Reproductive success and phenotypic selection gradients in hatchery- and natural-origin Chinook salmon in Catherine Creek, Grande Ronde basin (Northeast Oregon)

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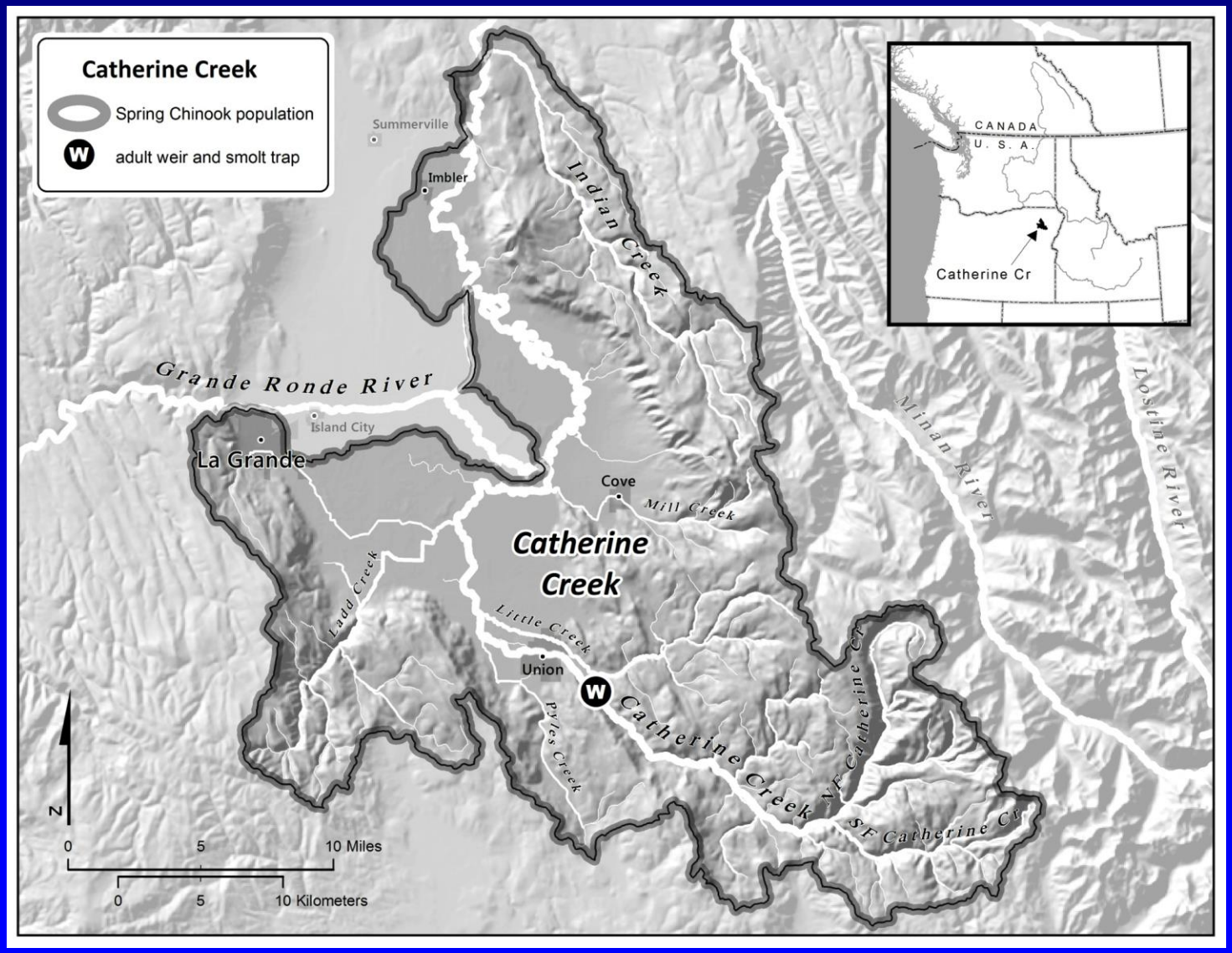
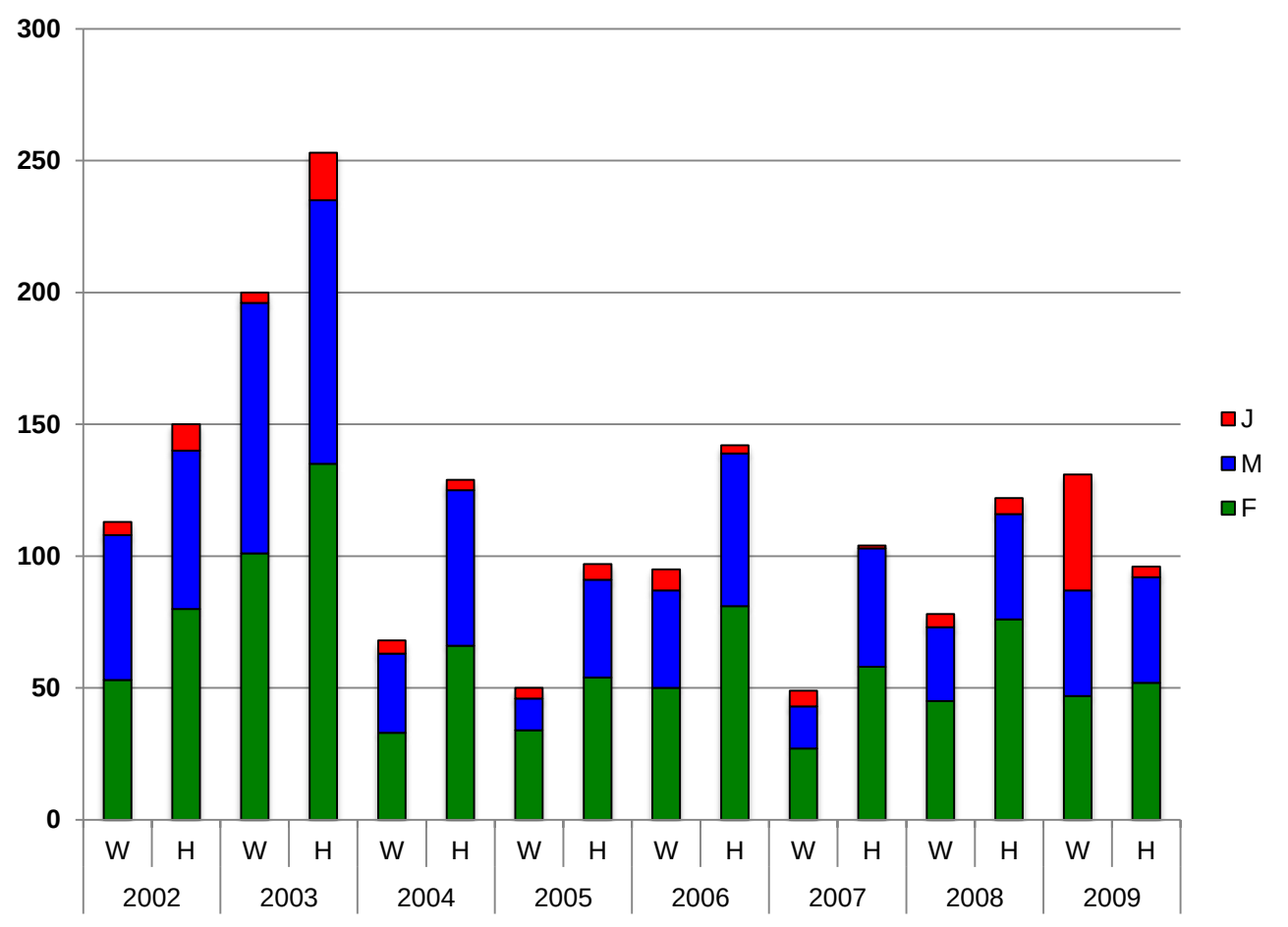
Catherine Creek captive broodstock program



