The influence of stream temperature on the relative abundance of juvenile salmon in the Deshka River

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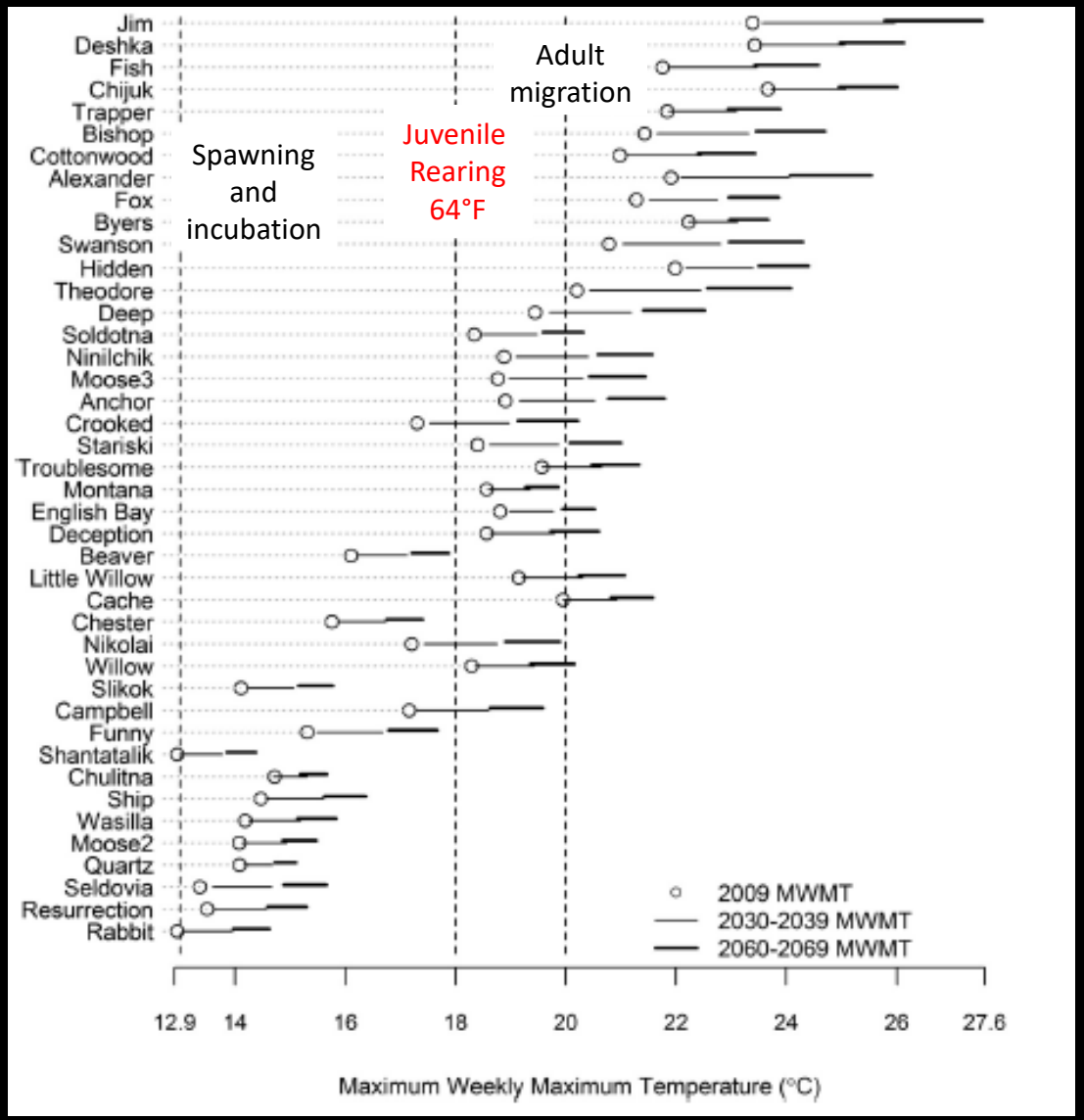
The Deshka is warm and getting warmer

