

Effects of Drought on Rivers and Salmon in Southeast Alaska



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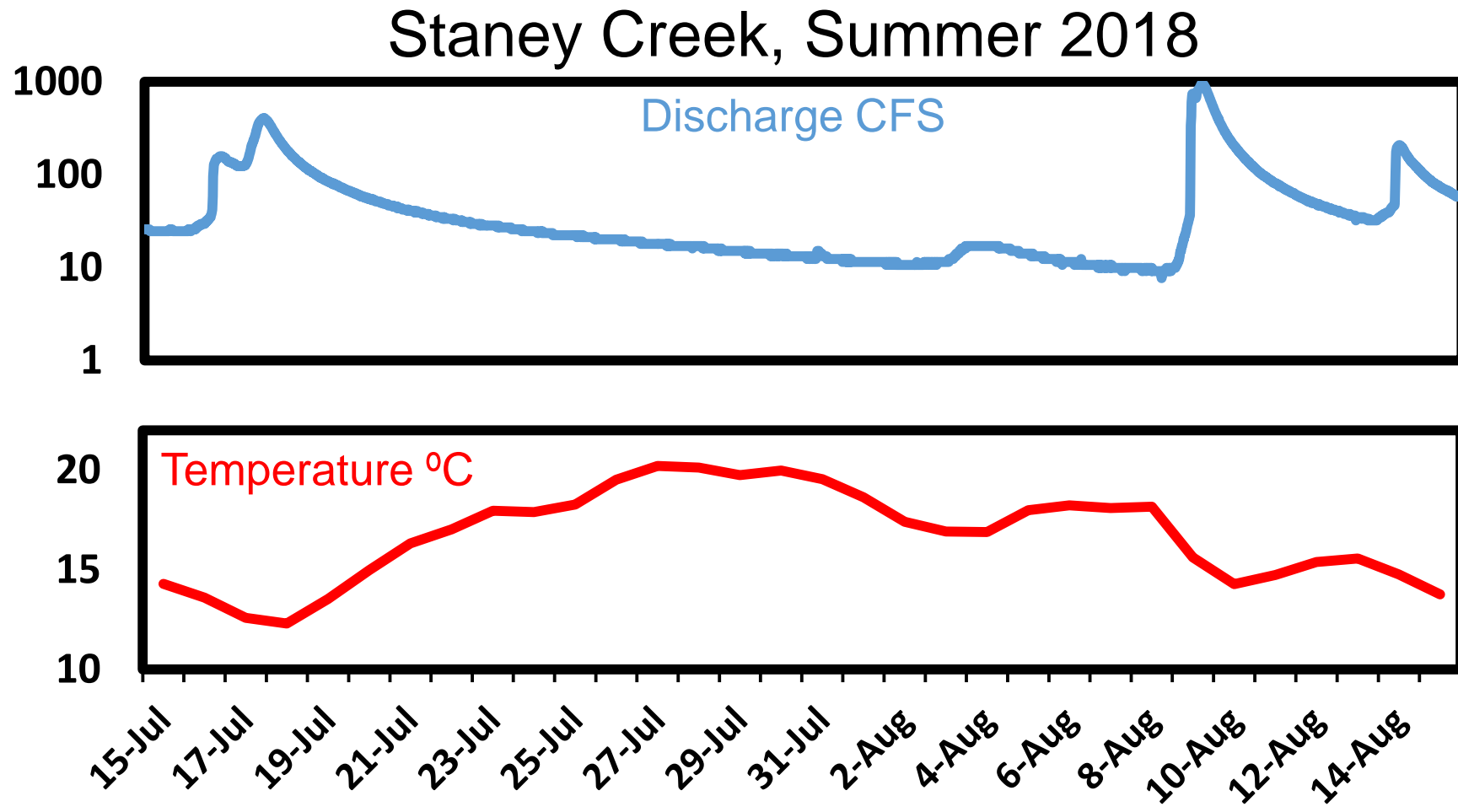
How Does Drought Effect SEAK Rivers?

Lower stream flow



How Does Drought Effect Rivers?

