Template for the review of the draft regional environmental management plan for the Area of the northern Mid-Atlantic Ridge with a focus on polymetallic sulphide deposits

Please use the review template below when providing comments. Line and page numbers have been provided in the draft REMP. Please use these as a reference as illustrated in the table below.

TEMPLATE FOR COMMENTS

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General Comments

When preparing the general comments, stakeholders are invited to consider the following:

1) The structure and layout of the draft REMP.
2) The level of detail of the draft REMP, while avoiding being too prescriptive.
3) The goals and objectives in the draft REMP in providing for long-term, effective protection of the marine environment in the Area of the northern Mid-Atlantic Ridge.
4) The management measures and their ability to achieve the goals and objectives in the draft REMP.

We welcome the opportunity to comment on the draft Regional Environmental Management Plan for the Area of the northern Mid-Atlantic Ridge with a focus on polymetallic sulphide deposits, issued by the ISA for public consultation in April 2022. iAtlantic is a multidisciplinary scientific research project working to improve our understanding of the health and status of ecosystems in the deep and open Atlantic Ocean, involving marine scientists from countries bordering the north and south Atlantic Ocean. We hope you find the following comments helpful and constructive.
There is a lack of definition of many of the terms used in the draft REMP document, for example “important species”, “key vulnerable/sensitive species”, “significant communities of fauna”, “serious harm”, “significant biological events”, etc. These terms must be defined, and robust scientific criteria (e.g., for terms such as “important species”, “vulnerable/sensitive species”) established to guide their use.
More clarity is needed on where responsibilities lie for implementing the objectives and actions described in this document. Currently, it is not clear who will develop thresholds, determine “key” species or monitor/assess impacts, among many other issues.
An overarching goal of the REMP is to encourage cooperation, but no mention is made of how the REMP acknowledges and will work with related processes - i.e. CBD EBSAs and GBF, FAO VMEs, and the emerging BBNJ regime. How stakeholder groups can interact with the activities and provisions laid out in the REMP is also unclear.
Climate change implications are not taken into consideration in this document, which in our view is a very significant omission. Climate drivers will alter deep-sea biodiversity and associated ecosystem services, and may interact with disturbance from resource extraction activities, as well as with impacts from other marine activities.
The vast majority of measures in the draft REMP relate to fundamental research questions (development of thresholds, assessment of cumulative impacts, definition of connectivity models, trophic interactions, ecosystem functions, sensitivity, etc.) and will require a very ambitious knowledge acquisition programme to be put in place. Who will do this and how will it be funded? Most of the measures are currently impossible to

implement as they relate to ongoing research questions - for example, it is critical that thresholds are in place before exploitation begins and that contractors are required to apply all established thresholds but the scientific knowledge to determine those thresholds is not yet sufficiently advanced.		
Establishment of a network of representative habitats: the draft REMP notes the need to discuss the application of a network criteria (para 31). Without such a network in place, it is not clear how many of the region-specific goals and objectives will be achieved.		
Cumulative impacts and the consideration of other human activities: the REMP should provide for the identification and mitigation of conflicts with other marine sectors, such as fisheries and submarine cables, including consideration of how other marine users contribute to cumulative impacts in the region. This is essential in ensuring all forms of stressors are accounted for in regional environmental assessments.		
Heavy emphasis on protection for active vents means that the ecological and biological significance of inactive vents is not given sufficient emphasis.		
Important underwater cultural heritage aspects are missing from the draft REMP. The REMP covers areas of underwater cultural significance, the implications of which are only recently being recognised (Turner et al., 2020).		
Specific Comments		
Page	Line	Comment
5	79	Article 11 a) should include cultural heritage. We suggest re-wording to: "**Common heritage of mankind.** The Area, its resources and its cultural artifacts are the common heritage of humankind. All rights to the resources of the Area are vested in humankind as a whole on whose behalf the Authority shall act". Appropriate adjustments should be made throughout the REMP to ensure cultural heritage aspects are appropriately addressed.
8	126	The section on "Environmental and geological setting" is lacking a clear statement on the fact that climate change is (and will) already affecting the benthic communities living on the MAR (Levin et al., 2020). Climate drivers will alter deep-sea biodiversity and associated ecosystem services, and may interact with disturbance from resource extraction activities or even climate geoengineering. On the northern MAR, where several mining exploration contracts exist around hydrothermal vents, multiple climate variables over large regions are projected under the RCP 8.5 scenario to see future variability exceeding historical variability by 2030 (termed the "Time of Emergence"), a period well within potential 20- to 30-year mining exploitation contracts. Under RCP 2.6, times of emergence for the MAR are later, but within this century. Mining, climate change, and fishing impacts will interact. For example, much of the northern MAR (about 84%) overlaps areas managed by the North East Atlantic Fisheries Commission (NEAFC) RFMO. This area may see climate ToE as soon as 2032 under RCP 8.5 and 2036 under RCP 2.6, and experience 15–45 times or 11–32 times the cumulative negative climate change hazard by 2081–2100 under RCP 8.5 and 2.6. Noting intensive trawling activity in the region, bottom trawlers could potentially fish approximately 28% of these depths (1,000–2,500 m), suggesting potential cumulative impacts with mining and climate change. The MAR also accounts for 76% of vulnerable marine ecosystems (VMEs) designated by NEAFC; these VMEs, identified as fragile areas protected from bottom fishing, are projected to experience ToE as early as 2031 (2037) and 19–44 times (13–29 times) cumulative negative hazards by 2081–2100 under RCP 8.5 (RCP 2.6).
8	166	The section on "Environmental and geological setting" lacks a clear statement on the importance of the MAR in supporting and connecting vulnerable marine ecosystems; namely habitat forming and long-lived

