The progress of offshore longline mariculture in Sungo Bay

Jihong Zhang, Jianguang Fang, Zengjie Jiang

zhangjh@ysfri.ac.cn

Yellow Sea Fisheries Research Institute, CAFS Qingdao 266071, China

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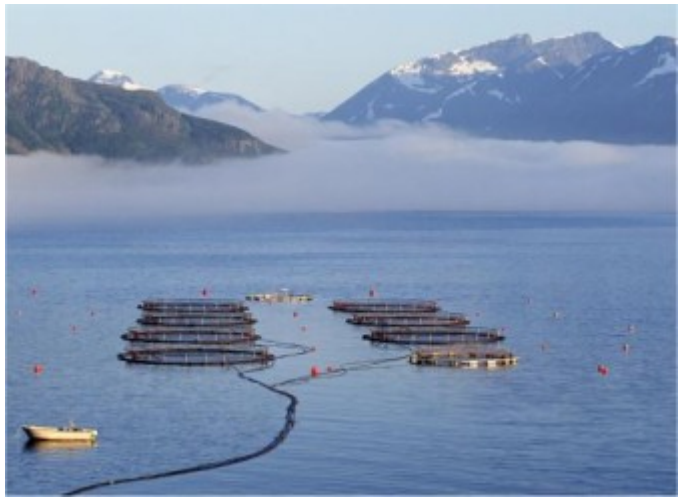
1. Progress of offshore longline culture in Sungo Bay

Moving to the offshore area would be a way to overcome the conflicts of space allotment and utilization and reducing environment impact of mariculture industry (Benetti et al., 2003; Michler-Cieluch et al., 2009).

1. Progress of offshore longline culture in Sungo Bay



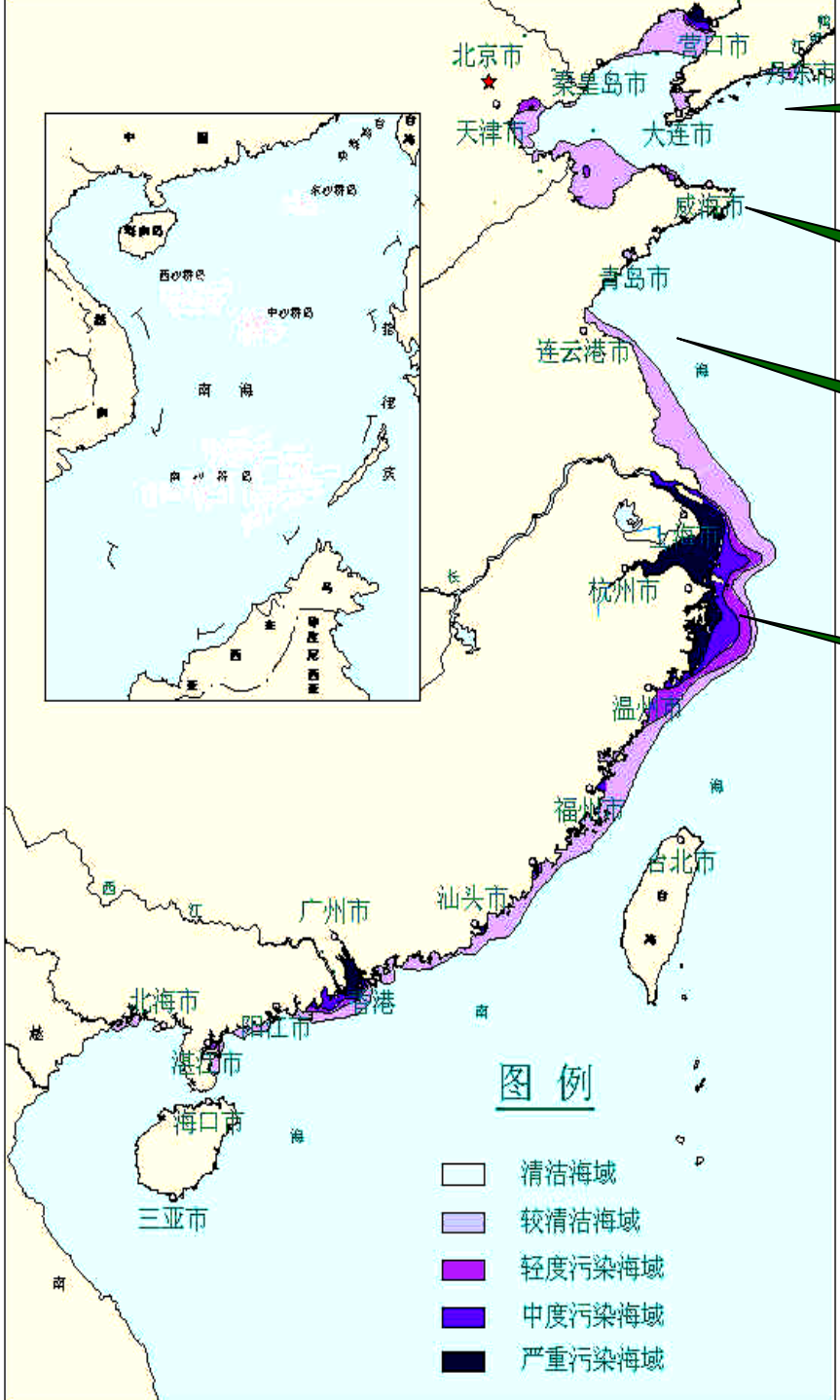
Currently, most of the emphasis worldwide is on the offshore farming of finfish, and because of the high costs and risks of practicing offshore aquaculture, initial attempts have focused largely on the production of high value species (Lipton and Kim, 2007).

