Spatial variations of phytoplankton communities in July of 2011 and 2013 in the East China Sea derived by photosynthetic pigments

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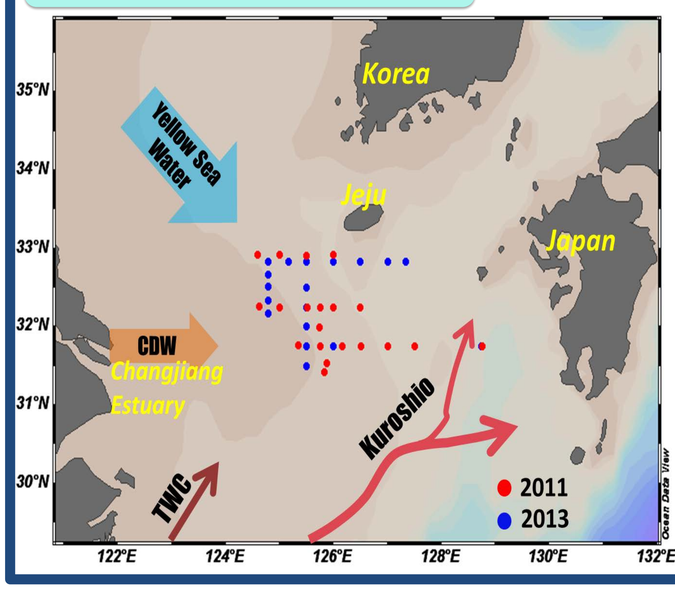
Introduction

Phytoplankton as a major primary producer in marine ecosystem can respond fast to the variations of physical and chemical properties. The East China Sea (ECS) is strongly influenced by the Changjiang Diluted Water (CDW) and Kuroshio Water (KW) in the western and southern side, respectively. Most studies in the ECS have focused in either limited areas or one year; information on interannual variations of phytoplankton community in relationship to different water masses is still limited. In this study, two cruises were conducted in July of 2011 and 2013 in the ECS. Distributions of phytoplankton community measured by HPLC in relationship to different water masses were analyzed.

Data and Method

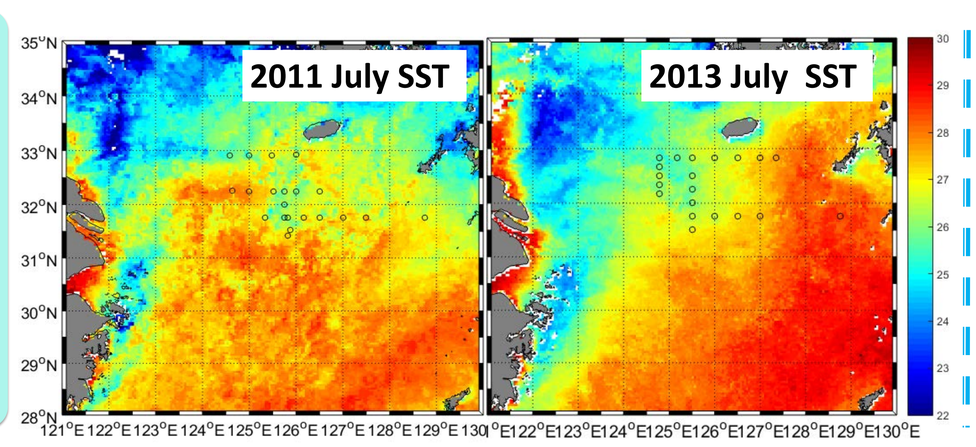


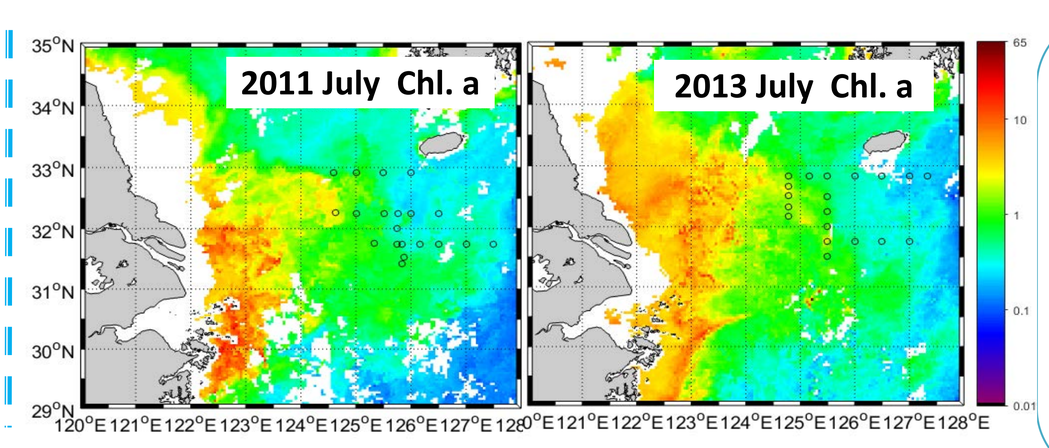
1. Water sampling and study area (Fig. 1)
   2011: July 15-25, 2013: July 19-29
   Temperature, salinity, nutrients were measured.
2. Satellite images: MODIS monthly averaged Chl. a and SST
3. Chlorophyll a concentration: Turner Fluorometer
4. Phytoplankton group estimation:
   HPLC- CHEMTAX analysis

