Ecosystem Status Report: Eastern Bering Sea 2024

Elizabeth Siddon

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NOAA FISHERIES

Outline

- Ecosystem Considerations for Risk Tables
- New and Noteworthy Topics
- Ecosystem Assessment
  - Southeastern Bering Sea
  - Northern Bering Sea

Ecosystem Considerations for Risk Tables

Level 1

No apparent ecosystem concerns related to biological status (e.g., environment, prey, competition, predation), or minor concerns with uncertain impacts on the stock.

EBS Pollock
Yellowfin sole
Northern rock sole
Greenland turbot
Kamchatka flounder
Alaska plaice
Flathead sole
Other flatfish
Sablefish +ESP

Level 2

Indicator(s) with adverse signals related to biological status (e.g., environment, prey, competition, predation).

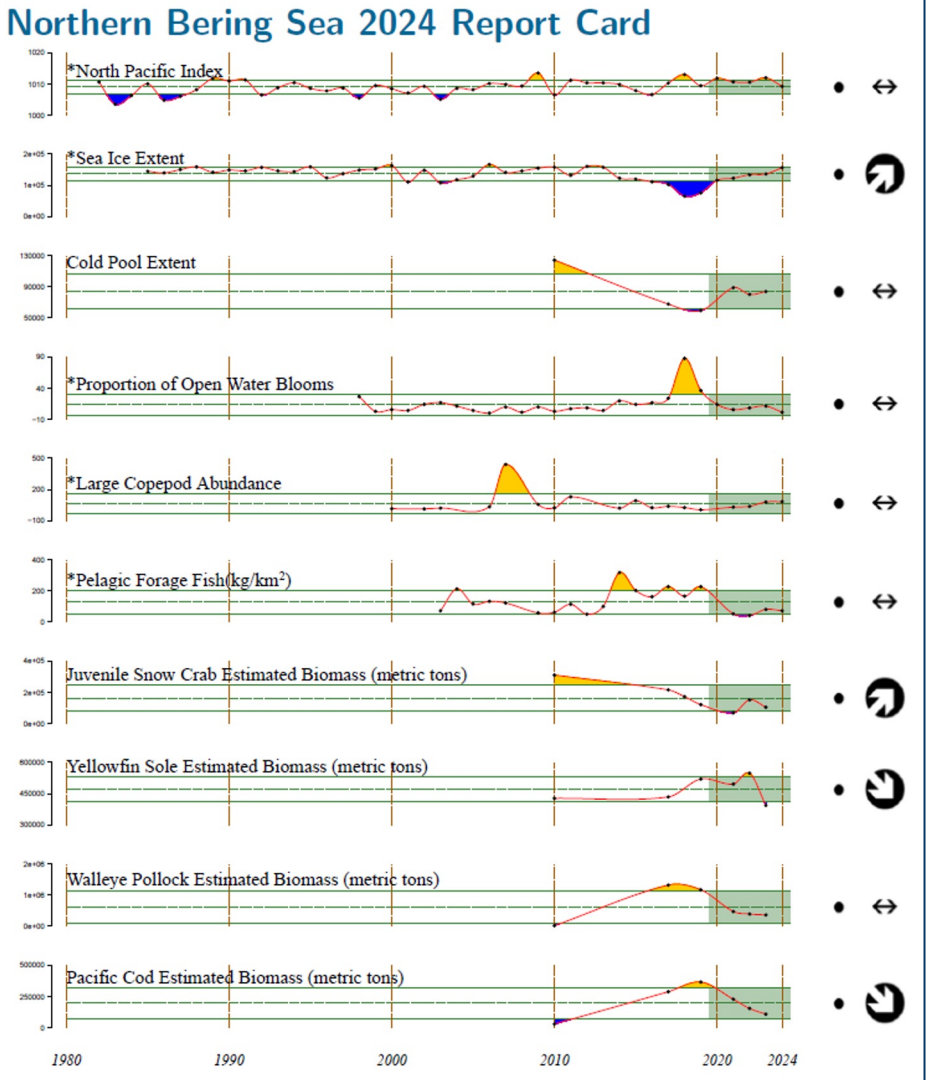
EBS Pacific cod

Environment: Oceanographic conditions were largely average based on multiple metrics

Prey: Prey conditions over the SEBS shelf potentially more limiting than over the NBS. Pcod condition continued to decrease over the SEBS from 2022 to 2024. The majority of the Pcod biomass has been over the SEBS in recent years.

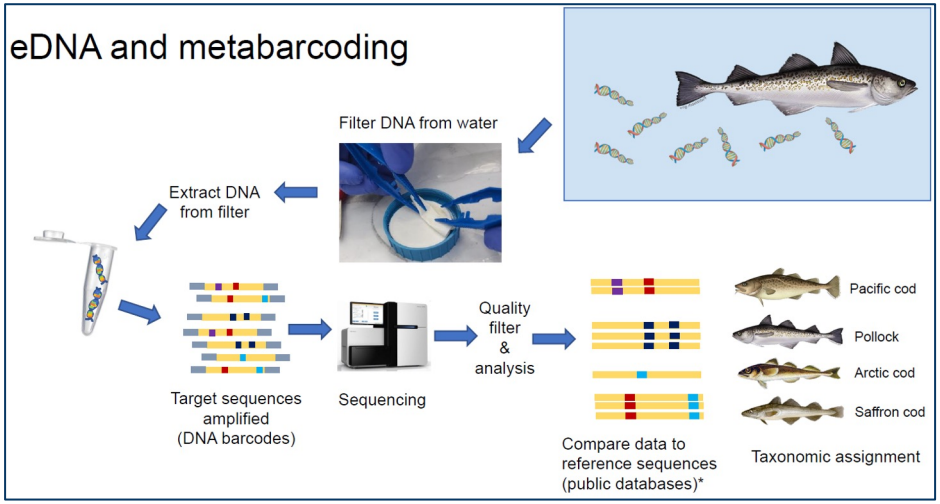
Competitors: Competitors of Pcod increased substantially from 2023 to 2024, including arrowtooth flounder and pollock, especially over the SEBS.

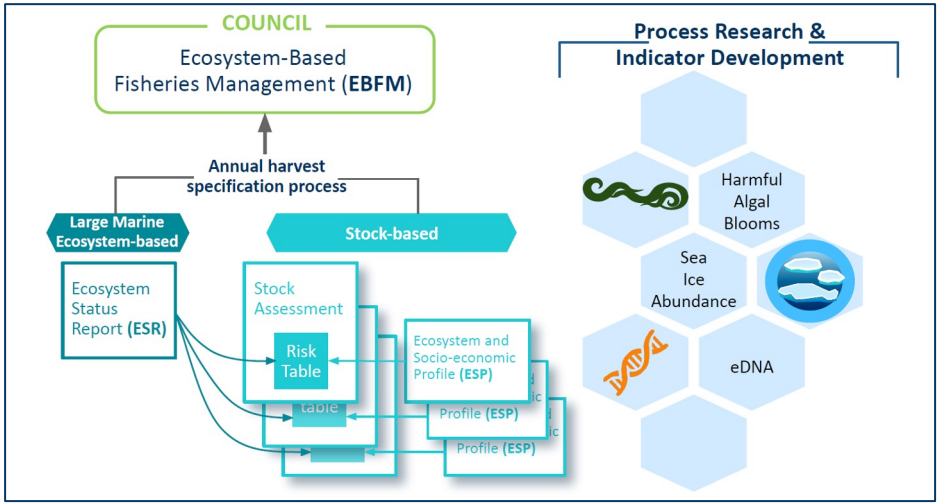
Predators: The CEATTLE model indicates above average predation pressure on Pcod; cannibalism may be mitigated by spatial overlap between juvenile and adult Pacific cod. +ESP



New in 2024

- Sea ice extent now available by sub-region
  - PolarWatch Shinyapp: https://polarwatch.github.io/alaska-seaice/
- Juvenile snow crab biomass
  - immature females + small males
- Foraging guilds (e.g., motile epifauna) not available for NBS
  - No ecopath-estimated catchability coefficient



