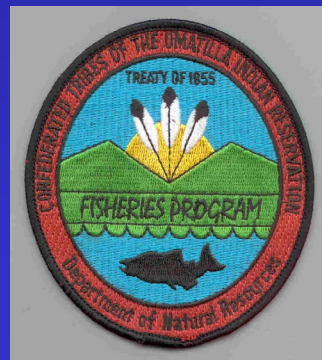


Imnaha River Summer Steelhead Hatchery Program Review

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Presentation Outline

- **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**
- **Supplementation effectiveness**
- **Conclusions and future challenges**

Mitigation Goals

Imnaha Stock Summer Steelhead Annual Goals

330,000 Smolts (*215,000 interim*)

2,000 Adults

**0.61% Smolt-to-Adult Return Rate
(*0.93 % interim SAR*)**

6,000 Total Adults

1.83% Smolt-to-Adult Survival Rate

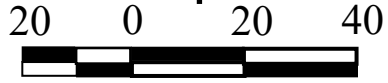
Management Objectives

- Establish an annual supply of broodstock capable of meeting production goals.
- Maintain and enhance natural production while maintaining long term fitness of the natural population.
- Re-establish historic tribal and recreational fisheries.
- Establish a total return of summer steelhead that meets the LSRCP compensation goal.
- Operate the hatchery program so we maintain the genetic and life history characteristics of the natural population and hatchery fish characteristics mimic those of the wild fish, while achieving management objectives.

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.
- Assess and compare recruits-per-spawner of hatchery and natural origin fish.
- Determine magnitude and patterns of straying.
- Assess response in natural population abundance and productivity (adult recruits-per-spawner, smolts-per-spawner) to supplementation.
- Assess and compare life history characteristics (age structure, run timing, sex ratios, smolt migration, fecundity) of hatchery and natural fish.
- Assess success in restoring fisheries to historical levels.

Grande Ronde and Imnaha River Basins Steelhead Hatchery Facilities

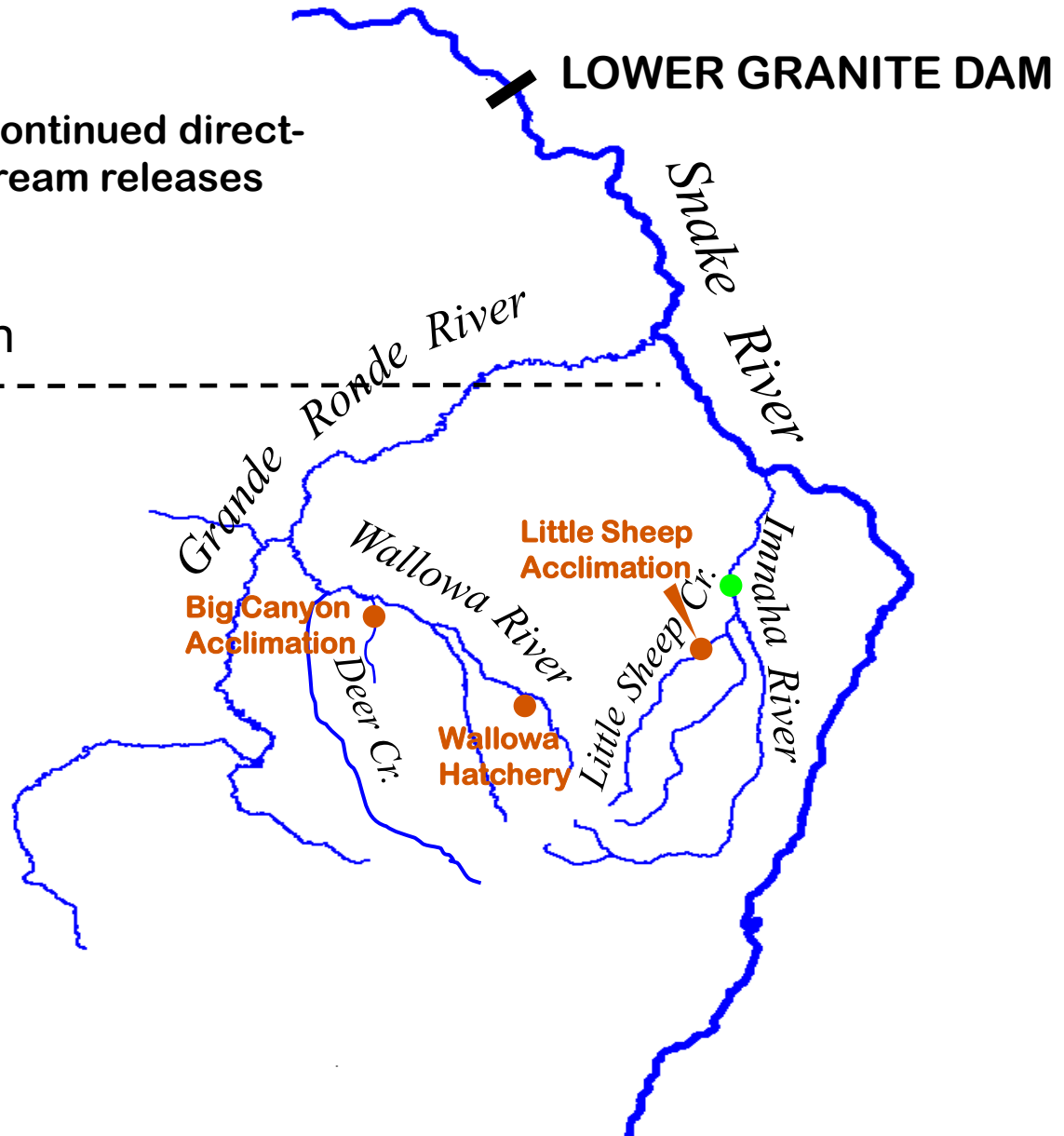


Kilometers

Discontinued direct-stream releases


Washington

Oregon



Little Sheep Creek Facility



Irrigon Fish Hatchery



Feeding steelhead smolts, Irrigon Hatchery



Little Sheep Acclimation Pond



Little Sheep Sliding Scale Management Plan

No. Natural-Origin Fish Returning to Weir	No. Natural-Origin Retained for Broodstock*	Percent Hatchery-Origin Fish Above Weir	PNI
≤100	10 (≤10%)	Any % hatchery to make 250 fish escapement goal	0.14**
150	30 (20%)	52%	0.30
200	50 (25%)	40%	0.48
250	70 (28%)	32%	0.65
300	90 (30%)	16%	0.81

** When number of natural fish > 100, keep 10 plus 40% of natural run greater than 100 for brood. ** Assumes return of 100 natural adults*

Broodstock History – Imnaha Stock

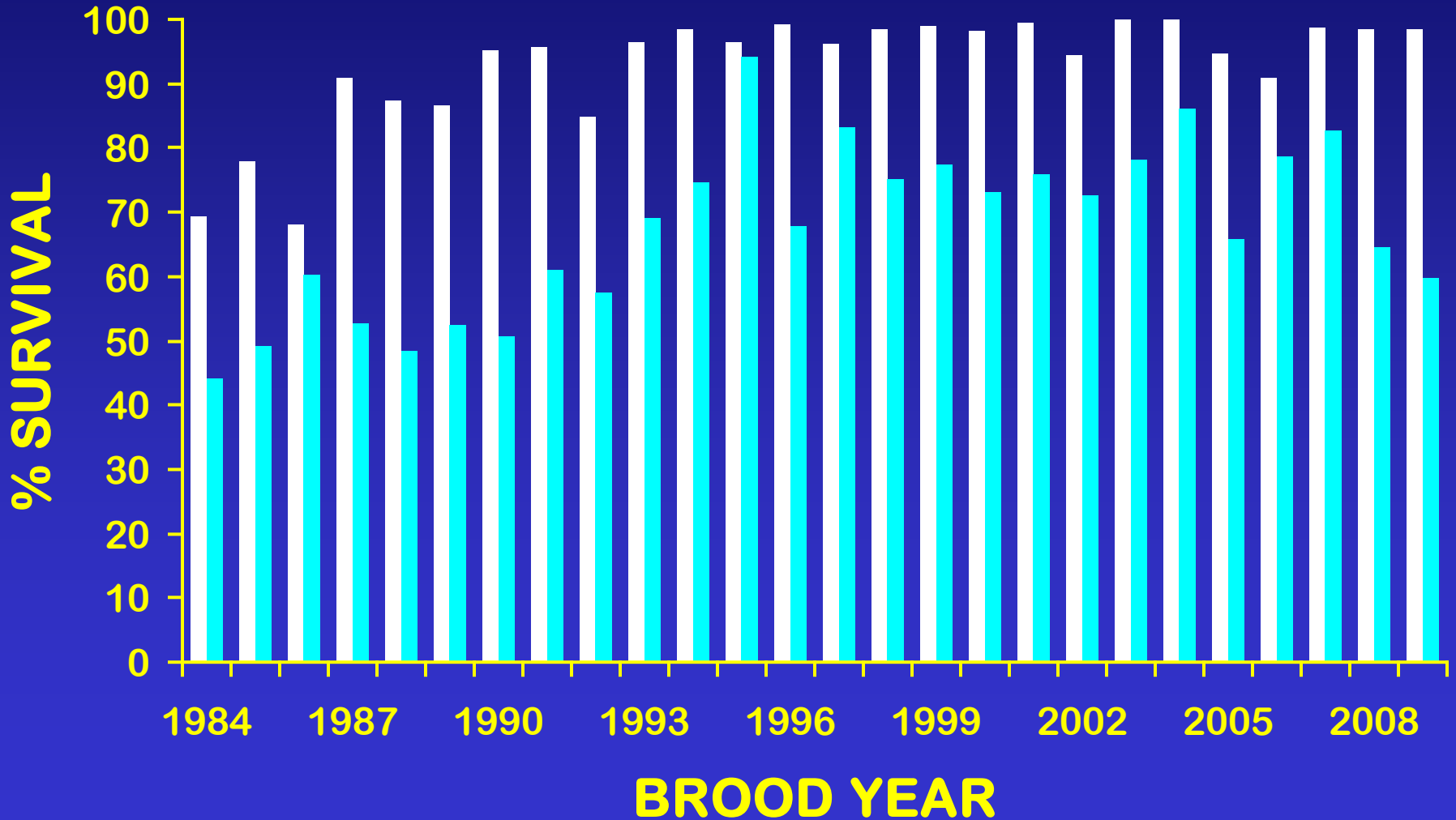
Spawn years	Number of females in broodstock		Percent natural run retained for broodstock
	Natural	Hatchery	
1982-1986	25-75	0-19	63.2-81.6
1987-1994	6-33	94-165	20.8-59.3
1995-2007	2-6	95-346	3.5-54.5
2008-2011	5-16	51-106	4.8-10.0

