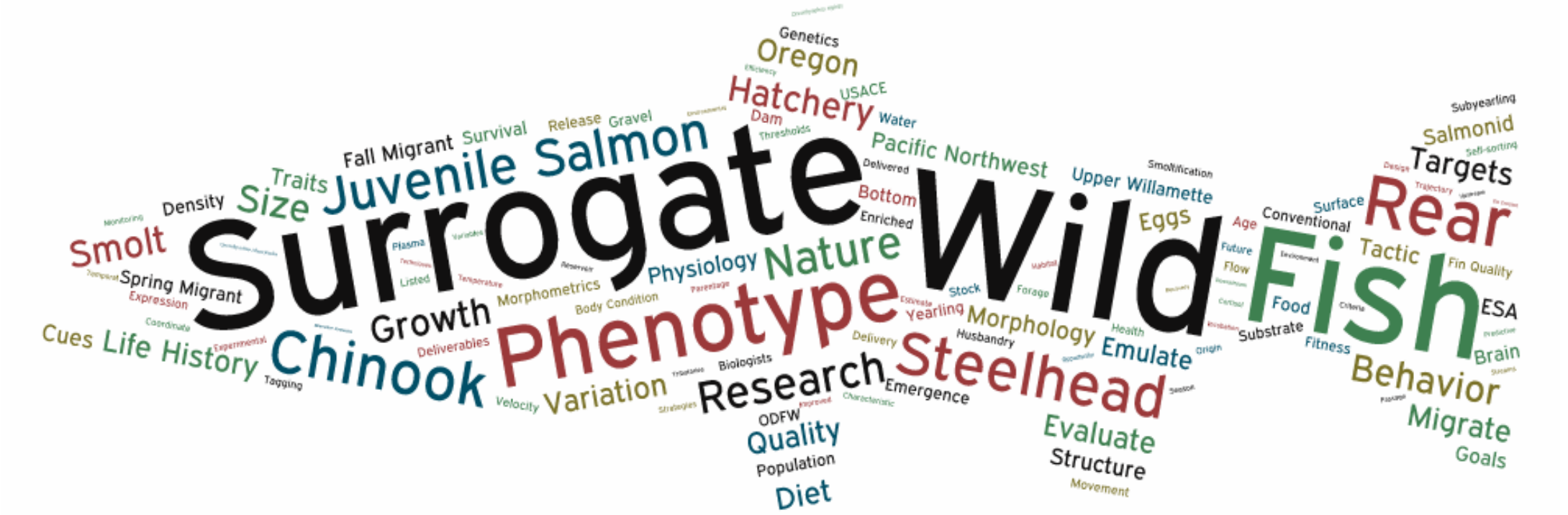
PROVIDING WILD FISH SURROGATES: UPDATES ON DELIVERY, REARING, AND QUALITY OF FISH



Karen Cogliati, David Noakes, Carl Schreck, Cameron Sharpe

OREGON STATE UNIVERSITY
USGS science for a changing world
US Army Corps of Engineers.
OREGON Fish & Wildlife
OREGON HATCHERY RESEARCH CENTER
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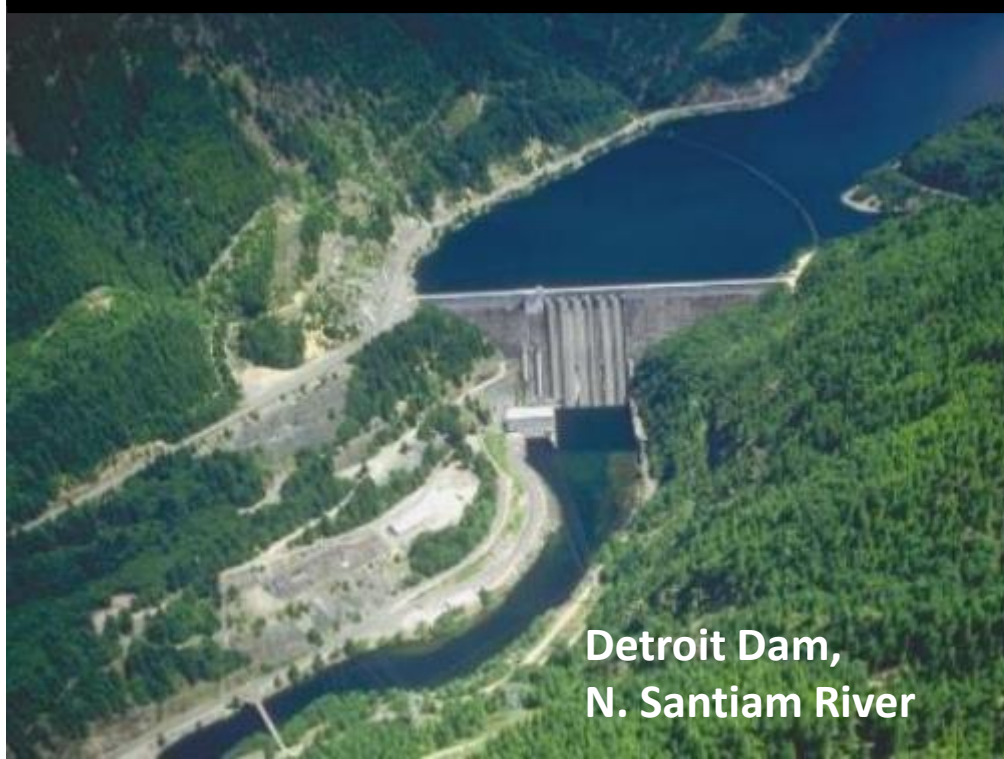
ODFW Researchers

Funding: Army Corps of Engineers

The complex issue of dams

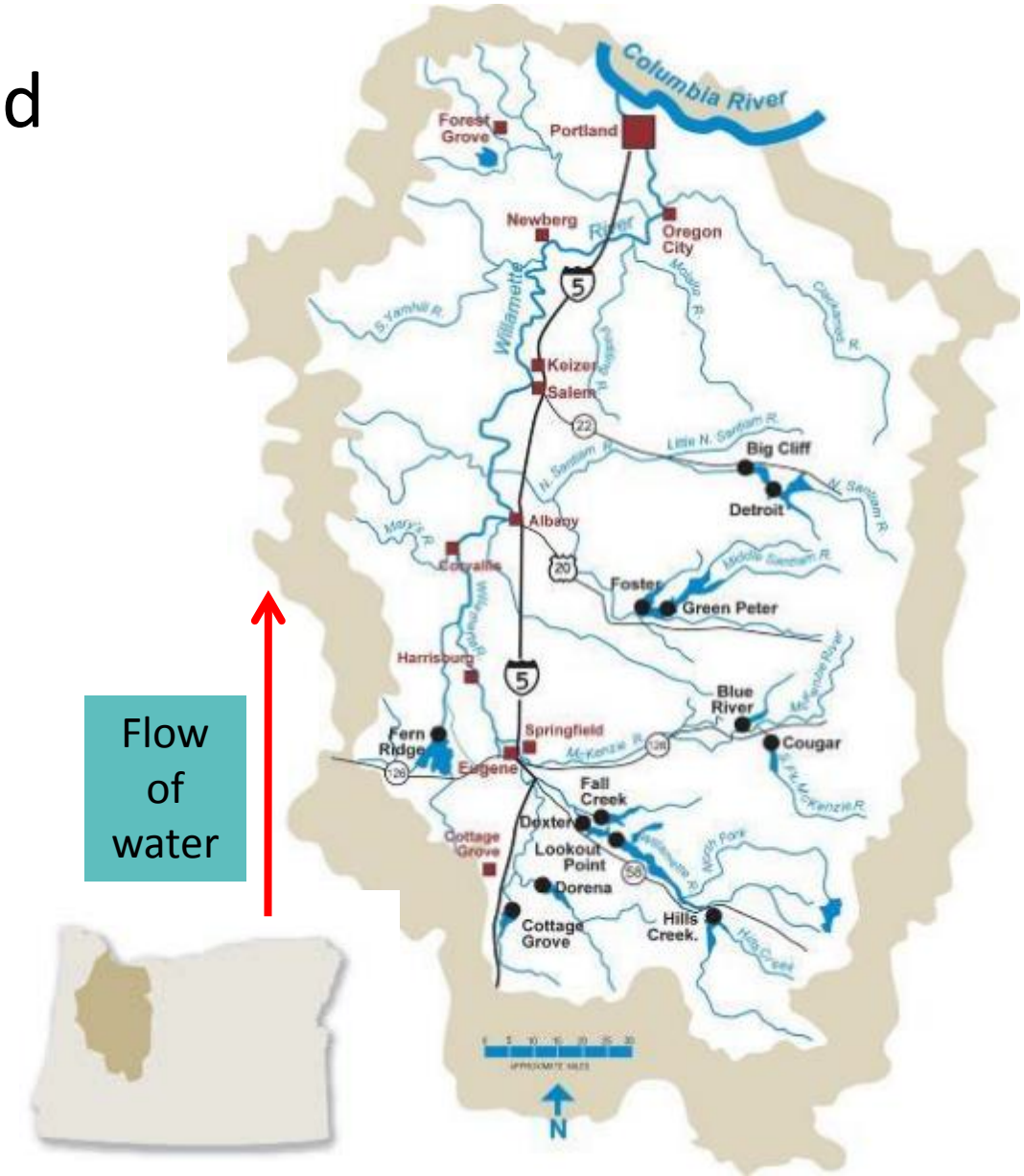
- Numerous benefits:
  - Hydroelectricity, flood control, recreation
- But, they change the landscape and environment
- Impair anadromous fish passage
  - Declines in wild fish populations
  - Hatchery fish added to the system


