Ecosystem Status Report: Gulf of Alaska 2024

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With contributions from:

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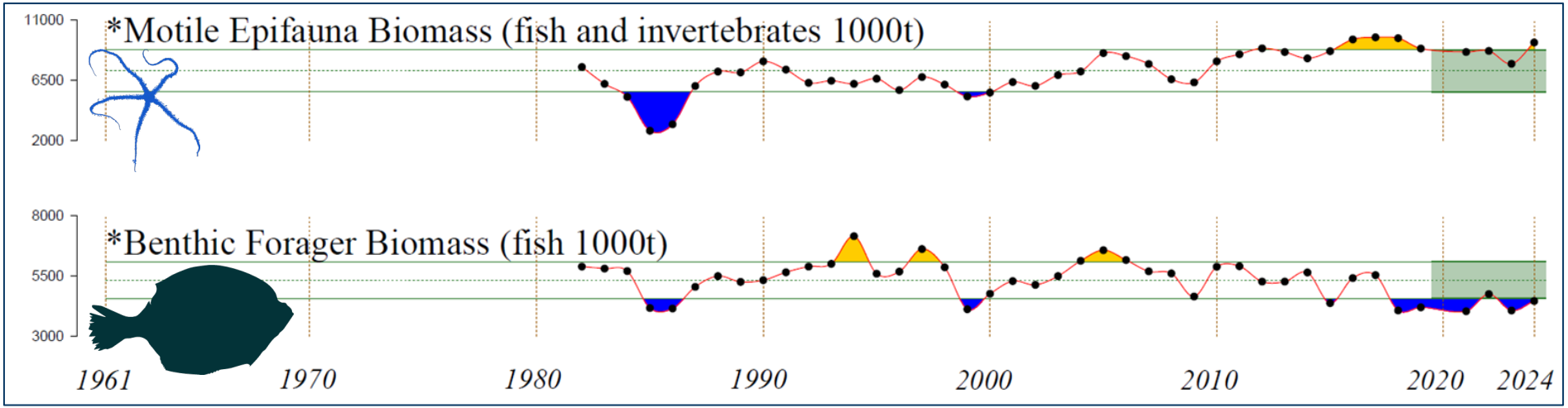
In Response to Mr. O'Donnell)

Eastern Bering Sea Benthic epifauna dominated by echinoderms (Slide from E. Siddon)



- 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 of small-mouthed flatfishes has been mixed since 2021

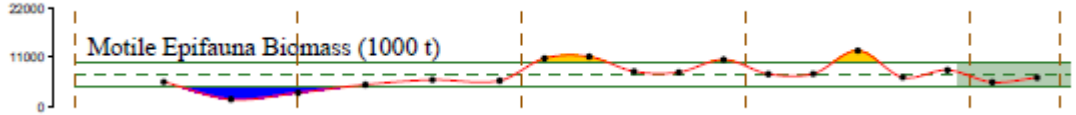
Whitehouse Fig. 2, GAP/SAP BTS, Prohaska Fig. 95

In Response to Mr. O'Donnell)

Gulf of Alaska Motile Epifauna Biomass

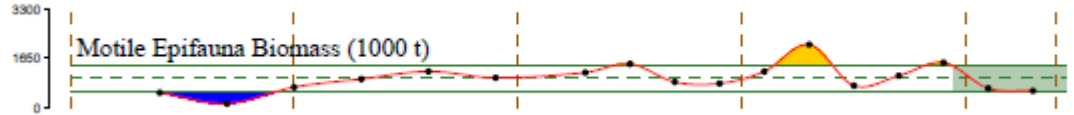
A. Whitehouse

Western GOA



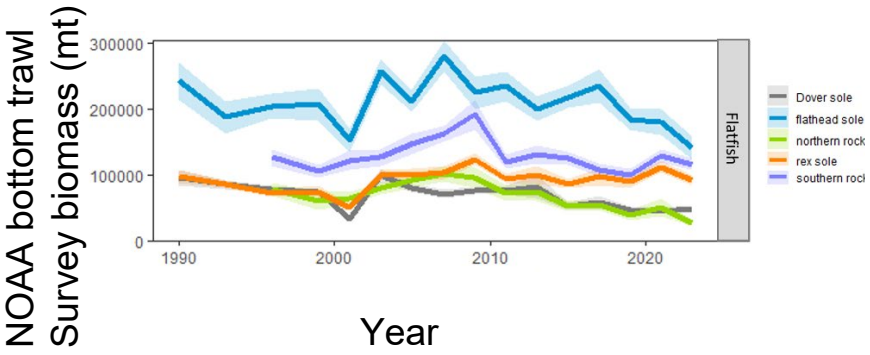
The biomass of this guild is dominated by hermit crabs, brittle stars, other echinoderms, and octopus. In 2023, brittle star biomass has declined from 2021 while the biomass of hermit crabs, octopus, and other echinoderms have all increased

Eastern GOA



Eelpouts, hermit crabs, brittle stars, and other echinoderms are dominant components of this guild. Brittle stars have decreased from 2021 to 2023 and are 1 standard deviation below their long term mean, while eelpouts, hermit crabs, and other echinoderms have increased from 2021 to 2023.

