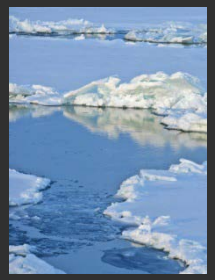
Ecosystem Considerations

for the *Eastern Bering Sea and Aleutian Islands*





North Pacific Fisheries Management Council

Groundfish Plan Team meeting

November 18, 2014

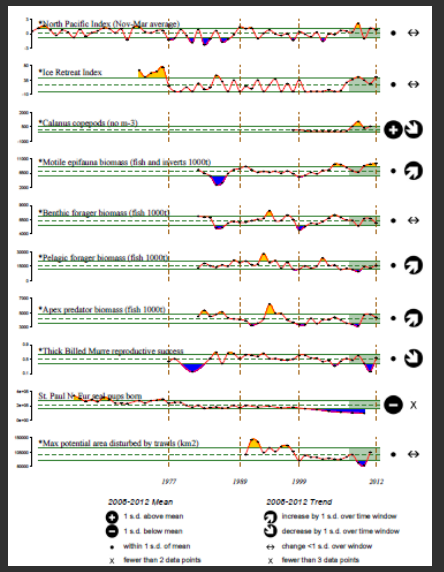
Ecosystem Considerations Report

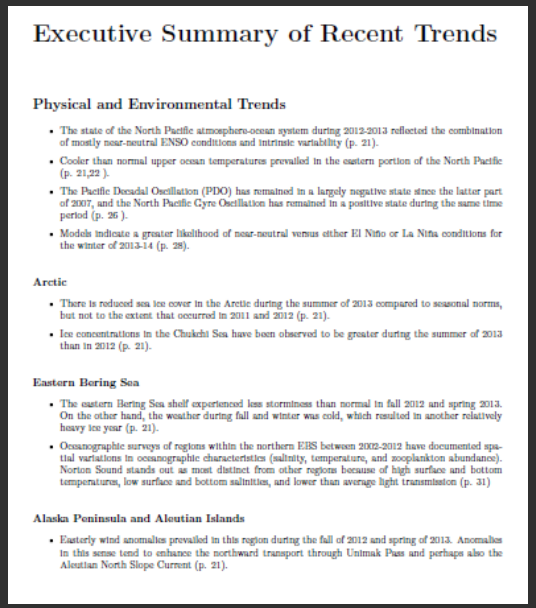
Major Sections

- Report Cards
  - EBS, AI
- Ecosystem Assessment
  - EBS, AI
- Ecosystem Status and Management Indicators
  - 50 (6 new)

Eastern Bering Sea 2014 Report Card

- The North Pacific atmosphere-ocean system during 2013-2014 featured the development of strongly positive SST anomalies south of Alaska. This warming was caused by unusually quiet weather conditions during the winter of 2013-14 in association with a weak Aleutian low (positive NPI), and abnormally high SLP off the coast of the Pacific Northwest.
- The eastern Bering Sea experienced warmer air temperatures and less sea ice that were related to the broader North Pacific conditions. Dates of sea ice retreat, summer surface and bottom temperatures, and the extent of the cold pool were similar to those of the warm years of 2003-2005.
- The summer acoustically-determined time series of euphausiids continues to decrease from its peak in 2009. This suggests that prey availability for planktivorous fish, seabirds, and mammals was low in 2014.
- Survey biomass of motile epifauna has been above its long-term mean since 2010, although the trend has stabilized. However, the trend of the last 30 years shows a decrease in crustaceans (especially commercial crabs) and a long-term increase in echinoderms, including brittle stars, sea stars, and sea urchins. It is not know the extent to which this reflects changes in survey methodology rather than actual trends.
- Survey biomass of benthic foragers has remained stable since 1982, with interannual variability driven by short-term fluctuations in yellowfin and rock sole abundance.
- Survey biomass of pelagic foragers has increased steadily since 2009 and is currently above its 30-year mean. While this is primarily driven by the increase in walleye pollock from its historical low in the survey in 2009, it is also a result of increases in capelin from 2009-2013, perhaps due to cold conditions prevalent in recent years.
- Fish apex predator survey biomass is currently above its 30-year mean, although the increasing trend seen in recent years has leveled off. The increase since 2009 back towards the mean is driven primarily by the increase in Pacific cod from low levels in the early 2000s. Arrowtooth flounder, while still above its long-term mean, has declined nearly 50% in the survey from early 2000s highs, although this may be due to a distributional shift in response to colder water over the last few years, rather than a population decline.
- The multivariate seabird breeding index is above the long term mean, indicating that seabirds bred earlier and more successfully in 2014. This suggests that foraging conditions were favorable for piscivorous seabirds.
- Northern fur seal pup production for St. Paul Island remained low in 2014, with fewer pups produced than the last survey in 2012.





Executive Summary of Recent Trends

Physical and Environmental Trends

- The state of the North Pacific atmosphere-ocean system during 2012-2013 reflected the combination of mostly near-neutral ENSO conditions and intrinsic variability (p. 21).
- Cooler than normal upper ocean temperatures prevailed in the eastern portion of the North Pacific (p. 21,22).
- The Pacific Decadal Oscillation (PDO) has remained in a largely negative state since the latter part of 2007, and the North Pacific Gyre Oscillation has remained in a positive state during the same time period (p. 26).
- Models indicate a greater likelihood of near-neutral versus either El Niño or La Niña conditions for the winter of 2013-14 (p. 28).

Arctic

- There is reduced sea ice cover in the Arctic during the summer of 2013 compared to seasonal norms, but not to the extent that occurred in 2011 and 2012 (p. 21).
- Ice concentrations in the Chukchi Sea have been observed to be greater during the summer of 2013 than in 2012 (p. 21).

Eastern Bering Sea

- The eastern Bering Sea shelf experienced less storminess than normal in fall 2012 and spring 2013. On the other hand, the weather during fall and winter was cold, which resulted in another relatively heavy ice year (p. 21).
- Oceanographic surveys of regions within the northern EBS between 2002-2012 have documented spatial variations in oceanographic characteristics (salinity, temperature, and zooplankton abundance). Norton Sound stands out as most distinct from other regions because of high surface and bottom temperatures, low surface and bottom salinities, and lower than average light transmission (p. 31)

Alaska Peninsula and Aleutian Islands

- Easterly wind anomalies prevailed in this region during the fall of 2012 and spring of 2013. Anomalies in this sense tend to enhance the northward transport through Unimak Pass and perhaps also the Aleutian North Slope Current (p. 21).

Outline

- Eastern Bering Sea
  - Past: Assessment
  - Present: Report Card, ecosystem trends
  - Future: preliminary 9 month forecast
- Aleutian Islands
  - Water temperatures
  - Report card
  - Assessment
  - Ecosystem trends

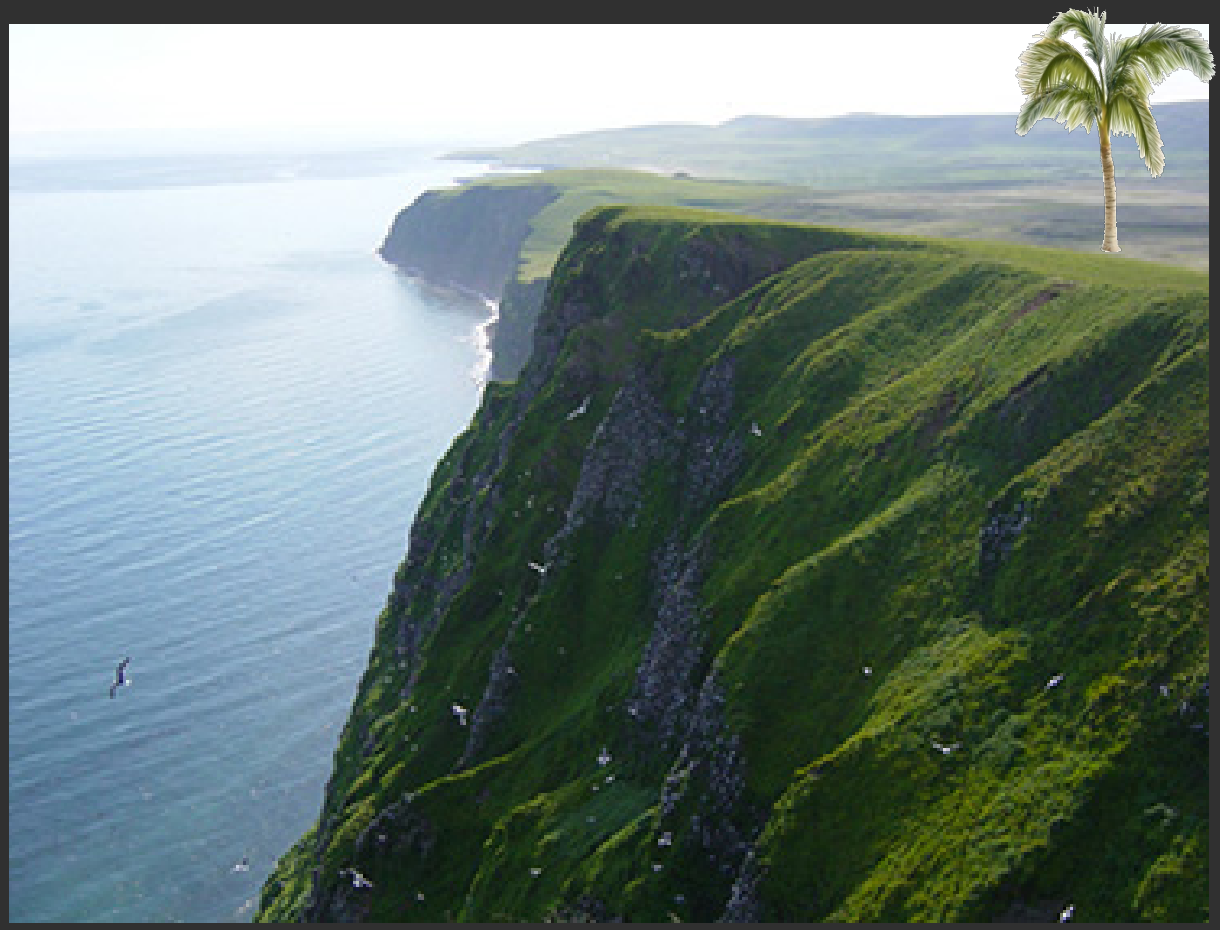

Eastern Bering Sea

EBS Assessment

- Recap of 2013 ecosystem state – complete
  - Overall a mixed signal in 2013. Some indicators suggesting increased productivity, some low.
  - Environment remained cold, similar to 2007
  - Jellyfish abundant
  - Groundfish length-weight residuals positive, indicating foraging conditions and ecosystem productivity positive for groundfish
  - Below median recruitment of age-1 pollock, influenced by extreme cold of 2012
  - Coho and some chum runs were above average; chinook and sockeye below
  - Seabirds breed earlier, but kittiwakes did poorly reproductively

