Long-term variations of macrobenthic community in the Yellow Sea and East China Sea

Xinzheng Li
Institue of Oceanology, Chinese Academy of Sciences

La Paz, Mexico
24 April, 2018

Outline

What is happening in the Yellow Sea and East China Sea? --Status of the ecosystem in the Yellow Sea and East China Sea

Whether macrobenthos changes? How does it change? And why?

Conclusion

Outline

What is happening in the Yellow Sea and East China Sea? --Status of the ecosystem in the Yellow Sea and East China Sea

Whether macrobenthos changes? How does it change? And why?

Conclusion

What is happening in the Yellow Sea and East China Sea?

Marine disasters !


Red
tide


“Green tide”
青岛钢铁

“White tide”

Next

X tide?


Hypoxia
Chengdu
Chongqing
Wuhan
Nanjing
Shanghai
Taipei
Taiwan
Guangzhou
(Canton)
Kowloon
Central
Macau
(Hanoi)
Hà Nội
Central Hong Kong
(Vientiane)
Viang Chan
Khonkhaen
Paracel Islands
Vietnam
Cambodia
Phnum Penh
(Phnom Penh)
Philippines
Manila
© 2006 Europa Technologies
Image © 2006 NASA
Image © 2006 TerraMetrics
Google

So many marine disasters are happening!

Outline

What is happening in the Yellow Sea and East China Sea? --Status of the ecosystem in the Yellow Sea and East China Sea

Whether macrobenthos changes?
How does it change? And why?

Conclusion

① Long-term variations of macrobenthic community in the southern Yellow Sea

② Influence of the Kuroshio Current on the East China Sea shelf

③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

④ Influence of the region in 32°~33°N on the distribution of macrobenthos.

⑤ Long-term variations of macrobenthic community in the Yangtze river estuary and its adjacent area

① **Long-term variations of macrobenthic community in the southern Yellow Sea**

② Influence of the Kuroshio Current on the East China Sea shelf

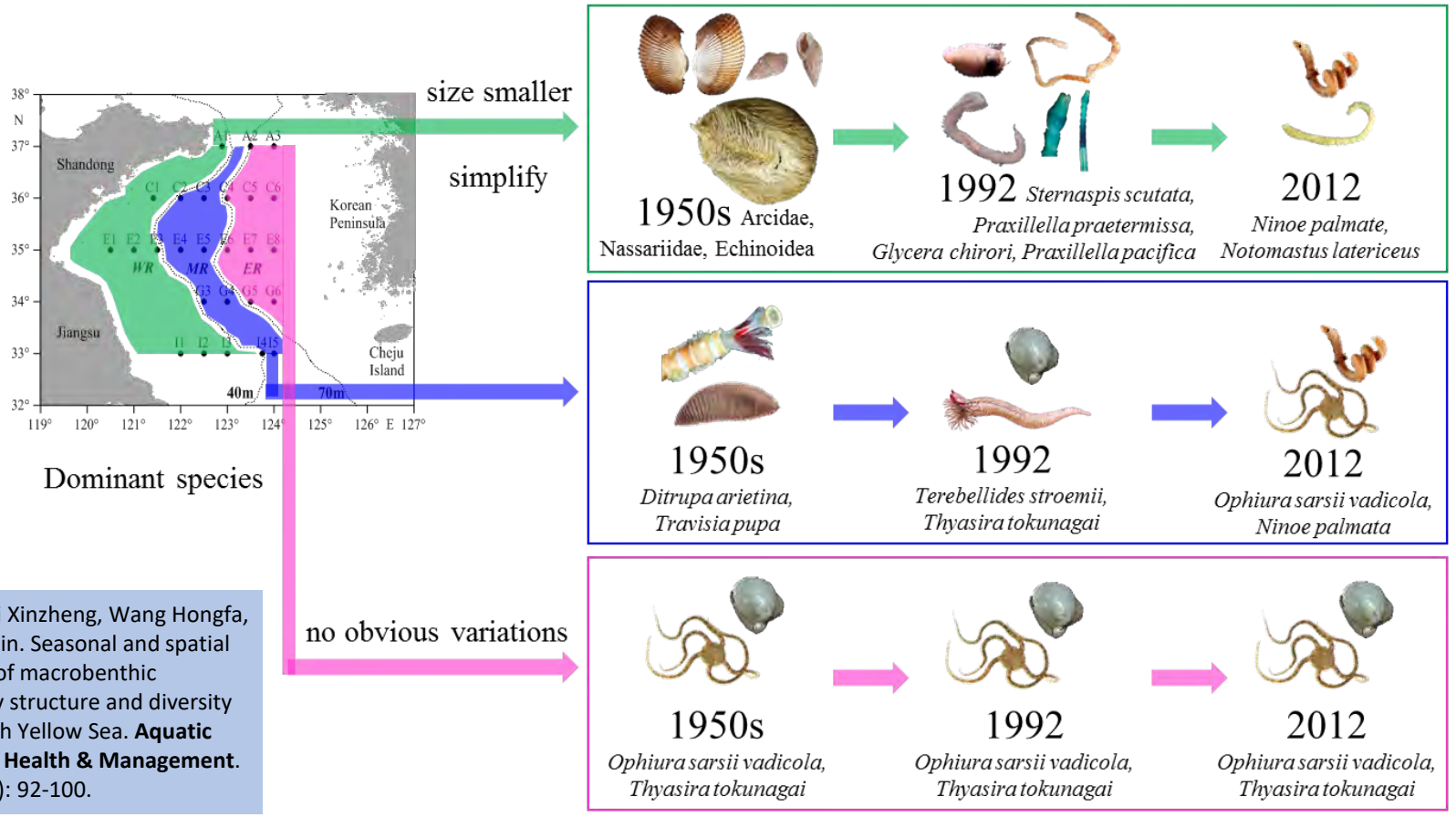
③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

④ Influence of the region in 32°~33°N on the distribution of macrobenthos.

⑤ Long-term variations of macrobenthic community in the Yangtze river estuary and its adjacent area

① Long-term variations of macrobenthic community in the southern Yellow Sea

Long-term variation of dominant species in each region -- literature analysis

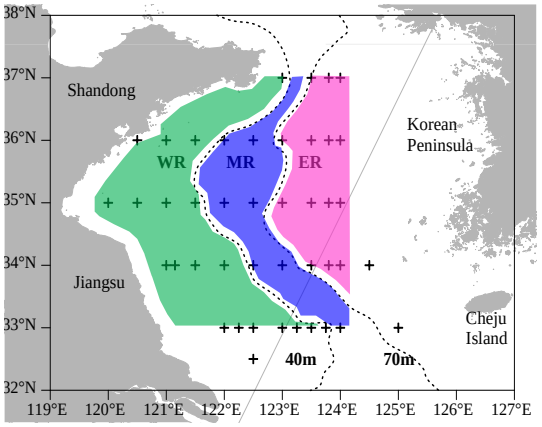


Xu Yong, Li Xinzheng, Wang Hongfa, Zhang Baolin. Seasonal and spatial variations of macrobenthic community structure and diversity in the South Yellow Sea. **Aquatic Ecosystem Health & Management**. 2016, 19(1): 92-100.

Variations of dominant macrobenthic species in the southern Yellow Sea
(WR: western region, MR: middle region, ER: eastern region of the southern Yellow Sea)

① Long-term variations of macrobenthic community in the southern Yellow Sea

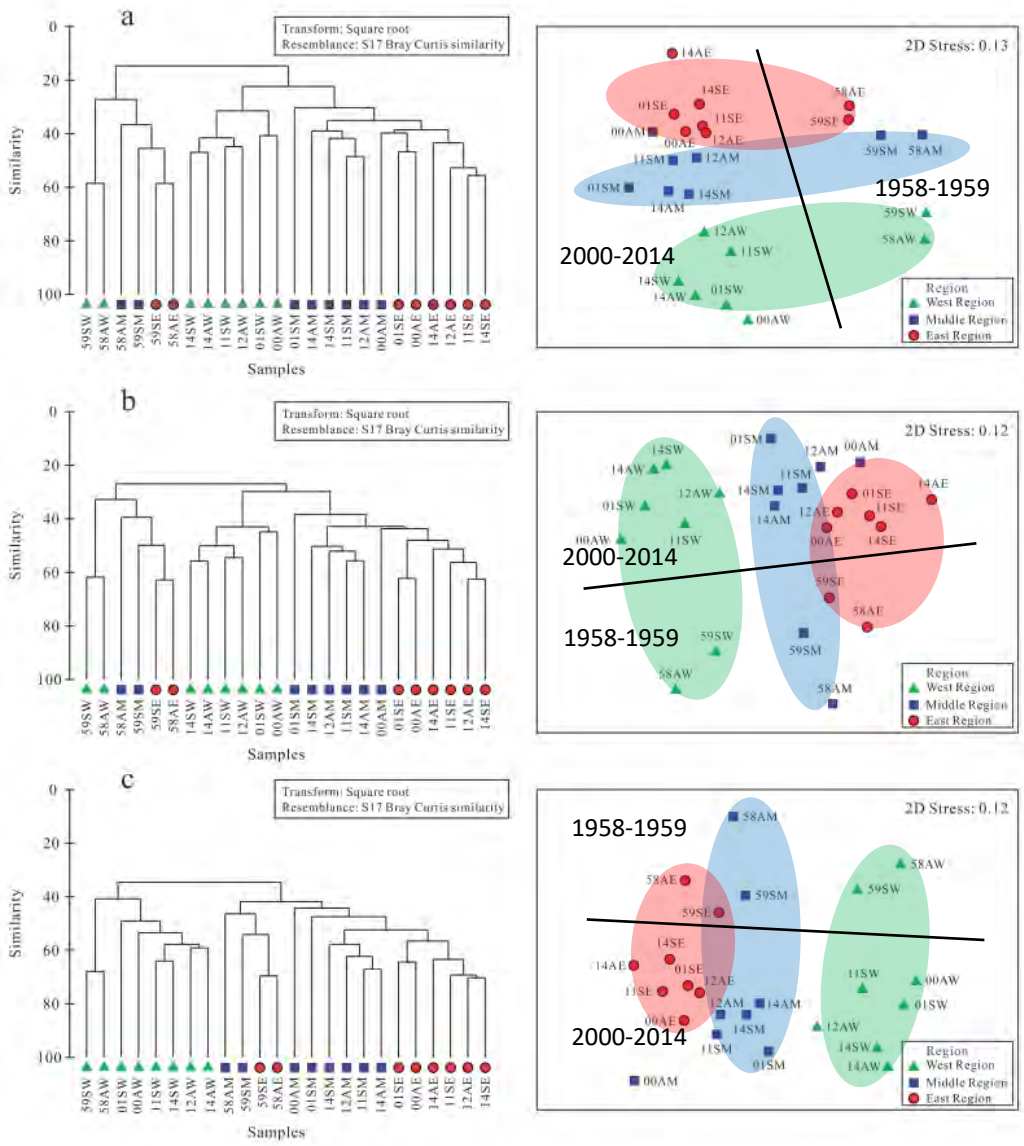
Community structure -- data analysis



Species

Genus

Family



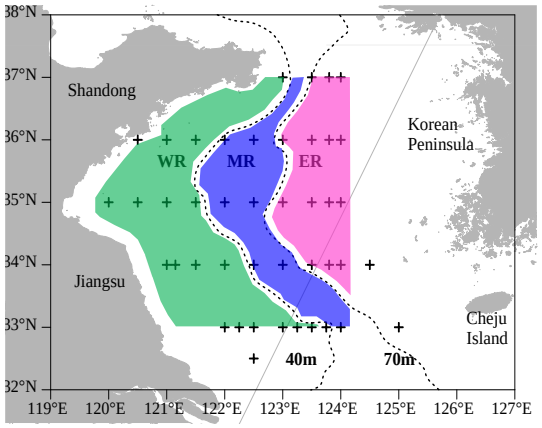
Community structure showed **significant differences** among regions (**green**/**blue**/**red circle**) and among periods (**black line**, 1958-1959 vs 2000-2014)

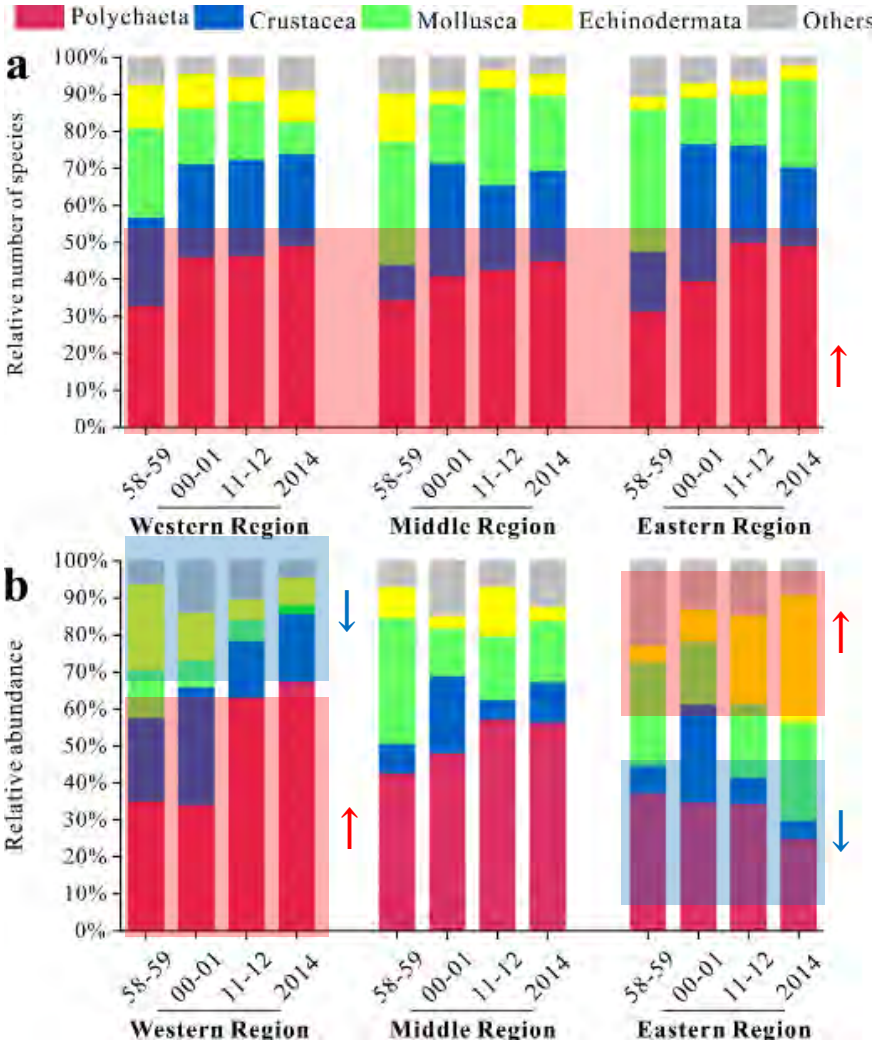
Sampling time:
1958-1959 / **2000-2001** / **2011-2012** / **2014**

