

Diversity and resilience: planning ahead

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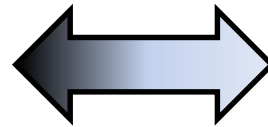
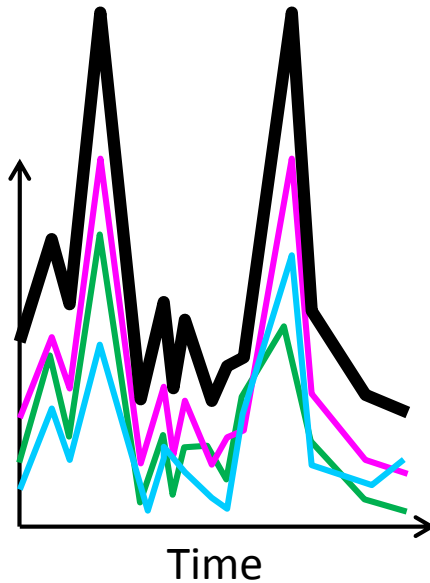
How do steelhead populations respond to decreased ocean survival?



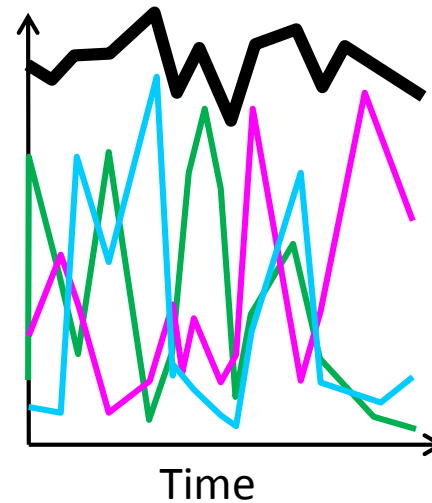
- Short-term—annual variation
- Long-term—decadal to century

Diversity can dampen variation

Synchrony: diversity
doesn't matter



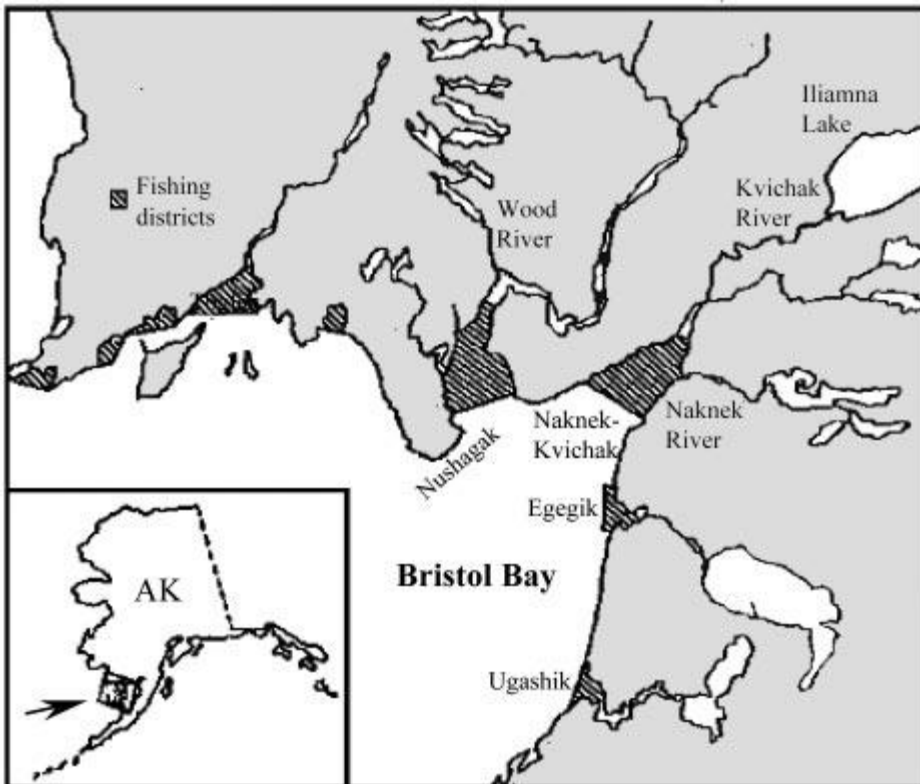
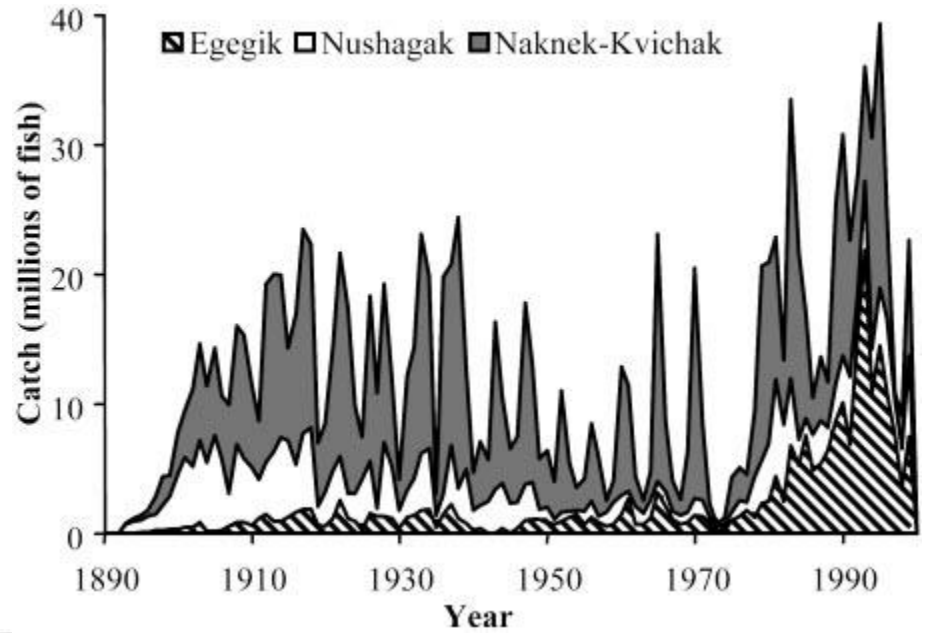
Asynchrony: diversity
increases stability