Atlantic salmon (*Salmo salar*);

rainbow trout (*Onchorynchus mykiss*)

1. Progress of offshore longline culture in Sungo Bay

Australia, New Zealand and New Hampshire of USA are engaged in longline mussel culture at exposed site several miles from shore (Langan and Horton, 2004).



North Yellow Sea
Zhang Zidao island

Mid-Yellow Sea
Sungo Bay

South Yellow Sea
Qian Sandao island

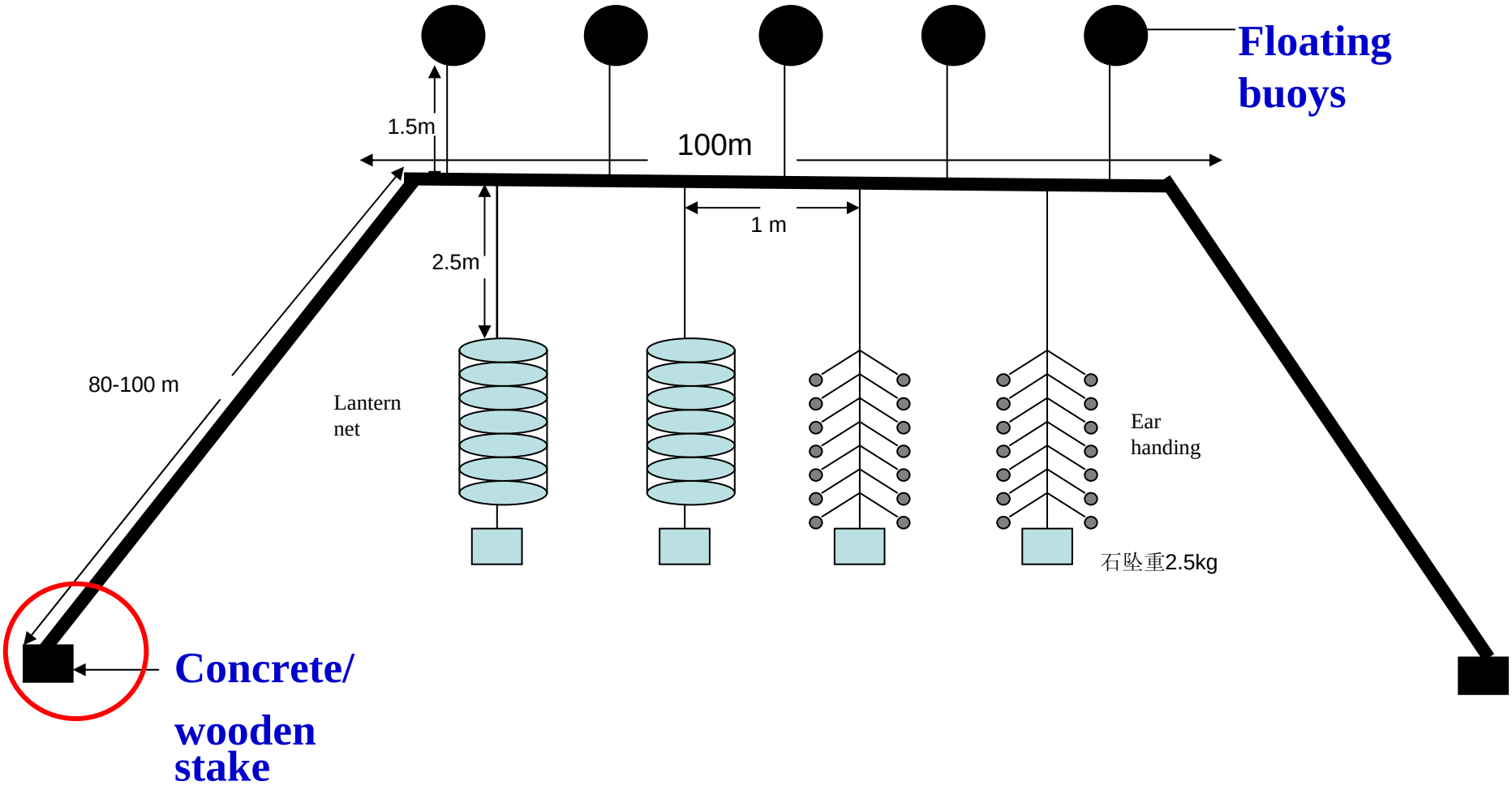
East Sea
Sheng Si

National High Technique Program: "Offshore longline mariculture engineering and technique": 2006-2010

