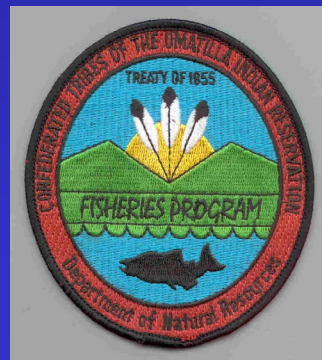


Grande Ronde River Summer Steelhead Hatchery Program Review

R. W. Carmichael, L. R. Clarke, M. Flesher,
D. Eddy, S. Warren and H. Stanton

Oregon Department of Fish and Wildlife
203 Badgley Hall
Eastern Oregon University



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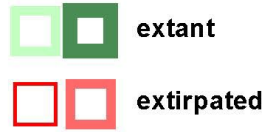
Presentation Outline

- **Natural population structure and status**
- **Management objectives and compensation/production goals**
- **Monitoring and evaluation objectives and methods**
- **Broodstock development and management strategies**
- **In - hatchery production performance**
- **Hatchery program performance – survival, adult returns, catch and escapement , straying, and fishery restoration**
- **Conclusions**
- **HSRG, HRT comments and responses, adaptive management changes and future challenges**

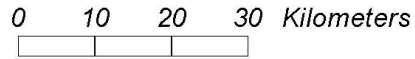
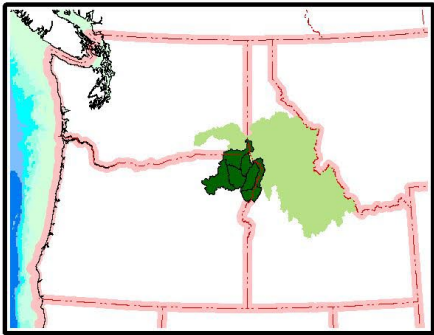
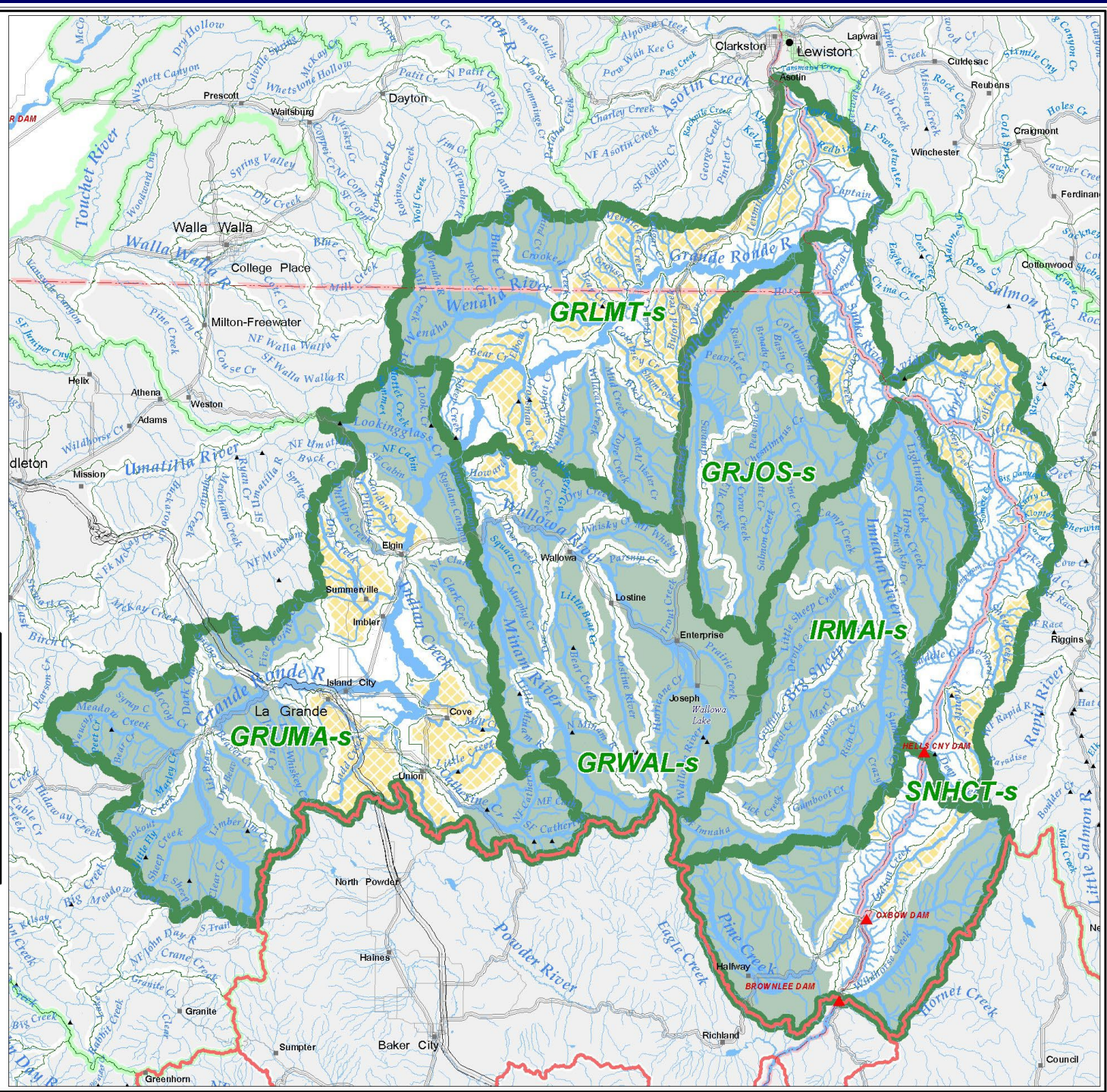
Snake River Steelhead ESU

Oregon Populations

Population Status



Spawning Aggregation



Map prepared January 2006.

Distribution of Oregon Snake River Steelhead Wild Fish and Hatchery Management Areas, Oregon

Snake River Steelhead DPS



Hatchery fish, and actions to address them, were identified as a key threat in an adopted conservation and recovery plan



