Climate Scenario Workshop Webinar #1
Climate Drivers, Processes, Impacts

Bridget Ferriss, NOAA Alaska Fisheries Science Center

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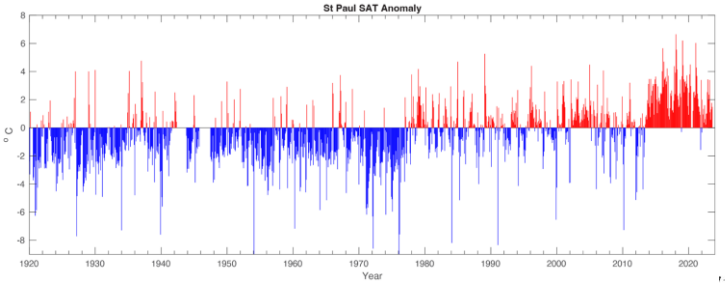
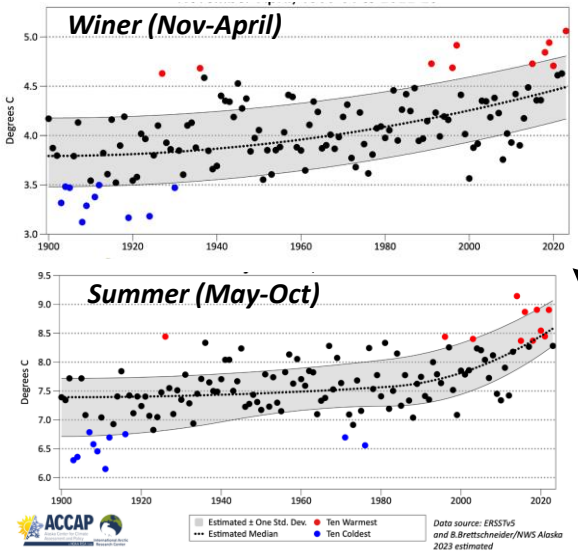
Bridget Ferriss, Elizabeth Siddon, Ivonne Ortiz, Stephani Zador

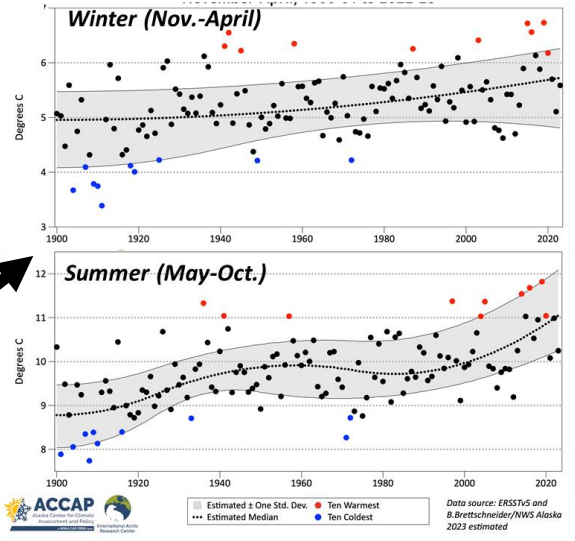



Ocean temperatures are increasing in Alaska (1900-2023)

R. Thoman, B. Brettschneider.
J. Overland, W. Cheng







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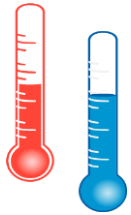
Eastern Bering Sea: Drivers & Processes

