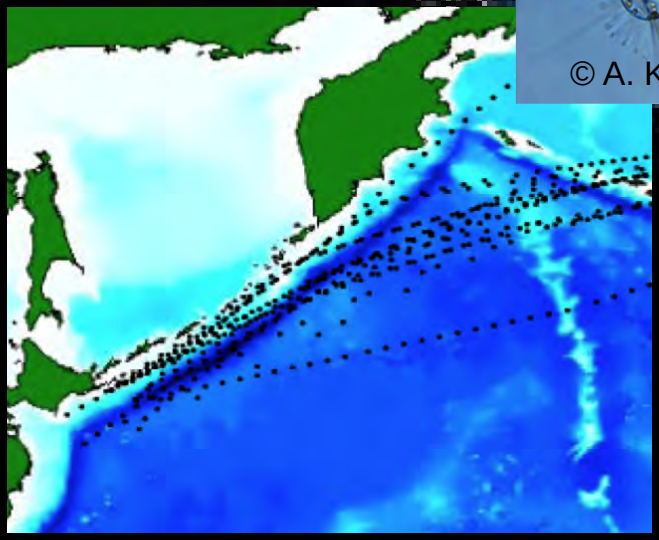
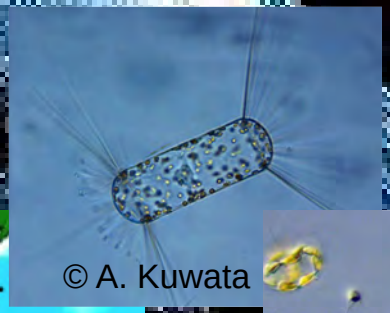
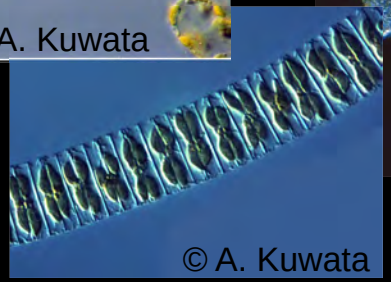
May 2012 2nd International Symposium “Effect of Climate Change on the World’s Ocean
Yeosu, Korea

Lower trophic level linkage and cool-warm cycle based on the North Pacific CPR survey 2001-2009: An implication for the future warming ocean

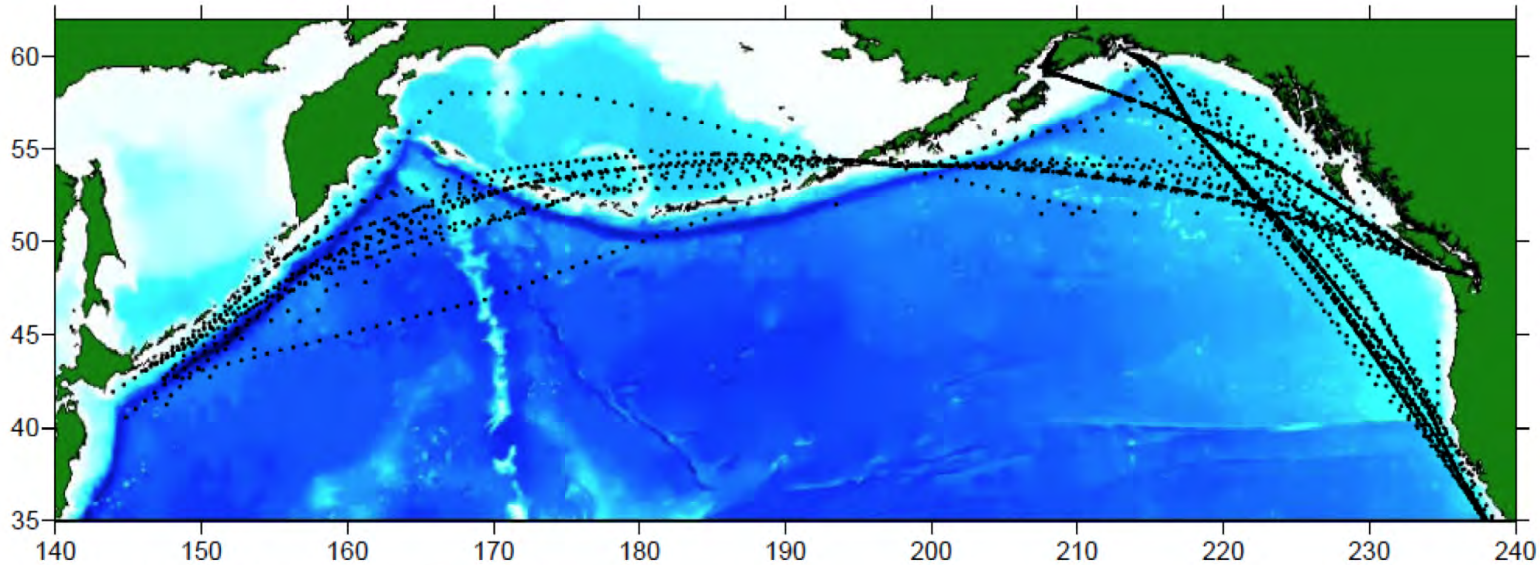






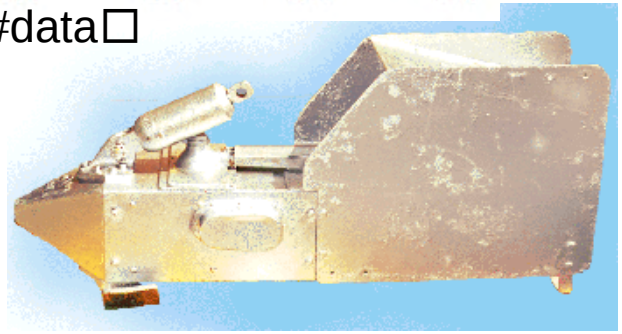
Sanae Chiba, T. Yoshiki, K. Sasaoka, H. Sugisaki, T. Ono and S. Batten
E-mail: chibas@jamstec.go.jp

North Pacific CPR Project (2000~)



http://www.pices.int/projects/tcprsotnp/default.aspx/#data□

Japanese Contribution:
Analysis of data taken < 170°E



JAMSTEC□ **Fisheries Resaerch Agency□**

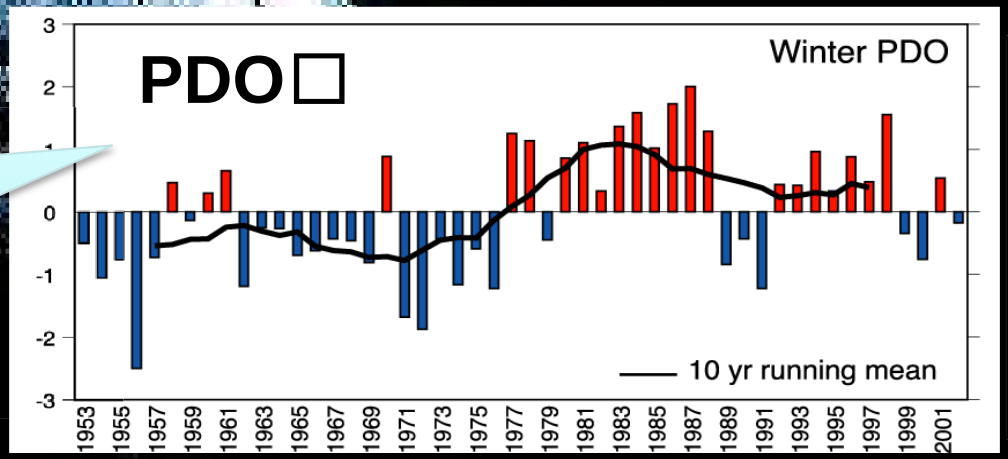
Funded by JSPS (MEXT)□

roll on – roll off cargo ship
SKAUBRYN

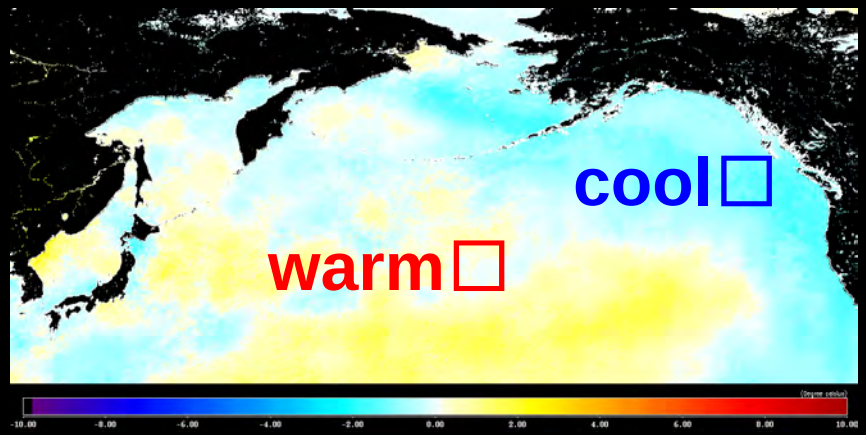
Background

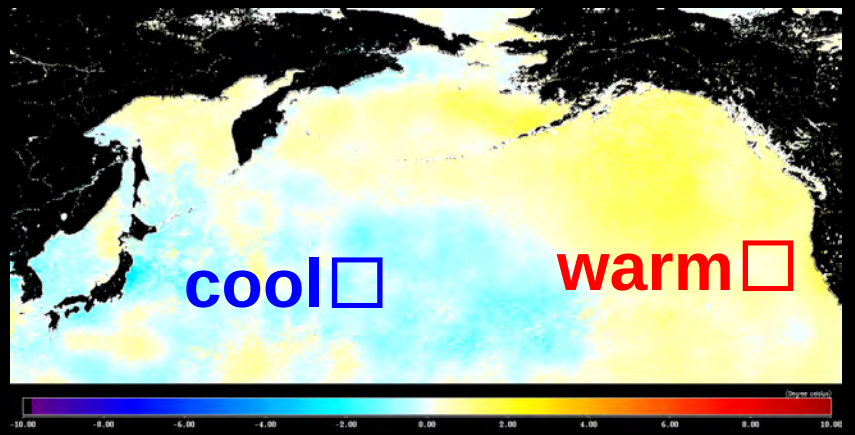
Climatic forcing e.g. ENSO and PDO derives dipole cool-warm cycles of inerannual~interdecadal scales over the North Pacific.

