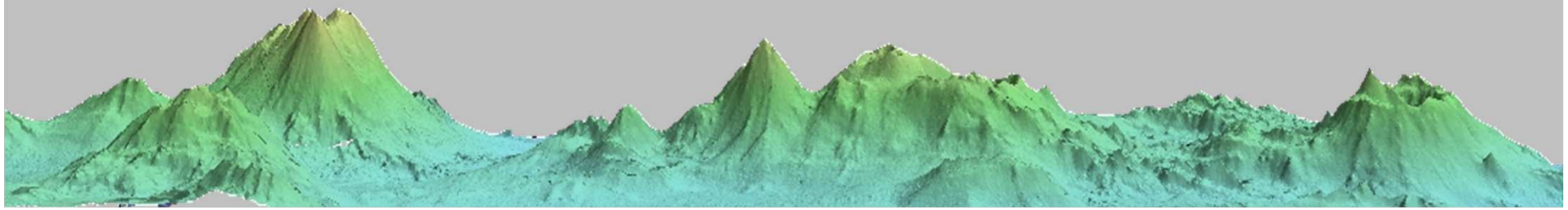
# Project-level Environmental Impact Assessment

Malcolm Clark

UBA-BGR-ISA workshop on deep-sea mining
Berlin, March 2017

# Presentation Outline

- EIA definition (skip the why, covered yesterday)
- EIA process
  - Bigger picture context
  - EIA sequence and ISA regulations
- EIA structure
  - Scope
  - Template (EIS)
- Key EIA content issues (draw on NZ experience)
  - Baseline data (ecosystem approach)
  - Role of risk assessment
  - Uncertainty
- Next steps (beyond this workshop



# What is an EIA?

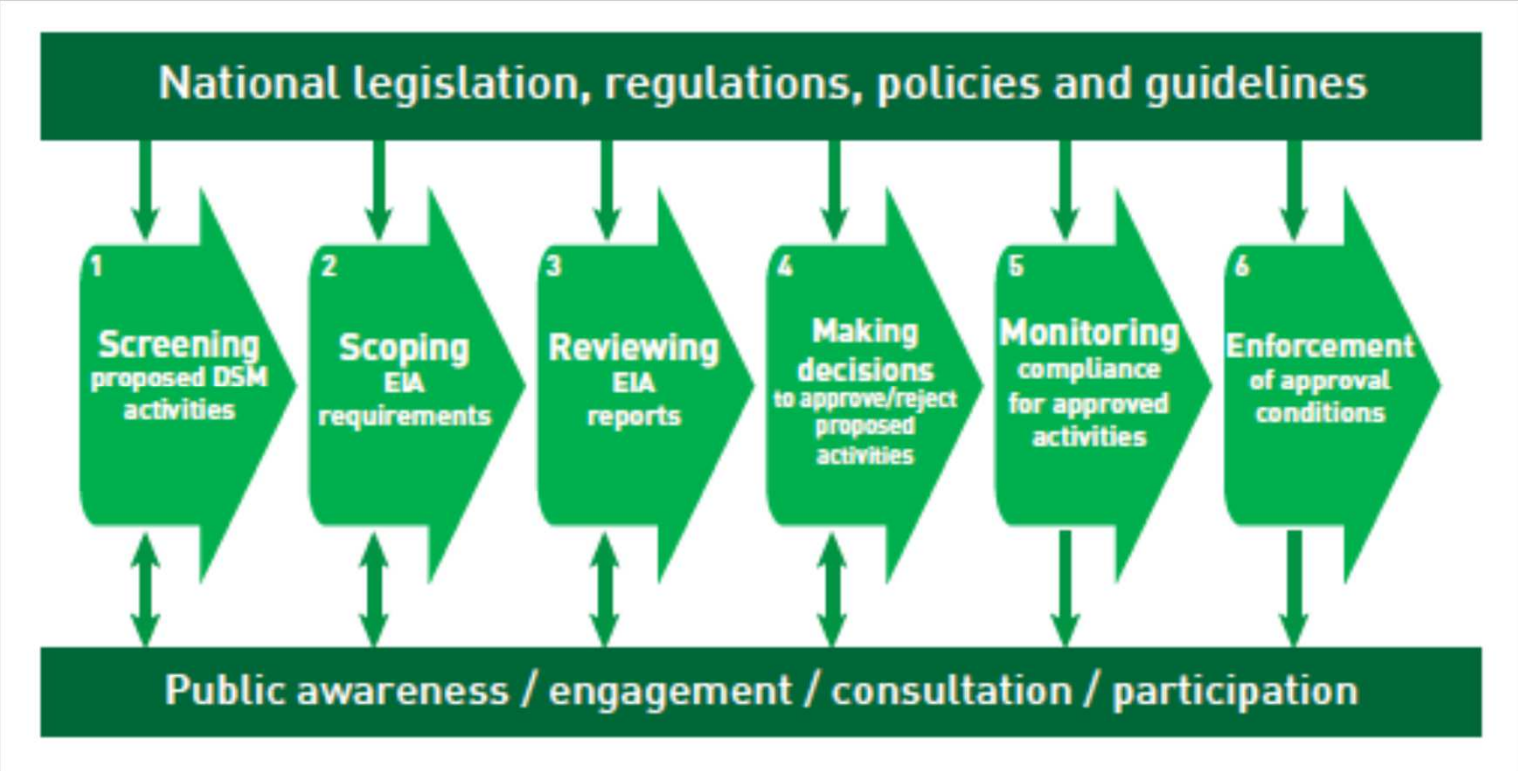
- EIA is "the process of **identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects** of development proposals prior to major decisions being taken and commitments made" (IAIA 1999)

Objectives

- To ensure that environmental considerations are explicitly addressed and incorporated into the development decision-making process; [impact description]
- To anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of development proposals; [mitigation, social elements as well]
- To protect the productivity and capacity of natural systems and the ecological processes which maintain their functions; [ecosystem implications]
- To promote development that generates less destruction and optimizes resource use and management opportunities. [management objectives]

# EIA is a PROCESS

- Not just a report, it is a structured process
- Several stages, from the initial scoping through to basis for approval conditions
- External input, engagement, feedback loops




[Swaddling 2016]

