Water Management in Chongming Island

Jianhua Lee

Key Laboratory of Yangtze Aquatic Environment, Ministry of Education, China

Tongji University

Contents

1 Characteristics of Chongming Island

2 Water resource management

3 Problems and conclusion

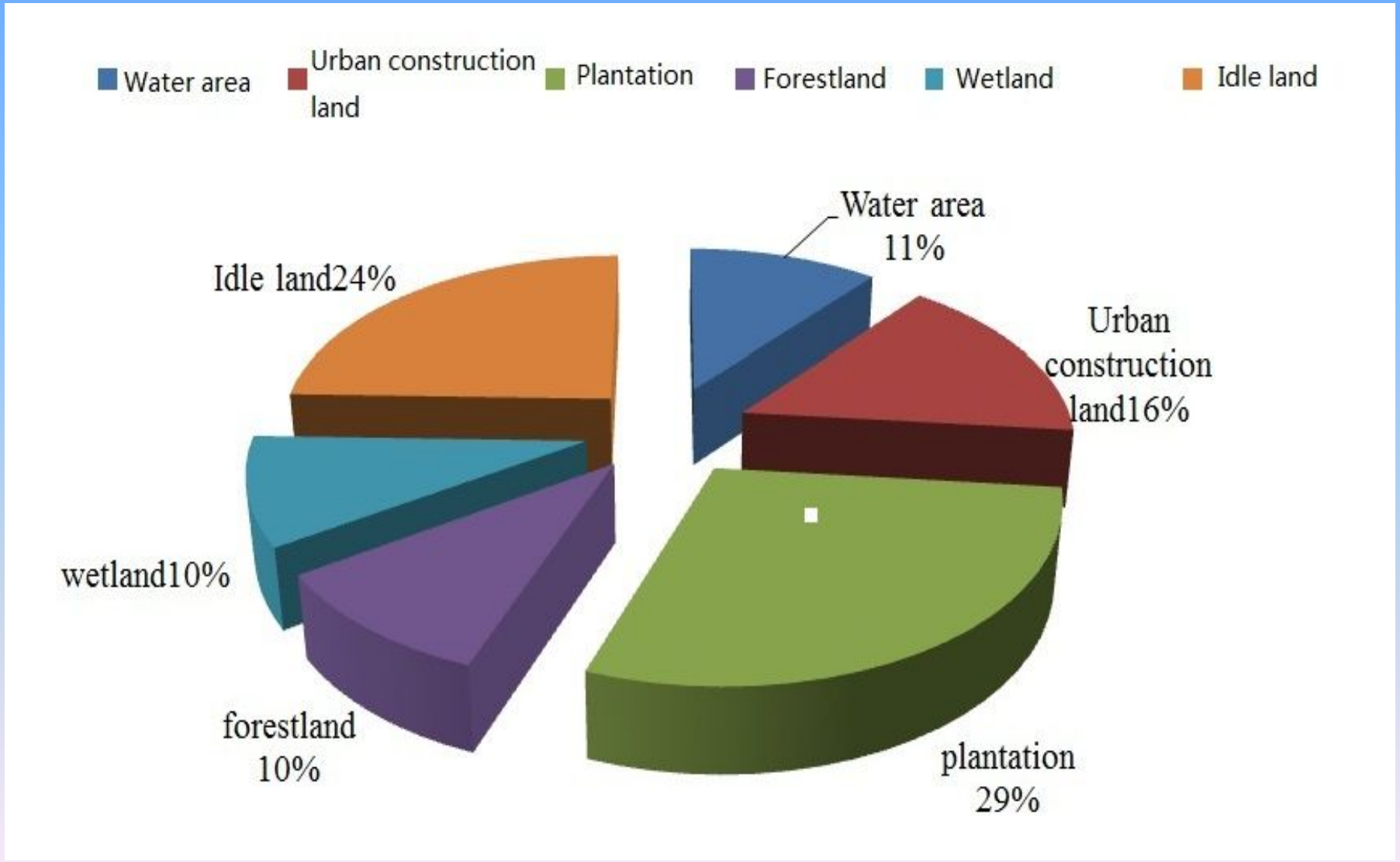
1、Characteristics of river system in Chongming Island

The third largest island of China, located in the Yangtze estuary, which is also the world‘s largest river alluvial island.

Chongming is the Food and vegetables base (supply 1/20) of Shanghai, also an important connecting hub of the Grand Coast .

Home of 1267km2(1/6 of shanghai),
820 000 People (1/30 of Shanghai),
19.44 billion RBM GDP (1/75 of Shanghai), GDP/capita is ¼ of Shanghai

Types of land use of chongming island

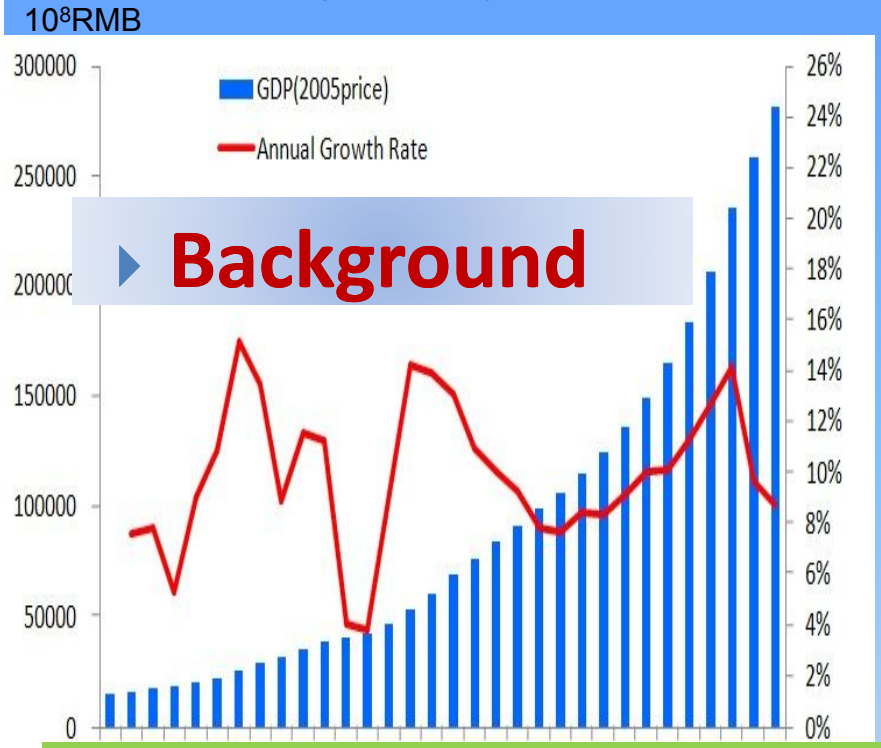


The ecological environment ch
Chongming Island

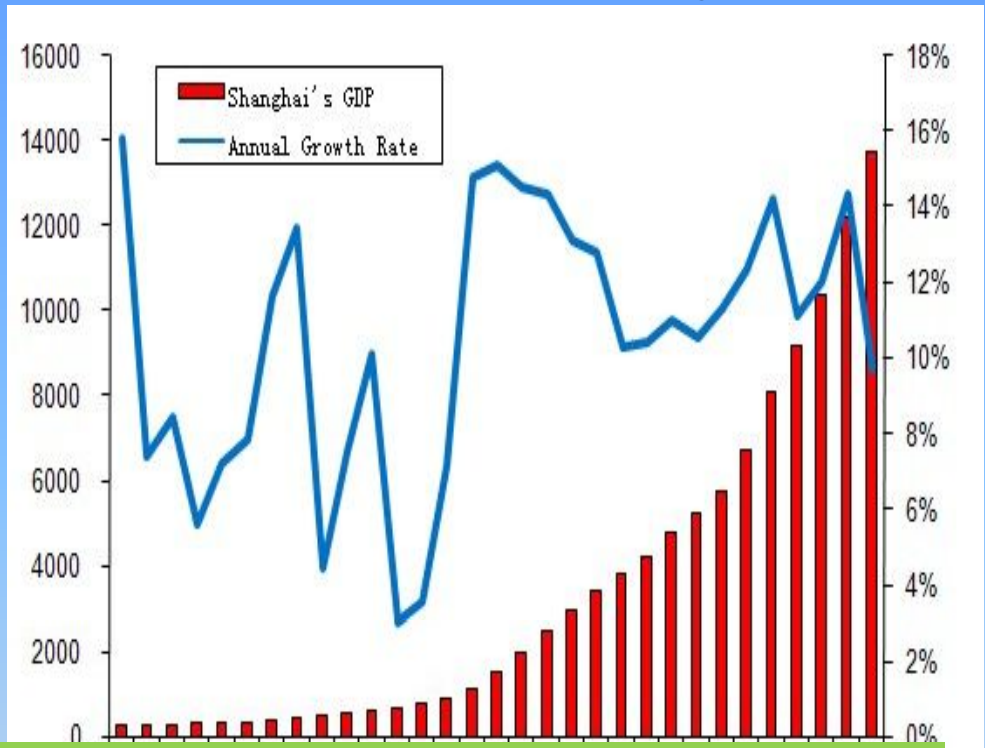
- One part of **Lake Taihu** basin
- Unique wetland landscape
- Rich biodiversity resources because of it's unique ecosystems of river-lake and estuary

