



## FISH PASSAGE CENTER

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### MEMORANDUM

TO: Charlie Morrill, WDFW

FROM: Michele DeHart

DATE: April 23, 2013

RE: Data Request

You recently submitted a request for FPC staff to determine a date in 2013 that would result in the implementation of the “spread the risk” management strategy for transportation in the Snake River. In response to your request the FPC staff has determined

- The 2013 runoff volume in the Snake River is predicted to be 75% of average above Lower Granite Dam (April 21, 2013 ESP). The low flows in the Snake River means that spill will be a higher proportion of flow leading to more fish remaining in-river.
- Based on our analysis it appears it would be unlikely that either Chinook or steelhead would reach 50 percent transport proportion in 2013 even if transport were to begin immediately. Based on our projection the maximum proportions of Chinook and steelhead that could be transported had transport begun at startup would have been between 28 and 46 percent.
- Recent improvement of SARs is due to the management change to a later start date for transport initiated in 2006. Consequently, attempting to increase the proportion of overall transported fish, by initiating transport in April would have a negative impact on wild yearling spring/summer Chinook SARs. In addition, early initiation of transport would also negatively impact hatchery steelhead SARs based on NOAA’s analysis of recent return data from 2006 to 2008.

- In addition, increasing transportation percentage for Snake River stocks increases the straying rate for the returning adults (Keefer and Caudill 2012; CSS 2011 Annual Report). Snake River steelhead that strayed tended to enter the Deschutes and John Day river basins which have small spawning populations as compared to the returning Snake River hatchery steelhead population. Snake River hatchery steelhead may be limiting the recovery of these two distinct steelhead populations.
- Lastly, as in-river survival increases, the effectiveness of transportation decreases. This is illustrated in the TIR vs. SR relationship in the CSS 2012 Annual Report.

## 1. Proportion Transported

The Fish Passage Center used PIT-tag detection probability data from 2010 juvenile fish outmigration to estimate the proportion of the population of yearling Chinook and Steelhead were destined for transport in that year (DeHart et. al. 2010). Destined means the proportion of the population arriving at Lower Granite Dam that would be routed into transportation at downstream dams regardless of survival in the reach. Those detection probabilities were summarized in Table 1 below. Based on detection probabilities from outmigration in 2010, a year projected to be similar to 2013, FPC projected when transportation with spill would have to be initiated in order to transport half of the yearling Chinook and/or steelhead. Based on our analysis it appears it would be unlikely that either Chinook or steelhead would reach 50 percent transport proportion in 2013 even if transport were to begin immediately. Based on our projection the maximum proportions of Chinook and steelhead that could be transported had transport begun at startup would have been between 28 and 46 percent (table 2).

If transport were to be initiated early, the species/rearing type with the highest projected transport proportion would be wild yearling Chinook. This species has been shown to have a higher in-river SAR during April compared to transport SAR especially in the most recent years analyzed -- 2006 to 2008 (NOAA 2013). Attempting to increase the proportion of overall transported fish, by initiating transport in April would have a negative impact on wild yearling spring/summer Chinook SARs. In addition, early initiation of transport would also negatively impact hatchery steelhead SARs based on NOAA's analysis of recent return data from 2006 to 2008. New analysis from NOAA shown to the USACE Technical Management Team also showed that in 2010, a low flow year similar to what 2013 is projected be, hatchery steelhead showed higher in-river SARs until May 1, and no benefit to transport until the end of May -- Julian Day 150 (NOAA 2012).

Based on these findings, it appears that early initiation to transport would be detrimental to wild yearling spring/summer Chinook and would also negatively impact hatchery steelhead SARs.

