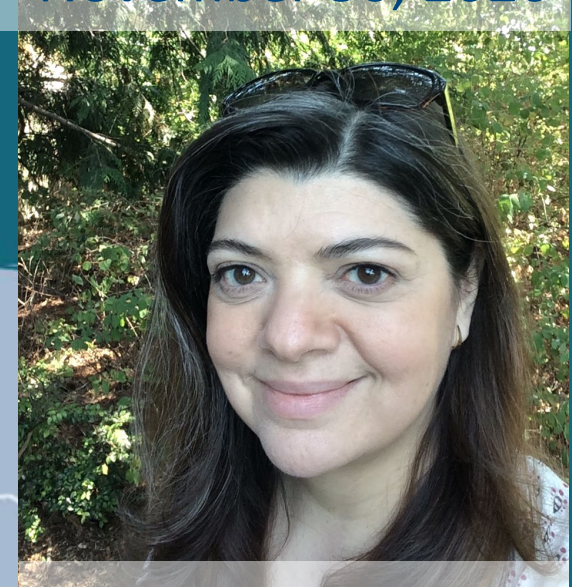











Aleutian Islands Ecosystem Status Report

North Pacific Fishery
Management Council
SSC presentation
November 30, 2020



Ivonne Ortiz &
Stephani Zador¹

Outline

Index Category		2019-2020
Physical Oceanography		2019-2020
Primary producers		2019
Zooplankton		2019
Salmon		2019
Groundfish		2018 updated
Seabirds		2019
Marine Mammals		2019
Ecosystem Indicators		2019
Fishing and Human Dimensions		2019-2020

- New this year
- Contributors
- Noteworthy
- Multi-year Patterns, Regional Coherency
- Regional Differences
- 2019 biological info; 2020 physical info
- Summary/ Implications
- Questions and/or Comments?

New this year

- Physical Environment Synthesis provides an overview of Climate, Regional Highlights, Winds, SST and Heat Waves, Mid Water Temperature, and Eddies.
- Integrated Seabird Information.
- Aleutian Islands Ecosystem Status Report In Brief
- Added new indicators with ecoregion-specific information when possible (Physical Environment Synthesis, Kamchatka pink salmon, marine mammal strandings, expanded Steller Sea Lion and seabird information). Processes/responses were synthesized for each ecoregion in an effort to provide insights to ongoing trends.

Individual Contributors

*Thank
you!*

Sonia Batten, Nick Bond, Hillary Burgess, Benjamin Fissel, Cate Jenipher, Tim Jones, Stephen Kasperski, Mandy Keogh, Joseph Krieger, Kathy Kuletz, Carol Ladd, Ned Laman, Jean Lee, Jackie Lindsey, Calvin Mordy, Clare Ostle, Noel Pelland, Heather Renner, Melissa Rhodes-Reese, Sean Rohan, Nora Rojek, Greg Ruggerone, Kim Sparks, Phyllis Stabeno, Katie Sweeney, Jordan Watson, George Whitehouse, Sarah Wise, and Stephani Zador

