

Variability in migration routes influences early marine survival of juvenile salmon smolts

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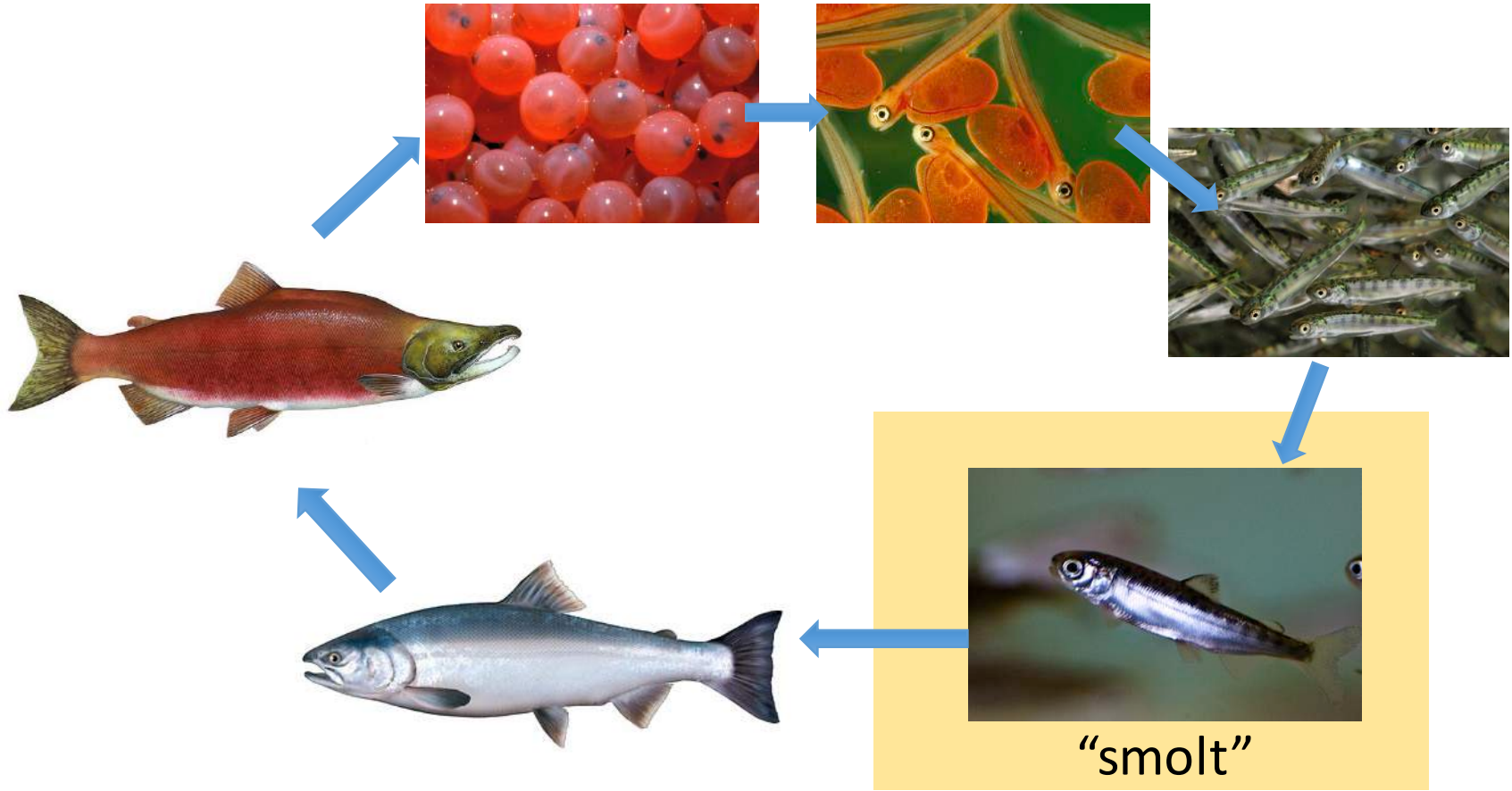
Vanier Canada
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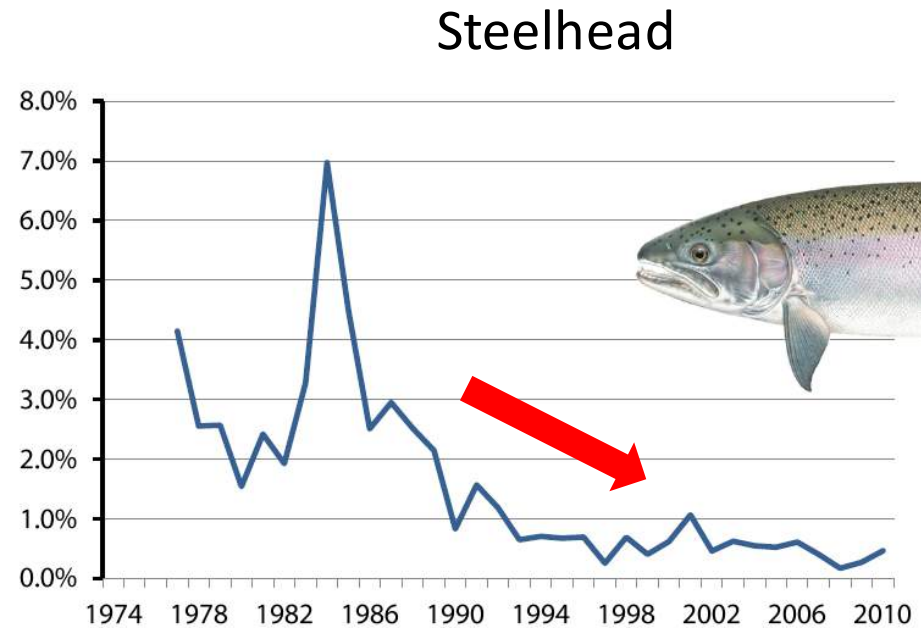
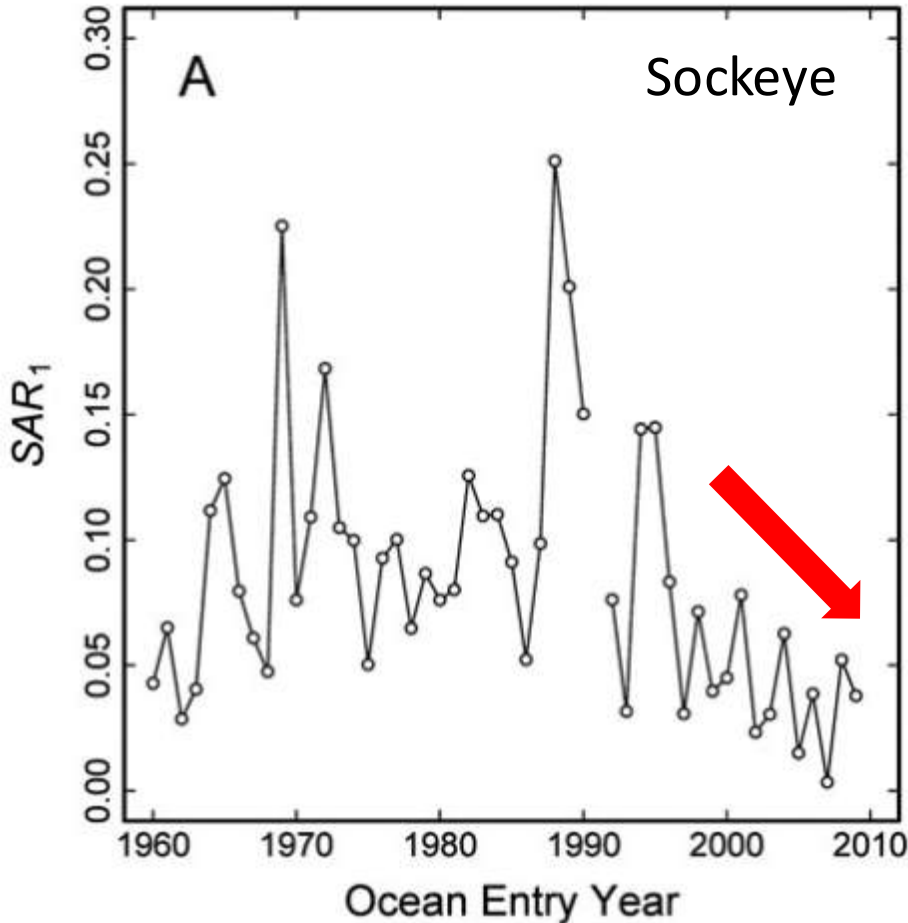
Bourses d'études
supérieures du Canada Vanier

