Forces Driving Sustainability in the Yellow Sea Mariculture of the South Korea

In Kwon Jang

West Sea Mariculture Research Center, NFRDI, South Korea

UNDP/GEF Yellow Sea Large Marine Ecosystem Project

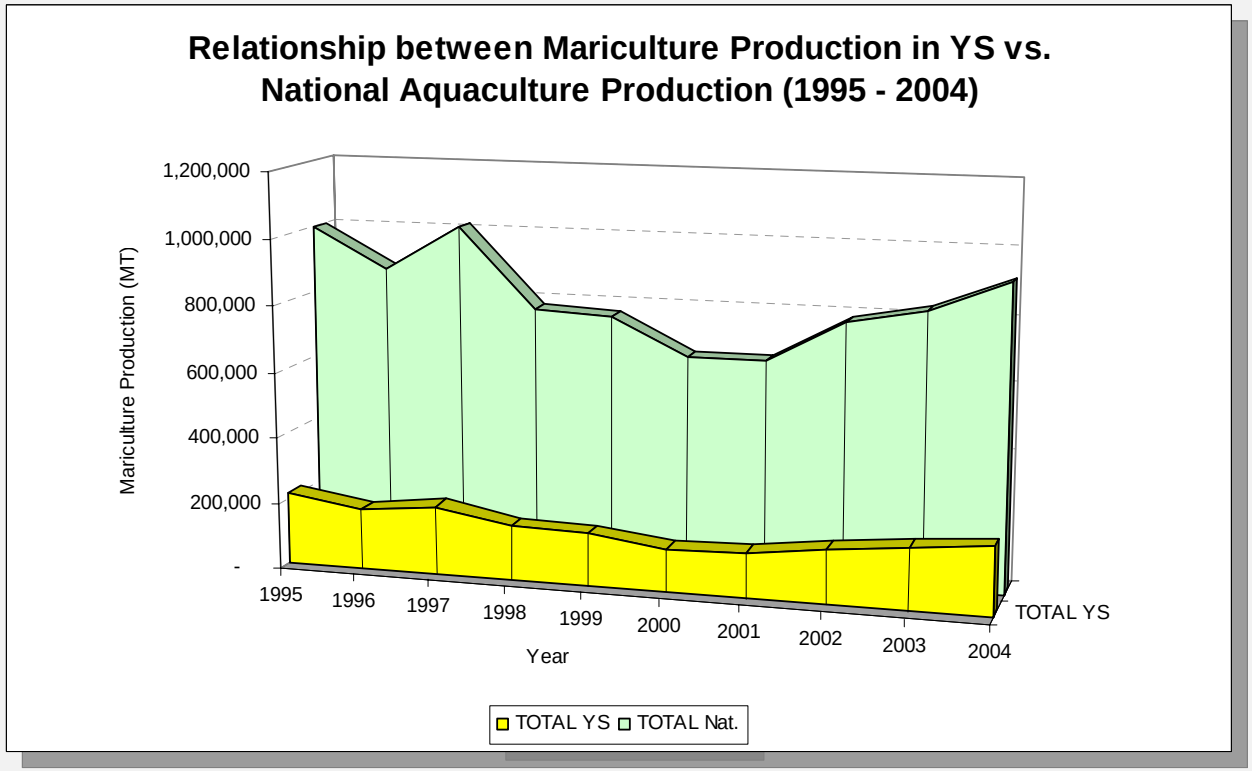
INTRODUCTION

- Mariculture production in the Yellow Sea (YS) coast of South Korea reached 208 × 10^3 MT or 22.7% of total national mariculture production in 2004.
- Total mariculture production in the Yellow Sea was not significantly changed during the last decade, decreased by 3.2% only.
- However, the production of seaweeds which reduces nutrients decreased by 17.4% and that of finfish increased by ten times during the same period.
- Although it is not so serious as in the southern area of Korea, YS is also facing environmental stress including disease outbreak, eutrophication and harmful algal blooms in the farming ground.