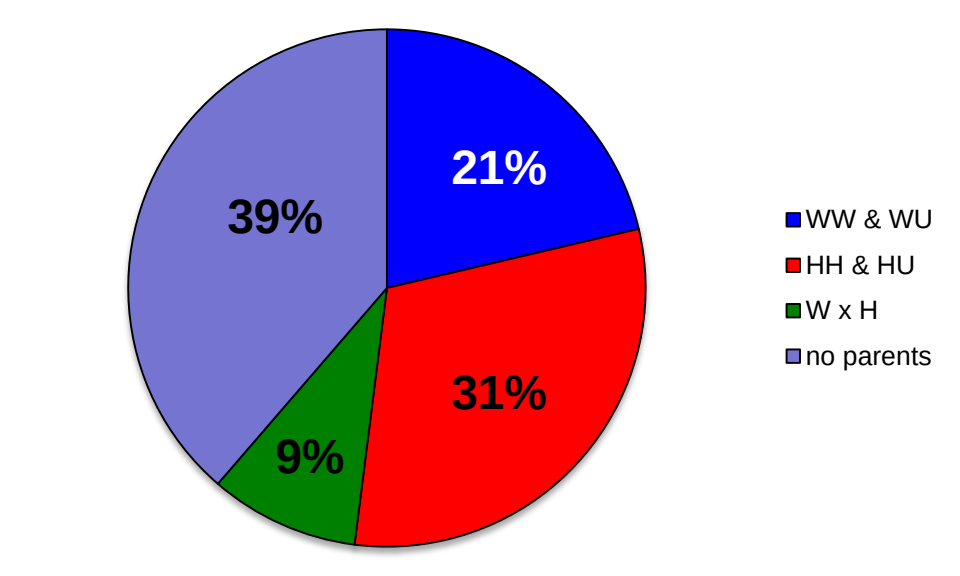
Pedigree analysis

- Sampled adults, parr, migrants, precocious parr
- 10 GAPS microsatellites
- Pedigrees by exclusion
- Reproductive Success (RS) = # offspring/parent
  - RRS = RS (hatchery)/RS (wild)
- Generalized Linear Modeling--phenotypic factors most important for RS
- Adult-to-juvenile, adult-to-adult results