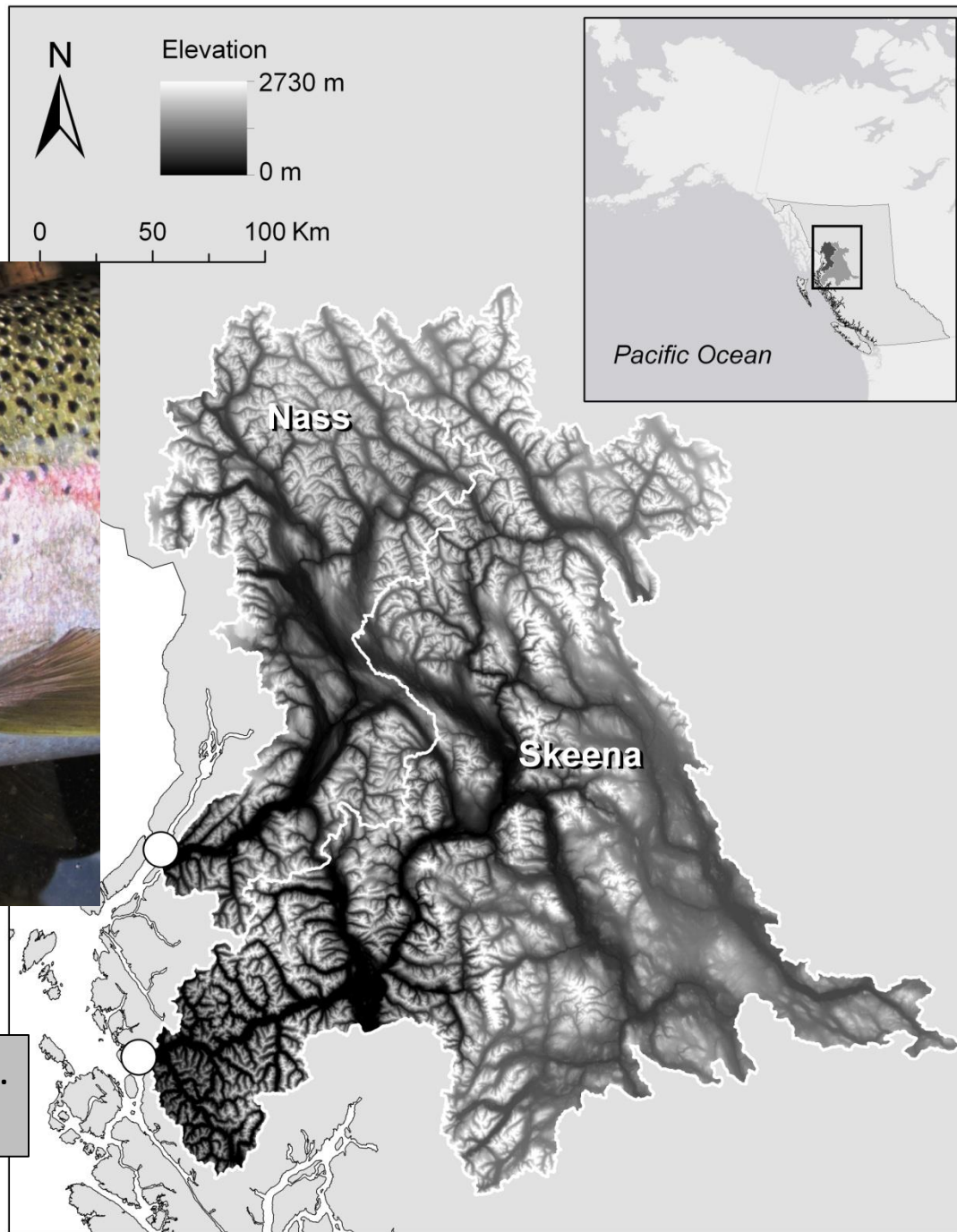


Fisheries sustainability and biodiversity

Hilborn et al. 2003

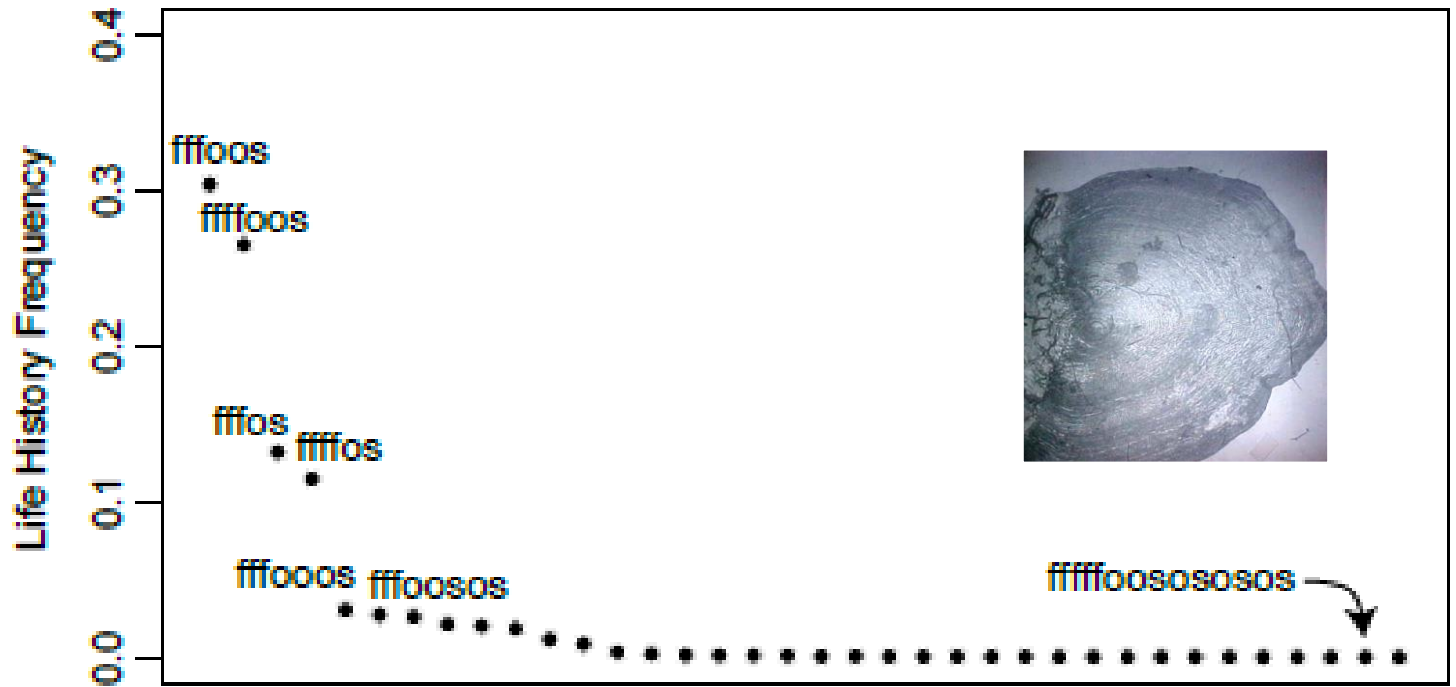
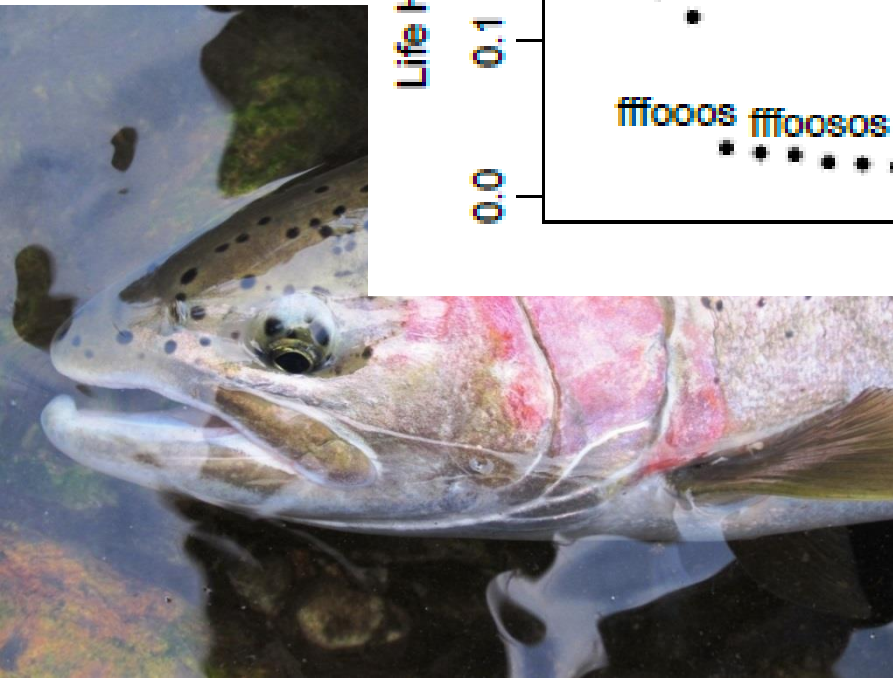
Schindler et al. 2010





