

STAR 2017

26th June, 2017

**The Pacific Islands Science, Technology and Resources
Network Conference**

【Session 2 Deep Sea Minerals】

**Appropriate Environmental Impact Assessment
Technologies for Seabed Mining**

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Introduction

Affiliation

Research and Development (R&G) Center of Submarine Resources,
Japan Agency for Marine-Earth Science and Technology (JAMSTEC).

Academic background

Tokyo University of Fisheries (bachelor degree)

Graduate school of fisheries science, Tokyo University of Fisheries (master degree).
Doctor of Science from Kyoto University.

Career

Ocean Policy Research Foundation (Research Fellow)

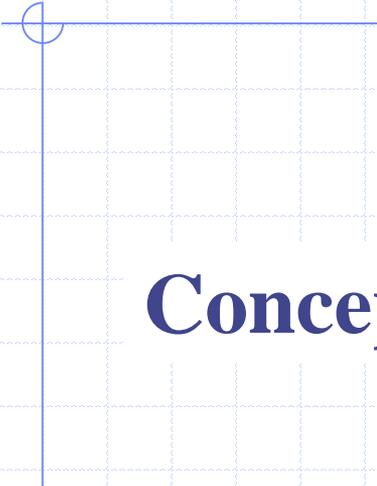
The University of Tokyo (Associate Professor)

Incumbent.

Topics of Research

Environmental assessment study of ocean mineral resource development

Interdisciplinary Ocean education / Ecology of benthic organisms in the deepsea.



Topics

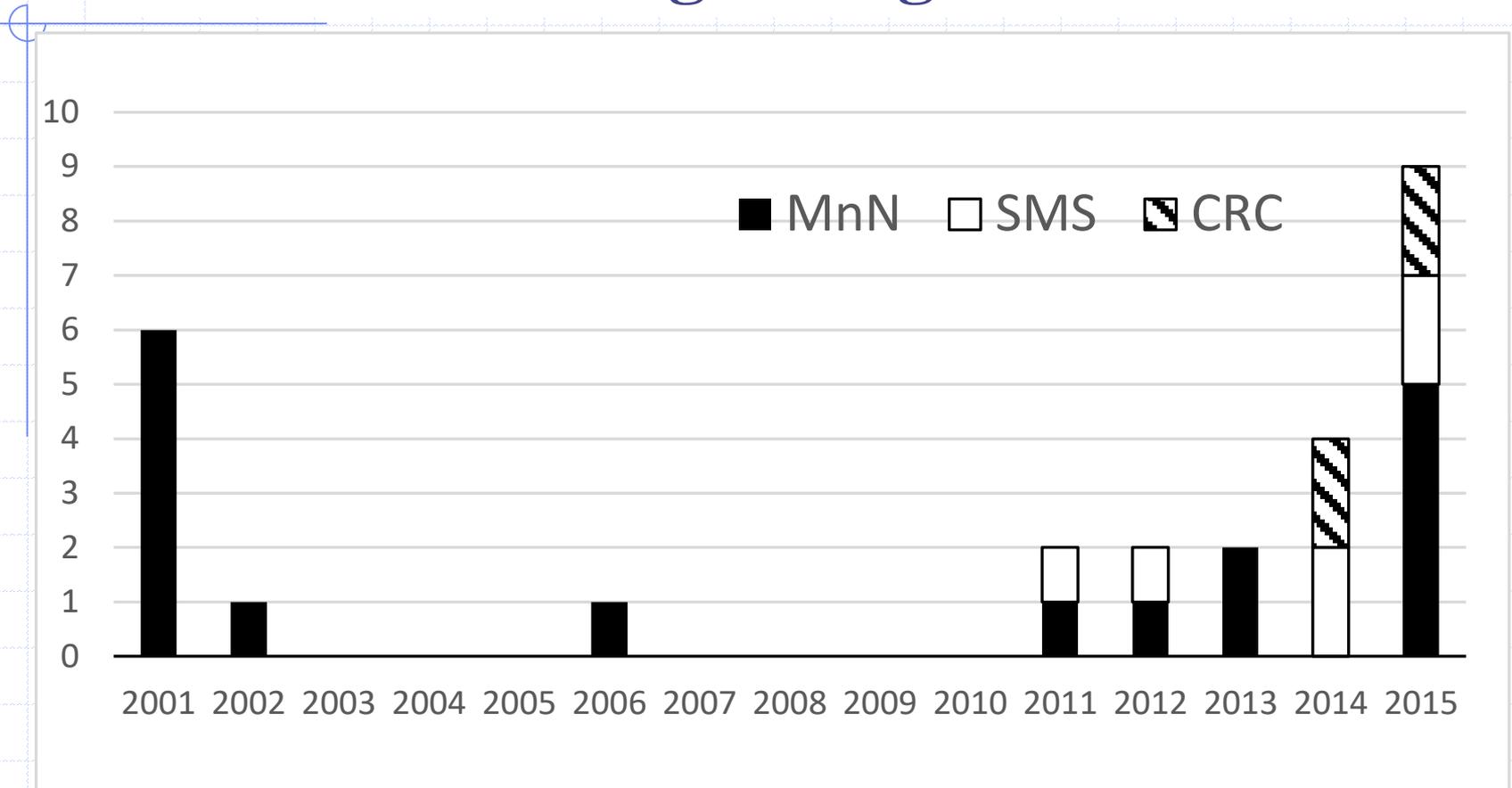
Conceptual Requirement for Seabed Mining