photos: photolib.noaa.gov

2020 Ecosystem Status Reports

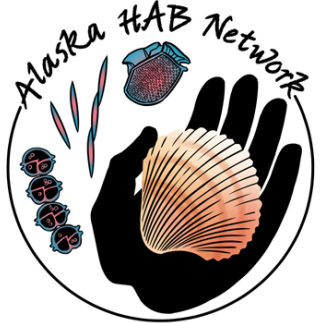
Contributing Partners



PRINCE WILLIAM SOUND
SCIENCE CENTER



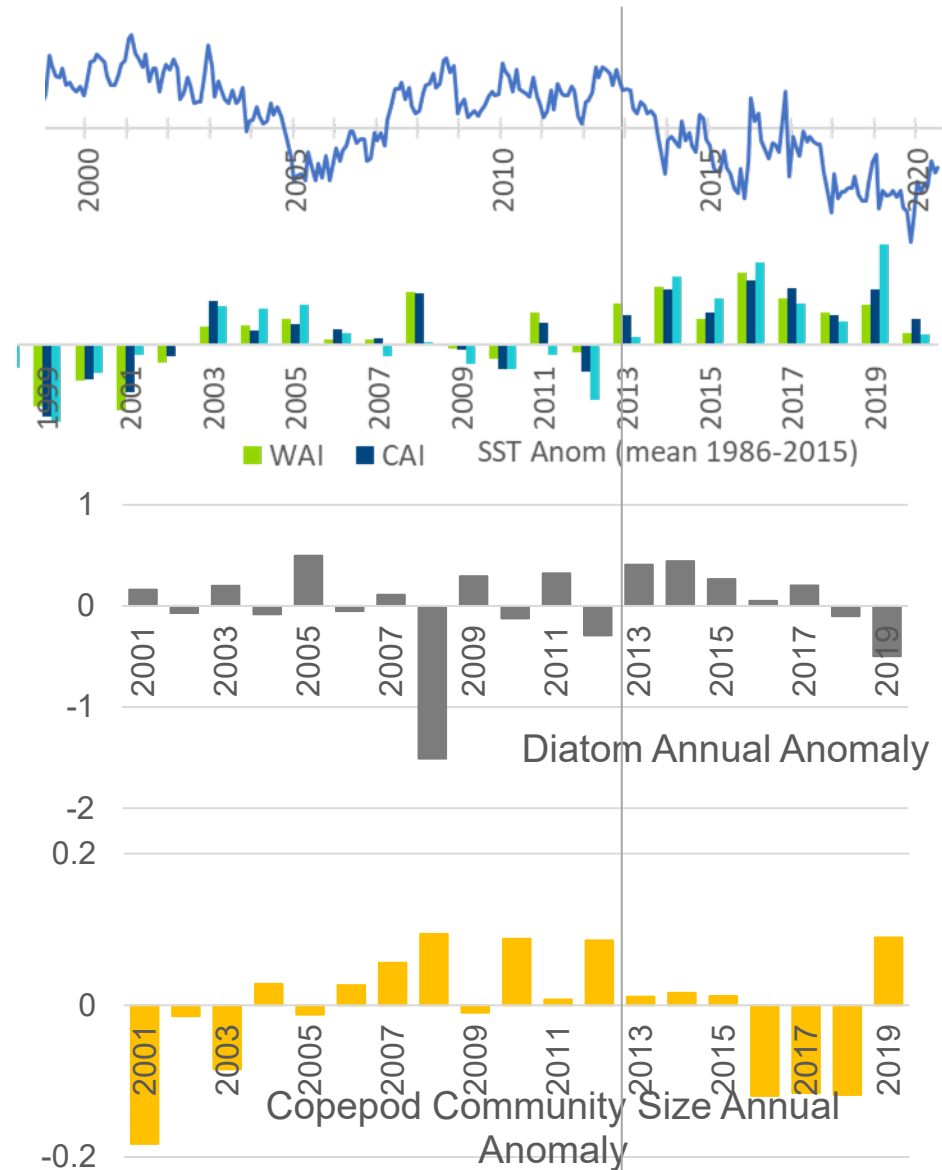
COAST



Noteworthy

- COVID-19 year: Industry spent over \$50 million to reduce the risk of COVID-19 transmissions. There were **no biological surveys** for fish, marine mammals or seabirds in the Aleutians; surveys were canceled or postponed.
- **HABS**: high toxicity in **Unalaska** (140 shellfish 140x above regulatory limit) where consumption of blue mussels and snails resulted in a community member fatality in July. **Kamchatka Peninsula** - extreme event (Sep '20) resulted in dead seals, octopi, benthic invertebrates, sickness in humans).
- Processing plant closes in Adak, previously closed in 2013 operated by Icicles Seafoods. The closure may set back the stability needed to maintain services, support a stable population, and attract long-term residents.

Multi-year Patterns

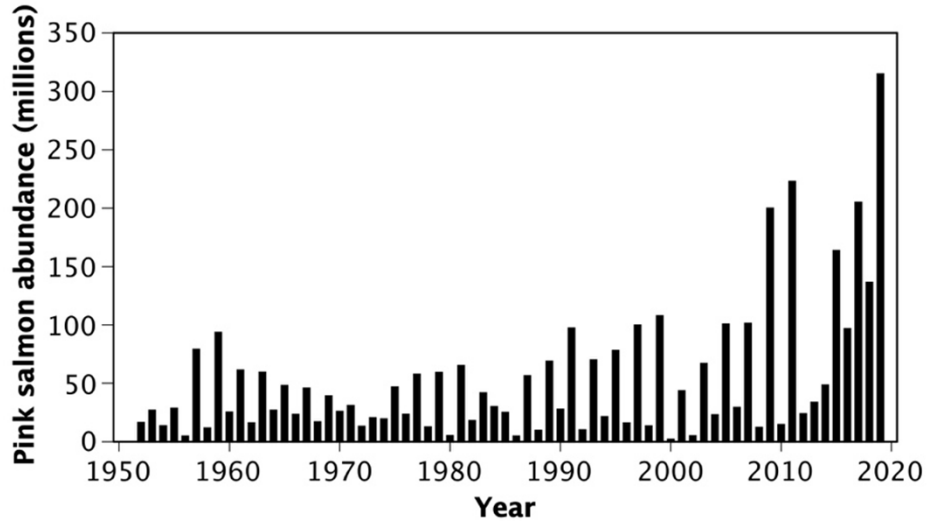


Multiple biophysical indicators showing consistent conditions since 2013-2014 across the entire Aleutians chain:

- NPGO: below long-term average since 2013-2014.
- Summer Sea Surface Temperatures (SST) above long-term mean.
- Decreasing trend in large diatom abundance
- Decreasing trend in copepod community size

NPGO, Nick Bond; Sea Surface Temperature, Jordan Watson; Diatom and Copepod Community Size, Clare Ostle and Sonia Batten ⁷

