Ecosystem Status Report
Gulf of Alaska
2022

Bridget Ferriss & Stephani Zador

ESR Reports
(1999-2021)

With contributions from:

Anna Abelman, Grant Adams, Opik Ahkinga, Don Anderson, Mayumi Arimitsu, Kelia Axler, Brenda Ballachey, Steve Barbeaux, Sonia Batten, James Bodkin, Nick Bond, Brian Brettschneider, Matt W. Callahan, Rob Campbell, Reuben Cash, Louisa Castrodale, Wei Cheng, Heather Coletti, Bryan Cormack, Juliana Cornett, Deana Crouser, Daniel Cushing, Seth Danielson, Tammy Davis, Thomas Dean, Alison Deary, Martin Dorn, Sherri Dressel, Brie Drummond, Kathleen Easley, Anne Marie Eich, Grace Ellwanger, Daniel Esler, Stacie Evans, Evangeline Fachon, Thomas Farrugia, Emily Fergusson, Christine Gabriele, Sarah Gaichas, Jeanette Gann, Tom Gelatt, Andrew Gray, Colleen Harpold, Scott Hatch, Kyle Hebert, Steve Heinl, Hanna Hellen, Jordan Hollarsmith, Kirstin Holsman, Dom Hondolero, Russell Hopcroft, Peter Hulson, Jim Ianelli, Katrin Iken, Timothy Jones, Robert Kaler, Mandy Keogh, Steve Kibler, David Kimmel, Kim Kloecker, Brenda Konar, Elizabeth Labunski, Ned Laman, Kari Lanphier, Kathi Lefebvre, Emily Lemagie, Mandy Lindeberg, Jackie Lindsey, Julie Matweyou, Jasmine Maurer, Lauren E. McCaslin, Cole Monnahan, Daniel Monson, John Moran, Jennifer Morella, Jamal Moss, Franz Mueter, Jim Murphy, Janet Neilson, Jens Nielsen, John Olson, Clare Ostle, Veronica Padula, Emma Pate, W. Scott Pegau, Noel Pelland, John Piatt, Cody Pinger, Andrew Piston, Meredith Pochardt, Chandra Poe, André Punt, Heather Renner, Sarah Rheinsmith, Brian Robinson, Lauren Rogers, Natalie Rouse, Joshua Russell, Kate Savage, Kalei Shotwell, Kevin Siwicke, Scott Smeltz, Matthew Smith, Ingrid Spies, Ian Stewart, William Stockhausen, Janice Straley, Wesley Strasburger, Suzanne Strom, Robert Suryan, Katie Sweeney, Rick Thoman, Cathy Tide, Sarah Traiger, Caroline van Hemert, Scott Vulstek, Andy Wall, Benjamin Weitzman, Shannon Whelan, George A. Whitehouse, Carrie Worton, Bruce Wright, Stephani Zador, Joshua Zahner, Molly Zaleski

Thank you!

Southeast AK Eulachon

- Chilkoot Indian Association
- Skagway Traditional Council
- Takshanuk Watershed Council

Zooplankton, Forage fish indicators (seabird diets), Seabird distribution, Intertidal monitoring, Phytoplankton size, Temperature, PWS Humpback whale, PWS Herring

Gulf Watch Alaska

- Prince William Sound Science Center
- National Park Service
- ADF&G
- University of Washington
- University of Alaska
- NOAA Fisheries

Commercial salmon catch, SEAK herring, ADF&G trawl, seabird reproductive success

- ADF&G
- USFWS

Skipper Science Partnership

- Community of fishermen

Seabird mortality events, seabird diets & reproductive success

- Coastal Observation & Seabird Survey Team (COASST): citizen science

Harmful Algal Bloom

Sampling Partners:

- Alaska Ocean Observing System
- Alaska Sea Grant
- Alaska Veterinary Pathologists
- Aleut Community of St. Paul
- Aleutian Pribilof Island Association
- Central Council of Tlingit and Haida*
- Chilkoot Indian Association*
- Craig Tribal Association*
- Hoonah Indian Association*
- Hydaburg Cooperative Association*
- Kachemak Bay NERR
- Ketchikan Indian Association*
- Klawock Cooperative Association*
- Knik Tribe of Alaska
- Kodiak Area Native Association
- Metlakatla Indian Community*
- NOAA Kasitsna Bay Lab
- NOAA WRRN-West
- North Slope Borough
- Norton Sound Health Corporation
- Organized Village of Kake*
- Organized Village of Kasaan*
- Petersburg Indian Association*
- Qawalangin Tribe of Unalaska
- Sitka Tribe of Alaska*
- Skagway Traditional Council*
- Southeast Alaska Tribal Ocean Research
- Sun'aq Tribe of Kodiak*
- University of Alaska Fairbanks
- USGS Alaska Science Center
- Woods Hole Oceanographic Institution
- Wrangell Cooperative Association*
- Yakutat Tlingit Tribe*

2022 Changes to GOA ESR/ Response to SSC

"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. 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.

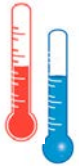
"The SSC supports a holistic review of how economic and social science information is communicated and applied to Council decision-informing analytic products…"

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

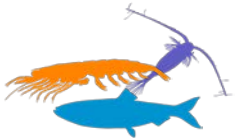
Other ESR Changes

- New: Meredith Pochardt (eulachon)
- New: Rick Thoman (long-term temperature)
- Formatting (standardized figures, report colors)
- CIE review in 2023

GOA 2022: Key Messages



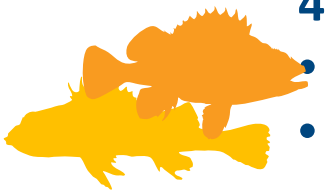
1. 3rd consecutive non-marine heatwave year*, BUT warm summer and fall surface & summer depth



2. Generally productive pelagic prey base

- Zooplankton: WGOA (below ave/average) EGOA (above average)
- Forage fish: above average

3. Marine mammals- Steller sea lions and humpback whales impacted by marine heatwaves?



4. Multi-year Trends*:*

- Shelf edge/upper slope habitat concerns
- 2023: Transitioning from marine heatwave to cooler but different community?

