

Ecosystem Status Report Gulf of Alaska 2020

Bridget Ferriss & Stephani Zador



With contributions from:



PRINCE WILLIAM SOUND
SCIENCE CENTER



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COASST



Thank you!

2020 Changes to GOA ESR/ Response to SSC

SSC: Synthesize subjects and Continue WGGOA/EGGOA

1. Oceanography
 - a. Oceanography Summary
 - b. Temperature
2. Seabird Synthesis

SSC: Continue development of Human Dimensions; Connections to Fisheries

1. Fisheries & Human Dimensions
 - a. Ongoing (map & spatial considerations, interpretation, balance of content across reports)

Other Changes

- a. Added: Harmful Algal Blooms, Shelikof Surface winds, Marine Heatwave
- b. Removed: LEO Network (ongoing LKTK discussions)
- c. Outreach/Education: In Brief, Videos

COVID-19 Related Ecosystem Data Loss in GOA (*limited*)



Data Collection

- Off-year for biennial NOAA surveys in GOA
- Other annual, regional NOAA surveys completed
- Existing partnerships continue to inform

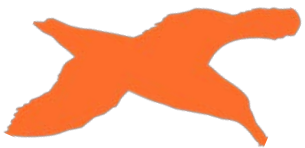
Data Loss

- Delayed analysis of 2019 data (lab access)
 - Zooplankton, larvae, ichthyofauna
- Cancelled/Reduced non-NOAA surveys
 - Seabird reproductive success (Alaska Maritime National Wildlife Refuge/USFWS)
 - Nearshore habitat sampling (National Parks Service)

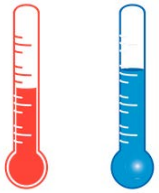


Data Mitigation

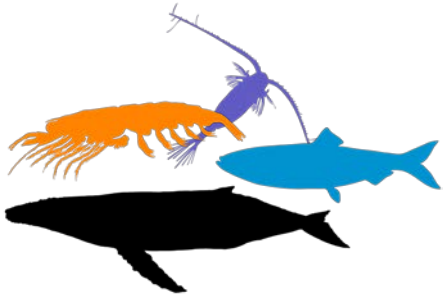
- Seabird synthesis (COASST, USFWS, USGS, ISRC)



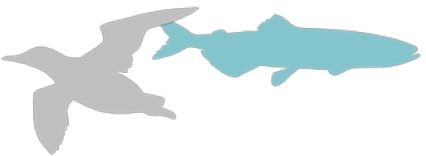
GOA 2020: Key Messages



1. Return to long-term mean surface temperatures after 2014-2016 and 2019 heatwave years



2. Average to positive trends in forage conditions & higher trophic level species (with exceptions)



3. Some species showing continued response to heatwave years

Risk Tables: Environmental/ Ecosystem Considerations

Level 1

(No apparent environmental/ ecosystem concerns)

- Walleye pollock
- Pacific cod
- Dusky rockfish
- GOA northern rockfish
- Pacific ocean perch
- GOA thornyhead complex
- GOA shark complex

Level 2

(Some indicators showing adverse signals relevant to the stock but the pattern is not consistent across all indicators.)

- Sablefish (statewide)

Fisheries & Human Dimensions 2019

Fissel, Lee, Kasperski, Rhodes-Reese, Wise



Landings:

- Apex predators and salmonids increased in 2019 due to increases in sablefish and rockfish, and odd year cycle increases in pink salmon
- Pollock landings decreased

Ex-vessel Revenue:

- Increased primarily due to increased revenues from salmon and Dungeness crab
- Continued to remain fairly stable over the long-term



Coastal Populations

- Unemployment Rate: WGOA (5.5%) and EGOA (5.4%) are both higher than the national rate (3.7%)
- Population: WGOA coastal communities continues to increase (both small and large communities), although at a lower rate than previous years, while EGOA coastal populations remains stable
- Schools:
 - WGOA: 10 schools with enrollments under 30 students and 2 school closures
 - EGOA: municipalities with school enrollment between 100 to 500 students, enrollment appears to be steady since 2015.
 - Larger districts such as Sitka and Ketchikan have the lowest graduation rates (both remaining under 60%) for the 2015-2019 cohorts

2020 Gulf of Alaska



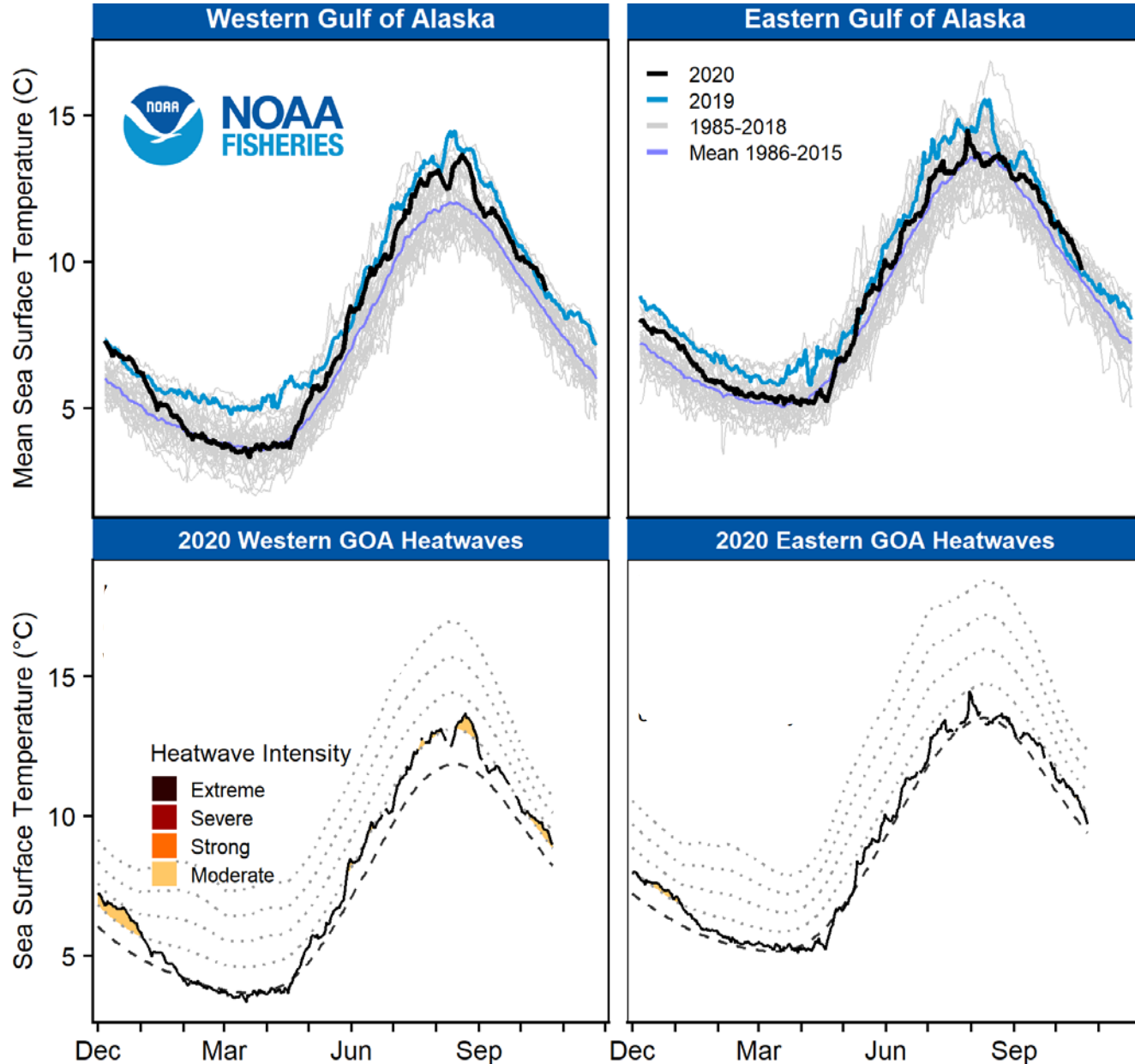
1. OCEANOGRAPHY

2. FORAGE CONDITIONS

3. SALMON, MARINE
MAMMALS, & SEABIRDS

Sea Surface Temperature & Marine Heatwaves

J. Watson



- 2020 GOA late winter temperatures cooled to the long-term mean (1985-2015) through April
- WGOA then warmed above the mean, oscillating around the marine heatwave threshold, for much of summer and fall
- EGOA warmed in the fall

