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2024 Ecosystem Surveys Bering Sea & Gulf of Alaska

Cross division/agency collaboration focused on ecosystem research to support ecosystem based fisheries management

- Ecosystem Monitoring and Assessment, Juneau/Seattle
- Recruitment Processes Program/EcoFOCI, Seattle
- Fisheries Behavioral Ecology, Newport
- Recruitment, Energetics & Coastal Assessment, Juneau
- Shellfish Assessment Program, Kodiak

Presenters: Ellen Yasumiishi, Lauren Rogers, Rob Suryan

September 17, 2024



Goal & Objectives

Goal

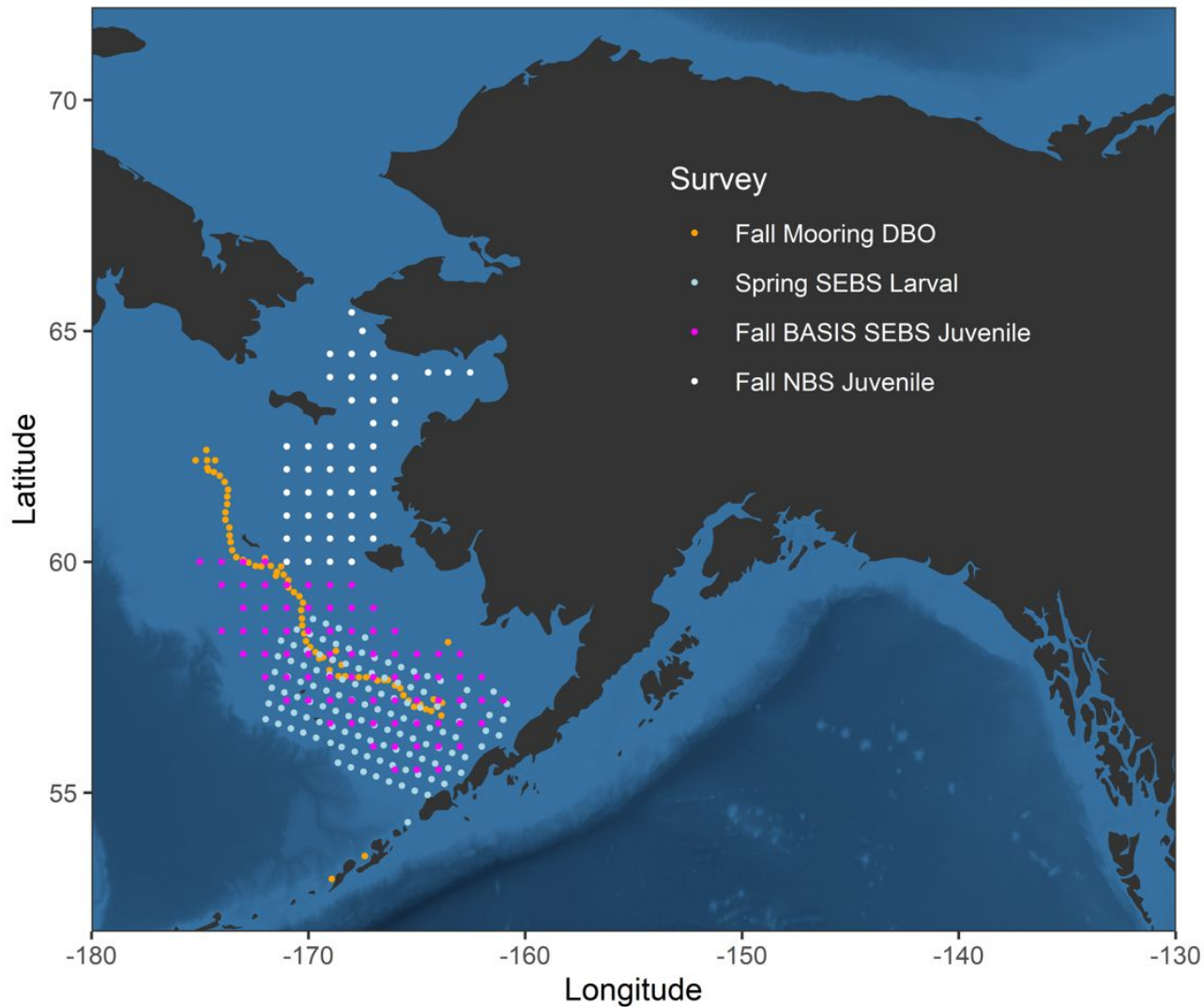
To provide the most recent information on ecosystem conditions affecting fish recruitment processes.

Objectives

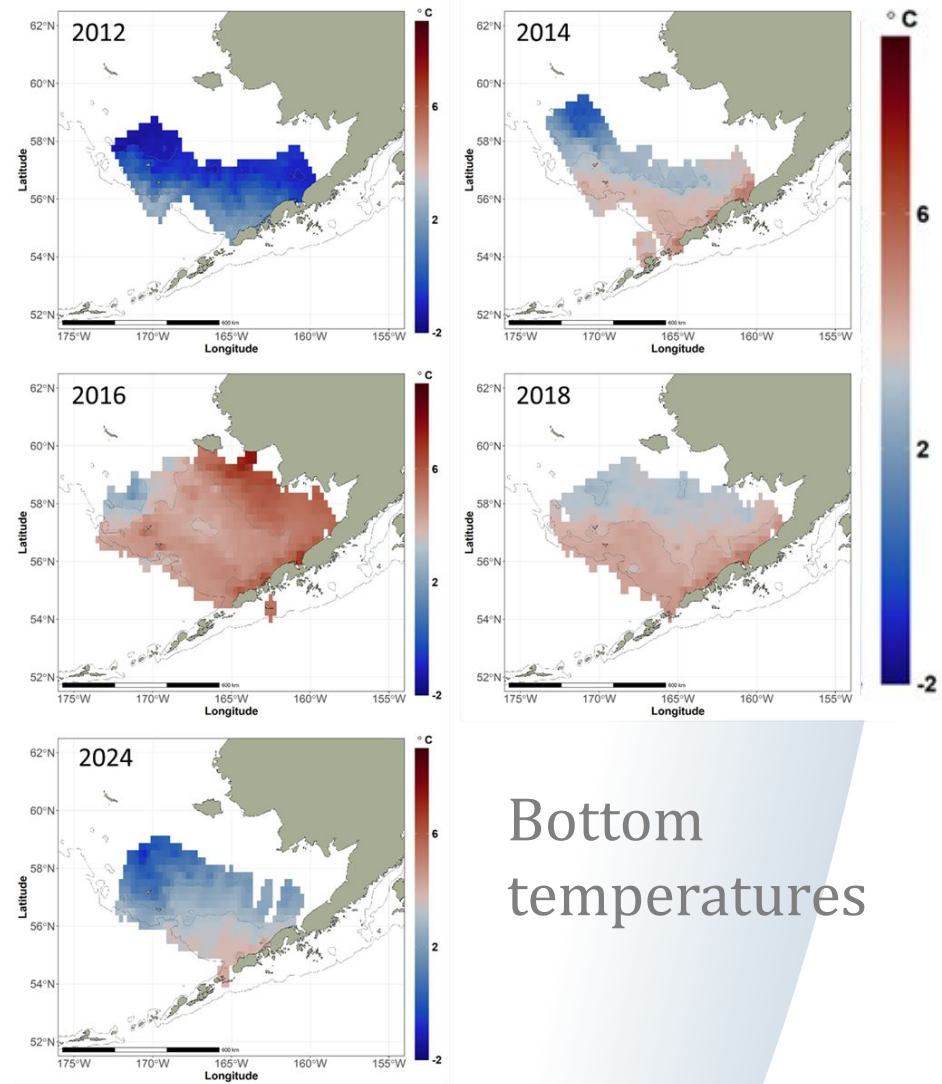
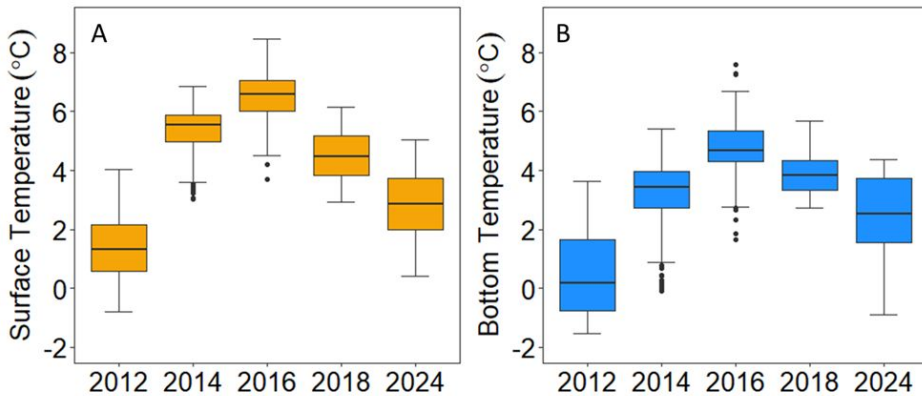
1. Provide an update on 2024 ecosystem survey observations of temperature, zooplankton, and fish.
2. Provide an update on recruitment indicators & new research.
3. Encourage discussions of data/indicators most useful to the Groundfish Plan Teams.



Bering Sea surveys



Spring - Temperatures



Bottom temperatures

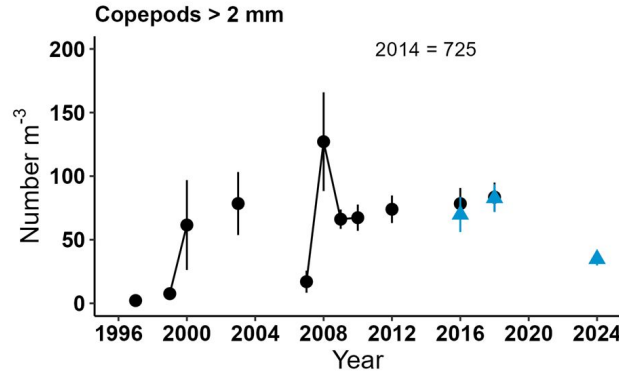
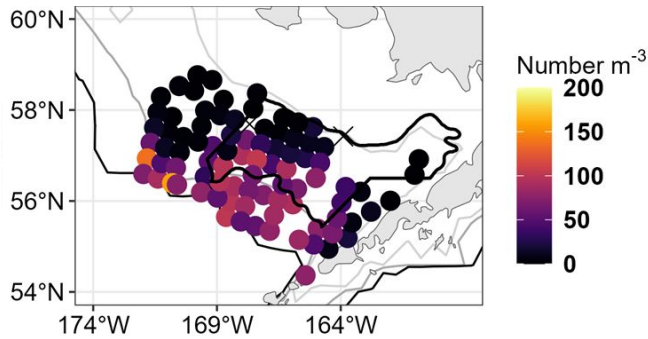
Take home: Spring (May) temperatures were relatively cool, with evidence of a cold pool. Not quite as cool as 2012.

