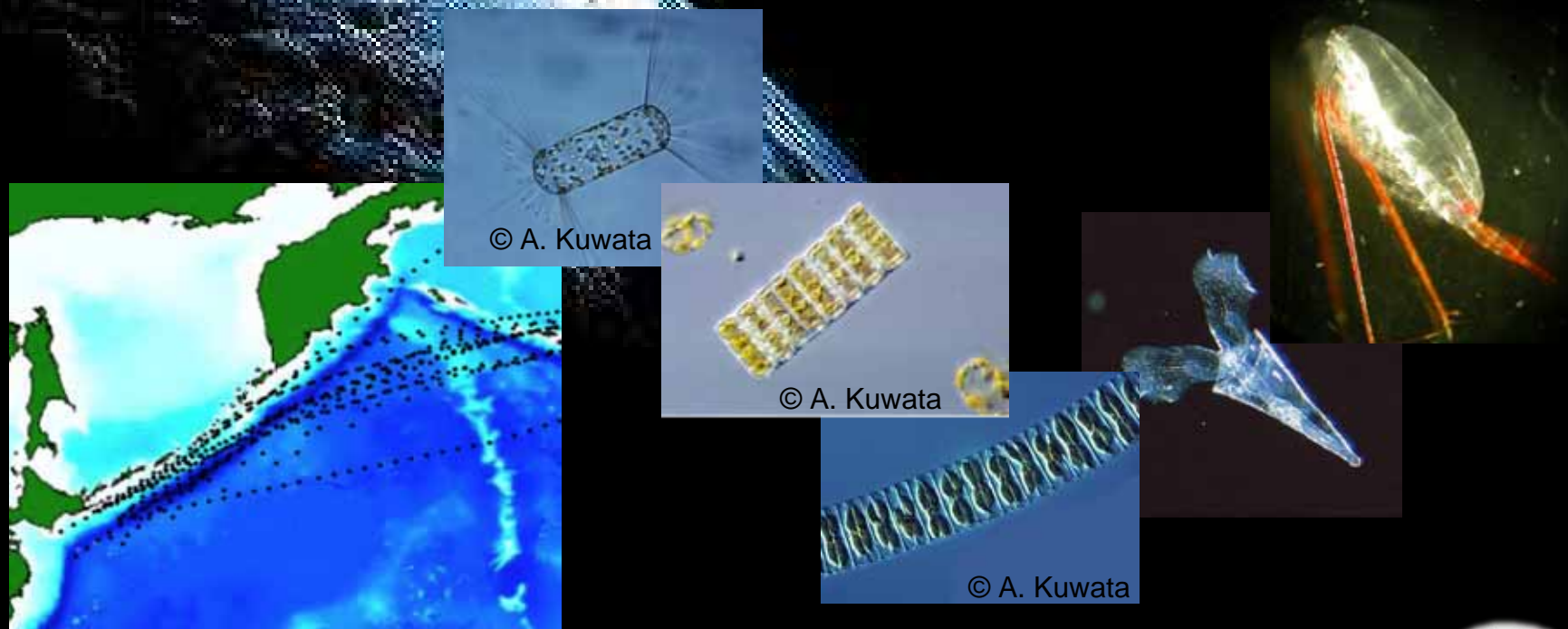


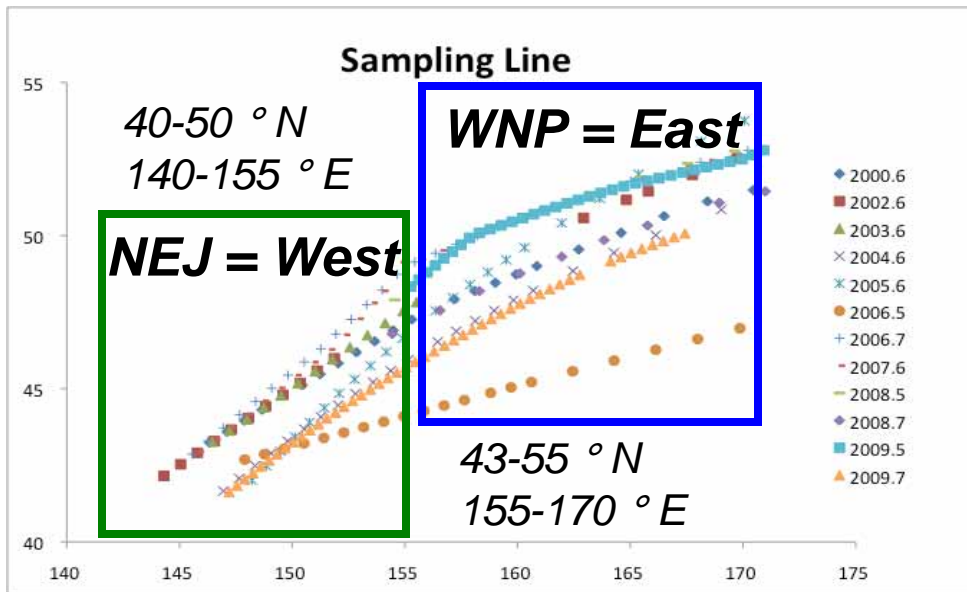
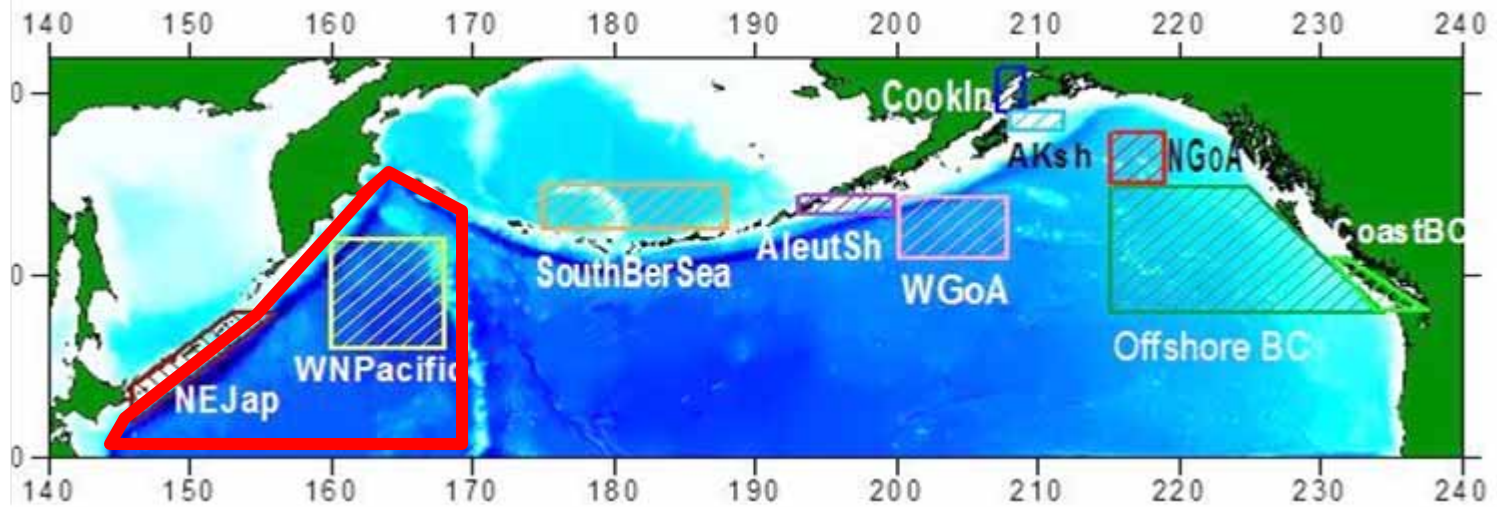
Phytoplankton phenology and community changes in the western subarctic North Pacific 2000-2009 based on satellite and CPR observation