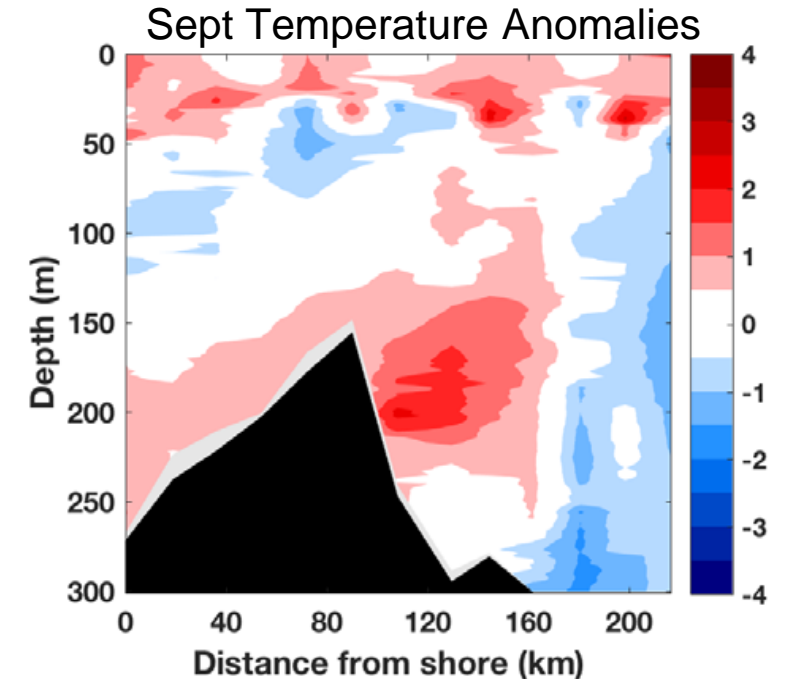
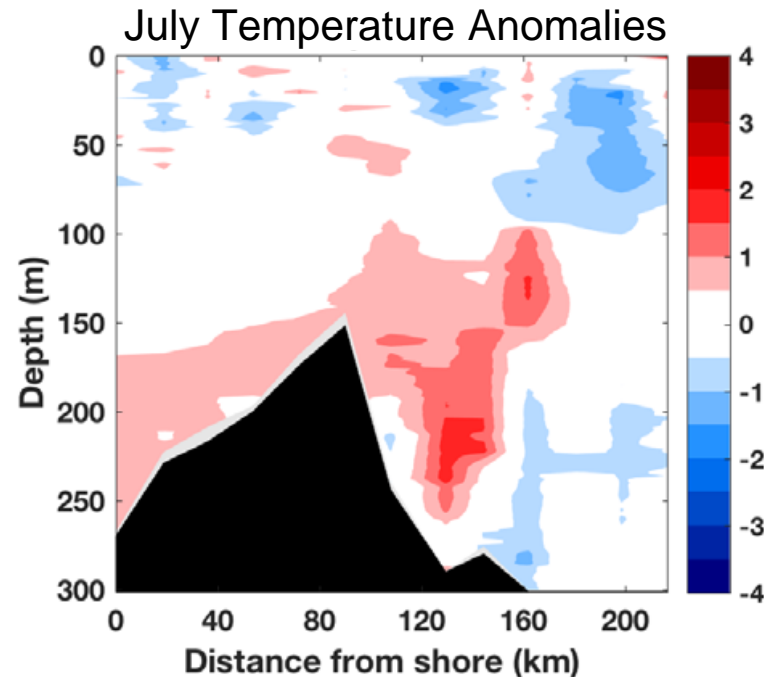
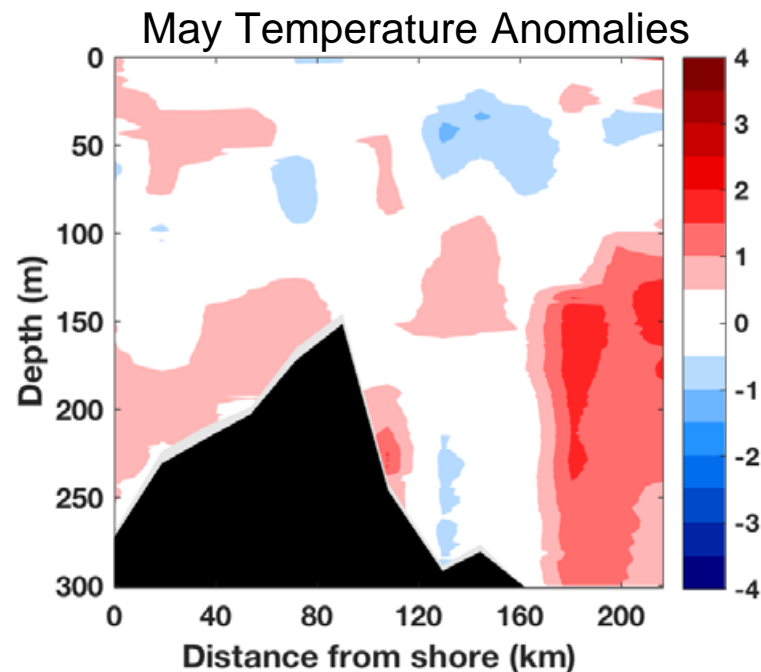
Return to more average thermal conditions at surface in general, with warmth in latter half of year

Ocean Temperature At Depth

S. Danielson, R. Hopcroft, R. Campbell

- Seward Line-cross shelf transect temperature anomaly profile

- Residual heat at depth (100m-250m) nearshore and at distance from shore
lagged effects of marine heatwaves?



Surface Transport: Shelikof Spring Wind

M. Wilson, L. Rogers

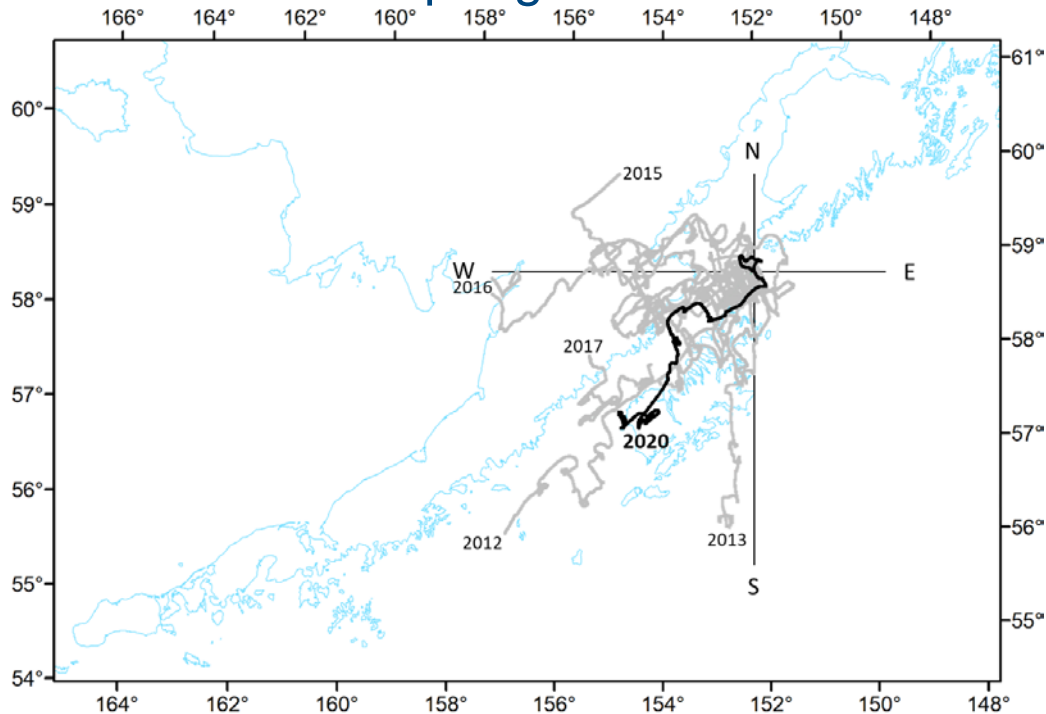


- Spring surface winds off NE Kodiak Archipelago indicating the direction of coastal flow

- Data:

- National Data Buoy Center (NDBC) at site AMAA2 (30min intervals, 2004-present)
- Model-based data from the National Centers for Environmental Prediction (NCEP) (monthly averages; 1948-2020)

