CHALLENGE OF OFFSHORE AQUACULTURE IN KOREA

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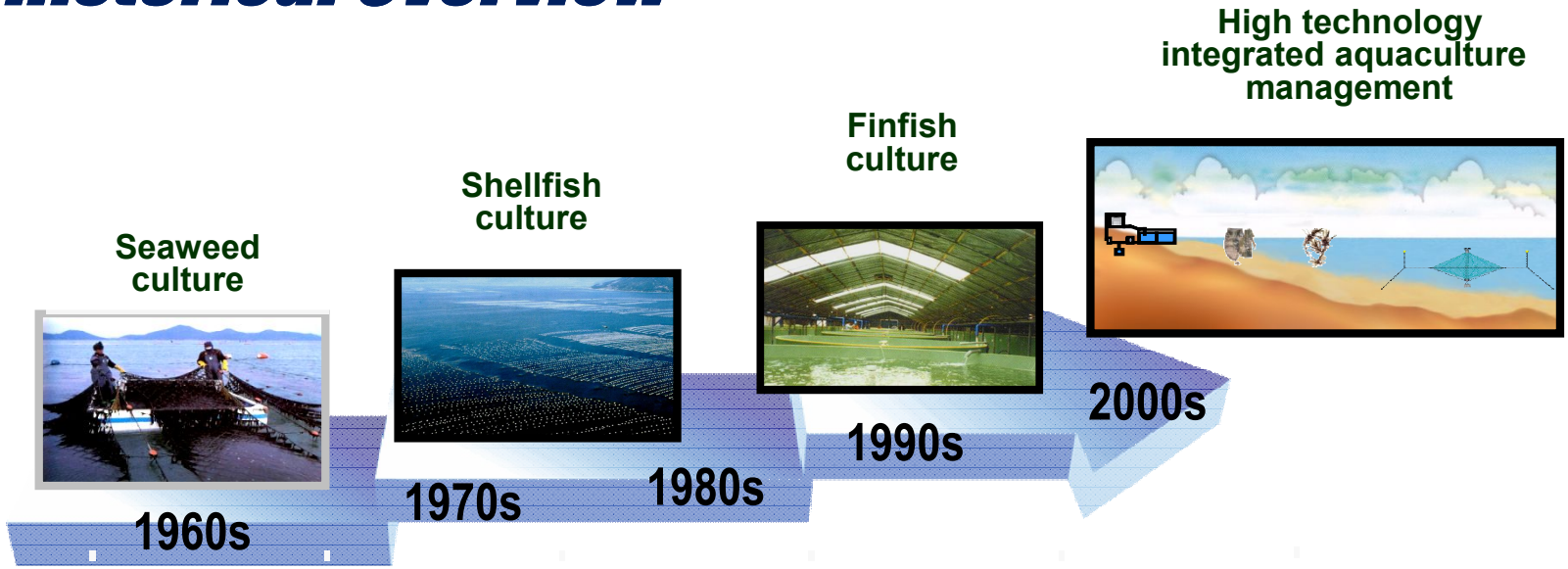
Korean Aquaculture

1. Historical Overview



- Marine culture has rapidly developed since the last 40 years in Korean sea and the major species have changed every 10-year term.
- Seaweed culture used to be the main species of marine culture from the 1960s to the middle 1970s, so as shellfish farming from the middle 1970s to the middle 1980s.
- Meantime, breeding and hatching techniques have been established for some marine fish, red sea bream, olive flounder as well as black rockfish from the 1980s to the 1990s.
- Since then, marine fish farming has become the most rapidly growing industry in Korea.

2. Characters

- Traditionally family-oriented and small scale business: high production cost
- Complicated license systems on aquaculture activities
- Various culture species and culture grounds
- High consumption propensity for fisheries products
  - Per capita food fish supply: 38.5kg (world average: 13.4 kg)
  - Various fisheries dishes: raw fish, soup, grilled, boiled, dried, etc.
- Highly developed culture technology
  - Seed production, on-growing, culture facilities, etc.
- Active support from the government
  - Research institutes, educational institutions, administration, etc.

3. Difficulties?

- **Over-cultured in South Sea where storms can be protected**
  - Low growth rate and pollution-driving disease outbreaks
- **Seasonal strong storms and typhoons, red tide, environmental impacts**
- **Complex legal and regulation aquaculture systems**
- **Negative images on culture products by disease, red tide, antibiotics**
  - Losing consumer' trust as valuable fish foods
- **Domestic and overseas circumstances**
  - Internally: demanding environment-friendly, food-safety aquaculture
  - Externally: importing low-cost fishery products
  - Quantity-oriented, few investment for aquaculture engineering

4. How to do?

1. To change the current aquaculture system

◆ Modification of culture methods

❖ Structure:

- Quantity-oriented ⇒ Quality and/or food safety-oriented aquaculture
- Intensive ⇒ Extensive and/or responsible aquaculture
- Integrated ⇒ Environment-sustainable and/or friendly aquaculture

❖ Culture site:

- Inshore ⇒ Offshore aquaculture

❖ Scale:

- Family-managed ⇒ Industrialized business
- Small-scale ⇒ Large-scale industry

How to do?

◆ *Up-grading of aquaculture business*

❖ Enhancement of internal and external competitiveness by

- Developing genetic engineering and breeding technology
- Minimizing disease's caused damages by quarantine and prevention from epidemics
- Diminishing production cost by automatic culture systems