Cluster analysis and nMDS ordination

① Long-term variations of macrobenthic community in the southern Yellow Sea

Relative number of species and relative abundance -- data analysis





Relative number of species:

Polychaeta↑, Echinodermata stable

Relative abundance:

Polychaeta Eastern Region↓, Western Region↑

Echinodermata opposed

Sampling time:

1958-1959 / 2000-2001 / 2011-2012 / 2014

① Long-term variations of macrobenthic community in the southern Yellow Sea

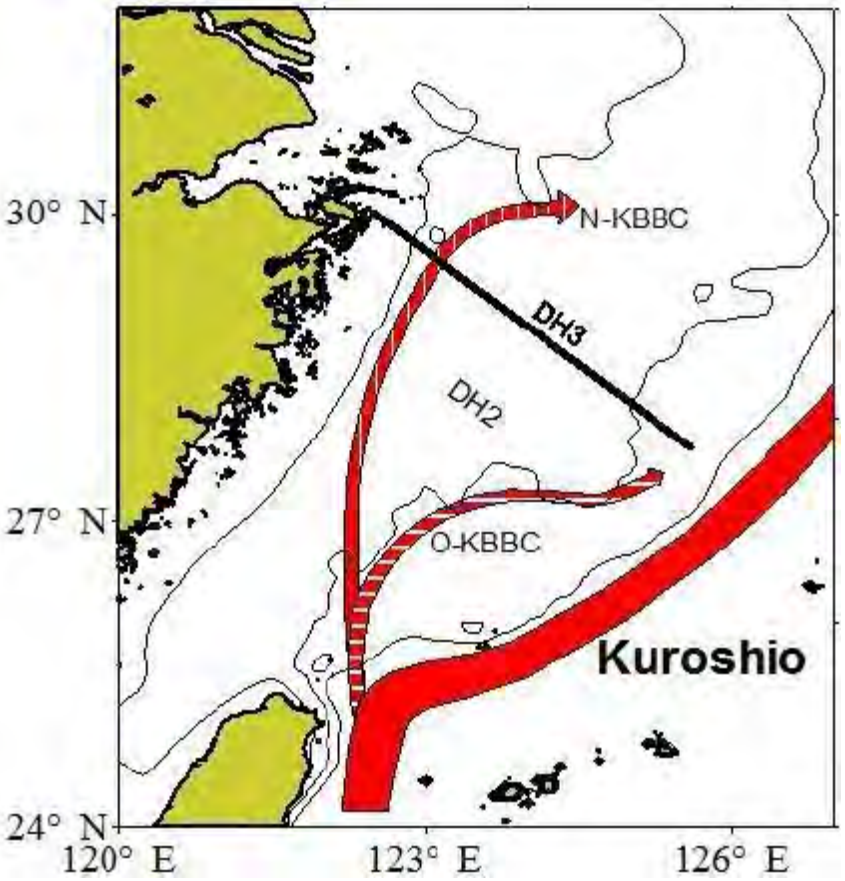
② **Influence of the Kuroshio Current on the East China Sea shelf**

③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

④ Influence of the region in 32°~33°N on the distribution of macrobenthos.

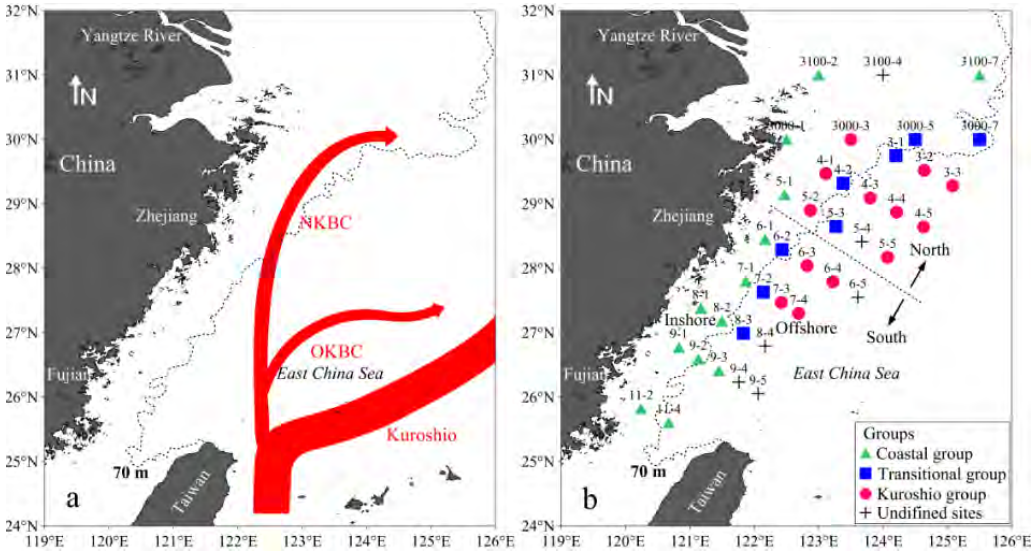
⑤ Long-term variations of macrobenthic community in the Yangtze river estuary and its adjacent area

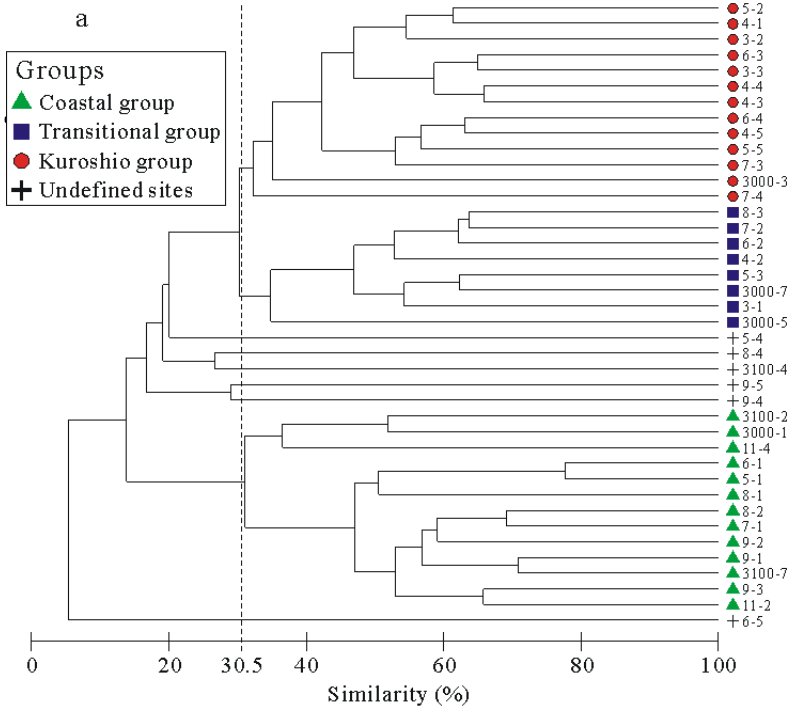
② Influence of the Kuroshio Current on the East China Sea shelf

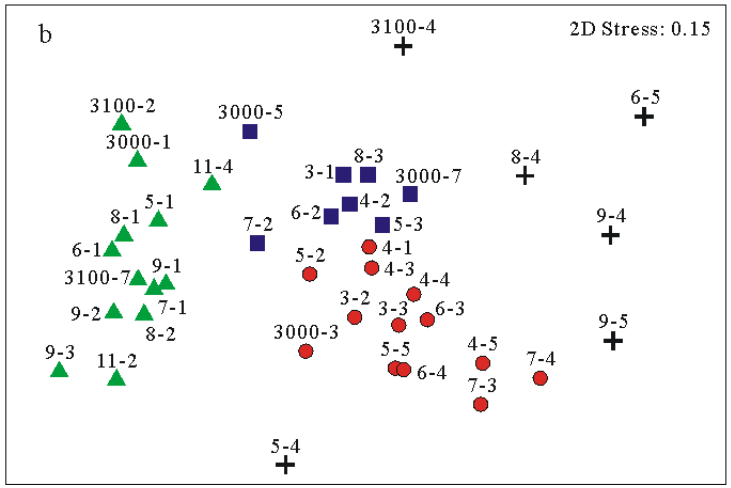


② Influence of the Kuroshio Current on

Community structure of demersal fish -- Agassiz trawl in the East China Sea







Cluster analysis and nMDS ordination

The position of the left edge of the kuroshio group was consistent with the Nearshore Kuroshio Branch Current (NKBC)

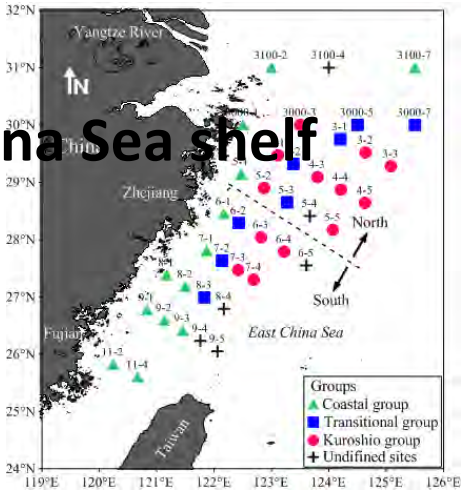
Sampling time

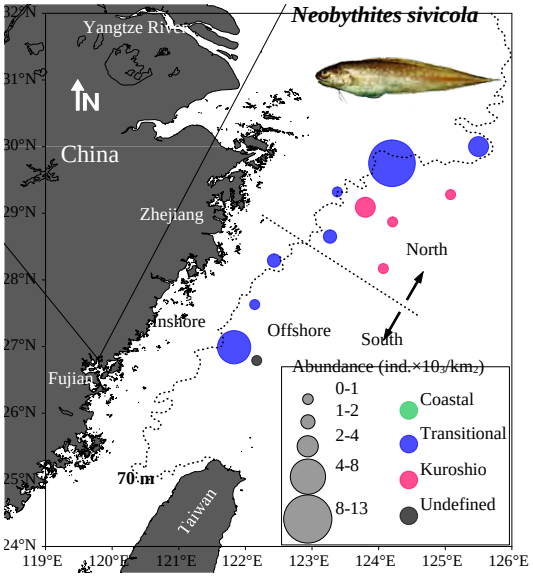
August-September, 2015

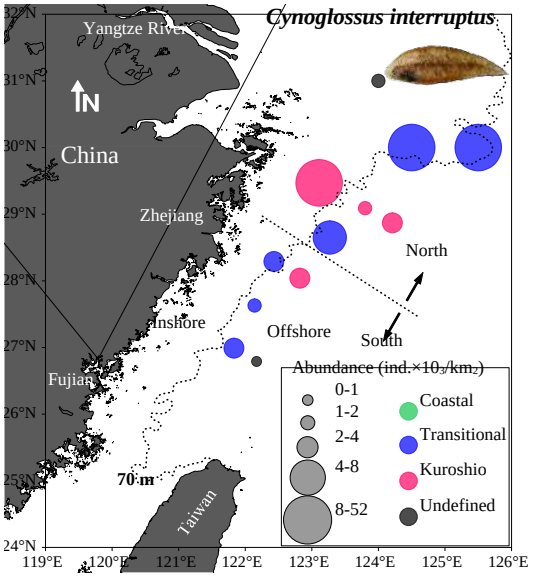
② Influence of the Kuroshio Current on the East China Sea shelf

Distribution of typical species in the transitional group -- Agassiz trawl in the East China Sea

Community structure





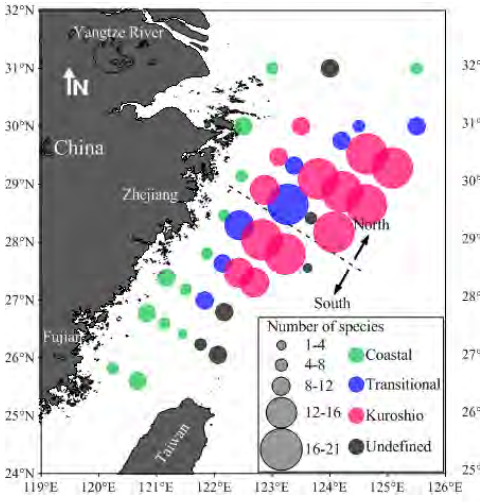


Sampling time

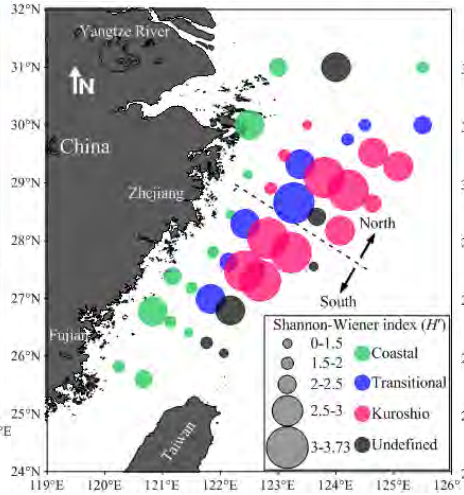
August-September, 2015

② Influence of the Kuroshio Current on the East C

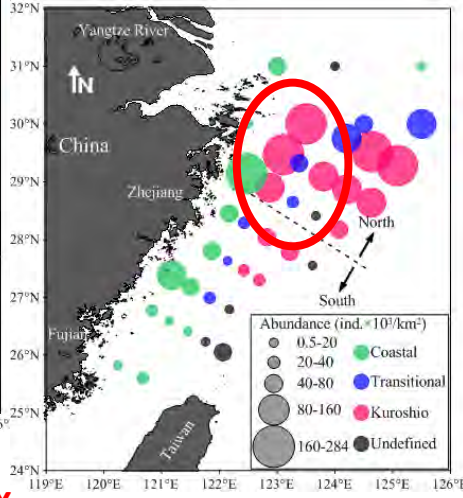
Distribution of number of species, Shannon-Wiener's index, abundance and biomass



