

Use of PIT tags to determine upstream migratory timing and survival of Columbia Basin sockeye salmon in 2008

Jeffrey K. Fryer
Columbia River Inter-Tribal Fish Commission



Background

- PSC Southern Fund project.
- Goal of this project to PIT tag sockeye salmon at Bonneville Dam as part of our PSC-funded sockeye salmon sampling program.
- PIT tag data can then be used to assess adult sockeye salmon migration, timing, escapement, age composition, stock composition, length composition, mortality, and fallback rates.
- We were also funded by the PSC Letter of Agreement process to PIT tag summer and fall Chinook salmon in 2008. We also PIT tagged spring Chinook.

Methods

- Sockeye salmon were sampled for scales, measured for length, and PIT tagged at the Adult Fish Facility on the Bonneville Dam Washington shore ladder. 2/3 were tagged with 12.5 mm tags and 1/3 with 8.5 mm tags provided by USFWS and USCOE to assess detection of the smaller tags in fish ladders.
- Data on the movement of these fish through dams with PIT tag detectors (Bonneville, McNary, Priest Rapids, Rock Island, Rocky Reach, Wells, Ice Harbor, and Lower Granite dams) was downloaded from www.ptagis.org.



PIT tag detection at mainstem dam fish ladders

- Believed to be virtually 100% (at least for 12.5 mm tags)
- Bonneville, McNary, Ice Harbor, and Lower Granite have a large number of individual detectors, making it possible to determine the direction of fish movement.
- Priest Rapids, Rock Island, Rocky Reach, and Wells dams have minimal detectors

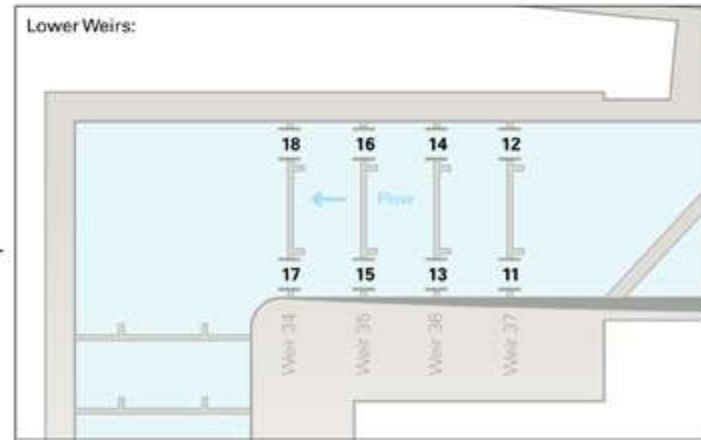
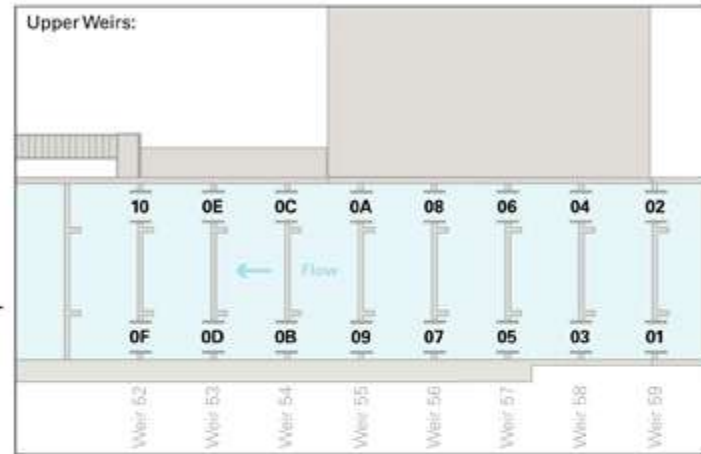
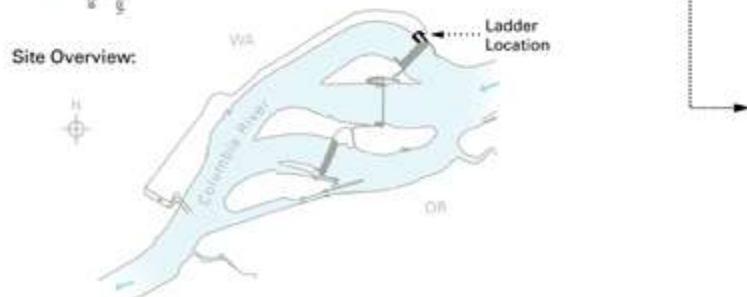
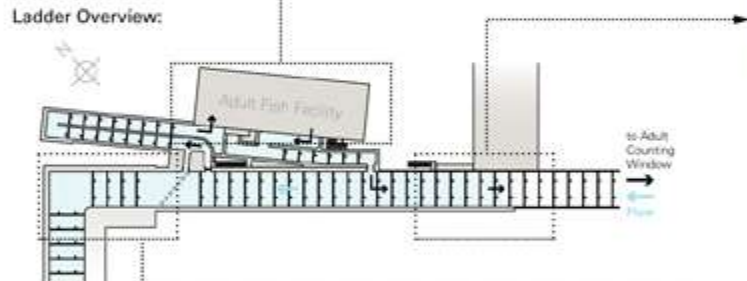
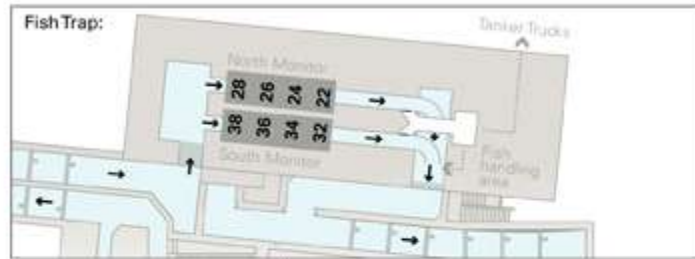
Bonneville Dam-WA shore



