PICES annual meeting, Khabarovsk, Rusia
19.Oct. 2011

Management strategies in a marine ranching ecosystem based on integrated fisheries risk analysis method for ecosystems (IFRAME) framework

Heewon **Park**, Jae Bong Lee, Young Il Seo and Chang Ik Zhang

PUKYONG NATIONAL UNIVERSITY

국립수산과학원 National Fisheries Research & Development Institute

Contents

Background

- ❖ **Need to apply holistic for ecosystem-based management**
- ❖ **Since 2007, IFRAME (Integrated Fisheries risk analysis methods for ecosystem) framework was studied**
- ❖ **EBFA (Ecosystem-based fisheries risk assessment and management system) was developed.**
  - **- Based on 3 objectives (Sustainability, Biodiversity, Habitat)**
  - **- Development for risk assessment methods for ecosystem**

Fisheries Research 100 (2009) 26–41

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

An ecosystem-based fisheries assessment approach for Korean fisheries

Chang Ik Zhang[a,*], Suam Kim[a], Donald Gunderson[a], Richard Marasco[b], Jae Bong Lee[c], Hee Won Park[a], Jong Hee Lee[a]

[a] Pukyong National University, Busan 608-737, Republic of Korea
[b] 18217 NE, 191st Street, Woodinville, WA 98077, USA
[c] National Fisheries Research and Development Institute, Busan 619-902, Republic of Korea

Background

- ❖ **EBFA was applied to Korean fisheries**

  - Large purseine (Cub mackerel),

  Marine ranching ecosystem (southern east and west of Korean waters)

- ❖ **IFRAME ("Integrated fisheries risk assessment forecasting and management for ecosystem")**

  - Add 1 more objectives (Socio-economic benefits)

  - Add forecast and management

- ❖ **IFRAME (Integrated fisheries risk analysis method for ecosystem)**

ICES Journal of Marine Science (2011), 68(6), 1318–1328. doi:10.1093/icesjms/fsr073

An IFRAME approach for assessing impacts of climate change on fisheries

Chang Ik Zhang[1], Anne Babcock Hollowed[2]*, Jae-Bong Lee[3], and Do-Hoon Kim[3]

[1]Division of Marine Production System Management, Pukyong National University, Busan 608-737, Korea
[2]National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115, USA
[3]National Fisheries Research and Development Institute, Busan 619-705, Korea

*Corresponding Author: tel: +1 206 526 4223; fax: +1 206 526 6723; e-mail: anne.hollowed@noaa.gov.

