国家海洋局第一海洋研究所
THE FIRST INSTITUTE OF OCEANOGRAPHY,SOA.

PICES

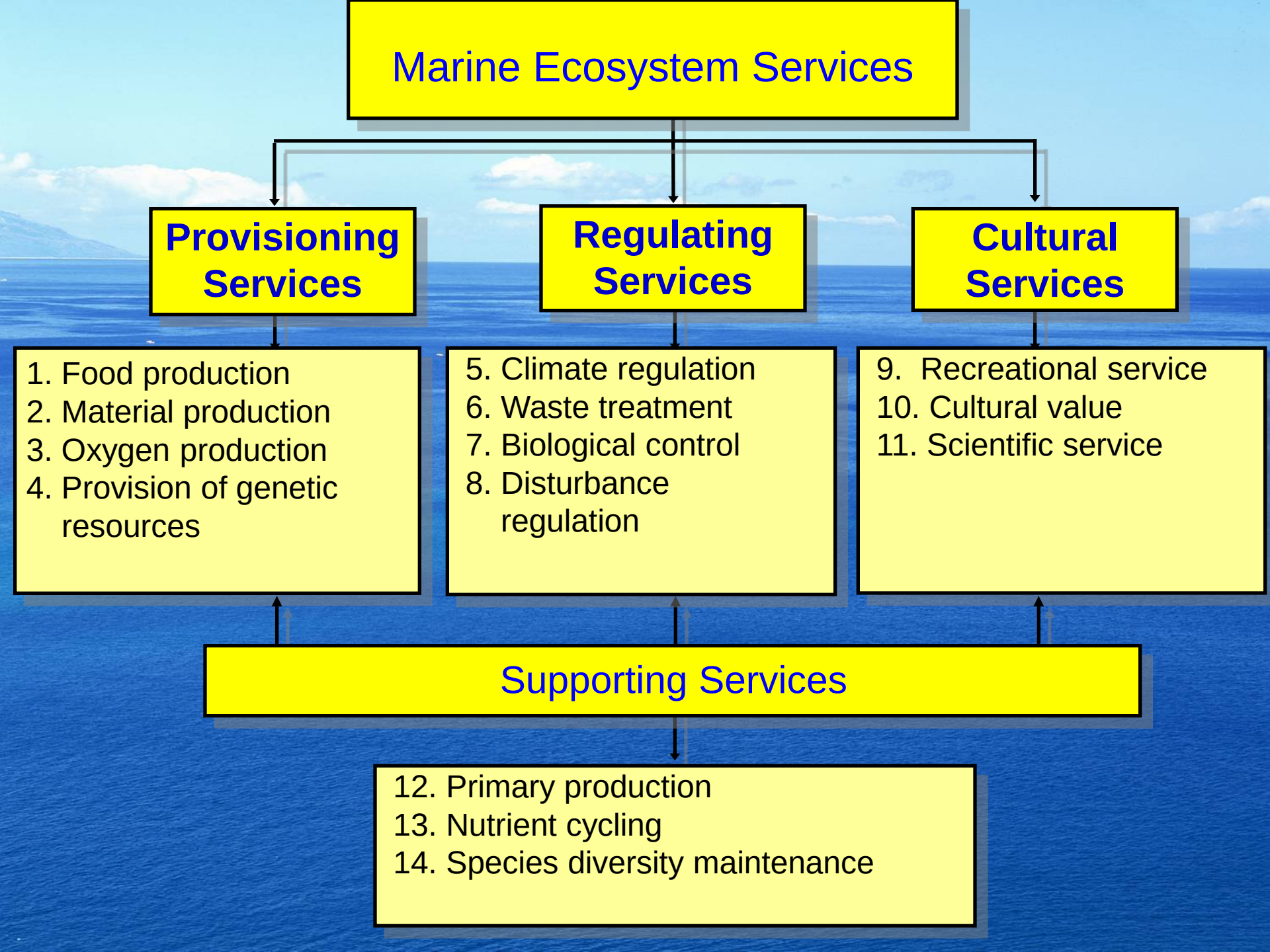
Marine ecological capital in China coastal waters: humman and climate factors

Shang Chen, Tao Xia, Yi Xiao & Zhiquan Chao

First Inst of Oceanography, SOA

1. What is Marine Ecological Capital (MEC) ?

- **Capital: natural capital, man-made capital, human capital and social capital.**
- **MEC is defined as marine ecological resources which have direct or indirect contributions to humans' social and economic production and provide benefits for humans.**
- **MEC value: the standing stock value of marine living resources and the flow value of marine ecosystem services**


Marine Ecosystem Services
Provisioning Services
Regulating Services
Cultural Services
1. Food production
2. Material production
3. Oxygen production
4. Provision of genetic resources
5. Climate regulation
6. Waste treatment
7. Biological control
8. Disturbance regulation
9. Recreational service
10. Cultural value
11. Scientific service
Supporting Services
12. Primary production
13. Nutrient cycling
14. Species diversity maintenance