  2 Ramsar Sites, more than 50 kinds of water birds.

Booming Economy in China



Economic Development in Shanghai

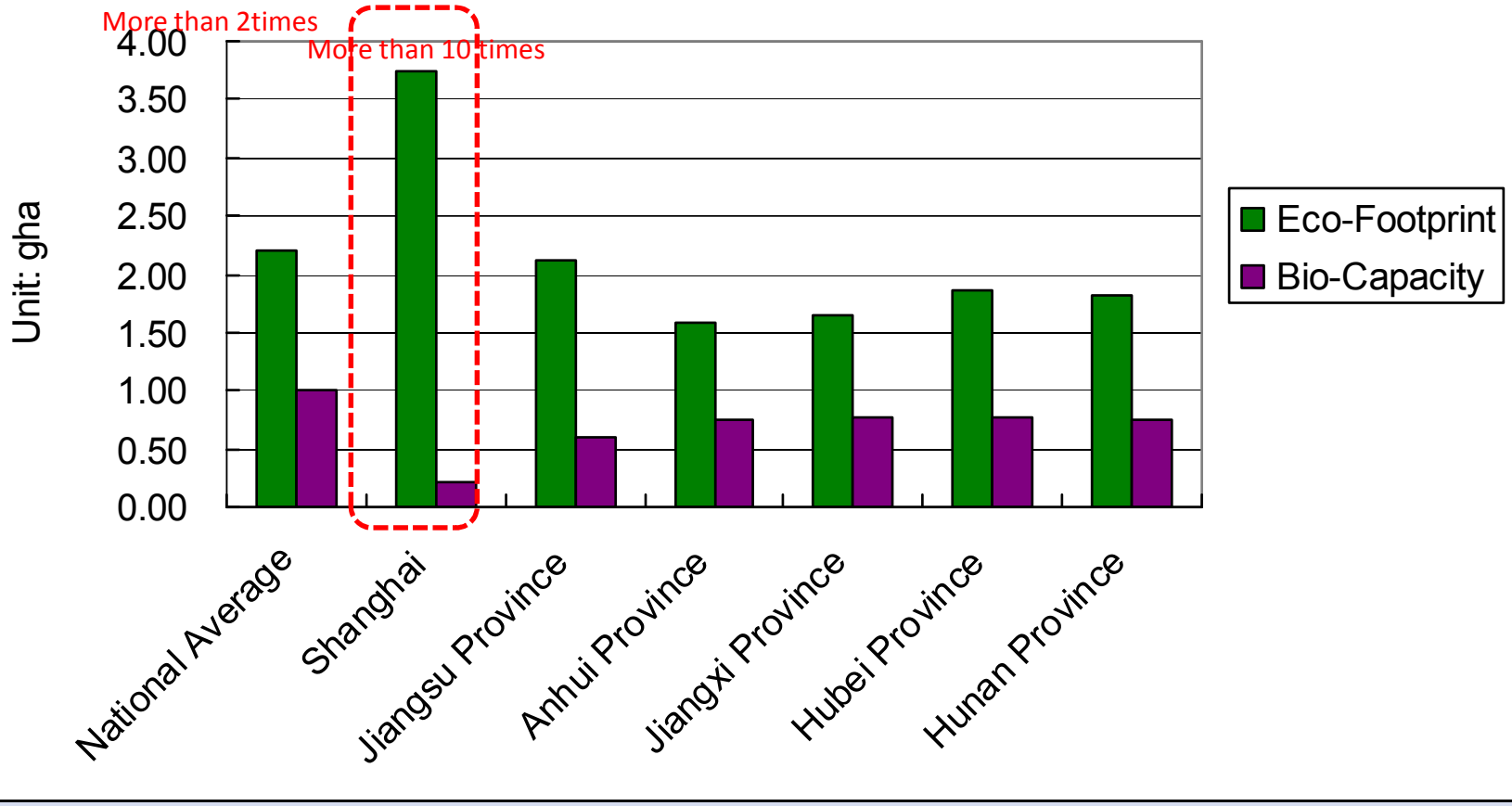


Background

- Robust in last 30 years: AAGR of 10.5% higher than 9.7% (state) since 1978

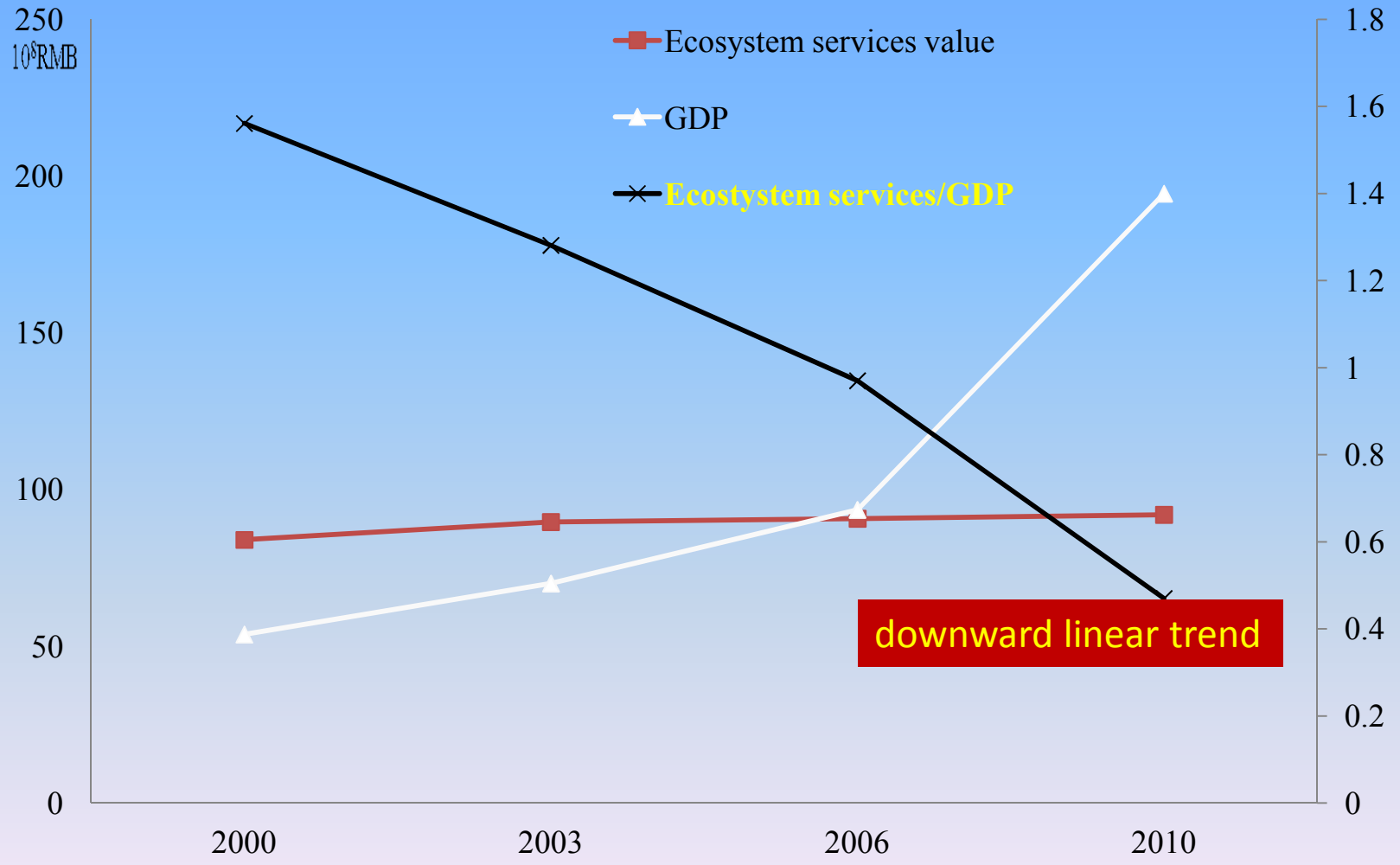
Bio-Capacity v.s. Eco-Footprint of Central&Lower Yangtze in 2008

(Data Source: China Ecological Footprint Report 2010)



Rapid urbanization and sustained economic growth in Shanghai resulted in more than 10 times of its ecological capacity, while more than 2 times of national ecological capacity, which put tremendous pressure on environmental and water resources management in Shanghai.

The changes of ecological service value in Chongming Island



Source: Su Jinghua, Valuing Ecosystem Services of Chongming Island

2、Water management in Chongming Island

River network in Chongming Island

More than 94% terrestrial elevation in Chongming Island is only 3.20-3.40m **EL**, low areas below 3.20m and the high areas above 3.40m **EL** account for 3.5% and 2.5%, respectively.

There are dikes surrounding the island. The top of dikes are designed as 8 meters, 27 lead drainage sluices including 14 head sluices and 11 drainage sluices are mainly responsible for the regulation water in Chongming island.

Characteristics of water resources in Chongming Island

average annual precipitation（$\times 10^8$ m^3 ）	10.93
average annual evaporation（$\times 10^8$ m^3 ）	7.48
average annual diversion volume（$\times 10^8$ m^3 ）	30.15
average annual runoff（$\times 10^8$ m^3 ）	3.45

There are plentiful water resources in Chongming Island, and the total volume of average annual surface water supplies is 33.60 $\times 10^8$ m^3. The local runoff accounts for only 10.27% of the total volume, and the diversion accounts for about 89.73% of the total volume.

