

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

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Fisheries and Oceans
Canada

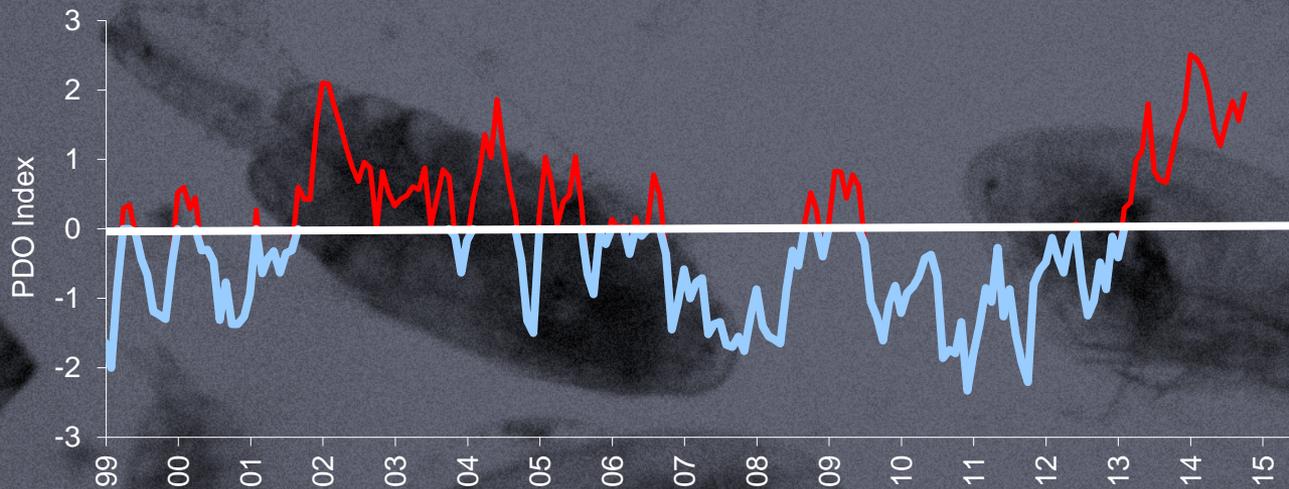
Pêches et Océans
Canada



EXXON VALDEZ OIL SPILL TRUSTEE COUNCIL

Outline of this presentation

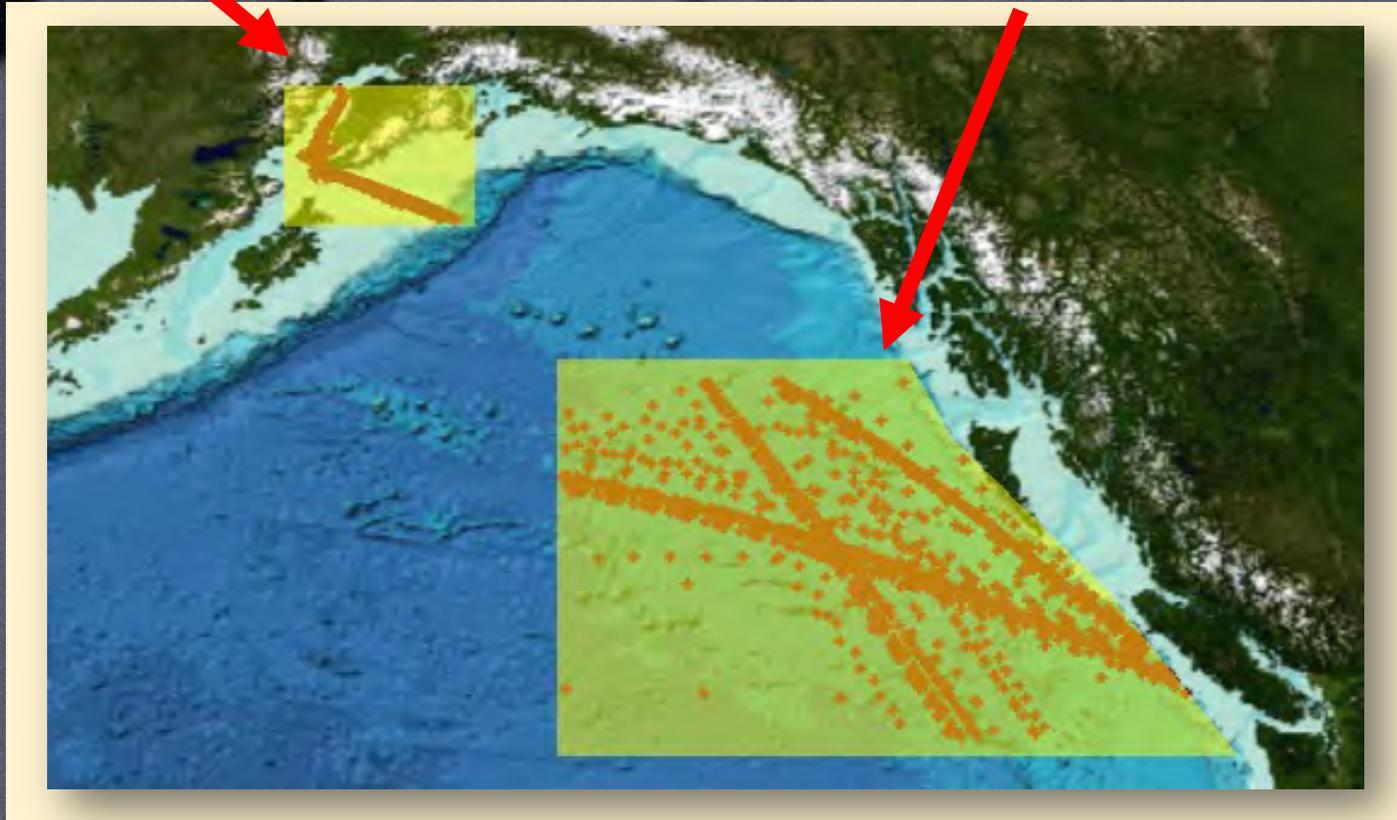
- Study areas and CPR data
 - Data limitations
- Results of comparison of 2014 data with 15 year time series
 - Broad taxonomic groups (e.g. diatoms)
 - More resolved groups
 - Community composition
- Summary of main findings and speculation



