

Alaska Hatchery Research Program: Study Question 3: Mechanisms Driving RRS



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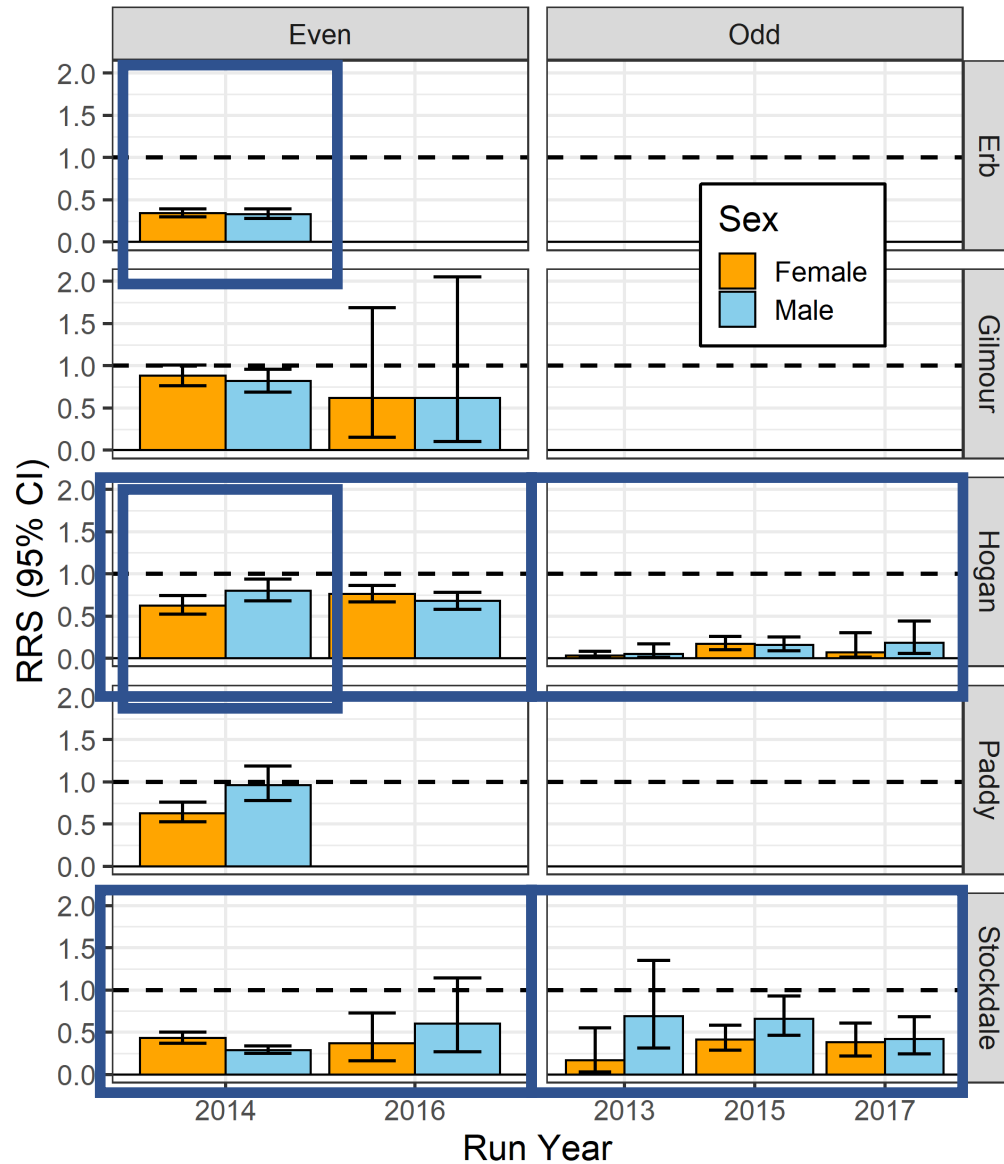
RRS Estimates: 40% Complete

RRS Interpretation: 20% Complete

- F1 for pink salmon: Much in; what patterns will hold?
 - Started: 5 streams for even, 2 for odd
 - Completed: 3 streams for even, 2 for odd
- F2 for pink and F1 for chum salmon: very limited:
 - Across generations (grand offspring)
 - Across species (chum salmon)