EBS Assessment

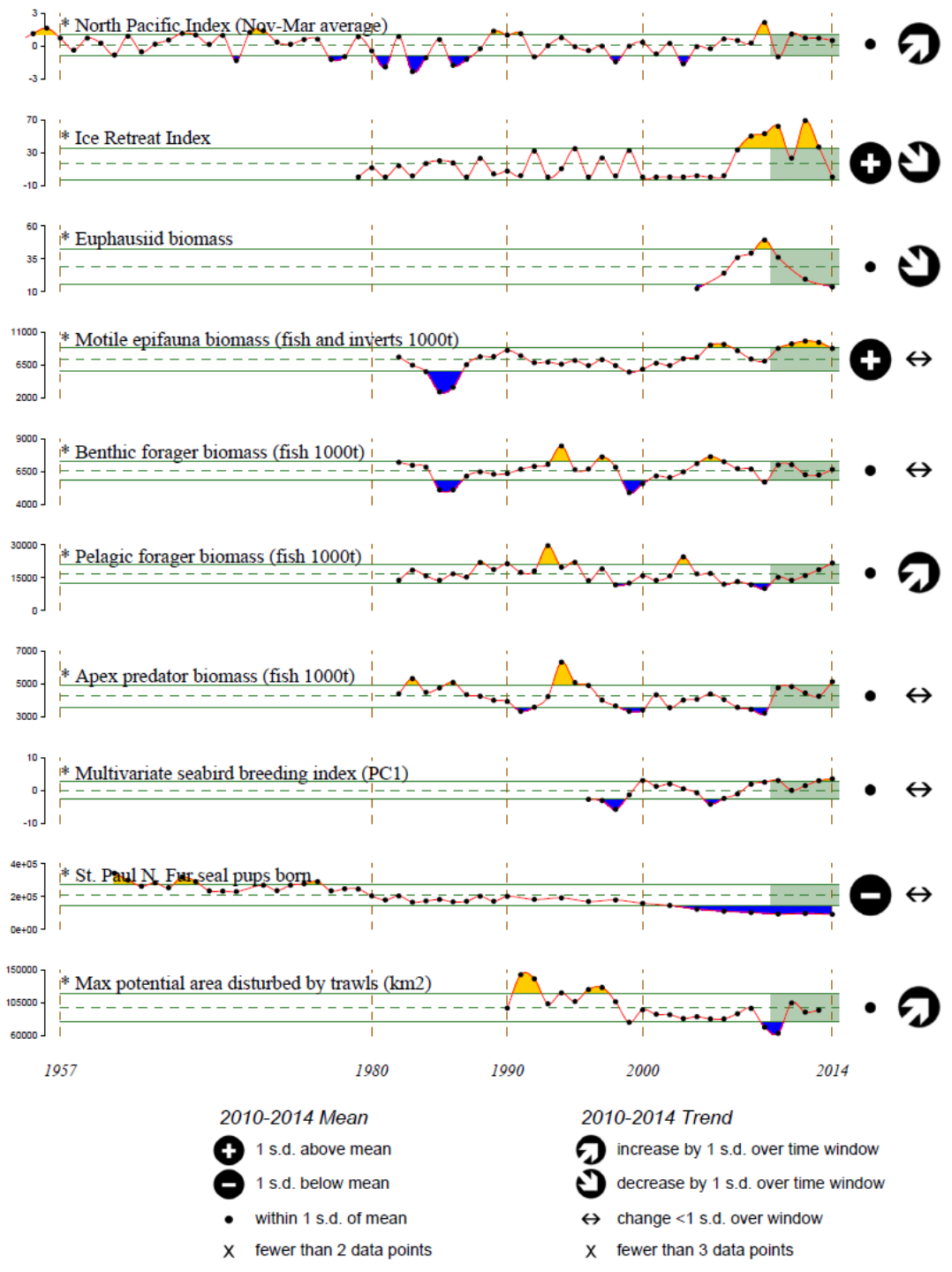
- Current conditions
  - *WARM, and different. Overall high productivity. Similar to burst of productivity after multiple cold years in 2003?*



2014 Report Card

1. North Pacific Index
2. *Eastern Bering Sea ice retreat **
3. *Euphausiid density **
4. Motile epifauna aggregate biomass
5. Benthic foragers aggregate biomass
6. Pelagic foragers aggregate biomass
7. Fish apex predators aggregate biomass
8. *Multivariate seabird breeding index **
9. St. Paul Island fur seal pup production
10. Maximum potential trawl area disturbed

All time series updated



Eastern Bering Sea 2014 Report Card

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- The **eastern Bering Sea experienced warmer air temperatures and less sea ice** that were related to the broader North Pacific conditions. Dates of sea ice retreat, summer surface and bottom temperatures, and the extent of the cold pool were **similar to those of the warm years of 2003-2005**.
- The summer **acoustically-determined time series of euphausiids continues to decrease** from its peak in 2009. This suggests that prey availability for planktivorous fish, seabirds, and mammals was low in 2014.
- **Survey biomass of motile epifauna** has been **above its long-term mean** since 2010, although the trend has stabilized. However, the trend of the last 30 years shows a **decrease in crustaceans** (especially commercial crabs) and a **long-term increase in echinoderms**, including brittle stars, sea stars, and sea urchins. It is not know the extent to which this reflects changes in survey methodology rather than actual trends.
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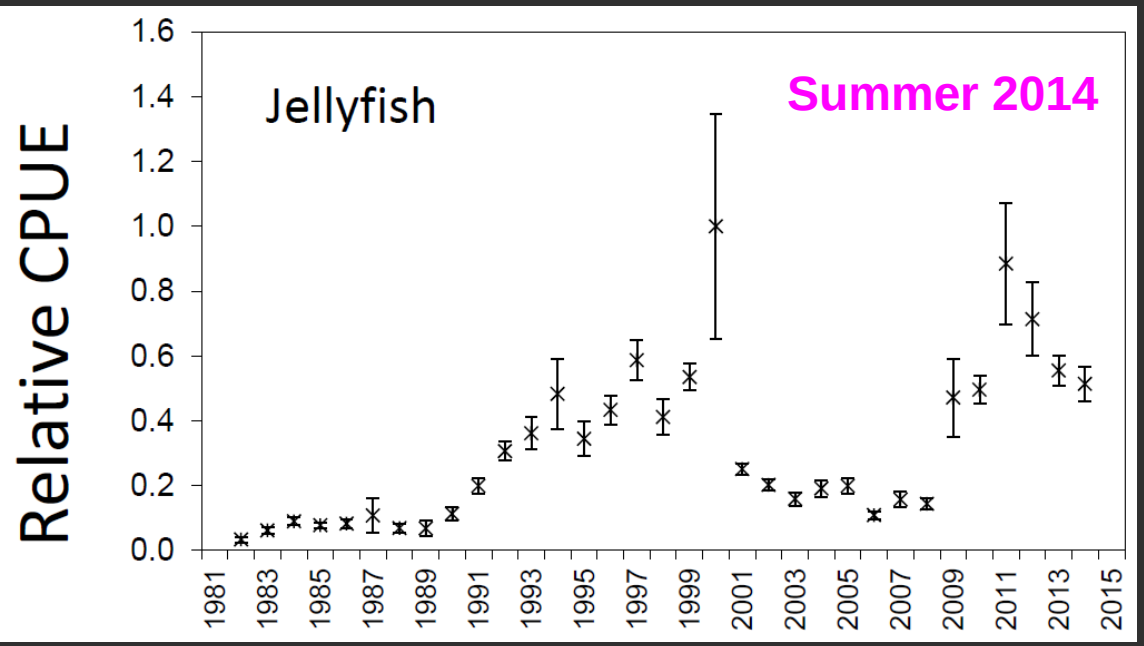
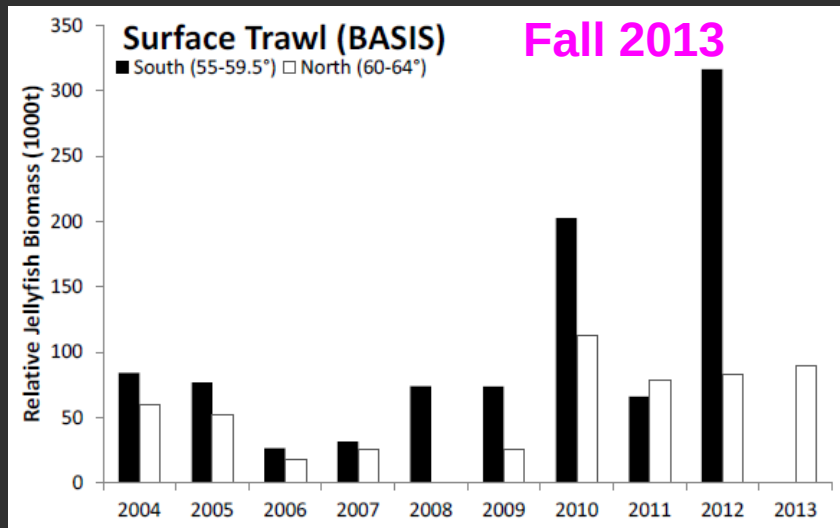
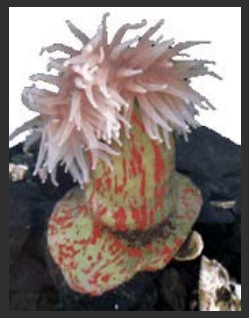
Jellyfish (Lauth and Hoff; Cieciel)

