

APPLICATIONS OF ALTERNATIVE REARING STRATEGIES TO PRODUCE JUVENILE MIGRATORY PHENOTYPES IN SPRING CHINOOK SALMON



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THE WILD FISHES SURROGATE PROJECT

Rear juvenile spring Chinook and winter steelhead in artificial environments to emulate specific wild migratory phenotypes



RESEARCH GOAL

Evaluate how aspects of the early rearing environment influence juvenile downstream migration phenotypes



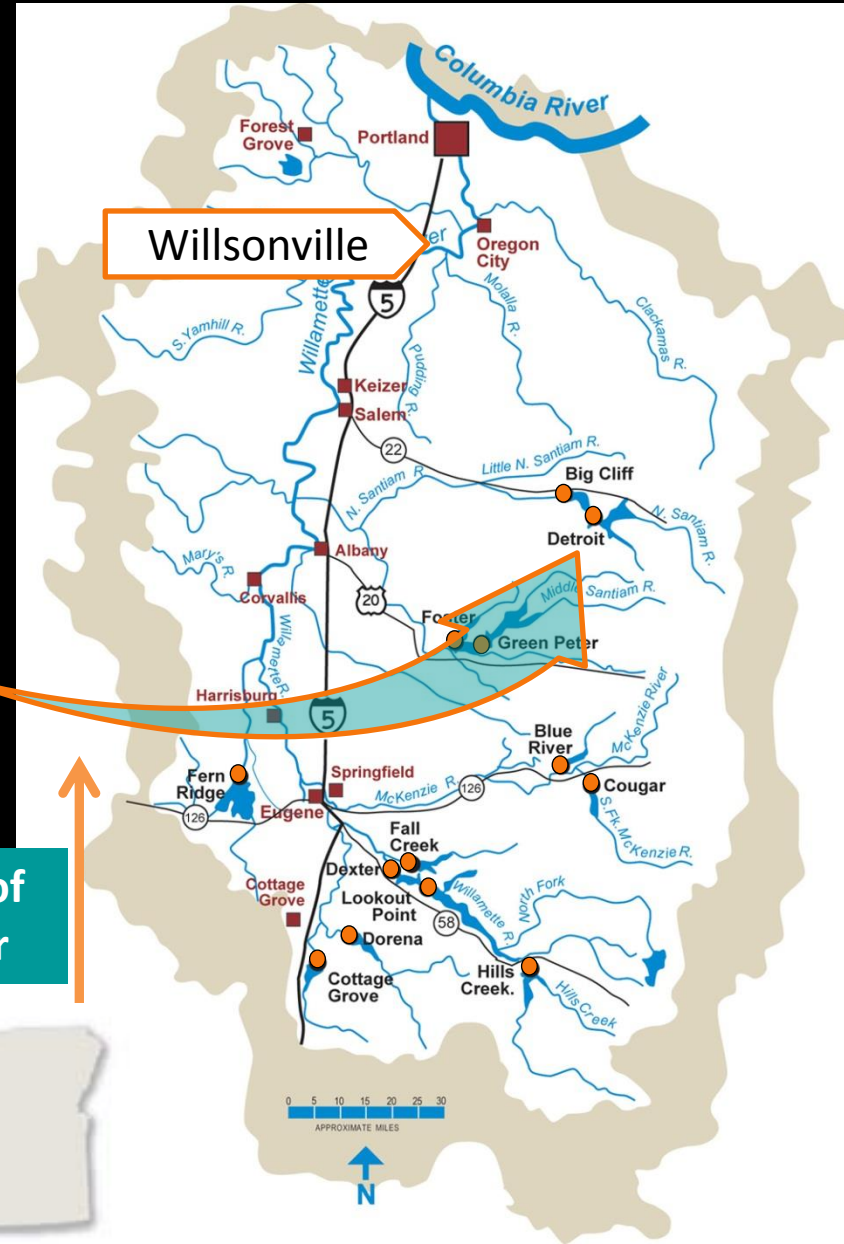
WILLAMETTE RIVER BASIN PROJECTS

Detroit Dam, N. Santiam

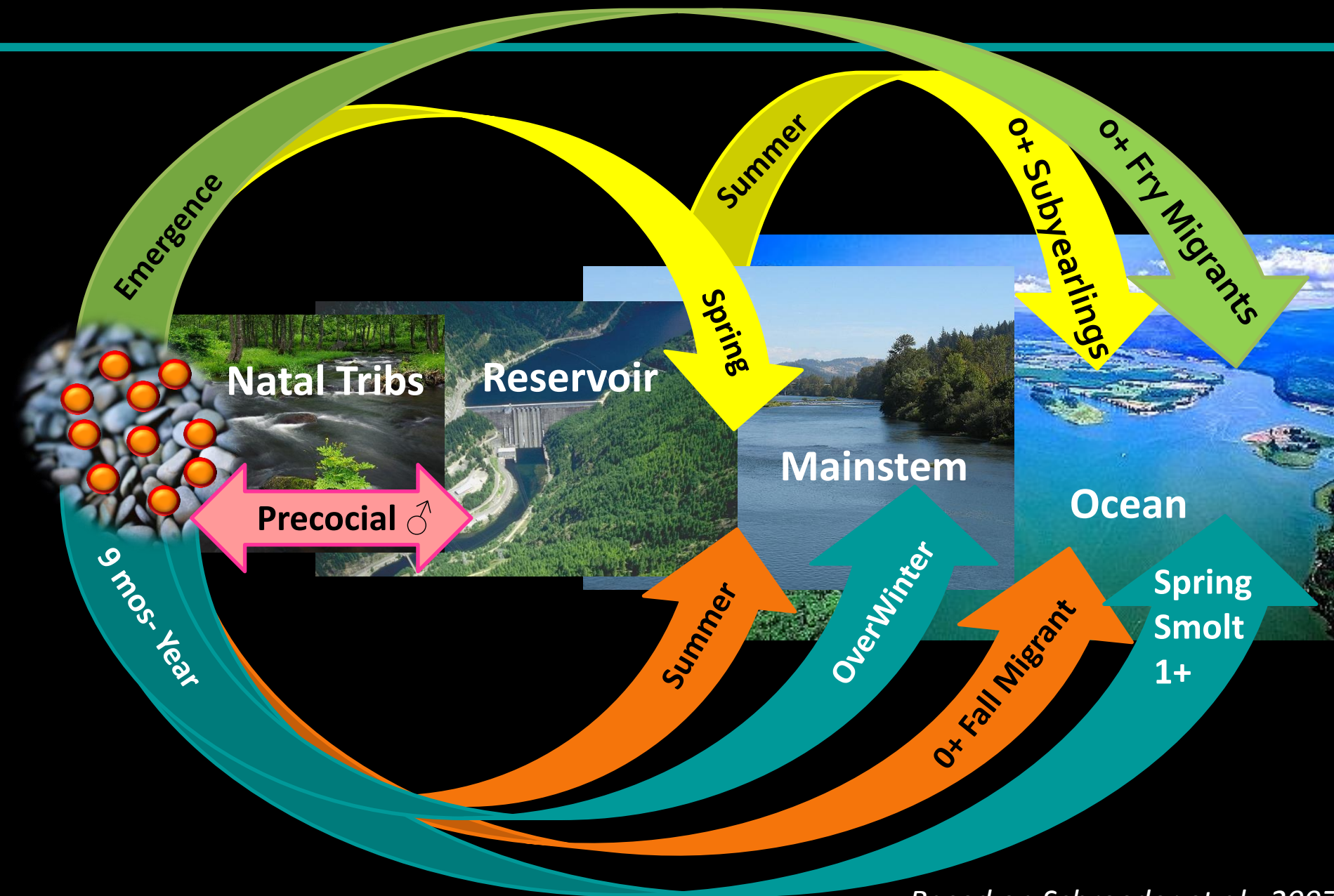


- Passage efficiency and survival through reservoirs and dams
- Good understanding of juvenile migration patterns