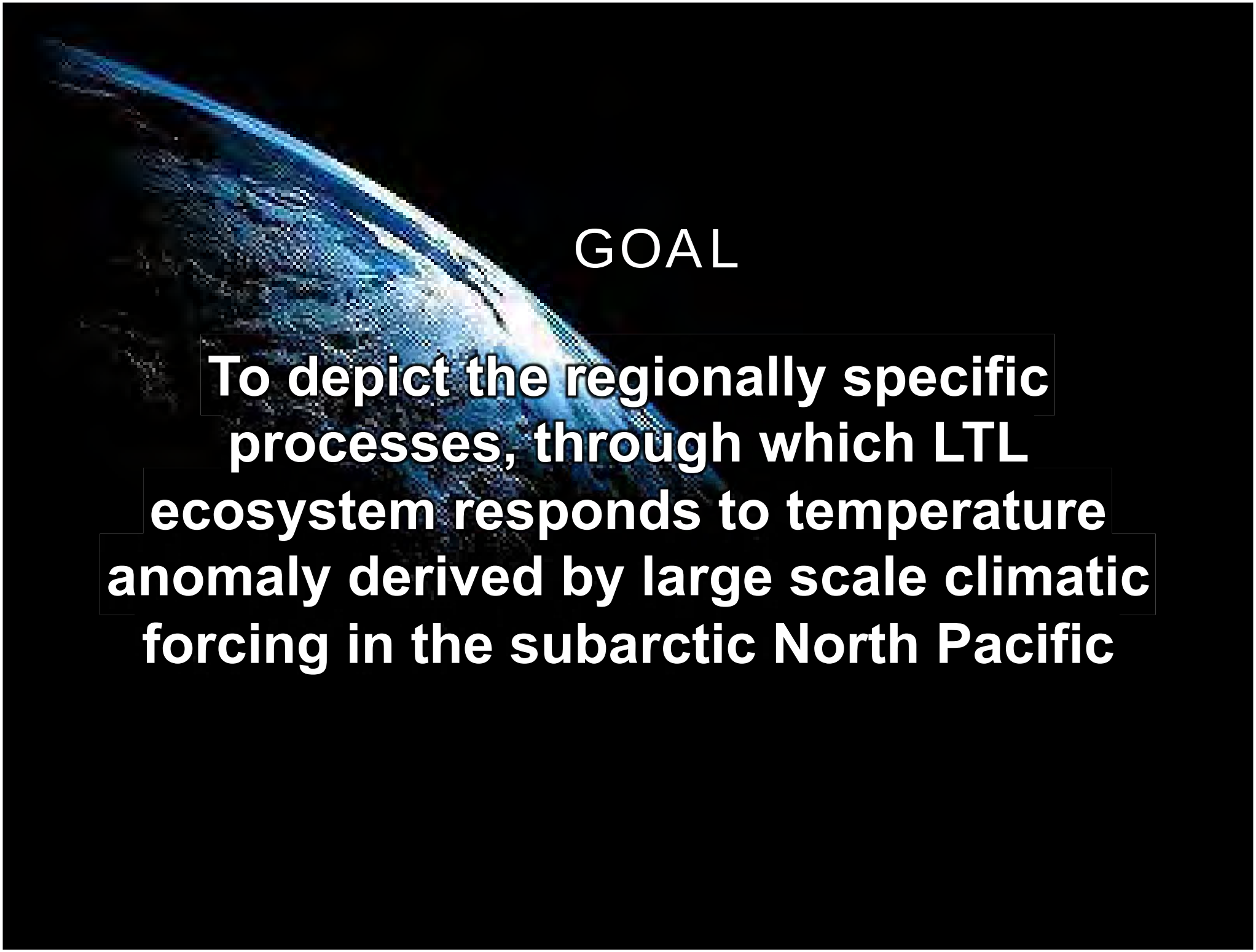
Their “warm” years are our “cool Years□



Implication of possible impact of warming trend□



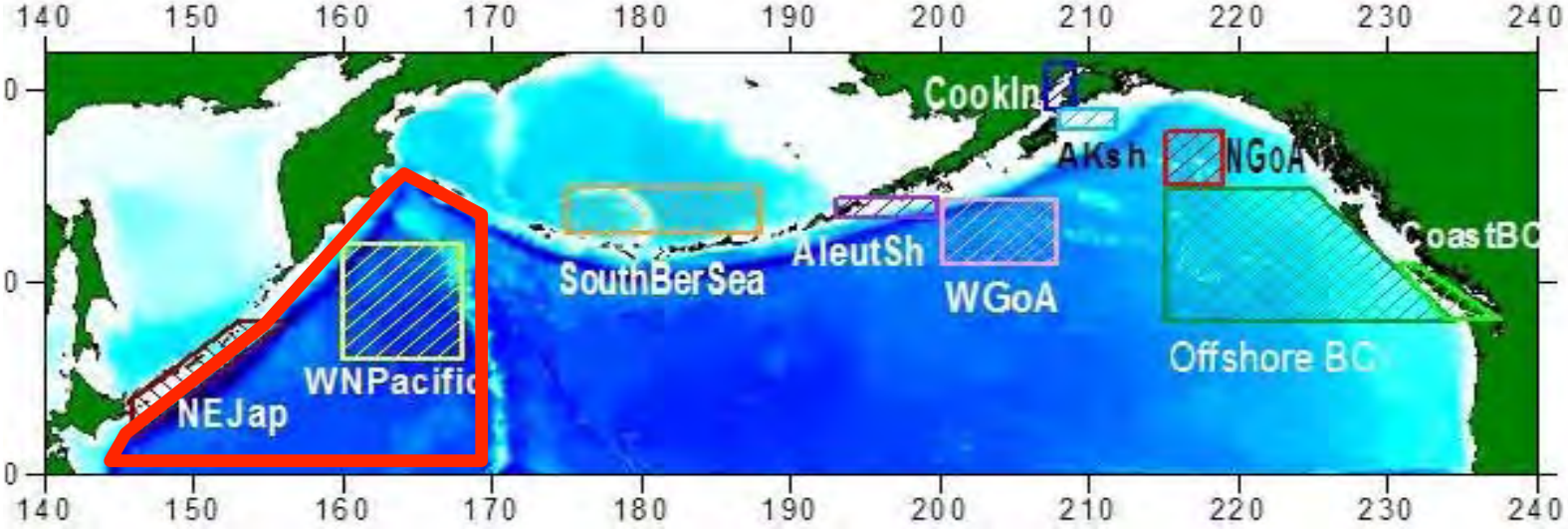




GOAL

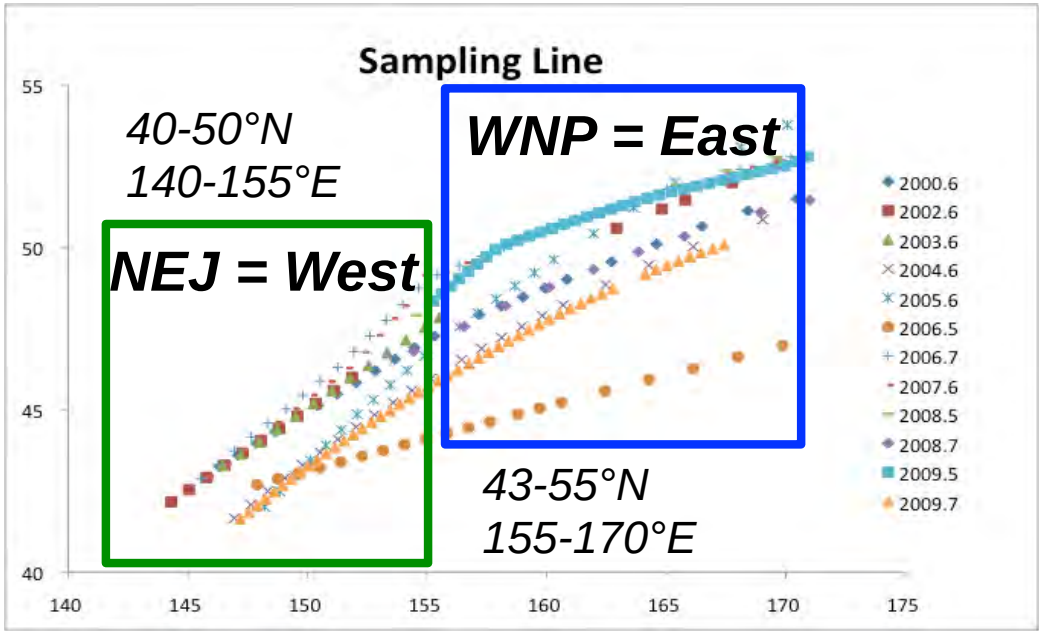
To depict the regionally specific processes, through which LTL ecosystem responds to temperature anomaly derived by large scale climatic forcing in the subarctic North Pacific

