

# Climate change and PNW Fisheries

*Climate Science on Tap  
Schooner Series, 2019*

**Megan Feddern**

School of Aquatic and Fishery Sciences, University of Washington

# What is the climate change impact?



Tolerating the  
heat!



Managing for  
Change



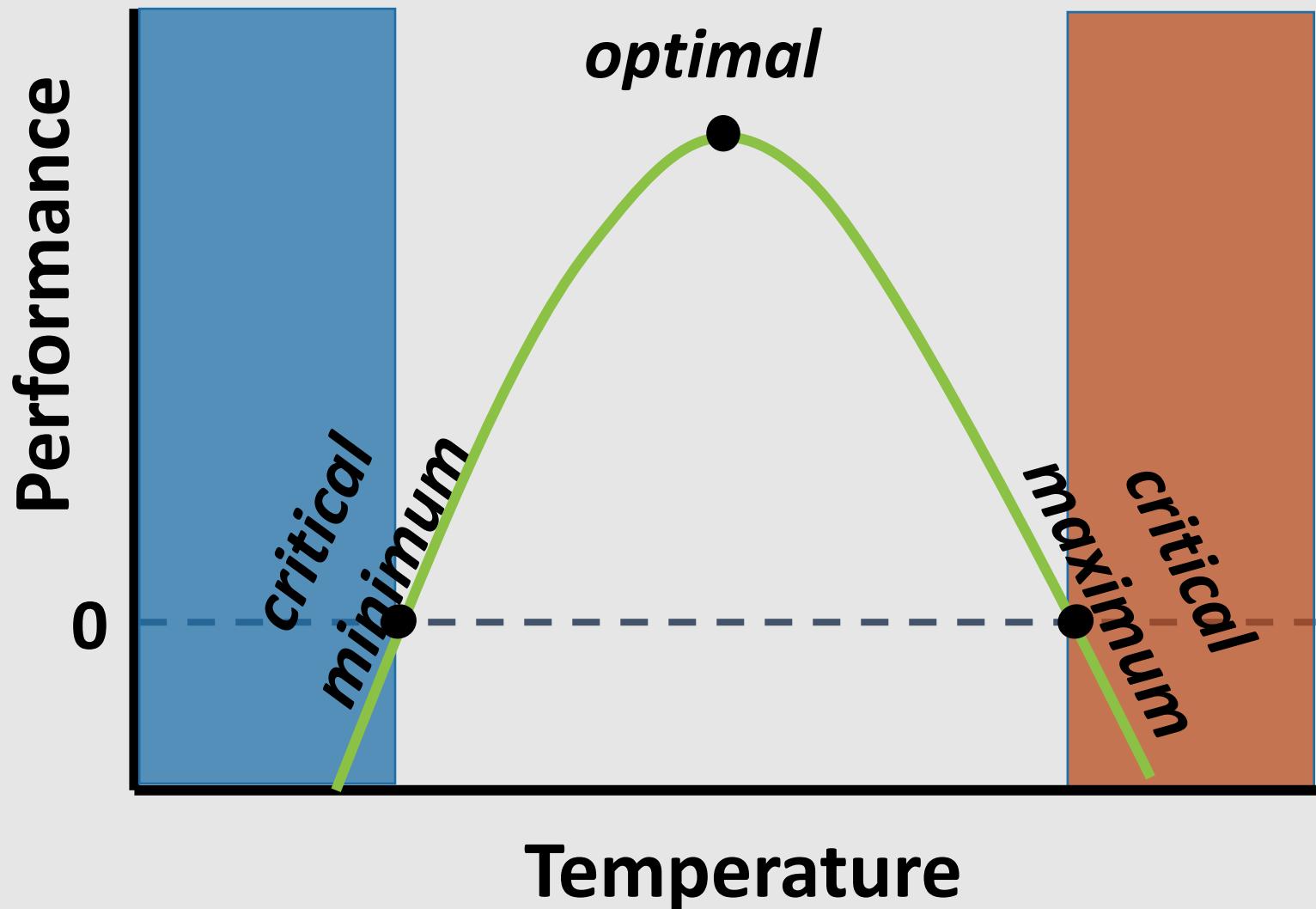
