

# Sustaining Fisheries and Mariculture for A Blue Economy in YSLME

Expert Group Meeting on Green Economy for Sustainable  
Development Goals: National Implementation of Low Carbon  
Development  
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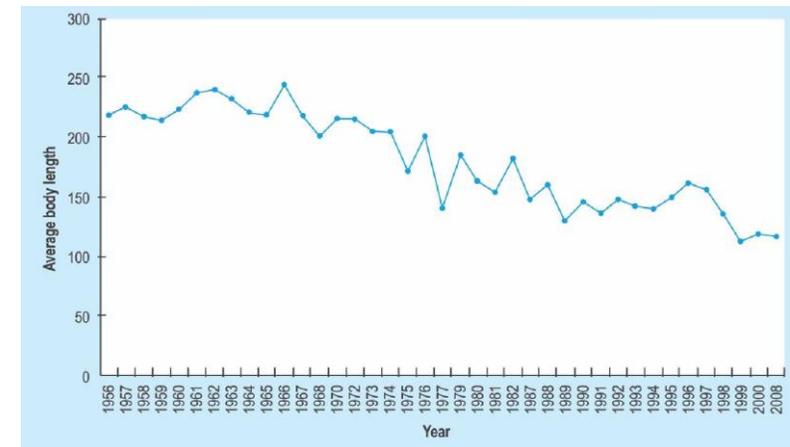
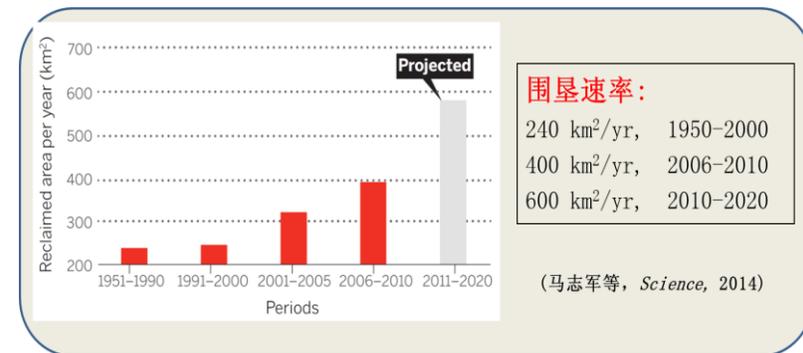
# Yellow Sea LME

- ❖ 400,000 km<sup>2</sup>
- ❖ Bordered by PR China, RO Korea, and DPR Korea
- ❖ Tens of millions of people in five large cities in three countries
- ❖ Vulnerable: 7 years flushing time
- ❖ Highly productive ecosystem, providing 1 m tons of capture fisheries and 14 m mariculture per year

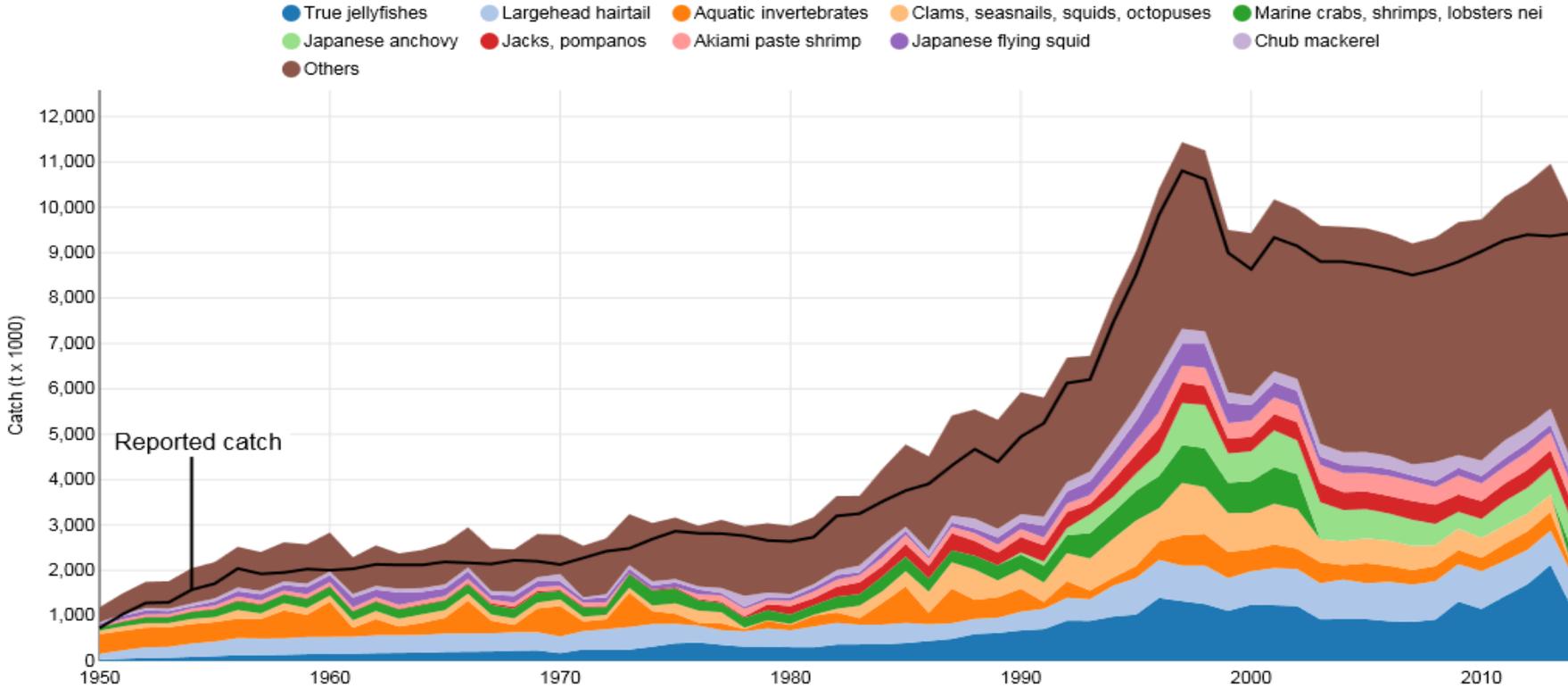


# Transboundary issues

- Pollution and contaminants;
  - ➡ Eutrophication
  - ➡ Harmful algae blooms (HABs)
- Fishing efforts exceeding ecosystem carrying capacity
- Unsustainable mariculture
- Habitat loss and degradation
- Jellyfish blooms
- Change in ecosystem structure
- Climate change-related issues