❖ Restoration of consumer's trust by

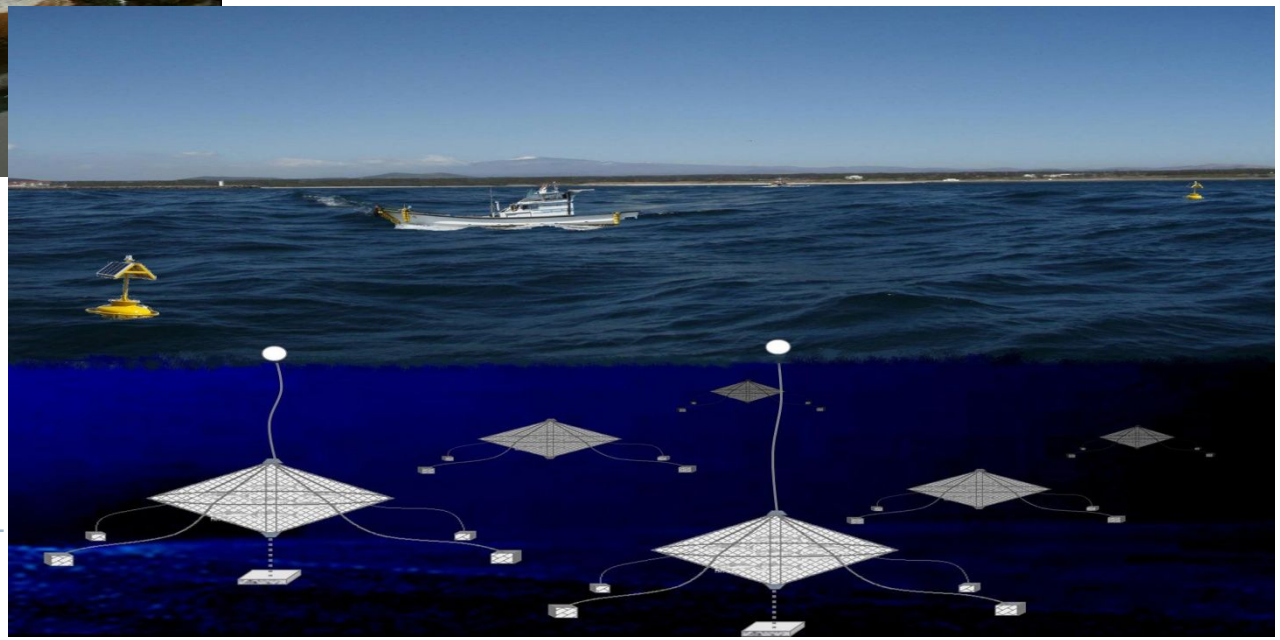
- Performing ecosystem-based aquaculture
- Reducing aquaculture-pollution loads by overall application of formulated feeds
- Minimizing medicine usage and vaccination
- Eco-friendly aquaculture by adapting recirculation culture system

How to do?

2. Current aquaculture paradigm shift by aquaculture grounds

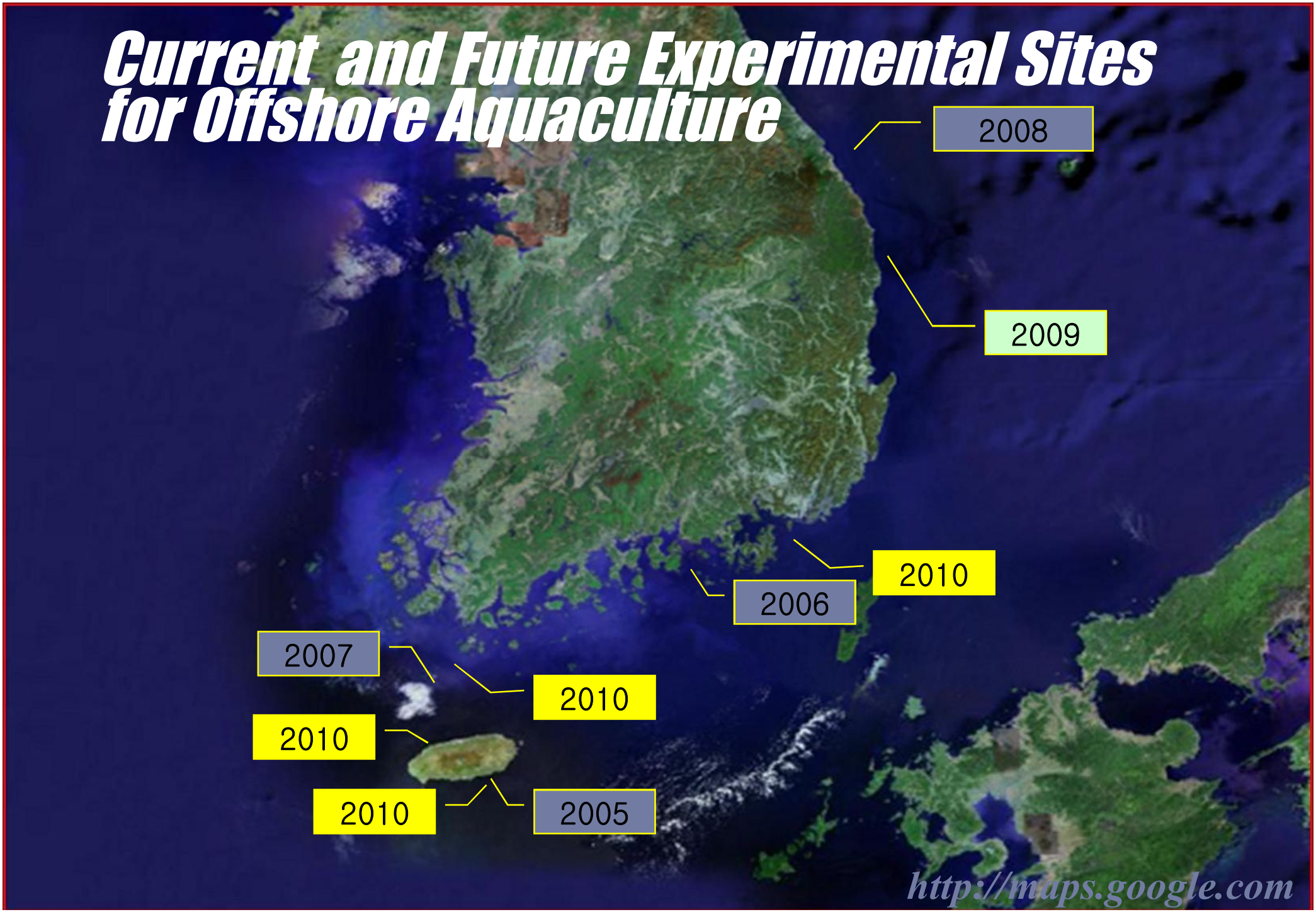
- ❖ **Inshore: Integrated Coastal Zone Management (ICZM)**
  - ➢ Finfish aquaculture within environmental capacity
  - ➢ Ecosystem-based aquaculture such as polyculture
  - ➢ Improvement of culture grounds by seaweed culture
  - ➢ Leisure/tourism-oriented coastal management
- ❖ **Offshore: Offshore Aquaculture**
  - ➢ ***Large industrialized cage aquaculture***

OFFSHORE AQUACULTURE



Brief History ?