Contact : Kelia Axler

Spring - Rapid Zooplankton Assessment

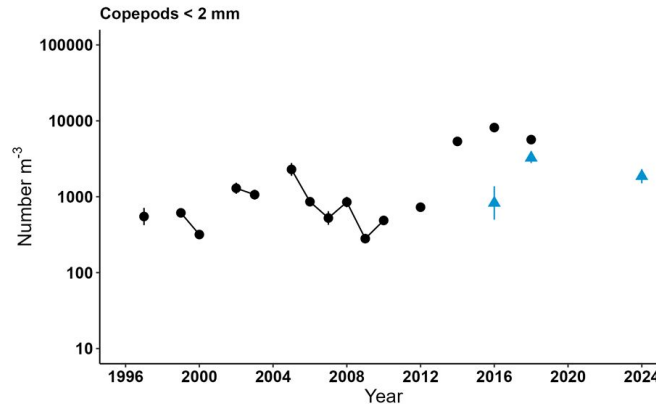
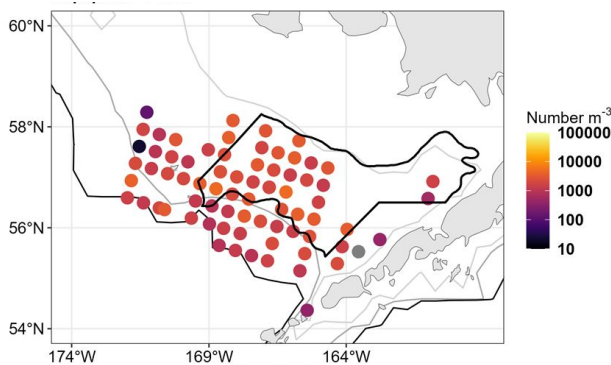
Large copepods (> 2 mm)

▲ RZA (at sea)
● Lab-processed



Relatively few large copepods on the shelf. Lots of outer shelf *Neocalanus*, but too big for larval pollock to eat.

Small copepods (< 2 mm)

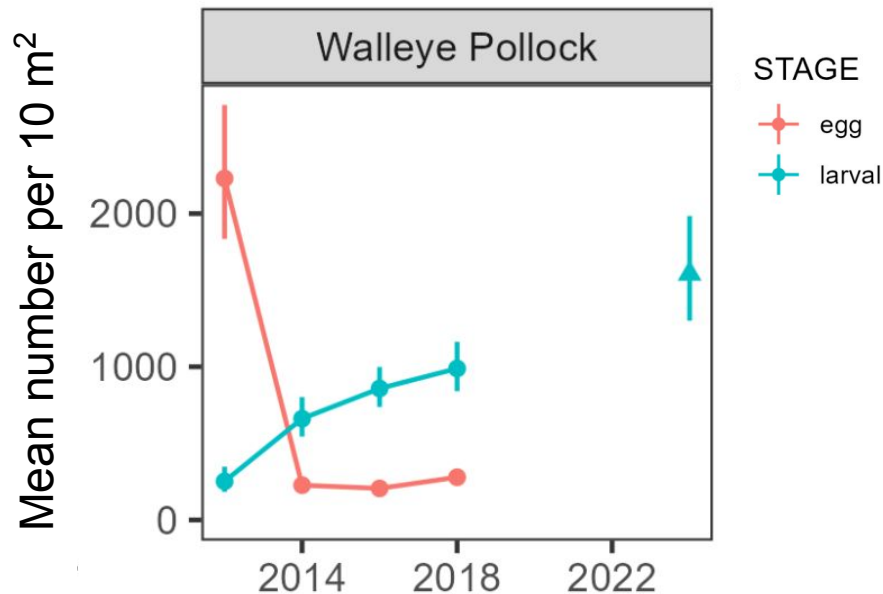


Average densities of small copepods: higher than cold years but lower than recent warm years. Adequate forage for larval fish.

Take home: Low large copepod densities and mostly on outer shelf. Small copepod densities were lower than in recent years, but still abundant suggesting adequate forage for larval fish.

Contact : Dave Kimmel

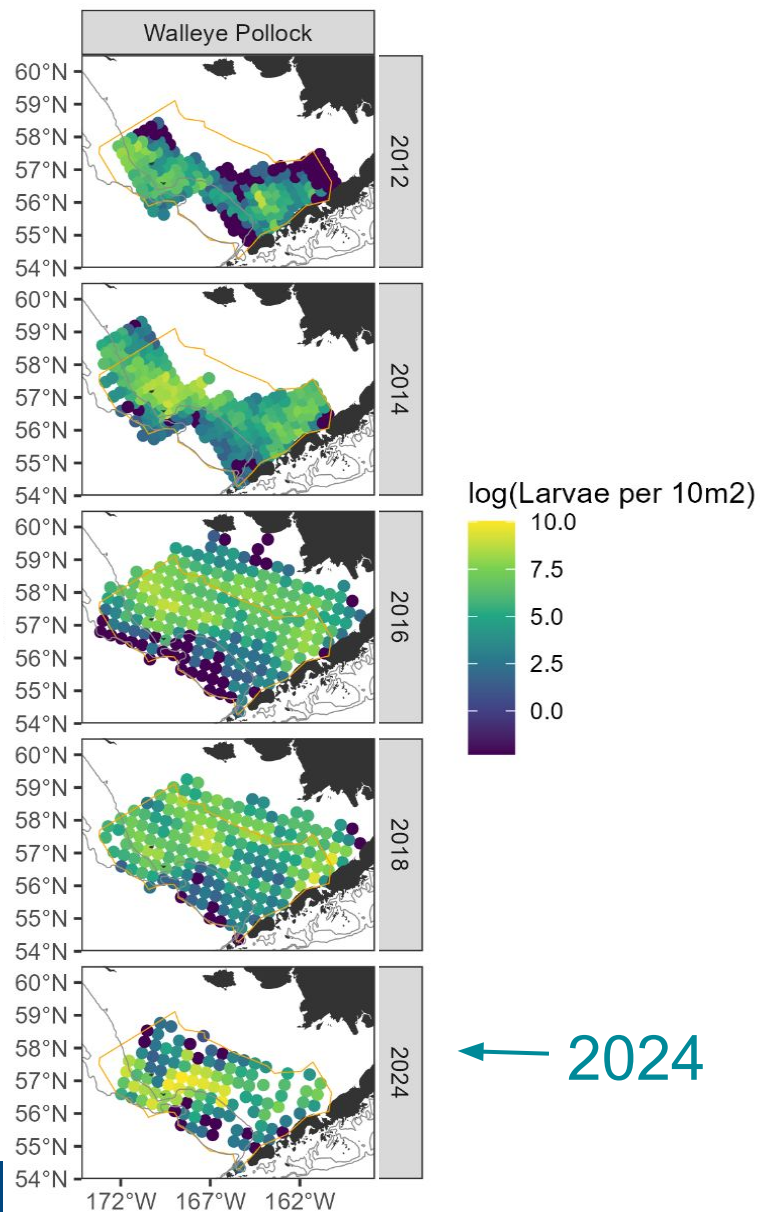
Spring - Larval pollock densities



2024 data from Rapid Larval Assessment at sea, subject to revision

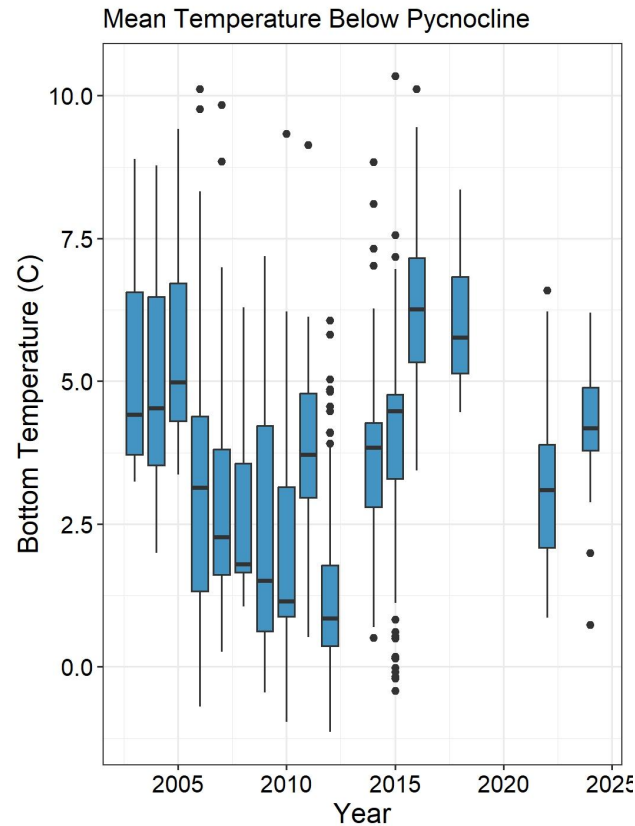
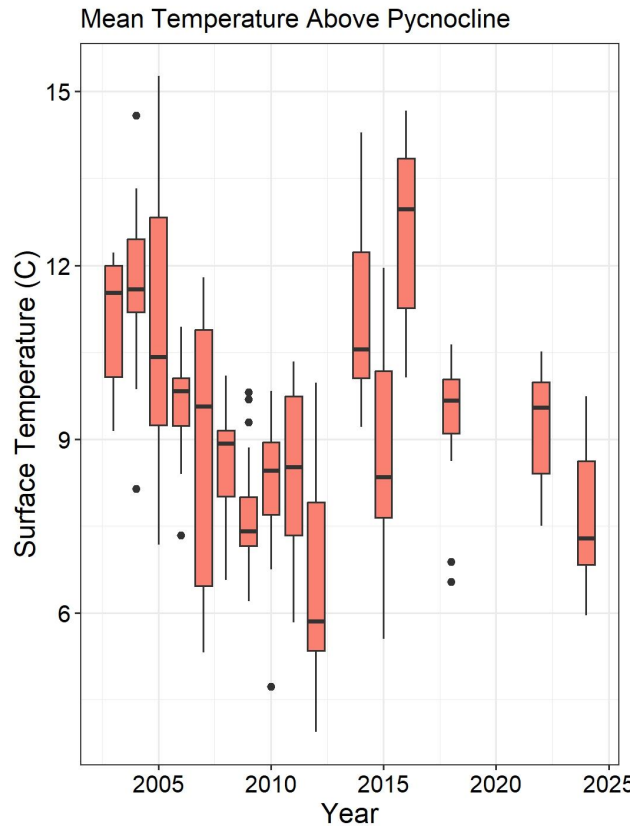
Take home: Very high larval pollock abundance, particularly near the Pribilofs. Anecdotally, eggs were also abundant in 2024, suggesting hatching was still ongoing.

