Use of Passive Integrated Transponder (PIT) Tags as a Tool to Monitor and Manage Adult Chinook Salmon Returns to Idaho

IDFG Response to ISRP Comments

ISRP Comments:

The value of this paper would be greatly enhanced if it reviewed all available literature in an effort to determine PIT tag shed rates for each age class of salmon. What factors contribute to tag loss? Are there methods to minimize tag loss? Continued research into tag loss is critical because many decisions in the Basin are based on PIT tag data. High and variable tag loss could introduce significant error in survival rate estimates, leading to the misinterpretation of data from hydrosystem and supplementation experiments, and from harvest management.

IDFG Response to ISRP comments:

Very little literature exists in regards to adult age- or sex- specific PIT tag retention. At this time, there are two papers that cover this topic to some degree.

Prentice, E. F., D. J. Maynard, S. L. Downing, D. A. Frost, M. S. Kellett, D. A. Bruland, P. Sparks-McConkey, F. W. Waknitz, R. N. Iwamoto, K. McIntyre, and N. Paasch. 1994. Comparison of long-term effects of PIT tags and CW tags on coho salmon (Oncorhynchus kisutch). Pages 123–137 in A study to determine the biological feasibility of a new fish tagging system. Bonneville Power Administration Annual report for 1990–1993, BPA Report DOE/BP-11982-5, Portland, Oregon.

Knudsen, C., M. Johnston, S. Shroder, W. Bosch, D. Fast, and C. Strom. 2009. Effects of Passive Integrated Transponder Tags on smolt-to-adult recruit survival, growth, and behavior of hatchery spring Chinook salmon. NAJFM 29:658-669.

In the Prentice et al. paper, it was determined through double tagging (PIT and CWT) that tag loss was higher in returning age 2 and 3 female Coho salmon than in returning age 2 and 3 males. Adult females showed a 47.9% loss of tags while males only lost 11.3% of their tags (data from two return years). This tag loss appeared to occur primarily during late maturation and it was concluded that females have a much higher rate of tag loss near full maturation due to the fact that female Salmonids drop eggs into their body cavity prior to being expelled through the ovipositor. Because fish are PIT tagged in the body cavity, the PIT tag would be free floating among the eggs and could be expelled as an irritant.

Similarly, we have found through investigations at the South Fork Salmon River ladder array, that there are differential tag loss rates between males and females. For brood years 2005 and 2006 combined, overall tag loss for males was 24.3% while for females it was 52.5% (Figure 7.)

To further investigate, all fish returning in 2011 to the SFSR trap with a PIT tag are being externally marked. When these fish are ripe and removed on spawning days, they will be checked again for tags to see what the rate of PIT tag shedding is in sexually maturing fish that have made it back to hatchery holding. If the majority of tag loss does occur primarily during late maturation as Prentice et al. suggest, then correcting PIT tag expansions at lower Snake River and Columbia River dams based off of adjusted adult tag rates at time of terminal trapping may not be valid and unadjusted expansions at these dams may be more accurate.

Figure 7. Estimated PIT tag loss for brood year 2005 and 2006 SFSR male and female Chinook salmon. Not enough tag recoveries were made to include the 3-ocean component from each brood year.

			1 and 2-Ocean Male Returns				2-Ocean Female Returns			
Brood Year	Return Year	Trap	Males Trapped	Expected CSS/BDL PIT Recoveries	Actual CSS/BDL PIT Recoveries	Estimated PIT Loss	Females Trapped	Expected CSS/BDL PIT Recoveries	Actual CSS/BDL PIT Recoveries	Estimated PIT Loss
2005	2008	SFSR	1,957	93	70	24.85%				
2005	2009	SFSR	1,480	70	53	24.77%	2,170	103	62	39.98%

2006	2009	SFSR	5,295	258	196	23.99%				
2006	2010	SFSR	1,686	82	62	24.49%	3,286	160	63	60.63%

The Knudsen paper did not investigate tag loss by sex but instead looked at tag loss across age classes and over time, using double tagging with PITs and CWT as well. This paper showed that average tag loss was 2.0% in juveniles prior to release, and 18.4% for fish returning 6 months to 4 years after release. This study indicated that most PIT tag loss had occurred within the first 6 months post-release, as no significant loss was observed in older fish. However, fish were examined prior to full development of gametes. The study also showed that due to tag loss and lowered survival of tagged fish, that SARs based on PIT tagged fish were 25% lower than SARs based off of CWT.

Preliminary data from these two papers coupled with preliminary data from IDFG could suggest that there is a differential survival/tag loss resulting in a 25% lower number of PIT tagged fish within the first six months and additional tag loss, up to 35%, occurs in females pre spawn. However, data supporting this conclusion is preliminary and additional years of monitoring are needed.

IDFG agrees that "*Continued research into tag loss is critical because many decisions in the Basin are based on PIT tag data."* And we are currently in the process of adding in-trap array systems to the three Clearwater Fish Hatchery satellite facilities (Powell, Red River, Crooked River) so that we can expand our ability to monitor differential return rates of PIT tagged fish and further investigate potential causes and timing of tag loss and differential survival. Once tag loss is better understood, methods to minimize it will be more attainable.