Variation in Straying Patterns and Rates of Snake River Hatchery Steelhead Stocks in the Deschutes River Basin, Oregon

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Presentation Outline

- Management issues
- History of straying into the Deschutes River Basin
- Study objectives and methods
- Stock specific stray rate comparisons
- Stock specific temporal and spatial straying patterns
- Factors influencing straying
- Summary and conclusions

Management Issues

- **Mid Columbia steelhead listed as threatened under Federal ESA with the Deschutes population considered an important component of the ESU.**
- **Hatchery strays comprise a substantial proportion of the harvest and recoveries at hatchery collection sites.**
- **Deschutes steelhead population considered at high risk of extinction due to abundance of stray hatchery fish (Chilcote 2001).**

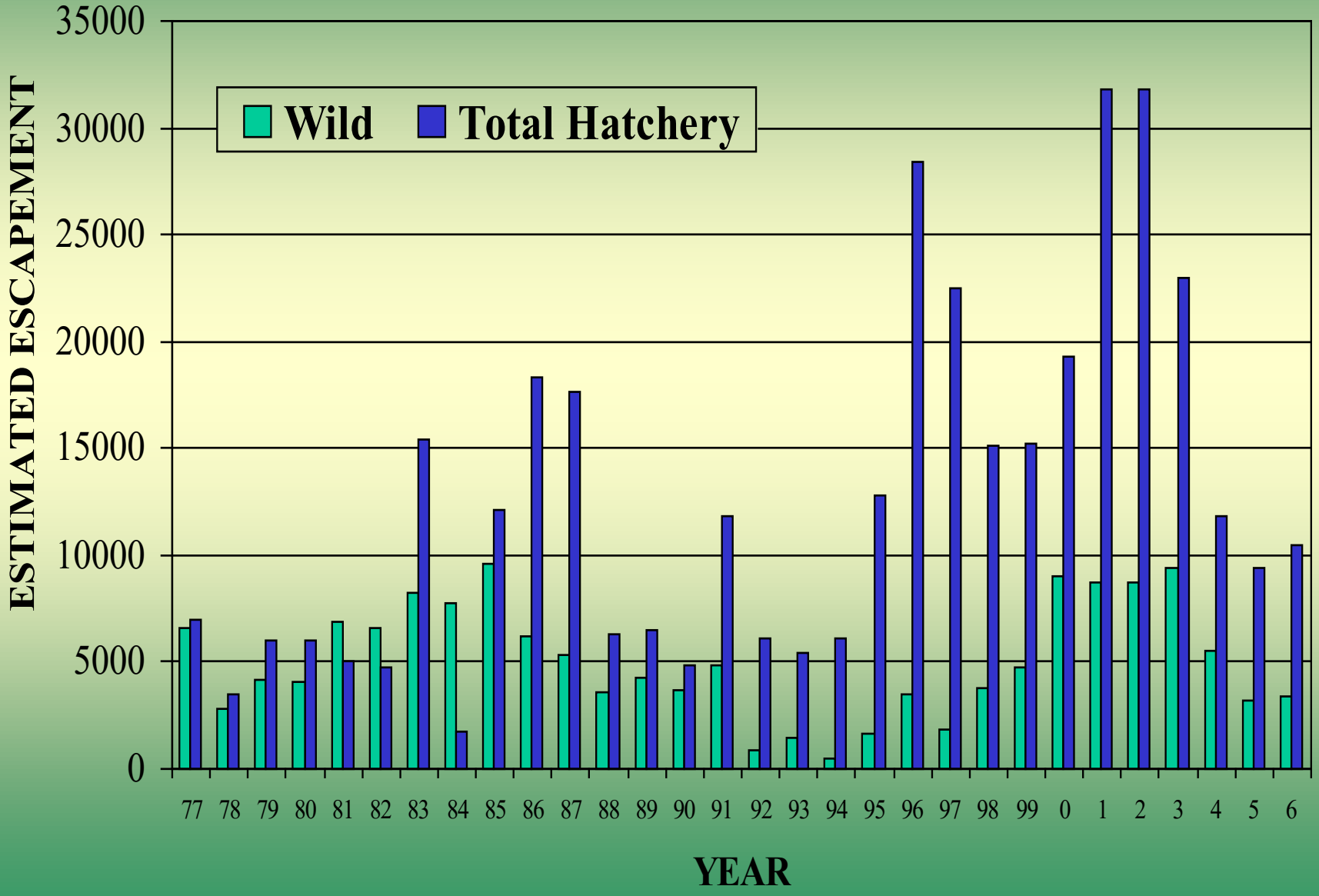
Management Issues

- **NMFS Hatchery Biop Conservation Recommendations for ODFW include "work with other fisheries managers to address the problems of Snake River Steelhead straying into the Deschutes River".**

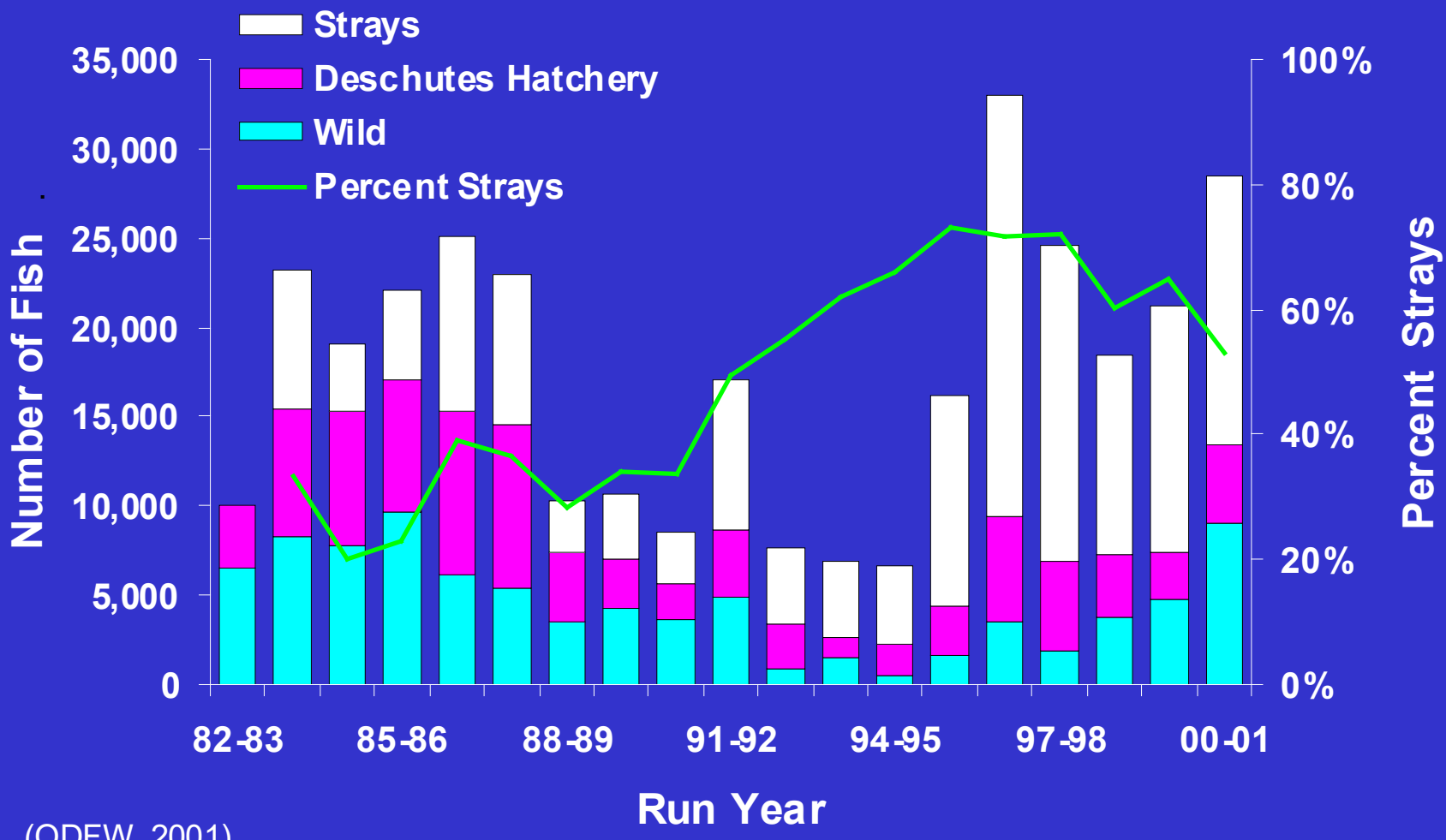
- **Oregon's Mid-Columbia River Steelhead Recovery Plan identifies Snake River hatchery steelhead strays as a primary threat to the Deschutes and John Day steelhead populations.**

- **ICTRT viability assessments rate the spawner composition as high risk for Deschutes population because of the high proportion of out-of-DPS stray spawners.**

Origin of Steelhead Escapement Above Sherars Falls



Estimated Escapement of Wild, Deschutes Hatchery, and Stray Hatchery Steelhead above Sherars Falls



(ODFW 2001)

Recent 10-Year Average Proportion of Natural Spawners That Were Snake River Strays (ICTRT)

Population	Spawner Abundance		Snake River Hatchery Stray Proportion
	Natural	Hatchery	
Deschutes River Eastside	975	526	35%
Deschutes River Westside	337	100	29%
Lower Mainstem John Day River	1620	180	10%
North Fork John Day River	1601	139	8%
Umatilla River	1398	74	5%

Objectives

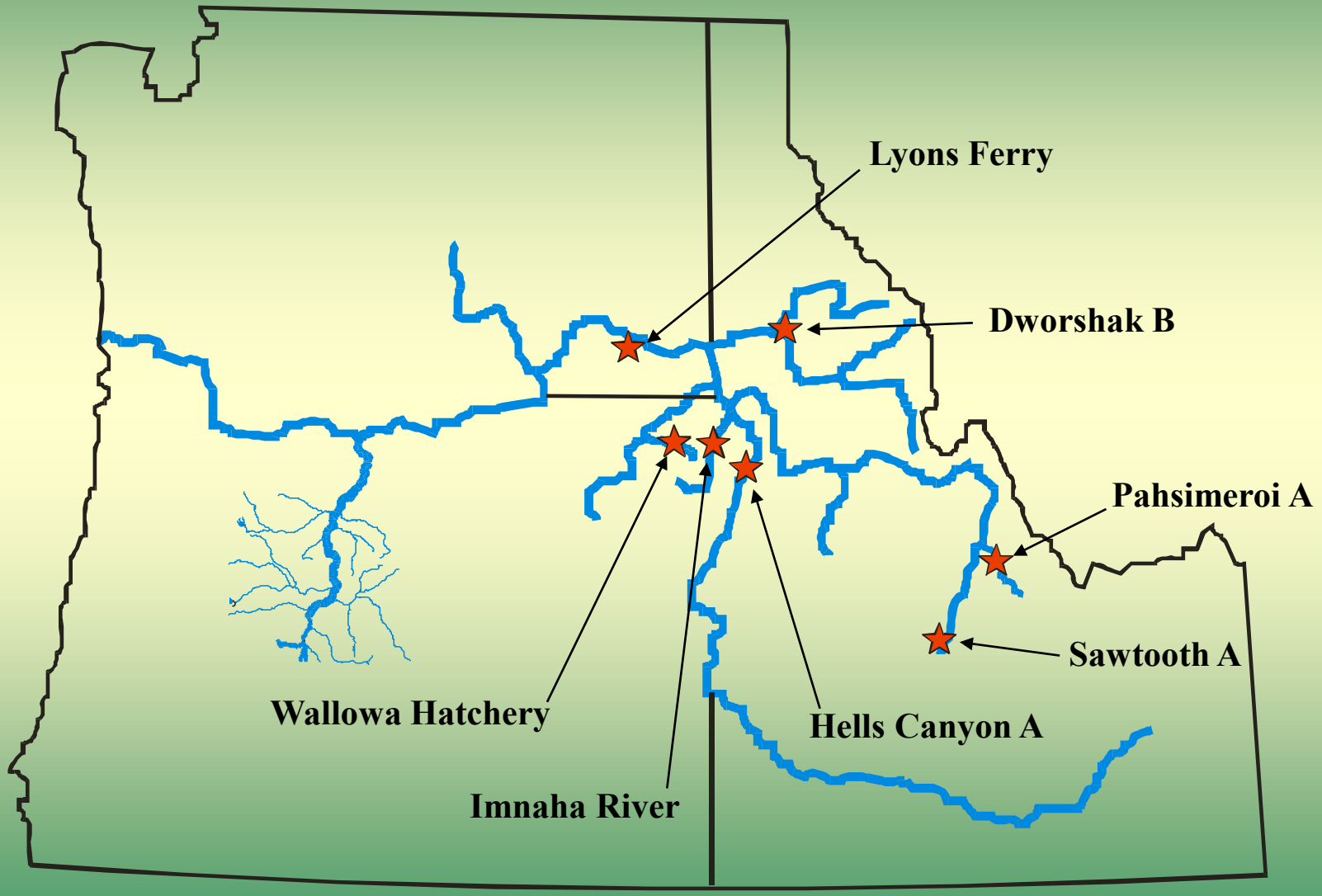
- **Assess the magnitude of straying and the origin of Snake River hatchery steelhead strays in the Deschutes River.**
- **Determine stray rates into the Deschutes River for all Snake River hatchery steelhead stocks.**
- **Characterize distribution (time and space) of each stock of Snake River hatchery strays within the Deschutes River Basin.**
- **Examine factors that may influence straying rates and patterns.**

<u>Definition:</u> We defined a Deschutes River stray as any fish recovered in the Deschutes River.

