FISH PASSAGE CENTER

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MEMORANDUM

TO: Tom Lorz (FPAC Co-Chair)

FROM: Michele DeHart

DATE: November 6, 2009

RE: Greater than 30% spill at Little Goose Dam and adult travel times and conversion rates.

During the September 1, 2009 FPAC conference call, FPAC requested that the FPC review travel time and conversion rate data for Chinook and steelhead adults passing between Ice Harbor (IHR) and Lower Granite (LGR) dams during periods of 30% spill at Little Goose Dam (LGS) and periods of greater than 30% spill at LGS. Below are our findings, followed by a more detailed explanation of our analyses.

- Spill levels of greater than 30% at LGS (up to 36.5%) had no effect on the travel times or conversion rates of adult Chinook or steelhead in Aug. 2009.
- Weighted regression showed no significant relationship between travel times of adult Chinook and steelhead and average spill percent, average flow, or average temperature.
- Regression analyses showed no significant relationship between conversion rates of adult Chinook and steelhead and average spill percent, average flow, or average temperature.

Methods and Results:

Voluntary summer spill at LGS is normally 30% of instantaneous flow, 24-hours per day from June 21st to August 31st. However, during the period of Aug. 17th to Aug. 31st, spill at LGS was greater than 30%. Summer spill at LGS is currently capped at 30% because of a belief that

greater than 30% spill at this project would lead to increased travel times or decreased conversion rates of adult salmon migrating upriver.

To determine travel times and conversion rates during the 30% spill and >30% spill operation at LGS, FPC staff relied on PIT-tagged adult Chinook detected at IHR between July 15th and August 28th and adult steelhead detected at IHR between July 15th and August 25th. Fish travel times (FTT) were estimated for those fish that were later detected at LGR. Based on these estimates of FTT and the distance between IHR and LGS, we estimated a LGS arrival date. Based on the estimated LGS arrival date, each individual fish was assigned an LGS spill operation (as percent spill), an LGS flow, and an LGS temperature that they would have experienced upon passing LGS.

Fish were then grouped based their IHR detection dates and estimated LGS environmental variables, attempting to have fish with similar environmental variables and timing in the same groups. This allowed for the estimation of an average (FTT), average LGS percent spill (percent spill), average LGS flow (average flow), and an average LGS temperature (average temperature) for each group. Because estimates of FTT are not normally distributed, these estimates were log-transformed (ln(FTT)). An average Ln(FTT) was then estimated for each group identified. Grouping also allowed for the estimation of variance around the average Ln(FTT) estimates. The grouping resulted in eight groups for adult Chinook and nine groups for adult steelhead (Table 1).

Table 1. Adult Chinook and steelhead groupings and associated estimates of average Ln(FTT) and conversion rates. Environmental variables for each group are also provided (average spill percent, average flow, and average temperature)

Species-Group	ICH Dates	Average Ln(FTT)	Variance Ln(FTT)	Average Spill Percent	Average Flow	Average Temp. (°C)	Conversion Rate (%)
CH-01	7/15-7/17	1.70	0.308	30.14	45.96	9.29	90.0
CH-02	7/18-7/26	1.98	0.604	29.82	37.84	20.16	83.8
CH-03	7/29-8/14	2.24	0.369	30.09	28.97	19.93	70.0
CH-04	8/15-8/20	1.91	0.235	33.52	33.23	19.42	90.5
CH-05	8/21-8/23	2.08	0.223	36.46	27.22	19.38	100.0
CH-06	8/24-8/25	2.09	0.129	27.82	26.55	19.31	95.8
CH-07	8/26-8/27	1.98	0.132	23.00	25.08	19.51	97.7
CH-08	8/28	1.90	0.049	6.76	25.56	19.64	96.2
ST-01	7/16-7/20	2.63	0.923	30.88	36.93	19.95	77.8
ST-02	7/22-8/4	2.86	0.586	26.71	33.61	20.25	79.7
ST-03	8/6-8/7	3.04	0.393	34.62	31.72	19.57	71.4
ST-04	8/8-8/9	2.07	0.173	30.11	30.63	19.75	100.0
ST-05	8/10-8/11	3.18	0.505	15.83	26.80	19.79	100.0
ST-06	8/13-8/18	2.63	0.161	33.71	30.98	19.36	83.3
ST-07	8/19-8/20	2.62	0.209	34.13	25.91	19.49	90.0
ST-08	8/21-8/22	2.57	0.117	24.59	27.04	19.44	96.0
ST-09	8/23-8/25	2.53	0.180	15.00	25.66	19.51	91.8

We also estimated conversion rates for the same groups of fish used in the FTT analysis. Conversion rates were calculated as the number of adults detected at Lower Granite Dam divided by the total number detected at Ice Harbor. Conversion rates were converted to percentages for presentation (Table 1). Because conversion rates were not normally distributed, we used logit-transformation. Regression analyses were conducted on these logit-transformed estimates of conversion rates.

We then conducted regression analyses to investigate the relationships between the environmental variables described above and average ln(FTT). For the analyses of average ln(FTT), we used weighted regression. Estimates were weighted on the inverse variance of the average ln(FTT) estimates.

There was no significant relationship between average Ln(FTT) and any of the environmental variables we estimated, for either Chinook or steelhead adults (Table 2). Regression analyses of logit-transformed conversion rates and environmental variables also revealed no significant relationships (Table 3).

Table 2. Results from weighted bi-variate regression analyses for Chinook and steelhead adults. Each environmental variable was regressed against average ln(FTT). Weighting was on the inverse variance of ln(FTT).

Environmental Variable	Chinook			Steelhead		
	Adjusted R^2	F Statistic (df =1,6)	P value	Adjusted R^2	F Statistic (df =1,7)	P value
Avg. Spill Percent	0.038	1.280	0.301	0.000	0.062	0.811
Avg. Flow	0.067	1.503	0.266	0.000	0.002	0.964
Avg. Temperature	0.000	0.056	0.820	0.000	0.002	0.970

Table 3. Results from bi-variate regression analyses for Chinook and steelhead adults. Each environmental variable was regressed against logit-transformed conversion rate.

Environmental Variable	Chinook			Steelhead		
	Adjusted R^2	F Statistic (df =1,6)	P value	Adjusted R^2	F Statistic (df =1,7)	P value
Avg. Spill Percent	0.000	0.411	0.545	0.033	1.272	0.296
Avg. Flow	0.000	0.783	0.410	0.000	0.645	0.448
Avg. Temperature	0.023	1.167	0.322	0.000	0.076	0.790