Comparison of Two Oceanic sub-Regions



CPR Transects (2001-2009)

Oyashio domain☐



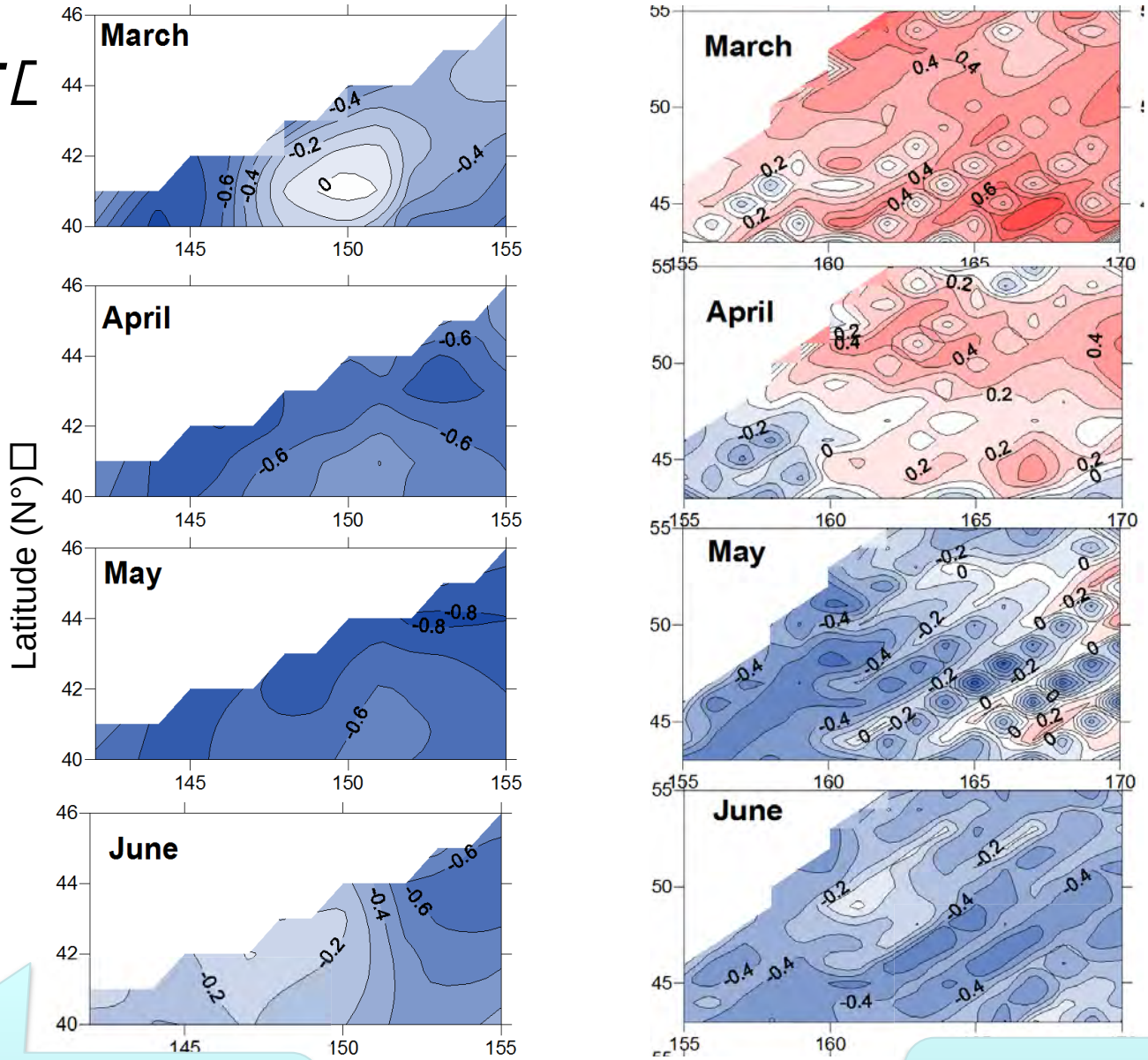
Subarctic gyre☐

3 transects per year (Apr-May, Jun-July, Sept-Oct)

PDO & SST Correlation Map (2001-2009) *(satellite SST)*

WEST

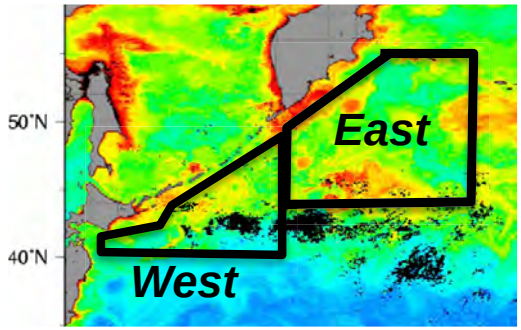
EAST



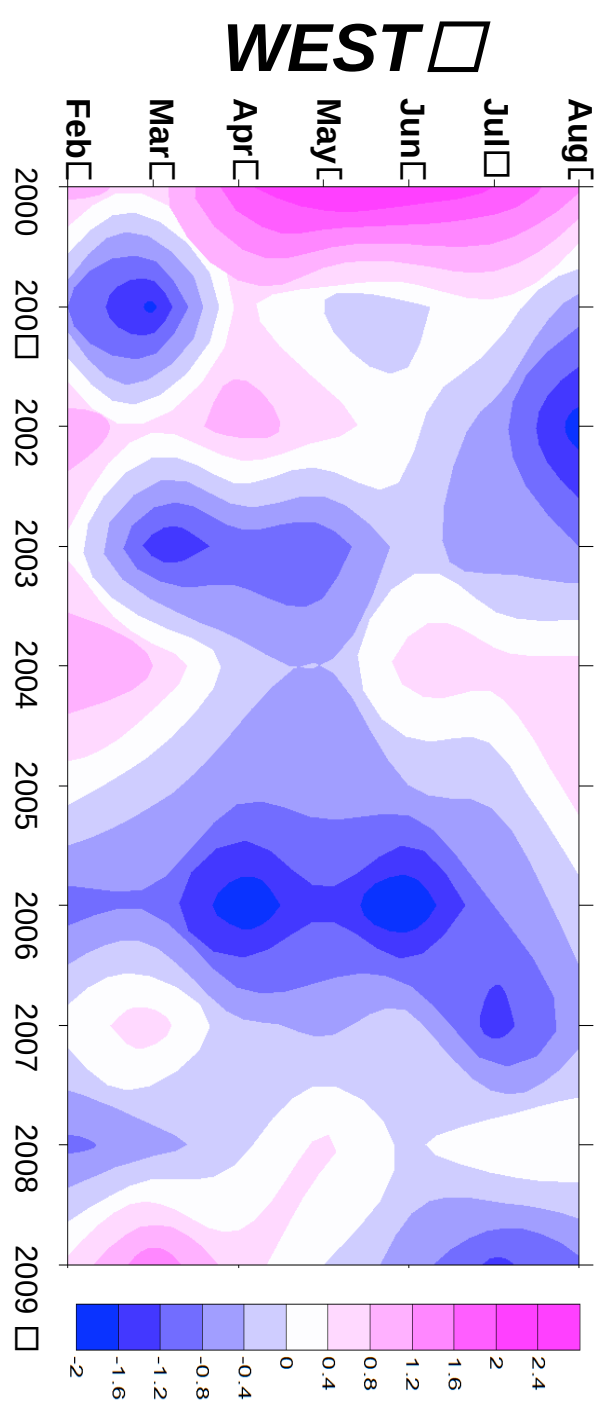
Negative correlation through the season: PDO positive (negative) = cool (warm)

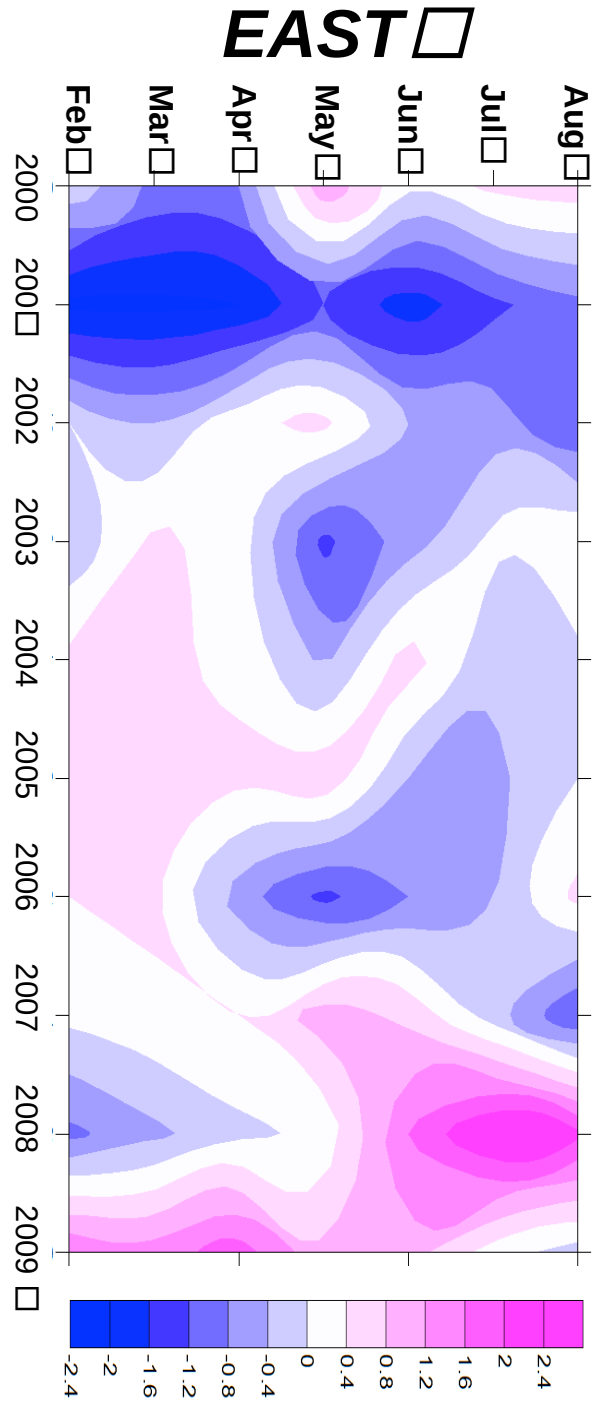
Correlation flipped from positive to negative from winter to summer