In Response to Mr. O'Donnell)



M. Callahan, L. Barnett

Survey biomass has been generally declining for butter sole, northern rock sole, and yellowfin sole, while English sole has been generally increasing (Figure 1). M. Bryan (2023 GOA Shallow water flatfish assessment)

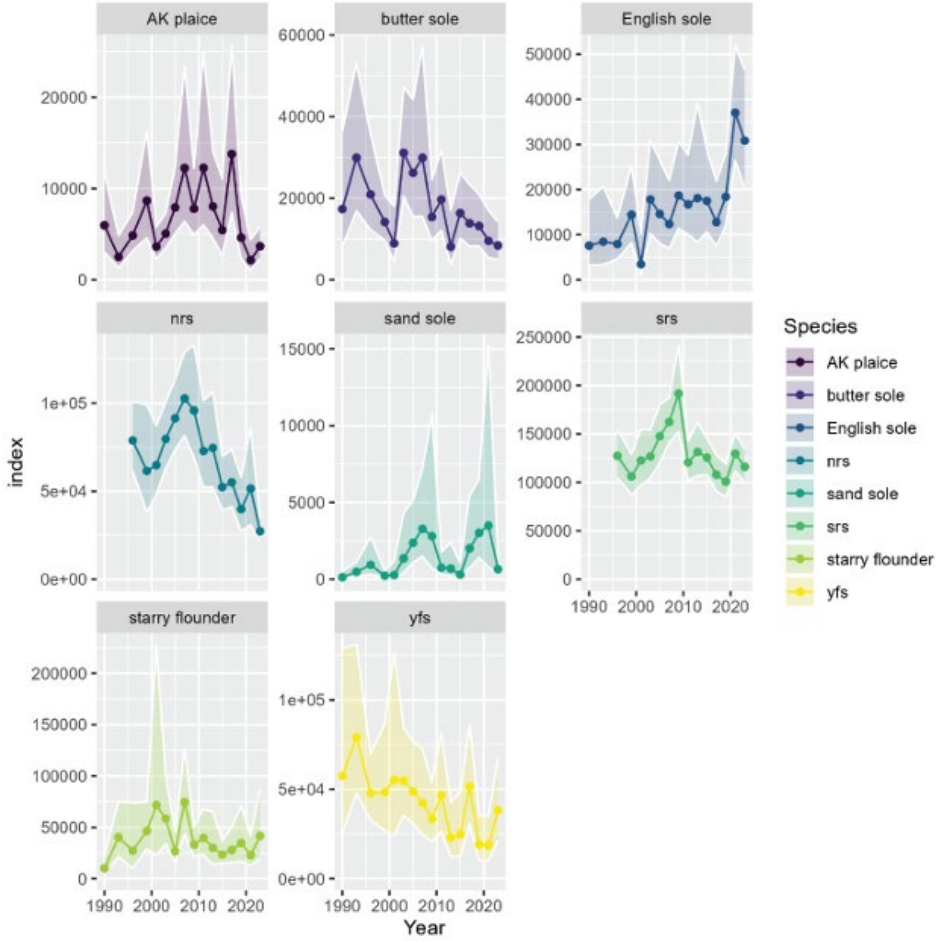
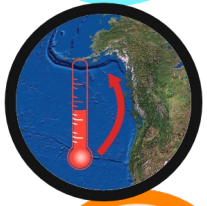


Figure 1. Biomass (t) estimates by species from the AFSC Gulf of Alaska biennial bottom trawl survey, 1990 - 2023, with 95% confidence intervals.

GOA 2024: Key Messages

1. Long-term trends in oceanography and groundfish community

- Warming through water column, less saline at surface & more at depth (incr. stratification)
- Groundfish dominated by planktivorous predators
- Response to 2014-2016 MHW still observed



2. Winter 2024: moderate El Niño in GOA

- Some oceanographic responses; No ecological shocks

3. Above-average, spatially consistent (where data available) pelagic prey base (zooplankton, forage fish); increased from 2023

- Potentially good larval & adult feeding conditions for numerous groundfish species

4. Low pink salmon returns

- Coastal shelf environment and potential competition in ocean gyre

5. Looking ahead to 2025 (weak La Niña)

- Neutral to cooling 2025 SST; 2024 good prey and fall temperature leading into 2025

GOA Full & Update Assessment Risk Tables: Environmental/ Ecosystem Considerations

