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Salish Sea Ecosystem Conference

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(Seattle, Wash.)

May 2nd, 8:30 AM - 10:00 AM

Size-selective mortality during freshwater and marine life stages of steelhead related to freshwater growth in the Skagit River, Washington

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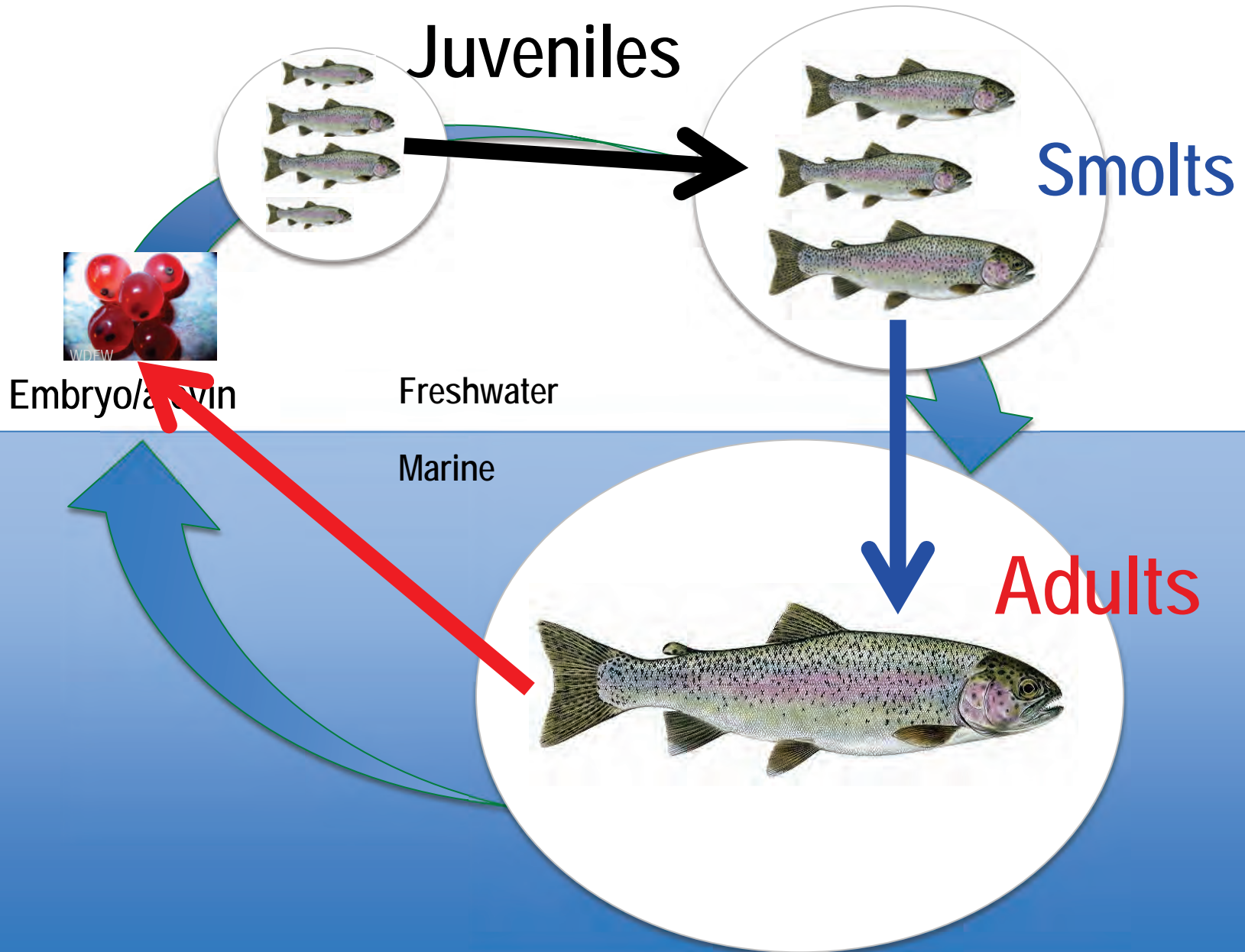
Size-selective mortality of steelhead during freshwater and marine life stages related to freshwater growth in the Skagit River, Washington

