Ecological Function Assessment of Created Intertidal Oyster Reef in the Yangtze River Estuary, China

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Ecological function

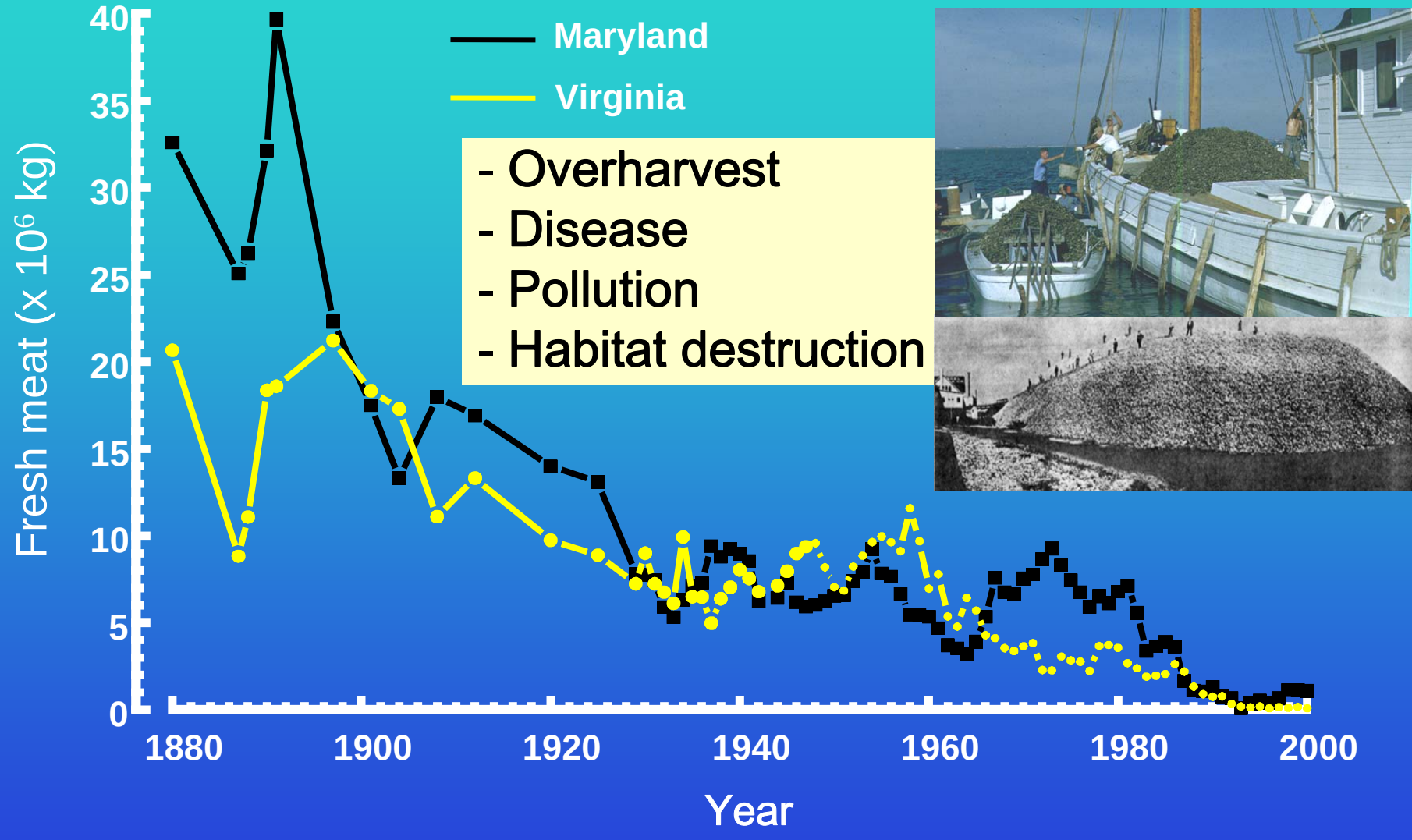
Filtration

- Improving water quality
- Benthic-pelagic coupling

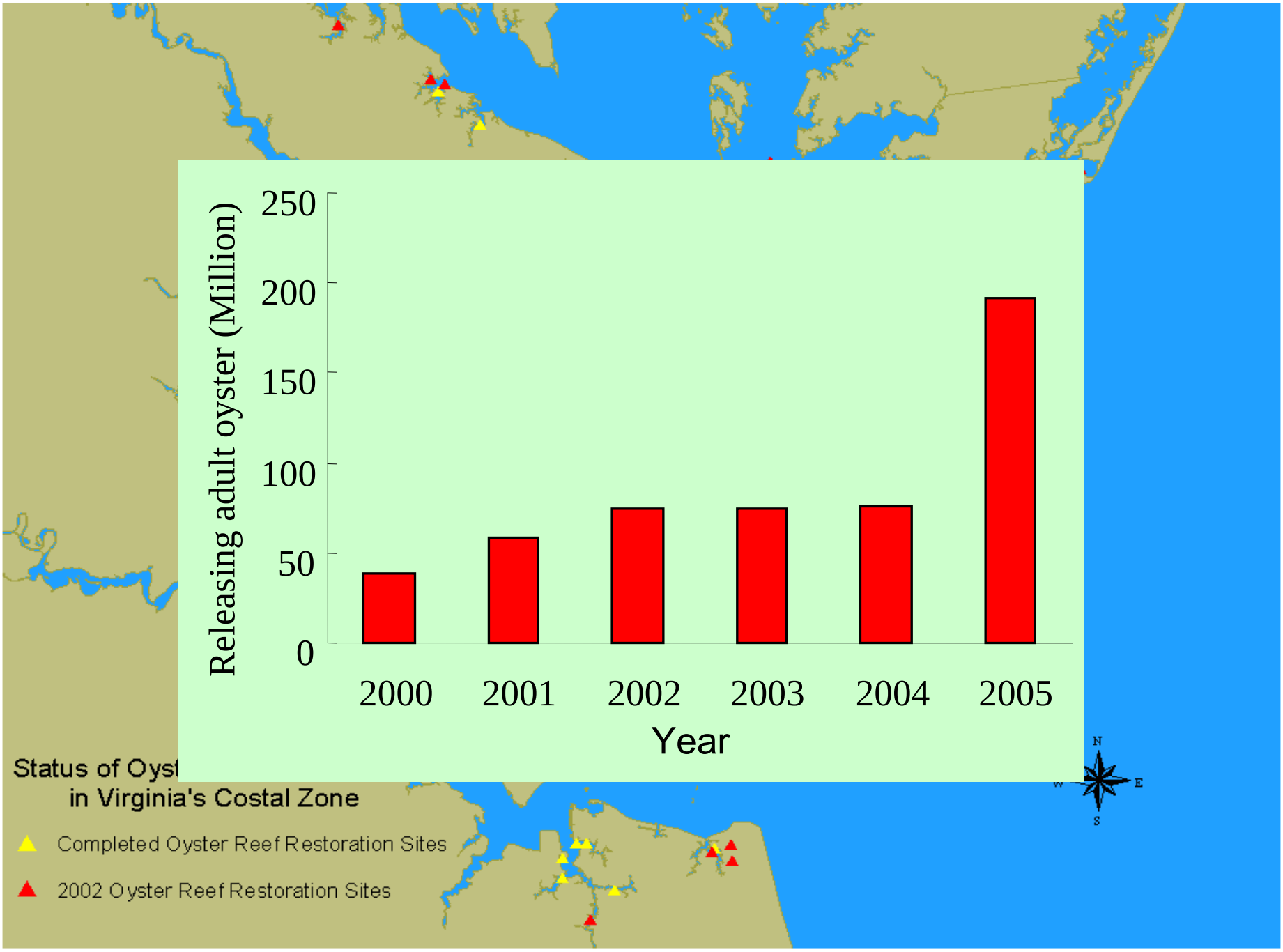
Habitat Value

- Fisheries production
- Biodiversity

Oyster Landings



Oyster Reef Restoration


Releasing adult oyster (Million)
250
200
150
100
50
0
2000
2001
2002
2003
2004
2005
Year
Status of Oyst
in Virginia's Costal Zone
Completed Oyster Reef Restoration Sites
2002 Oyster Reef Restoration Sites