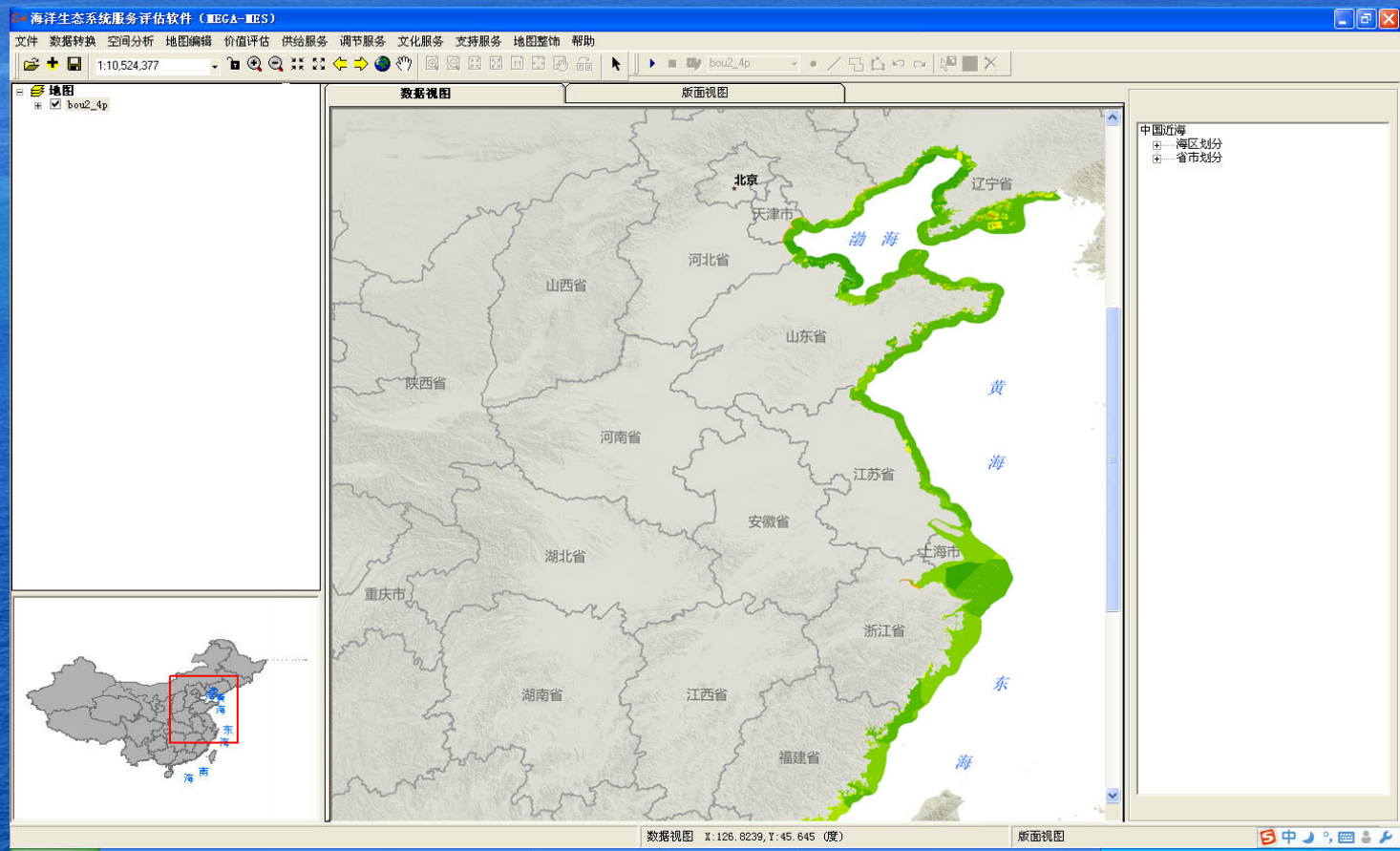
2. Assessment methods

1. How to decide:
   element of MEC value
2. How to select:
   assessment index, calculating equations
3. How to get raw data
4. How to calculate each element and total value
5. How to draft assessment report