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



Data for Community Analysis : CPR 2001-2009



Zooplankton

Neocalanus plumchrus

Eucalanus bungii

Abundance

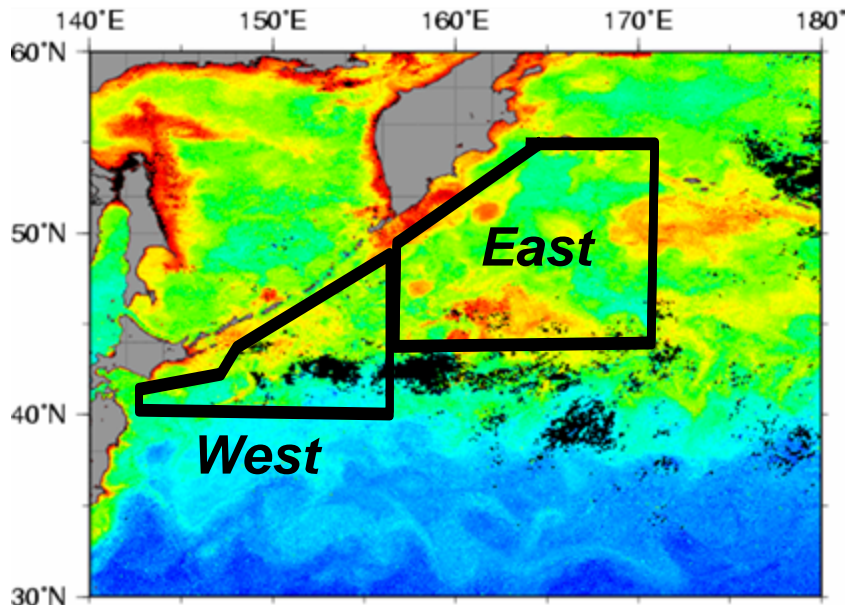
Developmental stage composition
(Mean copepodite stage)

Phytoplankton

Diatom & Dinoflagellates

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

Data for Phytoplankton Phenology: Satellite Ocean Color



Time-Series Surface Chl a

Area Average Chl a

Feb 1st – August 31st, 2000-2009

Based on 10 days composite of 1° x 1° data

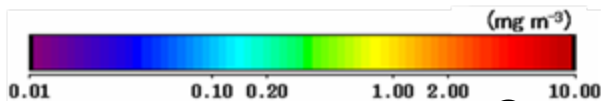
Phenology

Q-sum Analysis

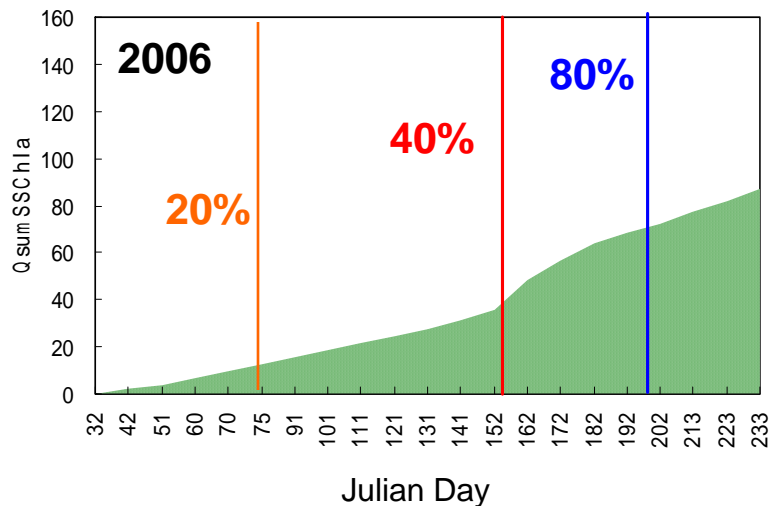
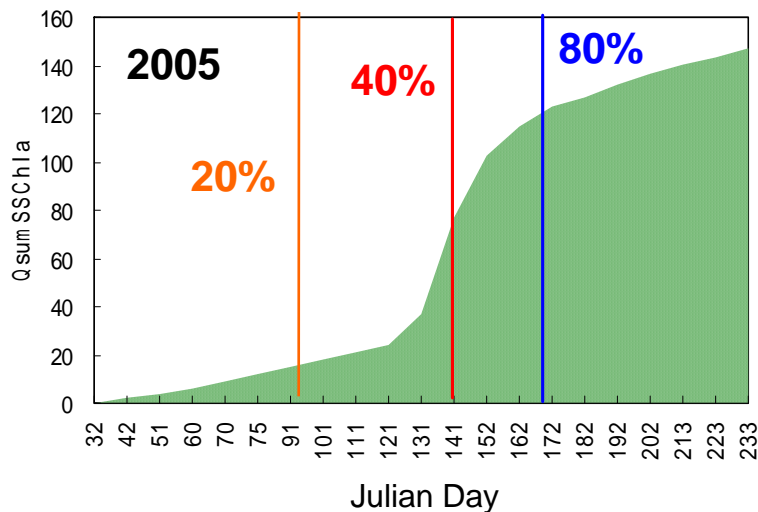
Julian Day on which Q-sum reaches 40% of overall (Feb-Aug) Q-sum = timing of bloom peak

(based on the Gaussian curve fit analysis)

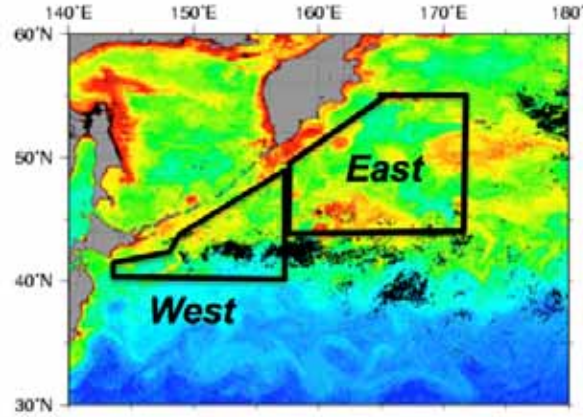
and that of 20% and 80% = beginning & end of bloom



Q-sum Chl a _ EAST (e.g.)

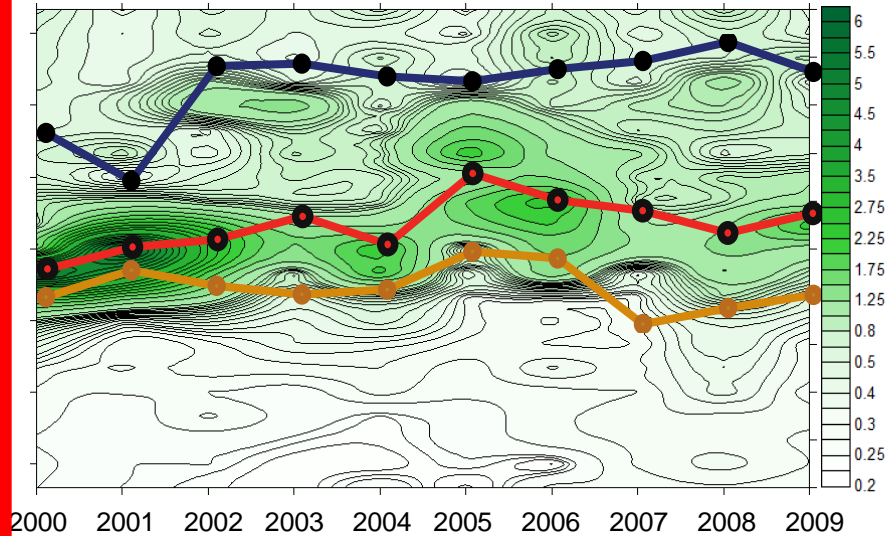
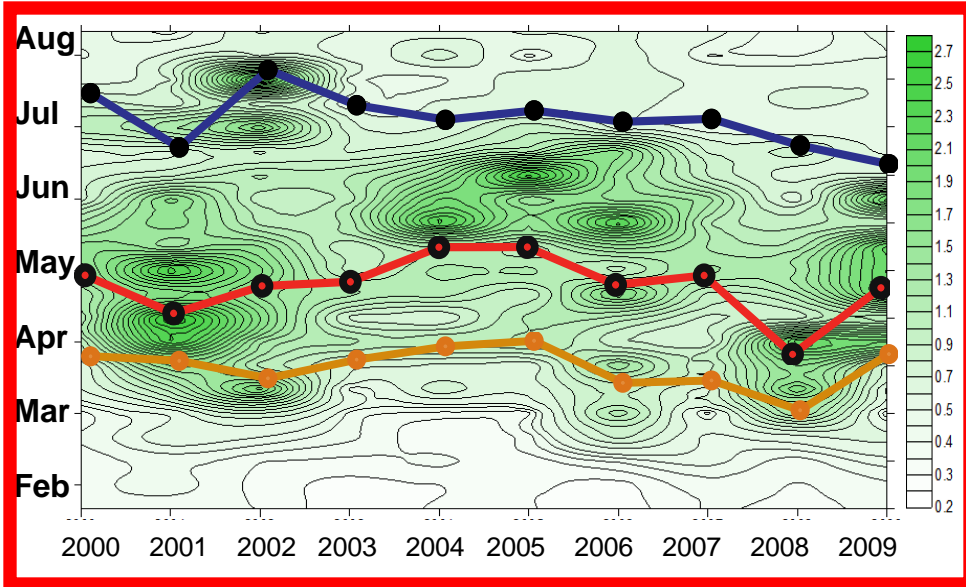


