Data and information required to administer the mineral resources of the Area: Acquisition of relevant information and data on the marine environment and its biodiversity

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Scientific Affairs Officer – Marine Biology
ISA

Outline

Current contractors

Workshops

ISA database

Collaborations

Current Contractors

Currently 8 contractors for nodule exploration

4 to be considered at 17th session
- 2 nodule exploration
- 2 sulphide exploration

Environmental requirements

Current Contractors

Environmental Requirements

Regulation 31 (Nodule code) / Regulation 34 (Sulphide code) – Protection and preservation of the marine environment:

- The Authority shall establish and keep under periodic review environmental rules and regulations to protect the environment.
- A precautionary approach should be used.
- Contractors shall take appropriate measures to prevent, control and reduce hazards to the marine environment.
- Each contractor shall gather environmental baselines against which to monitor impacts (LTC issue recommendations on specific details).
- Contractors shall report annually on their environmental activities.
- Contractors and their sponsoring states shall cooperate with the Authority in establishing and implementing environmental monitoring programmes.
- If the contractor applies for exploitation rights it shall propose areas to be set aside as impact reference zones and preservation reference zones.

Current Contractors

Environmental Requirements

Regulation 31 (Nodule code) / Regulation 34 (Sulphide code) – Protection and preservation of the marine environment

Environmental guidelines

- Based on recommendations from workshop
- ISBA/7/LTC/1/Rev.1** (2001)
- ISBA/16/LTC/7 (2010)

Workshops

12 workshops to date

6 concerned with environmental data and information

- Exploration Deep Seabed Polymetallic Exploration: Development of Environmental Guidelines (1998)
- Harmonisation Workshop on the Standardization of Environmental Data and Information: Development and Guidelines (2001)
- Workshop on prospects for international collaboration in marine environmental research to enhance understanding of the deep-sea environment (2002)
- Workshop on Polymetallic Sulphides and Cobalt-Rich Ferromanganese Crusts Deposits: Establishment of Environmental Baselines and an Associated Monitoring Programme During Exploration (2004)
- Workshop on Cobalt-Rich Crusts and the Diversity of Distribution Patterns of Seamount Fauna (2006)
- International Workshop for the Establishment of a Regional Environmental Management Plan for the Clarion-Clipperton Zone in the Central Pacific (2010)

- Other smaller meetings addressing specific environmental issues (eg. Nematode barcoding)

ISA Database

Overview

3 resources

8384 “datapoints”

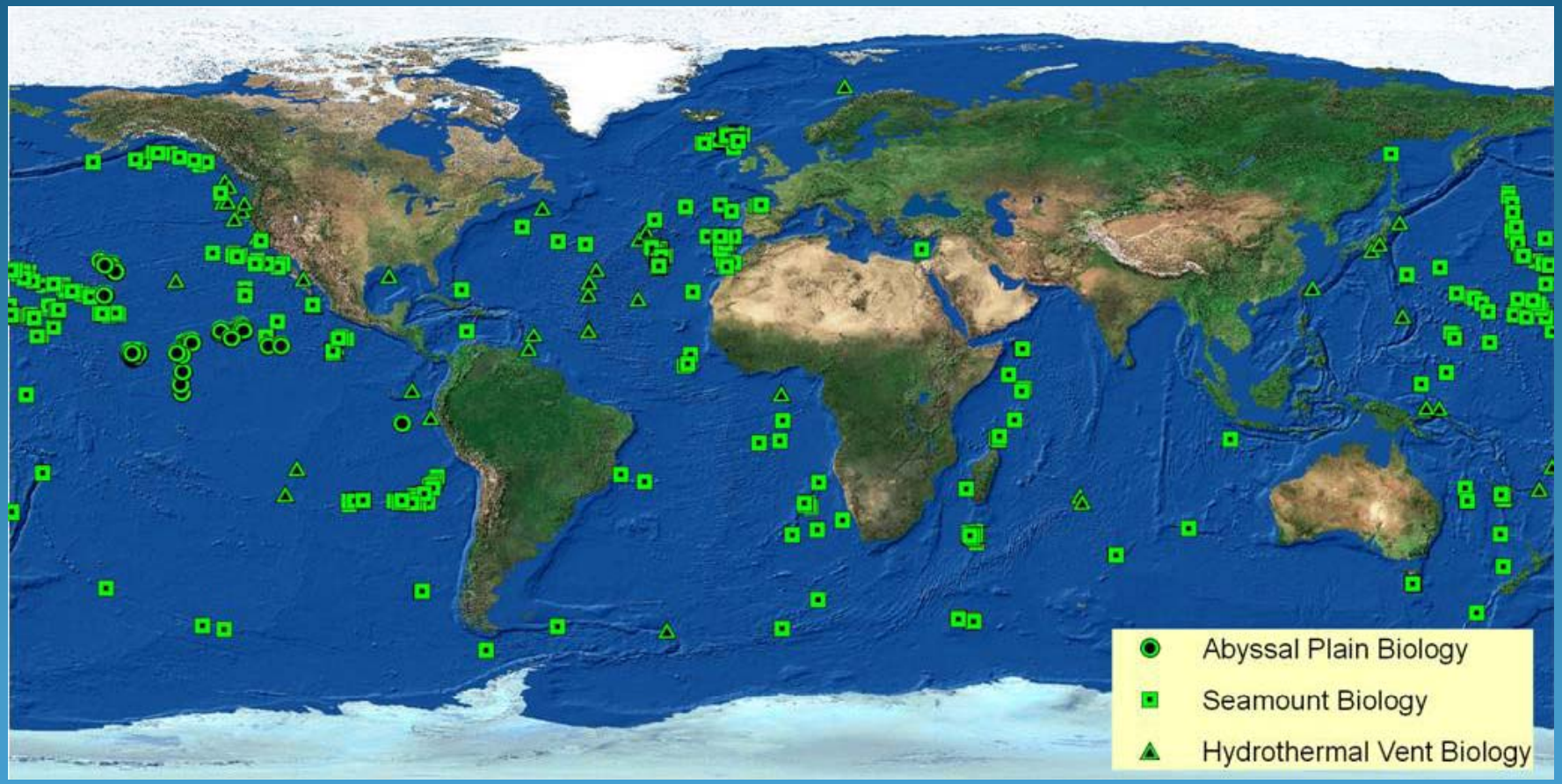
- Abyssal plane (Nodules) – 228 samples, 668 records
- Hydrothermal vents (Sulphides) – 47 “samples”, 397 records (all active)
- Seamounts (cobalt-rich crusts) –627 “samples”, 7,319 records