Technical Requirement for Seabed Mining

A 3D topographic map of a seabed, showing various geological features like ridges and valleys. The map is rendered in shades of green and brown. A specific area on the right side of the map is highlighted with a blue and purple glow, indicating a potential mining site. The text "Conceptual Requirement for Seabed Mining" is overlaid in yellow on the map.

Conceptual Requirement for Seabed Mining

Attention towards ocean mineral resources is growing in the world

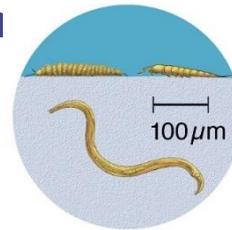


The number of applications for exploration area in each year to the ISA

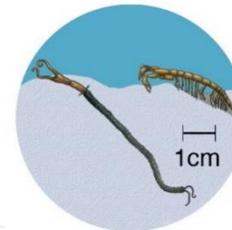
Environmental Impact Assessment (EIA) is also required

- Series of workshops for EIA of deep-sea mining are continued by the ISA-

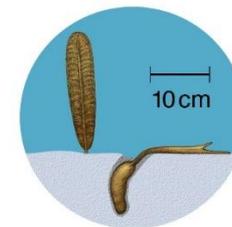
Workshop on Taxonomic Methods and Standardization of **Meiofauna** in the Clarion-Clipperton Zone (Dec 2015)



Workshop on Taxonomic Methods and Standardization of **Macrofauna** in the Clarion-Clipperton Fracture Zone [November 2014]



Workshop to Standardise **Megafaunal** Taxonomy for Exploration Contract Areas in the Clarion-Clipperton Fracture Zone [Jun 2013]



Rigorous Environmental Impact Assessments (EIA) is also Demanded.