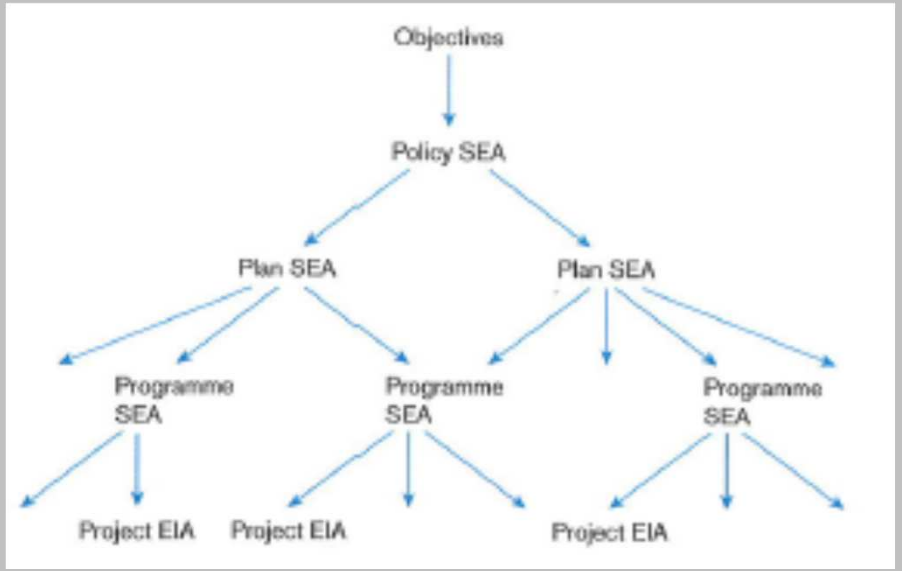
# Part of a bigger picture

- **Multiple processes**

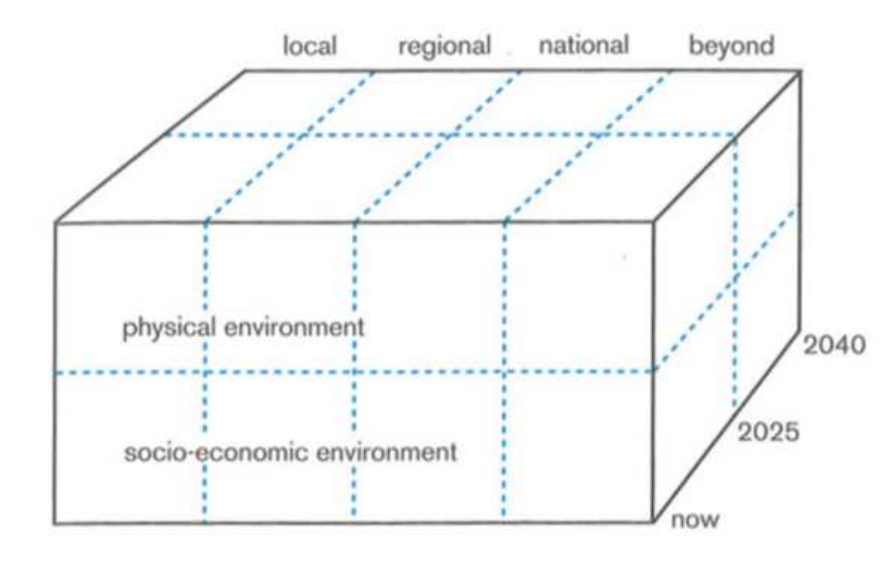

[MIDAS 2015]

# Part of a bigger picture (2)

- **Tiers and layers** of systems and tools
  - Policy initiatives
  - SEA/REA levels
  - EIA projects



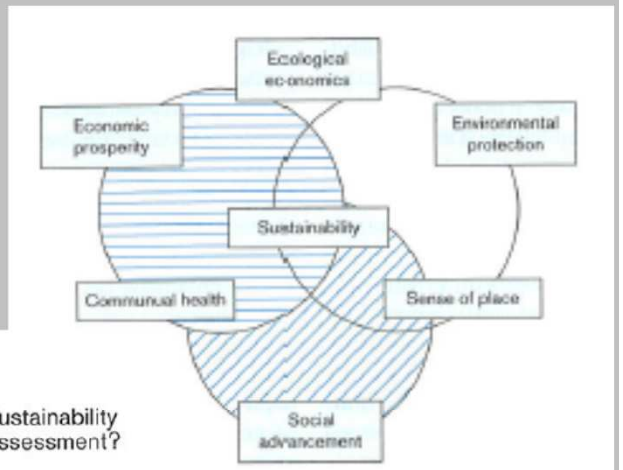

- **Multiple scales**
  - Temporal
  - Spatial
  - Differ between components

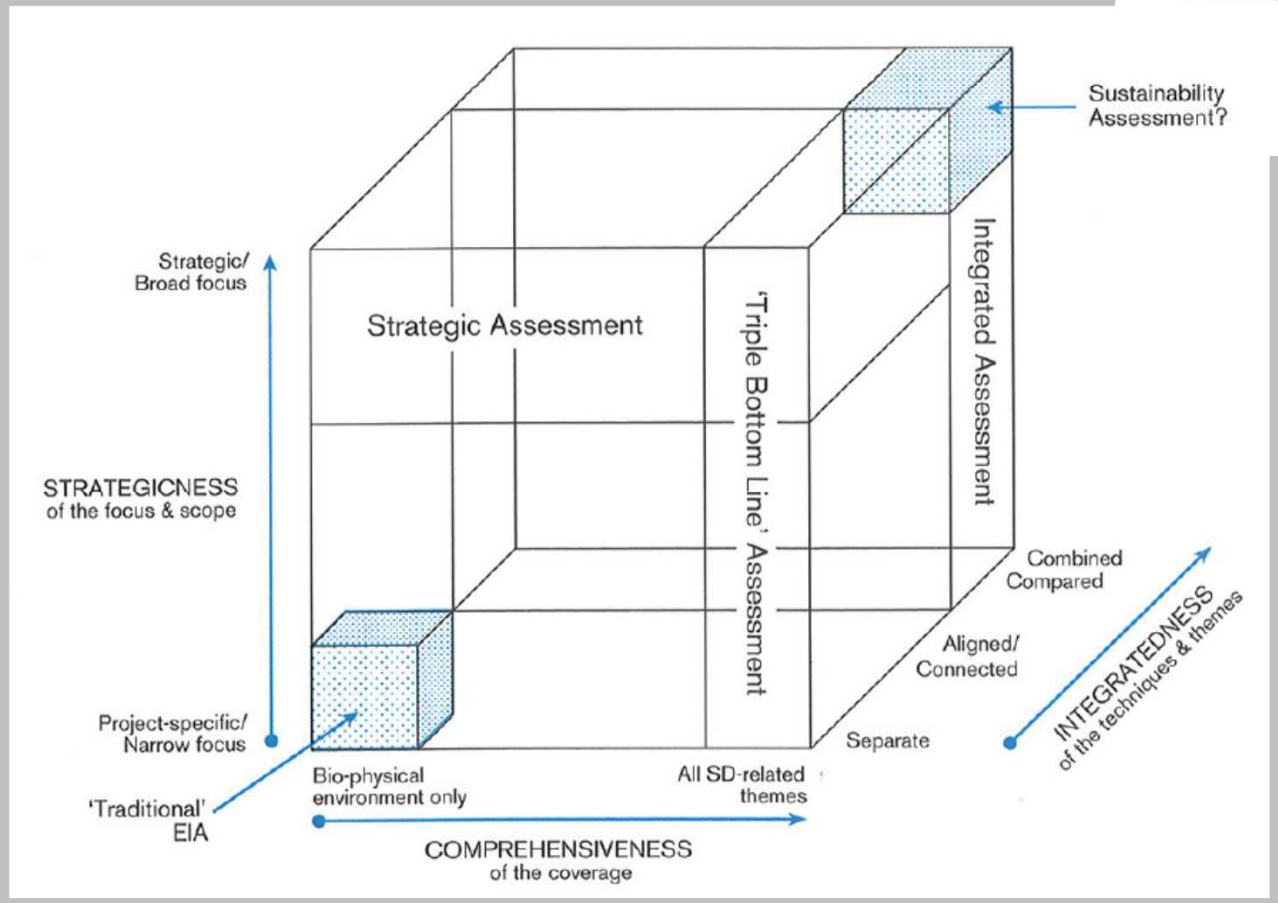



[Glasson et al. 2012]

# Part of a bigger picture (3)

- **Integrated ecosystem approaches**
  - Across sustainable development themes




[Hackling & Guthrie 2008]

# Keeping it practical and realistic

- Concepts can quickly get very complicated, well beyond our data and potential knowledge in the deep sea