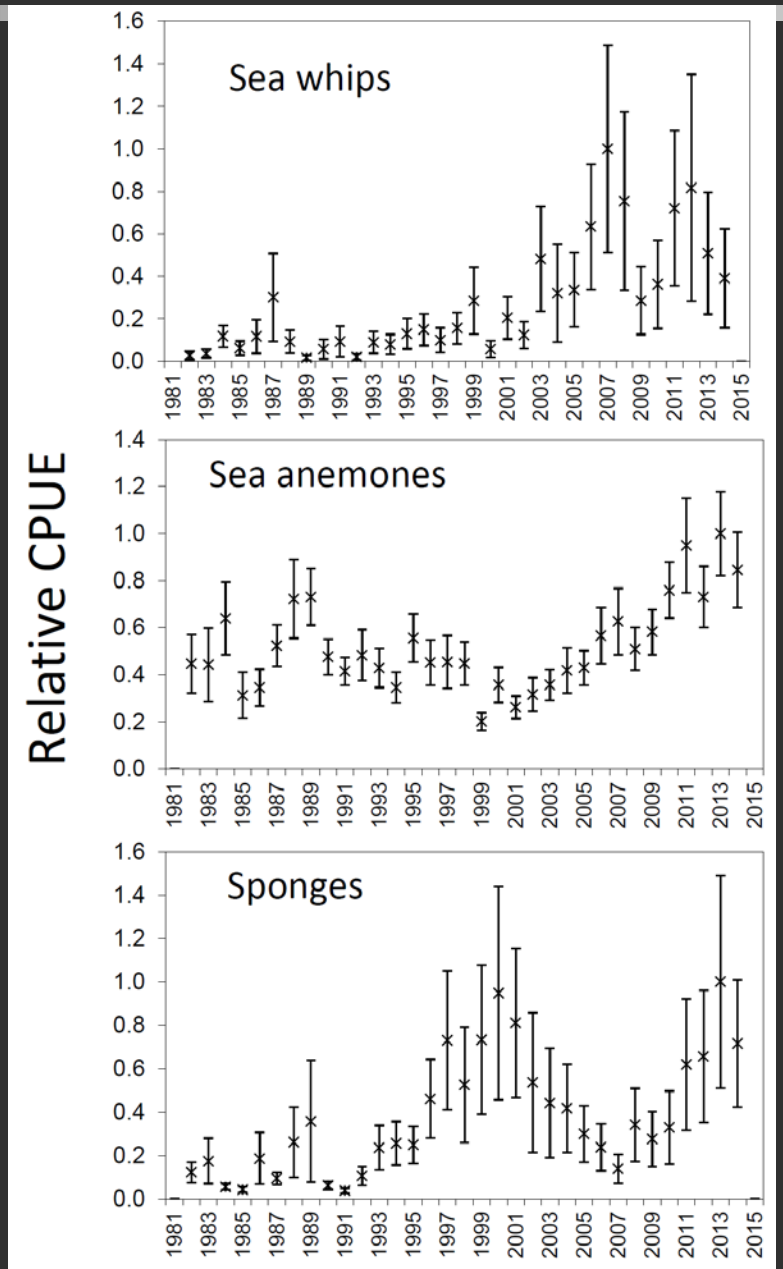


- Summer 2014 down slightly, but still high
- Jellyfish biomass influences: Ice cover, spring/summer SST, wind mixing
- Large blooms can have predatory impact on juvenile and forage fishes



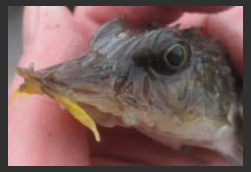
2014 Structural epifauna (HAPC biota) – survey (Lauth and Hoff)

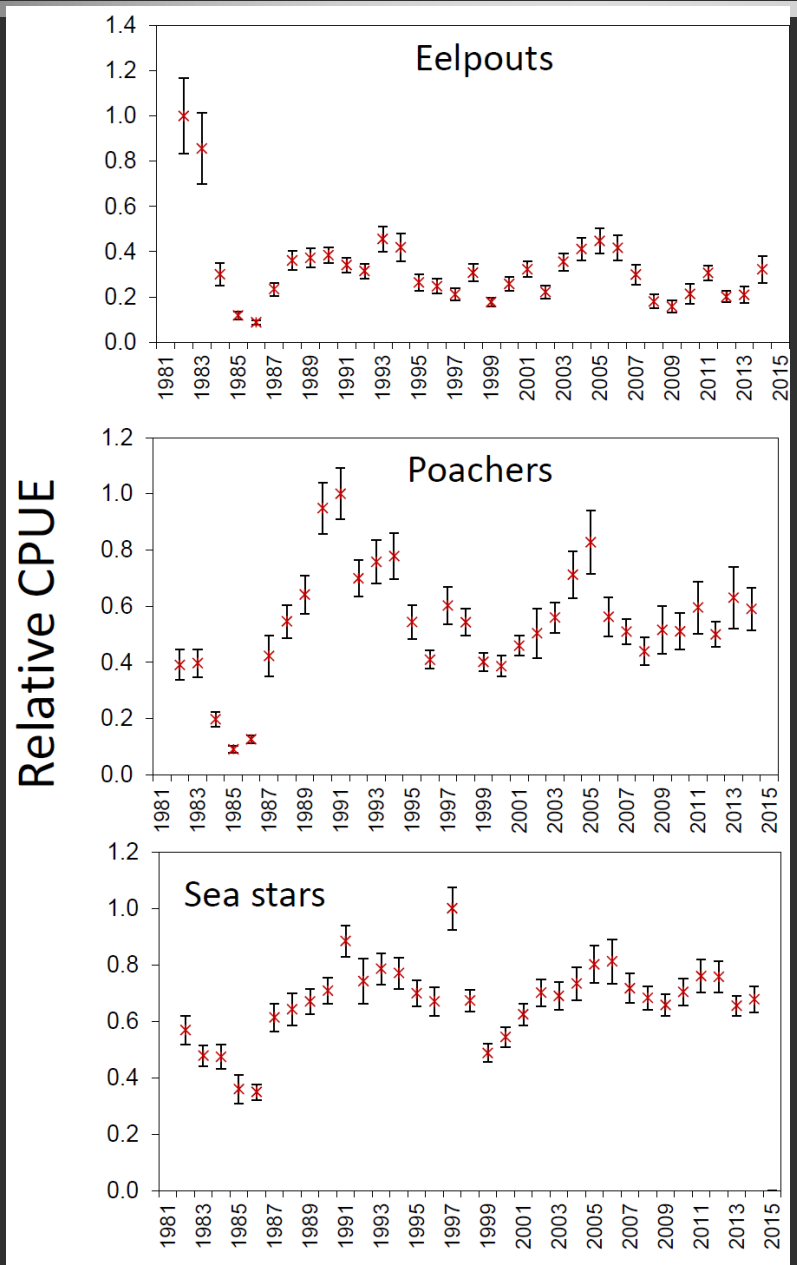




- Difficult to detect trends due to taxonomic uncertainty within groups
- May represent changes in habitat or variable field ID
- Sponges correlated with jellyfish?