GOA Full Assessment Risk Tables: Environmental/ Ecosystem Considerations

Level 1

(No apparent environmental/ ecosystem concerns)

- Walleye pollock
- Pacific cod
- Sablefish (statewide)
- Flathead sole*
- Northern rockfish
- Dusky rockfish
- Demersal shelf rockfish*
- Thornyhead rockfish*
- Sharks (statewide)*

**Higher uncertainty due to less relevant ecosystem/prey data; fewer known mechanistic relationships*

2022 Gulf of Alaska

1. OCEANOGRAPHY:

3rd consecutive non-marine heatwave year, BUT warm summer and fall surface & summer depth*

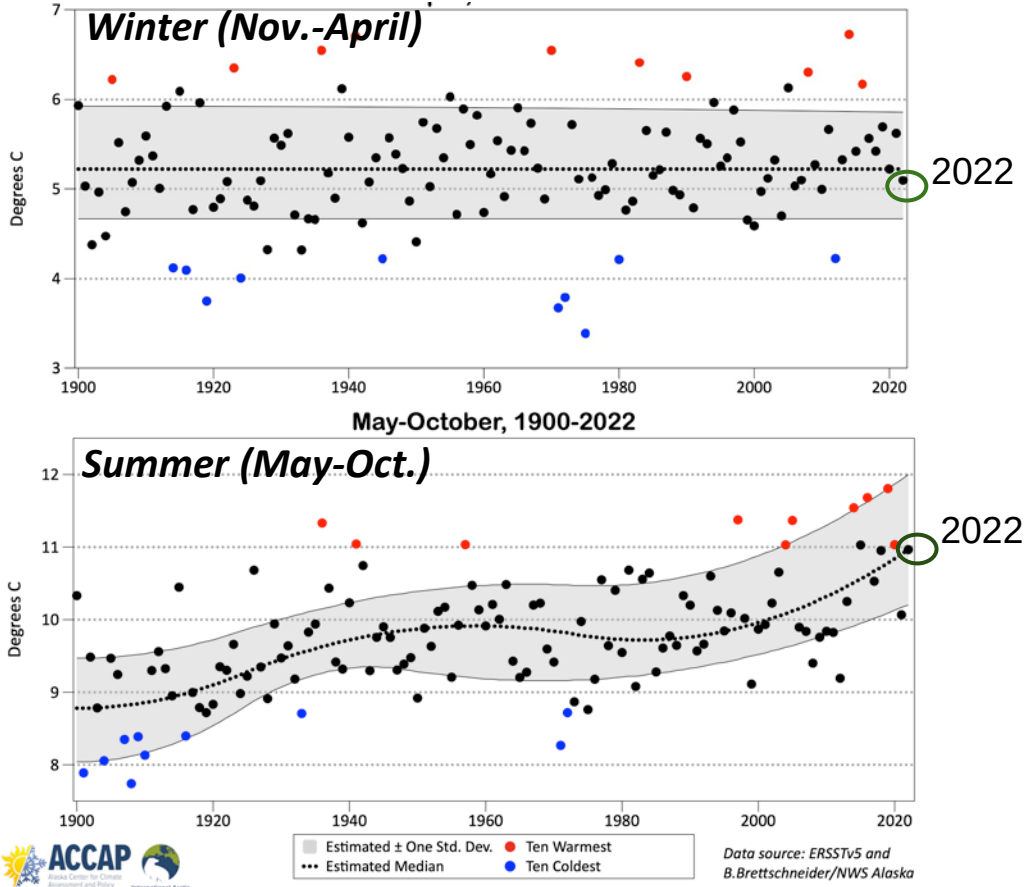
2. FORAGE CONDITIONS

3. SALMON, MARINE MAMMALS, & SEABIRDS

4. MULTI-YEAR TRENDS

Long-term GOA Sea Surface Temperature: *warming summer*

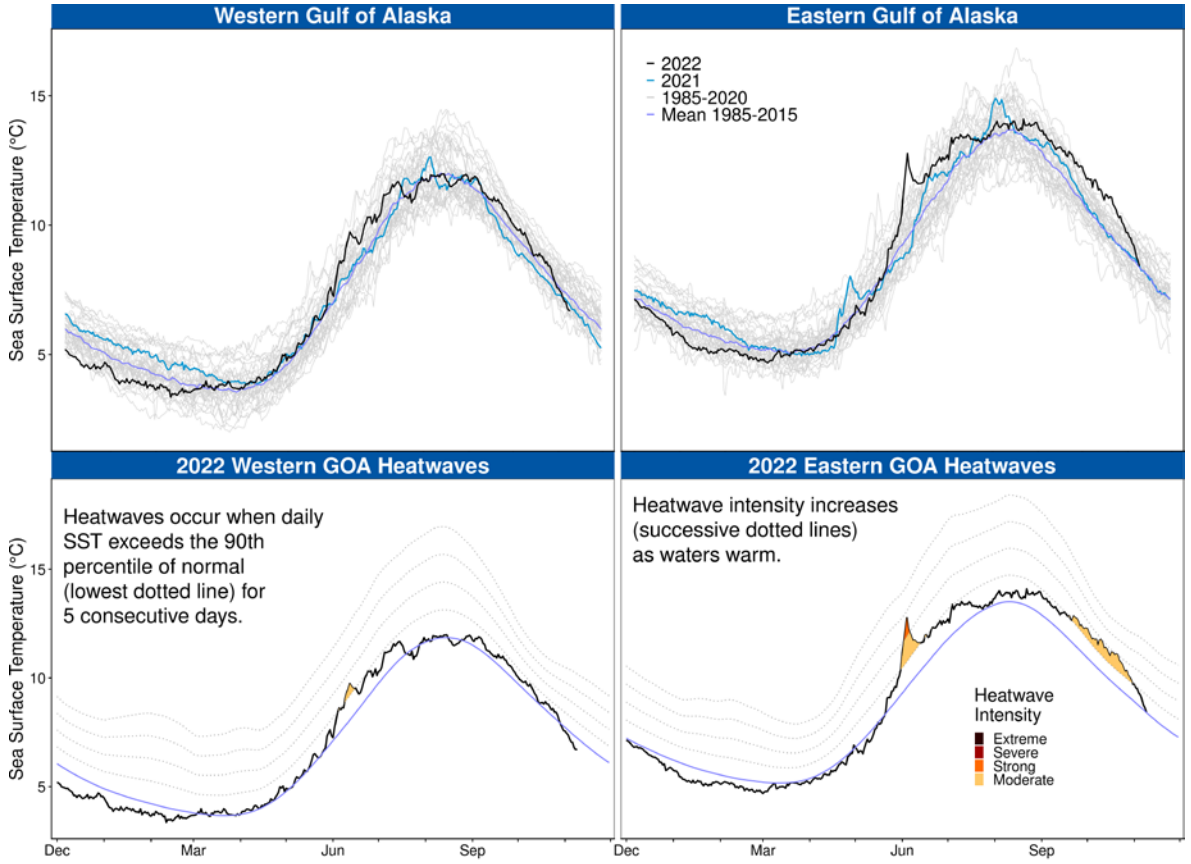
R. Thoman



- GOA shelf SST (NOAA's Extended Reconstructed SST, ERSSTv5)
- Winter (Nov.-April '21/'22) SST close to median; no long-term trend
- Summer (May-Oct. '22) approximately median SST of increasing trend over long-term