Standardisation

Bibliographic database

ISA Database

Location Of Samples



ISA Database

Typical Data For "Nodule" Samples

FIELD NAME	FIELD VALUE
Fid	*430*
Shape	*Multipoint*
Number	AAC-N-119
Latitude	0.1103
Longitude	-139.7327
Depth (m)	4305
Programme	EqPac
Project ID	JGOFS EqPac oN
Station	BC6
Device	BC
Sieve Size (µm)	45
Depth (mm)	10
Category	Nematode Abundance
Area of sample (cm^2)	10
Reference	Brown, CJ, Lambshead, PJD, Smith, CR, Hawkins, LE, Farley, R (2001) Phytodetritus and the abundance and biomass of abyssal nematodes in the central, equatorial Pacific. Deep-Sea Res 48: 555-565

ISA Database

Area Covered

Nodule data only

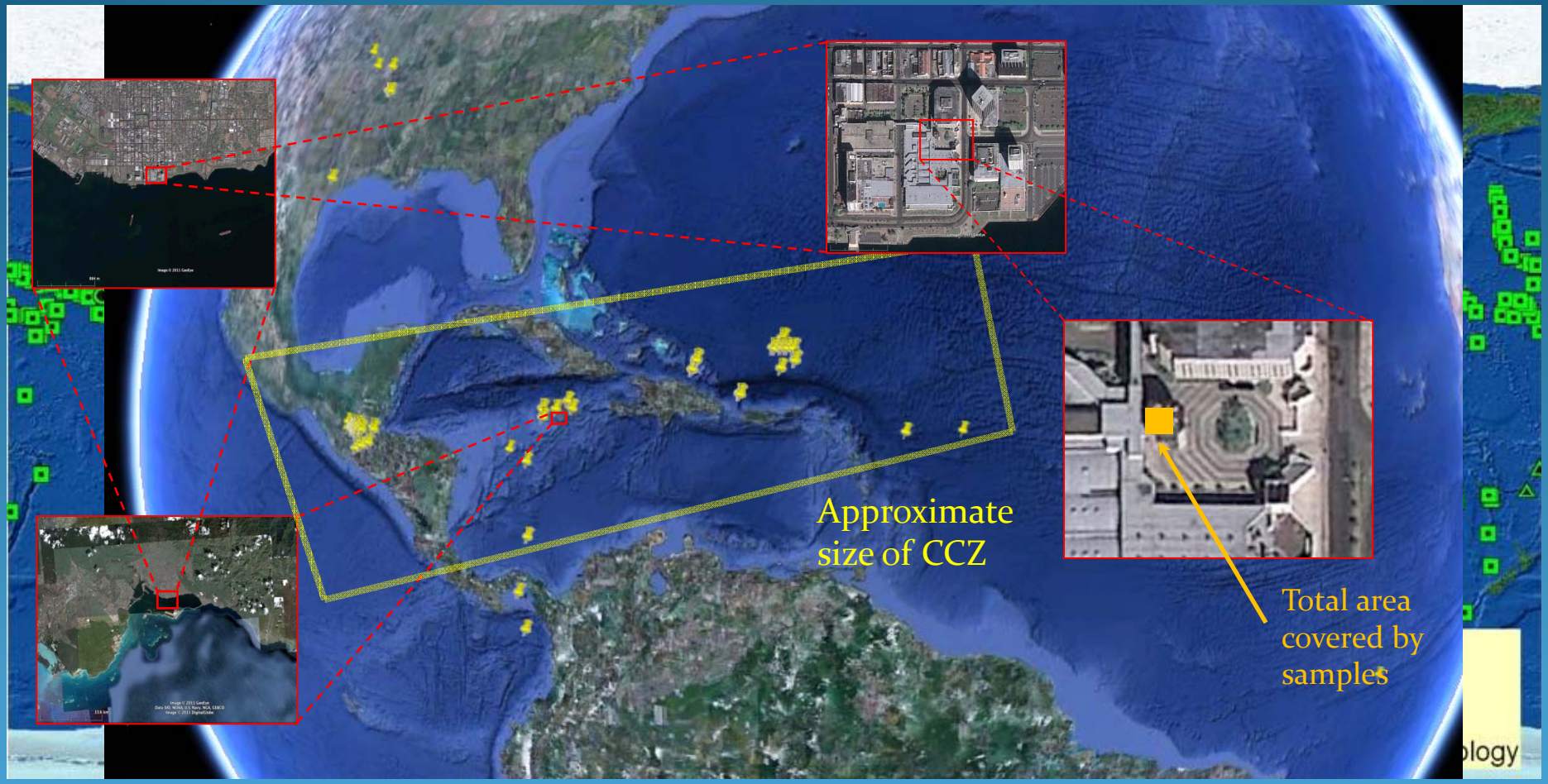
228 samples
All published and some unpublished data for CCZ and surrounding area

