The Atlantic Regional Environmental Management Plan (REMP) Project

European Maritime and Fisheries Fund (EMFF)

Subcontractors : Environmental Resources Management Ltd, UK, Jose Angel Alvarez Perez (Brazil), Alexander Turra (Brazil)

Written by P. Weaver, Seascape Consultants Ltd

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Contact: CINEA EMFF CONTRACTS

E-mail: CINEA-EMFF-CONTRACTS@ec.europa.eu

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The Atlantic Regional Environmental Management Plan (REMP) Project

Final Report

Service Contract
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ABSTRACT

The Atlantic REMP Project, was led by Seascape Consultants Ltd and worked closely with the secretariat of the International Seabed Authority (ISA) to support its efforts to develop a Regional Environmental Management Plan (REMP) for the Area in the North Atlantic, focusing on the polymetallic sulphide deposits of the Mid-Atlantic Ridge. The project supported three meetings:

1. To assess how other offshore industries are managed from an environmental perspective that took place in Paris in May 2019
2. To review all relevant scientific information that took place in Évora, Portugal in November 2019
3. To identify potential management measures based on the scientific review, including spatial and non-spatial measures, that could be included in the REMP that place by video conference in November/December 2020

The meetings were provided with a detailed Regional Environmental Assessment (REA) and data report, both produced by the project. The report from the 3rd meeting is being considered by the ISA's Legal and Technical Commission to produce a draft REMP for approval by the ISA's Council.

Additionally, a data report was compiled for the mid-ocean ridge area in the South Atlantic and a special issue publication in Frontiers in Marine Science is being produced to encourage papers on ocean ridges worldwide. An analysis of other stakeholders in the North Atlantic was produced as well as a review of their stakeholder consultation approaches.

EXECUTIVE SUMMARY

Background

The Atlantic Ocean has the potential to produce considerable mineral wealth in the form of polymetallic sulphides (PMS) deposits (also known as seafloor massive sulphides, SMS). These are found at some locations along the mid-ocean ridges and can contain zinc, lead, copper, gold and silver, often in higher proportions than found in many terrestrial mines. Whilst some of these resources lie within the Exclusive Economic Zones (EEZs) and extended continental shelves (ECSs) of Atlantic nations, a considerable portion of the Mid-Atlantic Ridge (MAR) lies in international waters, known as the Area. The Area is administered by the International Seabed Authority (ISA), which is a body affiliated with the United Nations and based in Kingston, Jamaica (http://www.isa.org.jm). The ISA has a unique, legally mandated opportunity to establish a comprehensive framework for commercially and environmentally responsible management of the emerging deep-sea mining industry and is currently developing its regulations to govern the mining activities. These regulations will include mechanisms for protecting the marine environment from harmful effects. At the regional scale this will involve the development of Regional Environmental Management Plans (REMPs).

The ISA Council discussed the need for a strategy to develop REMPs during its session in March 2018 (ISA document number ISBA/24/C/3). The Council agreed with the strategy proposed, which called for a 'coherent and coordinated approach' undertaken under the auspices of the ISA. The Council also supported the expansion by the ISA's secretariat of the breadth and depth of its strategic partnerships with relevant organisations and researchers, including exploring opportunities for new strategic partnerships, as the availability of data was a driver of the development of REMPs. In endorsing the need to develop a series of REMPs, the Council identified the Mid-Atlantic Ridge as a priority area (ISA document number ISBA/24/C/8). In 2019 the ISA issued a document providing "Guidance to facilitate the development of Regional Environmental Management Plans (REMPs)".

In 2018 the European Commission funded this project to work with the ISA to develop a draft REMP for the Mid-Atlantic Ridge. The project builds on the SEMPIA project that was funded by the EU in 2015 and 2016 to consider how a management plan for the North Atlantic could be developed. The project was awarded to a partnership of scientific organisations led by Seascape Consultants Ltd, who have worked in close collaboration with the ISA. The objective of REMPs is to provide the relevant organs of the ISA, as well as contractors to the ISA and their sponsoring States, with a proactive area-based management tool to support informed decision-making that balances resource development with conservation (ISA document number ISBA/24/C/3).

After consultation with the ISA it was agreed to work towards developing a REMP for the North Atlantic MAR, though the exact boundaries of the REMP remain to be defined by the ISA. Guided by the ISA and for the purposes of this project the working area was defined as extending from the southern end of the Icelandic extended continental shelf claim to the Romanche Fracture Zone at around 0° latitude, excluding the area of the Portuguese extended continental shelf claim around the Azores Islands and the Brazilian Exclusive Economic Zone (EEZ) around the islands of St Peter and St Paul (Figure 1). The final geographical scope of the REMP requires confirmation by the Legal and Technical Commission of the ISA.

