Assessment of Marine Water Quality Using Bioindicators

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In recent years, many shallow areas of the Seto Inland Sea have been reclaimed, taking a toll on the ecosystems, and entailing a loss of many species. In addition, with the increase of impurities in the water, there has been a consequential rise in harmful plankton resulting in a declining fish haul. Moreover, some of the recent reports indicate that environmental endocrine disrupters are wreaking havoc on the reproductive functions of marine organisms, including shellfish. In fact, a dramatic decrease has been seen in the populations of certain shellfish species in some sea areas.

Fact-finding about marine ecosystems and their environmental assessment has involved the use of monitoring rocky shore organisms. Therefore, we focused on these in a survey to assess the marine environment. At the same time, we prepared the following guide, titled "Simple Assessment of Marine water quality using coastal Bioindicator organisms (SAMB)", to introduce a rapid bioassessment technique for the general public to empower them to carry out such surveys on their own. It is intended for wide-range use, from elementary or junior high school students to adults.

We hope participation in this survey will allow more people to realize the ties between living organisms and the environment, as well as the importance of ecosystems, leading to a deeper understanding of environmental protection.

Assessment procedure of the SAMB

1. Check the populations of the listed species and circle the figures in the corresponding boxes(Table 1). As a general rule, circle a figure that comes under "Abundant" when you find the colonies of a target species covering 30% or more of the area (of 1 square meter of their habitats). In the case of *Tethya aurantium* and *Styela policata* ,do so when their populations number 10 or more per 1 square meter.
2. Enter the number of listed species that were found in the area.
3. Give 5 points per species as [Points based on N].
4. Calculate the total of the circled numbers with + to find the [Total number of + points].
5. Calculate the total of all the circled numbers regardless of + or – to find the [Total number of absolute values].

6. Find [Ratio of + points] by dividing [Total of + points] by [Total of absolute values].
7. Calculate the environmental assessment value by adding the value found by multiplying [Ratio of + points] by the remainder of 100 minus [the points based on N (S)].
8. Assessment of the area from the final figure, for example:

76-100 points : Clean seawater area (Rank Ⅰ area) :

National landscapes are well kept and water quality is excellent. Very important spots for people to enjoy contacts with water.

51-75 points : Low polluted seawater area (Rank Ⅱ) :

Good for seashell digging, fishing and watching coastal creatures. In some cases suited for bathing, too.

26-50 points : Polluted seawater area (RankⅢ) :

Good for shellfish digging and fishing but not suitable for bathing.

0-25 points : Highly polluted seawater area (RankⅣ) :

Red tide outbreaks are frequent in this area. Not very suitable for enjoying contact with the sea.

Table 1 Record sheet for simple assessment of marine water quality using coastal bioindicater organisms

Sampling locations / Time & Date / Bioindicators In intertidal zone / Volume		Kokurokamijima Island 4P.M. Aug. 8,1995		
		Not Found	Rare-moderate Vol.	Abundant
Green algae	*Caulerpa okamurae*	0	+1○	+2
	Ulva pertusa	0	0○	--1
Red algae	*Amphiroa zonota*	0	+1○	+2
	Choudrus sp.	0○	--1	--2
Crustaceans	*Capitullum mitella*	0	+1○	+2
	Balanus albicostatus	0	--1○	--2
Shellfish	*Serpulorbis imbricatus*	0	+1	+2○
	Mytilus alloprovincialis	0	--1○	--2
Sea sponge	*Tethya aurantium*	0	+1○	+2
Ascidians (Sea squirts)	*Styela plicata*	0	--1○	--2
No. of species found(N)		9		
Points based on N(S)=N×5		45		
[Ratio of +points](R)=[Total of +points] ／[Total of absolute values]		6／9		
Environmental assessment value = S + (100 - S)×R		81		
Assessment		Ⅰ		

Sample record sheet

The result of the survey is summarized in the sheet.

[No. of species found(N)] was : 9
So [Points based on N(S)] is :
9 species×5=45

[Total number of +points] is:
+1 + 1 + 1 + 2 + 1 = 6

[Total of absolute values] is the total of the circled figures disregarding + or –marks. For example, both +1 and –1 are calculated as 1.
+1 + 1 + 1 + 1 + 2 + 1 + 1 + 1 = 9

[Ratio of +points] is :
6/9=0.67

[Environmental assessment value] is :
45 + (100 - 45) × 0.67=81.8

Round 81.8 points down to 81 points

Therefore the [Assessment] is :
Clean seawater (Ⅰ).

□ **: Bioindicators of clean waters** □ **: Bioindicators of polluted waters**