Population Boundary



Extinct / Functionally Extirpated

Designation



Wild Fish Management Area



Augmentation (Integrated)-Wild Fish



Augmentation (Segregated)-Wild Fish



Supplementation



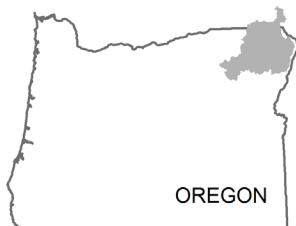
Reintroduction-Jump Start



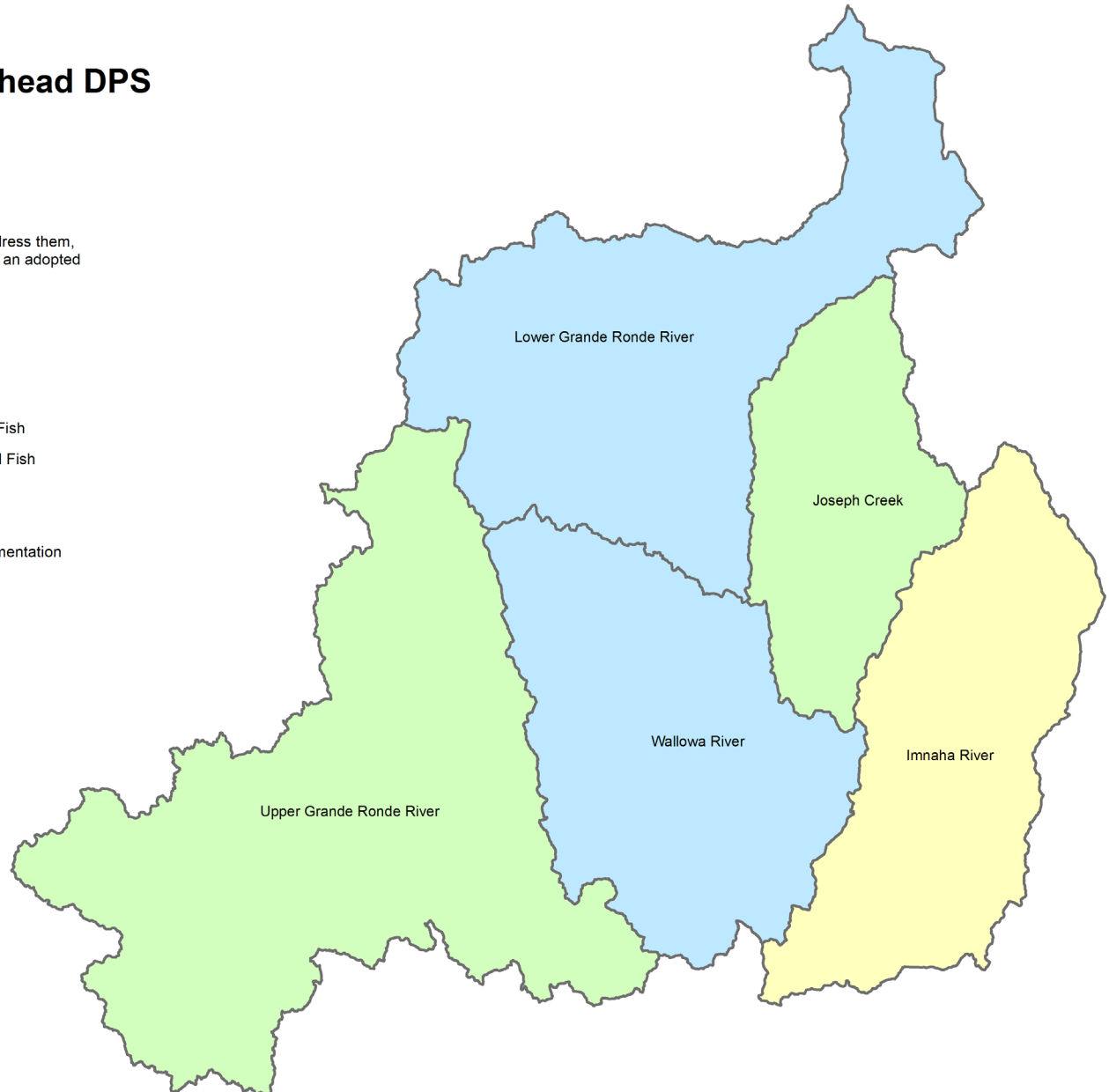
Reintroduction-Continue supplementation



To Be Determined

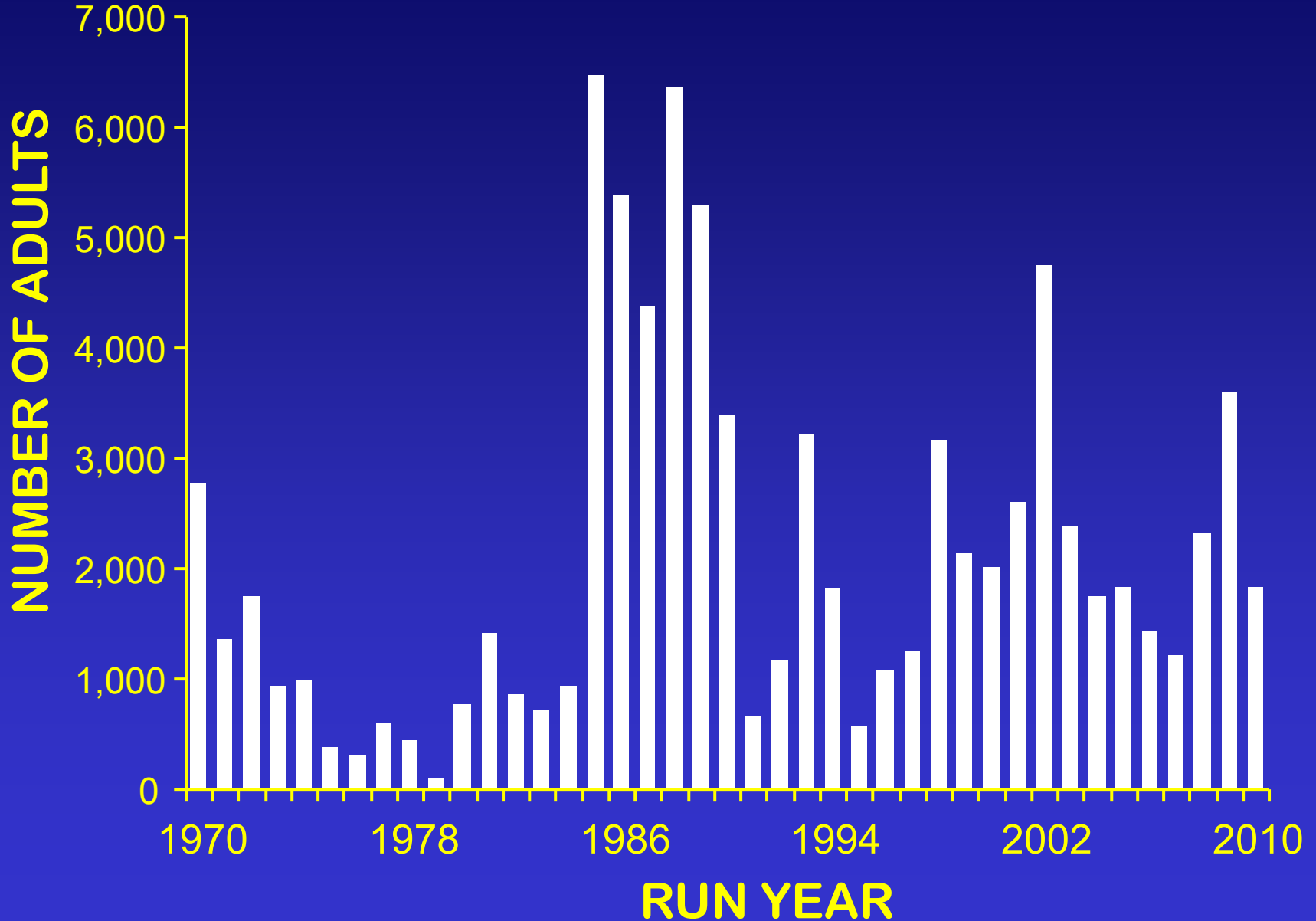


OREGON



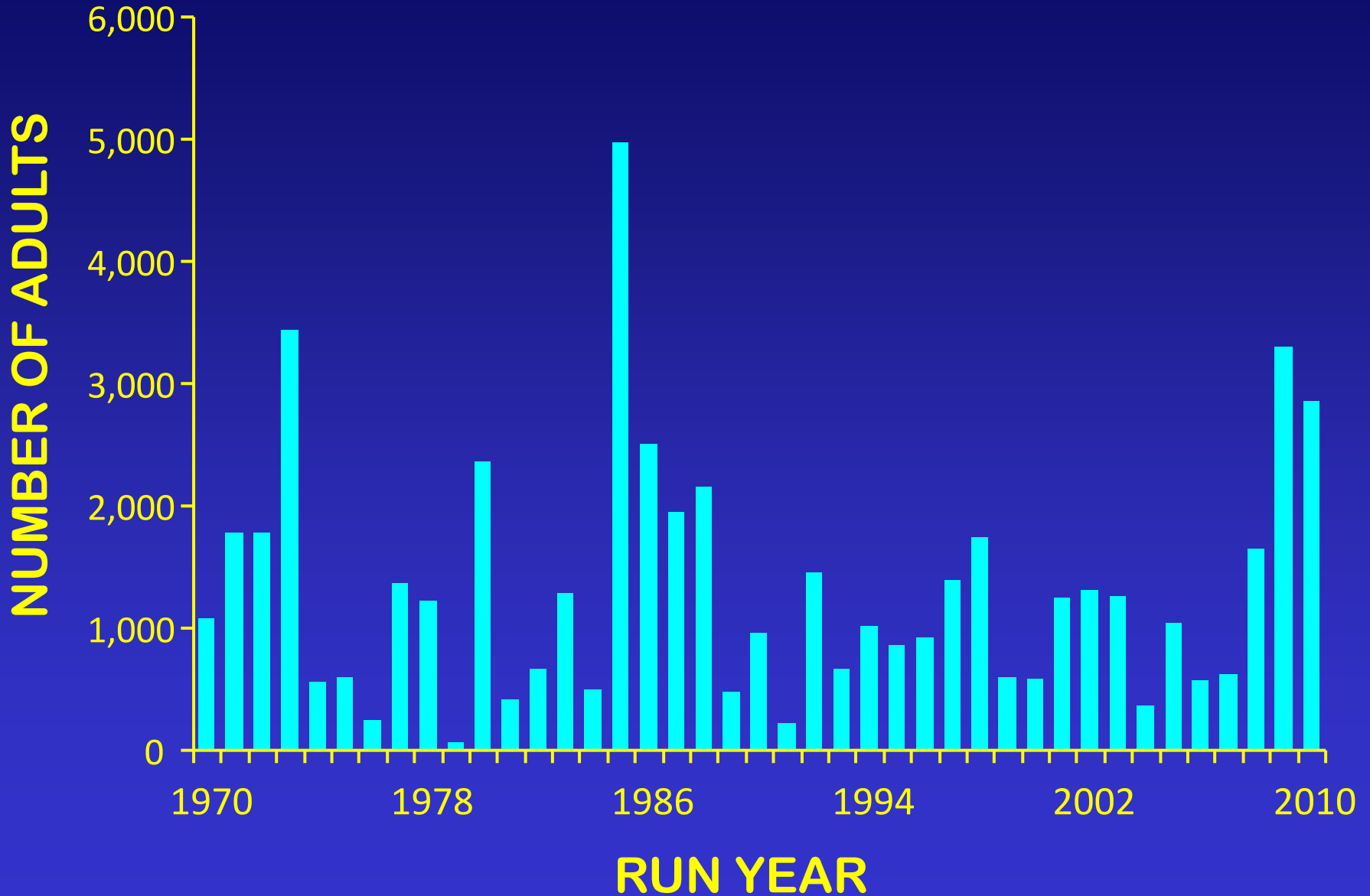
Natural Adult Abundance

Joseph Creek Population

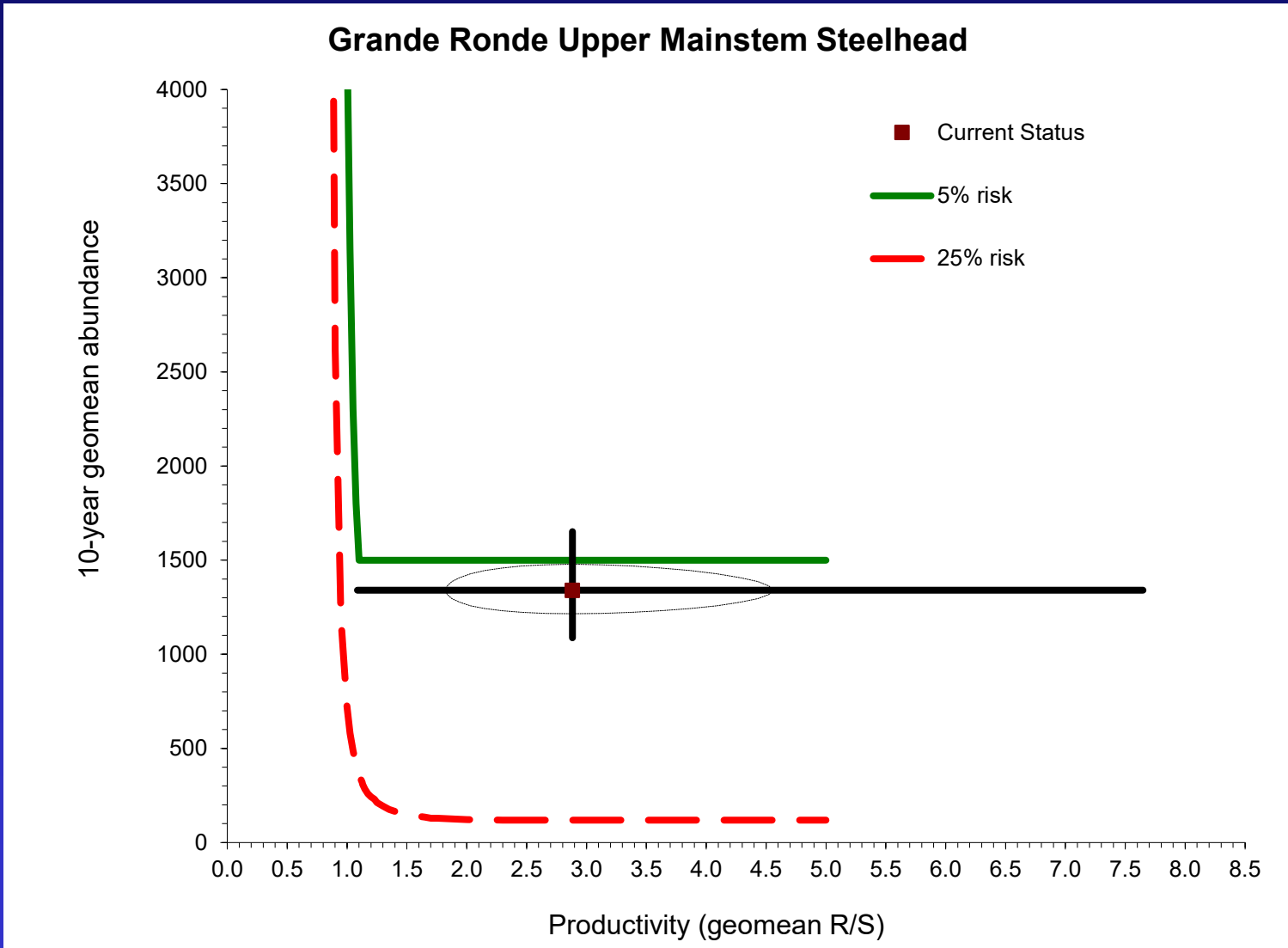


Natural Adult Abundance

Upper Mainstem Grande Ronde River Population



Grande Ronde Upper Mainstem Steelhead Population Abundance/Productivity Status



Mitigation Goals

Wallowa Stock Summer Steelhead Annual Goals

1,350,000 Smolts (*800,000 interim*)

9,184 Adults

**0.68% Smolt-to-Adult Return Rate
(*1.15% interim SAR*)**

27,552 Total Adults

2.04% Smolt-to-Adult Survival Rate

Management Objectives

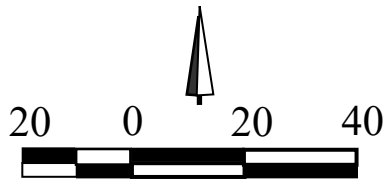
- Establish an annual supply of broodstock capable of meeting production goals.
 - Restore and maintain natural populations.
 - Re-establish historic tribal and recreational fisheries.
 - Establish a total return of summer steelhead that meets the LSRCP compensation goal.
 - Minimize the impacts of the hatchery program on resident fishes.
- *Although restore and maintain natural populations was an original objective it has never been a priority. The program has actually been operated as a harvest augmentation segregated program in terms of broodstock management and minimizing the number of hatchery fish spawning in nature.*

Monitoring and Evaluation Objectives

- Document and assess fish culture and hatchery operation practices and performance.
- Determine optimum rearing and release strategies that will produce maximum survival to adult.
- Determine total catch and escapement, smolt survival to LGD, total smolt-to-adult survival (SAS), smolt-to-adult return rate to the compensation area (SAR), and assess if adult production meets mitigation goals.
- Determine recruits-per-spawner of hatchery origin fish.
- Assess life history characteristics of hatchery fish (age structure, run timing, sex ratios, smolt migration) and monitor for changes through time .
- Determine the magnitude and patterns of within and out of basin straying.
- Determine success in restoring recreational fisheries to historical levels.

Grande Ronde and Imnaha River Basins Steelhead Hatchery Facilities

N



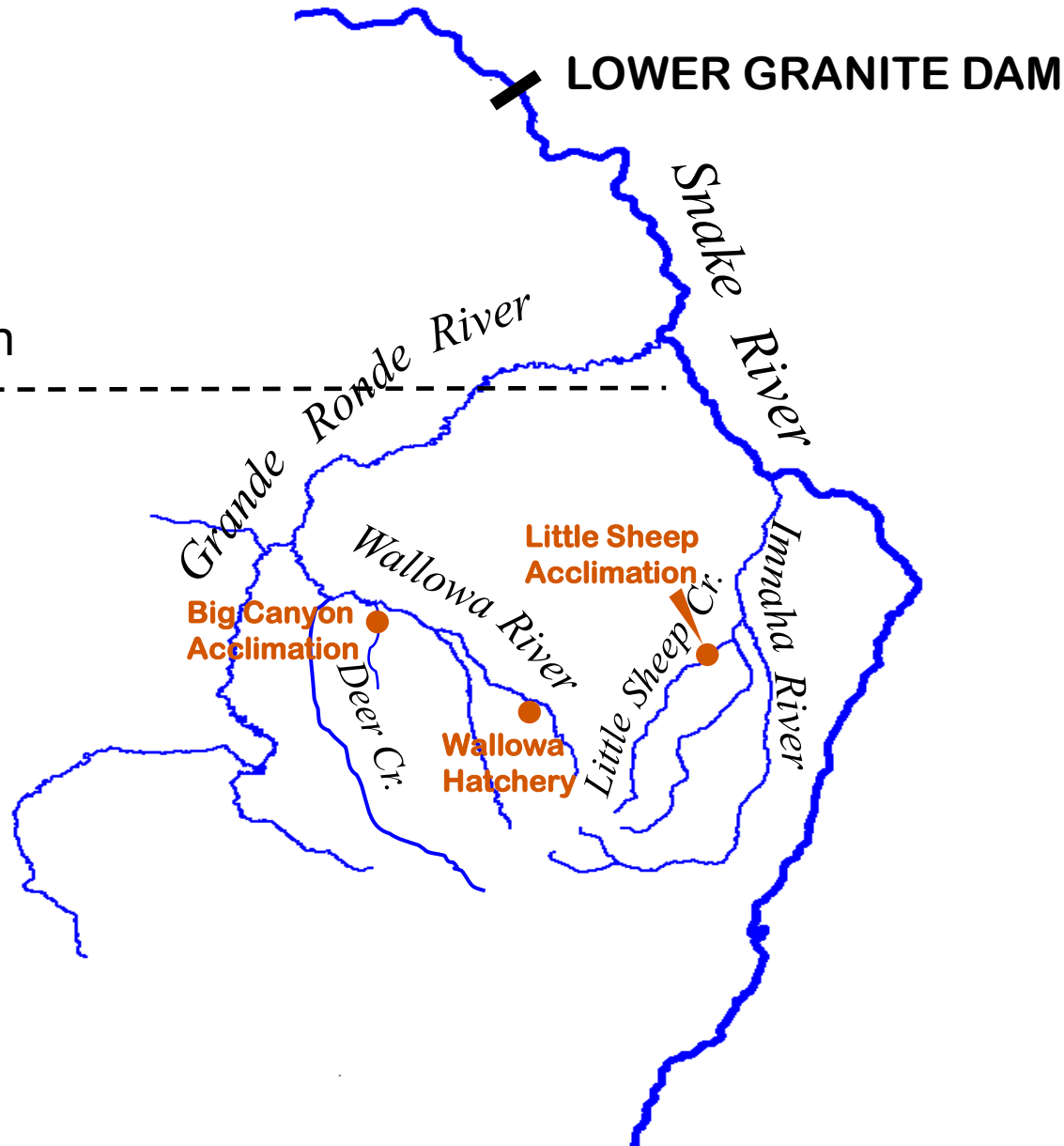
Kilometers

Washington

Oregon



Irrigon Hatchery



Wallowa Hatchery and Adult Ladder



Irrigon Fish Hatchery



Feeding steelhead smolts, Irrigon Hatchery



Wallowa Hatchery Acclimation Pond



Big Canyon Facility at Deer Creek



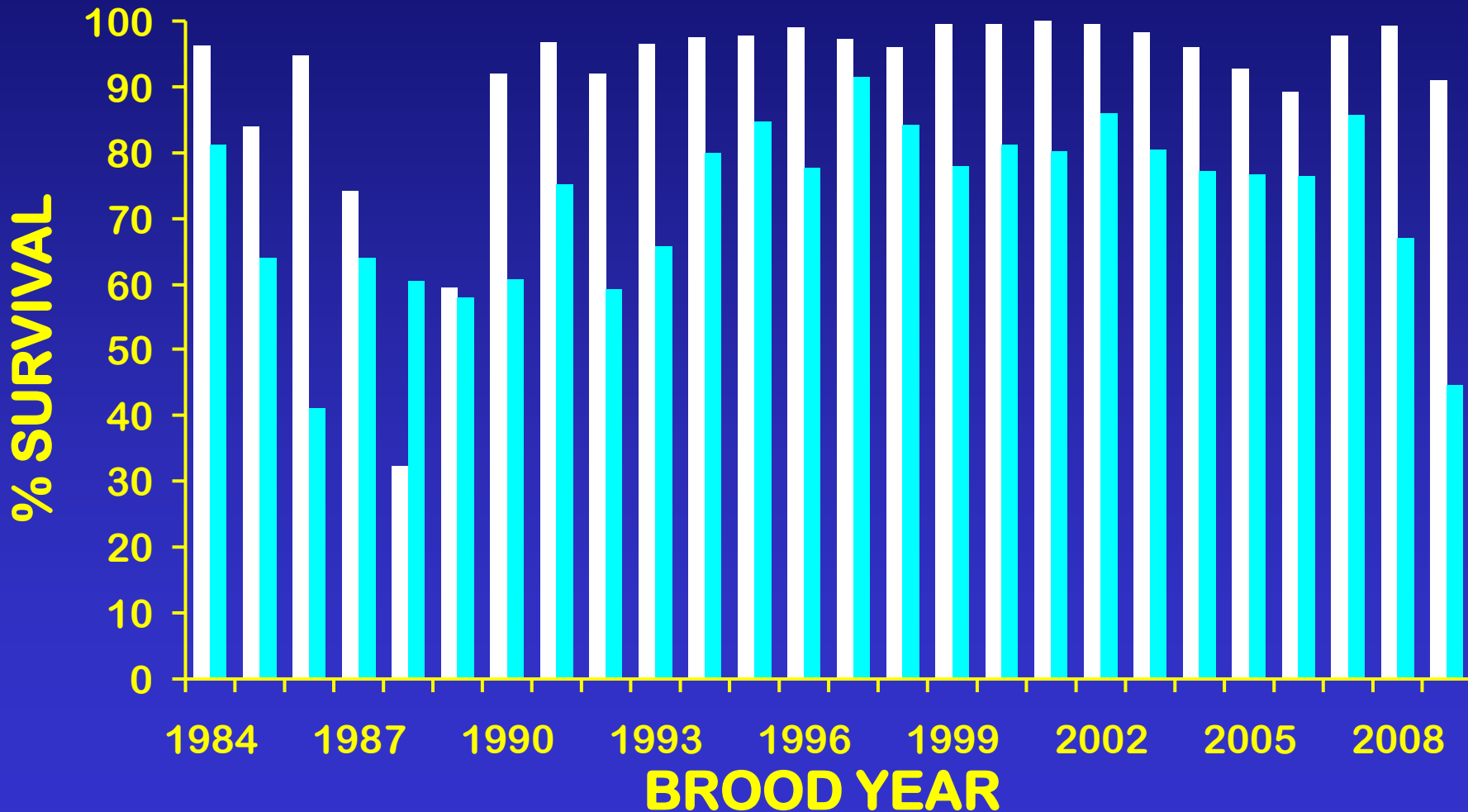
Broodstock History – Wallowa Stock

Stock of Origin	Spawn Years	Number of Females in Broodstock	
		Production	Autumn line
Snake River Wild	1976-1978	35-48	na
Pahsimeroi ID	1979	33	na
Wallowa Hatchery	1980-1985	85-384	na
Wallowa Hatchery	1986-2000	275-812	na
Wallowa Hatchery	2001-2011	180-242	31-54*