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

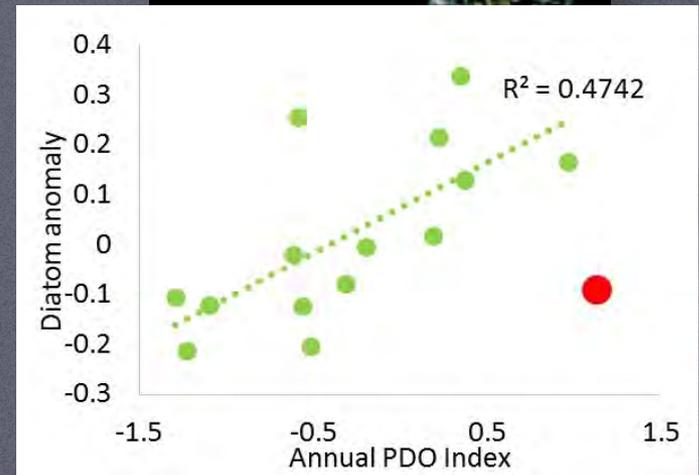
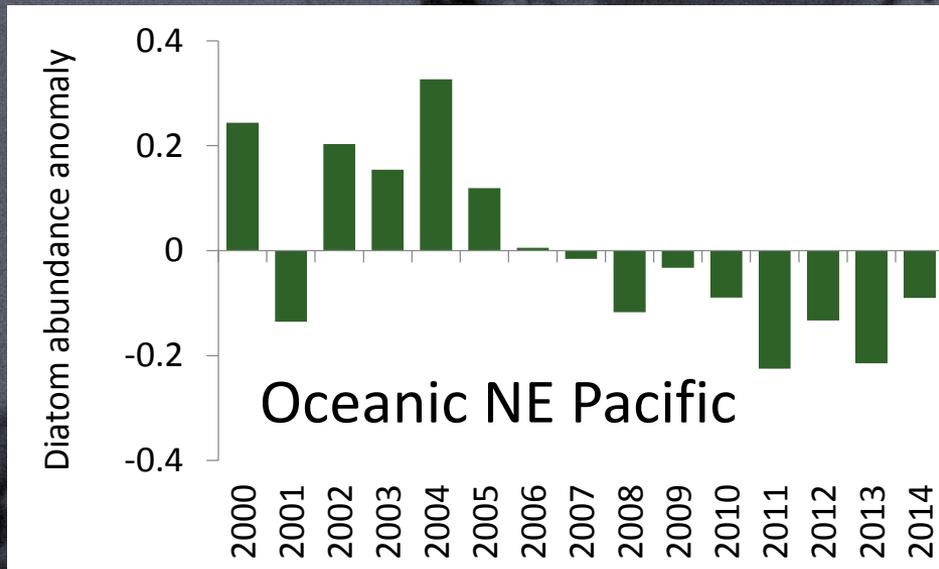
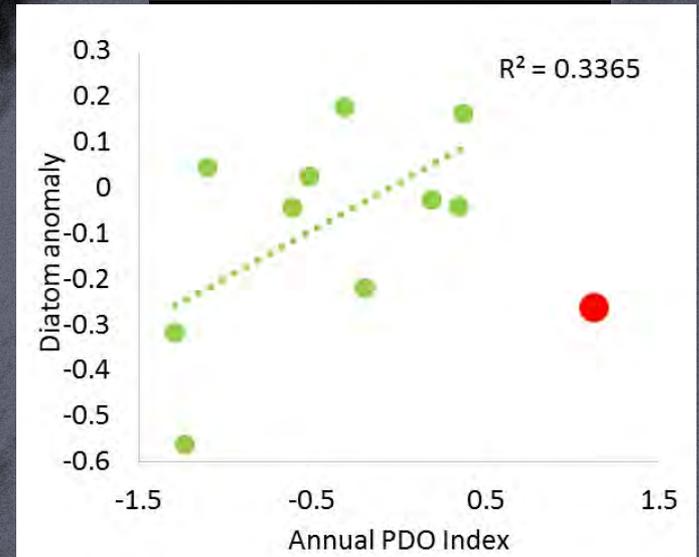
Crustacean plankton 😊

Organisms 200µm-1cm 😊

Organisms < 200µm, > 1cm or fragile 😐

Gelatinous plankton 😐

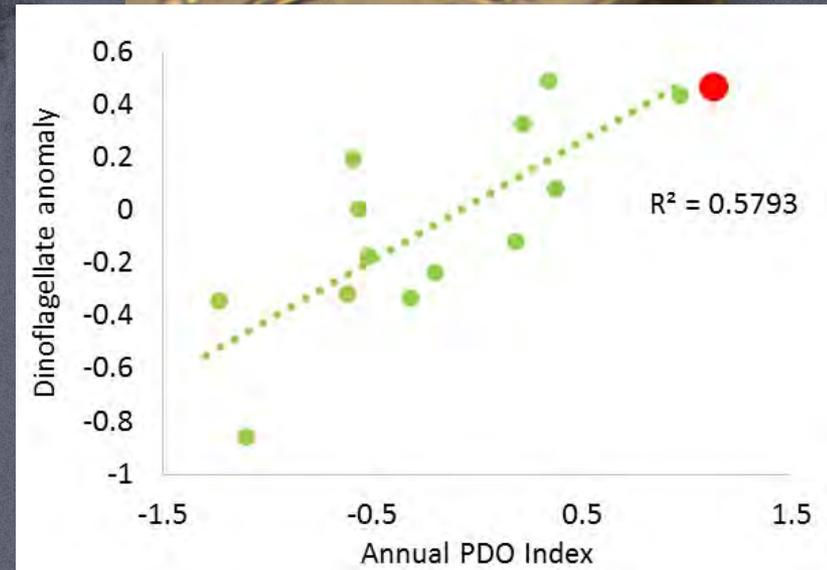
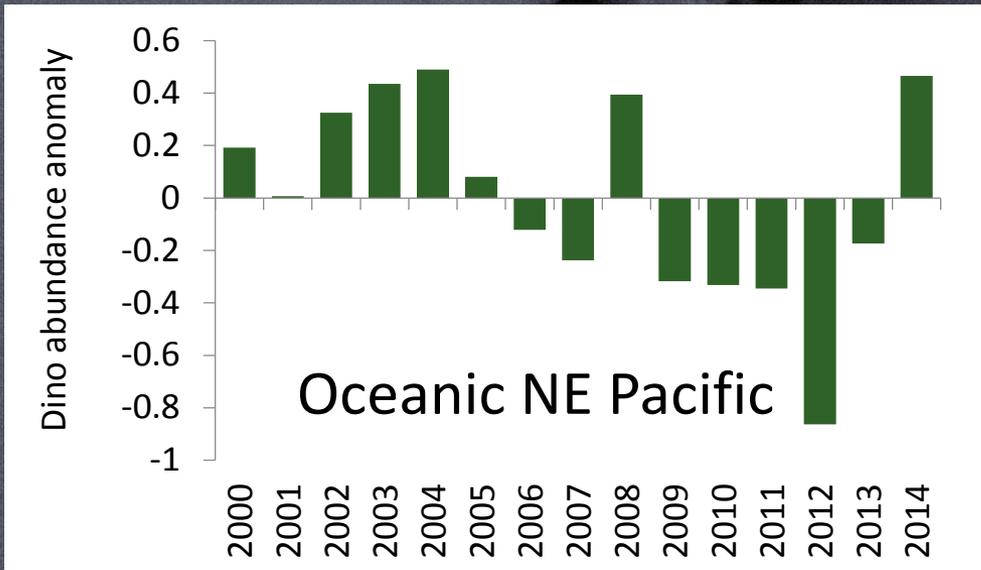
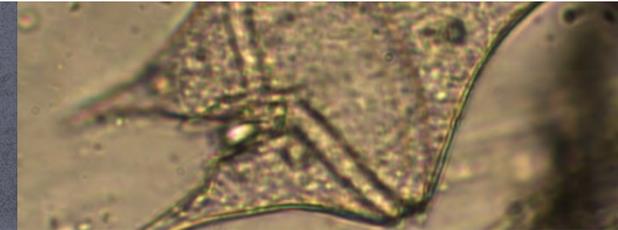
Broad Taxonomic Groups: Phytoplankton, large diatoms