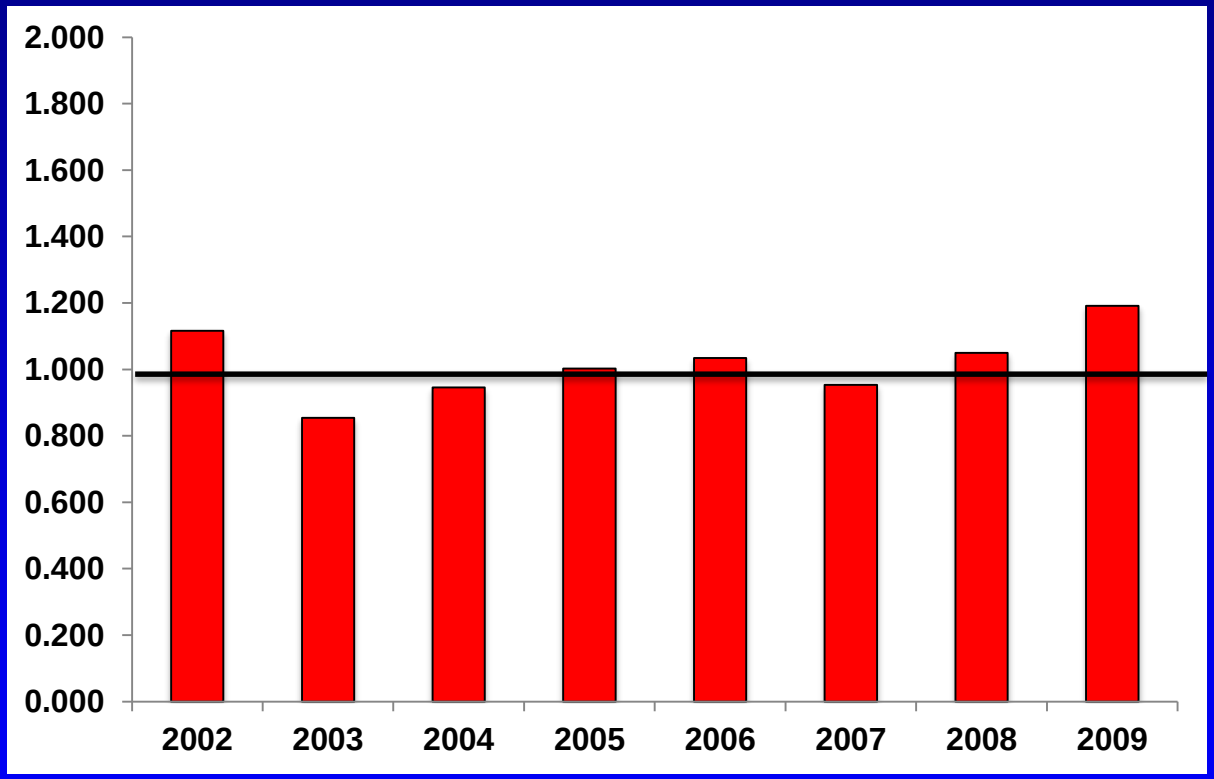
Sex and origin of spawning adults



Origin of “Conventional” broodstock

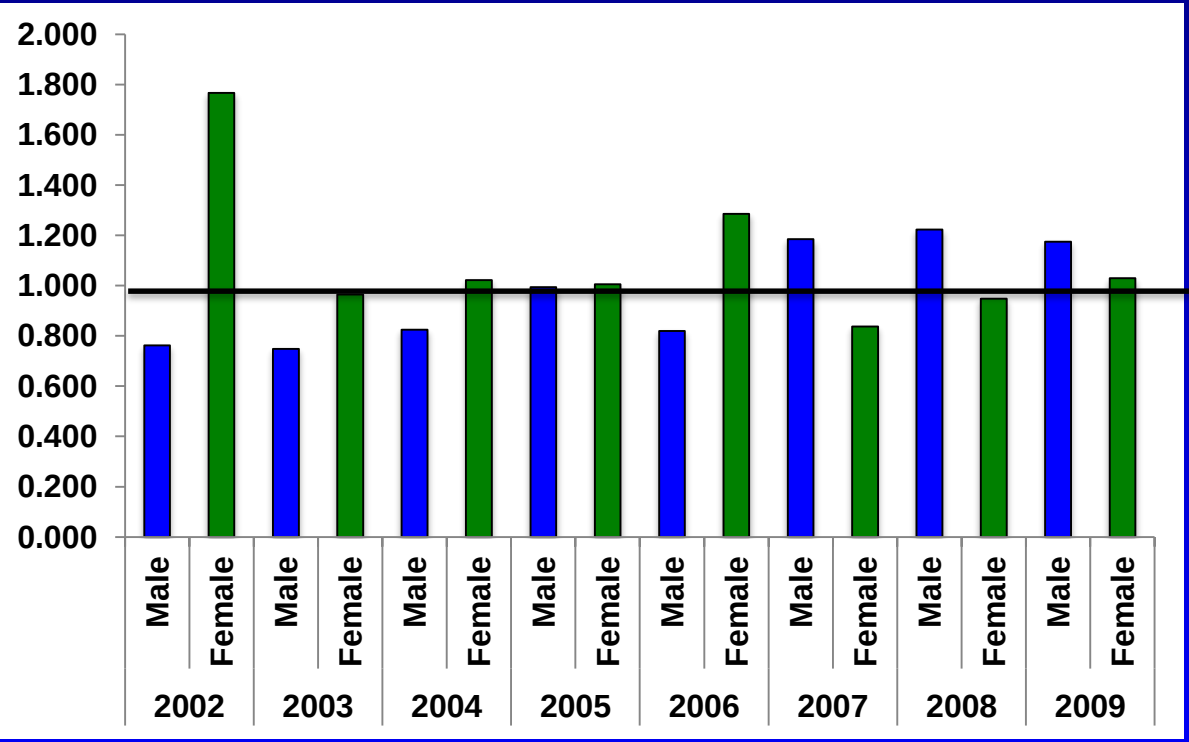


RRS H/W--Origin
(juvenile offspring)



