Adult Salmon PIT Systems and Performance Monitoring in the Columbia River Basin

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Chronology of Adult Salmon PIT Systems Activation at Columbia River Basin Dams

BONNEVILLE DAM

- 1998 - AFF flumes.
- 2002 – BI & CI ladder orifices.
- 2003 - WA shore ladder orifices.
- 2005 - WA shore ladder 4 vertical exit slots.
- 2006 - Bradford Is. Ladder 4 vertical exit slots.

MCNARY DAM

- 2002 - Both ladders paired orifices and OR window.
- 2007 - North ladder exit area.

ICE HARBOR DAM

- 2003 - Both ladders exit areas, 4 weirs/ladder.

LOWER GRANITE DAM

- 1988 - Adult trap.
- 2003 - Ladder exit area, 4 weirs.

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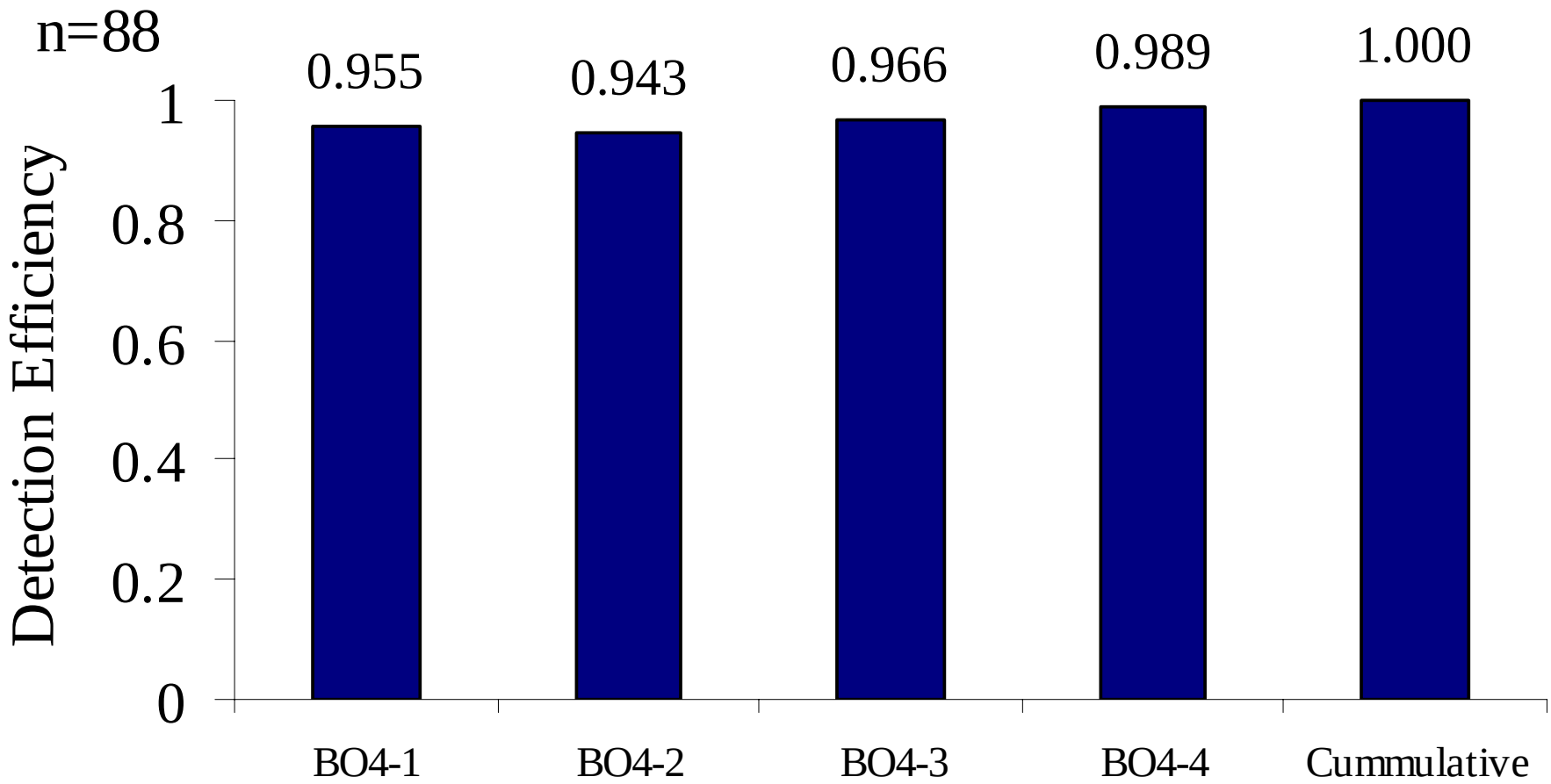
BON WA Exit Slot Adult SP/SU Chinook PIT Detection Efficiency: May & June 2005