Distribution of precipitation monitoring stations

The characteristic of precipitation and south branch tide level（雨季）

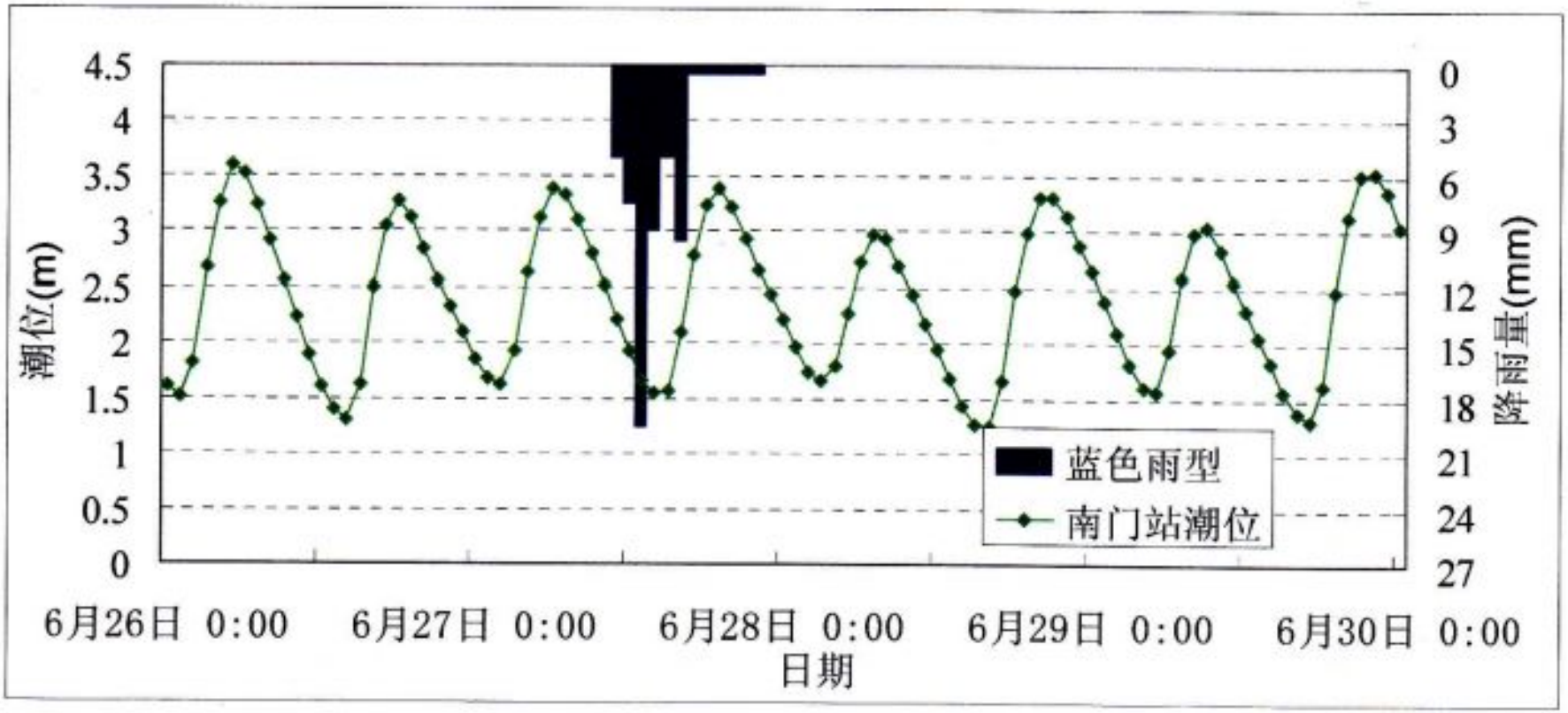


图 6.4-2　蓝色代表雨型以及南门潮位站同步潮型图

The characteristic of precipitation and south branch tide level in Chongming Island （台风）

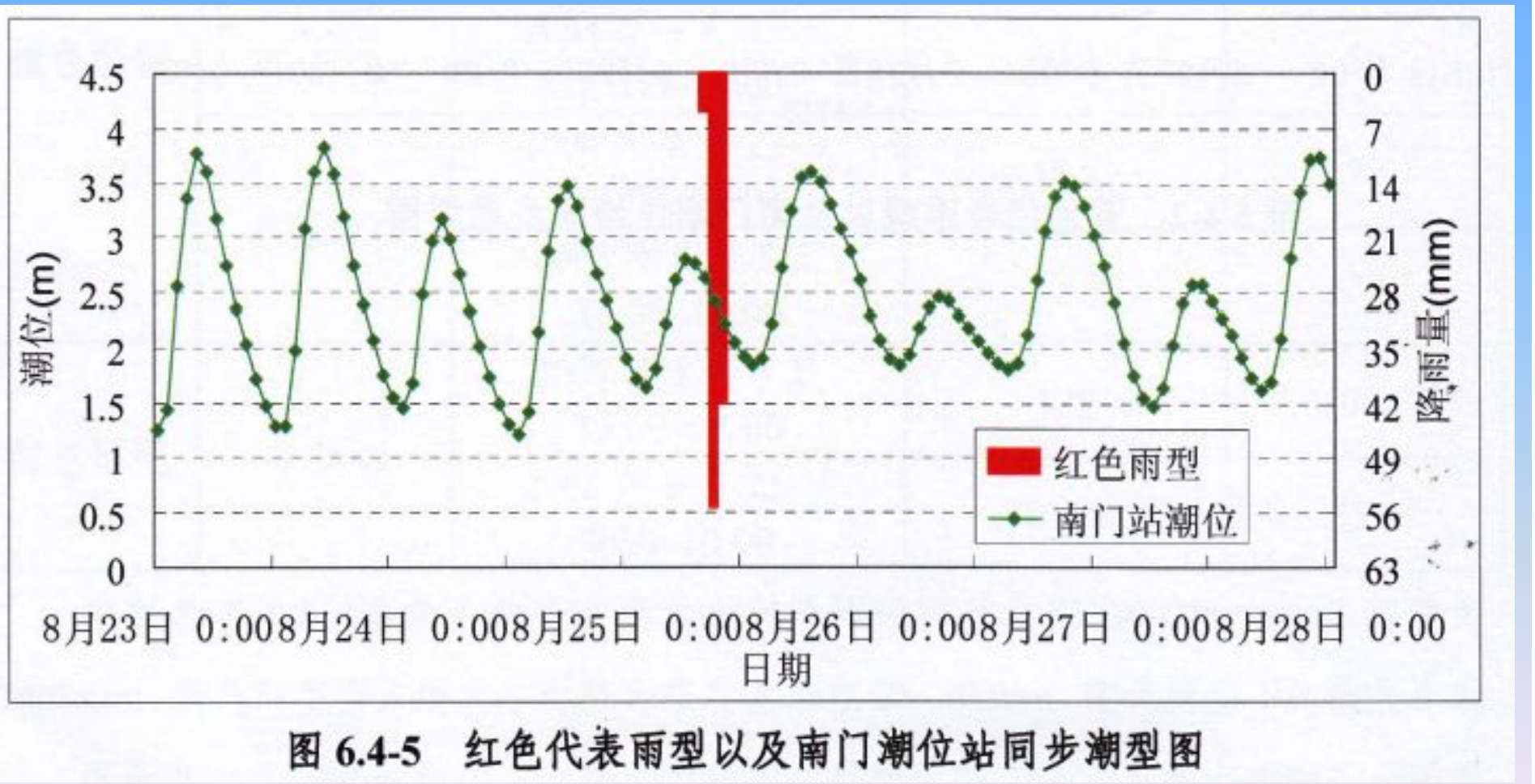


图 6.4-5 红色代表雨型以及南门潮位站同步潮型图

The highest or lowest tide levels in the south branch of Yangtze River around CM Island

Historic highest tide level(m)	6.03
Historic lowest tide level(m)	-0.19
Average annual tide high level(m)	3.35
Average annual tide low level(m)	0.89
Average annual tide level(m)	2.12
Flood tidal duration	4h38min
Ebb tidal duration	7h48min

Safety management principles of water resources

According to the ground and levee height， in order to ensure the safety regulation of water resources, 'Discharging before introducing' is employed generally, (Introducing water to normal water level when water level reach 1.5m by discharging).

Chongming island inland river water system take unified water level,namely the normal water level inside sluice is 2.8m, and it is 2.9m during agricultural irrigation season, whereas it is decreased to 2.6m when it is suffering from typhoon.

Traditional water diversion management （ 1986~2010）

- Water was introduced into inland river twice a year, all sluices consecutively drain three times at tide ebb, and then all sluices along the south introduce three times at high tide to attain normal water level.
- “Introducing at the south and draining at the north” is employed in normal climate, which is affected by spring tide.
- It was predicted to discharge to normal water level across the whole county when there was storm
- Water was introduced from all sluices along the south river, and it should not drain from the sluices along the north river, which was to control inland water level during high temperature and dry season.

Optimum water diversion management mode （2010~Now）

- Secondary introducing is canceled, and changed to a routine introducing and draining circularly to realize “Introduce clear more, drain waste more".
- On a regional water diversion, Chong Xi sluice is selected as water intake. Water is introduced persistently when the tide level is allowed. And then the water is transported from municipal river channel to low-level river channel.
- Selective water diversion, sluices along the south are selected as auxiliary intakes and sluices along the north as outlets, appropriate introducing and draining is employed according to unified management.
- Appropriate arrangement is employed according to weather report when there is special weather.

Evaluation of inland water quality diagram during the first water diversion experiment

Types of Watercourse		DO		COD		BOD_5		Ammonia nitrogen		chloride	Integrated assessment
		average	Water category	average	Water category	average	Water category	average	Water category	average	
The South leader river	After draining off water	6.3	Ⅱ	14.1	Ⅱ	3.2	Ⅲ	0.27	Ⅱ	66.5	Ⅲ
	After drawing water	7	Ⅱ	7.2	Ⅱ	1.8	Ⅱ	0.2	Ⅱ	27	Ⅱ
	Ratio of increasing or decreasing	11.00%		-48.80%		-45.20%		-28.00%		-59.50%	/
The North leader river	After draining off water	7	Ⅱ	14.7	Ⅱ	4	Ⅲ	0.28	Ⅱ	80	Ⅲ
	After drawing water	5.6	Ⅲ	13.4	Ⅱ	2.8	Ⅱ	0.26	Ⅱ	68.6	Ⅲ
	Ratio of increasing or decreasing	-19.60%		-8.90%		-29.60%		-8.70%		-14.20%	/
Vertical channel	After draining off water	6.4	Ⅱ	16.7	Ⅲ	3.7	Ⅲ	0.39	Ⅱ	93.2	Ⅲ
	After drawing water	7.3	Ⅱ	6.9	Ⅱ	1.2	Ⅱ	0.17	Ⅱ	30	Ⅱ
	Ratio of increasing or decreasing	14.40%		-58.90%		-67.80%		-57.20%		-67.80%	/
Entrance of water drawing	After draining off water	7.3	Ⅱ	13.3	Ⅱ	3.5	Ⅲ	0.33	Ⅱ	75.4	Ⅲ
	After drawing water	7.2	Ⅱ	9.5	Ⅱ	2.2	Ⅱ	0.23	Ⅱ	26.7	Ⅱ
	Ratio of increasing or decreasing	-1.10%		-28.90%		-36.50%		-29.10%		-64.60%	/

Actual observation of tide level changing process in Yangtze estuary during the second water diversion experiment

