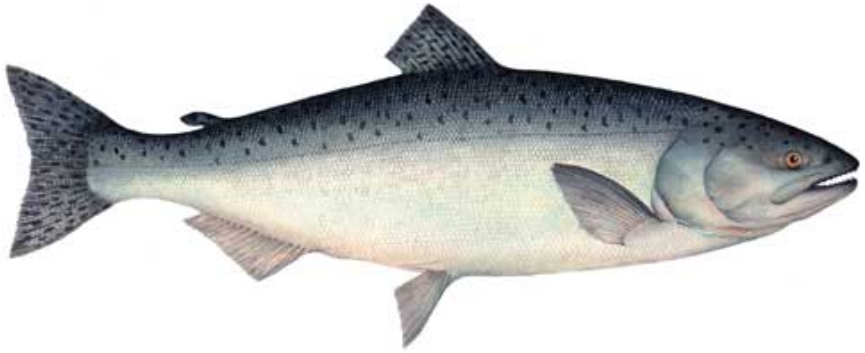
Evaluation of yearly and geographic variation in early male maturation in hatchery and wild spring Chinook salmon from the Yakima River, Washington.

Don Larsen, Brian Beckman, Paul Parkins - NOAA Fisheries

Deb Harstad, Kathy Cooper, Dina Spangenberg - University of Washington

Dave Fast, Charles Strom, Mark Johnston, - Yakama Nation Fisheries



Chinook Salmon
Onchorhynchus tshawytscha

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

SCHOOL OF AQUATIC & FISHERY SCIENCES
COLLEGE OF OCEAN AND FISHERY SCIENCES • UNIVERSITY OF WASHINGTON

FISHERIES YKFP YAKAMA NATION

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- Instats Consulting-Doug Neeley
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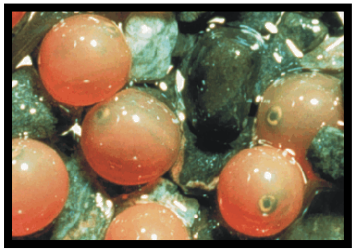
Spring Chinook Salmon

Spawning - Fall



Fry

Parr

Age-1 "Precocious parr"

Age-2 "Minijacks"

Jack

Age-3 M

Age-4

Age-5

Ocean to river in spring

Sub-adults

Smolting

1+ yr
Spring

Ocean

Variation in Age of Male Maturity

Mature male salmon

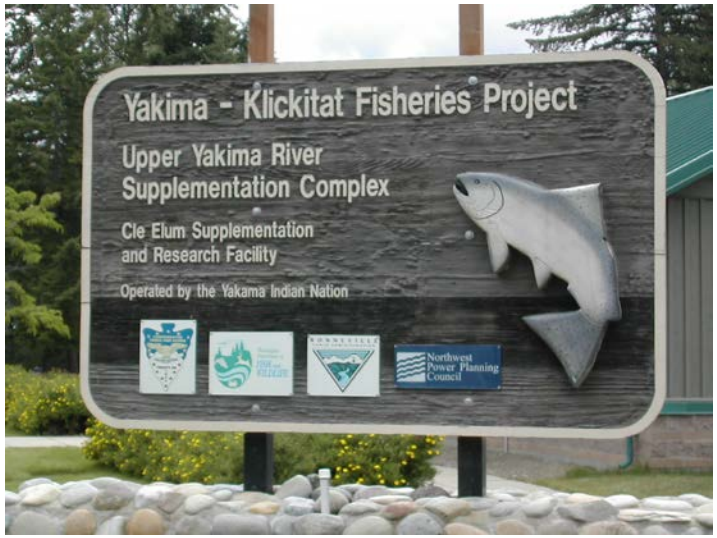
Factors Affecting Age of Maturation

- ✓ Genetics
- ✓ Environment
  - temperature
  - food availability
  - food quality

Growth & Body energy stores

The Hatchery environment can significantly influence age of maturation

We've been monitoring the physiology of Cle Elum Hatchery Spring Chinook since implementation in 1997



On average 50% of male Cle Elum hatchery spring Chinook precociously matured at age-2

BY	Release #	% of males	# Minijacks
1997	386,048	44%	84,931
1998	589,683	72%	211,107
1999	758,789	50%	189,697
2000	834,285	37%	153,508
2001	370,236	52%	95,520
		Avg. 50%	

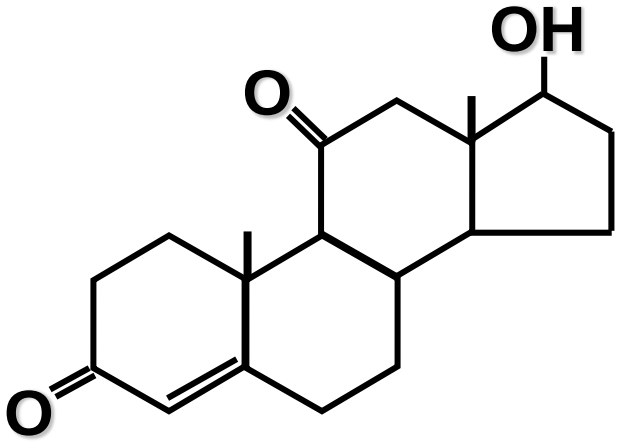
Larsen, D.A., Beckman, B.R., Cooper, K.A., Barrett, D., Johnston, M., Swanson, P., and Dickhoff, W.W. (2004). Assessment of high rates of precocious male maturation in a spring Chinook salmon supplementation hatchery program. Transactions of the American Fisheries Society. 133, 98-120.

Consequences of high levels of precocious maturation

- Ecological impacts
- Genetic impacts
- Increased straying
- Skewed gender ratio
- Alters accuracy of SAR
- Loss of adult production

