

Eastern Bering Sea Ecosystem Status Report

BSAI
Groundfish Plan Team
November 17, 2020



Elizabeth Siddon



With contributions from:

Thank You

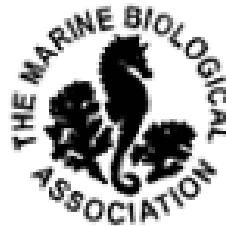
Don Anderson, Kerim Aydin, Shaun W. Bell, Nick Bond, Lyle Britt, Caroline Brown, Greg Buck, Dan Cooper, Jessica Cross, Deana Crouser, Curry J. Cunningham, Seth Danielson, Lauren Divine, Elizabeth Dobbins, Sherri Dressel, Darcy Dugan, Ginny Eckert, Serafima Edelen, Anne Marie Eich, Lisa Eisner, Benjamin Fissel, Sarah Gaichas, Jeanette C. Gann, Colleen Harpold, Jordan Head, Kris Holderied, Kirstin Holsman, Jim Ianelli, Tim Jones, Robb Kaler, Stephen Kasperski, Kelly Kearney, Esther Kennedy, David Kimmel, Alexander Kitaysky, Joseph Krieger, Kathy Kuletz, Elizabeth Labunski, Carol Ladd, Ned Laman, Geoffrey M. Lang, Kari Lanphier, Jean Lee, Kathi Lefebvre, Dennis Lekanof, Aaron Lestenkof, Jackie Lindsey, Christopher Long, Rosie Masui, Paul Melovidov, Sara Miller, Calvin W. Mordy, Franz Mueter, Peter Murphy, Jens M. Nielsen, Elena Oaks, Jim Overland, Darren Pilcher, Chandra Poe, Melissa Rhodes-Reese, Sean Rohan, Marc Romano, Kate Savage, Gay Sheffield, Punguk Shoogukwruk, Kalei Shotwell, Elizabeth Siddon, Kim Sparks, Ingrid Spies, Phyllis Stabeno, Richard L. Thoman, Grant Thompson, Stacy Vega, Andie Wall, Muyin Wang, Jordan T. Watson, George A. Whitehouse, Tom Wilderbuer, Alexis Will, Sarah Wise, and Ellen Yasumiishi

2020 Ecosystem Status Reports

Contributing Partners



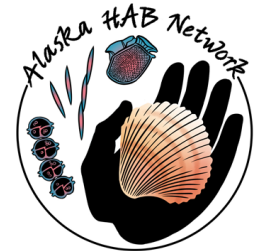
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Institute for Seabird
Conservation and
Research



















NRC






































Outline


























Indicator Category	2019	2020
Physical Oceanography		
Primary Producers		
Zooplankton		
Forage Fish		
Salmon		
Herring		
Groundfish		
Seabirds		
Marine Mammals		
Ecosystem Indicators		
Fishing and Human Dimensions		

For the complete summary of 2019 ecosystem conditions, please see the Assessment in the 2020 EBS ESR.

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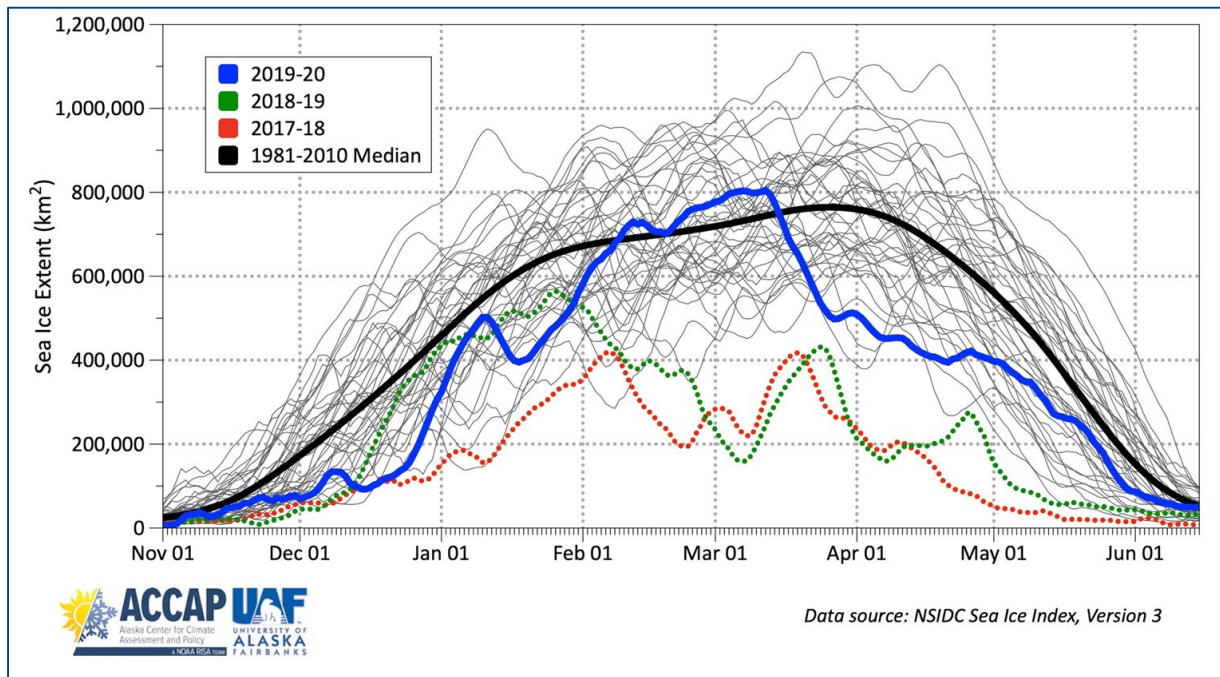
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 noteworthy