Monthly Normalized Area Mean SST Anomaly

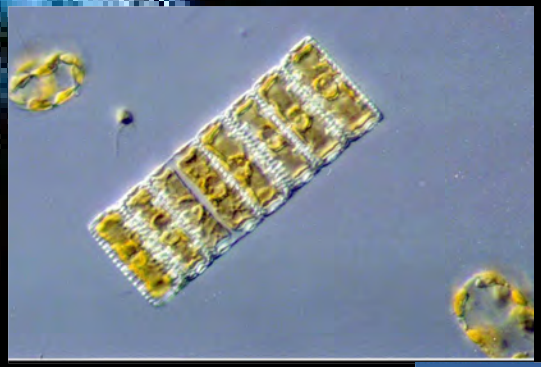


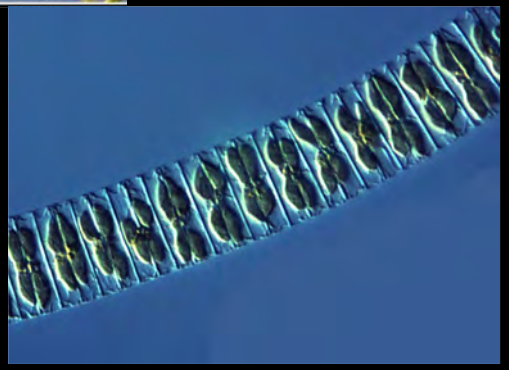
(Satellite SST)





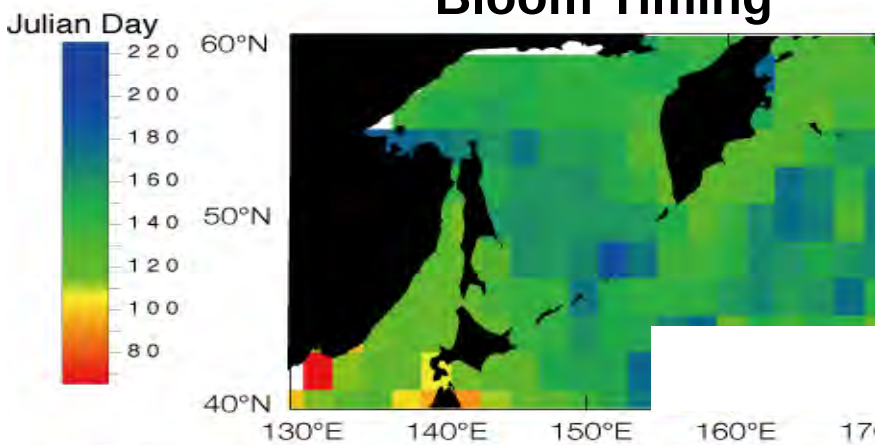
Phytoplankton



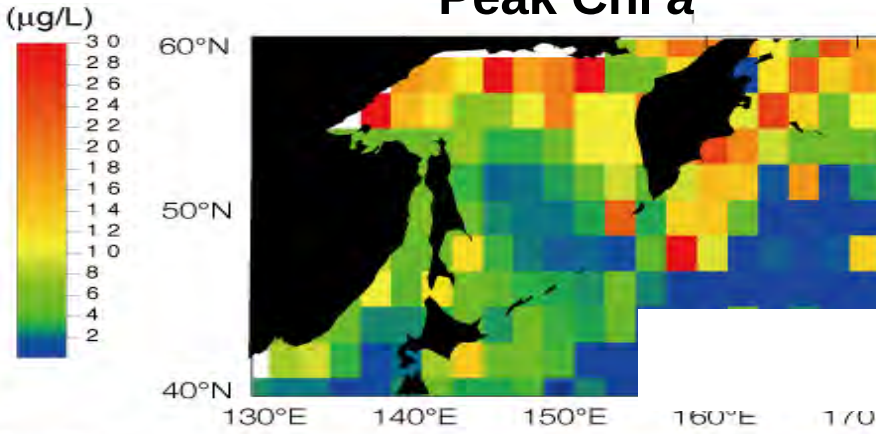


Seasonal Satellite Chl a and Timing of Bloom

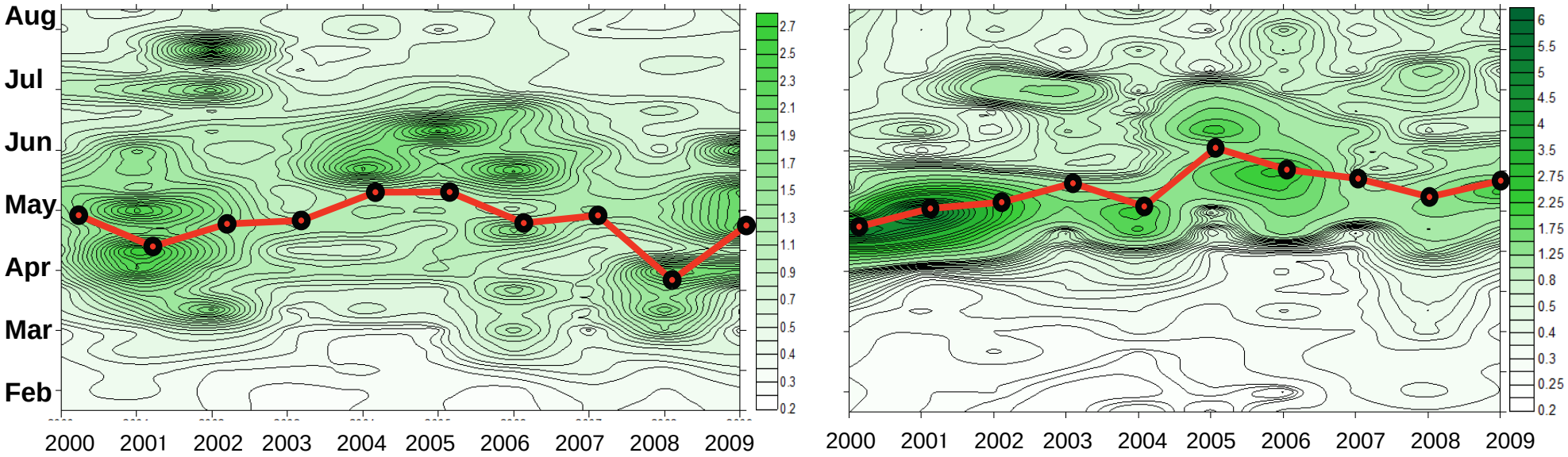
Bloom Timing



Peak Chl *a*



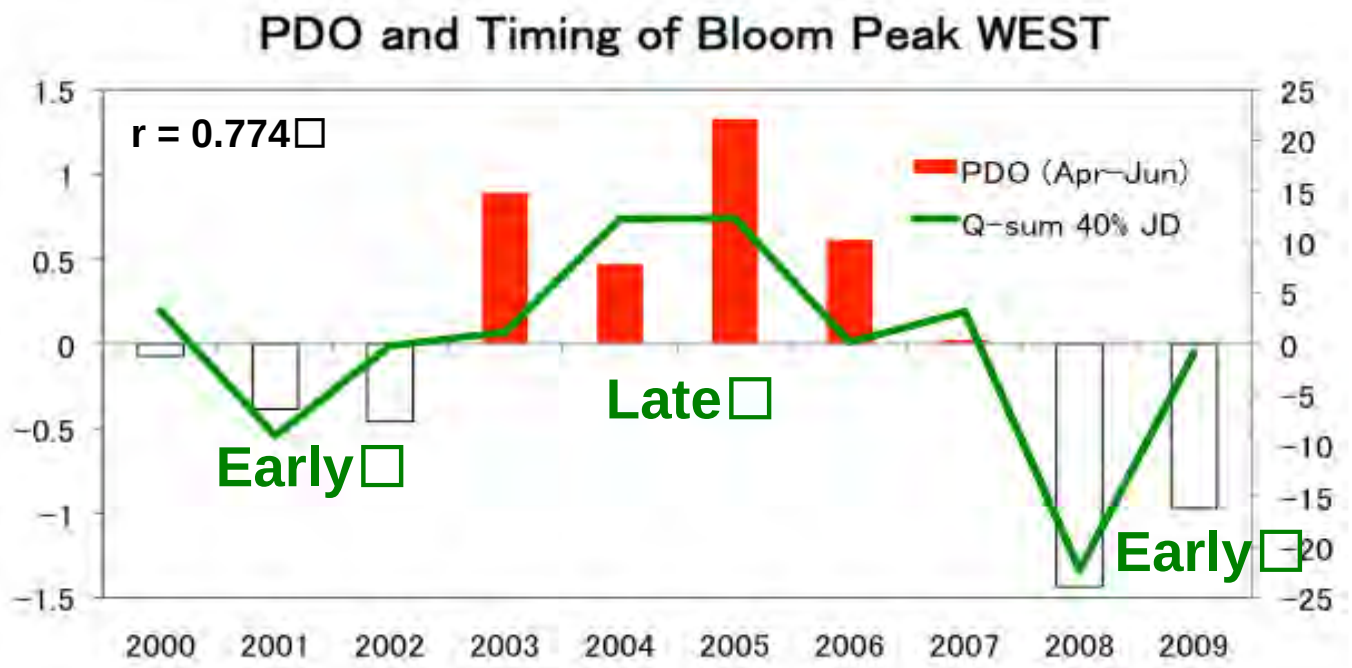
Area Mean Chl *a* (Satellite SST)

