

Patterns of Growth and Foraging by Chinook and Coho Salmon in Three Geomorphically Distinct Sub-basins of the Kenai River

Benjamin Meyer, Daniel Rinella, Erik Schoen, and Mark S. Wipfli



Or...

“Goldilocks and the Three Watersheds”



TOO COLD



JUST RIGHT



TOO HOT



The Kenai Peninsula: Your Neighbors to the South



Public perception about climate change and salmon can be... dramatic.

Environment

Is warmer water harming salmon survival in the famous Kenai River?

Author: **Jenny Neyman** Updated: May 31 Published September 21, 2013

When a baby is sick it can't clearly communicate what's wrong. So an examiner looks for symptoms to make a diagnosis -- collecting samples, measuring temperature, looking at

re-up.
opset and
sturbance.



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When Global Warming Kills Your God

Twenty-three Alaskan tribesmen broke the law when they overfished king salmon, but they claim their faith gave them no other choice.

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Chinook salmon could be wiped out by 2100, new study claims

The Canadian Press Posted: Dec 22, 2014 2:20 PM ET | Last Updated: Dec 23, 2014 11:38 AM ET



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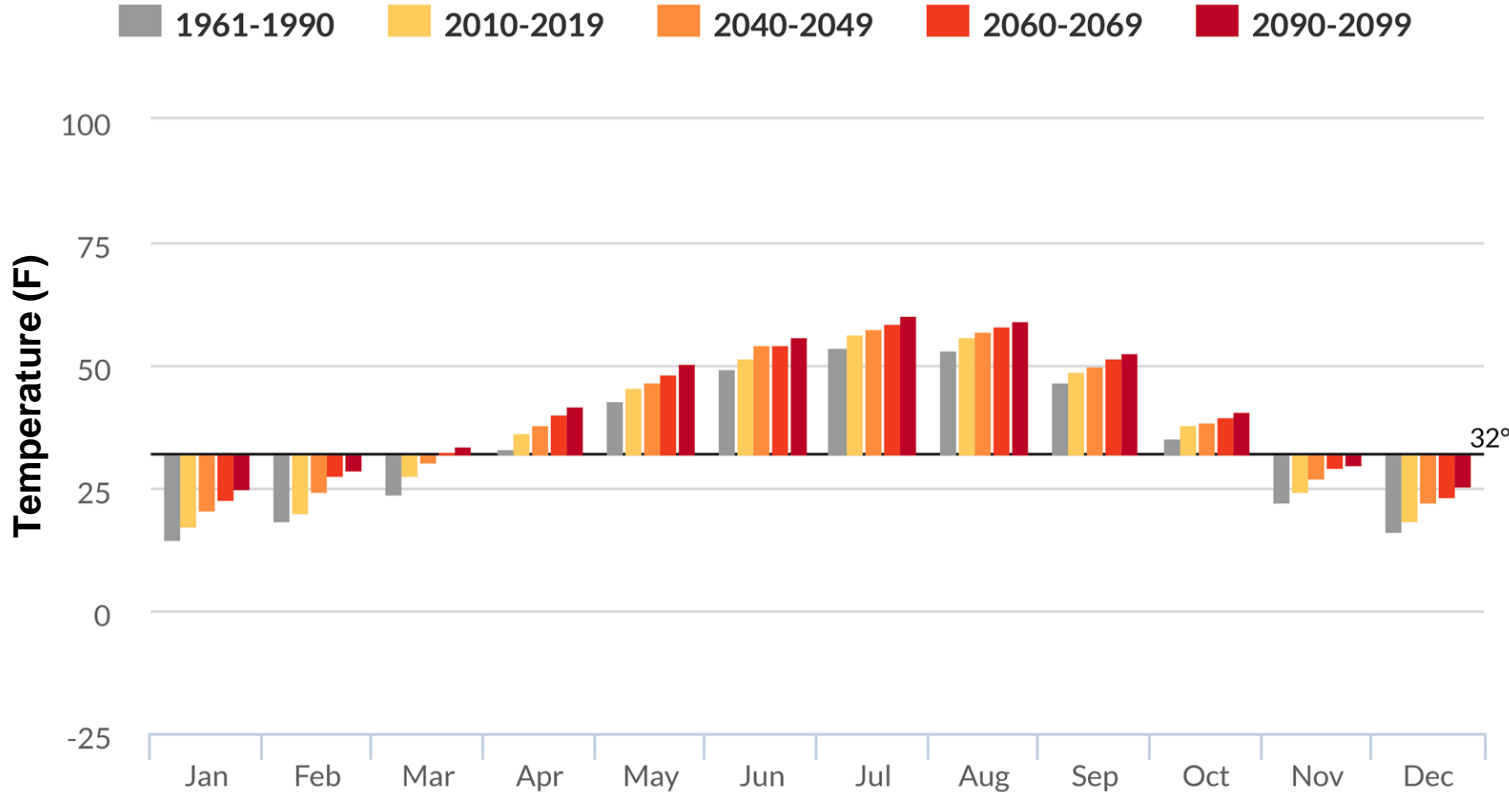
Top News Headlines

- Rejecting Mulcair's leadership, NDP delegates vote for new leader
- Mulcair's weakness also his strength: he's NDP closer to the centre
- Threatened with loss of Walking Dead, down on anti-LGBTQ law

We will revisit this later...