Cougar Dam,
McKenzie River

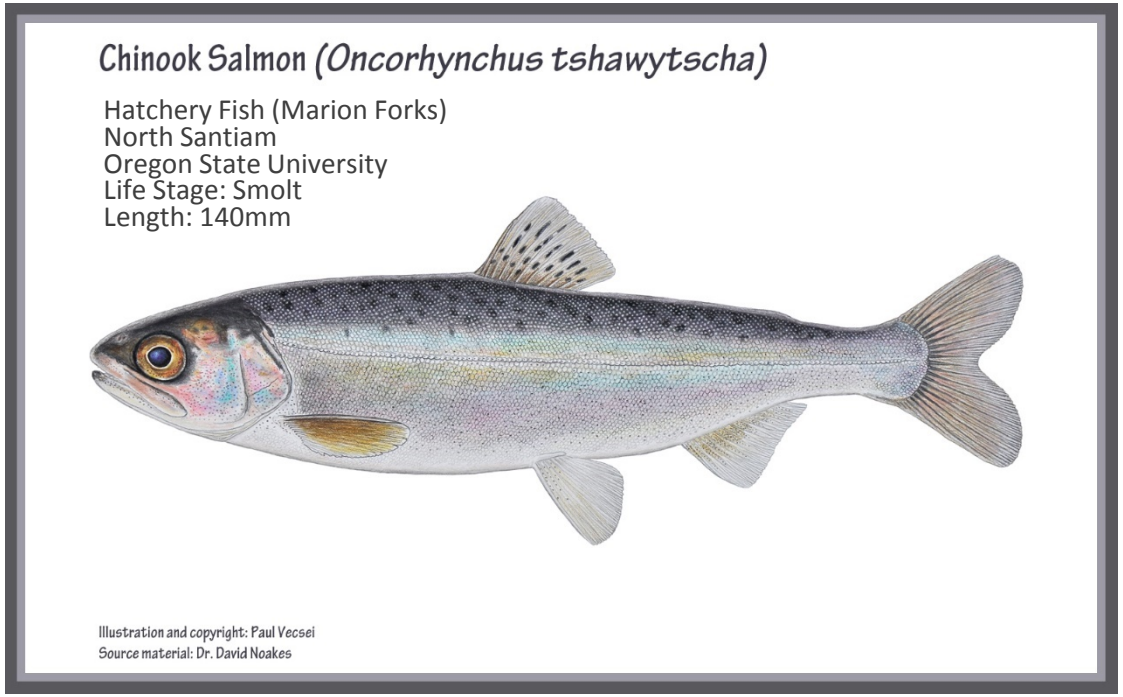

Detroit Dam,
N. Santiam River

Willamette Valley Project Dams (Oregon USA)

- Studies evaluating juvenile salmonid movement to and through dams
- Many salmonids ESA listed



Hatchery and Natural Fish Differences



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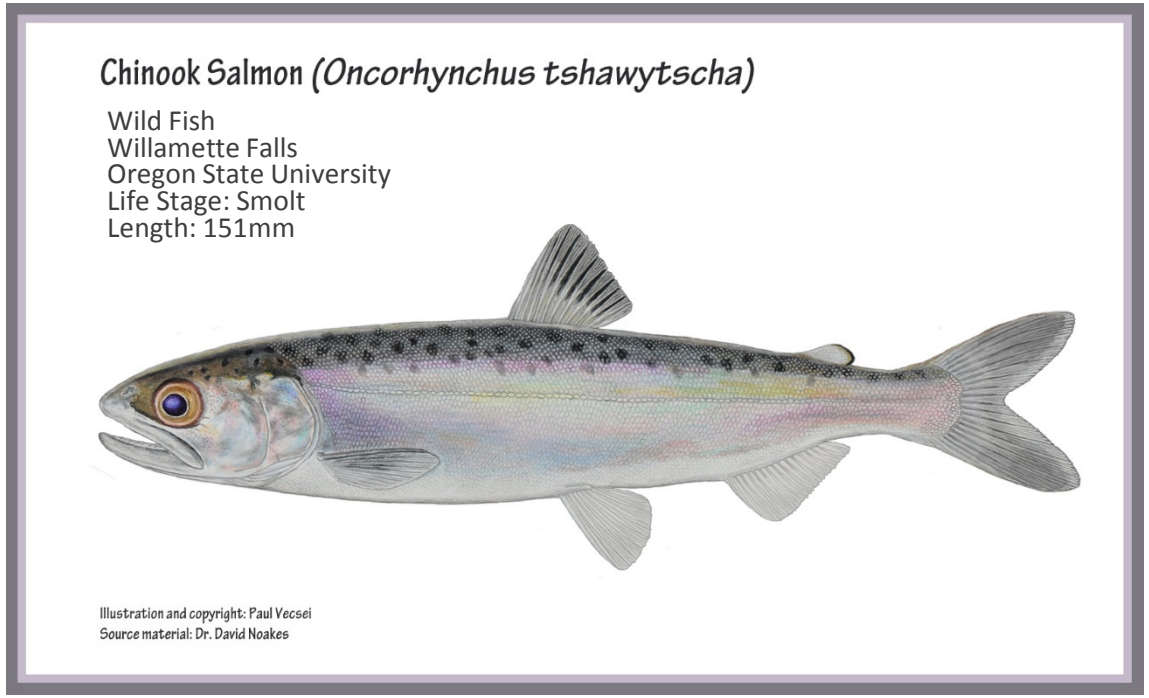

Hatchery origin

Natural origin

Behavior
Morphology
Physiology
Genetics

Hatchery and Natural Rearing Environment

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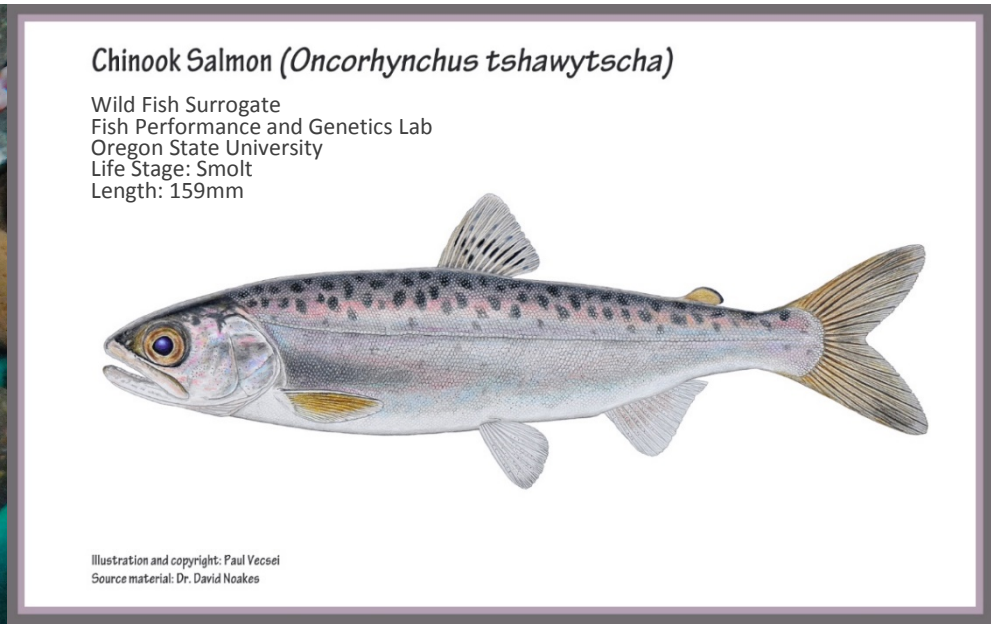
WILD FISH SURROGATE PROJECT

- Produce juvenile salmonids in artificial environments that emulate <u>specific wild fish phenotypes</u>
  - Spring Chinook salmon
  - Winter steelhead trout



Wild Fish Surrogate Project

Goal:

Rear and deliver wild fish surrogates to researchers

Objectives:

1. Coordinate fish needs with researchers
2. Develop rearing protocols that produce more wild-like fish
3. Evaluate the quality and phenotypic accuracy of our surrogates
4. Describe phenotypes of naturally-reared fish to establish target phenotypes
5. Describe phenotypes of hatchery-reared fish to determine the effects of conventional hatchery protocols

Step 1: Coordinate with researchers

- Planning 1-2 years in advance of fish needs
  - Rear from eyed-egg or green egg stages

- Information required from researchers:
  - Brood stock
  - Brood year
  - Time of release
  - Target size at release