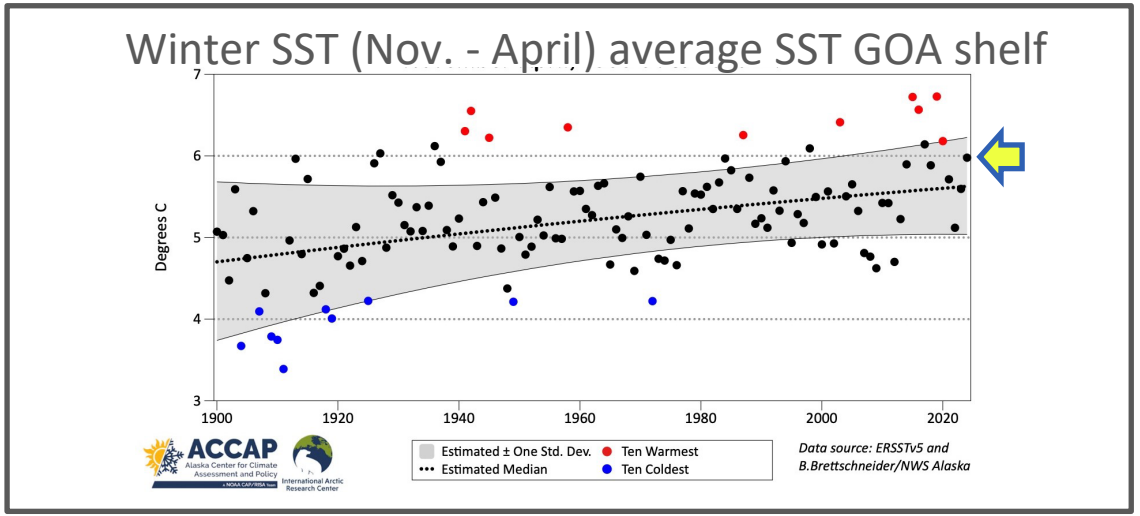
Level 1

(No apparent environmental/ ecosystem concerns)

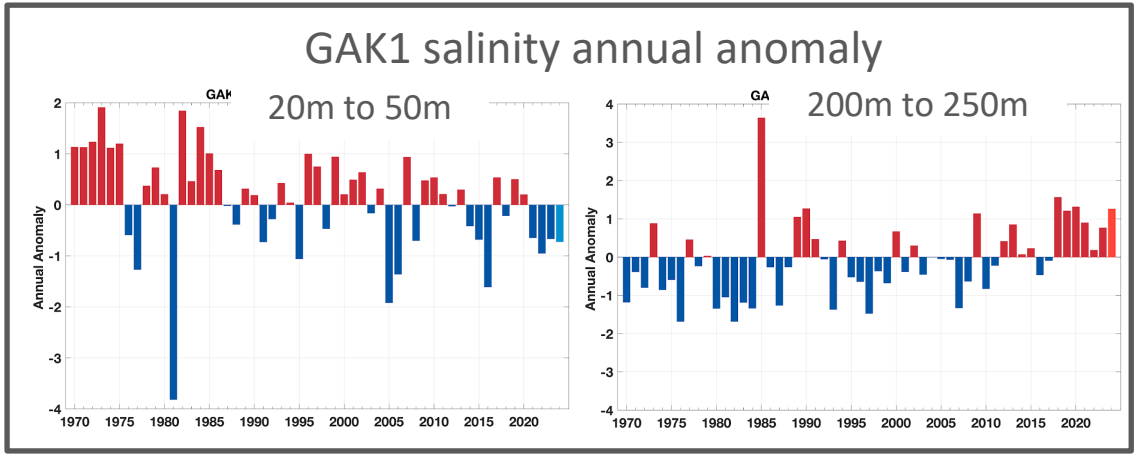
1. Walleye pollock *(+ESP)*
2. Pacific cod *(+ESP)*
3. Sablefish (statewide) *(+ESP)*
4. Dusky rockfish
5. Northern rockfish
6. Demersal shelf rockfish
7. Thornyhead rockfish

Message 1. Long-term Trends: Warming & Changes in Salinity

1. Warming of GOA shelf surface waters in winter and summer: 2024 warm winter
(R. Thoman, S. Danielson)



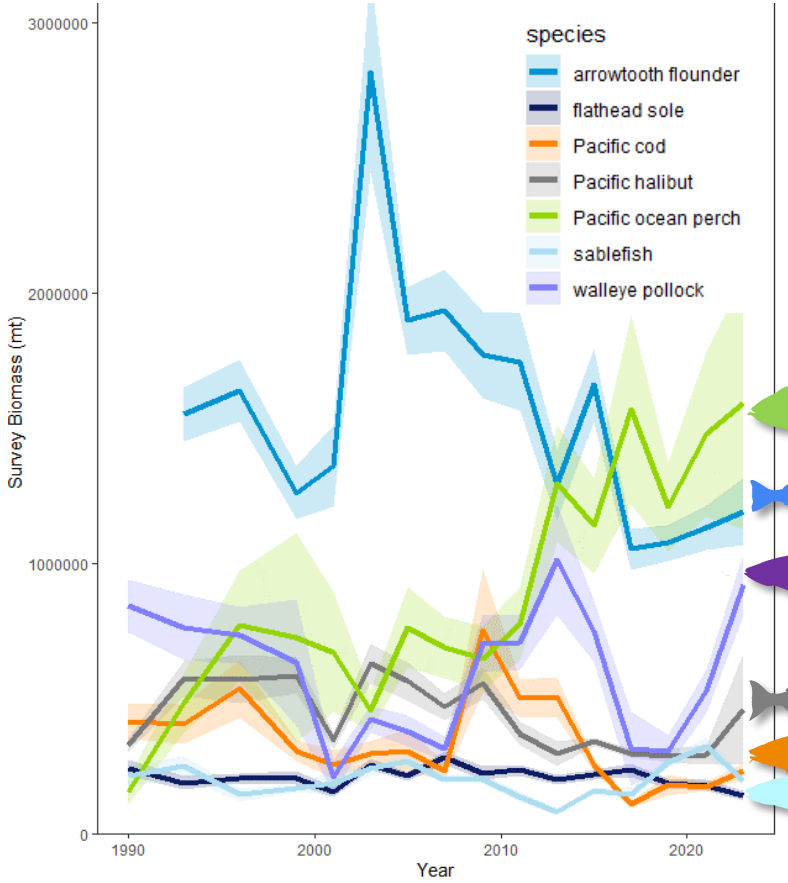
2. Less saline at surface and more saline at depth (GAK1)
(S. Danielson)



