



EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR MARITIME AFFAIRS AND FISHERIES
ATLANTIC, OUTERMOST REGIONS AND ARCTIC
MARITIME POLICY ATLANTIC, OUTERMOST REGIONS AND ARCTIC

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STUDY TO INVESTIGATE STATE OF KNOWLEDGE ON DEEP-SEA MINING

Subject **interim report(Ares(2014)1201428**

Thank you for the interim report and your presentation of it yesterday. A list of our comments is provided below. Could you please provide a revised report by 28 April 2014 together with a list of how our comments have been dealt with?

Iain Shepherd

1. INTRODUCTION AND GENERAL COMMENTS

In technology sector we would like to know EU market share for each piece of equipment together with a summary table

This is difficult to estimate since many stages/technologies are only in the exploratory stage. During the workshop as well as subsequent interviews additional information on this will be gathered and, where possible, estimates made. These will be presented in the final report.

Wherever possible each section should aim to produce summary tables with indicators to compare technologies, countries, different zones, different seas

As above. In addition the projects analysis (task 5) aims to deliver information on technologies applied in specific projects. This will also be included in the final report.

The technology readiness level looks to be a useful indicator. Could we have a table of all these indicators – possibly at the start of the technology sector?

Yes, we've made such a table. Inserted in the updated interim report. We note that the TRL levels will also be part of the discussion in the technology workshop 29 April and their scores may be adjusted afterwards.

Legal analysis should look at anti-corruption and transparency initiatives that are used for land-based mining – both international and EU.

Yes we will look at that anti corruption issues in the draft final report as well

There should also be an analysis of royalties and benefit sharing.

Royalties and benefit sharing is not really a legal issue but more a matter of economics. There is nothing on benefit sharing in legal rules in the area yet. Again though we can look at what there is in the draft final report.

The input on commitments for pilot projects under the European Innovation Partnership should be included in the "projects" section.

Agree, we'll include this as part of the reporting on task 5 projects analysis.

The environmental part has some repetitions and we need to know what we can say about criteria for good environmental status as used in Marine Strategy Framework Directive. Which criteria will it affect most?

We will revise the overall structure for the draft final report and we expect to bring in elements from Task 4 Geological Analysis diversifying the information of the chapters. We have added some amendments and clarifications relating to the MSFD criteria, however we expect to further elaborate on this taking into consideration the follow-up comments we have received from DG Environment.

Tidy up formatting. Either indent paragraphs or use a style that automatically leaves a space between paragraphs. You shouldn't have to insert blank spaces after paragraphs manually. It is inelegant.

Number all the figures

Don't use boxes unless it is to illustrate an example

A tidying up of the formatting, check on figures numbering and other layout checks will be done as part of the final report editing process.

1.1. Background and objective

First paragraph. We are not sure what the follow-up will be. Possibly not a Communication and impact assessment. It would be better to indicate that the Commission is preparing a position.

Text updated

The future production figures are too uncertain to quote here. Just indicate that technology allows us to exploit previously unreachable deposits

Added/revised.

1.1.1. Study purpose

Again we are not sure that an impact assessment will follow

Added/revised.

1.1.2. This study versus other (research) projects

It won't be obvious to a reader what FP7 is

Clarified

2. APPROACH

2.1. Aim and main elements within this task

2.2. Value chain concept

Again not obvious what FP means

Clarified

2.2.1. Exploration

A variety of techniques ARE used

Corrected

2.3. Technology assessment approach

3. EXPLORATION TECHNIQUES

3.1. Introduction into exploration

to exploration not *into*

Corrected

spell out *SMS*

Done

3.2. Technology assessment: Locating

Remove apostrophe from *area's*

Corrected

In this section you explain what the instruments measure but not how it relates to deposits. How do these deposits show up on the instruments?

3.2.1. Research vessels

Is the Dorado privately owned? Are any European research vessels being chartered by private companies

Info added on European research fleet.

3.2.2. Echo sounding (sonar) bathymetry

Sentence beginning "*The single beam echo*" should not have a bullet

Corrected

Echosunders can also measure surface roughness. Is this useful?

Yes, for locating, but also for analysis of sea bed roughness to assess excavation technology requirements. Further importance of this will be discussed in the workshop.

We need some pictures of the three types of deposits produced by these instruments.

Role/relevance of each technology vis-à-vis the deposit types varies and will be discussed in the workshop + eventual subsequent interviews.

3.2.2.1. Stage of development

Focussed should only have one s

Corrected

3.2.2.2. Company – overview

Is this an exhaustive list of companies? Can you say anything about market share? Manufactured in countries mentioned or only company headquarters?

See our comment above. It is noted that for some technologies, only a few suppliers are known, esp. those in early development stages. For other, more mature technologies longer lists are known.

3.2.2.3. Technology readiness level

This sounds quite a useful measure

Table overview included, see above. Approach will also be presented and discussed in the workshop.

3.2.3. Electromagnetics

Towed by what? What depths can they go down to?

By a ship, text added. Depth limitations currently some 4500m as experienced in the search for the MH370 aircraft.

Spell out acronyms such as AUVs

In the final report, a list of abbreviations will be included.

How does resistivity convert into deposits? What does it tell us about deep-sea mining?

Figure “Source: Goto et al. (2012) Electromagnetic survey around the seafloor massive “ is “float over text” make it “in-line”

Formatting checks will be done as part of final report editing.

Remove carriage returns from paragraphs beginning “*In a similar way*”

idem

3.2.3.1. Companies overview

We need some information here. Are there EU manufacturers? Share of market?

Information currently available added. If more is gathered in the subsequent phase this will be added as part of the final report. See also response to general comment above.