- ❖ May 2002: 1st Korea-U.S. Aquaculture Cooperation Meeting
- ❖ December 2004: Approved the new offshore aquaculture project
  - ➢ Project for Korean Offshore Aquaculture: 2005-2007
    - ✓ Project team formation
    - ✓ Site and cage selection, visit several oversea offshore companies
    - ✓ Legal permission from central government
- ❖ April to July 2005: Imported and installed offshore cages
  - ➢ Three SeaStation3000 and three SeaStation5400
  - ➢ Installed at southern Jeju coast
  - ➢ No financial support from the local and central governments at initial stage
- ❖ Financial support from government from 2006
  - ➢ $1.4 million for each installation site
  - ➢ Tongyoung and Geomundo offshore aquaculture followed

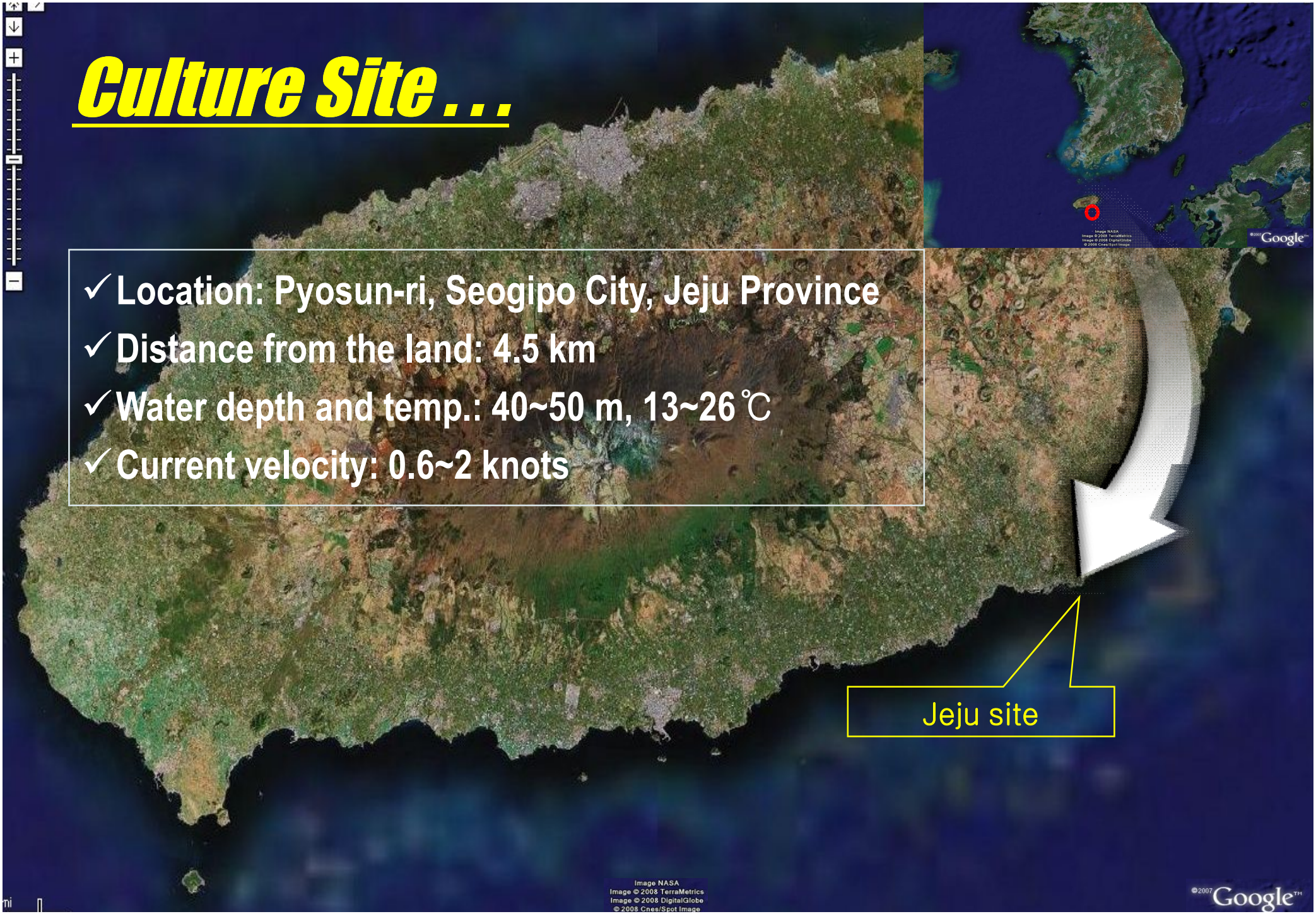

Current and Future Experimental Sites for Offshore Aquaculture
2008
2009
2010
2006
2007
2010
2010
2010
2005
http://maps.google.com

1. Offshore Aquaculture (Jeju)

♣*Project: Technology Development for Offshore Aquaculture*

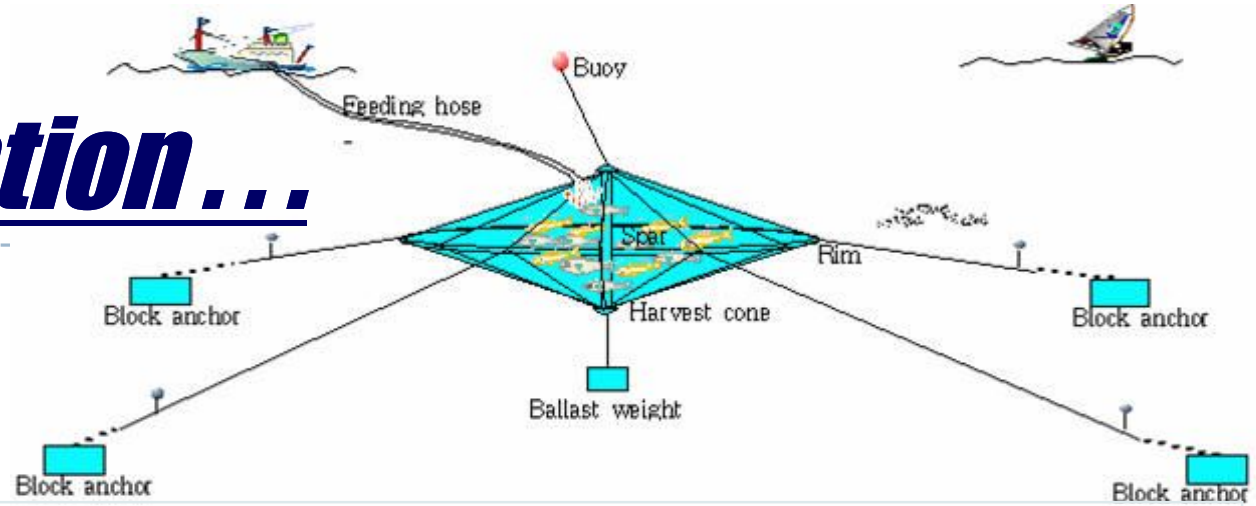
- ❖Experimental period: Three years (year 2005~2007)
- ❖Team formation and major roles:
  - ✓ Jeju Fisheries Institute, NFRDI: Culture techniques, target fishes, feed, etc.
  - ✓ Engineering department, NFRDI: Net-cage development suitable for Korean environments
  - ✓ Environment department, NFRDI: Environmental assessment
  - ✓ Noah Offshore Farm: Culture and business
- ❖Annual fund:
  - ✓ For research: R&D fund from NFRDI of $700 thousand
  - ✓ For business: Several million dollars from Noah Offshore Farm
- ❖Regal and social permission:
  - ✓ Experimental area: 10 ha

Culture Site . . .