PIT Tag Information Systems
Columbia Basin | ptagis.org

Bonneville Dam: Washington Shore Fish Ladder and AFF (BO3)

PIT Tag Interrogation Coil Map: Version 1.2, Cnfg. #110; Revised December, 2003
Orifice Dimensions: 18" wide x 18" high



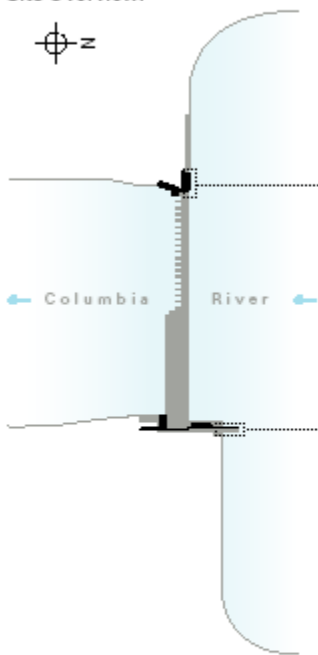
Wells Dam



PIT Tag Information Systems
Columbia Basin

Priest Rapids Dam Fish Ladders (PRA)
Interrogation Coil Map Revised: May, 2003 v.1.0, Crfg. #100

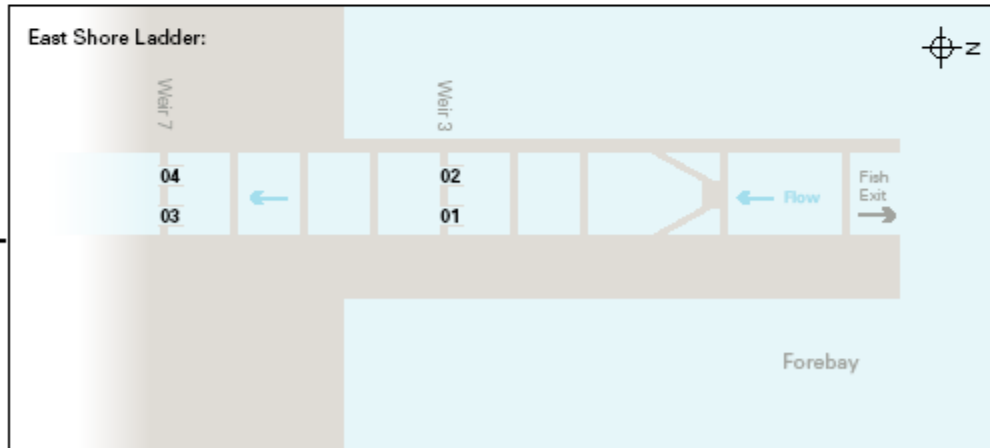
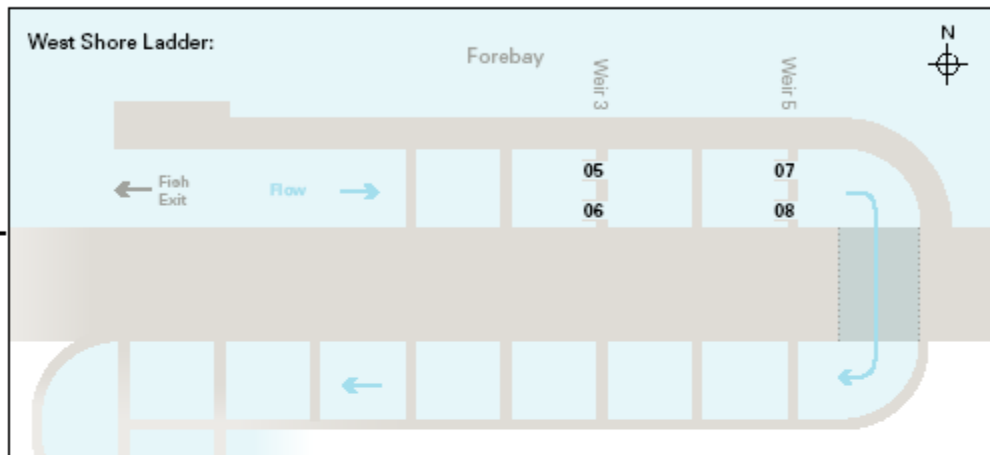
Site Overview:



PIT Tag Antenna Dimensions
two antennas per weir

West Shore (Right) Ladder
Weir 3: 22.5' wide x 43.0' high (ID)
Weir 5: 22.0' wide x 50.0' high (ID)

East Shore (Left) Ladder
Weir 3: 24.0' wide x 55.0' high (ID)
Weir 7: 24.5' wide x 45.0' high (ID)



Results

- PIT tagged 1133 sockeye salmon out of the 1162 we sampled as part of our PSC stock identification project.
- When the sockeye salmon hit Priest Rapids Dam, it was obvious that we had a problem...

PIT Tagged sockeye “missed” at dams

	Chinook	Sockeye			
	2008	2008	2008	2007	2006
Dam	8.5 mm	8.5 mm	12.5 mm	12.5 mm	12.5 mm
Bonneville	3.7%	1.7%	0.4%	2.1%	0.2%
McNary	0.8%	18.2%	10.1%	6.5%	3.1%
Priest Rapids	64.3%	33.7%	0.3%	0.8%	0.0%
Rock Island	41.9%	57.7%	6.9%	6.8%	1.3%
Rocky Reach	12.6%	28.3%	0.2%	0.7%	12.3%
Ice Harbor	3.6%	33.3%	0.0%		