Natural Spawners – Little Sheep Creek

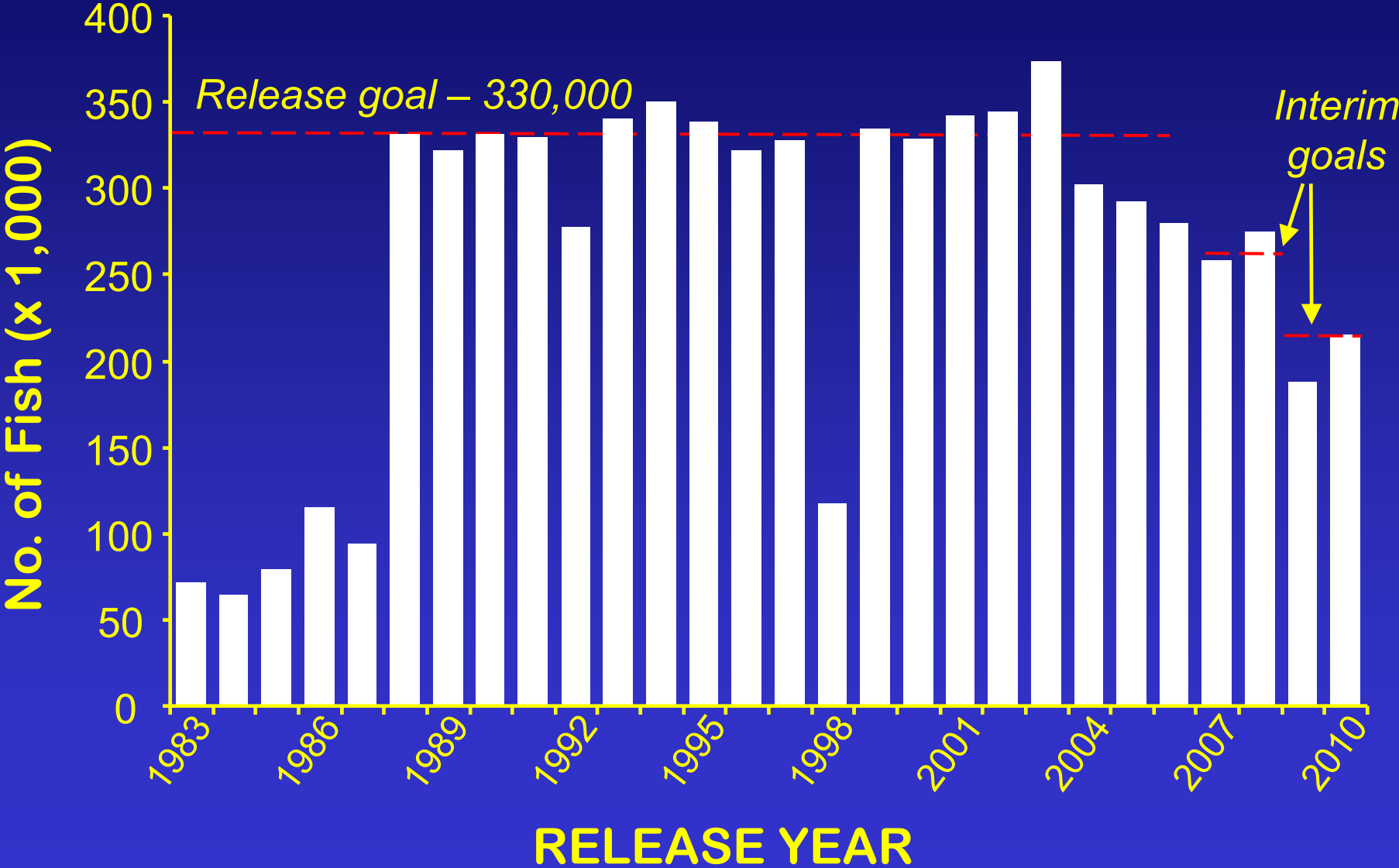
Spawn years	Total number spawning in nature	% hatchery origin spawning in nature (PHOS)	% natural origin in broodstock (PNOB)	PNI
1983-1986	0-36	0-8.3	71.0-100	0.90-1.0
1987-1994	55-610	46.8-97.0	4.2-15.3	0.02-0.18
1995-2007	46-1,387	66.0-93.8	1.1-9.7	0.02-0.06
2008-2011	281-346	25.1-52.2	12.4-25.2	0.10-0.50

