# Interannual changes in summer phytoplankton community composition in relation with water mass variability in the East China Sea

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## Introduction

Water masses of the mid-shelf East China Sea (ECS) comprise largely of the fresher Changjiang Diluted Water (CDW) and oceanic Kuroshio Water (KW). The CDW is nitrate rich, and because it is usually the dominant water mass in the ECS, phytoplankton are generally believed to be phosphate-limited. Here we present pigment and nutrient data collected during four summer cruises to the ECS in 2009, 2010, 2011 and 2013 which provide evidence of large interannual variability in phytoplankton community composition, that appear to be linked with summer-time incursions of subsurface KW on to mid-shelf region of the ECS. These results allow us to hypothesize that phytoplankton communities of the ECS, in particular the dominance of diatoms in any given year is tied to phosphate enrichment caused by upwelling of subsurface KW into the mid-shelf region of the ECS.

## Data and Method
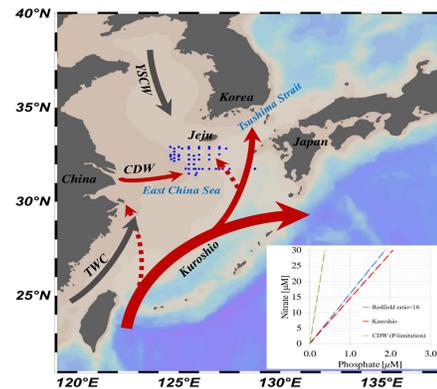


Fig. 1 Map of the sampling locations in the ECS in July.

CDW: Changjiang Diluted Water    TWC: Taiwan Warm Current    YSCW: Yellow Sea Coastal Water
Dashed lines indicated the two pathways of Kuroshio intrusion from northeast of Taiwan and southwest of Kyushu, respectively.

**1. Water sampling and study area** (Fig. 1)
   2009-2011, 2013: July 15-29
**2.** Data: temperature, salinity,
   nutrients (NOx: $NO_2+NO_3$, DIP)
   Chlorophyll a concentration (Chl a),
   phytoplankton communities (Fractions of
   different groups were calculated from HPLC
   pigments with CHEMTAX)
   **Excess Nitrate= $NO_x-R*DIP$** (R: Redfield ratio)
**3. Cluster analysis**: separation of different water masses with input of phytoplankton compositions

## Surface Hydrographic Conditions



Changjiang Diluted Water (CDW) region: salinity <30
Kuroshio Water (KW) region: salinity >32.9
2010&2011: High Nitrate Year /2009&2013: High Phosphate Year
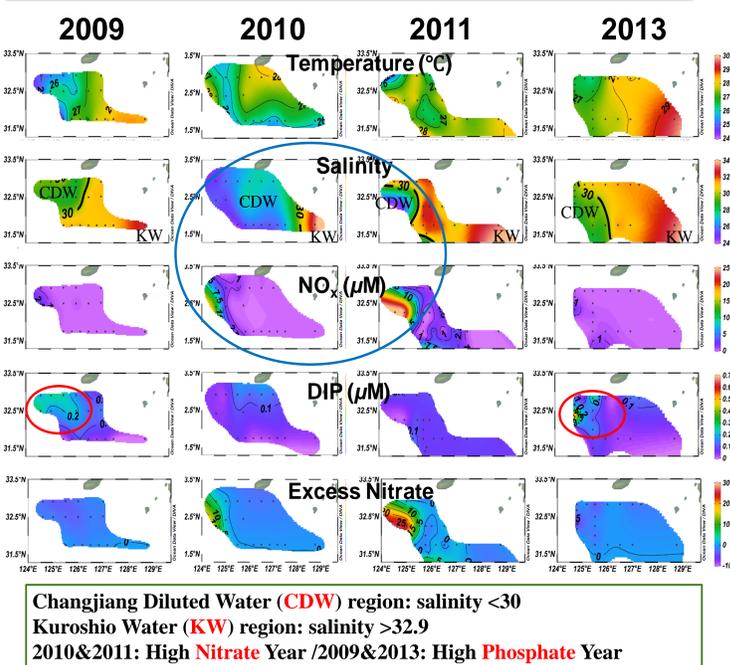
## Correlation between Phytoplankton Communities and Nutrient Conditions