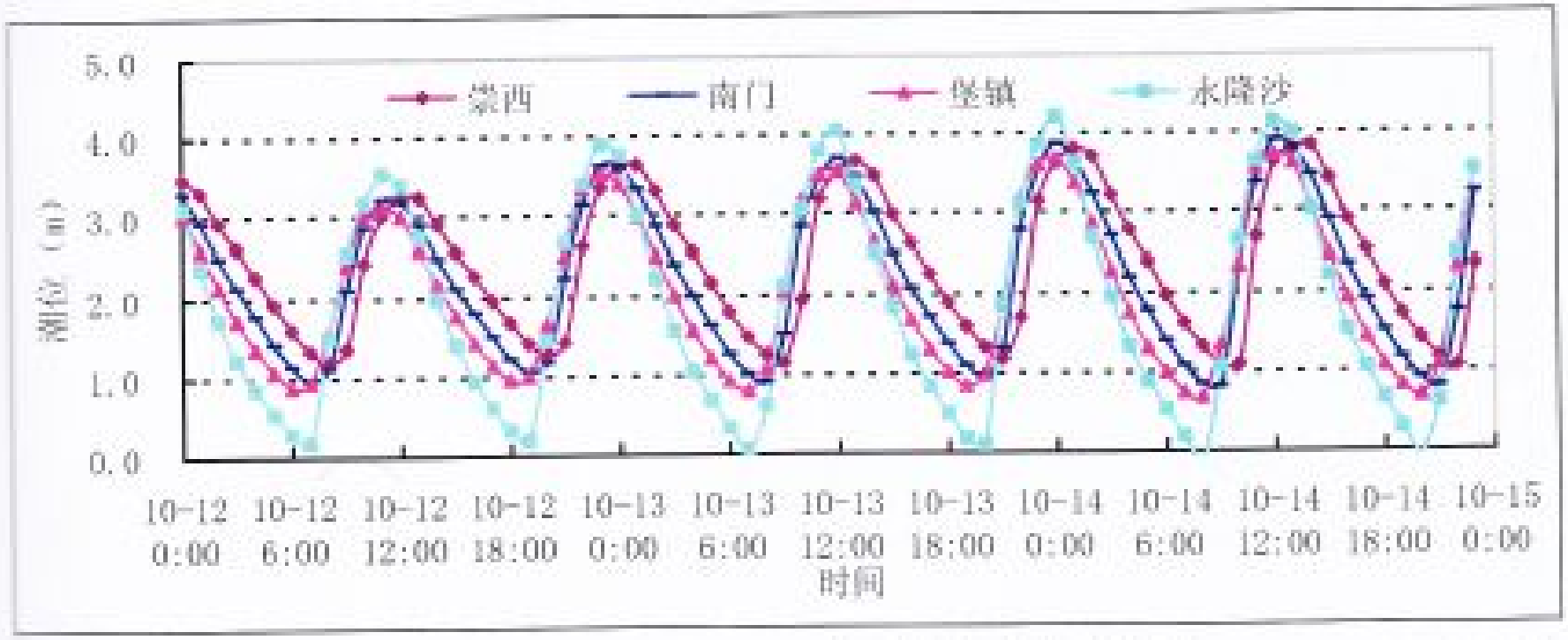
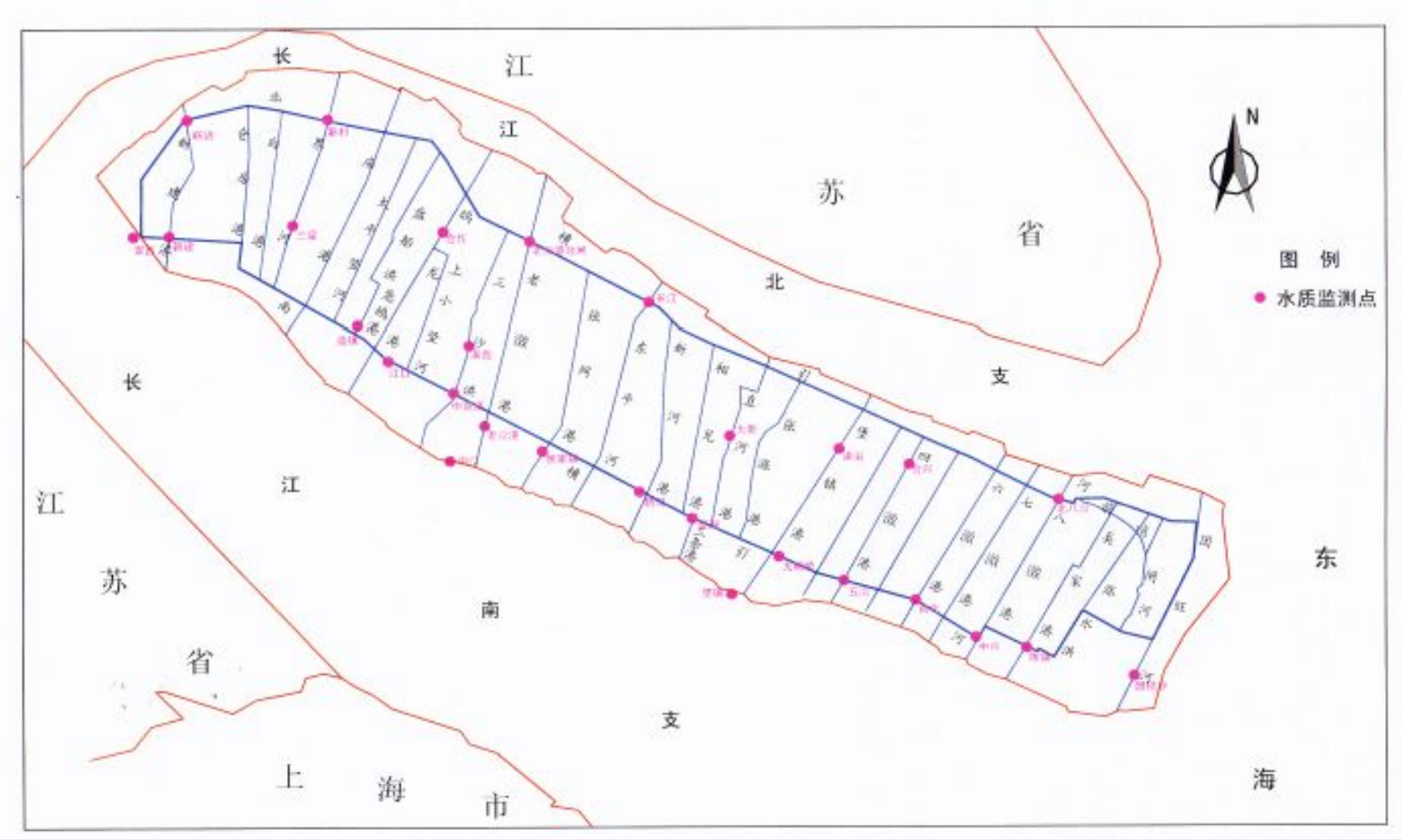


图 3.3-1　　第二次调水试验期间长江口实测潮位变化过程（2008.10.12~10.15）

Layout of current water quality monitoring sites in Chongming Island



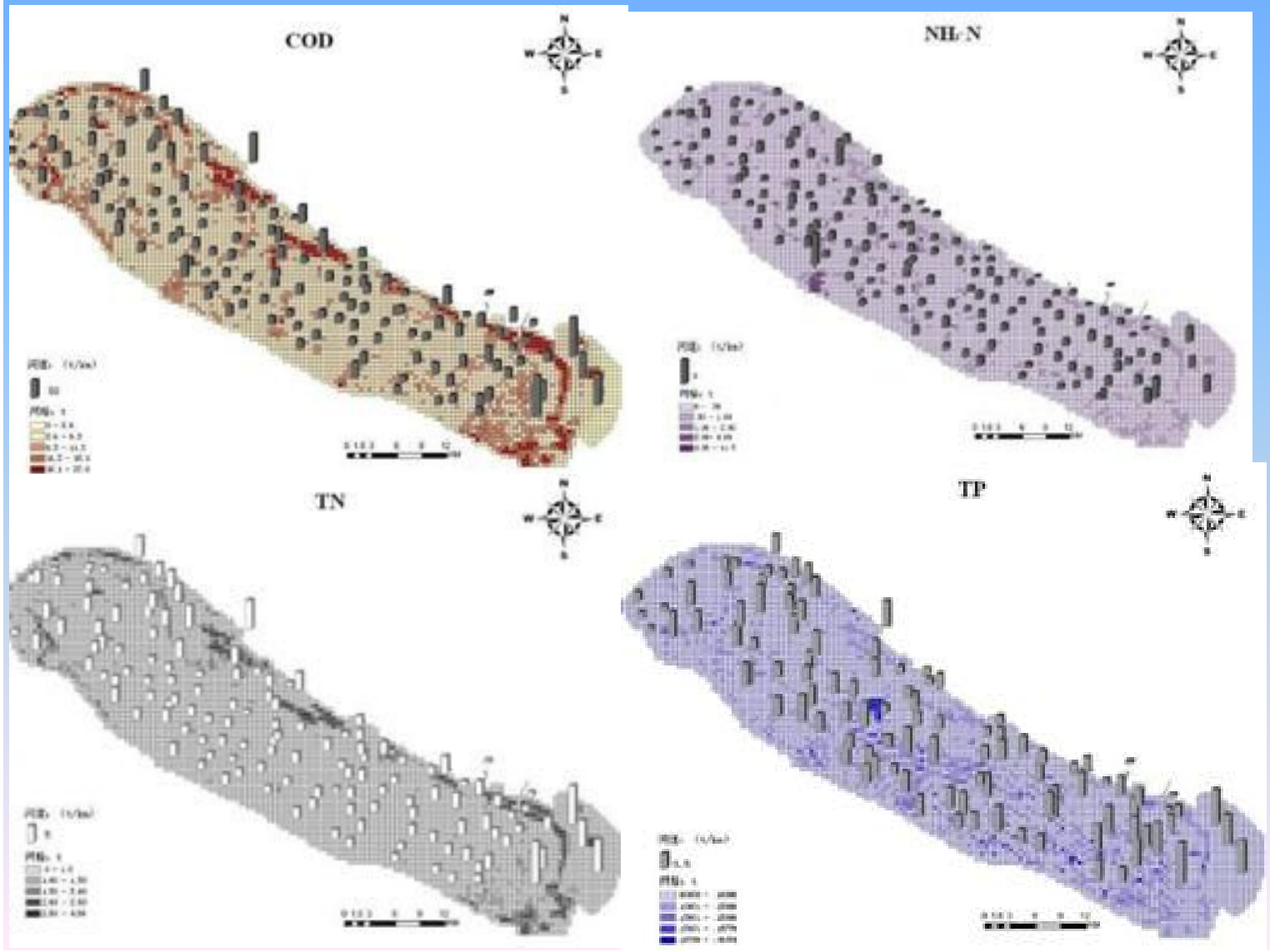
Evaluation of inland water quality during the second water diversion experiment period

