

Aleutian Islands Ecosystem Status Report



ESR Reports
1999-2021

BSAI
Groundfish Plan Team
November 14, 2022



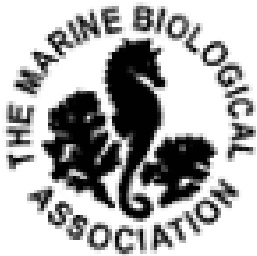
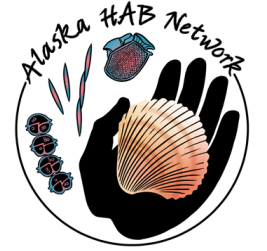
Ivonne Ortiz &
Stephani Zador



Thank you!



With contributions from: Anna Abelman, Sonia Batten, Nick Bond, Mathew W. Callahan, Jenipher Cate, Wei Cheng, Thomas Farrugia, Anne Marie Eich, Sarah Gaichas, Tom Gelatt, Timothy Jones, Mandy Keogh, Joseph Krieger, Kathy Kuletz, Carol Ladd, Ned Laman, Geoffrey M. Lang, Emily Lemagie, Jackie Lindsey, Calvin Mordy, Cecilia O’Leary, John Olson, Ivonne Ortiz, Clare Ostle, Noel Pelland, Chandra Poe, Heather Renner, Sean Rohan, Nora Rojek, Greg Ruggerone, Kate Savage, Kevin Siwicke, Matt Smith, Phyllis Stabeno, Katie Sweeney, Rick Thoman, Cathy Tyde, Caroline van Hemert, George Whitehouse, Bruce Wright, Stephani Zador



photos: 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 Rougheye/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 stays 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

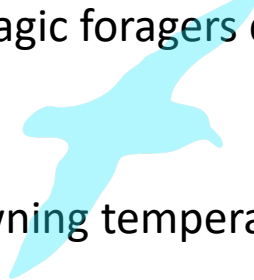
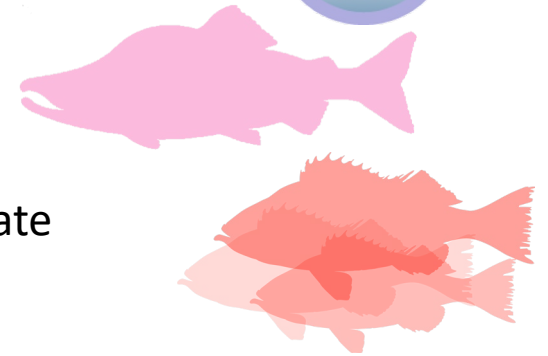
- Bottom & surface warmer temperatures, lower productivity
- Pinks impact: Biennial pattern in satellite chl-a combined all seabird bycatch, Tufted puffins hatch date age 3+ POP, age 2 Atka mackerel from fisheries,
- Pelagic foragers dominated by rockfish

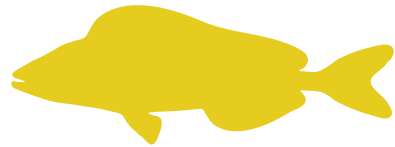
Implications for this year

- 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 transition to warmer temperature, high rockfish and pink salmon abundance





AI Atka mackerel



Persistent warm conditions, MHW coincidental with spawning / nesting season, increased metabolic demands, and below average length-weight residuals with near average condition, 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.

Response to SSC comments (Dec. 2021)

"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 CIE review in 2023

Aleutian Islands Bottom Trawl Survey GAP, RACE
Steller Sea lions Survey, AEP, MML

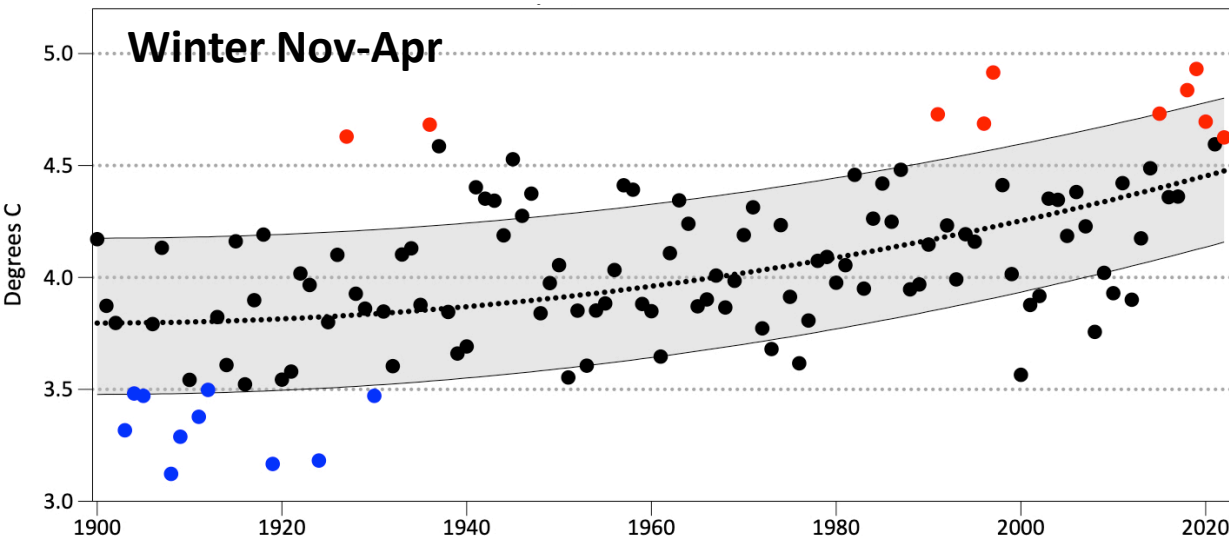
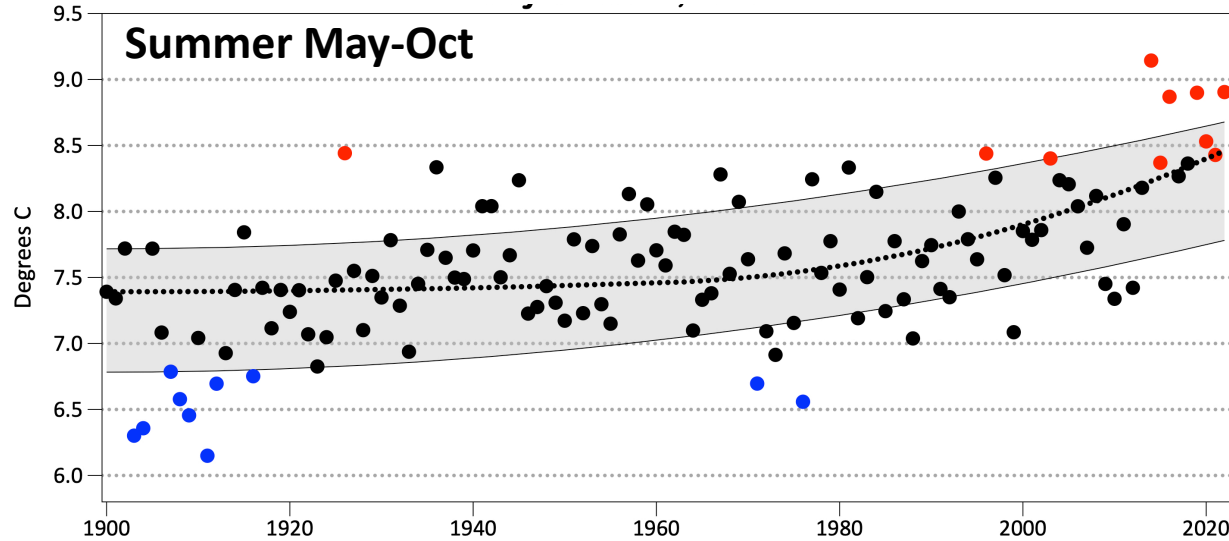
**Bottom Trawl Survey: 420 stations, 1700 km
Unimak Pass to Stalemate Bank
Updated 11 indicators, including:**