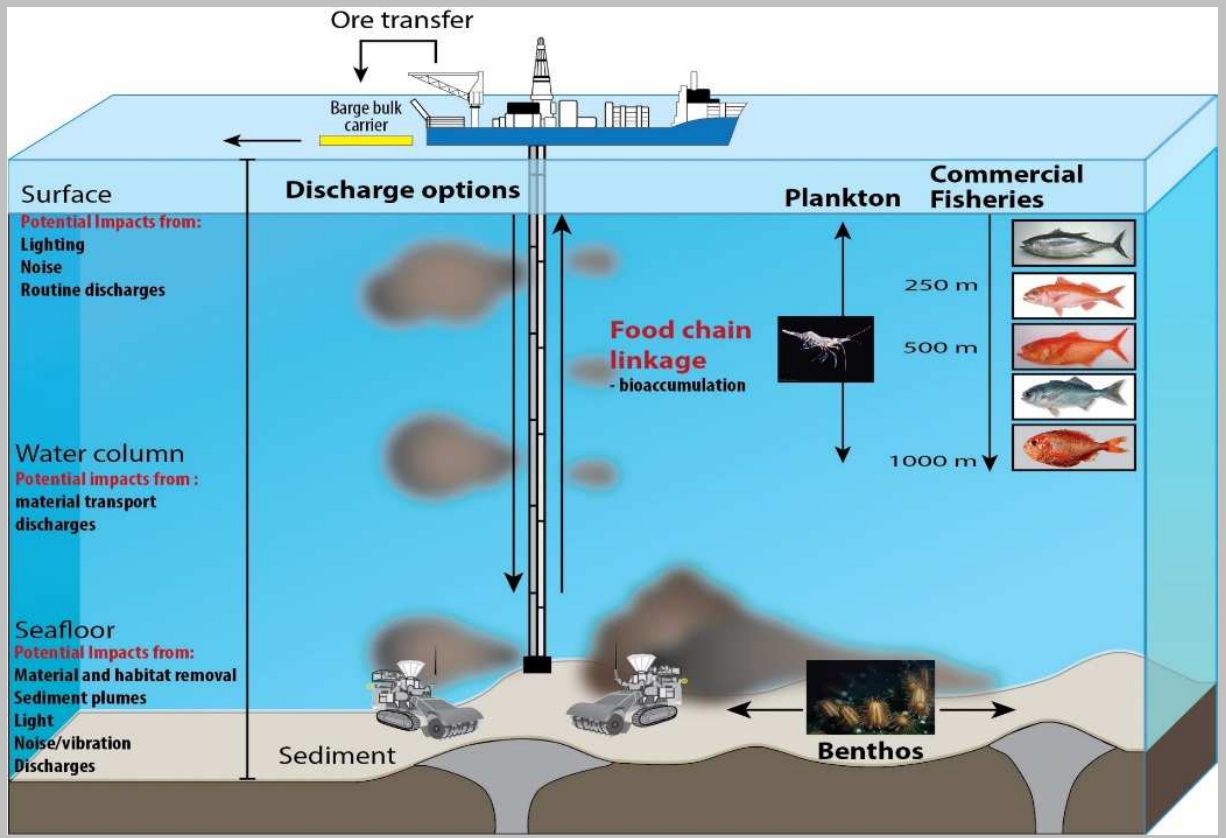
# Keeping it practical and realistic

- Concepts can quickly get very complicated, well beyond our data and potential knowledge in the deep sea

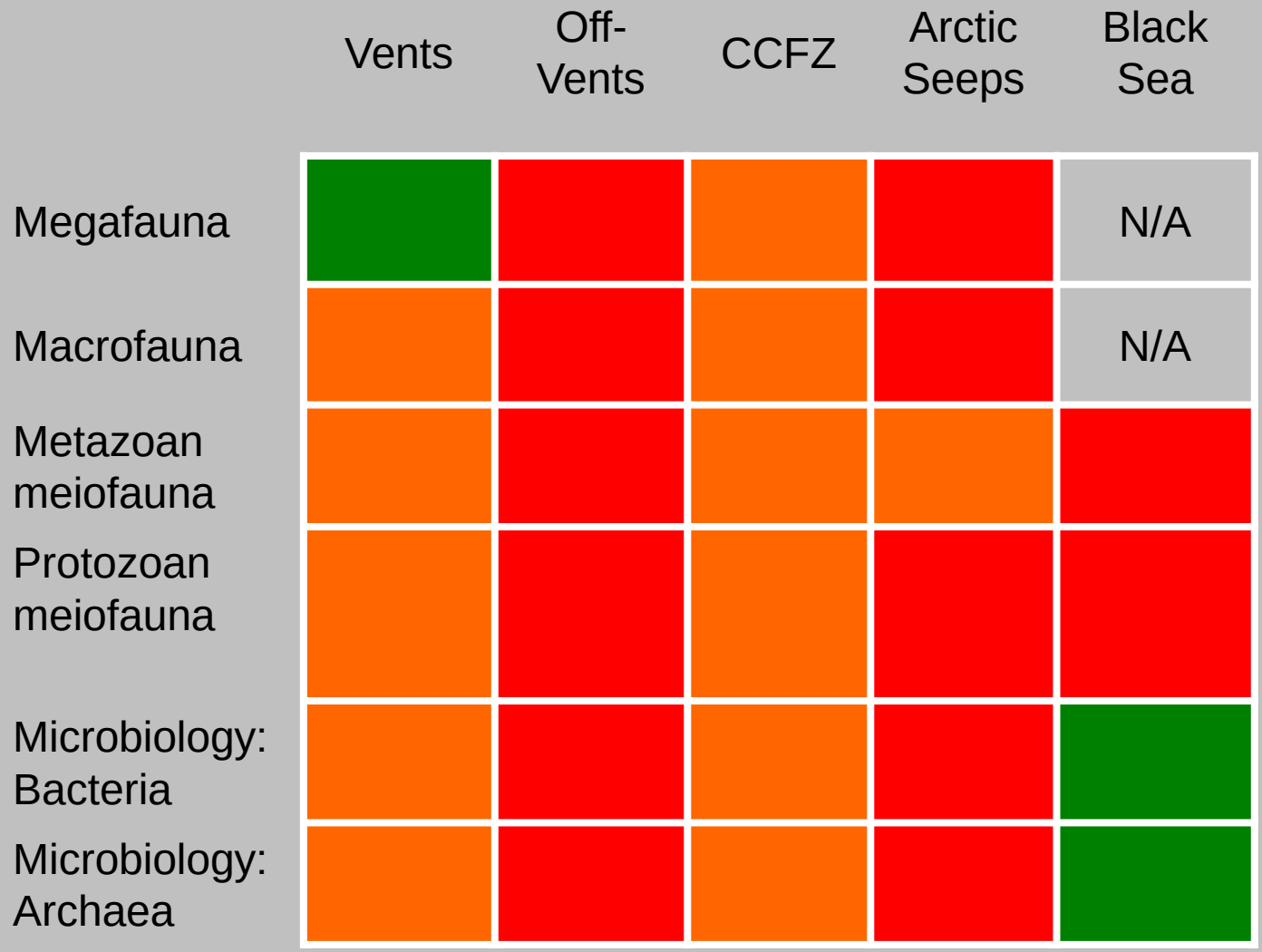
- Relative to onshore, coastal or O&G situations:
  - Very open and dynamic environment over large scales (hor,vert)
  - Remoteness makes it a challenging and expensive place to sample
  - Each DSM resource has its own set of scientific issues
  - **Basic ecological composition, and its spatial and temporal variability are difficult to measure and characterise**
  - **Ecosystem structure and function are very hard to define, let alone understand (spatial scale, environmental drivers)**
  - The nature and extent of actual mining impacts uncertain (but the mining footprint may be large)

# There is a lot for an EIA to consider

- Complex array of environmental and ecological factors, mining impacts, and interactions with other users
- What **must** science deliver to ensure ecosystem sustainability
- What **can** science realistically deliver (<<CCZ resources)



# State of environmental knowledge




[MIDAS 2016]

