Assessing Sustainability for Satoumi Coastal Governance

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Specially Appointed Professor
Ritsumeikan University
Presentation Outline

Introduction
- Current situation of coastal area in Japan
- Basic act on ocean policy (Japan)
- Satoumi

S13 Project “Coastal management method to realize the sustainable coastal sea”

Assessing sustainable development of “Satoumi” and integrated model for ecosystem services in coastal area

Beyond the Coastal Zone Governance
Current situation of coastal area in Japan

◆ Decrease of tidal flats area (40%) due to the development of economy in Japan.

◆ Unbalance between age structure and land utilization.
  ✓ **Decrease of population**
  Number of people involved in fishery:
  ✓ **Aging society**
  ✓ **Depopulation of rural area, esp., fishing village**

◆ Fishing industry in Tohoku area were destroyed by the great east japan earthquake (11th March, 2011).
  ✓ **Huge damage**
  ✓ **Bad reputation due to the accident of Fukushima nuclear power plant**
Basic Act on Ocean Policy; Basic Measures

Act No. 33 of April 27, 2007
Article 18 (Conservation of Marine Environment, etc.)

- The State shall take necessary measures to conserve the marine environment including
- securing the biodiversity in the oceans with conservation and improvement of the habitat,
- reduction of the pollution load caused by water flow into the oceans,
- prevention of the discharge of waste materials to the oceans,
- prompt prevention of the oil spill caused by accidents of the vessels and others,
- conservation of the seascape and others,
- in consideration of the fact that
- the oceans make a great impact on the conservation of the global environment such as the prevention of global warming and others.
Basic Act on Ocean Policy; Basic Measures

Article 25 (Integrated Management of the Coastal Zone)

• The State shall take necessary measures for the coastal sea areas and land areas, where recognized suitable for the measures to be implemented in a unified manner upon the natural and social conditions, to be managed properly,

• by the regulatory and other measures to the activities implemented in the integrated manner,

• in consideration of the fact that

• there are difficulties in keeping on enjoying the benefit brought by the resources, natural environment and others of the coastal sea areas in the future

• only by implementing the measures with respect to the coastal sea areas when issues in the coastal sea areas are originated by the activities on land.
Chapter 2. Measures the Government Should Take Comprehensively and Systematically with Regard to the Sea

(9) Comprehensive Management of Coastal Zones

1 Implementing comprehensive management of coastal zones
2 Implementing coastal zone management integrated with that of land areas
   • Implementing overall sediment management
   • Properly controlling nutrients and pollutant load and restoring and promoting cycles
   • Working to preserve aquatic life and its habitat and enjoy ecosystem services
   • Implementing actions to deal with articles drifting or washed ashore
   • Construct coasts that are friendly to nature and users
3 Implementing coastal zone management in enclosed coastal seas
4 Coordination of activities in coastal zones
Summary

• **Implementation of Coastal Zone Management Integrated with that of Land Areas**

Implement consistent overall sediment management covering all areas from mountains to coasts, reduction of pollutant burden coming from land areas, preservation of seaweed beds, tidal flats, coral reefs and actions to deal with articles drifting or washed ashore.

• **Coordination in Utilization in Coastal Zones**

Implement the process for establishment of sea surface utilization coordination rules in consideration of local actual status in coastal zones, improve accessibility to information on the utilization coordination rules in different regions and raise awareness among users of coastal areas.
Integrated management and sustainable development of coastal area are necessary.
Satoumi (里海)

“the coastal area where human interaction has resulted in a higher degree of productivity and biodiversity” (Prof. Dr. T. Yanagi, 2008)
Five elements of Satoumi

- **Ecosystem**
  - Three elements that support conservation and restoration
    - Diversity and productivity
    - Resource-controlled fishery
    - Seagrass beds and tidal flats

- **Material Circulation**
  - Appropriate nutrients
  - Sound material circulation
  - Water quality and sediment quality