Ocean Acidification

# *We change how we interact with the environment through space and time*



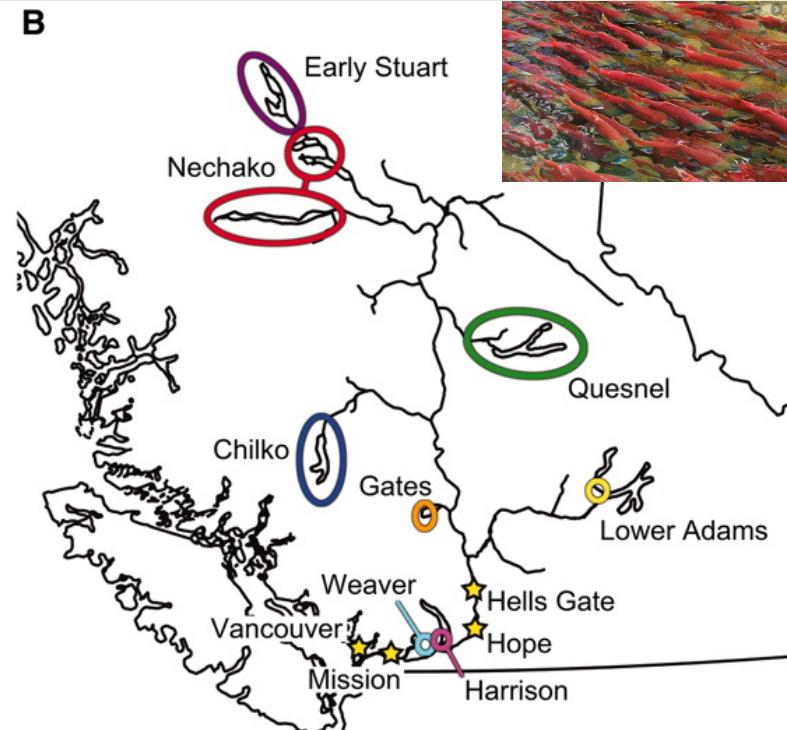
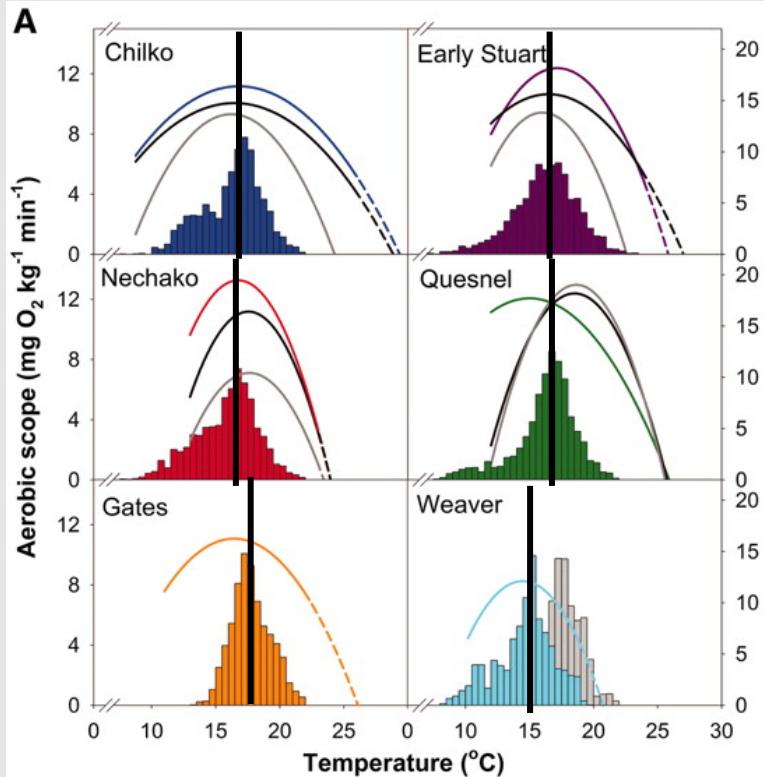
- Work in my office all day with AC
- Commute on the bus
- Exercise late in the evening (or early in the morning)
- Go to the beach