Contact : Lauren Rogers



← 2024

Fall - Temperatures SEBS Middle Domain

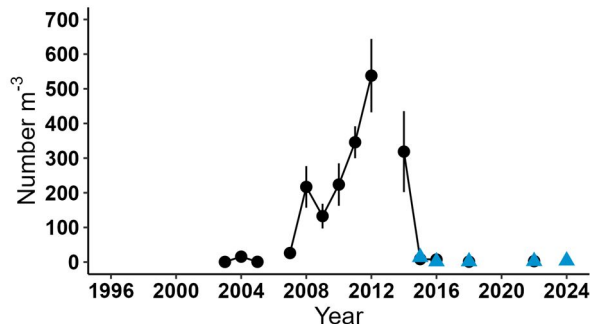
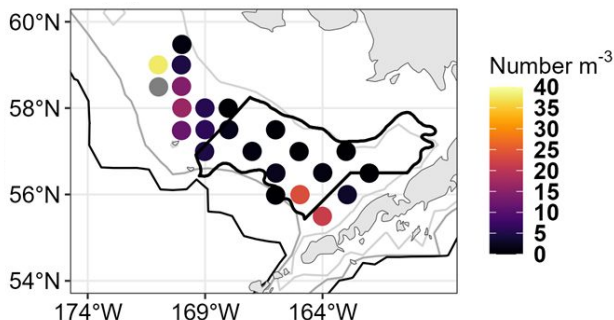


Take home: 2024 fall temperatures in the southeastern Bering Sea middle domain were cool in the surface and average at the bottom. Cold pool extended into SEBS.

Contact : Gann, Andrews, Porter, Fennie

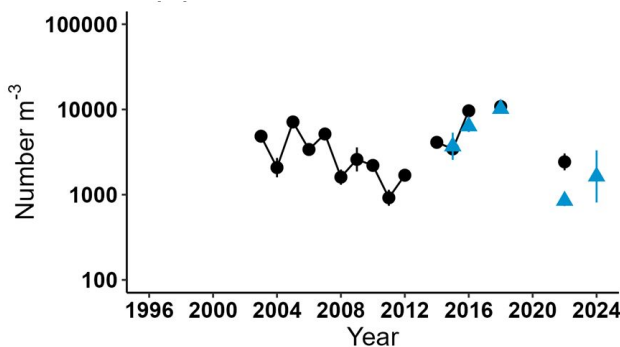
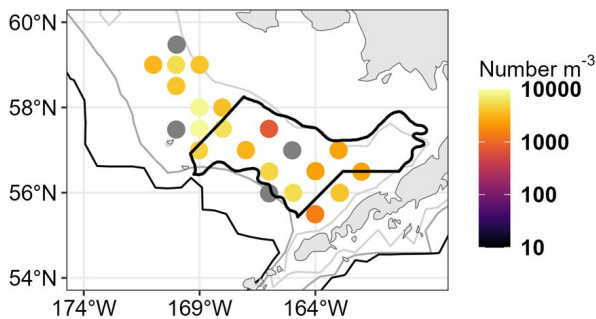
Fall - Rapid Zooplankton Assessment SEBS

Large copepods (> 2 mm)



Large copepod densities were very low in the SE Bering shelf. Densities increased moderately to the north where bottom temps were cooler. Observed many euphausiids.

Small copepods (< 2 mm)



Small copepods were moderate in abundance and similar to colder years. Reduced in comparison to more recent warm years.

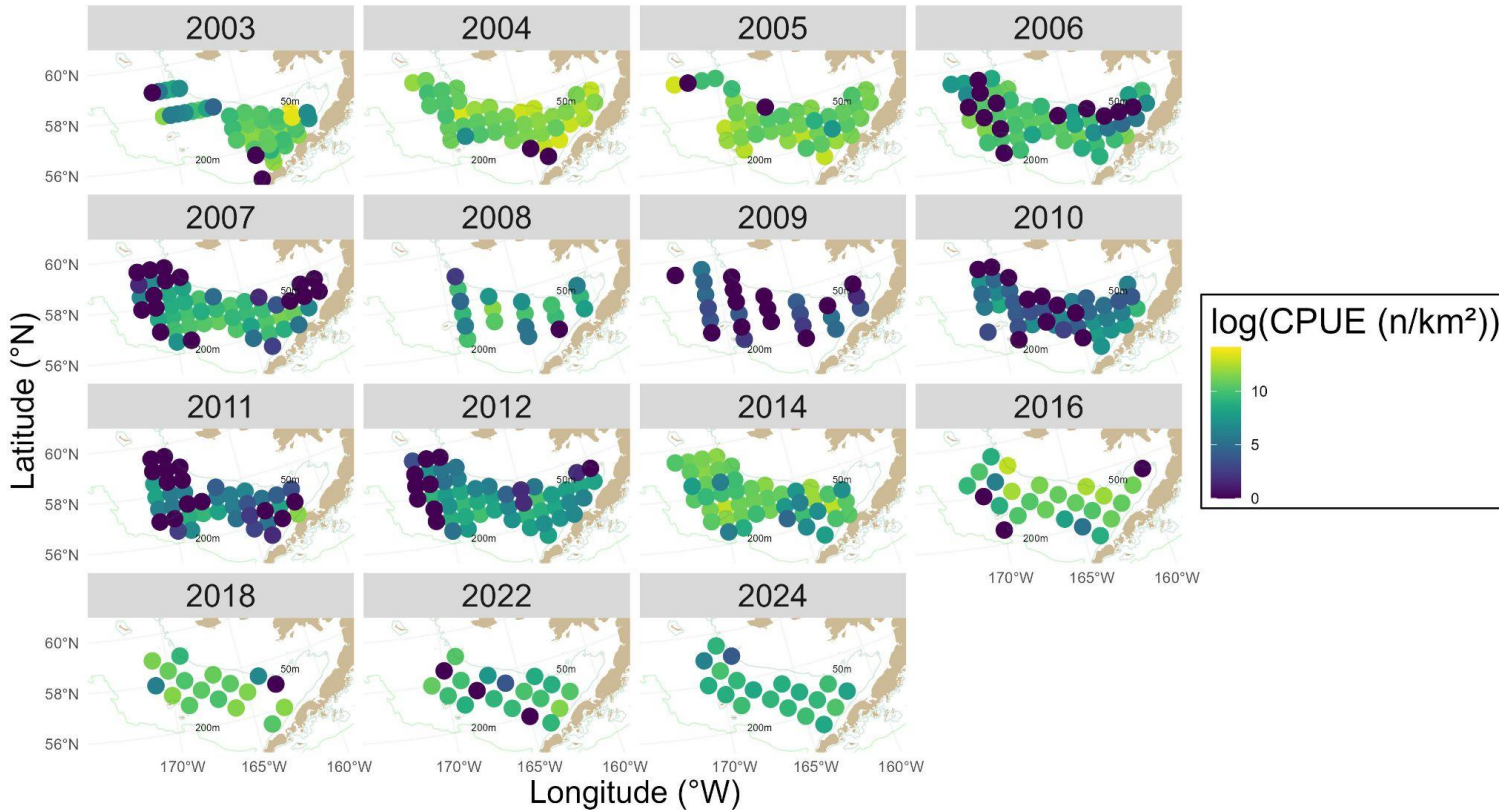
Take home: Few lipid-rich large copepods (*Calanus*) means less high-quality food for age-0 pollock on the SE Shelf. Reduced small copepods suggests lower productivity on the shelf.

Huge fall phytoplankton bloom observed now.

Contact : [Dave Kimmel](#)

Fall - Age-0 Pollock SEBS Middle Domain

Surface Tow A0 Pollock



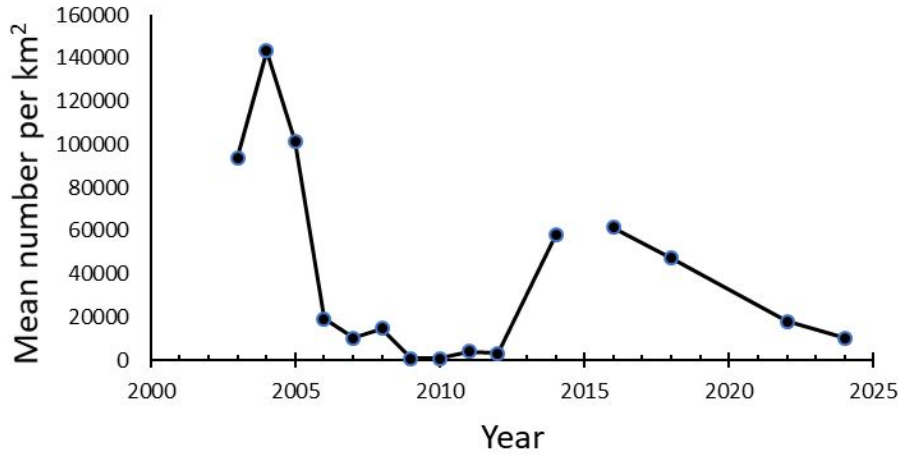
Credit : W. Fennie

Take home: In 2024, overall catches were average. In northern region of SEBS, age-0 pollock lengths were predominantly small indicating late larval hatch and slow growth.