Excess Nitrate (ExcN) = $NO_x-16*DIP$        If ExcN <0 NOx- limiting, ExcN >0 DIP- limiting
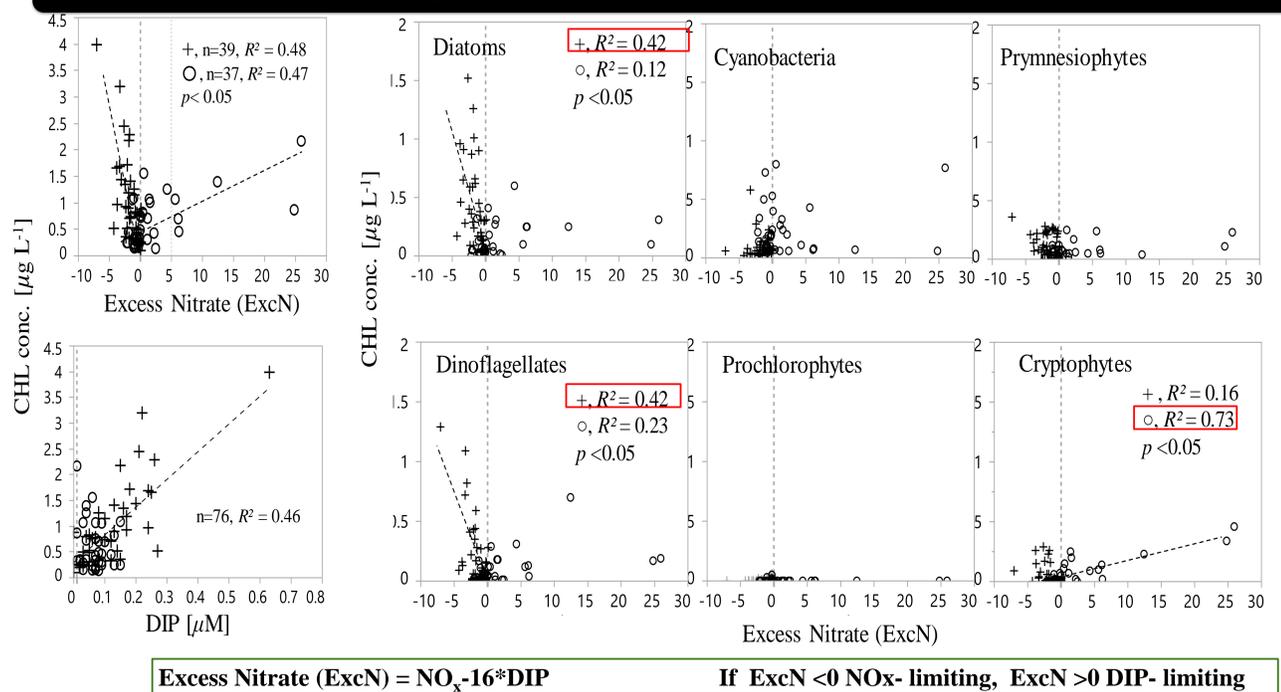
## Surface Phytoplankton Distributions