2014 Miscellaneous species – EBS survey (Lauth and Hoff)

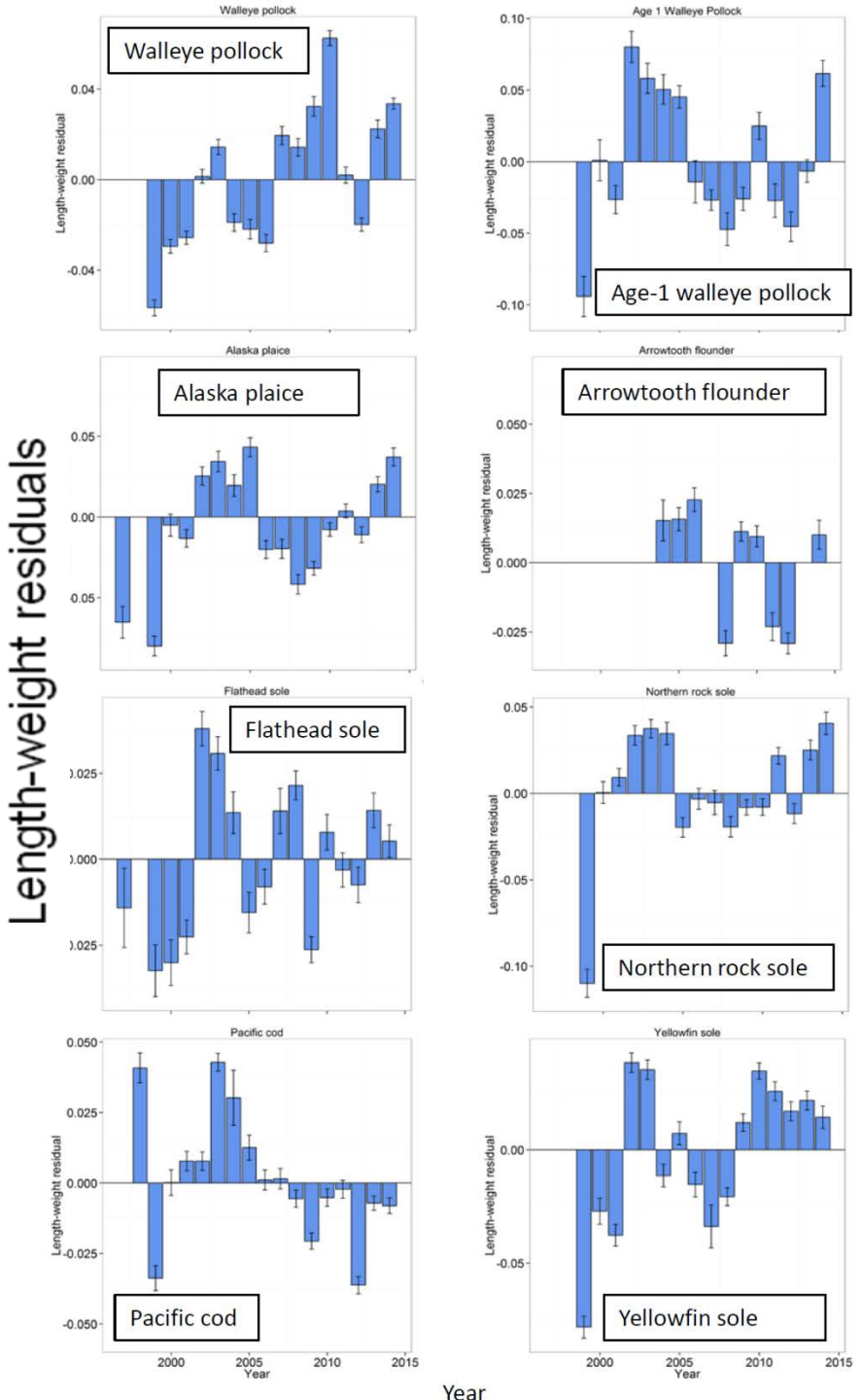




- Increase in eelpouts?
- Trends are similar among groups
- Unknown whether trends reflect response to environment or sampling artifact

2014 Groundfish Condition

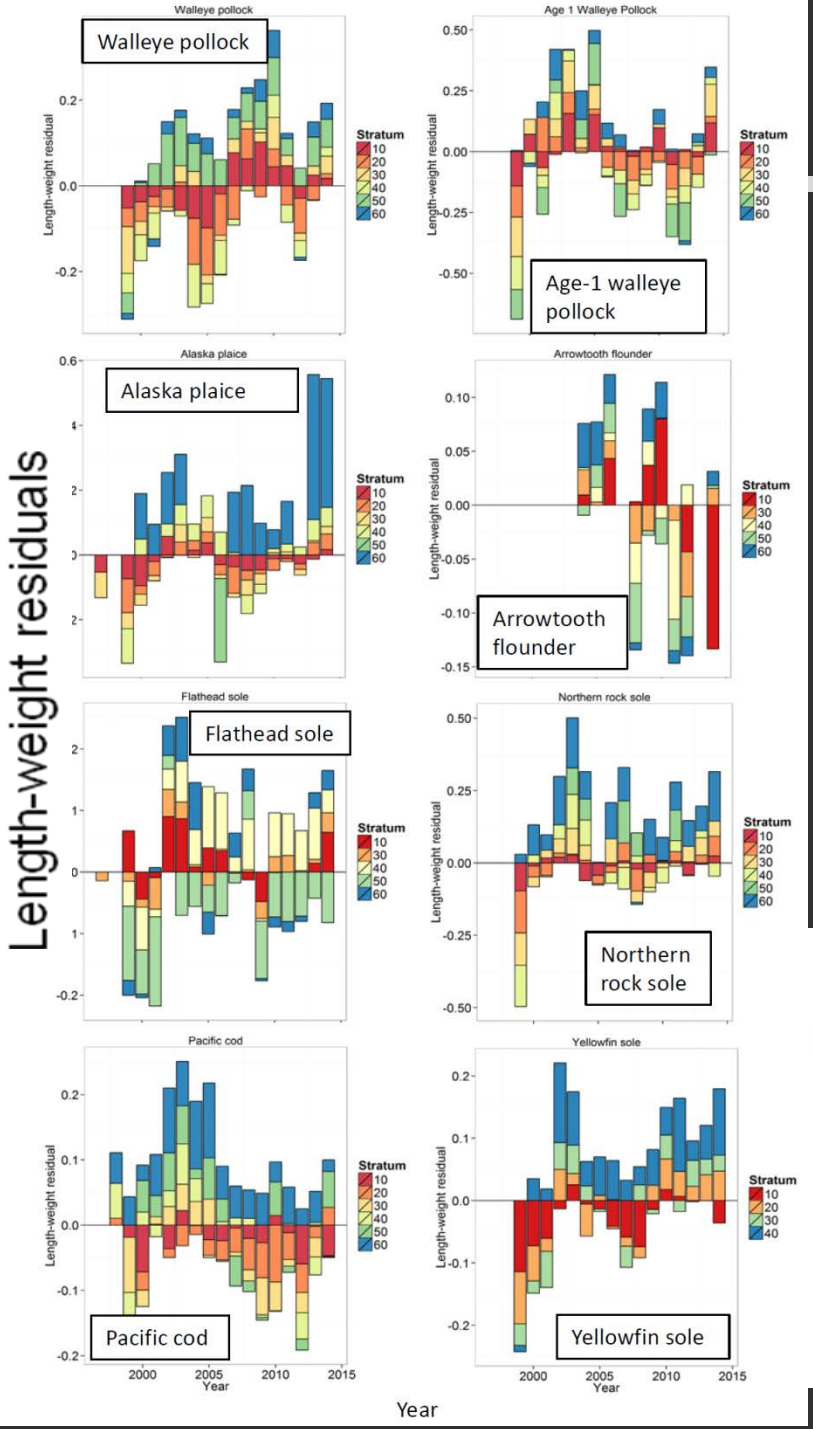
(Boldt, Rooper et al)



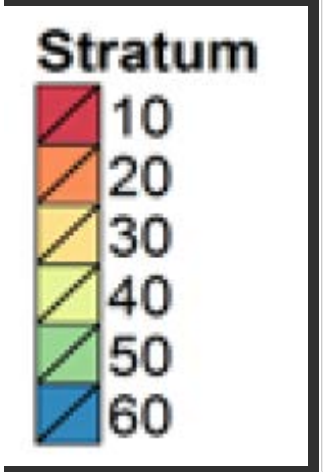
- Length-weight residuals from survey
- Negative trend in cod since 2003
- Residuals positive for all but cod in 2014
- Age-1 and age-2+ pollock not well correlated

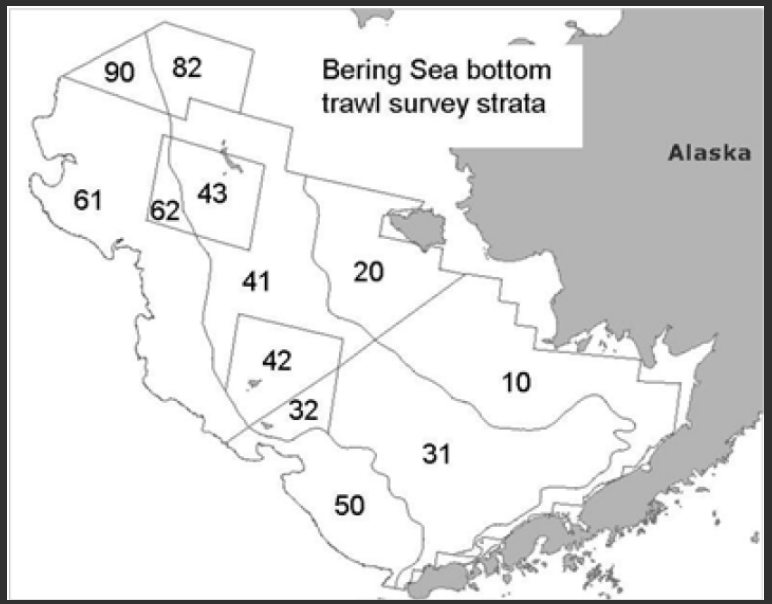
2014 Groundfish Condition

(Boldt et al)

