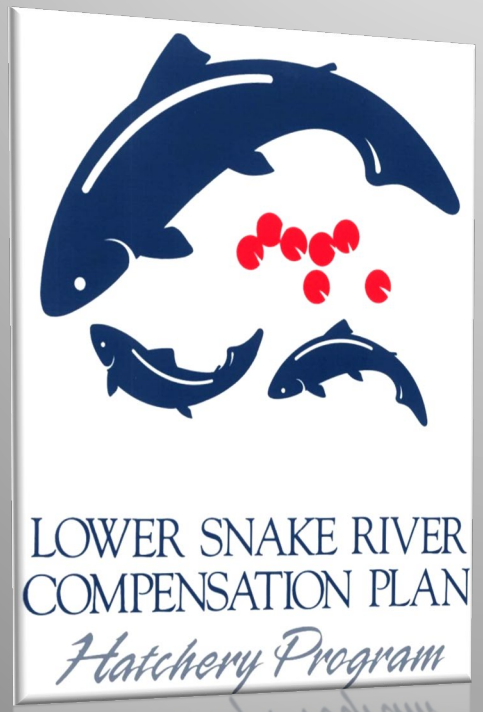
The Use of Passive Integrated Transponder (PIT) Tags as a Tool to Monitor and Manage Steelhead



John Cassinelli
Carl Stiefel
Regional Fisheries Biologists
Idaho Department of Fish and Game

LSRCP Program Review
Clarkston, Washington
June 20th and 21st, 2012

Brief History

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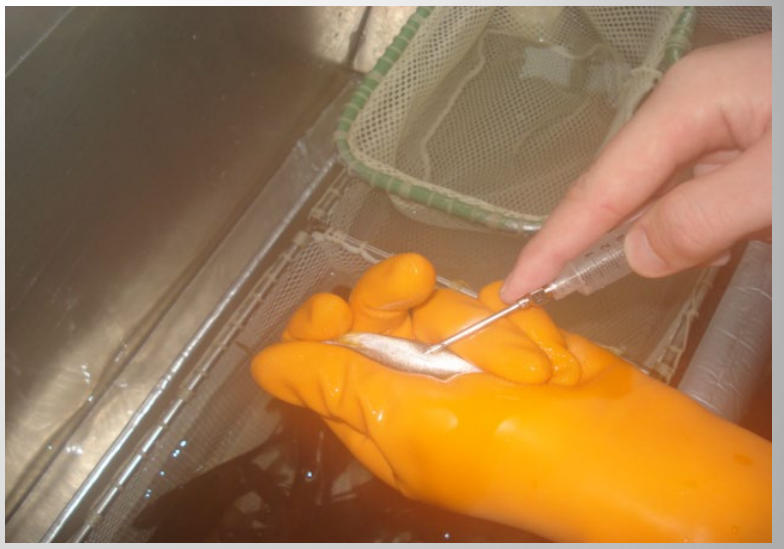
- **In more recent years, PIT tags have been more readily used in evaluating returning adult numbers and behavior**

Current PIT Tag Uses in Steelhead



PIT Tag Uses in Juveniles

PIT Tag Uses in Juveniles

- **Juvenile survival estimates and travel times from release to LGD**

IDFG juvenile hatchery steelhead release summary (release year 2011).

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	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)**

PIT Tag Uses in Juveniles

- **Juvenile survival estimates and travel times from release to LGD**

Little Sheep Cr. (OR) acclimation facility early, middle, and late volitional release comparisons.

Travel Time to LGR			
BY	**Early**	**Middle**	**Late**
2008	38.9 days	39.0 days	43.2 days
2009	41.9 days	48.6 days	57.1 days

Outmigration % detected at LGR			
BY	**Early**	**Middle**	**Late**
2008	36.4%	34.5%	28.8%
2009	17.30%	17.30%	18.70%

Smolt-to-Adult Survival 1-salt fish only for RY 2009			
BY	**Early**	**Middle**	**Late**
2008	2.00%	2.14%	0.81%
2009	1.54%	1.13%	1.17%

PIT Tag Uses in Juveniles

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PIT Tag Uses in Juveniles

- **Cooperative work with the Comparative Survival Study**
  - **Survival related to migration route and subsequent SAR's**

