

ECOSYSTEM STATUS REPORTS

Stephani Zador
Elizabeth Siddon
Ellen Yasumiishi

NPFMC, Homer
October, 2019

Early Warnings:
Bering Sea and Gulf of Alaska



Meeting objectives:

1. To identify areas of concern or unusual conditions that may be relevant to ecosystem and stock assessments.
2. To inform upcoming surveys and the Council process.



Bering Sea

- ▶ 2nd winter of low sea ice in the NBS.
- ▶ Gray whale Unusual Mortality Event (UME).

Gulf of Alaska

- ▶ Marine heatwave since Sept 2018.
- ▶ Low abundance of larval fish.



 2019 climate and oceanography

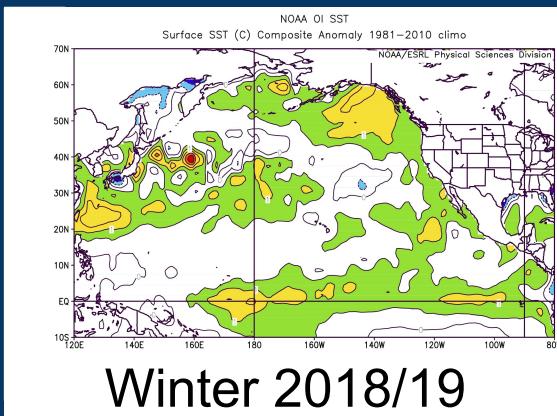
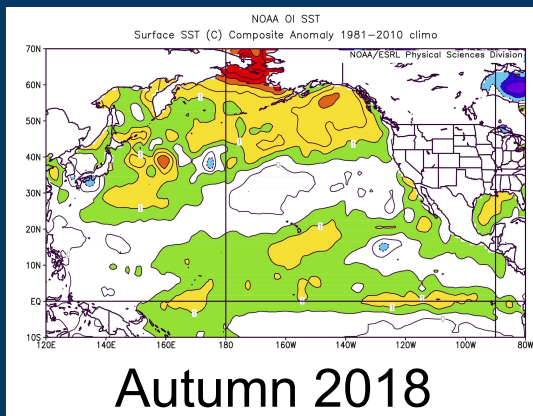
 2019 early warnings for the Bering Sea and Gulf of Alaska

 2020 sea surface temperature forecasts

Sea Surface Temperature Anomalies

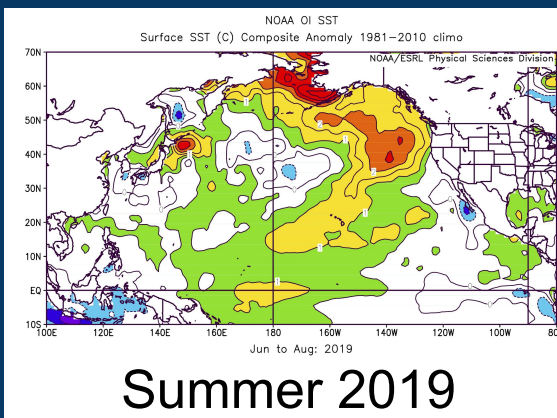
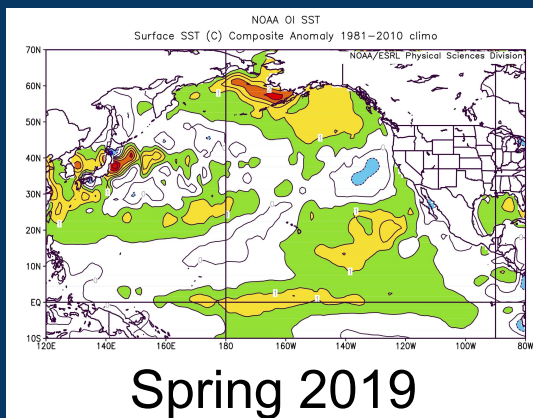
Bond

Warmth in the north delayed sea ice formation



Modulation of temperatures; weak El Niño

Warm temperatures in the EBS



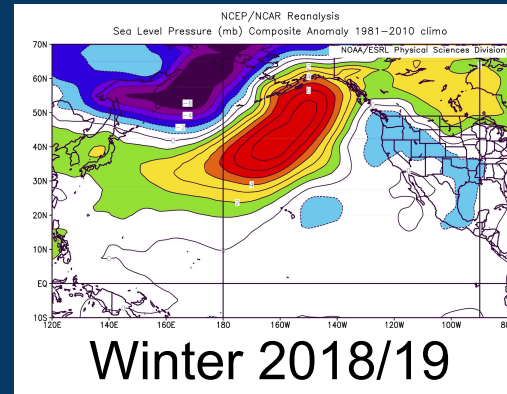
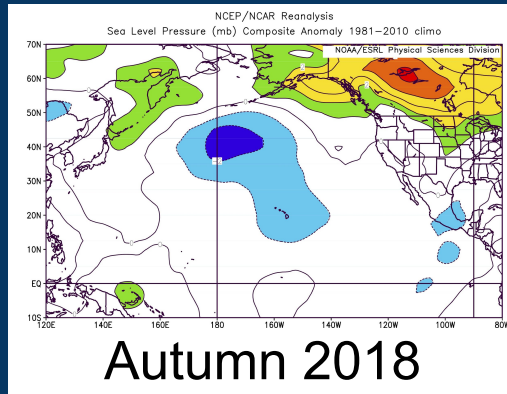
Increased warming in the EBS/GOA and PNW; beginning positive PDO pattern



Sea Level Pressure Anomalies

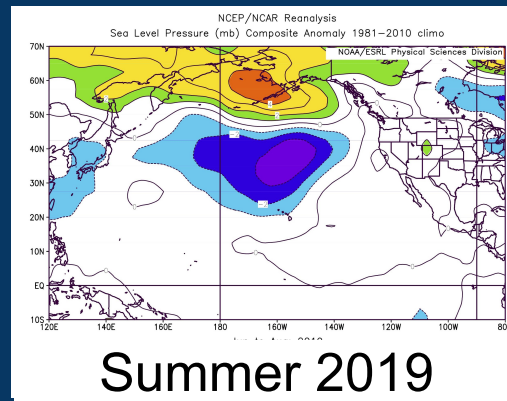
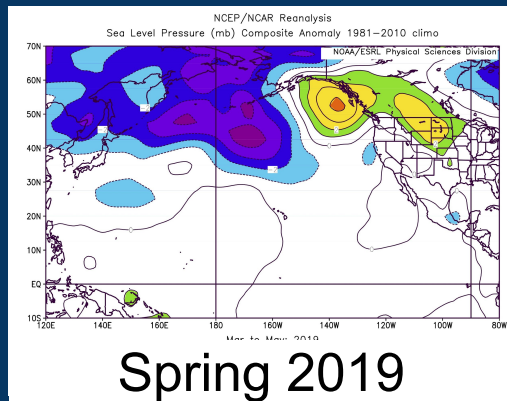
Bond

Suppressed storminess in the GOA related to development of warm SSTs



Highly unusual pattern with El Niño. Strong southern winds across the Bering (2nd winter)

Continuation of warm air flow from the south over the EBS and WGOA



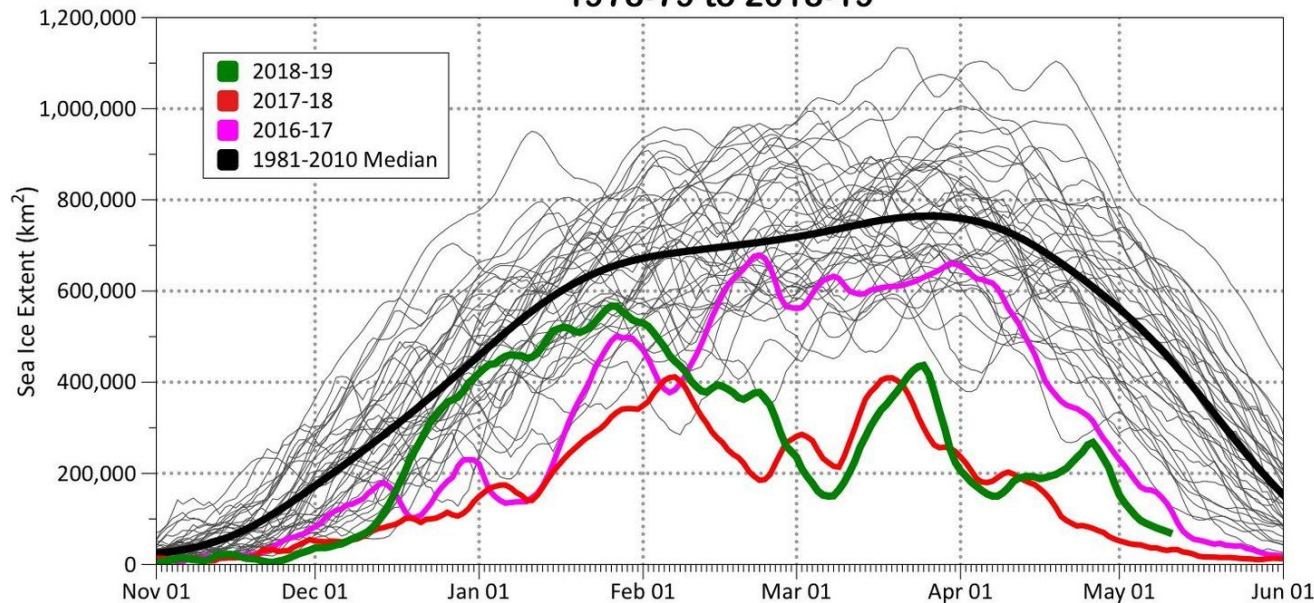
Suppressed storminess in the EBS/GOA contributing to warmth



Bering Sea sea ice extent

Thoman, Bond

Bering Sea Daily Ice Extent
1978-79 to 2018-19



A double whammy!