Step 1: Coordinate with researchers

- Planning 1-2 years in advance of fish needs
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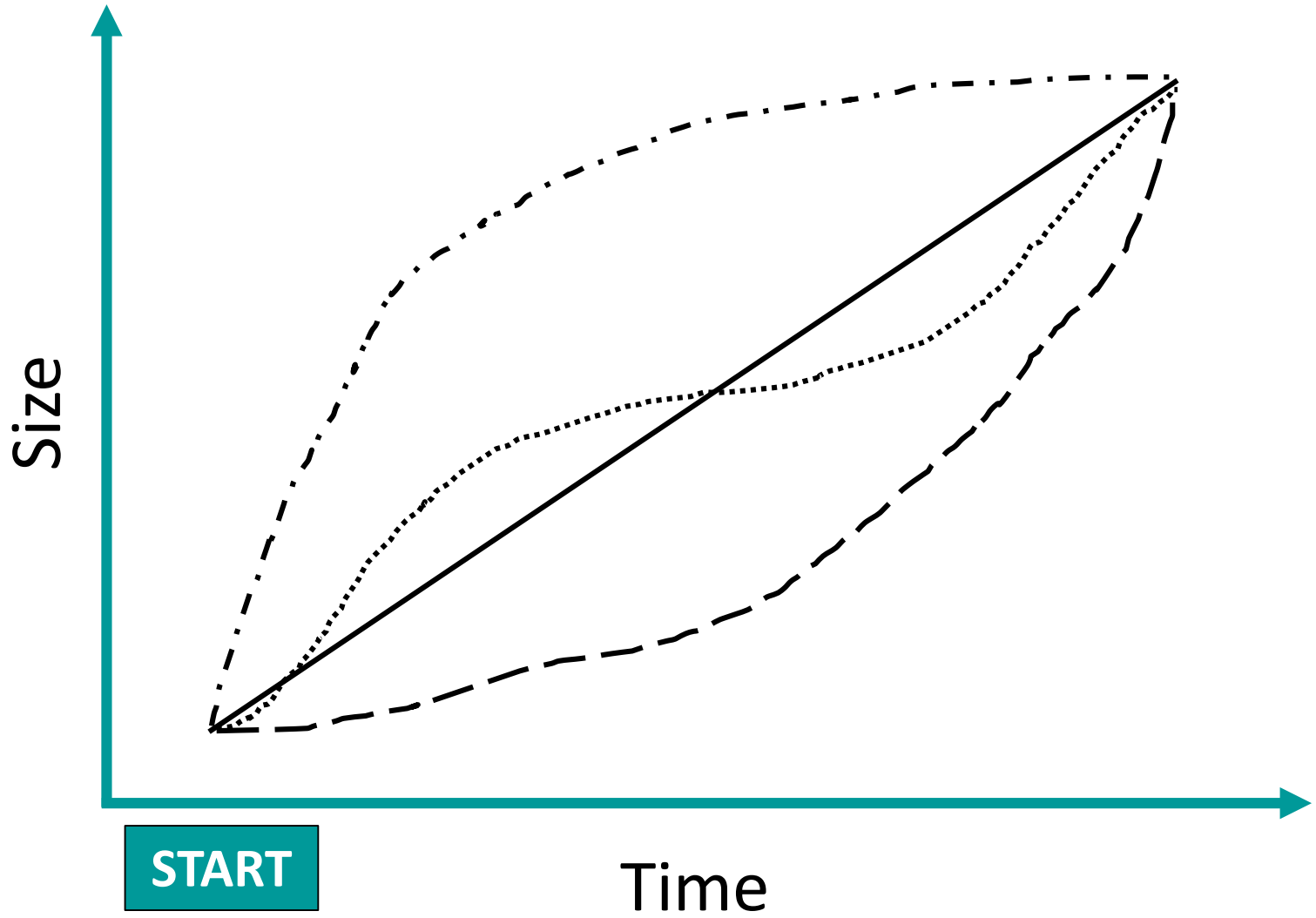
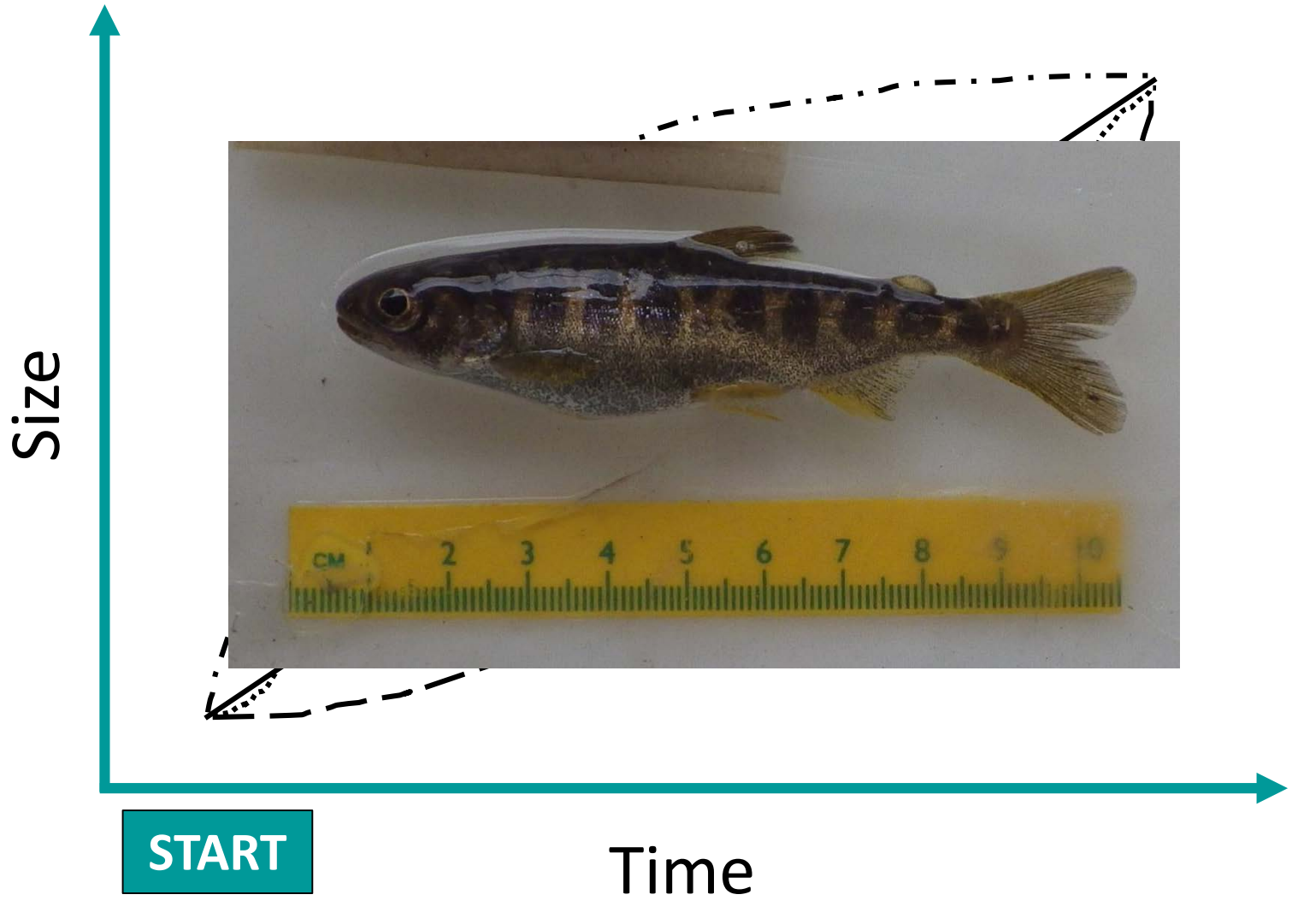
- Information required from researchers:
  - Brood stock
  - Brood year
  - **Time of release**
  - **Target size at release**

Target Size and Time

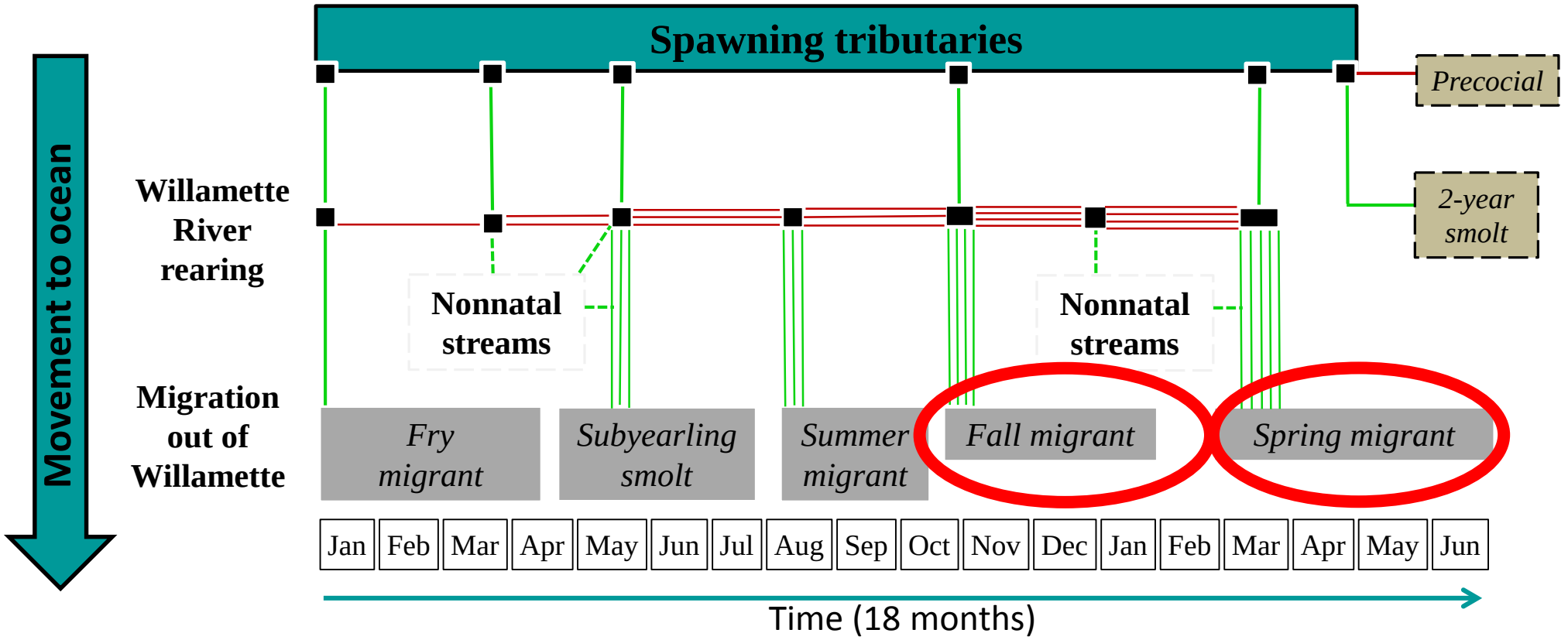


Target Size and Time



ESTABLISHING TARGET PHENOTYPES

Juvenile Migration and Rearing



■ **Threshold or decision points**

Migration downstream

Rearing

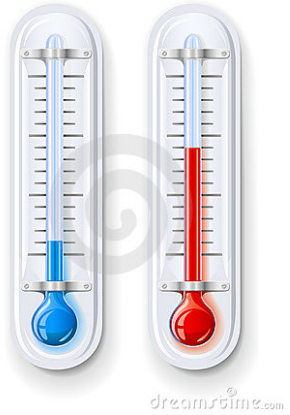
Schroeder et al. 2015

ALTERED REARING ENVIRONMENT

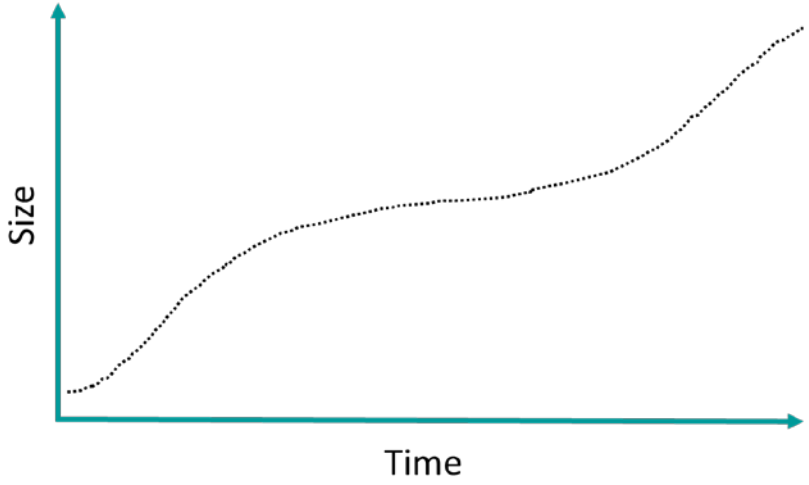
Diet

Density

Temperature



Wild-like growth



Tank environment

CHINOOK SALMON 2016 DELIVERIES

Location	Brood Year	Target type	# fish	Status
Foster	14	Yearling	750	RT and PIT tagged at FPGL Spring 2016
Green Peter	14	Yearling	500	Delivered May 2016
Foster	15	Sub-yearling	1,350	RT and PIT tagged at FPGL Fall 2016
Lookout Point	15	Sub-yearling	600	JSATS and PIT tagged at FPGL