1. Progress of offshore longline culture in Sungo Bay

- **Engineering: moorings, ropes or lines, containment equipment**
- **Choice on the potential target species: high value species, or simple management.**

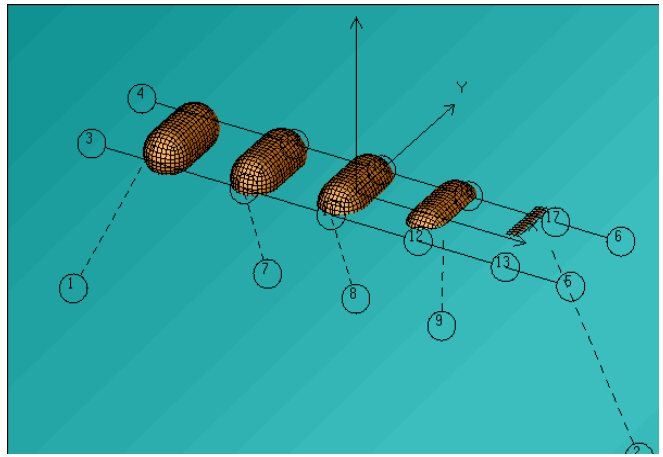
1. Progress of offshore longline culture in Sungo Bay

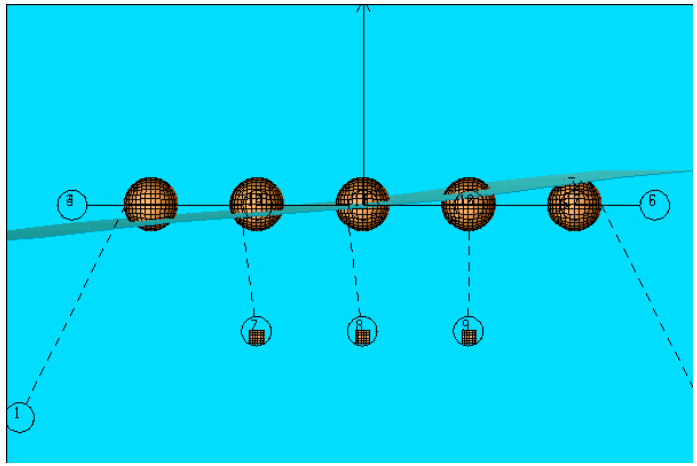


Sketch map on the offshore surface longline culture

1. Progress of offshore longline culture in Sungo Bay

Numerical modelling research and Simulation the raft resistant to the different current.