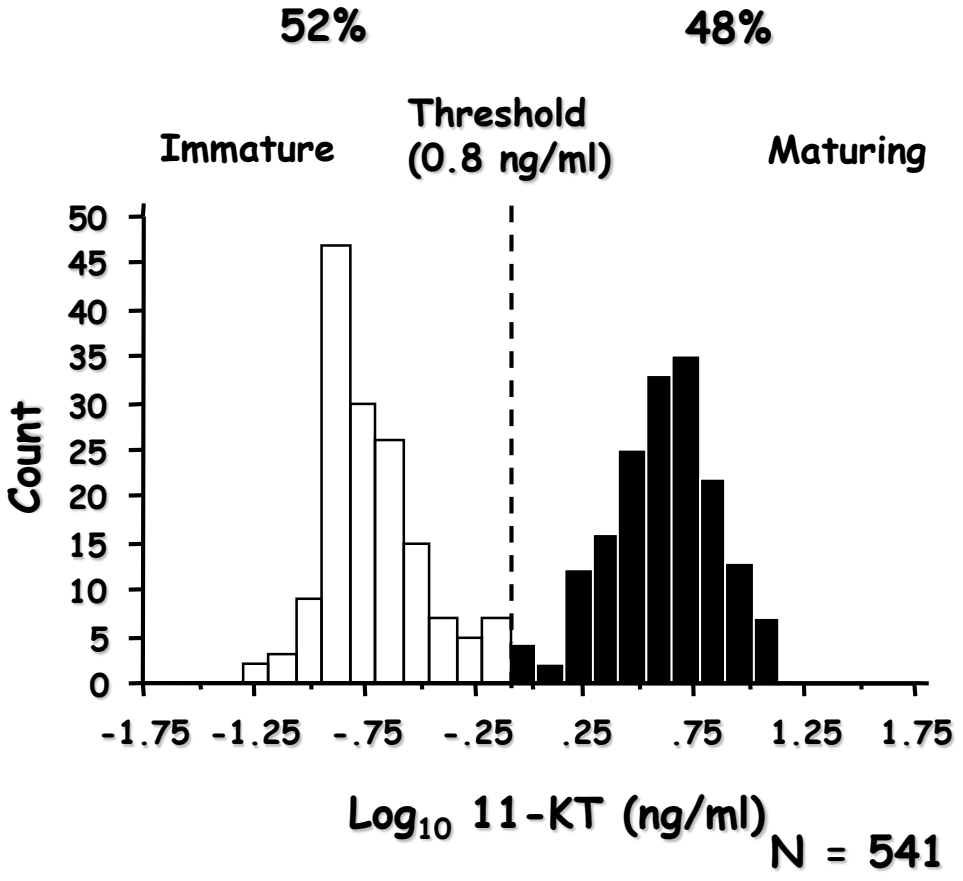
How do we assess precocious male maturation?

Plasma 11-ketotestosterone (11-KT)



- Major androgen in teleost fish
- Instrumental in the regulation of spermatogenesis

Every March the Cle Elum Chinook are screened for pathology just prior to volitional release



Life-history monitoring protocol

- Every March, just prior to release, we sample 60 fish per raceway
- Measure length, weight, condition factor, gender
- Measure 11-KT in plasma of all males to determine maturity status

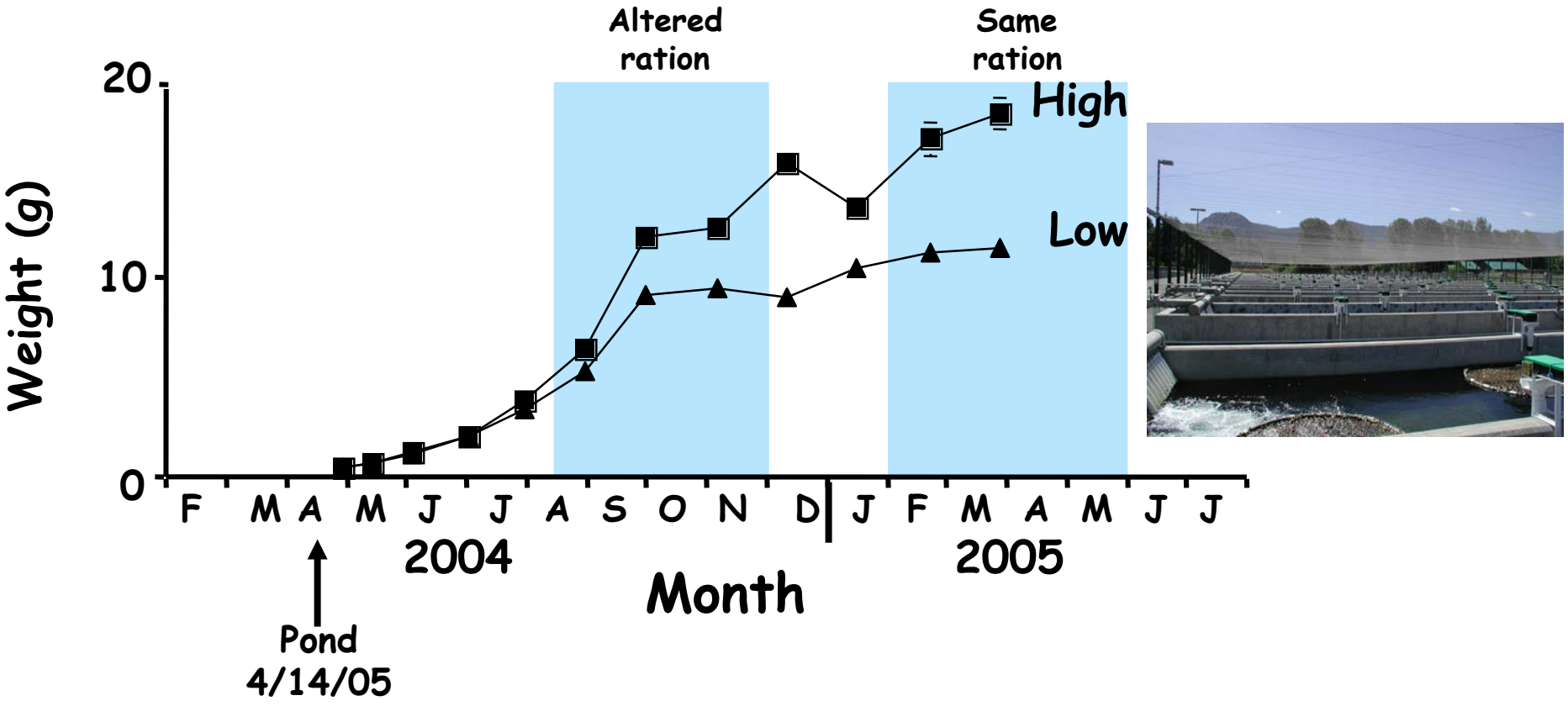
Previous Yakima Science and Management Conferences

