


발제문

지속가능한 생태계 기반 실행 목표:
관리를 위한 포화밀도 지표

장이항

(전 UNDP/GEF 황해광역해양생태계 프로젝트 매니저)

Y S L M E



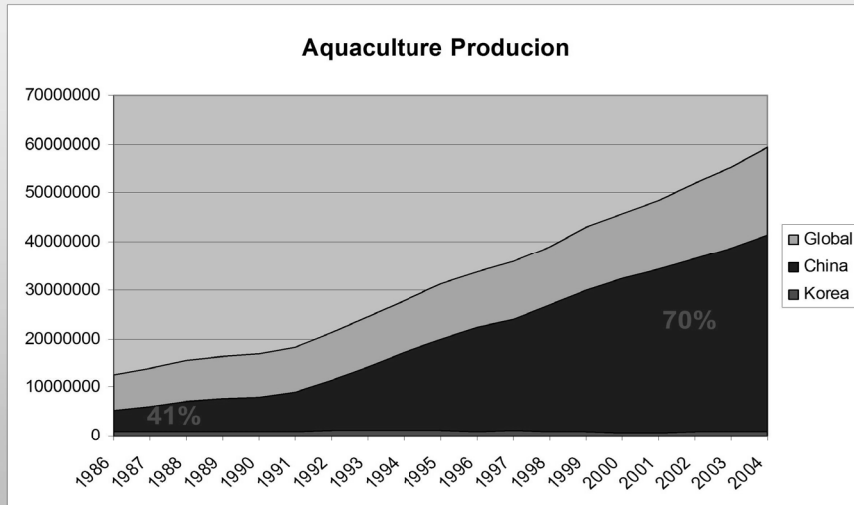
지속가능한 생태계 기반 실행 목표:
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장이항
제3회 환황해 포럼, 2017년 11월 1~3일
대한민국, 공주

<http://www.yslme.org>



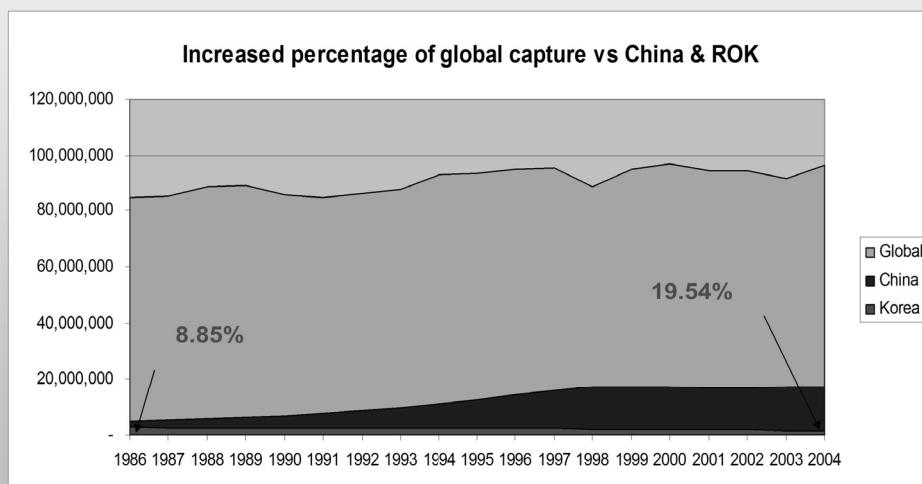
항해 바다양식 생산량



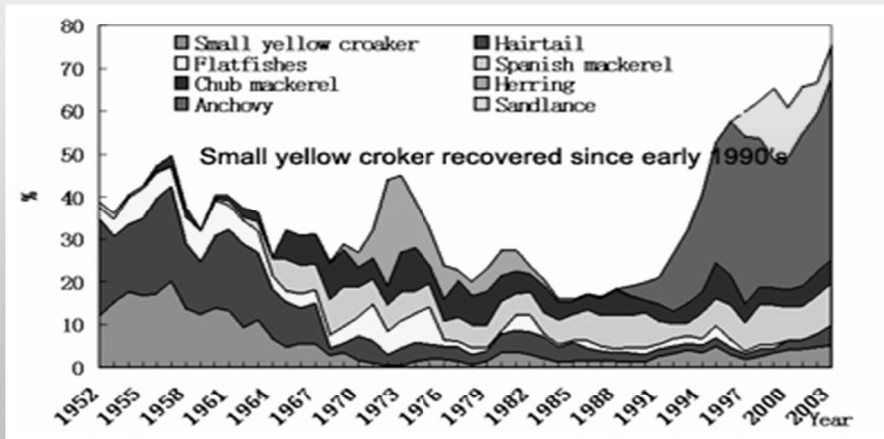
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항해 어획 어업



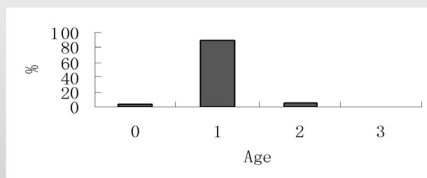
<http://www.yslme.org>



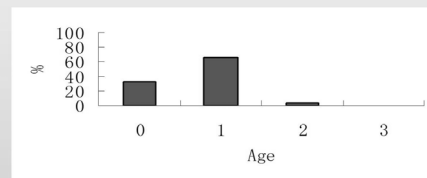
<http://www.yslme.org>



황해 어획 어업이 압박 받고 있는가?