Background

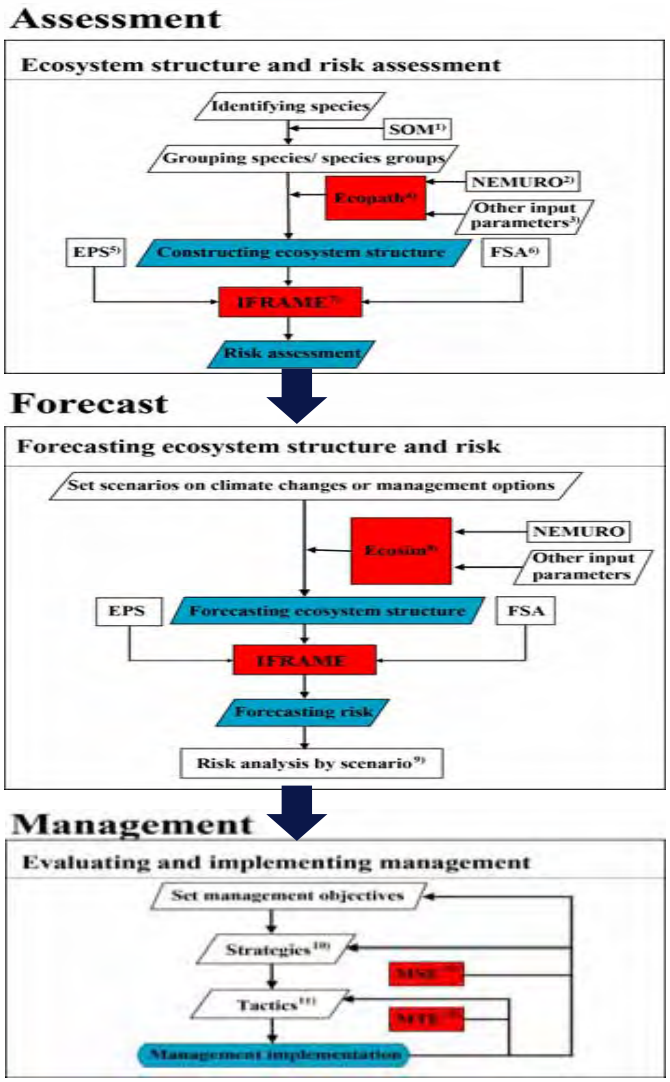
Goal

- **Introduce the IFRAME framework**
- **Suggestion of management strategies for marine ranching ecosystem based IFRAME assessment**

IFRAME

(Integrated fisheries risk analysis methods for ecosystem)