N
W
E
S

Restoring the Yangtze River Estuary

- Overfishing
- Pollution
- Wetland Reclamation
- Large Engineer

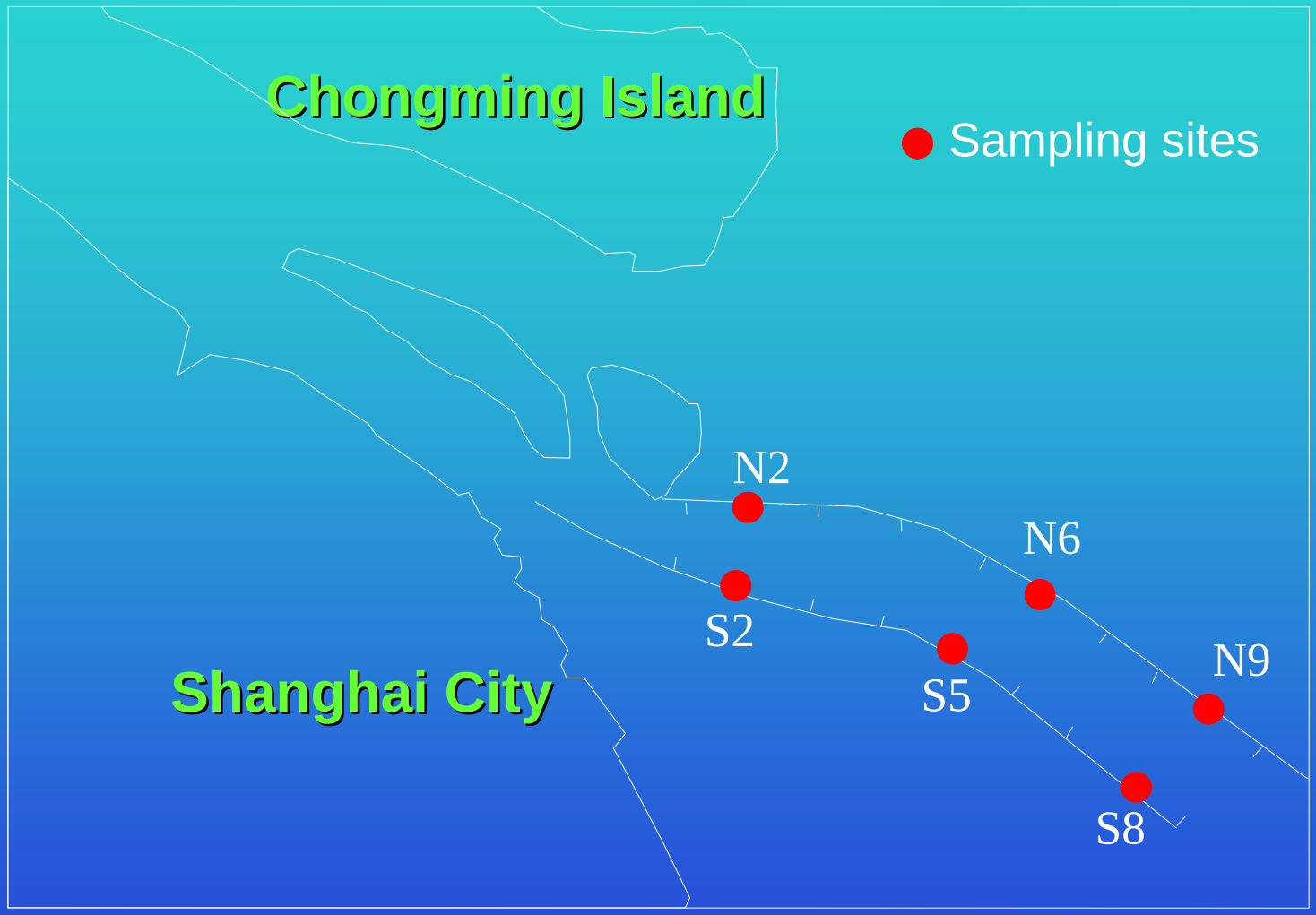
Deepwater Navigation Channel Regulation Project of the Yangtze River Estuary

Restoration of the oyster reef in the Yangtze River estuary(2004-4)

Key scientific question：whether the restoration of the oyster reef have succeed or not？

- Is there large enough oyster population on the created reef?
- Which motile epibenthic macrofauna have inhabited the created oyster reef?
- It is necessary to assess nekton utilization of the created oyster reef.