Technical Directives for Marine Ecological Capital Assessment

2. Assessment methods:

Arc GIS + MEGA-MES V1.0



3. Ecosystem services in China coastal waters

- National-scale: 100 000 km^2
- Provincial-scale: 10 000 km^2

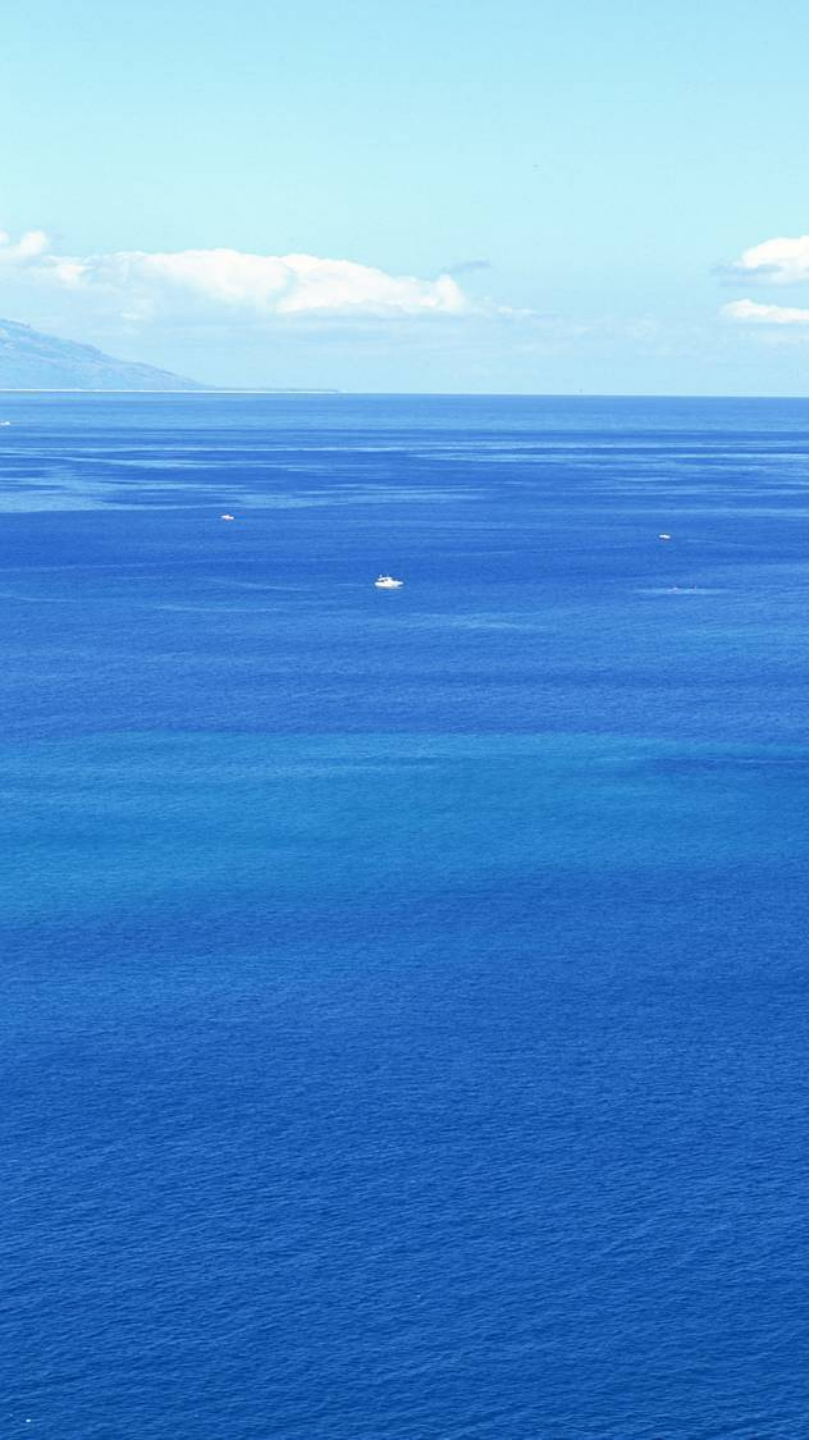
National assessment (2005-2011)

