May 2nd, 10:30 AM - 12:00 PM

Size-selective mortality and bioenergetic limitations of juvenile steelhead under different freshwater environmental constraints in the Skagit River, Washington

Jamie Thompson
R2 Resource Consultants, jamostomos@hotmail.com

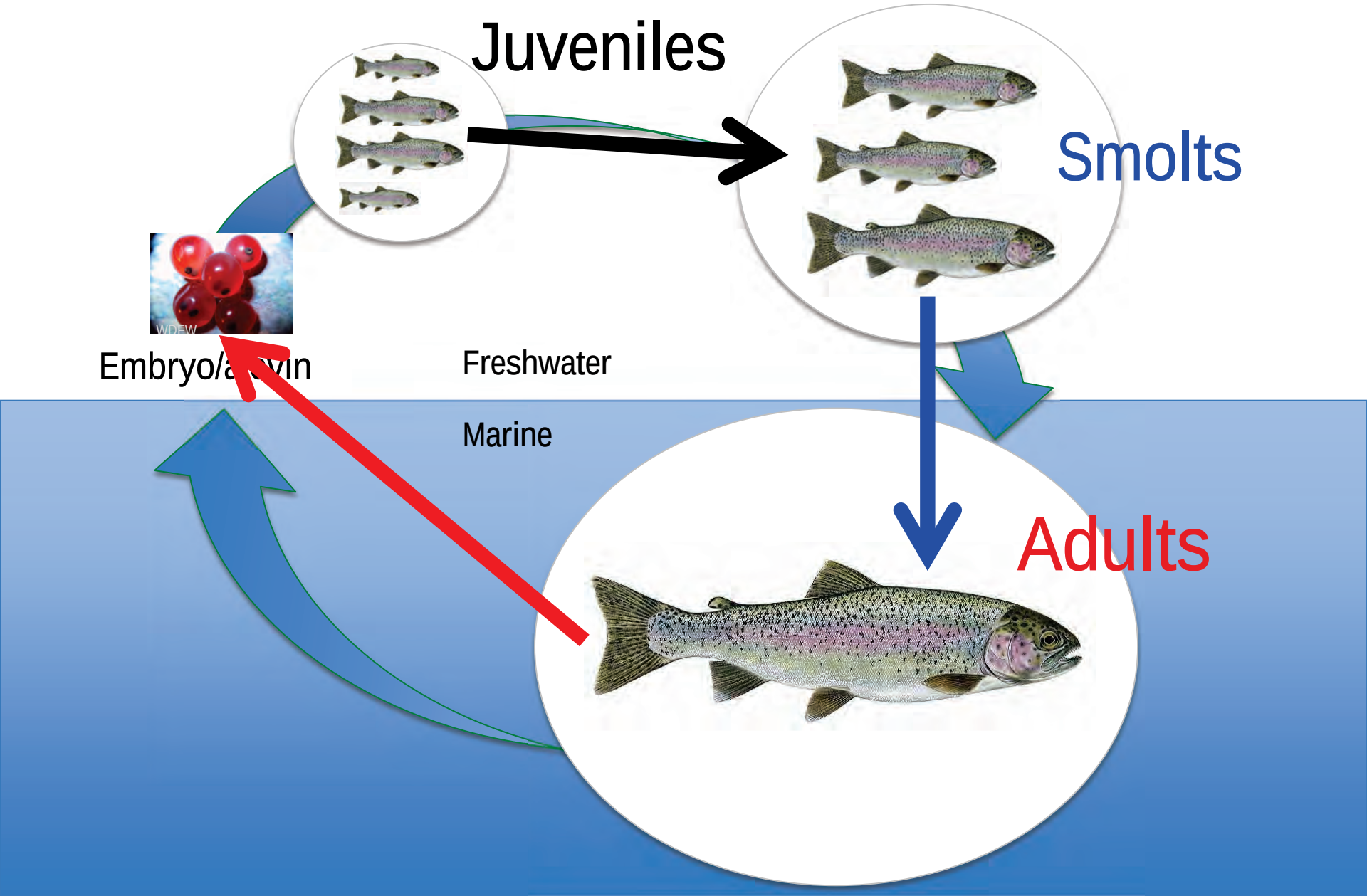
David A. Beauchamp
Washington Cooperative Fish and Wildlife Research Unit