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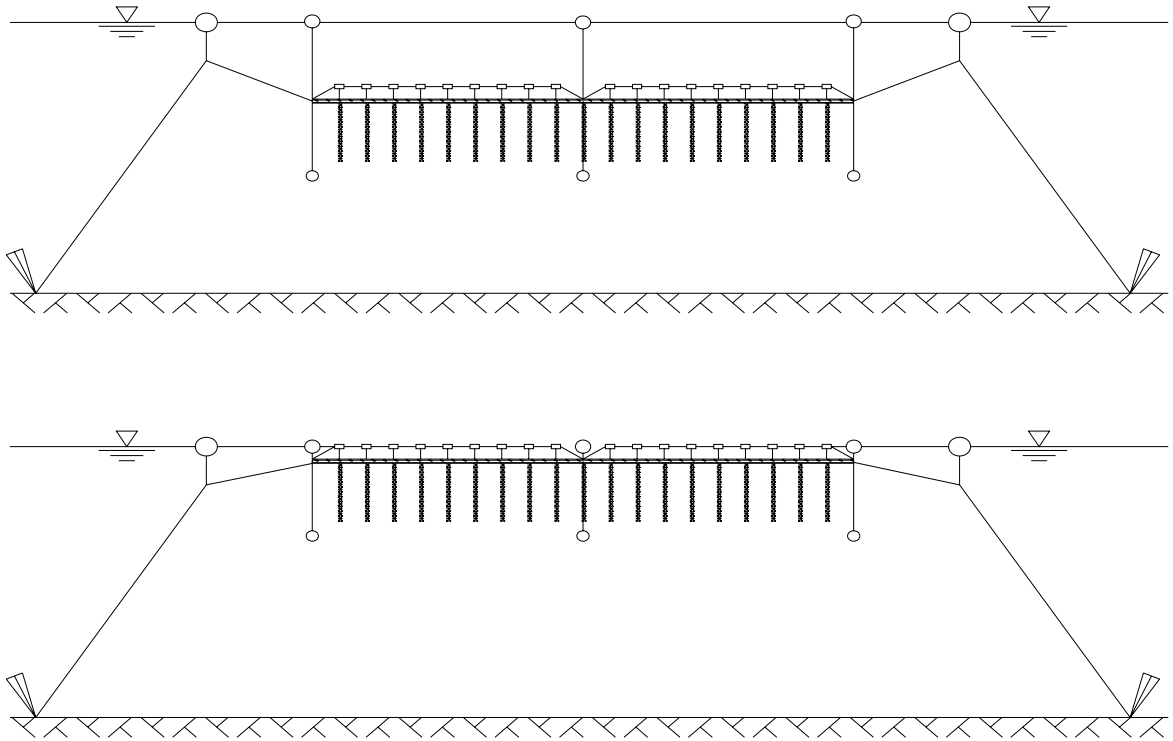
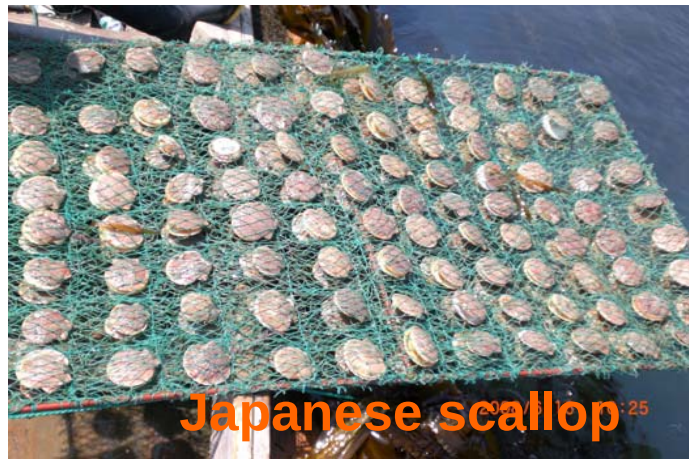


Floating buoys

Sketch map on the offshore submerged longline culture

1. Progress of offshore longline culture in Sungo Bay

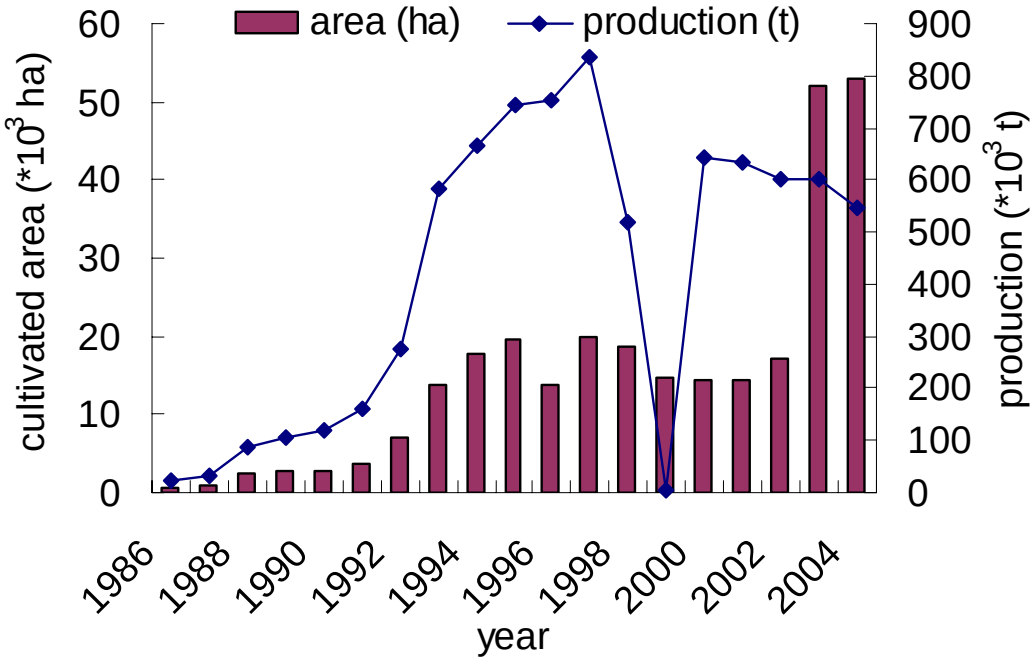
Containment equipment



2. Potential of offshore longline culture of scallops

Scallop *Chlamys farreri* is one of most important species that is farmed in the northern coast of China. In Shandong province, the mariculture industry of the scallop developed very quickly since 1992.

2. Potential of offshore longline culture of scallops



The annual production and cultivated area of scallop *Chlamys farreri* in Shandong province

Mainly culture species shifts from *Chlamys farreri* to bay scallop *Argopecten irradians* for the reason of high summer mortality rate.

