Introduce of seaweed beds on the artificial reefs in Korea and Japan

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INTRODUCTION

- **Seaweed bed**

  : Algal communities composed of large brown algae like *Sargassum* and Laminariales (kelp)

- One of the most important marine resources

- Habitat, shelter, nursery and spawning beds for some fishes, abalone and spiny lobster, which are valuable fishery resources

- **Recent devastation on coasts causing barren grounds is increasing in many parts of the world**

- Loss of natural population of many marine organisms

- Fishery resources such as abalone, lobster, fishes and seaweeds became extremely depleted

- **Many ecological study**

  : Special attention for re-establishment of artificial kelp forests using artificial reefs

- **Artificial reefs construction**

  : Important techniques in the coastal area for the enhancement of fishery resources

  - Bring an improvement of fishing by concentration fishes and increased natural production of biological resources

- **For purpose of recovering the lost seaweed beds, many fishery scientists and phycologists have tried to create new seaweed beds using artificial reefs**

- **Succession and construction of seaweed beds on the artificial reefs in Korea and Japan**

MATERIALS and METHODS

- **Korea**

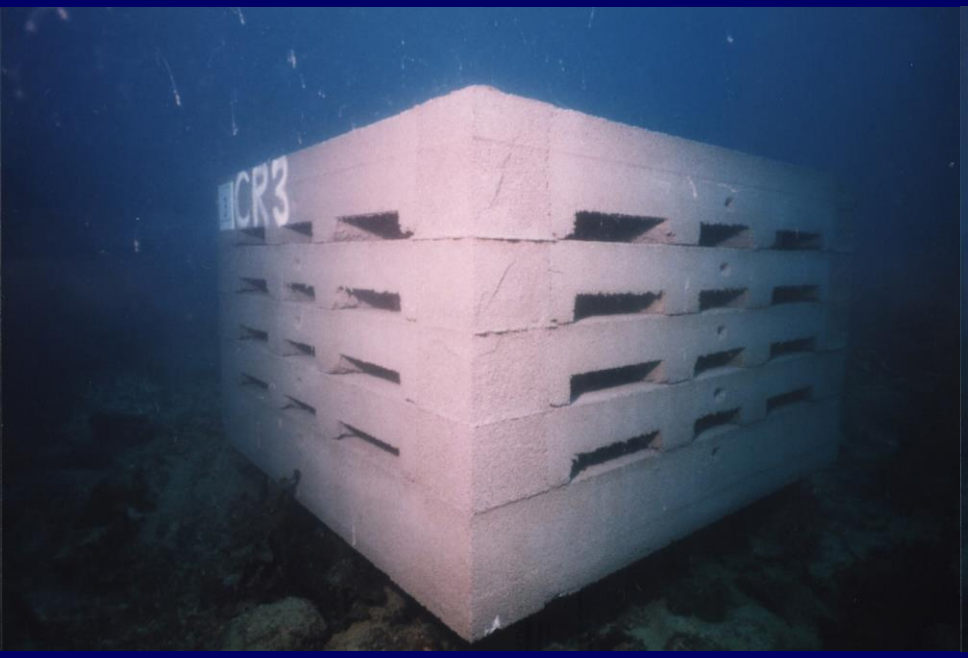
- **Site : Hosan, East coast of Korea**
- **Period : Jan. to Dec. 2002**
- **Observation : Monthly by SCUBA diving**
- **Seedlings : *Laminaria, Costaria, Undaria, Eisenia***
- **Construction : Hanging method**
  Spore bag method
  Plant transplantation
- **Photographs : Digital video camera, 35mm camera**

