Factors affecting residualism in hatchery steelhead trout.

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NOAA FISHERIES
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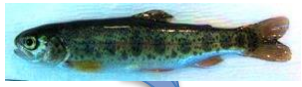
Steelhead, *Oncorhynchus mykiss*, life history

Maturation & spawning

Embryo

Anadromous Steelhead

Parr



Ocean (1–3 years)

Estuary/early marine (2 weeks)

Smolt (age 1 -3)

Resident Rainbow Trout

Maturation in fresh water

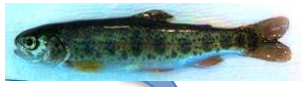
Hatchery steelhead life history

Maturation & spawning

Embryo

Anadromous Steelhead

Parr



Ocean (1–3 years)

Estuary/early marine (2 weeks)

Smolt (age 1 -2)

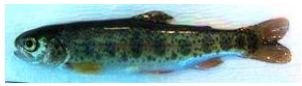
Residual life history

Hatchery broodstock

Embryo

Spawn with anadromous ♀

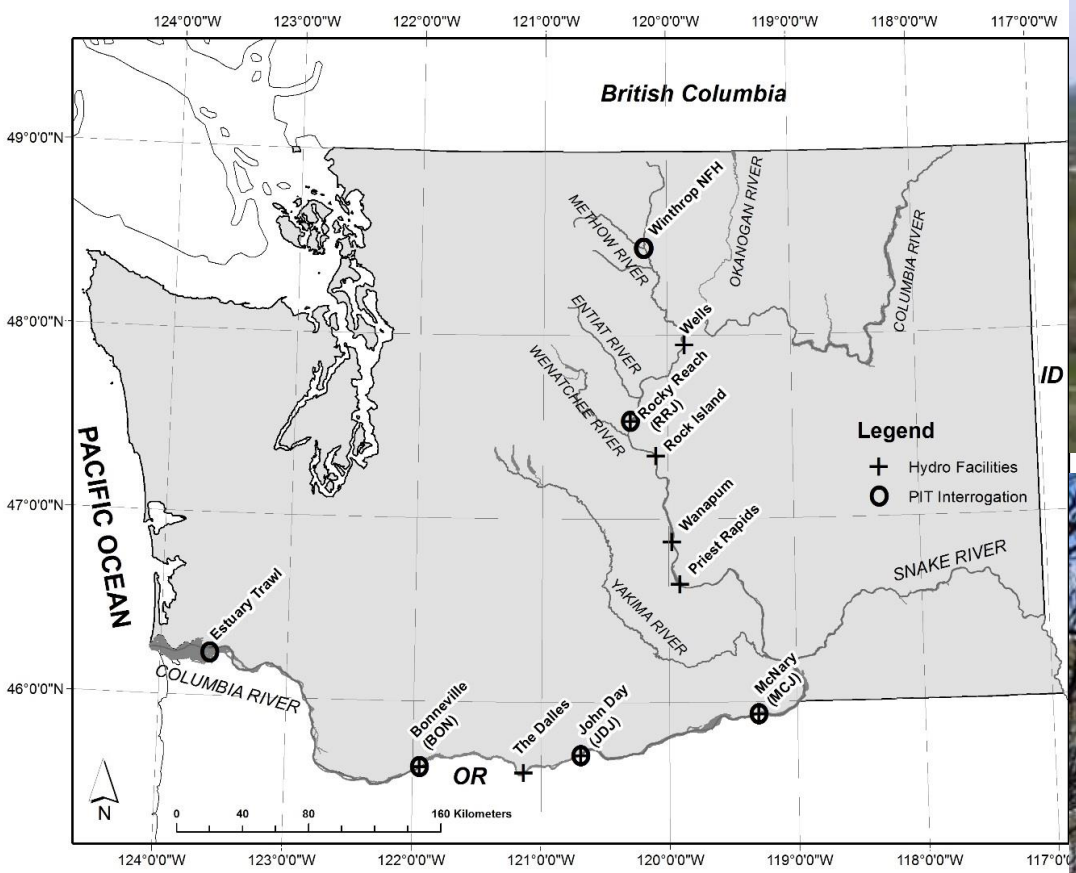
Mature at release ♂



Parr

Smolt (subsequent year?)

Winthrop National Fish Hatchery



Map: Michael Humling

WNFH summer steelhead programs

- Yearling smolts (S1)
- Broodstock collected at Wells Dam (Columbia River)
- Advanced spawn timing (3 months)
- Maximal growth
- Terminated RY 2016

- Age-2 smolts (S2)
- Began RY 2010
- Natural-origin broodstock from Methow River
- Natural spawn timing
- Modulated growth

Pre-release sampling

- PIT tagged S1 and S2 steelhead
- Smolt index
- Fork length (mm)
- Wet weight (g)
- 21,547 fish during release years 2011-2015; S1 ≈ S2