2. Potential of offshore longline culture of scallops

- **The cause of the high mortalities in summer has not been entirely identified, environment problem is one of the hypothesized causes.**

2. Potential of offshore longline culture of scallops

The aim of this experiment is to study the potential of long-line culture of scallop *Chlamys farreri* in offshore areas and to evaluate the optimized culture mode.

Experiment of scallop culture in different water depth

Material and methods

Experiment design

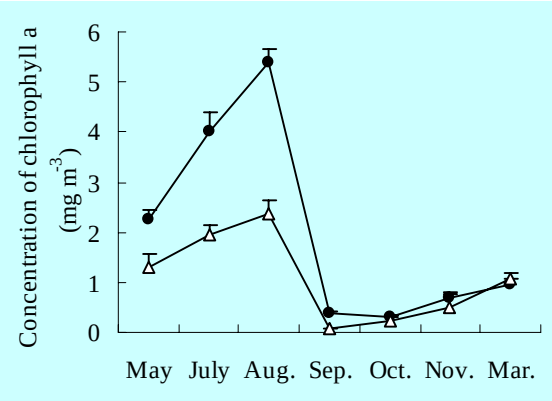
Inshore (ind./disk)	Offshore (ind./disk)	Scallop Density (ind./m^2)
20	20	280
30	30	425
40	40	565

Material and methods

20 scallops were sampled at random for each experimental groups every month from May 2007 to April 2008. Shell height, wet weight and dry weight of shell and soft body tissue were recorded.

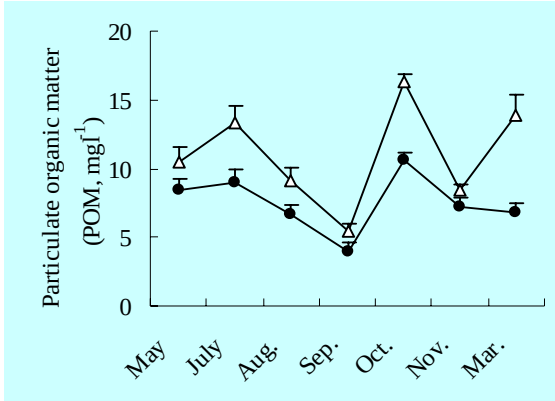
Meanwhile, environmental parameters: temperature, salinity, chlorophyll a, suspended particle materials, particle organic materials and dissolved inorganic nutrients were measure monthly. The current velocity at inshore and offshore were measured in May 2008 .

