A Historical Overview of Trophic Status in Jiaozhou Bay, China

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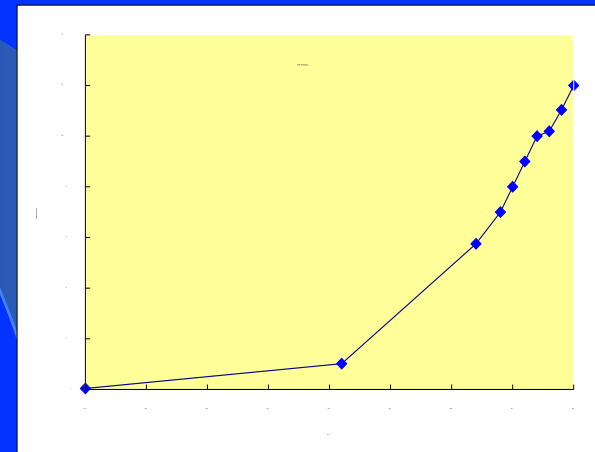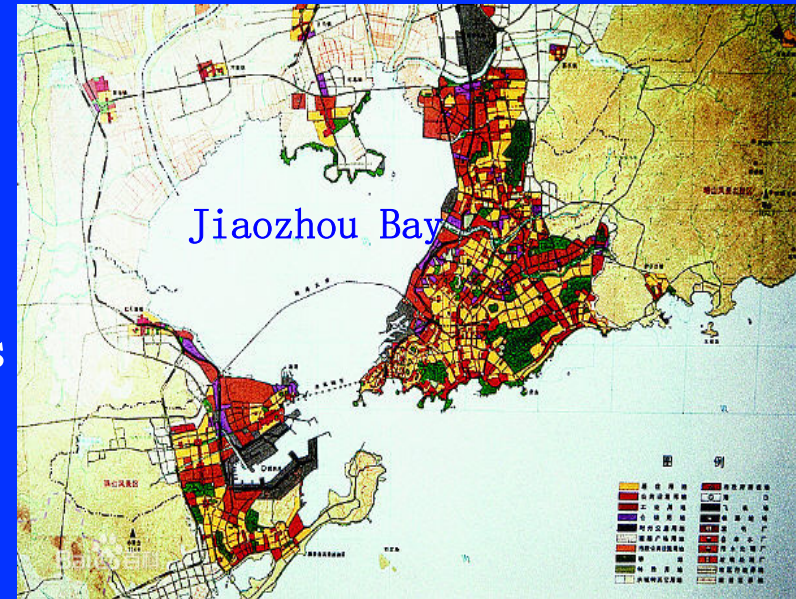
Qingdao, 2019.7

Contents

1. Introduction

- Qingdao has witnessed great achievements in almost every field over the past 40 year's reform and opening up (1978-2018)
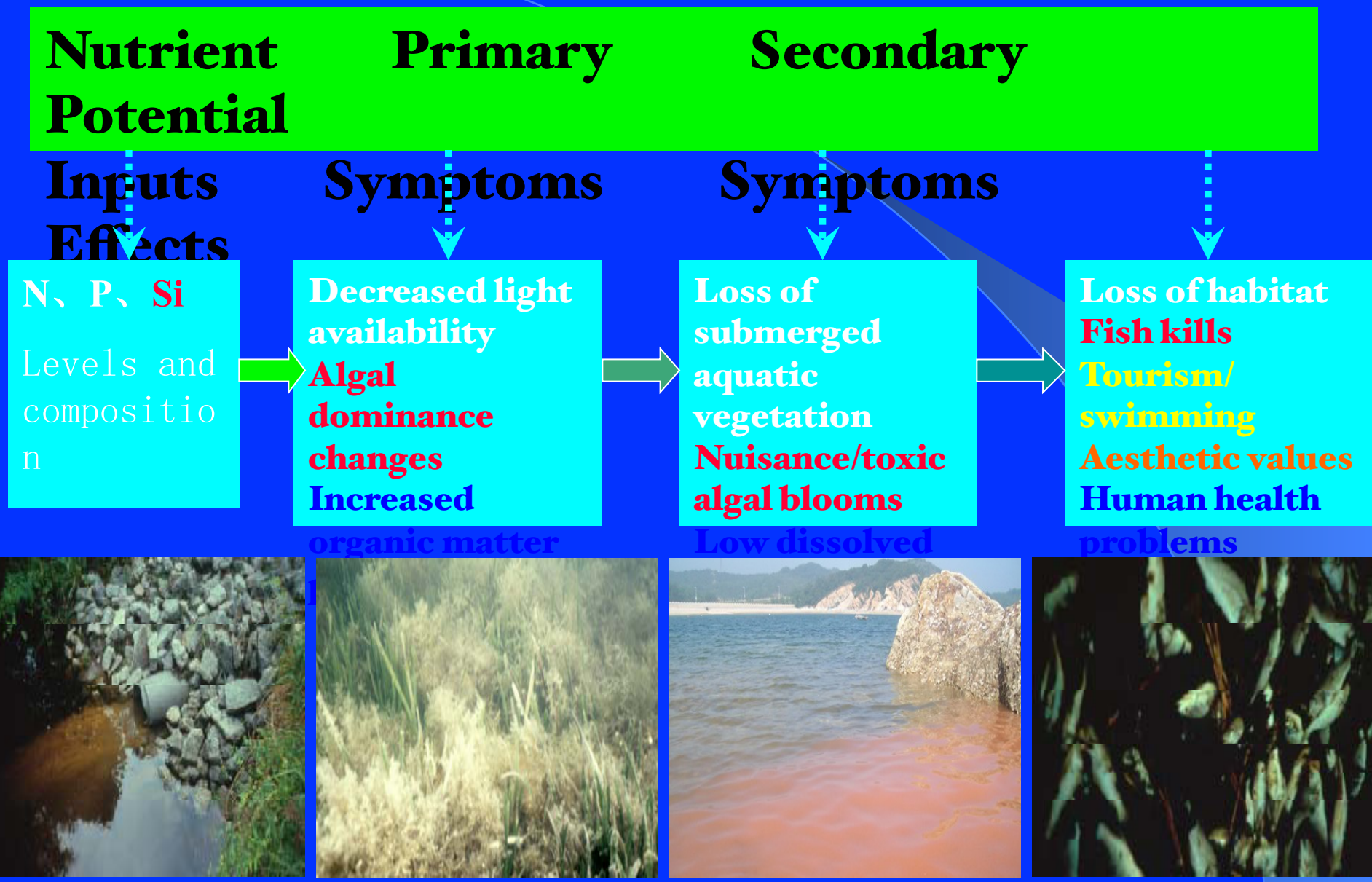
- GDP of Qingdao has grown by 300 times in 1978-2018