**Steller sea lion survey:
Non pups and pups at
Rookery Complex Areas 1- 6, WAI – EAI**



**Bottom temperature
Fish condition
Apex predator & pelagic foragers biomass
Mean lifespan**



New indicator

Long-term Sea Surface Temperature

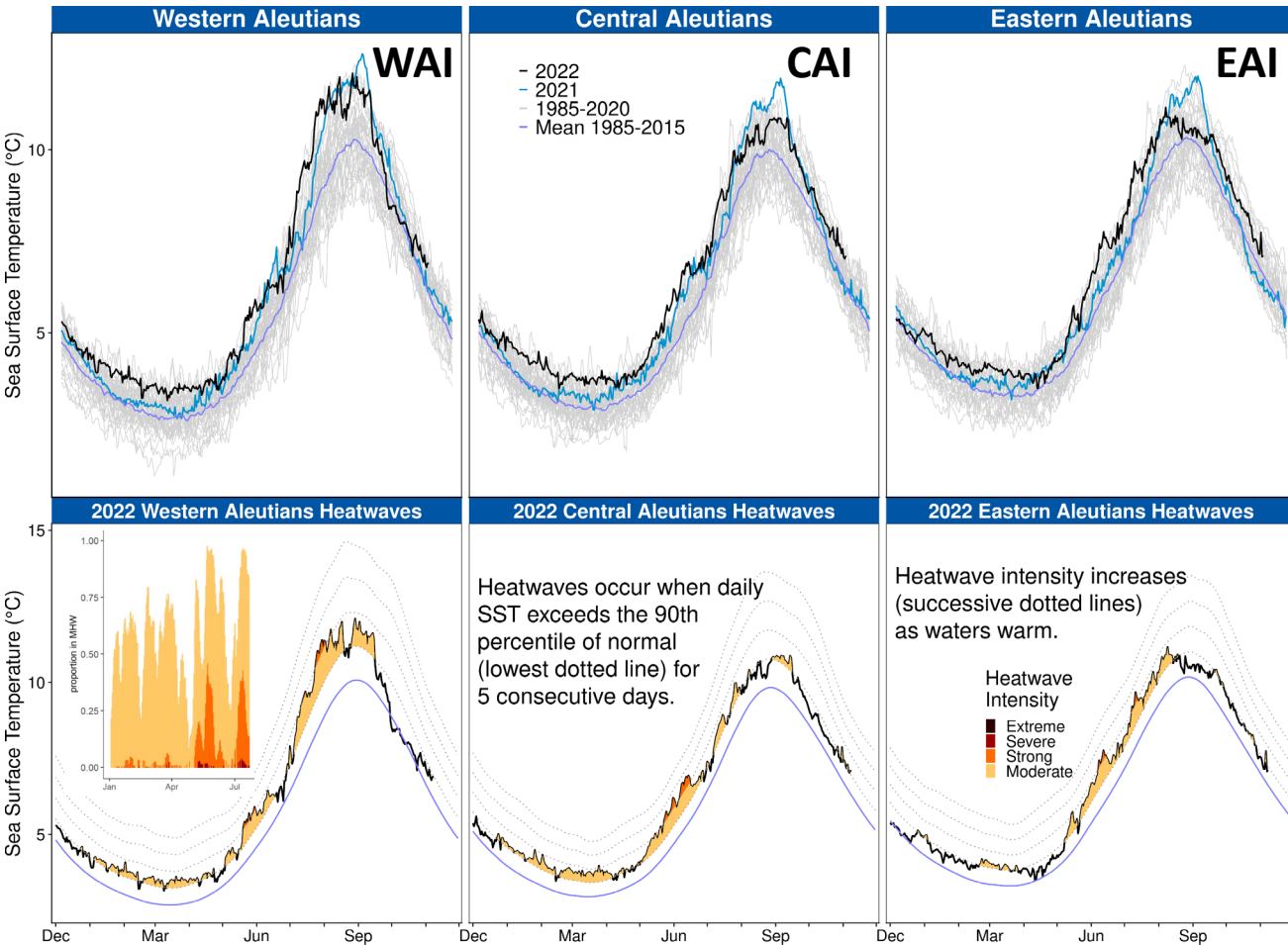
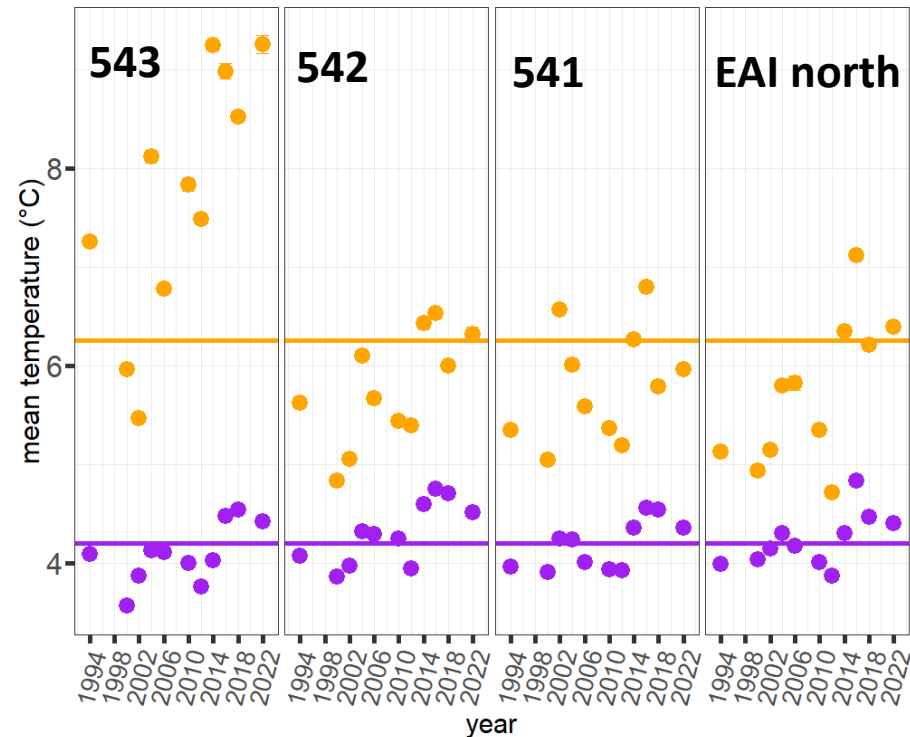
- Warming winter and summers
- 2022 Second warmest summer in 123 years

Satellite SST

Satellite SST

- Warm winter throughout
- Summer – warmest in WAI
- Moderate year-long MHW – WAI, CAI
- Water warmer than average top to bottom, SST above 2018; Bottom at or below 2018

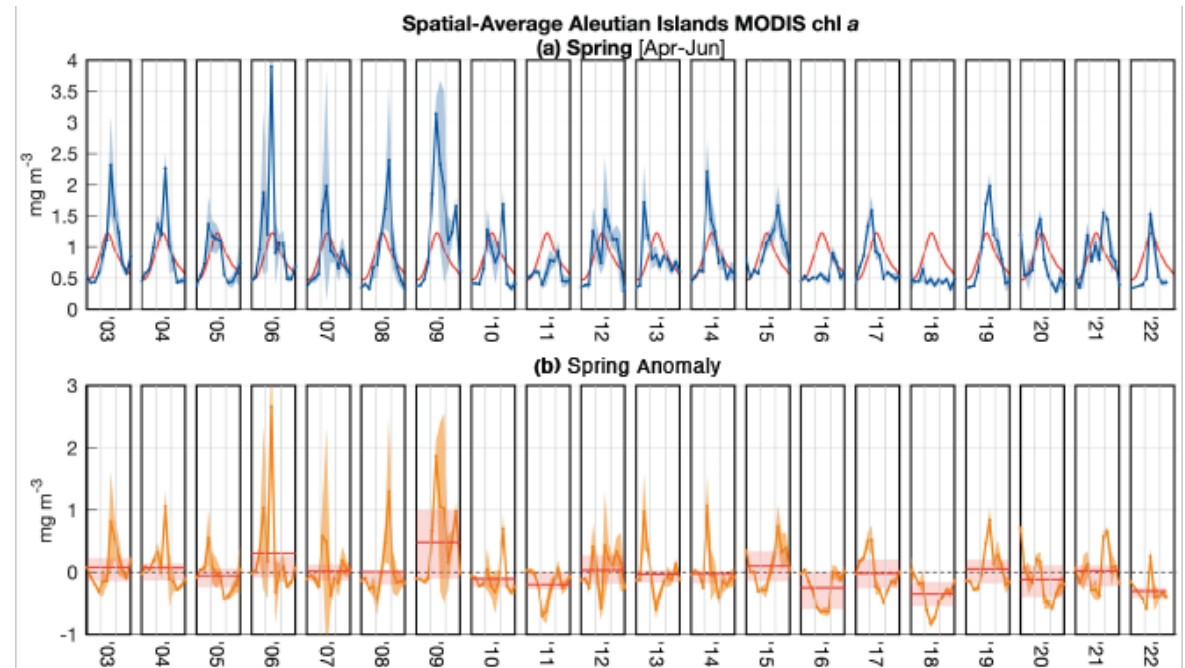
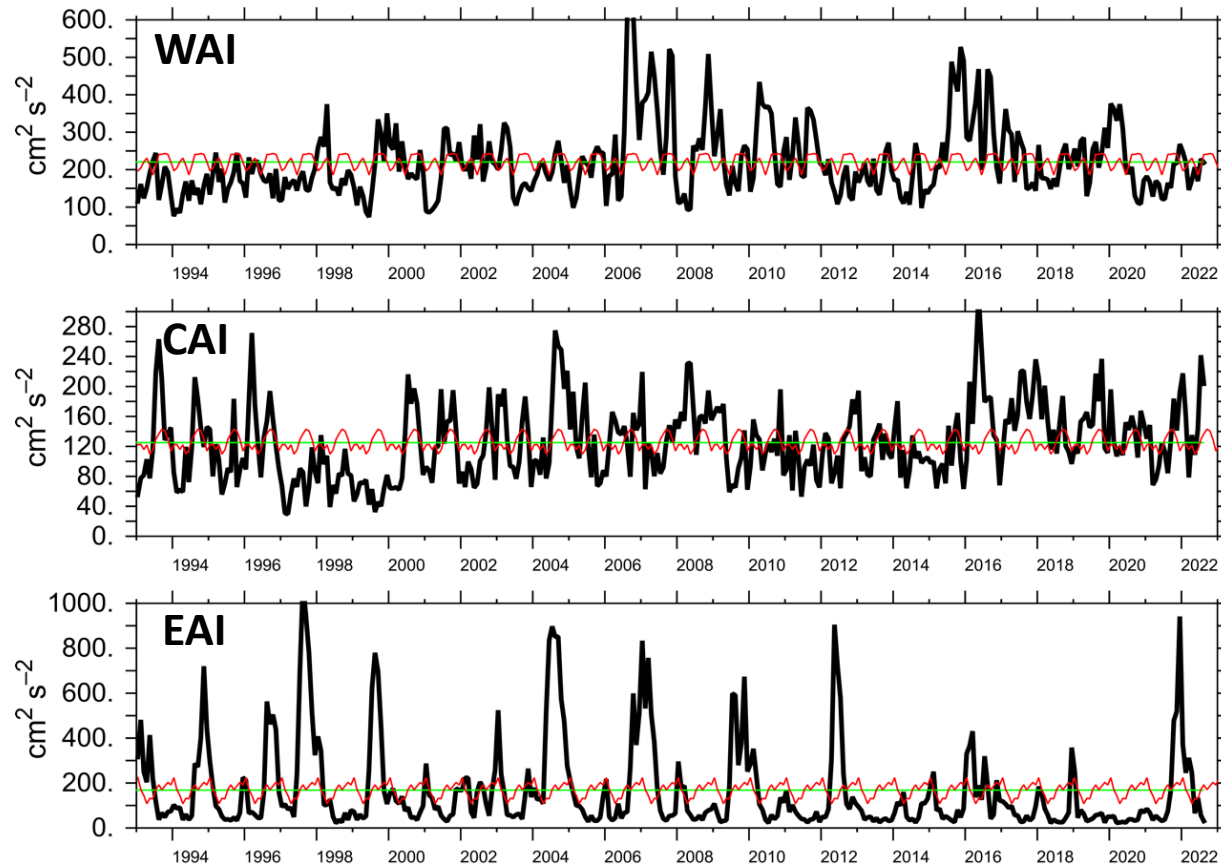
Mean SST and Bottom Temperature BT Survey 2022