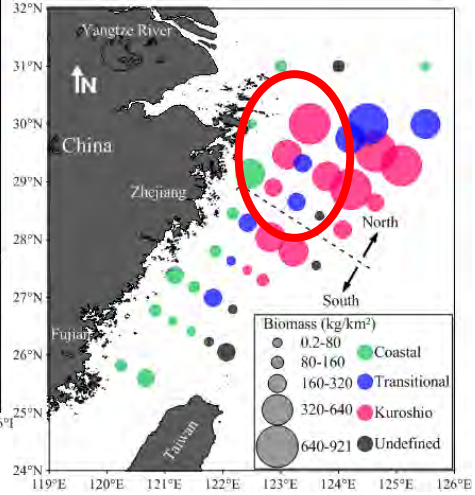
Number of species



Shannon-Wiener's index



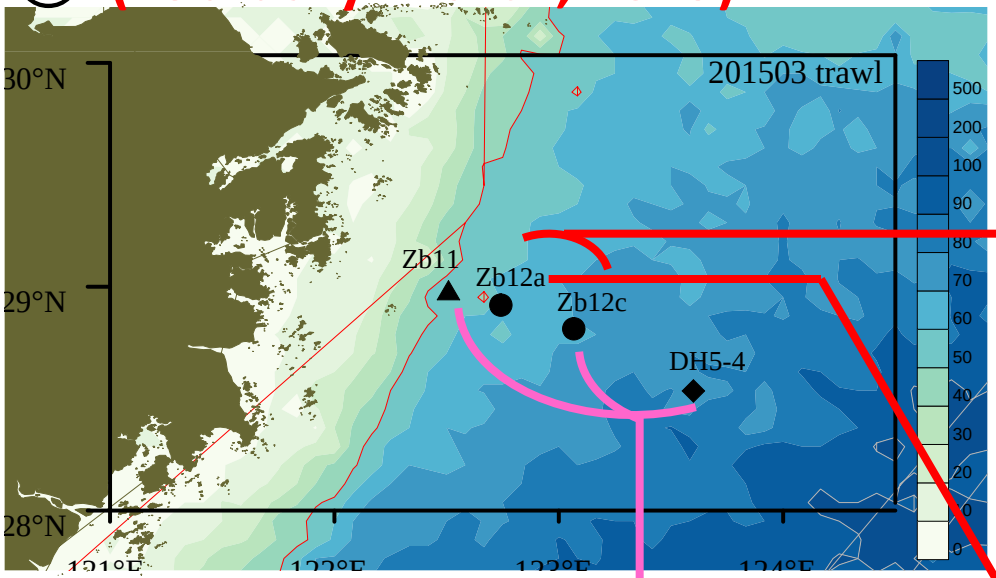
Abundance



Biomass

Abundance and biomass showed higher values in the region where NKBC went through.

② (February-March, 2015)



Zb12a and Zb12c

6 species only appeared in Zb12a and Zb12c	individuals Zb12a	Zb12c
栉鳞鳎 *Aseraggodes kobensis*	1	14
天竺鲷 *Apogon lineatus*	3	11
中华管鞭虾 *Solenocera crassicornis*	5	5
断线舌鳎 *Cynoglossus interruptus*	5	4
周氏新对虾 *Metapenaeus joyneri*	2	1
海百合 Crinoidea	1	4

10 species only appeared in Zb12a	Zb12a
褐管蛾螺 *Siphonalia spadicea*	6
滑脊等腕虾 *Heterocarpoides laevicarina*	3
金氏真蛇尾 *Ophiura kinbergi*	3
窄体舌鳎 *Cynoglossus gracilis*	2
扁指洁毛刺蟹 *Xestopilumnus cultripollex*	2
日本异指虾 *Processa japonica*	1
浅缝骨螺 *Murex trapa*	1
壳蛞蝓 *Philine* sp.	1
白姑鱼 *Argyrosomus argentatus*	1
海地瓜 *Acaudina molpadioides*	1

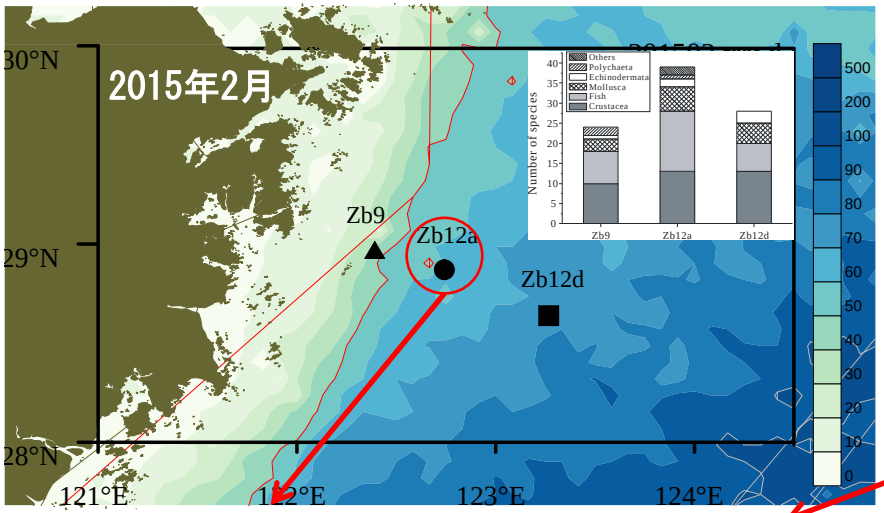
3 species not appeared in Zb12a, but in its adjacent stations.

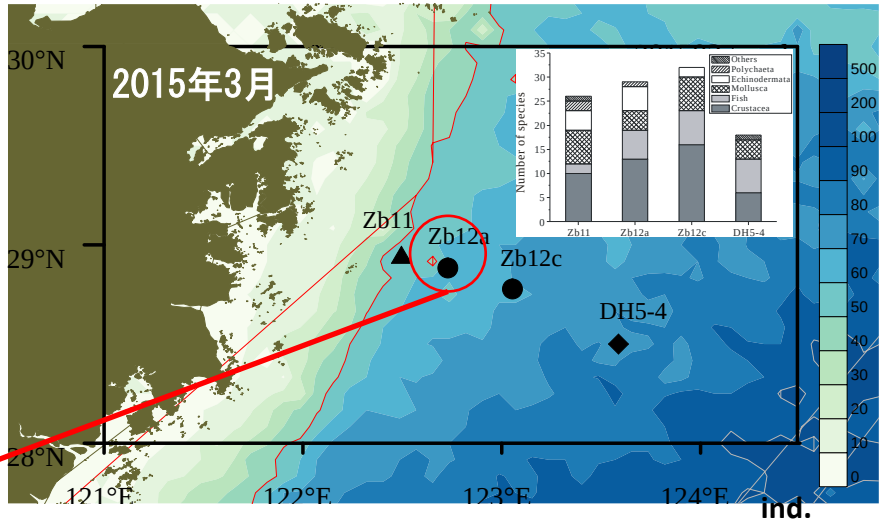
	Zb11	Zb12c	DH5-4
赤蛙螺 *Bufonaria* sp.	2	1	0
西格织纹螺 *Nassarius siquijorensis*	6	2	0
鲜明鼓虾 *Alpheus distinguendus*	1	1	0

5 species appeared with lots of individuals in Zb12a, but in other stations	Zb11	Zb12c	DH5-4
长腕红虾 *Plesionika* sp.	16	114	7
日本鼓虾 *Alpheus japonicus*	26	8	0
镶边海星 *Craspidaster hesperus*	3	6	0
凹裂星海胆 *Schizaster lacunosus*	2	0	0
六丝矛尾虾虎鱼 *Chaeturichthys hexanema*	5	6	1

5 species appeared with lots of individuals in Zb12a, but in other stations	Zb12a
长腕红虾 *Plesionika* sp.	145
日本鼓虾 *Alpheus japonicus*	99
镶边海星 *Craspidaster hesperus*	30
凹裂星海胆 *Schizaster lacunosus*	26
六丝矛尾虾虎鱼 *Chaeturichthys hexanema*	10

② Influence of the Kuroshio Current on the East China Sea shelf (February-March, 2015)





Zb12a (Totally 39 species in February)

26 species occurred in Zb12a exclusively	**ind.**
褐管蛾螺 *Siphonalia spadicea*	**65**
日本美丽海葵 *Calliactis japonica*	**65**
哈氏仿对虾 *Parapenaeopsis hardwickii*	**36**
断线舌鳎 *Cynoglossus interruptus*	**14**
凹裂星海胆 *Schizaster lacunosus*	**7**
海仙人掌 *Cavernularia* sp.	4
拟蚶 *Arcopsis* sp.	4
红色相机蟹 *Camatopsis rubida*	3
窄体舌鳎 *Cynoglossus gracilis*	3
麦氏犀鳕 *Bregmaceros macclellandi*	2
虻鱚 *Erisphex potti*	2
白姑鱼 *Argyrosomus argentatus*	1
鳚 *Blennius* sp.	1
宽体舌鳎 *Cynoglossus robustus*	1
绯[鱼衔] *Callionymus beniteguri*	1
卵鳎 *Solea ovata*	1
条鳎 *Trichiurus* sp.	1
新鳎 *Cynoglossus robustus*	1
扁玉螺 *Neverita didyma*	1
丽口螺 *Calliostoma* sp.	1
长蛸 *Octopus variabilis*	1
爱琴虾 *Aegaeon* sp.	1
滑脊等腕虾 *Heterocarpoides laevicarina*	1
长手隆背蟹 *Carcinoplax longimana*	1
裸盲蟹 *Typholcarcinus* sp.	1
刺管萨欧虫 *Sarsonuphis willemoesis*	1

Zb12a (Totally 65 species in March)

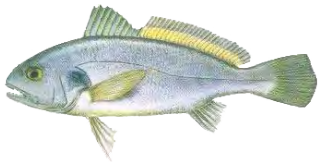
10 species occurred in Zb12a exclusively	**ind.**
褐管蛾螺 *Siphonalia spadicea*	6
滑脊等腕虾 *Heterocarpoides laevicarina*	3
金氏真蛇尾 *Ophiura kinbergi*	3
窄体舌鳎 *Cynoglossus gracilis*	2
扁指洁毛刺蟹 *Xestopilumnus cultripollex*	2
日本异指虾 *Processa japonica*	1
浅缝骨螺 *Murex trapa*	1
壳蛞蝓 *Philine* sp.	1
白姑鱼 *Argyrosomus argentatus*	1
海地瓜 *Acaudina molpadioides*	1

4 species occurred in Zb12a exclusively in Feb and Mar	**ind.** Feb	Mar
褐管蛾螺 *Siphonalia spadicea*	65	6
滑脊等腕虾 *Heterocarpoides laevicarina*	1	3
窄体舌鳎 *Cynoglossus gracilis*	3	2
白姑鱼 *Argyrosomus argentatus*	1	1

褐管蛾螺
Siphonalia spadicea

滑脊等腕虾
Heterocarpoides laevicarina

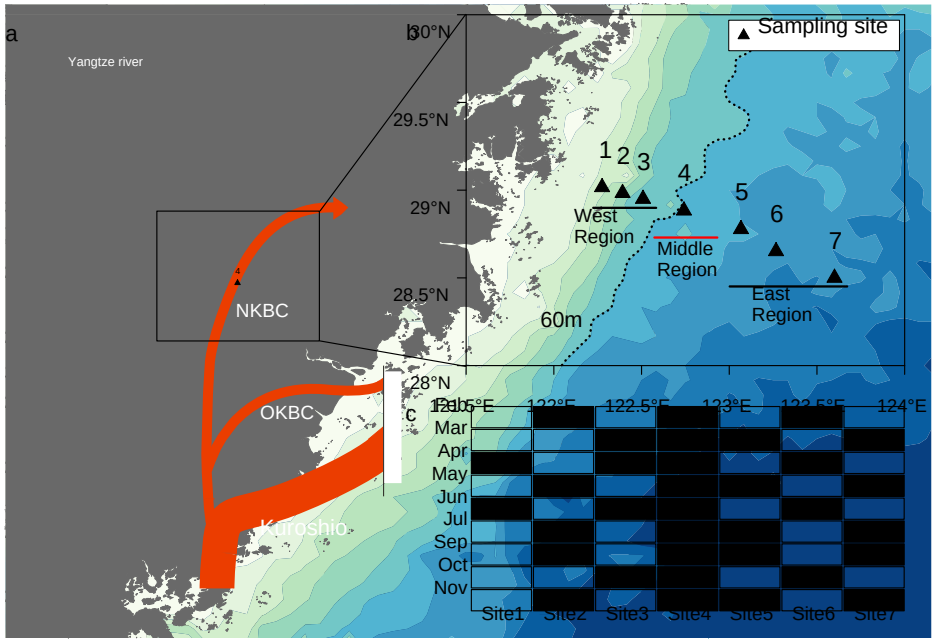
窄体舌鳎
Cynoglossus gracilis



白姑鱼
Argyrosomus argentatus

② Influence of the Kuroshio Current on the East China Sea shelf (February-November, 2015)

Principal component analysis (PCA) plots for environmental variables.