Canada

Salmon “smolt” life stage



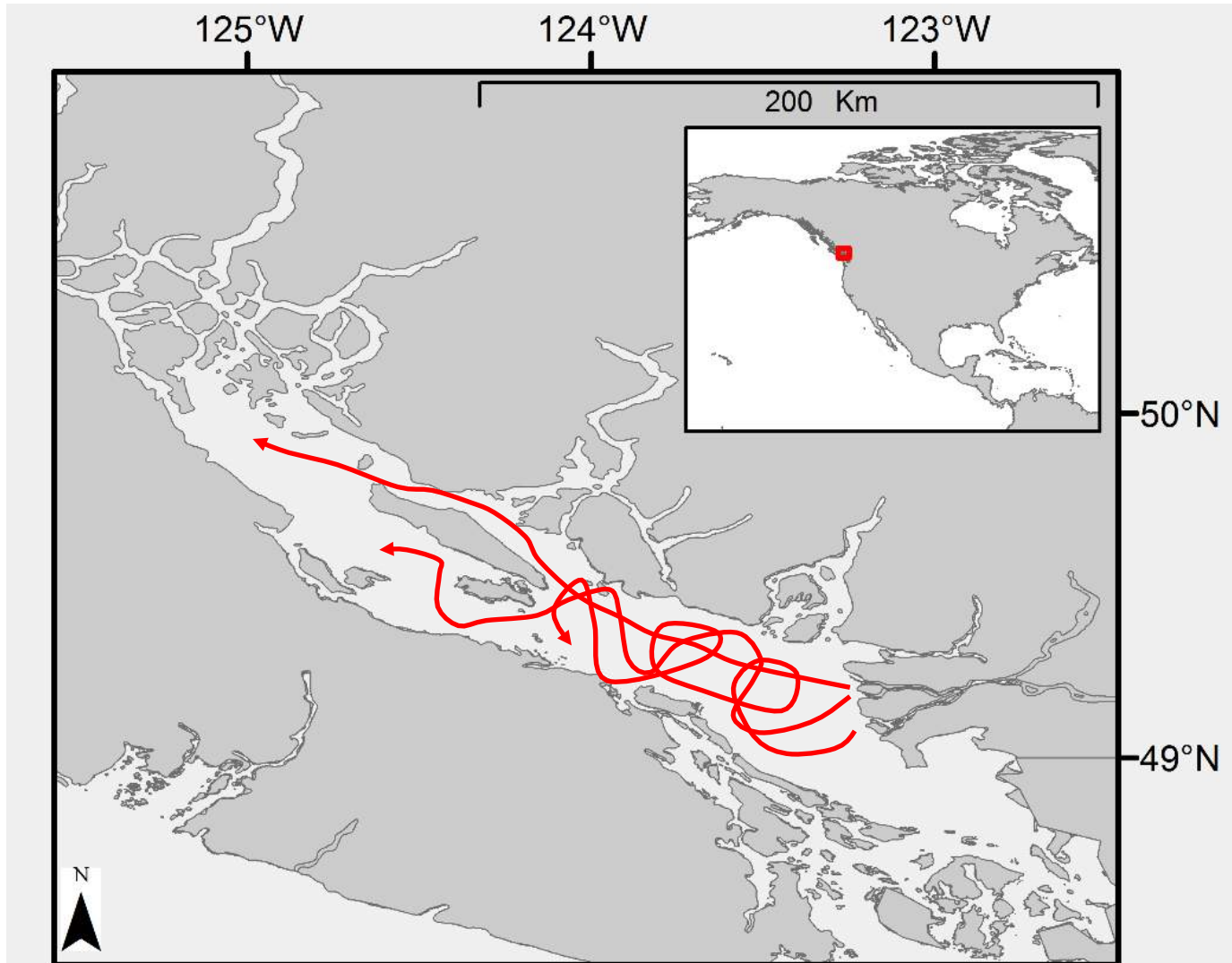
Smolt-to-adult survival declines



Pacific Salmon Foundation
Salish Sea Marine Survival Project

Irvine and Akenhead 2013

The Strait of Georgia

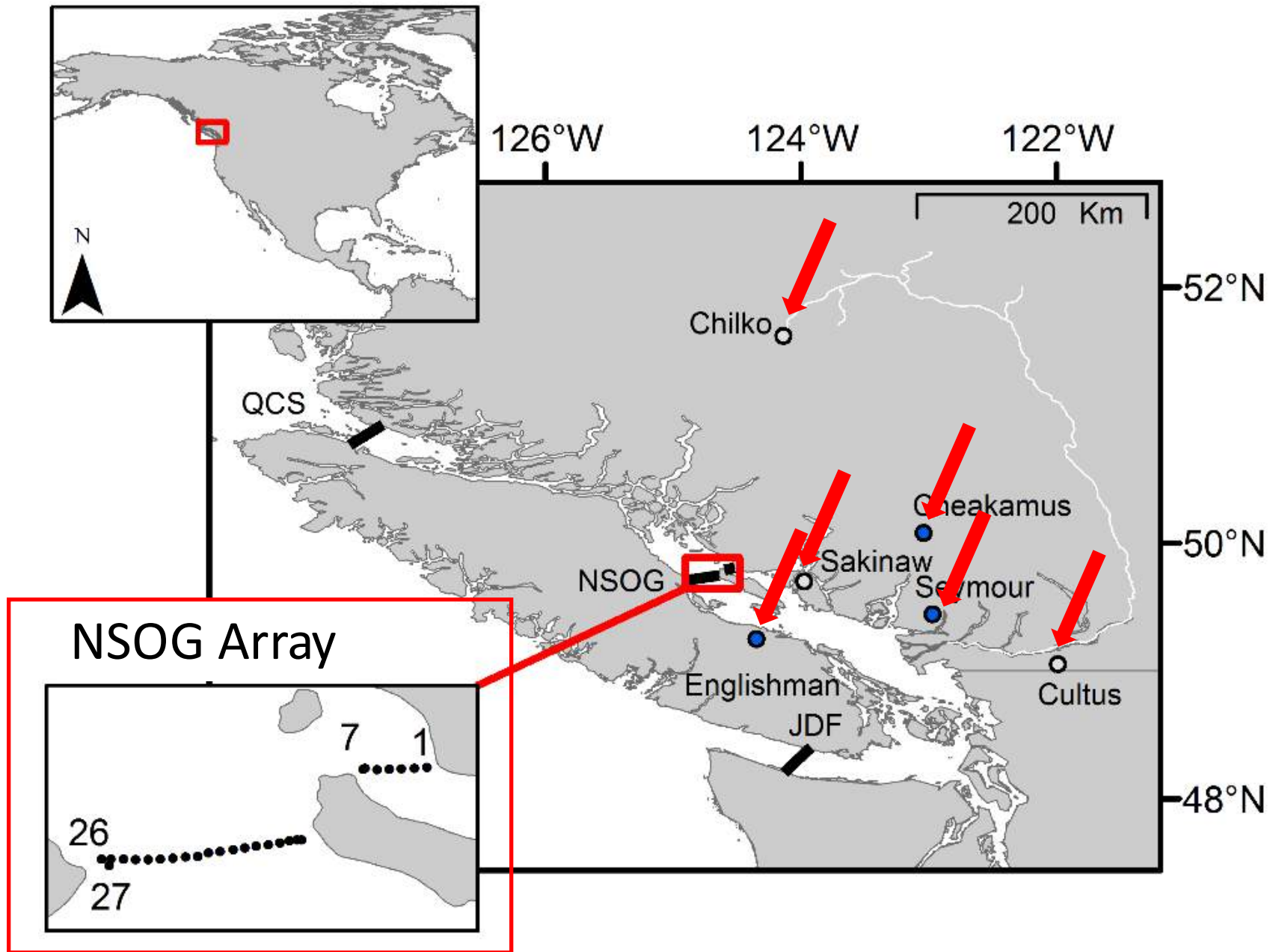


Acoustic telemetry can provide estimates of marine behaviour



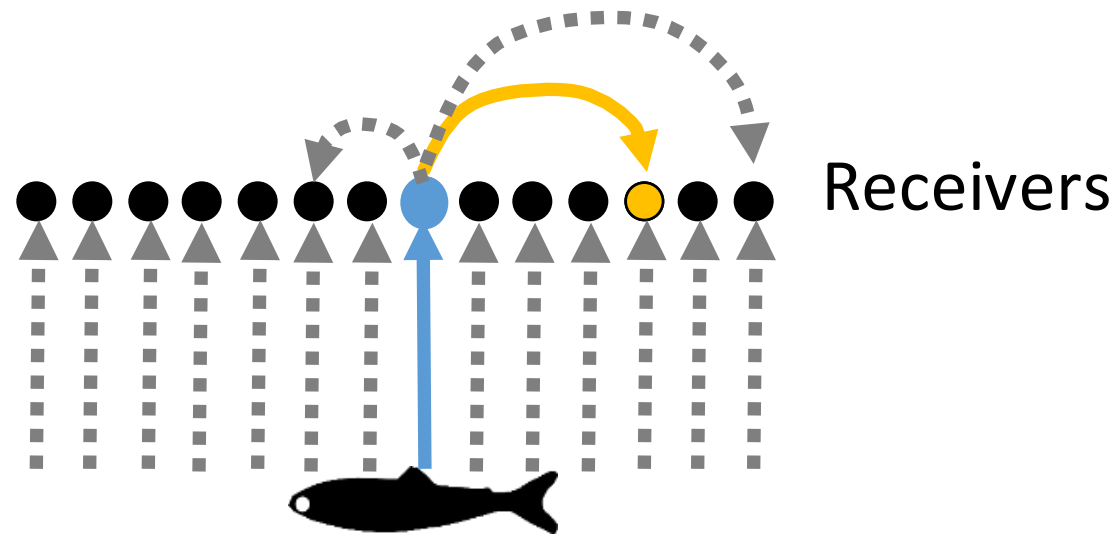
receiver





>850 fish between 2004-2013

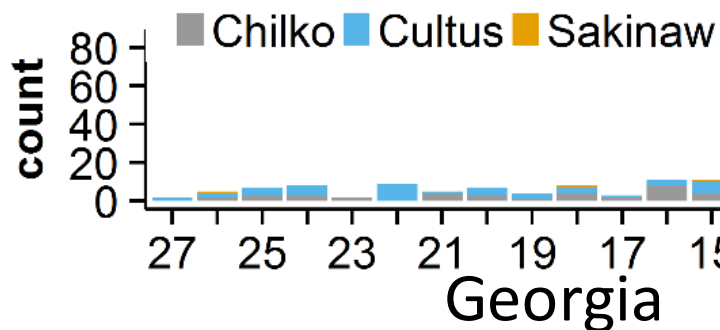