  - **Summer 2022 was 12th warmest in the time series**

GOA Surface Temperature: *cool then warm*

E. Lemagie, M. Callahan



NOAA Coral Reef Watch data, courtesy National Environmental Satellite, Data, and Information Service (Updated: 11-09-2022)
Data are modeled satellite products and periodic discrepancies or gaps may exist across sensors and products.
Contact: matt.callahan@noaa.gov

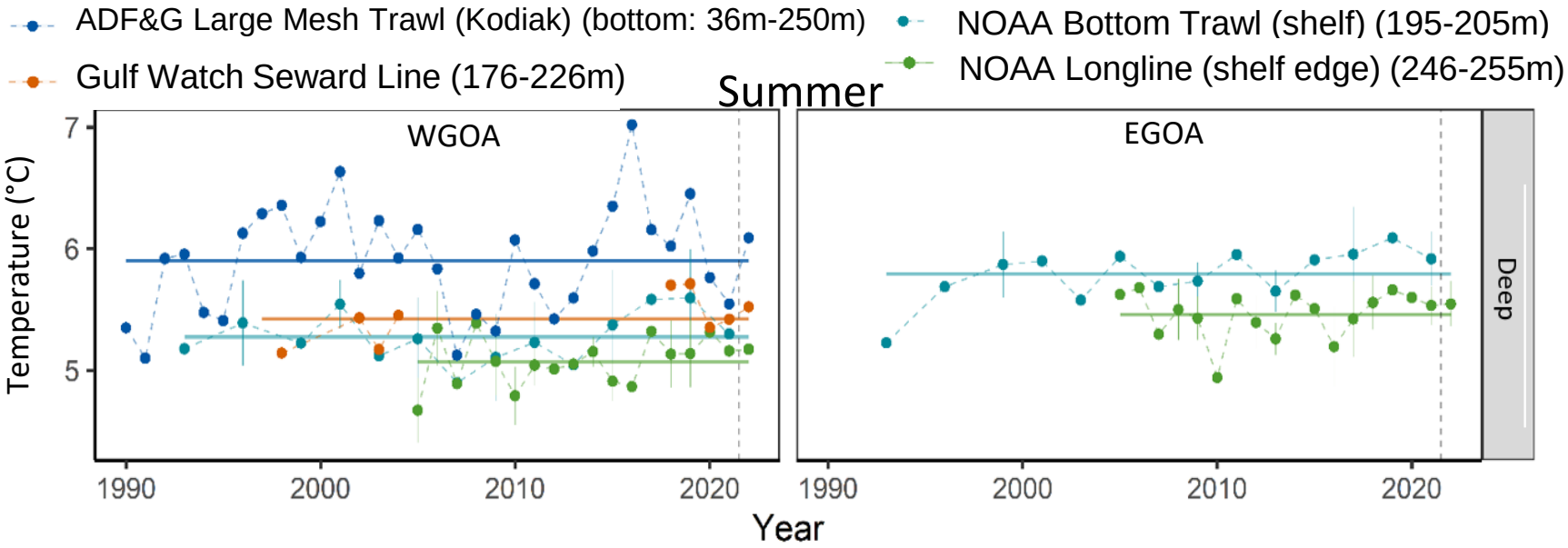
- Winter and early spring cooler than average (1985-2014): *moderate conditions for shelf spawning & spring larval conditions (P. cod, walleye pollock, N. rock sole)*
- Summer and Fall warmer than average: *warm surface may impact growth/winter survival of age-0*

Temperature at Depth: *warm in the summer*

K. Siwicke, N. Laman, S. Danielson, C. Worton

- Summer temperatures a depth were above survey-specific averages

- Summer temperatures at shelf edge (246-255m) above average since 2017 (WGOA)/ 2018 (EGOA) (green time series)