Multi-year Patterns: Fish

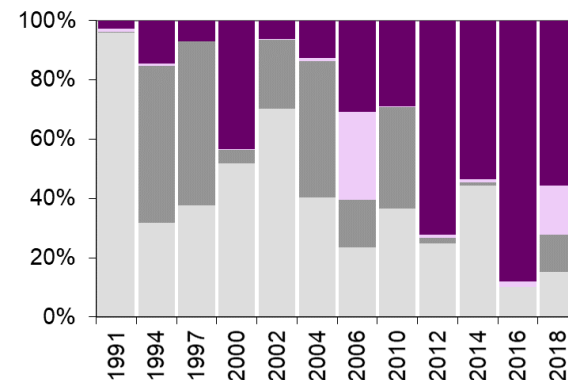
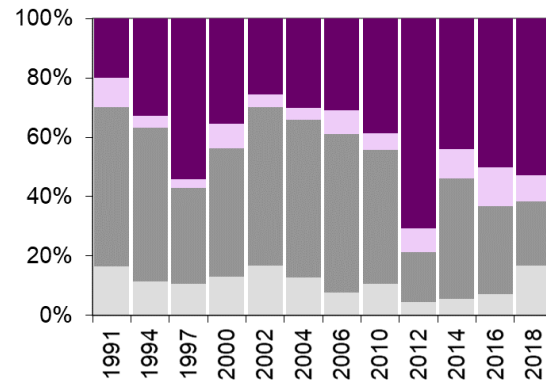
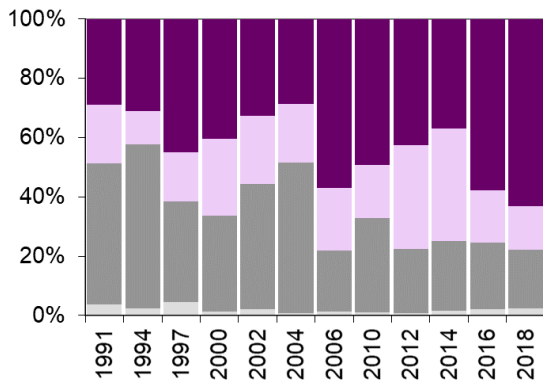


- Biomass of Kamchatka pink salmon and Pacific ocean perch (POP), primarily planktivorous species, has increased and stayed high in the last few years, while Atka mackerel has decreased.
- Area occupied by POP has also increased (Spencer et. al., POP SAFE)