Size-selective mortality and bioenergetic limitations of juvenile steelhead under different freshwater environmental constraints in the Skagit River, Washington

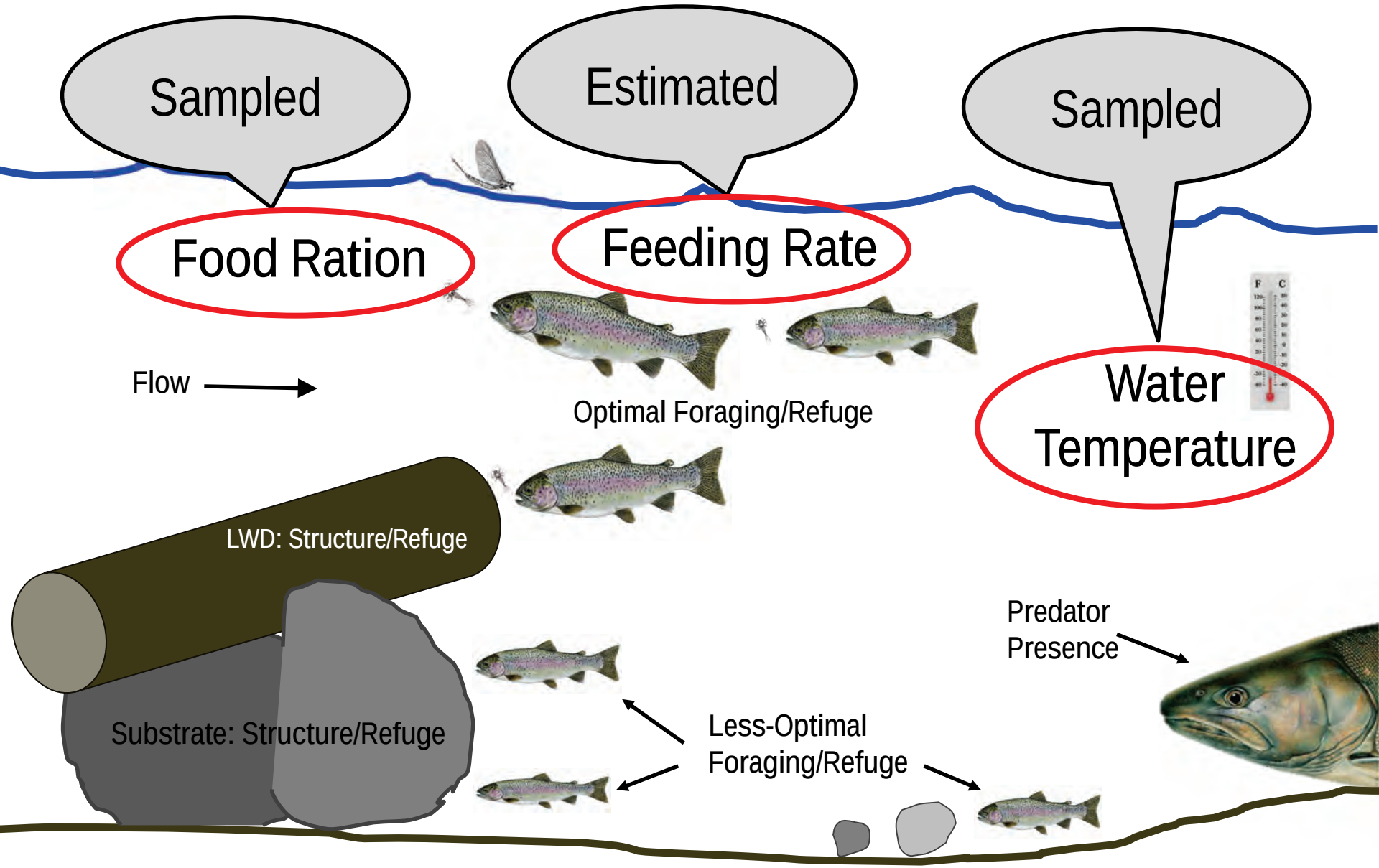
Jamie N. Thompson
R2 Resource Consultants, Inc.
Redmond, WA