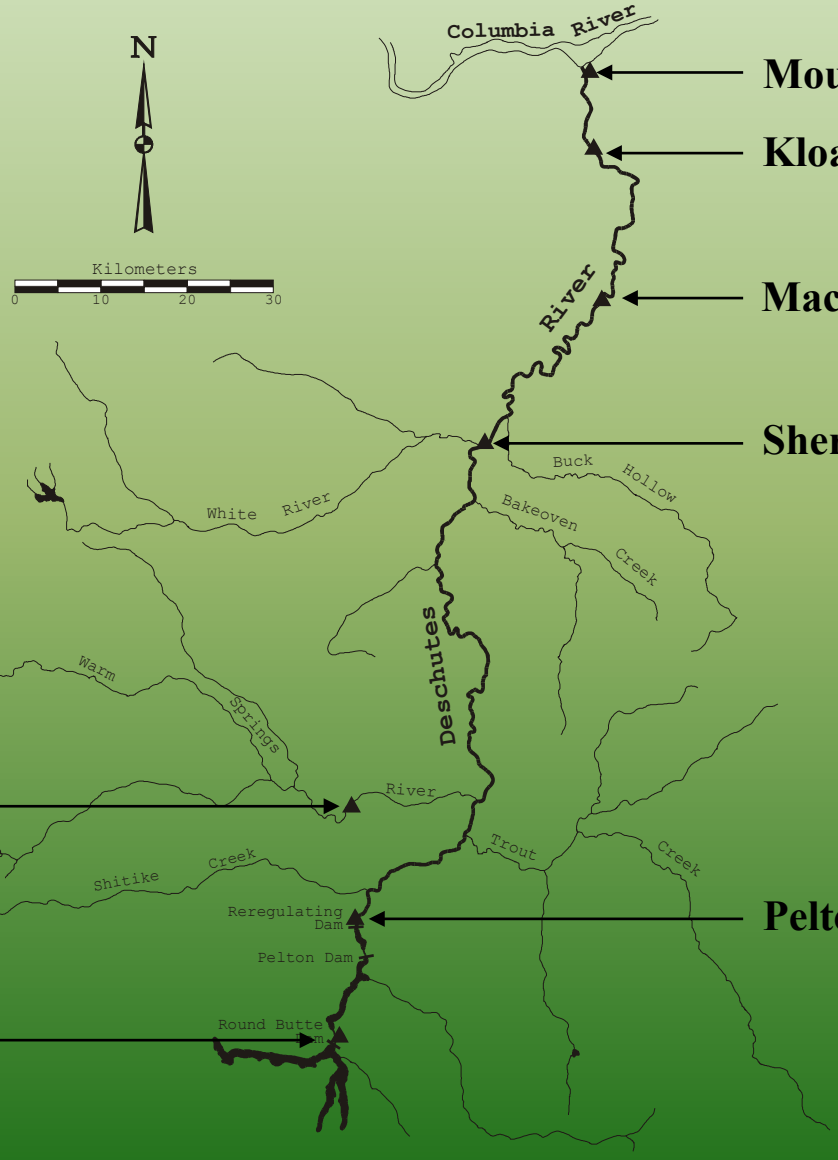
Methods

- **Assemble and analyze CWT release and recovery data for all Snake River steelhead hatchery releases.**
- **Develop mark-to-unmark expansion factors to account for all production releases.**
- **Calculate stray rates into the Deschutes River by code, release location, and run year for each Snake River hatchery stock.**
- **Calculate total hatchery contributions to the Deschutes River by run year for each stock and basin of release.**
- **Compare stray rates among Snake River steelhead hatchery stocks.**

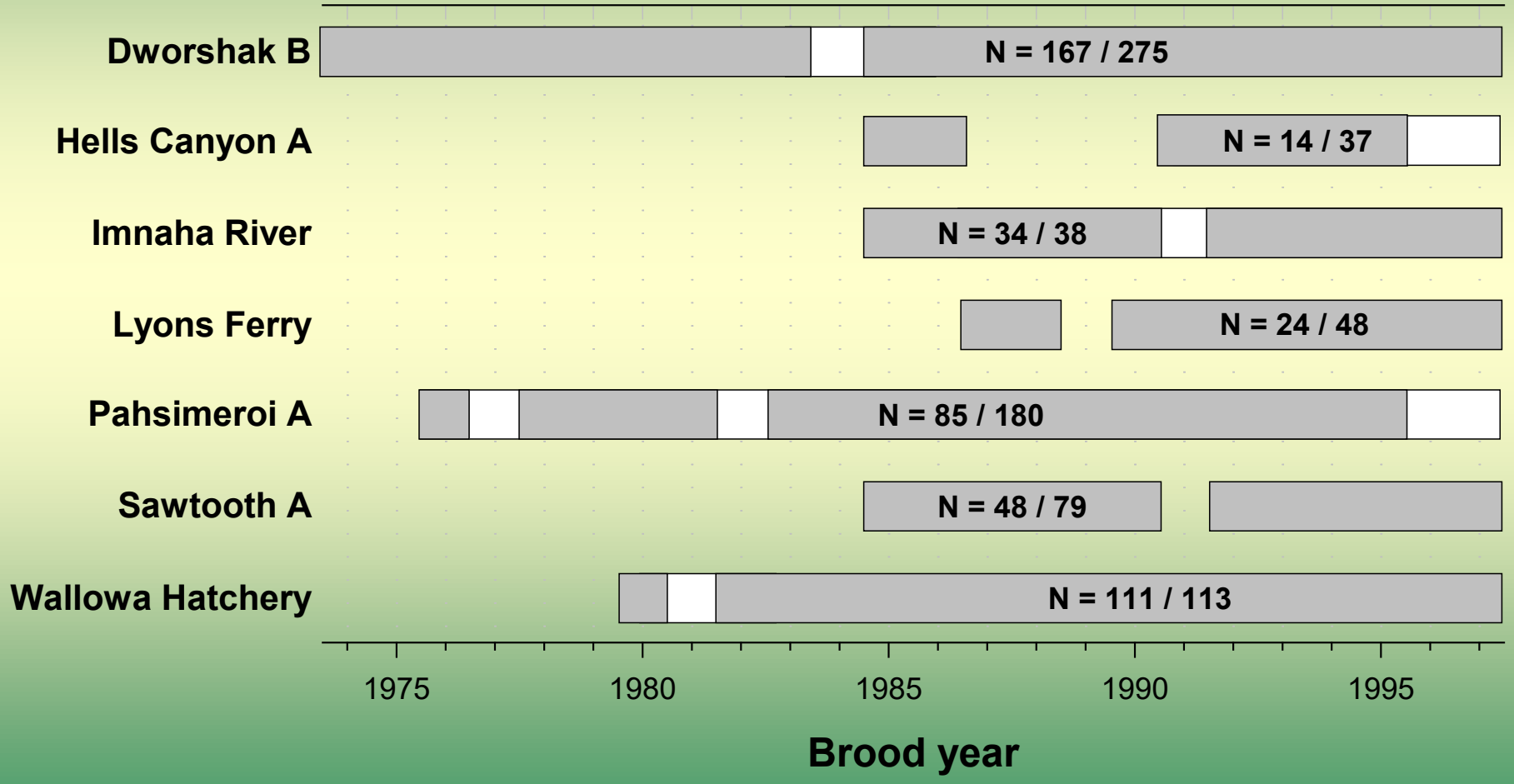
Snake River Hatchery Steelhead Stocks



Deschutes River



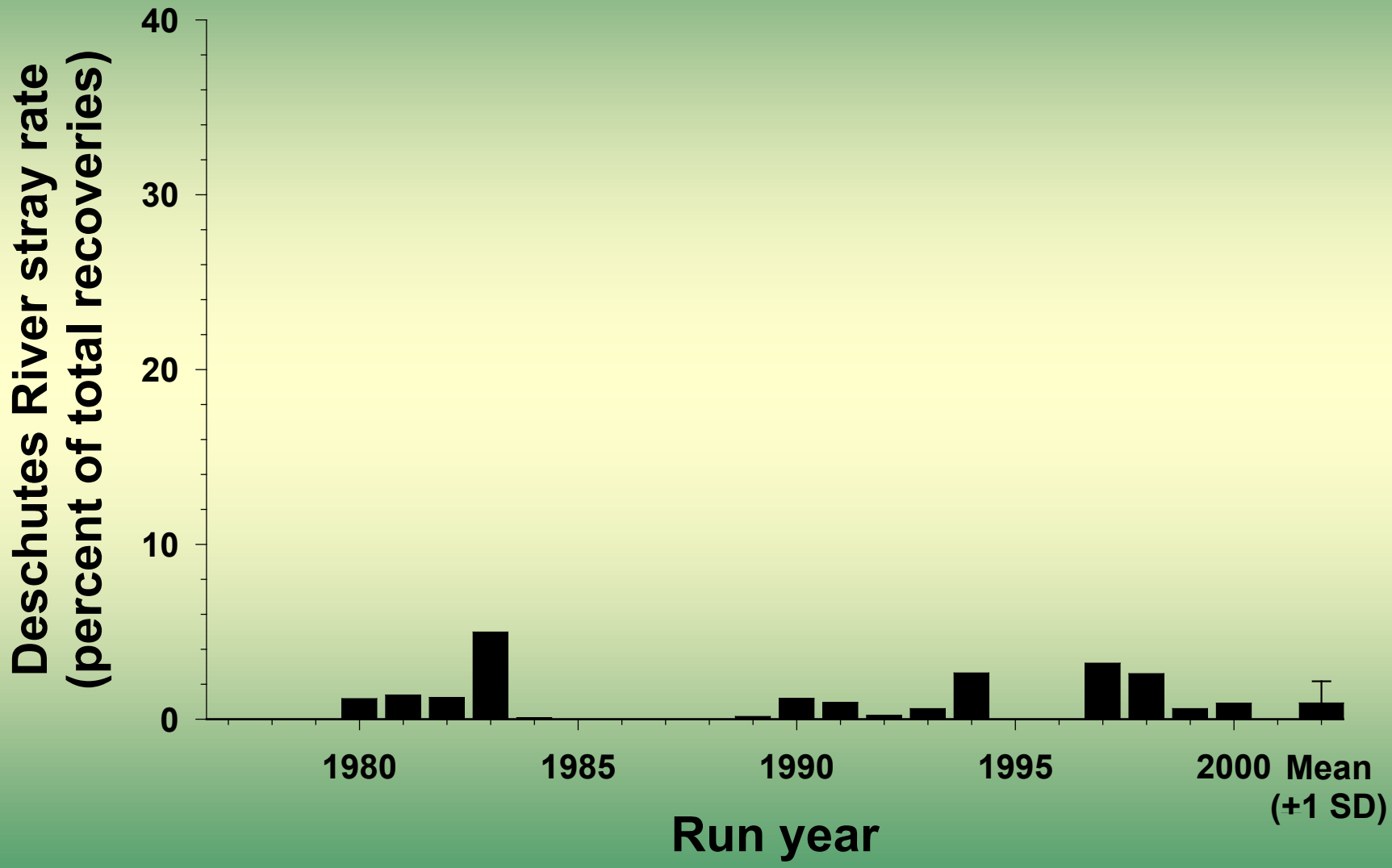
Coded-Wire Tag Groups



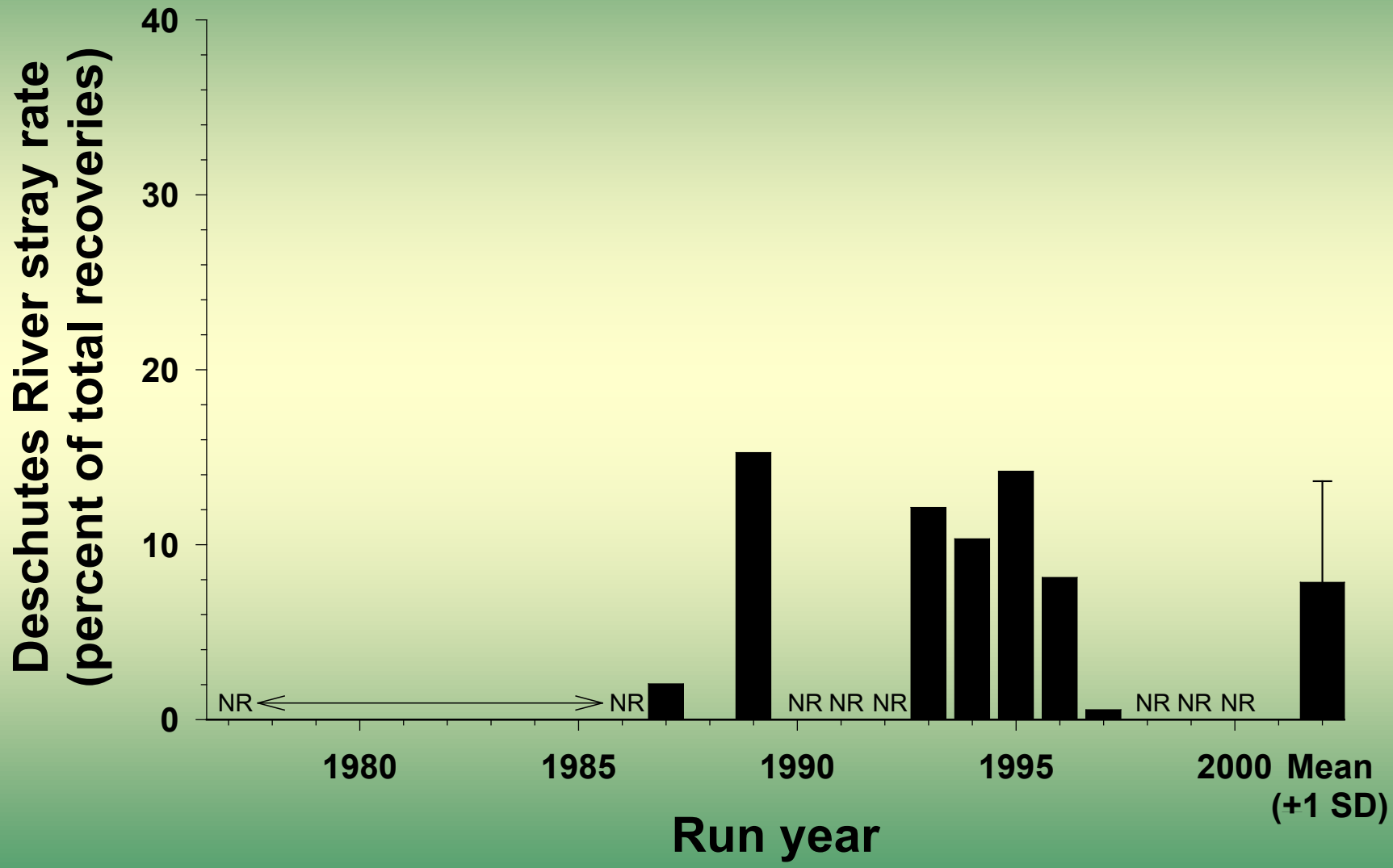
Coded-Wire Tags

Stock	Years	Number tagged	Total released	Percent tagged
Dworshak B	1974-1997	4,429,340	36,041,922	12.3
Hells Canyon A	1985-1995	476,375	3,911,455	12.2
Imnaha River	1985-1997	897,287	2,691,045	33.3
Lyons Ferry	1987-1997	534,813	684,381	78.1
Pahsimeroi A	1976-1997	2,495,772	12,905,758	19.3
Sawtooth A	1985-1997	1,036,204	6,736,447	15.4
Wallowa Hatchery	1980-1997	3,041,277	9,621,618	31.6