INTRODUCTION

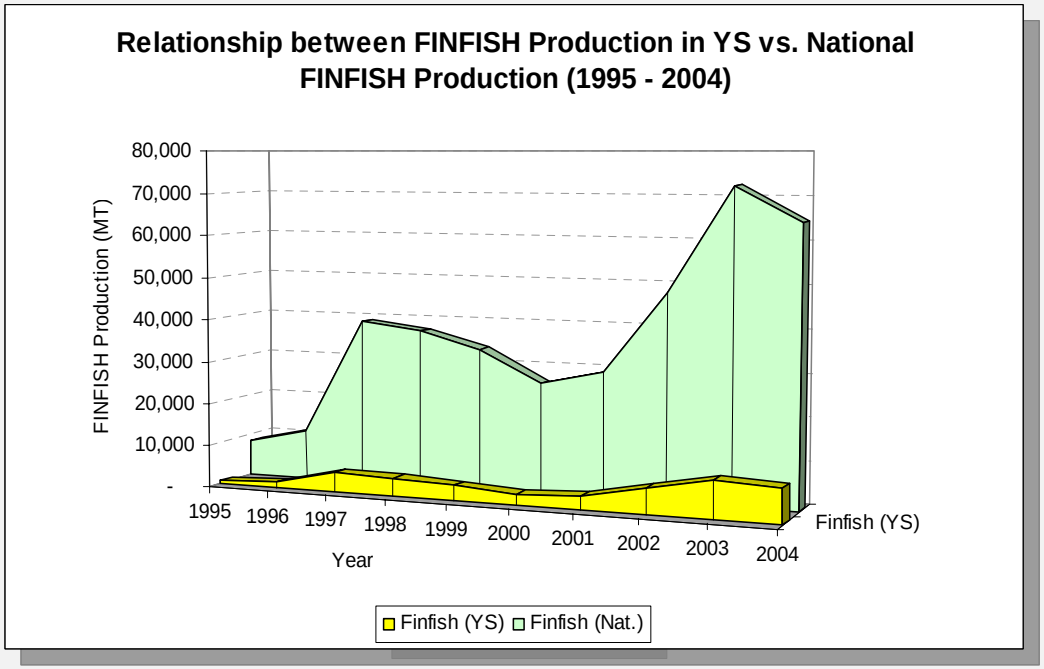
- To reduce environmental pollution and enhance sustainability of agriculture and aquaculture, the government is preparing development of green technology(GT) project
- Some studies have showed promising results
  - Limited water exchange shrimp culture, offshore aquaculture technology, marine ranching projects and vaccines
- In addition, the Aquatic Animal Disease Control Law (AADCL) and its enforcement regulations were enacted in December, 2008.

Total Aquaculture Production in National and YS coast in Korea



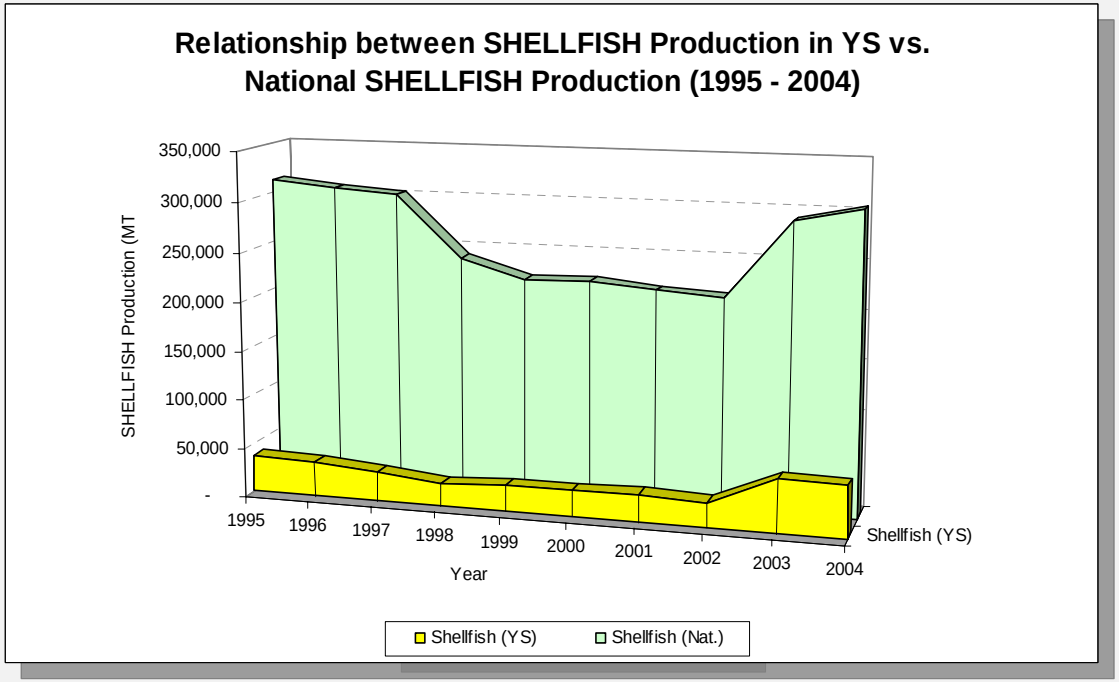
	YS	National	YS/national(%)
1995	215,763	996,451	21.65
2004	208,214	917,715	22.69
Increase(%)	-3.2	-7.9	4.8

