Managing Precocious Maturation in Chinook Salmon Captive Broodstock

Paul Adelizi, Jamie McGrath-Castro and Brian Erlandsen

California Department of Fish and Wildlife

2017 Northwest Fish Culture Concepts
Redding, California

December 6, 2017

Overview

- Hatchery Program Introduction
- Problems with Early Maturation
- Precocious Maturation Research
- Implications and Future Direction

SAN JOAQUIN RIVER RESTORATION PROGRAM

San Joaquin River

Challenges/Solutions

Challenges:

- Portions of the river had been dry for 50 years
- Spring-run Chinook Salmon are threatened in the Central Valley

Solutions:

- A legal settlement resulted in the development of restoration flows
- Fix the river
- Use a conservation hatchery to jumpstart fish reintroduction

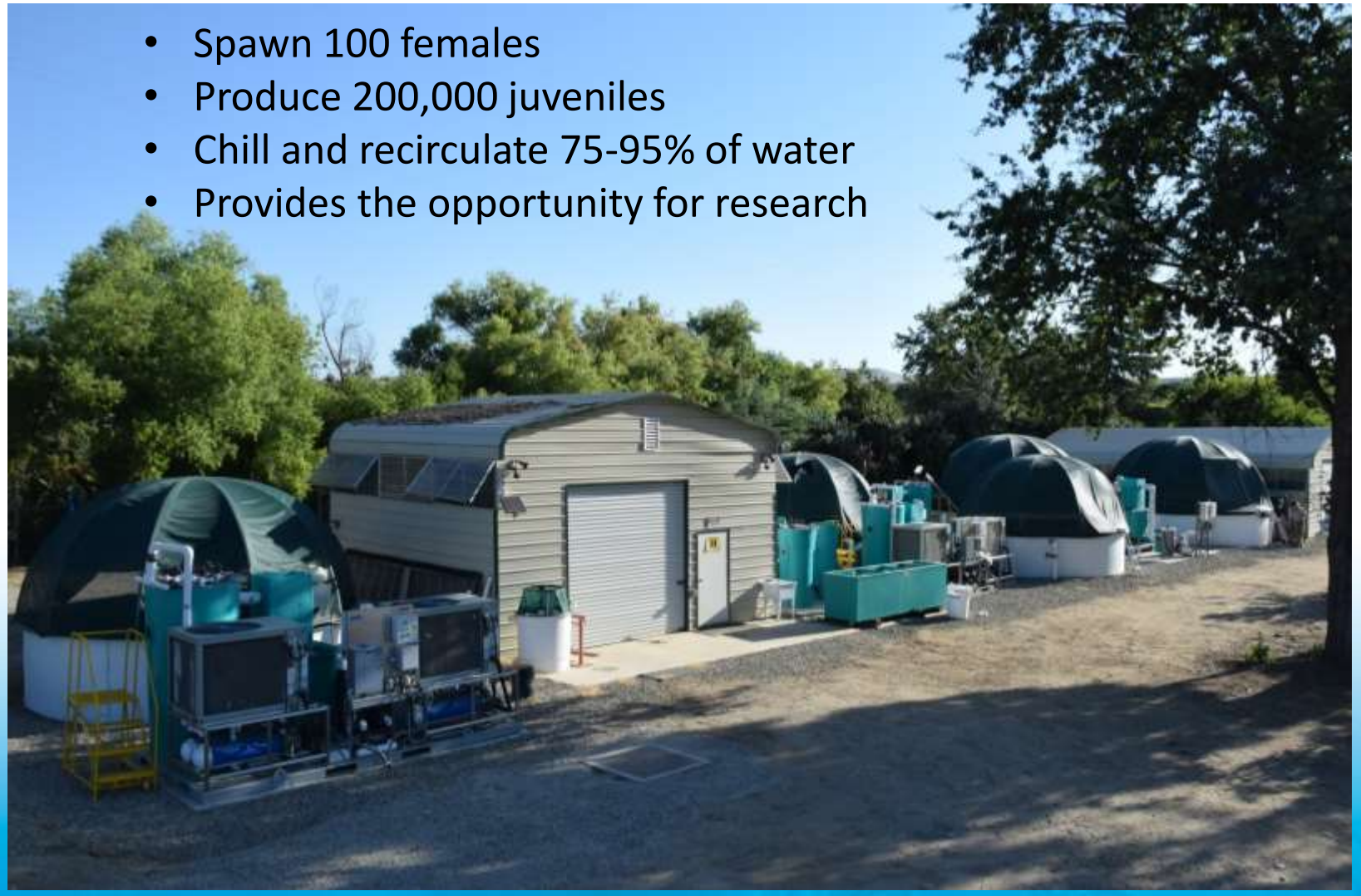
http://www.fresnoalliance.com/articles_dec_2009.htm

Proposed Conservation Hatchery

- 1 million smolt facility
- Volitional release channel
- Indoor and out research systems
- Target completion date of August 2018