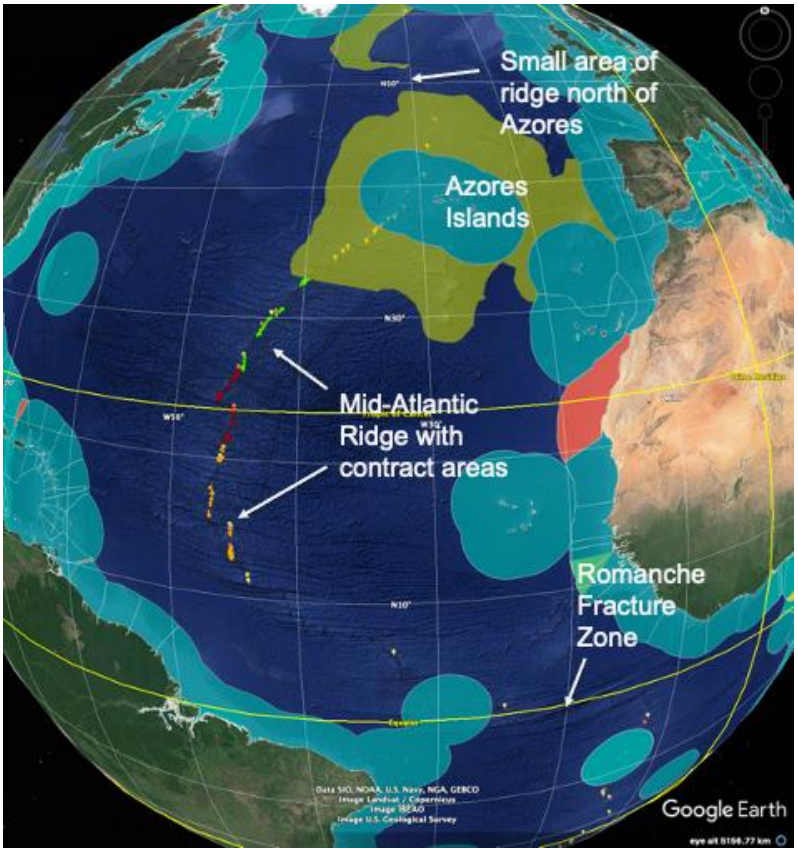


Figure 1. The geographic area under consideration for the development of the REMP. It extends along the Mid-Atlantic Ridge from the southern boundary of the Icelandic extended continental shelf (ECS) claim (green shading) to the Romanche Fracture Zone just south of the equator, exclusive of the Portuguese extended continental shelf (ECS) claim north and south of the Azores (green shading) and the Brazilian Exclusive Economic Zone (EEZ) around the islands of St Peter and St Paul (blue shading). Boundaries on this map should not be taken as confirmed and the reader is directed to the disclaimers associated with the data sources. Data compiled from Google Maps with maritime boundaries from the Flanders marine Institute (www.marineregions.orghttps://doi.org/10.14284/312).

Ecosystems along the MAR

The MAR represents an area where tectonic plates are moving apart, and new oceanic crust is being formed. This means that the substrate along the ridge axis is rocky. As the new crust is pushed progressively away from the ridge axis by seafloor spreading, sediment accumulates firstly in hollows but eventually blanketing the whole area. The MAR hosts a variety of diverse ecosystems that are controlled by the substrate as well as multiple factors such as water depth, food supply, and water mass characteristics. At certain locations along the ridge axis, volcanic activity drives the expulsion of hydrothermal fluids which sustain globally unique communities of organisms. In the Atlantic these communities are often dominated by dense aggregations of vent shrimp and mussels that are dependent on chemical compounds in the vent fluids rather than sunlight for their survival (Figure 3). Similar hydrothermal vent communities can be found all along this section of the North Atlantic MAR, although they differ from vent communities in other oceans.

The linear nature of mid-ocean ridges and intermittent occurrence of hydrothermally-active areas along ridges pose challenges to the populations of these specialised communities, whose populations need to be able to connect from one hydrothermal vent site to another. Areas with

low levels of hydrothermal venting together with inactive vent sites are poorly characterised but may support diverse and complex seafloor communities. Elsewhere along the MAR axis rocky substrates are common, and can support habitat-forming species, such as corals and sponges, that in turn host larger complex biological communities. Sedimented areas may also host rare organisms or groups of organisms such as acorn worms.

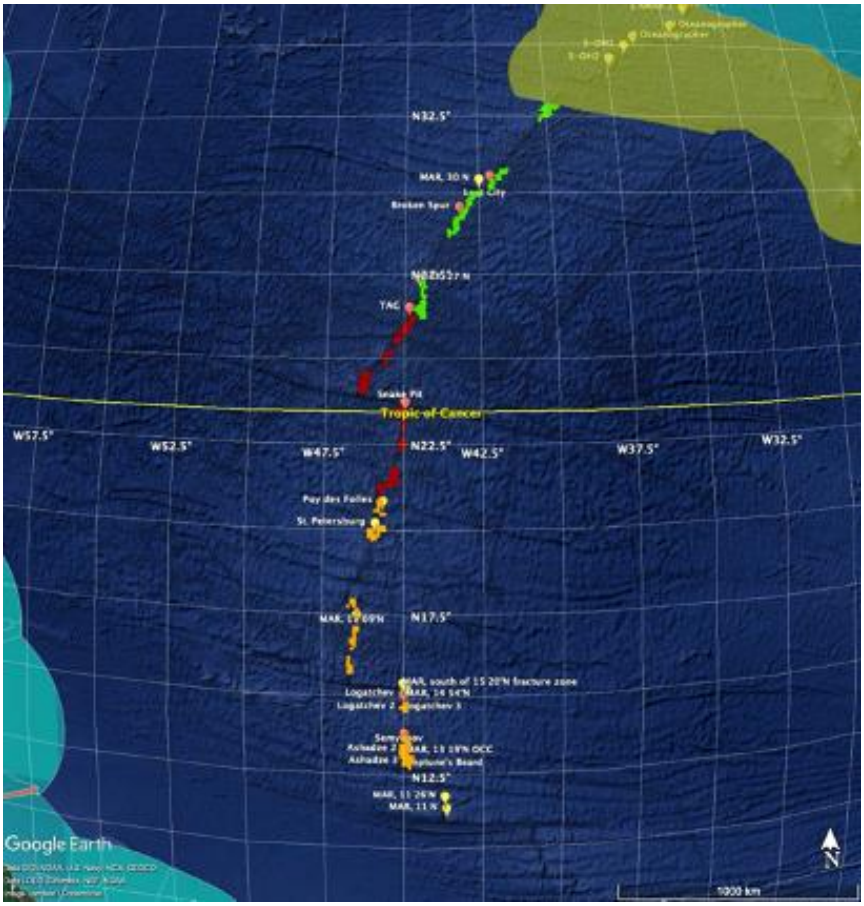


Figure 2 Contract blocks for exploration held by Poland (green), France (red) and Russia (yellow). Also shown are the known active hydrothermal vent sites distributed along the ridge axis.