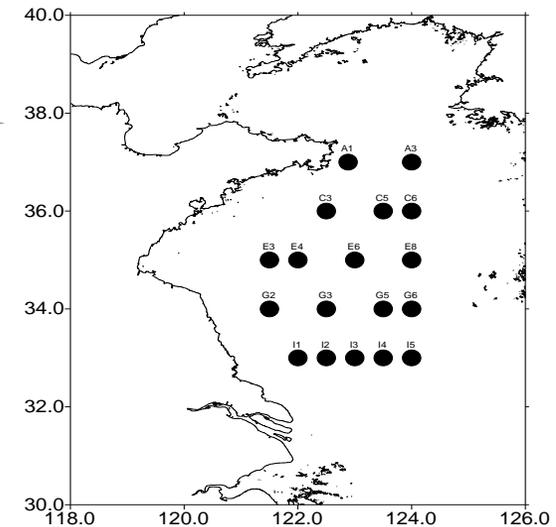
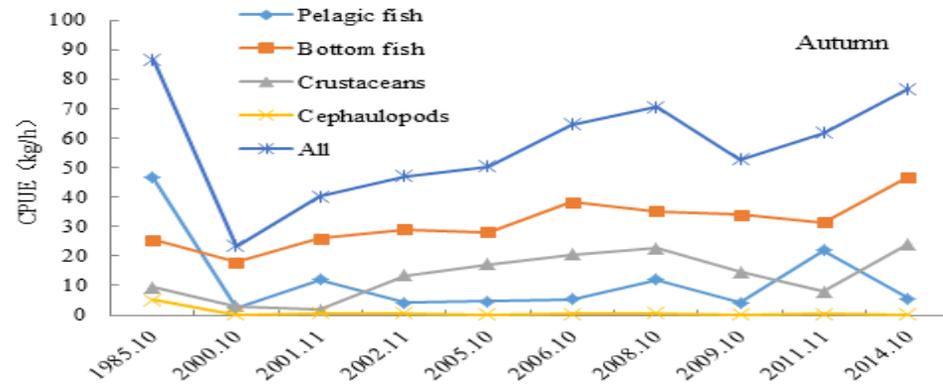
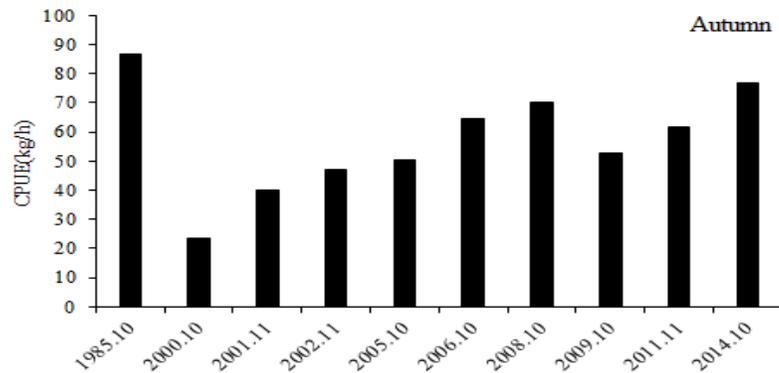
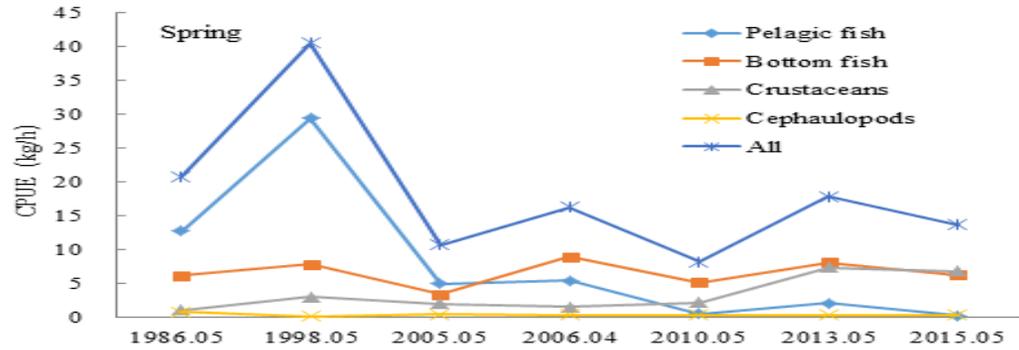
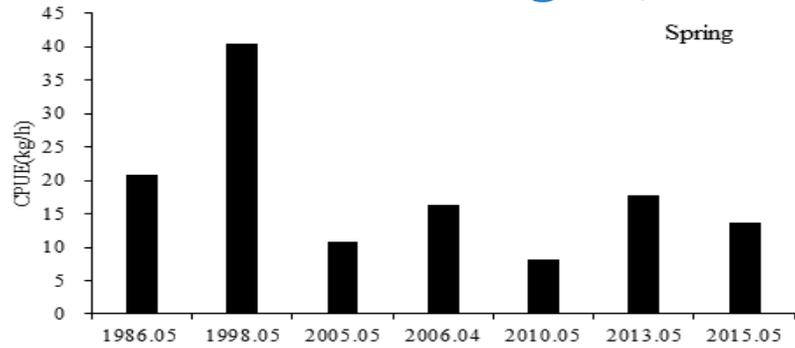