# *Thermal Tolerance*



# Thermal Tolerance of Fraser River Sockeye Salmon

Eliason et al. 2011

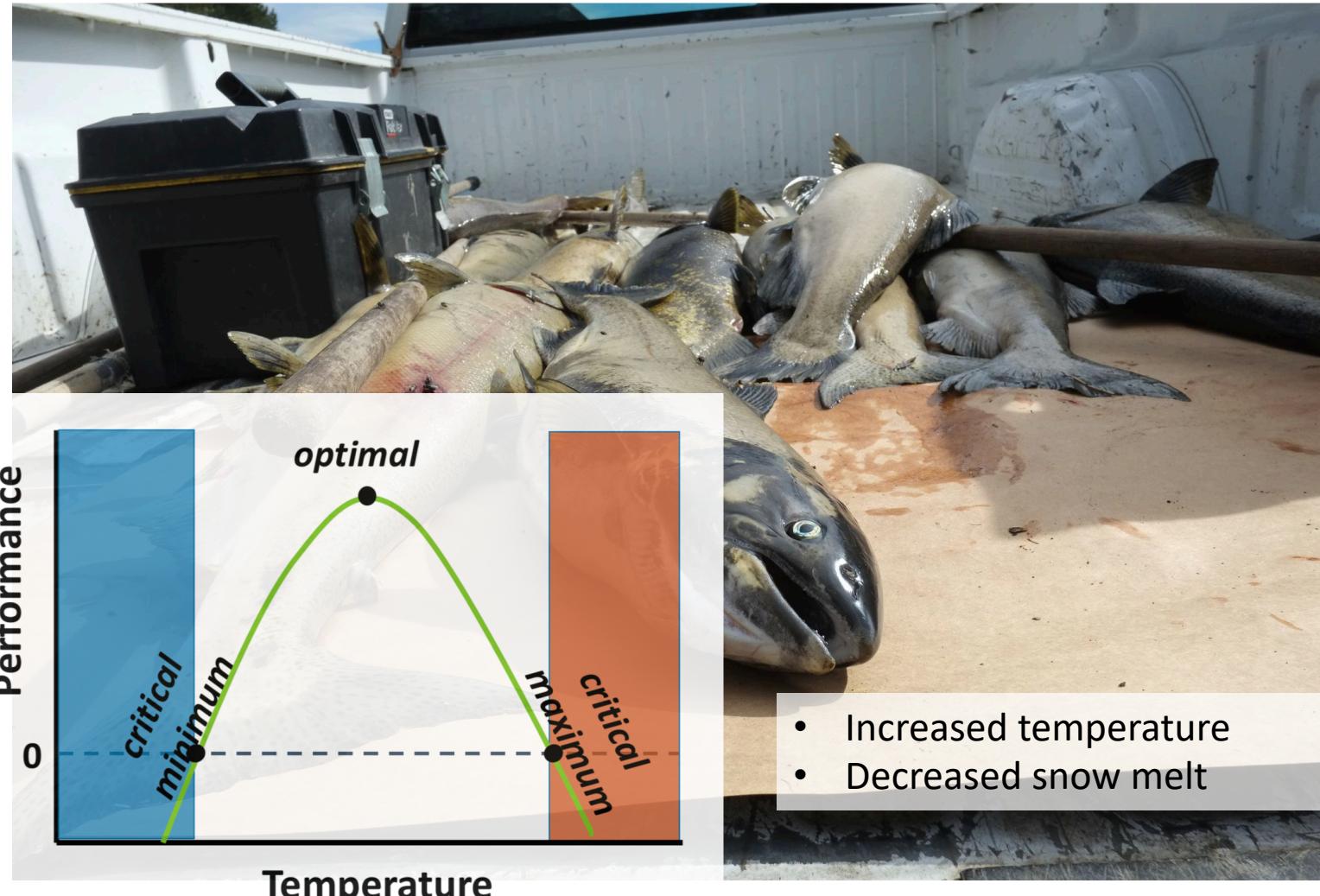


*Further from optimal temperature = closer to critical maximum temperature = less energy to spawn/reproduce*

# Climate change is cooking salmon in the Pacific Northwest

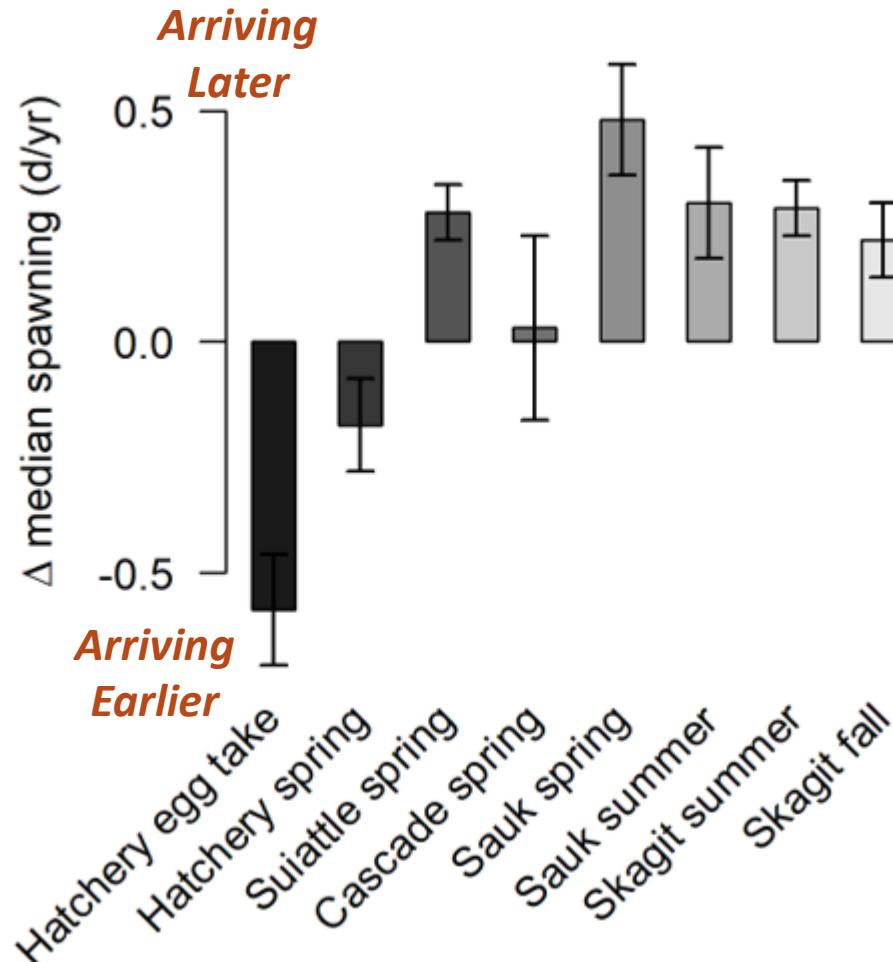
Warmer waters in the Pacific Northwest are killing salmon before they can reproduce.