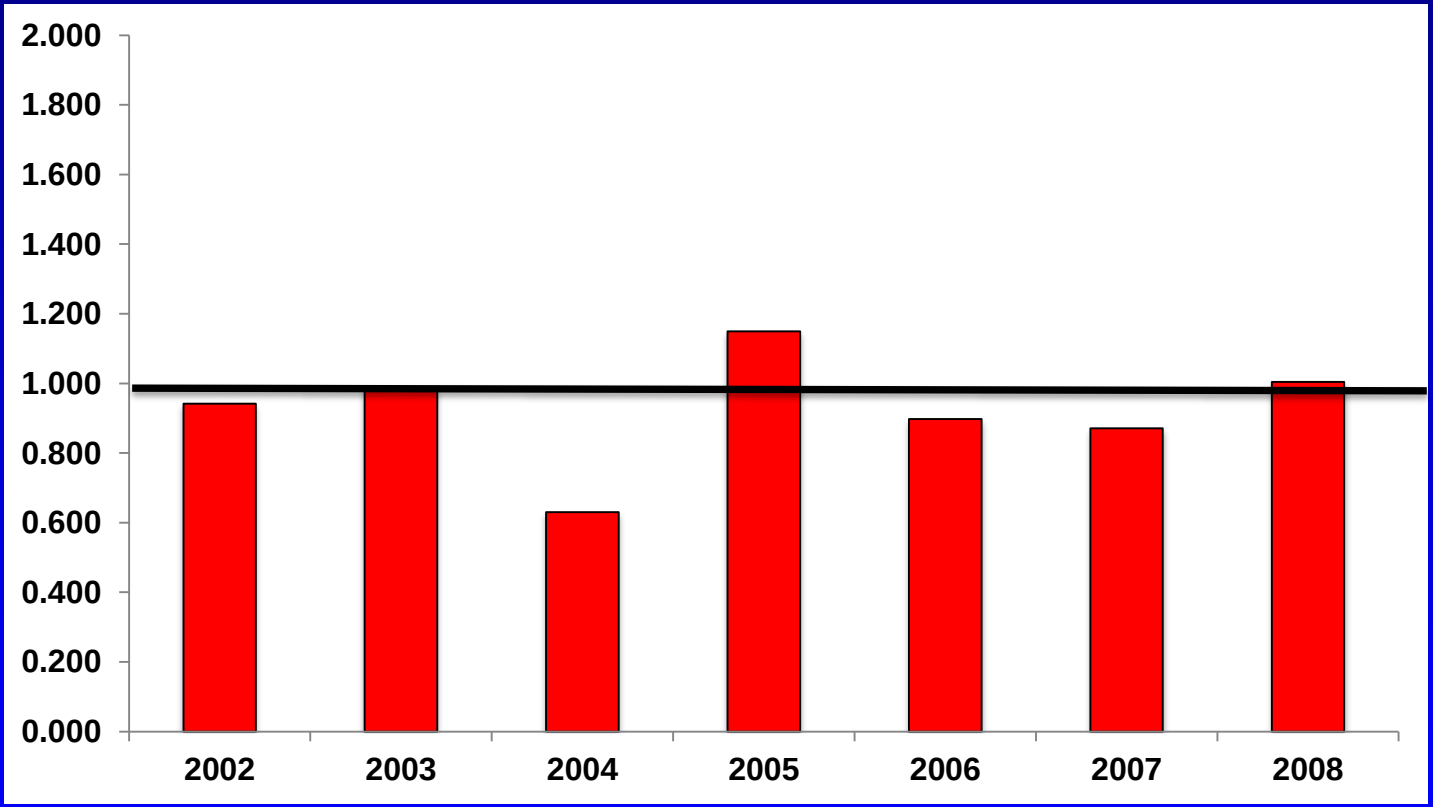
Geomean = 1.013

RRS H/W—Sex, Origin
(juvenile offspring)



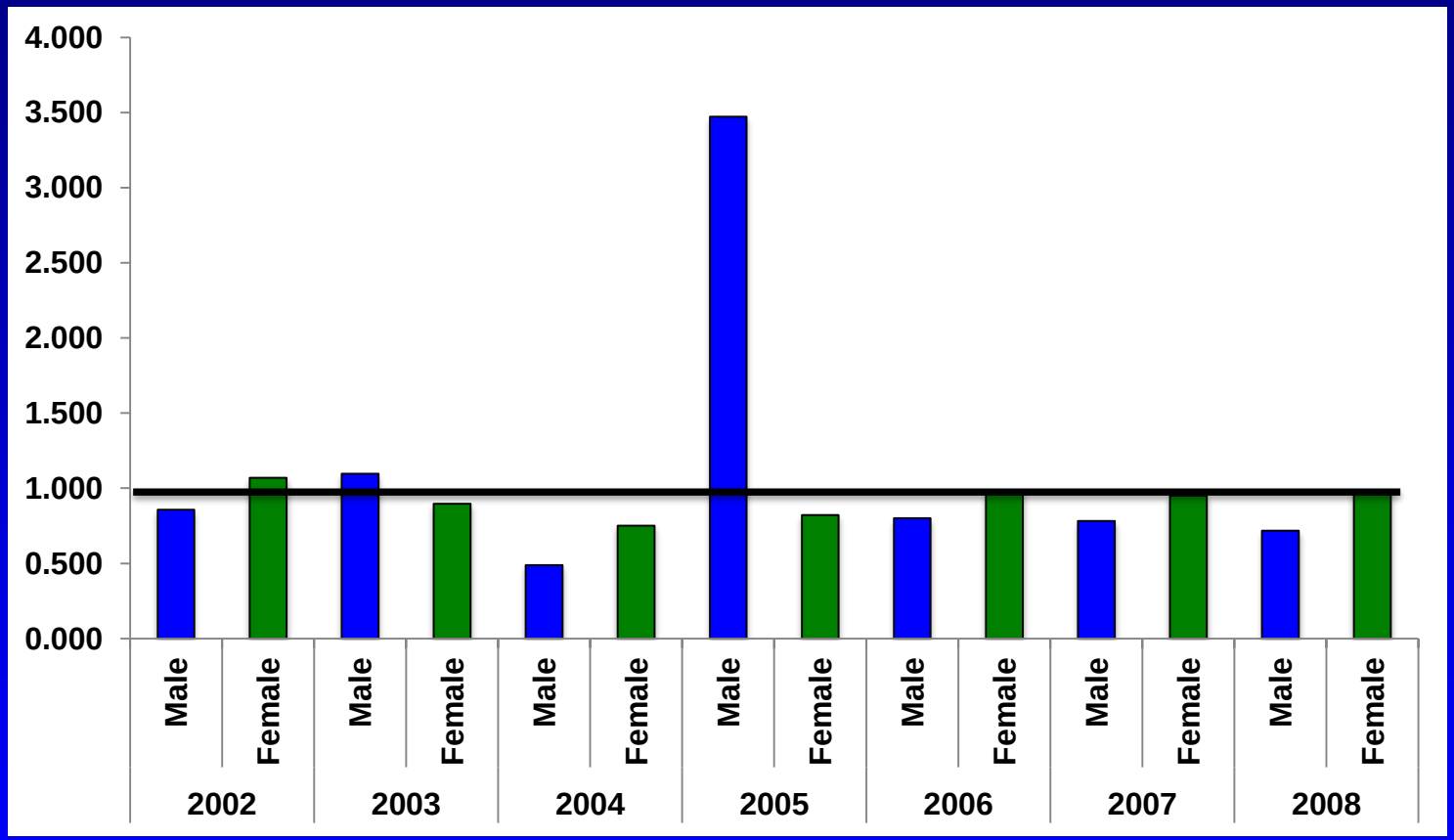
Geomean F = 1.079
Geomean M = 0.948

RRS H/W--Origin
(adult offspring)



Geomean = 0.913

RRS H/W—Sex, Origin
(adult offspring)



Geomean F = 0.918
Geomean M = 0.954

RRS
juvenile vs. adult offspring

- Easier to get large numbers of juveniles
- Potentially different RRS
- Low numbers of wild adults for analysis*

	Juvenile	Adult
Origin	**1.013**	**0.913**
Female	**1.079**	**0.918**
Male	**0.948**	**0.954**