Flow of
water

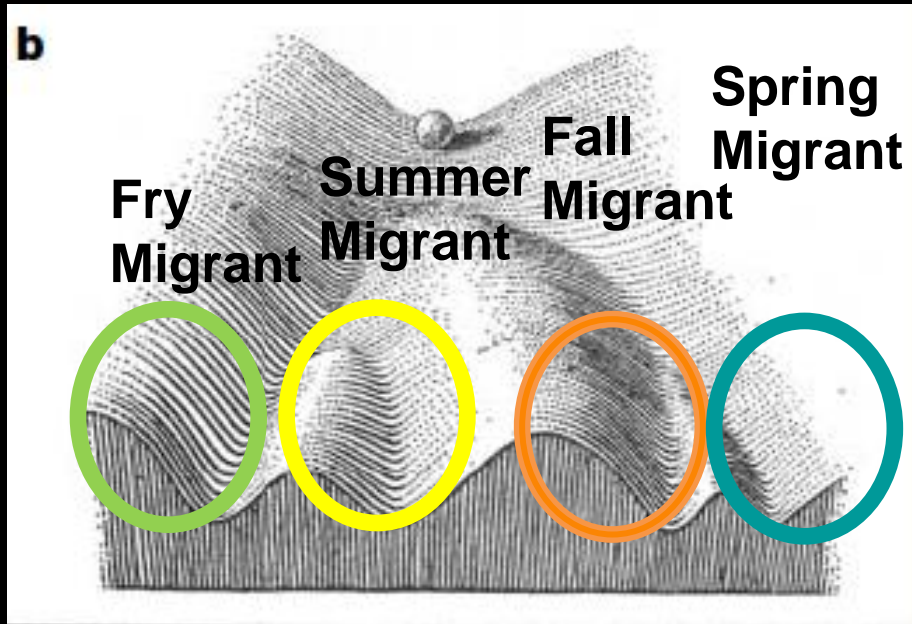


WILLAMETTE SPRING CHINOOK VARIATION

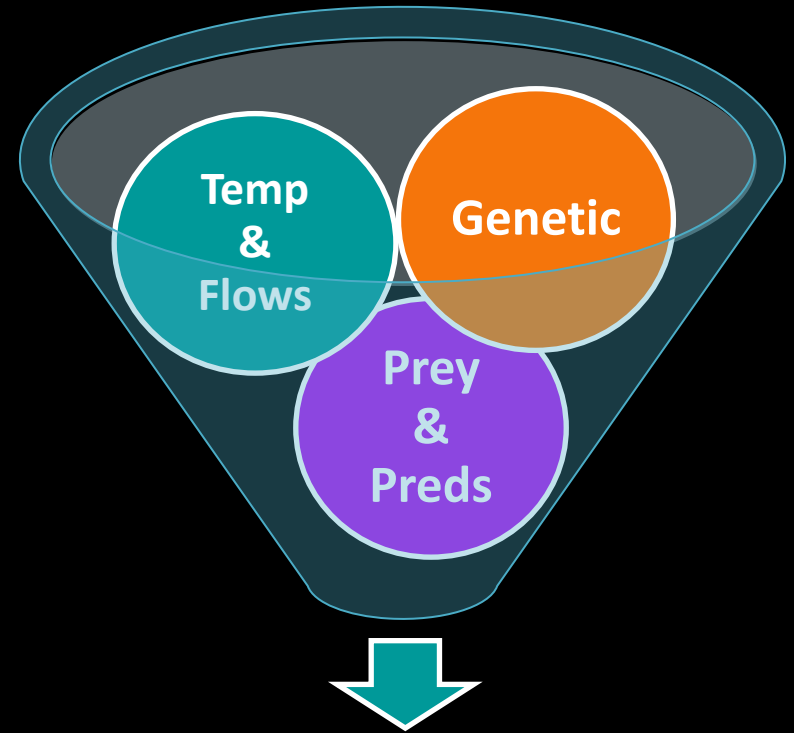


Based on Schroeder et al. 2007

TO MOVE OR STAY, THAT IS THE QUESTION



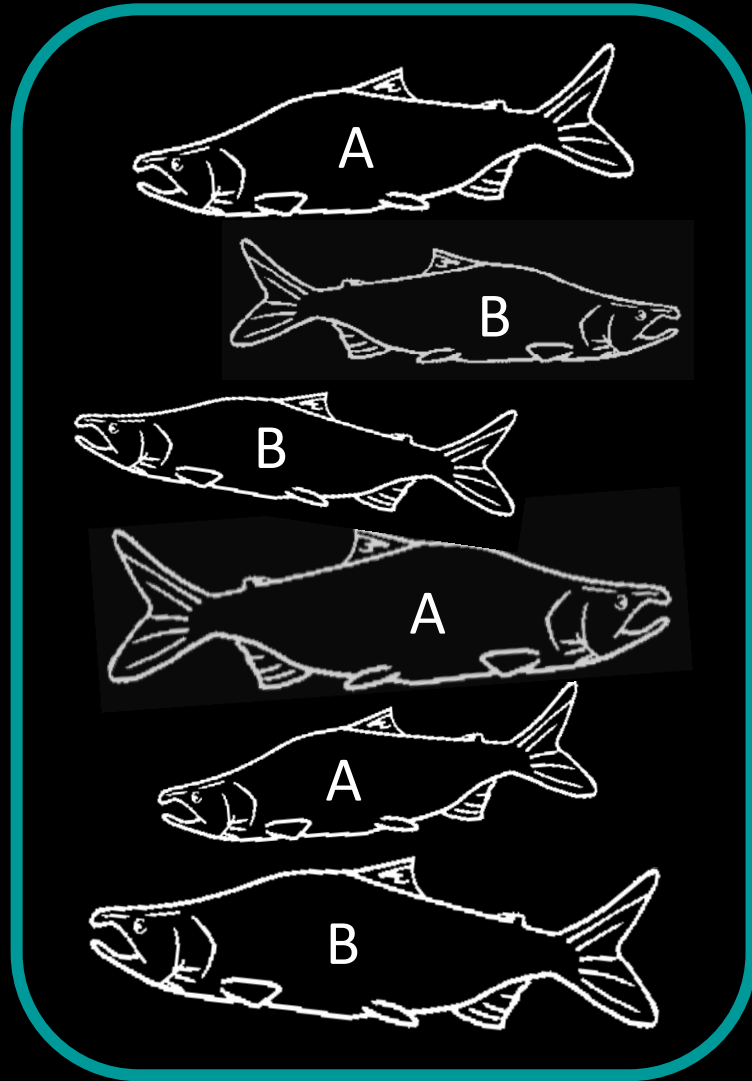
From Waddington 1957



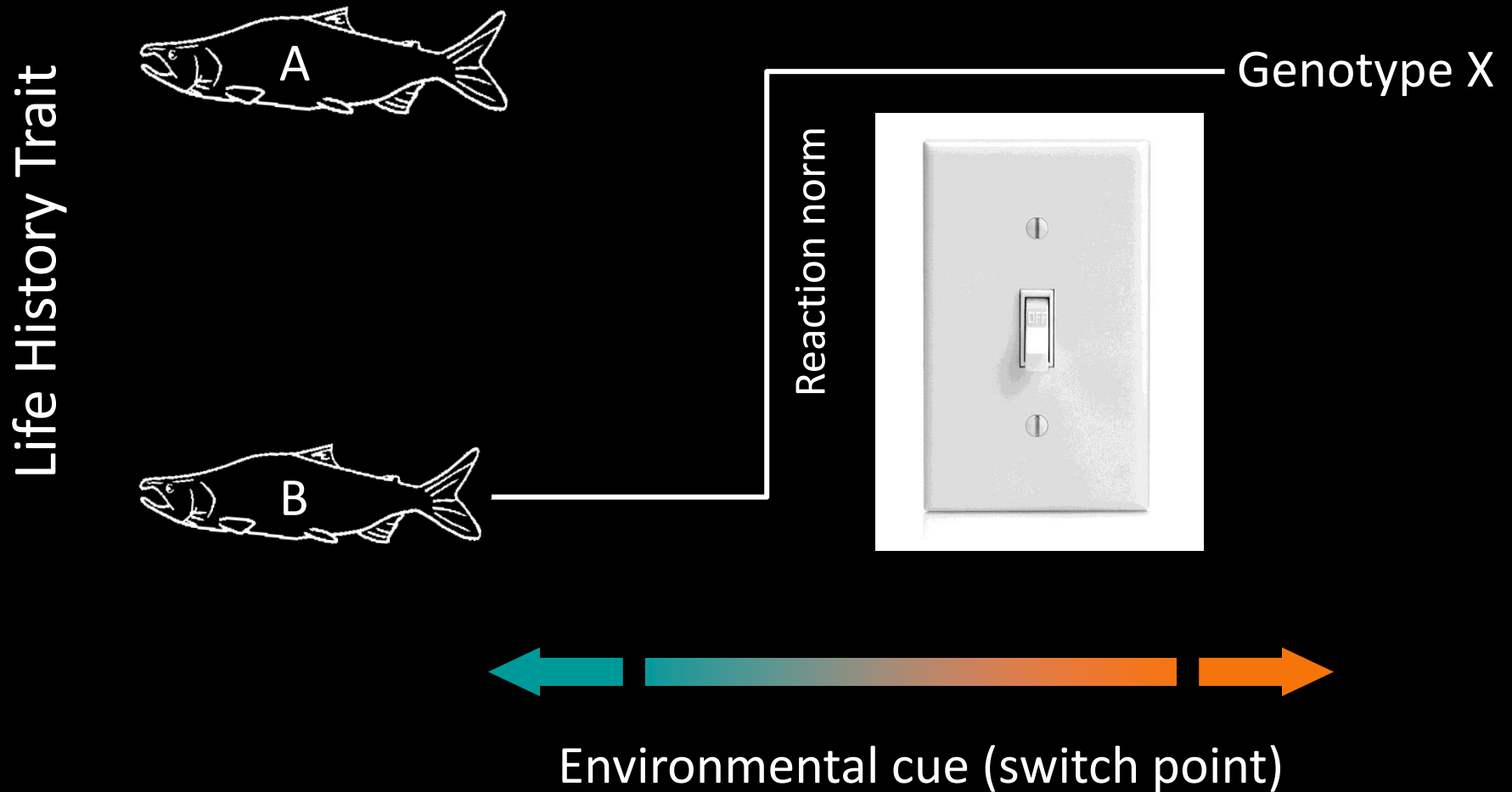
Life History Trajectory

Perkins and Jager (2011) subyearling vs. yearling life history trajectories may be determined soon after emergence.

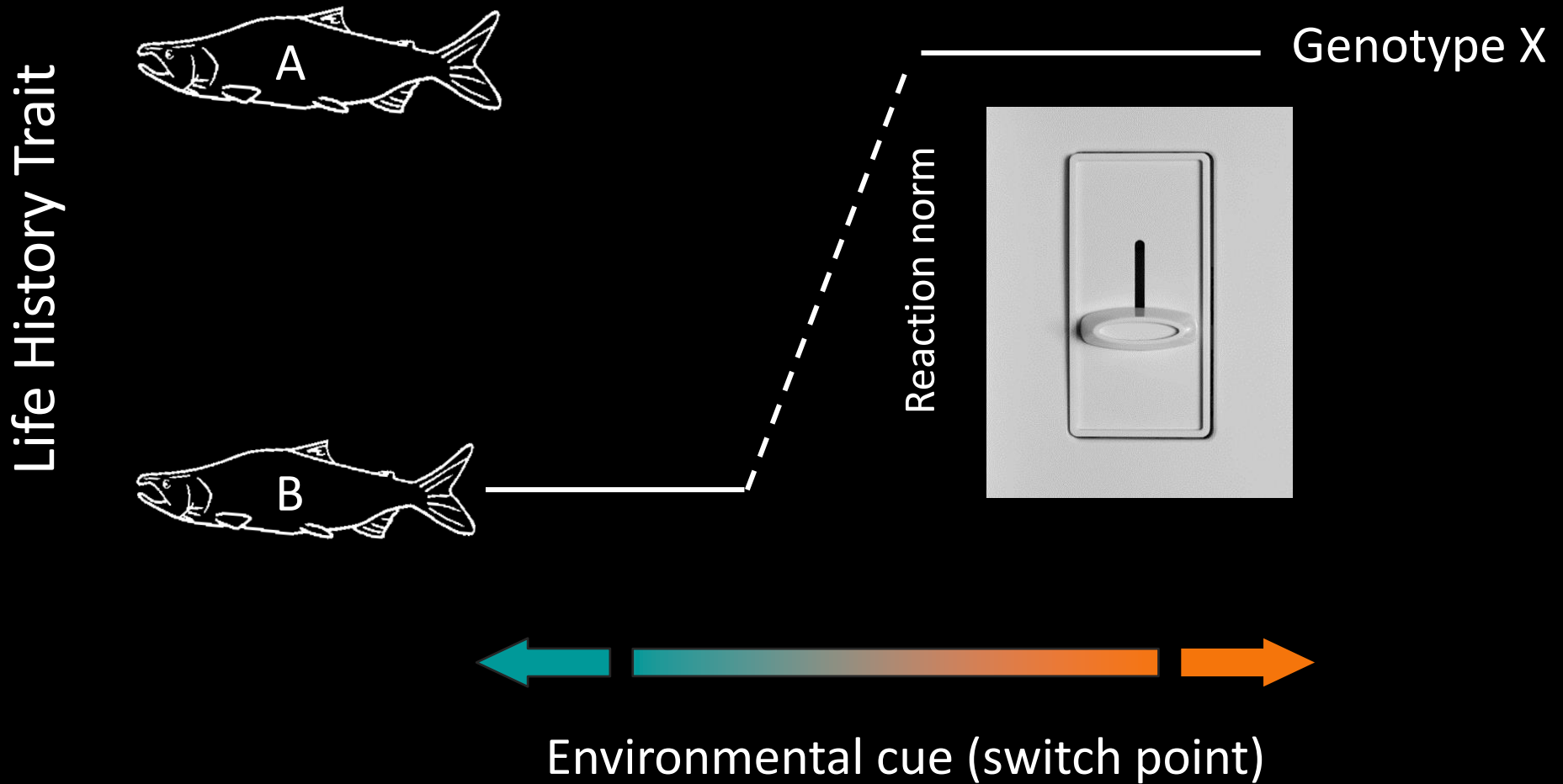
IMAGINE A POPULATION OF FISH...