Cultured Finfish Production



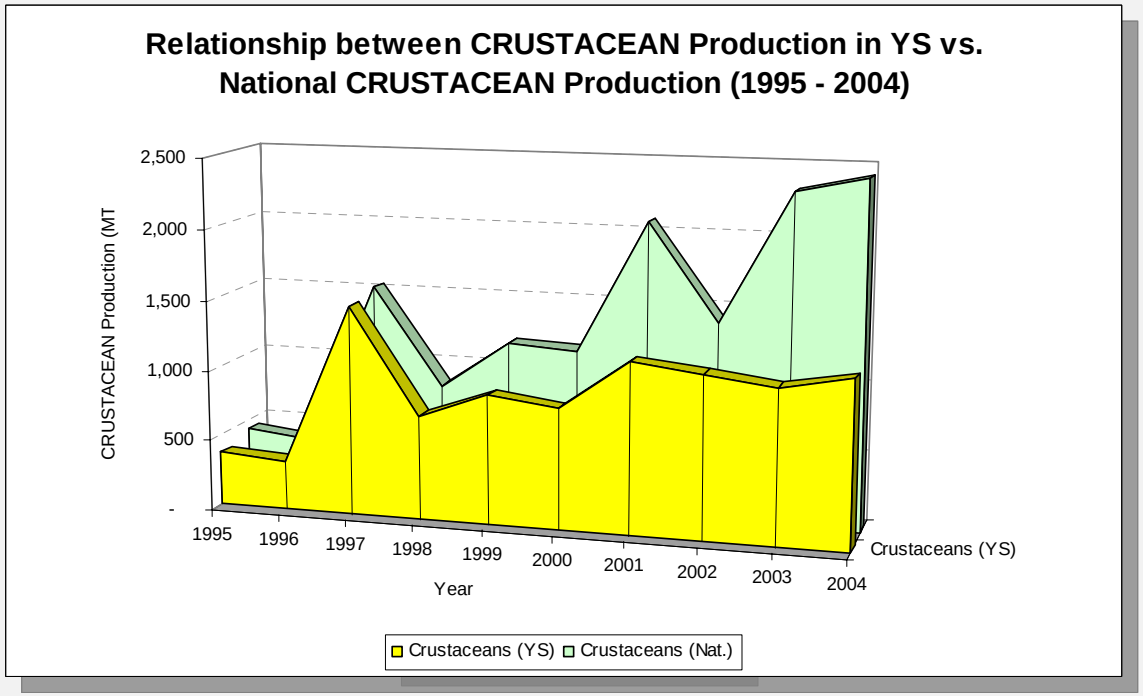
kind	species	1995		2004	
		YS	National	YS	National
Finfish	*Paralichthys olivaceus*	380.3	6,733.0	2,316.5	32,141.0
	Sebastes schlegelii	111.8	985.0	3,812.8	19,576.0
	others	226.0	633.0	1,920.0	12,759.0
	total	718.0	8,351.0	8,049.3	64,476.0

Cultured Shellfish Production



kind	species	1995		2004	
		YS	National	YS	National
Shellfish	*Crassostrea gigas*	17,252.3	191,156.0	23,479.8	239,270.0
	Ruditapes philippinarum	7,329.5	15,260.0	25,218.0	27,570.0
	others	12,699.3	105,836.0	4,393.3	38,049.0
	total	37,281.1	312,252.0	53,091.0	304,889.0