Estimated LGR-to-GRA SAR (%) for PIT-tagged hatchery steelhead in annual aggregate by juvenile outmigration type from 1997 to 2008

Mig. Year	SAR(T0) %	SAR(C0) %	SAR(C1) %
1997	0.52 (0.24 – 0.81)	0.24 (0.09 – 0.39)	0.17 (0.12 – 0.22)
1998	0.51 (0.22 – 0.84)	0.89 (0.61 – 1.19)	0.22 (0.17 – 0.28)
1999	0.90 (0.51 – 1.33)	1.04 (0.79 – 1.31)	0.59 (0.51 – 0.69)
2000	2.10 (1.22 – 3.07)	0.95 (0.71 – 1.19)	1.05 (0.92 – 1.18)
2001	0.94 (0.24 – 1.78)	{Assume =SAR(C1)}	0.016 (0.005 – 0.03)
2002	1.06 (0.32 – 2.11)	0.70 (0.54 – 0.88)	0.73 (0.61 – 0.85)
2003	1.81 (1.50 – 2.13)	0.68 (0.52 – 0.86)	0.37 (0.26 – 0.47)
2004	2.13 (1.17 – 3.27)	0.21 A (0.15 – 0.26)	
2005	2.03 (1.28 – 2.83)	0.24 A (0.18 – 0.30)	
2006	2.14 (1.49 – 2.84)	1.42 (0.94 – 1.93)	1.23 (1.06 – 1.41)
2007	1.94 (1.51 – 2.38)	1.17 (0.96 – 1.38)	0.92 (0.78 – 1.07)
2008	3.39 (3.23 – 3.55)	2.77 (2.63 – 2.90)	2.76 (2.55 – 2.96)
12-yr avg.	**1.62 (1.16 – 2.08)**	**0.86 (0.46 – 1.26)**	**0.71 (0.30 – 1.12)**

From COMPARATIVE SURVIVAL STUDY (CSS) of PIT-tagged Spring/Summer Chinook and Summer Steelhead 2011 Annual Report




Adult Tag Monitoring

Bonneville, McNary, Ice Harbor, and Lower Granite dams


PIT Tag Uses in Adults

- **Escapement to Bonneville, McNary, Ice Harbor, and Lower Granite dams**

Summary of expanded PIT tag estimates for one- and two-ocean (Brood Year 2008 and 2007) steelhead returning to Bonneville Dam by hatchery and stock.

Hatchery	Stock	1-Ocean	2-Ocean	Total
Clearwater	DWOR	485	11,473	11,958
	Clearwater Total	**485**	**11,473**	**11,958**
Hagerman	DWOR	88	1,014	1,102
	PAH	2,895	1,327	4,222
	SAW	14,070	6,163	20,232
	Hagerman Total	**17,052**	**8,504**	**25,556**
Magic Valley	DWOR	302	2,927	3,229
	EFNAT	313	1,043	1,357
	PAH	5,876	1,704	7,580
	SAW	4,618	3,202	7,820
	USAL	61	826	887
	Magic Valley Total	**11,170**	**9,702**	**20,872**
Niagara Springs	OX	16,238	-	16,238
	PAH	27,261	-	27,261
	Niagara Total	**43,499**	**-**	**43,499**
	Grand Total	**72,207**	**29,678**	**101,885**