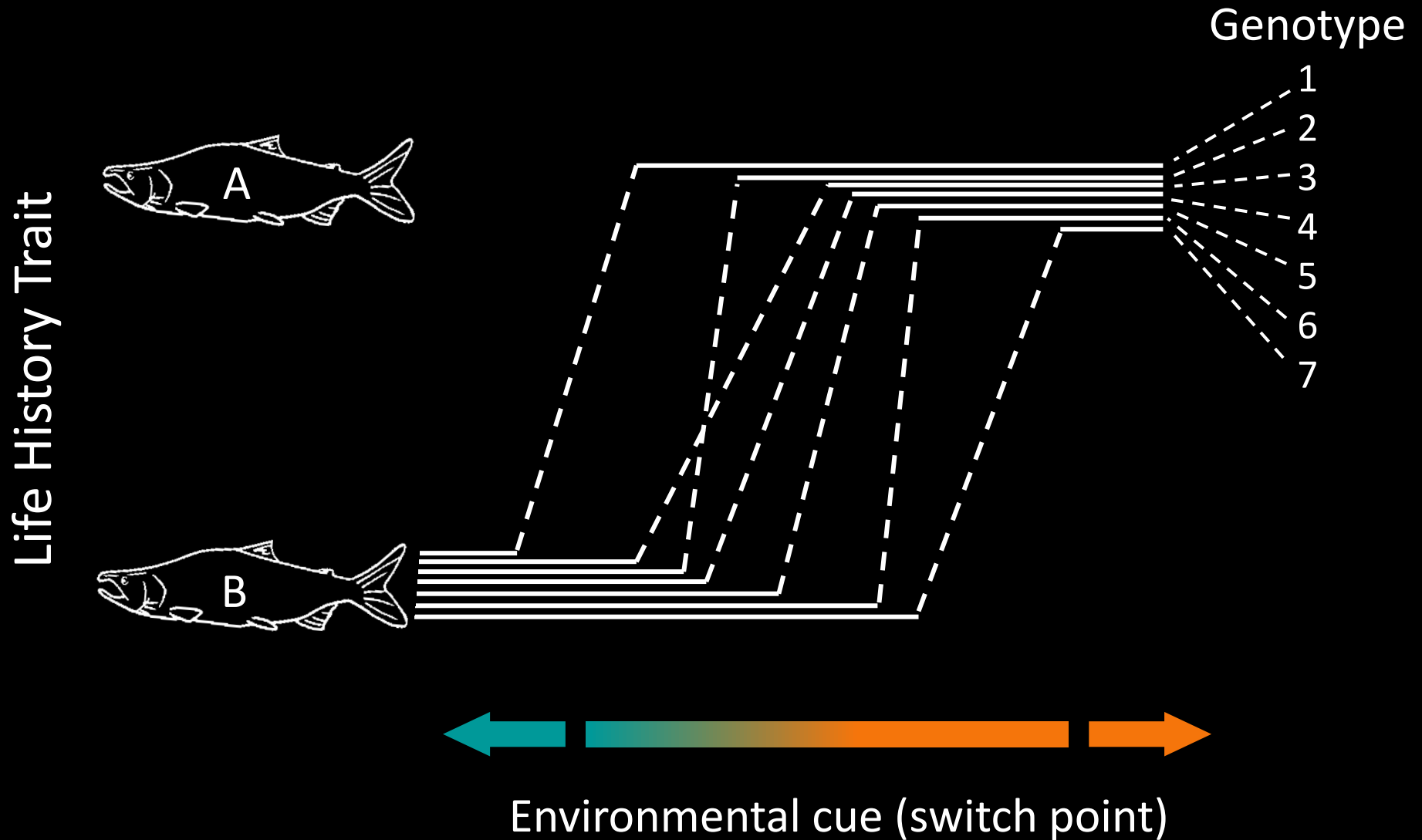
VARIATION AND REACTION NORMS



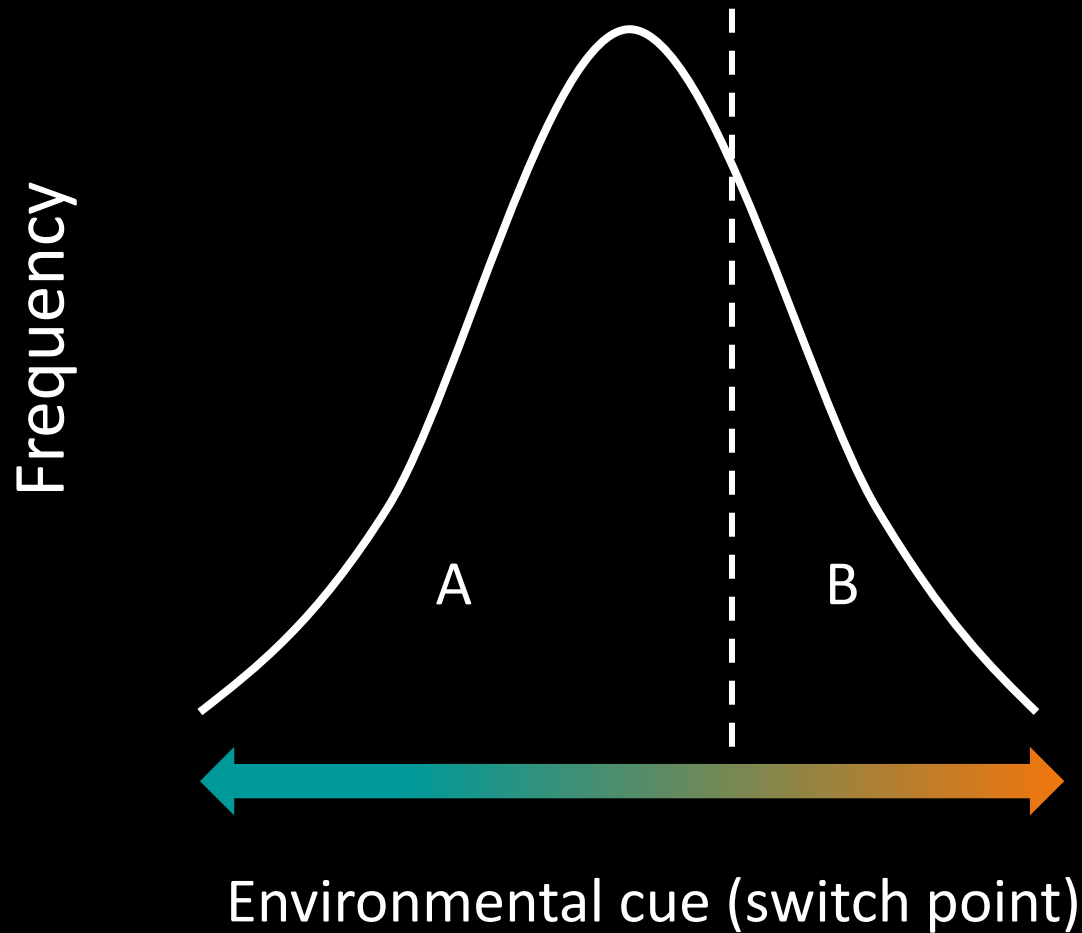
VARIATION AND REACTION NORMS



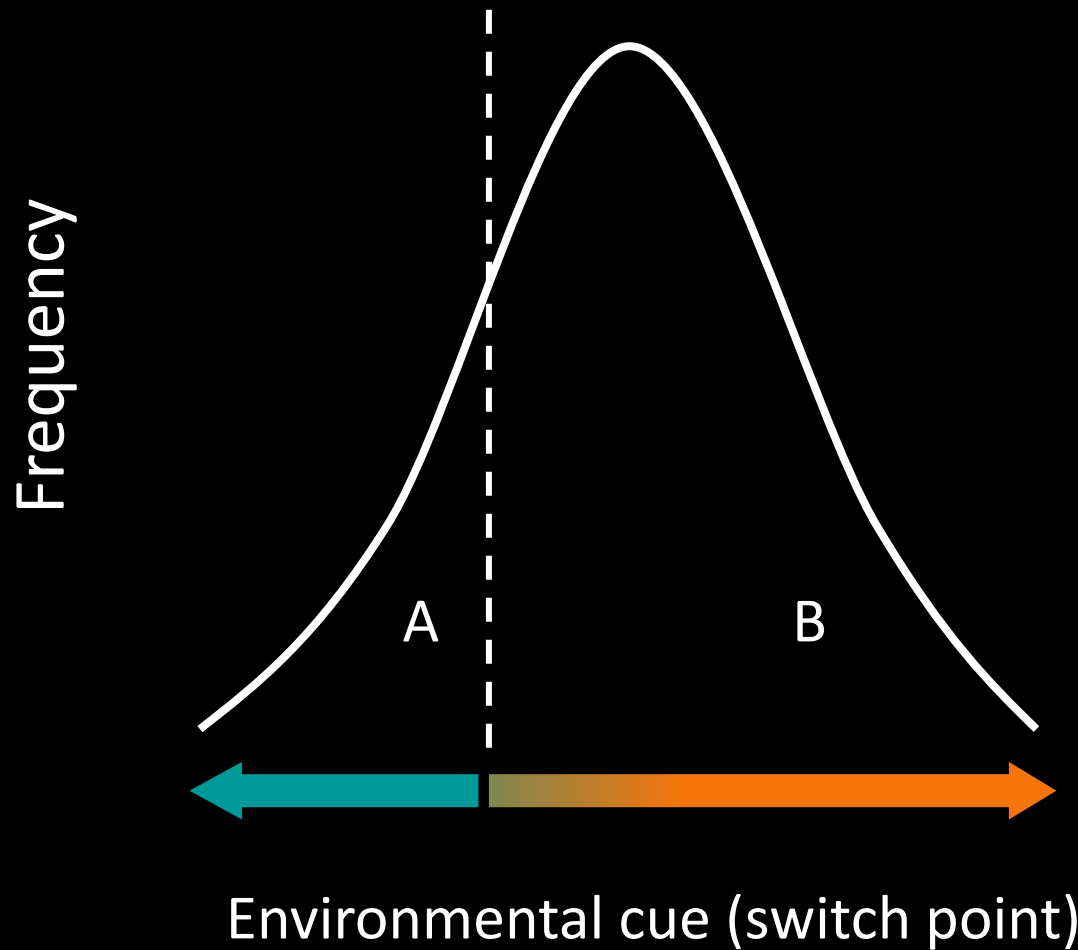
VARIATION AND REACTION NORMS