Annual Report

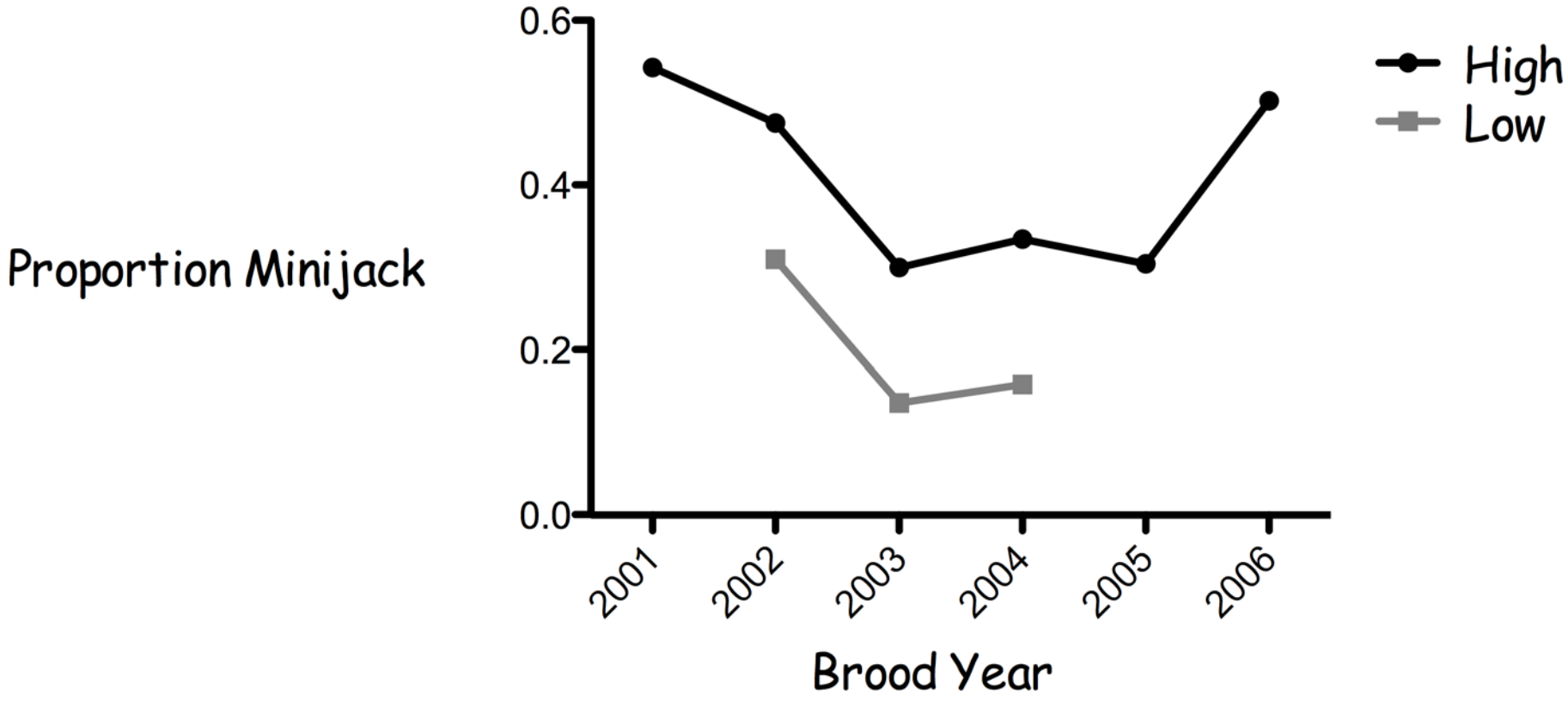
…….This year

Big Picture summarizing 6 years of data

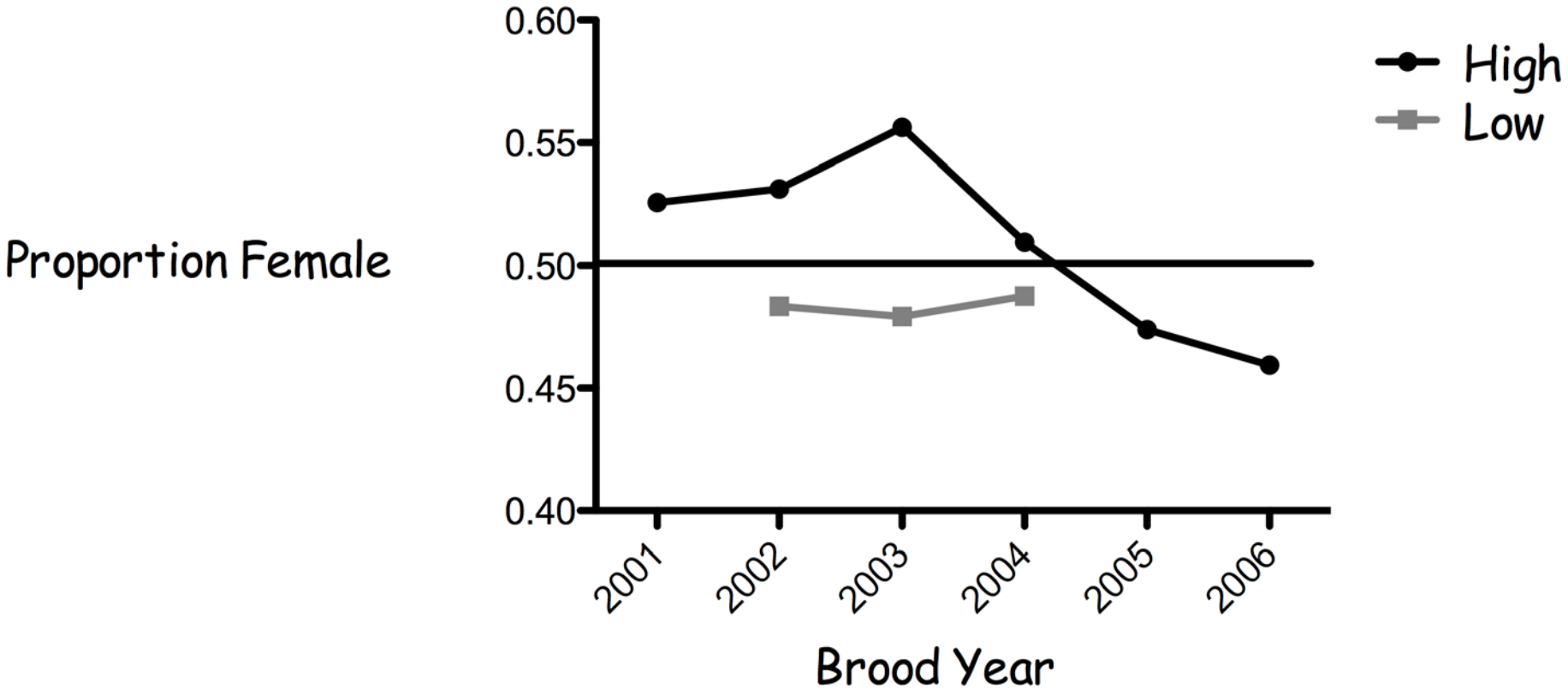
A Production Scale Growth Modulation Experiment (BY 2002-2004)



