Alaska Fisheries Science Center Salmon Research

Robert Foy and Ed Farley
and numerous staff from multiple AFSC Divisions:

- Auke Bay Laboratories
- Resource Ecology and Fisheries Management
- Resource Assessment and Conservation Engineering Division
- Fisheries Monitoring and Analysis

Presentation to North Pacific Fishery Management Council, June 2022

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AFSC salmon science

- **Response to NPFMC November 2021 request to DOC Secretary Raimondo**
- **Why does AFSC do salmon research?**

<u>Legislative Authorities</u>

- Magnuson-Stevens Fishery Conservation and Management Act (1976)
- High Seas Driftnet Fisheries Enforcement Act (1992)
- Pacific Salmon Treaty (1985) (Pacific Salmon Commission)
    - Yukon River Salmon Act of 2000 (Yukon River Panel)
- Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean (1992) (North Pacific Anadromous Fish Commission)
- Endangered Species Act (1973) (none in AK)
- Marine Mammal Protection Act (1972) (limited in AK)

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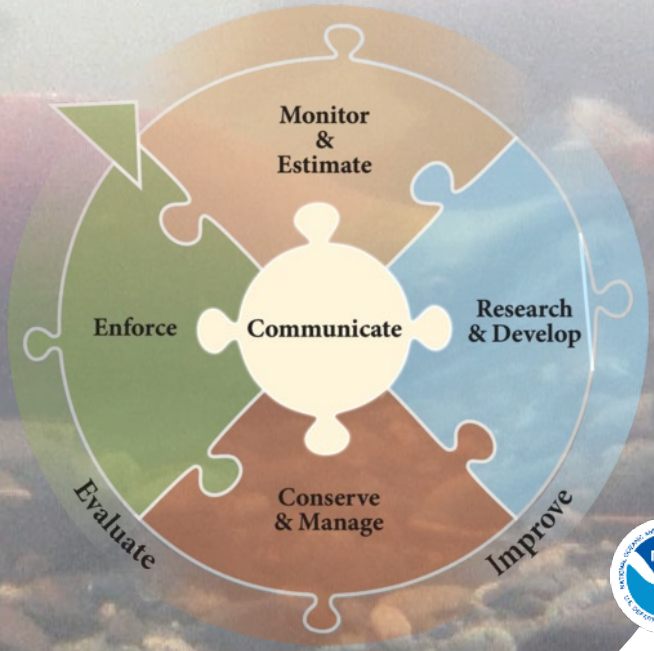
Bycatch, EFH, Communities

Magnuson Stevens Act

- Support NMFS-Alaska Regional Office and NPFMC
- National Standard 9 (minimize bycatch to the extent practicable)
- National Bycatch Reduction Strategy
- National Standard 8 (communities)

- Salmon Fishery Management Plan - analytical support for development and revisions (EFH)
- National Standard 1: Optimum Yield EBFM (NOAA EBFM Policy)



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Bycatch, EFH, Communities

Magnuson Stevens Act

- Quantify bycatch impacts -> Adult Equivalency (AEQ): How many bycatch salmon would have returned to AK rivers as adults?
- Where do the bycatch salmon come from? (genetics)
- Can we minimize salmon bycatch in groundfish fisheries (AFSC Conservation Engineering Program)
- Continued Observer Program support
- Models to estimate location and extent of salmon EFH

- Community collaboration
  - Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative MOU (prioritize research)
  - CDQ (Yukon Delta Fisheries Development Association) (salmon condition research)
- Ethnographic studies to understand community reliance on salmon.
- Salmon-focused climate-informed predicted impacts on communities
- Partner research on distribution and spp. overlap

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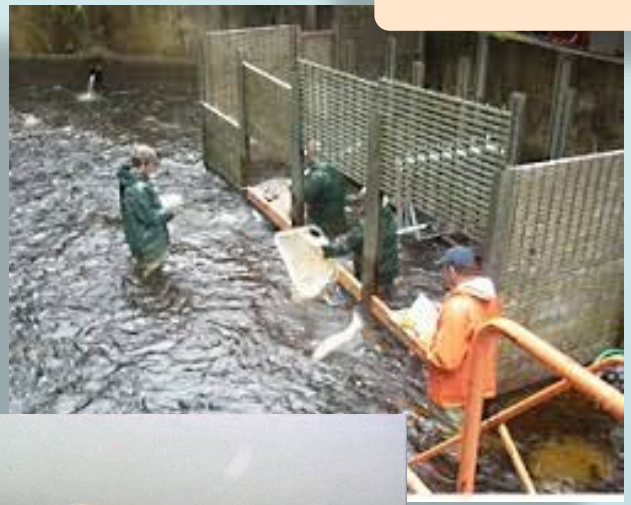
Stock status, funding review, marine survival, and catch origin

- US – Canada: cooperation in management, research, and enhancement of Pacific salmon stocks
- Genetic stock ID on sockeye salmon
- Technical and regulatory advice to the Commission through technical committees of review panels:
  - Northern Panel
  - Transboundary Panel

Pacific Salmon Treaty



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Stock status, funding review, marine survival, and catch origin

Pacific Salmon Treaty

NOAA-Auke Creek Weir (SE Alaska)

(ADF&G, UAS, UAF partners)

- Climate assessment on Coho, pink, and sockeye
- Genetics of salmon behavior
- Out migration and returns of pink and coho salmon for ADFG management and Treaty tracking.

NOAA-Little Port Water Research Station

- Hatchery returns to augment data from other private hatcheries to inform the Treaty
- Science to support hatchery operations in AK

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Stock status, funding review, marine survival, and catch origin

- **Southeast AK Survey**: Annual assessment of stock status and health of pink and Chinook during early marine residence (ADF&G partnership)
- **Bering Sea surveys**: to provide forecasts and marine ecology relative to climate and collect ecosystem indicator data (ADF&G partnership)

Pacific Salmon Treaty

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Stock status, funding review, marine survival, and catch origin

- US – Canada: International commitment to the restoration, conservation and management of salmon upon which Yukon River communities depend.
- Yukon River Panel
  - recommends annual management measures for salmon originating in the Yukon River.
  - Chinook Technical Committee
  - Joint Technical Committee

Pacific Salmon Treaty - Yukon River Salmon Act of 2000

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Salmon conservation: production and climate

Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean

- Coordinating and participating in international research initiatives w/ member nations.
- Salmon carrying capacity and winter conditioning
- Lead and participate in International Year of the Salmon research surveys.

High Seas Driftnet Fisheries Enforcement Act

- Predictive models for high seas salmon distribution used by US Coast Guard to apprehend fishing vessels engaged in IUU
- Stock and species composition analysis of salmon collected on the high seas during enforcement actions.

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PARTNERSHIPS: community, state, international, industry, academic

AFSC Integrated Ecosystem Research that contain Salmon Marine Ecology Objectives – A collaborative effort with ADFG


Jim Murphy


Jeanette Gann


Lisa Eisner


Wess Strasburger

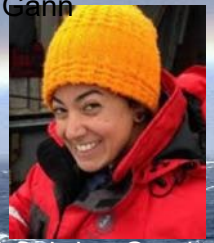

Alex Andrews


Elizabeth Siddon


Ed Farley


Ellen Yasumiishi


Kathrine Howard


Sabrina Garcia


Ben Gray

- Northern Bering Sea Survey
- Southern Bering Sea Survey
- Southeast Coastal Monitoring
- International Year of the Salmon

AFSC Integrated Ecosystem Surveys
Projects that have Pacific Salmon Marine Ecology Objectives

- The impact of Loss of Seasonal Sea Ice and warming on the food web, fish distribution, fitness, and survival.