Consequences: environmental problems

- **As a highly urbanized bay, Jiaozhou Bay has been under great**

Jiaozhou Bay

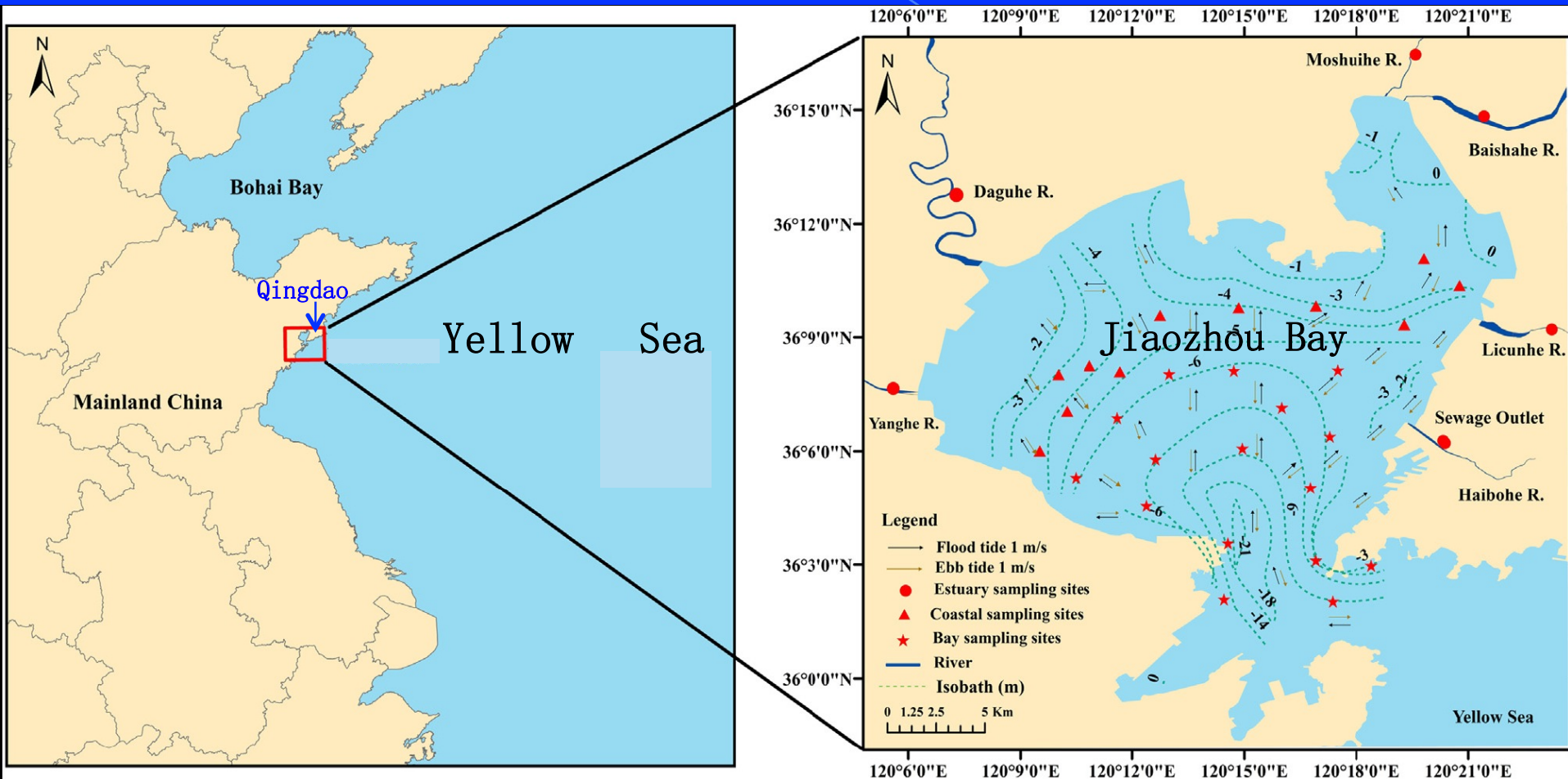Historical evolution and ecological effects of nutrient status in Jiaozhou Bay over the past 40 yeras

1. Introduction

Nutrient Potential	Primary	Secondary

Inputs

Effects

| N、P、Si Levels and composition | Decreased light availability Algal dominance changes Increased organic matter | Loss of submerged aquatic vegetation Nuisance/toxic algal blooms Low dissolved | Loss of habitat Fish kills Tourism/ swimming Aesthetic values Human health problems |

Symptoms   **Symptoms**

(NOAA: United States National Estuarine Eutrophication Assessment (NEEA))

2.1 Geographical settings

Sea area: 370 km^2; Mean depth: 7 m; Mean salinity: 32.0

2.2 Data and methods

◆Jiaozhou Bay is a region receiving extensive marine research.

◆Different studies have involved different sampling times, station locations, and sampling frequencies.

◆In order to **ensure comparability** of the data, only those datasets with **high spatial coverage** (at least 80% of the sea area)

