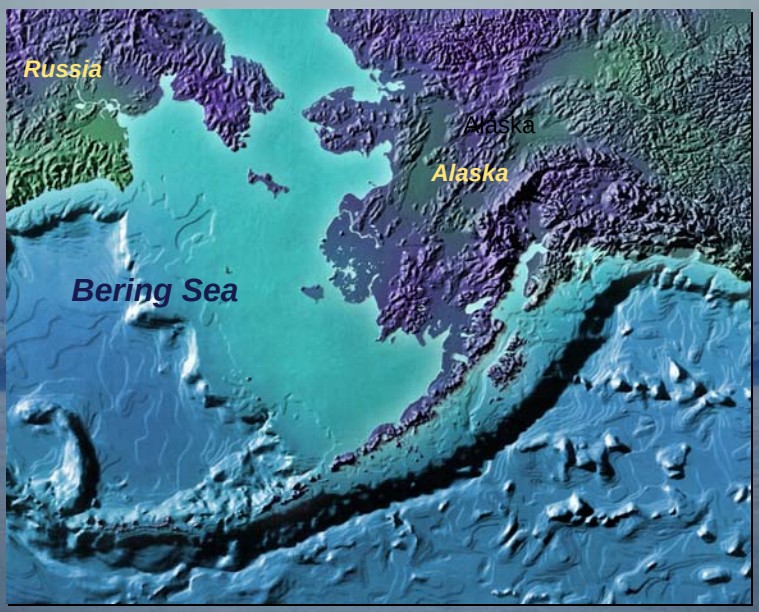
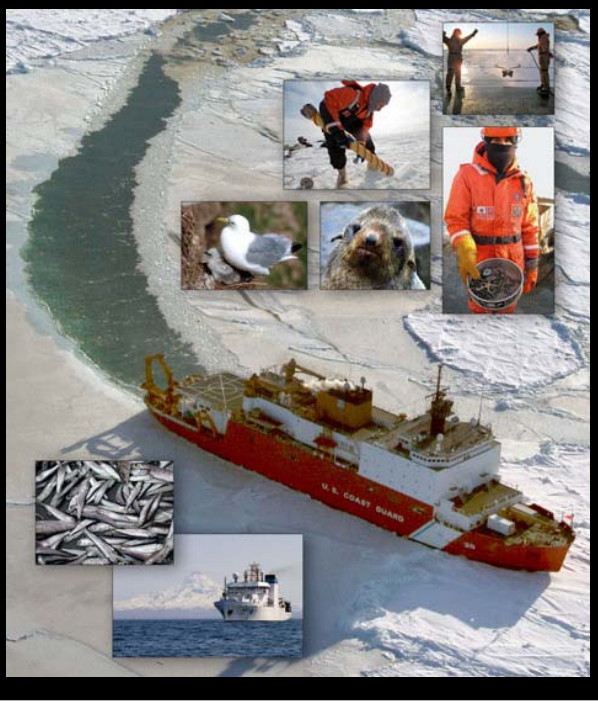
A comparison of the physics, chemistry, and biology of warm and cold years on the eastern Bering Sea shelf

Phyllis Stabeno, Sue Moore, Jeffrey Napp and Michael Sigler
NOAA, Seattle WA.

Calvin Mordy
University of Washington, Joint Institute for the Study of the Atmosphere and Ocean