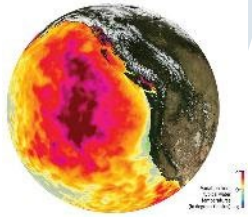
  Arctic, Northern and Southern Bering Sea (BASIS)

- Climate variability impacts on food web, distribution, fitness and survival within coastal regions of the Gulf of Alaska.

  Southeast Coastal Monitoring (SECM)

- Impact of Marine Heat Waves, salmon winter ecology.

  North Pacific – International Year of the Salmon



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Marine Critical Periods for Salmon

First Summer

Survival
- **Growth Rate**

Winter

Survival
- **Size and Fat Reserves attained during summer**

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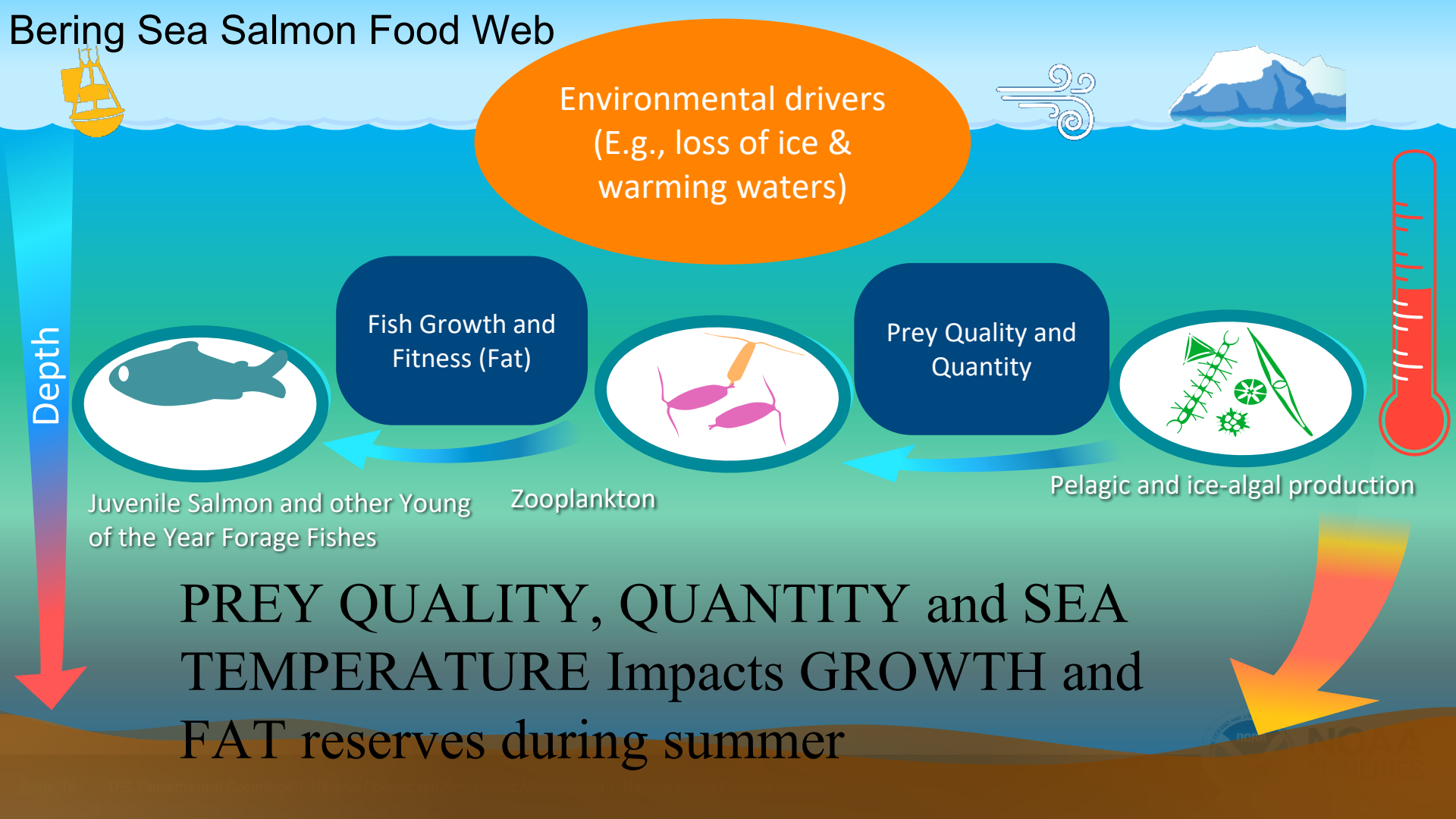
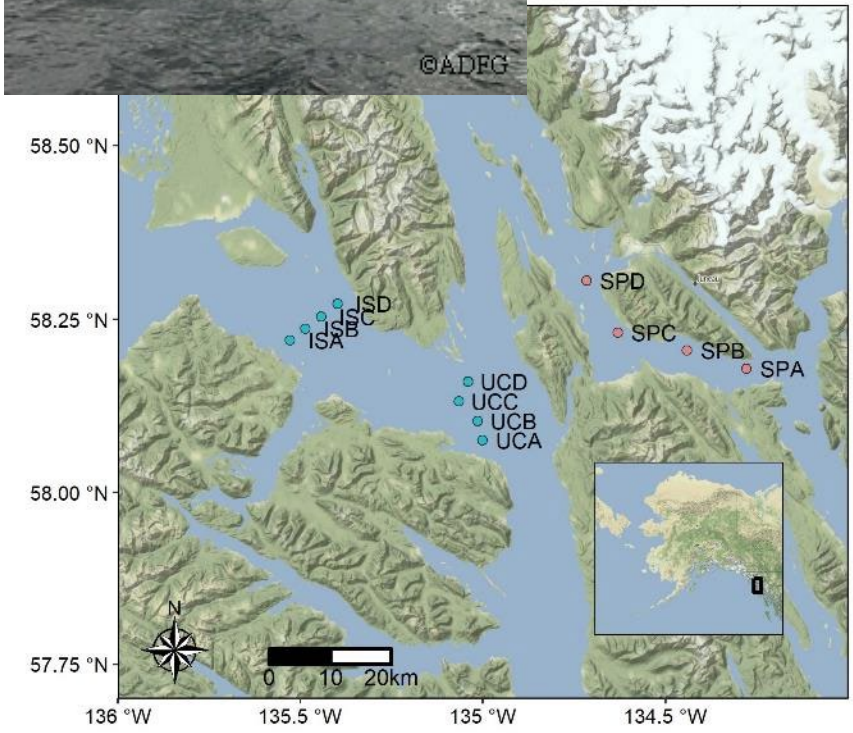
Bering Sea Salmon Food Web



PREY QUALITY, QUANTITY and SEA TEMPERATURE Impacts GROWTH and FAT reserves during summer

Southeast Coastal Monitoring (SECM)



When –June and July; 1997 to Present

Where – Northern Southeast Alaska

What – Ecosystem indicators including:

- bio/physical oceanography
- forage fishes
- Juvenile Pink salmon Index (forecast)
- Juvenile Chinook salmon Index (development)
- Juv. Chum salmon index (development)

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Southern Bering Sea (BASIS)

When –August-September; 2000 to Present
(Biennially since 2016-even years)

Where – Middle Domain

What – Ecosystem indicators including:

- Bio/physical Oceanography
- copepod index
- forage fish indices,
- age-0 groundfish indices
- Juvenile Bristol Bay sockeye salmon indices