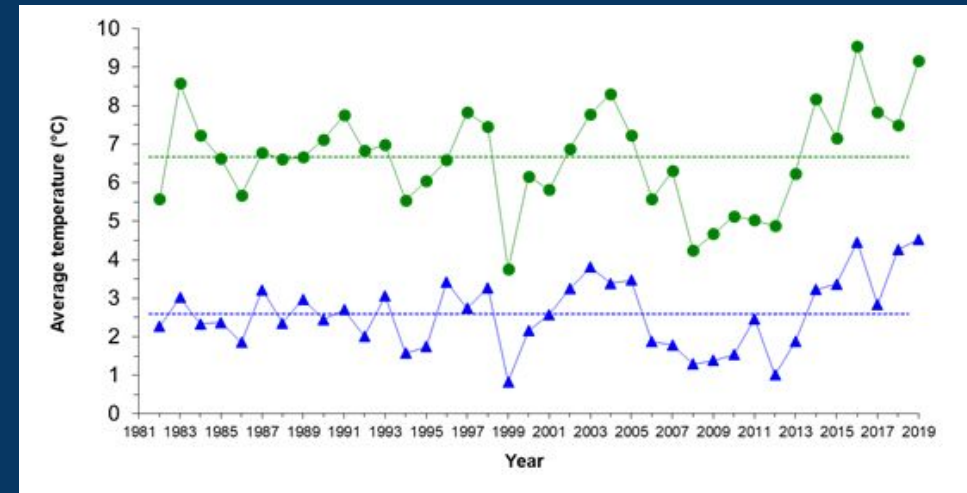
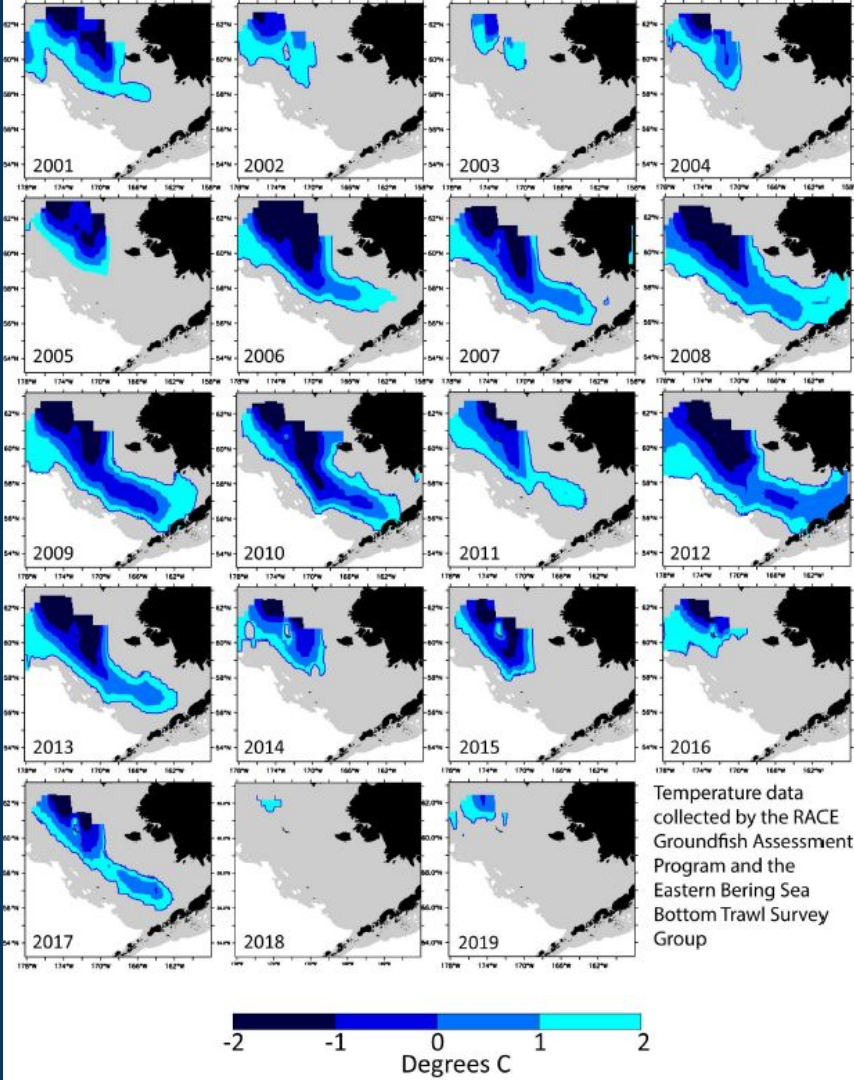
2nd winter of low sea
ice in the Bering Sea.

Early winter ice, but
southerly winds in
Feb caused retreat.

EBS cold pool and temperatures

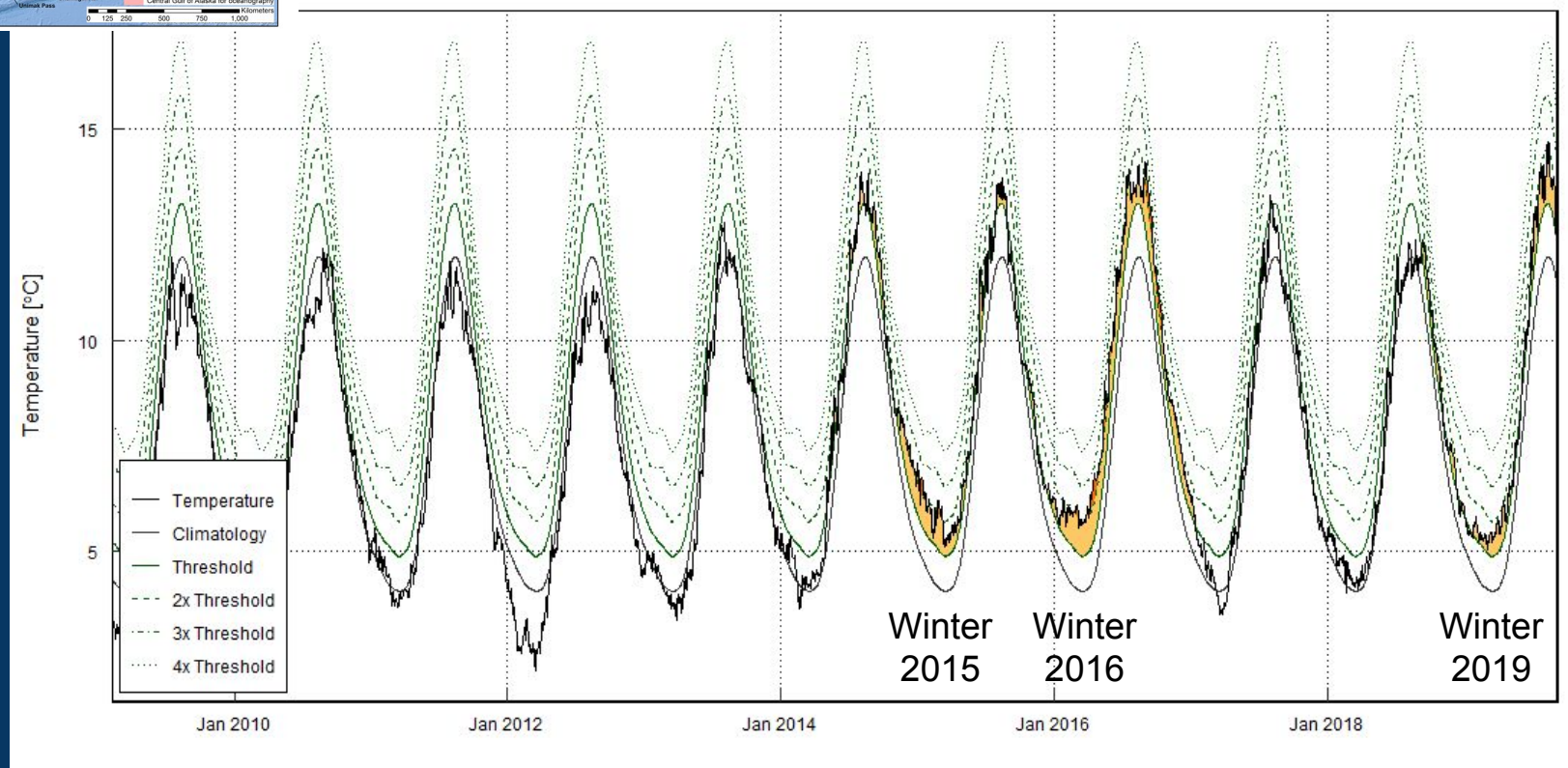
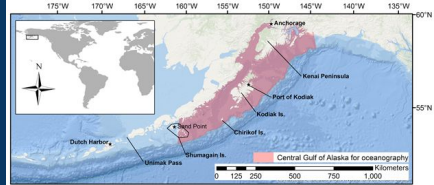
Ladd, Britt

- Second smallest cold pool
- Warmest bottom temperature
- 2nd warmest surface temperature