Contact : Alex Andrews, Andrew Dimond

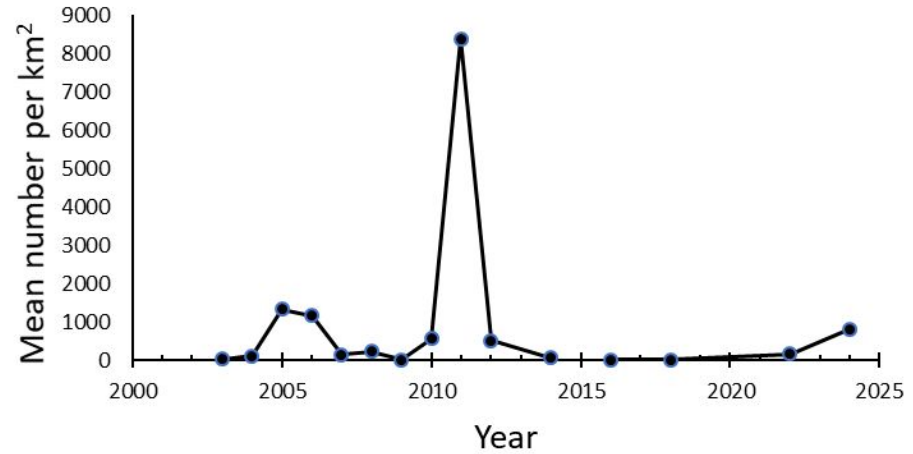
Fall Juvenile Gadids - SEBS Middle Domain Surface Tow

A0 Pollock - Surface Tow



Take home: Similarly to other cool years, 2024 mean values were lower than warm years.

A0 P. Cod - Surface Tow



Take home: 2024 frequency of occurrence and catch rates were highest observed in the last decade.

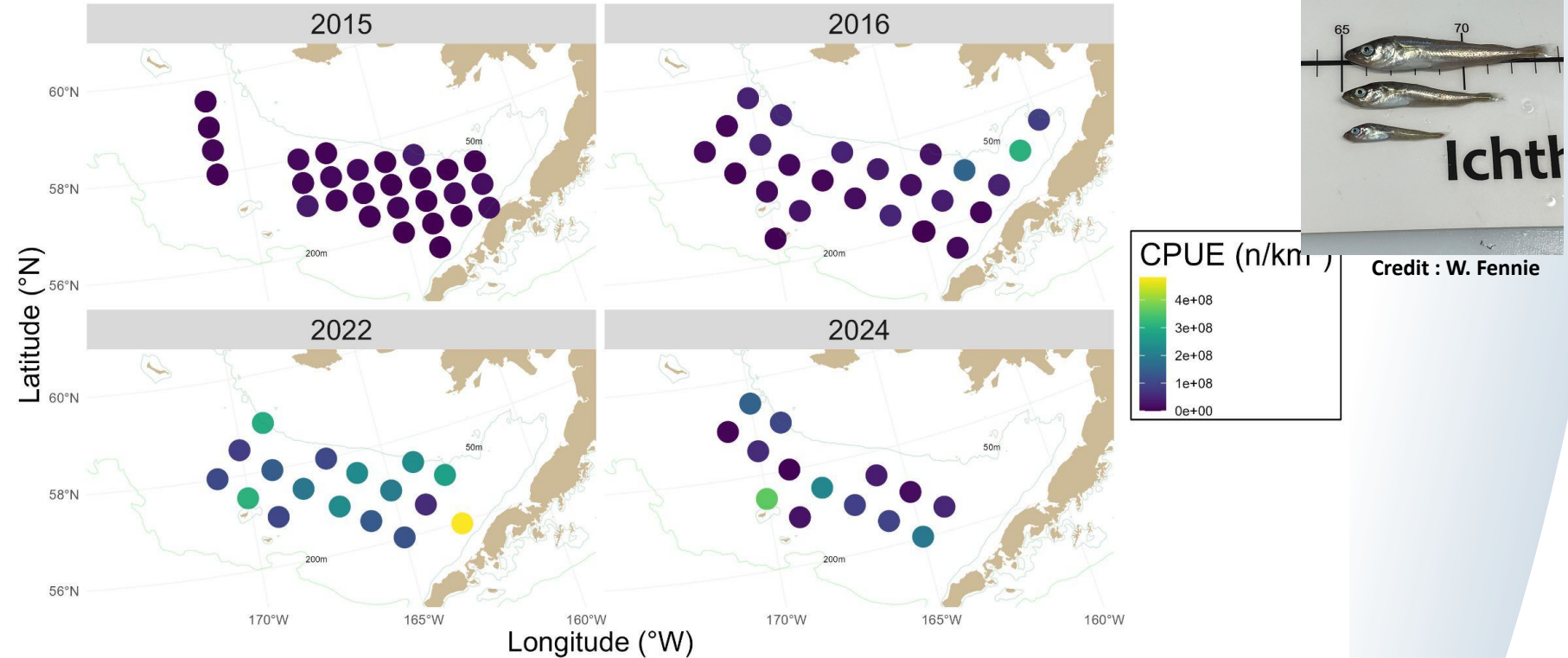
Contact : Alex Andrews, Andrew Dimond



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Fall - Age-0 Pollock SEBS Middle Domain

Oblique Tow A0 Pollock



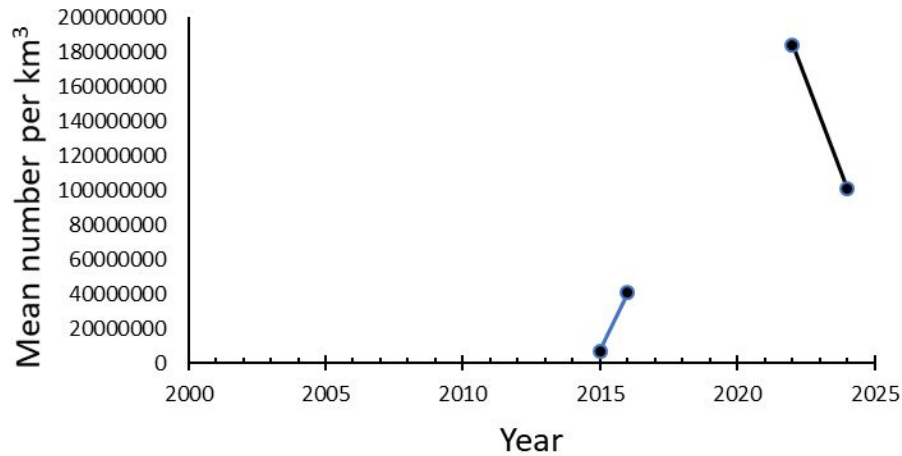
Credit : W. Fennie

Take home: Age-0 pollock catches are higher in cool years. This may indicate vertical movement deeper in the water column.

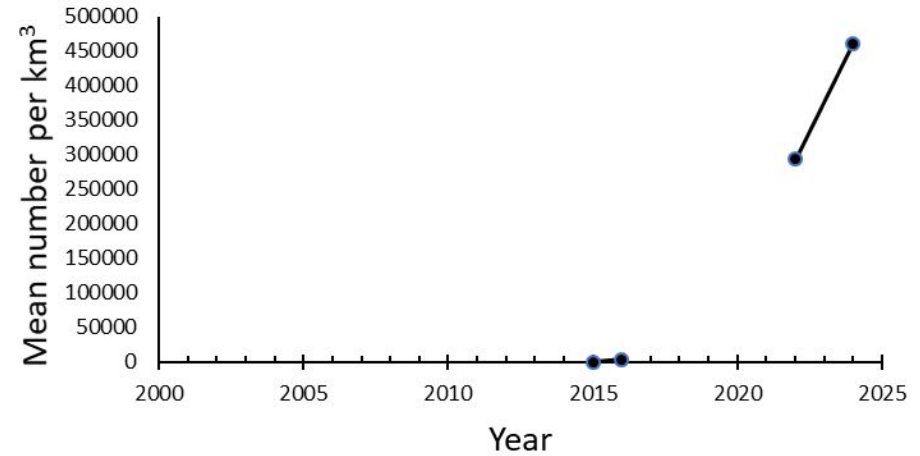
Contact : Alex Andrews, Andrew Dimond

Fall Juvenile Gadids - SEBS Middle Domain Oblique Tow

A0 Pollock - Oblique Tow



A0 P. Cod - Oblique Tow



Take home: Mean values were higher in cool years and support findings that age-0 pollock were deeper in the water column during cool years (Spear et al. 2022)

Take home: Mean values highest observed.
*Limited time series.

Contact : Alex Andrews, Andrew Dimond

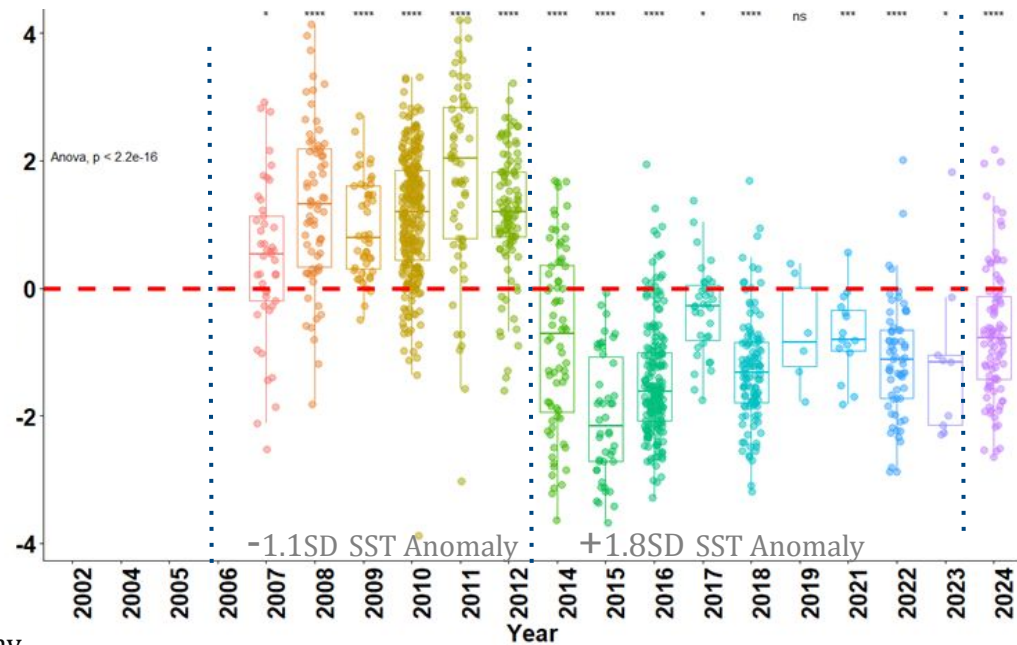
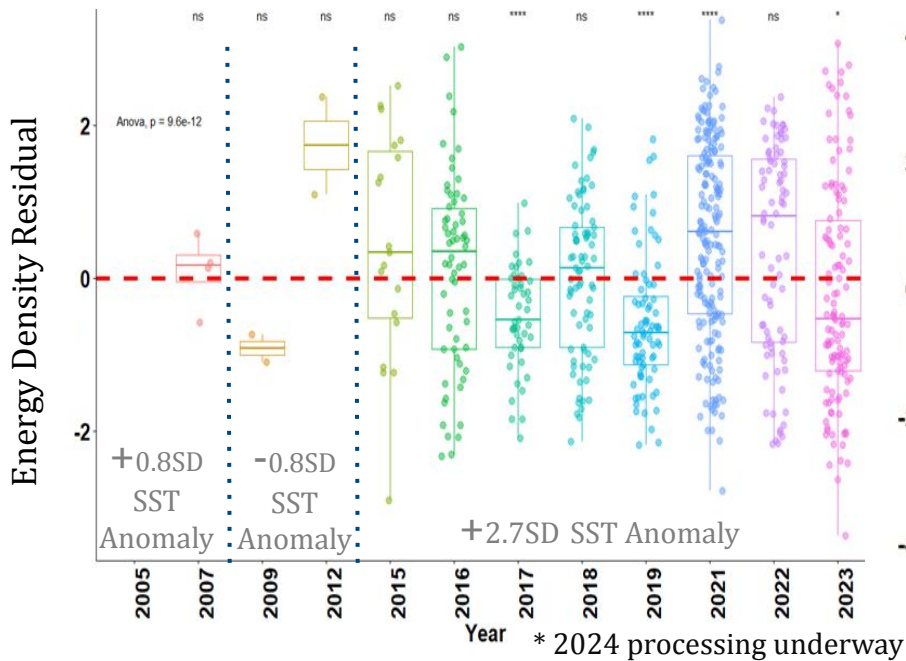