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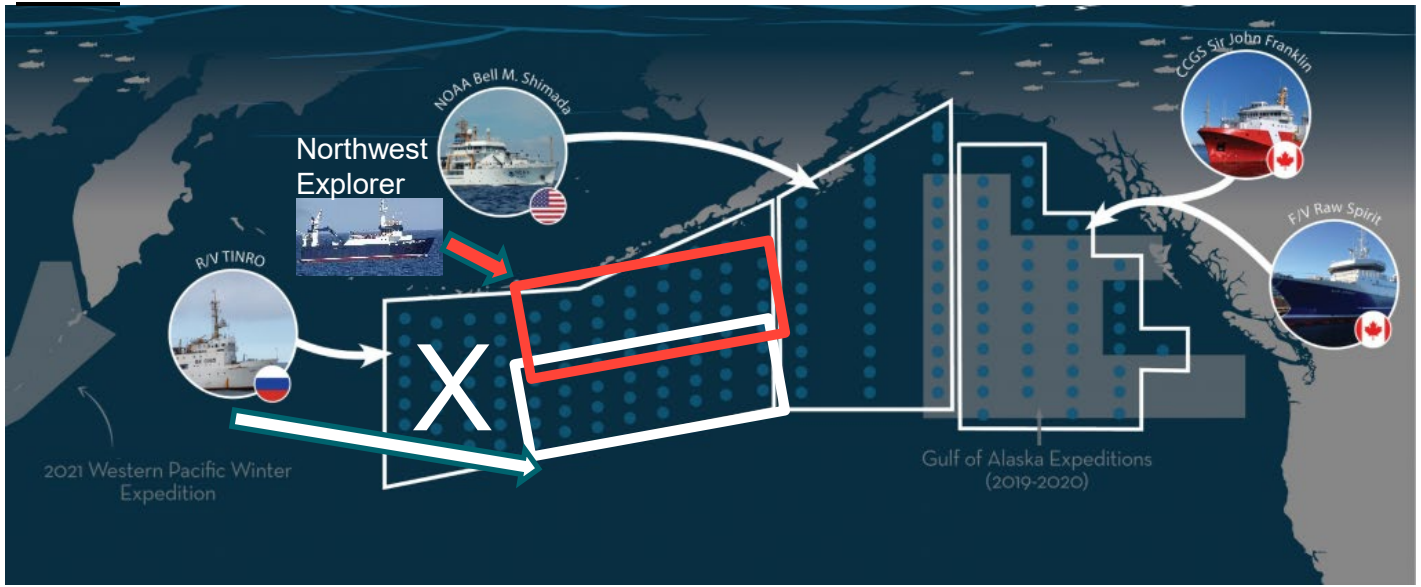
International Year of the Salmon
February – April 2022
LINK: https://npafc.org/iys/

Links to Winter Ecology for Western Alaska Chum salmon



North Pacific Anadromous Fish Commission (NPAFC) – Canada, Japan, Korea, Russia, United States

- **Winter Fitness** – stomach fullness; fat reserves; protein reserves
- **Predators** – eDNA
- **Competition** – food web; diet overlap; relative abundance
- **Distribution/Migration** – Genetics; otolith thermal marks; oceanography

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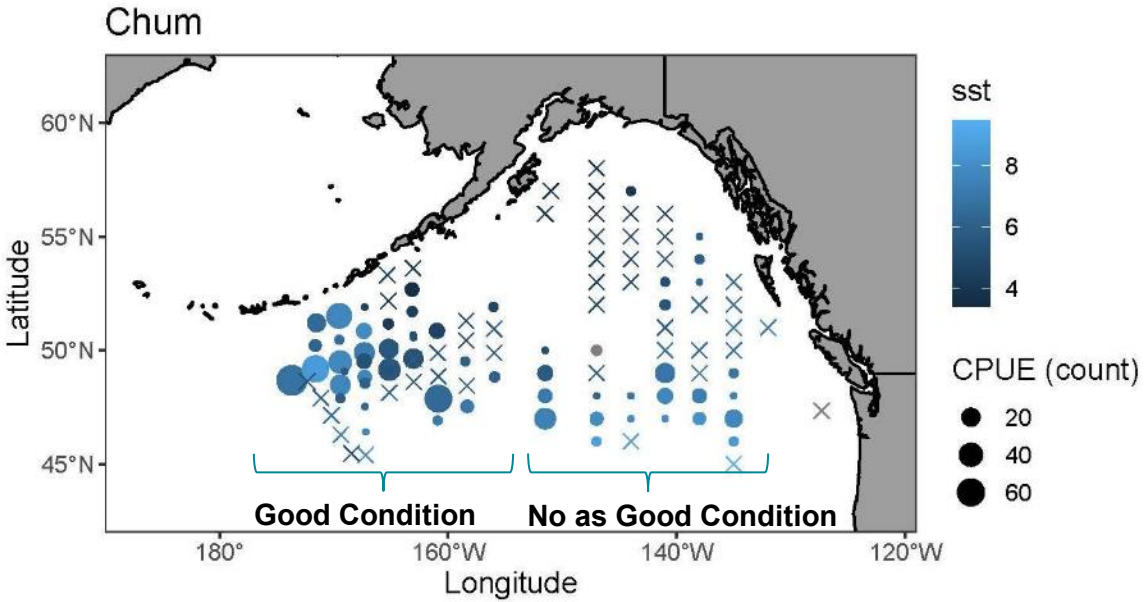
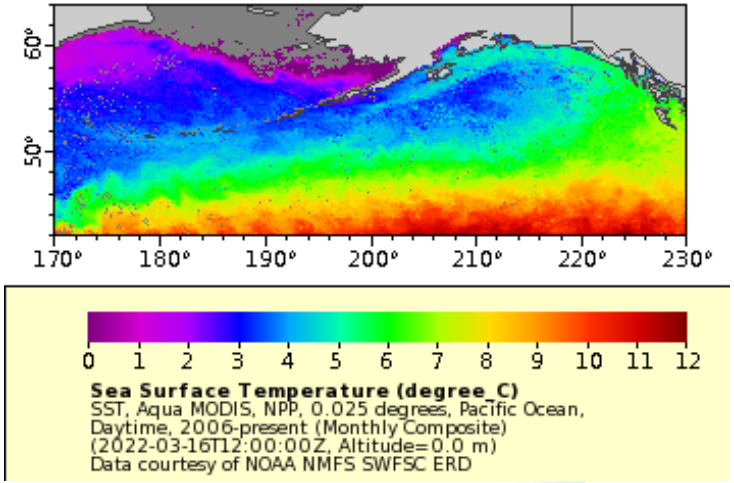
Immature Chum Salmon Distribution (Feb – early April)





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Northern Bering Sea

When: September 2002 to Present

Where: Northeastern Bering Sea

What: Ecosystem Metrics

- Juvenile salmon indices
- Copepod index
- Forage fish indices
- Benthic sampling – benthic –pelagic coupling