Message 1. Long-term Trends: Changing Groundfish Community

M. Callahan
L. Barnett

NOAA bottom trawl survey-estimated biomass (mt) top GOA groundfish species through 2023

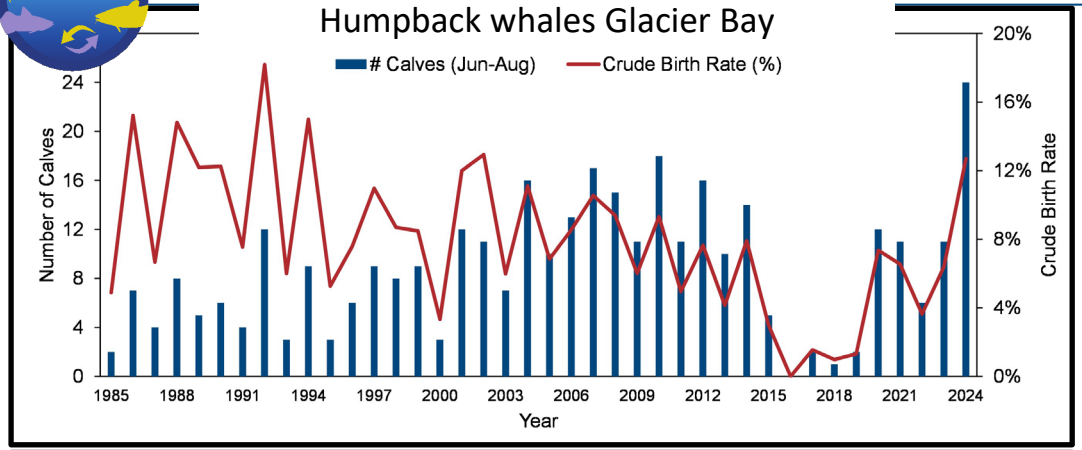


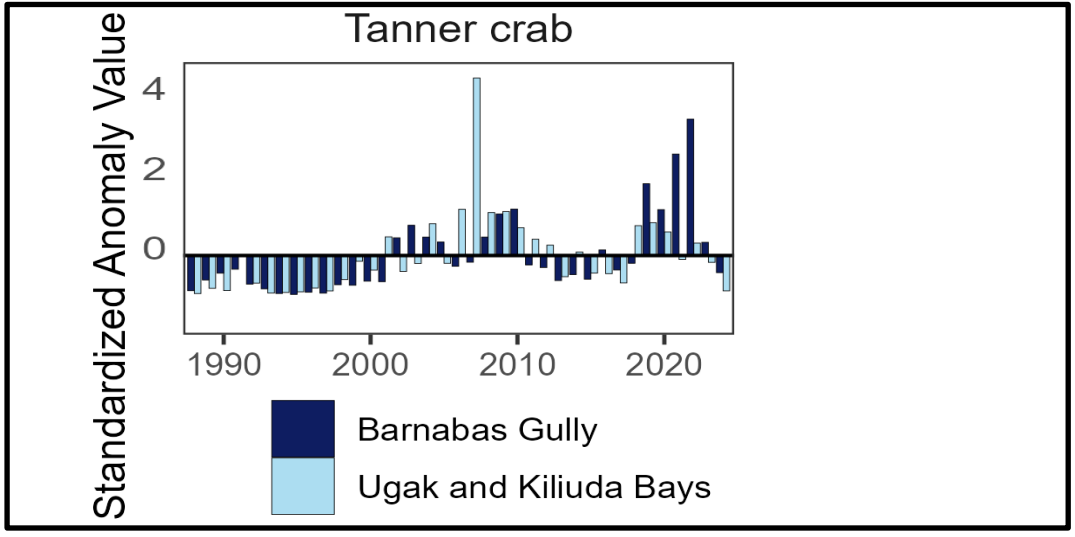
1. P. ocean perch
2. Arrowtooth flounder
3. W. pollock
4. P. halibut
5. P. cod
6. Sablefish
7. Flathead sole

- Planktivorous predators (POP, pollock) dominate top groundfish biomass (add pink salmon in odd years)
- POP replaced arrowtooth flounder as most dominant by biomass in 2017