3.2.4. AUVs

3.2.4.1. Companies overview

We need more information. Market share. Are they used operationally or just for research. There are far more manufacturers than this

Inputs from the workshop requested here; subsequent interviews as necessary. Results will be presented as part of the final report.

3.2.5. ROVs

Missing text

Inputs from the workshop requested here; subsequent interviews as necessary. Results will be presented as part of the final report.

3.3. Technology assessment: Sampling

3.3.1. Freefall devices

Missing text

Importance of the technologies yet to be assessed. Inputs from the workshop requested here; subsequent interviews as necessary. Results will be presented as part of the final report. Also the project analysis (task 5) may provide additional information on this.

3.3.2. Grab samplers

Missing text

Importance of the technologies yet to be assessed. Inputs from the workshop requested here; subsequent interviews as necessary. Results will be presented as part of the final report. Also the project analysis (task 5) may provide additional information on this.

3.3.3. Cable operated grabs and cameras

Missing text

Importance of the technologies yet to be assessed. Inputs from the workshop requested here; subsequent interviews as necessary. Results will be presented as part of the final report. Also the project analysis (task 5) may provide additional information on this.

3.4. Technology assessment: Drilling

Missing text

Importance of the technologies yet to be assessed. Inputs from the workshop requested here; subsequent interviews as necessary. Results will be presented as part of the final report. Also the project analysis (task 5) may provide additional information on this.

4. RESOURCE ASSESSMENT, RESERVE EVALUATION AND MINE PLANNING

We need some examples. For instance why did Nautilus choose its area. We need figures and tables.

Project areas are based on:

- Assessment of geological prospectivity. Metalliferous occurrences (not ore) occur in geologically predictable settings and areas. These areas are huge. The discovery of localised economically viable occurrences (ore) is challenging. Once likely areas have been identified it is then necessary to quantify the precise nature and amount of material present.
- Previously known occurrences of metalliferous material.
 - Nautilus did not “discover” Solwara 1. Black smokers were first discovered by a US scientific research vessel in 1985.
 - Subsequently studies of metalliferous sulphides in that general area have been conducted by researchers from France, US, England, Germany, Australia and Japan.
 - Solwara 1 was found in 1996 by the Australian CSIRO research organisation. They collected several tonnes of sulphide samples from Solwara 1 & 4.
 - Other scientific investigations studied the scientific aspects of sulphides and black smokers.
 - This data gave Nautilus and some initial investors sufficient confidence to commence economic exploration in the area. This economic exploration defined an inferred resource of 1 million tonnes of ore.

Section will be expanded as more specific project information becomes available (task 5) as part of the final report.

4.1. Introduction into demonstration and extraction

You infer that this is a standard procedure and yet later on you say that this is at proof of concept phase

This is standard for all conventional/terrestrial mining business cases. However the only deep sea project to have attempted this is Nautilus and only achieved inferred resources (low level of confidence)

4.2. Procedural Assessment: Resource Modelling

More explanations needed plus examples of how these techniques are used

Depending on information we can access from project specific information (task 5) this section will be updated as part of the final report. Note however that often project applications are considered commercially confidential.

4.3. Procedural assessment: Reserve Estimation and Mine Planning

How long does this phase last? How much does it cost?

This is project dependent. Depends upon the complexity of the project: geometry, spatial distribution & continuity of the deposit, variation in metal content, grades, differences in processing recoveries

Requires comprehensive resource – reserve assessment. Requires formulation of a sequential mine plan, mine layout. Needs to incorporate anticipated metal recoveries versus CAPEX & OPEX. Needs to incorporate marketing, legal, social and governmental factors.

4.4. Resource/Reserve Reporting Codes

Missing text

Insufficient knowledge at present. Are the standard reporting codes sufficient (ie JORC) ? Do the existing codes require definition of special sections purely for Deep sea deposits (this is the case for eg diamonds, coal) but it is unknown if this will be required for Deep Sea Deposits. The topic will be addressed during the workshop.

5. EXTRACTION, LIFTING AND SURFACE OPERATIONS

WE need to know EU market share in each of these technologies

See general comment above. Notion that there has not been any large scale extraction till date so there is not market yet to share.

A summary table with EU market share, approximate price, technological readiness plus comment (eg adapted from coal industry) would be useful

There are no production systems: only models or “concepts”. There is no market share. Aker Wirth plan to implement a system in 2020 for Mn nodule extraction. Nautilus has commissioned 1 cutter. We don’t think there is public information available on state of the art in China etc.

6. OFFSHORE AND ONSHORE LOGISTICS

6.1. Introduction into transportation, handling and storage

6.2. Technology assessment Transhipment from platform to ore carrier

We need more information about the type of vessel that might be needed for this operation. Has it really never been done?

The number of projects is limited and the number of projects where actually extraction/commercial operation is conducted is limited to only 2, with different specifics. Data is being gathered as part of the project analysis (task 2) and will be included as part of the final report.

7. PROCESSING TECHNIQUES

7.1. Introduction into Processing

7.1.1. Metals extractable

Indicate concentrations of metals in the various types of deposit. Cross-reference another part of the report if necessary

Depends on the deposit. Known averages: Cobalt rich crusts may contain up to 1.7% cobalt. Polymetallic Nodules may contain per nodule manganese (27-30%), nickel (1.25-1.5 %), copper (1-1.4 %) and cobalt (0.2-0.25 %). REY-rich mud has high REY contents, 1,000 - 2,230 ppm total REY (Σ REY) and 200 -430 ppm total HREE (Σ HREE).

More details of why processing cannot be on ship. How big would the platform need to be? Bigger than a typical oil platform

No, something like an oil platform. You would like to have a central processing place, with ships doing the transportation of material to that central place, and going back empty again to load fresh ore. On a platform one can also do a limited amount of stockpiling for continuous operation of processing equipment. Batch operation of such equipment is not practical.