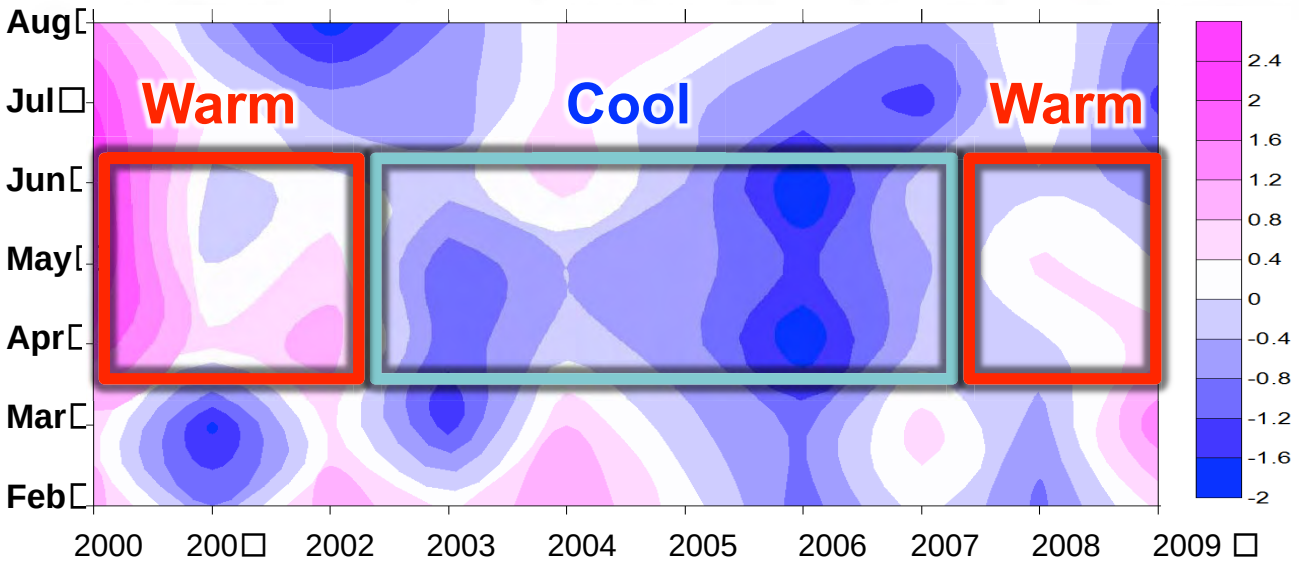


West Bloom Peak ***East***

(Date of 40% Q-sum Chl a)

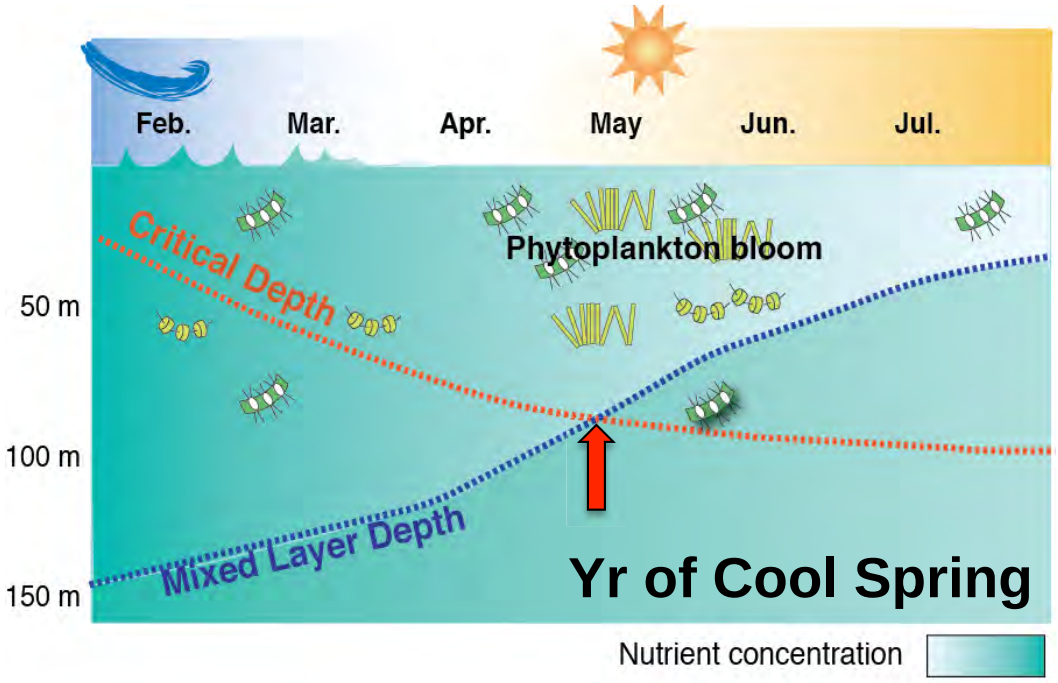
Phytoplankton Abundance Peak, SST & PDO (WEST)

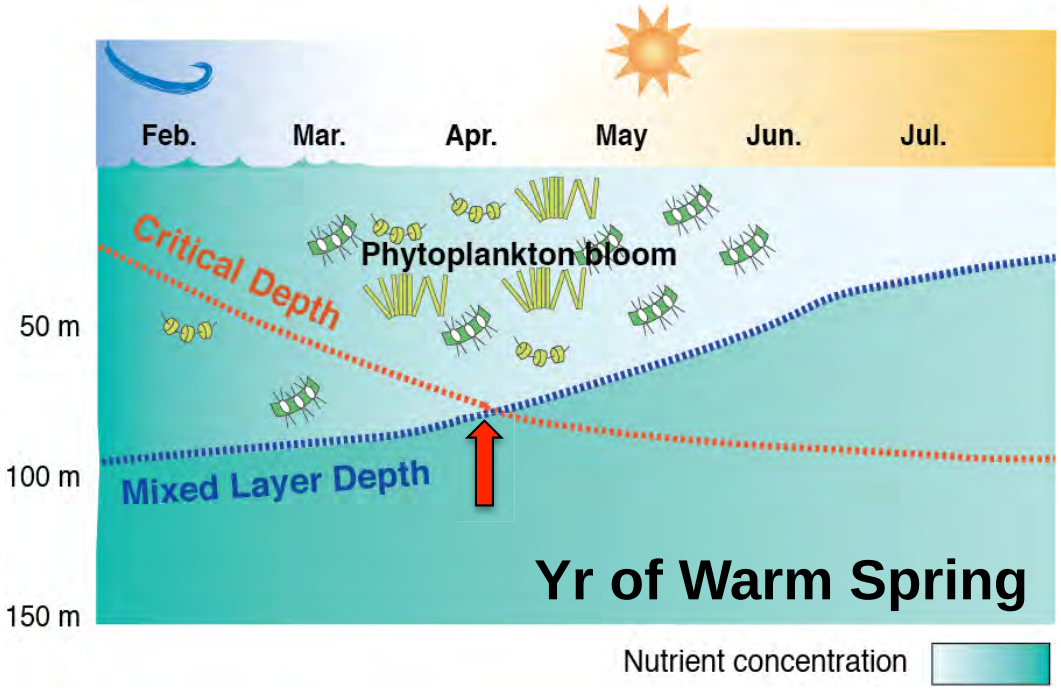




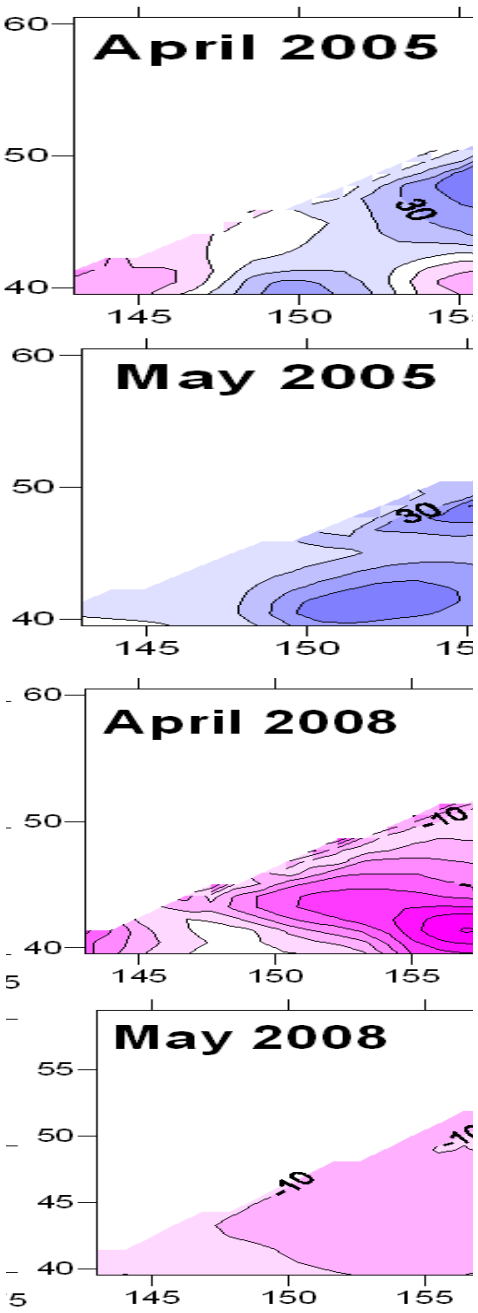
Monthly Normalized SST Anomaly (Satellite SST)