https://gulfwatchalaska.org/monitoring/pelagic-ecosystem/forage-fish-2/

2022 Gulf of Alaska

1. OCEANOGRAPHY:
3rd consecutive non-marine heatwave year, BUT warm summer and fall surface & summer depth*

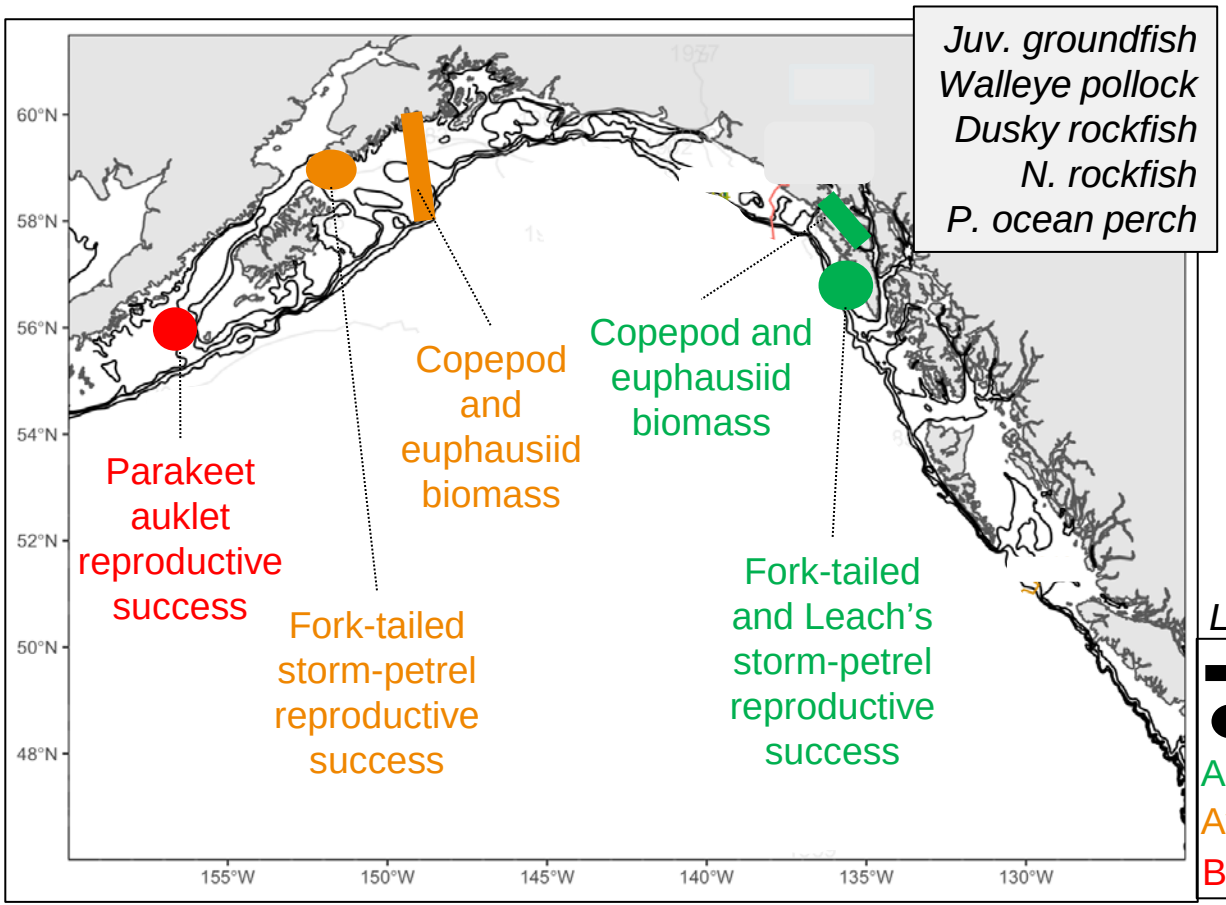
2. FORAGE CONDITIONS:
Generally productive pelagic prey base

3. SALMON, MARINE MAMMALS, & SEABIRDS

4. MULTI-YEAR TRENDS

Zooplanton Prey Base: *below to above average*

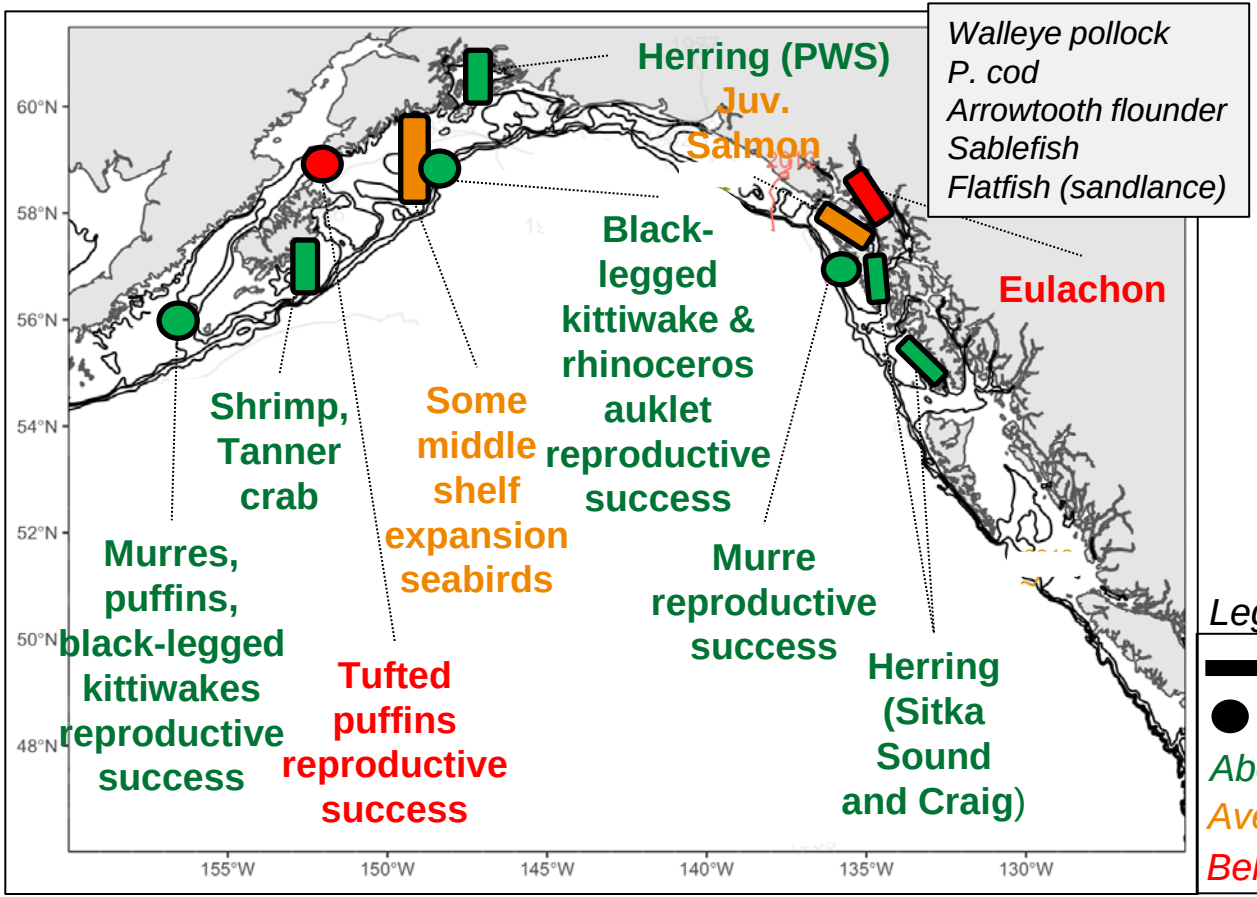
R. Hopcroft, E. Fergusson, B. Drummond



- Zooplankton surveys & Planktivorous seabird reproductive success
- WGOA below average to average (similar to 2021)
- EGOA above average