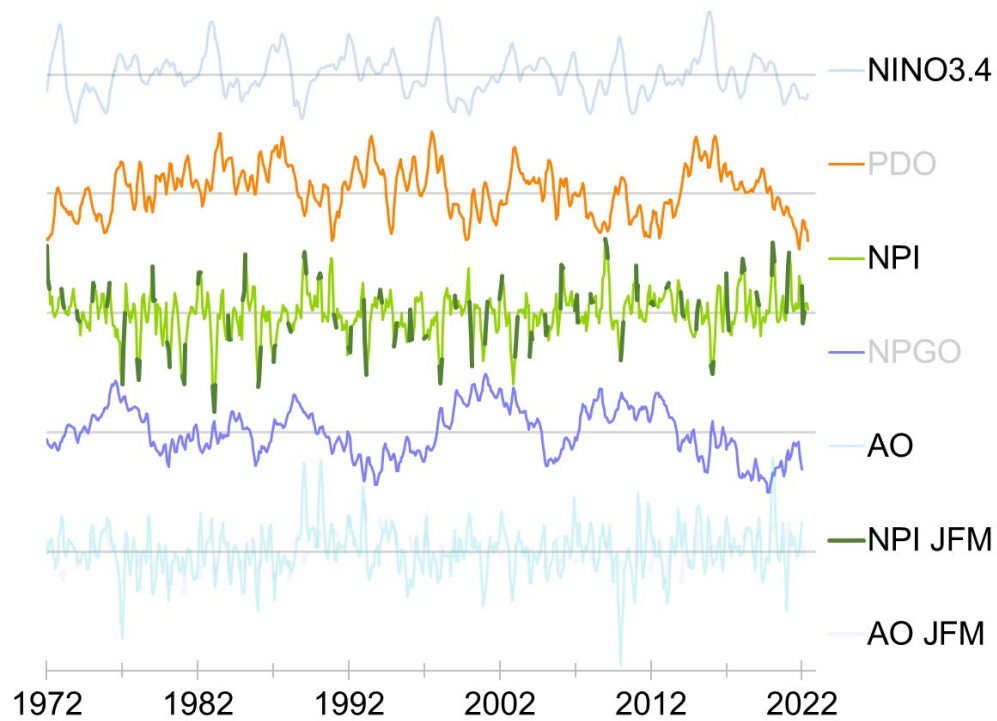


NOAA Coral Reef Watch data, courtesy National Environmental Satellite, Data, and Information Service (Updated: 11-08-2022)
 Data are modeled satellite products and periodic discrepancies or gaps may exist across sensors and products.
 Contact: matt.callahan@noaa.gov

Eddy Kinetic Energy

- Pulse eddy in EAI first since 2012
- Increased nutrient and heat flows through Unimak
- Moderate year-long MHW – WAI, CAI
- Satellite chl-a, phytoplankton biomass lower than average
- Decreased



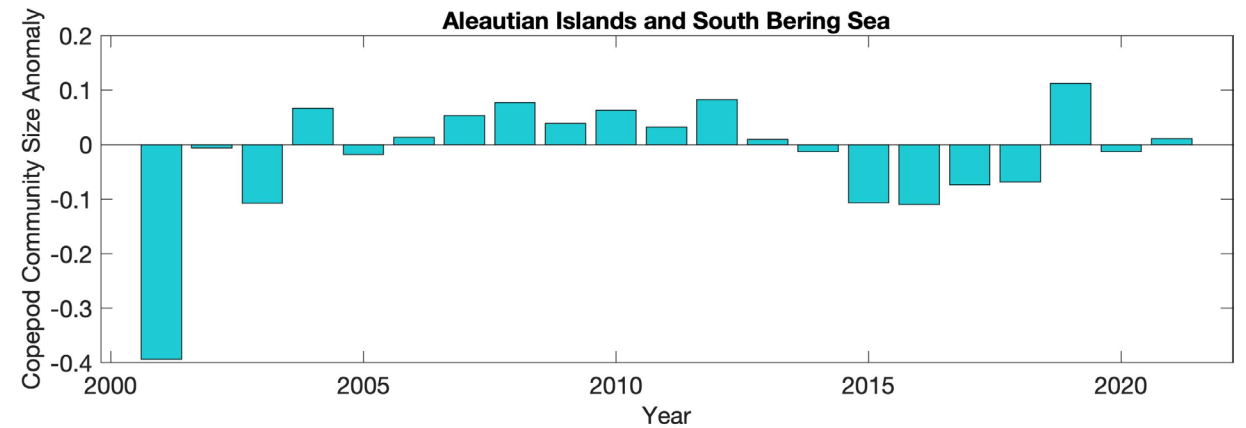


Climate Indices

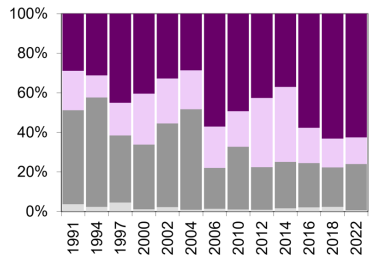
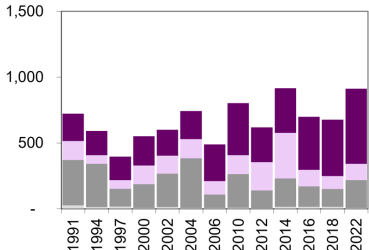
- Negative PDO, Negative NPGO, Positive NPI
Jointly support increased zooplankton

CPR Copepod size

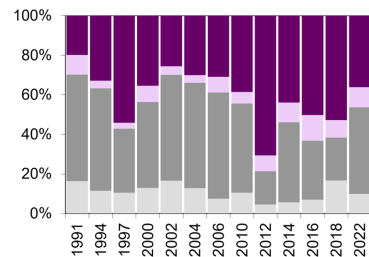
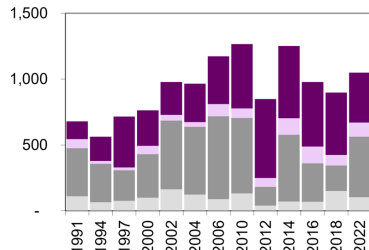
- Near average size in 2021 but note negative anomalies for sustained period since 2014



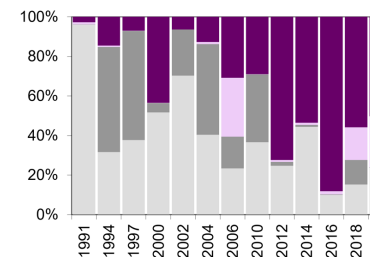
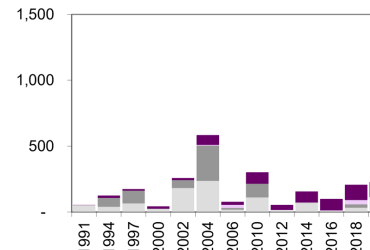
Pelagic Foragers: Western AI



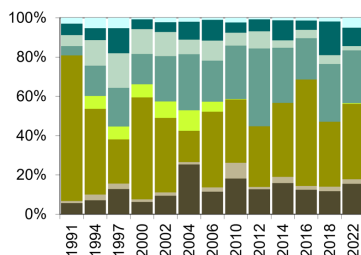
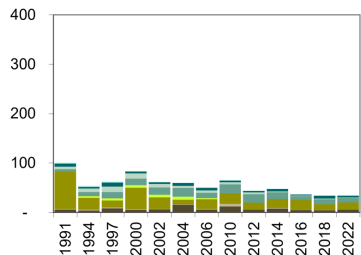
Central AI



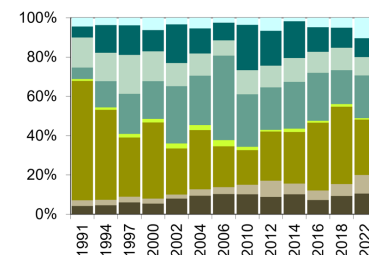
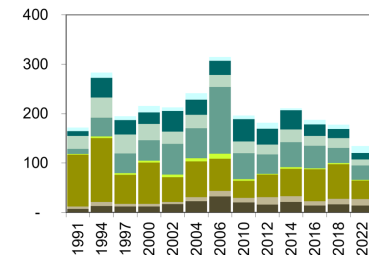
Eastern AI