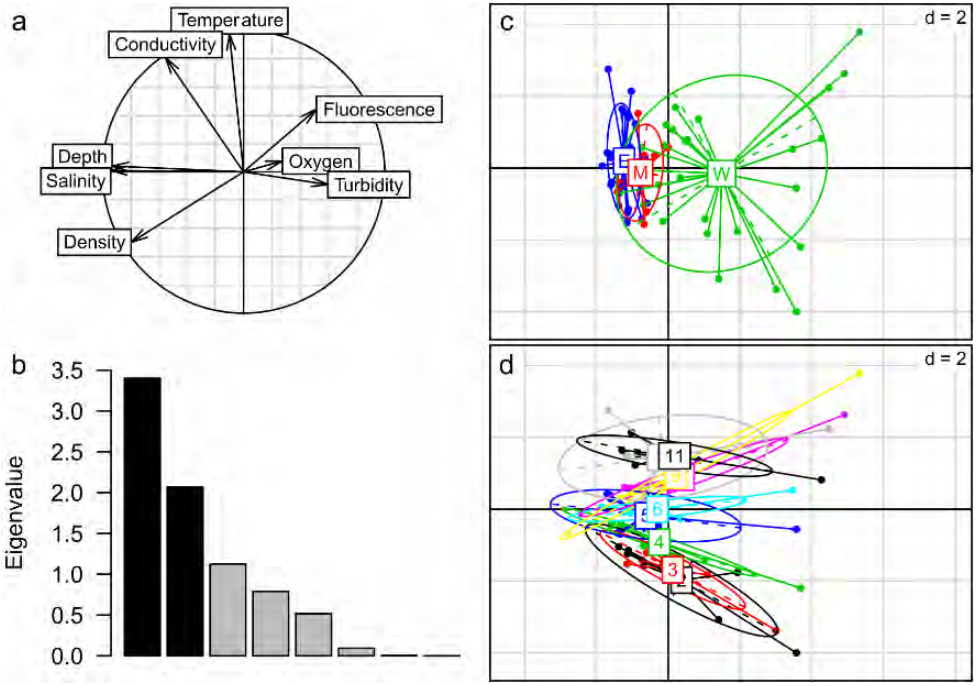


Location map of sampling sites in the East China Sea. (a) Kuroshio and its branches (NKBC: Nearshore Kuroshio Branch Current; OKBC: Offshore Kuroshio Branch Current) suggested by Yang (2012) and Wang (2016). (b) Seven sampling sites corresponding to three regions (Site 1-3: the West Region; Site 4: the Middle Region; Site 5-7: the East Region). (c) Sampling procedure for each month (the black rectangle: physical, chemical and biological site; the white rectangle: only physical and chemical site).

Sampling time

February-November, 2015

Correlations of environmental variables (a), eigenvalue (b), and mutlivariate analyses of environmental variables through a scatter diagram by regions (c) and months (d), respectively.



Depth, **salinity** and **density** were highly correlated with each other, but negatively associated with **turbidity**.

East Region and **Middle Region** were characterized by high water depth and salinity, whereas **West Region** was featured by high turbidity

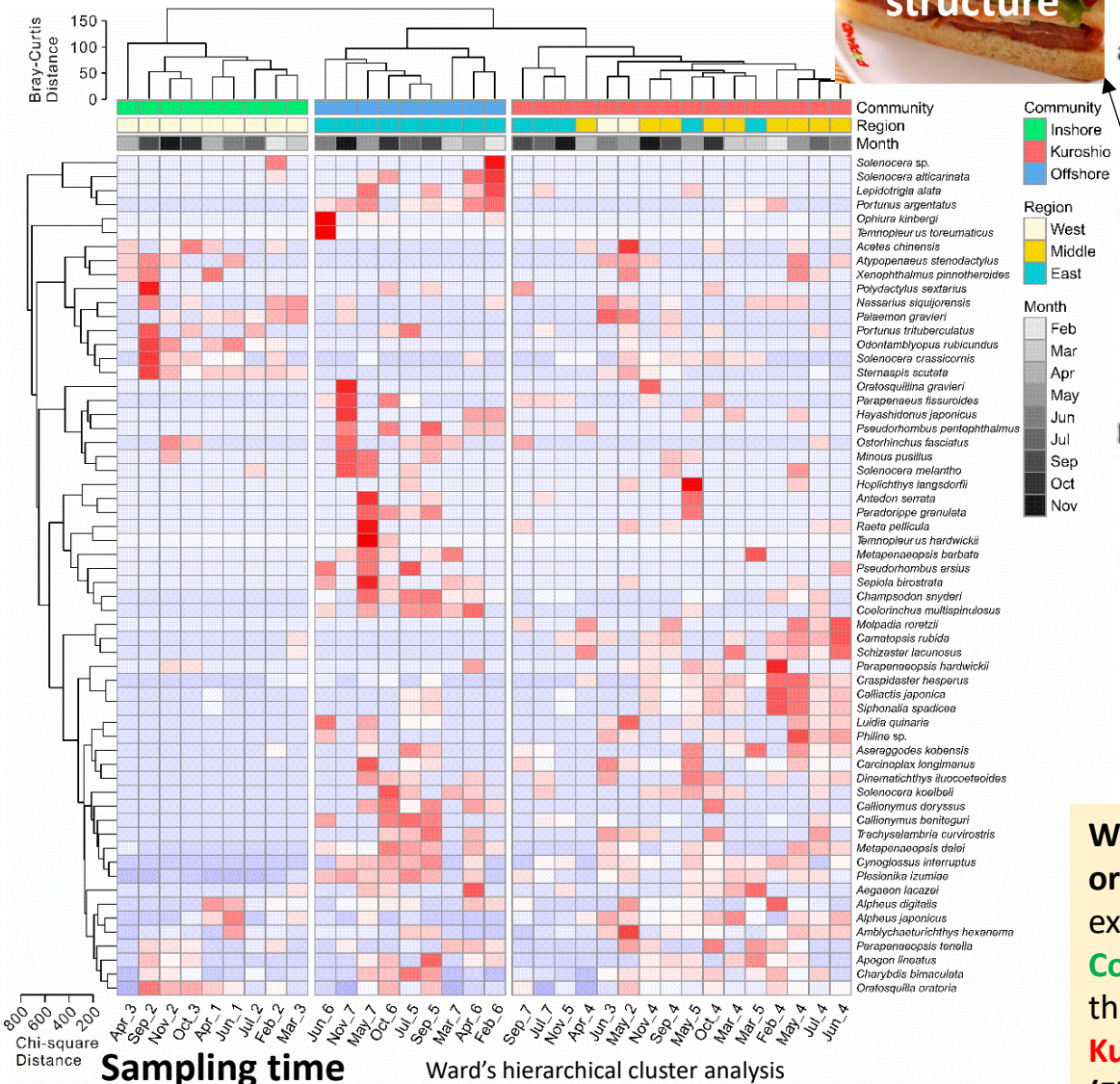
February, March and April were characterized by low temperature, and **the rest months (except May and June)** were opposed

② Influence of the Kuroshio Current on the East China Sea shelf (February-November, 2015)

Community structure

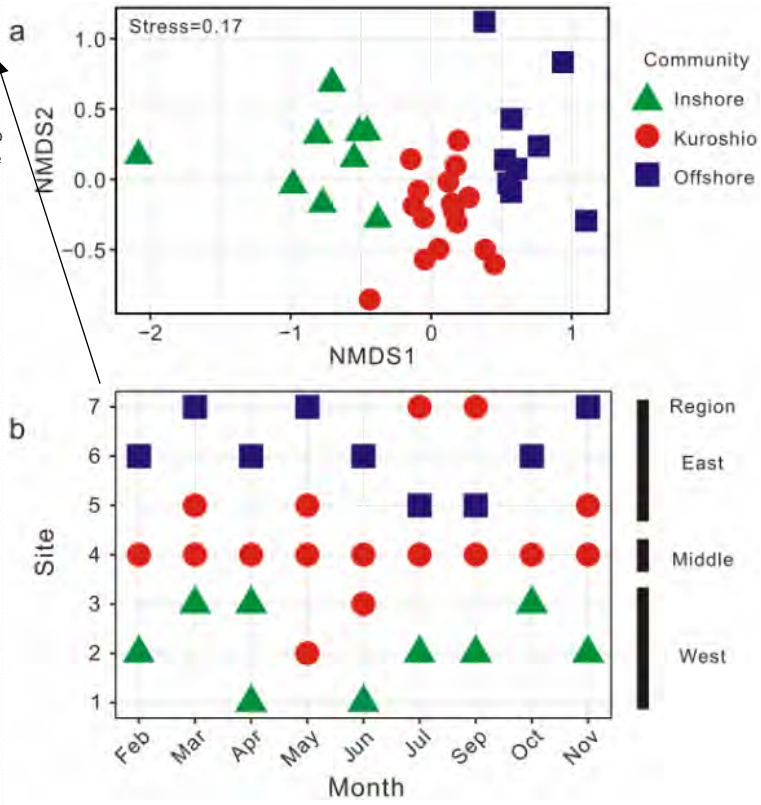
(a) Non-metric multidimensional scaling ordinations (nMDS) for macrofauna.

(b) Spatial distribution of different communities.



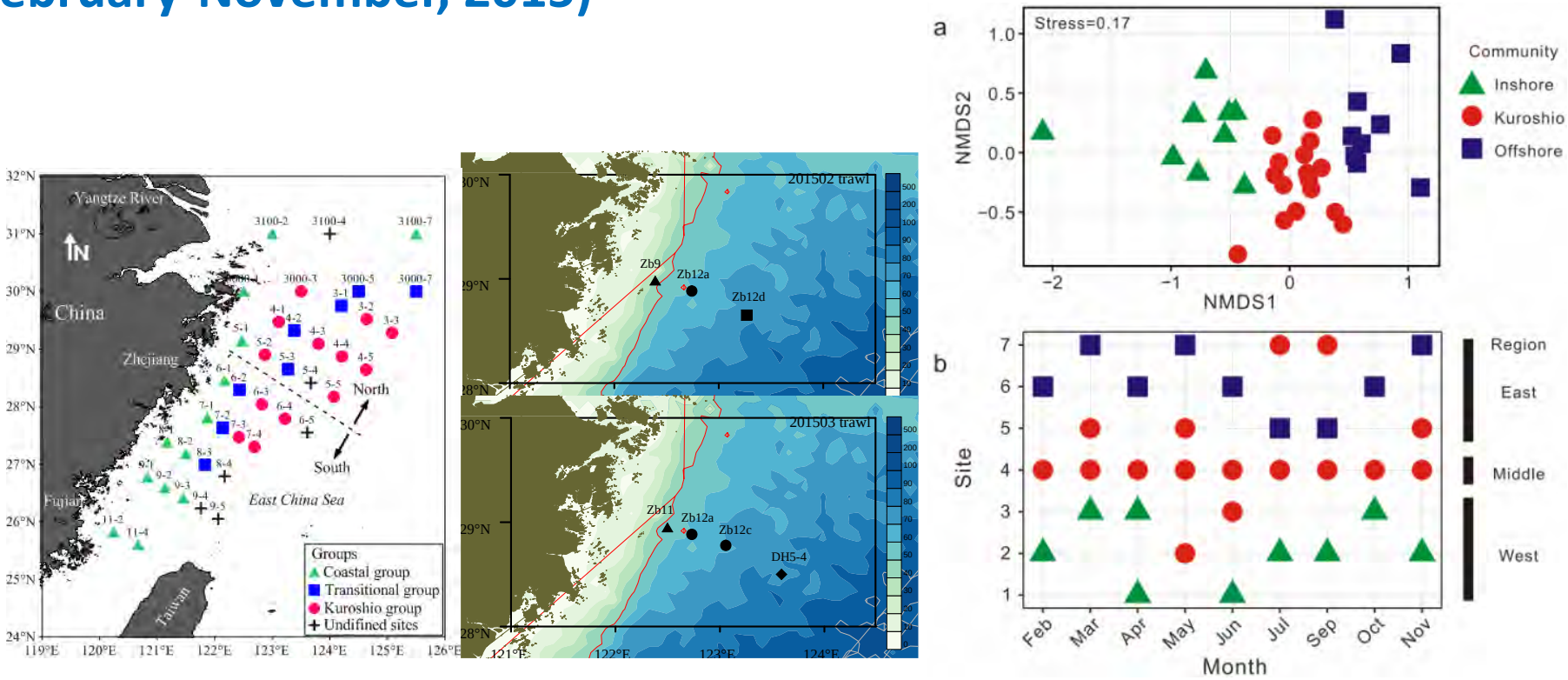
Sampling time Ward's hierarchical cluster analysis

February-November, 2015



Ward's hierarchical cluster analysis and nMDS ordination suggested **three communities** existing in the study area, named as: **Inshore Community, Kuroshio Community** (because of the pass of NKBC), **Offshore Community. Kuroshio community existed during the survey (Fig. b).**

② Influence of the Kuroshio Current on the East China Sea shelf (February-November, 2015)



We could preliminary confirm the existence of NKBC from the angle of macrobenthic community, with species collected by Agassiz trawl in the East China Sea shelf and a section off Yangtze river estuary. The kuroshio did influence the East China Sea shelf.

Evidence

① **Agassiz trawl in the East China Sea shelf** : **The position of the left edge of the kuroshio group was consistent with the Nearshore Kuroshio Branch Current (NKBC).**

② **Agassiz trawl in the section off Yangtze river estuary** : **The species composition in middle sites (Kuroshio community) were different from other sites, this phenomenon existed existed all year round.**

① Long-term variations of macrobenthic community in the southern Yellow Sea

② Influence of the Kuroshio Current on the East China Sea shelf

③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

④ Influence of the region in 32°~33°N on the distribution of macrobenthos.

