# Marine ecosystem changes in the Changjiang River Estuary and its relationships to the water conservancy

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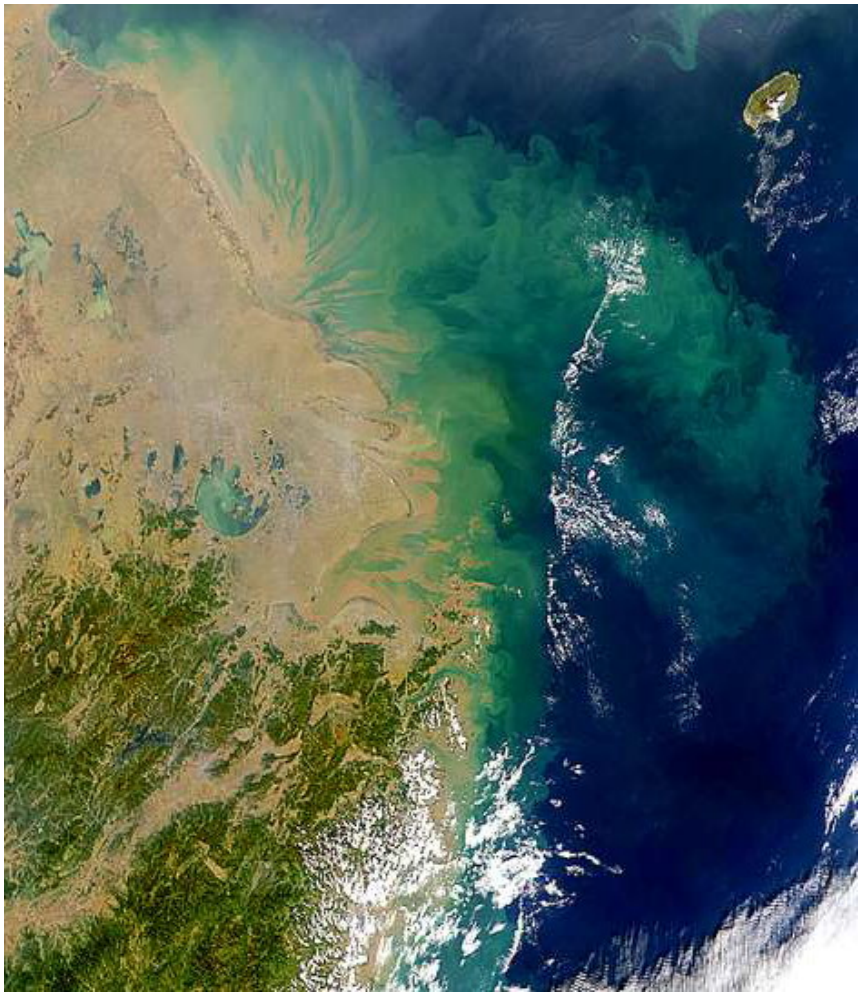
- The Changjiang River is one of the largest rivers in the world that discharges on average $9.24\times10^{11}m^3$ fresh water into the sea annually.

# Physical influence -- Dilute water



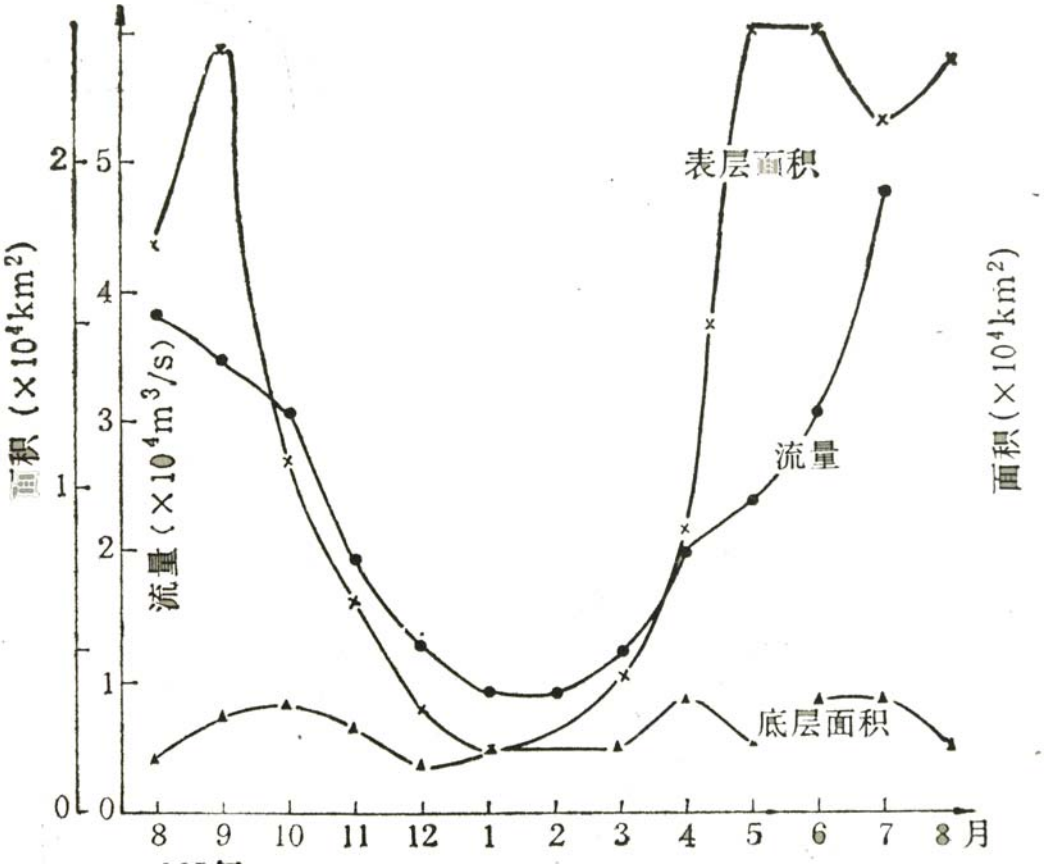
Annual transports of Nutrients($\times 10^4$ tons):