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

Early growth influences survival of steelhead



Constraints on growth in freshwater



Energy In = Energy Out

The Bioenergetics Model

Model Inputs

-Thermal experience

-Temporal diet composition

-Consumer growth (G)

-Predator energy density

-Prey energy density

Energy Out: Metabolism + Waste + Growth

Model Outputs

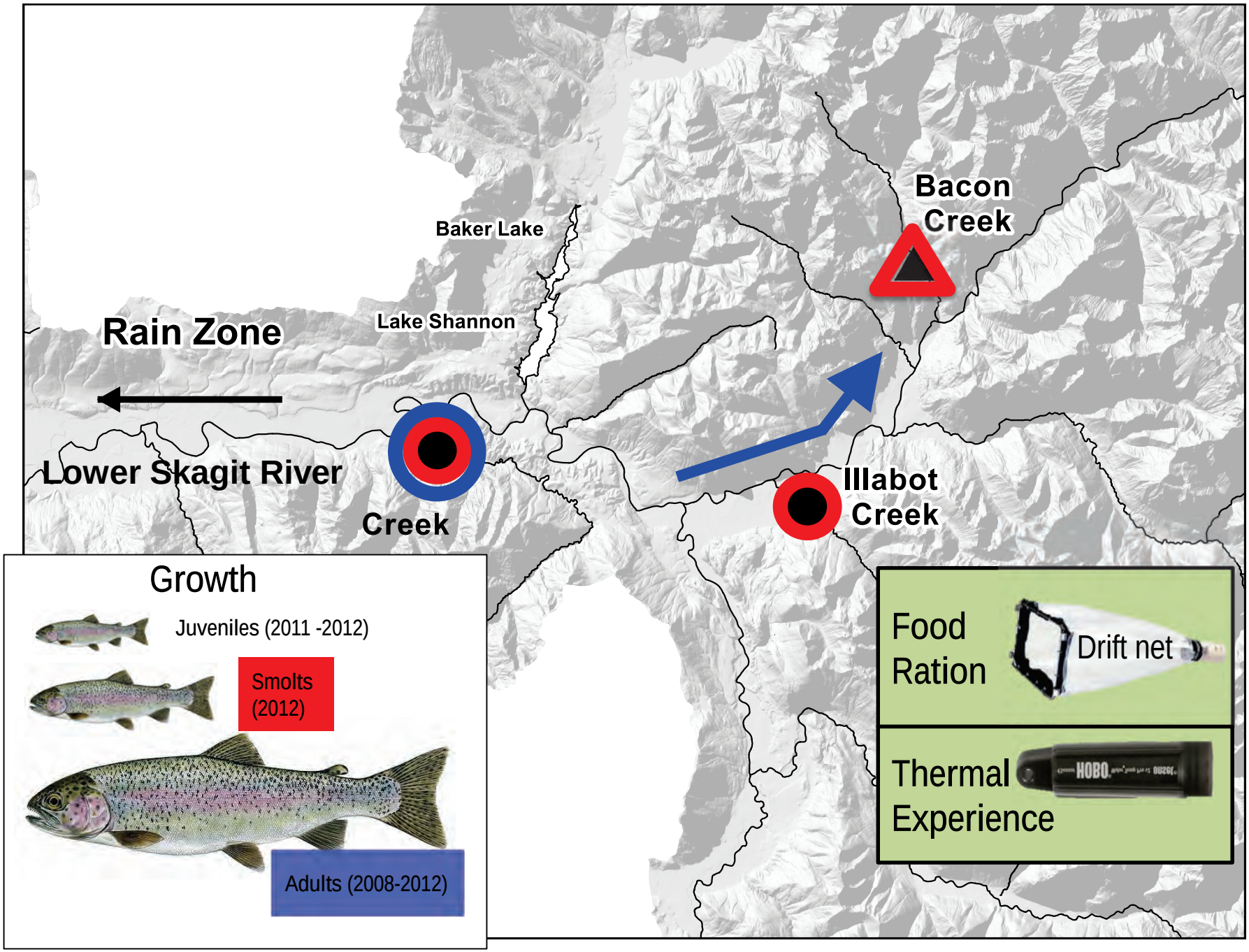
Estimated Energy In (given observed Growth & other input values)