By Howard Hsu | February 8, 2019



Salmon that have died in Washington's Wallace River before spawning. Howard Hsu

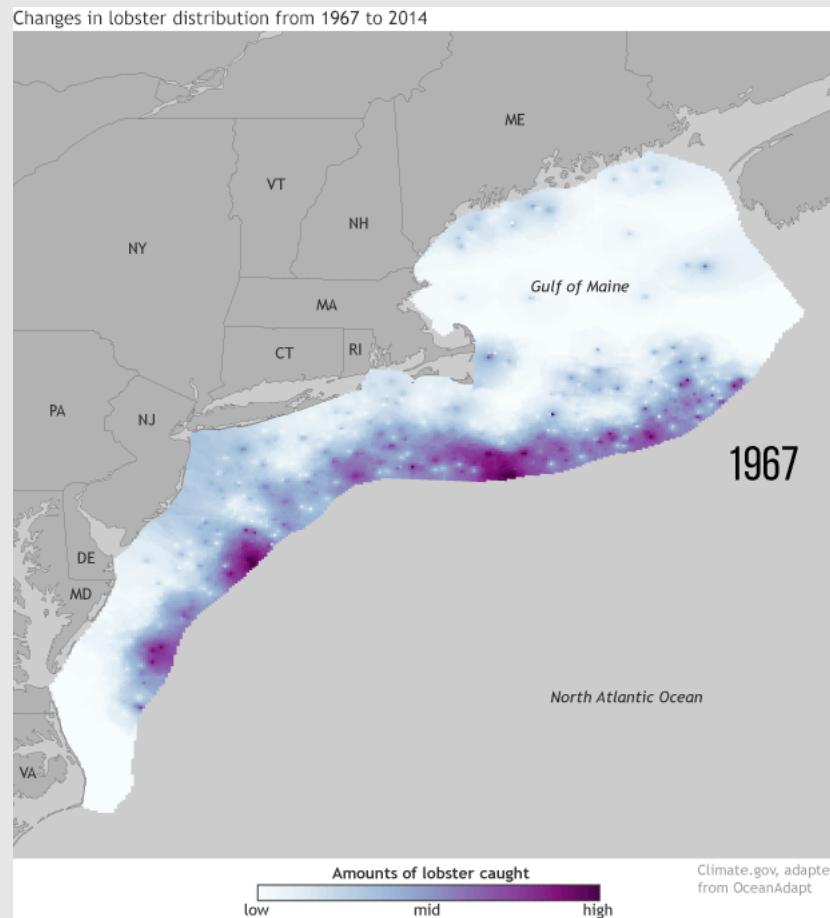
# Skagit River Chinook Salmon



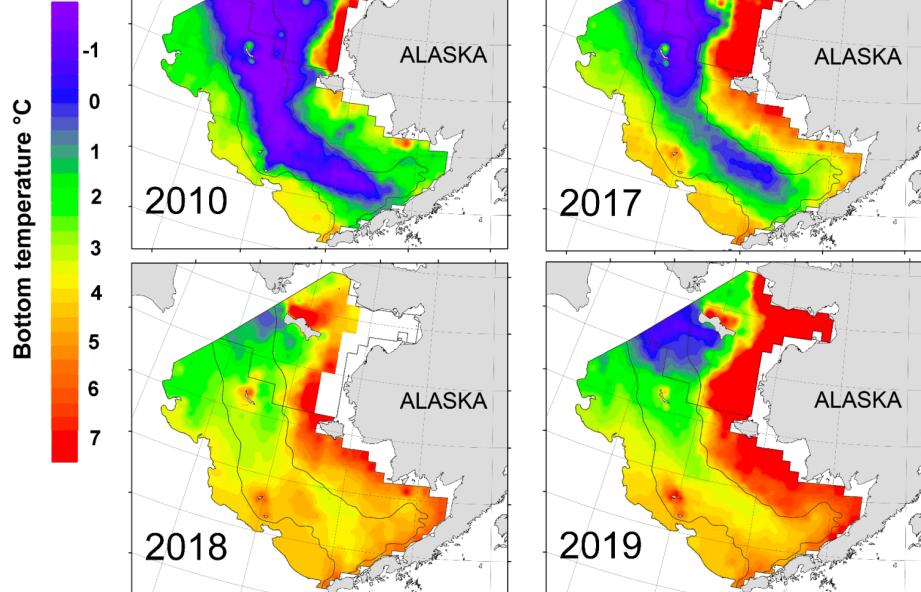
*Salmon alter how they interact with the environment through time*