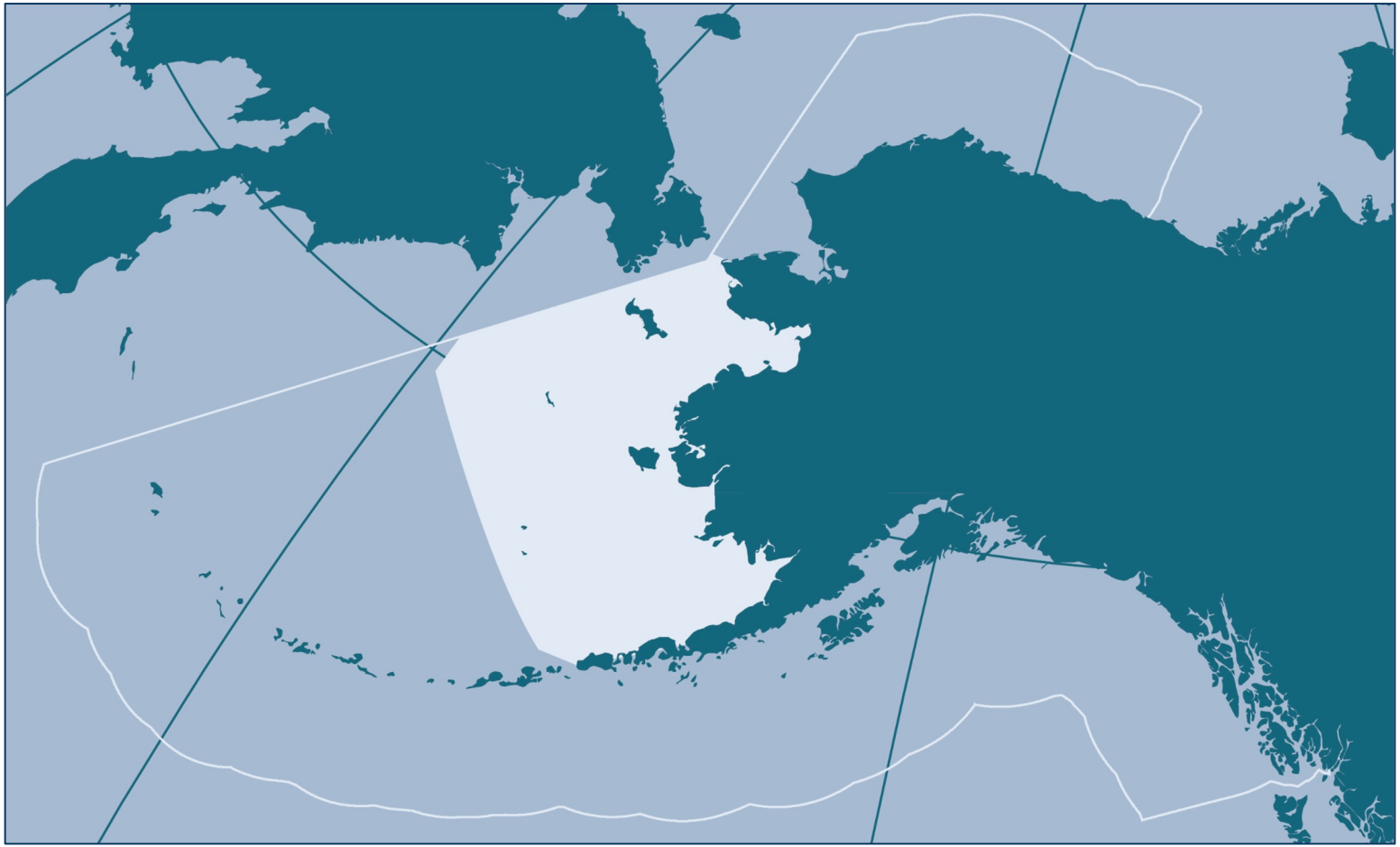


Noteworthy

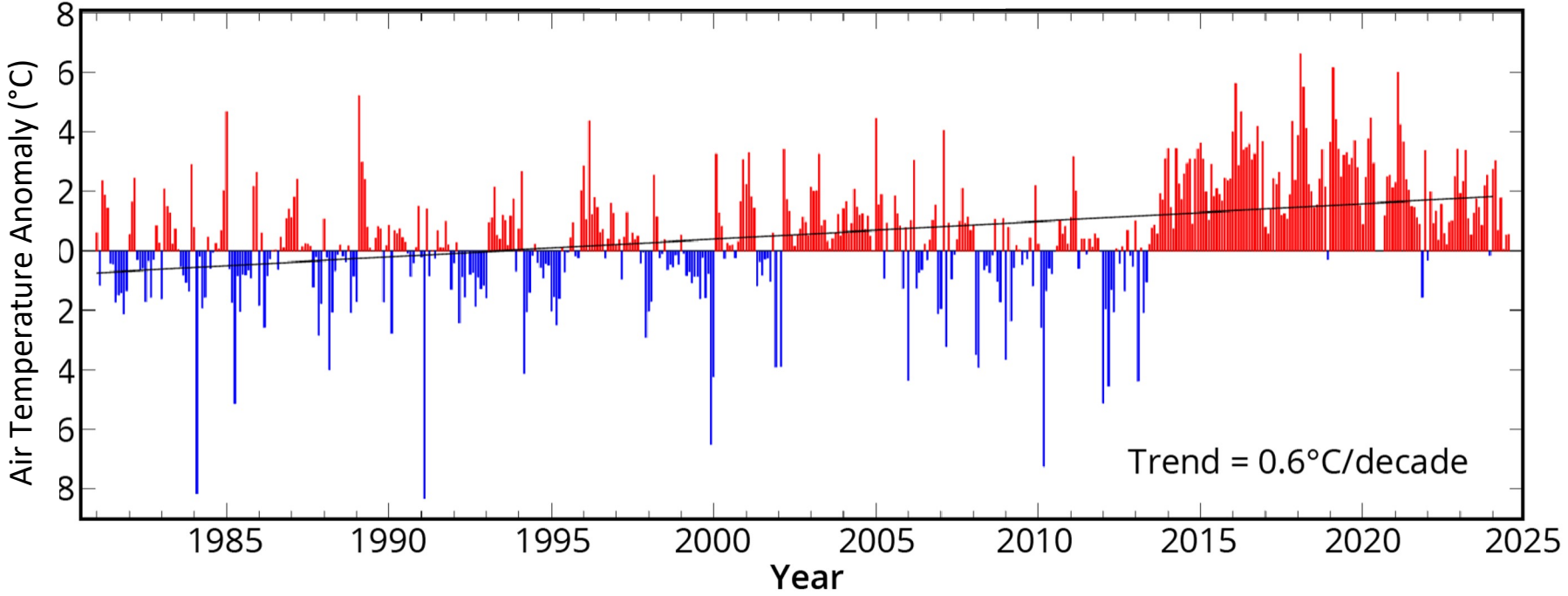
- Single-species quantitative PCR (qPCR)
  - eDNA concentration
- Multi-species metabarcoding
  - Relative abundance
- Advantages
  - Easy/efficient to collect
  - Fill spatial/temporal survey gaps
  - Detects species that avoid nets
- Drawbacks
  - Size/age class
  - Effective area sampled
  - Comparing to survey data sources
- Current collaborations
  - Arctic gadid distributions
  - Paired sampling on trawl surveys
  - Northern fur seal & Steller sea lion diets
  - Ice seal surveys

Baetscher & Ledger, page 29

Ecosystem Assessment



*The Bering Sea has **transitioned** from interannual variability, to multi-year stanzas, to the recent **extended warm** period*



Overland & Wang, page 55

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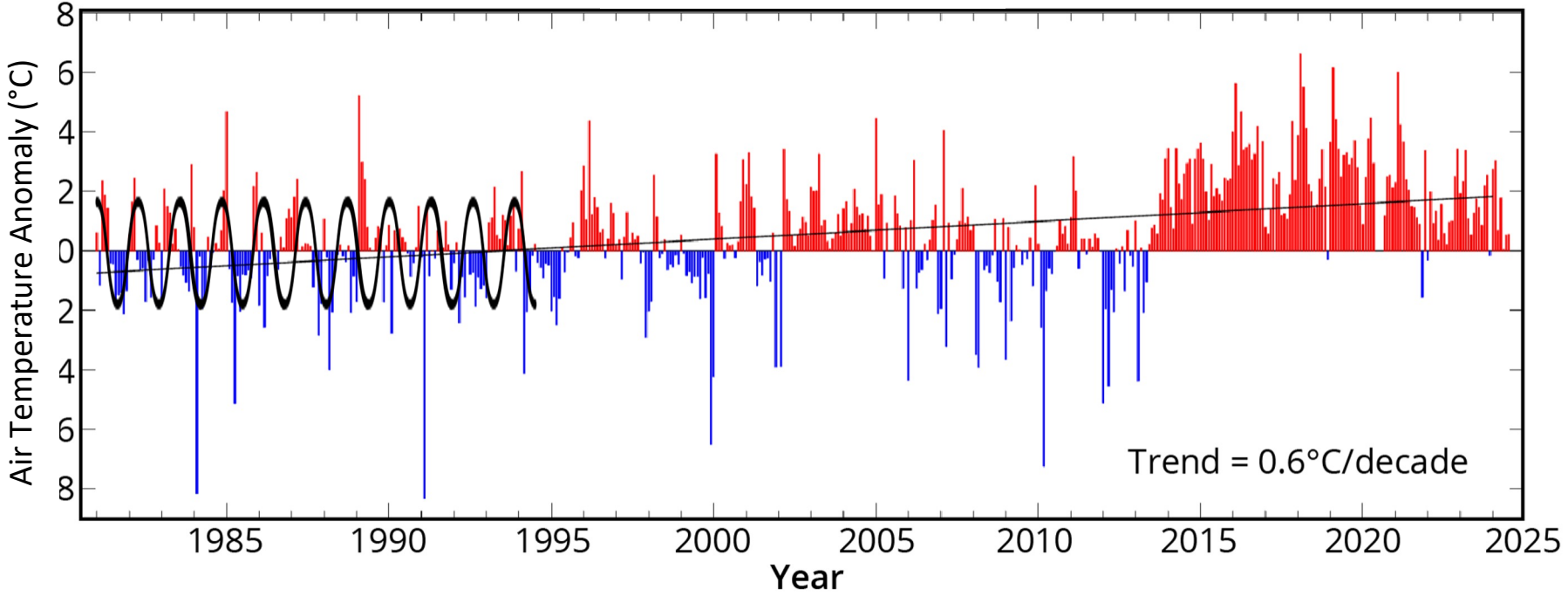