| | |
|---|---|
| TIN | 88.8 |
| $PO_4$-P | 1.4 |
| $SiO_3$-Si | 204.4 |

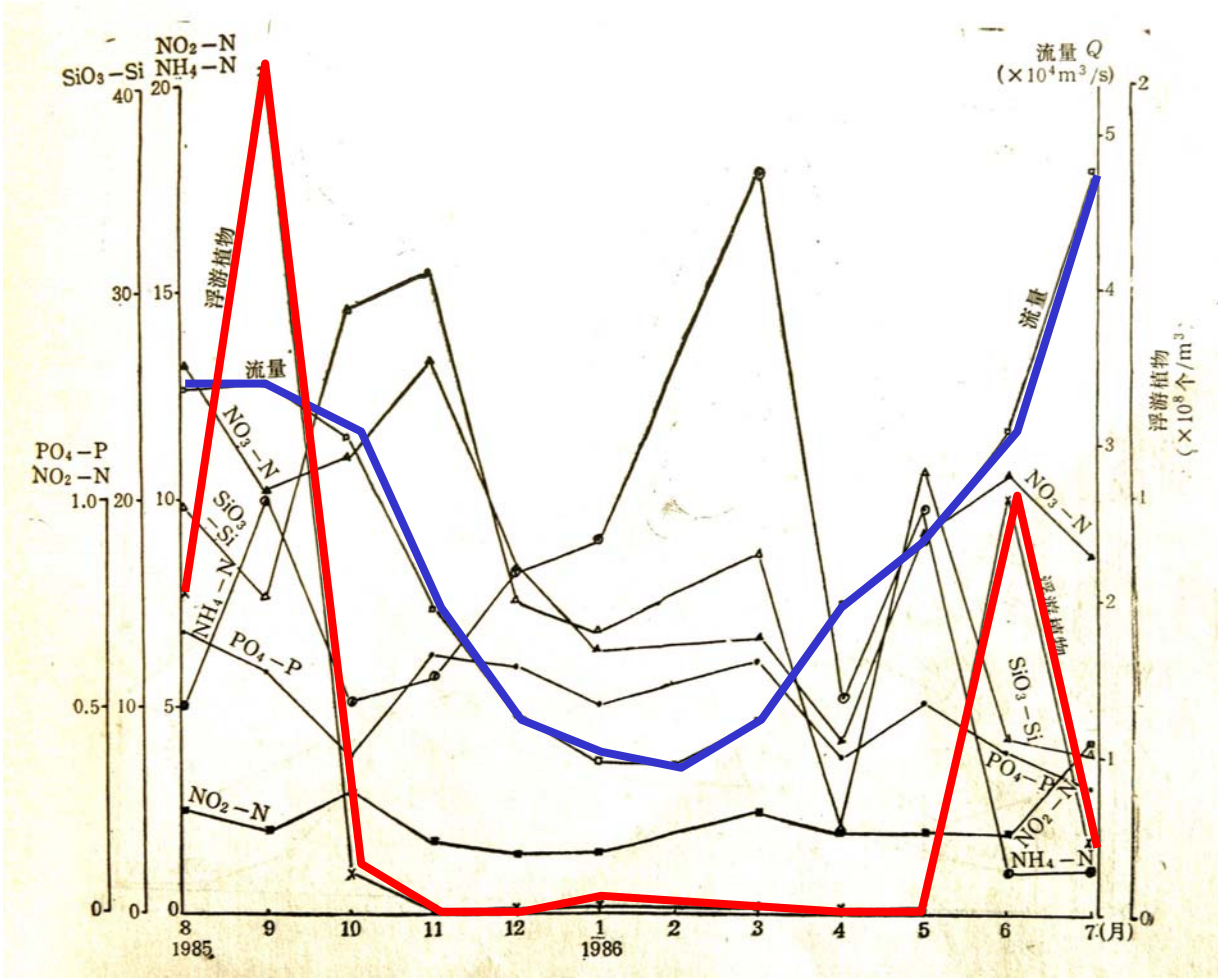
(Shen et al., 1992)

The estuary is known as spawning grounds of many commercially important species, such as hairtail, anchovy and crabs.

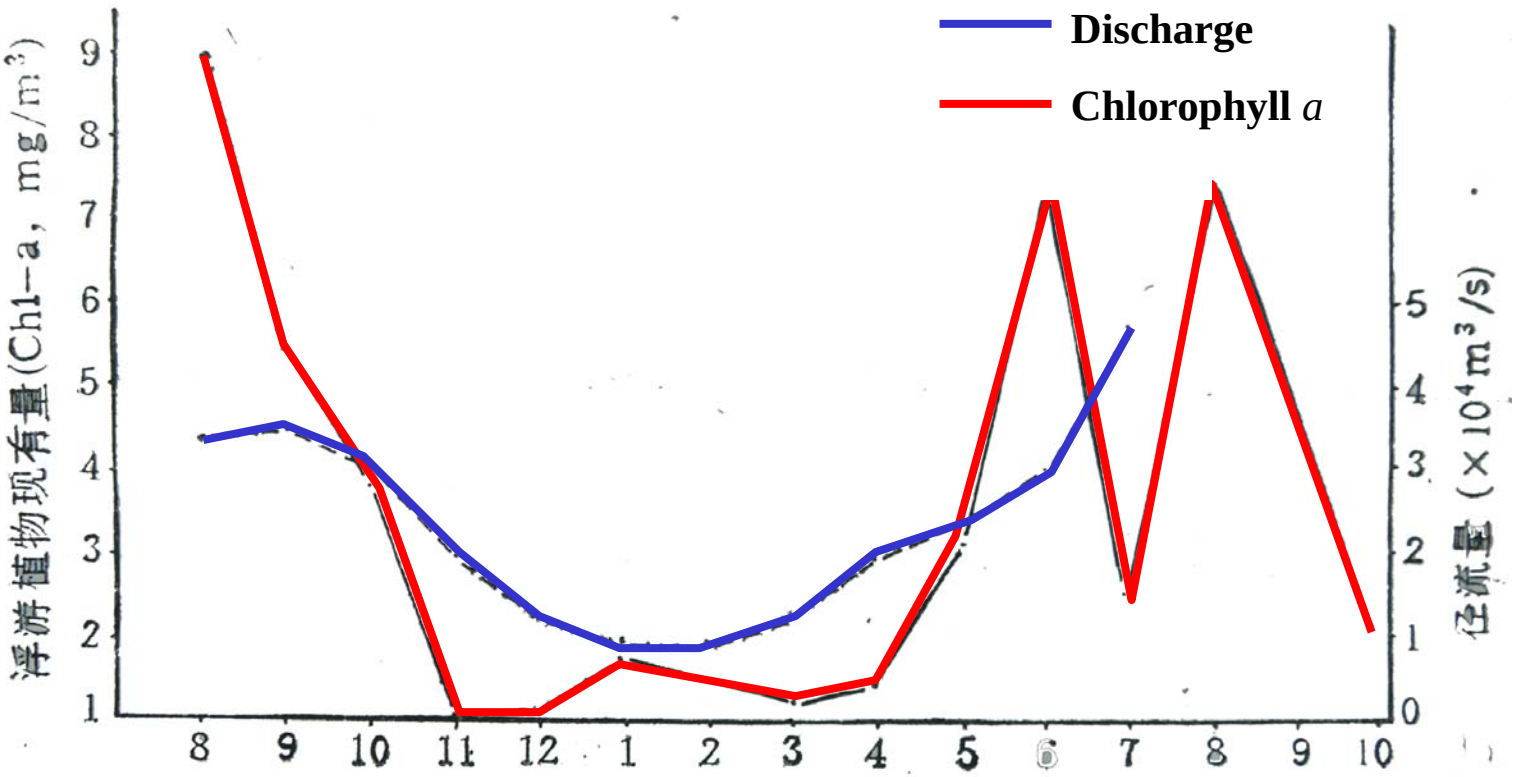
# Seasonal pattern of discharge have strong impact on the Estuary ecosystem