CHINOOK SALMON UPCOMING REQUESTS

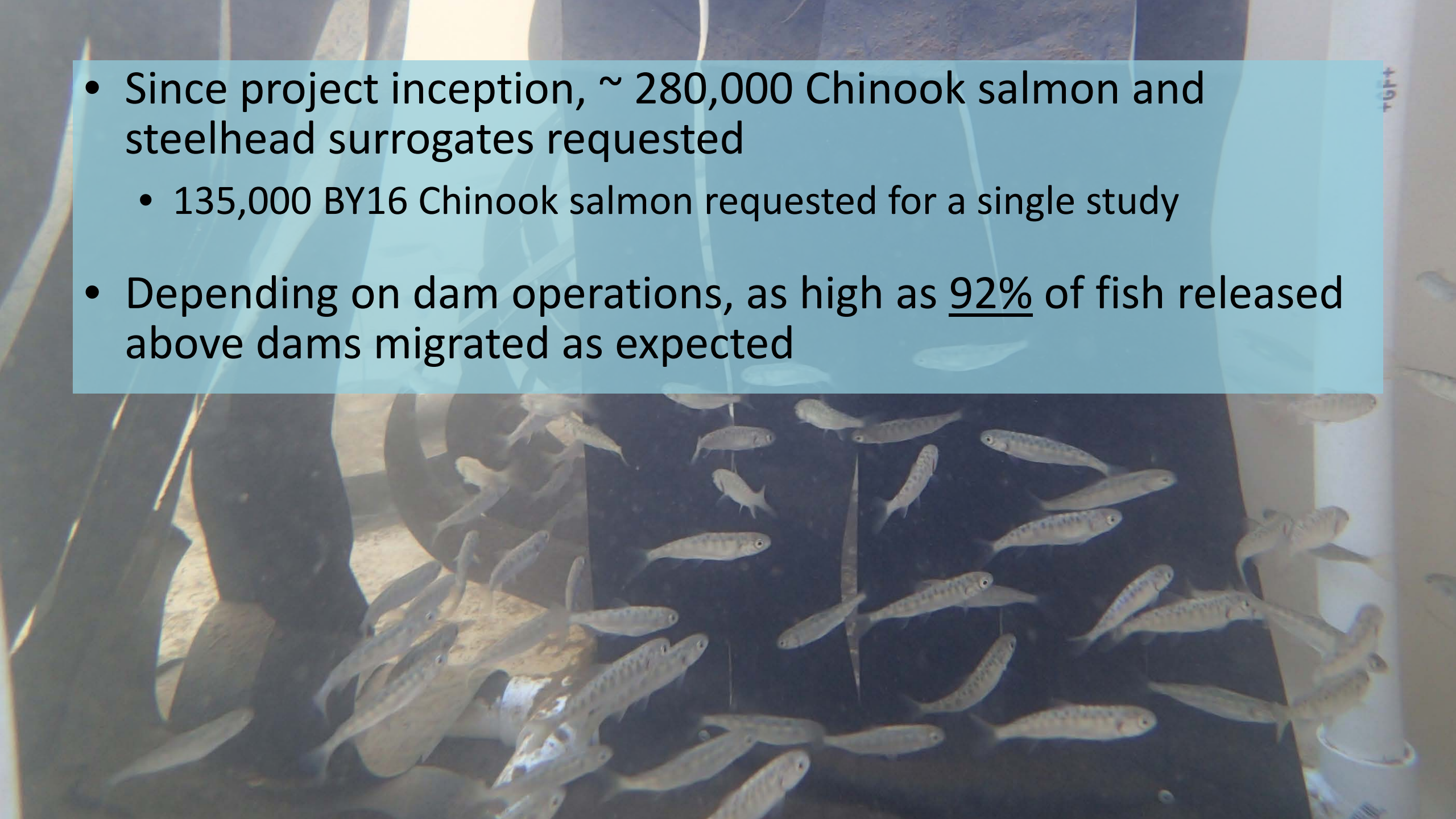
Location	Brood Year	Deliverable type	#	Target date	Target size (mm)
Cougar	15	Yearling	1,500	May 2017	140
Lookout Point	15	Yearling	600	March 2017	200
Lookout Point	16	Sub-yearling	1,625	Fall 2017	190
Lookout Point	16	Yearling	1,625	Spring 2018	200
Foster	16	Yearling	1,500	Spring 2018	210
Lookout Point	16	Fry-parr	135,000	Spring/Summer 2018	varies

WINTER STEELHEAD 2016 DELIVERIES

Location	Brood Year	Target type	# fish	Status
Foster	14	2-yr smolt	800	RT and PIT tagged at FPGL Spring 2016
Foster	15	Yearling	150	RT and PIT tagged at FPGL Fall 2016
Green Peter	14	2-yr smolt	500	Delivered May 2016
Detroit	15	Yearling	28,800	Delivered to Marion Forks Dec 2015 for Fall 2016 release
Detroit	16	Sub-yearling	27,000	Released by ODFW

WINTER STEELHEAD UPCOMING REQUESTS

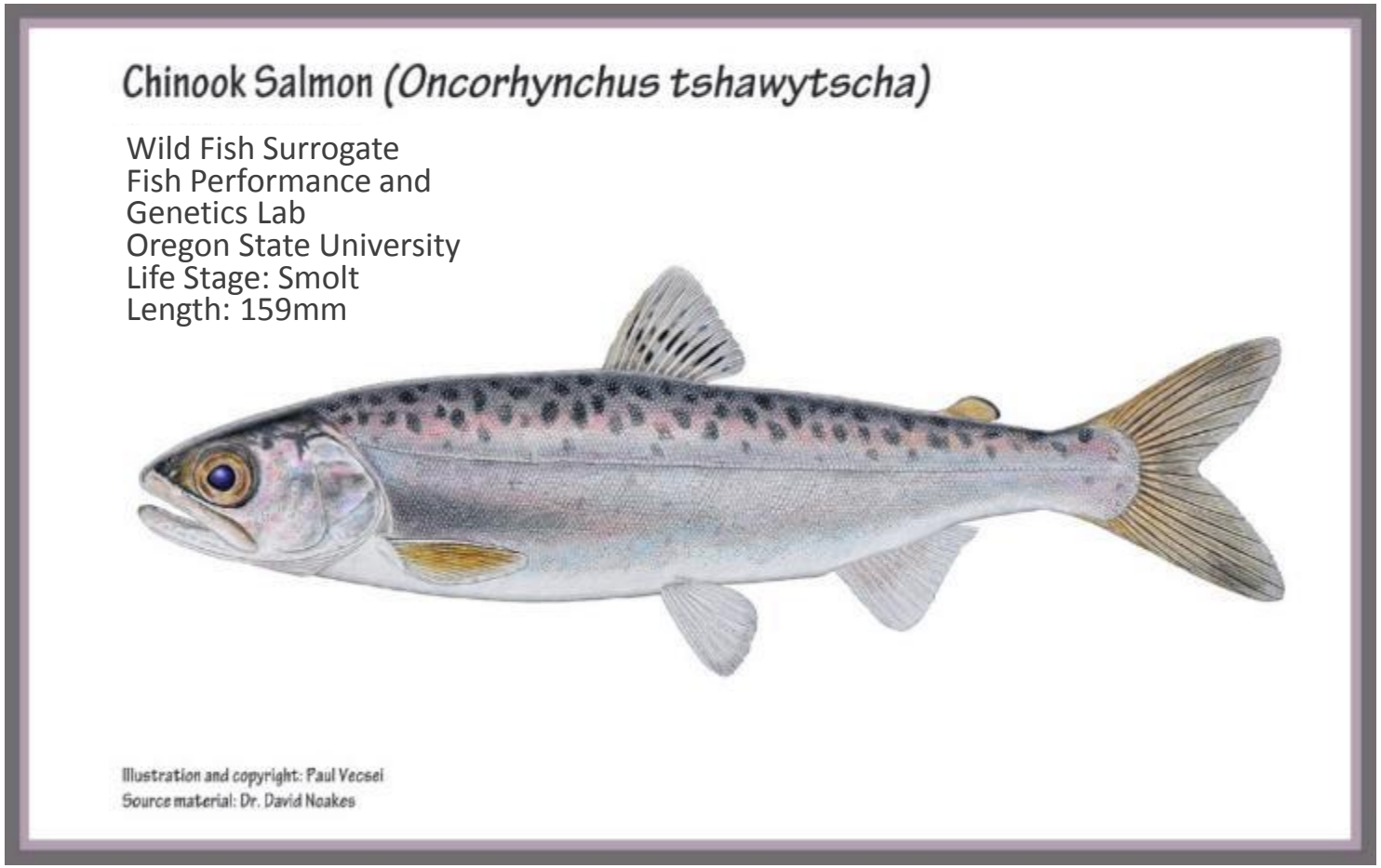
Location	Brood Year	Deliverable type	#	Target date	Target size (mm)
Foster	16	2-yr smolt	1,300	Spring 2018	160
Foster	17	Yearling	200	Fall 2018	140
Foster	17	2-yr smolt	1,300	Spring 2019	160



- Since project inception, ~ 280,000 Chinook salmon and steelhead surrogates requested
  - 135,000 BY16 Chinook salmon requested for a single study
- Depending on dam operations, as high as 92% of fish released above dams migrated as expected

How do our surrogates compare?

- Body morphometrics
- Osmoregulation
- Physiology
- Behaviour
- Genetics
- Fin quality
- Body composition
- Early maturing males



How do our surrogates compare?