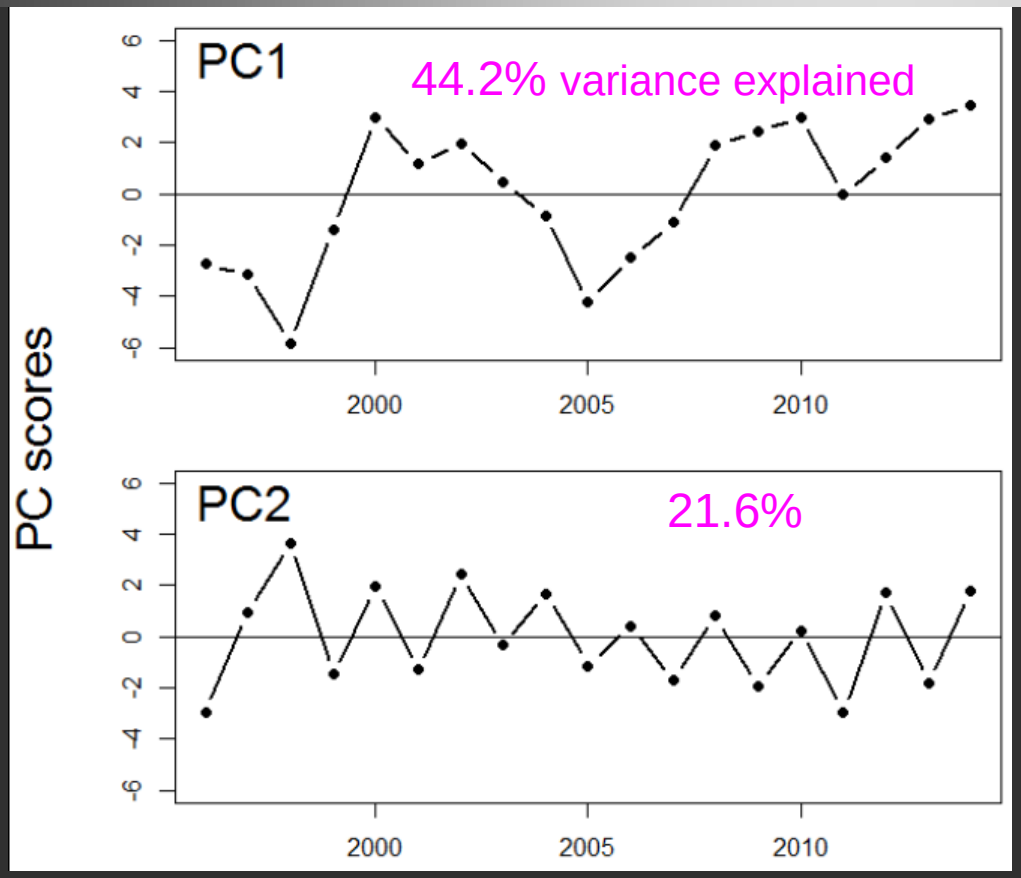


- Almost always positive on outer, especially northern outer, shelf
- Gadids tend to be negative on inner shelf
- Influential factors: temperature, survey timing, fish migration.





2014 Multivariate Pribilof Seabird Indices (Zador)



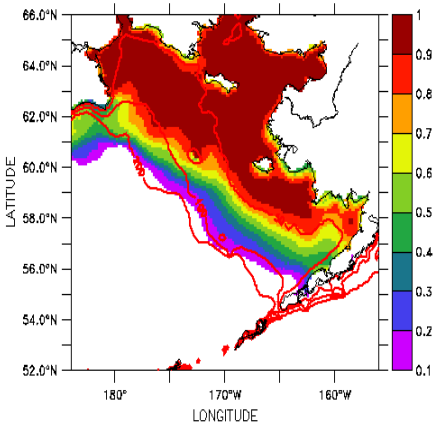
Higher murre and cormorant productivity. Earlier seabird hatch dates

Higher kittiwake productivity

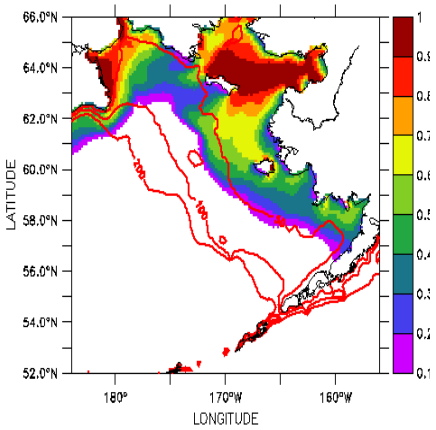
- 17 seabird reproductive effort datasets. St George thick-billed murre not correlated with either trend
- PC2 negatively correlated with Kamchatka pinks (p = 0.003)

Preliminary 9 month forecast

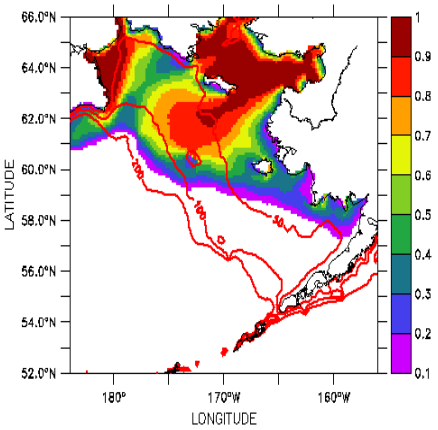
Nine-month forecast of Bering Ocean conditions – ROMS FEAST