Figure 3 Vent mussels, shrimp and crabs from the Mid-Atlantic Ridge © MISSÃO SEHAMA, 2002 (funded by FCT, PDCTM 1999/MAR/15281) (Photographs taken by VICTOR6000/IFREMER).

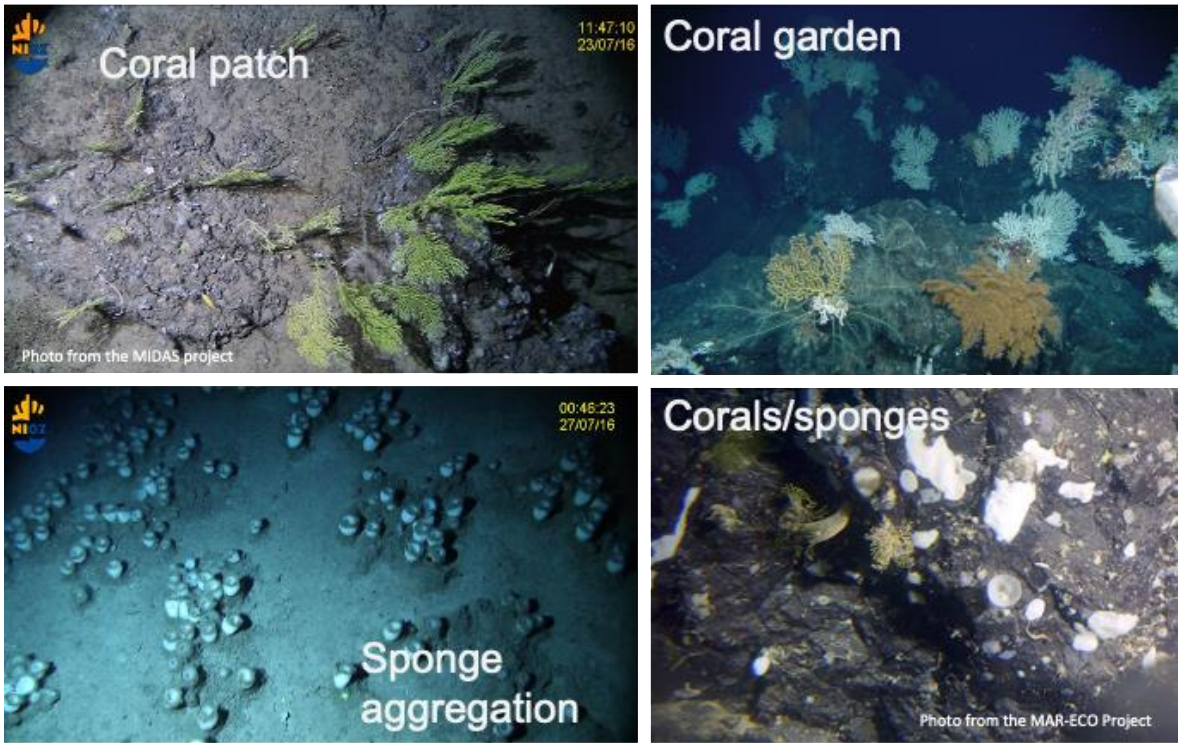


Figure 4 Coral and sponge beds mainly attached on hard substrates. If significant occurrences of these and potentially other organisms are encountered they may need protection as vulnerable marine ecosystems.

The objective of REMPs developed by the ISA is to identify vulnerable marine ecosystems, such as those described above, and prevent harmful effects on them whilst facilitating mining activities elsewhere along the MAR. How this was progressed for the North Atlantic is outlined below.

Steps in the process of REMP development

Project work in the North Atlantic to support the preparation of a draft REMP comprised the following steps:

1. Organisation of a workshop in collaboration with the ISA to assess how other offshore industries are managed from an environmental perspective. This took place in Paris in May 2019.
2. Compilation of all available data in the area and production of a North Atlantic data report. This was made available for the Évora workshop – see below;
3. Carrying out a Regional Environmental Assessment to provide a synthesis of all relevant information including geology, physical oceanography, biology, the expected mining process, and potential for cumulative impacts. This was made available for the Évora workshop – see below;
4. Assisting the ISA in organizing a workshop (with participation of selected scientists and stakeholders through the ISA's nomination process) to provide a scientific review of the information from steps 1-2. This took place in Évora, Portugal in November 2019;
5. Assisting the ISA in organizing a second workshop (with participation of selected scientists and stakeholders through ISA's nomination process) to review the outcomes from steps 1-4 and identify potential management measures, including spatial and non-spatial measures that could be included in a draft REMP. This took place by video conference in November/December 2020;

The Évora workshop was a great success and drew heavily on the REA and data report in its review of the scientific background for developing a REMP on the Mid-Atlantic Ridge of the North Atlantic. The workshop progressed along three lines of discussion:

- Scenario planning for adaptive management
- Area based management
- Approaches for addressing cumulative impact assessment

Collectively the discussions identified the key ecosystems that would need attention in a REMP and some key areas that would need consideration for protection. The outcomes of this workshop were presented to the Isa's Legal and Technical Commission (LTC) in February 2020 and were well received.