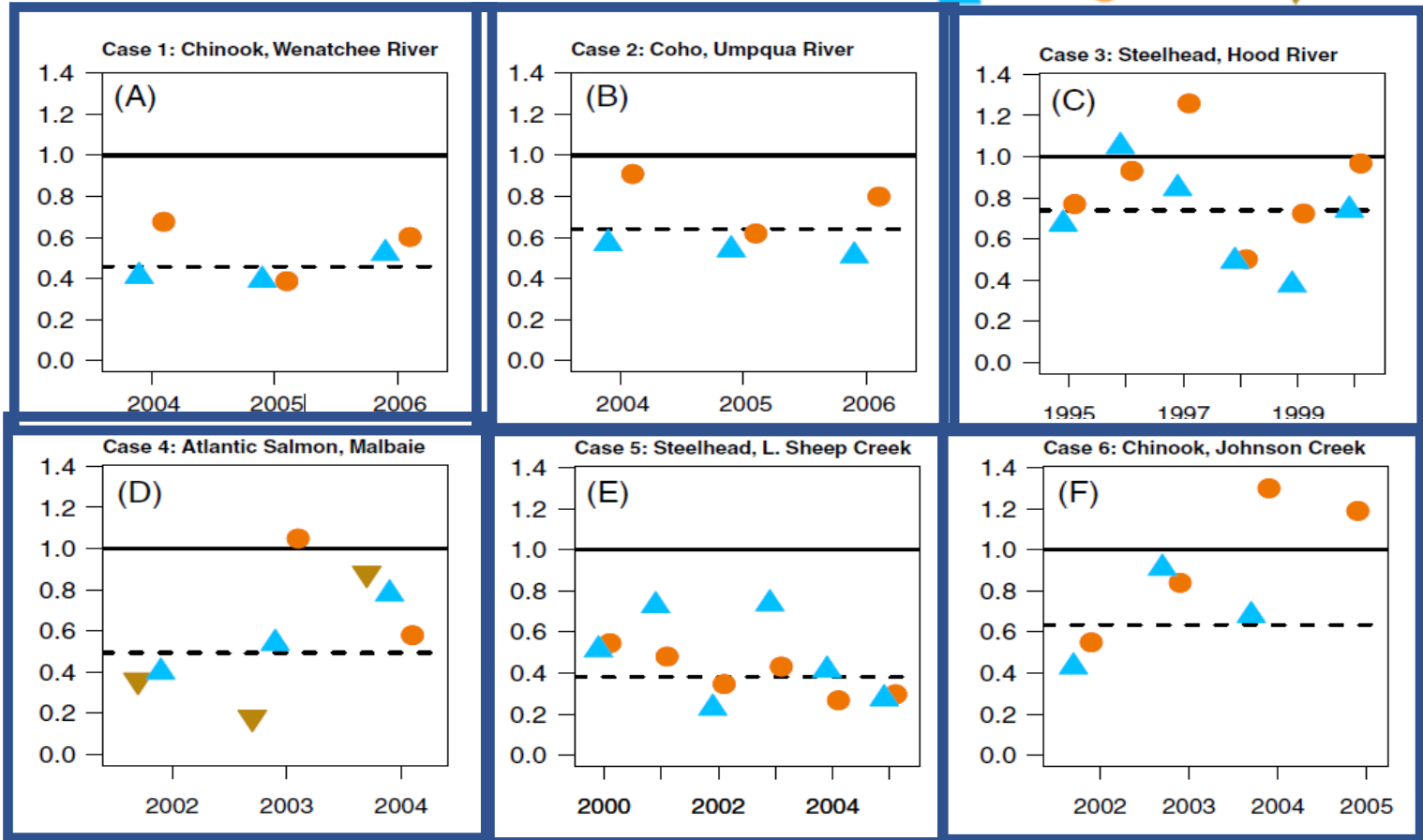
Results to Date: Consistent Reduced RRS, but More to Come on Interannual and Lineage Patterns



Examples of RRS Across Years Within Species and Locations

▲ Male ● Female ▼ Unknown

Relative reproductive success



From Christie et al. 2014;
original data various sources

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- F2 for pink and F1 for chum salmon: very limited:
 - Across generations (grand offspring)
 - Across species (chum salmon)
- **We do not know what is driving RRS**
 - Once we have more results, we can further investigate mechanisms

Many Mechanisms May Drive Measured RRS: Here are a Few

Many generations
(e.g. genetic)

One generation
(e.g. non-genetic)



Relaxation of natural selection

Relaxation of Selection: A Genetic Example

- Hatcheries increase survival – that’s the whole point
- Most mortality in the wild is due to unsurvivable events, e.g.:
 - Too much rain – scouring
 - Too little rain – dewatering
 - Too cold – freezing
 - Disturbance
- Some mortality in the wild is caused by genetic issues:
 - Most of these would die in a hatchery anyway
 - Some might survive in a hatchery, e.g.:
 - Lack of disease resistance
 - Inability to avoid predators
 - Intolerance for temperature or oxygen fluctuations
- The conditions in the hatchery do not select out the same fish as the conditions in the wild
 - Inadvertent “domestication selection”

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Relaxation of natural selection

Spawning ground familiarity

Spawning Ground Familiarity: A Non-Genetic Example

- Homing fish have the potential to find the location where they incubated
- These incubation locations were suitable (otherwise the fish would not have survived)
- Straying fish (regardless of origin), need to identify a suitable location
- Straying fish that do not find a suitable location, will produce fewer (if any) progeny
- Straying fish that find suitable locations, produce progeny that, if they home, will have the homing fish advantage
- Therefore, most of this effect is wiped out the next generation

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Relaxation of natural selection

Spawning ground familiarity

Epigenetics

Genetic drift

Broodstock incompatibility

Mate selection

Run timing-associated variables

- Fishery prosecution
- Spawning ground competition
- Straying fish delays
- Temporal sampling biases

Teasing Out Mechanisms Driving RRS

- Correlating patterns and mechanisms
 - Timing of spawning
 - Location within stream
 - Fishery prosecution
- Grandparent RRS
- Historical and contemporary genetic structure (PWS)
- Soon: whole genome sequences



Questions?