Fig. 1 Station map of the data sampling in the ECS in July.

CDW: Changjiang Diluted Water
TWC: Taiwan Warm Current

Satellite Observations

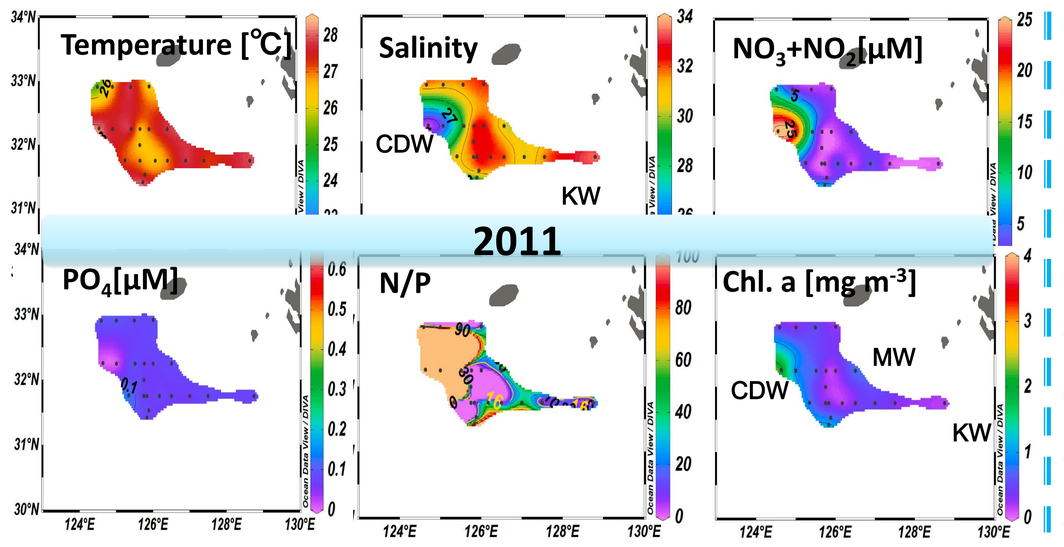


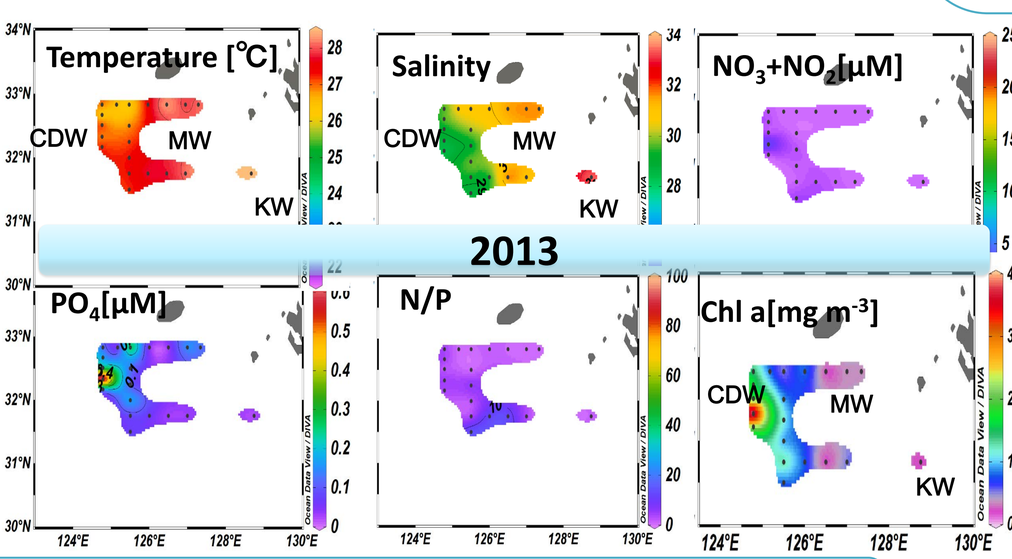


2013:
- **West: widely extended Chl. a**
- **East: higher SST**

Potential influences:
- **Stronger Kuroshio intrusion**
- **CDW extension**
- **Upwelling near coast**