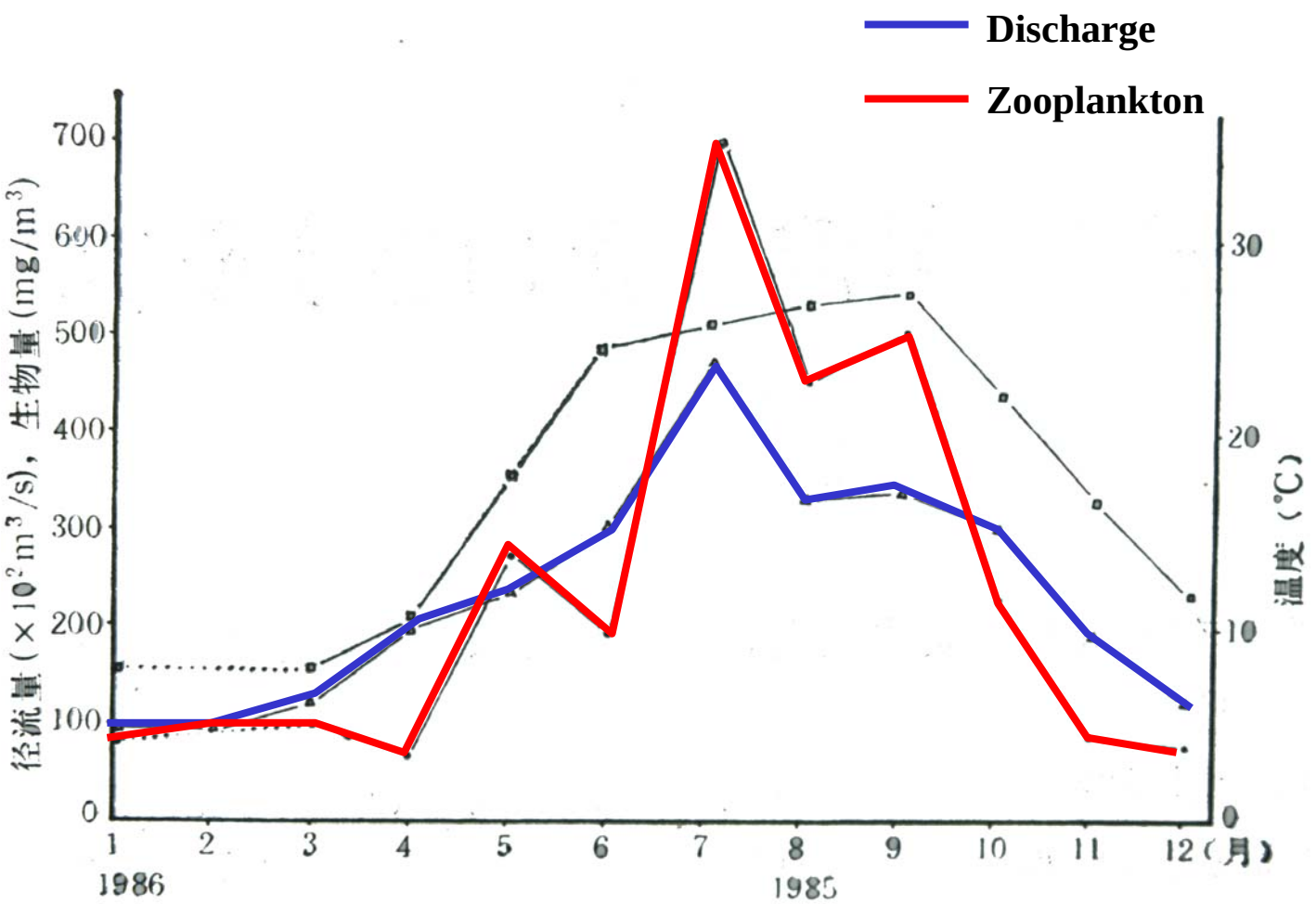
# Nutrients


NO₂−N
NH₄−N
SiO₃−Si
流量 Q
(×10⁴m³/s)
浮游植物
(×10⁸个/m³)
流量
NO₃−N
SiO₃−Si
NH₄−N
PO₄−P
NO₂−N
PO₄−P
NO₂−N
NO₃−N
浮游植物
SiO₃−Si
PO₄−P
NO₂−N
NH₄−N
8
9
10
11
12
1
2
3
4
5
6
7(月)
1985
1986