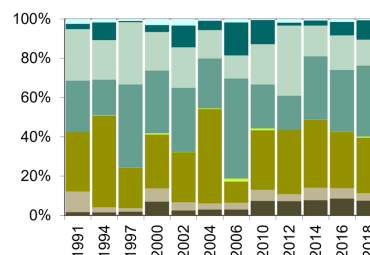
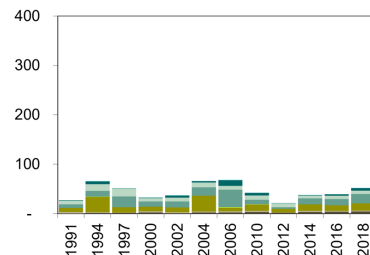
Apex Predators: Western AI



Central AI



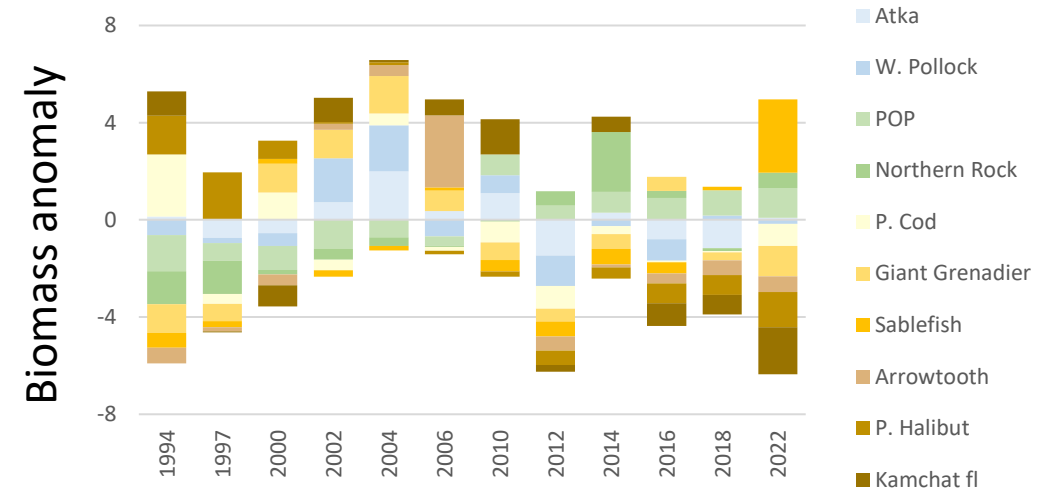
Eastern AI

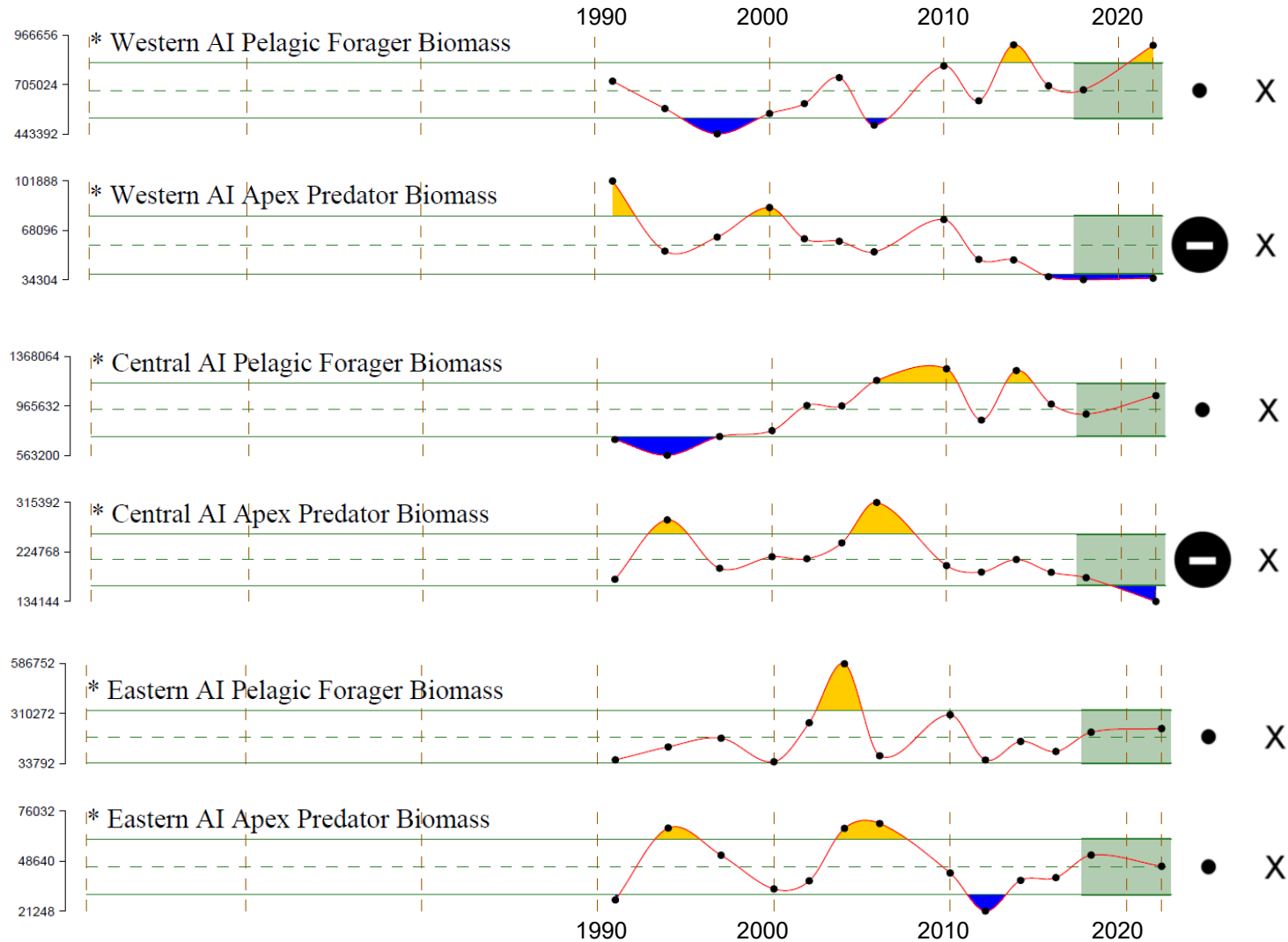


Pelagic foragers and Apex predator biomass

- Rockfish still dominate but Atka mackerel increased in WAI-CAI, pollock in EAI
- Large flatfish, Pacific cod decreased large sculpins increased
- Fish feeding near bottom not doing as well as fish feeding on pelagic prey - including sablefish (feed on squid, jellyfish, offal)