however

EIA study \neq Pure Science

trade off

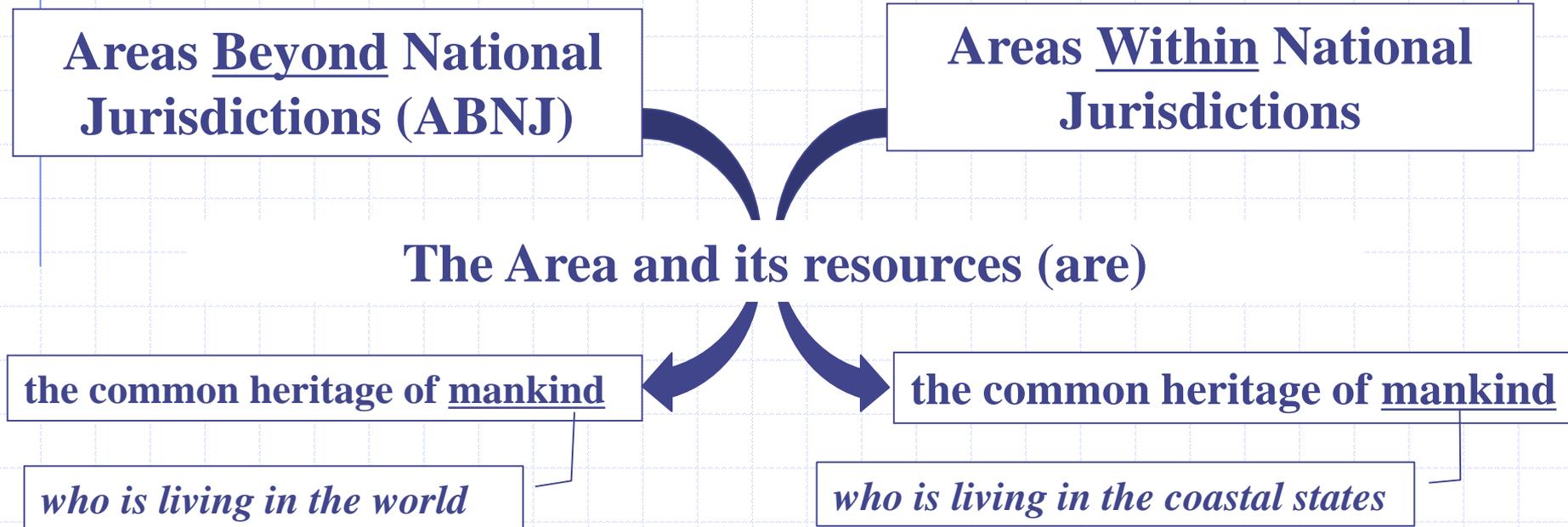
accuracy / precision



*economic rationality
working efficiency*

Who own the seabed resources?

Deep-sea mineral resources in the . . .