Key Message 1. Ongoing responses to 2014-2016 MHW

C. Gabriele, J. Neilson, H. Hoffbauer, C. Worton

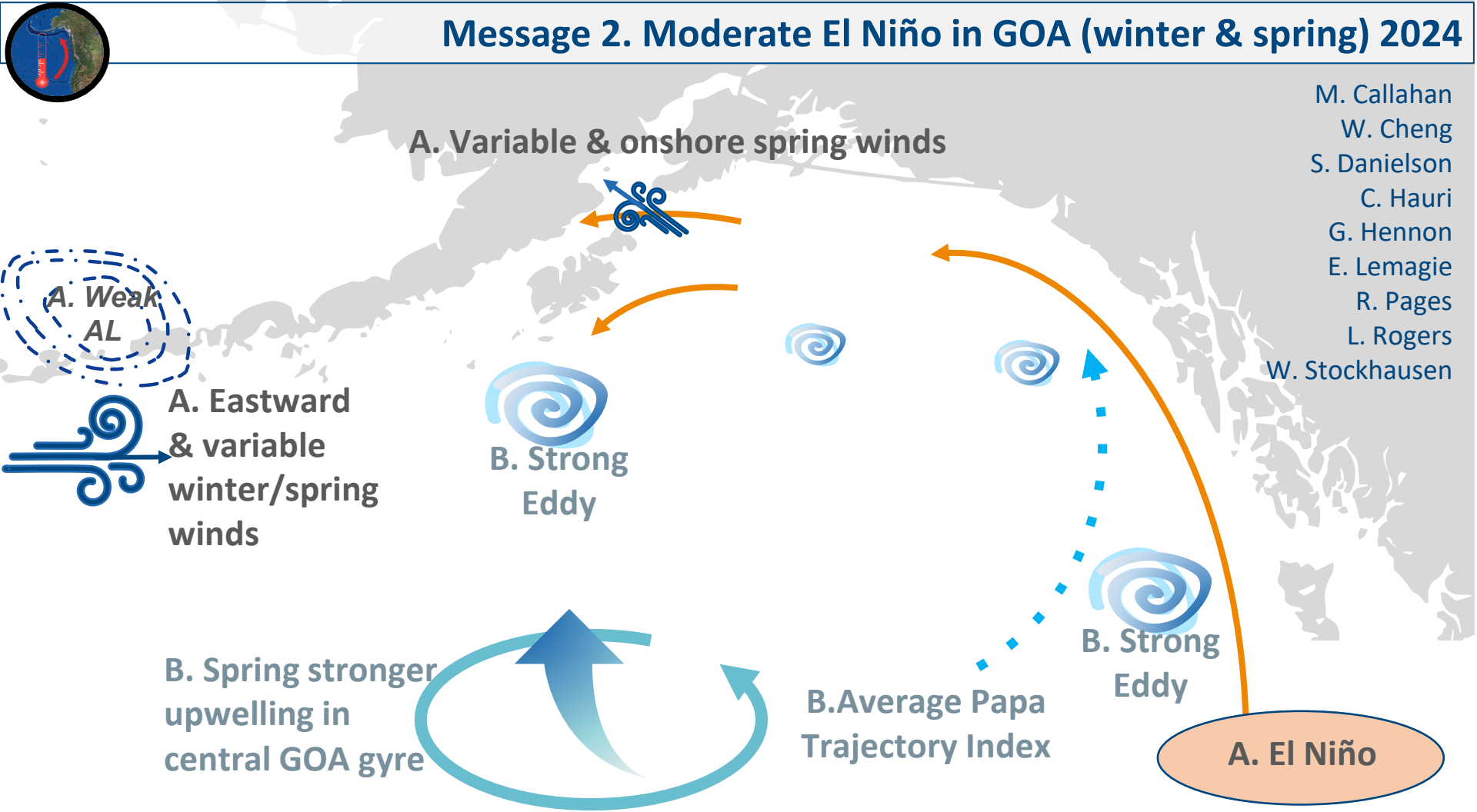




- Humpback whale crude birth rate returned to pre-2014 levels
- Capelin continues to be observed in ecosystem (2nd year)
- Tanner crab declining around Kodiak (2019 large year class)

Message 2. Moderate El Niño in GOA (winter & spring) 2024

M. Callahan
W. Cheng
S. Danielson
C. Hauri
G. Hennon
E. Lemagie
R. Pages
L. Rogers
W. Stockhausen



Message 2. Moderate El Niño in GOA (winter & spring) 2024

T. Farrugia, H. Coletti, B. Drummond, S. Whelan, authors on forage fish slide, M. Keogh

➢ No ecological signals of major warming event in 2024 (associated with strong El Niño's)

- Harmful algal blooms: no increase in intensity, frequency, duration
- Intertidal communities maintained local spatial variability
- No observed forage fish decline
- No large-scale seabird die-offs; seabird productivity was average/above average
- No increased marine mammal strandings
- Other indicators

➢ Revisiting 2023 predictions of 2024 El Niño potential impacts. Will know more in 2025 but…

Predicted Benefit (*incr. cross shelf transport, favorable EGOA late spring, summer warm SST)?* **✓True?**

- Larval/juv. ATF, rex sole, P. halibut, rockfish, sablefish (slope spawned larvae) (*larval transport*)
- Larval rockfish and sablefish (*warm waters*)

Predicted Vulnerable *(spring SST too high & persists; and reduced zooplankton)?* ✖ **Not true?**