### Changjiang diluted water (CDW)



### Shelf mixed water



### Kuroshio stations



Diatoms  Dinoflagellates  Chlorophytes
Chrysophytes  Prymnesiophytes  Cryptophytes
Prasinophytes  Cyanobacteria  Prochlorophytes
—Chl. a
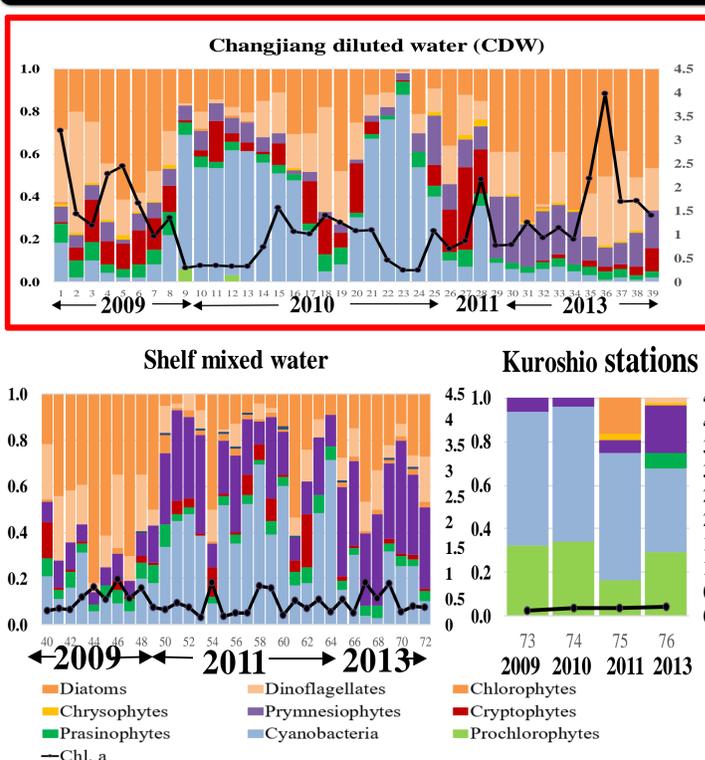
## Cluster analysis and Phytoplankton Variability in response to Water properties
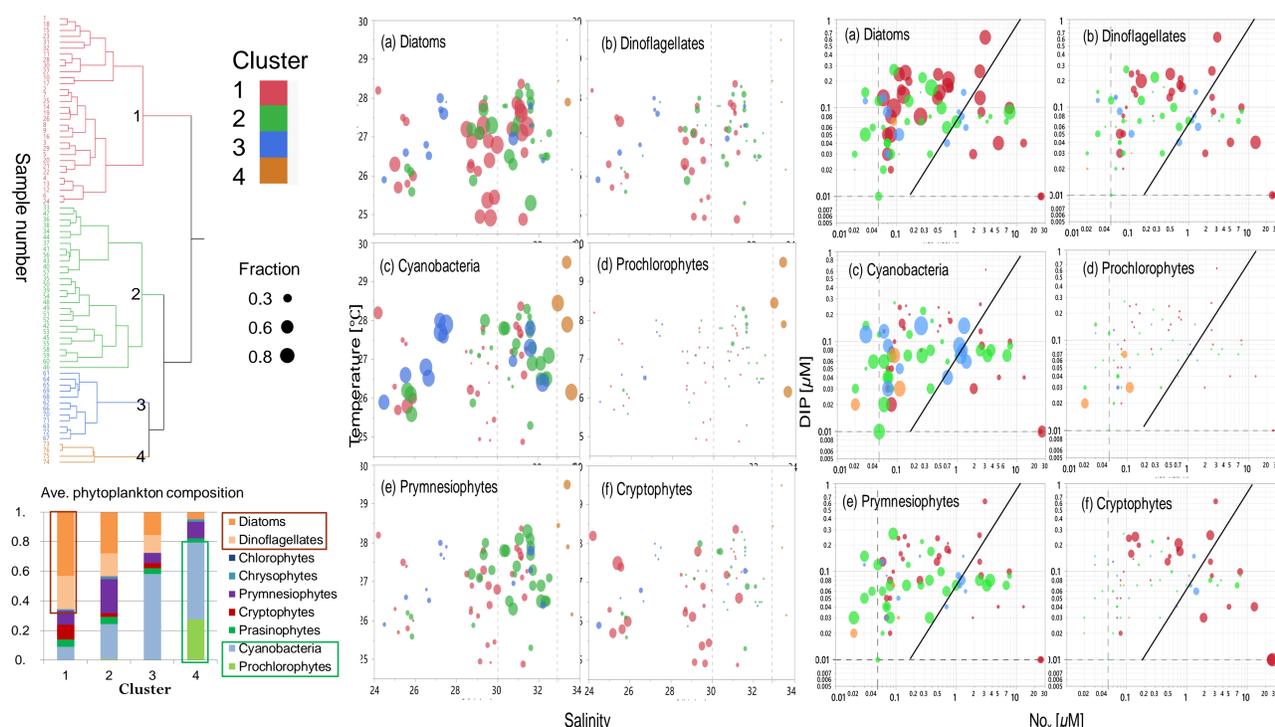


## Conclusions

- **This study describes interannual variations of phytoplankton community in the mid-shelf East China Seas in relationship to different water masses and their associated physical and chemical properties.**

- **Cyanobacteria were dominant in the oligotrophic Kuroshio water across the four years. In regions and years when high-nitrate CDW prevailed, phytoplankton communities were comprised of mixed populations of freshwater Cyanobacteria, Cryptophytes and Prymnesiophytes.**

- **Diatom domination was largely associated with phosphate enrichment caused by upwelling and intrusion of Kuroshio Intermediate Water into the upper euphotic column.**