Pelagic Foragers: Western AI

Central AI

Eastern AI

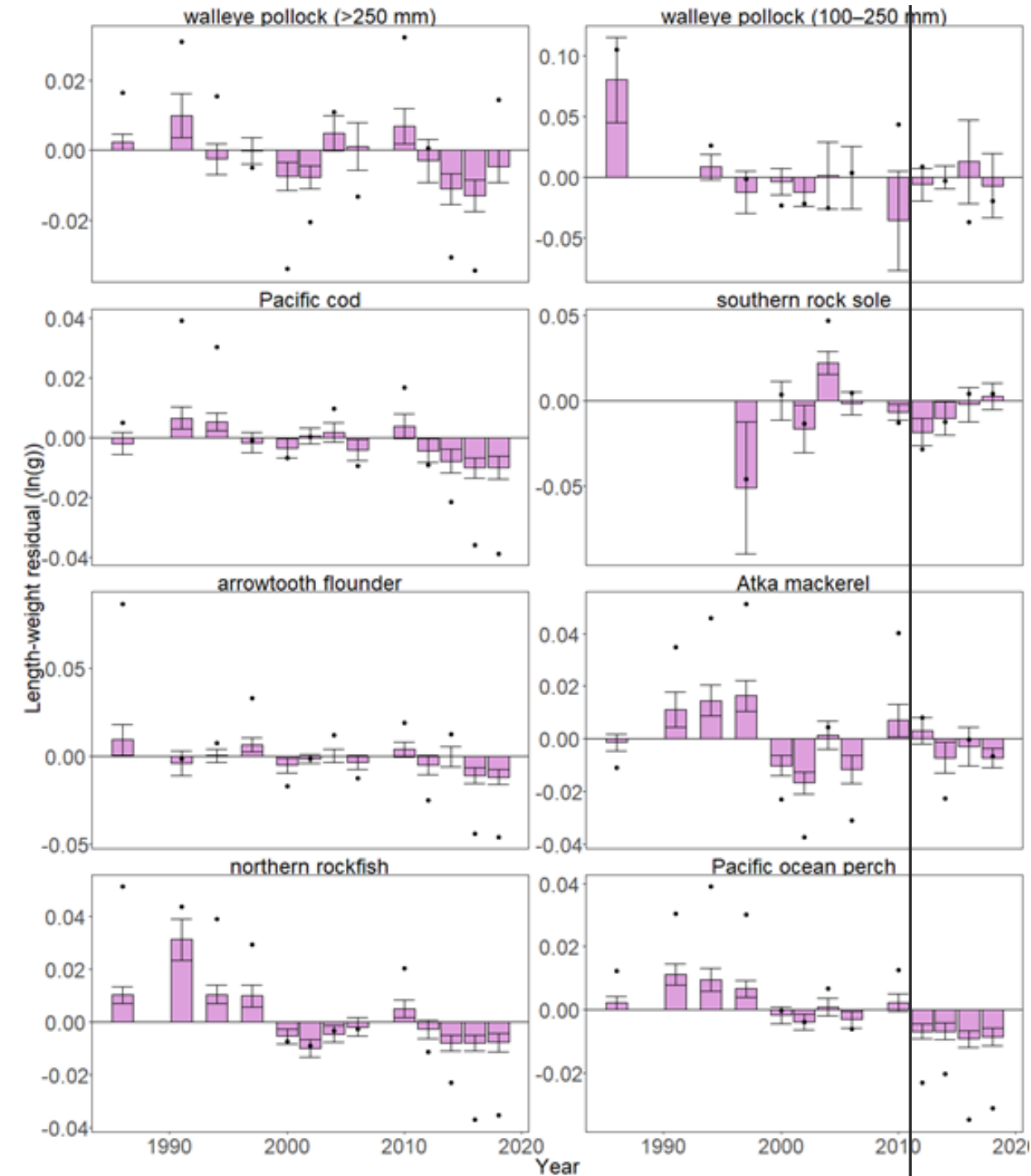


POP
Northern Rock
Atka mackerel
W. pollock

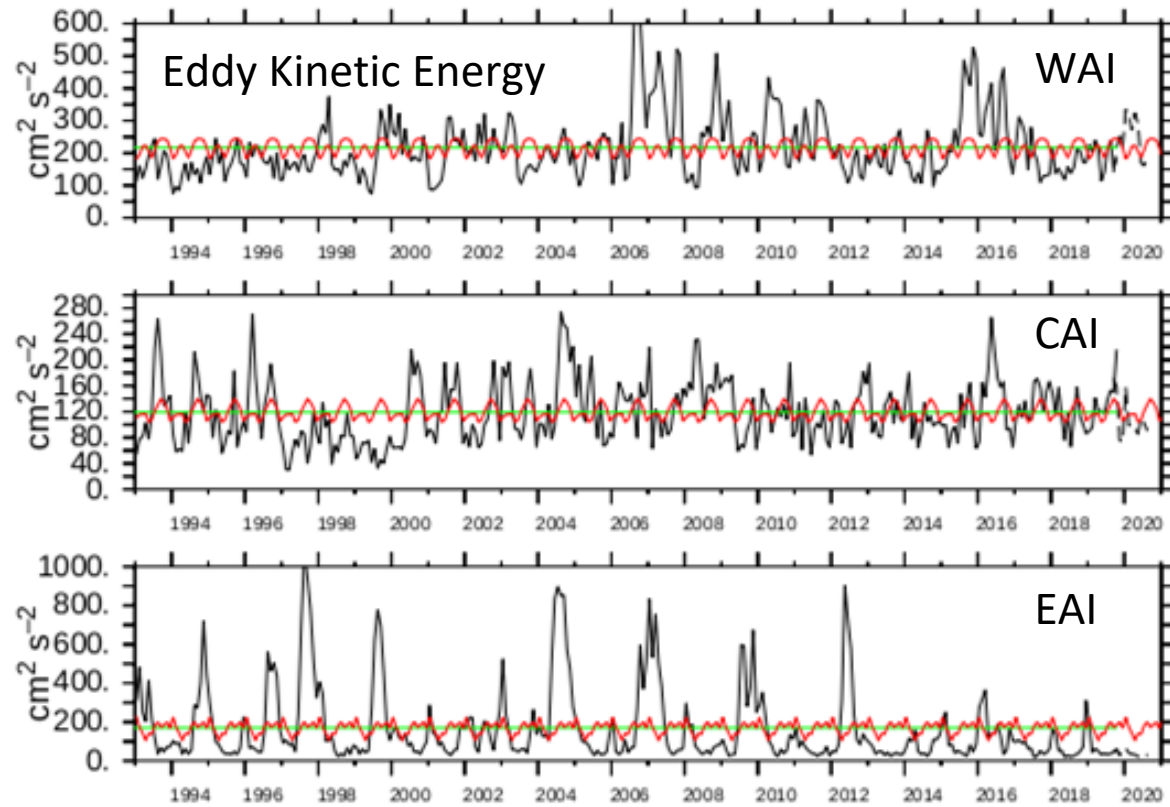
Kamchatka pink salmon,
Greg Ruggerone;
Pelagic forager biomass,
BT survey, Ivonne Ortiz

Multi-year Patterns: Fish Condition

- Lower than average fish condition since 2012 for several commercially important groundfish