- ✓ Location: Pyosun-ri, Seogipo City, Jeju Province
- ✓ Distance from the land: 4.5 km
- ✓ Water depth and temp.: 40~50 m, 13~26℃
- ✓ Current velocity: 0.6~2 knots

Cage Installation . . .



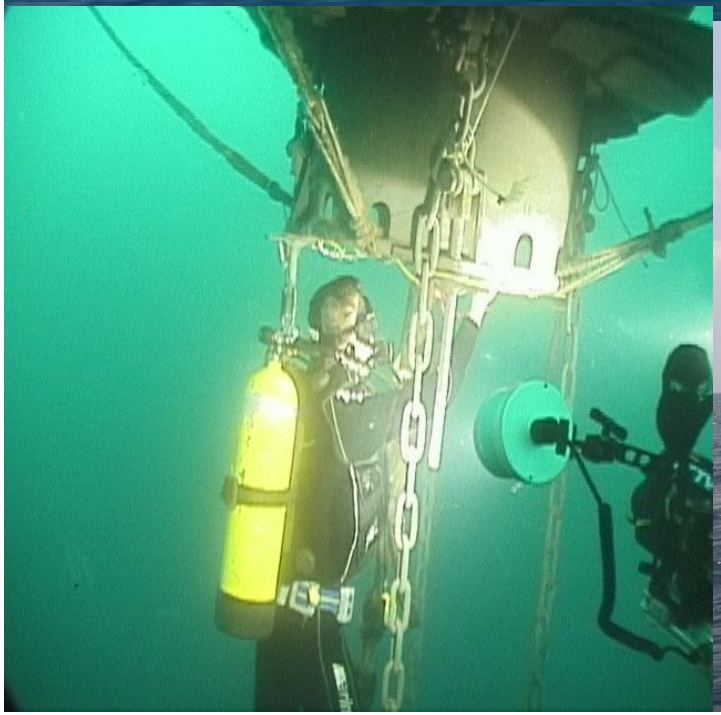
- SeaStation™ (OceanSpar LLC, USA)
- Main structure: Spar, rims, work desk, harvest cone, ballast weight, net, etc.

	SeaStation3000	SeaStation5400
No. cages	Three	Three
Date installed	May 5 – July 13, 2005	May 4 – 25, 2006
Height	15 m	22.5 m
Diameter	Φ25 m	Φ33 m
Total area	3,000 m^3	5,400 m^3
Anchor weight	25 ton, Four	37 ton, Four