 high sampling frequency (at least 4 seasonal cruises in one year or two

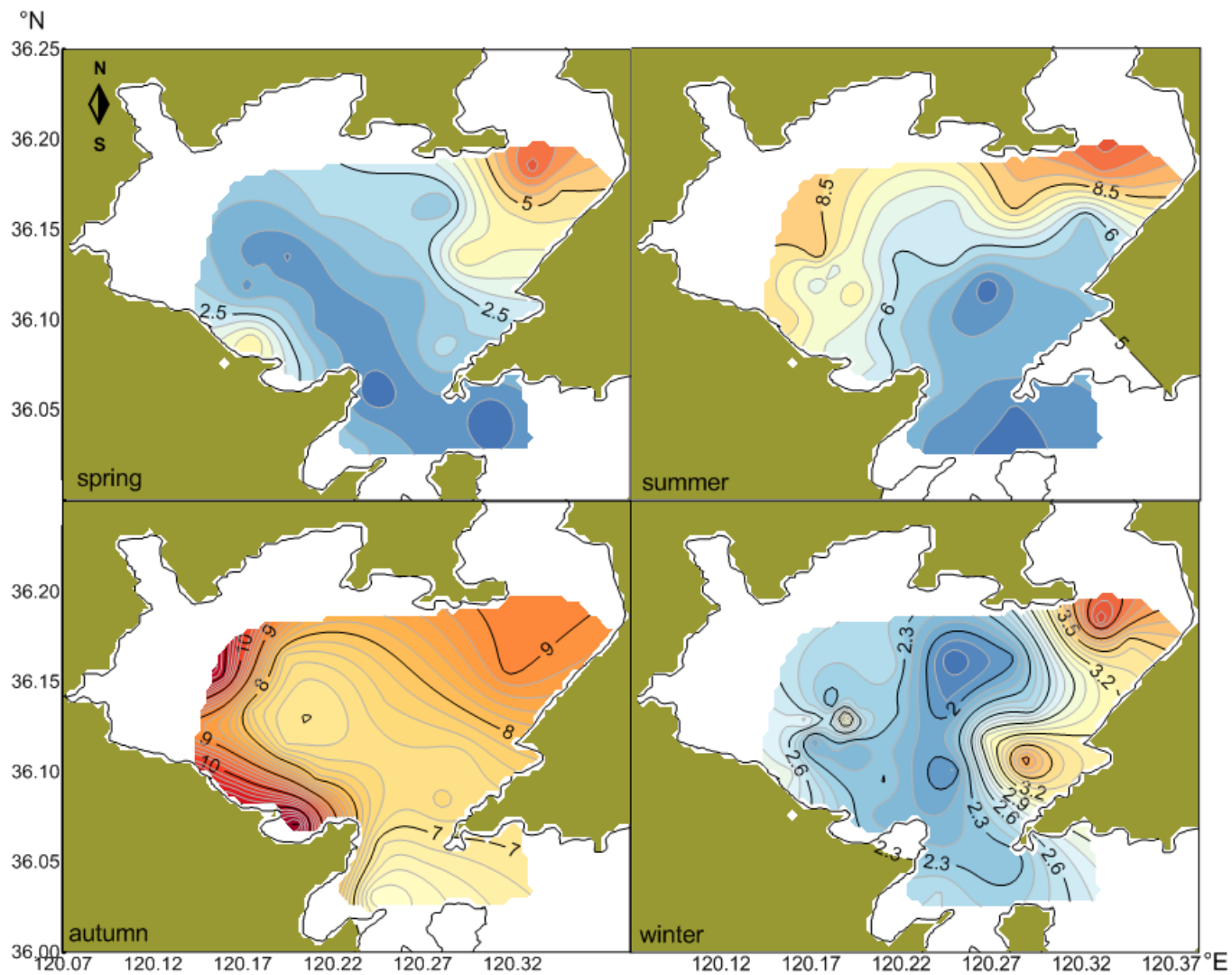years in succession) **were included in this study.**