# Phytoplankton



# Zooplankton



# Three Gorge dams

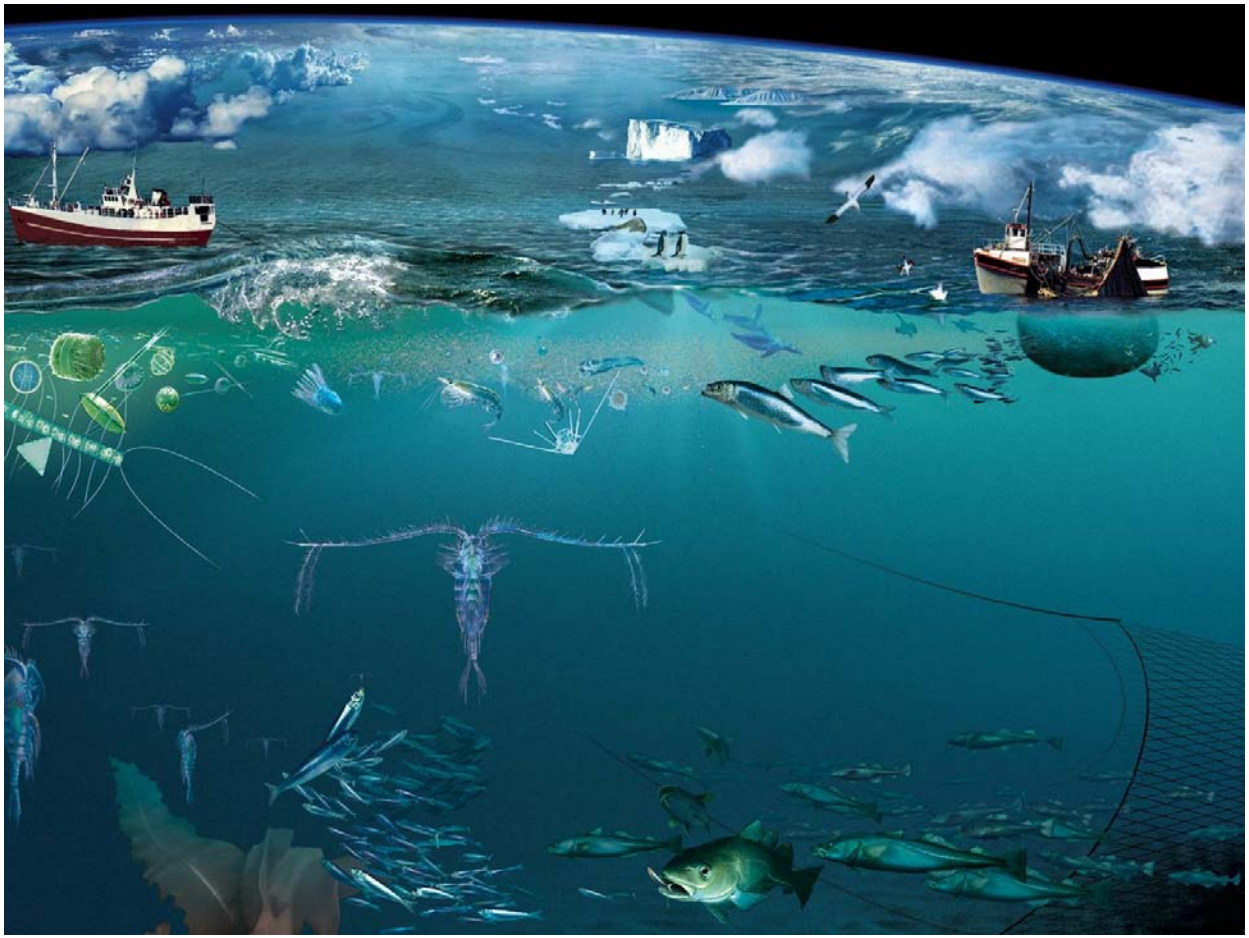
- The Three Gorges Reservoir (TGR) under construction is located in the middle reaches of the Changjiang River, 1800 km away from its mouth.

- Dammed the Changjiang River in November 1997
- Generate power at its first stage in 2003
- Fully completed in 2009.
- The reservoir is capable of containing $39.3\times10^9$ $m^3$ of waters and would lift the water surface

The reservoir is designed not to change the total annual discharge of the river flowing to the sea but does in seasonal.

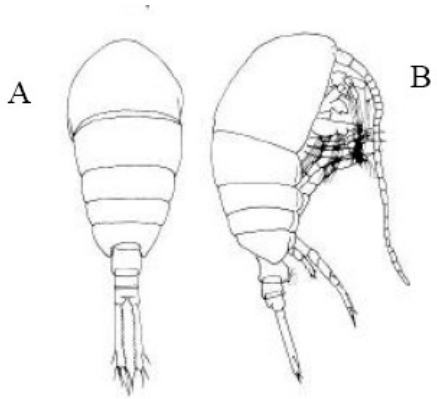
The reservoir will be controlled to store waters the most in October and to release extra runoff the most in February.

# What is the influence on the ecosystems?

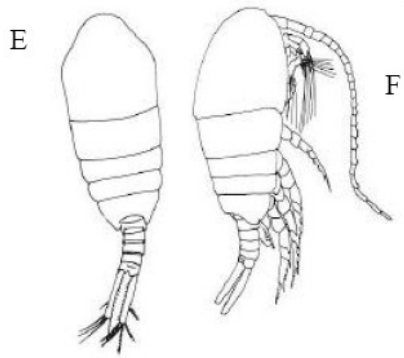


A case- zooplankton dominating species shift
Does the ecosystem changes occur in the CRE?