Small yellow croaker age structure caught in the spring survey



Small yellow croaker age structure caught in the autumn survey

황해광역해양생태계(YSLME) 지역 어획 자원 평가, 2009년 4월

<http://www.yslme.org>

유해적조(HAB) 감소 이후에, 왜 다시 영양염이 증가하는가?

	중국	한국
종	유령 해파리 & 자색 해파리	노무라입깃해파리
봄 (%)	14	0
가을 (%)	86	19

출처: YSLME 어획 자원 평가 크루즈



노무라입깃해파리

사진: Uye

예상 원인:

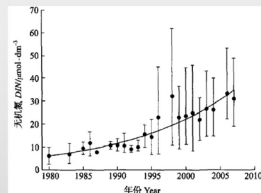
남획으로 인해 해파리 서식 공간이 증가함

규소(Si) 감소로 인해 규조류가 와편모충류로 변화함

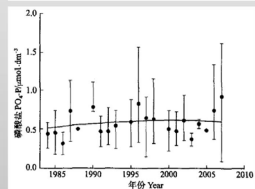
<http://www.yslme.org>



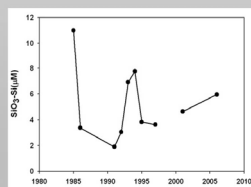
해파리 서식 환경이 압박받고 있는가?



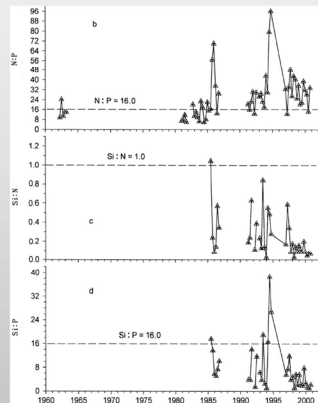
DIN



PO₄-P



SiO₃-Si



N/P > 16

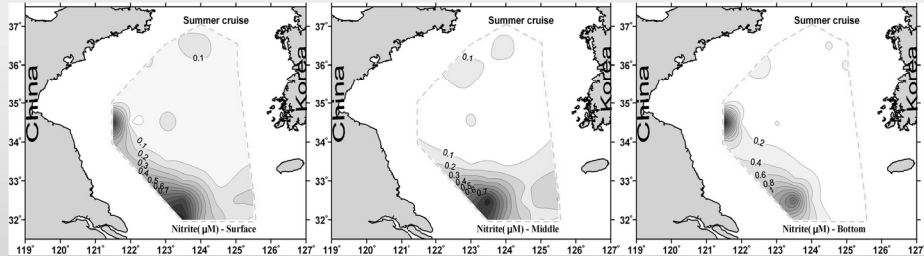
N/Si < 1

<http://www.yslme.org>

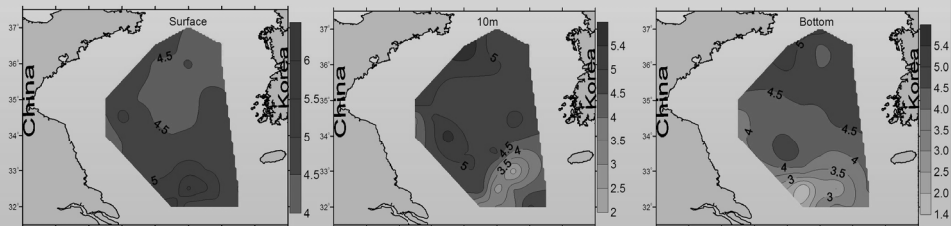




YSLME 합동 크루즈 조사에 의한 영양소 및 용존산소량(DO)



출처: YSLME Cooperative Cruises: 아질산염, 2008년 여름



출처: YSLME Cooperative Cruises: DO, 2008년 여름

<http://www.yslme.org>



유해적조(HAB) 감소 이후에, 왜 다시 영양염이 증가하는가?



