

Upper Grande Ronde River and Catherine Creek Spring Chinook Salmon Hatchery Program Review

Richard W. Carmichael

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



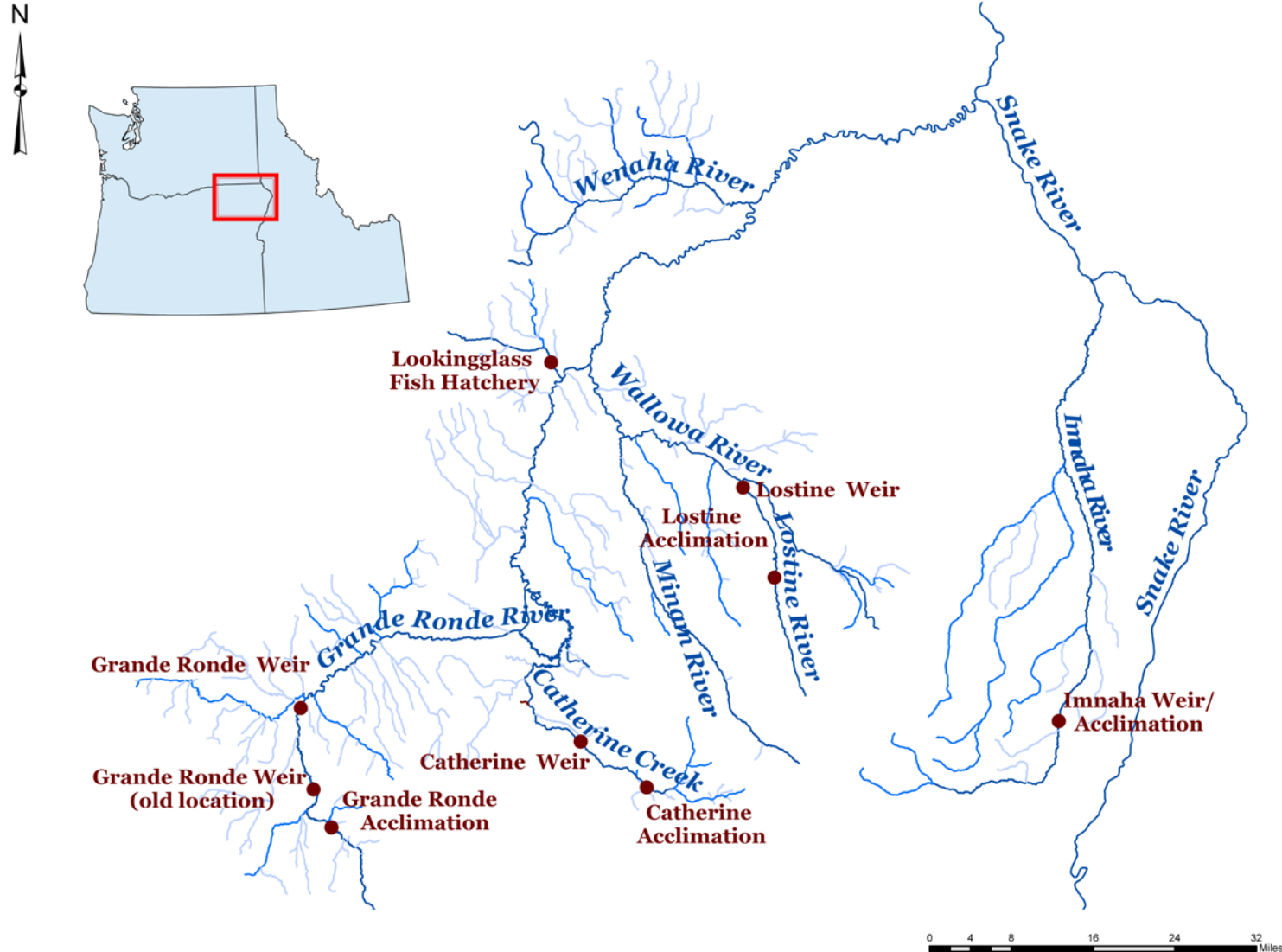
Presentation Outline

Upper Grande Ronde and Catherine Creek

- **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 and fishery restoration**
- **Supplementation effectiveness**
- **Conclusions and future challenge**

Grande Ronde and Imnaha River Basins

Chinook Hatchery Facilities



Mitigation Goals

Spring Chinook Salmon Upper Grande Ronde River and Catherine Creek

Upper Grande Ronde	250,000 Smolts 1,617 Adults
--------------------	--------------------------------

Catherine Creek	150,000 Smolts 970 Adults
-----------------	------------------------------

0.65% Smolt-to-Adult Survival

Adapted Management Objectives

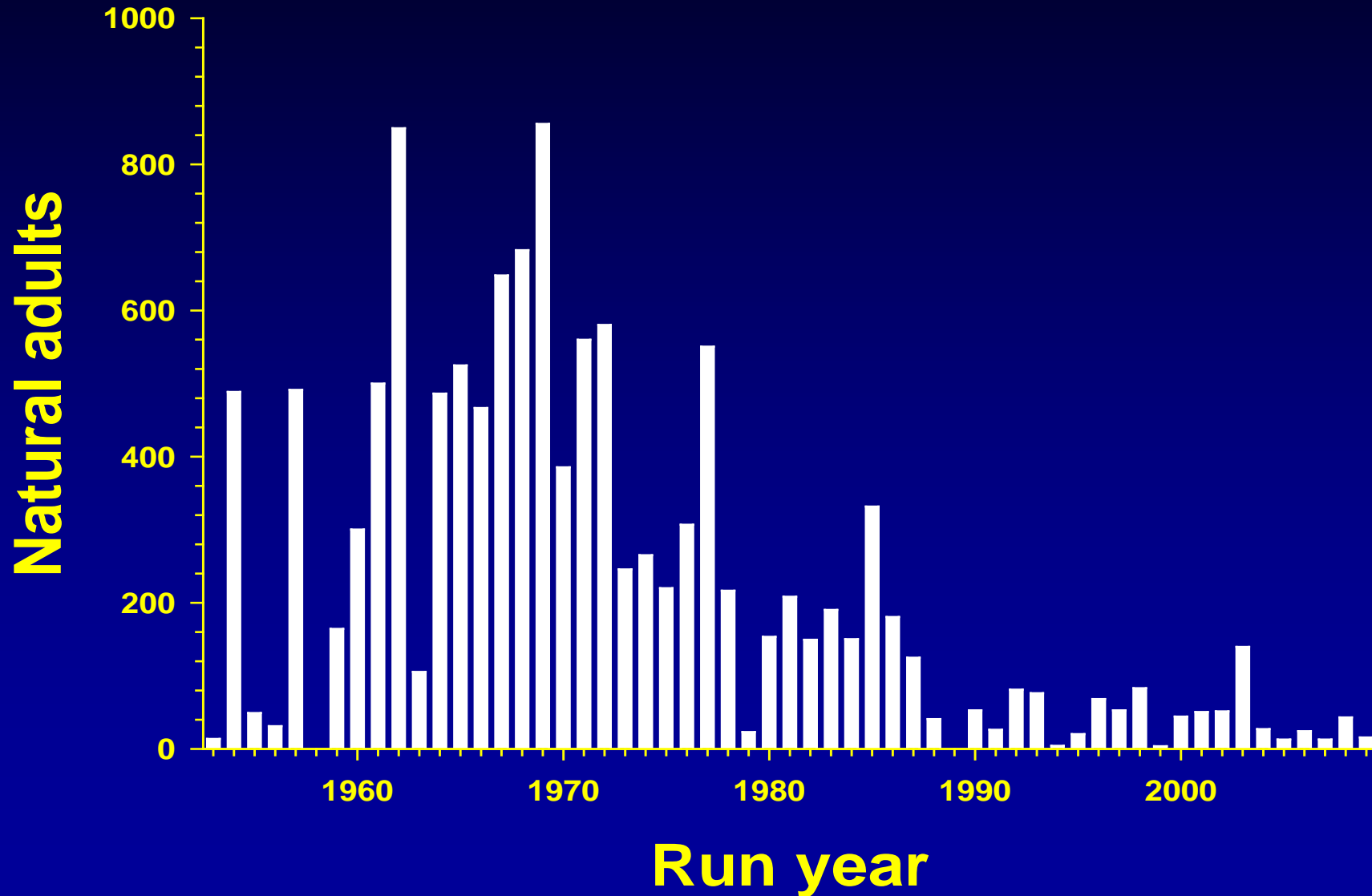
- **Prevent extinction of the Catherine Creek and Upper Grande Ronde River Chinook salmon populations.**
- **Establish adequate broodstock to meet annual production needs.**
- **Establish an annual return of 1,617 hatchery fish to the Grande Ronde River and 970 to Catherine Creek.**
- **Provide a demographic foundation to rebuild from after the key limiting factors and threats are addressed.**
- **Re-establish historic tribal and recreational fisheries.**
- **Maintain genetic and life history characteristics of the natural populations.**
- **Operate the hatchery program so that the genetic and life history characteristics of hatchery fish mimic wild fish.**
- **Maintain endemic wild populations of spring Chinook salmon in the Minam and Wenaha rivers – minimize straying.**

Monitoring and Evaluation Objectives

- Document and assess fish culture and hatchery operation practices and performance.
- Determine optimum rearing and release strategies.
- Determine total catch and escapement, smolt survival, smolt-to-adult survival, and assess if adult production meets mitigation goals.
- Compare recruits-per-spawner for hatchery and natural origin fish.
- 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 ratio, smolt migration, fecundity) of hatchery and natural fish.
- Determine the success of maintaining genetic integrity of endemic wild spring Chinook salmon in the Minam and Wenaha rivers.
- Assess success in restoring fisheries.

Upper Grande Ronde River Chinook Hatchery Program

Natural Origin Adult Spawner Abundance



Upper Grande Ronde River Acclimation pond



Upper Grande Ronde River Weir



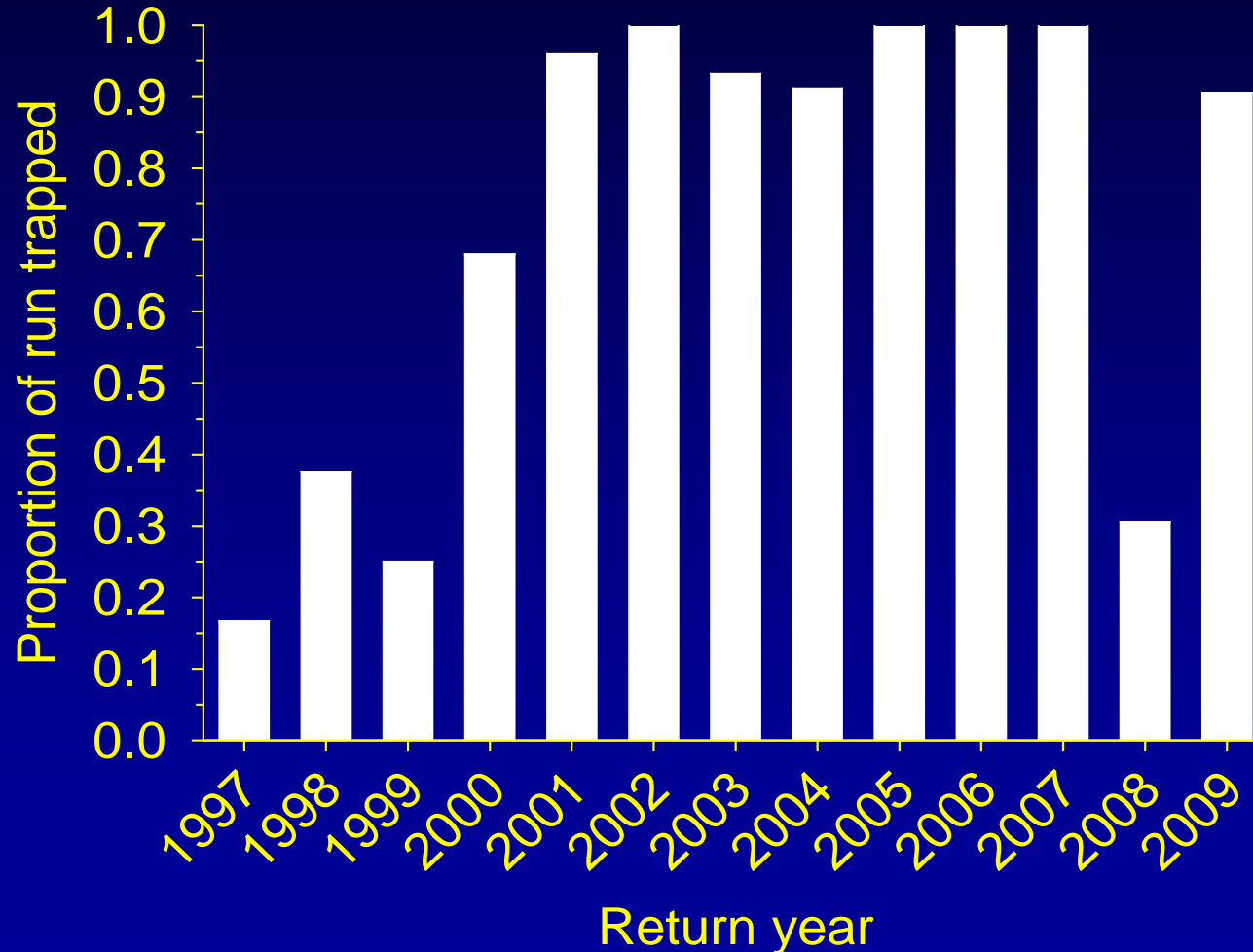
Lookingglass Fish Hatchery



Grande Ronde River Broodstock and Escapement Management Plan

Escapement Level	Maximum % Natural Retained for Broodstock	% Hatchery Above Weir	Minimum % of Natural Origin Broodstock
Pre-Season Estimate (Any Run Size or Composition)	≤ 50	• No Limit - Pass 100% of Captives and Pass All Conventionals Not Used for Broodstock	No Minimum - Not a Decision Factor

Proportion of Chinook Run Trapped at Upper Grande Ronde River Weir



Broodstock History – Grande Ronde River

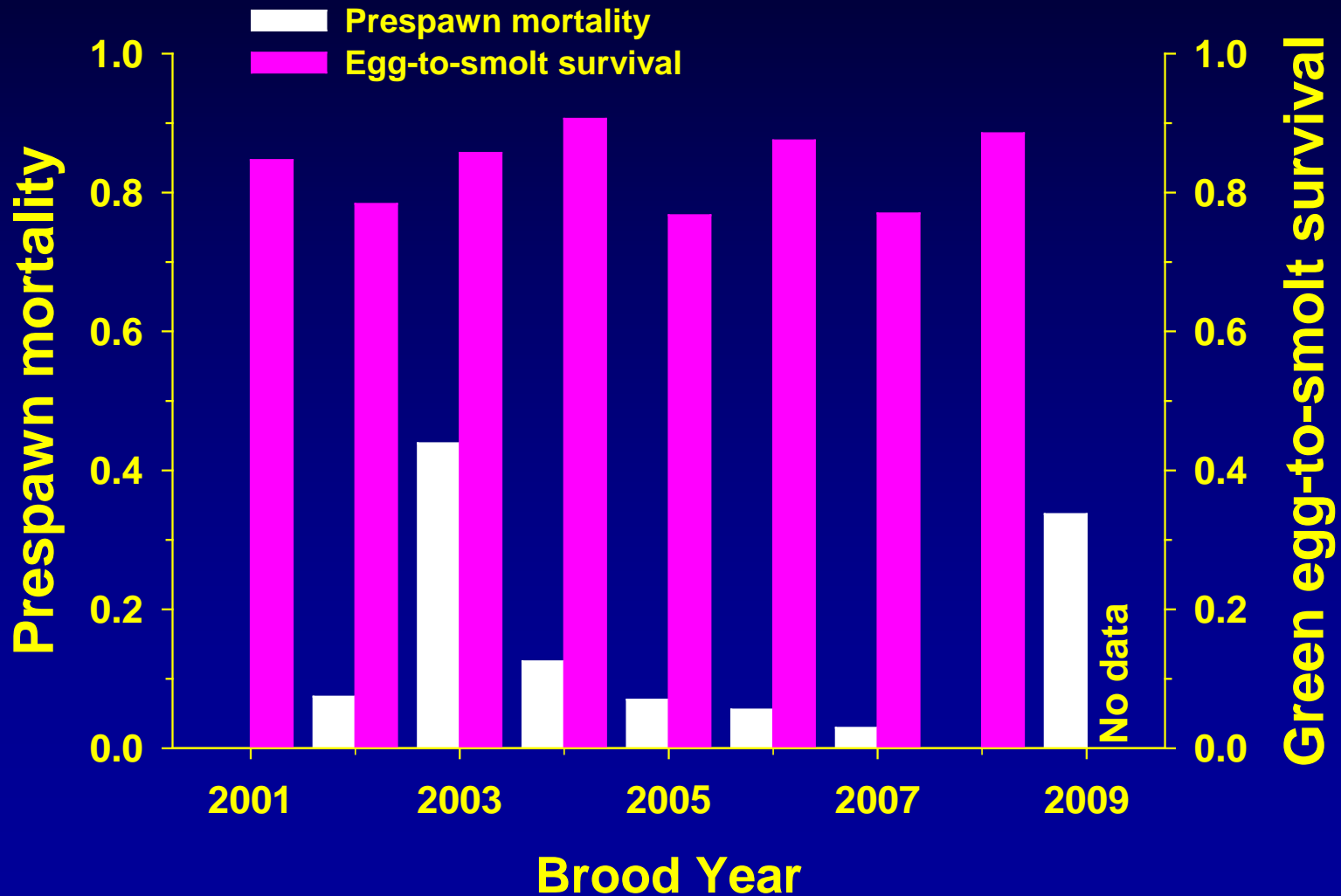
Spawn year	Number of females in broodstock		Percent natural origin adults in broodstock	Number of Captive Broodstock females
	Natural	Hatchery		
1998	0	0	0	4
1999	0	0	0	5
2000	0	0	0	188
2001	8	0	100	199
2002	17	0	100	56
2003	20	0	100	1
2004	7	0	93.3	1
2005	3	38	7.7	58
2006	12	71	17.7	5
2007	8	25	23.3	77
2008	5	8	36.0	109
2009	6	52	12.9	64