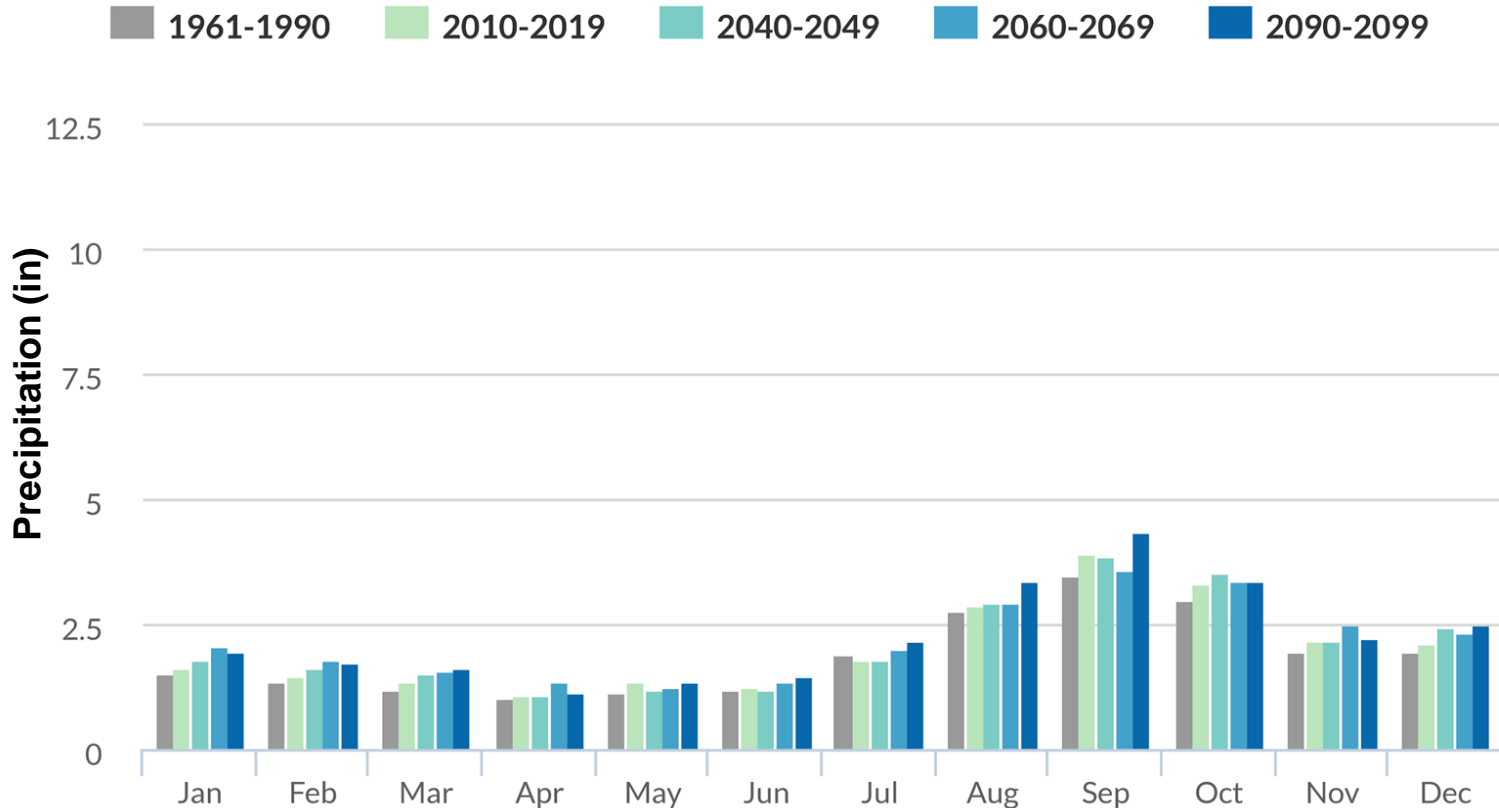
The Kenai Peninsula is predicted to get warmer...

Average Monthly Temperature for Soldotna, Alaska



And wetter....

Average Monthly Precipitation for Soldotna, Alaska

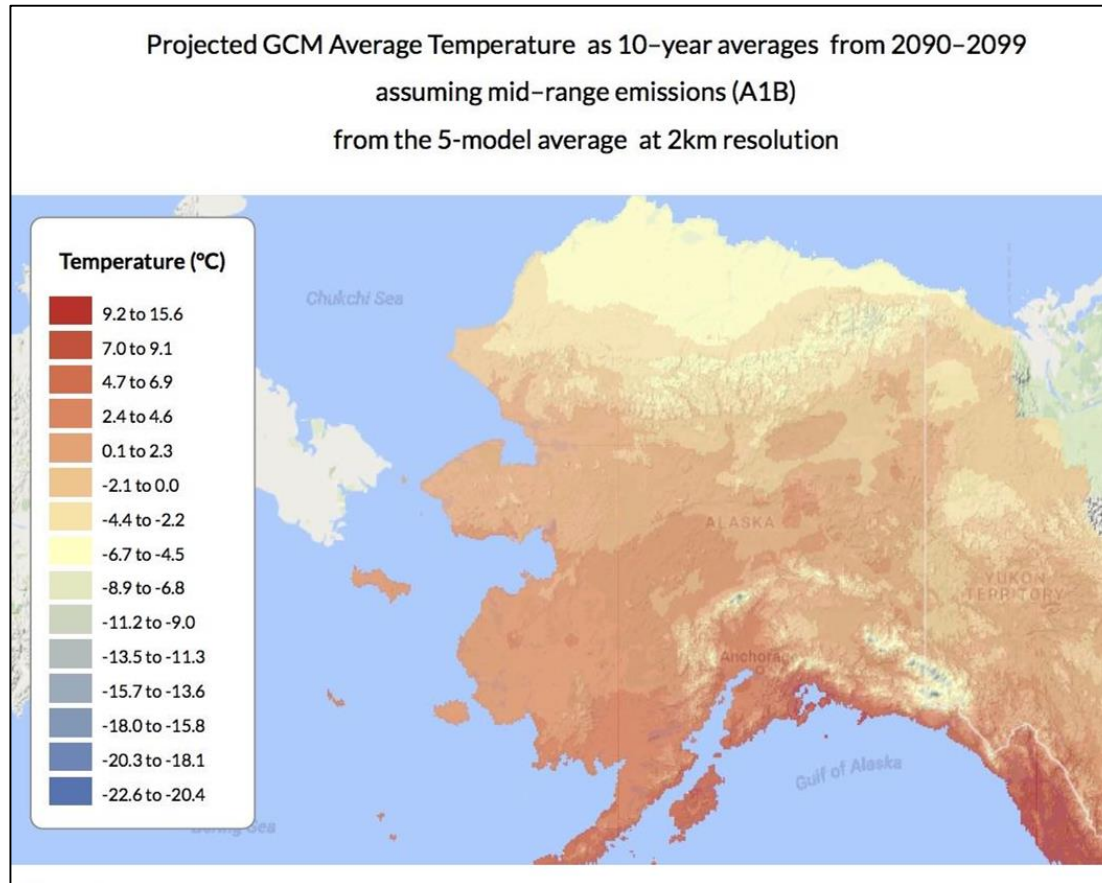


How could a shift in climate regime affect juvenile salmon rearing habitat?