**First year angler-caught autumn line(Fall Brood) were spawned was 2004. In 2008, we began using F₁ as brood and discontinued angler-caught program.*

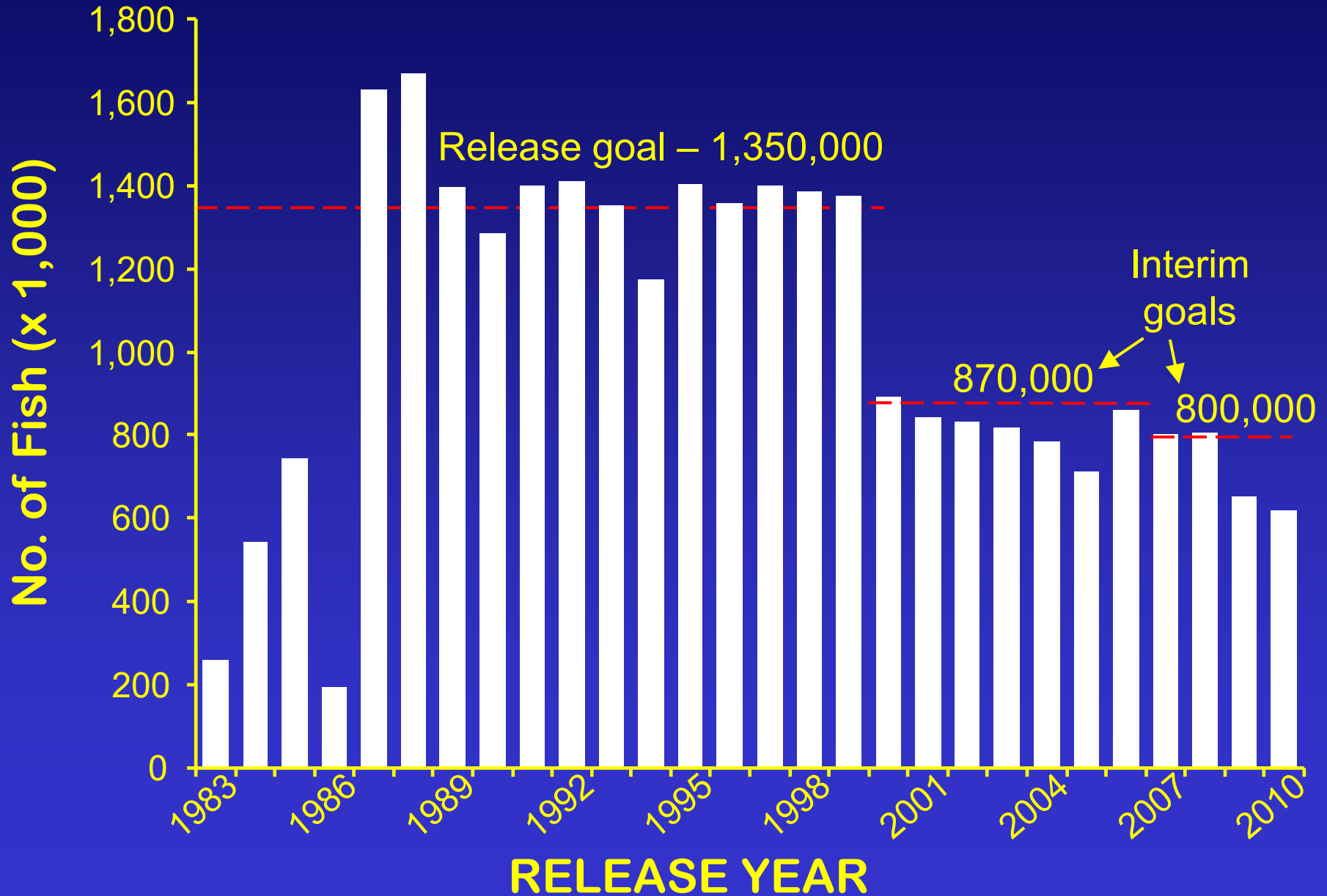
Wallowa Stock Adult Pre-Spawning and Egg to Smolt Survival

■ Pre-spawning ■ Green egg to smolt



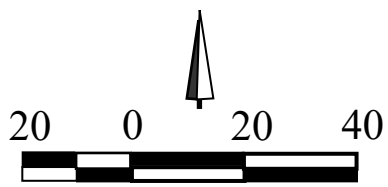
➤ Wallowa Stock data include Autumn Line unless specified otherwise