# *Temora turbinata*



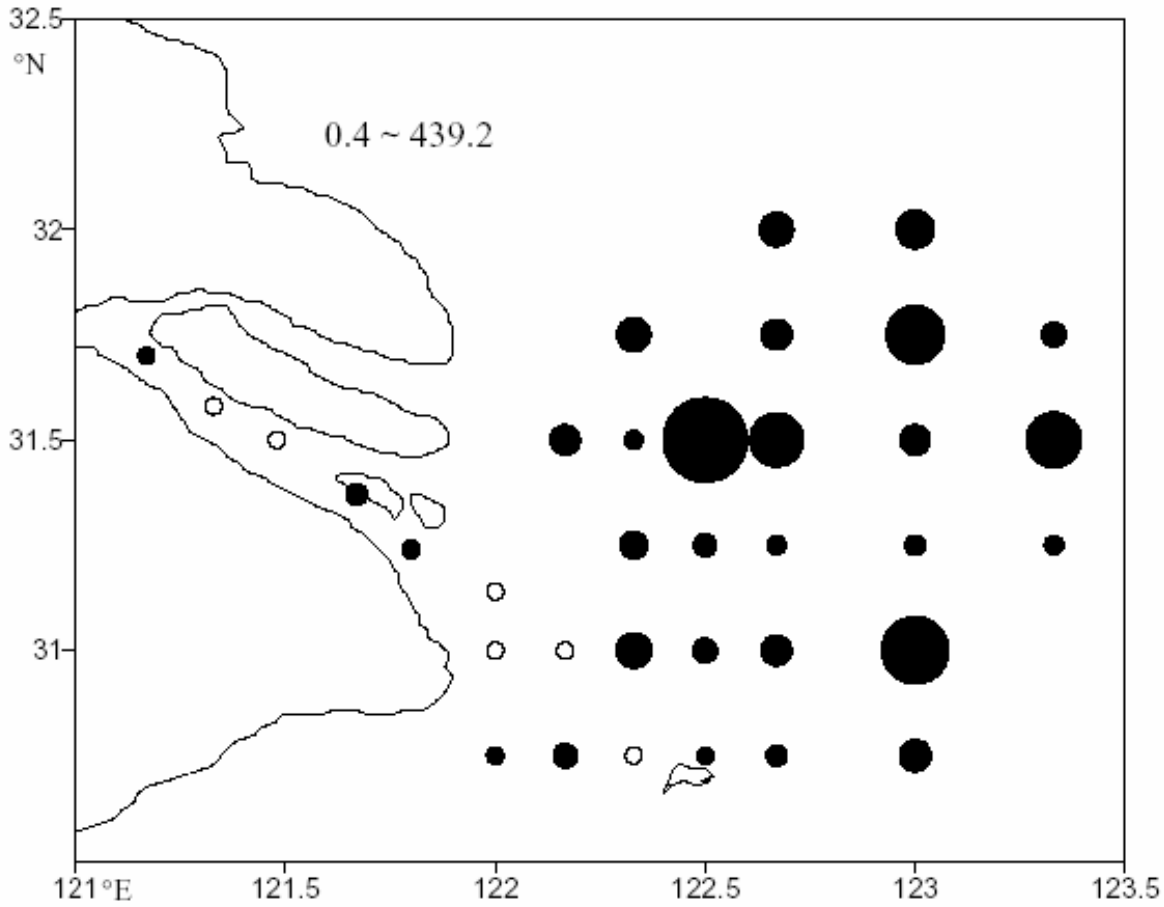

***Female***




***Male***

is often predominant in mesozooplankton communities in various environments, but usually it is considered as tropical-subtropical species.

(Goswami & Padmavati 1996; Lopez-Salgado & Suarez-Morales 1998; Ara 2002; Dunbar & Webber, 2003).




Geographical distribution of *Temora turbinata* (ind. $m^{-3}$) in August 2004, the second summer after water control of the Three Gorges Reservoir.

# Distribution in the China Sea:

It is common in coastal and estuary areas in the south of China, and usually predominant in early summer.

In the Jiulong River estuary,

April - June. 11-100 ind $m^{-3}$

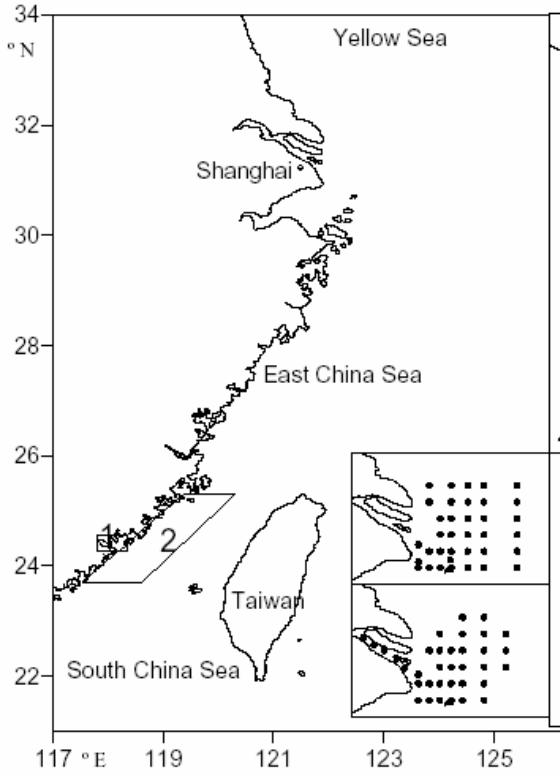
less than 10 ind $m^{-3}$ in the rest of a year