Physical Oceanography
Temperature

Biological Oceanography
Prey

Fish
Size, Diet, Energy

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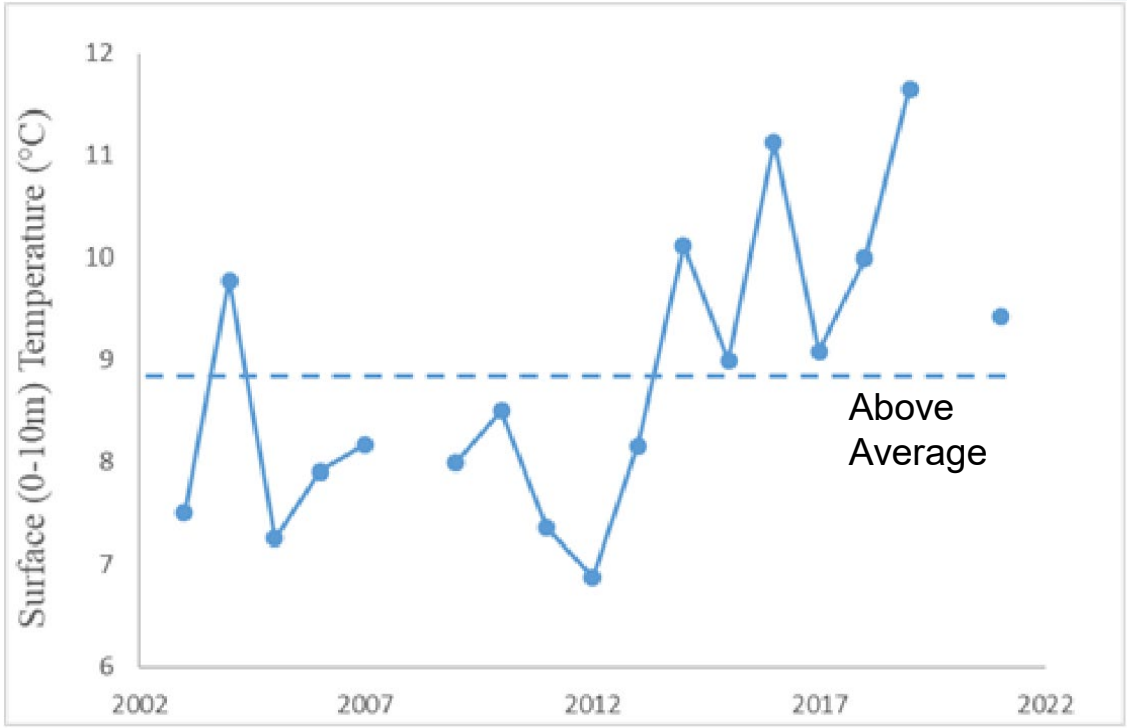
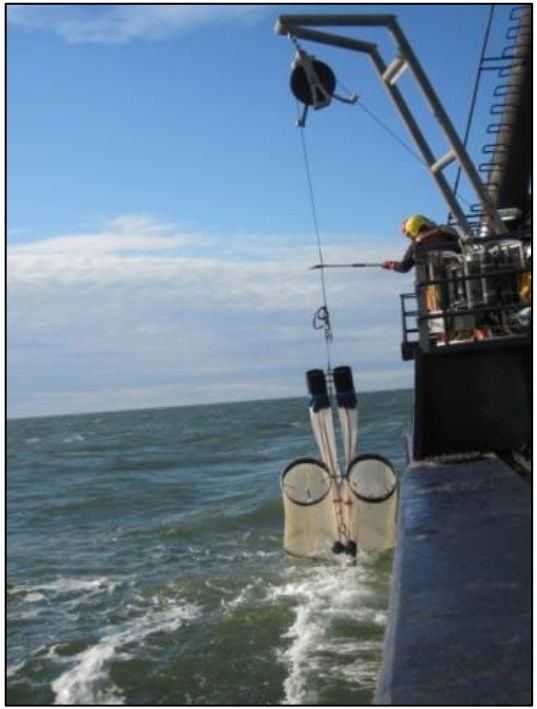
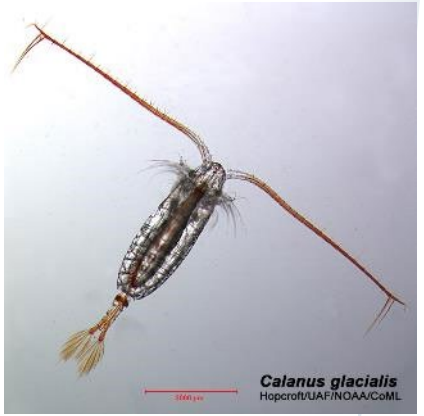
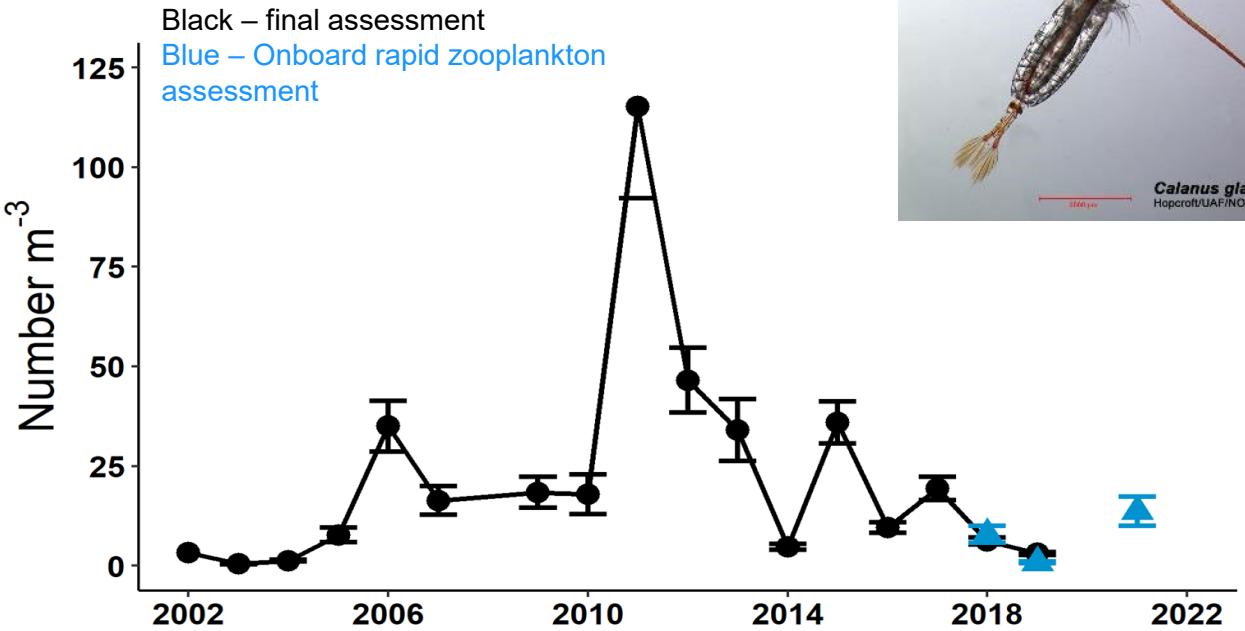
Northern Bering Sea Temperatures



