Assessing Mechanisms Driving Relative Reproductive Success

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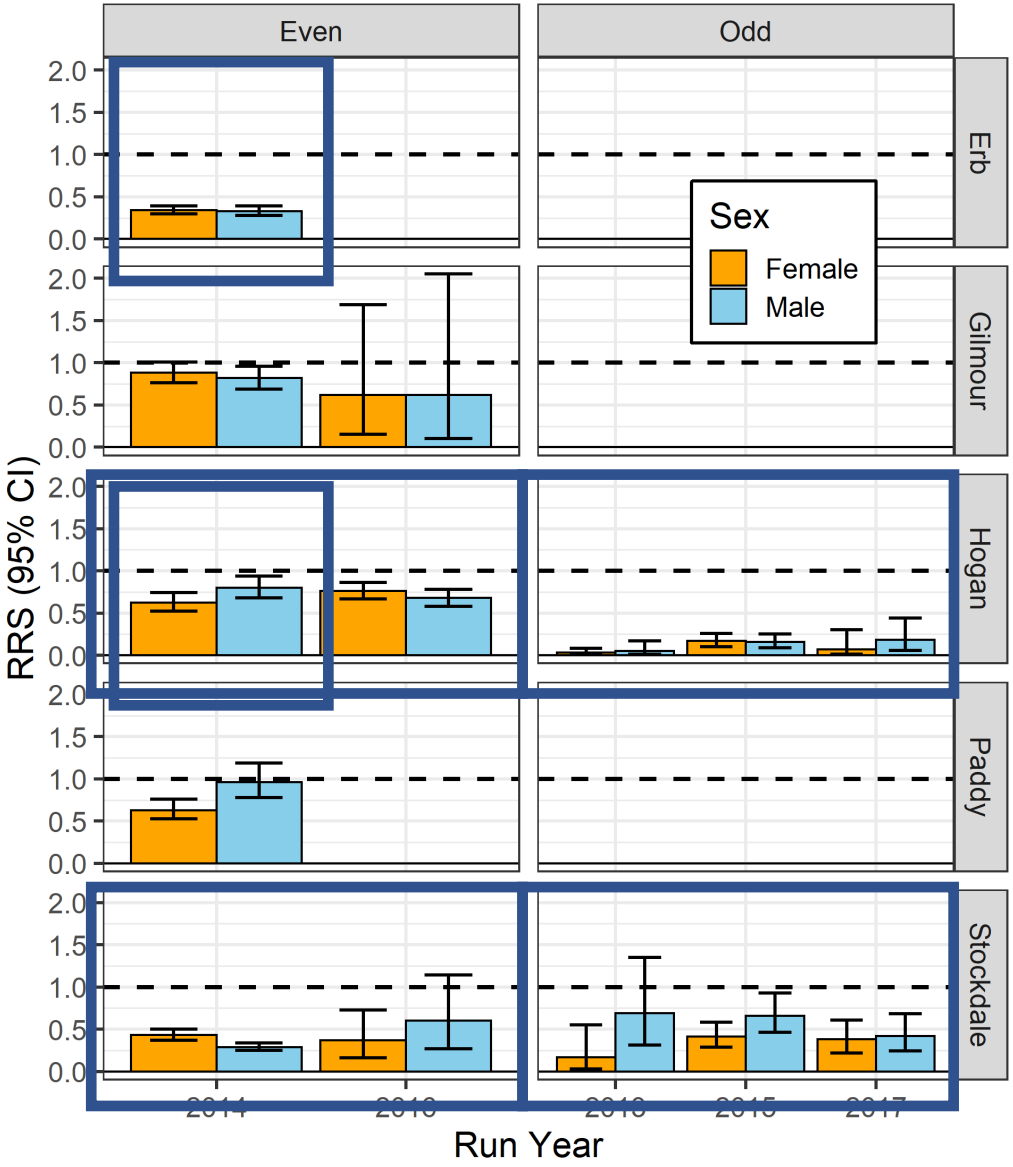
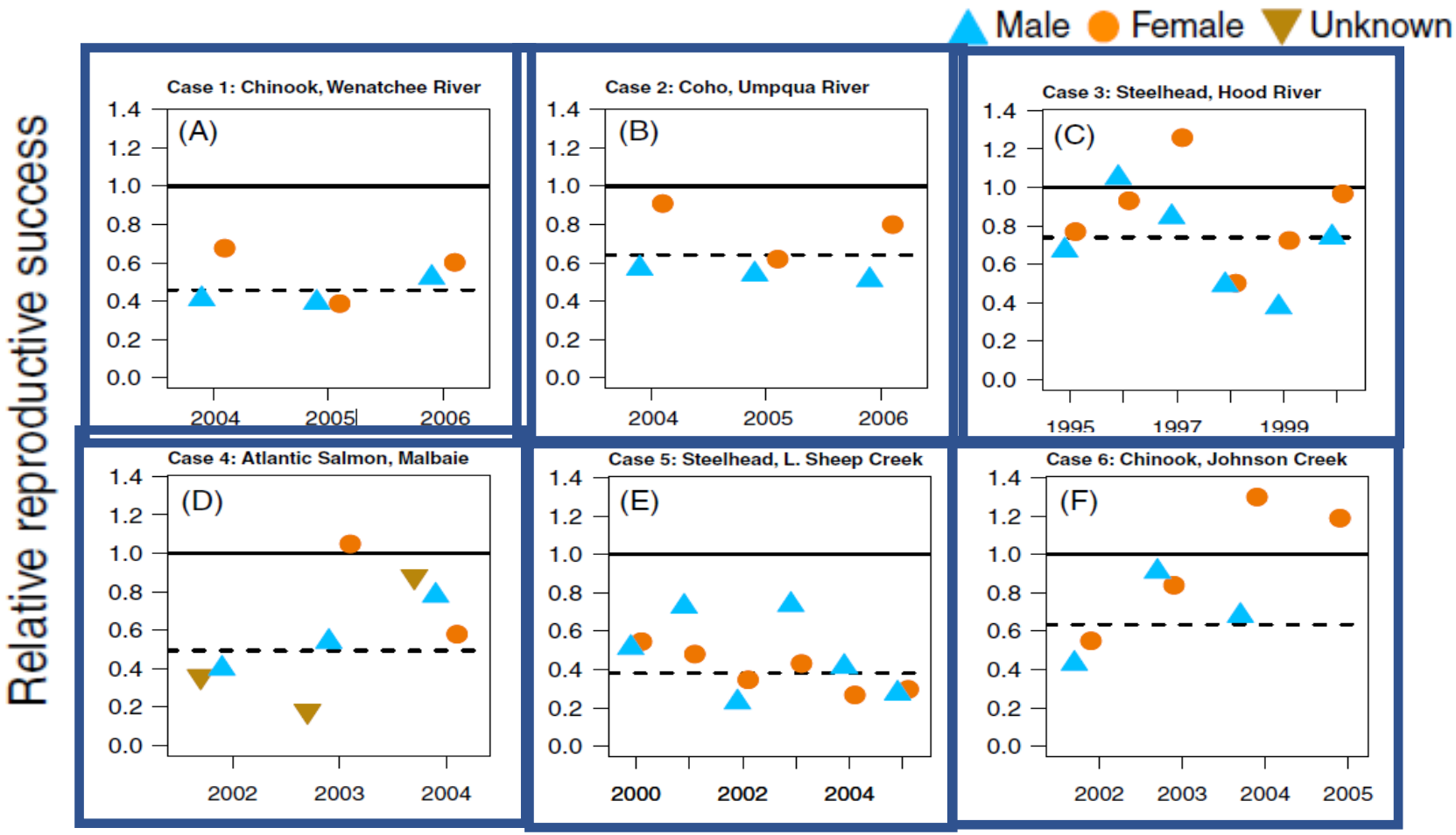
RRS Estimates: 40% Complete
RRS Interpretation: 20% Complete

- 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 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



From Christie et al. 2014;
original data various sources

RRS Estimates: 56% 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 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"

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

Spawning ground familiarity

Spawning Ground Familiarity: A Non-Genetic Example

- Homing fish have the potential to find the location where they were 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

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

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?