Detections grouped into “sequences”
to represent distinct presences at the
array



Note: smolt is NOT to scale

Lateral Distributions

Detection Sequence #

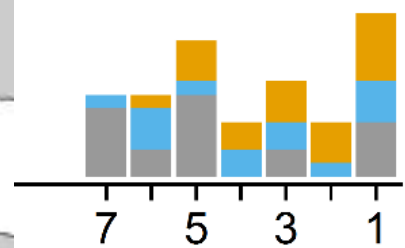
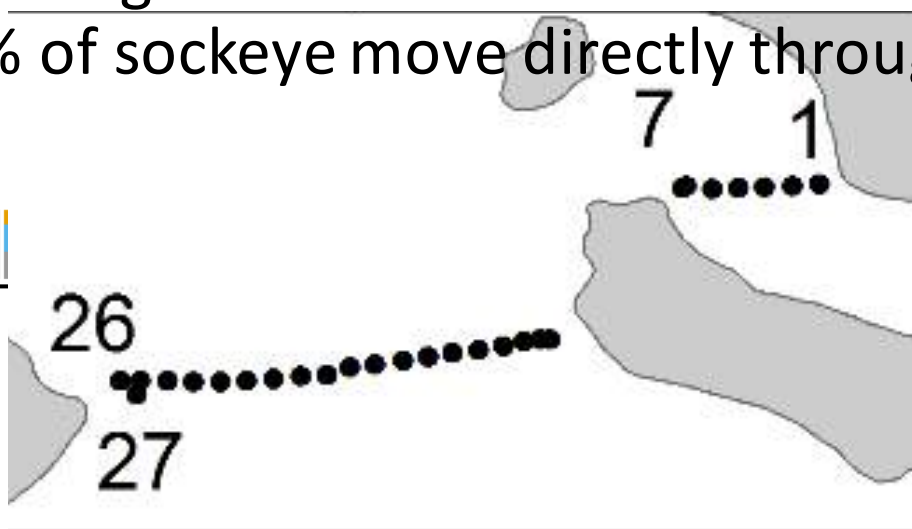
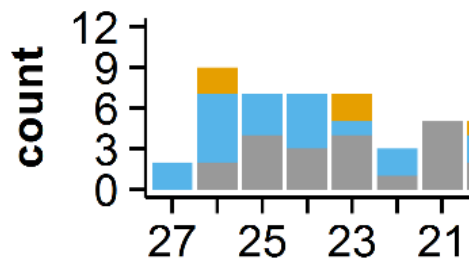


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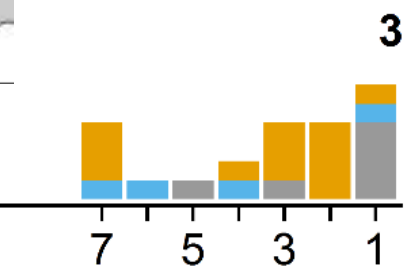
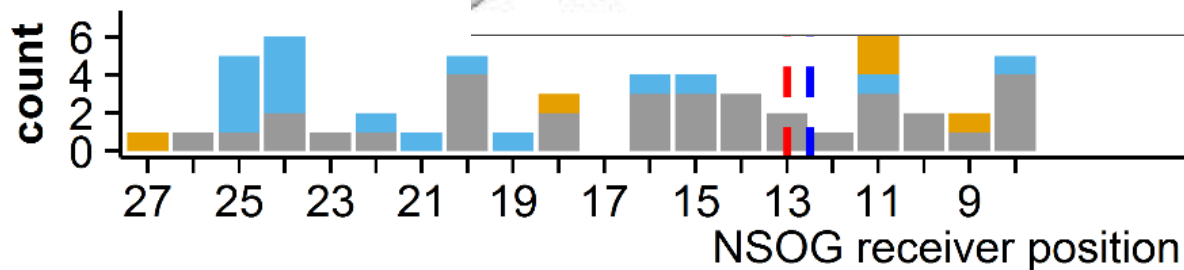