NRC Research Press

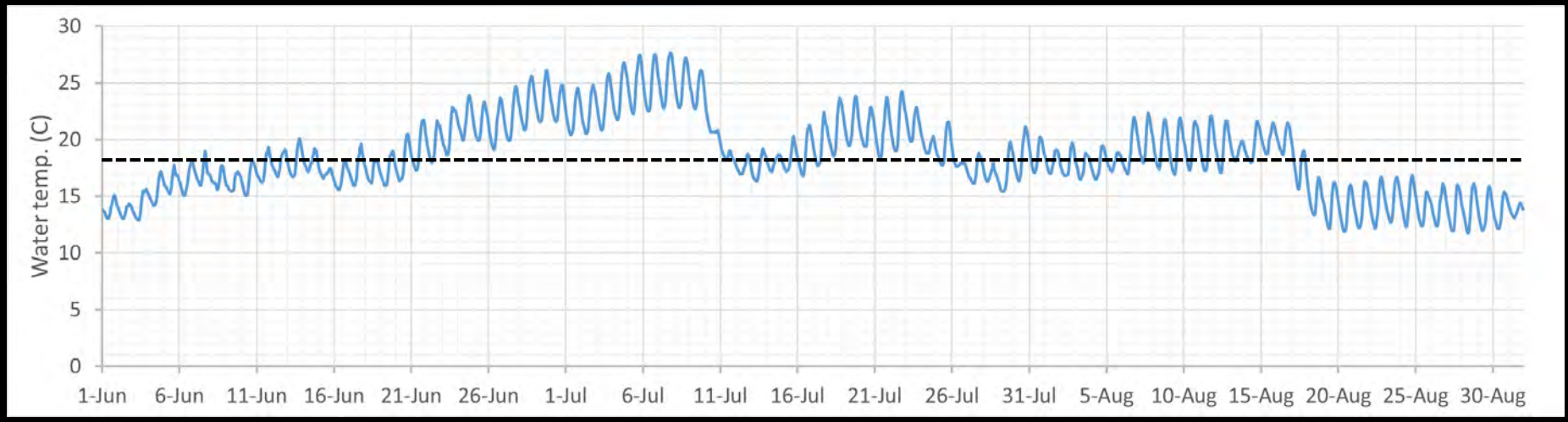
ARTICLE

Summer temperature regimes in southcentral Alaska streams: watershed drivers of variation and potential implications for Pacific salmon

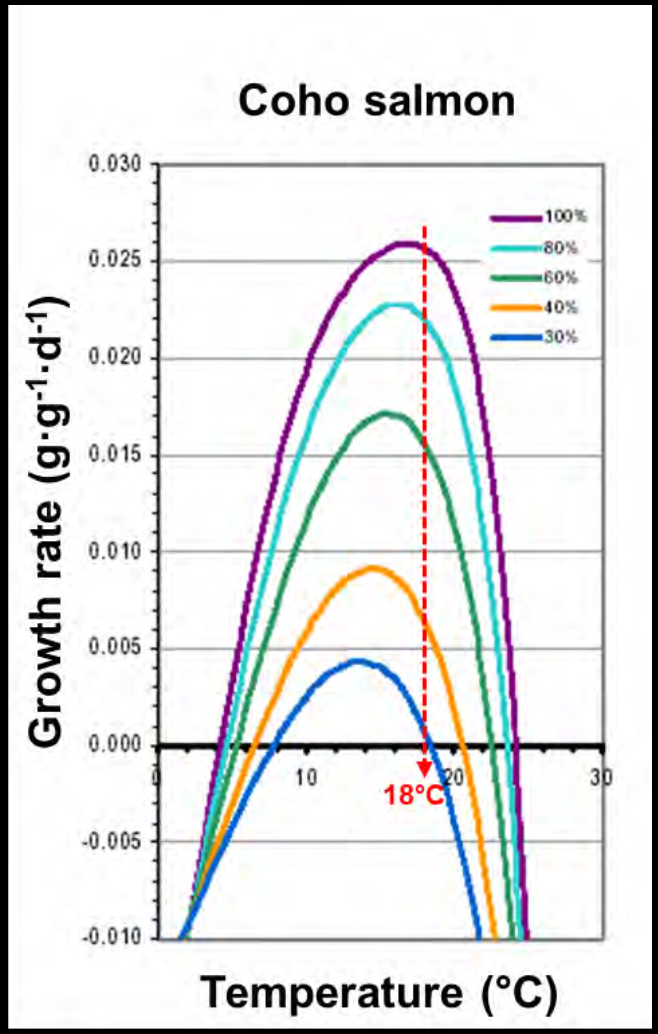
Sue Mauger, Rebecca Shaftel, Jason C. Leppi, and Daniel J. Rinella