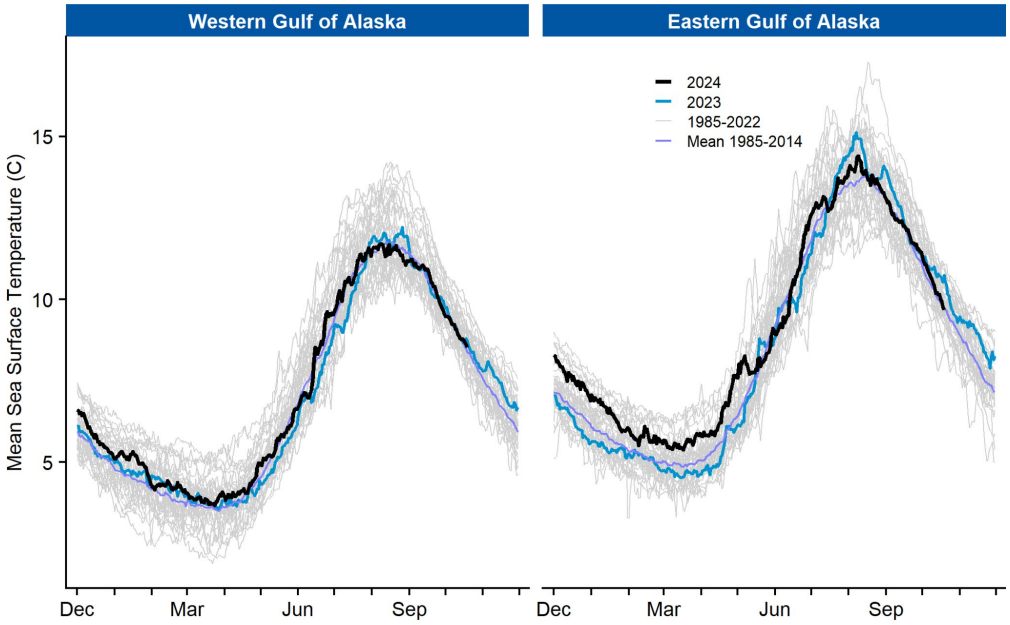
- Larval/juv. P. cod, walleye pollock, and northern rock sole
- Adult walleye pollock, Pacific Ocean perch, dusky & northern rockfish
- Deeper adult habitat could warm if heat event persists

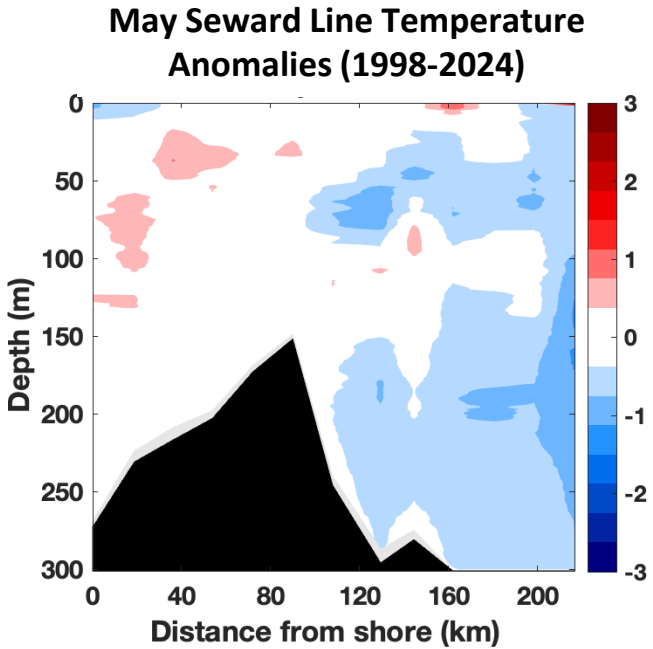
Message 2. Temperature 2024- winter & spring warm at surface

E. Lemagie & M. Callahan
S. Danielson et al.

- Sea surface temperature:
- WGOA: warm winter, average spring, summer & fall
- EGOA: warm winter & spring, average warm summer, average fall

- Ocean temperature shelf bottom: average to cooler (winter and spring)



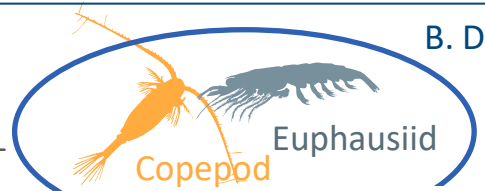


Message 3. Above-average productivity 2024: Primary and secondary

B. Drummond, S. Whelan, M. Arimitsu
G. Hennon
R. Hopcroft
R. Pages, C. Hauri

Planktivorous seabird reproductive success (Chowiet Isl., Middleton Isl., St. Lazaria Isl.)

