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)
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
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*
10. Maximum potential trawl area disturbed

*All time series updated*
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 known 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.
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?
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.
17 seabird reproductive effort datasets. St George thick-billed murre not correlated with either trend

PC2 negatively correlated with Kamchatka pinks ($p = 0.003$)

44.2% variance explained

21.6%

Higher murre and cormorant productivity. Earlier seabird hatch dates

Higher kittiwake productivity
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
• 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
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

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

Alaska Marine Ecosystem Considerations

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.

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