Imnaha Stock Adult Pre-Spawning and Egg to Smolt Survival

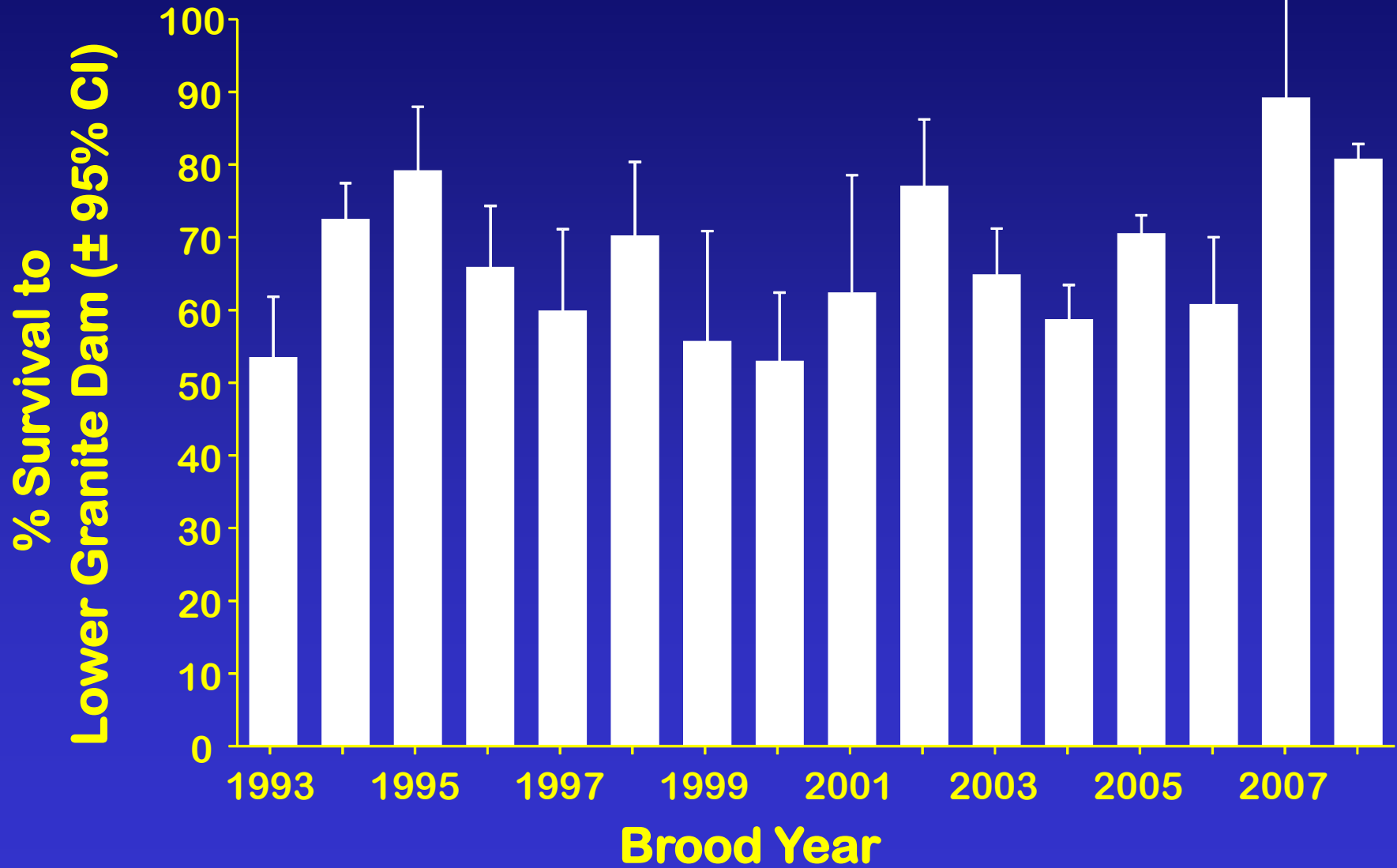
■ Pre-spawning ■ Green egg to smolt



Imnaha Stock Hatchery Smolt Releases

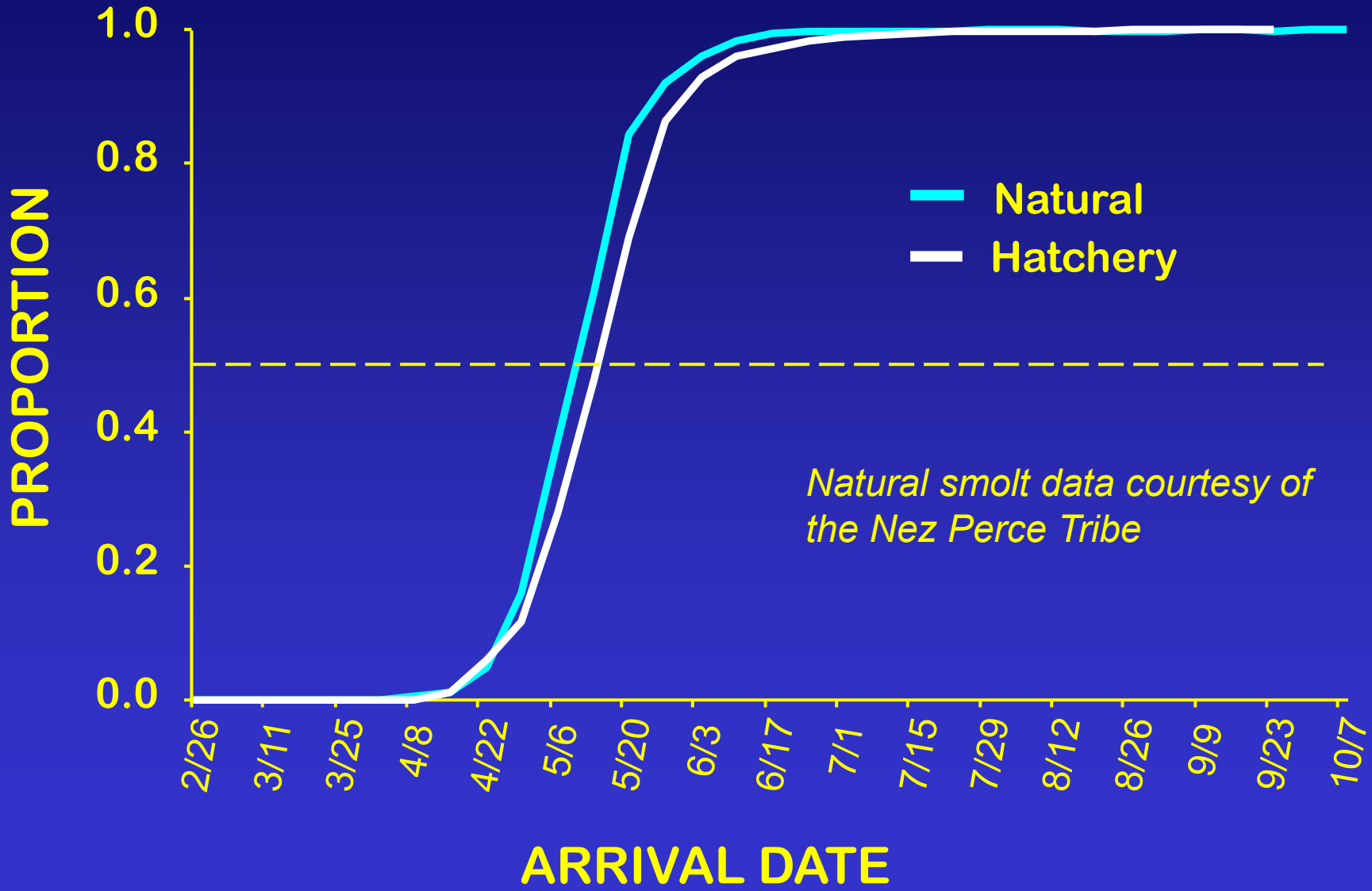


Imnaha Stock Smolt Survival to Lower Granite Dam



Smolt Migration Timing at Lower Granite Dam

MY 1994-2011

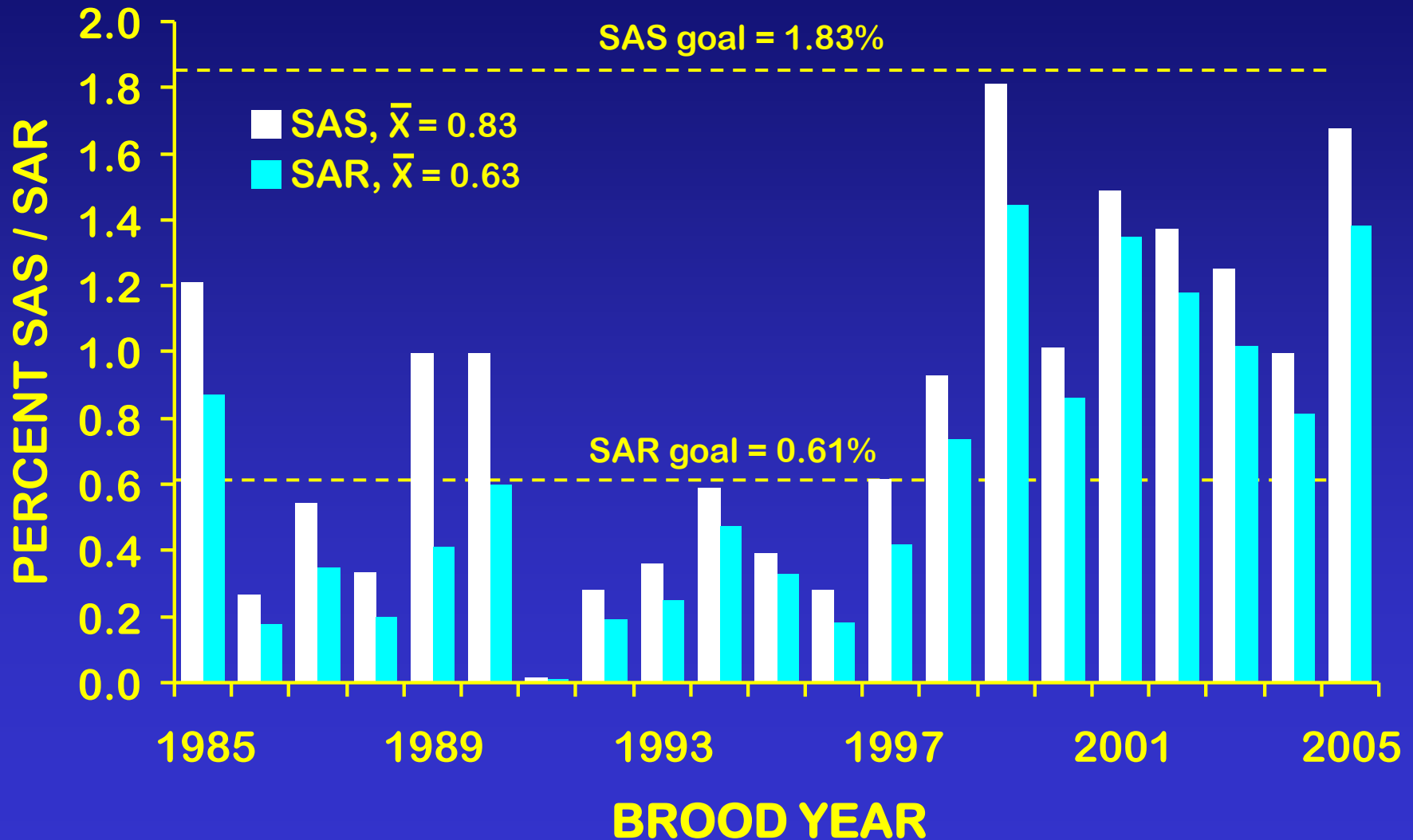