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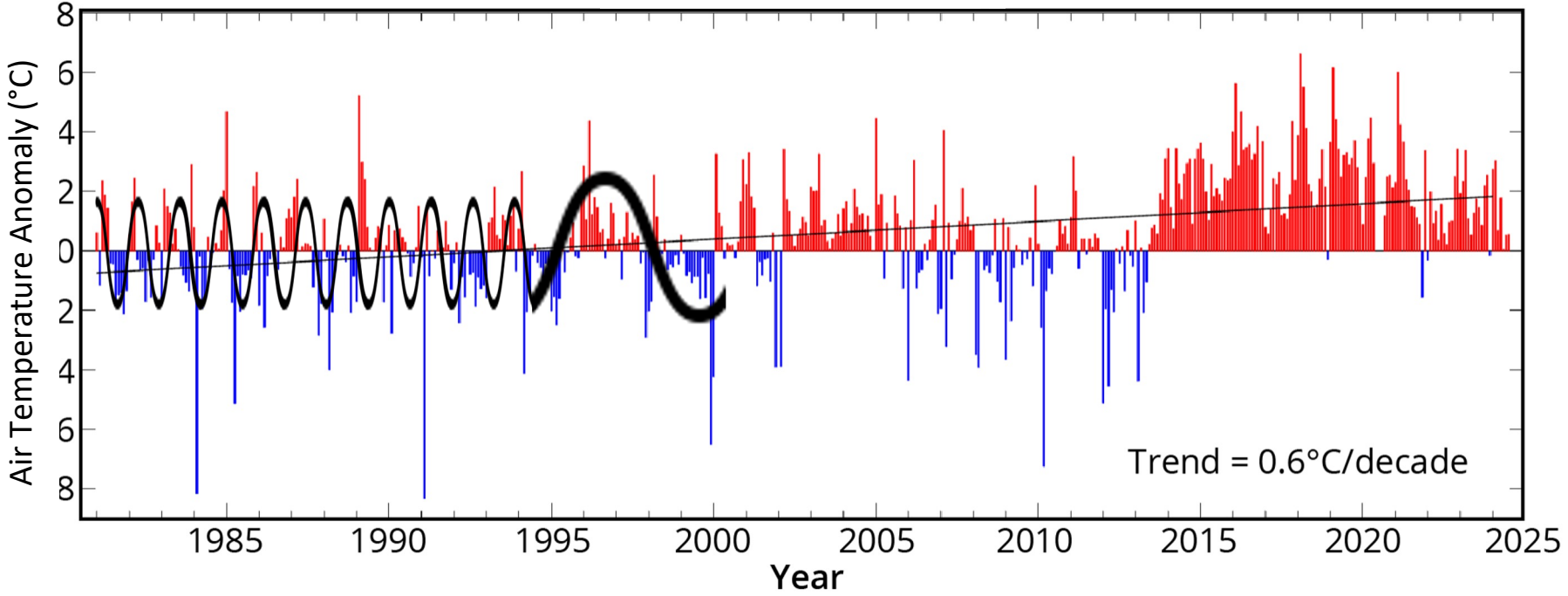

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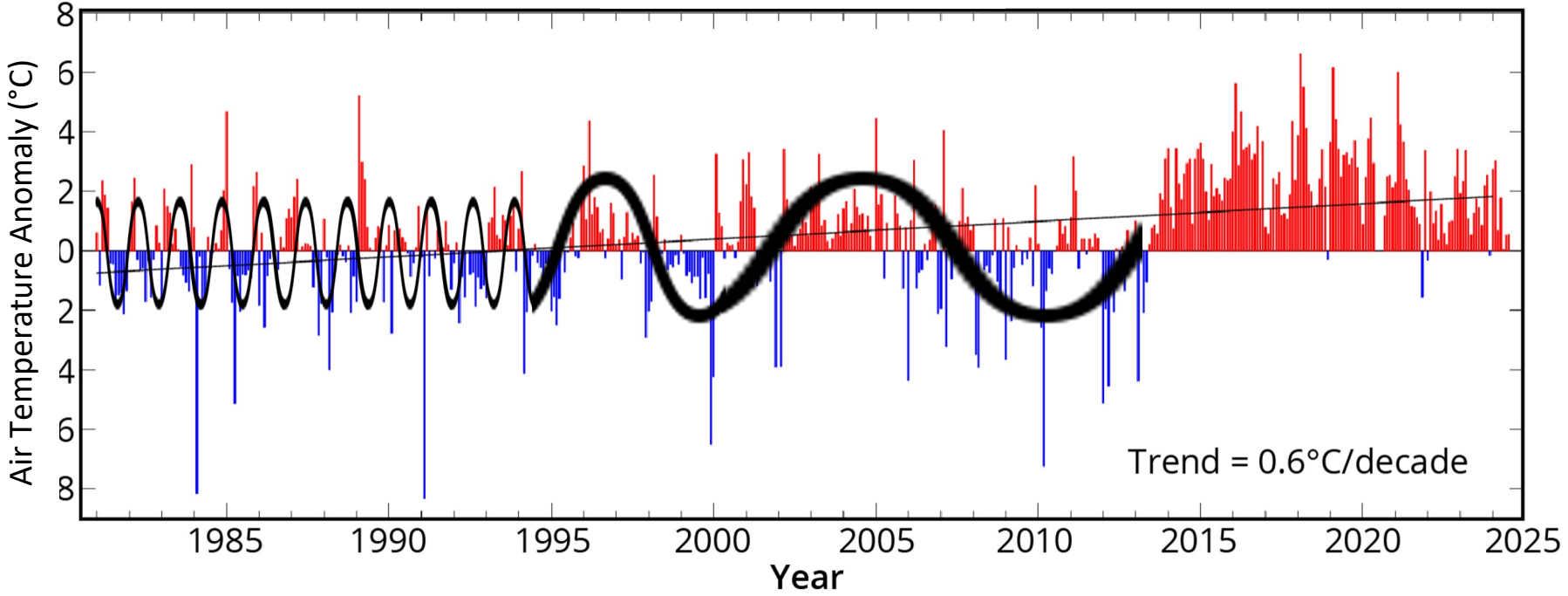