Natural Spawners – Grande Ronde River

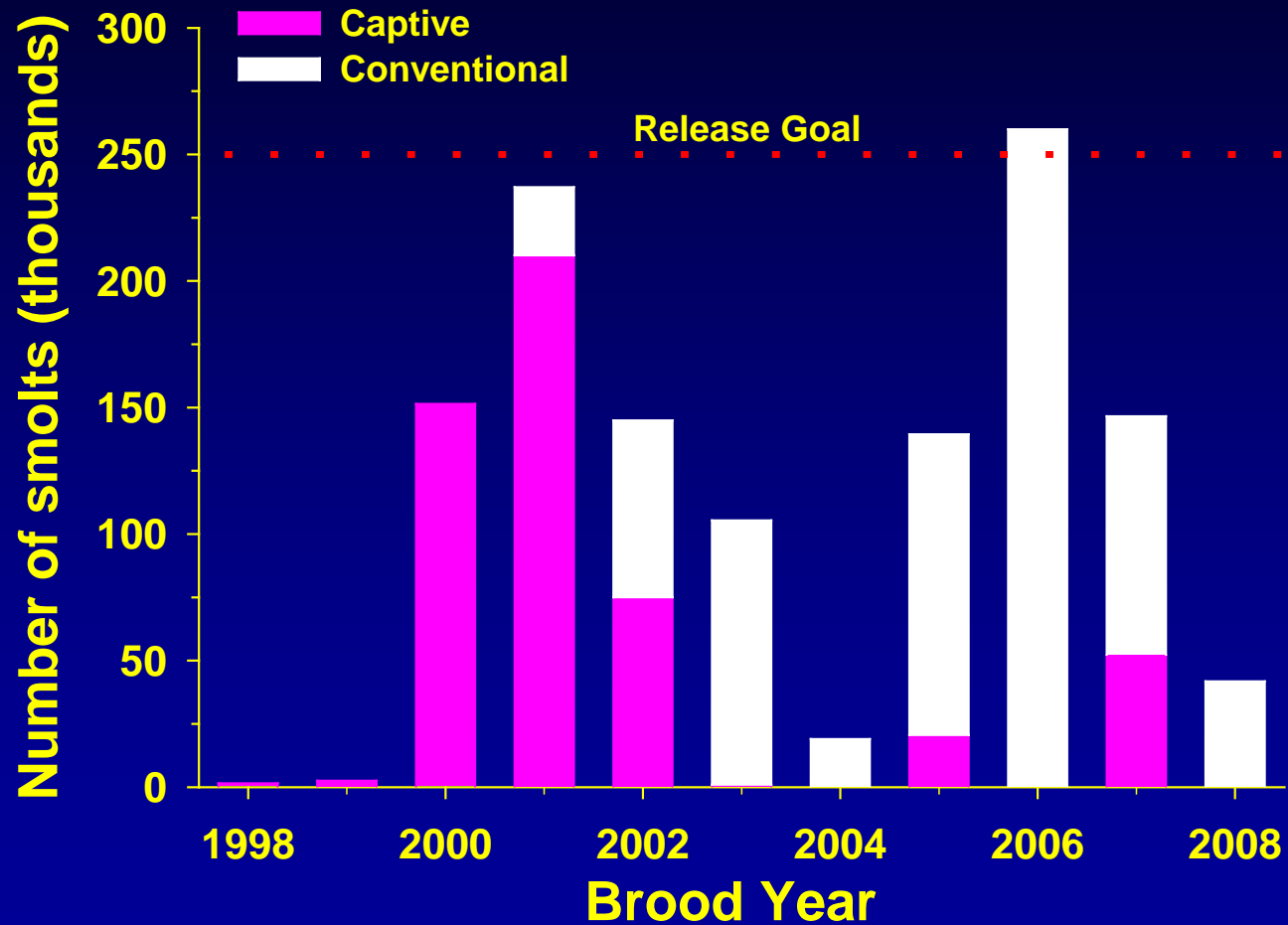
Spawn year	Total Number spawning in nature	Percent hatchery spawning in nature	Percent natural retained for broodstock	PNI
1998	88	0	4.3	
1999	4	0	0	
2000	51	0	3.8	
2001	56	0	27.3	
2002	60	5.0	47.2	0.889
2003	196	18.9	31.8	0.837
2004	638	94.8	32.7	0.505
2005	354	95.8	31.8	0.246
2006	62	51.6	48.3	0.122
2007	34	52.9	47.2	0.234
2008	465	84.9	11.4	0.134
2009	309	85.4	19.6	0.154

Prespawn Mortality

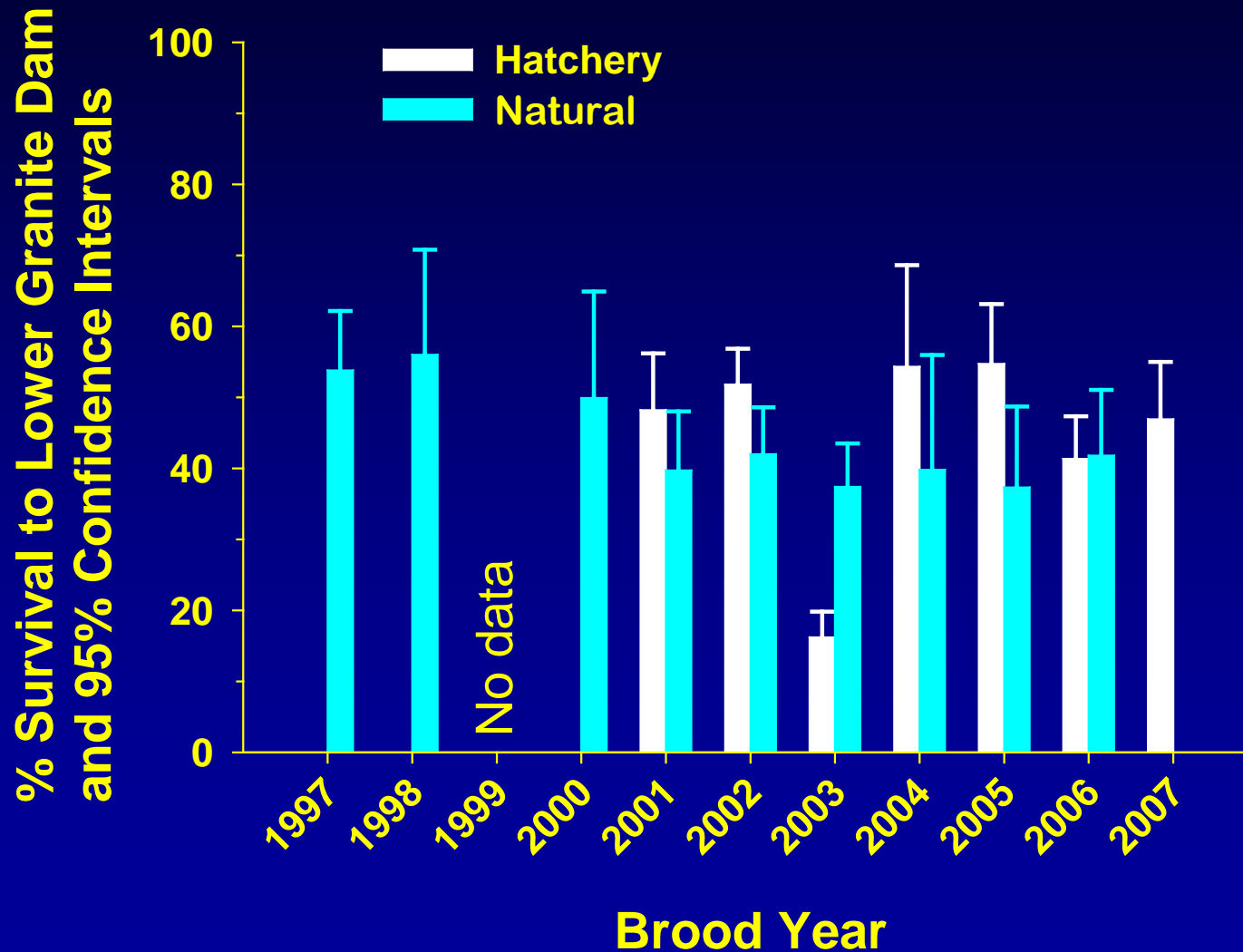
Green Egg-to-Smolt Survival



Upper Grande Ronde River Smolt Releases

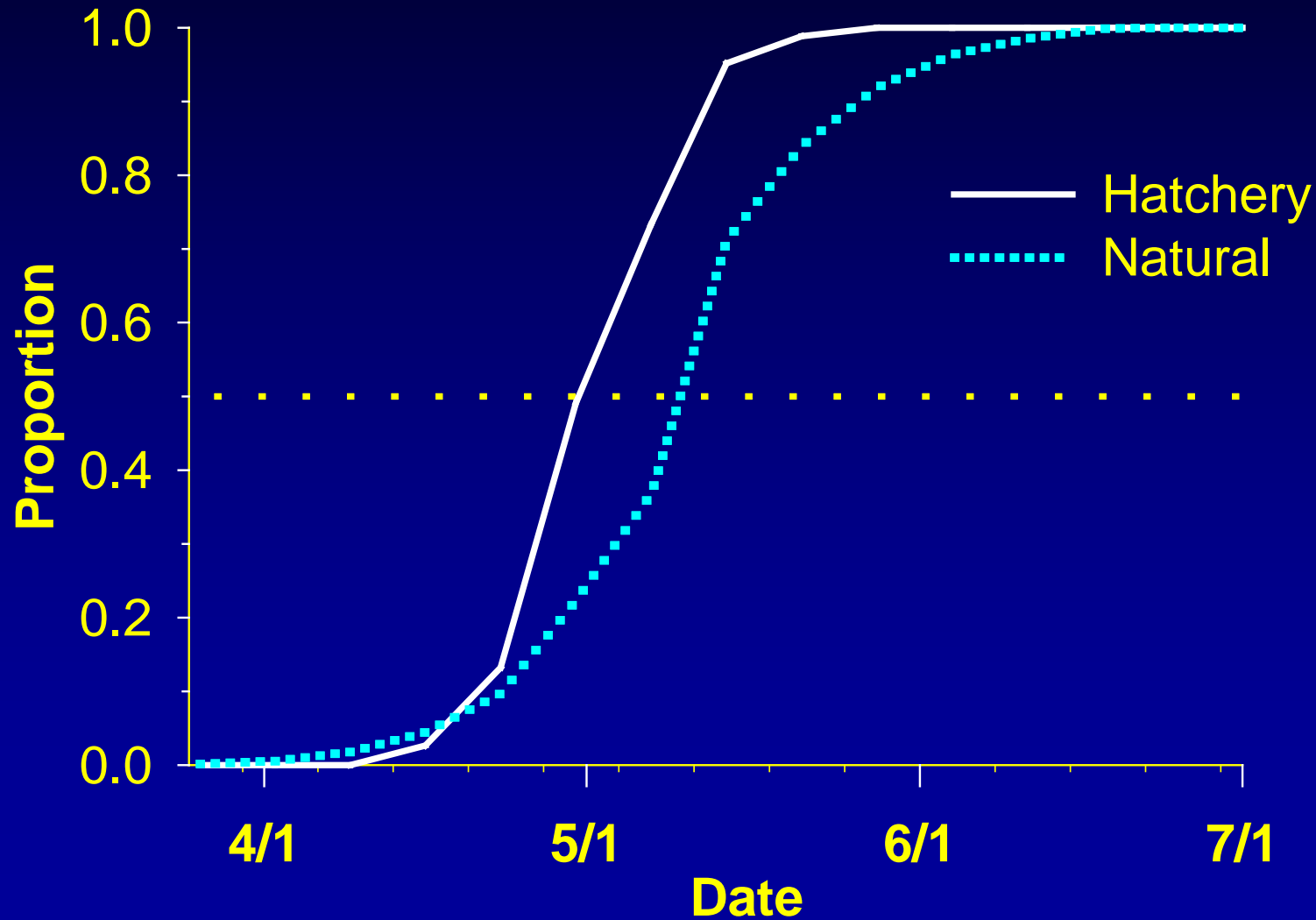


Mean Smolt Survival to Lower Granite Dam Upper Grande Ronde River



Smolt Migration Timing at Lower Granite Dam Upper Grande Ronde River

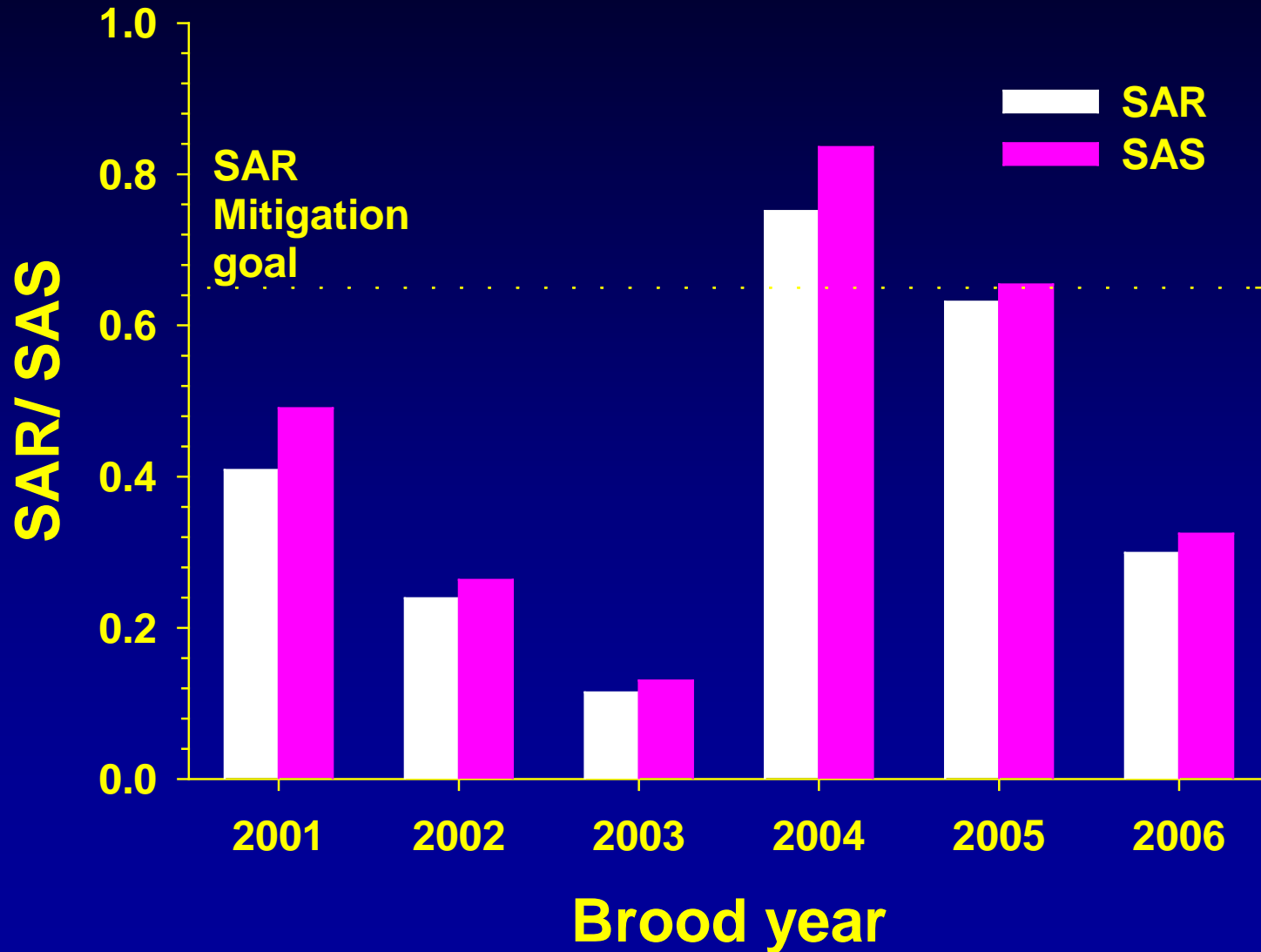
Migration Years 2003-2009



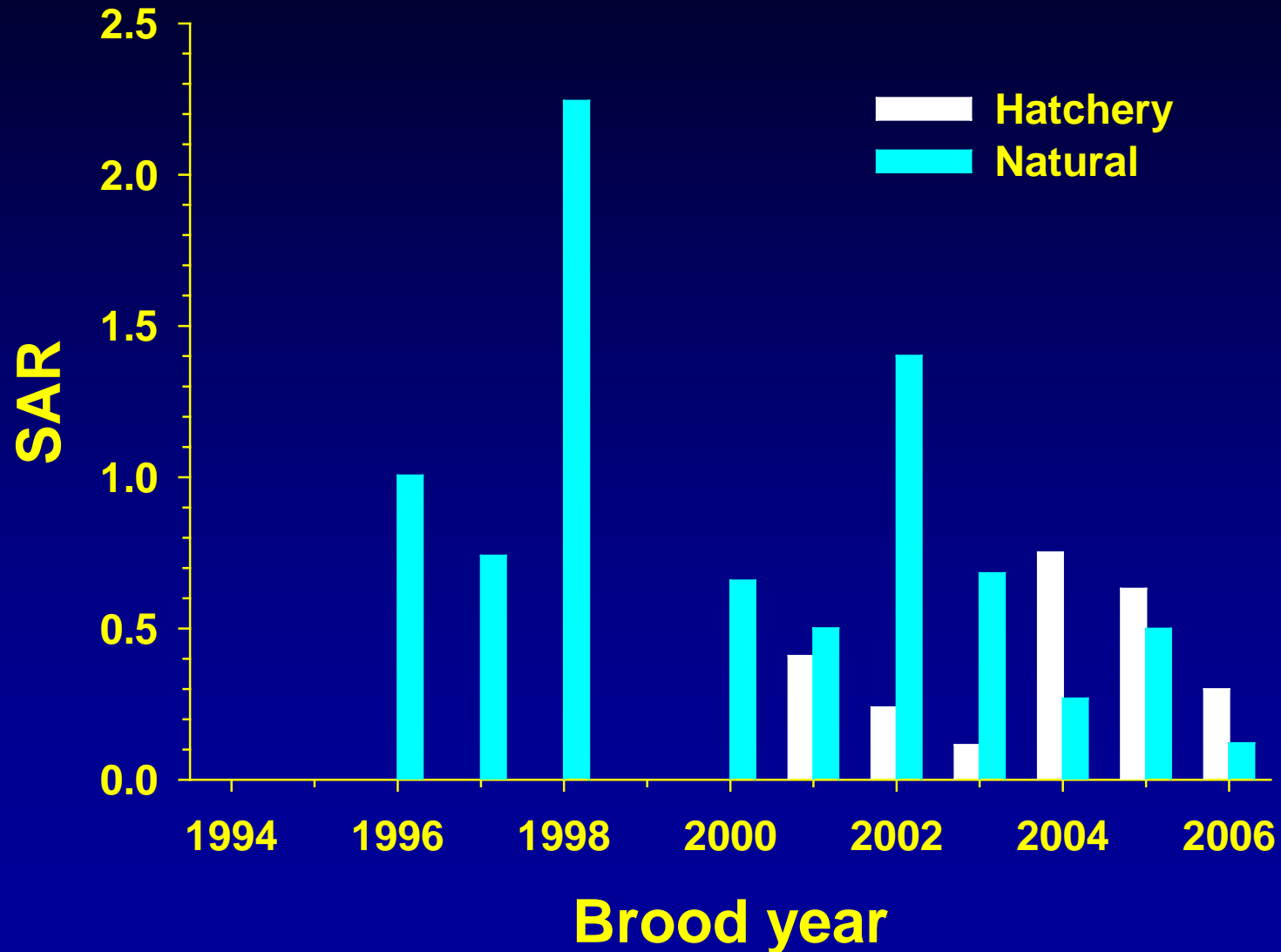
Adult Returns to the Compensation Area



Upper Grande Ronde River Smolt-to-Adult Survival and Return



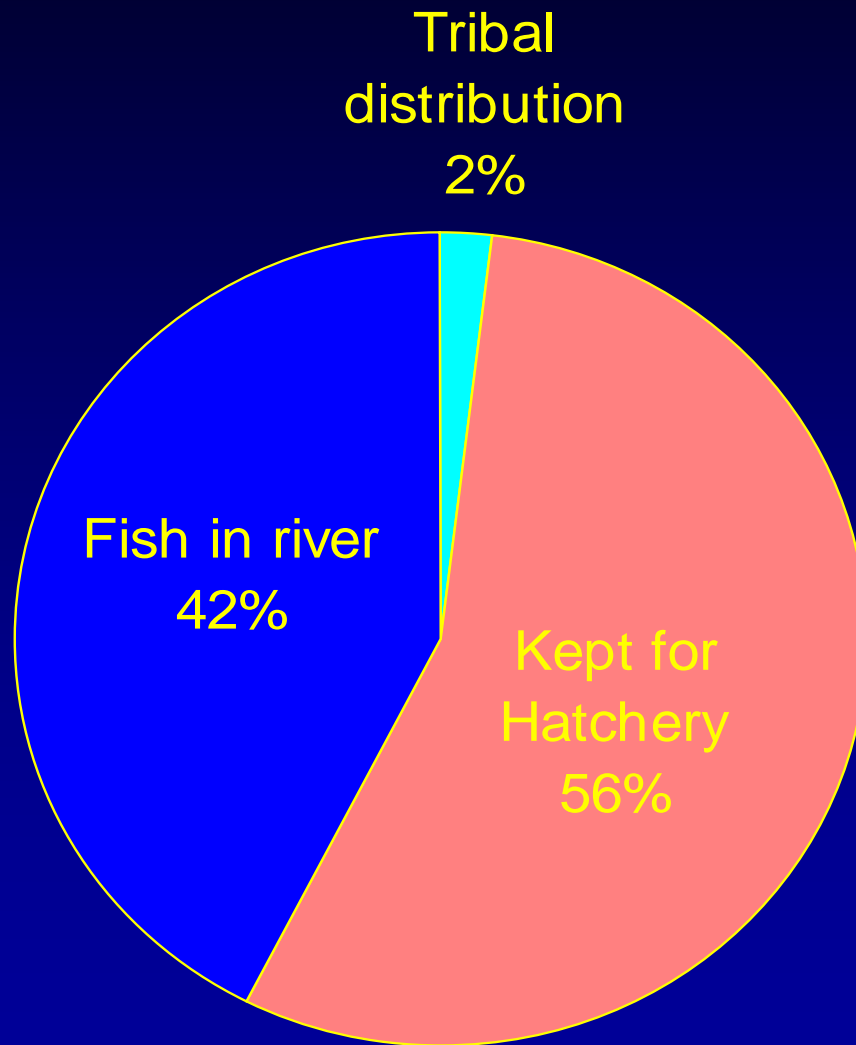
Upper Grande Ronde River Hatchery and Natural Smolt-to-Adult Survival



