A Health Examination for Ago Bay

Shima City, Mie Prefecture JAPAN

Ocean Policy Research Foundation (OPRF)
Geography of Ago Bay

Area: 26km²
Coast: 140km
Depth
  Max: 40m
  Bay mouth: 12m
Width of bay mouth: 1.7km
Birthplace of Cultured Pearls

Kokichi Mikimoto
Problems facing Ago Bay

- large accumulation of organisms on the bay floor
- hypoxia occurrence in summer
- red tides due to Dinoflagellates
- reduced productivity in pearl cultivation
- mass die-off of benthic organisms
Amount of pearl products
Ago Bay Revitalization Project (2003 ~ 2007)

A Reexamination of the Issues and Research on Policy Solutions towards Solving the Environmental Problems in Ago Bay

- Inspecting the material balance sheet between Ago Bay and the coastal zone
- Verification of material cycle ability in tidal flat and seagrass bed

Rather than aiming for “beautiful” seas through reduction of drainage matter, what is needed is the building up of “rich” seas (sato-umi) through active recycling of matter between the land and the sea.
Rebuilding Our City through a new Sato-umi policy
(Shima City Comprehensive Basic Plan)
Structure of an ecosystem and material flow

- River
- Load
- Tidal flat
- Seagrass beds
- Primary production (p.p.)
- Zonal production (z.p.)
- Food web
- Fish
- DO consumption
- Release
- Sinking
- Mixing
- Benthos
- Water exchange
- Decomposition
- Sedimentation
What is the “Healthy Ocean”?

Function of the ocean:
- Climate regulation
- Living space
- Voyage
- Amenity
- Fisheries-resources
- Supply
- Stability in ecosystem
- Smoothness in material circulation

<table>
<thead>
<tr>
<th>Stability in ecosystem</th>
<th>Smoothness in material circulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>composition</td>
<td>habitat space</td>
</tr>
<tr>
<td>catches</td>
<td>changes of tidal flats and seagrass bed</td>
</tr>
<tr>
<td>coastal organisms</td>
<td>rate of artificial coastline</td>
</tr>
</tbody>
</table>
Flow of Health Examination for the Ocean

Judge healthy / unhealthy

Check the condition of your health!!

The first check
A quick and easy healthy check with the data that is easy to get.

There is some doubt about unhealthy.

Unhealthy? Really?

The second check (re-inspection)
Check of result of the first check by the local detailed data.

Judge that is unhealthy

Investigation of the cause that is unhealthy

The second check (close examination)
Investigation of the factor by comprehensive analyses of the local detailed data.

Discovered the cause

How to get over?

Preparation of Prescription
based on each characteristic of the Sea
Result of the 1st check for Ago bay

Stability of an ecosystem
Composition: B
Habitat Space: B⁺
Environment: C⁺

Smoothness of a material circulation
Load and water exchange: B⁺
Decomposition and Sedimentation: B
The removal (fishing): C

The primary production: B

A: Good  B: Caution needed  C: Re-inspection necessary
Environmental changes in Ago bay

<table>
<thead>
<tr>
<th>Nutrients that flow in from the land</th>
<th>Habitats for Creature</th>
<th>Nutrients</th>
<th>Creature</th>
<th>Bottom Sediment</th>
<th>Fish Culturing</th>
<th>Oxygen-depleted water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tidal flats area (image)</td>
<td></td>
<td></td>
<td></td>
<td>Incidence of a mollusk (image)</td>
<td>A fish catch by coastal fishery</td>
<td>Occurrence of Oxygen-depleted water</td>
</tr>
<tr>
<td>Amount of the nutrients that flow in from the land (N)</td>
<td>Nutrients of sea (COD)</td>
<td>Nutrients of sea (COD)</td>
<td>Occurrence of Oxygen-depleted water</td>
<td>amount of pearl production</td>
<td>amount of oyster production</td>
<td>amount of sea lettuce production</td>
</tr>
<tr>
<td>Sole waste water treatment facility</td>
<td></td>
<td></td>
<td></td>
<td>Organic matter that store to the bottom material</td>
<td>Increase of the amount of pearl production</td>
<td>Increase of scale of occurrence of Oxygen-depleted water</td>
</tr>
<tr>
<td>Joint waste water treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population treated by septic tanks</td>
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</tbody>
</table>

1950

Increase of nutrients that flow in from the land

1960

Decrease of tidal flats and creature

1970

Increase of nutrients that flow in from the land

1980

Amount of the nutrients that flow in from the land (N)

1990

1995

2000

Gross dredging area

Bottom material COD

Incidence of a mollusk (image)
Prescription to make Ago bay healthy

Justice of nutrients that flow in from the land

Picking up nutrients by cultivation of sea weeds

Reduction of the loading from cultivation of pearls

Restoration and establishment of tidal flat and seagrass bed

Restore living space of creature and make material circulation active

Improvement of ability of disintegration by benthos

Control elution of nutrients from the seabed (sand capping)

Extract artificially organic matter, which has accumulated on bay floor (dredging)

Current material circulation

Expected material circulation once prescription is applied
(results for the entire bay shown in red)

Expected material circulation once prescription is applied
(results for the bay floor shown in blue)
The effective prescription order
In Ago bay

< Short-Term prescription >
- sand capping
- dredging
- Improvement of ability of disintegration by creature

Imagery of material circulation

Imagery of material circulation

Preserve habitats for creature
Ago bay where can keep healthy

< Long-Term prescription >
control the nutrient load from the land to keep the appropriate eco-system

< Medium-Term prescription >
- restore living space of creature and make material circulation active
- reduction of amount of the nutrients that flow in from the land
- reduction of the loading by aquaculture

Increase of creature

Stagnation ←
<<Condition of the material circulation>> → Smooth

Present

Healthy Ago bay
Thank you for your attentions!