

*Comparison of Life-History Traits
Between Second-Generation Hatchery-
and Natural-origin Upper Yakima River
Spring Chinook Salmon in 2006*

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		Hatchery fish begin returning to spawn				First NORs from naturally spawning hatchery fish						
Return year→		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
First Generation	Brood year ↓											
	1997	3	4	5								
	1998		3	4	5							
	1999			3	4	5						
	2000				3	4	5					
Second Generation		2001				3	4	5				
		2002					3	4	5			
		2003						3	4	5		
		2004							3	4	5	
		2005									3	4

First Generation Results Published in:

Knudsen, C. M., S. L. Schroder, C. A. Busack, M. V.
Johnston, T. N. Pearsons, W. J. Bosch, and
D. E. Fast. 2006.

*Comparison of life-history traits between first-generation
hatchery and wild Upper Yakima River spring Chinook salmon.*

Transactions of the American Fisheries Society 135:1130–1144.



First Phase Objective:

Compare first generation hatchery and wild origin fish returning from broodyears 1997 to 2000.

Phase 1 Conclusions

- **Wild fish were larger at age (grew faster) in all years, differing by as much as 1 SD from hatchery fish**
- **The differences in body size were significant in all comparisons except BY2000 age 4's**
- **Differences observed in age-3 fish had to occur sometime over the ~16 months after release**