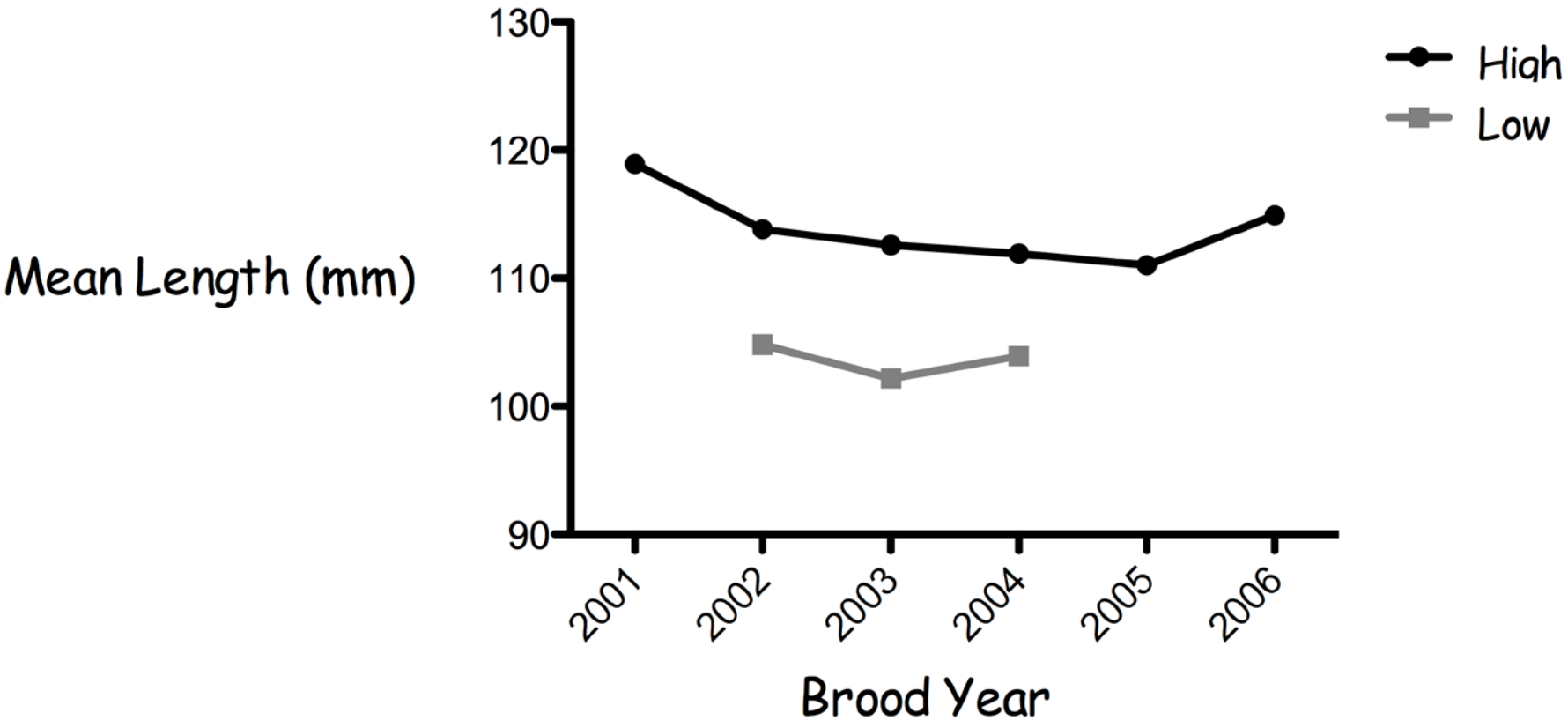
Minijack rates have been variable



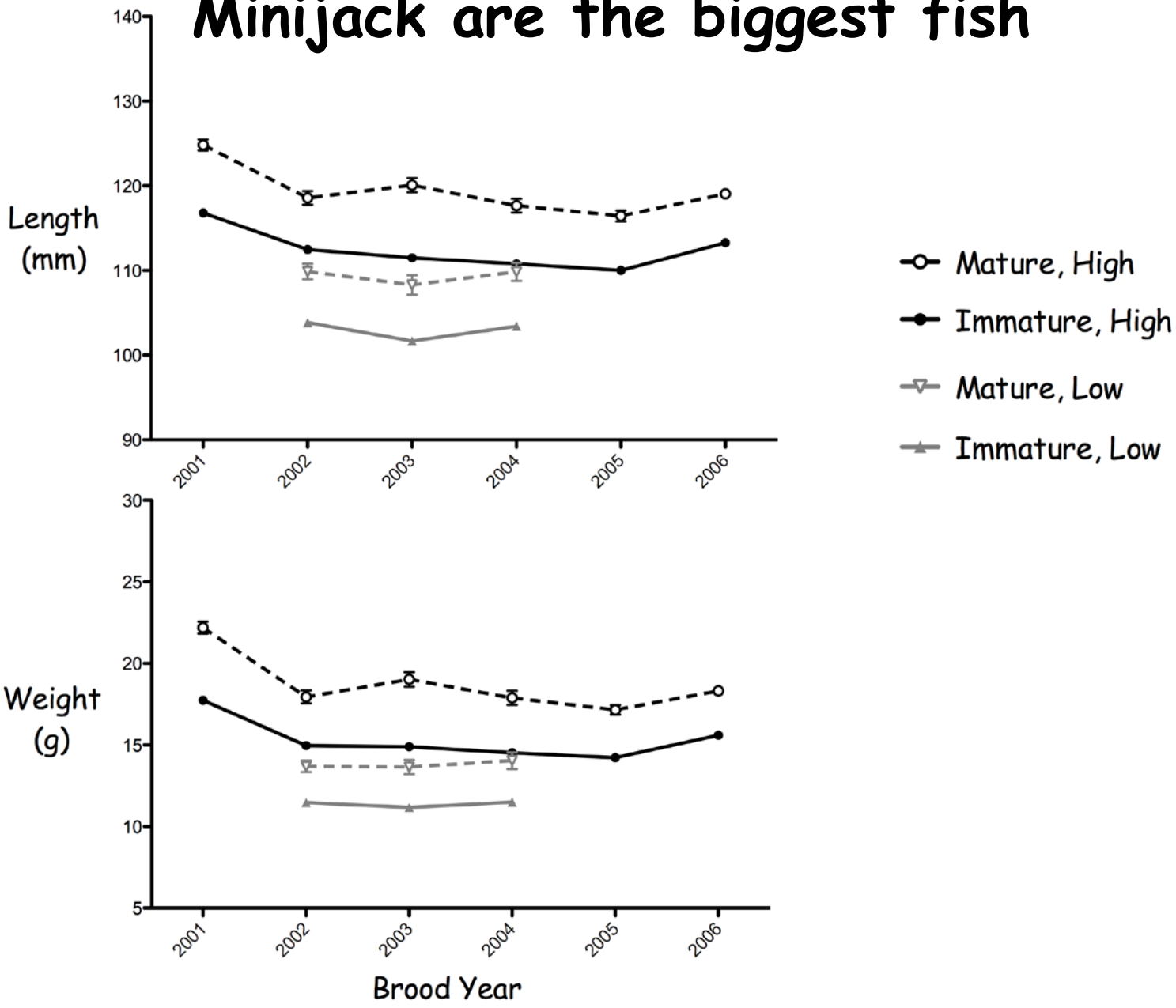
Pre-release gender ratios are near 50:50



