FISH PASSAGE CENTER

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MEMORANDUM

TO: Ron Boyce, ODFW

FROM: Michele DeHart, Manager FPC

DATE: March 9, 2005

RE: Data Request

The FPC staff is providing you with this analysis in response to your data request. In accordance with our normal procedures, this response will be posted on the FPC web site. You asked for the estimated proportion of Snake River yearling migrants transported annually since 2000. In addition you asked us to project the spill levels that would be necessary to achieve a 50/50 split of fish migrating in-river and transported.

The response to your first question is estimated based on annual collection efficiency estimates generated annually from the PIT tag information. These estimates are routinely developed and included in the FPC annual reports. The response to your second question is more difficult since collection efficiency estimates vary among years dependent on management scenarios and environmental variables. We have tried to calibrate the assumptions based on past years' collection efficiencies, but be advised that when using this information or considering implementation of management scenarios, it is important to keep within the limitations associated with the assumptions made for estimation purposes.

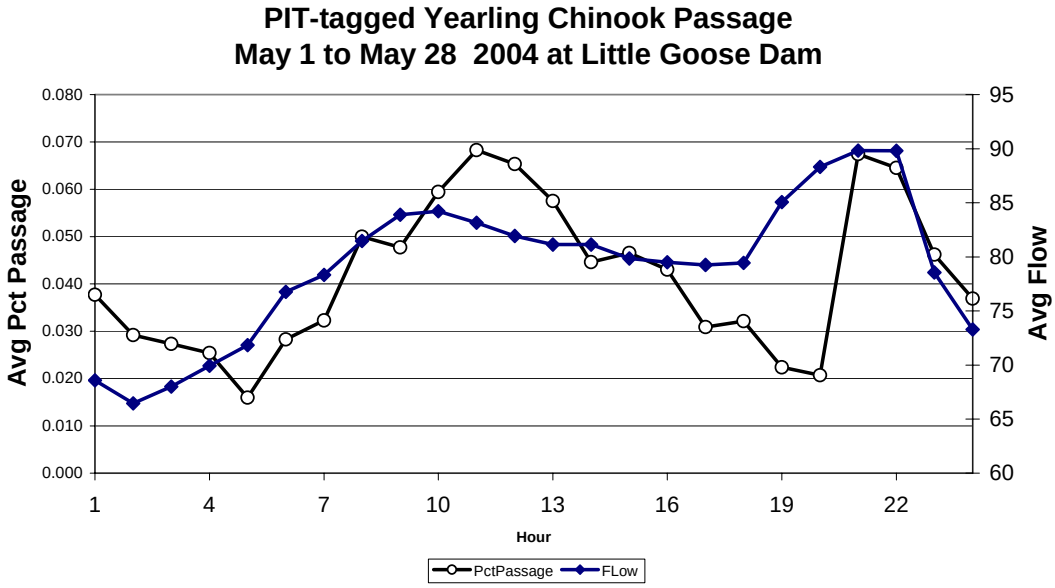
Estimates of the proportion of yearling and subyearling Chinook and steelhead arriving Lower Granite Dam (LGR) "destined" to the transportation strategy (*i.e.*, fish transported from all sites expressed in LGR equivalents) are computed with a probabilistic model and presented in the FPC Annual Reports from 2000 to 2003 (see Appendices G in 2000, and I in 2001-2003). The results are summarized in the following table:

Table 1. Estimated proportion of salmonids arriving Lower Granite Dam "destined" to the transportation strategy.

Salmonid Group	2000	2001	2002	2003	4-Year Average
Chinook Age 1	0.71	0.987	0.683	0.629	0.75
Steelhead	0.81	0.990	0.677	0.670	0.79
Chinook Age 0	0.93	0.962	0.929	0.895	0.93

In order to make the projections to future years under the 2000 BIOP and your recommended "enhanced" conditions, we have made the following set of assumptions:

- Transportation in springtime occurs at Lower Granite (LGR), Little Goose (LGS), and Lower Monumental (LMN) dams, but not at McNary Dam (MCN).
- The formula for estimating the proportion of fish "destined" for transportation is: P(transport) = P1 + (1-P1)•P2 + (1-P1)•(1-P2)•P3 where Pj is the probability of being alive in the forebay of the j^{th} dam and transported (j = 1 for LGR, 2 for LGS, and 3 for LMN) and Pj = [1-P(fish in spill)]•P(FGE)•P(transported given collected).
- Assumes 100% of collected fish are transported.
- Collection efficiency estimates (CE) obtained with yearling Chinook PIT-tag data from 2002 to 2004 is partitioned into components using CE = [1-P(fish in spill)]•P(FGE).
- FGEs of 65% LGR, 65% LGS, and 41% LMN and P(fish in spill) computed with spill effectiveness (SPE) odds of 2:1 SP:PH at LGS and 4:1 SP:PH at LMN most closely match the PIT-tag CE estimates.
- Spill effectiveness odds of 1:1 SP:PH at LGS and LMN do not calibrate well with the PIT-tag collection efficiency estimates, but results using those SPE are shown for comparison purposes as per your request.
- The proportion of fish passing through spill at LGR is based on recent RSW studies in 2003 that showed the RSW with 7 kcfs and training spill with 12 kcfs passed 66% of the yearling Chinook. This spill passage efficiency was applied to the 85 kcfs flow scenario and a prorated 51% passage (85/110 ratio times 0.66) was applied to the higher 110 kcfs flow scenario.
- The enhanced scenario with 8 kcfs additional training spill was included with the assumption that the additional 8 kcfs also increased the spill passage by 8 percentage points (i.e., +0.08).
- The enhanced scenario includes spilling at LGS to the gas cap of 43 kcfs for 24 hours instead of the BIOP 12 hours.
- Daytime yearling Chinook passage at LGS appears about equal to nighttime passage based on hourly PIT-tag passage in a non-spill year as shown in following figure:



Based on the above assumptions and conditions, the estimated proportions of yearling Chinook "destined" for transportation are shown in Table 2. The quantity 1-P(transport) is an estimate of the proportion of yearling Chinook arriving LGR "destined" to in-river migration through the combination of spill and turbine passage. Since mortality will occur as fish migrate from LGR to LGS and LMN, the actual number of survivors transported or remaining in-river below LMN will be less than those "destined" to start from LGR on that particular route of passage.

Table 2. Estimated proportion of yearling chinook "destined" for transportation under the 2000 BIOP and additional enhanced conditions for flows averaging 85 kcfs and 110 kcfs.

Conditions	Flow	Dam	FGE	Pj --low spe	Pj --high spe
BIOP Spill	85 kcfs	LGR	0.65	0.221	0.221
		LGS	0.65	0.488	0.325
		LMN	0.41	0.226	0.094
			P(transport)	0.691	0.524
	110 kcfs	LGR	0.65	0.319	0.319
		LGS	0.65	0.520	0.371
		LMN	0.41	0.185	0.070
			P(transport)	0.733	0.601
ENHANCED Spill	85 kcfs	LGR	0.65	0.169	0.169
		LGS	0.65	0.321	0.163
		LMN	0.41	0.226	0.094
			P(transport)	0.563	0.370
	110 kcfs	LGR	0.65	0.280	0.280
		LGS	0.65	0.396	0.221
		LMN	0.41	0.185	0.070
			P(transport)	0.645	0.478

The attainment of a 50% of fish arriving at LGR "destined" for transportation appears more likely to be achieved under the enhanced spill conditions than simply the BIOP conditions. Increasing the LGS spill from 12 to 24 hours at the 43 kcfs gas cap is the management action primarily responsible for reaching the 50% transport goal in this modeling exercise. This is because only an 8 kcfs increase in spill was modeled for LGR under the enhanced spill condition.

In summary, this modeling exercise demonstrates that a "spread-the-risk" management goal may be attainable if additional spill is provided at LGS in future years. Caution must be exercised when looking at the magnitude of the modeled P(transport) estimates due to the numerous assumptions that went into this modeling approach. The trends in the modeled P(transport) estimates should be viewed as the primary outcome of this data analysis for use in future management decisions.