Shelikof Spring Wind Direction

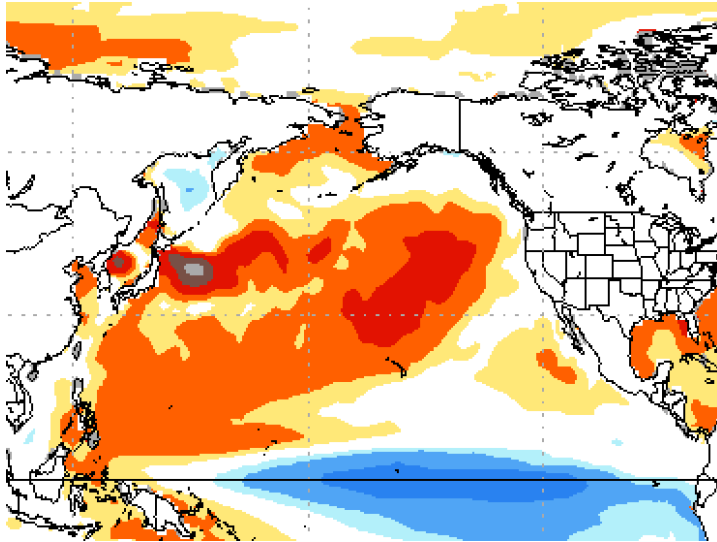


- 2020: Downwelling-favorable northeasterly spring winds (i.e., down Shelikof Strait)
- Predict good recruitment of 2020 pollock year class (correlation of southwest wind direction with estimates of age-1 pollock abundance)
 - Retention of larval and juvenile pollock in favorable habitat

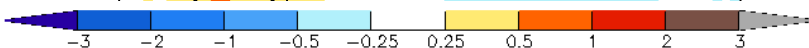
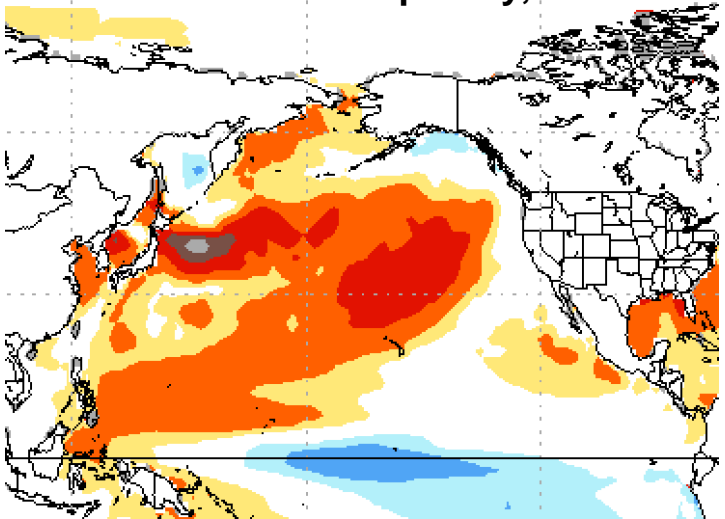
2021 Climate & SST Predictions

N. Bond

Months: Dec-Jan-Feb, 2021



Months: Mar-Apr-May, 2021



- National Multi-Model Ensemble (NMME)
- La Niña (winter)-uncertain strength of response in N. Pacific
- GOA coastal waters predicted to have near normal SST (Dec – Feb)
- And slightly cooler Mar-May
- Weaker Aleutian Low
- Positive SLP anomalies south of AK peninsula (similar to winter 2020 but weaker in amplitude)

2020 Gulf of Alaska



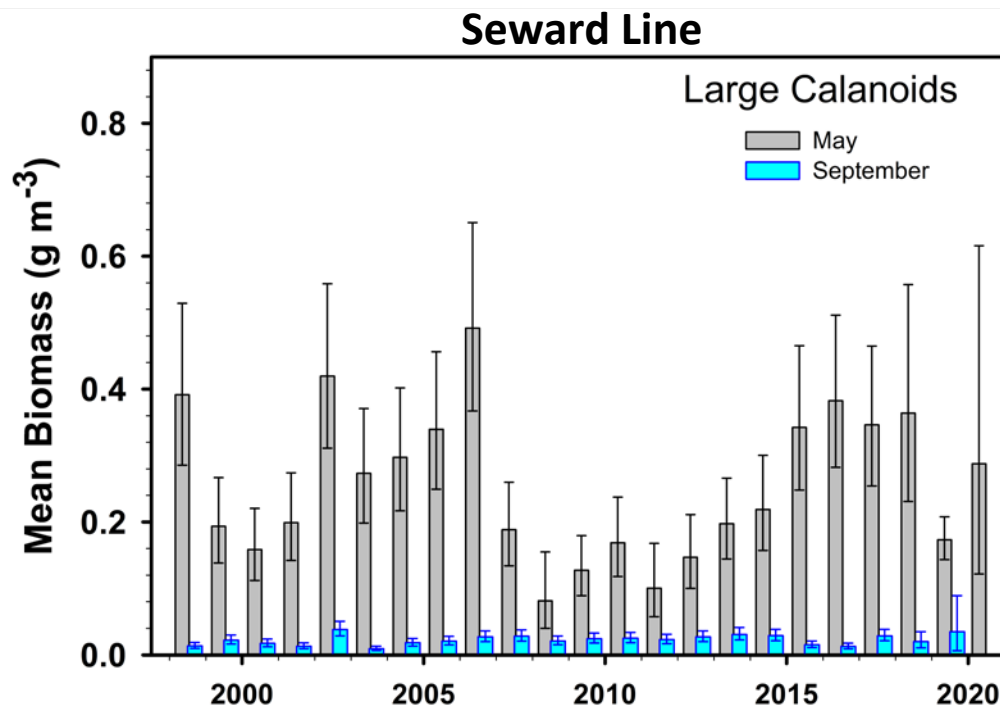
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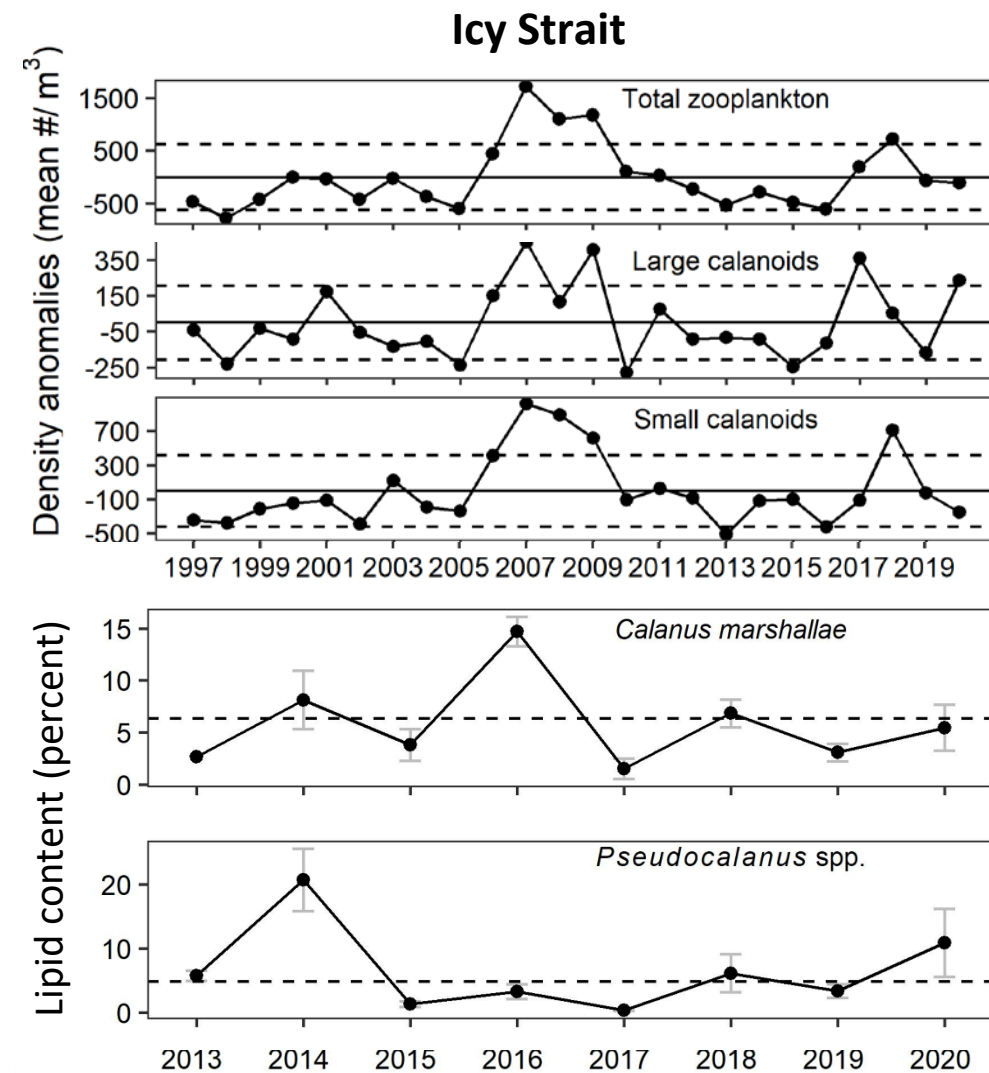
3. SALMON, MARINE
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Copepods