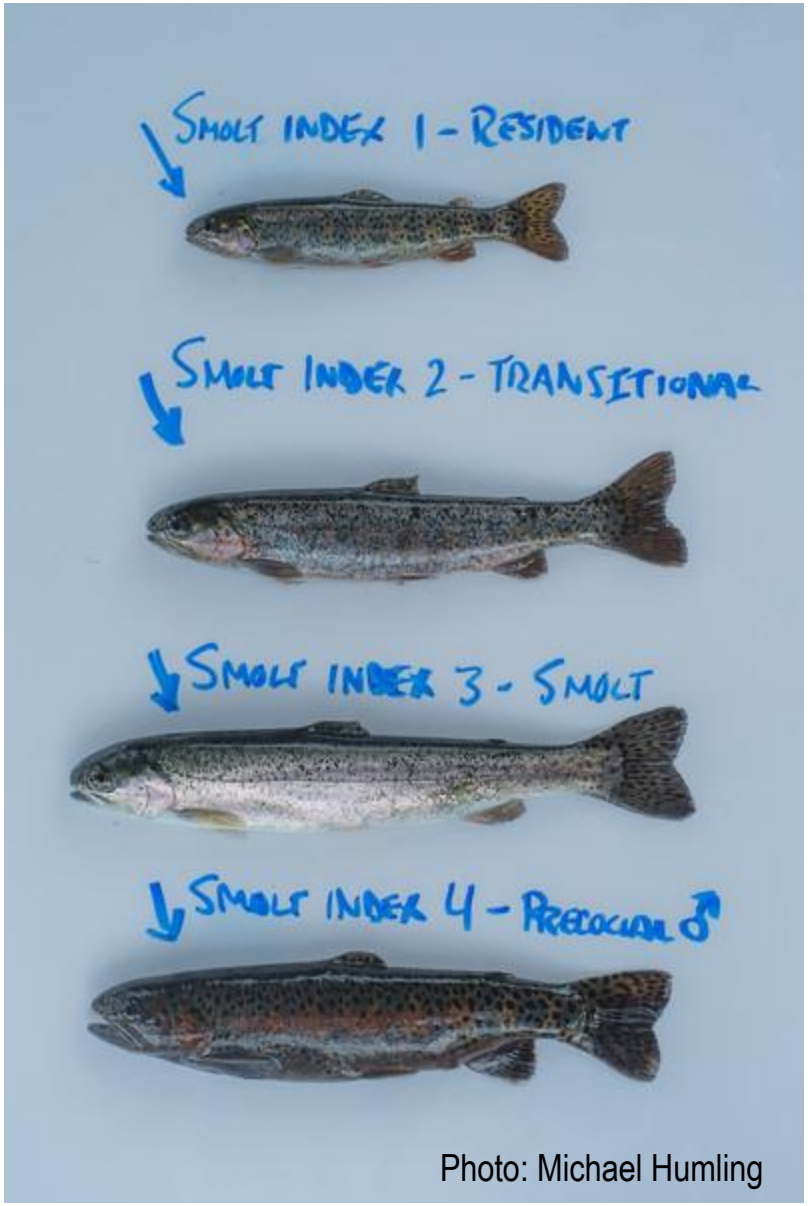
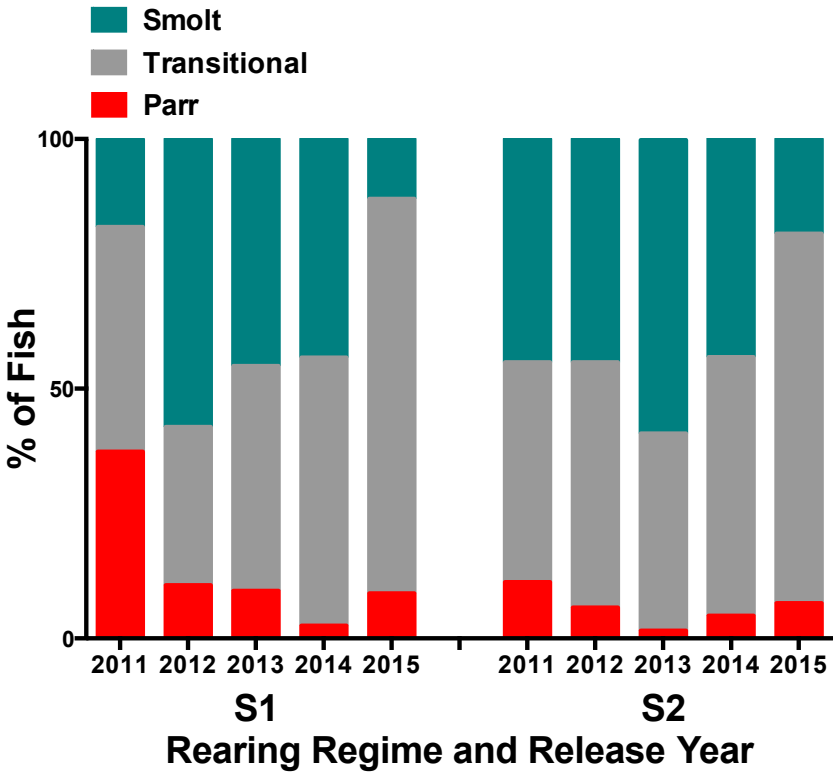
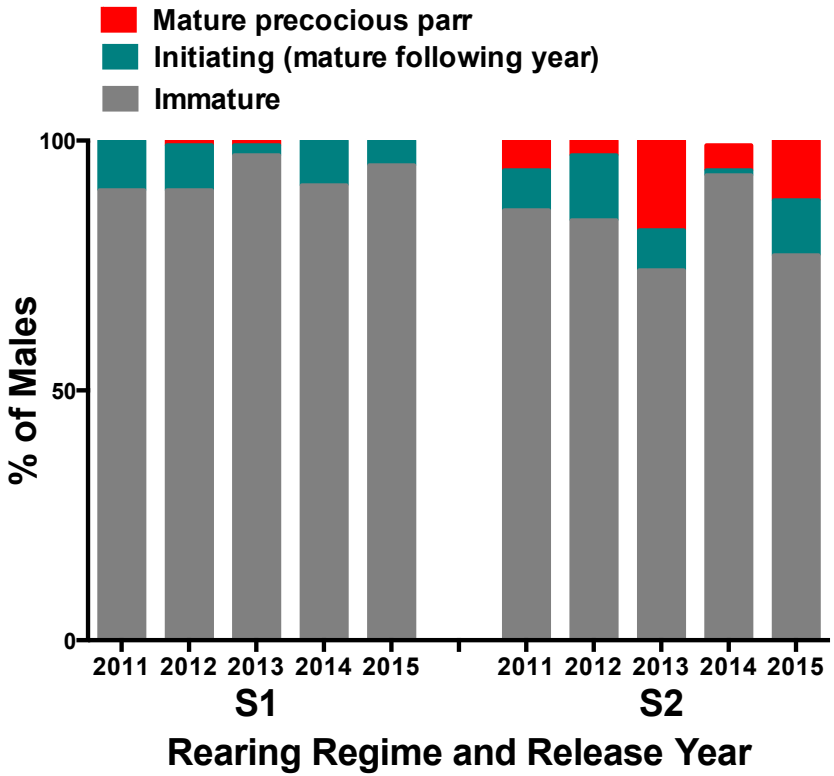