Field sampling



2004-9; 2005-6; 2007-8

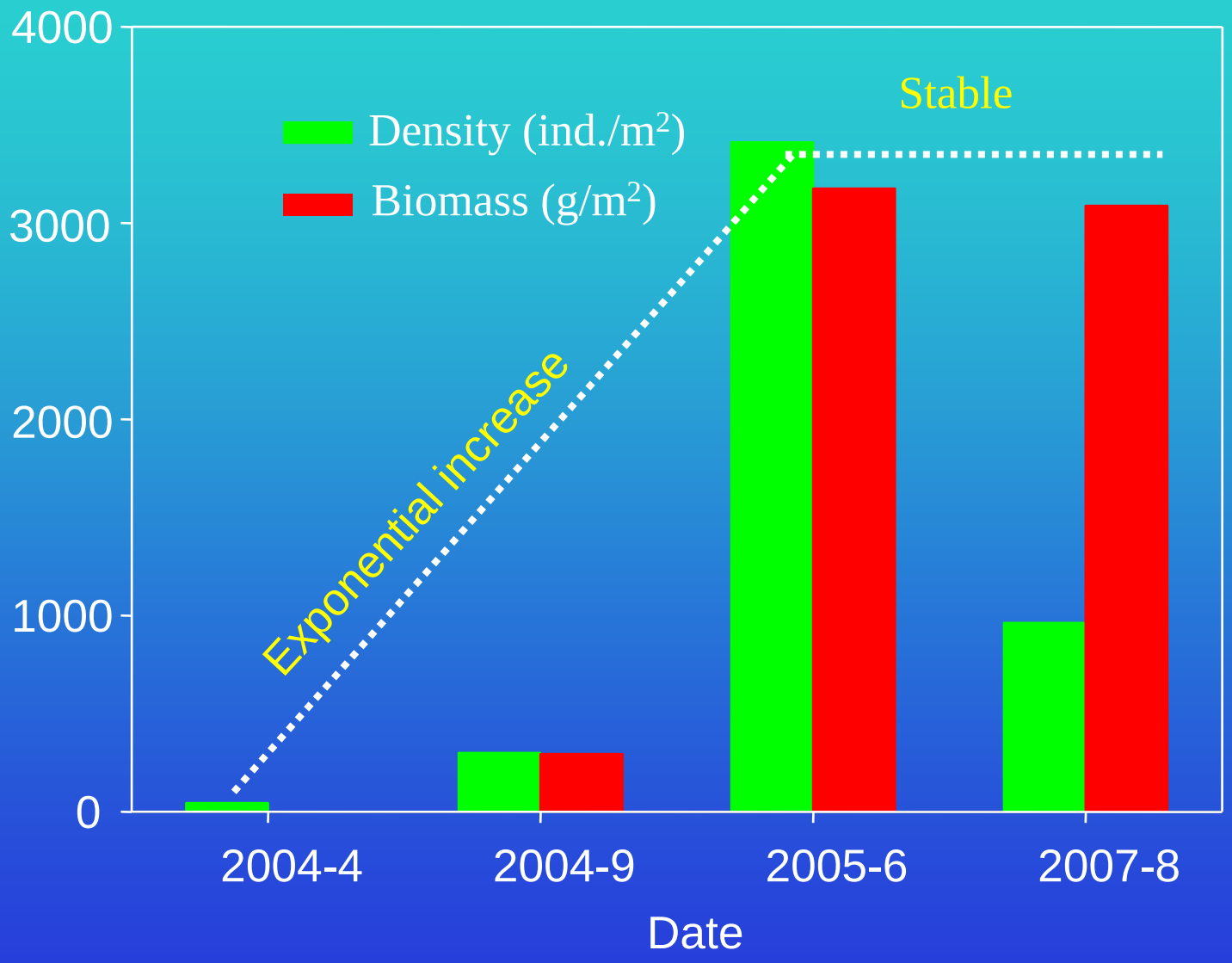
Sessile fauna

Nektons(2007-8)

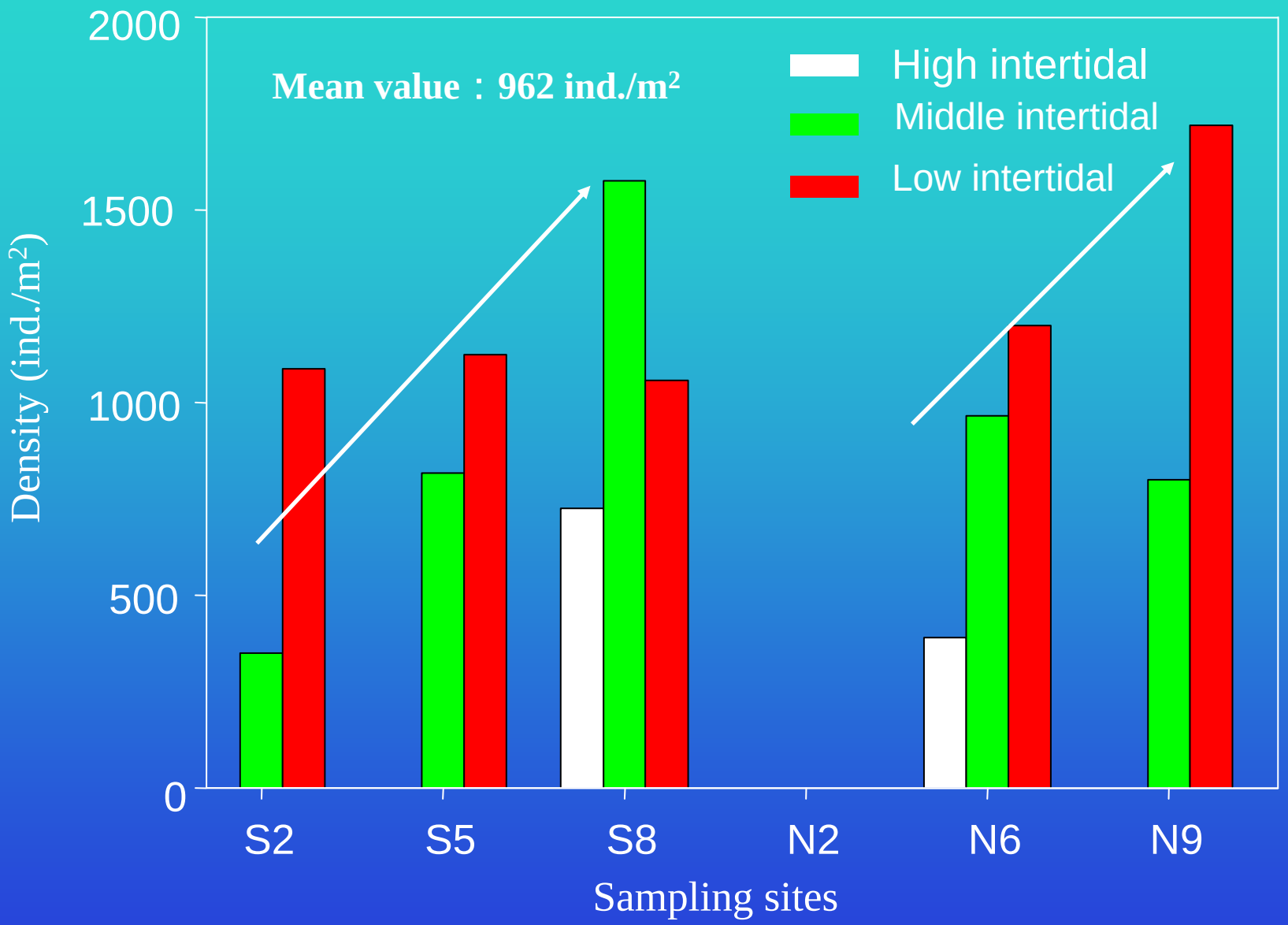
Fish trap (quantitative)