Northwest Fisheries Science Center

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Chronology of Adult Salmon PIT Systems Activation at Columbia River Basin Dams

PRIEST RAPIDS DAM

- 2003 - Both ladders, paired weir orifices.

PROSSER DAM

- 2004 - Two at count window.

ROCK ISLAND DAM

- 2003 - East ladder weir orifices.
- 2005 - Other 2 ladders weir orifices.

WELLS DAM

- 2002 - Both ladders, paired weir orifices.

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Adult Performance Requirements: Excerpt from 2004 BIOP

"10.5.1.1.5. Monitor Adult Survival. The Action Agencies will **estimate adult survival annually** from Bonneville to Priest Rapids and Lower Granite dams for Upper Columbia and Snake River ESUs, respectively. This information will be included in the annual progress reports, including estimates in Table 10.2."

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Adult Performance Requirements: Excerpt from 2005-2007 Implementation Plan

- **Performance Section, Annual Progress Reports, p.8:** ***"Adult and Juvenile Fish Survival Through the Hydrosystem*** • Report on adult and juvenile system survival estimates based on the best available empirical survival data. "
- **Incidental Take Section, RPAs, Monitoring Take, p.65.** "…Starting in 2005, with the addition of PIT-tag monitors located in the adult ladder systems, adult survival rates will be calculated."

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PIT Tag adequate stocks as juveniles 2+ years ahead

DETECTION SYSTEM NEEDS:

1. Adequate detection rate
2. Directionality
3. Adequate redundancy

Trib detectors (Deschutes, John Day Klickitat, White Salmon, Wind Rivers)

OCEAN

Returning PIT tagged Adults

BON Dam Adult PIT Starting Population

Harvest Rates
Straying Rates

MCN Dam Adult PIT Detections

Harvest Rates
Straying Rates

SURVIVAL CHECK POINT FOR UC ESU STOCKS

Yakima River & Priest Rapids Detectors

IHR Detectors

Harvest Rates
Straying Rates

LGR Dam Adult PIT Detections

Upstream Trib or

Spawning ground detections

SURVIVAL CHECK POINT FOR SNR ESU STOCKS

ADDIONAL INFORMATION:

1. Stock specific SAR information
2. Stock specific Jack returns
3. Ladder reascensions

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Advantages of PIT based Estimates

- Larger *n* for ESUs index stocks with adequate juvenile tagging effort.
- No adult tagging/handling.
- SAR, reascension, jack return data also obtained.
- Low cost after initial investment.
- Near real time data access.

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Hydro-system Survival Estimates Using PIT Data

1. Query PTAGIS for desired sample of those detected in the ladders at BON and end dam, e.g., LGR.
   - SNR sp chinook (kilometer starting with “522”).
   - Adults (2+ years after DS migration date).
2. Calculate an unadjusted system survival rate, S, as # @ LGR/ # at BON
   - Assumes a 100% detection rate at LGR
3. Calculate survival rate variance and 95% CI . Formula is from Burnham et al 1987 (p. 115).