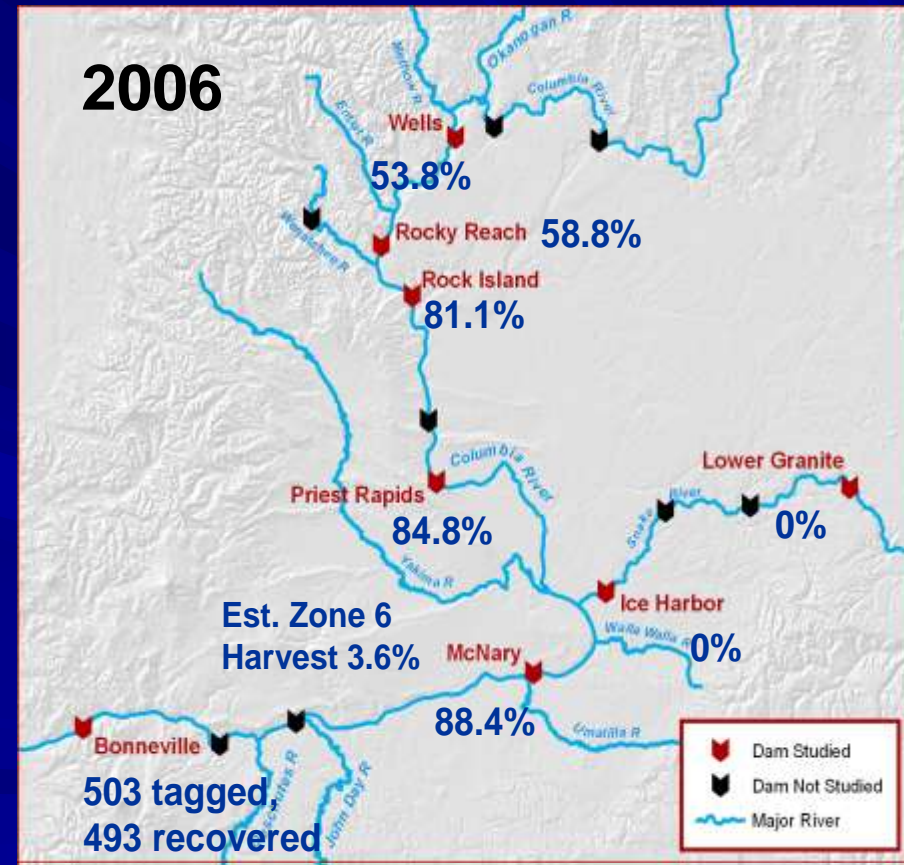
Conclusion:

Don't use 8.5 mm PIT tags if a high detection rate at PRD, RIS, and RRH fish ladders is desired (and possibly WEL and TUM as well).

Only 12.5 mm tag data was used in subsequent analyses. Tag output was 824, of which 813 were recovered.