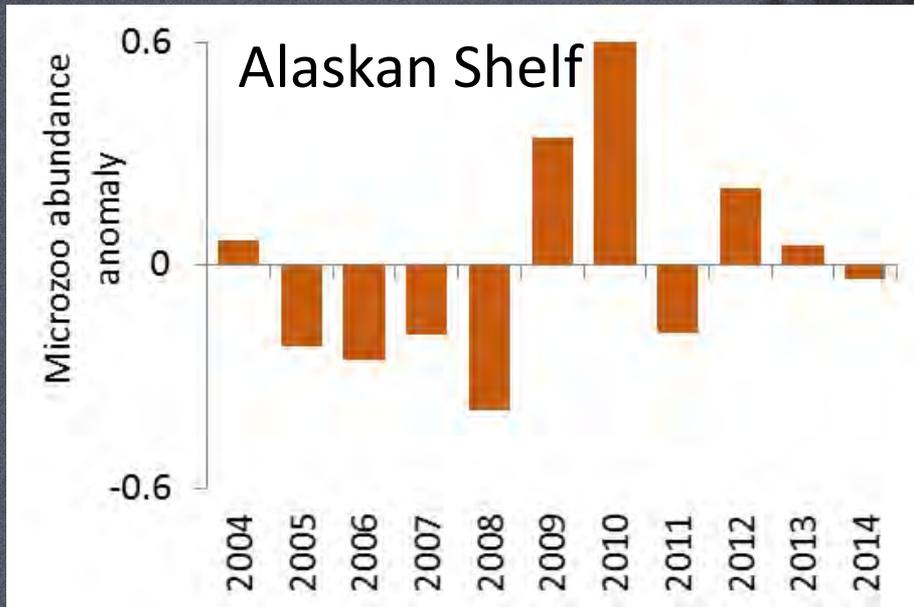
Broad Taxonomic Groups: Phytoplankton, dinoflagellates



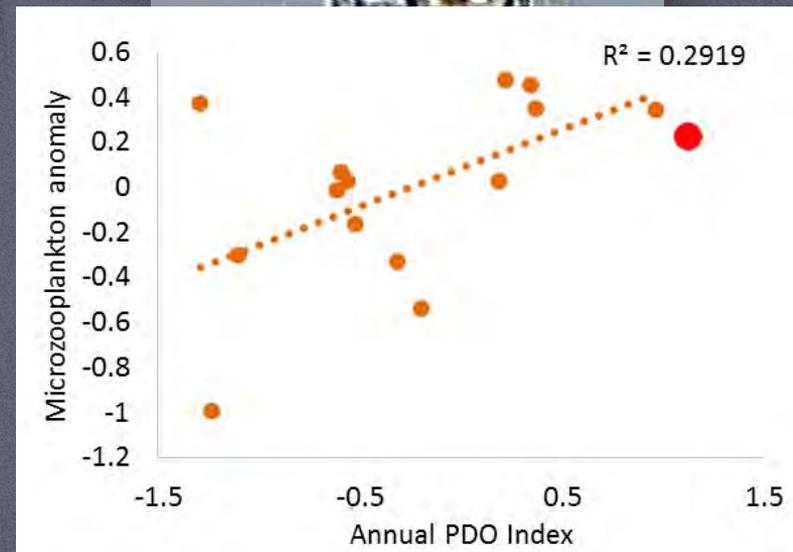
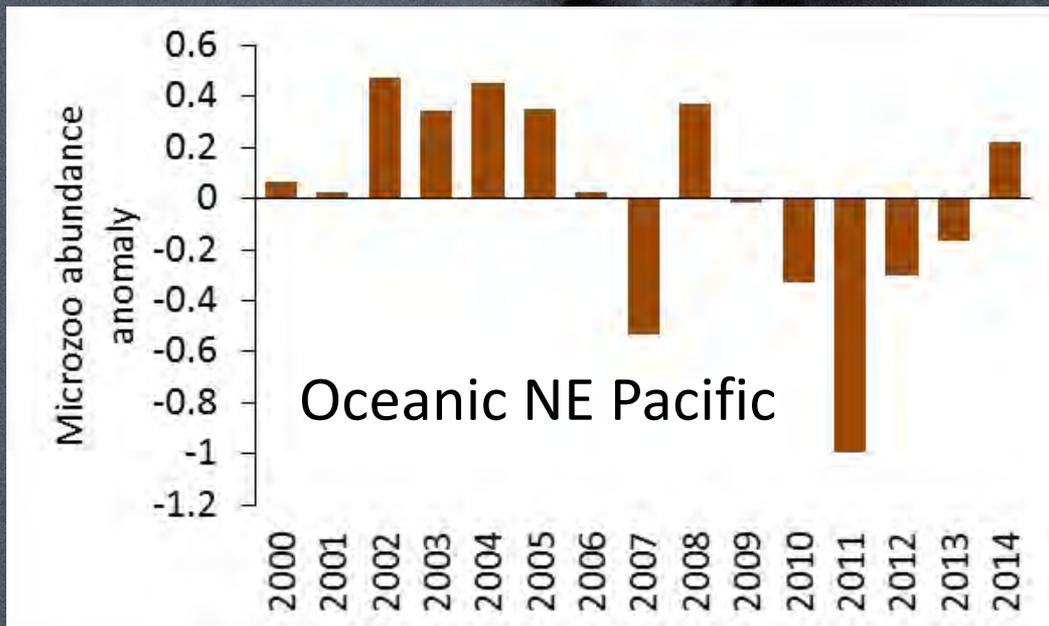
No significant relationship between dinoflagellates and the PDO/temperature on the Alaskan Shelf