Jamie N. Thompson
R2 Resource Consultants, Inc.
Redmond, WA

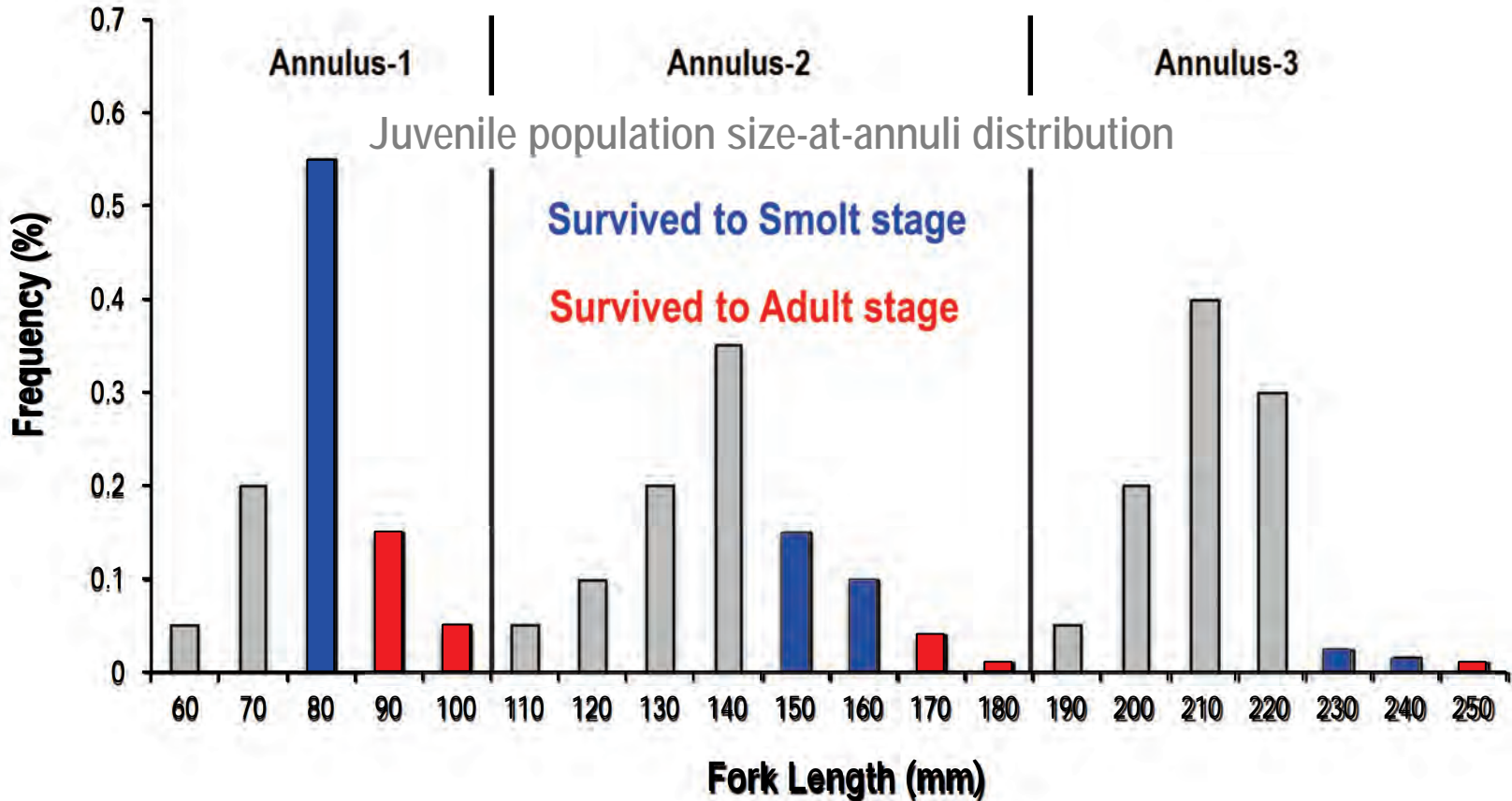
David A. Beauchamp
U.S. Geological Survey, Washington Cooperative Fish and Wildlife Research Unit
School of Aquatic and Fishery Sciences
University of Washington