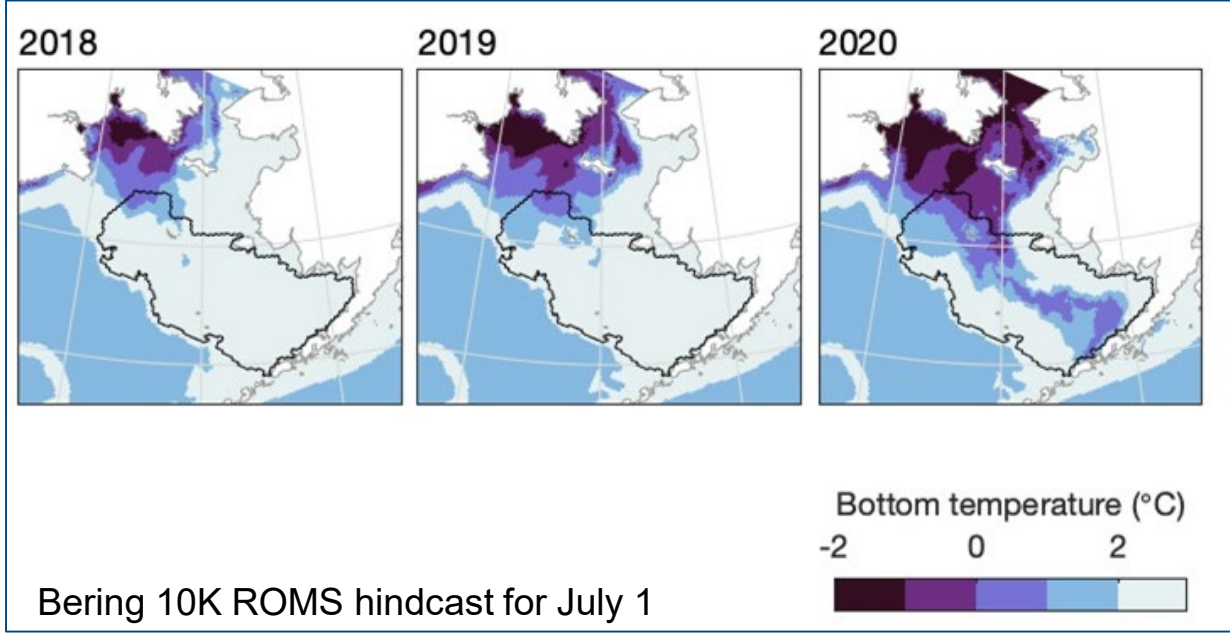
Sea Ice

Thoman



- Winters 2017/2018 and 2018/2019 had minimal sea ice.
- Endless summer?
- 2019/2020 had average ice extent, but ice was thin.
- Exceeded median in February/March.
- Southerly (warm) winds in spring lead to rapid ice retreat.

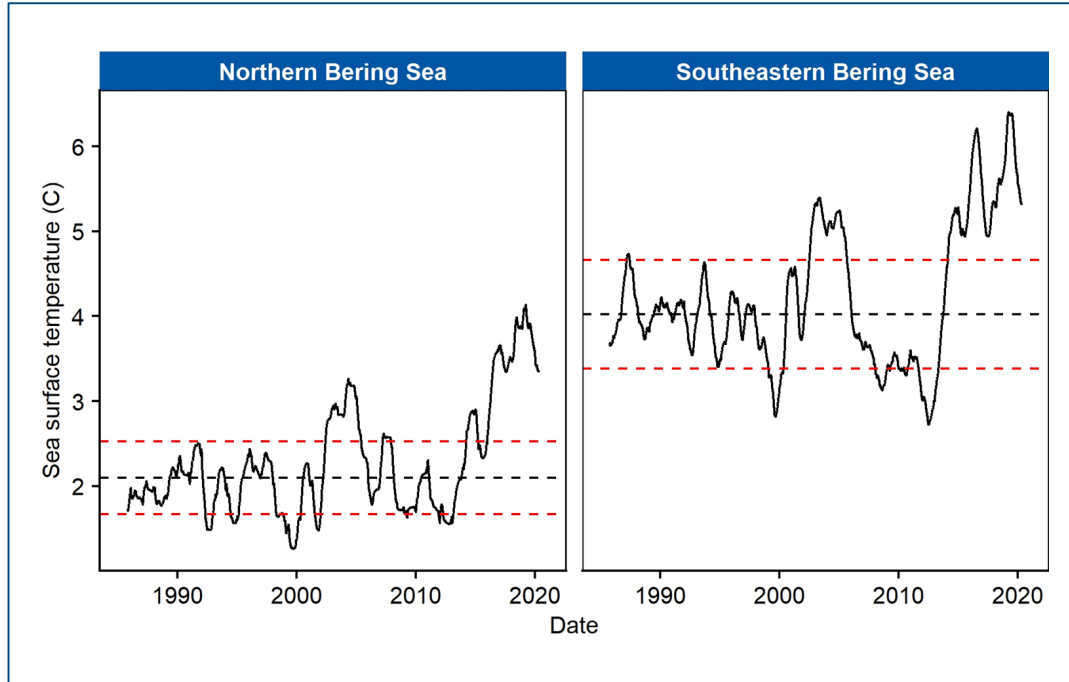
Cold pool Kearney



2020 was an 'average' year in terms of $<2^{\circ}\text{C}$ and $<0^{\circ}\text{C}$ waters in the standard bottom trawl survey area.

