Secretariat,   June 11, 2021
International Seabed Authority
14-20 Port Royal Street
Kingston, Jamaica
(submitted via email to ola@isa.org.jm)

RE: Stakeholder Consultation - Draft Guidelines for the Establishment of Baseline Environmental Data

Sir/Madam,

Below, please find below our Commentary on Draft Guidelines for the Establishment of Baseline Environmental Data as issued in May 2020.

As Group Leads, we submit on behalf of the **Deep-Sea Minerals Working Group of DOSI, the Deep-Ocean Stewardship Initiative**. The list of contributors is presented at the beginning of the document. Express Consent for sharing is granted.

Sincerely,

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DOSI comments on the ISA "Draft Guidelines for the Establishment of Baseline Environmental Data" (June 11, 2021)

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TEMPLATE FOR COMMENTS

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Document reviewed	
Title of the draft being reviewed:	Draft Guidelines for the Establishment of Baseline Environmental Data
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General Comments	
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We acknowledge the efforts of the LTC and consultants to draft an initial version of these guidelines for the establishment of baseline environmental data. Drafting such a document for the remote and comparably poorly-known deep-sea ecosystems is a very difficult task, especially as technologies used to obtain baseline data in the deep sea are under constant and rapid development.

We cannot underscore enough the importance of robust baseline data as a foundational basis for EIAs, EISs, EMMPs, and REMPs of this nascent industry . As such, it is essential that baseline data is collected and analysed in a comparable and standardized way. However, in its current form, this document does not, in our expert opinion, give enough advice to contractors so that they can gain robust, standardized, and comparable environmental baseline information. The document is not coherent and offers differing levels of detail for different parameters to be measured. This leads to uncertainty, which could result in non-standardized sampling and processing, as well as non-comparable data, including, critically, between contractors. This may have negative environmental consequences, not only for the management of each contract area but also for each region.

Please find below our general concerns as well as a list of specific comments. We also include suggestions for improving the document, as well as supporting references.

Standards / Obligatory Minimum Requirements

The entire document includes guidelines and recommendations only. We recommend that a set of standards and/or obligatory minimum requirements is established, in order to allow for a level playing field among contractors and to aid comparability of baseline data, which is essential for e.g., the success of the REMP.

Imbalance

The document is imbalanced in the level of detail and specificity requested. While the specific methodologies are described in detail and are supported by literature, much of the guidance on sampling design, including format, sample sizes, levels of replication, power, and detection thresholds are vague or misleading. In some instances, the recommendation is as broad as "as appropriate" while others are very specific (recommending a minimum number of sampling units) without any supporting literature or justification. Additionally, the common mistake of prescribing sampling design rather than providing the methods in developing a design fit for purpose is made in several places in this document.

Lacking Guidance to Operationalise

The guidance within this document is almost impossible to operationalise. There is, for example, currently no mention of the importance of parameters that should be documented (for different purposes) or the rationale as to why they are important. While there is a detailed description of how to collect measurements for most parameters, it would be very difficult for a contractor to design a sampling scheme to capture all these measurements that is efficient and effective. In the context of these being Guidelines and not standards, the very long list of measurements gives contractors the option to pick and choose what to measure without any guidance on prioritization. This will result in a very disparate set of measurements that will not allow for cohesive or integrated analysis. This document should guarantee that baselines are fit for purpose (allow for the detection of change and mitigation of impacts).

Coherency

Any recommendation on sampling methodology should be coherent throughout this document, and also with other ISA documents, in order to avoid confusion. For example, there are currently different recommendations on which sediment depths should be

sampled, or how different faunal groups are determined (strict size class identification versus traditional ecological separation). This causes unnecessary confusion and will have consequences for data comparability.

Recommendations/Standards to Support Pre-Cruise Survey Design

Throughout the text, it is recommended that the level of sampling required should be determined through power analyses and species accumulation curves (e.g., Pg 9 line 282, Pg 34 line 1319, Pg 58 line 2320). Whilst these are excellent methods, these analyses are undertaken only after data collection and already require a certain baseline. This may cause confusion. A section should be created that highlights this and recommends which preliminary data are needed to inform sampling strategies. This could be, for example, a guideline or standard to support pre-cruise survey design through recommendations on minimum sampling requirements. Only based on these, should the next step of power-analyses be taken.

Process of Developing the Standards and Guidelines

DOSI would like to see more transparency around the process for drafting the Standards and Guidelines. For example,, a list of contributors and affiliations (both formal members of the technical working group, and formal and informal consultants) should be included. There is no information in the public domain about how contributors were selected, whether objective criteria were applied, and whether conflict of interests were declared and/or managed.