Boxcore Area = 0.25 m^2 (~ a typical manhole cover)
Multicore Area = 25 cm^2 (~ a typical credit card)

Assume boxcore

Total area sampled 57 m^2
- 7.5m x 7.5m
- 24.5ft x 24.5ft
- ~ 4.5 × area of a typical car parking space

Samples Overlaid On Caribbean



ISA Database

Area Covered In Database Relative To Rest Of Deep-Sea

Total area in nodule database ~ 57 m^2

Area of CCZ ~ 5 million km^2

~ 0.000 000 001 % (1 Billionth %) sampled

Equivalent to describing Jamaica (~11,000km^2) using total sampling area of ~1 square foot

Total area of deep seabed ~ 325 million km^2

0.000 000 001 % of total deep seabed is ~ 3,250 m^2

~ 13,000 box cores

More than 1 boxcore every day since the modern boxcore invented in 1974 to get same coverage as in nodule database for CCZ

Data in database is not lacking, quantitative data for deep sea in general is lacking

Coverage in database probably better than typical for deep-sea

ISA Database

Standardisation

Harmonisation Workshop on the Standardization of Environmental Data and Information: Development and Guidelines (2001)

Objectives:

1. To propose standards for the measurement of the biological, chemical, geological and physical components of the marine environment essential for establishing environmental baselines and for environmental impact assessment
2. To recommend general sampling designs for the acquisition of environmental baseline data and for conducting monitoring tests
3. To recommend appropriate standardization strategies for ongoing efforts in taxonomy, sample processing and field collection of data if desirable
4. To recommend strategies that will facilitate the conversion of relevant data and information that have been acquired by the registered pioneer investors and concerned international scientific institutions into the standards proposed, thereby enabling the creation of a central database for subsequent use in managing impacts from deep seabed mining of polymetallic nodules when it occurs

ISA Database

Standardisation

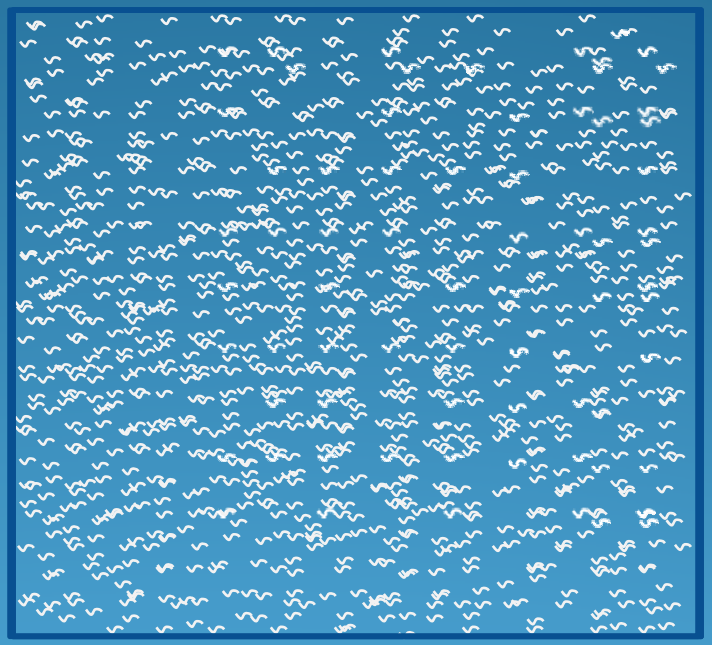
Harmonisation Workshop on the Standardization of Environmental Data and Information: Development and Guidelines (2001)

