Department Framework for Interpretation of Results

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Alaska Hatchery Research Program Informational Meeting

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AHRP identified three questions that would help inform policy and that were attainable

1) What is the genetic structure of pink and chum in PWS and SEAK?
2) What is the extent and annual variability of straying?
3) What is the impact on fitness (productivity) of natural pink and chum stocks?

http://www.adfg.alaska.gov/index.cfm?adfg=fishingHatcheriesResearch.main

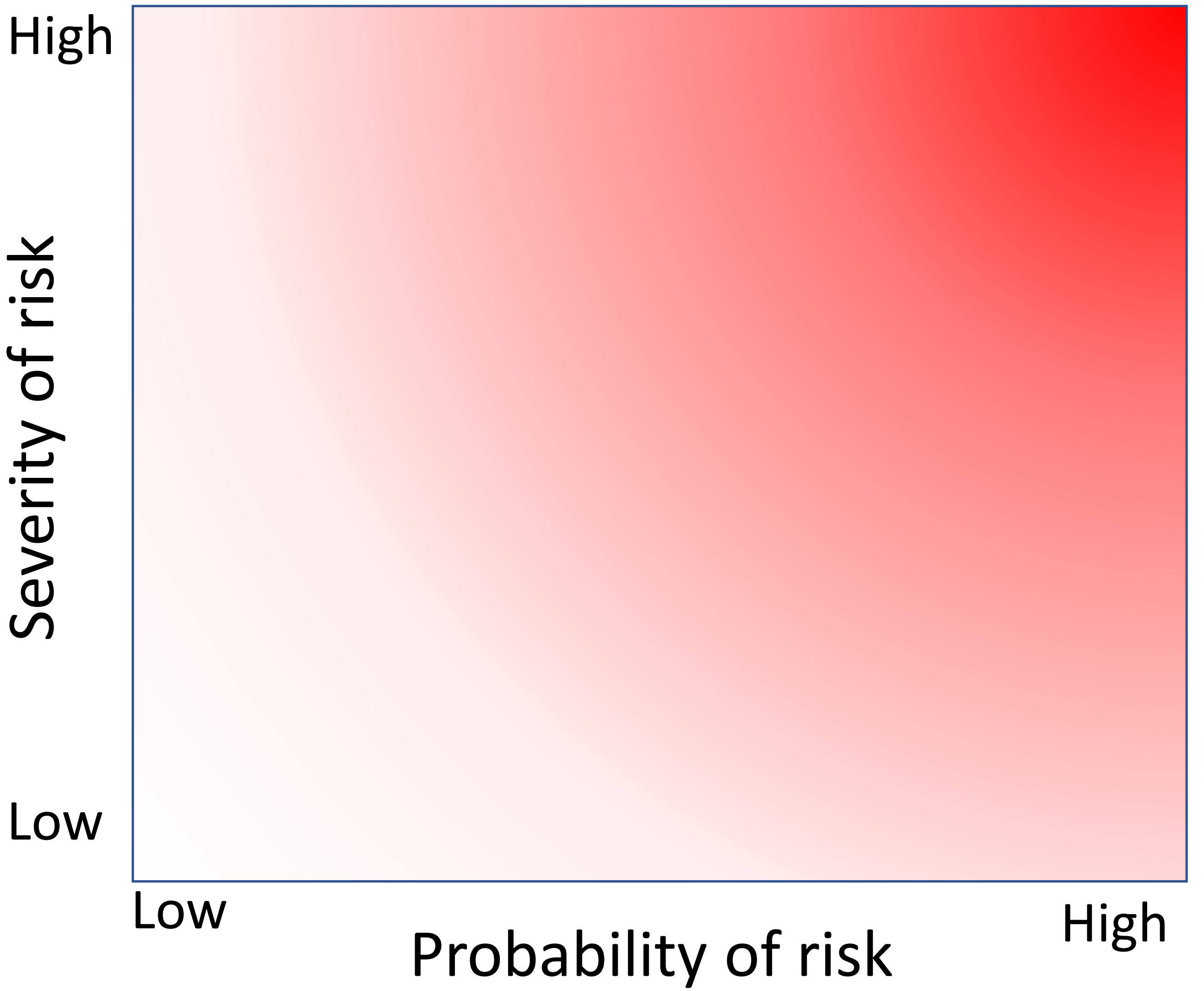
Some questions that I've been asked that are not addressed by AHRP

- What are the competition and predation effects of hatchery fish?
  - Within and across species
  - Within marine and freshwater habitats
- Do hatchery fish reduce genetic resilience of wild populations?
- If changes in productivity are observed, what mechanisms could be driving these differences?
- How will findings affect policy?
- How do these hatchery fish in wild systems affect assessment of escapement?