References

In many places in the document, there are no references or explanations provided on recommended methods (e.g., on temporal and spatial coverage, resolution, replication). This causes confusion and may hinder the establishment of a robust baseline by contractors.

Define "Sufficient Sampling" and Rare Species

Further consideration is needed on what amounts to "sufficient" sampling. In the CCZ, there are a few common megafauna morphotypes and many very rare morphotypes (Amon et al., 2016; Simon-Lledó et al., 2019, 2020). In their summary of environmental requirements for

deep-sea mining, Bräger et al. note that "special emphasis should be put on rare species as they may be the first to be lost" (Bräger et al., 2018), and many rare species have become a priority for conservation efforts in other ecosystems (Gaston & Fuller, 2007). This is reflected in the criteria for identifying Vulnerable Marine Ecosystems (FAO, 2009) and Ecologically or Biologically Significant Marine Areas (CBD, 2009). While biodiversity is widely accepted to support ecosystem function, the impact of loss of rare species on ecosystem functioning is not well understood (Jain et al., 2014; Lyons et al., 2005). If rare species that are lost perform functions that directly or indirectly affect ecosystem functioning, this could be significant (e.g., Danovaro et al., 2008; Lyons & Schwartz, 2001), particularly for ecosystem recovery and/or resilience to change. While there is debate around the contribution of rare species to ecosystem function, a precautionary approach to environmental management should involve sampling a high proportion of the faunal community, perhaps higher than is required to detect change.

Definition of Key Terms

Throughout the text, there are multiple references to "Best Available Techniques" and "Good Industrial Practice", with no clarity on where information on these should be sought or what this refers to. While there are lessons to be learned from existing practices, including other deep-sea or offshore industries, a new industry such as deep-seabed mining should be seeking to break new ground with regards to sustainability and environmental performance.

Standards for Data Quality Control

There is no indication of how power analyses and other statistics used to justify sampling design (e.g., number of replicates, Pg 58 lines 2322-2328) will be reviewed or how quality will be assured, by either the contractor, ISA or independent reviewer. This is a crucial step to ensure that any analyses and conclusions drawn are reliable. Ideally templates, including the units of measurements, for required data should be provided to enforce reporting standardisation, with raw data in original units and formats also being required to be uploaded to a dedicated ISA portal.

Sharing of Data and Methods for Environmental Baseline Studies

We welcome the recommendation for cooperation and exchange of data and methods/sampling strategy among contractors and between contractors and scientists. However, this needs to be stronger and it could be obligatory that their environmental data is shared with scientists/the public. In order for contractor results to be comparable, and allow for meta-analyses on the scale required to fully support regional environmental management, there needs to be a high degree of collaboration amongst contractors. There is a role for Regional Environmental Assessment, to design and implement a large-scale, coordinated, strategic environmental assessment of areas of interest. This has been successfully employed in other industries (e.g. in UK oil and gas industry (Bett, 2001), aggregate dredging (BMAPA, 2019; Wallingford, 2010), and offshore energy development (Gill et al., 2005; UK Gov, 2019; Nedwell et al., 2007)). This would ensure sampling by individual contractors is strategically coordinated, avoids duplication of efforts, and allows better understanding of the region as a whole to provide a regional context for project-specific EIAs.

Define the Role of Contractors and the ISA to Obtain Baselines in APEIs

Whilst we are aware that this baseline document covers baseline environmental data for the contract areas, we note that it is very important to develop documents on responsibilities and guidelines/standards for the establishment of baseline environmental data in APEIs. To our knowledge, there is, to date, no document on how APEIs should be sampled. APEIs were established to capture the full range of habitats and communities present in the CCZ (ISA, 2011), but it is currently unclear if they support similar biological communities in areas under exploration, or whether environmental conditions in APEIs are different (McQuaid et al., 2020; Washburn et al., 2021; Perelman et al. 2021). Recommendations for a strategy to sample APEIs would be welcome, including one that links to the need for Regional Environmental Assessment.

Guidance/Standards for the Collection of Social and Economic Data

There is no guidance for the collection, storage and sharing of social and economic baseline data, including ecosystem services. This should be rectified; otherwise social and economic data cannot be compared or scaled making impact difficult, if not impossible, to determine.

Baseline Data Collection During Exploration and Exploitation

If we understand correctly, this document shall be used during exploration and exploitation. A clarification in the document would be welcome, and how/if this impacts the use (or non-use) of past documents (e.g. ISBA/25/LTC/6/Rev.1 and /Corr.1) developed for the exploration phase.