Seasonal Satellite Chl a and Timing of Bloom



West

East

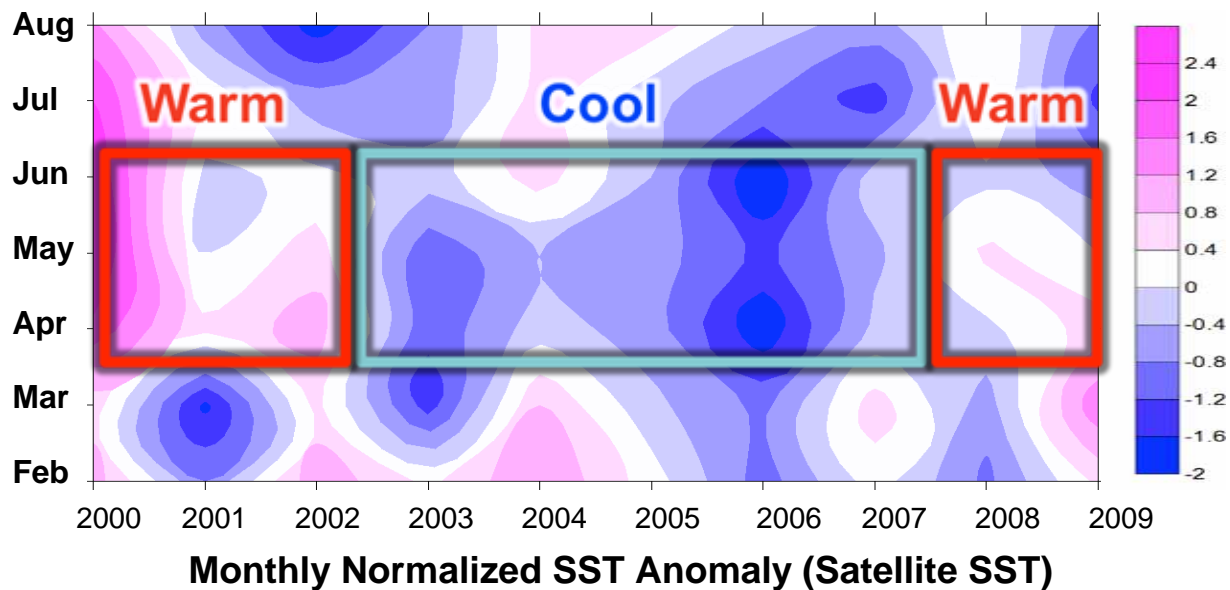
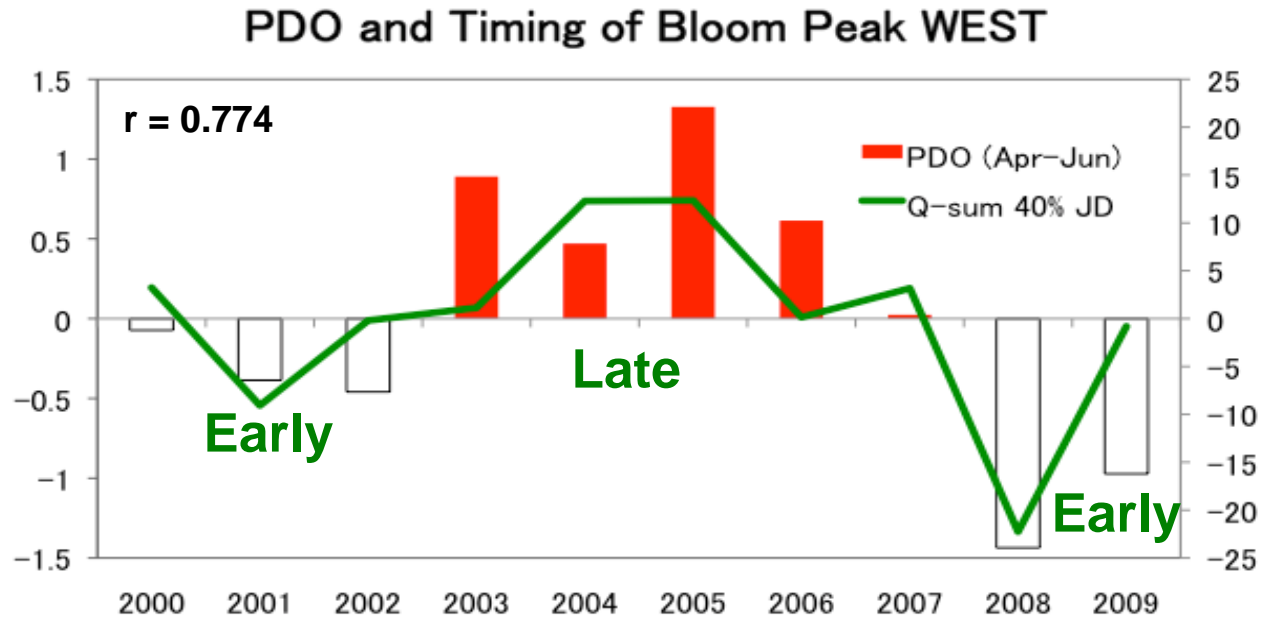


Bloom Peak

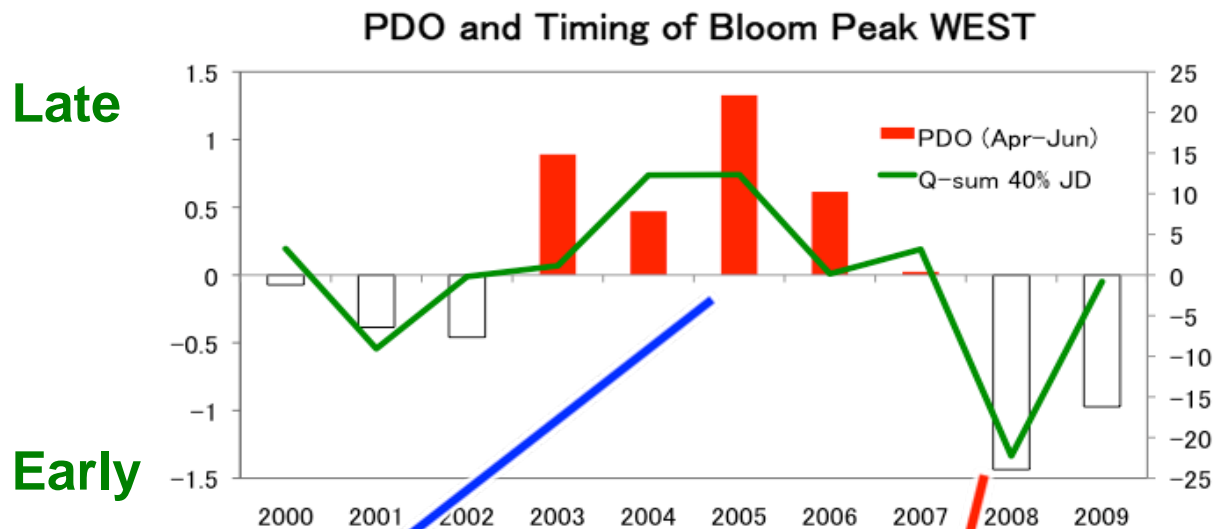
Bloom Beginning

Bloom End

Results: Phytoplankton Bloom Peak & PDO (WEST)