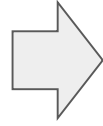
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Drivers

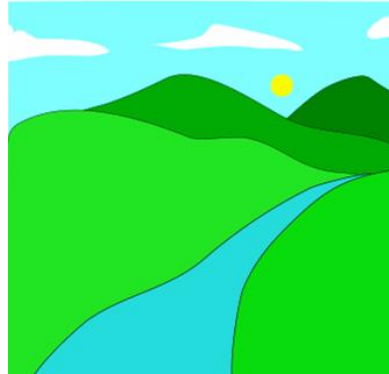
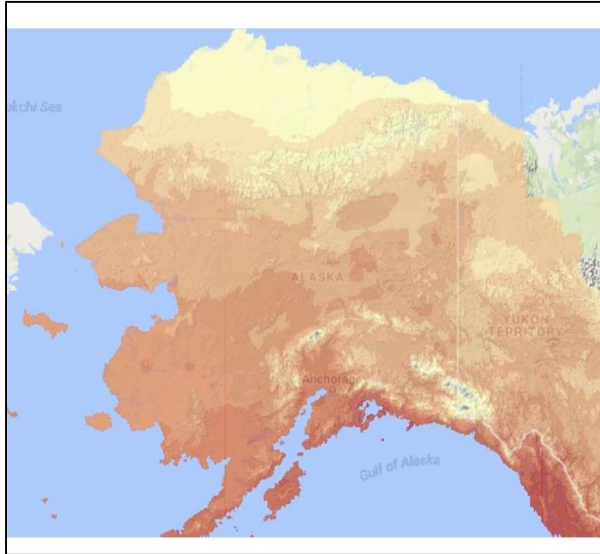


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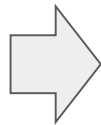


Habitat Changes

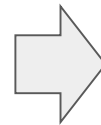


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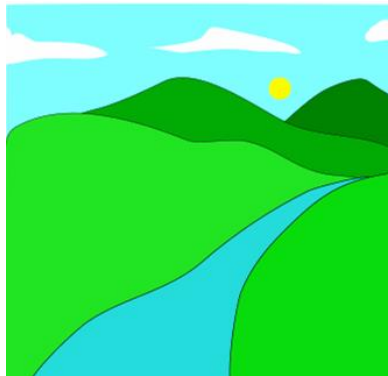
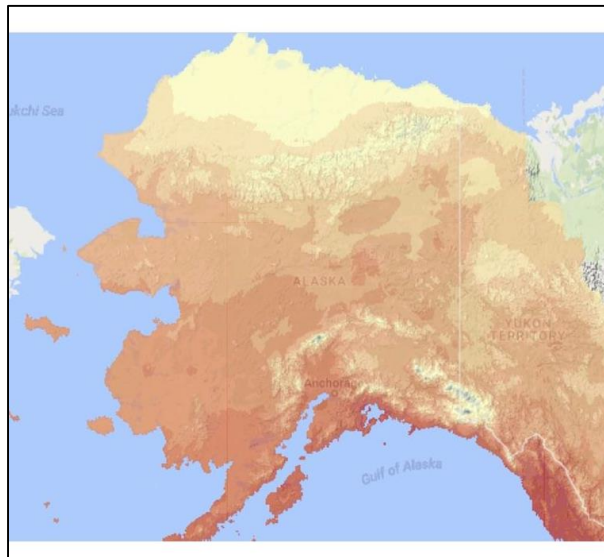
Drivers



Habitat Changes

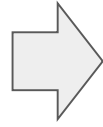


Responses

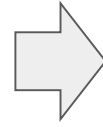


How could a shift in climate regime affect juvenile salmon rearing habitat?

Drivers



Habitat Changes



Responses

This Study:

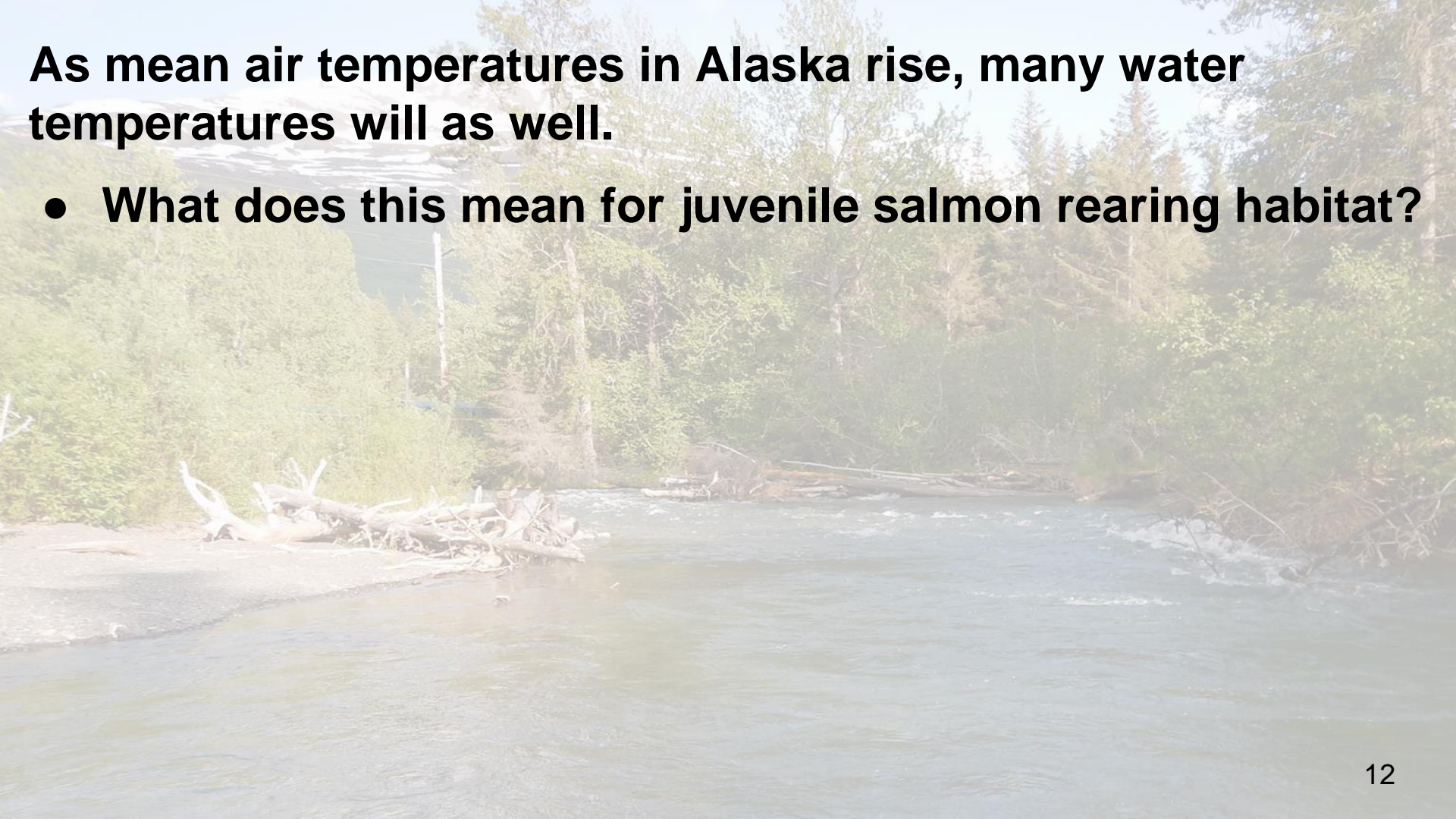
Climate
**Mean Air
Temperature
Increase**

**Thermal
Regimes**
**Summer Water
Temperatures**

**Juvenile
Growth**

As mean air temperatures in Alaska rise, many water temperatures will as well.