Western Gulf of Alaska heatwave

Barbeau

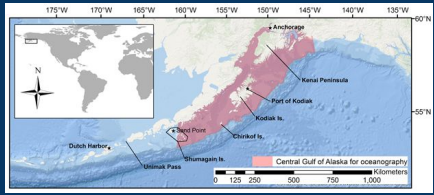
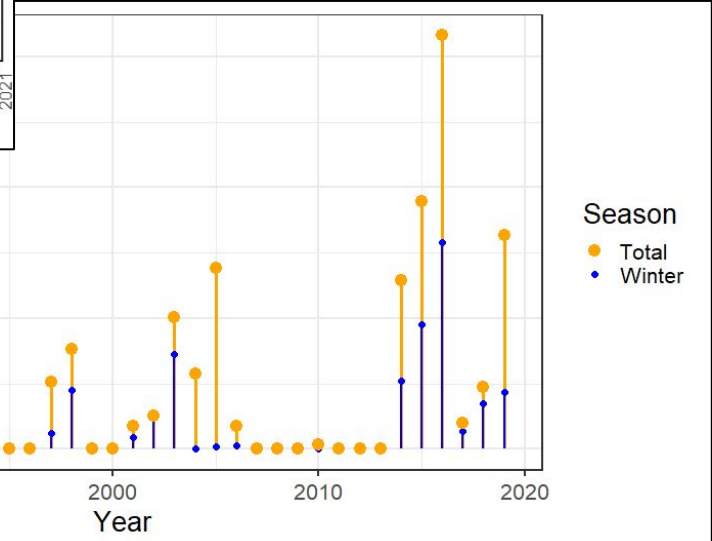
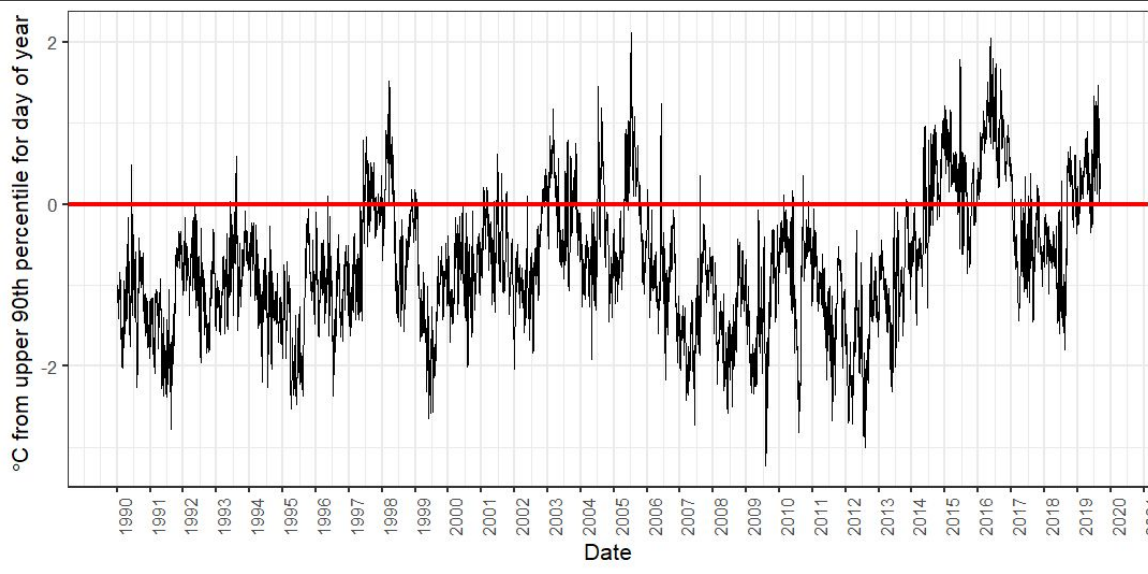


Western Gulf of Alaska heatwave

Barbeaux

New heatwave

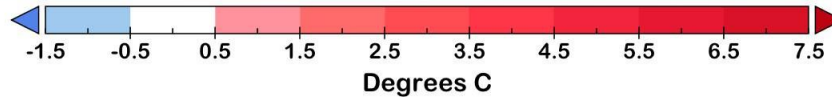
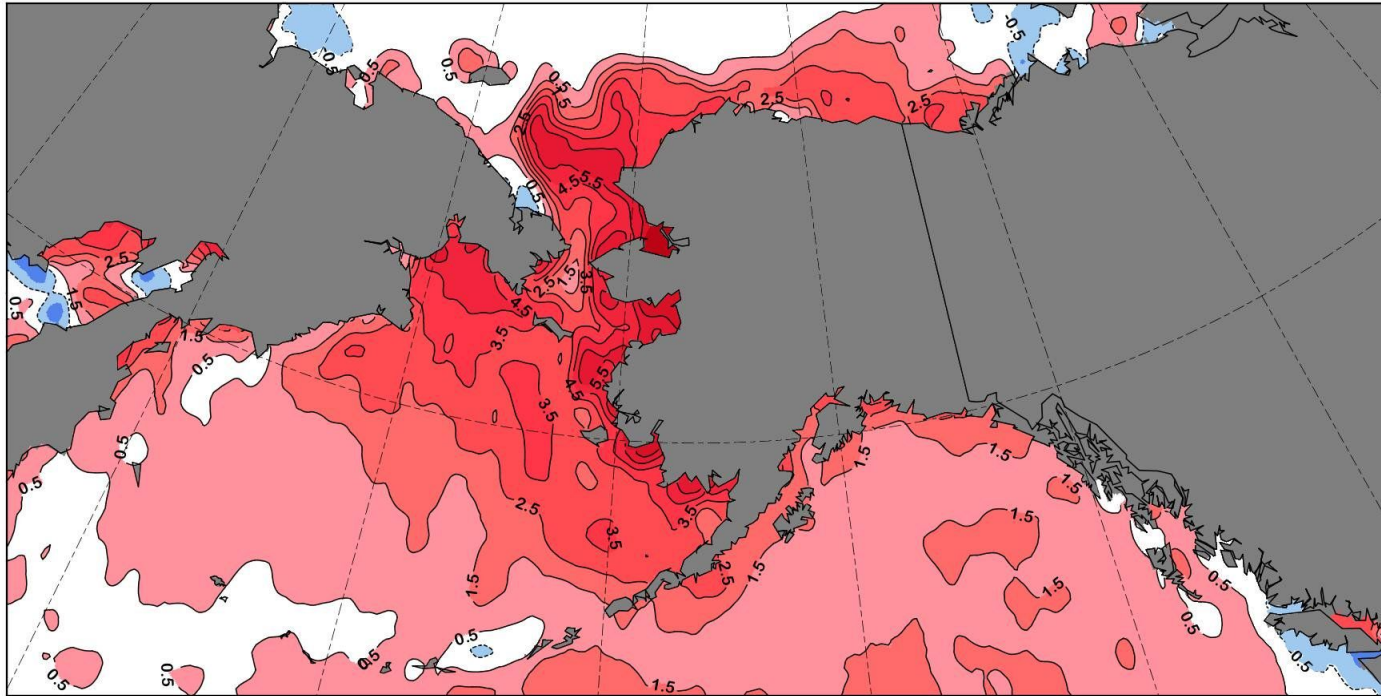
- Similar sustained warmth as 2014.
- Number of heatwave days in 2019 already similar to 2015 (through Sept 10).



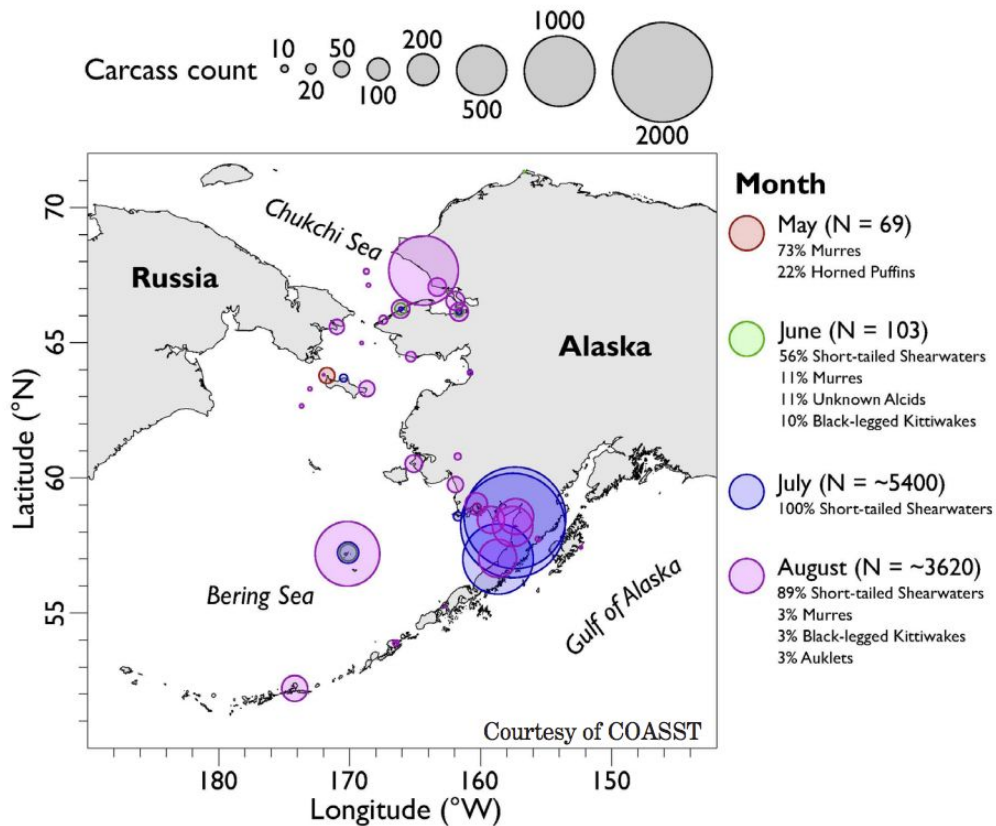
Ecosystem 'red flags'

Sea Surface Temperature Departure From Normal

June 2019



Seabirds



Mainly short-tailed shearwaters.

Most birds were emaciated.