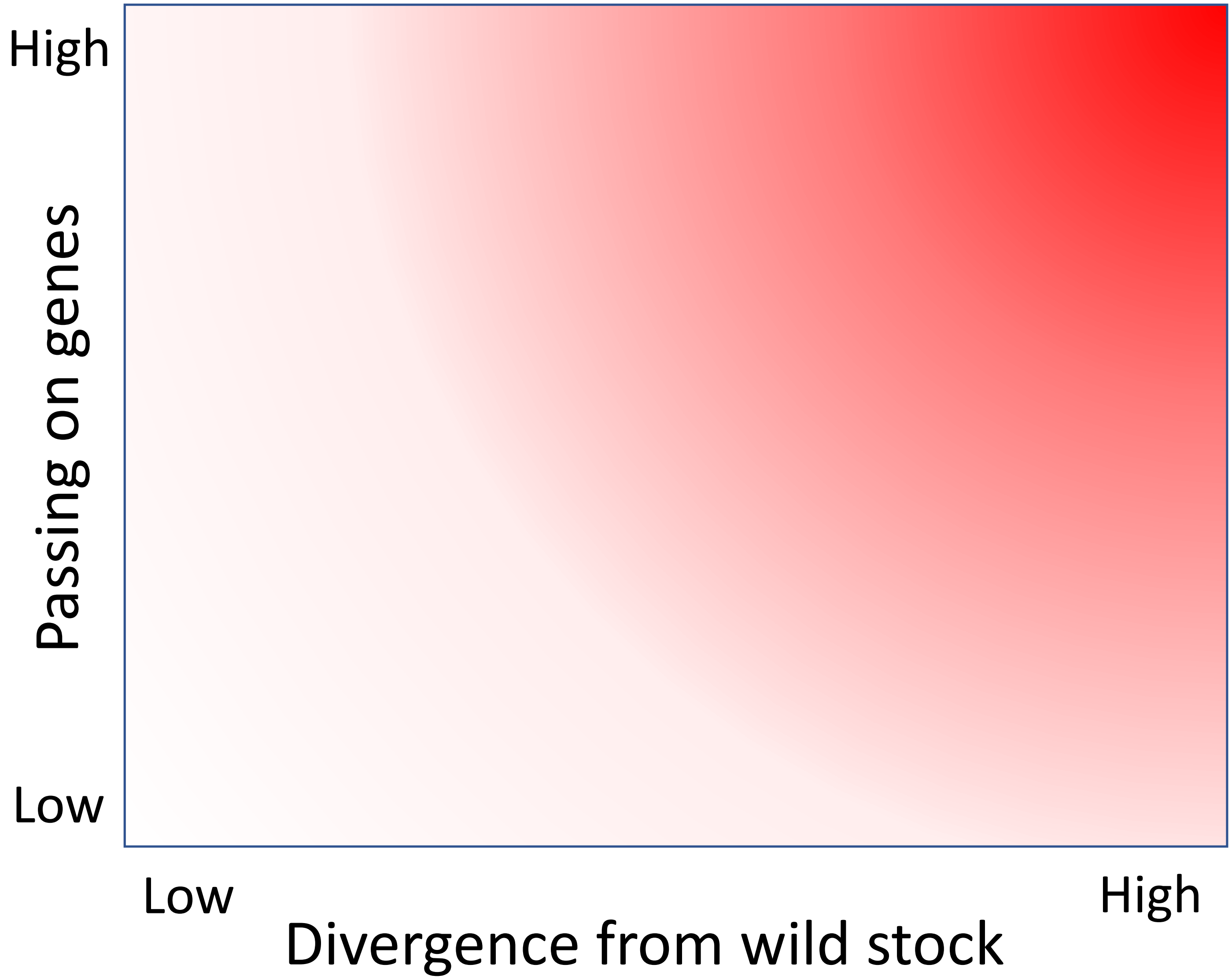
Department is assessing risk

- What we have now:
  - Wild system productivity
  - Hatchery proportions
- What we are working on now:
  - Contemporary population structure – 90% PWS and SEAK
  - Historical population structure – 50% PWS
  - RRS estimates – 7% PWS, 0% SEAK
- Once all AHRG RRS results are complete:
  - RRS interpretation
  - Implications for assessment of escapement
- In the meantime, literature review
  - Genetic resilience of wild populations
  - Competition and predation effects of hatchery fish
    - Within and across species
    - Within marine and freshwater habitats
- Analyses and interpretation will inform policy maker decisions