Overall fish biomass

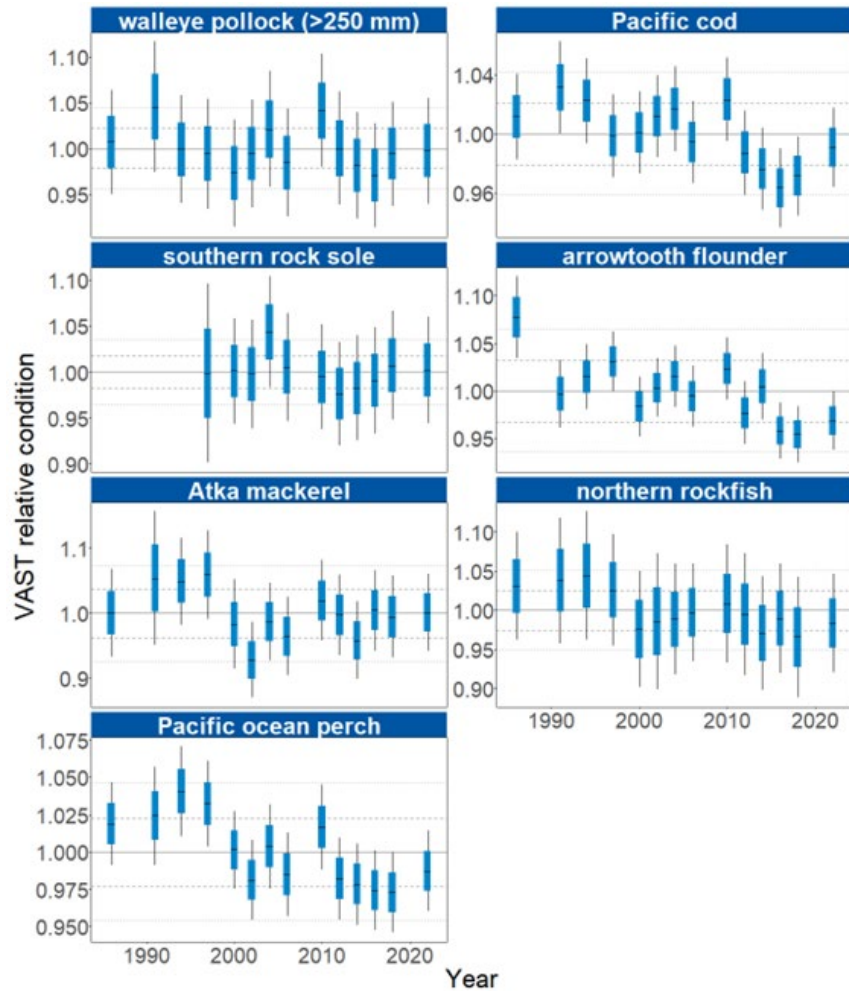




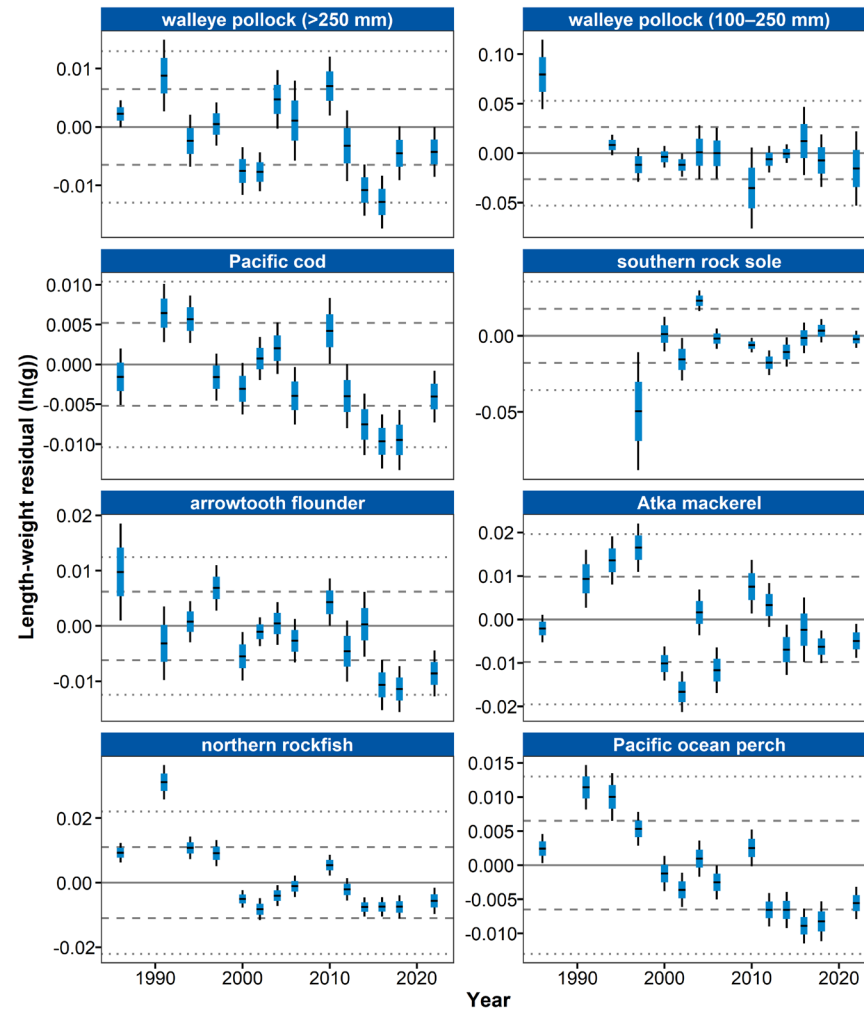
Pelagic foragers and Apex predator biomass

- Decreasing trend in WAI and CAI
- Large flatfish, Pcod decreased
large sculpins increased
- Fish feeding near bottom not doing as well as fish feeding on pelagic prey - including sablefish (feed on squid, jellyfish, offal)

New VAST relative condition

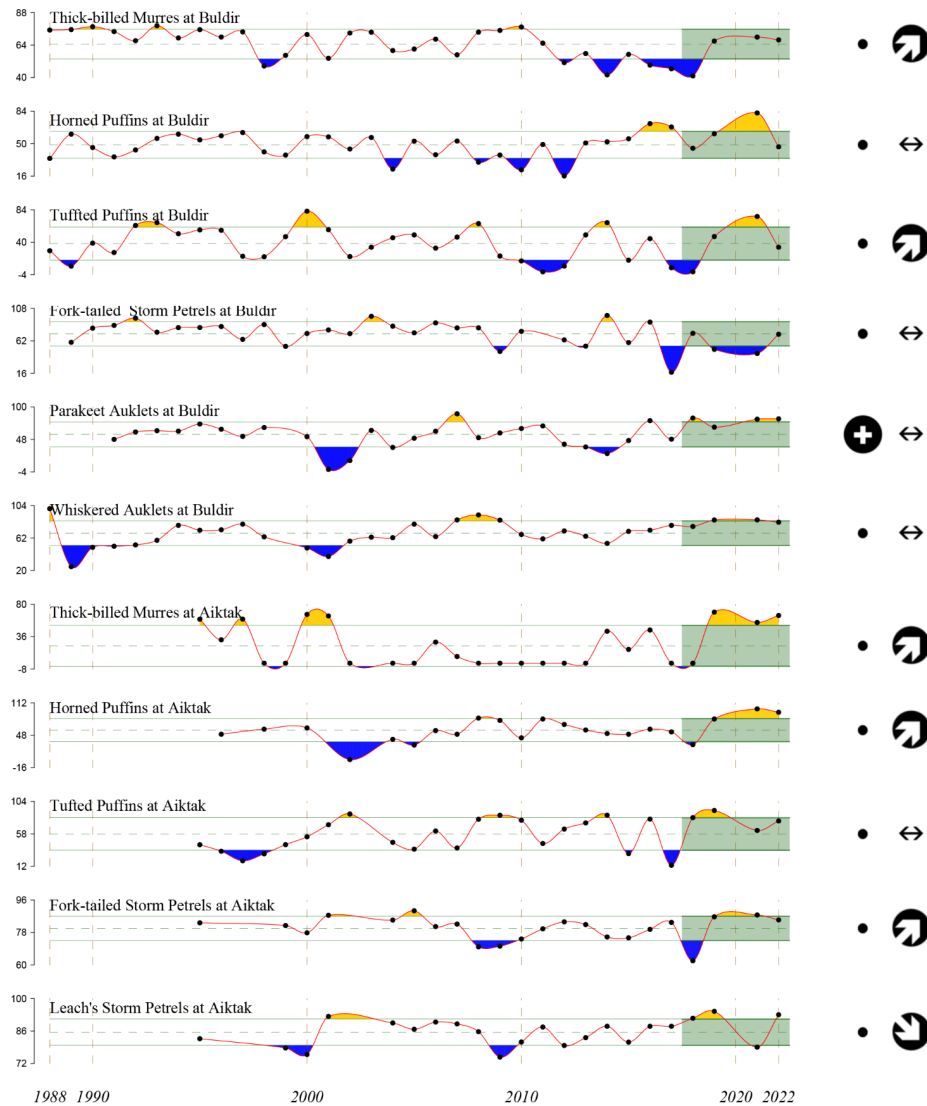


Old length-weight residuals



Fish condition

- Near average for pollock, Atka mackerel, southern sole
- Below average for rockfish, Pacific cod, arrowtooth flounder
- Length-weight residuals negative for all



2018-2022 Mean
 + 1 s.d. above mean
 - 1 s.d. below mean
 • within 1 s.d. of mean
 x fewer than 2 data points

2018-2022 Trend
 ↗ increase by 1 s.d. over time window
 ↘ decrease by 1 s.d. over time window
 ↔ change <1 s.d. over window
 x fewer than 3 data points

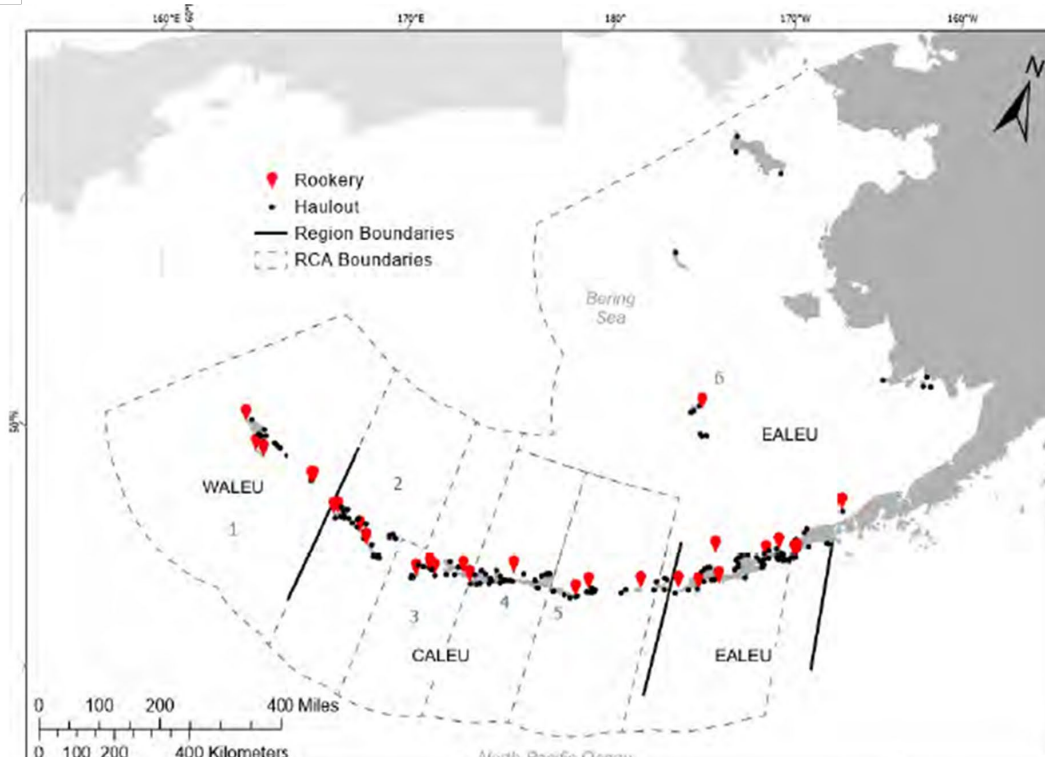
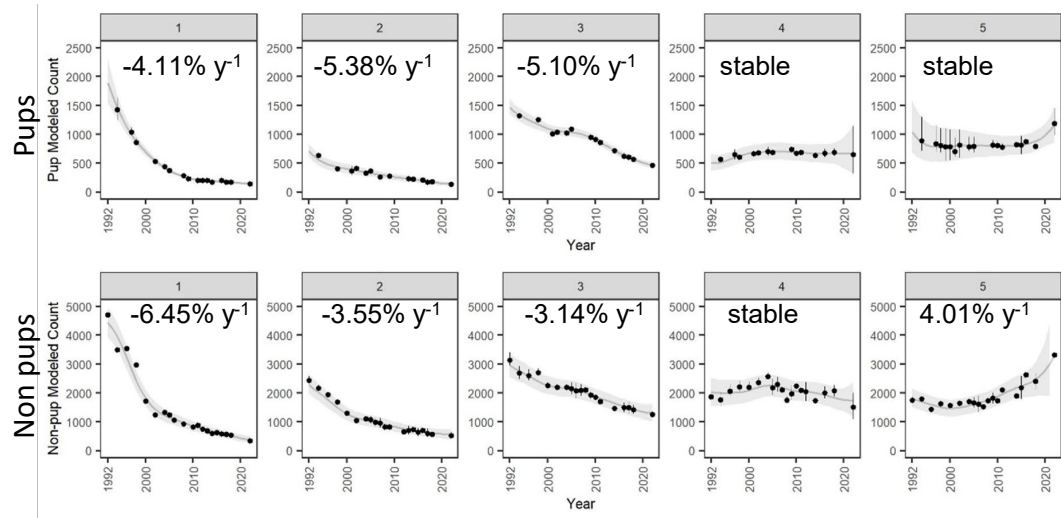
Seabird hatch time