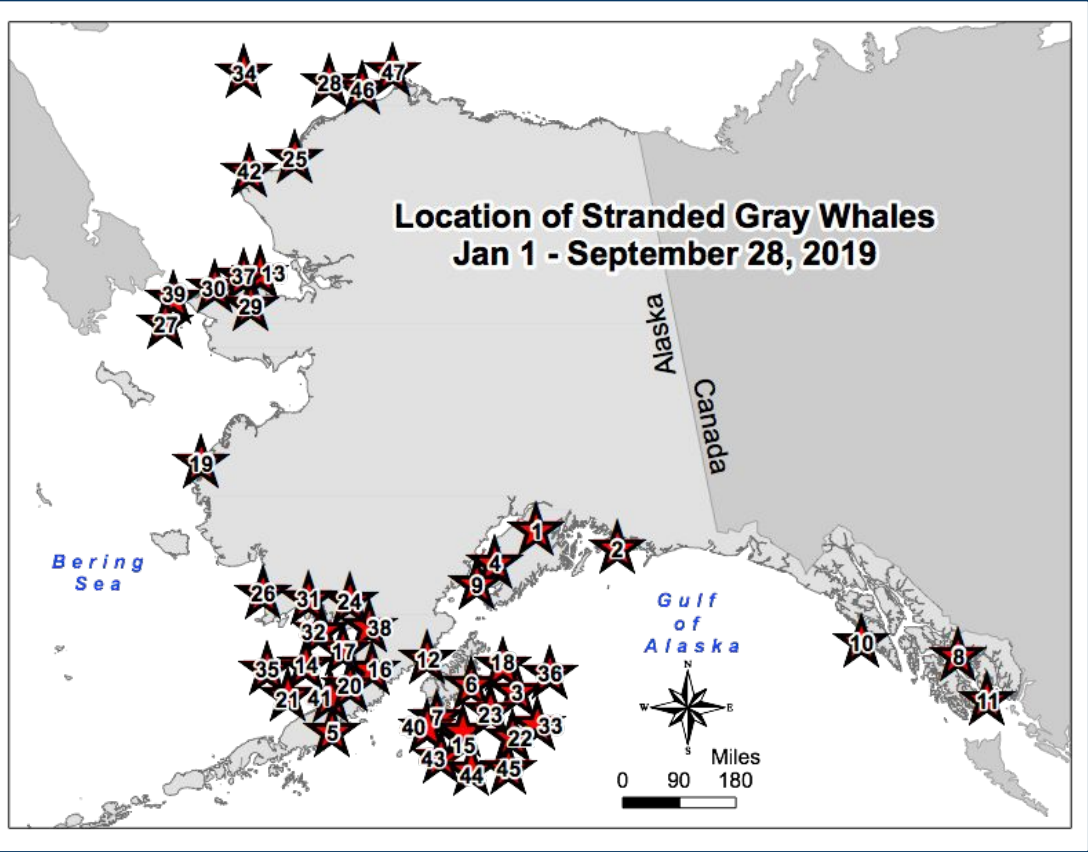
Saxitoxin linked to Arctic Tern mortality in southeast Alaska (EGOA).



Updated September 9, 2019

Gray whale UME

Savage



Gray Whale Strandings in 2019

Canada	10
US Total	124
Alaska - 47	
Washington - 34	
Oregon - 6	
California - 37	
Mexico	81
Total	215



Gray whale UME

Savage

Preliminary necropsy results show evidence of emaciation.

Annual migration of up to 20,000 km.

- Summer and fall in the Bering and Chukchi Seas feeding.
- Feed on amphipods, mysids, crab larvae.
- Overwinter (mating, calving) along the west coast of southern Baja California Peninsula.



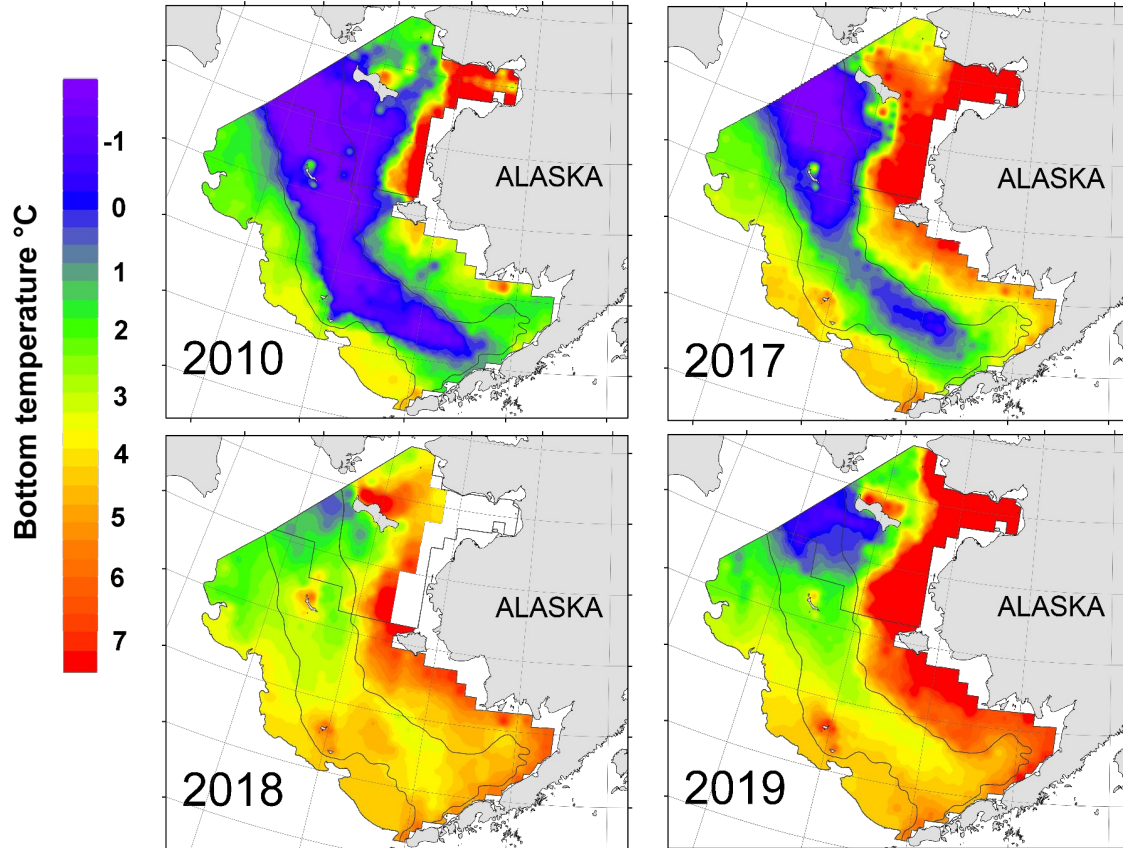
Suzie Hanlan
NOAA/NMFS/AFSC/MML
NMFS Permit No. 204655
Funded by BOEM (IA Contract No. M17PG00031)

A map of the Bering Sea region, showing the coastline of Alaska and the Bering Sea to the west. The map is overlaid with a grid of latitude and longitude lines. A white outline highlights the Bering Sea area. A white rectangular box is positioned on the right side of the map, containing the text "Bering Sea".

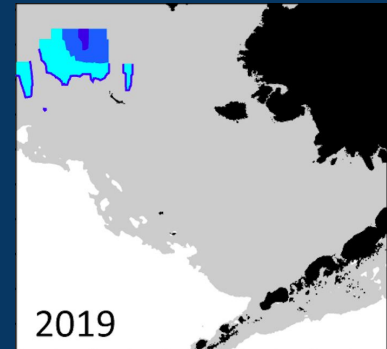
Bering Sea

BT survey bottom temperatures

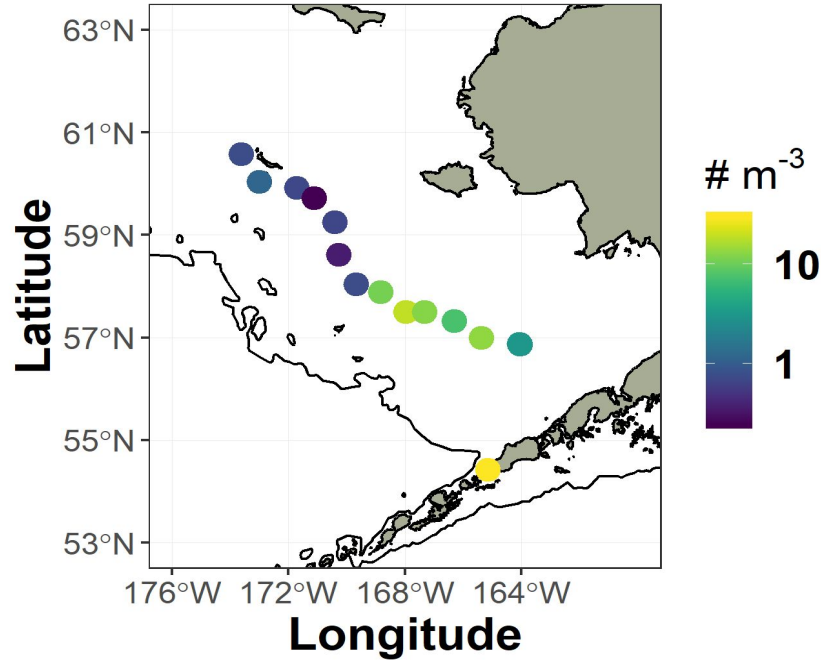
Britt



- 2018 had no cold pool, but inner domain temperatures were not as warm as 2019.
- 2019 had a small cold pool up north and the inner domain was very warm.



Spring Large Copepod Abundance



Spring SEBS

- Small copepod abundance higher compared to historical average.
- Large copepod abundance low; north/south gradient.