Cumulative Effects and Climate Change

There is no mention of the importance of the parameters that should be documented or the timescales over which they need to be assessed for distinguishing climate-change impacts from mining impacts. Overall, there should be recognition that climate change will cause shifting baselines.

Accounting for Future Developments

The current document provides guidelines for methodologies currently used. We recommend adding the importance of future technologies/methods and also providing a link to a platform or document that is regularly updated to inform contractors about these new developments. For example, methods to monitor biodiversity in the (near) future may include proteomic fingerprinting. Methods to monitor change may also include a greater focus on species life-traits. This links to the need to clarify "Best Available Techniques" and provide insight into where information on this should be sought.

Developing Standards Collaboratively

The entire document describes guidelines. The establishment of additional standards is recommended, so as to guarantee that results between contracts meet the same quality and can be compared. Standards would also allow for a level playing field between contractors. This should be enforced through reporting requirements and intercalibration experiments would facilitate comparisons, especially with legacy data. We recommend that in-person workshops are organized (as soon as this is possible again) that invite and ask members of the Assembly to send environmental experts from their countries, invite additional experts in the field, and are open for Observers. This would also allow for more transparency on how the document is developed.

Specific Comments		
Page	Line	Comment
4	65	We acknowledge that the focus of this document is on polymetallic nodules. However, it remains unclear how or when standards and guidelines for baseline environmental data for polymetallic sulfides and ferromanganese crusts are added into this document whilst maintaining clarity. Thus, we recommend that the name of this document be changed to "baseline environmental data for polymetallic nodules", and that two additional documents (building upon the current one) are developed and named according to resource type.
4	80	Regional Environmental Management Plan (REMP) should be added to the list of EIA, EIS, EMMP, and EMS.
4	82-86	The statement "The primary goal of the acquisition of baseline data is to enable an assessment of the possible impacts of exploration and exploitation activities on the marine environment prior to those activities taking place." may need some expansion. As a suggestion: The primary goal of baseline data acquisition is to characterise the existing environment, prior to an impact occurring, so that an assessment of the possible impacts and effects of exploration and exploitation activities on the marine environment can be made prior to those activities taking place.
4	93	For the statement, "Scope, coverage and standard of baseline data needed to characterize the physical, chemical, geological as well as sediment properties and biological communities in the Area.", we strongly suggest replacing "Area" with "Marine Environment" or "impact zone", which must include the benthos and water column.

		"Area" is legally defined as "the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction." (UNCLOS, article 1(1)(1)). In addition to environmental impacts on the seabed, many of the environmental impacts of deep-seabed mining will be in the water column and possibly on the ocean surface. The ISA is legally required to protect *all* areas of the marine environment from the harmful effects of deep-seabed mining (UNCLOS, articles 145, 192). Limiting baselines to the seabed and subsoil would not be in accordance with UNCLOS.
5	104	It is suggested that in addition to the listed headings, one heading is dedicated to connection of the properties. It is crucial to understand the linkages between the physico-chemical and biological environment, and specific analytical methods for analysing baseline data should be recommended.
5	114-119	There are standard analytical tools (e.g., power and time-series analyses) that can be used after an initial sampling survey to estimate both the required replication and frequency required to detect change (or no change). There should be a reference to this here to help guide the process. In addition (as mentioned in the general comments), these guidelines may also include minimum standards, e.g., drawing from literature, including recent/upcoming results from large scientific projects (e.g., Mining Impact 2). These minimum requirements should include temporal and spatial replicates.
5	122	Clear definitions of IRZ and PRZ and their requirements should be given or referred to, before using them in various contexts.
5	124	"Typical" ocean conditions do not exist. Replace with "conditions that encompass the natural variation in ocean conditions".

5	125	The arrangement should also include substrate type (e.g., soft and hard substrate).
5	129	In addition to the global ocean biogeography (according to depth), it is very important to include the biogeography of the (benthic) fauna.
5	134-135	"The area considered should extend beyond the contract area" – this definition should be more specific. "At least 20 years" – please provide a reference or explain why 20 years is suggested.
5	139	There is a need to be cautious when using terms such as "homogeneous stable conditions". These do not exist. Stability (in time) and homogeneity (in space) should be defined based on mean and variance (perhaps coefficients of variation).
6	Figure 1	Box-coring at seamounts may be very difficult/impossible due to the presence of hard substrates. In the current document, only sampling for soft substrates (sediments) is considered. The document may refer here to a (future) document on ferromanganese-crust environmental baseline data.
6	Figure 1	It is suggested that examples of "biogeochemical entities" and "physiographic zones" be provided and/or there be definitions of these terms.
6	141	Does "stratum" refer to stratified sampling? If yes, this needs to be introduced before this statement. If not, it is unclear what "stratum" refers to.
6	144	A nested stratified sampling scheme is mentioned for sediment, pore-water and benthic biological sampling. Nested sampling