# Catches in the Yellow Sea increased from 120,000 tonnes in 1950s to more than 1.1 million tonnes around 2015



Annual catches (tonnes) reported from 1950 to 2015 in the YS (SAU, 2017)

# The total biomass of fishery species fluctuated in last 30 years, and increased slightly last 10 years; trophic level appears stable

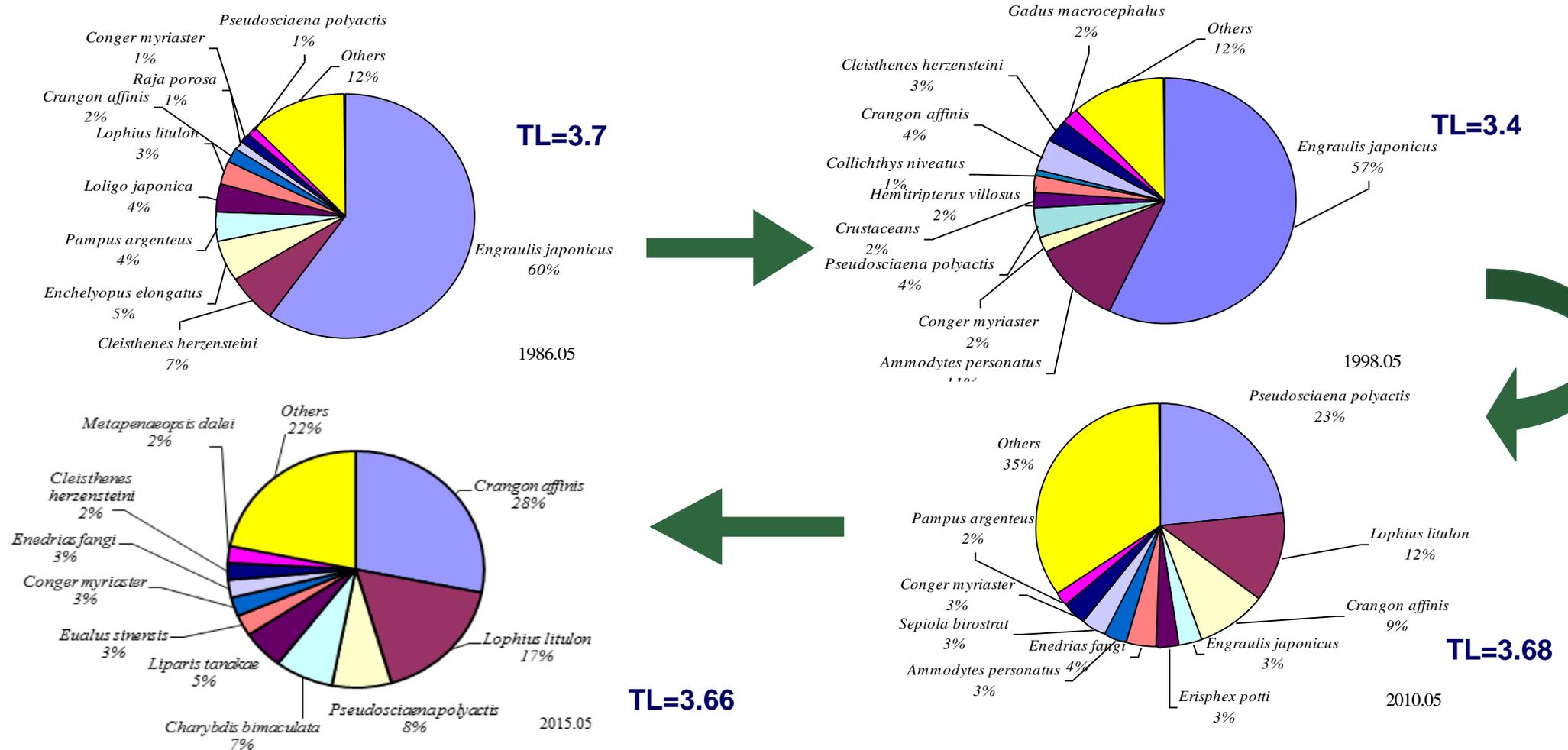


(Survey data by R/V BeiDou of YSFRI)



(SAU, 2017)

# There are changes in biomass yields of dominant species



(Tang, Environmental Development, 2016)

- The commercially important long-lived, high trophic level, piscivorous bottom fish have been replaced by the low-valued shorted-lived, low trophic level, planktivorous pelagic fish.

# Responses

- 25-30% reduction in fishing efforts
- Rebuilding marine living resources
- Improving mariculture techniques to reduce environmental stress

- Maintenance and improvement of current populations and distributions of genetic diversity of living organisms including endangered and endemic species
- Habitat maintenance according to 2007 standards
- reduction of risks of introduced species