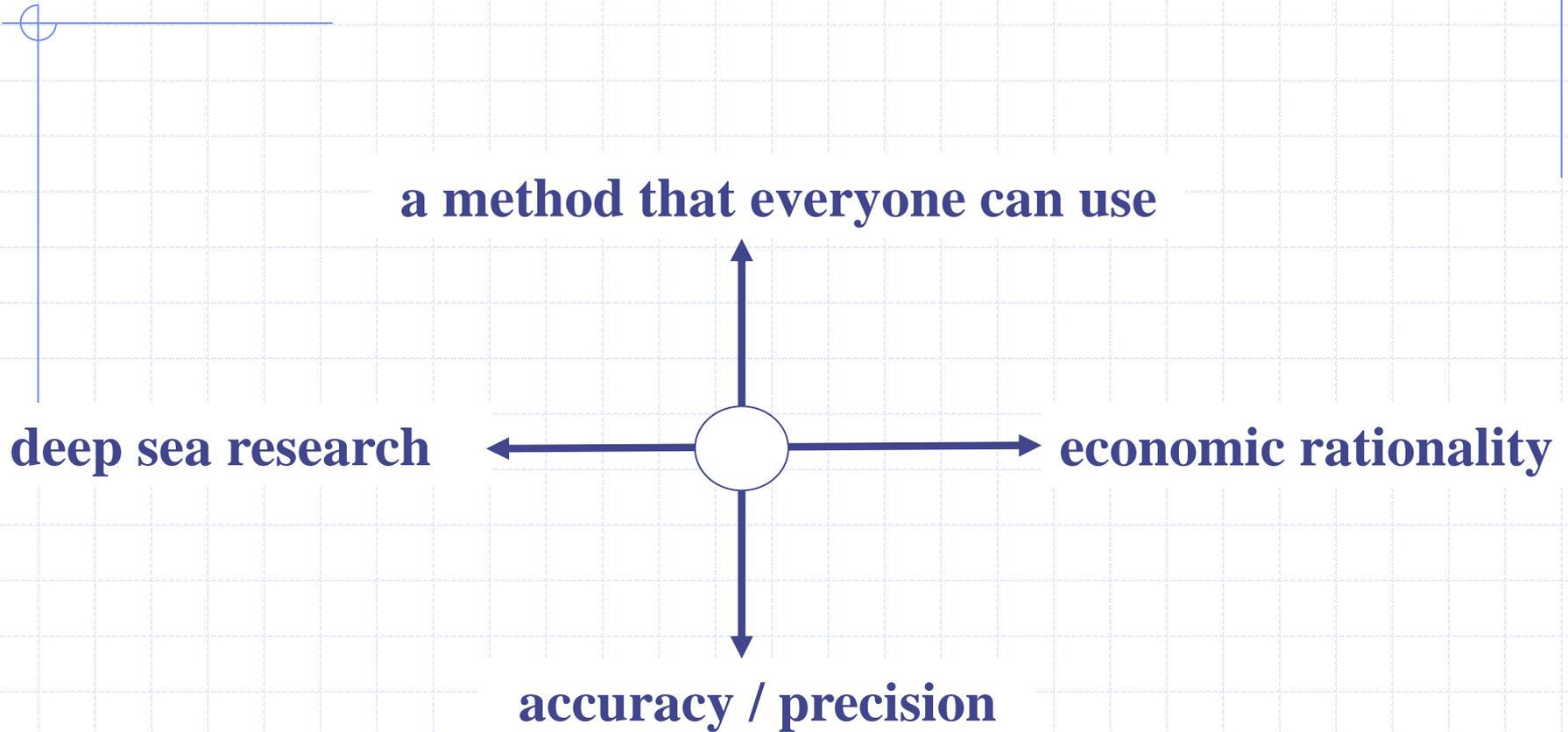


In any case, development opportunities should be given in addition to some other pioneer investors.

A photograph of a hydrothermal vent chimney, likely a black smoker, with a thick, dark, mineral-rich plume of superheated water being emitted from its top. The chimney is situated on a rocky, mineral-rich seafloor. The background shows the rugged, dark, and mineral-laden walls of the hydrothermal vent field.

Technical Requirement for Seabed Mining

There are a lot of Technical Requirements



- 1 Analysis for biological samples
- 2 Observe for seafloor conditions

Imaging Flow Cytometer

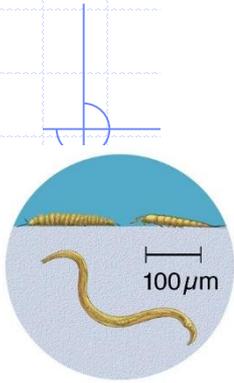
an instrument for Meiofauna analysis



- Automatic sorting system
- Automatic photo taking system

Problems of meiofauna analysis 1

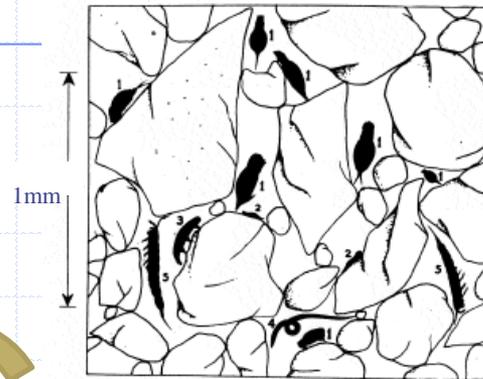
- *need delicate handling* -



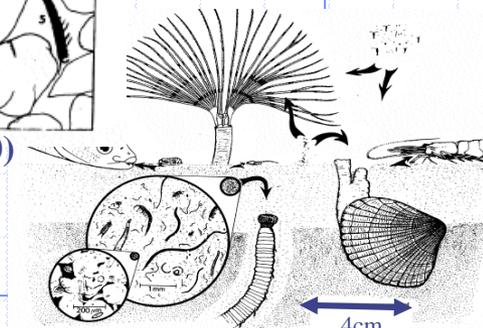
smaller animals

fauna in aquatic sediment

Meiofauna Animals of the benthic community that are intermediate in size between macrofauna and microfauna. Operationally defined as $>32 \mu\text{m}$ and $<250 \mu\text{m}$. (ISBA/19/LTC/8)



after Pennak (1940)