3. Results and discussion
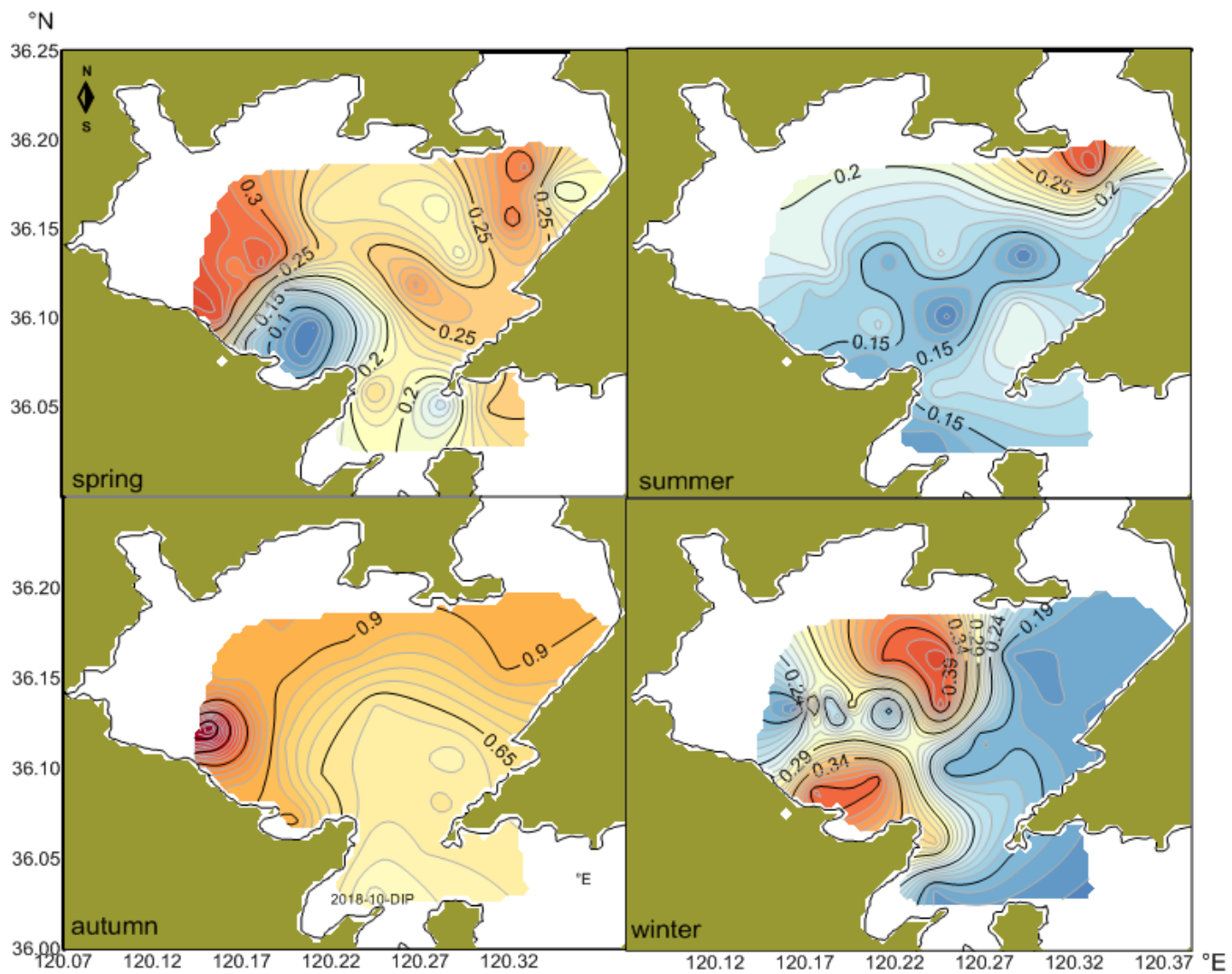## 3.1 Surface distributions of nutrients in Jiaozhou Bay
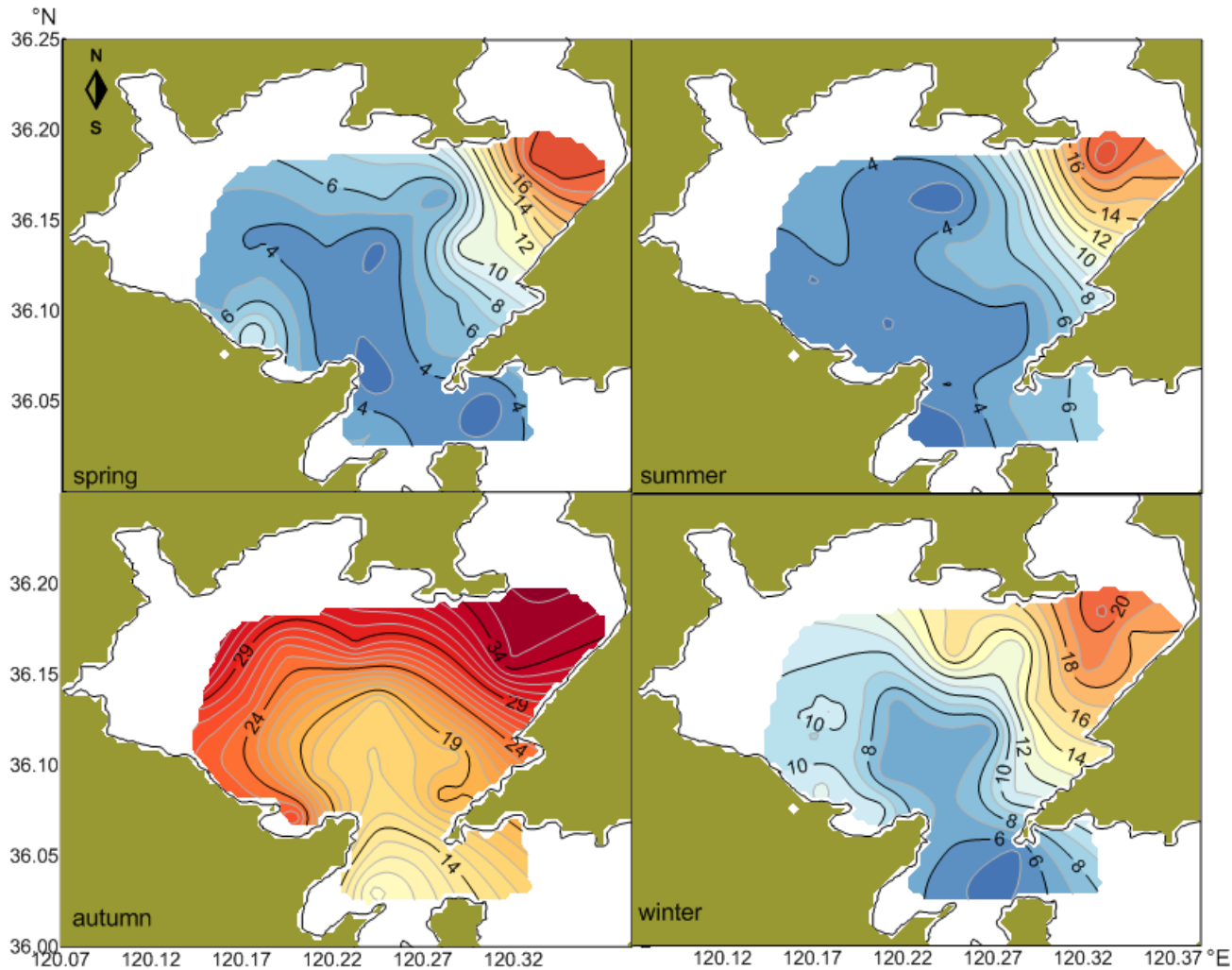