<http://www.yslme.org>



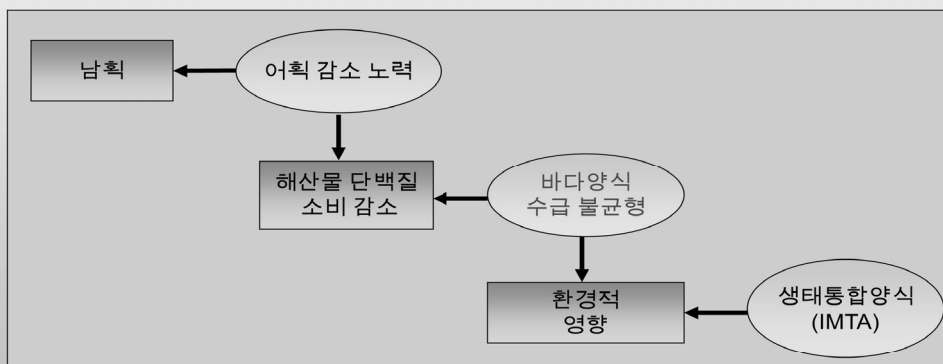
풀어야 할 “오래된” 문제들이 많고,
이해해야 할 “새로운” 문제들이 많다 ...

우리가 할 수 있는 유용한 일은
무엇인가???

<http://www.yslme.org>



영양염류 유출량 감소를 위한 대책 바다양식 관련 예

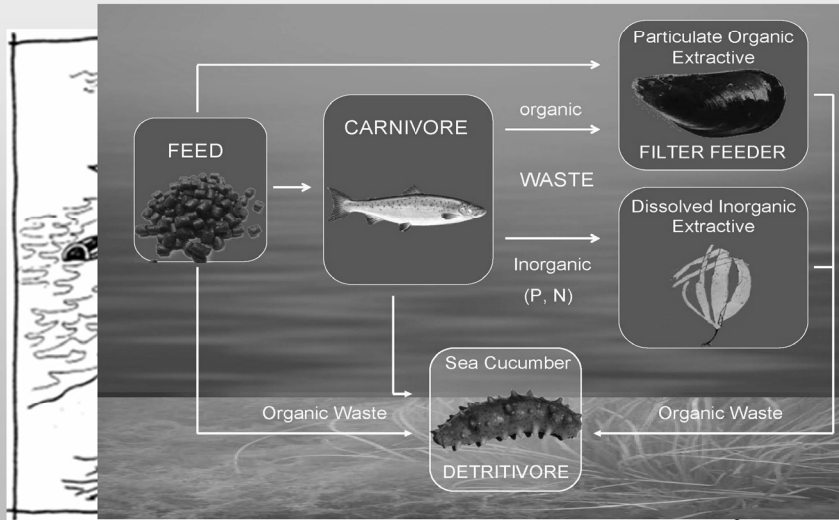


<http://www.yslme.org>



영양염류 유출량 감소를 위한 대책

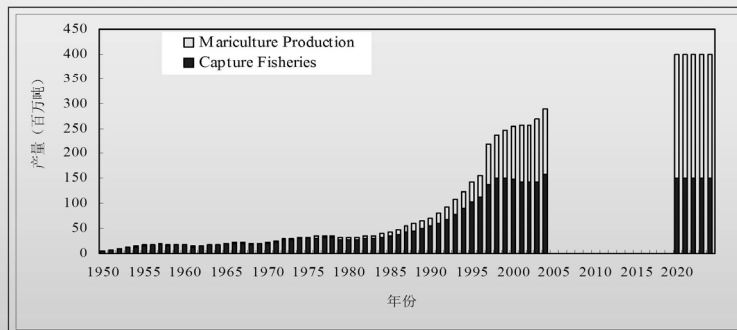
바다양식 관련 예



<http://www.yslme.org>



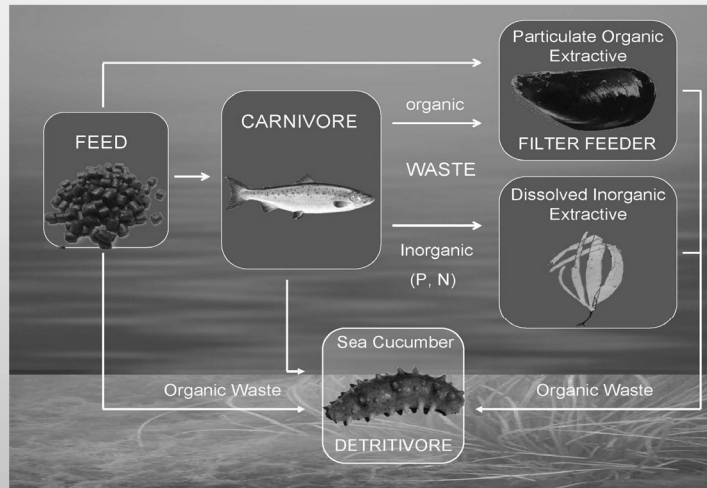
항해 어류 자원 보호



인구 증가로 인해 양식 생산에 대한 수요가 증가하고 있다.
2020년에는 약 2천 5백만 톤의 해산물이 양식에 의해 생산되어야 할 것으로 예상된다.- Dr. Wang Q.Y.