- **Communication**
  - Harmonious coexistence with nature
  - Local coalition

- **Field for Activity**
  - Fishing villages and urban areas
    - River basins (Mountain, River, Countryside, Sea area)

- **Executors for activity**
  - Citizens in coastal areas, such as fishermen
  - Citizens in urban areas who utilize the sea
  - Citizens in river basins (Mountain, River, Countryside, Sea area)

- **Sustainability**
  - Two elements that support implementation
S13 Project “Coastal management method to realize the sustainable coastal sea” (FY2014—FY2018)

Ministry of the Environment

Purpose and overview

This study will involve a comprehensive examination of natural and human activity in coastal seas and the land areas that constitute their hinterlands, in order to determine how these areas should be changed from their present state to an appropriate status in terms of material circulation and ecotones. Specific actions will be proposed as methods for the environmental management of coastal seas in Japan.

About EMECS Center(http://www.emecs.or.jp/en/)

The International EMECS Center is an organization established for promoting international exchanges on not only coastal but also catchment areas of the enclosed coastal seas in a wide range of fields such as research, policy, civic action, education and industrial activities and so forth to solve the problem on the environmental conservation of enclosed coastal seas in the world such as the Seto Inland Sea (Japan), the Chesapeake Bay (USA), the Baltic Sea (Northern Europe), and the Mediterranean Sea (Southern Europe). The name of the Center is an acronym for Environmental Management of Enclosed Coastal Seas. The organization was established in Kobe City, Japan in 1994 after the success of the first and second International Conferences on the Environmental Management of Enclosed Coastal Seas, and became a foundation under the cojurisdiction of the Ministry of Foreign Affairs and the Ministry of the Environment in 2000. The organization became a public interest incorporated foundation in 2012.
Development of Coastal Management Method to Realize the Sustainable Coastal Sea

**Topic 1**

Development of methods for managing nutrient salt concentrations in the Seto inland Sea (enclosed coastal sea)

1. Development of methods for managing nutrient salt concentrations
2. Determination of the function of tidal flats and seaweed beds in nutrient circulation and biological reproduction

**Topic 2**

Development of coastal environmental management methods on the Sanriku Coast, which has a succession of open inner bays

1. Monitoring of changes in coastal environments use of the results to develop methods for coastal sea management
2. Determination of the mechanism of nutrient transfer among forests, rivers and oceans
3. Determination of the role of organic matter in material transport between forests and oceans

**Topic 3**

Development of methods for ocean management in the Japan Sea, an international enclosed coastal sea that includes continental shelves and islands

1. Proposed management methods for international enclosed coastal seas
2. Construction of a model to predict environmental changes in the Japan Sea
3. Construction of a high-order ecosystem model for the Japan Sea

**Topic 4**

Proposed economic assessment and integrated coastal management model for ecosystem services in coastal seas

1. Economic assessment of ecosystem services
2. Proposed three-stage management method for coastal seas
3. Discovery, construction and passing on of stories that connect the general public with coastal seas, based on discussion from a humanities perspective
4. Coordination of fisheries activities in the Tsushima and Goto marine protected areas

**General Overview**

- Establishment of a philosophy for coastal sea management in a world that is undergoing dramatic changes
- Policies needed to achieve quantitative environmental indicators for realizing desirable coastal seas
- Model that integrates nature, society and the humanities as a policy support tool

**Integrated coastal sea model**

**Environmental administration policy**

**Council (3-stage management organization)**

**Achievement of sustainable coastal seas that are beautiful, abundant and vibrant**
Study areas for different topics

- Tohoku
- Japan sea
- Seto inland sea
Research topics and four different Research groups

Topic 1
Development of methods for managing nutrients concentrations in the Seto Inland Sea (enclosed coastal sea).

*Topic leader: Wataru Nishijima (Professor and Director, Environmental Research and Management Center, Hiroshima University)*

Topic 2
Development of coastal environmental management methods on the Sanriku Coast.