Phase 1 Conclusions - cont'd

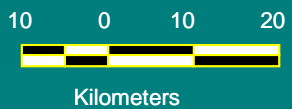
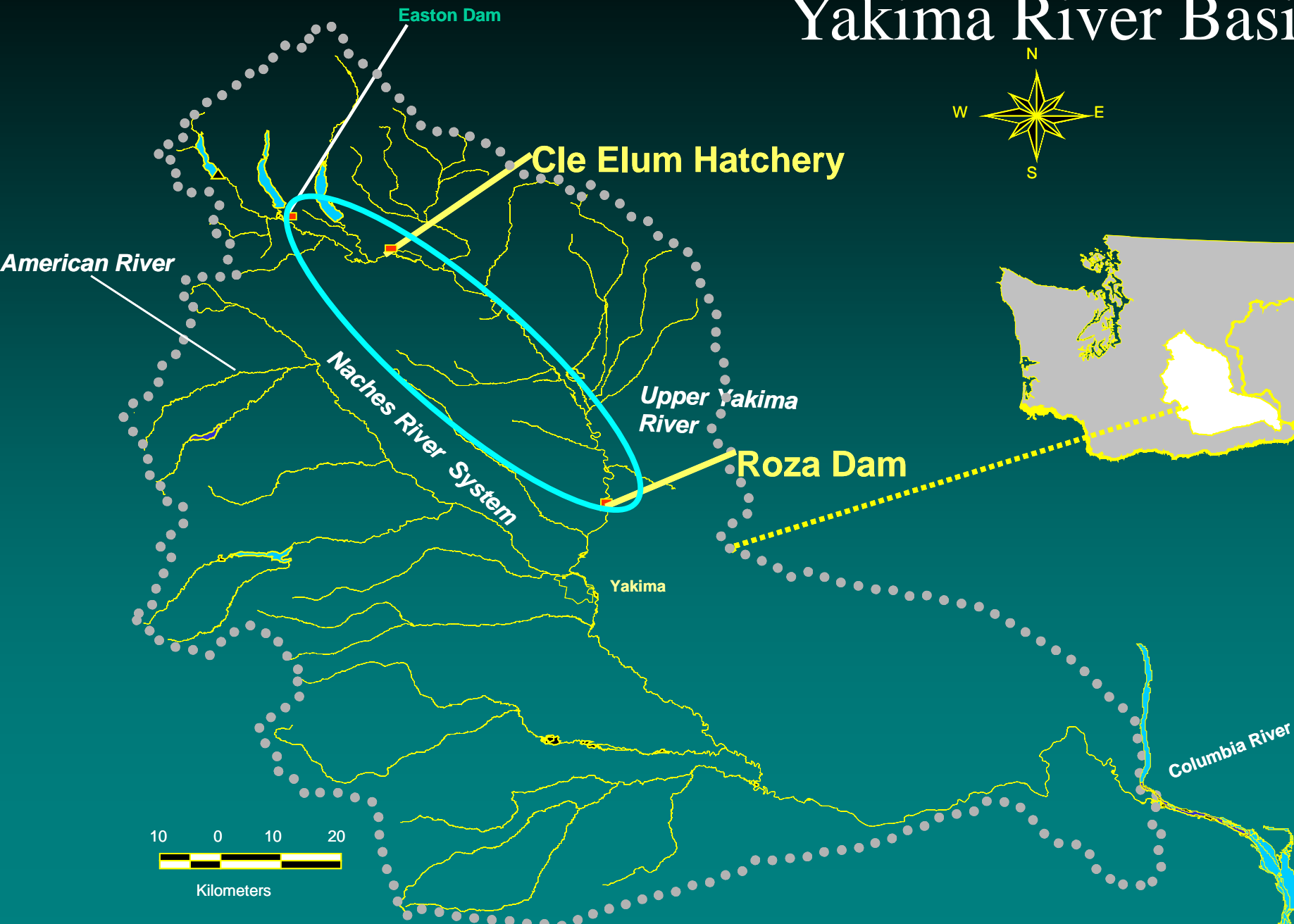
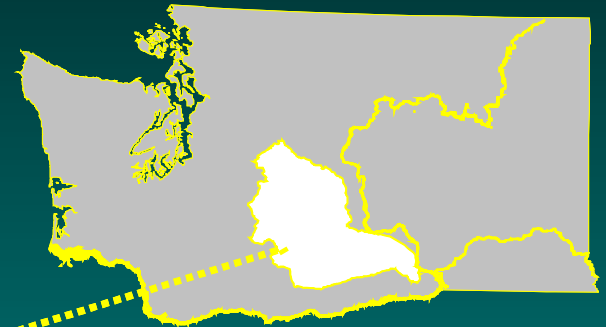
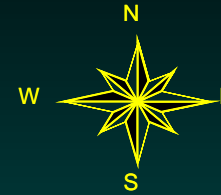
- **Age Composition** – increasing proportion of hatchery age 3 returns.
- **Sex Ratios** – increasing proportion of hatchery male returns.
- **Passage timing at RAMF** - Hatchery and wild was significantly different in some years, but the differences were relatively small with no trend.
- **Spawn timing at CESRF** - Hatchery fish consistently spawned earlier by 5.1 days on average.

First Phase Objective: Compare first generation hatchery and wild origin fish returning from broodyears 1997 to 2000.

Second Phase Objective:

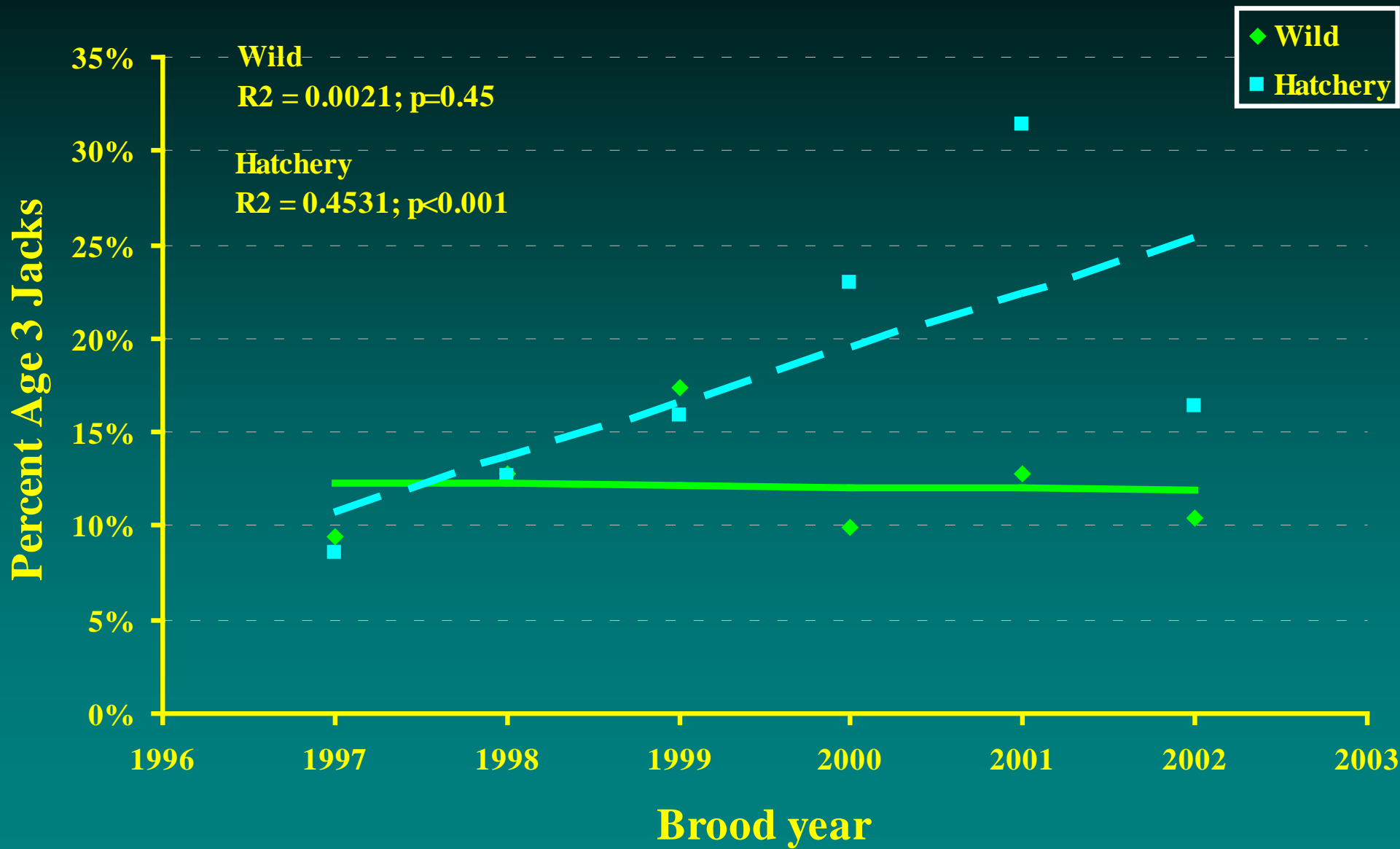
Compare second generation Hatchery- and Natural-origin fish returning from broodyears 2001 to 2004.