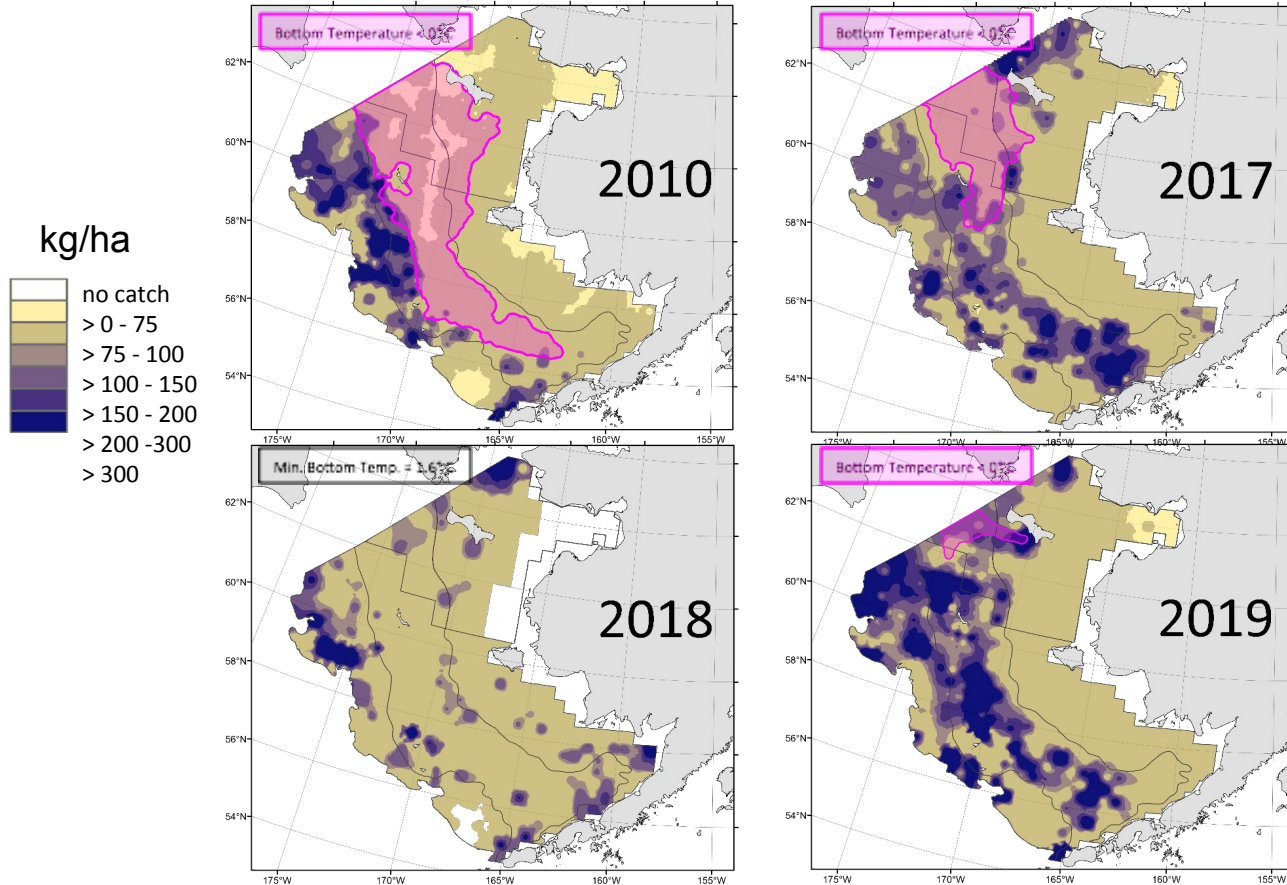
Fall NBS

- Small copepod abundance high.
- Large copepod abundance low.



BT survey: Walleye pollock

Britt



SEBS (movement)

- Biomass +75% from 2018 (at 5.46 mmt). Just above the long-term mean.
- Abundance +53%.

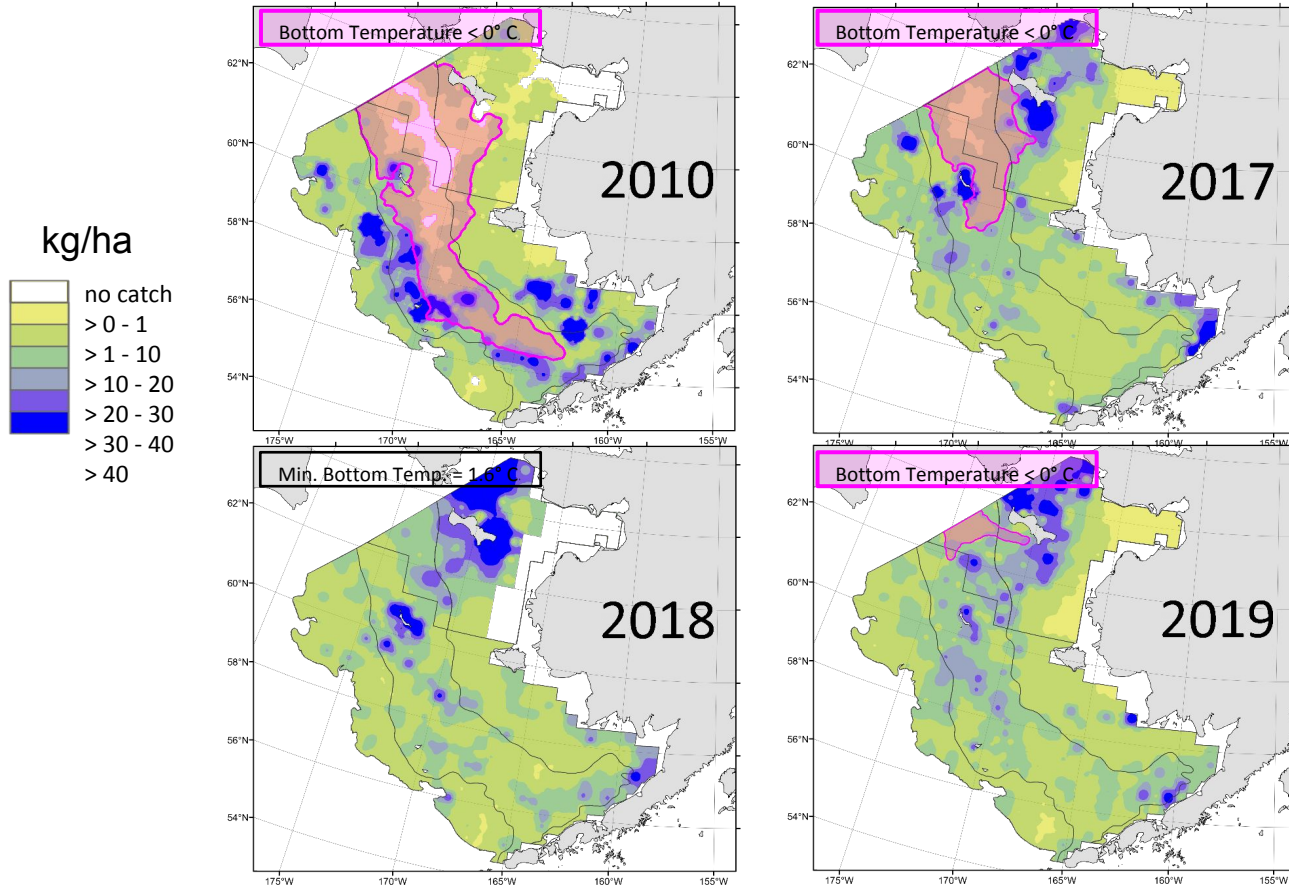
NBS (recruitment)

- Biomass -11% from 2017 (at 1.17 mmt).
- Abundance +59%



BT survey: Pacific cod

Britt



SEBS (recruitment)

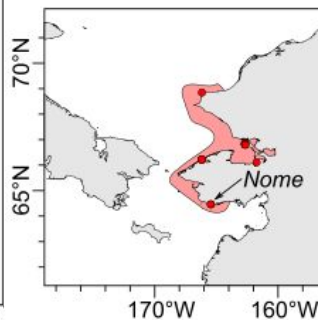
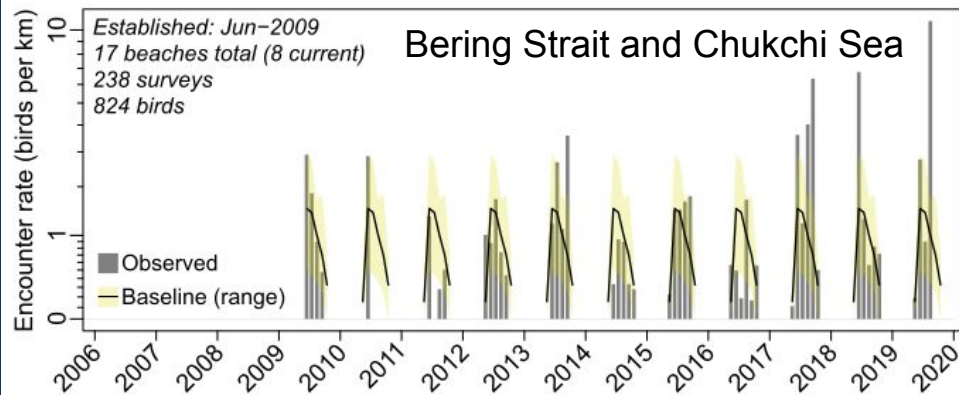
- Biomass +2% from 2018 (at 517K mt). Below the long-term mean.
- Abundance +112%.

NBS

- Biomass +30% from 2017 (at 368K mt).
- Abundance +52%.

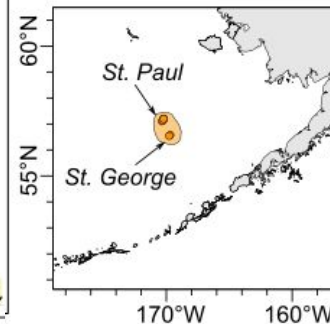
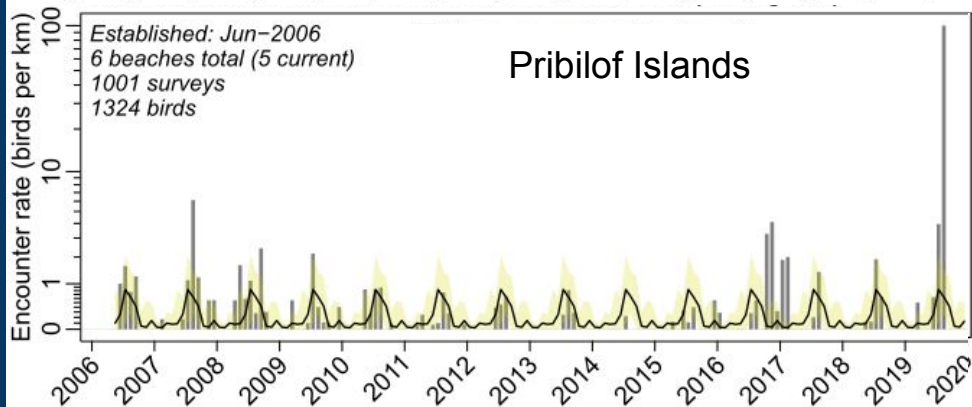
Seabirds

COASST, AMNWR



NBS

- Die-off events have occurred in 2017-2019.
- Shearwater die-off extended north in August.
- Also other species (murre and kittiwakes).