Summer 2019 was crazy hot



Temperature (and food) control growth
growth = survival



Overarching objective: *predict changes in extent/distribution of thermally suitable habitat for salmon life stages*

- Build basin-wide stream temperature model
- Characterize preferred temperature for salmon life stages (i.e., thermal niches)
- Use temperature model to forecast changes in preferred temperatures

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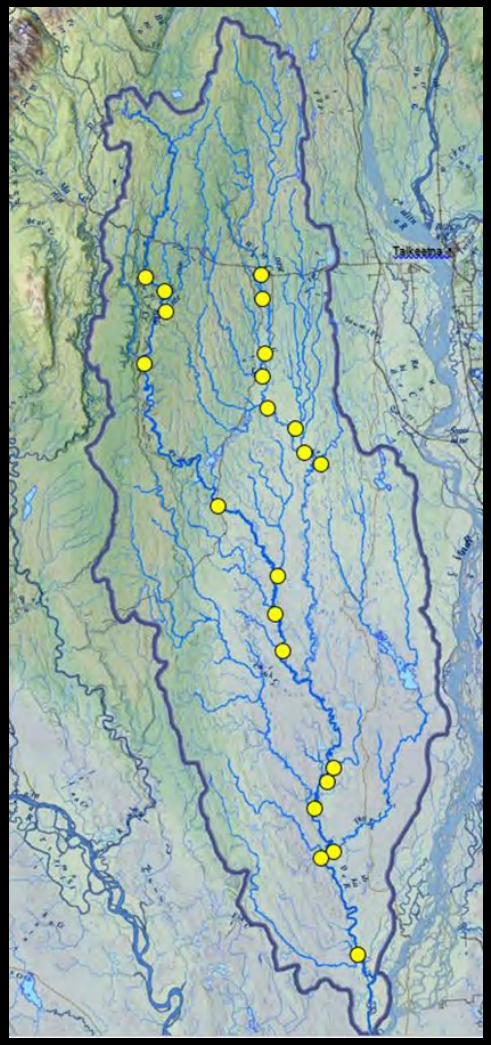

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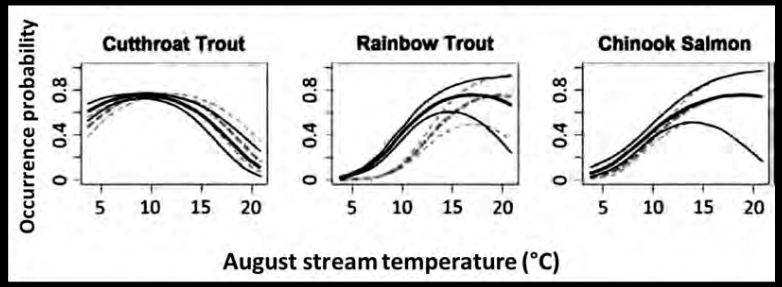
Big biology meets microclimatology: defining thermal niches of ectotherms at landscape scales for conservation planning

Daniel J. Isaak,[1,4] Seth J. Wenger,[2] and Michael K. Young[3]