Photo: Michael Humling

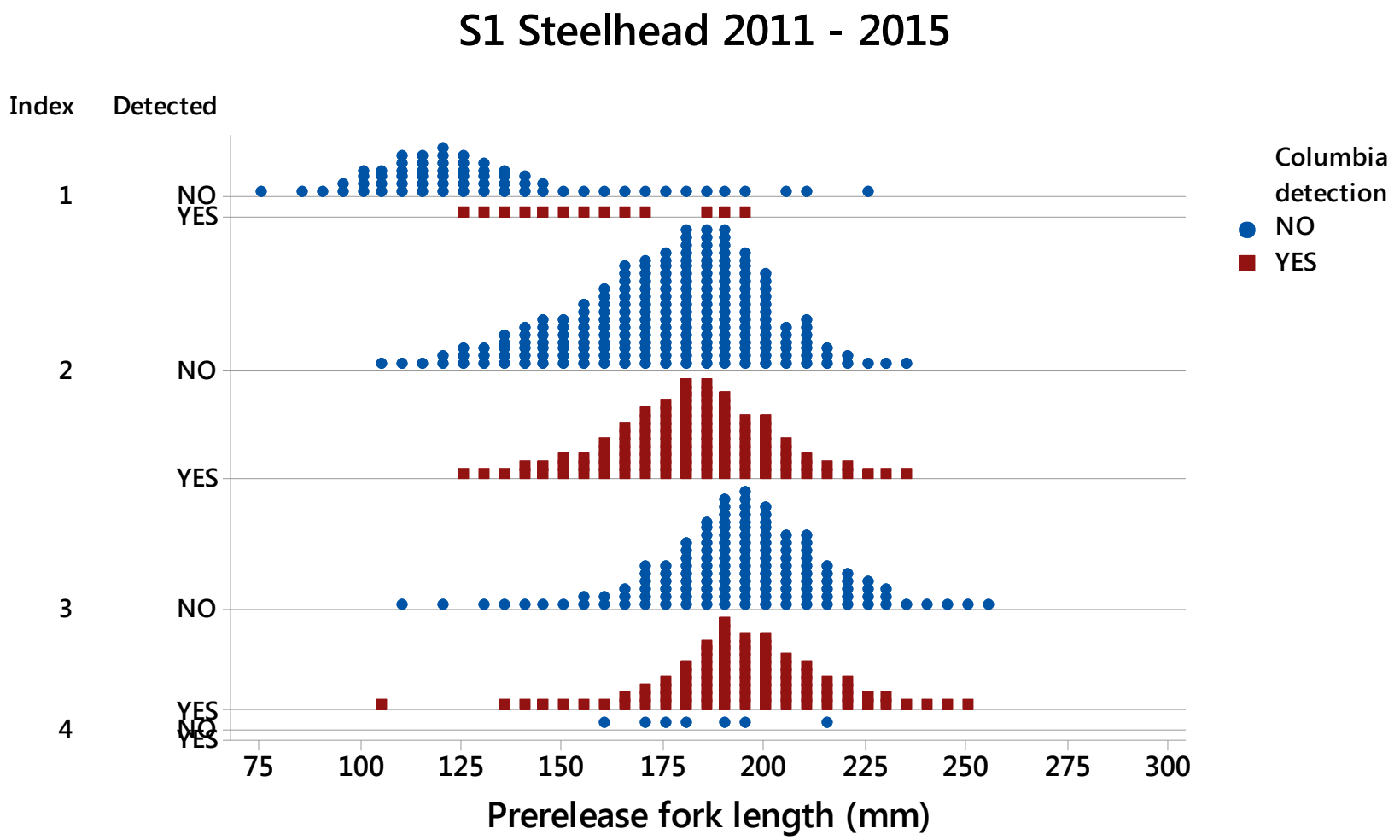
Smoltification and Precocious Maturation