Sea Surface Temperatures

Watson

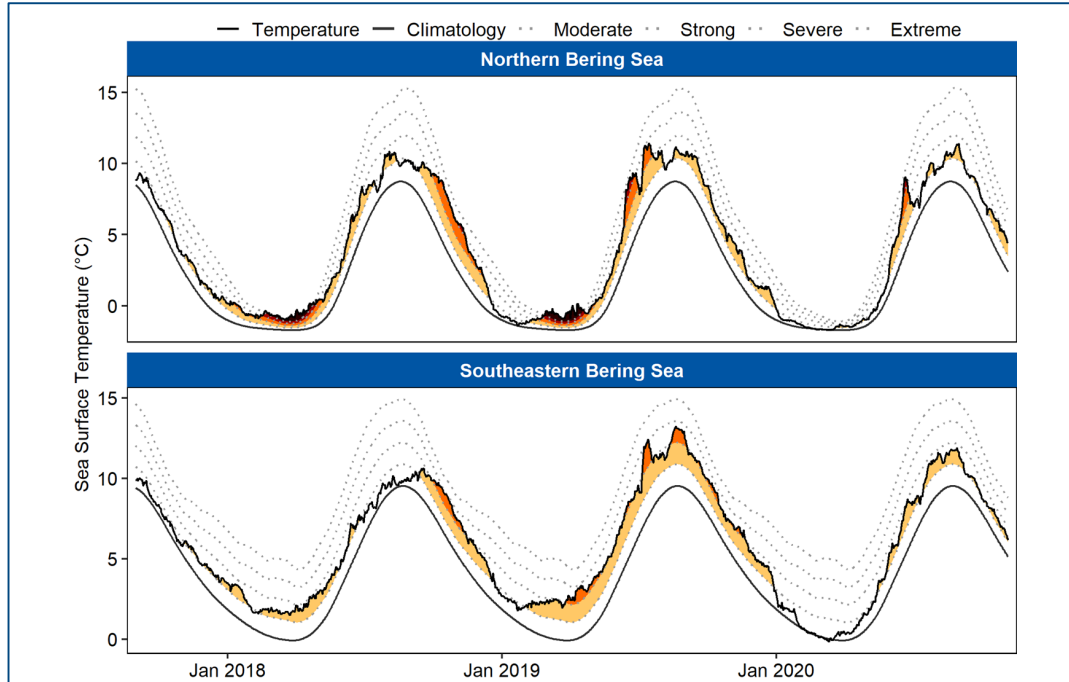


- Removed seasonality and noise from the time series.
- Trends are compared to the mean (± 1 SD) from baseline (1986-2015).
- Both regions are in a persistent warm stanza that is greater in magnitude and duration than the early 2000s.



★ Marine Heatwave

Watson



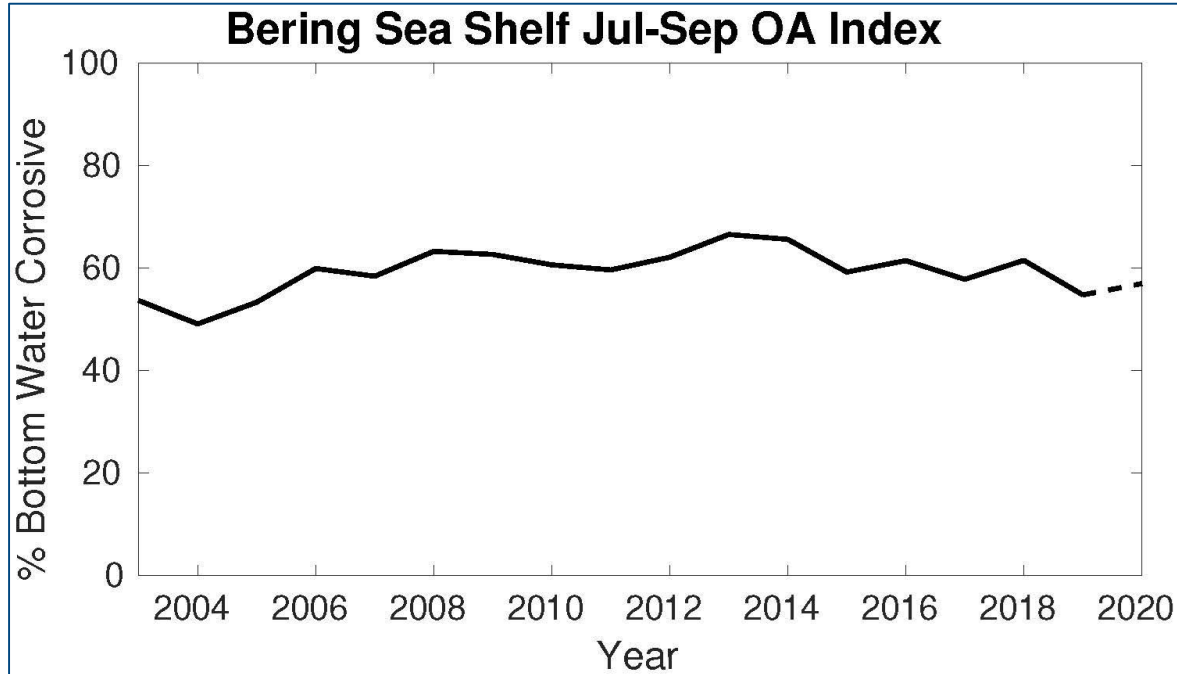
Marine Heatwave status (Sept 2017 to current). Darker colors indicate more intense heatwave conditions.