Bloom Timing in WNP: Mechanisms



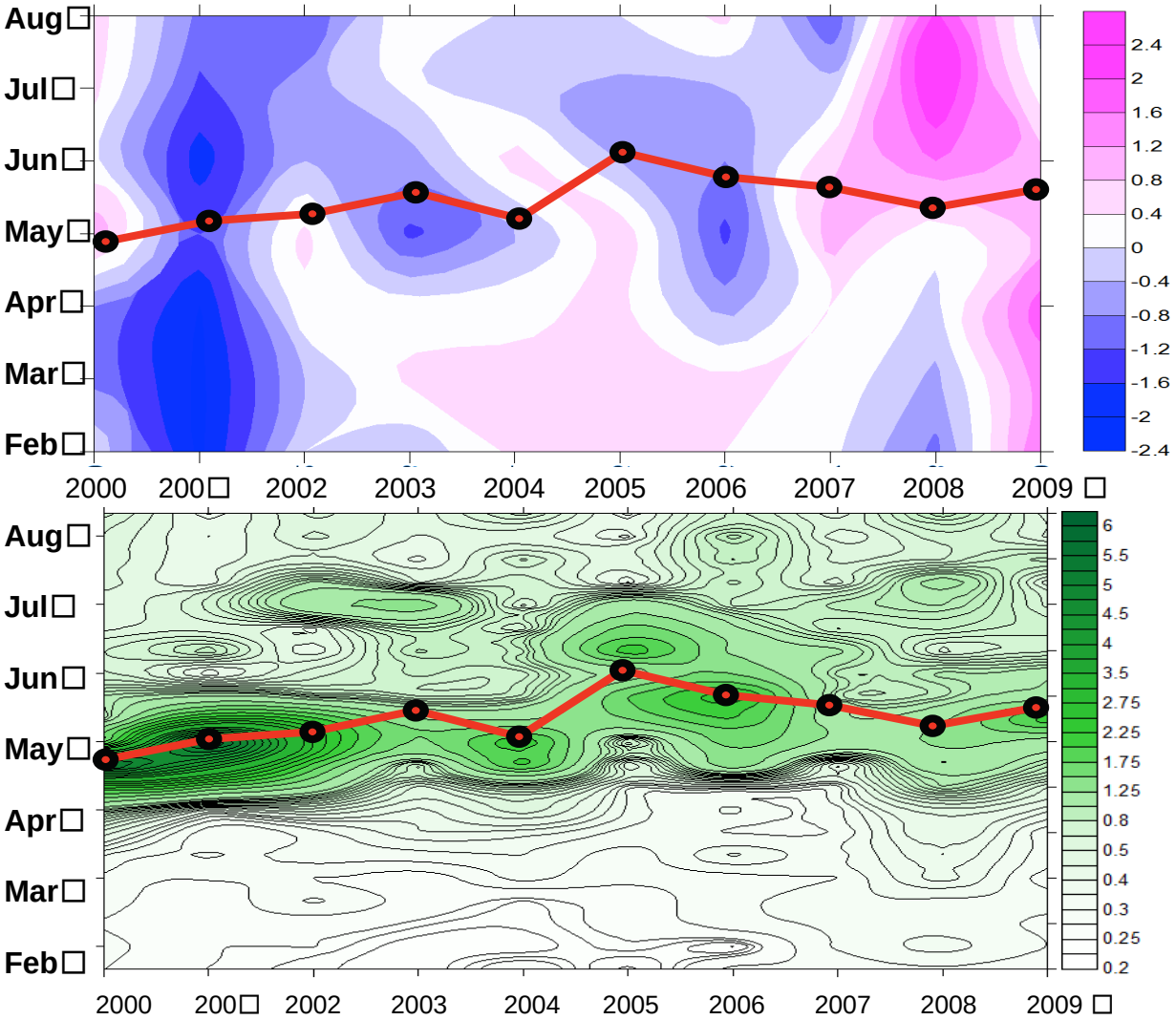


MLD Anomaly (2001-2009)



Source:
Argo Datasets

Phytoplankton Phenology (EAST)



No clear relationship bw/ SST & bloom timing

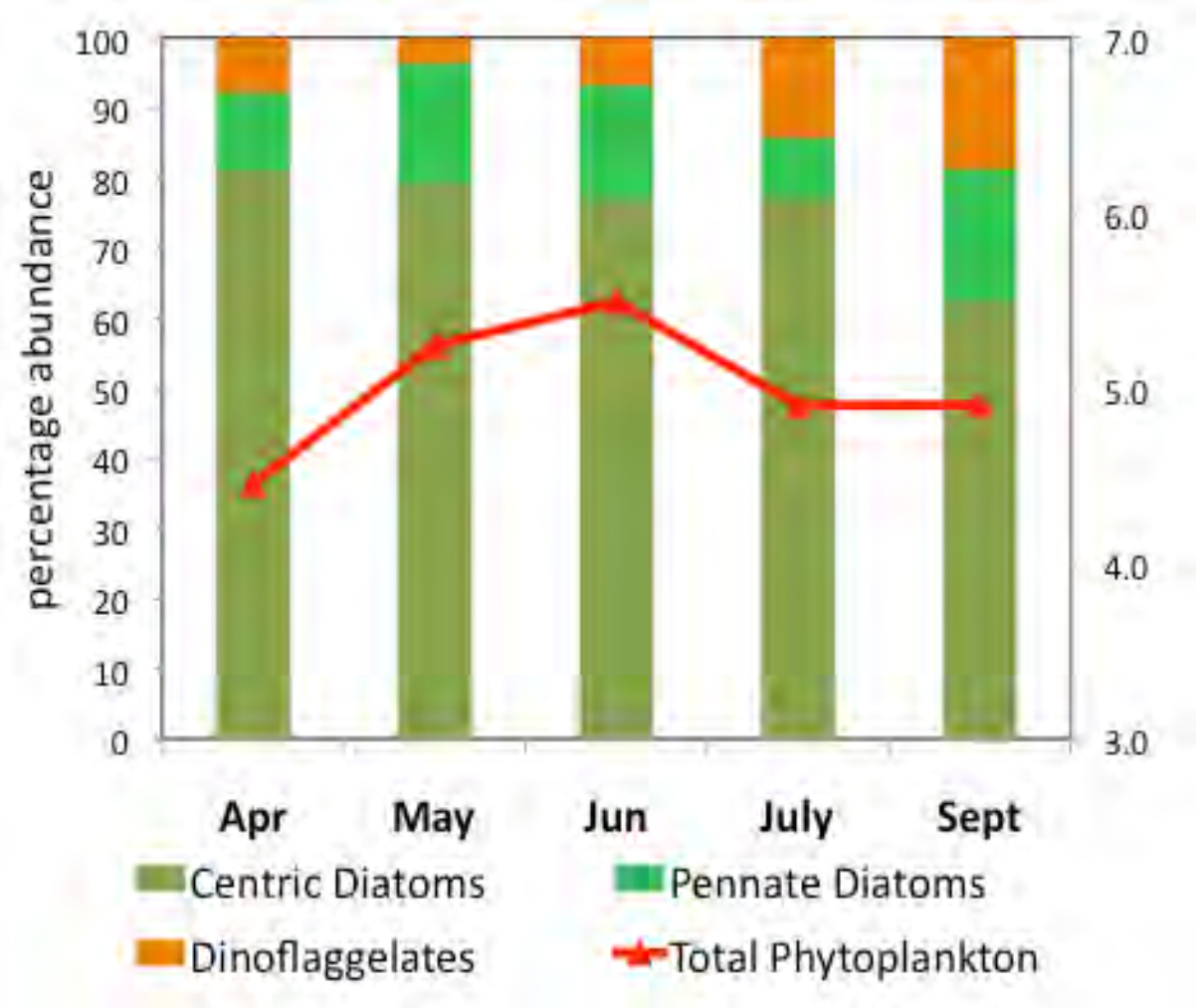
Due to complex seasonality in SST?