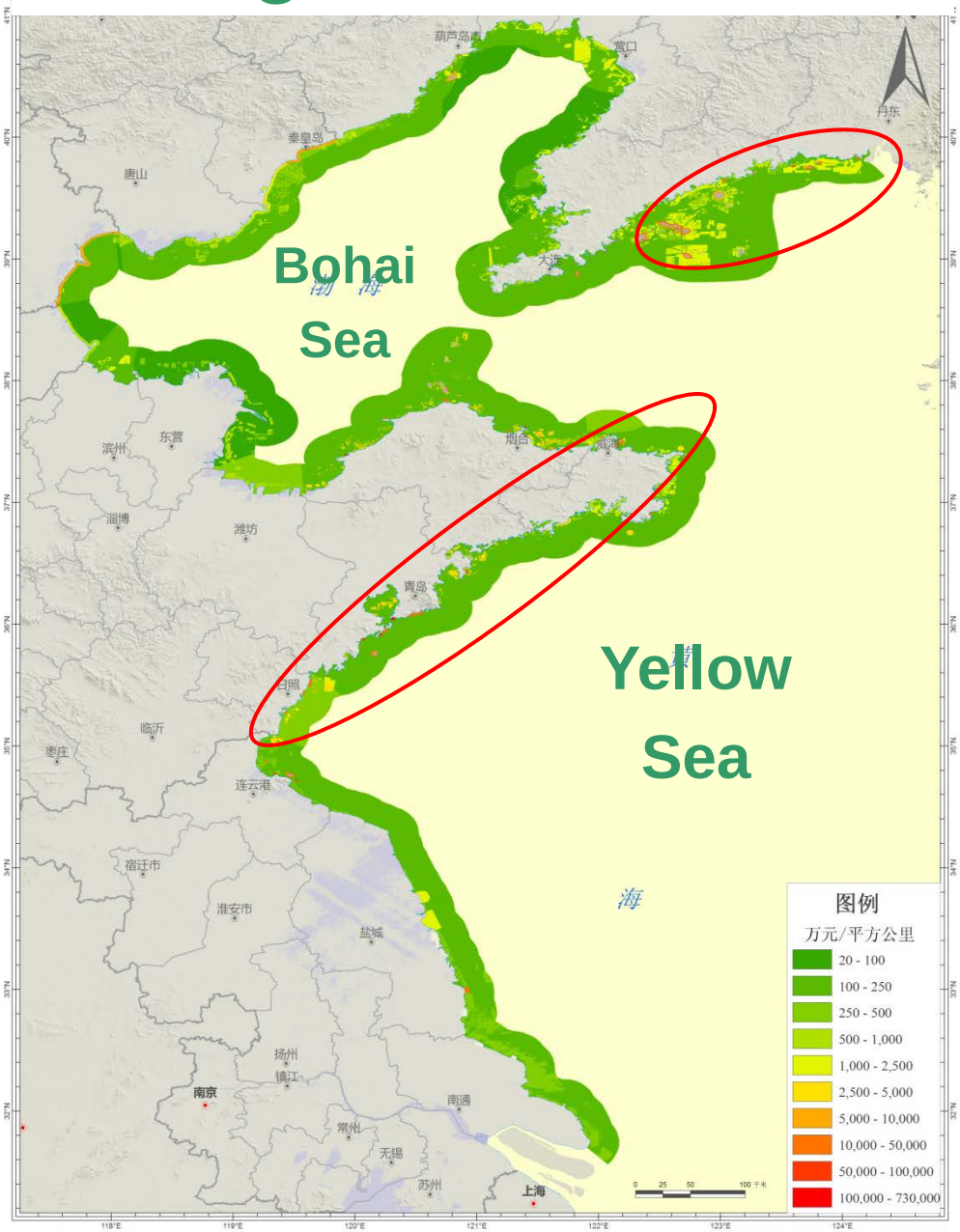
Value of coastal ecosystem services

	Assessed area（km^2）	Total value/（Billion CNY/year）	Average value/ (mil. CNY/ (km2.year)
2008 year			

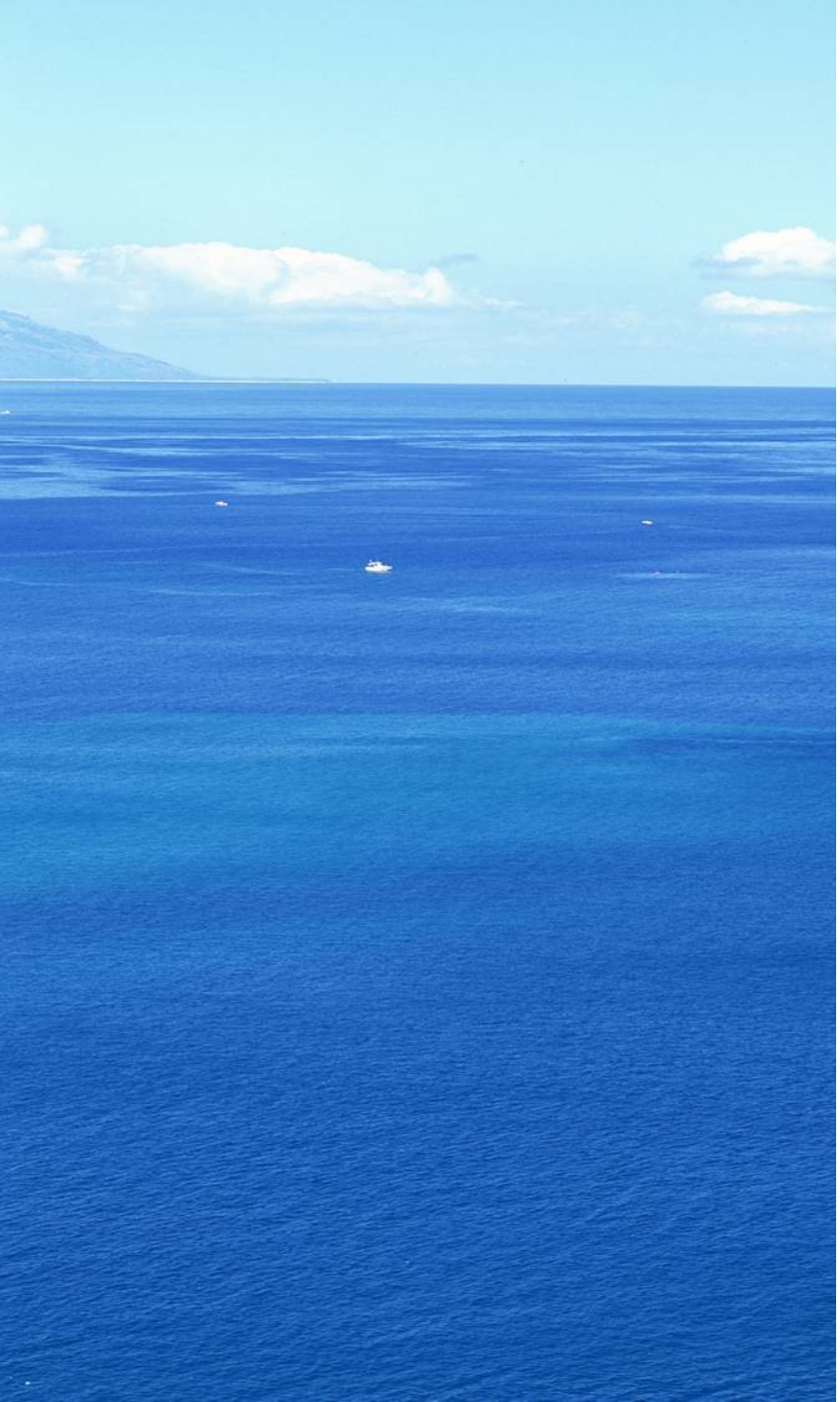
- China’s seas provided 1,034 billion CNY of ecosystem services in 2008, which supported 1,740 billion CNY of marine industrial output
- 1 Dollar of ecological service support 1.7 dollar of marine economic product

