ECOSYSTEM STATUS REPORTS

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NPFMC, Homer
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Early Warnings:
Bering Sea and Gulf of Alaska

Spring PEEC
Preview of Ecosystem and Economic Conditions

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

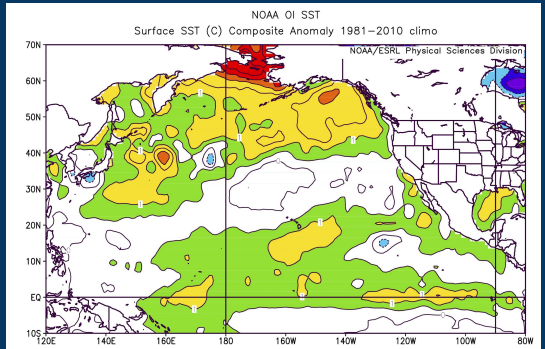
- Marine heatwave since Sept 2018.
- Low abundance of larval fish.

- 2019 climate and oceanography
- 2019 early warnings for the Bering Sea and Gulf of Alaska
- 2020 sea surface temperature forecasts

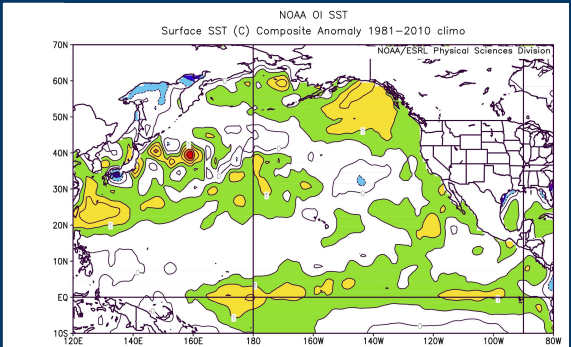
Sea Surface Temperature Anomalies

Bond

Warmth in the north delayed sea ice formation



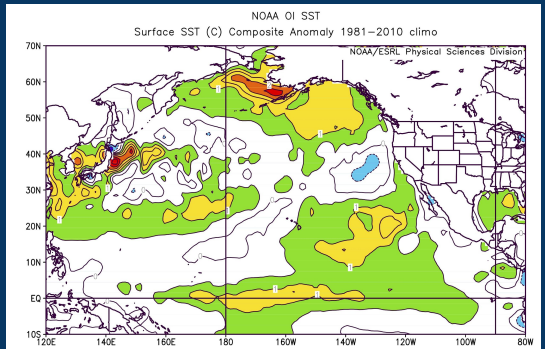
Autumn 2018



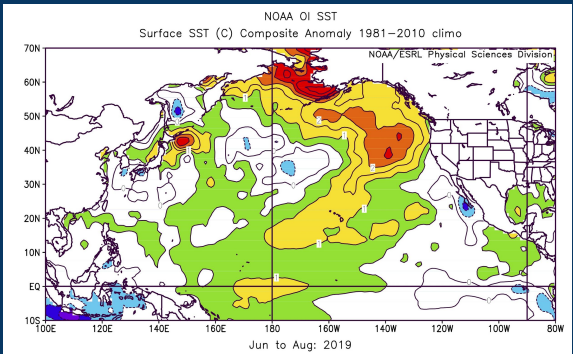
Winter 2018/19

Modulation of temperatures; weak El Niño

Warm temperatures in the EBS

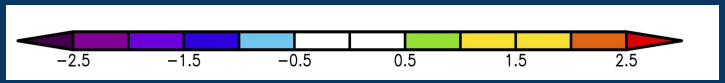


Spring 2019



Summer 2019

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

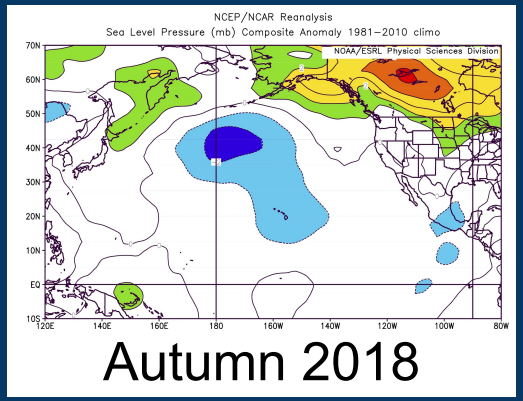


From NOAA's Optimum Interpolation SST analysis

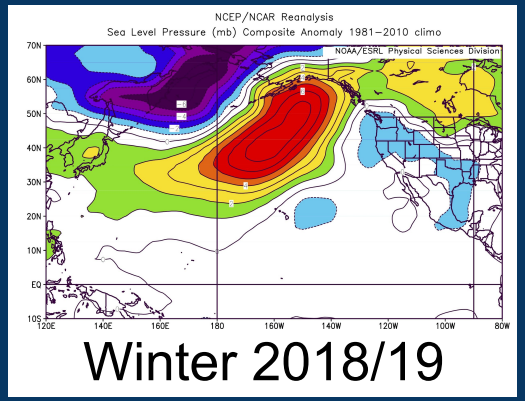
Sea Level Pressure Anomalies

Bond

Suppressed storminess in the GOA related to development of warm SSTs



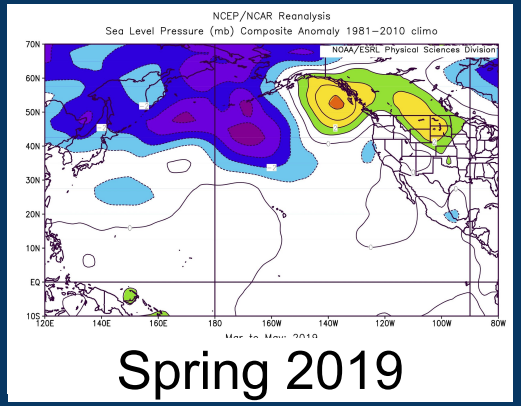
Autumn 2018



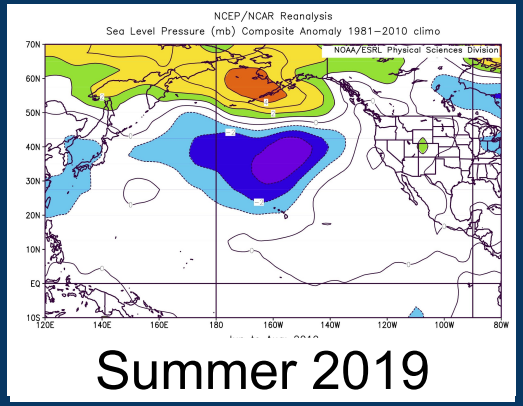
Winter 2018/19

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



Spring 2019



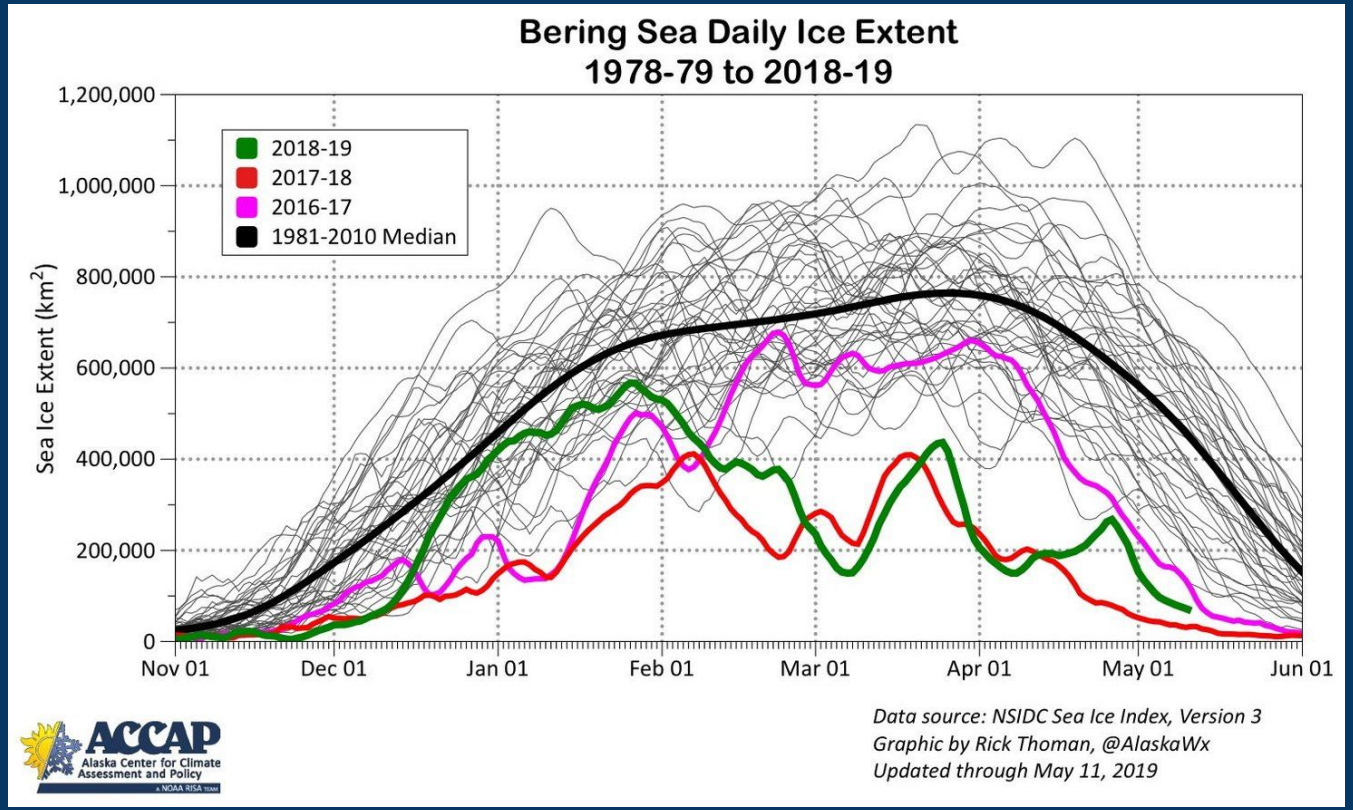
Summer 2019

Suppressed storminess in the EBS/GOA contributing to warmth

From the NCEP/NCAR Reanalysis project

Bering Sea sea ice extent

Thoman, Bond



A double whammy!

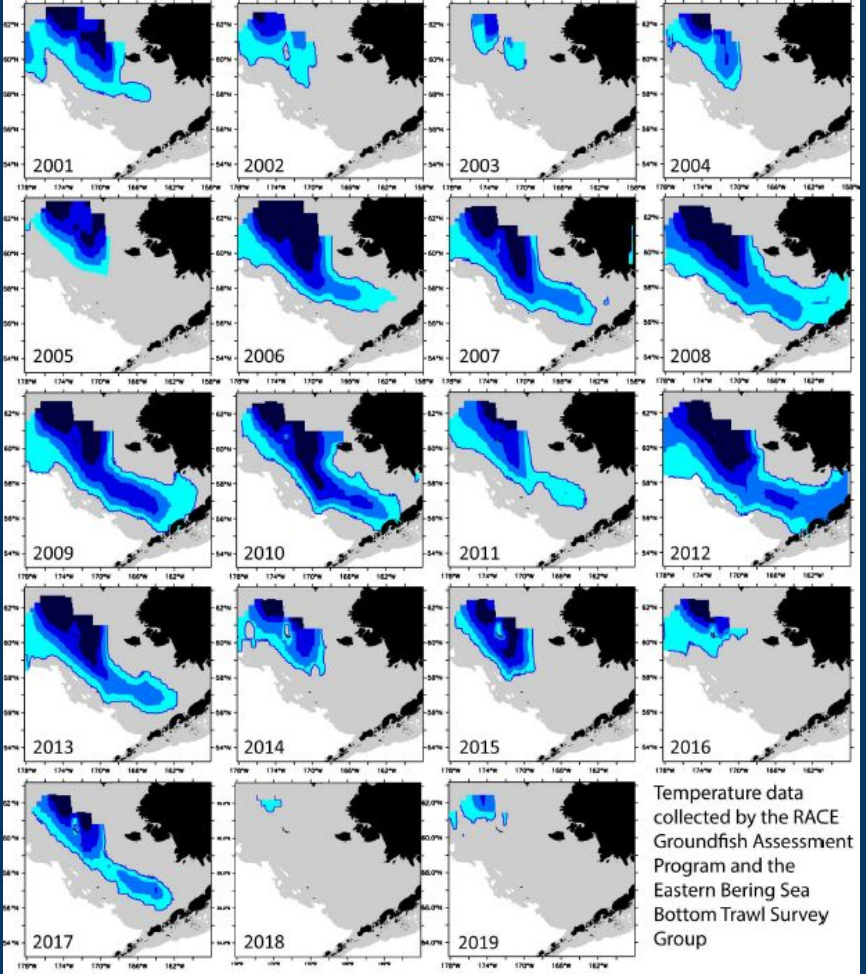
2nd winter of low sea ice in the Bering Sea. Early winter ice, but southerly winds in Feb caused retreat.