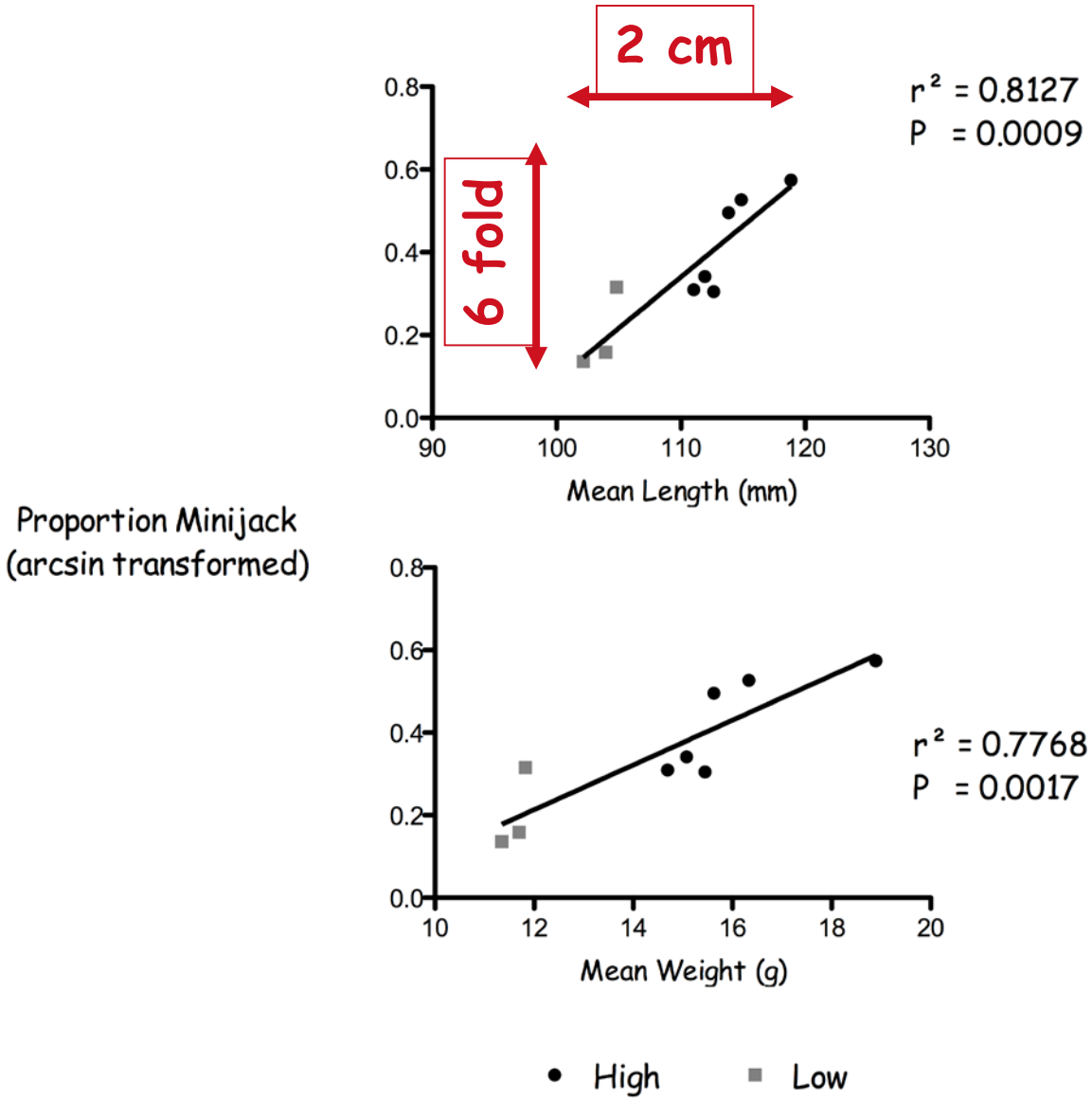
Release size has varied modestly



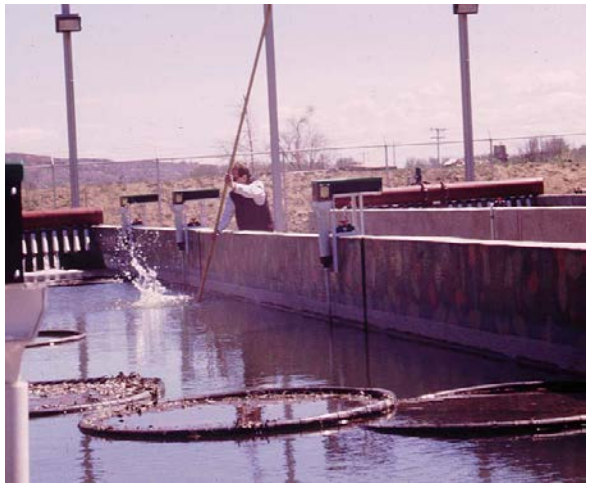
Minijack are the biggest fish



Minijack rates correlate significantly with release size (March)



Yakima hatchery
Spring Chinook

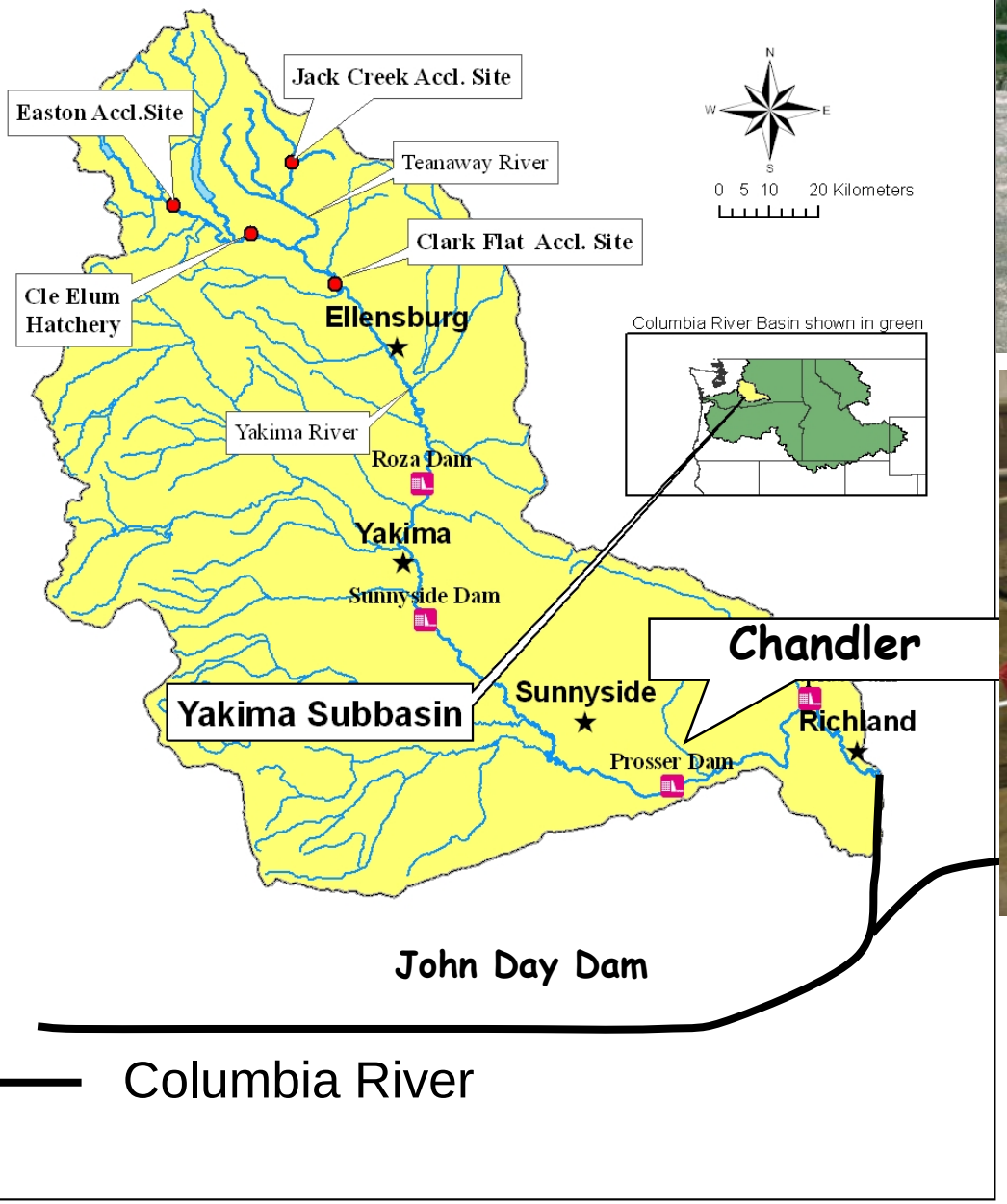


N=300-600 fish/pt.

