

# Ecosystem Status Report: Aleutian Islands 2022

04 AIESR  
December 2022

Ivonne Ortiz & Stephani Zador



*Thank you!*

## With contributions from:

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photos: [photolib.noaa.gov](https://photolib.noaa.gov)



## Risk Table Environmental/Ecosystem Considerations

### Level 2

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

- AI Pacific cod
- Atka mackerel

### Level 1

(No apparent environmental/ecosystem concerns)

- Pacific ocean perch
- Northern Rockfish,
- AI pollock,
- Bogoslof pollock,
- BSAI Rougheyeye/Blackspotted,
- BSAI Other Rockfish &
- BSAI Shortraker
- Sablefish (statewide)

### Noteworthy

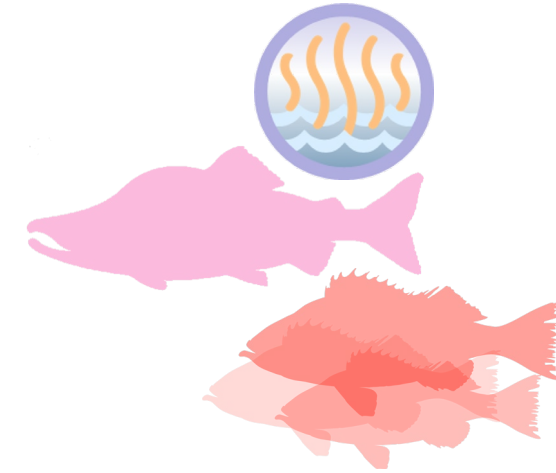
- BTS & SSL surveys in 2022!  
Updates - since 2018

### Assessment 2022

- Concern for uninterrupted warmer temperature; forecast - warm for CAI, WAI
- High SST in WAI, CAI, punctuated by severe MHW
- Continued seabirds above average reproduction success
- Apex predators decreasing except for large sculpins,
- Fish condition below average

### Multi-year since 2014

- Persistent warm conditions top to bottom, lower productivity
- Pinks impact: Biennial pattern in satellite chl-a, combined all seabird bycatch, Tufted puffins hatch date age 3+ POP, age 2 Atka mackerel from fisheries,
- Pelagic foragers dominated by rockfish



### Implications for this year

- SST reaching upper limit of Atka mackerel spawning temperatures
  - wide prey availability expected for planktivorous and piscivorous predators

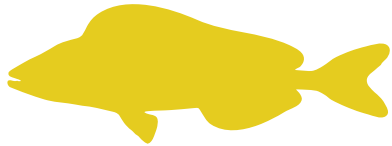
### Cumulative effects

- bioenergetic costs
- lower productivity
- zooplankton grows faster
- changes in prey field timing, composition and location
- system transitioning to warmer temperature, high rockfish and pink salmon abundance

# 2022 AI Risk Tables

## Level 2

### AI Atka mackerel



- Persistent warm conditions,
- MHW coincidental with spawning / nesting season,
- Increased metabolic demands,
- Average body condition, but below average length-weight residuals,
- Potential increased competition from POP

### AI Pacific cod



- Persistent warm conditions,
- Lower prey quality resulting in reduced fish condition.
- Decreased consumption of Atka as prey due to lower availability of Atka.

***"The SSC supports a holistic review of how economic and social science information is communicated and applied to Council decision-informing analytic products..."***

Economic and social science contributions will focus on other products to inform Council (Economic SAFE, ACEPO reports, AKFIN's Human Dimensions of Fisheries Data Explorer, ESPs) but will not be in the ESRs.

***"The SSC suggests including a flow chart/infographic in the ``Purpose of the Ecosystem Status Reports'' section of the ESR to visualize the process."***

A flow diagram has been added to the ESR (next slide).

***"In Briefs': The SSC is supportive of these continued efforts to disseminate ESR information to stakeholders and communities"***  
ESR editors, with AFSC Comms Program, will be producing In Briefs for 2022 ESRs (available for December Council meeting).

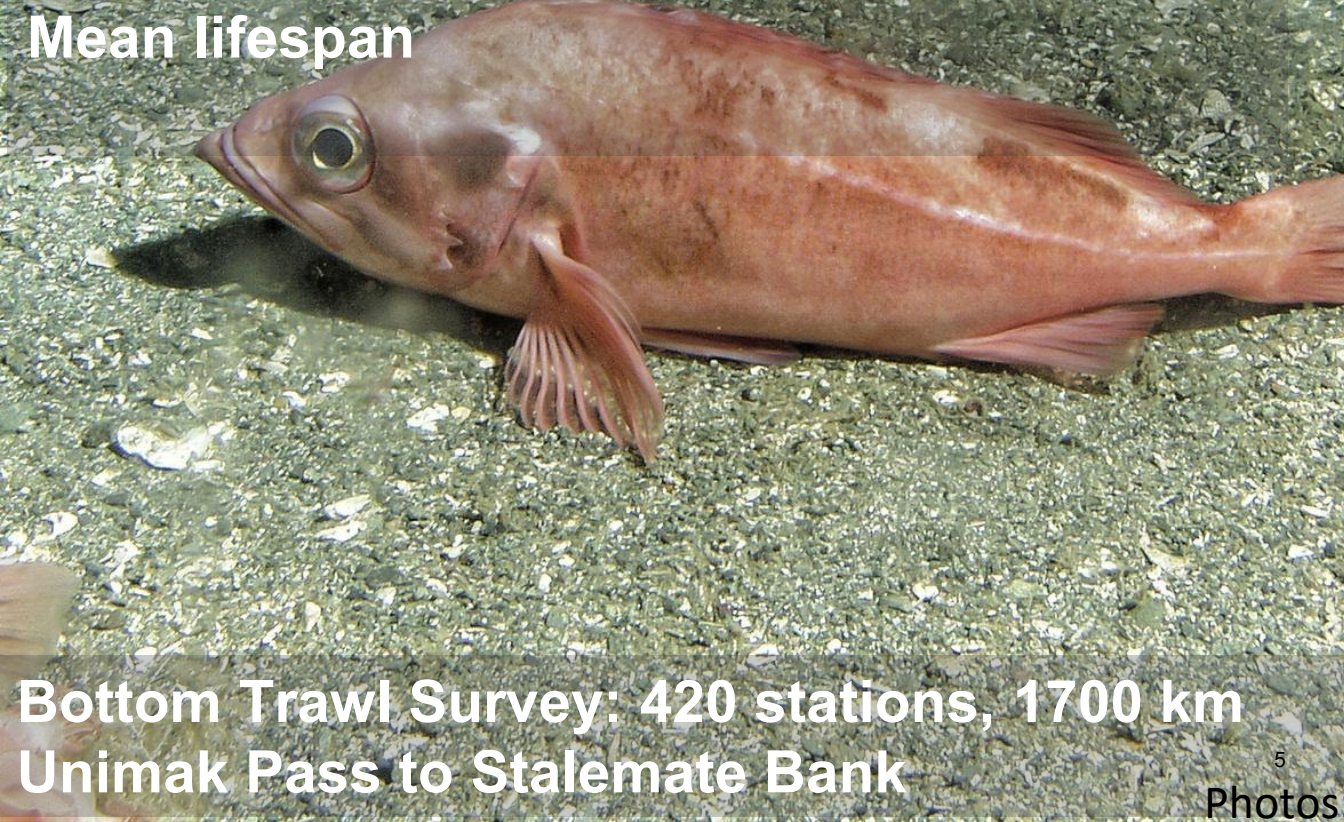
***"The SSC concurs with the BSAI GPT recommendation for a forage species workshop..."***

The ESR editors, the Forage Report editor, and others at NOAA's Alaska Fisheries Science Center convened a virtual ``Forage Congress'' in March-April 2022 with four main objectives. The workshop helped to develop an understanding of AFSC's internal engagement in forage research and monitoring, to be able to better engage in the broader discussions described by the SSC in their request.

\*\*ESRs will have a public CIE review February 28 - March 2, 2023

**AI Bottom Trawl Survey GAP, RACE**

Updated 11 indicators, including:  
Bottom temperature  
Fish condition  
Apex predator & pelagic foragers biomass  
Mean lifespan