Yakima River Basin



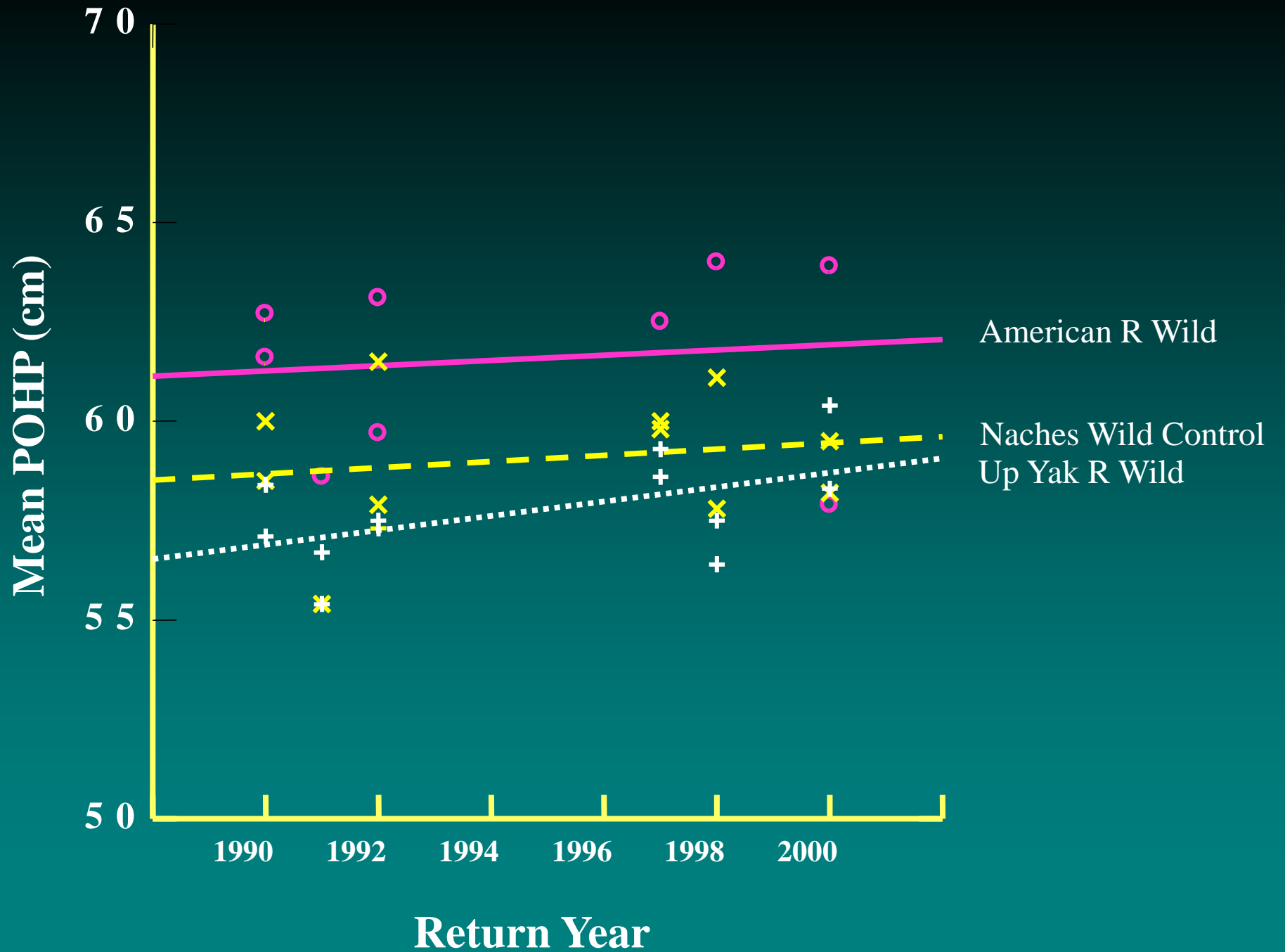


Age Composition