Northern Bering Sea (Food Web)
Large Copepods – HIGH FAT CONTENT

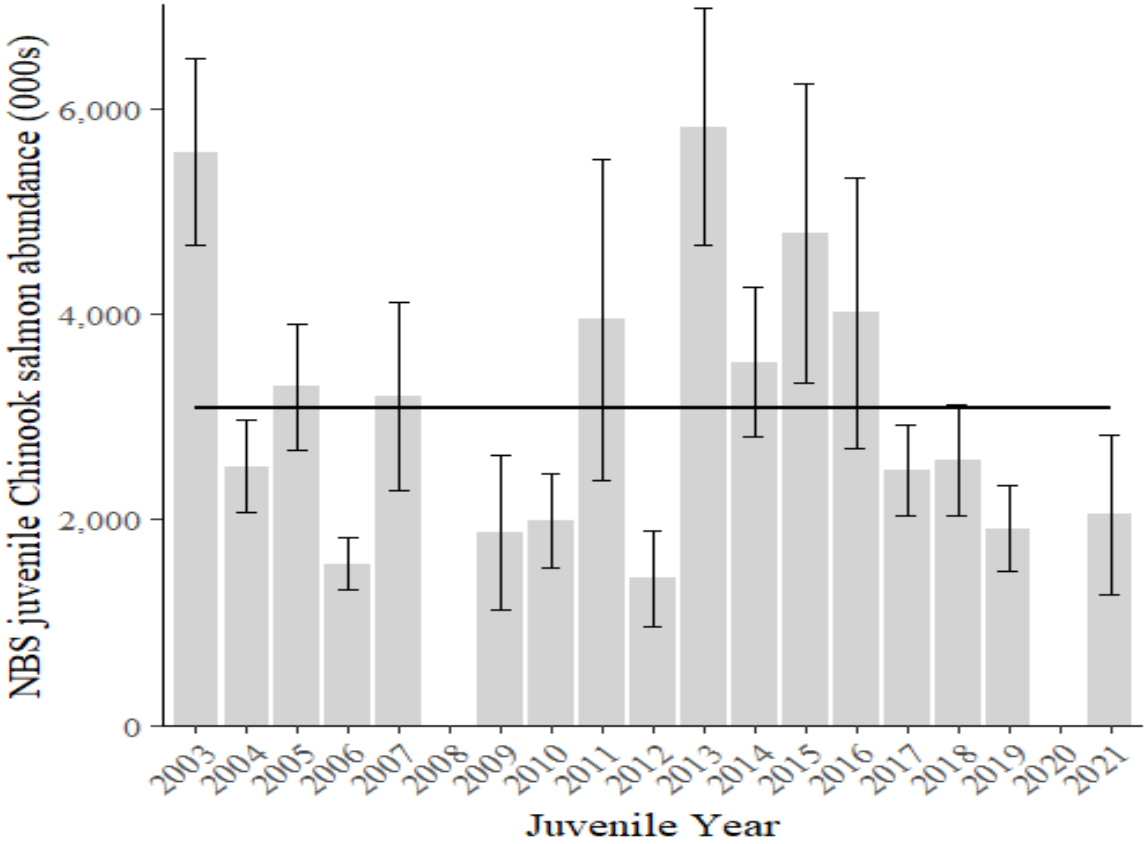






Warmer Summer Sea Temperature related to REDUCED numbers of Large Copepods

Juvenile Chinook salmon Abundance



Abundance of Juvenile Chinook has been below average since 2017

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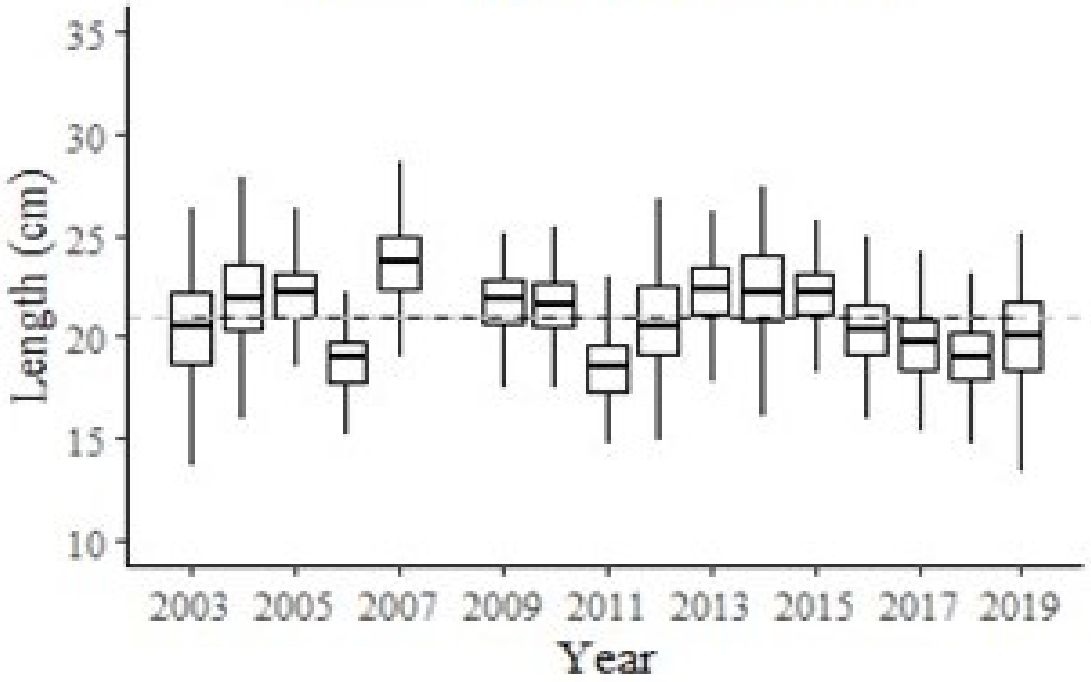
Juvenile Chinook salmon Length



Smaller than average Size during recent warm years

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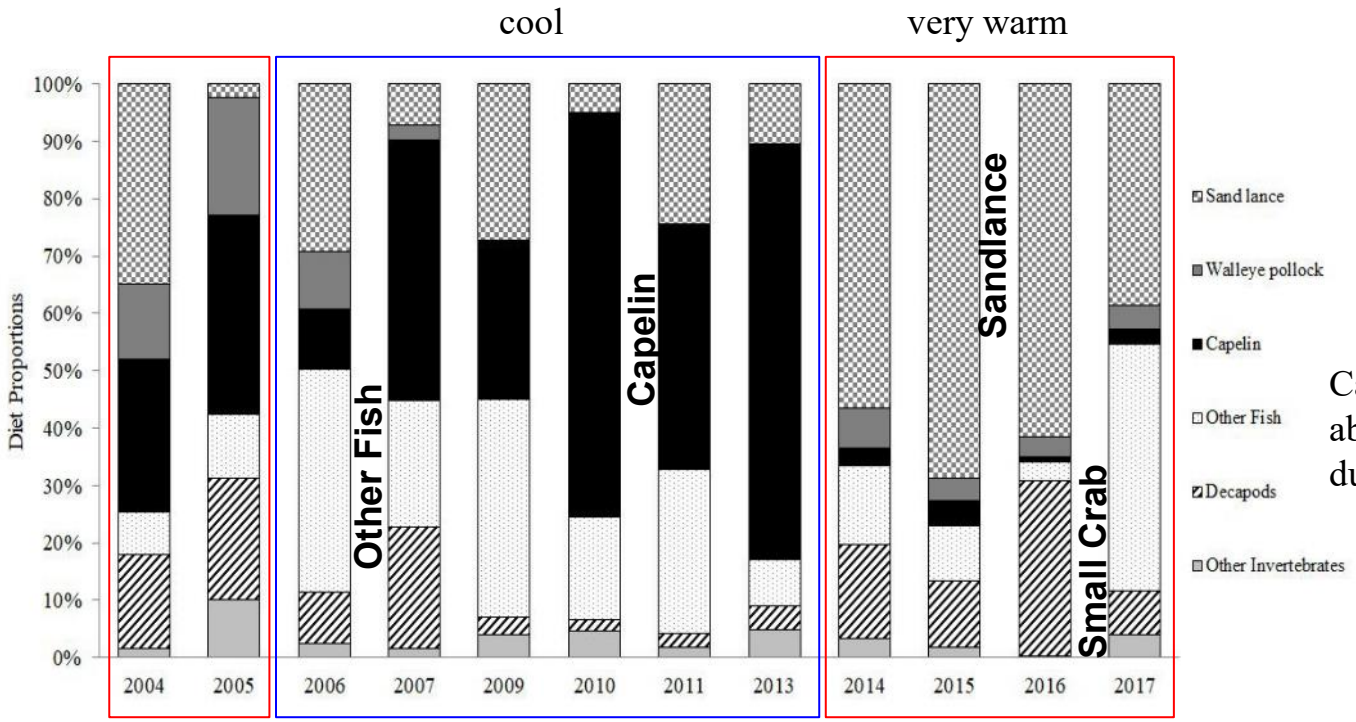
Juvenile Chinook Salmon Diet



Capelin, a high quality prey, are absent from Chinook salmon diet during recent warm years.