What is the IFRAME framework

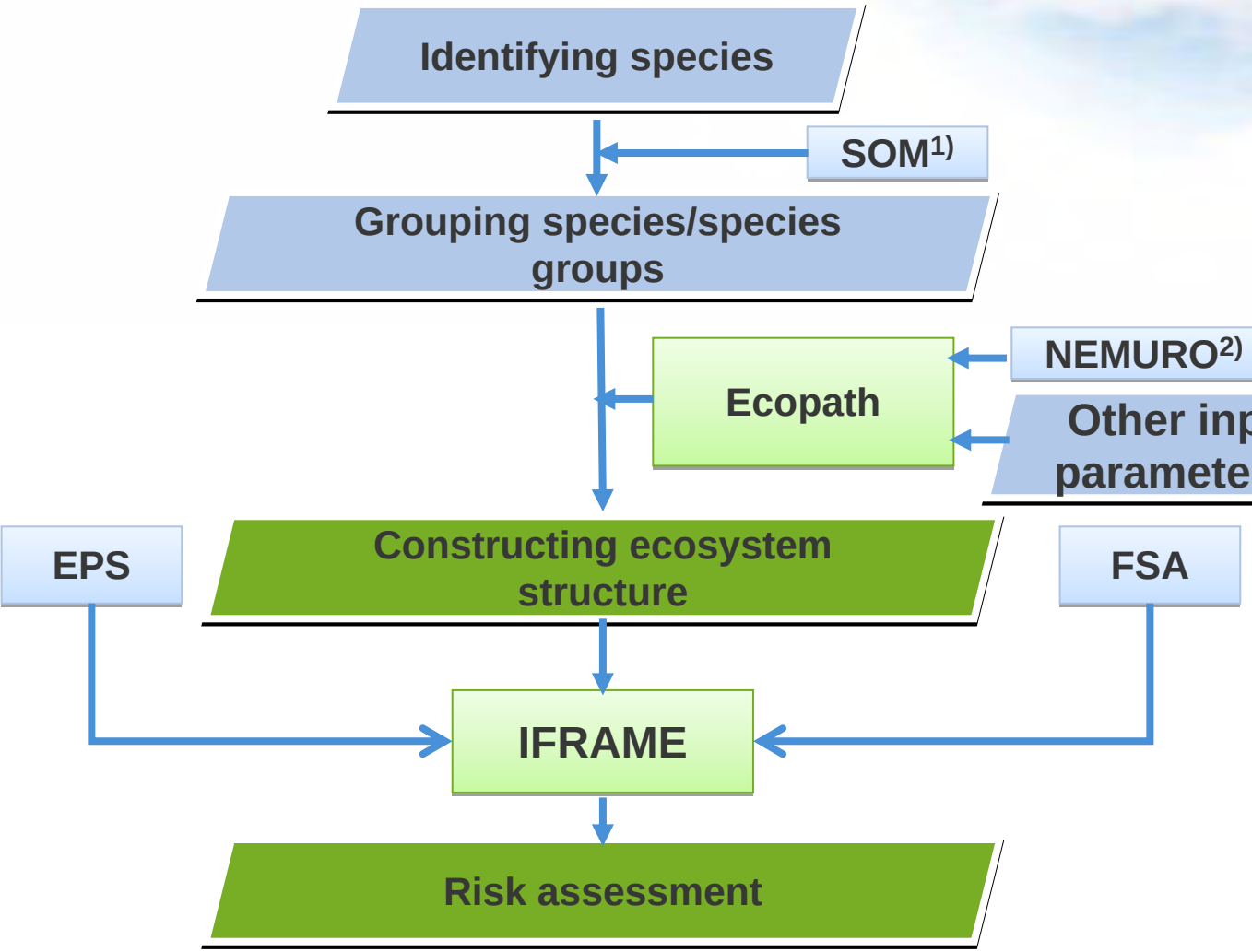


- **IFRAME framework was divided 3 parts, assessment, forecast, management**

- **Assessment**
  - **Constructing ecosystem structure**
  - **Risk assessment for ecosystem**
- **Forecast**
  - **Forecasting ecosystem structure by scenarios**
  - **Forecasting risk**
- **Management**
  - **Evaluating and implementing management**

What is the IFRAME framework

Assessment



1) Ecological characteristic : swimming ability, size, bone, depth, shape, habitat, feeding, foot type, longevity