Hatchery

Surrogate

Natural

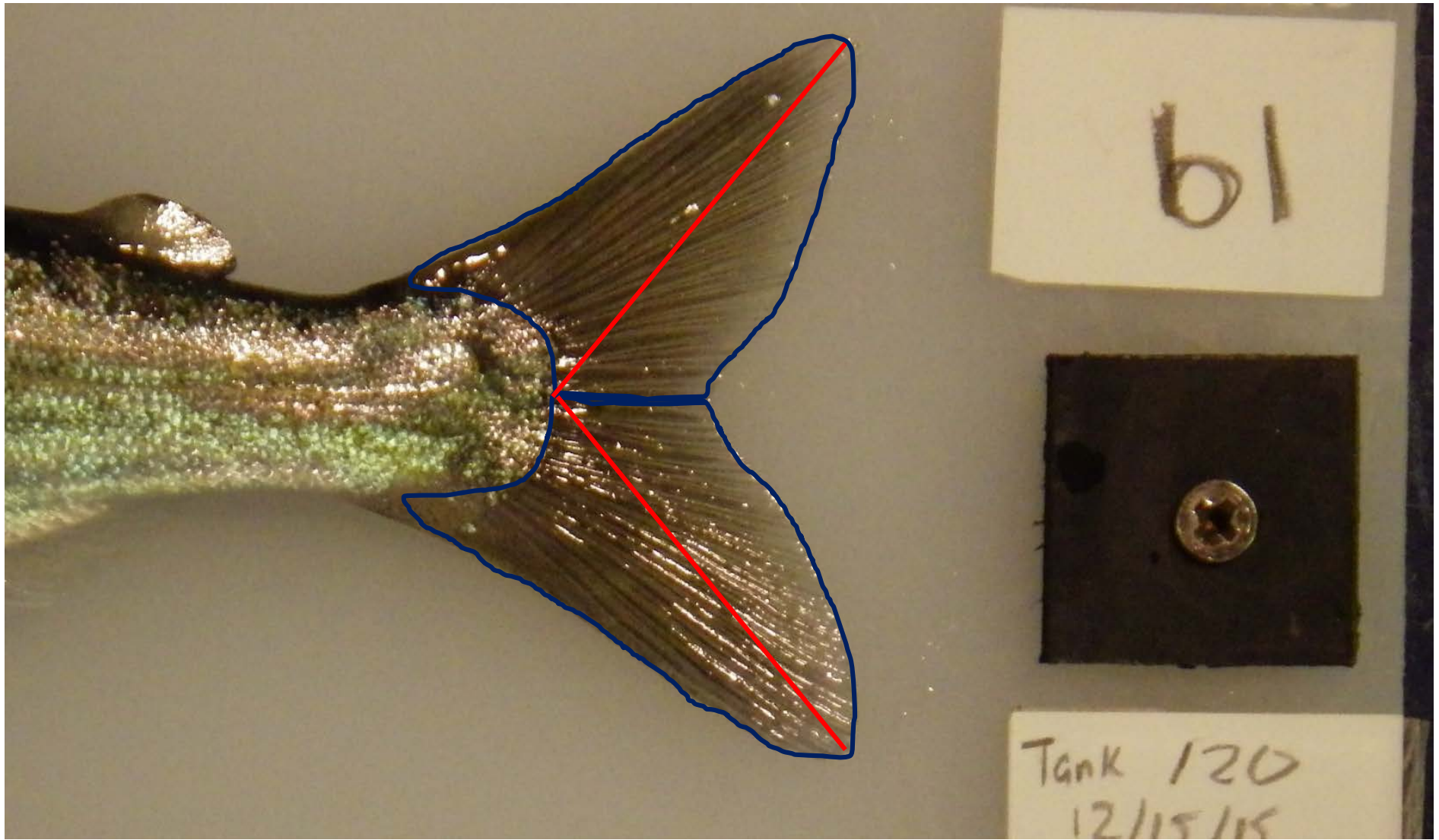
CAUDAL FIN QUALITY

Hatchery

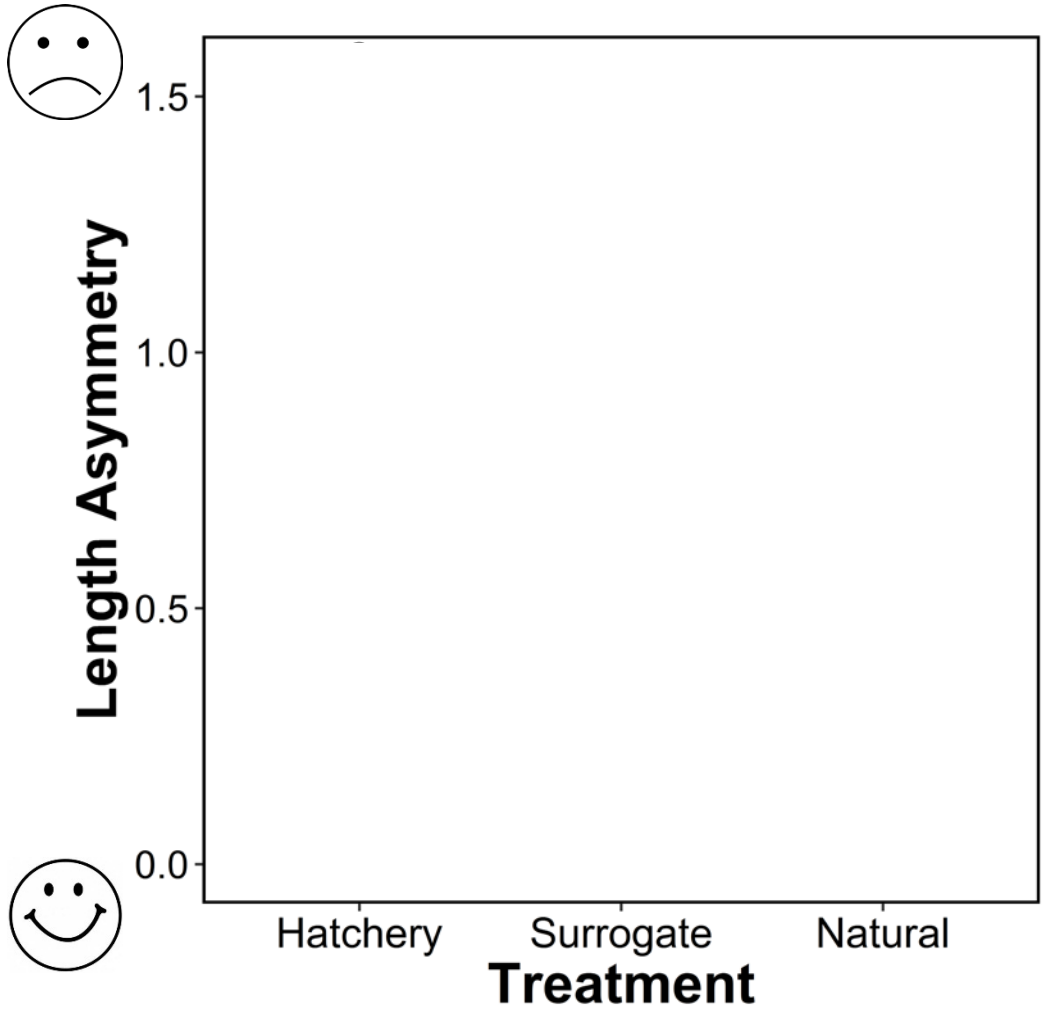
Surrogate

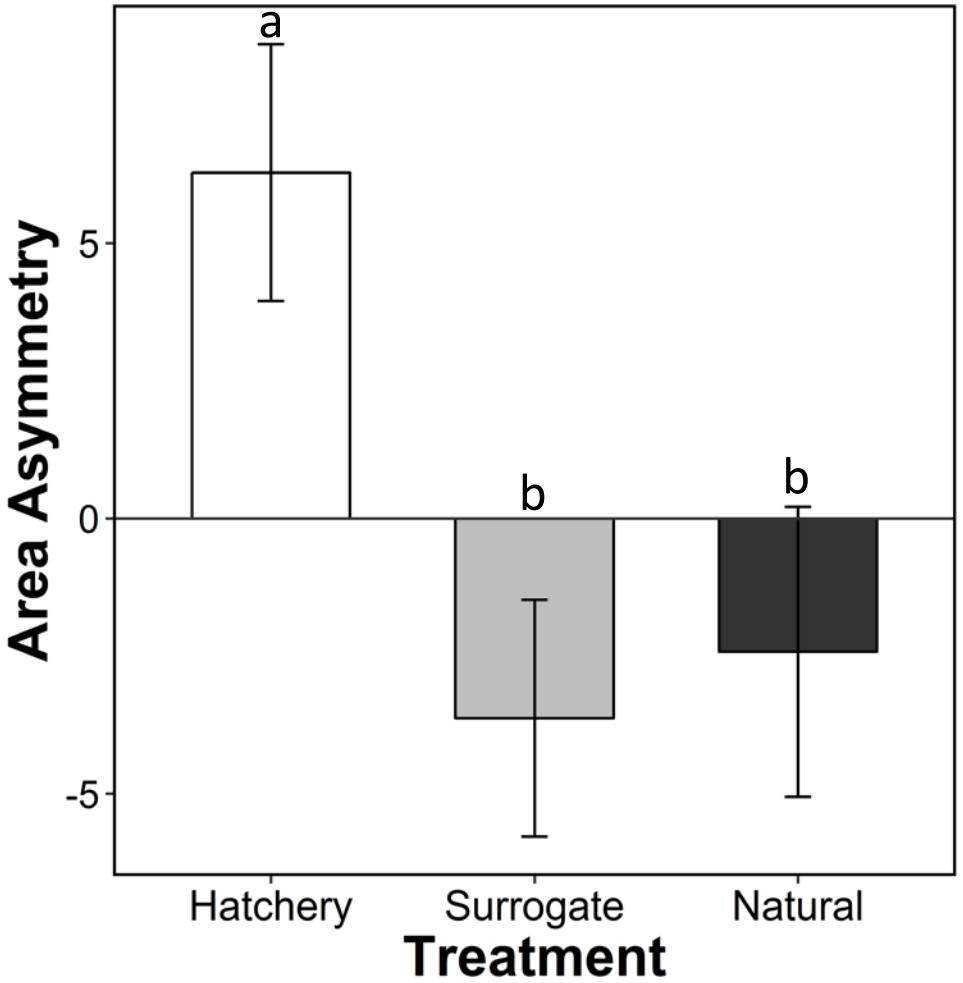
Natural

DIGITIZE IMAGES USING IMAGEJ



DORSAL – VENTRAL LOBE ASYMMETRIES





Values represent least square means, controlling for body size

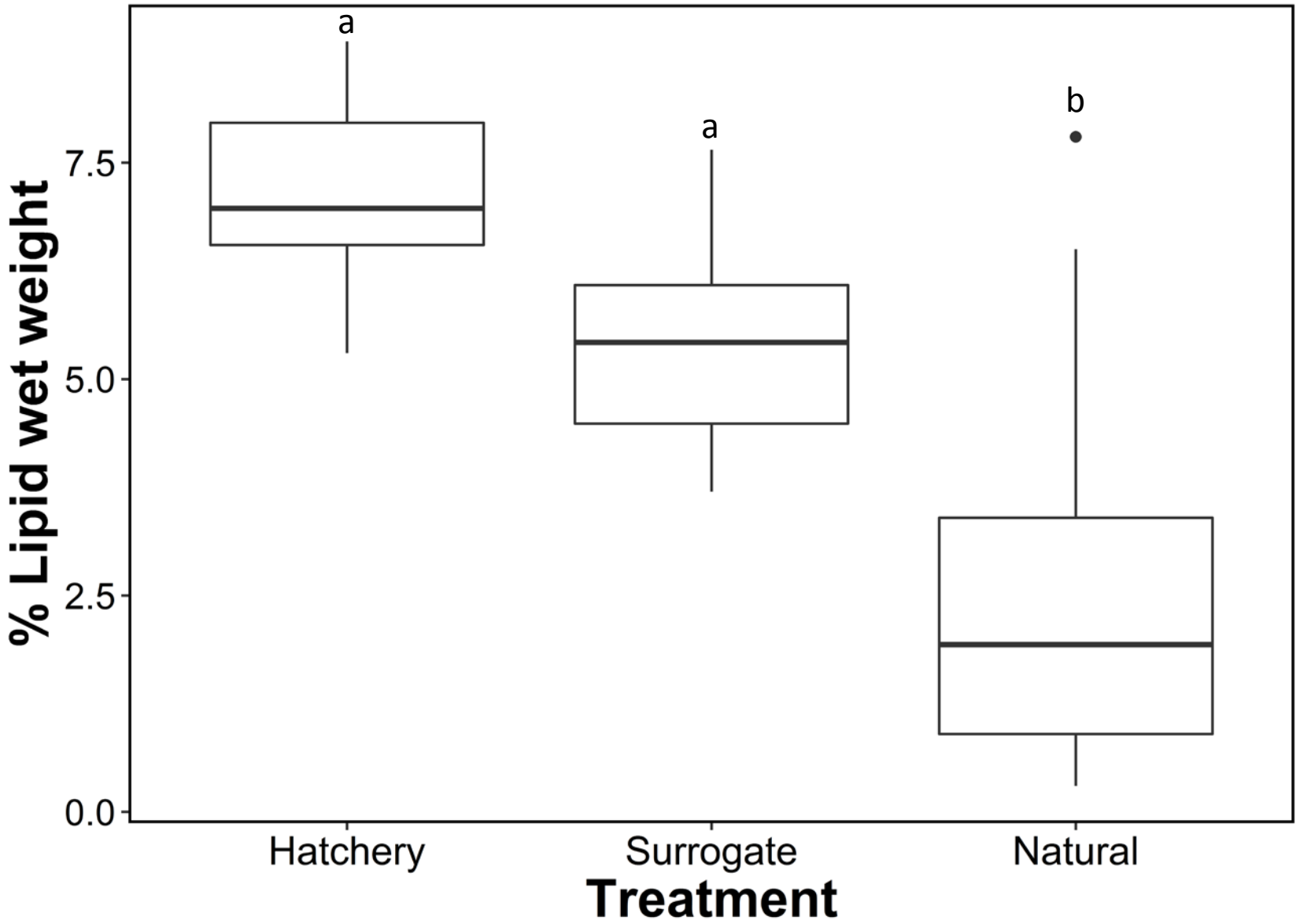