⑤ Long-term variations of macrobenthic community in the Yangtze river estuary and its adjacent area

③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

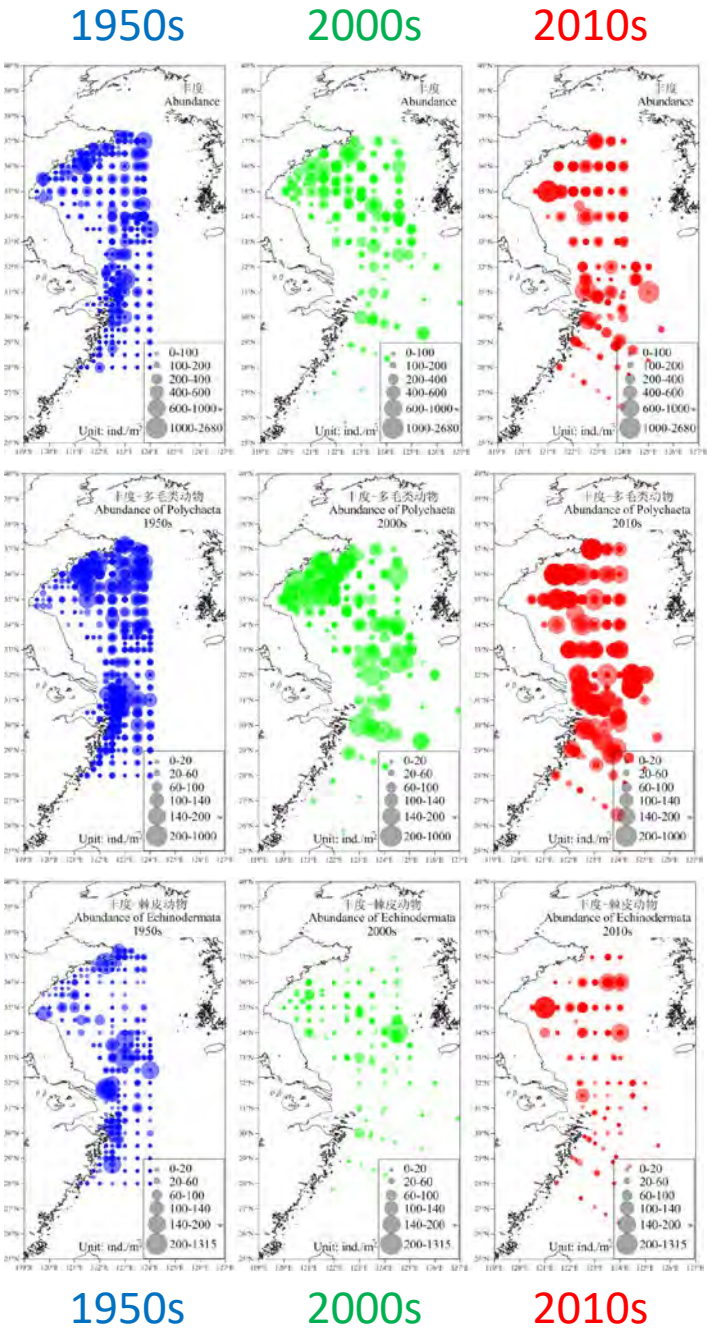
1950s-2010s

Macrobenthic abundance → Not obvious →

Abundance of polychaete → Increasing obviously →

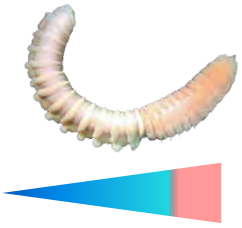
Abundance of echinoderm → Decreasing obviously →

Abundance of mollusk and crustacean, not obvious.



③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

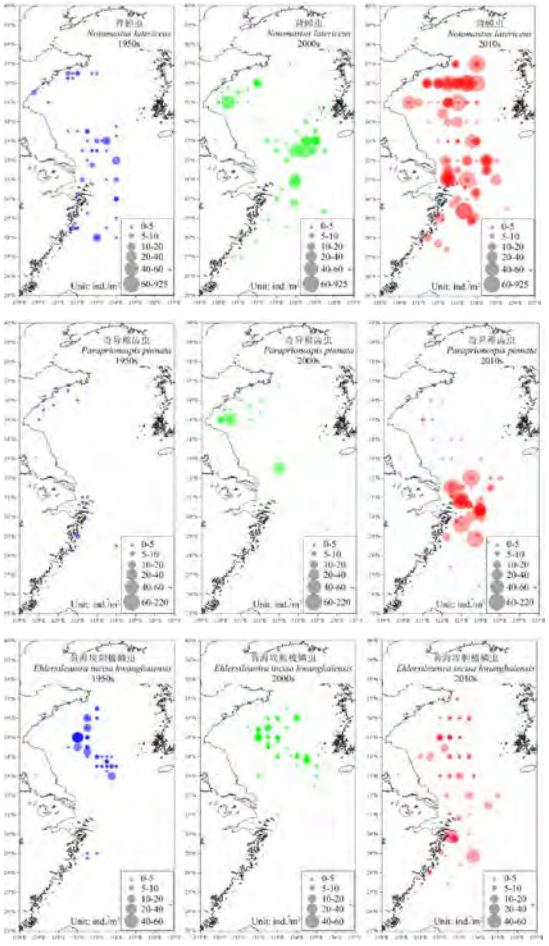
Polychaetes 1950s-2010s

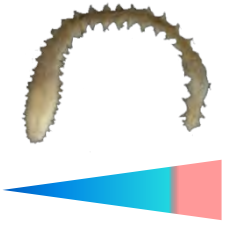


背蚓虫
Notomastus latericeus

奇异稚齿虫
Paraprionospis pinnata

黄海埃刺梳鳞虫
Ehlersileanira incisa hwanghaiensis





寡鳃齿吻沙蚕
Nephtys oligobranchia

蜈蚣欧努菲虫(大型)
Onuphis geophiliformis

掌鳃索沙蚕
Ninoe palmata

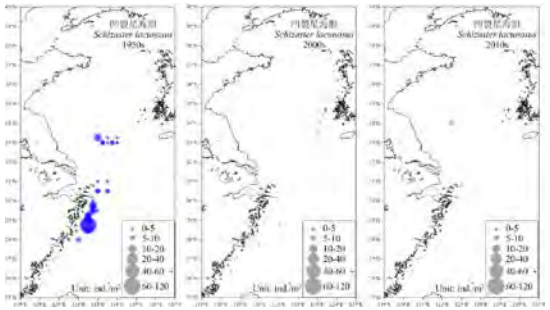
From 1950s to 2010s, **most opportunistic polychaete species with small size** increased in abundance and distribution range. **Large size species** like *Onuphis geophiliformis* also increased in diatribuion range, but decreased in abundance.

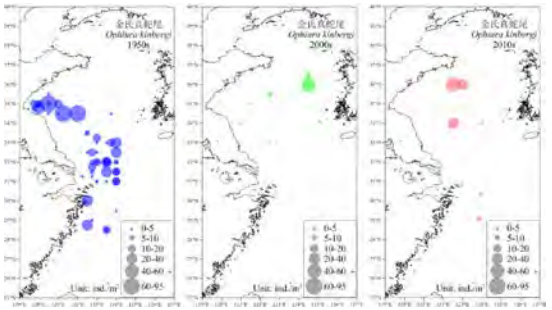
③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

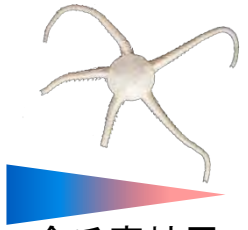
Echinoderms 1950s-2010s

1950s 2000s 2010s 1950s 2000s 2010s

凹裂星海胆
Schizaster lacunosus

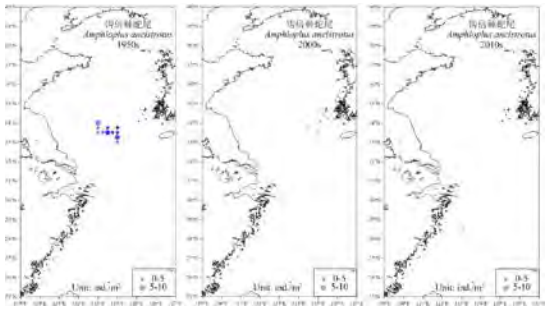


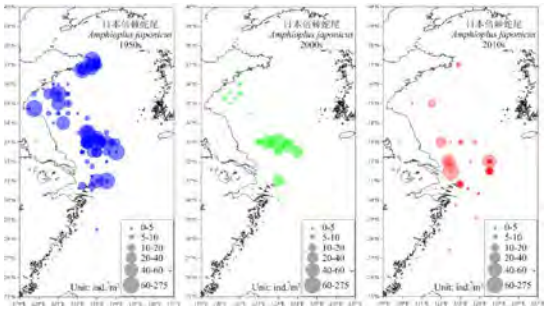




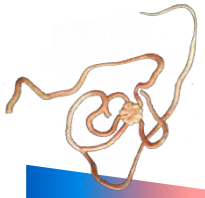
金氏真蛇尾
Ophiura kinbergi

钩倍棘蛇尾
Amphioplus ancistrotus

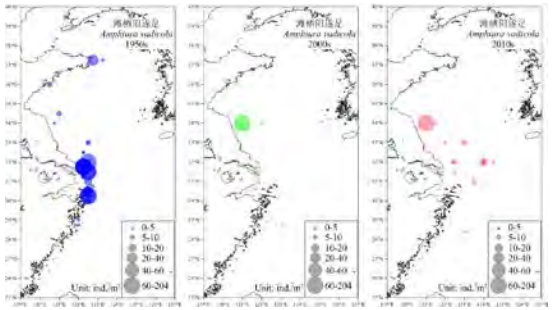


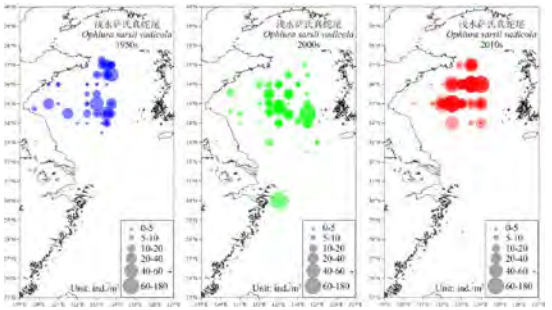


日本倍棘蛇尾
Amphioplus japonicus



滩栖阳遂足
Amphiura vadicola





浅水萨氏真蛇尾
Ophiura sarsii vadicola

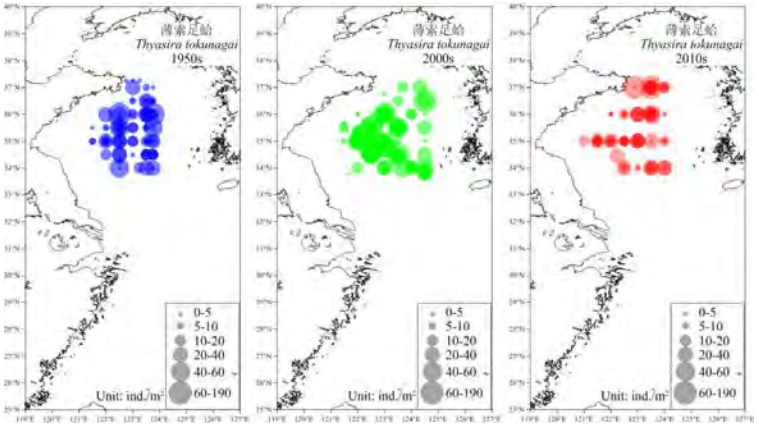
1950s 2000s 2010s 1950s 2000s 2010s

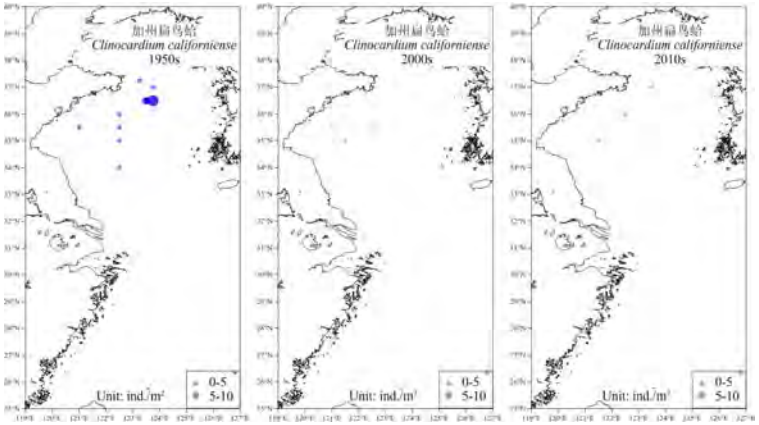
From 1950s to 2010s, **most echinoderm species** decreased in abundance and distribution range. ***Ophiura sarsii vadicola*** decreased in distribuion range, but increased obviously in abundance.

③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

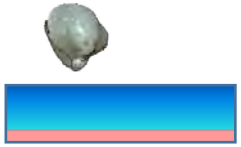
Mollusks 1950s-2010s

1950s 2000s 2010s

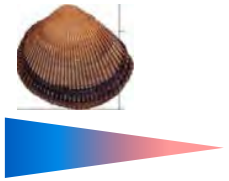




1950s 2000s 2010s



薄索足蛤 *Thyasira tokunagai*
Distribution range: **No obvious variation**
Abundance: **Increased in 2000s**



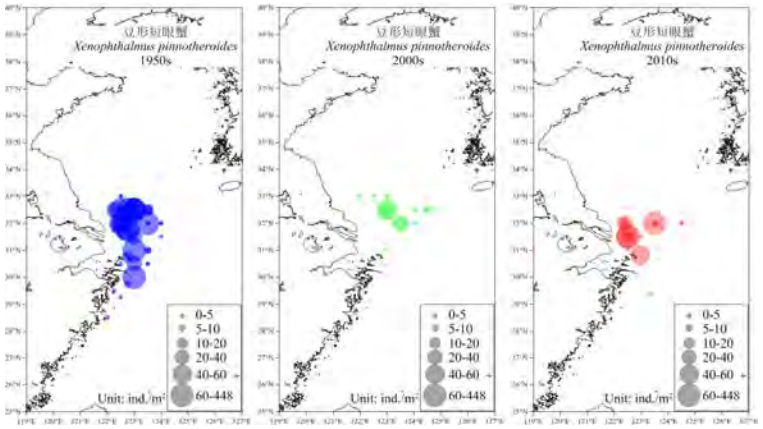
加州扁乌蛤 *Clinocardium californiense*
Distribution range: **Fragmentated**
Abundance: **Decreased**

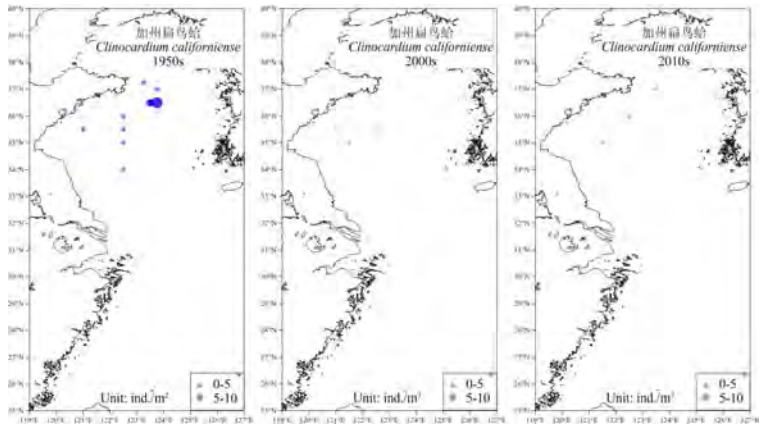
From 1950s to 2010s, **Small size cold water species mainly distributed in the Yellow Sea Cold Water Mass**. Large size species decreased in abundance whose distribution was fragmented.