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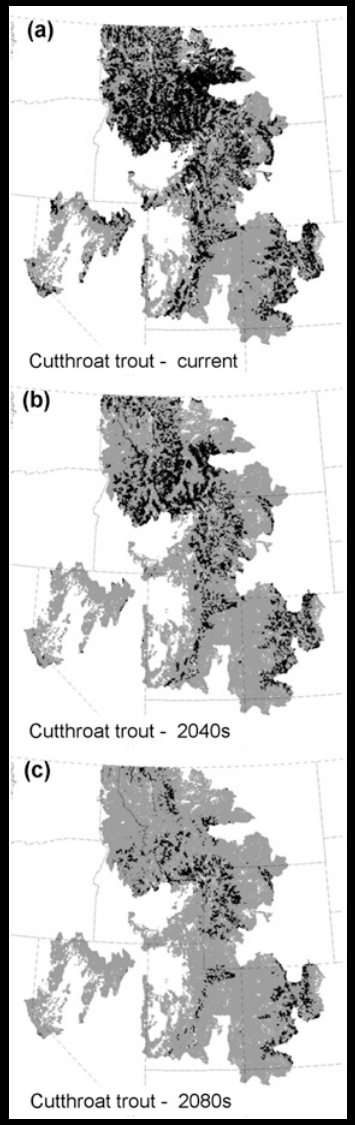
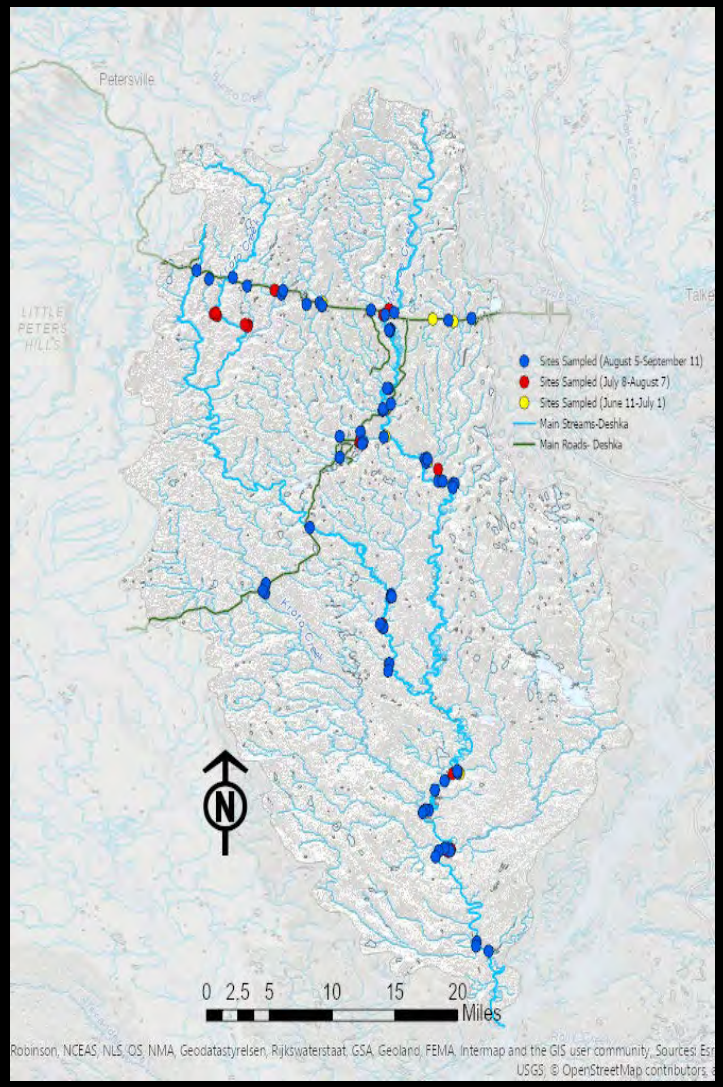


Flow regime, temperature, and biotic interactions drive differential declines of trout species under climate change

Seth J. Wenger[a,1], Daniel J. Isaak[b], Charles H. Luce[b], Helen M. Neville[a], Kurt D. Fausch[c], Jason B. Dunham[d], Daniel C. Dauwalter[a], Michael K. Young[e], Marketa M. Elsner[f], Bruce E. Rieman[g], Alan F. Hamlet[f], and Jack E. Williams[h]

Characterizing preferred temperatures for juvenile salmon

- Sampled 75 sites across the Deshka watershed
- Chinook and Coho
- Summer growing season
  - ~June, July, Augst
- Year-round temperature loggers at each site