Moore, Yeakel, Peard, Lough, Beere. 2014.
Journal of Animal Ecology

Extraordinary life-history diversity

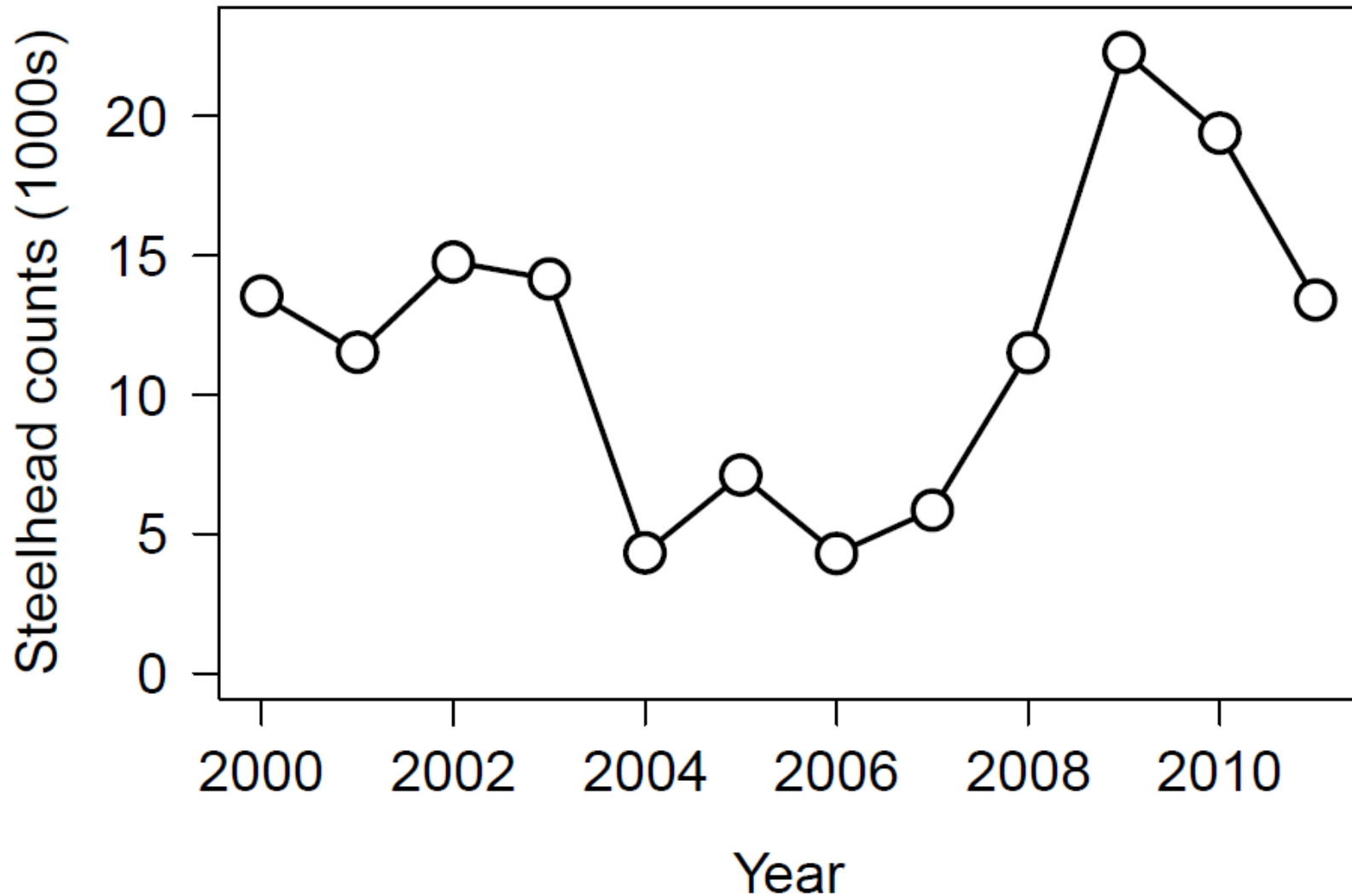


Unique Life History Trajectories

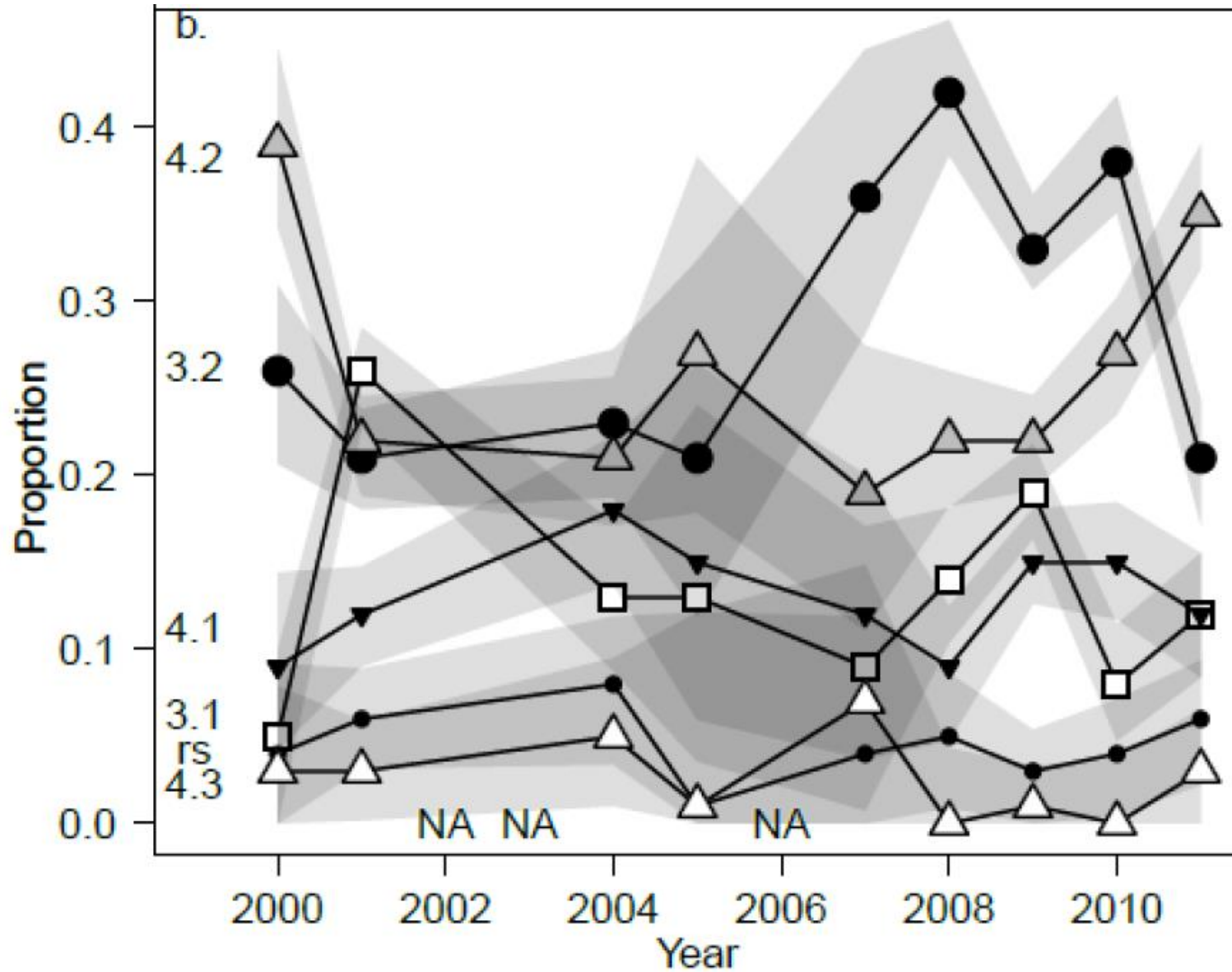
N = 8667

36 manifestations of the anadromous life history

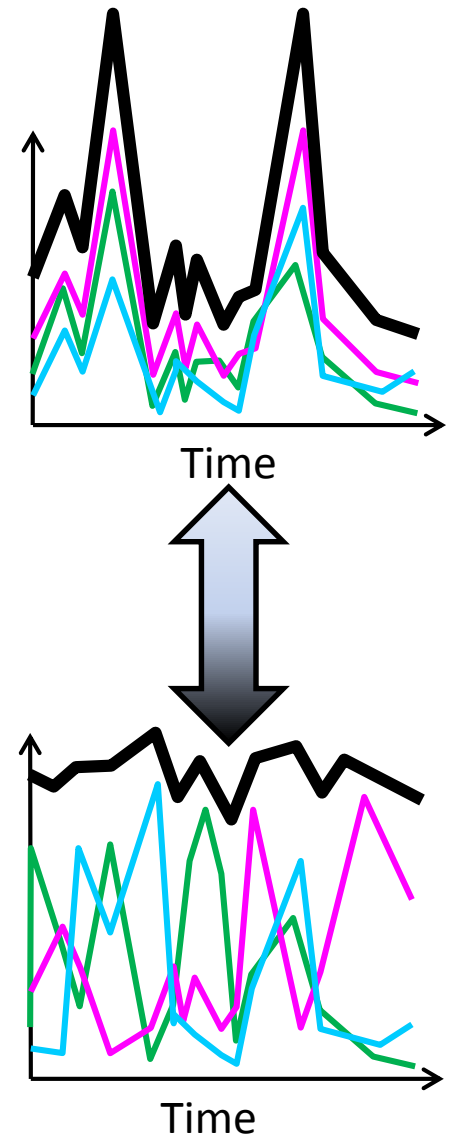