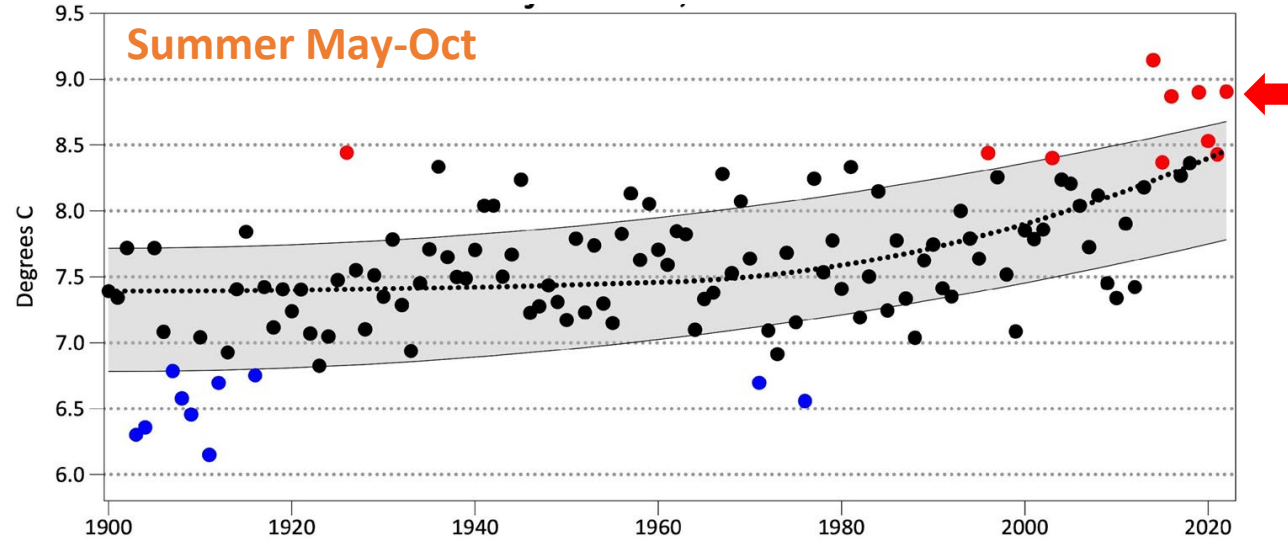


Bottom Trawl Survey: 420 stations, 1700 km  
Unimak Pass to Stalemate Bank

**Steller sea lion survey, AEP, MML**

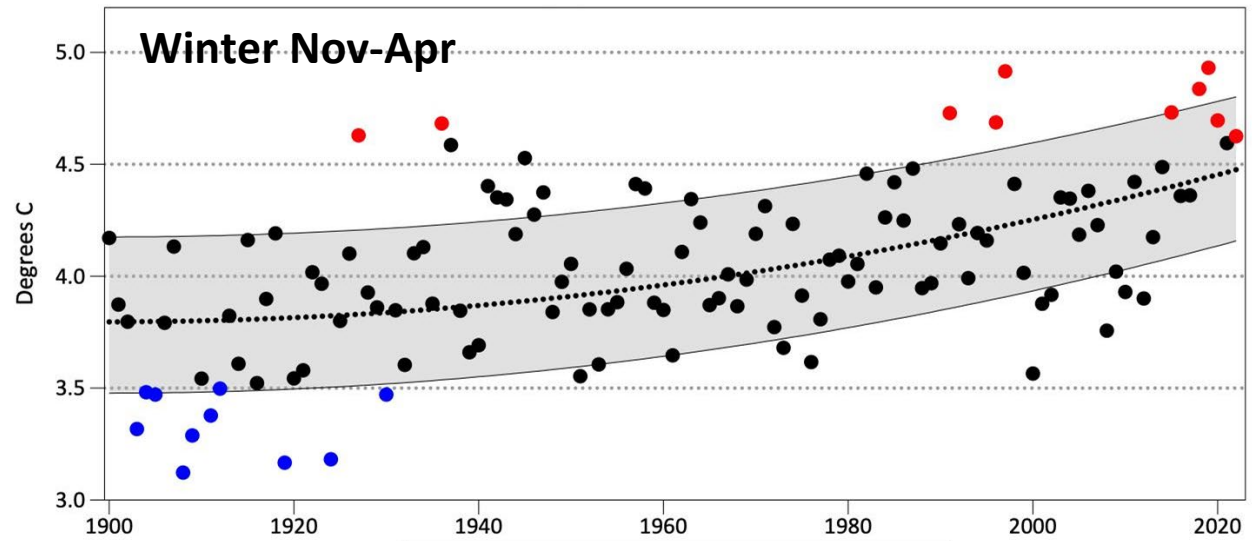
Non pups and pups at  
Rookery Complex Areas 1- 6, WAI – EAI  
Only regular marine mammal survey in  
Aleutian Islands





Long-term Sea Surface Temperature

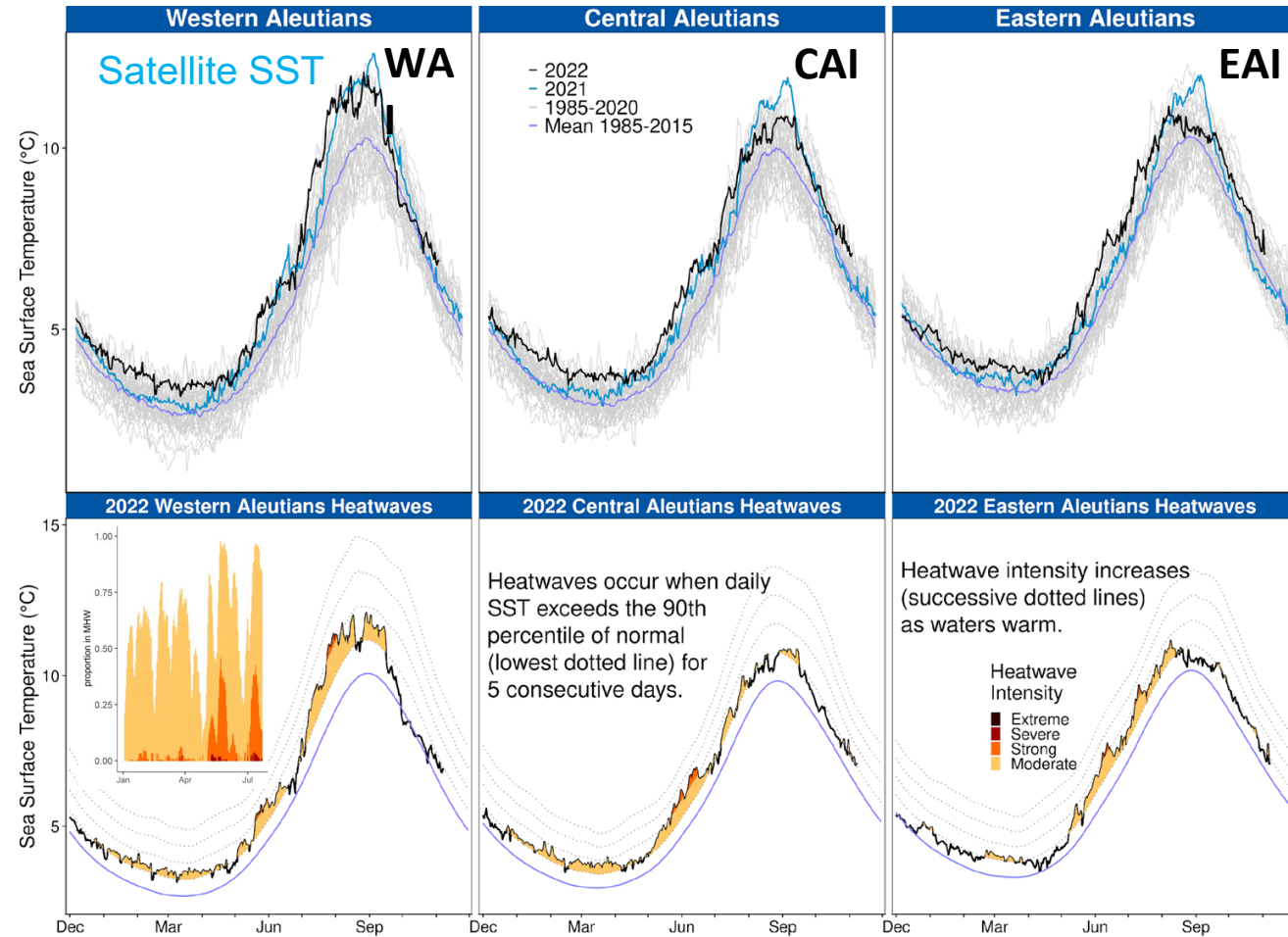
- 2022 – 2nd warmest summer in 123 years
- Warming trend winter and summer



Estimated  $\pm$  One Std. Dev.
  Ten Warmest
  Ten Coldest

Estimated Median

Data source: ERSSTv5  
and B.Brettschneider/NWS Alaska



NOAA Coral Reef Watch data, courtesy National Environmental Satellite, Data, and Information Service (Updated: 11-08-2022)  
Data are modeled satellite products and periodic discrepancies or gaps may exist across sensors and products.  
Contact: matt.callahan@noaa.gov