BODY COMPOSITION: % LIPID WET WEIGHT

Hatchery

Surrogate

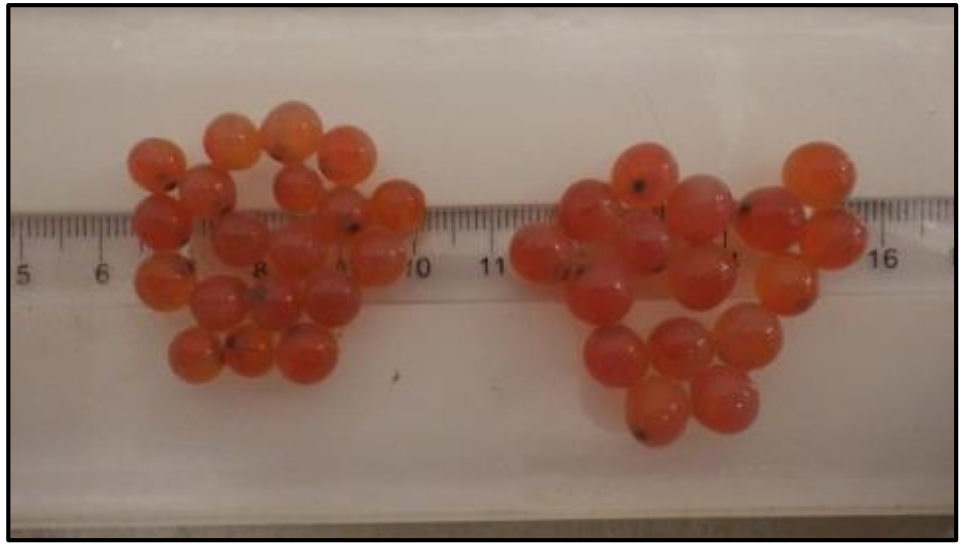
Natural

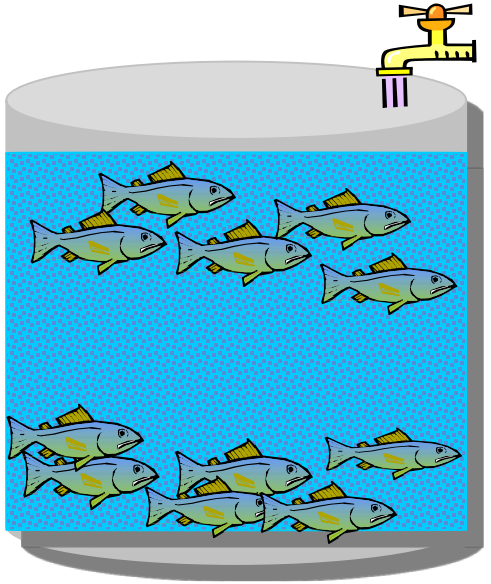
Body composition – Chinook salmon



Hatchery: N = 6
Surrogate: N = 18
Natural: N = 53

NATURAL LIFE HISTORY VARIATION

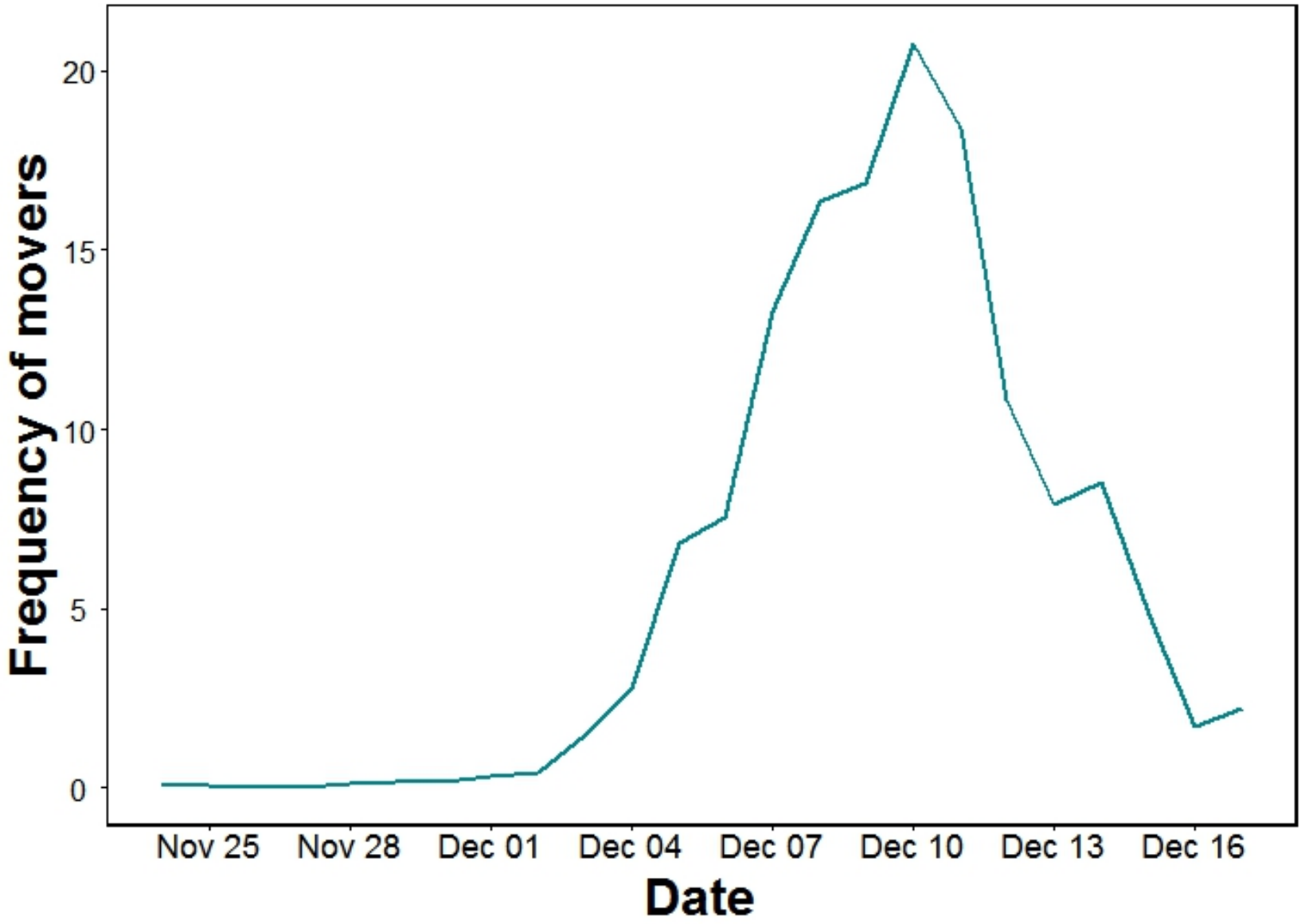




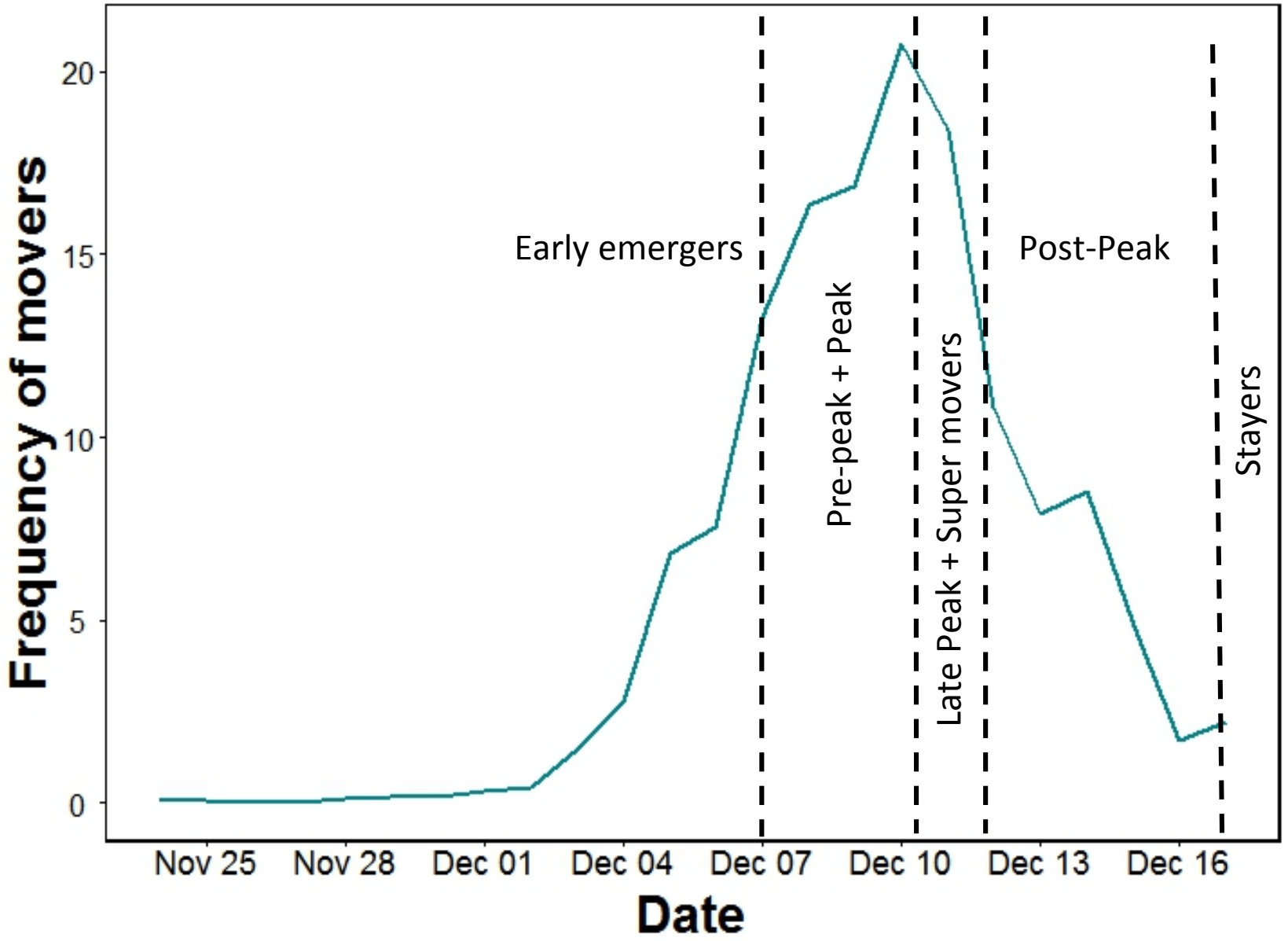