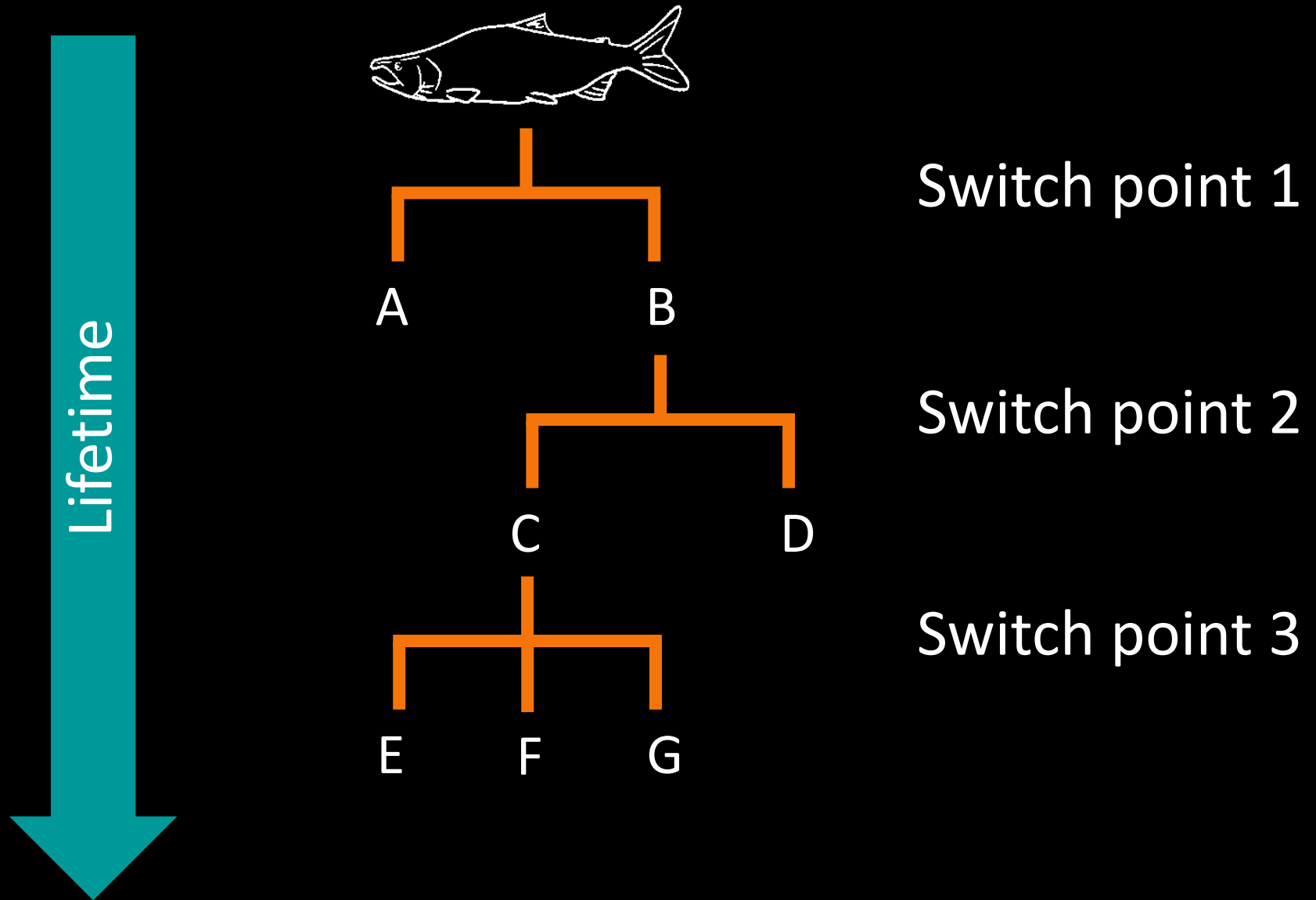
FREQUENCY OF LIFE HISTORY TRAITS



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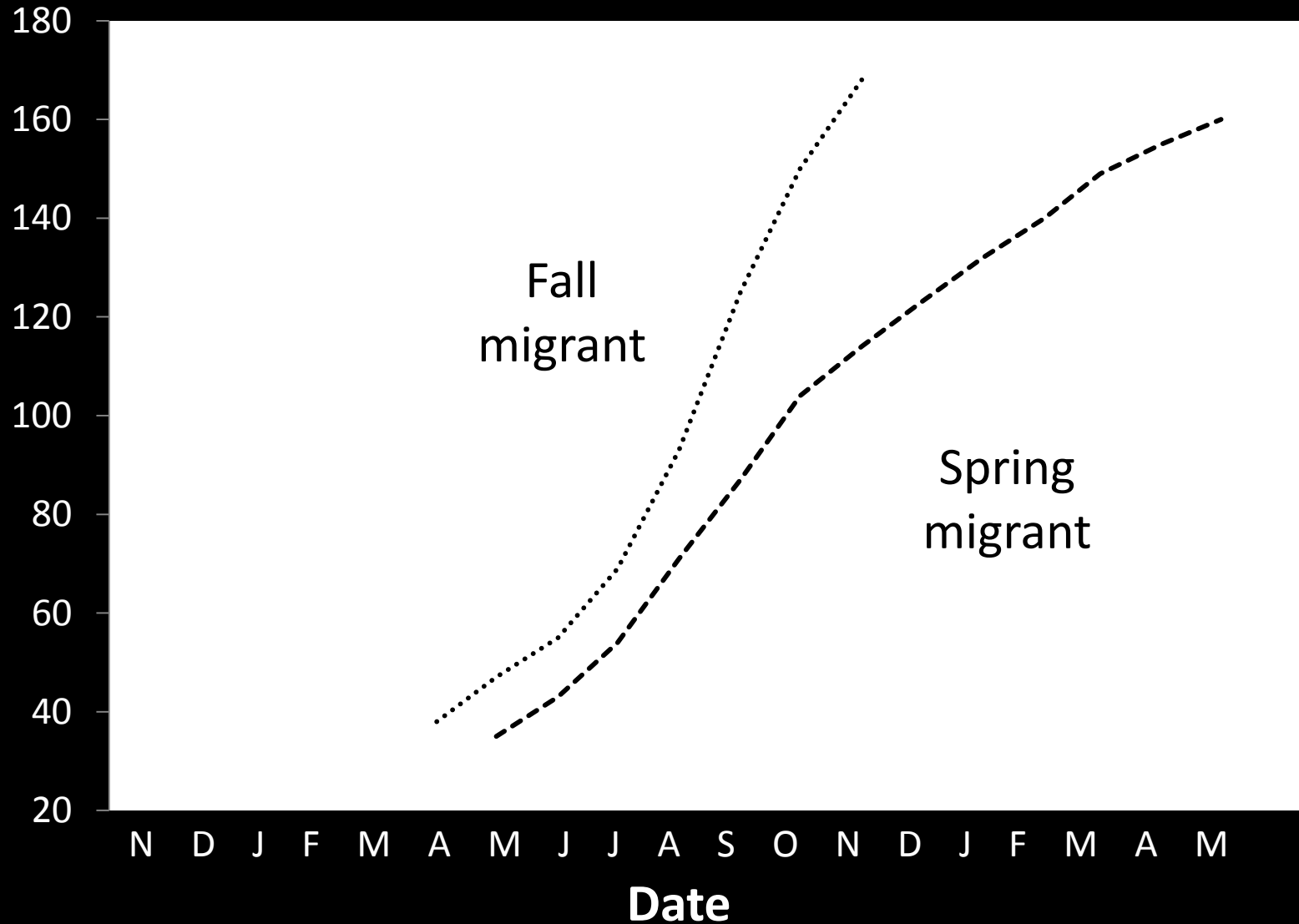
LIFE HISTORY PATHWAYS