Forage Fish Prey Base: *above average*

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



- Forage surveys & Piscivorous seabird reproductive success
- Generally above average across GOA (with exceptions)

Legend

Surveys

Seabird survey (Islands)

Above Average

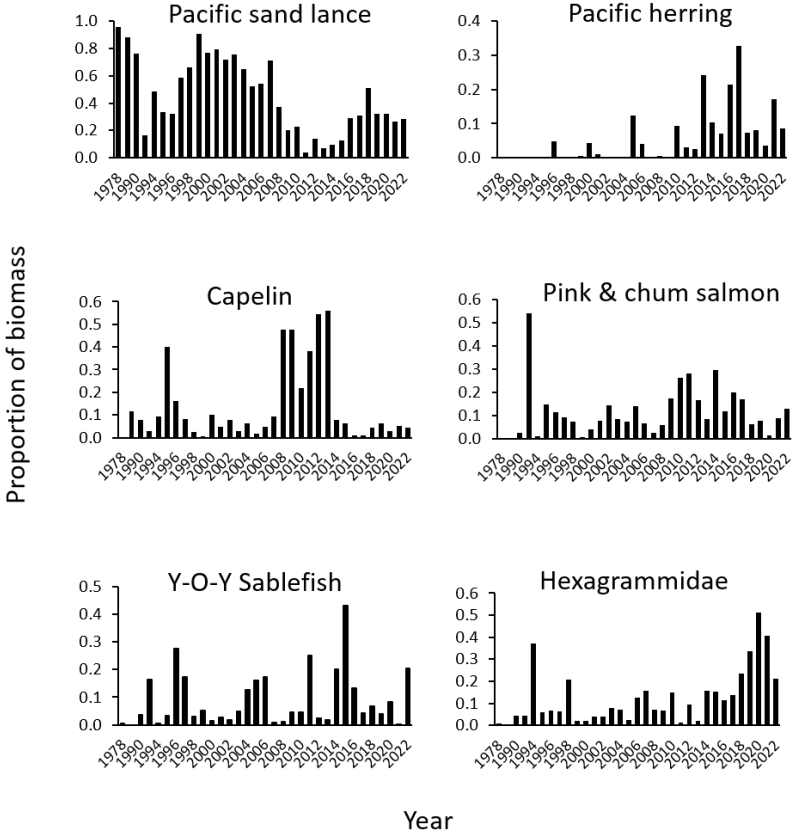
Average

Below Average

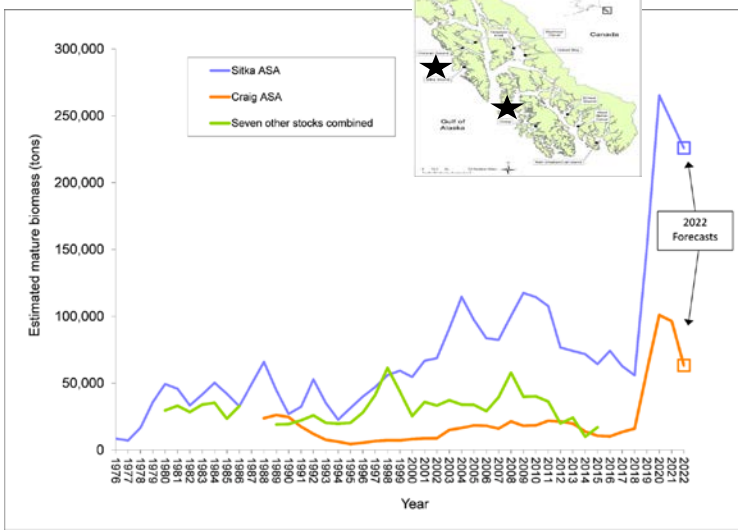
Forage Fish Community

S. Hatch, K. Hebert, S. Pegau

Prey species in rhinoceros auklet chick diets (Middleton Island; CGOA near edge of shelf)



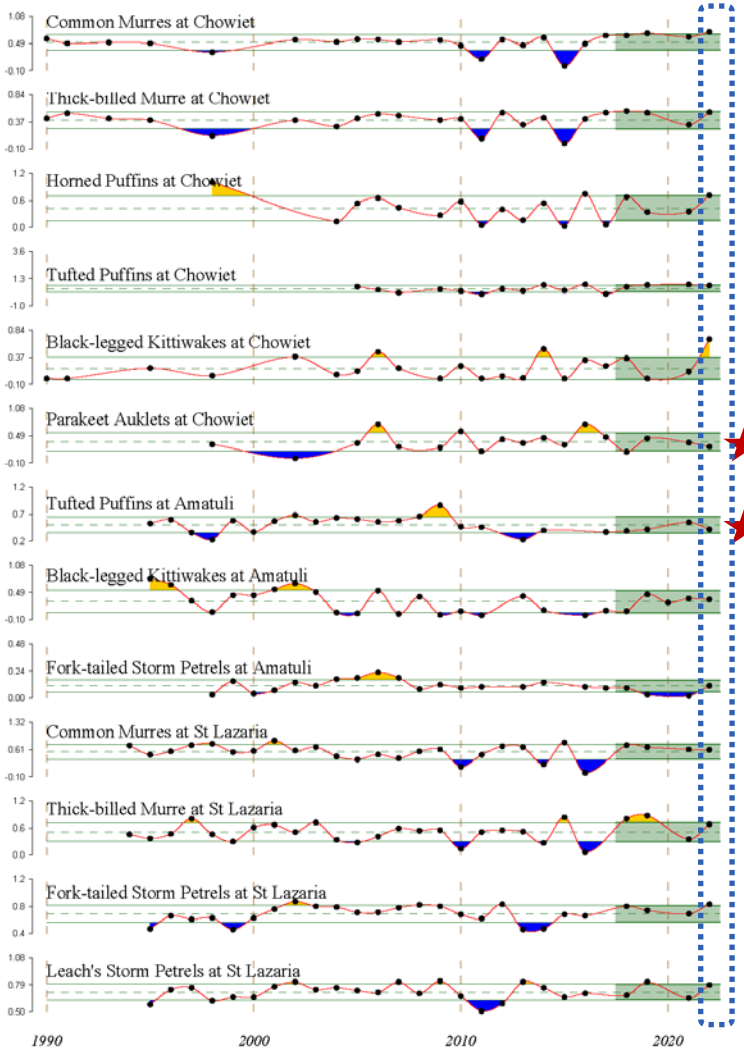
- Herring still elevated (SEAK, PWS) (2016 year class plus potential younger cohorts)
- Capelin still reduced
- Sand lance moderate?
- Age-0 sablefish
- Kelp greenling (hexagrammidae)



