



FISH PASSAGE CENTER

1827 NE 44th Ave., Suite 240, Portland, OR 97213

Phone: (503) 230-4099 Fax: (503) 230-7559

<http://www.fpc.org/>

e-mail us at fpcstaff@fpc.org

MEMORANDUM

TO: Russ Kiefer

FROM: Michele DeHart

DATE: May 21, 2009

RE: Ice Harbor bypass effects on Snake River hatchery Chinook returns

In response to your data request, FPC staff analyzed PIT tag data to discern if there was a measurable effect of Ice Harbor Dam bypass on adult returns for Chinook emigrating from the Snake River basin. The Ice Harbor juvenile detection system (ICH hereafter) has been operational since 2005. Because returns for Chinook are complete for migration year 2005 and available through 2-salts for 2006 emigrants, these analyses are currently limited to these two cohorts. There were many more PIT tags available from Snake River Chinook than steelhead and relatively few adults returning from the 2005 and 2006 migration years. Therefore, we did not conduct these analyses for steelhead groups. We found that:

1. Using Snake River PIT tagged Chinook we detected a negative effect on SARs for fish bypassed at Ice Harbor in 2006. This would indicate a post Ice Harbor Dam bypass effect as expressed in adult returns to LGR. In other words, fish that passed through the bypass did not survive to adulthood at LGR as well as the group that included spill, RSW and turbine passage.
2. Due to higher spill in 2005 and lower adult returns, the sample size was too small to draw conclusions about that year.
3. This method of testing for a lower SAR of bypassed fish (*ICH detect*) is a conservative metric because:
 - o We are comparing bypassed fish to a group that includes turbine passed fish (possibly biasing the *No ICH detect* SAR low).

- The fish bypassed at Ice Harbor Dam all survived to that Dam, while a portion of the group without detections may not have (also biasing the *No ICH detect* SAR low).

Data description and approach

We aggregated the data from 5 Chinook hatcheries in the Comparative Survival Study (*eg.* Catherine Creek, Dworshak, Imnaha, McCall’s, and Rapid River hatcheries), and hatchery Chinook marked at Lower Granite Dam by NOAA from the migration years 2005-2006. We grouped these by migration year and included only those fish that had PIT-tag detections at Lower Monumental Dam (LMN). We excluded any transported or other removals at LMN or any downstream dams. This resulted in 16705 and 32669 smolts at LMN in 2005 and 2006 respectively (Table 1). For Ice Harbor detections, we only included those that occurred during the juvenile outmigration of interest and did not count later mini-jack, jack, or adult detections.

Table 1 Aggregated Snake River hatchery Chinook for 2005 & 2006. LMN = detected and released in-river at LMN, ICH = juvenile Ice Harbor detect, and LGR_Adult = non-Jack return to Lower Granite Dam.

Migr. Yr.	LMN	ICH	LGR_ADULT
2005	16705	516	27
2006	32669	4470	127

Using this dataset we calculated LMN to Lower Granite Dam (LGR) SAR’s for each year. We then calculated these SAR’s for the subset of fish detected at ICH and not detected at ICH. Finally, we calculated a new test statistic θ where, $\theta = SAR_{ICH\ detect} \div SAR_{No\ ICH\ detect}$. A non-parametric bootstrap approach (*e.g.* resampling with replacement) was performed when calculating measurements. All of the SAR’s did not include jacks.

The 90% confidence interval around the statistic θ in relation to the value 1 was used to indicate whether the *ICH detect* SAR was greater or less than the *No ICH detect* SAR. If the upper confidence interval is less than one, then the ICH detect fish resulted in a statistically lower SAR. It should be noted that fish detected and bypassed at ICH (*ICH detect*) would be expected to have a *higher* SAR than fish not seen at ICH (*No ICH detect*). This is because the *ICH detect* group only includes fish that survived to ICH and the *No ICH detect* group includes fish that have not survived and have survived to ICH. Additionally, the inclusion of turbine passed fish in the *No ICH detect* SAR would be expected to be the lowest of various routes of passage. So, when testing for a lower *ICH detect* SAR (*ie.* testing for a bypass effect on adult returns) this is a conservative measure of this effect.

Results

The overall LMN to LGR SARs were low in 2005 and 2006: 0.16% and 0.39% respectively. This is similar in magnitude to in-river SARs for CSS hatcheries expressed in LGR to LGR SARs (Figure 1; from CSS 2008 annual report).