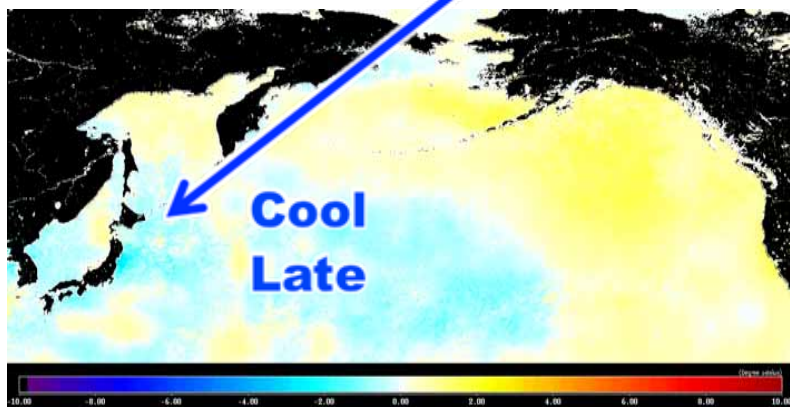


Results : Phytoplankton Bloom Peak & PDO Pattern (WEST)



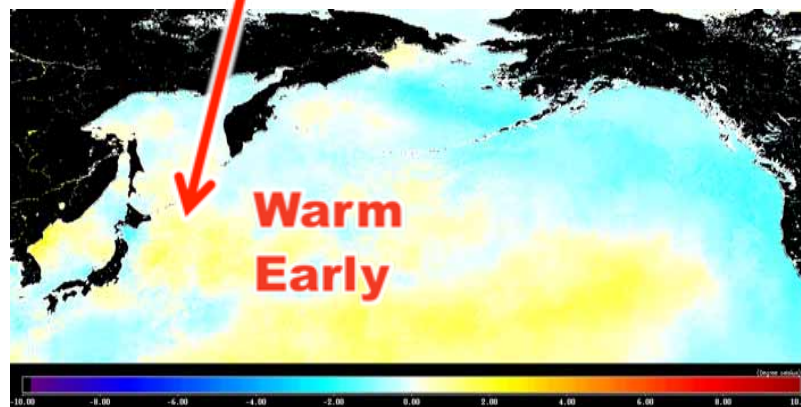
Late

Early



Cool
Late

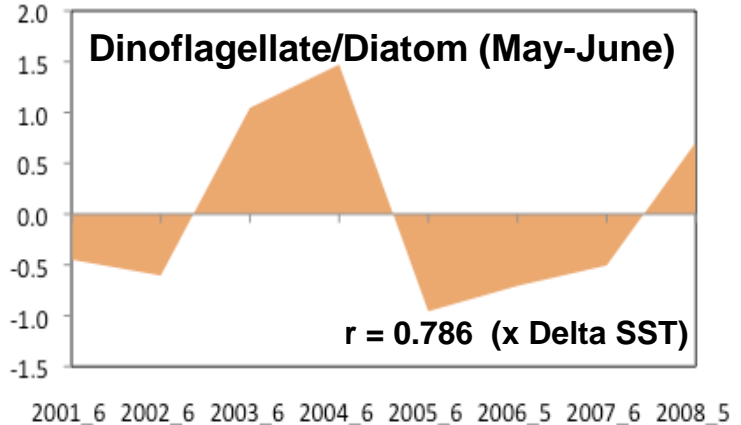
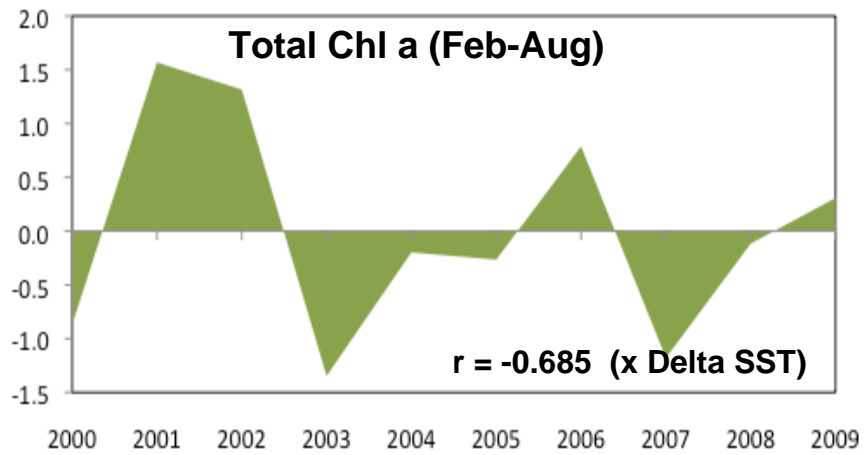
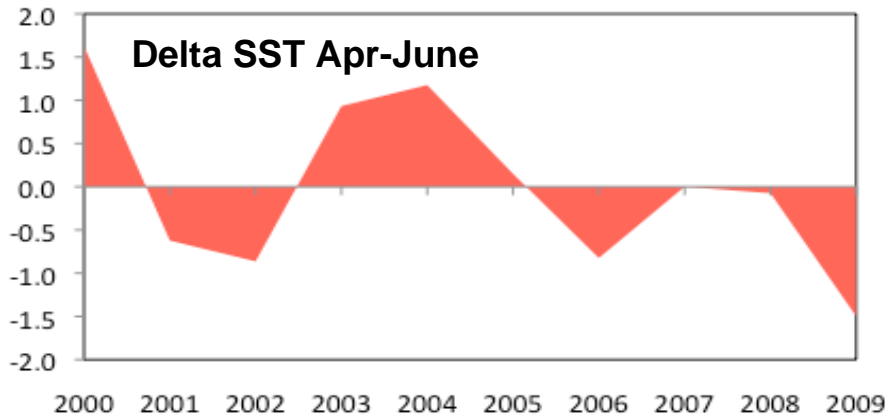
2005 Mar-May SST anomaly



Warm
Early

2008 Mar-May SST anomaly

SST and Phytoplankton Community (WEST)

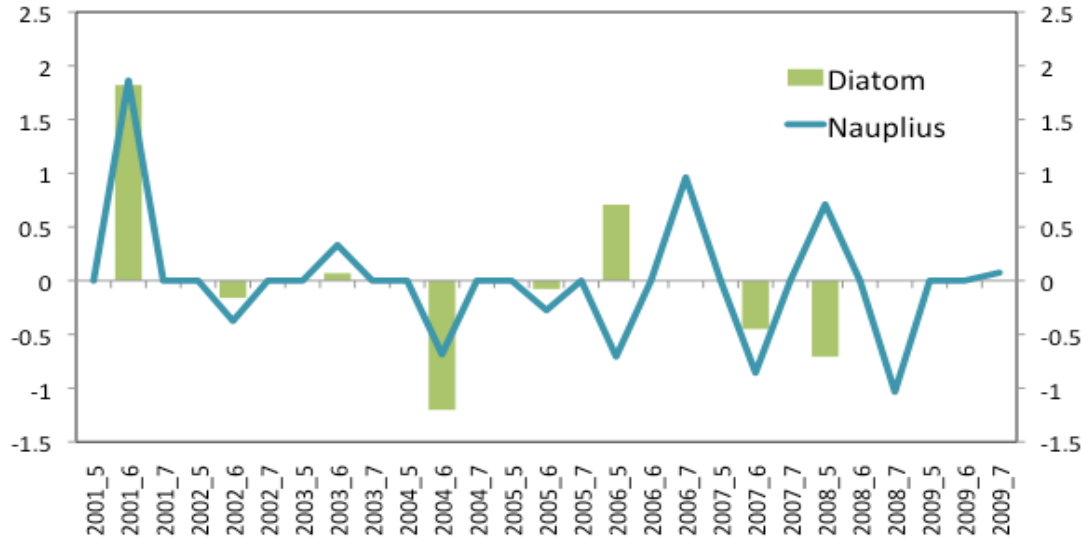


1. Annual phytoplankton abundance **decreased** (**increased**),
2. Relative abundance of **dinoflagellates** to diatoms **increases** (**decrease**) in the year of **large** (**small**) SST increase for Apr-June.