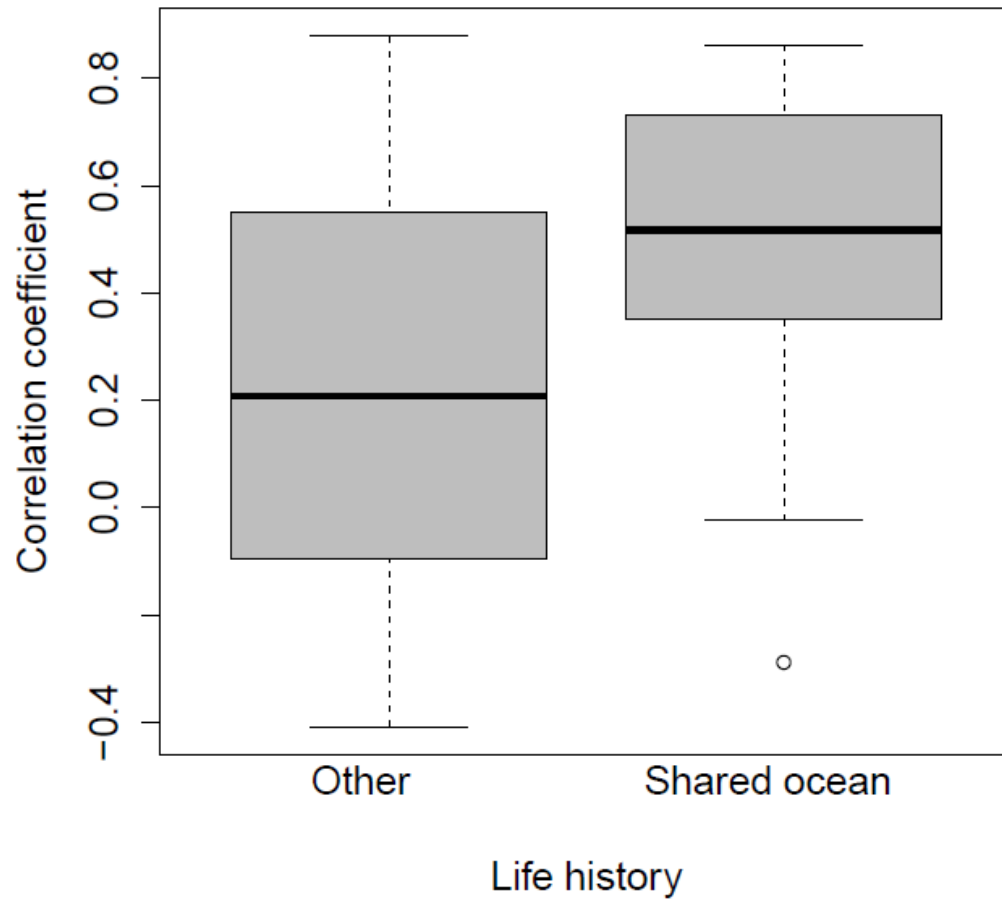
Nass steelhead dynamics



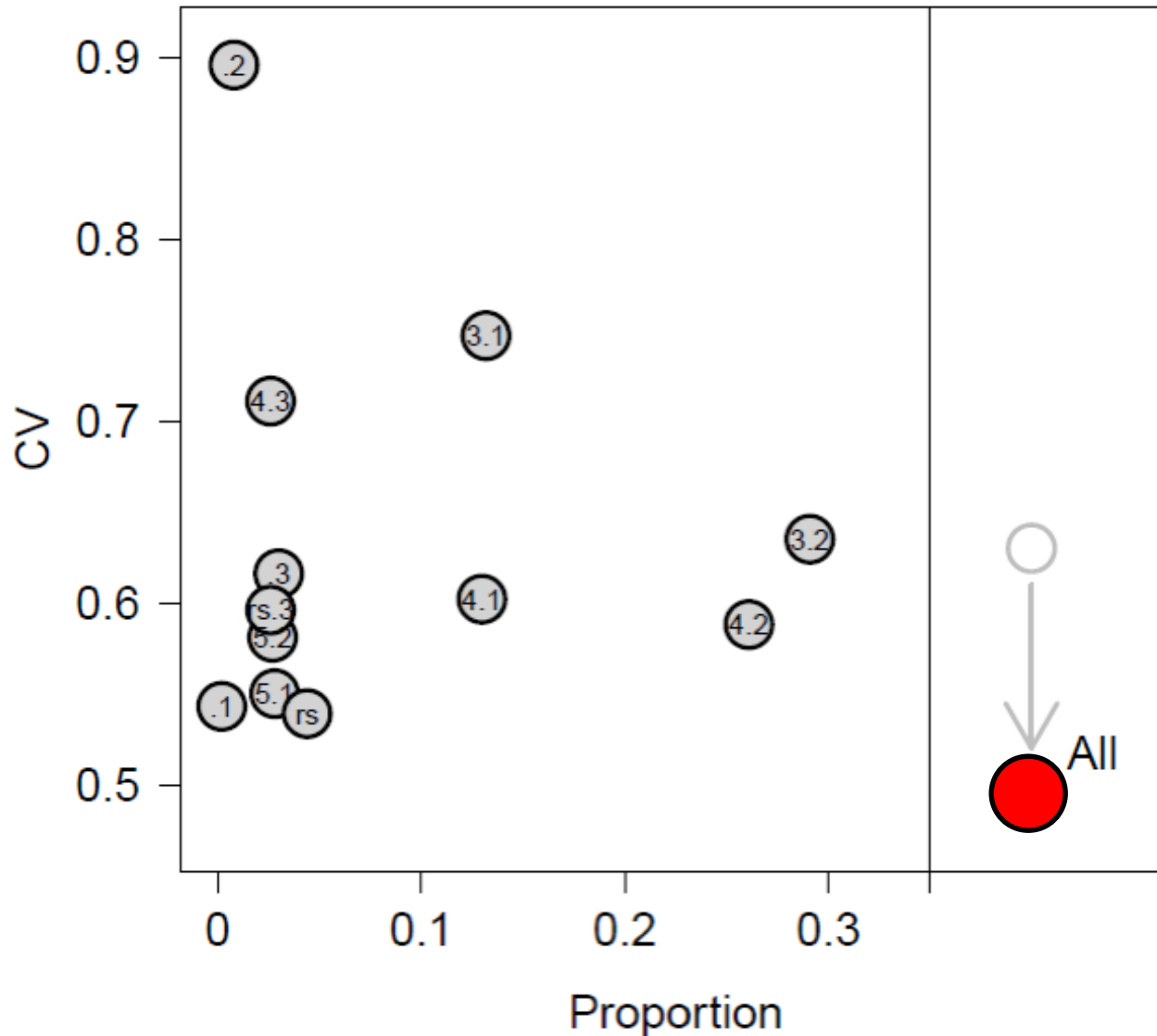
Different life-histories have different dynamics



Diversity in ocean -> asynchrony



Life-history diversity stabilizes Nass steelhead



How do steelhead populations respond to decreased ocean survival?



