Semi-quantification of spartina invasion's effects on wetland ecosystems services: Yancheng case from China

Shang Chen

FIO, SOA

qdcs@163.com

Outline

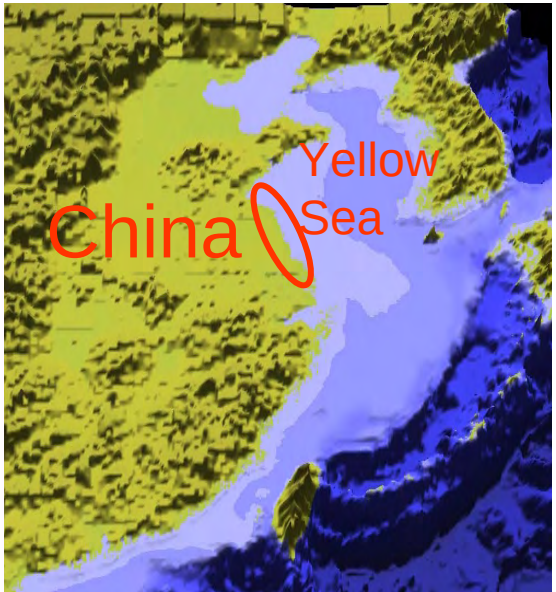
1. Why this study?
2. Studied waters and ecosystem services identified
3. Spartina Effect Index
4. Services impacted by spartina invasion
5. Semi-quantification of service change caused by spartina invasion
6. Take-home message

Why this study?

- We already know alien species may affect on local ecosystem's structure, function, health and services etc.
- When make policy on alien species, we need balance the economic benefit and ecological benefit.
- How to assess those ecological benefits in money?

Studied waters

- **Reed wetland reserve in west Yellow Sea**
- **with spartina invasion since 1970's**
- **Pool-based mariculture**



Services of Yancheng wetland

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

Supporting Services:

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

Major Services of Yancheng wetland

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. Recreation
10. Cultural value
11. Scientific service

Supporting Services:

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

Spartina Effect Index(SEI)

- SEI= Effect index value of spartina' invasion on each service
- Value_before=Value_after/(1+SEI)
- Changed Value=Value_after*SEI/(1+SEI)
- Conduct questionnaire to get SEI through face-to-face visit Qingdao' institutes and universities in Nov-Dec 2009.
- 50 scientists in marine and wetland ecology with master degree or above.

Questionnaire contents

1. A letter to be surveyed person
2. Brief introduction on general and spartina's invasion of Yancheng wetland
3. Brief explanation of each service of Yancheng wetland ecosystem
4. Relative importance rank table of ecosystem services
5. Spartina Effect Score Table for ecosystem services

Spartina Effect Score Table

	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 spartina's invasion on Yancheng wetland ecosystem services

Service	Effect index
Species diversity maintenance	**-0.65**
Food production	**-0.52**
Provision of genetic resources	**-0.58**
Disturbance regulation	0.57
Waste treatment	0.54
Primary production	0.53
Nutrients cycling	0.53
Scientific service	0.55
Material production	0.54
Oxygen production	0.48
Climate regulation	0.49
Biological control	0.11
Recreational service	0.05
Cultural usage	0.05

(Based on expert survey method)

Change in service value of Yancheng wetland ecosystem mainly caused by spartina' invasion

Service	Value /bil. RMB		Change
	After (2006)	Before (1970-80)	
Food production	7.88	16.42	-8.54
Nutrients cycling	29.9	19.54	10.36
Climate regulation	1.06	0.71	0.35
Oxygen production	1.13	0.76	0.37
Scientific service	0.043	0.028	0.015
Waste treatment	1.03	0.67	0.36
Recreation	0.035	0.033	0.002
Total	41.078	43.041	-1.963

1 mil.RMB=150 thou. USD

The spartina' invasion may evidently decrease the value of 3 ecosystem services

- Food production
- Provision of genetic resources
- Species diversity maintenance

The spartina' invasion may evidently increase the value of 8 ecosystem services

- Disturbance regulation
- Waste treatment
- Primary production
- Nutrients cycling
- Scientific service
- Material production
- Oxygen production
- Climate regulation.

Take-home message

- In pool-based and benthic mariculture areas
- or in key wetland habitats,
- Direct loss caused by spartina' invasion may be much more than benefits.

Acknowledgements:

- SOA,
- PICES,
- NOAA