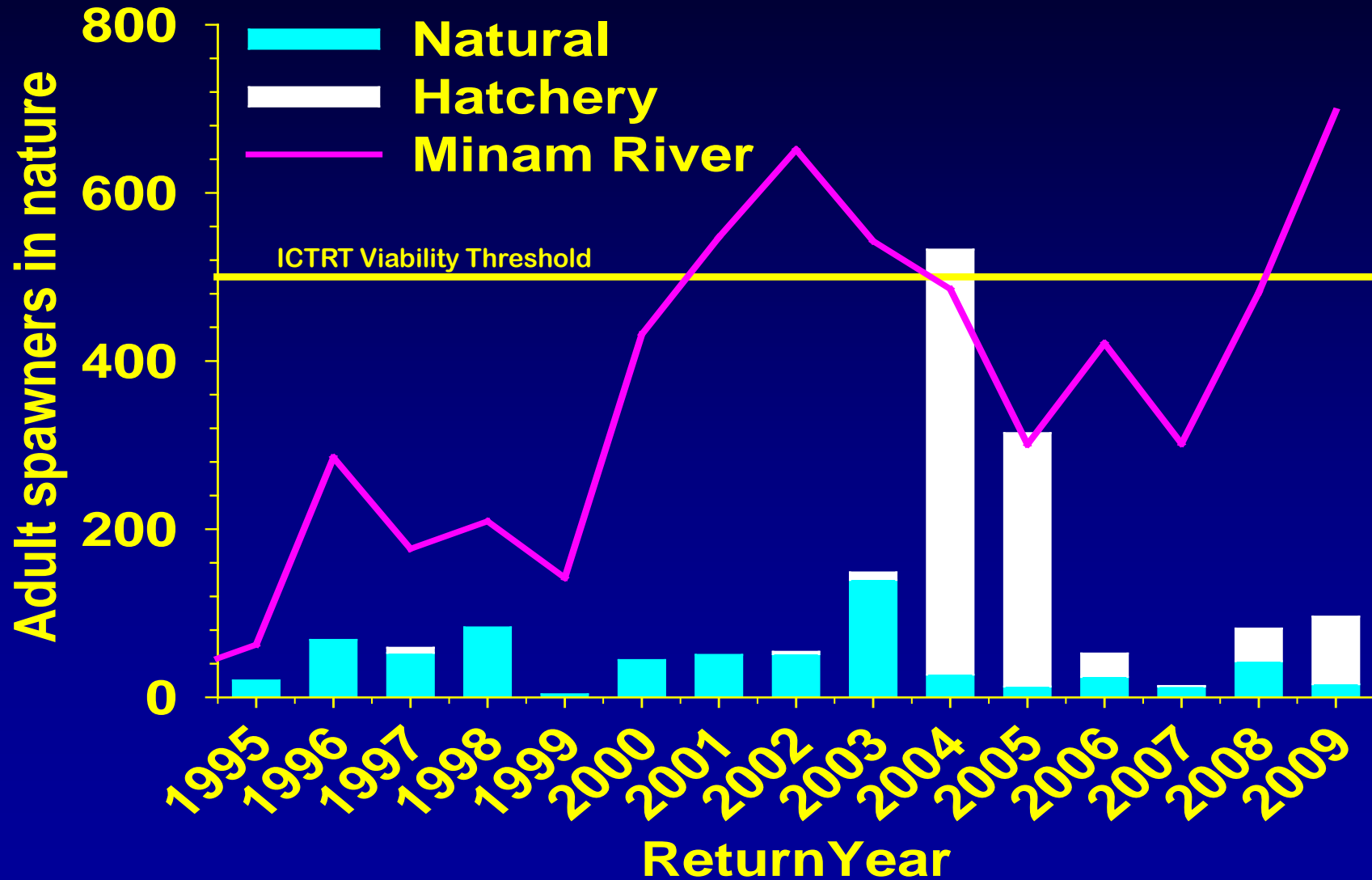
Catch and Escapement (%) of Spring Chinook Salmon Released in the Upper Grande Ronde River Basin

	<u>Brood Year</u>				<u>Mean</u>
	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	
Ocean	0.7	2.2	0.0	0.0	0.7
<u>Columbia River Harvest</u>					
Tribal	0.0	0.0	0.0	3.2	0.8
Sport	11.9	0.0	0.0	0.0	3.0
Commercial Net	3.3	0.0	0.0	0.0	0.8
<u>Snake River</u>					
Stray below LGD	0.0	0.5	0.0	0.0	0.1
Stray above LGD	4.1	6.5	12.0	7.1	7.4
Sport above LGD	0.0	0.0	0.0	0.0	0.0
Tribal above LGD	0.0	0.0	0.0	0.0	0.0
Escapement to River	80.0	90.8	88.0	89.7	87.1

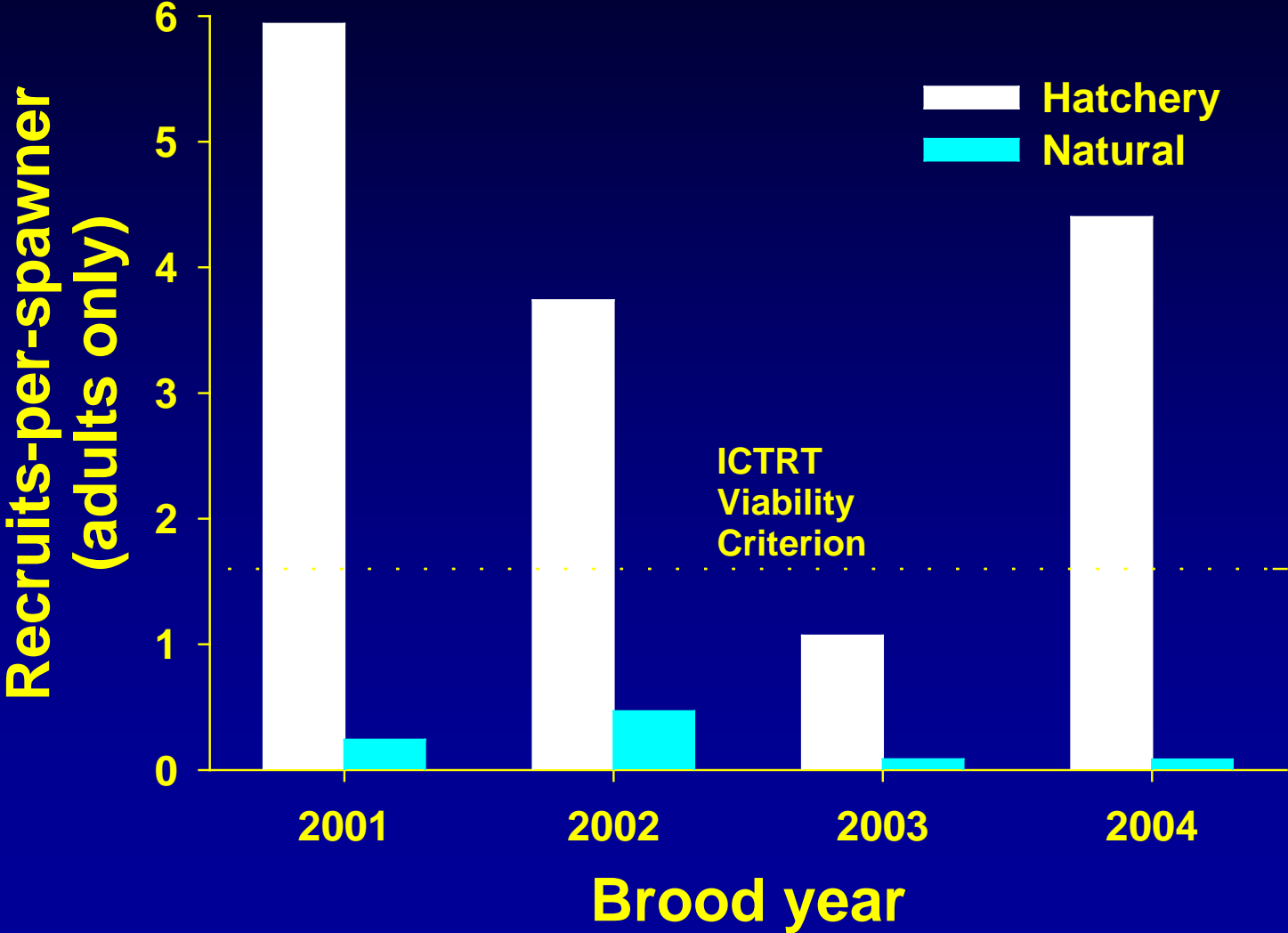
Escapement Disposition of Upper Grande Ronde River Spring Chinook from the 2001-2004 Brood Years



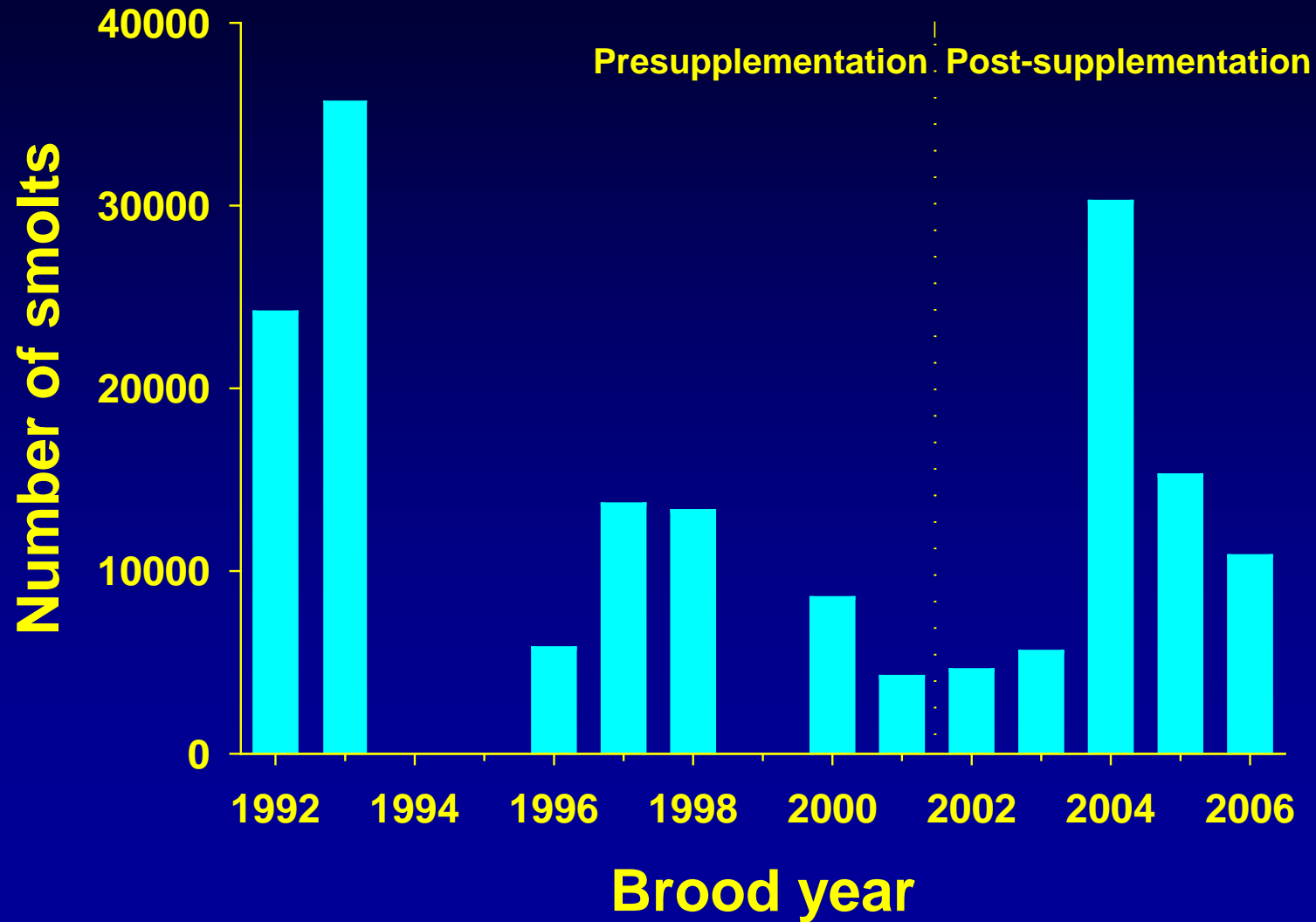
Total Adult Spawners in Nature Upper Grande Ronde and Minam River's



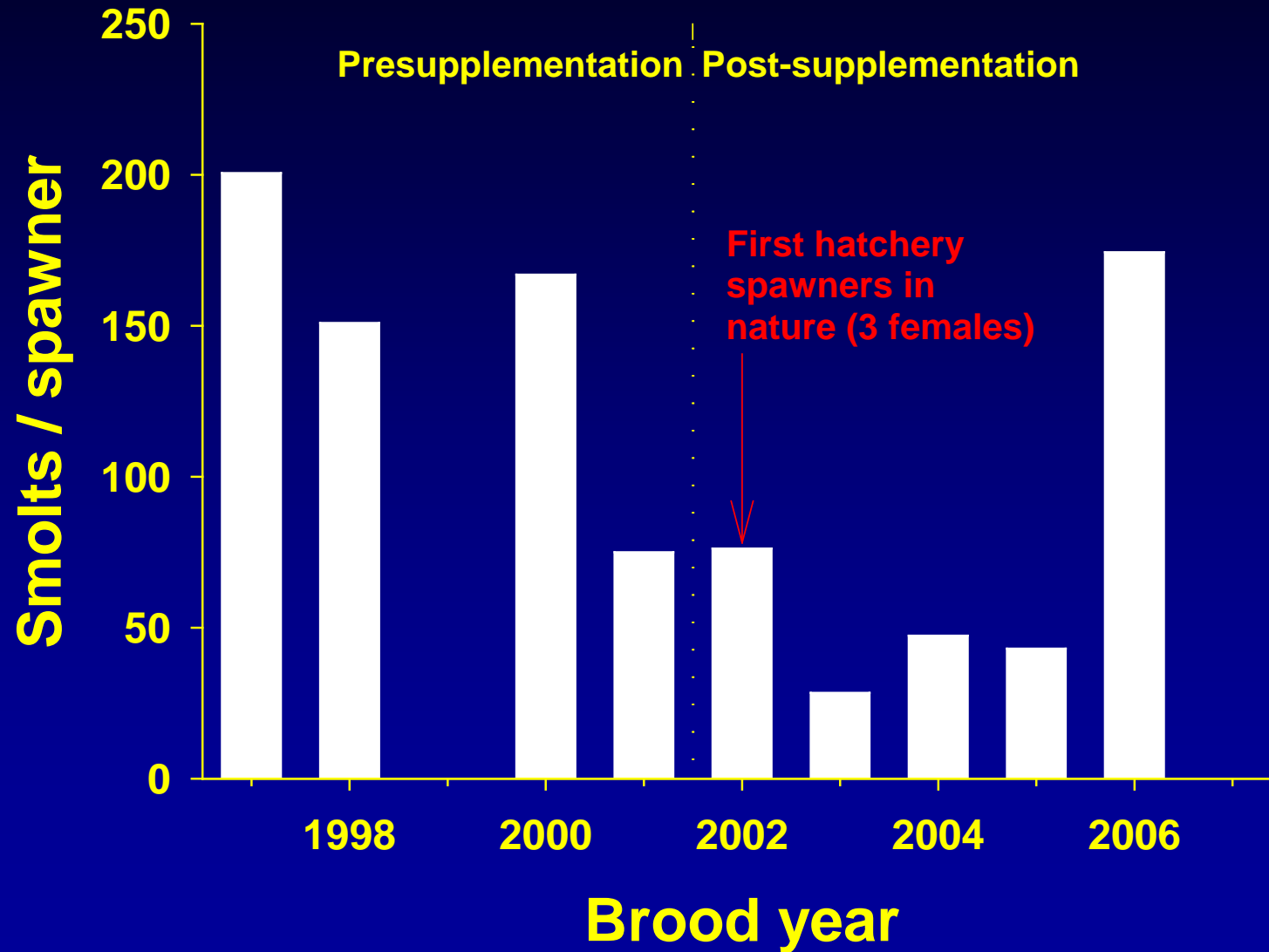
Upper Grande Ronde River Recruits per Spawner