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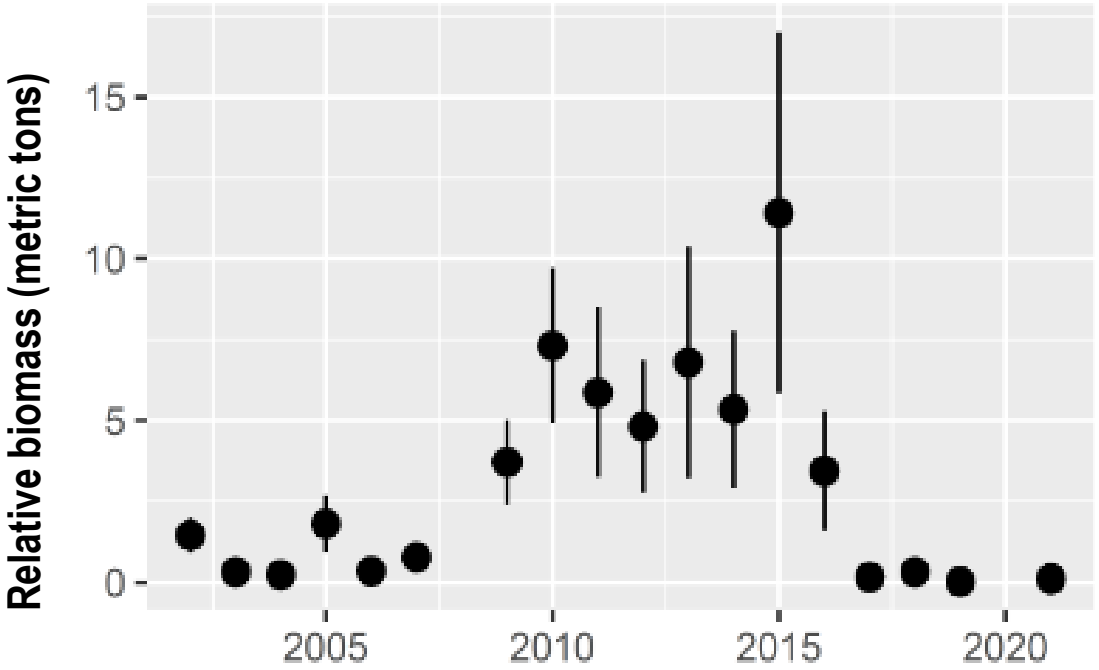
Capelin Relative Biomass

Less Capelin when warm



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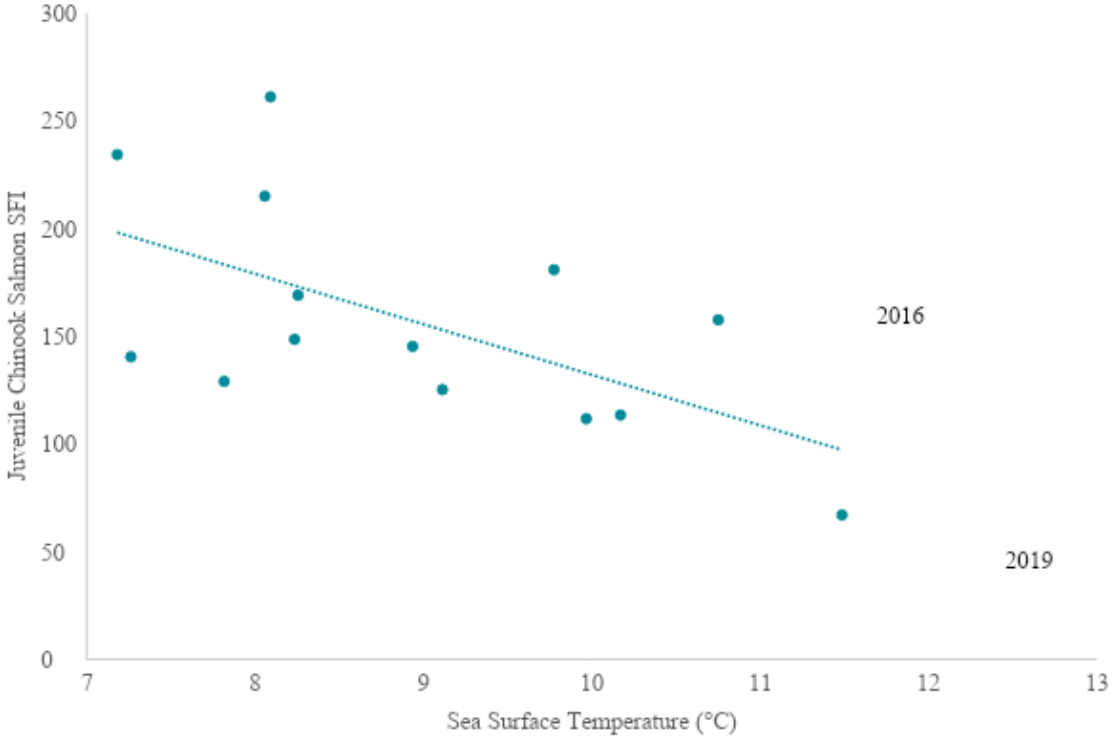
Juvenile Chinook salmon Stomach Fullness



Stomach fullness declines as ocean temperatures warm

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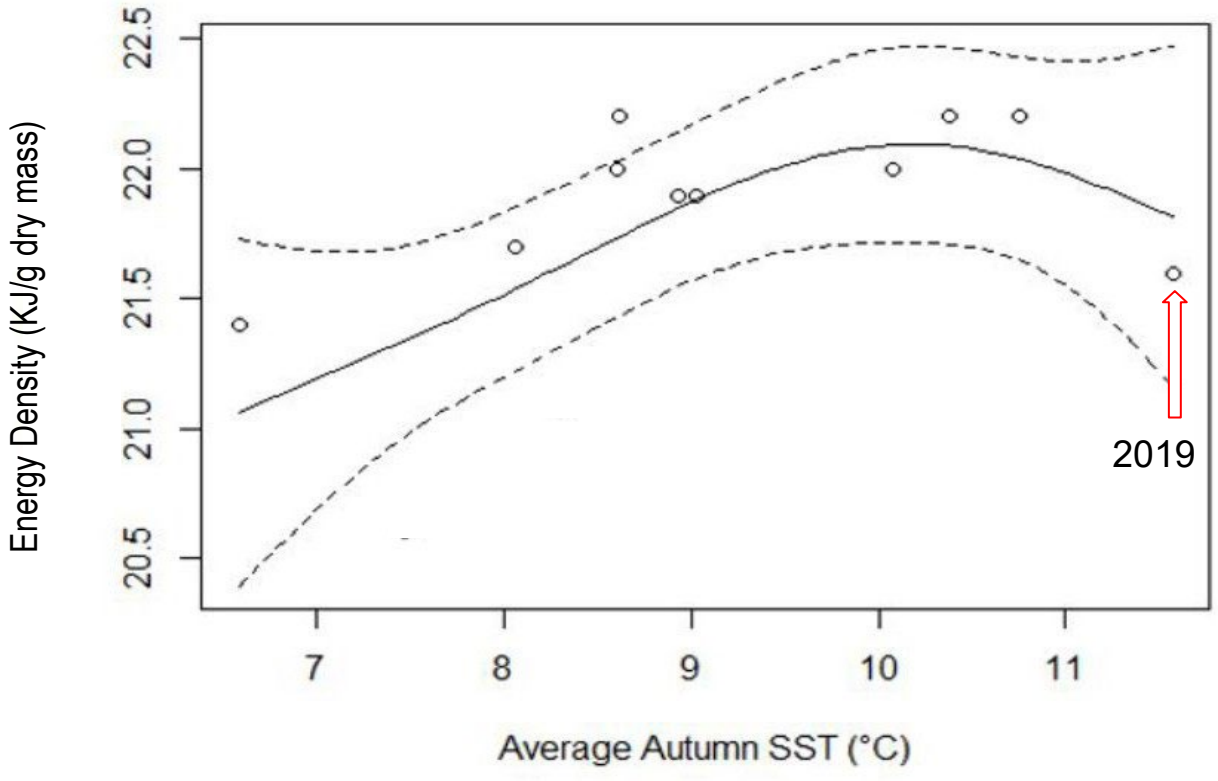
Juvenile Chinook salmon Condition