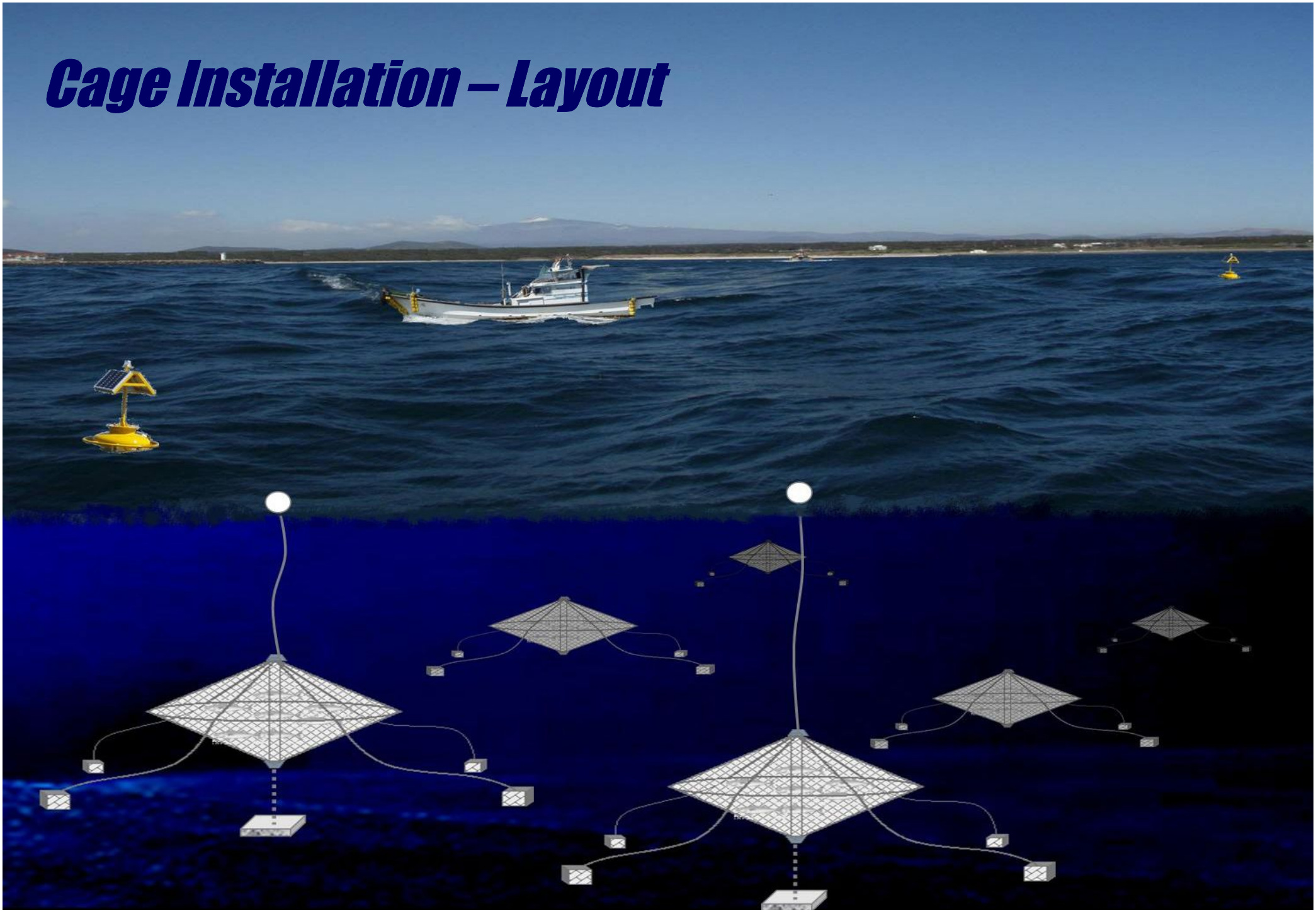




Cage Installation – Sea works

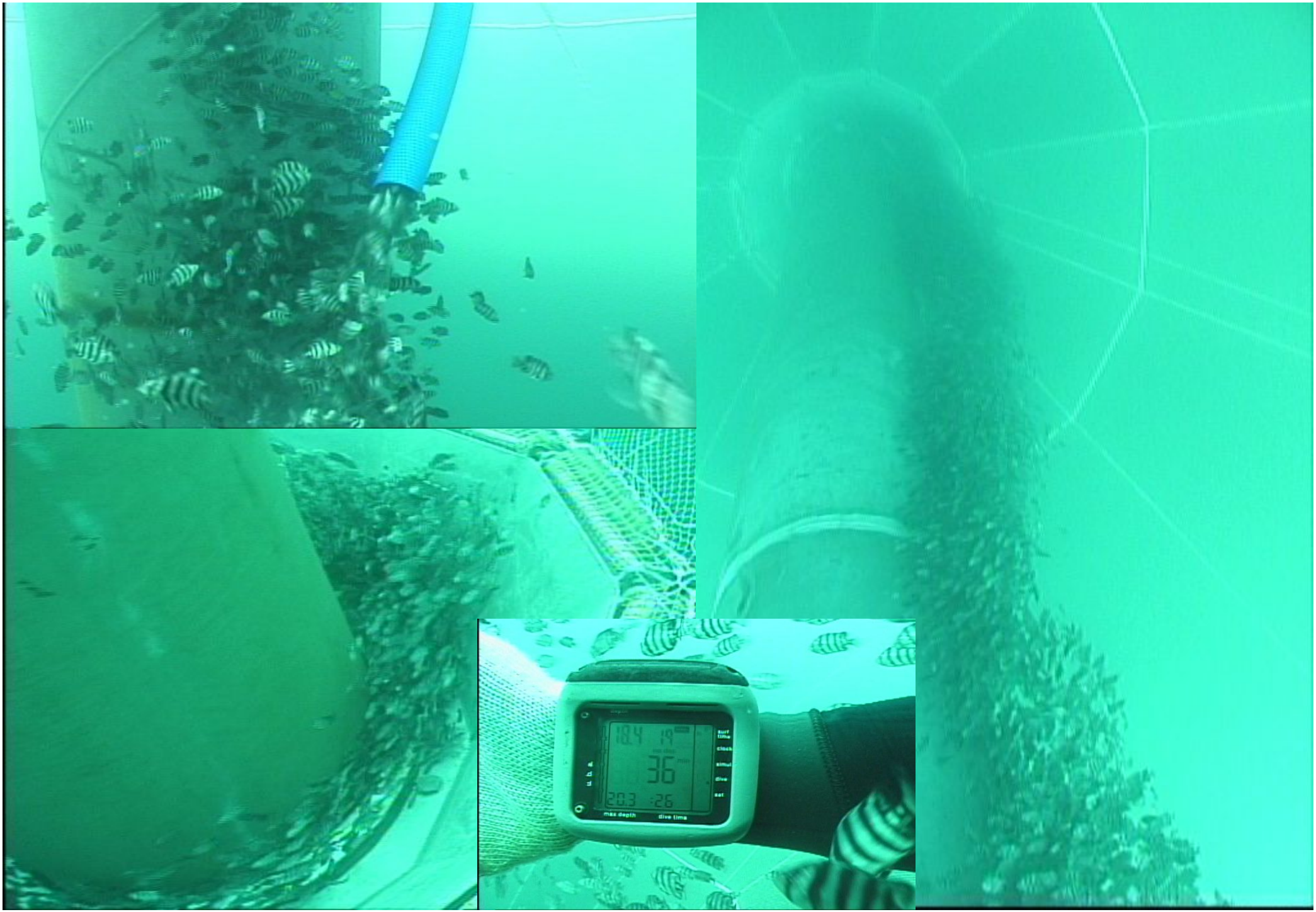


Cage Installation – Layout



Target culture fish

- Major culture fish at first phase: Parrot fish (*Oplegnathus fasciatus*)
  - Relatively expensive (larger fish size, higher market price)
  - Suitable for raw fish (taste, texture, etc.)
  - Artificial mass seedling production possible
  - Optimal temperature range in Jeju sea where cages are installed
  - **Competition with inshore aquaculture fish species**


18.4 19
36
20.3 :26
max depth
dive time
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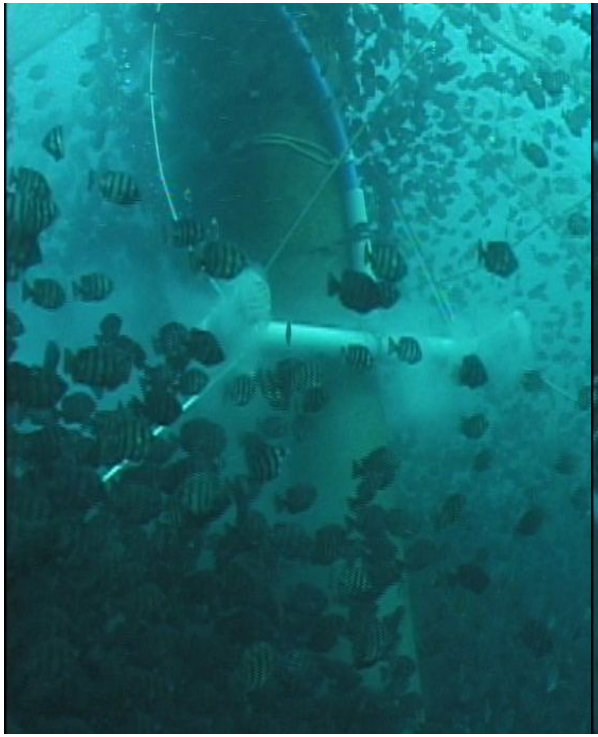
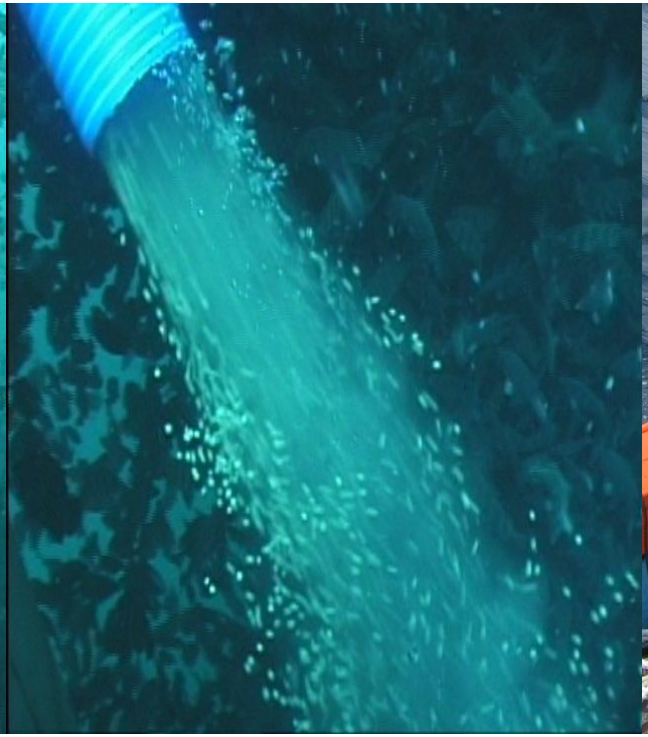
Feeding