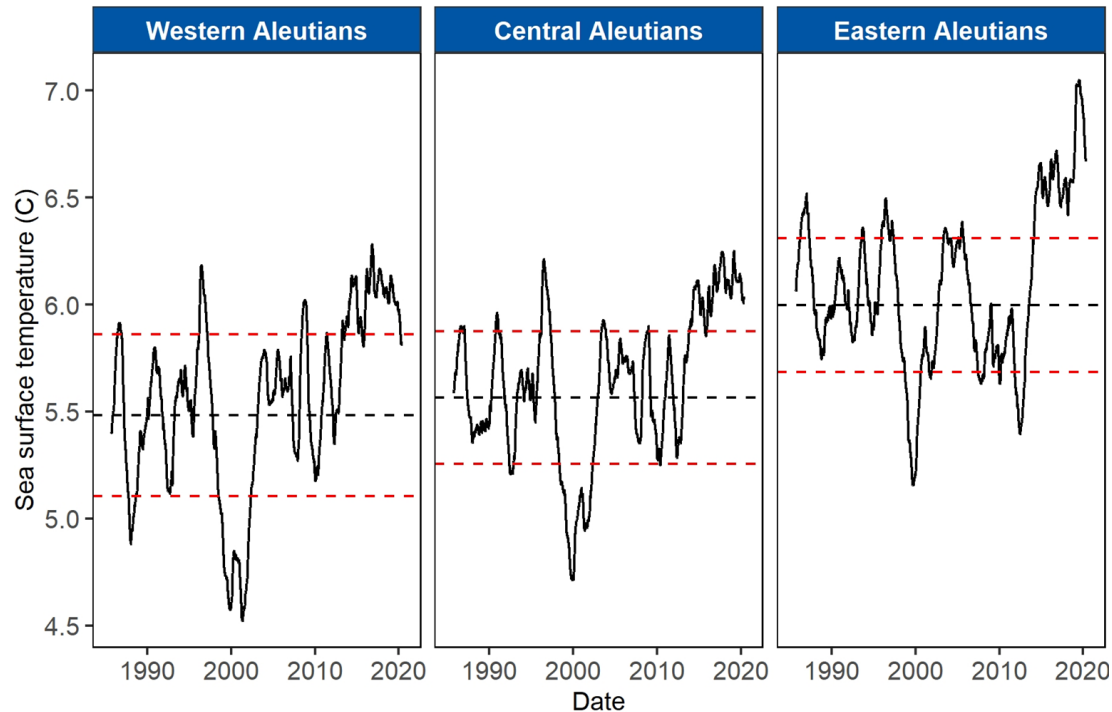


Regional Differences: Eddy Kinetic Energy



- **WEST:** Multi-year or consecutive eddies of lower intensity
- **EAST:** Discrete intense eddy events;
- Black line Black (line with highest variability): monthly EKE (dashed part of line is from near-real-time altimetry product which is less accurate than the delayed altimetry product).
- Red: seasonal cycle.
- Green (straight line) : mean over entire time series (1993 - Dec 2019)
- Near average eddy kinetic energy in western and central AI; low in eastern AI. Lower volume, heat salt and nutrient fluxes through passes.

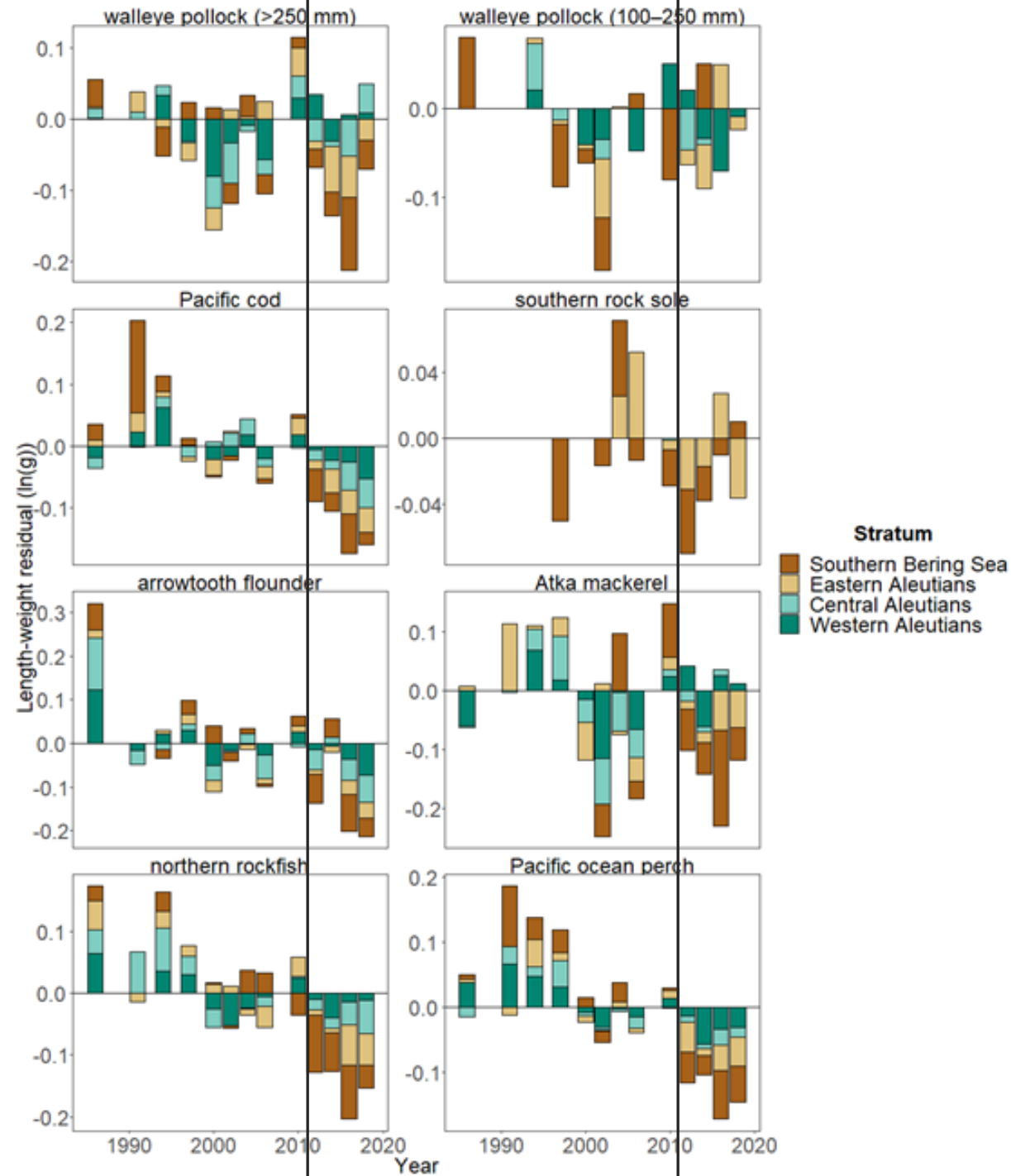
Regional Differences: Sea Surface Temperature