The November 2020 workshop took the outcomes of the Évora science meeting and used them to identify measures for consideration in the development of the REMP. Two main categories were discussed, namely:

- Area-based management measures
- Non-area-based management measures

The meeting benefitted from several participants who had direct experience of managing deep-sea ecosystems (Secretary of NEAFC, Executive Secretary of NAFO), working within a regulated offshore regime (senior advisor sustainability, hydrocarbon industry) or working as an environmental specialist in land-based mining. The workshop therefore took the scientific concerns described in the Évora report and considered how they could form a management plan.

The report from the meeting identifies **Areas in Need of Protection**, such as the large fracture zones, and **Sites in Need of Protection,** such as the active hydrothermal vents. It also suggests that exploration is likely to reveal habitat that would be regarded as Vulnerable Marine Ecosystems (VMEs) by fishery bodies e.g., coral aggregations and sponge beds, and that these should be considered for protection once identified. In this way protection of the marine environment by the ISA and fishery bodies would have a common foundation. The ISA would need to develop its thresholds for defining such habitat and mechanisms for protection and monitoring. Thresholds would also need to be determined for the level of impact that could be tolerated by each protected ecosystem in terms of particulate load and toxicity of the plume. Buffer zones around all areas in need of protection were discussed and if adopted their dimensions would depend on the impact thresholds. Issues related to impact on midwater ecosystems were discussed but are more difficult to deal with due to lack of knowledge of both the ecosystem and the mining process. The report notes that the development of good technology could significantly reduce impacts through limiting plume generation.

The report from the final virtual workshop of November/December 2020 was provided to the LTC in February 2021 by the ISA Secretariat for them to use as a basis for the development of a draft REMP. It is anticipated that the draft REMP will be generated by the LTC in their spring meeting in 2022, following which there will be a period of public consultation before either amendment or approval by the ISA Council.

Other project activities

The project has produced a data report for the South Atlantic covering the area of the Mid-Atlantic Ridge from the Equator to the northern end of the EEZ of Tristan da Cuna at around 34°S, excluding the EEZ of Ascension Island. This data report includes 130 maps of datasets and analyses pertaining to the southern Mid-Atlantic Ridge and surrounding ocean areas. This report may be used at a later date to aid the development of any REMP which the ISA chooses to define in this area.

A review of stakeholders and their activities in the North Atlantic was carried out. These stakeholders can be broadly grouped into those with commercial activities, States (plus the European Union), UN and other intergovernmental organisations, and NGOs who are observers to the ISA. In addition, a review was undertaken of the stakeholder engagement strategies of the United Nations bodies that operate in the North Atlantic. The largest bodies (UNEP, CBD and the IMO) have the most developed strategies and these work well. The smaller regional bodies (OSPAR, NEAFC and NAFO) have less well-developed strategies.

A number of publications will be produced by the project.

1. The Regional Environmental Assessment is regarded as an extremely useful document and the ISA are in the process of publishing it, with support from the project. It will be part of the ISA's Technical Series (ISA Technical Study No 28).

2. A paper was published in Frontiers in Marine Science with the title "Northern Mid-Atlantic Ridge Hydrothermal Habitats: A Systematic Review of Knowledge Status for Environmental Management". This paper provides a revised taxa list of benthic invertebrates associated with hydrothermally active habitats and provides a biogeographic analysis of active vent fields together with identification of key knowledge gaps in relation to management.
3. A Special Issue of scientific papers related to mid Ocean ridges is being produced in the journal Frontiers in Marine Science. The topic of the Special Issue is "Understanding Ocean Ridges, a New Frontier for Science and Development" and the editors are P. Weaver (Seascape Consultants), D. Billett (Deep Seas Environmental Solutions), Pei-Yuan Qian (Hong Kong University) and J. Sarrazin (IFREMER). A total of 25 papers are expected to be contributed.

EXECUTIVE SUMMARY IN FRENCH

Le Plan Régional de Gestion Environnementale (REMP) de l'Atlantique

L'océan Atlantique abrite une quantité considérable de ressources minérales incluant des gisements de sulfures polymétalliques. Ceux-ci sont disséminés le long des dorsales médio-océaniques et peuvent être riches en zinc, plomb, cuivre, or et argent, souvent dans des proportions plus élevées que celles de plusieurs mines terrestres. Alors que certaines de ces ressources se trouvent dans les zones économiques exclusives (ZEE) et dans la zone d'extension des plateaux continentaux des nations atlantiques, la majeure partie de la dorsale médio-Atlantique se déploie dans les eaux internationales, appelées « la Zone » par la Convention des Nations Unies sur le droit de la mer.

La Zone est administrée par L'autorité Internationale des Fonds Marins (AIFM), un organisme affilié aux Nations Unies et basé à Kingston en Jamaïque (www.isa.org.jm). L'AIFM se trouve dans une conjoncture unique puisqu'elle est légalement mandatée pour établir les tous premiers plans de gestion environnementale écologiquement responsables pour l'exploitation des ressources des environnements marins profonds, destinés à une industrie minière émergente. Par ailleurs, le AIFM est en train d'élaborer la réglementation qui permettra de régir les activités minières dans ces milieux. Cette réglementation comprendra des mécanismes de protection des écosystèmes marins contre les effets néfastes de telles activités. À l'échelle régionale, cela impliquera l'élaboration de plans régionaux de gestion de l'environnement (Regional Environmental Management Plans (REMPs)).