Effect of early ice?

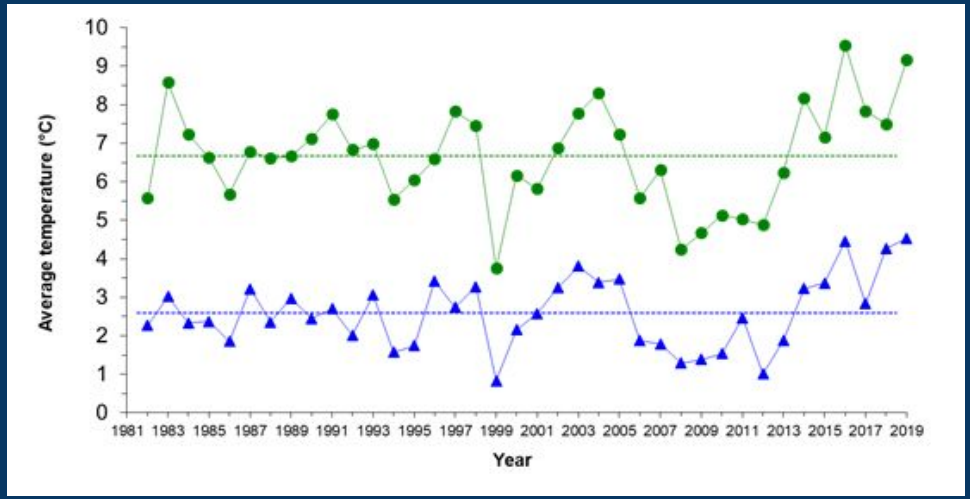
EBS cold pool and temperatures

Ladd, Britt

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

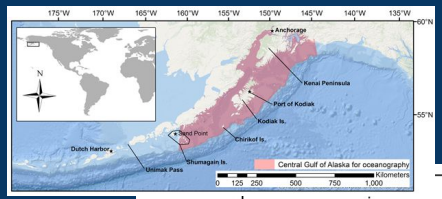


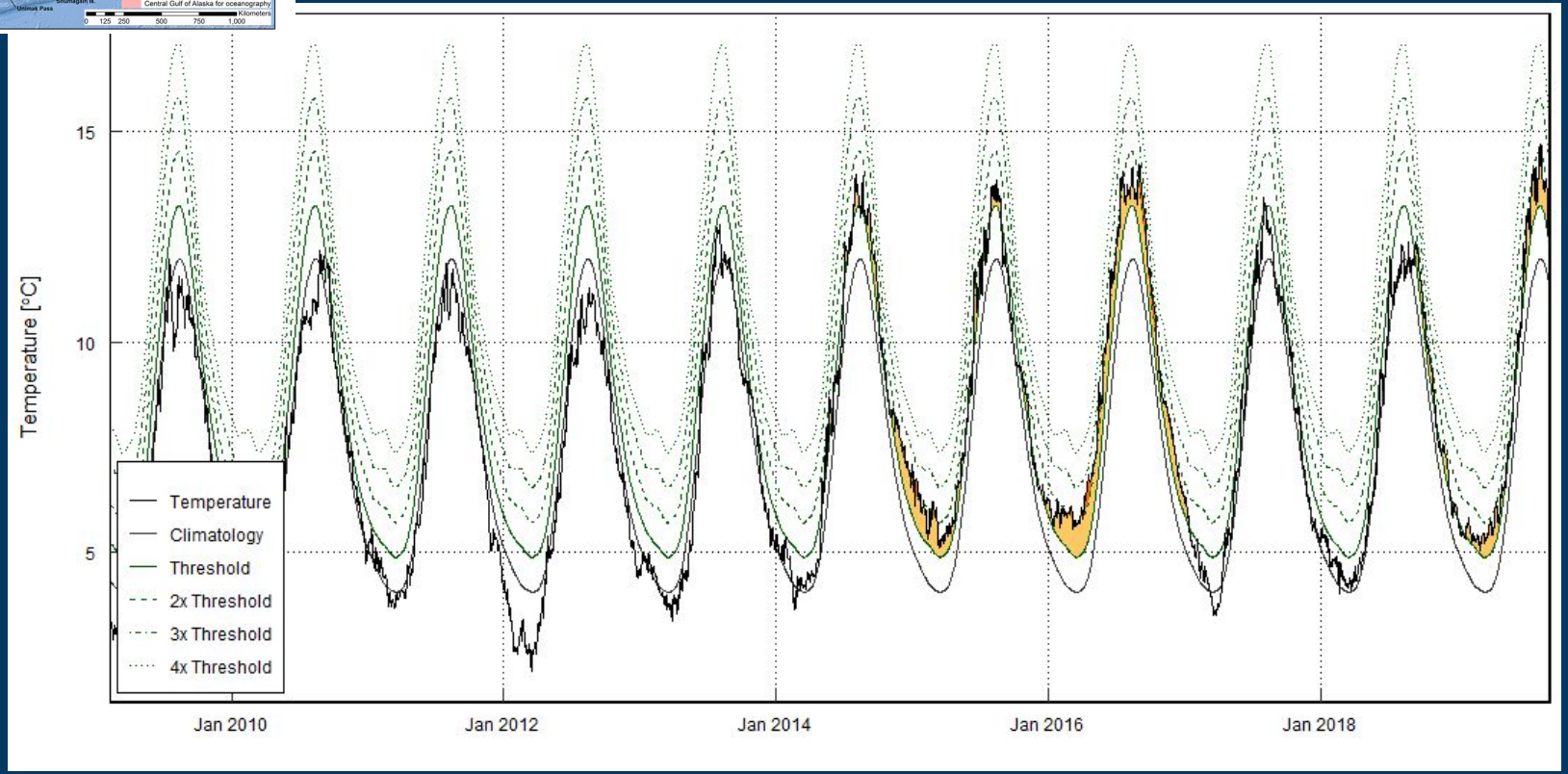
Temperature data collected by the RACE Groundfish Assessment Program and the Eastern Bering Sea Bottom Trawl Survey Group



Western Gulf of Alaska heatwave

Barbeaux

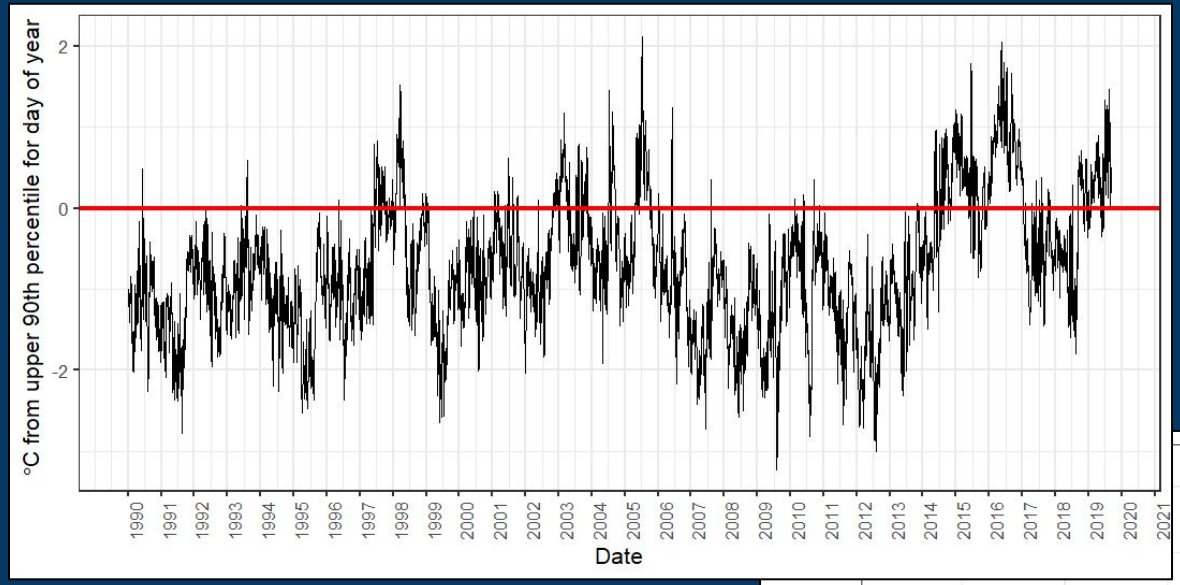


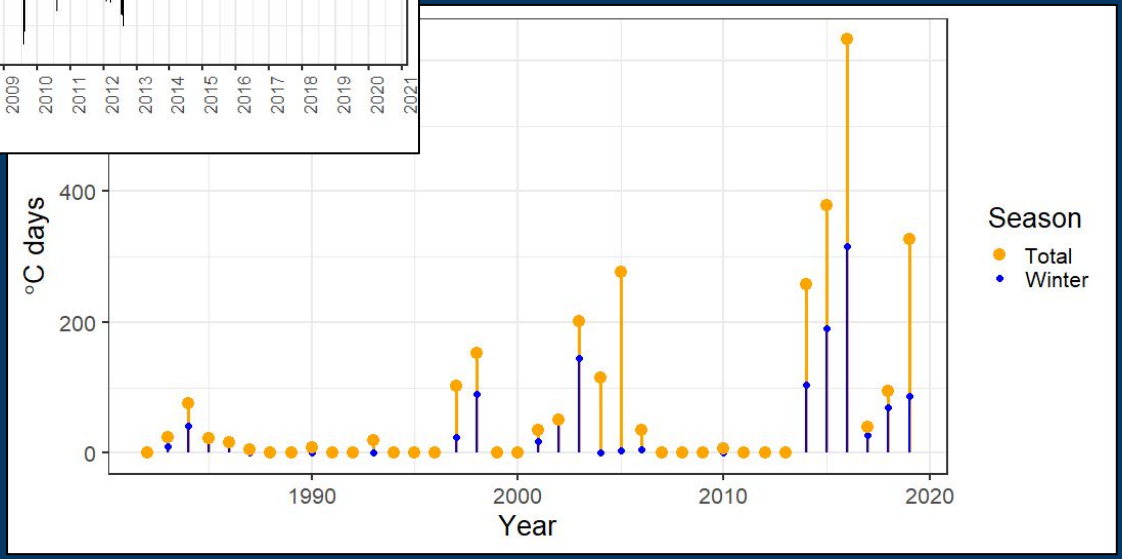


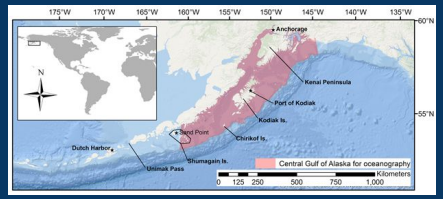
A. Hobday algorithm, through Sept 10, 2019