PIT Tag Uses in Adults

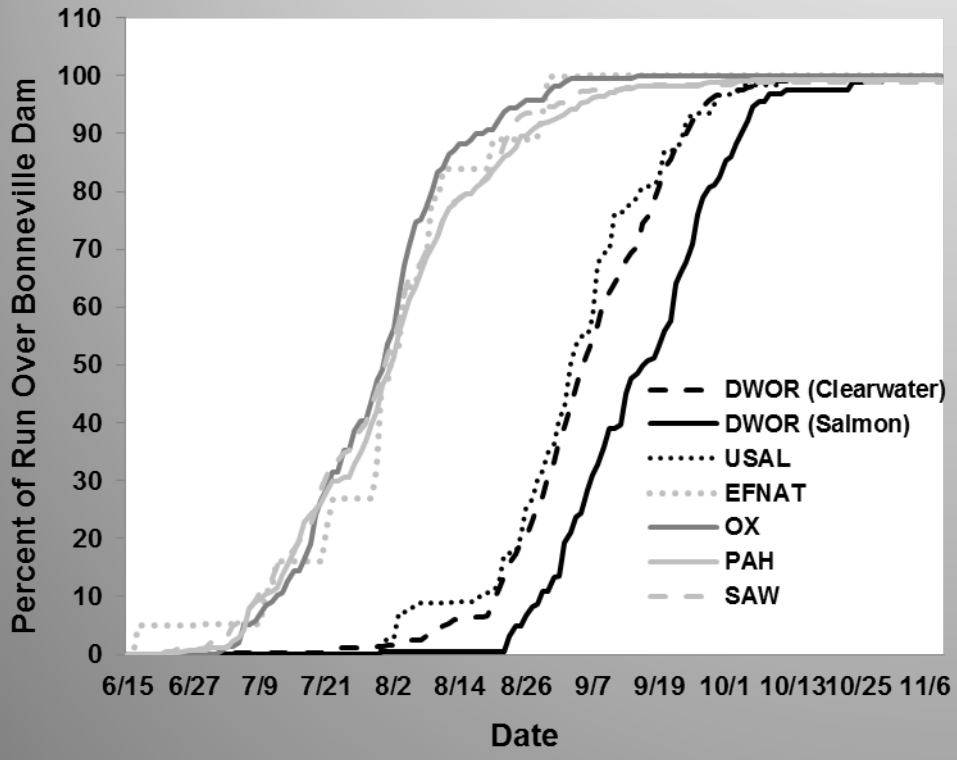
- **Conversion rates between dams and back to racks**

	(%) Bonneville to McNary		(%)Bonneville to Lower Granite	
	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

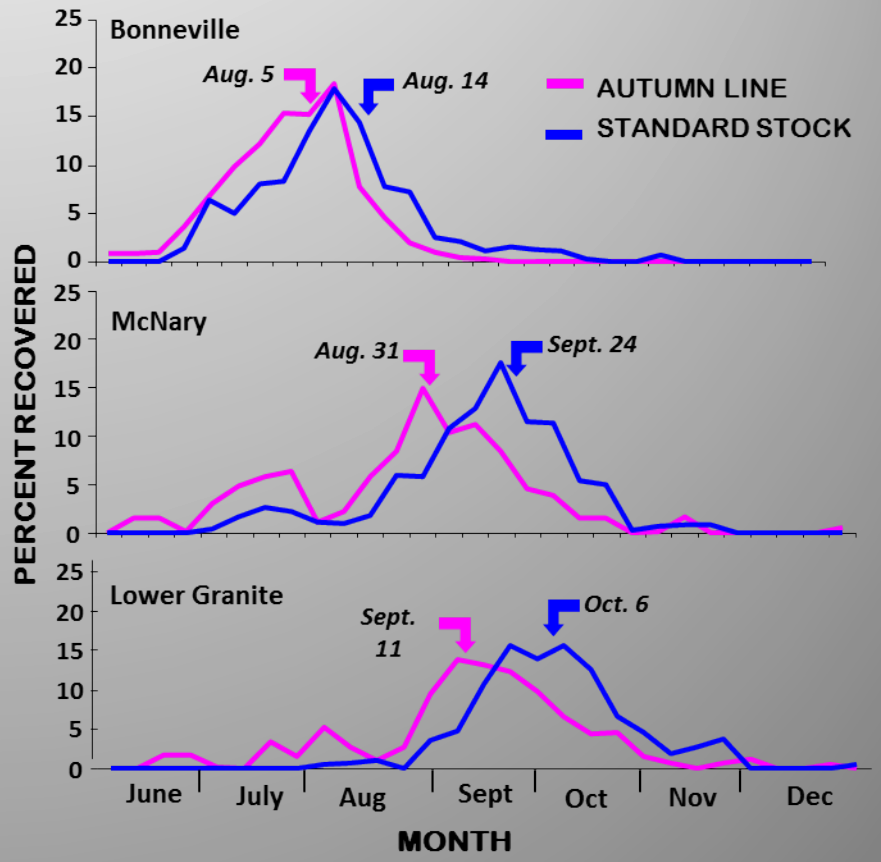
PIT Tag Uses in Adults

- **Migration timing**

IDFG 2011 summary of stock-specific adult migration timing over Bonneville Dam



ODFW adult return timing of F1 Generation of Wallowa broodstock collection experiment