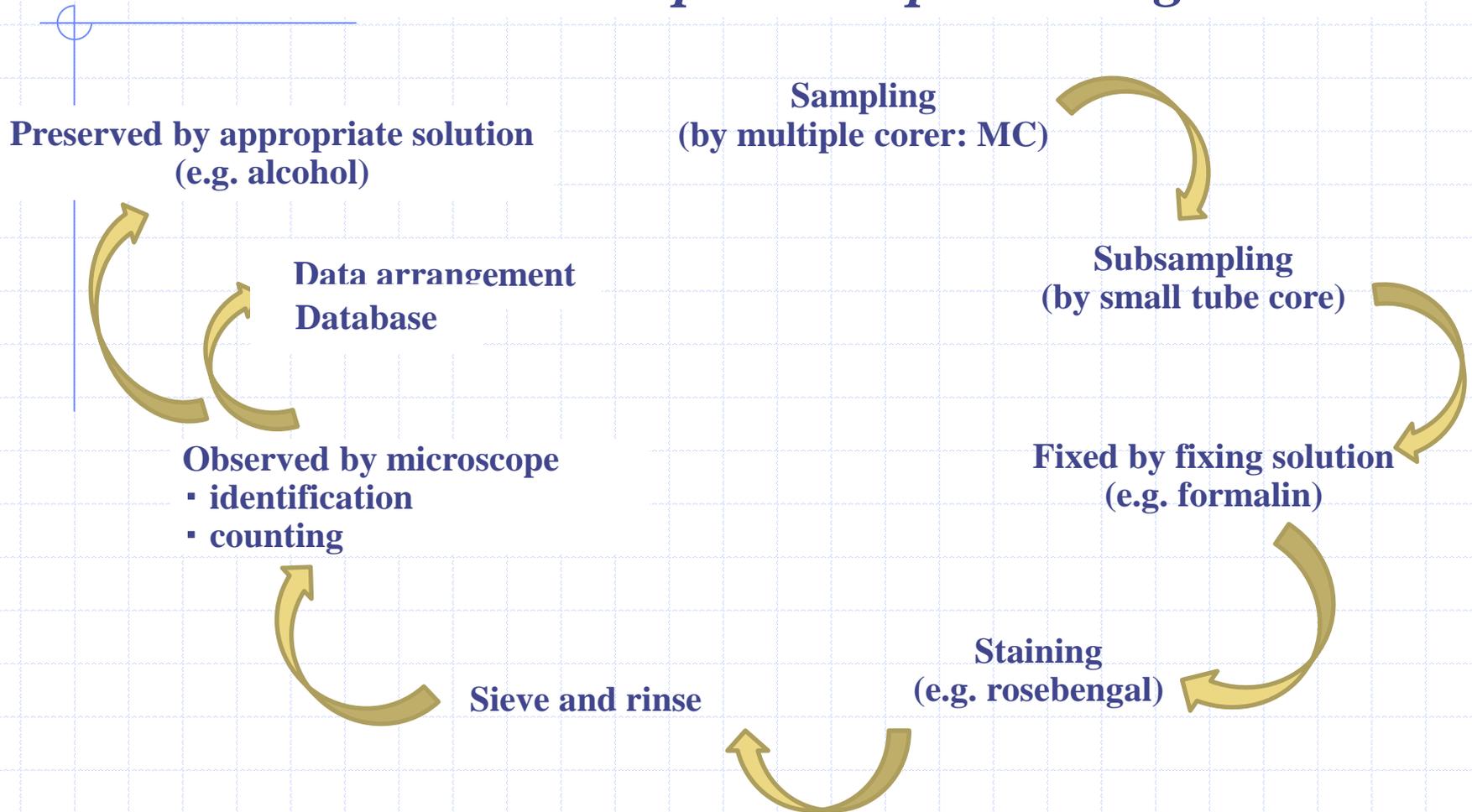


after Platt (1981)

need delicate handling

Problems of meiofauna analysis 2

- *need complicated processing* -



⇒ **need complicated processing**

In case of meiofauna analysis Need working efficiency

Need complicated processing

Need delicate handling

Need large number of samples

Need working efficiency

Automatic sorting

Automatic photo-taking

Imaging Flow Cytometry (SIP protocol series NO3)