③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

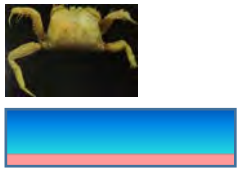
Crustaceans 1950s-2010s

1950s 2000s 2010s





1950s 2000s 2010s



豆形短眼蟹 *Xenophthalmus pinnotheroides*
Distribution range: **No obvious variation**
Abundance: **Decreased**

泥足隆背蟹 *Carcinoplax vestita*
Distribution range: **Fragmentated**
Abundance: **Decreased**

From 1950s to 2010s, **the distribution range of crustaceans decreased or not changed, with abundance decreased.**

Distribution area of warm water algae <u>moved northward</u>

厚网藻

Pachydictyon coriaceum

Distributed in the south area of Zhoushan, Zhejiang Province originally.

Pingdao island, Rizhao, Shandong Province, July, 2015

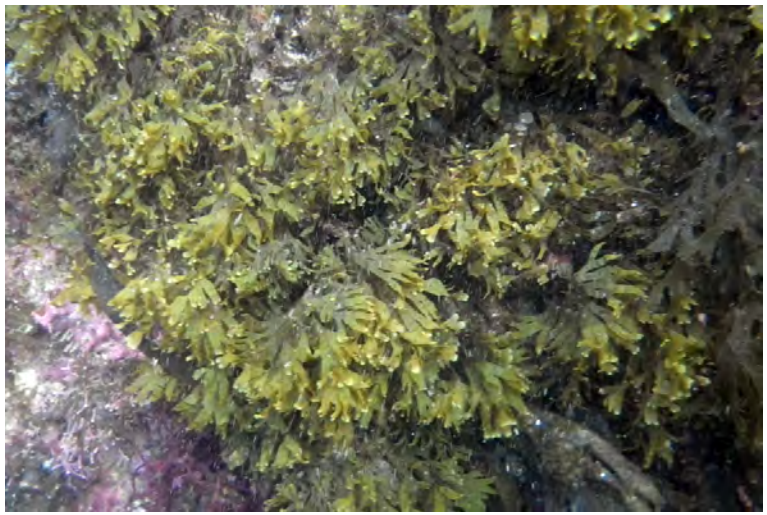
Qingdao, Shandong Province, June, 2015

Distribution area of warm water algae <u>moved northward</u>

厚缘藻

Rugulopteryx okamurae

Distributed in the south area of Nanji island, Zhejiang Province originally.



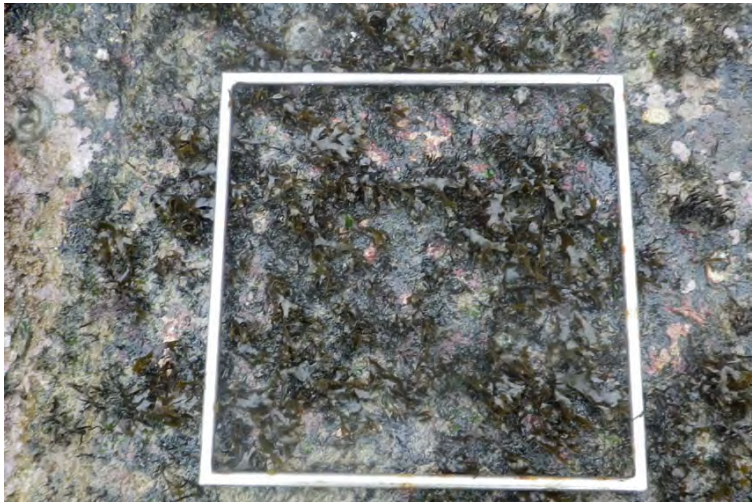
Gouqi island, Zhejiang Province,
July, 2015

Investigation results during first half year of 2015

(1) Found the distribution area of some algae move northward, which may be related to the increase of the sea water.

(2) Diversity and biomass of macroalgae increased.

(3) The increase of transparency of sea water may be the main reason for the recovery of macroalgae.



Distribution area of reef coral move northward

Zhican Tang and Jianzhang Sun found the north boundary of the distribution area of reef coral moved northward from Dongshan, Fujian Province to Nanji island, Zhejiang Province in 2007, and the boundary vanished for a time.

皱齿星珊瑚 *Oulastrea crispata* was found in Nanji island again in May, 2015

Nanji island, Zhejiang Province,
May, 2015

③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

Conclusion

Polychaetes: **most opportunistic polychaete species with small size increased** in abundance and distribution range; **some species** trended to distribute along the coastal line and the sea area off Yangtze river estuary with large abundance; these species could indicate the environment condition in this area.
Echinoderms: **most echinoderm species** decreased in abundance and distribution range.
Cold water species like ***Ophiura sarsii vadicola*** **decreased** in distribuion range, but increased obviously in abundance. The decrease of distribution range of cold water species may be related to **global warming**.
Mollusks: **Small size cold water species mainly distributed in the Yellow Sea Cold Water Mass**. Large size species decreased in abundance whose distribution was fragmented.
Crustaceans: no obvious variation in distribution range and abundance.

From above results we could concluded that the **polychaetes** had the superiority in adaptation to environment and trended to be dominant in the Yellow Sea and East China Sea.

We found **some macroalgaes** with **distribution area moving northward**, which may be related to the increase of the sea water.

① Long-term variations of macrobenthic community in the southern Yellow Sea

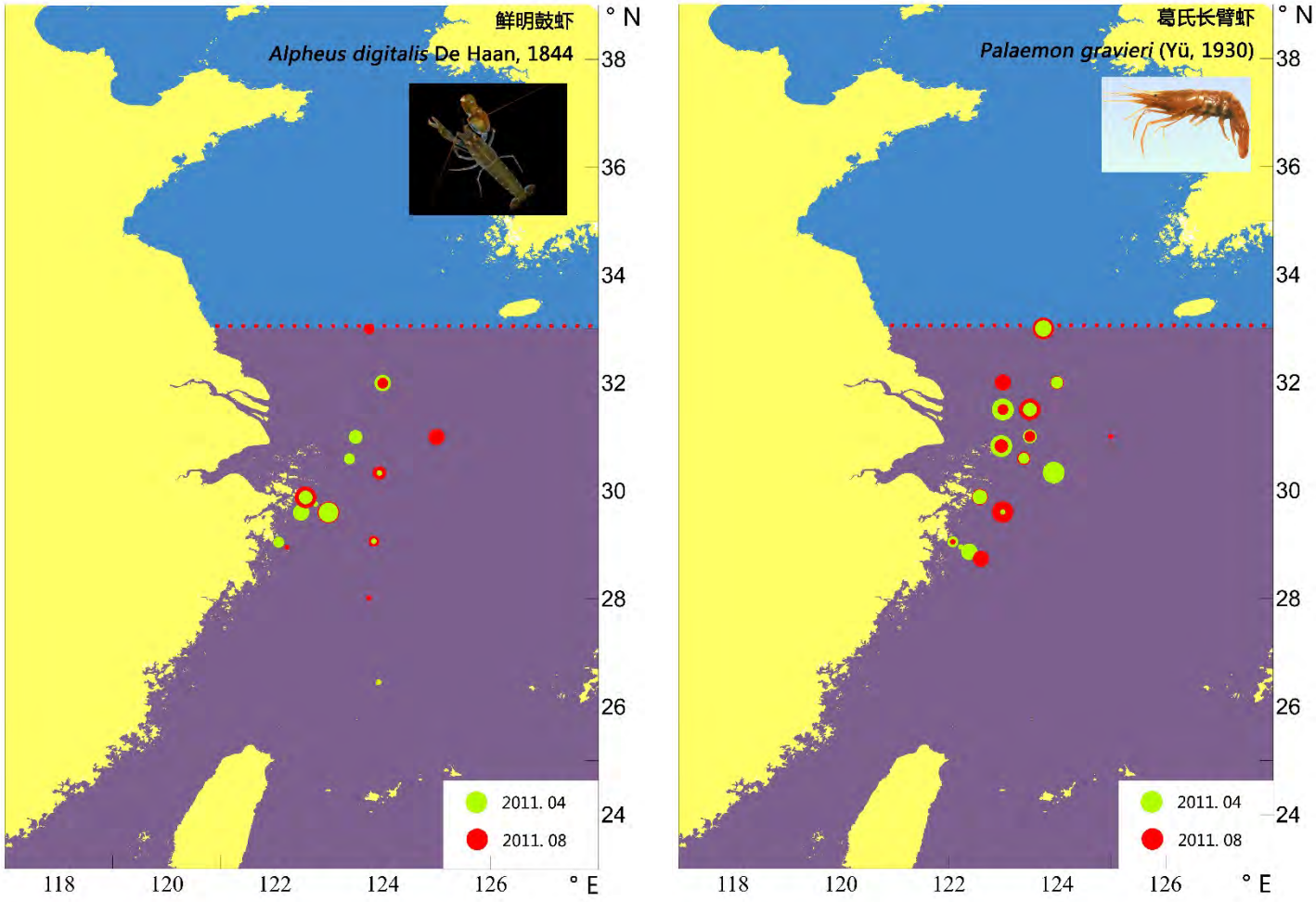
② Influence of the Kuroshio Current on the East China Sea shelf

③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

④ Influence of the region in 32°~33°N on the distribution of macrobenthos.

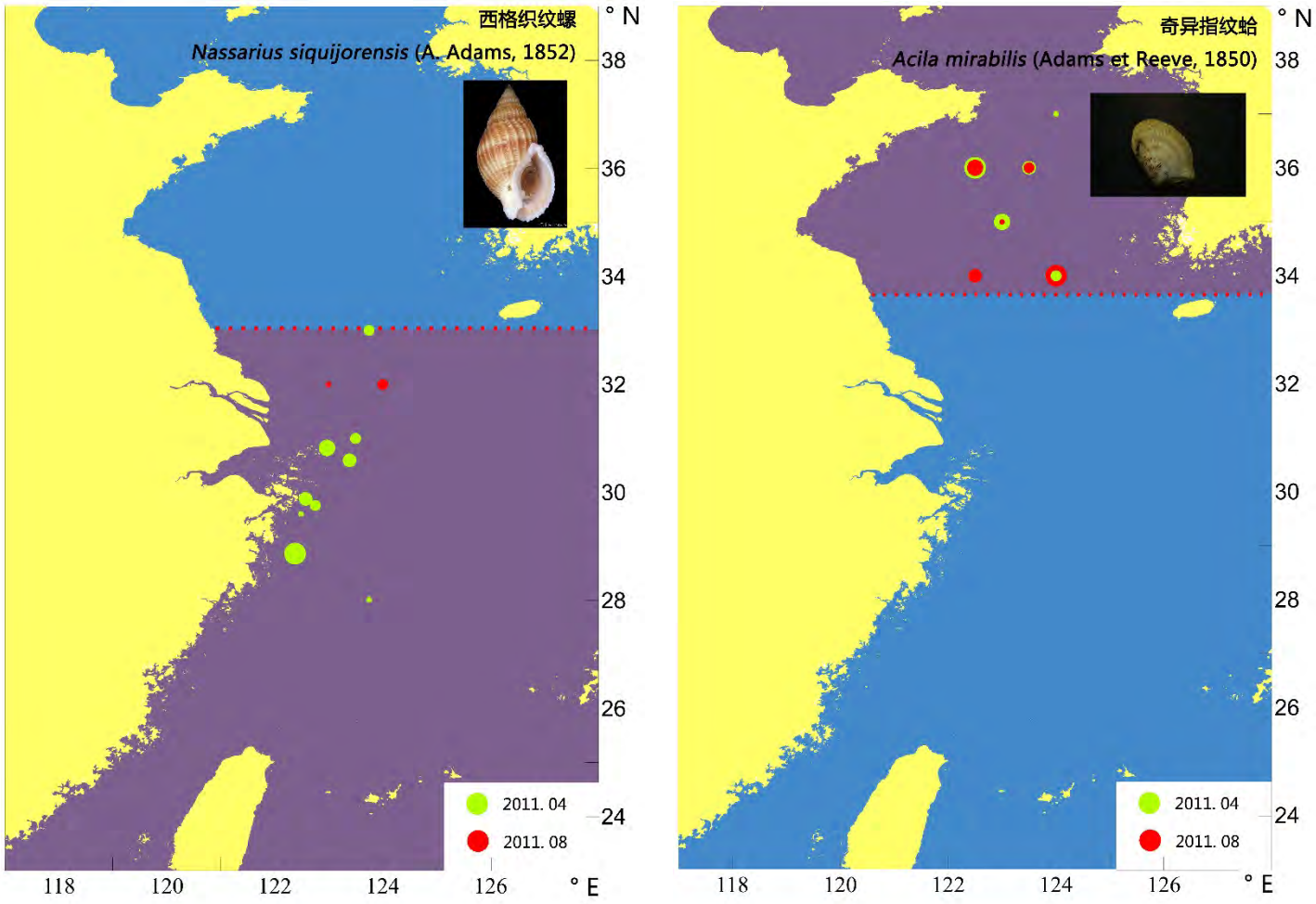
⑤ Long-term variations of macrobenthic community in the Yangtze river estuary and its adjacent area