		deep-sea corals and sponges. Recent studies[1] and surveys[2] have shown that, at least shallow (<1,200m depth) hard substrate along the MAR, host extensive and dense coral gardens (Morato et al., 2021a,b; see also the cruise reports listed in footnote) that are very susceptible to deep-sea mining plume impacts (Carreiro-Silva et al., 2022), that may spread an average linear distance of 10 to 20 km, cover an area of 17 to 150 km^2, and extend more than 800 m in the water column (Morato et al., 2022). The MAR has also been demonstrated to be important in the ocean basin scale connectivity of these species. Moreover, Combes et al. (2021) showed that the Mid-Atlantic Ridge are "crucial zones" for preserving the deep-sea biodiversity of the North Atlantic. • Morato et al. (2021a). Dense cold-water coral garden of *Paragorgia johnsoni* suggests the importance of the Mid-Atlantic Ridge for deep-sea biodiversity. Ecology and Evolution, 11(23), 16426-16433. • Morato et al. (2021b). North Atlantic Basin-Scale Multi-Criteria Assessment Database to Inform Effective Management and Protection of Vulnerable Marine Ecosystems. Frontiers in Marine Science, 8, 255. • Carrreiro-Silva et al. (submitted). Mechanical and toxicological effects of deep-sea mining sediment plumes on a habitat-forming cold-water octocoral. Frontiers in Marine Science. • Morato et al. (submitted) Modelling the dispersion of Seafloor Massive Sulphide mining plumes in the Mid Atlantic Ridge around the Azores. Frontiers Marine Sciences. • Combes et al. (2021). Systematic conservation planning at an ocean basin scale: identifying a viable network of deep-sea protected areas in the North Atlantic and the Mediterranean. Frontiers in Marine Science 8: 611358
9	206	Para 26: Surely a key region-specific goal is to facilitate/ensure a sustainable approach to exploration and exploitation activities? This is missing from the list.
9	217	Section II A - These are not management objectives, but mostly aim at filling knowledge gaps required for strategic management. Many of the bullet points listed under in Para 27 are baseline activities that should be pre-requisites for a level of understanding upon which the REMP is based, rather than part of the 'management' plan. Para 27 should explain this.
9	220	Para 27, point a) Needs clarification whether this only refers to benthic habitats or if it includes pelagic ecosystems. Which habitat classification system should be used?

[1] https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.8319

[2] Morato et al. (2021). iMAR: Integrated assessment of the distribution of Vulnerable Marine Ecosystem along the Mid-Atlantic Ridge in the Azores region. Zenodo. https://doi.org/10.5281/ZENODO.6556837

Cruise reports:

Morato et al. (2020). MapGES 2019: Summer 2019 cruise on board of N/I Arquipélago. Zenodo. https://doi.org/10.5281/ZENODO.3727570

Morato et al. (2020). MapGES 2019: Summer 2019 cruise on board of N/I Arquipélago. Zenodo. https://doi.org/10.5281/ZENODO.3727570

Carreiro-Silva et al. (2019). Greenpeace Pole-to-Pole expedition – Azores 2019. Zenodo. https://doi.org/10.5281/ZENODO.6557865