Estimated as…

Feeding Rate ($\%C_{max}$)

or…

Consumption (g of prey/day)


Bacon Creek
Baker Lake
Lake Shannon
Rain Zone
Lower Skagit River
Creek
Illabot Creek
Growth
Juveniles (2011 -2012)
Smolts (2012)
Adults (2008-2012)
Food Ration
Drift net
Thermal Experience
HOBO

Data collection: Growth (FL-to-weight)

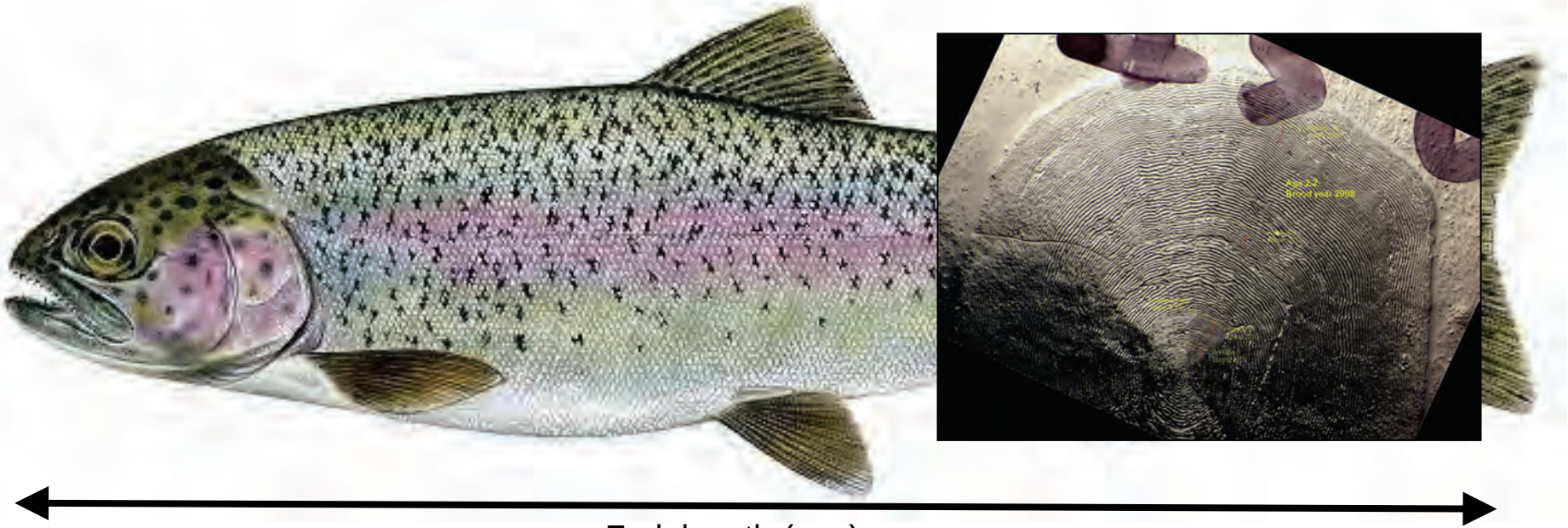
Juveniles

Fork length (mm)