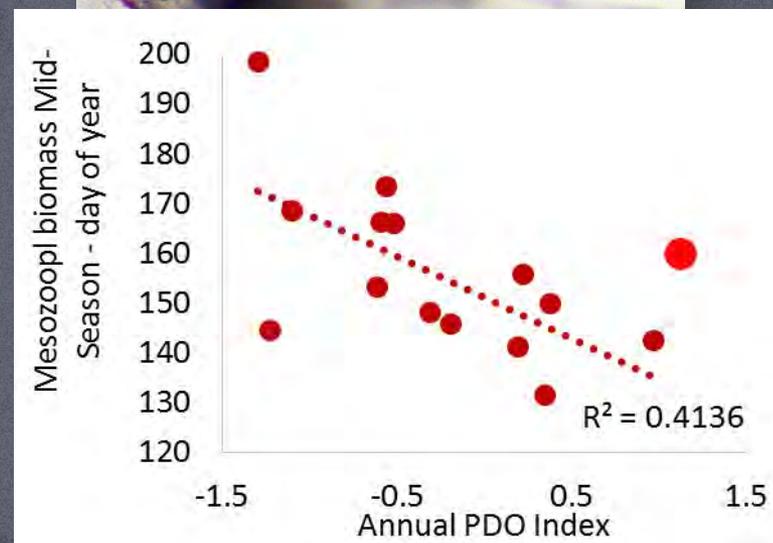
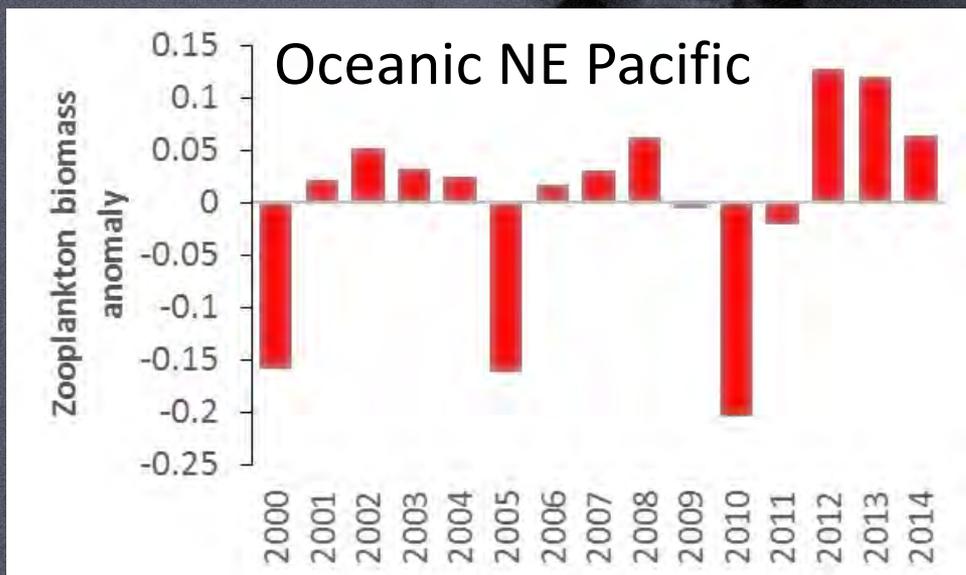
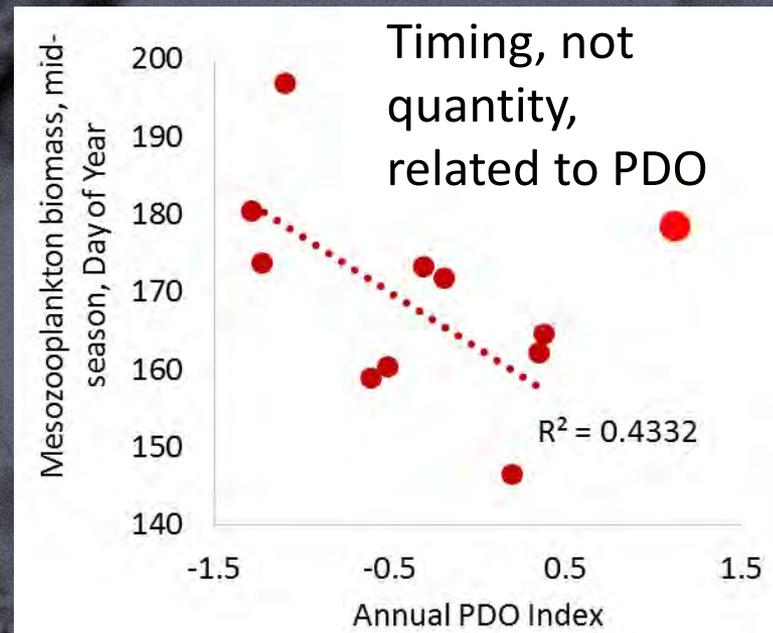
Broad Taxonomic Groups: Microplankton (ciliates)