Seward Line Spring Survey



Increased mesozooplankton vs. microzooplankton

Seward Line Spring Survey

Increased diatom vs. nanophytoplankton

NO_3^- **Increased nitrate on shelf**

North Gulf of Alaska Oscillation Index

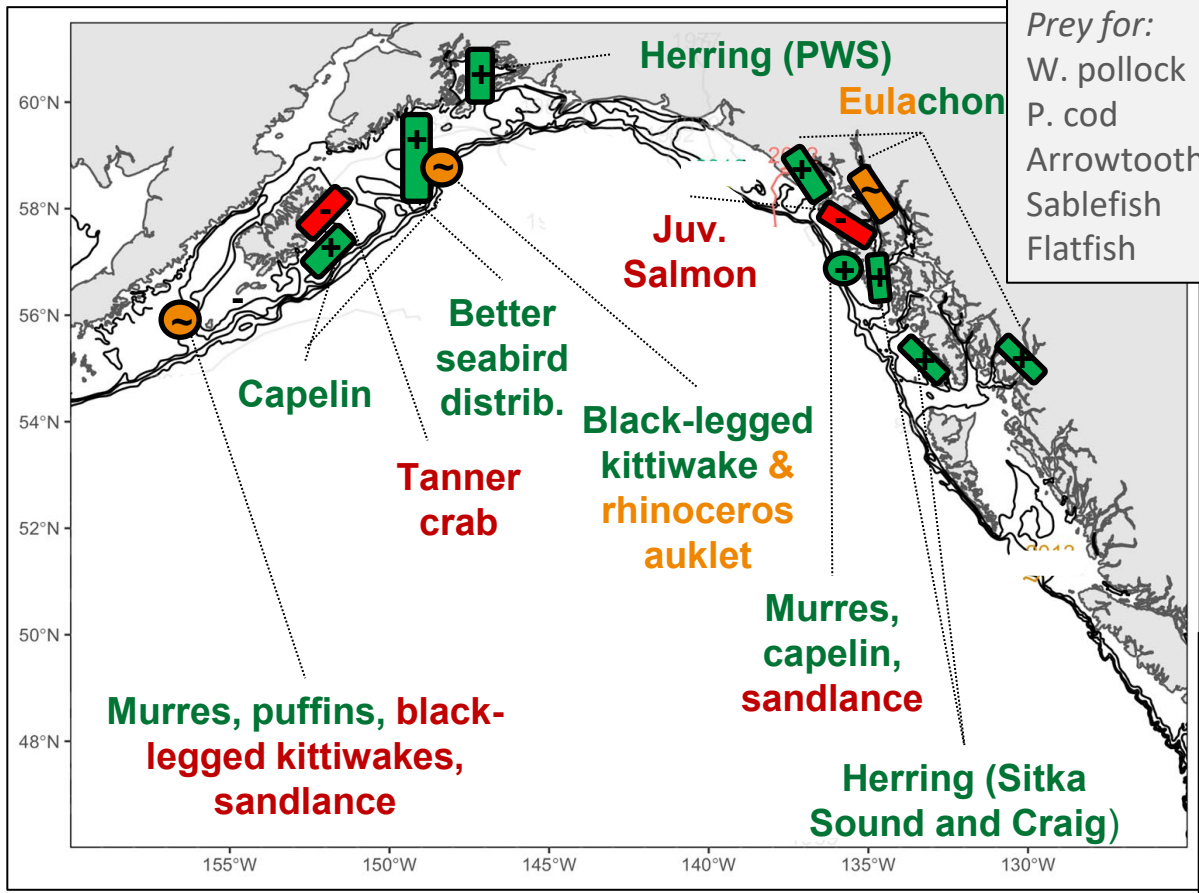
Spring stronger upwelling in central GOA gyre

Prey for:
W. pollock
P. ocean perch
Dusky rockfish
N. rockfish
Juv. groundfish

Conceptual model based on Conte et al. 2024

Message 3. Forage fish average/above-average 2024

B. Drummond, D. Cushing, S. Hatch, K. Hebert, S. Pegau, E. Pochardt, W. Strasburger, C. Worton



Prey for:
W. pollock
P. cod
Arrowtooth fl.
Sablefish
Flatfish

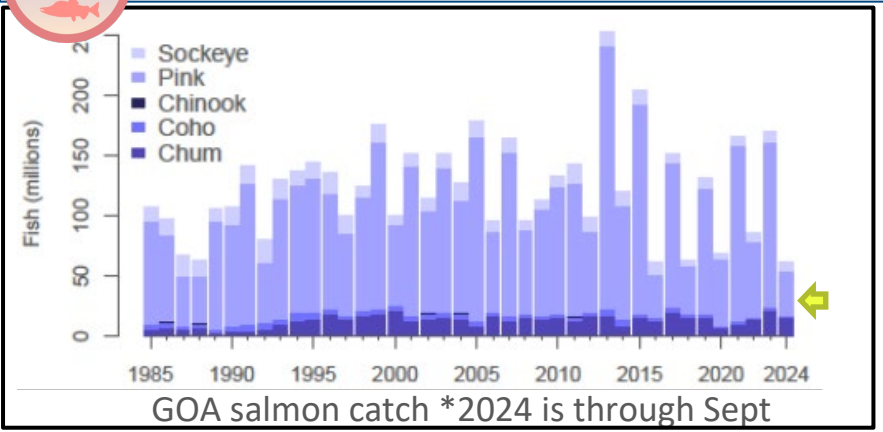
- Survey baselines from 1990's/early 2000's to present)
- Average to above average
- Incr.: capelin, herring, some eulachon
- Decr.: sandlance, juv. salmon, Tanner crab