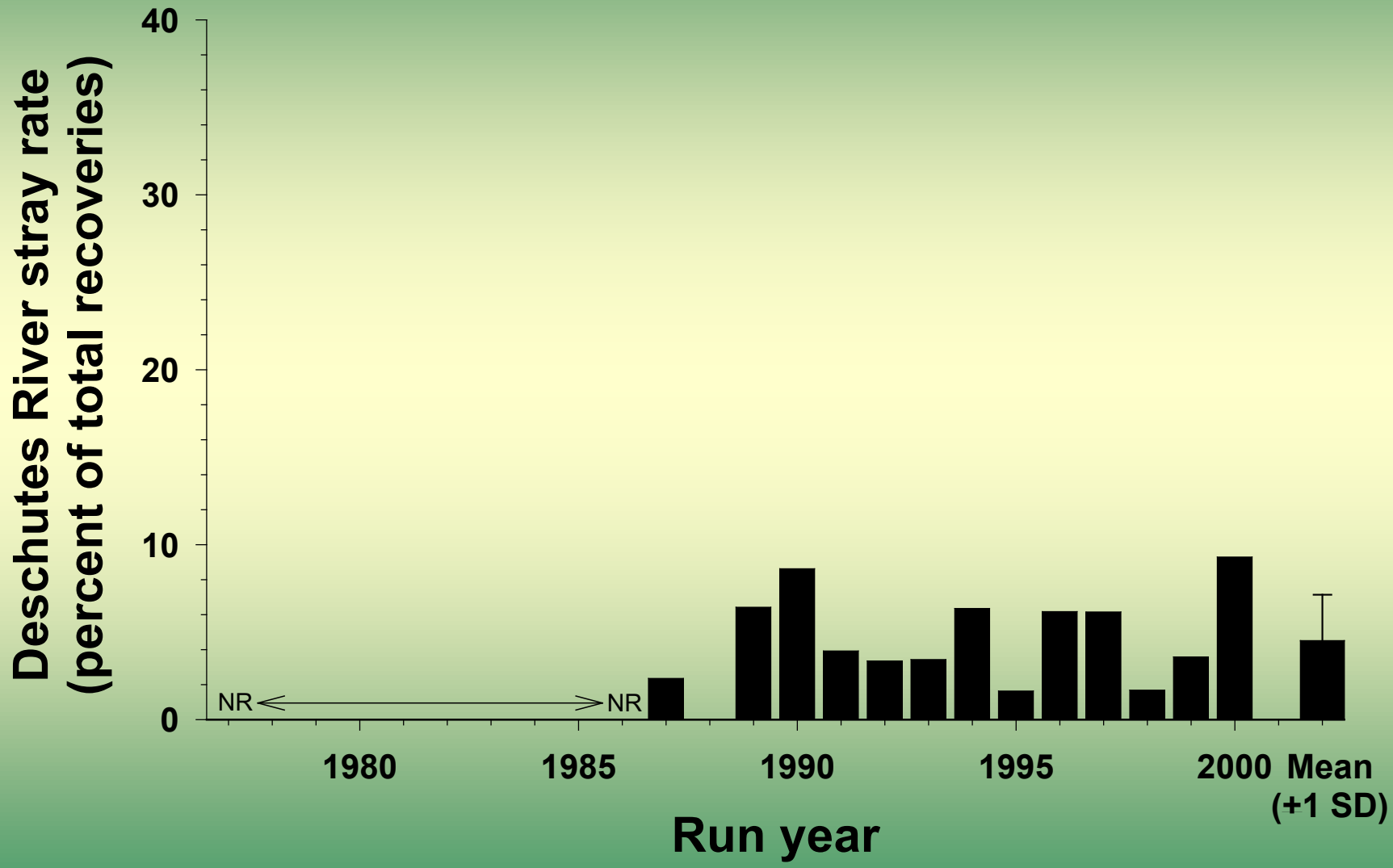
Annual Stray Rates – Dworshak B



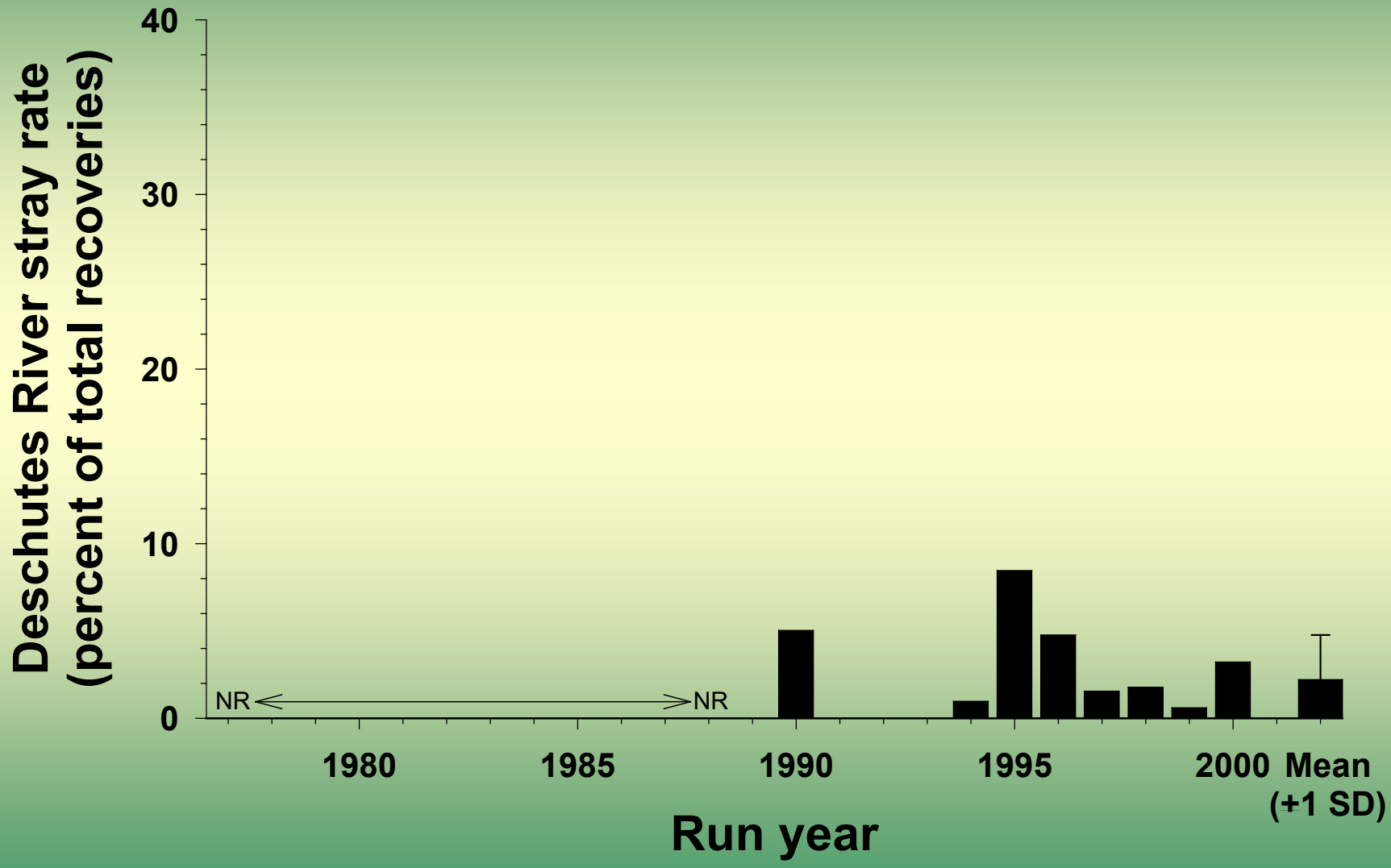
Annual Stray Rates – Hells Canyon A



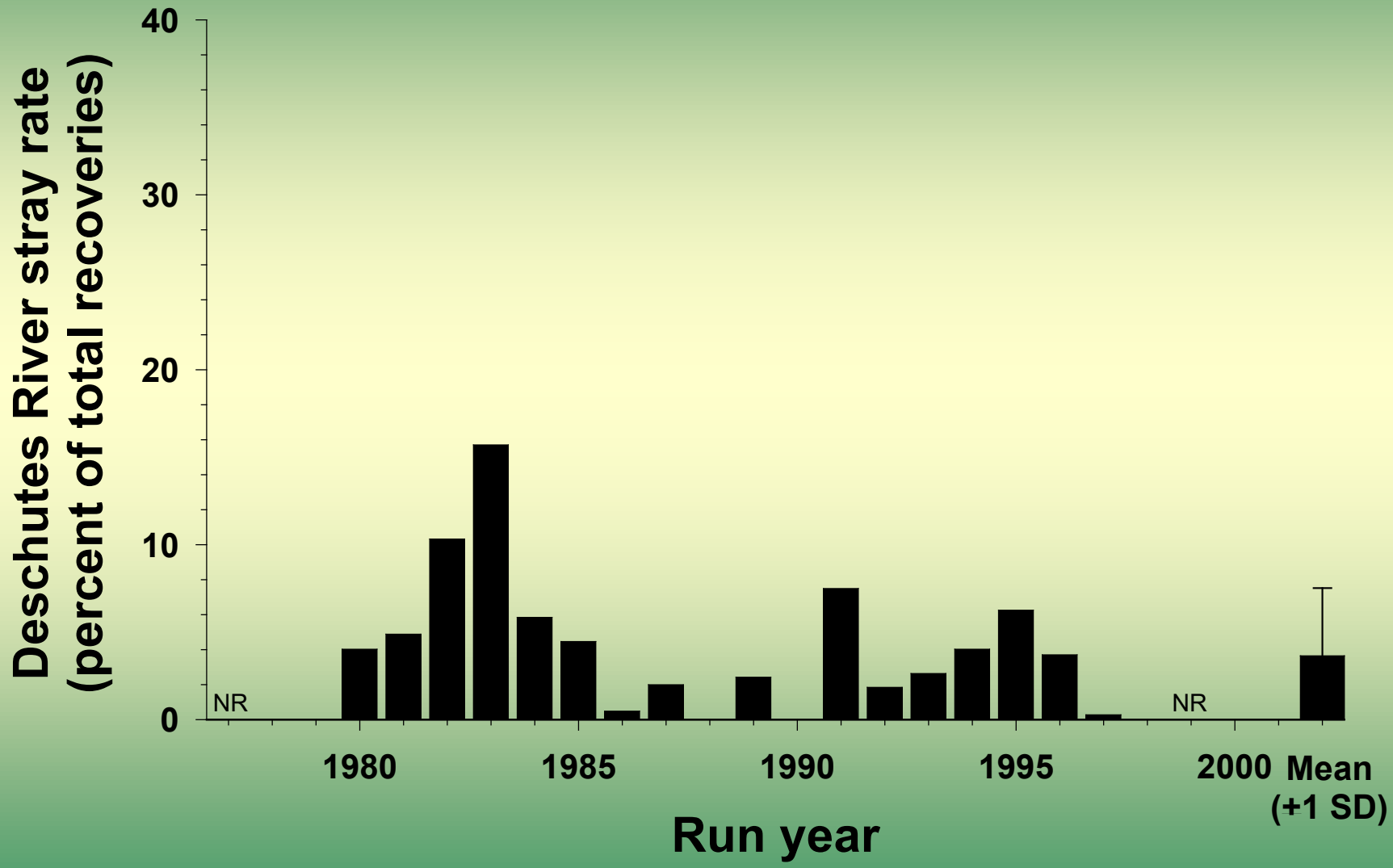
Annual Stray Rates – Imnaha River



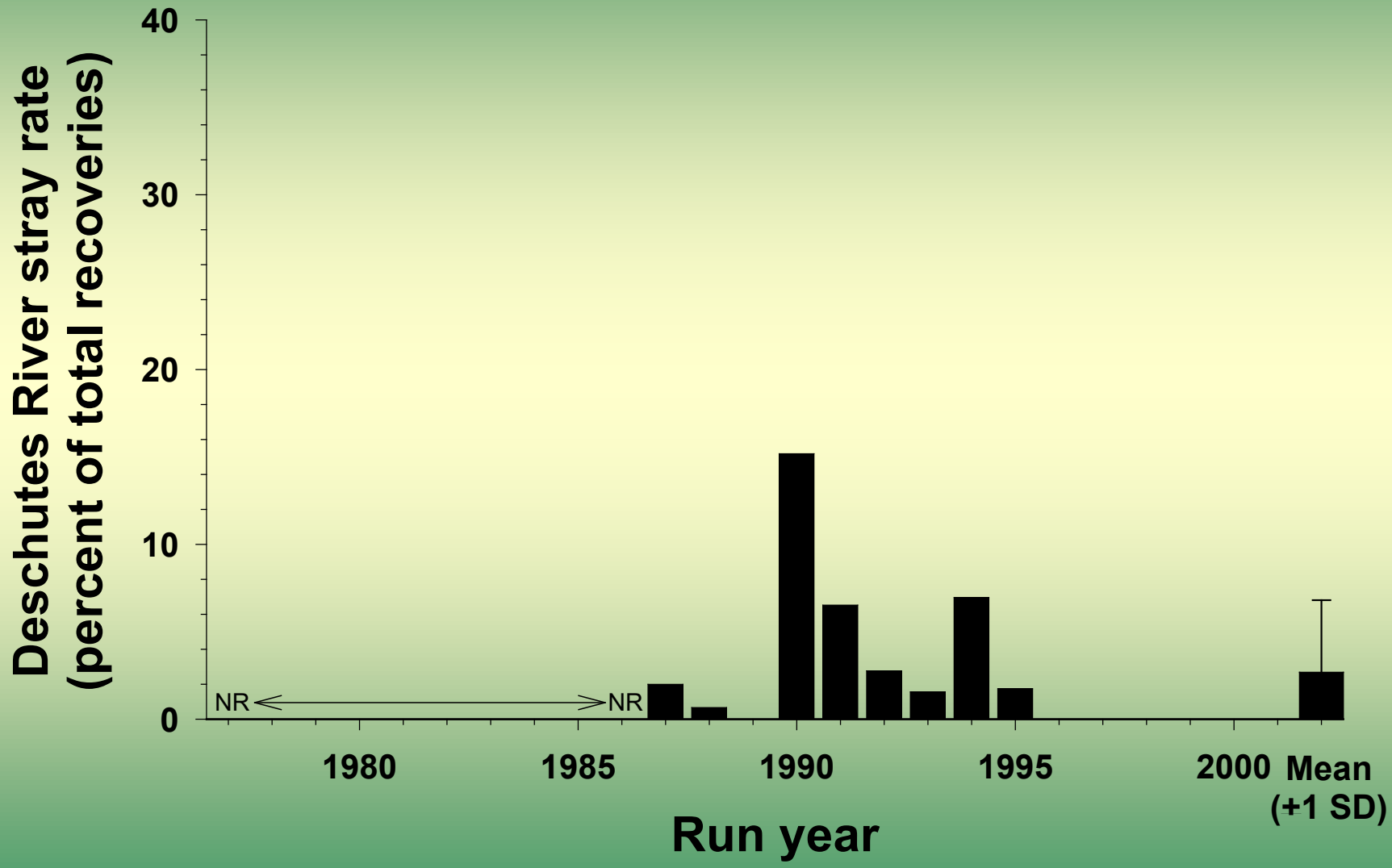
Annual Stray Rates – Lyons Ferry



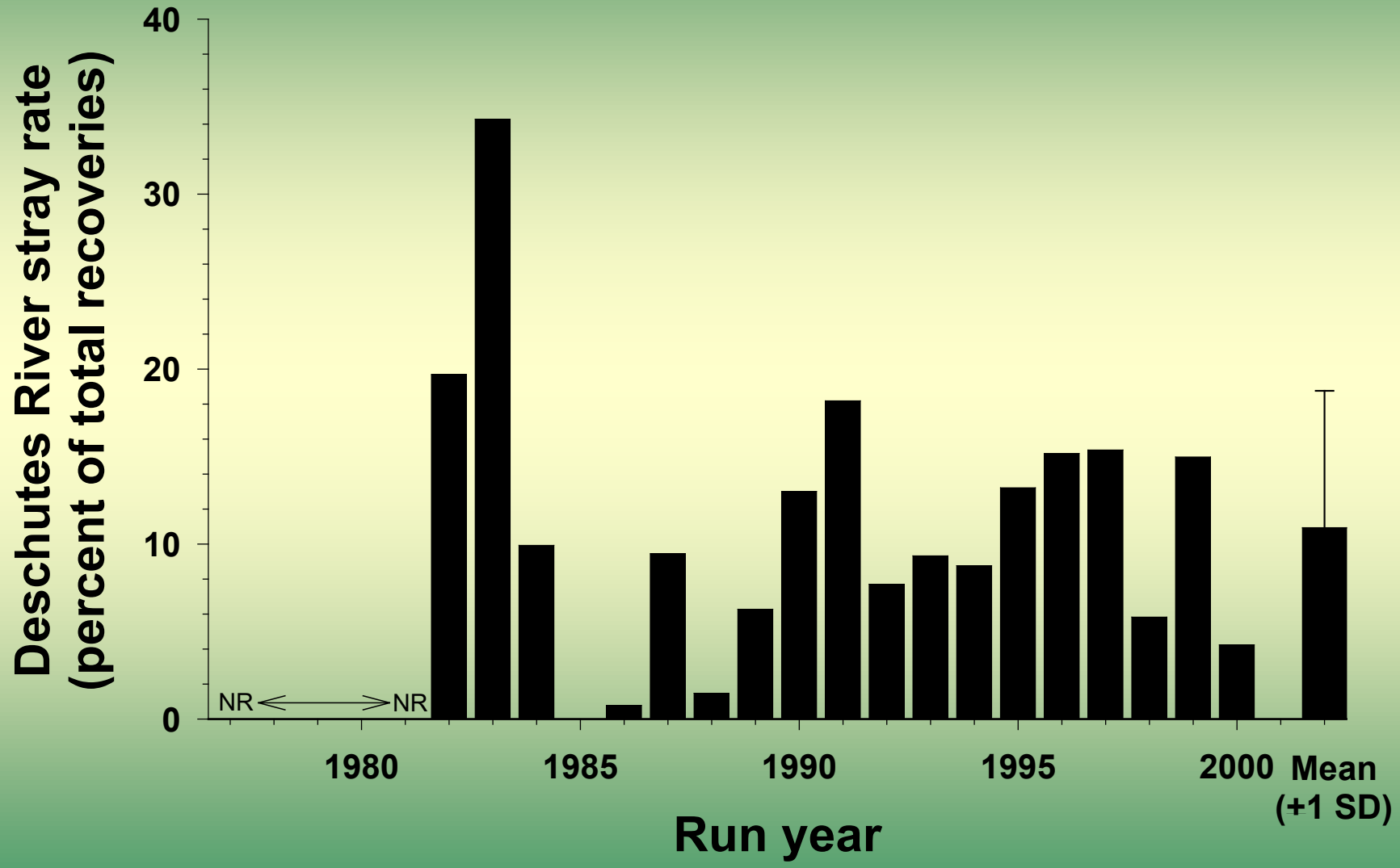