Note: there are a variety of SST and MHW metrics in the Noteworthy that assessment authors might find useful.



★ Ocean Acidification

Pilcher et al.

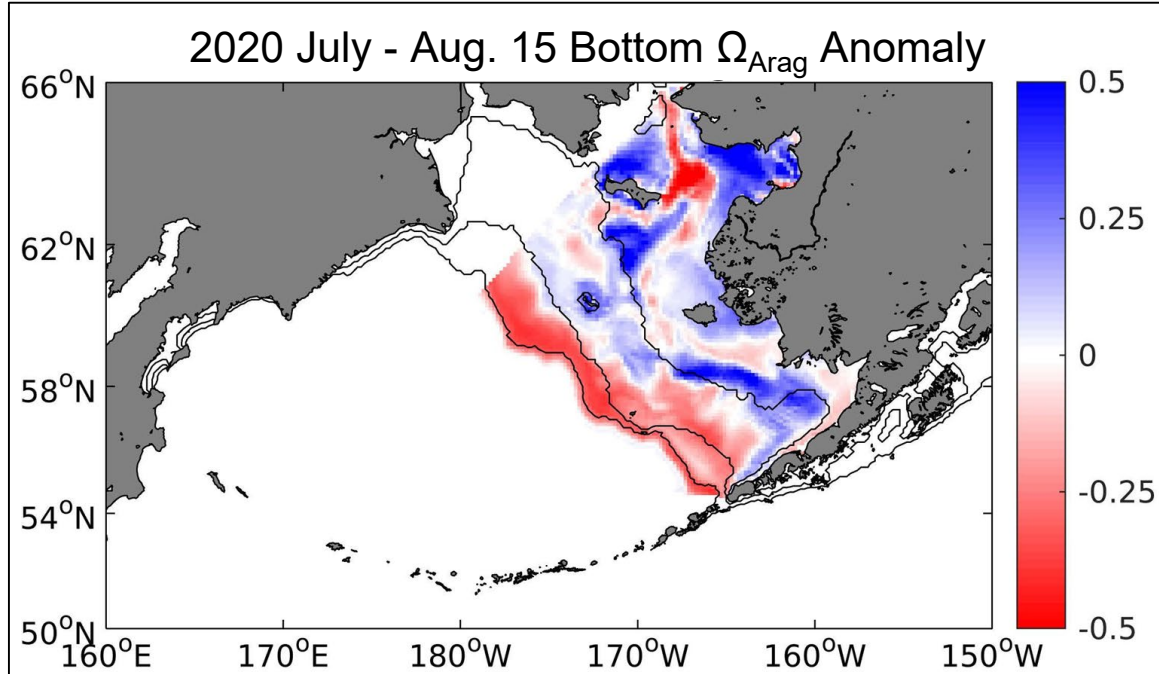


- The spatial extent of bottom waters with an Ω_{arag} value < 1 .
- $\Omega_{arag} < 1 \approx \text{pH} 7.8$. Considered corrosive.
- 2020 value only through Aug. 15 (underestimate).



★ Ocean Acidification

Pilcher et al.



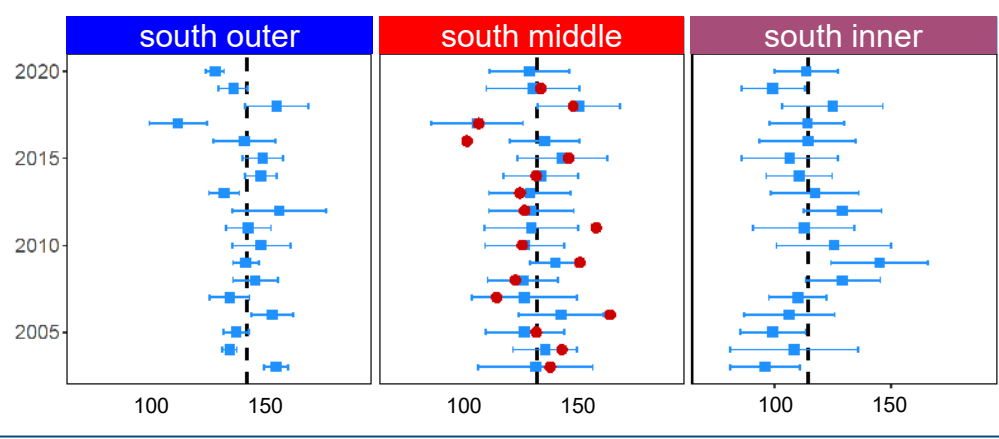
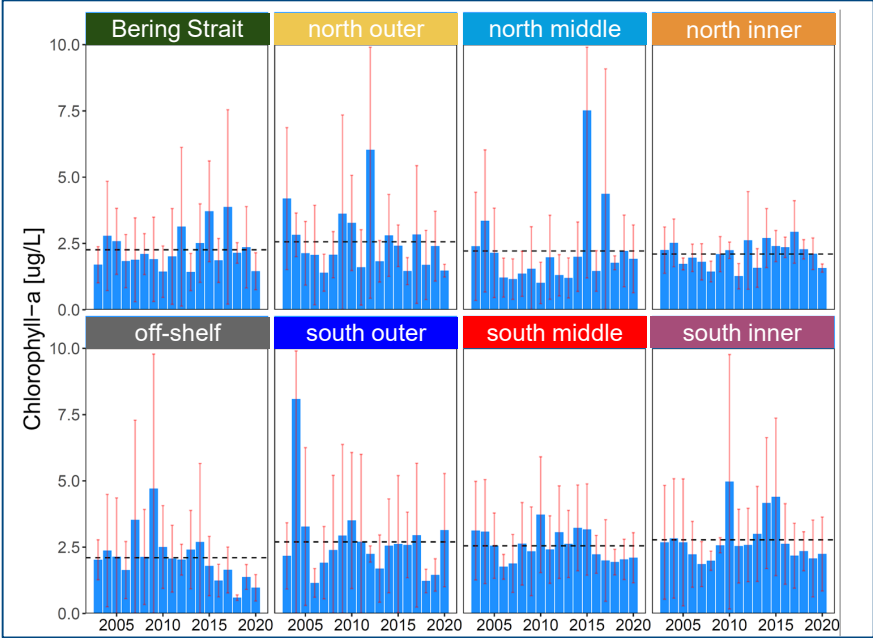
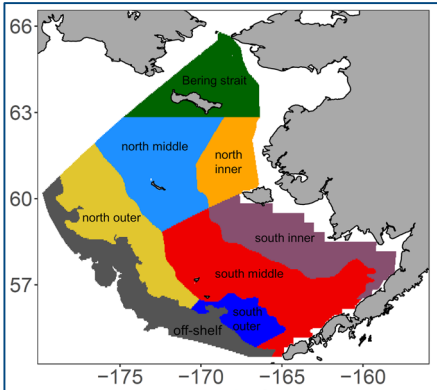
- Anomaly plot shows 2020 compared to the 2003-2019 mean.