Outcomes:

1. Environmental guidelines
2. There is more than one “acceptable” strategy
3. More standardisation required

Standardisation Example

Nematodes

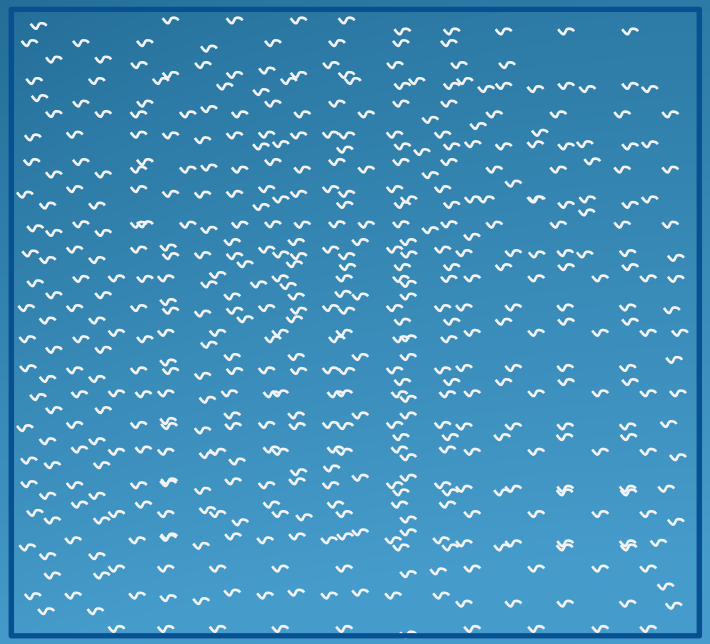


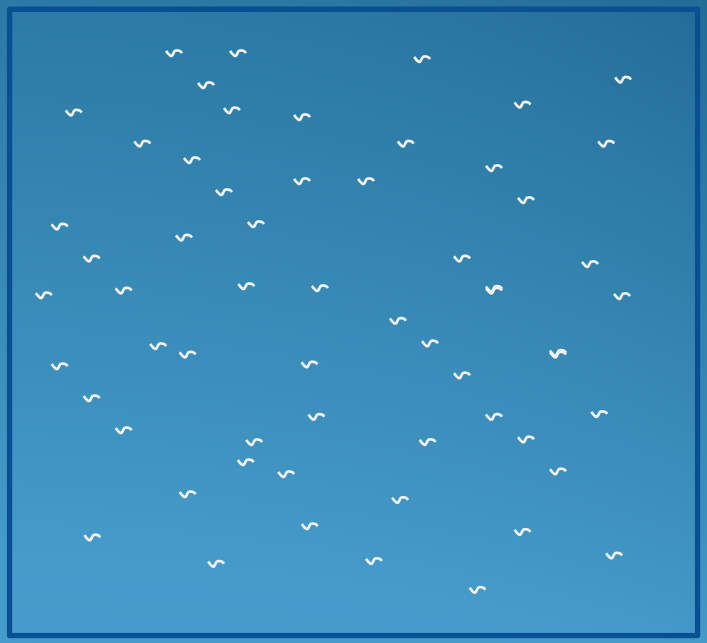
"Ideal" Sample:
32µm sieve
10cm depth
Multicore
500 per 10cm²

Potential sample:
63µm sieve
1cm depth
Box core
60 per 10cm²
(12% of "ideal" sample)