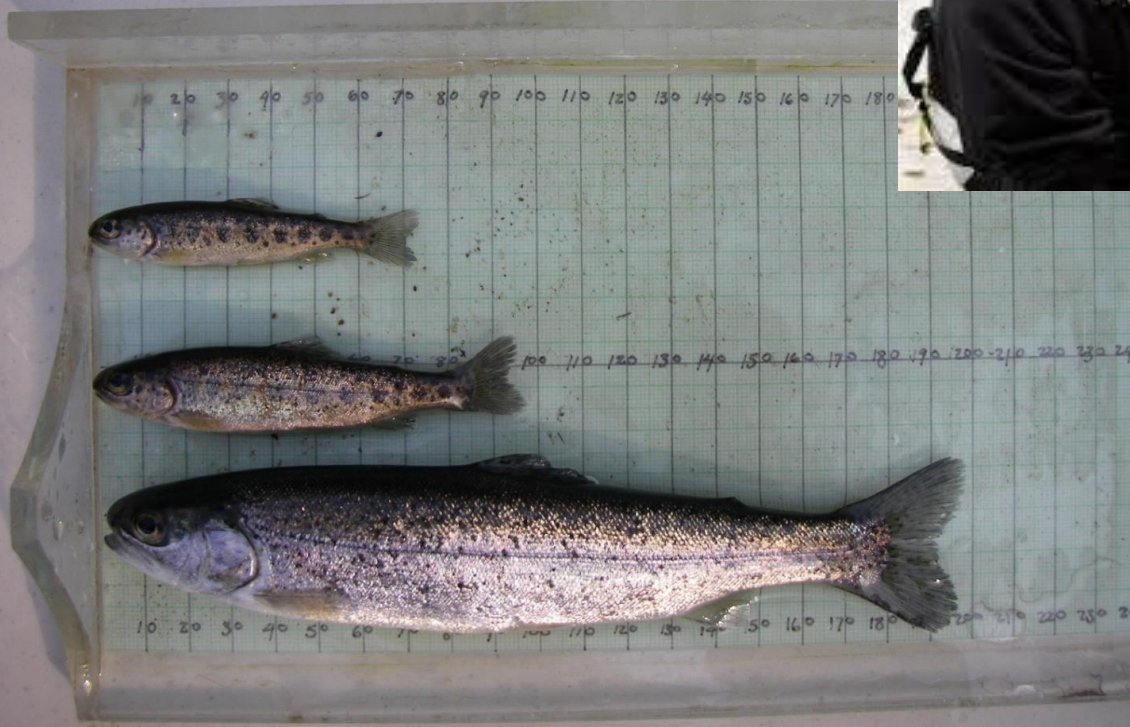
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- Long-term—decadal to century