Salmon Conservation and Research Facility, San Joaquin River

Interim Salmon Conservation and Research Facility



SAN JOAQUIN RIVER RESTORATION PROGRAM

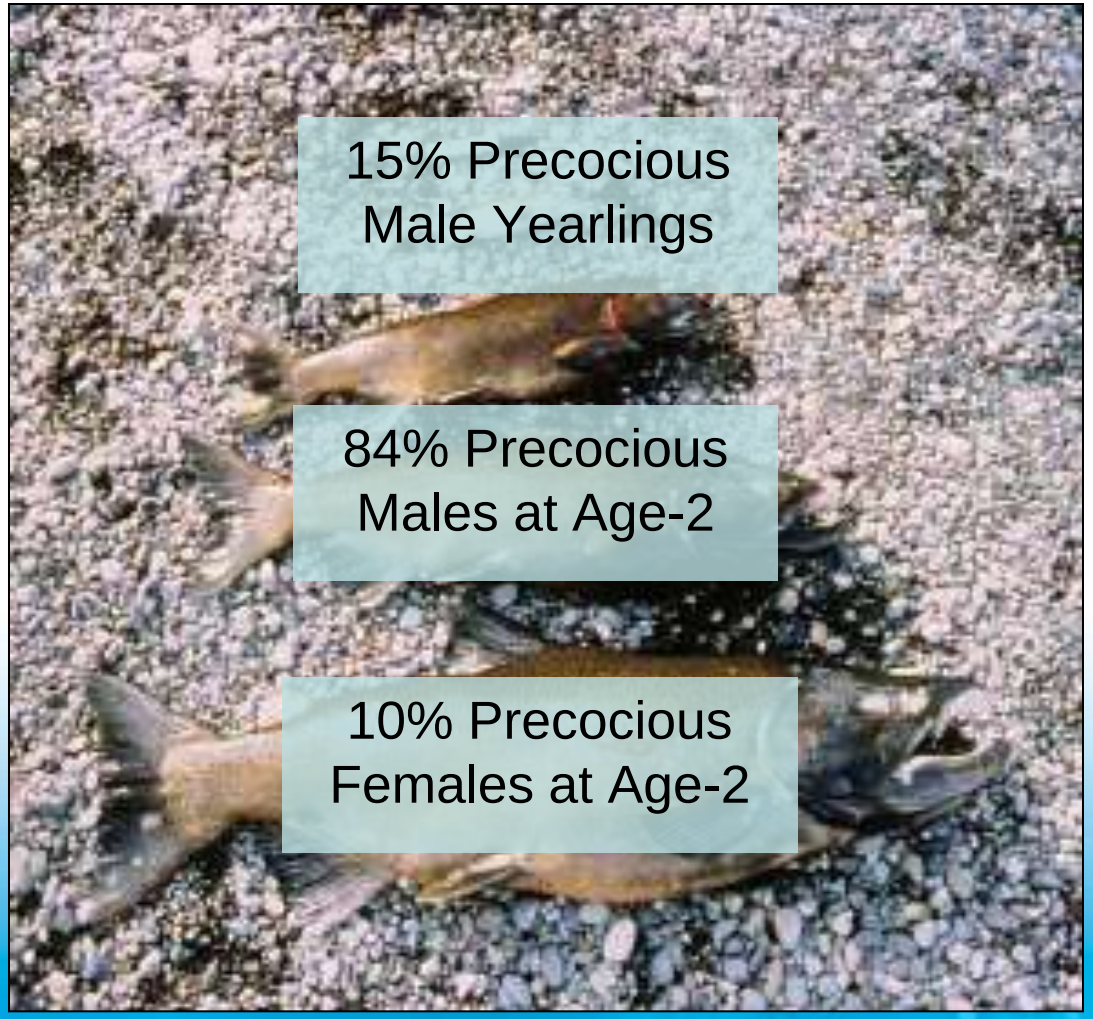