- **What does this mean for juvenile salmon rearing habitat?**



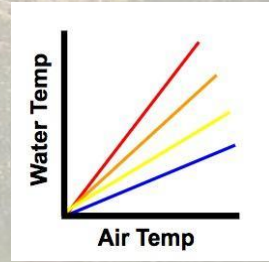
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It Depends...

On Geography

- **Air - Water Temperature “Sensitivity”**



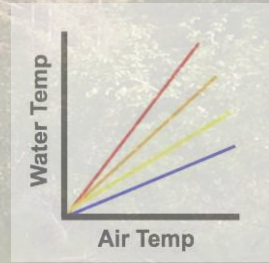
As mean air temperatures in Alaska rise, many water temperatures will as well.

- What does this mean for juvenile salmon rearing habitat?

It Depends...

On Geography

- Air - Water Temperature “Sensitivity”



On Physiology

- Are fish presently “too hot” or “too cold”?
- How “well-fed” are they?



Geography

Landscape Influences
Air - Water
Temperature
Sensitivity

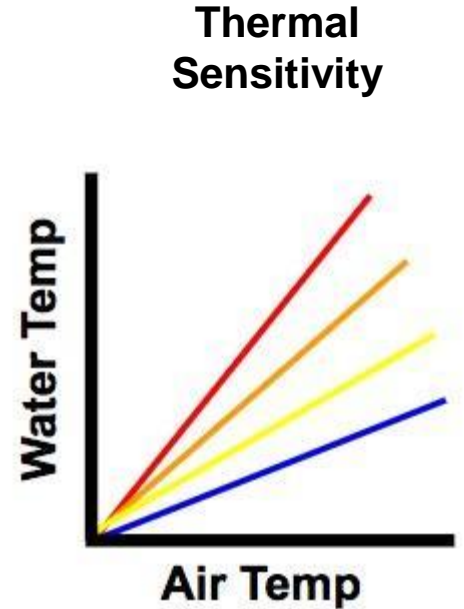
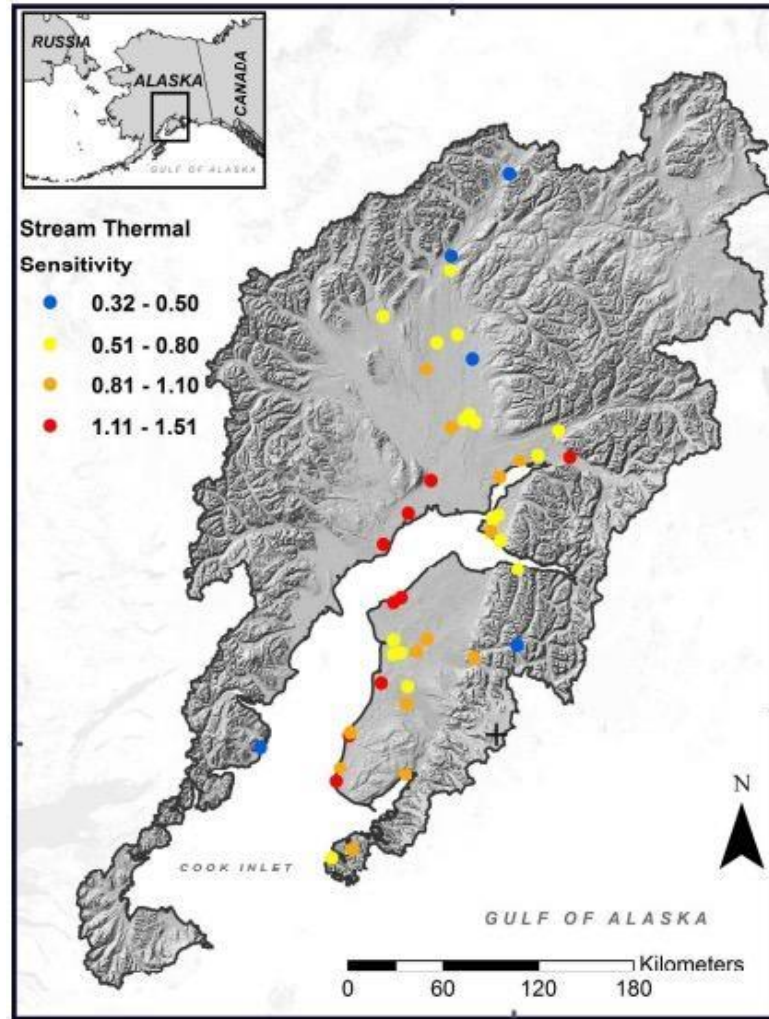
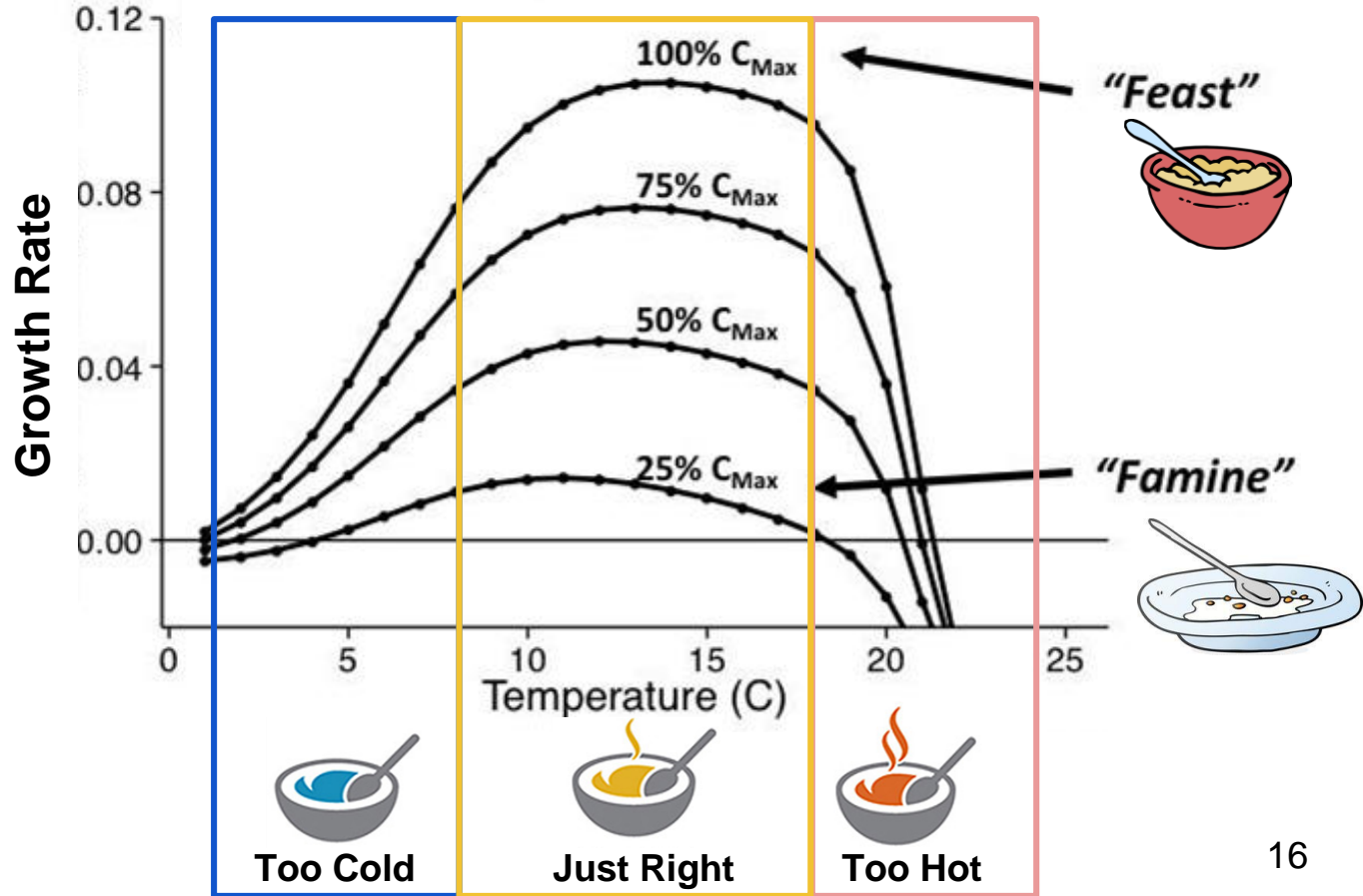