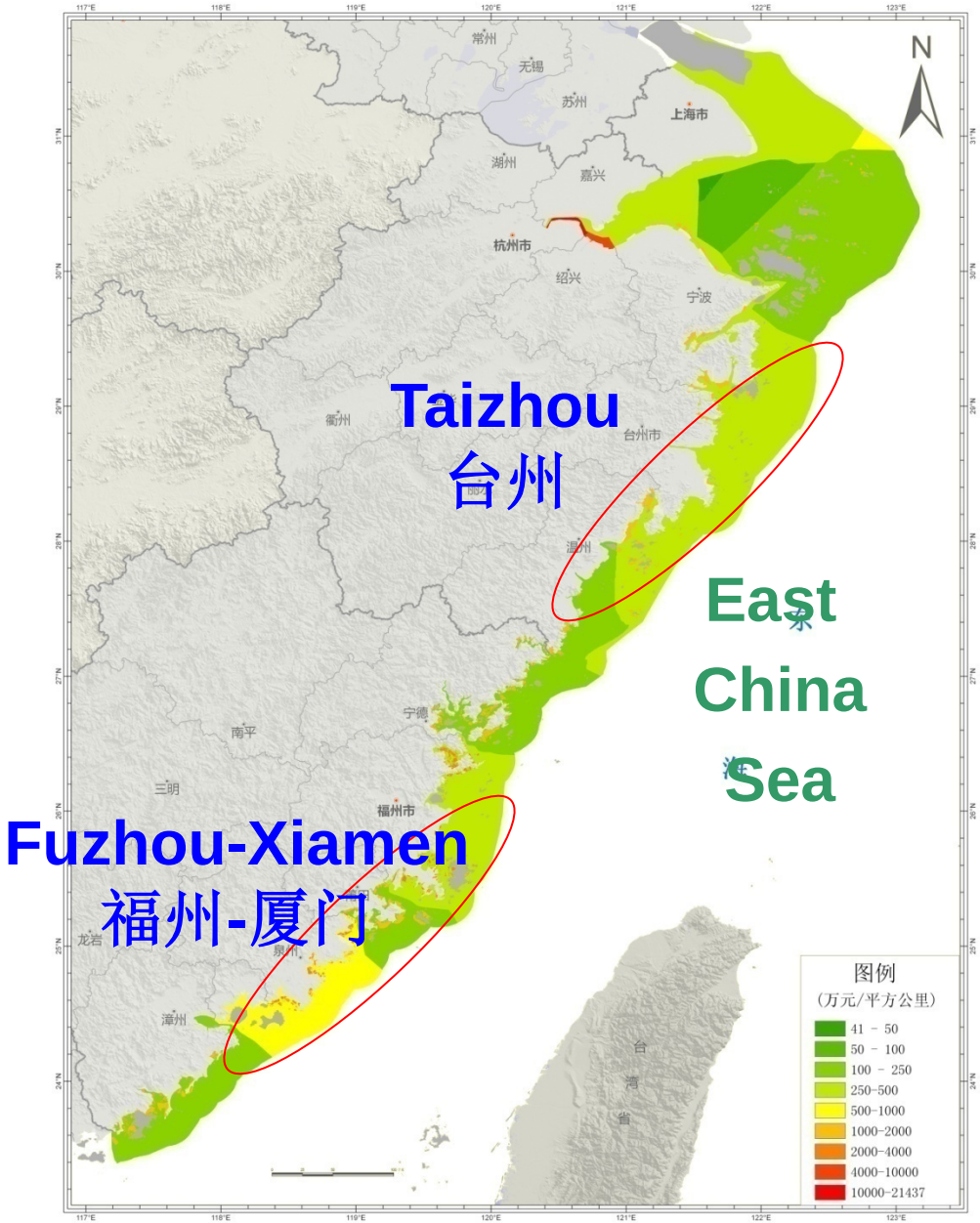
High value zone





High value zone



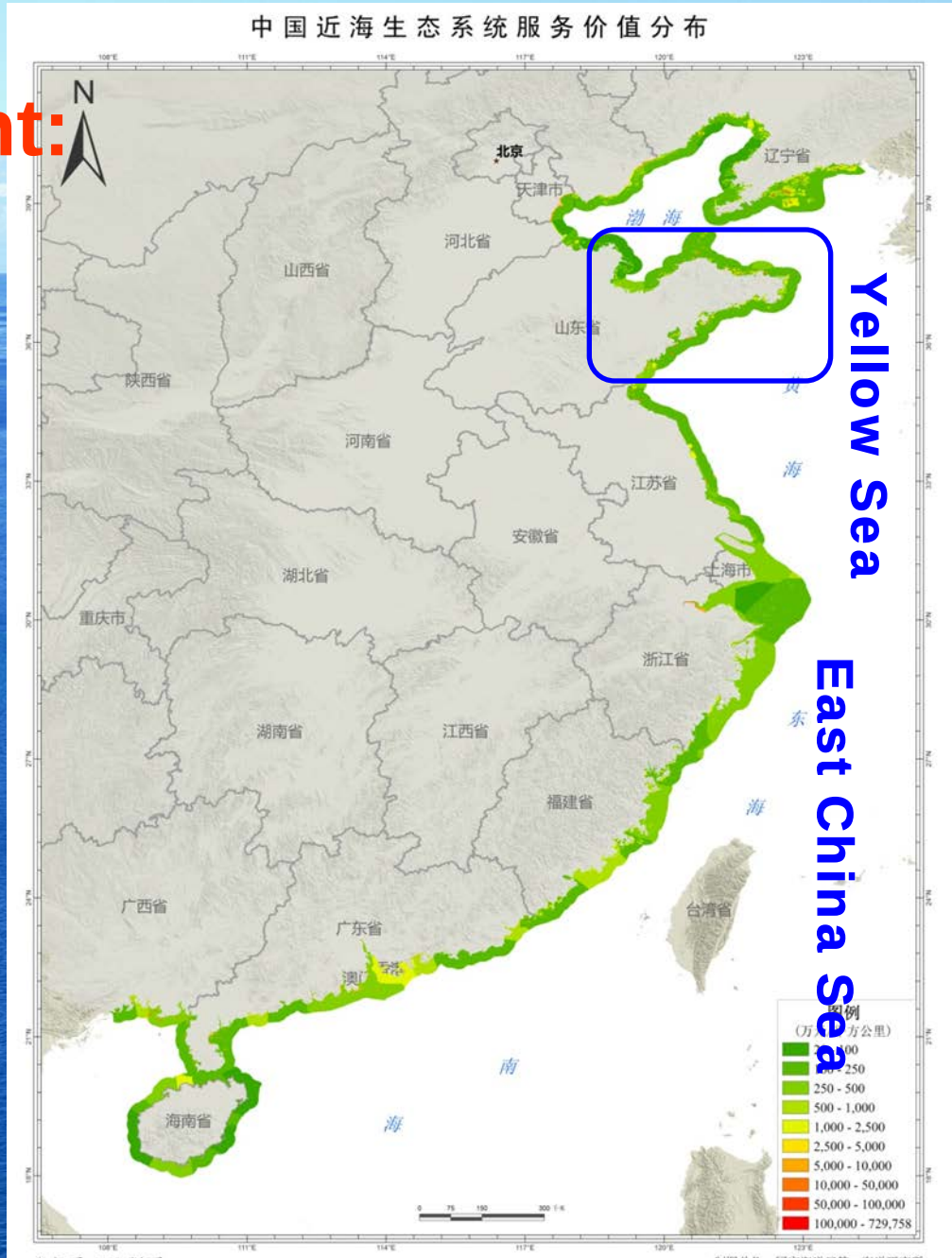


High value zone

Provincial Assessment:

Shandong coastal waters:

31 600 km^2, 2008 year



- **Shandong coastal waters:**