Surface Hydrographic conditions





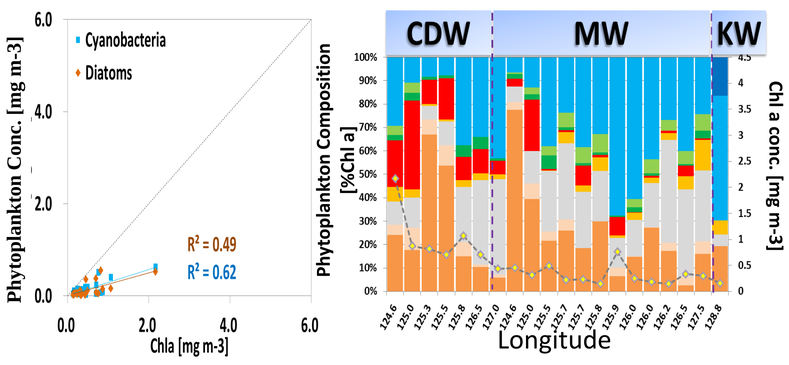
Different water masses
CDW (salinity<=31, temperautre>=23)

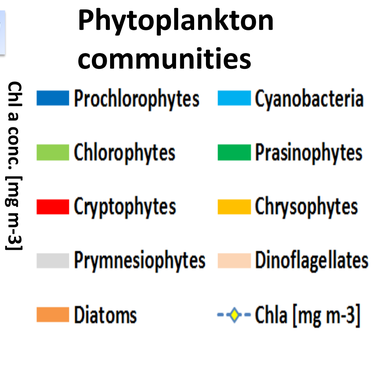
KW: Kuroshio Water (salinity>=34)

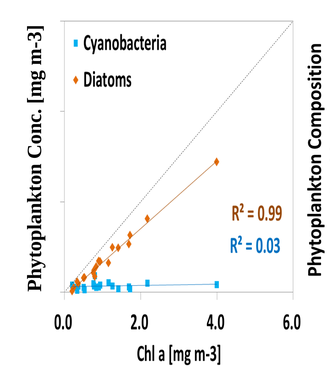
MW: Mixed Water (water between CDW and KW)

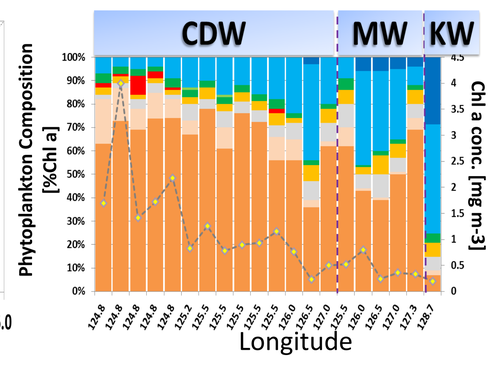
2011: Extremely low salinity water is corresponded to high NO_3+NO_2 , low PO_4 and abnormal N/P in CDW.
2013: Clear pattern of three water masses distribute from west to east. Depleted NO_3+NO_2 , low N/P in most areas.

