

The Use of Passive Integrated Transponder (PIT) Tags as a Tool to Monitor and Manage Steelhead

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Passive Integrated Transponder (PIT) tags were introduced to the market in 1987 and the PTAGIS database was implemented in 1991. Through the 1990's and early 2000's, PIT tags were primarily used in anadromous fish to assess juvenile survival rates during outmigration through the Snake River and Columbia River hydropower system. However, in more recent years, PIT tags have been more readily used in evaluating returning adult numbers and behavior. Currently, PIT tags are used to monitor a variety of juvenile and adult metrics in steelhead.

In juvenile steelhead, PIT tags are used to estimate stock- and release site-specific travel times and juvenile survival rates from release to Lower Granite Dam (LGD) as well as arrival timing at LGD (Figure 1). Additionally, PIT tags are currently being used in cooperative work with the Comparative Survival Study (CSS) to evaluate survival related to migration route and subsequent smolt-to-adult return rates (SARs).

Hatchery	Release Group	Stock	PIT-tagged Fish Released	Release Date	50% Passage Date	80% Arrival Window (# Days)	% Survival (95% CI)
Clearwater	Newsome Creek	DWOR	3,591	4/11-4/18	5/15	4/28 - 6/2	74.7 (± 4.1)
	Peasley Creek	DWOR	5,195	4/15	5/9	4/21 - 5/20	81.1 (± 2.5)
		DWOR	2,098	4/15	4/28	4/20 - 5/16	83.2 (± 3.9)
	SFCLW	SFCLW	11,277	4/15	5/10	4/21 - 5/22	80.3 (± 1.7)
		SFCLW	3,987	4/15-4/15	5/10	4/21 - 5/23	80.5 (± 2.6)
	Red House Hole	DWOR	7,674	4/12-4/13	4/21	4/17 - 5/11	81.8 (± 1.6)
Hagerman	Upper East Fork Salmon River	EFNAT	6,981	5/3-5/5	5/19	5/13 - 6/5	79.9 (± 4.1)
National	Sawtooth Weir	SAW	13,409	4/13-4/29	5/9	4/29 - 5/16	82.8 (± 2.5)
	Yankee Fork	SAW	4,070	5/6-5/16	5/26	5/19 - 6/12	77.9 (± 4.5)
	Yankee Fork	SAW	4,142	5/6-5/16	5/29	5/17 - 6/15	72.3 (± 4.3)
Magic Valley	Colston Corner	PAH	2,095	4/6-4/8	5/12	4/25 - 5/8	71.6 (± 4.3)
	Little Salmon River	DWOR	3,981	4/12-4/14	5/13	4/29 - 5/27	85.0 (± 3.1)
		PAH	3,678	4/8-4/12	5/10	4/21 - 5/22	85.7 (± 2.7)
	Lower East Fork Salmon River	DWOR	4,983	4/14-4/18	5/14	5/9 - 5/23	72.1 (± 3.9)
	McNabb Point	SAW	2,093	4/22-4/25	5/10	5/3 - 5/15	87.1 (± 5.8)
	Pahsimeroi Weir	DWOR	1,795	4/26	5/12	5/9 - 5/21	83.9 (± 5.9)
		USAL	5,371	4/26-4/27	5/12	5/8 - 5/21	89.3 (± 3.8)
	Red Rock	PAH	2,081	4/4-4/5	5/11	4/26 - 5/16	75.9 (± 4.4)
	Shoup Bridge	PAH	1,599	4/5-4/6	5/11	4/24 - 5/14	76.4 (± 5.3)
	Squaw Creek	DWOR	5,076	4/19-4/22	5/14	5/9 - 5/26	60.4 (± 3.2)
Niagara	Hells Canyon Dam	OXA	8,234	3/28-4/4	5/2	4/6 - 5/21	72.8 (± 2.0)
Springs	Little Salmon River	PAH	6,922	4/5-4/11	5/11	4/20 - 5/28	79.4 (± 2.4)
	Pahsimeroi Weir	PAH	12,840	4/12-4/28	5/12	5/5 - 5/19	75.2 (± 2.3)

Figure 1.

In adult steelhead, PIT tags are being used to estimate stock-specific escapement to Bonneville, McNary, Ice Harbor, and Lower Granite dams as well as conversion rates between the dams (Figure 2), and after-hours passage and fallback/reascension rates at the dams.