*Topic leader: Teruhisa Komatsu (Associate Professor, Atmosphere and Ocean Research Institute, The University of Tokyo)*

Topic 3
Development of methods for ocean management in the Japan Sea.

*Topic leader: Takafumi Yoshida (Chief Researcher, Northwest Pacific Region Environmental Cooperation Center)*
Research topics and four different Research groups

Topic 4
Proposed economic assessment and integrated coastal management model for ecosystem services in coastal seas.

*Topic leader: Kenichi Nakagami (Professor, Ritsumeikan University)*

- **(1)** Economic assessment of ecosystem services
  - *Ritsumeikan University*

- **(2)** Proposed three-stage management method
  - *Kinki University*

- **(3)** Discovery, construction and passing on of stories that connect public with coastal seas
  - *Aichi University*  
  - *Kyushu University*

- **(4)** Coordination of fishery activities in the Tsushima and Goto marine protected areas
  - *Kyushu University*

General overview and Topic 5
General overview and establishment of integrated numerical models for coastal sea management

*Topic leader: Prof. Dr. T. Yanagi (International EMECS center)*
**Research objective**

From the perspective of socio-economics, proposing necessary management and evaluation methods to achieve a robust and prosperous Sato-Umi by the year 2050.

| Establishment of data base for Sato-umi management  
(Sub-project leader: Dr. Norio Obata) |
<table>
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<tbody>
<tr>
<td><strong>Objective</strong>: To make use of data for the management of Sato-umi, i.e., supporting relevant decision-making processes.</td>
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<td><strong>Content</strong>: To collect data of Sato-umi all over Japan by taking into consideration the aspects of economy, environment, disaster prevention, society and resources.</td>
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| Evaluation of Sato-umi sustainability  
(Sub-project leader: Dr. Ken’ichi Nakagami) |
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<tr>
<td><strong>Objective</strong>: To develop quantitative method for sustainability evaluation, aiming at achieving a robust and prosperous Sato-umi by 2050.</td>
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<tr>
<td><strong>Content</strong>: From the viewpoint of environment, economy and society, to select indicators reflecting the sustainability of Sato-umi, followed by a quantitative integration of these.</td>
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| Evaluation of Sato-umi based on Costanza method  
(Sub-project leader: Dr. Takuro Uehara) |
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<tr>
<td><strong>Objective</strong>: To evaluate economic value of Japanese Sato-umi ecosystem services by comparison with the other important sea areas all over the world and reveal the state of Japanese Sato-umi ecosystem services.</td>
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<td><strong>Content</strong>: To apply universally accepted Costanza method to the coastal zone of Japan, and then utilize the obtained values for comparison with the global cases.</td>
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| Economic valuation of ecosystem services of Sato-umi  
(Sub-project leader: Dr. Katsuki Takao) |
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<td><strong>Objective</strong>: To evaluate various ecosystem services of three different types of coastal zone, i.e., Seto Inland Sea, northern Sea of Japan and Sanriku Coast.</td>
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<tr>
<td><strong>Content</strong>: To reveal economic value of various ecosystem services offered by Sato-umi.</td>
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**Contact**

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College of Policy Science, Ritsumeikan University

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Ministry of the Environment  Environment Research and Technology Development Fund (S-13)
Development of Management Methods toward a Sustainable Coastal Zone - Economic Valuation of Ecosystem Service of Coastal Zone & Display of Integrated Coastal Zone Management Model -

(Source: Ministry of the Environment, 2009)

Photos of Seto Inland Sea  
(Location: Tomonoura of Fukuyama City, Hiroshima Prefecture)
Development of Management Methods toward a Sustainable Coastal Zone - Economic Valuation of Ecosystem Service of Coastal Zone & Display of Integrated Coastal Zone Management Model -

- **Function**
  - Year
  - Area

**Establishment of data base for Sato-umi management**

**Seto Inland Sea**
- Creating “Satoumi”
- High Biodiversity & Productivity

**Sanriku Coast**
- Regenerate ecotone and Zosterabed
- Sanriku Fukko (Reconstruction) National Park Sanriku

**Northern Sea of Japan**
- MPA and Biodiversity
- MPA and Fishery Regulation
An Operational Framework for Sustainability Assessment of A Regional Scale ICZM: An Application of Sato-umi