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Fall - Age-0 pollock condition EBS

NBS: Pollock Length-adjusted Energy Density

SEBS: Pollock Length-adjusted Energy Density



Take home: SEBS: age-0 pollock have below average length-adjusted energy density for the last 10 years coincident with warm ocean temperatures, with low energy and low mass residuals despite cooling temperatures in 2024. Typically age-0 pollock are in better condition during cool years.

NBS: Age-0 pollock energy density for a given length is not correlated with ocean temperature. 2024 sample processing is underway.

Contact : Johanna Page, Jacek Maselko, Rob Suryan



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2024 Bering Sea Summary



Ocean conditions

- Cooler than the heatwave years, not as cold as 2012.

Zooplankton

- Lower densities of large copepods and moderate smaller copepods during spring and fall but increase in the north. Lots of euphausiids and moderate copepods in north SEBS along 70m. Large fall bloom of phytoplankton now following a large storm.

Fish densities

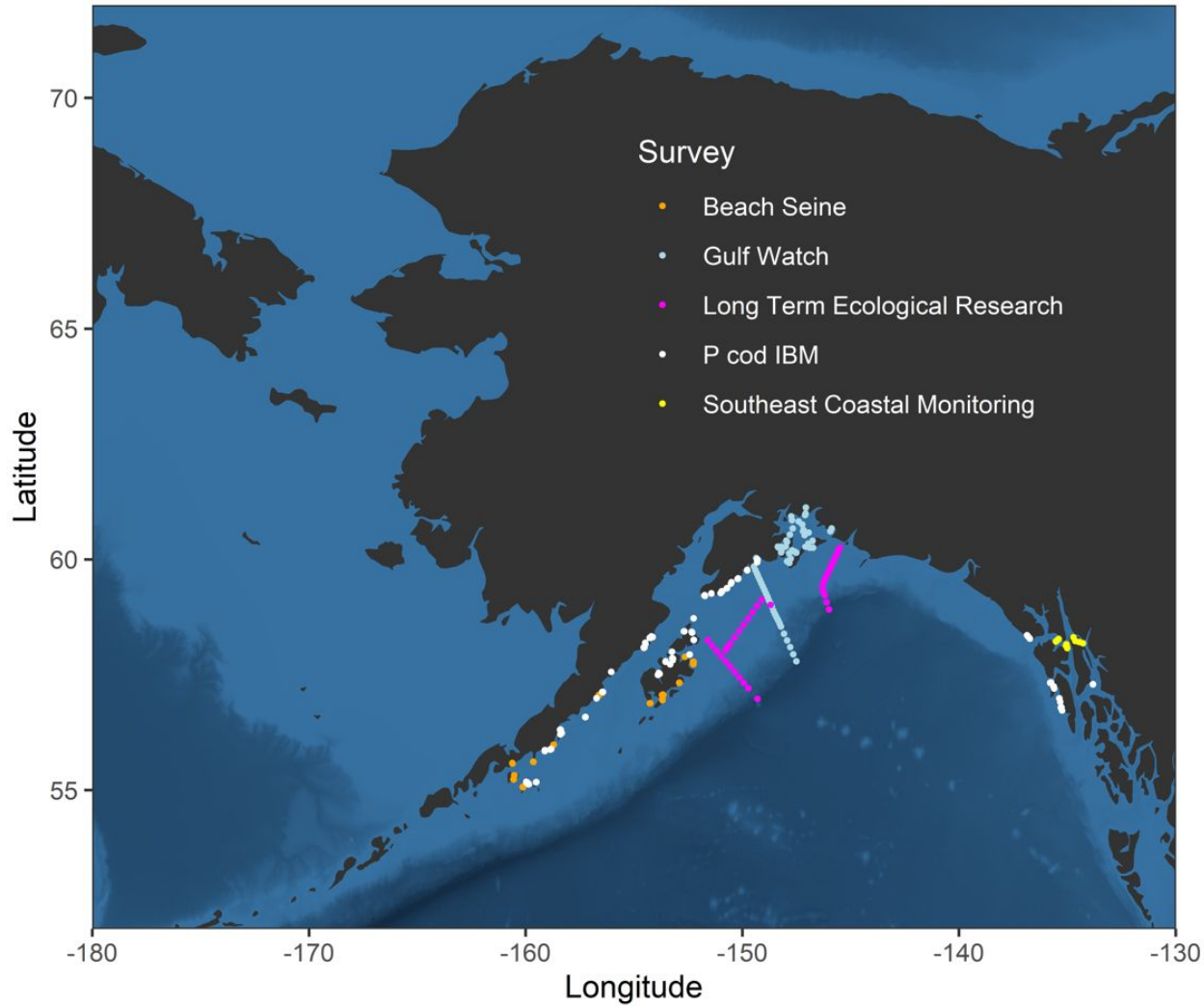
- Spring - high densities of egg and larvae for pollock. Fall - low surface densities of age-0 pollock (small) and age-0 P cod, but higher densities through the water column. Lots of age-1 pollock eating euphausiids. NBS many age-0 pollock, capelin, lamprey, and juvenile chum.

Fish condition

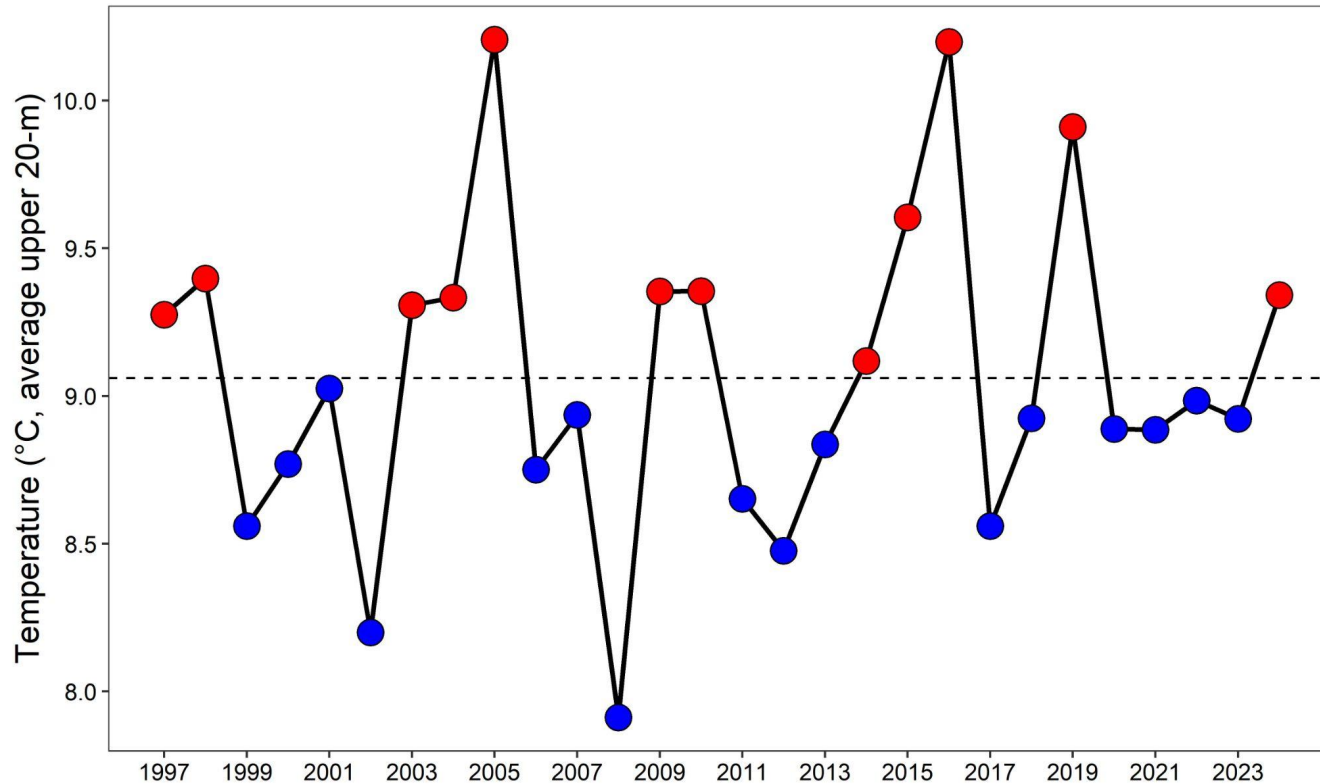
- Age-0 pollock had low body condition and size in the SEBS