R. Hopcroft, Coyle, E. Ferguson



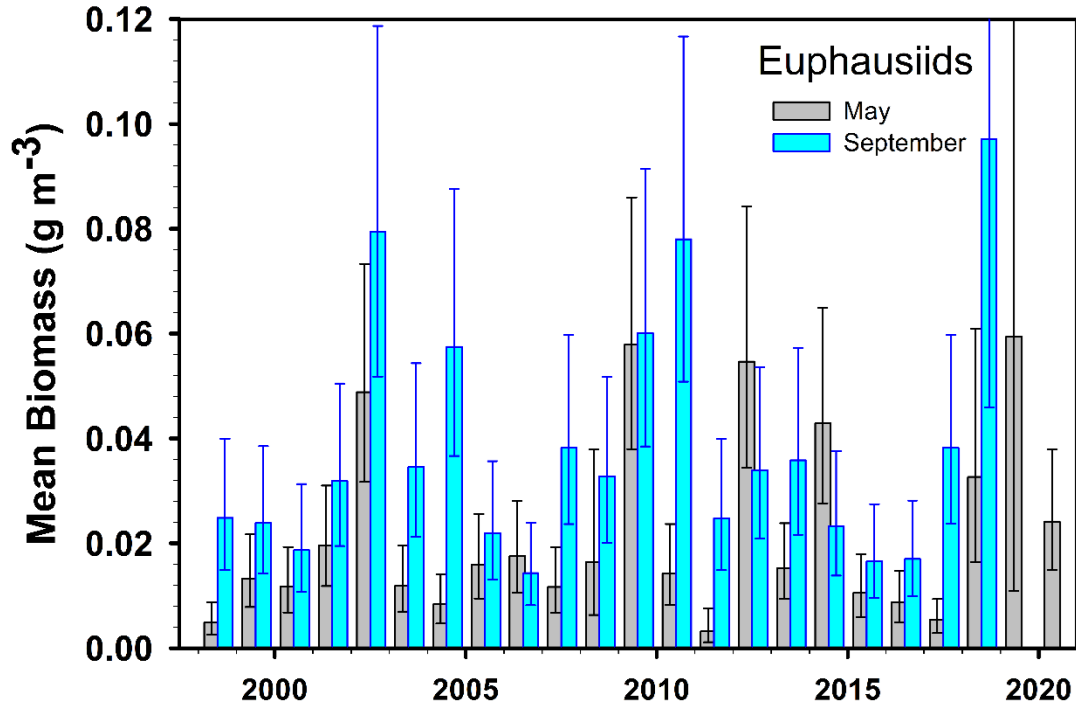
- Seward Line, large calanoid copepod biomass in May 2020 was at or slightly above average, higher than 2019.
- In Icy Strait, the 2020 total density was average (large calanoid copepods increased while small calanoid copepods decreased) and zooplankton lipid content increased to average (*Calanus marshallae*) and above average (*Pseudocalanus spp.*)



Euphausiids

R. Hopcroft, Coyle, E. Fergusson

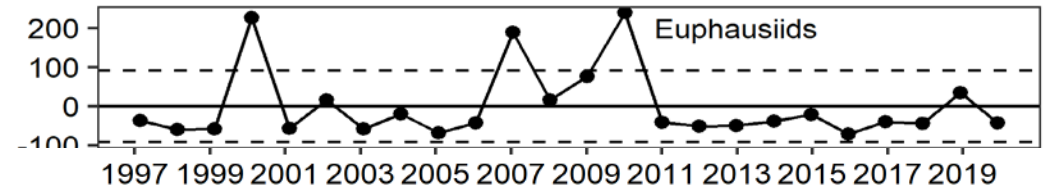
Seward Line



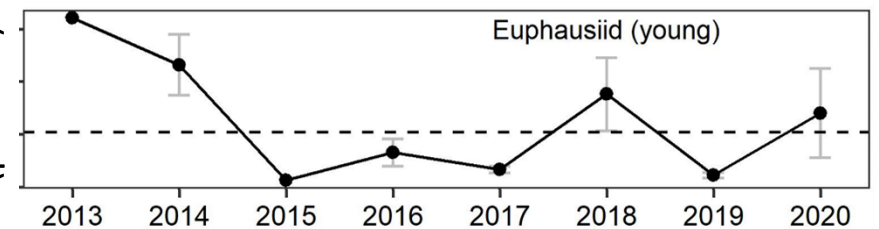
- Seward Line -Euphausiid biomass during May 2020 was slightly above average (lower than 2019); Sept 2019 & 2020 data not available
- In Icy Strait, euphausiid larvae density below average but percent lipid content increased

Icy Strait

Density anomalies
(mean #/m³)



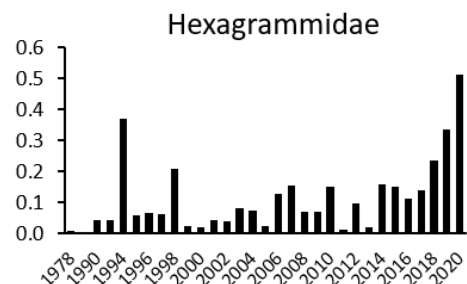
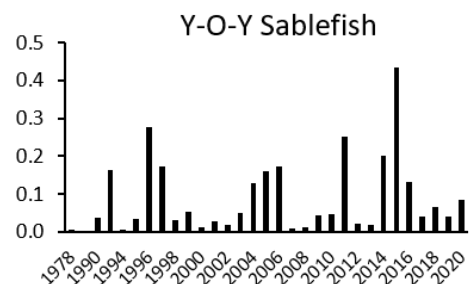
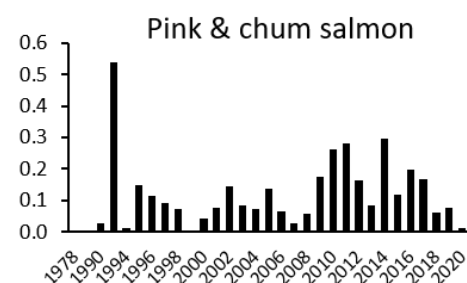
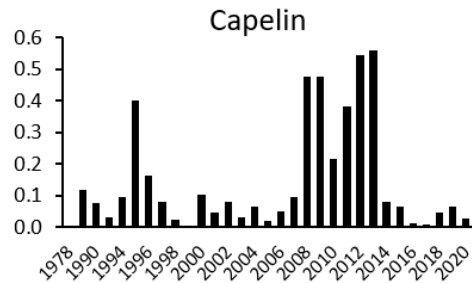
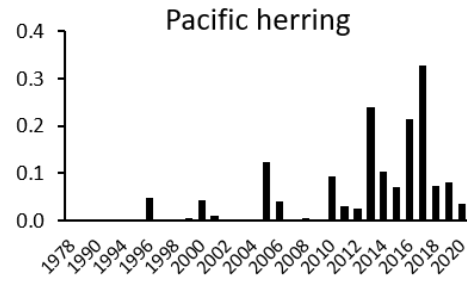
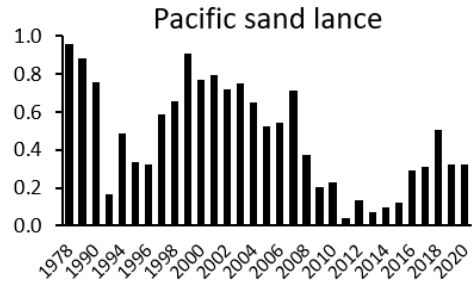
Lipid content
(percent)



Forage Fish

S. Hatch, M. Arimitsu, J. Piatt

Rhinoceros Auklet Chick Diet (Middleton Island) (diving)