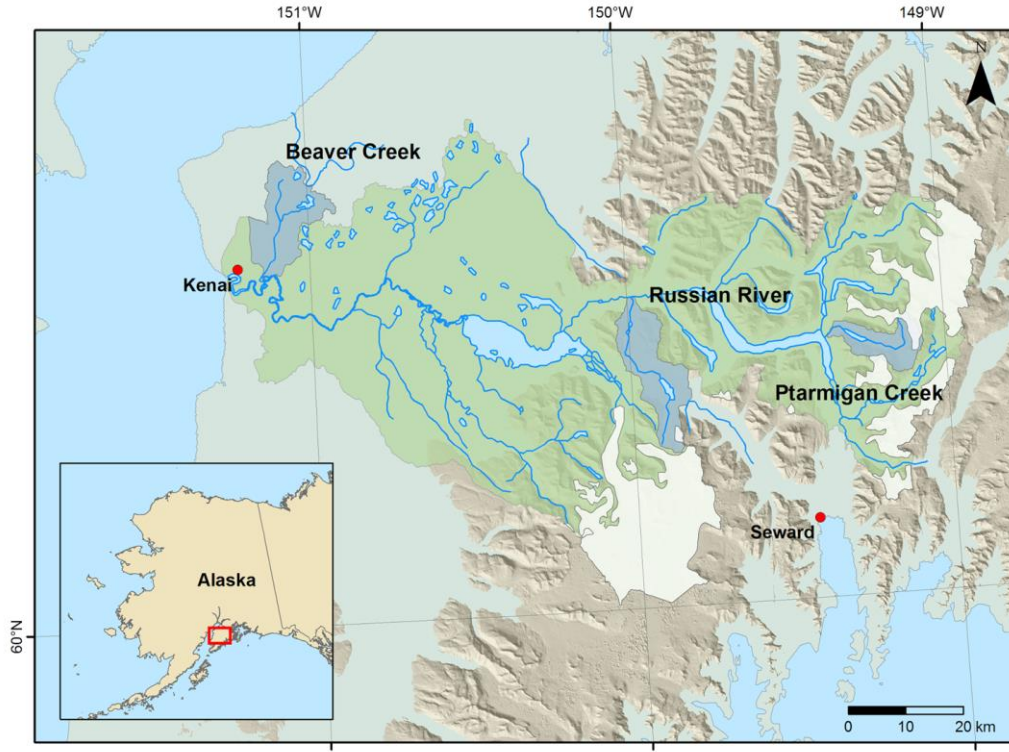
Figure from Mauger et al. 2016

Physiology

Food and
Water
Temperature
Influence
Growth Rates



How could a shift in climate regime affect juvenile salmon rearing habitat... in a complex landscape?