Western Gulf of Alaska heatwave

Barbeaux

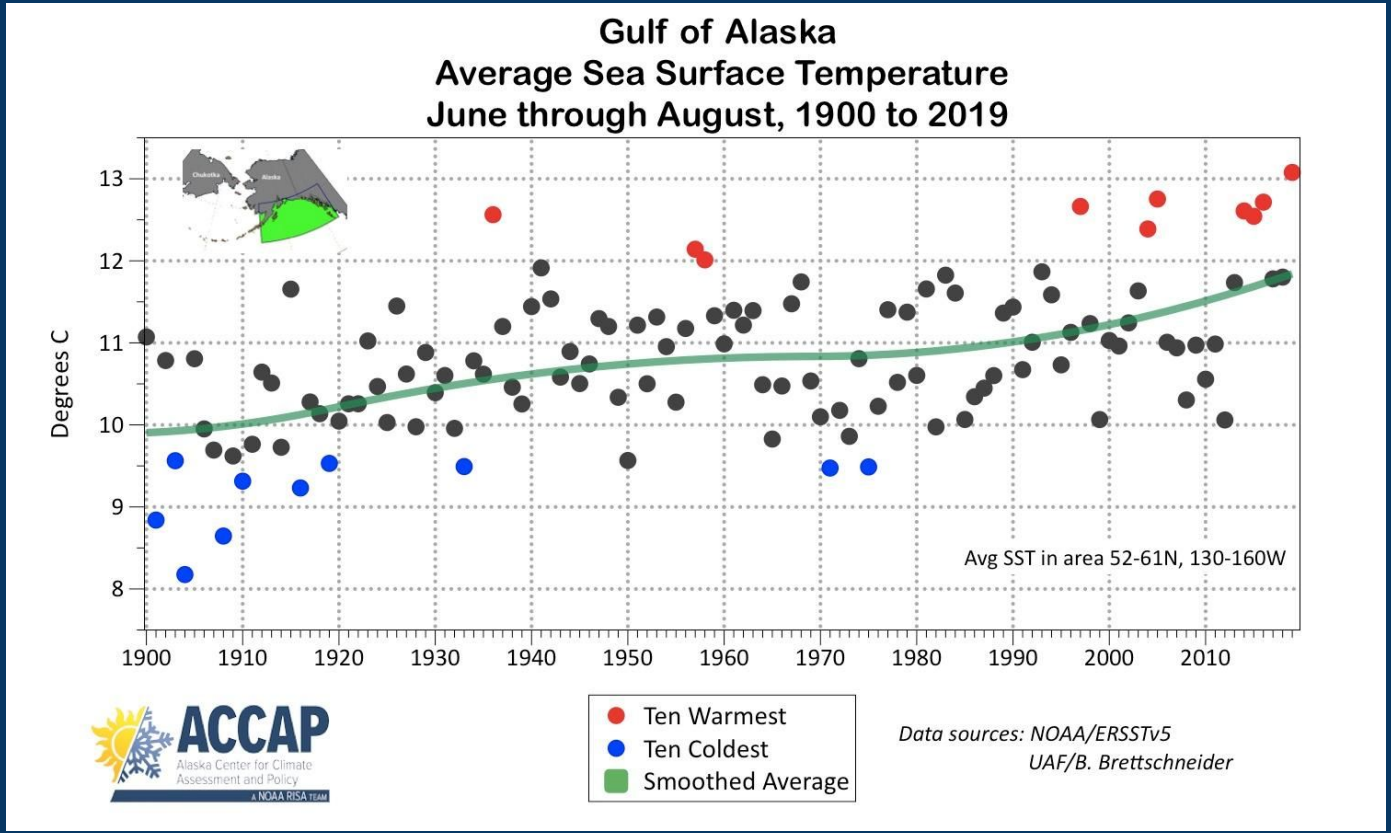




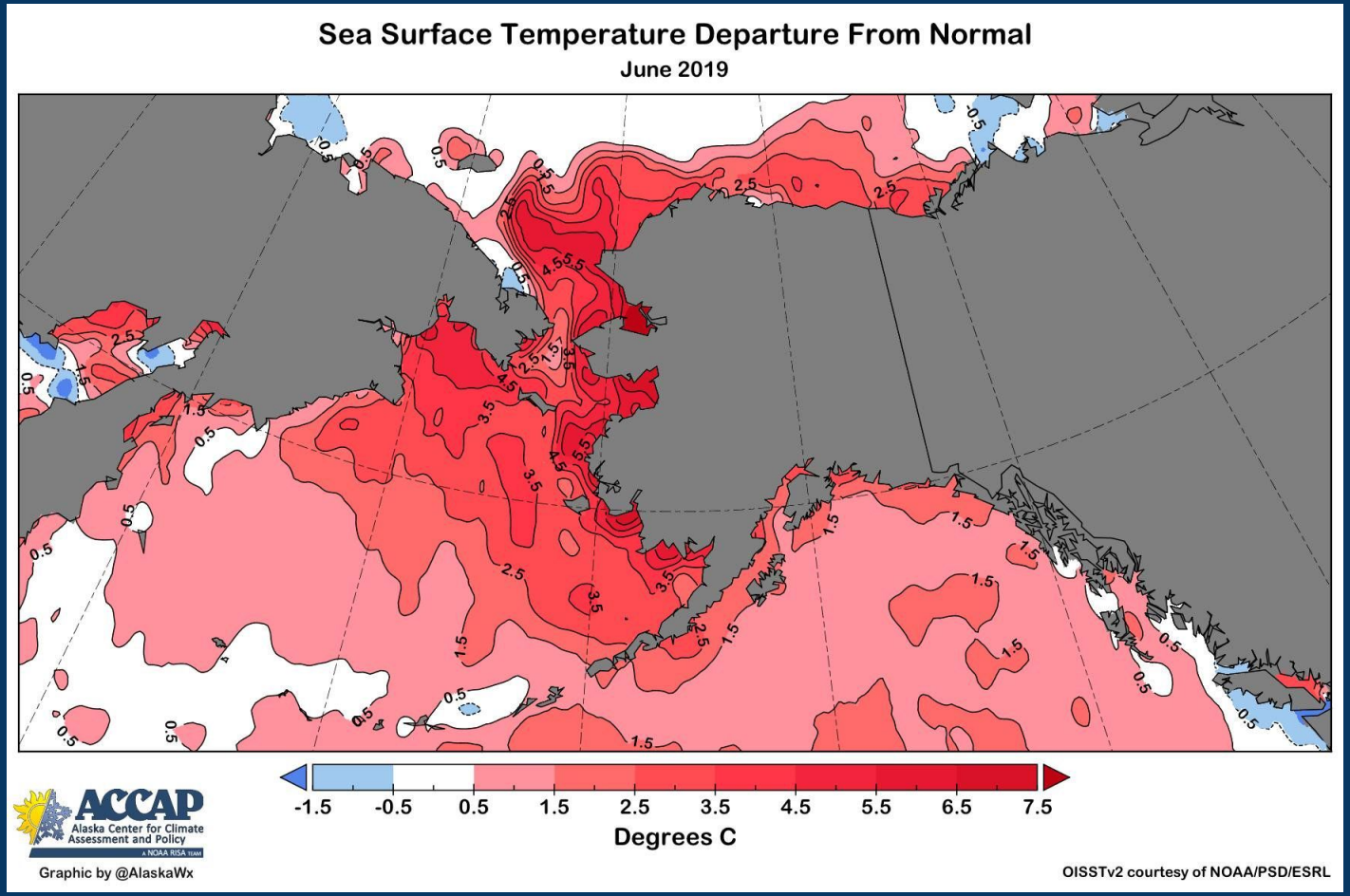


GOA Sea Surface Temperatures

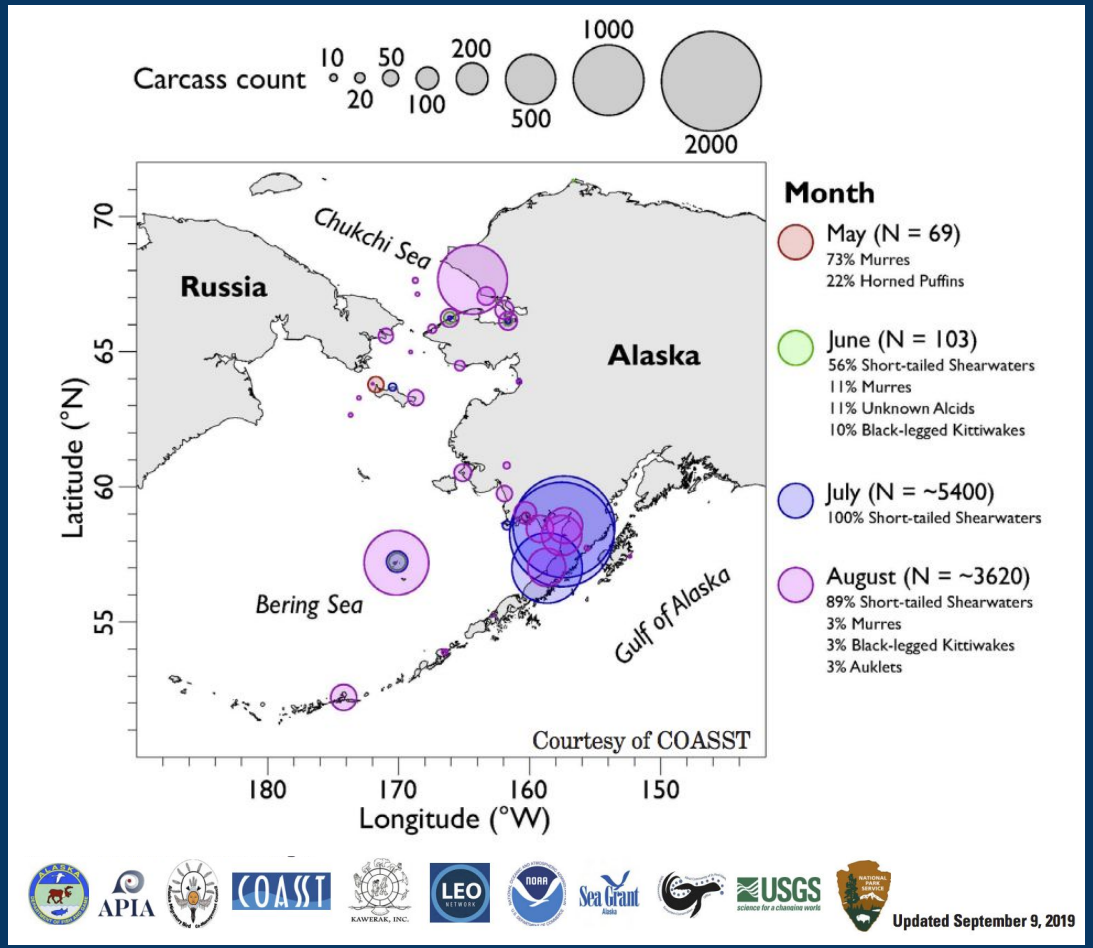
Thoman



Ecosystem ‘red flags’



Seabirds



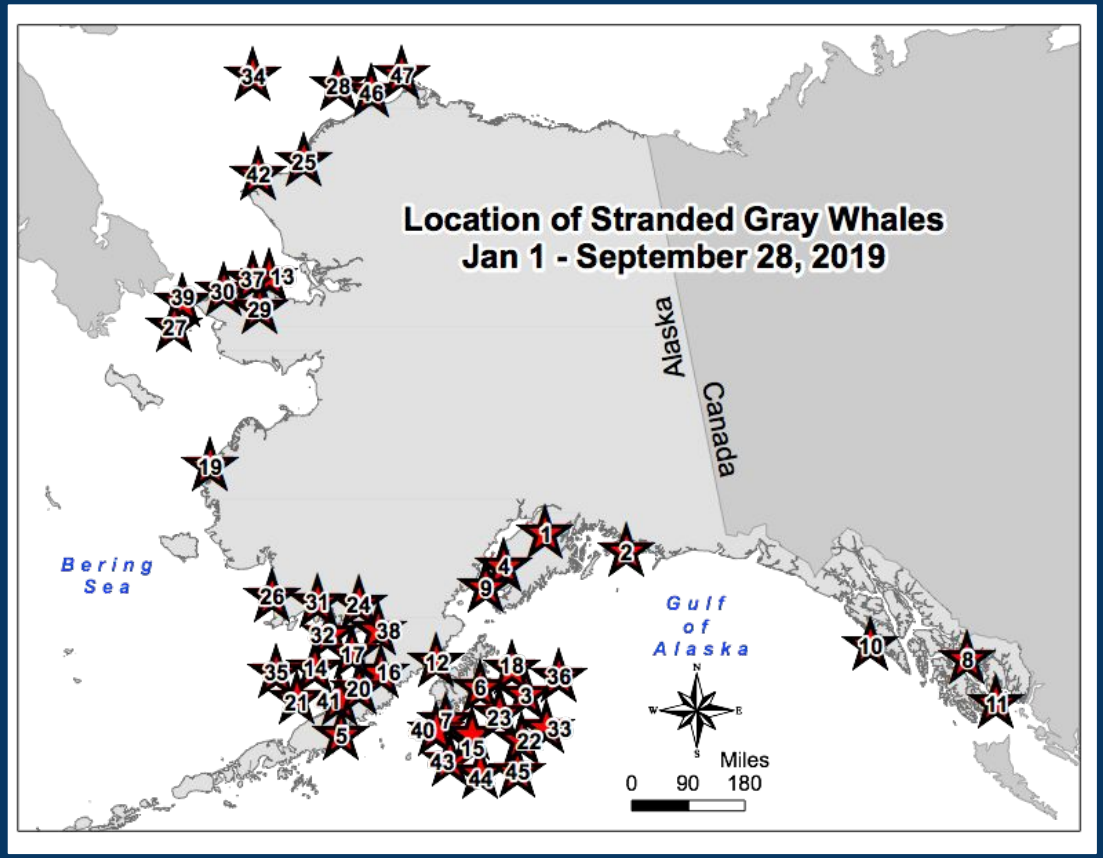
Mainly short-tailed shearwaters.