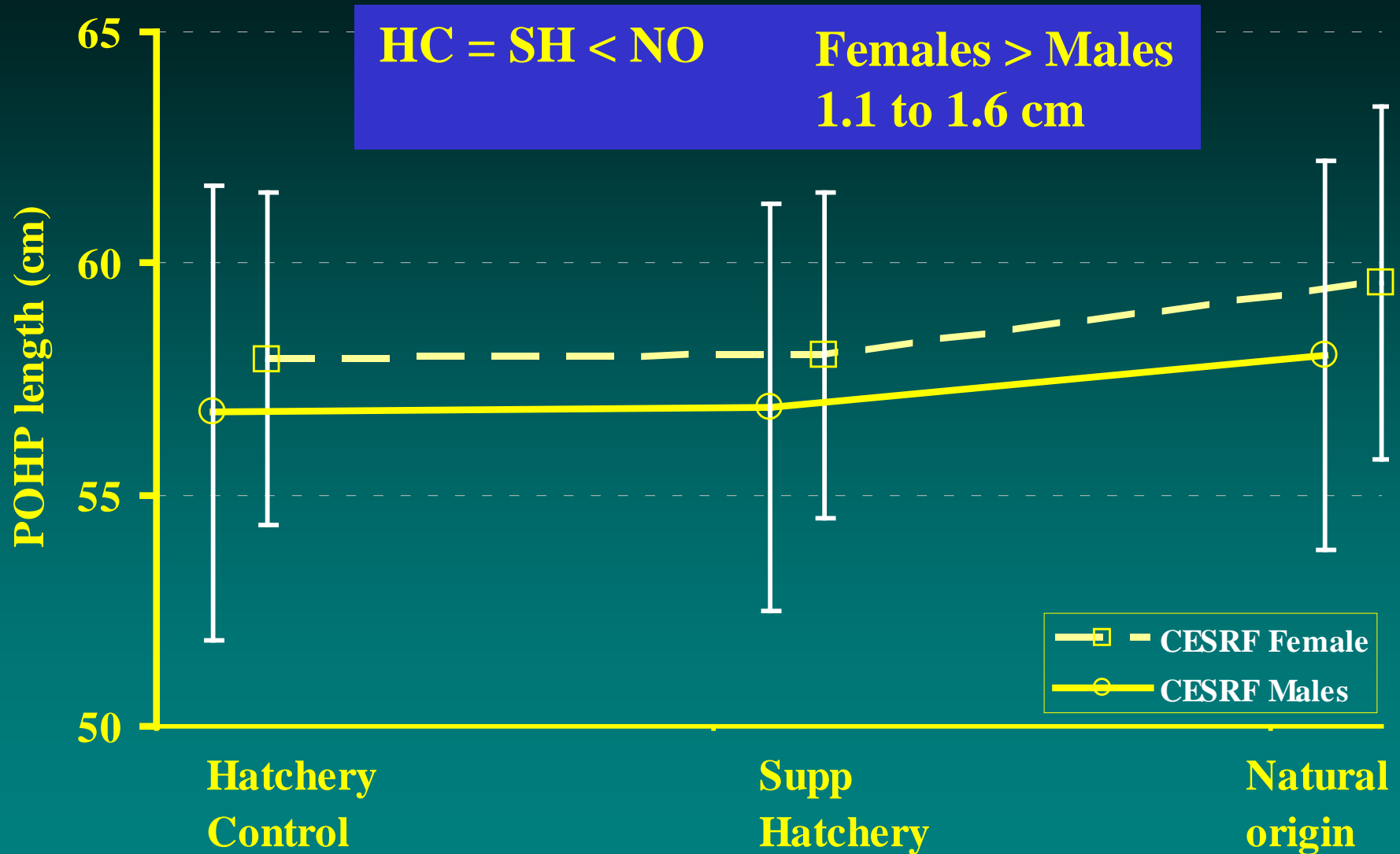
Size-at-Age (reflecting growth rates)