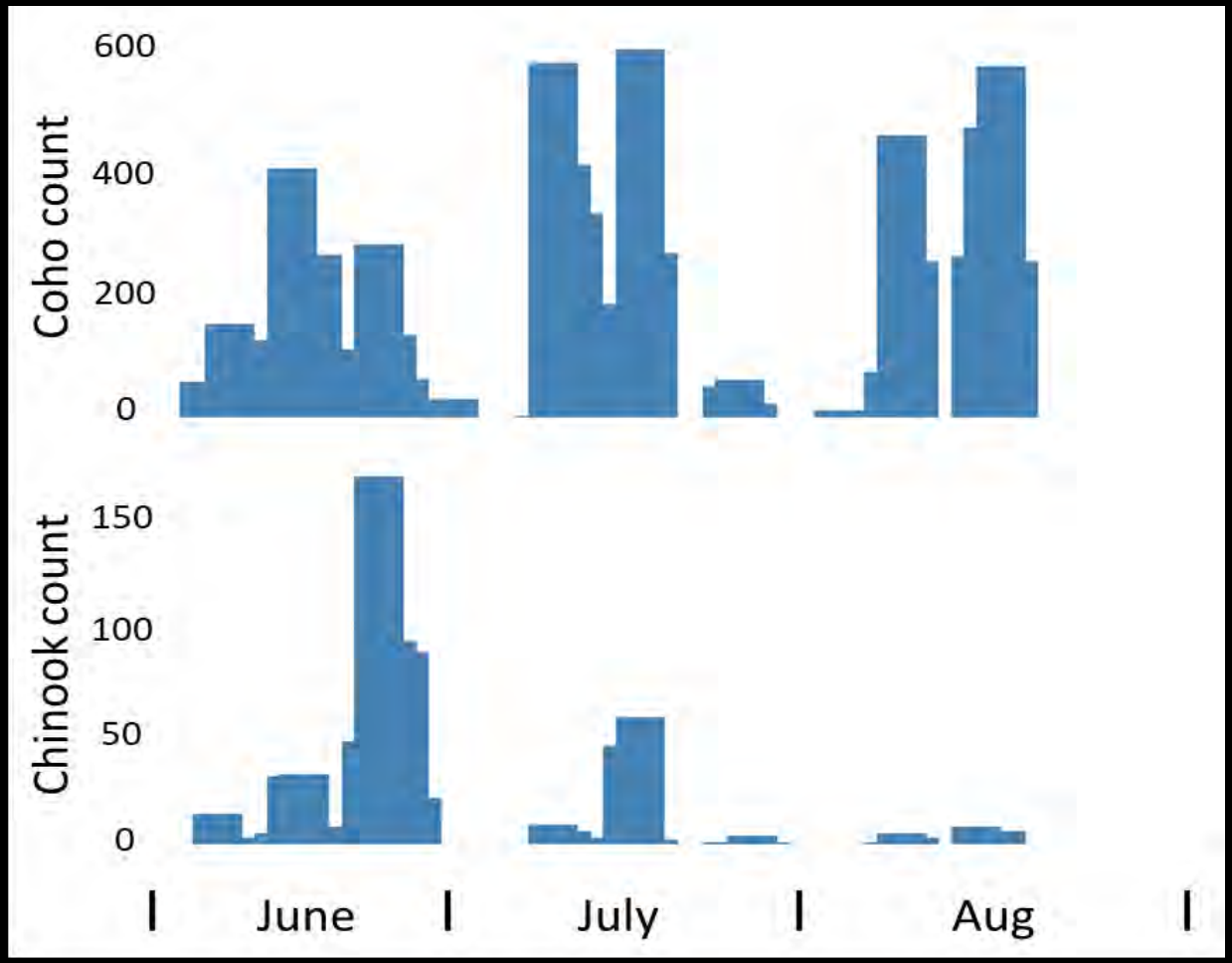
Characterizing preferred temperatures for juvenile salmon

- 10 baited minnow traps/100-m study reach
- 1-hour soak
- Trap-scale measurements
  - Temperature
  - Depth
  - Velocity
  - Substrate composition
  - Fish cover