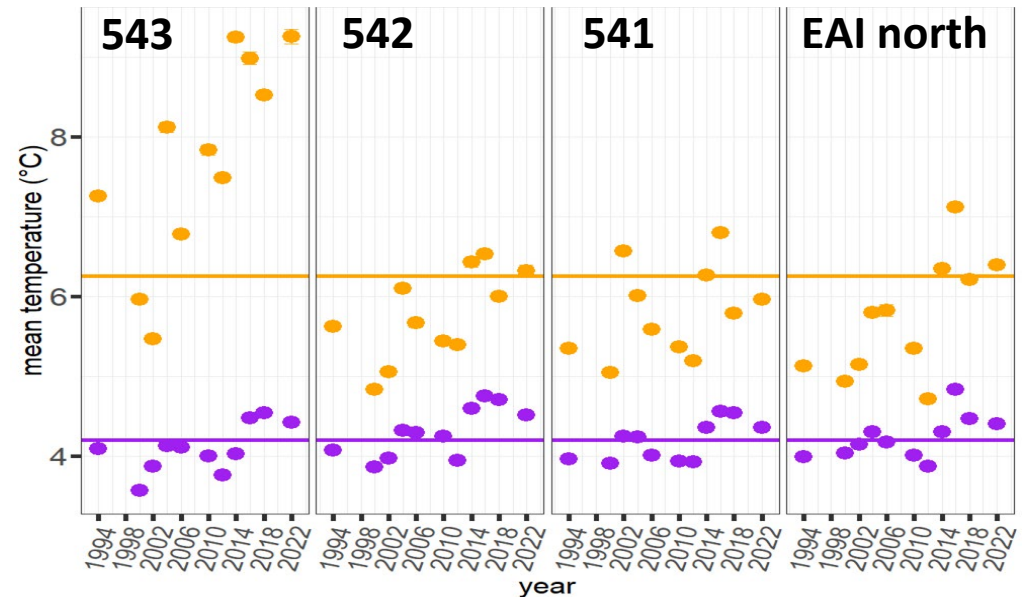
### Satellite SST

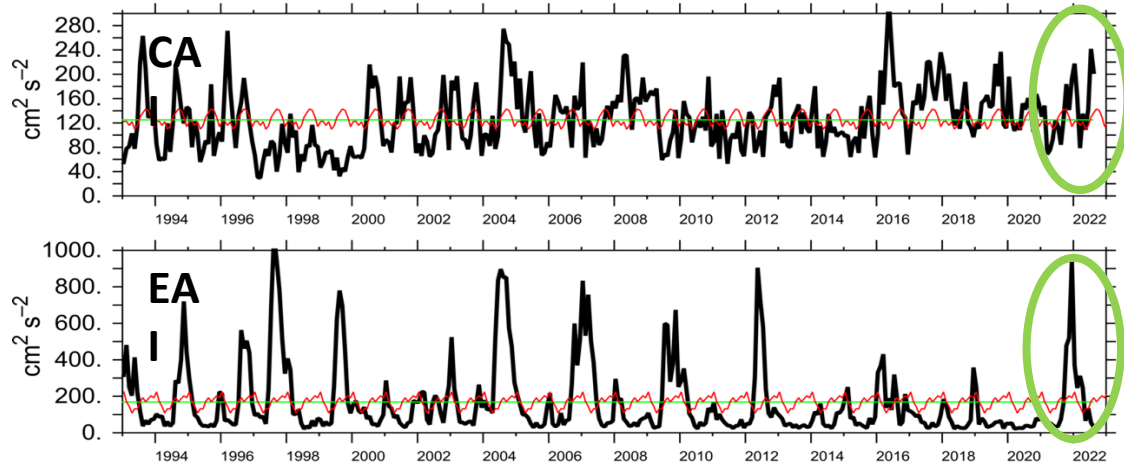
- Warm winter throughout
- Summer – warmest in WAI
- Moderate year-long MHW – WAI, CAI

### Survey

- Water warmer than average top to bottom
- SST above 2018;
- Bottom temperature at or below 2018

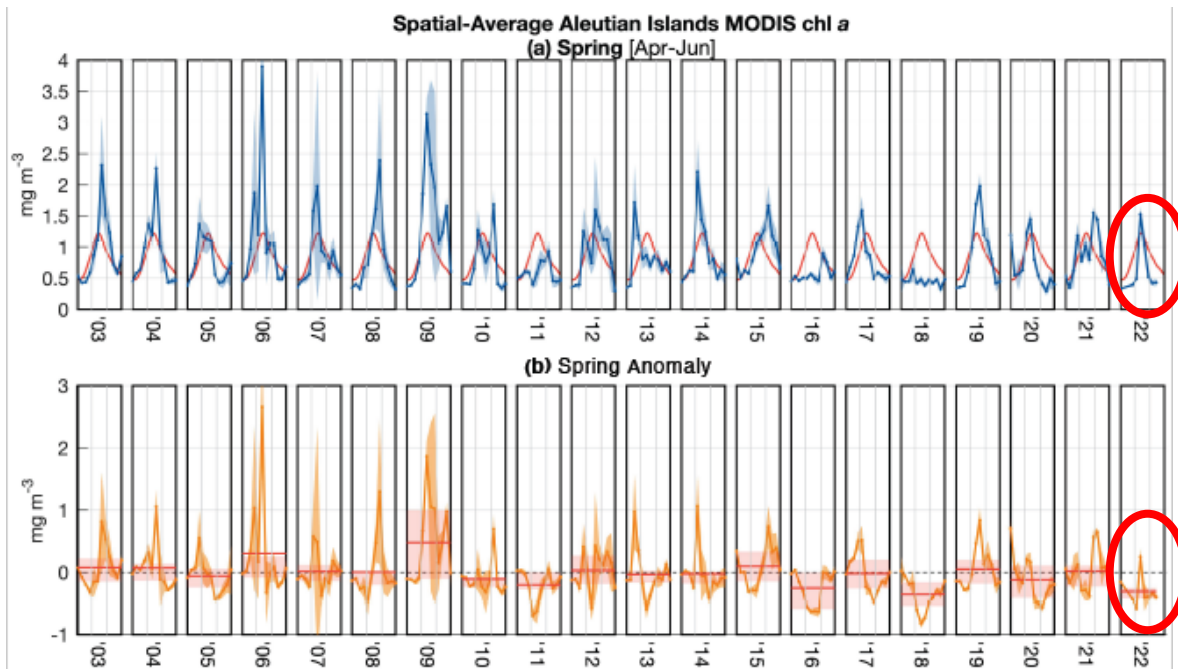
### Survey: Mean SST and Bottom Temperature BT Survey 2022





Eddy Kinetic Energy

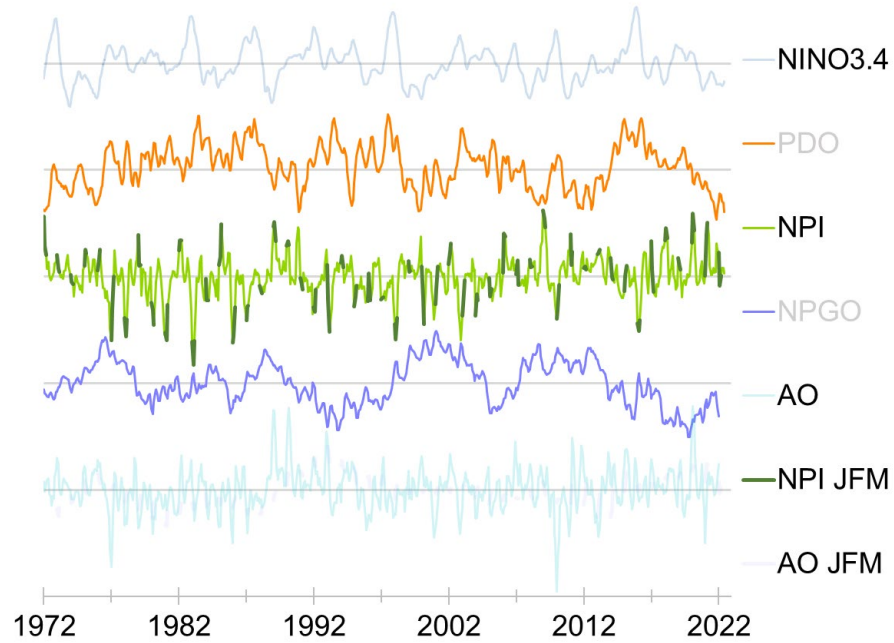
- Pulse eddy in EAI first since 2012
- Increased nutrient and heat flows through Unimak and CAI



Satellite chl-a

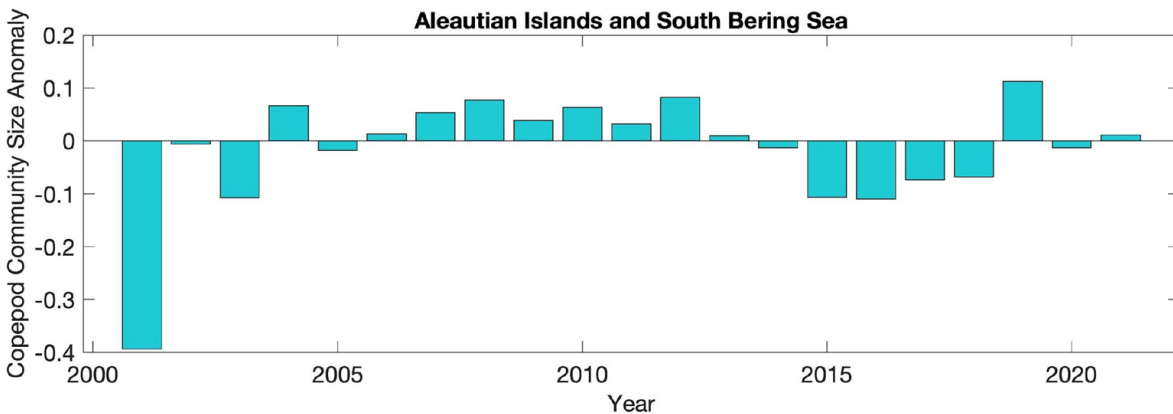
- Satellite chl-a, spring phytoplankton biomass lower than average





Climate Indices

- Negative PDO, Positive NPI, Negative NPGO jointly support increased zooplankton



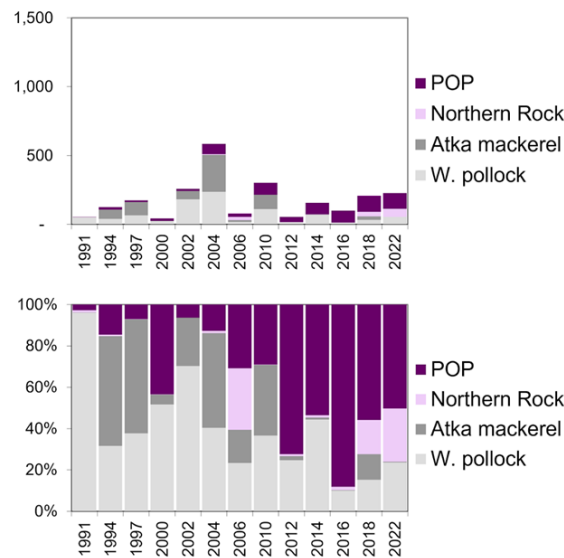
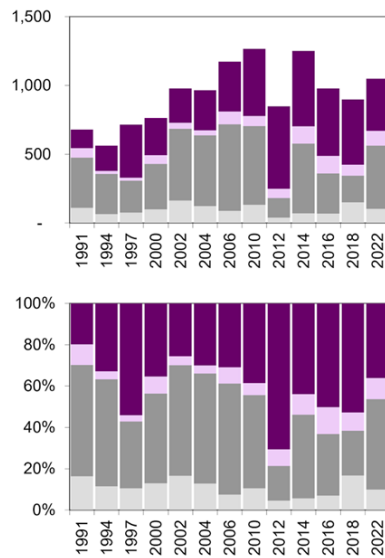
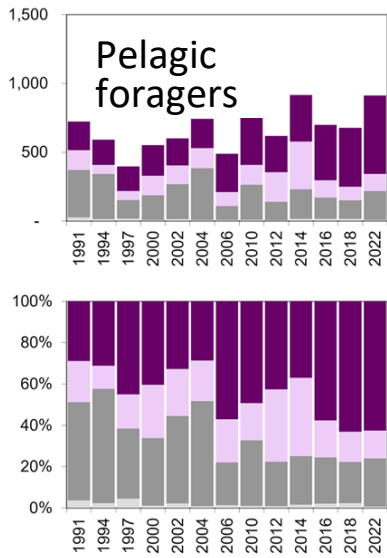
CPR Copepod Community size

