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To: Glen Mendel (WDFW)
From: Matt Keefer and Chris Caudill

Re: Behavior of radio-tagged Chinook salmon and steelhead associated with the Tucannon River

This summary was assembled in response to concerns about low adult returns of spring Chinook salmon and summer steelhead to the Tuccanon River in recent years. Managers have noted that many PIT-tagged Tucannon River fish have been recorded upstream from the Tucannon River's confluence with the Snake River at PIT-tag interrogators at Lower Granite Dam. Many of these fish have not subsequently been recorded at the Tucannon River in-stream PIT detector or in adult sampling efforts in the river.

In the large-scale adult radiotelemetry studies conducted by the UI and NMFS, we have referred to this type of 'missed' tributary turnoff as 'tributary overshoot' (see Keefer et al. 2008). The behavior occurs for many populations, and particularly when tributaries are located close to upstream dams, or when tributary discharge is very small relative to Snake or Columbia River discharge — as with the Tucannon.

Methods and Results: For this summary, we examined telemetry data for two groups of adult fish that were collected and radio tagged at Bonneville Dam. First, we looked at Chinook salmon and steelhead that had been PIT tagged as juveniles in the Tucannon River (Table 1). These samples were from 2000-2004 run years. Second, we examined data for all adults that were recorded in the Tucannon River from 1996-1998 and 2000-2004 (Table 2). This group was detected in the Tucannon either by mobile-tracking (WDFW, UI), in spawning ground surveys, and from transmitter return data from various sources (i.e., found transmitters, fishery returns, etc.).

Over the years, we radio-tagged 13 steelhead and 1 spring Chinook salmon that had been PIT-tagged in the Tucannon River. The single Chinook returned to the Tucannon River (Table 1). Of the 13 steelhead, 8 (62%) returned to the Snake River. Seven of the 8 (88%) were recorded passing Little Goose Dam and were also recorded at one or more receivers at Lower Granite Dam. Four of the 8 (50%) passed Lower Granite Dam. None of the steelhead that entered the Snake River were recorded in the Tucannon River (Table 1). However, some fish were last recorded in the Little Goose and Lower Monumental reservoirs, and it is possible some of these fish entered the Tucannon but were not detected in any surveys.

The larger sample of fish recorded in the Tucannon River included 38 steelhead and 22 Chinook salmon (Table 2). Across years, 69% of the steelhead and 81% of the Chinook were recorded at Little Goose Dam, 41% of steelhead and 31% of Chinook passed Little

Goose Dam, and 24% and 0%, respectively, passed Lower Granite Dam. About 90% of each species had their last record (i.e., recapture, mobile track record) in the Tucannon River.

Discussion: We wish to emphasize that these two samples differed substantially from each other. The PIT-tagged group presumably better reflects the behavior of all fish with origins in the Tucannon River, whereas the larger radio-tagged group is strongly biased towards fish that successfully located and entered the Tucannon on return. We would expect that the latter group was less likely to be recorded at Little Goose or Lower Granite dams than the population overall. Given the bias for successful fish, data for this group also were not well-suited to addressing questions about potential 'loss' of Tucannon River fish from the Tucannon basin. A final caveat: the telemetry data probably underestimate the number of fish that entered the Tucannon because there was no fixed receiver site in the river and because steelhead that overwintered in the Snake River were somewhat less likely to have functional transmitters if they entered the Tucannon prior to spring spawning.

Overall, results clearly indicated that many Tucannon River fish at least initially overshot the Tucannon during their homing migration. This behavior has potential energetic costs as well as direct mortality risks for fish that must fall back downstream over dams to reach the Tucannon River (e.g., Boggs et al. 2004; Keefer et al. 2005, 2008). The telemetry results were consistent with the PIT-tag records of Tucannon fish at Lower Granite Dam, and the two methods combined suggest a significant potential risk for these populations. Sample sizes were too small in our studies to evaluate potential environmental effects (i.e., Tucannon or Snake River discharge or temperature levels) on the likelihood that fish entered the Tucannon River, but such analyses may be possible with the larger PIT-tag database.

Table 1. Summary of individual steelhead and Chinook salmon PIT-tagged and/or released in the Tucannon River as juveniles and then radio-tagged at Bonneville Dam as adults. All fish recorded at Lower Granite Dam were also recorded at Little Goose Dam.

Run	Year	Passed L. Goose	Recorded L. Granite	Passed L. Granite	Fallback L. Granite	Final location
Steelhead	2001	No	-	-	-	Col. R. fishery
	2003	No	-	-	-	At Bonneville
	2003	No	-	-	-	At Bonneville
	2003	No	-	-	-	Herman Ck.
	2004	No	-	-	-	Col. R. fishery
	2000	Yes	Yes	Yes	Yes	Goose pool
	2001	Yes	Yes	Yes	Yes	Top of Granite
	2002	Yes	Yes	Yes	Yes	Granite tailrace
	2002	Yes	Yes	Yes	No	Salmon River
	2003	Yes	Yes	Yes	Yes	LoMo pool
	2004	Yes	No	-	-	Goose pool
	2004	Yes	Yes	Yes	-	Spit transmitter
	2004	Yes	Yes	Yes	No	Abv Granite pool
Chinook	2001	Yes	No	-	-	TUC survey

Table 2. Summary of all radio-tagged adult Chinook salmon and steelhead that were recorded in the Tucannon River.

Run	Year	Recorded TUC (*n*)	Percent (%) At Goose	Past Goose	At Granite	Past Granite	Last rec in TUC
Steelhead	1996	9	n/a	n/a	44%	11%	100%
	1997	12	75%	58%	50%	42%	83%
	2000	5	60%	20%	80%	80%	60%
	2001	3	66%	33%	33%	33%	100%
	2002	8	63%	25%	13%	13%	100%
	2004	1	100%	100%	100%	0%	100%
	Total	38	69%[a]	41%[a]	37%	24%	89%
Chinook	1996	6	n/a	n/a	50%	33%	66%
	1997	6	100%	17%	33%	33%	100%
	1998	4	50%	50%	25%	25%	100%
	2000	2	50%	50%	50%	0%	100%
	2001	1	50%	0%	0%	0%	100%
	2002	1	50%	0%	0%	0%	100%
	2003	2	100%	100%	50%	0%	100%
	Total	22	81%[b]	31%[b]	36%	23%	91%

[a] because L. Goose was not monitored in 1996, the denominator here was 29 steelhead
[b] Because L. Goose was not monitored in 1996, the denominator here was 16 Chinook

Literature cited

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