↓
1

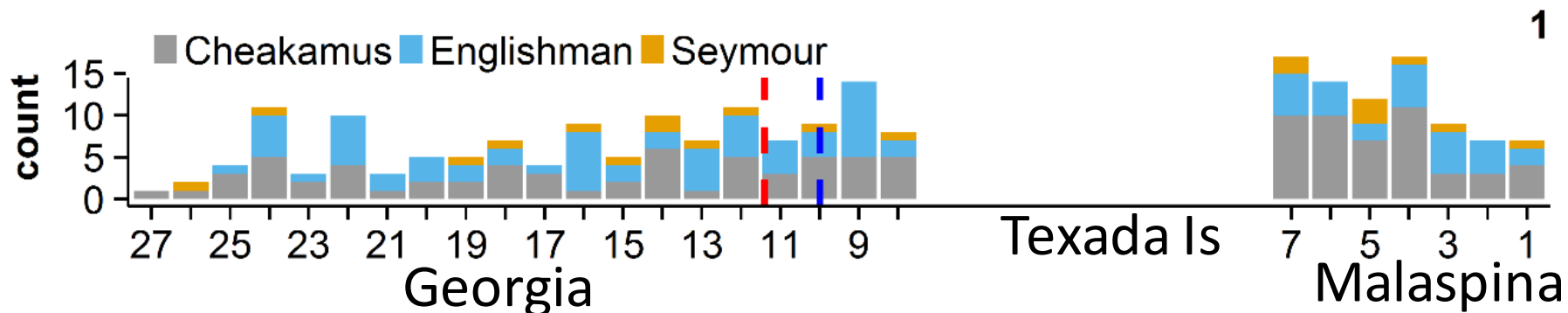
50-75% of sockeye move directly through the array



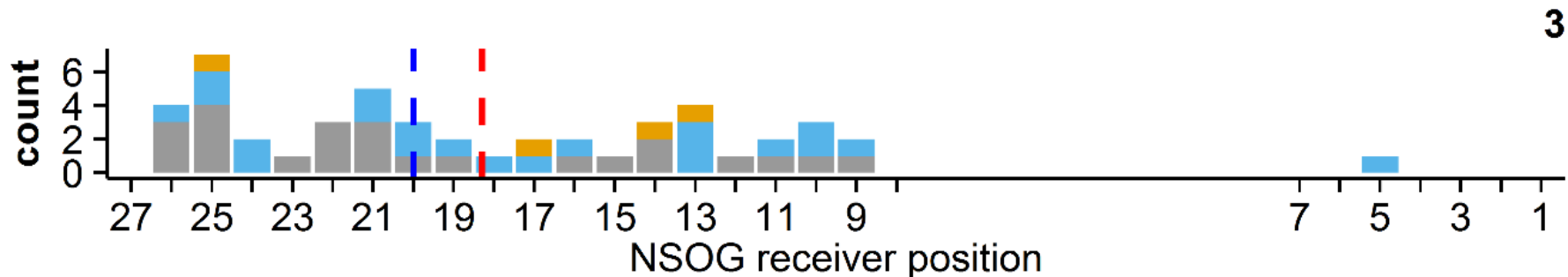
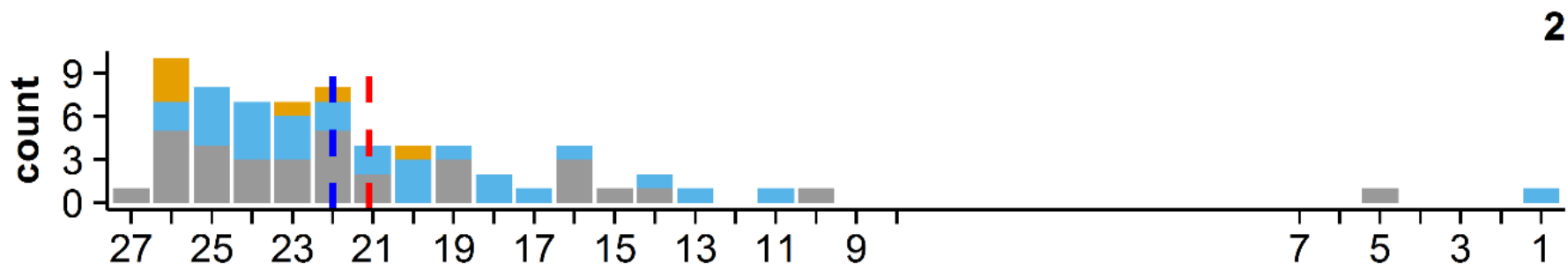
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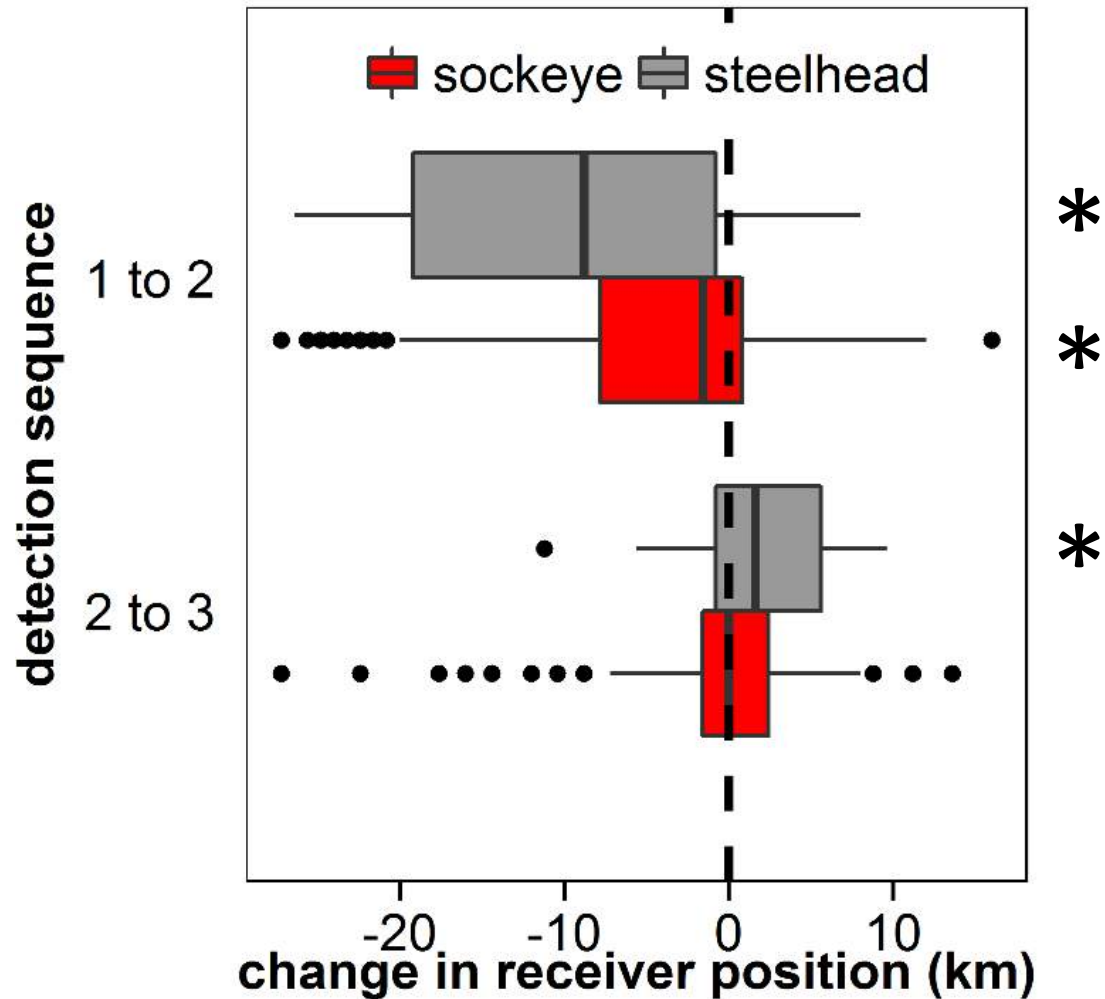
3