Phytoplankton Communty (CPR data)

Centric diatoms = bloom species☐

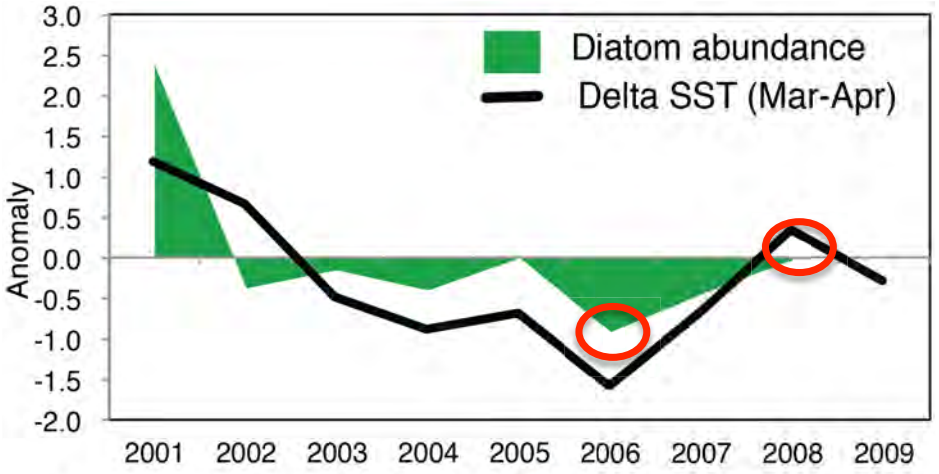
Seasonal variation larger in east☐

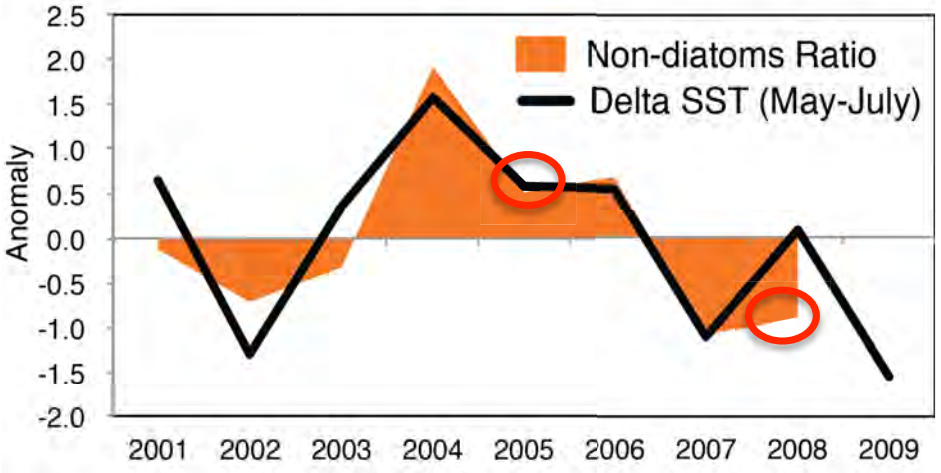
WEST☐



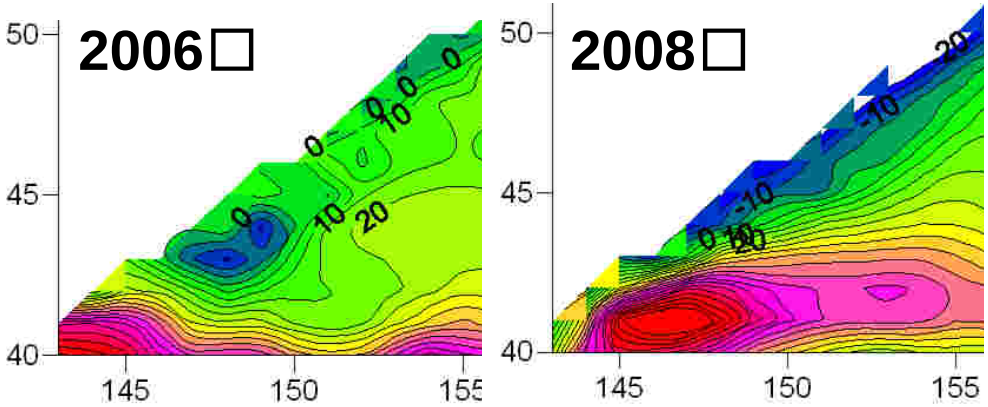
Phytoplankton Communty (CPR data) WEST

PP community changed responding to extent of seasonal warming (and ML shoaling) rather than SST value at a time☐

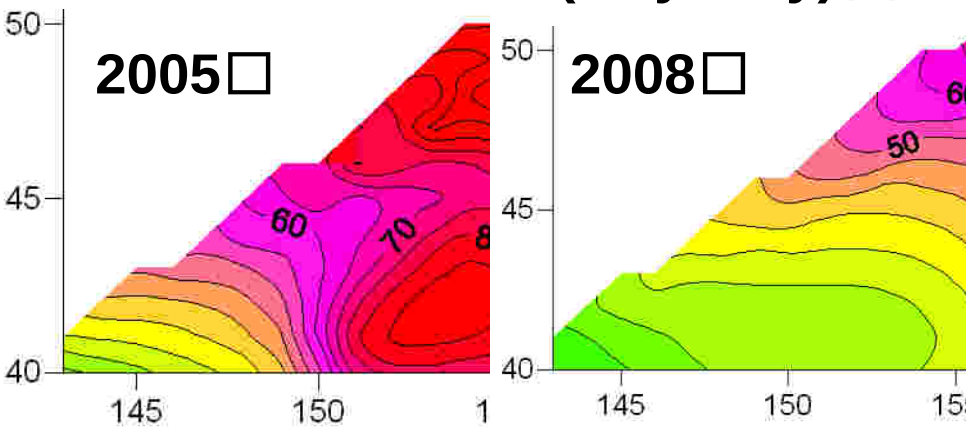




Delta MLD (Mar-Apr)☐



Delta MLD (May-July)(m)☐



Rapid warming (and quick stratification) in early spring benefits Diatoms and that in summer benefits Dinoflagellates☐

Source:
Argo Datasets☐

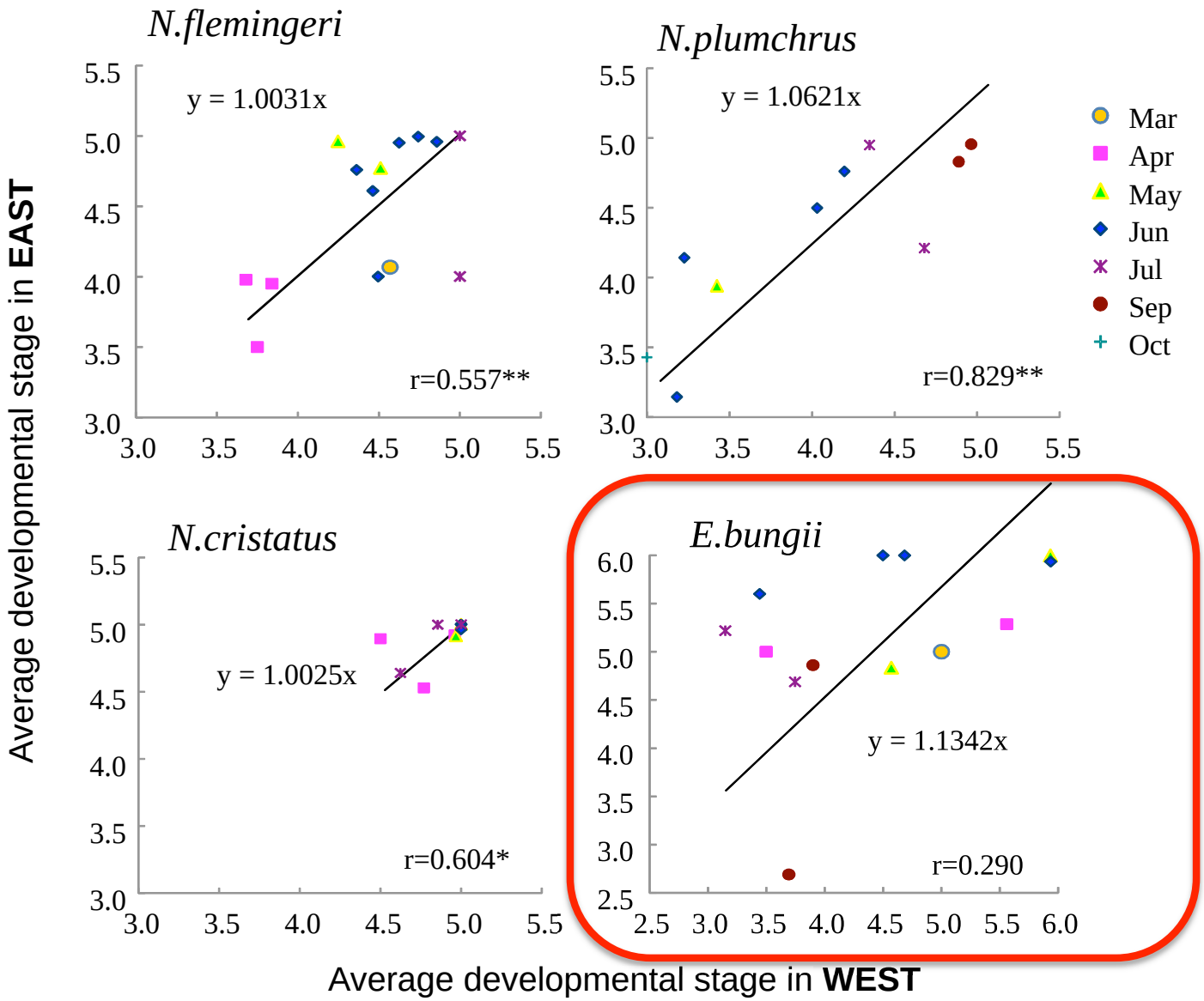
Zooplankton

(Photo: by Dr. T. Kobari)

4 dominant herbivores:

Neocalanus cristatus
Neocalanus flemingeri
Neocalanus plumchrus
Eucalanus bungii

Copepod Phenology (CPR data) East vs. WEST



No difference in developmental timing of the ***Neocalanus* spp**. between EAST and WEST. Only ***E. bungii*** showed the regional difference.☐