Results: Trophic Link (West)

(Anomaly from monthly mean, May - July)

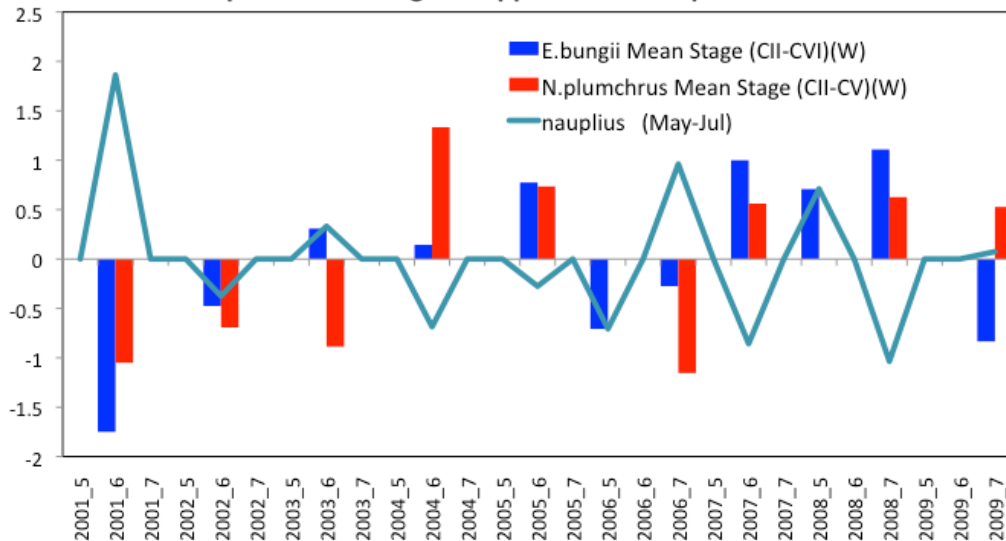
Diatom & Copepod Nauplius Abundance



diatom
X
nauplius

$r = 0.579$
 $r = 0.941$ (if June only)

Developmental Timing of Copepod and Nauplius Abundance



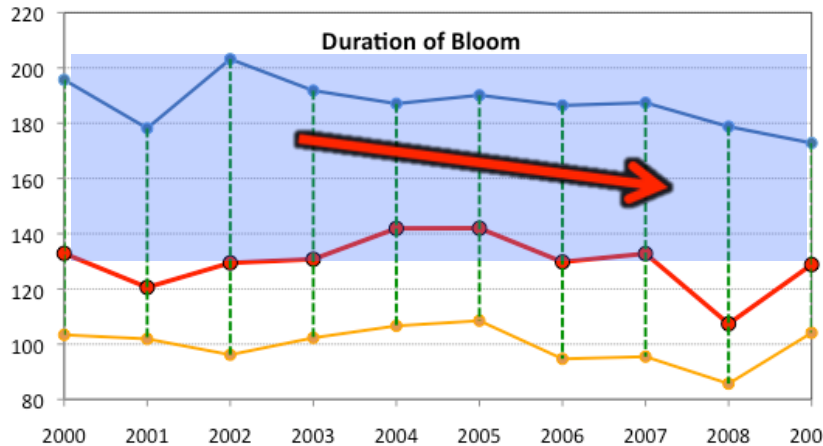
nauplius
X
copepod
development:
get **Earlier**

$r = -0.735$ for Np x nauplius

Phenology & Trophic Link (West)