Improving Broodstock Quality

- Size
- Fecundity
- Egg Quality

SAN JOAQUIN RIVER RESTORATION PROGRAM

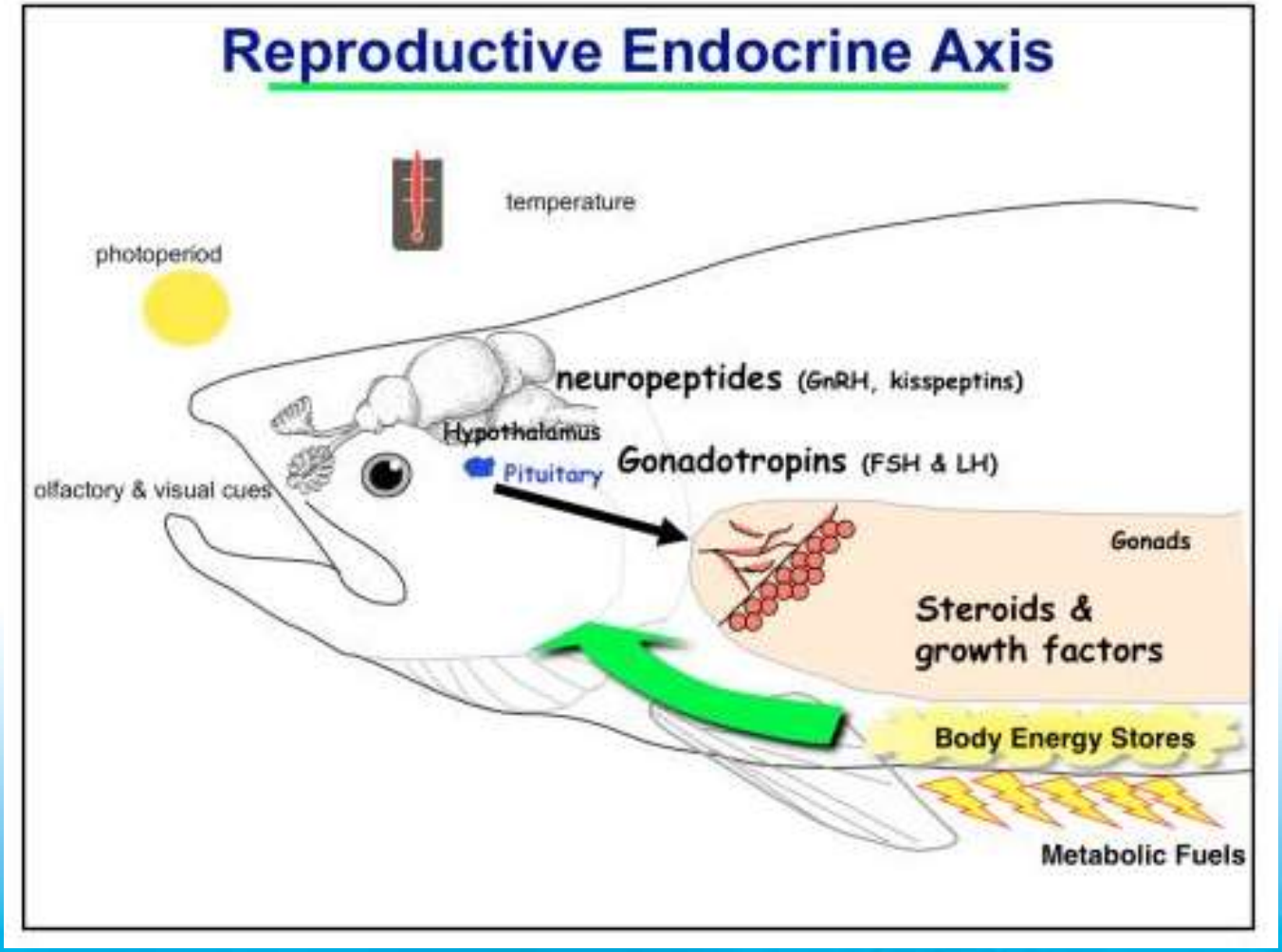
What is Precocious Maturation?