SEAK herring surveys (Sitka Sound and Craig)

Seabird Reproductive Success: *available prey*

B. Drummund



- Planktivorous & piscivorous seabirds above-average reproductive success (increases from 2021)
- 2 exceptions (★): parakeet auklet at Semidi Isl. (zooplankton, diving), and tufted puffin at E. Amatuli Isl. (fish, diving)
- Generally early breeding timing
- **Indicates available and nutritious pelagic prey (zooplankton and forage fish) for shelf groundfish**

2022 Gulf of Alaska

1. OCEANOGRAPHY:
3rd consecutive non-marine heatwave year, BUT warm summer and fall surface & summer depth*

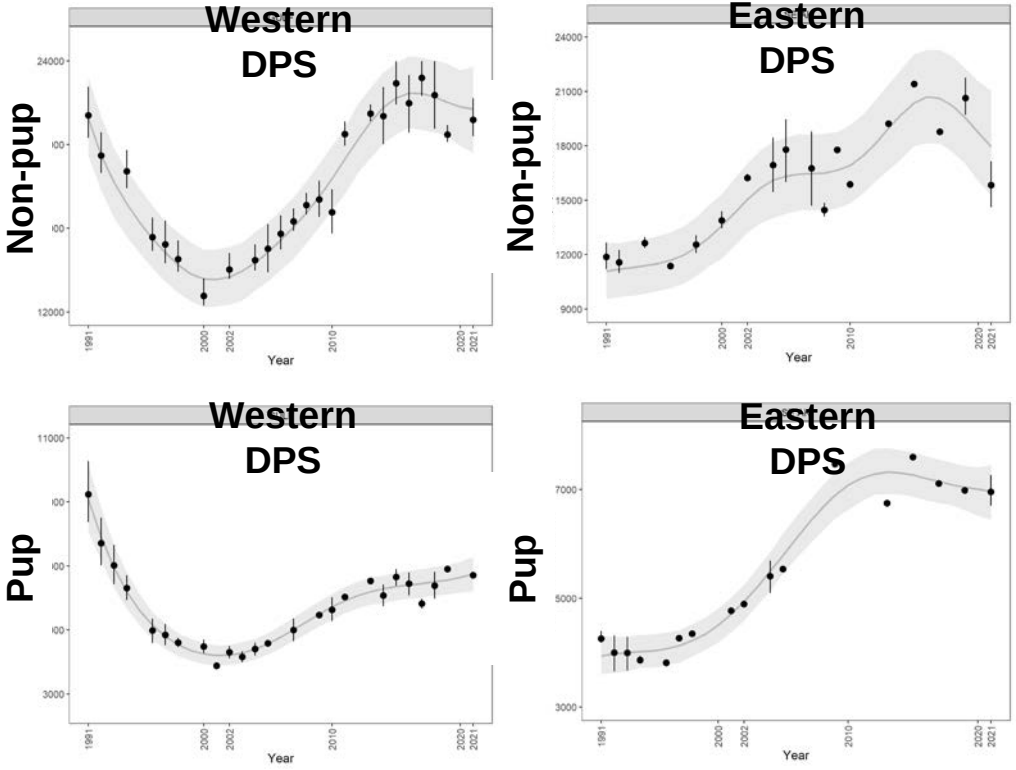
2. FORAGE CONDITIONS:
Generally productive pelagic prey base