가능한가? 수백만 톤의 해산물 부족 현상

<http://www.yslme.org>



생태통합양식(IMTA) 개념: 물기둥 안의 미립자 폐기물은 여과섭식성 이매패류에 의해 제거되고, 해저와 맞닿은 부분에서는 미립자 폐기물이 해삼에 의해 활용된다. 용존무기영양염류(N, P, CO₂)는 산소를 발생시키는 해조류에 의해 흡수되고, 이후 흡수된 산소는 다른 양식 생물에 의해 이용된다. 수정-(Fang et al. 2009)

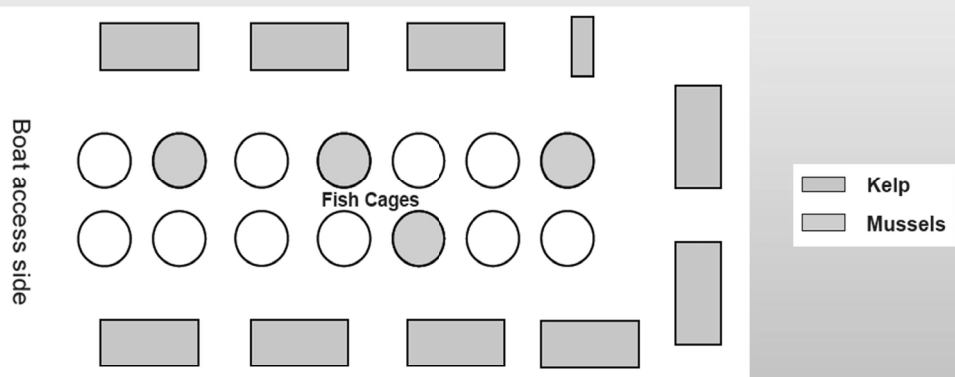
<http://www.yslme.org>



<http://www.yslme.org>



지속가능한 바다양식에 대한 노력 - 최적의 상황



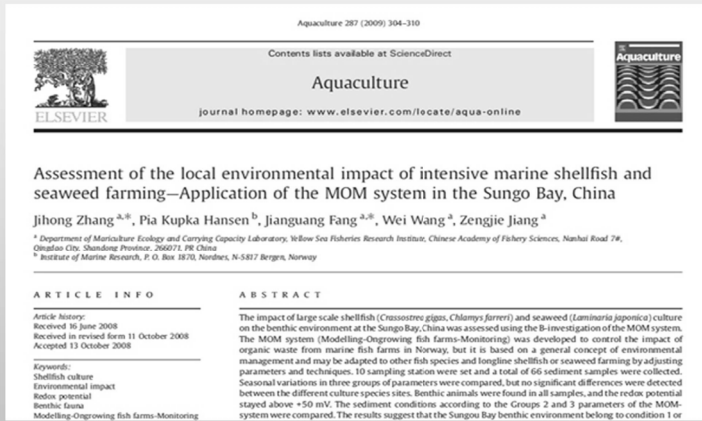
<http://www.yslme.org>



<http://www.yslme.org>



효과가 있을까?



중국 Sungo 만에서, 조개류와 해조류의 장기 대량 양식이 해저 환경에 미친 영향은 미미했다.

<http://www.yslme.org>



효과가 있을까?