- **WEST**: lower temperatures
- **EAST**: higher temperatures, higher variability

- Satellite-derived sea surface temperature
- Removed seasonality and noise from the time series.
- Trends are compared to the mean (± 1 SD) from 30-year baseline (1986-2015).
- All regions are in a persistent warm period starting 2013

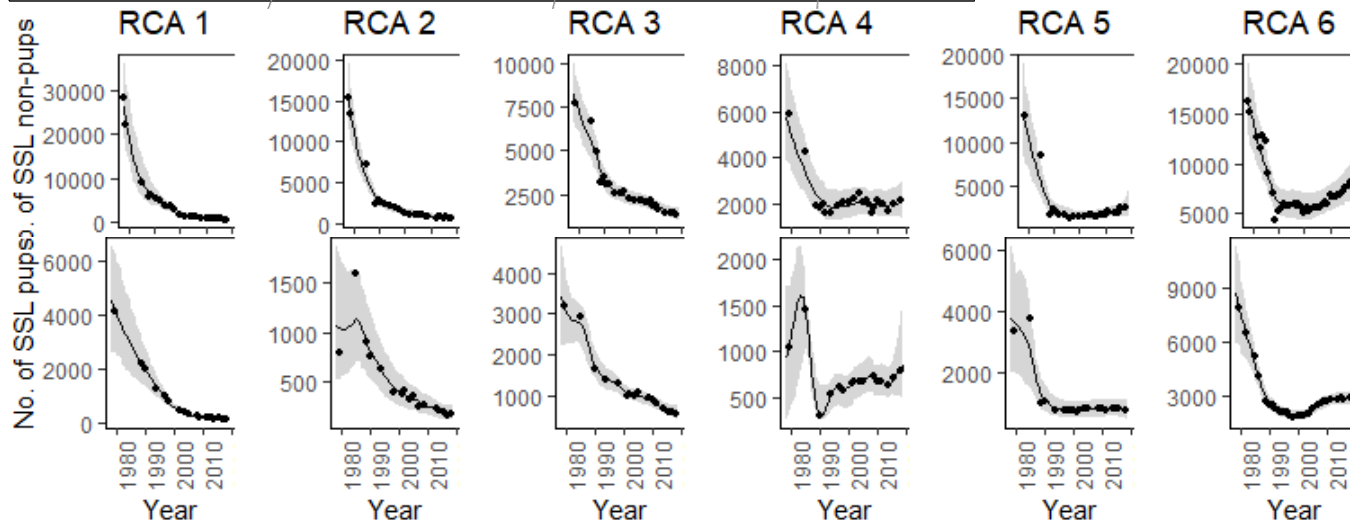
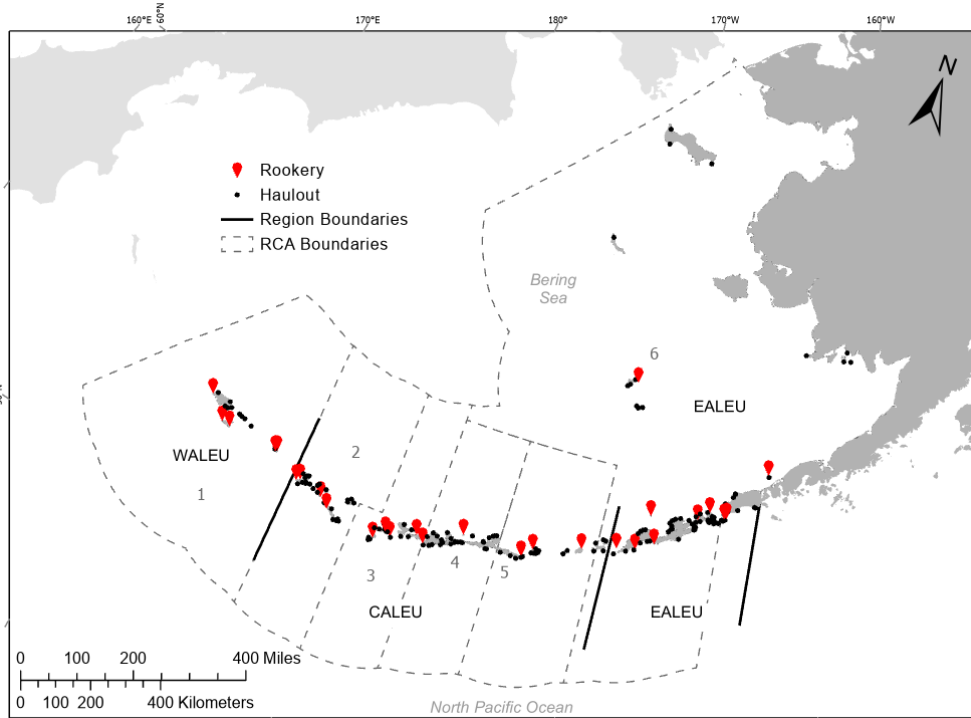
Regional Differences: Fish Condition