Percentage of tagged sockeye salmon detected at upstream dams

2008



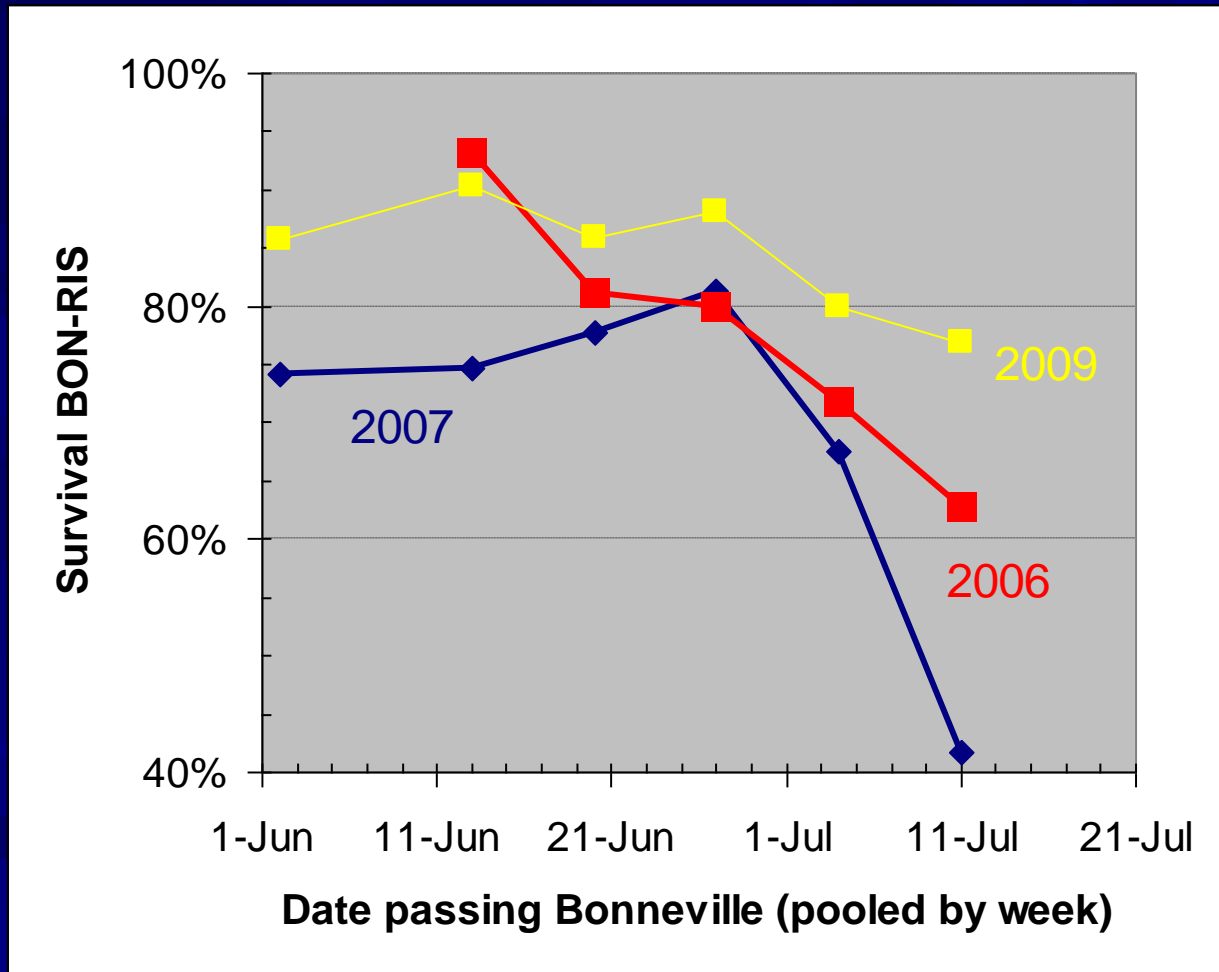
Percent night (2000-0400) passage at dams

Dam	2008 Wenatchee	2008 Okanogan	2007 Okanogan	2006 Okanogan
Bonneville	1.5	2.8	2.4	0.0
McNary-OR shore	3.3	6.0	6.0	5.0
McNary-WA shore	8.8	5.2	6.9	8.7
Priest Rapids	1.5	5.9	6.1	4.8
Rock Island	3.2	4.4	4.8	4.9
Rocky Reach	33.3	8.3	8.8	10.9
Wells	0.0	7.1	15.2	15.9
Tumwater	6.1	NA		

Sockeye fallback at mainstem dams

Dam	2008	2007	2006
Bonneville	0.5%	2.7%	0.2%
McNary	1.1%	0.2%	0.5%
Priest Rapids	1.6%	3.0%	0.8%
Rock Island	1.0%	1.2%	1.0%
Rocky Reach	4.0%	1.0%	1.5%
Wells	0.7%	2.7%	3.3%
Tumwater	1.5%		
Ice Harbor	0.0%		
Lower Granite	33.3%		

Upstream survival through selected reaches



Sockeye Escapement at Mainstem Dams as estimated using PIT tags and Visual Fish Counts

Dam	PIT Tag Estimate	Visual Fish Ladder Count	% difference
Bonneville	0	213,500	
McNary	191,000	147,000	29.9%
Priest Rapids	184,000	197,000	-6.6%
Rock Island	183,000	194,000	-5.7%
Rocky Reach	164,000	161,000	1.9%
Wells	160,000	165,000	-3.0%
Tumwater	20,000	28,000	-28.6%
Ice Harbor	600	500	20.0%
Lower Granite	600	900	-33.3%