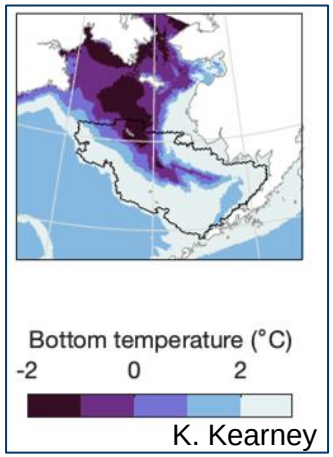
Sea ice

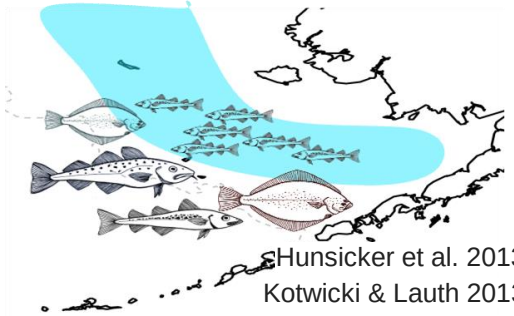


Temperature

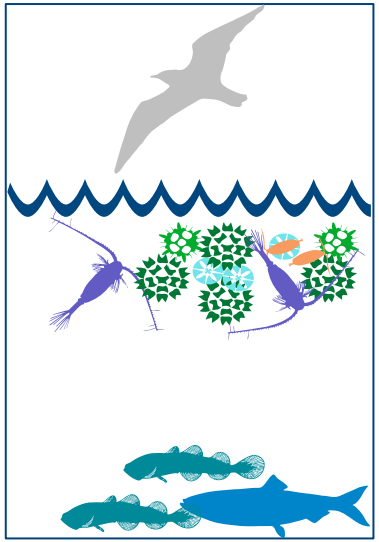
Winds

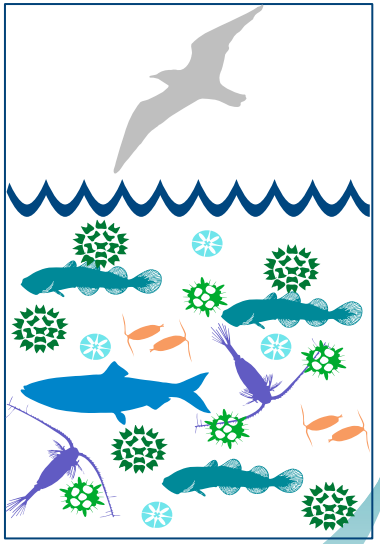
The “cold pool”





Hunsicker et al. 2013
Kotwicki & Lauth 2013
Spencer et al. 2016





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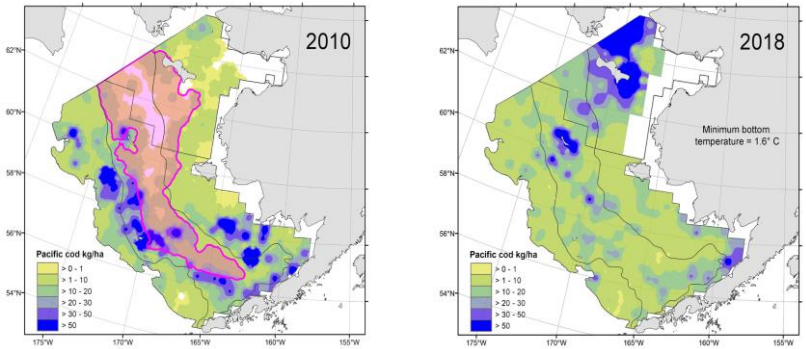
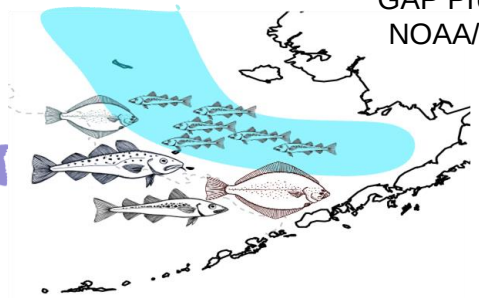
Eastern Bering Sea: Groundfish & Crab Impacts

1. Changes in distribution
   Example: Pacific cod



GAP Program, NOAA/AFSC

1. Predator/prey dynamics
   Example: walleye pollock



1. Metabolic demands
   Example: snow crab

Szuwalski et al., 2023

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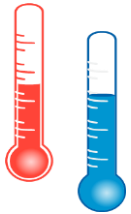
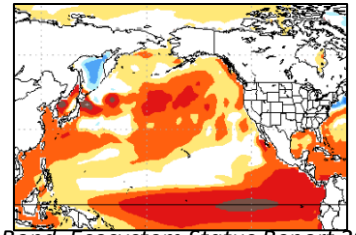
Aleutian Islands: Drivers & Processes



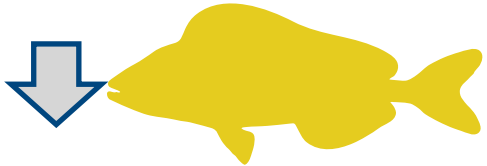
Warmer Temperature



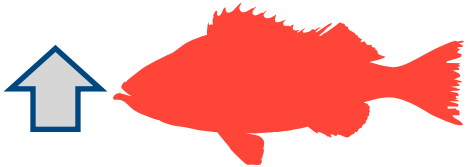
Bond, Ecosystem Status Report 2023

Warmer ocean

Warmer temperature winter and summer → Increased cost of living in fish & Need more food → Lower fish condition



Atka Mackerel



Pacific Ocean Perch

Recovery of Pacific Ocean perch and decrease in Atka mackerel (not necessarily climate driven)

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Aleutian Islands: Groundfish Impacts