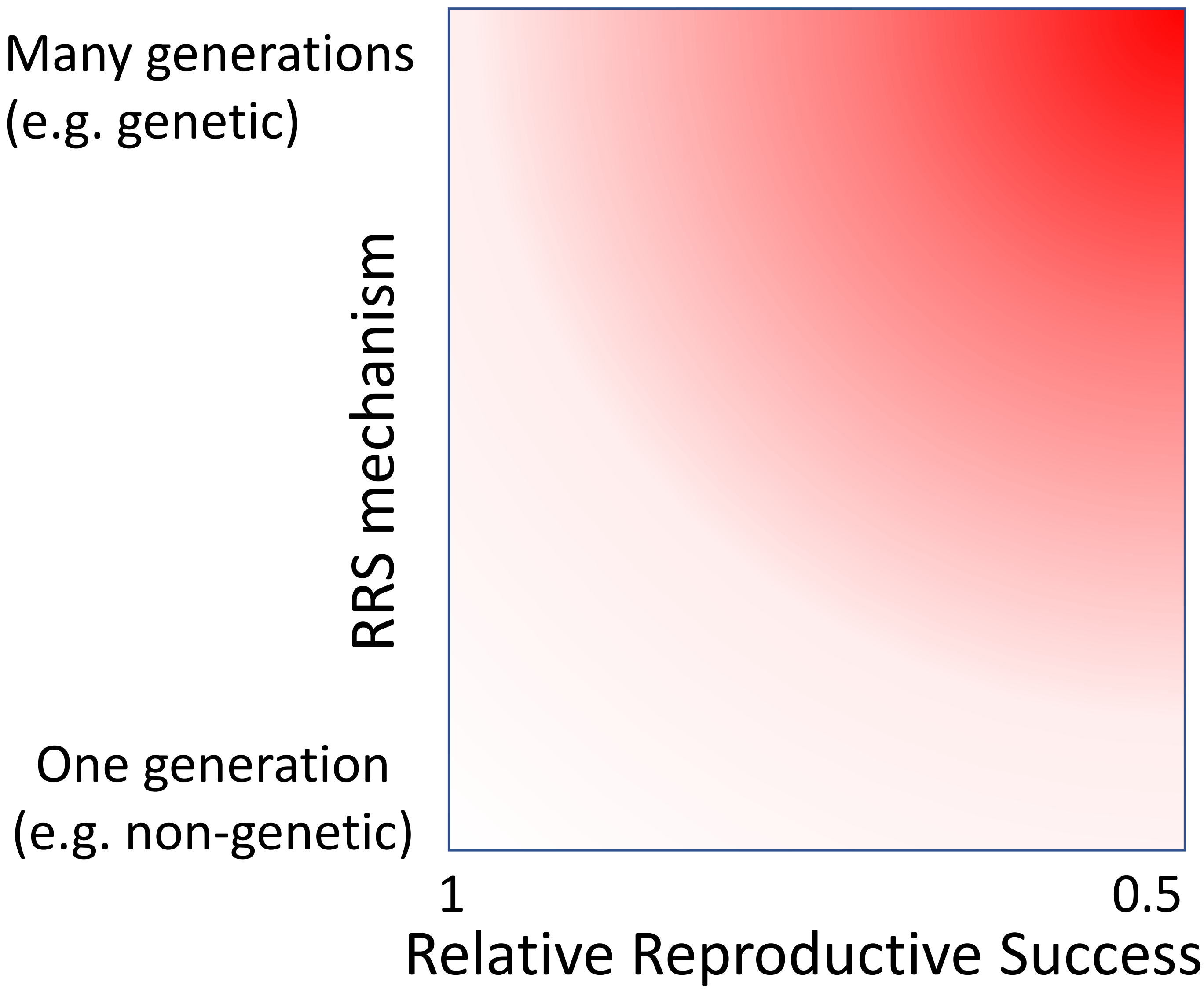
Conceptual model for assessing risk



Conceptual model for assessing risk



Conceptual model for assessing risk



Assessing mechanisms driving