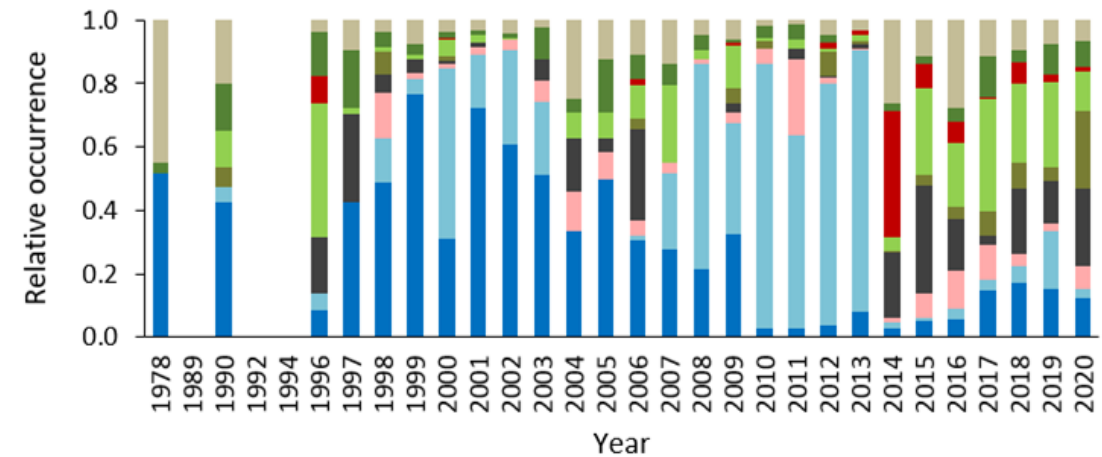


- Prey species occurrence in the diet of piscivorous seabirds on Middleton Island from 1978–2020
- Sand lance continues to be prominent (increased since 2014–2016 heatwave)
- Capelin remain scarce following 2014–2016 heatwave
- High hexagrammidae (mainly greenling, but also lingcod, Atka mackerel)

Proportion of biomass

Year

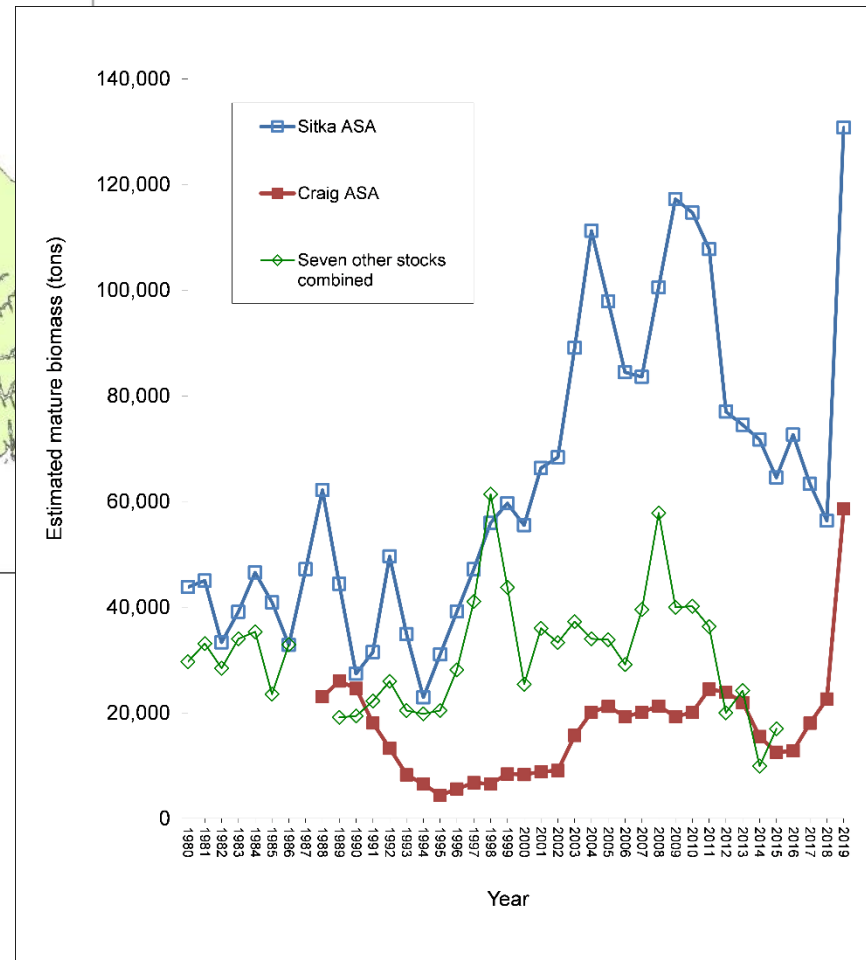
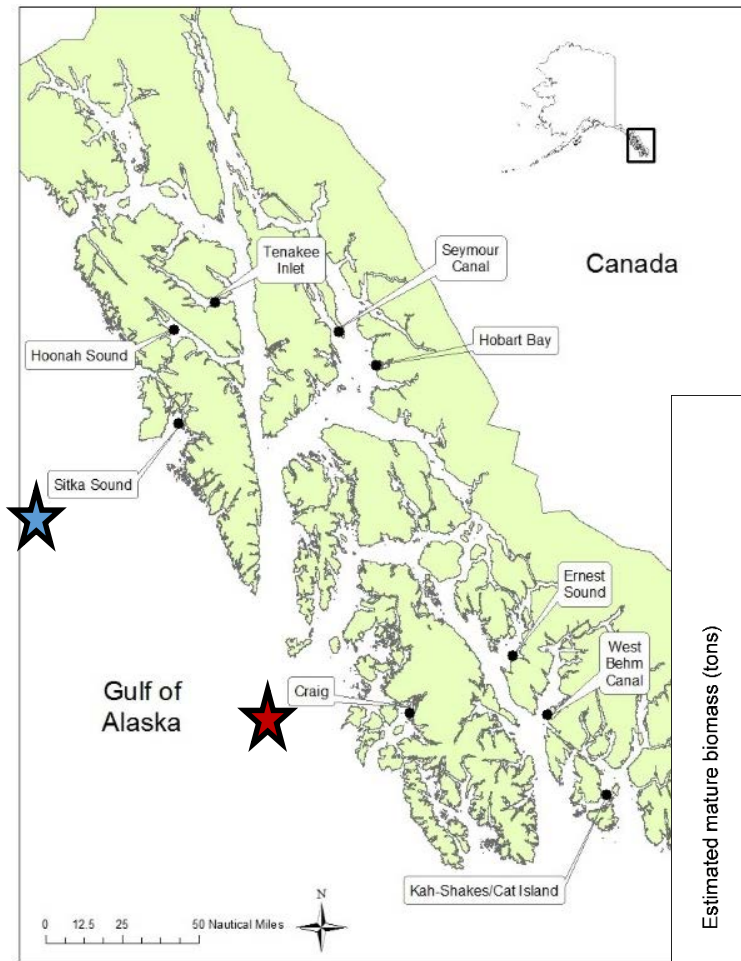
Kittiwake Chick Diet Jun-Aug (surface)



- Sand lance
- Capelin
- Salmon
- Sablefish
- Hexagrammidae
- Herring
- Myctophids
- Other fish
- Invertebrates

Herring

Hebert, Dressel, Pagau, Trochta, Haught

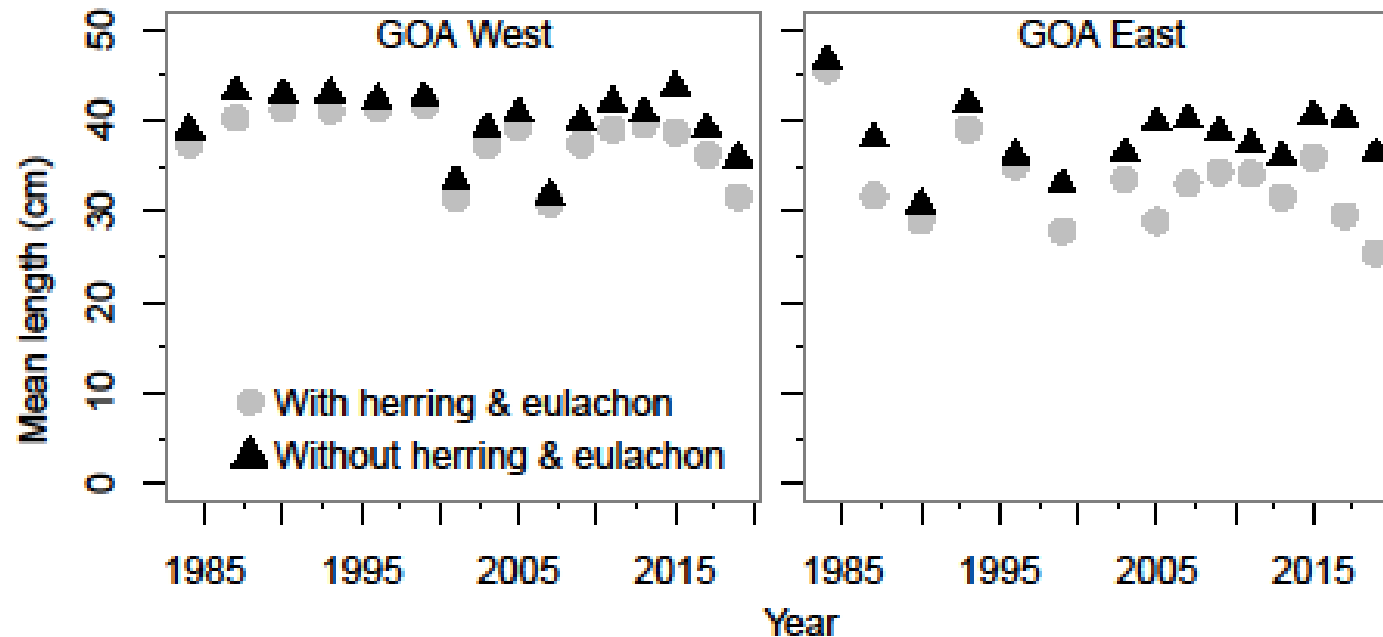


- SEAK: Increase in populations exposed to ocean influence (Sitka Sound & Craig): large recruitment event of age-3 herring observed in 2019 and preliminary 2020 data show age-4 herring for Sitka and Craig stocks were very high
- PWS: remains low but slight increase in 2019, 2020 – recruitment of large 2016 year class into spawning biomass