2) Estimation of biomass and production of LTL groups

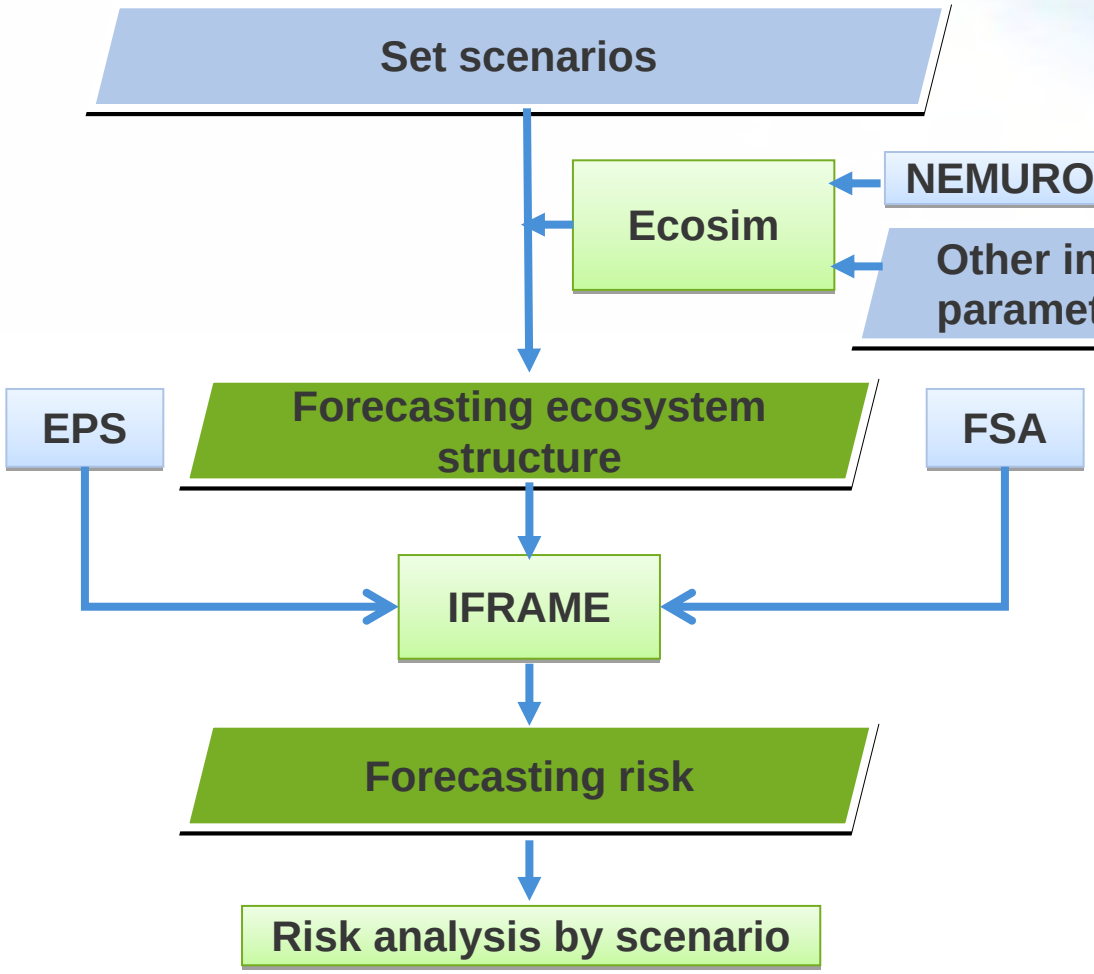
3) Biomass, catch, P/B, Q/B, DC

5) Ecological Process Studies on relevant physical, chemical and biological oceanographic processes