Most birds were emaciated.

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

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.

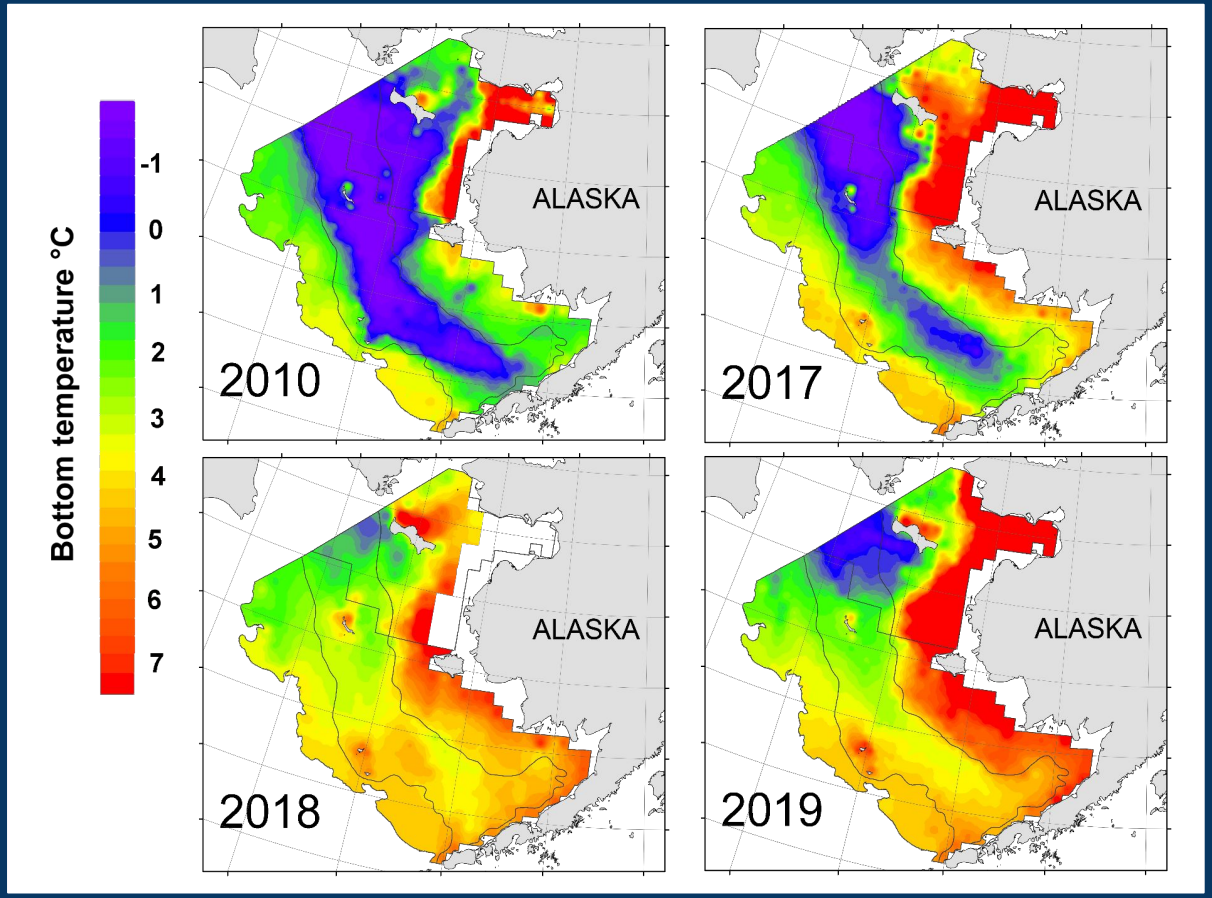
Annual migration of up to 20,000 km.

- 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.

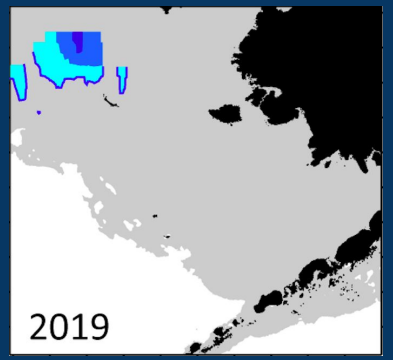

Bering Sea

BT survey bottom temperatures

Britt



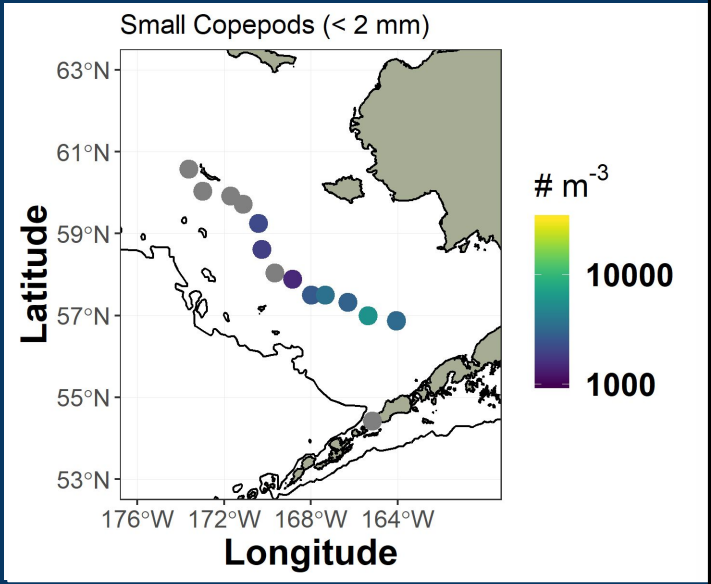
- 2018 had no cold pool, but inner domain temperatures were not as warm as 2019.
- 2019 had a small cold pool up north and the inner domain was very warm.

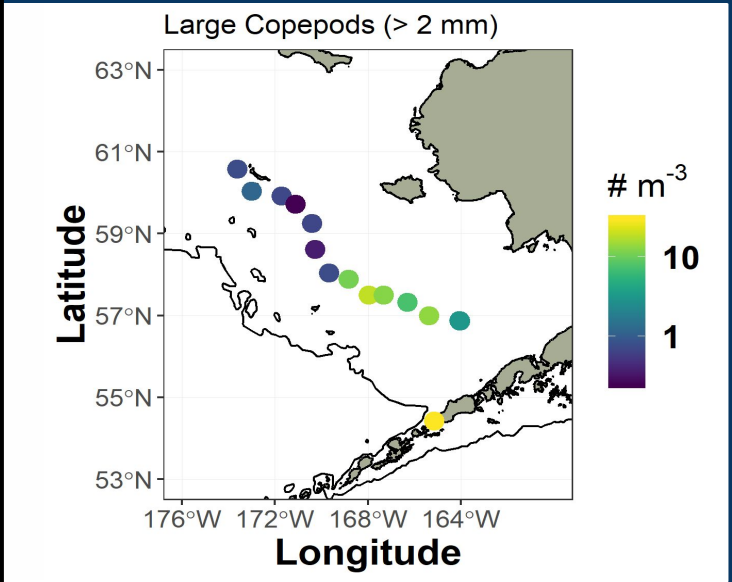


EBS Zooplankton

AFSC-RPA

Spring





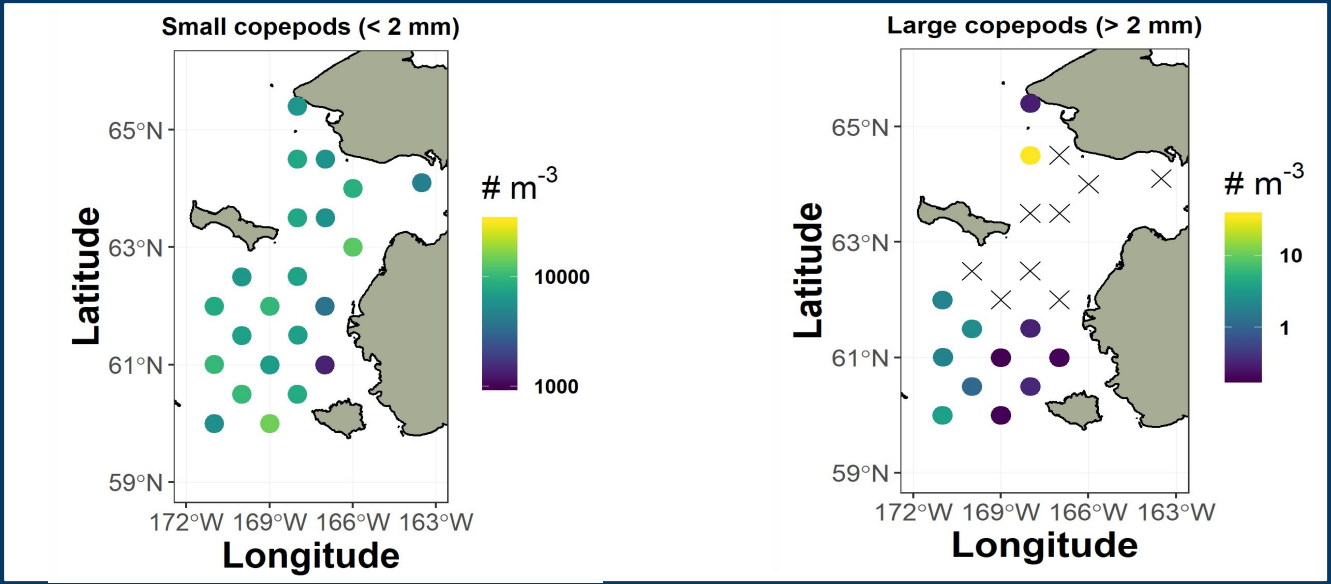
- Similar along the 70m isobath.
- Abundance higher compared to historical average.

- North/south gradient.
- Abundance was low, but not historically low.

NBS Zooplankton

AFSC-RPA

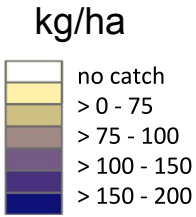
Fall

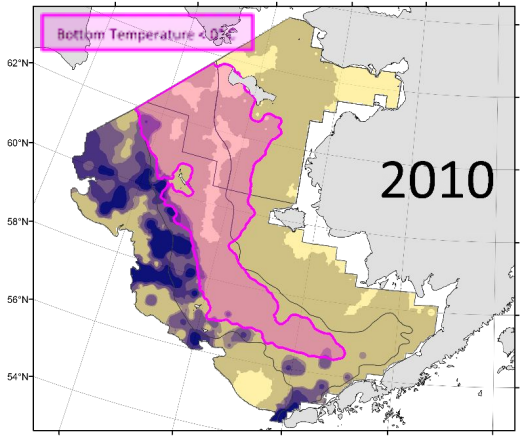


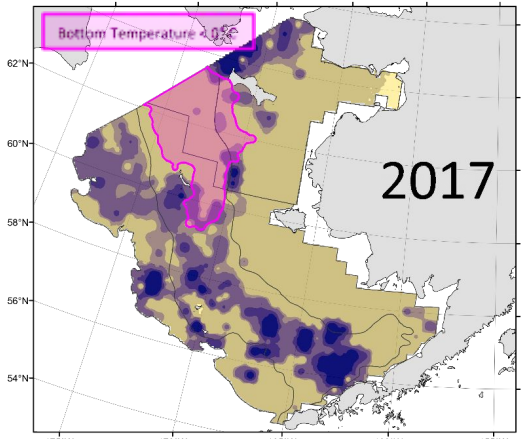
- Abundance was high.
- Abundance was low.