Natural smolt data courtesy of the Nez Perce Tribe

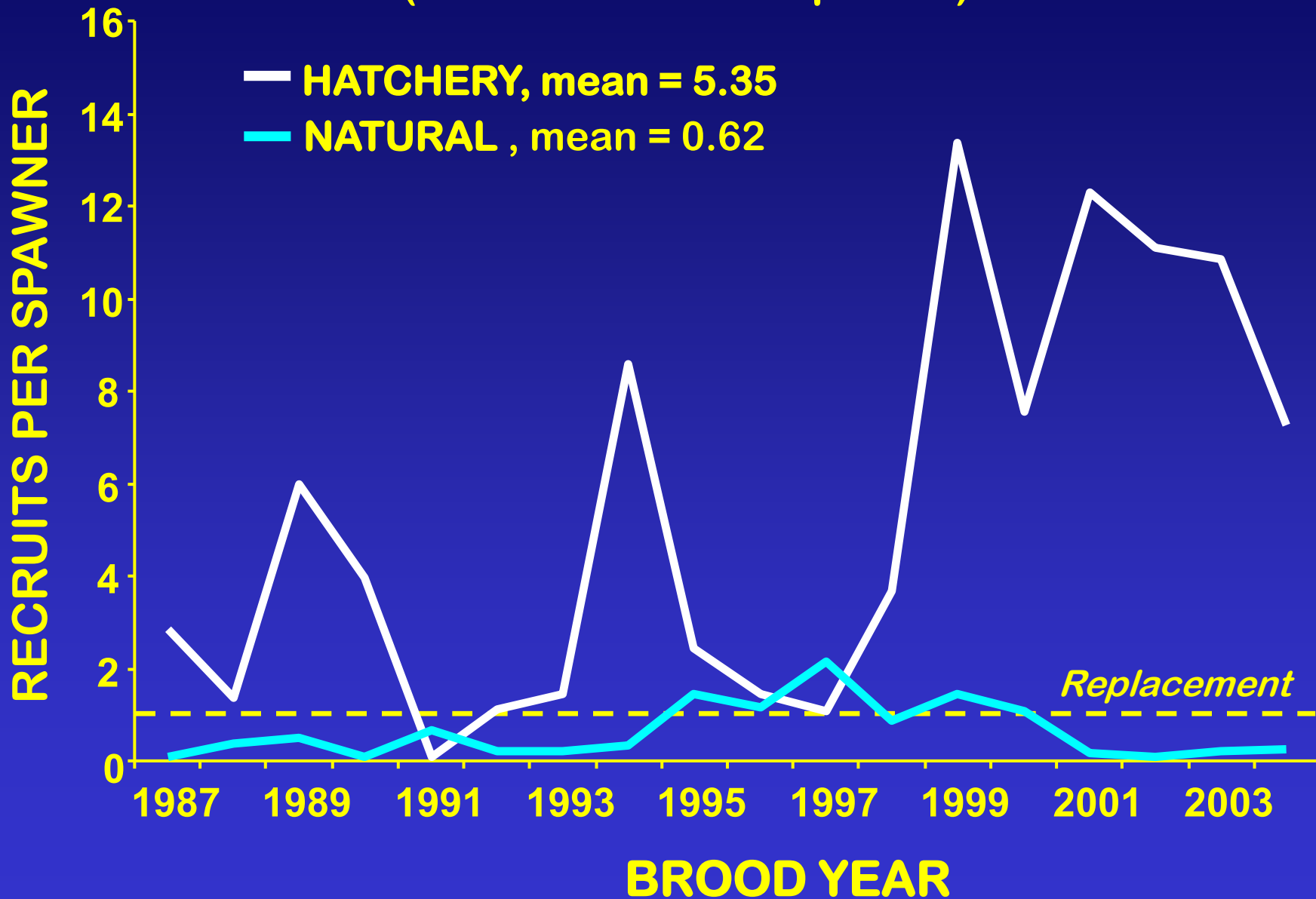
Imnaha Stock Returns to Compensation Area



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



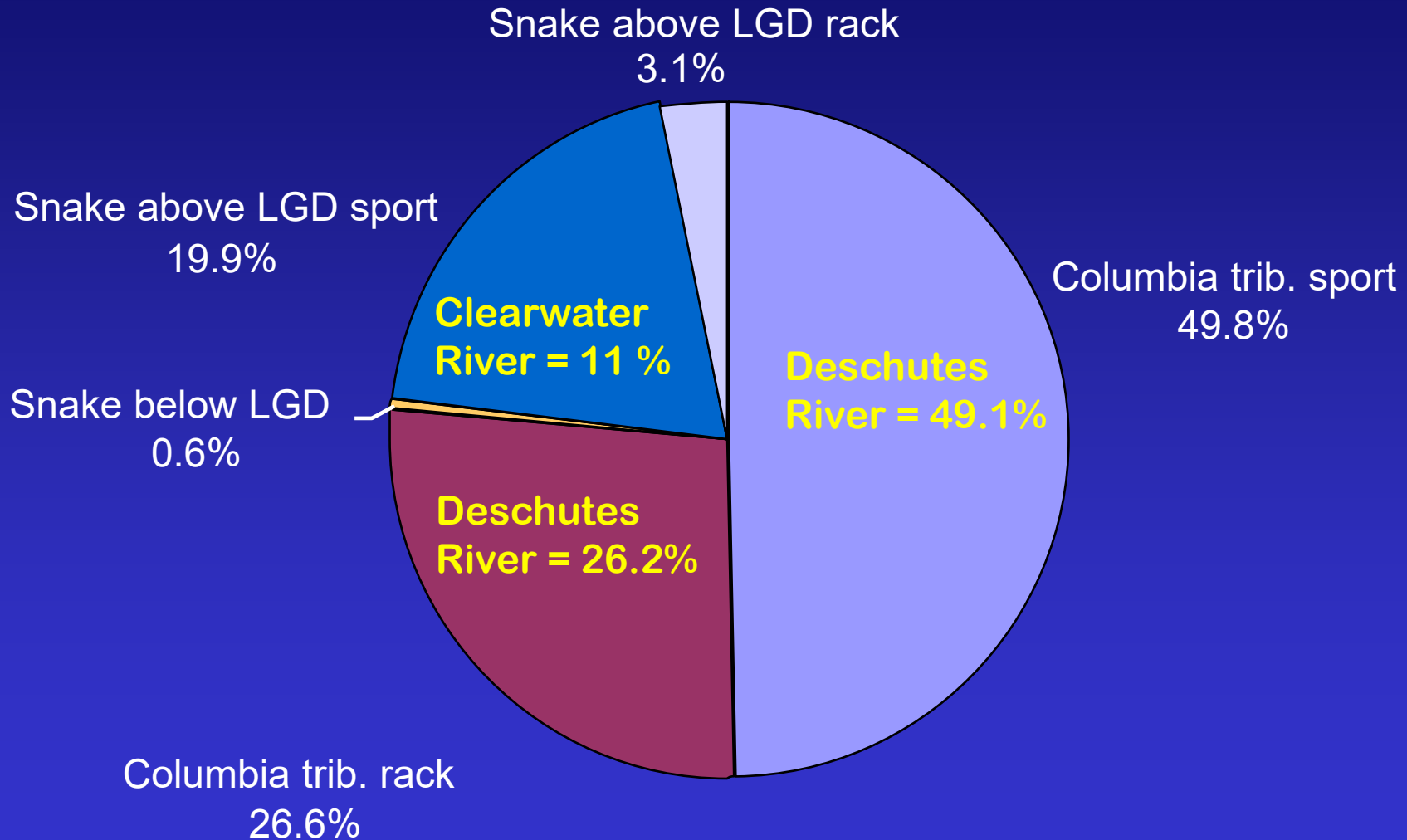
Imnaha Stock Adult Recruits per Spawner (to the Little Sheep weir)



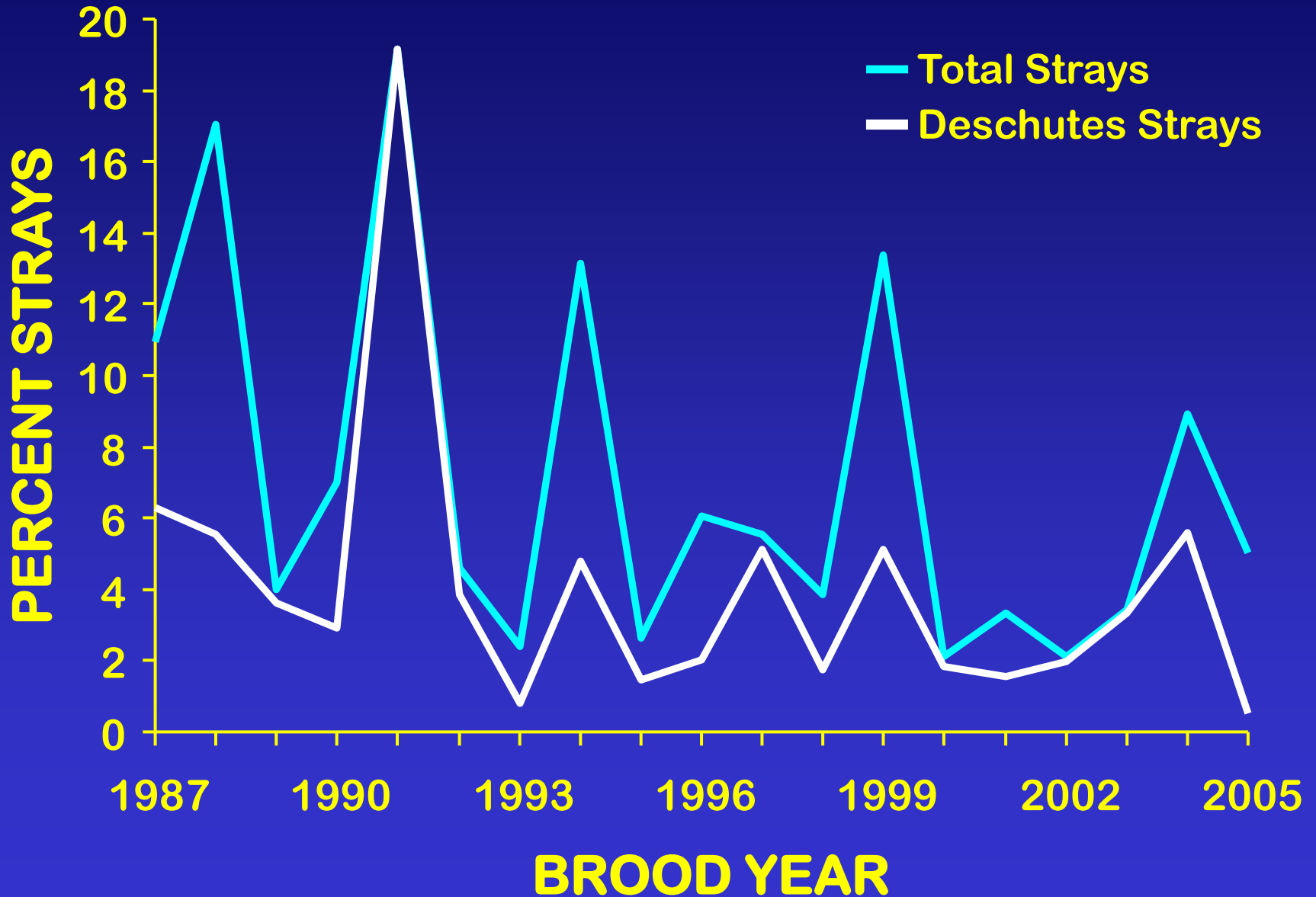
Percent Harvest and Escapement of Imnaha Stock Releases