Life stages and survival of steelhead



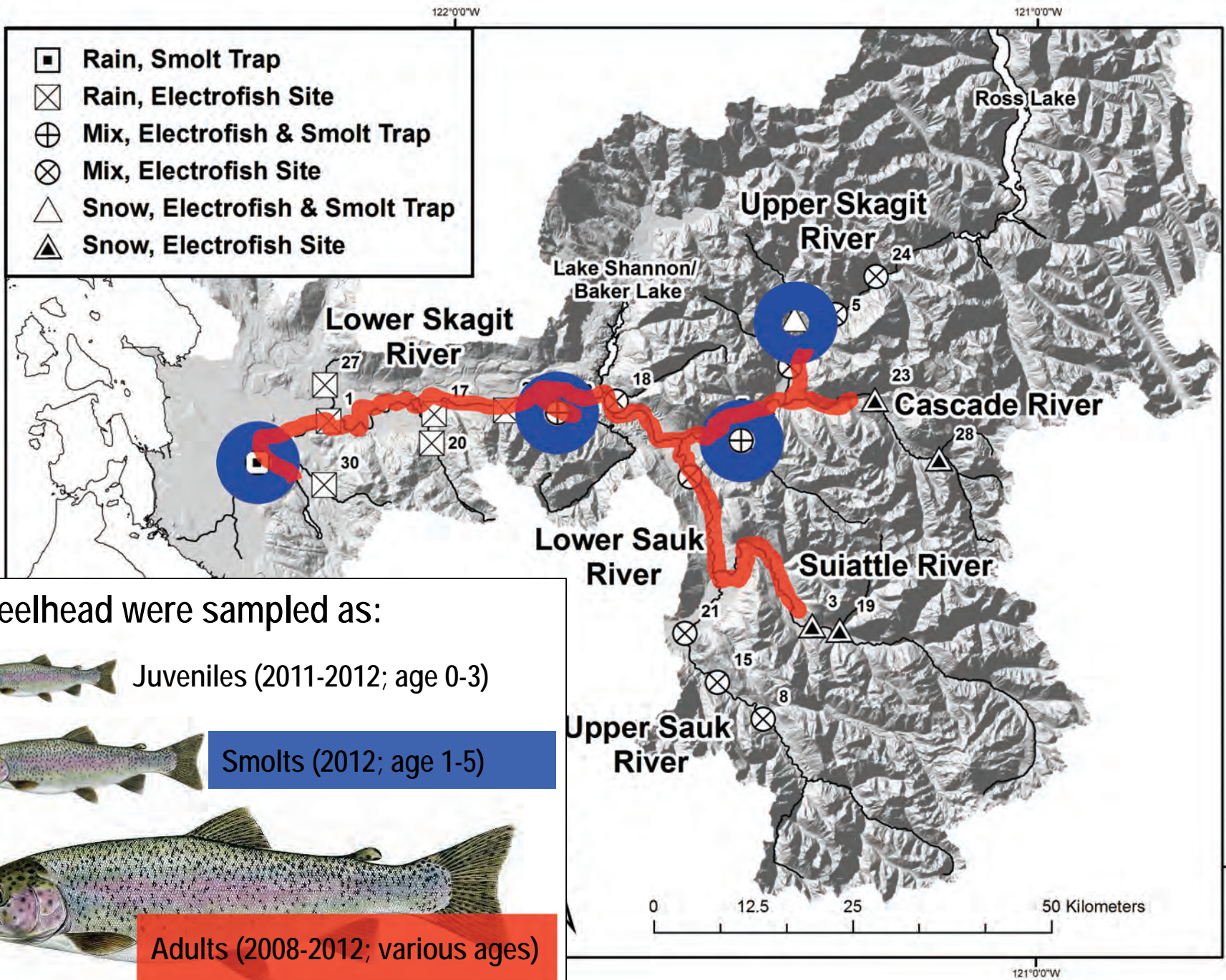
Size-selective mortality



Questions:

- Are faster-growing juveniles more likely to survive to later stages?
- Does size matter more in certain habitats?





Steelhead were sampled as:

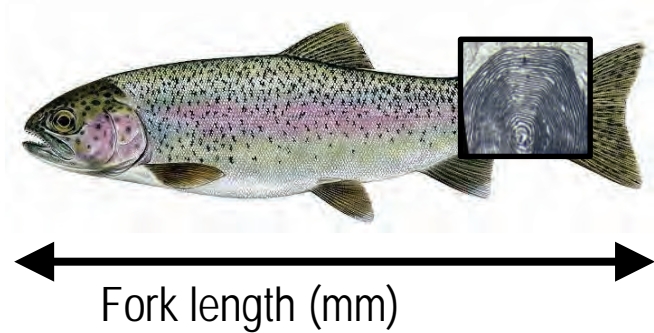
 Juveniles (2011-2012; age 0-3)

 Smolts (2012; age 1-5)