  Standing stock value of living resources: 19.41 billion CNY

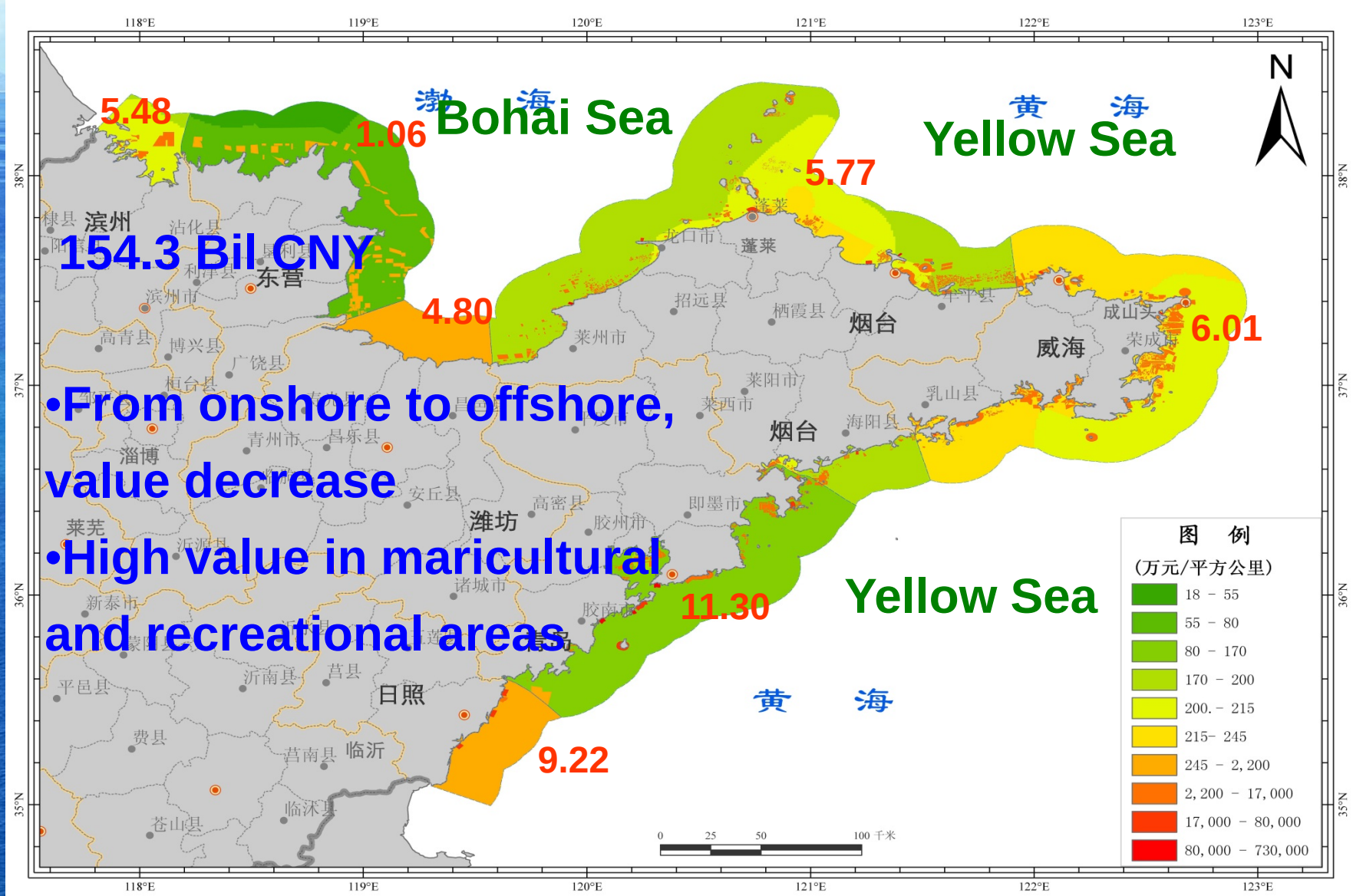
  Value of ecosystem services: 154.3 billion CNY

Each dollar of living resources support 8 dollars of service output !