Standardisation Example

Nematodes





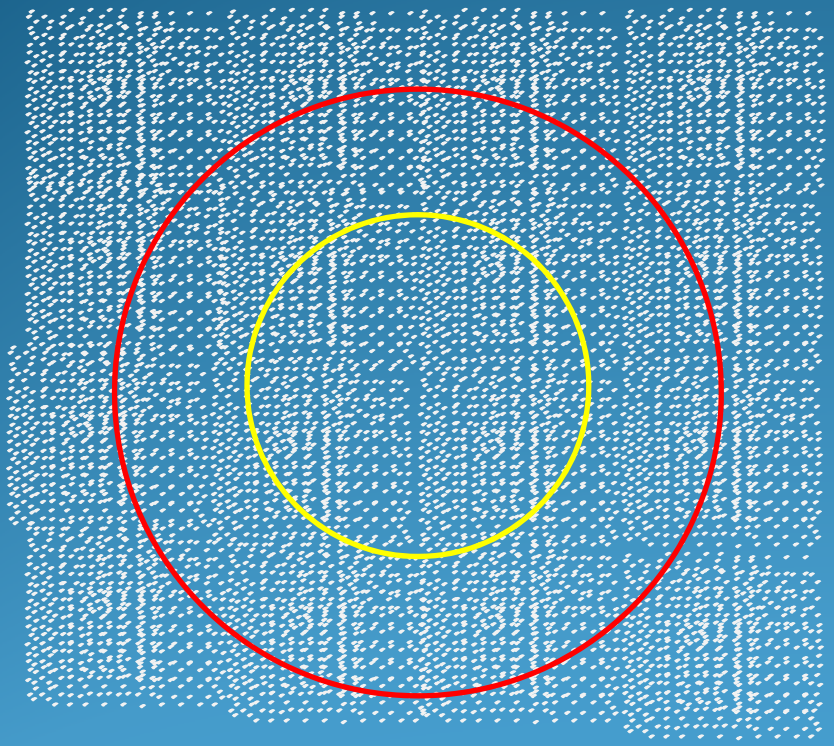
32µm
Multicore
10cm
500 individuals

BOTH ARE
ACCEPTABLE
TECHNIQUES

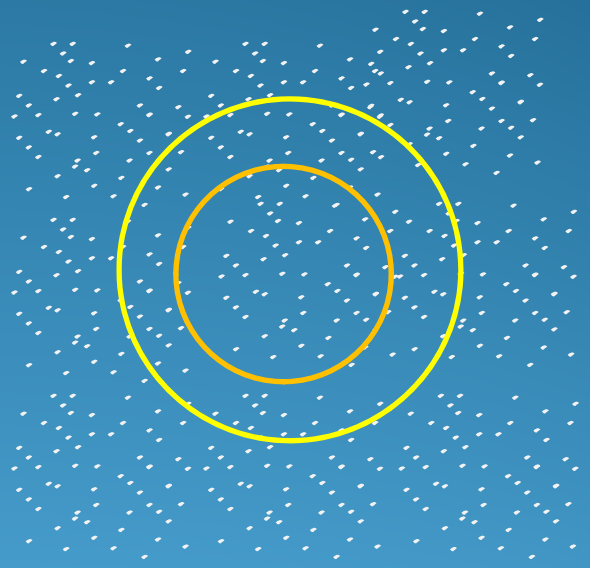
63µm
Boxcore
1cm
60 individuals

Standardisation Example

Nematodes



Abundance sampled with mega-/multi-core
(500 individuals per 10 cm²)
Multicore – 1,250 Individuals
Megacore – 3,926 Individuals



Abundance sampled with box core
(60 individuals per 10 cm²)
25cm² subcore - 150 Individuals
10cm² subcore - 60 Individuals

ISA Databases

Bibliographic Database

~2500 references

Searchable by author, keyword, journal, year, etc.

Contains abstracts and links to full article online where available

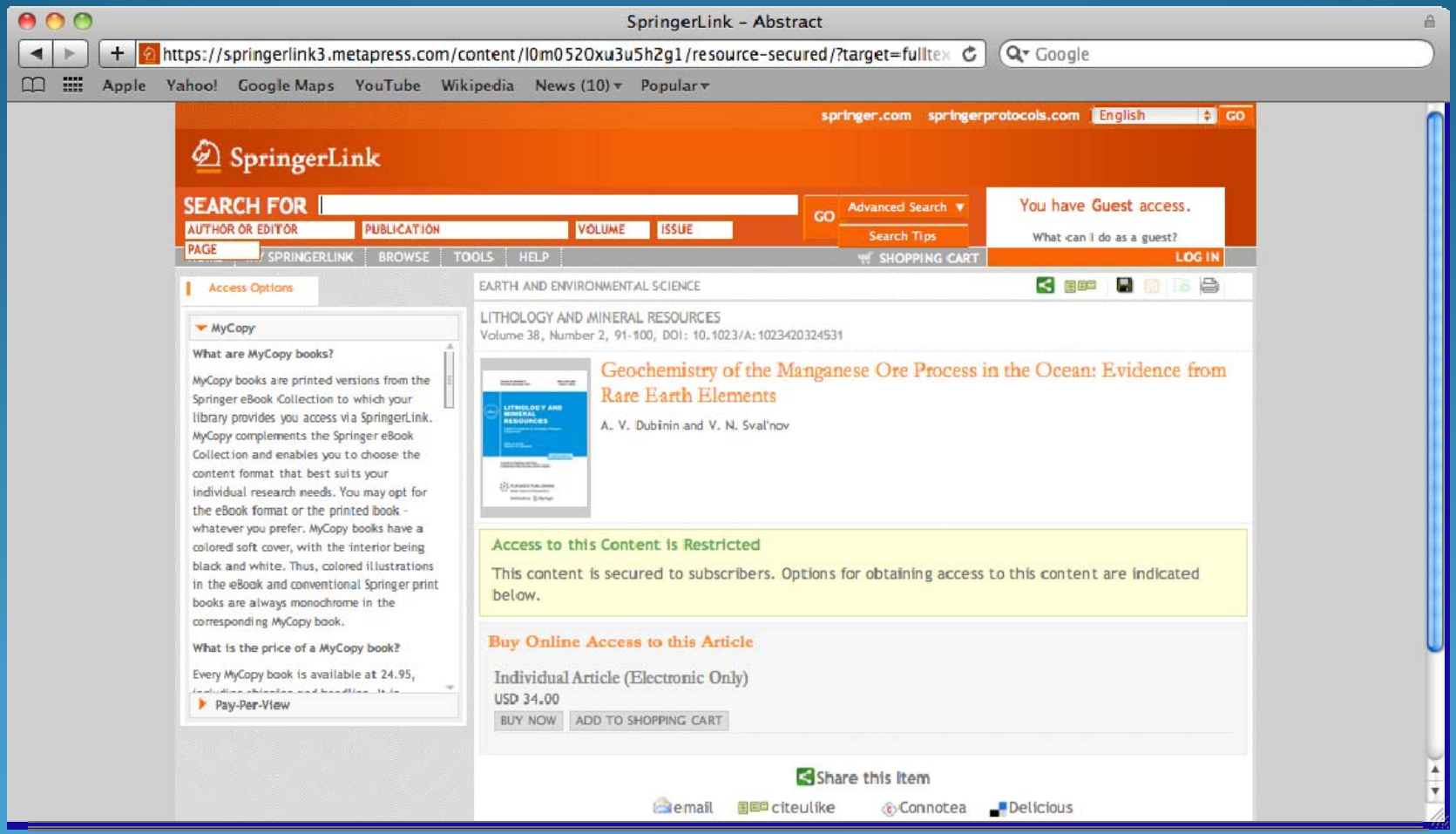
User can go straight to article and read or purchase