La nécessité d'élaborer une stratégie pour favoriser le développement de ces REMP a été discutée par le Conseil de le AIFM lors de sa session de mars 2018 (document le AIFM numéro ISBA/24/C/3). La stratégie proposée et adoptée par le Conseil appelle à initier une « approche cohérente et coordonnée » sous les auspices de le AIFM. La disponibilité des données étant un moteur du développement des REMP, le Conseil a également soutenu l'élargissement, par le secrétariat de le AIFM, de ses partenariats stratégiques avec les organisations et chercheurs concernés ainsi que l'exploration de nouveaux partenariats. En approuvant le développement d'une série de REMP, le Conseil a identifié la dorsale médio-Atlantique comme zone prioritaire (document AIFM numéro ISBA/24/C/8). En 2019, un document fournissant des « Guidance to facilitate the development of Regional Environmental Management Plans (REMPs) » (Conseils pour faciliter le développement des Plans Régionaux de Gestion Environnementale – REMPs) a été rédigé.

En 2018, un projet pour travailler, de concert avec le AIFM, à l'élaboration d'un REMP pour la dorsale médio-Atlantique a été financé par la Commission européenne. Le projet s'appuie sur le projet SEMPIA qui a été financé par l'UE en 2015 et 2016 pour examiner comment un plan de gestion pour l'Atlantique Nord pourrait être développé. Ce projet a été attribué à Seascape Consultants Ltd., une compagnie privée qui fait appel à plusieurs organisations scientifiques et travaille en étroite collaboration avec le AIFM. L'objectif de ces REMP est de fournir aux organes compétents de le AIFM, ainsi qu'à ses contractants et leurs États souverains, un outil de gestion proactif par zone, permettant une prise de décision éclairée et l'atteinte d'un équilibre entre développement des ressources et conservation de l'environnement (numéro de document AIFM ISBA/24/C/3).

Après consultation avec le AIFM, il a été convenu de travailler à l'élaboration d'un REMP pour la partie nord de la dorsale médio-Atlantique, bien que les limites exactes de ce REMP restent à définir. Guidé par le AIFM et aux fins de ce projet, la zone de travail a été définie comme s'étendant de l'extrémité sud de la revendication de l'extension du plateau continental de

l'Islande jusqu'à la zone de fracture de Romanche à environ 0° de latitude, à l'exception de la zone de revendication de l'extension du plateau continental du Portugal autour des îles des Açores et de la zone économique exclusive (ZEE) brésilienne autour des îles de Saint-Pierre et Saint-Paul (Figure 1). Une approche similaire a été suivie lors d'une seconde réunion en novembre 2020. L'étendue spatiale finale du REMP doit être confirmée par la Commission Juridique et Technique (LTC) de le AIFM.

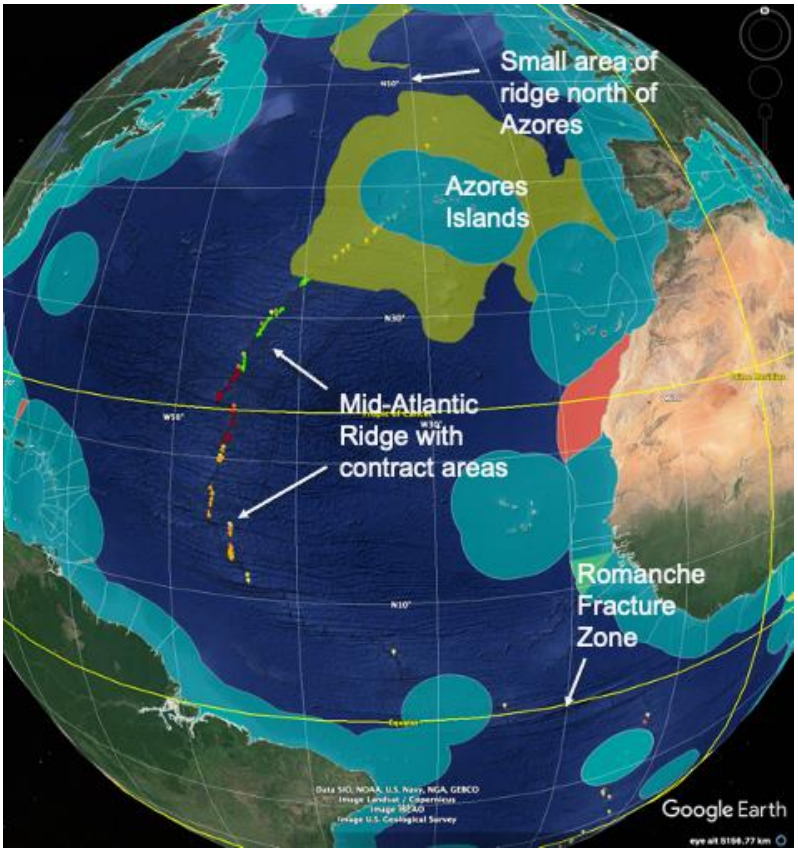


Figure 1. La zone géographique considérée pour le développement du REMP de l'Atlantique nord. Il s'étend le long de la dorsale médio-Atlantique depuis la limite sud de la revendication de l'extension du plateau continental islandais (zone ombrée en vert) jusqu'à la zone de fracture de Romanche au sud de l'équateur, à l'exclusion du plateau continental étendu (PCE) revendiqué par le Portugal au nord et au sud des Açores (zone ombrée en vert) et de la zone économique exclusive (ZEE) du Brésil autour des îles de Saint-Pierre et Saint-Paul (zone ombrée en bleu). Les limites sur cette carte ne doivent pas être considérées comme confirmées et le lecteur est invité à se référer aux producteurs de ces sources de données. Les données ont été compilées à partir de Google Maps avec les limites maritimes données par le « Flanders Marine Institute » (www.marineregions.orghttps://doi.org/10.14284/312).