Rapid evolution of migration

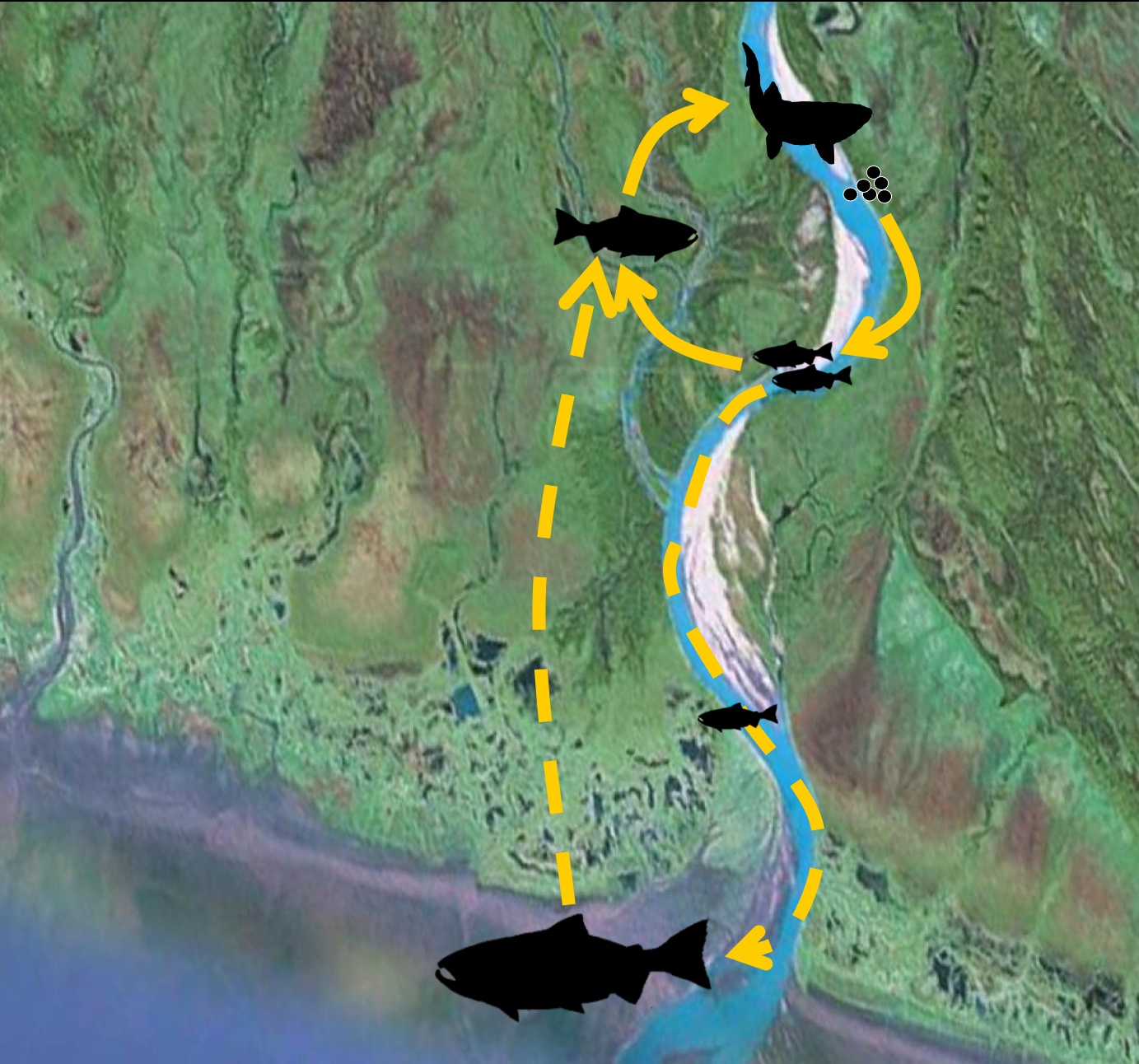
Corey Phillis



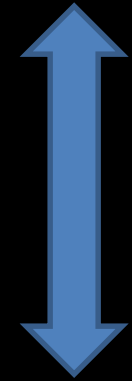
Scott Creek, California



Life Histories of *O. mykiss*

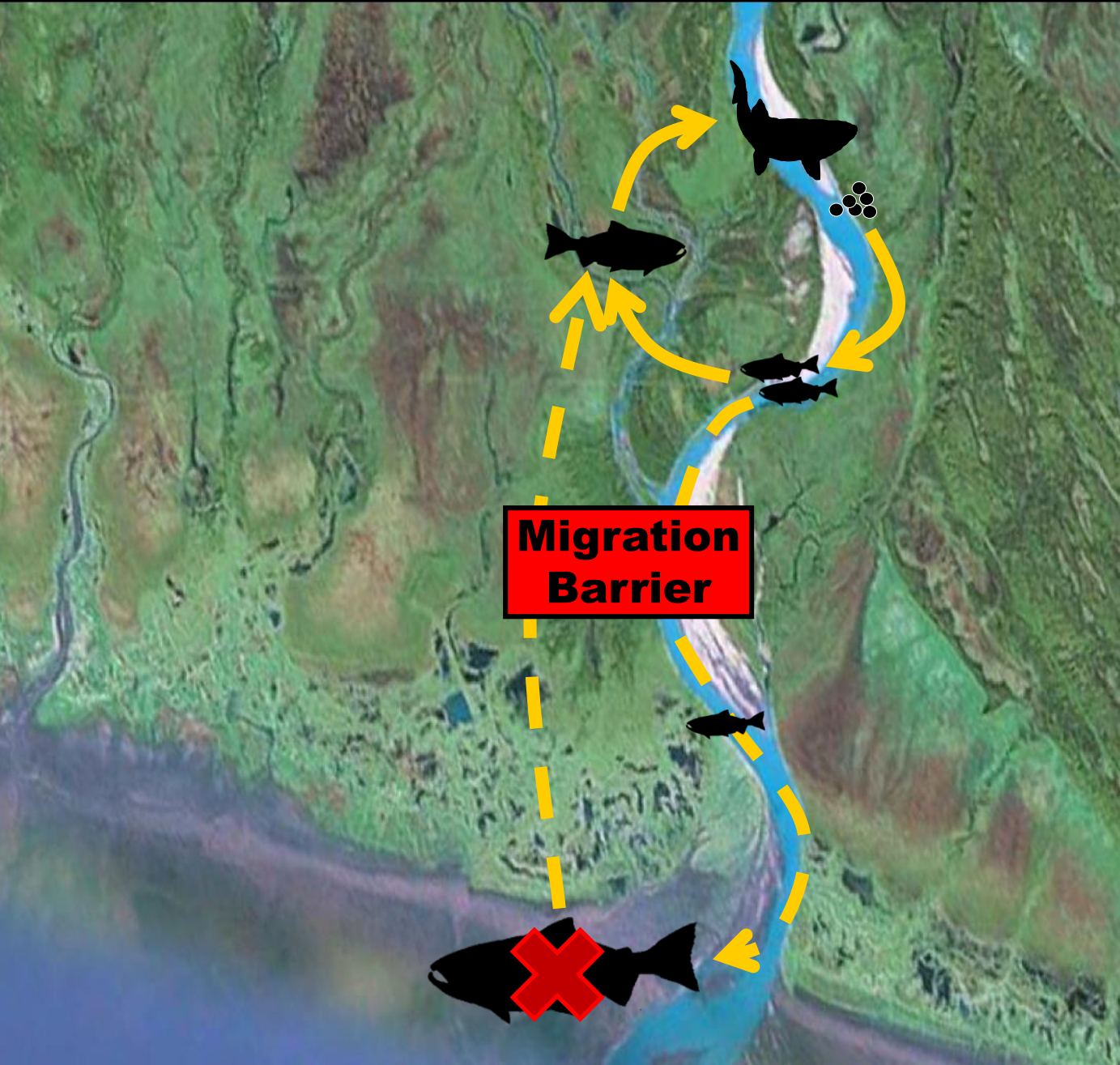


Resident

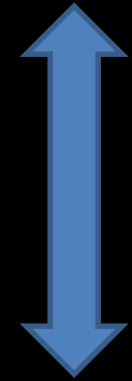


Anadromous

Can *O. mykiss* evolve from anadromous to resident?