Do phenotypic differences expressed early in life lead to different phenotypes expressed later?

DOES EMERGENCE TIME PREDICT MOVEMENT?

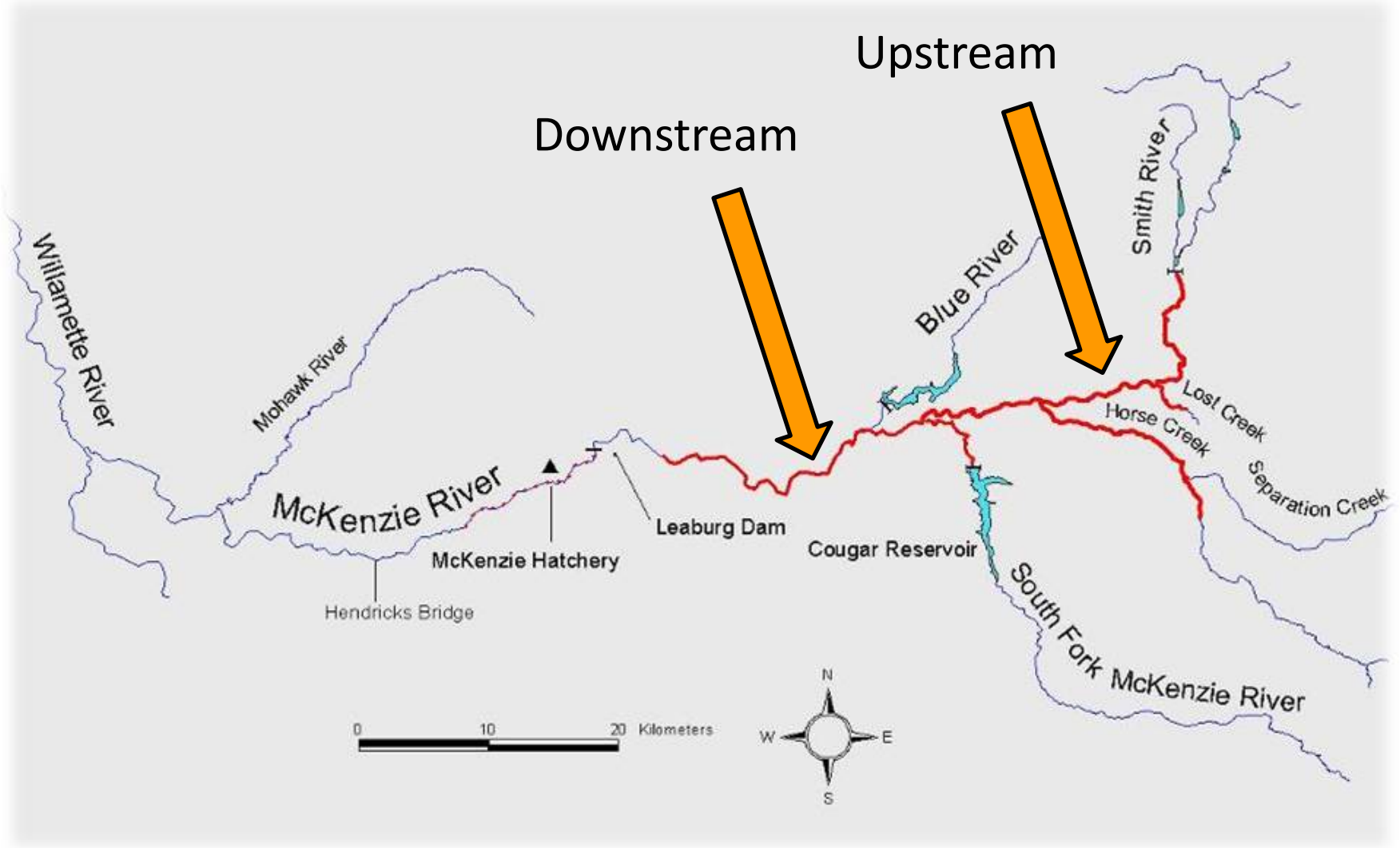
Natural life history variation and movement – Chinook salmon



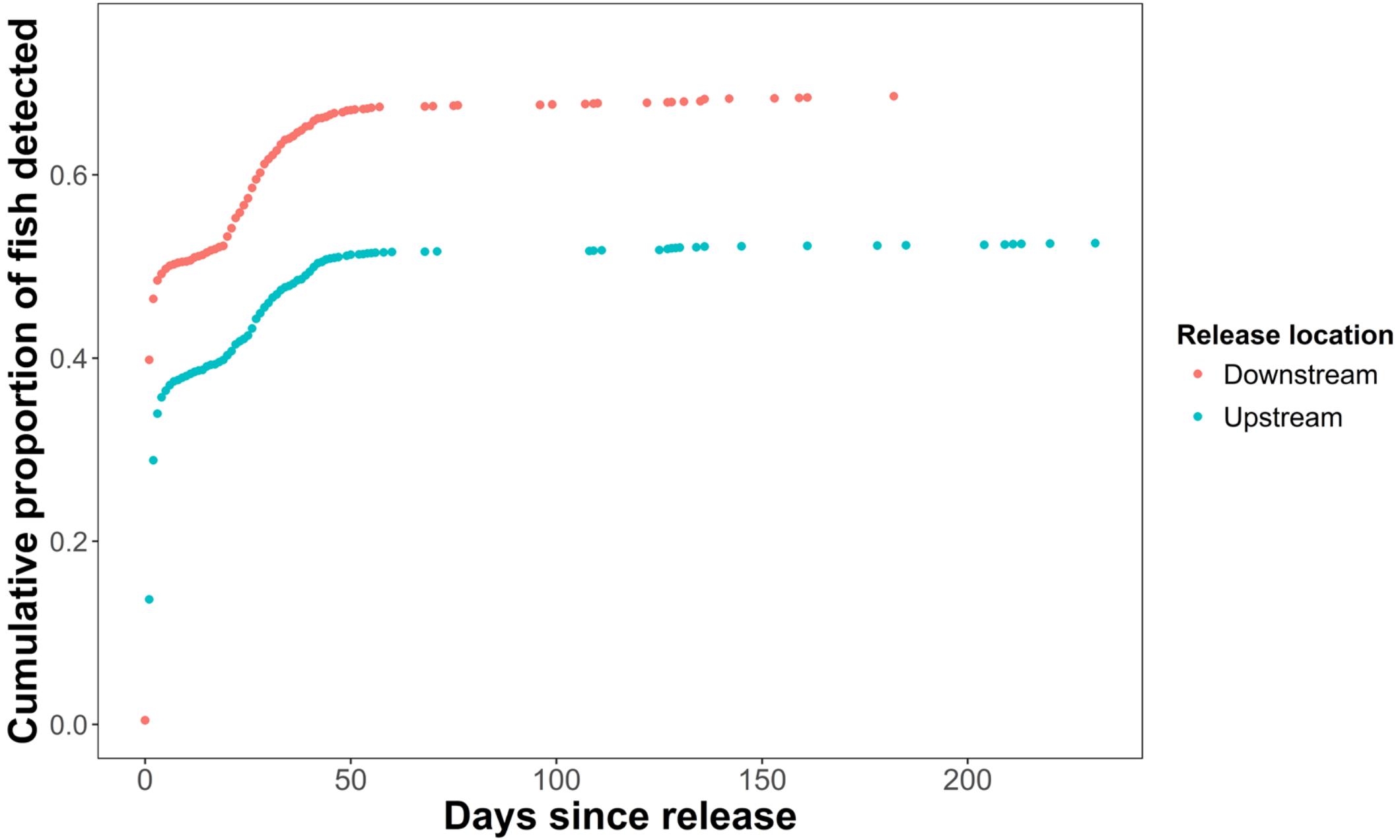
Natural life history variation and movement – Chinook salmon