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



Broad Taxonomic Groups: Mesozooplankton biomass

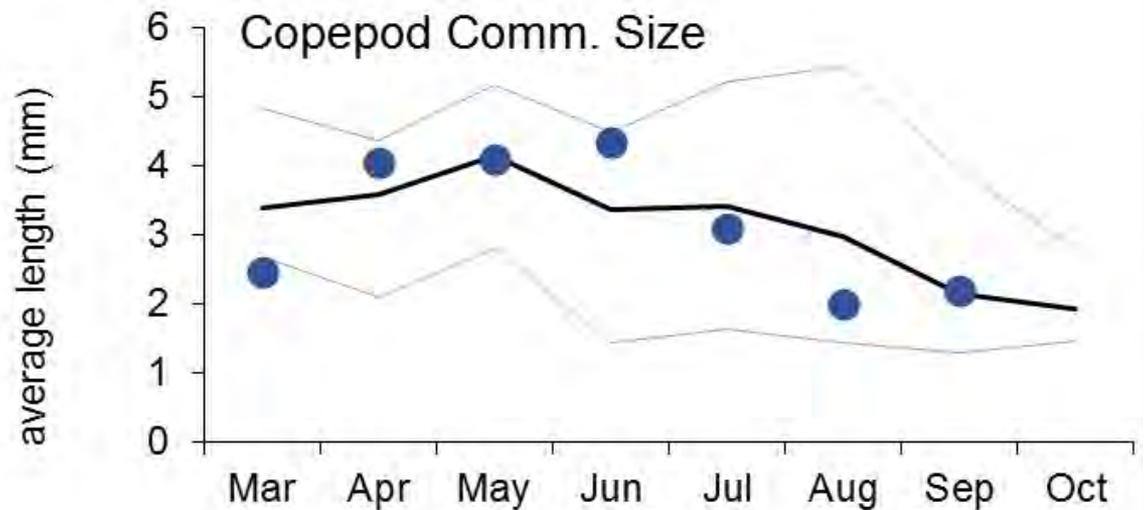
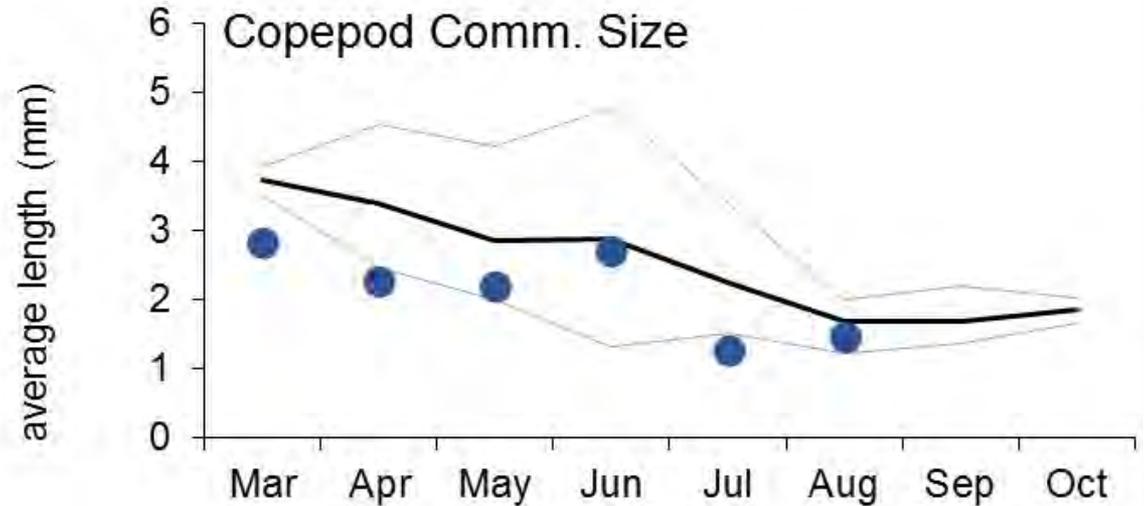


Later, not because spring subarctic copepod peak was later, but because small copepods were more abundant and extended the season.....

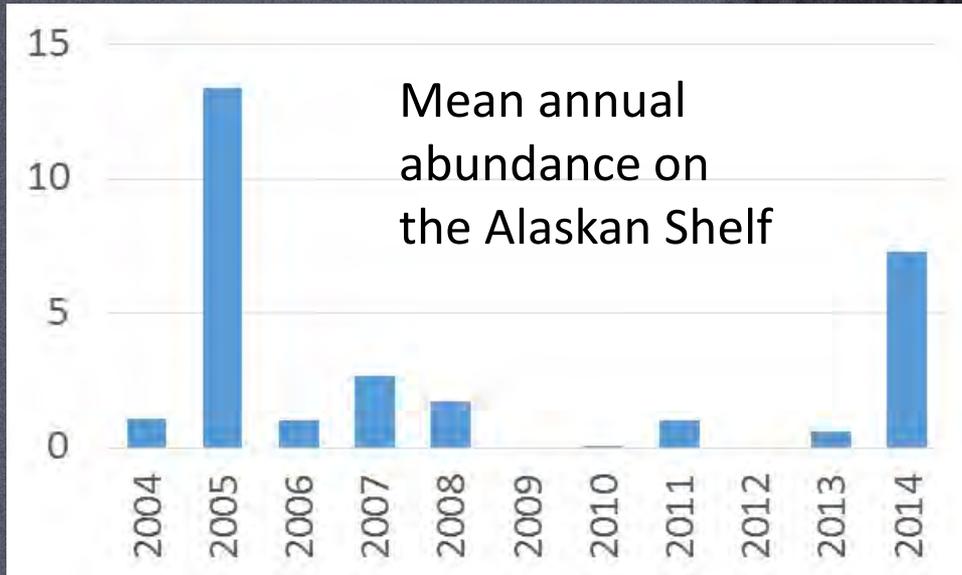
Alaska Shelf

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

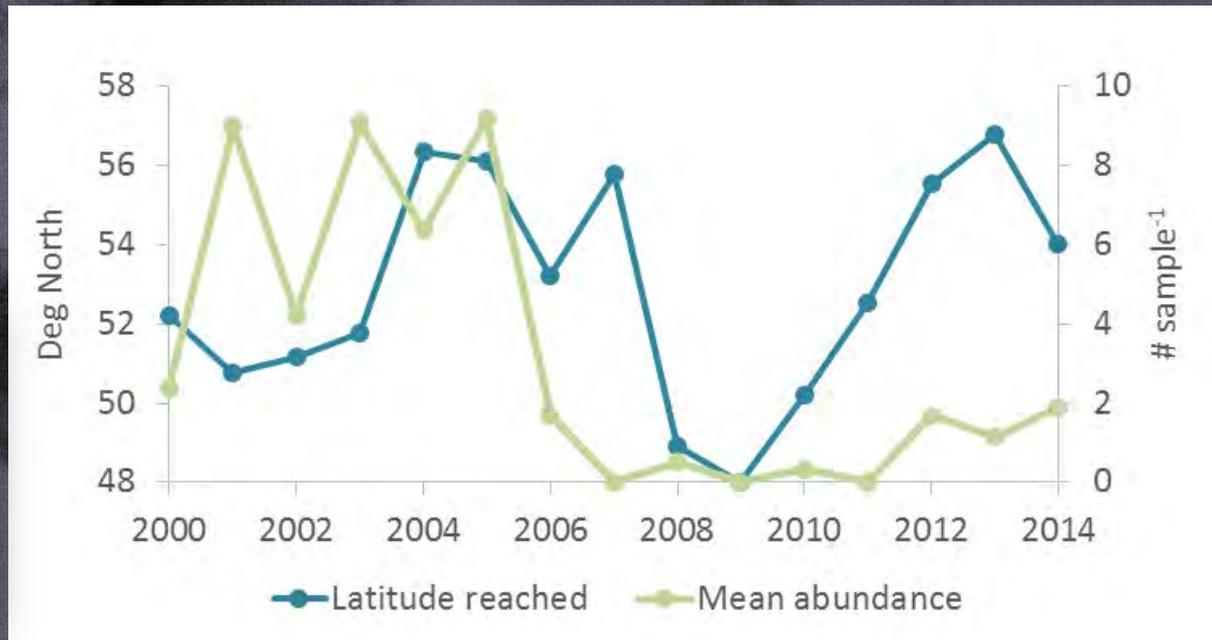
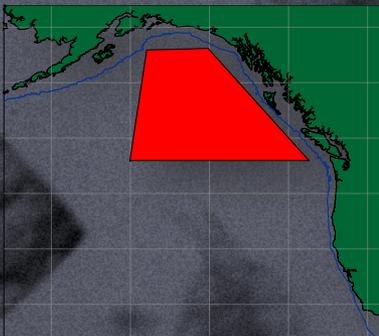
Oceanic NE Pacific