Wallowa Stock Hatchery Smolt Releases



Grande Ronde and Imnaha River Basins Steelhead Hatchery Facilities

N



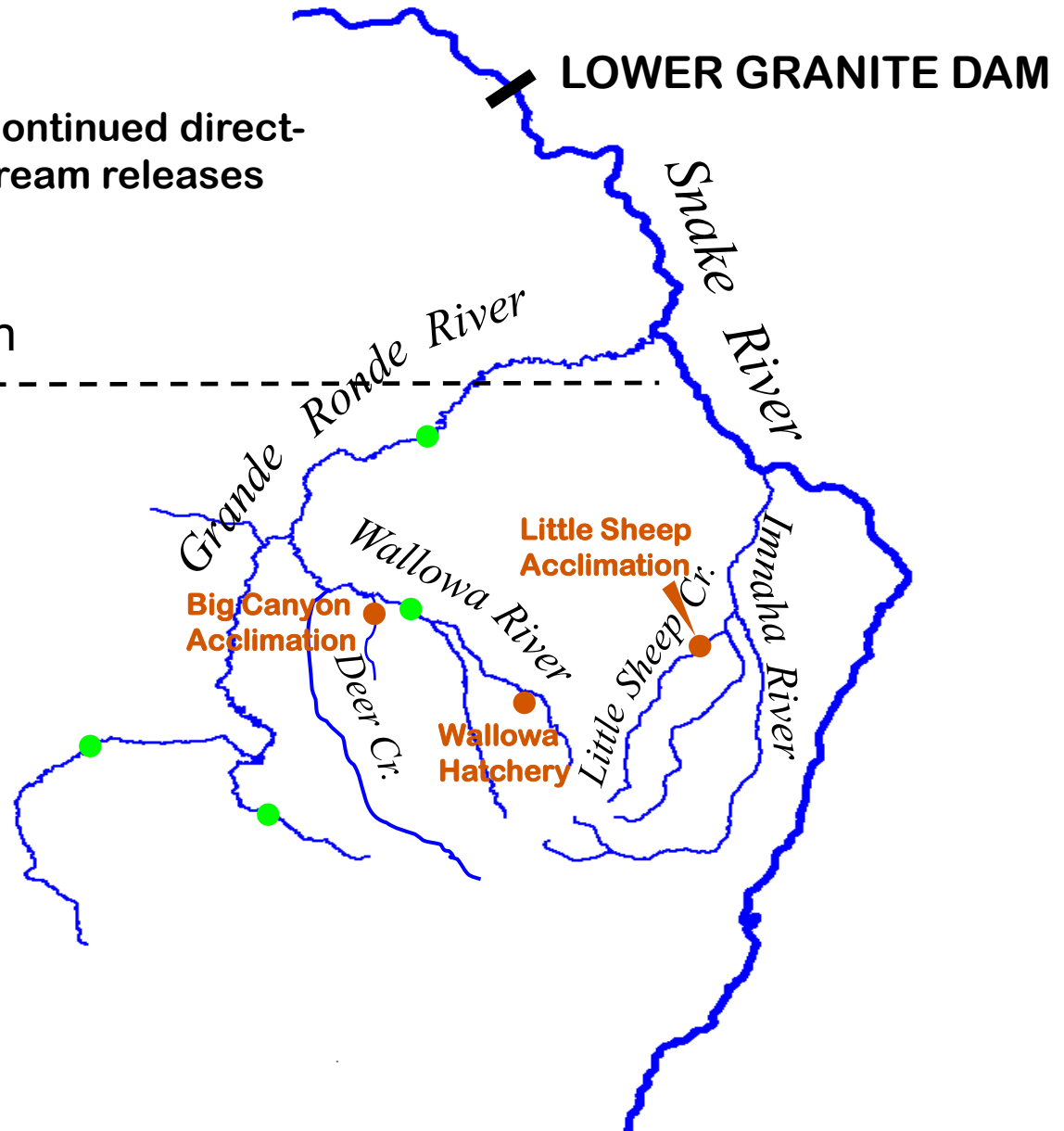
Kilometers

Discontinued direct-stream releases

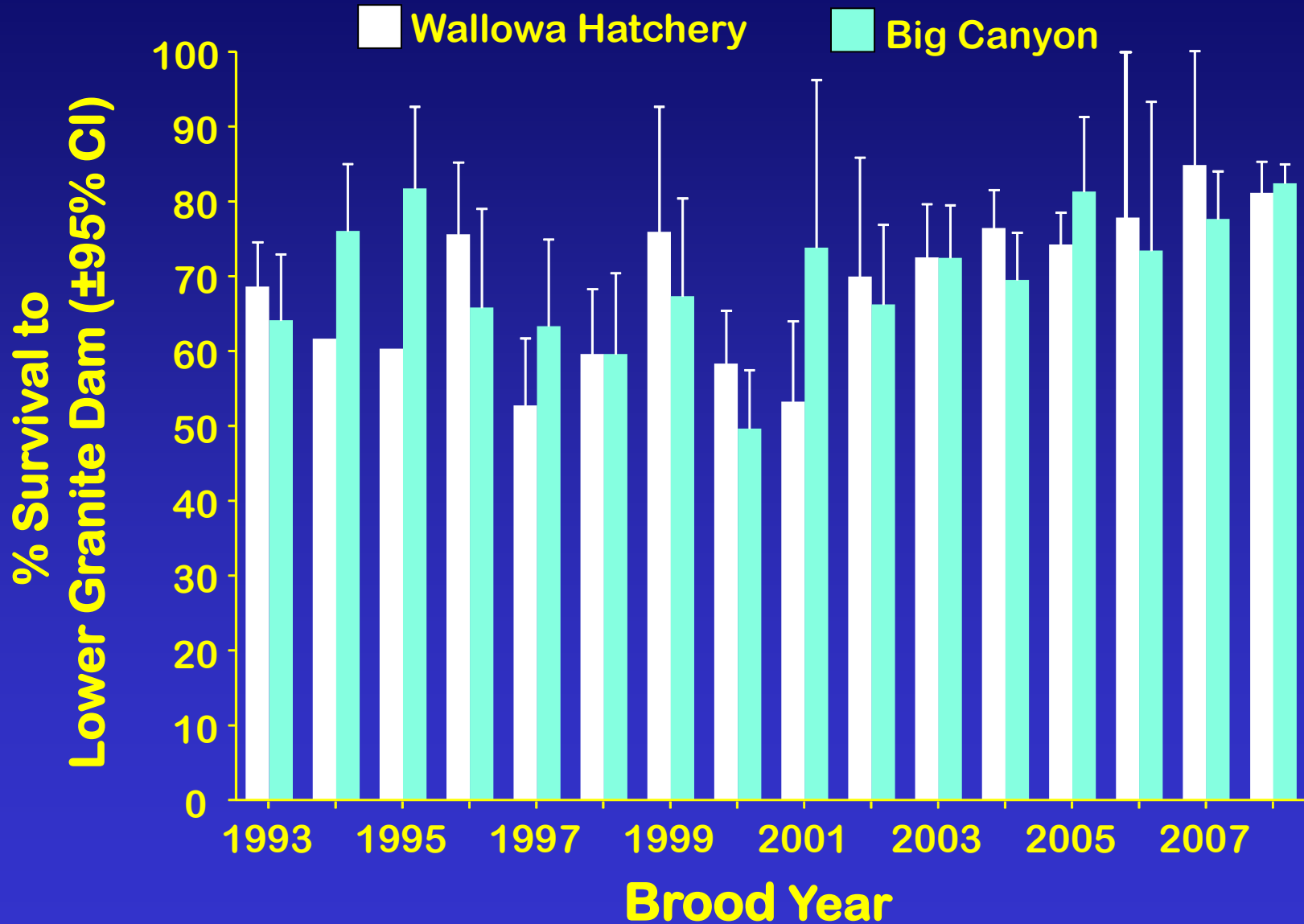


Washington

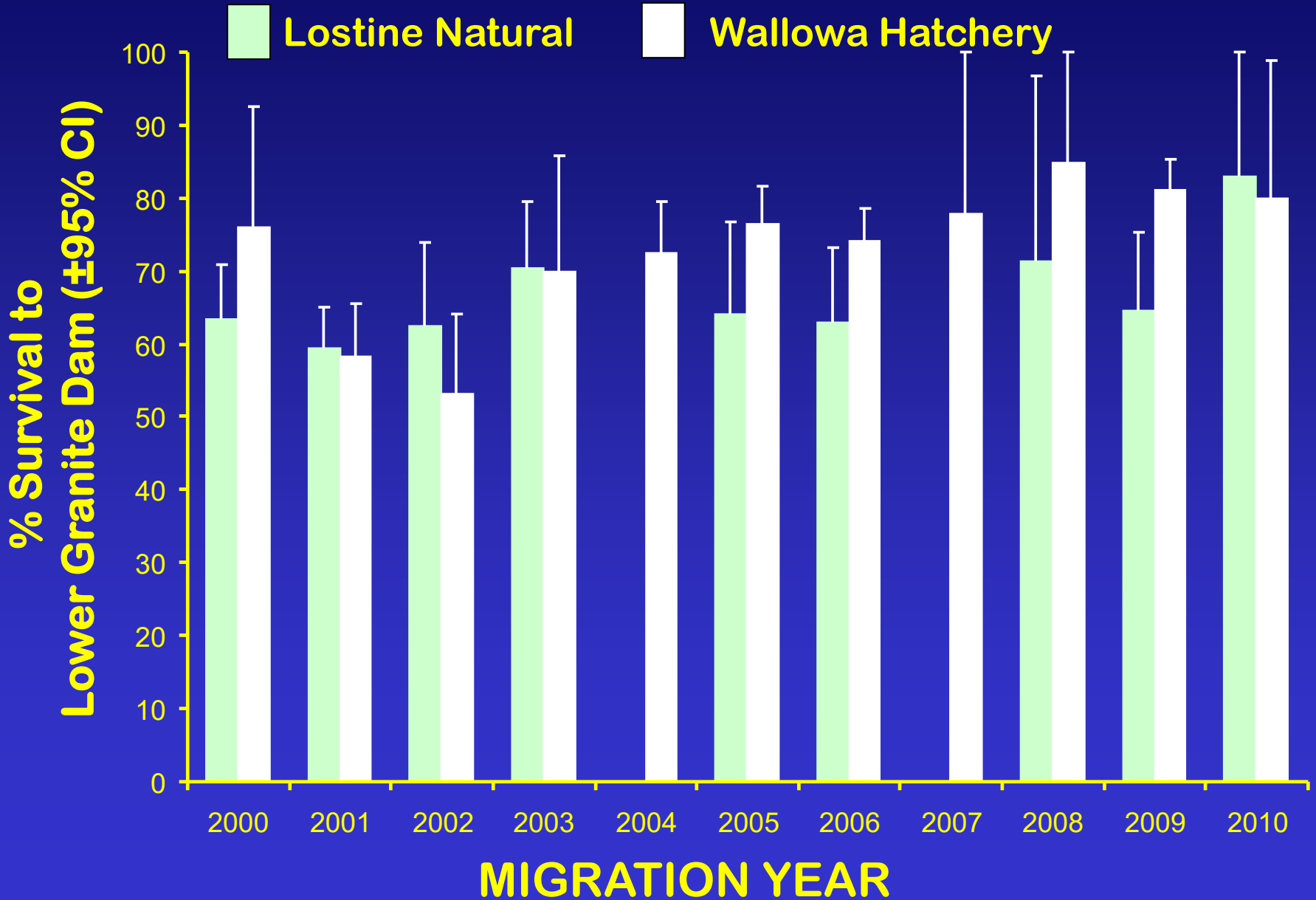
Oregon



Wallowa Stock Smolt Survival to Lower Granite Dam by Release Site

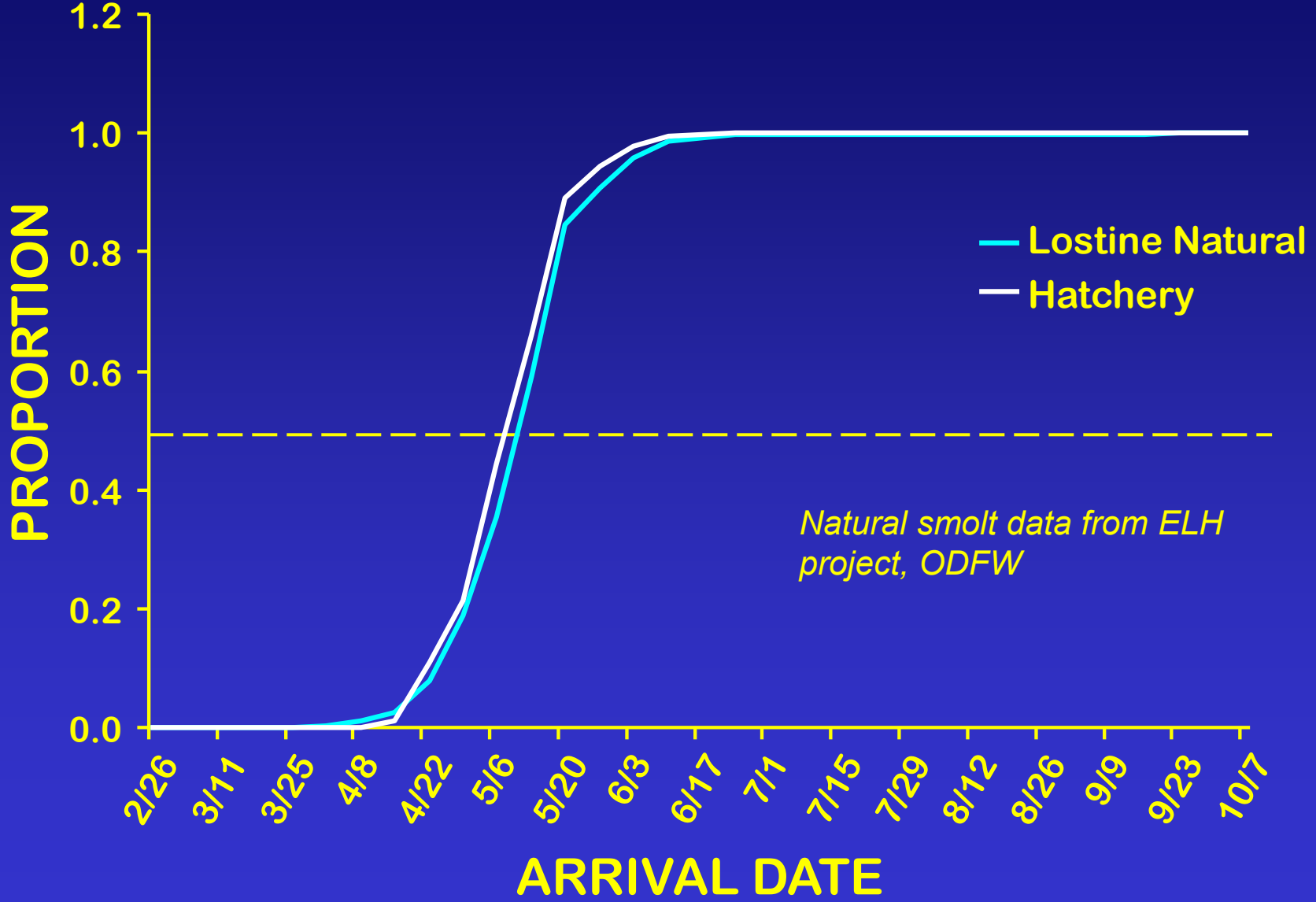


Natural and Hatchery Origin Smolt Outmigration Survival

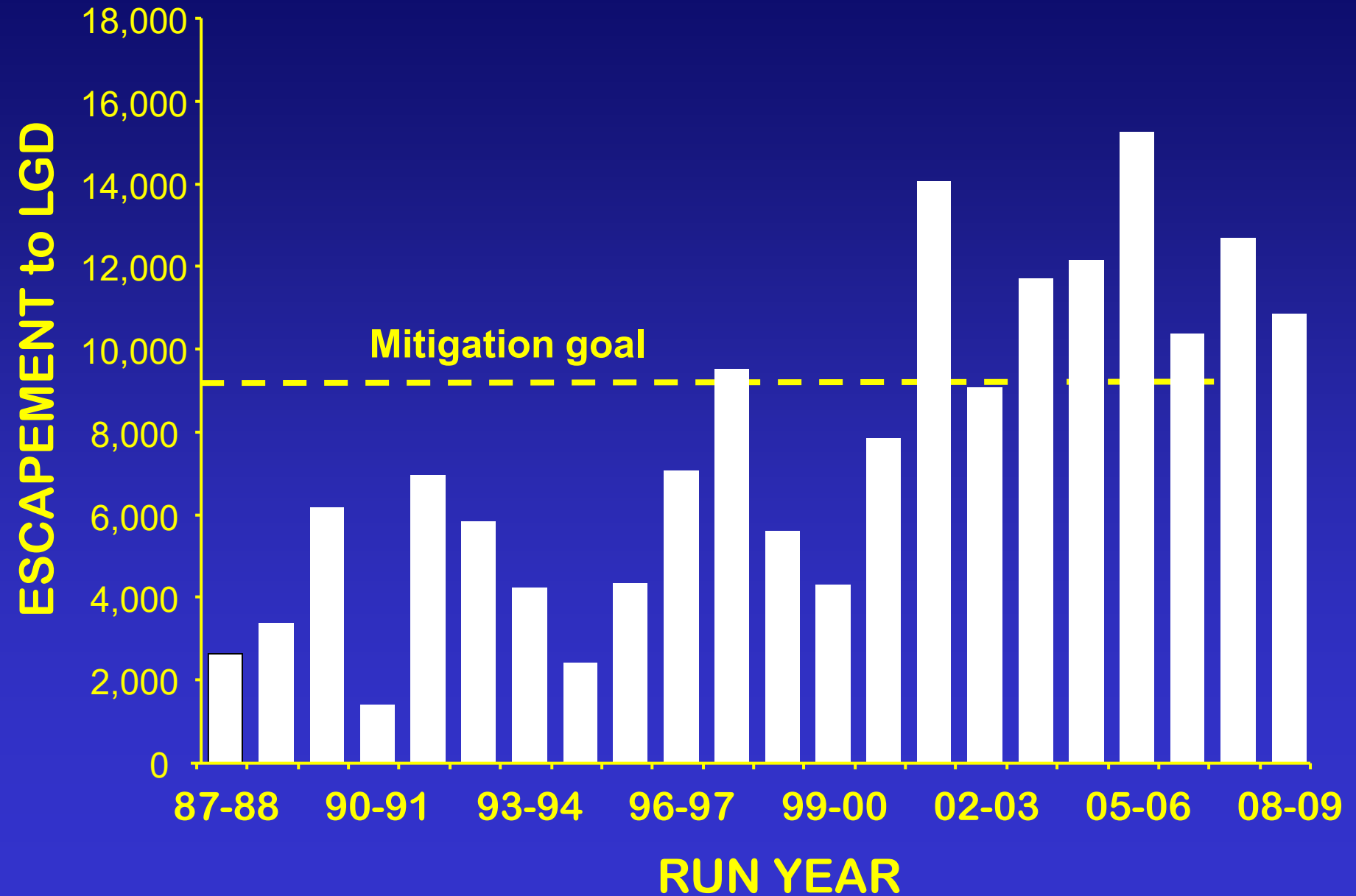


Smolt Migration Timing at Lower Granite Dam

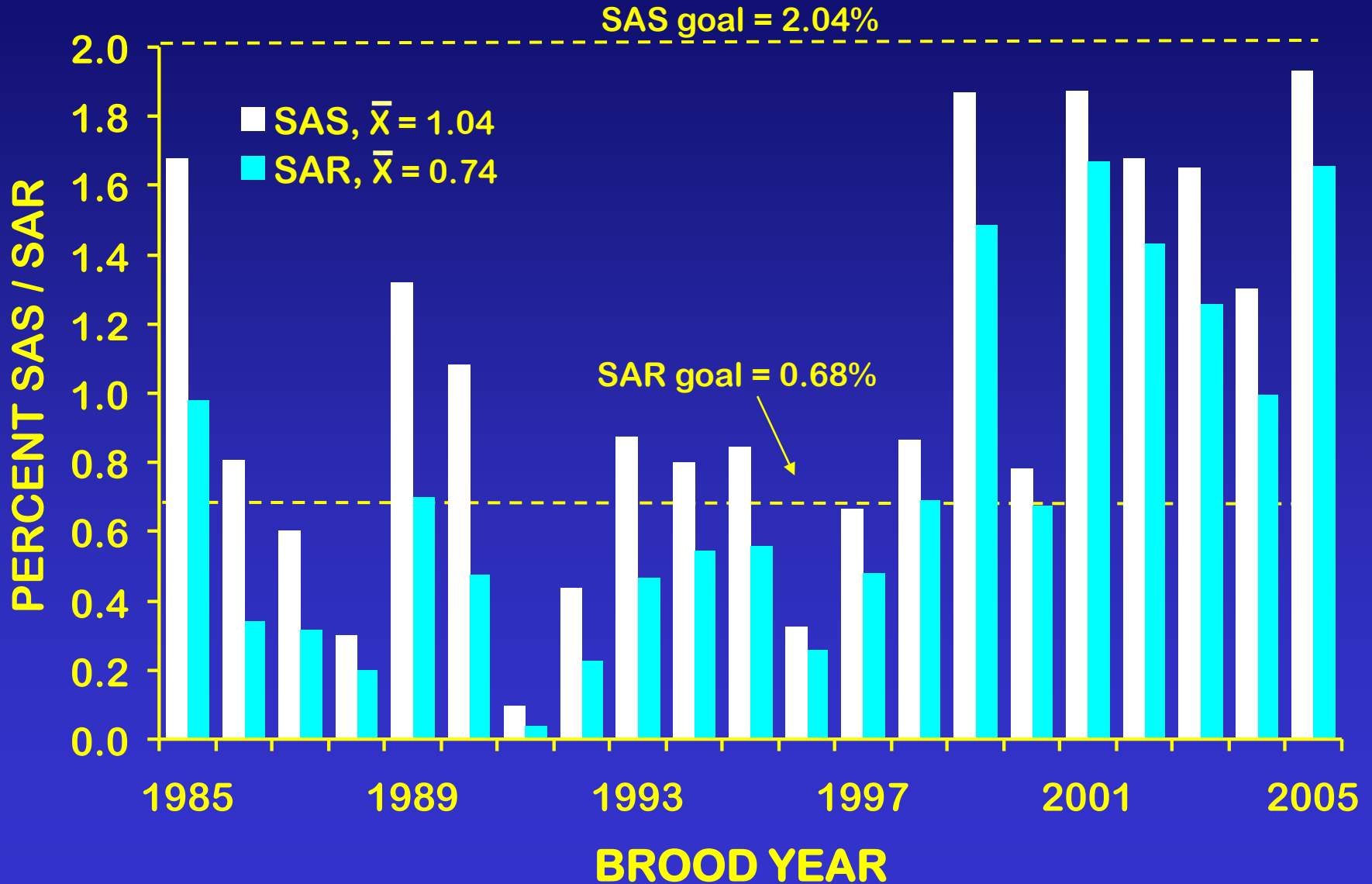
MY 2007-2011



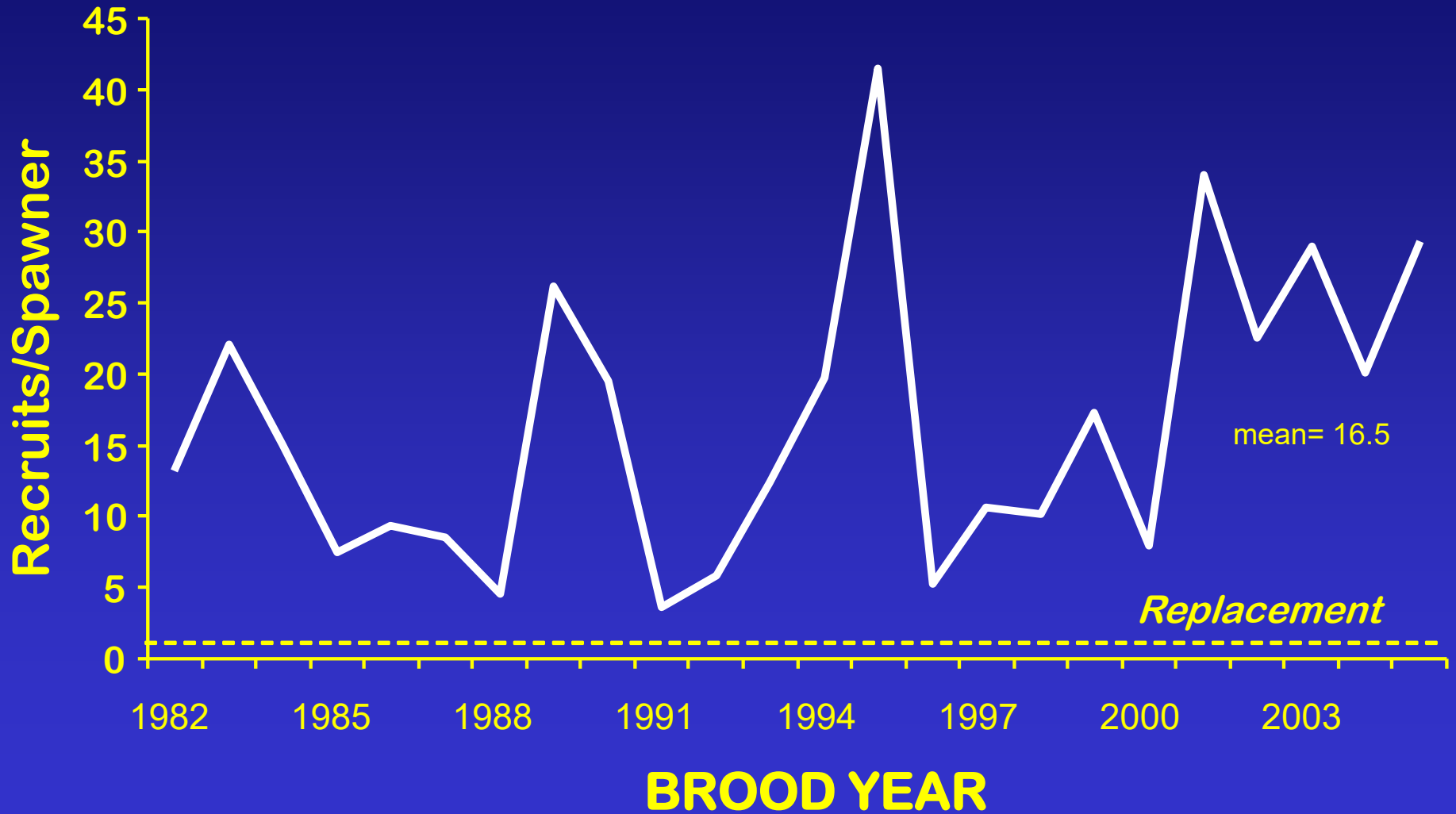
Wallowa Stock Returns to Compensation Area