Types of Watercourse		DO		COD		BOD_5		Ammonia nitrogen		chloride	Integrated assessment
		average	Water category	average	Water category	average	Water category	average	Water category	average	
The South leader river	After draining off water	7	Ⅱ	11.5	Ⅱ	1.6	Ⅱ	0.31	Ⅱ	21.9	Ⅱ
	After drawing water	6.7	Ⅱ	11	Ⅱ	1.2	Ⅱ	0.24	Ⅱ	27	Ⅱ
	Ratio of increasing or decreasing	-5.2.0%		-4.70%		-24.20%		-23.30%		8.70%	/
The North leader river	After draining off water	6.9	Ⅱ	13.7	Ⅱ	1.8	Ⅱ	0.39	Ⅱ	63.5	Ⅱ
	After drawing water	6.6	Ⅱ	14.5	Ⅱ	1.4	Ⅱ	0.32	Ⅱ	57.4	Ⅱ
	Ratio of increasing or decreasing	-4.50%		-5.80%		-26.40%		-16.60%		-9.60%	/
Vertical channel	After draining off water	6.5	Ⅱ	14.7	Ⅱ	2.8.	Ⅱ	0.32	Ⅱ	34.4	Ⅱ
	After drawing water	6.8	Ⅱ	11.5	Ⅱ	1.9	Ⅱ	0.23	Ⅱ	31.6	Ⅱ
	Ratio of increasing or decreasing	4.70%		-21.90%		-33.50%		-27.50%		-8.10%	/
Entrance of water drawing	After draining off water	6.6	Ⅱ	7.8	Ⅱ	2.5	Ⅲ	0.24	Ⅱ	20.6	Ⅱ
	After drawing water	6.9	Ⅱ	7.4		1.7	Ⅱ	0.27	Ⅱ	22.3	Ⅱ
	Ratio of increasing or decreasing	5.10%		-4.60%		-32.90%		14.20%		8.20%	/

Non-point source pollution in Chongming Island

Non-point source type	COD_{Cr} (t/a)	NH_3-N (t/a)
Animal Husbandry	9265.25	1853.05
Aquaculture	13010.75	175.44
Farmland surface runoff	8199.85	176.18
Domestic pollution	8299.21	1088.35
Total	38775.06	3293.02