Cultured Crustacean Production



kind	species	1995		2004	
		YS	National	YS	National
Crustacean	*Fenneropenaeus chinensis*	352.8	404.0	1,179.0	2,426.0
	Penaeus japonicus	25.3	34.0	0.0	0.0
	total	378.1	438.0	1,179.0	2,426.0

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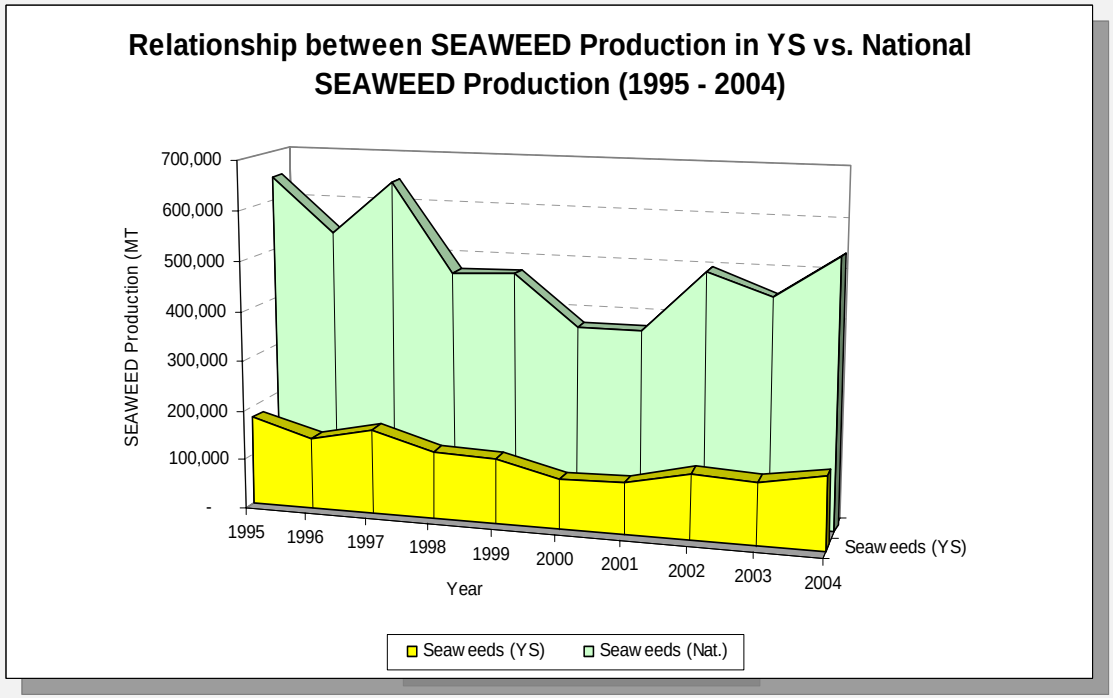
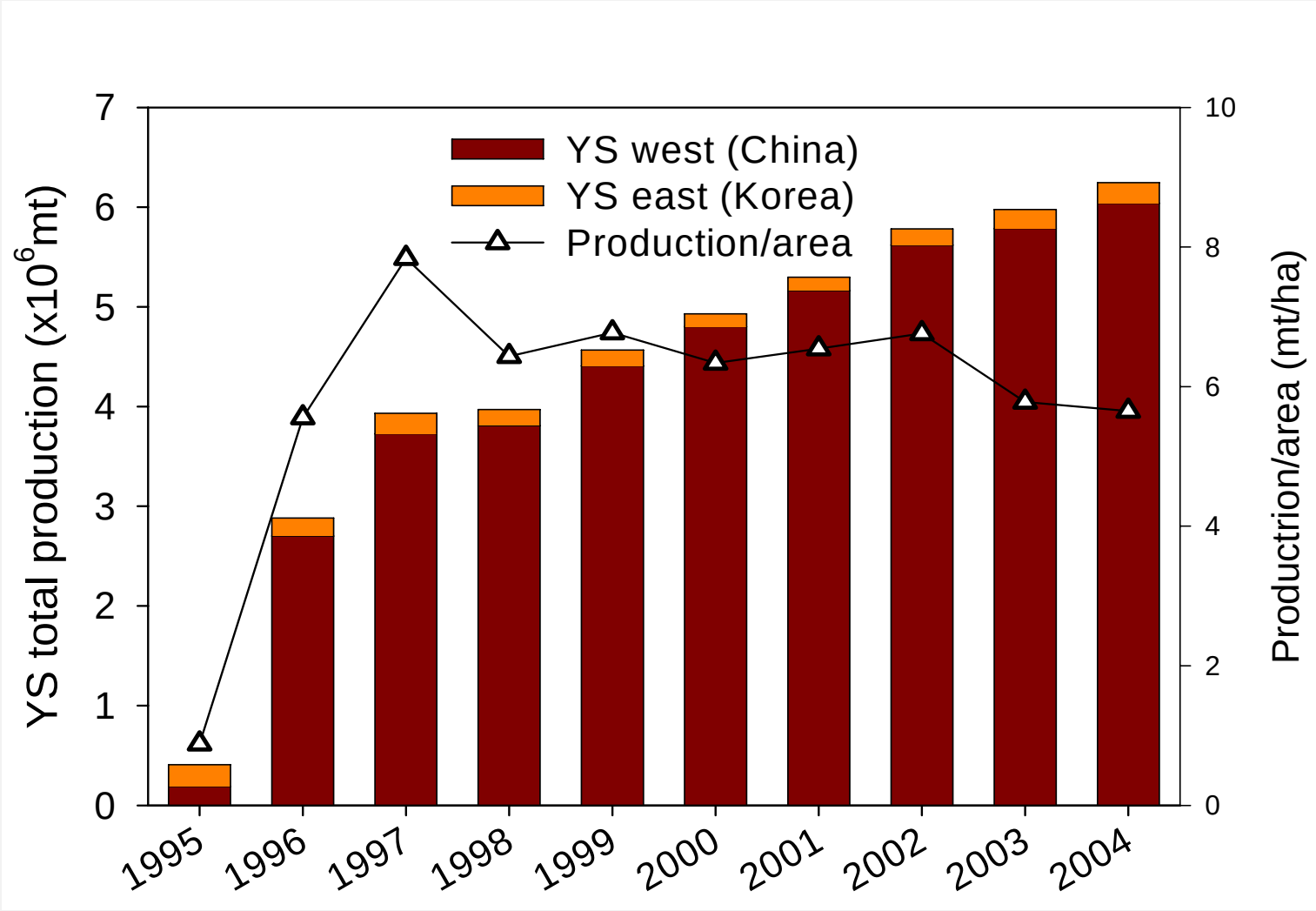
Cultured Seaweed Production