Wallowa Stock Steelhead Smolt-to-Adult Survival/Return Rates



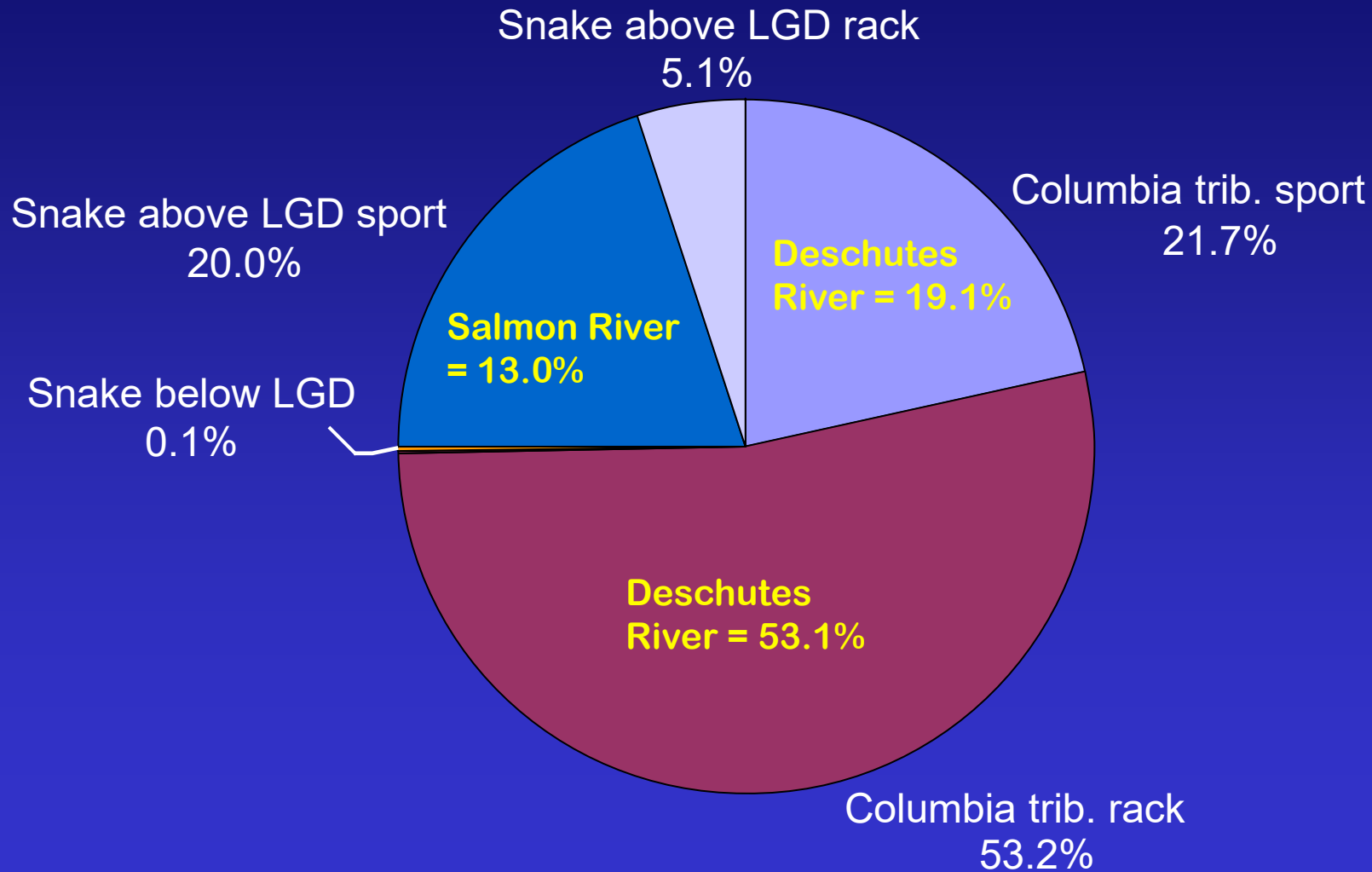
Wallowa Stock Adult Recruits per Spawner



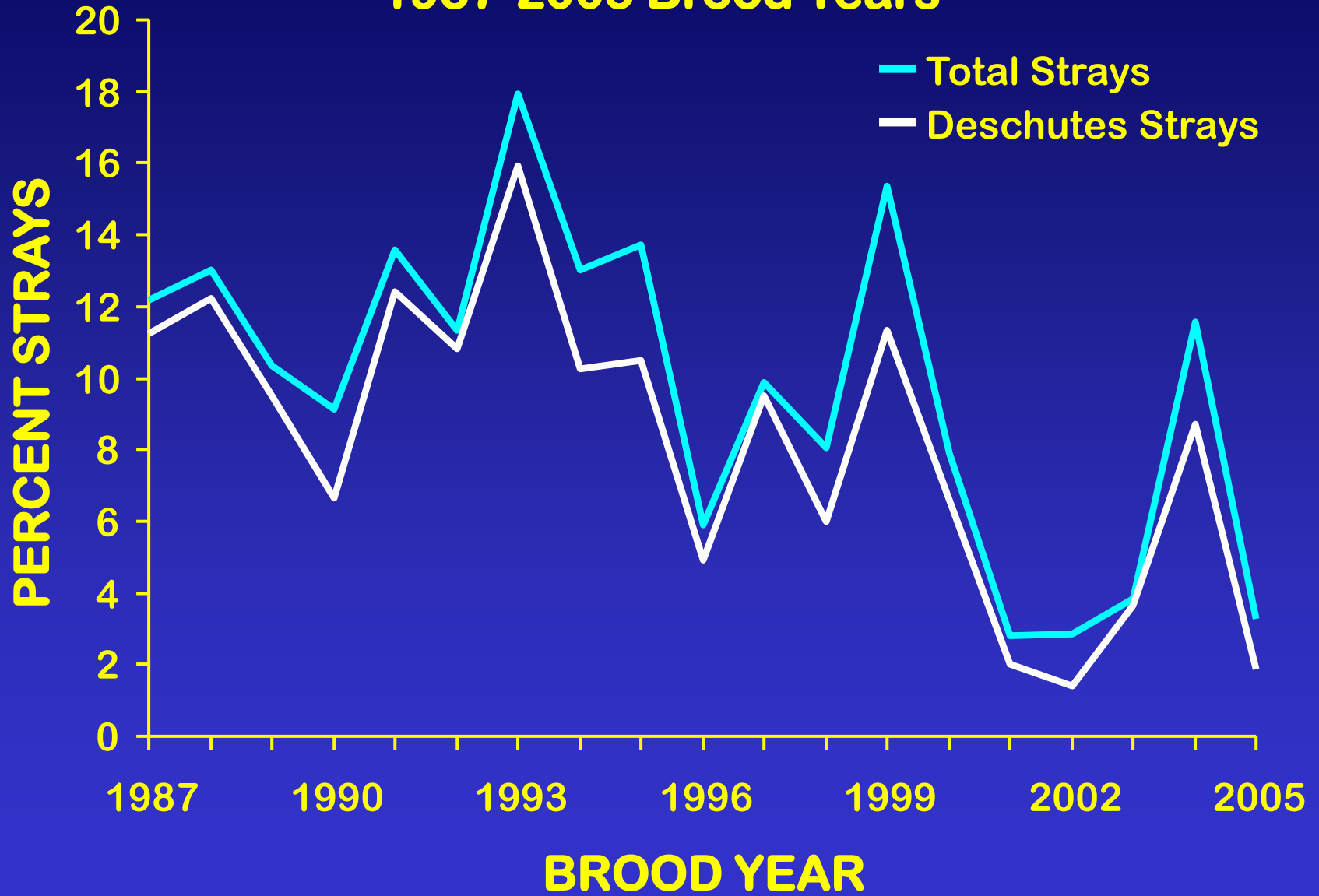
Percent Harvest and Escapement of Wallowa Stock Releases

		<u>Brood Year</u>				
		<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>Mean</u>
Ocean		0.0	0.0	0.0	0.0	0.0
Columbia River						
	Tribal	4.2	5.9	14.4	8.0	8.1
	Sport	2.3	3.7	1.9	3.2	2.8
	Stray Harvest	0.5	0.4	1.4	2.3	1.1
	Stray Rack	1.6	1.0	2.4	7.0	3.0
Snake River						
	Stray below LGD	0.0	0.0	0.0	0.0	0.0
	Stray above LGD Harvest	0.6	1.2	0.0	2.2	1.0
	Stray above LGD Rack	0.2	0.3	0.1	0.0	0.2
	Sport below LGD	2.3	3.9	4.0	3.2	3.3
	Sport above LGD	22.0	17.2	17.4	13.9	17.6
	Grande Ronde Sport	31.9	39.9	25.0	27.3	31.0
Escapement to Weir		34.6	26.6	33.5	32.8	31.9

Distribution of Wallowa Stock Strays, 2001-04 Brood Years



Wallowa Stock Strays in the Deschutes River 1987-2005 Brood Years



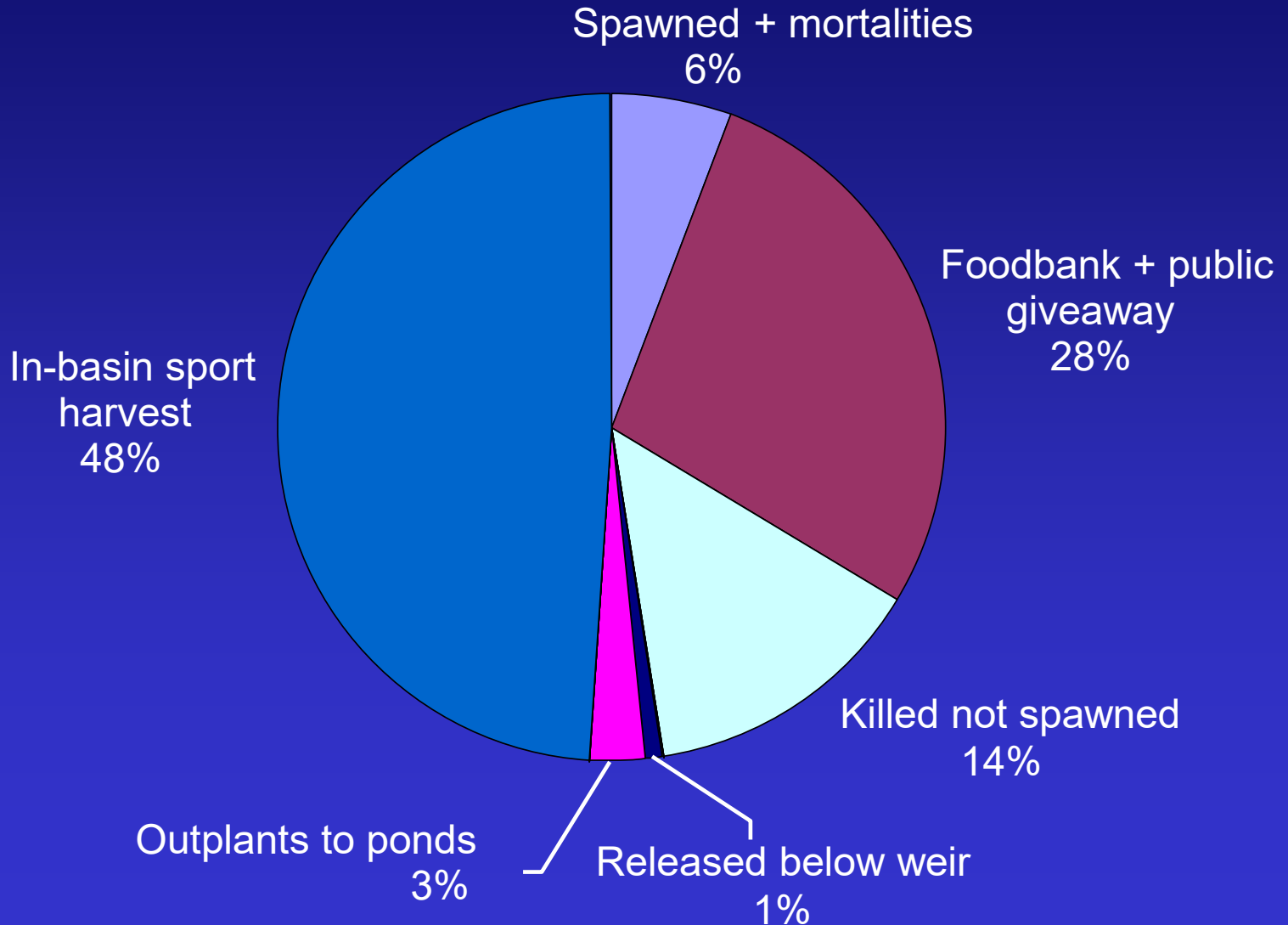
Adult Returns to Grande Ronde Weirs

Return Years 2001-10

Weir Location	Avg. Total No. of Adults	Avg. % Hatchery Origin	Range of % Hatchery Origin
Catherine Cr.	200	0.37	0-1.6
Lookingglass Cr.	186	1.61	0-2.4
Upper Grande Ronde	44	0.67	0-1.4

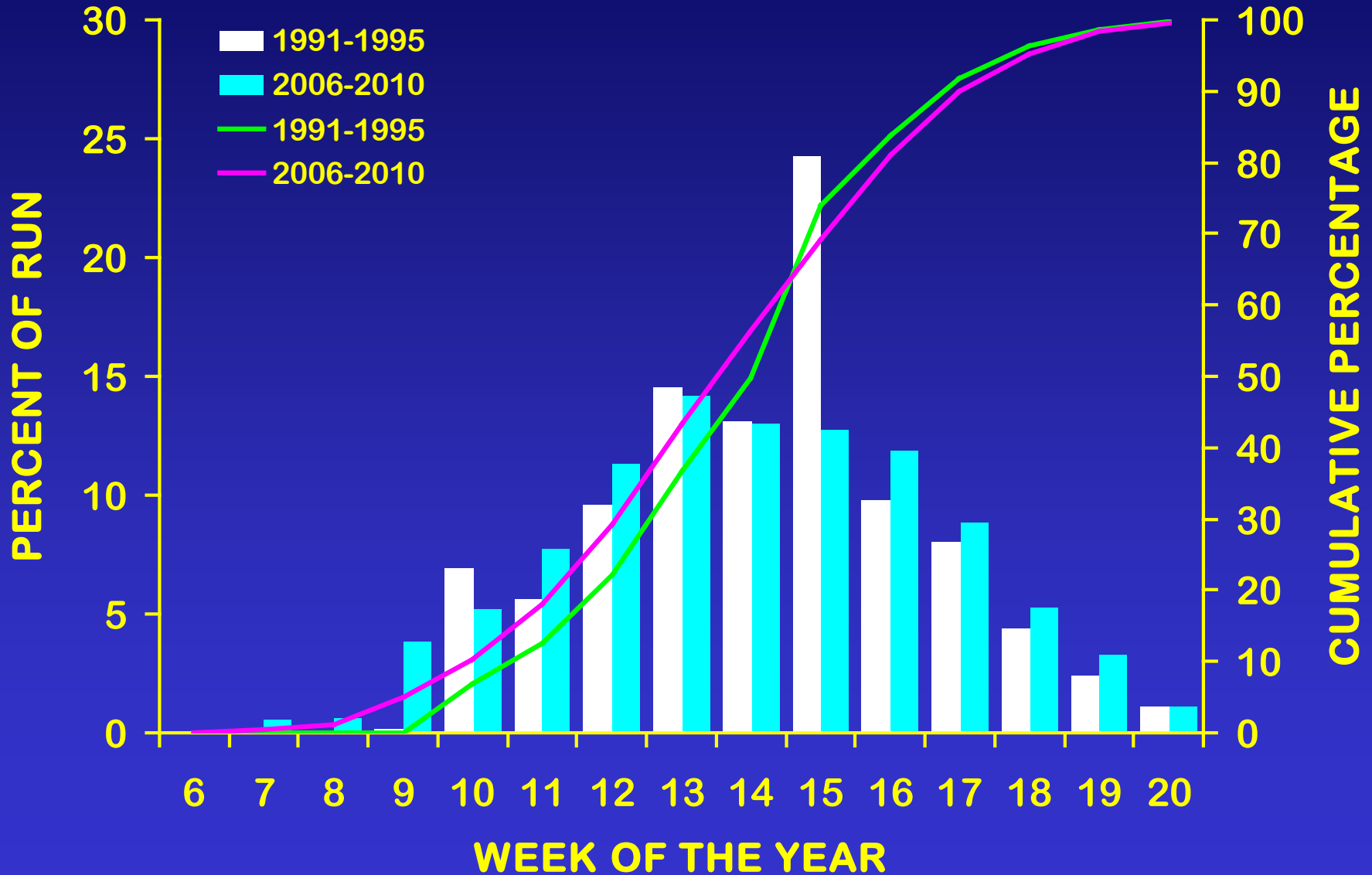
Grande Ronde Basin Escapement Distribution of Wallowa Stock