7.1.2. Mineral processing

7.1.3. Ship and platform

7.1.4. Dry versus Wet Processing

Under what circumstances will wetness or conductivity play a role?

Wetness plays a role in grinding and separation. Grinding can be done dry, or wet, but as the deep sea material is wet anyway, why dry it? The seawater however, is salty, therefore it is conductive (and corrosive).

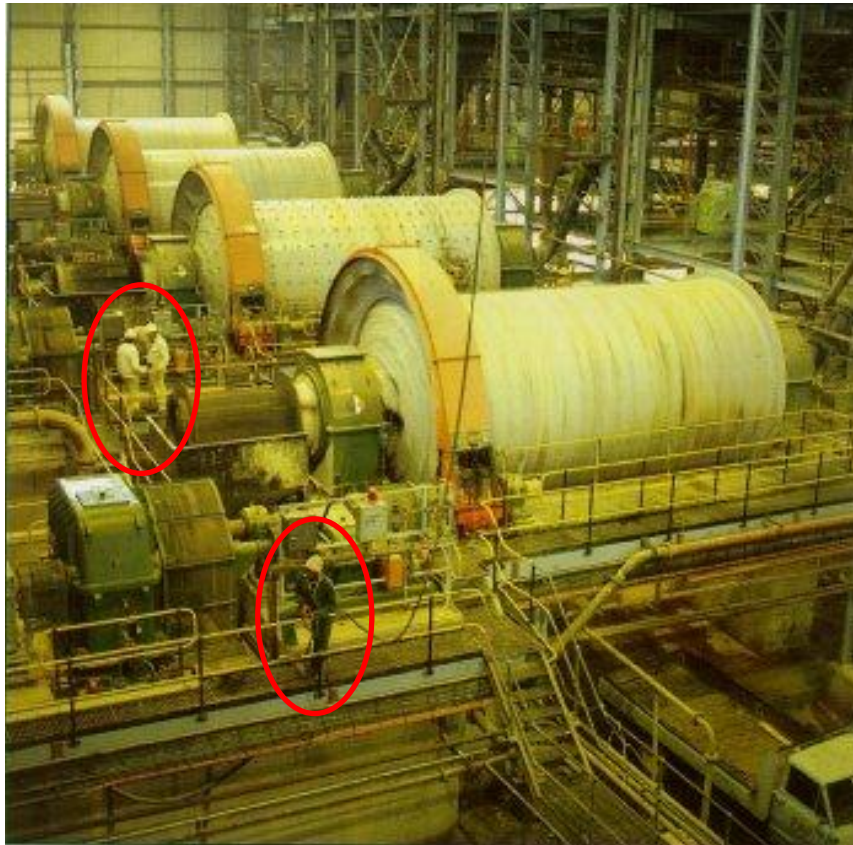
There is a lot of discussion about the problems of wet processing. Is drying impractical

Yes, we think so. Drying involves a lot of energy, which must be produced. Where to do that? What is gained, as the processing can just as well be done wet?

7.2. Technology assessment: Comminution

“as the industrial scale equipment used for these is quite large, and rather heavy”. You need to be precise. How big?

Think of equipment of, say, 10 - 15 meters long, about 3 - 5 meters high. See picture of a typical milling plant below. Note the persons in the red ovals as a measure for scale.



7.3. Technology Assessment: Classification

Are these processes (comminution and classification) needed for all deposits. Whatever the source.

Yes, this is always necessary. No ore consists of one hundred percent valuable material. In order to process the valuable material, it must be liberated from the unwanted material by separation. To achieve liberation (making the mineral grains “free” from each other), comminution (breaking, grinding) is necessary. The amount of comminution needed will differ per ore.

7.4. Technology assessment: Mineral Separation

What sort of mass reduction can we expect from separation for the different deposits and different metals. Surely this is a factor as to whether it is best to do it at sea or on land.

This depends on the ore. No definite answer can be given. It can be 95%, or 50%, or 10%. . . Until you have the ore itself, it will be a guess.

7.5. Technology assessment: Tailings Handling

What are flotation tailings?

These are the unwanted minerals from the flotation separation. They are also contaminated by the chemicals in the flotation solution.

Tailings is in mineral processing the general term for the not-concentrated material from a separation process. Usually this is the unwanted waste material, unless more than one mineral must be separated. Flotation can only separate one mineral at a time.

8. INTERNATIONAL LAW

You could mention the most significant States that have not signed up to UNCLOS and the impact that has. Are all EU states signed up?

The text has been amended to add a number of other 'significant' States that have yet to sign UNCLOS. All EU MS are party to UNCLOS (this is mentioned in section XX).

8.1. UNCLOS

Explain what US finds objectionable.

The draft final report will contain more information on this. However the provisions on DSM, as mentioned in section of the draft interim report, are one of the key issues that the US finds objectionable.

Could you explain a bit more what extra rights has if it declares an EEZ over a continental shelf. Deep sea mining is probably a case where it makes a difference. Oil exploration must be on continental shelf but deep-sea mining probably isn't.

If a coastal State claims an EEZ it obtains sovereign rights over certain resources/the right to regulate certain activities in the water column and on the surface. As DSM takes place on the sea bed it is hard to see what additional rights in A coastal State gains nothing in terms of DSM by claiming an EEZ over its continental shelf (or to be more specific the area of seabed extending up to 200 nm from the baseline)

"In practice most States seek to claim all of the maritime zones that they can". I thought that this is not the case for the Mediterranean

This was long the case but now really only Greece and Turkey are the holdouts – Turkey because it does not want to claim an EEZ in the Med (although it has claimed one in the Black Sea) and Greece because... well if it tried to do so then it would be war! See http://ec.europa.eu/maritimeaffairs/documentation/studies/study-maritime-zones-in-mediterranean-sea_en.htm

In other words the Area and "high seas" are not synonymous. Maybe make this point clear

Yes. OK text amended accordingly.