- Near average size in 2021
- Negative anomalies for sustained period since 2014

Western AI

Central AI

Eastern AI



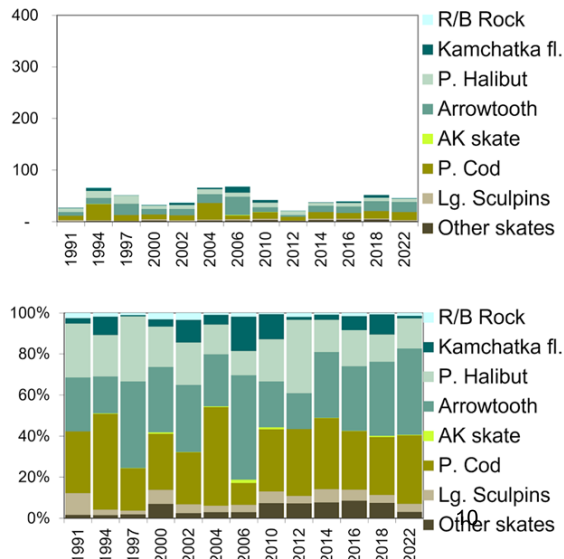
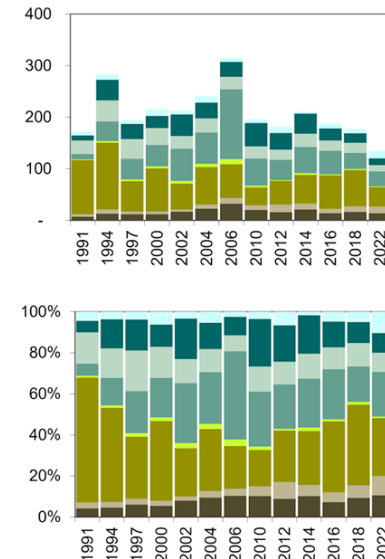
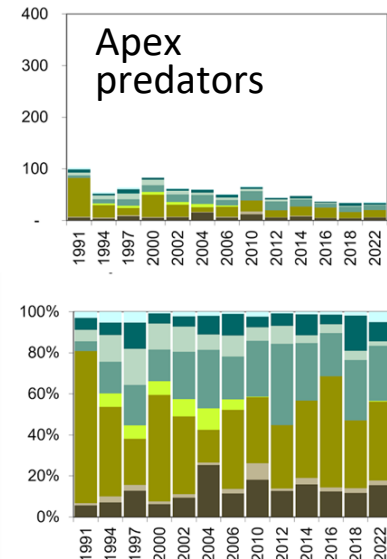
Pelagic Foragers Biomass

- Rockfish dominate
- Atka mackerel did increase in WAI-CAI
- Pollock increased in EAI

Western AI

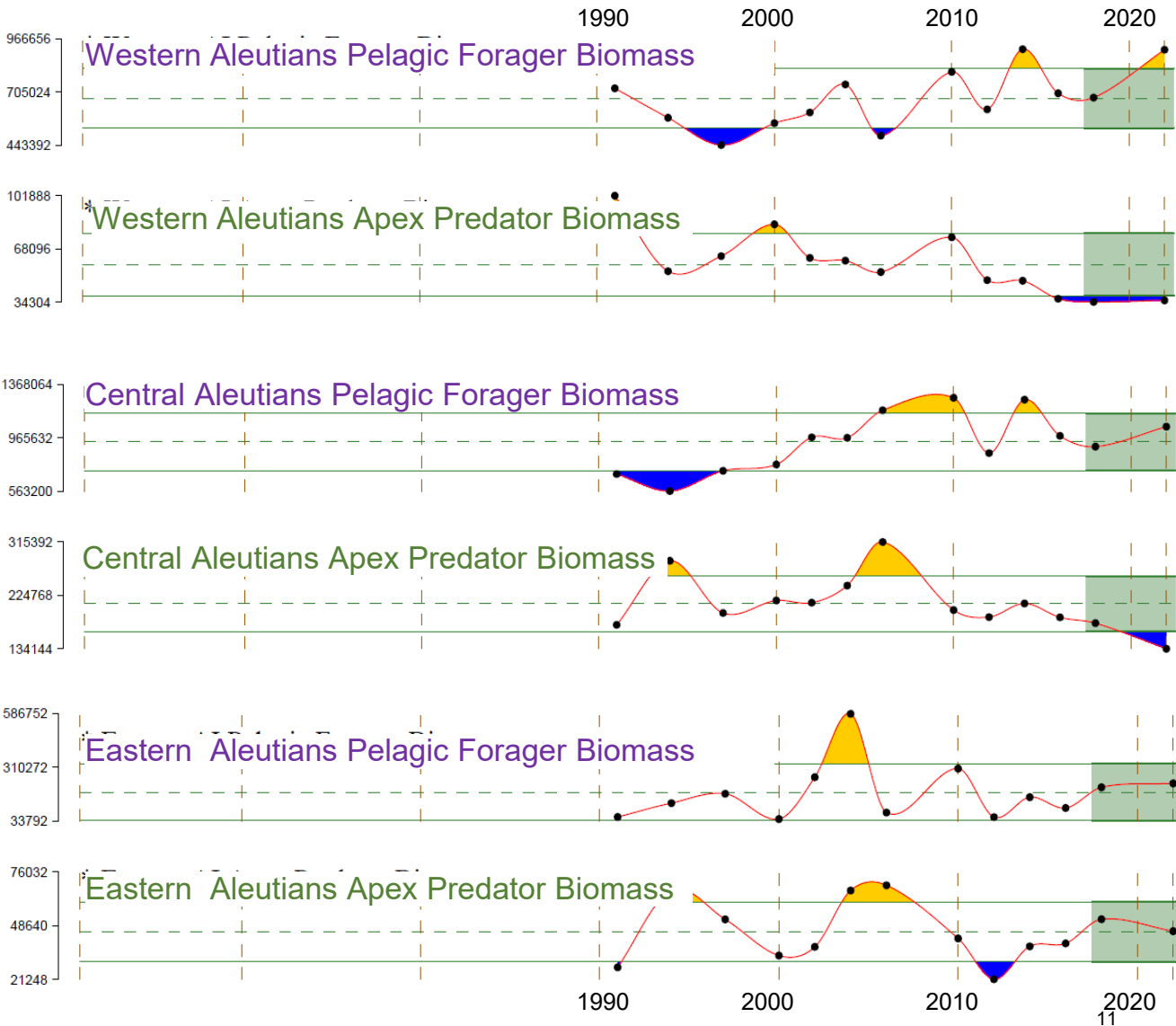
Central AI

Eastern AI



Apex Predator Biomass

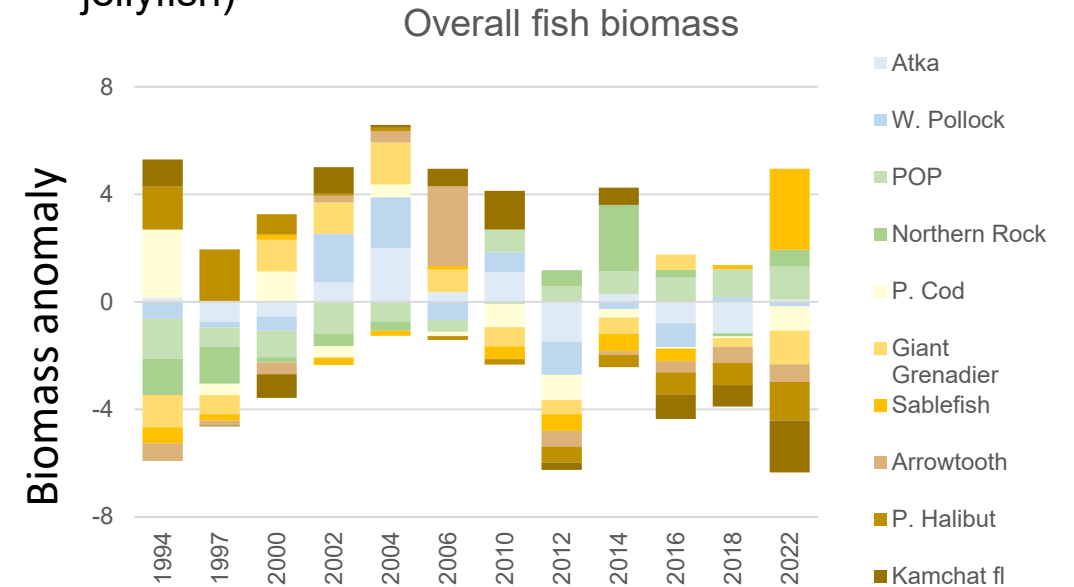
- Large flatfish, Pacific cod decreased
- Large sculpins increased