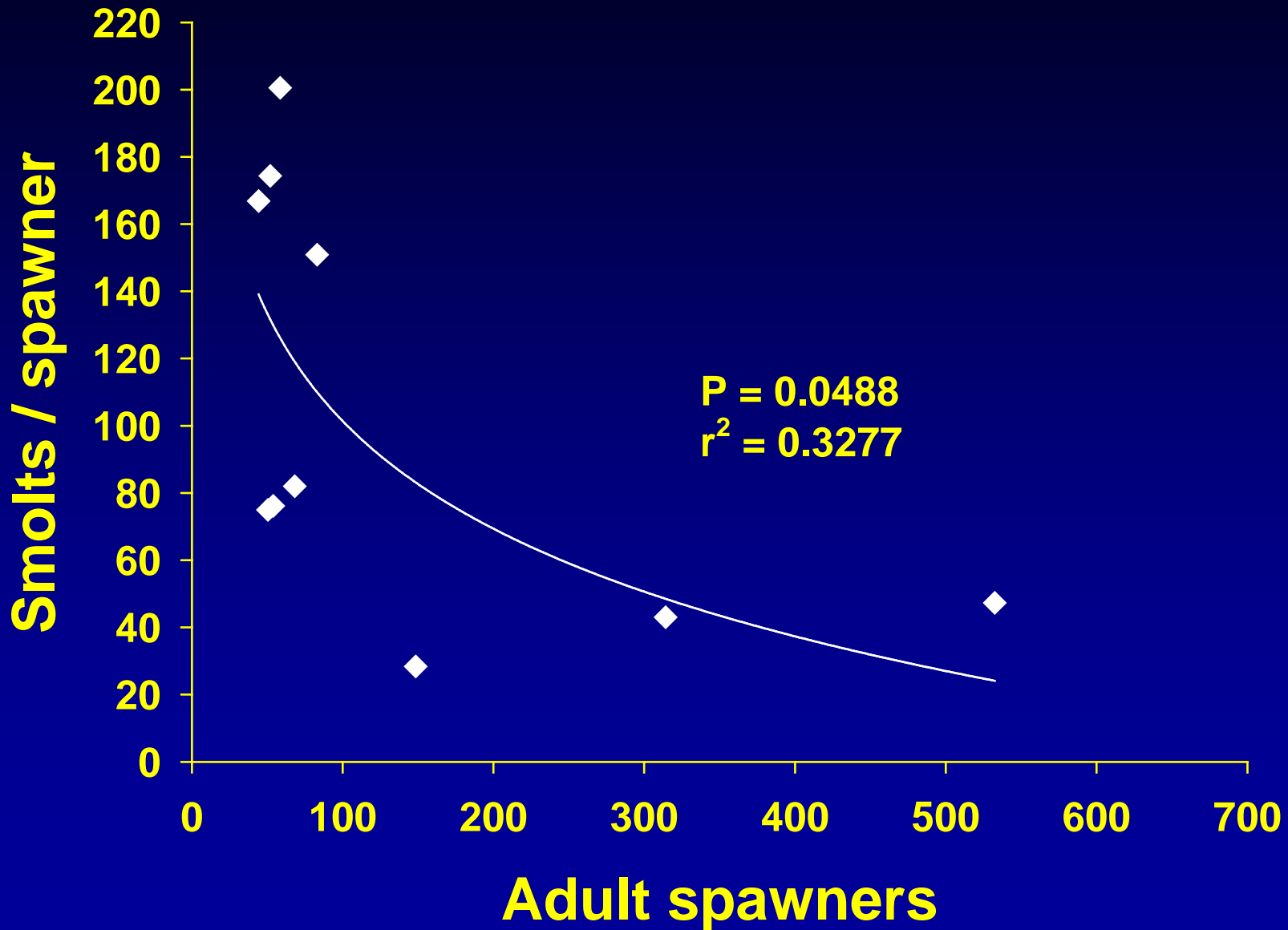
Natural Origin Smolt Abundance



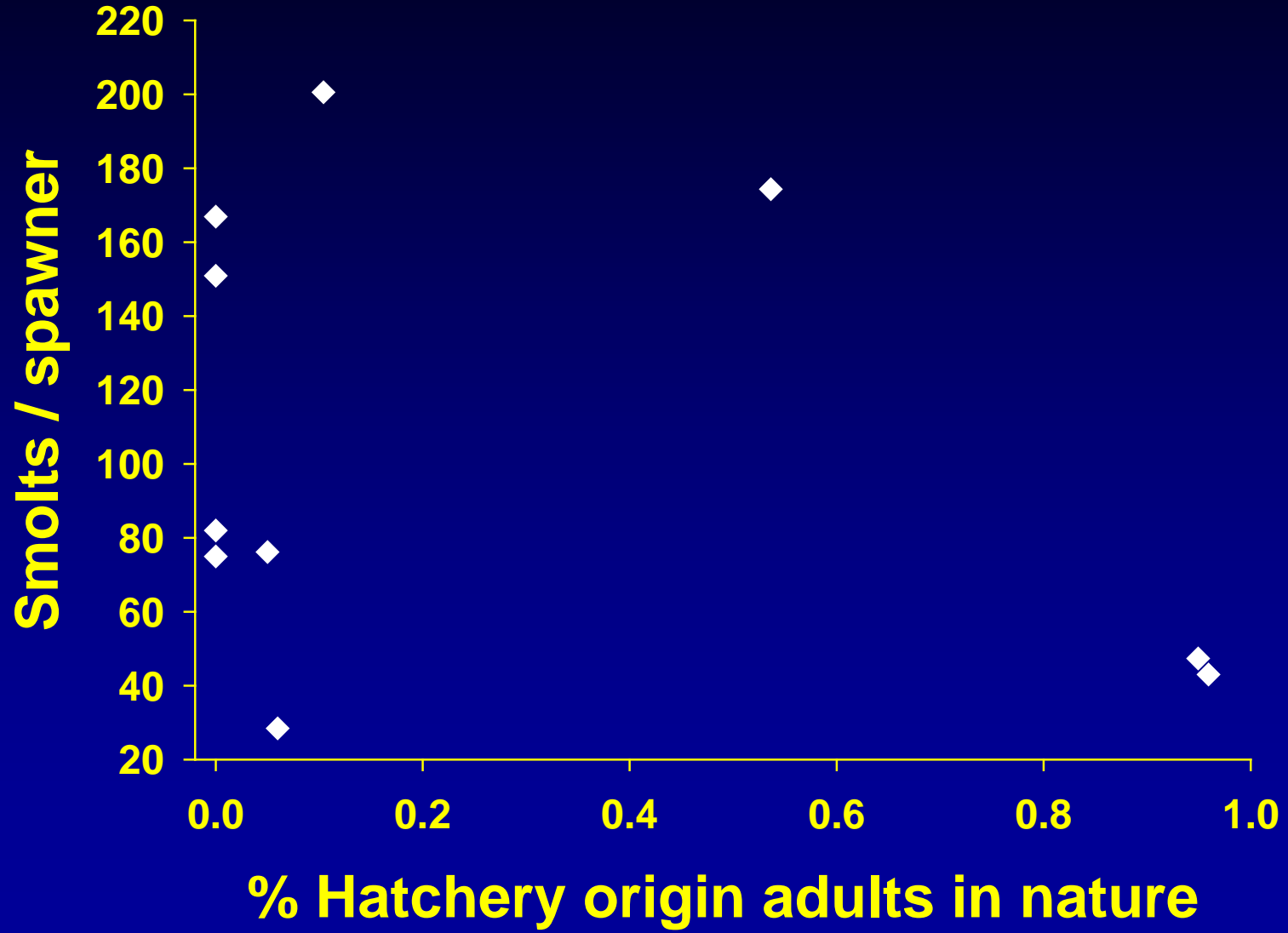
Upper Grande Ronde River Smolts per Spawner



Upper Grande Ronde River Smolts-per-Spawner and Adult Spawners

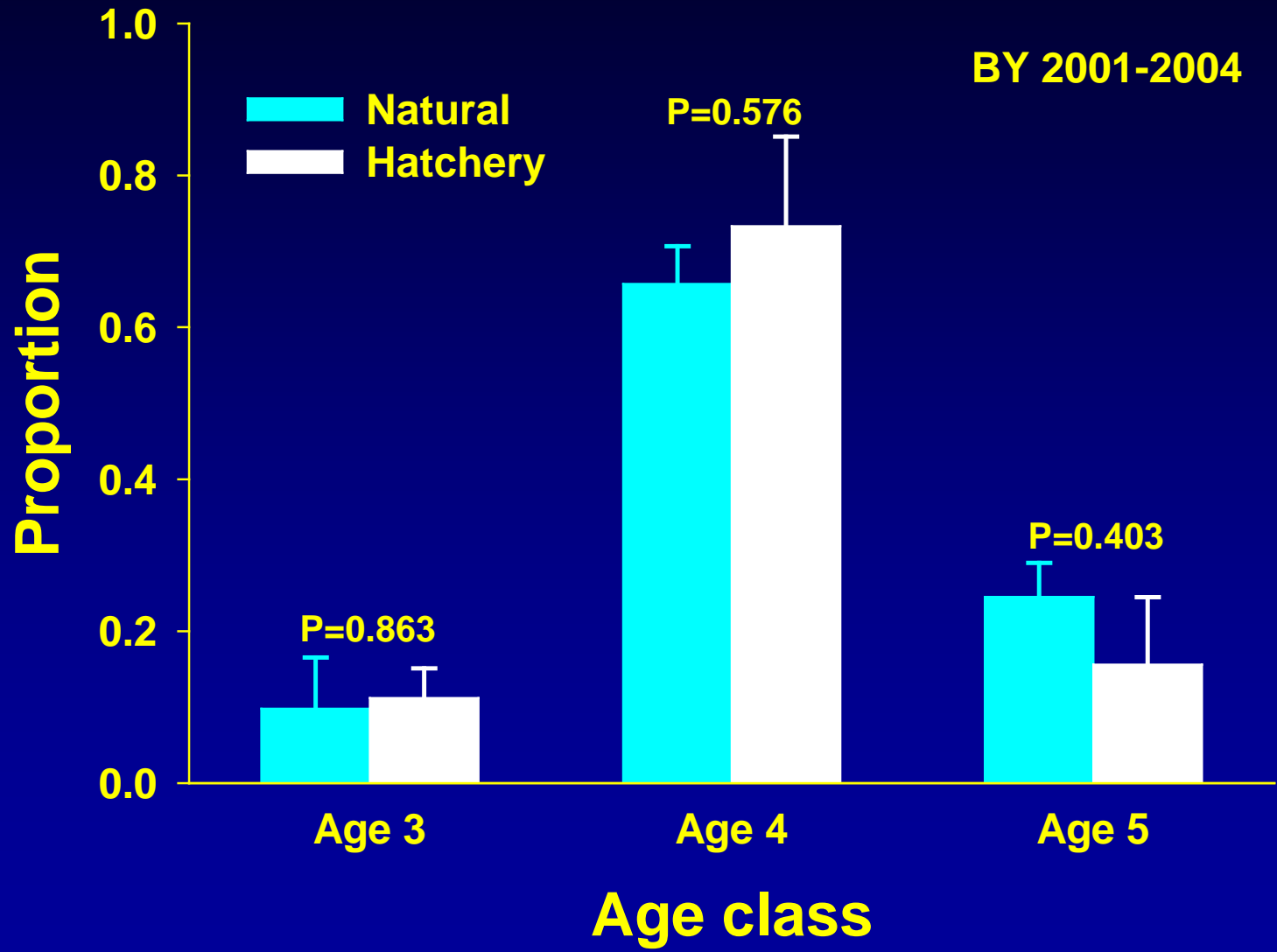


Upper Grande Ronde River Smolts-per-Spawner and % Hatchery Spawners

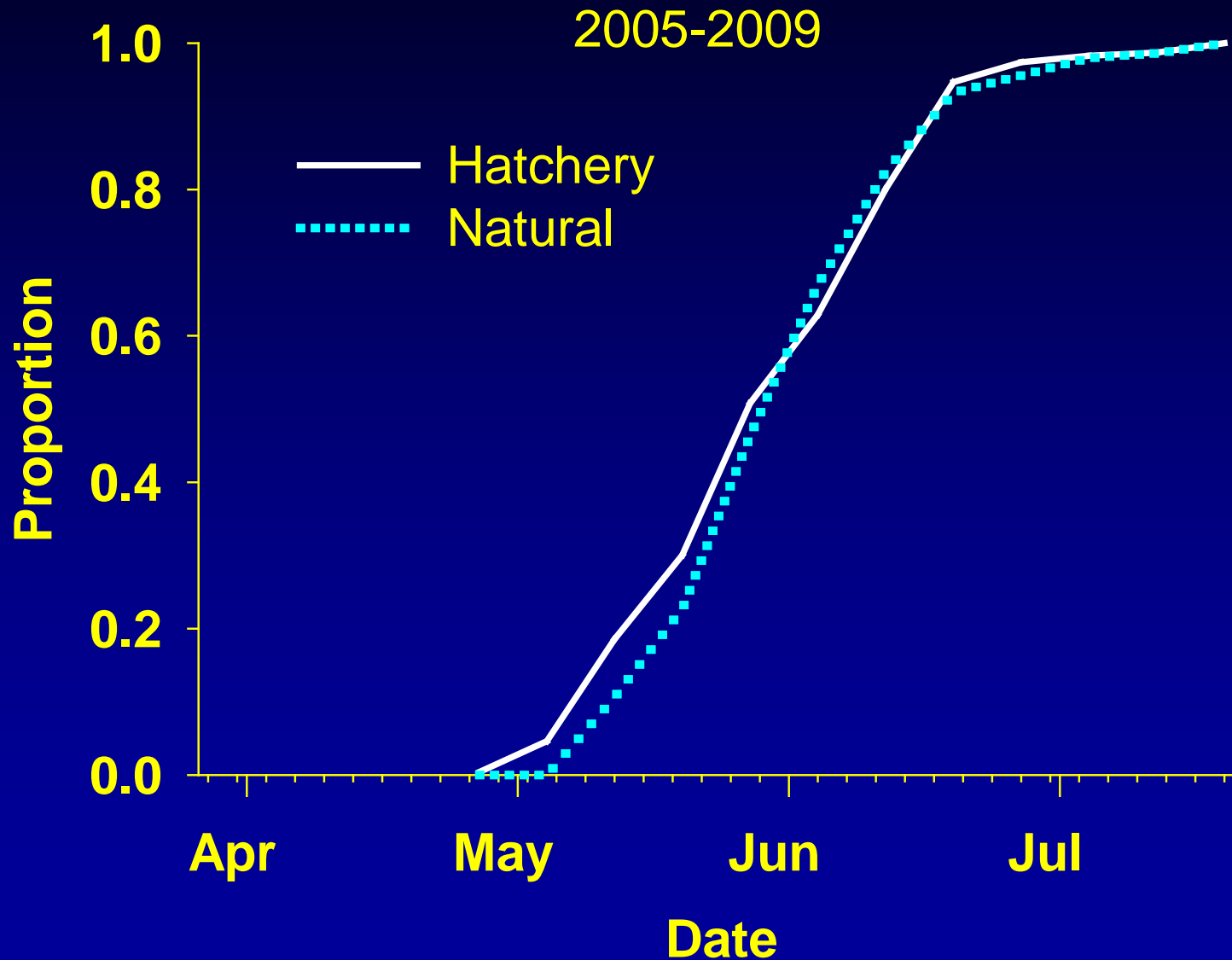


Age at Return

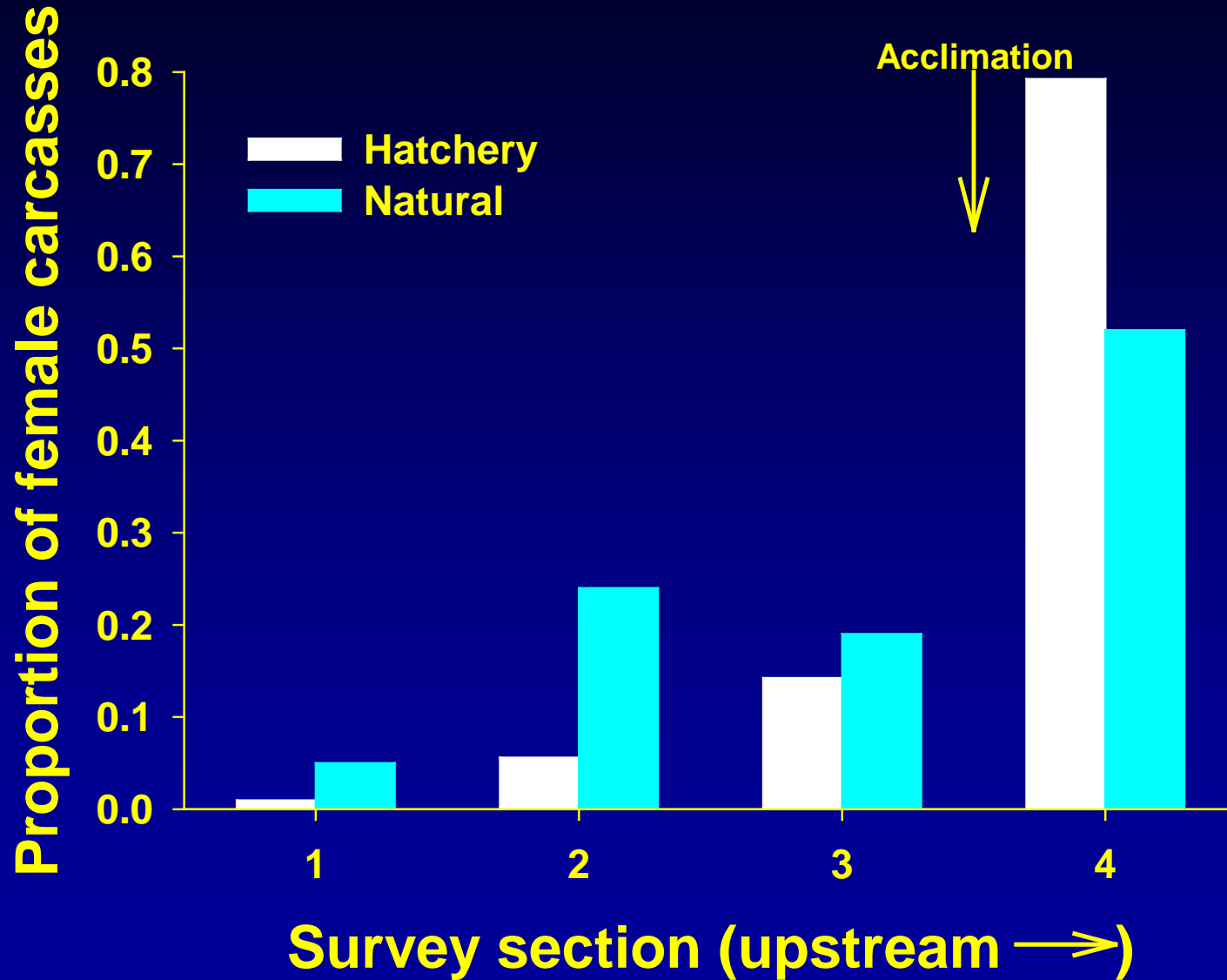
Upper Grande Ronde River 2001-2004



Adult Migration Timing at Upper Grande Ronde Weir



Spawning Distribution Hatchery and Natural Origin Females



Upper Grande Ronde Program Performance Summary

• Broodstock Development – Management:

- Successful transition from non-local to local broodstock
- Limited availability of natural adults for broodstock
- Low PNI's
- High proportion of adults escape weir untrapped in some years

• In-Hatchery Performance:

- Egg-to-smolt survival consistently high
- Adult prespawn mortality variable, high in some years

• Hatchery Program Performance:

- Below smolt goals due to low abundance of hatchery and natural adults
- Lower end of smolt survival to Lower Granite among hatchery stocks
- Adult returns below goal
- SAR's near or at goal about 50% of the recent broodyears, much improved
- Low catch to escapement ratios, little contribution to ocean/downriver
- Low stray rates and few fish into the Minam and Wenaha
- No recreational harvest due to low abundance of natural origin adults – never reaching minimum abundance threshold

Program Performance Summary

- **Supplementation:**

- Substantial increase in total spawners with additional hatchery spawners – high hatchery % in nature
- No change in natural smolt production
- Substantial decrease in smolts-per-spawner, related to density
- Similar life history characteristics except age-at-maturity
- No significant change in natural origin abundance
- Continuation of very low natural productivity (adult recruits per spawner)
- High natural prespawn mortality in some years

Upper Grande Ronde HSRG and HRT Recommendations

•Smolt Goal: HSRG – Maintain current 250,000 with Captive Safety Net: HRT – Reduce to 120,000 with Captive Safety Net and focus on conservation and preventing extinction of endemic population:

Response: Maintain current goal of 250,000 with Captive Safety Net

•Facility Rearing Capacities: HSRG – Increase acclimation capacity: HRT – Expand early rearing and smolt rearing capacities by modification of Lookingglass or construction of Lostine NEOH facility, consider a new weir and location:

Response: Currently under consideration and in planning by co-managers, new weir completed

•Rearing-Release Strategies: HSRG – Increase smolt size at release

Response : Not considered beneficial for survival or age-at-return

•Reduce High natural pre-spawn mortality: HSRG – Managers explore ways to reduce high pre-spawning mortality of adults:

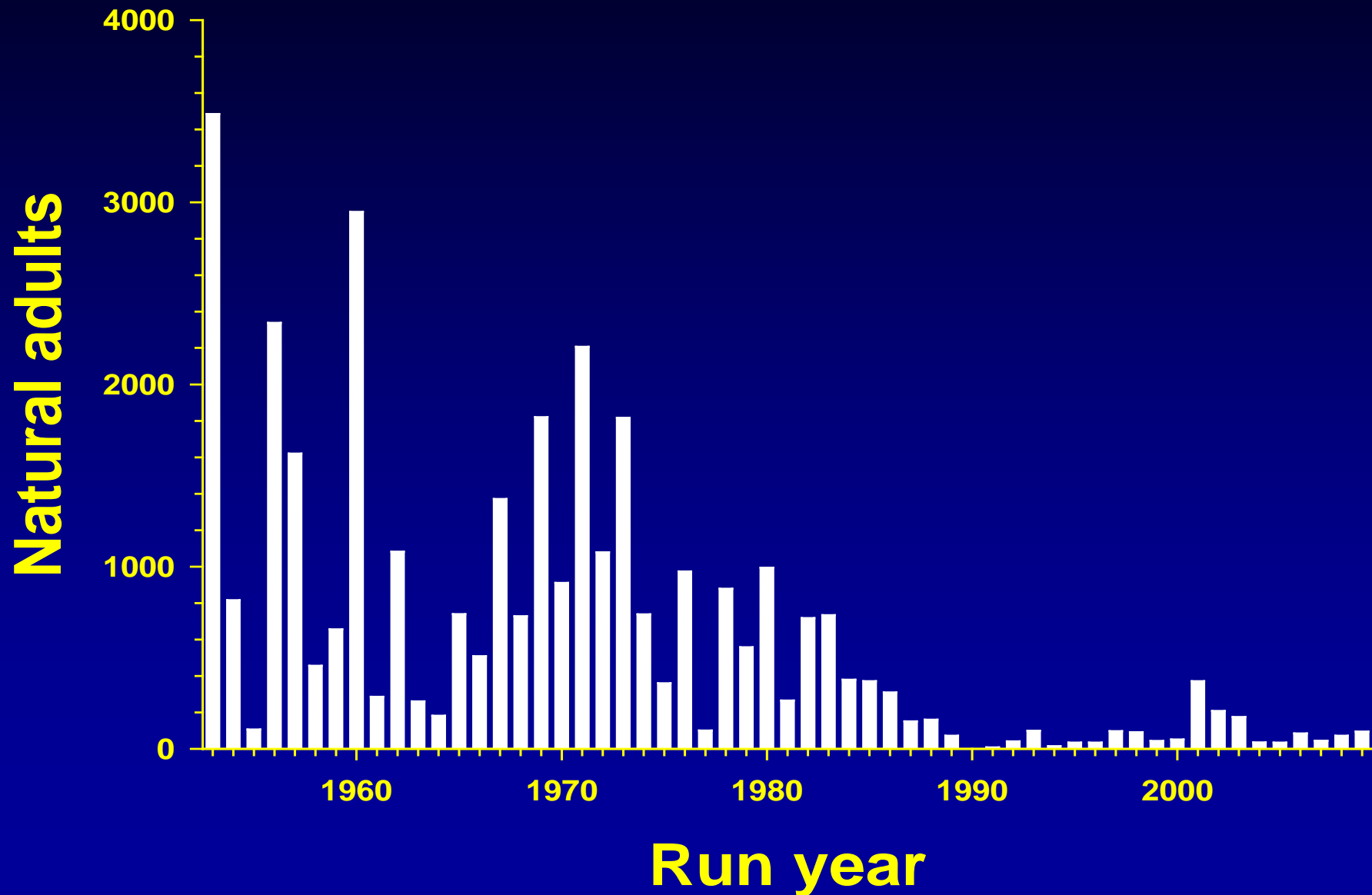
Response: Weir location changed and weir operational practices modified so that when temperatures reach 19C the weir is removed to avoid delay and stalling of migration at the weir location

•Increase understanding of natural production capacity: HSRG – Review existing habitat potential, (capacity and productivity) as it will influence program conditions and contributions to recovery:

Response : We have completed initial analysis of density-dependent effects and will be implementing an IMW to better understand life stage survival, limiting factors and response to extensive habitat improvement projects

Catherine Creek Chinook Salmon Hatchery Program

Natural Origin Adult Spawner Abundance Catherine Creek



Catherine Creek Weir



Catherine Creek Acclimation Pond

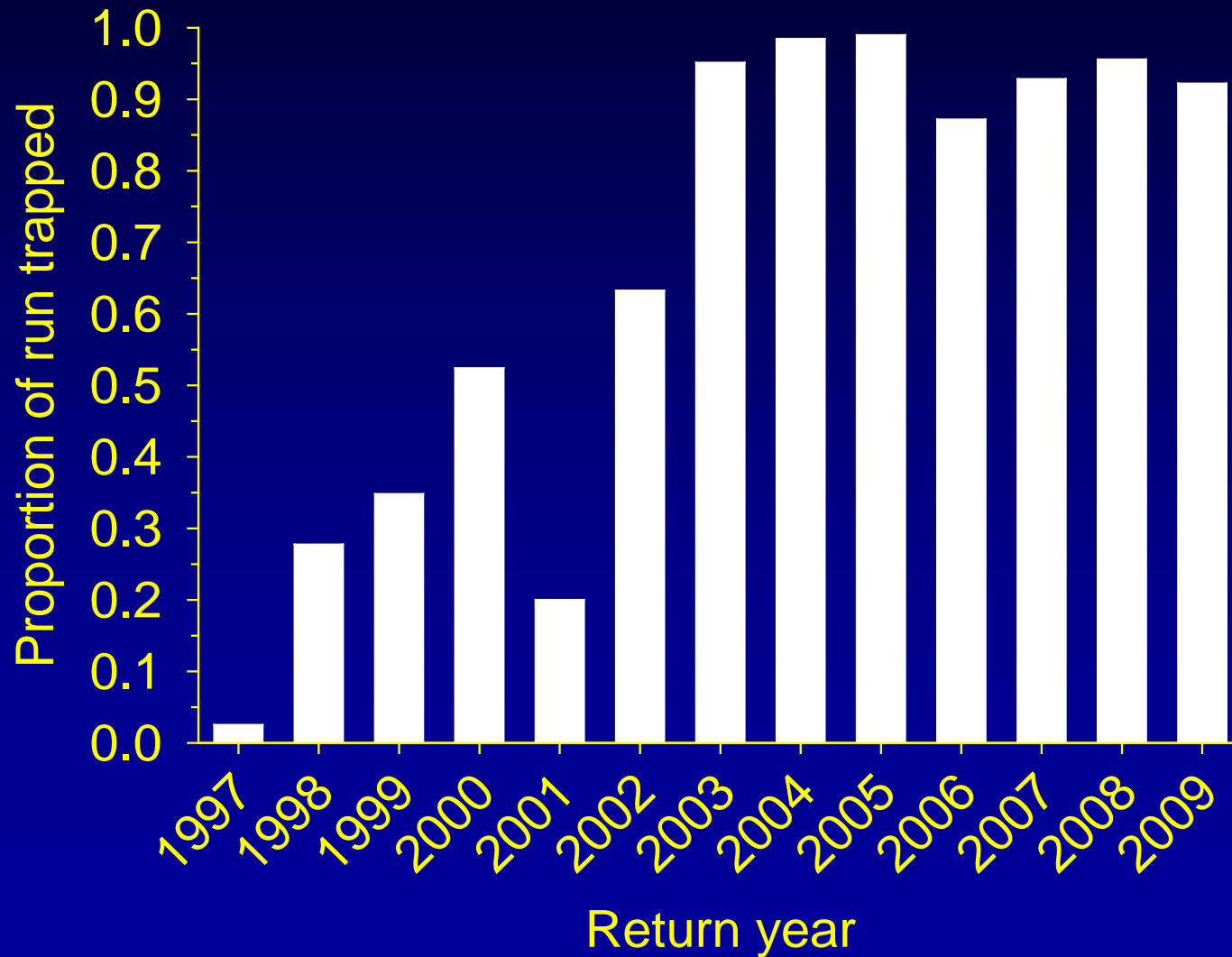


Catherine Creek Sliding Scale Management Plan

Escapement Level	Maximum % Natural Retained for Broodstock	% Hatchery Above Weir	Minimum % of Natural Origin Broodstock
< 250	40	d	d
251-500	20	≤ 70	≥ 20
> 500	≤ 40	≤ 50	≥ 30

d = Not to exceed 130,000 smolt production initially

Proportion of Chinook Run Trapped at Catherine Creek Weir



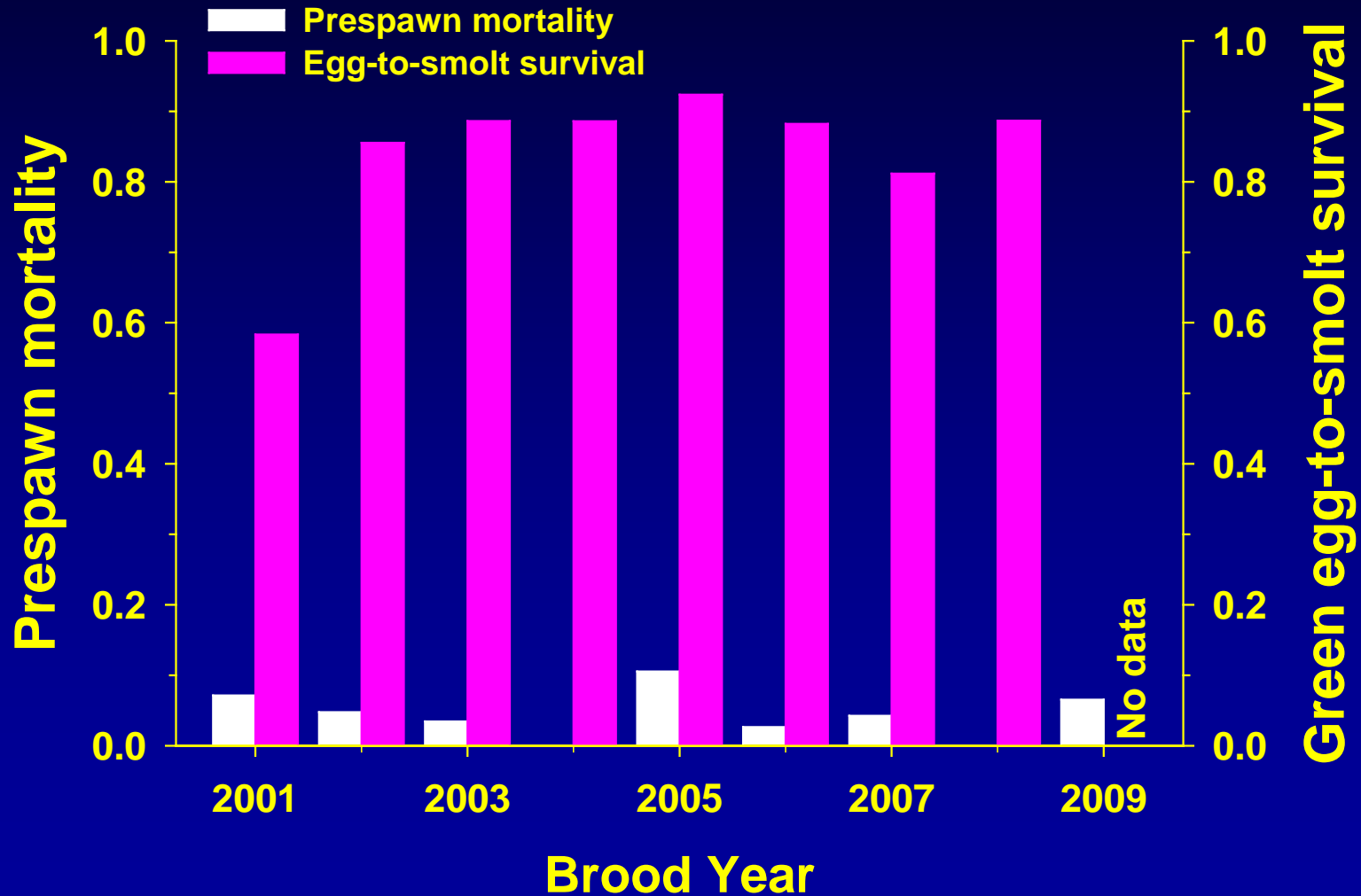
Broodstock History – Catherine Creek

Spawn year	Number of females in broodstock		Percent natural origin adults in broodstock	Number of Captive Broodstock females
	Natural	Hatchery		
1998	0	0	0	69
1999	0	0	0	162
2000	0	0	0	177
2001	13	0	100	124
2002	20	0	100	128
2003	28	0	100	160
2004	9	0	100	77
2005	8	9	29.4	44
2006	8	29	30.8	83
2007	14	31	37.3	79
2008	11	21	31.6	81
2009	13	30	35.0	69

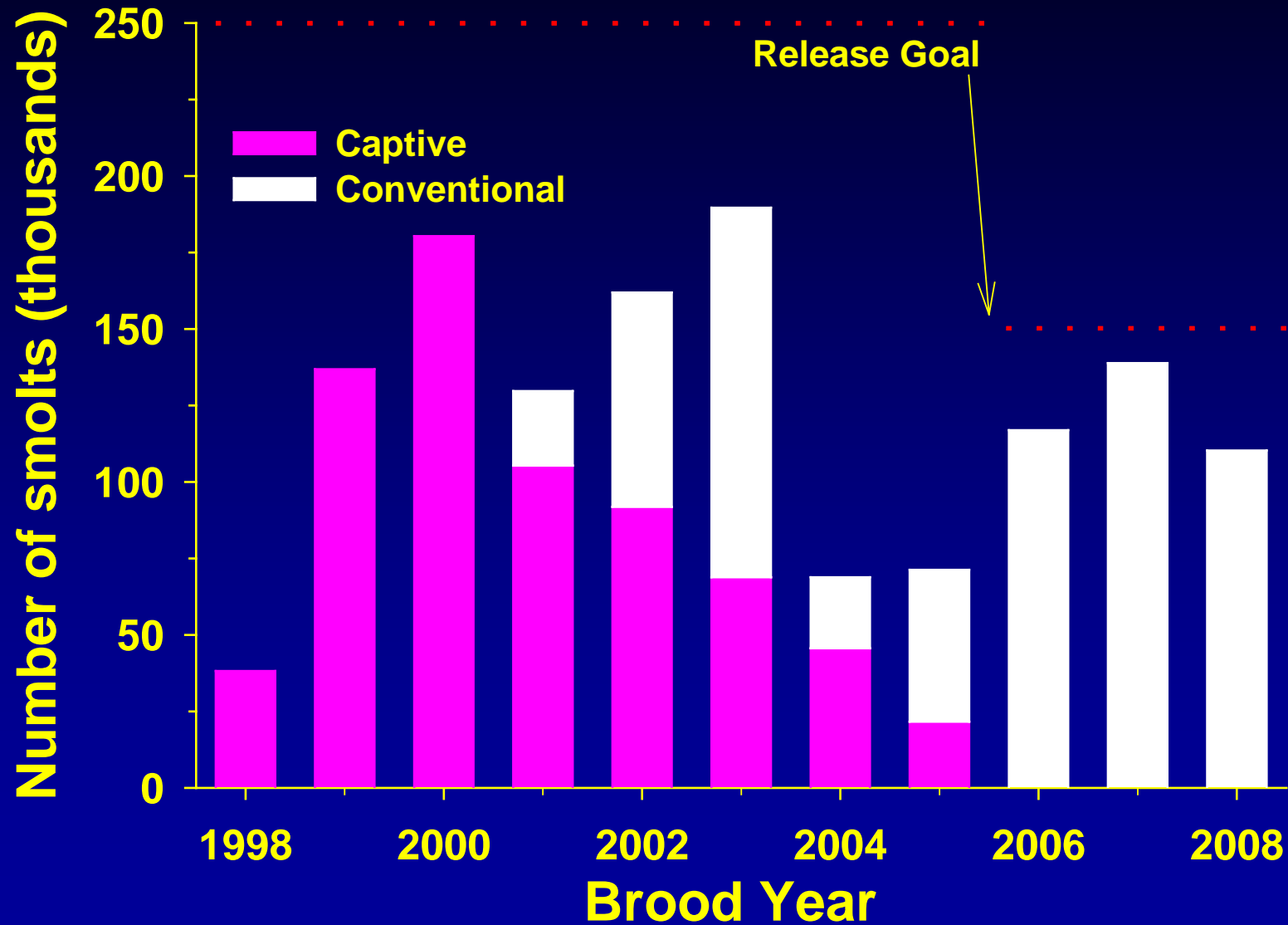
Natural Spawners – Catherine Creek

Spawn year	Total Number spawning in nature	Percent hatchery spawning in nature	Percent natural retained for broodstock	PNI
1998	101	0	0	
1999	48	0	0	
2000	58	0	3.3	
2001	557	22.6	5.5	0
2002	457	49.7	14.5	0.316
2003	487	58.7	20.9	0.292
2004	215	82.8	32.7	0.378
2005	152	74.3	20.4	0.276
2006	282	63.1	16.8	0.155
2007	171	71.3	36.3	0.206
2008	216	64.8	19.1	0.259
2009	287	54.0	21.0	0.312

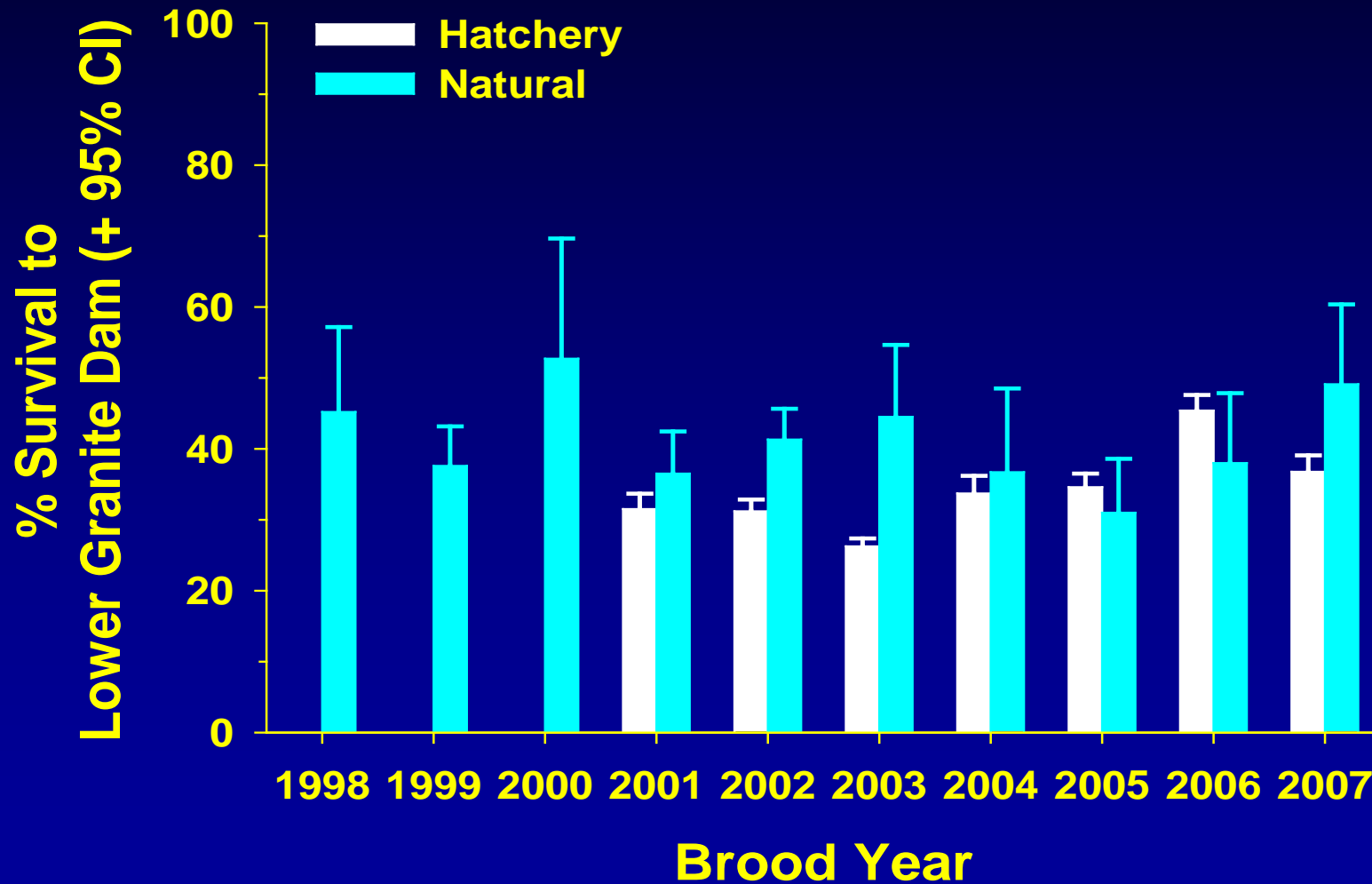
Prespawn Mortality; Green Egg-to-Smolt Survival