	<u>Brood Year</u>				<u>Mean</u>
	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	
Ocean	0.0	0.0	0.1	0.0	0.0
Columbia River					
Sport	3.5	6.4	11.9	6.1	7.0
Tribal	2.3	2.0	1.3	1.4	1.8
Stray Harvest	1.4	1.4	1.7	3.8	2.1
Stray Rack	0.2	0.7	1.7	1.8	1.1
Snake River					
Stray below LGD	0.0	0.0	0.1	0.0	0.0
Stray above LGD Harvest	1.6	0.0	0.0	2.6	1.1
Stray above LGD Rack	0.1	0.0	0.0	0.7	0.2
Sport below LGD	2.0	3.5	2.2	5.1	3.2
Sport above LGD	13.1	13.2	9.8	14.1	12.6
Imnaha Sport	5.2	8.5	7.1	7.9	7.2
Escapement to Weir	70.6	64.3	64.2	56.3	63.9

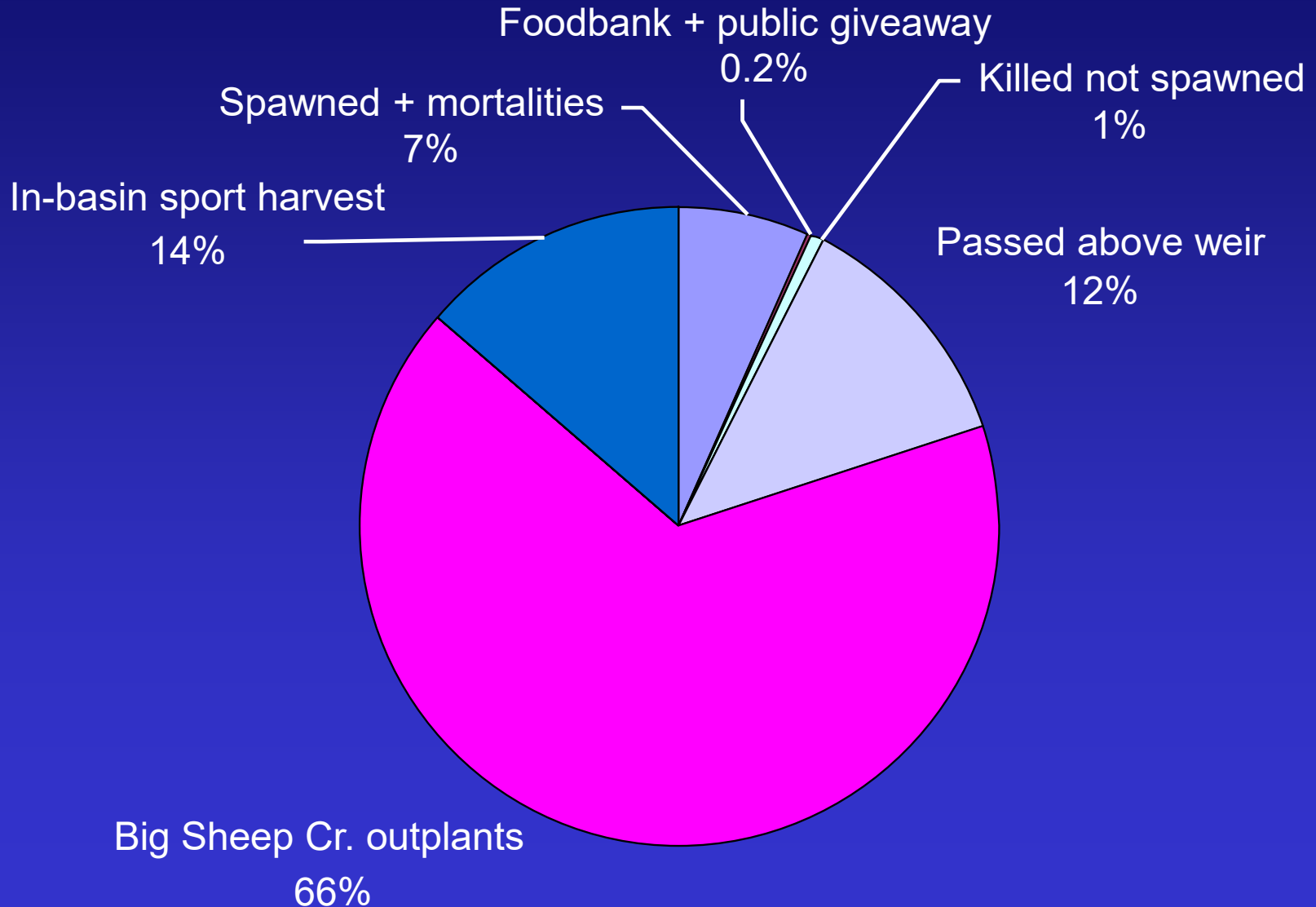
Distribution of Imnaha Stock Strays, 2001-2004 Brood Years



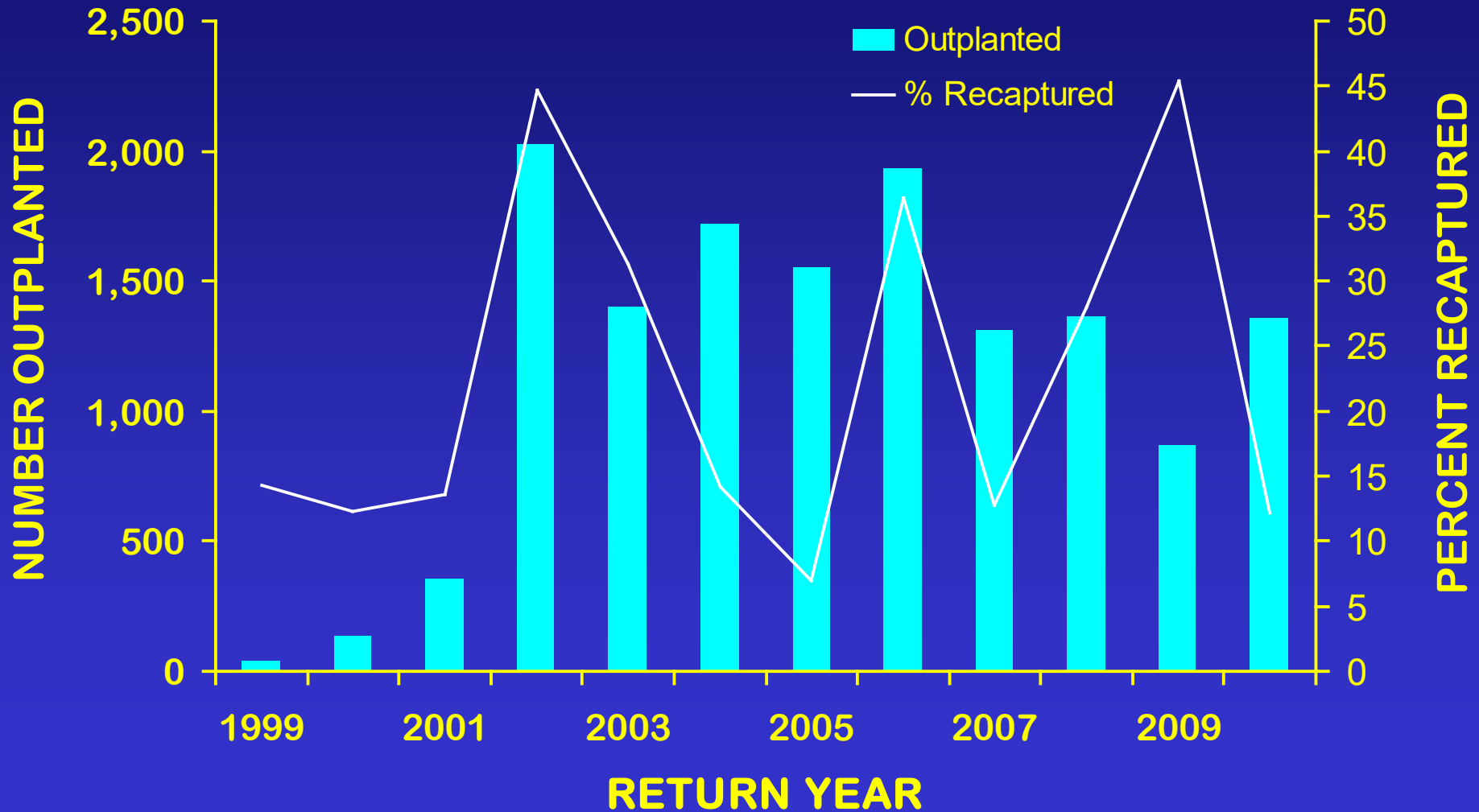
Percent of Total Strays in the Deschutes River 1987-2005 Brood Years



Escapement Distribution of Innaha Hatchery Stock Run Years 2003-04 to 2007-08



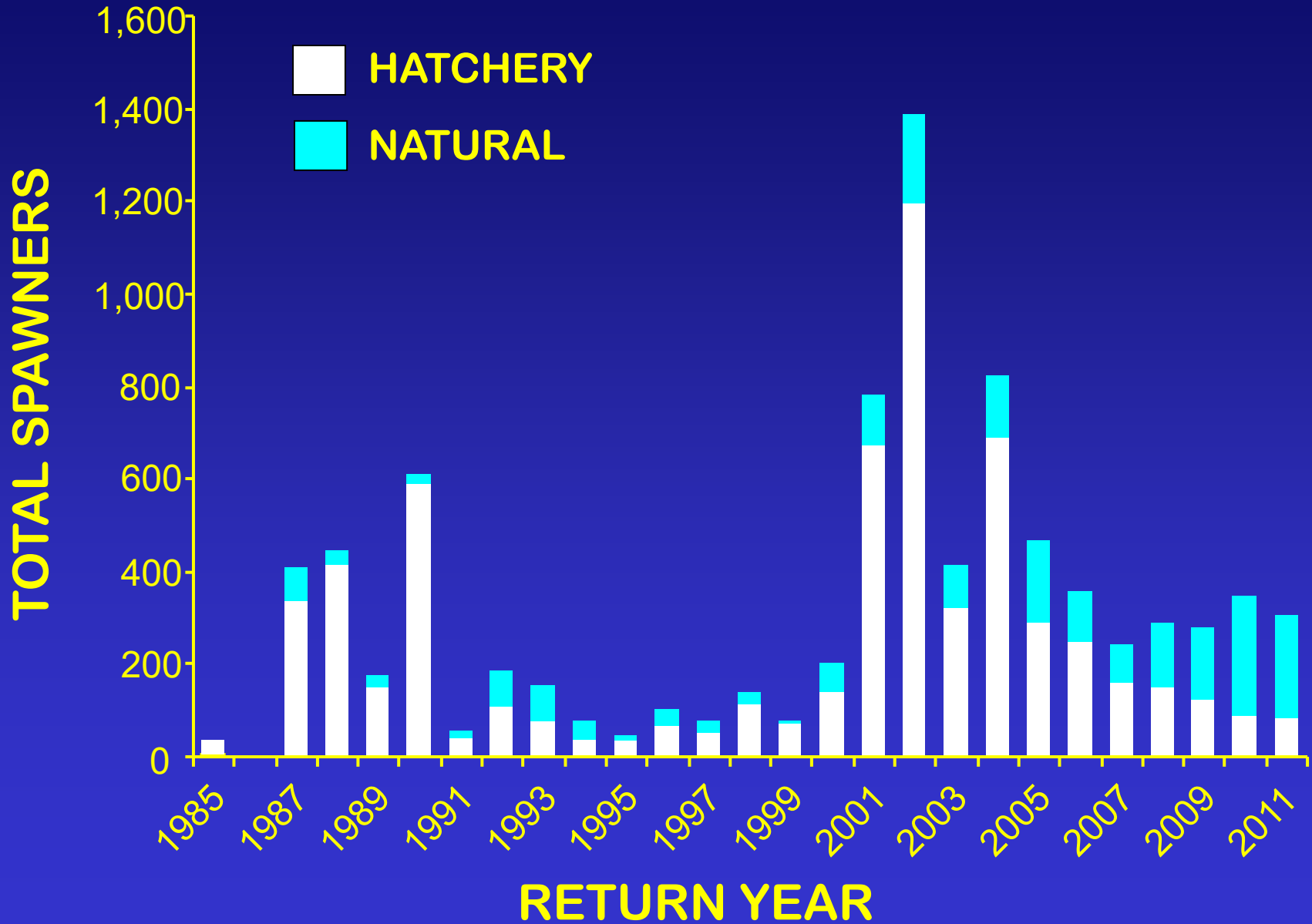
Number of Adults Outplanted to Big Sheep Creek and Percent Recaptured at the Weir