Lower stream flow often associated with warmer water



Drought and Salmon

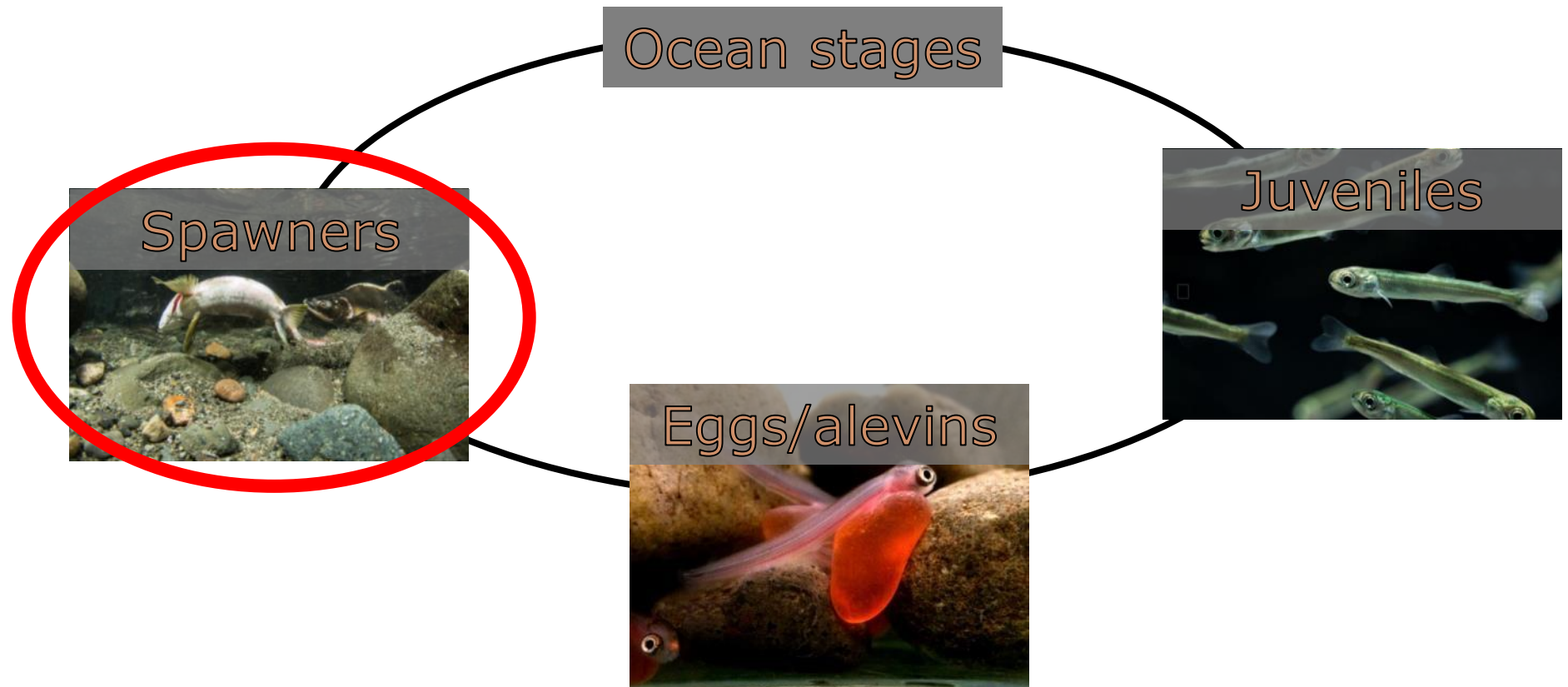
How do **flow** and **temperature** changes affect salmon?



Photo credit:
Jonny Armstrong

Drought and Salmon

Drought induced changes in stream **flow** and **temperature** will affect ALL freshwater salmon life stages.



Effects of Drought on Adult Salmon

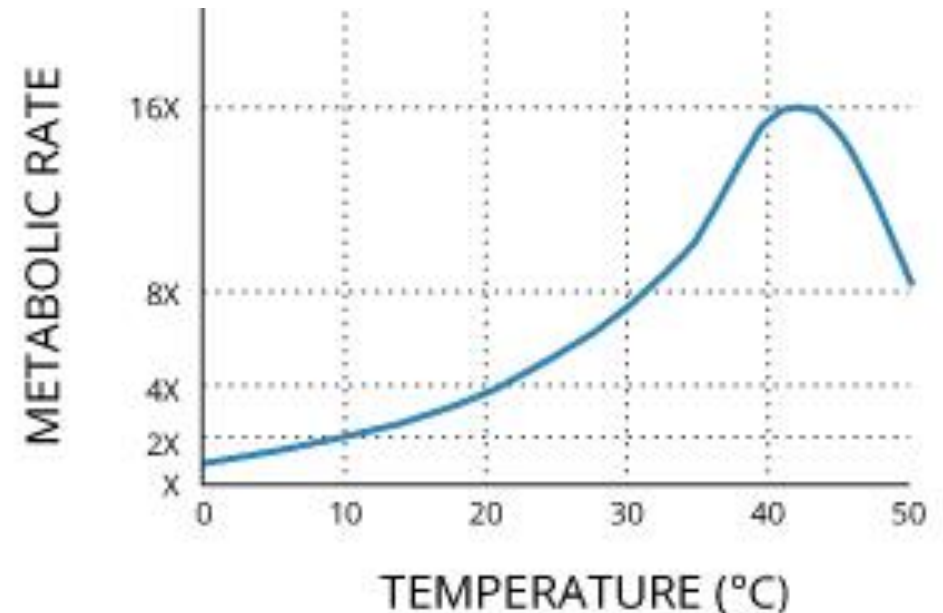
Low Summer Flows:

- ❖ Limit access to rivers
- ❖ Less wetted surfaces for spawning



High Water Temperatures:

- ❖ Increase salmon metabolism = more energy expenditures



Effects of Drought on Adult Salmon

Hypoxia! Dude, I can't breath in here.