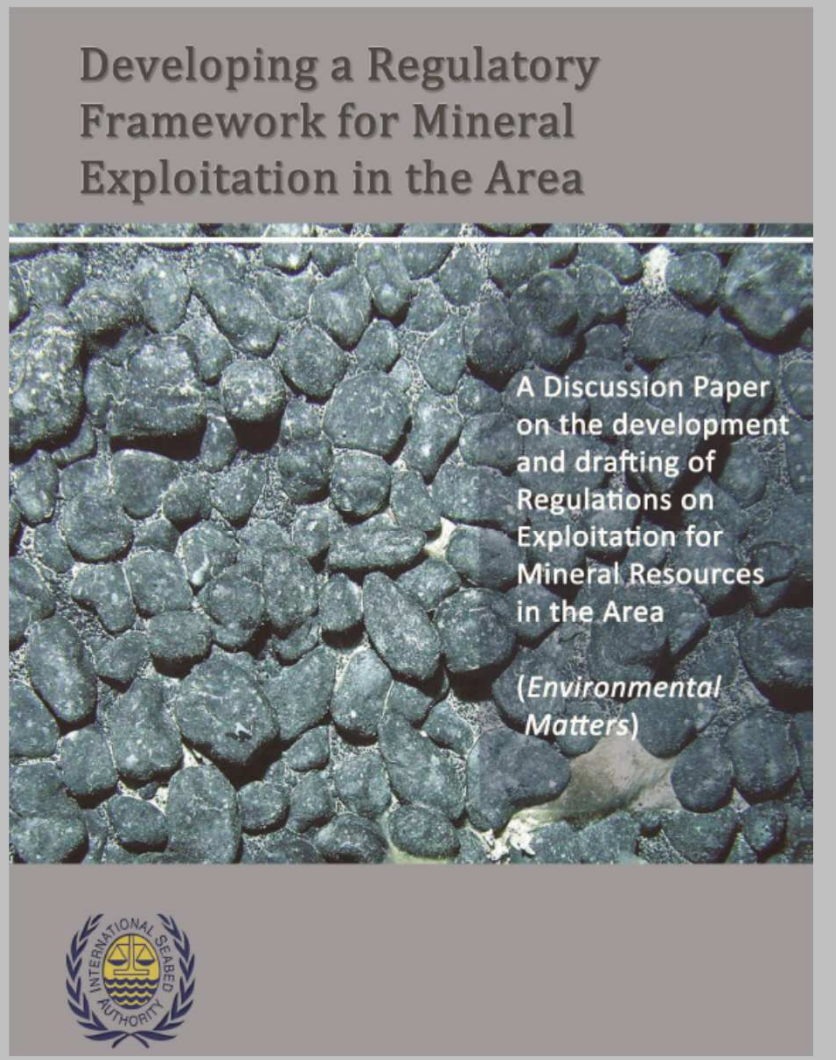
**Little or primary information only – significant gaps in knowledge**

**Some useful data available. Still some fundamental gaps**

**Good knowledge with ability to make informed predictions**

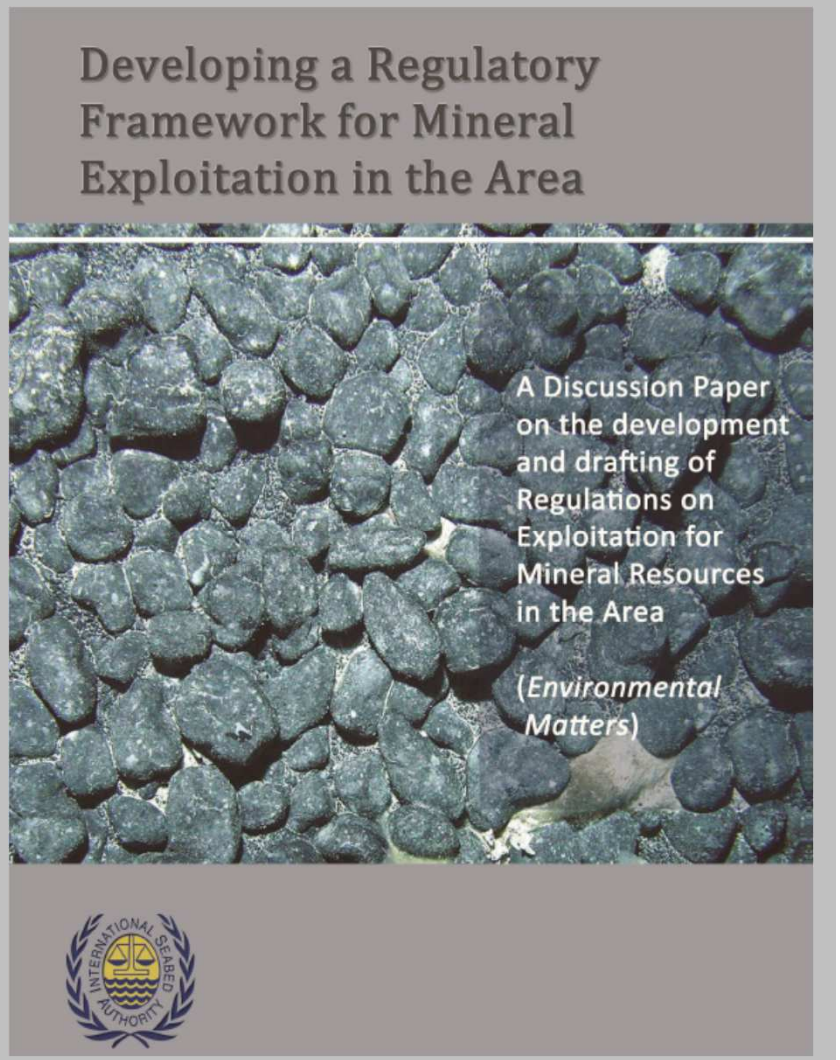
# The role of the EIA

- Limited knowledge means the EIA is critical in assessing state of knowledge, and the nature and scale of potential impacts **to support and ensure a precautionary approach**
  - Relative to management objectives (and not compromising legal reqts)



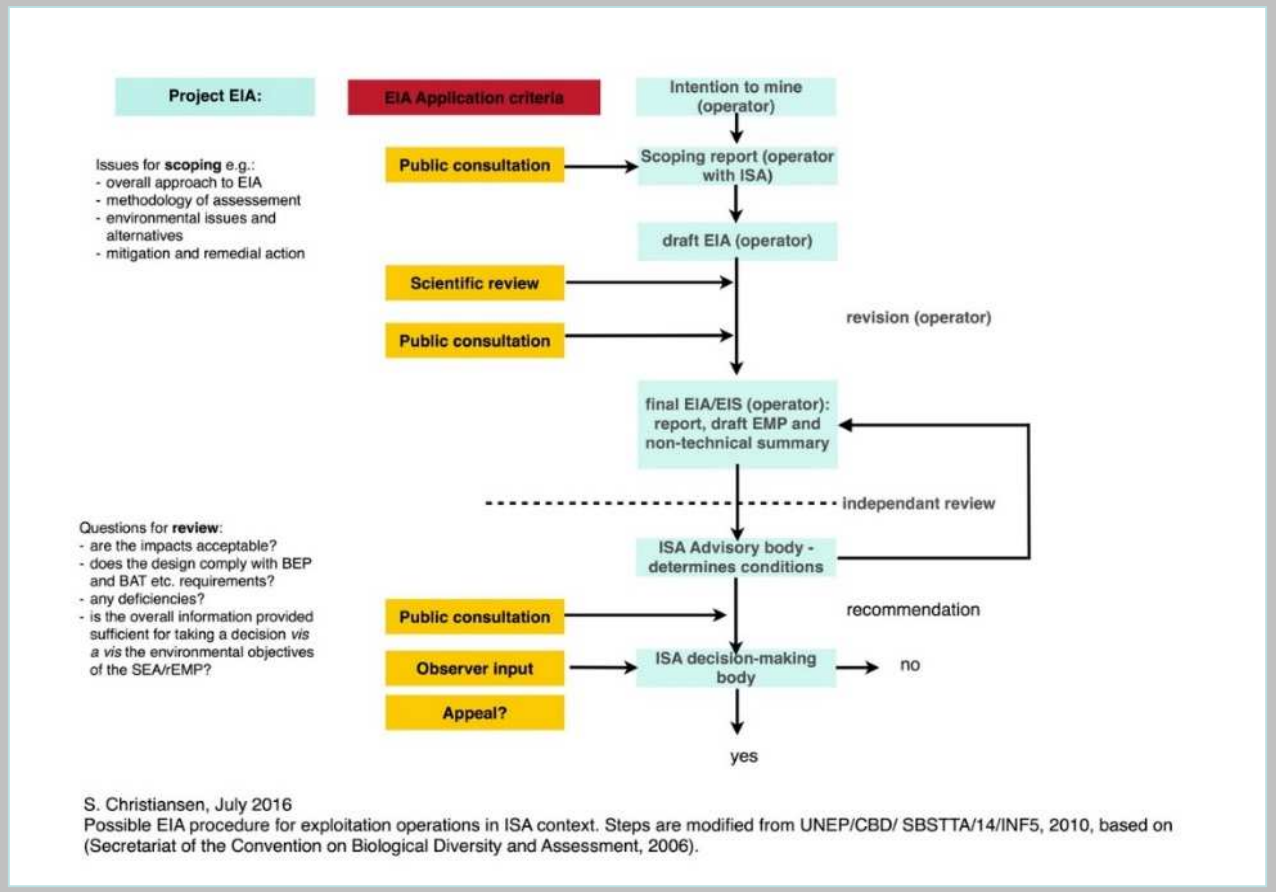
# The role of the EIA

- Limited knowledge means the EIA is critical in assessing state of knowledge, and the nature and scale of potential impacts **to support and ensure a precautionary approach**
  - Relative to management objectives (and not compromising legal reqts)
- The ISA Environmental Regulations (at this stage) need to
  - Keep things simple
  - Get the basic structure and processes right
  - The more prescriptive detail comes as industry and knowledge develop