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Corresponding Author: Takuro Uehara, Associate Professor, Ritsumeikan University
Email: ueharatakuro@gmail.com

1. Background

1) Concerns about the sustainability of coastal zones: population decline in coastal zones, degradation of coastal ecosystems.
2) Need for Integrated Coastal Zone Management (ICZM): The Basic Act on Ocean Policy (Act No.33 of 2007) stipulates the implementation of ICZM.
3) Importance of sustainability indicators for ICZM: For successful ICZM, the development of practical indicators is essential (Maccarrone et al., 2014).
4) Lack of an operational sustainability assessment framework for a regional ICZM: a paucity of literature on sustainability science for ICZM (Cummins and McKenna, 2010); Key yet less developed attributes of the assessment (System Boundary, Stock Assessment, and Long-term Perspectives).

2. Key Attributes of Sustainability Assessment for A Regional Scale ICZM

1) System Boundary: It is a challenge to set a sound system boundary as a region is not a closed system but an open system; There could be multiple-level system boundaries. For instance, a system boundary for ecosystem services and a scale of management may not be identical (see Cummins & Mackenna (2010) for a large scale management authorities).
2) Stock Assessment: Asheim (1994) shows a rigorous mathematical proof that it is impossible for a flow assessment to gauge the sustainability; Gains and losses of stocks stipulate the future flow of ecosystem services (Banzhaf & Boyd, 2012); In view of management, it is stock such as clean air, water quality, and habitat (e.g., seagrass bed) that policy makers can directly target.
3) Long-term Perspectives: Future projections are essential for ICZM to realize the long-term success.

3. Assessment Framework

- **Sato-umi**: Guides to identify ecosystem services of our interest (Yanagi, 2008; Henocque, 2013); Guides to identify the system boundary; Guides to an ideal state of coastal zones.
- **Ecosystem services Framework (UKNEAFO, 2011)**: Guides to identify ecosystem services and the stocks providing them; Guides to identify the system boundary (Abson et al., 2014; Böhnke-Henrichs et al., 2013; UKNEAFO, 2011); Solidify the sustainability concept by providing systems knowledge, normative knowledge, and transformative knowledge (Abson et al., 2014).
- **Inclusive Wealth**: Stock-based sustainability assessment method (Pearson et al., 2013).
- **Scenario Analysis**: Qualitative (e.g., storytelling) and Quantitative (e.g., modeling) scenario building and analysis (Millennium Ecosystem Assessment, 2005).

4. Construction and Analysis Procedure

- **Distinct Components**: For successful Sato-umi, the incorporation of the voluntary contribution of significant labor by ecosystem users such as fishers (Berque and Matsuda, 2014). The contributions of NPOs and NGOs are also significant.
- **Data Collection**: The collection of shadow prices is always a challenge for this sort of computation. In addition to data available on market, we could also apply benefit transfer (e.g., Costanza et al., 2014). For unique and heterogeneous value such as Fure-ai (contacts), original estimates should be made. UKNEAFO (2011) points out the lack of valuation studies on spiritual/aesthetic values.
- **Scenario Analysis**: Modeling approach to the dynamics of stocks is rare (an exception is Tokimatsu et al., 2013 which uses the Genuine Savings in combination with an Integrated Assessment Model to make future projections). System Dynamics (Sterman, 2000) that is essentially a modeling approach to understand the dynamics of stocks could be an alternative.