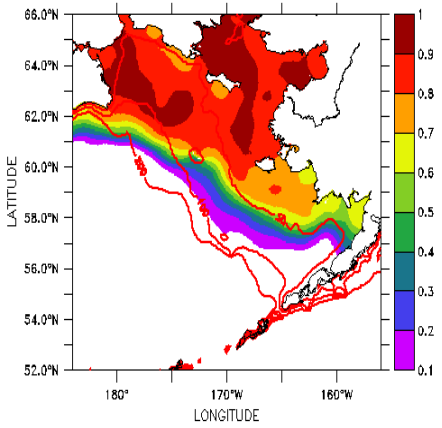
modeled Jan 2012



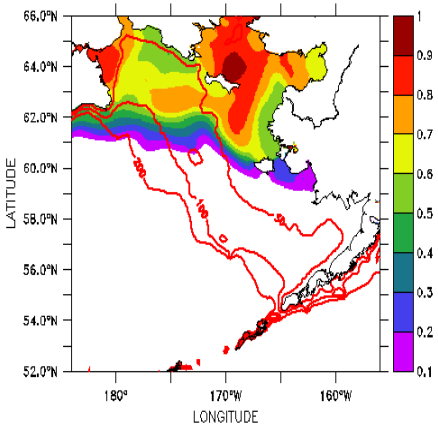
predicted Jan 2014



predicted Jan 2015

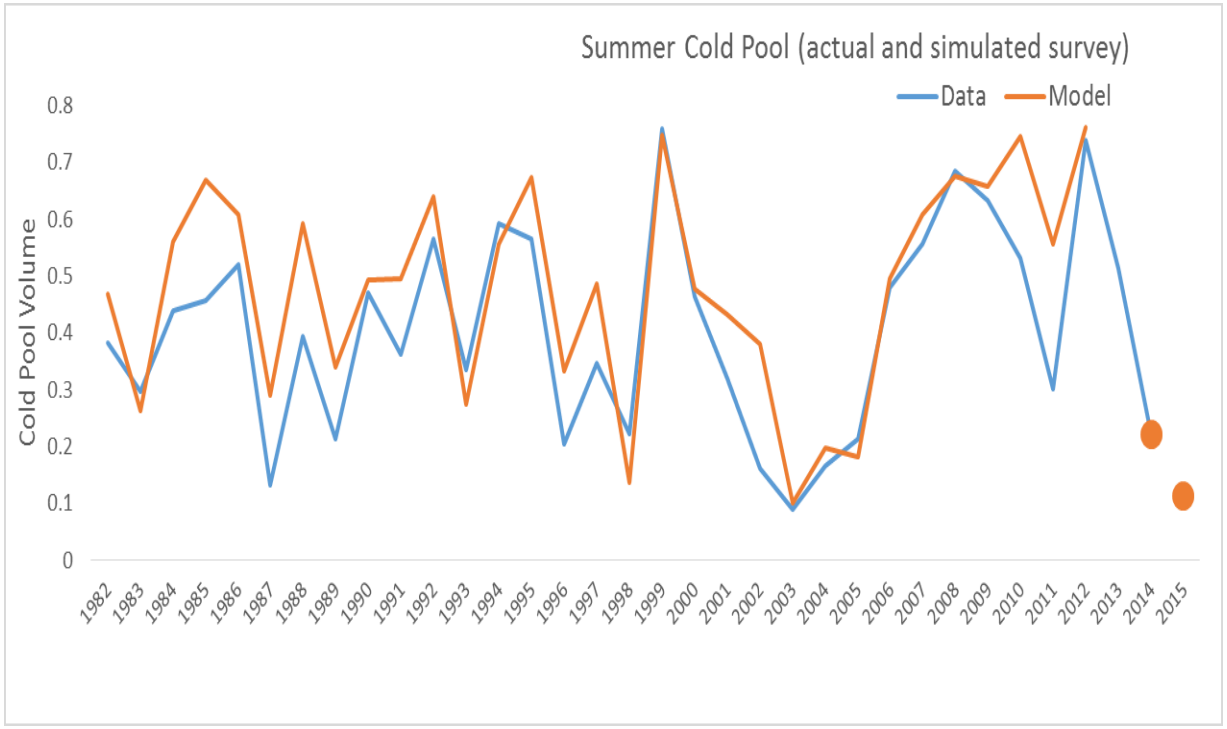


observed Jan 2012



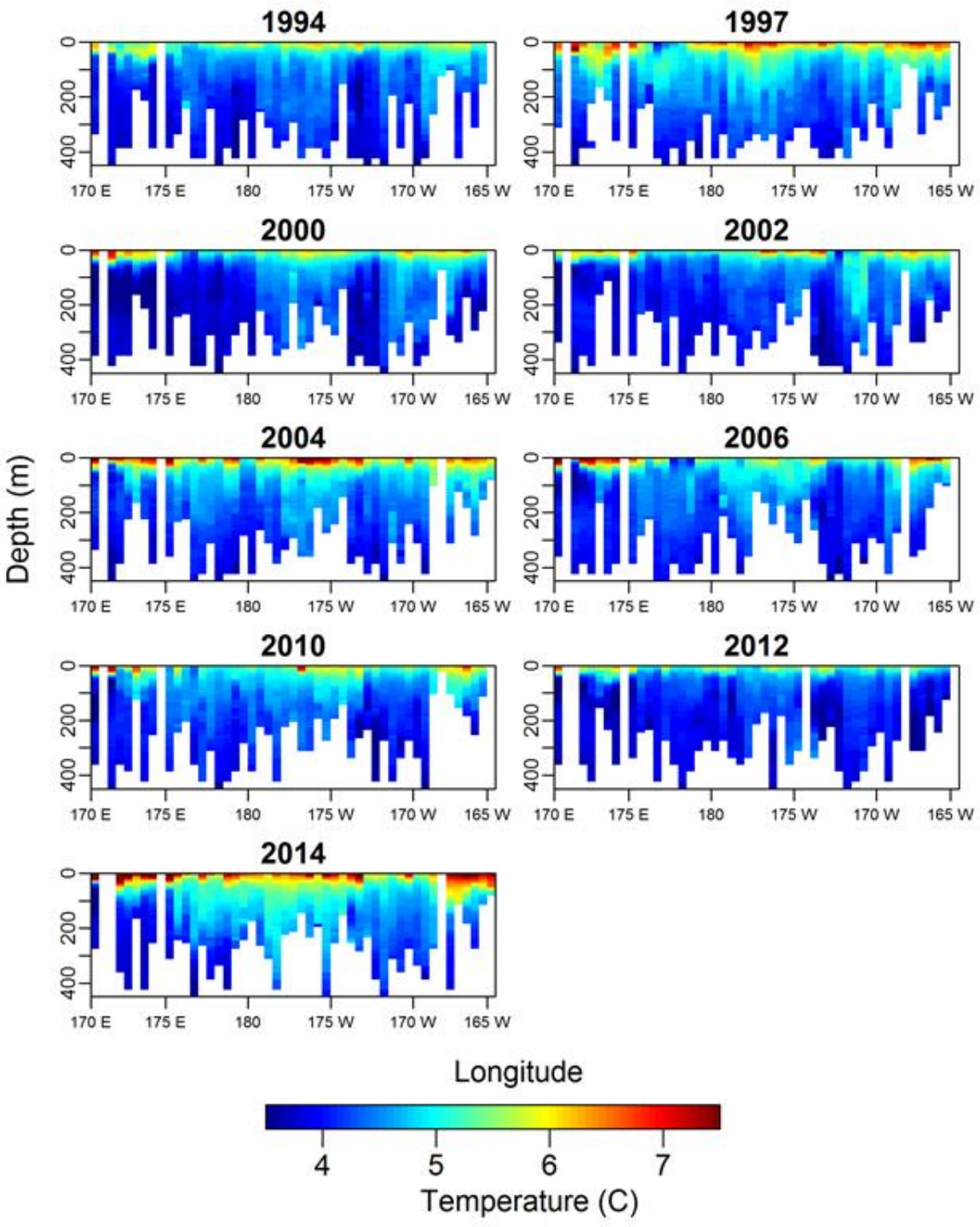
observed Jan 2014

Summer 2015 prediction (single realization)

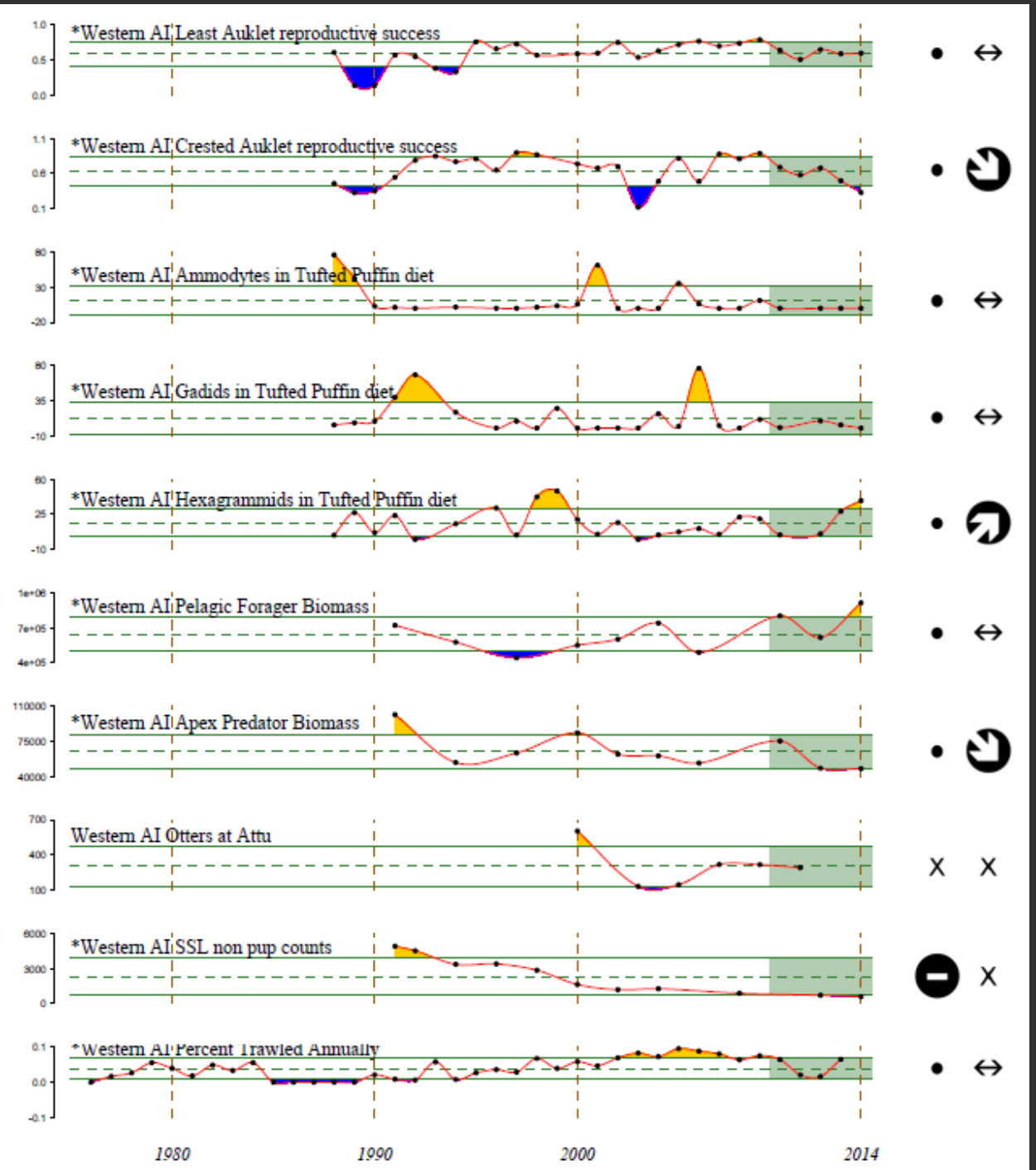


Aleutian Islands

AI Water Temperature (Laman)



- Temperatures most broadly distributed (vertically and horizontally) and warmest in 2014
- 2012 was the coldest
- Temps standardized to median survey date



Aleutian Islands Report Card

Western Ecoregion

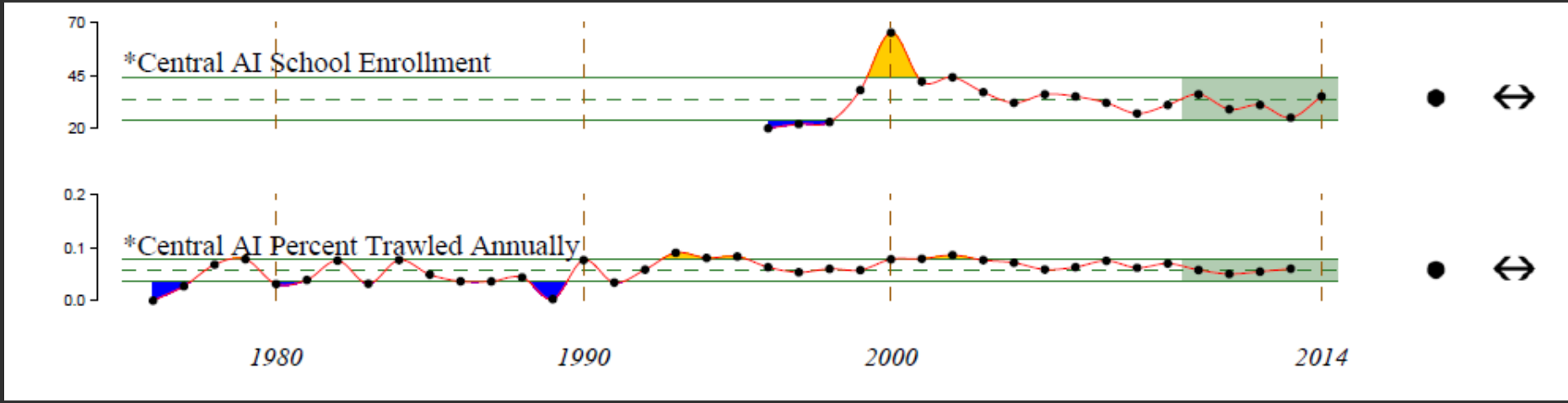
A mixed bag

- Zooplankton down?
- High Atka mackerel recruitment?
- Fish apex predator biomass trending down
- Ave to low seabird breeding success
- Lowest sea lion count

