The effects of the anomalous warming on lower trophic levels in the NE Pacific.

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Outline of this presentation

• Study areas and CPR data
  • Data limitations
• Results of comparison of 2014 data with 15 year time series
  • Broad taxonomic groups (e.g. diatoms)
  • More resolved groups
  • Community composition
• Summary of main findings and speculation
Continuous Plankton Recorder sampling in this presentation

Alaskan shelf from 2004

NE Oceanic Pacific from 2000

Both regions sampled monthly (spring to autumn) and > 10 samples per month
Caveats:

Near surface, large scale, sampling (~mixed 10-15m sample collected over 18.5 km)

Taxonomic resolution and catch efficiency varies with taxa:

Phytoplankton Taxa
- Larger diatoms, hard-shelled dinoflagellates 😊
- Small, single cells 😐
- *Naked flagellates* 😞

Zooplankton Taxa
- Crustacean plankton 😊
- Organisms 200µm-1cm 😊
- Organisms < 200µm, > 1cm or fragile 😐
- Gelatinous plankton 😞
Broad Taxonomic Groups: Phytoplankton, large diatoms

Alaskan Shelf

Oceanic NE Pacific
Broad Taxonomic Groups: Phytoplankton, dinoflagellates

No significant relationship between dinoflagellates and the PDO/temperature on the Alaskan Shelf.

Oceanic NE Pacific

R² = 0.5793
Broad Taxonomic Groups: Microplankton (ciliates)

No significant relationship between microplankton and the PDO/temperature on the Alaskan Shelf.
Broad Taxonomic Groups: Mesozooplankton biomass

**Alaskan Shelf**

Timing, not quantity, related to PDO

**Oceanic NE Pacific**

Mesozooplankton biomass, mid-season, Day of Year

Mesozooplankton biomass Mid-Season - day of year

$R^2 = 0.4332$

$R^2 = 0.4136$
Later, not because spring subarctic copepod peak was later, but because small copepods were more abundant and extended the season.

Alaska Shelf

Graphs show (lines) long term monthly mean and min/max with 2014 monthly data as blue points.

Oceanic NE Pacific
Warm Water Copepods

Mean annual abundance on the Alaskan Shelf

Mean abundance and northwards extension in the oceanic NE Pacific (region extended north to shelf)
Coelenterates/cnidaria
Not sampled well – presence/absence only for now.
Other taxa of interest – quick look
Caveat – some of these organisms are larger than CPR aperture

Adult Euphausiids

Salps/doliolids

Alaskan Shelf

Oceanic NE Pacific
Community composition, phytoplankton

Alaska Shelf, 73 taxa

Oceanic NE Pacific 107 taxa

2014 different from most years (esp. 2013)
Ratio of long, thin diatom cells to round diatoms in spring:

In both regions, more equivalent in 2014 than recent years.

In the Oceanic region especially, their absolute abundance has been higher but only when round cells were also high.
Community composition, zooplankton

Alaska Shelf, 84 taxa
Oceanic NE Pacific 100 taxa

2014 does not appear to be very different
Summary, phytoplankton

• Large diatoms were low in 2014 in both regions, not what would be predicted.
  In the ocean at least this is likely linked with reduced mixing in winter discussed in Whitney, 2015 and low nutrients reported for Line P.

• Dinoflagellates were high in the oceanic region, but low on the shelf
  Prefer warm, stratified water so low on shelf is a surprise, but high in ocean was expected.

• Phytoplankton more biased towards long, thin cells in spring in both regions. In oceanic region especially, round cells were relatively scarce.
  Implications for different nutritional value or feeding efficiency by higher trophic levels?
Summary, zooplankton

- Mesozooplankton biomass anomalies were positive in both regions, but midpoint of the season was later than predicted in each – more extended season. On the Alaskan shelf years with high diatoms typically have high mesozoo biomass, not so in 2014.

- Copepods biased towards smaller forms especially on Alaskan shelf.

- Warm water species were more abundant, but not as abundant as predicted in the oceanic region. Is this because the source of the warm water was different?

- Jellies were found in more samples than in any other year, in both regions.

- Spring community composition not unusual, and in oceanic region consistent with PDO/NPGO.
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R.I.P. “Skaubryn”, CPR ship from 2000-2014
welcome “AAL Melbourne” 2015-?