6) Fisheries and Socio-economic Assessment

What is the IFRAME framework

Forecast



- ❖ **Scenarios**

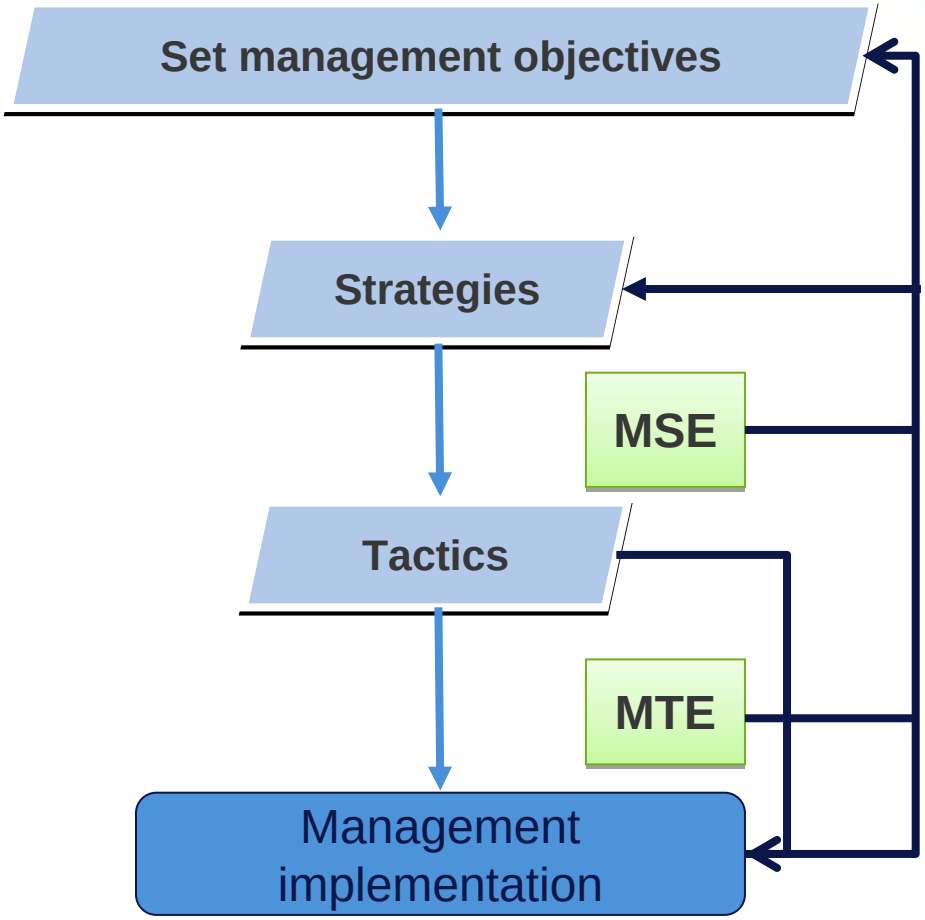
  : Climate change

  : Management option

- ❖ **The level for ecosystem are forecasted by ecosim model**
- ❖ **To calculate forecasting risk**
- ❖ **To analysis by scenario**

What is the IFRAME framework

Management

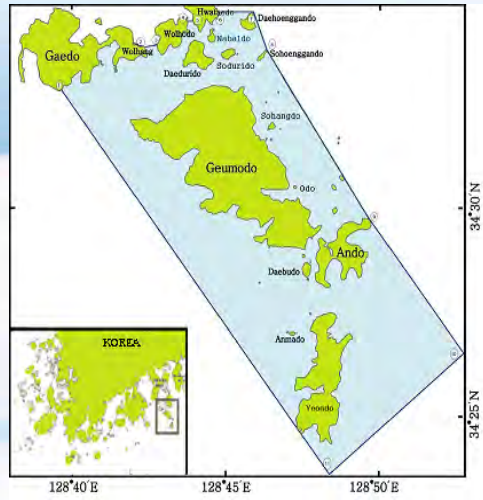


- **Translate objectives to strategies, 'what will be done'**
- **Translate strategies to tactics, ' how will be done'**
- **MSE : Management strategy evaluation**
- **MTE : Management tactic evaluation**

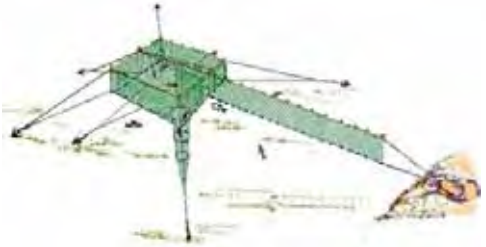
Application

- Jeonnama marine ranching ecosystem-

Assessment for marine ranching ecosystem



- **Target ecosystem : Jeonnama marine ranching ecosystem (110km^2)**
- **Target fishery : Stationary gillnet**