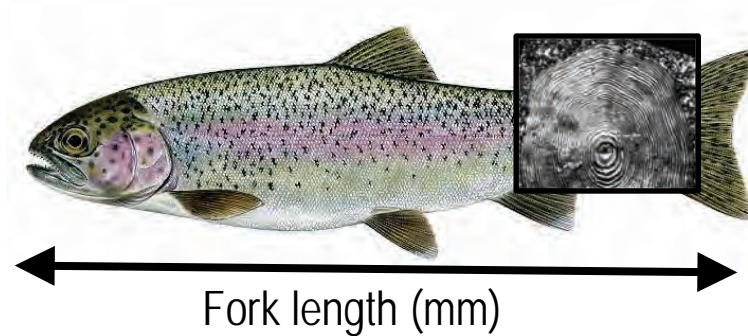
 Adults (2008-2012; various ages)

Data collection

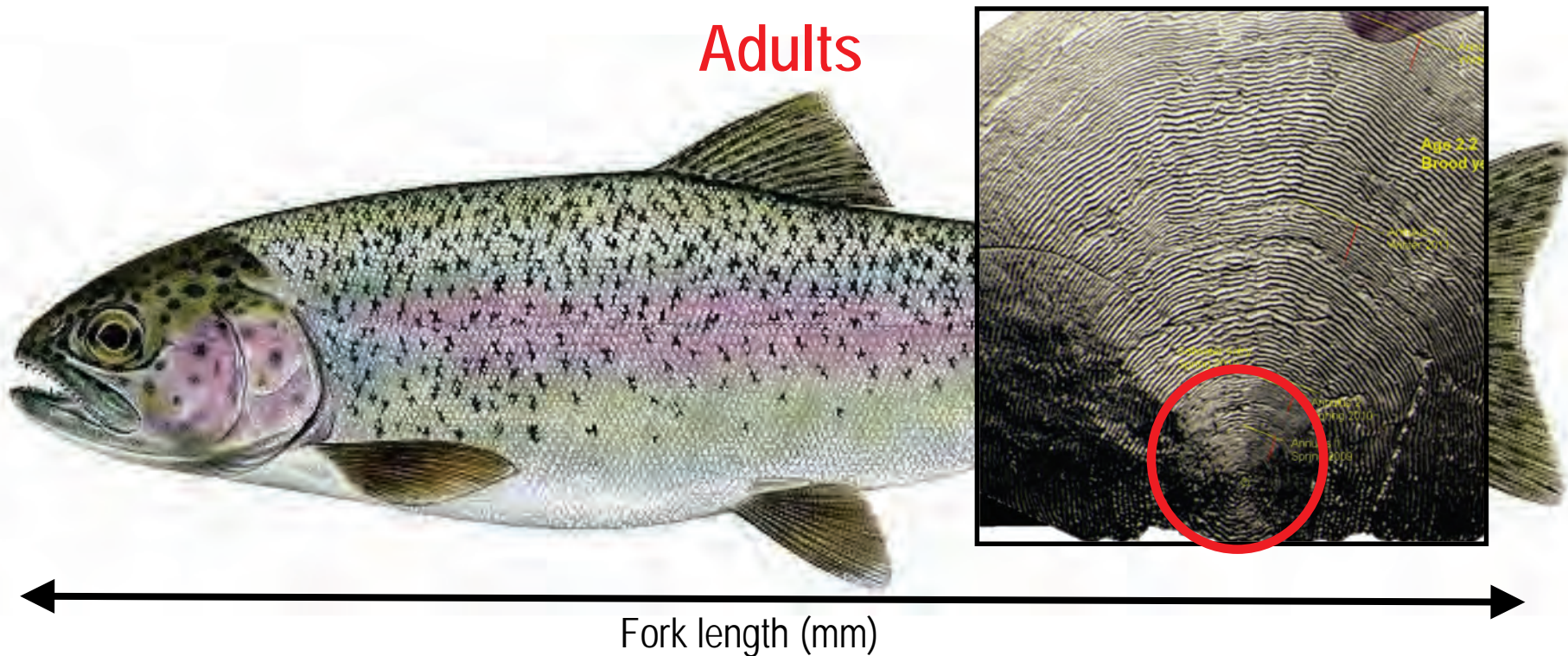
Juveniles