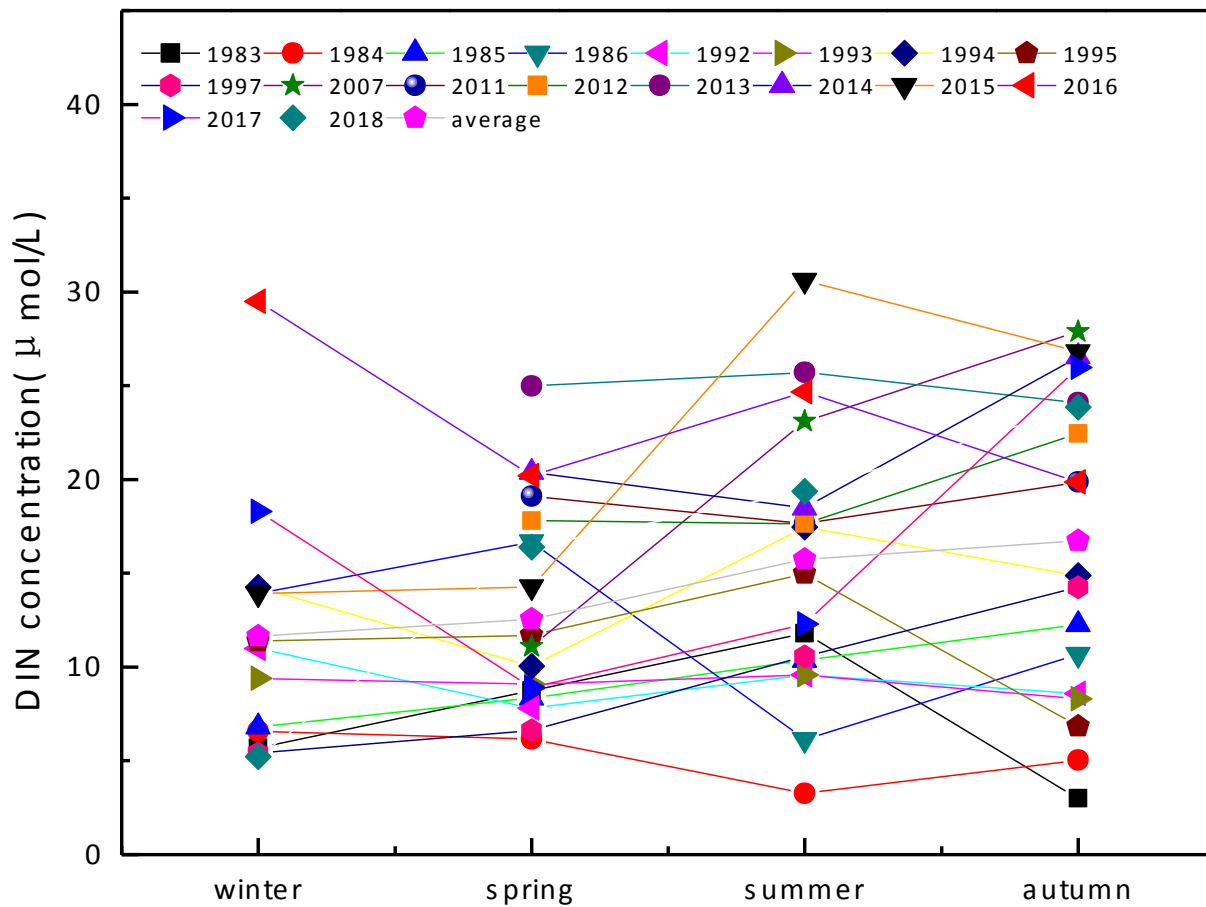Surface distributions of DIN in Jiaozhou Bay in 2018/19
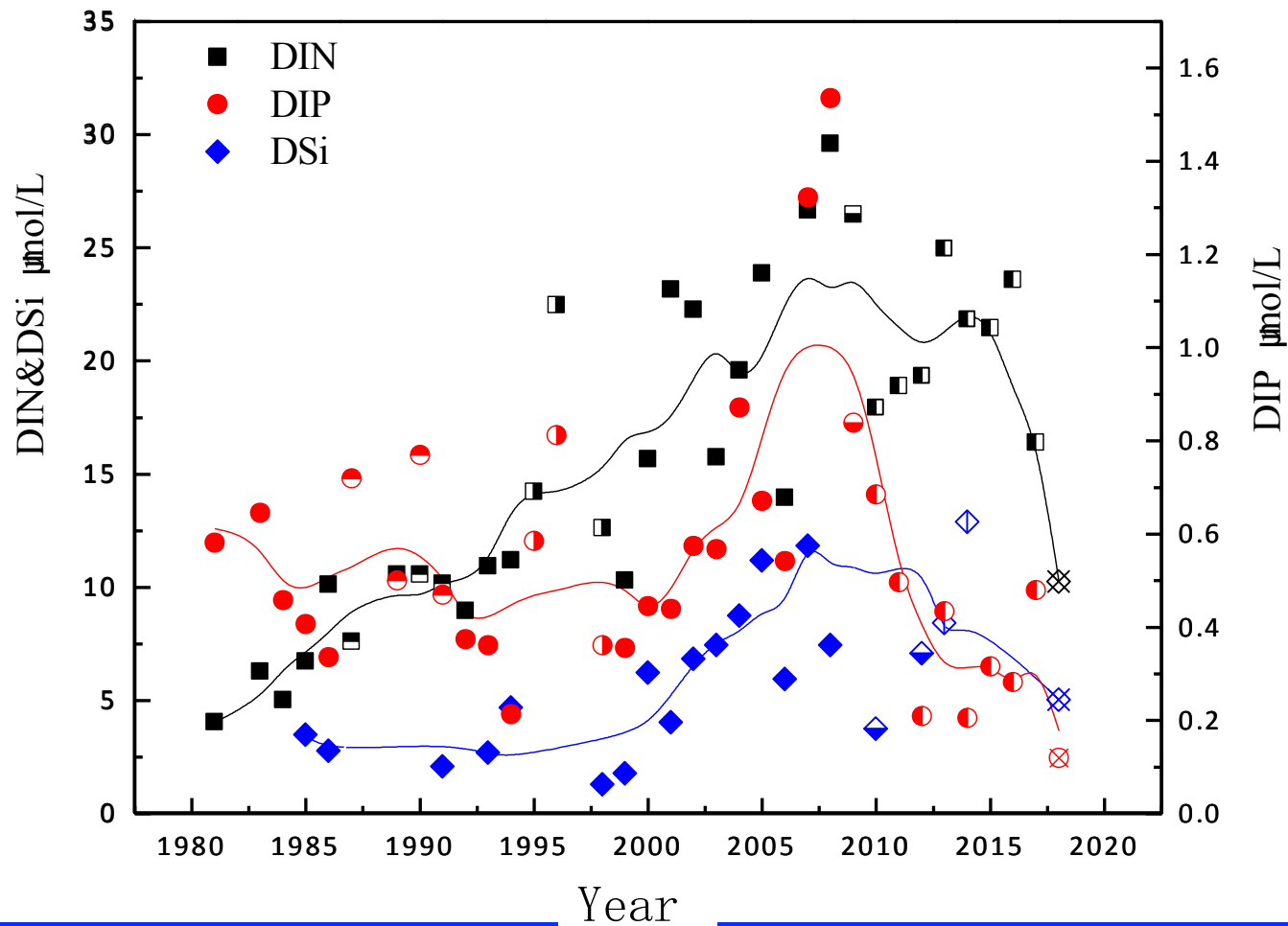
Surface distributions of DSi in Jiaozhou Bay in 2018/19