We noticed a decline in Condition during recent very warm year

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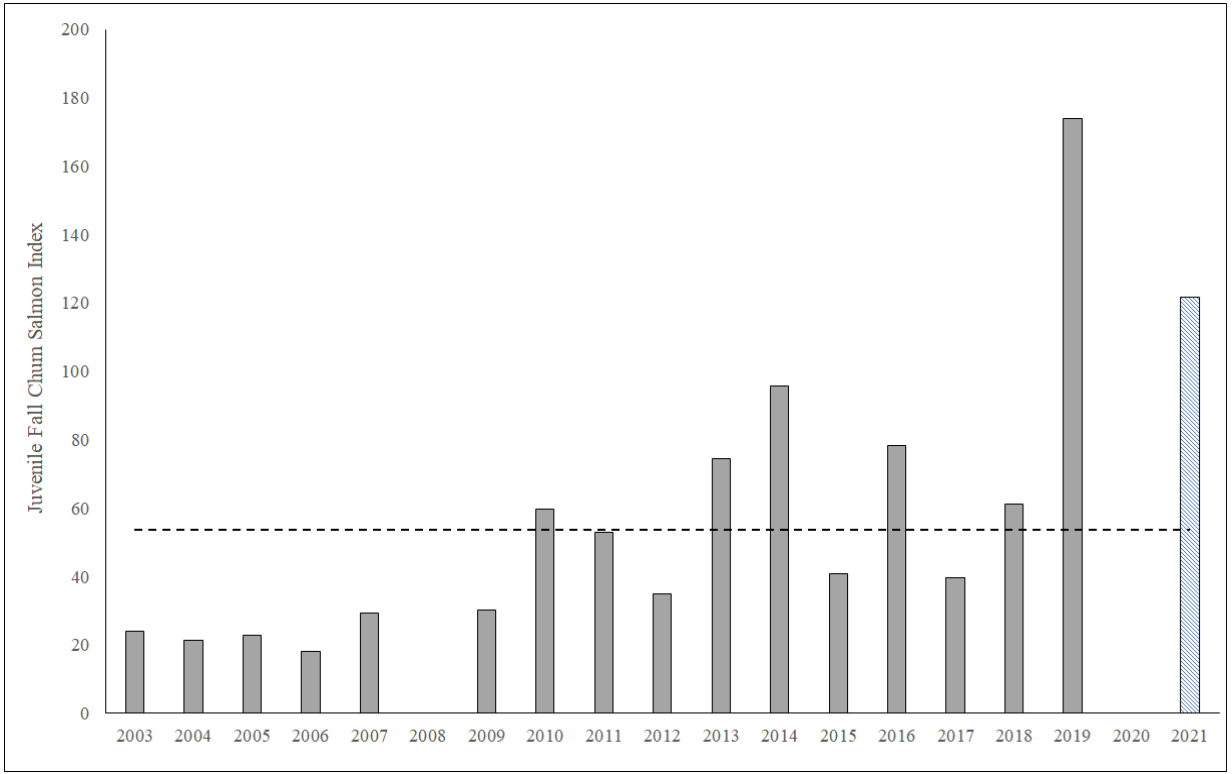
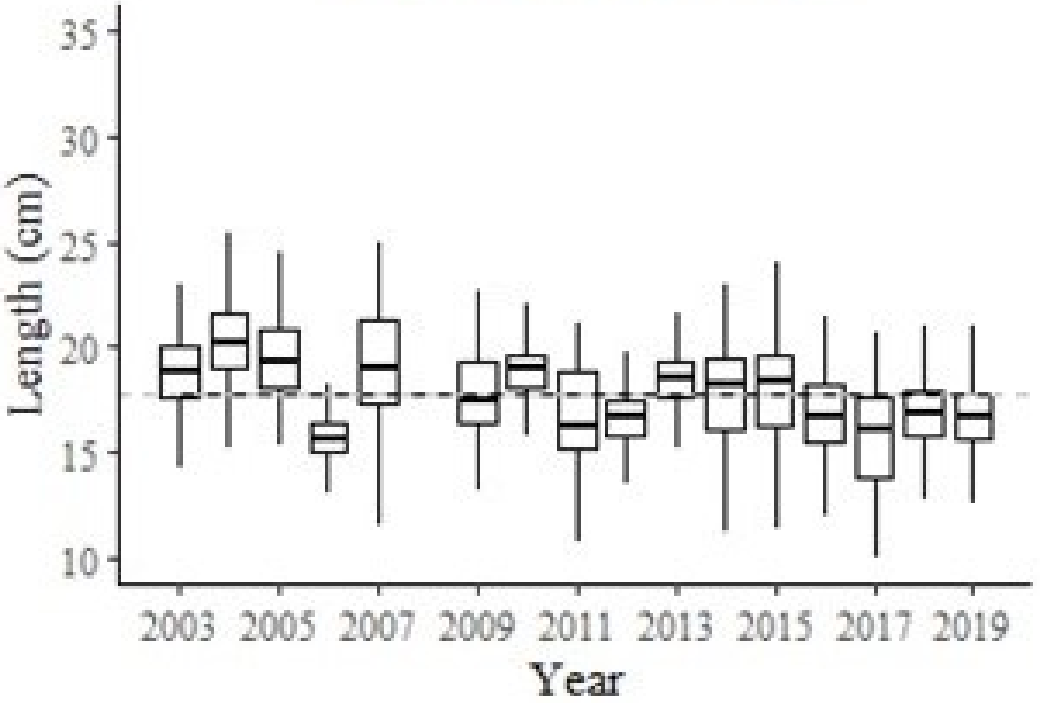
Juvenile Chum salmon Abundance Index



Abundance of Juvenile Chum salmon has been above average for most years since 2016

Juvenile Chum salmon Length



Similar to Chinook, Chum salmon Size at the end of summer is below average during recent warm years

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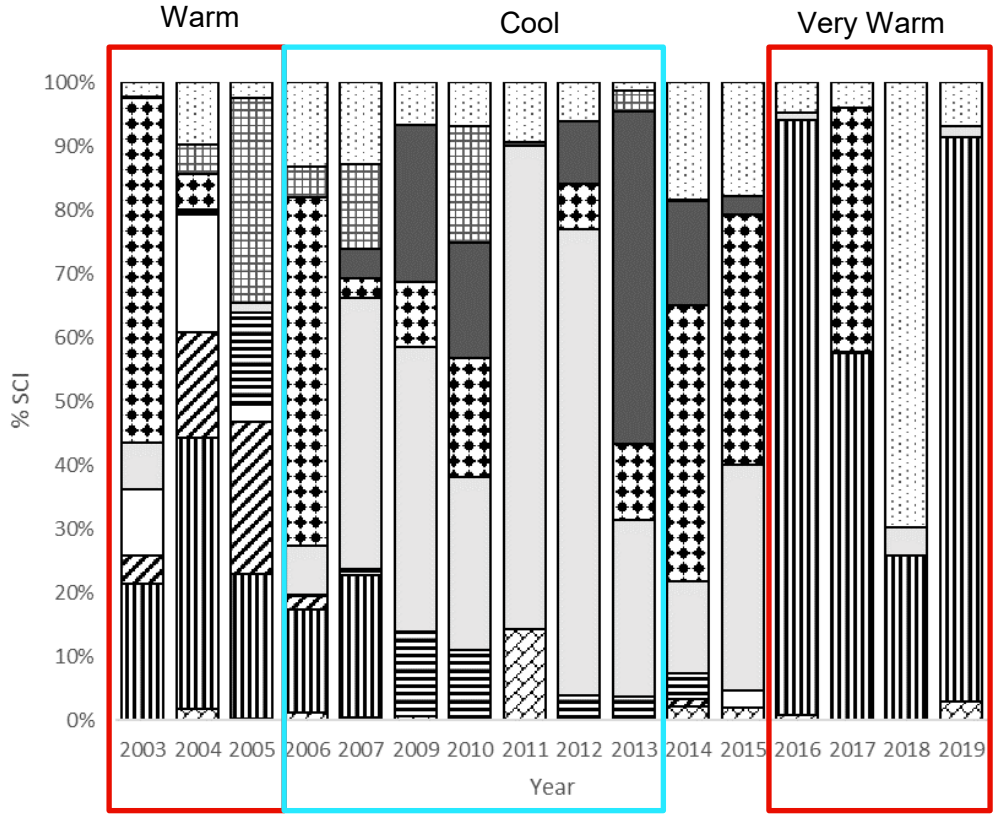
Juvenile Chum salmon Diet