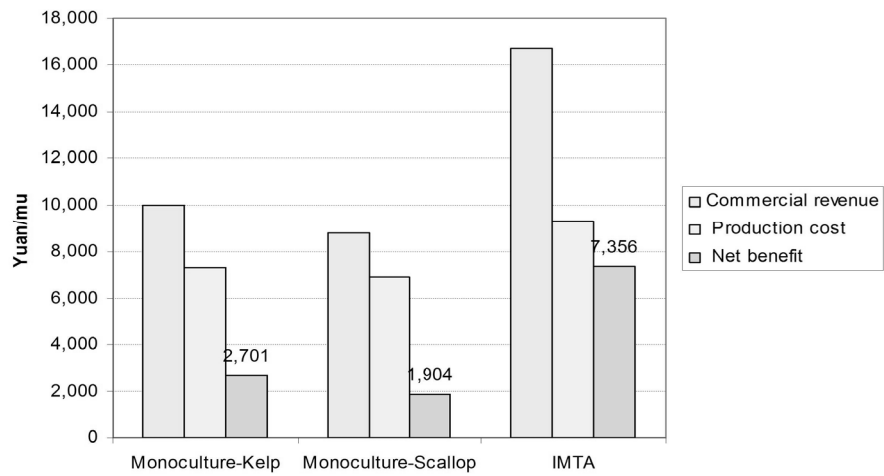
확인 중



<http://www.yslme.org>



생태통합양식(IMTA)의 경제적 가치



발제문

**Towards Ecosystem-based Sustainable
Practice : Carrying Capacity
– Indicator for Management**

Jiang Yihang
Former Project Manager, UNDP/GEF YSLME Project

Y S L M E



**Towards Ecosystem-based Sustainable Practice:
Carrying Capacity – Indicator for Management**

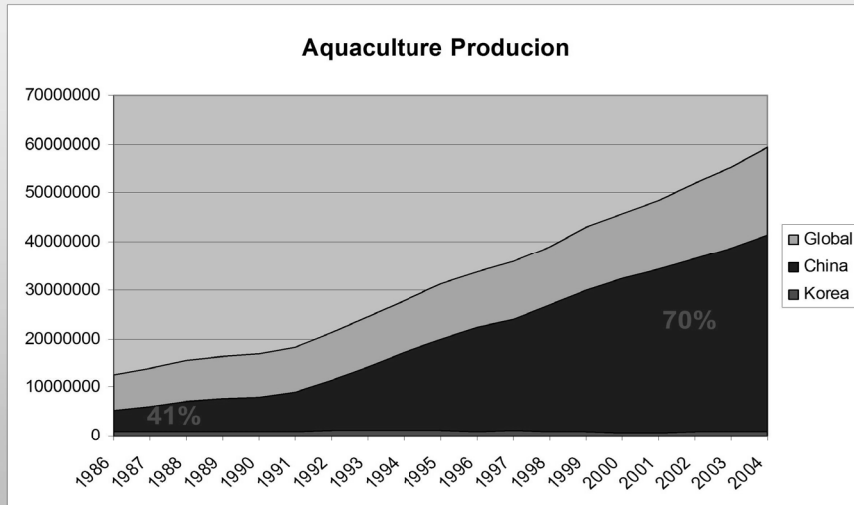
Yihang Jiang

*3rd Pan-Yellow Sea Forum, 1-3 November, 2017
Gongju, RO Korea*

<http://www.yslme.org>



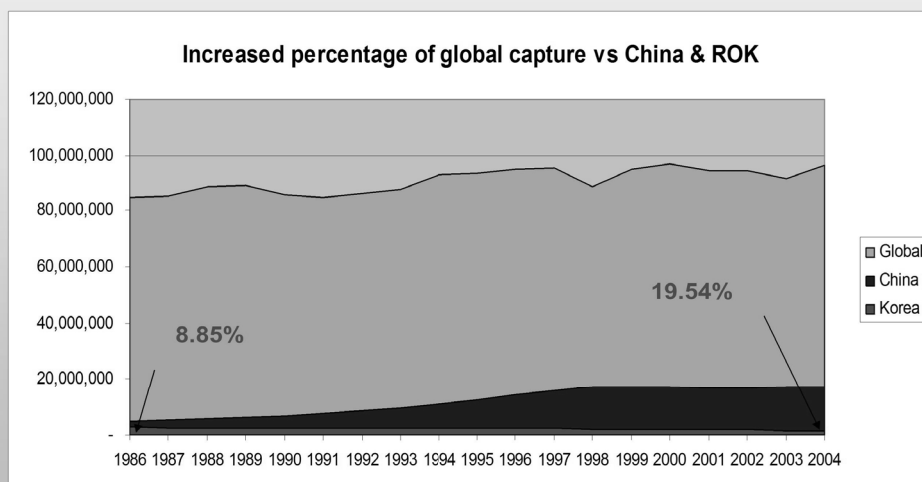
Yellow Sea Mariculture Production



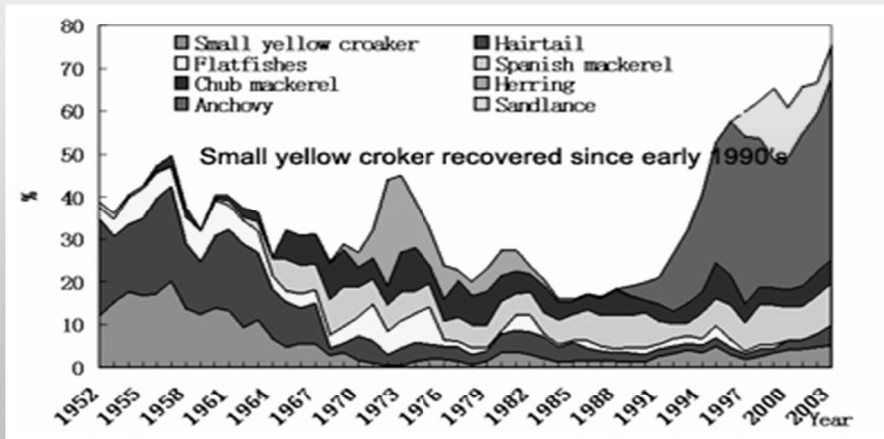
<http://www.yslme.org>



Yellow Sea capture fisheries



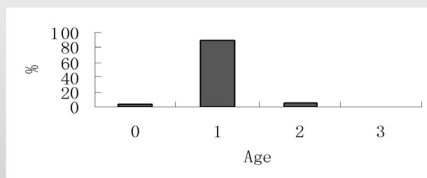
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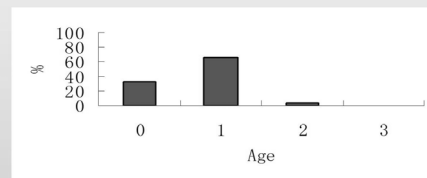
<http://www.yslme.org>



Yellow Sea capture fisheries under stress?