Annual Stray Rates – Pahsimeroi A



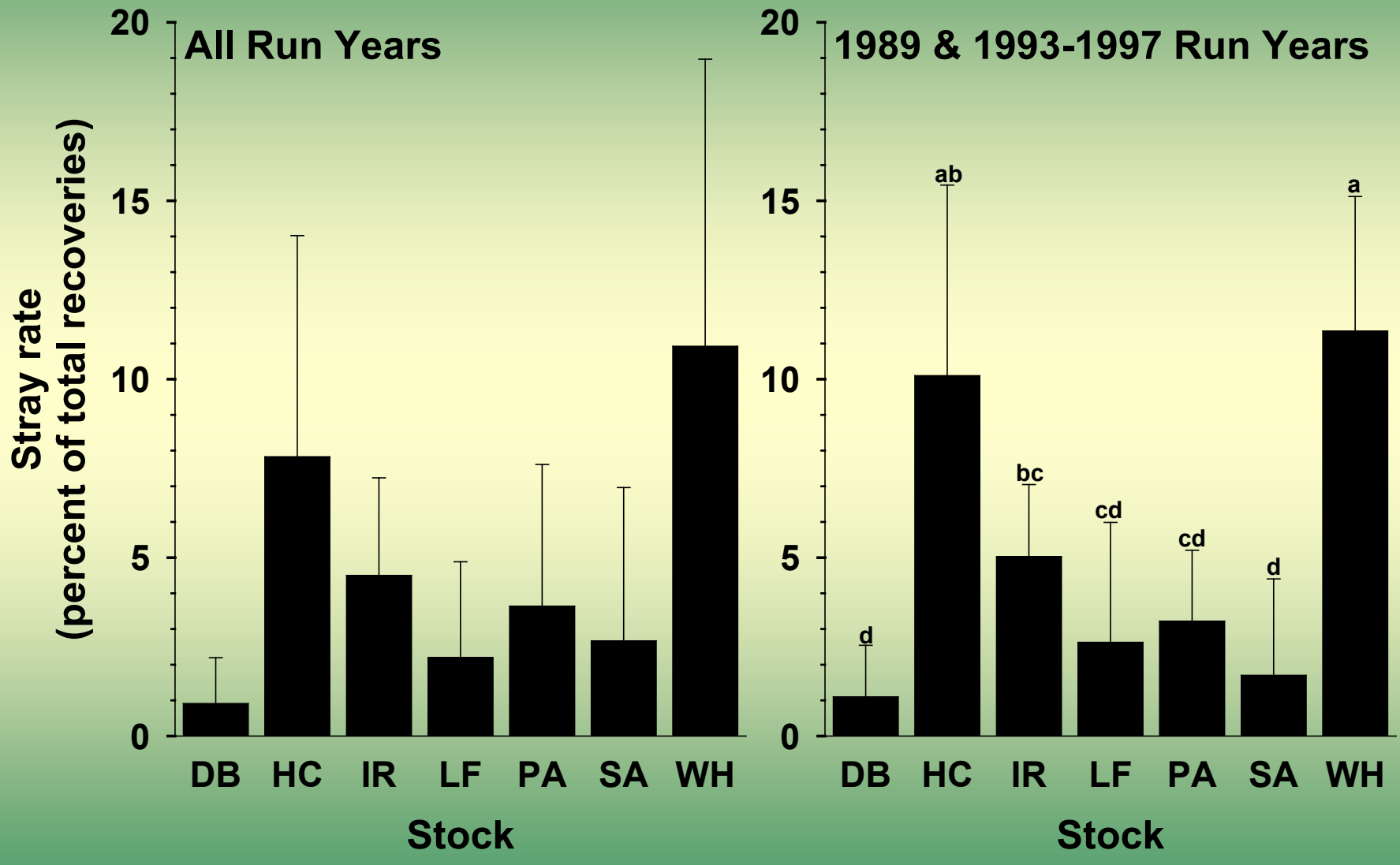
Annual Stray Rates – Sawtooth A



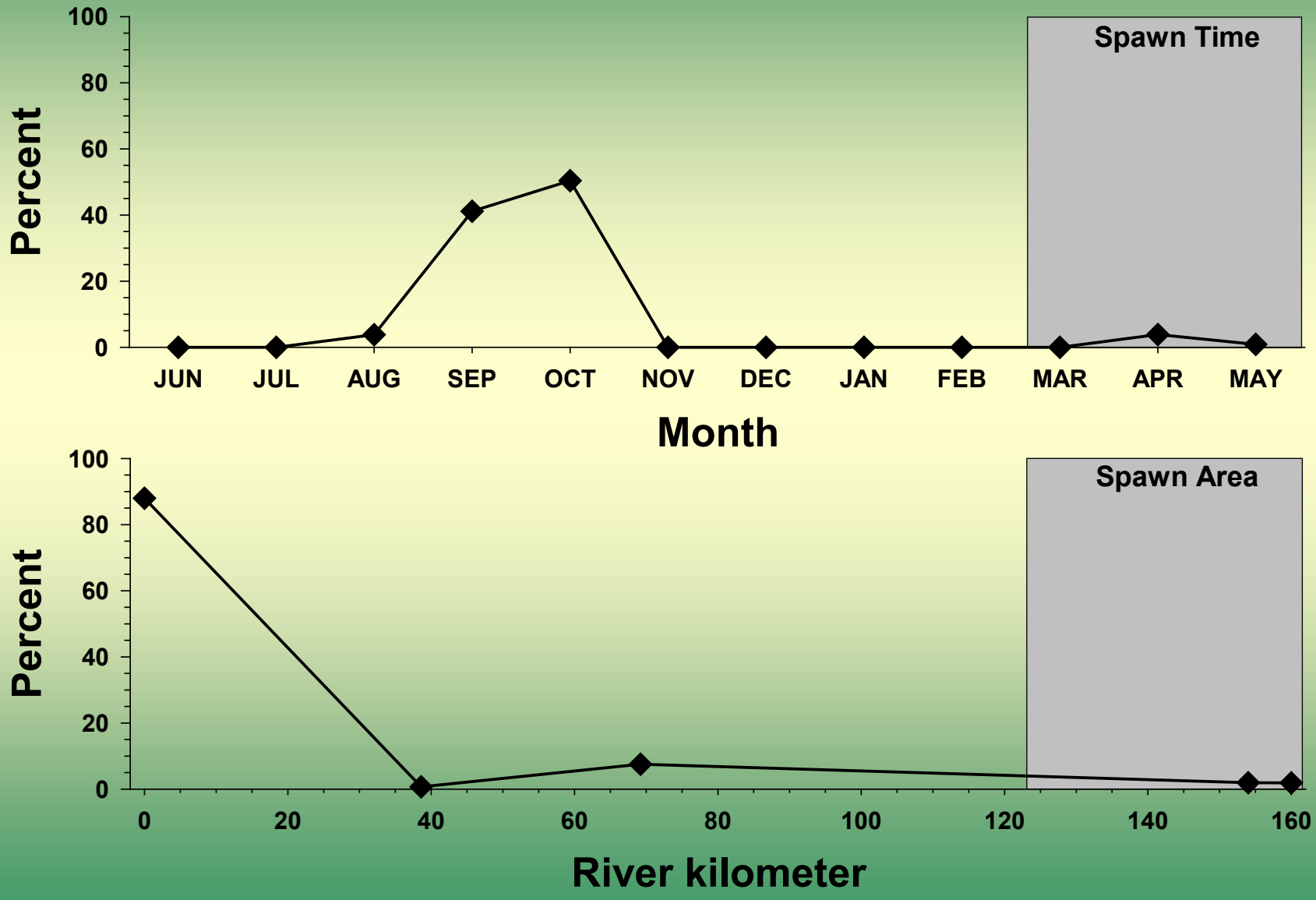
Annual Stray Rates – Wallowa Hatchery



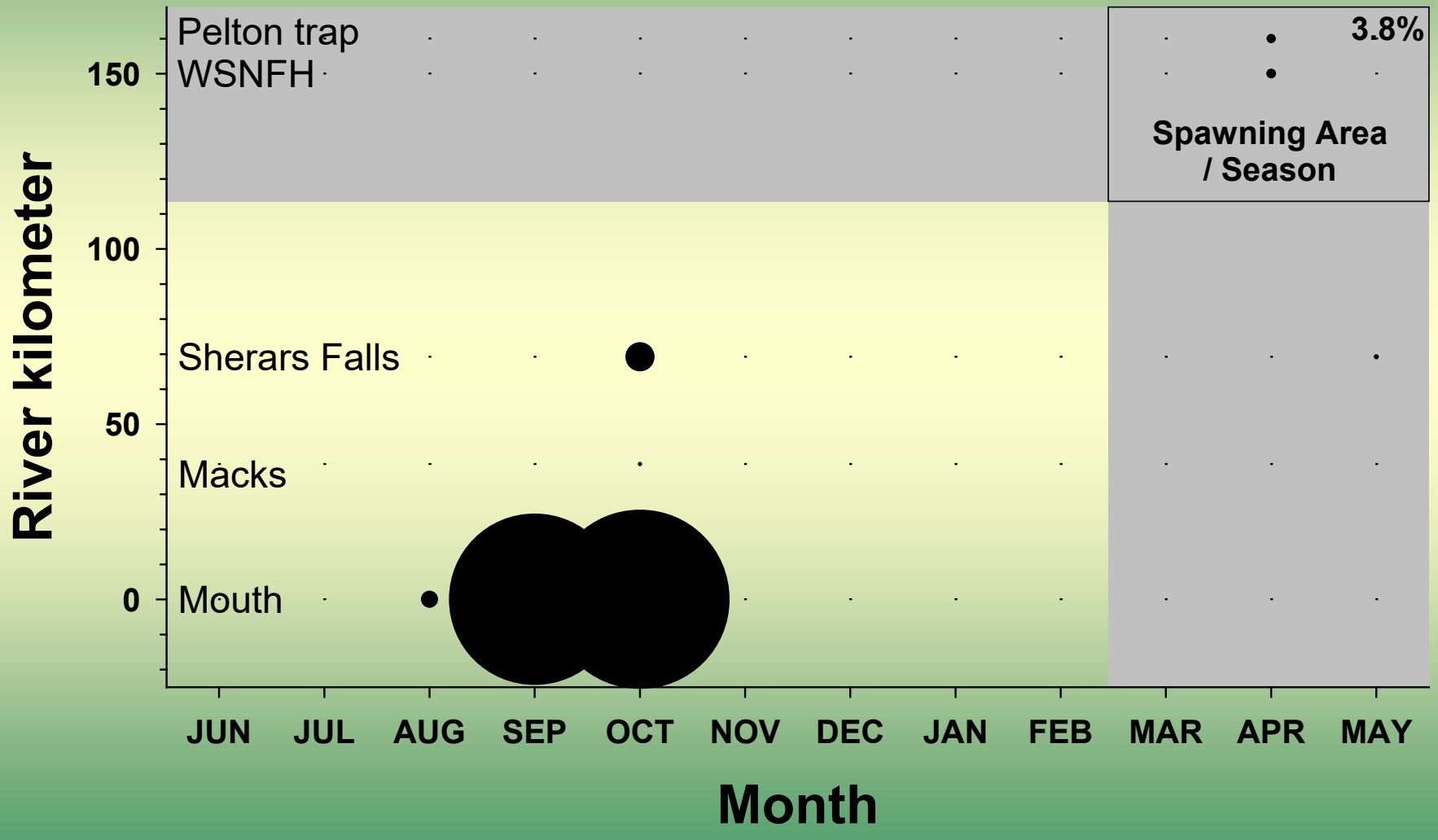
Deschutes River Stray Rates



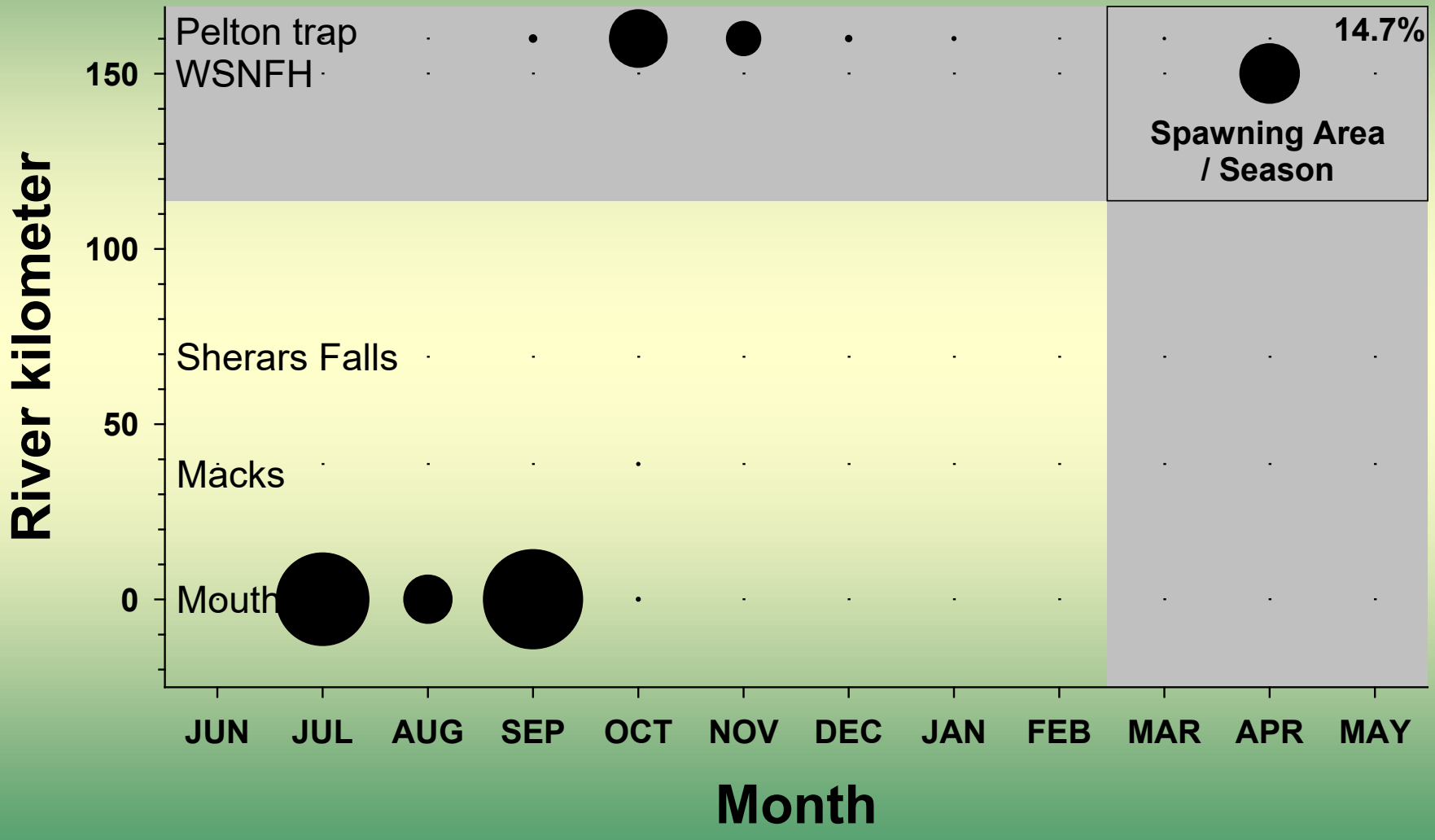