In contrast, UNCLOS supplemented by the Part XI Agreement sets out a relatively detailed legal framework for DSM In contrast to what? Presumably to DSM in the continental shelf.

Yes text amended accordingly

Protection of the marine environment. What happens if a coastal state does not respect the marine environment? Can they be taken to court?

In practice not really – this is one of the weaknesses of international law. This is an issue that we will consider in more detail in the draft final report when a clearer picture of national legislation emerges. There is a kind of contradiction here in that it seems likely that DSM will begin on the continental shelf whereas such international standards as exist apply to the Area.

Research. Presumably including extended continental shelf. What about research on the overlying water column?

A reference to the EEZ has been added.

8.2. Part XI Deep Sea Mining Agreement

The members of ISA are ipso facto the parties to UNCLOS and therefore include the EU and its Member States. You say that the EU is a party. This should have been mentioned in the part about UNCLOS

It is mentioned at the beginning of chapter 8.

Finally it is important to note that in accordance with article 139(1) a State must ensure that activities in the Area carried out by natural or legal persons that possess the nationality of that State or are effectively controlled by nationals of that State must be carried out in conformity with Part XI. Does this imply that applications to ISA must be sponsored by a State? ie. a company cannot submit one? What happens if the company is registered in the US or another non-signatory?

Basically yes – this is what is a bit unusual about Part XI as mentioned at the meeting. The draft final report will contain more discussion on this point but yes you could in theory try and get round ISA through a non-party. However the US does have legislation in place on this topic and this will be described in the draft final report.

8.3. Convention on Biological Diversity

However the CBD itself foresees. Is it clairvoyant or do you mean “envisages”?

Yes. The wording has been changed.

What are reporting obligations? Is there a web-site with all the information?

These are set out in article 26 which says:

Each Contracting Party shall, at intervals to be determined by the Conference of the Parties, present to the Conference of the Parties, reports on measures which it has taken for the implementation of the provisions of this Convention and their effectiveness in meeting the objectives of this Convention.

See: <http://www.cbd.int/reports/>

Is there a Secretariat? Which UN body monitors it?

It has its own secretariat but its linked to UNEP. See <http://www.cbd.int/secretariat/role.shtml>

What provisions are there for a State that does not provide inventories of national resources? What court can try cases? Has it ever happened?

There are none. Nor are there any real enforcement mechanisms to ensure compliance with such requirements.

On p. 94, at the beginning of the para. referring to Art. 3 CBD, the word "however" should be deleted as there is no opposition to what is said before. Same on p. 95, in the last sentence of the first para.: delete "However".

Text changed.

P. 95, 2nd para: "the CBD has stimulated the perception of ecosystems, habitats (and "areas") in the marine environment" – what is this supposed to mean?

Text modified.

Same para., 2nd sentence: delete "potentially" – this might be justified when talking about ABNJ but relevance for areas under national jurisdiction is straightforward and follows directly from the analysis before.

Text modified.

8.4. London Convention

Why have some nations not signed? Do they want to continue dumping?

No information available on this.

8.5. Agreements on navigation concluded under the auspices of IMO

What happens to a vessel that doesn't obey IMO rules? How is it found out? How is it punished? Give some examples

This will be addressed in the draft final report in the context of the notion of state sponsorship of DSM in the Area.

8.6. Regional agreements

What is the practical impact of these agreements? How might they restrict seabed mining?

This will be addressed in the draft final report but basically they may eventually restrict seabed mining if they stipulate particularly high levels of marine protection.

9. EU LAW

9.1. The EIA Directive

Spell out acronyms – at least in title. We are checking whether it is correct that no impact assessment is required. It would be extraordinary if true.

Our colleagues are of the view that the Directive does cover deep sea mining, in Annex II under "Extraction of minerals by marine or fluvial dredging". To my mind, this depends on what exactly is involved in the type of mining activity is being carried out. If it is taking minerals which are on the surface of the deep sea bed, then it could fall under "marine dredging". If it is more digging into the seabed to get at what is beneath, then perhaps not. We could do with some clarity on this. The EIA colleagues provide a useful CJEU reference here: "The wording of the **EIA Directive** indicates that it has a **wide scope** and a **broad purpose**". (C-72/95, Kraaijeveld and Others, paragraphs 31, 39; C-435/97, WWF and Others, paragraph 40; C-2/07, Abraham and Others – *Liège airport*, paragraph 32, C-275/09, Brussels Hoofdstedelijk Gewest and Others, paragraph 29)

Acronym changed. It is proposed that this issue will be discussed with DG ENV and in more detail in the draft final report. However the idea that DSM can be simply described as dredging seems arguable.

9.2. SEA Directive

You will need to go into this in a bit more detail. Give examples where EIA is not required but SIA is.

This issue will be considered in more detail in the draft final report. As will issues relating to the Azores.

Can you find any cases in the Azores (also for EIA)?

See above

9.3. The Marine Strategy Framework Directive (MSFD)

Commission has already reported on Member States' assessments COM/2014/097 final

The Marine Strategy Framework Directive has a number of criteria for good environmental status. Which of these might be applicable to deep sea mining? (Cross reference to discussion of environmental impact if necessary)

To follow in the draft final report. This also needs further discussion with the environmental team and DG ENV.

9.4. The Birds Directive and the Habitats Directive

It isn't very clear what the difference is between annex 1 sites and annex 2 sites in terms of their nature or the level of protection

The text is mostly about the legal aspects of applying the directives in marine waters but it is not very clear as it refers to some fishery-related Commission Communication and Council conclusions; however there has been more recent jurisprudence clarifying that BHD apply in all waters where MSs exercise covering rights – all that is clearly explained in our marine guidelines

http://ec.europa.eu/environment/nature/natura2000/marine/docs/marine_guidelines.pdf.