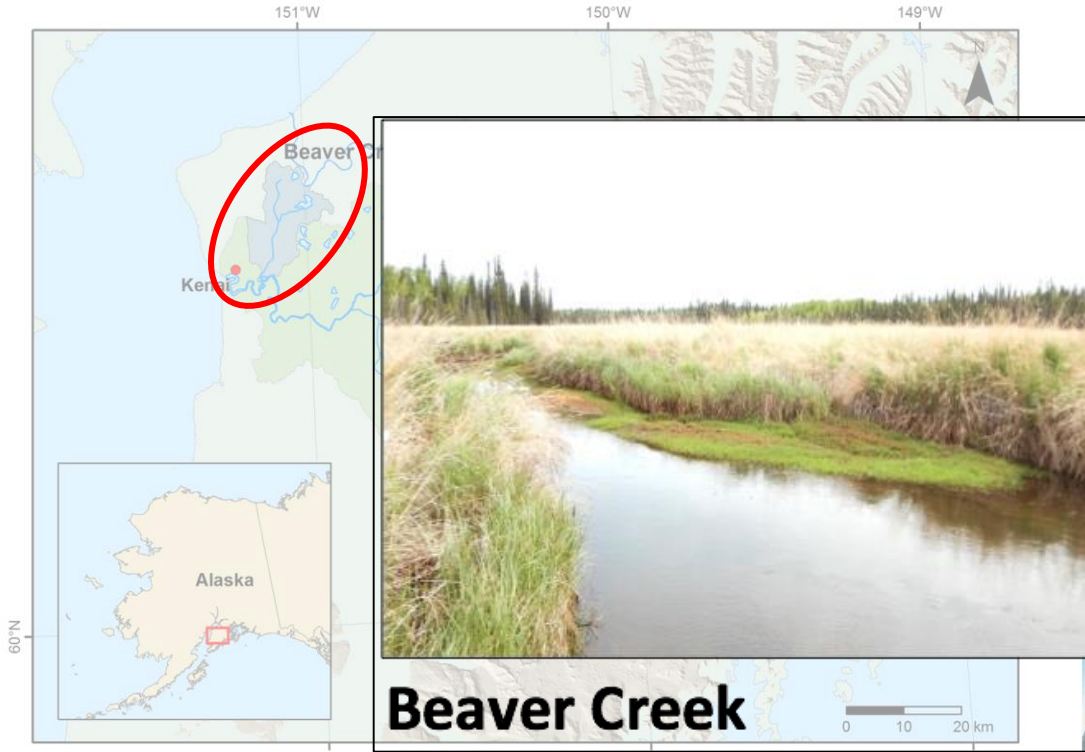
Lowland



Mountainous



How could a shift in climate regime affect juvenile salmon rearing habitat... in a complex landscape?



Lowland



Mountainous



How could a shift in climate regime affect juvenile salmon rearing habitat... in a complex landscape?



Russian River

Lowland



Mountainous



How could a shift in climate regime affect juvenile salmon rearing habitat... in a complex landscape?



Lowland



Ptarmigan Creek

Mountainous



Juvenile Chinook and Coho rearing habitat is found throughout the Kenai watershed.

Chinook (*Oncorhynchus tshawytscha*)



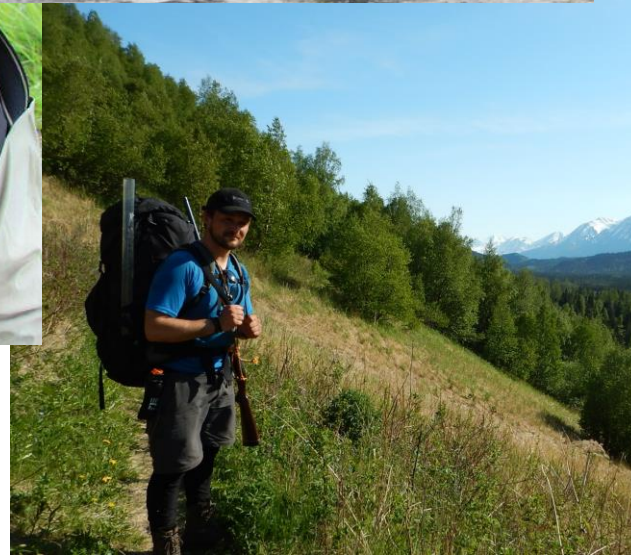
*Lives 0 - 1
years in
Freshwater*

Coho (*Oncorhynchus kisutch*)



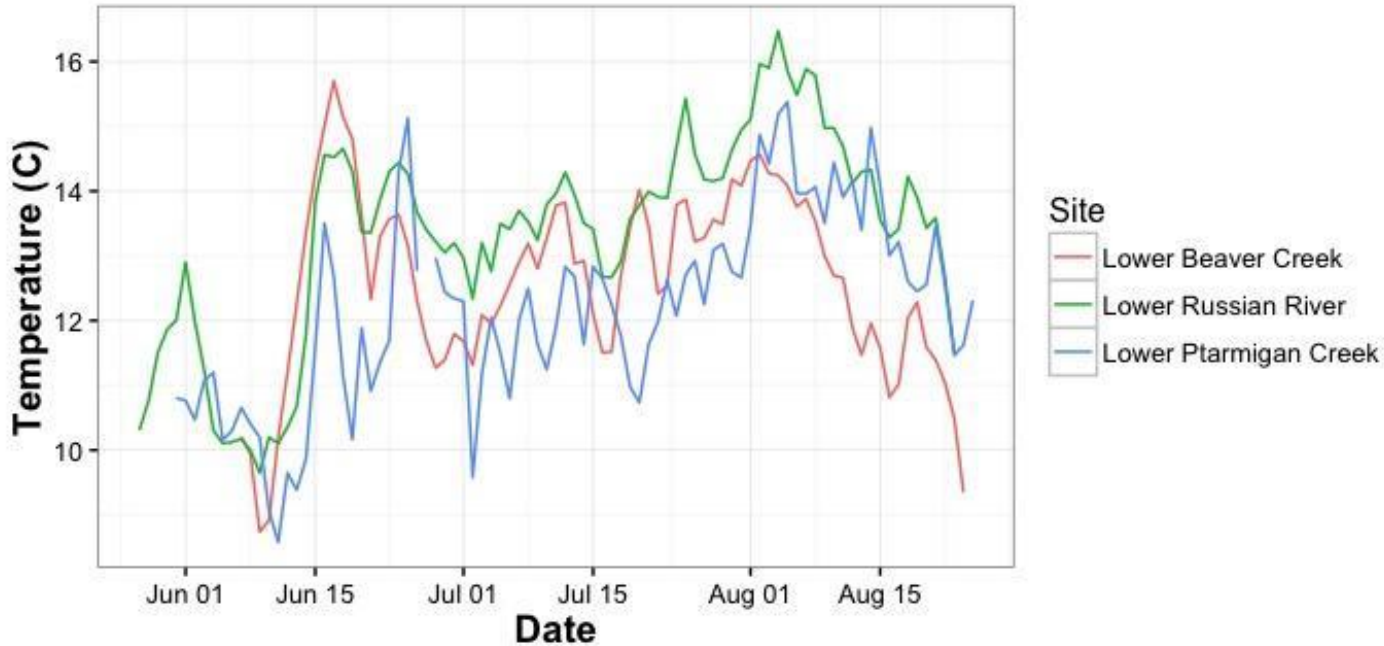
*Lives 1-3
years in
Freshwater*





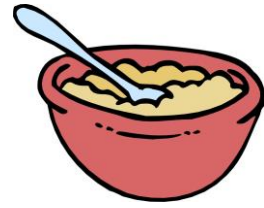
What water temperatures do juvenile salmon experience?