Photo: Amy Hemenway

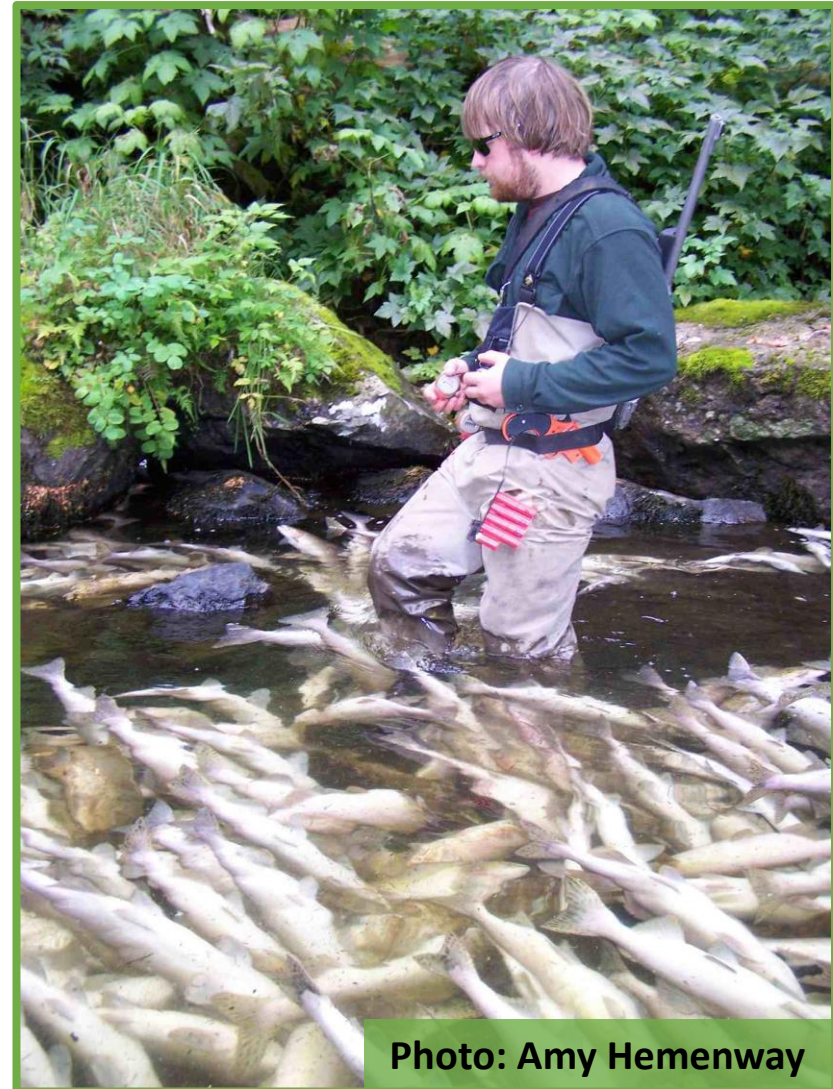