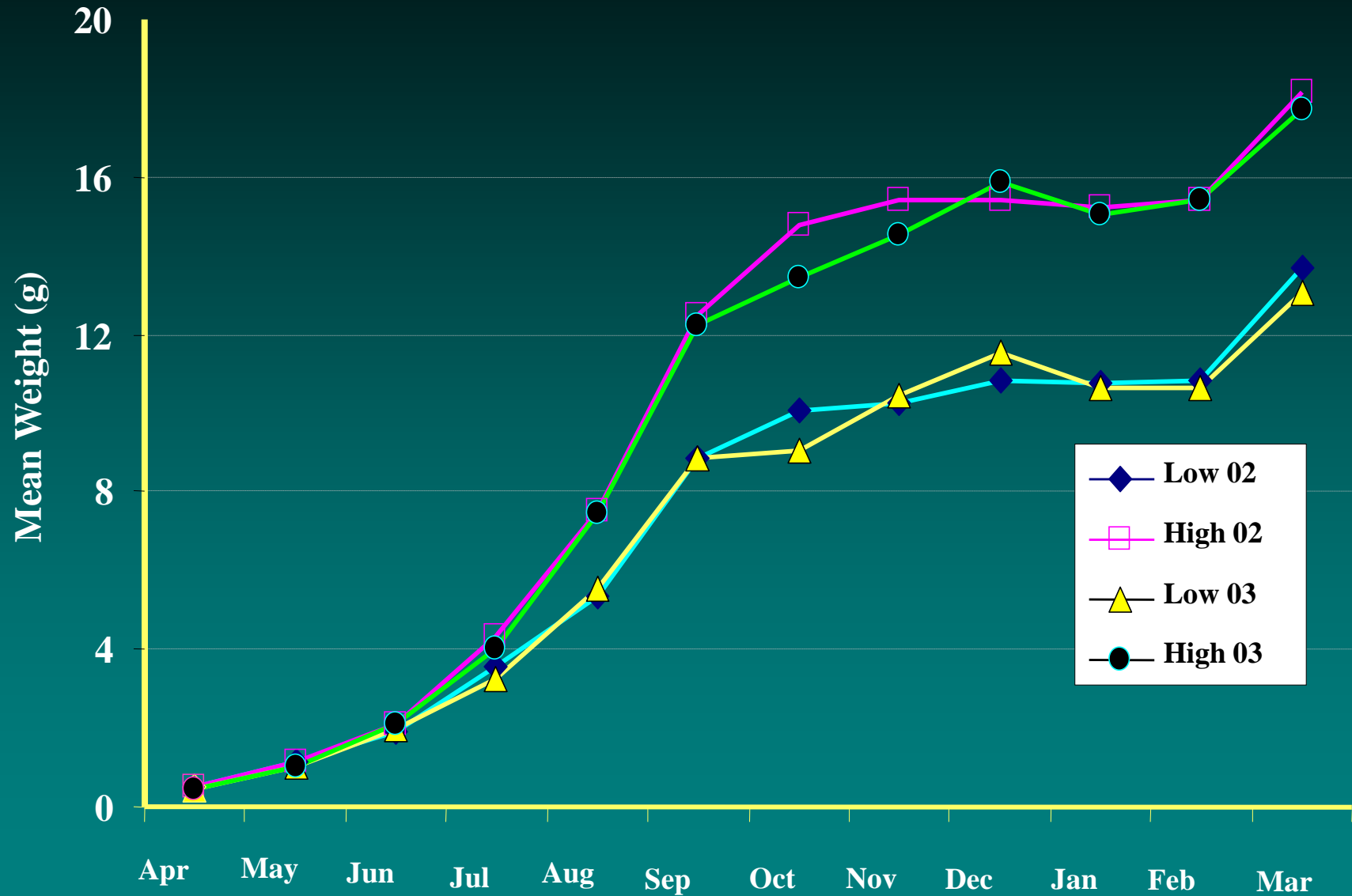


POHP (± 1 sd) Age 4 Females and Males 2006

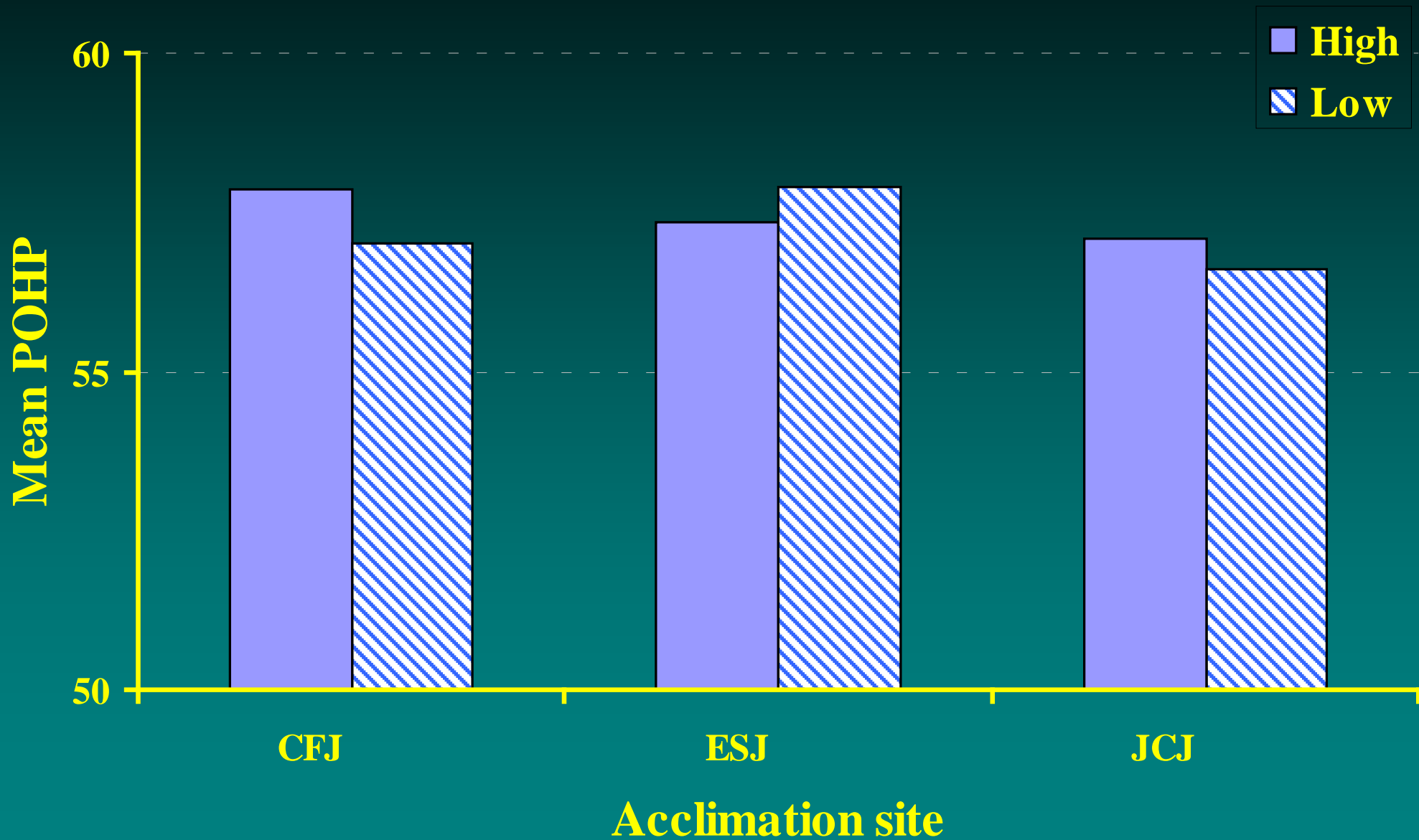


High and Low Growth Treatments

High and Low Growth Juvenile Body Weight



High and Low Growth Age 4 POHP Lengths 2006



ANOVA: High vs Low POHP

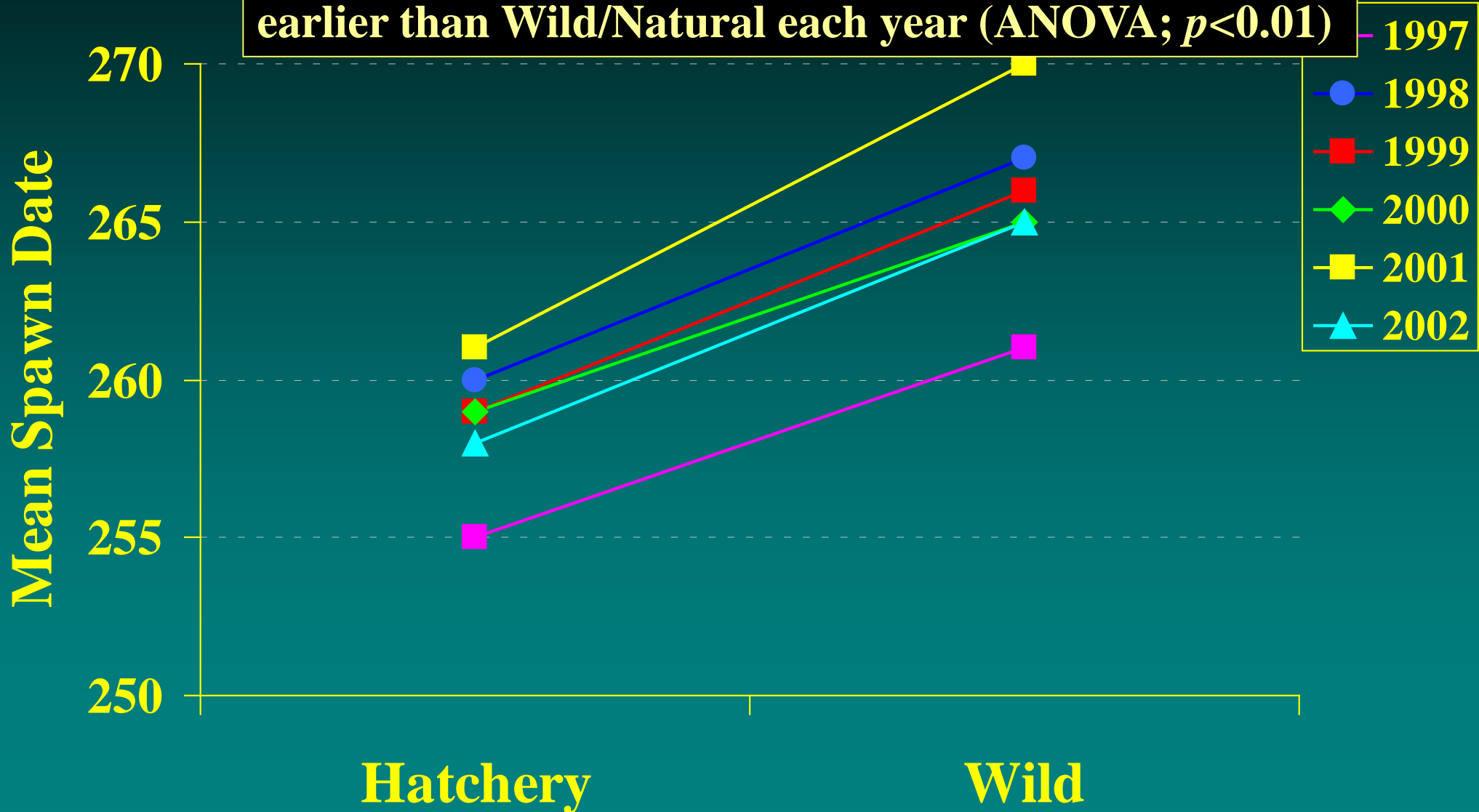
Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Treatment	6.863	1	6.863	0.390	0.533
Acclimation Site	37.178	2	18.589	1.056	0.349
Treat*Acc Site	42.371	2	21.186	1.204	0.301
Error	8571.006	487	17.600		

Spawn Timing At CESRF

An aerial photograph of a rugged, rocky coastline. The rocks are dark and jagged, with some patches of green moss or algae. A large, dark, shadowed area is visible in the center-right of the image, possibly a cave or a deep crevice. The overall scene is dark and textured.

Spawn Timing At CESRF

Hatchery mean spawn date was significantly earlier than Wild/Natural each year (ANOVA; $p < 0.01$)



Conclusions

- Hatchery fish continue to return at smaller size-at-age than Natural origin fish
- Increased proportions of age 3 jacks continues
- Age 4 fish from all Yakima River populations have significantly declines in size since 2001
- 2006 was the first year we observed significant sexual dimorphism (females>males)
- Spawn timing of hatchery fish at CESRF was once again earlier than natural origin fish

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