Surface distributions of DIP in Jiaozhou Bay in 2018/19

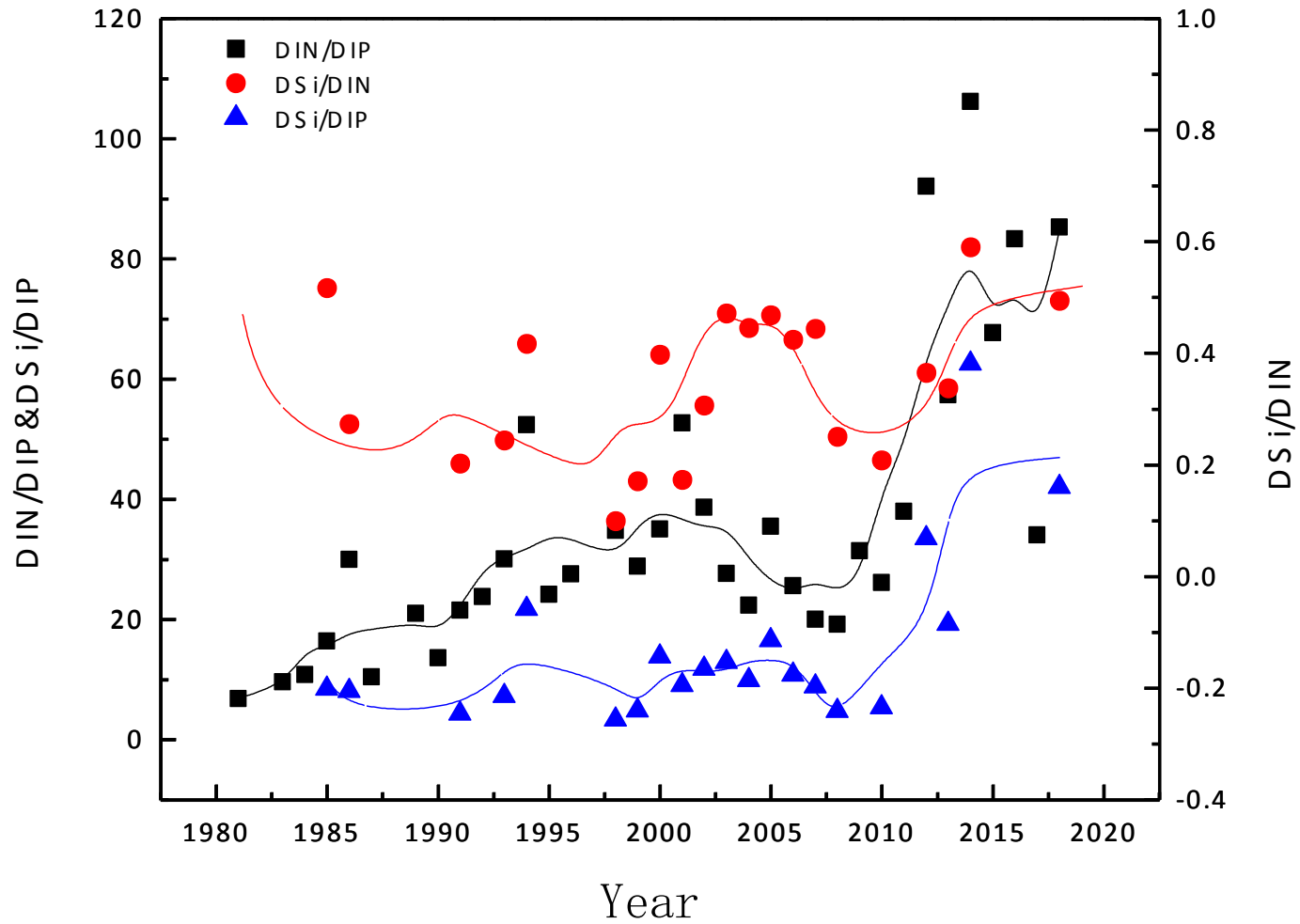# 3.2 Seasonal variation of nutrients in Jiaozhou Bay
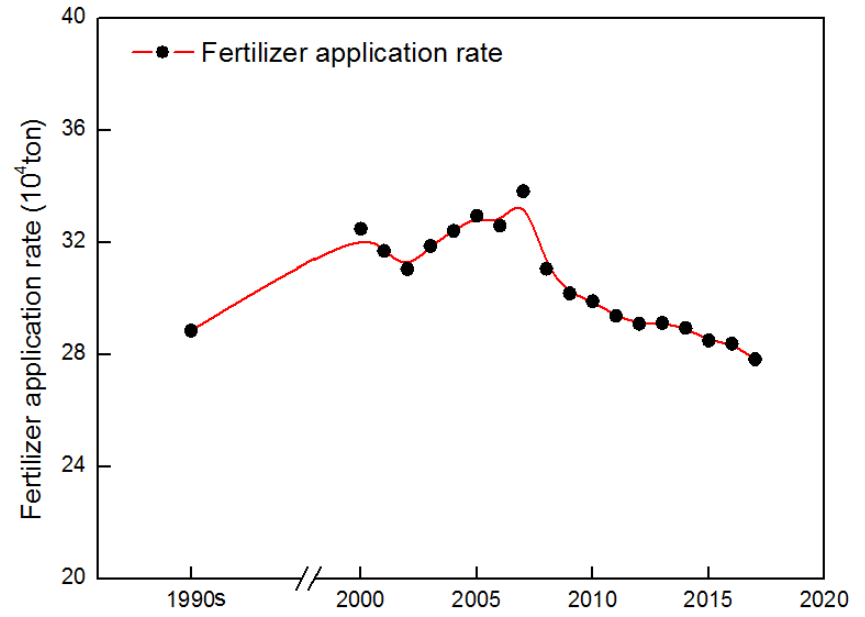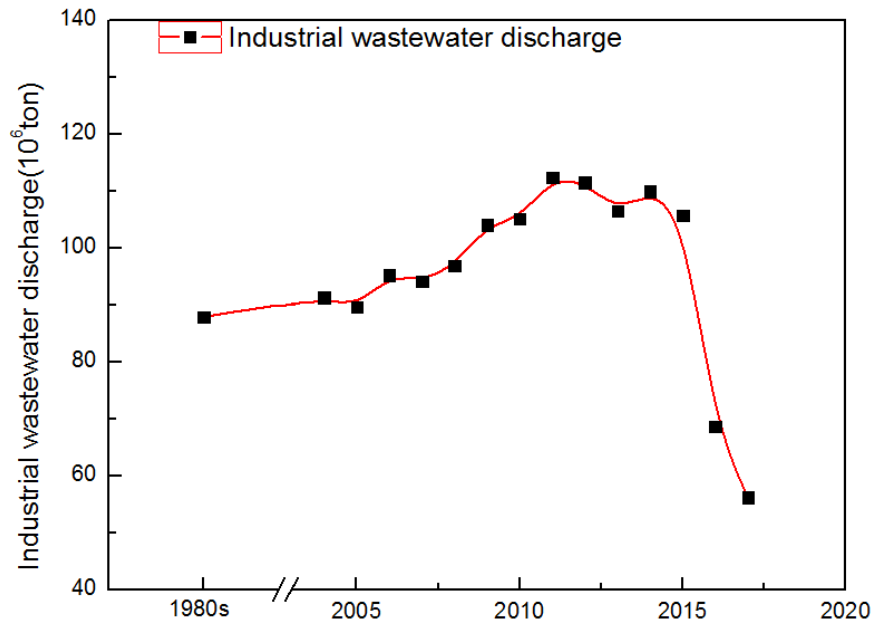
Nutrient concentrations