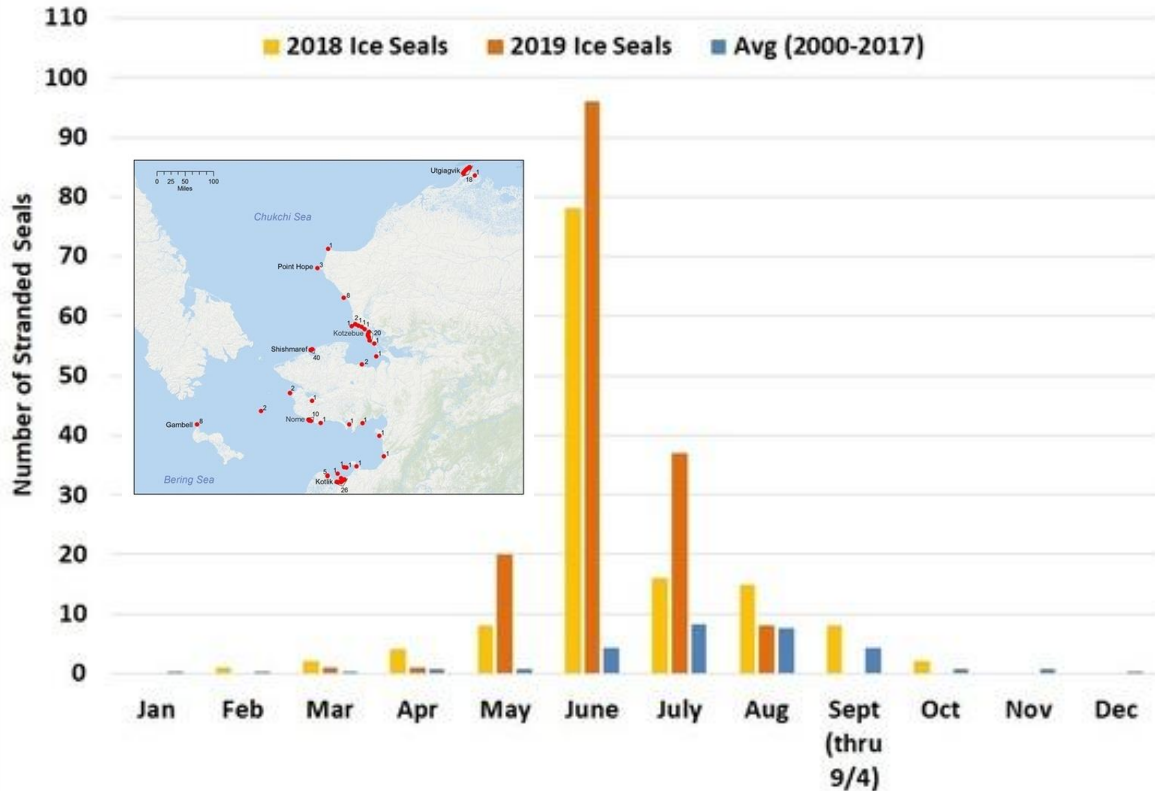
SEBS

- Extremely large die-off event in 2019 of shearwaters.
- But, seabirds at colonies appear to have done fairly well.

Ice seal UME

Boveng

Ice Seal Strandings by Month



- In 2018 & 2019, 282 ice seal carcasses were reported from the Bering and Chukchi seas.
- Mainly young and emaciated.
- Approximately 5-7 times the 2000-2017 annual average.
- Dramatic loss of sea ice habitat and competition for prey with shifts in fish distributions.

EBS: Implications



2nd winter of low sea ice in NBS; unprecedented warm inner domain. Impacts to fish distribution.



Zooplankton prey base dominated by small, lipid-poor copepods; low abundances of large copepods and euphausiids. Impacts to carrying capacity throughout the system.



Pollock increase represents movement of adult fish into SEBS; PCod biomass continues to increase in the NBS.



Seabird die-off (mainly short-tailed shearwaters) attributed to starvation. Concerns about food security in NBS. Seabirds at colonies did better than expected.

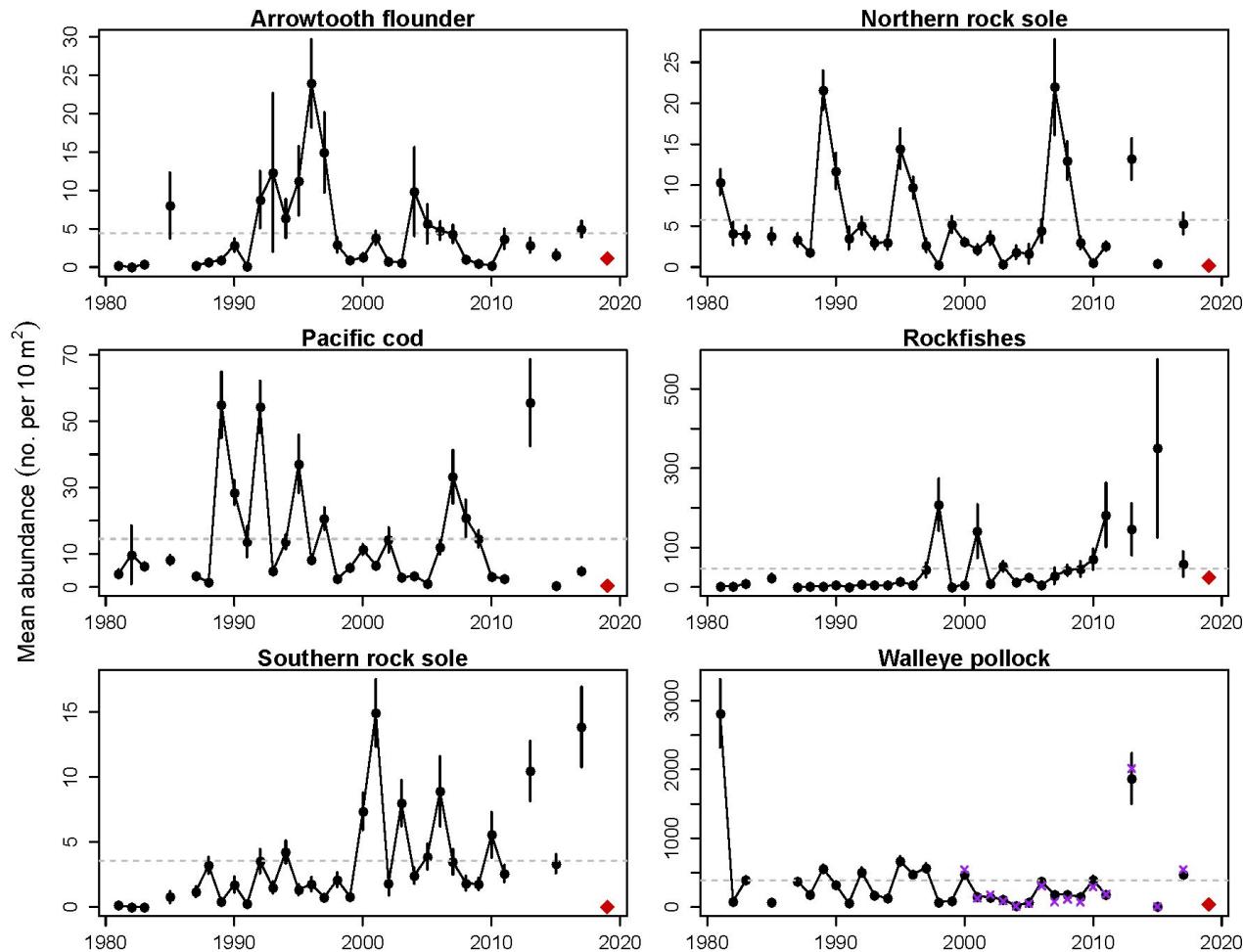


Gray whale UME; ice seal UME. Indicates cumulative impacts of changes in food web structure and carrying capacity of the NBS.