DETERMINE WILD FISH PHENOTYPES



WILD FISH GROWTH TRAJECTORIES

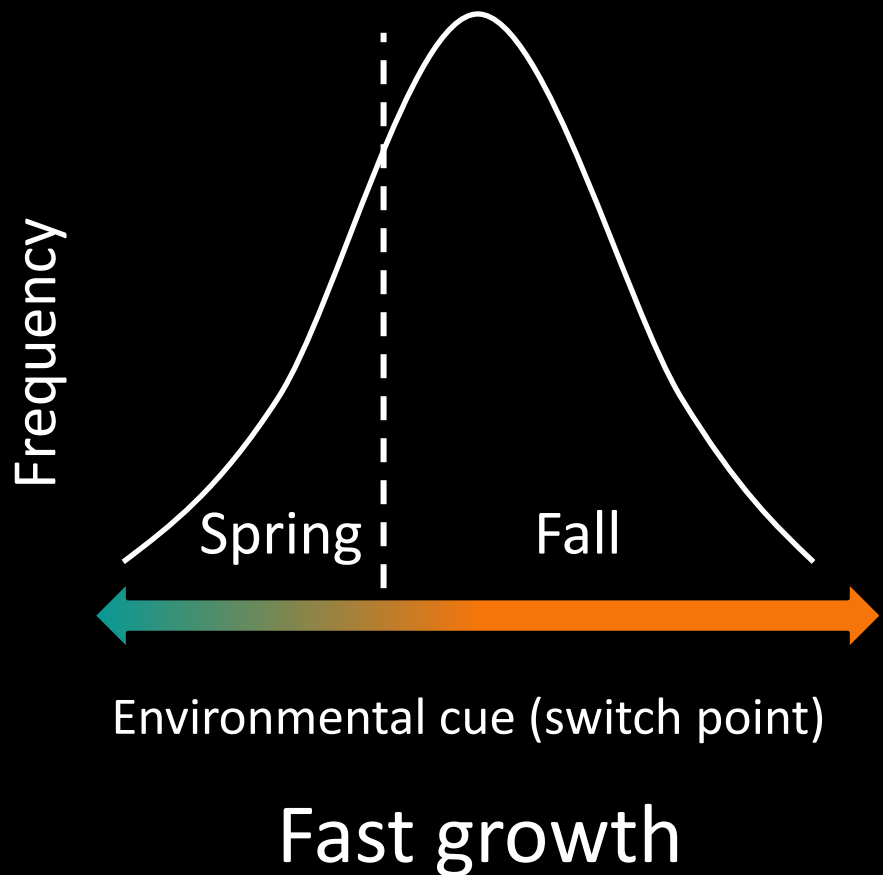
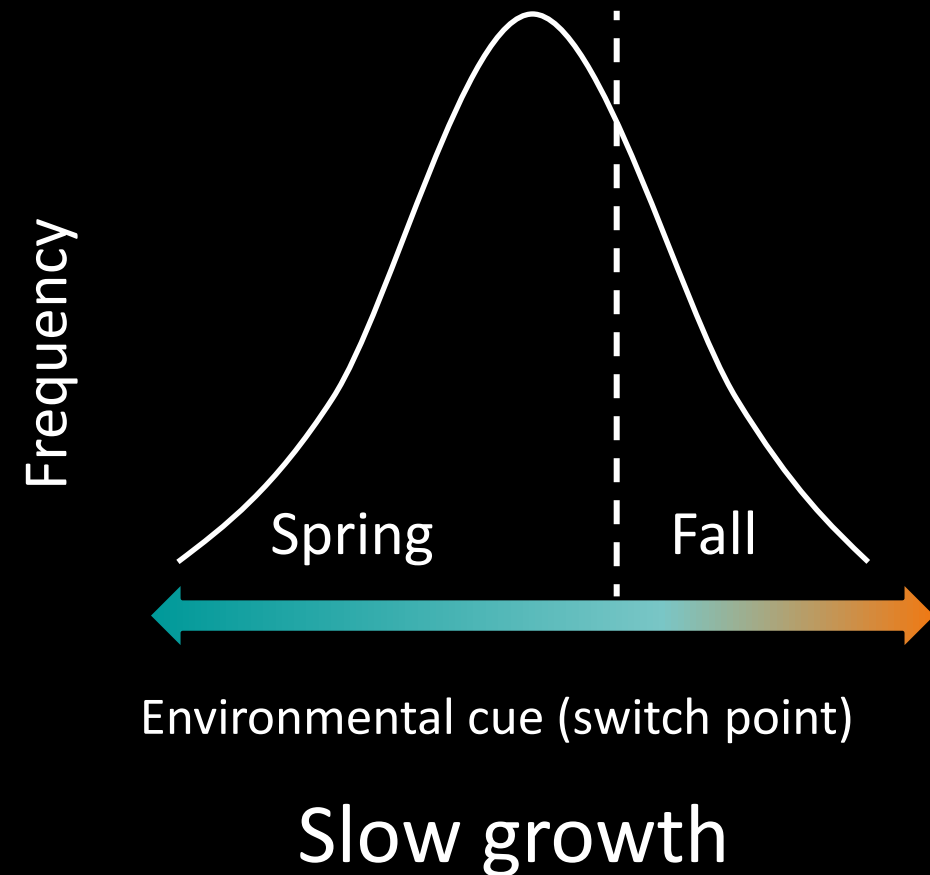


ALTERNATIVE REARING STRATEGIES

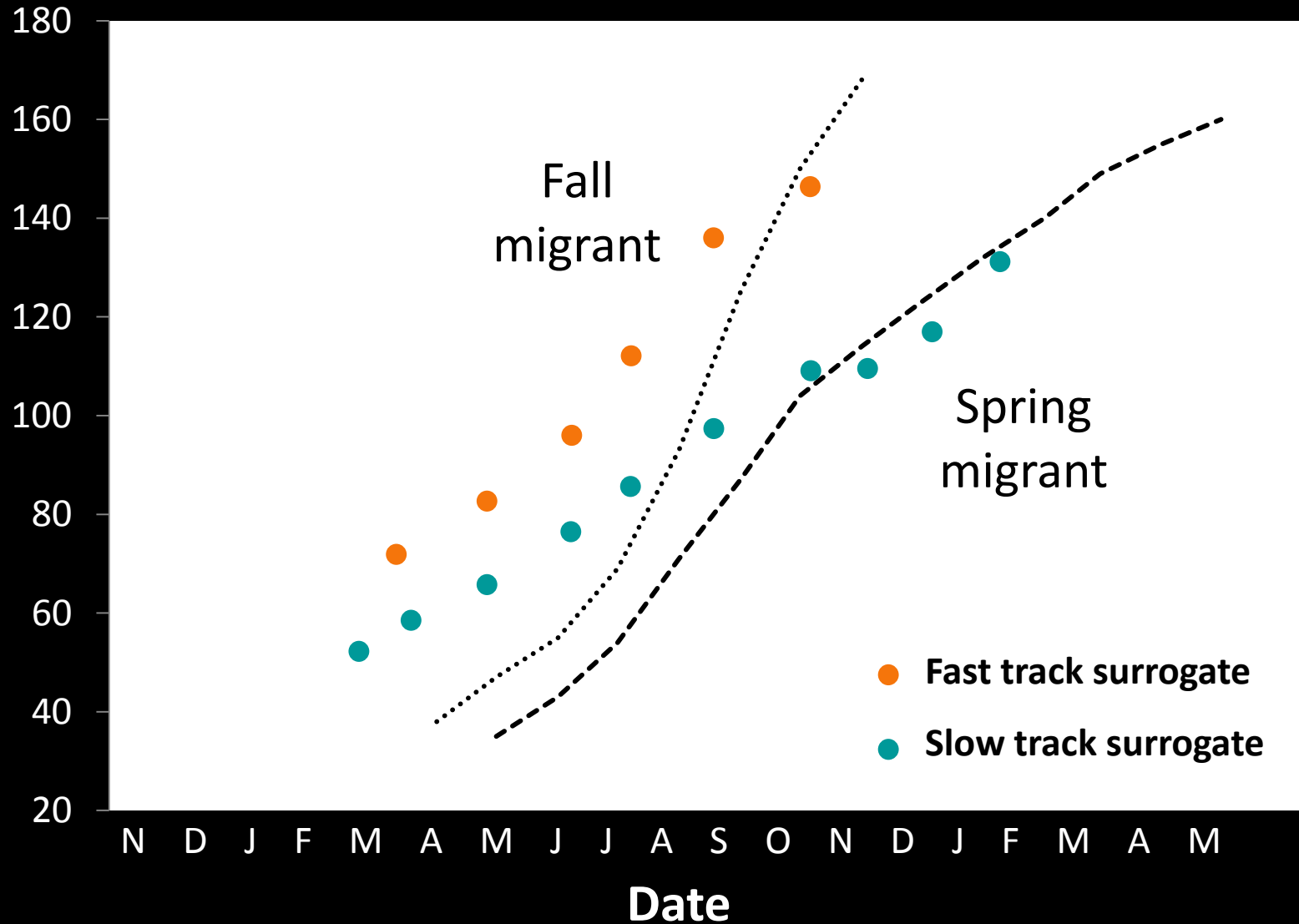
- Incubation & Rearing Temperature
- Substrate & Structure
- Density
- Diet & Feeding