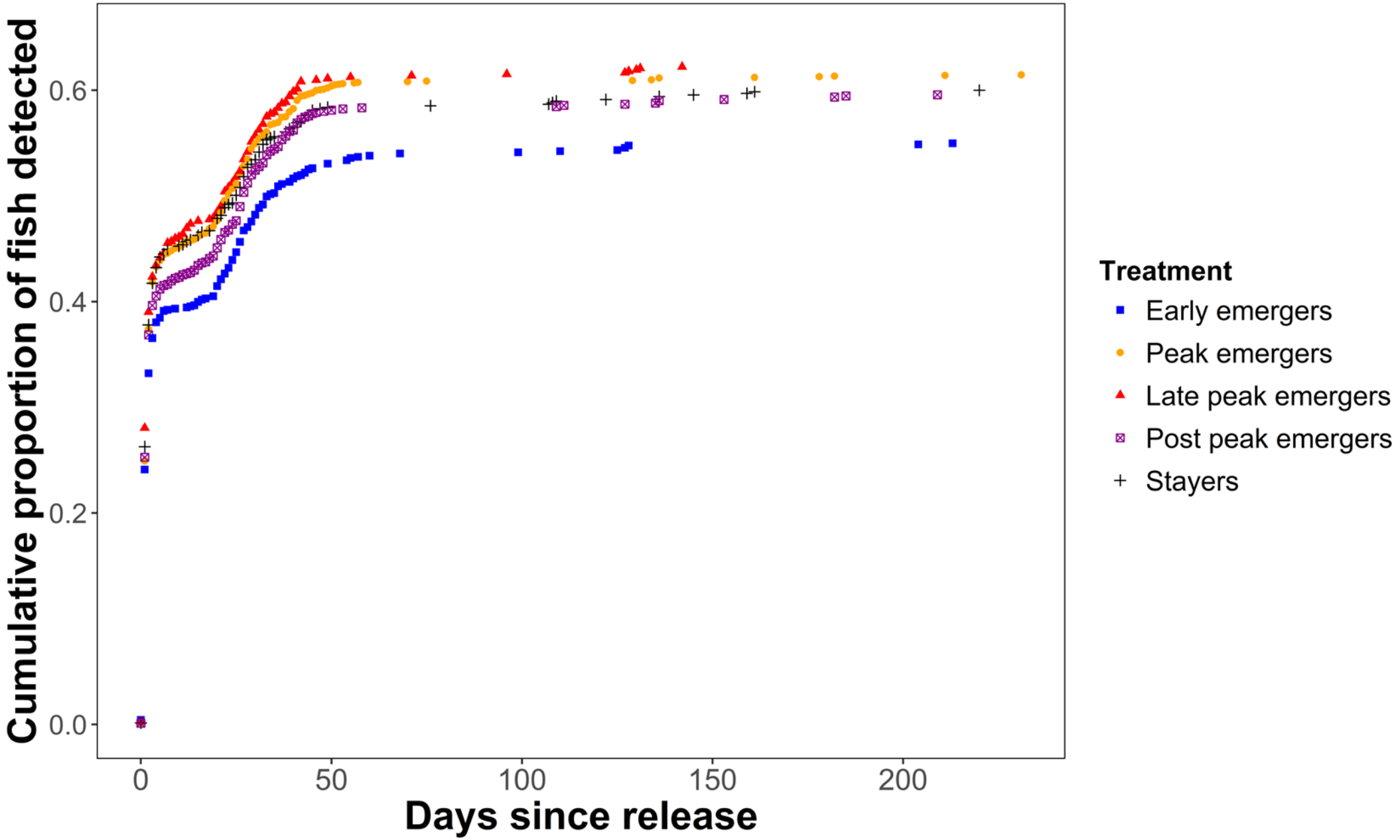
RELEASED INTO THE MCKENZIE RIVER – MAY 2016



Natural life history variation and movement – Chinook salmon



Natural life history variation and movement – Chinook salmon



WILLAMETTE FALLS DETECTIONS

- 2 detections Oct 2016
  - Peak and post peak emergence groups
- Monitoring detections through spring 2017

HIGH QUALITY SURROGATES

Does altered rearing environment

+

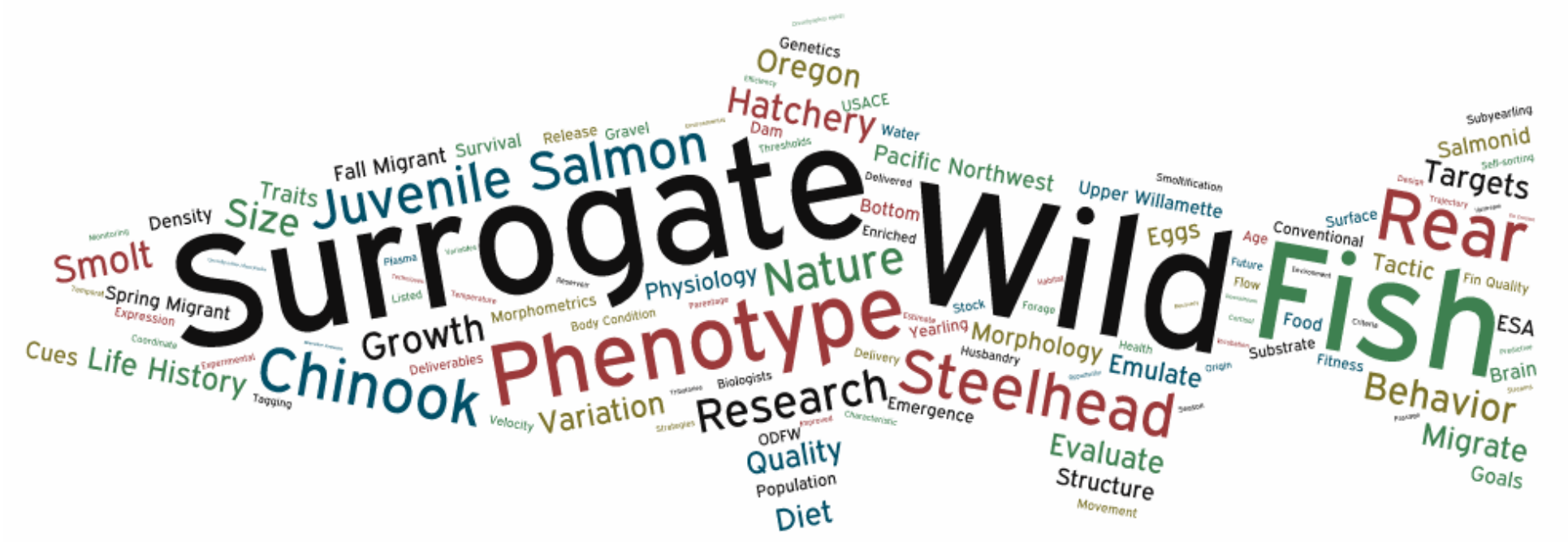
Natural life history

=

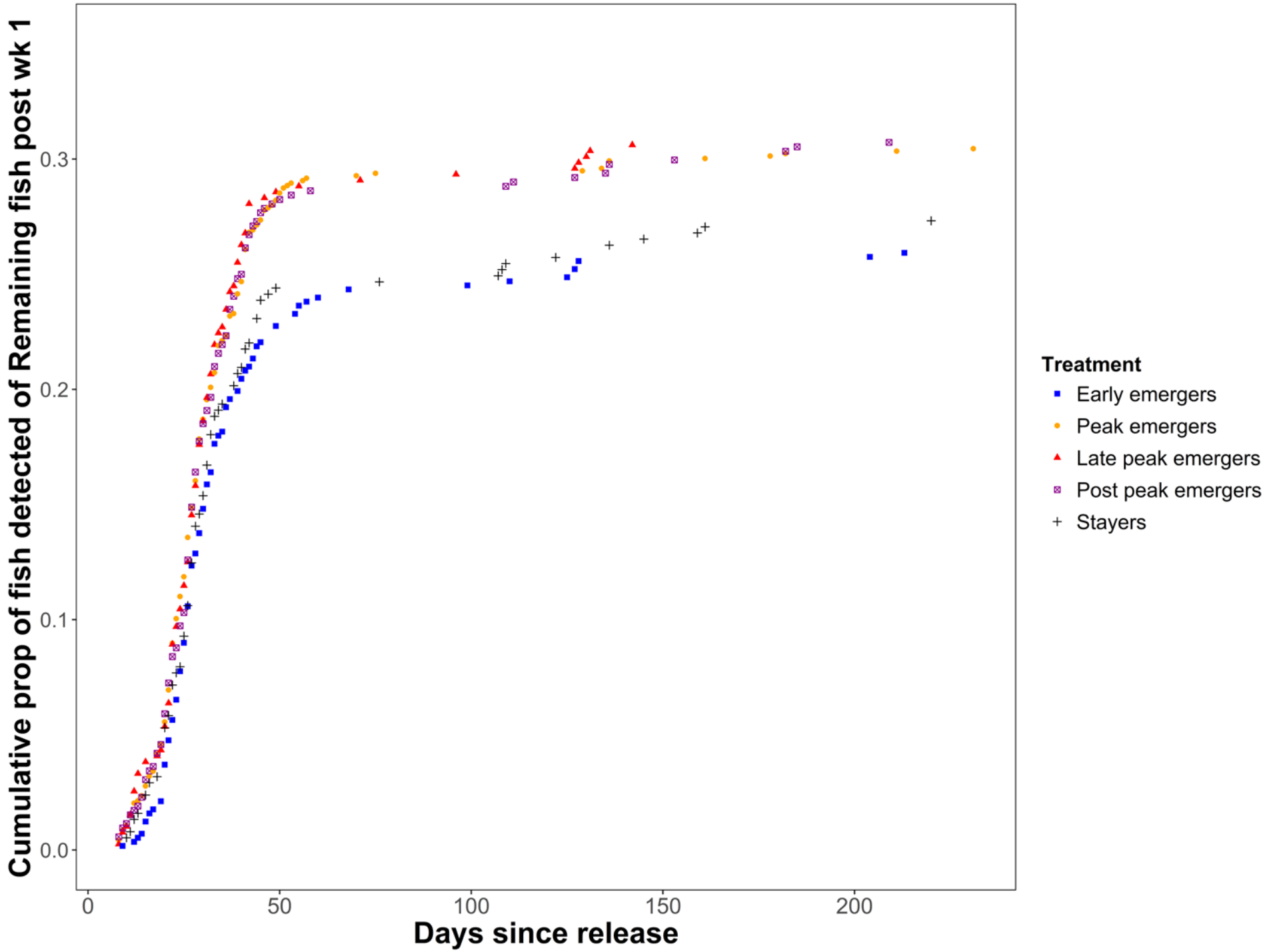
More wild-like fish?

Photo by Todd Pierce

THANK YOU



QUESTIONS?


Cumulative prop of fish detected of Remaining fish post wk 1
0.0
0.1
0.2
0.3
0
50
100
150
200
Days since release
Treatment
Early emergers
Peak emergers
Late peak emergers
Post peak emergers
Stayers