What happens to the minijacks after release?

"The migrating minijack"

The Yakima River Basin

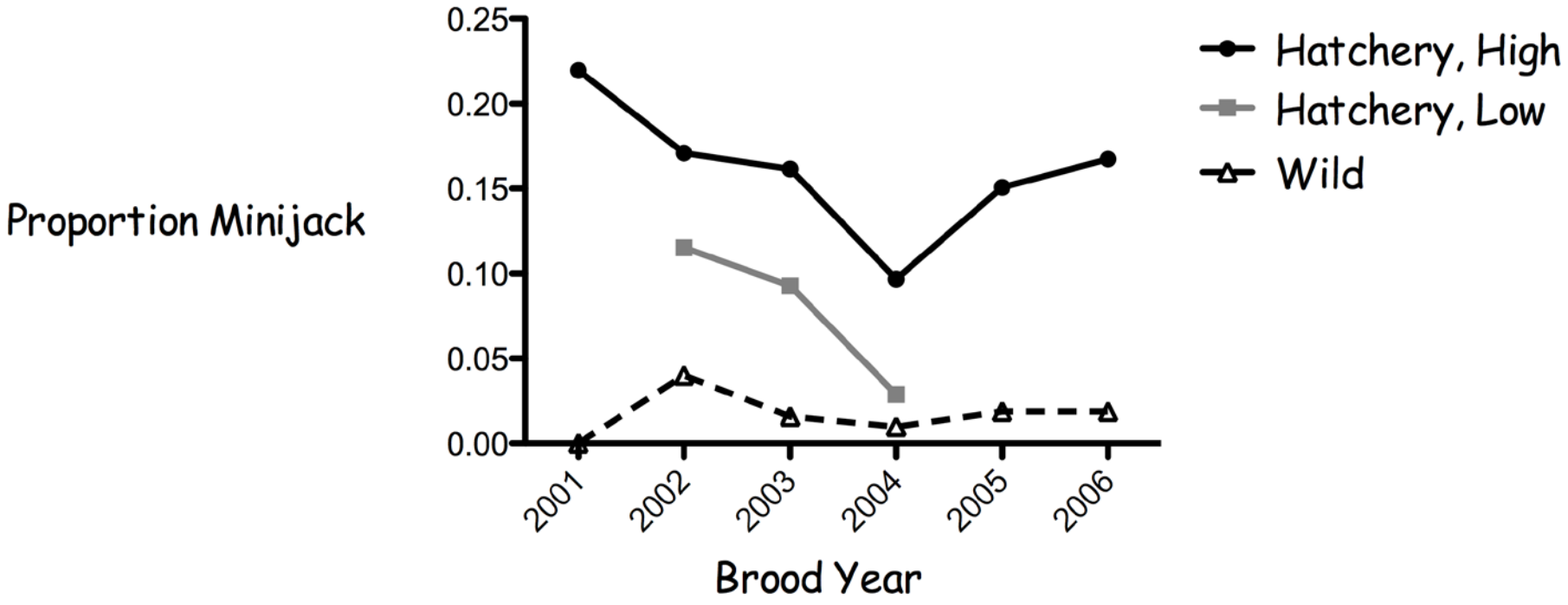


Prosser (Chandler smolt by-pass) collections

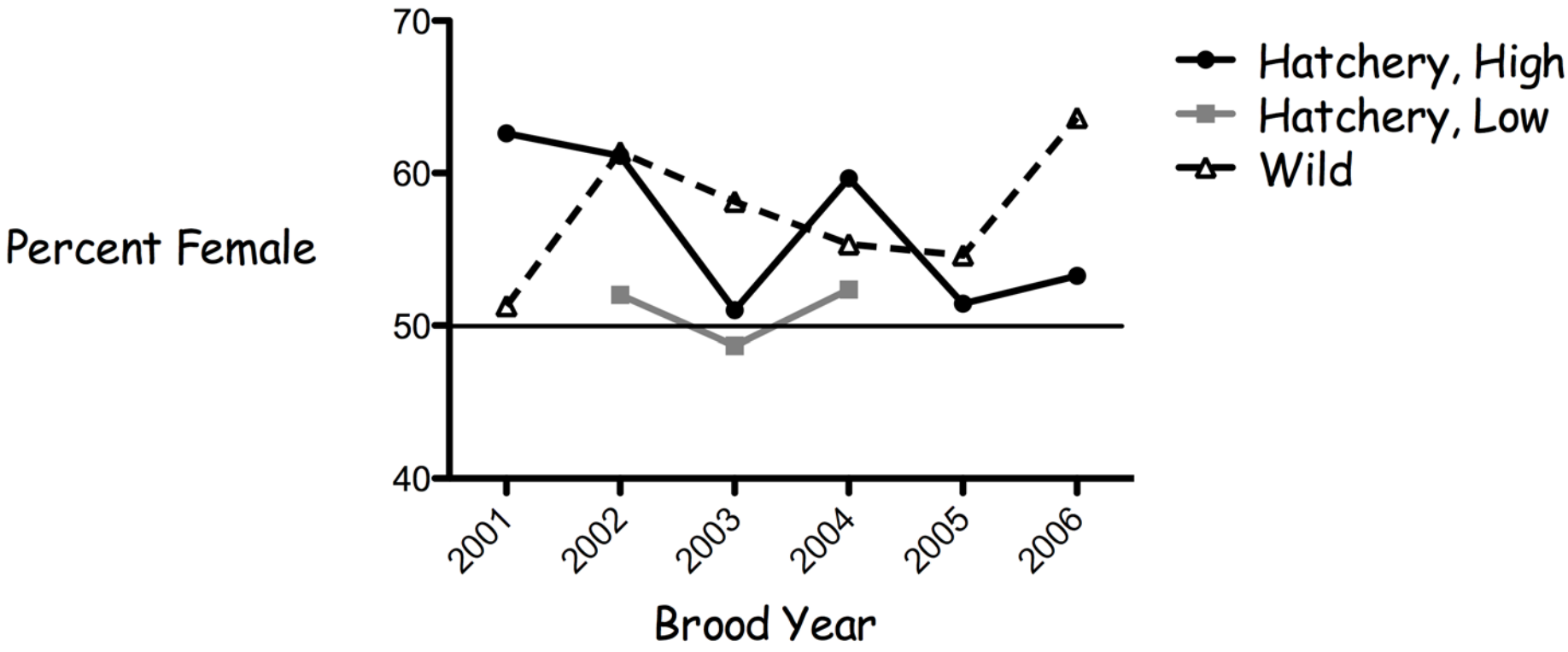
- Throughout the spring we collect approximately 300-600 wild (Yak.+Natches) and Cle Elum hatchery migrants