3. SALMON, MARINE MAMMALS, & SEABIRDS:
Steller sea lions and humpback whales still impacted by marine heatwaves?

4. MULTI-YEAR TRENDS

Steller Sea Lions (2021): *declining/plateauing*

K. Sweeney, Skipper Science Partnership

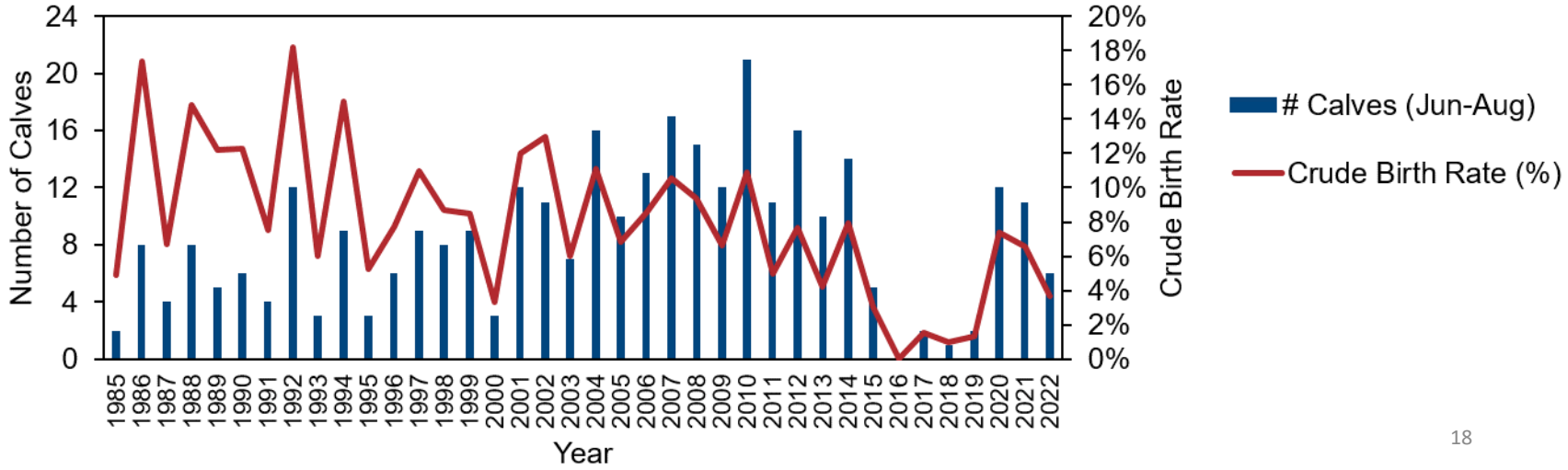


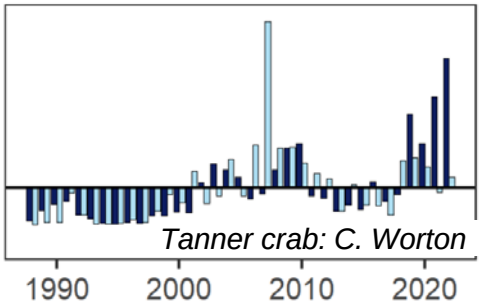
- WGOA/EGOA: increasing since 2000 then decline/plateau since 2017
- Prey availability (P. cod, walleye pollock)? EGOA adult movement
- 2022 (Skipper Science) -More and increasing numbers of Steller sea lions than expected; “More fish with ‘shark bites’ on salmon” - (these were Steller sea lion or seal bites) - observations reported from WGOA, SEAK

Glacier Bay/ Icy Strait Humpback Whales: *lower # calves*

C. Gabriele

- Reduced # calves in 2022 after increases in ‘20/’21
- Forage conditions in 2020/2021?
- Missing cohort of reproductive females (mortality as juveniles in 2014-2016)
- Prince William Sound humpback sightings have not returned to pre-2014 levels





2022 Gulf of Alaska

1. OCEANOGRAPHY:

3rd consecutive non-marine heatwave year, BUT warm summer and fall surface & summer depth*

2. FORAGE CONDITIONS:

Generally productive pelagic prey base

3. SALMON, MARINE MAMMALS, & SEABIRDS:

Steller sea lions and humpback whales still impacted by marine heatwaves?

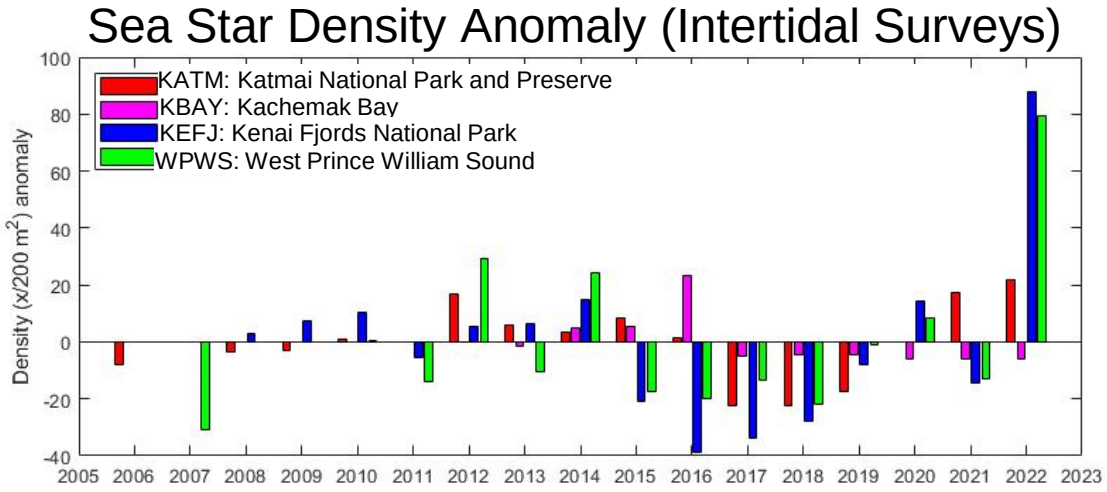
4. MULTI-YEAR TRENDS

Shelf edge/upper slope habitat concerns

2023: Transitioning from marine heatwave to cooler but different community?

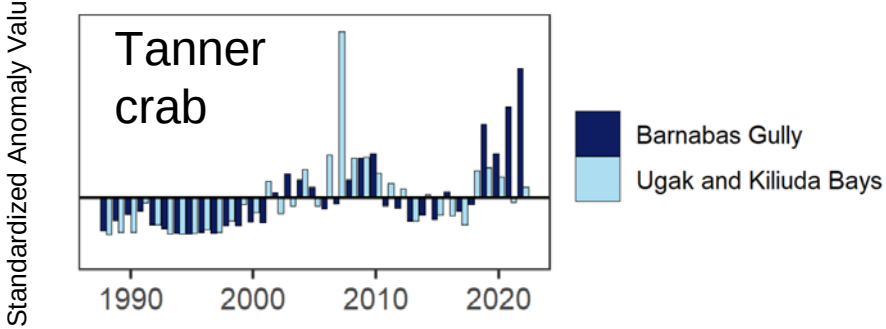
Sea Stars: *recovering from sea star wasting disease*

H. Coletti, C. Worton



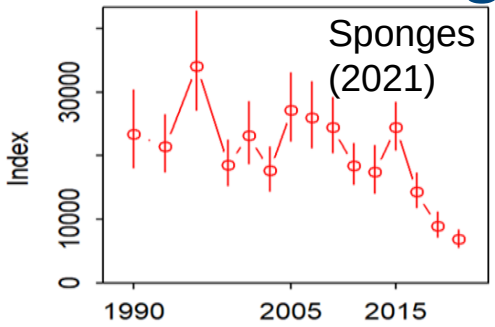
- Sea stars recovering from sea star wasting disease/marine heatwave
- Also increased sea star CPUE in ADF&G large mesh trawl (Kodiak)

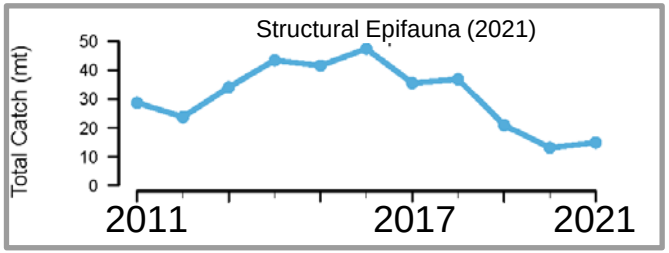
Tanner crab (Kodiak): *cont. increase* C. Worton



- Tanner crab continued increasing trend (ADF&G Survey Barnabas Gully off Kodiak)
- Predator (groundfish) release?