Gill net (qualitative)

Increase of the oyster population



Density



Spatial pattern：S8>S5>S2，N9>N6>N2；L>M>L

Sessile macrofauna

Twenty-night motile epibenthic macrofauna species were recorded, including 12 crustaceans, 11 mollusks, 4 annelids and 2 fishes.

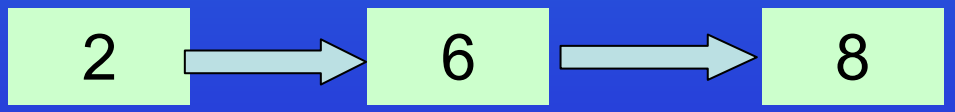
Crustaceans (12)

Species	Sep. 2004	Jun.2005	Aug.2007
Alpheus japonicus		●	●
Eriocheir leptognathus			●
Balanus albicostatus		●	●
Metopograpsus frontalis		●	●
Metopograpsus latifrons		●	●
Metopograpsus quadridentatus			●
Pilumnus scabrisculus		●	●
Sesarma dehaani		●	●
Sesarma bidens	●	●	●
Sesarma tripectinis			●
Balanus albicostatus	●	●	●
Synidotea laevidorsalis		●	●

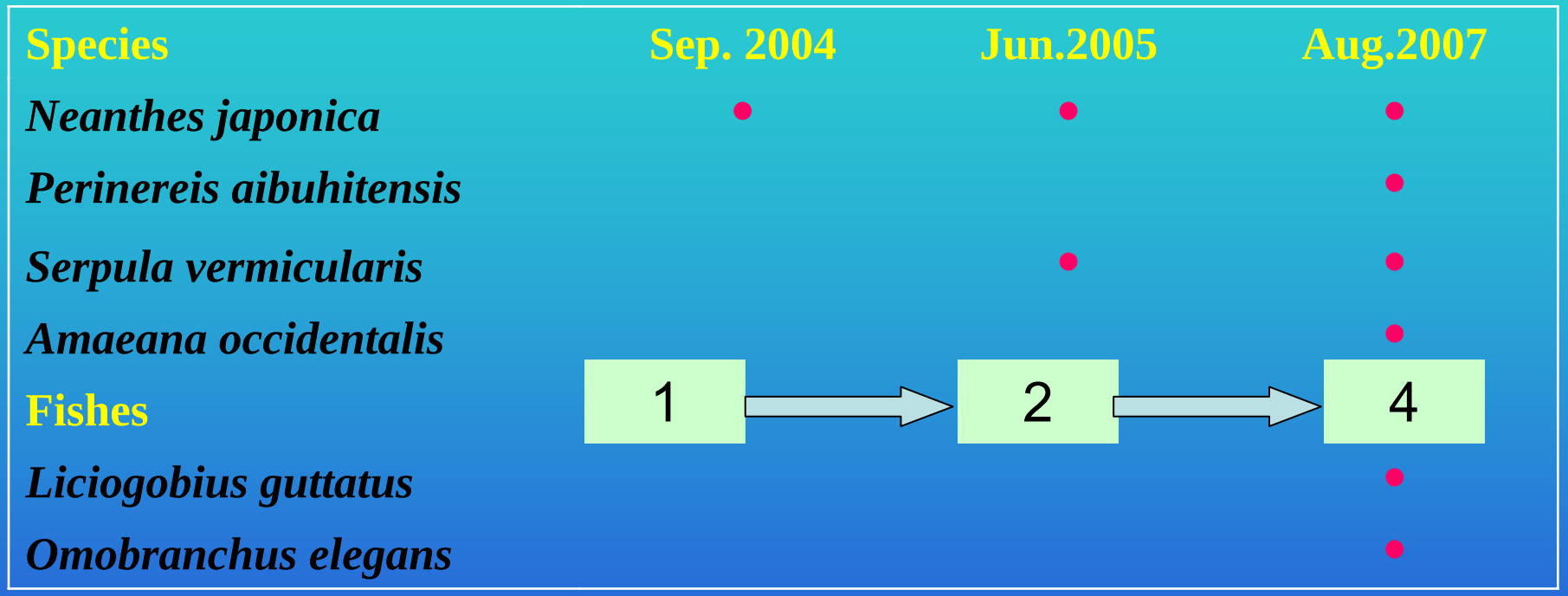
2 → 9 → 12

mollusks (11)