- Blue is better; red is worse.

Note: Additional OA outputs (e.g., pH, calcite saturation) are available as spatially and temporally explicit indicators that assessment authors might find useful.

Spring Bloom

Nielsen et al.

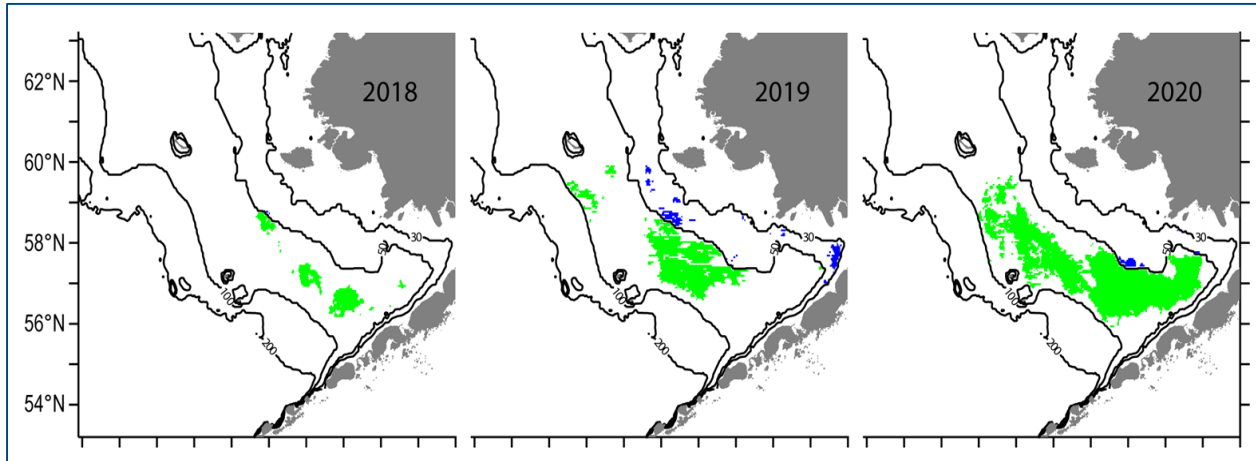


- 2020 spring bloom peak timing earlier than average;
- 2019 about a week earlier;
- 2018 among the latest;
- 2017 among the earliest in most regions.

- Chl-a biomass; dotted line is 2003-2020 average.
- North: 2019 at average; 2020 below average.
- South: below average since at least 2016, except outer domain above-average.

Coccolithophores

Ladd and Eisner



- 2017 was lowest index on record.
- Bloom index below average in 2018 and 2019.
- Increased, particularly on the middle shelf, in 2020.

Implications: coccolithophores result in longer trophic chains, may be a less desirable food source, and can reduce foraging success for visual predators.

★ Gray Whale UME

Savage



- Unusual Mortality Event continued into 2020.
- Whales spend summer and fall in the Bering and Chukchi Seas feeding on invertebrates (e.g., mysids, amphipods, crab larvae).
- Potential explanations include:
 - nutritional stress,
 - contaminants,
 - biotoxins,
 - disease and parasites,
 - direct anthropogenic factors, and
 - reaching carrying capacity.

Integrated Seabird Information

This integration is in response to ongoing collaborative efforts within the seabird community and contains contributions from (in alphabetical order):

Lauren Divine (Ecosystem Conservation Office at Aleut Community of St. Paul Island)

Serafima Edelen (Community member, St. Paul Island)

Tim Jones (University of Washington, Coastal Observation and Seabird Survey Team (COASST), Seattle, WA)

Robb Kaler (U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, AK)

Alexander Kitaysky (University of Alaska Fairbanks, Institute of Arctic Biology, Fairbanks, AK)

Kathy Kuletz (U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, AK)

Elizabeth Labunski (U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, AK)

Dennis Lekanof (Community member, Island Sentinel, St. George Island)

Aaron Lestenkof (Community member, Island Sentinel, St. Paul Island)