There are also several inaccuracies which create confusion, e.g. "the Habitats Directive regulates habitats beyond 12 nm offshore (listed in Annex 1 are "reefs" and "submerged sandbanks") and species occurring in the EEZ," (the dir covers several other marine habitats and species, also occurring inshore; also, in addition to reefs and sandbanks, structures made of leaking gases (bubbling reefs) also occur offshore); it further states that "the types of marine habitat listed are: 1. 1170 "reefs", and 2. 1180 "submarine structures made by leaking gases" while there are several other marine habitats listed; it fails to refer to seabirds requiring SPA designation; it fails to refer to the new CFP and its specific provisions for MPAs (Art. 11).

Importantly, it fails to refer to Art. 6 of Hab Dir which is relevant to the planning and authorisation of DSM activities affecting the sea bed in N2000. Please also note that our guidelines on extractive industries&N2000 include a section on marine aggregate extraction (unless that is irrelevant to DSM).

The relationship between DSM and these directives will be discussed further in the draft final report following a broader discussion with the environmental team as to the potential adverse impacts of DSM. There is no point describing for example all of the kinds of marine habitats if those are not likely to be so affected. DSM is not the same as marine aggregate extraction.

9.5. Waste legislation

However this directive does not apply to waste generated as a result of DSM: article 2(2)(b) provides that it does apply to 'waste resulting from the offshore prospecting, extraction and treatment of mineral resources'

This text is contradictory

The text has been amended.

Nevertheless given the manner in which wastes are generated in terms of DSM it is hard to conclude, on the basis of an initial analysis, that this topic is at present clearly regulated in terms of EU law.

Why?

The text has been amended. This issue will be considered in more detail in the draft final report.

9.6. Proposed maritime spatial planning directive

Whether or not it is mentioned, it is clearly an activity that will affect other activities such as fishing so cannot be excluded from any spatial plans. Or is that a wrong interpretation?

In April 2014 the European Parliament Commission proposed the adoption of adopted a Directive on maritime spatial planning and integrated coastal zone management. If adopted in the form proposed, the Directive will require Member States to develop the development by the Member States of maritime spatial plans relating to covering the activities taking place in their 'marine waters' as defined in the MSFD and including the water column, seabed and subsoil.

However, The draft Directive includes a number of policy objectives for maritime spatial planning (MSP), including securing the EU's energy supply, and also lists a number of maritime activities that that must be taken into consideration, including maritime transport routes, and fishing areas and marine protected areas. However, although it does not contain any explicit reference to DSM, this would be expected to be addressed in any assessment of activities taking place within the areas covered by a Maritime Spatial Plan. The potential interactions between DSM and other uses made of marine and coastal resources should also be addressed so that the effective planning for their sustainable development and utilisation can be successfully carried out.

Text amended as suggested. In fact the draft report was submitted at the end of March!

10. NATIONAL LEGISLATION

A general reader is unlikely to know what an OCT is, Give examples.

Yes. Amended.

How do you define the country that "sponsors" the activity?

This issue will be addressed in more detail in the draft final report.

10.1. Member States

This subheading is wrong and may be unnecessary

11. PRELIMINARY OBSERVATIONS

We need a bit more information somewhere about the “sponsor” concept

Agreed. This issue will be addressed in more detail in the draft final report.

12. INTRODUCTION

12.1. Background and overview of the environmental analysis

12.2. Introduction to the three main sources of deep sea minerals

12.2.1. Sea-floor Massive Sulphides

Give an example of a substance that becomes toxic if it changes phase (different crystalline form? Solid-liquid?)

“Total length of vent systems”: this would be explained in Task 4 when looking into the “geology of these systems”. They can range in duration from thousands to 10’s of thousands of years depending on things like the rate of spreading (for deposits on spreading ridges); efficiency of plumbing system (example in back arc settings). The draft final report will bring in information from the Task 4 and we will provide the required examples. Do we have any idea of the total length of vent systems?

Do we have any idea of the total length of vent systems?

Their distribution is sporadic

The vent system or the food webs?

The vent system. Sentence has been corrected.

What is difference between “localised” hydrothermal vent ecosystem and inactive one on mid-ocean ridge. Is the Papua New Guinea site active.?

Vent ecosystems are highly localized as they are entirely dependent on venting hot fluids. Even going just a few meters away from a source of hot fluids, biodiversity and biomass levels drop very significantly.

An inactive site is one that is no longer venting fluids. If inactive sites are located amongst a broader field of active vents, they may still have organisms interacting with them ...likely macro organisms and some bacteria. However isolated inactive sites will be like deserts...very to no significant biomass.

The Papua New Guinea site harbours both active vents and inactive ones. But overall, this is an area of active venting.

What is difference ecologically between active and inactive sites

Active vents are home to complex ecosystems with high biodiversity and relatively high biomass.

Inactive vents located amongst active ones will be part of that complex ecosystem.

Inactive vents isolated from active ones will have simple ecosystems with limited biodiversity and biomass.

12.2.2. Manganese nodules

Manganese nodules are found in highly stable environments where particle flux to the seabed is low

Particles of what?

This refers to both organic (e.g. fish carbon and detritus from water column) and inorganic (e.g. silicates, sand) particles that eventually settle on the seabed a proportion of which can be a source of food for certain organisms. We will explain this in more detail in the draft final report bringing in input also from Task 4 Geological Analysis.

There is a significant problem in achieving a consistent taxonomy of species within an ocean basin, let alone across oceans

What does this mean?