PROVIDE DIFFERENT CUES FOR REARING



SURROGATE GROWTH TRAJECTORIES



MORPHOLOGICAL COMPARISONS

Hatchery



Surrogate



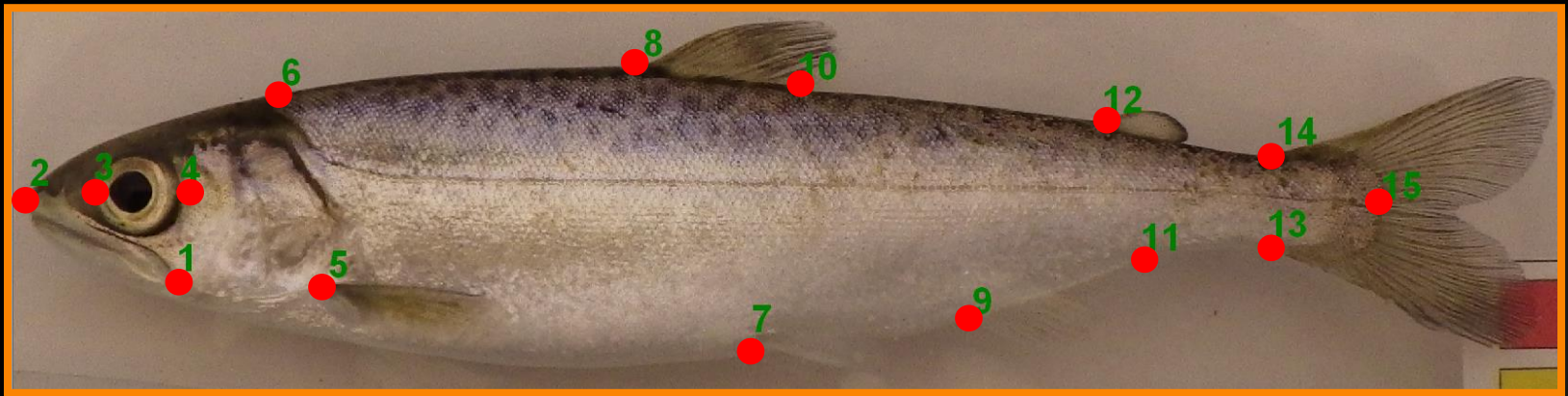
Wild



Photos are to scale

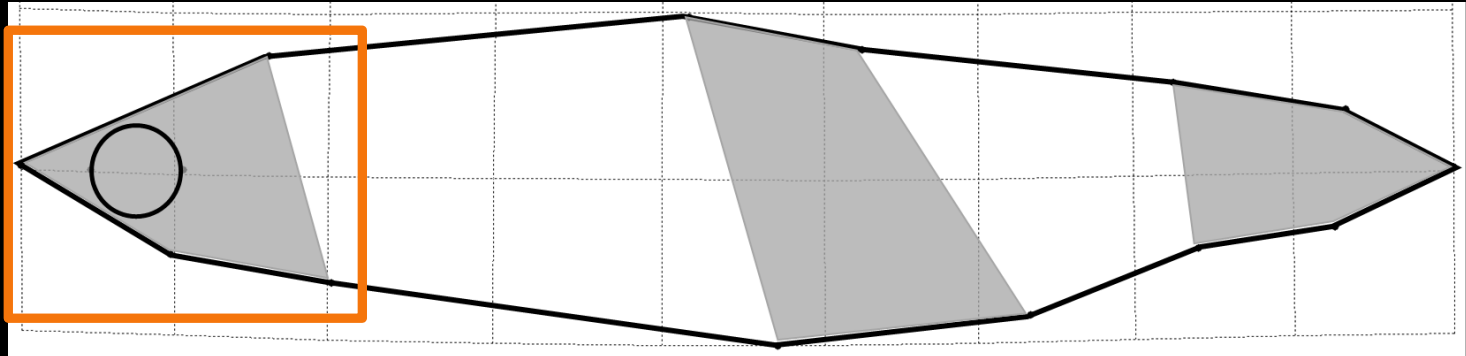
MORPHOLOGICAL COMPARISONS

- Landmark-based geometric morphometrics

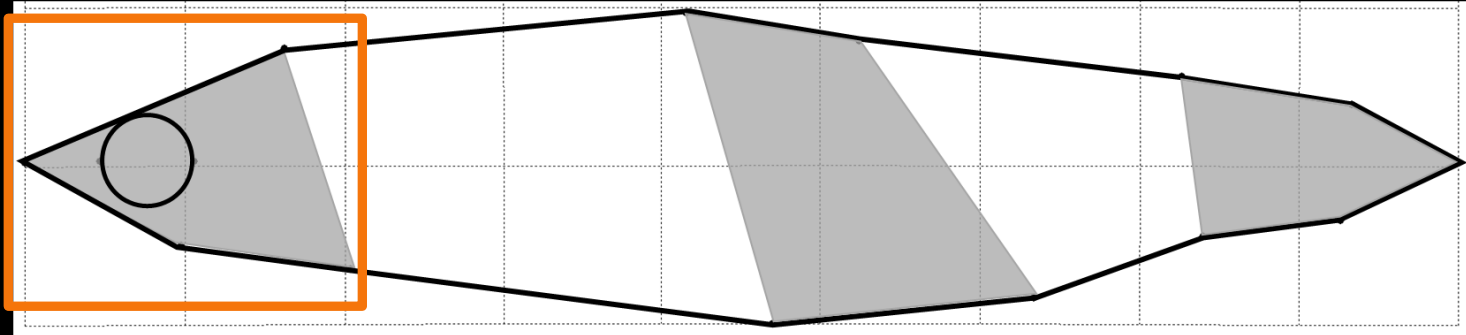


MORPHOLOGICAL COMPARISONS

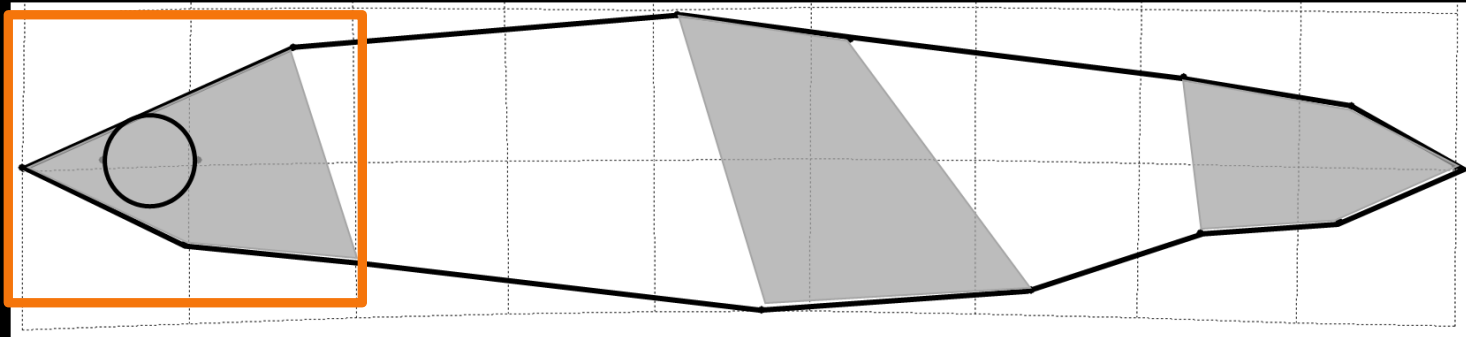
Hatchery



Surrogate

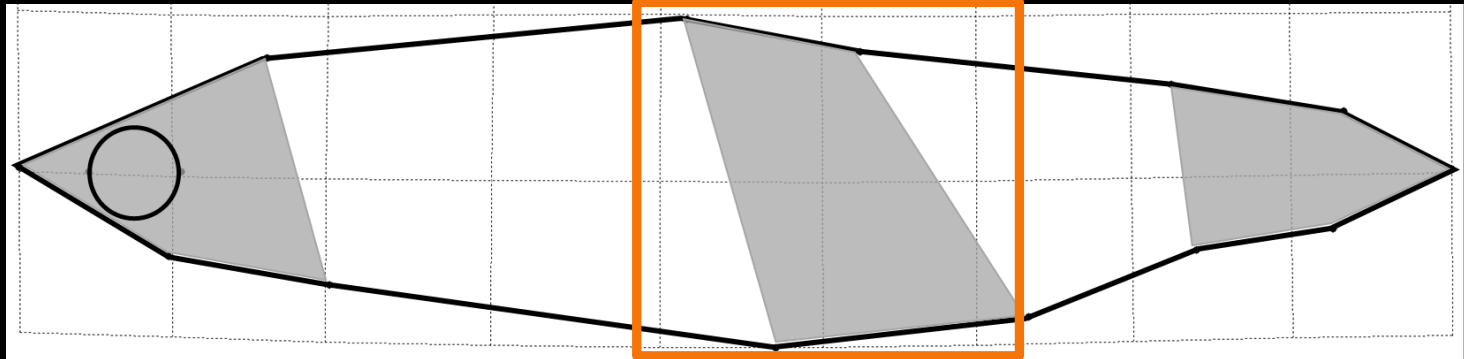


Wild

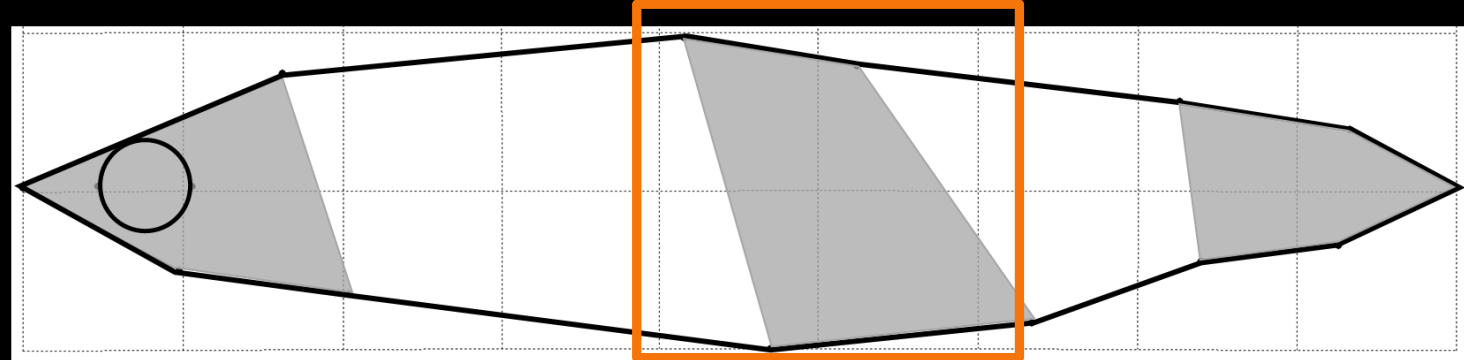


MORPHOLOGICAL COMPARISONS

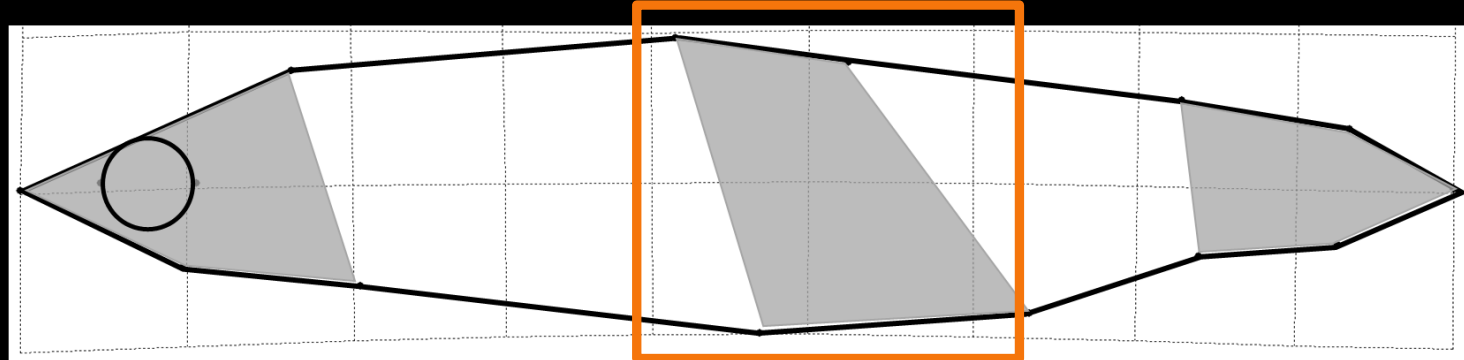
Hatchery



Surrogate



Wild