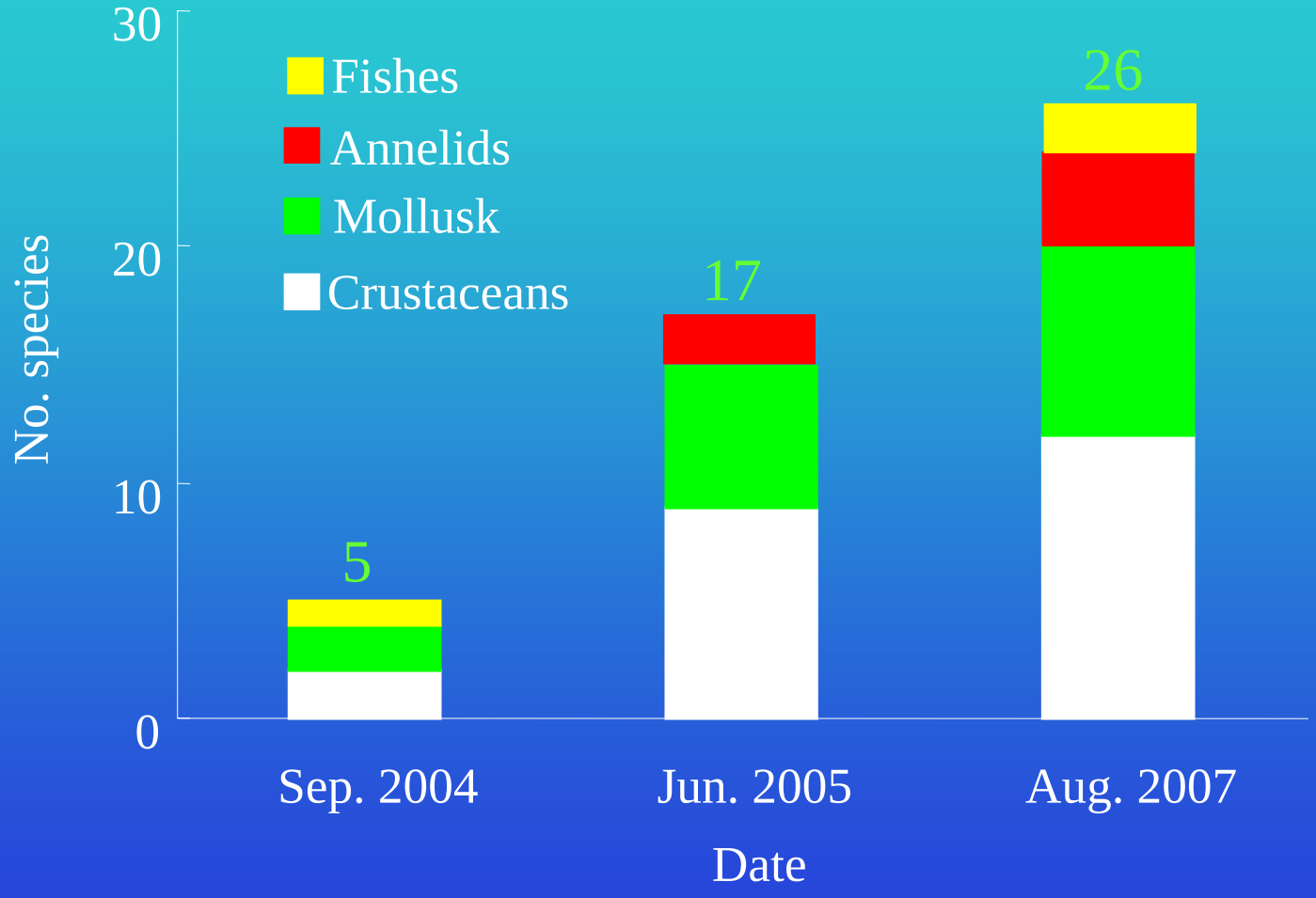
Species	Sep. 2004	Jun.2005	Aug.2007
Barbatia bistrigata	●	●	●
Mytilus edulis		●	
Littorina brevicula			●
Littorinopsis intermedia		●	●
Nerita yoldi			●
Nassarius variciferus			●
Thais clavigera			●
Modiolus flavidus	●	●	●
Pyrene bella			●
Trapezium liratum		●	
Nassarius succinctus		●	



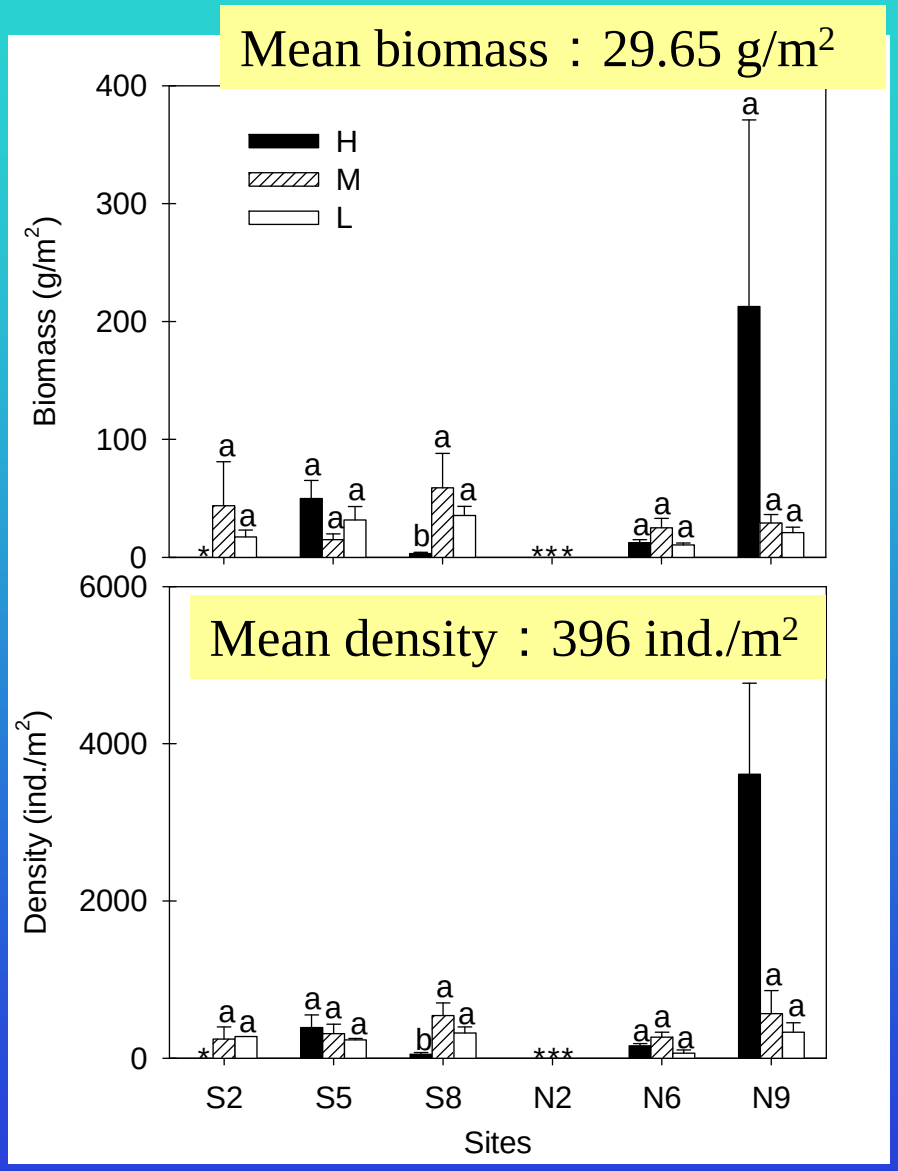
Annelids (4) and Fishes (2)