Preliminary analysis

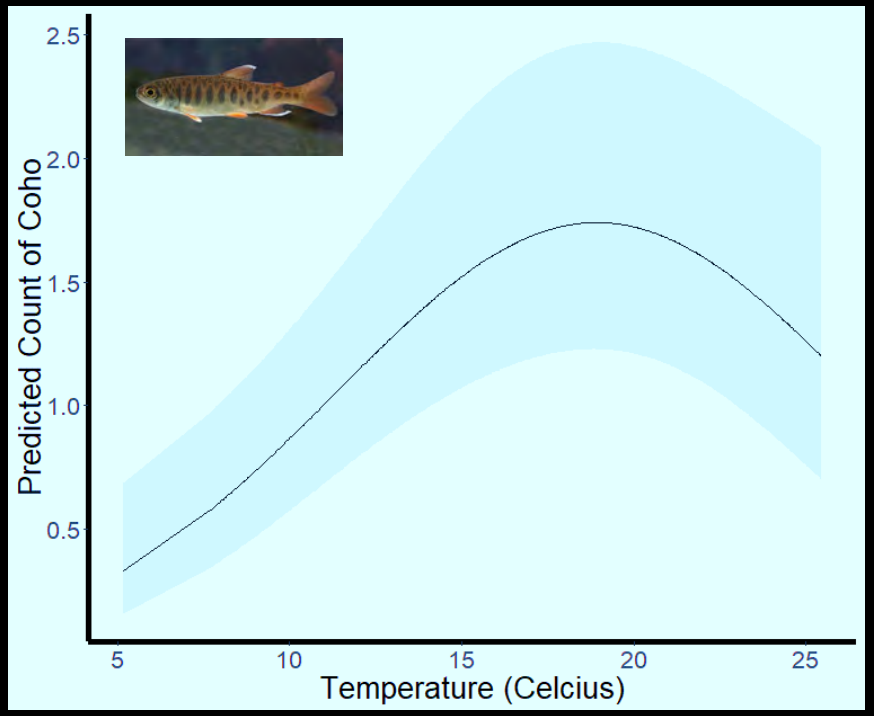
- Evaluated the effect of temperature and other covariates on catch
  - At the trap scale
  - Final analysis will be at the reach scale (100 m)
- Negative binomial distribution, GLMM

Preliminary results (raw data)



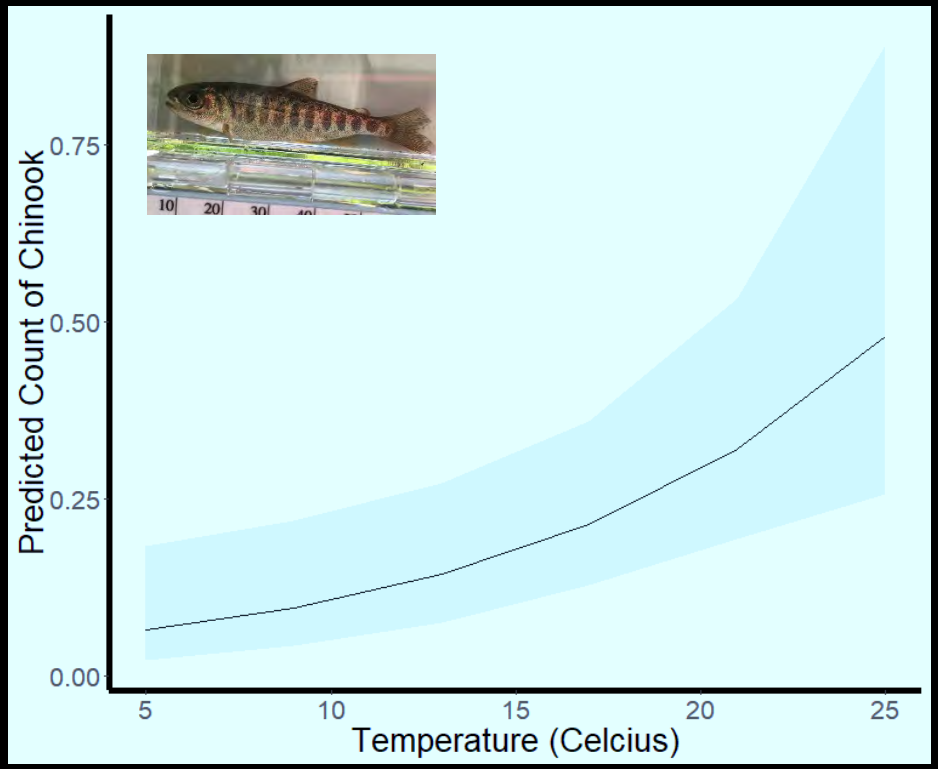
Preliminary results -- Coho

- Temperature was the most important variable
- Modeled catch rate peaked around 18°C
- Warmer peak than expected
  - Abundant food? (= rapid growth)
  - Local adaptation?
  - Cooler water not available?



Preliminary results -- Chinook

- Temperature was the most important variable
- Modeled catch rate climbed throughout the observed temp range
- Sampling artifact?



Next steps:

- 2 more years of fish/temp data
  - Where are Chinook rearing?
  - Heat stress USGS collaboration
- Build reach-scale fish models
- Mapping/modeling future habitat
- Analysis of temperature effects on growth/condition

Acknowledgments

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