Precocious Maturation – 2010 BY Fall-run



Don Larsen, NOAA Fisheries

Onset of Puberty

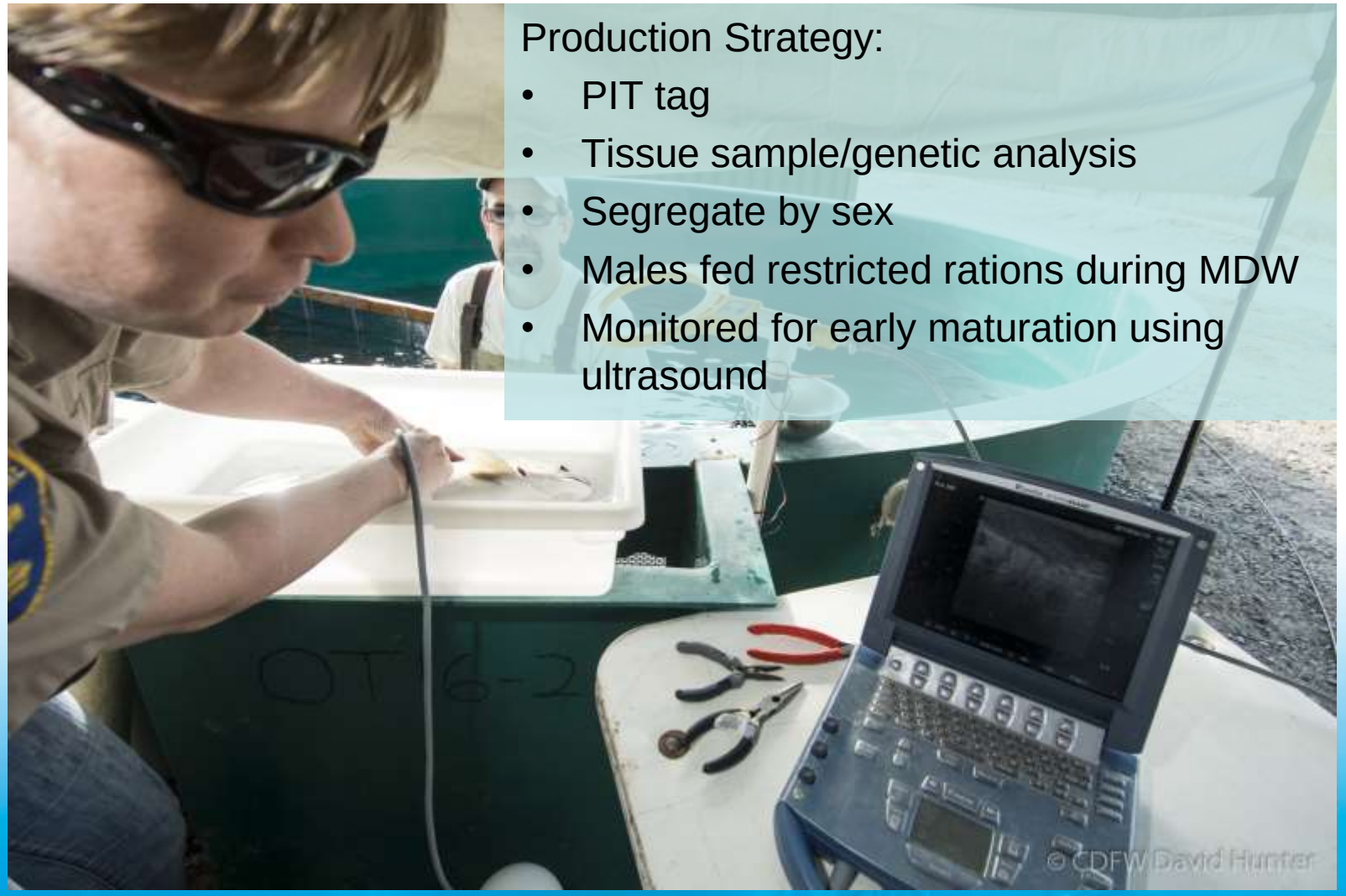


Swanson, Beckman and Larsen NOAA Fisheries

Egg Collection at Feather River Hatchery

- Collecting donor stock annually since 2012
- No collections occurred in 2017
- Collect from 500 -2,700 eggs