Gulf of Alaska surveys



SECM: May-July temperatures



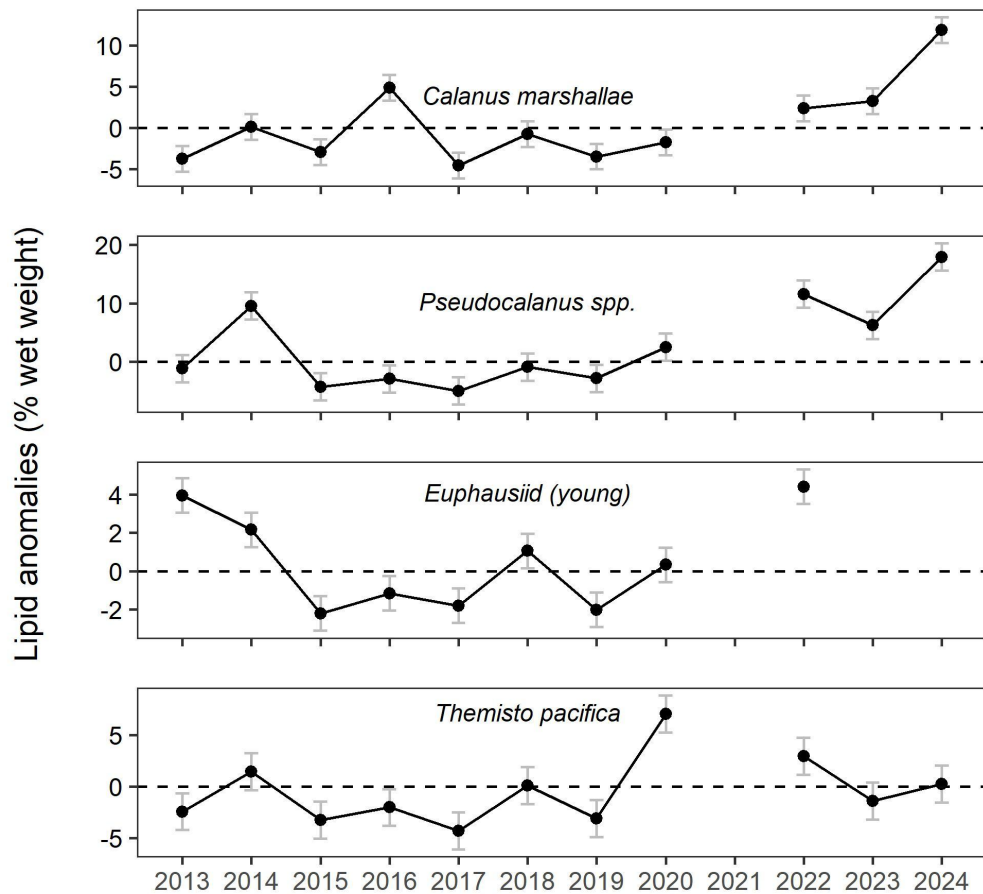
Take home: Warmer than average nearshore northern southeast Alaska waters.

Contact : Emily Fergusson



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SECM: Condition of zooplankton



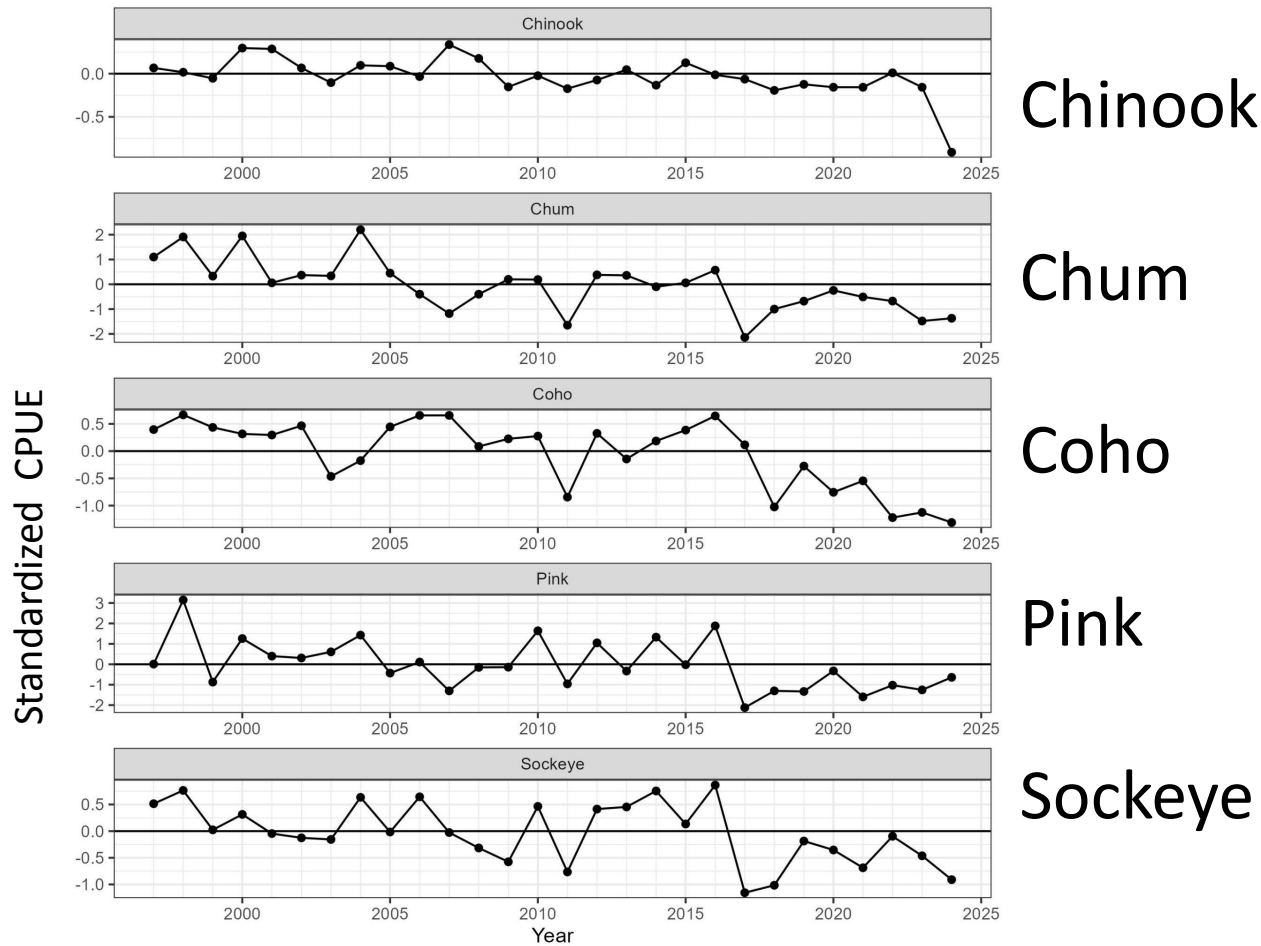
Take home: For fish feeding on copepods and amphipods, the average to positive lipid anomalies indicates positive nutritional quality.

Contact : Emily Fergusson



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SECM: Juvenile salmon densities



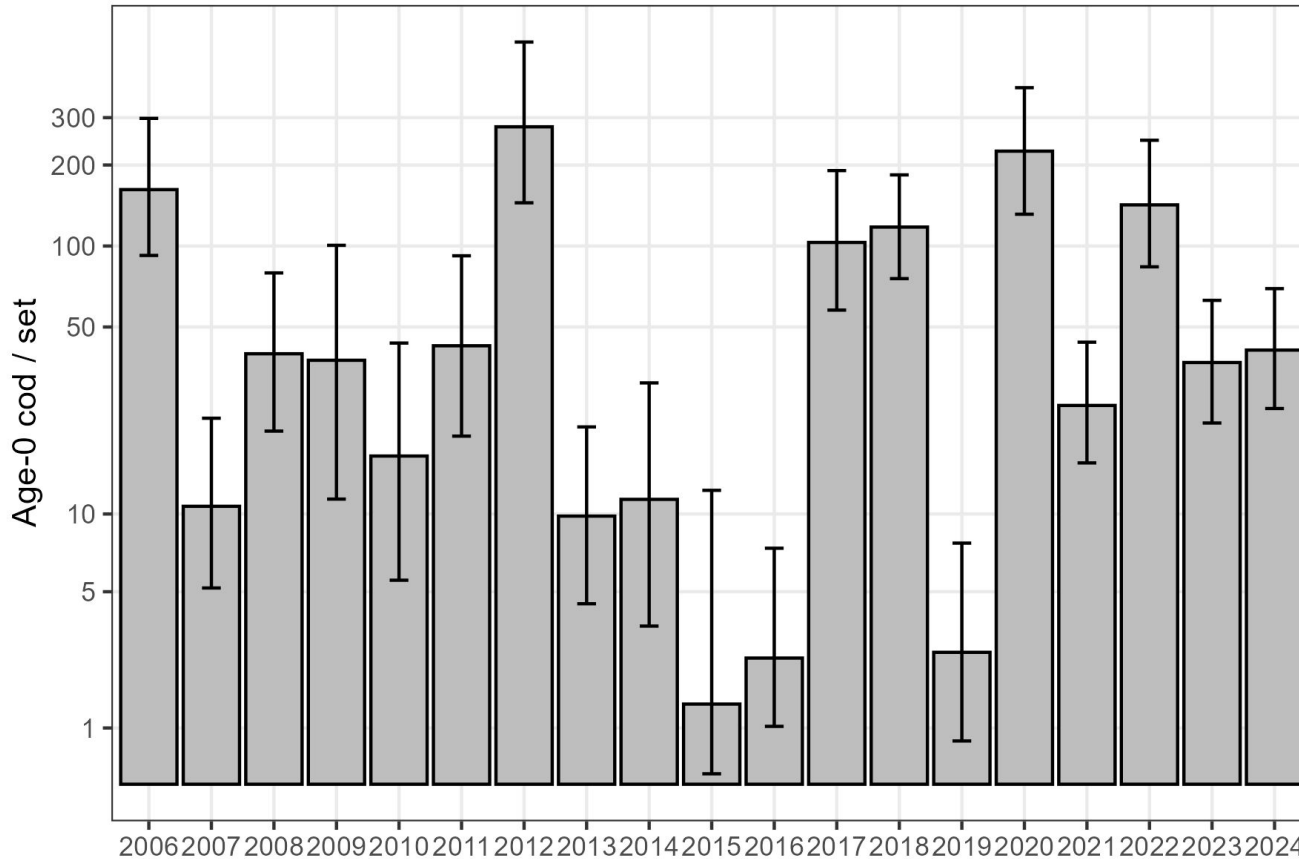
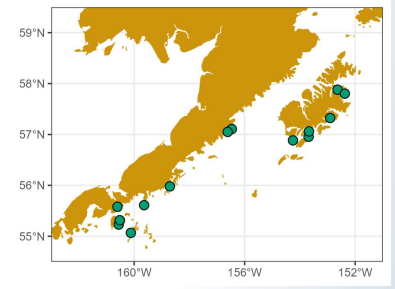
Take home: Low catches of age-0 Pacific cod, pollock, and sablefish. Low juvenile salmon densities.