Results

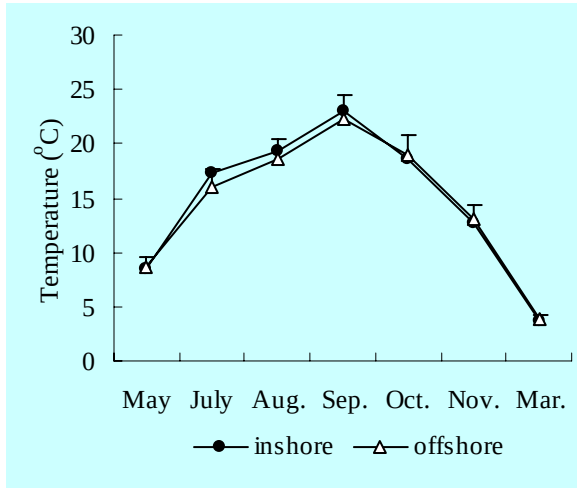


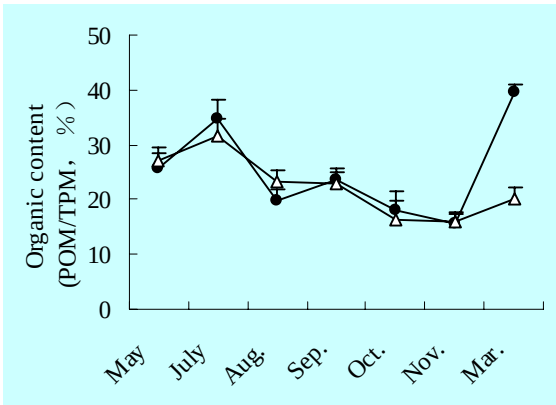
Inshore chla: 2.67±2.35

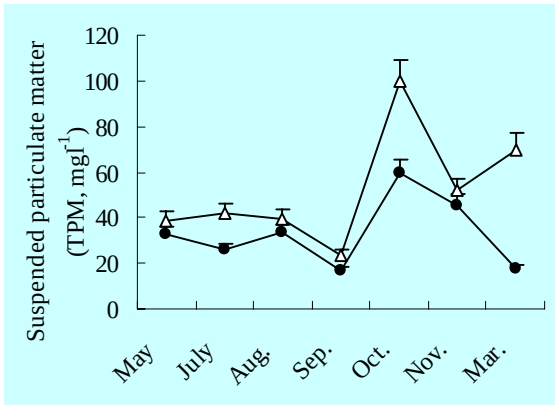
Offshore : 1.90±1.56 mg/m3



POM (mg/l)
Inshore:12.29±9.07
Offshore:16.99±8.09



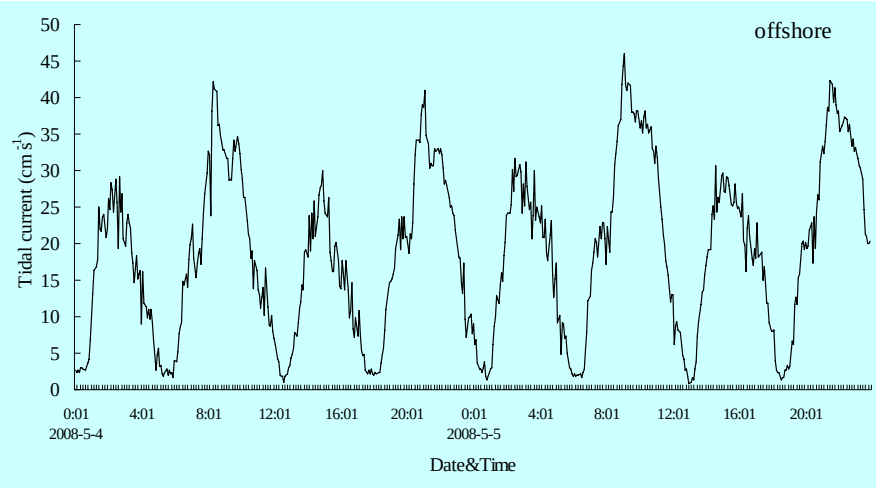


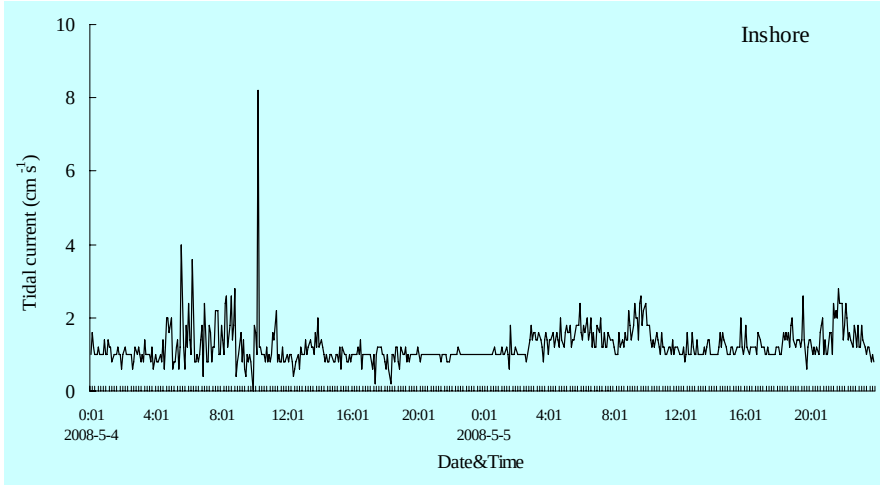


TPM (mg/l)
Inshore: 43.98±35.56
Offshore: 65.82±31.61

Results

Mean current speed at one tidal cycle of inshore and offshore area were 1.39±0.385 and 20.40±12.24cm s^{-1} , respectively, with a maximal speed of 2.60 and 46.0cm s^{-1}, respectively.