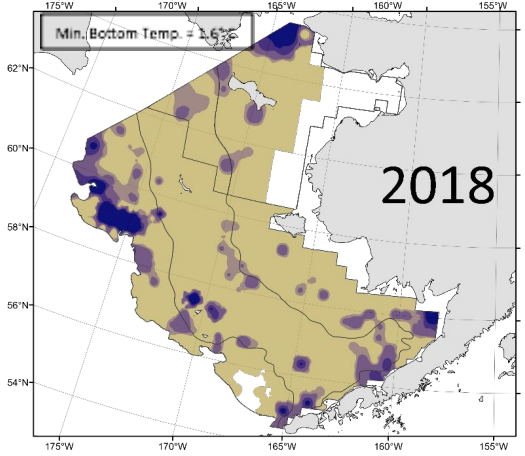
BT survey: Walleye pollock

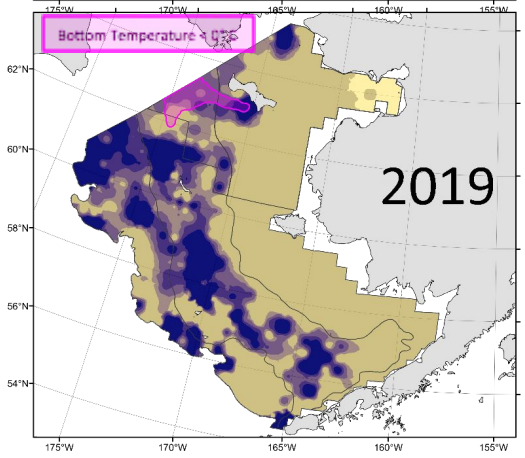
Britt











SEBS (movement)

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

Abundance +53%.

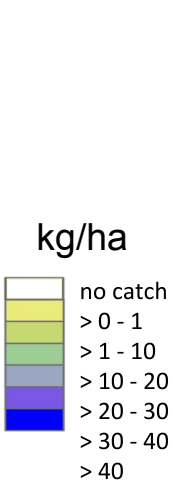
NBS (recruitment)

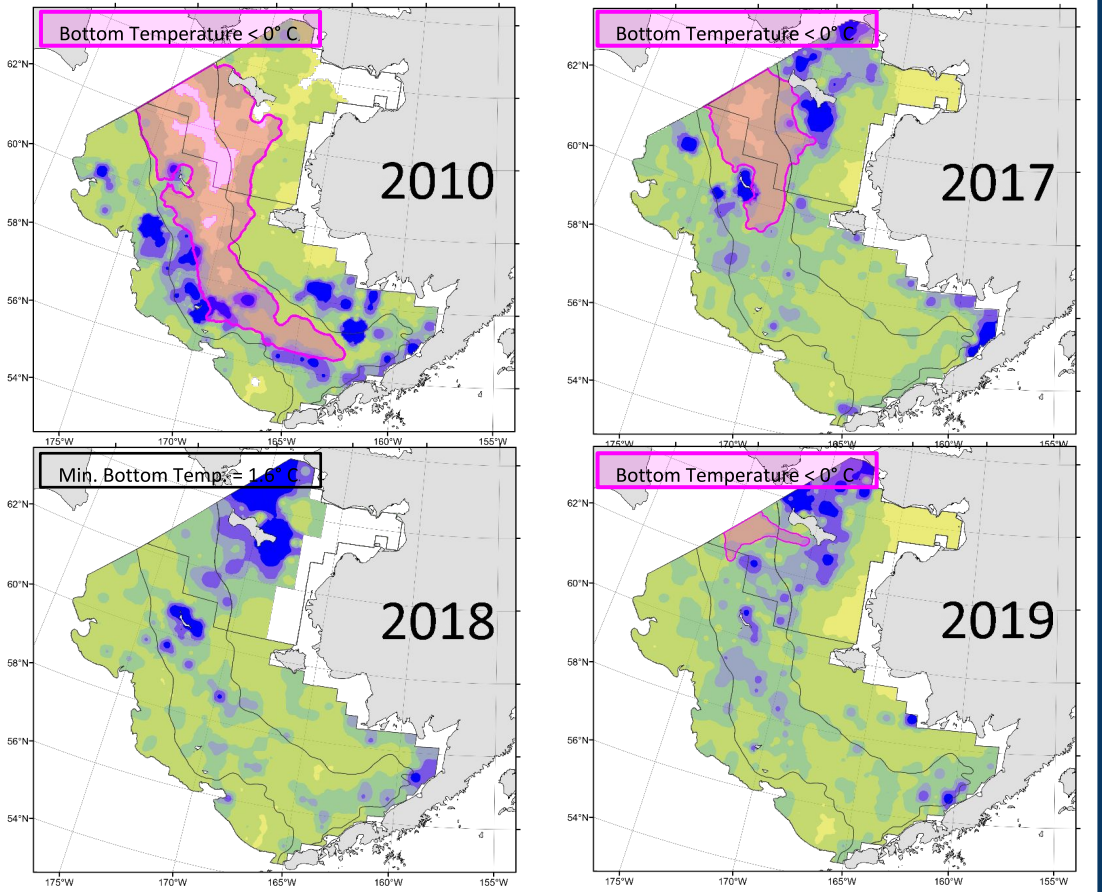
Biomass -11% from 2017 (at 1.17 mmt).

Abundance +59%

BT survey: Pacific cod

Britt





<u>SEBS</u> (recruitment)

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

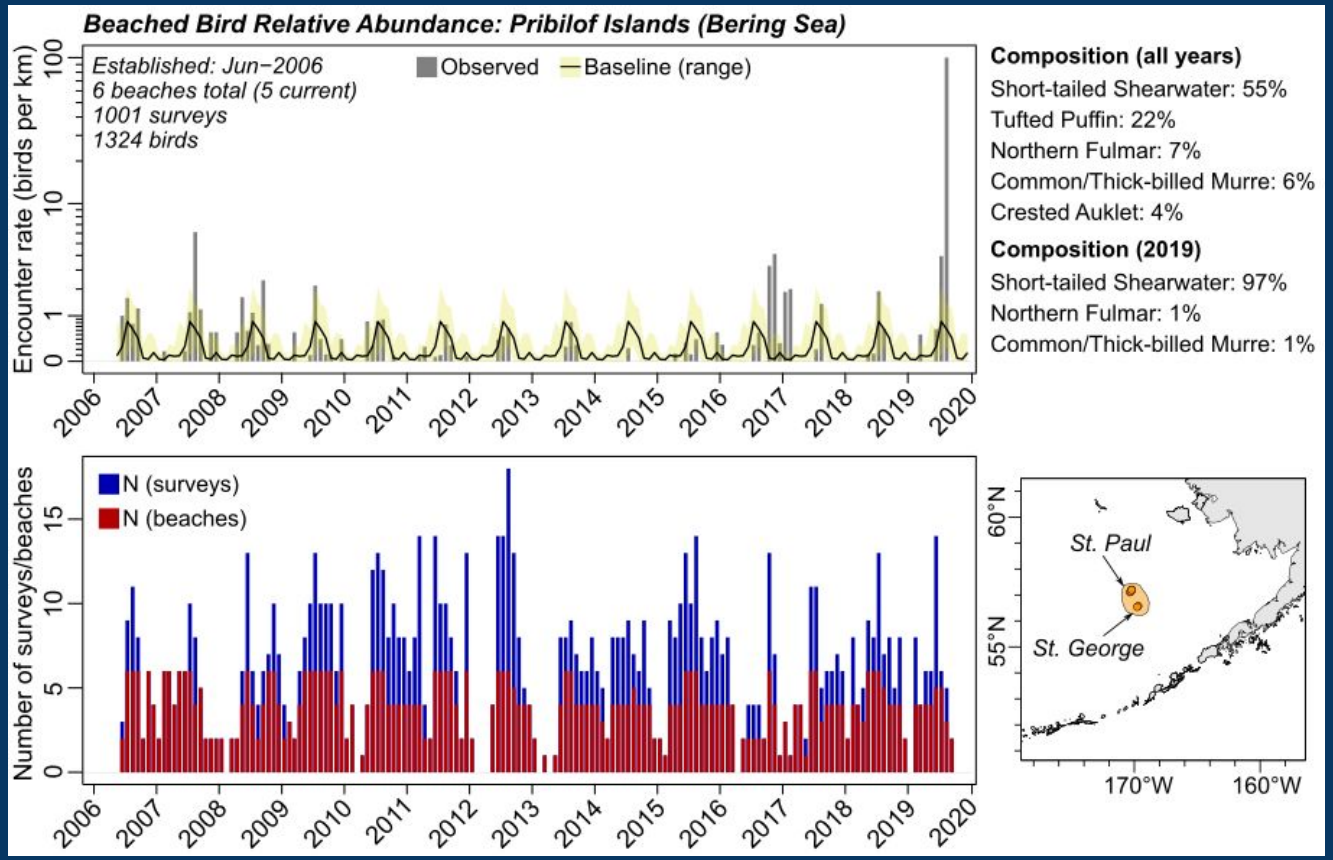
Abundance +112%.

<u>NBS</u>

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

Abundance +52%.

Seabirds
COASST, ANWR



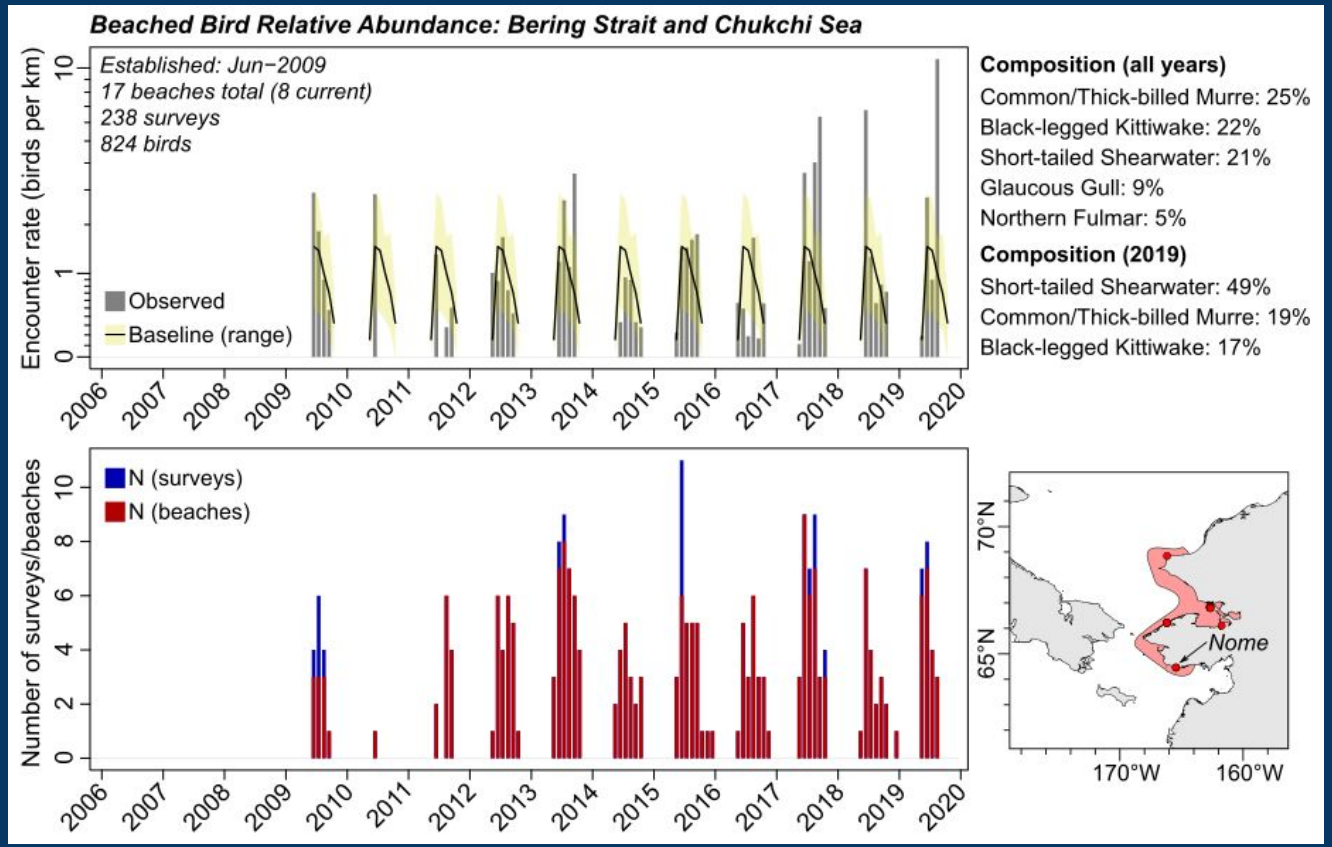
PRIBILOF ISLANDS

Top plot:
Long term trends of seabird die-offs.