# *So...who gets the fish?*

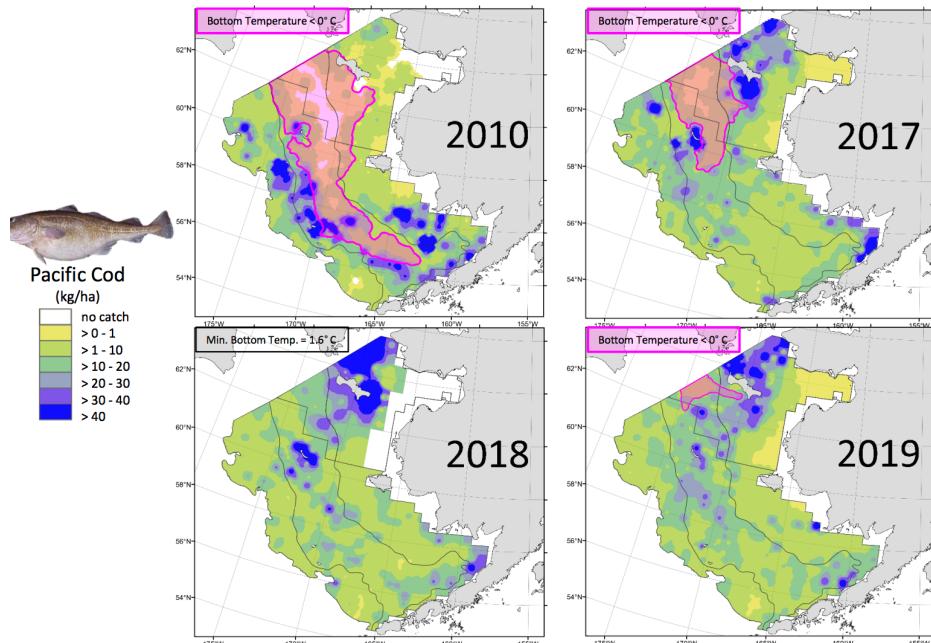
*Species such as  
lobster and  
summer flounder  
have been found  
at higher  
latitudes during  
more recent,  
warmer time  
periods*