Dominguez-Carrió et al. (2019). Cruise Report—NICO Cruise Leg 12, Hopper dives on board of R/V Pelagia. Zenodo. https://doi.org/10.5281/ZENODO.3416992

Morato et al. (2019). Cruise Report - MapGES / ATLAS Project: August 2018 Cruise on board of R/V Arquipélago. Zenodo. https://doi.org/10.5281/ZENODO.3417021

Morato et al. (2019). Cruise Report—BLUE AZORES PROGRAM EXPEDITION 2018 ON BOARD THE NRP GAGO COUTINHO. Zenodo. https://doi.org/10.5281/ZENODO.3416897

Morato et al. (2020). MapGES_2020 Cruise Report: Exploration of Azores deep-sea habitats, summer 2020. Zenodo. https://doi.org/10.5281/ZENODO.5503634

Morato et al. (2020). MapGES 2019: Summer 2019 cruise on board of N/I Arquipélago. Zenodo. https://doi.org/10.5281/ZENODO.3727570

9	224	Para 27, point c) “where appropriate” is unnecessary
10	227	Para 27, point e) should specify what cumulative impacts refer to, specifically mentioning climate change. This is explained in the “Regional Environmental Assessment of the Northern Mid-Atlantic Ridge” but since there are impacts from multiple mining operations as well as from other activities such as fishing and from climate change, this should be made clear in the document as well.
10	237	Para 27, point i) Change to “Assess the distribution and connectivity of habitats…” More important than “assess” or “model” is to use that information to identify climate refugia and vulnerable regions for multiple species under climate change.
10	251	Para 28, point a) Delete “with significant megafauna communities”. It should read, “Avoid harmful environmental impacts on active vent sites, including loss of vent communities in areas around a potential mine site.”
10	263	Para 28, point c) Change “minimize” to “avoid”. It should read “Avoid harmful environmental impacts on important species for the maintenance of ecosystem functioning and integrity”
10	256	Para 28, point c) “Important species” should be defined - perhaps via a table listing important species for each of the 4 groups of habitats in Para 21
11	270	Para 30: Contractors should conduct environmental surveys outside their contract areas; mainly in areas with high probability of being impacted by mining plumes. Since the PMS blocks are small, there’s a high probability of mining plume to disperse outside the contracted area (Morato et al., 2022). Suggest changing it to, “Contractors should conduct environmental surveys outside their contract areas, in cooperation with the scientific community and in particular those from developing countries, mainly in areas with high probability of being impacted by mining plumes”.
11	272	Para 31: The ABMT criteria are not defined and therefore we can’t assess if the network criteria (representativity and connectivity) are the only ones missing; perhaps climate change criteria/considerations may also be missing in the ABMTs criteria guiding this REMP (Levin et al., 2020). Article 31 should clearly state that this analysis could/should provide additions to the AINP or SINP lists. We suggest adding the ABMT criteria in the document and also change the text to: “This REMP does not include ABMTs identified through the application of network and climate change criteria such as representativity and connectivity, based on a regional analysis. It is noted that additional expert discussion led by the LTC will be needed in the future on the application of the network criteria.”
11	276	Para 32: Change “describing” to “assessing” or “identifying”. The REMP should assess and identify the occurrence of vulnerable ecosystem features in the application of the criteria for ABMTs.
11	285	Paras 33-34: The rationale for identifying AINPs is not clear or transparent. Also, it is not clear how the AINPs are related to other existing areas, such as APEIs or EBSAs - most relevantly the EBSAs described for the NE Atlantic (e.g. Johnson DE (2019) Protecting the Lost City Vent System: all is not lost, or is it? Marine Policy 107, 103593). Along with the fractures zones, the background document and the scientific literature identify many other areas that fit the AINP criteria and that should be considered here; e.g. Biogeographic transition zones, Genetic hybrid zones (Dunn et al., 2018). AINPs should also consider climate change.
11	287	Para 33: The designation of AINPs should also follow the best available scientific knowledge and criteria (e.g. Dunn et al., 2018);