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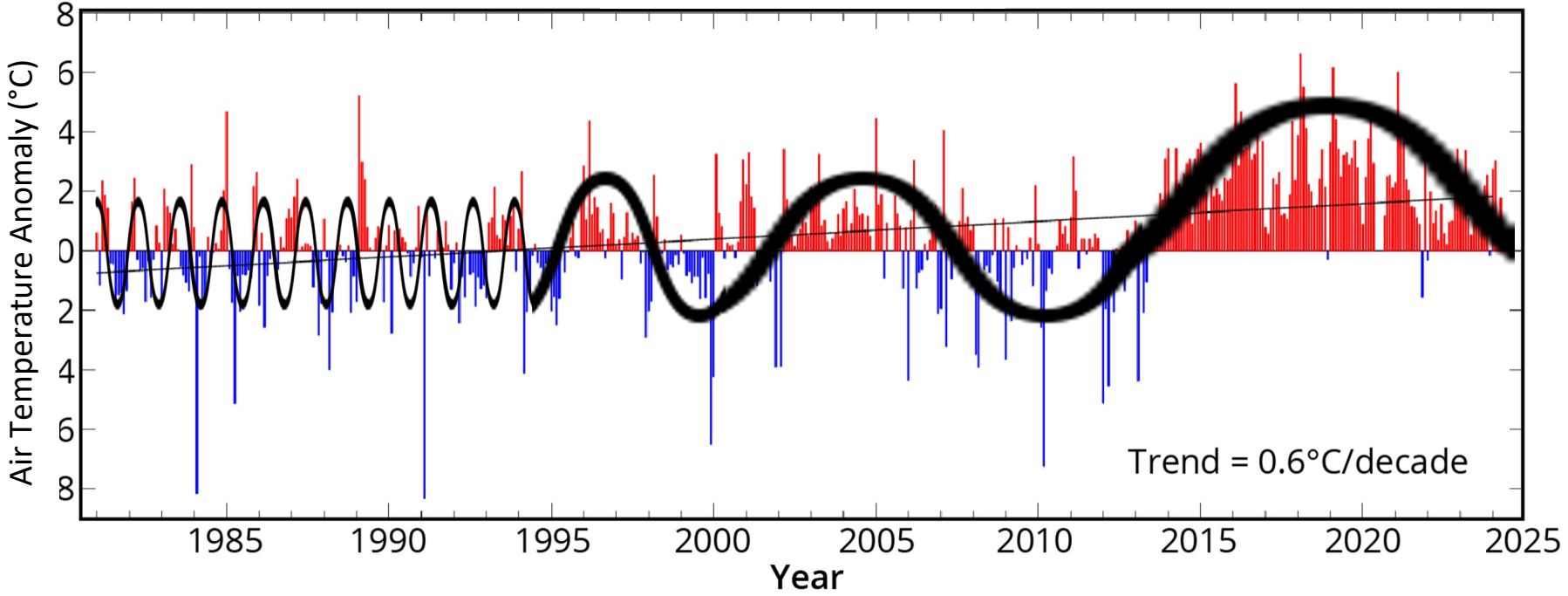
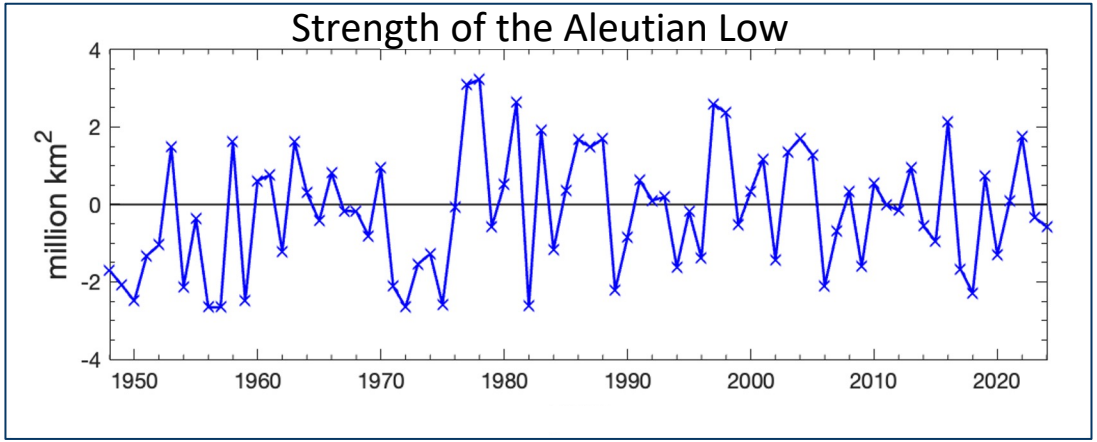
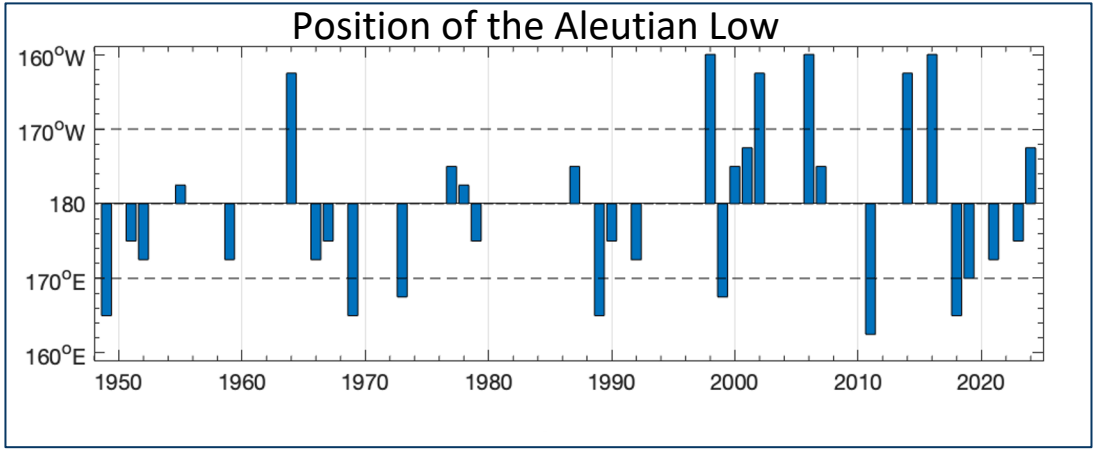


*The Bering Sea **cooled to average** between 2021 - 2024*
Is average the new cool?

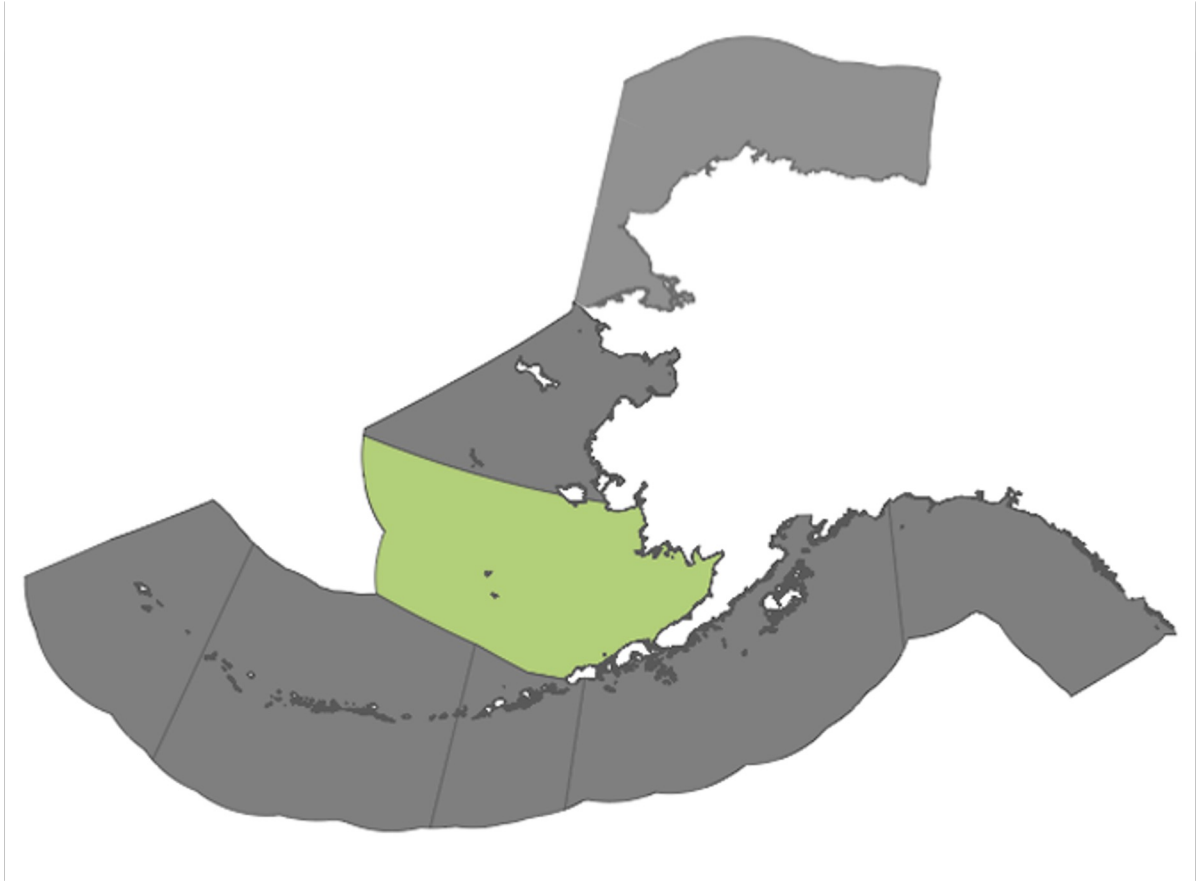




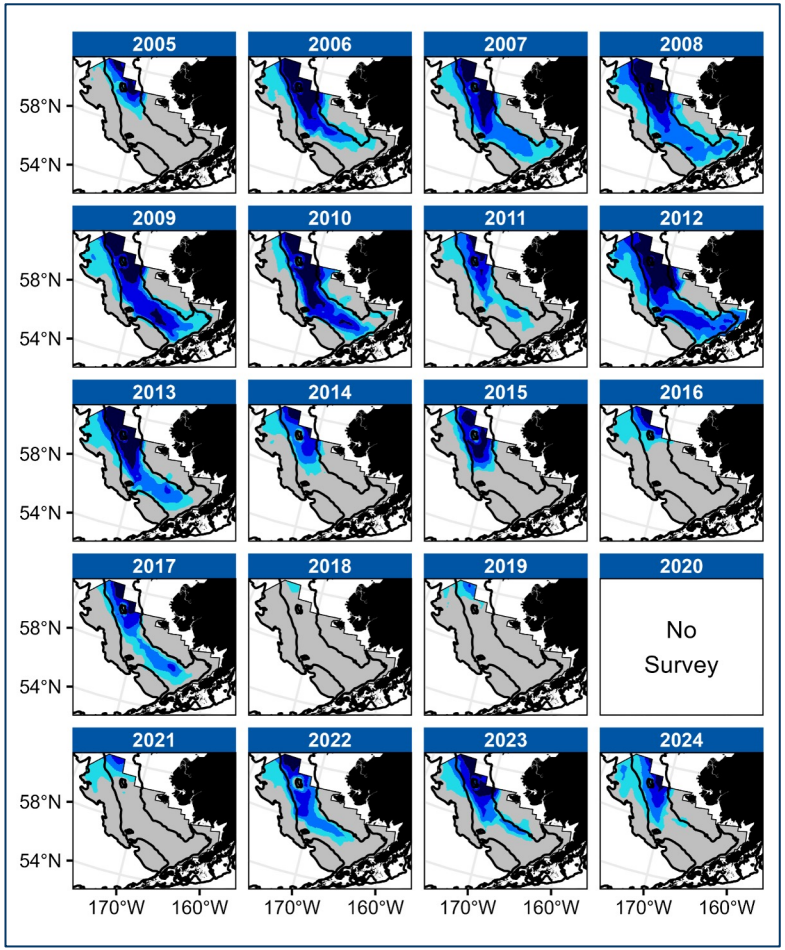
- Aleutian Low (Jan-Feb) is the dominant atmospheric pressure system in the region
  - Strength and location were near average in 2024 (i.e., a 'normal year')