45-65% of steelhead move directly through the array

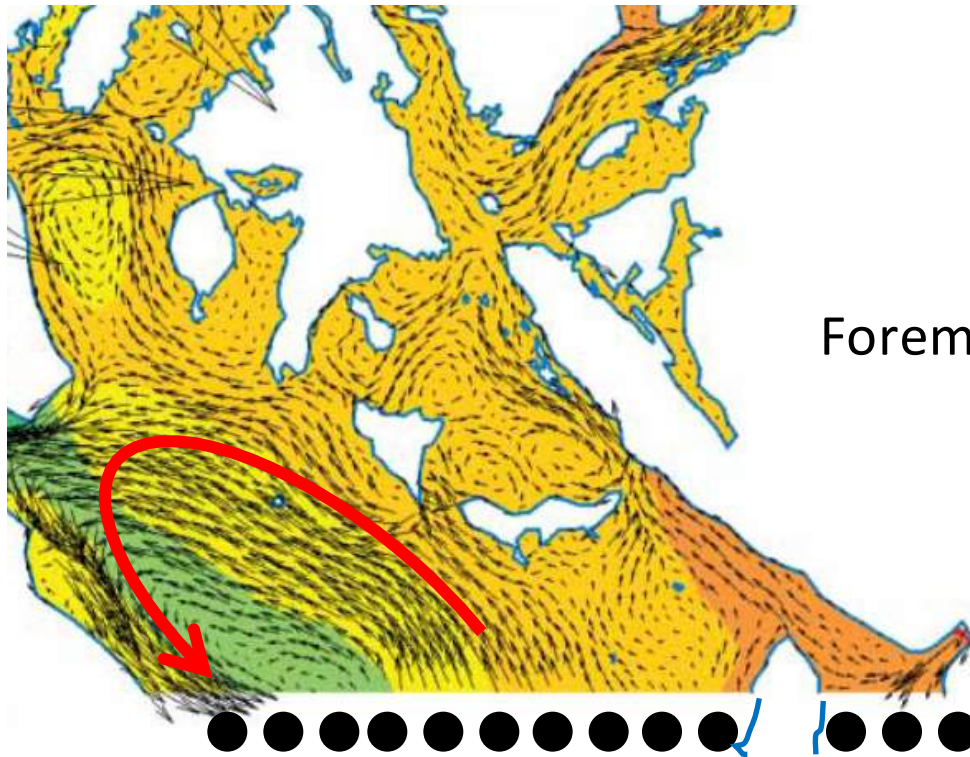


Smolts move west, possible counterclockwise movements by steelhead



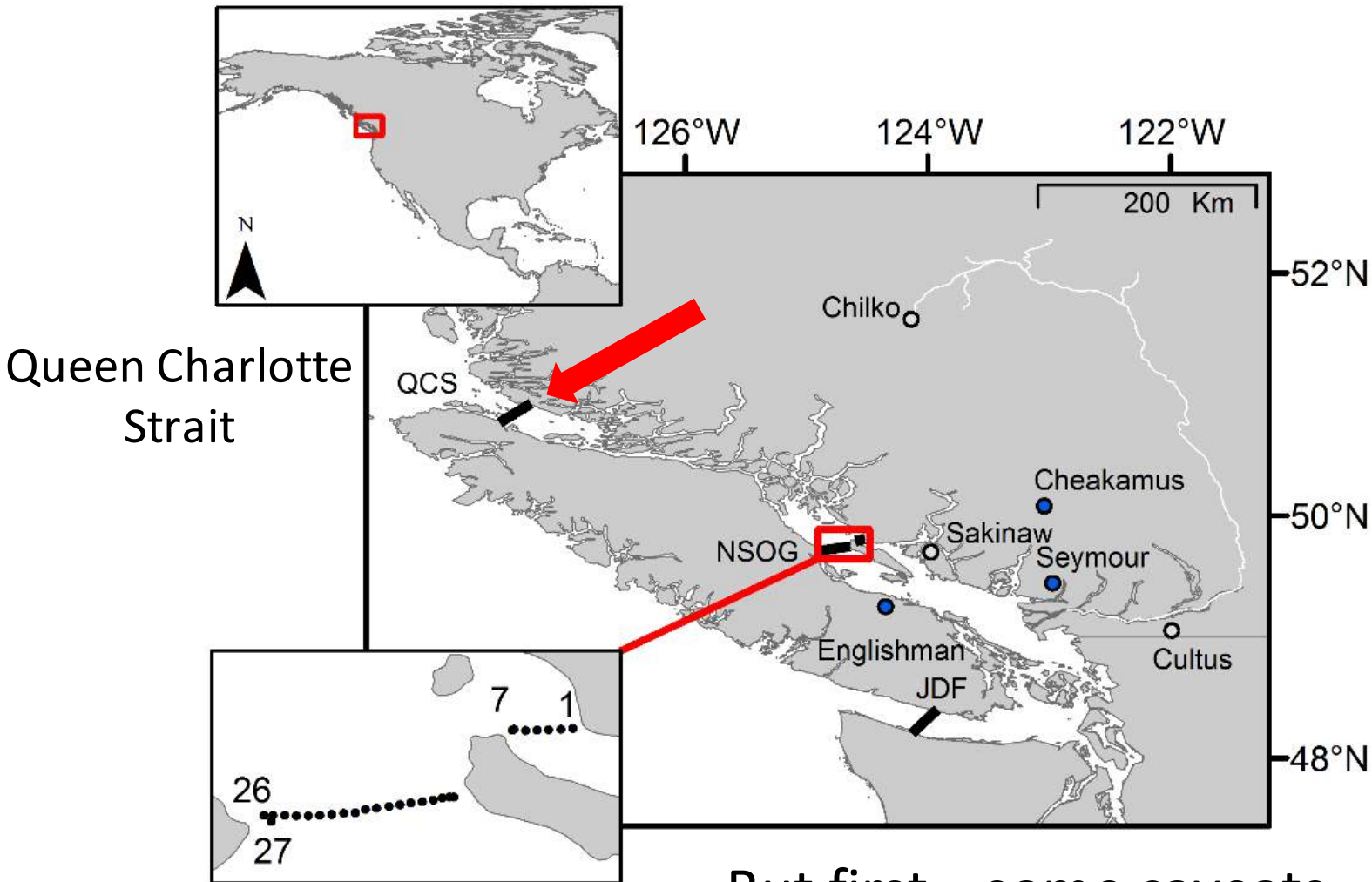
Smolts start east, transported west

- Consistent with region's fine-scale oceanography (Foreman et al. 2012)
- But do migration patterns matter?