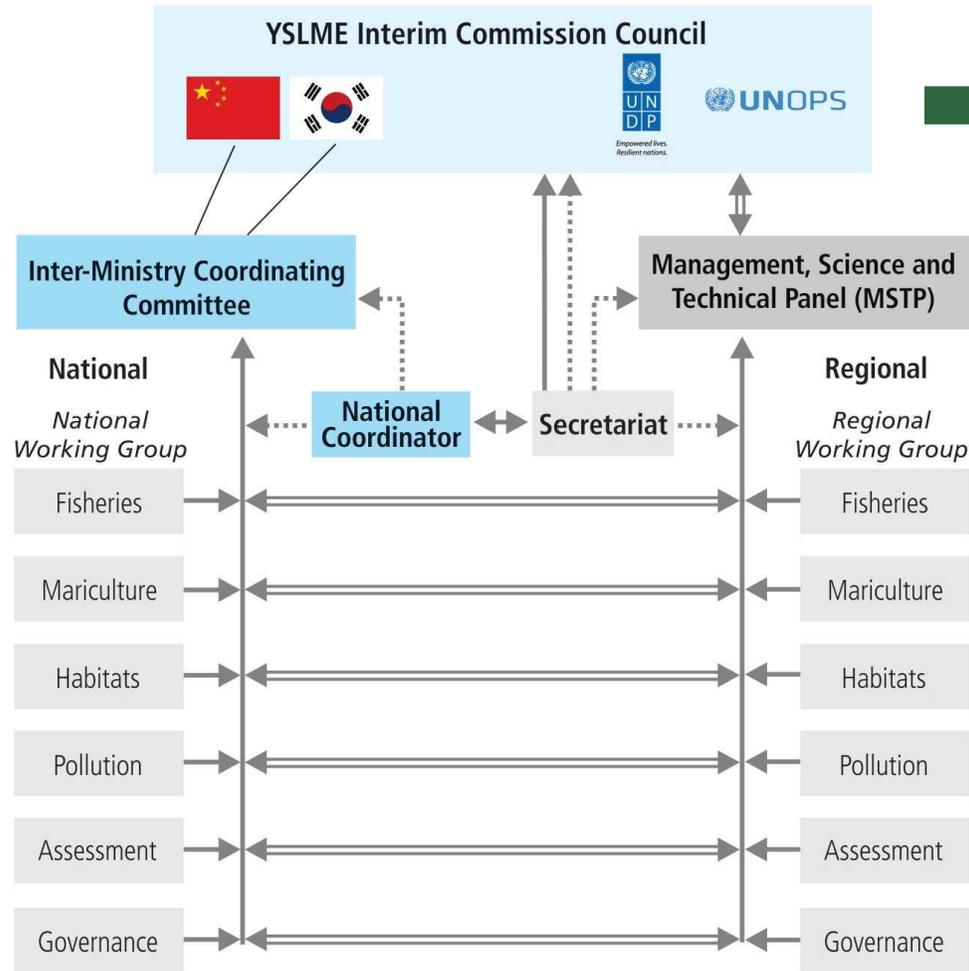
- Meeting international requirements on contaminants

## 11 YSLME SAP Targets

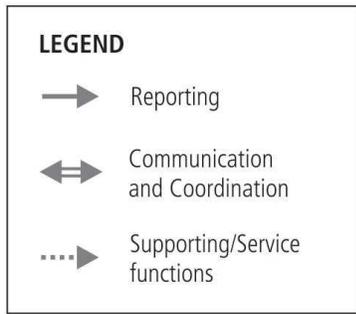
- Reduction of total loading of nutrients from 2006 level
- Reduced standing stock of marine litter
- Reducing contaminants in bathing beaches and other marine recreational waters

- Better understanding and prediction of ecosystem changes for adaptive management

# Yellow Sea Partnership



**YSLME  
Commission**



# Conservation of fish spawning, nursery and feeding grounds



## PPAs

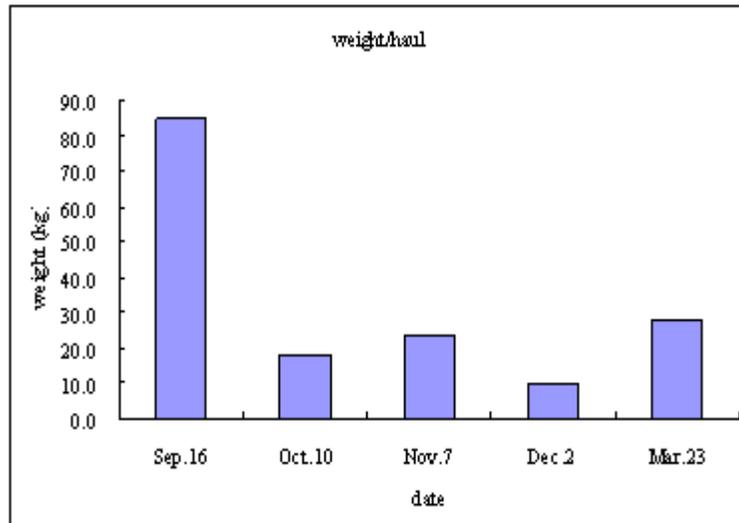
- |                                  |                                          |
|----------------------------------|------------------------------------------|
| 1. Zhoushan Islands              | 13. Changshandao                         |
| 2. Yangtze River Estuary Wetland | 14. Yalu River Estuary                   |
| 3. Southern Jiangsu Coast        | 15. Baengnyeong Island/Yeonpyeong Island |
| 4. Northern Jiangsu Coast        | 16. Gyeonggi Bay                         |
| 5. Haizhou Bay                   | 17. Cheonsu Bay                          |
| 6. Qingshi                       | 18. Geum/Mangyeong/Dongjin River Estuary |
| 7. Yanwei                        | 19. Heuksan Island                       |
| 8. Yellow River/Laizhou Bay      | 20. Yeongsan River Estuary               |
| 9. Bo Hai                        | 21. Boseong/Yeoja Bay                    |
| 10. Qinhuangdao                  | 22. Jeju Island                          |
| 11. Liaohe River Estuary         | 23. Yellow Sea Cold Water Mass           |
| 12. Haiyangdao/Changxing         |                                          |



# Expand closed seasons and areas; reduce fishing efforts and total catch

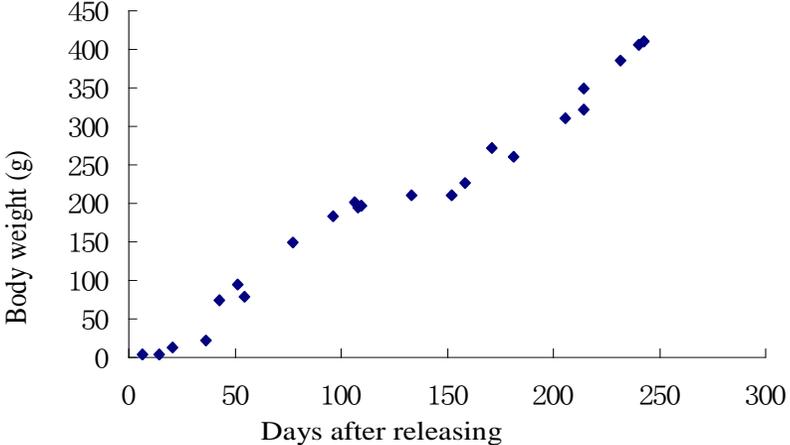
## Country commitments and progress:

- From 2017 on, Yellow Sea is closed to fishing for 135 days (May 1 to Sept. 16) (PR China);
- From 2015 to 2020, 20,000 fishing vessels with a total capacity of 1.5 million kW will be reduced through implementation of buy-back scheme (PR China).
- From 2015 to 2020, nearly 15% of total catch in China EEZ is to be reduced (PR China).
- From 1994-2013, fishing vessels have been reduced to 18,560 with costs of 1.6 trillion KRW (RO Korea)
- From 1990 to 2007, capture fishery in RO Korea decreased by 27% (SOC report, 2017)



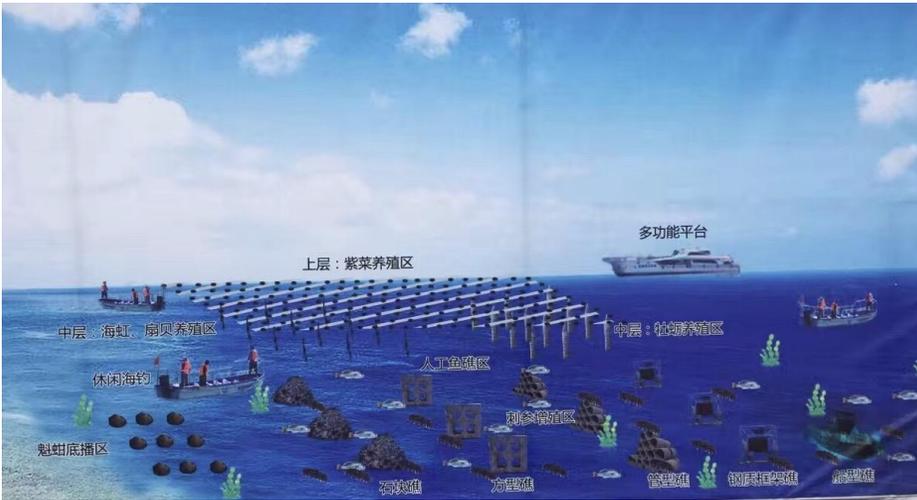
During YSLME Phase II, after fishing closure there is increase in capture immediately after the lift of closure, but sharp decrease one month after. The harvest species changed from dominant fish species to crustaceans and cephalopods.

# Stock enhancement and marine ranching



Release results before 2007: 10% survival rate after 9 months (YSLME)

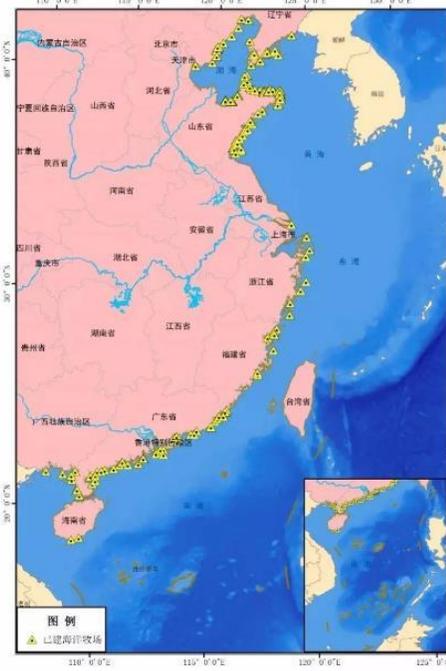
Illustration of marine ranching in FuHan Co. Ltd, Shandong, PR China