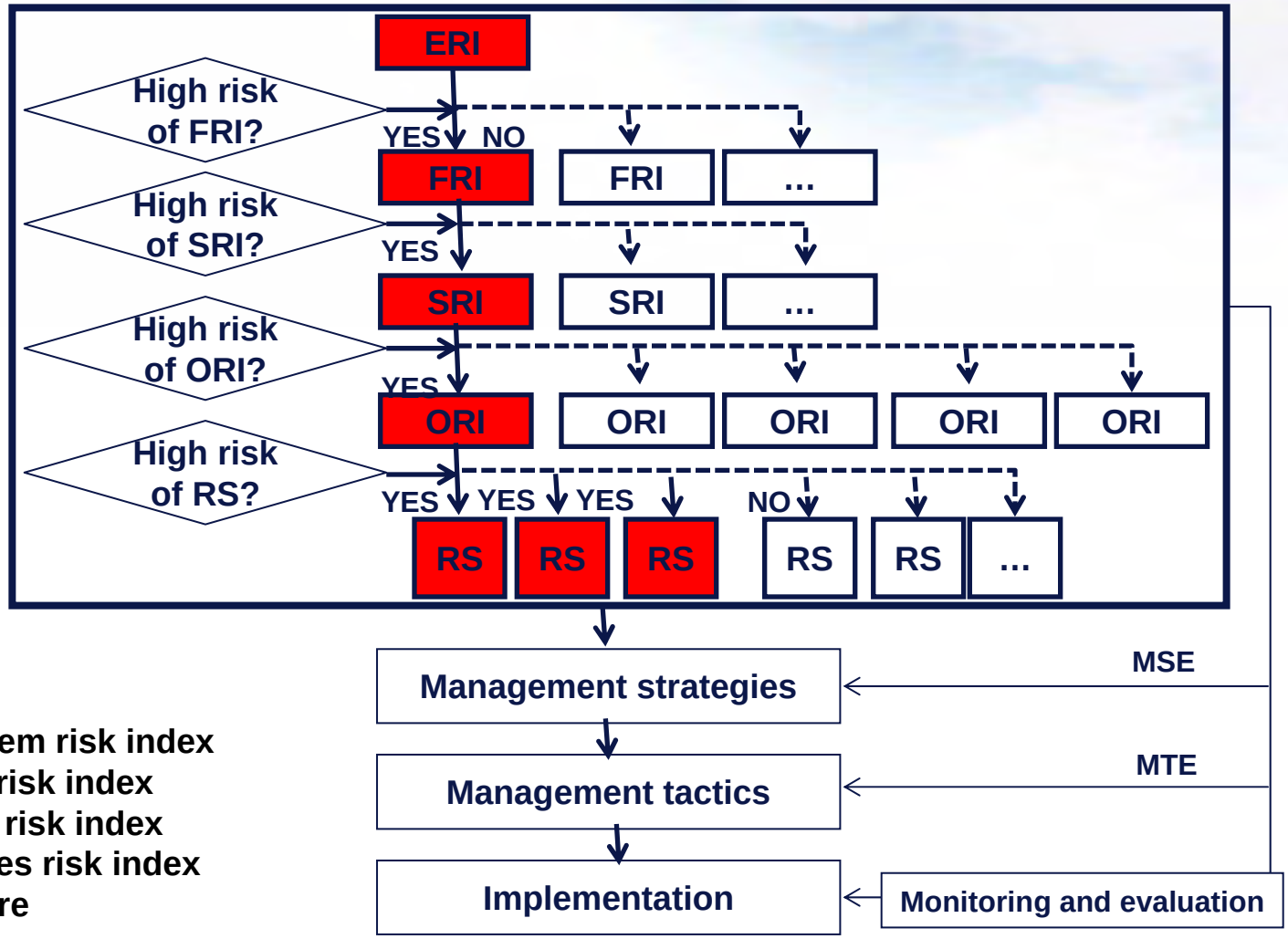


- **Target species : Black seabream, *Acanthopagrus schlegelii***
- **Study periods : 2003~2010**

"FIS-P-7657"

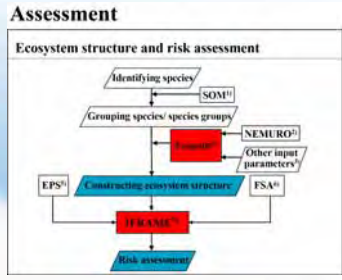
Management for marine ranching ecosystem

Management system based on IFRAME



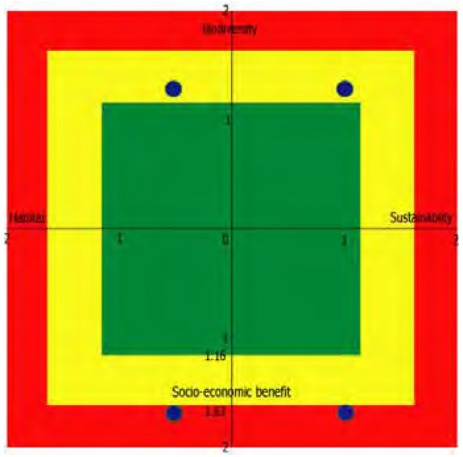
ERI : Ecosystem risk index
FRI : Fishery risk index
SRI : Species risk index
ORI: Objectives risk index
RS : Risk score