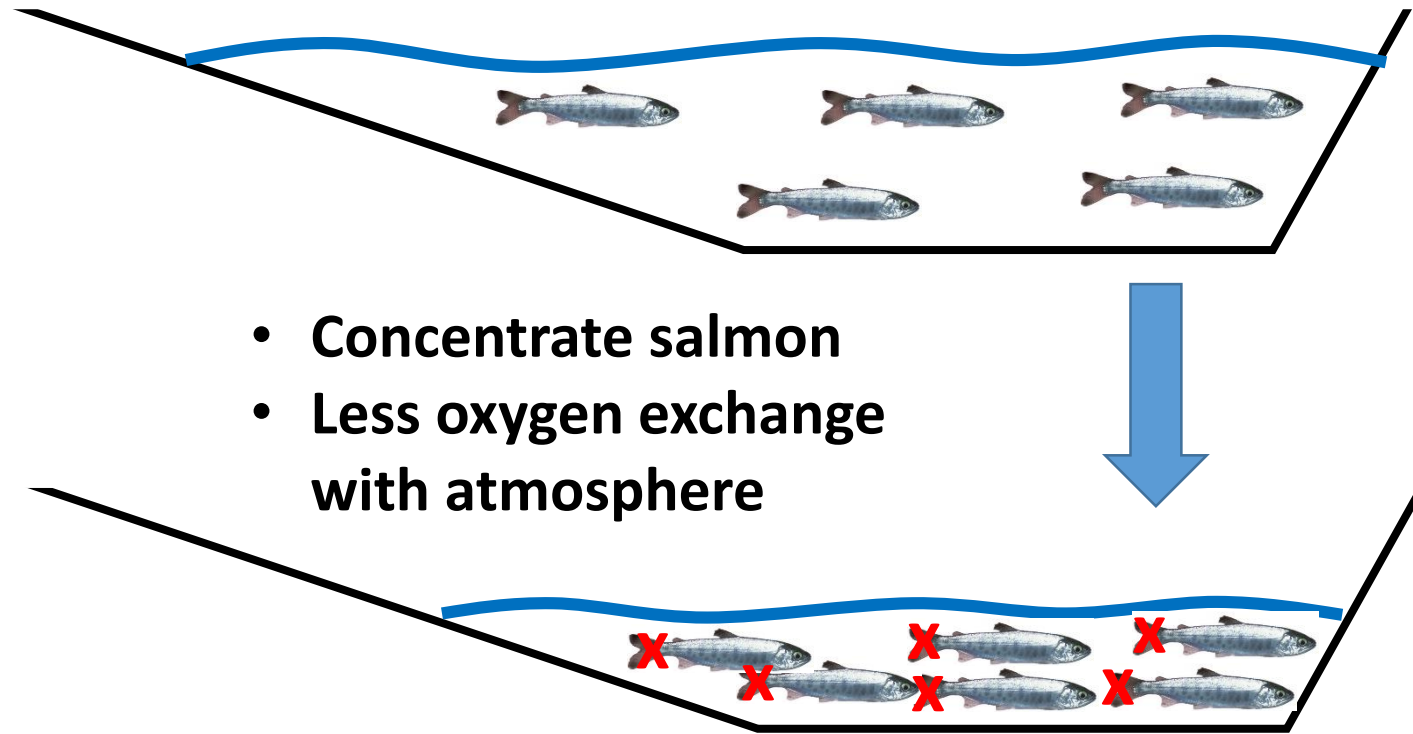
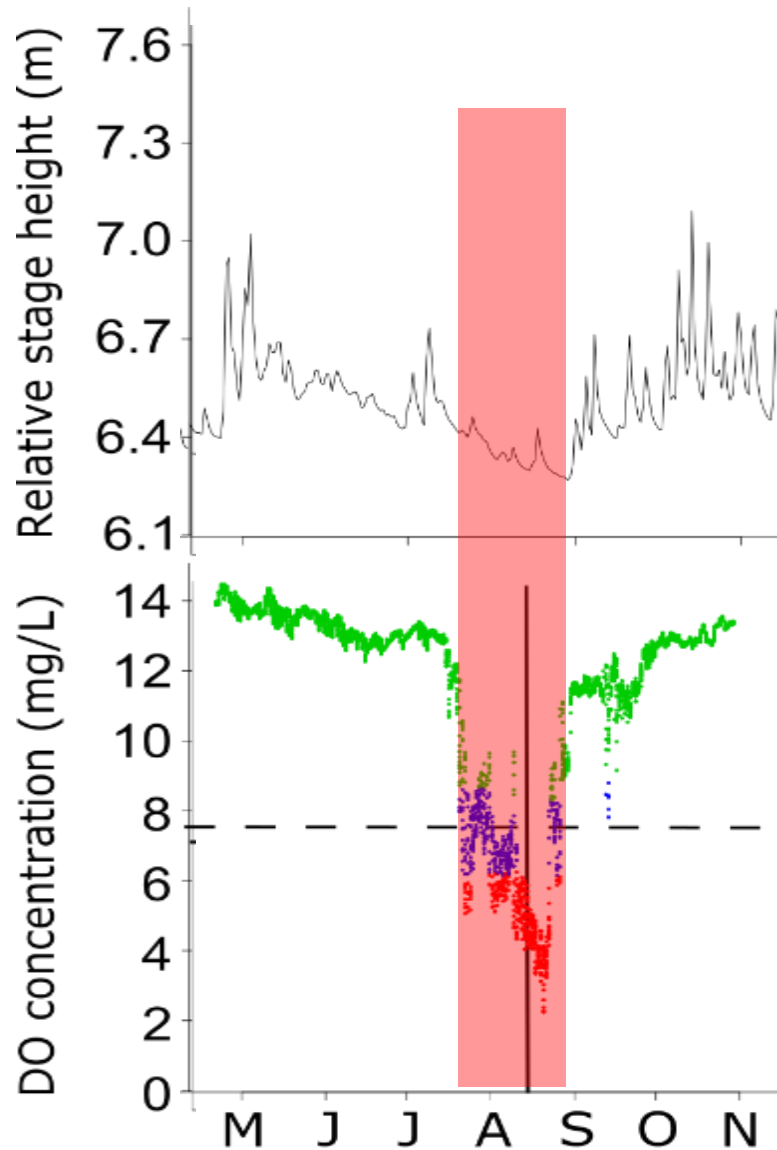