		should be applied for all variables, including pelagic and non-sediments. These should be clearly added throughout the document.
6	146	"Range of environmental settings" is unclear. Please be more specific here.
6	144-157	This paragraph is difficult to understand. Please provide a direct reference to Figure 6. It is unclear why the order of biogeochemical entities is placed above physiographic zones. Please provide reasoning. We are not per se questioning that this is not a good approach, but it should be justified. What does e.g., a biogeochemical entity include? Please refer directly to the appendix so the reader knows which parameters are considered as such. It is unclear why biological knowledge on e.g., benthic biogeography and species ranges are not considered.
7	166	Please be specific what is "deep", as it is known that seasonality does have an impact on sediments. This depth may be related to bioturbation/being below perturbation. In addition, it is not clear how sampling once can be used for any statistical comparison. Also of consideration in defining "deep" is how deep the sediments in the mined location may be affected.
7	167-169	Three years of sampling will not capture periodic events unless their periodicity is every three years or less. It is assumed that

		what is meant is stochastic events. Still, the choice of three years is arbitrary and while it is understood that a period should be recommended, it should be based on known periodicities in the physical (e.g., weather, El Nino) and ecological parameters (e.g., life cycles).
7	179-184	Midwater sampling should be conducted, especially since midwater impact is to be expected.
7	185-194	The depth ranges given are different to, for example, what is given in ISBA/25/LTC/6/Rev.1. We agree with the suggestions in the current document and suggest making sampling guidelines coherent within ISA documents.
7	195-203	Specific guidelines or standards for sampling design/replication/statistics should be referred to here. Minimum standards for replication should be given. See general comment above.
8	225	Who will carry out "Independent feedback", and how will this be reported?
9	245-250	We recommend a stronger emphasis on Regional Environmental Assessment as observed in other industries (e.g., oil and gas, aggregate dredging). See general comment above.
9	251	It should be an obligation (standard) for contractors to share environmental data with other contractors, rather than a recommendation.
9	262	We acknowledge that the lack of biology and biogeochemistry is mentioned here. How does the document account for this lack of knowledge? Please provide recommendations on how to close these gaps.

9	264-272	We recommend that standard protocols for data quality control are developed and referred to here.
10	300	References for "appropriate" standards may be given here.
10	317	Standard metadata should include time and date (UTC with Time Zone information), and reporting formats should follow ISO guidelines (eg. YYYYMMDDTHHMMSS.ssssZ for datetime in UTC).
12	384-388	In addition to the suggested depths, consideration of any discharge plume (return water) should be considered.
13	439-441	CTD or appropriate sensors can also be mounted on wires.
14	470	References for such models should be given.
14	479	This paragraph describes specific objectives and should be moved to another part of the document.
21	759	References for "the appropriate methods" should be given.
22	799-802	Is there a specific guidance (and references) for the "appropriate temporal and spatial resolution"?
22	807-808	"Throughout the water column" is uninformative. We suggest including more information.
22	820-822	We recommend that "long-term" is specified.
25	918	To the best of our knowledge, there is no study that would quantitatively compare respiration in sediments and on nodules, so this sentence should be deleted.

33	1276	A reference may be given on how these parameters should be measured.
34	1324	Reasoning and a reference should be given for "30%" and statistical power of "0.8".
38	1498	Just as for the benthic community section, it will be helpful to include a size range here; pelagic organisms range from bacteria to whales.
39	1509	Connectivity should include the full range of ecological connectivity including, but not limited to, genetic connectivity. In addition we suggest adding the terms "biogeography" and "endemicity/habitat restriction" to connectivity. If a species is restricted, for example, to live on/in nodules, it won't be able to recover in the area where its habitat is lost.
39	1525	Seabirds are not easier to study than any other marine vertebrates. This statement should be removed.
39	1527	Temporal variations should also include possible interannual variability in macro- and meiofaunal communities, due to the variability mentioned for abiotic parameters in previous sections.
39	1543	The term "homogeneous" is repeated here as earlier. A definition is necessary (i.e., within a range of variation), as many would argue that spatial homogeneity does not exist in the ocean.
40	1548-1552	Net sampling can be augmented by imaging systems above 1000 metres, not just "Particularly below 1000 m", to ensure the capture of the more fragile organisms that may not have been captured by nets.