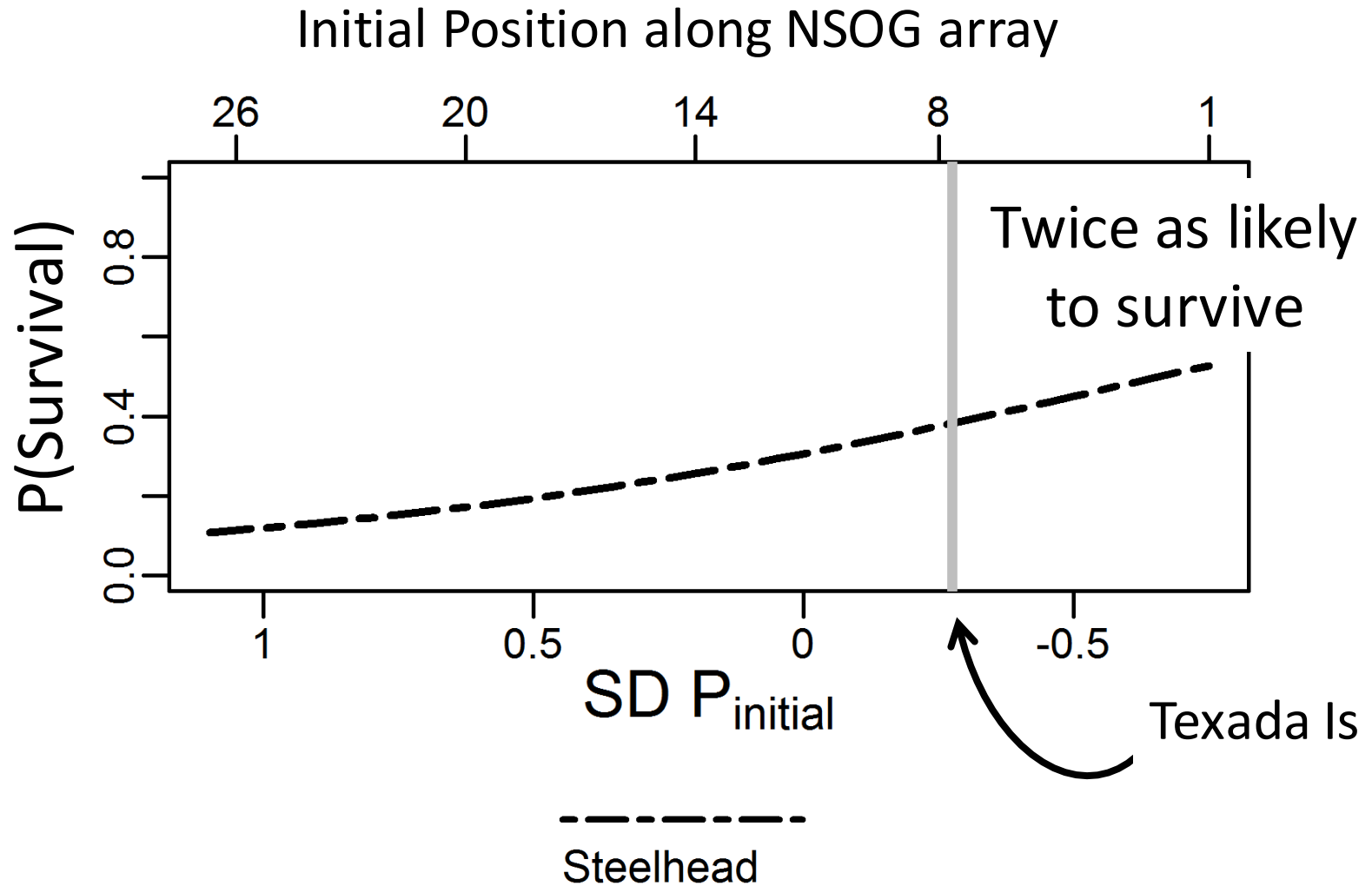
Foreman et al., 2012

Relating migratory behavior to subsequent survival (via GLMs)

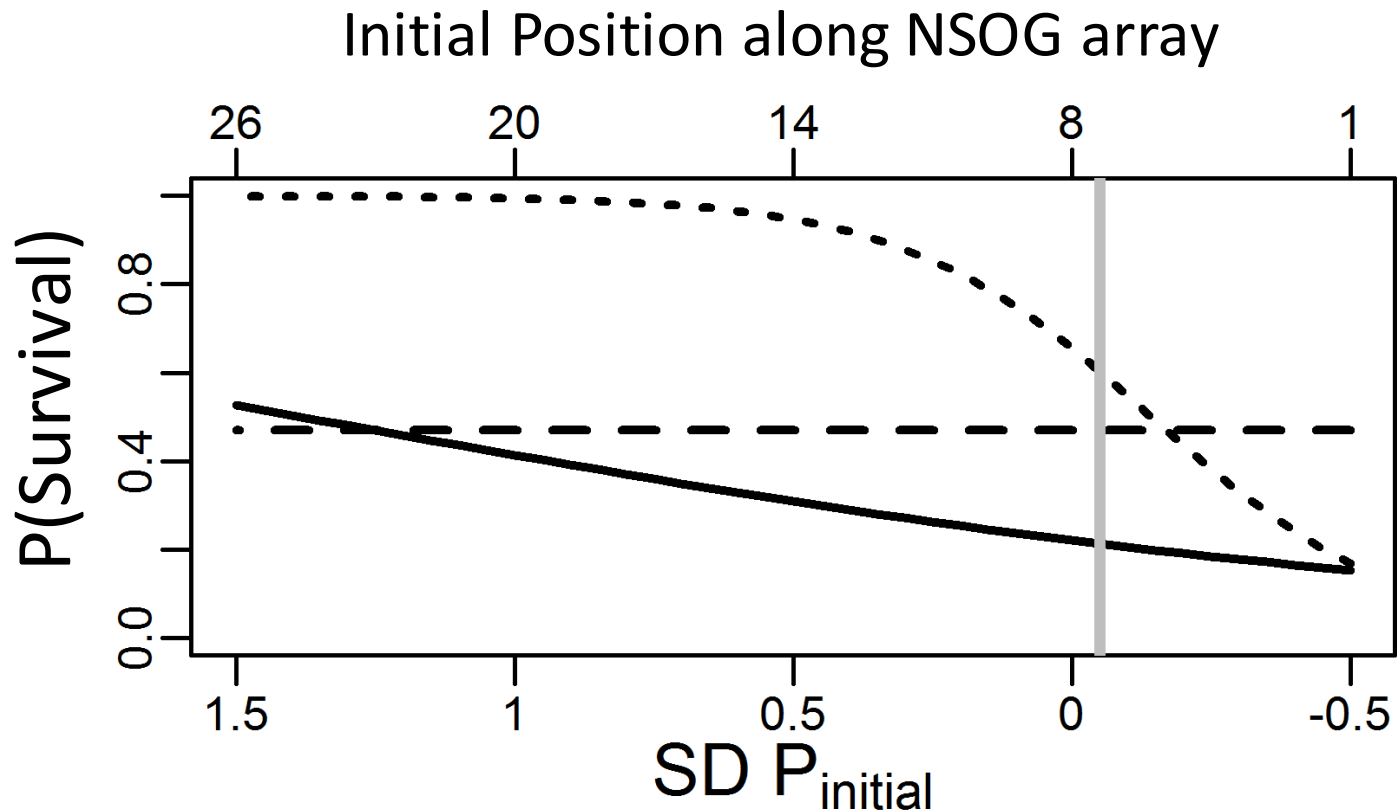


But first... some caveats

Migration route important for steelhead



Migration routes less important for sockeye

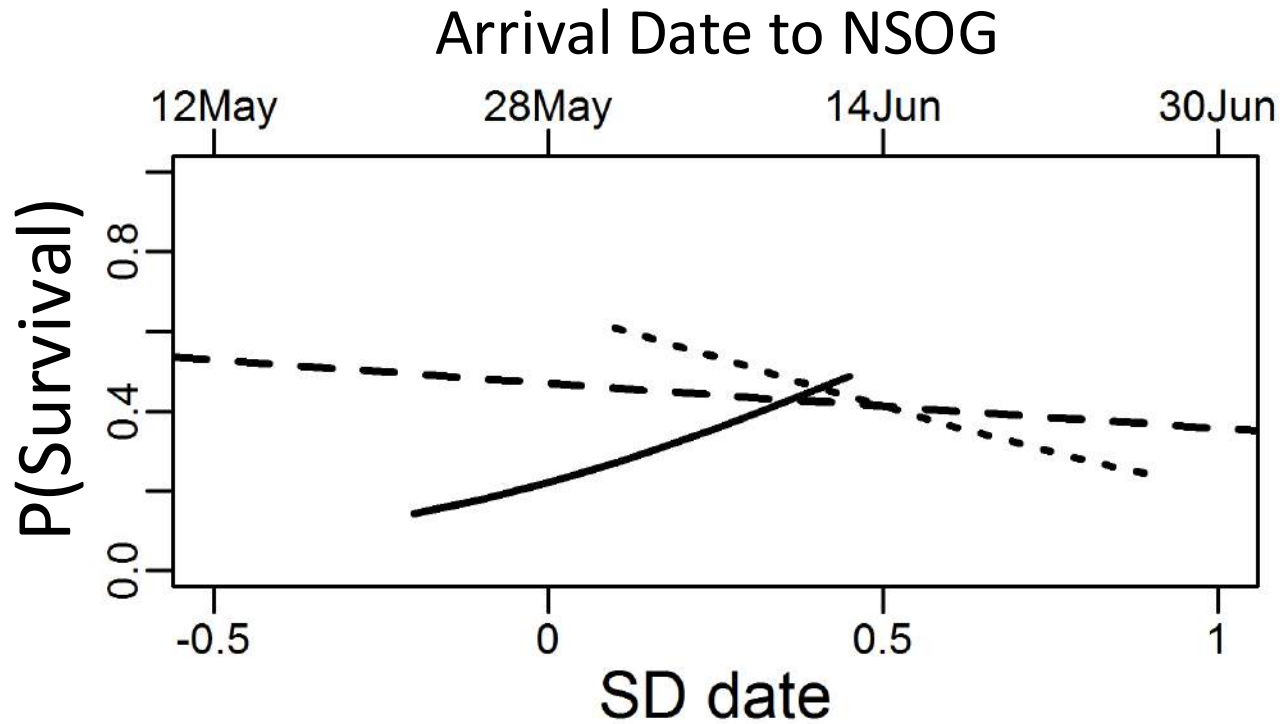


Chilko
(sockeye)