Run Years 2003-04 to 2007-08

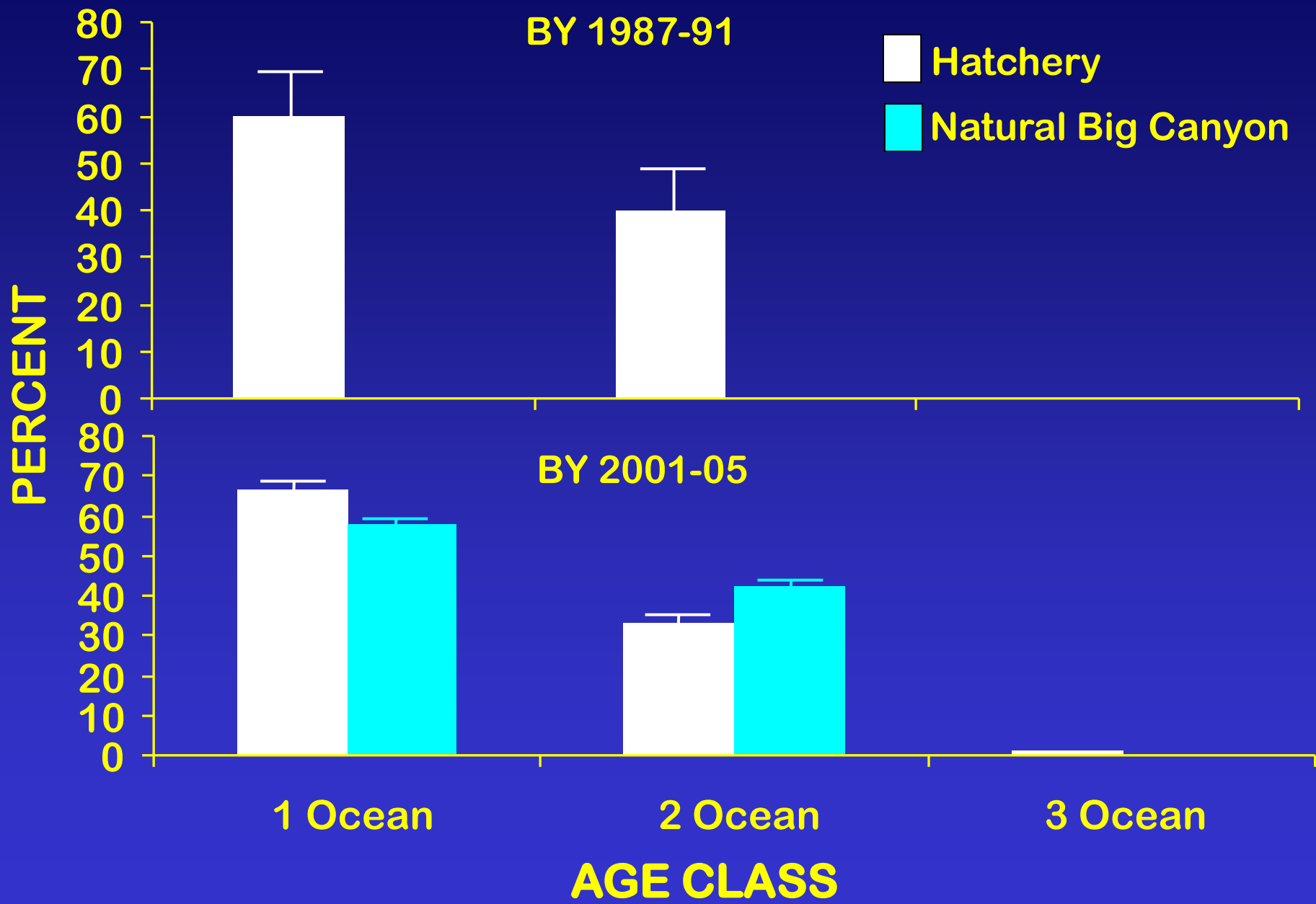


Wallowa Stock Adult Return Timing

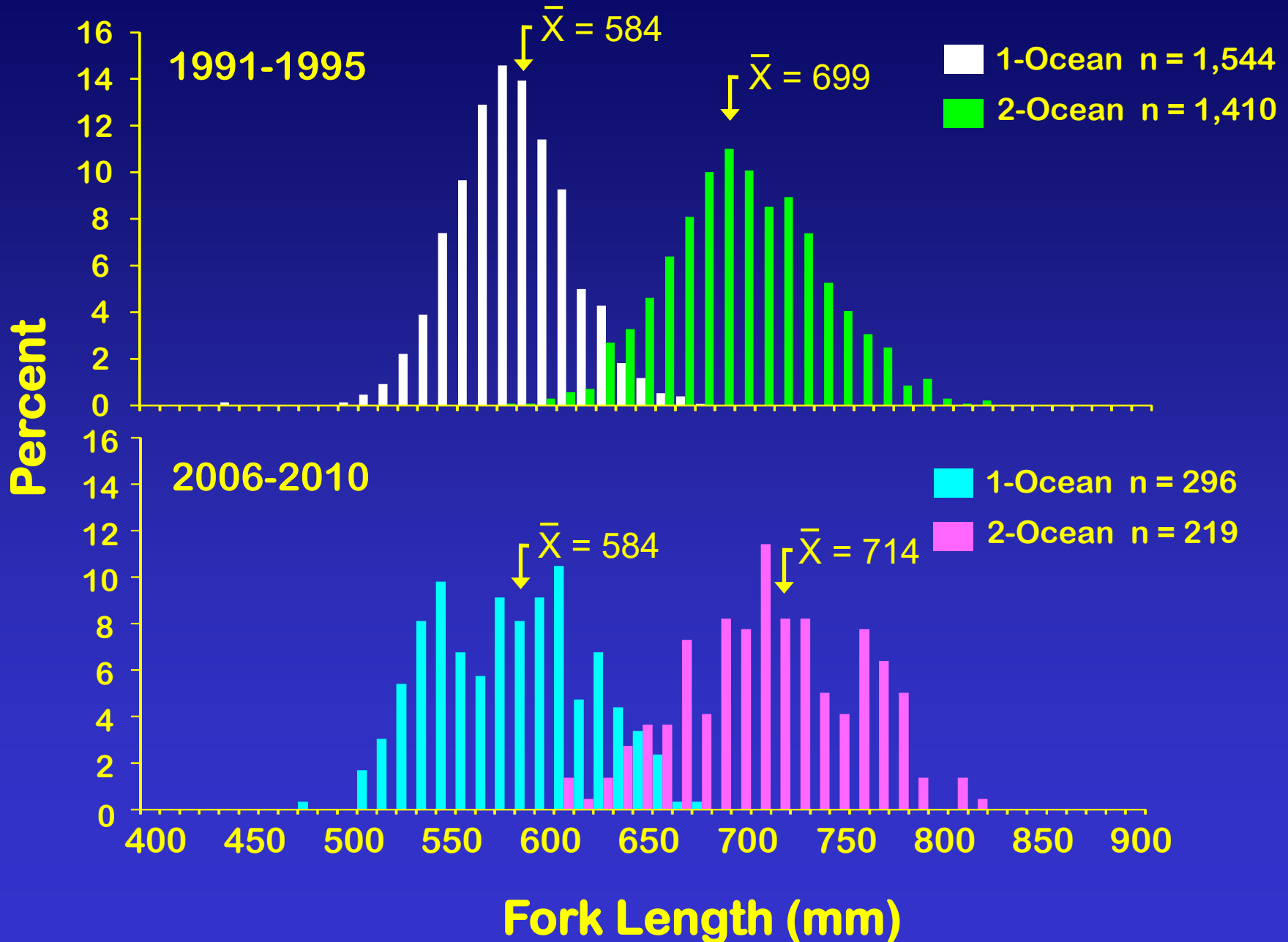
Wallowa Hatchery Weir



Wallowa Stock Age at Return



Wallowa Stock Average Length at Age

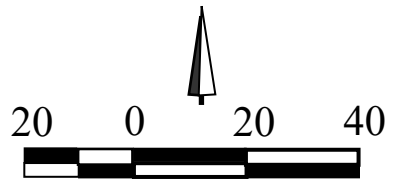


Fish Health Highlights for Wallowa Stock

Disease Issues	Consequences	Fish Health Response
Bacterial coldwater disease (CWD) caused by <i>Flavobacterium psychrophilum</i> (Fp)	<ul style="list-style-type: none">• CWD loss in most brood years after ponding fry into indoor circular tanks at Irrigon• After hauling to acclimation some smolts develop open sores with CWD bacteria being a contributing factor	<ul style="list-style-type: none">• Antibiotic treatment with florfenicol for 10 d• 2005-2009 used florfenicol at 15 mg/kg Some repeat treatments necessary• Collaborative research with U of I on new broodstock screening methods for Fp
Transfer of smolts to Big Canyon in cold weather	<ul style="list-style-type: none">• Loss from temperature shock and post hauling stress (2001 & 2009)• CWD can be a contributing factor causing chronic loss (2012)	<ul style="list-style-type: none">• Recommend delaying transfers till March• Recommend no hauling to acclimation if water temperature is < 35 F