Nutrient composition

Factors influencing long-term variation of nutrients

1) Land-sourced nutrient input

Measures `for` reducing nutrient input to Jiaozhou Bay

- Reducing land-sourced nutrient input

  › Restoration of estuarine wetlands

  › Sewage interception and pollution control of rivers

  › Construction of sewage treatment plants

- Clean up pollution sources at sea

  › Clear up all the aquaculture ponds

  › Clear up all the aquaculture rafts and cages in Jiaozhou Bay
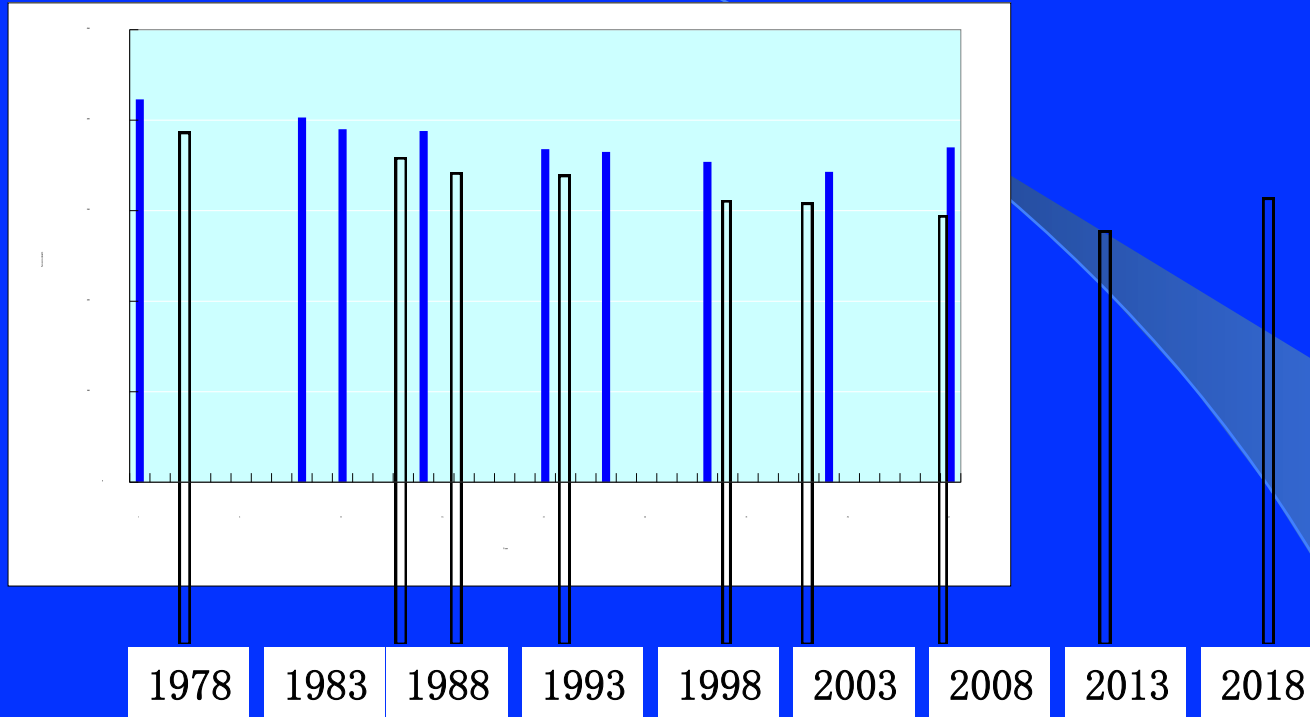

Daguhe estuarine wetland

Daguhe River

Licunhe River

Factors influencing long-term variation of nutrients

2) Changes in sea area in Jiaozhou Bay

| 1978 | 1983 | 1988 | 1993 | 1998 | 2003 | 2008 | 2013 | 2018 |

Reasons for reduction:
Aquaculture ponds
Reclamation
Consequence:
Reduce tidal capacity

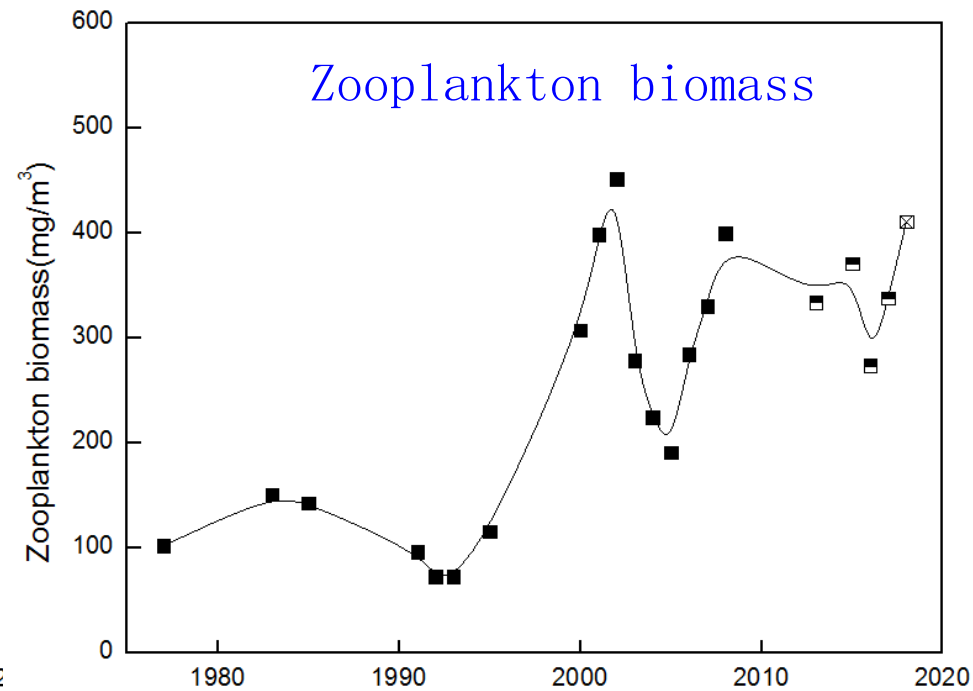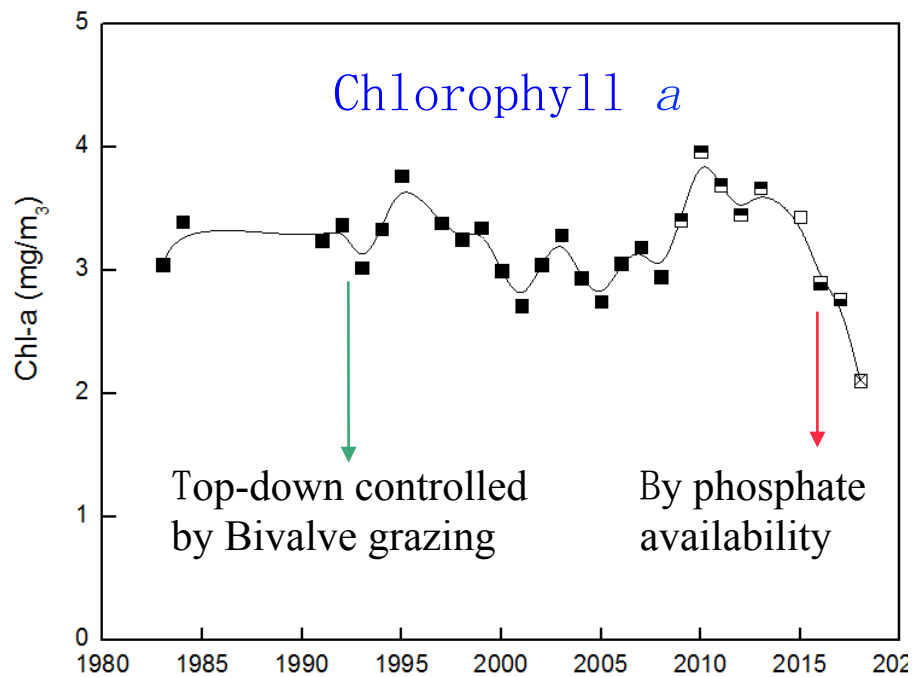Restoration measures:
Clearance of all the aquaculture pon
Stop reclamation
Consequence:
Increase tidal capacity