Catherine Creek Smolt Releases

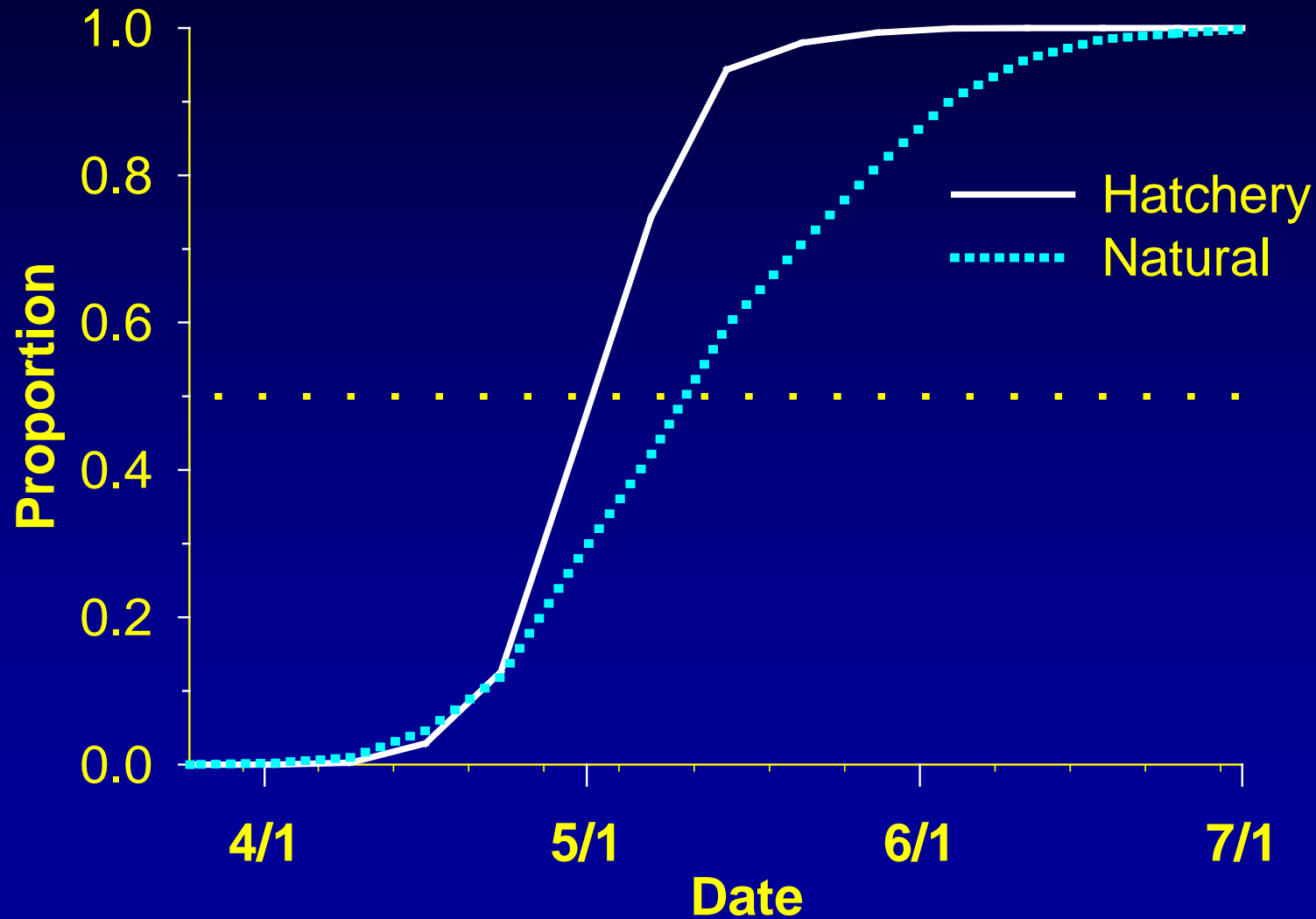


Smolt Survival to Lower Granite Dam Catherine Creek

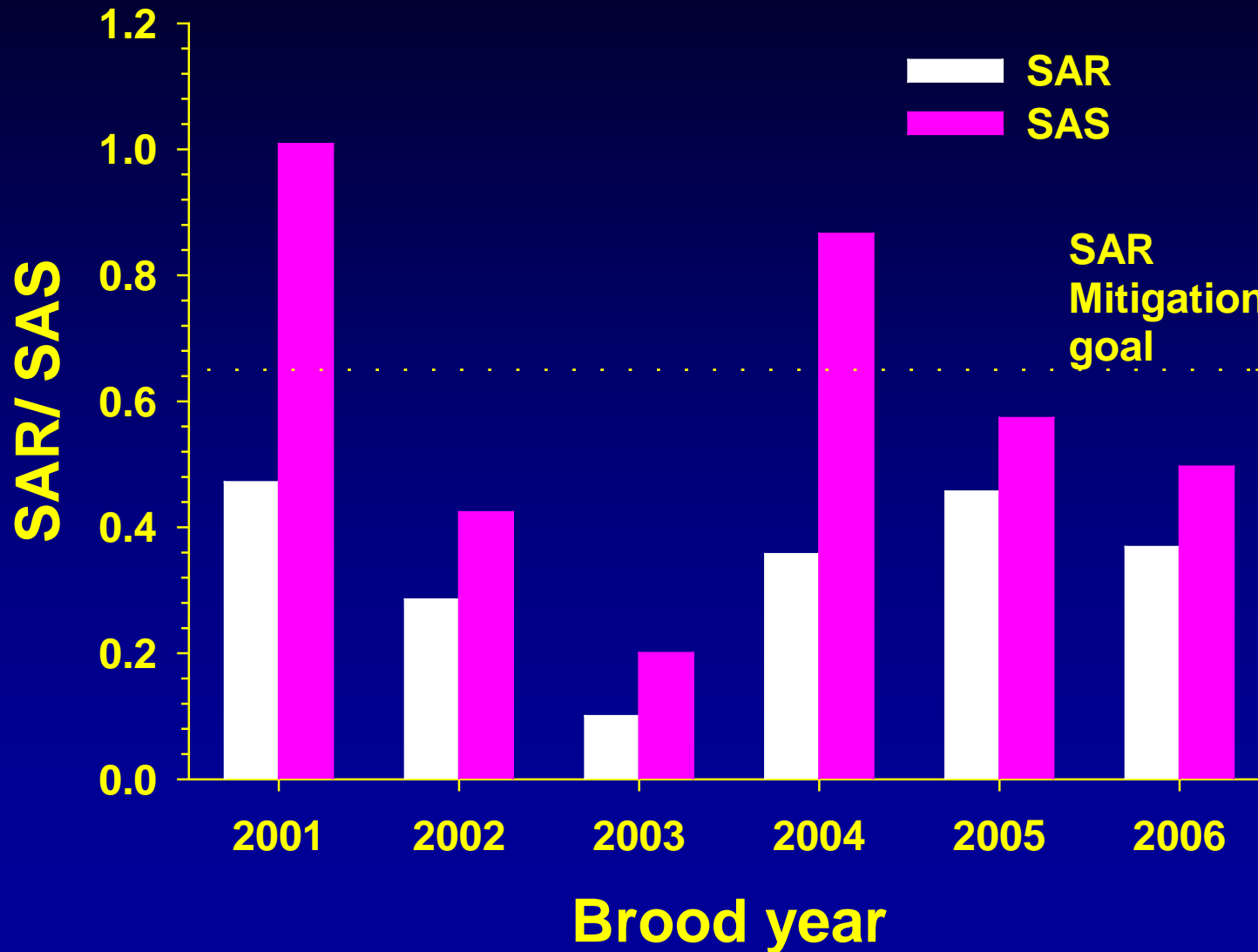


Smolt Migration Timing at Lower Granite Dam Catherine Creek

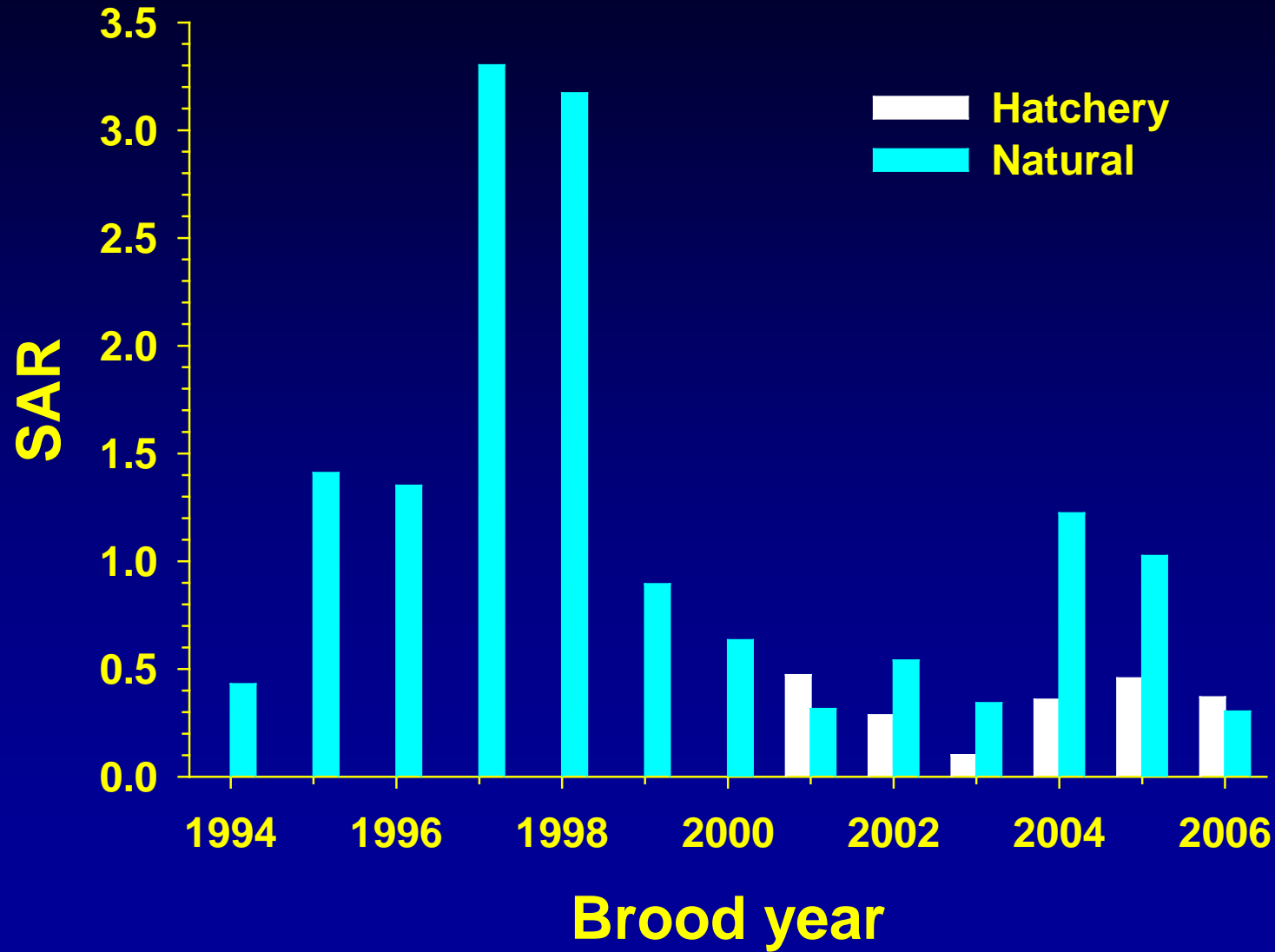
Migration Years 2003-2009



Catherine Creek SAR/SAS



Catherine Creek Natural and Hatchery Smolt-to-Adult Return



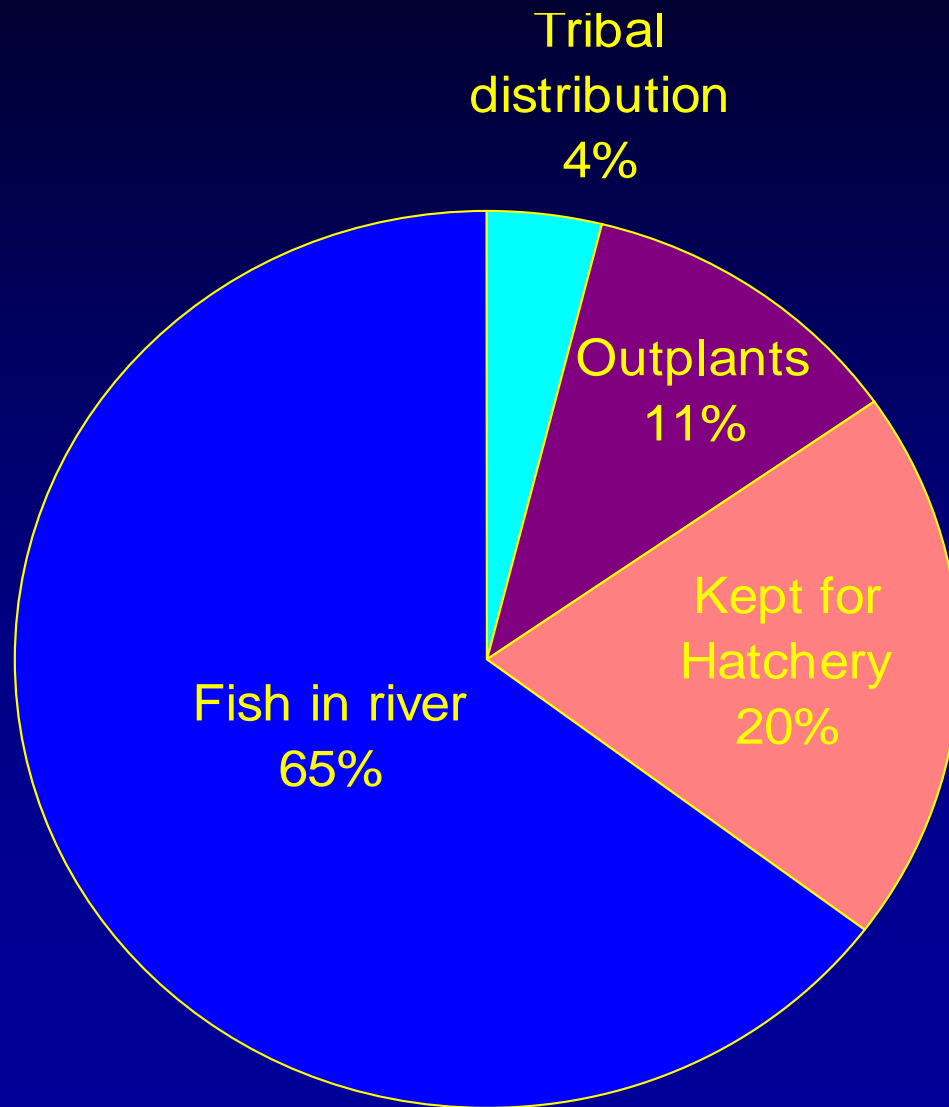
Adult Returns to the Compensation Area



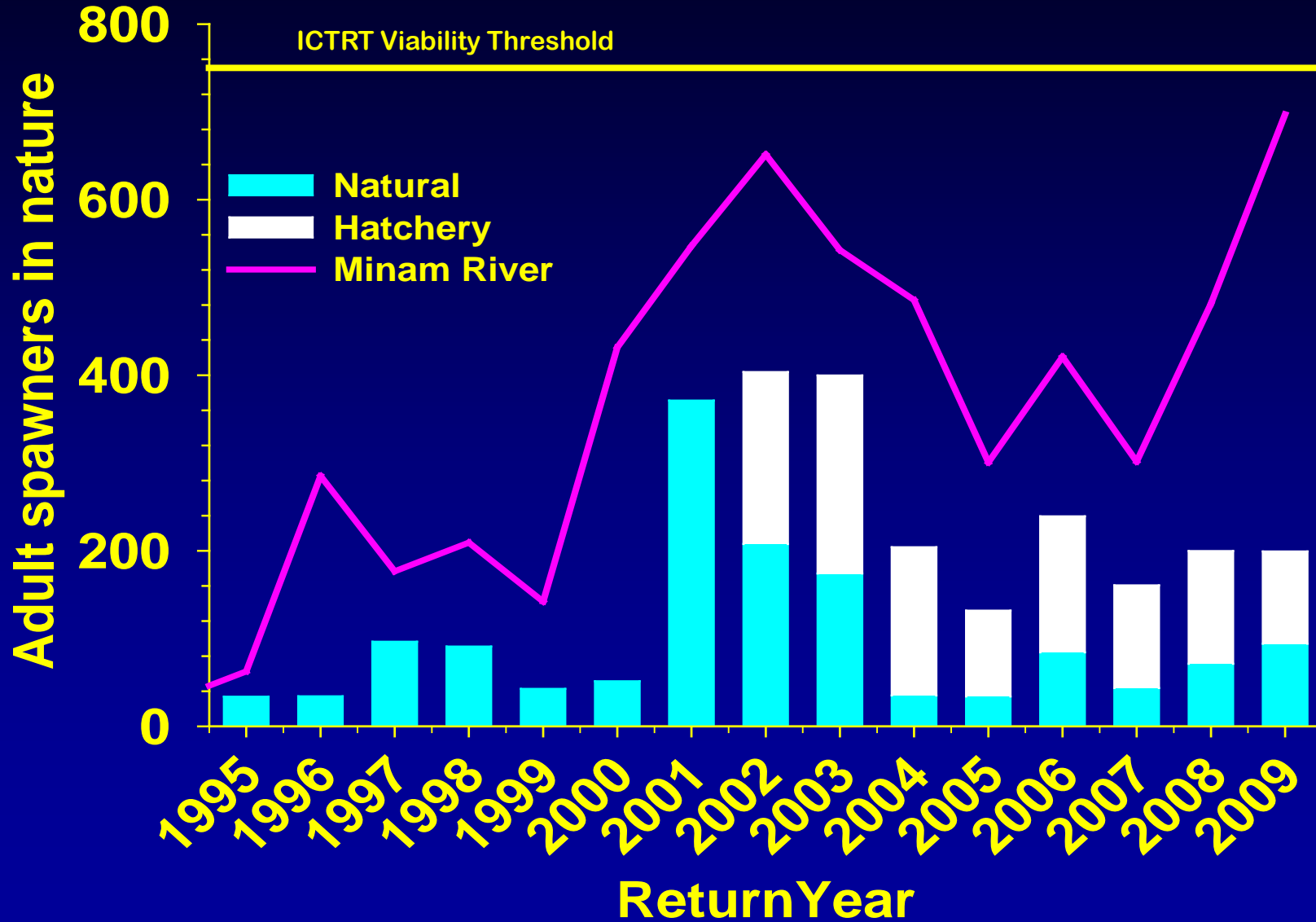
Catch and Escapement (%) of Spring Chinook Salmon Released in Catherine Creek

		<u>Brood Year</u>				
		<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>Mean</u>
Ocean		3.3	0.3	0.3	1.9	1.5
<u>Columbia River Harvest</u>						
	Tribal	7.4	4.3	21.3	8.9	10.5
	Sport	24.2	15.1	15.5	28.5	20.8
	Commercial Net	4.7	2.4	2.0	1.9	2.8
<u>Snake River</u>						
	Stray below LGD	1.9	0.3	1.0	3.9	1.8
	Stray above LGD	5.5	3.5	5.1	1.7	3.9
	Sport above LGD	1.1	1.6	0.0	0.0	0.7
	Tribal above LGD	0.0	0.0	0.0	0.0	0.0
Escapement to River		51.9	72.5	54.7	53.2	58.1