   $V(s) = S^2 * [1/\#(LGR) – 1/\#(BON)]$

   95% CI on S = $(+/- 2* V(s)^{0.5})$.
4. Add estimates for *harvest* (TAC estimates for zone 6) & *straying* to obtain performance standard equivalent.

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Adult Performance Requirements: Adjustments for Straying

- System survival goals include harvest and straying estimates as corrections.
- Existing straying estimates based on 3 years of known source RT fish data.
- PIT tagged fish monitoring at dams cannot estimate straying.
- Undetected straying fish will be called an unaccounted loss toward hydro-system survival goals (up to 10% or more for some stocks).

Mean Straying Rates for Salmon Species (RT –based 2000-2003)

Sp/Su Chinook - 2%

Fall Chinook - 4%

Summer Steelhead - 7%

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Straying Rates: Steelhead 2000-2002 Combined RT Results

		STRAY RATE
STOCK	n	%
All Steelhead	1414	6.8%
Snake River	905	5.6%
Clearwater River	61	1.6%
Upper Columbia R.	469	7.0%
Rock Island Dam	76	7.9%
Rocky Reach Dam	64	18.8%
All Wells Hatchery	329	4.6%

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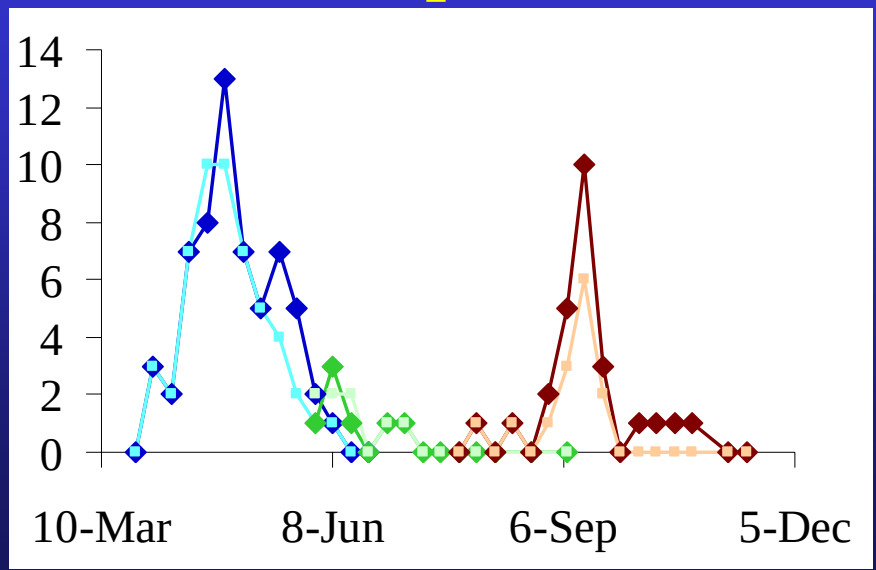
PIT Based Ladder Reascensions and Adult Fallback

- Algorithm-based model for repeat ladder passage.
- FALLBACK surrogate.
  - Important for count corrections and to monitor passage problems.
  - No consistent relationship between FB and reascension; varies with time and species.
  - Misses fallbacks without reascension; overshoots, strays, &navlock passage.



Development of PIT-tag Detectors to Investigate Straying in the Lower Columbia River

Trib PIT Detection Goal

- Establish PIT-tag detectors in selected tributaries to the lower Columbia River to provide data for determination of permanent straying rate of adult salmon and steelhead.