❖**Semiautomatic feeder**

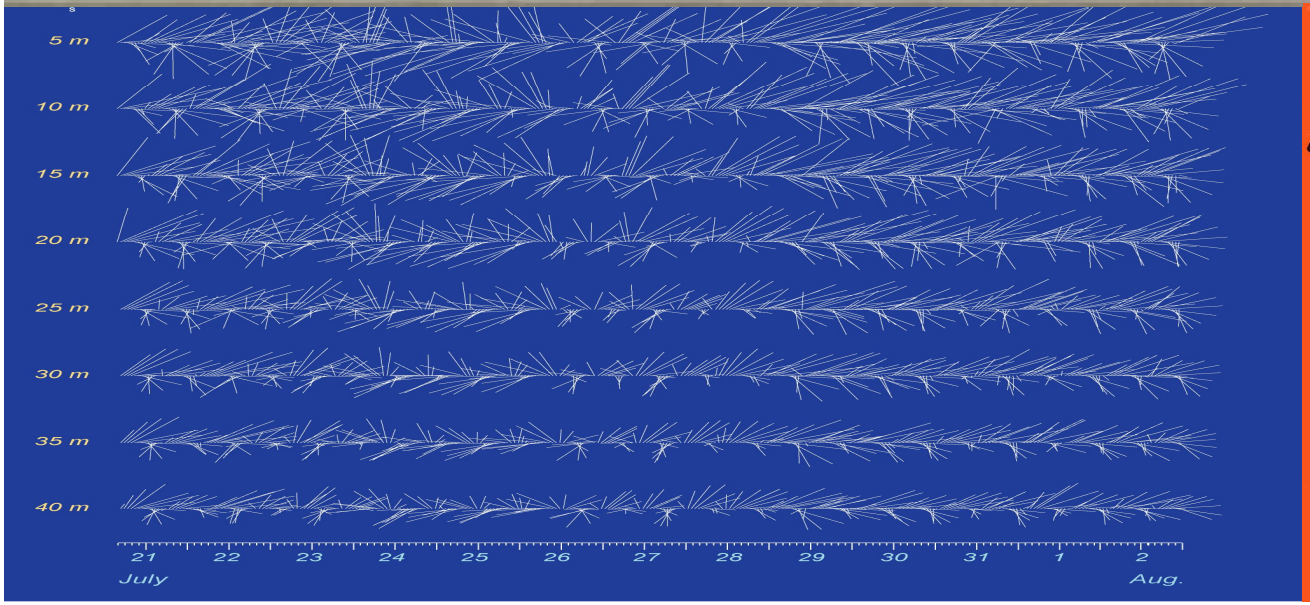
- Feeding by siphoning with water, 2 to 5 times per week
- No enough feeding by strong storms and water currents
- No feed storage and barge

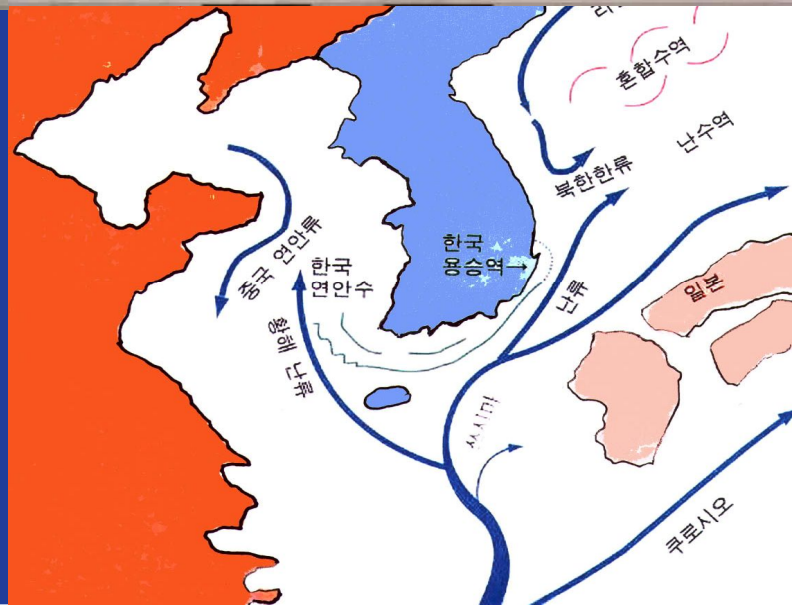




Cage Security

- ***By storms***
  - Three times of typhoons with 6 to 8 m wave
  - Destructed all buoys on the surface
  - No damage of cage and animal
  - Many times of big storms but no damage
- ***By water currents***
  - 50 to 70 cm/s (max. 120 ㎝/sec)
  - Enforced anchor lines





2. Offshore Aquaculture (Tongyoung)

- Culture site: Tongyoung city, South Gyeongsang Province
- Period of experiment: 2006-2008
- Cage: Three types of experimental systems developed by KORDI
- Institution: Korea Oceanic Research Development Institute (KORDI)
- Major target fishes: Brown croaker (*Miichthys miuiiy*), Red seabream (*Pagrus major*)