Warm Water Copepods

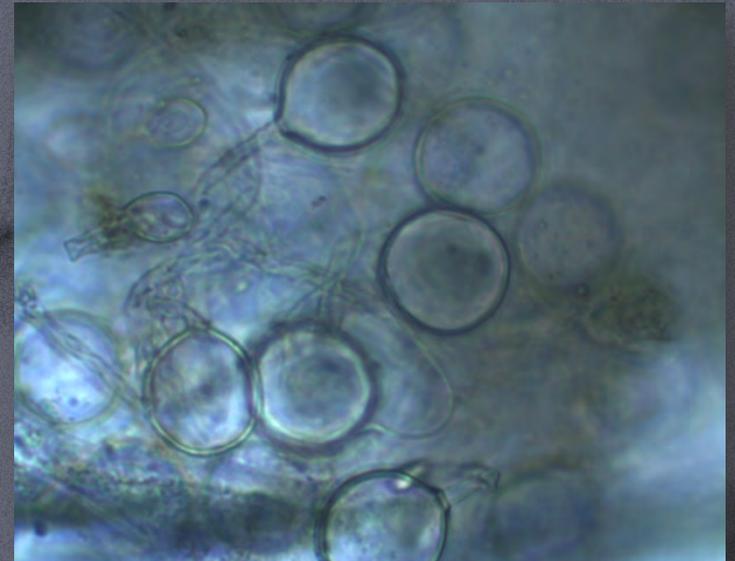
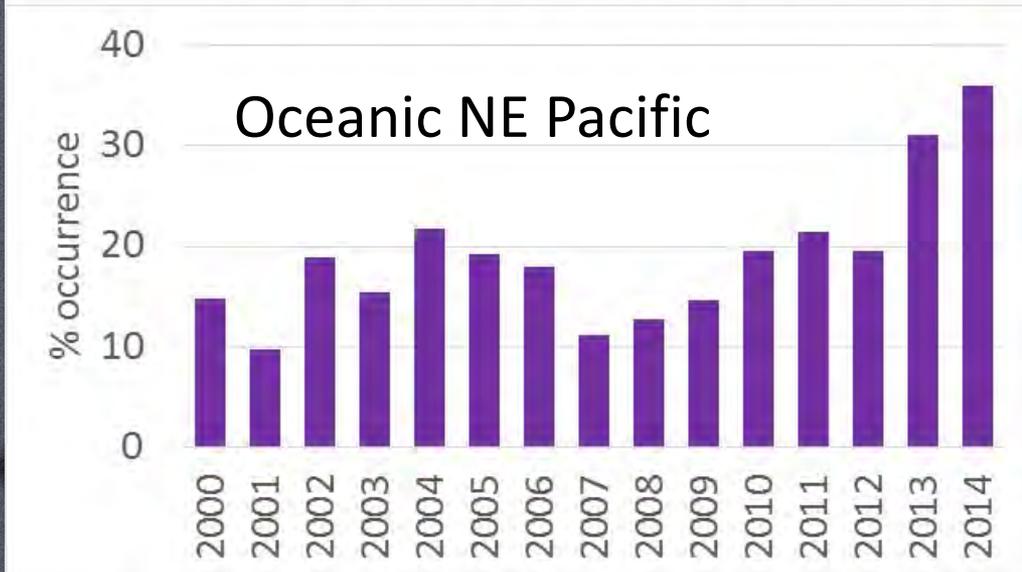
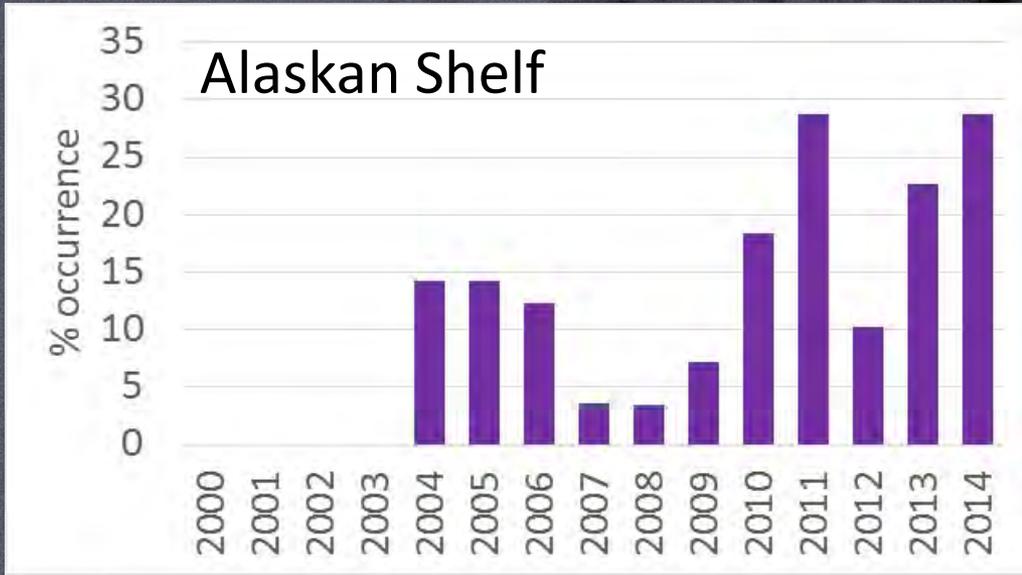


Mean abundance and northwards extension in the oceanic NE Pacific (region extended north to shelf)



Coelenterates/cnidaria

Not sampled well – presence/absence only for now.