Current velocity of inshore and offshore area in Sungo Bay

Scallop cultivated in offshore area

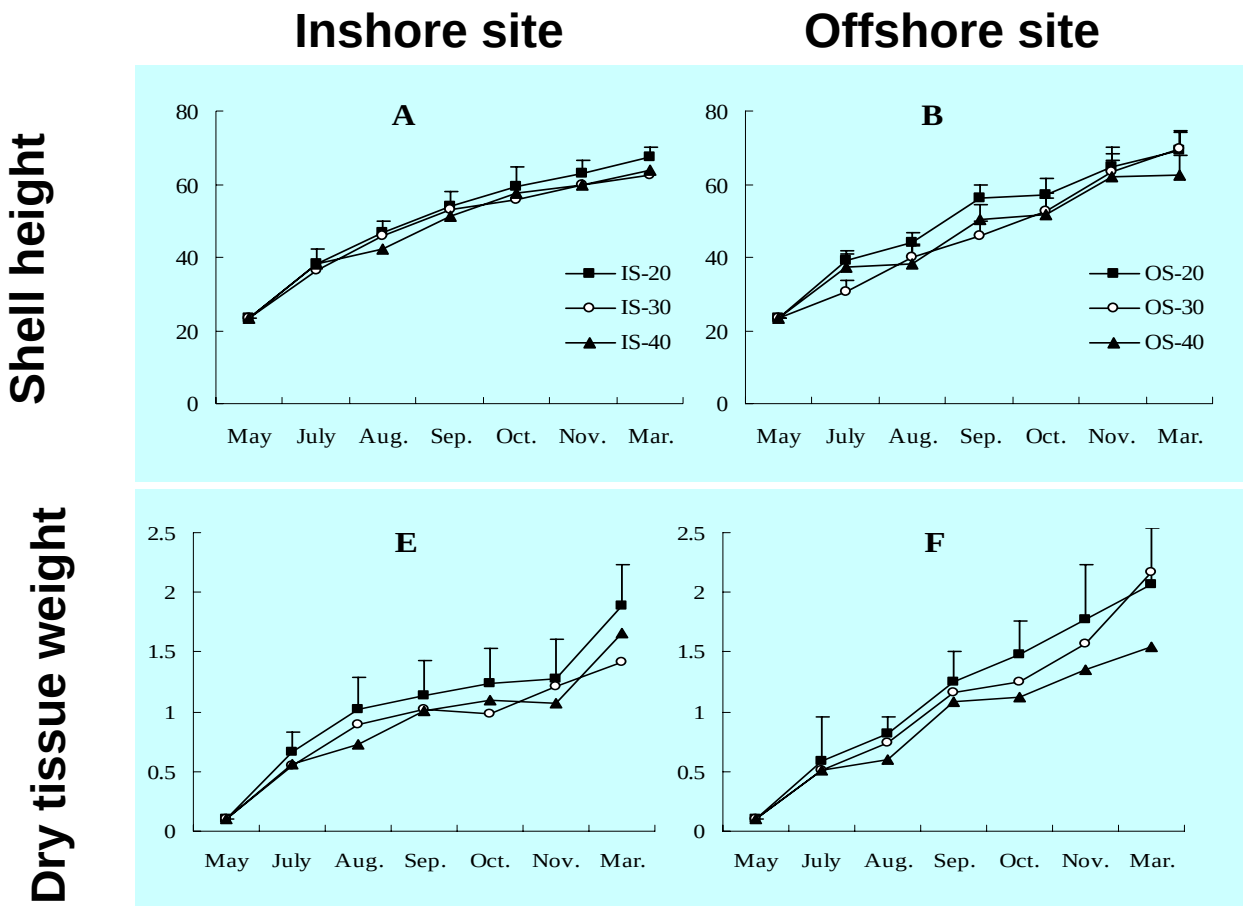
Scallop cultivated in inshore area

Results

Mean survival (% survivors related to the initial number) of scallops *Chlamys farreri* for 11 months (average ±SE).

Initial density (Ind./disk)	Offshore site (%)	Inshore site (%)
20	92±2	86±1
30	90±1	83±2
40	86±3	82±2

Results



The groups OS-30 and OS-20 had greater dry soft tissue weights than the others (ANOVA, $p<0.05$)

Results

Instantaneous growth rate of the scallop (dry tissue weight)

	OS-20	OS-30	OS-40	IS-20	IS-30	IS-40
July	3.34	2.28	3.10	3.52	3.22	3.25
Aug.	1.05	2.86	0.35	1.46	2.00	0.88
Sep.	1.44	0.59	2.23	0.34	0.06	1.08
Oct.	0.58	0.87	0.00	0.30	-0.14	0.28
Nov.	0.58	1.05	0.64	0.12	0.69	-0.07
Jan.				0.66	1.01	1.80
Mar.	0.13	0.27	0.11	0.32	-0.25	-0.18
April	1.03	1.13	0.99	0.95	1.01	0.52

Results

The growth of the scallop at inshore and offshore sites were described using Von Bertalanffy model:

$$H_t = H_\infty (1 - e^{-k(t-to)})$$

H_t : predicted standard shell height at age t;

H_∞: the asymptotic height;

k is a growth constant;

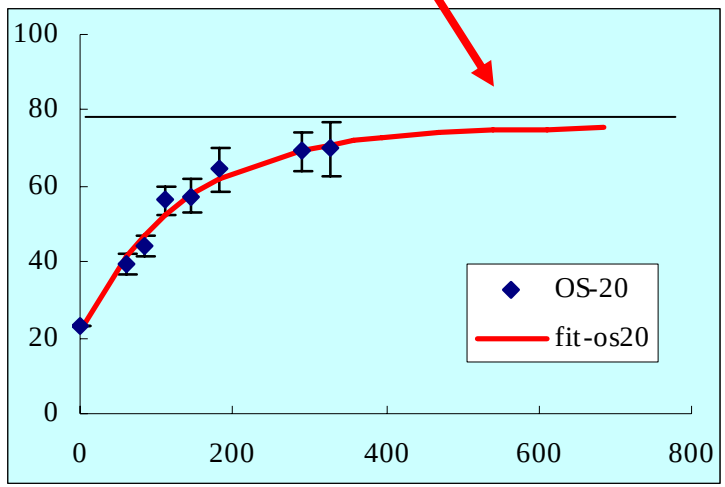
t_0 : age at which the theoretical height is 0.