The sentence points to the fact that currently we do not have a consistent and comprehensive overview of all the species that live at deep sea mining sites. This makes the identification of impacts more difficult. All these challenges point to the fact that more should be done on collecting information and data with regard to the ecosystems of these sites.

How deep are these nodules found?

It is mentioned that manganese nodules are most abundant at 4000-6500 meters depth.

12.2.3 Cobalt-rich Ferromanganese Crusts

hotspots of diversity, abundance, biomass and endemism

I can see why their isolated nature might allow endemism but I can't see how that makes them hotspots for diversity, biomass or abundance

This is what the follow-up text explains the initial ideas (hypothesis) that these might be hotspots of biodiversity, biomass or abundance have not been confirmed.

the 'distinctness' of assemblages on seamounts appears unlikely

The large differences between seamounts in terms of the characteristics

Isn't that contradictory?

There is contradictory information regarding the community structures living off seamounts. As suggested by the text there is not enough information at this stage to draw a comprehensive picture of the ecosystems supported by the seamounts.

the geological description of the Atlantis II DEEP deposit provided in Task 4

I wouldn't assume that the reader knows what task 4 is

We have corrected the reference and included the full task name.

planktonic organisms present in all waters in the vicinity of the possible tailings plumes are the most vulnerable life forms that would be affected by heavy metals and chemical processing agents that could be discharged

Why "would be" affected? Was it or wasn't it

The research in question only went so far as to identify organisms that might bear the brunt of toxic plumes but did not go so far as to quantify where or not they were affected. No toxic plume was released to test the effect on organisms.

Pilot mining operations and environmental assessing should be given at least a two year cycle

Not sure what this means

We have rephrased this sentence which is meant to say pilot mining operations and follow up environmental assessment at sites would need to take place for at least 2 years (prior to commercial scale mining) in order to identify and measure the full-scale of environmental and social impacts of the particular operations.

Studies to distinguish between impacts caused by the mining activity and similar impacts caused by other land-driven natural and man-made sources.

Is this supposed to be a bullet point?

We have corrected this in the text.

13. APPROACH TO ENVIRONMENTAL ANALYSIS

13.1. Approach

controls on sub-seabed fluid flows supporting hydrothermal vent regimes

what does this mean?

This refers to the “plumbing system” that controls the flow of fluids underneath the seafloor. There is a poor scientific understanding of how that system evolves over time and what influences it. When fluid flux rate, chemistry, temperature etc. changes, this has an immediate effect on organisms dependent on the fluids.

13.2. Overview of environmental concerns

13.2.1. Sea floor massive sulphides

Based on current deep sea exploration technologies (which use “plume sniffing” to locate SMS sites), only active seafloor hydrothermal systems (and/or inactive ones found in proximity to active sites) have been the targets of possible deep sea mining efforts.

Doesn't this contradict what you said before? Aren't ISA only granting licences for inactive areas

Important again to distinguish between inactive VENT and inactive site (or field). Today's technology is predominantly only able to detect active venting. Once detected, you go down and do a visual survey. This could lead to discovery of a broad vent field that has both active and inactive vents. Overall, the “field” would be deemed active. If moving to mining operations, the preference would be to target the parts of the “field” that are less or inactive (combination of environmental and technological reasons).

Using certain types of geophysics, some isolated, no longer active vent fields have been identified buried under sediments (only their geophysical signature was visible so 100% proof of existence is not confirmed). They are located away from the original heat source (off axis) or in defunct arc or back-arc settings.

ISA is granting licenses based on spatial considerations only...just like land based prospecting blocks. You don't know in advance what you may or may not have in your block. It is however easier to know what you might find because the geological setting (mid ocean ridge, abyssal plane) is known in advance. During the exploration phase, ISA regulates the activities of the country according to its environmental guidelines.

When a country identifies a site of interest for mining, a set of mining protocols would come into effect to regulate the country.

The impact of the discharge plume will depend on the depth at which the plume is released. If the plume is released at the sea surface it could have a major impact on plankton by possibly reducing light penetration, or by stimulating greater growth by the introduction of nitrate, phosphate silicate and other nutrients, and through possible toxic chemical content

Isn't this a drop in the ocean?

Not necessarily a drop in the ocean. If discharge of contaminated material occurred in the Mediterranean (hypothetical mining of deposits near Italy), a relative closed sea with slow rates of water exchange with the Atlantic, the resulting effect would have a high potential for environmentally devastating consequences. It of course depends on how much is released and how the currents can effect dispersal, etc. Like with oil spills...ecosystems can tolerate some levels of input, but when those limits are exceeded, ecological consequences can be dramatic.

Important also to note that deep sea mining has not take place. So the effects of metals and certain minerals in some parts of the water column are not well known at all.

13.2.2. Ferromanganese Nodules

A numerical simulation study estimated that the finer fractions of re-suspended material from mining activity could remain in the water column for 3-14 years depending on factor such as inter-annual variation in environmental conditions

What sort of numerical simulation model? This seems a bit unlikely. Material from Fukushima was rapidly diluted in the water column and transported across the Pacific

We will explain the numerical simulation for the draft final report.

13.2.3. Cobalt rich ferromanganese crusts

but this may occur over very long timescales

how long?

Best reference would be “beyond human time scales”. We will correct these references for the draft final report.

13.3. Environmental policy and management approaches

These are detailed further in Chapter 5 together with details on the possible application of GES descriptors specific to the deep-sea environment.

No they are not. Probably better to deal with here and cross reference in chapter 9.3 It is a scientific issue – not a legal one.

We have adapted the text and will develop it further for the draft final report.

Box 3: Example for MSP from Solwara looks quite useful but I wouldn't put it in a box Probably better as a chapter

Box 4. Again not a box please. Under what circumstances did the experts meet?