Increased age herring abundance in SEAK (but not PWS)

Mean Length of Groundfish Community

A. Whitehouse



- Bottom trawl survey mean length of fish (species-specific mean lengths, weighted by biomass indices)
- Herring decreases mean length in EGOA (2017,2019)

Support for increased herring abundance in EGOA in 2017, 2019

2020 Gulf of Alaska



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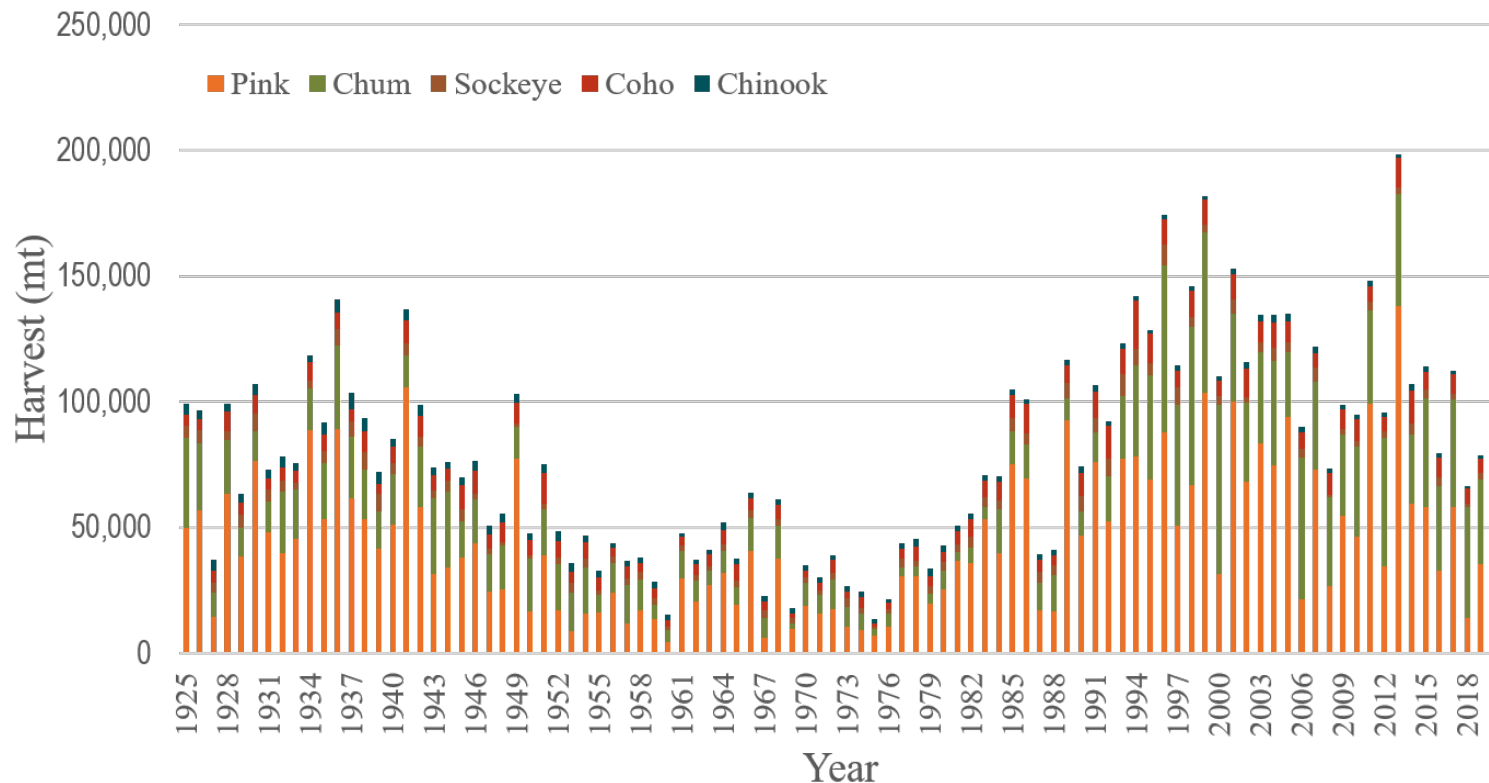
3. SALMON, MARINE
MAMMALS, & SEABIRDS

Low Salmon Catches in GOA & SE Alaska

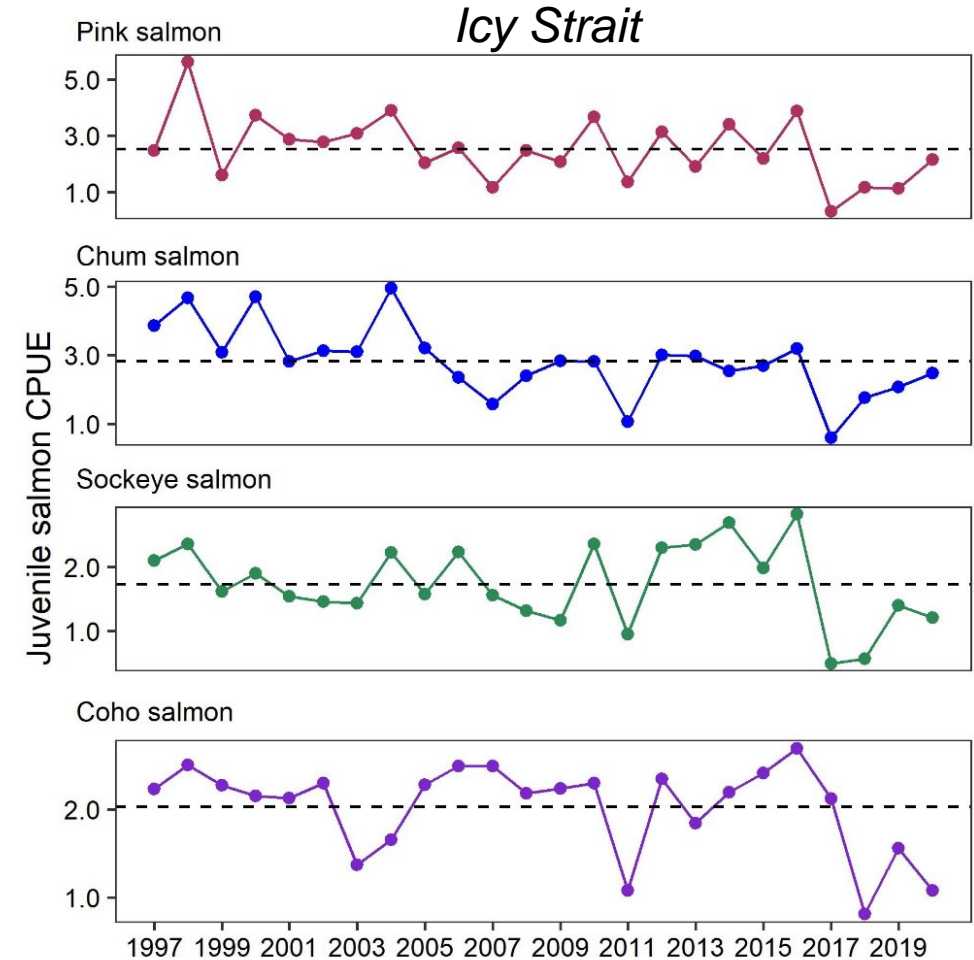
J. Murphy, R. Brenner

- GOA low commercial salmon catches (chum & sockeye)
- SEAK lowest since 1976 (pink, sockeye, chum)
- Increasing juvenile abundance since 2017 indicates harvests will increase in coming years although may still be below average