# Issue 1: The Process

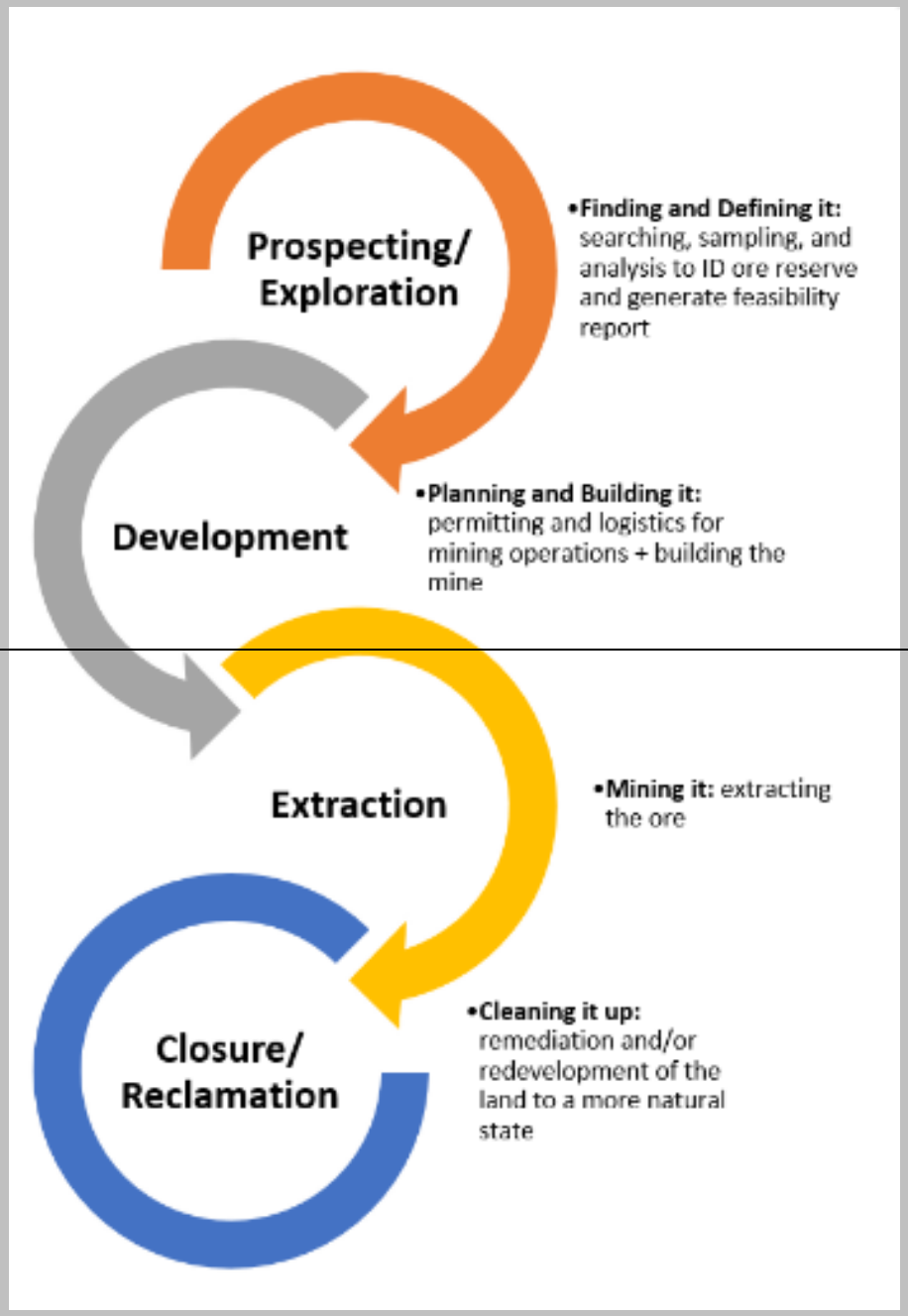
- The underlying approach is exactly the same as an EIA anywhere, no need to re-invent the wheel
- But numerous variations on the theme (refer Annex I of Gold Coast workshop with 5 process options)




S. Christiansen, July 2016
Possible EIA procedure for exploitation operations in ISA context. Steps are modified from UNEP/CBD/ SBSTTA/14/INF5, 2010, based on (Secretariat of the Convention on Biological Diversity and Assessment, 2006).

# Issue 1: The Process

- The underlying approach is exactly the same as an EIA anywhere, no need to re-invent the wheel
- But numerous variations on the theme (refer Annex I of Gold Coast workshop)
- Importantly, how do the various stages overlap with ISA Exploration and Exploitation Regulations?
- There is a continuum in the EIA process from exploration through to exploitation- they are not discrete
- Screening, scoping stages are Exploration
  - Test mining EIA
- Subsequent main EIA stages are Exploitation
  - EIA for mining licence




## Exploration regulations

Initial scoping EIA report

Test mining EIA

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## Exploitation regulations

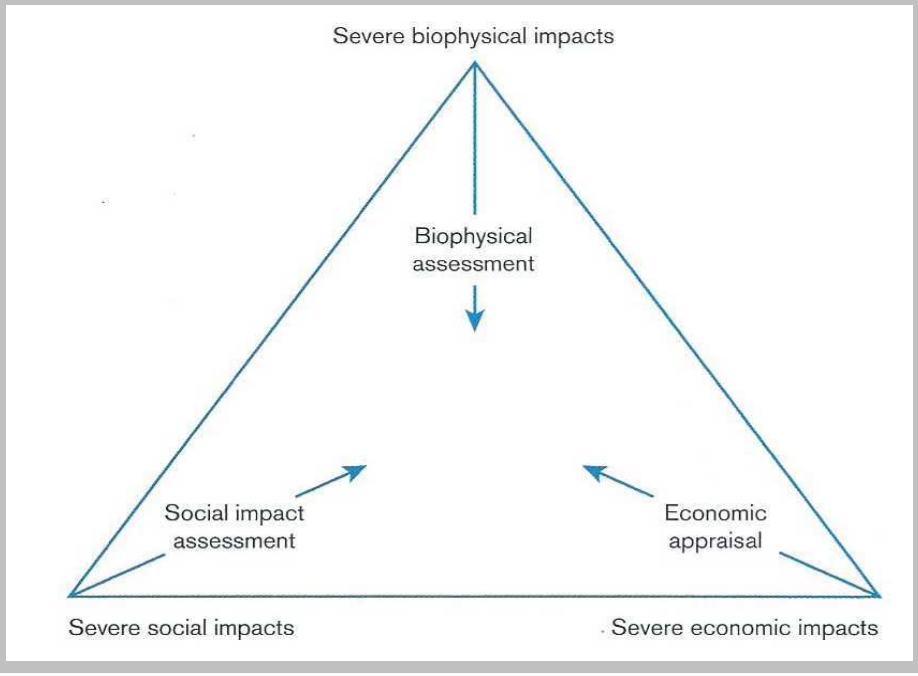
Application EIA for mining

# Issue 2: Scope

- Tendency in recent years for EIAs to expand, and become more generic “whole system” IAs
- Not just simple biophysical assessments, but socio-economic considerations as well
  - Links back to IAIA definitions
- Role of EIA to identify environmental limits and constraints **on the project**, not just its impacts on the environment
- Balance to avoid compromising EIA focus, and the quality of each component
  - Should the Env Regs specify a single combined EIA
  - Separate environmental, socio-economic, cultural etc
  - Current thinking is combine, but have other schedules if needed

# Issue 2: Scope (cont)

- Should the EIA consider the operation outside the Area?
  - "cradle-to-grave" EIA rather than just operations in the Area
  - Clear direction in the past not to…ISA responsibility is the Area
- Does it consider economic issues, given the mandate to manage for the CHM?
  - Where does economic gain fit into the evaluation of whether a certain level of environmental impact is warranted?