Spatial distribution of ecosystem service

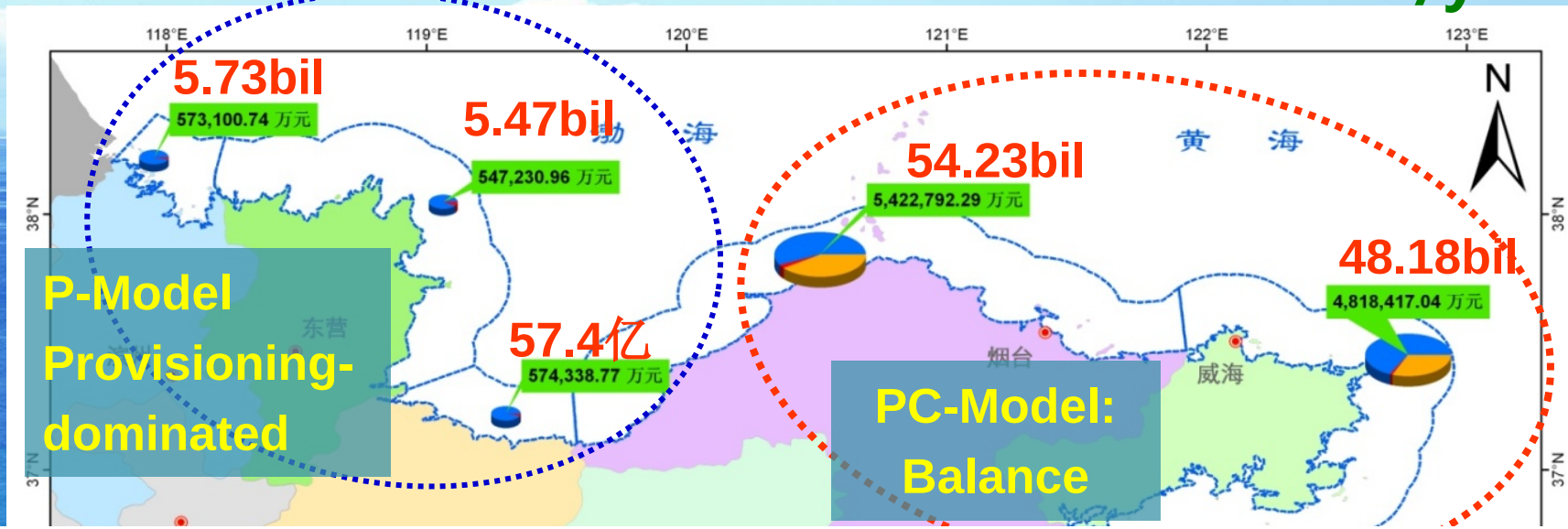
Shandong Province

Million CNY/km².year

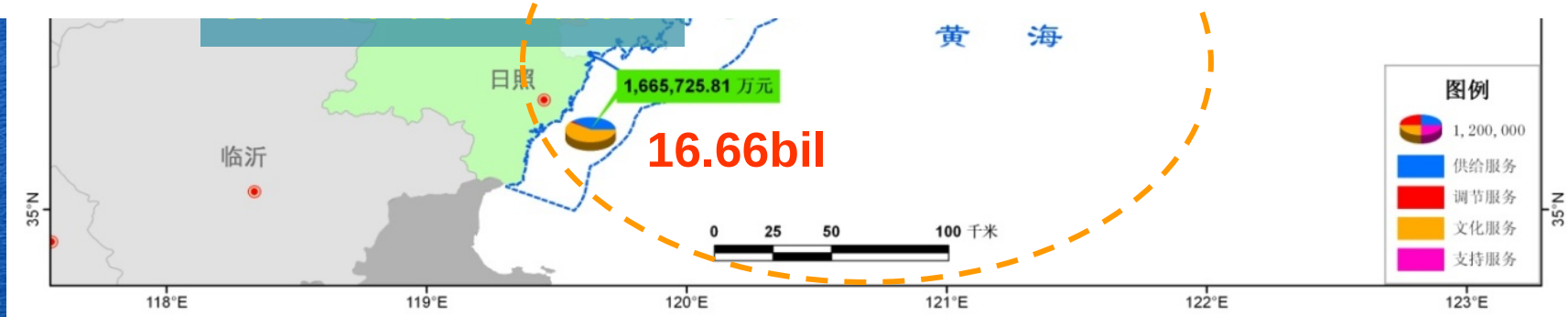


Ecosystem service:
3 kinds of utilization model

Billion CNY/year



- P-Model deeply depends on marine living resources
- C-Model highly depends on marine environmental quality