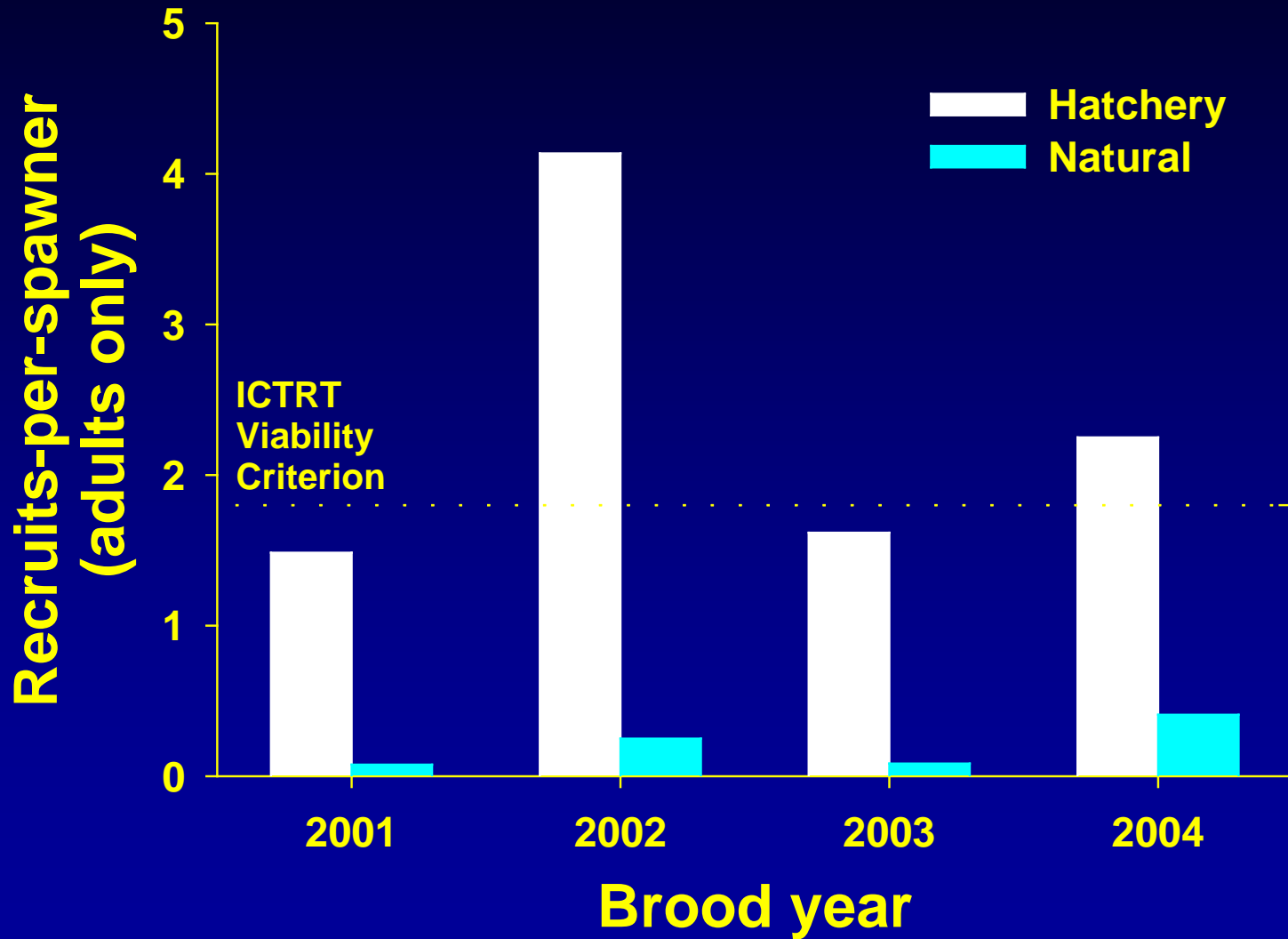
Escapement Disposition of Catherine Creek Spring Chinook from the 2001-2004 Brood Years



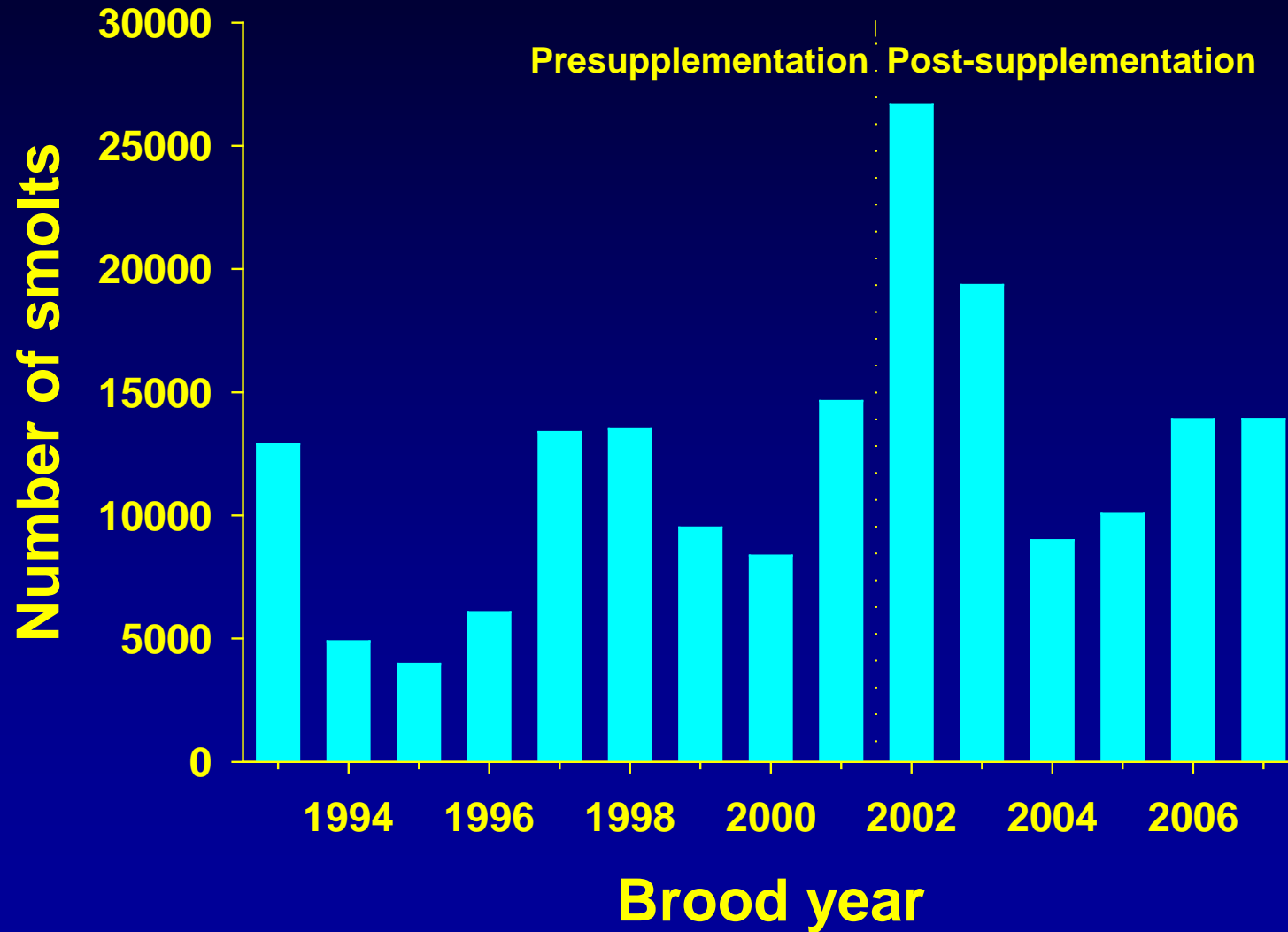
Total Adult Spawners in Nature



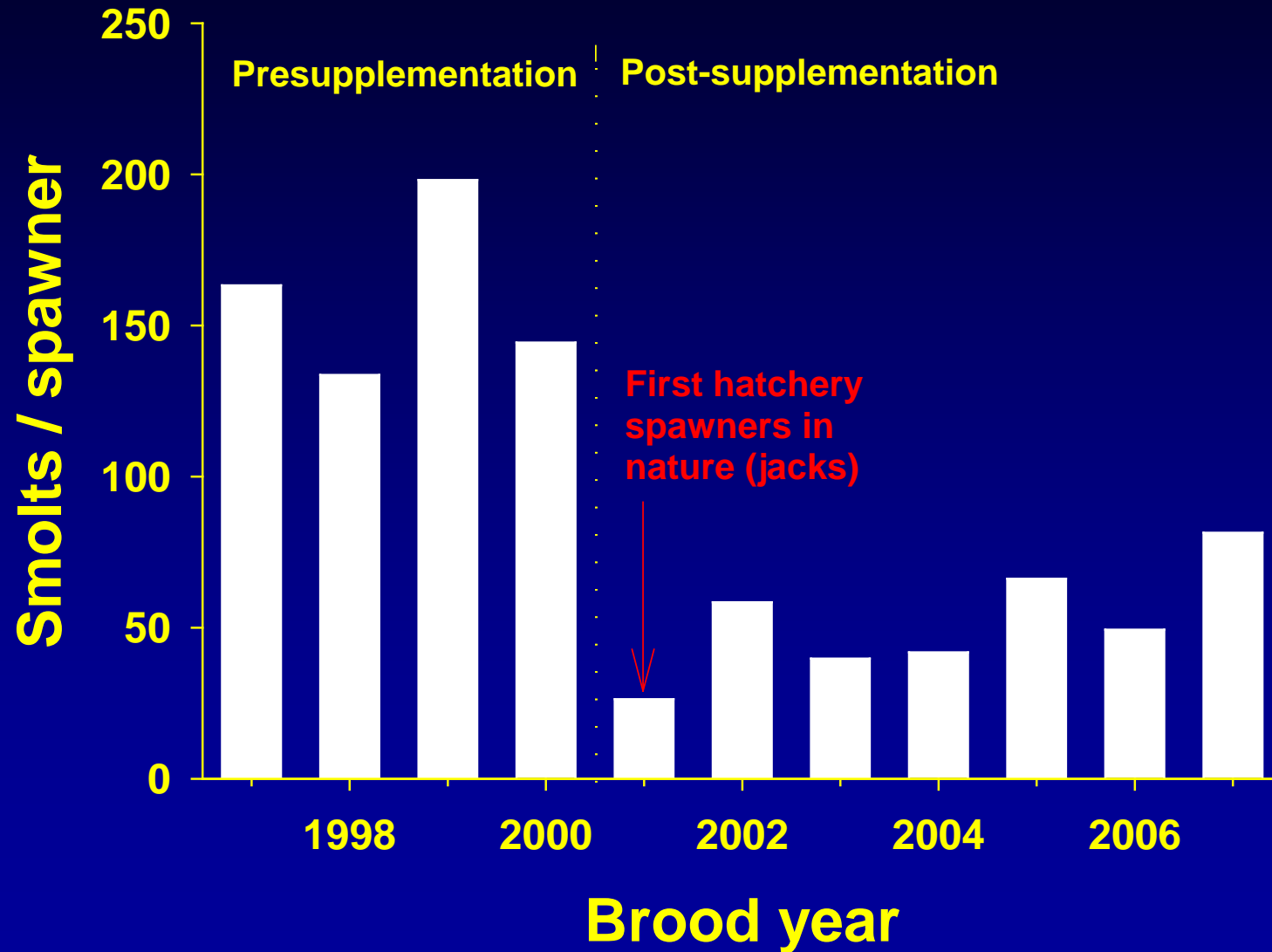
Catherine Creek Recruits per Spawner



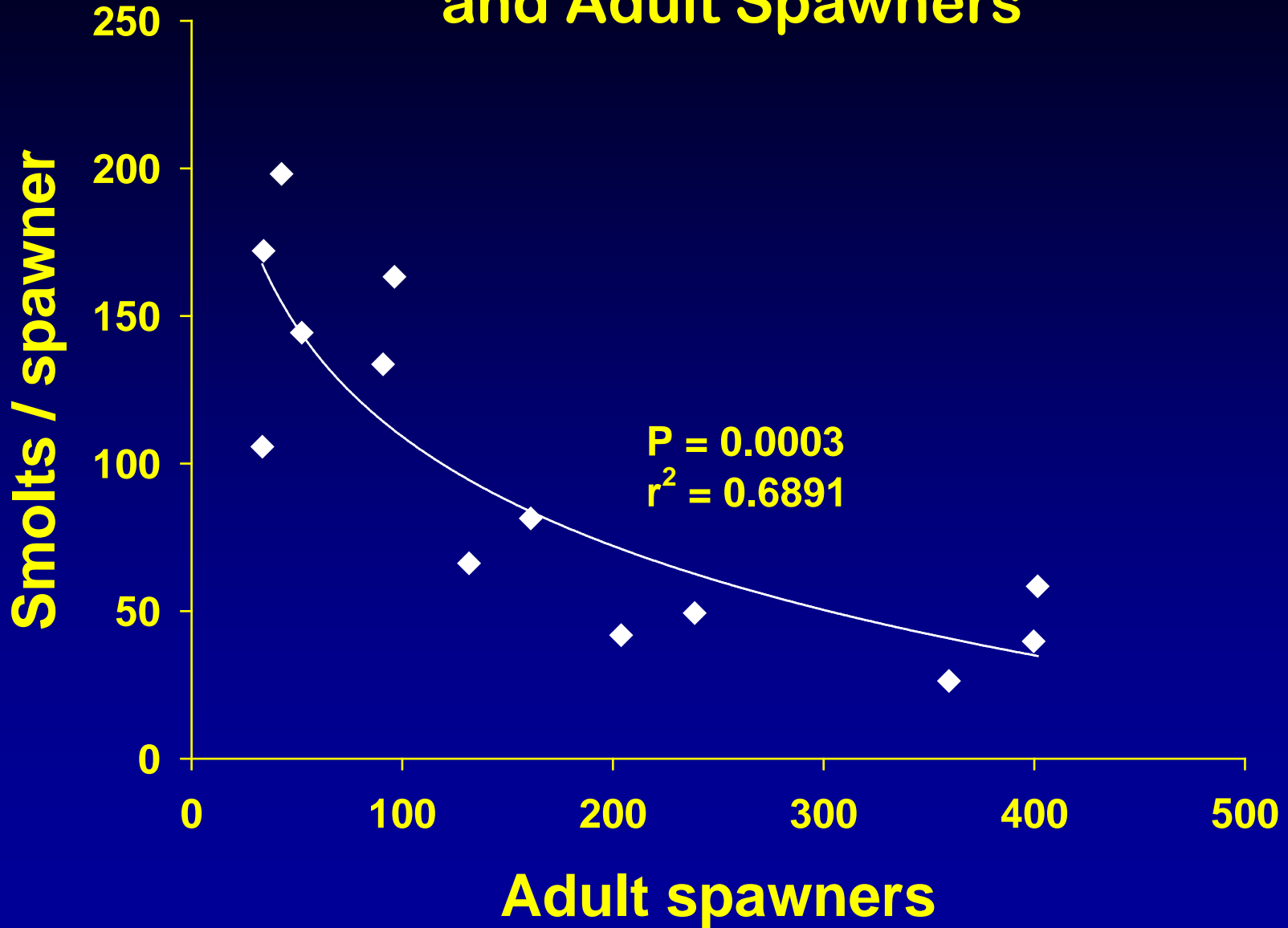
Natural Origin Smolt Abundance Catherine Creek



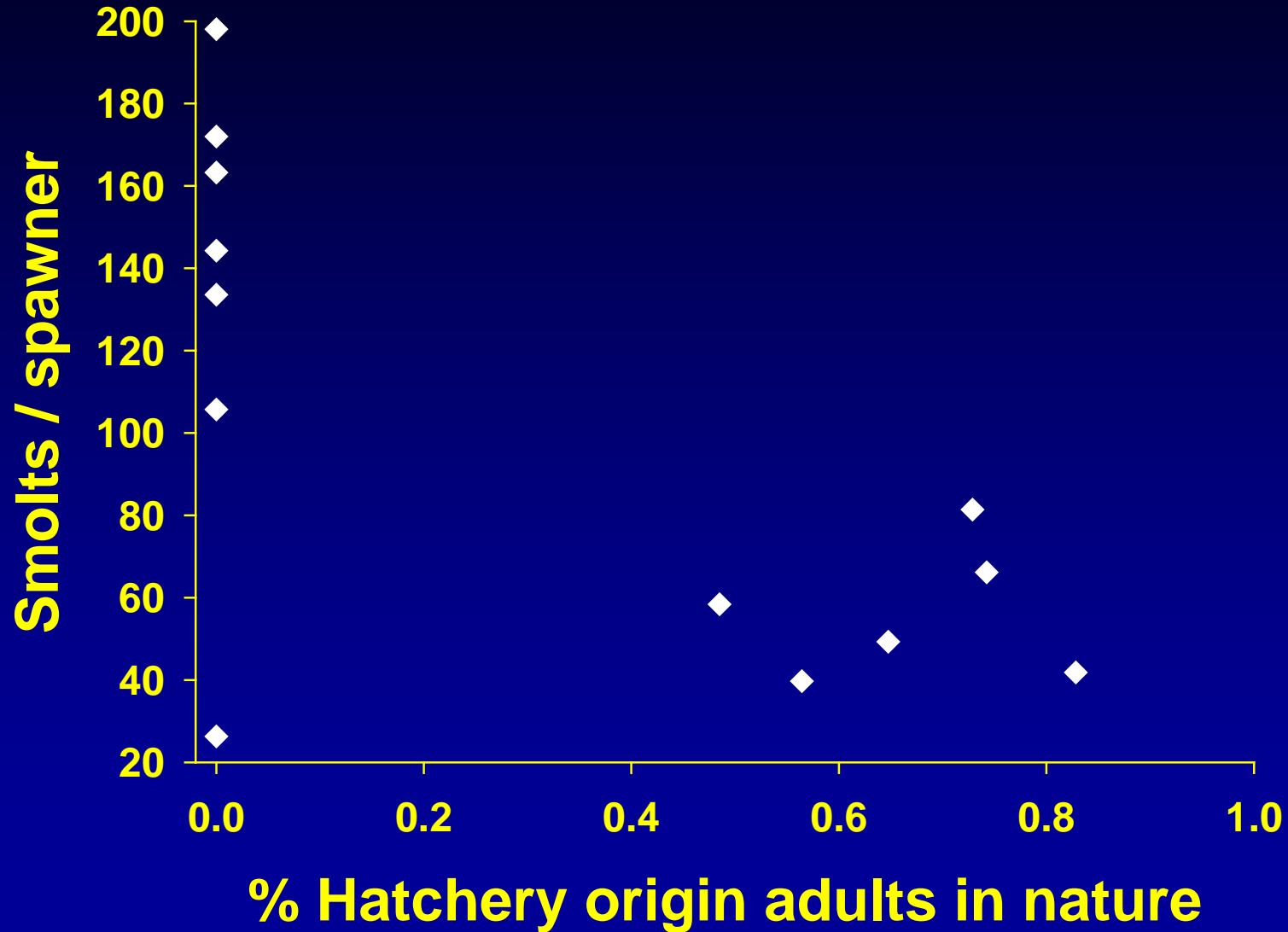
Catherine Creek Smolts per Spawner



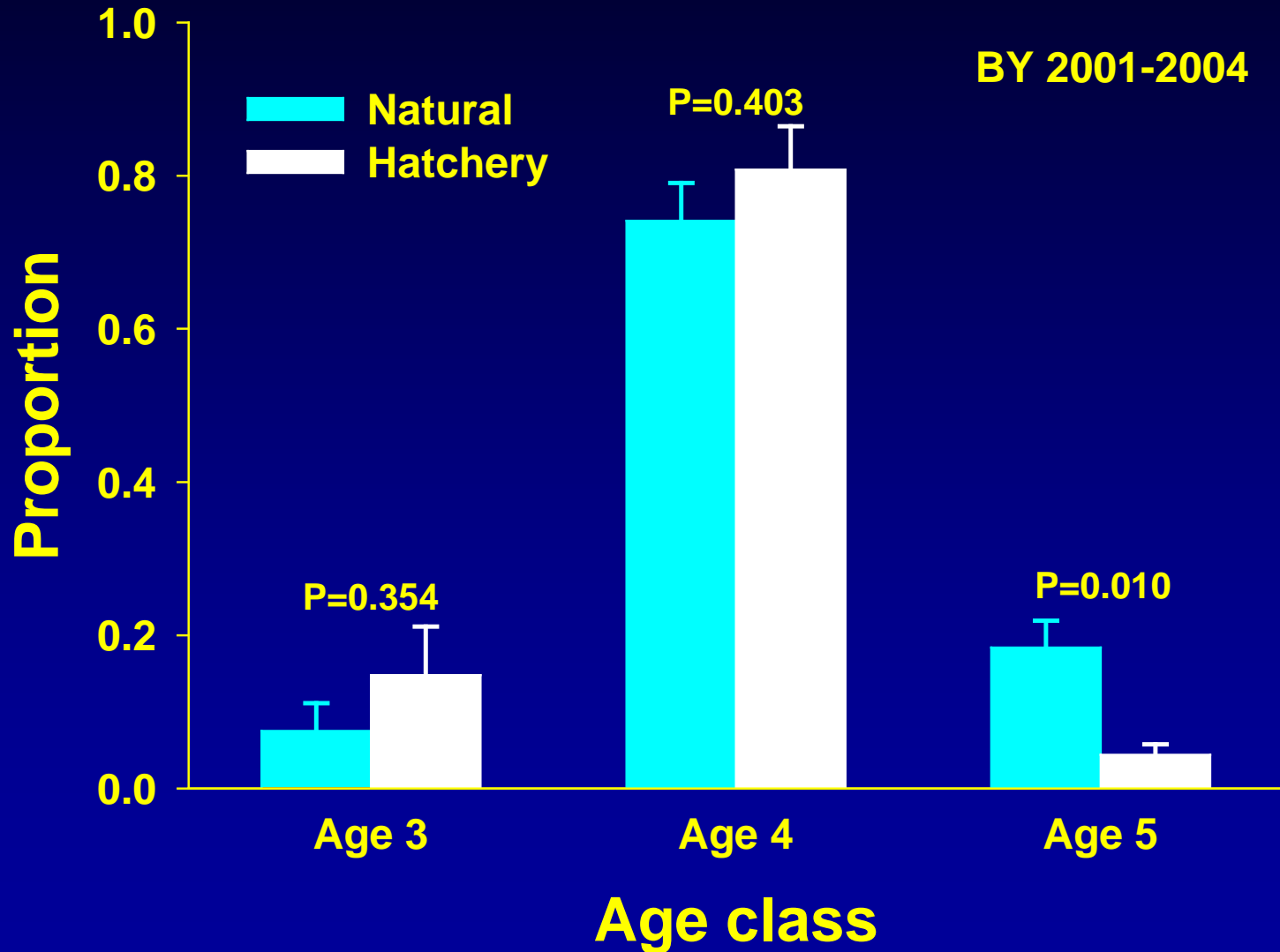
Catherine Creek Smolts-per-Spawner and Adult Spawners