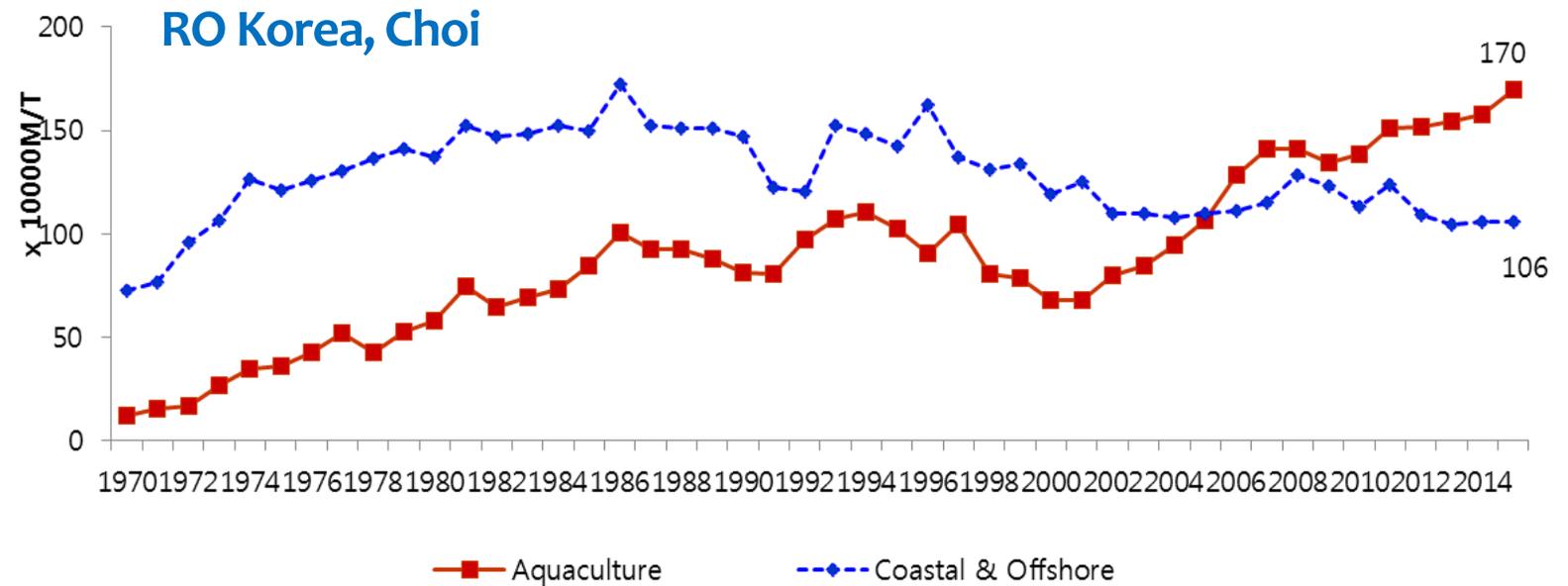
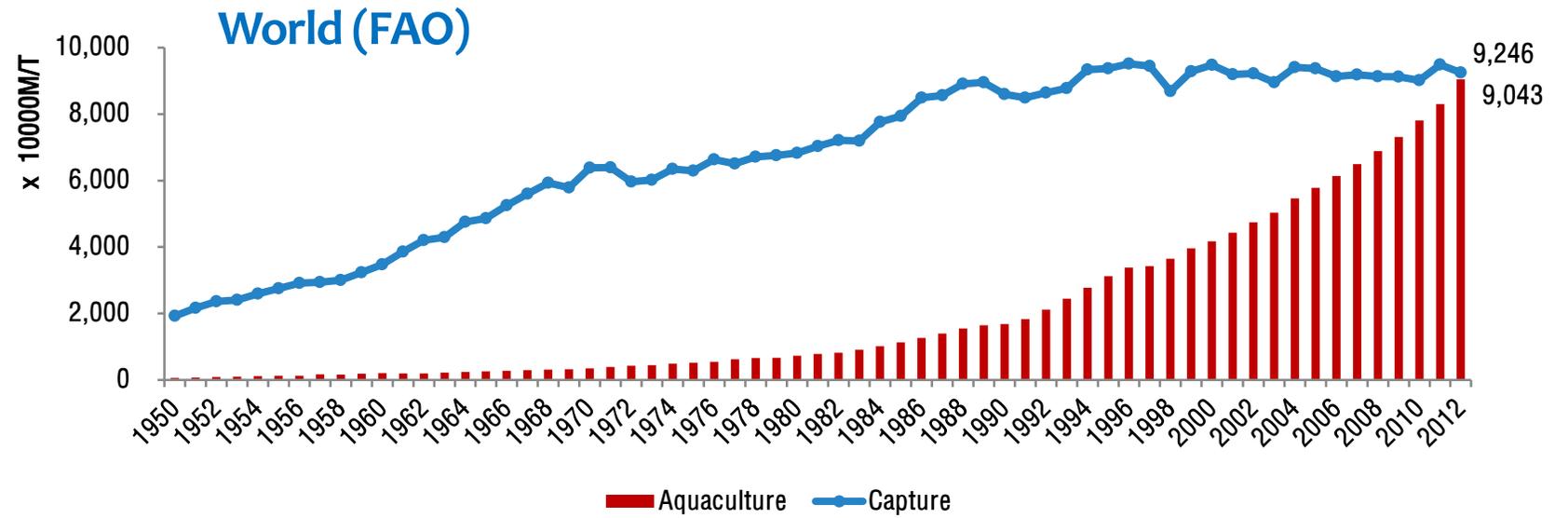
A typical release campaign in China



62 national marine ranching demonstration sites established in PR China, 36 in RO Korea