See ⇒ **Ocean Data Practices**

<http://www.oceandatapactices.net/handle/11329/321>

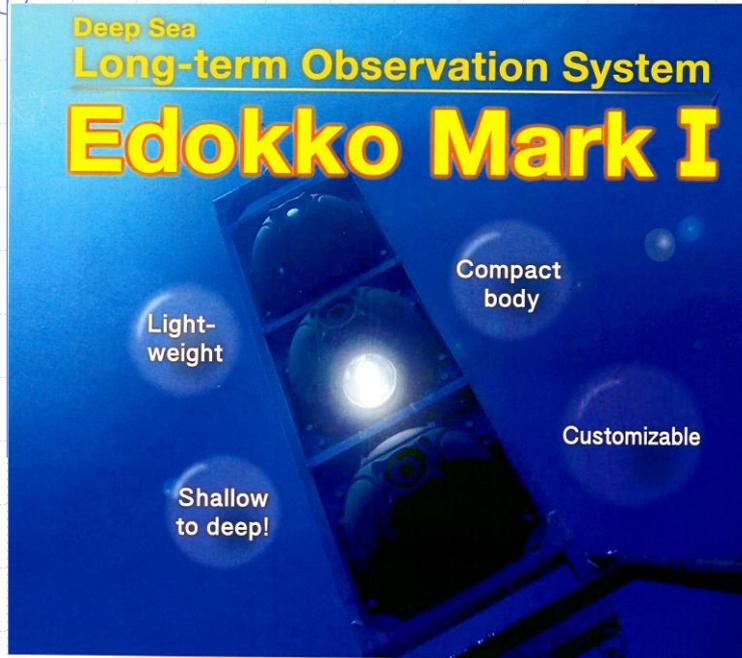
SIP Protocol Series No.3

A rapid method to analyze meiofaunal assemblages
Using an Imaging Flow Cytometer

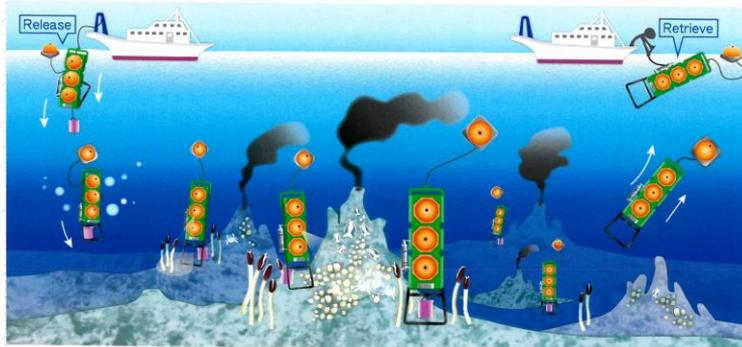


Edokko Mark I

an instrument for long-term seafloor observation system

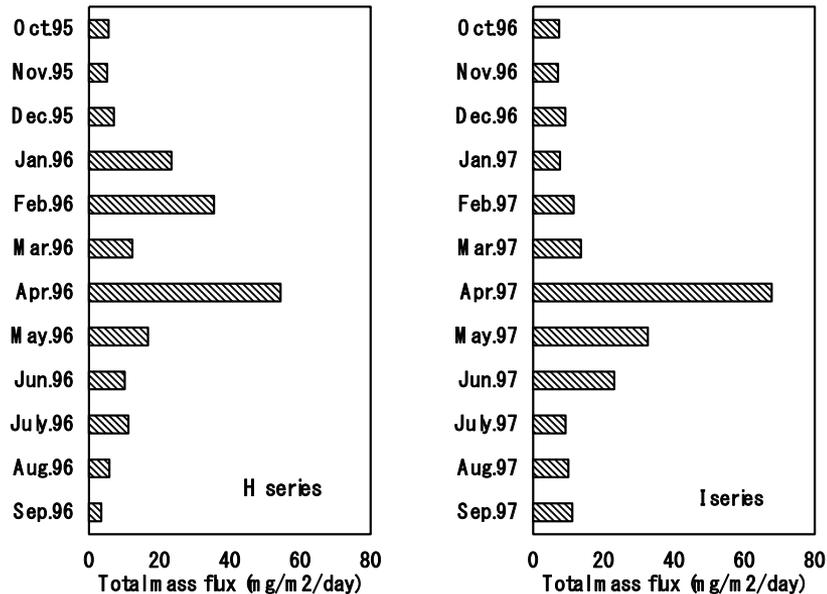


- Practical Use
- General purpose

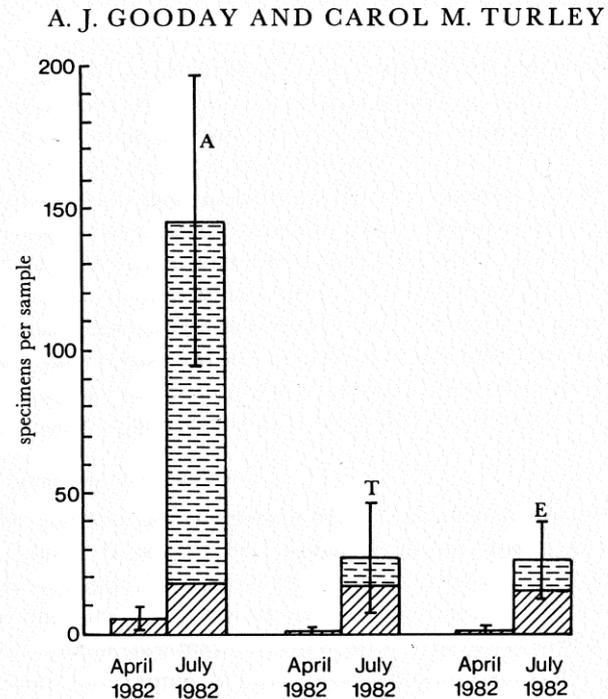


Problems of long-term seafloor observation system 1

- *need observation throughout a year* -



Total mass flux fluctuates annually
(after Fukushima et al)