- Measure length, weight, condition factor, gender, maturation status (males)

There are more migrating minijacks in the hatchery population and rates are variable



Gender ratios favor females among both wild and large hatchery fish



Spring Chinook Salmon

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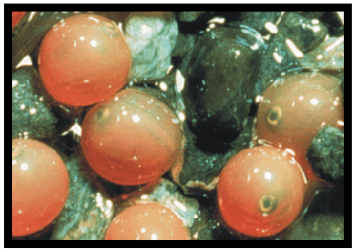

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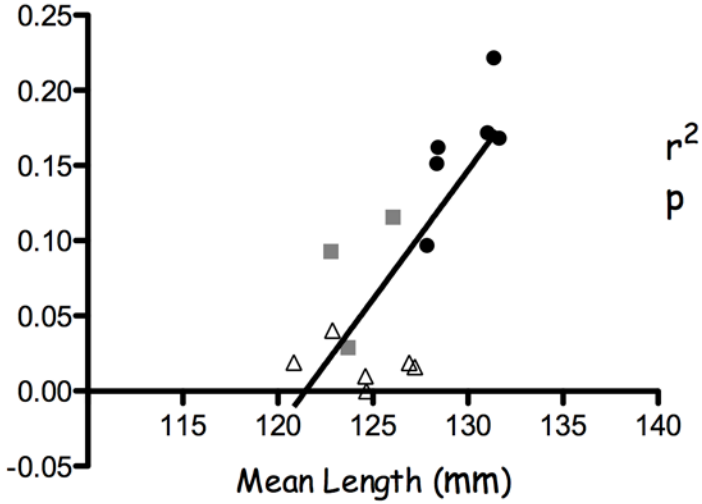
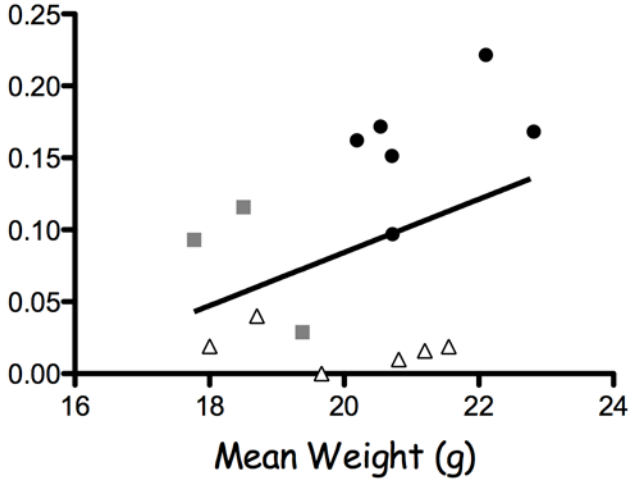
Migrating minijack rate correlates with length but not weight



$r^2 = 0.5965$
$p = 0.0007$

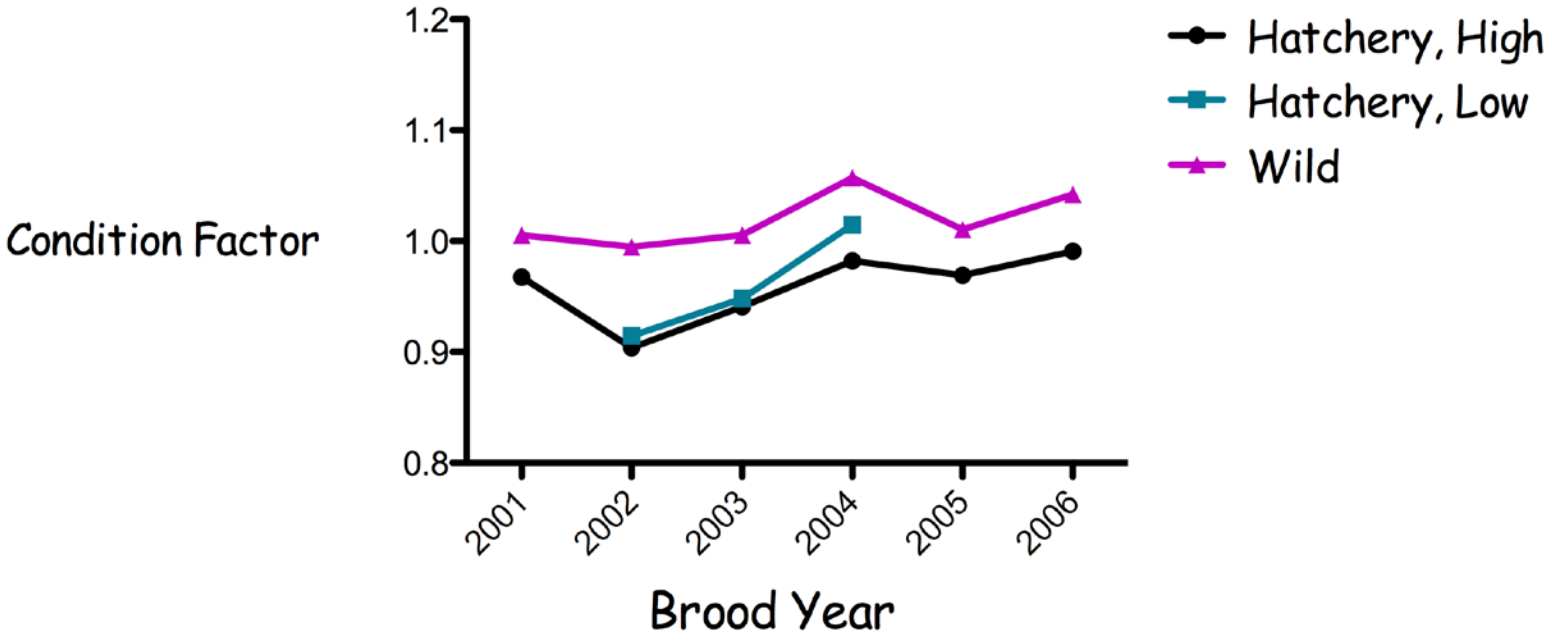
Proportion Minijack
(arcsin transformed)