Relative Reproductive Success

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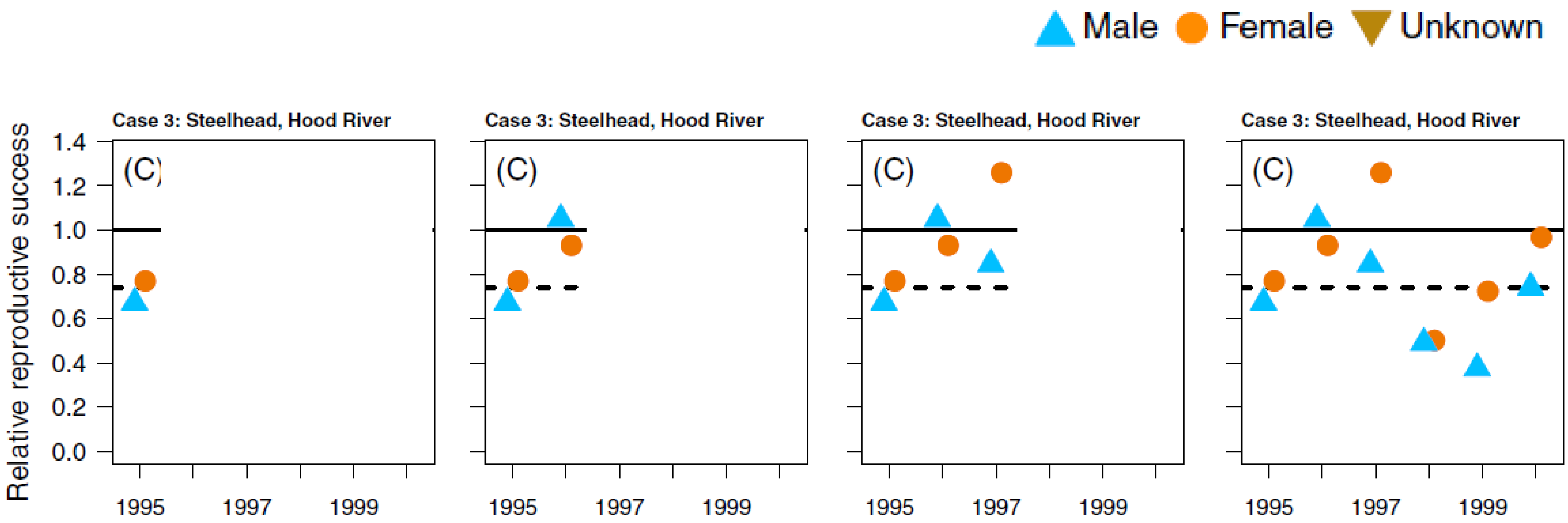
RRS estimates: 7% complete
RRS interpretation: 0% complete