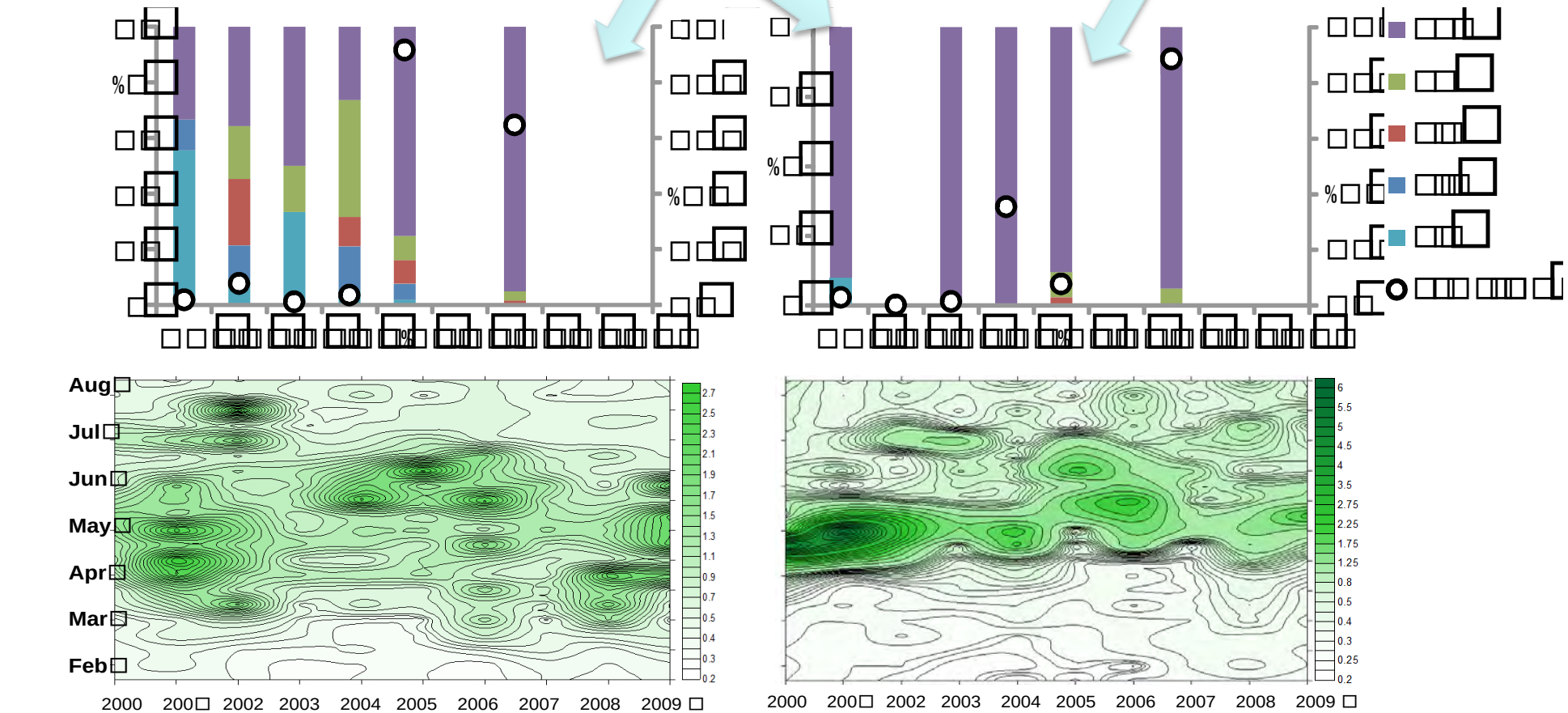
Developmental composition of Eucalanus bungii *(June)*

Different lifecycle strategy (e.g. 1yr vs. 2yr cycle)?

Late reproduction due to the late bloom timing in EAST?

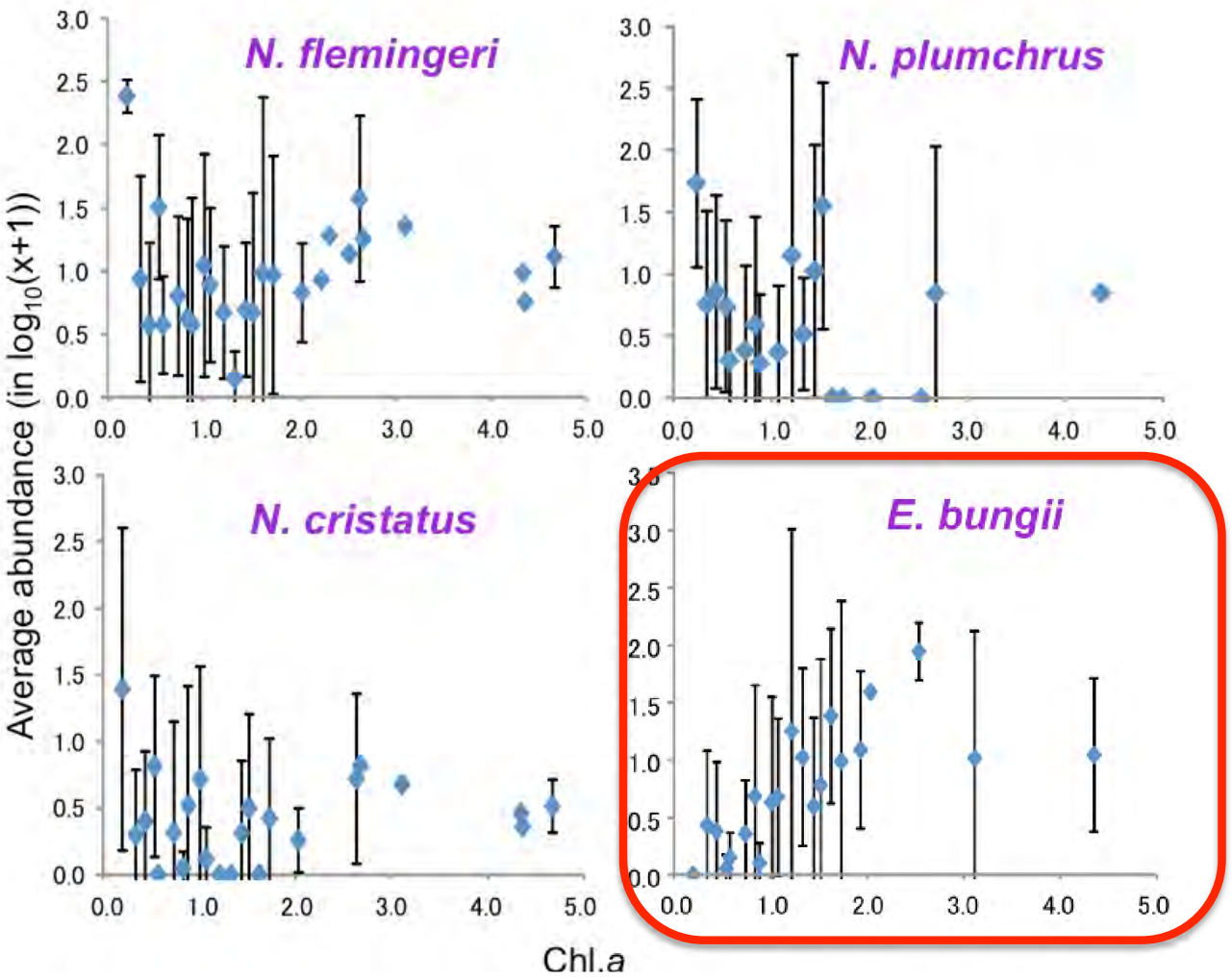
WEST

EAST



Area Mean Chl a

Copepods Abundance & Chl a (Apr – Jul, all area)



Abundance varies depending on phytoplankton availability only for ***E. bungii*** ($r = 0.655$, $p < 0.001$)

Was *Neocalanus* production more largely determined by factors other than PP availability?

Summary 1

Springtime Cool-Warm anomaly, which related to PDO (so ENSO, too) determines timing of phytoplankton bloom

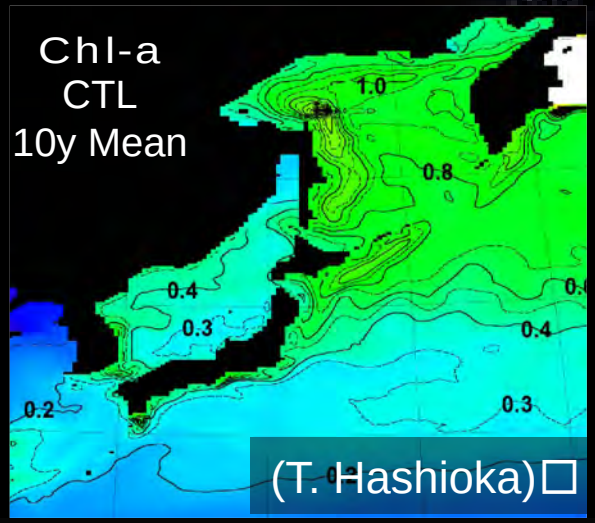
Extent of seasonal warming (ML process) determines seasonal succession of phytoplankton community structure

To better predict phytoplankton response to future climate change, not only change in interannual C-W cycle, but change in seasonal C-W cycle must be understand□

Summary 2

Zooplankton response to phytoplankton phenology are species specific

To describe PP-ZP link more realistically, zooplankton lifecycle strategy must be considered. ☐



ZP

Impact on HTL?☐

Change in BCP?☐

Warming experiment of PP☐