PIT Tag Uses in Adults

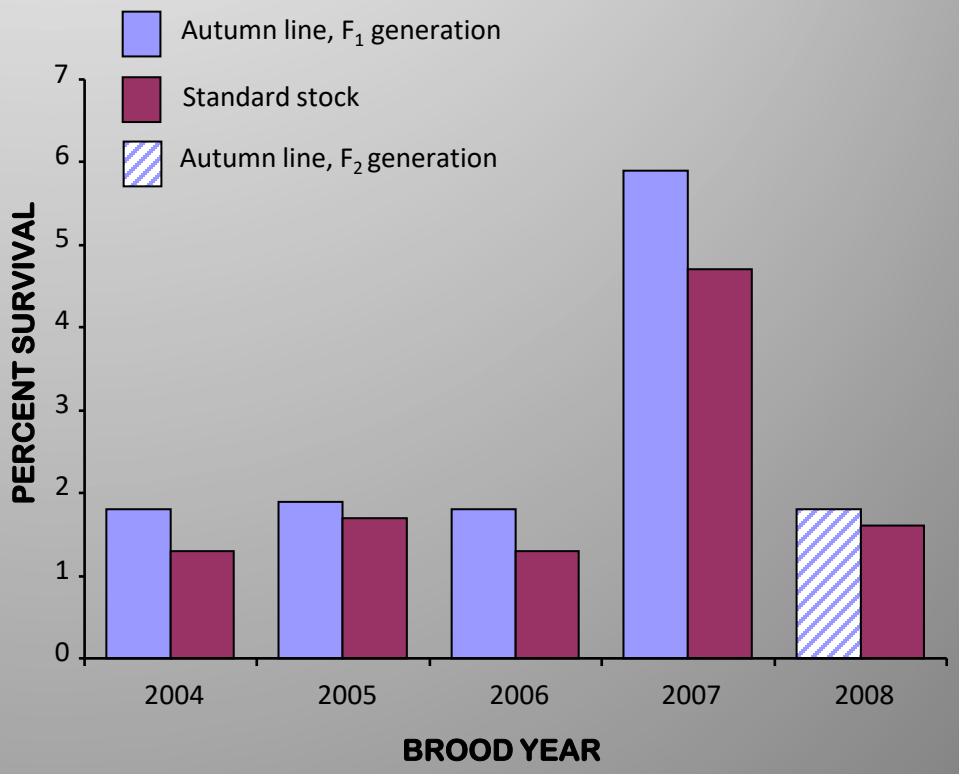
- **Relative SAR's between hatcheries, stocks, and release sites**

Aggregate Snake River Basin hatchery Steelhead

Juvenile Migration Year	Smolts Arriving @ LGD	LGR-to-GRA		
		SAR Estimate	90% LL	90% UL
1997	24,710	**0.39**	0.23	0.57
1998	23,507	**0.56**	0.31	0.85
1999	27,193	**0.92**	0.59	1.28
2000	24,565	**1.89**	1.16	2.68
2001	20,877	**0.92**	0.24	1.74
2002	20,681	**0.95**	0.4	1.72
2003	21,400	**1.46**	1.24	1.68
2004	17,082	**2.08**	1.14	3.19
2005	19,640	**1.83**	1.17	2.55
2006	13,473	**1.96**	1.32	2.62
2007	21,828	**1.64**	1.37	1.92
2008	16,858	**4.53**	4.24	4.82
2008	12,468	**4.5**	4.14	4.83
2008	17,429	**4.93**	4.66	5.25
2008	18,369	**1.05**	0.92	1.17
2008	24,718	**1.41**	1.29	1.54
2008	89,884	**3.08**	2.97	3.18
geomean (97-08)		**1.27**		