Bottom plot:
COASST beach surveys Standard methods since 2006.

On the bright side:
Seabirds at colonies appear to have done fairly well (ANWR).

Seabirds
COASST

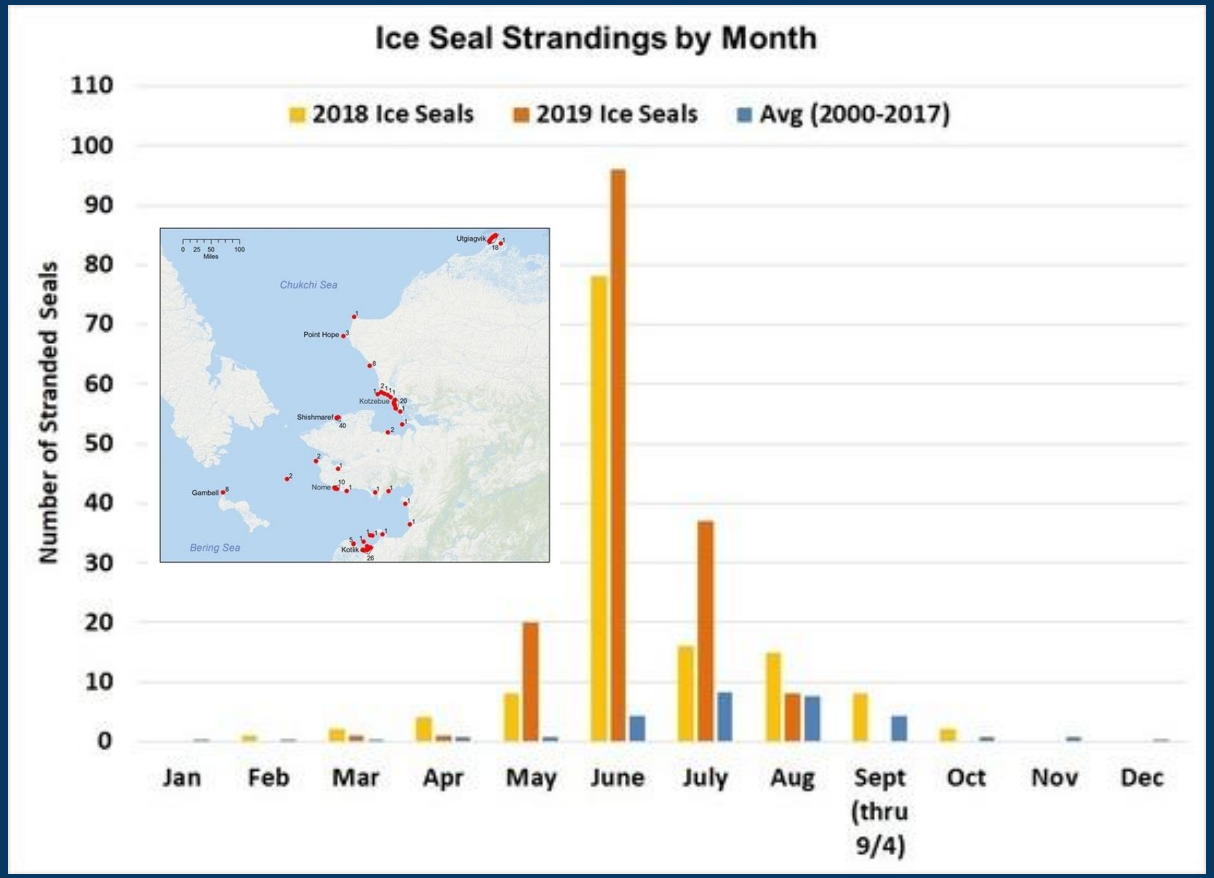


BERING STRAIT/CHUKCHI
Shearwater die-off extended north.
Also other species (murres and kittiwakes).

Integrated Seabird Contribution
We are seeking community observations on seabird timing, reproductive success, and other notable observations.

Ice seal UME

Boveng



- 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.

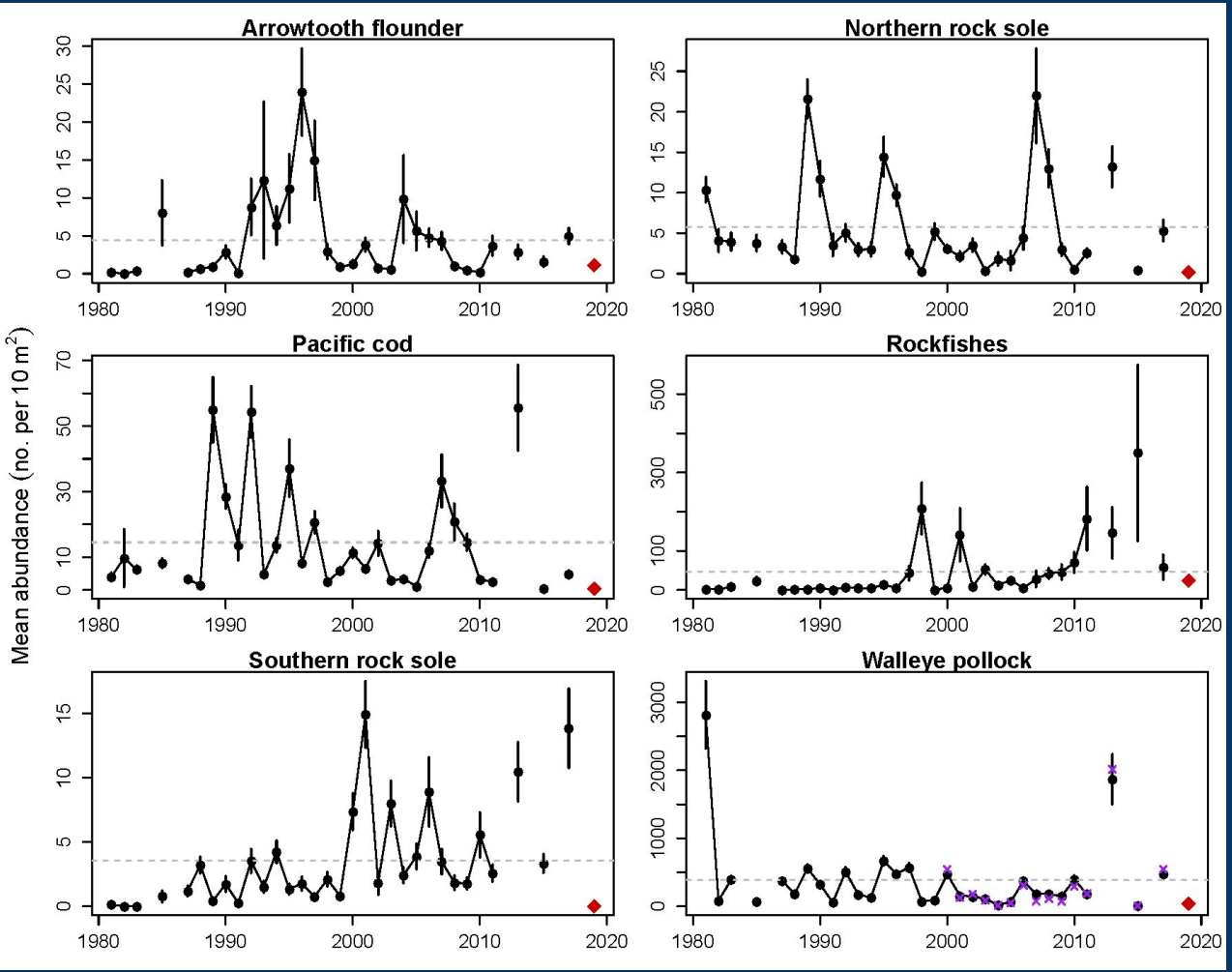
Seabird die-off (mainly short-tailed shearwaters) attributed to starvation. Concerns about food security in NBS. Seabirds at colonies did better than expected.

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

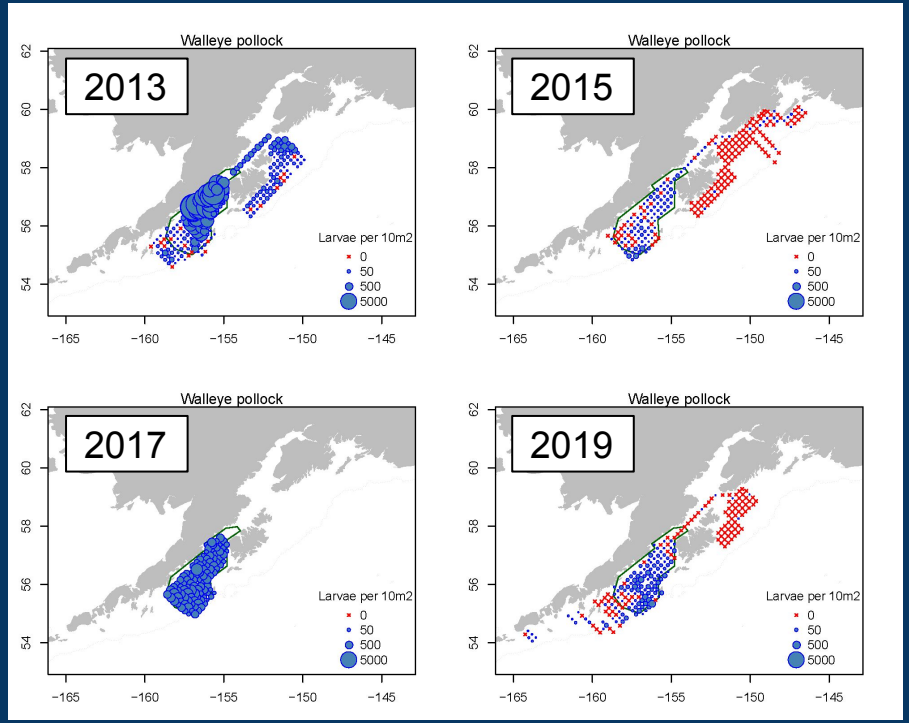


- Few larval fish in spring
- 3rd lowest pollock catch
- 2nd lowest Pacific cod catch
- Few rockfish