Aleutian Islands Report Card

Central Ecoregion

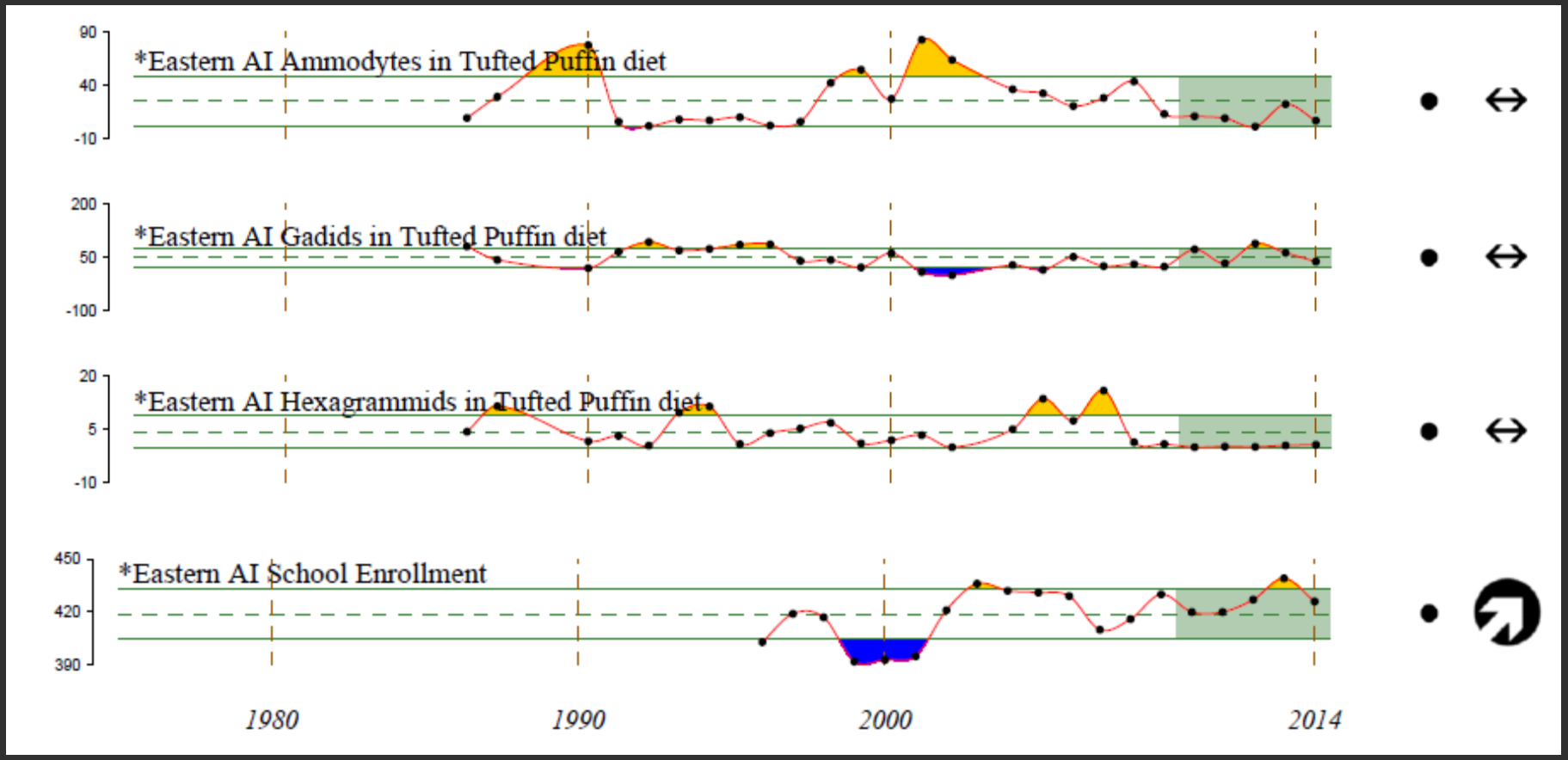
No changes in mean or trend in past 5 years in all indicators



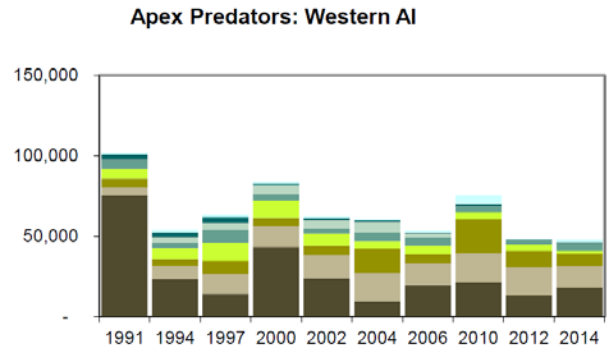
Aleutian Islands Report Card

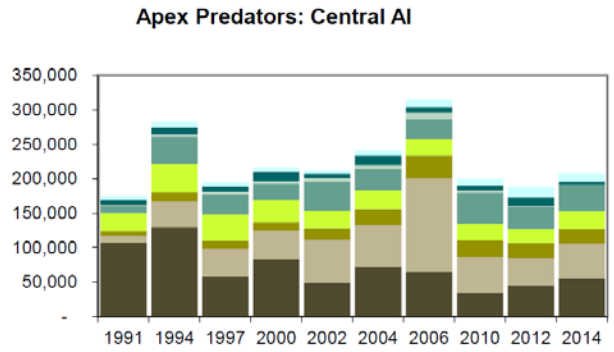
Eastern Ecoregion

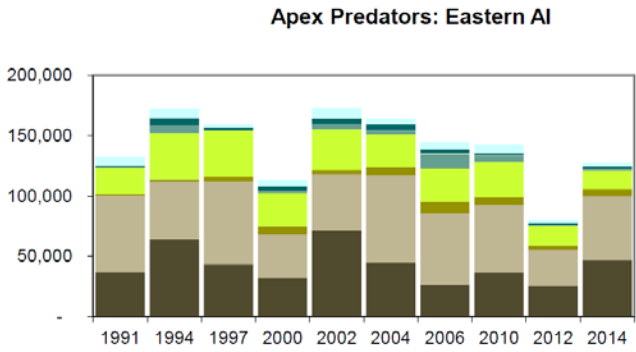
One of the best years for puffins. Very good for nearly all other seabird species

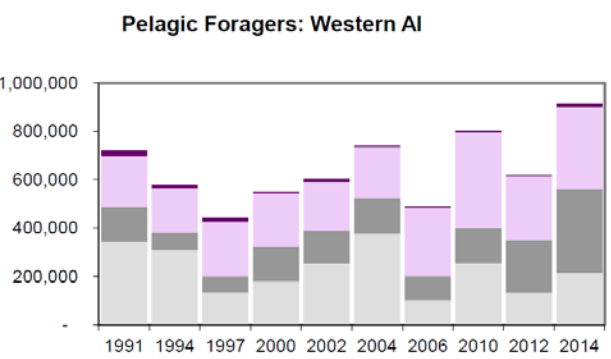


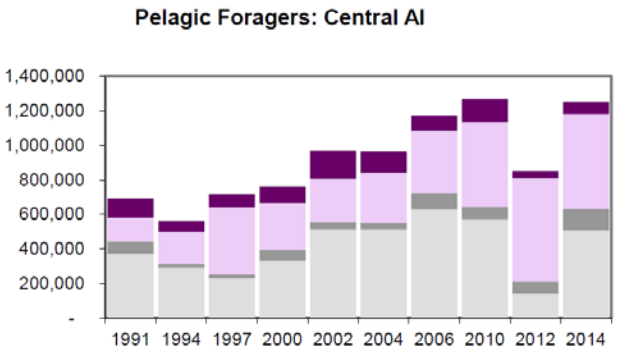
Aleutian Islands 2014 Report Card
Fish biomass indices