Daily Mean Water Temperatures 2015



HOBO® Temp Pro v2

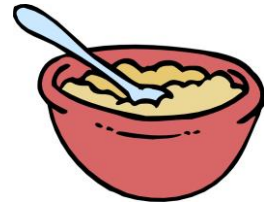
What do juvenile salmon eat?



1 Collect diet samples with non-lethal gastric lavage.



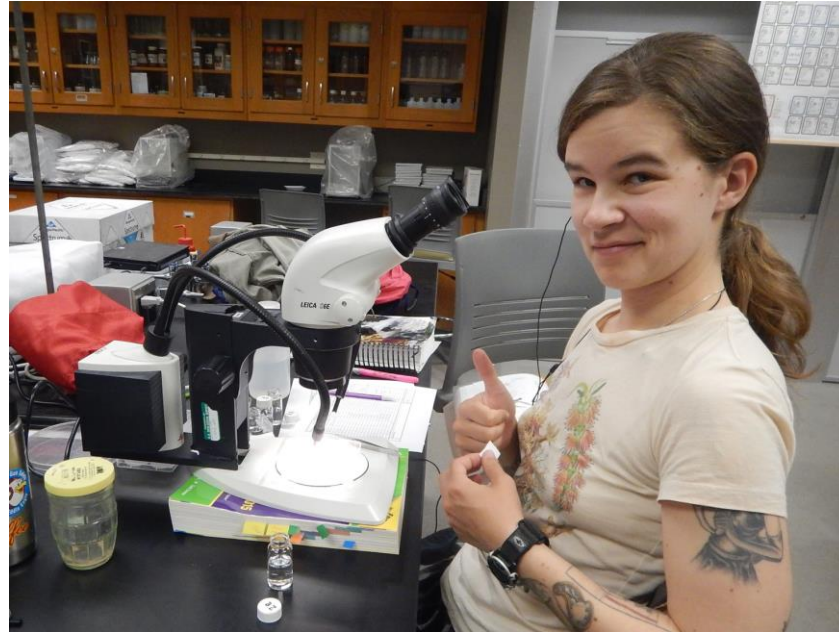
What do juvenile salmon eat?



1 Collect diet samples with non-lethal gastric lavage.



2 Count and measure individual diet items.



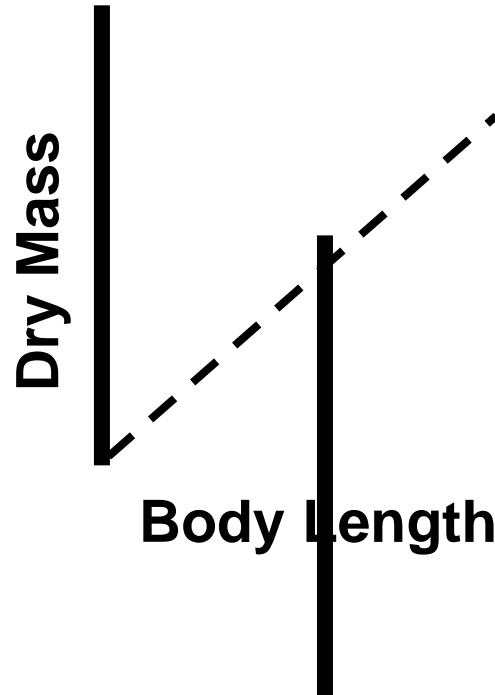
What do juvenile salmon eat?

- # 1 Collect diet samples with non-lethal gastric lavage.



- # 3 Apply length-mass regressions from literature.

- # 2 Count and measure individual diet items.



What do juvenile salmon eat?



Lower Beaver Creek 2015 Juvenile Coho Diet (% Dry Mass)