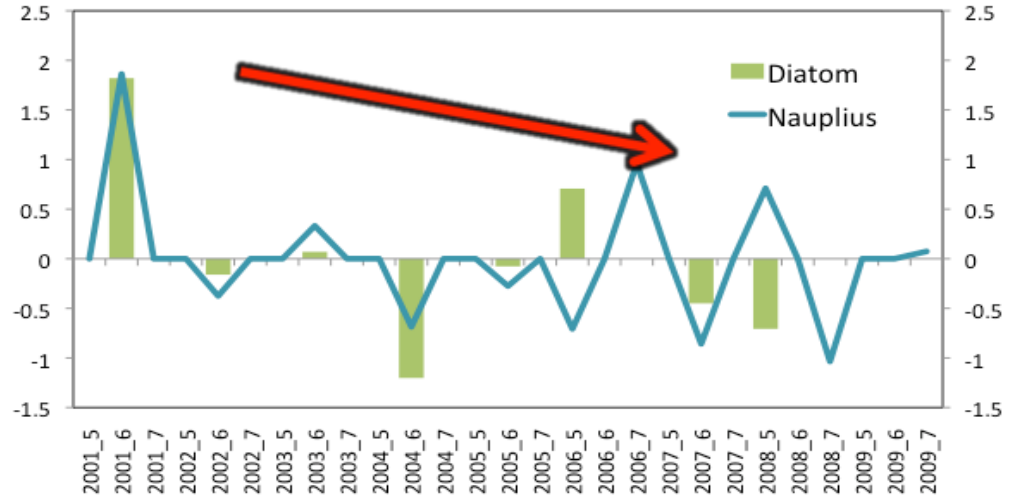
May-July

Timing of Phytoplankton Bloom

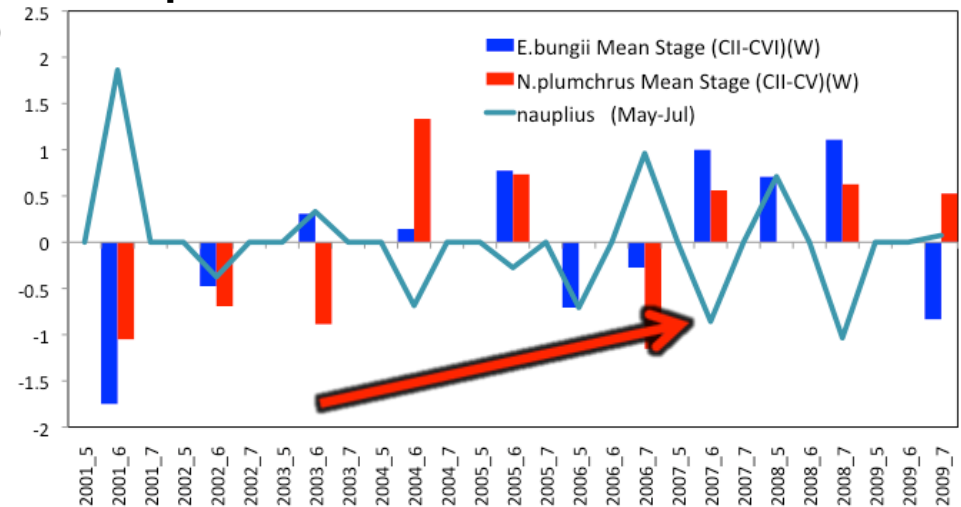


Seasonality of lower trophic is shifting earlier

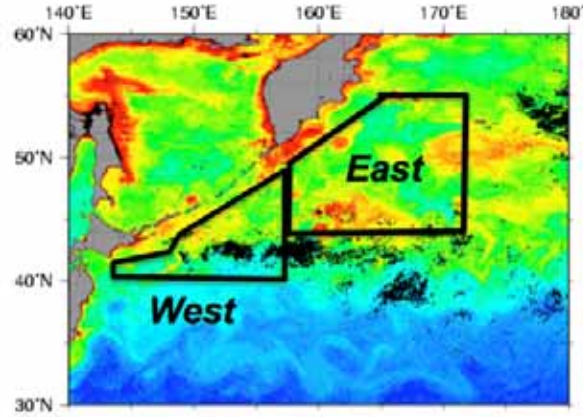
Diatom & Copepod Nauplius Abundance



Developmental Timing of Copepods and Nauplius Abundance

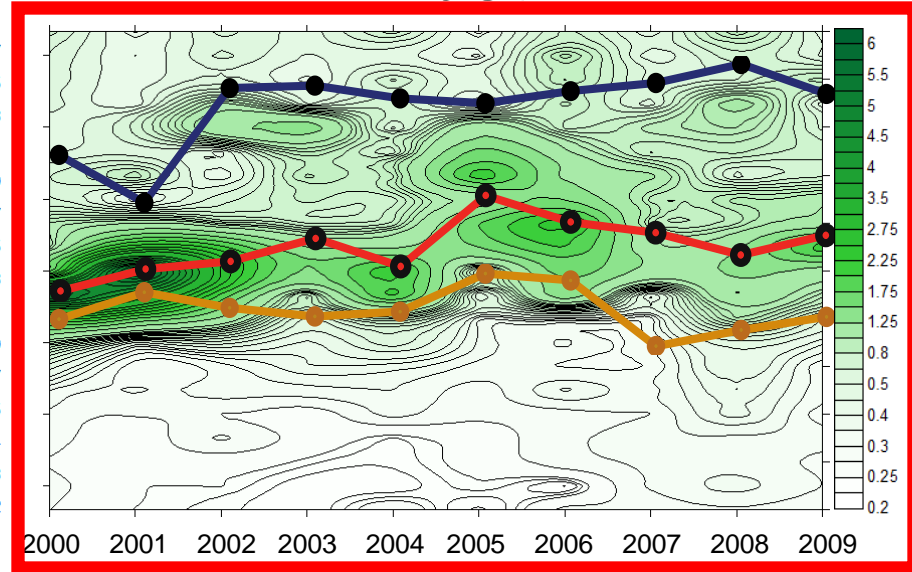
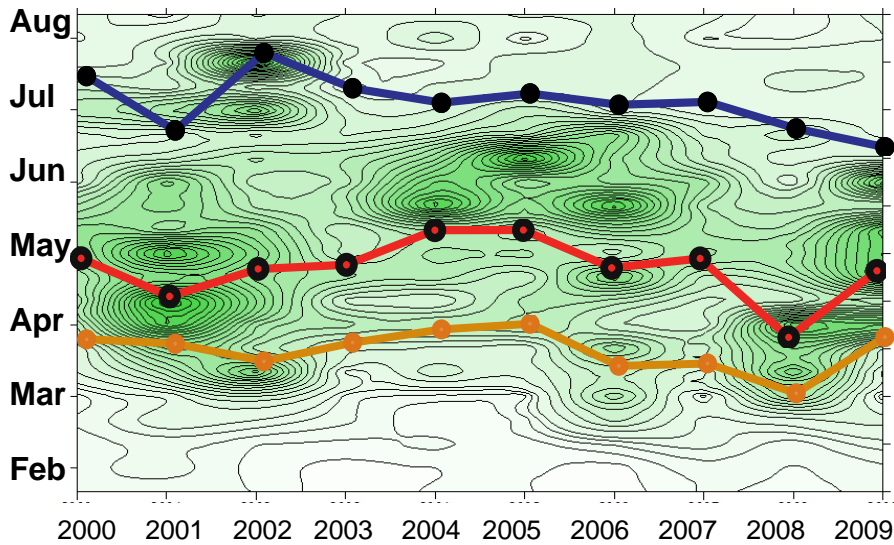


Seasonal Satellite Chl a and Timing of Bloom



West

East

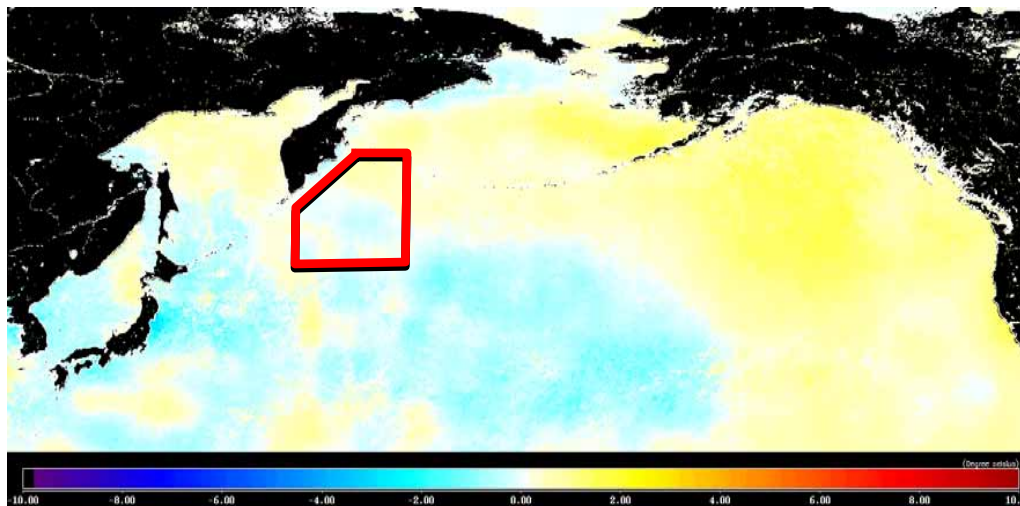
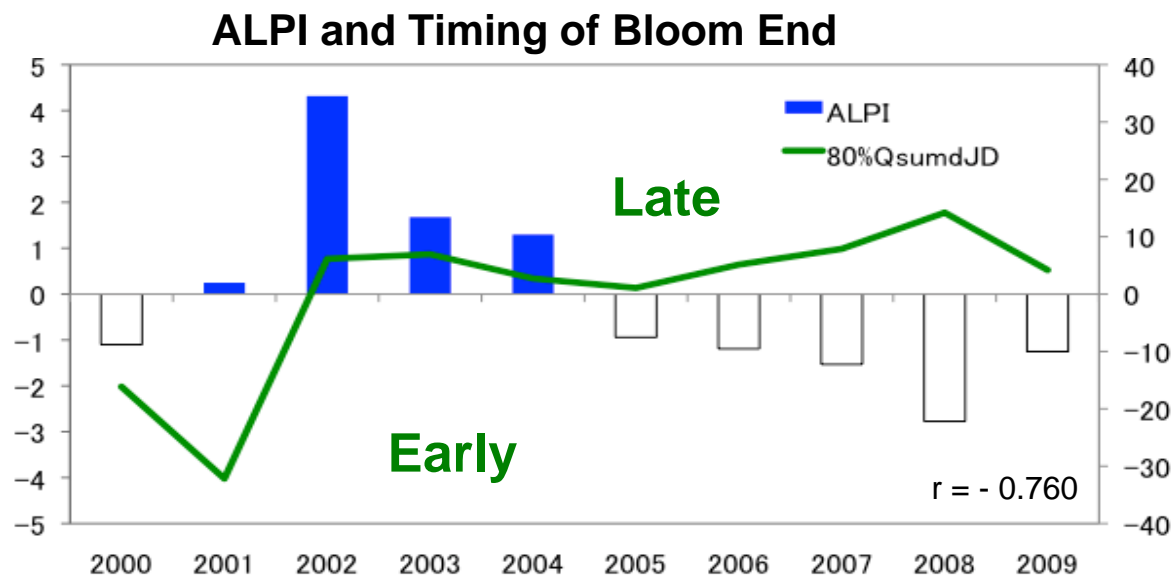