Grande Ronde and Innaha River Basins Steelhead Fishery Areas

N

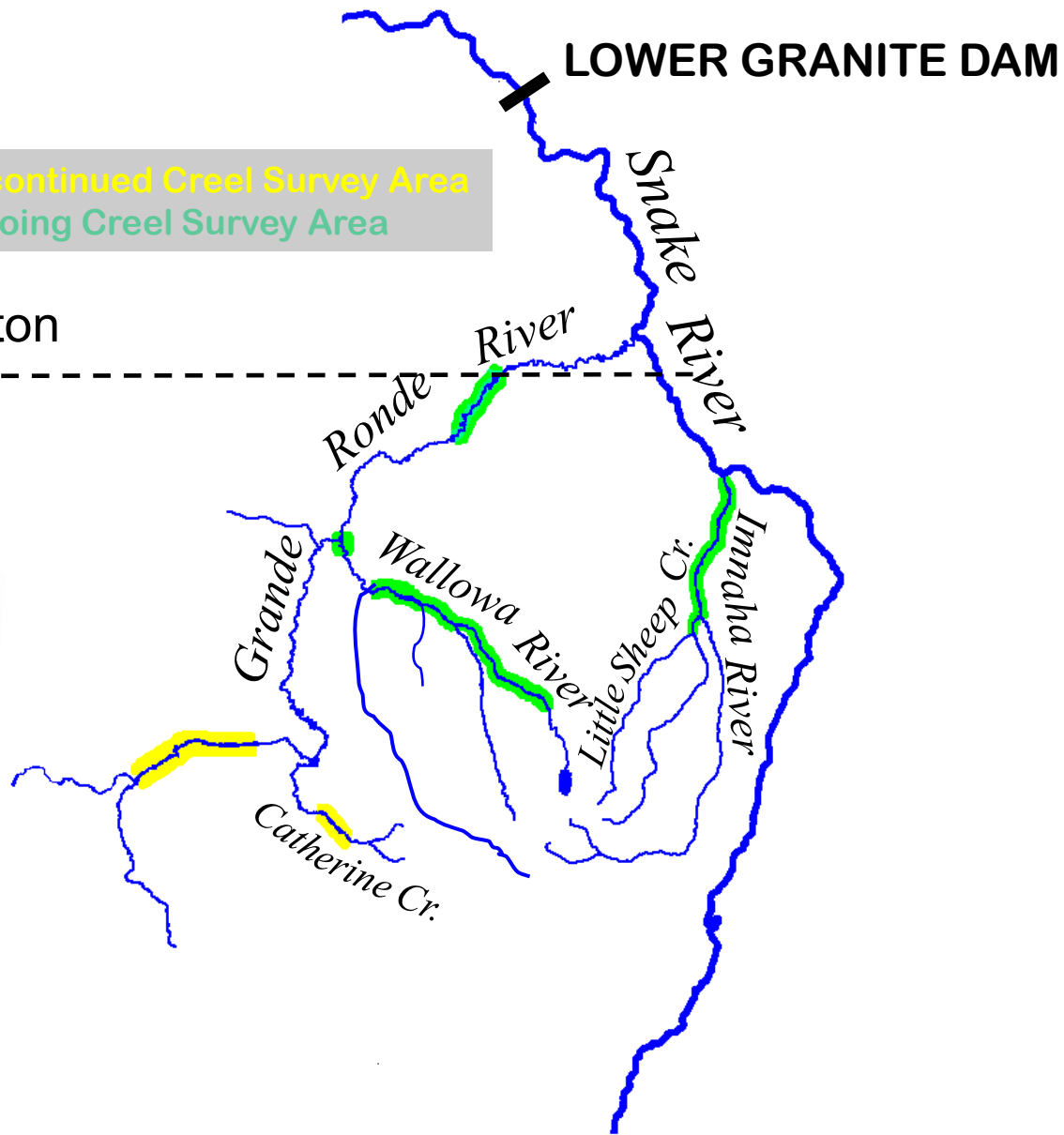


Kilometers

Discontinued Creel Survey Area
Ongoing Creel Survey Area

Washington

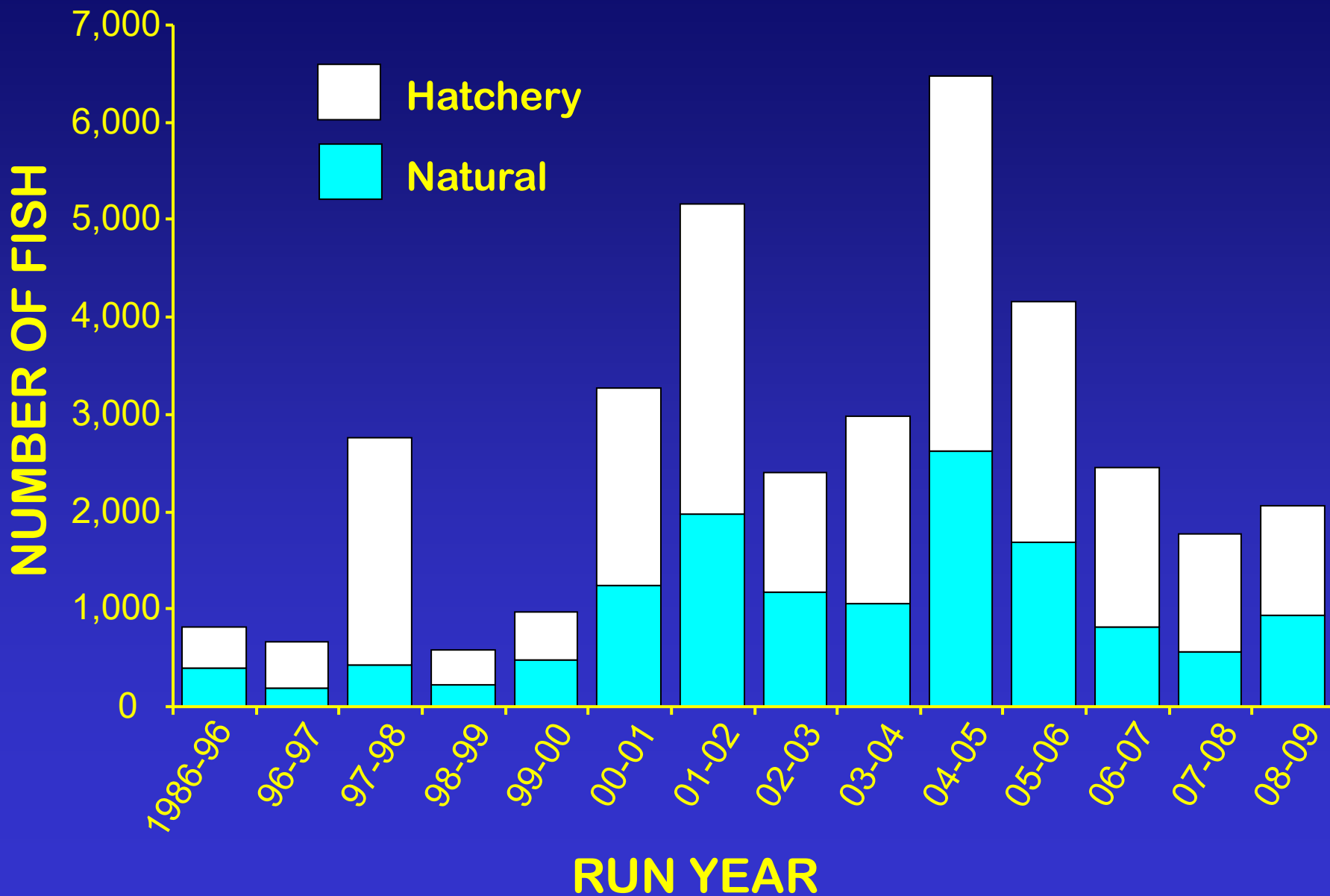
Oregon



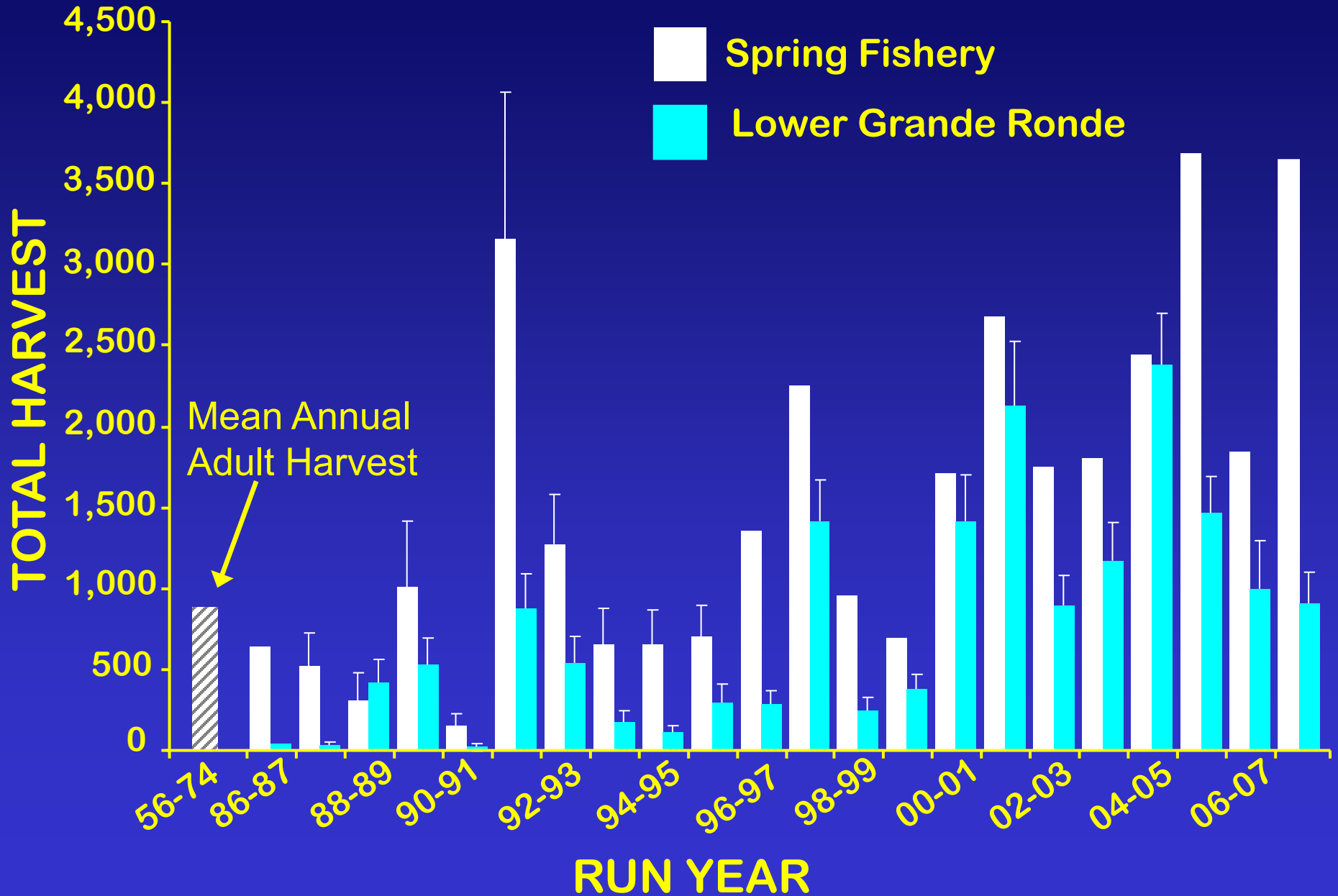
History of Steelhead Harvest Regulations in the Grande Ronde Basin, 1974 to 2012

- 1974 to 1984 – CLOSED - due to depressed status
- 1985 – Catch and release only
 - Season - Autumn (122 d)
 - Area - Lower Grande Ronde - 24 km (15 mi)
- 1986 to Current – Consumptive fisheries re-opened
 - Season - Autumn (122 d); Spring (105-120 d) = 227-242 d
 - Area - 1986-1988: 111 km (69 mi)
 - 1989-1994: 300 km (186 mi)
 - 1994-current: 336 km (209 mi)
 - Bag limit - 1986-2001: 2 fish/d
 - 2002-current: 3 fish/d

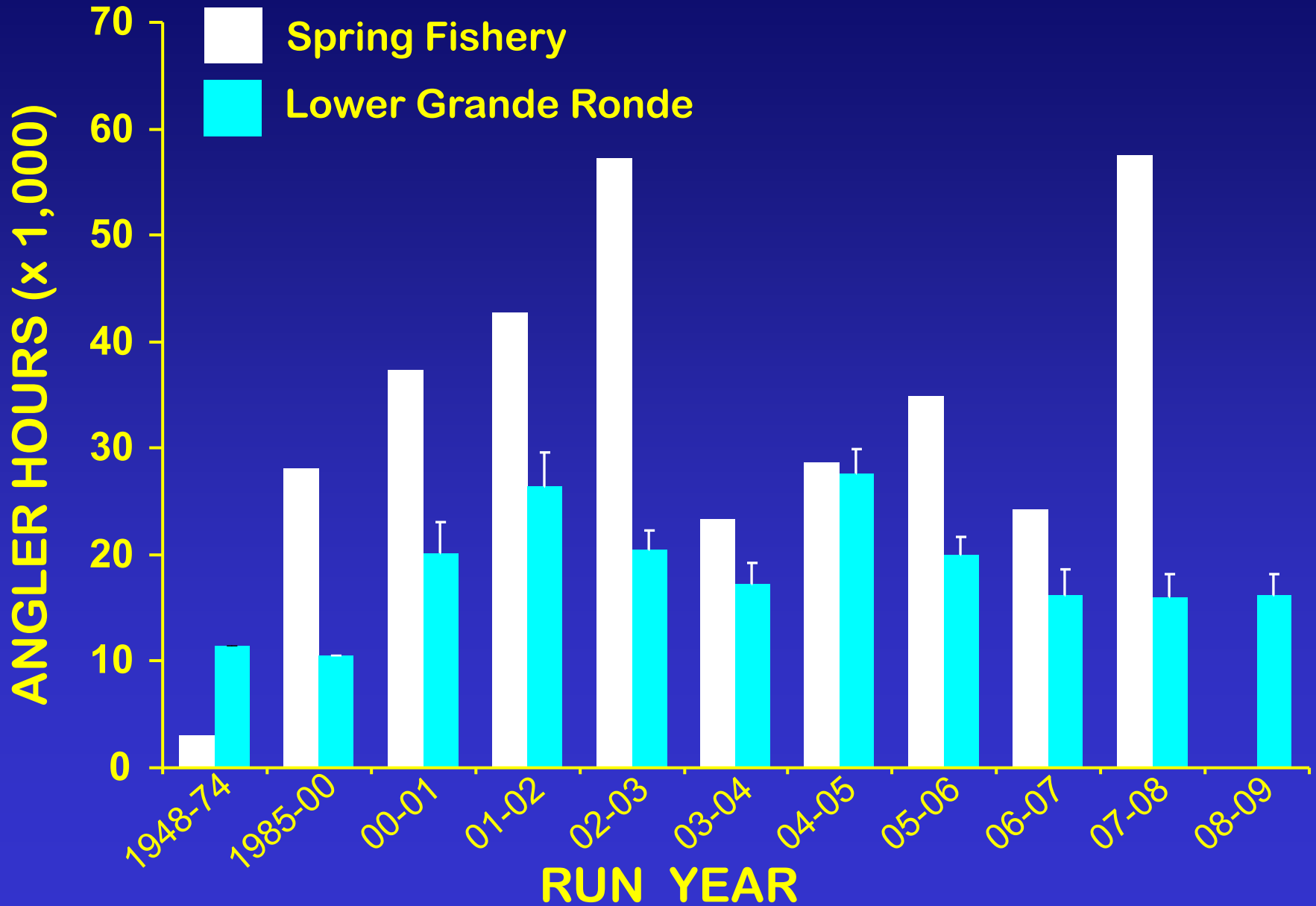
Recreational Catch in Lower Grande Ronde River (Oregon section)