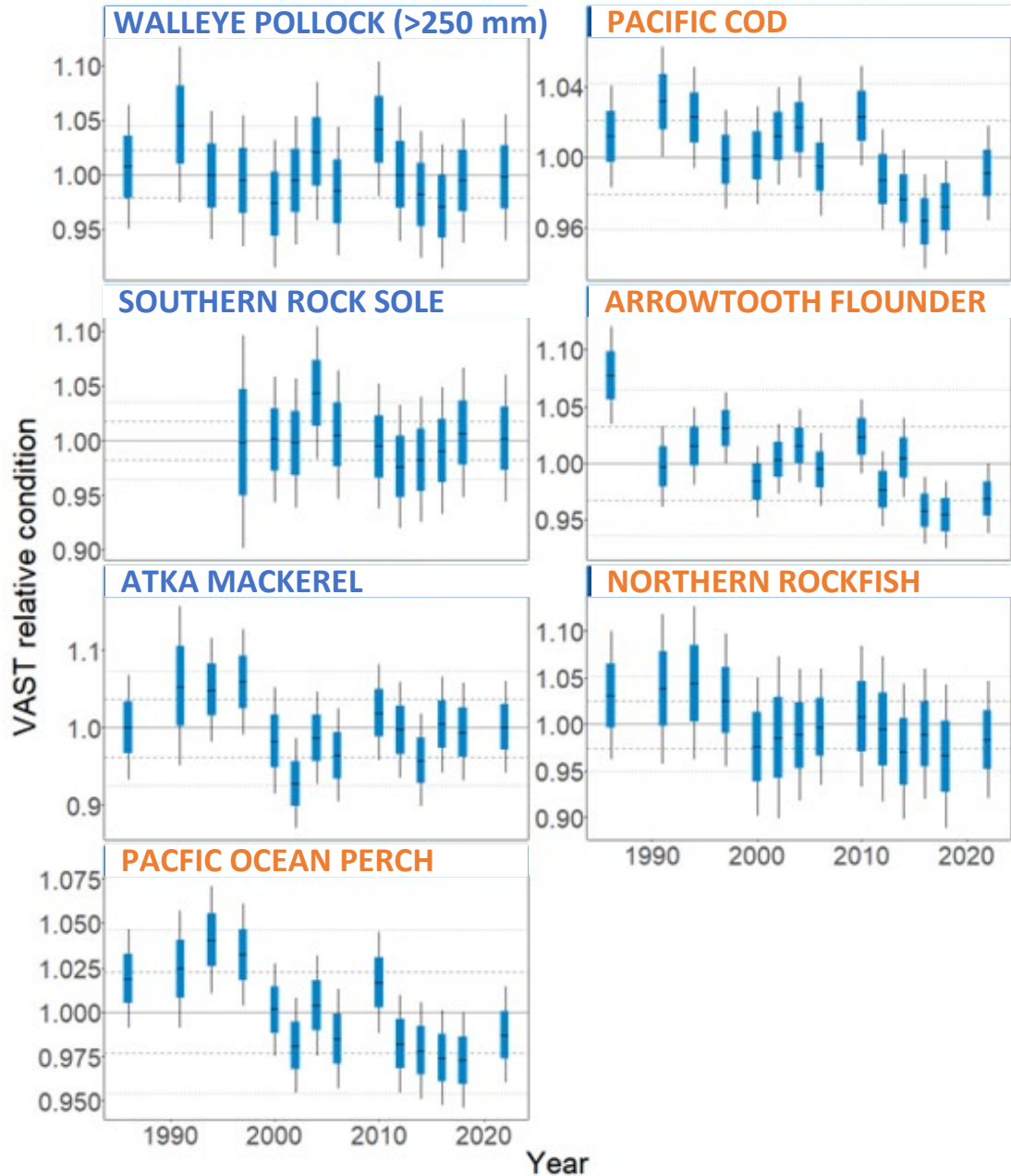


### Pelagic foragers and apex predator biomass

- Pelagic foragers increasing or stable
- Apex predators decreased or remained low

- Fish feeding near bottom not doing as well as fish feeding on pelagic prey e.g. rockfish or **sablefish** (sablefish feeds on squid, jellyfish)

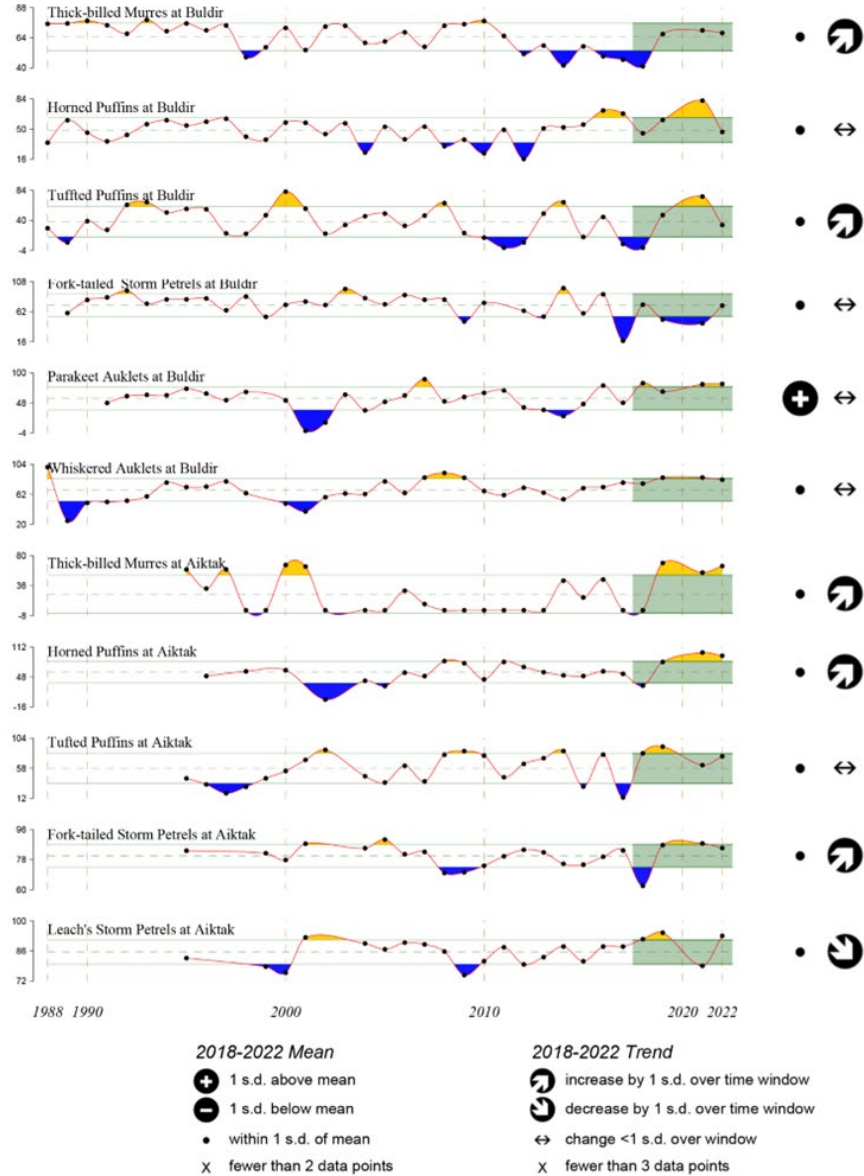




Fish condition

- Near average for pollock, Atka mackerel, southern rock sole
- Below average for rockfish, Pacific cod, arrowtooth flounder
- Length-weight residuals negative for all (not shown)

Seabird Reproductive Success



Seabird Hatch Time

- Earlier or average for all seabirds:  
good foraging conditions **in spring** for plankton and fish foragers

Site	Species											
	primarily fish eaters						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	🕒	-	🕒	🕒	-	🕒	🕒	🕒	-	-	-	-
Buldir	🕒	🕒	🕒	🕒	🕒	🕒	🕒	-	🕒	🕒	🕒	🕒