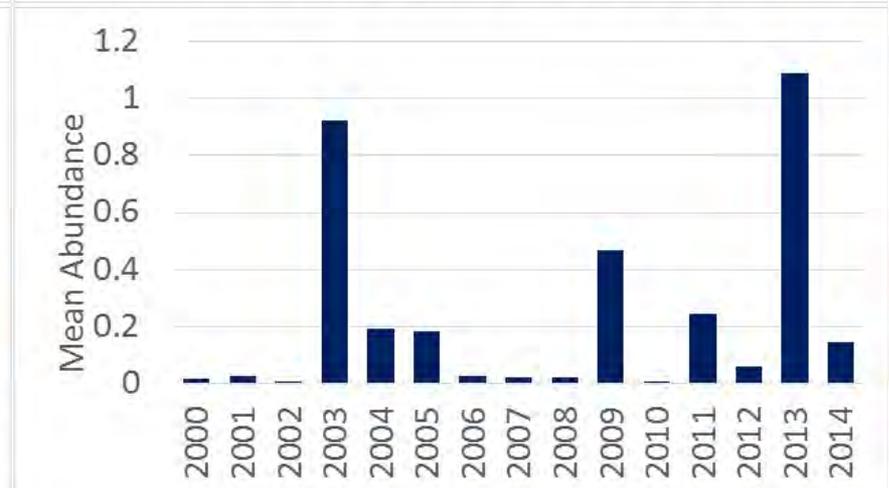
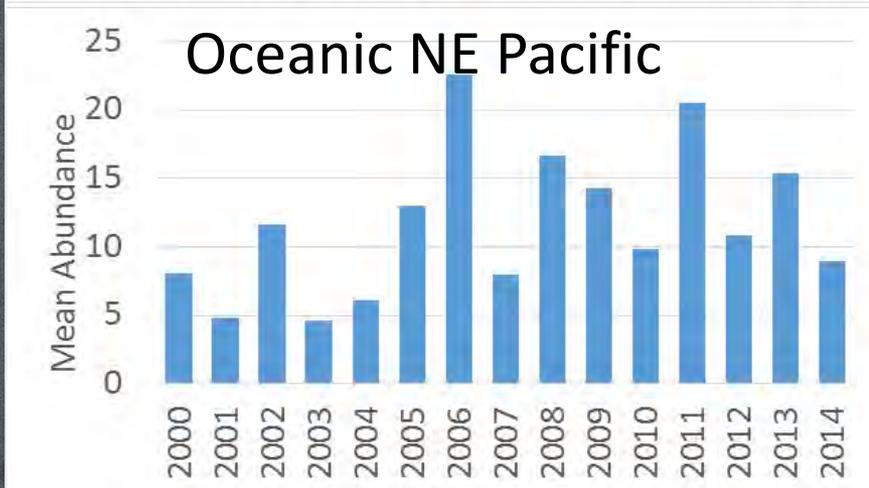
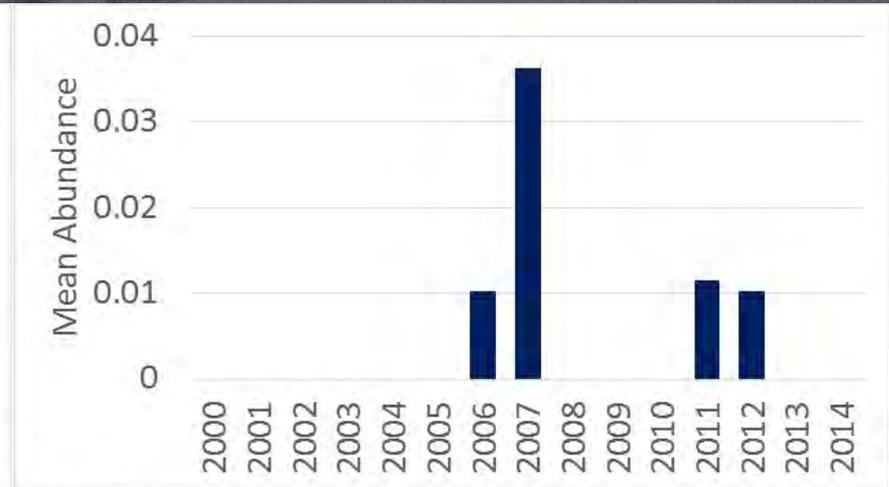
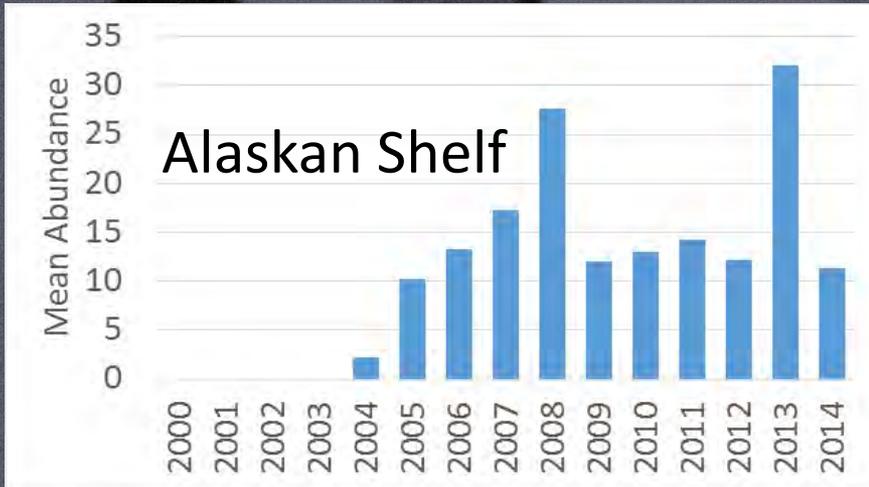