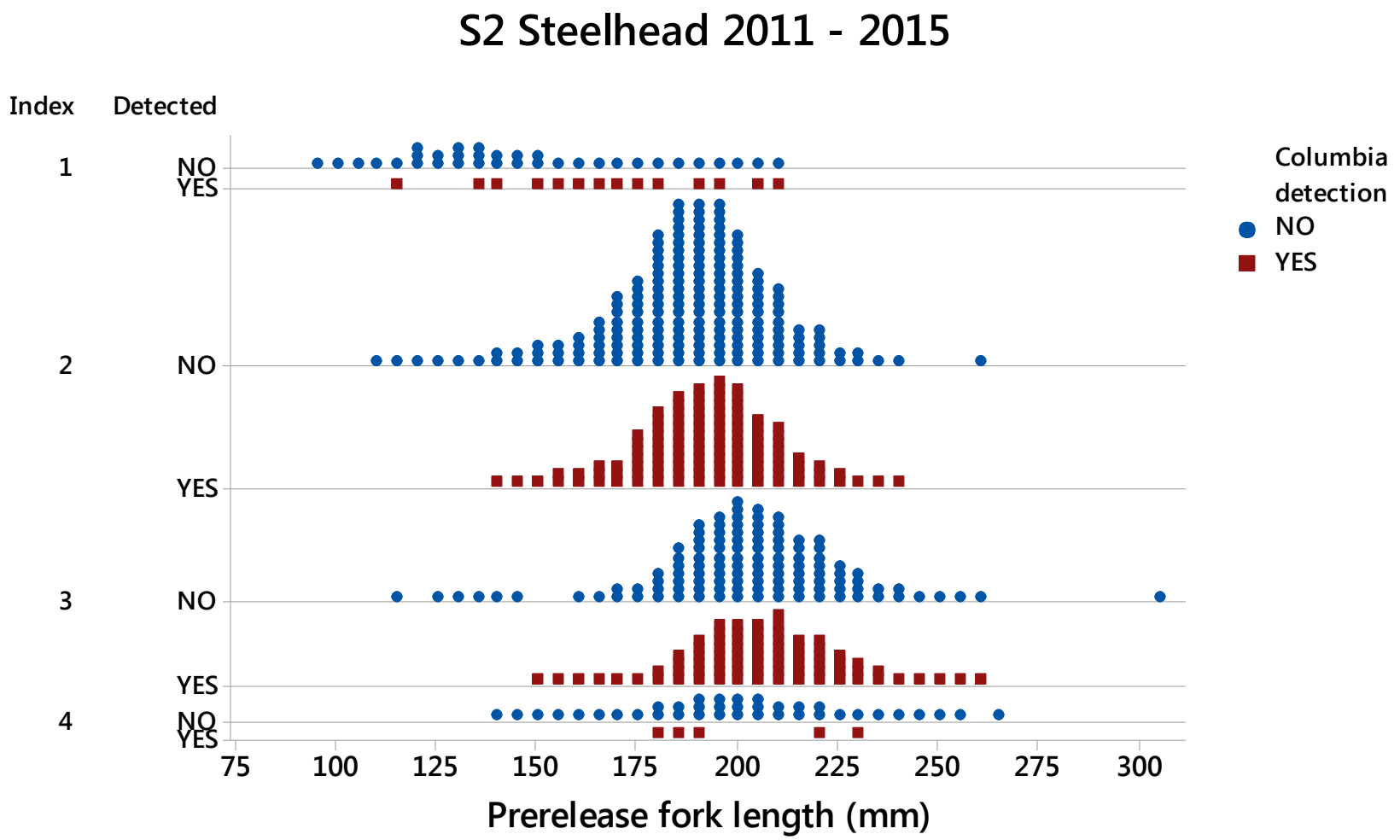
Volitional release of steelhead

Age, size, and maturation affect residualism



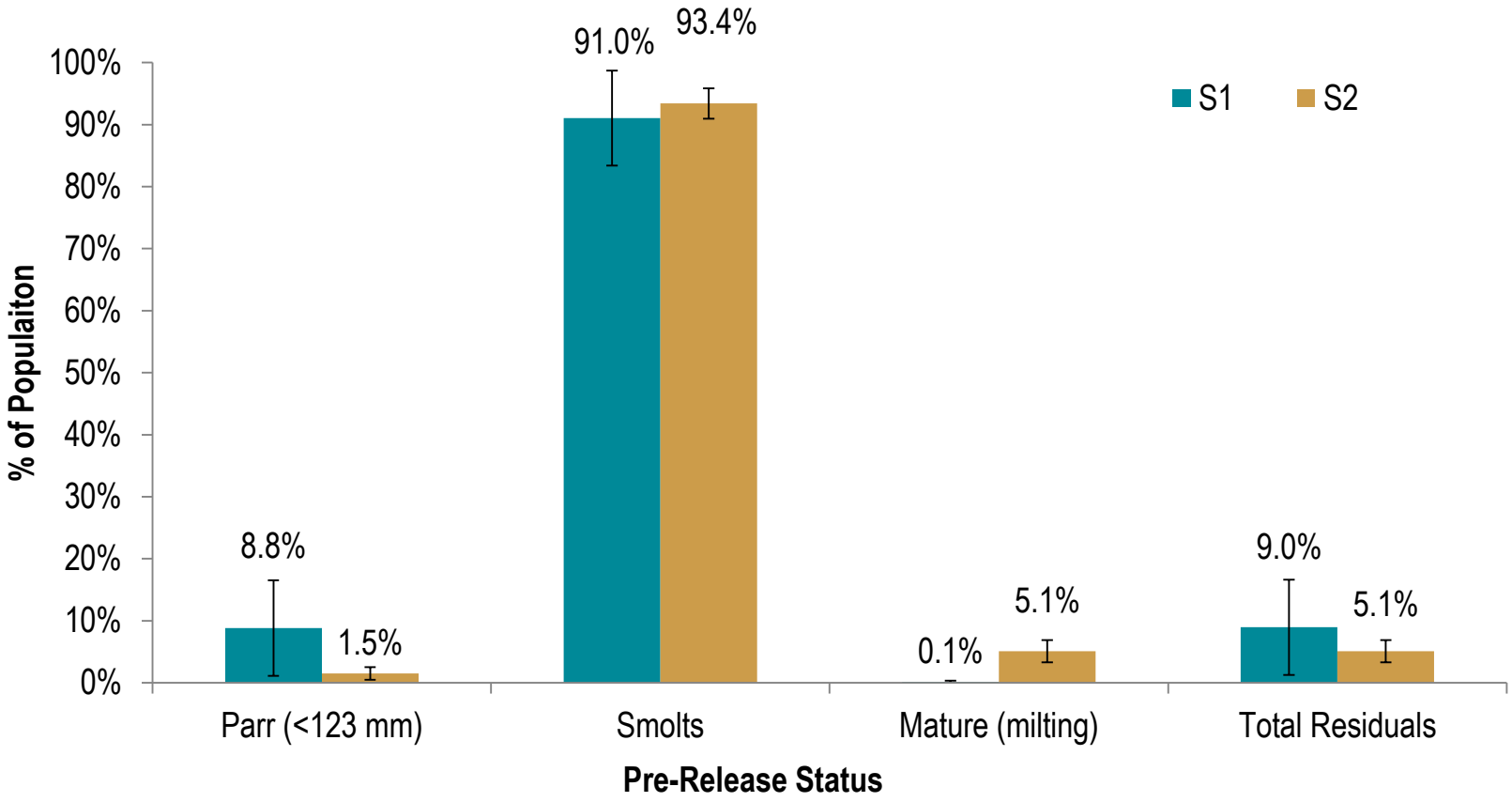
Each symbol represents up to 20 observations.