Contact : Wess Strasburger



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Beach seine: Age-0 Pacific cod



Take home: 2024 age-0 Pacific cod abundance was similar to 2023, approx. average. Temperatures were relatively cool in the region. Kodiak and west.

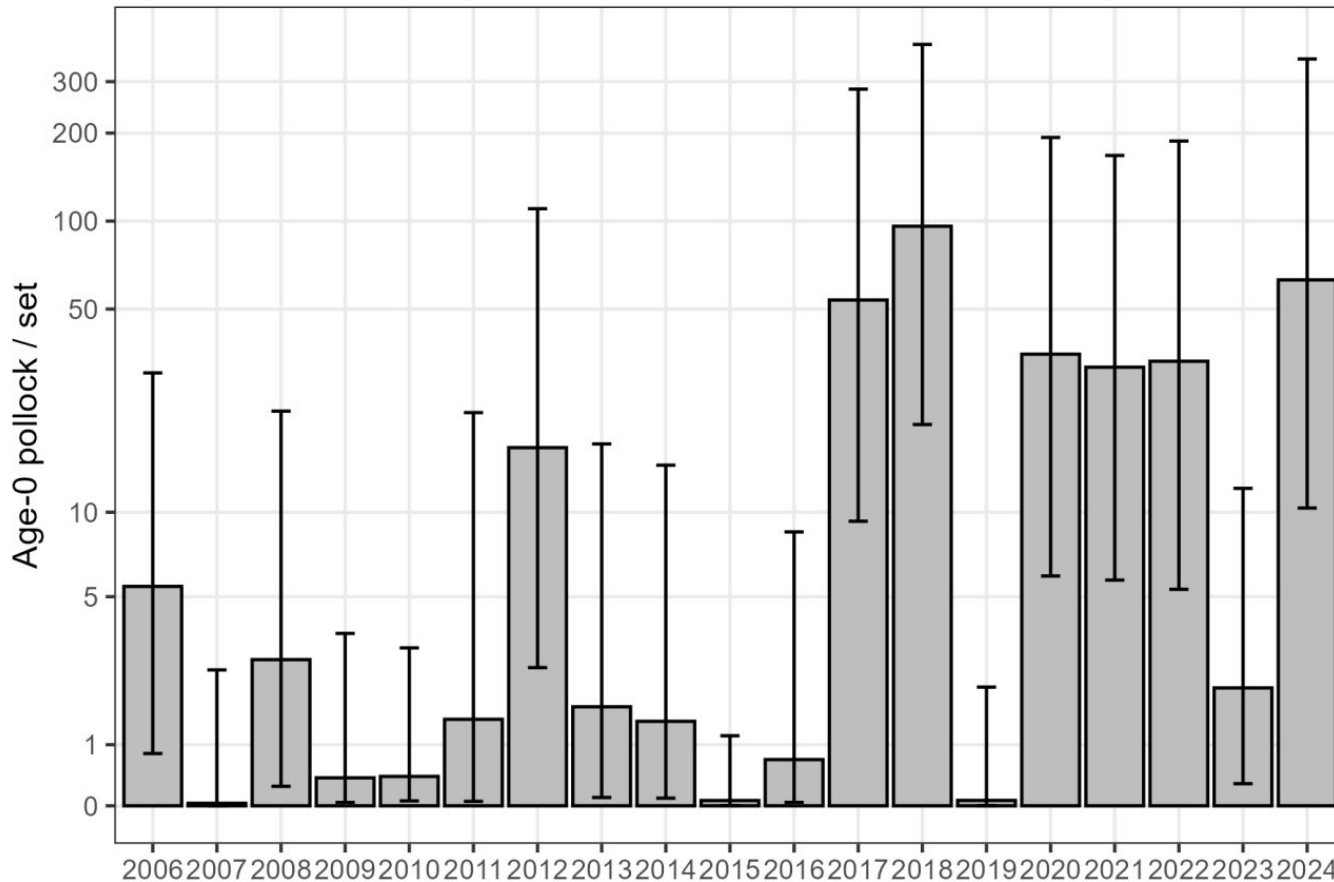
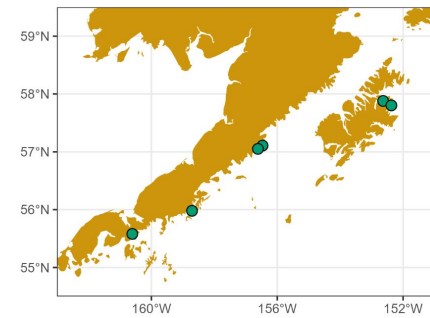
Data and code at <https://github.com/mikelitzow/seine-data>

Contact : Ben Laurel, Alisa Abookire, Mike Litzow



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Beach seine: Age-0 Pollock



Take home: Very high age-0 pollock (more pollock per set than P cod!). In general, we are seeing increased use of nearshore habitat by age-0 pollock in recent years.

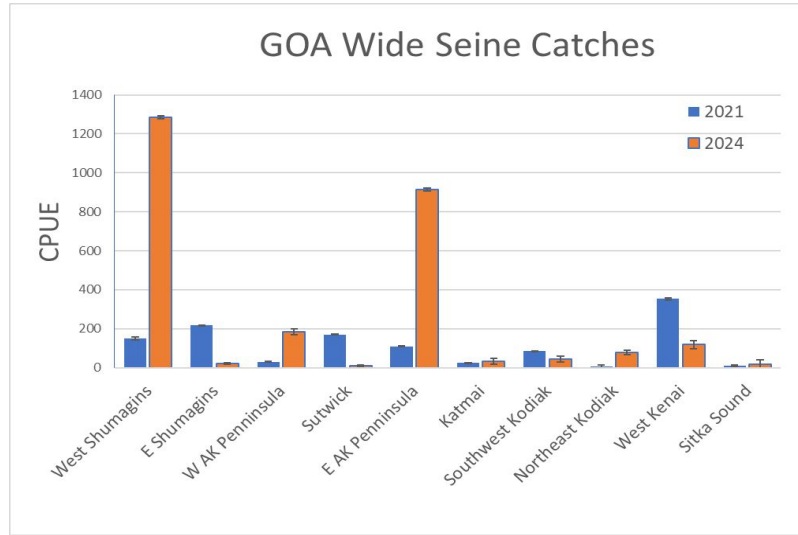
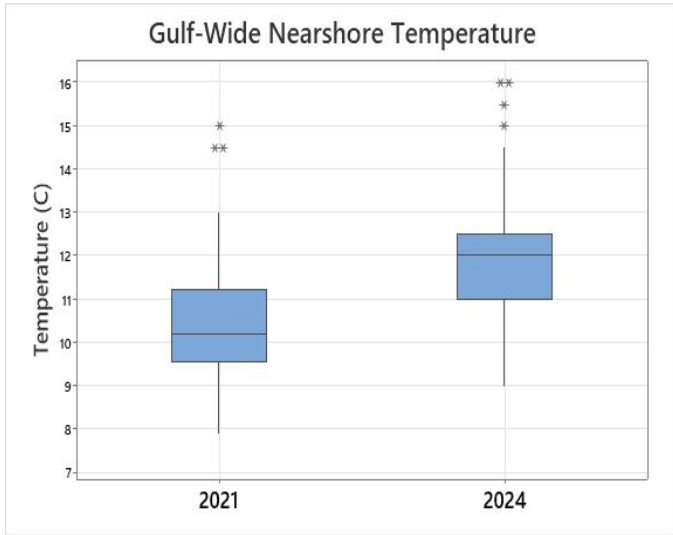
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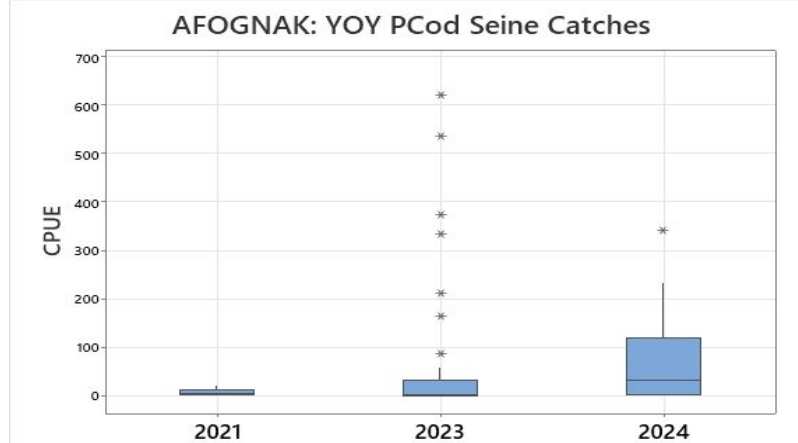
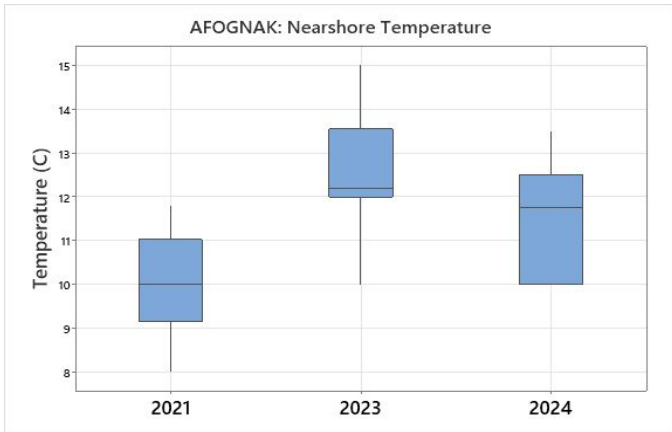


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2024 GOA age-0 Pacific Cod IBM Validation



	FO
2021	89%
2024	73%



	FO
2021	82%
2023	60%
2024	92%

Take home: GOA wide catches were higher in 2024 than 2021, especially the E AK PEN and Shumigan Islands. Afognak catches were also higher in 2024 than 2021 and 2023. Cameras indicate high age 1+ abundances and adult nearshore. Fisherman say catches were higher this year.