kind	species	1995		2004	
		YS	National	YS	National
Seaweeds	*Porphyra* spp.	67,757.5	192,960.0	80,191.0	228,554.0
	Undaria pinnatifida	93,658.3	386,819.0	54,686.5	261,574.0
	others	15,970.8	69,320.0	11,018.0	46,620.0
	total	177,386.5	649,099.0	145,895.5	536,748.0

Mariculture Production in YS coast of Korea and China



Different Types of Farms in the Yellow Sea coast of Korea

Green Technology Project

- Recently, the government is giving an impetus to development of new innovative technologies, i.e. Green Technology(GT)
  - To reduce CO_2 and environmental pollution and enhance sustainability of agriculture and aquaculture
  - Established by the National Science and Technology Committee and the National Future Planning Committee in January, 2009
- In the fisheries and aquaculture, a total of 28 major sub-projects are under preparation and enormous budget will be invested in the next decade.
- Of these, many projects are related to that of enhancing sustainability of aquaculture and reducing environmental stress in the Yellow Sea.

GT in Aquaculture

- Green Technology for Future Generation
  - Environmental-friendly and Energy-saving Fisheries Technologies: Bio-degrading fishing nets and gears etc
  - Bio-energy using macro algae
  - Highly efficient aquafeeds
  - Highly efficient RAS
- Promoting Environmentally-friendly Fisheries Industry
  - EBM (ecosystem based management) aquaculture based on carrying capacity
  - High-tech HAB monitoring and warning system

GT in Aquaculture

- Production of Green Seafood
  - LOHAS (lifestyle of health and sustainability) seafood
  - Organic aquaculture technology
  - Natural products (e.g. AMP) and probiotics for aquaculture
  - Offshore aquaculture technology

- Technologies Meeting with Global Warming
  - Aquaculture technologies coping with climatic changes
  - New cultured species and/or strains for climatic change
  - Vaccines for cultured animals