Age, size, and maturation affect residualism



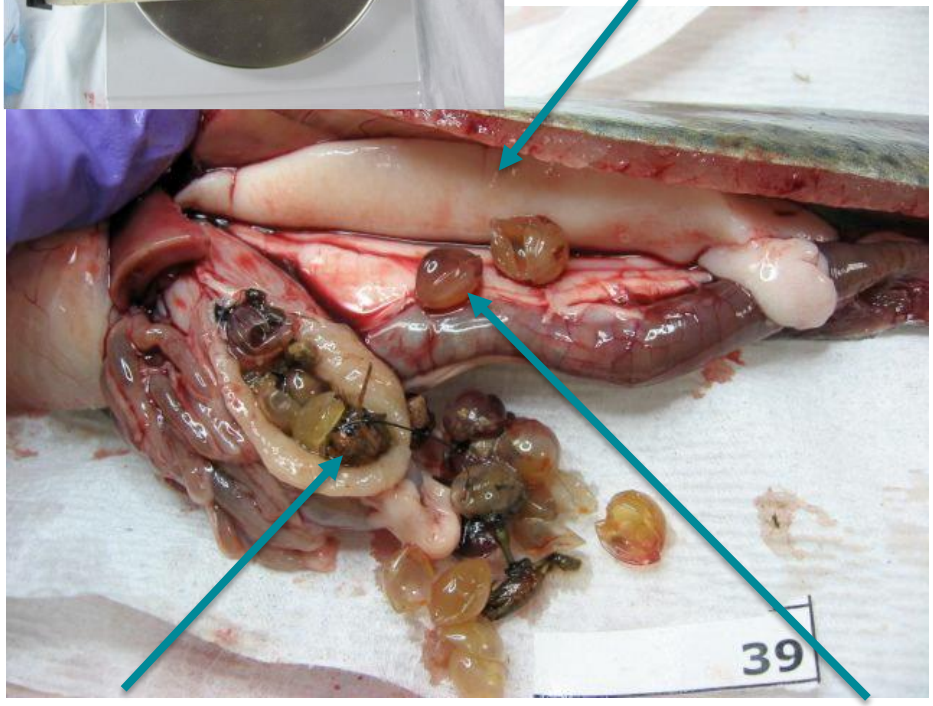
Each symbol represents up to 22 observations.