Distribution – Time and Space



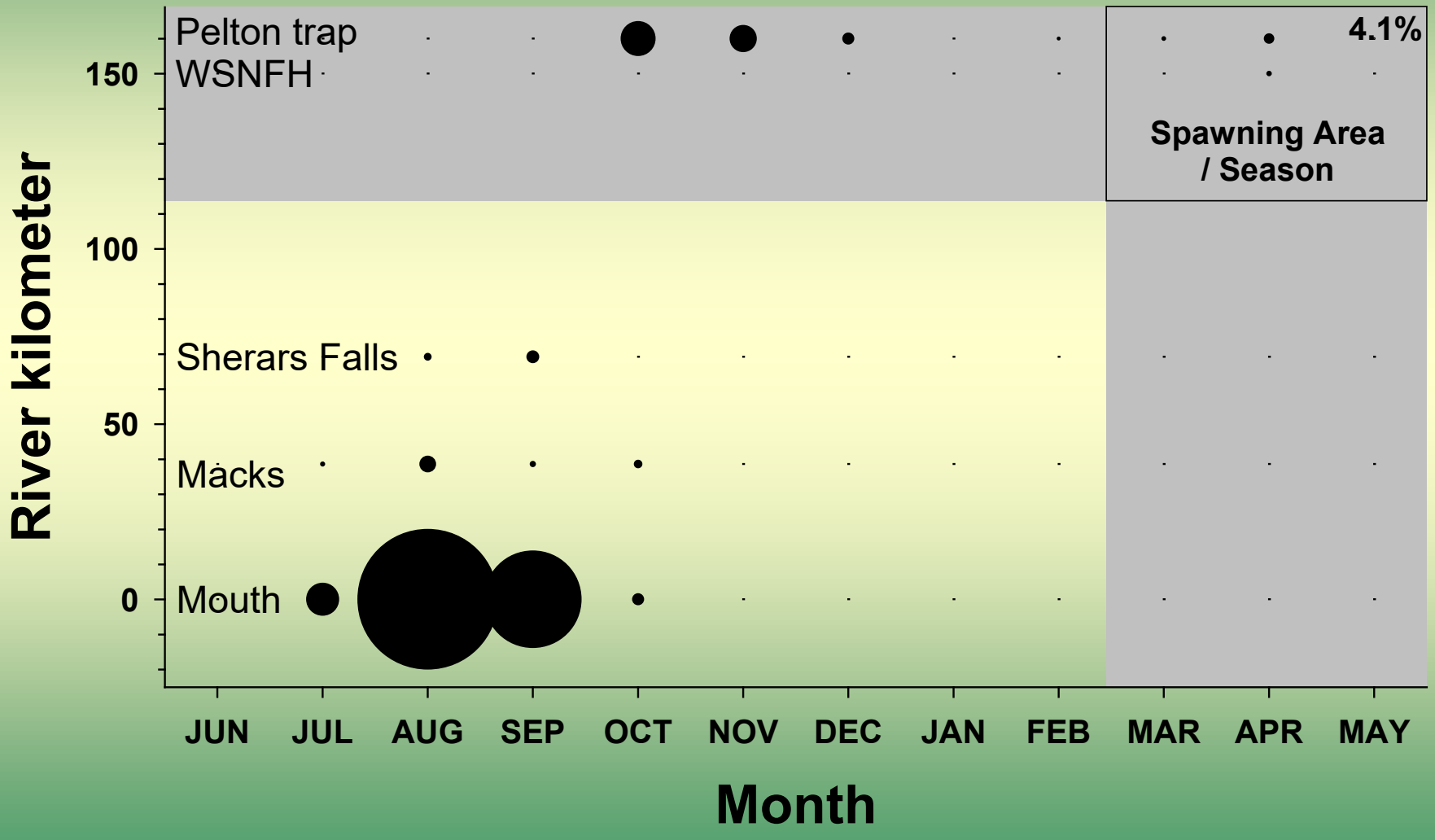
Distribution – Dworshak B



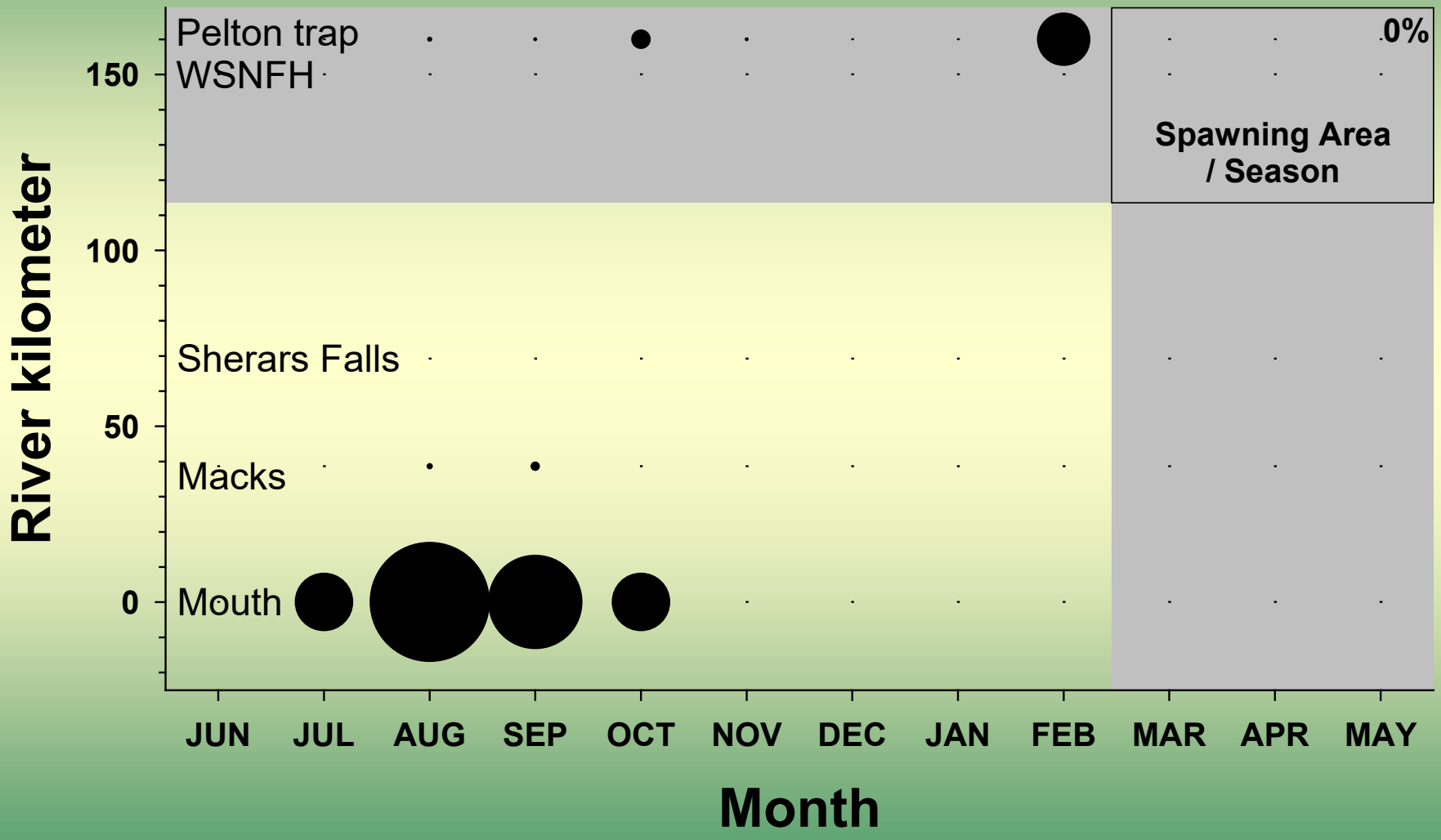
Distribution – Hells Canyon A



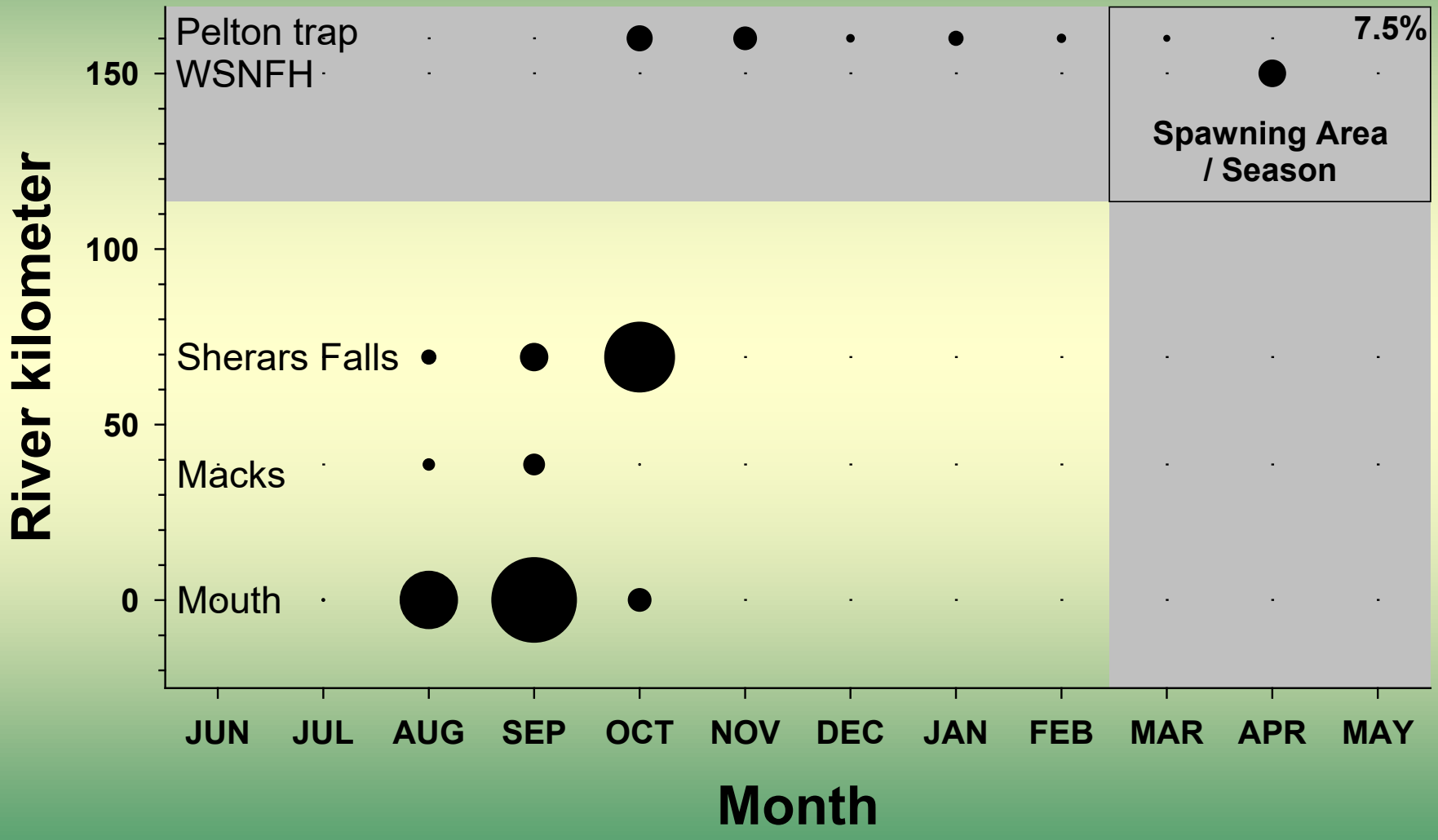
Distribution – Imnaha River



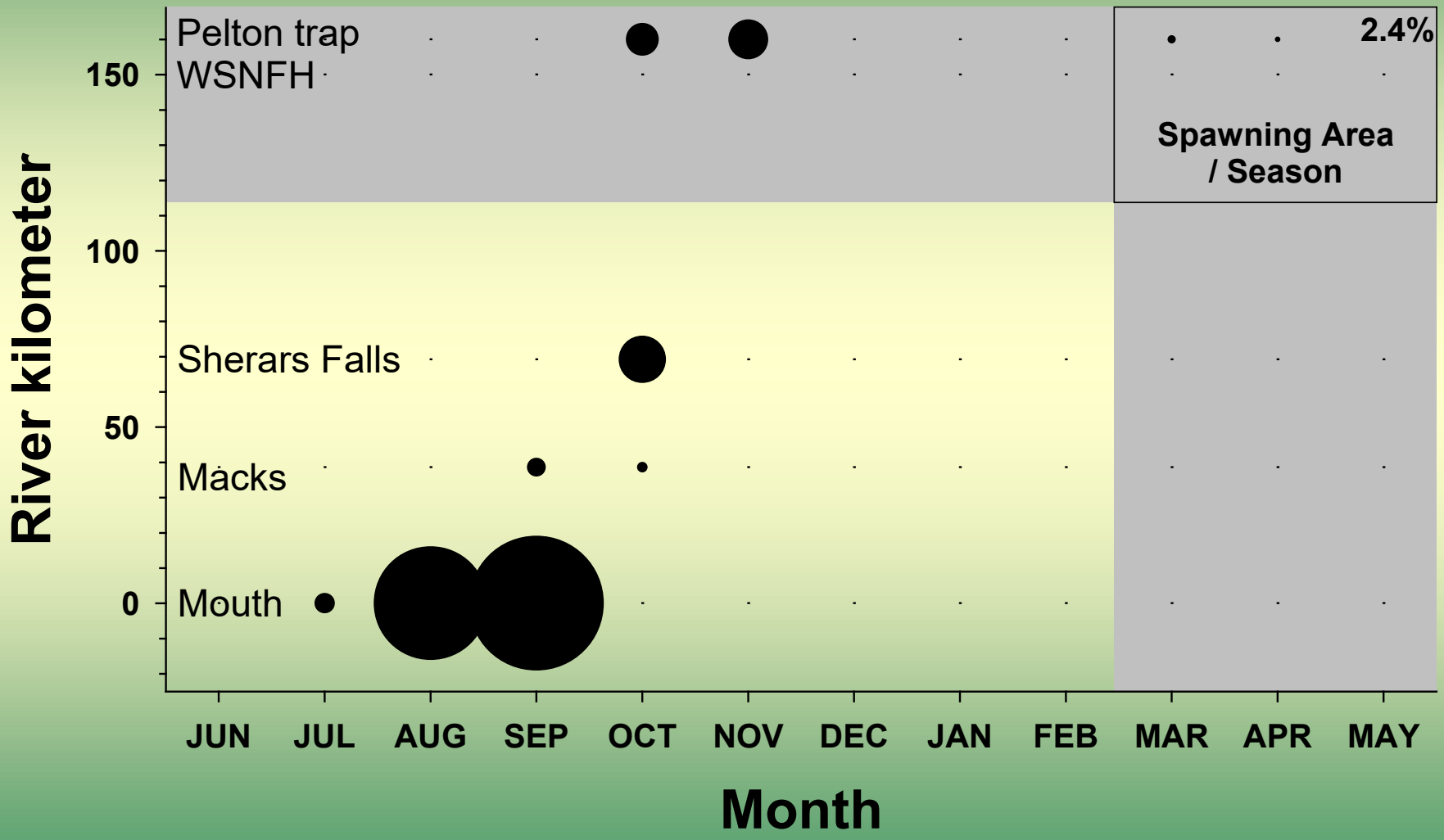
Distribution – Lyons Ferry



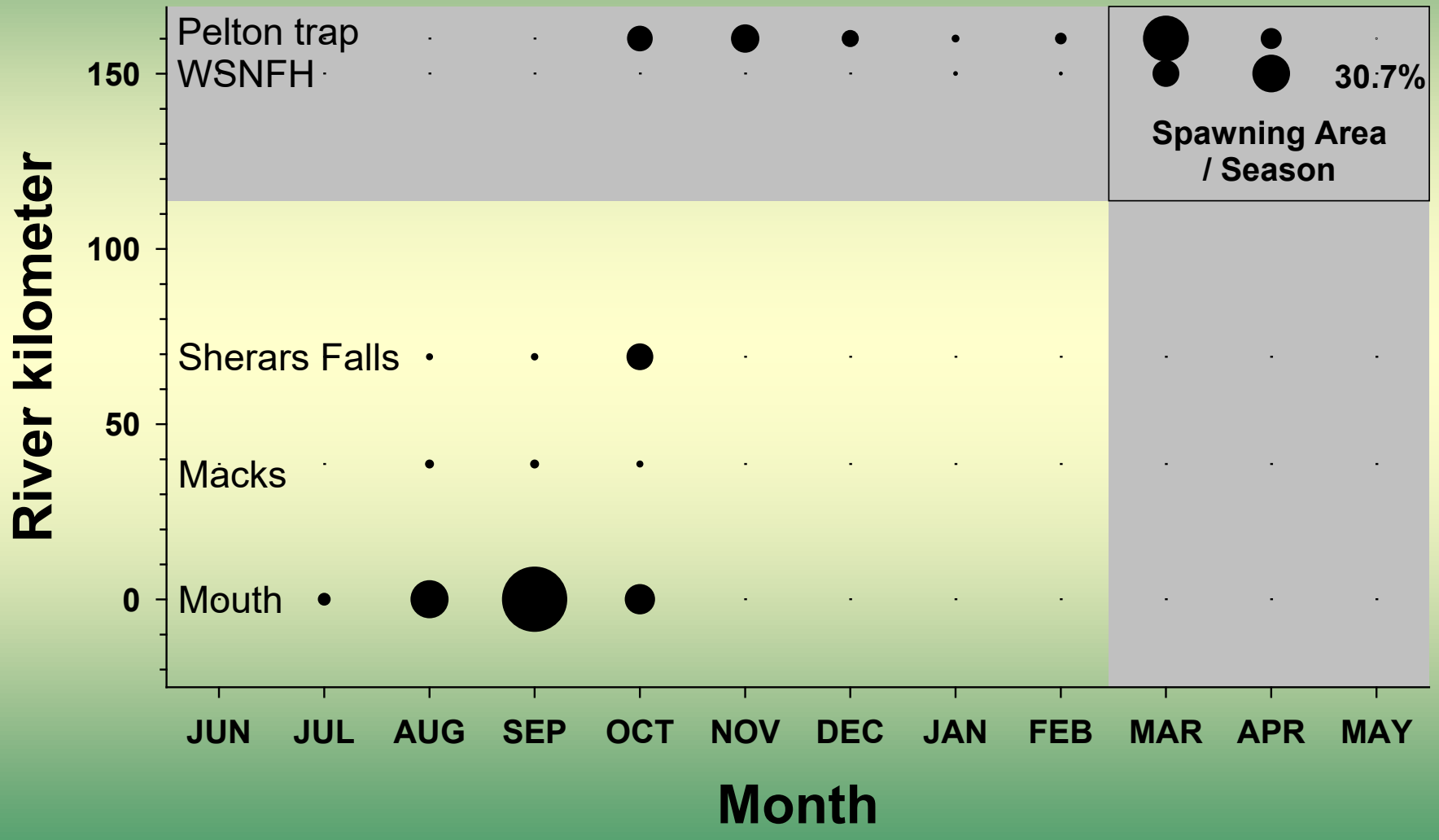