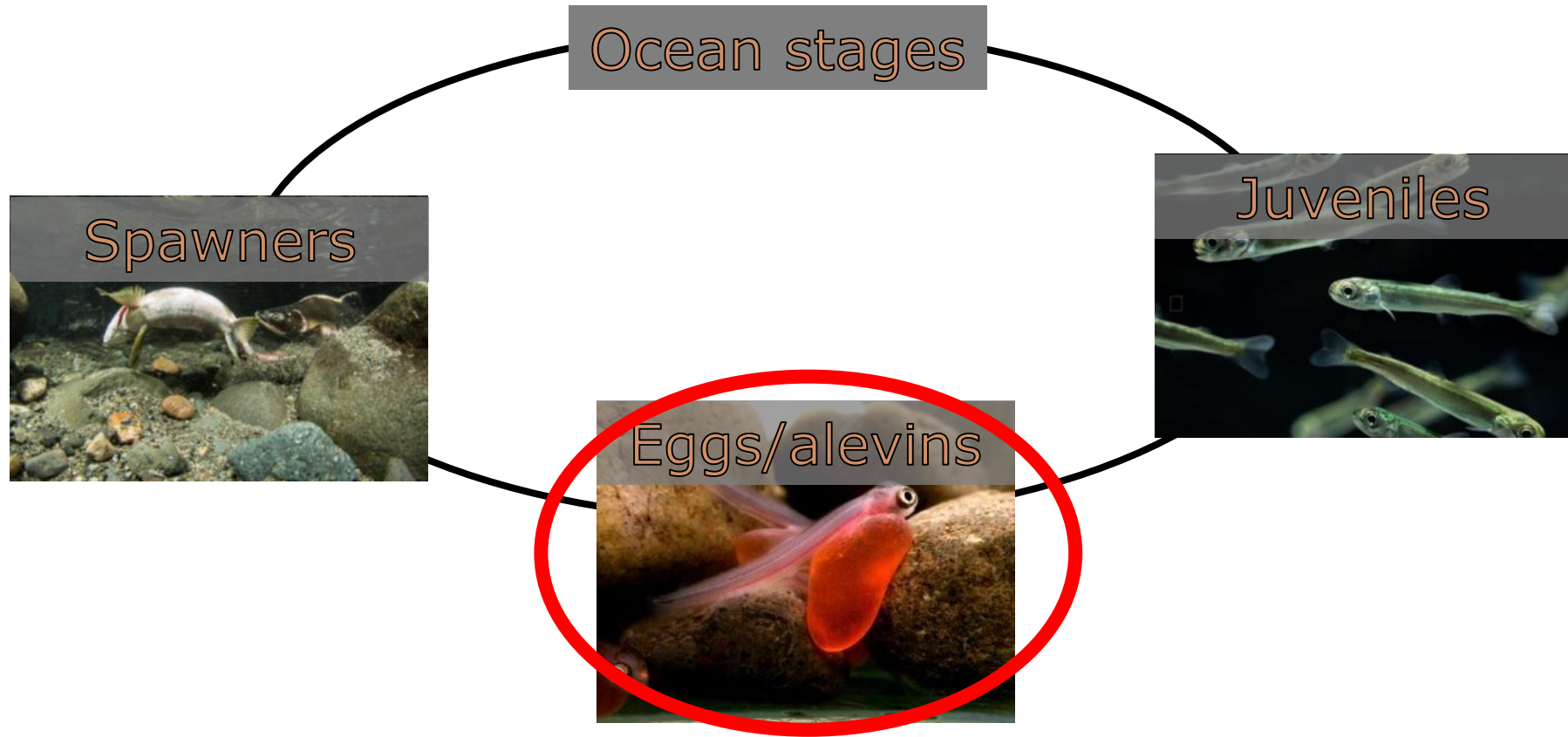
Photo: Amy Hemenway

Effects of Drought on Adult Salmon



Salmon breath in oxygen faster than it can be replaced by atmosphere!

Drought and Salmon



Salmon and Climate Change

Low Flows:

- ❖ Desiccation of redds?

High Water Temperatures:

- ❖ Faster Egg Incubation

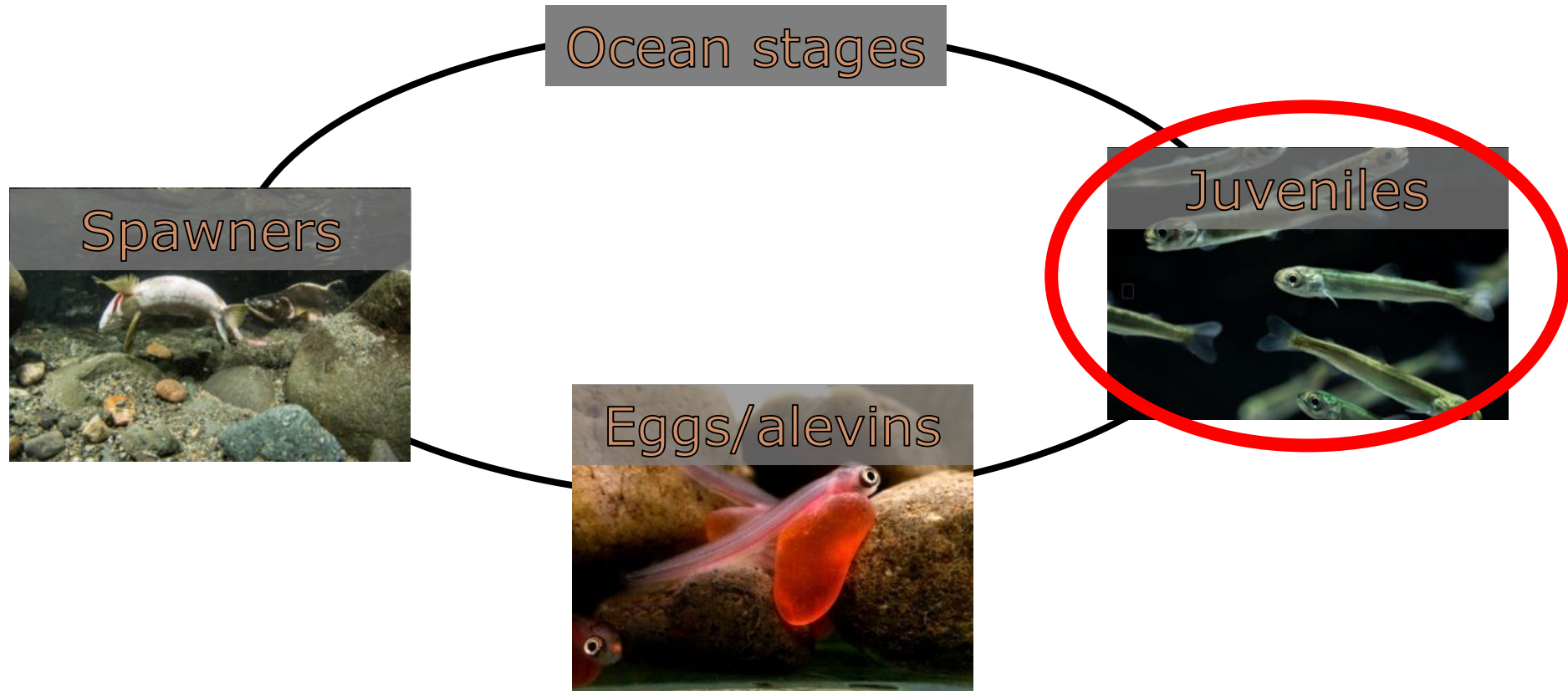
- ❖ Eggs hatch earlier

(Taylor 2007, Global Change Biology)