④ Influence of the region in 32° ~33° N on the distribution of macrobenthos



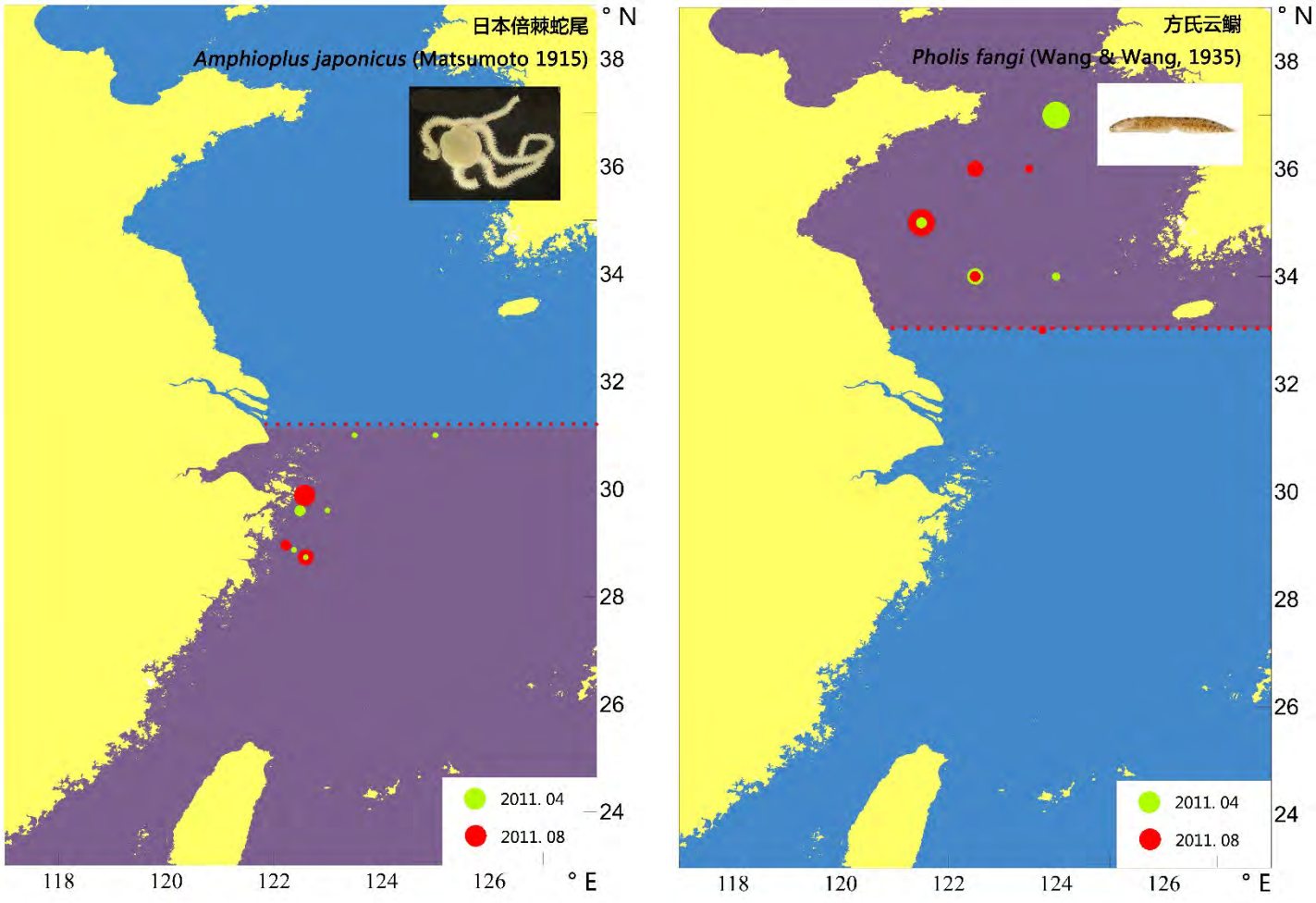
Crustaceans: We found two crustaceans (*Alpheus digitalis* and *Palaemon gravieri*) distributed in the south of the latitude 33° N in the Yellow Sea and East China Sea in spring and summer.

④ Influence of the region in 32°~33° N on the distribution of macrobenthos



Mollusks: *Nassarius siquejrensis* distributed in the south of 33° N, while *Acila mirabilis* distributed in the north of 33° N.

④ Influence of the region in 32°~33° N on the distribution of macrobenthos



Echinoderm: *Amphioplus japonicus* distributed in the south of the Yangtze river estuary.

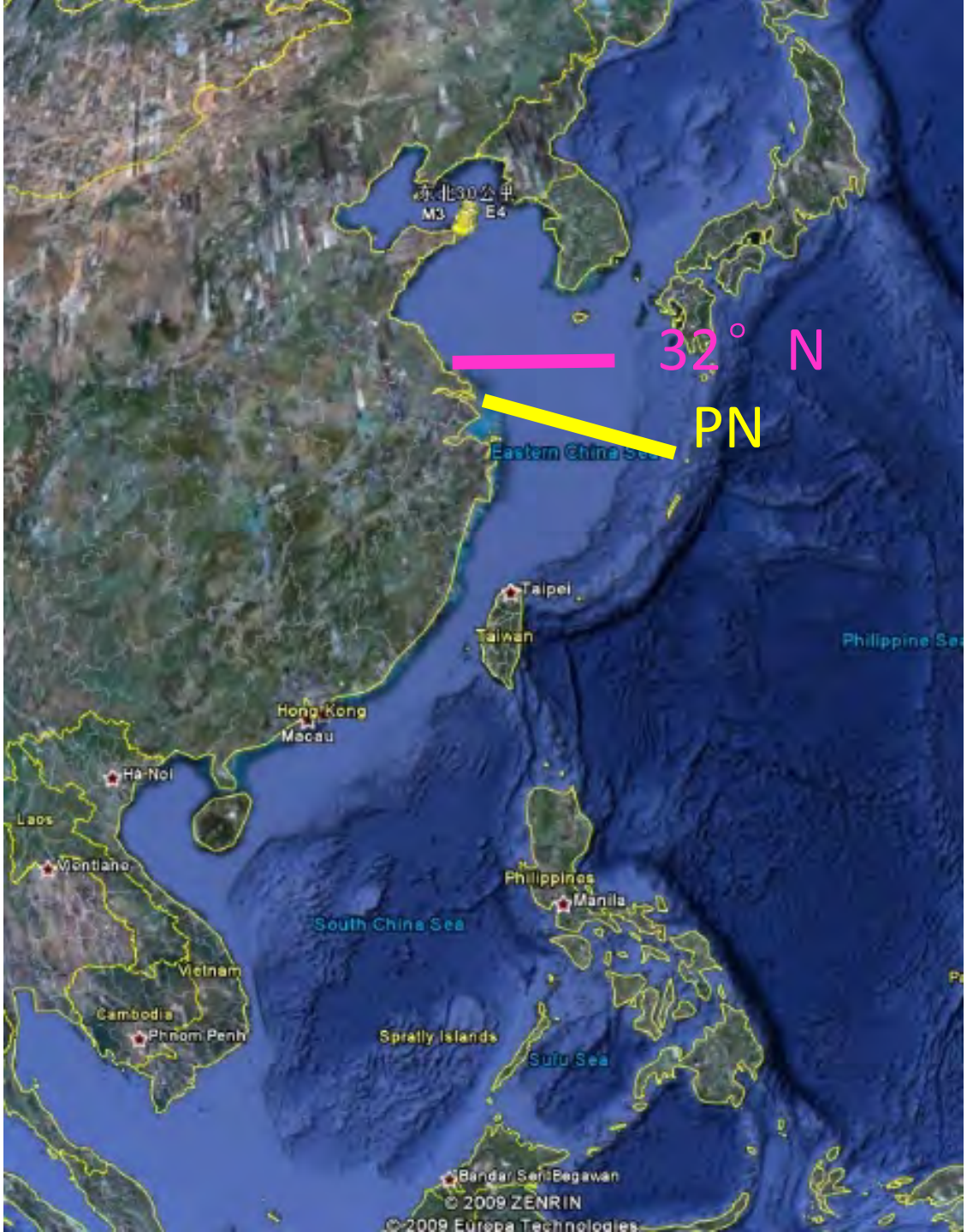
Fish: *Enedrias fangi* distributed in the north of 33° N.

④ Influence of the region in 32° ~33° N on the distribution of macrobenthos

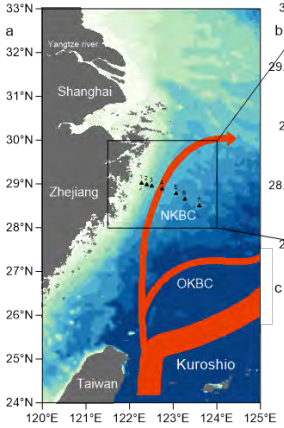
Conclusion

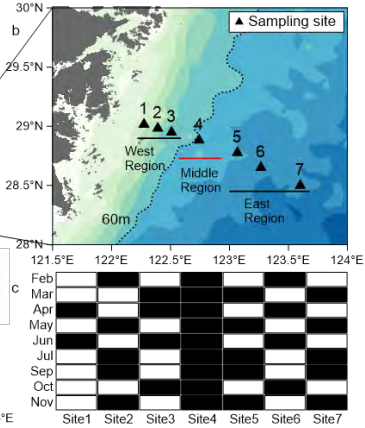
Based on the investigation data in spring and summer, 2011, we found the distribution of crustacean (*Palaemon gravieri*), mollusks (*Nassarius siquejrensis* and *Acila mirabilis*), echinoderm (*Amphioplus japonicus*) and fish (*Enedrias fangi*) had relationship with **32° - 33° N**.

The region in 32° -33° N obstructed the distribution of some macrobenthos, and it may be useful for studying the distribution of macrobenthos.


32° N
PN
Eastern China Sea
Taipei
Taiwan
Philippine Sea
Hong Kong
Macau
Ha Noi
Laos
Vientiane
Philippines
Manila
South China Sea
Vietnam
Cambodia
Phnom Penh
Spratly Islands
Sulu Sea
Bandar Seri Begawan
© 2009 ZENRIN
© 2009 Europa Technologies


M3
E4
Eastern China Sea
Taipei
Taiwan
Philippine Sea
Hong Kong
Macau
Ha Noi
Laos
Vientiane
Philippines
Manila
South China Sea
Vietnam
Cambodia
Phnom Penh
Spratly Islands
Sulu Sea
Bandar Seri Begawan
© 2009 ZENRIN
© 2009 Europa Technologies


a
Yangtze river
Shanghai
Zhejiang
NKBC
OKBC
Kuroshio
Taiwan
33°N
32°N
31°N
30°N
29°N
28°N
27°N
26°N
25°N
24°N
120°E
121°E
122°E
123°E
124°E
125°E


b
▲ Sampling site
1
2
3
4
5
6
7
West Region
Middle Region
East Region
60m
30°N
29.5°N
29°N
28.5°N
28°N
121.5°E
122°E
122.5°E
123°E
123.5°E
124°E
c
Feb
Mar
Apr
May
Jun
Jul
Sep
Oct
Nov
Site1
Site2
Site3
Site4
Site5
Site6
Site7

① Long-term variations of macrobenthic community in the southern Yellow Sea

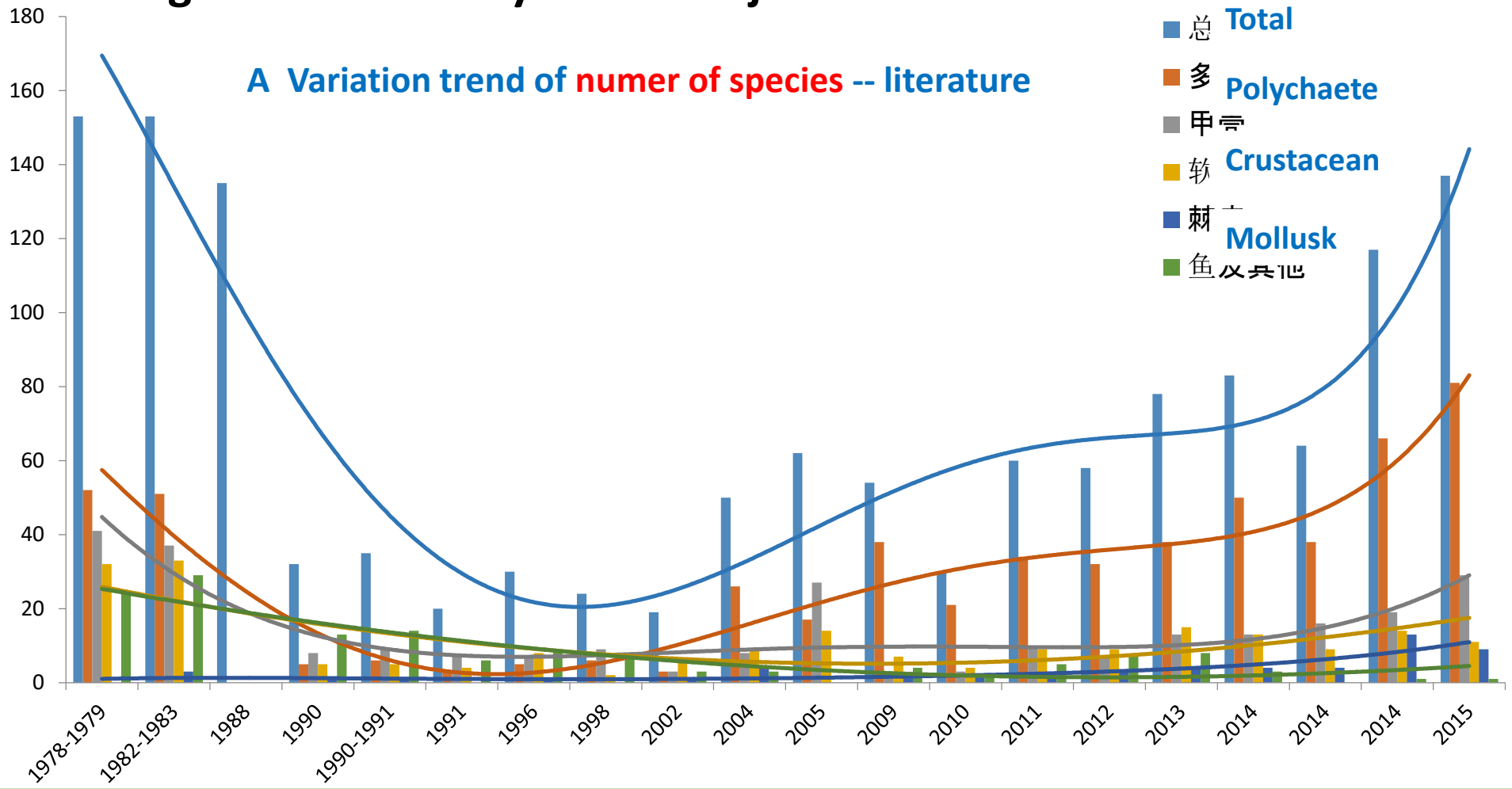
② Influence of the Kuroshio Current on the East China Sea shelf

③ Global change and long-term variations of the species distribution pattern in the Yellow Sea and East China Sea

④ Influence of the region in 32°~33°N on the distribution of macrobenthos.