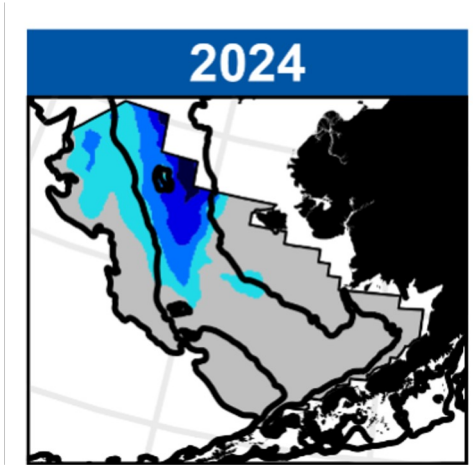
- SSTs cooled to near average
  - Northern & southern shelves (Fig 30)
  - No MHWs (Fig 29)

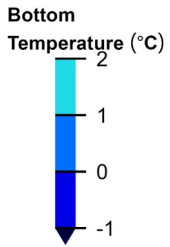
Southeastern Bering Sea

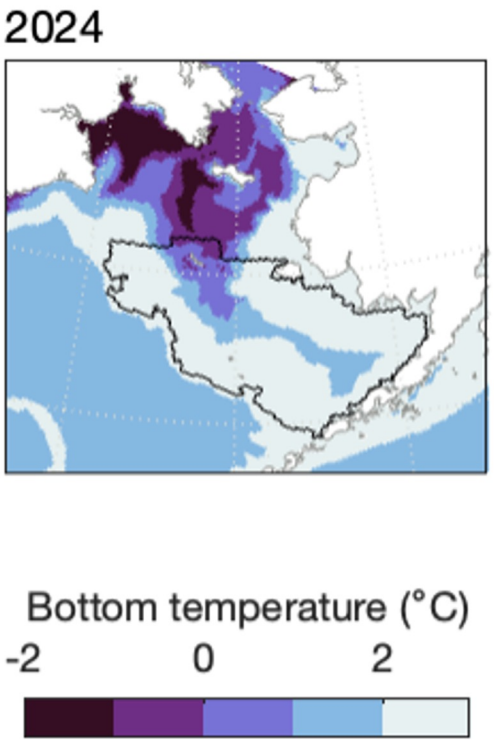


The cold pool (<2°C) was average extent over the SEBS;
the extent of coldest bottom waters (<0°C, <-1°C) was similar to warm years





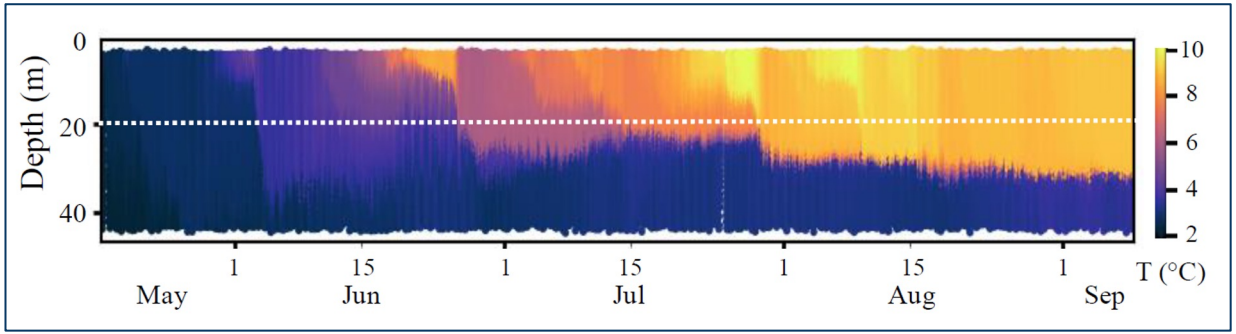


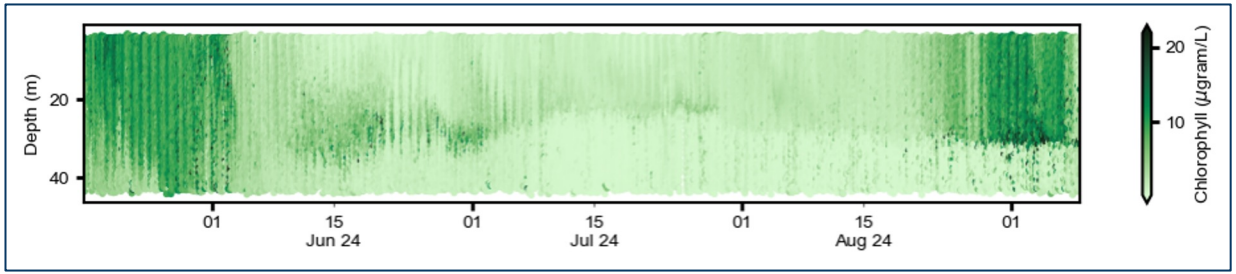


Rohan & Barnett, Kearney, page 74

Kearney et al., in press

Storms → deeper mixed layer → cooler SSTs
Storms → weaker stratification & nutrients → early fall bloom



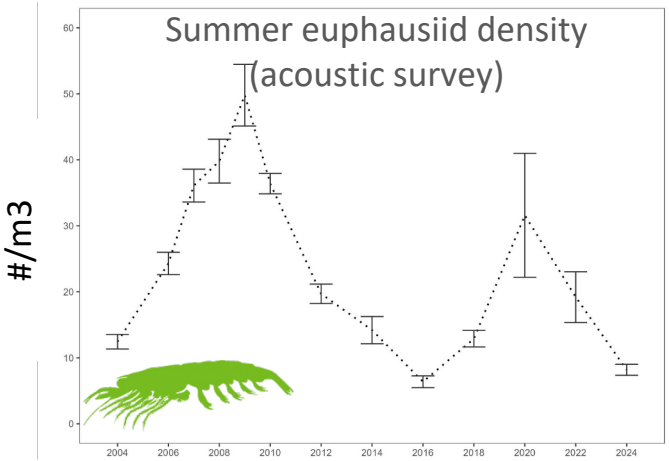


- Persistent storms resulted in a deeper mixed layer
  - Cooler water from depth
  - SSTs remained cooler
- Storms also resulted in weaker stratification
  - Mixing brought nutrients to the surface
  - Early fall bloom
  - Reduced coccolithophore bloom
  - May provide a sustained prey resource for zooplankton through the fall

Stabeno, Stabeno et al., page 62 & 84

Pelagic prey dominated by small copepods;
Large copepods have not increased in abundance as thermal conditions returned to average

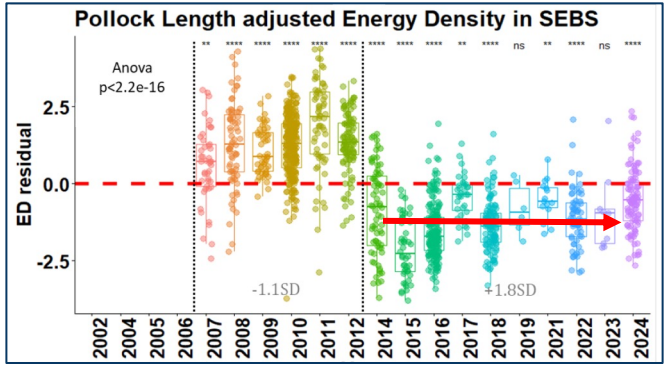
	Spring	Summer	Fall
Small copepods	Moderate	Low	Moderate
Large copepods	Low	Near-zero	Near-zero
Small euphausiids	Near-zero	Moderate	Low



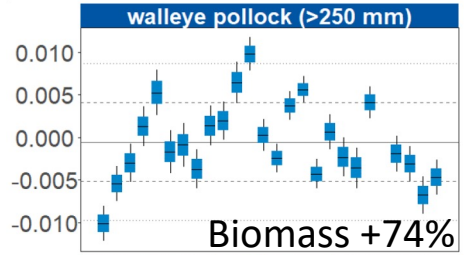
- Pelagic prey was dominated by small copepods
- Euphausiid density during the summer acoustic survey declined to the second-lowest value
- Jellyfish biomass remained low to average
  - no significant change in competitive pressure for planktivorous predators