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

Seabird Reproductive success

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

		Species													
		primarily fish eaters						primarily zooplankton eaters							
Site		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		🕒	🕒	🕒	🕒	🕒	🕒	🕒	-	🕒	🕒	🕒	🕒		
Site		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		😊	-	😊	😊	😊	😊	😊	😊	-	😊	😊	😊	😊	😊



Steller sea lion counts

Overall western Distinct Segment Population between 2007 - 2022

- Pups: Increased 1.06% y⁻¹
- Non pups 1.41% y⁻¹

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

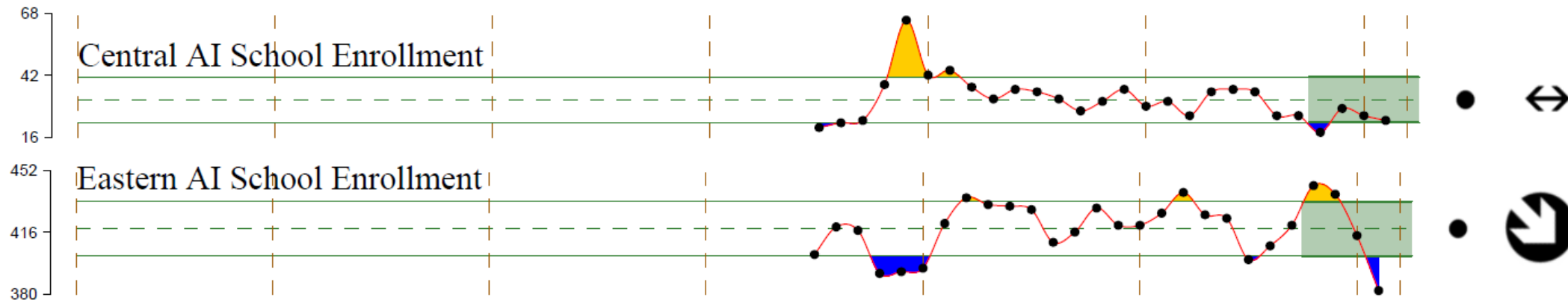


Harmful Algal Blooms

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

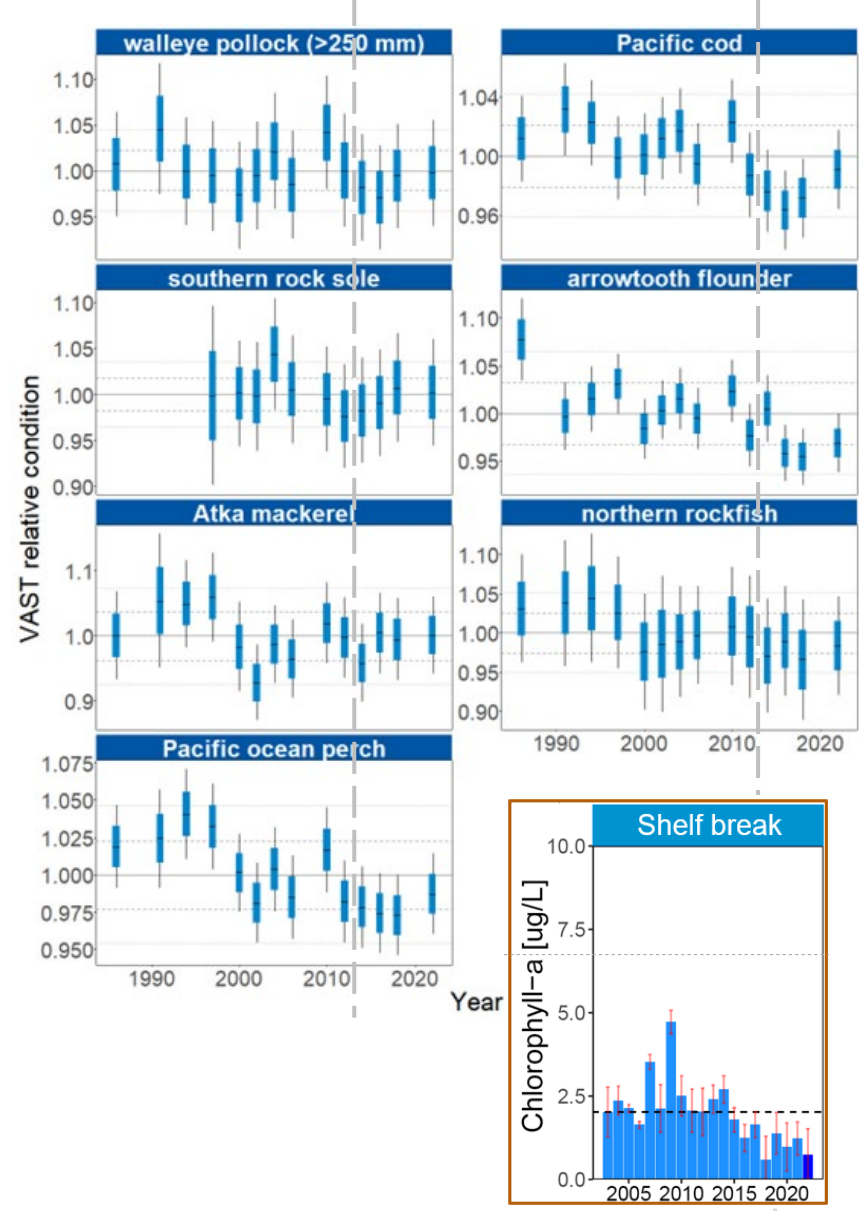
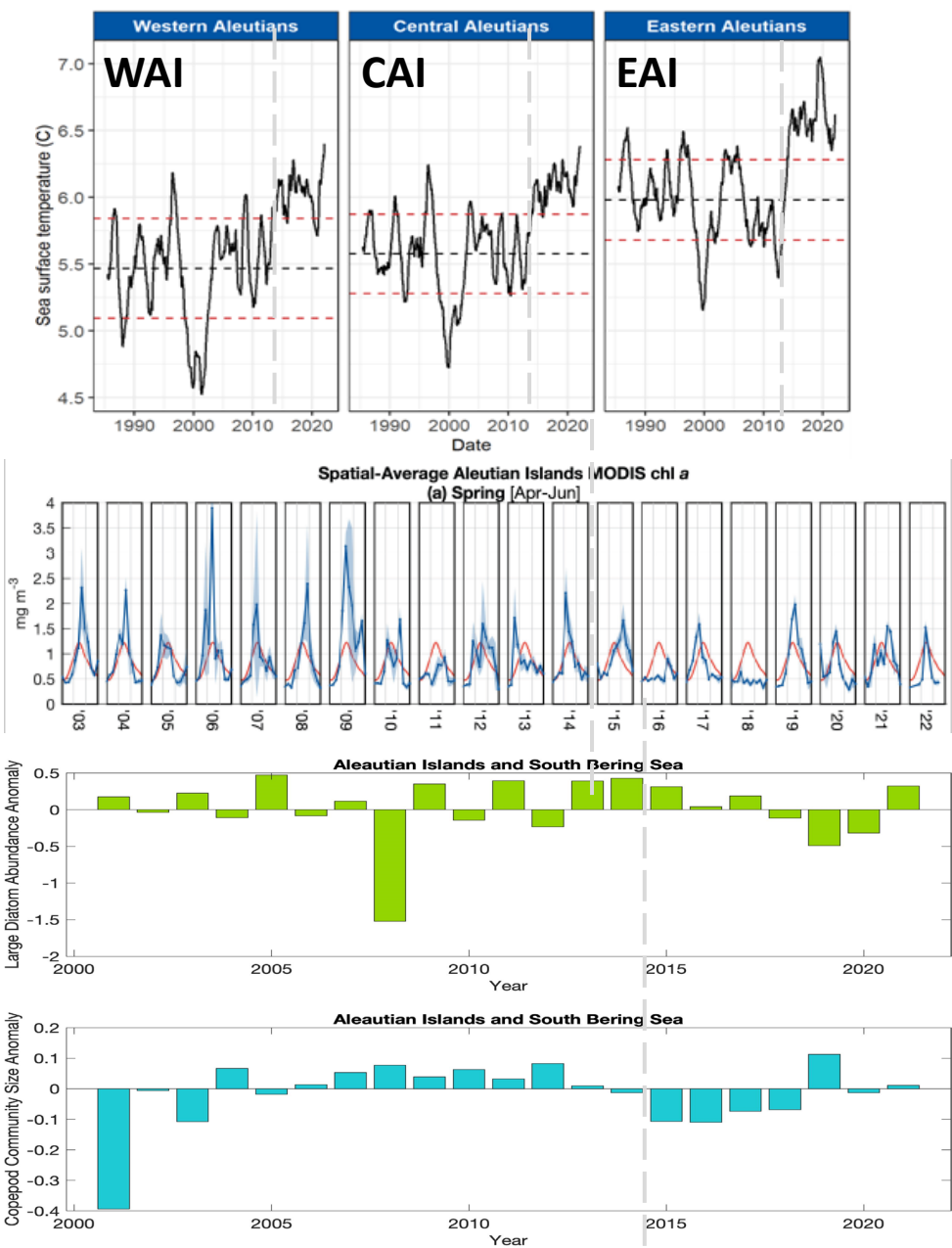
School enrollment