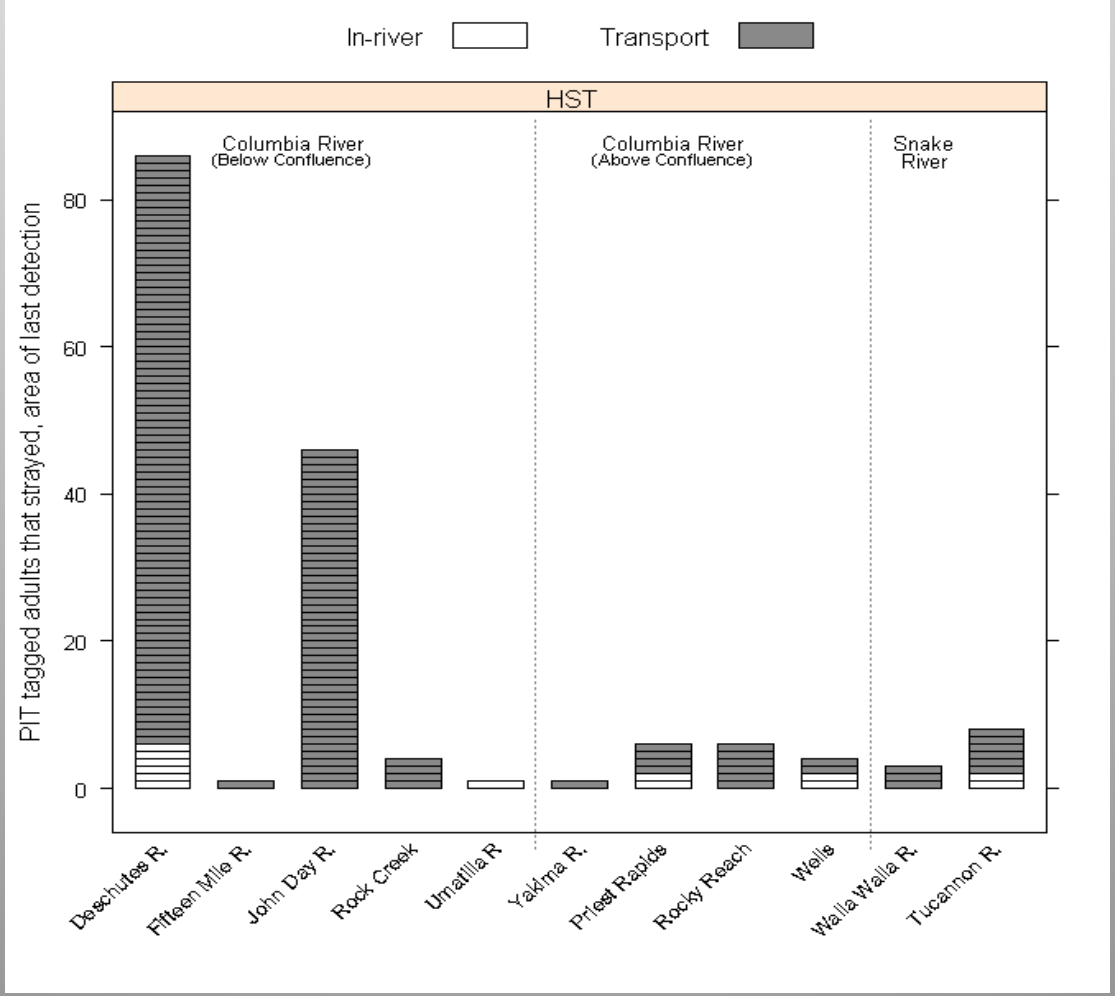
From COMPARATIVE SURVIVAL STUDY (CSS) of PIT-tagged Spring/Summer Chinook and Summer Steelhead 2011 Annual Report

ODFW SAS of Wallowa broodstock collection experiment



PIT Tag Uses in Adults

- **Stray/wandering rates**



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PIT Tag Uses in Adults

- **Fallback/reascension rates and after-hours passage**

Detections of one-ocean PIT tagged steelhead during the 2009/2010 run and reascension rates at Lower Granite Dam.