Hopcroft/NOAA



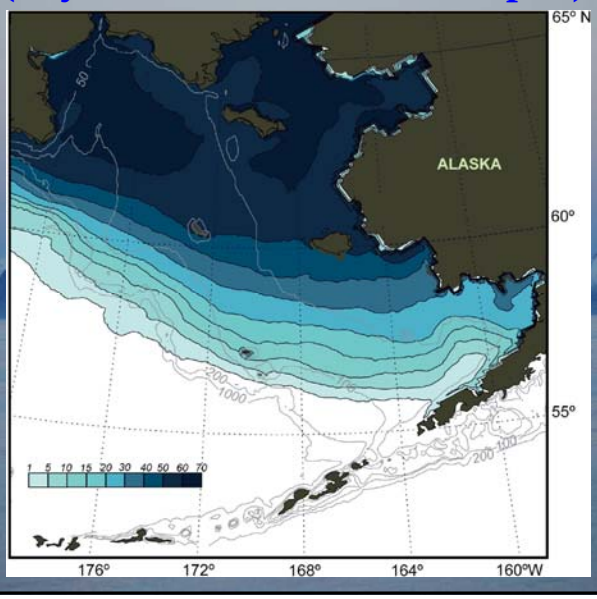
BEST

and

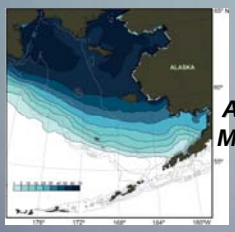
BSIERP

Areal Sea Ice Extent

(days of ice in March and April)

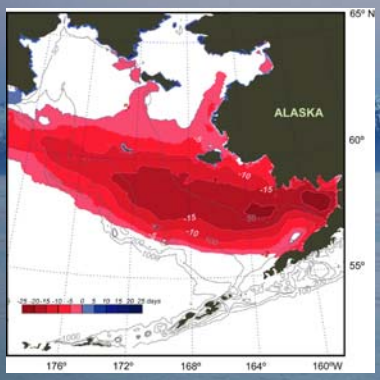


Sea Ice

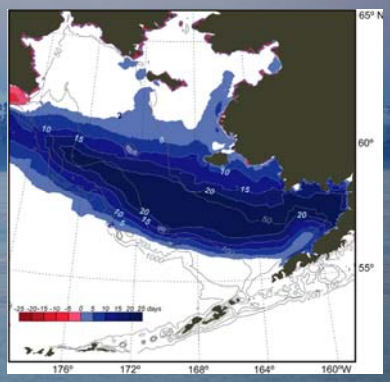


Average Mar - Apr

Differences in number of days of ice cover in March and April during **warm** and **cold** years



Warm (2001-2005)

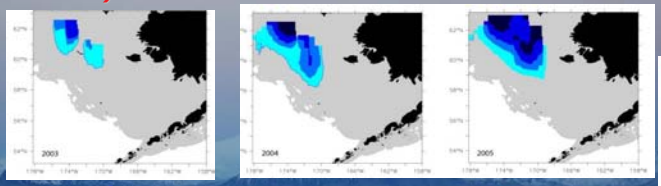


Cold (2007-2010)

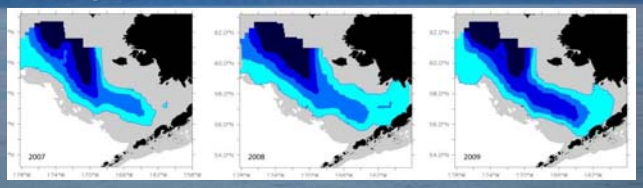
Cold Pool

Differences in the extent of the cold pool in warm and cold years

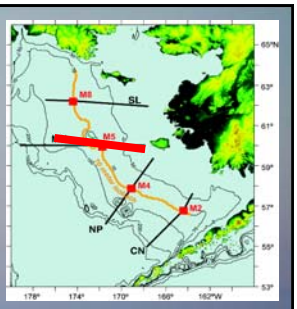
Warm (2003-2005)



Cold (2007-2009)