	(%) Bonneville to McNary		(%)Bonneville to LGD	
	One-ocean	Two-ocean	One-ocean	Two-ocean
DWOR (Clearwater)	88.3	71.1	84.5	70.8
DWOR (Salmon)	80.3	88.7	79.7	73.1
E.F. Naturals	99.4	79.7	98.7	79.2
Oxbow	78.8		65.4	
Pahsimeroi	79.1	82.8	73.0	82.6
Sawtooth	85.0	80.6	77.6	74.9
Upper Salmon River B's	79.1	68.9	40.9	58.3

Figure 2.

Additionally, tags are used to monitor adult hatchery-, stock-, and release site- specific migration timing, relative smolt-to-adult return rates (Figure 3), and stray/wandering rates. Lastly, PIT tags are often used as a tool in-season to coordinate the anticipated abundance of hatchery returns, by release site, as fish are returning and being detected downriver.

Because PIT tags provide real-time, in-season data, it is important for agencies to communicate findings

throughout the run in order for accurate management decisions to be made. To facilitate this coordination, weekly teleconference calls are held throughout the fall (in conjunction with fall



Figure 4.

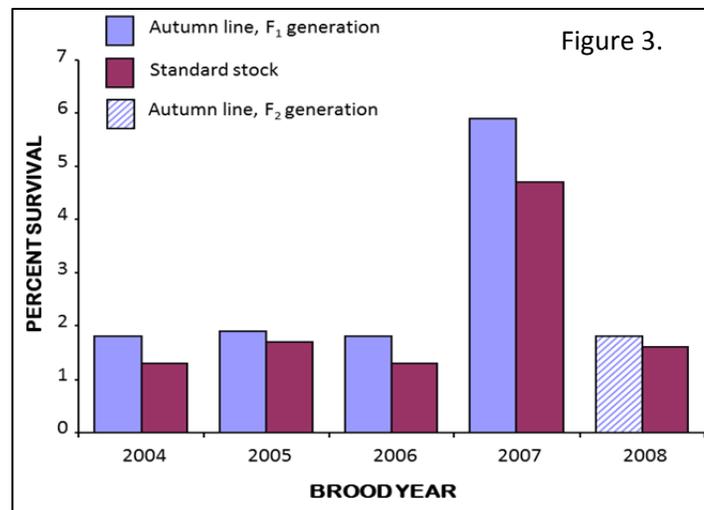


Figure 3.

Chinook salmon coordination) to discuss run status and its potential impacts on hatchery operations and fisheries.

Participation in the teleconference process typically includes Idaho Department of Fish and Game (IDFG), Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, U.S. Fish and Wildlife Service, Nez Perce Tribe, Shoshone Bannock Tribe, and Idaho Power Company.

While PIT tags are an important tool that provide real-time data valuable to researchers and managers, there are shortcomings associated with using the tags as a monitoring tool. Because tags can be shed and survival rates of tagged fish could differ from those of untagged fish, a PIT tagged group could underrepresent the adjacent untagged

population. Underrepresentation has been shown in Chinook salmon. Historically, it had been difficult to determine the rate of tagged fish in adult returns because hand scanning at the hatchery racks is not 100% efficient and the actual efficiency of the hand scanning could not be determined. To get at true tagged proportions in adult returns, IDFG installed in-ladder detection arrays at the Sawtooth Trap (Figure 4). These repeat arrays, coupled with routine hand scanning, allow us to determine overall detection efficiencies and get at the true proportion of tagged fish in the adult return. Through two years of evaluating, results are mixed as to how well returning adult PIT tagged steelhead account for untagged fish based on juvenile tagging rates with uncorrected expansion estimates accounting for 65-140% of the actual return (Figure 5). Much of the variability observed to date is likely directly related to some small sample sizes and continued monitoring of returns to these arrays will provide more insight.

Brood Year	Return Year	Juvenile Expansion Rate	Run At Large PIT Tags at Trap Array	Return to River PIT Tags at Trap Array	Estimated Expanded Return	Actual Return	Corrected Expansion Rate
2007	09/10	108.6	50	19	5,449	5,699	113.6
2007	10/11	113.6	6	0	656	1,003	101.6
2008	10/11	141.3	20	3	2,799	2,000	173.5

Figure 5.

Monitoring and evaluation staff will continue to work towards identifying rates of PIT tag loss and this type of work is ongoing in both steelhead and Chinook salmon. Additional work double tagging Chinook salmon at LGD to evaluate tag loss in adults between LGD and adult traps is also ongoing. Also, the expanded use of parental based tagging (PBT) in the Snake River Basin and at LGD, will provide a tool to directly compare return estimates based on PIT tags versus those generated from genetic sampling and provide another comparison point for estimating the level of representation provided by expanding PIT tags in returning adults.