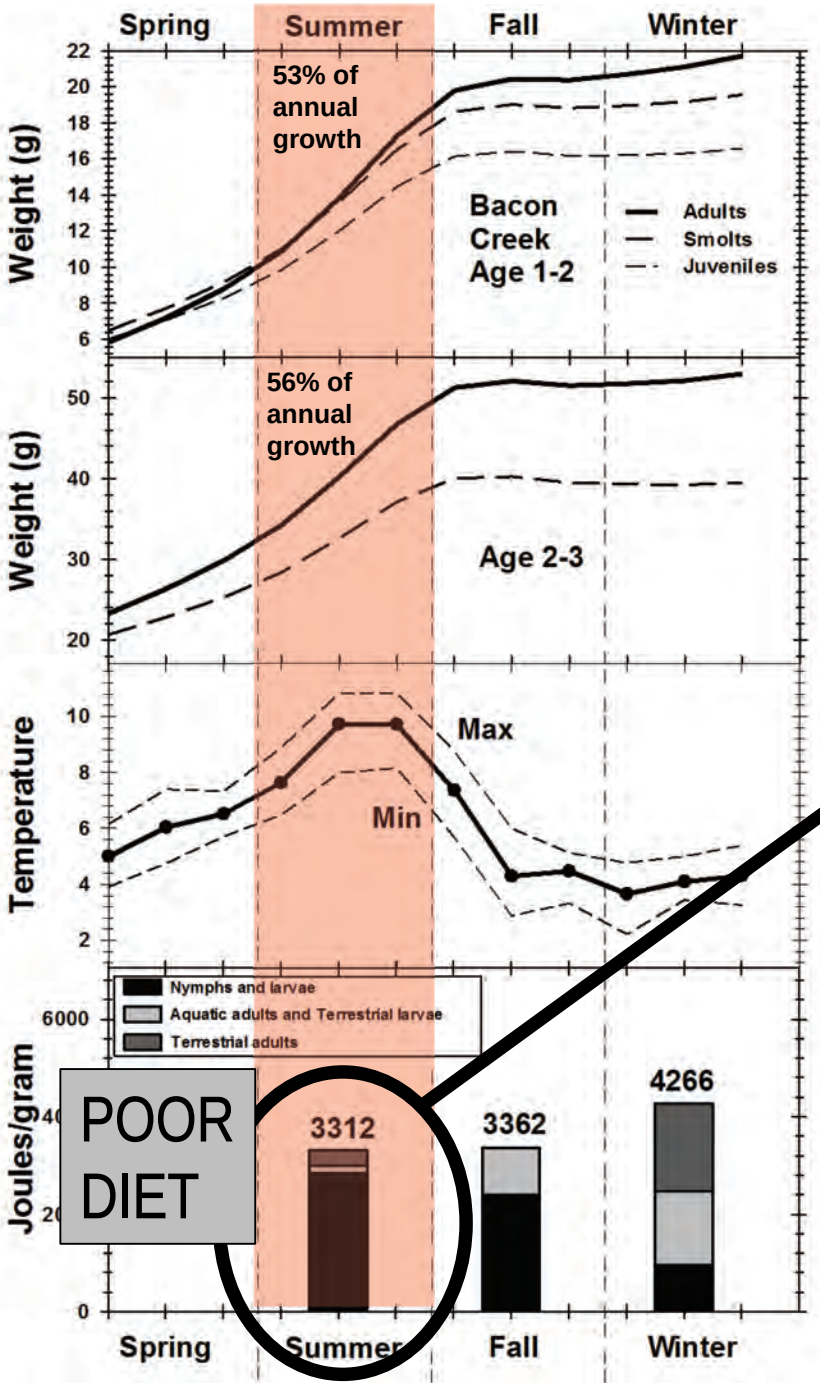
Smolts

Fork length (mm)