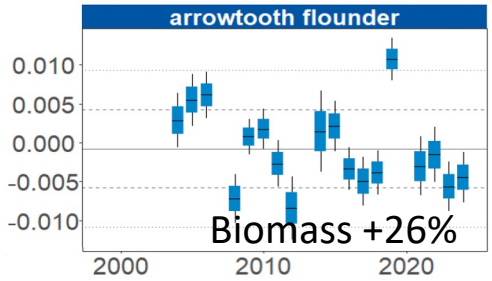
Kimmel et al., page 89, Levine & Ressler, page 101,
Yasumiishi et al., page 104, Buser & Rohan, page 106

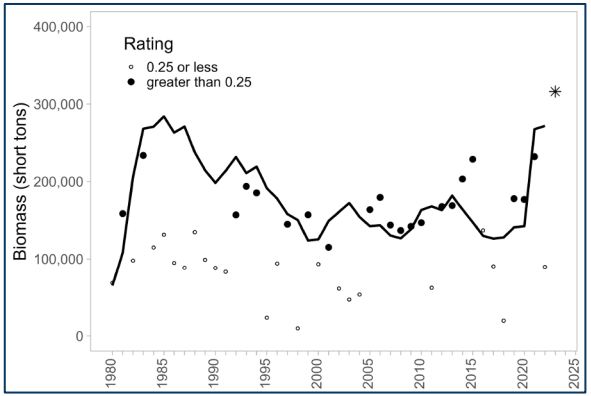
Measures of pelagic productivity were mixed:
Individual fish condition low, population biomass buoyed by previous year classes



- Age-0 pollock energy density low; % lipid average (page 124)
- Juvenile chum & sockeye energy density low (Fig. 144)
- Pelagic forager condition decreased and/or remained below average (Fig. 95), but biomass estimates increased for some
- Seabird reproductive success was mixed; higher on St. George Island than on St. Paul Island (page 191)



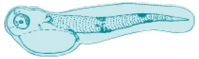




- Togiak herring biomass remains high (strong 2016 & 2017 year classes) (page 133)
- Bristol Bay sockeye abundance down from 2022 peak, but above average since 2015 (Fig. 90)

Page et al, page 124, Fergusson et al., page 143, Prohaska et al., page 155, Lindsey et al., page 191, Dressel et al., page 133, Cunningham et al., page 149

Unexpected patterns for pollock?



- Larval pollock (May; page 108)
  - Highest estimated abundance since 2012 (warm or cold)

Rogers et al., page 108, Andrews et al., page 120, Garcia et al., page 32, Spear & Andrews, page 123, Aydin, page 163

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- Age-0 pollock (late-summer)
  - Low estimated abundance (middle domain; page 120)
  - Most numerous non-salmonid (inner domain; page 32)
  - Shallower distribution (similar to warm years; page 123)

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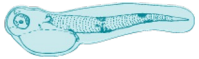

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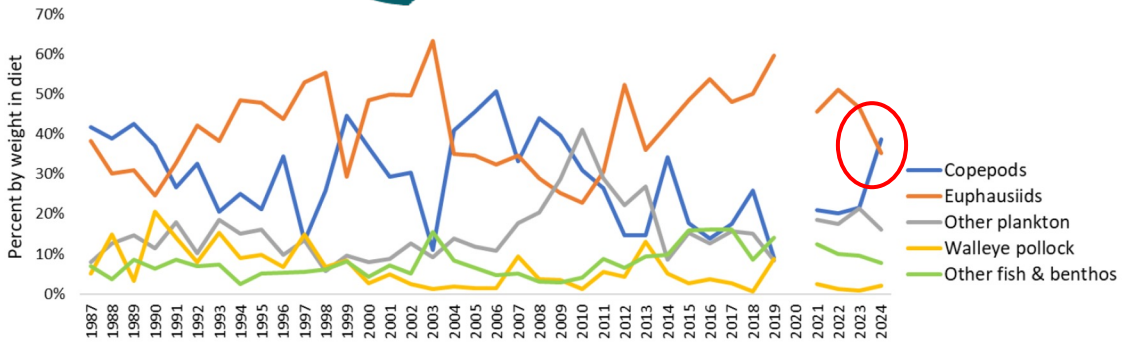

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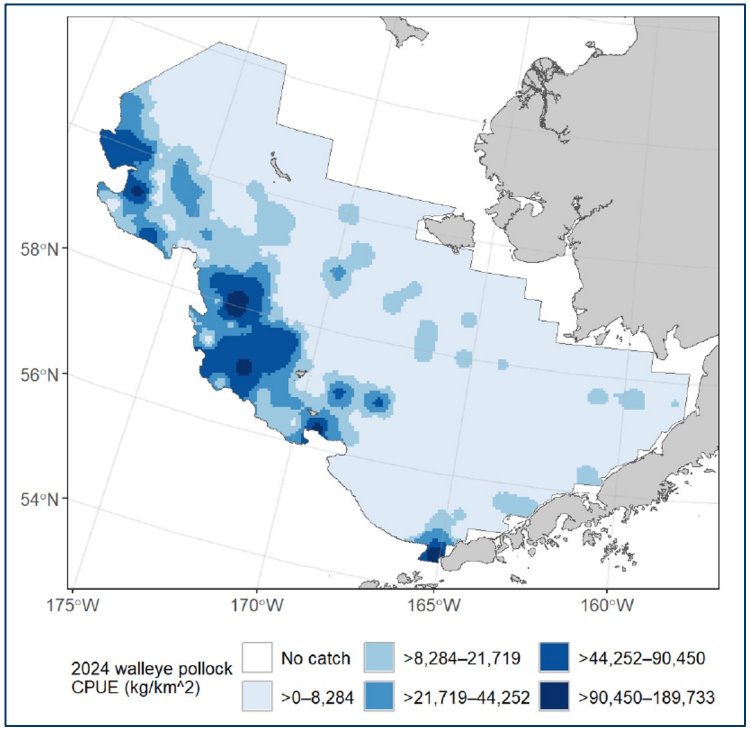

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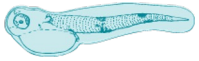

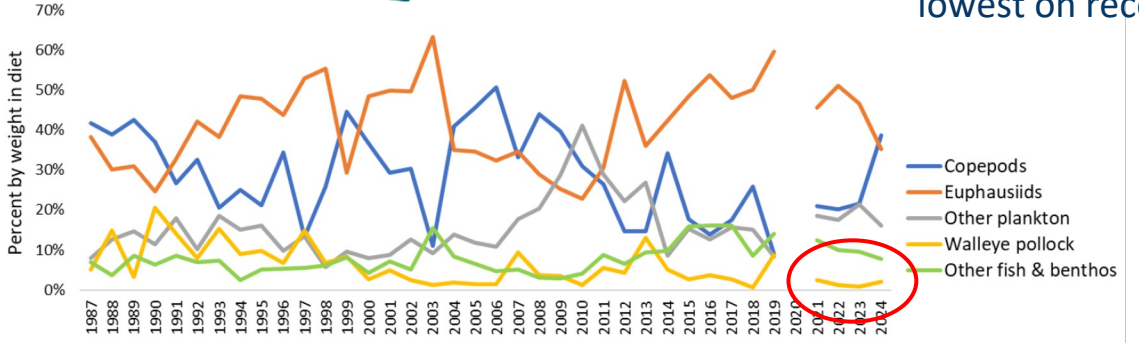

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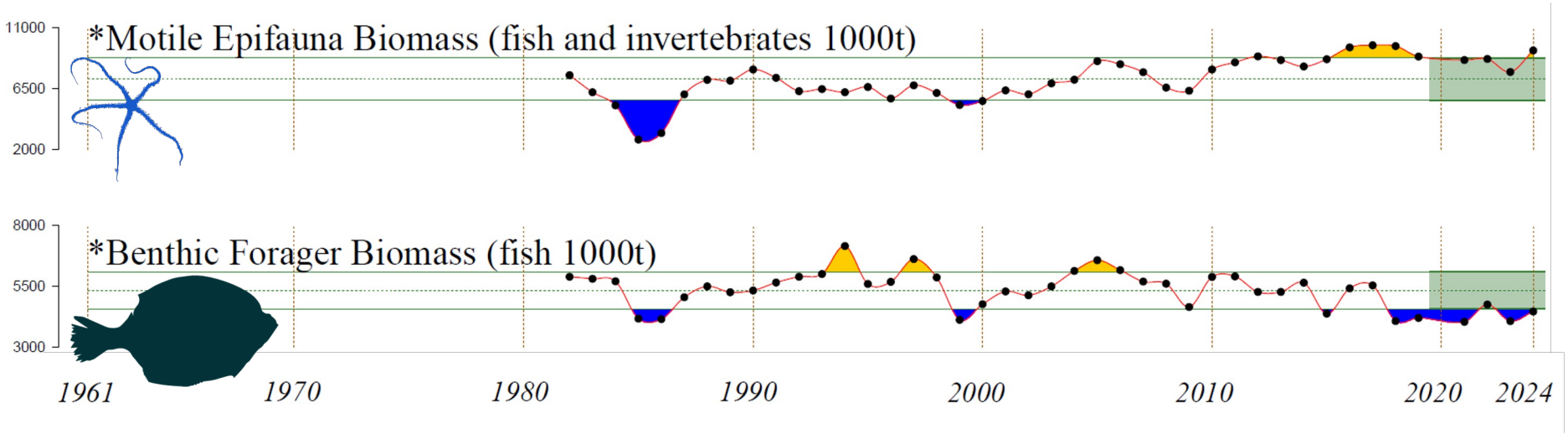
  - Rates of cannibalism low between 2021-2024 (2018 was lowest on record)