Distribution – Pahsimeroi A



Distribution – Sawtooth A



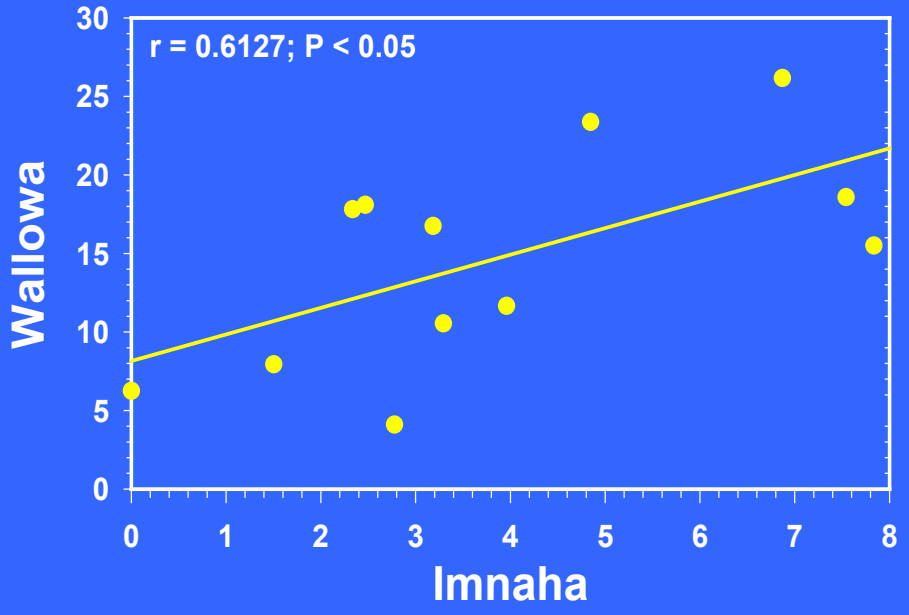
Distribution – Wallowa Hatchery

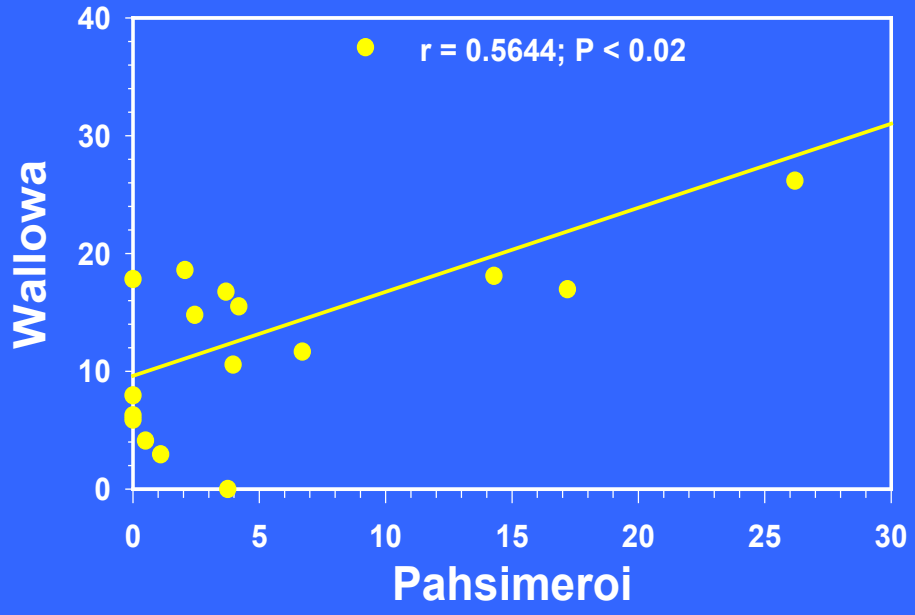


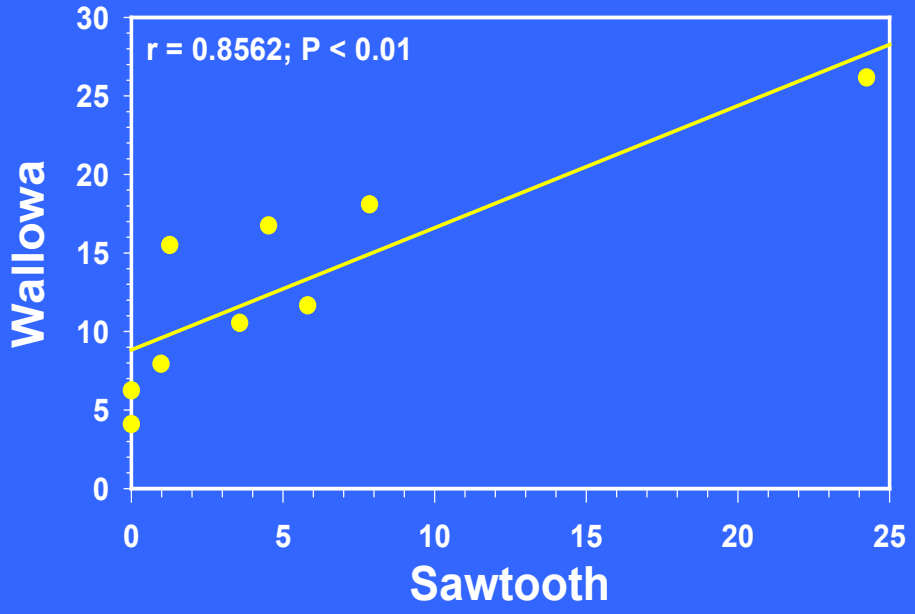
Potential Factors Influencing Straying

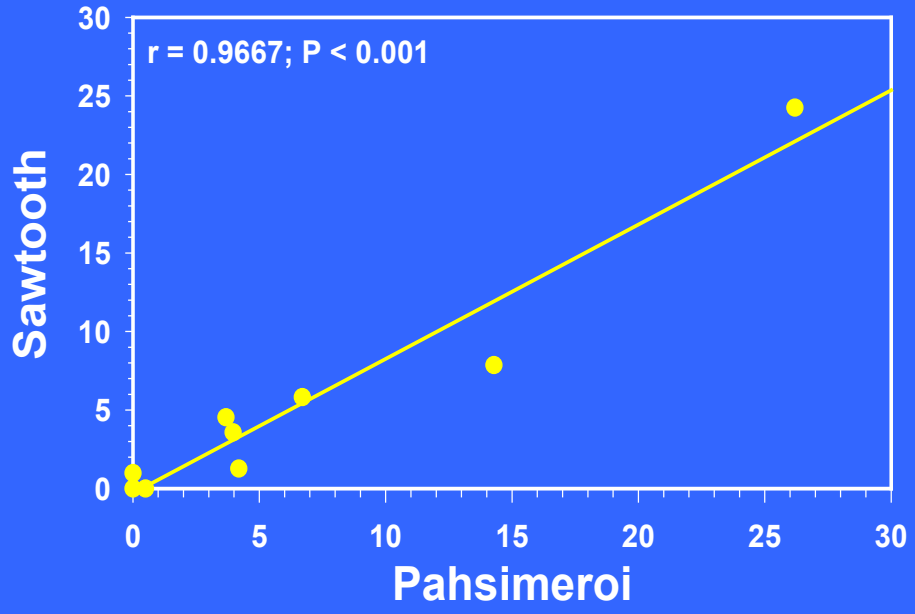
- Incubation, Rearing, and Release Strategies