Jackie Lindsey (University of Washington, Coastal Observation and Seabird Survey Team (COASST), Seattle, WA)

Paul Melovidov (Community member, Island Sentinel, St. Paul Island)

Elena Oaks (Community member, Hooper Bay)

Marc Romano (U.S. Fish and Wildlife Service, Alaska Maritime National Wildlife Refuge, Homer, AK)

Gay Sheffield (University of Alaska Fairbanks, Alaska Sea Grant, Nome, AK)

Punguk Shoogukwruk (Community member, Savoonga, AK)

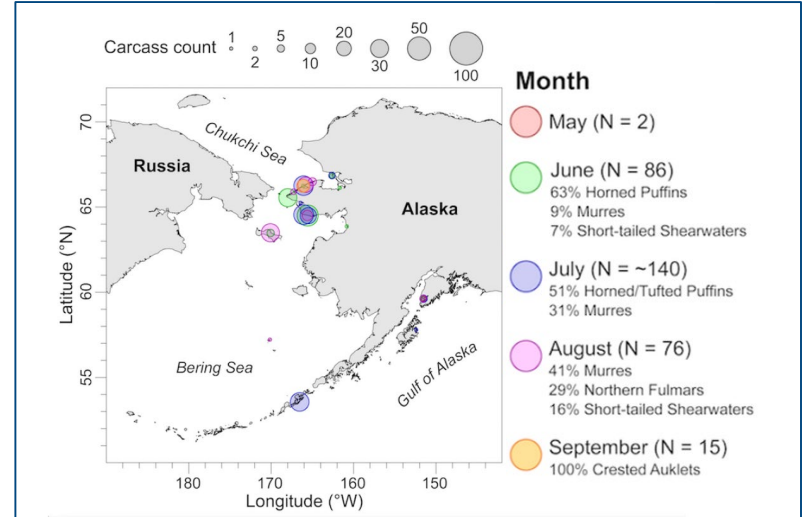
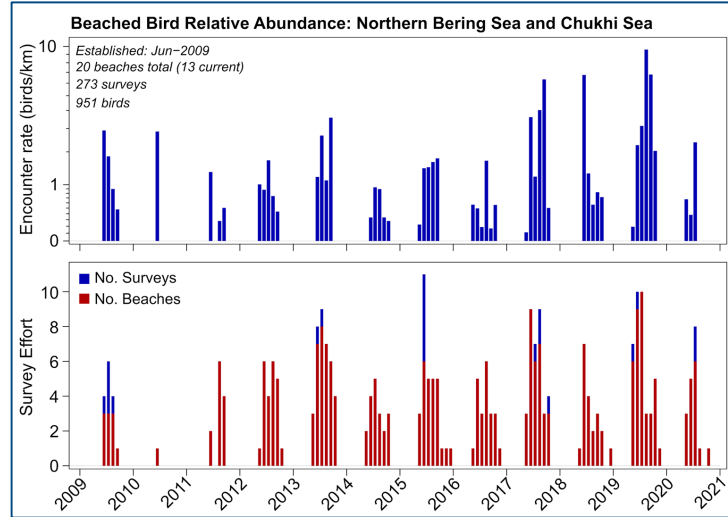
Alexis Will (University of Alaska Fairbanks, Institute of Arctic Biology, Fairbanks, AK)



Integrated Seabird Information

Summary Statement

During 2020, the U.S. Fish and Wildlife Service was unable to conduct field research in the eastern and northern Bering Sea due to COVID-19 travel restrictions. Coastal community members, tribal governments, and state/university partners provided information on seabird dynamics; the U.S. Fish and Wildlife Service biologists helped to synthesize this information.



Over 330 seabird carcasses were reported from the Bering Sea, with most reported from the Bering Strait region.

Implications: most were fish-eating birds, but plankton-eating birds also affected, suggesting some impact across trophic levels.