*Christie et al. 2014 power analysis

Life history variation—
Male age-at-return

- Jacks passed in relatively low numbers
- Lower RS than older males in most years, some years have high RS (= large variance)

Inheritance of “Jack” trait

	N	% jack parents
Jack returns	17	0.53
Adult male returns	381	0.07

Precocious parr

- ~140 individuals over 4 years
- Identified their parents
  - Nearly all were 2-year-olds
  - Both W- and H-origin parents
- Identified their offspring, 3 of 4 years
  - Equal-opportunity spawners (but low #s)
- *Do particular families produce PP?*

Male RRS by age
(relative to 4's/5's)

Age	Juvenile Offspring	Adult Offspring
2	0.065	0.098
3	0.523	0.59
4's / 5's	1.000	1.000

Proportion of missing parents

	% Total Offspring
Two parents	39
Missing Dam	11
Missing Sire	28
Missing both	22

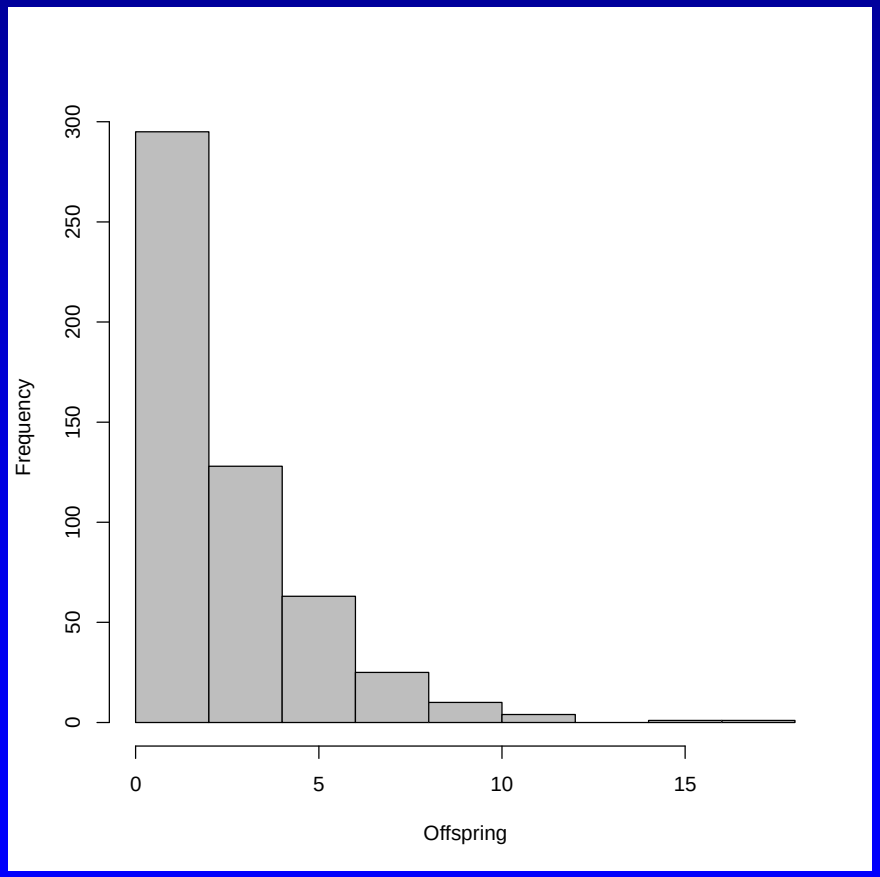
GLM--Covariates assessed*

- Sexes analyzed separately
- Year as fixed effect (factor)
- Origin (Captive, Conventional, W)
- Age of male parent
- Julian Day, Julian Day ^ 2
- Length
- Mate characteristics
  - # Mates
  - # Wild mates
- stepAIC() used for model selection