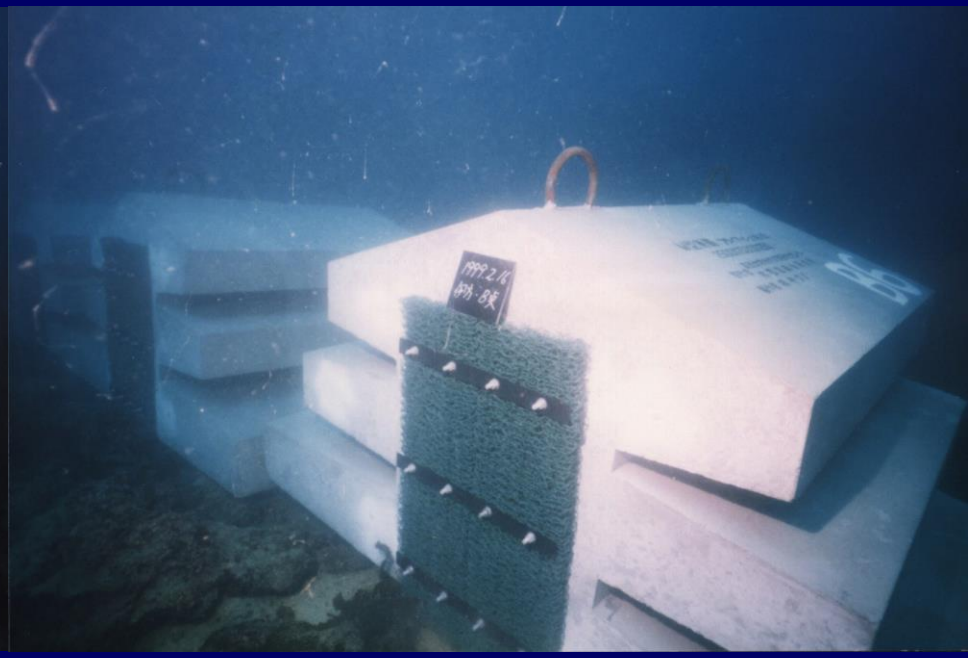
- **Japan**

- **Site : Muronohana, Ikata, Shikoku, Japan**
- **Period : Feb. 1999 to May 2003**
- **Observation : Monthly or bimonthly**
- **Photographs : Digital video camera, 35mm camera**
- **Artificial reefs : Concrete (M, RF type)**

Iron type reefs

Set up an artificial reefs





RF type reef

M type reef

Schooling *Girella punctata* inside of the RF type reef

RESULTS

- **Biomass of seaweed on artificial reefs**

- ***Laminaria japonica*** **increased to between 128.1 kg/m to 328.1 kg/m → maximum on Jun.**
- ***Costaria costata*** **increased to between 40.6 kg/m to 50.0 kg/m → disappeared after Jul.**
- ***Eisenia bicyclis*** **increased to bewteen 1.4 kg/m to 4.3 kg/m on Jun. to Oct. → 25cm length on Oct.**

Monthly biomass on transplanted seaweed

(Unit: kg/m)

	Depth (m)	May	Jun.	Jul.	Aug.	Sep.	Oct.
L. Japonica	6	169.3	326.7	129.7	203.3	167.0	156.8
	8	245.1		217.4	162.7		
	10	157.4	326.8	205.0	223.6	117.5	137.8
C. Costata	6	50.8	41.5	10.3			
	8	52.4					
	10	46.3	41.6	10.5			
E. bicyclis			1.4	1.9	2.2	2.1	4.3






Growth of young plants on the artificial reefs




Formation of *Laminaria japonica* beds on artificial reefs




Formation of *Costaria costata* beds on artificial reefs




Formation of *Undaria pinnatifica* and *Eisenia bicyclis* beds

- **Growth of transplanted seaweeds**

- ***Laminaria japonica*** **: Max. about 2m on Jun.**
  Reduced after Aug.
  Formation of sorus after Sep.
- ***Eisenia bicyclis*** **: Max. about 25cm on Oct.**
  8m depth than 3 to 5m depths

Formation of various seaweed beds on artificial reefs by hanging and spore bag methods