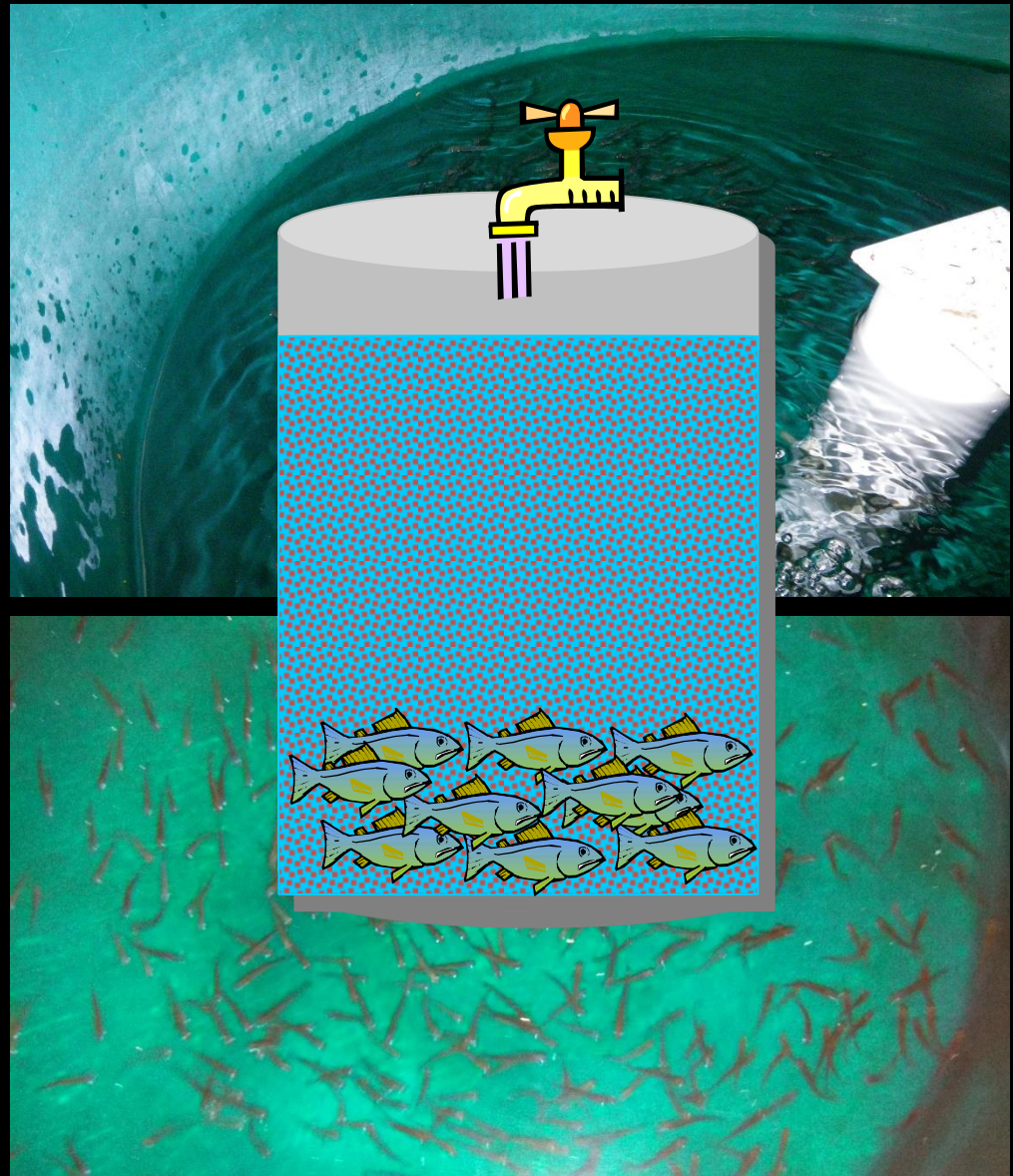
ALTERNATIVE REARING STRATEGIES

- Incubation & Rearing Temperature
- Substrate & Structure
- Density
- Diet & Feeding
- **Behavioral Self-Sorting**



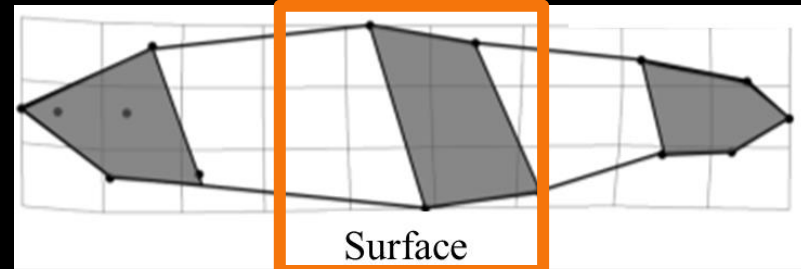
VERTICAL SELF-SORTING

- Recorded in BY 2011, 2012, 2013 & 2014
- McKenzie, N. Santiam & S. Santiam Stocks
- FPGL & OHRC Facilities
- Maintain orientation & feeding location after separation

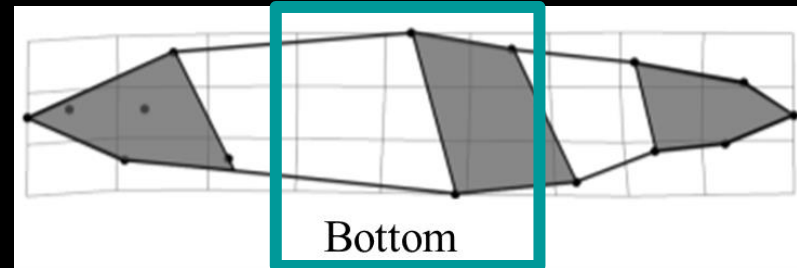


VERTICALLY SORTED PHENOTYPES

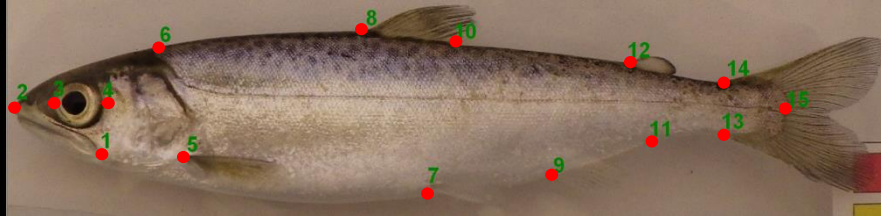
Surface Type



Bottom Type

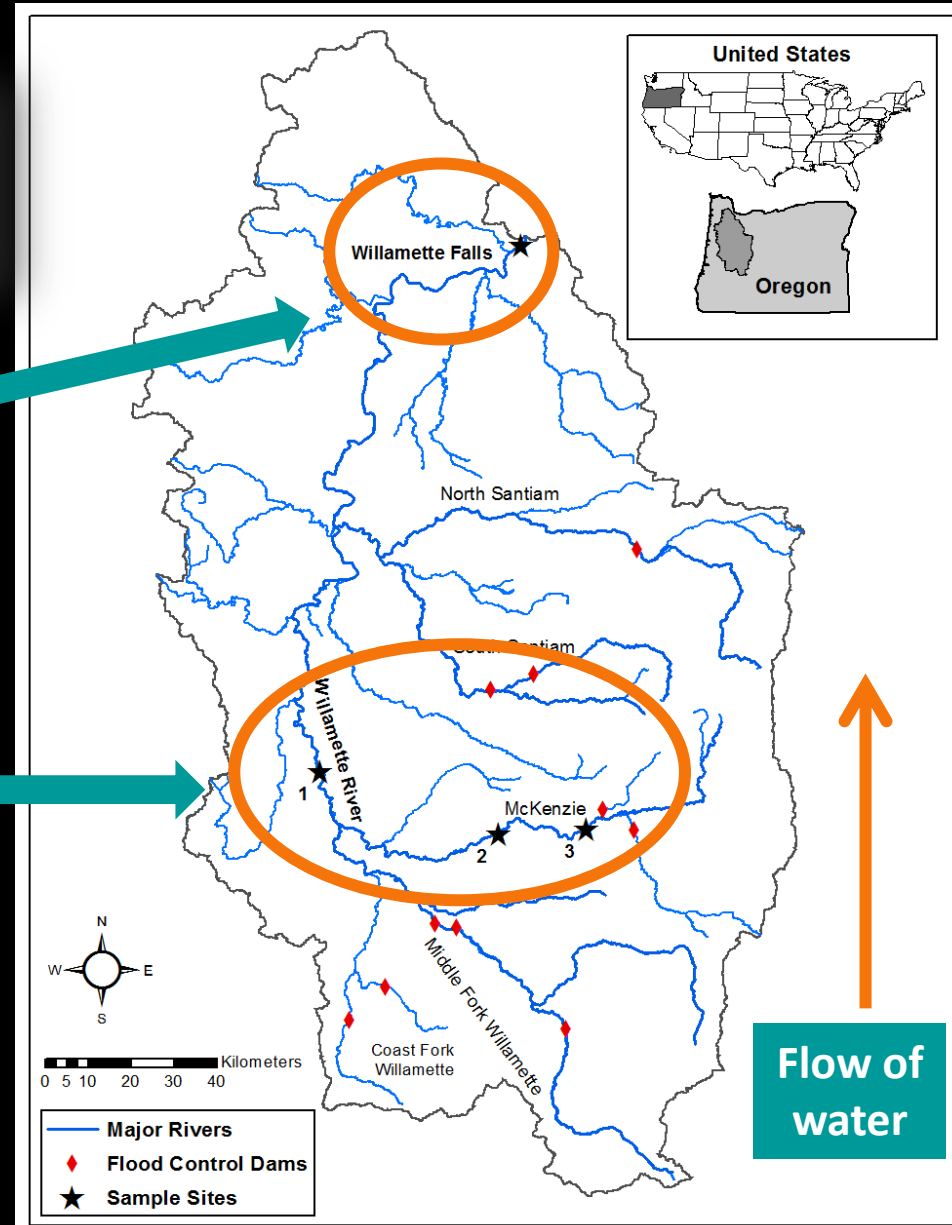
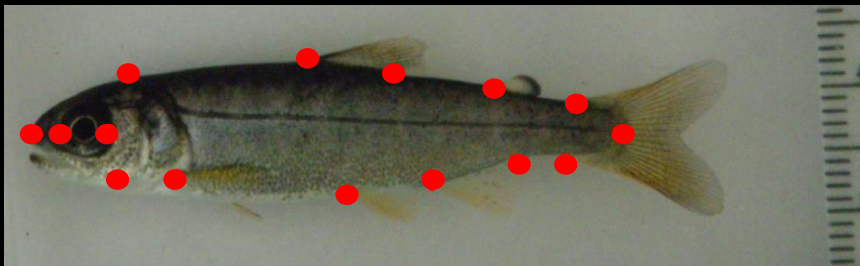