Shelf Edge/ Upper Slope Conditions: *habitat concerns*

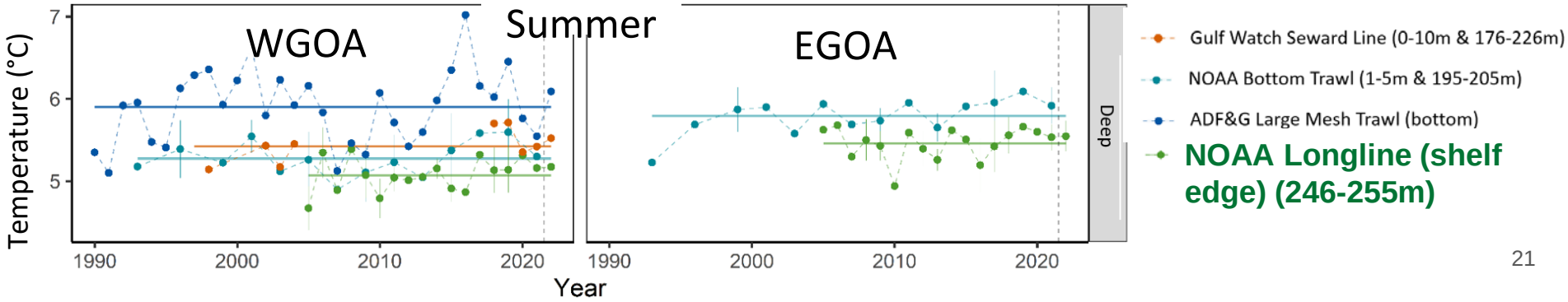




K. Siwicke, G. Whitehouse, Others

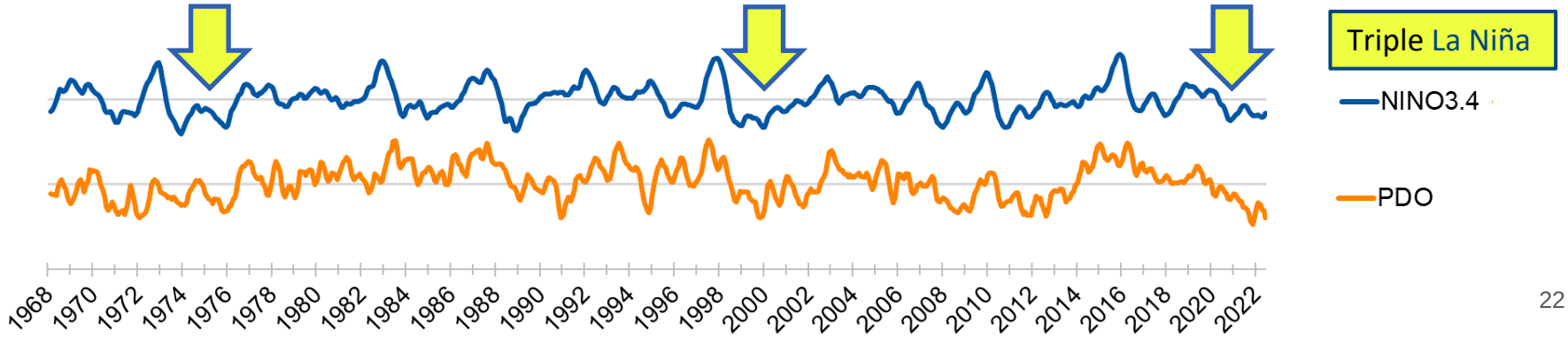
Sablefish, rockfish (e.g., shortraker rockfish, rougheye/blackspotted rockfish, thornyhead rockfish, Pacific ocean perch), and flatfish (deepwater flatfish complex, including Dover sole)

- Structural epifauna (e.g., sponges) declining; important rockfish habitat
- Summer temperature (250m) on shelf edge above average since 2017 (WGOA)/ 2018 (EGOA)

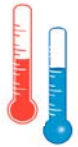


Where are we headed (2023 +)?

- Predicted third **La Niña** winter in a row, previous in 1973-76, 1998-2001; **PDO** continues negative (N. Bond)
- Dec-May 2023 GOA SST coastal waters predicted to be cooler than average (National Multi-Model Ensemble) (N. Bond)
- GOA transitioning from marine heatwave community to (different) cooler community? (sablefish & P. Ocean perch ⇧; arrowtooth flounder, P. cod ⇩)

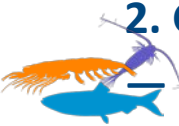


GOA 2022: Key Messages



1. 3rd consecutive non-marine heatwave year*, BUT some warmth

- Winter/spring: *moderate conditions for shelf spawning & spring larval conditions (P. cod, walleye pollock, N. rock sole)*
- Summer (SST&depth)/fall (SST) : *SST may impact growth/winter survival of age-0*



2. Generally productive pelagic prey base (zooplankton, forage fish, shrimp, tanner crab) — *Productive pelagic shelf system for piscivorous and planktivorous groundfish but data gap for prey of adult demersal/benthic rockfish and flatfish (e.g., thornyhead, FH sole)*

3. Marine mammals- still impacted by marine heatwaves? — *Steller sea lions reduced populations and humpback whales reduced calves*

4. Multi-year Trends*:*

- Shelf edge/upper slope habitat concerns — *Temperature, structural epifauna*
- 2023: Transitioning from marine heatwave to cooler but different community?