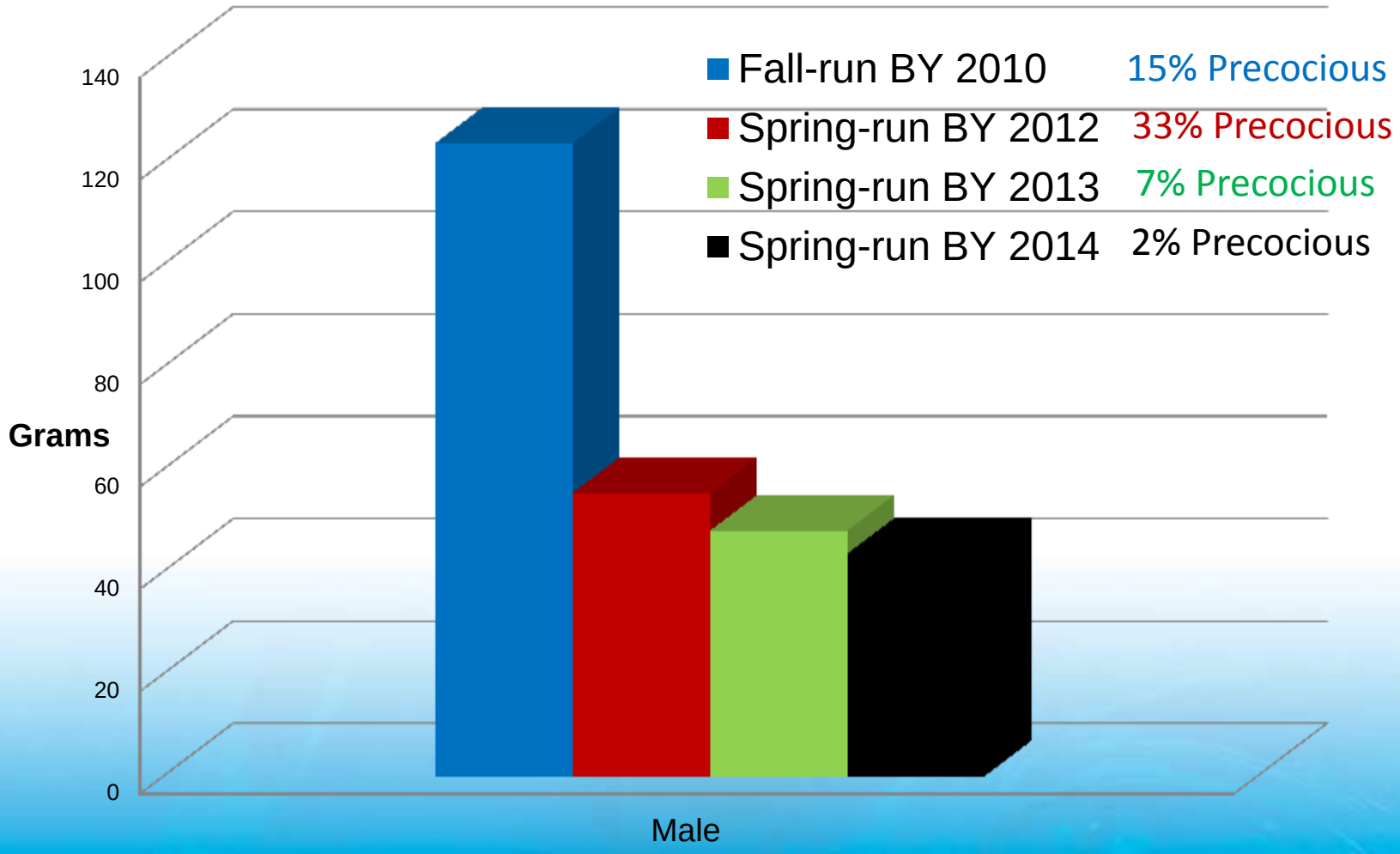
Methods



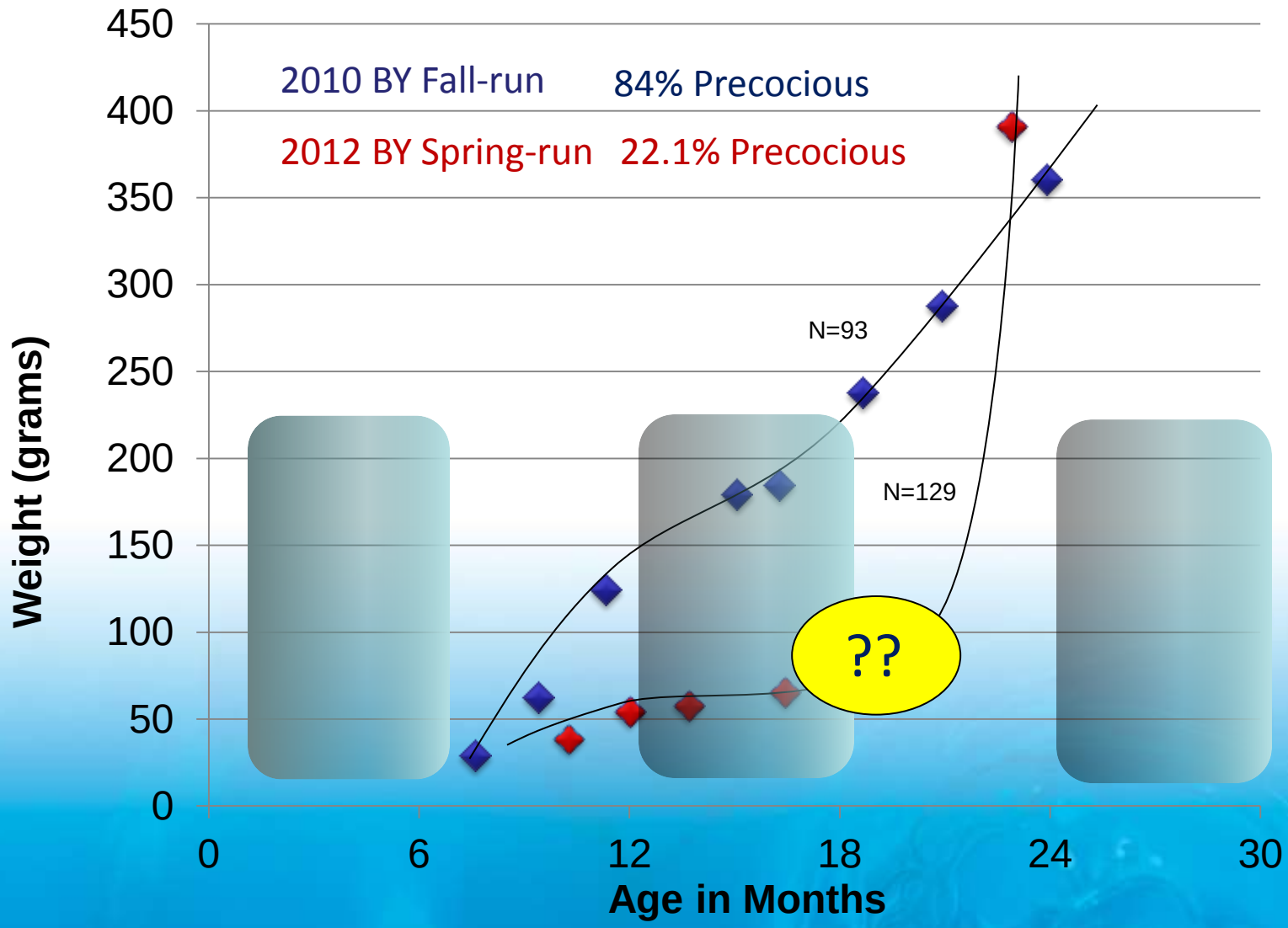
Production Strategy:

- PIT tag
- Tissue sample/genetic analysis
- Segregate by sex
- Males fed restricted rations during MDW
- Monitored for early maturation using ultrasound

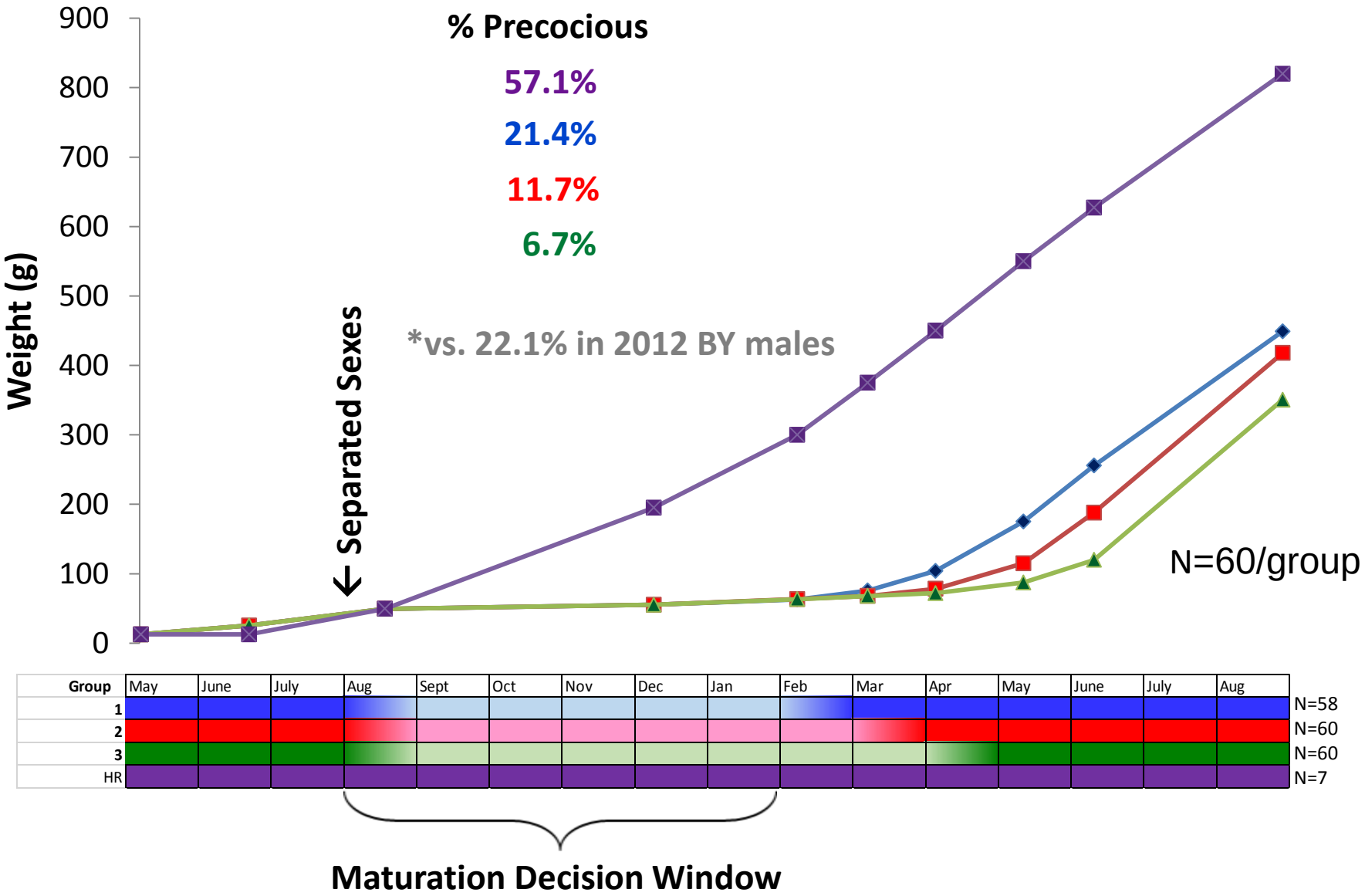
Weight comparison of four year-classes of Fall-run and Spring-run Chinook Salmon yearling broodstock



Comparison of the average weight of male 2010 BY Fall-run and 2012 BY Spring-run Chinook Salmon



Growth rate of experimental male 2013 BY Spring-run Chinook Salmon (age-2)



Period of reduced ration throughout the decision window for maturation: 2015 BY study