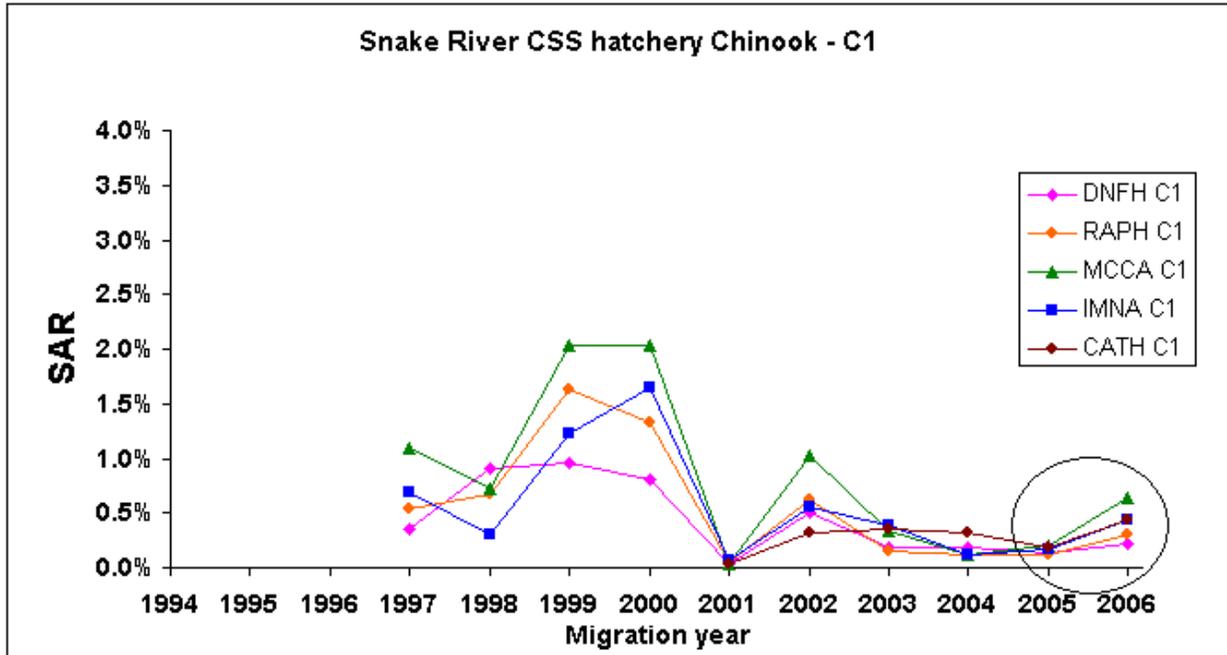
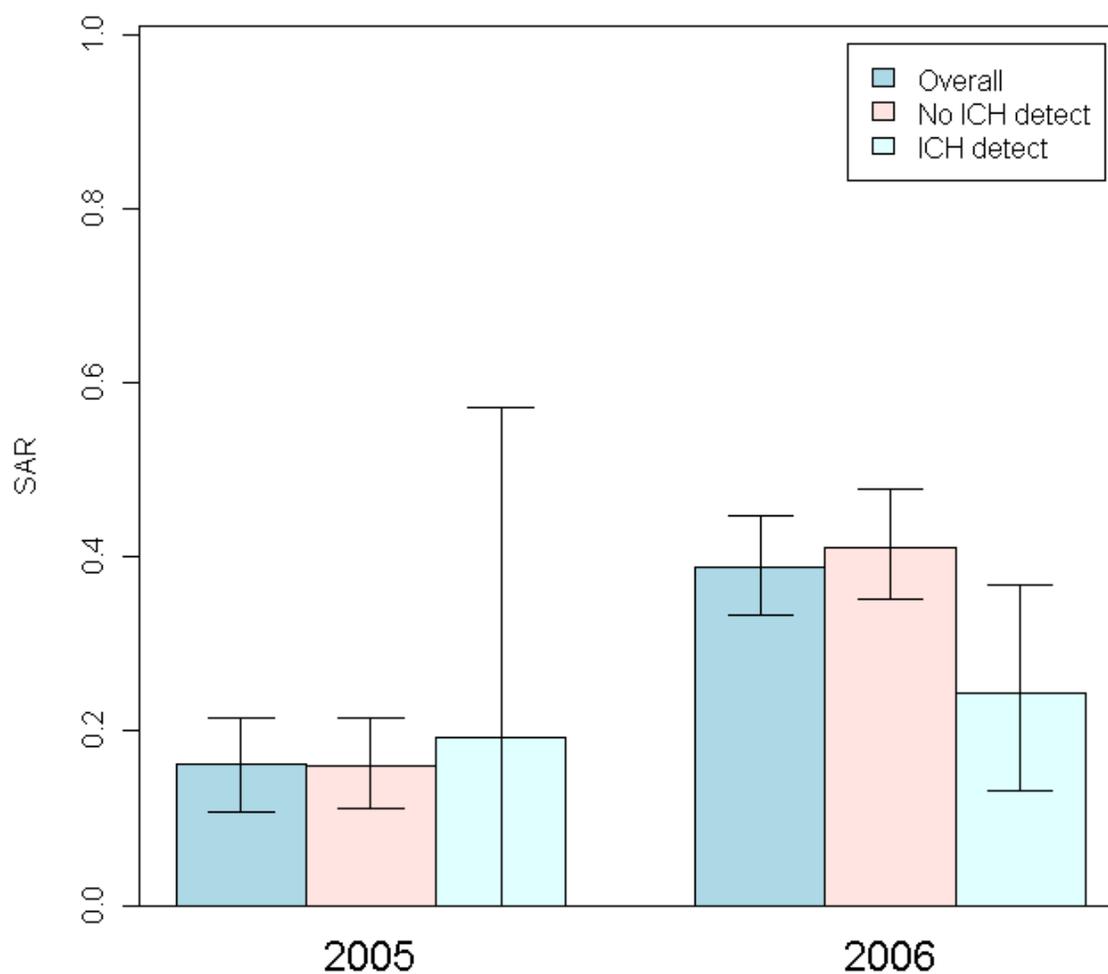