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



Persistent warm conditions

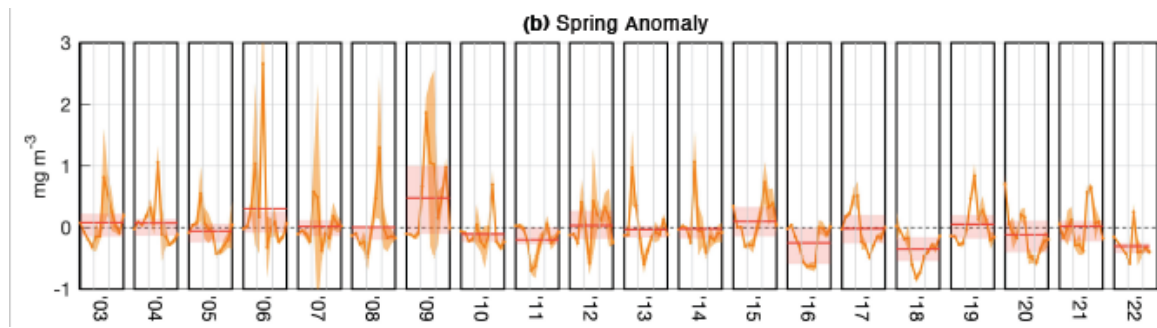
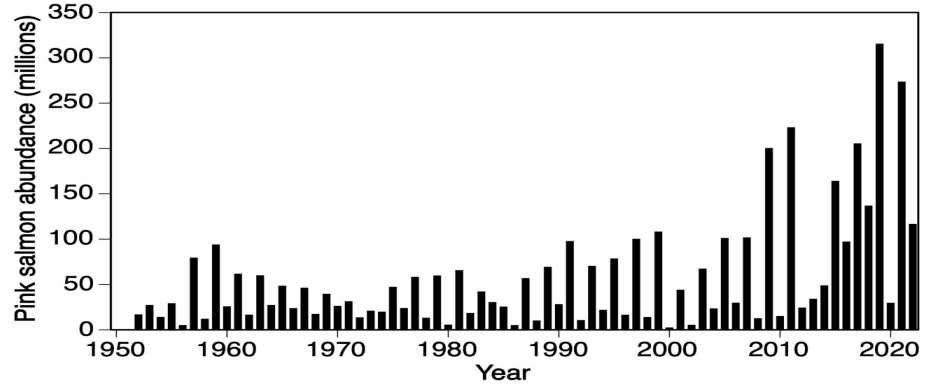
Multiyear patterns



- Persistent warm temperature top to bottom
- Eddy kinetic energy first large pulse eddy in EAI since 2012
- Increased satellite chl-a and large diatoms in 2021 but satellite-derived chl-a reverted to generally lower than average since 2014. Satellite chl-a in EBS shelf break also decreasing since 2014
- Smaller zooplankton
- Condition factor some improvement but still average or below

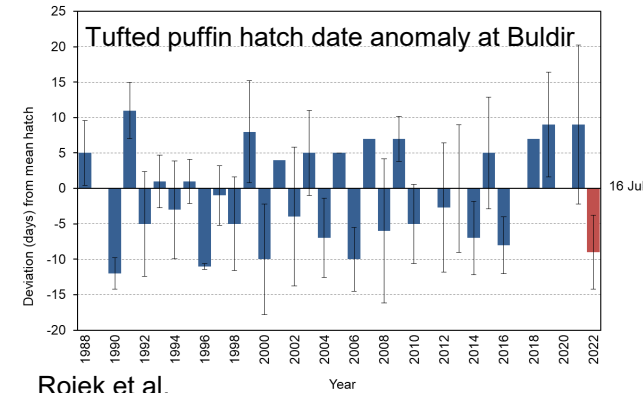
Eastern Kamchatka pink salmon in odd years

Multi-year patterns



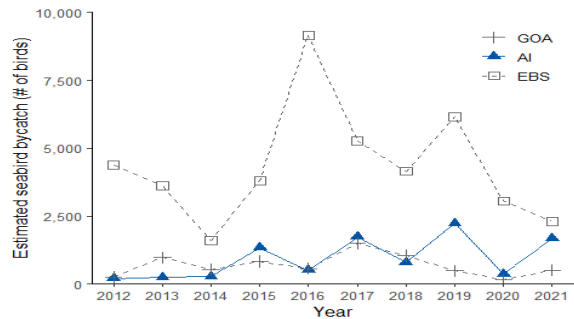
Eastern Kamchatka pink salmon

- Continued high level for a low abundance year
- Biennial pattern observed 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?

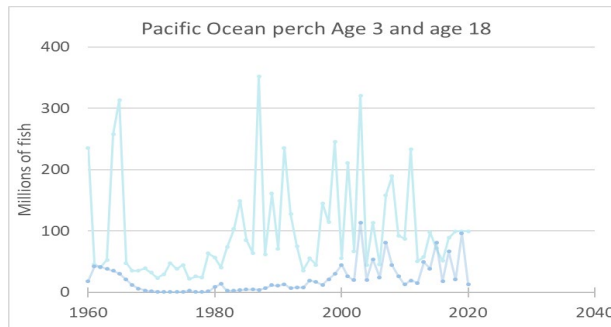


Rojek et al.

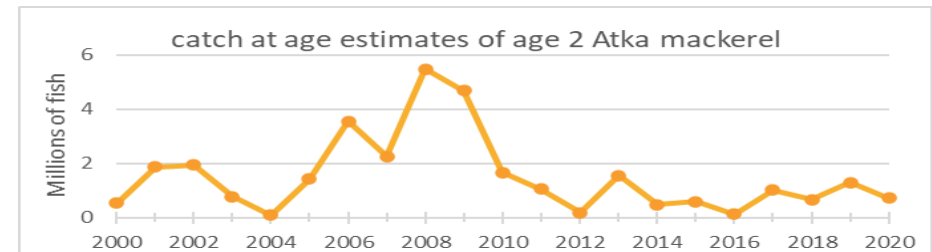
Seabird bycatch in groundfish and halibut fisheries