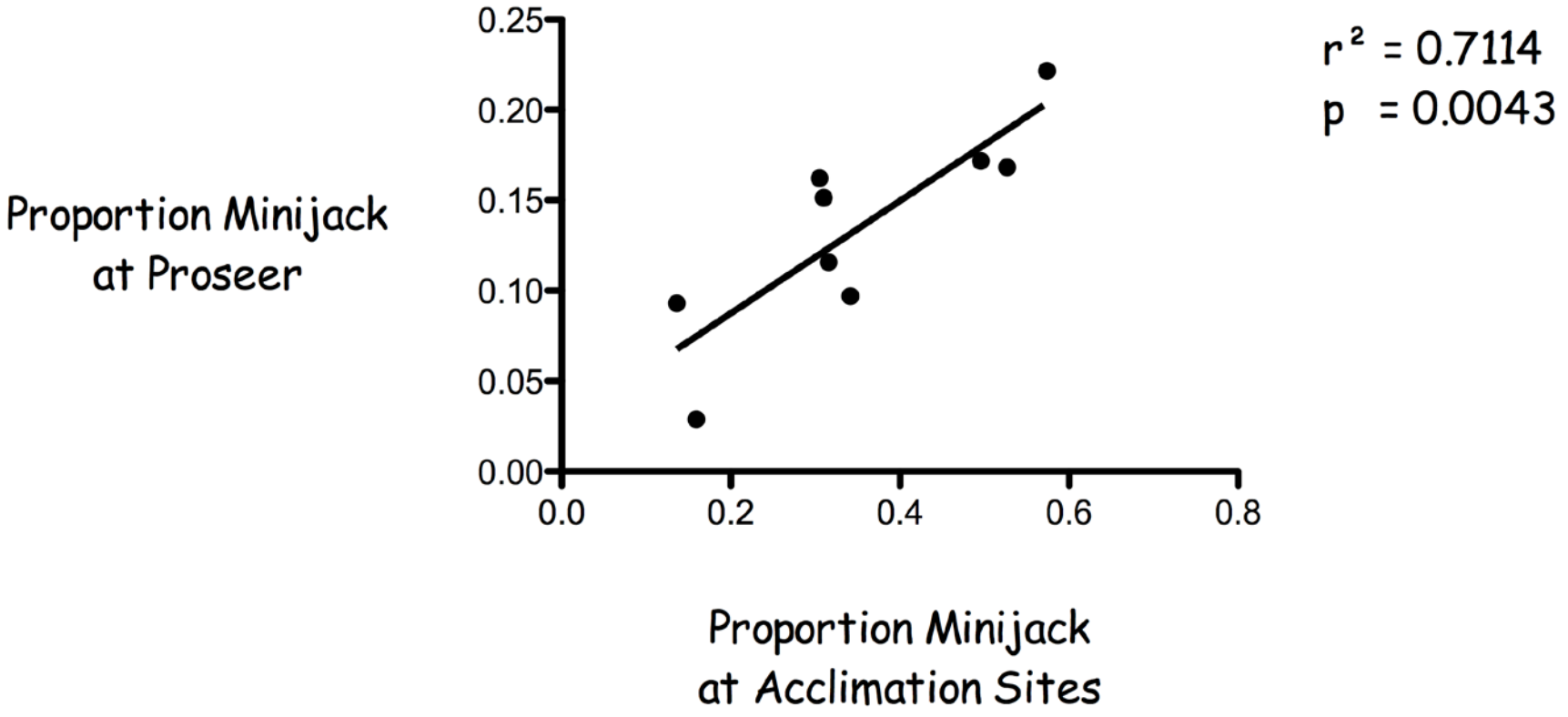
$r^2 = 0.1400$
$p = 0.1694$

- ● Hatchery, High
- ■ Hatchery, Low
- △ Wild

Condition factor is higher in migrating wild than hatchery fish



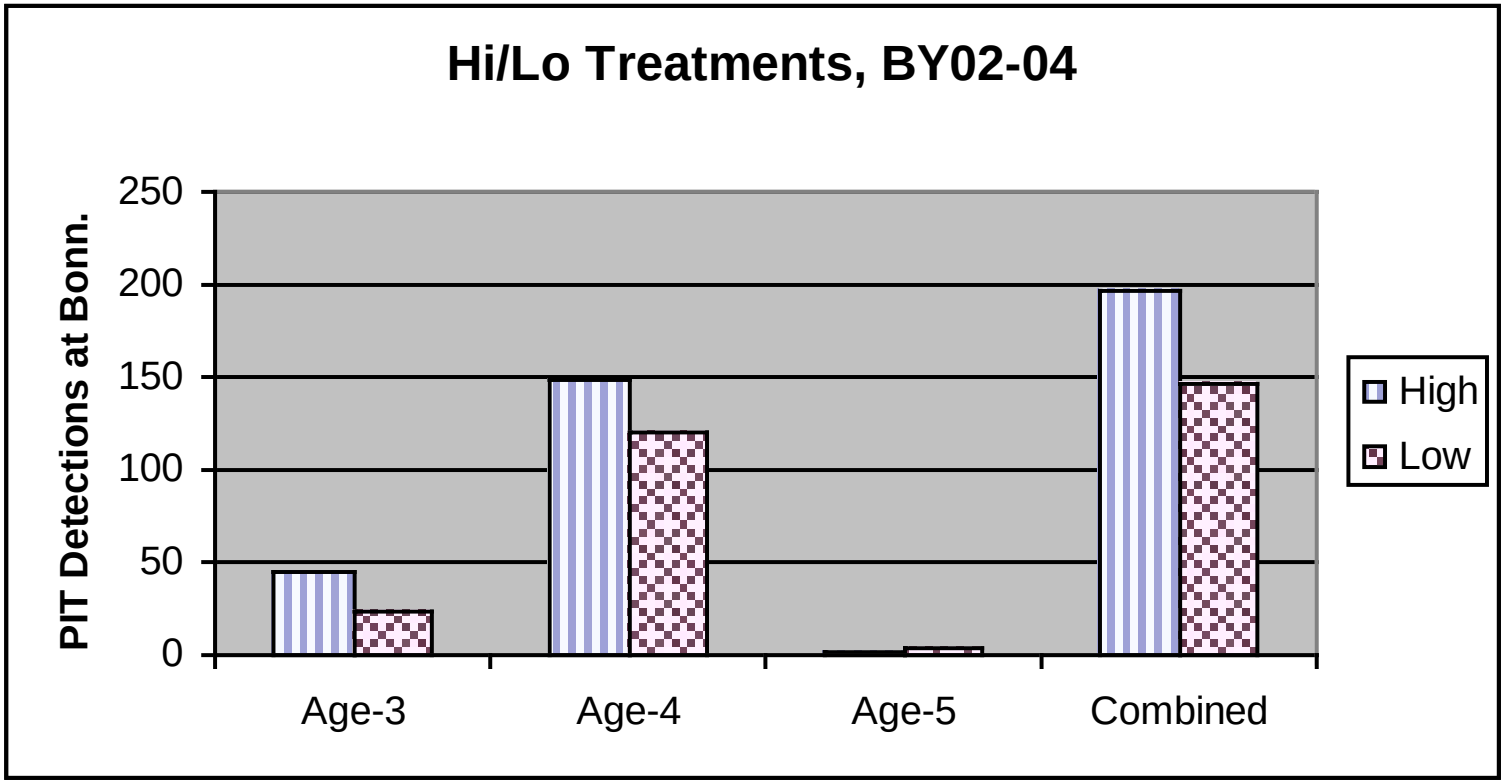
The proportion of minijacks at release is strongly correlated with the proportion of migrating minijacks



Conclusions

- Minijack rates at release and Prosser vary annually and are highly correlated
- Rates are strongly correlated with size at release
- Rates are 10-20 fold lower in Wild fish
- Female biased gender ratios are found in both wild and hatchery fish

All Years Combined



Bosch 2008