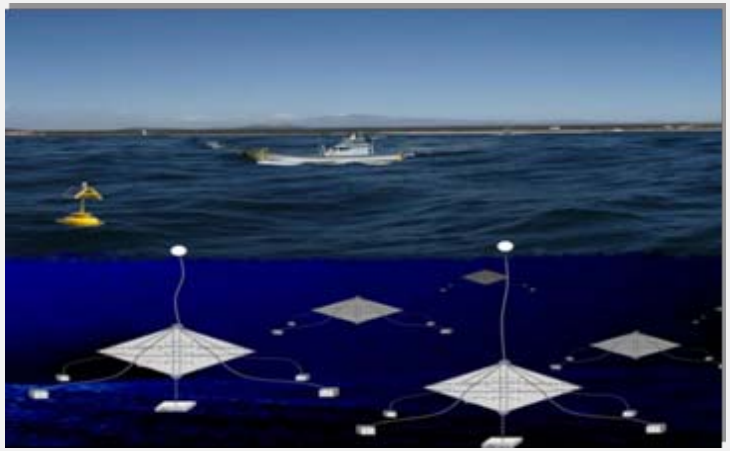
Some Technologies have Promising Results

- Regardless of GT project, some studies have showed excellent achievements and implemented to private sectors.
  - In Offshore aquaculture technology, several sets of commercial cages have been built and are now operating in Jeju and other places;
  - Limited water exchange shrimp culture technology has been developed and is now implemented by private farmers;
  - Big-scale Marine ranching projects are successfully progressing in several locations funded by central and local governments; and
  - Different kinds of Vaccines are commercially produced and provided to fish farms.

- Those have contributed to sustainability of aquaculture in YS

1. Offshore Aquaculture

- Farming fish under environments having 'higher carrying capacity', minimizing pollution and disease infection, and providing sustainability in aquaculture
- Projects in Jeju, Tongyoung and Geomundo-Is. ('05-'07)
- Culture units in Jeju are under operation and producing finfish
  - Constructed in 2005-2006
  - Three units of 3000m^3 and 5400m^3, respectively
  - Size : 15-22.5m (height) x 25-33m (diameter)



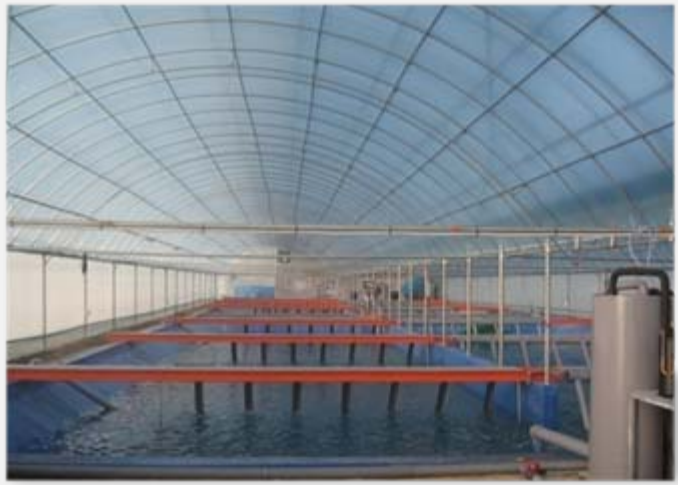
2. Limited Water Exchange Shrimp Culture

- No/Limited water exchange shrimp culture method using well-developed bacterial floc
  - Heterotrophic bacteria remove (assimilate) nitrogen compounds
  - Minimize pollution and viral transmission
  - Higher producible and less expensive than traditional RAS

  - Current technology can produce 20-25 kg/m^3 (2.5 crop/yr) which is 70-80 times higher than traditional pond culture

- Greenhouse enclosed super-intensive shrimp culture (NFRDI)
  - Pilot scale raceways of 18-28 m^2 (‘04-’08)
  - Commercial-scale prototype system of 600m^2 (‘08)
  - Implemented to private sector (two units in the east coast)