Cultus
(sockeye)

Sakinaw
(sockeye)

Migration timing (arrival to NSOG array) important for some sockeye

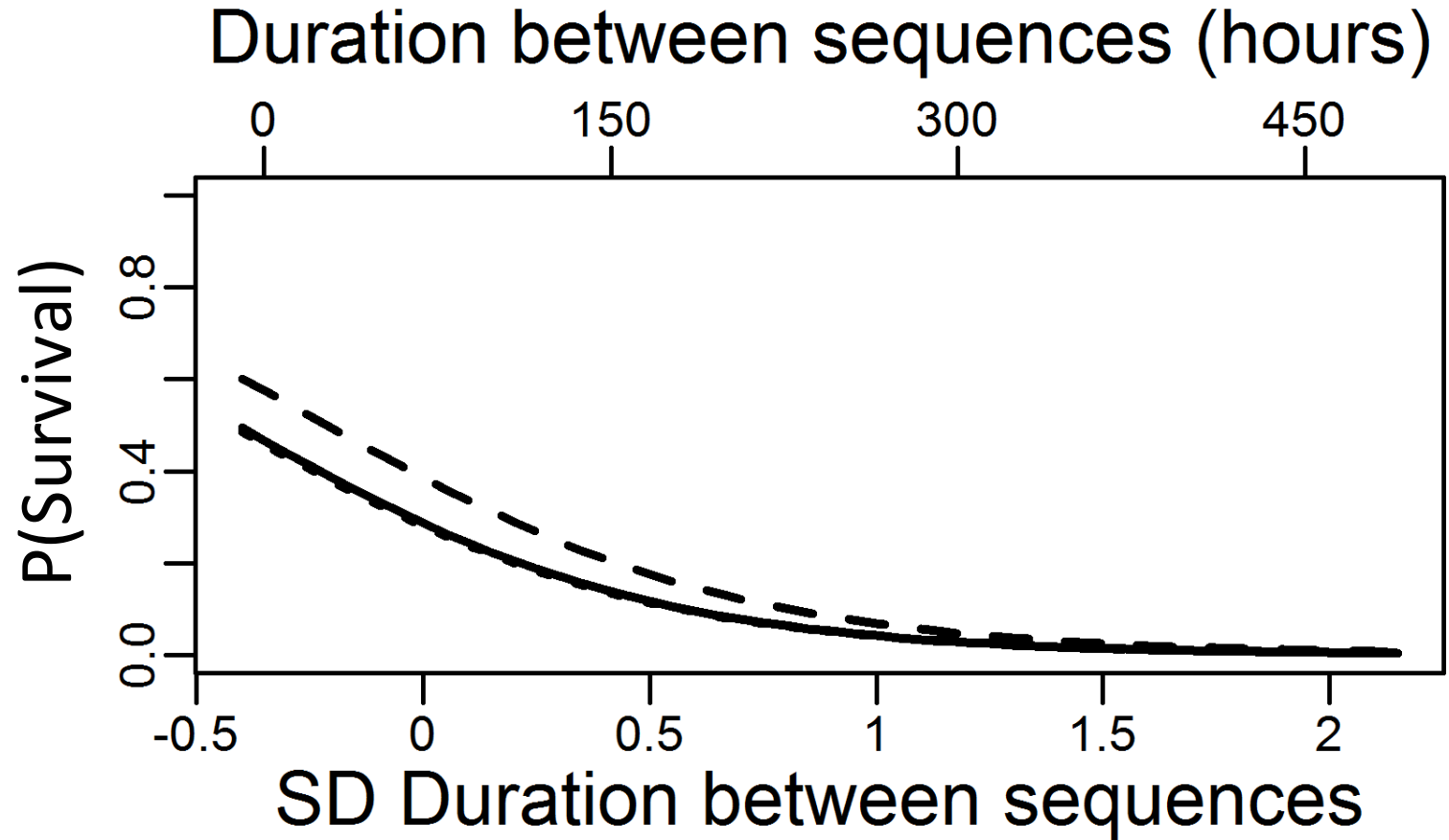


—
Chilko
(sockeye)

- - -
Cultus
(sockeye)

.....
Sakinaw
(sockeye)

Sockeye survival may be time-dependent



—
Chilko
(sockeye)

- - -
Cultus
(sockeye)

.....
Sakinaw
(sockeye)

Factors influencing survival are spatially and temporally variable

- Currents (growth and bioenergetics)
- Prey availability
- Harmful algal blooms
- Pathogens
- Predators
- Little known regarding fine-scale spatiotemporal variability