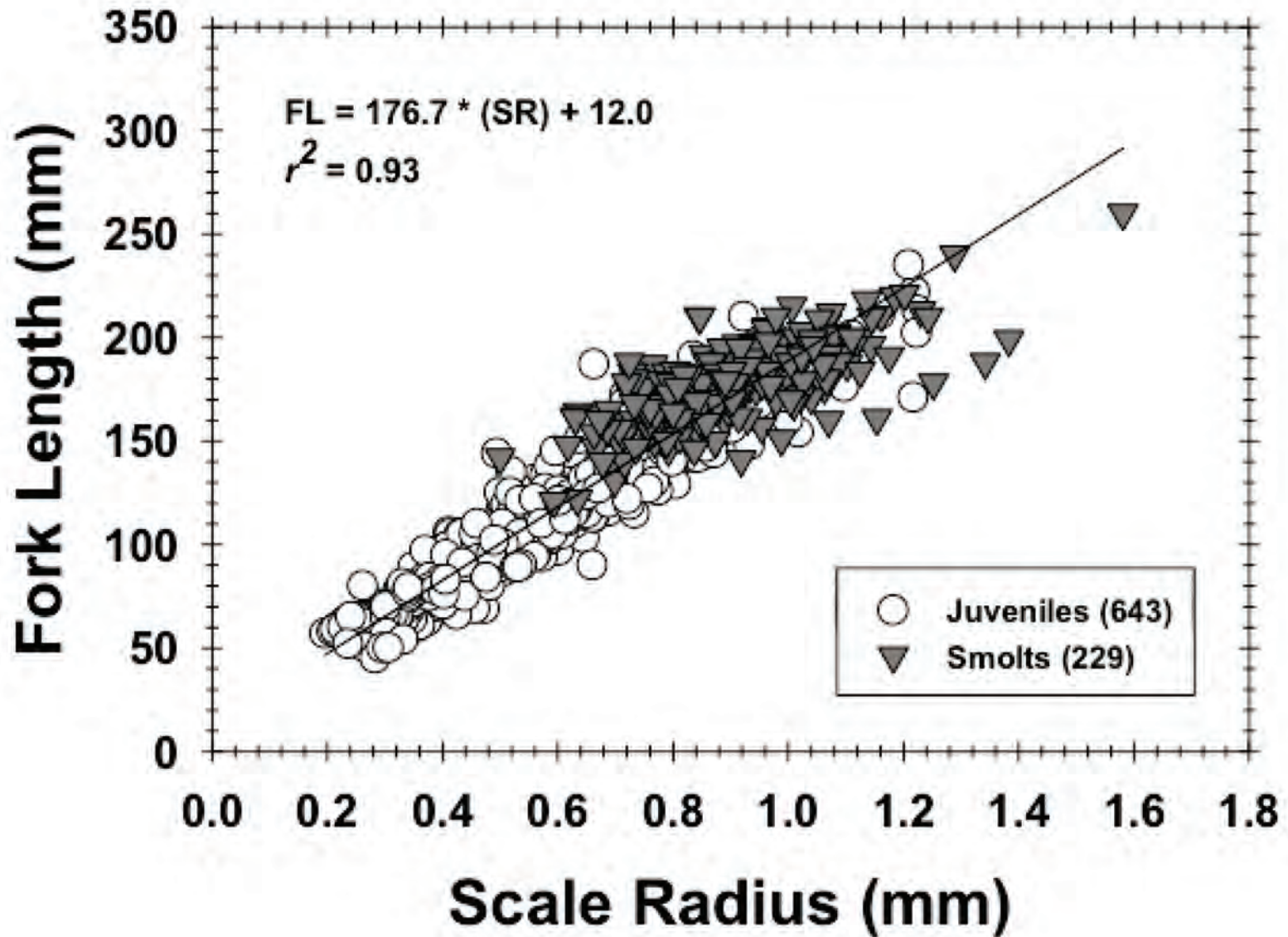
Smolts



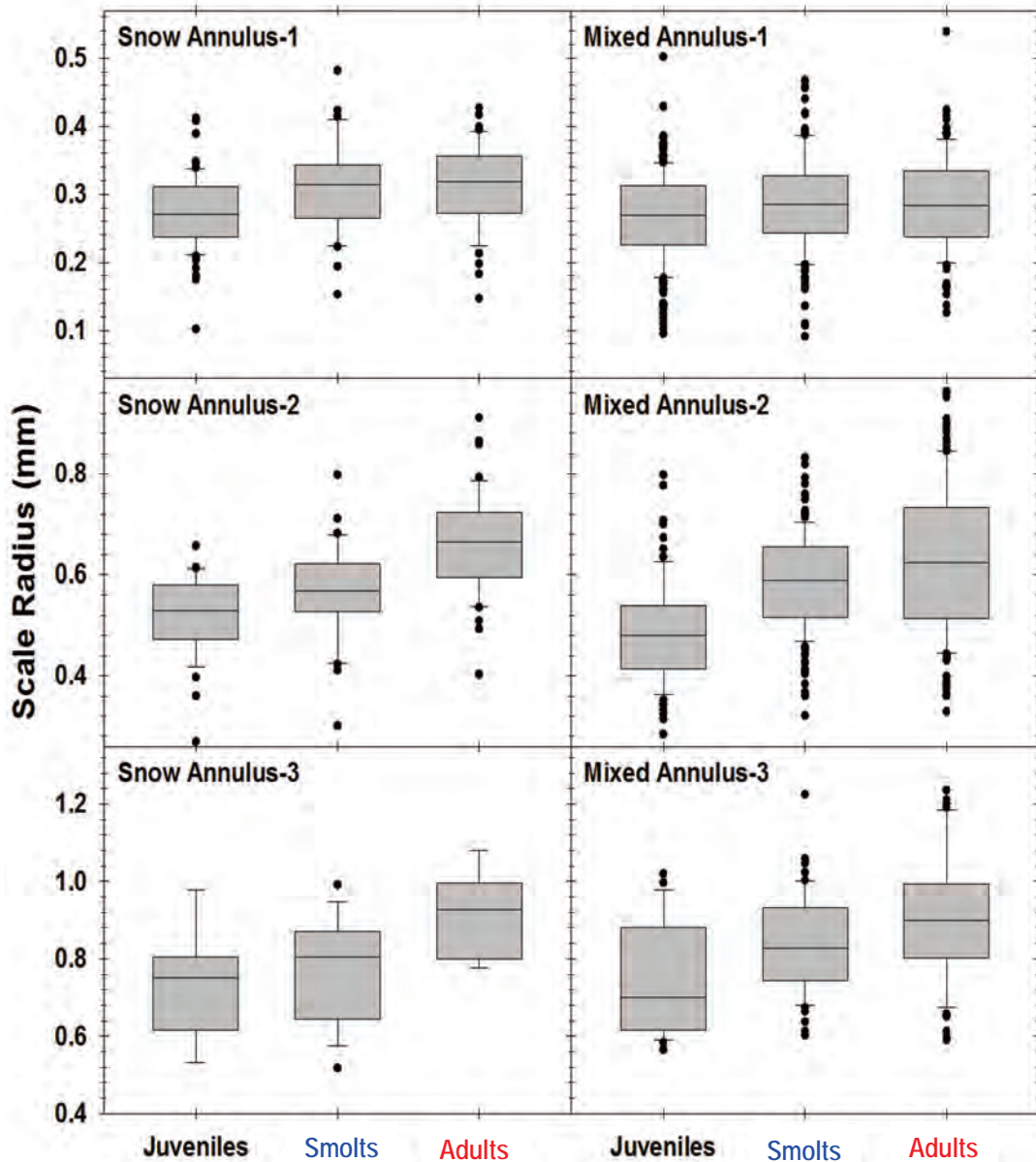
Adults



Back-calculate size-at-annuli



Occurrence of size-selective mortality: 2-way ANOVA



Annulus-1:

Snow > Mixed (no interaction)

Juveniles < Smolts & Adults

= Freshwater SSM

Annulus-2:

Juveniles < Smolts < Adults

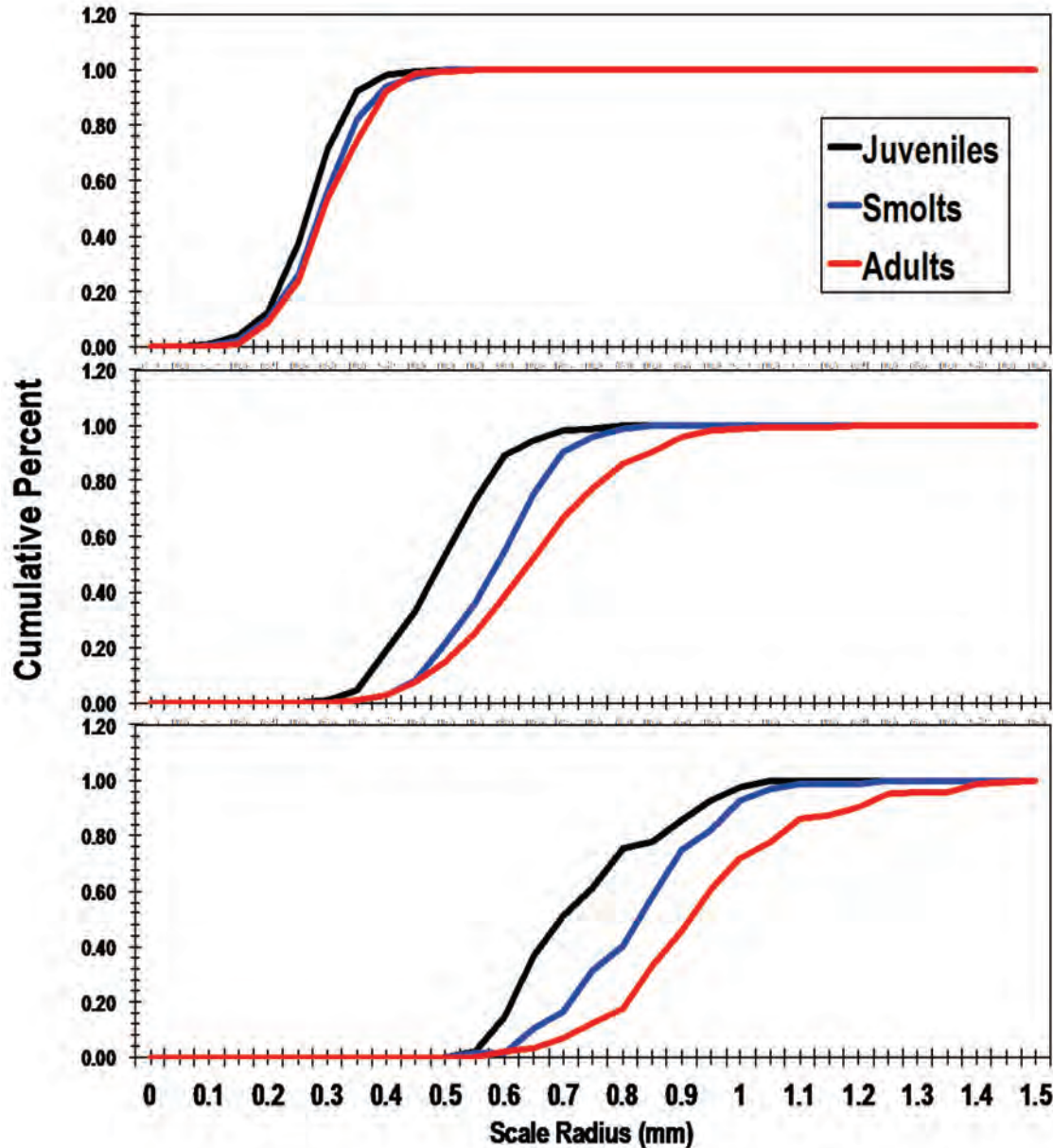
= Freshwater & Marine SSM

Annulus-3:

Juveniles & Smolts < Adults

= Freshwater & Marine SSM

Magnitude of size-selective mortality: K-S 2 Sample Test



Annulus-1:

Juveniles \neq Smolts & Adults

Low-to-moderate Freshwater SSM

Annulus-2:

Juveniles \neq Smolts \neq Adults

High Freshwater & Marine SSM

Annulus-3:

Juveniles \neq Smolts \neq Adults

High Freshwater & Marine SSM

Conclusions

- 1) Size at annuli-2 and -3 strongly influences survival
- 1) Growth in natal habitats important, but we need more detailed evaluation of habitat effects on growth and survival
- 1) Usefulness: If SSM is significant, evaluating and improving growth in freshwater habitats could be useful tool for recovery