Escapement Disposition of Little Sheep Natural Origin Adults, Return Years 2004-08

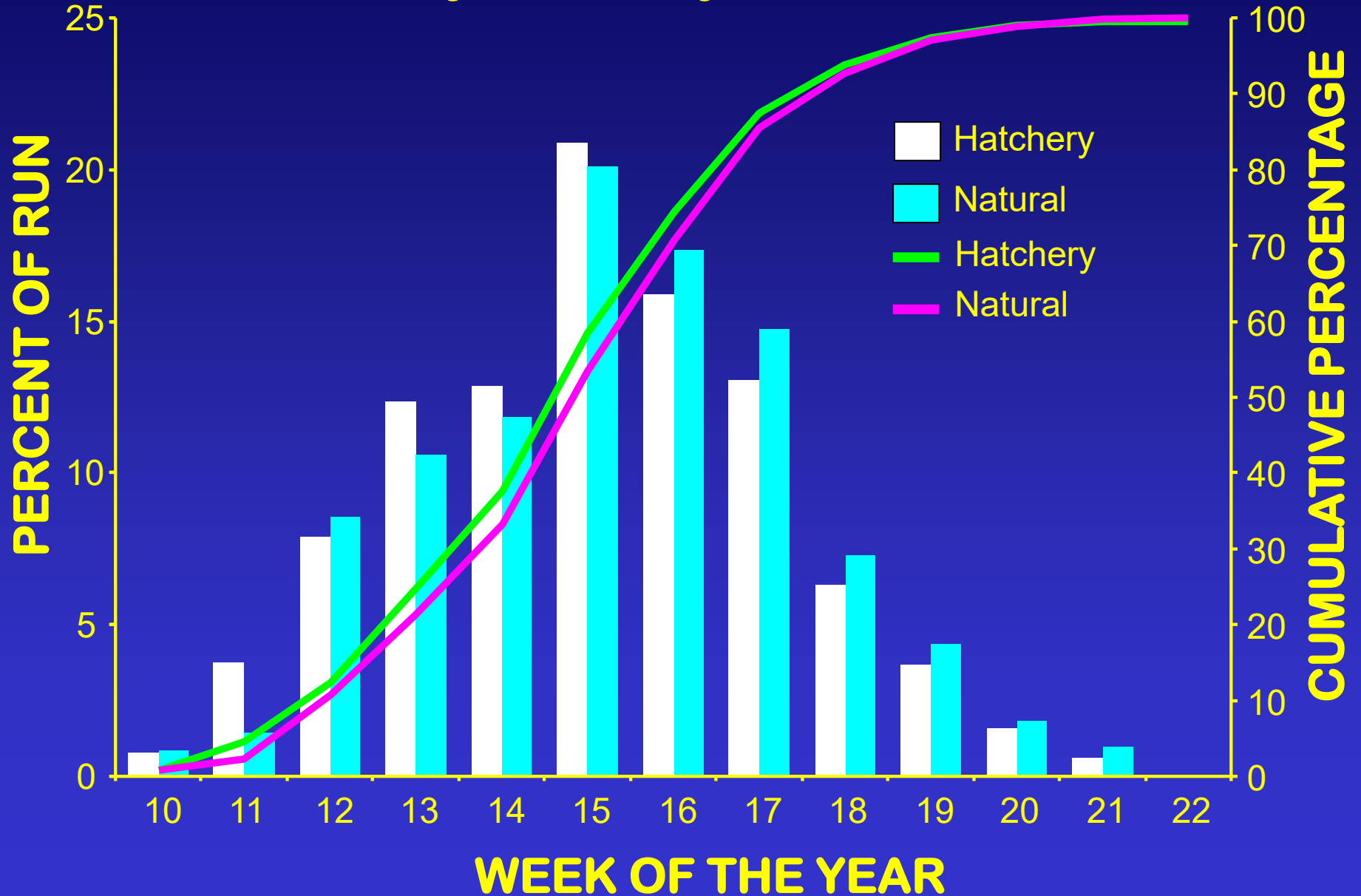


Little Sheep Spawners Above Weir

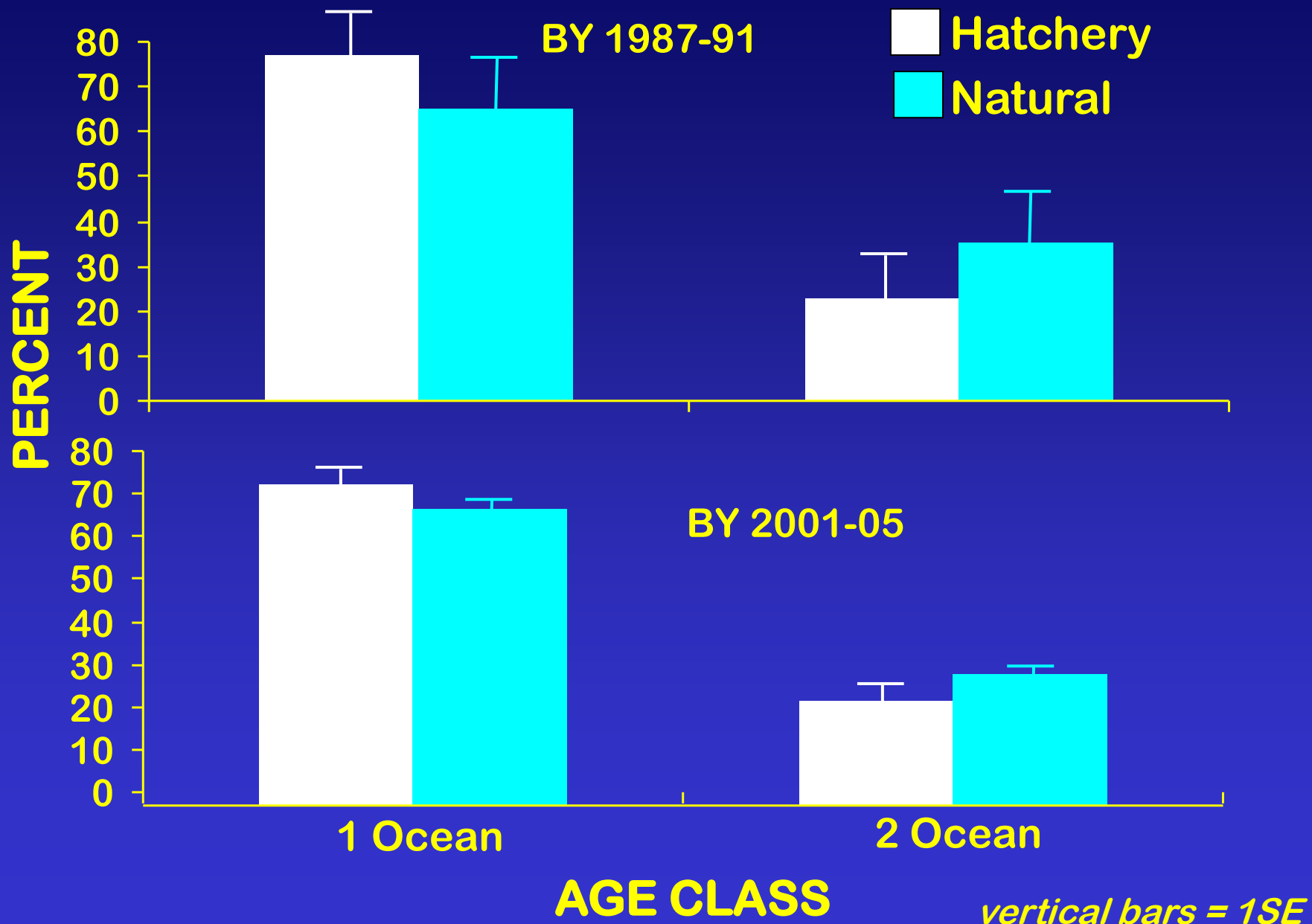


Imnaha Stock Adult Return Timing

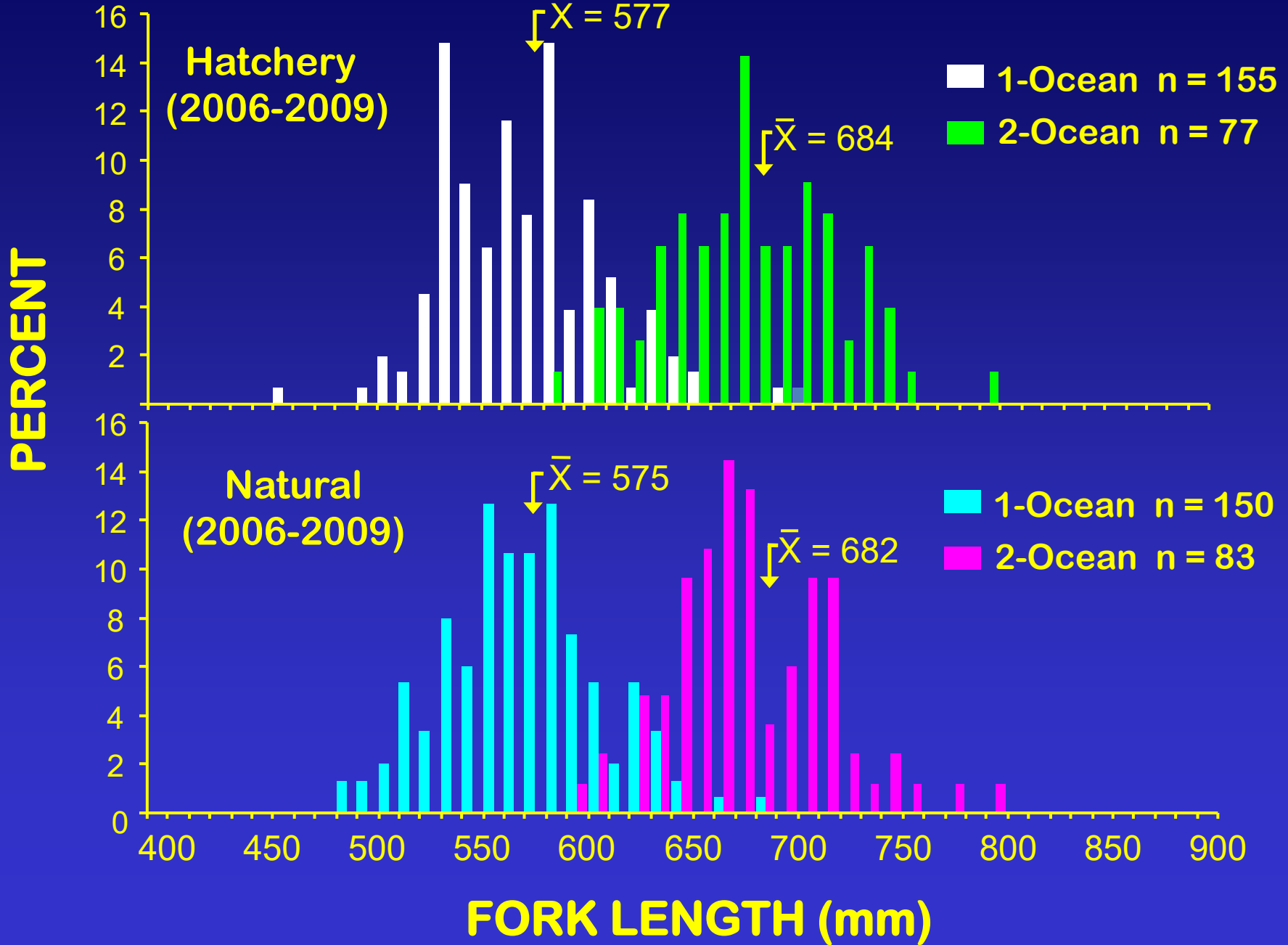
Hatchery Weir, run years 2006-10



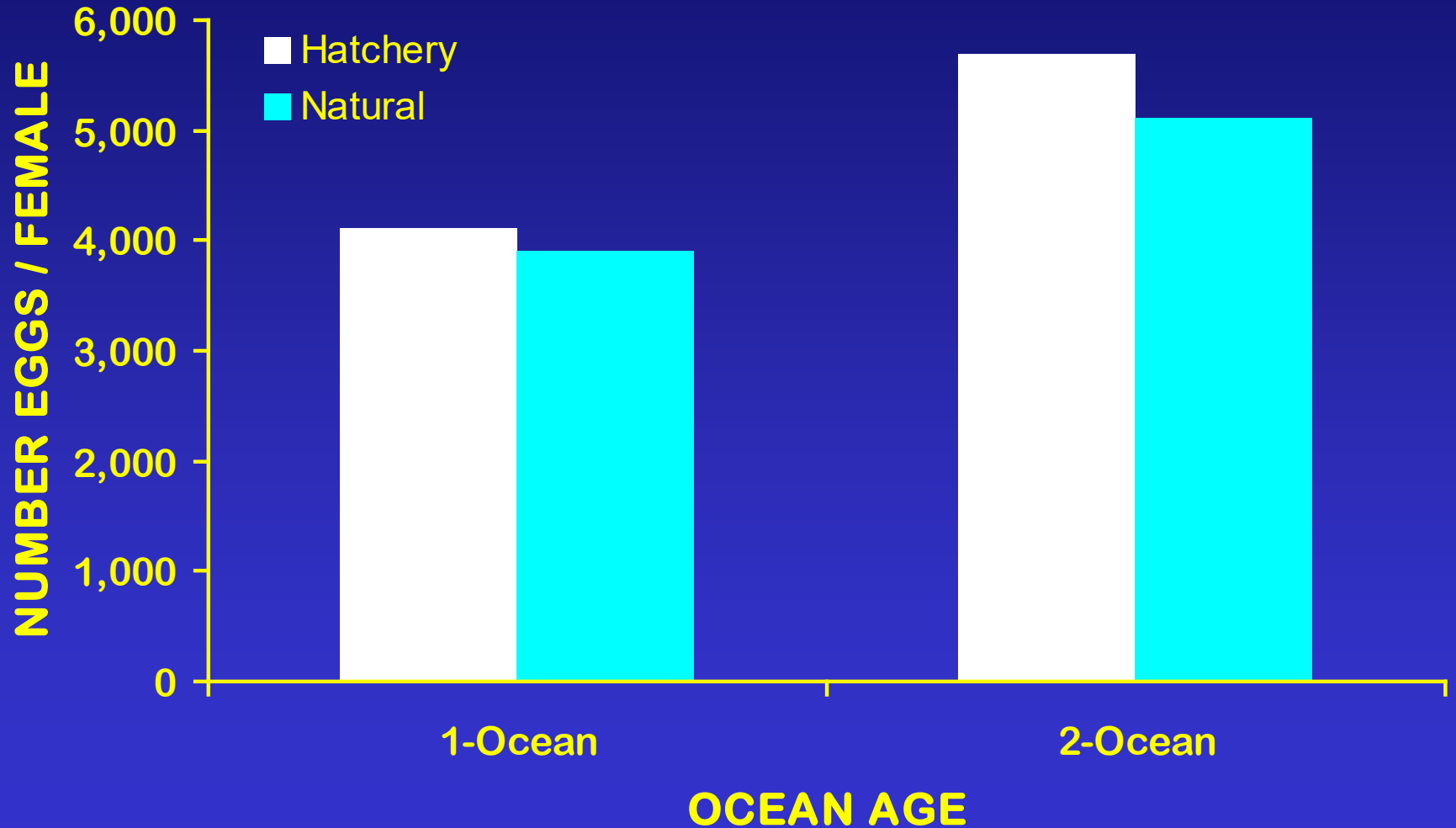
Imnaha Stock Age at Return



Imnaha Stock Average Length at Age



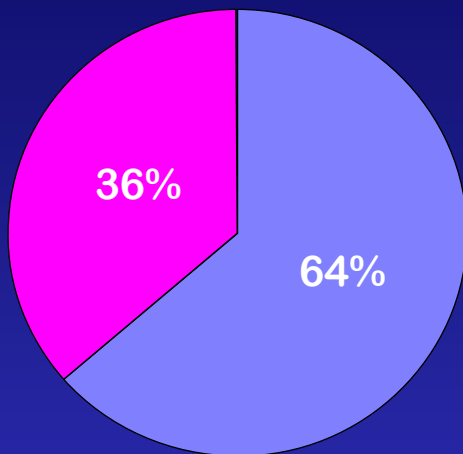
Fecundity of Hatchery and Natural Imnaha Stock Steelhead, 1990-1993 Broods



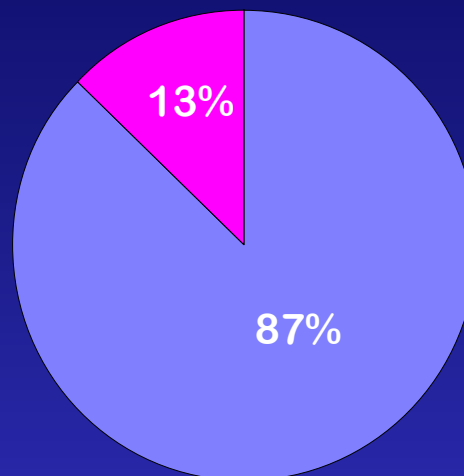
Age by Gender of Hatchery and Natural Imnaha Stock Steelhead, 1986-2004 Broods