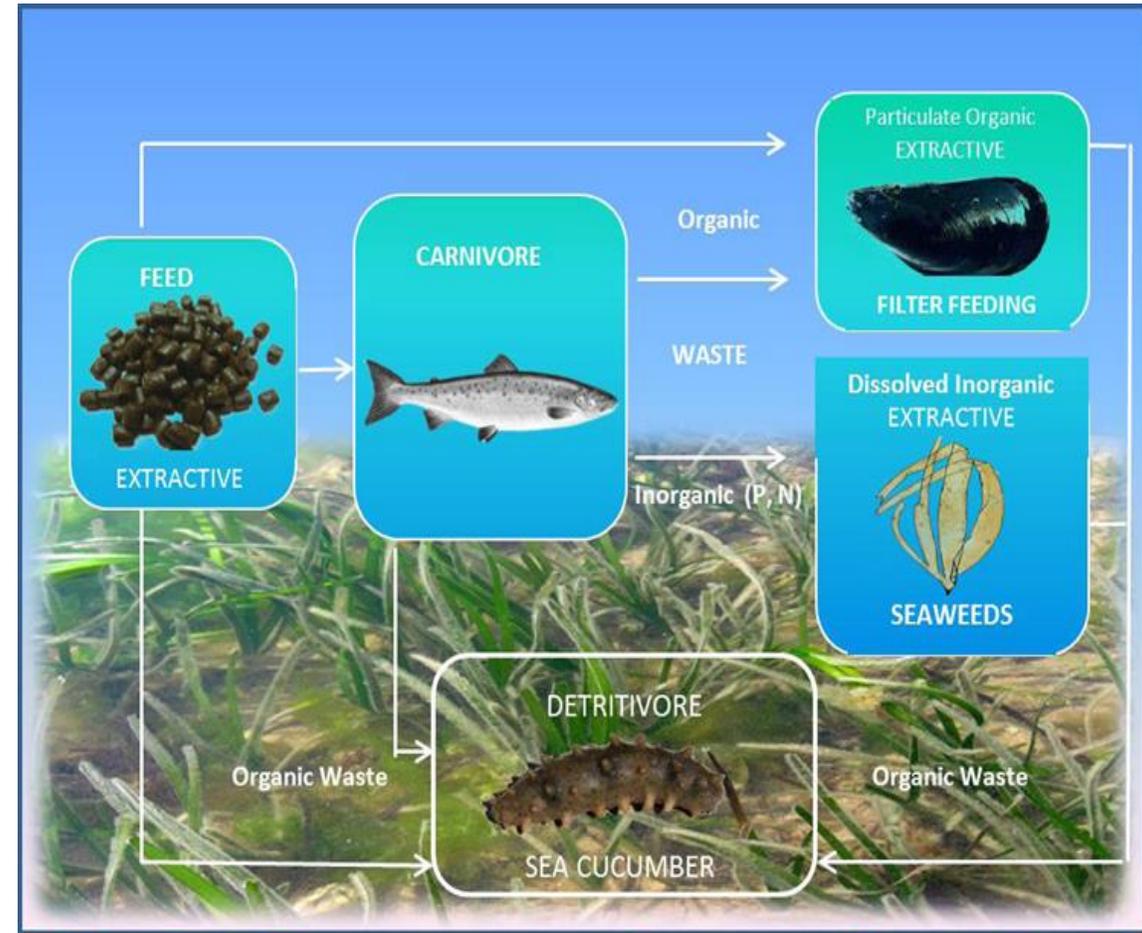


# Aquaculture vs capture fishery



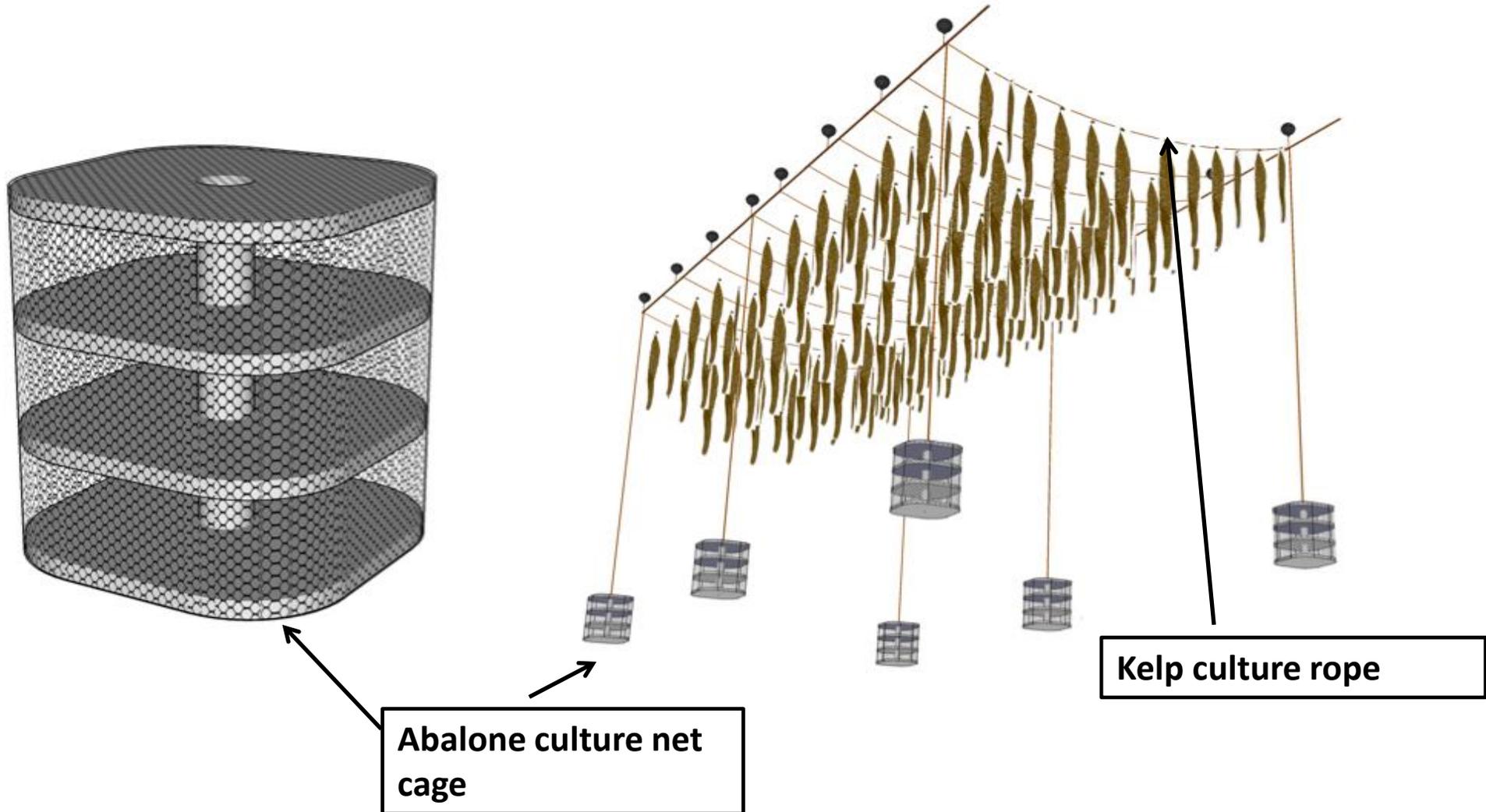
# Integrated Multitrophic Aquaculture to address multi-stressors in Mariculture in Sungo Bay, PR China

- Highly energy efficient
- High production per unit area
- Increases the social acceptability of culturing systems
- optimizing the carrying capacity of coastal embayments
- improving water quality through intake of nutrients and phosphorus
- increasing protein yields
- through carbon capture, contributing to mitigation of the effects of climate change