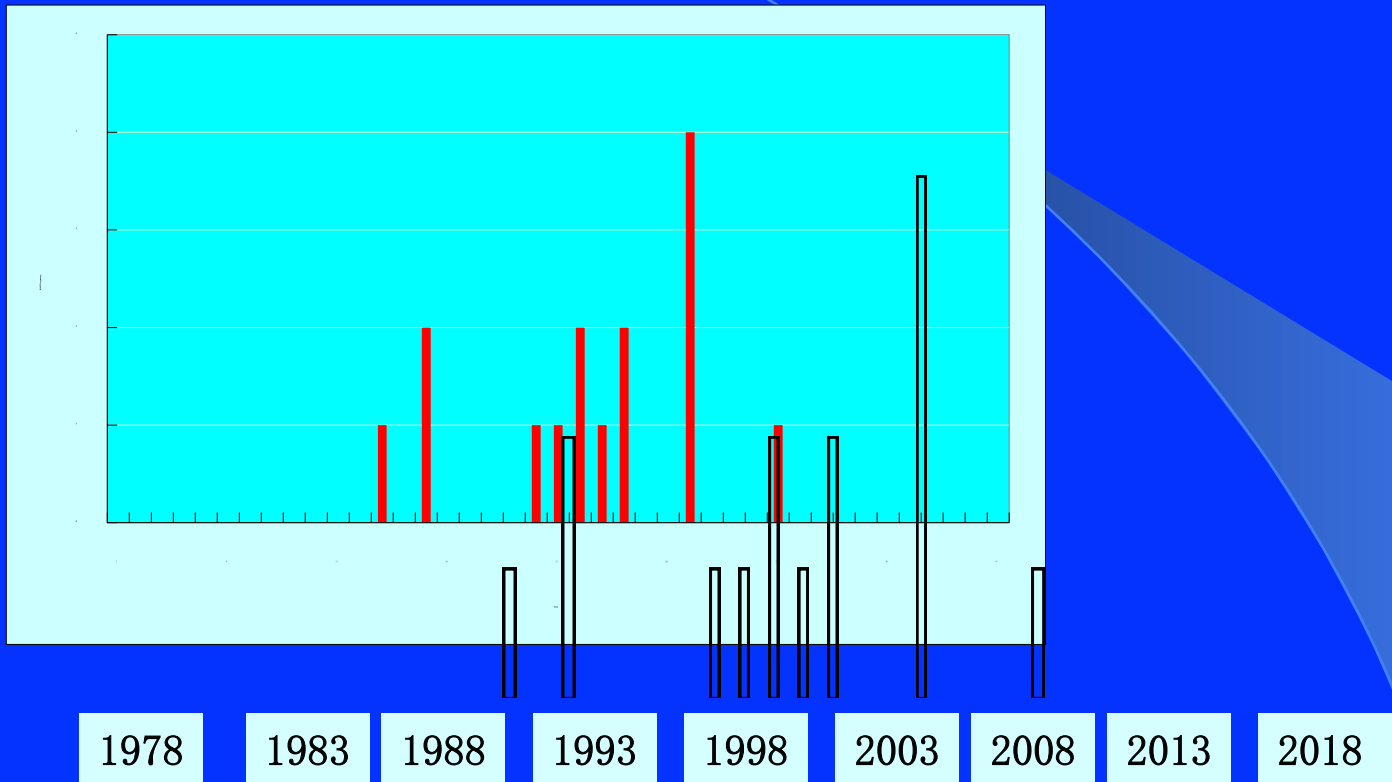**1) Biomass of plankton**

Long-term variation in surface chlorophyll *a* concentration and zooplankton biomass in Jiaozhou Bay

2) Harmful algal blooms

Long-term changes in annual frequency of red tide events in Jiaozhou Bay

4. Summary

● **Before the late 2000s, DIN increased continually, whereas DIP and DSi decreased slightly and then increased rapidly in Jiaozhou Bay; After the late 2000s, all the three kind of nutrients decreased rapidly in Jiaozhou Bay.**

● **The nutrient limitation shifted from N-limitation in the early 1980s to Si-limitation in the 1990s, and finally to P-limitation in recent years.**

● **Phytoplankton biomass was top-down controlled by Bivalve grazing before 2010, but it was bottom-up controlled by phosphate availability in recent years.**

● **In general, the evolution of trophic status in Jiaozhou Bay was closely related to Qingdao's GDP and growth rate, development pattern, as well as environmental protection policies and measures in place.**

Thanks for your attention !