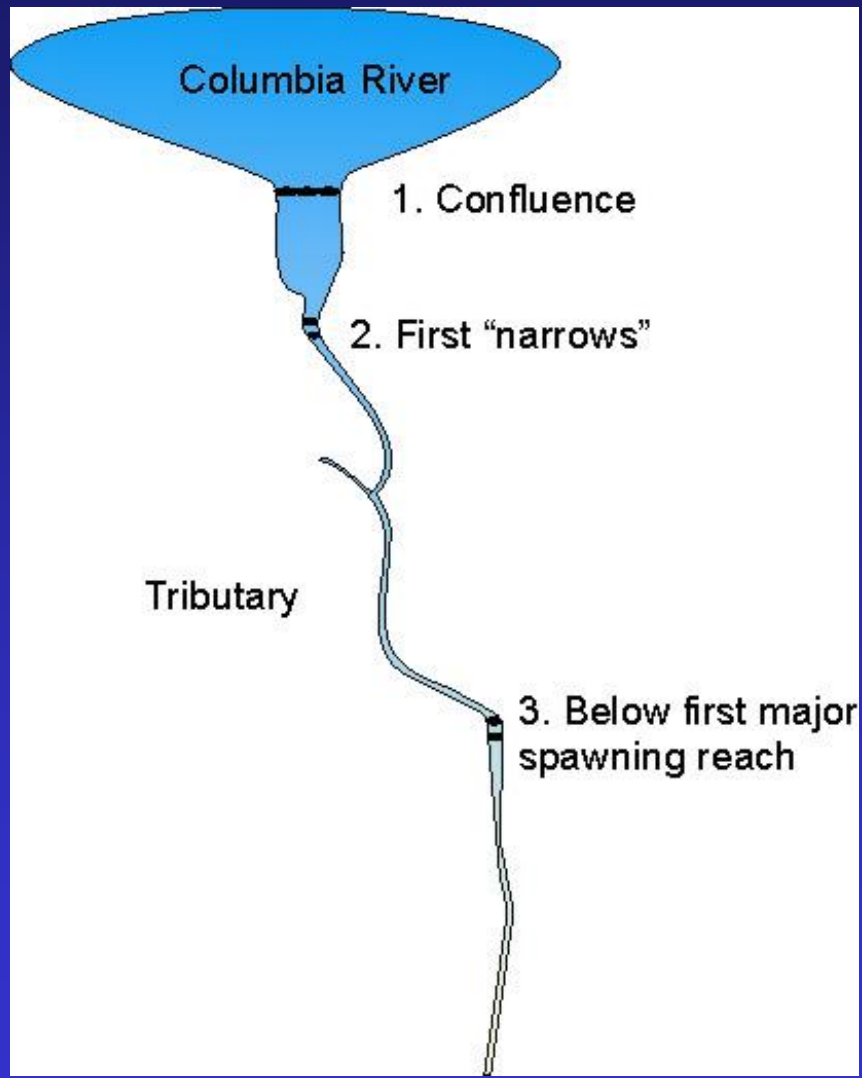
Project Objectives

- Identify candidate river(s), and sites, to monitor straying of adult salmon and steelhead.
- Design, construct, and install PIT-tag detectors at selected sites.
- Characterize performance in laboratory and field.

Multiple Antenna System

Project Approach

- **Use RT data to select river(s)**
- Three potential sites
  - 1. Confluence
  - 2. First “narrows”
  - 3. Below first major spawning reach
- **Two arrays at sites 2 and 3**
  - Adapt adult ladder for needed DE
  - Infer direction of passage



Problems With BON Orifice Adult PIT Tag Detection System

- 20-25% of the fall chinook and coho salmon & 10% of steelhead were not detected in the Washington Shore Ladder because fish avoided 8 consecutive orifice detectors.
- Location of antenna in lower part of ladder made passage and reascension more difficult to determine with PIT only data.

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RT vs. PIT Adult Performance Standard Results - SR Sp/Su Chinook

	RT-Based			PIT - Based	
Year	**Esc 3**	**Stray**	**Harvest**	**Esc 3**	**Harvest***
2000	***78%***	0%	0%	***86%***	7.2%
2001	***95%***	2%	12%	***94%***	14%
2002	***90%***	1%	12%	***87%***	12.4%
2003	92%	-	-	-	-

•= Zone 6 TAC estimates based on population at
•Bonneville Dam.

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