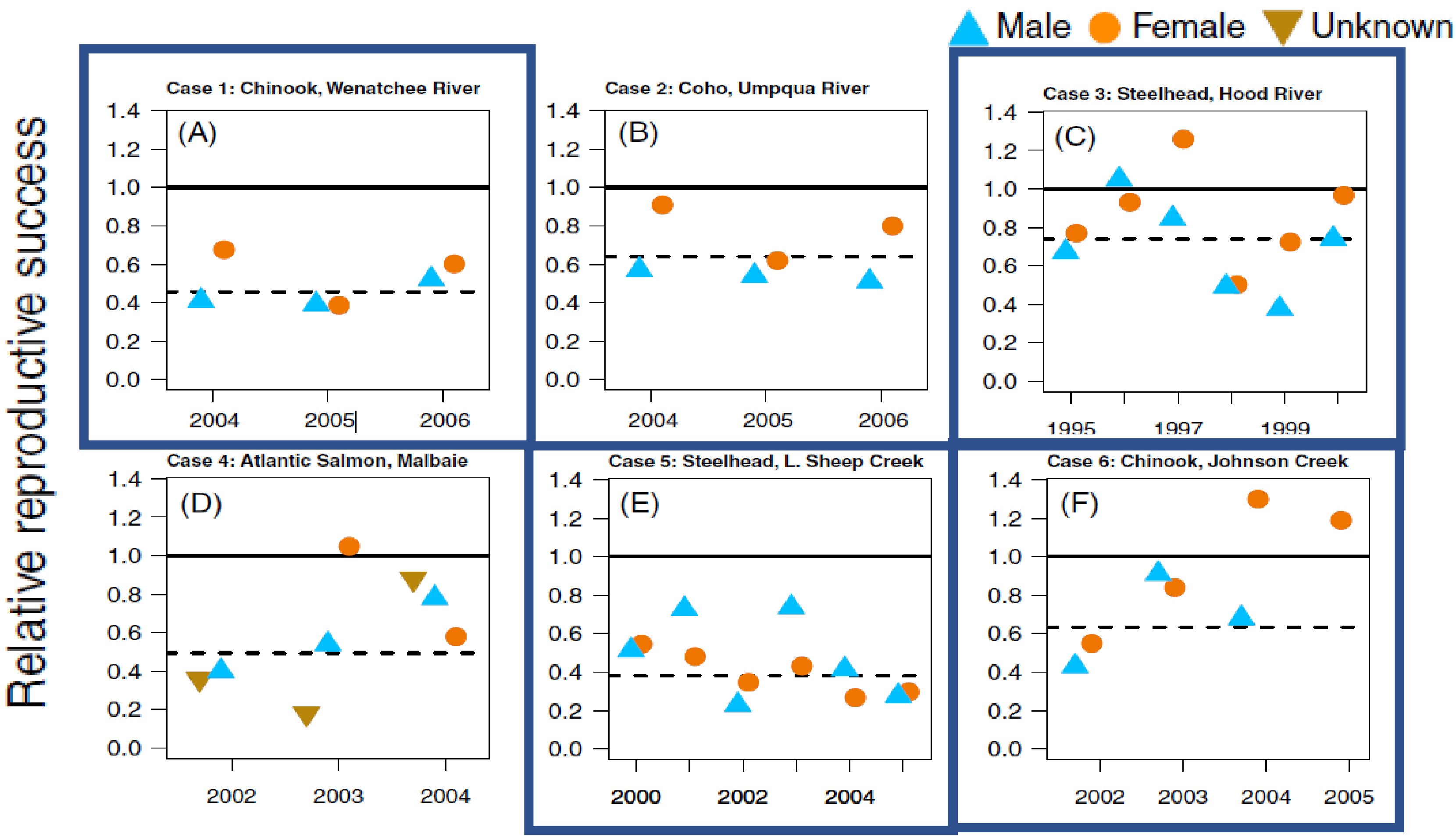
- Inappropriate to interpret beyond:
  - 1 stream (Hogan Bay)
  - 1 generation for even- and odd-years
- Does not represent variation:
  - Across years, within stream
  - Across steams
  - Across generations (grandparents)
  - Across species (chum salmon)

Example of RRS across years within species and location: Steelhead, Hood River



From Christie et al. 2014;
original data Araki et al. 2007

Examples of RRS across years within species and locations



From Christie et al. 2014;
original data various sources

RRS estimates: 7% complete
RRS interpretation: 0% complete

- Inappropriate to interpret beyond:
  - 1 stream (Hogan Bay)
  - 1 generation for even- and odd-years
- Does not represent variation:
  - Across species (chum salmon)
  - Within stream, across years
  - Across steams
  - Across generations (grandparents)
- We do not know what is driving RRS
  - Once we have results, we can 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
    - Tolerance of temperature or oxygen fluctuations
- The conditions in the hatchery do not select out the same fish as the conditions in the wild

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)
- Staying fish (regardless of origin), need to identify a suitable location
- Straying fish that find suitable locations, produce progeny that, if they home, will have the homing fish advantage
- Straying fish that do not find a suitable location, will produce fewer (if any) progeny.
- 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

Domestication selection

Epigenetics

Genetic drift

Broodstock incompatibility

Run timing-associated variables
- Fishery prosecution
- Spawning ground competition
- Straying fish delays

Sexual selection

Data available to investigate mechanisms driving RRS

- Genetic mechanisms
  - Modeling
  - Grandparent RRS
  - Historical and contemporary genetic structure (PWS)

- Non-genetic mechanisms
  - Timing of spawning
  - Location within stream
  - Fishery prosecution


Questions?