Legend

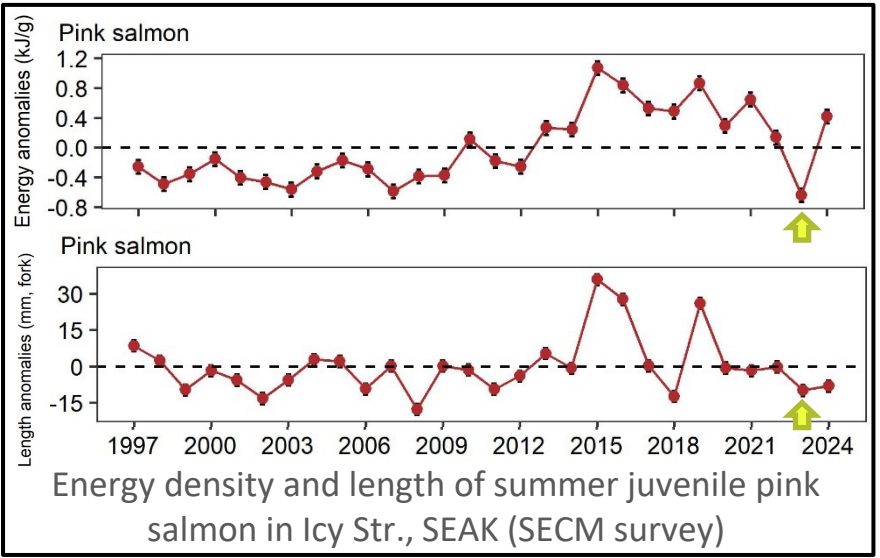
- *Surveys*
- *Seabird Reproductive Success*
- \+ *Above Average*
- ~ *Average*
- \- *Below Average*

Message 4: Low Pink Salmon Returns 2024

A. Whitehouse, E. Fergusson, W. Strasburger



GOA salmon catch *2024 is through Sept



Energy density and length of summer juvenile pink salmon in Icy Str., SEAK (SECM survey)

- Some of lowest pink salmon returns since 1985; driven by Prince William Sound

X **Freshwater** (Affected hatchery and wild stocks)

✓ **Nearshore** (2023)

- Low zooplankton biomass but elevated large copepod biomass
- SEAK juv. pinks were smaller and lower energy density
- SEAK forecast (based on previous year juvenile survey) was more accurate than other AK (based on 2 year previous returns)

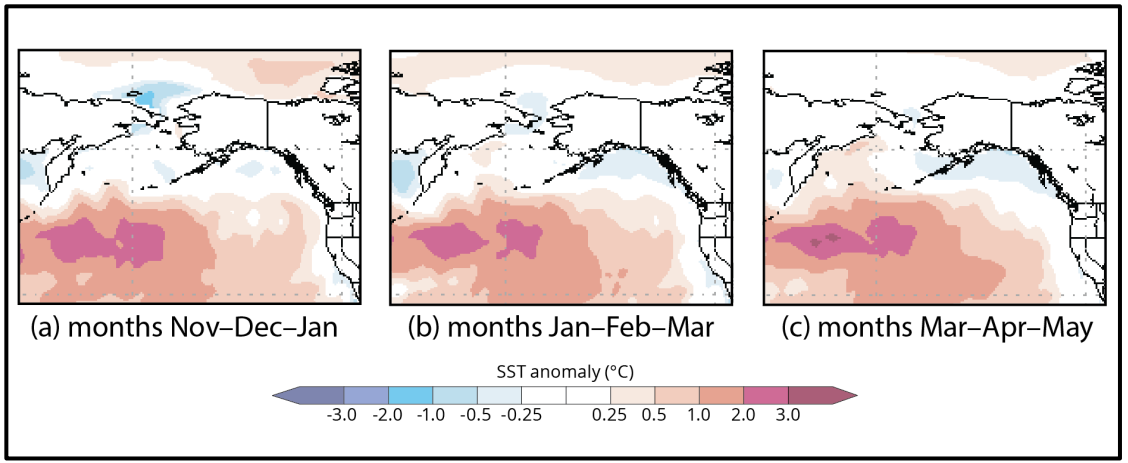
? **Ocean** (2023/2024)

- Competition with hatchery fish and with 2023 large cohort of returning adults (Ruggerone et al., 2023, Connors et al. 2024)

Message 5: Looking ahead to 2025 (weak La Niña): cool-ish SST

E. Lemagie, S. Bell, T. Hennon, S. Danielson

- National Multi-Model Ensemble predict cooler sea surface temperatures in winter/spring 2025 (baseline: 1991-2020)
- La Niña is late in developing (more likely to be weak or neutral)
- Groundfish entering 2025 from a relatively good 2024 (temperature and pelagic prey availability)



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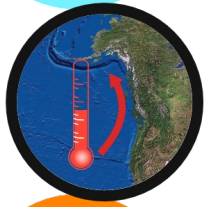

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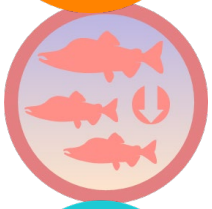

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