The calculation results of non-point source pollution load



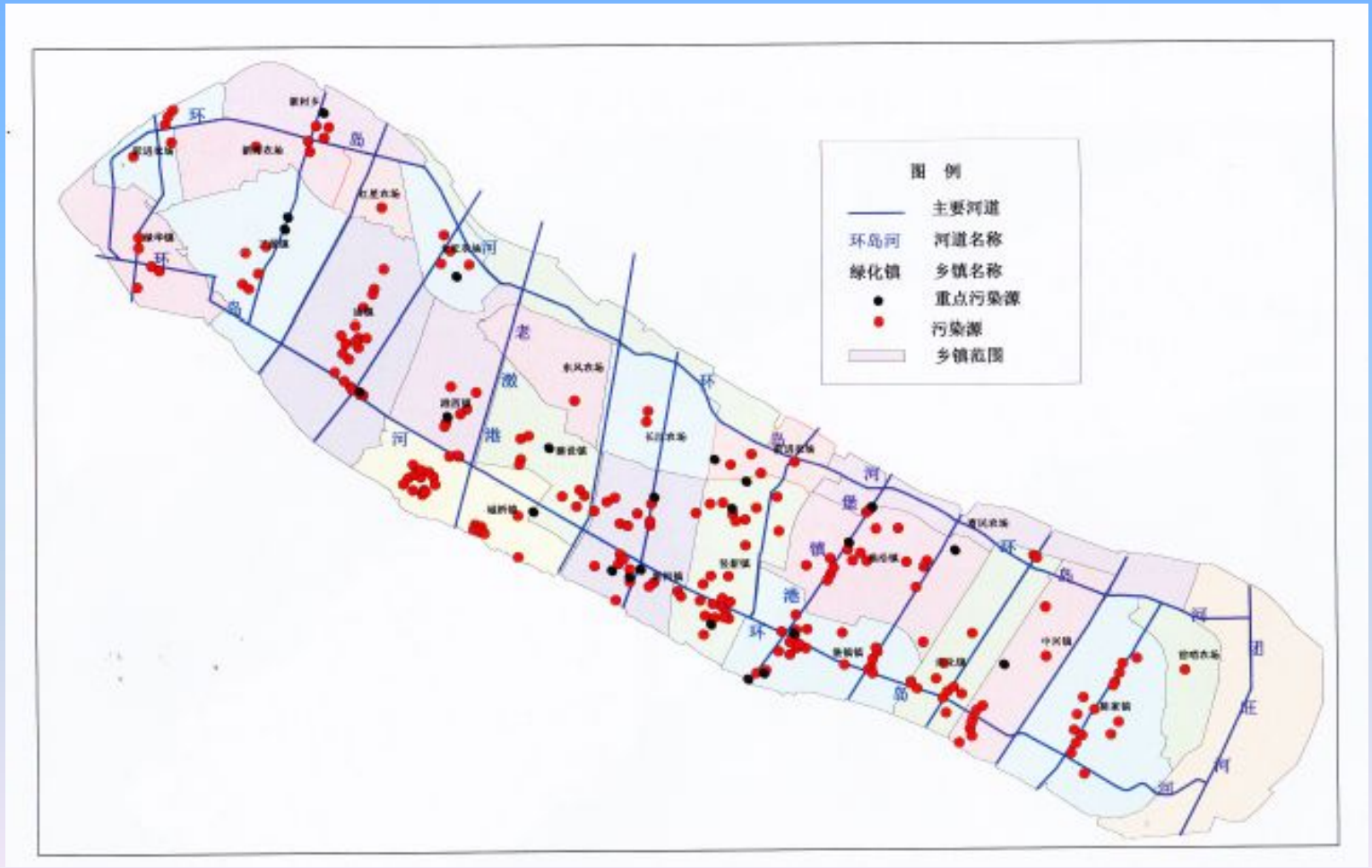
COD: 30849.8t

NH3-N: 1464.6t

TN: 3514.5t

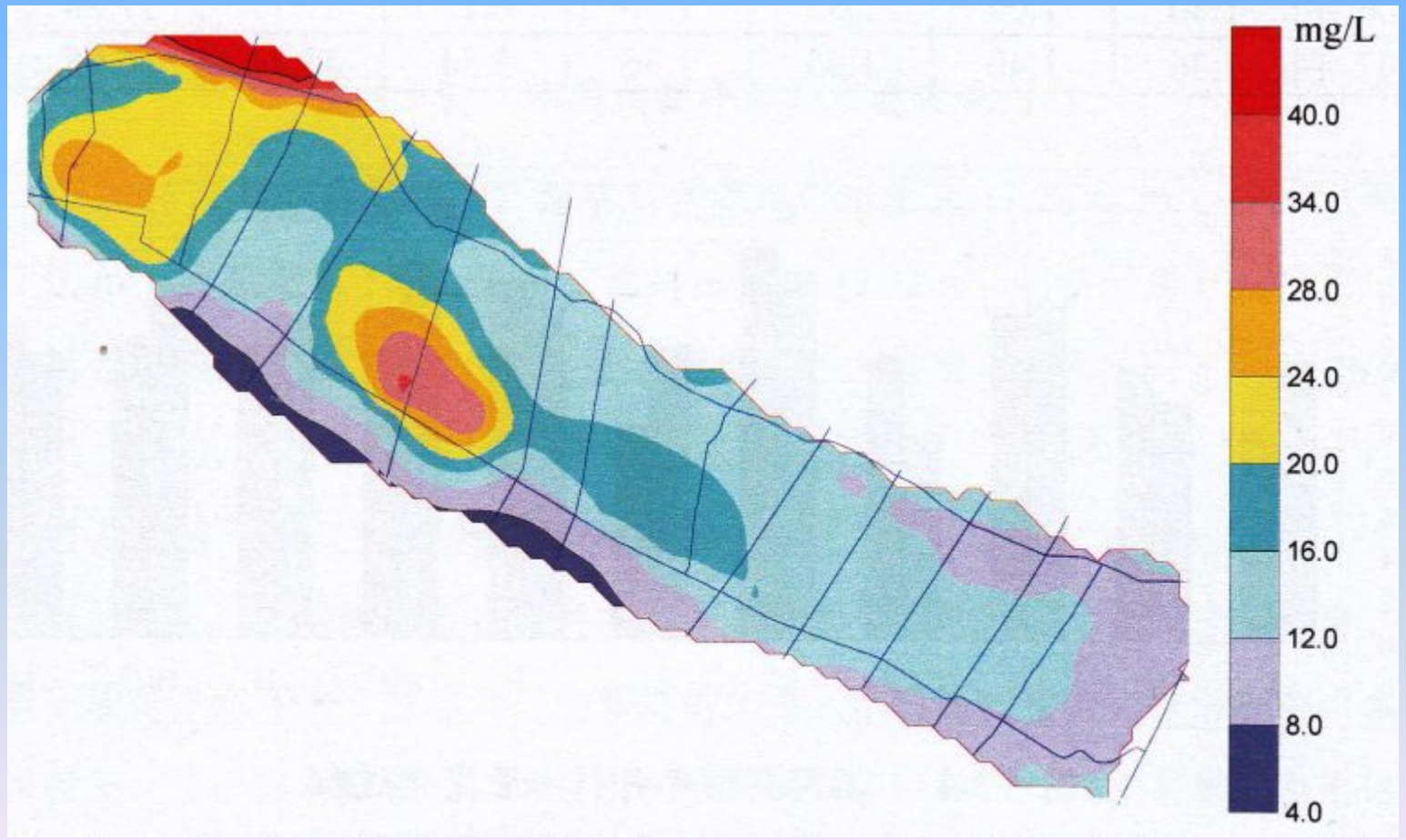
TP: 387.4t

Distribution of main point pollution source in 2007

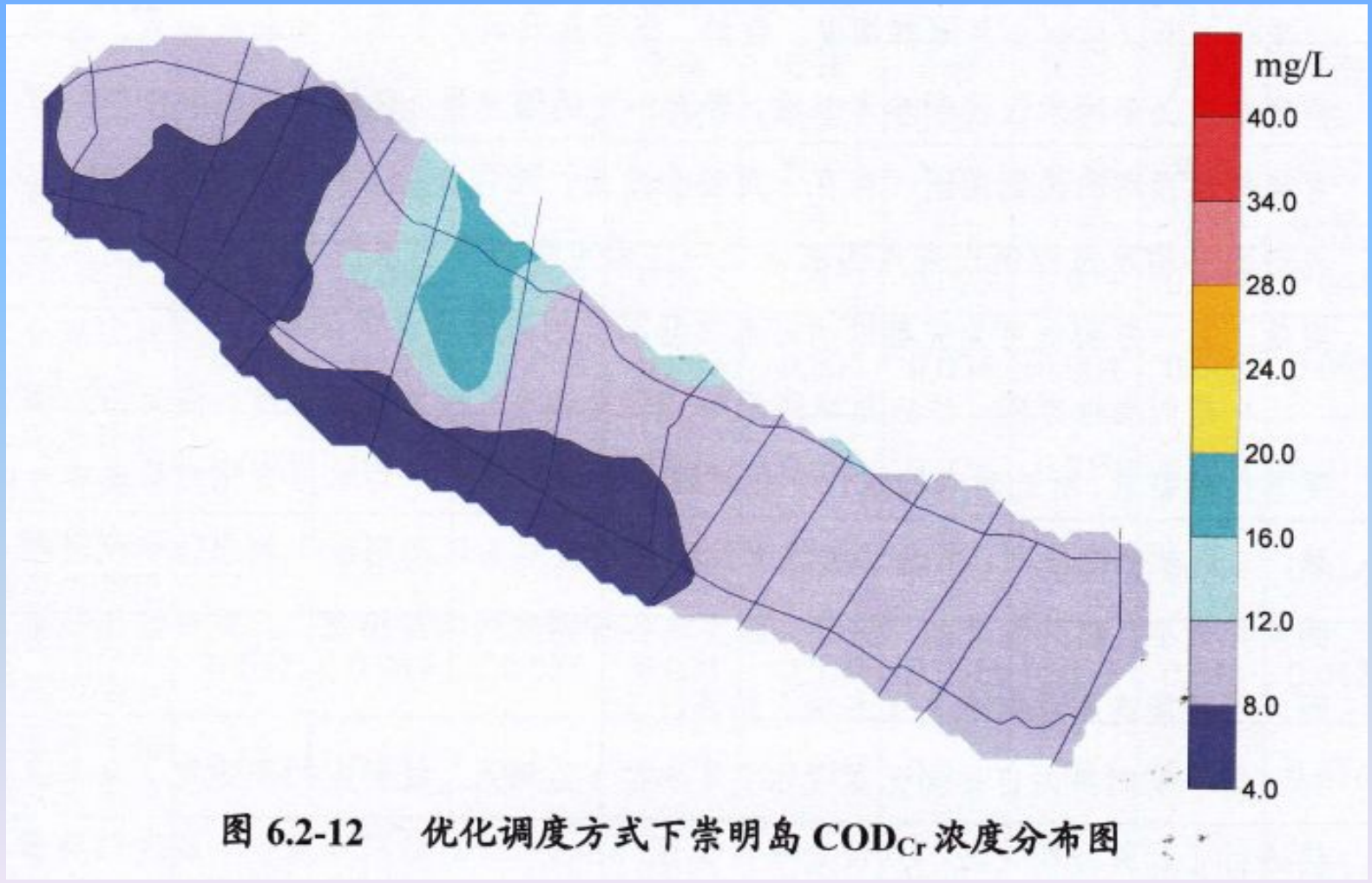


water quality improvement transfer schemes without avoiding salt water

Distribution of COD_{Cr} concentration under current water regulation in Chongming Island

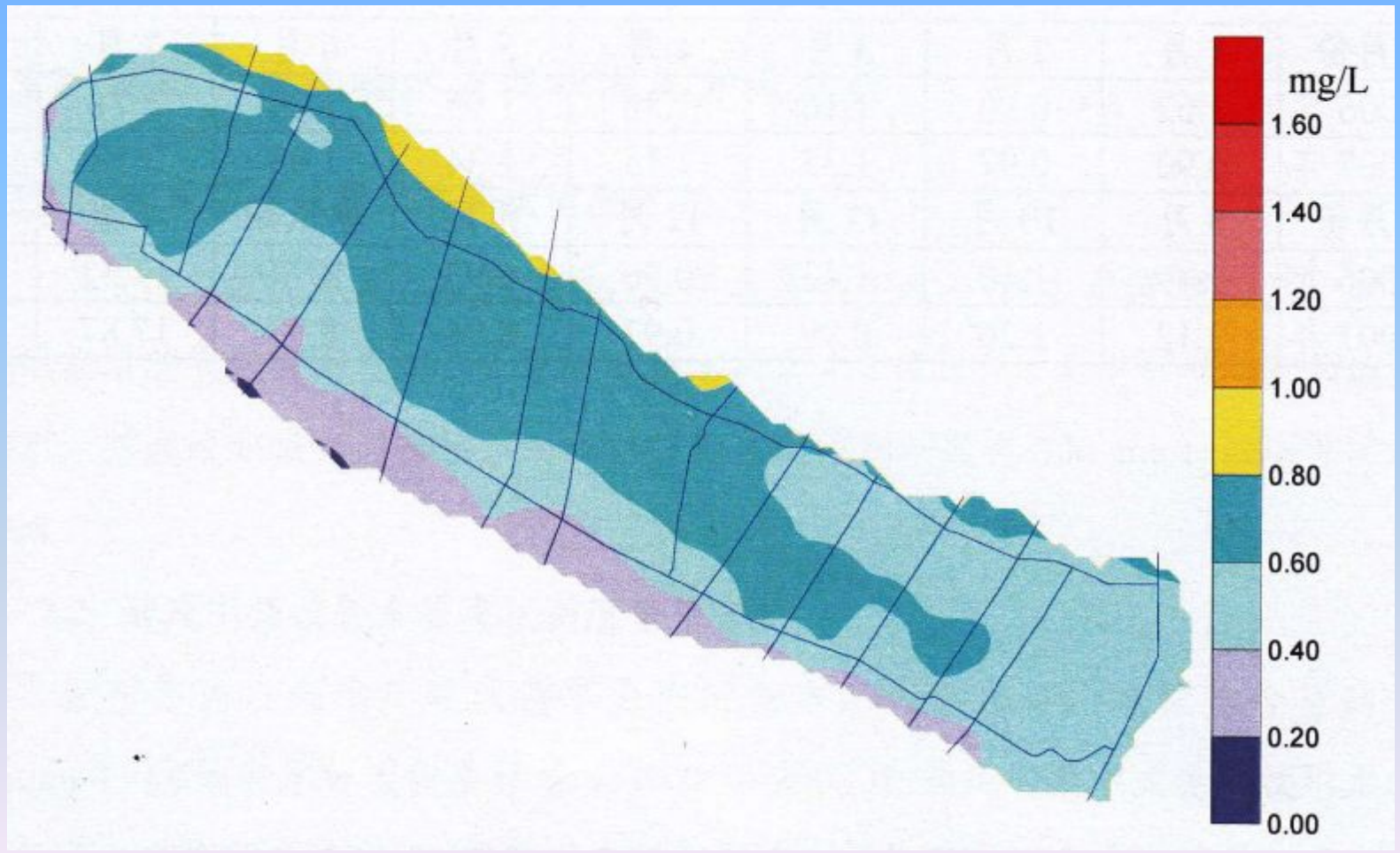


Chongming Island COD_{Cr} concentration distribution picture in optimal regulation



Pic 6.2-12 Chongming Island COD_{Cr} concentration distribution picture in optimal regulation

Distribution of NH_3-N concentration under current water regulation in Chongming Island