Social economic concerns in 2020



SE Alaska Commercial Salmon Harvest through Sept 22, 2020; ADFG



Humpback Whales

Gabriele, Neilson, Moran, Straley

- *Prince William Sound: #whales and encounter rate remain low (below pre-MHW levels)*

*Reduced herring?
Change distribution?*

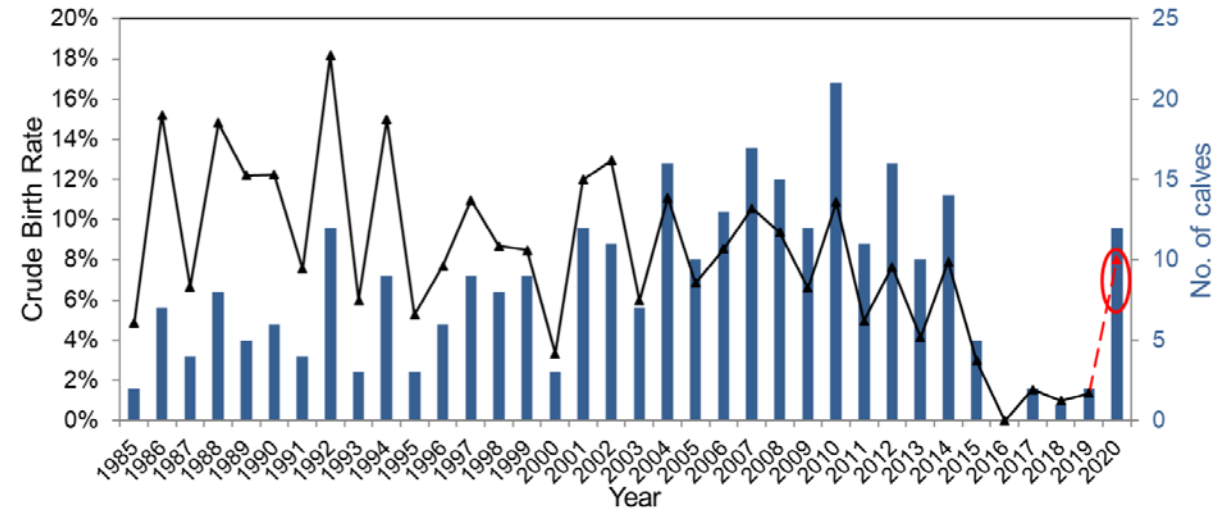
Prince William Sound Humpback Whales

Month/year	Counts of whales	Counts of calves	Nautical miles surveyed	Encounter rate Whale/NM
Sep-08	71	17	412	0.17
Oct-11	62	2	441	0.14
Sep-12	81	5	444	0.18
Sep-13	113	6	355	0.32
Sep-14	181	1	427	0.42
Sep-17	12	0	543	0.02
Sep-18	17	1	541	0.03
Sep-19	35	0	573	0.06
Sep-20	14	2	331	0.04

- *Glacier Bay: Increased #calves to pre-MHW levels(12 calves documented in June-Aug); calf survival also increased*

Increased herring?

Glacier Bay & Icy Strait Humpback Whales



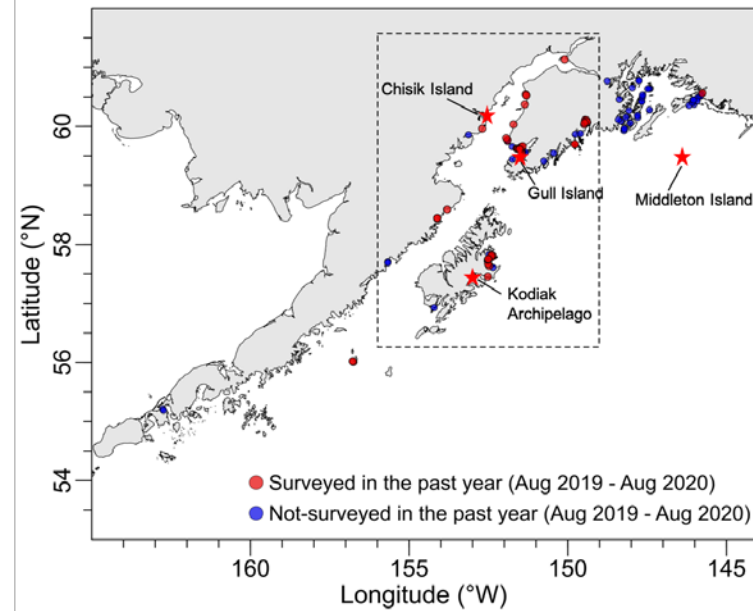
Seabird Synthesis

Hatch (Inst. for Seabird Res. & Cons.)







Jones, Lindsey, Burgess (COASST)


Corcoran (USFWS)


Arimitsu, Piatt, Marsteller, Schoen (USGS)



Surface-feeding

Black-legged kittiwake	
	• Some colonies newly abandoned • Breeding timing average
	• Reproductive success fair to good
	• No unusual mortality detected
Common murre, tufted puffin, pelagic cormorant, rhinoceros auklet	
	• Low murre colony counts • Earlier breeding by cormorants
	• Reproductive success fair to good
	• No unusual mortality detected

 Colony attendance & timing of breeding

 Reproductive performance

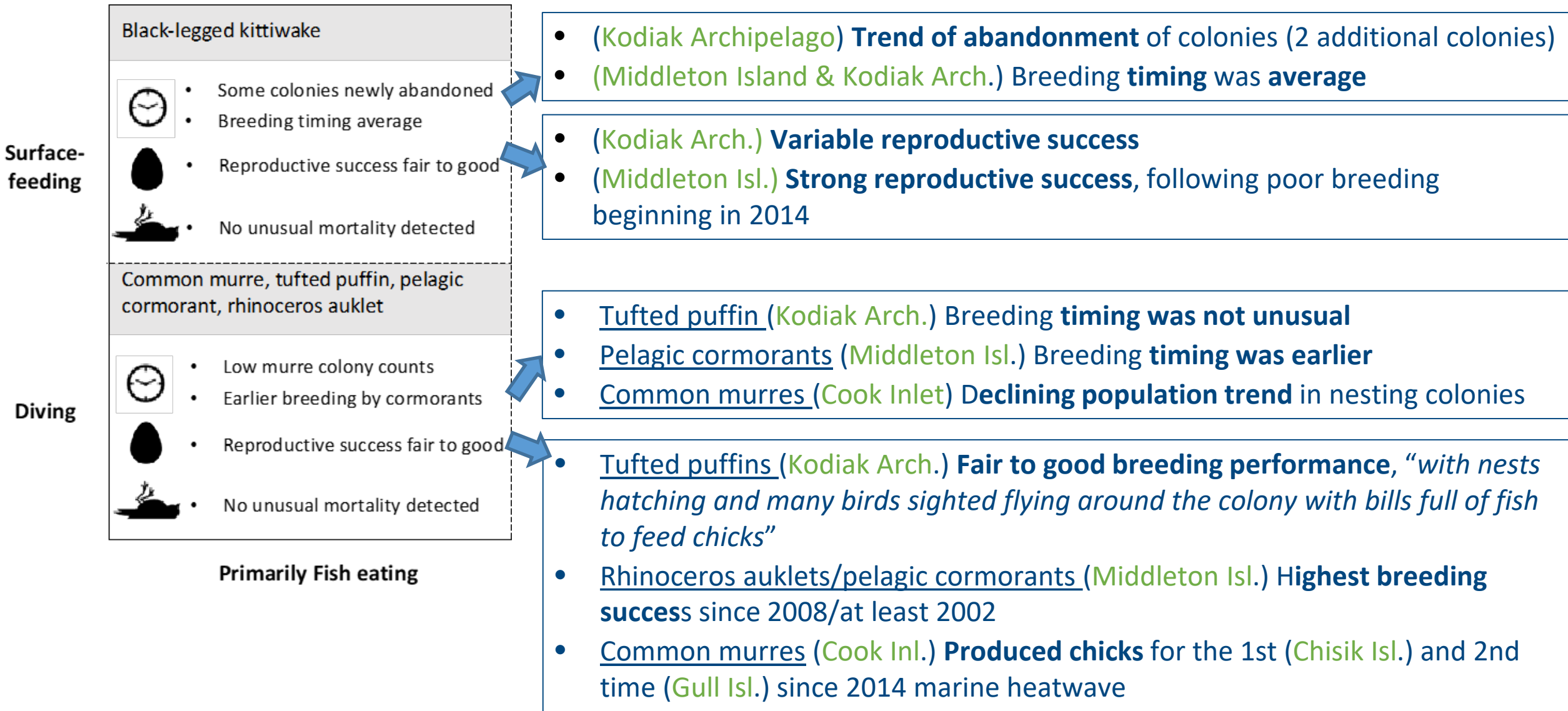
 Mortality index

Diving

Primarily Fish eating

- Missing USFWS Alaska Maritime National Wildlife Refuge Seabird surveys (COVID-19)
- Colony attendance remains low in some populations
- Reproductive success fair to good for fish-eating birds (surface and diving) (where they showed up)
- No large scale mortality events