Pre-Release Status & predicted % residuals for S1 & S2 Steelhead 2011-2015



Residualism: ecological & genetic interactions

Mature testes



Yellow jackets

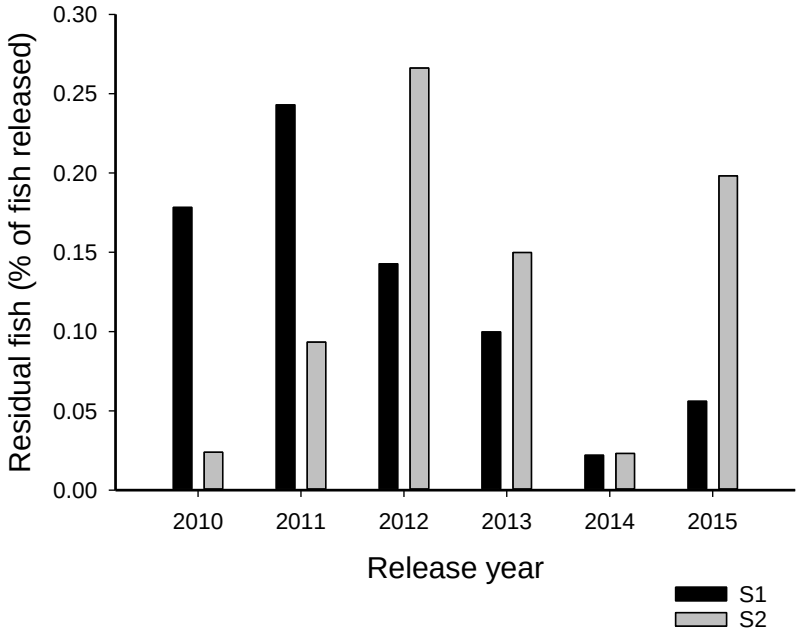
Chinook eggs

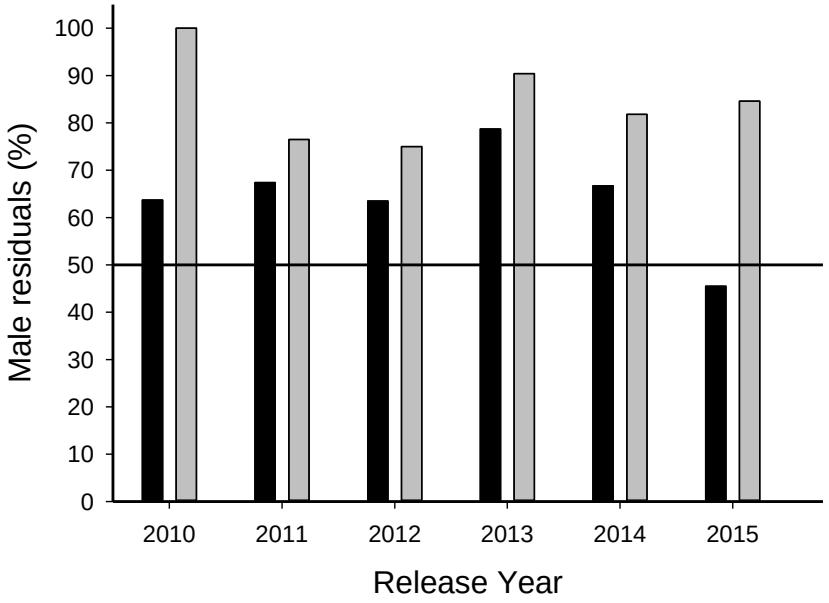
Precocious hatchery males

Anadromous female on redd

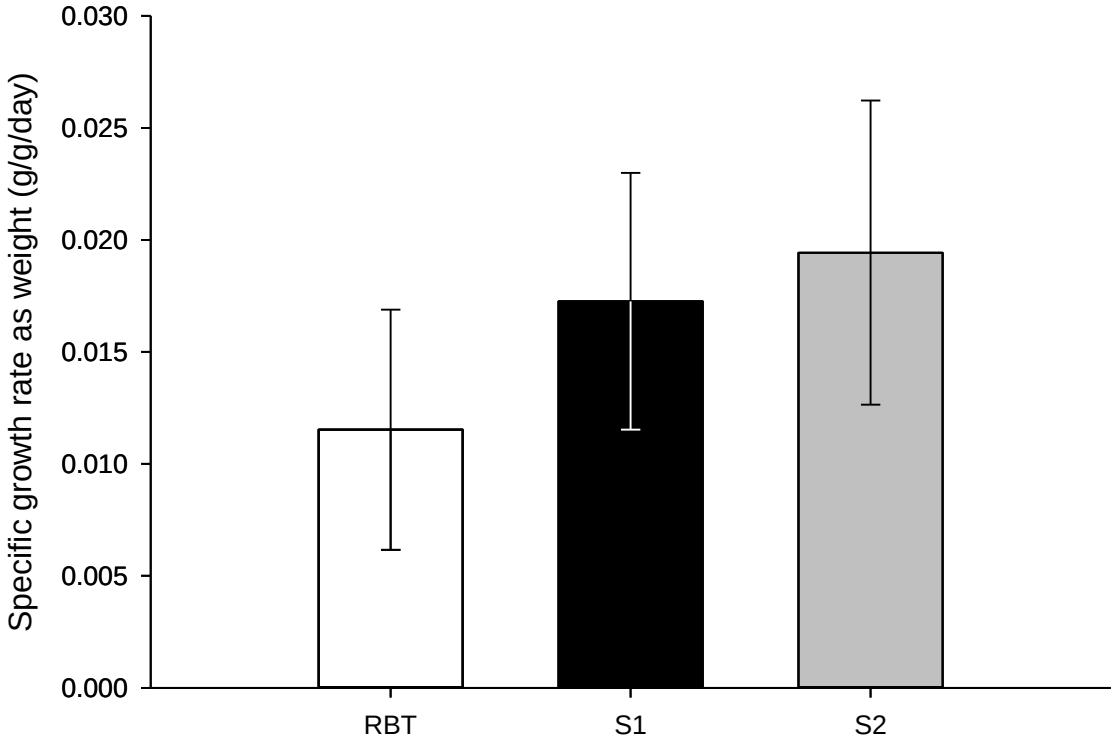
Residual surveys

Residual index and sex ratio of residuals

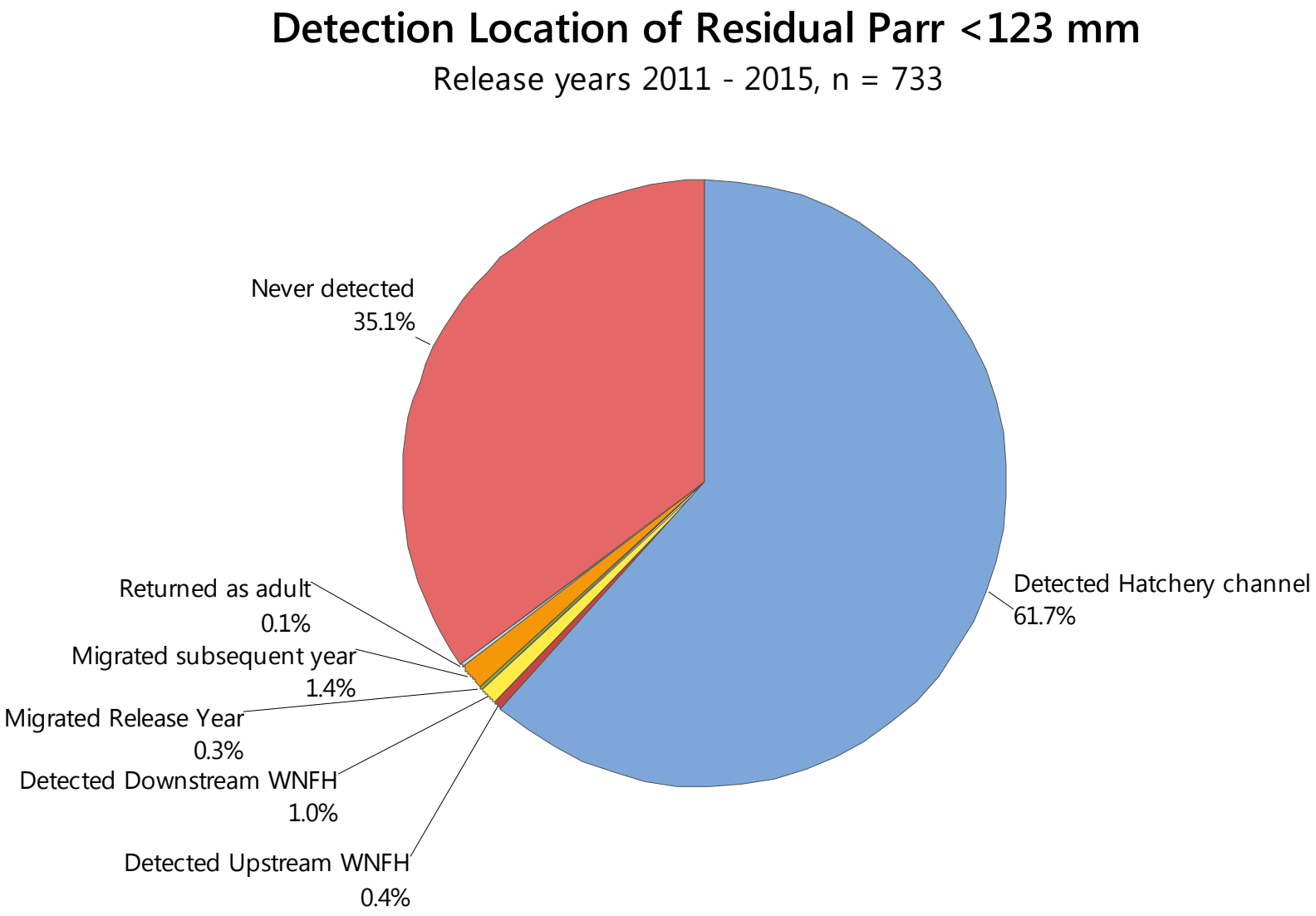




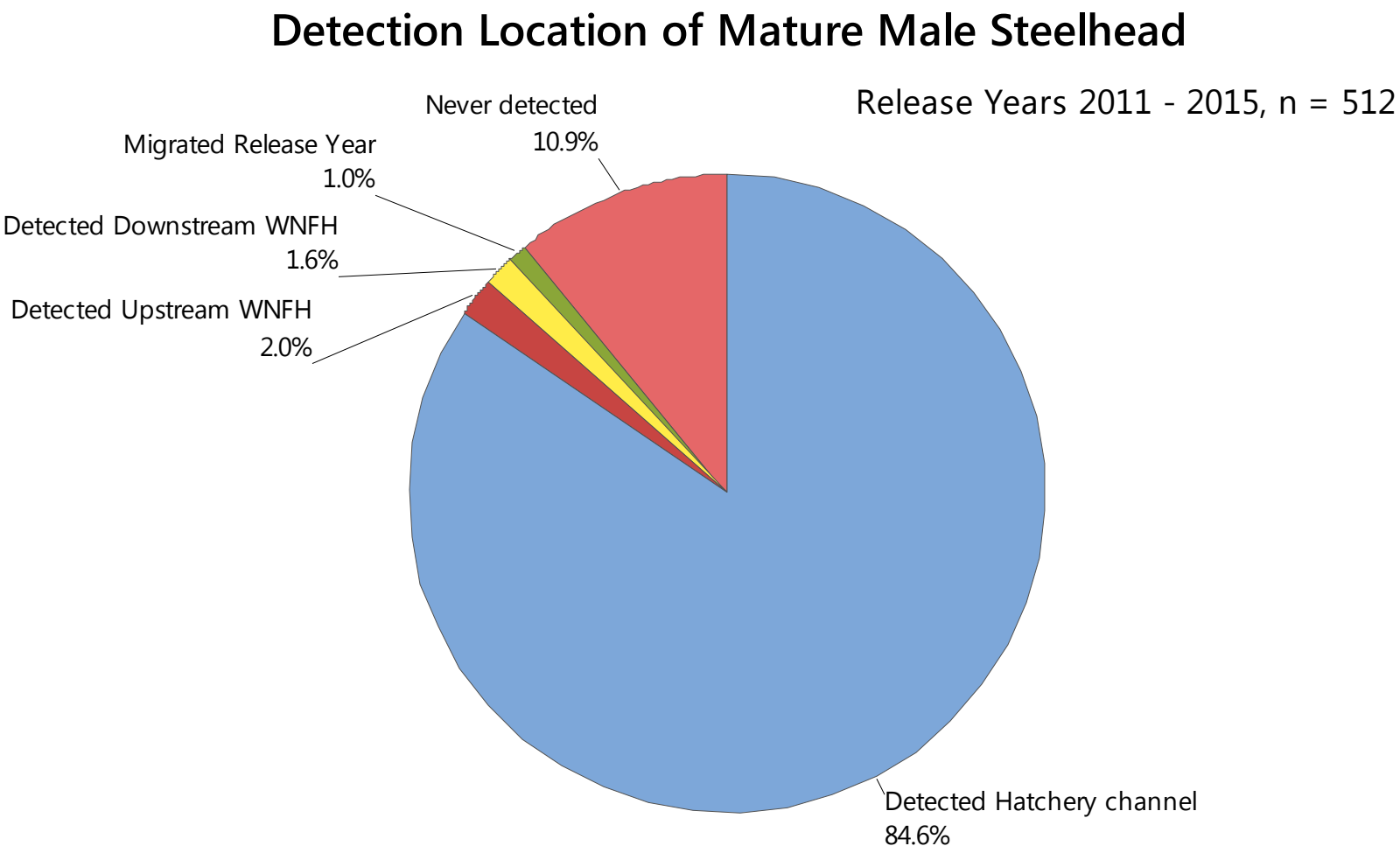
Growth of residual steelhead after release



Location and fate of residual parr



Location and fate of mature males



Conclusions

- S1 and S-2 programs produce similar proportion of residual steelhead
- Characteristics of S1 and S2 residuals differed
  - S1 residuals typically immature parr < 125 mm
  - S2 residuals typically mature male fish
- S1 & S2 residual populations were male biased
- S1 and S2 residuals have similar growth rates as natural fish after release – effective competitors

Conclusions

- Immature parr and mature males were mostly detected in the hatchery release channel
- Methow river detections were low, but…
  - Parr were more likely detected downstream
  - Mature males were detected near anadromous spawning habitat during spawning period – genetic management
- Very few S1 and S2 residuals return as anadromous adults