- Other
- Thysanoessa raschii
- Themisto libellula
- Sand Lance
- Oikopleura spp
- Mallotus villosus
- Hermit Crab
- Gadus chalcogrammus
- Cnidaria
- Chaetognatha

Low quality prey - < ½ the caloric content of other prey items

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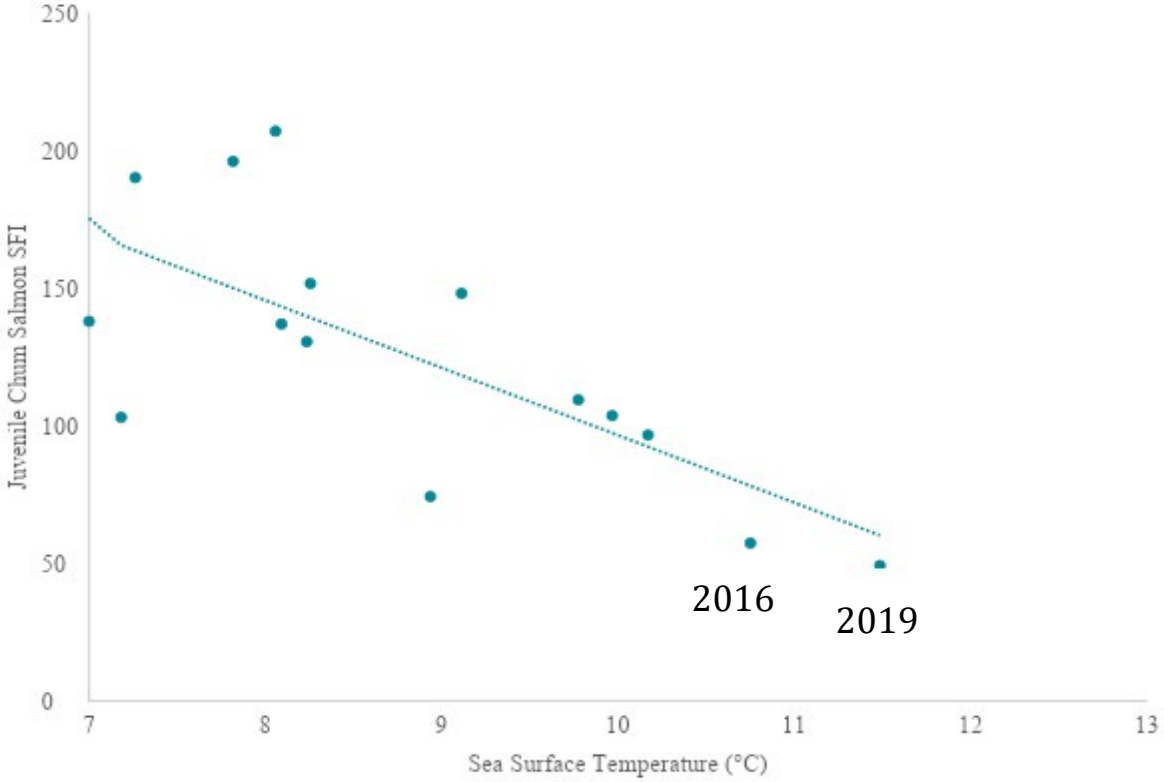
Juvenile Chum salmon Stomach Fullness



Stomach fullness declines as ocean temperatures warm

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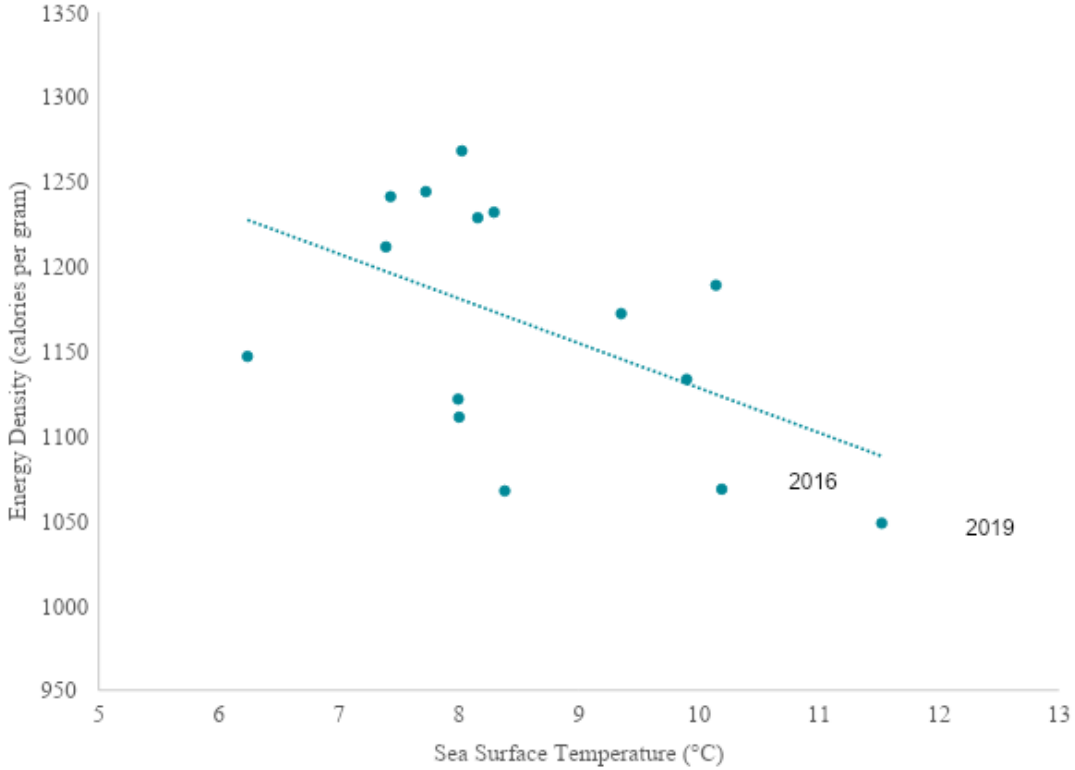
Juvenile Chum salmon Condition



Decline in Condition when Chum salmon are feeding primarily on low quality prey

Partnerships

Our strongest marine research programs are through partnerships

These collaborations help us identify where bottlenecks occur in salmon life history

Ocean surveys provide management advice and inform stakeholders on potential numbers of salmon returning in the future.

Coastal Impacts Assistance Program

Alaska Sustainable Salmon Fund

Thank You!

AFSC Salmon Research Website
https://www.fisheries.noaa.gov/alaska/sustainable-fisheries/collaborative-marine-salmon-research-foundational-understanding

AFSC 2021 Year in Review
https://www.fisheries.noaa.gov/alaska/2021-alaska-fisheries-science-center-year-review

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