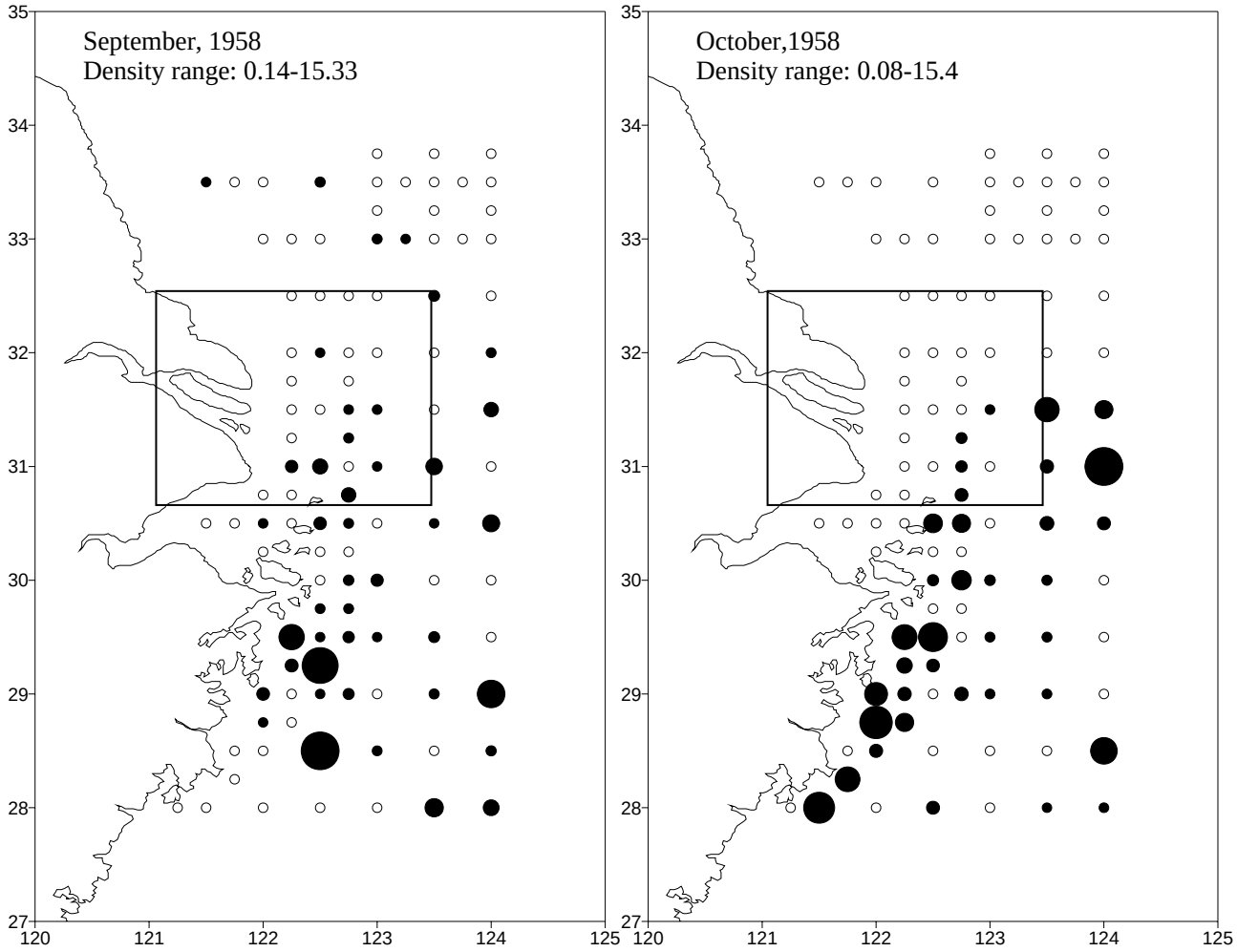
(Huang & Chen 1985).

Taiwan Strait,

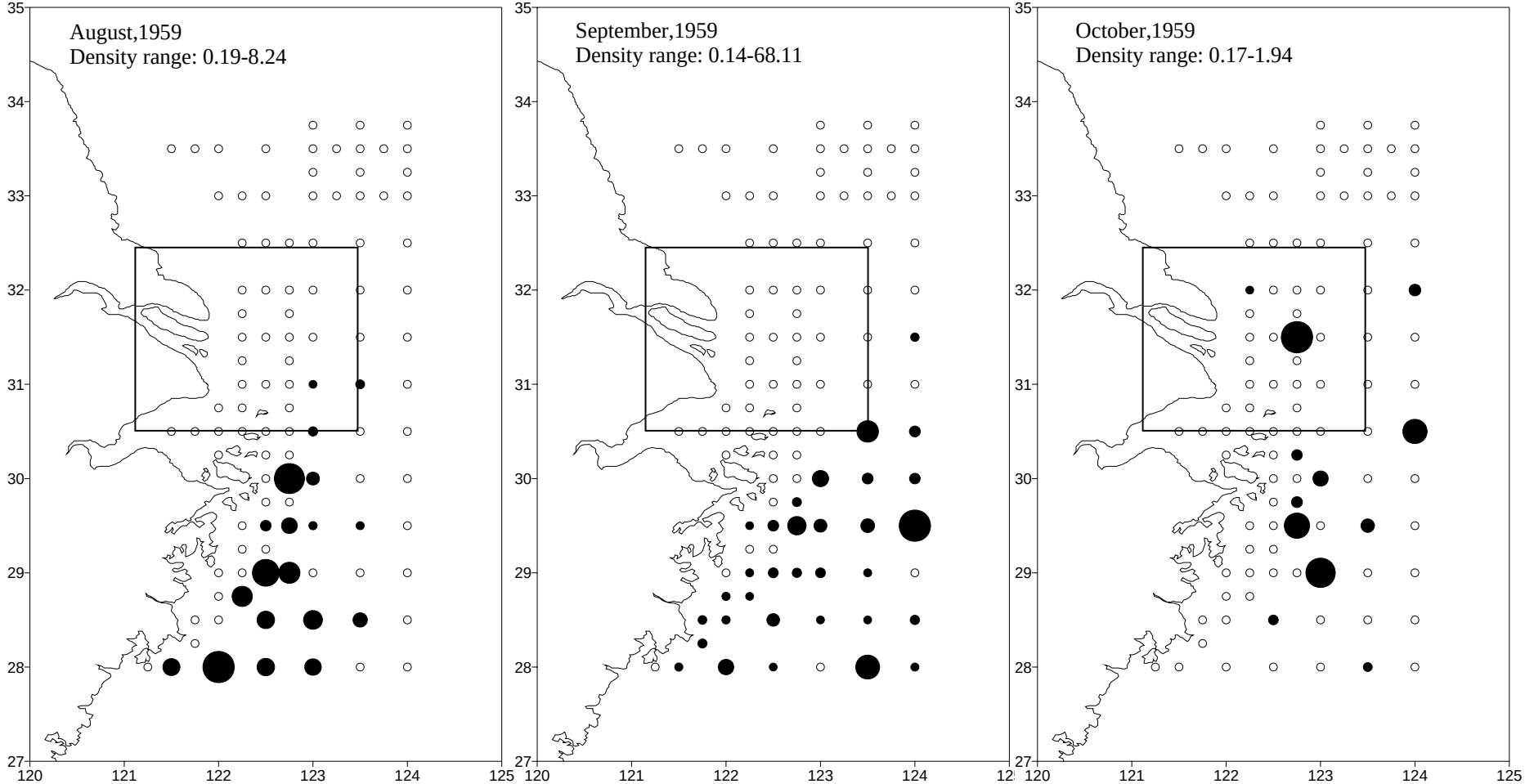
In May, 25 - 250 ind $m^{-3}$, with a density averaged in 65 ind $m^{-3}$ (Lan et al. 2004).