*This study was funded by the Environment Research and Technology Development Fund of the Ministry of the Environment Government of Japan.*
Sustainability assessment framework

Inclusive Wealth (Economic measurement)

Assessment Framework

Ecosystem Services Science

Satoumi

Inclusive Wealth: Capital-based sustainability assessment method (*Pearson et al., 2013*)
Proposed framework

Set the System Boundary

Identify the Ecosystem Services

Identify the indicators

Collect Shadow Prices

Collect the Stock Data

Inclusive Wealth Index
Case study—Seto Inland Sea

Length: 450 km,
Average depth: 30 m
Most industrialized area in Japan (Osaka, Kobe, Hiroshima, Kurashiki, Kure, …)
Population: Over 35 million people
Gone through devastating pollution since 1965

Master Plan for the Environmental Conservation of the Seto Inland Sea

Development of three multiple functions of the Seto Inland Sea

“Garden”
Scenery, Relaxation
Habitats for biodiversity

“Farm”
High bio-productivity

“Sea way”
Sea road for the flow of products and people
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<th>Criterion I</th>
<th>Criterion II</th>
<th>Criterion III</th>
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<tr>
<td>MA framework (Ecosystem services)</td>
<td>Desired state &amp; ES provided by Satoumi in Seto Inland Sea</td>
<td>(IW method &amp; Satoumi)</td>
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<td><strong>Provisioning services</strong></td>
<td><strong>Fish</strong></td>
<td>Stock of plankton</td>
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<td></td>
<td></td>
<td>Stock of Fish</td>
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<tr>
<td></td>
<td></td>
<td>Number of fishing boat</td>
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<tr>
<td></td>
<td></td>
<td>Number of fishermen</td>
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<td></td>
<td></td>
<td>Area of &quot;no fishing zones&quot;</td>
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<td></td>
<td><strong>Oysters</strong></td>
<td>Stock of oysters</td>
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<td>Area of oyster farm</td>
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<td></td>
<td></td>
<td>Area of oyster rafts</td>
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<tr>
<td></td>
<td></td>
<td>Number of people harvesting oyster</td>
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<td><strong>Regulating services</strong></td>
<td>Regulating water environment</td>
<td>Area of tidal flats</td>
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<td></td>
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<td>Area of seagrass beds</td>
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<tr>
<td></td>
<td></td>
<td>Number of sewage treatment plants</td>
</tr>
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<td></td>
<td>Carbon control</td>
<td>Number of peoples joining the activities to eliminating pollutants</td>
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<td>Area of seagrass beds</td>
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Prospect

The research achievements produced for each topic will be integrated to provide coastal zone management methods that can achieve sustainable utilization of coastal zone in 21st Century.
Beyond the Coastal Zone Governance

In 1976, the US Congress directed the EPA to “undertake a comprehensive study of the Bay’s resources and water quality, and to identify appropriate management strategies to protect this national resource”. The year 1983 became known as the “Year of the Bay” and the “Coastal Seas Governance Project” was born subsequently. In the past 40 years, the discussion of the conceptual definition related governance progressed. And we have a good practice in common worldwide.

Creating sustainable development of “Satoumi” means to build the “Coastal Zone Governance based on Sustainability”. Coastal zone Sustainability index including environment, social and economic factors should be developed for the sake of comprehensively evaluating the “Satoumi”. (Nakagami, 1994)

The conceptual and institutional examine of the governance should be based on the current situation. However, the final question is how we achieve sustainability. Especially, the Tsunami caused by the Great East Japan Earthquake destroyed “Satoumi” in Sanriku Coast. Then new idea and system are required to rebuild “seagrass bed, tideland and shoal” based on coastal zone sustainability.

The resolution is to rebuild a good and innovative relationship between individual policies including national land policy, regional policy and environmental policy based on “Satoumi”.
Ministry of the Environment, Japan
EMECS International Center

- **Group members from Ritsumeikan University**
  - Prof. Norio Obata
  - Prof. Katsuki Takao
  - Assoc. Prof. Takuro Uehara
  - Dr. Ryo sakurai
  - Dr. Taisuke Yoshioka
  - Dr. Jia Niu
  - Dr. Xiaochen Chen

- **Group member from Nagasaki University**
  - Assoc. Prof. Takahiro Ota
Thank you very much for your kind attention

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