North-South Differences

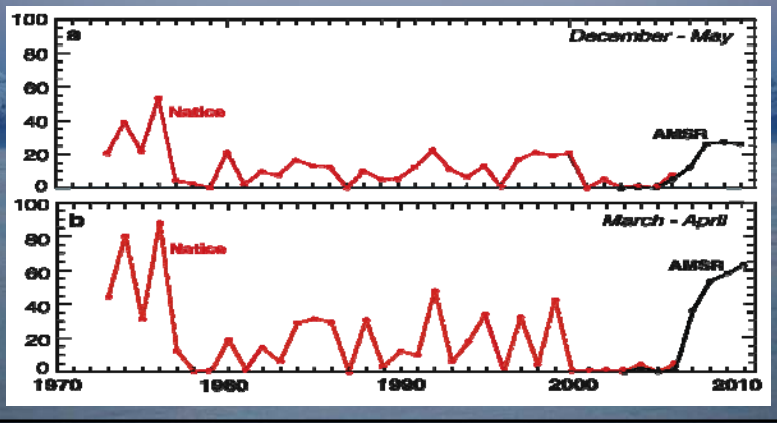


A north-south transition exists near 60°N that divides the northern and southern Bering Sea.

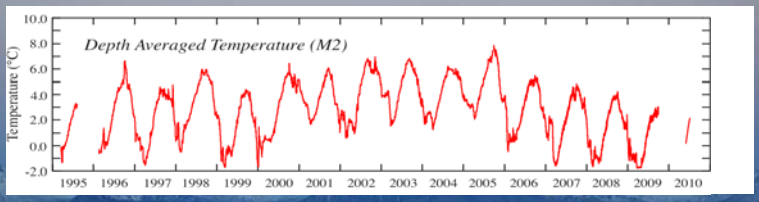
	North	South
Ice (Mar – Apr)	Extensive Ice	Decrease
Temperature	Cold	Warmer
Tides	Weaker	Stronger
Vertical Structure	~10 m pycnocline T, S equal	< 3 m pycnocline T dominated
Chlorophyll	Subsurface	Upper mixed layer

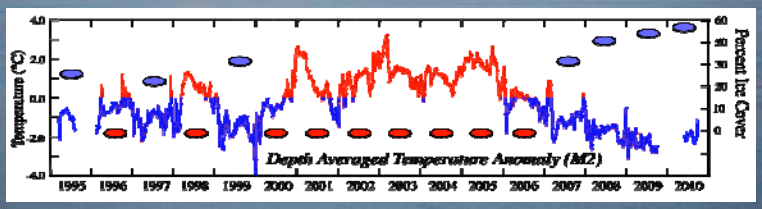
Sea Ice

Percent ice cover in a 100 km x 100 km box around M2.