- ❖ *If fish emerge earlier will where be resources available to support them?*



Drought and Salmon



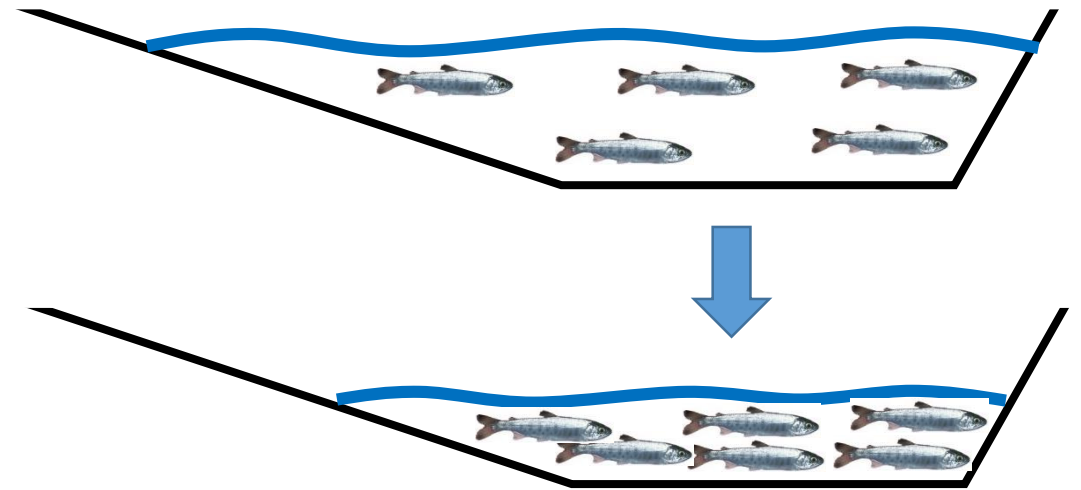
Effects of Drought on Juvenile Salmon

Low Flows:

- ❖ Less rearing habitat = greater fish density and more competition

High Water Temperatures:

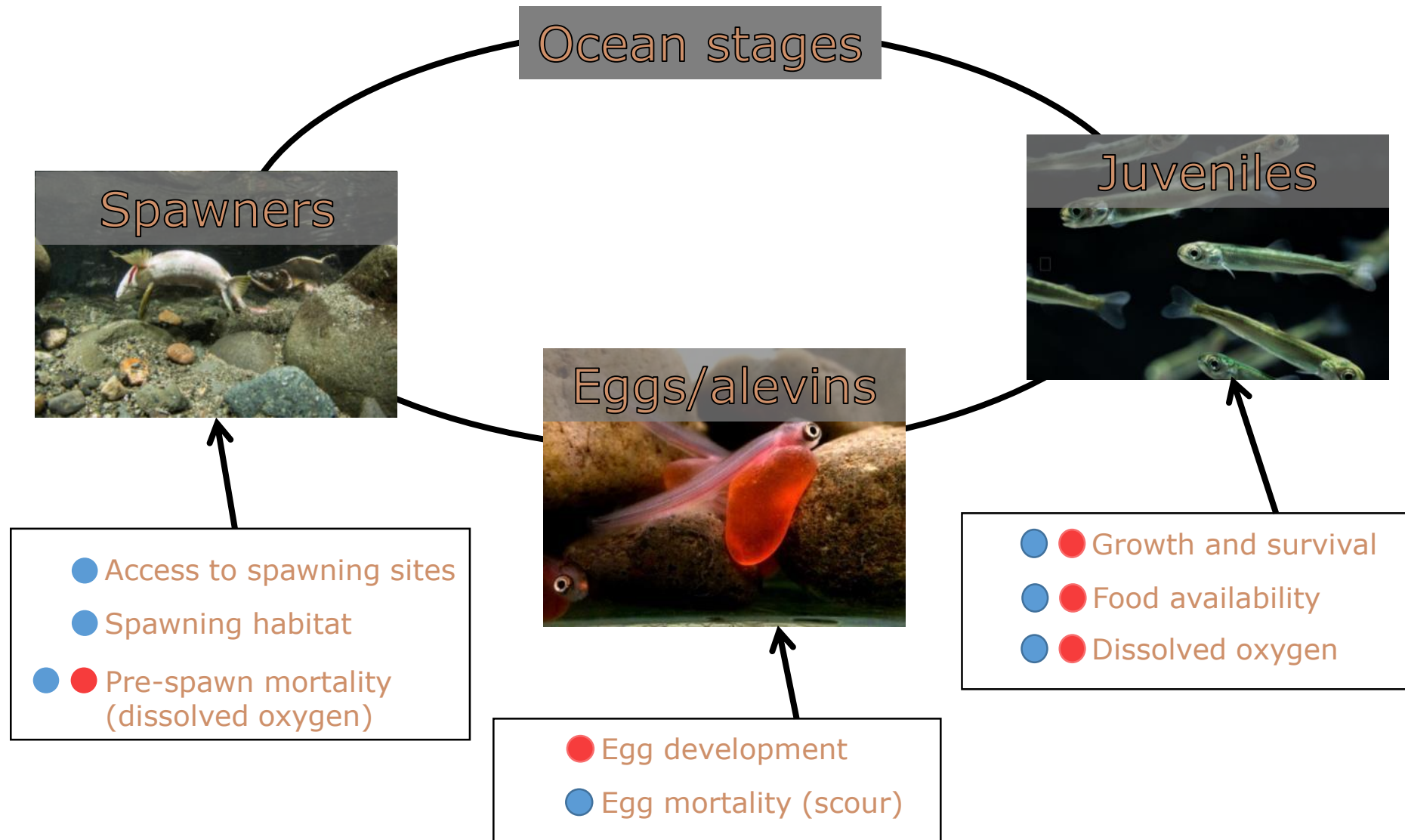
- ❖ Greater growth potential, assuming adequate food resources are available.