Provides access to research material to investigators in developing countries without extensive library/reference facilities

http://biblio.isa.org.jm/wwwisis/ACREF.02/form.htm

ISA Databases

Bibliographic database



Collaborations

Kaplan project

Census of Marine Life:

(CeDAMar)

CenSeam

ChEss

INDEEP

InterRidge

Kaplan Project

Goals

1) To estimate, using modern molecular and morphological methods, the number of polychaete, nematode and foraminiferal species at two to three stations spaced at ~1,500 km intervals across the Pacific nodule province.

2) To evaluate, using state-of-the-art molecular and morphological techniques, levels of species overlap and, if possible, rates of gene flow, over scales of 1,000 - 3,000 km for key components of the polychaete, nematode and foraminiferan fauna.

3) To broadly communicate findings to the scientific and mining-management communities, and make specific recommendations to the International Seabed Authority on minimising risks to biodiversity resulting from mining.

Kaplan Project

Main Participants

Craig R. Smith (University of Hawaii, USA)
John Lambshead (Natural History Museum, UK)
Gordorn Paterson (Natural History Museum, UK)
Alex Rogers (British Antarctic Survey, UK)
Andy Gooday (Southampton Oceanography Centre, UK)
Hiroshi Katazato (JAMSTEC, Japan)
Myriam Sibuet (IFREMER, France)
Joelle Galeron (IFREMER, France)
Karsten Zengler (Diversa Corporation, USA)

Kaplan Project

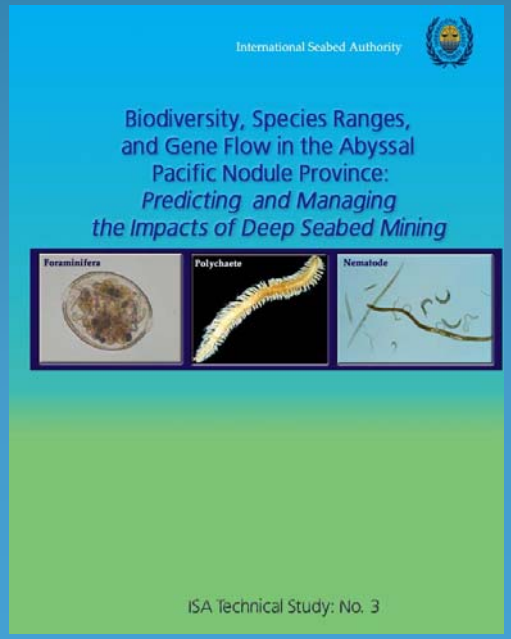
Results

1. High, unanticipated, and still poorly sampled levels of species diversity for all three sediment-dwelling faunal components (foraminifera, nematodes and polychaetes) at individual study sites.
2. Cryptic speciation (i.e., the presence of multiple species previously identified as single species) appears to be very common in the polychaetes and nematodes.
3. Habitat heterogeneity also appears to be higher than previously appreciated.
4. Total species richness of sediment-dwelling foraminifera, nematodes and polychaetes (a subset of the total fauna) at a single site in the CCZ could easily exceed 1,000 species.
5. There is a characteristic fauna of the abyss, i.e., that abyssal habitats have sustained species radiations and are not merely sinks of non-reproducing individuals transported from ocean margins.
6. There is significant evidence that the community structure of the foraminifera and polychaetes differs substantially over scales of 1,000–3,000 across the CCZ.

Kaplan Project

Full details in:

ISA Technical Study: No.3: Biodiversity, Species Ranges and Gene Flow in the Abyssal Pacific Nodule Province: Predicting and Managing the Impacts of Deep Seabed Mining. ISBN 978-976-95217-2-8



Kaplan Project

Outcomes

Nematode Barcoding

Areas of Potential Environmental Interest Proposal

Nematode Barcoding

Nematode identification using traditional morphological methods and light microscopes is difficult, time consuming and expensive.