		1. AINPs should be representative of the biophysical seascape 2. The AINPs network should minimize the average and maximum distances between AINPs 3. The AINPs should be replicated within biogeographic provinces to capture along-axis variation in faunal composition 4. Each AINP within the network should include a core area of sufficient length and width to maintain viable populations and ecosystem function. 5. Each AINP unit within the network should include an appropriately sized buffer zone to protect core areas from indirect mining effects 6. Projected biophysical conditions (temperature, pH, dissolved O2 7. concentrations, and POC flux to the seafloor) in AINPs should include the range of current conditions across the study area. The current list of AINPs (Article 35) does not follow the best scientific advice. Provision also needs to be made for situations where new scientific information or data indicates that new areas need to be considered as AINPs (or indeed SINPs).
11	309	Para 37: As for AINPS, the rationale for identifying SINPs is not clear or transparent. Also, it is not clear how the SINPs related to other existing areas, such as APEIs or EBSAs.
12	313	Para 38: This REMP should include all known or inferred VMEs, including cold-water coral reefs, CWC gardens, sponge grounds or other VME-like ecosystems. As in Dunn et al. (2018), the REMP should also define targets for representativity and other criteria. The objectives should include the protection of a representative amount (30, 50%, 100%) of key habitats within the area (e.g., spreading ridges, active and inactive vents, seamounts, transform faults, etc.). Active hydrothermal vents and other vulnerable marine ecosystems are at risk of serious harm from SMS mining activities should be 100% included.
12	329	Para 40, point c) The sizes of the buffer zones should be defined here
12	348	Para 41, point d) “described and assessed against the criteria for SINPs” - who has responsibility for this? Who validates it? An expert workshop process?
13	383	Para 48, point a) This should include exploration as well as exploitation activities
13	387	Para 48, point c) “serious harm” needs to be defined - not only for clarity, but also to guide the delimitation of effective thresholds
13	398	Para 48, point c) Add an additional bullet point to the list to include “acceptable levels of in-situ resuspension of particulate content”
14	402	Para 49, point a) It is not clear if this refers to active vent sites that have not been classified as SINPs. If mining on active vent sites is not permitted then this statement should be deleted.
14	406	Para 49, point b) Modalities/metrics for “monitoring” should be defined, for example diversity, population density, etc.
14	415	Para 49, point e) is poorly worded and requires clarification
14	445	Para 49, point p) “Significant biological events” requires definition
14	437	Para 49, point m) should be consistent with other international legislation - e.g., ballast water regulation, etc.
15	457	Para 50, point b) “Oceanographic models” - this could specify the deep water circulation through the ridge conduits e.g. central valley, fracture

		zones that would guide a better understanding of plume dispersion and patterns of species connectivity through larval transport
15	457	Para 50, point b) Oceanographic observations should be carried out at different times of the year to cover seasonal changes in productivity and hydrodynamic conditions. They should also take into account changes in ocean circulation, seawater temperature and pH due to climate change and the AMOC variability. This can only be achieved through close cooperation with the scientific community and the transatlantic AMOC monitoring programmes.
15	462	Para 50, point c) "Diversity": Beta diversity spatial analyses should be highlighted here. It should demonstrate spatial differences in species composition which in turn relate to all protection measures
15	464	Para 50, point d) Any existing connectivity models are limited by scientific understanding of larval biology as this has a very significant role determining species dispersal potential (Gary et al. 2020). This knowledge gap should be recognised. Furthermore, the great potential of the latest population genomic approaches to assess population connectivity should be noted here. The iAtlantic project is currently assessing transatlantic population genetics of hydrothermal vent species and through this hoped to be in a position to publish very relevant new research on this issue. iAtlantic has also been assessing the stability of vent mussel assemblages at the Lucky Strike vent field finding unexpectedly high levels of stability between 2012-2019, contrasting to the paradigm that vents are normally ephemeral and highly dynamic environments. Gary SF, Fox AD, Biastoch A, Roberts JM, Cunningham SA (2020) Larval behaviour, dispersal and population connectivity in the deep sea. Nature Scientific Reports 10:10675
16	522	Para III, point d) Development of other thresholds: Thresholds should be identified through a phased approach, in collaboration with contractors, scientific communities and other relevant international bodies. Particular relevance should be given to thresholds in metal toxicity in the return water for different biota (benthic/pelagic) under different conditions of temperature and pH. Estimating thresholds considering climate change is particularly important as changes in temperature and pH may change the toxicity of trace metals (e.g. Hauton et al 2017; Millero et al 2009) • Millero, F J., et al. (2009) Effect of ocean acidification on the speciation of metals in seawater. Oceanography, 22.4: 72-85. • Hauton, C. et al. (2017) Identifying toxic impacts of metals potentially released during deep-sea mining—a synthesis of the challenges to quantifying risk. Frontiers in Marine Science, 4, 368.