>GROWTH POTENTIAL



Drought and Salmon



modified from Chris Sergeant

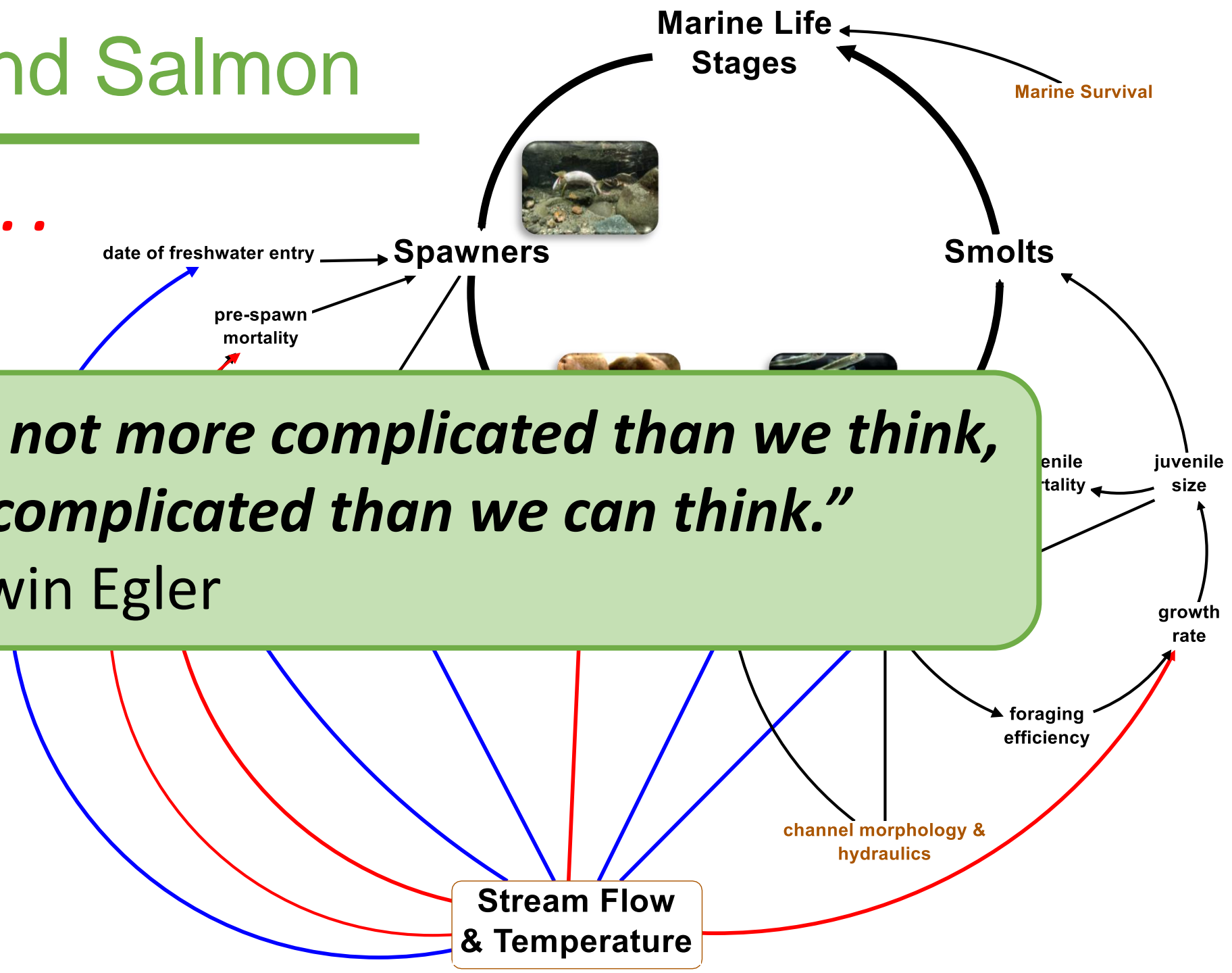
Drought and Salmon

It's complicated...