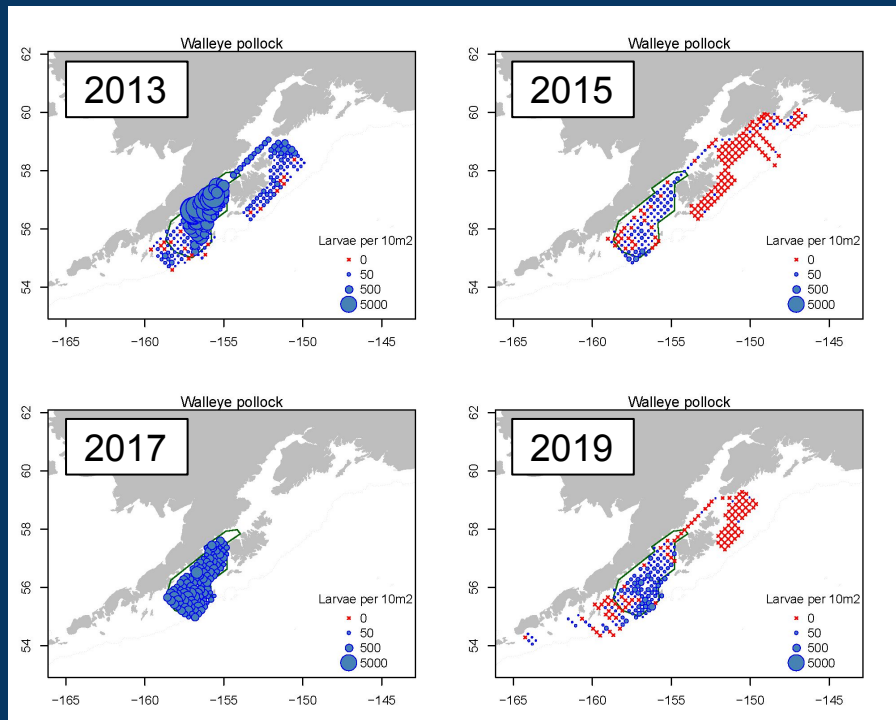
Gulf of Alaska

GOA Larval Fish Survey Duffy-Anderson



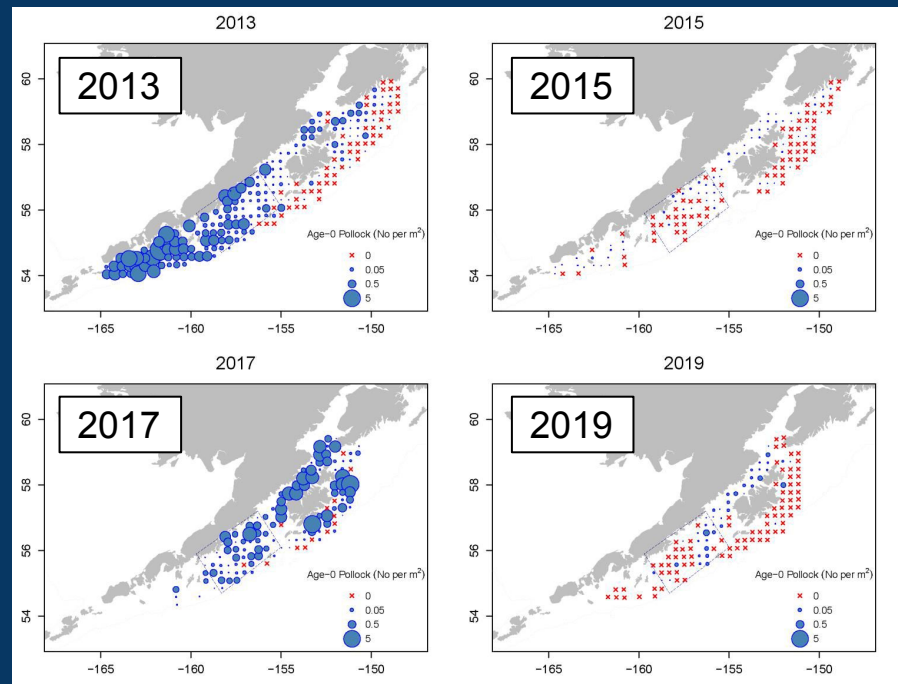
- Few larval fish in spring
- 3rd lowest pollock catch
- 2nd lowest Pacific cod catch
- Few rockfish