Tide and Eich



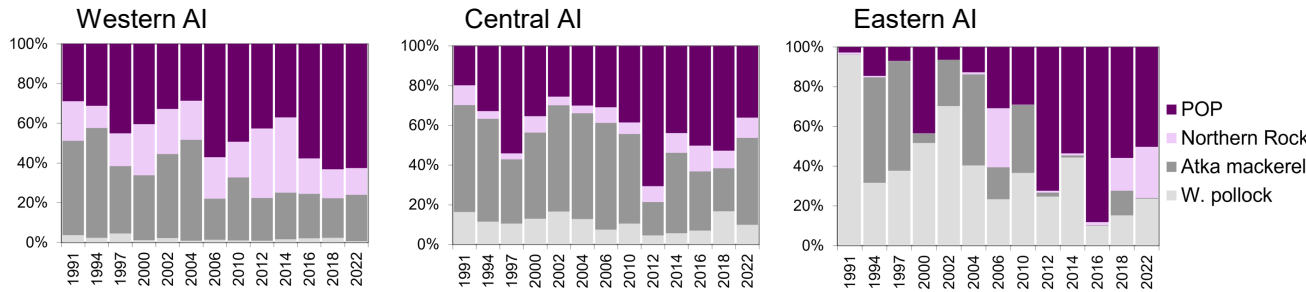
Spencer et al. 2020



Lowé et al. 2021

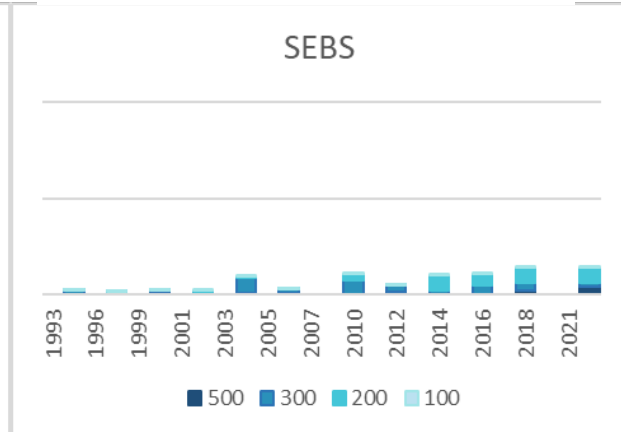
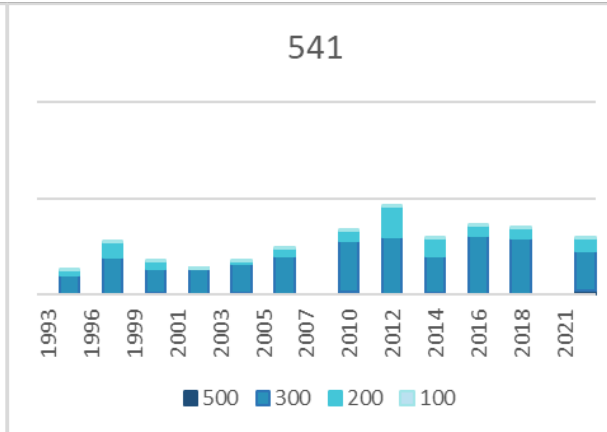
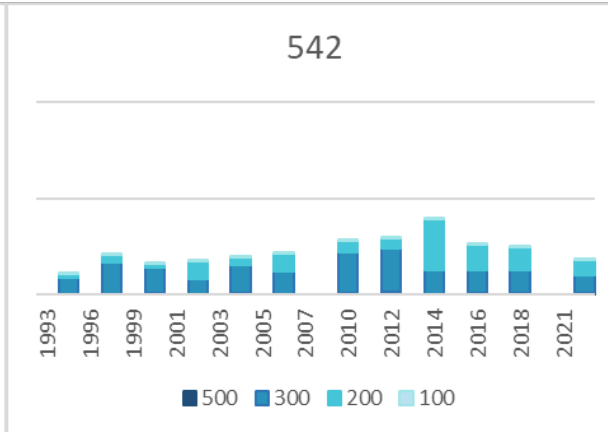
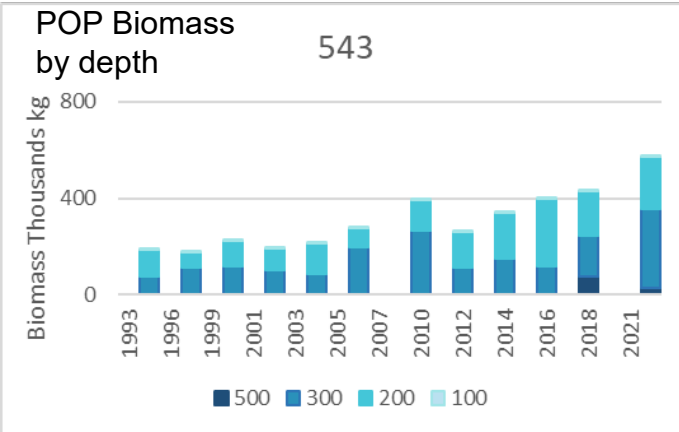
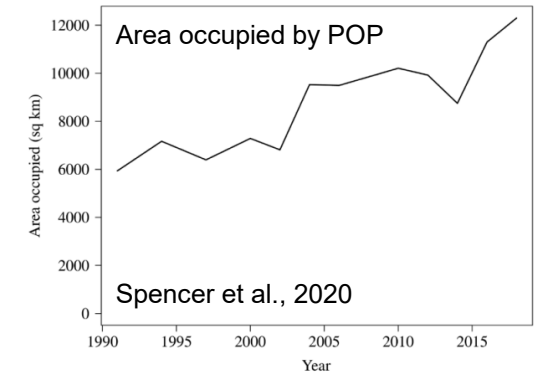
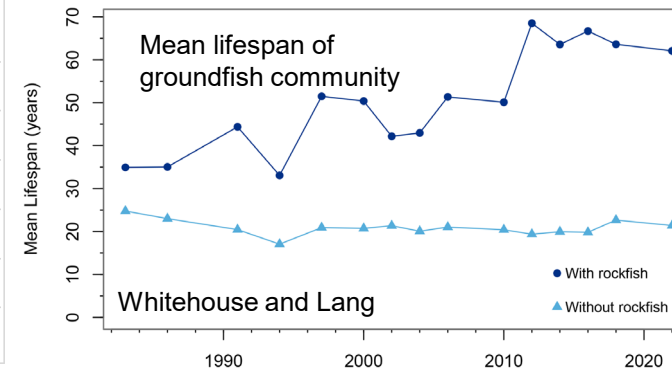
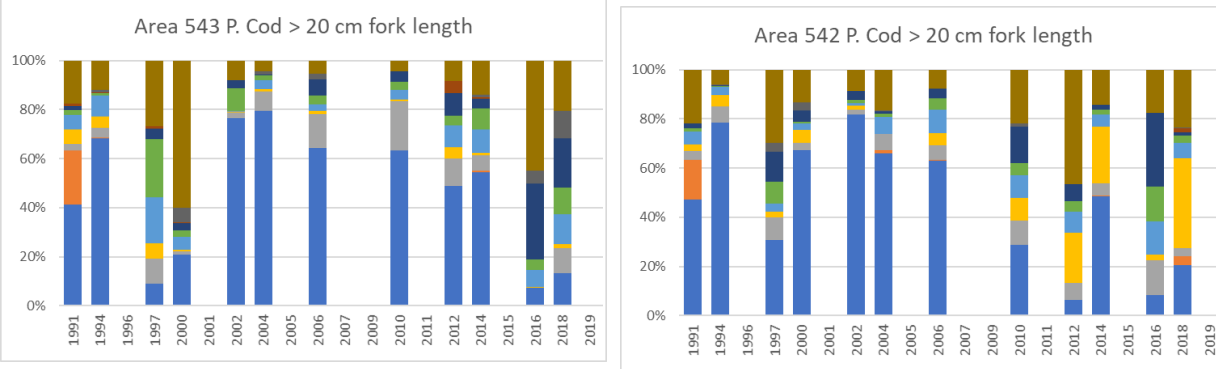
Rockfish main pelagic foragers

Multi-year patterns

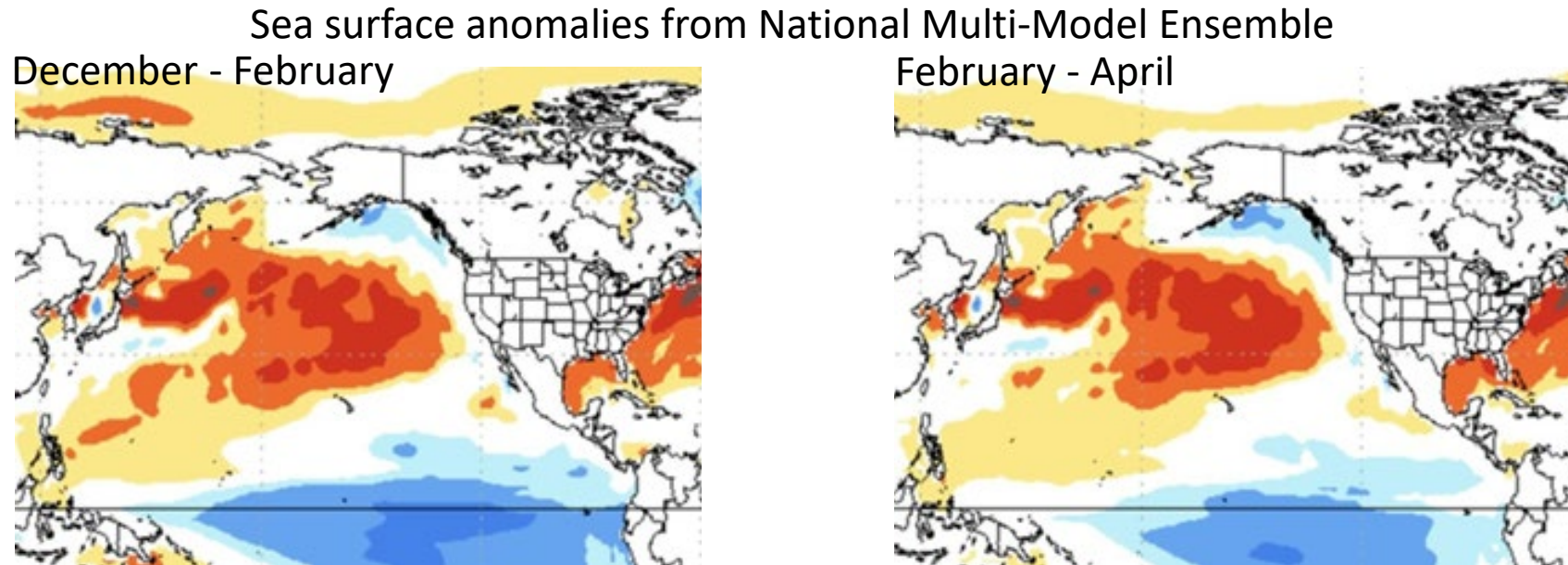


- POP encroaching into depths within 100-200 m and expanding area occupied
- May hamper predators feeding on other prey within 100-200m
- Spatial competition with Atka mackerel, pollock?
- Longer mean lifespan of groundfish community (35 to 60 years) means a slower turnover rate & dampened effects of environmental variability

Pacific cod >20cm diets in Western and Central Aleutians



- There is a **76% chance of La Niña** during December-February 2022-23, with a transition to ENSO-neutral favored in February-April 2023 (57% chance). Climate prediction center, NOAA
https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.shtml
- **Warm** conditions for western Aleutians (NMME, Bond)
- PDO to continue negative (Bond)
- With continued negative PDO, Negative NPGO, Positive NPI, continued favorable zooplankton conditions

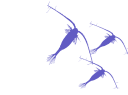


Summary and implications



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



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 spatial competition and decreasing availability of other prey for fish and marine mammals, potentially higher concern at depths between 100-200 m.



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, increasing POP abundance and increasing pink salmon abundance jointly might indicate a transition of the ecosystem to a new state