- **WEST**: Fish condition occasionally above long-term average in Atka mackerel and large pollock
- **EAST**: Occasionally above long-term average condition of small pollock and rock sole
- Overall lower condition since 2012 in Pacific cod, Northern rockfish, Pacific ocean perch
- Strata refer to:
 - Southern Bering Sea = Eastern AI east of 170°W;
 - Central and Eastern = Central AI 170°W-177°E

Regional Differences: Steller Sea Lions

- **WEST:** Declining numbers of pups and non-pups
- **EAST:** Increasing estimated numbers of pups and non-pup



Steller sea lion estimated numbers, Katie Sweeney

2019 Seabirds: Hatching chronology

- **WEST & EAST:** Average or earlier hatching chronology of plankton and fish-eating seabirds, and larger copepod size (from CPR), may signal early spring bloom.

Site	Species											
	Primarily fish species						Primarily zooplankton eaters					
	glaucous winged gull	thick billed murre	horned puffin	tufted puffin	black-legged kittiwake	fork-tailed storm- petrel	Leach' s storm-petrel	ancient murrelet	parakeet auklet	least auklet	whiskered auklet	crested auklet
Aiktak	-	-	White bird	White bird	-	White bird	White bird	White bird	-	-	-	-
Buldir	White bird	White bird	White bird	Black bird	White bird	White bird	White bird	-	White bird	White bird	White bird	White bird

White bird indicates hatching chronology was >3 days earlier than average.
 Gray bird within 3 days of average.
 Black bird <3 days later than average.

Hatching chronology, Nora Rojek, Heather Renner



2019 Seabirds: reproductive success

- **WEST & EAST:** Average or above average **reproductive success** of plankton and fish-eating seabirds compared to previous failure of fish-eating seabirds

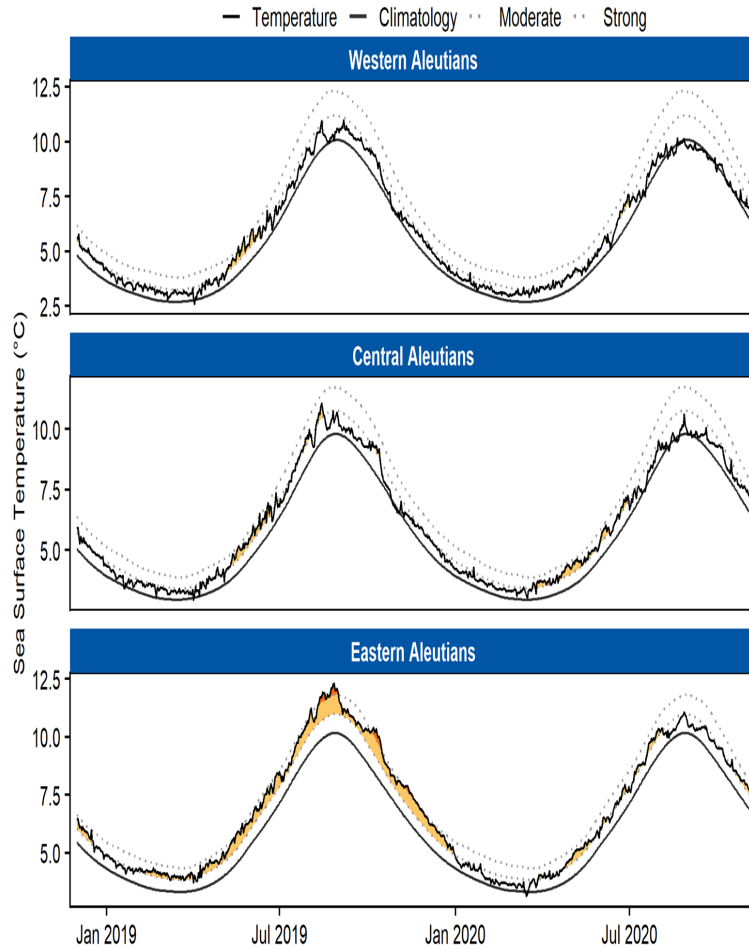
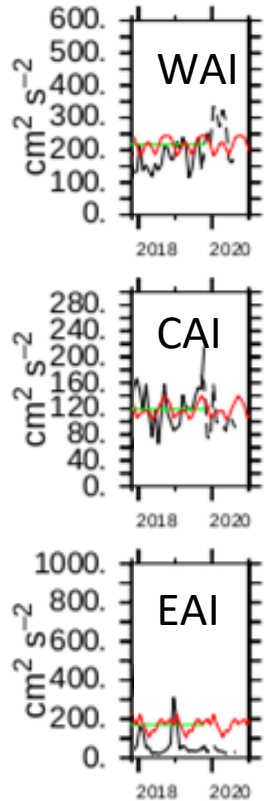
Site	Species														
	Primarily fish eaters - - - - -							Primarily zooplankton eaters							
	red-faced cormorant	glaucous winged gull	Common murre	thick-billed murre	horned puffin	tufted puffin	red-legged kittiwakes	black-legged kittiwakes	fork-tailed storm-petrel	Leach' s storm-petrel	ancient murrelet	parakeet auklets	least auklets	whiskered auklets	crested auklets
<u>Aiktak</u>	☺	☺	☺	☺	☺	☺	-	-	☺	☺	☺	-	-	-	-
<u>Buldir</u>	-	☺	☹	☺	☺	☺	☹	☺	☹	☺	-	☺	☺	☺	☺

White bird indicates hatching chronology was >3 days earlier than average.
 Gray bird within 3 days of average.
 Black bird <3 days later than average.