Small yellow croaker age structure caught in the spring survey



Small yellow croaker age structure caught in the autumn survey

From YSLME regional fishery stock assessment, April 2009

<http://www.yslme.org>



Following Reduction of HAB, Why Nutrients Again?

	China	Korea
Species	Cyanea nozakii & Cyanea purpure	Nemopilema nomurai
Spring (%)	14	0
Fall (%)	86	19

Source: YSLME fishery stock assessment cruises



Nemopilema nomurai Photo: Uye

Possible causes:

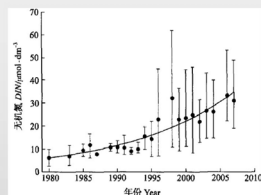
Over-fishing left more spaces for jellyfish

Diatom shift to dinoflagellates due to reduction of Si.

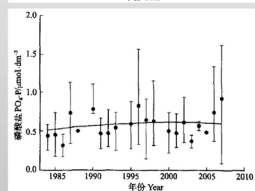
<http://www.yslme.org>



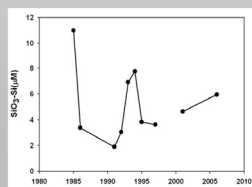
Environment for fishery is under stress?



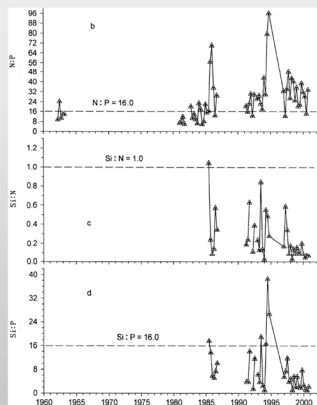
DIN



PO₄-P



SiO₃-Si



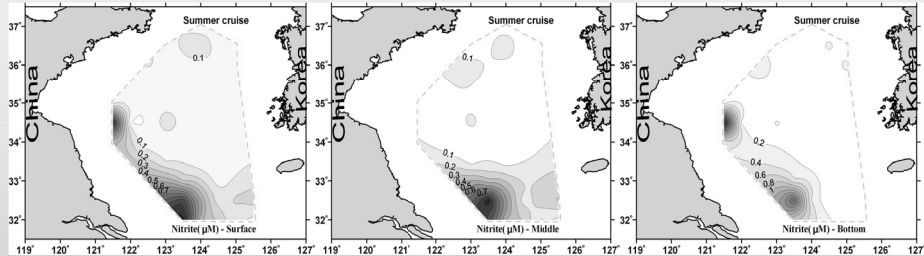
N/P > 16

N/Si < 1

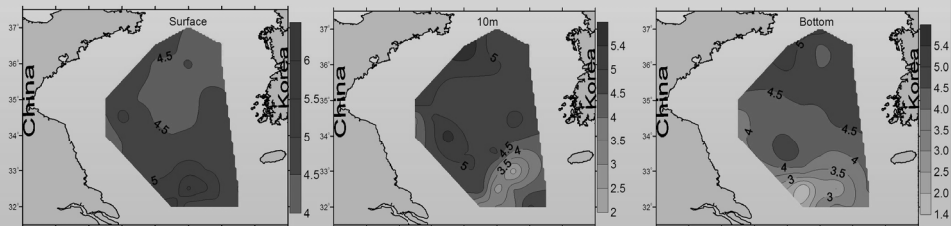
<http://www.yslme.org>



Nutrients and DO from the YSLME Joint Cruises



Source: YSLME Cooperative Cruises: Nitrite, summer 2008



Source: YSLME Cooperative Cruises: DO, summer 2008

<http://www.yslme.org>



Following Reduction of HAB, Why Nutrients Again?



<http://www.yslme.org>



We have so many “old” problems to be solved,
we have many “new” problems to be understood ...

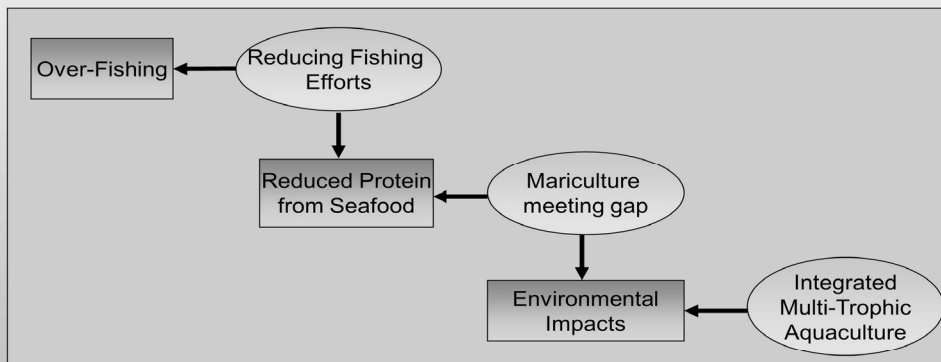
Can we do something useful ???