In August it was predominant in the north of the Taiwan Strait and south of the East China Sea (Hsieh et al. 2005).

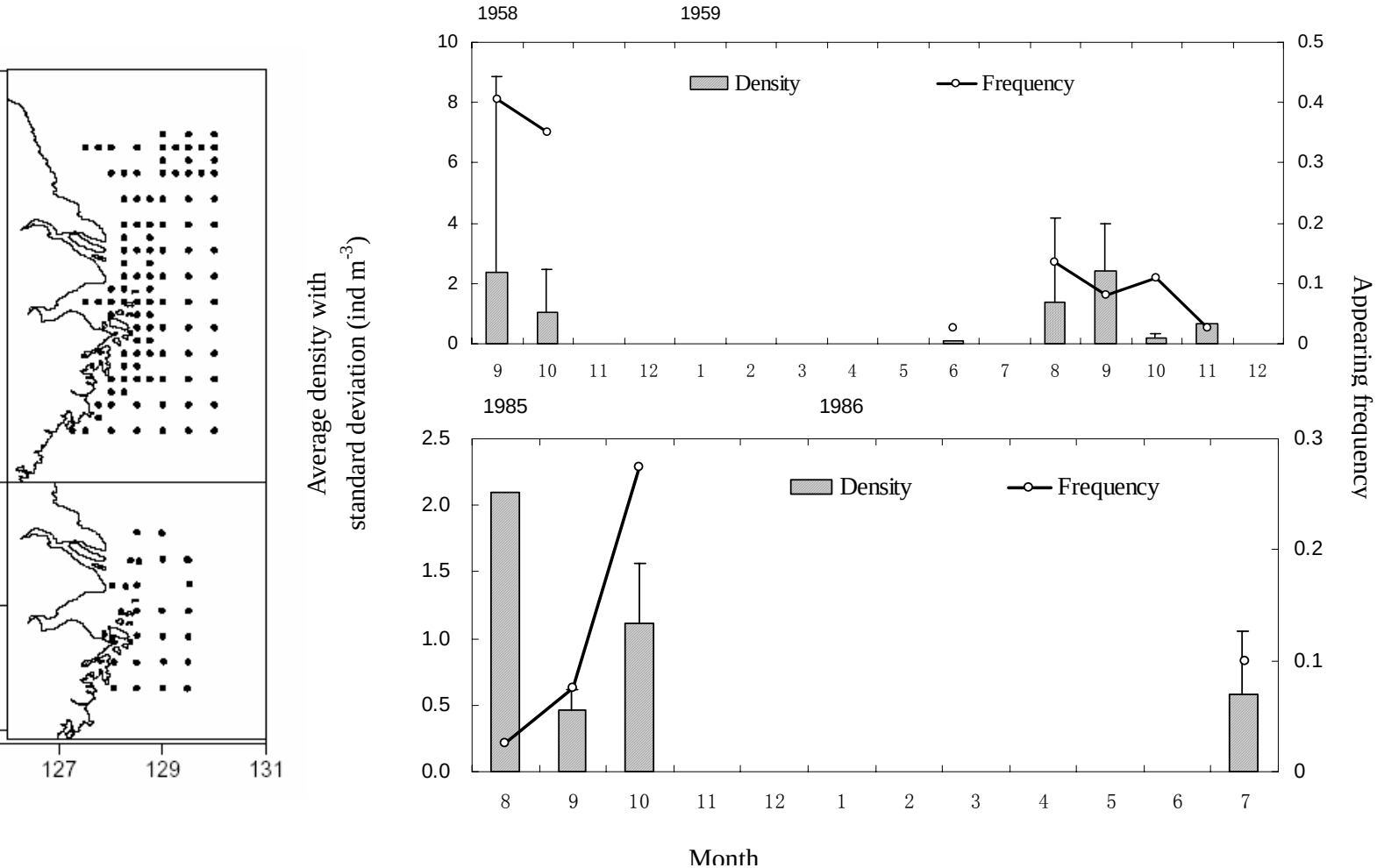





# In the Yellow Sea and East China Sea




# In the Yellow Sea and East China Sea (Continue)




# In the Changjiang River estuary

# Hypothesis

- *Temora turbinata* is be transported to the Changjiang River Estuary by the TWC
- It appearances seasonally in the CRE, but exists continuously in the southern East China Sea
- The peak in CRE is later than that in Taiwan Strait
- The decrease of Changjiang River discharge in the summer results the TWC north forward further
- Changjiang River runoff in 2002 summer (39500 $m^3$ $s^{-1}$) is lower than the average value (40290 $m^3$ $s^{-1}$)

# Hypothesis

Northwards invasion of the TWC influences on zooplankton assemblages in the Changjiang River Estuary:

- Zooplankton from north and east, such as *Calanus sinicus, Labidocera euchaeta* and *Euchaeta concinna*, will have lower opportunity entering the estuary area.
- Invasion of the TWC can also change the physical environments.