40	1571	Please provide a reference for the 5-10 cores per physiographic unit.
40	1584	Night transects should also be included and maximum transect speeds defined. Both night and day observations can inform diel vertical migration dynamics. Also note, that at least 3 times 24-h cycles need to be obtained to classify diel vertical migration (Pg. 41 line 1591) .
41	1596-1629	Fragile organisms, such as ctenophores, jellyfish and siphonophores will not be sampled well with the methods listed, which are all nets. To observe gelatinous organisms, video observations via ROV transects in both day and night will be required.
41	1607	Mesh should be much less than 1 mm if meroplankton is to be captured; 0.250 mm or smaller (e.g., 0.063 mm) is more appropriate.
41	1612	A minimum of two tows is not adequate or an appropriate method to estimate uncertainty. In addition, there should be day and night tows. Same for mesopelagic micronekton and nekton sampling - day and night tows should be required, each with more than two tows for uncertainty estimates.
42	1639	Biomass should be included too; diel vertical migration of micronekton should also be measured
42	1651-1655	Copepoda are also present in macrofauna samples but typically excluded from macrofaunal studies (and better represented in meiofaunal samples).

42	1675	Add "Virus". Analyses of viruses are absent in the current document. Whilst little is yet known, recent studies show that they may play very important roles for ecosystem processes. See, for example, Zhang et al., 2020.
42	1648& 1710	Strictly speaking, there is no protistan megafauna as protists are not fauna. It is mentioned in line 1712 that Xenophyophores should be analysed separately. We suggest adding Protists to the list of measured variables.
43	1677	Please elaborate on what is meant by "broad scales of relevance to mining operations".
43		Please provide references and/or the rationale/methodology for assigned values to be used for, for example, seabed images and recommended number of specimens identified.
44	1726	Please amend to either "highest taxonomic resolution" or "lowest taxonomic level possible".
44	1741	Observation of species on video/photo should be verified by taxonomic and/or genetic analyses of several collected specimens. Recent scientific literature also shows that megafauna, like ophiuroids, show hidden species complexes/dark biodiversity (e.g., Christodoulou et al., 2020).
45	1772	DESS may not be the best method for nematodes, as difficulties can be encountered during genetic analyses. It is currently being investigated whether 96% EtOH preservation may be better.
45	1790	Data from macrofauna encountered in the meiofaunal size class (e.g., juvenile macrofauna) may be added to macrofaunal data.

46	1823	A reference should be given as to why "2 ml" of volume should be used.
47	1877/1878	Is there a reason why 90% EtOH is suggested? For molecular analyses, typically 96% or 99.5% are used, whilst for storage after formaldehyde fixation, 70% EtOH is used. Gelatinous macrofauna are often stored in formalin rather than ethanol to prevent shrinkage. Meiofauna cannot be photographed immediately (requires slide preparation). Should it be "macrofauna" that is photographed?
47	1880	Why is "25 micrometers" suggested? The mesh size should be the same as used for treatment of sediments.
47	1885	There are currently ongoing studies on alternatives to mechanically breaking nodules. These should be added in a revised draft.
49	1951	Video transects and imagery collected by ROVs, AUVs or drop cameras are not ideal for sampling fish as they can attract or deter and thus bias the species composition and abundance. They should not be given first on the list of sampling tools and their caveats should be emphasized.
49	1959	A reference for the minimum amount of ten replicates should be given.
50-51		The entire section on connectivity is focused on genetic connectivity. As stated above, ecological connectivity (of which genetic connectivity is a part), should also be considered.
50	2006-2008	A reference to programs and software should be given.

51	2042	It is unclear why these analyses are restricted to infauna samples and the benthic environment.
55	2203	The guideline clearly is focused on the masking effect of noise: *"Noise is created by numerous sources located both inside the ocean and on its surface and can affect communication in marine mammals and other marine organisms."* What seems to be missing from the document in regards to noise and fauna is the planning of what may be needed to allow impact assessment of mining operations. The document is missing any mention of impact associated with displacement – with the current draft baseline, this really couldn't be measured, but it is of equal importance to masking. We suggest that the document should include collation of AIS data from any shipping that should be included in a baseline as well as collation of spatial and temporal marine mammal abundance and density in the area to be mined. The latest SCANS project should be referenced (SCANS III). Towed hydrophones and PAM are both acoustic monitoring. Please amend.
57	2276	A guidance on standardisation should be added.
58	2332	A reference and reasoning should be provided as to why 25 nodules and three box cores should be collected.
58	2322-2328	A reference should be provided for the BACI analyses. There should be additional methods to ensure statistical robustness.
58	2345	A reference to a metadata file should be provided.

59	2372	The bibliography should be carefully checked as it is incomplete; references listed in the text are missing.

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