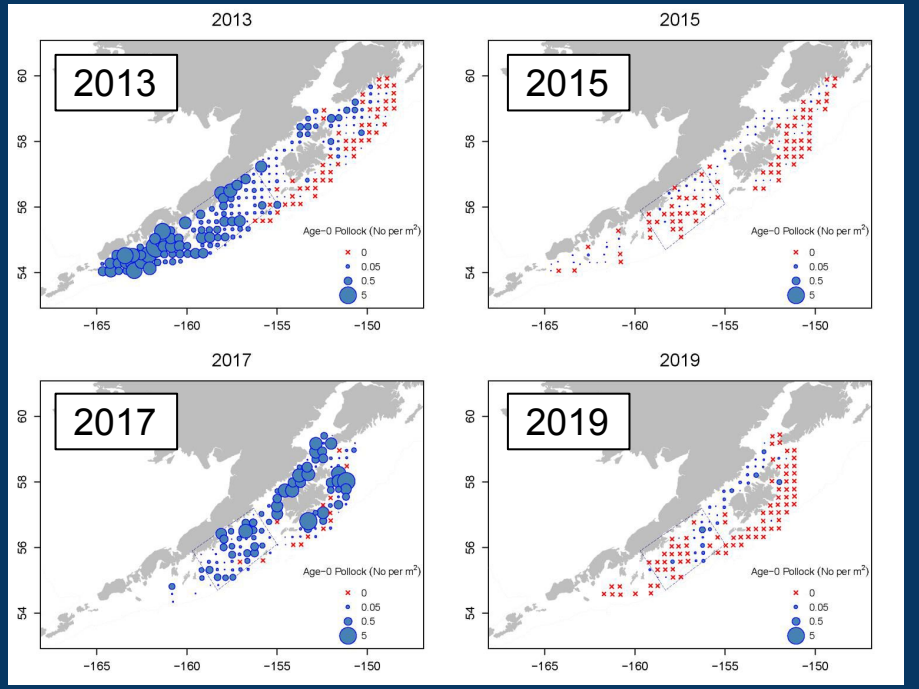
2019 pollock year class

Duffy-Anderson

Spring



Summer

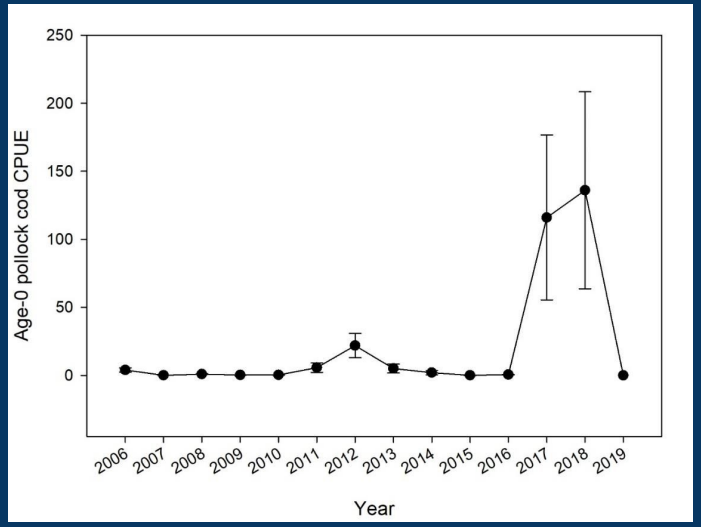


2019 pollock year class

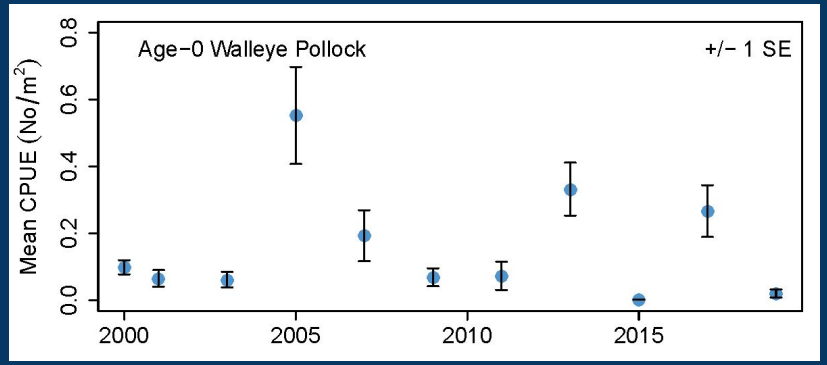
Laurel, Duffy-Anderson

Summer

Kodiak beach seines



Surface trawl

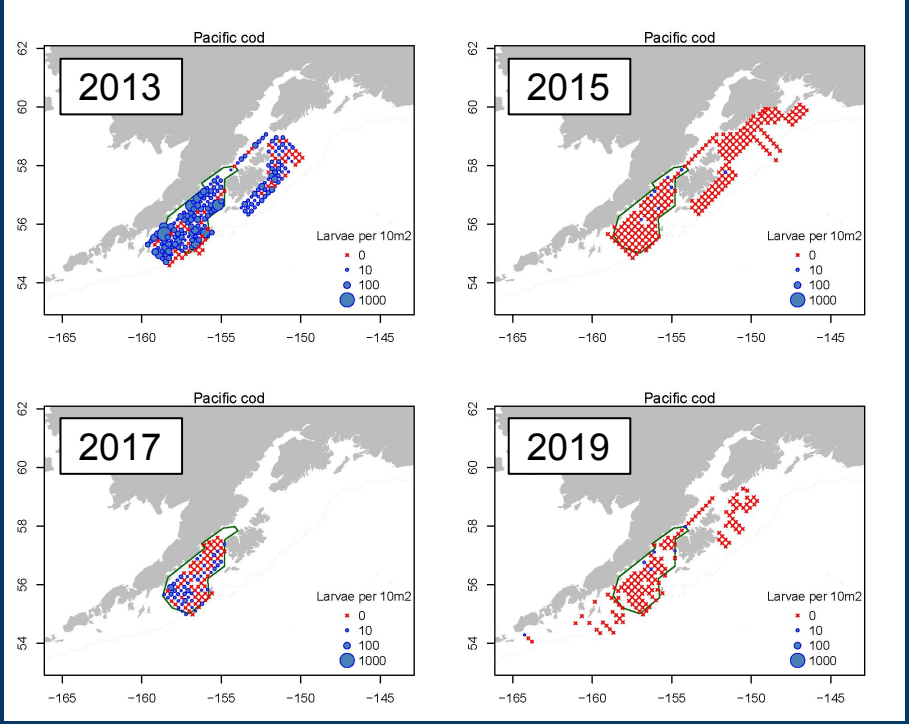


Beach seines and surface trawls saw few 2019 pollock

2019 Pacific cod year class

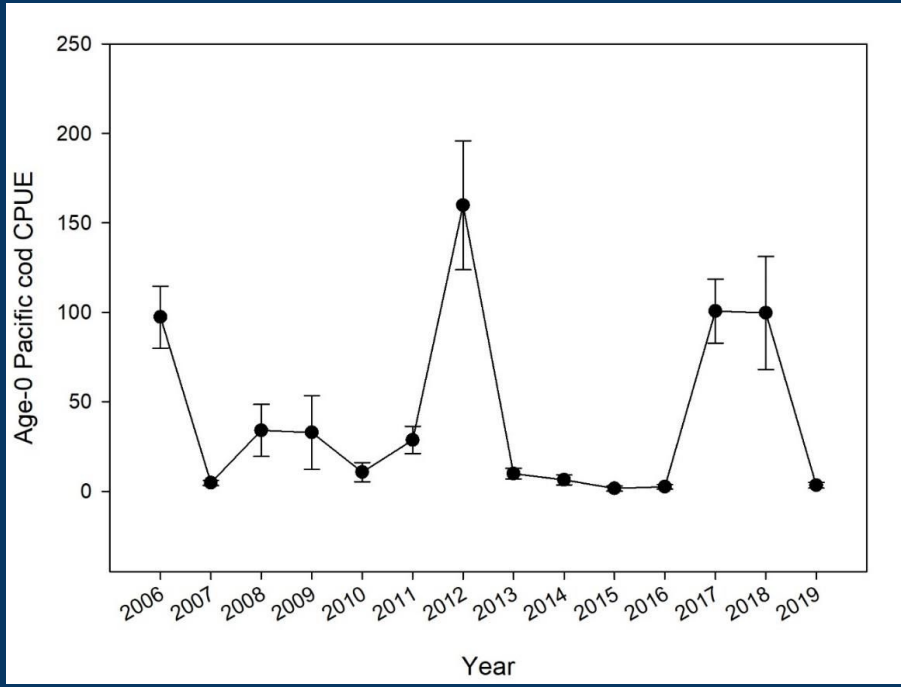
Duffy-Anderson, Laurel

Spring



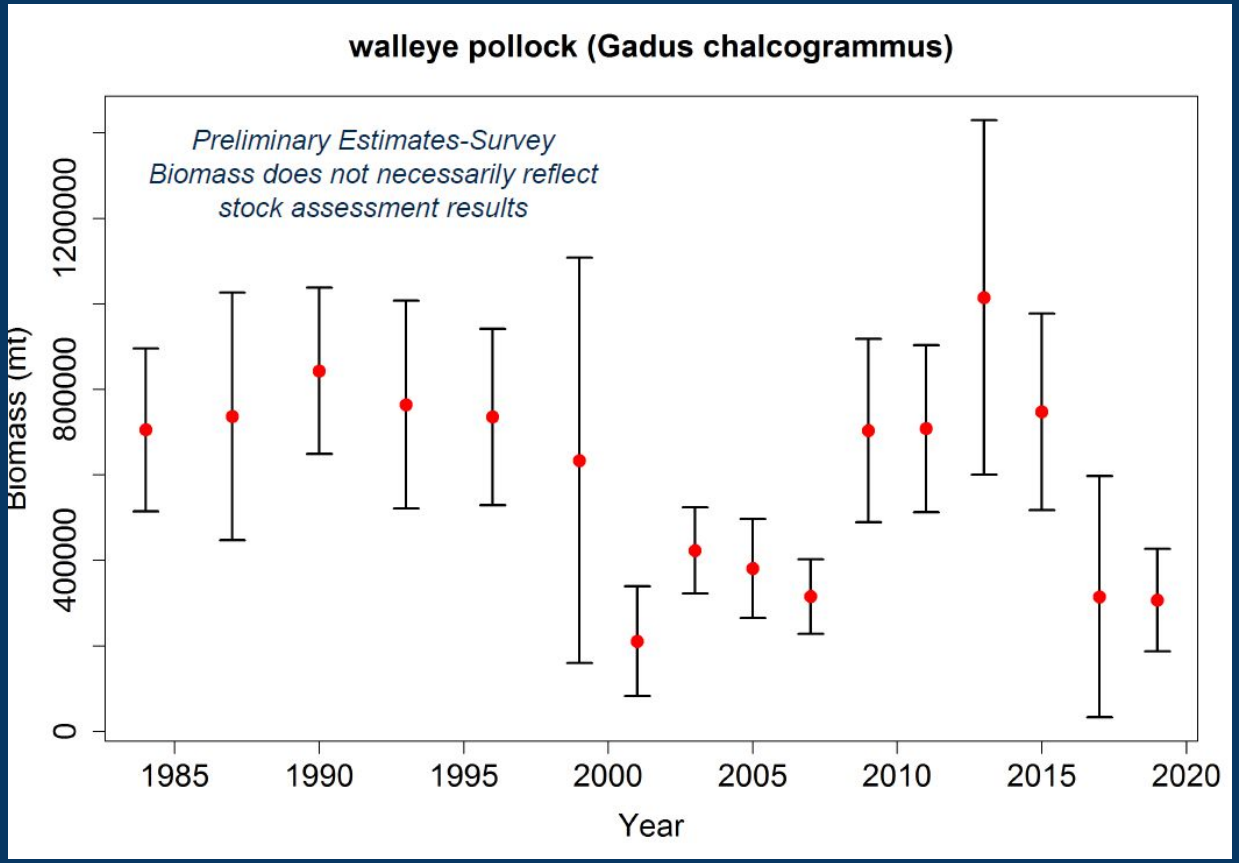
Summer

Kodiak beach seines



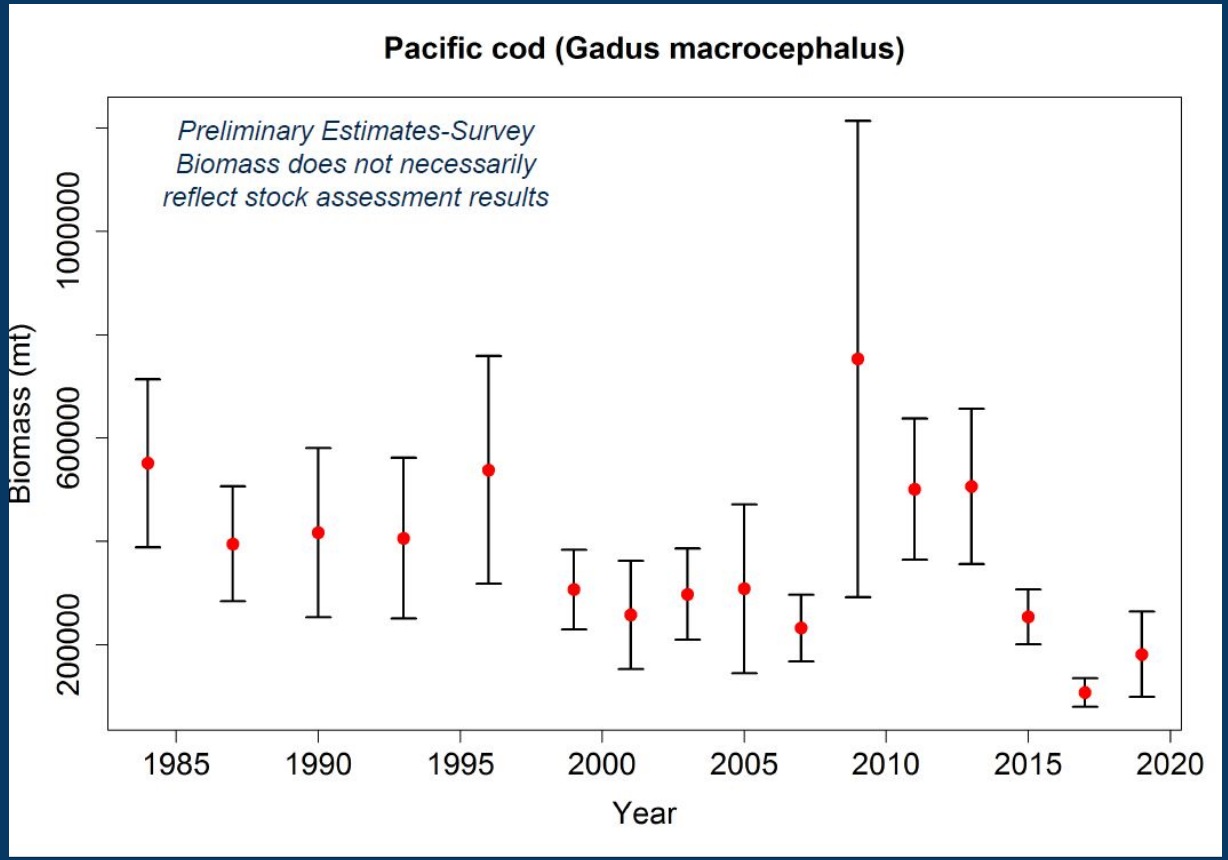
GOA bottom trawl survey: pollock

Palsson



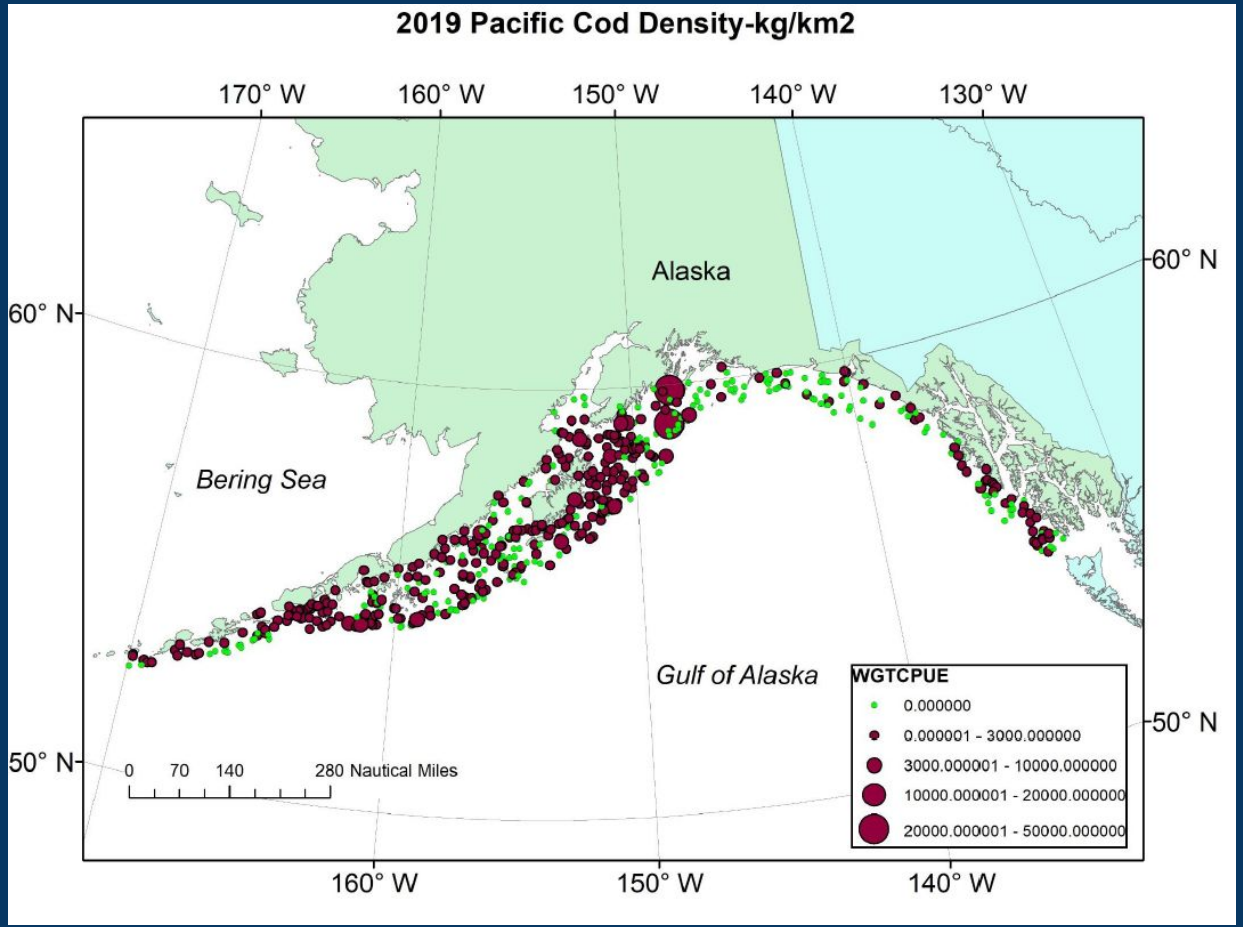