Other taxa of interest – quick look

Caveat – some of these organisms are larger than CPR aperture

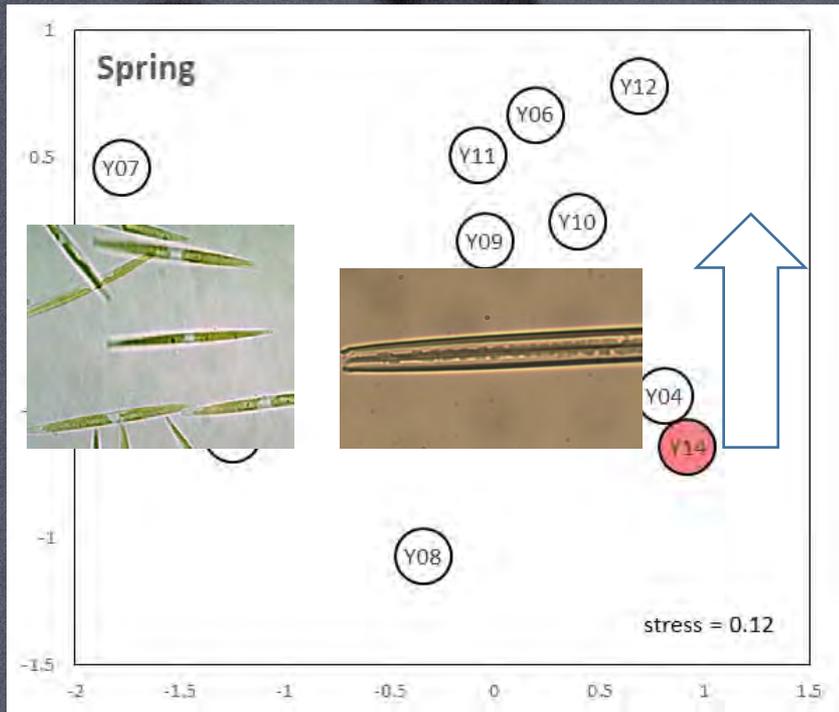
Adult Euphausiids

Salps/doliolids

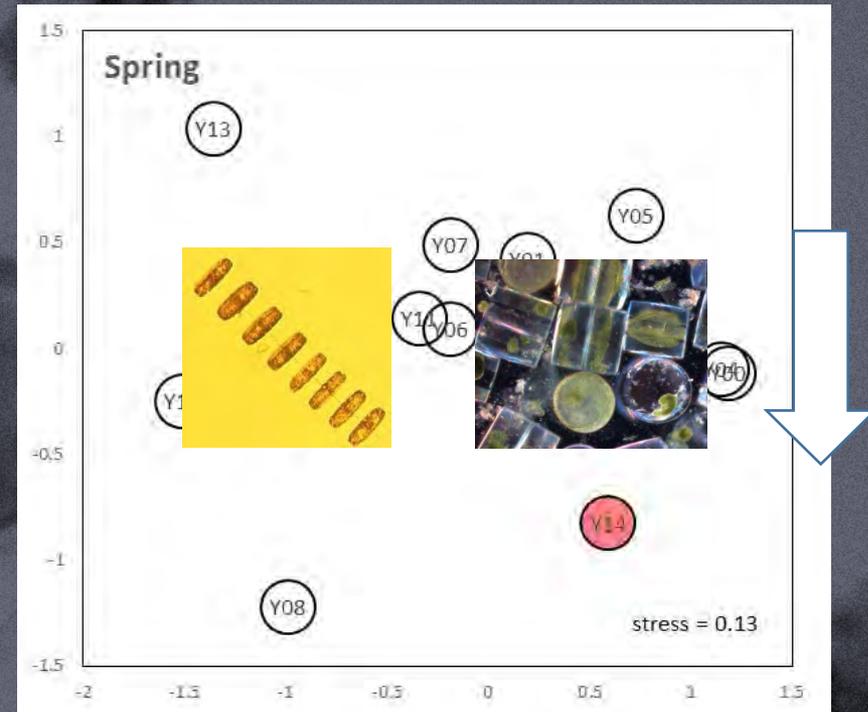


Community composition, phytoplankton

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.

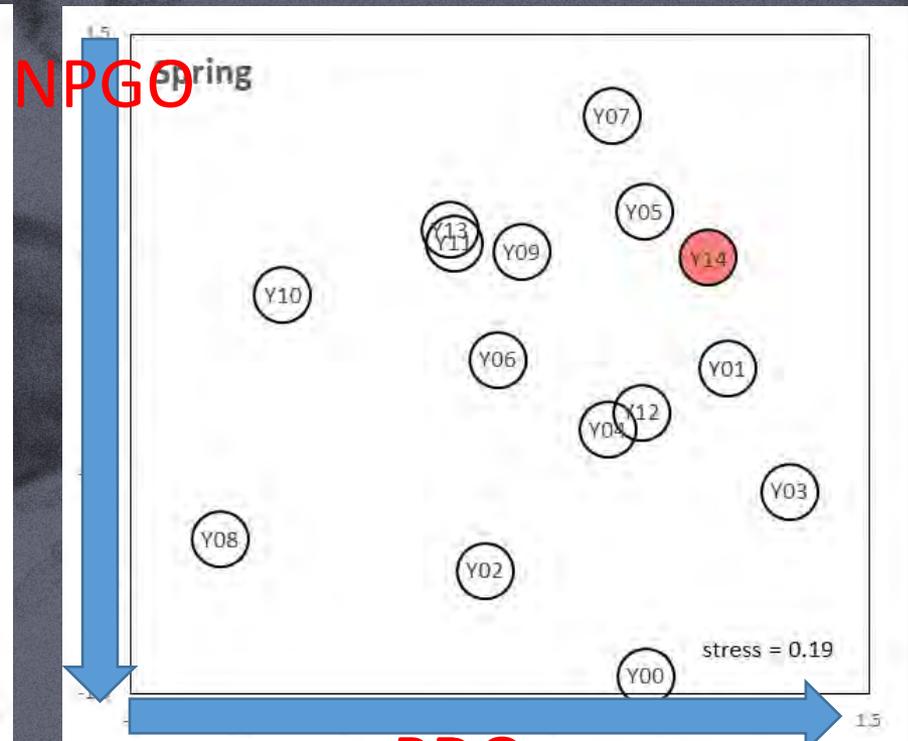
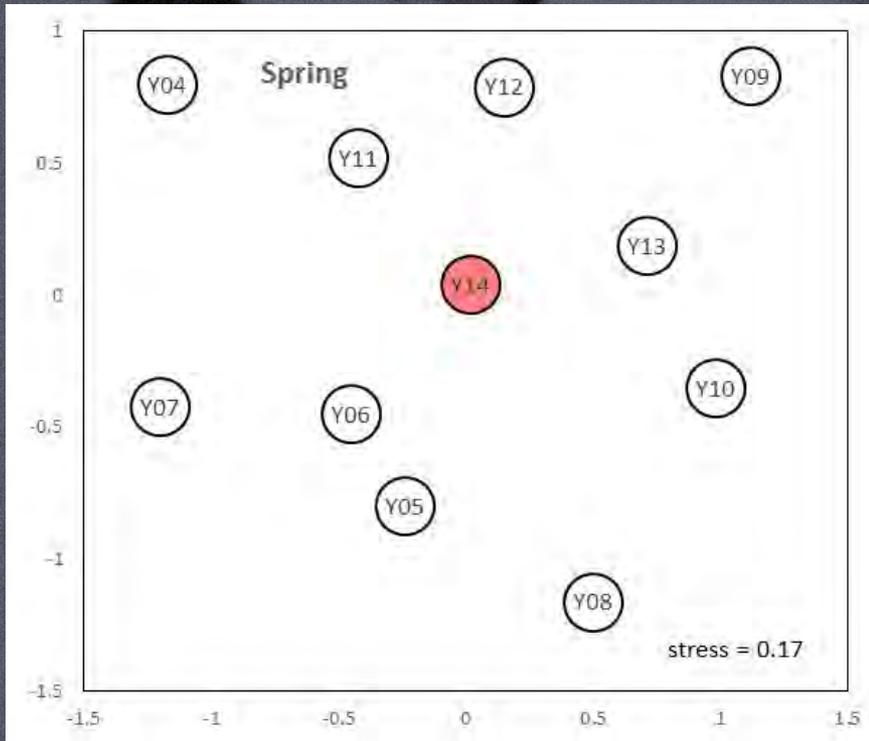
In the Oceanic region especially, their absolute abundance has been higher but only when round cells were also high.



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

Acknowledgments

Grateful thanks to:

- Volunteer vessels, crew and operating companies that tow CPRs
- Analysts who spend so much time at the microscope
- Members of the North Pacific CPR Funding Consortium



R.I.P. "Skaubryn", CPR ship from 2000-2014



welcome "AAL Melbourne" 2015-?