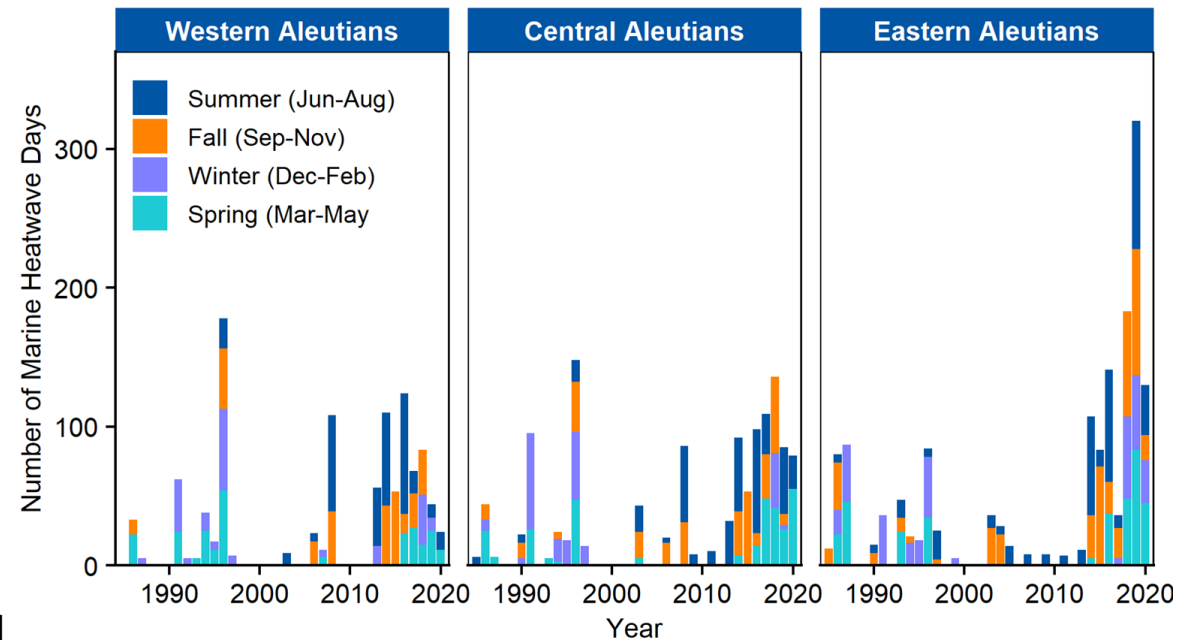


2020 Oceanography

Eddy Kinetic Energy



- **WEST & EAST:** Low eddy kinetic energy (EKE), lower sea surface temperature (SST) but still above long-term average; fewer marine heatwave days.



Summary and Implications- Multi-year trends

- Extended period of **above average sea surface temperatures** and subsurface temperatures with lower volume of heat, salt and nutrient flow through passes coincides with decreasing trend in large diatom abundance and copepod size.
- Higher temperatures increase bioenergetic costs, which may have **increased prey consumption**. Actual effect of higher temperatures depends on the thermal tolerance of each species.
- The **lower fish condition** may indicate a detrimental effect of temperature. Higher biomass of Kamchatka pink salmon and POP signal **potentially higher competition for available prey**. This may have contributed to the decrease in Atka mackerel biomass and lower groundfish condition; **lower prey availability and quality** would also cascade to apex predators.
- Western Aleutians have the lowest SST and the lowest proportion of Atka mackerel and pollock with respect to rockfish. These might make them less available as prey than in the central and eastern Aleutians.

Summary and Implications: 2019

- Together, the **increased copepod size and early hatching chronology in 2019 might signal an earlier spring bloom**, to which surface feeding seabirds as well as seabirds with long breeding seasons are more sensitive to than diving species and those with short breeding seasons (Descamps 2019). The **decrease in large diatom abundance supports a higher abundance of large copepods**.
- Average or above average reproductive success of seabirds in the western and eastern Aleutians signals **favorable foraging conditions for rearing chicks**, potentially also **favorable foraging for groundfish in 2019**, despite the almost year long heatwave in eastern Aleutians.

Summary and Implications: 2020 and forecast

- The Aleutians Islands region experienced **suppressed storminess through fall and winter 2019/2020** across the region, **favoring seabird foraging**. La Niña conditions are present, most climate indices are near long-term average, lower SST in 2020 compared to 2019 but still above long-term average.
- HABS, **high toxicity at both ends of Aleutian chain** during summer 2020 — in Unalaska and Kamchatka Peninsula — **impacted marine mammals, fish, as well as subsistence harvest and human health**.
- **Sea surface temperatures are forecasted to increase slightly in Winter - early Spring 2021** in the central and western Aleutians.

Questions and/or comments?