Rogers et al., page 108, Andrews et al., page 120, Garcia et al., page 32, Spear & Andrews, page 123, Aydin, page 163

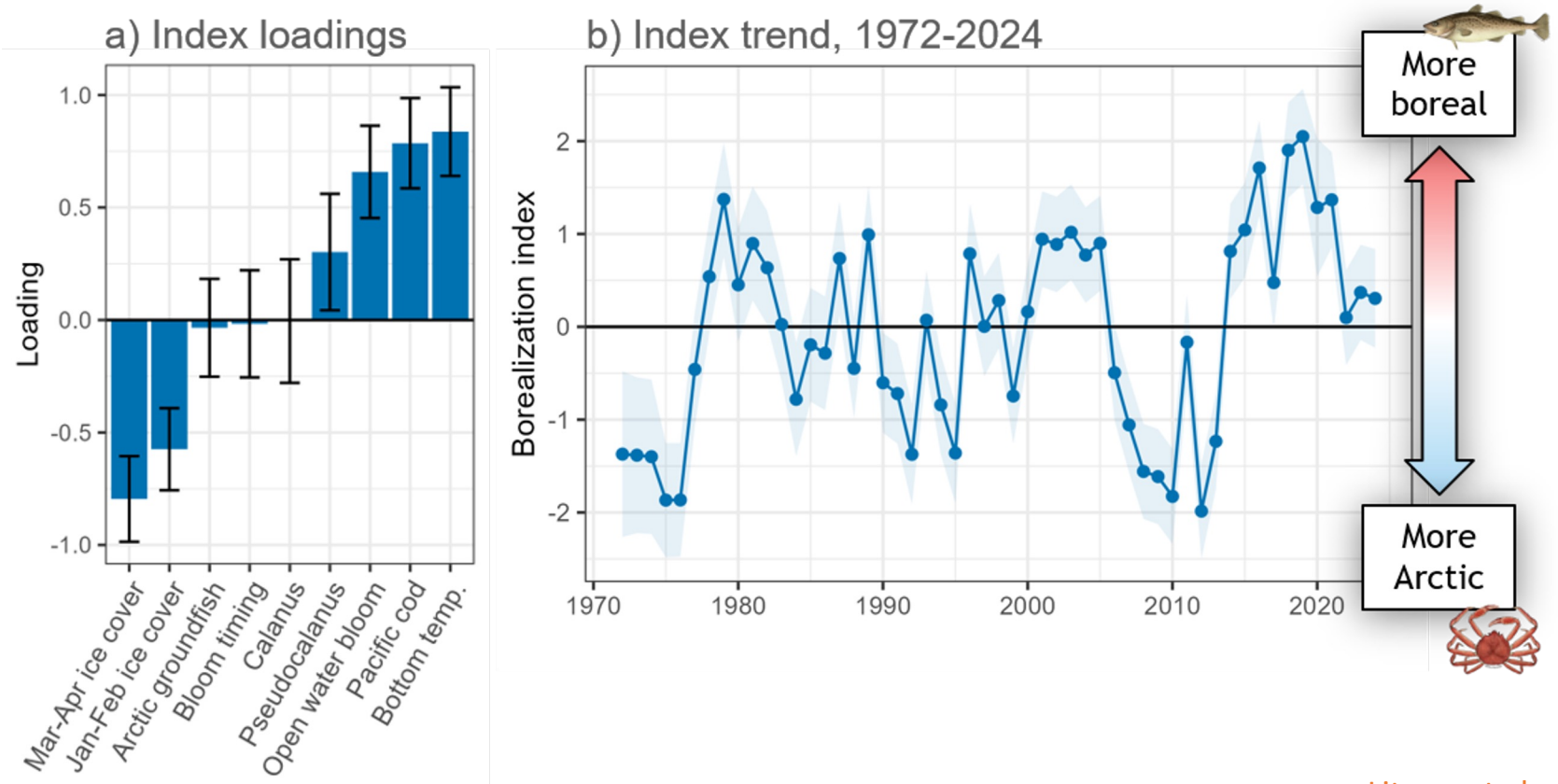
Measures of benthic productivity were mixed over the SEBS



- Motile epifauna remain above the long-term mean
  - Echinoderm biomass above average
  - Crab biomass below average
- Benthic foragers (e.g., small-mouthed flatfishes) remain below the long-term mean
  - Estimates of biomass mixed in 2024 (YFS +8%, NRS +4%, plaice -3%)
  - Condition (L/W residuals) of small-mouthed flatfishes has been mixed since 2021

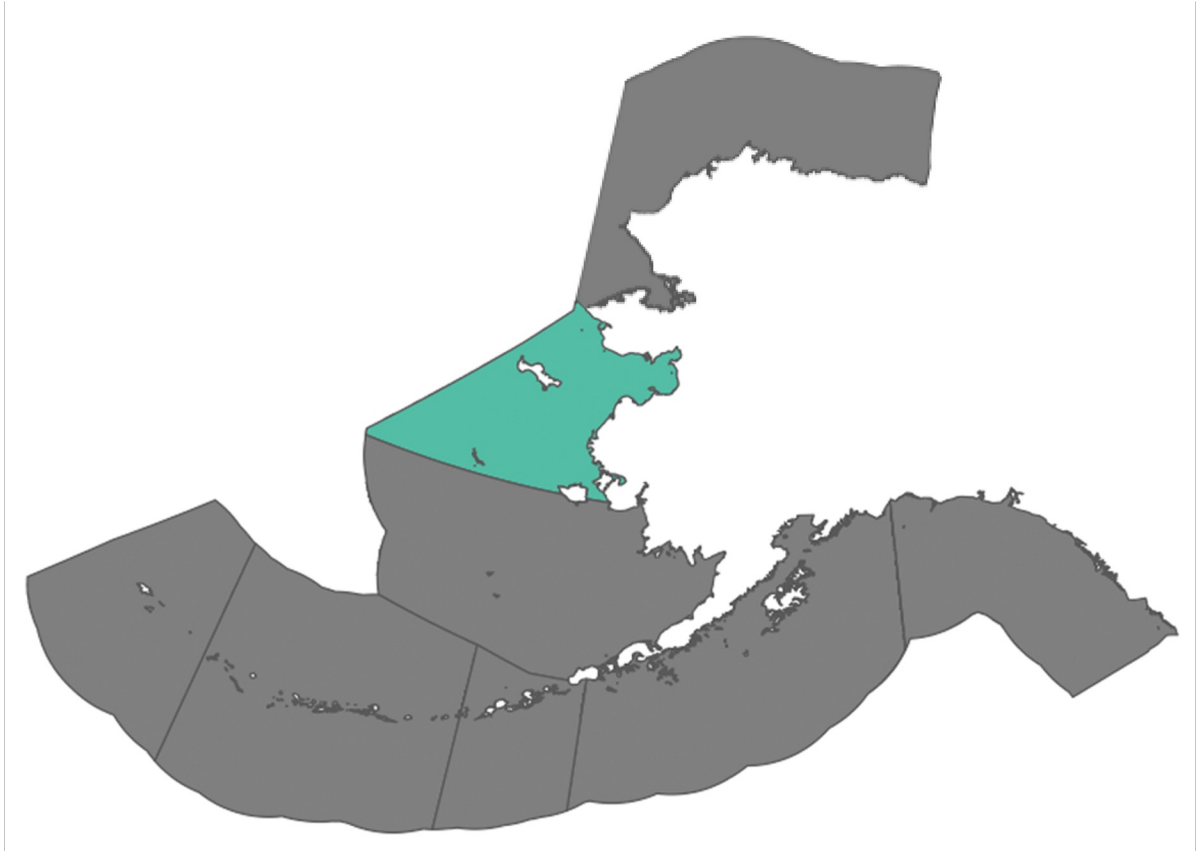
Whitehouse Fig 2, GAP/SAP BTS, Prohaska Fig 95