Integrated impact assessment, Glasson et al. 2012

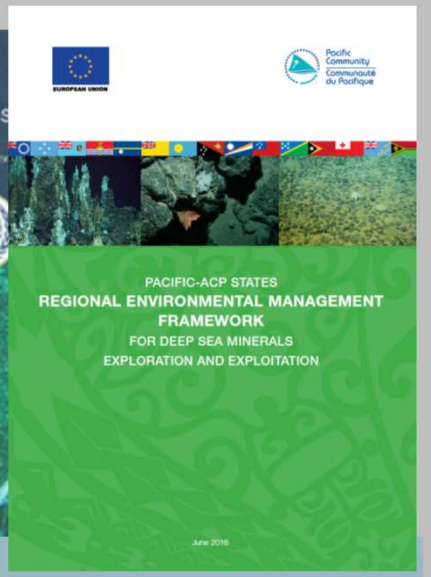
# Issue 3: Structure of EIA-EIS

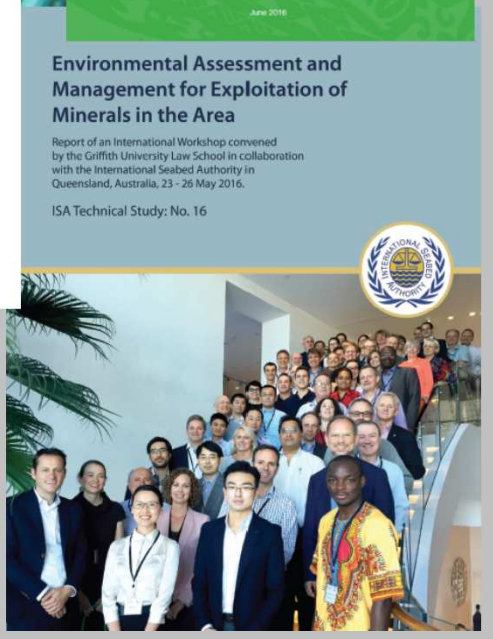
- Terminology
  - EIA the process
  - EIS is basically the report that wraps it all together
    - Includes mitigation, management implications
- Many ways to structure and format an EIA
- Tend to converge within sectors
  - once a successful formula is found
  - oil and gas is a good example
- Advantages in consistency
  - Operators know the format they need to follow, and the general information requirements
  - Managers know what to expect.
- Approach developed by the ISA

# Existing “ISA” EIS templates

## Evolving process

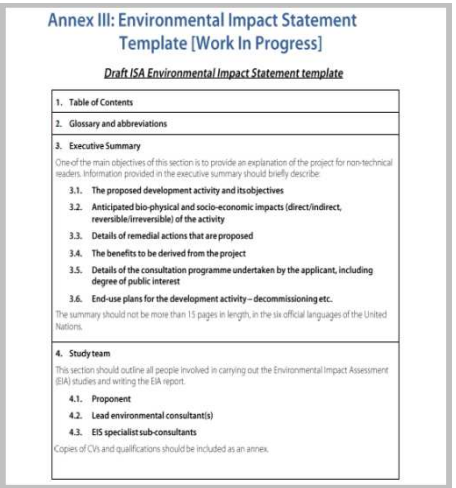
- Nautilus 2008
- ISA 2012
- NIWA 2014
- SPC 2016 (REMF)
- ISA 2017
- NIWA 2017


- Confirm template structure (ISA 2017)
  - https://www.isa.org.jm/sites/default/files/files/documents/ts16_finalweb_0.pdf
- Consider more detailed guidance (NIWA 2017)
  - https://www.niwa.co.nz/coasts-and-oceans/research-projects/enabling-management-of-offshore-mining

# Template structure



Annex III: Environmental Impact Statement Template [Work In Progress]

*Draft ISA Environmental Impact Statement template*

1. Table of Contents
2. Glossary and abbreviations
3. Executive Summary

One of the main objectives of this section is to provide an explanation of the project for non-technical readers. Information provided in the executive summary should briefly describe:

- 3.1. The proposed development activity and itsobjectives
- 3.2. Anticipated bio-physical and socio-economic impacts (direct/indirect, reversible/irreversible) of the activity
- 3.3. Details of remedial actions that are proposed
- 3.4. The benefits to be derived from the project
- 3.5. Details of the consultation programme undertaken by the applicant, including degree of public interest
- 3.6. End-use plans for the development activity – decommissioning etc.

The summary should not be more than 15 pages in length, in the six official languages of the United Nations.

4. Study team

This section should outline all people involved in carrying out the Environmental Impact Assessment (EIA) studies and writing the EIA report.

- 4.1. Proponent
- 4.2. Lead environmental consultant(s)
- 4.3. EIS specialist sub-consultants

Copies of CVs and qualifications should be included as an annex.

- Focus on headings (for consistent format)
  - Fairly standard structure
  - Not prescriptive in content (allow contractor, mineral resource, site-specific flexibility)
- Key description of existing environment, assessment of impacts, mitigation measures, residual impacts
- Physico-chemical, biological, (onshore), socio-economic sections
- Supporting sections on policy-legal, project description, management outline, consultation process
- Structure assessment by depth (surface, midwater, bottom) as well as receptor (e.g., macrofauna, meiofauna, fish)

### 15.3 Impact categories

This sub-section is an overview and description of general impact categories caused by the mining operation. This is not expected to be detailed, but introduce the major types of effect, such as material removal, creation of sediment plumes, noise, light etc. A description should be included of any lessons learnt from activities during the exploratory phase of the programme (e.g. test mining trials). Include direct, indirect, and cumulative impacts. Include direct, indirect, and cumulative impacts.

### 15.4 Identification of threats

Using the same structure as Section 11.4, describe the effects on individuals, communities, populations, and meta-populations.

*The format of these subsequent subsections should be consistent between and within sections. Each subsection should include:*

A. *The nature and extent of any impact;*

B. *Measures that will be taken to avoid, mitigate or minimize such impact;and*

C. *What unavoidable impacts will remain (residual impacts).*

It is expected that some repetition will occur between sections, notably where an impact of the mining operation will affect several components of the environment at thesite.

#### 15.4.1 Pelagic

#### 15.4.2 Midwater

#### 15.4.3 Benthic

#### 15.4.4 Biosecurity

Consider need for equipment cleaning between locations. e.g. ballast water issues and ship movement into the area and out for servicing / processing

#### 15.4.5 Cumulative impacts

The nature and extent of any interactions between various impacts, where they may have cumulative effects must be considered.

##### 15.4.5.1 Proposed operations impacts

Cumulative within the scope of the mining proposed herein.

##### 15.4.5.2 Regional operation impacts

Cumulative between activities where known in the region

#### 15.4.6 Other issues

Outline where there are other more general issues, i.e. aspects of existing conservation areas and management plans etc.

#### 15.4.7 Summary of residual effects

## 16. Assessment of impacts on the onshore environment and proposed mitigation

### 16.1 Key messages

[ISA 2017]

- *Benthic invertebrate and fish communities, including infauna to an appropriate depth of sediment, and demersal fish up to a distance of 50 m from the seafloor.*

*5.4 Summary of existing biological environment*

- *Bring together key findings such as any sensitive environments or highly valued areas.*
- *This will be up to a page, and more extensive than the Key messages in section 5.1.*

The depth ranges given above apply to deep-sea resources. In shallow areas (e.g., ironsand deposits) the depth ranges to describe the surface-seabed characteristics would be different.