% Precocious

	Month											
	June	July	August	September	October	November	December	January	February	March	April	May
Sample Group												
C						32						
D						27						
E						19						

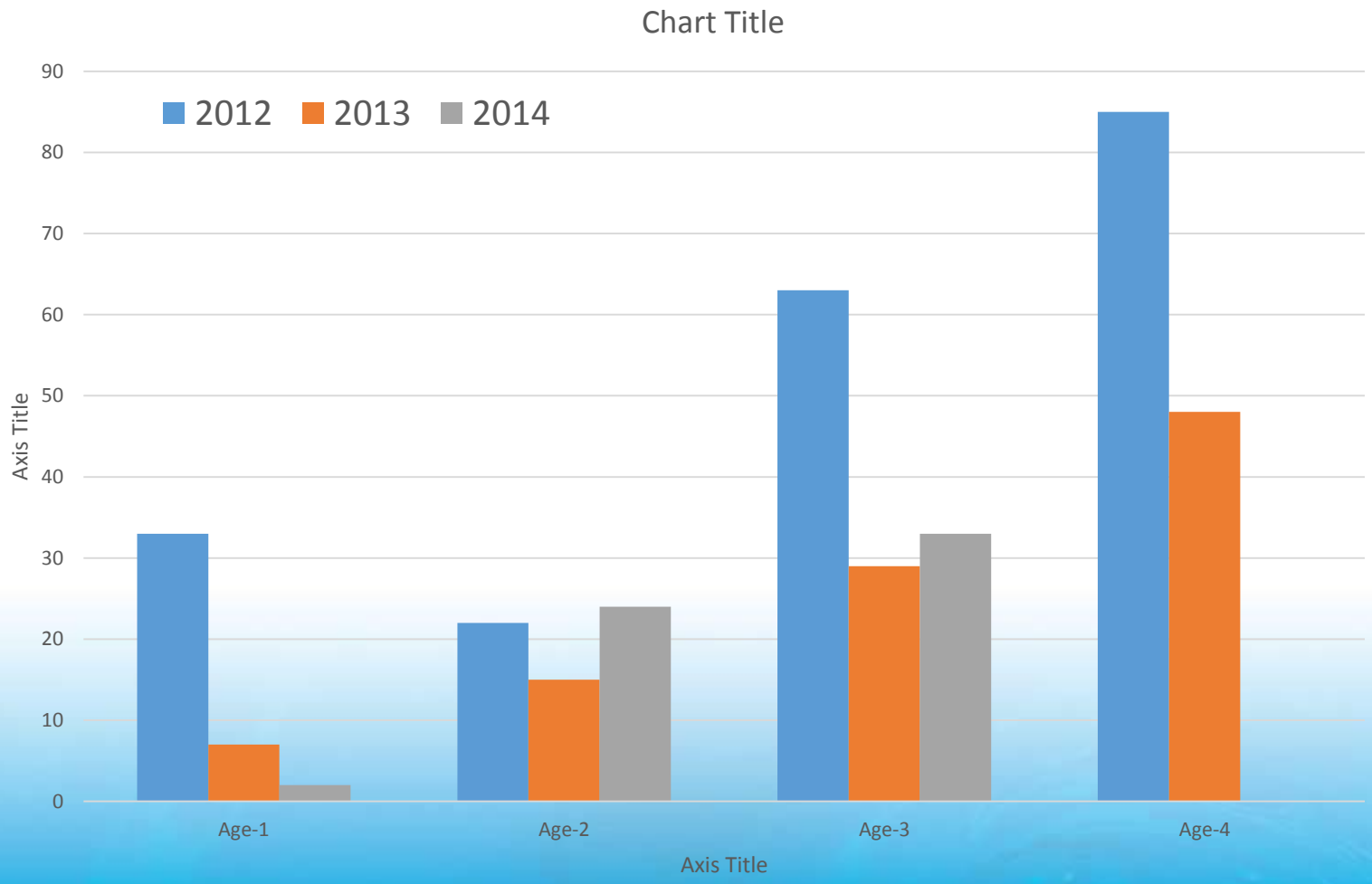
	Month											
	June	July	August	September	October	November	December	January	February	March	April	May
Sample Group												
A						28						
B						28						
C						32						

	Month											
	June	July	August	September	October	November	December	January	February	March	April	May
Sample Group												
A						28						
F						10						
E						19						

*** Compared to 61% precocious males in untreated males**

High Ration (120% AGR)
Low Ration (25% AGR)

Percent of Maturing Males at the San Joaquin Salmon Interim Facility by Age and Brood Year