Need a modeling
framework that
integrates
these
and fe

***"Nature is not more complicated than we think,
it is more complicated than we can think."***

~Frank Edwin Egler



Life Cycle Modeling

Team Members:

Chris Sergeant, PhD Student

Jeff Falke

Davin Holen

Rebecca Bellmore

Ryan Bellmore



Southeast Alaska Salmon Simulator

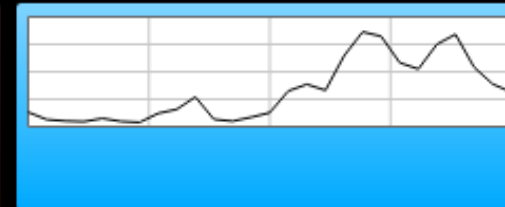
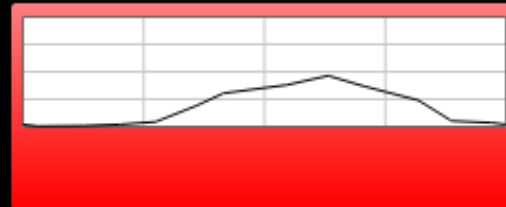
Use this model to explore how changes in stream flow and water temperature influence the number of returning adult salmon.

Click on the "thermal regime" and "flow regime" graphs to trace your own pattern of flow and temperature, or upload field data from your stream.

Run Model

Clear Graph

Upload Flow & Temperature Data



Restore Original Flow & Thermal Regimes

Drought and River Food Webs

Climate change impacts the entire food web

Team Members:

Matt Dunkle, PhD student

Jason Fellman

Eran Hood

Allison Bidlack

Chris Caudill

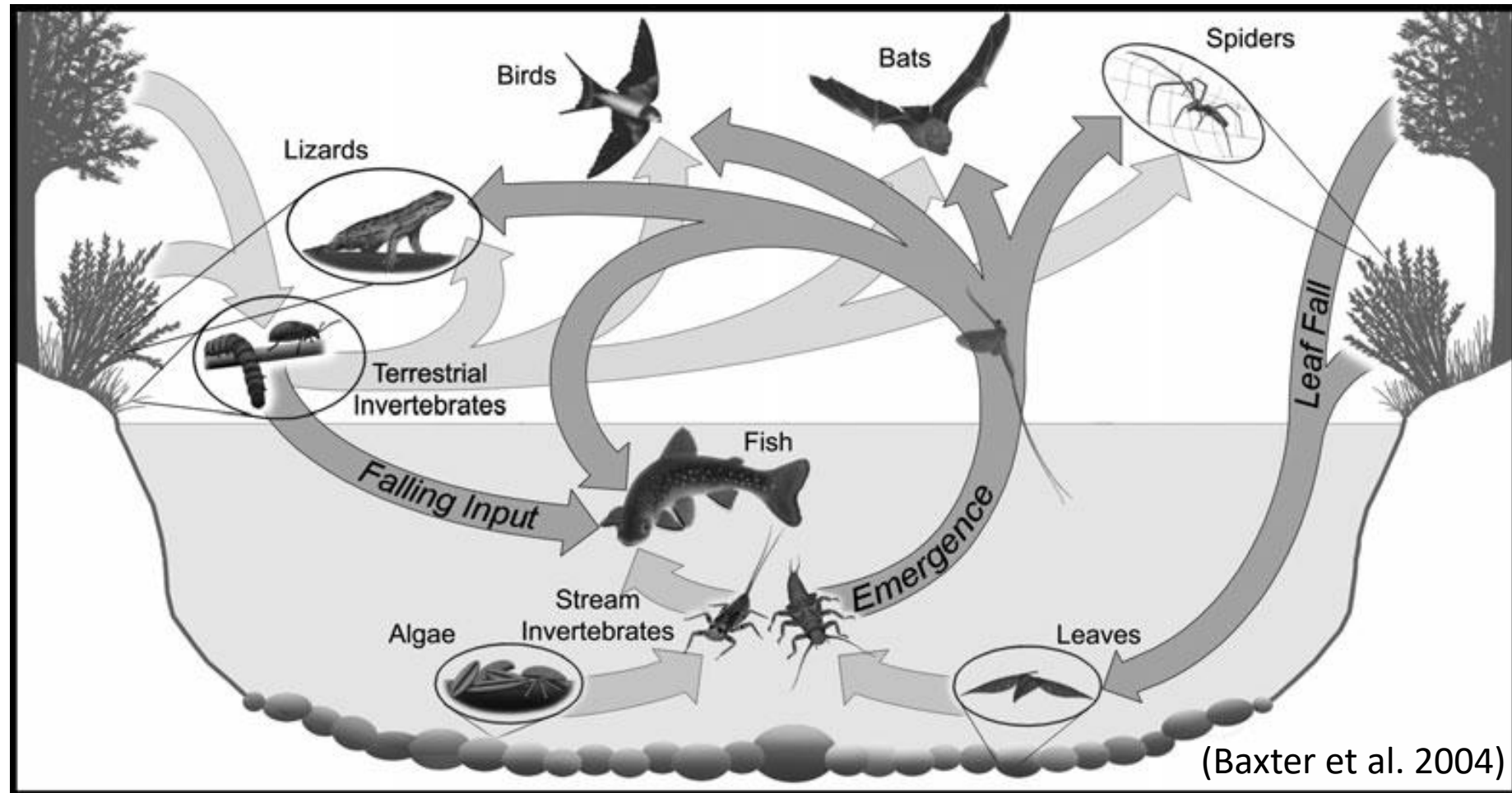
Dave D'Amore

Rick Edwards

Di Johnson

Mark Lukey

Emily Whitney



(Baxter et al. 2004)

Thank you!

ALASKA

Sea Grant
Alaska



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UNIVERSITY OF ALASKA
SOUTHEAST

AK CASO
Alaska Climate Adaptation Science Center