Travel time between dam pairs

Dam pair	Dis- tance (km)	Median time (days)	2008 Median travel time (km/day)	2007 Median travel time (km/day)	2006 Median travel time (km/day)
Bonneville-McNary	231	5.7	40.3	47.3	46.1
McNary-Priest Rapids	167	4.6	36.4	34.3	37.2
Priest Rapids-Rock Island	89	3.2	28.2	24.5	22.6
Rock Island-Rocky Reach	33	1.1	30.7	21.3	24.4
Rock Island-Tumwater	73	11.6	6.3		
Rocky Reach-Wells	65	2.2	29.3	28.2	22.7
Bonneville-Rock Island	487	14.0	34.7	35.1	34.9
Bonneville-Wells	585	15.2	32.5	32.8	32.2

Time spent at mainstem dams

	2008		2007	2006
Dam	Median Passage Time (minutes)	Taking more than 12 hours (%)	Taking more than 12 hours (%)	Taking more than 12 hours (%)
Bonneville	76	6.9	15.8%	6.8%
McNary	0	1.4	1.8%	3.2%
Priest Rapids	6	0.6	2.4%	2.4%
Rock Island	3	0.3	1.2%	1.8%
Rocky Reach	2	1.0	1.2%	2.7%
Wells	2	0.8	1.7%	4.8%
Tumwater	6690 (4.6 d)	62.1	(16.0d for Spring Chinook, 0.9d for Summer Chinook)	

Stock Composition Estimates

Statistical Week	Wenatchee (%)	Okanogan (%)	Snake (%)
22-23	0.0	100.0	0
24	7.1	92.9	0
25	10.9	89.1	0
26	14.4	85.6	0
27	15.1	82.4	2.5
28	5.3	94.7	0
29	6.9	93.1	0
Composite	12.3	87.4	0.4
Dam Counts (WEN=RIS-RRH)	16.7	83.3	82.3
Dam Counts (WEN=Tumwater)	14.9	85.1	81.9

2008 Age Composition Estimates

	Age					
	1.1	1.2	1.3	2.1	2.2	2.3
Wenatchee PIT tag		87.7 4.4	4.8 2.9		5.5 3.2	2.0 1.5
Wenatchee-Tumwater		90.3 1.8	1.0 0.6		8.6 1.7	0.1 0.1
Okanogan PIT Tag	7.4 1.0	86.4 1.4	0.7 0.4	2.3 0.7	3.2 0.8	
Bonneville Dam	7.1 0.8	87.4 1.1	0.5 0.2	1.7 0.5	3.1 0.6	0.1

What worked and didn't work in 2008

- We sampled lots of fish. Unfortunately, 1/3 of them were largely thrown out due to problems detecting 8.5mm tags in the mid-Columbia.
- Compared to last year, this study had far fewer mortalities (0 vs. 4) and fish not detected after release (1.3% vs. 7.6%)
- Video worked well for validating fish lengths and PIT Tag codes (but could work better!)



Sockeye Stories

- Five sockeye fell back through the John Day juvenile bypass and one through Bonneville Dam
- Two sockeye passed Rocky Reach Dam and ended up at Tumwater, one passed Wells and ended up at Tumwater.
- Six tagged sockeye salmon passed Snake River dams. All six were tagged the week of June 29, five were detected passing Ice Harbor the following week, and five of six passed Lower Granite within six days (July 10-15). The age composition was 66.7% Age 1.1, 16.7% Age 2.2, and 16.7% Age 1.2. Two were ad clipped only, two were AD+RV clipped, and one was AD+RP clipped.
- PIT tags of 48 cm sockeye tagged June 12 and a 52.5 cm fish sockeye tagged June 16 were recovered at the Badger Island Pelican colony. Another was recovered in the Zone 6 tribal fishery.

Conclusions

- 8.5 mm tags don't work at PRD, RIS, RRH adult ladders (and there may be problems at TUM and WEL, and possibly at MCN and IHR with sockeye).
- This study uncovered the extent of delays at Tumwater Dam.
- Once again, study results indicate that upstream survival decreases as the migration progresses at Bonneville Dam. Unlike the 2006 and 2007, there was not a trend in the stock composition as the migration progressed.
- A technical report describing results of this year's study will be available later this month at www.critfc.org/tech/tech_rep.html.
- Next year's tagging will be conducted as part of an MOA project.