<http://www.yslme.org>



Measures to Reduce Nutrient Discharges

Example on Mariculture

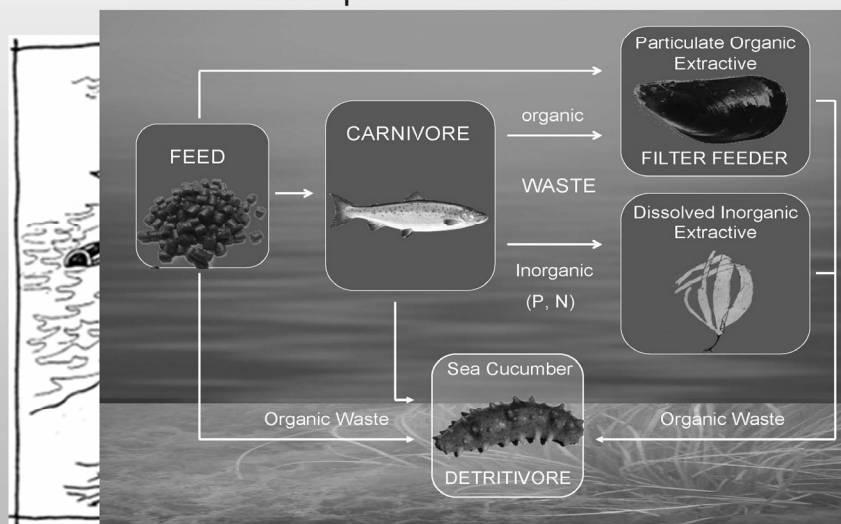


<http://www.yslme.org>



Measures to Reduce Nutrient Discharges

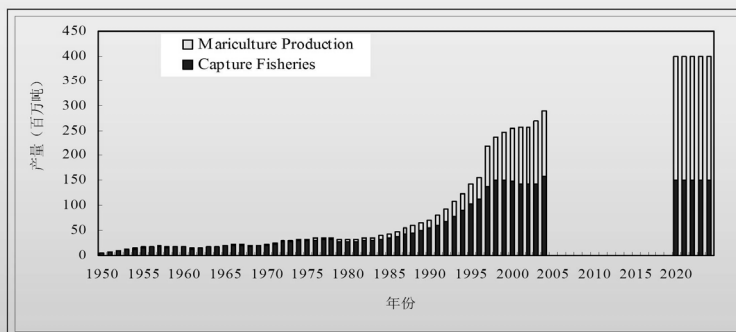
Example on Mariculture



<http://www.yslme.org>



Protecting Yellow Sea fish stocks



The growth of population has put more demand on aquaculture for ever higher production. It is anticipated that in 2020, about 25 million tons sea food need to be produced from mariculture.

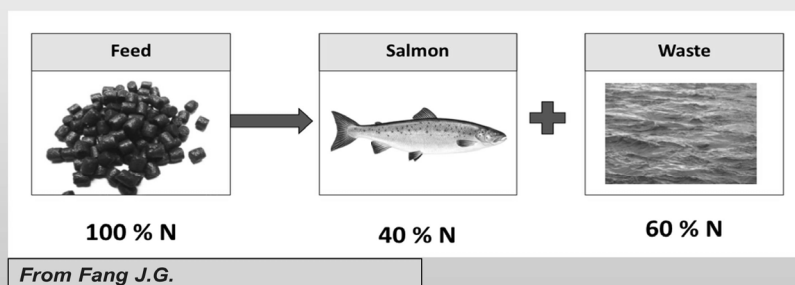
From – Dr. Wang Q. Y.

There would be ? Million tones of sea food lacking

<http://www.yslme.org>



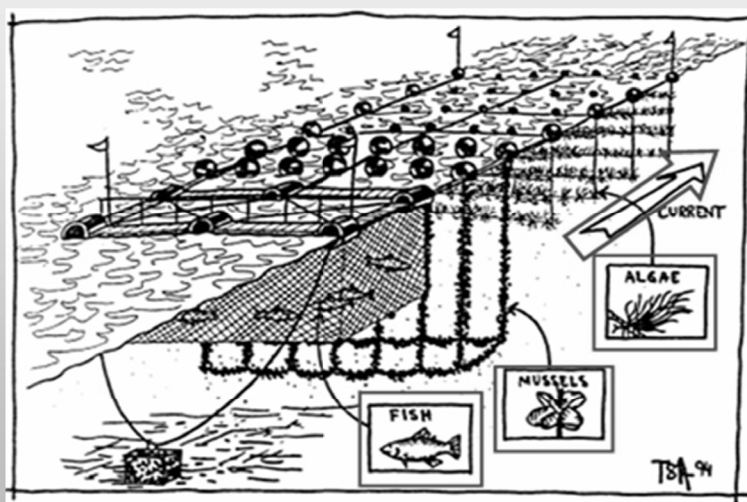
Potential Impacts of Mariculture to Environment