Results

Estimated results of Von Bertalanffy growth parameter for different treatment groups.

	H_∞	K (year^{-1})
OS-20	75.48	2.73
OS-30	100.66	1.25
OS-40	69.34	2.55
IS-20	72.08	3.04
IS-30	65.76	3.43
IS-40	68.90	2.96

Asymptotic height



Conclusion

Simple economic evaluation

Item	OS-20	OS-30	OS-40	IS-20	IS-30	IS-40
Wet weight per scallop (g)	34.13	36.54	28.11	34.02	26.39	29.61
Survival rate (%)	92	90	86	86	83	82
Yields per lantern net (kg)	9.42	9.87	7.25	8.78	6.57	7.28
Seeding cost per lantern net (US$)	0.17	0.26	0.34	0.17	0.26	0.34
Profit per lantern net (US$)	5.21	5.38	3.80	4.84	3.50	3.82

Conclusion

- **Offshore long-line culture of scallop *Chlamys farreri* is successful.**
- **OS-30 treatment group has higher production, larger shell height and economic benefit.**

Prospect

A major problem with longline culture of lantern cage is the biofouling, which may reduce growth rates in scallop culture.

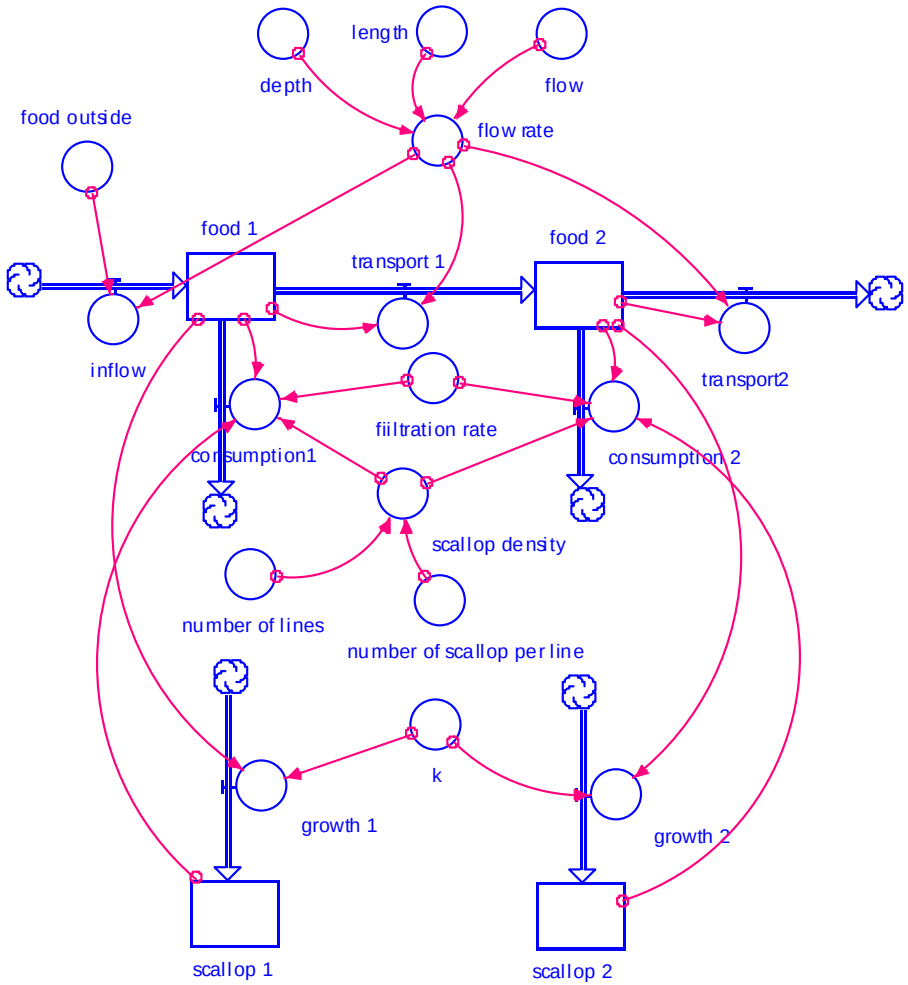
Work is going …..

Work is going …..

- **The individual filtration rate, excretion rate and respiration rate of the scallop at inshore and offshore area had been measured, we will try to evaluate the carrying capacity in the offshore.**

Biodeposit trap

Work is going …..



Conceptual model for the food consumption

- To simulate and evaluate the influence of cultivated density on the growth rate of scallop.
- To expect the growth and production of scallop at different area.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