Figure 1 Historical in-river (C1) SARs for CSS hatchery Chinook. SARs are LGR to LGR without jacks.

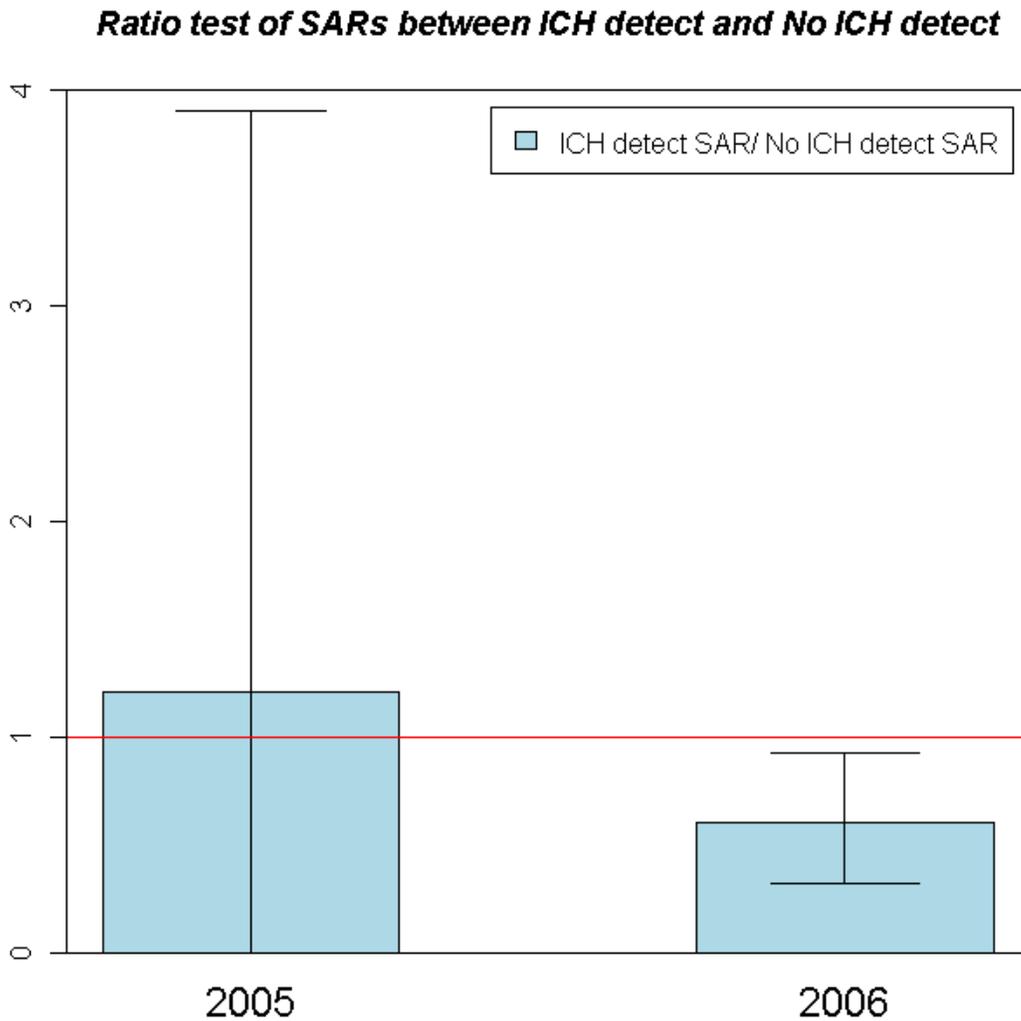
SAR from LMN to LGR (Hatchery Chinook)