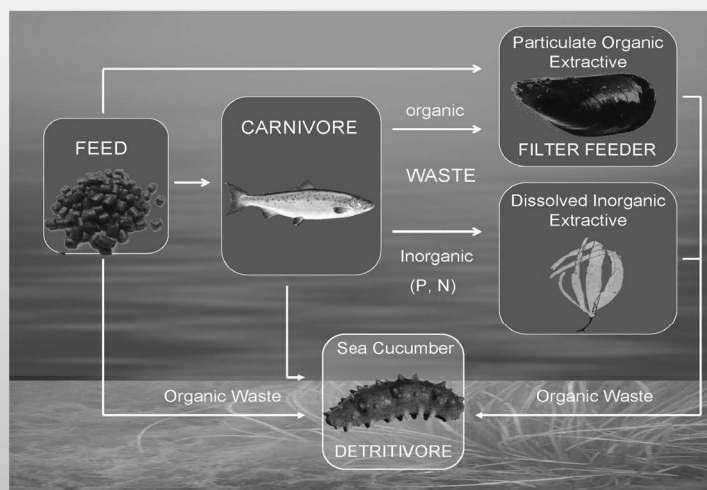
<http://www.yslme.org>



Concept of IMTA



<http://www.yslme.org>



IMTA concept: The particulate waste in the water column is removed by filter feeding bivalves, while the portion that ends on the seafloor is utilised by sea cucumbers. The dissolved inorganic nutrients (N, P & CO₂) are absorbed by the seaweed that also produces oxygen, which in turn is used by the other cultured organisms. Modified from (Fang et al. 2009)

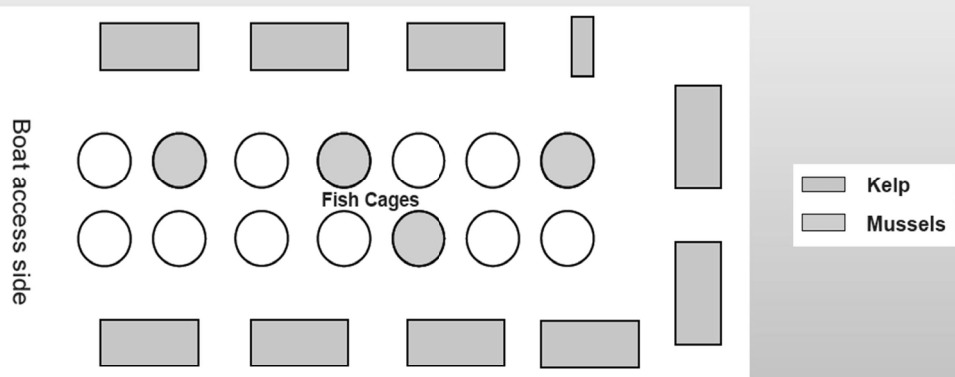
<http://www.yslme.org>



<http://www.yslme.org>



Efforts in Sustainable Mariculture - optimal situation



Fish-Seaweed-Oyster (wet weight)
1 kg : 7 kg : 4 kg

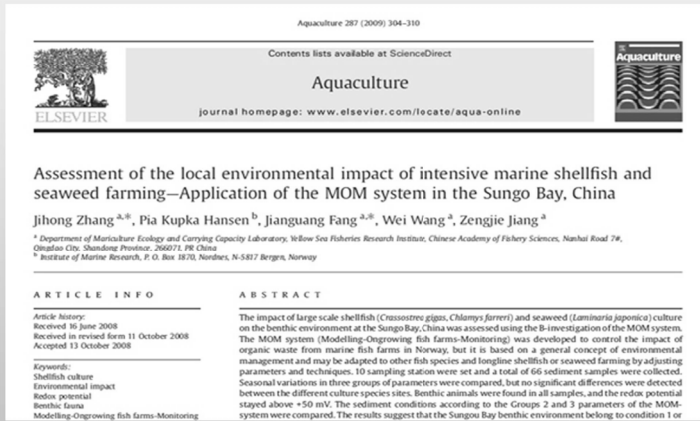
<http://www.yslme.org>



<http://www.yslme.org>



Is This Working?



in the Sungo Bay the impact of long-term large scale aquaculture of shellfish and seaweed on the benthic environment was low

<http://www.yslme.org>



Is This Working?

Checking



<http://www.yslme.org>



Economic Valuation of IMTA