Adults

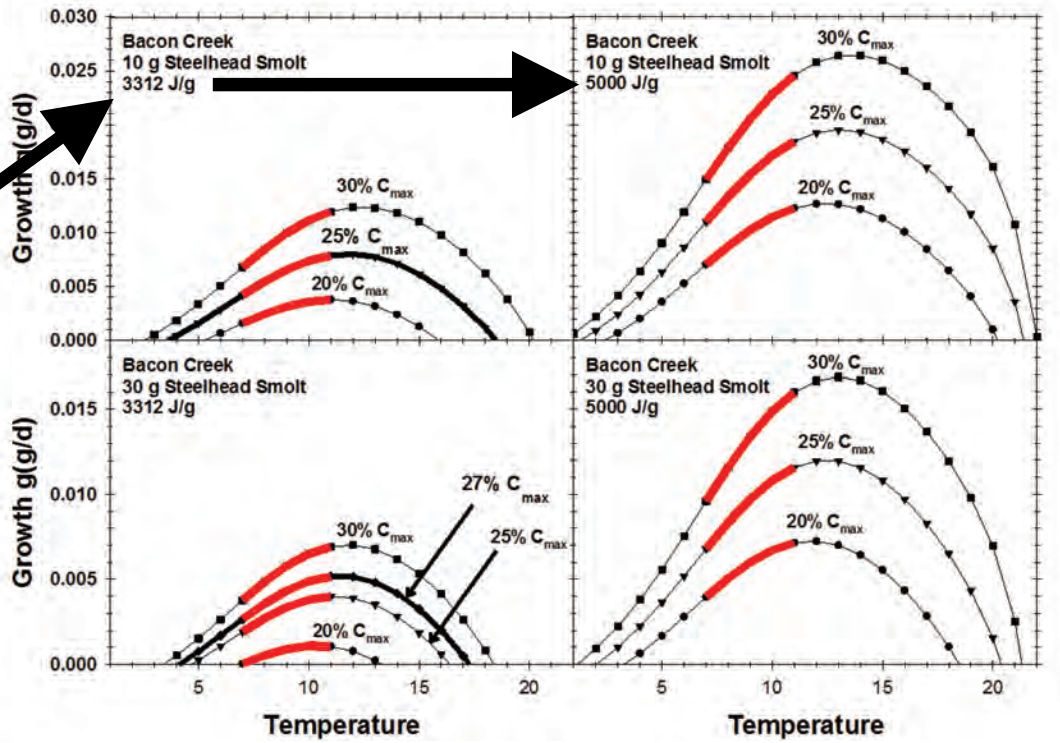


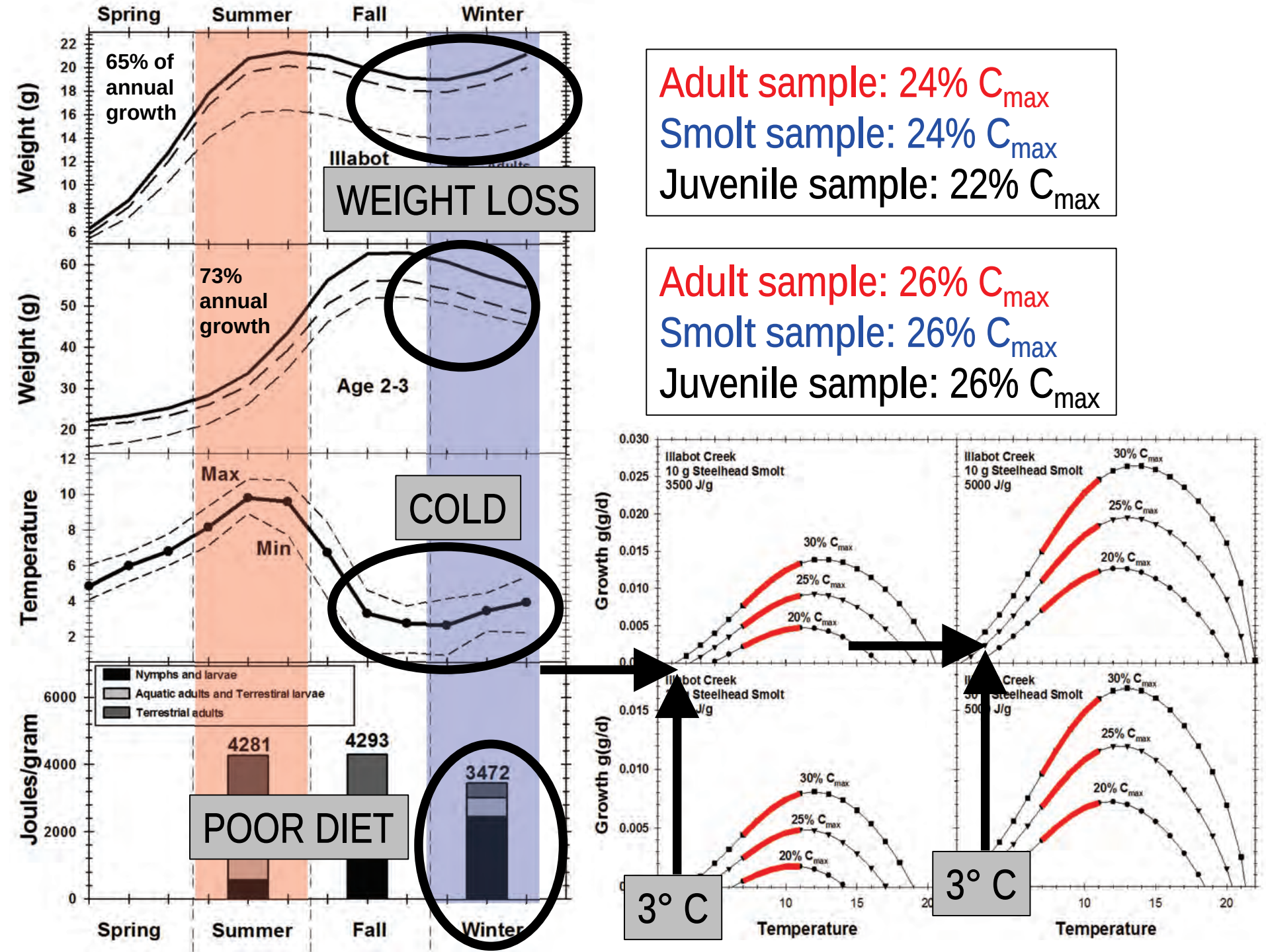
Fork length (mm)