⑤ Long-term variations of macrobenthic community in the Yangtze river estuary and its adjacent area

⑤ Long-term variations of macrobenthic community in the Yangtze river estuary and its adjacent areaⅠ



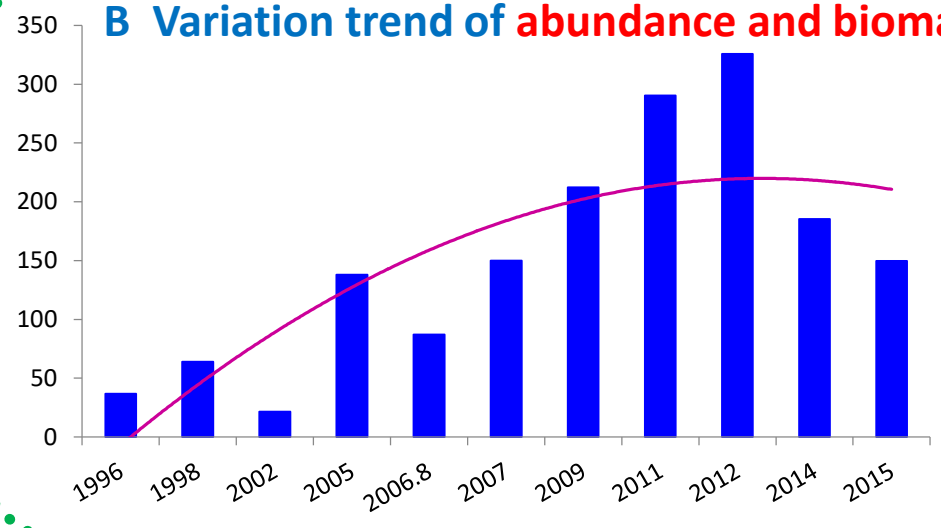
1 Number of species had low values during 1990-2000, increased during 2004-2009, and increased rapidly during 2013-2015.

2 Number of polychaete species increased during 2004-2009 and 2013-2015, with other species not obvious.

3 Number of fish species and others (species not belonging to polychaete, crustacean, mollusk and echinoderm) decreased.

⑤ Long-term variations of macrobenthic community in the Yangtze river estuary and its adjacent areaⅠ

B Variation trend of abundance and biomass -- literature

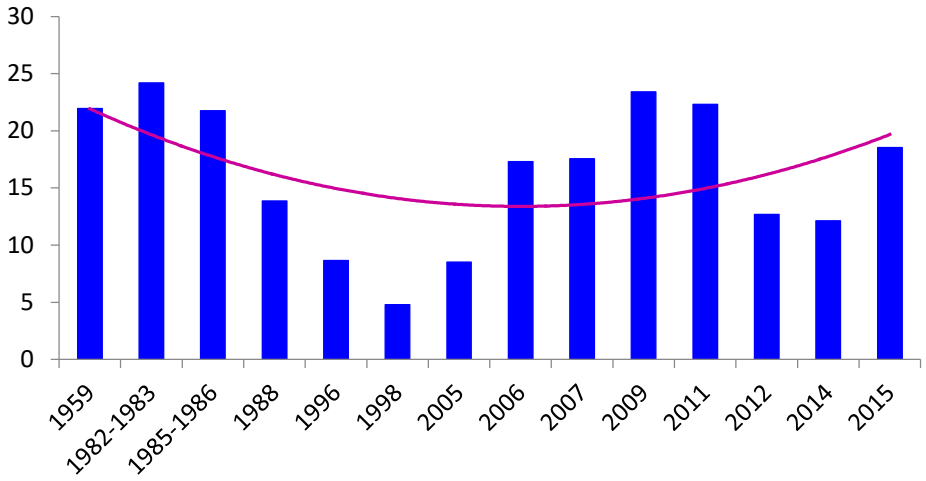


Abundance：

Low value in 2002; increased significantly since 2005, perhaps because of the increase of small size polychaetes; highest value in 2012.

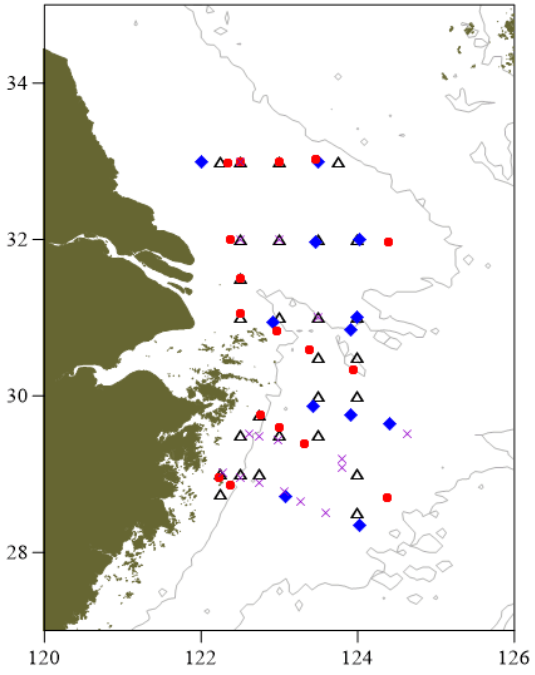
Biomass:

In late 1990s, biomass decreased sharply because of human activity; increased gradually during 2000; most increased species were polychaetes, and contributed little to the biomass.

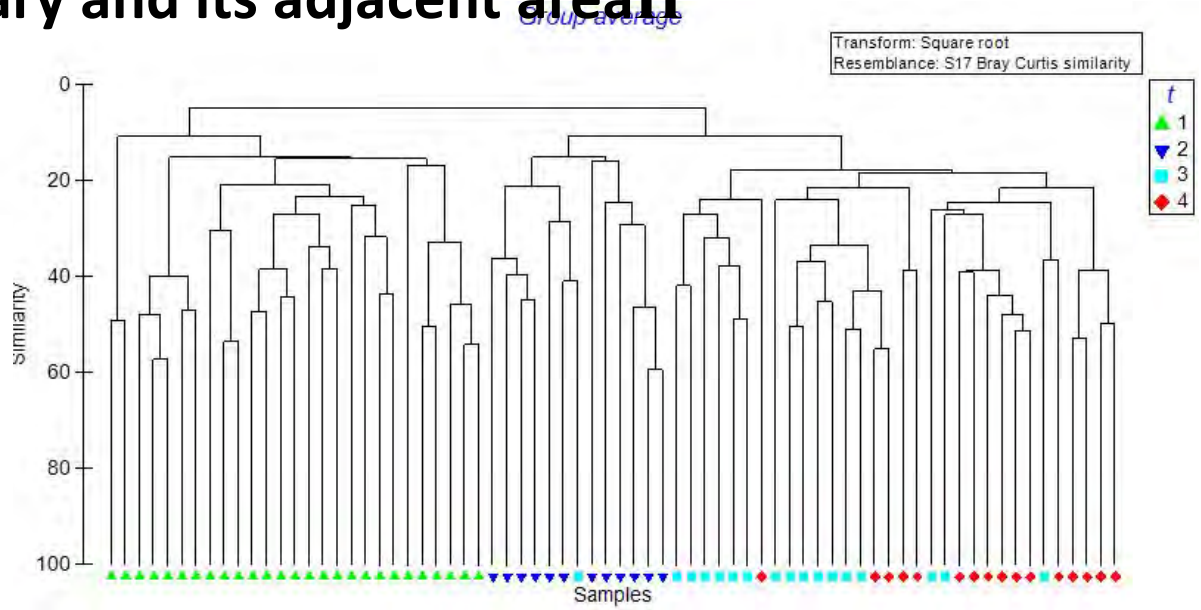


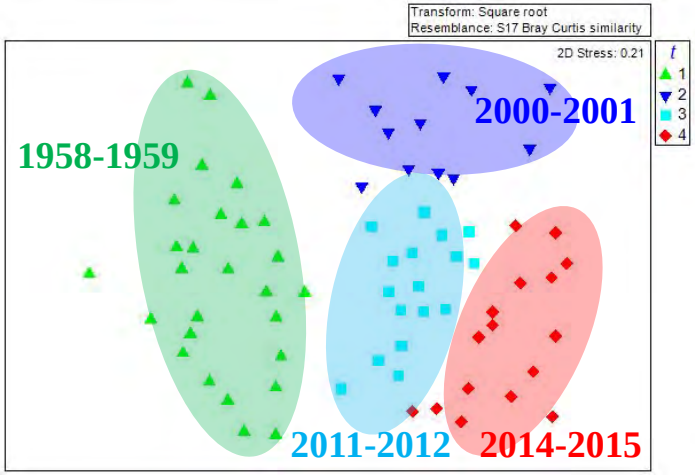
⑤ Long-term variations of macrobenthic community in the Yangtze river estuary and its adjacent areaII

Data analysis



Sampling sites



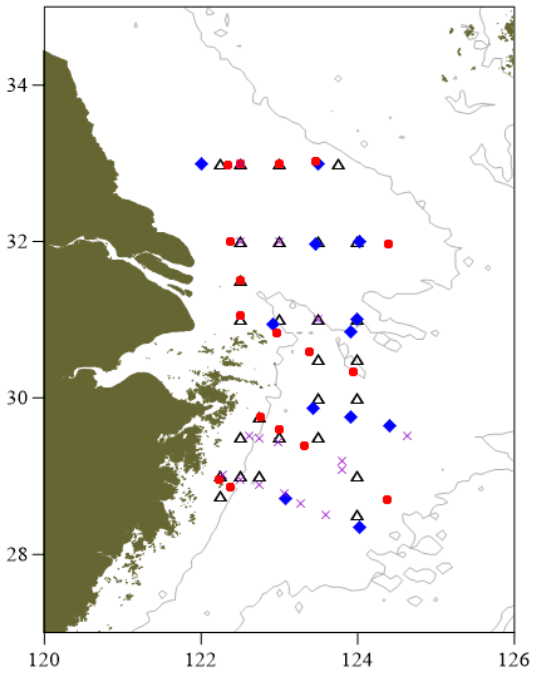


Cluster analysis and nMDS ordination

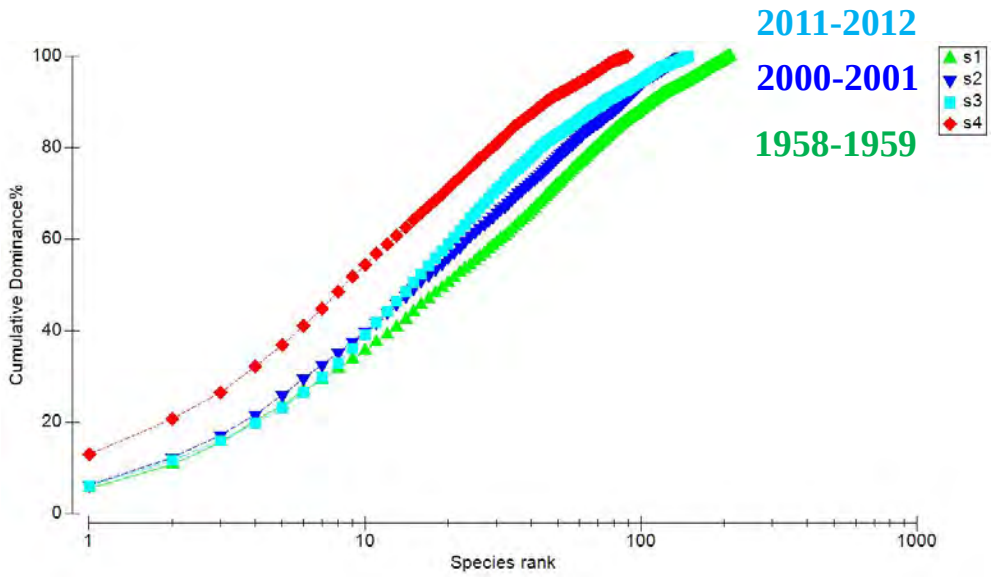
Cluster analysis and nMDS ordination showed the macrobenthic community structure changed significantly in the past 60 years.

⑤ Long-term variations of macrobenthic community in the Yangtze river estuary and its adjacent areaII

Data analysis



Sampling sites



K-dominance curves in different periods:

K-dominance curves had the lowest height during 1958-1959, showing the highest diversity and the slightest disturbance, and had the highest height during 2014-2015, showing the lowest diversity and the most serious disturbance.

⑤ Long-term variations of macrobenthic community in the Yangtze river estuary and its adjacent area

Literature

- **Number of species** had low values during 1990-2000, increased during 2004-2009, and increased rapidly during 2013-2015. Number of fish species and others decreased.
- **Abundance**：Low value in 2002; increased significantly since 2005, perhaps because of the increase of small size polychaetes; highest value in 2012.
- **Biomass:** In late 1990s, biomass decreased sharply because of human activity; increased gradually during 2000; most increased species were polychaetes, and contributed little to the biomass.

Data analysis

- From 1958 to 2015, the **macrobenthic community structure changed significantly**; diversity decreased with the increase of disturbance.

Outline

What is happening in the Yellow Sea and East China Sea? --Status of the ecosystem in the Yellow Sea and East China Sea

Whether macrobenthos changes? How does it change? And why?

Conclusion

Conclusion

The ecosystem in the Yellow Sea and East China Sea is undergoing fundamental and irreversible change;

Climate change and human activity together influenced the variation of marine ecosystem;

For macrobenthic community, the variation in coastal area was caused by human activity, while the variation in offshore area by climate change;

As time goes on, the northward movement and fragmentation of macrobenthic distribution range is inevitable;

Conclusion(continued)

In coastal community, polychaetes increased in abundance; echinoderm increased in offshore area;

32° N was the boundary for the distribution of macrobenthos in the Yellow Sea and East China Sea, like the PN line formed by the Yangtze river diluted water;

The macrobenthos in the coastal area of the East China Sea was influenced by branches of Kuroshio Current, and the response of macrobenthos to the branch is not occasionally, but always.

The variation of macrobenthic abundance in low oxygen region was not obvious, but the community structure had changed fundamentally.

Acknowledgement

Funding：

1. The Strategic Priority Research Program of the Chinese Academy of Sciences(A):

Western Pacific Ocean System: Structure, Dynamics and Consequences

2. 973 program

the Dynamics of Ecosystem and Sustainable Use of Biological Resources from the East China Sea and Yellow Sea, the Key Processes, Mechanism and Ecological Consequences of Jellyfish Bloom in Chinese Coastal Waters

3. The National Natural Science Foundation of China:

The variation of macrobenthic community over 50 years and its mechanism

…… ……

Acknowledgement

谢谢！

Thank you ！