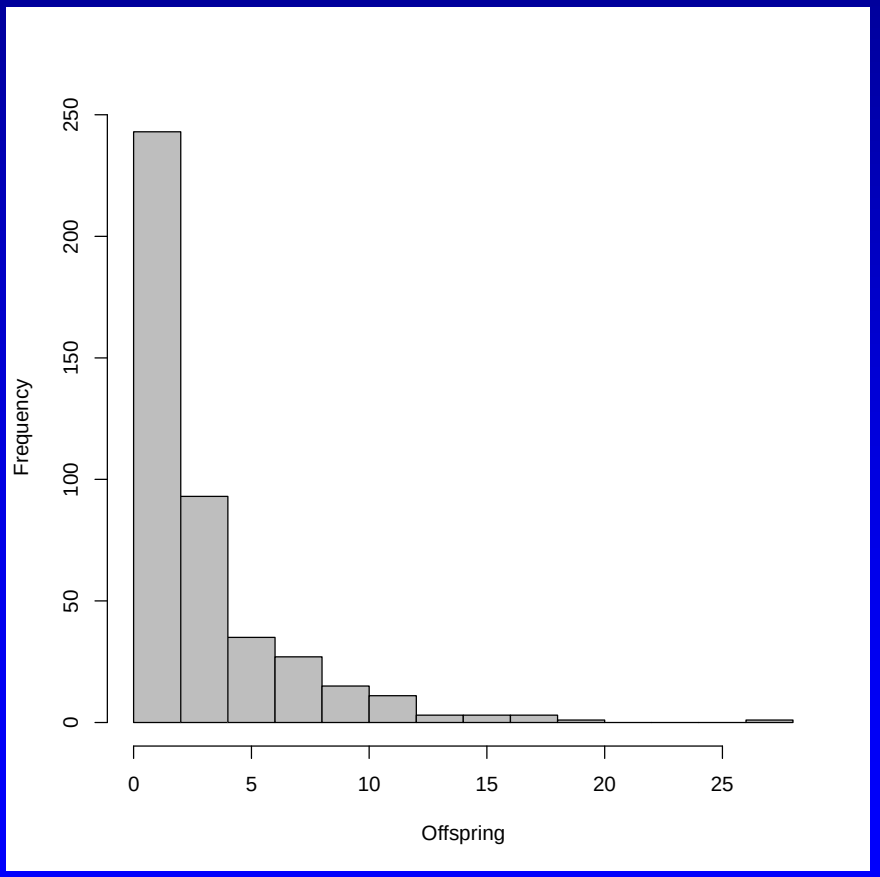
**Extremely preliminarily so…*

RS data are not normally distributed

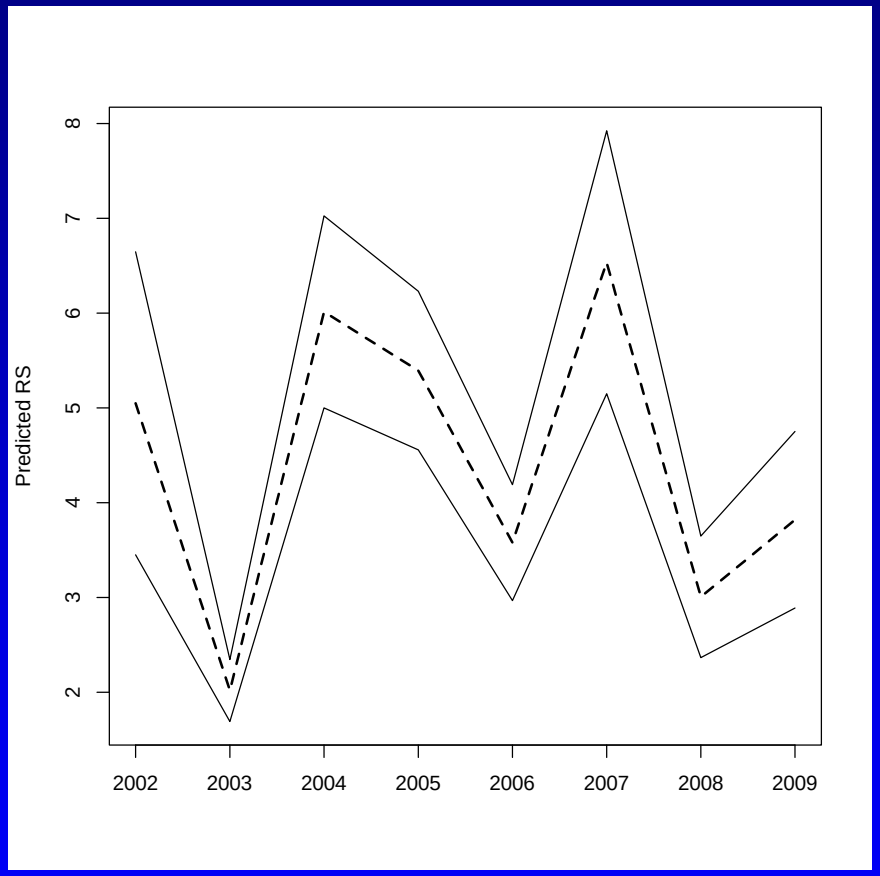
Female RS (n = 527)



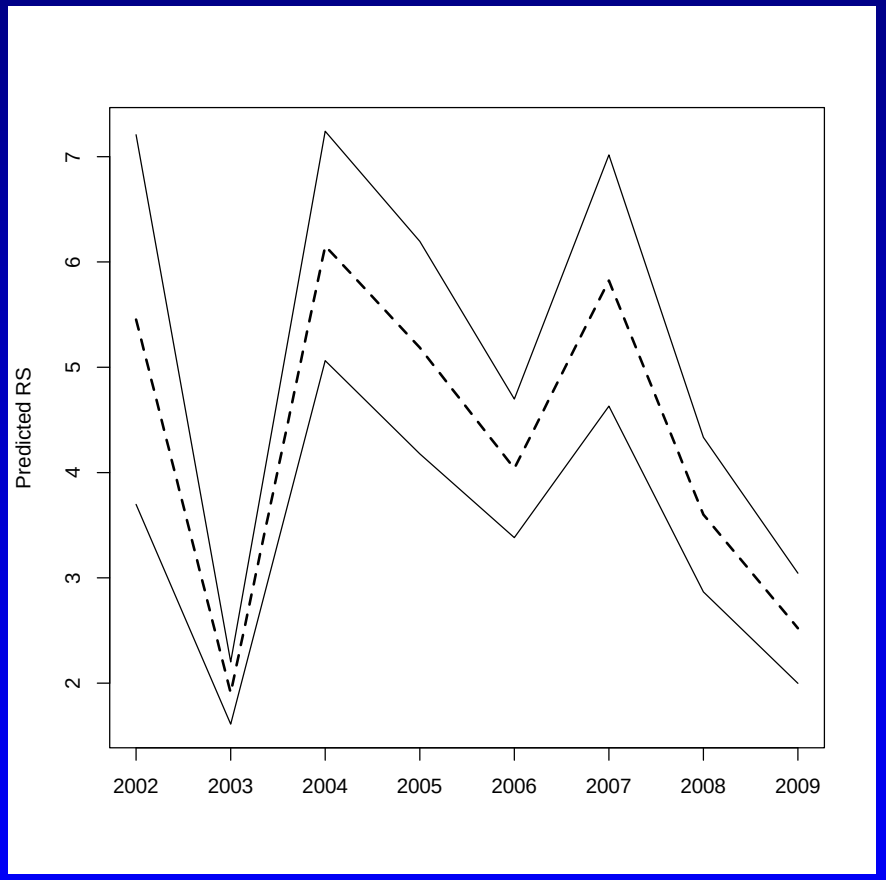
Male RS (n = 435)