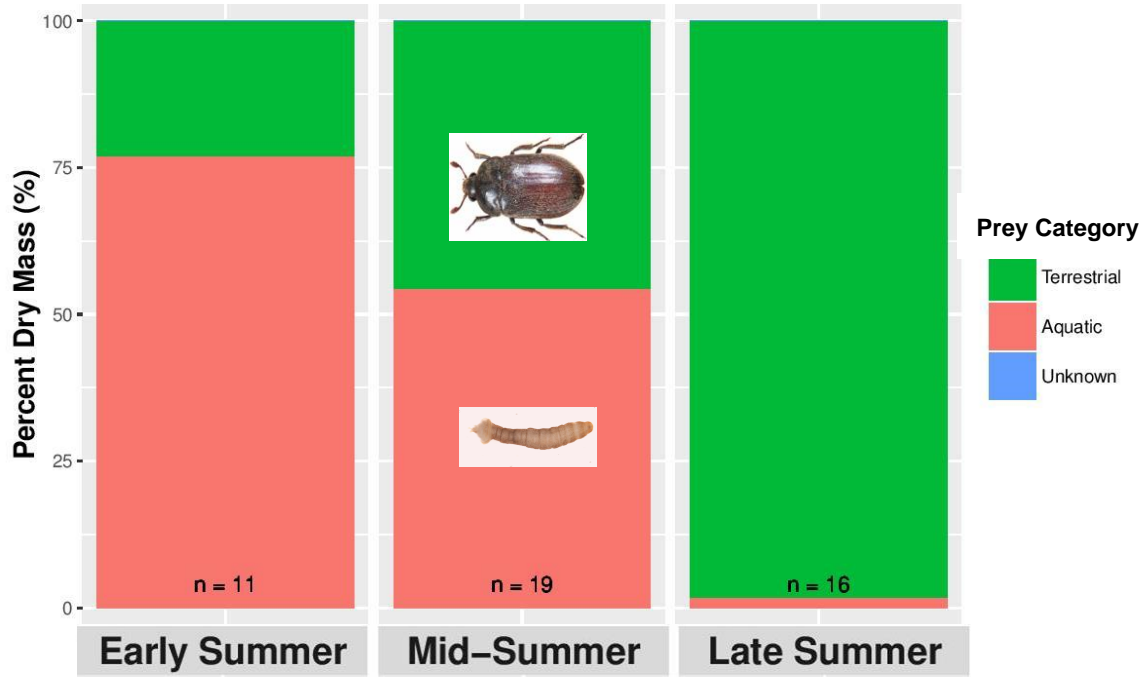
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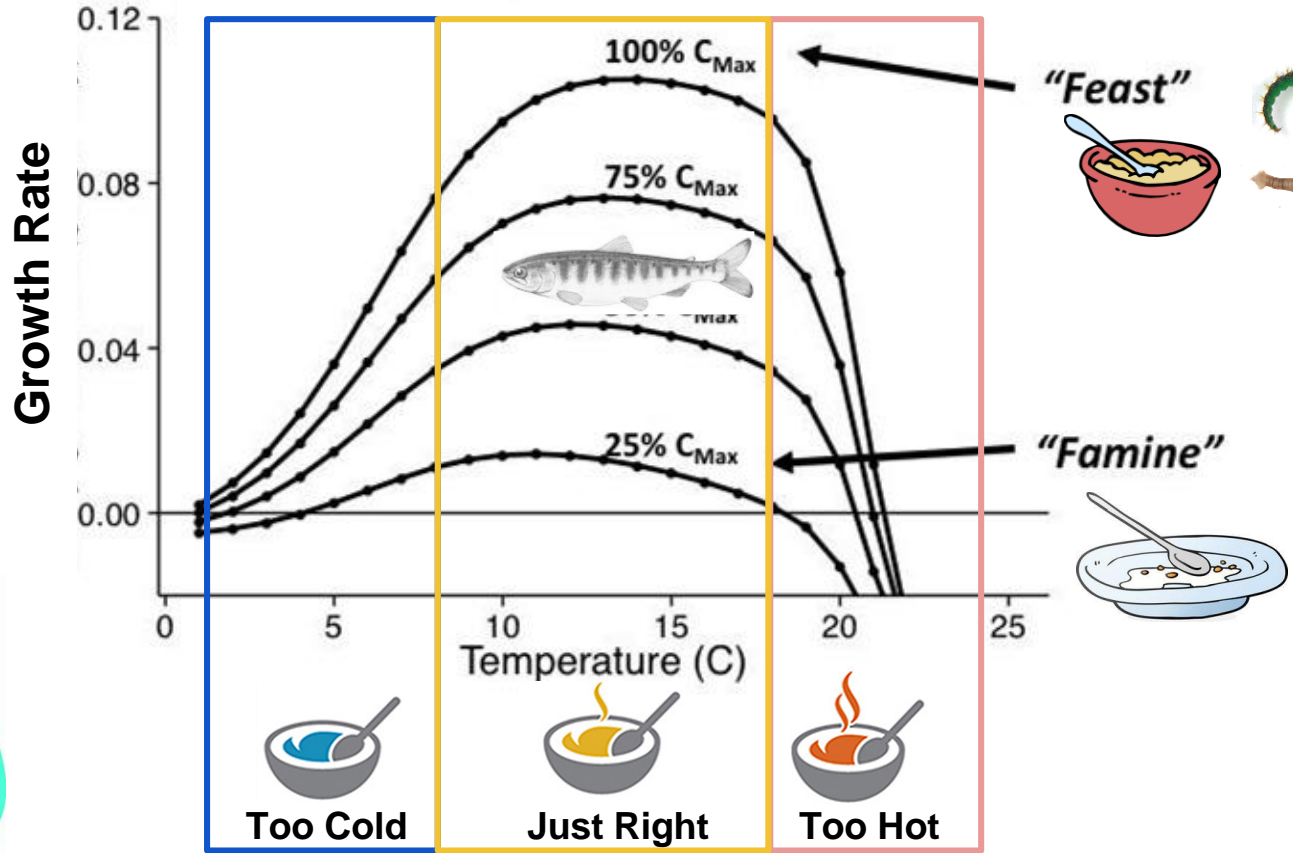
2 Count and measure individual diet items.



3 Apply length-mass regressions from literature.



Put it all together....



Take home points

- **As air temperatures warm, water temperatures will change differently based on geography.**
- **Some temperature regimes will shift a lot, some will shift little.**

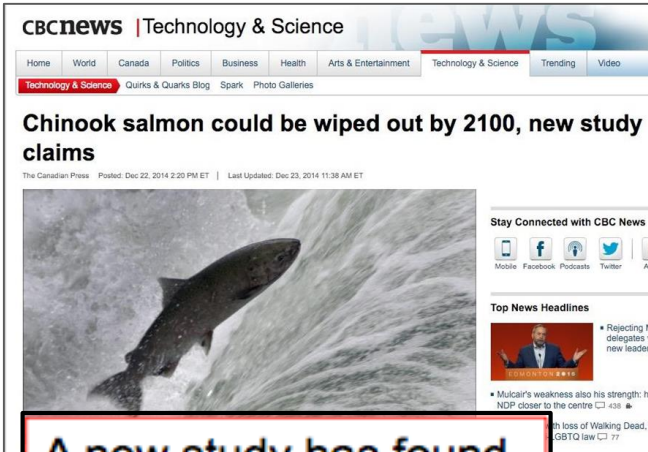
Take home points

- As air temperatures warm, water temperatures will change differently based on geography.
 - Some temperature regimes will shift a lot, some will shift little.
- **Water temperatures may shift either...**
 - **Towards metabolic optimum for juvenile salmon.**
 - **Away from metabolic optimum for juvenile salmon.**

Take home points

- As air temperatures warm, water temperatures will change differently based on geography.
 - Some temperature regimes will shift a lot, some will shift little.
- Water temperature regimes may shift either...
 - Towards metabolic optimum for juvenile salmon.
 - Away from metabolic optimum for juvenile salmon.
- **In temperatures outside the “Goldilocks” zone,**
 - **Well-fed fish can still grow fast**
 - **Under-fed fish grow slower**

Is Climate Change Bad News for Alaska Salmon?



A new study has found that 98% of Chinook salmon will be gone by 2100 if climate change warms the water

Corrections

- An earlier version of this story, which was based on information provided by UBC, said that upwards of 98 per cent of chinook salmon will be gone by 2100. The university later corrected that to say there's a 98 per cent chance the population will suffer catastrophic losses by 2100.

Dec 22, 2014 9:28 PM ET

Ben's Translation...

“Sometimes misleading headlines get published...”

Thanks!

bemeyer@alaska.edu

Funding

- Alaska EPSCoR NSF award #OIA-1208927 and the State of Alaska

Advisory Committee

- Dr. Mark Wipfli
- Dr. Daniel Rinella
- Dr. Jeff Falke
- Dr. Erik Schoen

Field and Laboratory Assistance

- Christina Mielke
- Emily Neideigh
- Michael Lunde

Regional Expertise and In-Kind Support

- Kenai Watershed Forum
- Cook Inletkeeper
- Kenai Peninsula College