Total Harvest in the Oregon Grande Ronde Basin



Oregon Grande Ronde Basin Recreational Fishery Effort

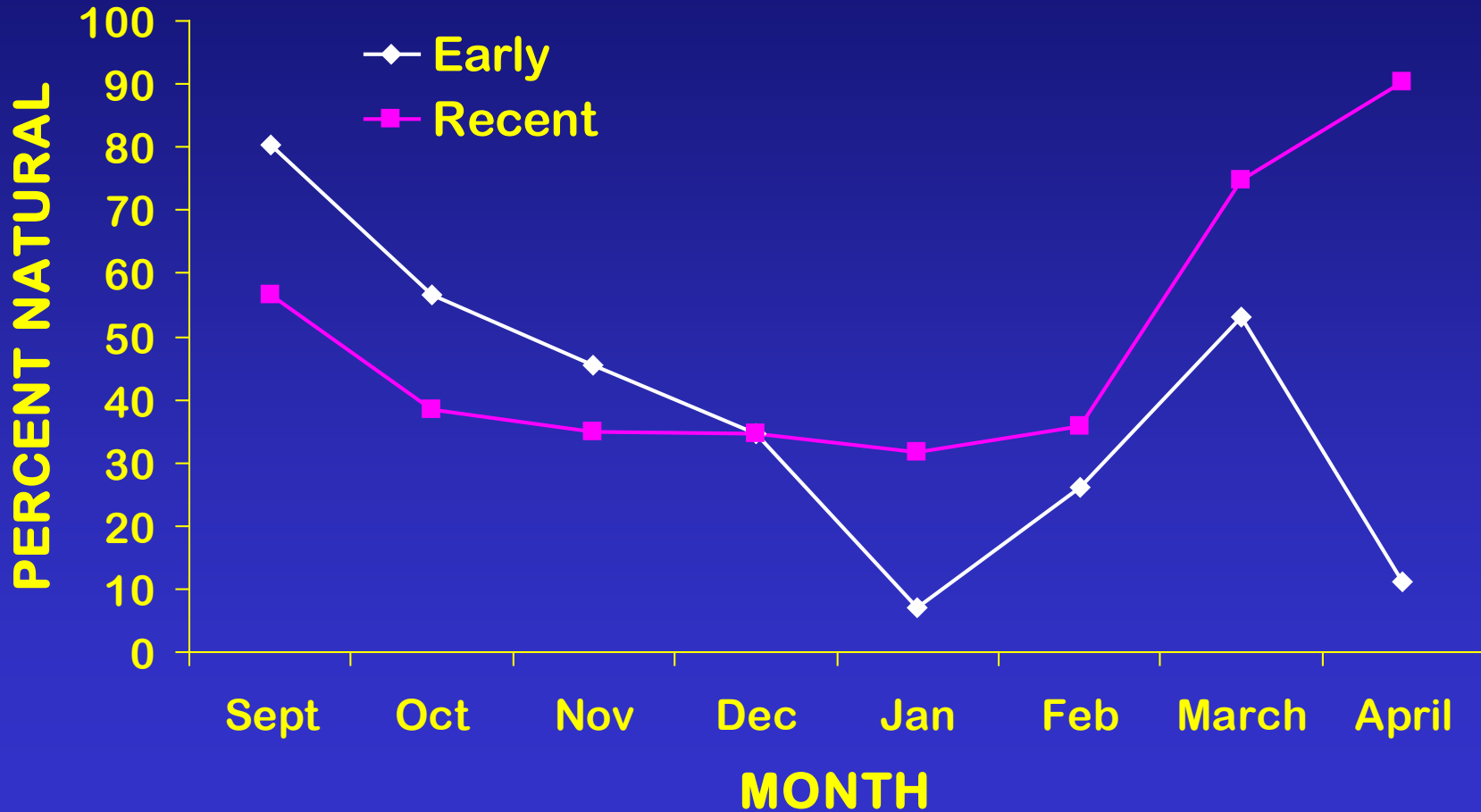


Oregon Grande Ronde Basin Recreational Fishery

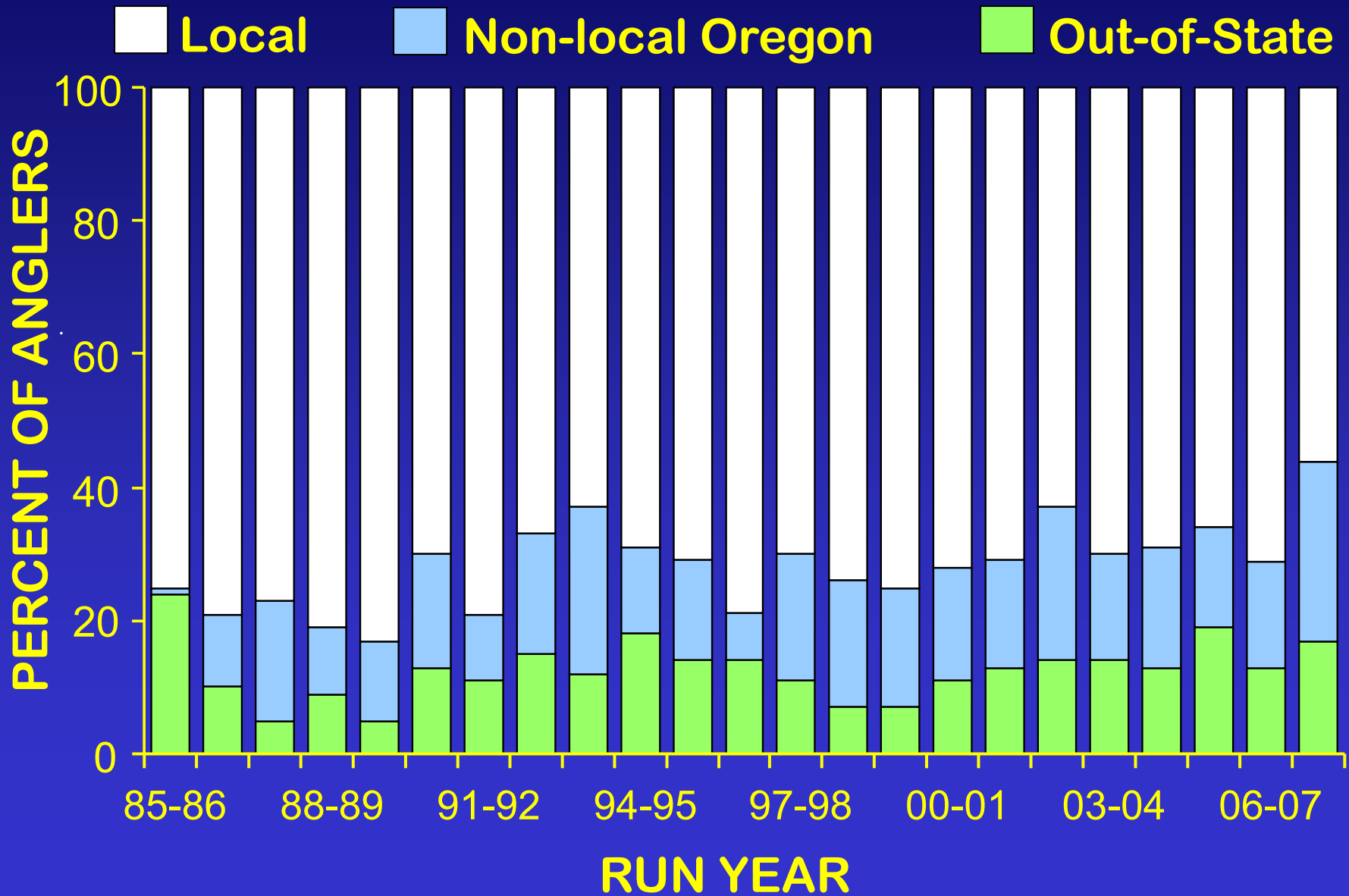
Effort and Catch Rate



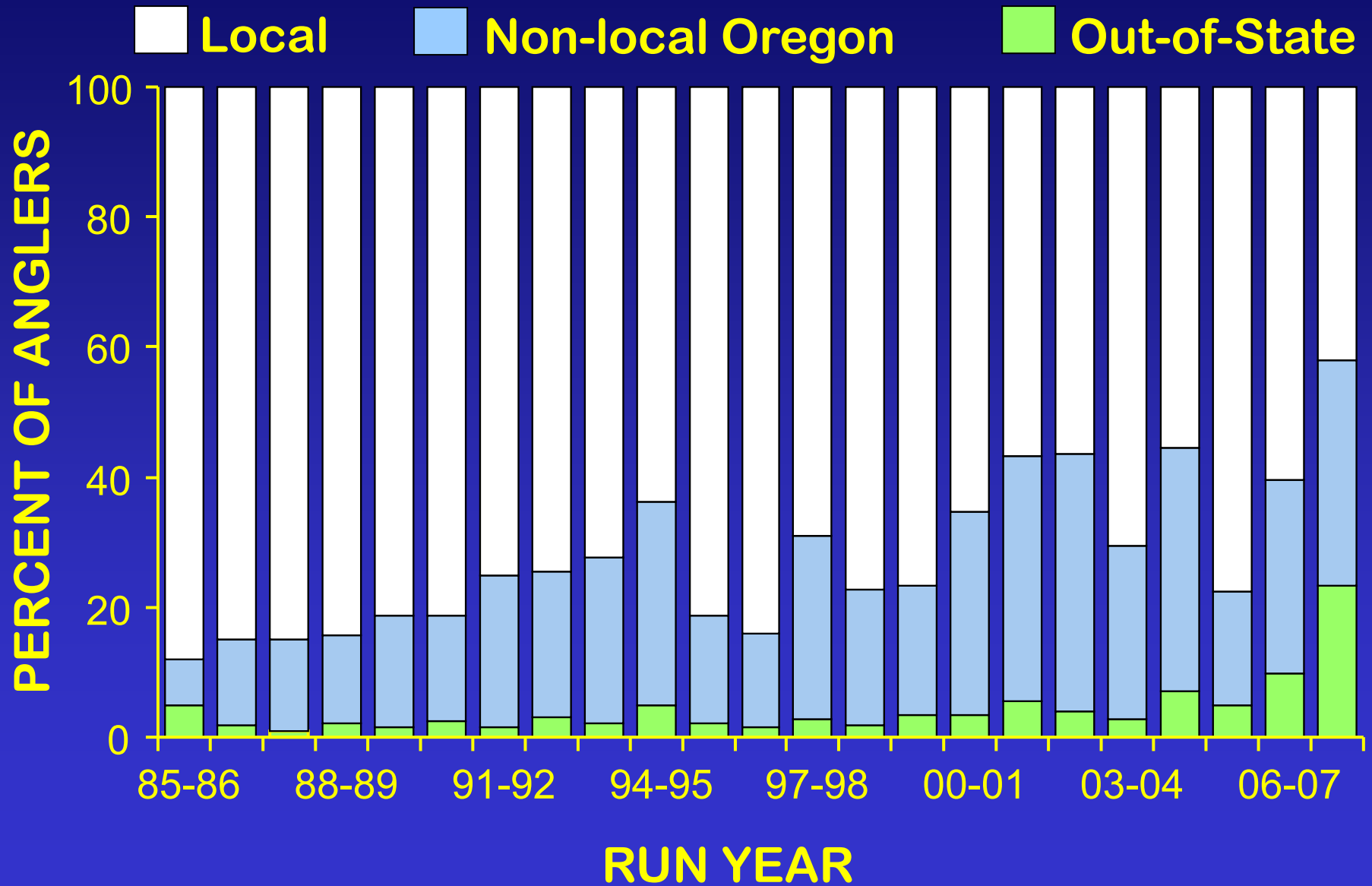
Percent Catch by Month of Natural Adults in the Lower Grande Ronde River in Early (89-90 to 93-94) and Recent (04-05 to 08-09) Run Years



Origin of Anglers in the Lower Grande Ronde Fishery

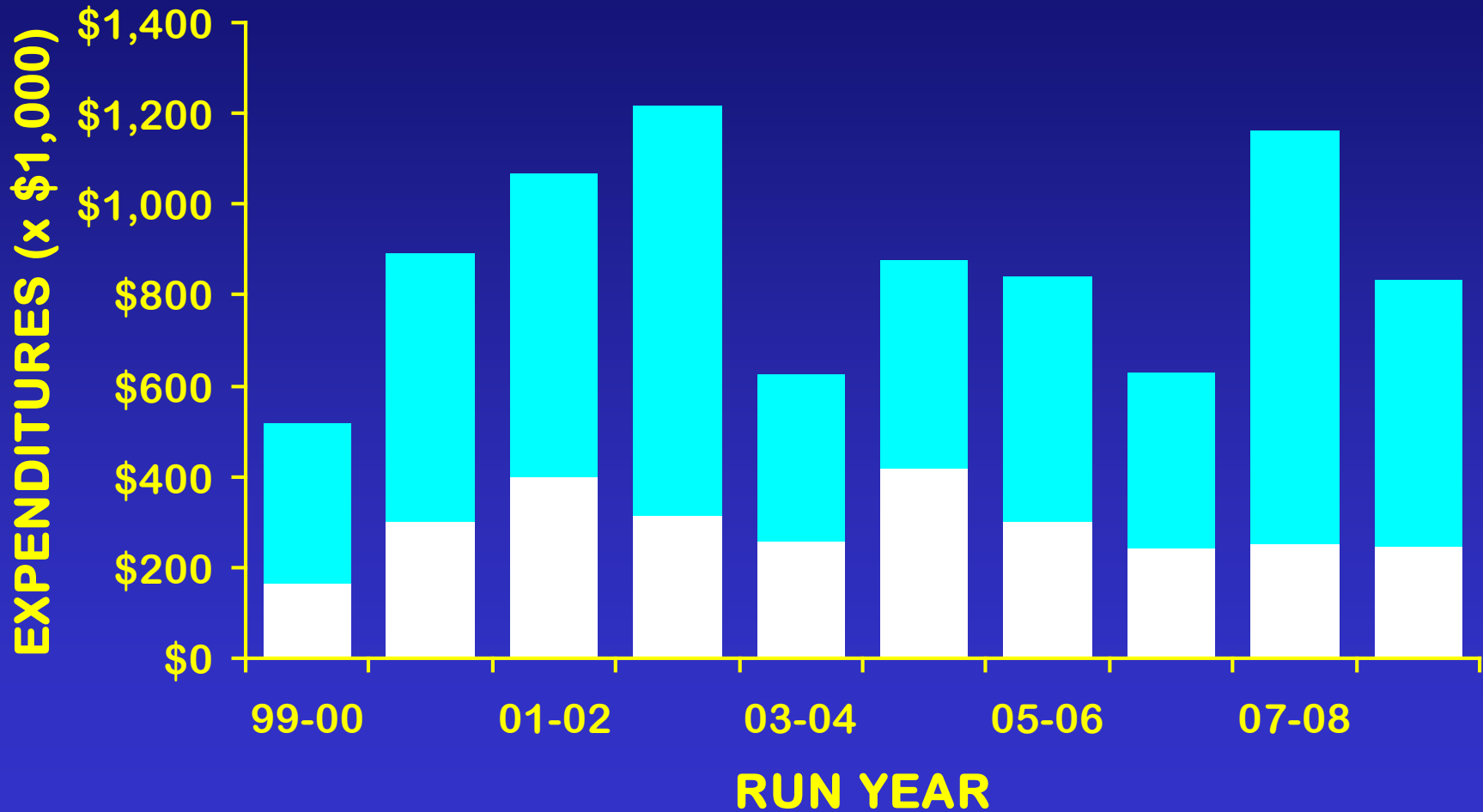


Origin of Anglers in Spring Fishery Areas



Average Annual Expenditures in the Grande Ronde Basin Fisheries, Oregon

■ Lower Grande Ronde (OR) ■ Spring Fisheries



Economic data from Dean Runyan, 2009 Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon, courtesy of Aaron Jenkins, Economist, ODFW

Residual Steelhead Evaluations

- Studies conducted in Oregon from 1992-96.
- Temporal and spatial residual steelhead distribution quantified and mapped.
- Residuals examined to determine size, gender, state of maturation. Coded wire tags were recovered to identify individuals to release groups.
- The potential for residual steelhead to prey on juvenile spring Chinook salmon was evaluated. Stomach content of captured residuals was analyzed.

Summary of Results from Residual Studies

- Residual densities near highest near release sites, decreasing upstream and downstream, and variable by year. No relationship in densities between release sites within year or release numbers. Densities at sites decreased throughout the year.. Some residuals survived for multiple years.
- Residuals originated from smaller fish in release groups, 80-90% are males, most of which are immature in summer. Seventy percent of males become mature the following spring. Direct-release groups may produce more residuals.
- Residual predation on Chinook of greatest concern in lower river reaches. However, only 1 Chinook identified in stomach contents of over 1,000 residuals.

Grande Ronde Program Performance Summary

- **Broodstock Development – Management:**
 - Slow building(10 years) to meet production needs
 - More than adequate broodstock since 1986 with high number of breeders
 - Autumn line broodstock development providing substantial returns
- **In-Hatchery Performance:**
 - Adult prespawn mortality low in all recent years
 - Egg-to-smolt survival high, except in a few recent years due to CWD loss
- **Hatchery Program Performance:**
 - Smolt production at or near goals since 1986
 - Smolt survival to LGD high and equal to or greater than natural
 - Adult return goals reached in eight of recent 10 years
 - SAR's consistently at or above goal (8 of last 10 years)
 - SAS has not reached the goal
 - Recruits per spawner high exceeding 16 on average
 - High exploitation rates(total 65%) through entire adult migratory path

Grande Ronde Program Performance Summary

- **Hatchery Program Performance(cont.):**

High stray rates into the Deschutes River in some years; however, low in recent years. Very low stray rates into other Snake River tributaries and within the Grande Ronde Basin.

Recreational fisheries have been restored to levels well above historical levels, with exceptional catch rates and substantial economic value.

- **Life History Characteristics:**

Adult migration timing has increased variability over time.

There has been no change in age at return or length at age.

- **Natural Production Monitoring:**

Natural population viability status is relatively good with the Joseph Creek population at Highly Viable and Upper Grande Ronde population close to viable.

Viability monitoring expanded considerably with GRTS based redd counts, PIT tag adult array estimates and an extensive habitat monitoring program for the Upper Grande Ronde population(BPA funded). These efforts will improve abundance/productivity and hatchery fraction datasets.

Grande Ronde River Hatchery Steelhead Adaptive Management Changes

- **Reduced smolt production numbers to reduce straying impact in the Deschutes Basin.**
- **Eliminated direct stream releases in lower Grande Ronde, upper Grande Ronde and Catherine Creek to reduce natural spawning hatchery fish risks to natural populations.**
- **Implemented 100% acclimation releases and adult trapping and removal for all production to reduce abundance of natural spawning hatchery fish.**
- **Implemented volitional release strategies with removal of non-migrants to reduce juvenile ecological interaction risks.**
- **Implemented 4/lb release size goal over 5/lb to maximize SAS.**
- **Developing and evaluating alternative broodstocks(Autumn line) to reduce straying and improve fishery contributions in Oregon. Transitioning to 50% Autumn Line by 2014.**
- **Developed food bank outlets for surplus hatchery returns.**

Grande Ronde Program HSRG and HRT Recommendations

- HSRG – “The HSRG has no specific recommendations to improve this hatchery program”

Response: Great and a much appreciated conclusion.

- HRT – Continue to investigate the use of fall-returning(Autumn Line) adults verses production adults and research different rearing strategies.

Response: The Autumn Line broodstock investigation continues and includes evaluation of the progeny of returns from the original broodstock. We are scoping out options for alternative rearing/release strategies (comparison of Lyons Ferry reared smolts with Irrigon Hatchery reared smolts).

- HRT - Investigate other broodstock sources as alternatives to the current Wallowa Stock including Endemic and Little Sheep Creek. The team believes control/treatment evaluations should be performed to determine whether these recommendations affect survival and stray rate before large scale changes to the program occur.

Response : Other alternative broodstocks have been discussed and will be further evaluated after completion of the Autumn Line investigations. Any alternative broodstock will be evaluated with control/treatment design to determine affect on survival and straying, the same as the Autumn Line investigation. We are transitioning toward 50% Autumn Line production by 2014.

Grande Ronde River HSRG and HRT Recommendations

- HRT - Discontinue recycling of Wallowa Stock adults returning to Big Canyon.

Response: Recycling continues at a reduced rate of 100 adults.

- HRT - Continue to monitor residualism

Response: Monitoring of residual abundance and characteristics continues in Deer Creek.

- HRT - Monitor natural escapement to ensure that less than 5% of natural spawning populations are hatchery origin Wallowa stock, particularly in Joseph Creek and the Wenaha River.

Response : Extensive monitoring of hatchery fractions in natural spawning areas is underway including trapping on Joseph Creek, Lookingglass Creek, Upper Grande Ronde River, Lostine River and Catherine Creek. In addition, extensive GRTS based spawning surveys are underway in the Upper Grande Ronde and Joseph Creek populations. Multiple in-stream PIT detectors are in place in Joseph Creek and the Upper Grande Ronde, and more are planned for the Grande Ronde and Wallowa Rivers.

Grande Ronde Basin Hatchery Steelhead Program Challenges

- **Reduce straying into the Oregon's Mid-C steelhead populations (Deschutes and John Day)**
 - **Identify most effective broodstock source to meet all management objectives**
 - **Identify potential alternative rearing/release strategies to maximize SAS, fishery contribution objectives and to minimize straying into Mid-C steelhead populations.**
 - **Maintain emphasis on spread the risk mainstem migration pathways with court ordered spill and a significant proportion of smolts as in-river migrants.**
- **Better understanding of the magnitude, characteristics and ecological effects of residuals.**