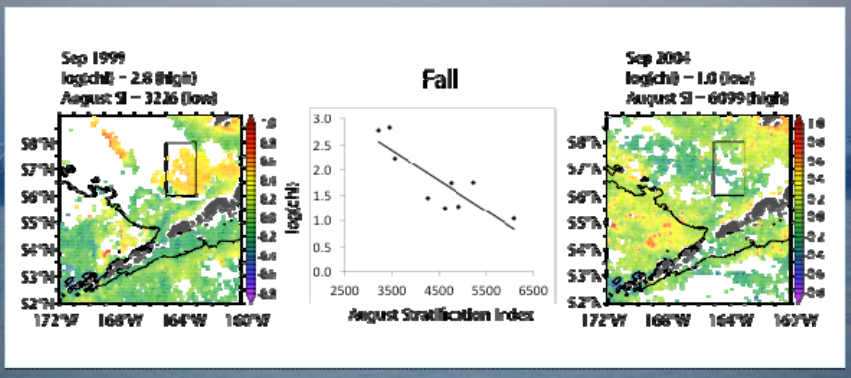
Temperature at M2





Phytoplankton Bloom

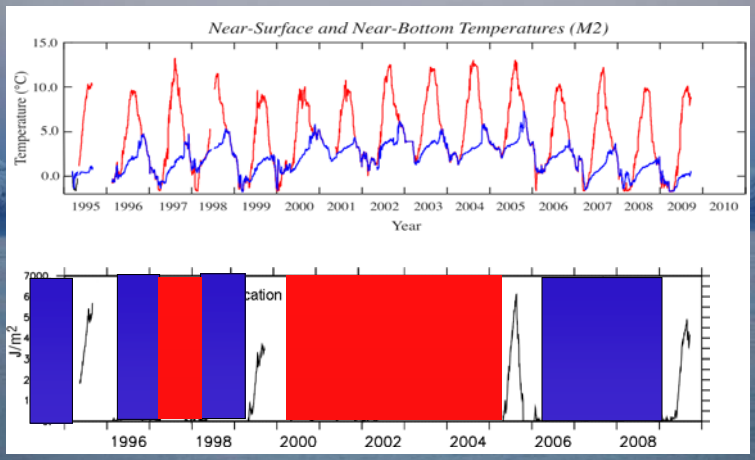
August stratification negatively correlated with fall chlorophyll



Ladd and Stabeno, submitted

Vertical Stratification

Warm or cold years do not associated with the strength of stratification

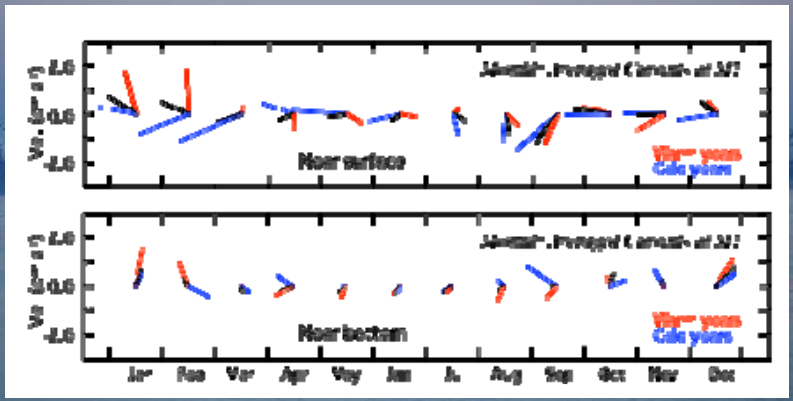


Ladd and Stabeno, submitted

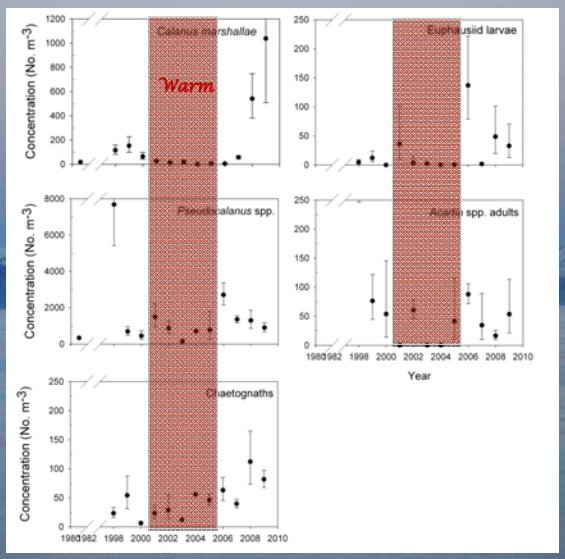
Monthly Mean Currents at M2

(1995 – 2010)

Warm and cold years are not associated with different flow patterns -at least at M2.