Contact: Johanna Page johanna.vollenweider@noaa.gov

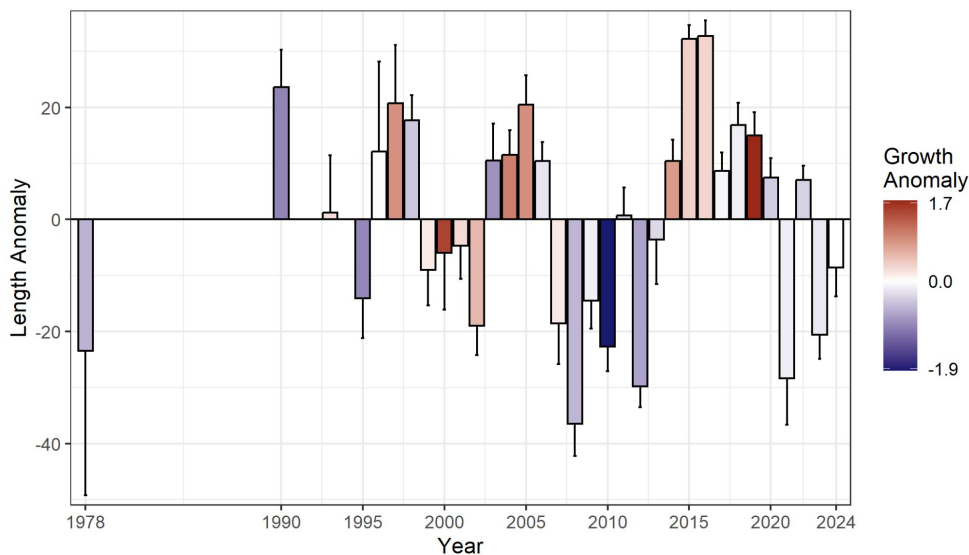


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Sablefish condition



- ↑ age-0 sablefish growth in warm years



Rhinoceros Auklets and Tufted Puffins bringing fish in to feed chicks on Middleton island, sampled June-August.



Take home: During 2024, below average length on median sample and average growth over the season.

Contact : Yumi Arimitsu, Scott Hatch, Shannon Whelan

2024 Gulf of Alaska summary



Ocean conditions

- Western GOA cooled by July during 2024. Cooler in 2024 than 2023. Nearshore eastern GOA warmer in July.

Zooplankton

- High lipid content.

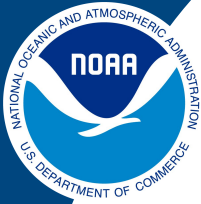
Fish densities

- Average age-0 Pacific cod densities in the nearshore (similar to 2023), and above average age-0 pollock densities. Lower fish densities in the EGOA in July than in 2023.

Fish condition

- Age-0 sablefish were shorter than average but had average growth rates.





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Highlighted projects

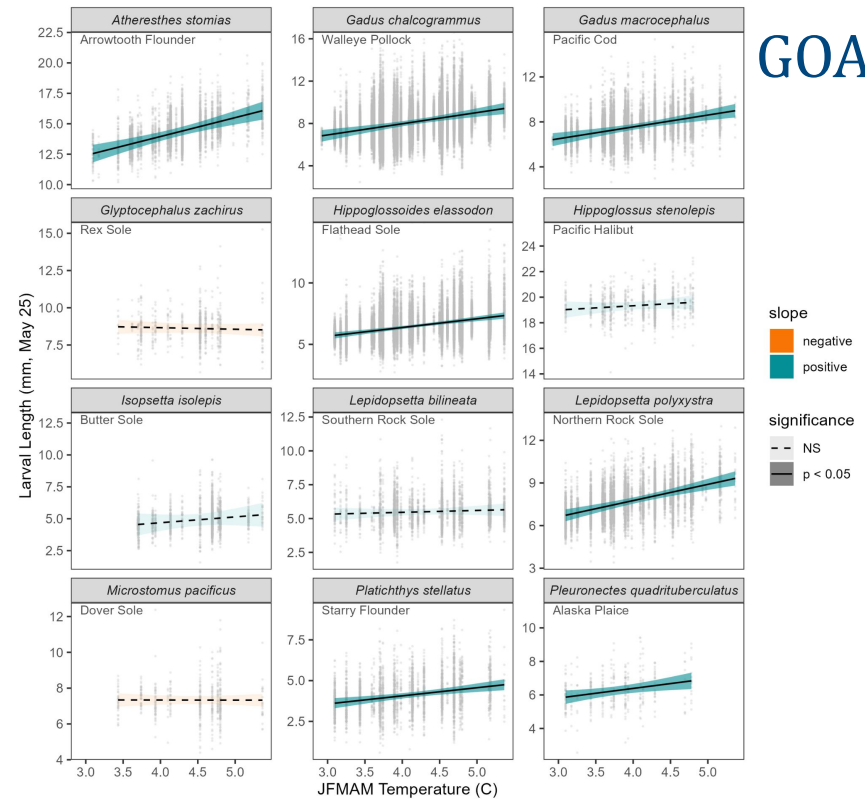
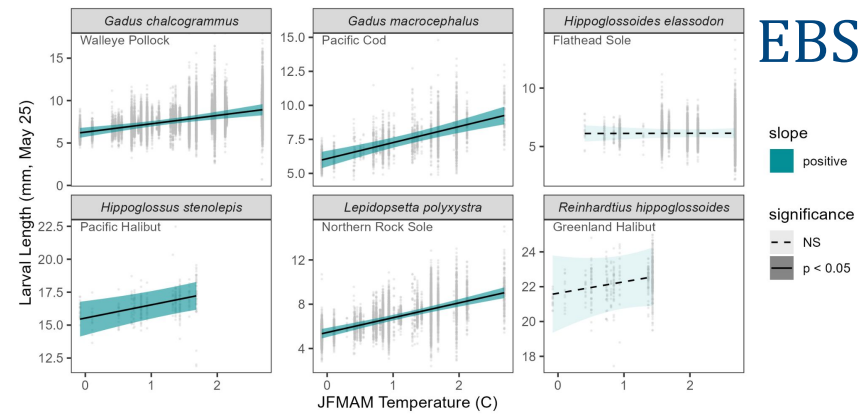
Shifting phenology of fish early life stages

Larval size-at-date increases in warm years for most species (showing assessed species). This indicates earlier spawning and/or faster growth and development in warm years.

Implications:

- Changing spawn time matters for fisheries and surveys.
- Match-mismatch dynamics may affect first-feeding larval survival.
- Size at end of first summer may affect ability to consume larger prey (e.g. krill), overwinter survival.

Take home: Most species are sensitive to thermal conditions in spring and will likely shift their timing with future warming.



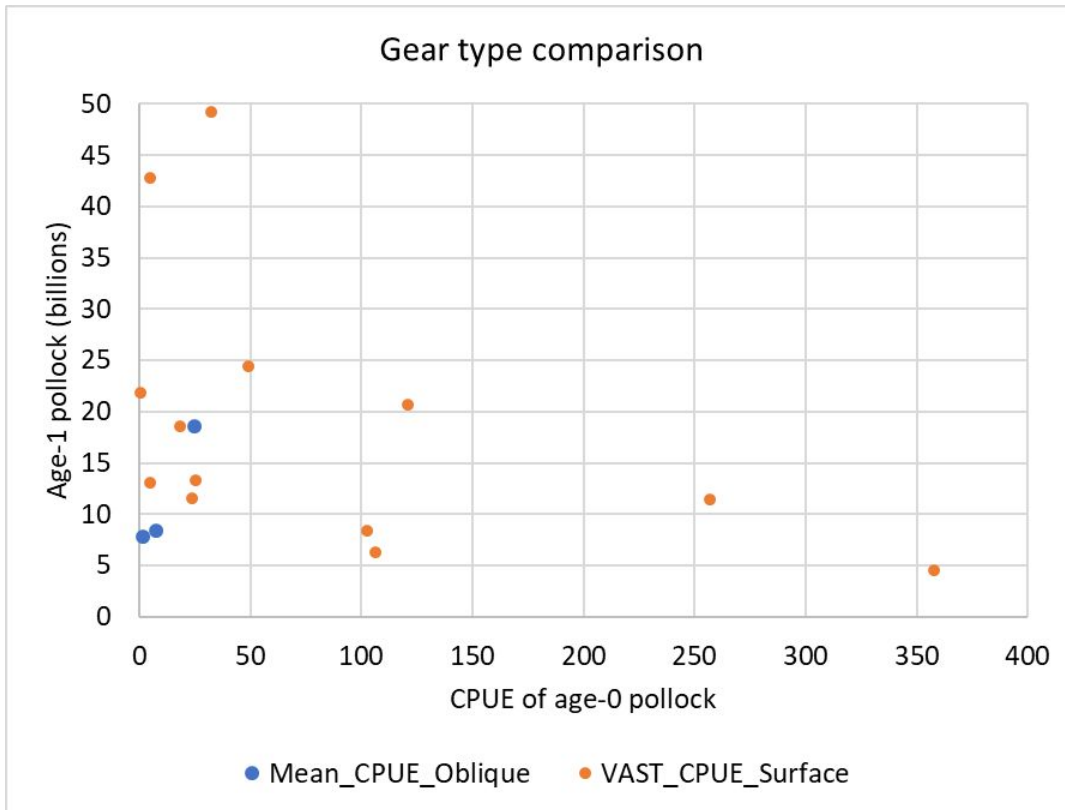
Contact : L. Rogers

Rogers, L.A., Axler, K., Bigman, J. et al. *in prep.*



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BASIS: age-0 densities vs recruitment to age-1



Take home: Oblique vs surface tows. Exploring the utility of the oblique tow catches of age-0 pollock as an index of year class strength. Age-1 pollock from Ianelli 2023. No 2018 data.

Contact : Andrews, Yasumiishi



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Acknowledgements

There's more information, just ask!

Thank to everyone who helped collect these data (too many to list)! We appreciate your time, effort, and thoughtful insights.

NOAA Contacts:

Ed Farley

Rob Suryan

Julie Keister

Mike Litzow

Tom Hurst

Ellen.Yasumiishi@noaa.gov



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