New Marine Environmental Assessment Method for Toyama Bay, Japan

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Indicators of Status and Change within North Pacific Marine Ecosystems: A FUTURE Workshop
Objective
To contribute to create the healthy marine environment in order to conserve marine ecosystems and to restore the damaged ecosystems

Basic assessment concepts
- To assess comprehensively using indicators related to marine ecosystems
- To create a favorable environment for marine life based on the conservation of marine ecosystems
Recommendation to stakeholders

Comprehensive assessment

Impact assessment

Indicators of human activities on land

Strong
Moderate
Weak

Achievement Assessment

Current situation of marine environment, marine life

Future desirable vision (Target value)

Comprehensive assessment

Recommendation to stakeholders
# Assessment Indicators

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicator</th>
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<tbody>
<tr>
<td>Category I (Impact from the land)</td>
<td>Change in population</td>
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<td>Land use</td>
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<td></td>
<td>Number of dam</td>
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<td>Change in sewage improvement</td>
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<td>Number of livestock</td>
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<td>Use of fertilizer</td>
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<td>Amount of use of synthetic agricultural chemicals</td>
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<td>Meteorological information</td>
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<td>River flow rate</td>
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<td>Category</td>
<td>Indicator</td>
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<td>Category II (Marine environment)</td>
<td>Change in the coast</td>
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<td>Natural coast and manmade coast</td>
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<td>Distribution of seagrass and seaweed beds</td>
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<td>Water temperature</td>
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<td>Sea bottom substrates and sediments</td>
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<td>Submarine groundwater discharge</td>
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<td>Eutrophication</td>
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<td>Enter of foreign ships in major harbors</td>
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<td>Enter of alien species accompanied by planting and aquaculture</td>
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<td>Marine litter</td>
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<td>Category</td>
<td>Indicator</td>
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<tr>
<td>Category III (Marine life)</td>
<td>Fish catch</td>
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<td>Distribution of benthos</td>
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<td>Phytoplankton</td>
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<td>Zooplankton</td>
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<td>Occurrence of red tide</td>
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Population and Land Use

**Impact:** Weak

**Population**

(Source is statistical yearbook of Toyama Prefecture)

**Land use**

(Source is statistical yearbook of Toyama Prefecture)

**Impact Assessment from Land**

**Dam**

(Source is GIS of Ministry of Land, Infrastructure, Transport and Tourism)
Impact Assessment from Land Nutrients Load

Impact: Weak

**Sewage improvement**

**Livestock**

The use of fertilizer

(Source is statistical yearbook of Toyama Prefecture)
Impact Assessment from Land

Other Chemicals

Impact: Weak

The use of pesticide and herbicide

- Red: Pesticides
- Blue: Herbicides

Climate Condition

Impact: Weak

Temperature
- Average air temperature
- Maximum air temperature
- Minimum air temperature
- Hours of sunlight

Rainfall and snowfall
- Rainfall
- Snowfall

River input
- High water
- Ordinary water
- Low water
- Drought

Graphs showing temperature, rainfall, snowfall, and river input over the years.
For Designing the Desirable Future Vision of Toyama Bay (Target Value)

Did the environment of Toyama Bay change?

- Unclear: 26%
- Changed: 66%
- Not Changed: 8%
- To be better: 8%
- Other: 12%
- To be worse: 80%

What is future desirable vision?
- Natural sand beaches
- Clean water
- Wide seaweed bed areas
- Diversity of marine species
Future Desirable Vision of Toyama Bay

Questionnaire
Interview
Council of advisers

- Creation of desirable environment for marine life based on natural material cycle and marine ecosystem
- Keep current state or change to better condition on marine life (fishery level)

Achievement assessment
Creation of Favorable Habitats for Marine Life

**Coastline**
- Favorable vision: All seawalls are renewed by ecological friendly structure
- Achievement: 0%

**Seaweed bed**
- Favorable vision: The area of seaweed bed is recovered to past level
- Achievement: 70%
Creation of Favorable Marine Environment for Marine Life

Sea bottom environment
Favorable vision: There is no area over the standard value
Achievement: 90%

COD in bottom sediment

In 2006

Sulfide concentration in bottom sediment

In 2006

Water temperature

Favorable vision: No trend of increase
Achievement: 100%

Eutrophication
Favorable vision: Lower level of nitrate and phosphate concentration than standard value
Achievement: 30%
Lowering of Threat to Marine Life

Enter of foreign ships

Achievement: 50%

Number of collected marine litter

Favorable vision: No damage on marine ecosystem by alien invasive species
(Effectuation of International Convention for the control and management of Ship’s Ballast Water and Sediments)

Achievement: 0%

Enter of alien species by accompanied by aquaculture

Favorable vision: No change of ecosystem by alien species

Achievement: 100%

Favorable vision: No damage on marine ecosystem by marine litter

Achievement: 50%
**Achievement:** 100%

**Fish catch**

- Total fish catches
- Fish catches by set net

**Biodiversity index of benthos**

**Marine trophic level**

**Favorable vision:** Maintaining current level
Comprehensive Assessment

**Impact assessment**
- Population and Land Use
- Climate Condition
- Nutrients Load
- Other Chemicals

**Achievement assessment**
- Creation of favorable habitats
- Lowering of threats
- Creation of favorable marine environment

Recommendation for improvement of the current situation
1. Reduction of nutrients load
2. Restoration of coastal environment
3. Lowering of threats to marine life
4. Collection and accumulation of more biological data