## Survey bottom temperatures

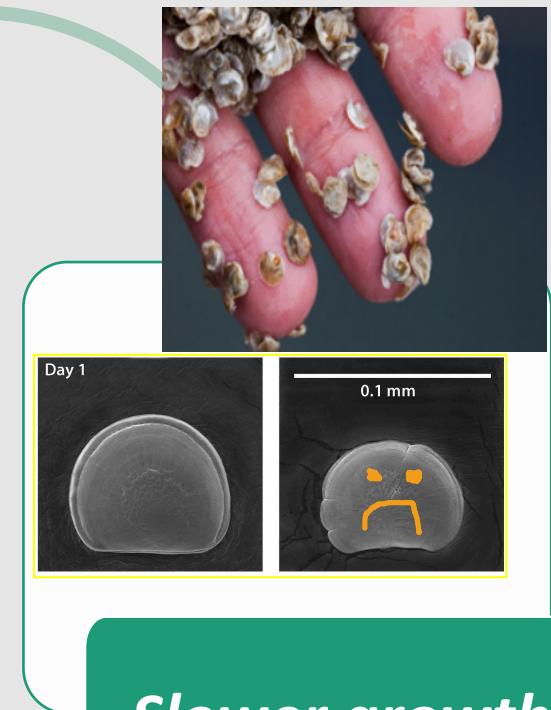
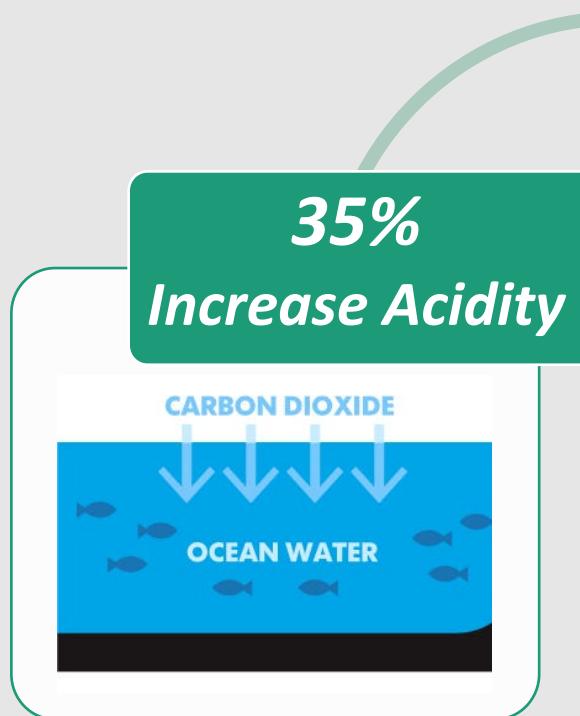
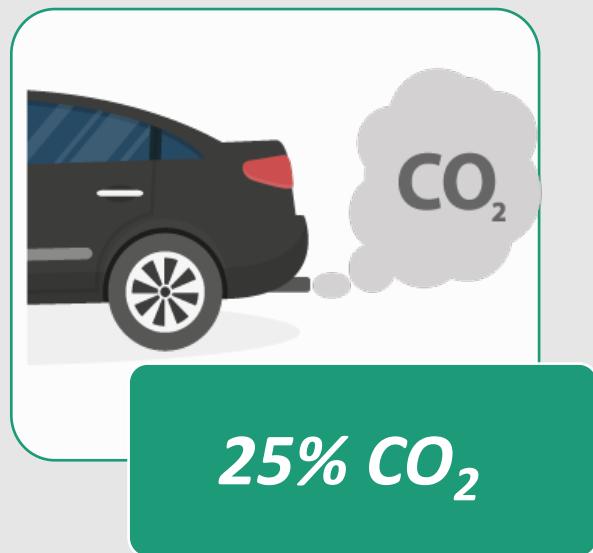


## Bering Sea Pacific Cod Distribution



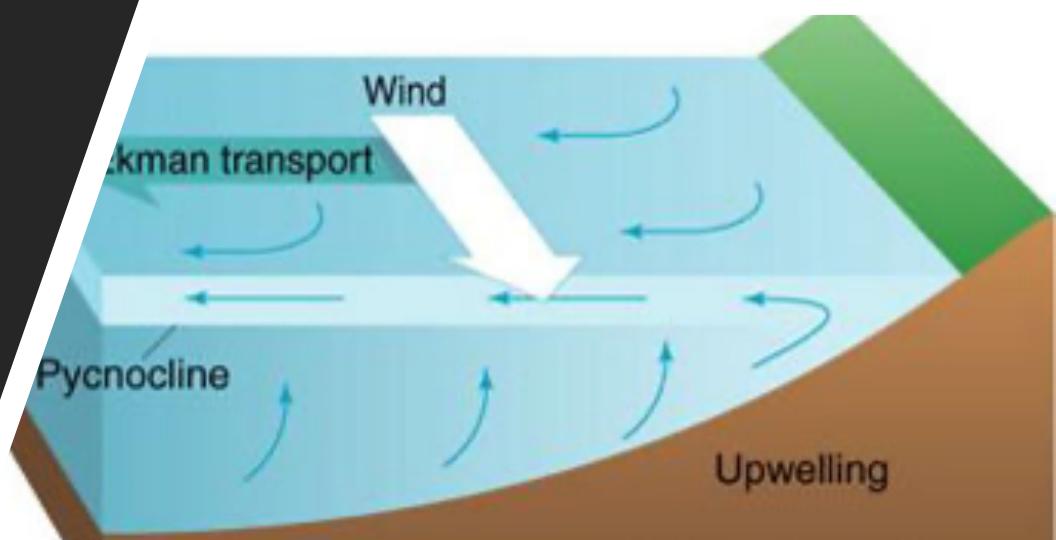
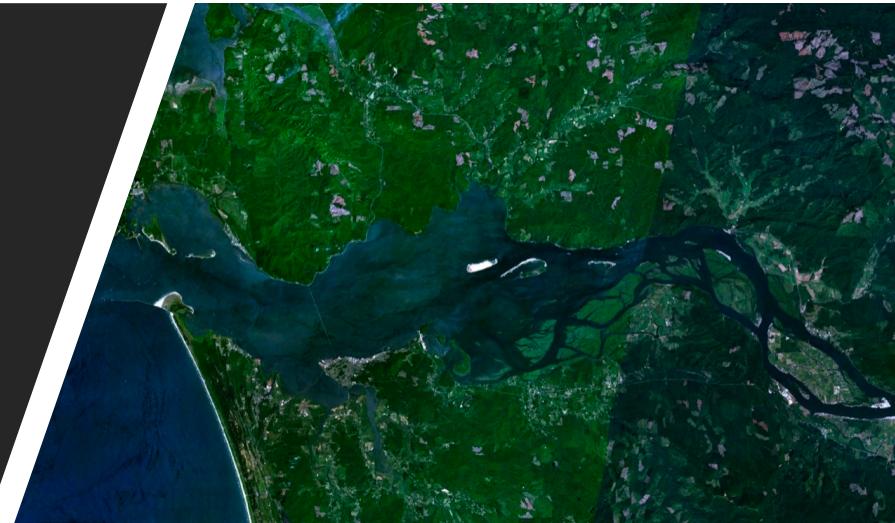
*Many species alter how they interact with the environment through time*