Year -- highly significant

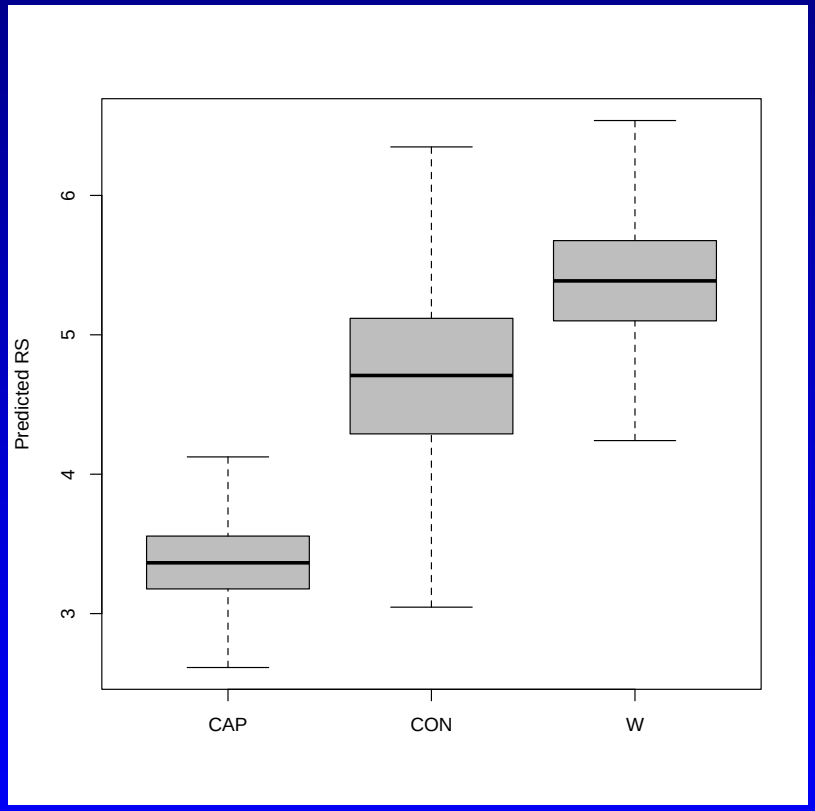


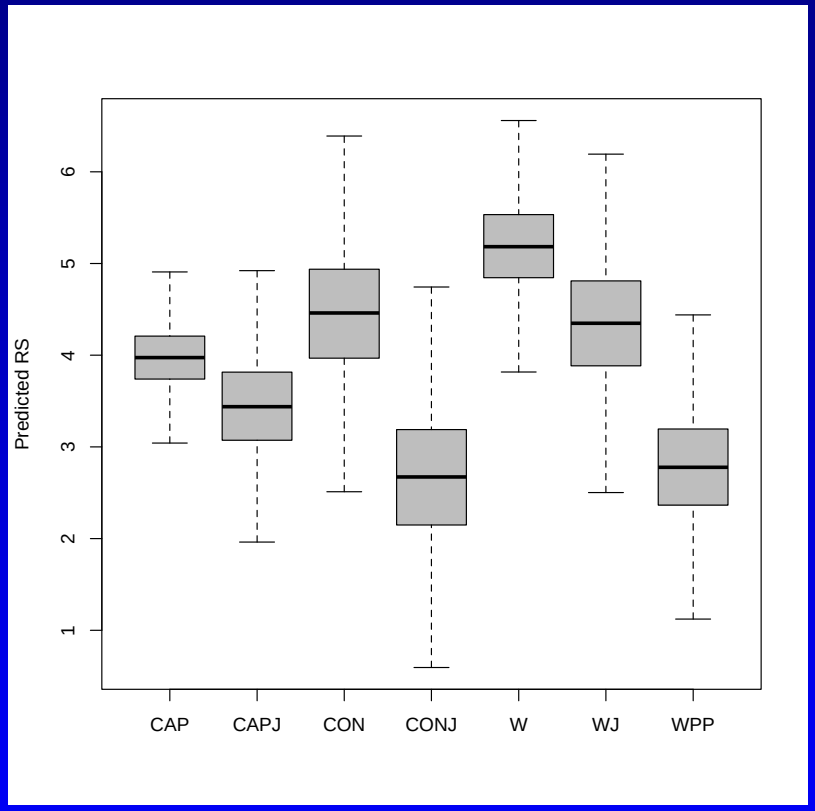
Females



Males

Origin





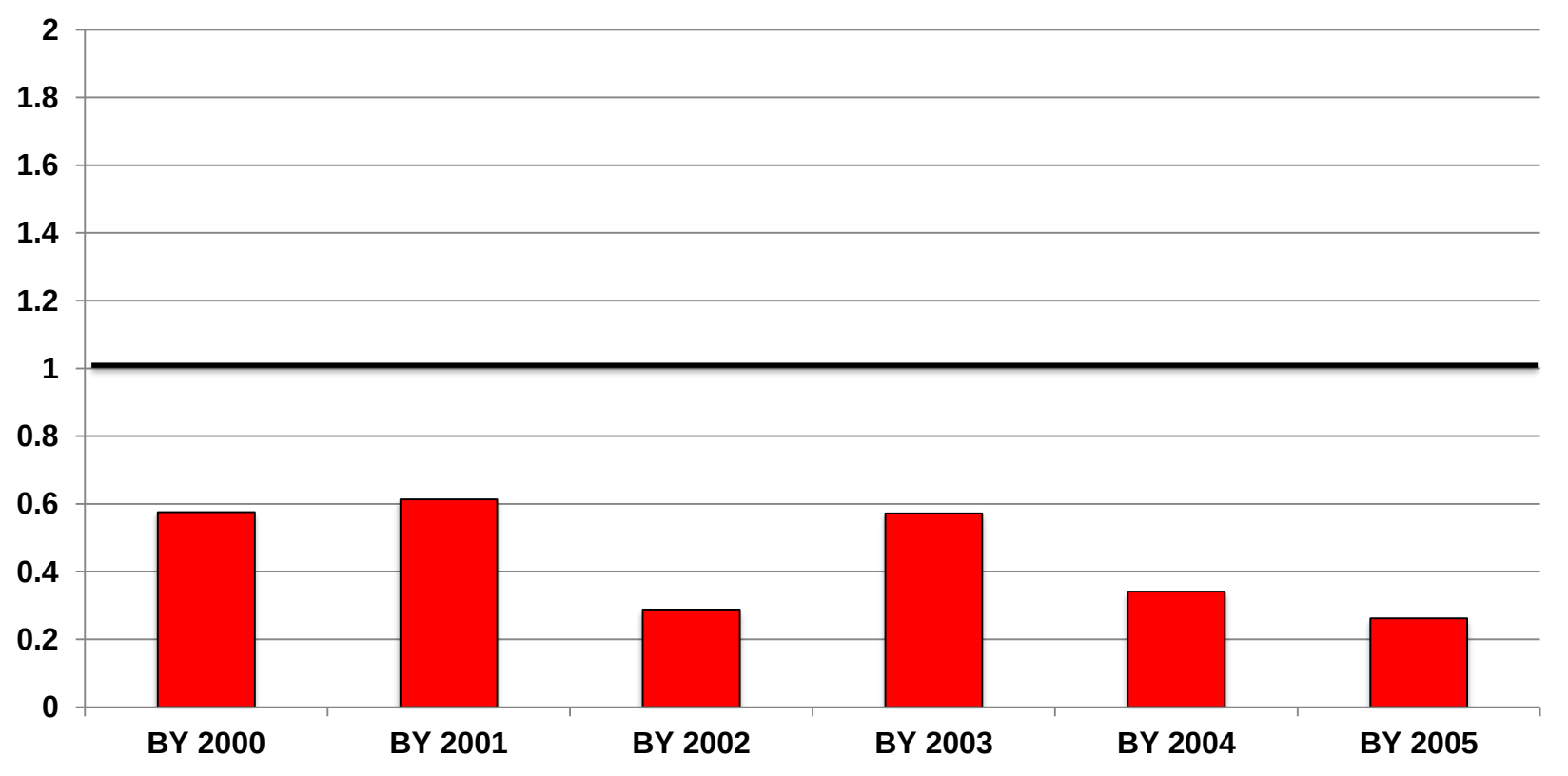
Females

Males

Results of Catherine Creek pedigree study

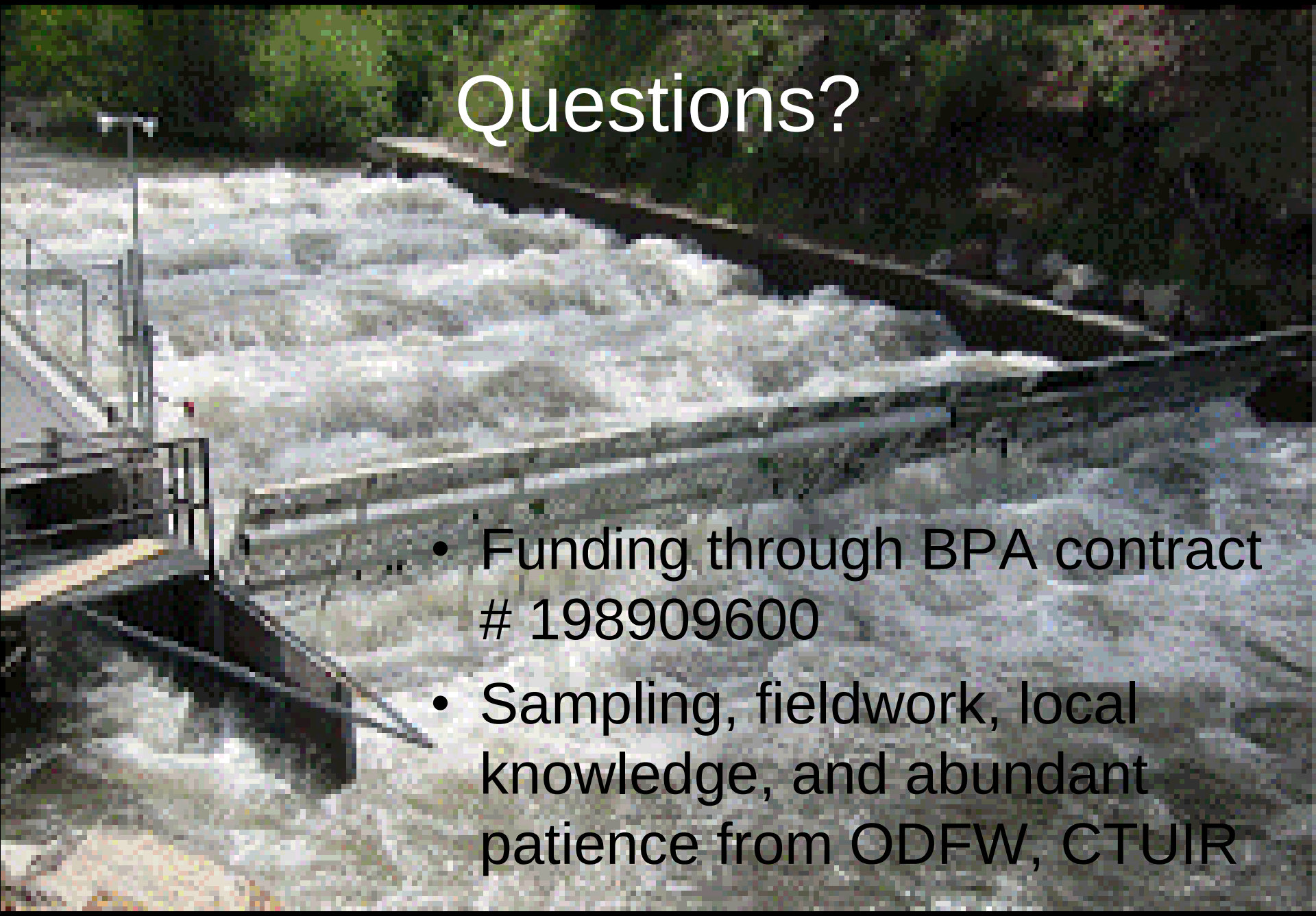
- ~ Equal RRS measured with juvenile offspring, lower (non-significant) as adult offspring
- Year, origin, length, # of mates significant
- Conventional program fish slightly higher RS than Captive
- Jacks and precocious parr do contribute, less than older males

Comparison—Little Sheep Creek steelhead RRS H vs. W



Berntson et al. (2011) TAFS 140:685-698.

- *Next steps:*
  - *Which factors key to survival from juveniles to adults?*
  - *Why big differences between species and systems?*
  - *Do RS results change with more generations in hatchery?*



Questions?

- Funding through BPA contract # 198909600
- Sampling, fieldwork, local knowledge, and abundant patience from ODFW, CTUIR