4. Human and climate factors affecting ecosystem services

Directly use 7 services

Marine Ecosystem Services

Provisioning Services

1. Food production
2. Material production
3. Oxygen production
4. Provision of genetic resources

Regulating Services

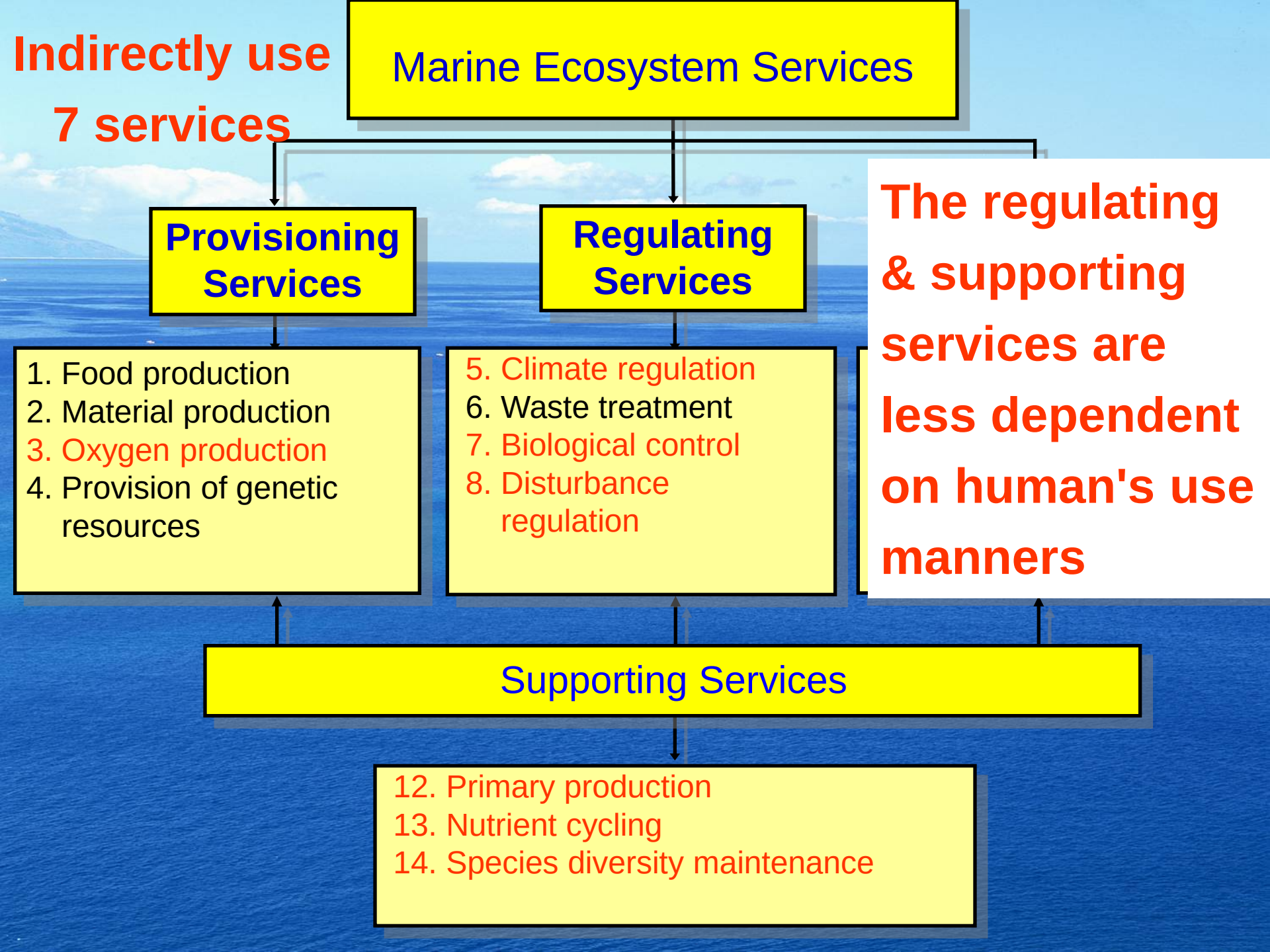
5. Climate regulation
6. Waste treatment
7. Biological control
8. Disturbance regulation

Cultural Services

9. Recreational service
10. Cultural usage
11. Scientific service

The provisioning & cultural services are highly dependent on human's use manners

12. Primary production
13. Nutrient cycling
14. Species diversity maintenance


Indirectly use 7 services
Marine Ecosystem Services
Provisioning Services
Regulating Services
1. Food production
2. Material production
3. Oxygen production
4. Provision of genetic resources
5. Climate regulation
6. Waste treatment
7. Biological control
8. Disturbance regulation
The regulating & supporting services are less dependent on human's use manners
Supporting Services
12. Primary production
13. Nutrient cycling
14. Species diversity maintenance

Sensitive to climate
7 services

Marine Ecosystem Services

Provisioning Services

1. Food production
2. Material production
3. Oxygen production
4. Provision of genetic resources

Regulating Services

5. Climate regulation
6. Waste treatment
7. Biological control
8. Disturbance regulation

Cultural Services

9. Recreational service
10. Cultural value
11. Scientific service

The provisioning and regulating services are more sensitive to climate change in sea

12. Primary production
13. Nutrient cycling
14. Species diversity maintenance

5. Take-home messages

- Average value of ecosystem services in China coastal waters:0.9 million USD/km^2.yr.
- Value of ecosystem services shows decreasing trend from onshore to offshore
- Provisioning and cultural services are more depedent on human's use manners than the regulating and supporting services
- Provisioning and regulating services are more sensitive to climate change in sea than the cultural and supporting services

Acknowledgement

SOA 908 program(2005-2010)

Ocean & Fisheries Dept of Shandong Province

Ocean & Fisheries Dept of Fujian Province

NSFC of China