# *Ocean Acidification*

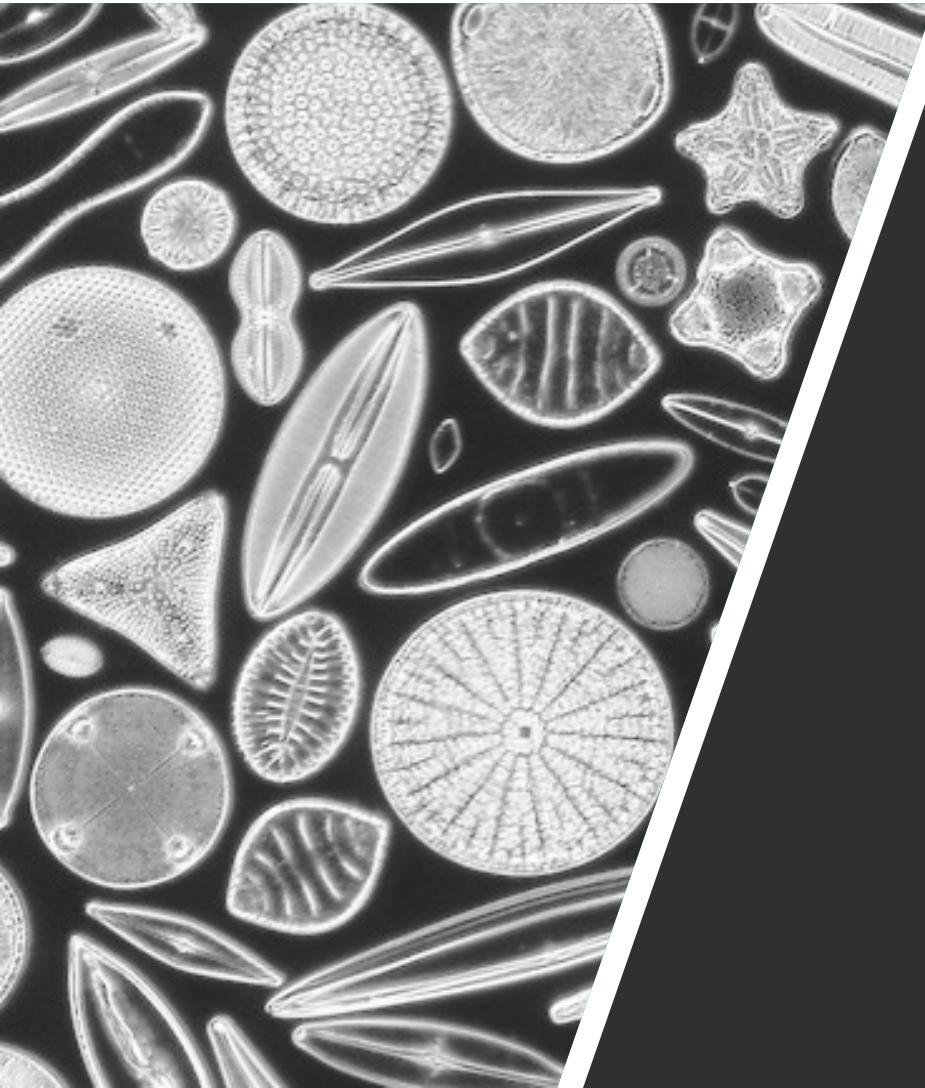


# *Ocean Acidification: WA*

- Runoff of nutrients and decaying organic matter
- Coastal upwelling of CO<sub>2</sub> rich, low pH (high acidity) waters from deep ocean to WA coast
- Emissions of other acidifying gases (nitrogen and sulfur oxides)