1-ocean
2-ocean

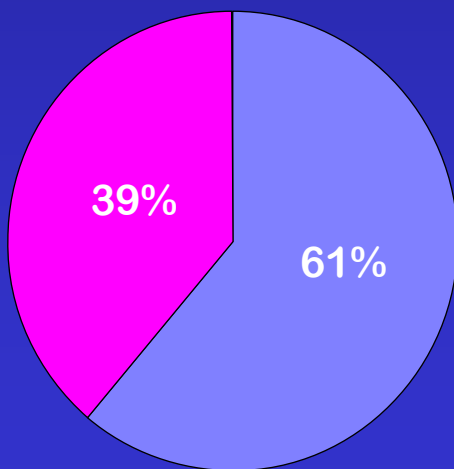
Hatchery Females



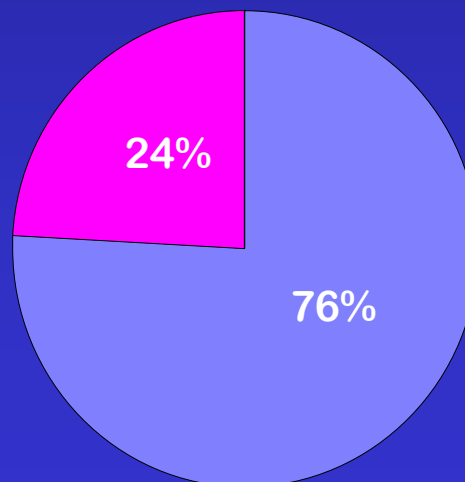
Hatchery Males



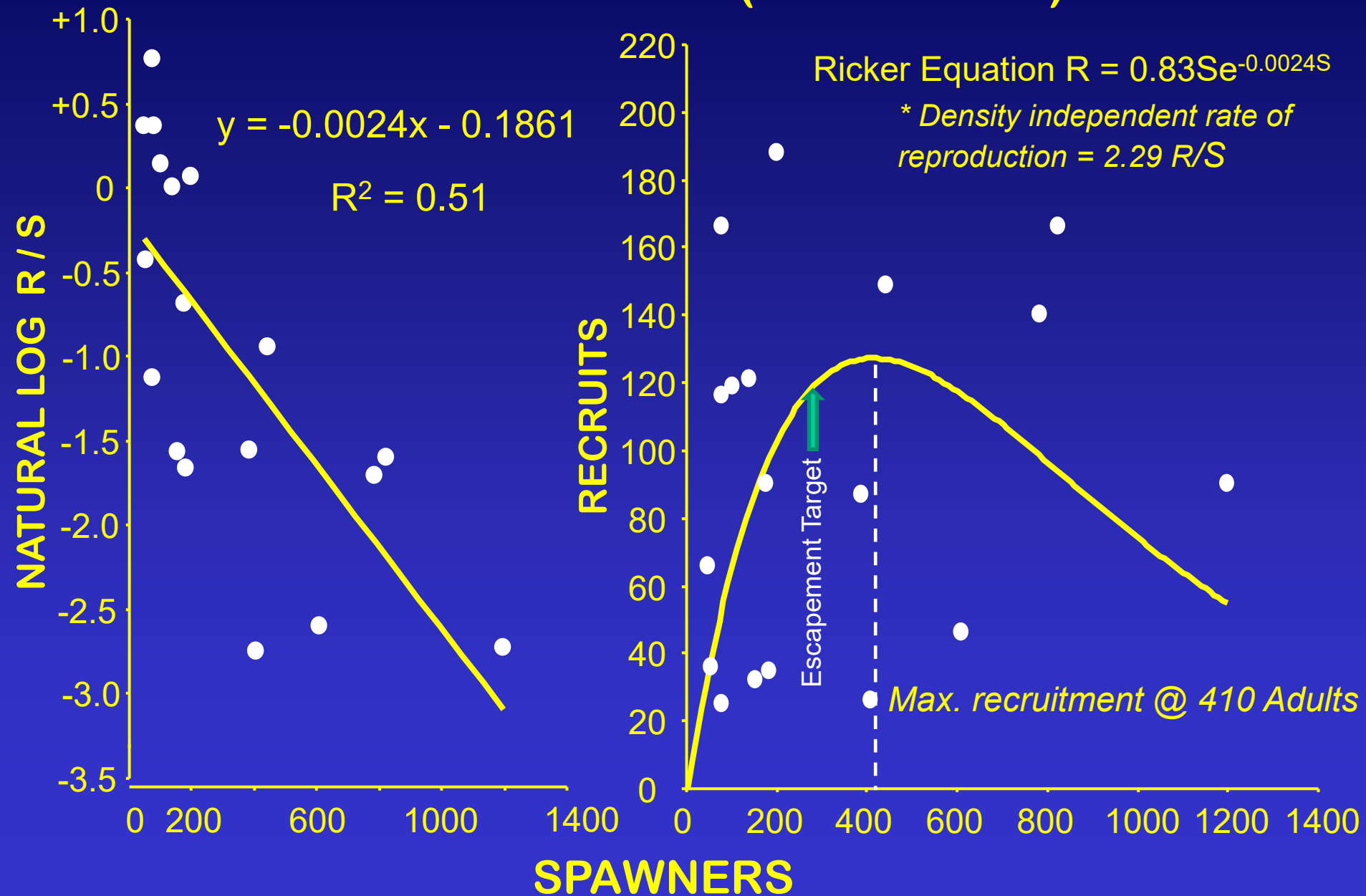
Natural Females



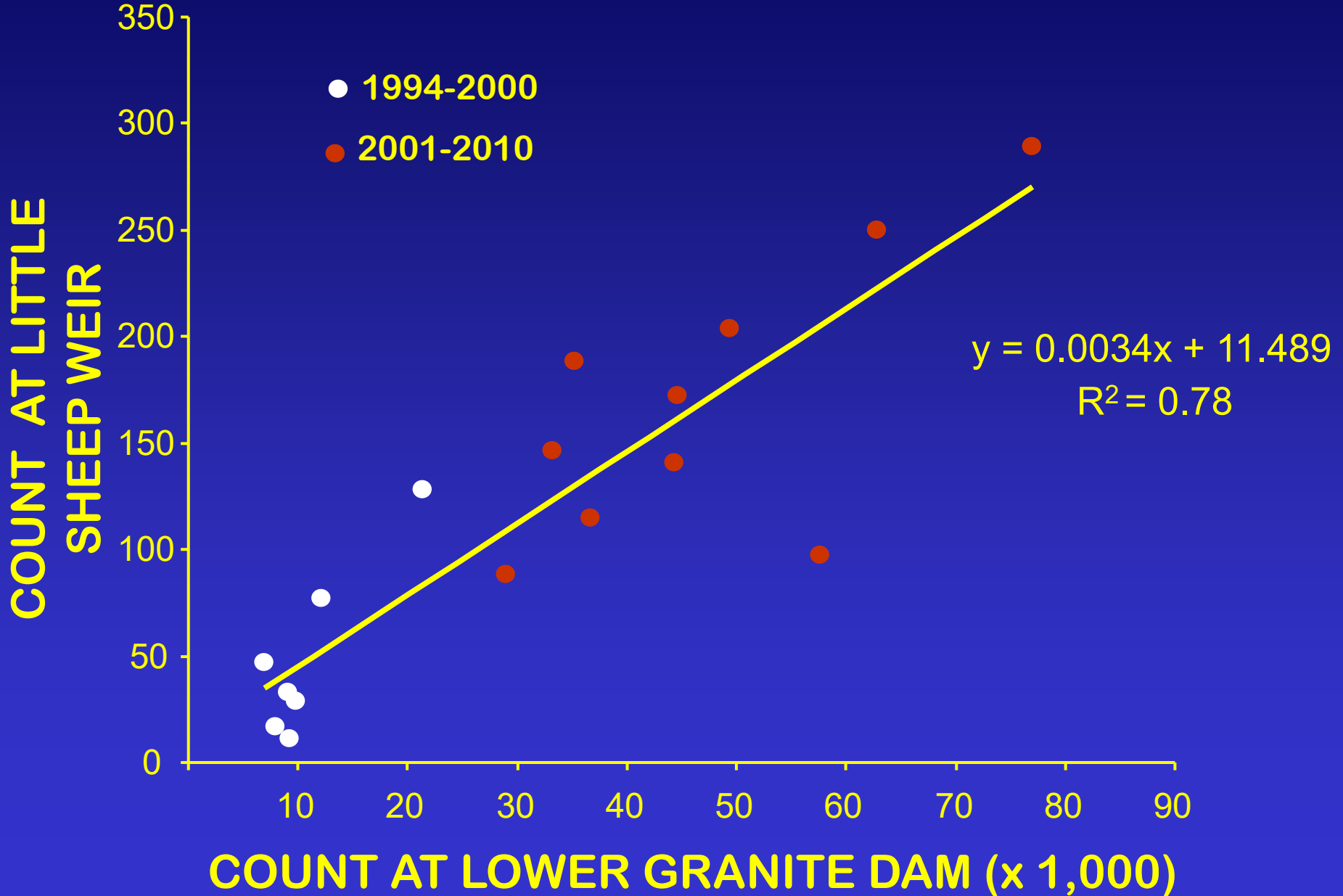
Natural Males



Adult-to-Adult Recruitment Curve for Spawning Above the Weir (BY 1987-04)



Natural Adult Abundance Relationship Little Sheep vs. Snake Basin, 1994-2010



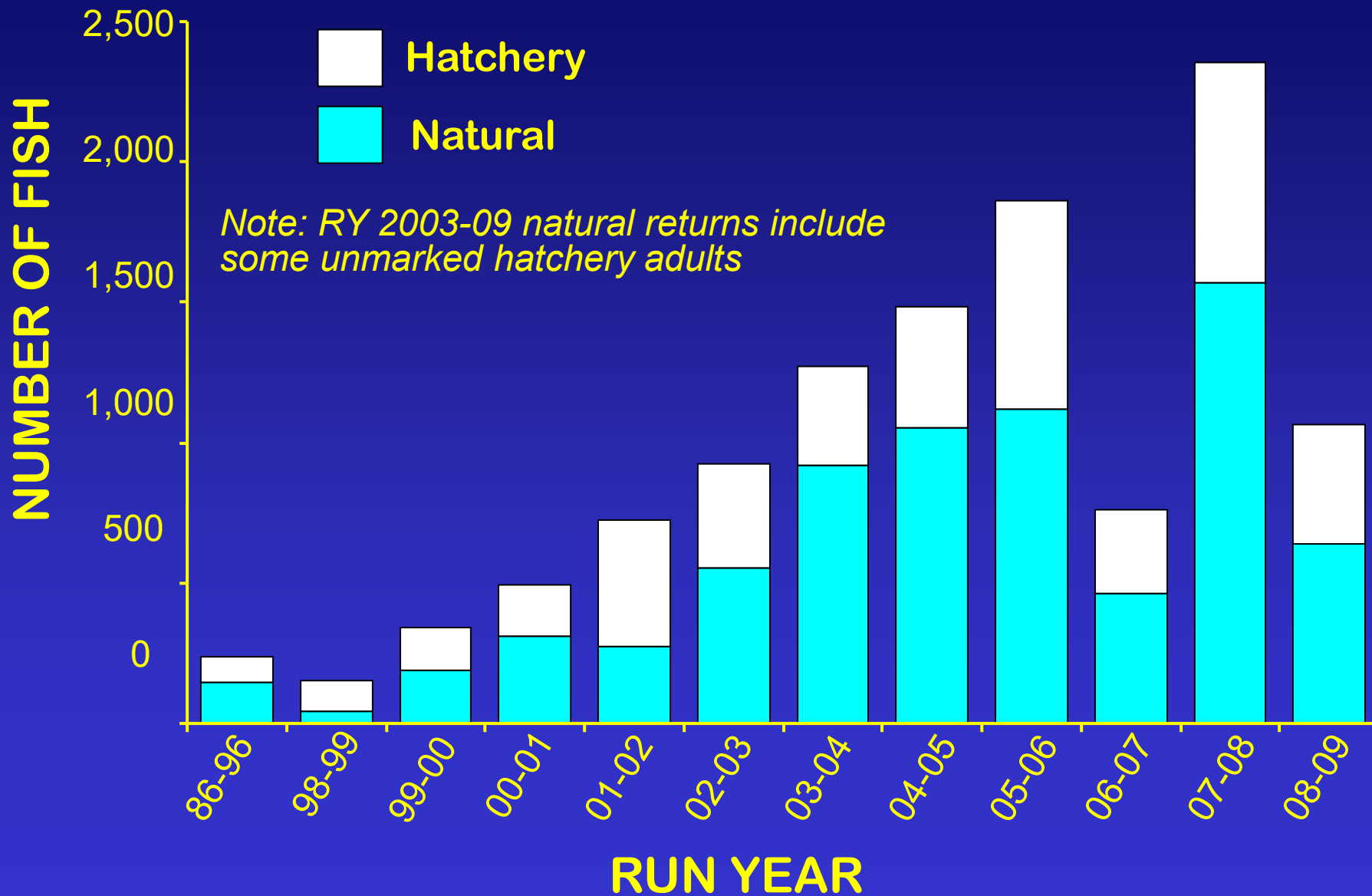
Fish Health Highlights for Imnaha Stock

Disease Issues	Consequences	Fish Health Response
<p>Bacterial coldwater disease (CWD) caused by <i>Flavobacterium psychrophilum</i></p>	<ul style="list-style-type: none">• CWD loss in most brood years primarily after ponding fry into indoor circular tanks at Irrigon Hatchery in late June/early July• 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• Recent years have had to treat at 10 mg/kg. Some repeat treatments necessary.• A couple of new approaches to be taken in 2012 for prevention of early lifestage CWD loss:<ol style="list-style-type: none">1) Vexar substrate for heath trays for both stocks2) BioPro starter feed trial for both stocks

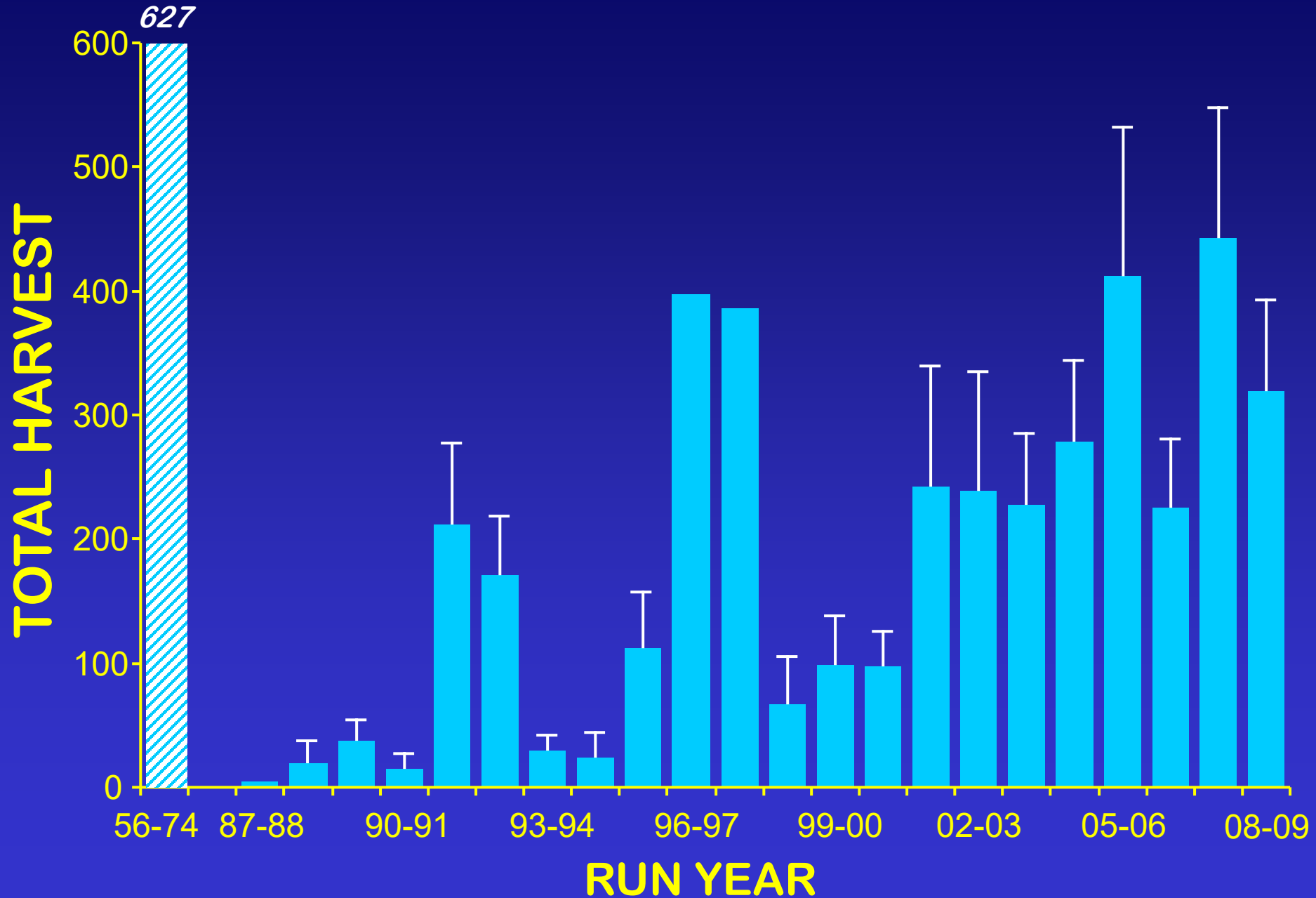
History of Steelhead Harvest Regulations in the Imnaha Basin, 1974 to 2012

- 1974 to 1985 – CLOSED - due to depressed status
- 1986 to Current – Consumptive fishery re-opened
 - Season - Fall (122 d); Spring (105-120 d) = 227-242 d
 - Area - 1986-2001: 32 km (20 mi)
2002-current: 37 km (23 mi)
 - Bag Limit - 1986-2001: 2 fish/d
1991: 1 fish/d
2002-current: 3 fish/d