This section gives a detailed account of the state of information on biological communities. It starts with a general regional overview, which covers broad-scale characteristics such as biogeographic provinces, particular topographic features that may have a certain type of fauna (e.g., hydrothermal vent sites, seamounts, canyons), as well as any existing areas or species subject to management. Template section 5.2 is relatively high level, but sets the scene for a more in-depth description in section 5.3.

There are several recent biogeographical accounts that applicants may find useful, including global pelagic (Spalding et al. 2012) and benthic (Watling et al. 2013) classifications. There are also a number of more regional or New Zealand accounts, including Rowden et al. (2005) for seamounts, Francis et al. (2002) for demersal fishes, and two recent generic environmental classifications of the EEZ, the Marine Environment Classification (MEC) (Snelder et al. 2006), and a Benthic Optimised MEC (Leathwick et al. 2012).

A comprehensive species list should be provided for the area. This can be compiled from a number of sources, including:

- a literature review to uncover all published records. A good place to start is the summary by Gordon et al. (2010) and the 3 volume series on New Zealand's biodiversity (Gordon, 2009, 2010, 2012).
- museum, university or research institute collection specimen records (e.g., National Fish Collection at Te Papa, NIWA Invertebrate Collection,)
- research databases available from national institutes (e.g., NIWA, Te Papa, Auckland Museum) or government agencies. The New Zealand National Aquatic Biodiversity Information System (NABIS - www.nabis.govt.nz) provides information on the distribution of marine species (in particular fishes) in the New Zealand region
- global biodiversity databases, available online (e.g. www.iobis.org, www.fishbase.org for invertebrates and fishes respectively).

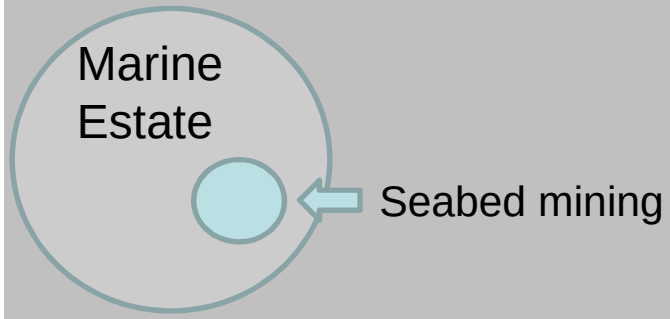
There should also be notes provided on particular characteristics of the species, especially if they may be endemic (restricted in their distribution to just the site, resource substrate, or localised region) or known to be rare, threatened or endangered. The IUCN redlist of endangered species (www.iucnredlist.org) with additional data provided by national lists (Freeman et al., 2010 for New Zealand species) can then be linked with species lists from the area to know if they are present.

[NIWA (Clark et al.) 2017]

# Issue 4: Content

- Balance between detailed description of everything known about an area, and evaluation of major impacts
  - some guidance on headings content in NIWA (2017) report
- Need to focus on aspects of high risk (still include lower risk activities and impacts, but reduce volume)
- Importance of **risk assessment** at two key times:
  - At project start, so exploration gathers the important data to inform the EIA (qualitative, “level 1”)
  - At EIA stage where mitigation measures are proposed, and so the EMP can be informed (semi-quantitative, “level 2”)
  - Plus a smaller ERA for mine closure
- Recognised as an important component of the EIA process in the Discussion paper
  - Warrants more consideration of approach and methodology

# Links between ERA and EIA




Integration across the multiple environmental components of DSM mining

**New Zealand EEZ Act Impact Assessment**

**ERA** (Ecological Risk Assessment) ⇔ **EIA** (Environmental Impact Assessment/Statement) ⇔ **EMP** (Environmental Management Plan)

- Risk scoping (level I)
- Advanced ERA (level II)
- **Identify threats**
- **Ask the right questions**!

- **Focus on main risks**
- Ecosystem approach
- Cumulative impacts
- Other activities
- Spatial scale variability
- Traditional knowledge

- **Monitoring programmes**
- **Adaptive management** options
- Appropriate spatial and temporal scale

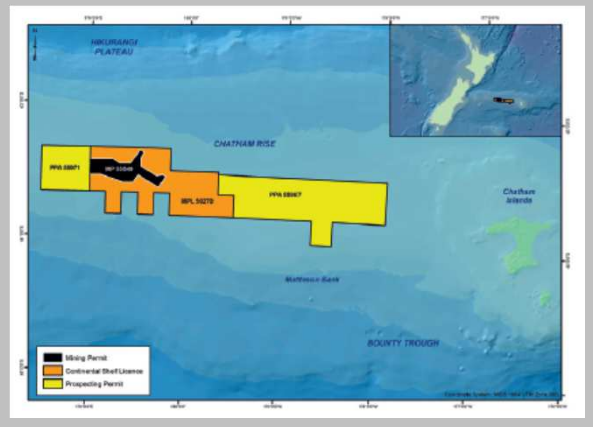
# Issue 5: Underlying data

- Deep-sea environments can (will) be data-poor
- Adequate data are at the core of a robust EIA
- Issues of quantity or quality
  - lack of standardisation of data or sampling procedures
  - poor integration of all available data
  - no assessment of what is an adequate baseline dataset
  - inadequate baseline survey design (often not enough thought given to natural variability)
  - insufficient regional setting for studies done at a smaller-scale site of interest
  - insufficient assessment of potential cumulative impacts
  - limited expression or acknowledgement of uncertainty
- But what are the key data issues to address?

# Lessons from New Zealand

- Phosphorite mining licence application in 2014, after 4 years of exploration work
- Together with ar st applications under new EEZ enviro





# EIA problems identified

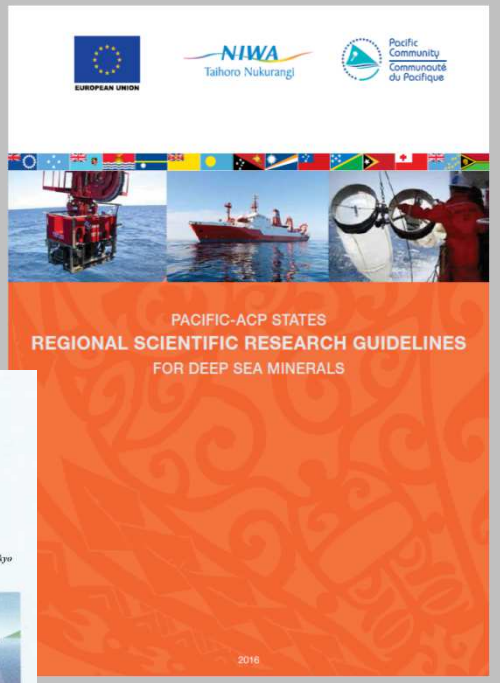
- A complex of environmental, social, economic and cultural issues involved in decisions
- Process
  - Focus on descriptive EIA (the issue of lots of description, too little interpretation of impacts)
  - Lack of SEA meant the mining application was treated in isolation from other uses (especially fisheries), and led to considerable tension between sectors
    - Discussion paper refers often to ISA SEA and SEMP….
  - Concern over national economic benefits
  - Consultation issues, especially with indigenous iwi
    - Highlights the public consultation feedback loops in the process to be followed