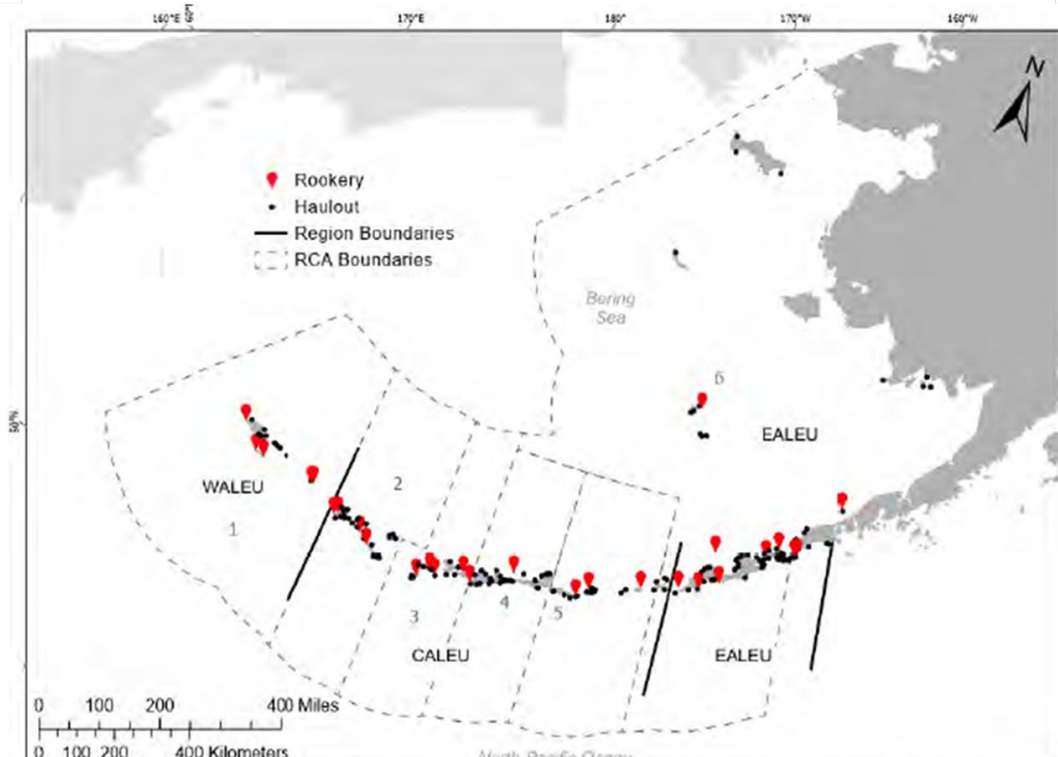
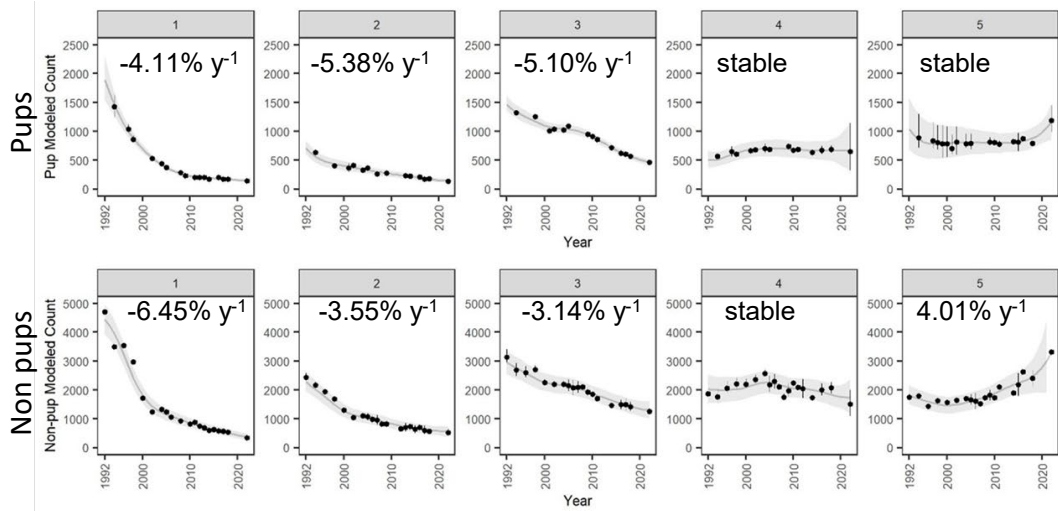
earlier 🕒  
average 🕒

Seabird Reproductive Success

- Average or above for all seabirds:  
good foraging conditions **in summer** for plankton and fish foragers

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

above 😊  
13  
average 😐



## Steller sea lion counts

- Overall western Distinct Segment Population between 2007–2022

Pups: Increased 1.06% y<sup>-1</sup>  
 Non pups: Increased 1.41% y<sup>-1</sup>

- Increases in eastern areas offset decline in western areas

WAI: decreasing

CAI: stable

RCA 5 survey was fairly incomplete,  
 one rookery and several haulout sites missed

EAI: counts still being analyzed

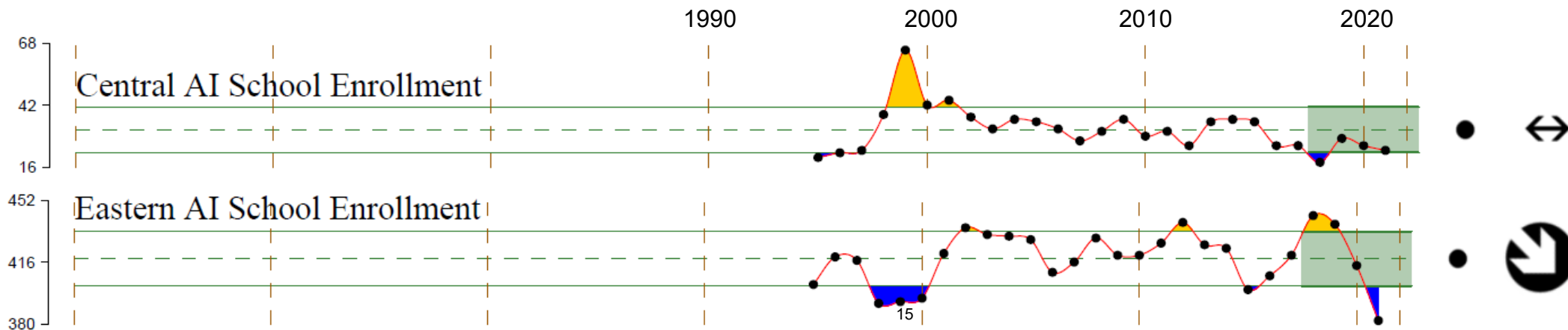


### Harmful Algal Blooms

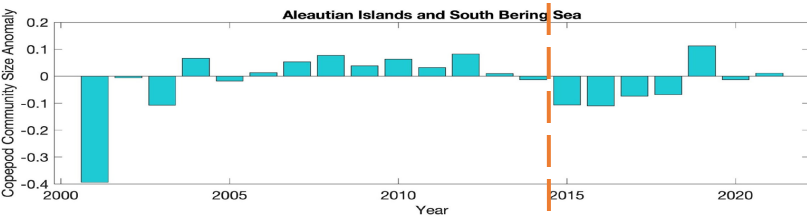
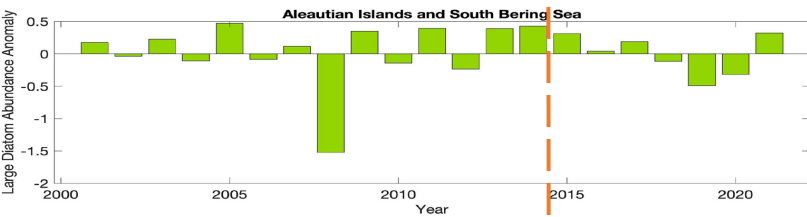
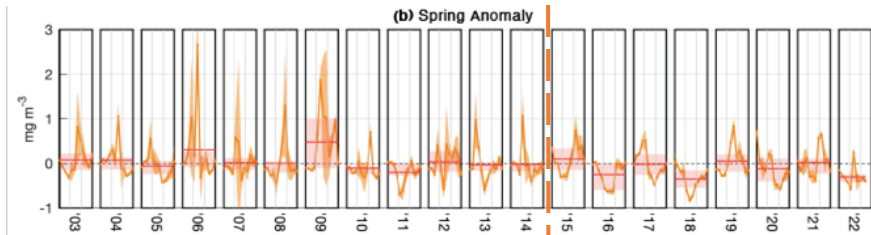
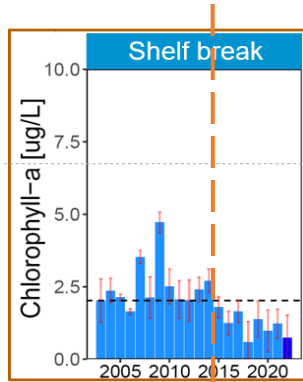
- 3.4x the legal limit significantly **lower than in recent years** (e.g. 76x in 2021)
- Decreased risk for community and food web

### School enrollment

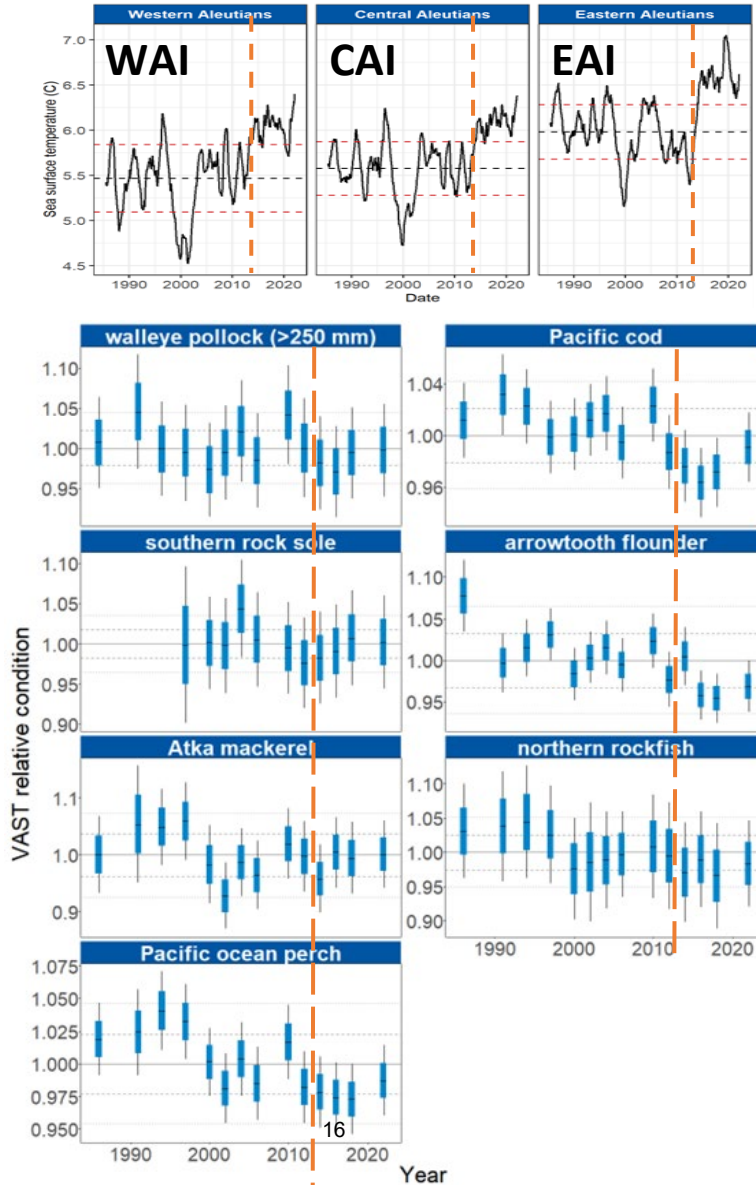
- Lower enrollment decreases the stability of the community.
- Enrollment bottomed out in AK in 2020-21 and **has not recovered in the Aleutians.**