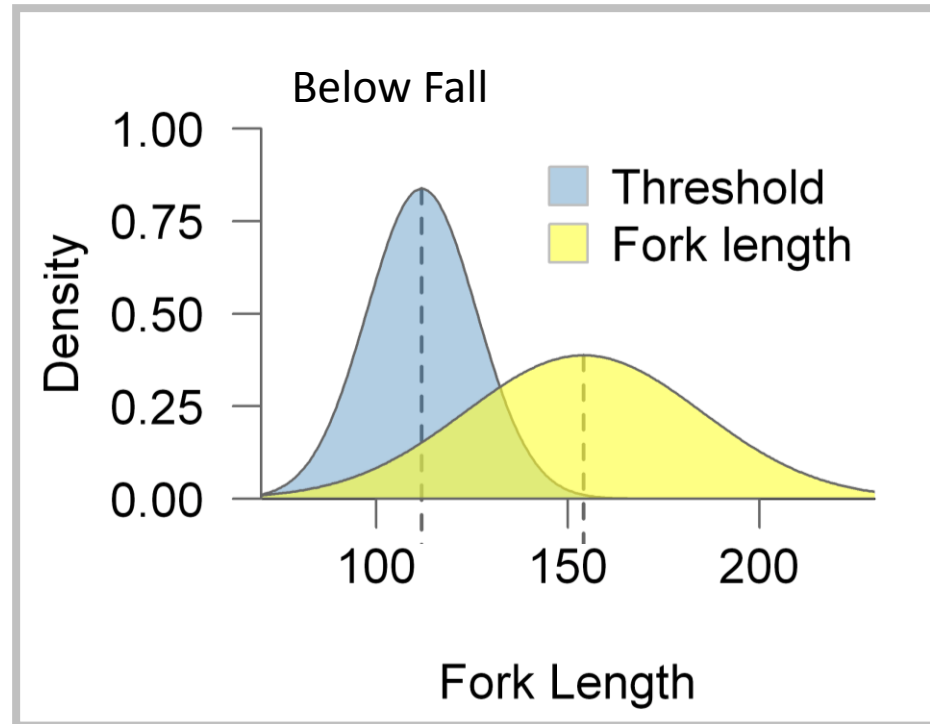


Resident

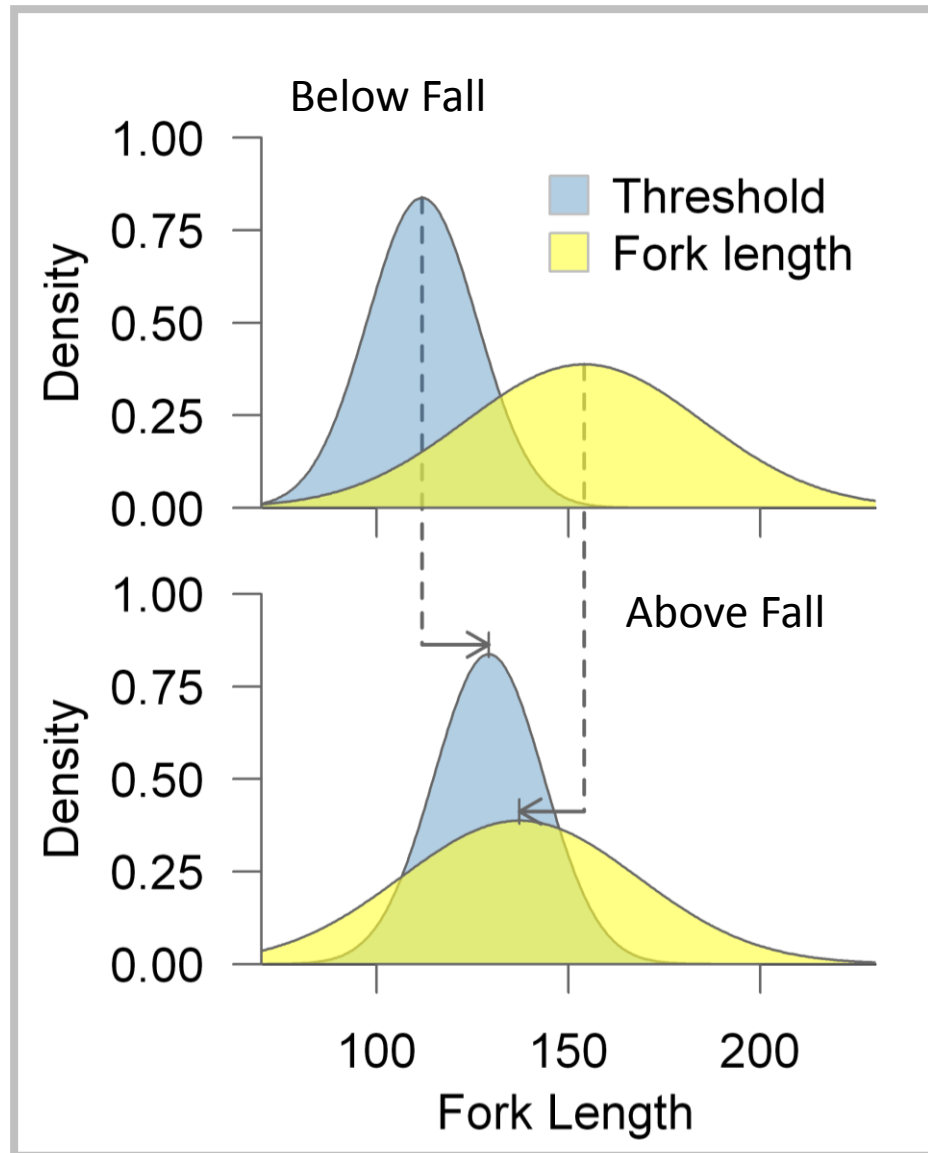


Anadromous

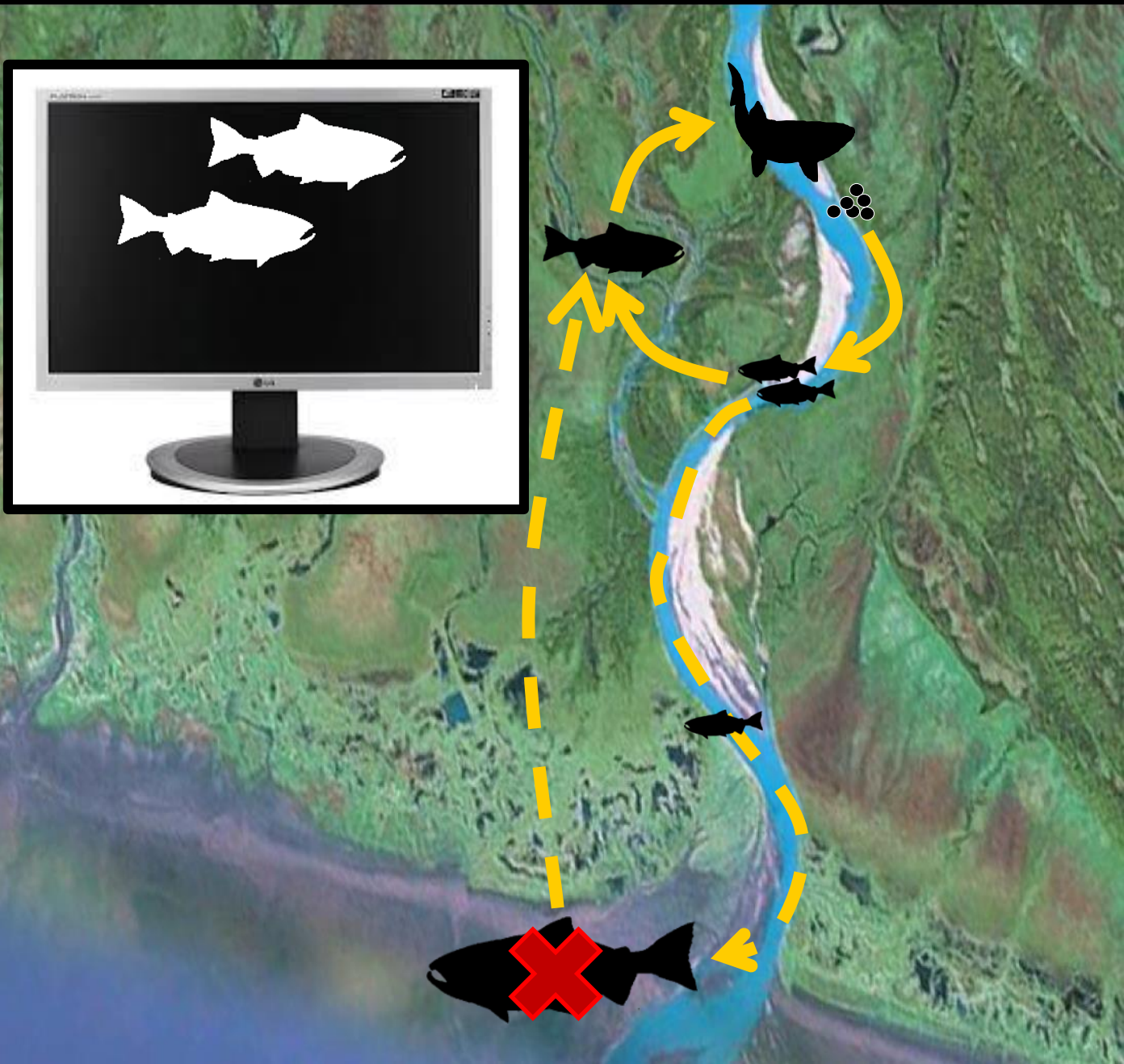
Below Fall Are Larger Than Their Threshold



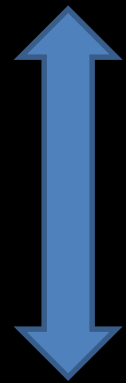
Evolution of Threshold & Size



Will poor ocean survival drive evolution of *O. mykiss*?