Surface Phytoplankton Communities

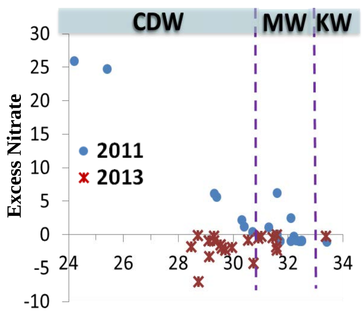


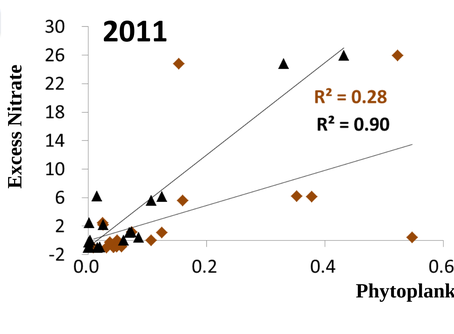


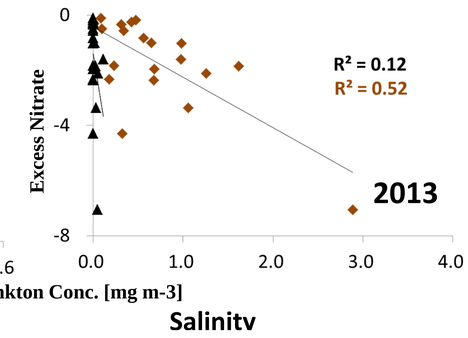




2011: Patchy distribution patter of different phytoplankton communities.
2013: Diatoms dominate in CDW, cyanobacteria decreased from KW to CDW.



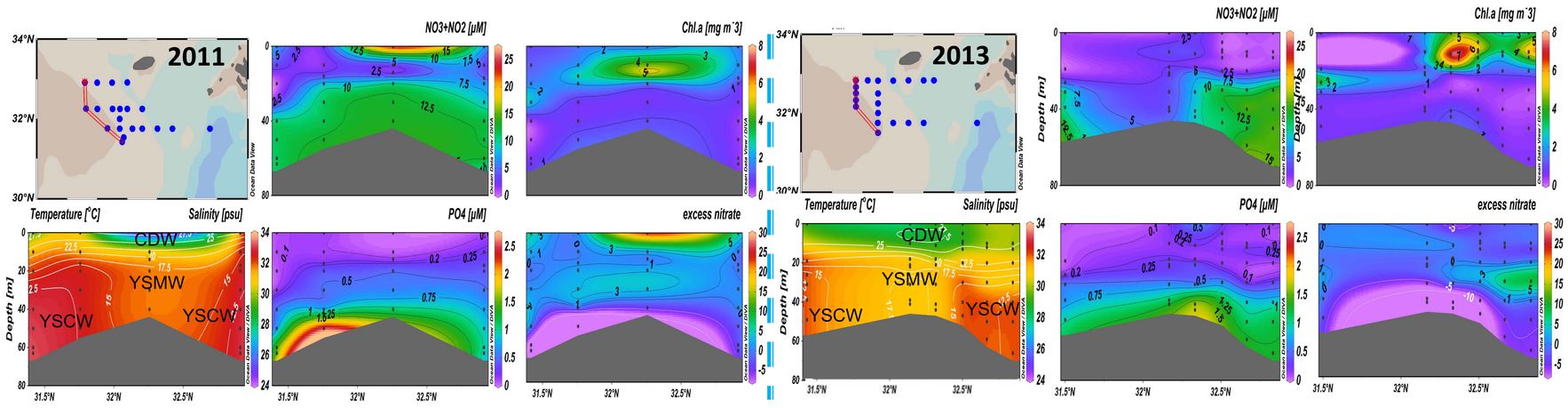




◆ Diatom
▲ Cryptophytes

2011: Excess nitrate > Redfield ratio in CDW (High nitrate condition). High correlation between cryptophytes and excess nitrate.
2013: Excess nitrate < Redfield ratio in the whole areas (Low nitrate condition). Diatoms increase with excess nitrate decrease.

Vertical Profiles



High NO_3+NO_2 and PO_4 in CDW and YSCW, respectively.

2011
- **Intensive CDW**
- **High excess nitrate**

2013
- **Weaker CDW**
- **Higher PO_4 from vertical mixing**

YSMW: Yellow Sea Mixed Water (temperature between 14.5 and 23, salinity <34) **YSCW: Yellow Sea Cold Water (temperature <14.5, salinity <34)**

Conclusion

- Differences on satellite SST and Chl. a observed from the eastern and western of the ECS in 2011 and 2013, indicated the potential influences from Kuroshio intermediate water and CDW on the nutrient condition in study areas.
- The change of the nutrient condition of CDW (excess nitrate conditions) had a big impact on phytoplankton biomass and composition
- KW and MW were contributed by cyanobacteria, and prochlorophytes was observed only in KW in both years.
- During 2011 under excess nitrate conditions and low salinity of the CDW, cryptophytes, prymnesiophytes dominant phytoplankton groups. In 2013, when the CDW waters mixed with phosphate rich YSCW, and excess nitrate was low, diatoms were the dominant phytoplankton group.
- It appears from this study that phytoplankton dynamics and community composition in the East China Sea controlled to a great extent by interannual variability of the current system.