Abundance of Benthic organisms fluctuates annually
(after Gooday and Turley)

Deep-sea environment is **not constant** throughout a year

Problems of long-term seafloor observation system 2

- the recommendation is seeking to search **temporal seabed variability** -



ISBA/19/LTC/8

III. Environmental baseline studies.

13. It is important to obtain sufficient information from the exploration area to document the natural conditions that exist prior to test mining, to gain insight into natural processes such as dispersion and settling of particles and benthic faunal succession, and to gather other data that may make it possible to acquire the capability necessary to make accurate environmental impact predictions. The impact of naturally occurring periodic processes on the marine environment may be significant but is not well quantified. It is therefore important **to acquire as long a history as possible of the natural responses of sea-surface, mid-water and seabed communities to natural environmental variability.**

III. Environmental baseline studies.

Baseline data requirement

15. (e) (vi)

Establish at least one station within each habitat type or region, as appropriate, **to evaluate temporal variations in water column and seabed communities**

Environmental baseline should be obtained by multiple observations

Problems of long-term seafloor observation system 3

- the recommendation is seeking to search **continuously** at least one year -



ISBA/19/LTC/8

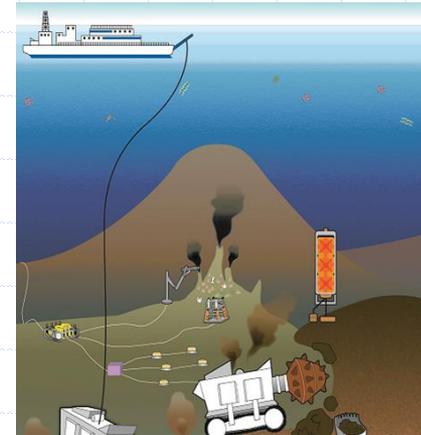
Annex I

Explanatory commentary

36. The data to be collected and the corresponding methodology for the various classes/sizes of seabed fauna should be as follows:

(f) Demersal scavenger. **A time-lapse baited camera should be installed** at the study area for **at least one year** to examine the physical dynamics of surface sediment and to document the activity level of surface megafauna and the frequency of resuspension events. Baited traps may be used to characterize the community species composition. Amphipod necrophage communities should be determined using short-term (24-48 hours) baited traps.

**Need seafloor observation
at least one year**



Survey cruises more than once per year are not realistic

In case of long-term seafloor observation system Need new observation system

Deep-sea environment is not constant throughout a year

.....to acquire

seabed communities to natural
environmental variability.

.....to evaluate temporal variations

..... and seabed communities.

Need observation throughout a year

(From economical point of view)

Multiple survey per year are difficult

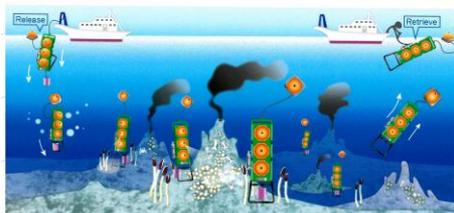
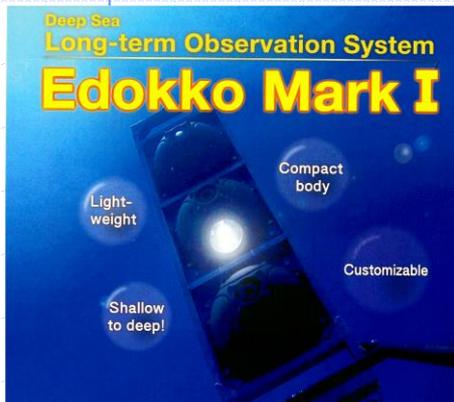
Need technical development

The Area and its resources are the
common heritage of mankind.

technical developments should be done not only for
pioneer investors, but also new entrants
(light-weight, compact body, ready-made parts, easy to use)

See ⇒ **Ocean Data Practices**

<http://www.oceandatapactices.net/handle/11329/321>





Thank you for your kind attention

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