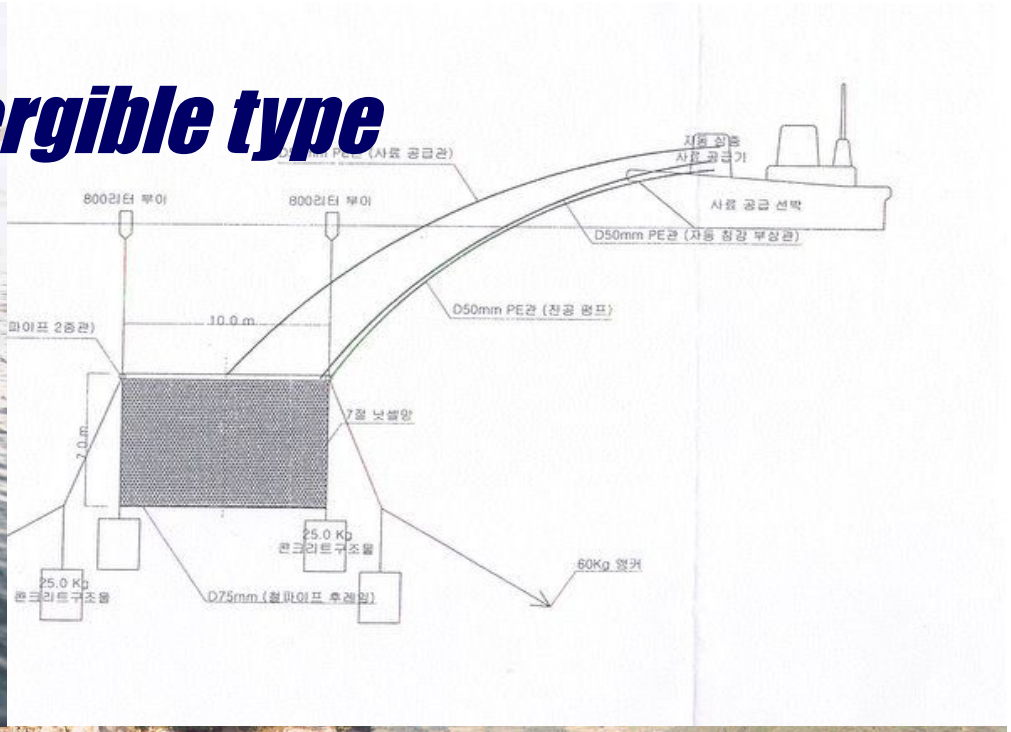
Culture Site . . .

Cage Installation

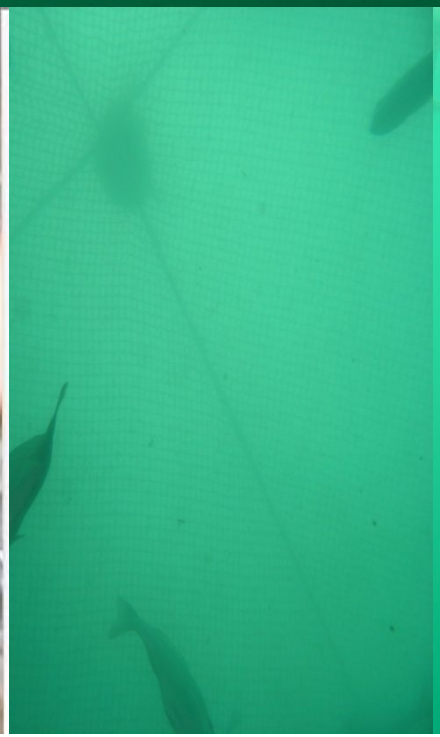
- Basic guidelines
  - Wind: 35m/sec
  - Wave: 5m high
  - Current velocity: 0.5-1.5m/sec

Cage Installation –Circular type

Cage Installation –Submergible type



Target fish and Feeding

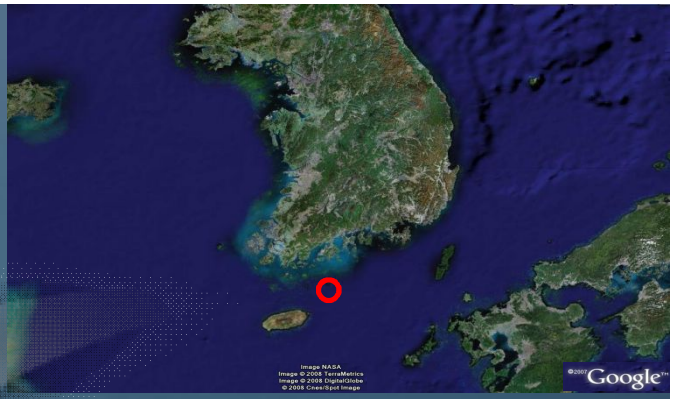


3. Offshore Aquaculture (Geomundo)

- Culture site: Geomundo, South Jeonlla Province
  - Licensed 5 hectare
- Experimental period: 2007-2009
- Cage: Four SeaStation^{TM}5400/Grid mooring type
- Name of company: Geomundo Offshore Farms/NFRDI
- Major target fishes and production capacity
  - Parrot fish (*Oplegnathus faciatus*), Red sea bream (*Pagrus major*), Mackeral (*Scomber japonicus*)

Culture site . . .

GEOMUNDO



DONGDO

SEODO

KODO

Geomundo site

Cage Installation . . .

- **SeaStation5400^{TM} (OceanSpar LLC)**
  - Volume: 5,400m^3
  - Composition: central spar of 22.5 m high, circular rims, harvest cone, net, etc
  - Anchored with four concrete blocks of 37 tons