90 Percent bootstrapped CI's

Figure 2 LMN to LGR SARs for all fish released in-river at LMN (Overall), and the subcategories of *No ICH detect* and *ICH detect*. All SARs are shown with 90% non-parametric bootstrapped confidence intervals.

The LMN to LGR SARs for these analyses are shown in Figure 2. Because few adults returned from these years, confidence intervals are wide for the LMN to LGR SARs. Even fewer of these fish were detected at ICH (table 1) and this resulted in the widest CI's of the three groups shown (Figure 2). In both years, the *No ICH detect* estimate is similar to the overall estimate in both magnitude and CI. In 2005, the confidence interval around the *ICH detect* SAR is extremely wide revealing an unstable estimate that resulted from few available adults. In 2006 however, the *ICH detect* estimate is markedly lower than either of the other two SAR estimates.



90 Percent bootstrapped CI's

Figure 3. Ratio test of SAR for *ICH detect* and *No ICH detect*. The red horizontal line denotes equality between groups (value of 1).

When comparing the *No ICH detect* and *ICH detect* groups in the ratio test, the 2005 estimate is again unstable and has a wide confidence interval. The 2006 ratio test shows that the *ICH detect* group is statistically lower than the *No ICH detect* group. The point estimate of the *ICH detect* group SAR was 60% of *No ICH detect*.

Summary

Using Snake River PIT tagged Chinook we detected a negative effect on SARs for fish bypassed at Ice Harbor in 2006. This would indicate a post Ice Harbor Dam bypass effect as expressed in adult returns to LGR. However, this effect was only expressed in one year of the two tested.

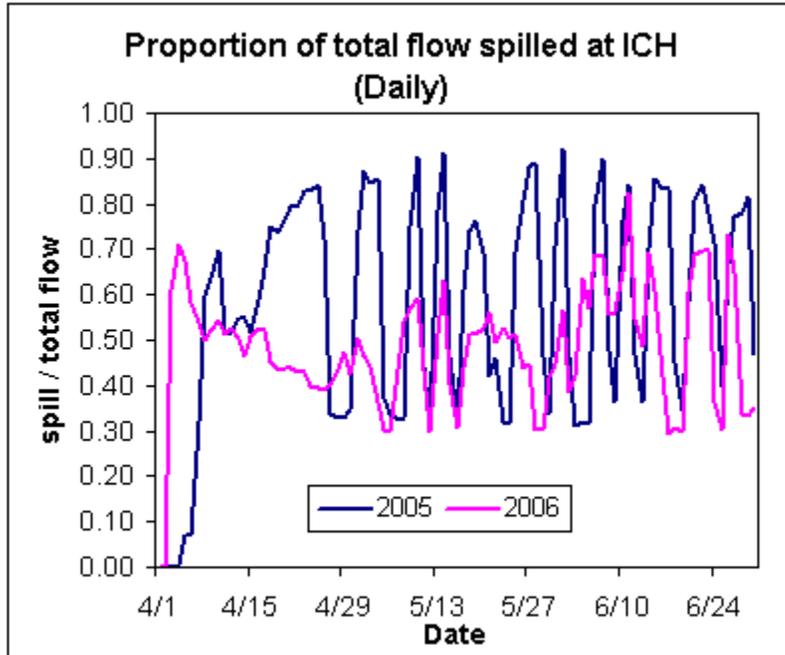


Figure 4. Proportion of total flow spilled at ICH. Values are daily for spring/summer 2005-2006.

The proportion spill at Ice Harbor Dam was much higher in 2005 than 2006 (figure 4). This probably contributed to the smaller sample of *ICH detect* in 2005 (table 1) and the inability to calculate a valid estimate. The relatively low adult returns in these migration years also contributed to the variance of these estimates. However, for the incomplete 2006 returns the indication is that fish that passed through the bypass did not survive to adulthood at LGR as well as the group that included spill, RSW and turbine passage. With only 2 years of data, these results are preliminary at best. With continued monitoring, especially if there are higher adult returns for post-2006 emigrants, more extensive analyses may be possible.