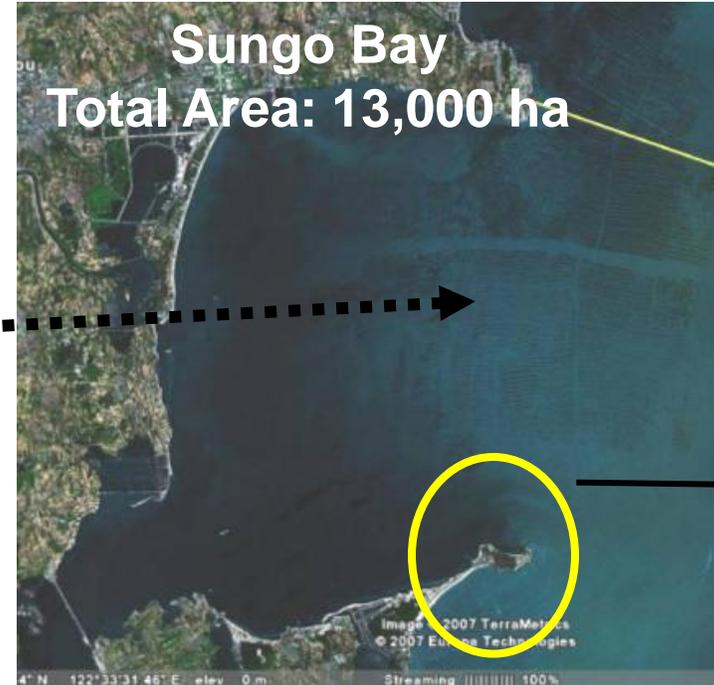


(IMTA structure from Fang et al. 2009)

## Integrated farming system of abalone and kelp



# Aquaculture species and production in Sungo Bay



ChuDao

## Annual production

- Kelp: 80,000t, dry**
- Abalone: 2,000t, fresh with shell**
- Oyster: 120,000t, fresh with shell**
- Scallop: 10,000t, fresh with shell**
- Fishes: 100 tones**
- Sea cucumber: 50 tones .....**

In Shandong Province, mariculture sequesters over 110,000 t of carbon each year (YSFRI)

# Ecosystem services of Integrated Multitrophic Aquaculture

- The value of food provisioning service and climate/nutrient regulating service provided by the IMTA mode is much higher than in a monoculture.

**Services in different mariculture modes in Sungo Bay (adapted from Liu et al., 2013)**

Mariculture mode	Net profit from sale (US\$/ha/yr)	Value of climate regulating service (US\$/ha/yr)
Kelp monoculture	7, 238	715
Abalone monoculture	34, 618	1,208
Abalone and kelp IMTA	47,875	1,999
Abalone, sea cucumber and kelp IMTA	71,164	2,034

# Carbon and Nitrogen removal by harvest of shellfish in China in 2006

**Unit: MT**

Species	Production	Soft tissue		Shell		Sum	
		C	N	C	N	C	N
Scallop	1148764	36789	10365	74382	585	111172	10950
Mussel	746058	15780	3912	66788	2897	82567	6809
Oyster	3892027	22718	4503	286054	2980	308772	7124
Clam	3018803	99580	25011	172760	8486	272340	33498
Other	2330281	53656	12663	163560	3653	217217	16316

**Total Sum: 992068    74697**

Carbon and Nitrogen removal by harvest of seaweed in 2006

**C: 377,000 MT , N: 21,400 Mt 。**

The total C and N removal by harvest of shellfish and seaweed in 2006 is 1.37 million MT and 96,000 MT respectively



Monumental facilities

Education and awareness



Partnership with academia



ChuDao Community sea-use zoning



Culture-based tourism as new sources of revenue generation

# YSLME IMTA study sites in PR China and RO Korea

Studies by NIFS of ROK on IMTA of Sea Tangle, Gulfweed, Korean Rockfish, Pacific Oyster and Sea Cucumber indicates that:

- **Sea Cucumber grew 2.7 times faster;**
- **survival rate of Korean Rockfish increased by 33.4% (from 56.8% to 90.5%);**
- **no fish disease occurred in IMTA (40% of Rockfish farmed in monoculture infected with disease)**

In the IMTA in Namhae of Korean Rockfish, Sea Cucumber, Pacific Oyster, Undaria and brown Algae, studies found that:

- **No significant difference in growth of body length and weight of Korean Rockfish;**
- **No disease found in Rockfish (36.7% under monoculture);**
- **Pacific Oyster grow faster by >20% in shell height and whole and meat weight, and 22.5% higher fatness;**
- **Sea Cucumber grew >40% faster**



# IMTA is a Typical Example of A Blue Economy

## Elements of Blue Economy (summary of Session II of 2nd BE Forum, 2012, Tianjin)

- Sustaining environment and ecosystem services
- Sustainable economic growth
- Job generation
- Social equity and inclusiveness
- Poverty alleviation
- Science-based and innovation
- Governance
- Public participation
- Prevention and reduction of natural disasters

# Barriers and Solutions to Promoting IMTA:

## Barriers for commercialization

Lack of adequate financial resources and technical knowledge

Lack of awareness

Inefficient flow of information

Inadequate policy framework and peer pressure favouring unsustainable practices.

Engagement of service providers to develop the capacity and transfer knowledge

Building partnerships with supply chains for sustainable aquaculture certification schemes

Linking with policy makers

Engaging with customers towards ethical purchases and uses, and access to finance by investors

Partnerships with academia to closely monitor the health of species and monitoring of marine environment

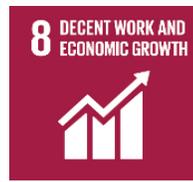
Development of a marine spatial plan which provides secure access to sea use by farmers

Exploring Nutrient Trading Credits and Carbon Trading Credits

# Implementation of YSLME SAP and NSAPs Supports and advances the implementation of SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development



- 14.1 Pollution reduction
- 14.2 Areas under ecosystem-based approach
- 14.3 Ocean acidification (blue carbon)
- 14.4 Sustainable fisheries/end IUU
- 14.5 Marine Protected Areas
- 14.6 reduction and elimination of fishery subsidies
- 14.a Increase scientific knowledge
- 14.c Implement international ocean law



***Yellow Sea:***  
Sea of Friendship  
Sea of Peace  
Sea of Cooperation  
Sea of Prosperity

**Thank you!**

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