GOA bottom trawl survey: Pacific cod

Palsson



GOA bottom trawl survey: Pacific cod

Palsson



GOA: Implications

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

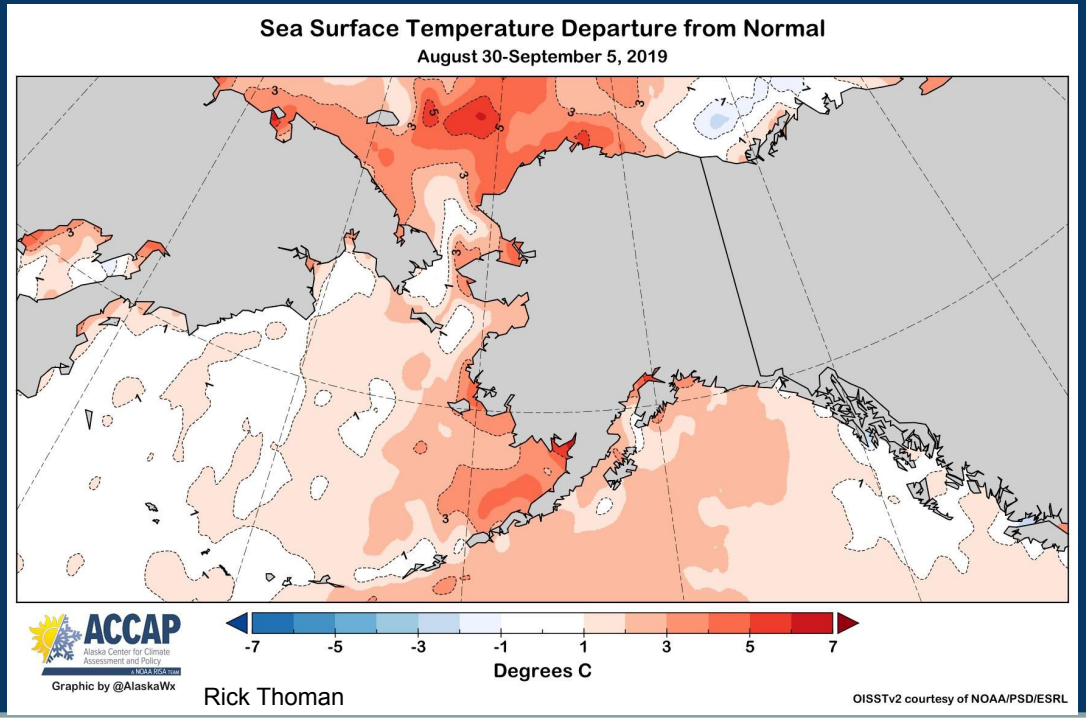
Few pollock and Pacific cod young of year

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.

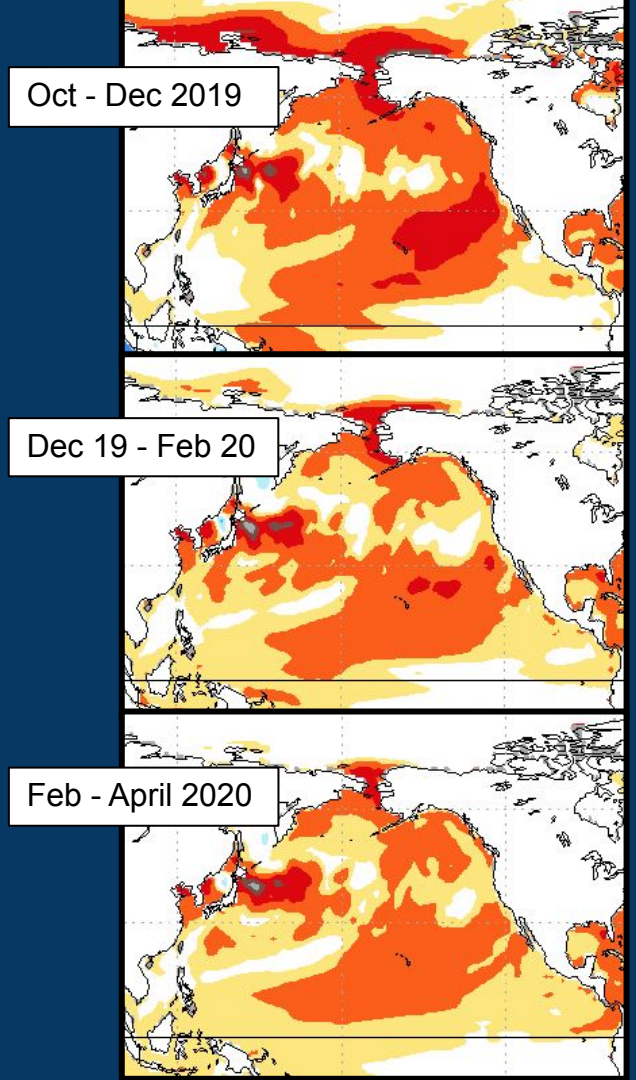
Few humpback calves indicates minor, lagged improvement from previous heatwave.



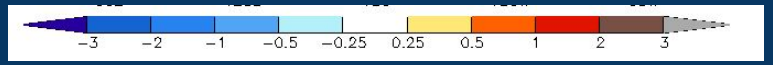
2020 Sea Surface Temperature Forecasts

SST Projections from the National Multi-Model Ensemble

Bond



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



NOAA Fisheries