We have adapted the text. The workshop took place in 2010 in Dinard, France. The aim of the workshop was to formulate general guidelines for the conservation of vent and seep ecosystems at regional and global scales and to establish a research agenda aimed at improving existing plans for the spatial management of vent and seep ecosystems <http://www.isa.org.jm/files/documents/EN/Pubs/TS9/index.html#/1/>

We have now included this reference in the text.

13.4. Spill-over impacts affecting ecosystem services

This section should also consider possible use of genetic resources

We would consider, beyond perhaps mentioning it, the issue of genetic resources well beyond the scope of this report. It is highly unlikely that individual mining operations would affect access to potential genetic resources. Cumulatively, if deep sea mining targets every vent field, then yes there would be an impact.

So I am not sure if the reviewer would be ok with a mentioning and brief description of genetic resources as another ecosystem services?

14. DESK-BASED RESEARCH

The environment part of this report needs to be re-ordered. There is some repetition between chapters 13 and 14

I would put all the parts for sea-floor sulphides together and the same for the other two parts.

The environmental reporting will be restructured. The limited timeframe for the resubmission did not allow us to carry out the complete restructuring of the relevant chapters. We would like to make sure that no information is lost.

14.1. Finding

14.2. Unique environmental impacts

14.3. Comparison with land-based mining

Additionally, for some countries including many in the EU that have limited land-based resources,

Why should certain countries in EU have difficulties with land-based resources while there is an internal market? Maybe certain industries have difficulty?

We have now clarified this sentence. The sentence means to say that those countries that have no or difficult access to land-based minerals within their own countries might be interested to turn towards deep sea mining as opposed to buy minerals from other countries if they find it to be a financially feasible alternative.

I.e. A country might find that it is easier to set up a DSM operation in the Pacific than to buy resources from other countries (increasing prices, difficulties in assuring future contracts etc). If these countries will turn towards DSM their decision will likely to include financial aspects (is it less expensive on the long run to engage in DSM?). However other aspects such as environmental and social concerns should also weigh in their decisions.

One argument is however clear: simply adding deep sea mining to a country or region's total mining portfolio and raw mineral resources streams (e.g. imports) can in no way be deemed or labeled ecologically sustainable or part of a "blue growth" strategy.

I don't see that it is valid for each country to have an ecological balance. Surely the question is whether for a given quantity of material to be delivered to a certain place, is it ecologically better to extract it from land or sea?

Agreed. We have rephrased this sentence.

Table 14.6 is interesting. Maybe you could include use of energy and greenhouse emissions as a separate issue. One difference it throws up is transport away from the mine – surely better by sea than building roads through tropical forests

We have now included energy and GHG emissions as an additional parameter; however a more detailed assessment of this aspect will be carried out for the draft final report.

14.4. Spill-over impacts affecting ecosystem services

In the environmental analysis, the section on ecosystem services (p. 130 ff.) in our view is not sufficiently developed and should be expanded. Inter alia, it would be good to elaborate on TEEB Oceans & Coasts (and, given that TEEB OC is not funded yet, on related initiatives such as the study "Blue natural capital: towards a new economy"

http://www.gulbenkian.pt/mediaRep/gulbenkian/files/institucional/FTP_files/pdfs/IG_Oceanos/Oceanos_BlueCapital2014/index.html

as well as on their relevance for this study and its follow-up. Also the nexus of insufficient knowledge, the need for further research and "prudent management" (= application of precautionary principle?) should be more fully addressed

We will further develop this section and elaborate on ecosystem services in the draft final report. We will rely on the relevant literature and also take into consideration the results of the other currently on-going tasks.

15. ROADMAP TO IDENTIFY OPERATIONAL TARGETS FOR GOOD ENVIRONMENTAL STATUS

In this section we would expect to see an analysis of the likely impact on all the criteria identified in the Marine Strategy Framework Directive Process.

The rest of this chapter looks like it has been lifted from somewhere and seems to have little direct relevance.

According to the TOR Task 6 should propose a roadmap towards a sufficient assessment of impacts from mineral exploration and exploitation in order to define operational targets for GES. Each element of the roadmap should be accompanied by an estimation of costs and benefits. This is what we have included here. We have all sources referenced and we have not lifted the content from elsewhere.

What the comment refers to is the inventory of impacts and their relevance to the GES descriptors. As per the earlier comment within the chapter on Environmental policy and management approaches - we have inserted an overview of the relevant GES descriptors for deep sea mining.

Furthermore we have amended the tables on the likely environmental impact with a column marking their relevance to one or more of the GES descriptors.

16. REVIEW AND INVENTORY OF MONITORING TECHNIQUES

16.1. Inventory of monitoring techniques

You need to comment on whether a set of instruments can be left on the site and monitored from afar or whether someone would go back occasionally. What is done for shallow water mining, aggregates or disused oil wells? What did Nautilus say they would do in Papua New Guinea?

We have extended the text. Most of the buoys and moorings can be monitored remotely they do not require adjustment. We have also included examples from the Solwara I environmental report. Monitoring of shallow water mining sites is quite similar .

We will look into these in more detail and present additional information in the final report. The monitoring of disused oil wells is a bit different and might not be very relevant. The well and the wellhead pressure can be monitored by personnel. The wells need to be sealed and constantly monitored to ensure there is no leaking. We do not have examples for how decommissioning and follow-up monitoring would work in practice for deep sea mining yet. Presumably it would involve removing all offshore structures including cables etc. We will strive to gather more examples for the draft final report.

16.2. Analysis and Reporting

In the case of both SEA and EIA the analysis takes into consideration a wider set of impacts and looks at a longer time frame.

Longer than what?

What about reporting to the International seabed authority and to the countries analysed in section 10.1.