Recent molecular research has raised doubts about whether the traditional morphological characters used are adequate to distinguish sibling species or those demonstrating convergent evolution.

There are insufficient traditional marine nematode taxonomists to undertake an extensive deep-sea monitoring campaign, and training new experts would be an extraordinarily slow and expensive business.

New molecular technology offers the potential of a cheap, fast and, more importantly, objective way of identifying deep-sea nematodes.

Molecular identification, or 'barcoding', does not require taxonomic expertise but uses more widely distributed technical skills.

Nematode Barcoding

Working group meeting in 2006

Barcoding manual prepared

Publication due out in the next few months

Encourage all studies to use the techniques outlined

Results are standardised and can be used in regional (or global) environmental databases

Areas Of Potential Environmental Interest

Background

The Kaplan project led to a Pew Fellowship examining the potential for MPAs in International waters (Craig Smith and Anthony Koslow)

A workshop was held at the University of Hawaii in October 2007 to design marine protected areas for seamounts and the abyssal nodule province in Pacific high seas

The goal of the workshop was to design a set of representative preservation reference areas to safeguard biodiversity and ecosystem function in the abyssal Pacific region targeted for nodule mining (the Clarion-Clipperton Zone)

The workshop proposed 9 areas be set aside in the CCZ for protection of the marine environment

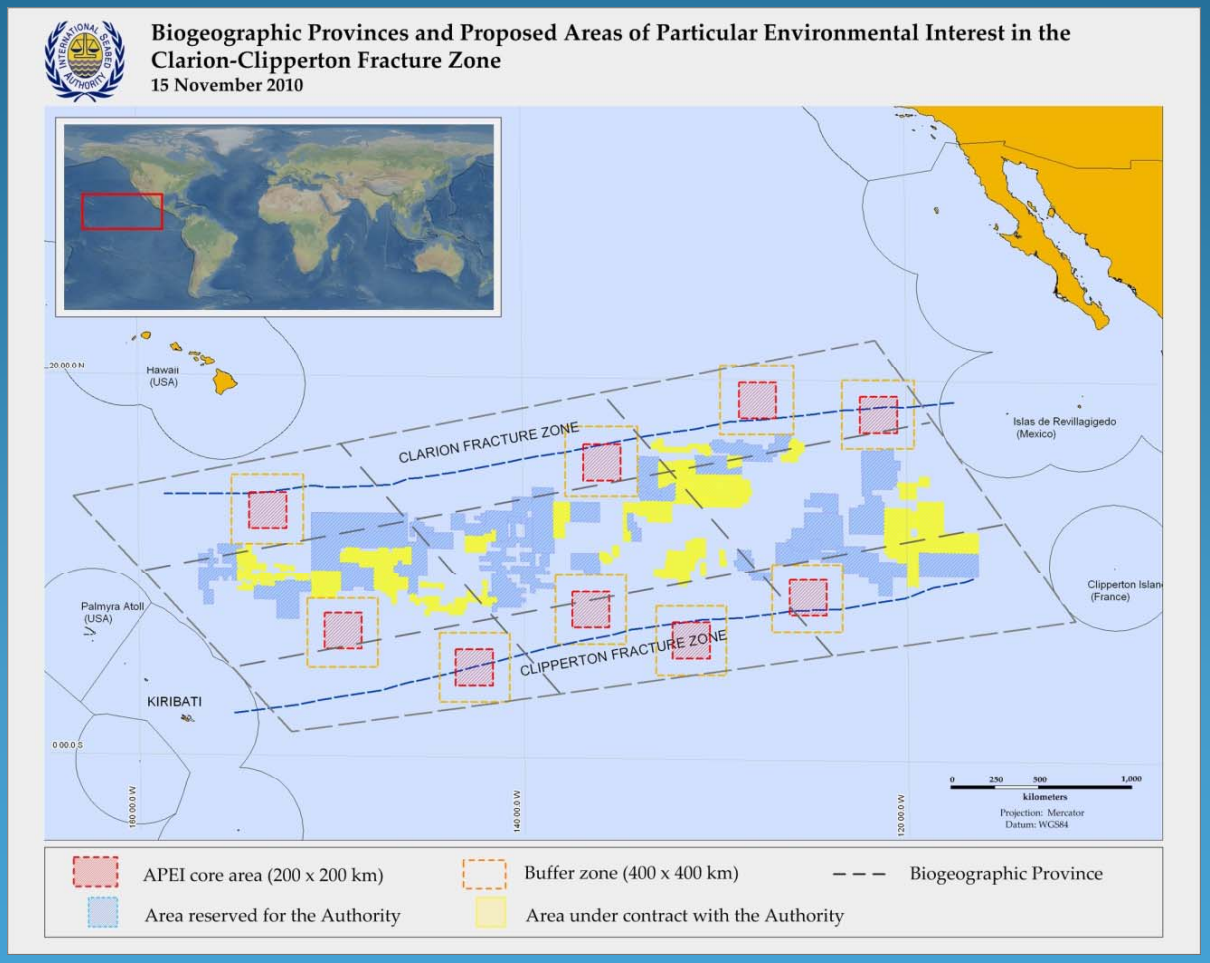
This idea been discussed by LTC since 2008 (ISBA/14/LTC/2* and ISBA/15/LTC/4)