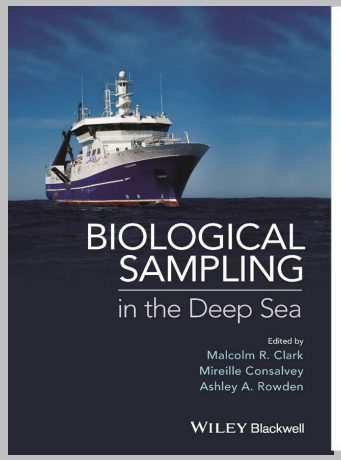
# EIA problems identified

- Key environmental scientific issues arose
  - Inadequate baseline data, partial community descriptions
    - e.g. meiofauna not sampled; hyperbenthos ignored
  - Limited characterisation of ecosystem structure and function
    - no examination of relationship of nodules with biodiversity; importance of habitat-providing species (e.g., corals) poor
  - Inadequate assessment of impacts
    - especially **indirect effects** such as footprint and intensity of sediment plumes-modelling but no ground-truthing
    - Impacts on a **protected coral** community not quantified
  - Inadequate description and treatment of scientific uncertainty (how uncertain, what to do about it)
  - Treatment of residual impacts not well addressed in monitoring plans and adaptive management regime (IA context)

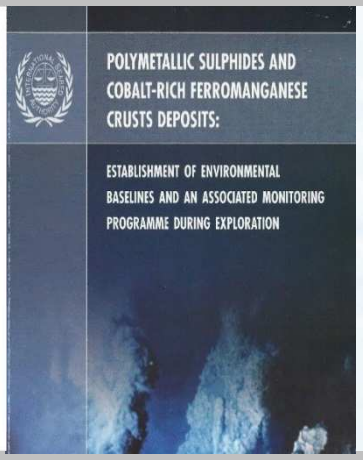
# Baseline/monitoring data

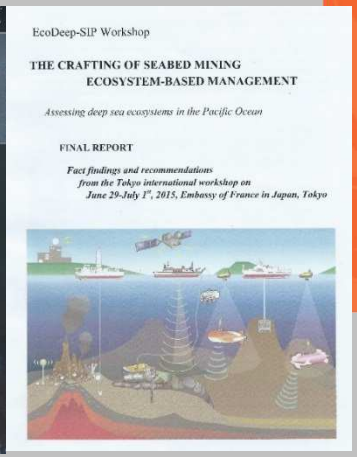
- These data are critical to the EIA and EMP
- Why, what and how of environmental measurements
- The **why** and the **how** are not major problems (AnnexII)
- Developing guidance
  - ISA LTC recommendations (ISBA/19/LTC/8)
  - SPC-NIWA RSRG (Swaddling et al. 2016)
  - MIDAS (2015, WP10, 10.1)
  - Also ISA sampling, taxonomic workshops
  - JAMSTEC SIP protocol series (2017)







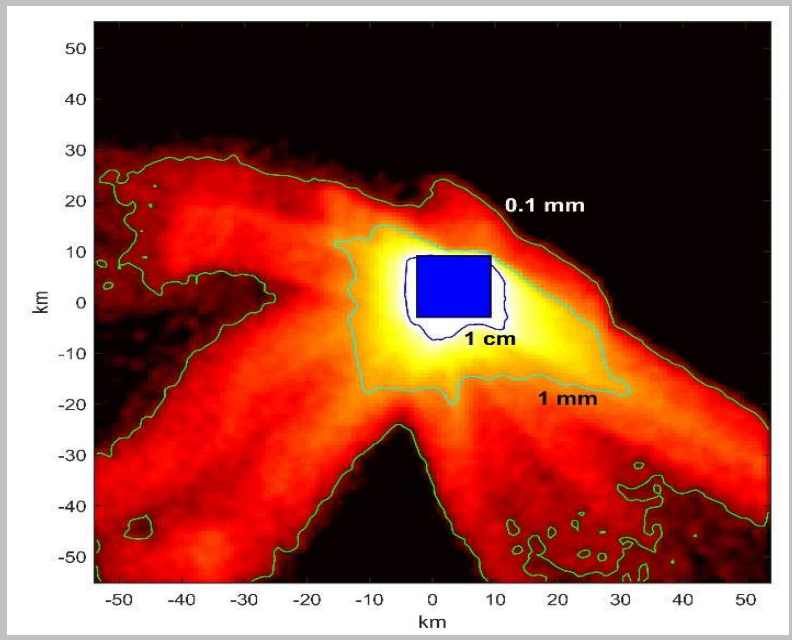



# Baseline/monitoring

- These data are critical to the EIA and EMP
- Why, what and how of environmental measurements
- The **why** and the **how** are not major problems
- Developing guidance
  - Etc
- But the what is problematic
  - What are the key indicators of system health?
  - Check we can measure with enough precision to detect change
  - What is an acceptable level of change (thresholds)?
- Links to standards, and definitions of when are data (e.g., a baseline survey) good enough?
  - Is this external to the EIA, or embedded into it?
  - Critical to evaluating the consequences of the EIA

# Understanding indirect impacts

- Key issues identified in NZ
  - Lack of validation of sediment plume modelling
  - No data on biological impacts from sedimentation
  - Limited ecotoxicology work carried out, deep-sea tests
- Some progress since then (e.g., MIDAS, EMOM, END) but still limited
- Test Mining under ISA Exploration regulations important to inform EIA



# Uncertainty

- Expression of how well we know what we know, and especially what we don't know
- NZ applications struck problems with:
  - Describing longer-term natural variability (how representative were the surveys the companies carried out, given environmental changes (El Nino, La Nina etc)
  - How good were the biological parameters based on modelling, such as the sediment plume models (no ground-truthing or laboratory experiments), and benthic community species distribution models (based on p/a, not biomass)
- Sources of uncertainty need description
  - Statistical confidence OK
  - Qualitative confidence measures?

# Uncertainty sources (2)

- **Knowledge uncertainty** arises where there is incomplete understanding of processes, interactions or system behaviours (e.g., natural variability) –survey/data/analysis
- **Unpredictabilit**y arises from chaotic (often random) components of complex systems or of human behaviour
- **Structural uncertainty** arises from inadequate models, ambiguous system boundaries, or over simplification or omission of processes from models –validation
- **Value uncertainty** arises from missing or inaccurate data, inappropriate spatial or temporal resolution, or poorly known model parameters -survey/sampling programme
- **Uncertain interpretations**, arise when values or terms are interpreted differently by different user groups –more discussion/communication

[Clark et al. 2017]

# Developing EIA criteria

- Discussion paper Section 19 is a start
- Process quality
  - Not really a problem
  - Principles and criteria as per background paper (rigorous, practical, focussed, integrated etc)
  - Checklist of acceptability
- Scientific quality
  - OK for what is done, how complete, adequacy of methods, precision of data, high risk focus etc
  - More difficult to assess is the issue of assessing the consequences of a certain level of impact
  - Change thresholds very difficult (DOSI 2013)
- Links with the EMP
  - Importance of spatial management, adaptive management options, in dealing with risk/lack of information.

# Conclusions

- EIA needs to consider multiple spatial scales [SEA/REA/EIA]
- Complex array of impacts, direct and indirect, and cumulative
- Ecosystem approach integrates benthic and midwater components across physical, oceanographic and biological elements.
- Nothing new, but deep-sea assessments may be data-limited
- Baseline studies
  - What are the really critical ecosystem components to describe?
  - Spatial scale issues (regional to site, within site, variability)
- Some impacts are not well described: plume dynamics and biological effects; ecotoxicity and potential bioaccumulation
- Assessing ecological risk is a key element of the process
- Precaution will require managing high uncertainty in the EIA
- Acceptability will depend on environmental management options

# EIA beyond Berlin workshop


- Ongoing LTC review of Environmental Regulations
  - Development of document through 2017-18
- Need for further specific workshops
- Not just ISA, link with international bodies, regional programmes, national initiatives
  - LTC proposal for IRZ/PRZ design and implementation workshop
  - Environmental indicators and standardisation (Nekton, Oxford)
  - DSM impacts (MIDAS results, JPI-O, NZ sedimentation project)
  - Cumulative impacts (NIWA, August 2016)
  - Ecosystem function approaches (“EcoDeep”)
  - Spatial management planning (SEMPIA, LTC review of APEIs?)
  - Links with DOSI and IUCN DSM working groups
- Next few days can help set the scene

# Vielen dank..haben sie noch fragen?

Stone crab (Lithodes longispinosus) on Rumble II West seamount (SMS)