Bloom Peak

Bloom Beginning

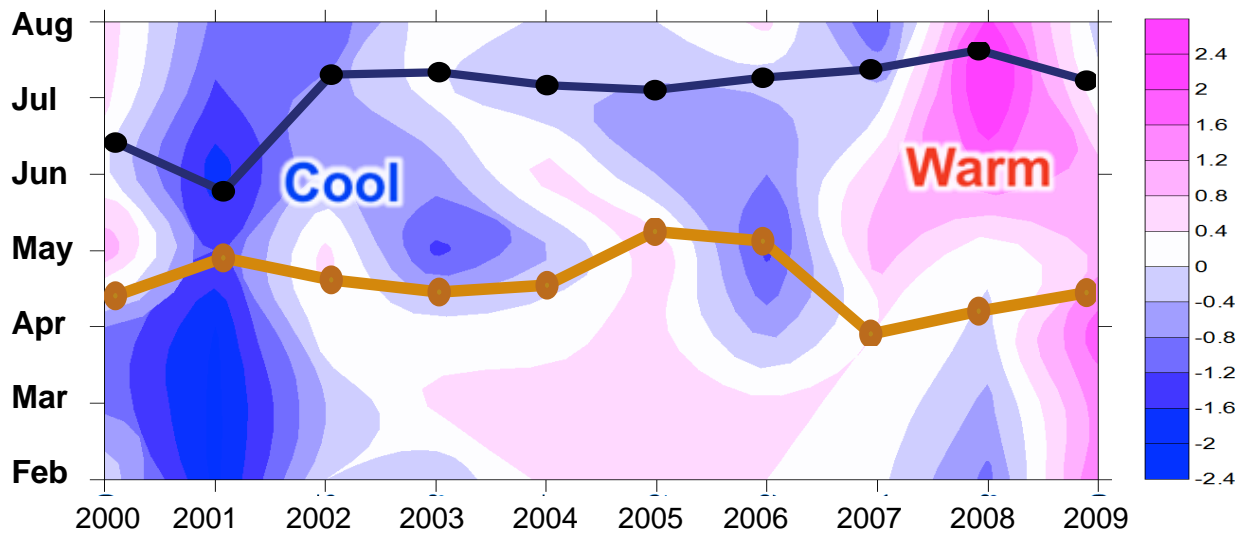
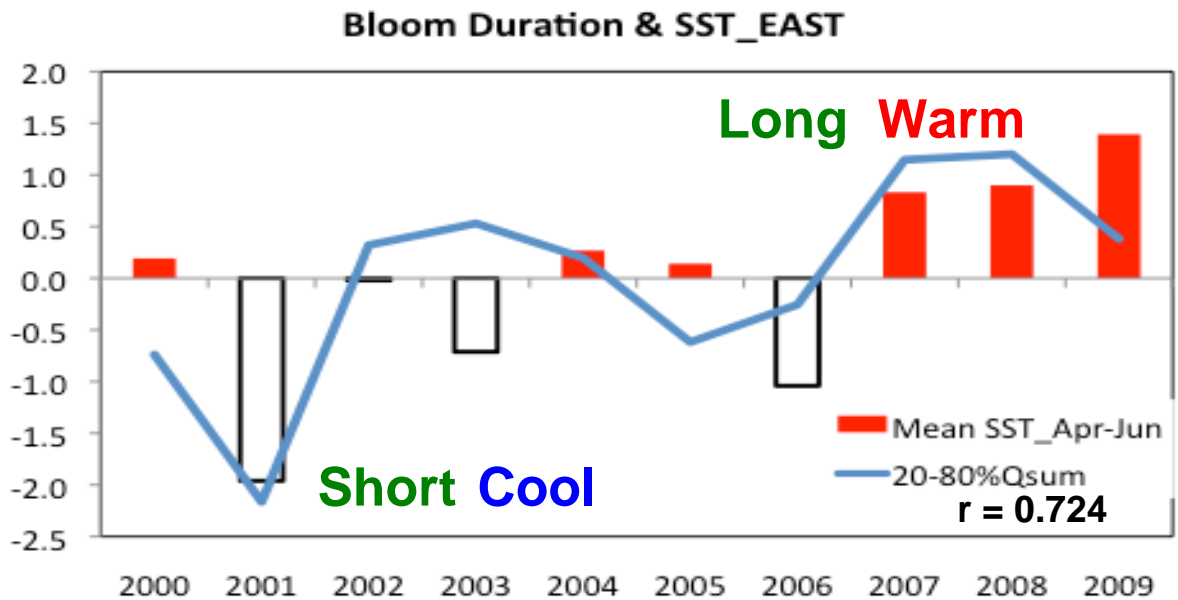
Bloom End

Results : Phytoplankton Phenology (EAST)

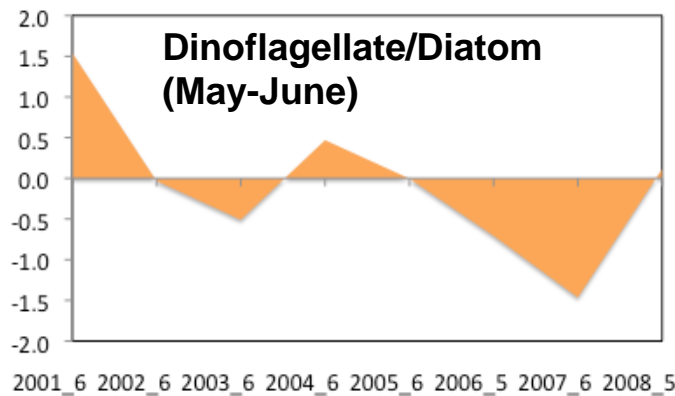
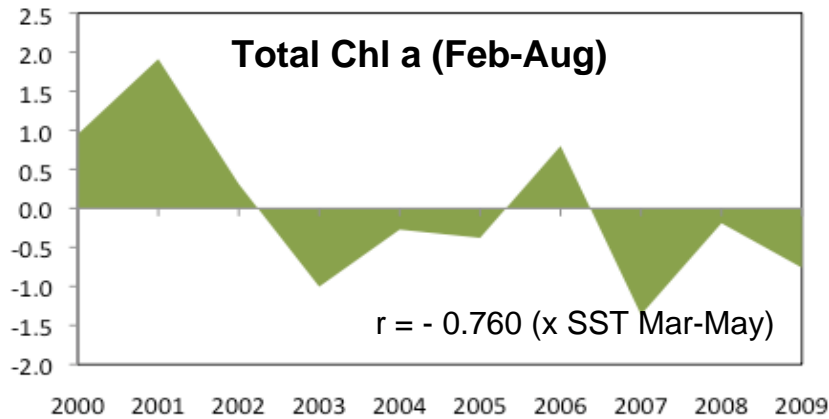
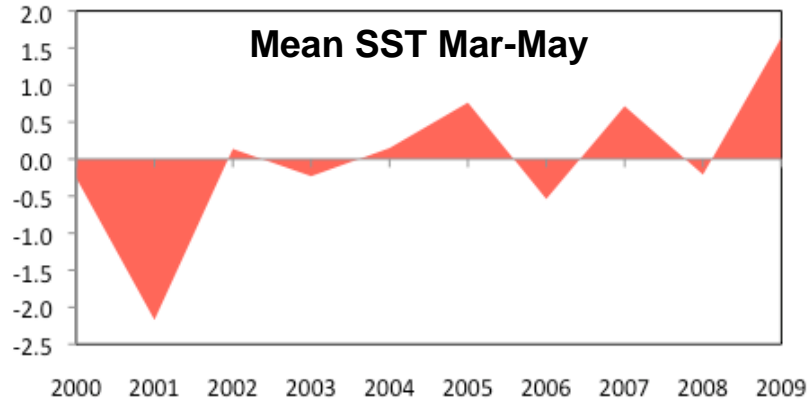


2005 Mar-May SST anomaly

Results : Phytoplankton Phenology (EAST)

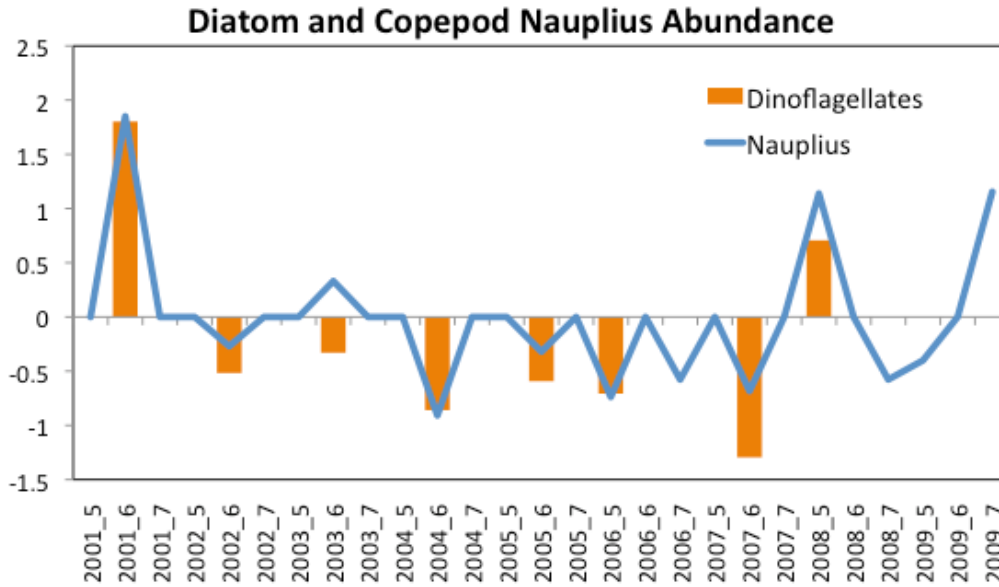


SST and Phytoplankton Community _ EAST



Annual Phytoplankton biomass **decreases** (**increases**) while bloom duration lasts longer in **warm** (**cool**) sp-sum condition