Recreational Catch in the Imnaha River

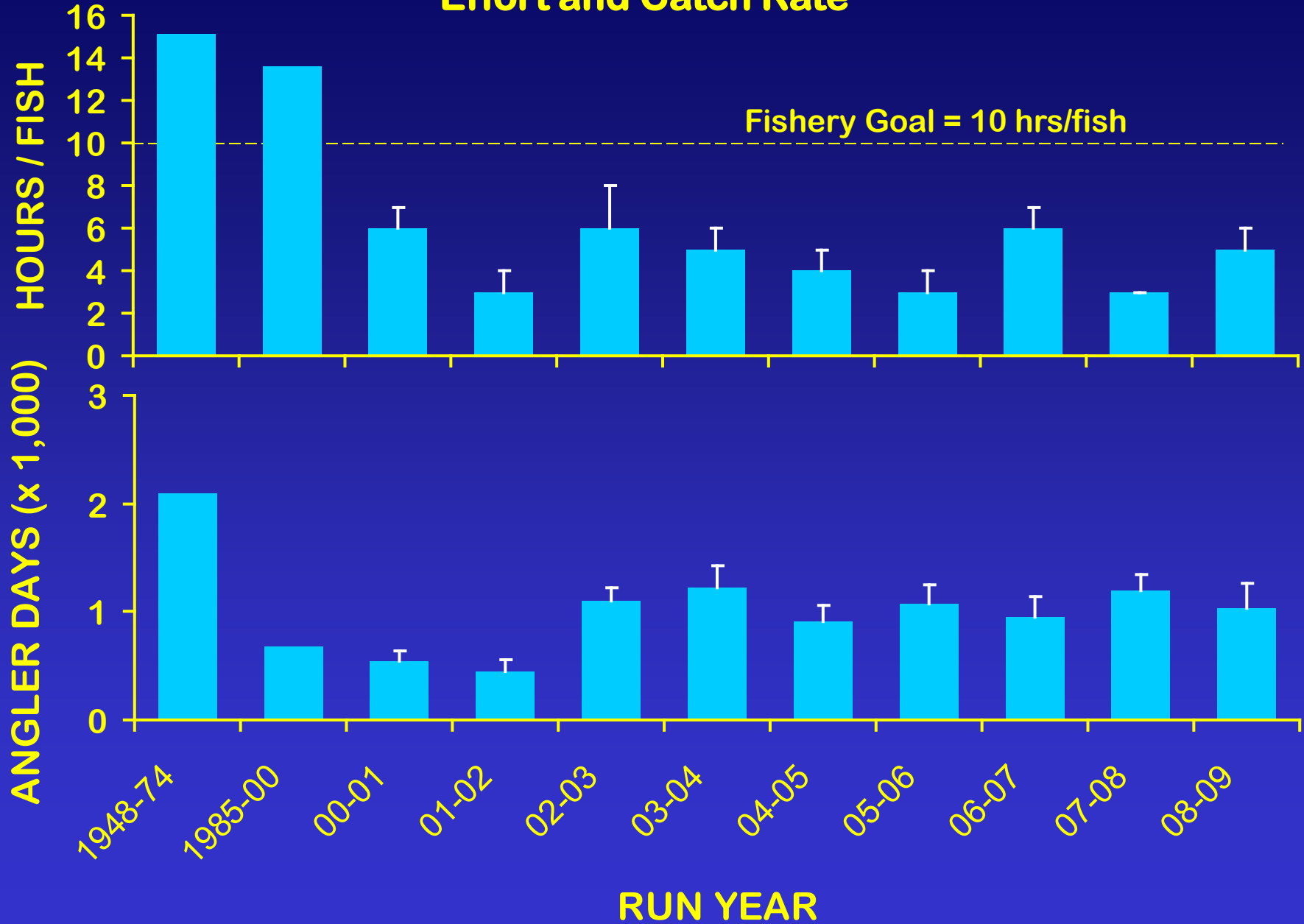


Total Harvest in the Imnaha River



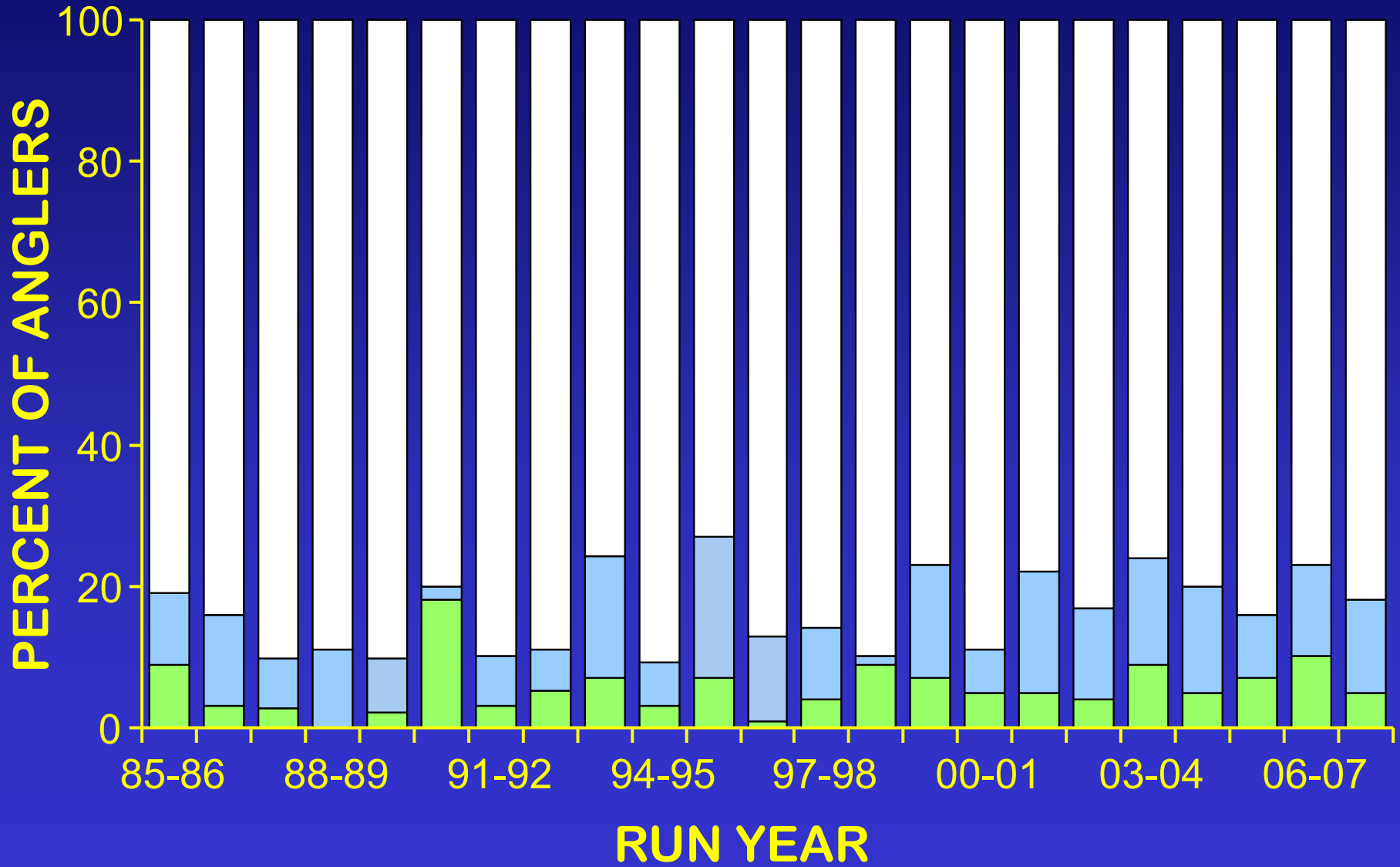
Imnaha Recreational Fishery

Effort and Catch Rate



Origin of Anglers in the Imnaha River Fishery

Local Non-local Oregon Out-of-State



Average Annual Expenditures in the Imnaha Fishery



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

Imnaha Program Performance Summary

- **Broodstock Development – Management:**

- Rapid building (5 years) to meet production needs

- High proportion natural origin early on and then very low from 1987-2007

- Low PNI until recent years, PNI has improved under new sliding scale management plan

- **In-Hatchery Performance:**

- Adult prespawn mortality low in all recent years

- Egg-to-smolt survival variable and poor in some years due to CWD loss

- **Hatchery Program Performance:**

- Smolt production at or near goals since 1988

- Smolt survival to LGD moderate and lower than Wallowa stock

- 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, nine times better than natural

- Relatively low exploitation rates (total 35%) with high escapement rates to the weir (64%).

- Majority of adult escapement to the weir is outplanted to Big Sheep Creek.

- A substantial proportion of outplants rerun back to Little Sheep Creek.

Innaha Program Performance Summary

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

Stray rates generally low with a majority of strays into the Deschutes River. Very low stray rates into Snake Basin tributaries and within the Innaha Basin.

Recreational fisheries have not been restored to historical levels due to angler participation. Exceptional catch rates; however, low economic value.

- **Natural Production Monitoring:**

Natural population viability status is unknown due to lack of data.

Viability monitoring expanded considerably due to adult PIT array estimates and weirs (BPA funded). These efforts will improve estimated abundance/productivity, spatial distribution and hatchery fraction datasets.

Program Performance Summary

Supplementation: Life History and Spawning Characteristics

- Hatchery fish return at a similar ocean age as natural fish.
- Hatchery fish return and spawn at the same time as natural fish.
- There is no difference in size at age between hatchery and natural fish.
- Hatchery fish return a higher proportion of males.

Program Performance Summary

Supplementation: Abundance and Productivity

- We have achieved a significant life cycle survival advantage for hatchery steelhead with a recruit per spawner advantage of 9:1.
- We have substantially increased the number of total spawners in Little Sheep Creek; however, most were hatchery origin until recent years.
- We have observed a trend of increased number of natural-origin spawners in recent years; however, the trend parallels the total Snake Basin natural returns at Lower Granite Dam.
- Recruits per spawner for naturally spawning hatchery and natural steelhead has averaged much less than 1 and has been above replacement for only 5 of the last 18 brood years.
- There is a strong correlation between Little Sheep Creek natural origin returns and the total natural origin returns to the Snake Basin. There is no indication that the relationship has changed through time.

Program Performance Summary

Supplementation: Abundance and Productivity

- Stock recruitment analyses indicates that adult escapement was well into the range of strong density dependence for many recent years and that the 250 escapement goal is sound.

Imnaha Hatchery Program Adaptive Management Changes

- **Reduced smolt production numbers to reduce the magnitude of surplus returns to Little Sheep Creek.**
- **Modified sliding scale to increase proportion of natural origin broodstock, reduce hatchery proportion above the weir, improve PNI, and provide a more reasonable escapement level given capacity considerations.**
- **Implemented volitional release strategies with removal of non-migrants to reduce juvenile ecological interaction risks.**
- **Implemented 4.5/lb release size goal over 5/lb to maximize SAS.**
- **Developed food bank outlets for surplus hatchery returns.**

Imnaha Program HSRG and HRT Recommendations

- **HSRG – Develop conservation objectives for the Big Sheep Creek component, develop abundance and productivity estimates, develop a properly integrated program with appropriate PNI, pNOB and pHOS to achieve conservation standards. Requires ability to collect natural origin adults and manage spawning composition.**

Response: Outplanting of large numbers of adults continues and discussions are underway on conservation objectives and monitoring plan. Adult PIT arrays will provide estimates of natural escapement.

- **HSRG – Convert the existing integrated program into a “stepping stone” program for Little Sheep Creek. Include a small integrated program to achieve conservation benefit and a segregated program to achieve the harvest**

Response: Managers have not yet adopted this strategy, rather they reduced smolt production and revised the sliding scale management plan to address the concerns with low PNI.

- **HRT – Discontinue the release of smolts and adults into Big Sheep Creek unless this activity can be justified based on specific goals. Goals must be developed and weighed against the risks the outplants pose to the natural population, which are currently high. Develop a monitoring and evaluation program that will determine if the desired benefits are being obtained.**

Response: The Big Sheep outplanting program is under co-manager discussion. No actions have been taken to address the HRT recommendations.

Imnaha Program HSRG and HRT Recommendations

- HRT - Revisit and adjust the sliding scale so that it is consistent with research and conservation goals of the program.

Response : The sliding scale has been revised to reduce hatchery proportions spawning naturally to 50% and to increase the natural origin proportions in the broodstock.

- HRT – Continue to monitor residualism .

Response: Monitoring of residual abundance and characteristics continues annually in Little Sheep Creek.

Imnaha Basin Hatchery Steelhead Program Challenges

- Improving PNI to a level appropriate for a supplementation program.
 - Inadequate numbers of natural origin fish.
 - Significant number of broodstock needed to meet smolt goals.
- Better understanding of the magnitude, characteristics and ecological effects of residuals.
- Developing rearing and release strategies that maximize SAS and minimize residualism.
- Disposition of large numbers of surplus hatchery fish.

Imnaha Basin Hatchery Steelhead Program Challenges

- Improving relative reproductive success of hatchery origin fish in nature.
- Continued outplanting into Big Sheep Creek without clearly defined objectives and adequate evaluation. It will be difficult to assess outplanting success without pre-treatment and control data.
- Increasing angler participation in the recreational fishery through public outreach.