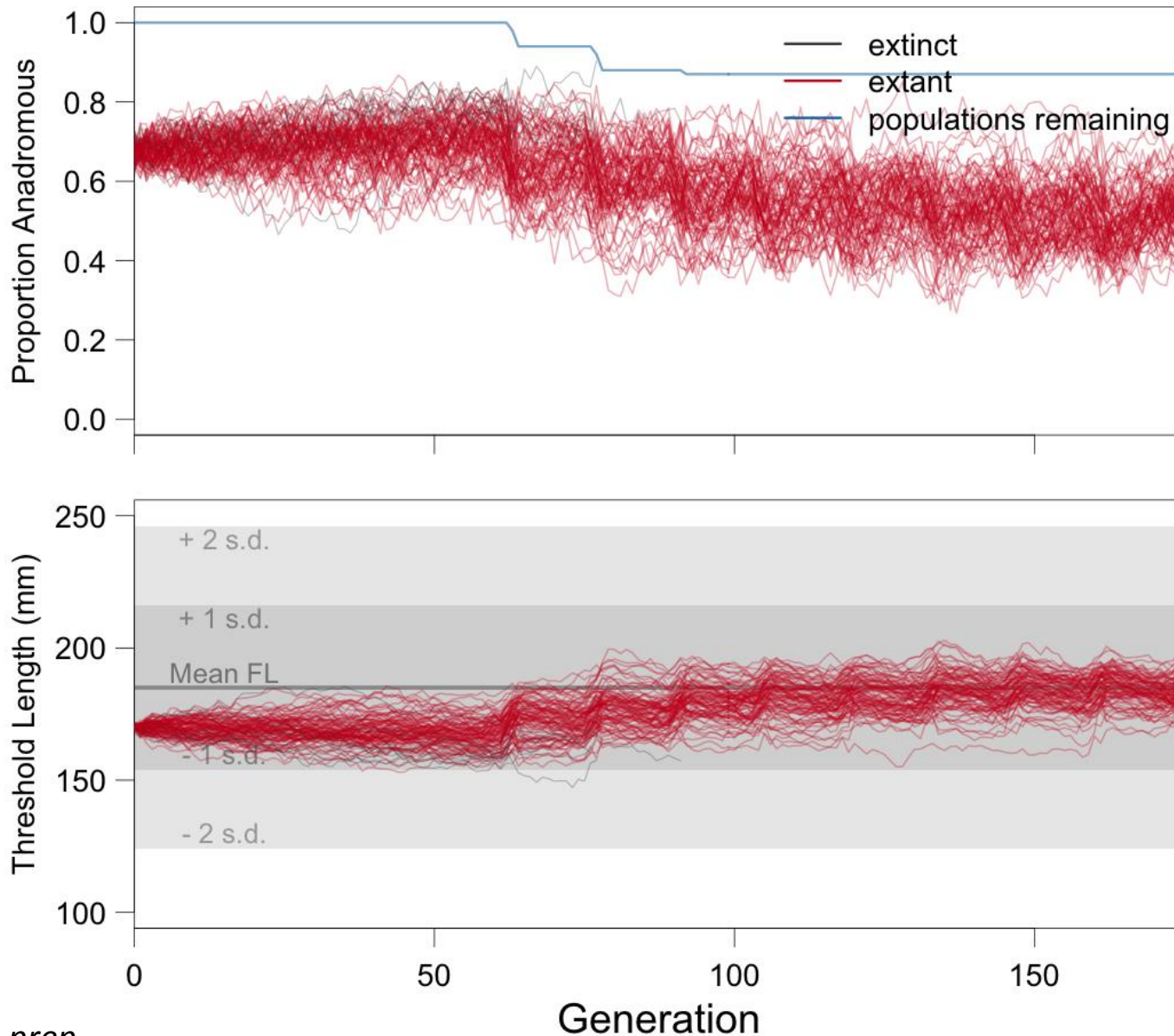


Resident



Anadromous

Evolution of (loss of) anadromy





O. mykiss and a variable ocean

- Short-term → Life-history diversity
- Long-term → Rapid evolution

O. mykiss and a variable ocean

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- What are limits of stability and resilience?
- How are freshwater conditions linked to stability to ocean variability?
- What are trade-offs of diversity?
- How do we manage for stability?

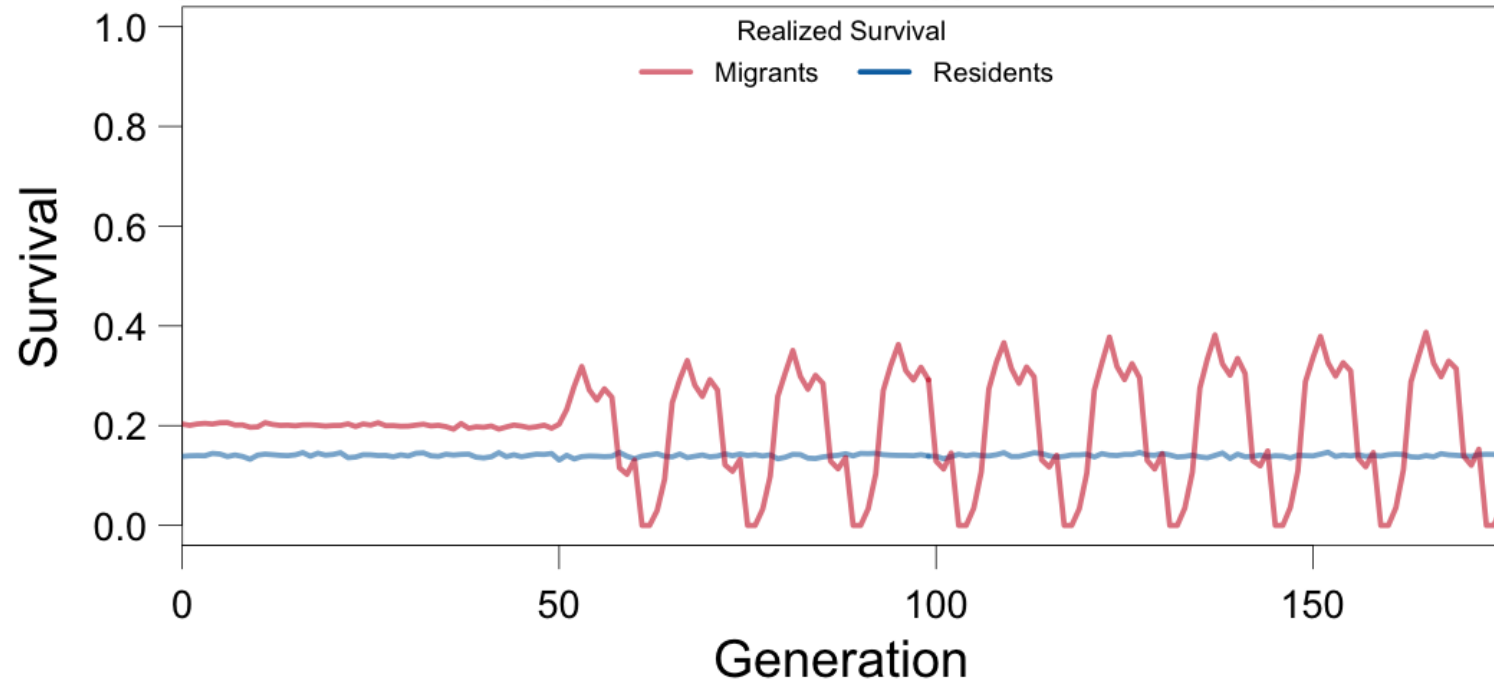
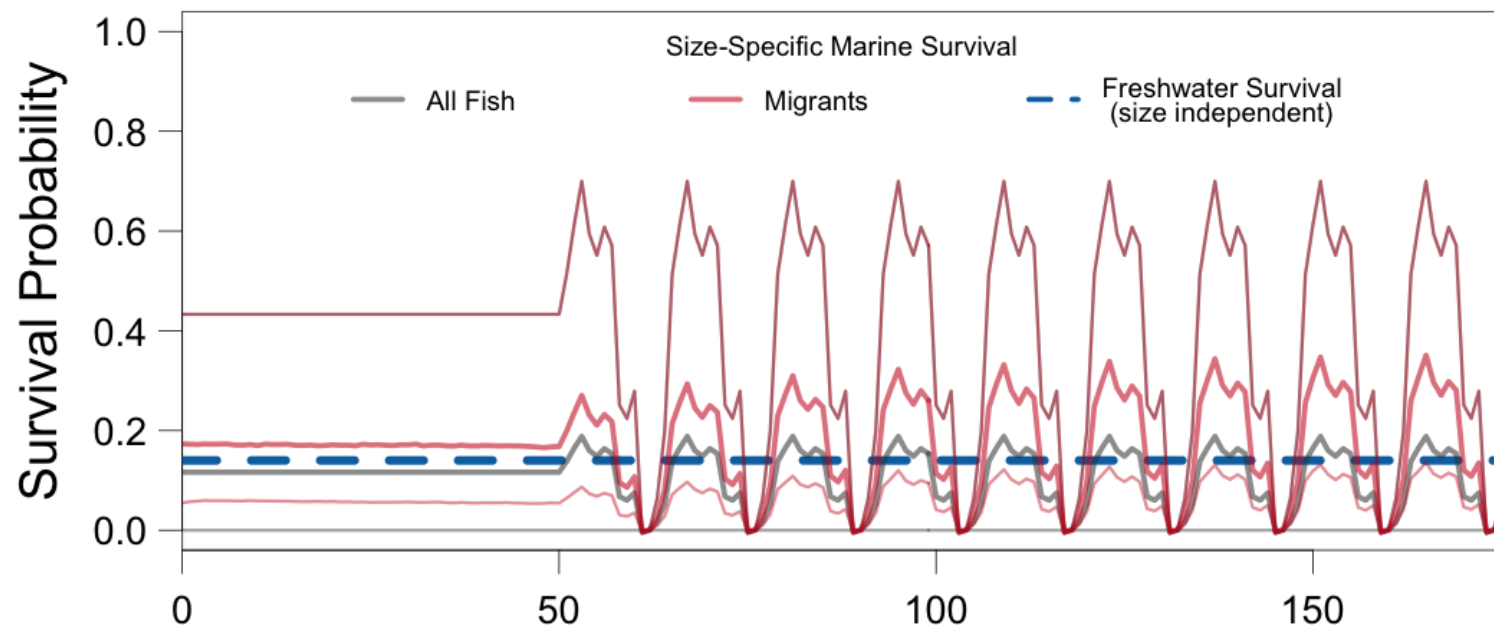


*Centre for Coastal Science
and Management*



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Computer simulations: stability and life-histories