# Hypothesis

**Low river discharge in the history:**

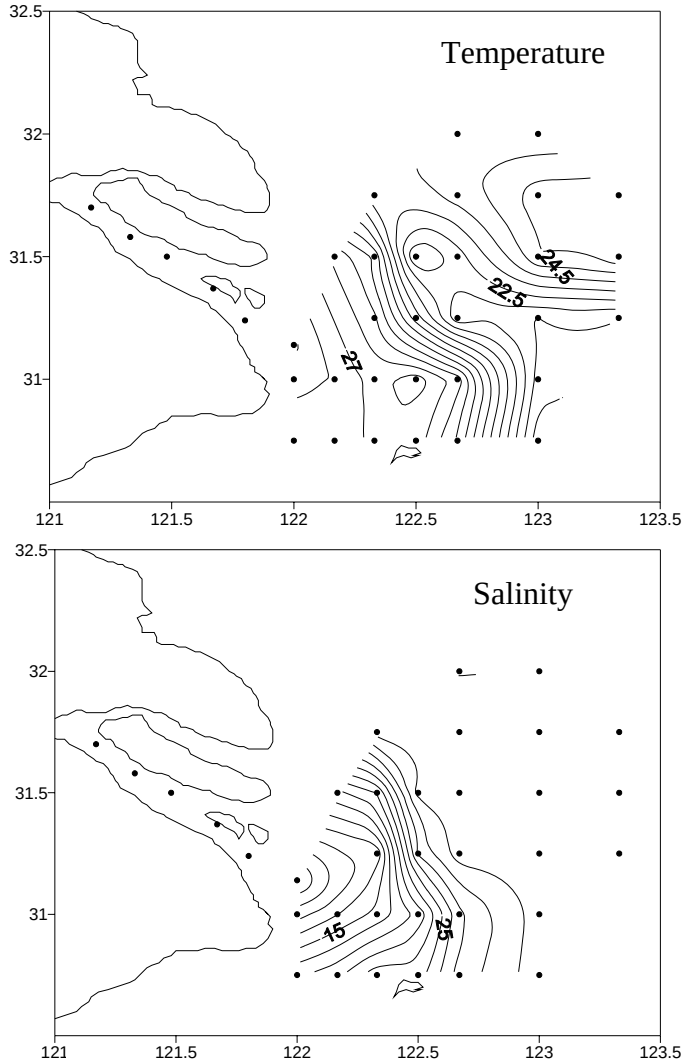
In August 2000 (39500 $m^3$ $s^{-1}$)

Dominant species:

*Labidocera euchaeta*

*Calanus sinicus*

*Euchaeta concinna*

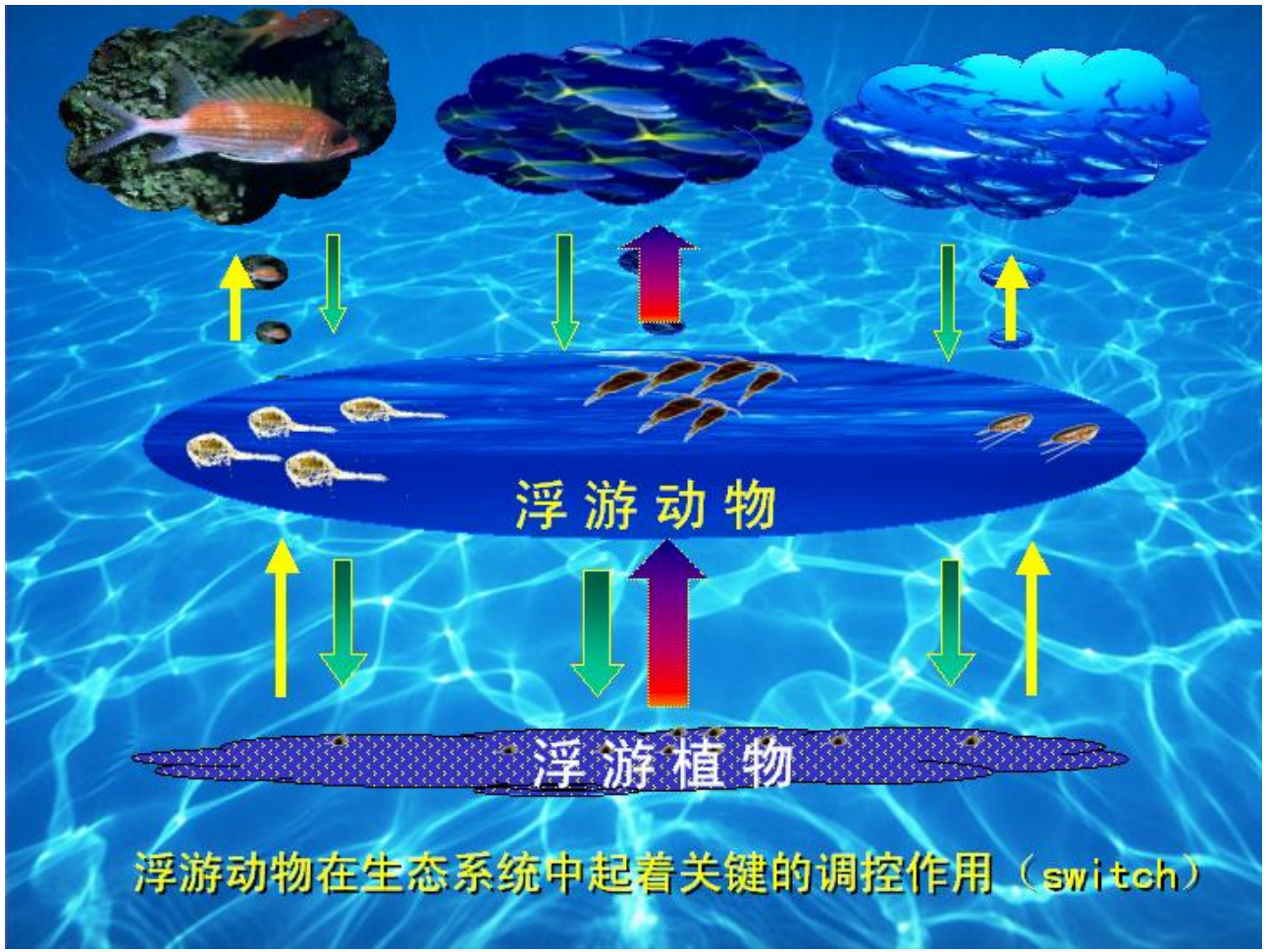


# But …

- Was the low river discharge resulted from the water control of TGR?
- Prevalence of *T. turbinata* should be established in a long period rather than in certain one month.

Specific case

Ecosystem change



Thanks for your attention