Summary of available information on straying of Snake River steelhead in the Columbia River

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Over a number of years , researchers at the University of Idaho and NOAA Fisheries have investigated incidents of straying behavior for adult salmon and steelhead in the Columbia River either directly or incidentally to other ongoing research. Most of this information was collected using radiotelemetry, and much of that information is available at our website: http://www.cnr.uidaho.edu/uiferl/. As a result of those early studies, a dedicated in-stream PIT detection station was installed within the John Day River primarily as a means to track out-of-basin straying for adult anadromous salmonids. That information will be summarized separately. Here I attempt to summarize the main points from our efforts relative to adult steelhead stray behavior.

Radiotelemetry Studies

Over seven year period (1996-2004), UI and NOAA researchers collected and tagged a total of 4,750 randomly selected adult steelhead and 940 known-source Snake River steelhead. Most of the latter were PIT-tagged as juveniles as part of the transportation study. The randomly sampled fish are of limited use since we do not know their stream of origin. These fish were primarily used to document temporary straying, fish that enter one tributary for a period of time but then eventually leave and end up in a different tributary assumed to be their intended destination. Temporary straying can be very important in steelhead migration behavior. Obviously known-source fish are more valuable for estimating (permanent) straying because stream of origin (Snake River) has been verified.

Temporary straying. Significant numbers of Snake River steelhead stray into the Deschutes and John Day (and other) rivers and the behavior appears to be temperature dependent. Peak stray times are from late July to early September when water temperatures in the mainstem Columbia River are 20°C or higher. From 30 to 60% of steelhead we tracked that ultimately returned to the Snake River were detected in lower river tributaries for durations of hours to weeks. Proportions of hatchery (clipped) temporary strays were 5 to 10% higher than unclipped steelhead. In the Deschutes river, about 20% of the temporary strays reached as far upstream as Sherars Falls.

Permanent straying. Based on known-source fish, an average of 1.6% of all Snake River steelhead strayed permanently into the Deschutes River and 2.2% permanently strayed in The John Day River during the period 2000 to 2004. Since average counts of steelhead at Bonneville Dam during this time was 415,084, this equates to an estimated annual number of strays of 6,641steelhead into The Deschutes River and 9,132 into the John Day River for this period. We do not have available what proportion of the spawning escapement this makes up for the two basins for the study period. But as food for thought, Jim Ruzycki, (ODFW), estimated spawner escapement to John Day River was 16,292 adults, of which an estimated 5,702 were hatchery origin. All hatchery fish in the John Day River are strays because there is no hatchery supplementation program in the John Day River. About 13 to 14% of the strays we identified from the telemetry study were actually fish known to have been harvested in the two basins and so did not have the opportunity to spawn or leave again if they were temporary strays.

Table 1. Known-source fish from Snake and Upper Columbia rivers that strayed into the Deschutes and John Day Rivers.

	Straying into the Deschutes				Straying into the John Day			
	Snake		Upper Columbia		Snake		Upper Columbia	
	n	%	n	%	n	%	n	%
2000	8	0.0%	1	0.0%	8	0.0%	1	0.0%
2001	327	2.4%	285	1.8%	307	2.9%	257	0.0%
2002	386	1.0%	117	0.9%	359	1.4%	107	0.0%
2003	80	0.0%	1	0.0%	73	2.7%	1	0.0%
2004	30	3.3%	15	0.0%	28	0.0%	15	0.0%
Total	831	1.6%	419	1.4%	775	2.2%	381	0.0%
Hatchery	218	1.8%	394	1.5%	207	2.9%		
Wild	613	1.5%	25	0.0%	568	1.6%		

Transport effects. Steelhead that had been transported on barges as sea-ward migrating smolts had lower homing rates as adult migrants than those fish that migrated in-river (Table 2). Those lower homing rates were associated with lower escapement (greater unaccounted loss of radio-tagged fish), higher fallback rates at dams, and higher permanent stray rates for transported fish (Tables 2 & 3). These behaviors are likely related to lower sequential imprinting for smolts that are transported to lower Columbia River in barges. For unclipped steelhead, 2% of all in-river Snake River steelhead strayed compared to 7.3% of transported steelhead. These rates were 7.6% (in-river) and 10.2% (barged) for clipped steelhead. For barged (clipped and unclipped) steelhead, 3.1% strayed to the John Day River, 2.2% to the Deschutes River and 1.2% to some other location. For in-river migrants the proportions were 0%, 1.7%, and 1.7%, respectively. Again, over 400,000 adult steelhead escaped to the Columbia River per year during this period, so these percentages represent thousands of straying steelhead to these tributaries.

Table 2. Number and percent of radio-tagged adult steelhead that homed, permanently strayed, or were unaccounted for during upstream migration, by juvenile transportation history, adult return year, juvenile outmigration year, and rearing history. All harvested fish were excluded.

Group by:	Year	Treatment	*n*	Percent (%)		
				Homed	Strayed	Unaccounted
All fish	All	In-river	238	88.7	3.4	8.0
		Barged	409	75.6	6.9	17.6
Outmigration	1999	In-river	36	83.3	8.3	8.3
		Barged	61	75.4	4.9	19.7
	2000	In-river	186	89.3	2.7	8.1
		Barged	226	78.8	7.5	13.7
	2001	In-river				
		Barged	87	70.1	8.1	21.8
	2002	In-river	16	93.8		6.3
		Barged	35	68.6	2.9	28.6
Adult return	2001	In-river	112	89.3	5.4	5.4
		Barged	154	72.7	8.4	18.8
	2002	In-river	110	87.3	1.8	10.9
		Barged	201	79.1	7.0	13.9
	2003	In-river	16	93.8		6.3
		Barged	54	70.4	1.9	27.8
Hatchery	All	In-river	70	87.1	7.1	5.7
		Barged	59	79.7	8.5	11.9
Wild	All	In-river	168	89.3	1.8	8.9
		Barged	350	74.9	6.6	18.6

Table 3. Percent (n) of radio-tagged adult steelhead that fell back at one or more dams during upstream migration, and fallback frequency (total number of fallback events divided by number of fish that fell back), by juvenile transportation history, adult return year, juvenile outmigration year, and rearing history. Harvested fish excluded.

		Percent (n) that fell back				Fallback frequency	
Group by:	Year	In-River	Barged	χ^2	*P*	In-River	Barged
All fish	All	10.5 (238)	18.1 (409)	6.7	0.010	1.2 (25)	2.1 (74)
Adult return	2001	8.9 (112)	18.8 (154)	5.1	0.024	1.2 (10)	2.1 (29)
	2002	12.7 (110)	13.4 (201)	0.0	0.860	1.1 (14)	1.6 (27)
	2003	6.3 (16)	33.3 (54)	4.6	0.032	1.0 (1)	2.8 (18)
Outmigration	1999	11.1 (36)	14.8 (61)	0.3	0.661	1.0 (4)	1.7 (9)
	2000	10.8 (186)	15.5 (226)	2.0	0.160	1.2 (20)	1.9 (35)
	2001		20.7 (87)				2.3 (18)
	2002	6.3 (16)	34.3 (35)	4.5	0.033	1.0 (1)	2.8 (12)
Hatchery	All	14.3 (70)	13.6 (59)	0.0	0.906	1.1 (10)	2.3 (8)
Wild	All	8.9 (168)	18.9 (350)	8.5	0.004	1.2 (15)	2.1 (66)

Sources

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