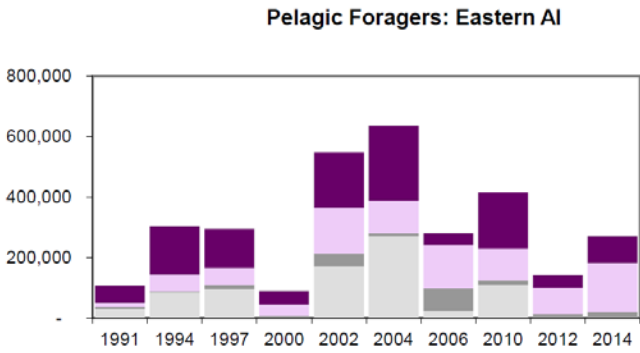










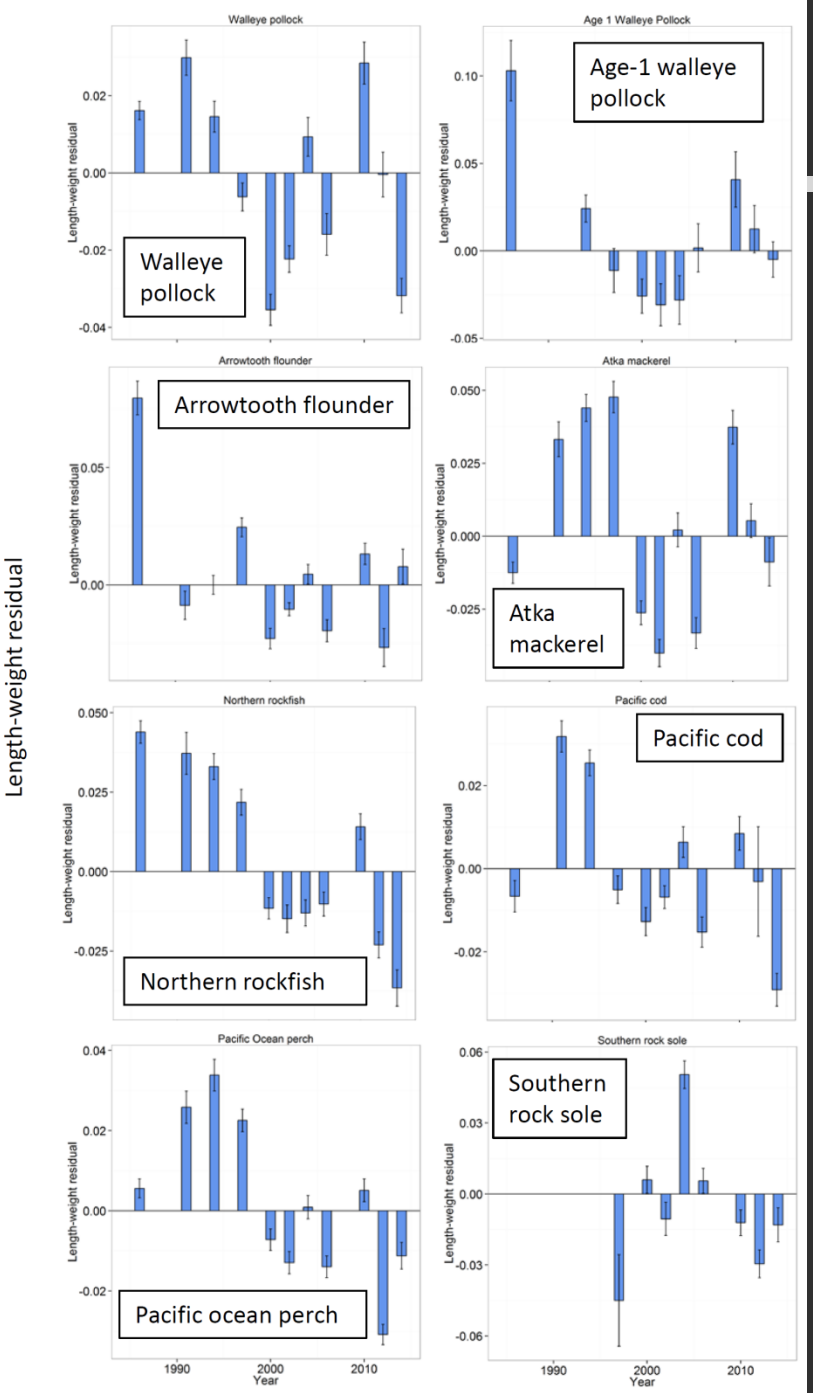


- Lg. Sculpins
- Rougheye/ Blackspotted
- Alaska skate
- Kamchatka fl.
- P. Halibut
- Other skates
- Arrowtooth
- P. Cod

- W. pollock
- POP
- Northern Rock
- Atka mackerel

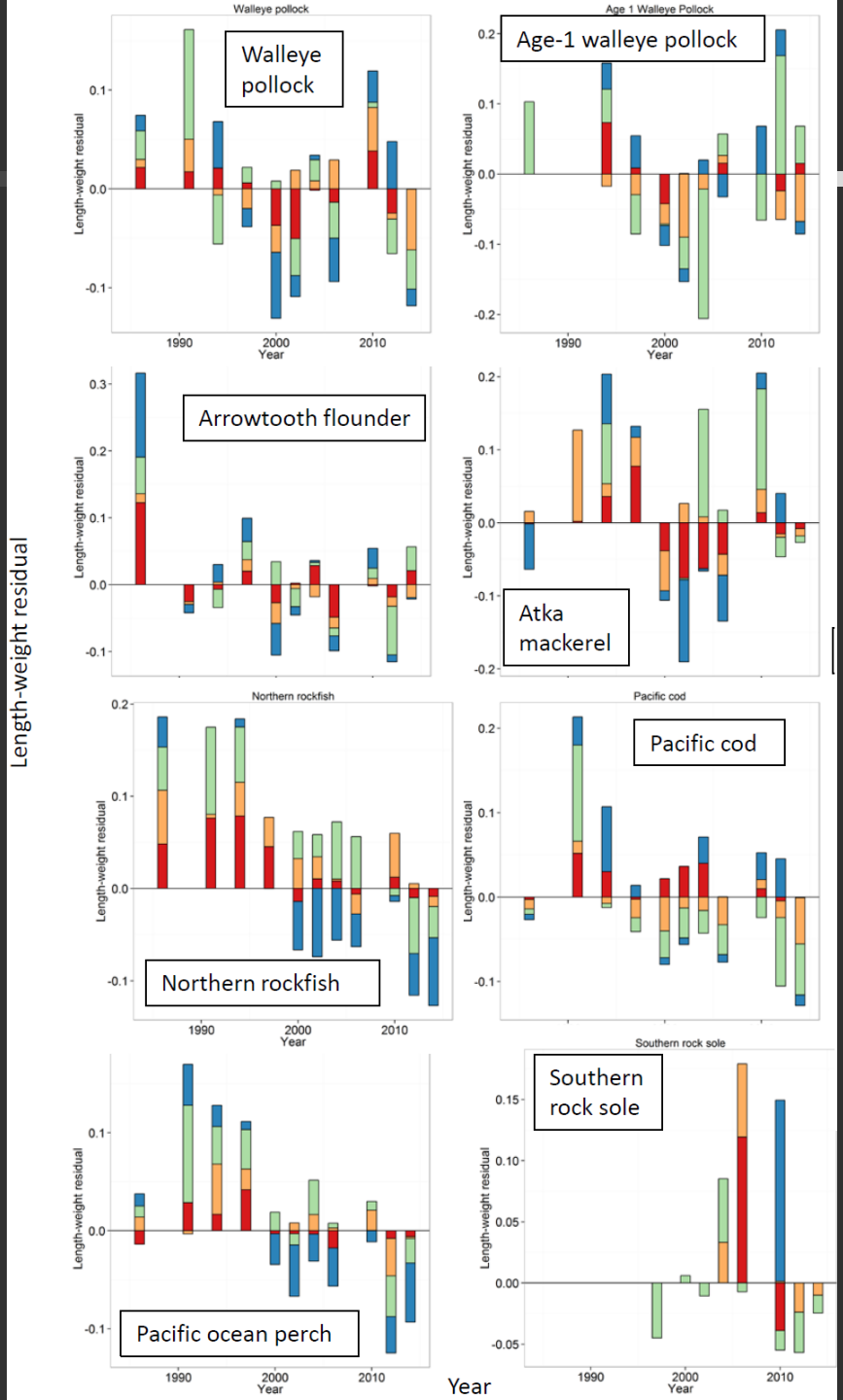
Indices up from 2012 for all but apex predators in the Western ecoregion

AI groundfish condition
(Rooper)

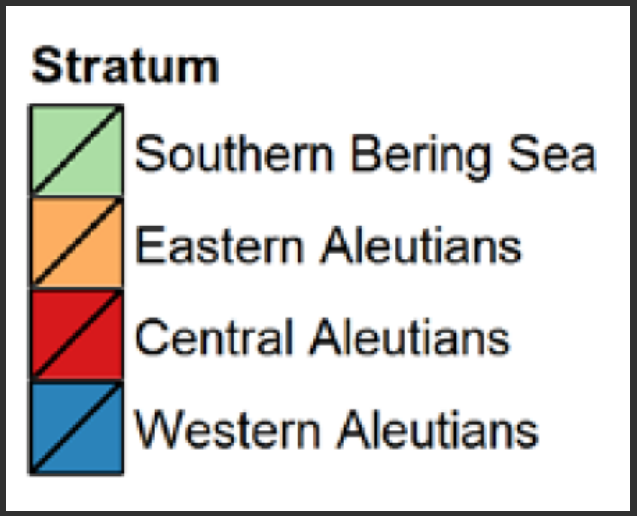


- Length-weight residuals mostly negative from 2000-2006
- Positive for all but southern rock sole in 2010
- Negative for all in 2014
- Northern rockfish, cod, POP generally declining over the survey

AI rockfish distribution
(Rooper)



- Best condition in the southern Bering Sea (except cod)
- Worst in the western AI (except cod)



Website

http://access.afsc.noaa.gov/reem/ecoweb/index.cfm

This work is made possible through support from the Fisheries and the Environment (FATE) program

This report is produced annually to compile and summarize information about the Alaska Marine Ecosystem for the North Pacific Fisheries Management Council, the scientific community and the public. The report includes an ecosystem assessment, contributions with updated status and trend indices, and ecosystem-based management indices and information for the Bering Sea (BS), Aleutian Islands (AI) and the Gulf of Alaska (GOA) ecosystems.

December 2012 Update	Links	Archive
• Download current report (PDF approx. 6.5 MB) • Download Eastern Bering Sea Report Card (PDF approx. 500 KB) • Download Aleutian Island Report Card (PDF approx. 700 KB) • Guidelines for citing this document	• 2012 Stock Assessments for 2013 Fishery Recommendations • Data access for most contributions (Dec. 2011 Update) • Data use is contingent upon compliance with the AFSC Data Use Conditions • A collection of links relevant to the report contents • Contact Stephani Zador (Editor) for further information	• Contribution archive • Stock assessment archives