The borealization index for the SEBS has reverted to the mean during 2022–2024

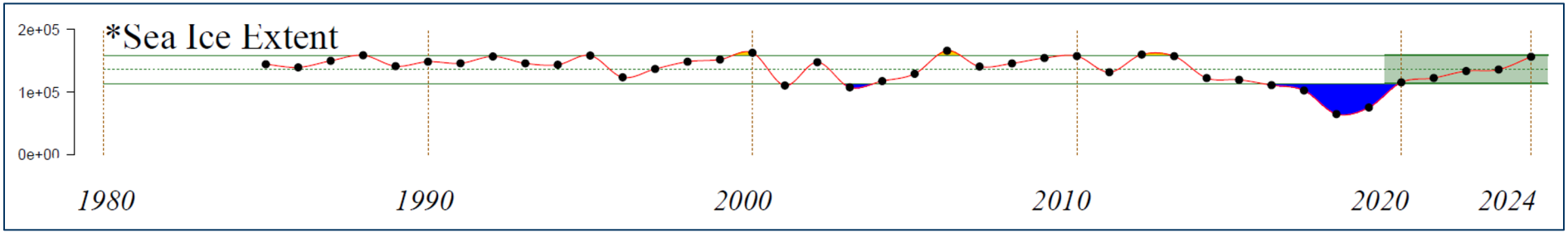


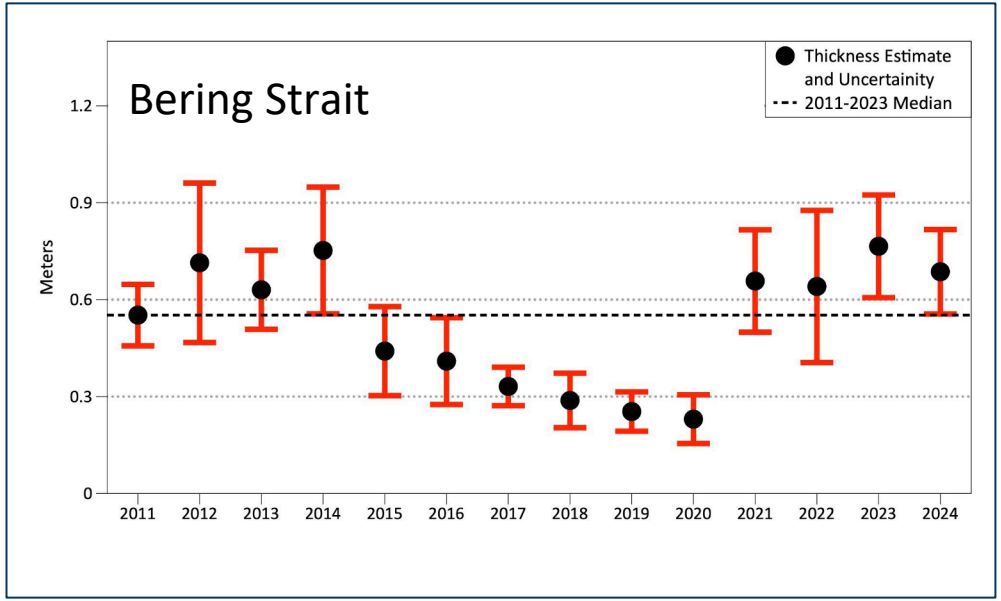
Litzow et al., page 35

Northern Bering Sea



Steady increase in sea-ice extent since 2018; step-change increase in sea-ice thickness since 2021

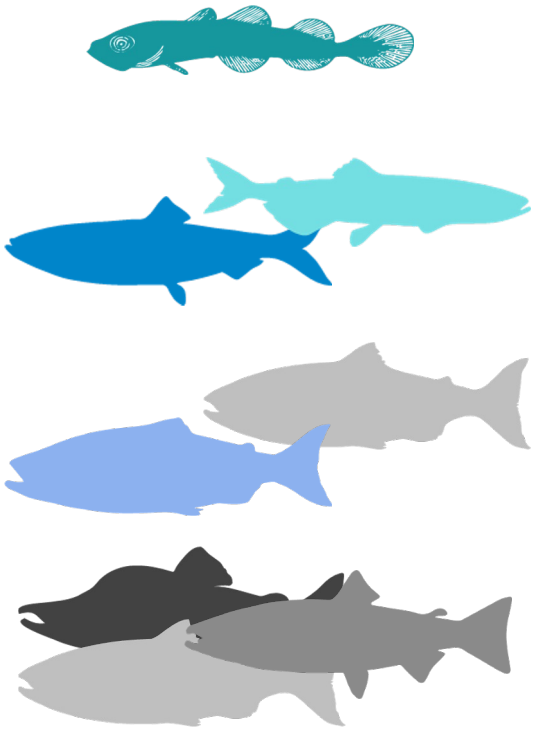




- Steady increase in ice extent since 2018
- Increase in ice thickness since 2021
- Ice thickness → residency → ice algae → productivity of NBS ecosystem
- Large copepod abundance has increased to the mean since 2021 (Fig 3)
- Jellyfish biomass increased in 2023 and remained hgh in 2024 (Fig 62)
- *Pelagic forage has increased in the NBS since 2021*

Bak-Hospital, Fig 3, Thoman, page 70

Pelagic productivity has been mixed since 2021; a potential lagged response to average thermal conditions

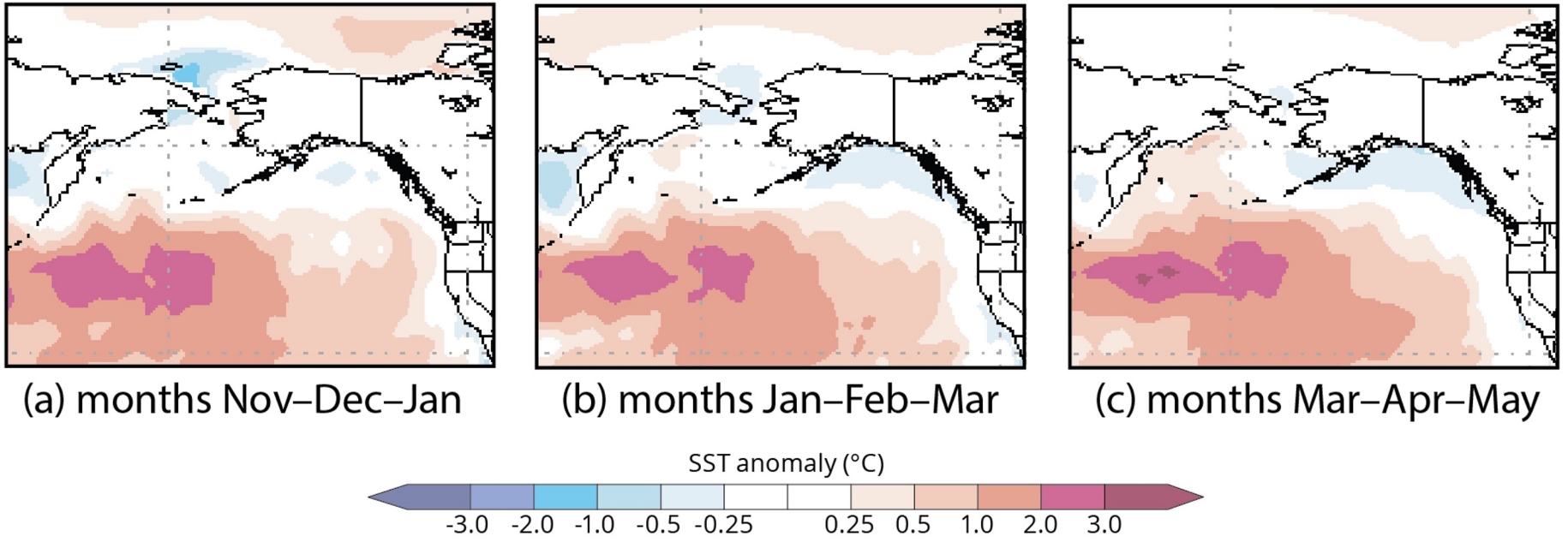


NBS surface trawl survey

- Age-0 pollock
  - Low abundance, low weight, low energy density, average % lipid
- Herring abundance low
- Capelin abundance high
- Chinook salmon abundance at record low
- Fall juvenile chum abundance at record high
- Juvenile pink, chum, and coho salmon condition decreased from positive to average

Andrews et al., page 120, Page et al., page 124, Andrews et al., page 130, Murphy et al., page 146, Fergusson et al., page 143

Winter 2024/2025



- Expected transition to La Niña → continued cooler conditions (within 0.25°C of normal)
- Cooler conditions in early ice season (Oct - Dec) may contribute to earlier formation of sea ice
- Fall storms may now entrain relatively warmer water into surface layer and delay ice formation

Lemagie, Figure 16

2024 Summary and *implications*

The Bering Sea has transitioned from interannual variability, to multi-year stanzas, to the recent extended warm period

Is average the new cold?

Southeastern Bering Sea

- Pelagic productivity was moderate to low

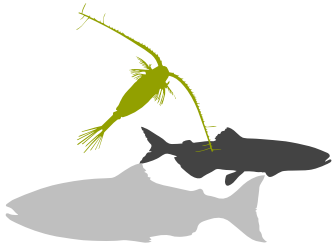
Reduced fish size and lower body condition

- Increased pelagic predators

Potential competitive pressure (i.e., Togiak herring, Bristol Bay sockeye salmon, pollock, arrowtooth flounder)

- Benthic productivity was mixed

Echinoderms continue to do well; multiple crab stocks still low; small-mouthed flatfishes had mixed responses



Northern Bering Sea

- Biological response has differed from the southeastern shelf ecosystem

Faster ecological response (recovery/resilience) to cooler conditions?

- Pelagic productivity increased to the north

Improved forage conditions relative to the southeastern shelf

- Pelagic predators were mixed

Herring low, capelin high; Chinook salmon low, fall chum salmon high