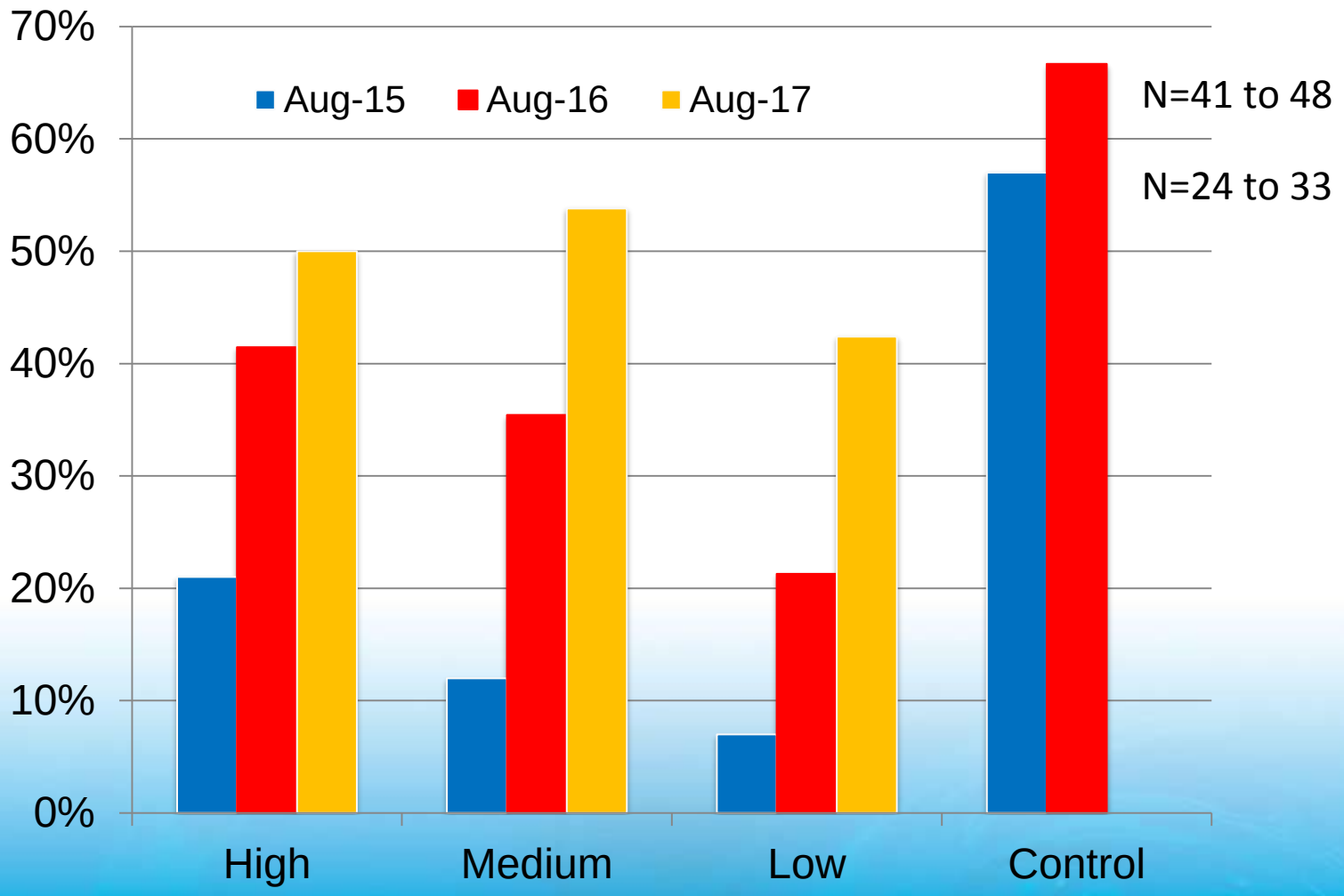


Age-class of adults returning to Feather River Hatchery between 2000 – 2004

Percent by Age of Spawning Run to Returning to Hatchery				
Year	Age2	Age 3	Age4	Age 5
2000	10.4	48.0	41.5	0.01
2001	3.1	70.3	26.3	0.03
2002	4.9	48.8	45.5	0.05
2003	5.9	17.7	76.0	0.04
2004	30.2	49.7	16.9	3.3

FRH HGMP 2012

Percentage of mature salmon at age-2, -3, and -4 from the 2013 BY Precocity Study



What We Learned

- Beginning to understand the mechanisms associated with precocity
- We are can now use temperature and modulated growth rate to influence precocity
- Early manipulations of growth rate and precocity appear to be influencing maturation in subsequent years

Implications

- Hatcheries are capable of effecting the age of maturation in salmonid populations
- Hatcheries can employ strategies to reduce early maturation
- Hatcheries may be able to develop strategies to reach size targets for juveniles without increasing precocity rates

Future Areas of Investigation

- Determine the actual cause of the reduction in early maturation that we are experiencing
- Investigate the effects that different feeding regimes have on female maturation
- Investigate whether high growth rates in the wild influence precocity rates
- Investigate the long-term effects to maturation of reducing feed levels at early life stages

Acknowledgements

- US Fish and Wildlife Service
- National Marine Fisheries Service
- NOAA's Southwest Fisheries Science Center
- US Bureau of Reclamation
- UC Davis Genomic Variation Lab
- Matt Bigelow - CDFW