Assessment for marine ranching ecosystem

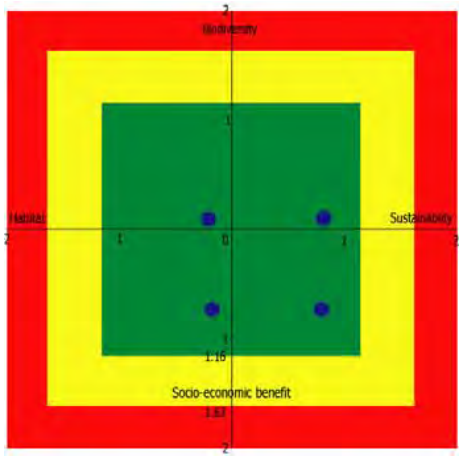


Summary of result for assessment (FIS-P-7657)

Objectives	Objectives risk index (ORI)		MSI
	2003	2010	
Sustainability	**1.530**	**1.129**	**26.20**
Biodiversity	**1.282**	**0.088**	**93.12**
Habitat quality	0.686	0.400	41.72
Socio-economic benefit	1.667	0.750	55.00
SRI	1.291	0.592	54.17



Pre-construction



Post-construction

Management strategies for marine ranching ecosystem

- According to assessment result Sustainability are almost changed
- " Biomass" indicator are not changed in 2010.
- Biomass for Black seabream (*Acanthopagrus schlegelii*) :