Écosystèmes le long de la dorsale médio-Atlantique

La dorsale médio-Atlantique est une zone où les plaques tectoniques se séparent et où une nouvelle croûte océanique se forme. Cela signifie que le substrat le long de l'axe de la dorsale est rocheux. Au fur et à mesure que cette nouvelle croûte s'éloigne par l'extension du plancher océanique, les sédiments s'accumulent d'abord dans les creux puis finissent par recouvrir la zone, à plus ou moins grande distance de la dorsale. Grâce à cette diversité géologique, la dorsale médio-Atlantique abrite une variété d'écosystèmes dont la structure est contrôlée par la nature du substrat ainsi que par de multiples facteurs tels que la profondeur, les apports en nourriture et les caractéristiques des masses d'eau. À certains endroits, l'activité volcanique entraîne l'expulsion de fluides hydrothermaux de haute température qui soutiennent des communautés d'organismes endémiques uniques au monde. Dans l'Atlantique nord, ces communautés sont dominées par des agrégations denses de crevette et de moules qui dépendent, via un processus appelé chimiosynthèse, des composés chimiques contenus dans ces fluides chauds plutôt que de la lumière du soleil pour leur survie (Figure 3). Ces communautés hydrothermales sont présentes de façon irrégulière tout le long de la dorsale médio-Atlantique et leur composition diffèrent de celle des communautés hydrothermales des autres océans.

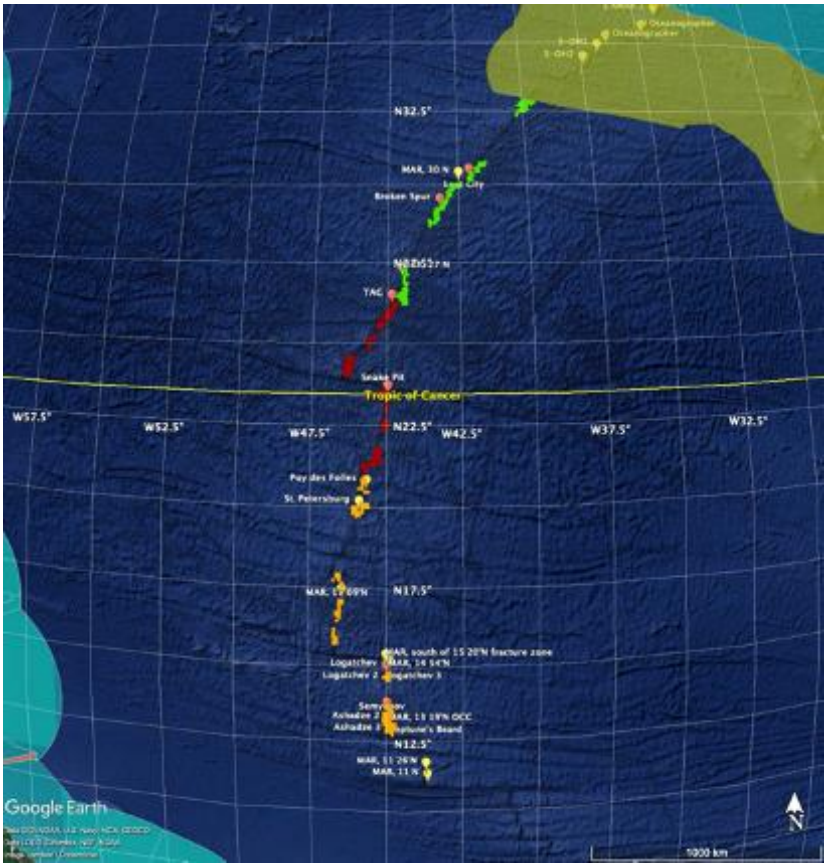


Figure 2. Blocs de contrats d'exploration détenus par la Pologne (en vert), la France (en rouge) et la Russie (en jaune). Sont également représentées les sources hydrothermales actives connues, réparties le long de l'axe de la dorsale.

La nature linéaire des dorsales médio-océaniques et l'occurrence intermittente de zones hydrothermales actives posent des défis à ces communautés de faune spécialisée, dont les

populations doivent pouvoir se disséminer d'une source hydrothermale active à une autre. Les zones de faibles niveaux d'activité ainsi que les sites inactifs sont mal caractérisés mais semblent abriter de riches communautés qui diffèrent significativement de celles des sources actives.

Figure 3. Moules, crevettes et crabes colonisant les sources hydrothermales actives de la dorsale médio-Atlantique © MISSÃO SEHAMA, 2002 (financée par FCT, PDCTM 1999/MAR/15281). Photographies prises par le ROV Victor6000/Ifremer.

Ailleurs le long de l'axe de la dorsale, les substrats rocheux sont abondants et peuvent abriter des espèces formatrices d'habitats, telles que les coraux et les éponges, qui hébergent de complexes communautés biologiques. Les zones sédimentaires peuvent également être colonisées par des organismes rares ou des groupes d'organismes tels que les vers entéropneustes.