Cage Installation –land and beachworks

Cage Installation –Sea works






Feeding

❖Autofeeder

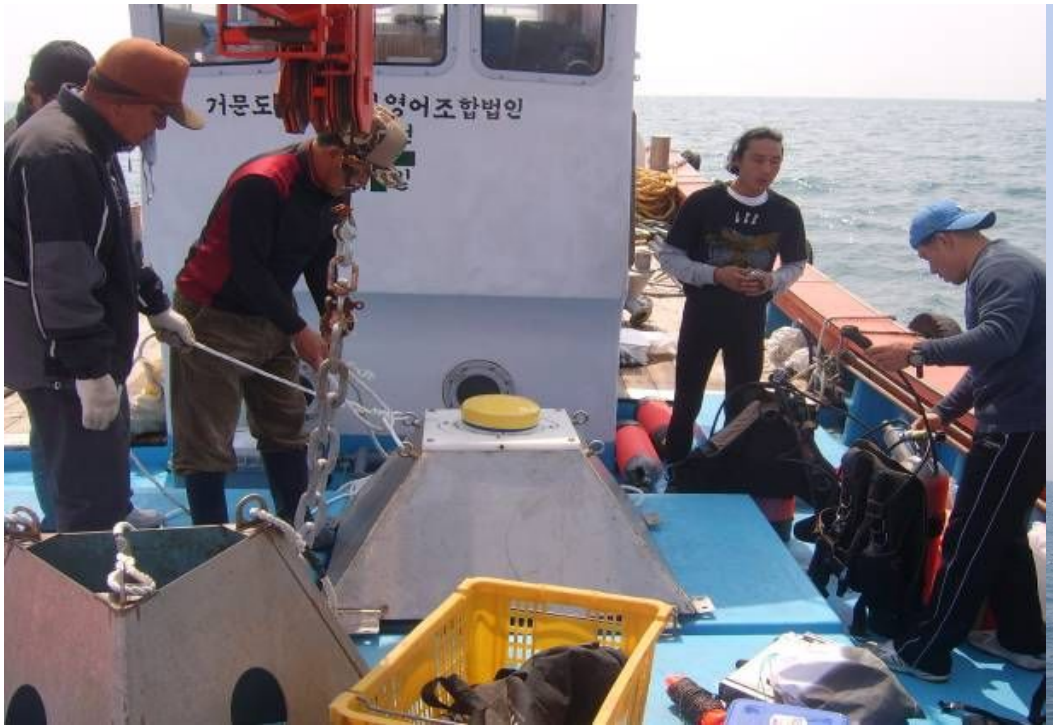
- Feed storage: totally 20 tons (5 tons with 4 chambers)
- Feeding: Four separate feeding with water pumping
- Manufactured by Hosan Manufacturing Co.

Target culture fish

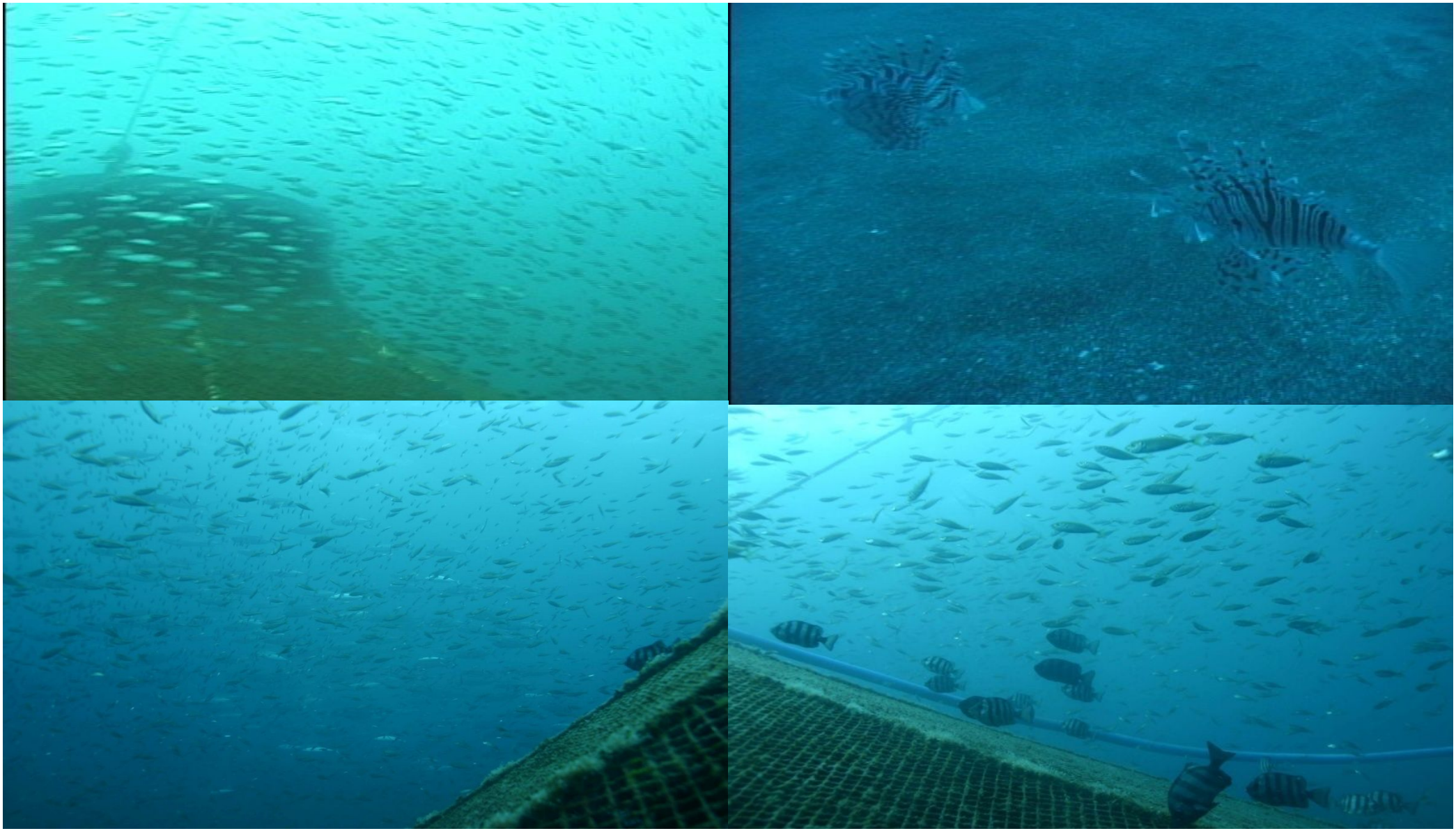
- Major target fishes:
  - Grouper (*Epinephelus septemphasiatus*), red seabream (*Pagrus major*)
- Annual production:
- Stocking:
  - July –August 2007
  - Stocked 1 year old fish overwintered
- Feeding: two to five times depending water temp.

Cage Safety

- ❖ Water currents ranged from 40 to 60 m/s
  - ➢ No damage of fish and cages
- ❖ Typhoon NARI was attacked around offshore site
  - ➢ Forty meter per sec velocity and three days (Sep. 2007)
  - ➢ No damage to cage, anchoring, rim, spar and culture animals



Fish schooling around offshore cages




감사합니다...
Thank you and enjoy your trip in Jeju!!!
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