## Satellite chl-a, Diatoms & Copepods



## Temperature and Fish Condition



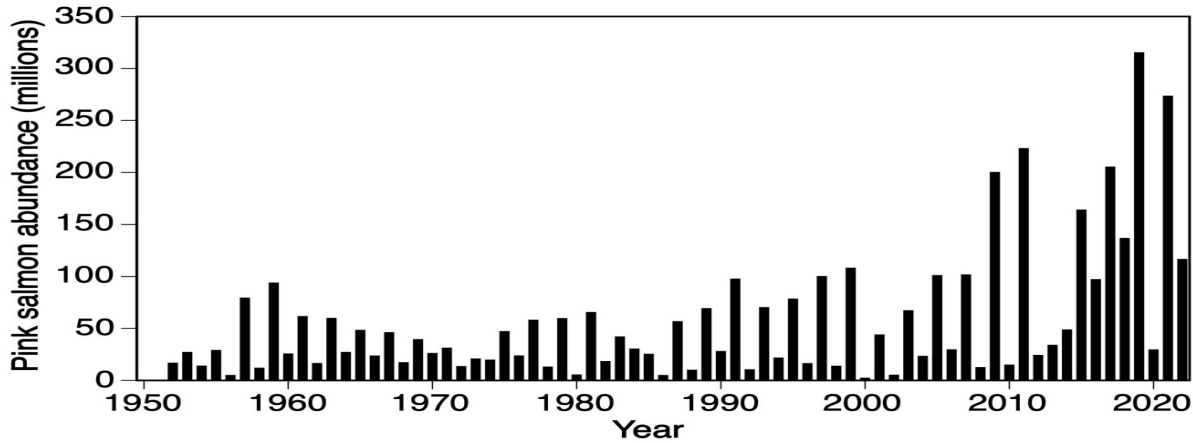
## Satellite chl-a, Diatoms & Copepods

- Satellite-derived chl-a reverted to generally lower than average since 2014. Decreasing large diatom abundance
- Satellite chl-a in EBS shelf break also decreasing since 2014
- Smaller zooplankton

## Temperature and Fish Conditions

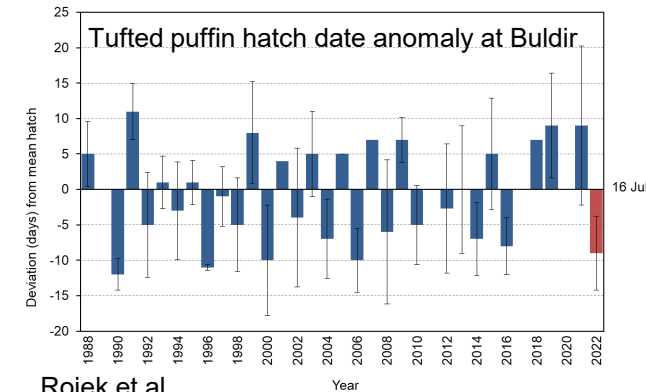
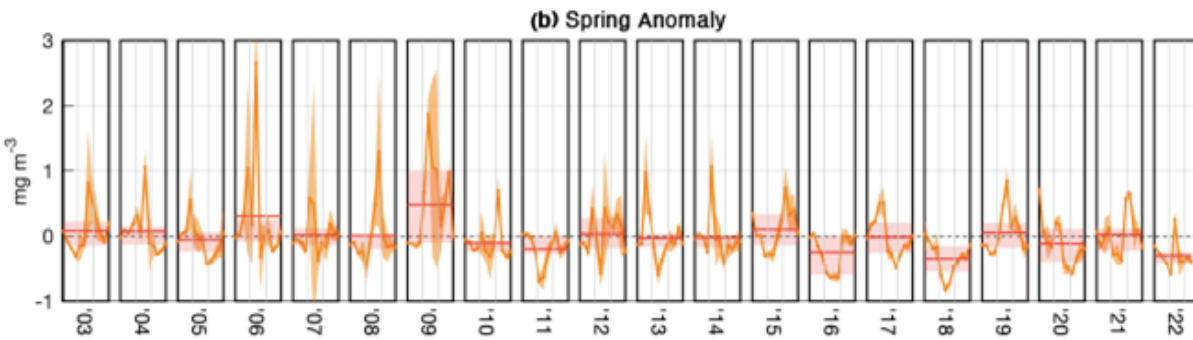
- Warm temperature top to bottom
- Condition factor some improvement but still average or below





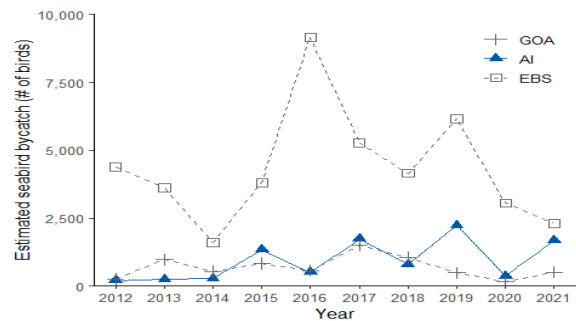
## Eastern Kamchatka pink salmon

- Continued high level for a low abundance year
- **Biennial pattern at several trophic levels from diverse sources**
- No statistical analysis has been conducted
- Potential thresholds: 2009 for high abundance years  
2016 for low abundance years?

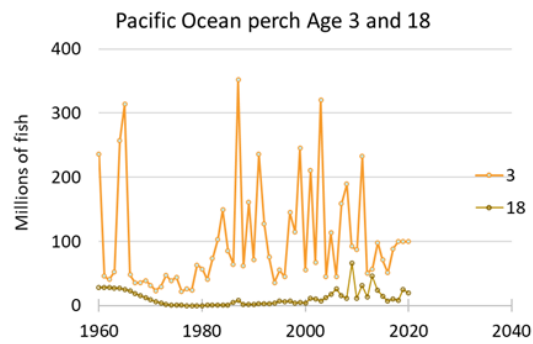


Rojek et al.

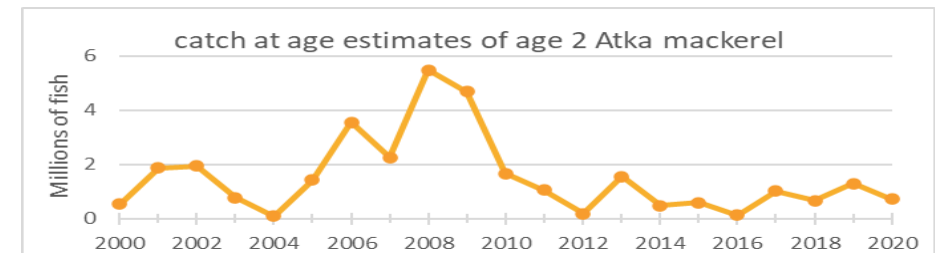
## Seabird bycatch in groundfish and halibut fisheries



Tide and Eich

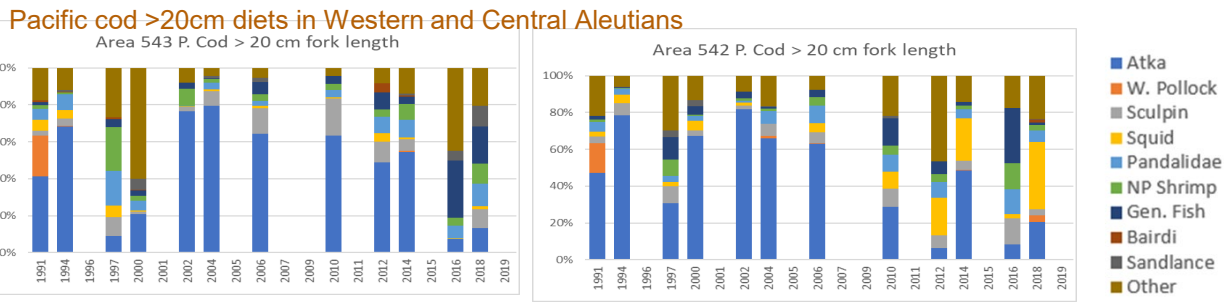
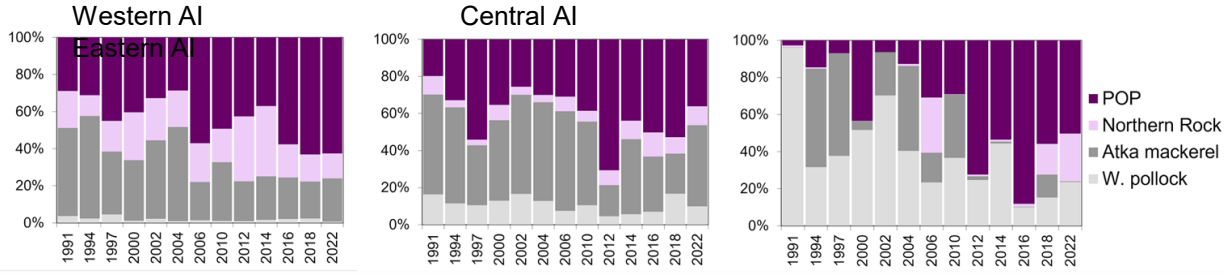