Commercial-sized unit is under operation in NFRDI

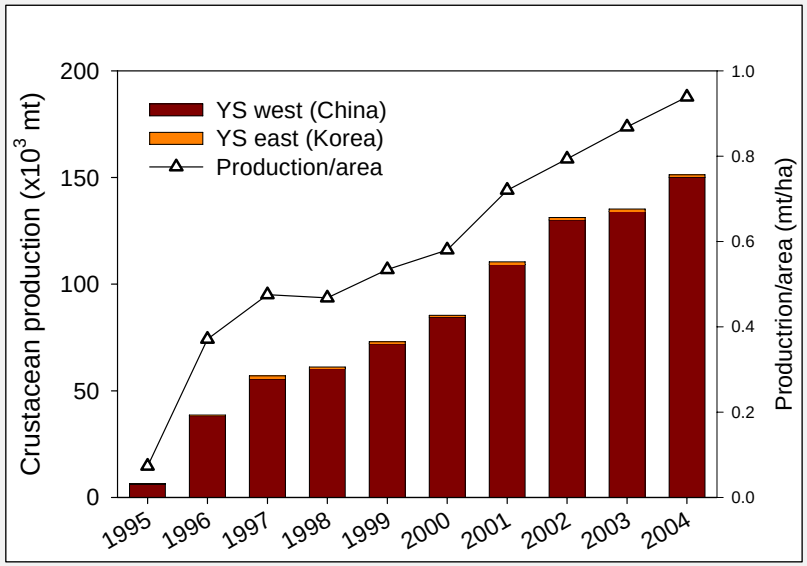


Prototype for implementation and training farmers (600m^2, Dec. 2008)

- Bacteria removes nitrogen compounds
- Stocking 500PL/m^2 in Feb. ’09
- Save 80% energy cost using heat exchange pump
- Three patents registered

Limited exchange technology solves problems

- No pollution without discharge
- No chemical and antibiotics, i.e. organic shrimp
- No viral disease outbreak because of no chance of transmission
- *Sustainability and Productivity are maximized*



RAS and Microbubbles technology for finfish culture

3. Marine Ranching Project

- To make favorable conditions to sea animals in limited areas, enhance wild stocks and conserve marine ecosystem
  - Construct artificial reefs, transplant seaweeds and release juveniles
- The central government selected five places and invests 1,589 million USD during 1998-2011
- A total of 583 million USD has been invested by 2007
- Taean is a project site in the Yellow Sea (2002 to 2011)

Long-term Marine Ranching Project			
Stages	1st stage	2nd stage	3rd stage
Purpose	Developing models	Expansion	Implementation
Financial sources	Central government	Local government	Non-government
No. of sites	five	50	500
Period	'98-'10	'05-'14	'15-'30