  - 2003 : 505mt

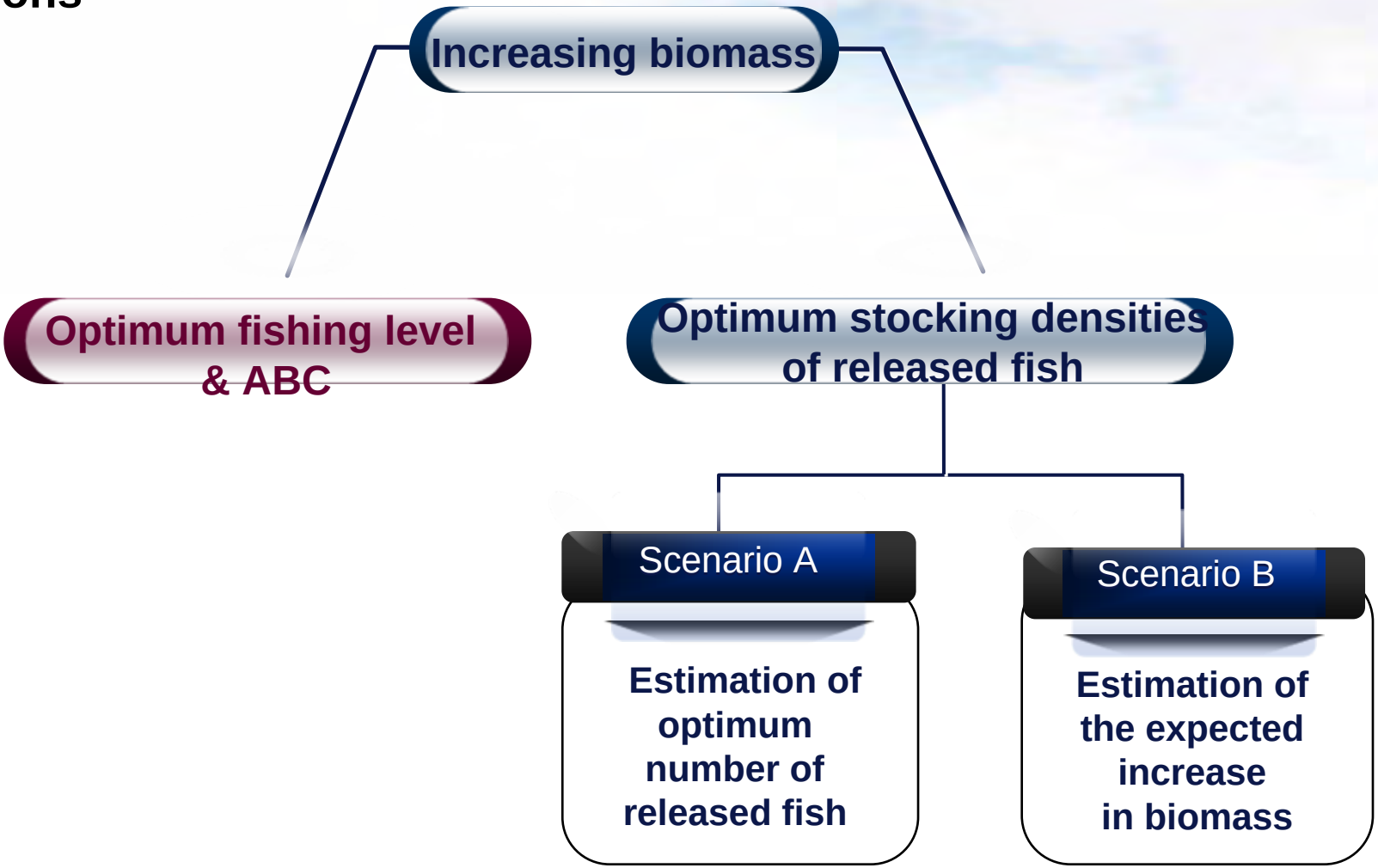
  - 2010 : 675mt

- Set the management strategy focus on sustainability

Management Objective	Management strategy	Management tactic
Sustainability	Increasing biomass	2 options

Management strategies for marine ranching ecosystem

2 options



Management strategies for marine ranching ecosystem

Optimum fishing level & ABC

❖ **Estimation of optimum fishing level and acceptable biological catch (ABC)**

- **Current biomass (B) : 675mt (2010)**
- **Optimum fishing level ($F_{40\%}$) : 0.249/year**
- **ABC : 130 mt**
- **Current catch : 312.66 mt**
- **Current fishing level : 0.751**

In this option,

To reduce the current catch to the ABC level

Management strategies for marine ranching ecosystem

Optimum stocking densities of released fish

Scenario A : Estimation of optimum number of released fish (which could produce the level of curent catch)

- **Using the Berverton & Holt theory and IFRAME forecast**
- **In optimum fishing level ($F_{40\%}$=0.249/year)**
- **The optimum released fish : 2,280,939 inds. (114 mt)**

114mt fish were released it produce the level of the current catch

Management strategies for marine ranching ecosystem

Optimum stocking densities of released fish

Scenario B : Estimation of the expected increase in biomass from the previously released fish to project the expected catch of the next year

- **In 2008 : 650,000 inds. (33mt) were released**
- **In optimum fishing level ($F_{40\%}$=0.249/year)**
- **The expected increase in biomass from the previously released fish was 975mt**

The expected catch of the next year was projected to be 181mt

Summary

- IFRAME (Integrated fisheries risk analysis methods for ecosystem) framework is introduced
  - Assessment, Forecast, Management
- By the application for the marine ranching ecosystem
  - Sustainability are almost changed by assessment because of the biomass indicator
- Suggestion of management objectives and strategies and tactics for sustainability

Summary

Suggestion 2 options

1st : optimum fishing level and acceptable biological catch (ABC) were estimated and then the management strategy was suggested

: To reduce the current catch to the ABC level

2nd : Assessment of optimum stocking densities of released fish

Scenario A: the optimum number of released fish was estimated to be 114mt, which could produce the level of the current catch

Scenario B : the expected increase in biomass from the previously released fish (0.65 million individuals) was 975mt, and so the expected catch of the next year was projected to be 181mt