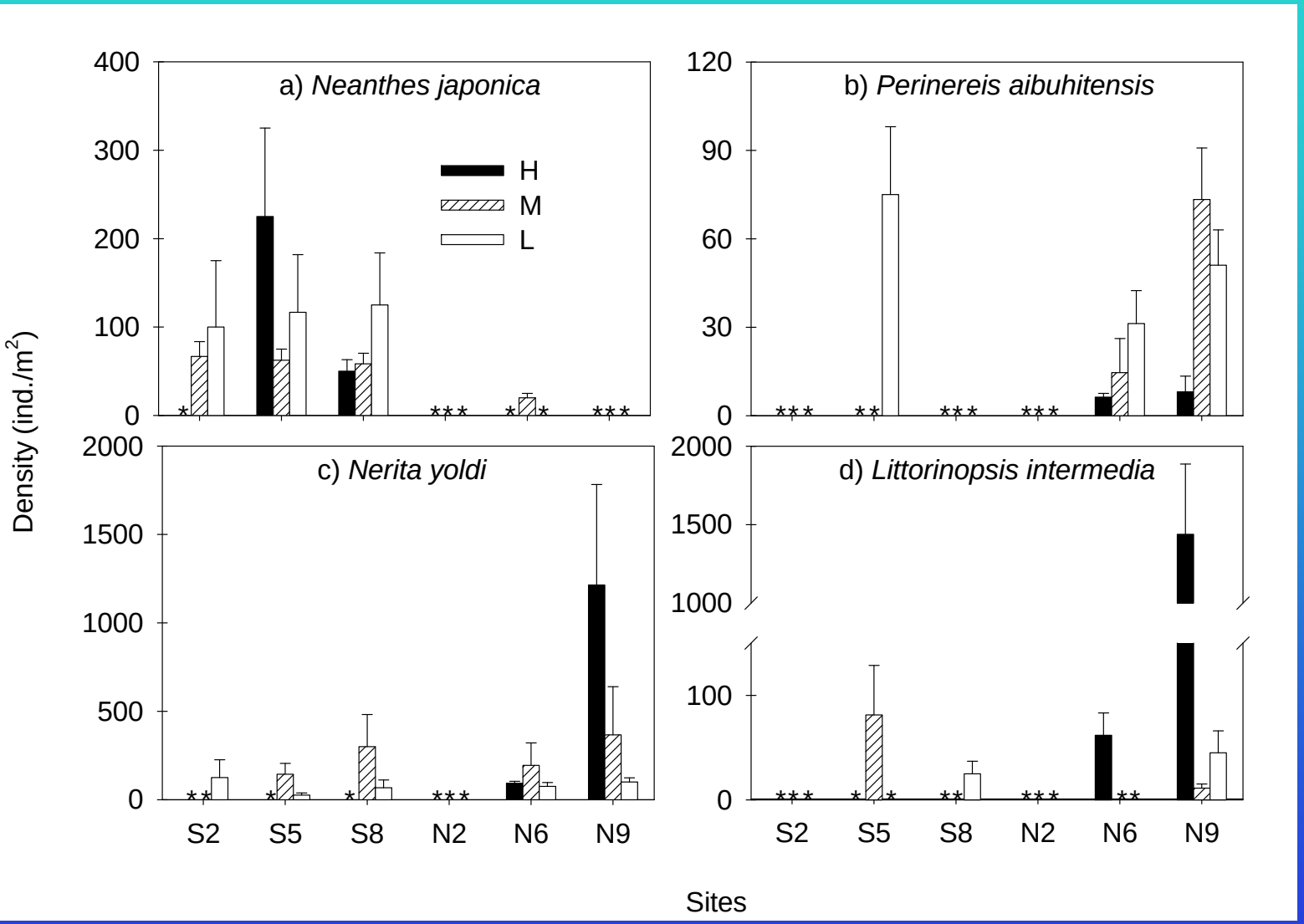
Increase in species richness



The total density and biomass of motile epibenthic macrofauna



Density of four dominant motile epibenthic macrofauna



Nekton utilization of oyster reef

A total of 50 nekton species was recorded on the created oyster reef, including 31 fishes, 9 shrimps and 10 crabs.