Integrated Seabird Information

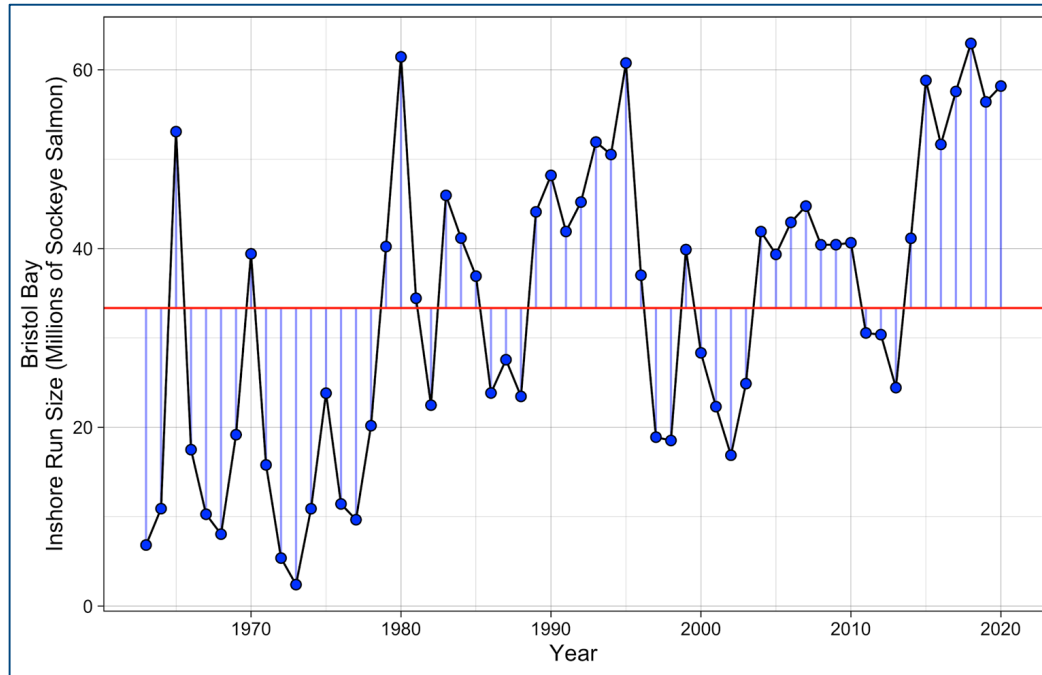


- At the Pribilof Islands, it was an average, to slightly below average, year for most fish-eating seabird species (e.g., black-legged kittiwakes, common murres).
- Planktivorous species (e.g., least auklets) continued to decline.
- Complete lack of parakeet auklets (planktivorous) from St. Paul Island, which had been the most abundant auklet species since monitoring began in the late 1970s.

Implications: Fish-eating species were able to find moderate/sufficient food; planktivorous species were not.

Bristol Bay Sockeye Salmon

Cunningham et al.



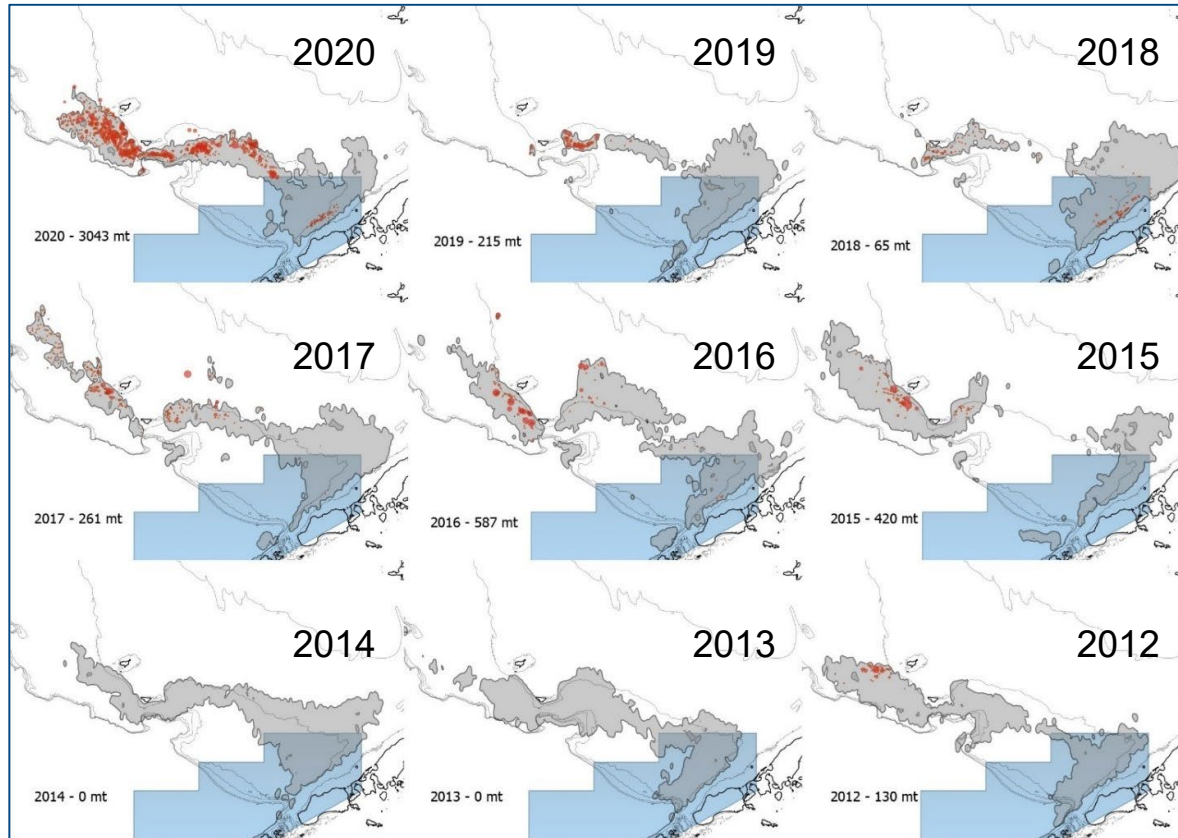
- 2020 is the 5th largest run on record since 1963.
- Inshore runs in 2015-2020 all exceeded 50 million.
- Positive ocean conditions in summers of 2017 and 2018, and winters 2017/2018 and 2018/2019.

Implications: Juvenile sockeye feed on zooplankton and age-0 pollock in warm years; adults feed on zooplankton and krill.

★ Incidental Catch of Herring in 2020

Siddon et al.