Acknowledgements

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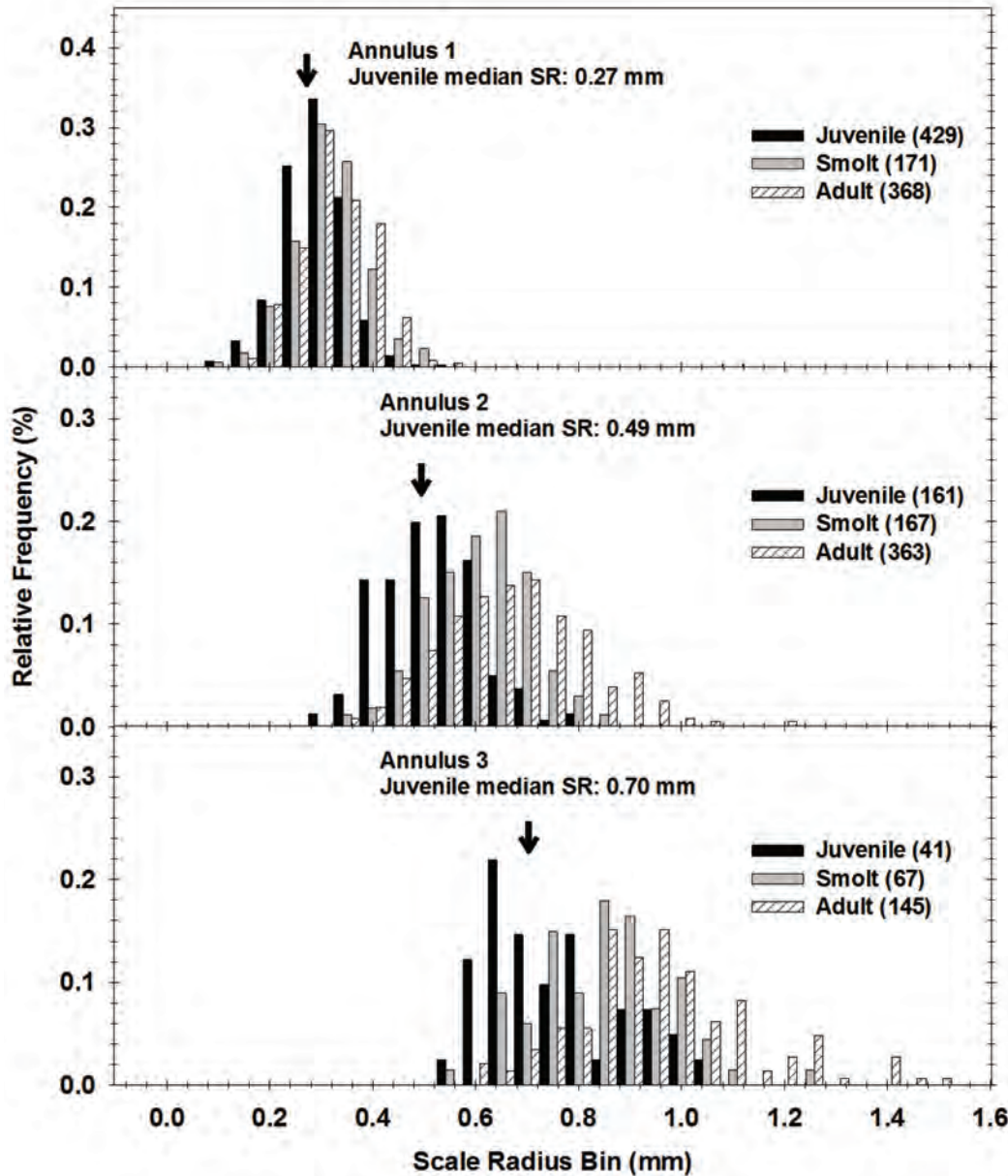
Upper Skagit Indian Tribe

Jon-Paul Shannahan, Tim Shelton, Josh Adams

Washington Department of Fish and Wildlife

Lance Campbell, Clayton Kinsel, Mara Zimmerman, Brett Barkdull, Lucinda Morrow

Measure of size-selective mortality: K-S 2 Sample Test



Annulus-1:

Juveniles \neq Smolts & Adults

Annulus-2:

Juveniles \neq Smolts \neq Adults

Annulus-3:

Juveniles \neq Smolts \neq Adults

Larger smolt = Greater marine survival

Between final annulus and smolting...

Smolt sample grew 22% in FL

Adult sample ONLY grew 16% in FL

Smolt sample grew 11% in FL

Adult sample ONLY grew 9% in FL

Precipitation Zone	n	Back-calculated FL (mm)		
		FL at annulus-2 (mm)	FL at annulus-3 (mm)	Smolt Size (mm)
<u>Smolted at age-2</u>				
<i>Smolt sample</i>				
Snow	16	119 ± 3	-	146 ± 2
Mixed	84	120 ± 1	-	155 ± 2
		120 ± 1		154 ± 2
<i>Adult sample</i>				
Snow	33	130 ± 2	-	159 ± 4
Mixed	75	130 ± 2	-	154 ± 2
		130 ± 2		156 ± 2
<u>Smolted at age-3</u>				
<i>Smolt sample</i>				
Snow	11	114 ± 3	151 ± 4	169 ± 5
Mixed	50	112 ± 2	155 ± 3	174 ± 2
		113 ± 2	154 ± 2	173 ± 2
<i>Adult sample</i>				
Snow	6	118 ± 8	163 ± 8	177 ± 8
Mixed	55	115 ± 2	165 ± 3	181 ± 4
		115 ± 2	165 ± 3	181 ± 3