Anguilla japonica

Muraenesox cinereus

Coilia mystus

Coilia nasus

Harpodon nehereus

Protosalanx hyalocranius

Saurogobio dumerili

Mylopharyngodon piceus

Cultrichthys erythropterus

Liza haematocheila

Mugil cephalus

Liza carinatus

Triaenopogon barbtus

Lateolabrax maculatus

Periophthalmus magnuspinnatus

Synechogobius ommaturus

Coillichthys lucidus

Arius sinensis

Nibea albiflora

Nibea miichthioides

Johnius distinctus

Johnius belengeri

Miichthys miiuy

Triaenopogon barbtus

Tridentiger trigonocephalus

Odontamblyopus rubicundus

Platycephalus indicus

Cynoglossus gracilis

Takifugu niphobles

Takifugu xanthopterus

Takifugu bimaculatus

Shrimps

Macrobrachium nipponense

Palaemon macrodactylus

Palaemon gravieri

Exopalaemon annandalei

Exopalaemon carinicauda

Leptochela gracilis

Alpheus japonicus

Metapenaeus joyneri

Penaeus japonicus

Crabs

Eriocheir sinensis

Eriocheir leptognathus

Helice wuana

Scylla serrata

Sesarma bidens

Charybdis japonica

Charybdis affinis

Portunus trituberculatus

Macrophthalmus dilatatum

Macrophthalmus japonicus


Japanese eel


Spotted sea bass


Catfish


Shokihaze goby


So-iny mullet

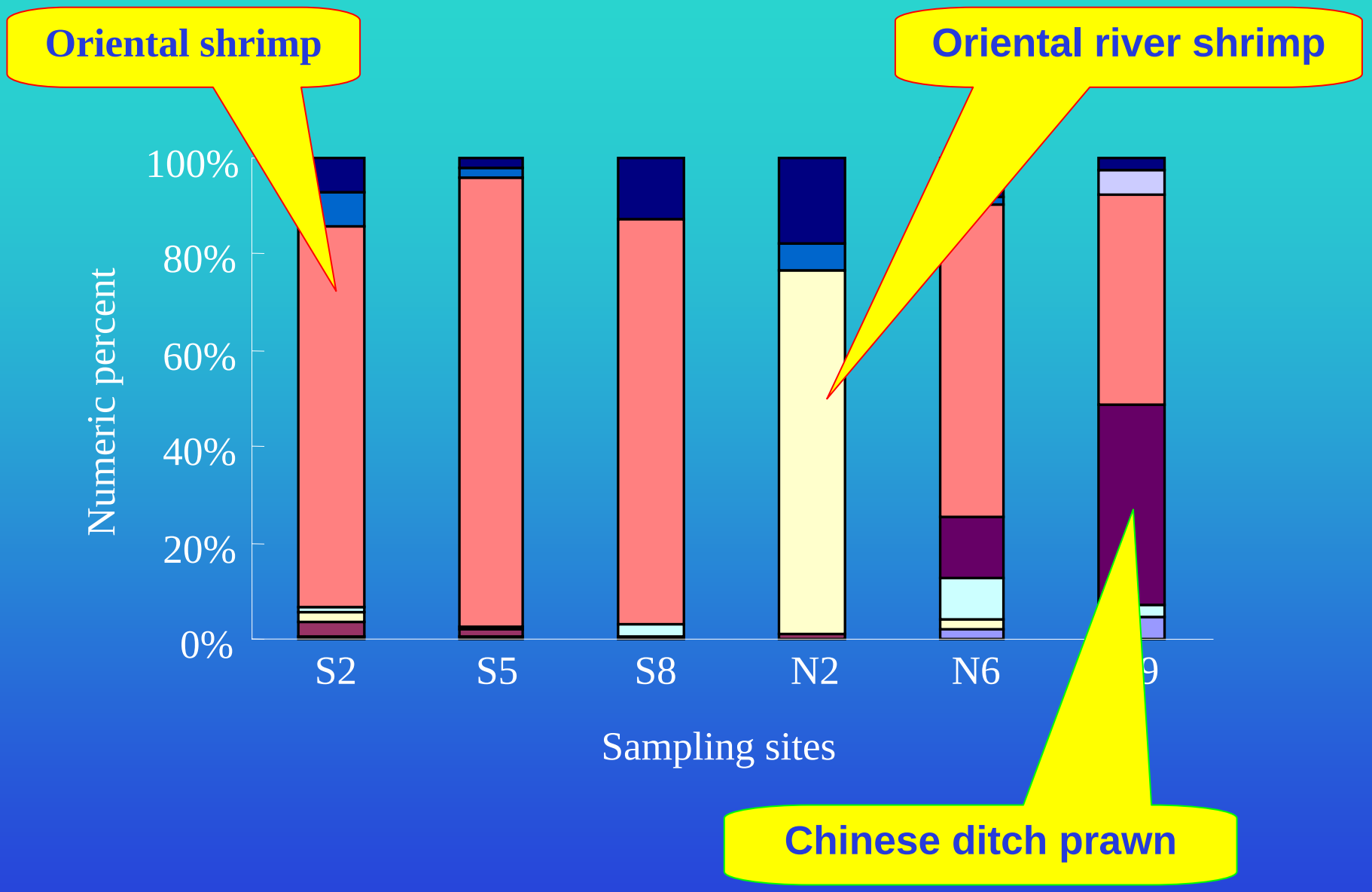

Flathead mullet


Samoan crab