Sea Ranching Projects are on-going in YS

4. Vaccine

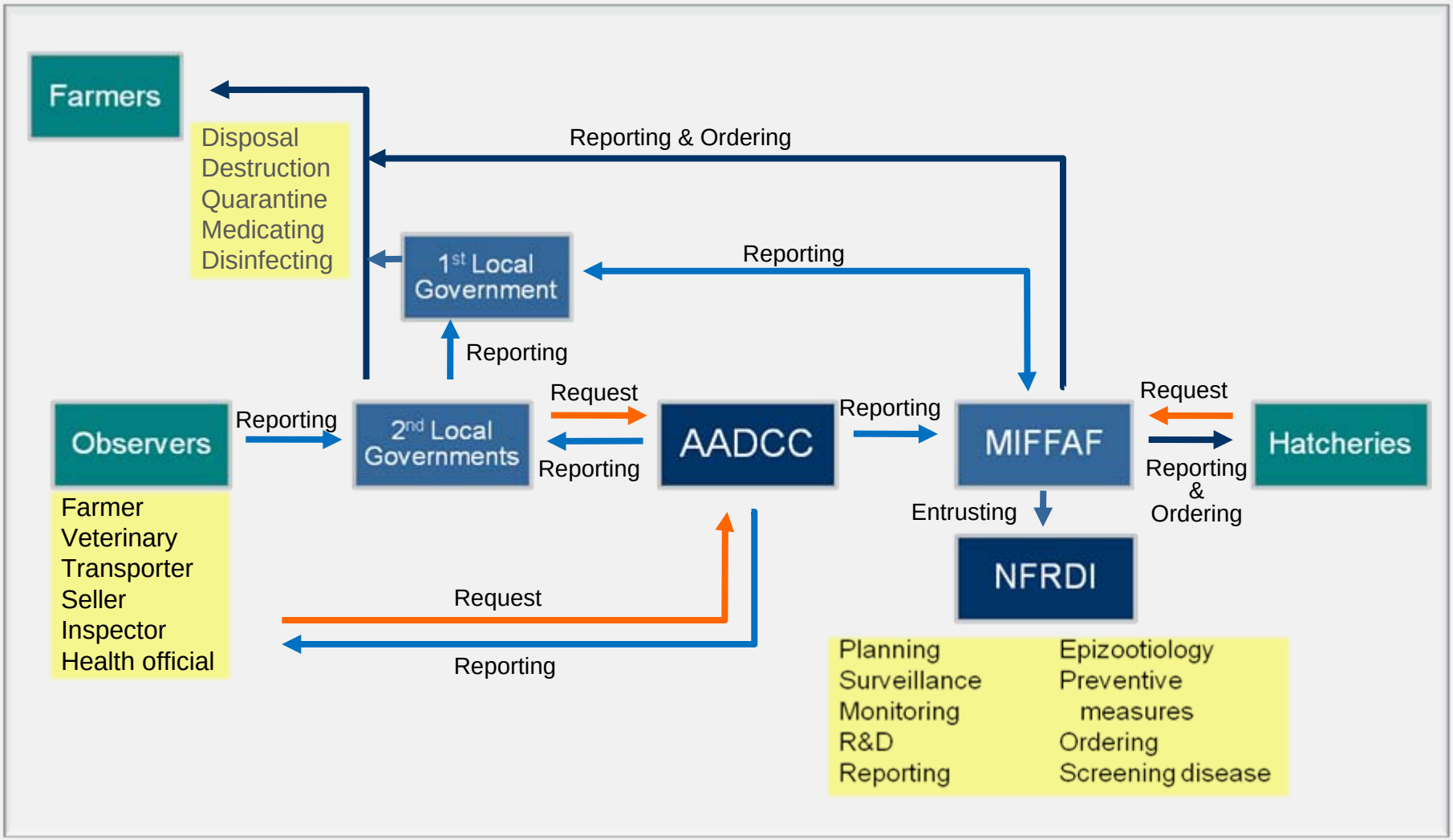
- Some vaccines are commercially available, and technologies of others were transferred to commercial companies or under developing

Vaccine	Target fish	Method	Remarks
Inactivate Edwardsiella	Flounder	Dipping	Commercially available
Inactivate Iridovirus	Sea bream	Injection	Developed in 2002
Inactivated Streptococcus	Flounder	Injection	Commercially available
Recombinant Iridovirus	Flounder	Injection	Developed in 2006
Inactivated Strepto+Edward	Flounder	Injection	Under developing

Aquatic Animal Disease Control Law

- Aquatic Animal Disease Control Law (AADCL) and its enforcement regulations were took effect in December, 2008.
  - Surveillance, monitoring, quarantine, disease control and jurisdiction
- Infectious diseases designated by law (11 kinds)
  - Red sea bream iridovirus (RSIV), spring viraemia of carp virus (SVCV), Koi herpesvirus (KHVD), viral nervous necrosis (VNN), viral hemorrhagic septicemia virus (VHSV), epizootic ulcerative syndrome (EUS), infectious pancreatic necrosis virus (IPNV), yellow head virus (YHV), Taura syndrome virus (TSV), white spot syndrome virus (WSSV) etc.
  - Fourteen kinds of Infectious diseases by enforcement ordinance
- An Aquatic Animal Disease Control Center and other seven reference laboratories were established
  - Epizootiological surveillance, warning, reporting, destruction and disposal of the infected animals from the aquatic farms in the country.

How to control diseases of aquatic animals



What to Do

- To reduce environmental stress and enhance sustainability of mariculture in the Yellow Sea
- Restrict or manage the exploitation of coastal area for new farms based on 'Integrated Coastal Governance'
- Develop the technologies reducing coastal pollution, i.e. offshore aquaculture, no water exchange culture, highly-efficient aquafeed, EBM aquaculture, selective breeding, disease warning and control and so on
- Financially or politically support the environmentally-friendly aquafarms and farming practices
- Green technologies in aquaculture and recently enacted AADCL are expected to act as a strong forces driving sustainability in the Yellow Sea mariculture of the South Korea in future

YSLME project is aiming
to reduce Environmental Stress
in the Yellow Sea Large Marine Ecosystem