Mixed trends in seabird recovery from marine heatwaves: Population decline reflects lack of recovery from MHW, Reproductive success suggests increase in availability of forage fish in WGOA in 2020

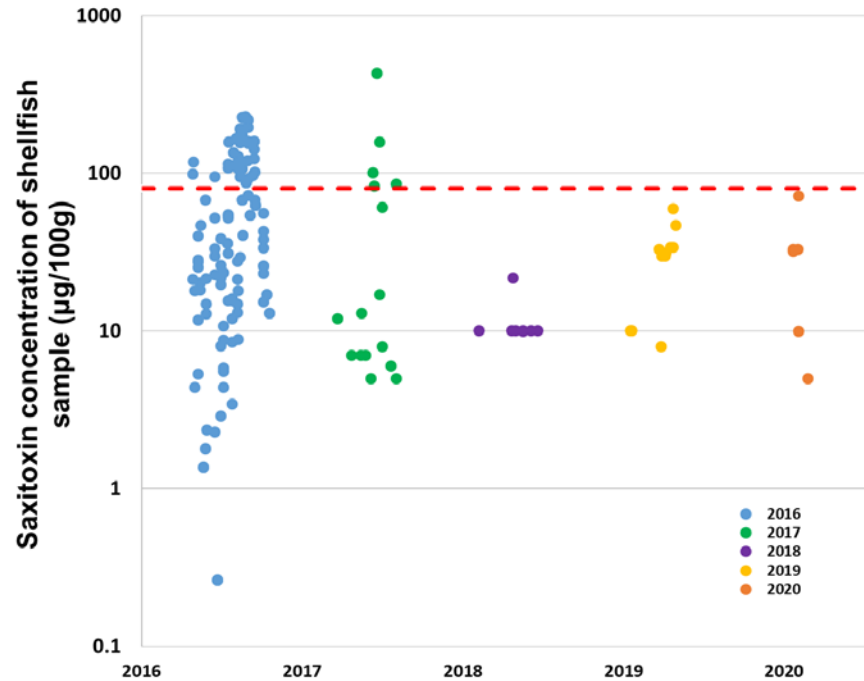
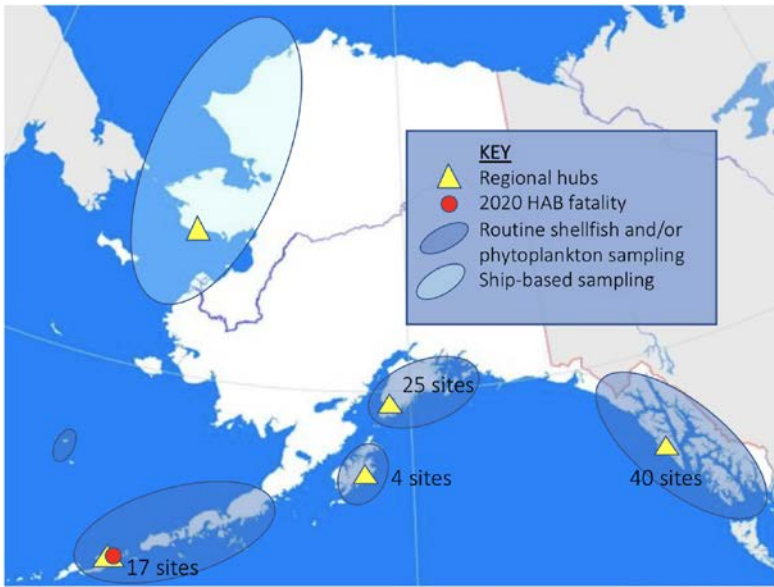


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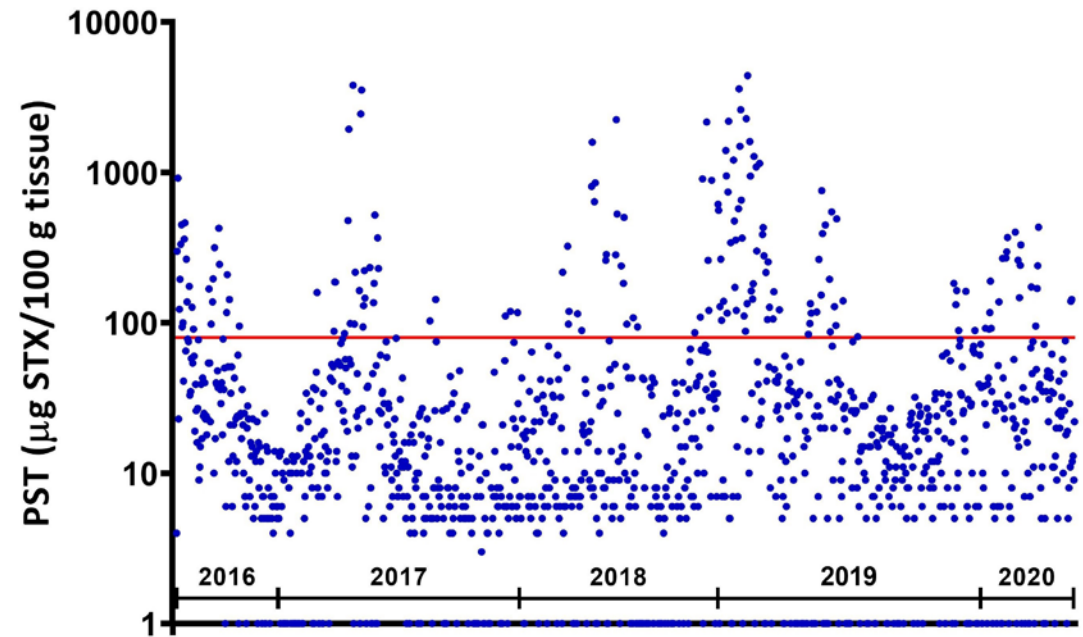
Harmful Algal Blooms

Alaska Harmful Algal Bloom Network (AHAB)

- 29 Sampling partners
- Shellfish and phytoplankton monitoring showed a consistent presence of harmful algal blooms (HABs) in 2020
- Bivalve shellfish from areas that are well known for having PSP levels above the regulatory limit, including Southeast Alaska and Kodiak, continued to test above the regulatory limit



Kachemak Bay; Data collected by Kachemak Bay National Estuarine Research Reserve and NOAA Kasitsna Bay Lab.



SEAK and Kodiak communities. Data provided by SEATOR

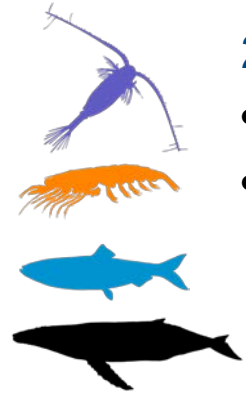
GOA 2020: Key Messages

1. Return to long-term mean surface temperature after 2014-2016 and 2019 heatwave years



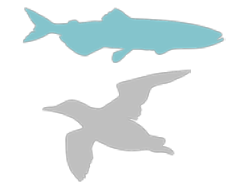
- Near-long term average SST winter & spring; warm summer (WGOA) and fall (WGOA & EGOA); predicted La Niña 2021 — *improved spawning conditions in spring (relative to 2019) and predicted end of elevated SST in winter 2021*

2. Positive trends in forage conditions & higher trophic level species (with exceptions)



- Average to increased zooplankton (increased large copepods)
- Mixed forage fish trends *limited data: some forage fish moderate to incr., (e.g., some herring, sandlance, juv. Salmon; seabird breeding success) — *improving prey base for planktivorous & piscivorous groundfish, some seabirds (e.g., Middleton Island) & humpback whales (Glacier Bay/Icy Strait)*

3. Some species showing continued response to heatwave years



- Residual warmth at depth (Seward Line) — *potential implications for early survival of groundfish that use these habitats for spawning (e.g., Pacific cod)*
- Mixed forage fish trends *limited data: some key species still low (e.g., capelin) —
- Some groundfish, seabird, whale populations still low — *some seabirds show colony abandonment, low population (e.g., murre), and Prince William Sound humpback whales*