Areas Of Potential Environmental Interest

Rationale

- Full rationale and explanation in ISBA/14/LTC/2* and ISBA/15/LTC/4
    - The zones should fit into the existing legal framework of the Authority
    - The interests of all stakeholders should be incorporated into the design process
    - The zones should be established as soon as possible
    - The zone system should be designed to allow the management of mining activities whilst preserving marine biodiversity and ecosystems
    - Because of productivity gradients, the CCZ should be divided into nine distinct subregions, each requiring an APEI
    - The boundaries of APEIs should be straight lines
    - Each APEI should contain the full range of habitat types found within its subregion;
    - Each APEI should consist of a core area surrounded by a buffer zone to ensure that the core is not affected by mining plumes created outside the APEI
    - The dimensions of each APEI should be 400 x 400 km

Areas Of Potential Environmental Interest



Areas Of Potential Environmental Interest

Next Steps

2010 Workshop – International Workshop for the Establishment of a Regional Environmental Management Plan for the Clarion-Clipperton Zone in the Central Pacific

Incorporated APEI proposal

To be discussed by LTC at 17th session (ISBA/17/LTC/2)

Hopefully it will encourage more scientific studies in the APEIs

CenSeam Collaboration

Outline

Seamounts in the central-west Pacific Ocean are known to have thick, cobalt-rich ferromanganese crusts of commercial interest for mining.

Very little is known about the faunal communities on these seamounts, and in particular whether they could be different from those that occur on seamounts which do not have thick cobalt-rich crusts.

Such information is fundamental to evaluating the potential impacts of mining operations, and formulating environmental guidelines for mining operations.

Aims were to assess patterns of community composition and diversity on seamounts with, and without, cobalt-rich crusts, and the factors that determine these patterns.

CenSeam Collaboration

Participants

Malcolm Clark (NIWA, New Zealand)

Christopher Kelley (Hawaiian Underwater Research Laboratory, USA)

Amy Baco (Florida State University, USA)

Ashley Rowden (NIWA, New Zealand).

CenSeam Collaboration

Results

Species varied between locations, with 209 recorded only from cobalt-rich sites, 271 from non cobalt-rich sites, and 487 seen at both types of crust locations.

Depth was major driving force in separating samples, with three zones defined: approximately 200–350 m; 360–600 m; and 750–1800 m.

No significant difference in the invertebrate community composition between cobalt-rich and non cobalt-rich sites.

The seamount communities could be protected without restricting cobalt-crust mining.

CenSeam Collaboration

Next Steps

The study provided a considerable advance in our knowledge of the biodiversity of cobalt-rich crusts, and factors that might drive community composition.

However, the database and analyses can be expanded to improve the results.

In particular, data on substrate type can be incorporated, and analyses can extend beyond presence-absence to include abundance.

A small meeting is planned for May 2011 to expand the analyses.

Dinard Meeting

Environmental Management Of Deep-sea Chemosynthetic Ecosystems: Justification Of And Considerations For A Spatially Based Approach

31 May - 4 June 2010

Partially sponsored by ISA

31 participants from 14 countries

Aims:

- Formulating general guidelines for the conservation of vent and seep ecosystems at regional and global scales.
- Outlining research needs to improve plans for the spatial management of vent and seep ecosystems.

Outcomes:

- "*Uncharted Waters: Placing Deep-Sea Chemosynthetic Ecosystems In Reserve*" submitted to *Science* journal for publication
- Workshop document to be published by ISA
- Increase in collaborations for data collection and analysis

INDEEP

International Network For Scientific Investigation Of Deep-Sea Ecosystems

Aims:

- To create a global network of committed scientists to maintain and develop the international collaborations first fostered during the Census of Marine Life programme.
- To address key gaps in knowledge relating to deep-sea ecosystem science
- To provide a framework to bridge the gap between scientists and policy makers.

5 Working groups:

- Taxonomy and evolution
- Global biodiversity and biogeography
- Population connectivity
- Ecosystem functioning
- Anthropogenic impact and social policy

ISA representative at planning meeting and active participant in all working groups

Likely to be the main source of global marine environmental data

Summary

Contractors are the main source of activity in nodule zone but we need to ensure raw data is provided in standardised format. They are doing well but could do better.

It is hoped that all future contractors will follow, and build on, the example of current nodule contractors.

The ISA has been active in holding workshops that address relevant information and data on the marine environment and its biodiversity.

The ISA is leading the way for environmental data compilation but we have a long way to go

Standardisation needs to be addressed in more detail.

Collaboration is essential to advance understanding.

More research is needed but this requires significant funding.

Thank You

Any Questions?

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