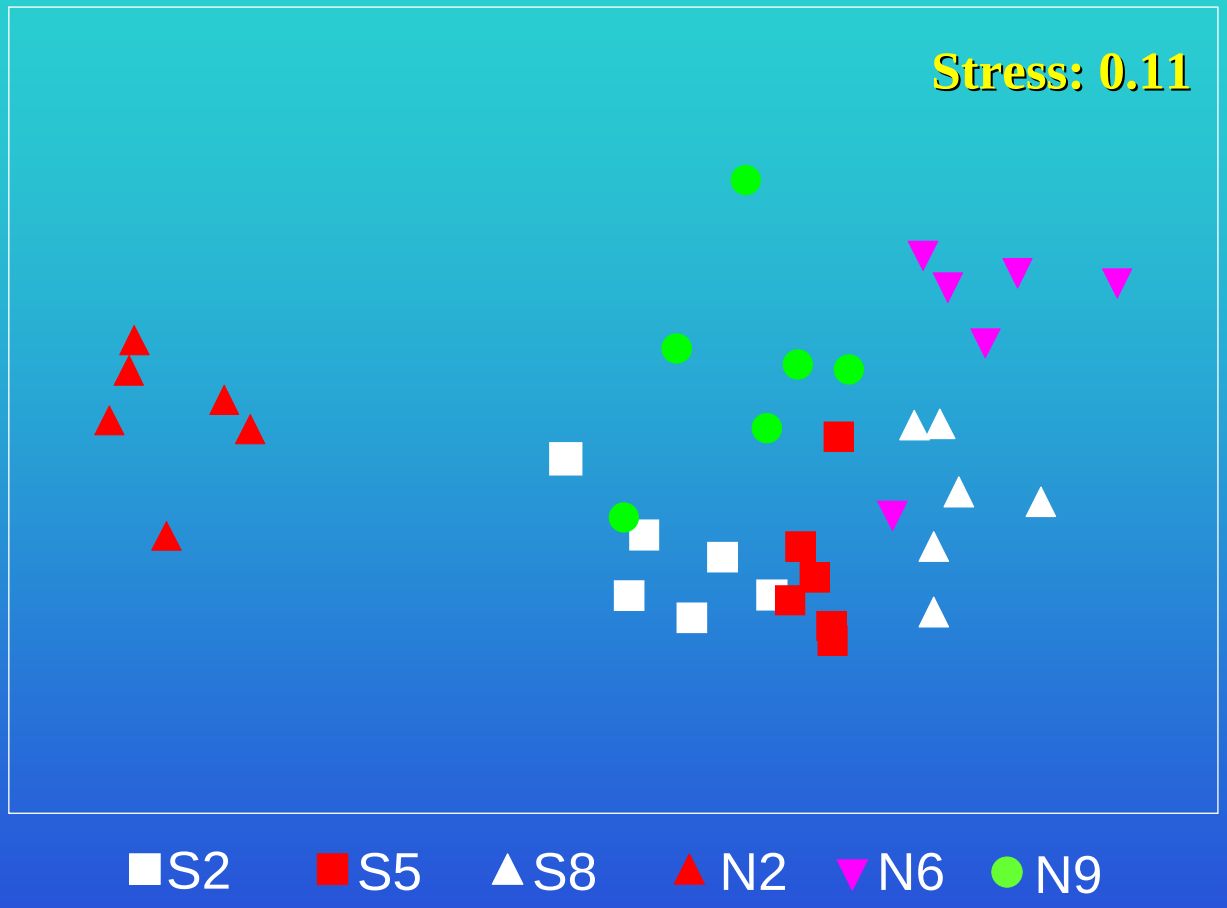

Japenese stone crab


Chinese mitten crab

Community structure of nektons

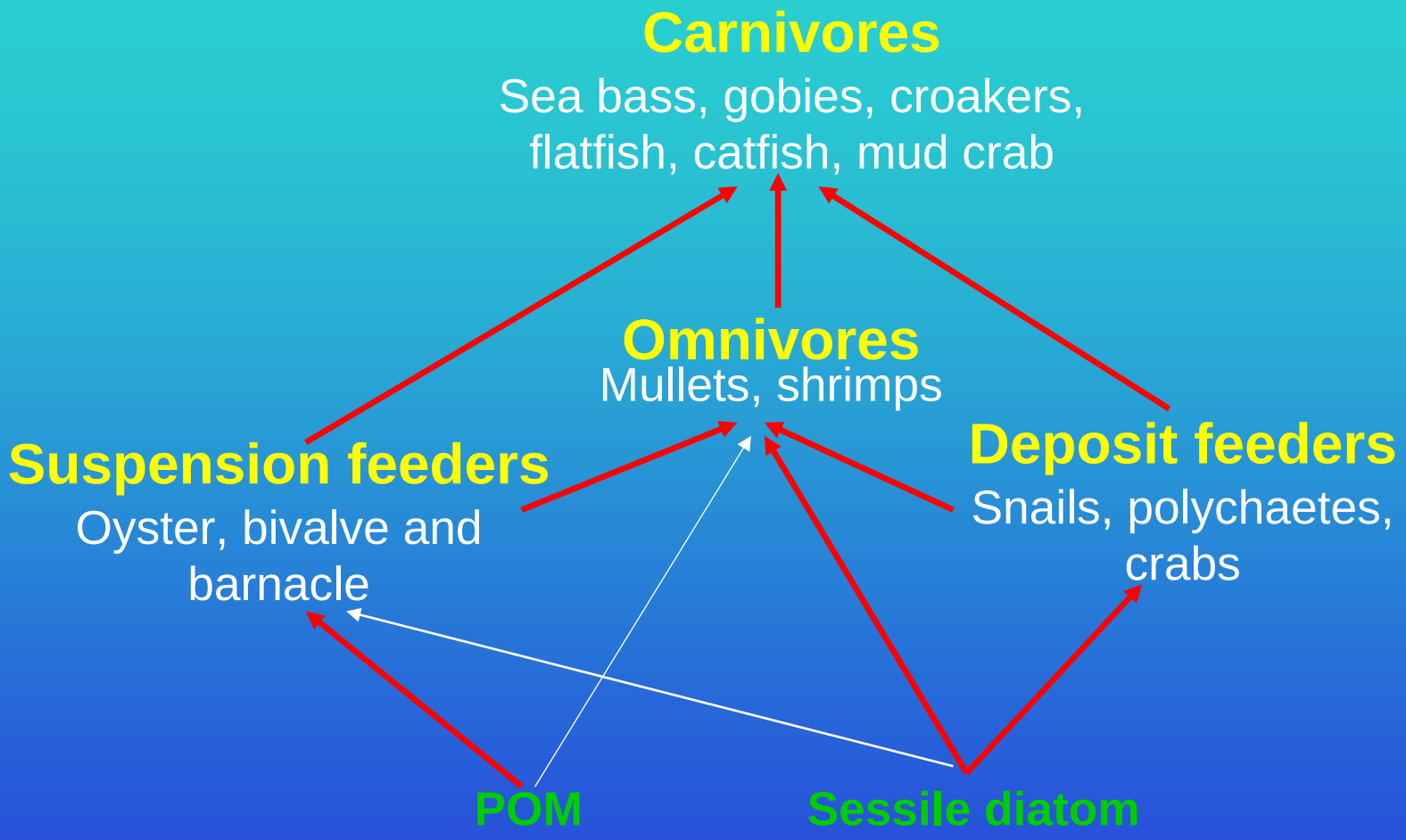


Non-metric multi-dimensional scaling (MDS) ordination



Nekton Utilization of the oyster reef

Simplified food web of the created oyster reef



Conclusion

1. **Since the oyster reef restoration, the oyster *Crassostrea rivularis* population rapidly increased, and reach the apex density (3410 ± 241 ind./m^2) and biomass (3175 ± 532 g/m^2) after 1 yr.**

2. **The created intertidal oyster reef also supported a diverse of motile epibenthic macrofauna (28 species). A total of 50 nekton species were found to utilize the created intertidal oyster reef habitat. The dominant taxonomic groups included gobies, mullet, sea bass, spot, mud crab, grass shrimp and white prawn.**

3. **Since the created intertidal oyster reef supported a diverse of reef community and abundant nekton species, it should be recognized as the critical fish habitat in the Yangtze River estuary, China.**

Take home message

It is more important to rebuild and restore the critical fish habitat than protect the fishery resources itself.

Acknowledgements

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