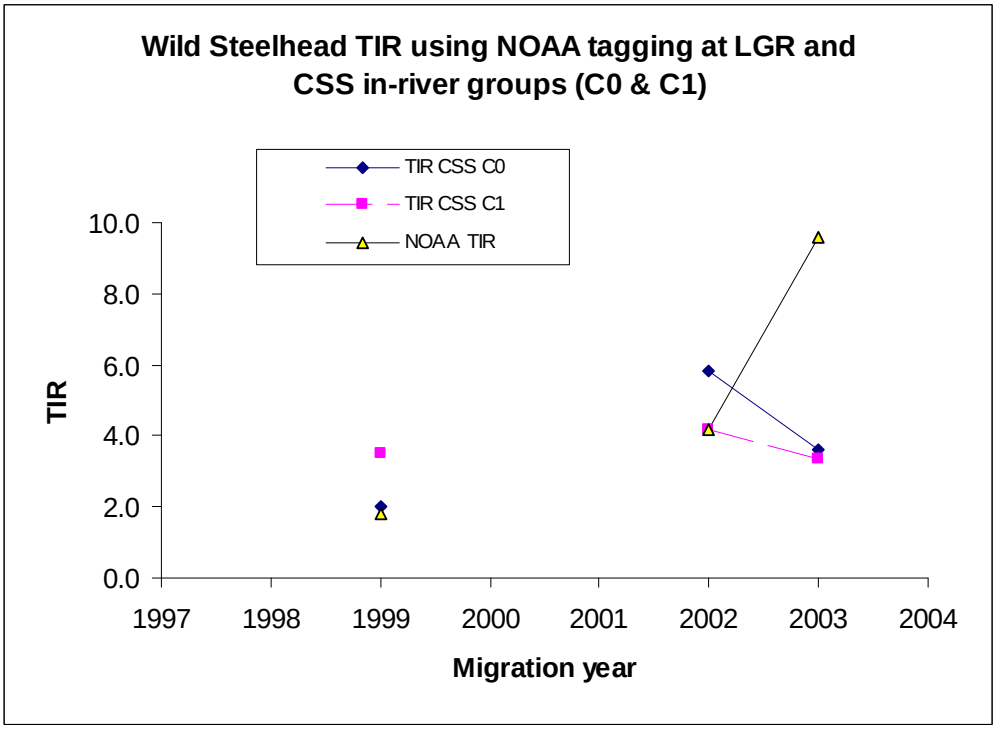

Figure 8. Annual TIRs for NOAA transport study compared to TIRs from CSS smolts using C_0 and C_1 in-river groups, wild steelhead.

The magnitude and direction of TIR differences suggest that collection, tagging and bypass at LGR may positively bias TIRs. Caution is warranted in interpreting TIR estimates based on collection, tagging and bypass at LGR because of this potential bias. The effect of a positive TIR bias would be to artificially shift the apparent date for transport benefit earlier in the season.