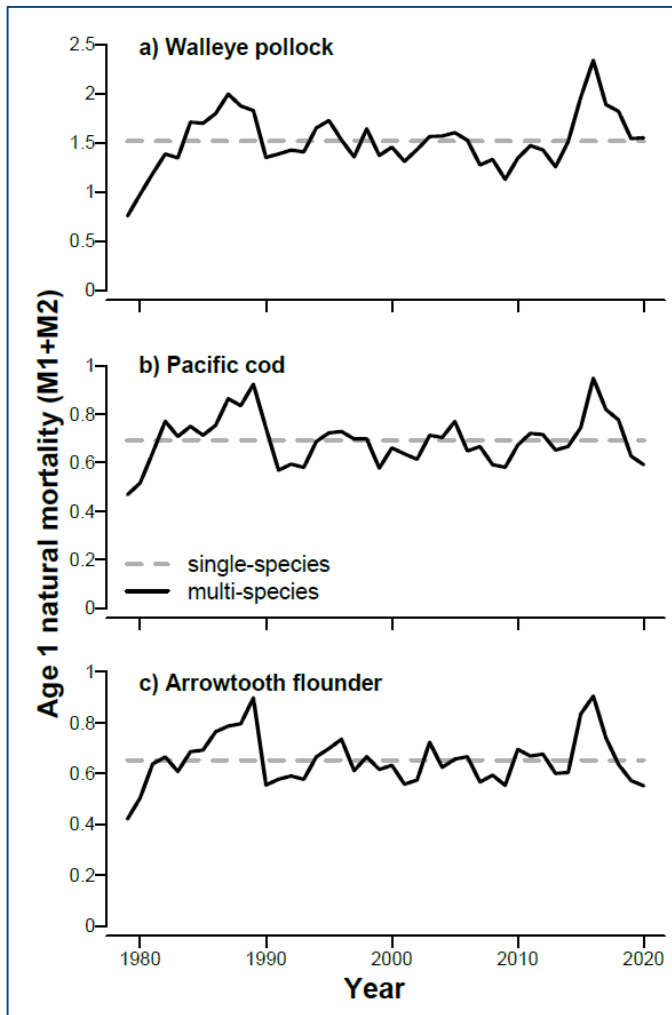
Figure provided by SeaState, Inc.



- Contribution explores hypotheses that may explain the increased herring catch.
- Provides areas of research to help inform the hypotheses.
- Gray: Pollock A season footprint.
- Red: Herring bycatch.

Groundfish

Holsman et al.

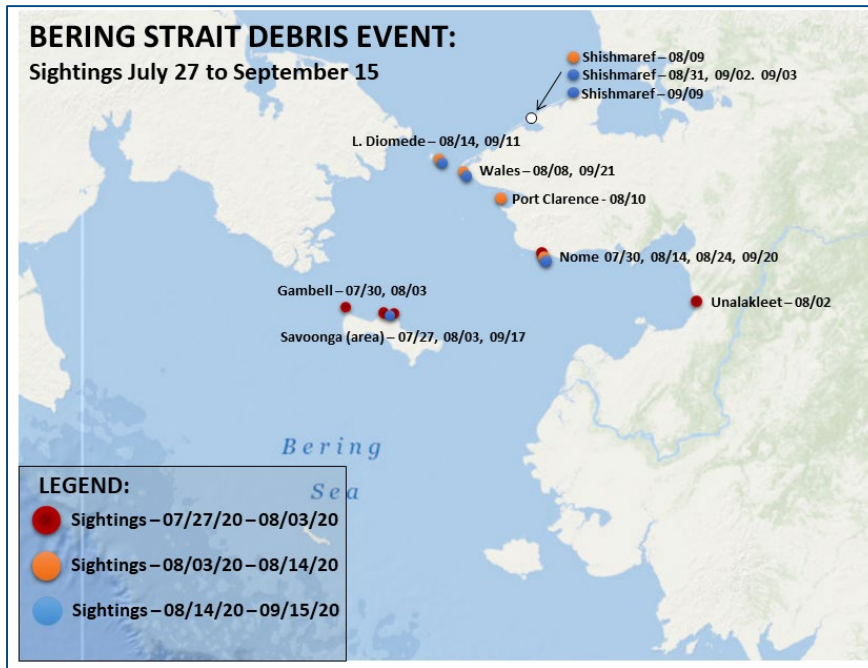


- CEATTLE model estimates of age-1 predation mortality continued to decline.
- Age-1 predation mortality for pollock is at the long-term mean.
- Age-1 Pacific cod and Arrowtooth flounder remain below their long-term means.

Implications: declines in predator biomass mean an overall decline in age-1 mortality.

★ Marine Debris

Murphy and Sheffield



- Marine debris reported in Bering Strait communities from July through October 2020.
- Predominantly foreign in manufacture, with identifiable Russian and Korean writing.
- Adds to existing concerns in the region regarding food security and economic impacts with an increase in commercial fishing/processing activities and other industrial vessel traffic.



2020 Summary and Implications



Sea ice extent was near-normal, but ice was thin/weak. Average cold pool extent. SSTs above average and NBS in “heatwave” status. *Implications: EBS is in a persistent warm stanza.*



Chl-a biomass was below average and peak bloom timing was earlier than average in most regions. *Implications: Low chl-a biomass could indicate reduced production and/or increased grazing by zooplankton.* Coccolithophores increased. *Implications: longer trophic chains, less desirable food source, and reduced foraging success for visual predators.*



Gray whale UME continued. *Implications: cumulative impacts of changes in food web structure and carrying capacity of the NBS.*



Seabird die-offs in the NBS were mostly fish-eating species, but plankton-eating birds were also affected. Colony attendance at the Pribilofs indicated fish-eating species were able to find sufficient food, but planktivorous species were not. *Implications: regional differences in foraging conditions with fish-eating birds doing better in the south and plankton-eating birds doing better in the north.*



Sockeye salmon returns indicate favorable ocean conditions in summers 2017 and 2018, and winters 2017/2018 and 2018/2019. *Implications: Juveniles feed on zooplankton and age-0 pollock in warm years; adults feed on zooplankton and krill.*



CEATTLE model shows declines in age-1 predation mortality for Pollock, PCod, and ATF. *Implications: indicates potential declines in predator biomass.*