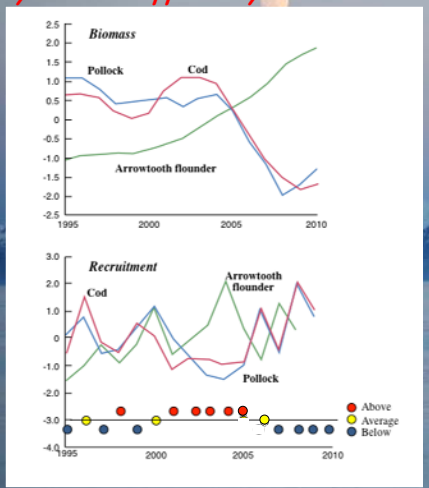


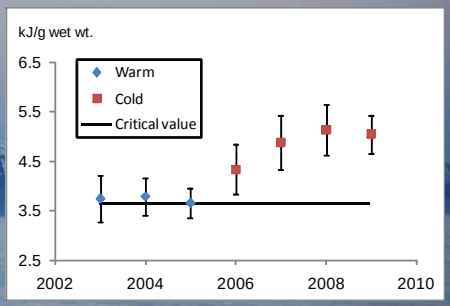
Zooplankton



Groundfish

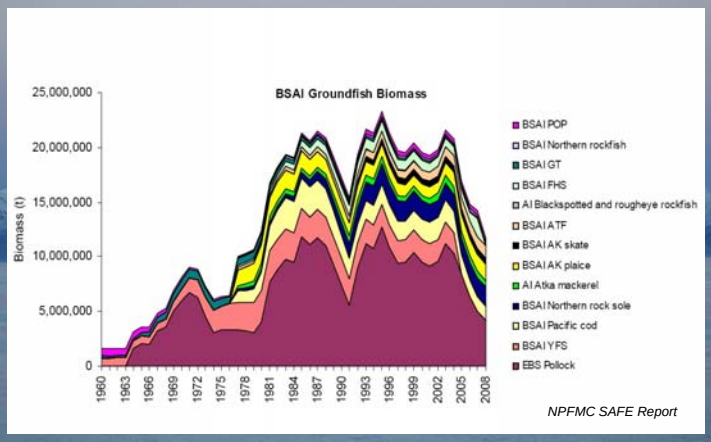
Young of the year pollock entered winter with low energy reserves in warm years and apparently did not survive the winter.





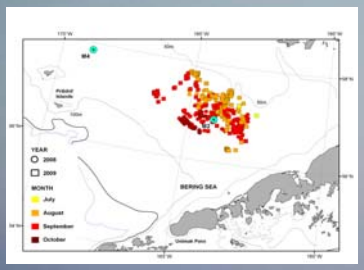
Heintz, Farley

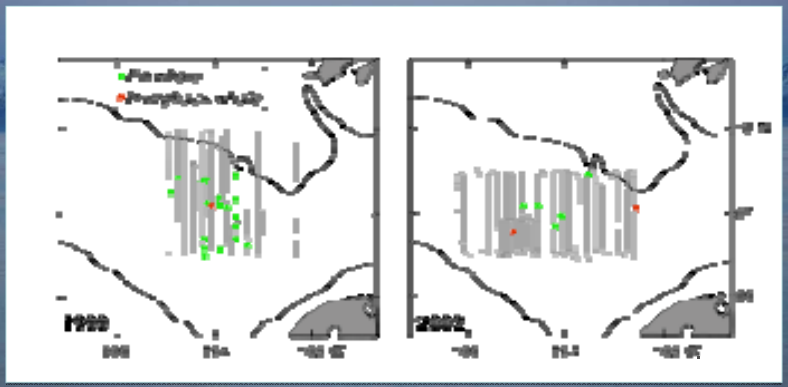
Groundfish Biomass



NPFMC SAFE Report

Whales





Summary

- Northern Bering Sea will remain ice covered during winter and cold, the southern shelf is more susceptible to warming climate.
- In 2000 there appeared to be a shift from interannual variability to multi-year patterns.
- Water column stability does not appear to determined by whether it is a warm or cold year.
- Summer population of large zooplankton over the southern shelf were low during warm years (2001 – 2005), and have rebounded during the recent cold period.
- Overwintering survival of age-0 pollock was low in warm years over the southern shelf, likely as a result of poor condition as they entered their first winter.

Future

- **If the northern middle shelf remains cold, it will not likely be suitable habitat for pollock.**
- **If the southern middle shelf warms similar to 2001-2005, there could be a reduction in the abundance of large zooplankton which would influence upper trophic levels.**