Semi-quantification of maricultural effects on coastal ecosystems services: Sanggou Bay case from China

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Outline

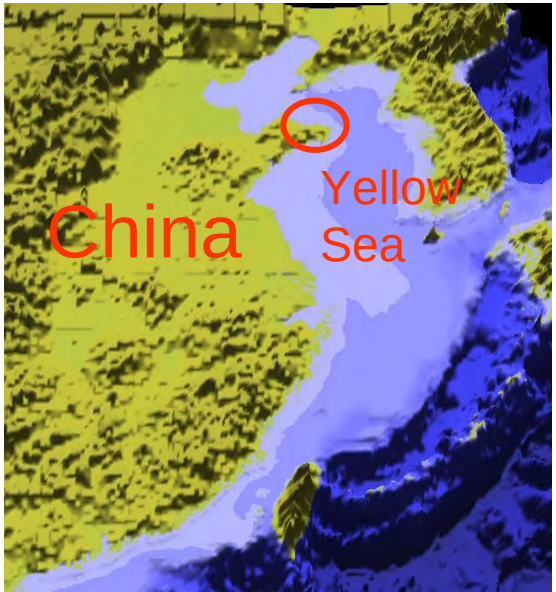
1. Why this study?
2. Studied waters and ecosystem services identified
3. Maricultural Effect Index
4. Services impacted by maricultural activities
5. Semi-quantification of services change caused by maricultural activities
6. Take-home message

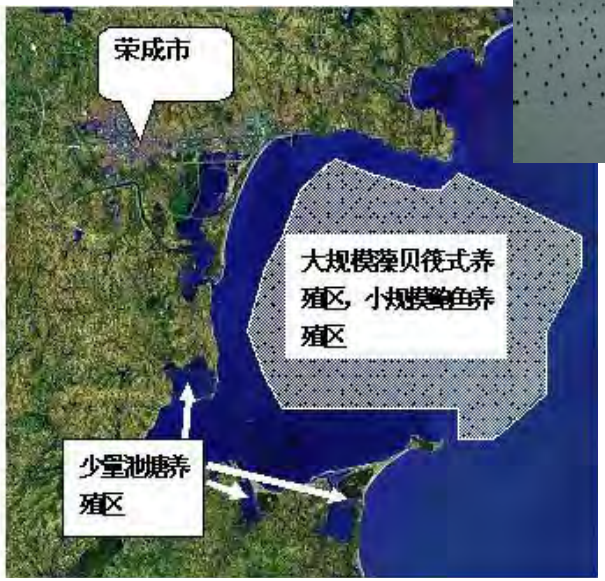
Why this study?

- We already know impacts of mariculture on local ecosystem's structure, function, health and services
- While we pursue sustainable mariculture models, we need balance economic benefit and ecological cost of mariculture activity.
- How to assess those ecological cost in money?

Studied waters

- A typical mariculture bay in the west Yellow Sea
- Suspended shellfish-kelp polyculture is the main human activity





Services of Sanggou bay

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

Supporting Services:

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

7 Major Services of Sanggou Bay

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

Supporting Services:

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

Mariculture Effect Index(MEI)

- MEI= Effect index value of mariculture on each service
- Value_before=Value_after/(1+MEI)
- Changed Value=Value_after*MEI/(1+MEI)

- Conduct questionnaire for MEI through face-to-face visit Qingdao' institutes and universities in May-June 2010.
- 40 marine scientists in aquaculture, ecology, biology with master degree or above.

Questionnaire contents

1. A letter to be surveyed person
2. Brief introduction on general and mariculture conditions of Sanggou bay
3. Brief explanation of each service of Sanggou bay ecosystem
4. Relative importance rank table of ecosystem services
5. Mariculture Effect Score Table of ecosystem services

Mariculture Effect Score Table (Shellfish-kelp polyculture)

	Positive (1-10)	None (0)	Negative (-1--10)
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 usage			
11.Scientific service			
12.Primary production			
13.Nutrients cycling			
14.Species diversity maintenance			

Relative Importance Rank of each ecosystem service of Sanggou bay

Service	Weight
Food production	0.11
Scientific service	0.1
Material production	0.09
Primary production	0.09
Nutrients cycling	0.09
Oxygen production	0.07
Species diversity maintenance	0.07
Provision of genetic resources	0.06
Climate regulation	0.06
Biological control	0.06
Waste treatment	0.05
Disturbance regulation	0.05
Recreational service	0.05
Cultural usage	0.05

Effect index rank of Shellfish-kelp mariculture on each service of Sanggou bay ecosystem

Service		Effect index
Food production	Highly Positive	0.87
Material production		0.7
Scientific service		0.67
Oxygen production	Moderate Positive	0.5
Primary production		0.5
Nutrients cycling		0.51
Climate regulation	Slight Positive	0.35
Waste treatment		0.36
Biological control		0.39
Disturbance regulation	Not	0.28
Cultural usage		0.22
Recreational service		0.03
Provision of genetic resources	Negative	-0.37
Species diversity maintenance		-0.38

Changed value of Sanggou bay ecosystem services due to shellfish-kelp mariculture

Service	Value /mil. RMB		Change
	After aquaculture (2000-)	Before aquaculture (1970-90)	
Food production	1,123.40	600.29	523.11
Climate regulation	55.74	41.20	14.54
Oxygen Production	33.20	22.13	11.07
Scientific service	9.00	5.37	3.62
Waste treatment	7.55	5.55	2.00
Material production	5.09	2.99	2.09
Total	**1,233.99**	**677.55**	**556.44 (82%)**

1 mil.RMB=150 thou. USD

The suspended shellfish-kelp polyculture model may improve the value of 9 ecosystem services

- food production, material production,
- scientific service, nutrient cycling,
- primary production, oxygen production,
- biological control, waste treatment,
- climate regulation

This model reduces the value of 2 ecosystem services

- provision of genetic resources
- species diversity maintenance.

Take-home message

- Shellfish-kelp polyculture is a friendly ecological mariculture model to use ecosystem services.
- Totally, it can improve ecosystem services. However it has adverse impacts to local biodiversity and genetic resources of native species.
- Therefore, selection of mariculture area should except the key habitats such as spawning and overwintering grounds of wild species.

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