**Table 1. Detection probabilities for hatchery and wild yearling Chinook and Hatchery and wild Steelhead in 2010 at transport sites in the Snake River.**

Dam	Hatchery Yearling Chinook	Wild Yearling Chinook	Hatchery Steelhead	Wild Steelhead
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Lower Granite	<b>0.17</b>	<b>0.26</b>	<b>0.19</b>	<b>0.22</b>
Little Goose	<b>0.12</b>	<b>0.24</b>	<b>0.23</b>	<b>0.22</b>
Lower Monumental	<b>0.03</b>	<b>0.06</b>	<b>0.04</b>	<b>0.05</b>

**Table 2. Maximum projected proportions destined for transport that could be achieved in 2013 if spill levels in 2013 and detection probabilities at collector dams are similar to what occurred in 2010.**

<b>Dam</b>	<b>Hatchery Yearling Chinook</b>	<b>Wild Yearling Chinook</b>	<b>Hatchery Steelhead</b>	<b>Wild Steelhead</b>
Projected transport proportion	<b>0.29</b>	<b>0.46</b>	<b>0.40</b>	<b>0.43</b>

## 2. Straying

The Conservation and Recovery Plan (Recovery Plan) for Oregon Steelhead Populations in the Middle Columbia River (Carmichael et al, 2010) has identified steelhead straying from other areas as a limiting factor for recovery of distinct steelhead populations in the Deschutes and John Day rivers and recommends to reduce the proportion of Snake River strays by reducing transportation of smolts.

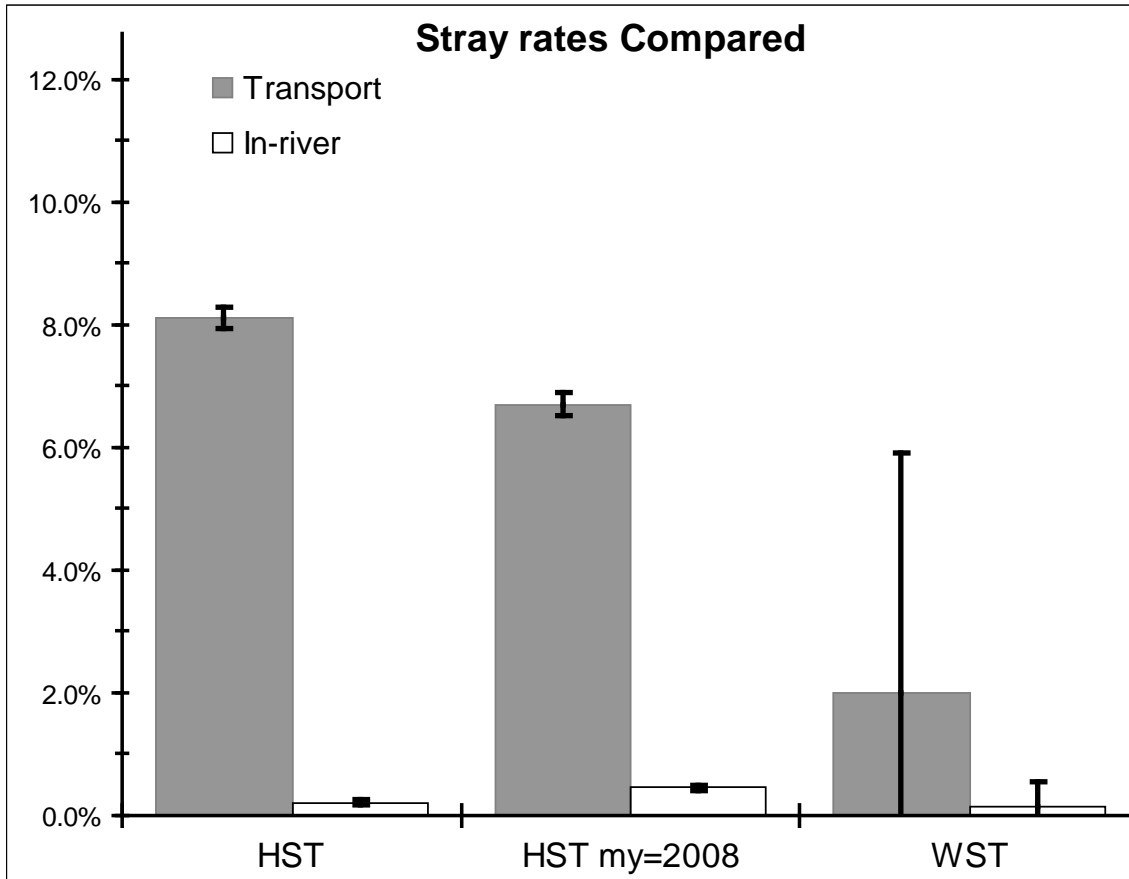
In the viability assessment discussion (page 6.3 paragraph 3) of spawner composition criteria, the Recovery Plan states that, “a significant proportion of natural spawners are out-of-DPS strays that resulted in a high risk rating for the spawner composition metric”. In discussion of limiting factors, (page 8.2) the Recovery Plan states:

“Out-of-DPS hatchery strays pose significant risk to several of Oregon’s Mid-C steelhead populations, particularly to the Eastside and Westside Deschutes and John Day populations. Viability assessments, summarized in Section 6 of this document and presented in Appendix B, identified that a significant proportion of spawners in the Deschutes River and John Day River populations were out-of-DPS strays. In addition, these populations were rated at high risk for spawner composition due to the abundance of strays.”

In the Recovery Plan discussion of Management Strategies to recover these stocks under Overall Hatchery Strategies and Actions, the Recovery Plan identifies management recommends to:

“Reduce the proportion of Snake River hatchery smolts that are transported from Lower Granite and Little Goose dams. [Recent evidence from Perry et al. (2006 unpublished data) indicates that transported smolts may stray at significantly higher rates than in-river migrants. There are limited data available to examine the relationship. This

is a non-consensus action that the Sounding Board indicated should be examined in more detail when additional data are available.]”

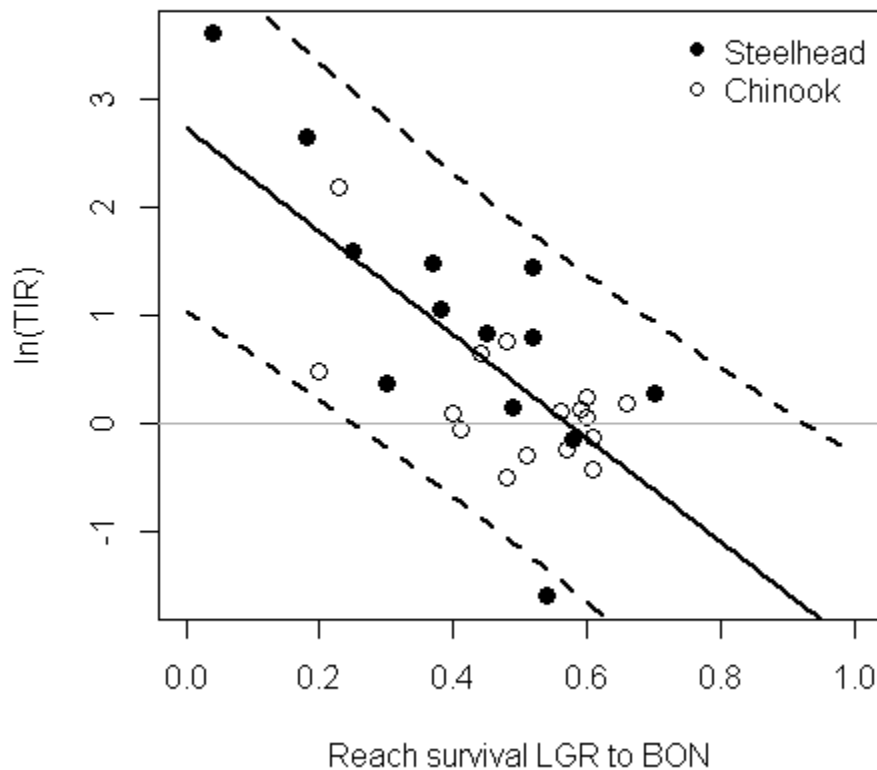


**Figure 1. Adult stray rates for previously transported fish vs. In-river outmigrants. Left to right, the groups compared are: hatchery steelhead (pooled across migration years 2005-2007), hatchery steelhead for migration year 2008, and wild steelhead (pooled across migration years 2005-2008). The nonparametric bootstrapped 90% confidence interval for each rate is plotted. Strays were defined as adults detected outside the FCRPS without a subsequent detection within the FCRPS (including at LGR) or above LGR.**

The recent summary straying report (Keefer and Caudill 2012) notes that, “there is growing consensus that barging juvenile salmon and steelhead downstream increases the likelihood that they will stray as adults.” The CSS (2011 report) found that straying rates during the adult migration were higher for individuals that were transported as juveniles versus those that outmigrated in-river. Further the majority of the steelhead strays were found in lower Columbia River subbasins (Deschutes and John Day rivers) Increasing the proportion of steelhead transported will result in an increase in straying rates.