Chongming Island NH_3-N concentration distribution picture in optimal regulation

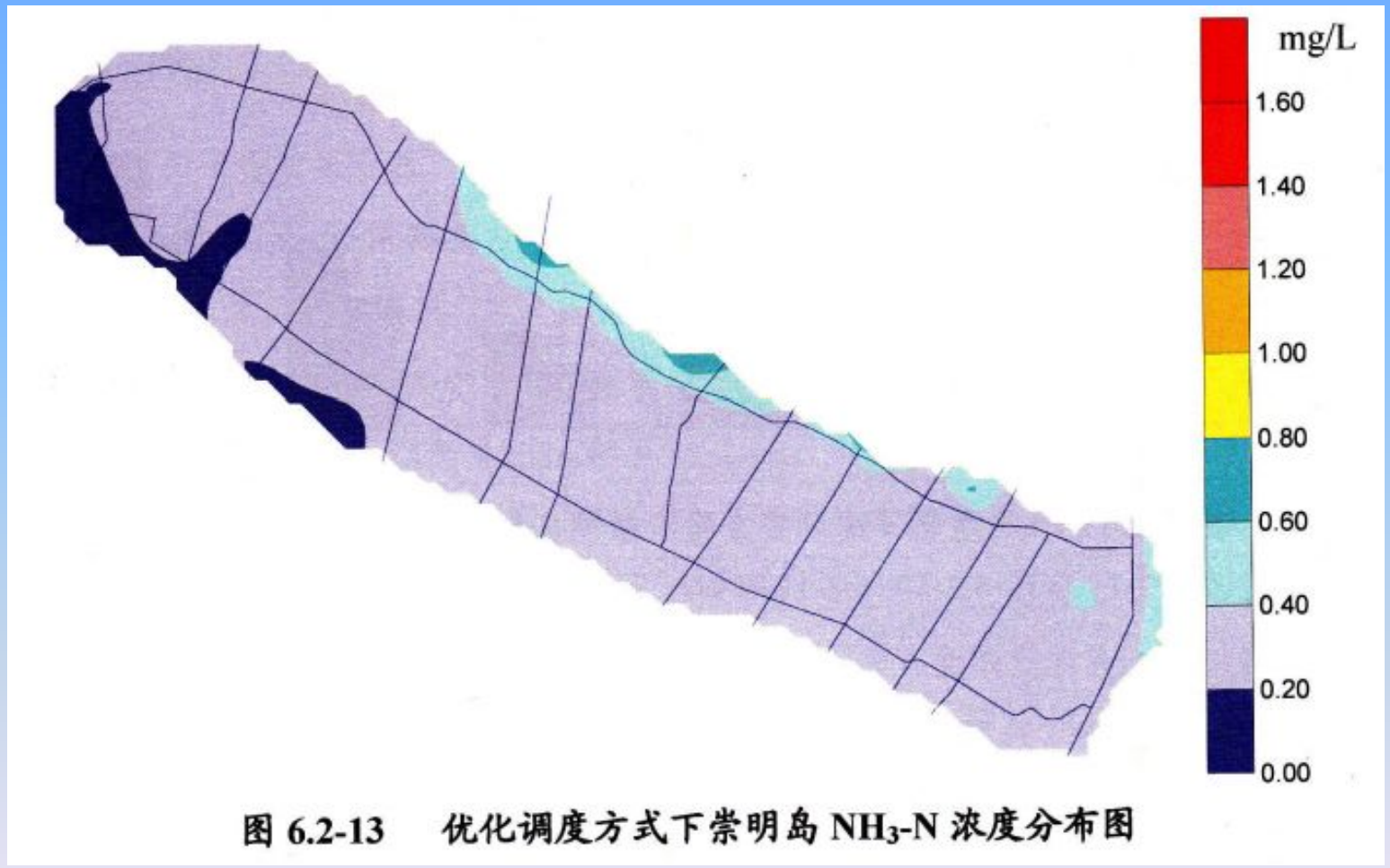


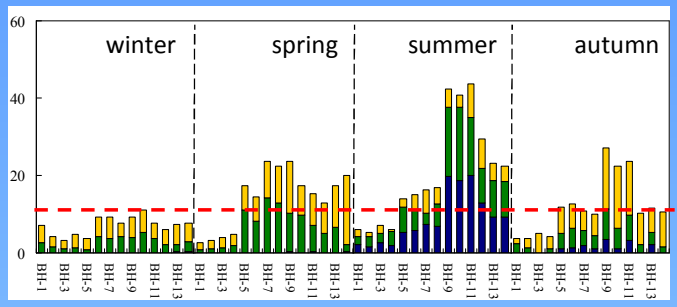
图 6.2-13　优化调度方式下崇明岛 NH_3-N 浓度分布图

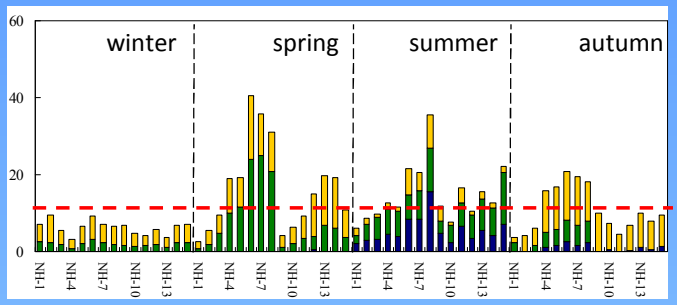
Pic 6.2-13 Chongming Island NH_3-N concentration distribution picture in optimal regulation