Acknowledgements

Image: Michael Humling

Collaborators

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- UW
- USGS
- WDFW

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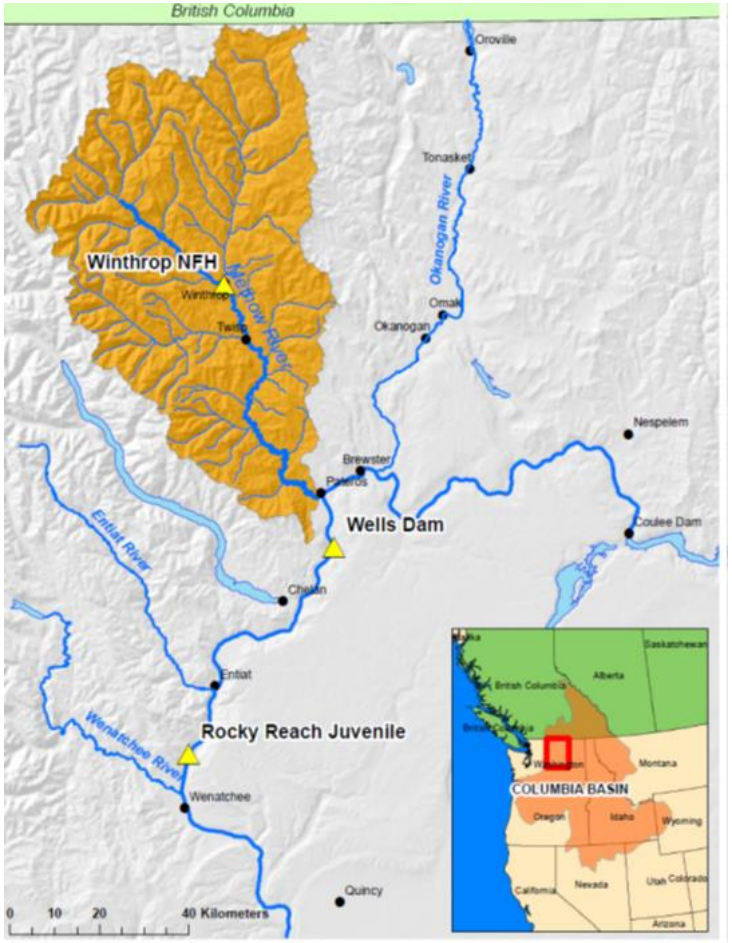
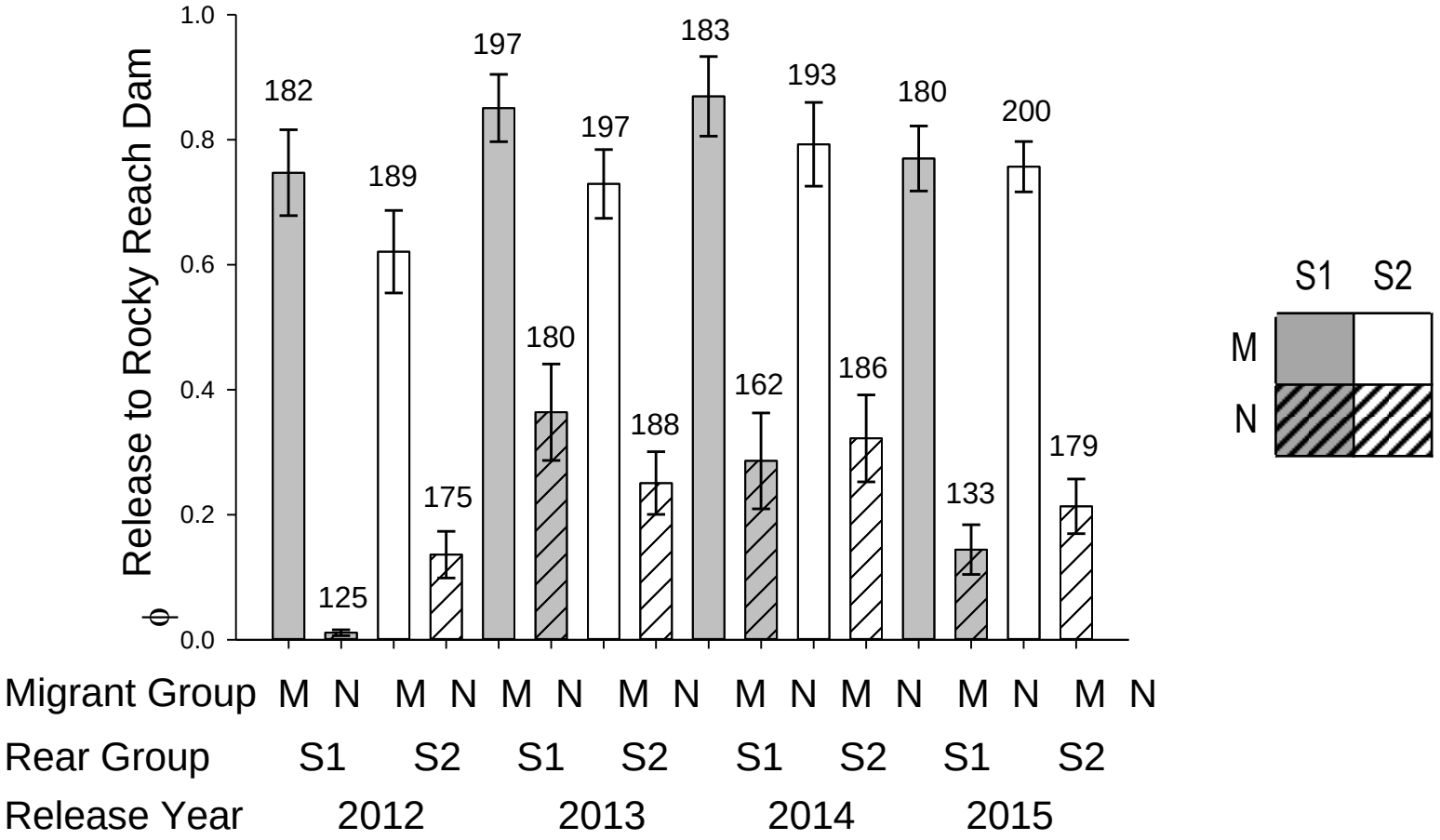
Winthrop National Fish Hatchery



Survival of migrants and non-migrants

Φ(rear+mig+year+length+length^2) p(rear+year+length)



Precocious maturation in steelhead