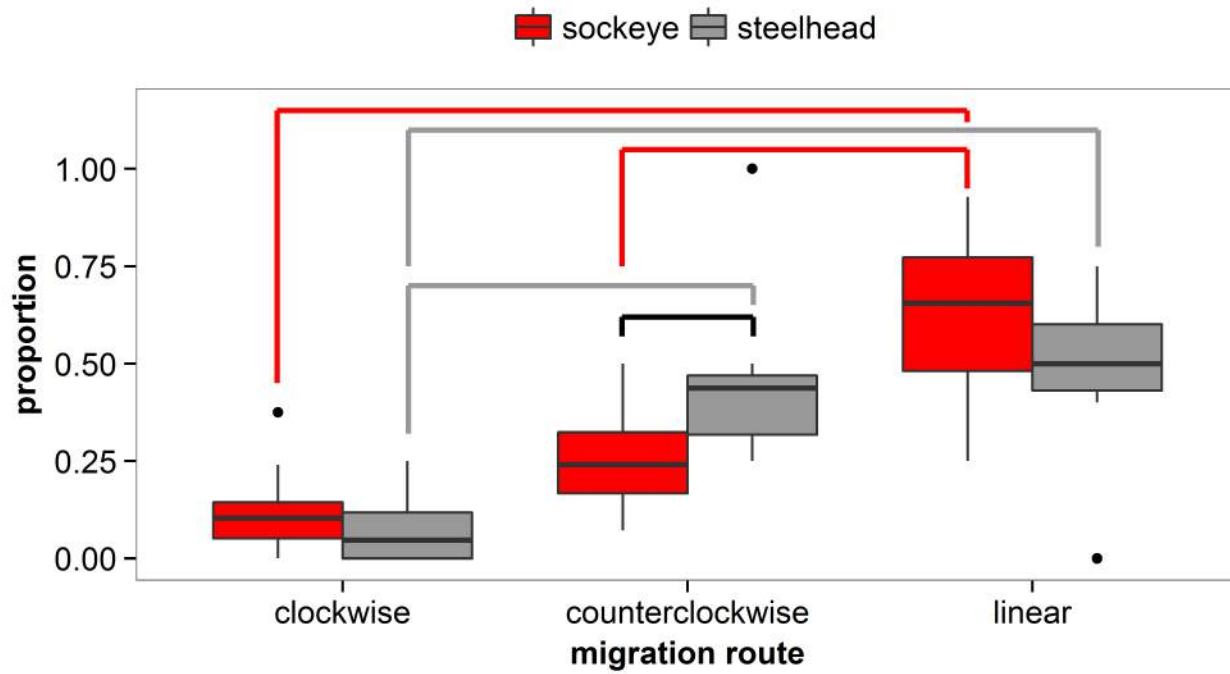
Conclusions

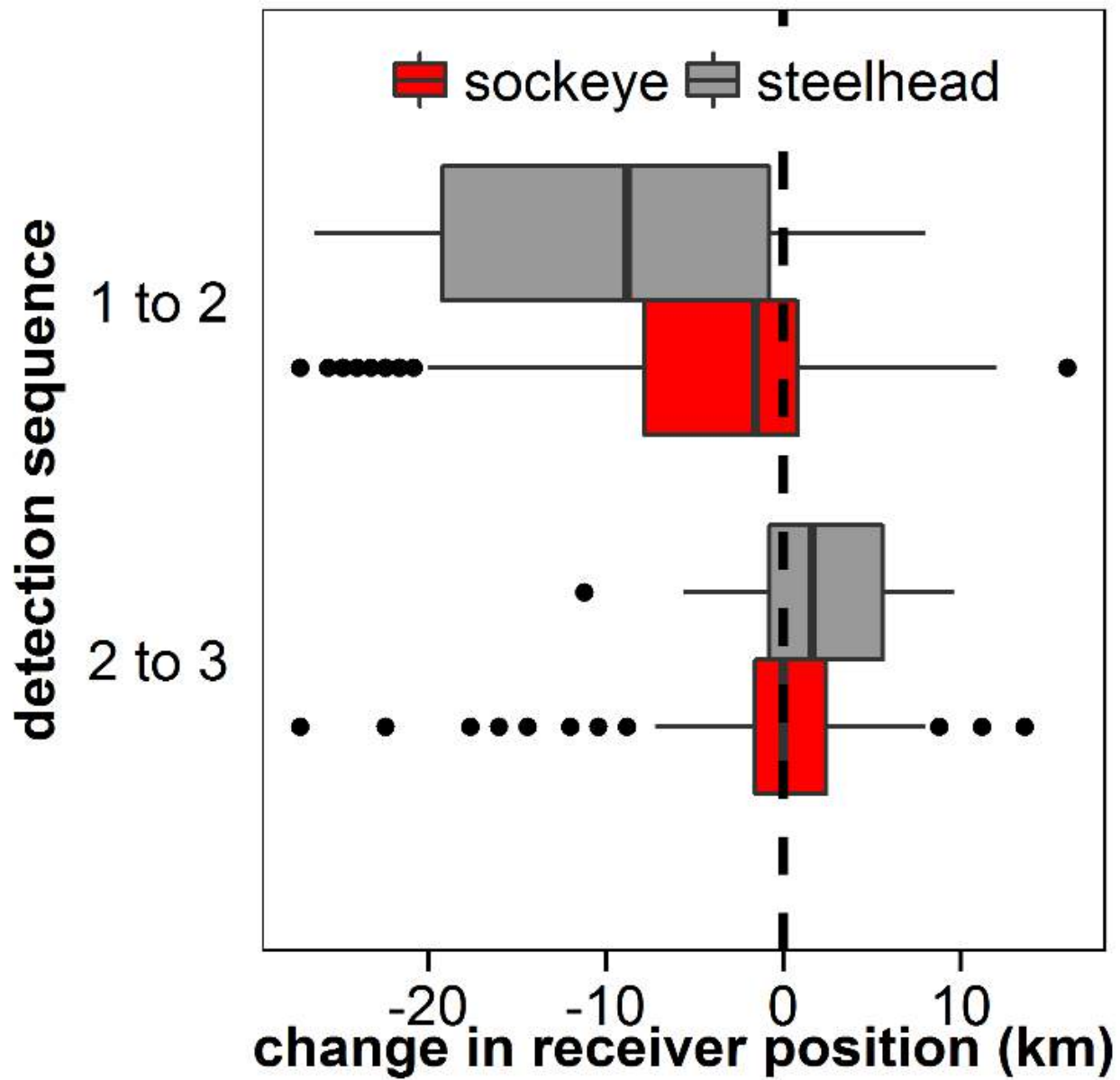
- Repeatable trends in migration routes observed, but considerable variability exists
- The influence of routes can be species- and population-specific
- Telemetry arrays can be used to examine movements at finer scales than originally intended

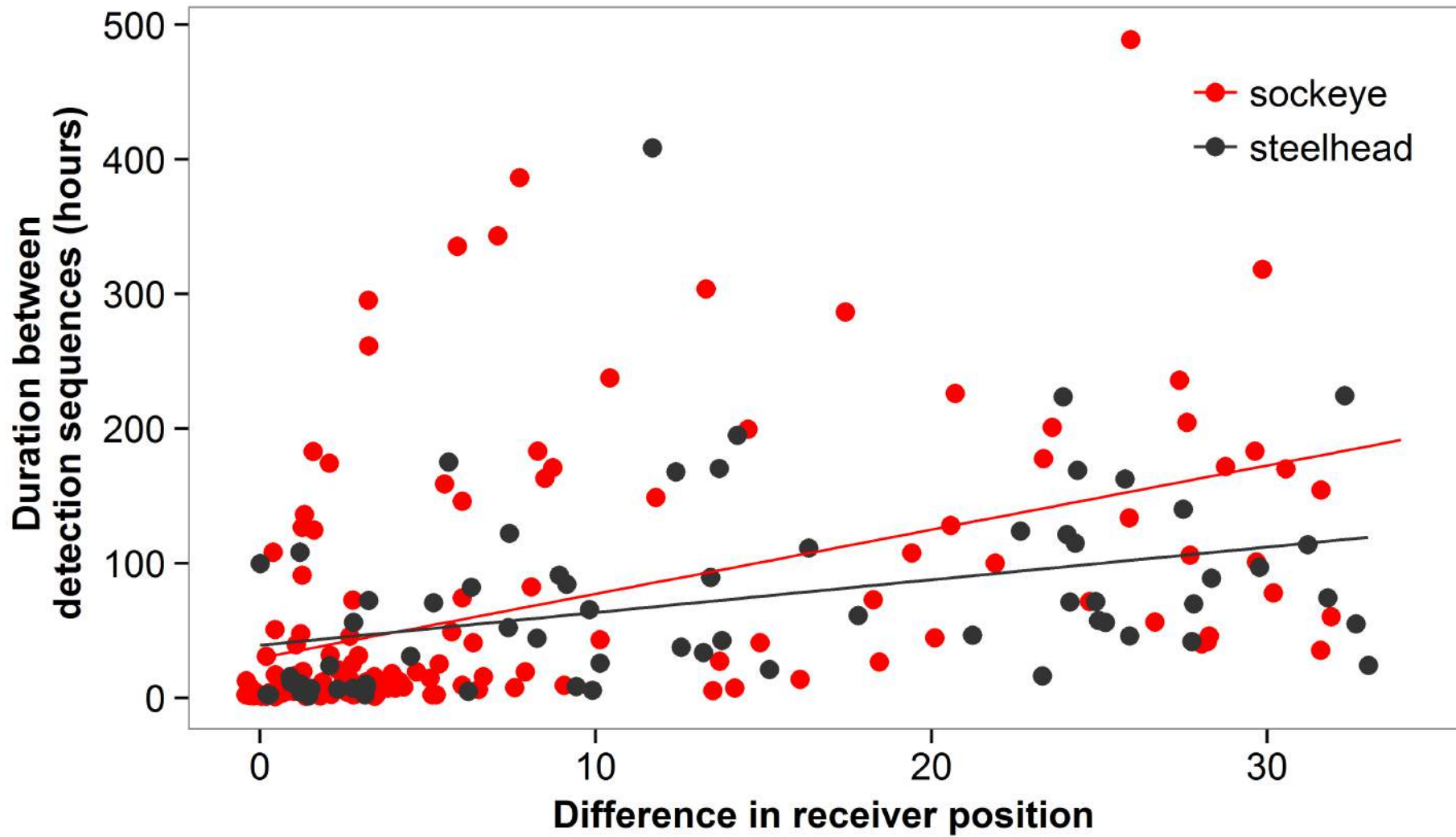
Thank you!

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Smolts start east, transported/ move west

Sockeye
Steelhead