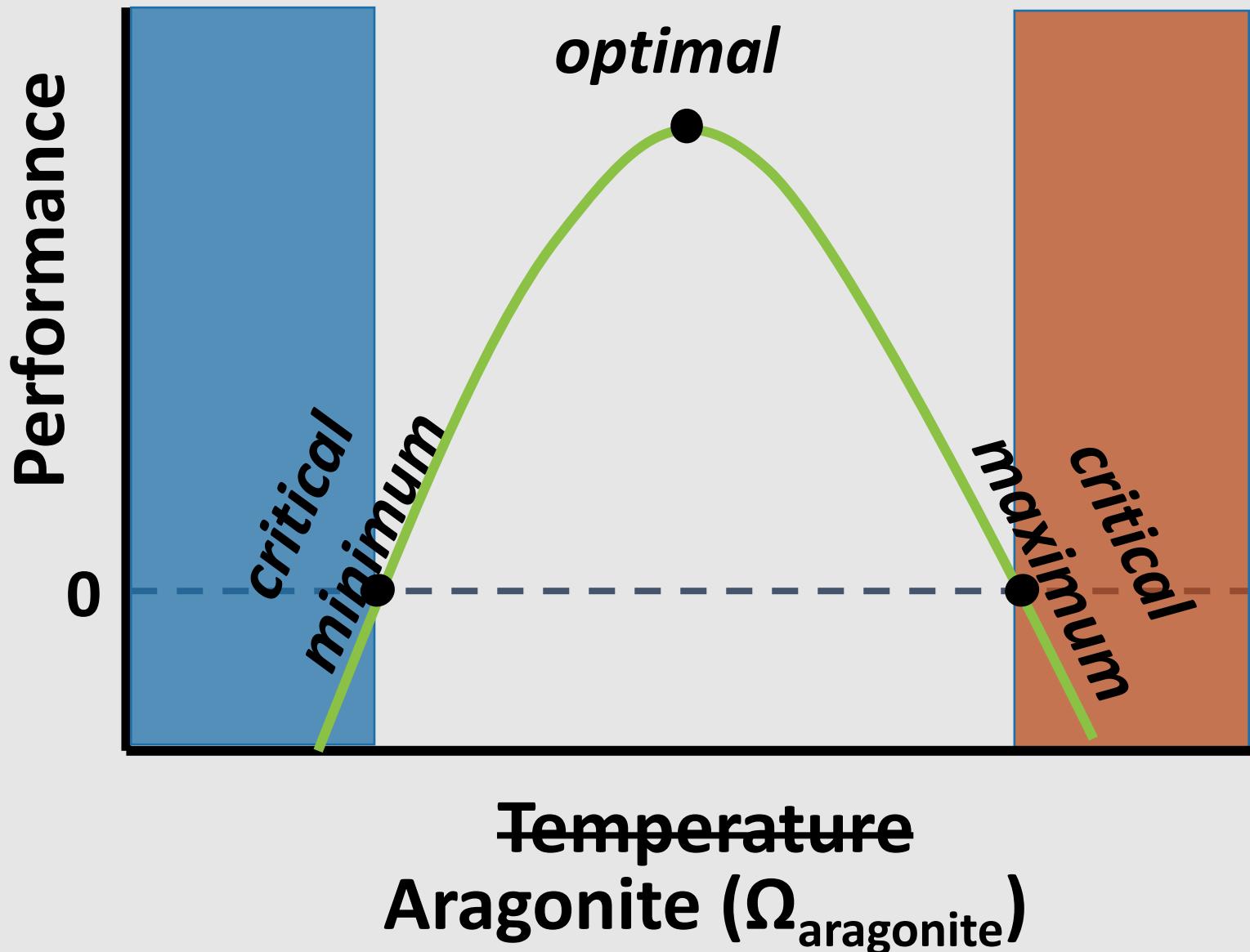


# *Ocean Acidification in WA... but why does it matter?*



- More than 30% of Puget Sound species are calcifiers
  - Oysters, clams, geoduck
  - Sea cucumbers, seaweed, diatoms
- \$270 million annually
- Supports 3,200 jobs
- Important component of subsistence fisheries

# Aragonite Tolerance



# *The State of the Science*

- Identify aragonite and thermal tolerance for a range of species
- Identify the breadth of variability in tolerance among individuals
- Understand how tolerance is passed to offspring

## **Shellfish growers fight to keep species thriving amid rising acid levels in Puget Sound**

Growers at Taylor Shellfish farms in Jefferson County are working to keep shellfish alive, by testing water for acid levels and growing algae for them to eat.

# What is the climate change impact?



Species modify  
their use of  
space and timing



Management must be  
modified to minimize  
impacts of change



The PNW is particularly  
vulnerable to  
acidification

# *Shifts in timing: good or bad?*



*Small and Juvenile Fishes*

*Zooplankton Increase*

*Phytoplankton Increase*

*Upwelling*

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Month