- Release Location
- Stock Origin
- Seaward Migration Pathways (Inriver –Transported)
- Columbia River and Deschutes Water Temperatures

Significantly Correlated Stray Rates

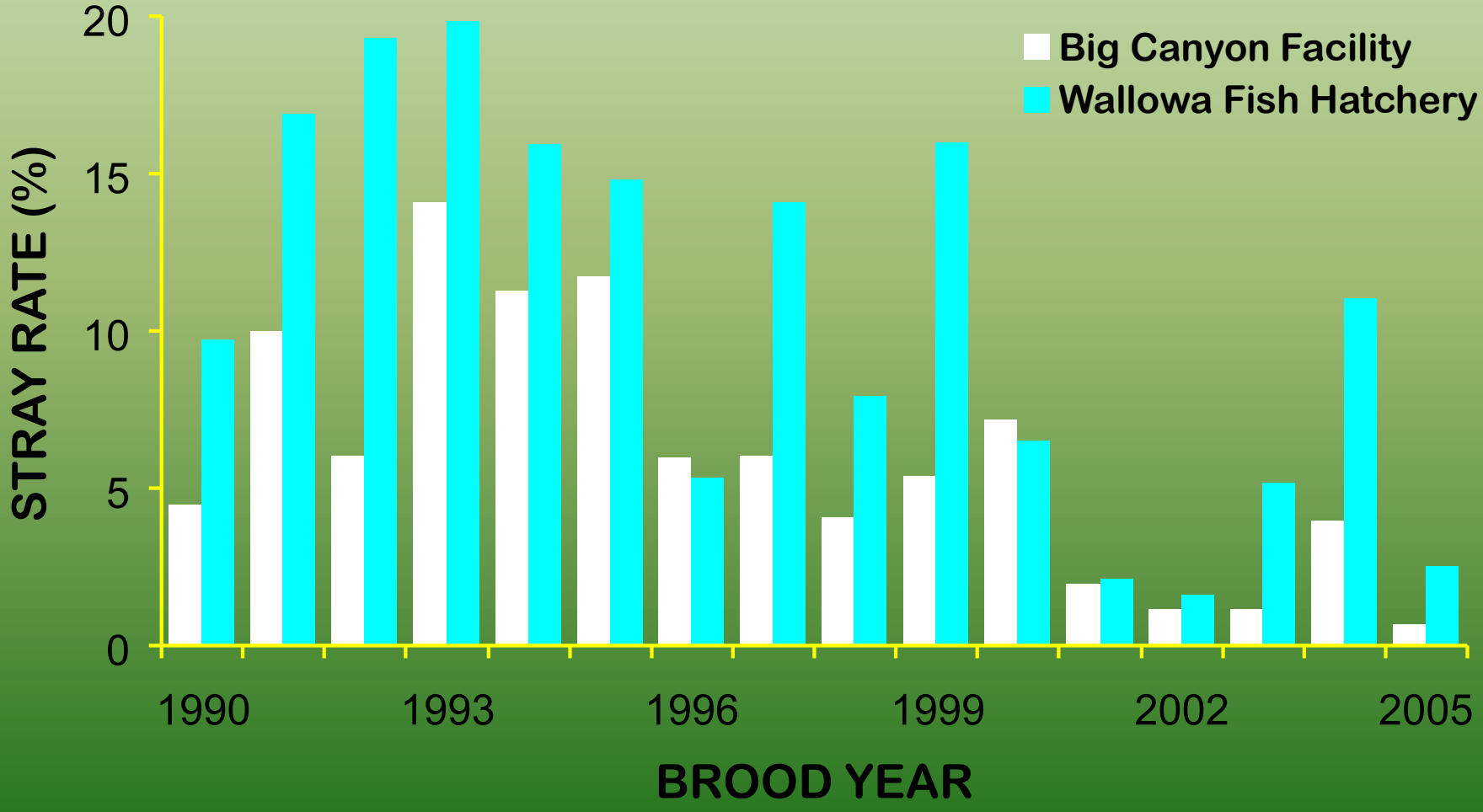








Release Location Influence
Stray Rates into Mid-Columbia Basin Tributaries, 1990-2005 Brood Years