The CSS 2011 report found that straying rates were higher for transported smolts than their in-river counterparts (Figure 1). Most Snake River steelhead strays tended to enter the John Day and Deschutes River sub-basins. It should be noted that several of these PIT tag detector sites were operating only over a portion of the years aggregated. The John Day river detector (JD1) and the Sherar's falls detector (SHERFT) have operated only since 2007; the Sherar's falls detected operated only over a portion of 2007. This suggests that many fish that were never seen after BON during years prior to 2007 may have been entering these Lower Columbia River tributary rivers.

### 3. The relationship between transport benefits and juvenile survival, and in-river conditions



**Figure 2.** Natural logarithm of Transportation: In-river Ratio (TIR) versus in-river survival rate ( $S_R$ ) for wild Chinook (open points) for juvenile migration years 1994-2010 and wild steelhead (filled points) for juvenile migration years 1997-2010. Broken lines represent the 95% prediction intervals for  $\log_e(TIR)$ . Note the log scale for TIR so that when  $TIR=1$ , the plotted  $\log_e(TIR) = \text{zero}$ .

The CSS study has documented a relationship between TIRs and in-river survival conditions (CSS 2012) across all available years. TIR measures the effectiveness of the transportation program by comparing Smolt to Adult survival for transported groups to their in-river counterparts. When this metric is above, equal to, or below the value of one the transportation program was beneficial, had no effect or was detrimental. The effects of changes in in-river survival on TIRs were consistent between wild steelhead and Chinook. These results indicated that the average TIRs are expected to be less than one when in-river survival from LGR to BON ( $S_R$ ) values are greater than 0.55 and lend support to the hypothesis that TIRs decrease as in-river survival increases. This relationship suggests a relative detriment of transportation when  $S_R$  increases above 55%.

### **Literature Cited**

DeHart, M. 2010. Fish Passage Center 2010 Annual Report to Bonneville Power Administration. BPA Contract # 50744.

Keefer, M.L. and C.C. Caudill. 2012. A review of adult salmon and steelhead straying with an emphasis on Columbia River populations. Technical Report 2012-6. 77 electronic pages. Prepared for: U.S. Army Corps of Engineers Walla Walla District.

Smith, S. 2012. Smolt Survival and Travel Time and Adult Return Rates for Salmonids in the Snake and Columbia Rivers. Technical Management Team Year-End Review December 5, 2012.

Smith, S., D. Marsh D., R. Emmett, W. Muir, and R. Zabel. 2013. A Study to Determine Seasonal Effects of Transporting Fish from the Snake River to Optimize a Transportation Strategy, NOAA Memorandum to USACE, MIPR Number W68SBV10698480.