3. Problems and conclusion of water management in Chongming Island

Chlorophyll's seasonal changing rule in Chongming river channel

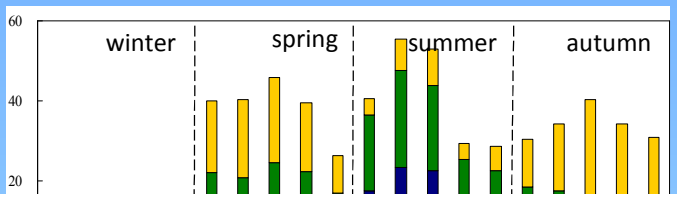
The North leader river

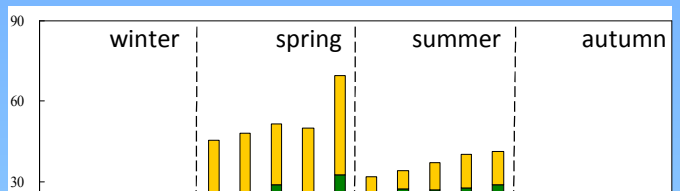




The South leader river

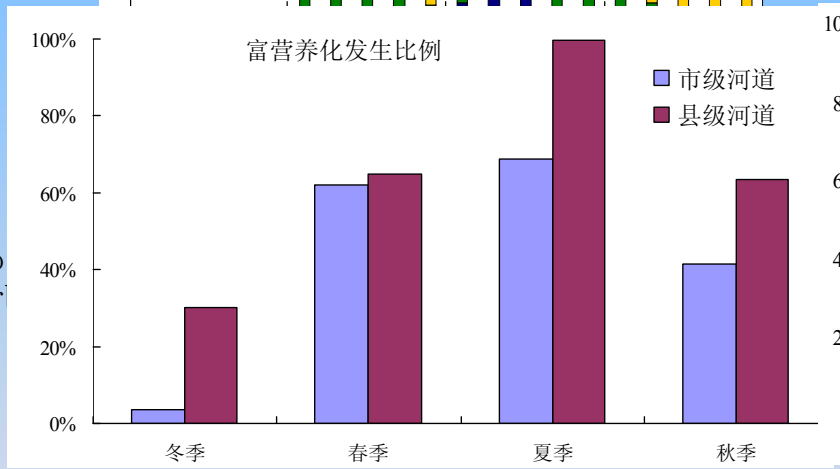
Ge Long Harbor

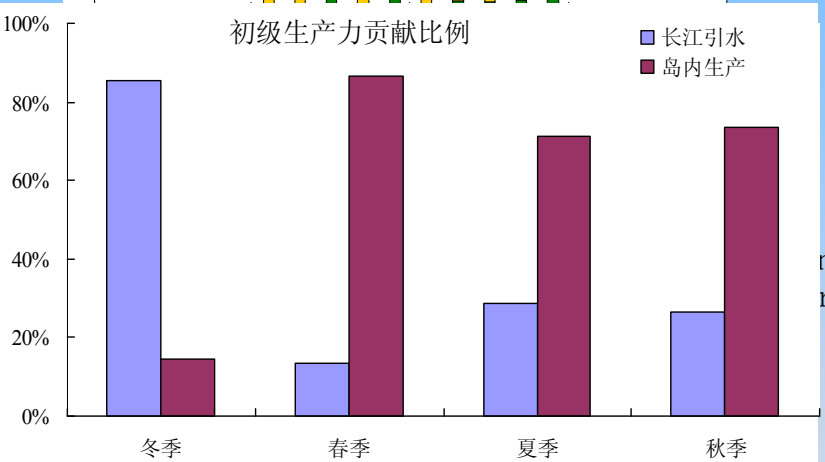




Xin Jian Harbor

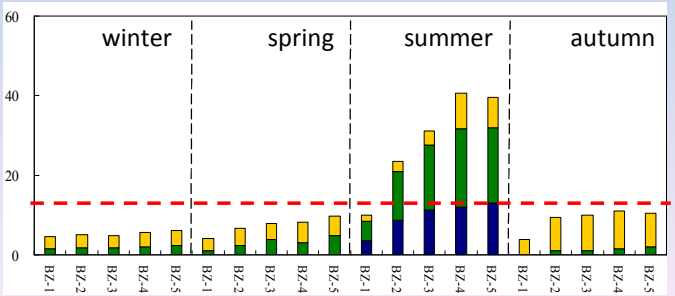
Lao Har

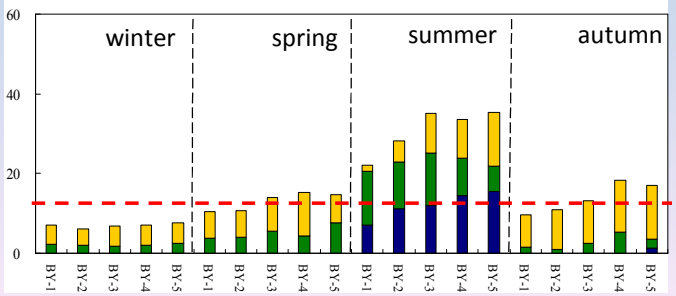




n He rbor

Bao Zhen Harbor

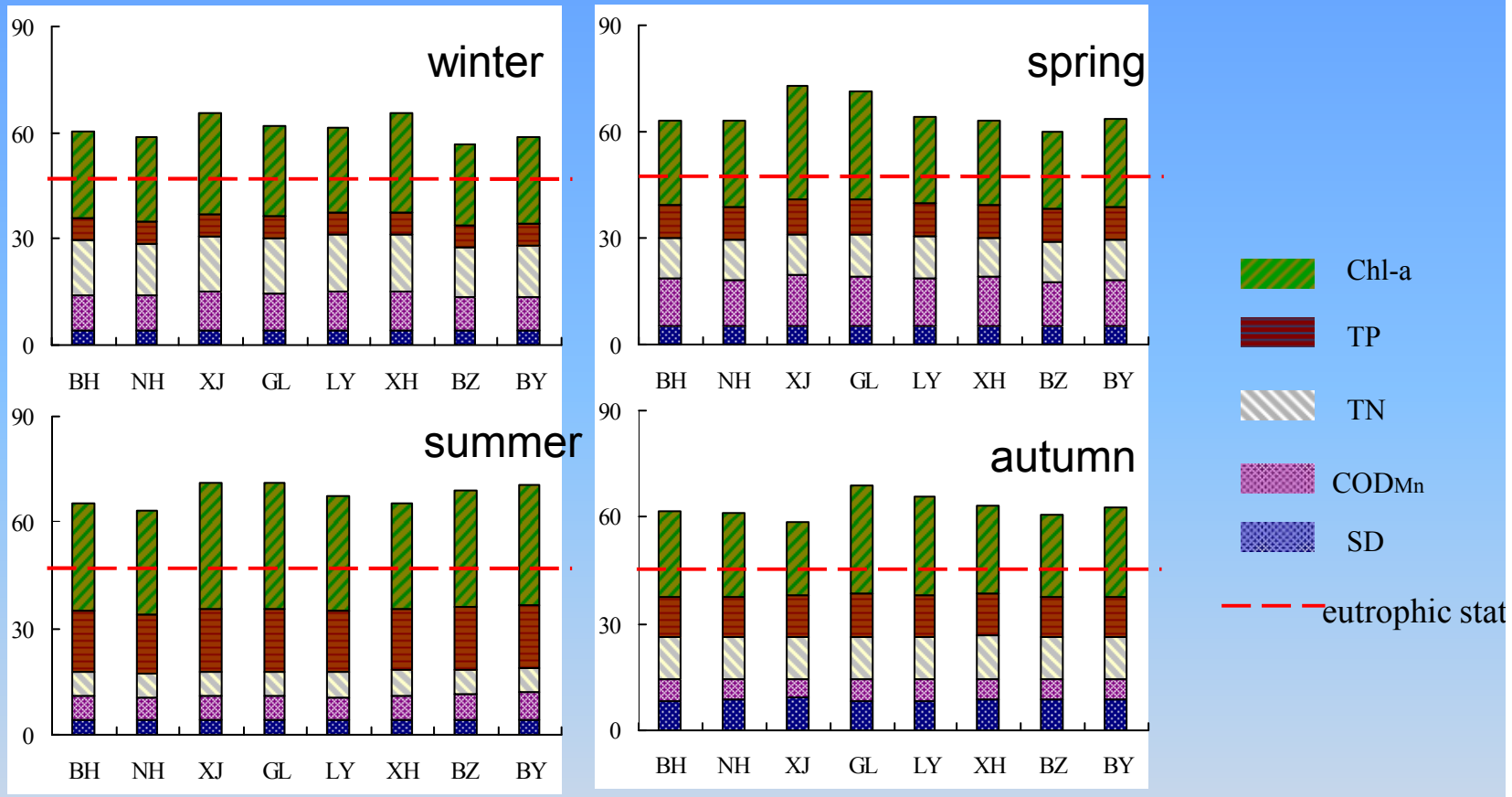




Ba Yao Harbor

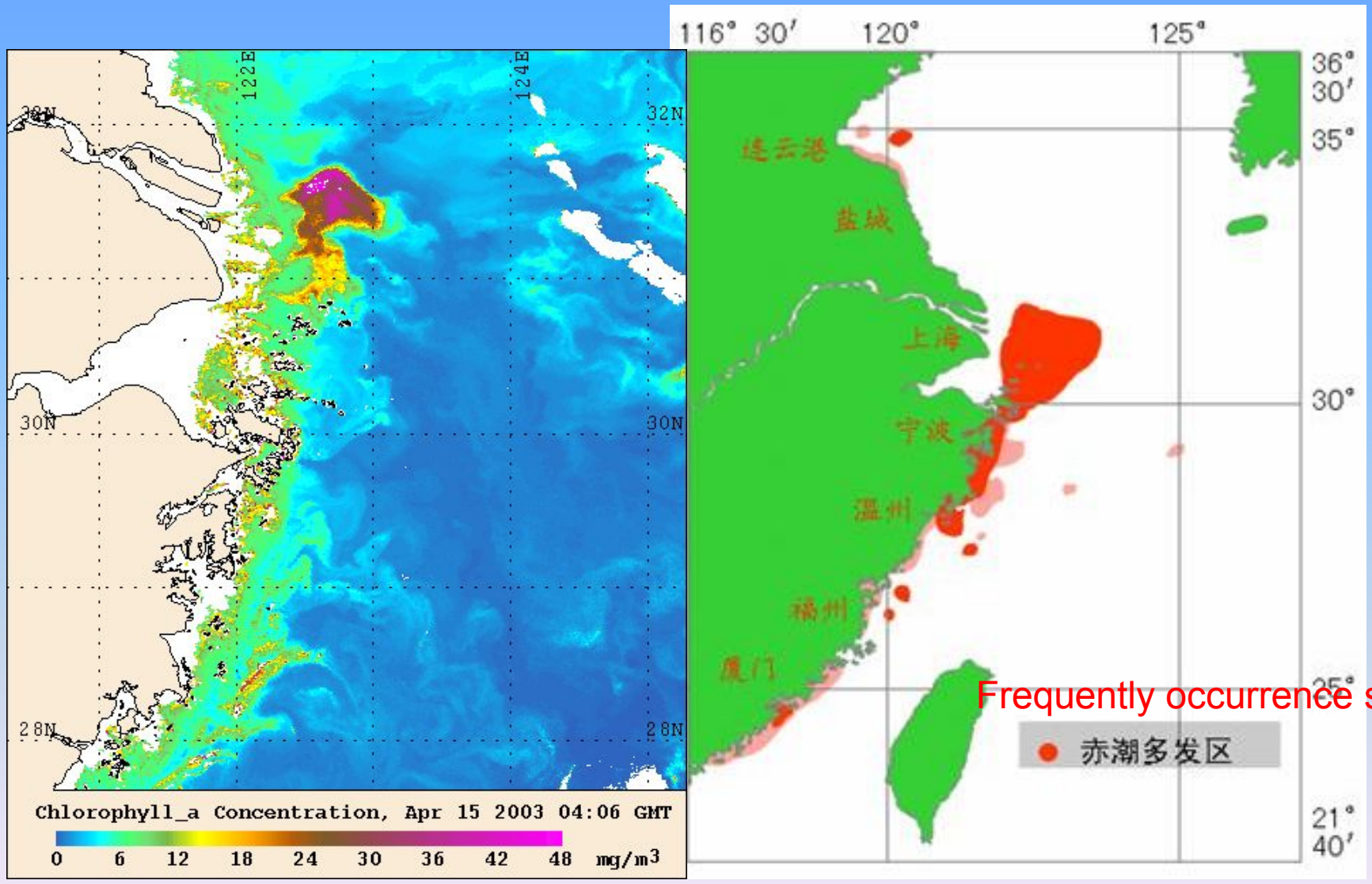
Blue algae Green algae Diadinoxanthin algae

TSI_M evaluation in Chongming river channel



	Oligotropher		Mesotropher		eutrophy		serious eutrophy	
	sample quantity	percentage	sample quantity	percentage	sample quantity	percentage	sample quantity	percentage
winter	0	0%	0	0%	50	84.7%	9	15.3%
spring	0	0%	0	0%	31	52.5%	28	47.5%
summer	0	0%	0	0%	20	33.9%	39	66.1%
autumn	0	0%	0	0%	46	78.0%	13	22.0%

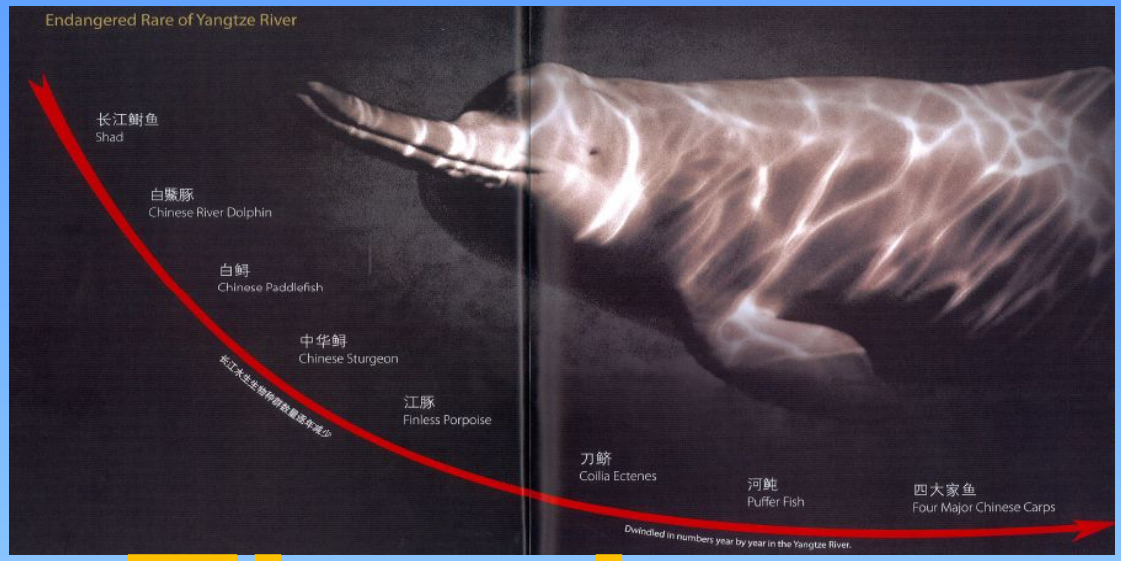
Red tide explosion in the Coastal China near Yangtze River



The reason of changing C、 N、 P and Si proportio

conclusion

The water from Yangtze River and runoff in the Island accounts for 90%, and 10% of water resources in the Chongming Island, respectively. Therefore, water transfer from the Yangtze River becomes a powerful tool to ensure resources and improve water quality in the inland river. With the rapid development of urbanization and economy, pollutant from the Yangtze River and the Island pose a threat to water management in the Chongming Island. Thus, the protection and integrated management of water resources in the Estuary of Yangtze River and Inland water in the Chongming Island is vital essential.


Endangered Rare of Yangtze River
长江鲥鱼
Shad
白鳘豚
Chinese River Dolphin
白鲟
Chinese Paddlefish
中华鲟
Chinese Sturgeon
江豚
Finless Porpoise
刀鲚
Coilia Ectenes
河鲀
Puffer Fish
四大家鱼
Four Major Chinese Carps
Dwindled in numbers year by year in the Yangtze River.

Thank you