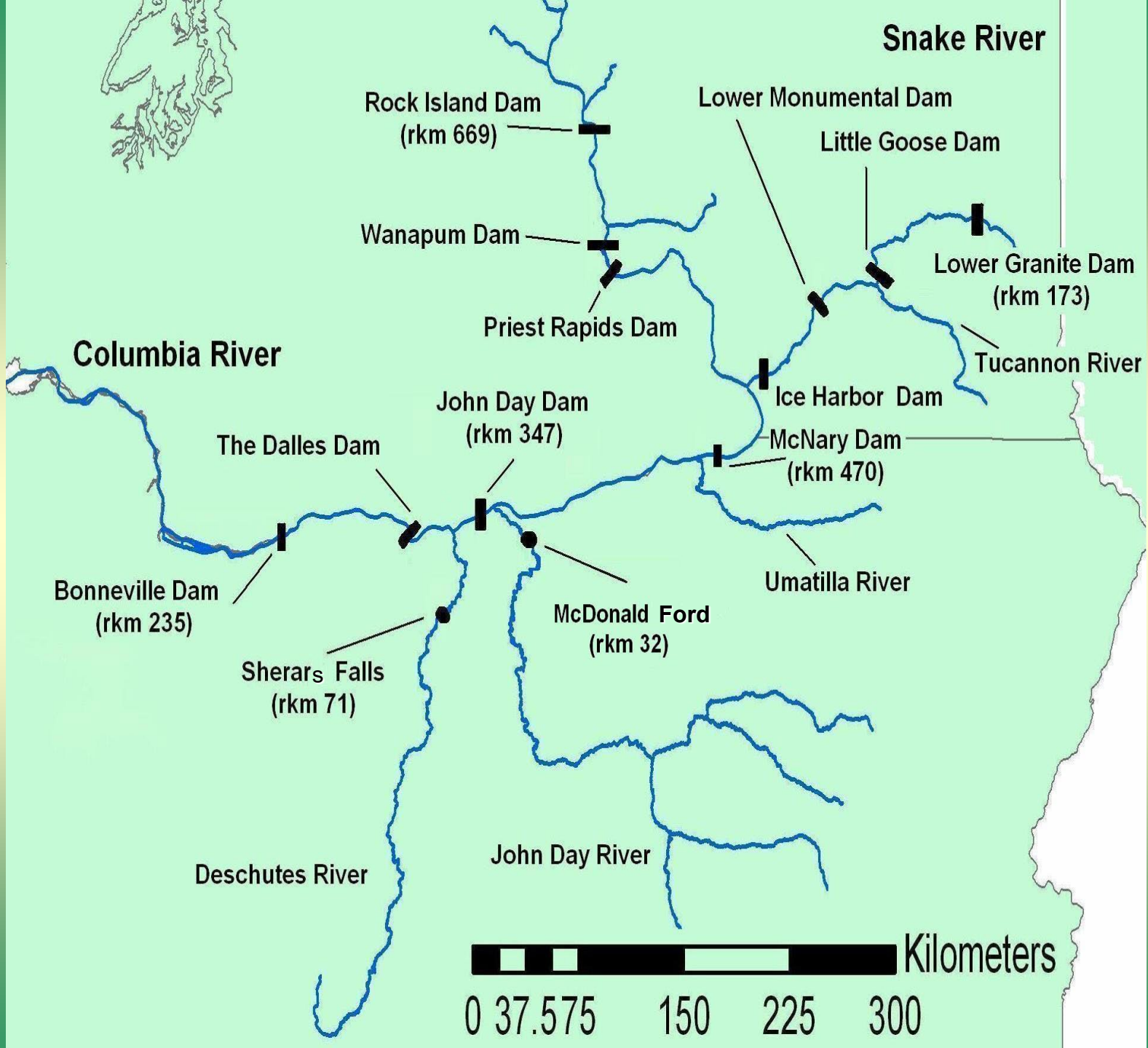


Adult PIT-tag Stray Analysis 2007-08 and 08-09 Run Years

- **NOAA transport tag groups**
  - **Released at Lower Granite Dam as smolts in 2005, 2006, and 2007**
  - **Return to the river group (RR)**
  - **Barge transported group (BR)**

- **Queried adult detections at Bonneville (N)**

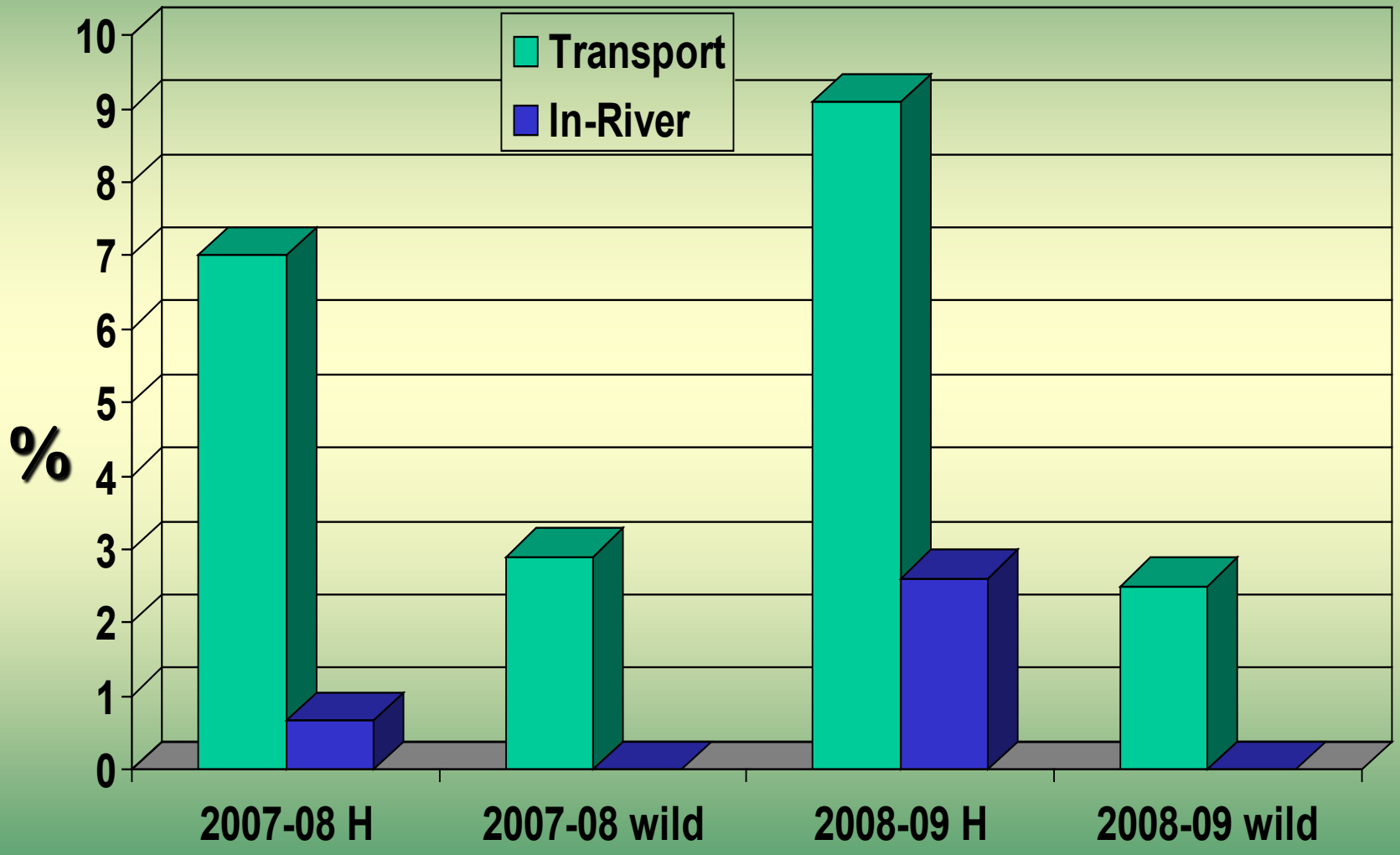
- **Compared proportion of Bonneville adults that were detected as strays from barged and return to river groups**
  - **z-tests: statistical test to compare detection rates of two groups (RR vs. BR or hatchery vs. natural)**
  - **John Day River: McDonald Ford**
  - **Deschutes River: Sherars Falls**
    - **Unknown detection efficiency at the Deschutes River John Day sites**


Snake River
Rock Island Dam
(rkm 669)
Lower Monumental Dam
Little Goose Dam
Wanapum Dam
Lower Granite Dam
(rkm 173)
Priest Rapids Dam
Columbia River
Tucannon River
Ice Harbor Dam
John Day Dam
(rkm 347)
The Dalles Dam
McNary Dam
(rkm 470)
Umatilla River
Bonneville Dam
(rkm 235)
McDonald Ford
(rkm 32)
Sherars Falls
(rkm 71)
John Day River
Deschutes River
Kilometers
0 37.575 150 225 300

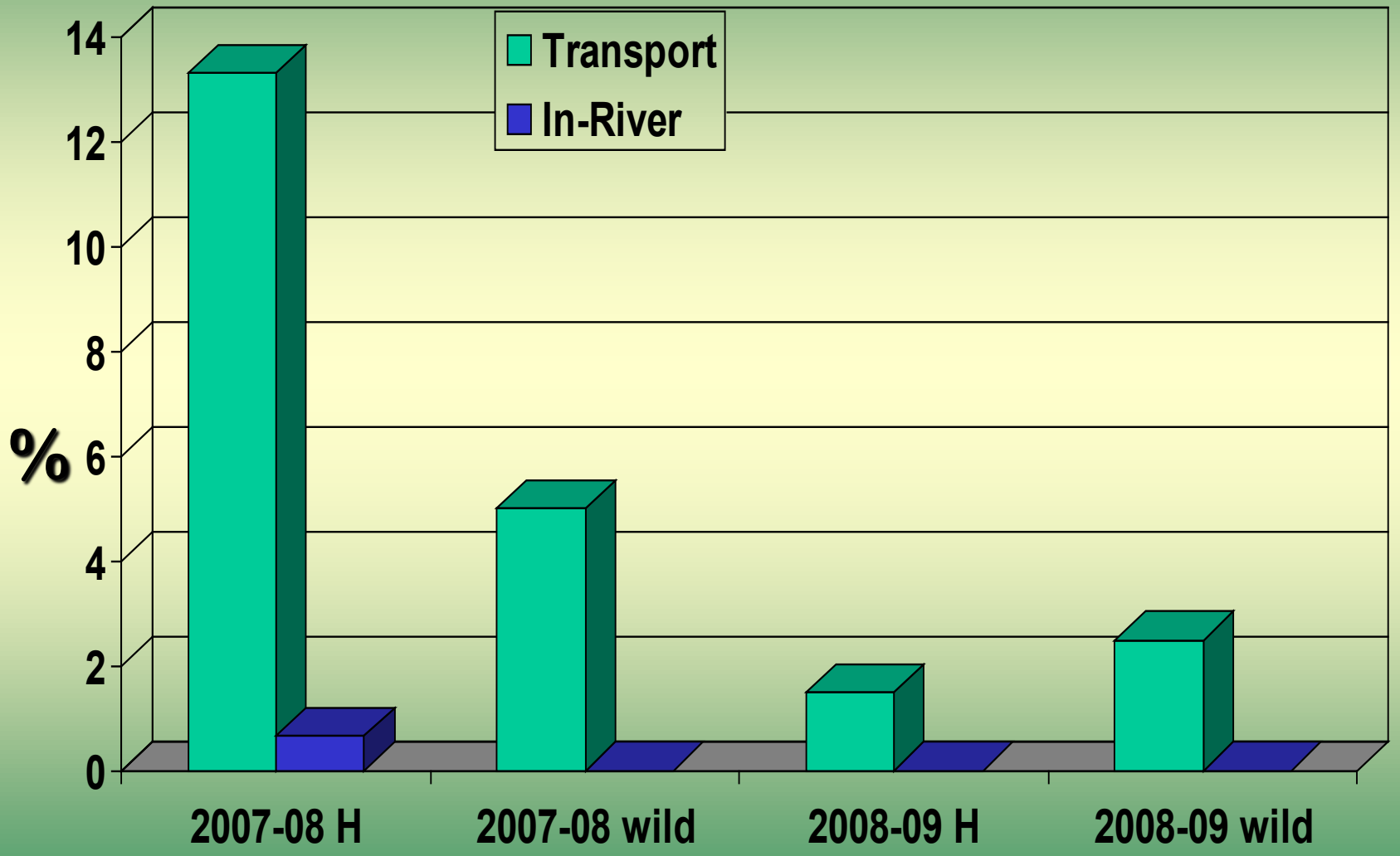
Adult Steelhead Detections of Transport Study Groups - 2007-08 and 2008-09 Run Years

Smolt Group	Bonneville Dam (N)			John Day River			Deschutes River		
	Hatchery	Wild	All	Hatchery	Wild	%	Hatchery	Wild	%
Barged 2007-08	918	343	1,261	29	17	3.6	64	10	5.9
In-River 2007-08	151	77	228	1	0	0.4	1	0	0.4
Barged 2008-09	1584	612	2196	23	15	1.7	144	40	8.4
In-River 2008-09	152	87	239	0	0	0.0	4	0	1.6

Stray Rates Into the Deschutes for Transported and In-River Migrants



Stray Rates Into the John Day for Transported and In-River Migrants



Statistical Results (z-tests)

- **Returning adults that were transported as smolts (BR) stray at greater rates than those that were allowed to migrate the river corridor (RR).**
  - **% detections of BR fish > % RR fish in John Day, P = 0.003**
  - **% detections of BR fish > % RR fish in Deschutes, P < 0.001**

- **Transported hatchery adults stray at greater rates into the Deschutes River than transported natural adults, P < 0.001**

- **Similar rates of straying of transported hatchery and natural adults into the John Day River. There was no significant difference, P = 0.19**

Summary

- **Snake River hatchery strays are considered a significant threat to viability of Oregon's Mid-C steelhead populations, model results indicate reduction in hatchery spawners will provide a significant productivity improvement.**
- **We observed highly variable patterns in stray rates, distribution, and timing between stocks.**
- **Snake River hatchery steelhead contribute substantially to tribal and sport fisheries in the Deschutes River.**
- **Wallowa Hatchery and Hells Canyon A steelhead had the highest mean stray rate into the Deschutes River.**

Summary

- **Wallowa Hatchery and Hells Canyon A steelhead were the stocks that had the highest proportion and number recovered in spawning areas during the spawning season.**
- **There were some strong correlations in annual stray rates among stocks.**
- **Release locations influence stray rates.**
- **Two years of observations from the Deschutes and John Day rivers pit-tag monitoring indicate that adults, transported as smolts, stray at significantly higher rates than adults that were in-river migrants and these adults are the primary source of strays in Oregon's Mid-C steelhead populations.**

Summary

- **Maintaining a reduced number of Snake River hatchery smolts that are transported will contribute significantly to recovery of Mid-C steelhead in Oregon and improve returns to the LSRCP area.**