WILD FISH MORPHOLOGY

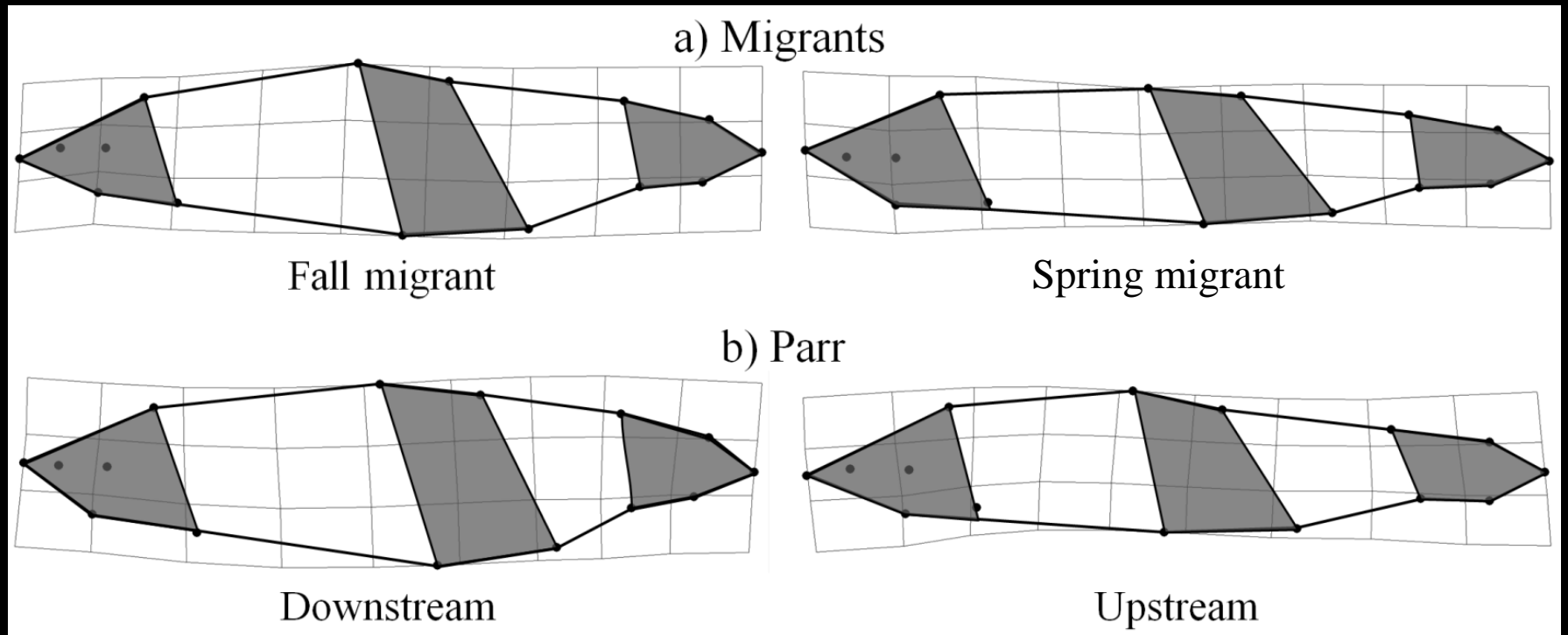


Fall & spring
migrants

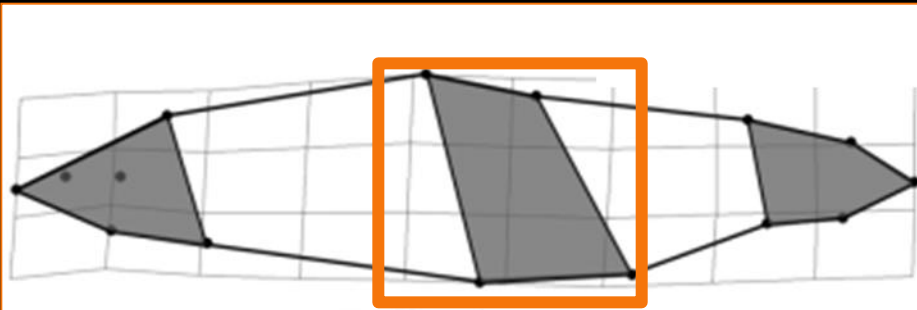
Tributary &
mainstem
rearing parr



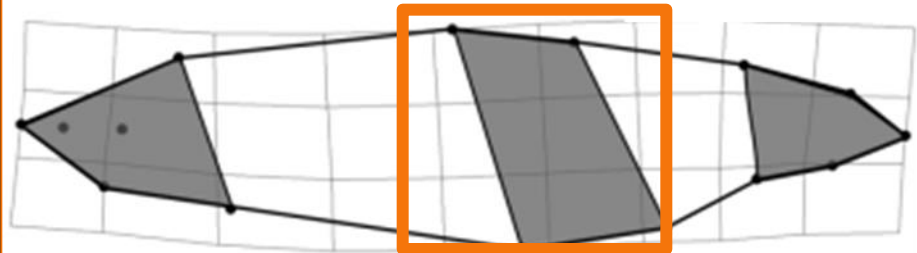
WILD FISH MORPHOLOGY



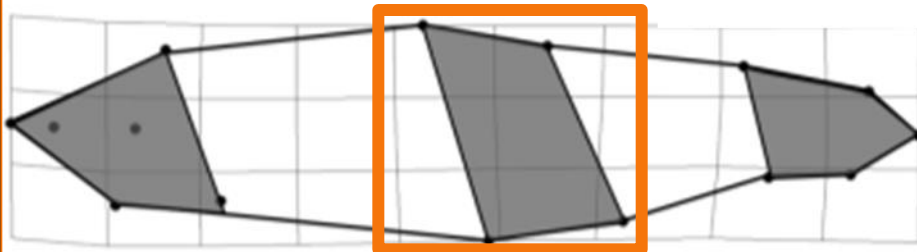
Vertically Sorted Phenotype Morphology



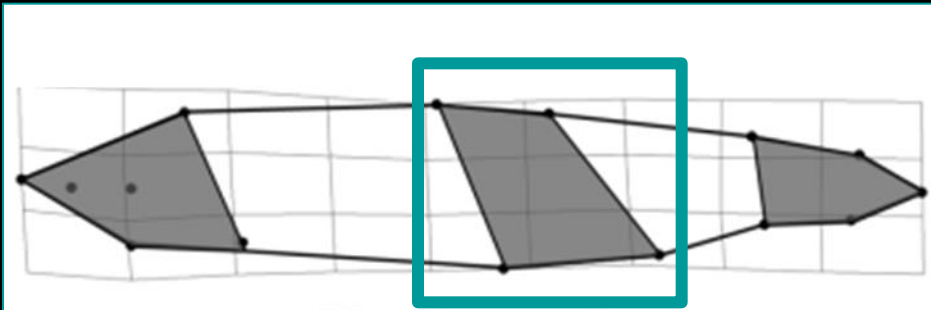
Fall migrant



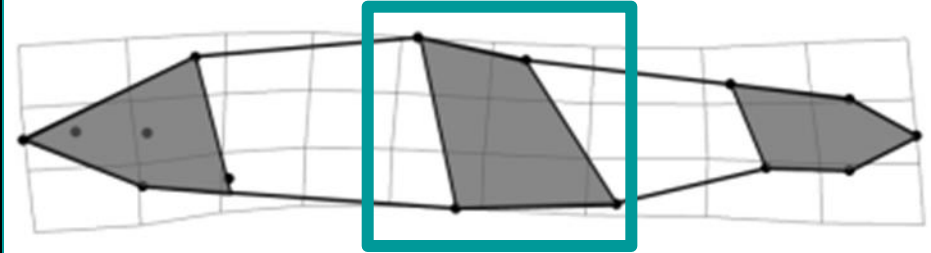
Downstream



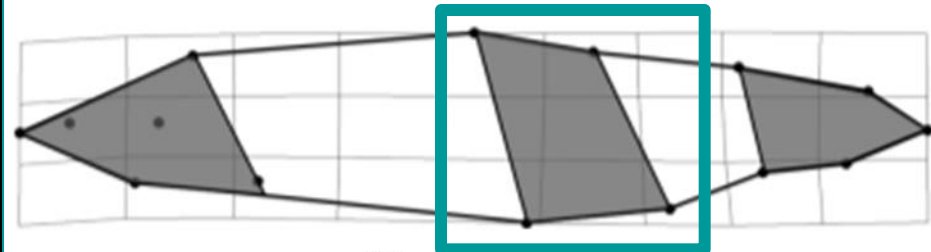
Surface



Yearling smolt



Upstream

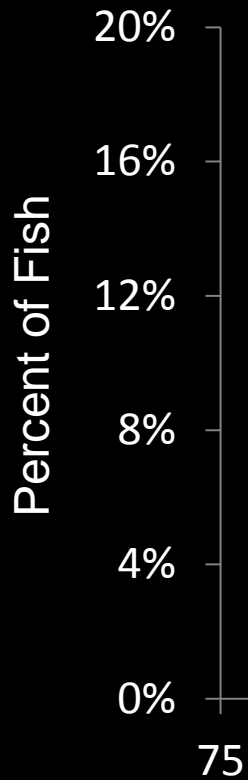


Bottom

REAL WORLD

Fork L

captures at WF



◆ Percent at Release

■ Percent at Capture



225

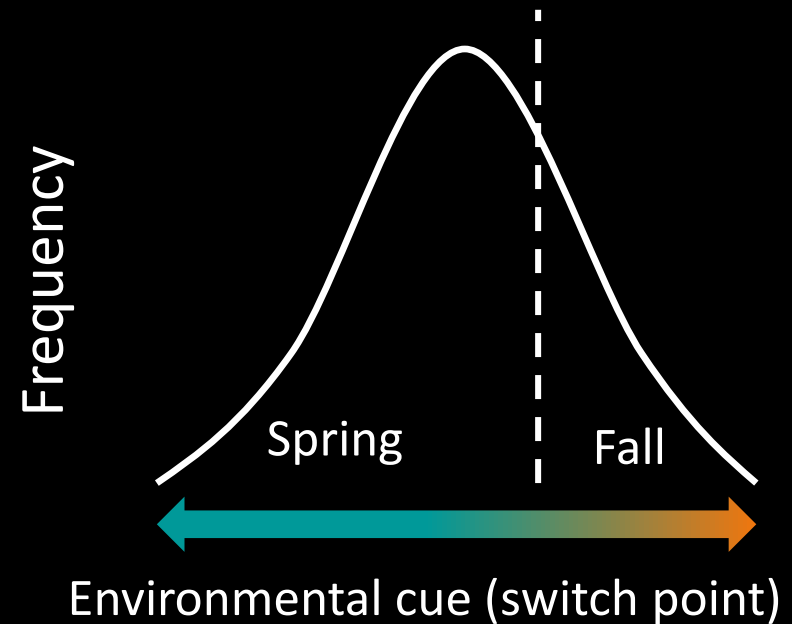
EVALUATION OF SURROGATES

- >95% of Chinook surrogates moved as expected when released
- Able to rear fish that emulate wild migratory phenotypes



RESEARCH IMPLICATIONS

- Life history theory and environmental influences
- Salmon ecology and possible impacts of changing climates
- The use of alternative rearing strategies in production and conservation hatcheries



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Heather Stewart

Kate Self

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OHRC Staff:

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Joseph O'Neil

Joyce Mahr

ODFW staff and hatchery managers



QUESTIONS?