Spencer et al. 2020

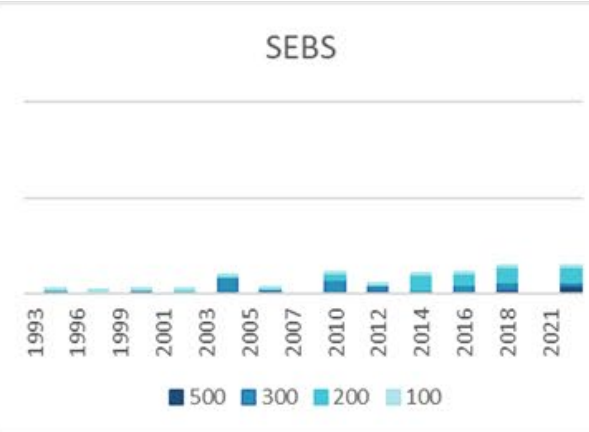
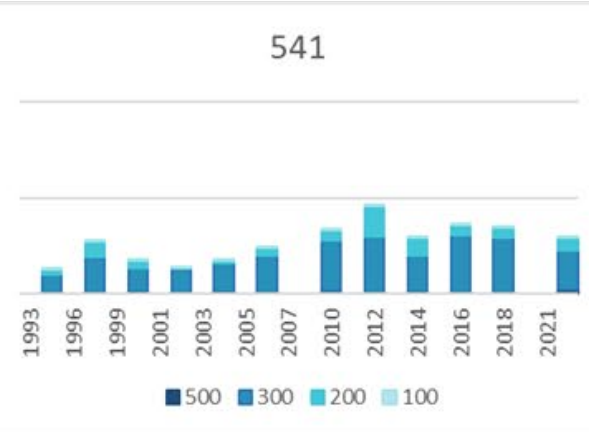
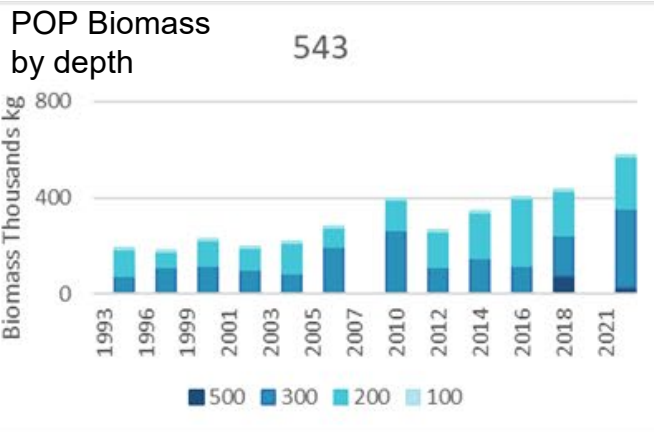
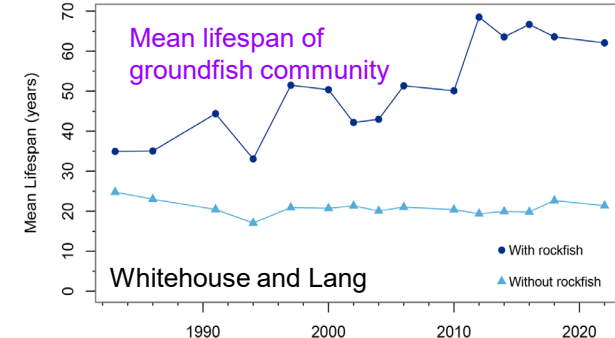
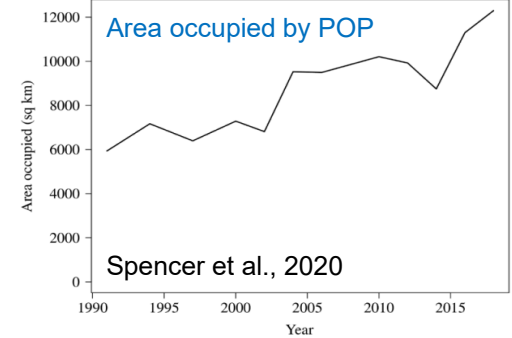


Lowé et al. 2021

# Rockfish main pelagic foragers



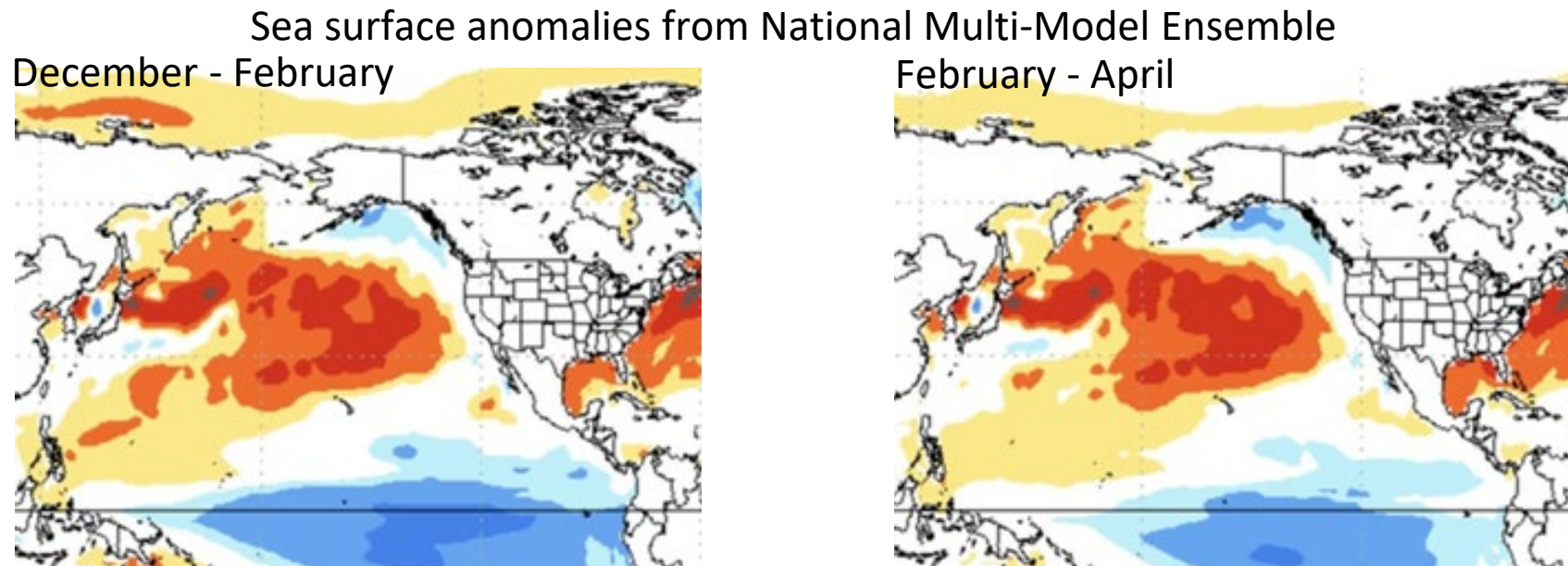
- Increased competition with other fish feeding on zooplankton, changes in cod diet due to decreasing Atka mackerel
- POP expanding area occupied
- Longer mean lifespan of groundfish community (35 to 60 years) means a slower turnover rate & dampened effects of environmental variability (increased ecological stability)
- Spatial competition with Atka mackerel, pollock?



- **76% chance of La Niña** during December-February 2022-23,
- **57% chance transition to ENSO-neutral** favored in February-April 2023

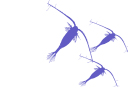
Climate prediction center, NOAA [https://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/enso\\_advisory/ensodisc.shtml](https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.shtml)

- **Warm** conditions for western Aleutians (NMME, Bond) for December - February
- PDO to continue negative (Bond)
- With continued negative PDO, Negative NPGO, Positive NPI, continued favorable zooplankton conditions





Jan – Aug warm conditions with moderate and at times severe MHW in WAI and CAI, warmer waters top to bottom continue  
*Potential concern for spawning season of Atka mackerel, higher bioenergetic costs, changes in timing of prey and growth rates*



Lower than average phytoplankton biomass (sat chl-a) and small copepod size  
*Decreased primary production/ lower availability of large copepods as prey, despite favorable climatological conditions for zooplankton*



Apex predators (Pacific cod, large flatfish) decreasing  
*Decreased biomass of commercially important species and potential prey for marine mammals; combined with low condition, indicates unfavorable conditions for fish feeding primarily on fish and/or large invertebrates*



Some improvement in fish condition but still mostly average or below  
*Indicates either lower availability or lower quality of prey. Potentially some density dependence effects in rockfish due to high biomass. Issue may be exacerbated by increased bioenergetic demands due to warmer temperatures. Fish with low condition are in turn low quality prey for piscivorous fish and marine mammals.*

Early seabird hatch dates and average or above reproductive success for plankton and fish eating seabirds  
*Indicates potential availability of prey and good foraging conditions for both plankton and fish eating groundfish*



Rockfish dominance of pelagic forage fish biomass  
*Potential for increased competition and decreasing availability Atka mackerel and pollock as prey for fish and marine mammals,*



Increasing Eastern Kamchatka pink salmon during both low abundance and high abundance years  
*Potential biennial pattern cascading to fish and combined with increased temperatures since 2014, becoming more evident in the ecosystem*

*The persistent warm conditions + rockfish dominance + increasing pink salmon abundance jointly might indicate **a transition of the ecosystem to a new state***

## Additional Information Available

**Aleutian Islands:** [Full GPT presentation](#) (@1:26:35) , [ppt only](#) , [AI In Brief](#), [AI full report](#)

**Eastern Bering Sea:** [Full GPT presentation](#) (@28:15), [ppt only](#), [EBS In Brief](#), [EBS full report](#)

**Gulf of Alaska:** [Full GPT presentation](#) (@33:17), [ppt only](#), [GOA In Brief](#), [GOA full report](#)

Ecosystem Status Reports through 2021 are available [here](#):

ESR Reports (1999-2021)