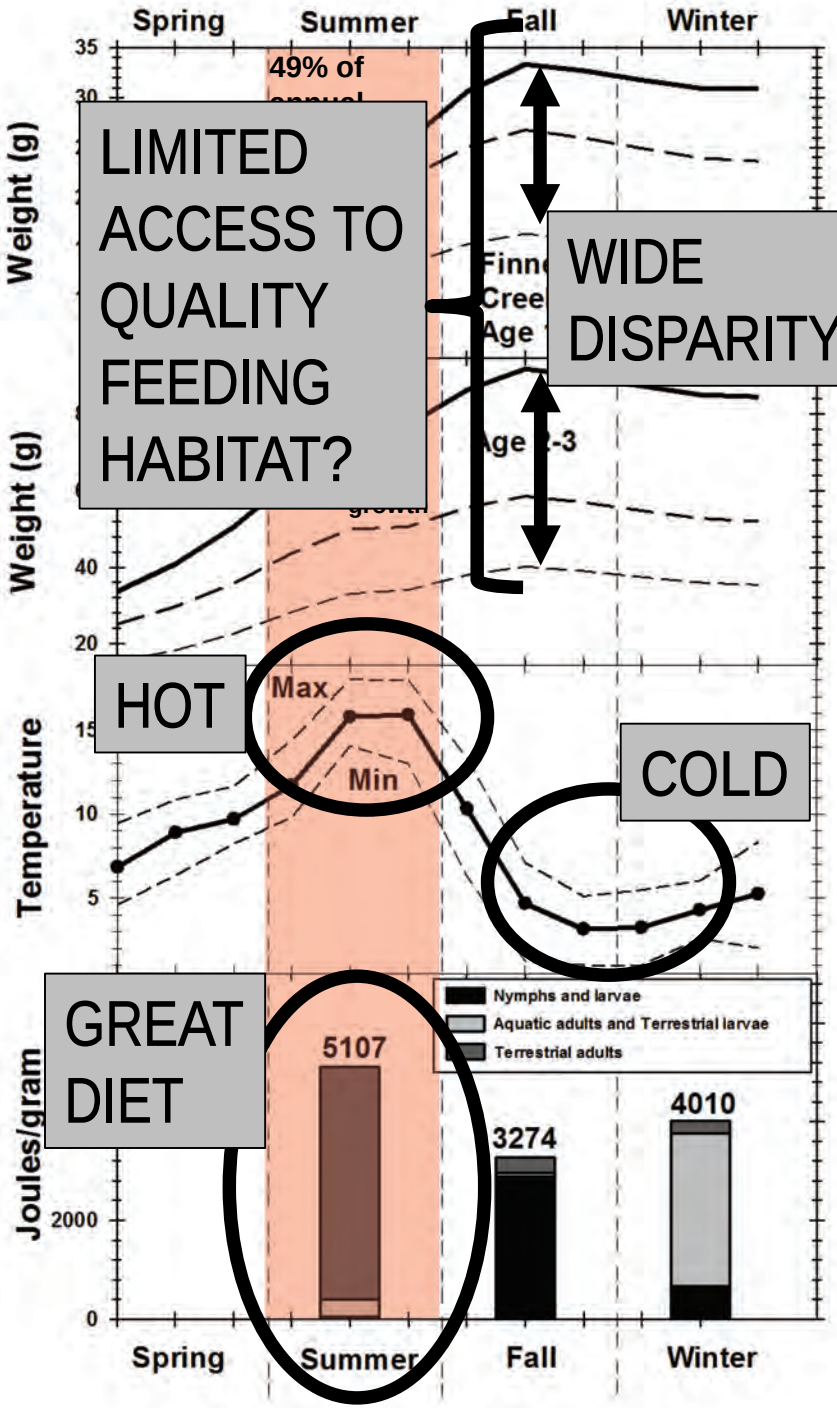


Adult sample: 25% C_{max}
Smolt sample: 24% C_{max}
Juvenile sample: 23% C_{max}

Adult sample: 27% C_{max}
Smolt sample: 25% C_{max}
No Juvenile sample




Spring
Summer
Fall
Winter
Weight (g)
65% of annual growth
Illabot
WEIGHT LOSS
73% annual growth
Age 2-3
Temperature
Max
Min
COLD
Nymphs and larvae
Aquatic adults and Terrestrial larvae
Terrestrial adults
Joules/gram
4281
4293
3472
POOR DIET
Adult sample: 24% Cmax
Smolt sample: 24% Cmax
Juvenile sample: 22% Cmax
Adult sample: 26% Cmax
Smolt sample: 26% Cmax
Juvenile sample: 26% Cmax
Illabot Creek
10 g Steelhead Smolt
3500 J/g
5000 J/g
Growth g(g/d)
30% Cmax
25% Cmax
20% Cmax
3° C
Temperature



Adult sample: 25% C_{max}

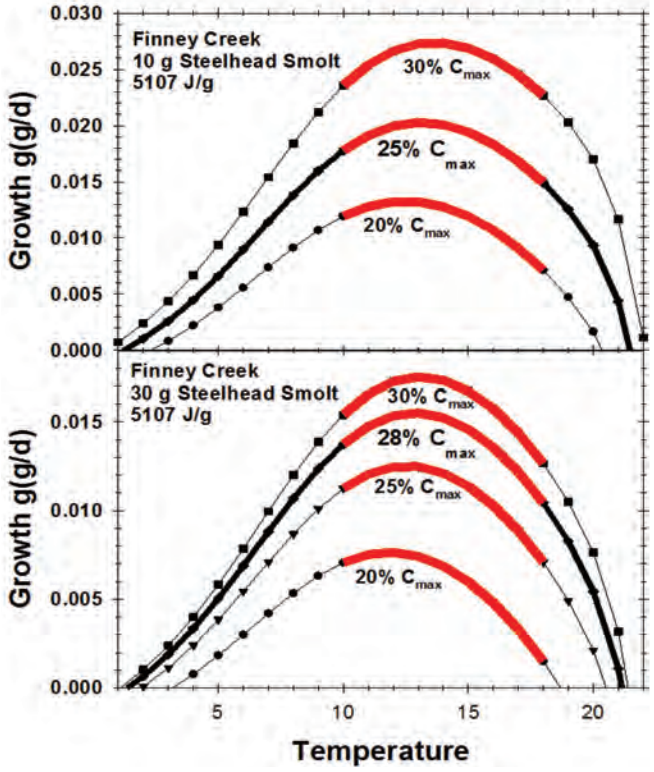
Smolt sample: 22% C_{max}

Juvenile sample: 21% C_{max}

Adult sample: 28% C_{max}

Smolt sample: 25% C_{max}

Juvenile sample: 23% C_{max}



Conclusions

1) Early growth influences survival during later life stages

2) Water temperature, consumption, feeding rate, and prey energy density affect growth differently according to the local environment

3) Usefulness: If freshwater SSM is significant, evaluating and improving growth in freshwater habitats could be useful tool for recovery

4) Usefulness: Bioenergetics modeling can help identify the main factors inhibiting growth

Acknowledgements

Funding: Fidalgo Chapter of Puget Sound Anglers, Seattle City Light, Upper Skagit Indian Tribe, and Wild Steelhead Coalition

Seattle City Light

Ed Connor and Dave Pflug

University of Washington

Christian Torgersen, Mark Sorel, Bryan Donahue, Ava Fuller, Verna Blackhurst, Adam Hansen, Collin Gross, Rebecca Anderson, Jeff Cordell, Erin Lowery, Allison McCoy, Iris Kemp, Megsie Siple, Casey Clark

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