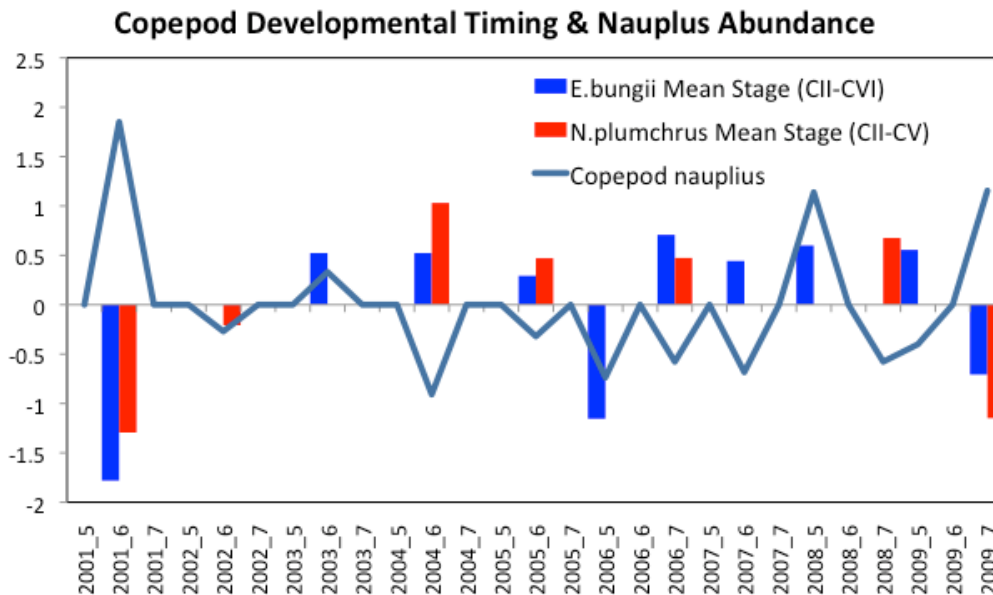
Results: Trophic Link (East)



dinoflagellates
 X
 nauplius



$r = 0.917$ (May-Jul)



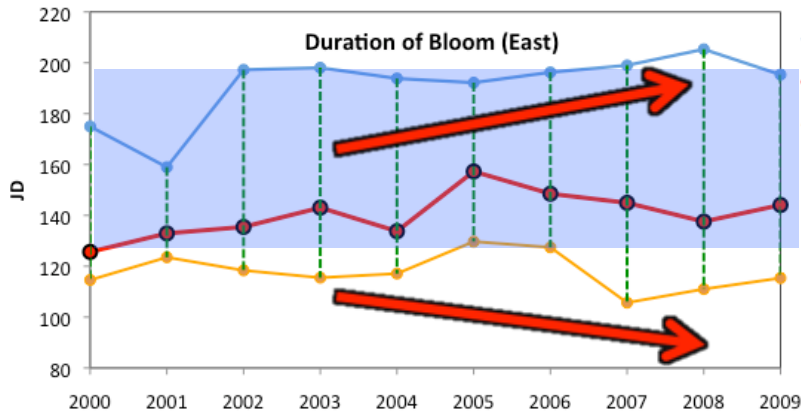
nauplius
 X
 Neocalanus
 development:
 Early



$r = -0.957$ (for Jun, Jul)

Results: Trophic Link (East)

May-July

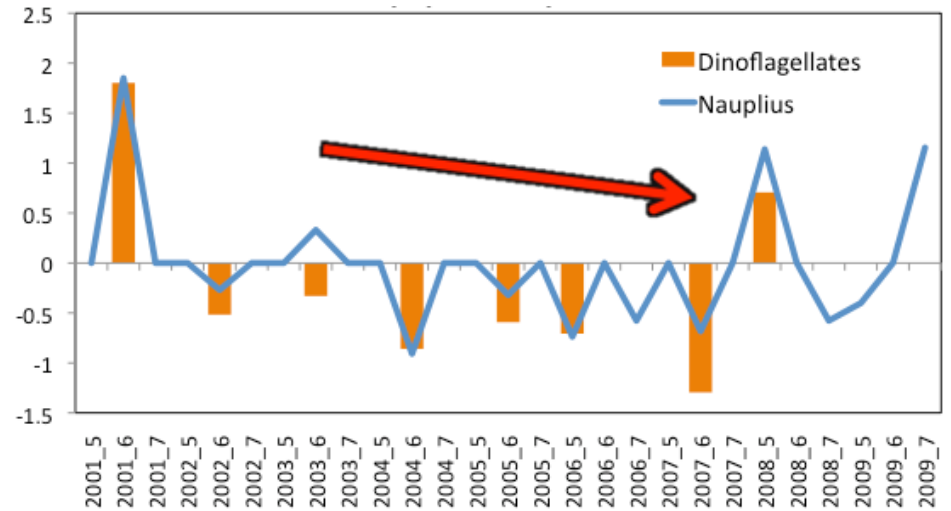


Bloom Season got longer

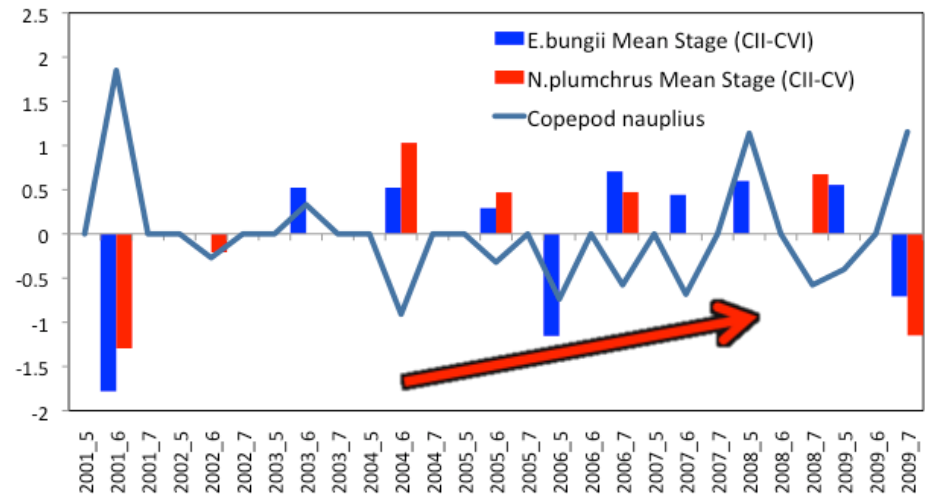
LINK???

Copepod development shifted earlier (due to early beginning of bloom?)

Dinoflagellate & Copepod Nauplius Abundance



Developmental Timing of Copepods and Nauplius Abundance



Observed Change for 2000-2009 EAST – WEST Comparison

	WEST	EAST
Spring SST (Apr-Jun)	As PDO (Warm-Cool-Warm)	Warming trend
Annual Chl a	Decreased	
Diatom Abundance (May-July)	Decreased	
Diatom vs. Dinoflagellate (May-July)	Out of phase	In phase
Bloom Peak	As PDO (Early-Late-Early)	-
Bloom Beginning	Shifted Earlier	
Bloom End	Shifted Earlier	Shifted Later
Zooplankton Development (May-July)	Shifted Earlier	

Questions:

- **Why did PP decrease in both regions while SST varied in different way?**
- **Why did the timing of ZP was similar while the timing of PP was different?**

Possible key: Phytoplankton composition? Timing of stratification, etc.

A photograph of a jellyfish tank. The background is dark, and several jellyfish are visible. Some are glowing blue, while others are glowing yellow. The text "Thank you" is written in a white, cursive font in the center of the image. Below the main text, there is a faint, mirrored version of the text "I DON'T KNOW".

Thank you

p.s. PLS see the another presentation from Japanese contribution to the NP-CPR project by Session 4, from 10:15 October 20th, by Tomoko Yoshiki