We have amended the text. In comparison with the annually audited environmental certification schemes EIA and SEA often looks at a longer time frame e.g. 3 years. That is not to say that EIAs and SEAs cannot be performed after one year of activity however in terms of data collection 3 years would be enough to illustrate trends and recovery processes. We will further improve this part of the report and incorporate social aspects into the reporting requirements for the draft final report.

Reporting to the ISA and the countries would ideally have to be based on similar requirements that would make comparison of impacts comparable. We will analyse this possibility for the draft final report.

17. NEXT STEPS

Include timing of final report

We have amended the text.

18. REFERENCES

19. ECONOMIC ANALYSIS

19.1. aim

19.2. activities

19.3. commodity markets

Resource nationalism is an interesting issue. Could we have more details of royalties, export restrictions and whether there is a requirement for local processing. We would need a table of each country's policy.

The issue of royalties will be addressed in the context of the legal analysis, and its implications on the project economic feasibility will be included in the economic model. Both will be presented as part of the draft final report (task 2 economic analysis).

The EU produces a list of strategic raw materials based on their scarceness or value to European industry. How does this relate to seabed mining?

A detailed analysis of specific commodities as regards their scarceness, and the impact of sea bed mining as a new resource on this is being studied right now and will be included in the draft final report (task 2 economic analysis).

20. GEOLOGICAL ANALYSIS

Please comment on the database of the International Seabed Authority. Is it authoritative? Is it complete?

Could we have a summary table for each sea. For instance we say that the Pacific has the most promising areas. It would be useful to have some justification for this.

We will take these comments into consideration for the draft final report and will elaborate on the above two points.

21. PROJECTS ANALYSIS

ANNEX 1: LEGAL ASPECTS FOR SELECTED COUNTRIES

We would need a summary table comparing the different countries using indicators.

Agree. Once all country data is gathered, we will compose such and present in the (draft) final report.

Additional comments received 24 April via e-mail

Can you deal with these (or at least indicate how they will be dealt with) in your interim report?

Iain

Also some further comments from our side:

- The legal analysis does identifies some possible gaps (e.g. the question about whether the EIA applies). Is it foreseen that they will present options to address these (e.g. new legislation, adaptation of existing legislation etc.) or is that beyond the scope?

The terms of reference call mainly for a description of the legal framework.

- When looking at the scope of existing legislation, it needs to be made clear MSFD applies to EEZ and continental shelf. One issue which seems to be ignored is also how to address sea bed mining in overseas territories from the EU, as I understand most sea bed mining in the EU would happen there (and the MSFD for instance, does not apply, not sure about the scope of other ENV legislation there)

There is a specific reference to its application to the continental shelf but the text has been amended to include a specific reference to the EEZ (although

earlier the report does say that references to the continental shelf should be understood to include a reference to the EEZ for the sake of brevity. This issue will be addressed in the national legislation section specifically WRT the OCTs.

- references to MSP should refer to the latest text adopted

Done.

- in the analysis of RSCs, HELCOM and the Black sea Commission are forgotten, I am not sure why?

The reason for this is to double check as to the extent DSM is possible in those seas. If so then these sea agreements will be included in the draft final report.

- The env impact analysis does not seem to look at possible accidents/ their consequences, there is also little about the possible impact of exploration activities

In the draft final report we will bring together information from all the 7 tasks and will identify potential risks from operations using the findings of Task 1 technology analysis. At this stage when we only have limited information on the possible accidents.

- A major comment is that, while it is useful to compare impact with land based mining, recycling is completely ignored (i.e. sourcing some of the materials that are on the sea floor not just from land-based mines, but from recycled waste), This is something that must be looked into from a resource efficiency perspective, as we would need to know what minerals, if any, that we want to extract could be made available through recycling, in which quantities etc... there also seem to be no comparisons of costs (current and foreseen as compared to planned evolution of market prices)

Recycling is a very important aspect of the EUs waste management policy. In the draft final report we will look at the what % of the metals can be recovered via recycling and how much of the demand these recycled elements would eventually cover.

- P121 the MSFD is quoted as an important instrument for regulating SBM but the consultant should make clear MSFD is not a means to regulate an individual activity, as it looks on cumulated pressure. The chapter on criteria for SBM under MSFD seems a little odd to me too, especially as it mentions a review of MSFD to address sea bed mining, which is not foreseen.

We understand that purpose of the MSFD is to manage the cumulative impacts of the marine and maritime activities on the environment. However analysis of the 11 descriptors of the MSFD in the context of DSM (and relating an inventory of impacts to them) was one of the requirements of the terms of references for this project. We have now inserted a clarification sentence which underlines that the practices of the MSFD are meant to serve as an illustration on how to approach the mitigation of impacts in the context of DSM.

- For the whole section 16 on the roadmap "Roadmap to identify operational targets for Good Environmental Status" (pp. 149-155), it is not

clear what they are planning to do with this roadmap once it is established. It also seems that they are looking to develop a parallel process of defining GES targets specifically in the context of DSM. It is welcome that GES is the primary environmental benchmark against which to judge the sustainability of DSM, but the MSFD is not an instrument that works in a way that says "this level of activity X keeps you within the boundaries of GES, but 10% more and you are over the limit". It is a broader, ecosystem approach. We thus have doubts about the compatibility with the MSFD. We could perhaps discuss this further at the workshop.

The roadmap to establish operational targets for GES was one of the requirements of the terms of references under this project. It brings a step-by-step guidance to policymakers on how to establish baselines for good practices in DSM activities. The ultimate aim is to ensure that European mining companies engage in environmentally and socially conscious behaviour. The steps of the roadmap allow for the incorporation of the findings (e.g. environmental indicators) of parallel projects (such as MIDAS and Blue Mining).