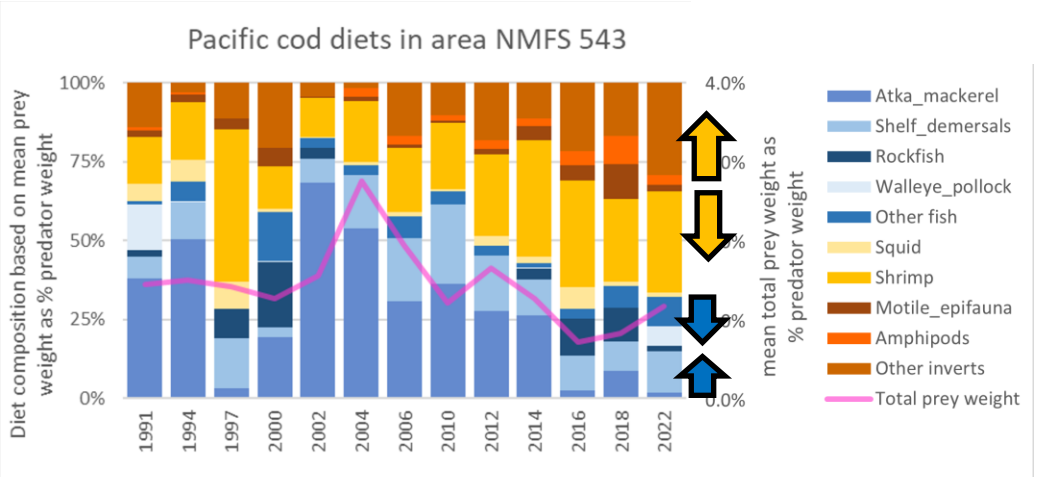
1. Changes in diet

Example, Pacific cod

Ortiz et al. 2023

2. Less fish as prey

Example, less Atka mackerel



3. Metabolic demands

Example, Pacific cod

Skinnier fish

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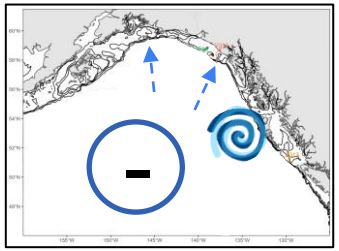
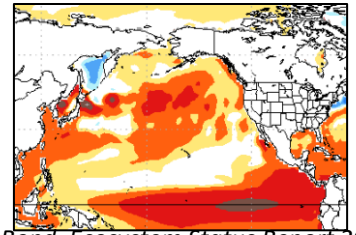
Gulf of Alaska: Drivers & Processes



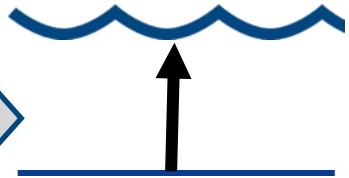
Weaker subarctic gyre



Bond, Ecosystem Status Report 2023

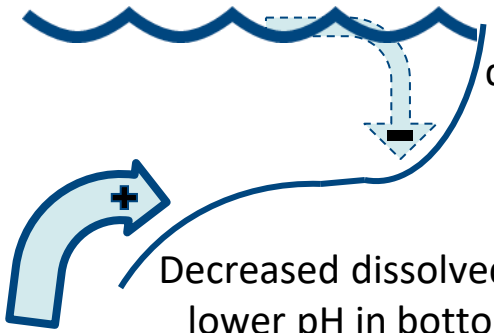
Warmer ocean

Warmer & wetter winter



Shallower mixed layer depth (earlier stratification)

Earlier & more intense spring Bloom



Reduced downwelling & mixing

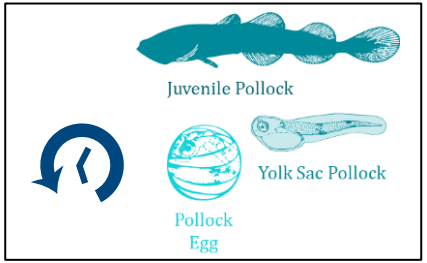
Decreased dissolved oxygen & lower pH in bottom waters

Gulf of Alaska: Groundfish Impacts

1. **Phenology**

Example: walleye pollock

Rogers et al., 2024



2. **Optimal thermal ranges**

Example: groundfish larvae

Laurel et al., 2023, Krieger et al., 2020

Optimal thermal ranges for groundfish

P. cod larvae (5-6°C)

W. pollock larvae (3-7°C)

Sablefish larvae & YOY (12-16°C)

3. Groundfish Community Structure

Example: ecosystem states

Suryan et al. 2021

Litzow et al. 2019

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Climate Questions Across Alaska Large Marine Ecosystems

1) Pace of change
2) Indirect & cumulative effects
3) Mechanistic links between environment and groundfish
4) Non-stationarity
5) Thresholds / tipping points
6) Novel environmental conditions

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