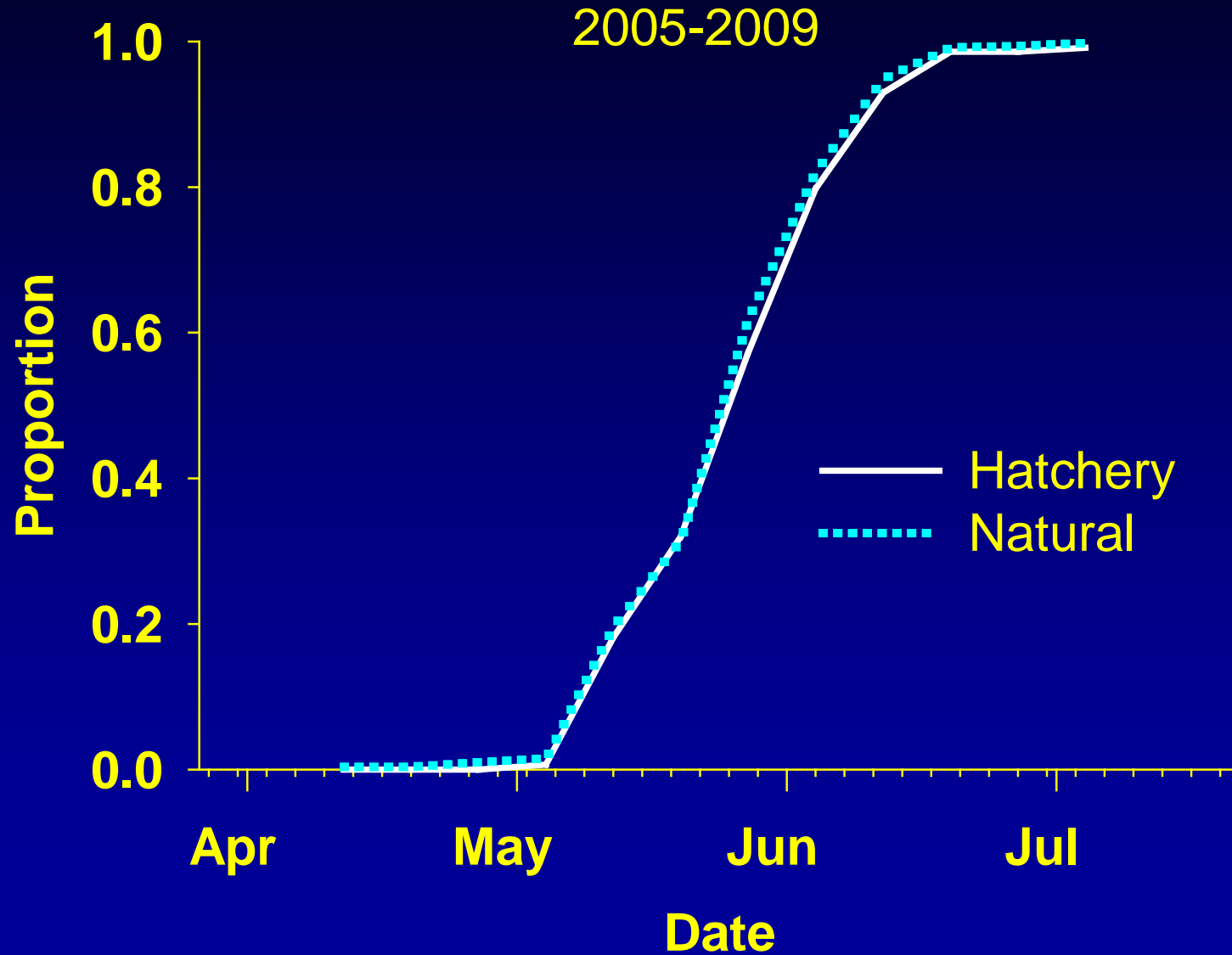
Catherine Creek Smolts-per-Spawner and % Hatchery Spawners



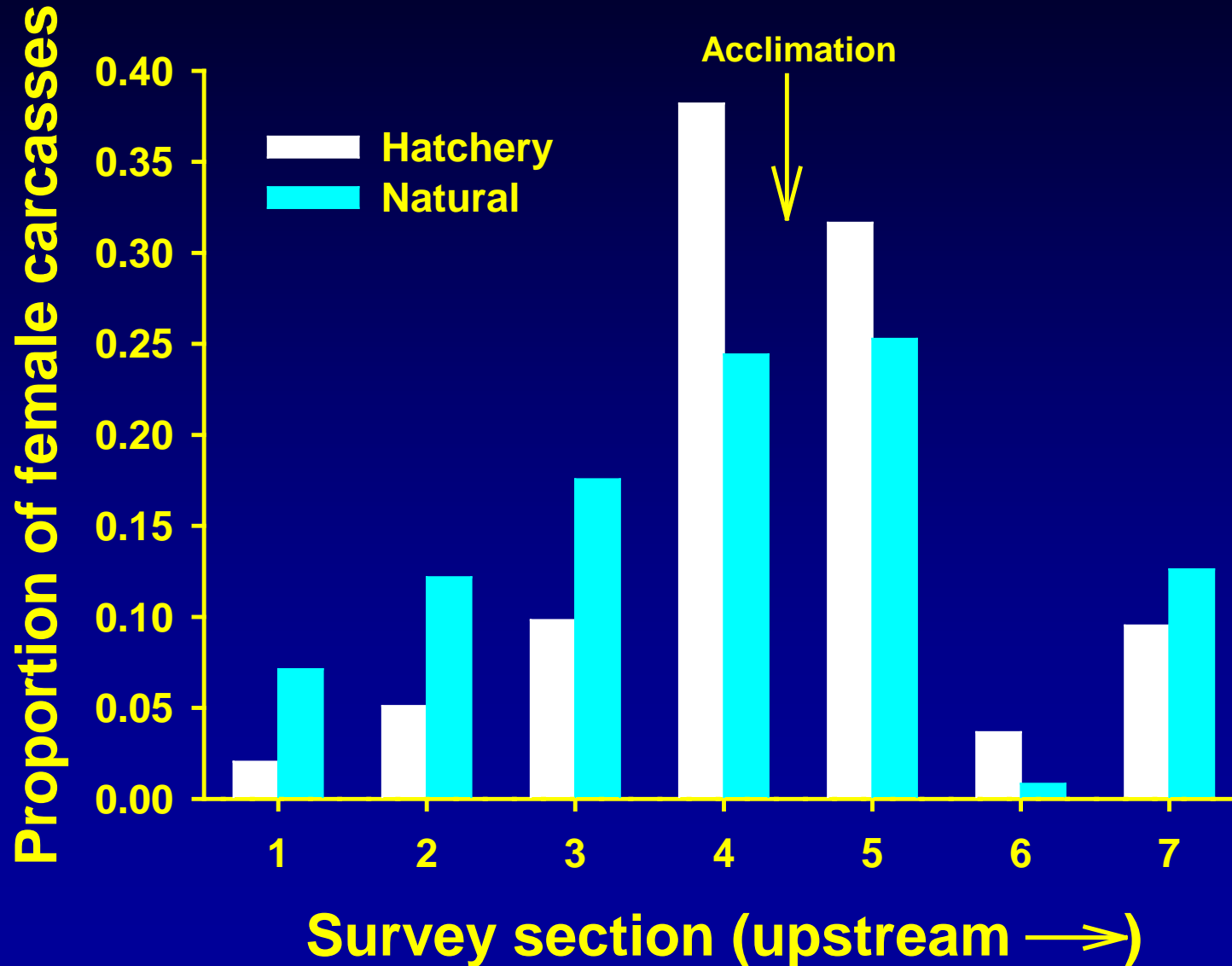
Age at Return Catherine Creek 2001-2004



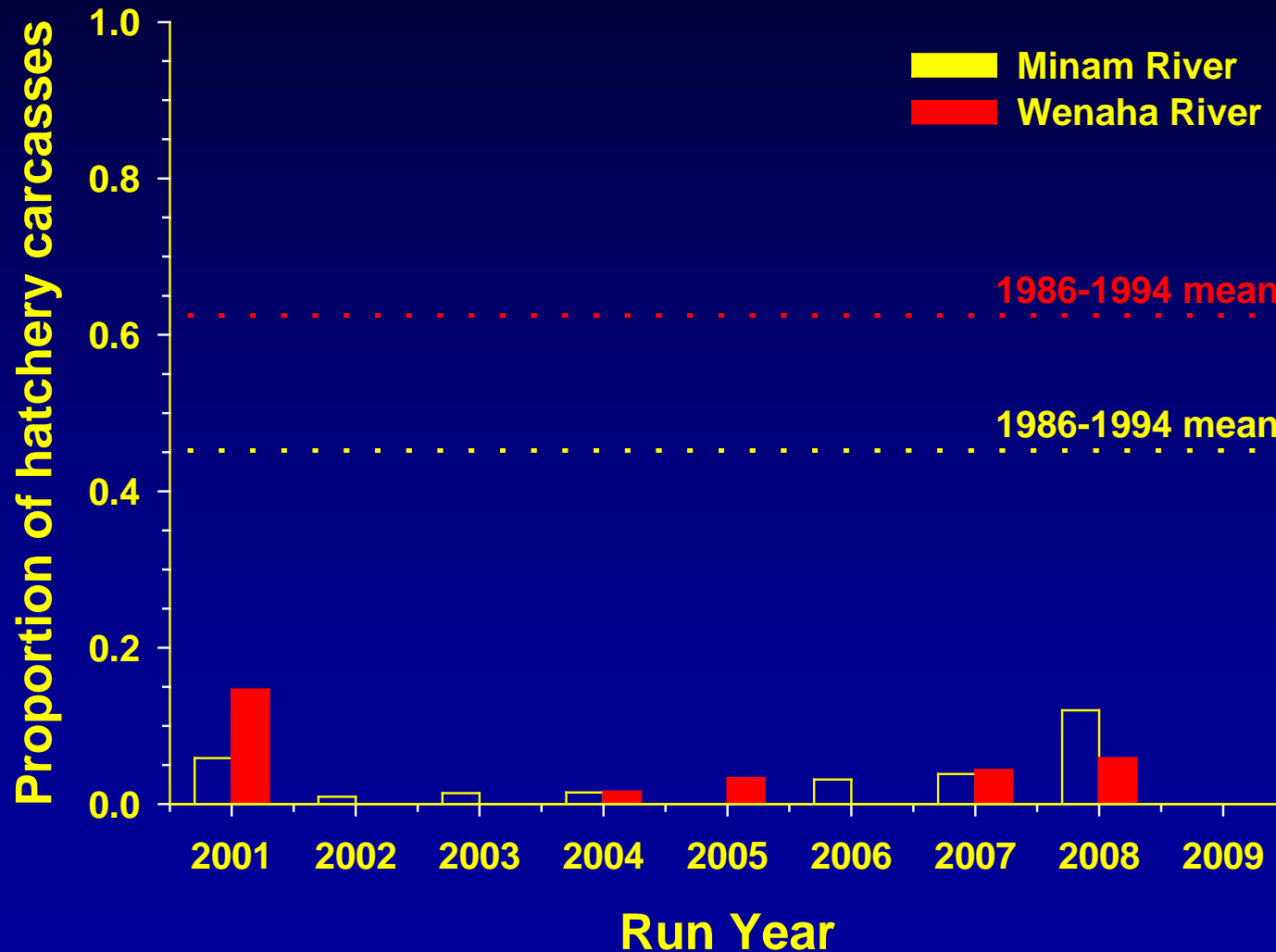
Adult Migration Timing at Catherine Creek Weir



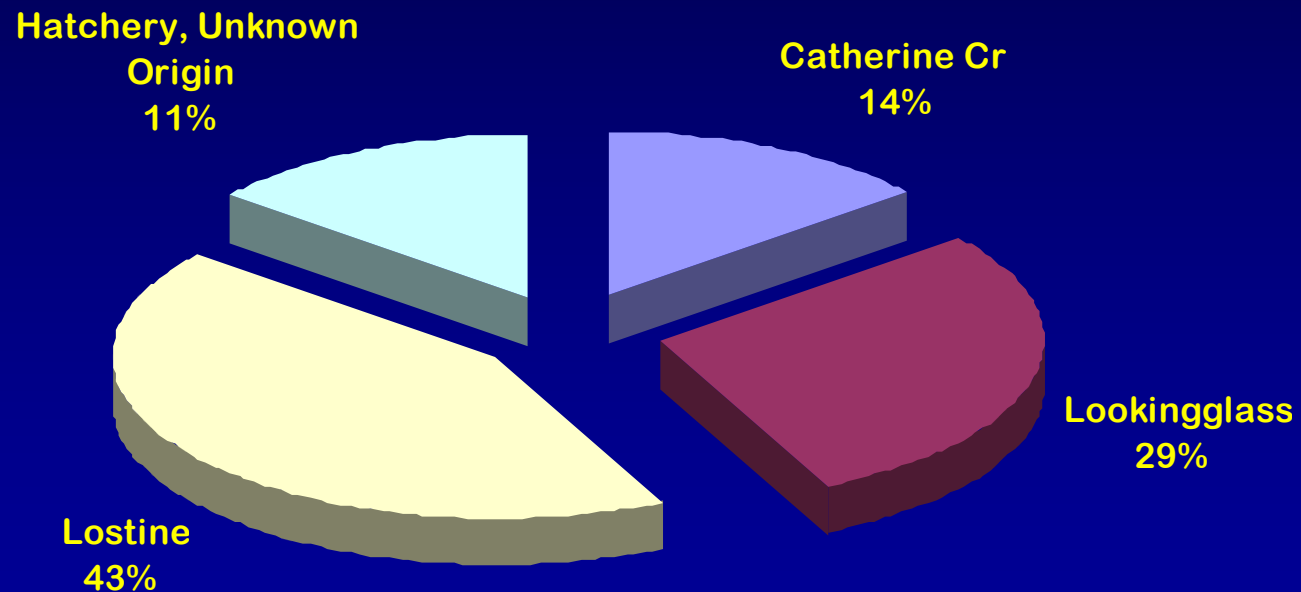
Spawning Distribution of Hatchery and Natural Females



Minam and Wenaha Rivers Hatchery Fraction



Origin of Hatchery Strays in the Minam and Wenaha Rivers



Catherine Creek Program Performance Summary

- **Broodstock Development – Management:**

- Successful transition from non-local to local broodstock
- Limited availability of natural adults for broodstock
- Low PNI's

- **In-Hatchery Performance:**

- Egg-to-smolt survival consistently high
- Adult prespawn mortality consistently low

- **Hatchery Program Performance:**

- Smolt goals nearly reached in recent years
- Lower end of smolt survival to Lower Granite for hatchery stocks
- Adult returns below goal
- SAR's consistently below goal (50%)
- Highest catch to escapement ratio with relatively high exploitation in all lower Columbia fisheries
- Low stray rates and few fish into the Minam and Wenaha
- No recreational harvest due to low abundance of natural origin adults – never reaching minimum abundance threshold

Program Performance Summary

- **Supplementation:**

- Substantial increase in total spawners with the additional hatchery spawners – high hatchery % in nature
- Increased natural smolt production in post supplementation
- Substantial decrease in smolts-per-spawner, related to density
- Similar life history characteristics except age-at-maturity
- Adult hatchery spawners distributed more near release location than natural adults, range is the same
- No significant change in natural origin abundance
- Continuation of very low natural productivity (adult recruits per spawner)

Catherine Creek HSRG and HRT Recommendations

•Program Goals: HSRG – Reduce smolt goal to 75,000 and improve PNI to .51-.67 :
HRT – Maintain current 150,000, identify natural origin escapement level with 0% hatchery adults in nature:

Response: Maintain current goal of 150,000 , PNI improvement and high end of sliding scale for future co-manager consideration

•Facility Rearing Capacities: HSRG – No comments: HRT – Expand early rearing and smolt rearing capacities by modification of Lookingglass Hatchery or construction of Lostine NEOH facility:

Response: Currently under consideration and in planning by co-managers

•Rearing-Release Strategies: HSRG – Increase smolt size-at-release:

Response : Not considered beneficial for survival or age-at-return

•Increase understanding of natural production capacity: HSRG – Review existing habitat potential, (capacity and productivity) as it will influence program conditions and contribution to recovery:

Response : We have completed initial analysis of density dependent effects and will be implementing an IMW to better understand life stage survival, limiting factors and response to extensive habitat improvement plans

Upper Grande Ronde and Catherine Creek Chinook Program Challenges

- Low natural productivity and natural origin abundance
 - Populations remain at high risk of extinction without hatchery supplementation
 - Difficult to improve PNI
 - Limits or precludes access to harvest due to natural fish impacts
 - Generates hatchery surplus above that needed for broodstock and natural spawning
- Grande Ronde broodstock collection – Current operations provide reduced risk for delayed migration and pre-spawn mortality in the river, however it may result in selective broodstock collection and uncontrolled escapement for the late part of the run
- Understanding the influence of capacity on the potential benefits that supplementation can provide
- Understanding the relationship between hatchery spawner abundance/proportion and productivity
- Understanding the factors that influence smolt survival to Lower Granite Dam