- **Algal succession on the reefs**

- **Within one month of placement**

  : Diatom colonized on the reefs

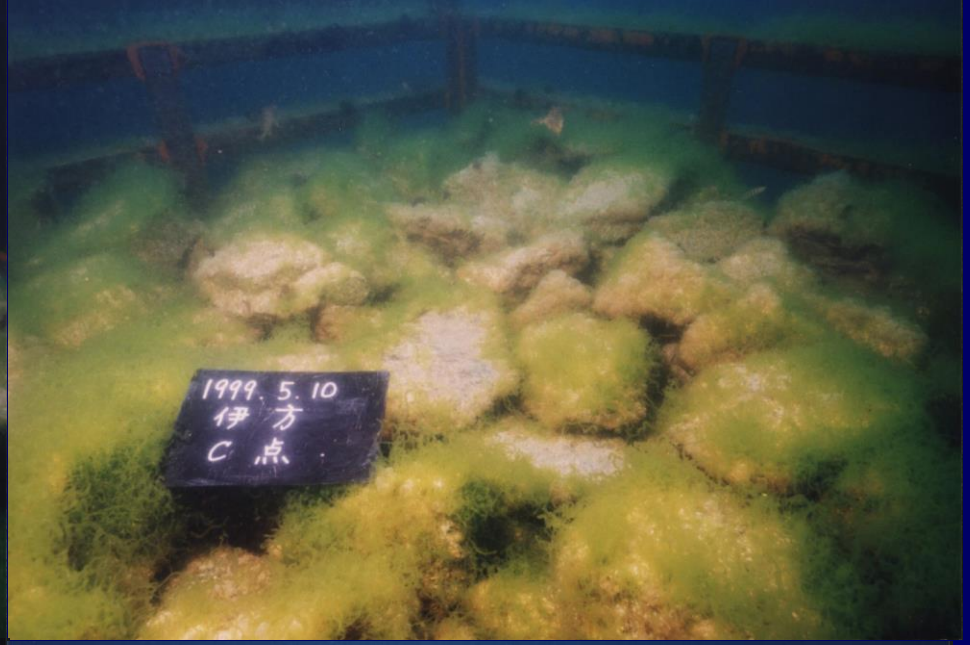
- **After three months**

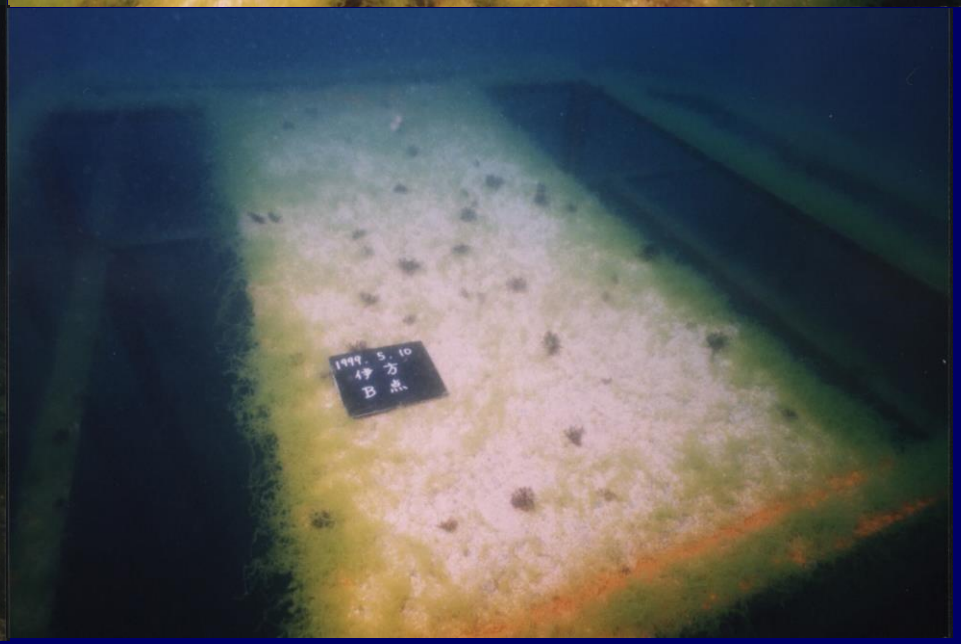
  : *Enteromorpha intestinalis* and *Colpomenia sinuosa* dominated in spring season

- **Seaweed on the reefs decreased during in summer season**

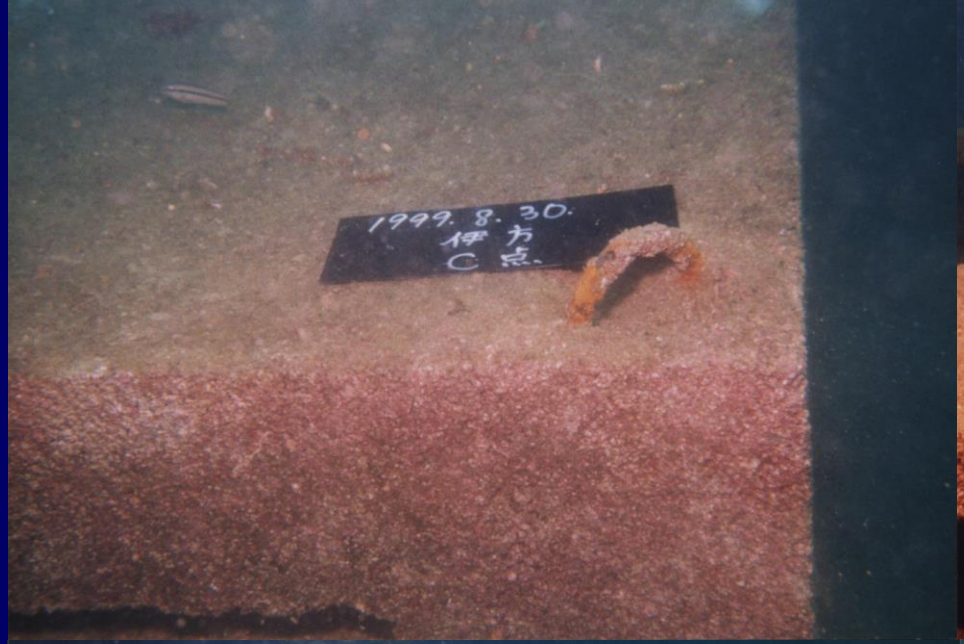
  Several species of Melobesioidea dominated

Diatom colonized and gathering sea cucumber on the reefs





Enteromorpha intestinalis* and *Colpomenia sinuosa



Decreased seaweed and dominated Melobesioidea

- **After 12 to 24 months**

  : Seaweeds grew up again and dominant on the artificial reefs

  Sargassum* spp., *Ecklonia kurome*, *Padina arborescens

- **Restoration of seaweed beds on the reefs**

  : Attained after two years since the artificial reefs were placement

Restoration of seaweed beds on the reefs

CONCLUSIONS

- **Algal succession on the reefs**

- Early stage : Diatom

Enteromorpha intestinalis

Colpomenia sinuosa

- Second stage : Coralline algae

- Climax stage : *Sargassum* spp.

Ecklonia kurome

Padina arborescens

- **Successional steps**

- **Season**
- **Water depth**
- **Differences of the surface roughness of the substrates**
- **Recruitment of spores and eggs for the mature plants**

- **Collaboration among different sector is absolutely required to achieve the objectives of construction of seaweed bed, such as marine ecologist, constructor, aquaculturist, coastal engineer, research scientist, government official**