L'objectif du REMP est d'identifier les écosystèmes marins vulnérables, tels que ceux décrits ci-dessus, et de prévenir les effets néfastes sur eux tout en facilitant les activités minières ailleurs le long de la MAR. Comment cela a été réalisé est décrit ci-dessous.

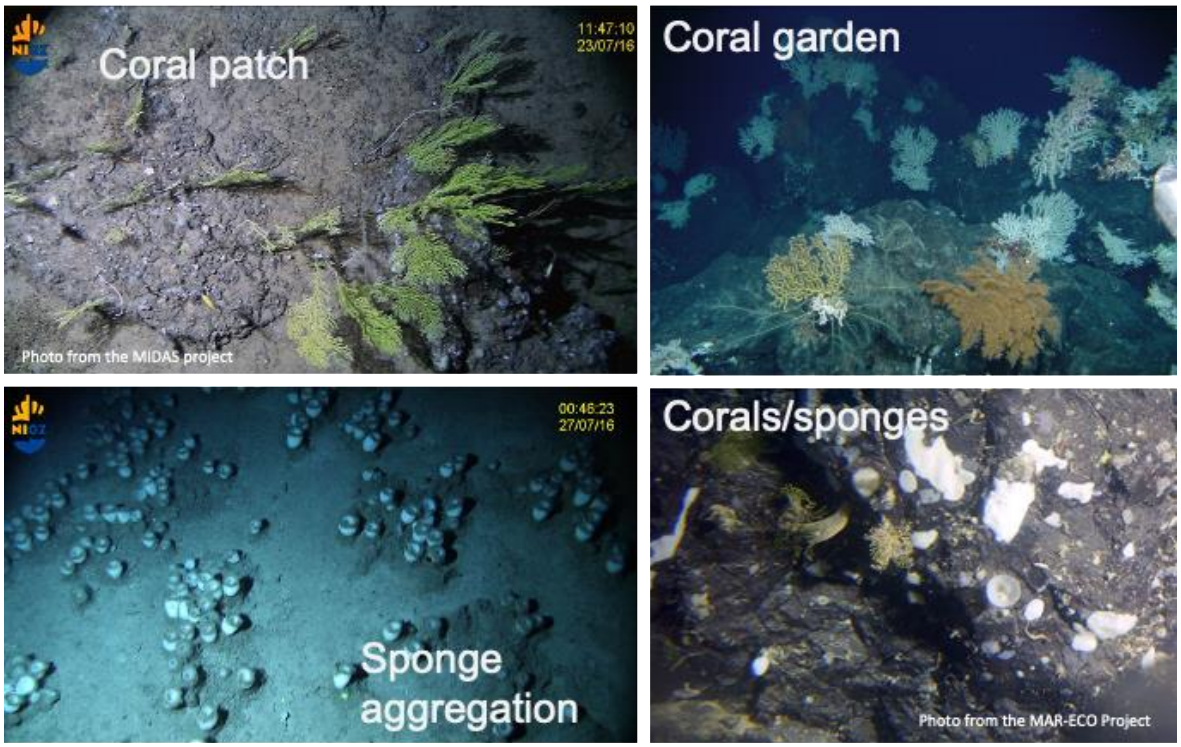


Figure 4. Agrégations de coraux et d'éponges principalement fixés sur des substrats durs. Si des occurrences importantes de ces taxons et potentiellement d'autres organismes sont rencontrées, ils pourraient avoir besoin d'être protégés en tant qu'écosystèmes marins vulnérables (EMV).

Étapes du processus de développement du REMP

Les travaux du projet pour soutenir la préparation d'un projet de REMP dans l'Atlantique nord ont compris les étapes suivantes :

1. Organisation d'un atelier en collaboration avec AIFM pour évaluer comment les autres industries « offshore » sont gérées d'un point de vue environnemental. Cet atelier a eu lieu à Paris en mai 2019.
2. Compilation de toutes les données disponibles dans la région et production d'un rapport de données sur l'Atlantique nord. Celui-ci a été mis à disposition pour l'atelier de travail qui a eu lieu à Évora – voir ci-dessous;
3. Réalisation d'une évaluation environnementale régionale permettant de compiler une synthèse de toutes les informations pertinentes, y compris la géologie, l'océanographie physique, la biologie, les processus d'exploitation minière envisagés et l'évaluation des impacts cumulatifs. Cette synthèse a été mise à disposition pour l'atelier d'Évora – voir ci-dessous;
4. Aide à l'organisation d'un atelier (avec la participation de scientifiques et de parties prenantes sélectionnés à travers le processus de nomination de AIFM) pour examiner les résultats des étapes 1 et 2. Cet atelier a eu lieu à Évora, au Portugal, en novembre 2019;

5. Aide à l'organisation d'un deuxième atelier (avec la participation de scientifiques et de parties prenantes sélectionnés à travers le processus de nomination de AIFM) pour examiner les résultats des étapes 1 à 4 et identifier les mesures potentielles de gestion, y compris des stratégies de gestion spatialisées et non spatialisées qui pourraient être incluses dans un projet de REMP. Cet atelier a eu lieu par visioconférence en novembre/décembre 2020;

L'atelier d'Évora a été un grand succès et s'est fortement inspiré de l'évaluation environnementale régionale et du rapport de données sur le contexte scientifique pour l'élaboration d'un REMP sur la dorsale médio-Atlantique nord.