Spring



2019 pollock year class Duffy-Anderson

Summer

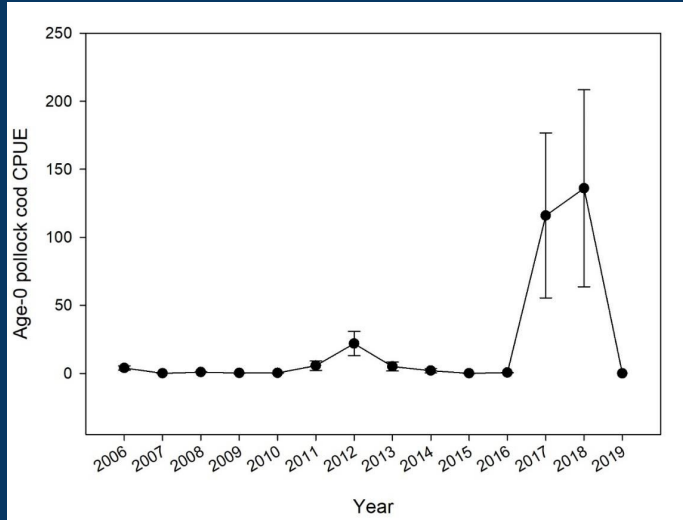


Summer

2019 pollock year class

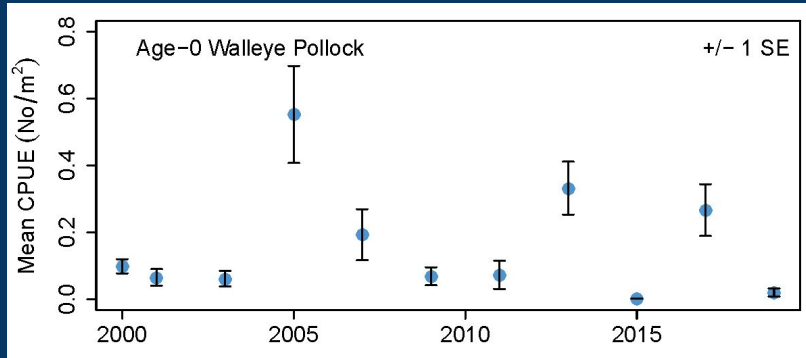
Laurel, Duffy-Anderson

Kodiak beach seines



Beach seines and surface trawls saw few 2019 pollock

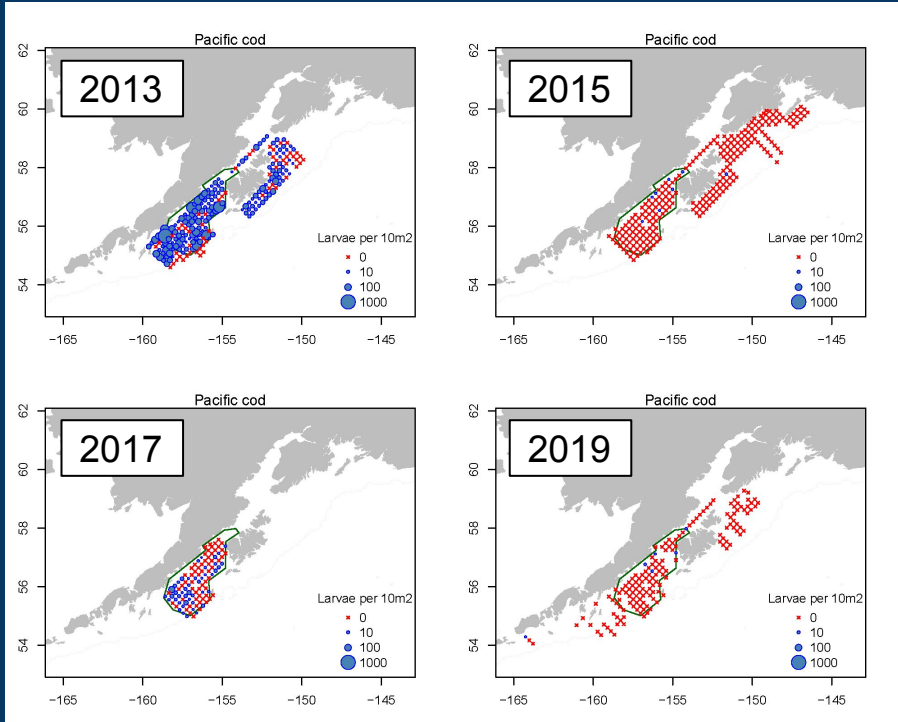
Surface trawl



2019 Pacific cod year class

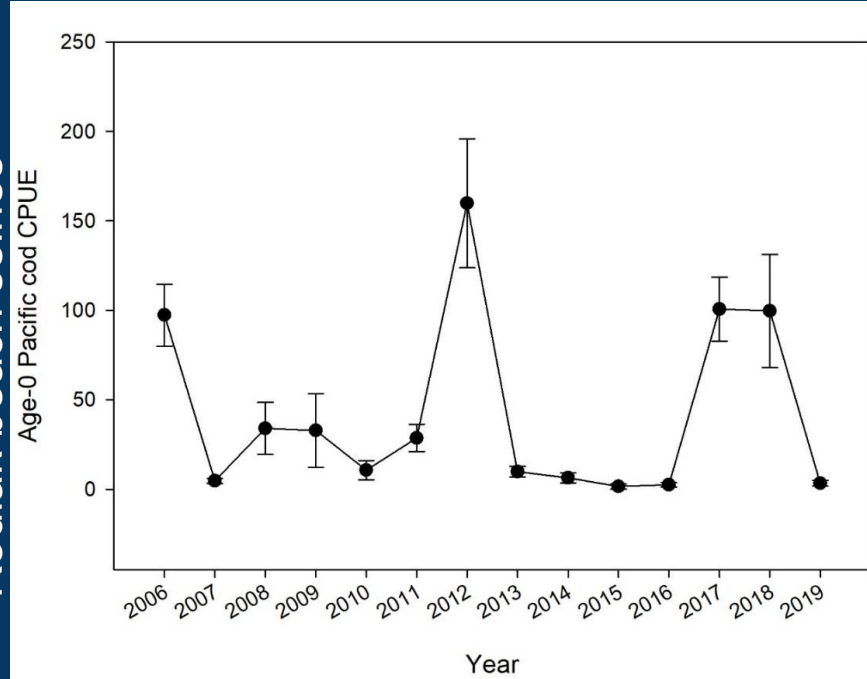
Duffy-Anderson, Laurel

Spring



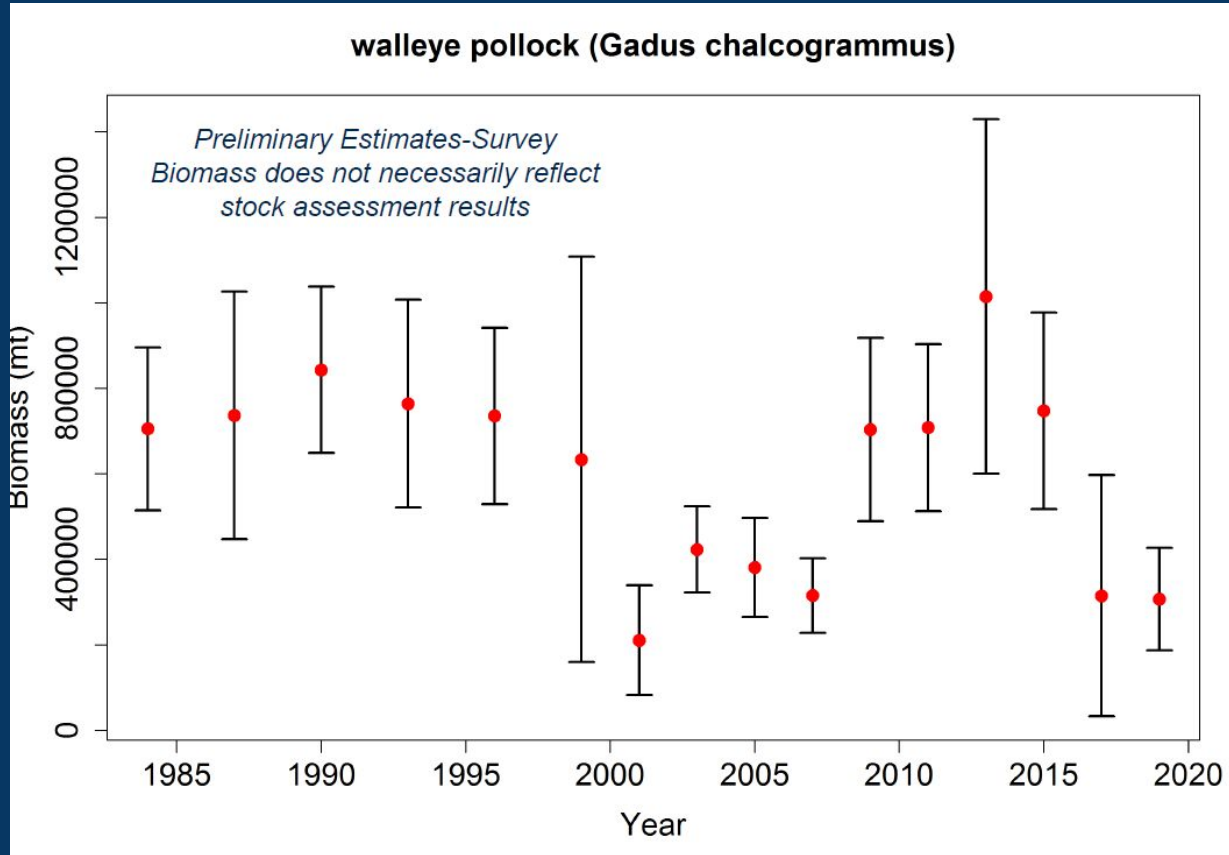
Summer

Kodiak beach seines



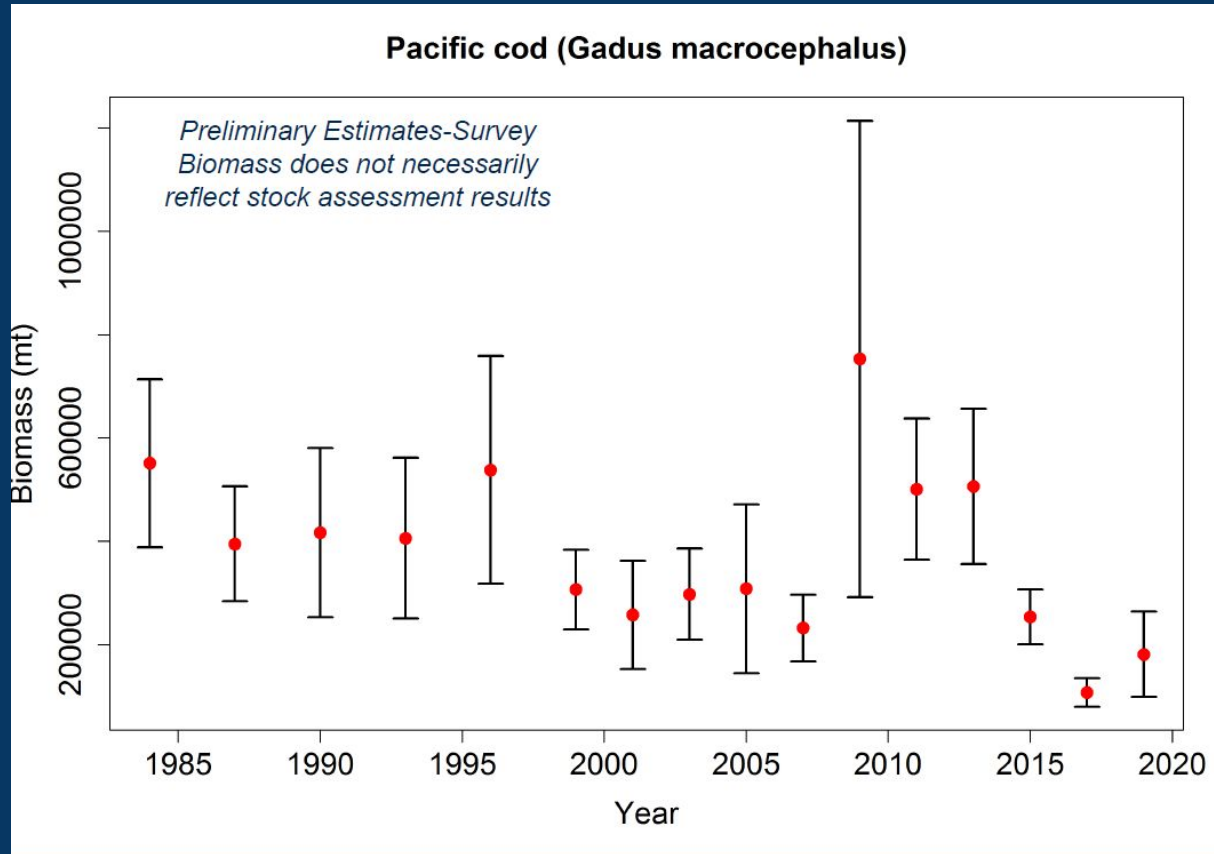
GOA bottom trawl survey: pollock

Palsson



GOA bottom trawl survey: Pacific cod

Palsson



GOA: Implications



Warm temperatures through winter, similar to the beginning of the 2014-2016 heat wave.

Few pollock and Pacific cod young of year.

Adult pollock and cod biomass remains low.

Seabirds at colonies did well, foraging more nearshore; saxitoxin linked to localized tern die-off.

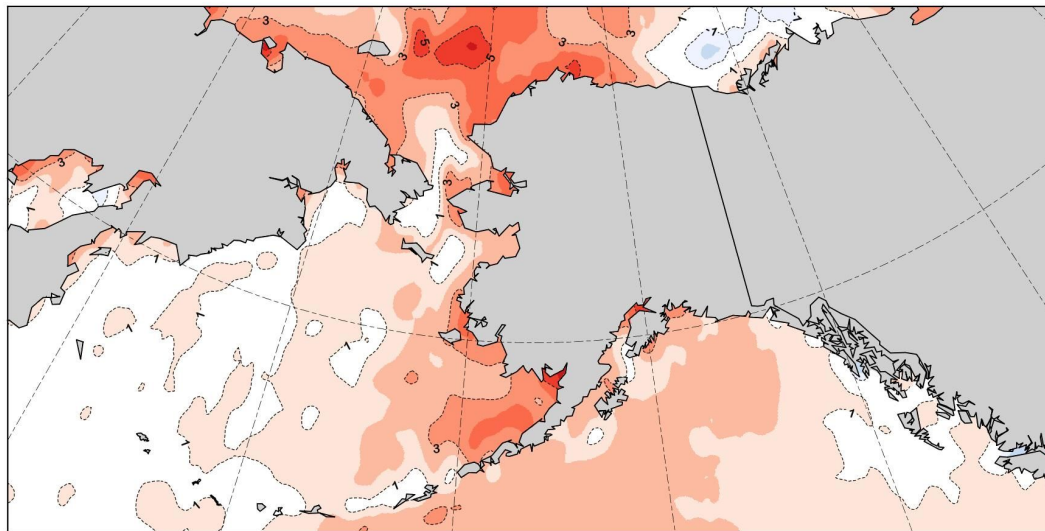
Gray whale UME likely indicates cumulative impacts of changes in food web structure in the NBS.

Few humpback calves indicates minor, lagged improvement from previous heatwave.

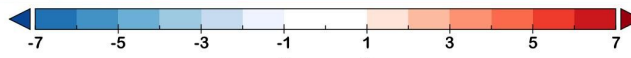


Sea Surface Temperature Departure from Normal

August 30-September 5, 2019



Graphic by @AlaskaWx



Degrees C

Rick Thoman

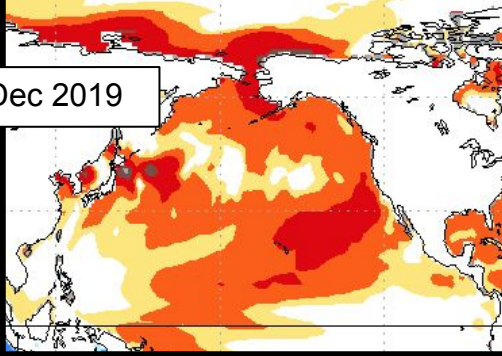
OISSTv2 courtesy of NOAA/PSD/ESRL

2020 Sea Surface Temperature Forecasts

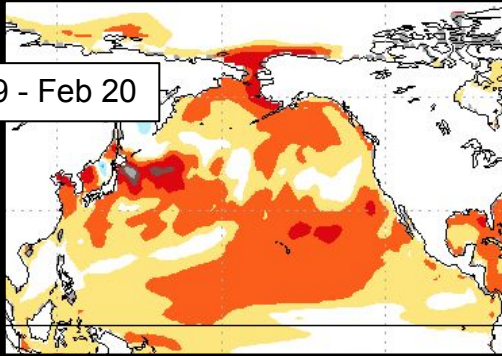
SST Projections from the National Multi-Model Ensemble

Bond

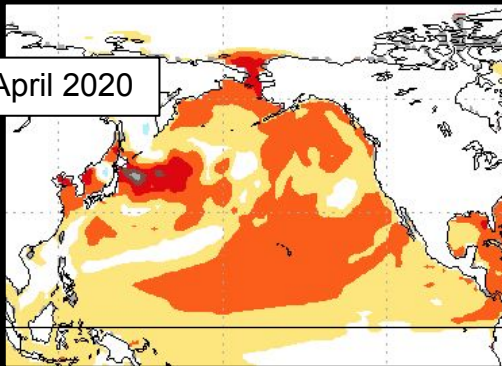
Oct - Dec 2019



Dec 19 - Feb 20



Feb - April 2020



- Projected continuation of warmth but reduced magnitude
- Previous projections were warm, but not warm enough
- Warmest north of Kuroshio Extension
- Neutral ENSO projected