Hatchery	Stock	PIT Detections	Fallback / Reascension	Percent
Clearwater	DWORB	20	1	5.0
Hagerman	DWORB	23	0	0.0
National	PAHA	253	5	2.0
	SAWA	471	8	1.7
Magic Valley	DWORB	10	0	0.0
	EF Nat.	18	1	5.6
	PAHA	200	2	1.0
	SAWA	166	3	1.8
	USALB	14	0	0.0
	Total	**1,199**	**21**	**1.7**

PIT Tag Uses in Adults

- **In-season coordination of anticipated abundance of hatchery returns by release site**

2011 LGD Estimates

Idaho Estimates	Stock	1-Ocean	2-Ocean	3-Ocean	Total
CLFH	DWOR	1,845	5,320	112	7,278
	CLFH Total	**1,845**	**5,320**	**112**	**7,278**
DNFH	DWOR	683	15,577	750	17,010
	DNFH Total	**683**	**15,577**	**750**	**17,010**
HNFH	DWOR	0	1,120	0	1,120
	PAH	0	632	0	632
	SAW	12,907	2,269	0	15,176
	EF NAT.	854	NA	NA	-
	HNFH Total	**13,761**	**4,021**	**0**	**17,782**
MVFH	DWOR	302	2,240	0	2,542
	EF Nat.	NA	310	69	-
	PAH	13,421	1,347	0	14,767
	SAW	2,411	1,400	119	3,929
	USAL	152	405	14	571
	MVFH Total	**16,285**	**5,702**	**201**	**22,188**
NISP	OX	11,114	7,124	NA	18,239
	PAH	16,374	2,871	NA	19,245
	NISP Total	**27,488**	**9,996**	**NA**	**37,484**
	Idaho Total	**60,062**	**40,616**	**1,063**	**101,741**
Oregon Estimates	**Stock**	**1-Ocean**	**2-Ocean**	**3-Ocean**	**Total**
WALA	WAHL	5,001	2,594	**NA**	7,595
	SHEEP	2,132	434	**NA**	2,566
	Oregon Total	**7,133**	**3,028**	**NA**	**10,161**
Washington Estimates	**Stock**	**1-Ocean**	**2-Ocean**	**3-Ocean**	**Total**
LFH	LFH	2,982	669	**NA**	3,651
	WAHL	2,394	880	**NA**	3,273
	TUCAN	173	0	**NA**	173
	TOUCH	0	6	**NA**	6
Washington Total		**5,548**	**1,555**	**NA**	**7,103**
Hatchery Steelhead Grand Total		**72,743**	**45,199**		**119,005**

Coordination

- Teleconference calls are held through the fall to discuss run status (in conjunction with fall Chinook coordination)
- In-season run status can have implications on hatchery operations and fisheries
- Participation typically includes IDFG, ODFW, WDFW, USFWS, NPT, SBT, and IPC

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- **This process enables the most up to date in-season estimates to be available for all co-managers and for real time management decisions to be made**

What are Potential Shortcomings?

- **Expanding PIT tagged adults by juvenile tagging rates could underestimate the return (well documented in Chinook)**

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What are Potential Shortcomings?

- Expanding PIT tagged adults by juvenile tagging rates could underestimate the return (well documented in Chinook)
- Tags are shed and there is the possibility for differential survival between tagged and untagged fish resulting in lower representation of tagged fish in the returning population
- **Historically, rates of tagged fish in adults have been difficult to determine because hand scanning at hatchery racks in not 100% efficient**

How are we Addressing Issues?

- **To get at true tagged proportions in adult returns, we have installed in-ladder detection arrays at the Sawtooth Trap**

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- **Through two years of evaluating, initial results are mixed as to the how well returning adult PIT tagged steelhead account for untagged fish based on juvenile tagging rates**

How are we Addressing Issues?

Return year 2009/2010 corrected expansion rate for the Sawtooth Weir steelhead release group derived from the in-ladder PIT tag array at the Sawtooth trap.

Brood 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	108.6	50	19	5,449	5,699	113.6

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Brood 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
2008	141.3	20	3	2,799	2,000	101.6
2007	113.6	6	0	656	1,003	173.5

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- In-season estimates coupled with weekly conference calls allow for more accurate and timely management decisions and better multi-agency coordination.
- **Variation in the tagged to untagged ratio between juvenile releases and returning adult PIT tagged steelhead is still unclear and may be variable across return years, ages, and stocks. Evaluation is ongoing.**

Acknowledgments

LSRCP

IPC

ODFW - Lance Clarke

WDFW - Joe Bumgarner

NPT

SBT

IDFG

Regional Staff

Hatchery Staff

Research Staff

PSMFC

Questions?