L'atelier s'est déroulé selon trois axes de discussion :

- Élaboration de scénarios pour une gestion adaptative
- Mesures de gestion par zone
- Identification d'approches pour l'évaluation des impacts cumulatifs

Collectivement, les discussions ont identifié les écosystèmes clés qui méritent attention dans un REMP ainsi que certains domaines prioritaires qui devront être pris en considération pour assurer la protection de ces milieux. Les résultats de cet atelier ont été présentés à la Commission Juridique et Technique (LTC) de le AIFM en février 2020 et ont été bien reçus.

L'atelier de novembre 2020 a utilisés les résultats de la réunion scientifique d'Évora pour identifier des stratégies de gestion à prendre en compte dans le développement du REMP. Deux catégories principales ont été discutées, à savoir

- Mesures de gestion par zone
- Mesures de gestion non basées sur la zone

La réunion a rassemblé plusieurs participants ayant une expérience directe de la gestion d'écosystèmes marins profonds (Secrétaire de NEAFC, Secrétaire exécutif de NAFO), travaillant au sein d'un régime *offshore* réglementé (conseiller principal durabilité, industrie pétrolière) ou travaillant comme spécialiste de l'environnement dans l'exploitation minière terrestre. L'atelier a donc considéré les préoccupations scientifiques décrites dans le rapport d'Évora et examiné comment elles pourraient être prises en compte dans un plan de gestion. Le rapport de cette réunion identifie les zones nécessitant une protection, telles que les zones de fracture majeures et les sources hydrothermales actives. Ce rapport mentionne également que l'exploration est susceptible de révéler des habitats qui sont considérés comme des écosystèmes marins vulnérables (EMV) par les organisations de pêche, par exemple les agrégations de coraux et les jardins d'éponges, et que ceux-ci devraient être pris en compte pour assurer leur protection une fois identifiés.

Ainsi, la protection de l'environnement marin par le AIFM et les organisations de pêche aurait un socle commun. Le AIFM devra développer ses propres seuils pour la définition de ces habitats et proposer des mécanismes de protection et de surveillance. Des seuils devraient également être déterminés pour le niveau d'impact qui pourrait être toléré par chaque écosystème protégé en termes de charge particulaire et de toxicité du panache. Des zones tampons autour de toutes les zones nécessitant une protection ont été discutées et si elles étaient adoptées, leurs dimensions dépendraient des seuils d'impact. Les problèmes liés à l'impact sur les écosystèmes pélagiques ont été discutés mais sont plus difficiles à traiter en raison du manque de connaissance à la fois de l'écosystème et aussi des procédés utilisés par l'exploitation

minière en milieu marin profond. Le rapport note que le développement d'une bonne technologie pourrait réduire considérablement les impacts en limitant la génération du panache.

Le rapport de l'atelier virtuel final du Novembre/Decembre 2020 a été fourni à la Commission Juridique et Technique (LTC) en février 2021 par le secrétariat de le AIFM pour qu'il puisse l'utiliser comme base pour l'élaboration d'un projet de REMP. Il est prévu que le projet de REMP soit généré par cette Commission lors de sa réunion au printemps 2022, à la suite de laquelle il y aura une période de consultation publique avant d'être amendé ou approuvé par le Conseil de le AIFM.

Autres activités du projet

Ce projet de REMP a également contribué à la production d'un rapport de données pour l'Atlantique sud couvrant la dorsale médio-Atlantique, de l'équateur à l'extrémité nord de la zone économique exclusive de Tristan da Cuna à environ 34°S, à l'exception de la zone économique exclusive de l'île de l'Ascension. Ce rapport de données comprend 130 cartes d'ensembles de données et d'analyses concernant la dorsale médio-atlantique méridionale et les zones océaniques environnantes. Il pourra contribuer au développement de tout REMP envisagé par le AIFM dans cette région.

Un examen des activités des parties prenantes dans l'Atlantique Nord a été effectué. Ces parties prenantes peuvent être globalement regroupées en 4 groupes : (i) celles ayant des activités commerciales, (ii) les États (plus l'Union européenne), (iii) les Nations Unies et d'autres organisations intergouvernementales, et (iv) les ONG qui sont un rôle d'observateurs auprès de le AIFM. En outre, un examen des stratégies d'engagement des parties prenantes des organismes des Nations Unies qui opèrent dans l'Atlantique Nord a été entrepris. Les plus grands organismes (PNUE, CDB and l'OMI) ont les stratégies les plus développées et celles-ci fonctionnent bien. Les organismes régionaux plus petits (OSPAR, CPANE et l'OPANO) ont des stratégies moins bien développées.

Un certain nombre de publications ont été ou seront produites par le projet.

1. L'Évaluation Environnementale Régionale est considérée comme un document extrêmement utile et le AIFM est en train de la publier, avec le soutien du projet. Il fera partie de la série technique de le AIFM (Étude technique de l'AIFM No 28).
2. Un article a été publié dans Frontiers in Marine Science sous le titre « Northern Mid-Atlantic Ridge Hydrothermal Habitats: A Systematic Review of Knowledge Status for Environmental Management ». Cet article présente une liste révisée des taxons d'invertébrés benthiques associés aux habitats hydrothermaux actifs, fournit une analyse biogéographique des champs hydrothermaux actifs et identifie les principales lacunes de connaissances en matière de gestion.
3. Un numéro spécial rassemblant plusieurs articles scientifiques sur les dorsales médio-océaniques est en cours de publication dans la revue Frontiers in Marine Science. Le sujet du numéro spécial est « Understanding Ocean Ridges, a New Frontier for Science and Development » et les éditeurs sont P. Weaver (Seascape Consultants), D. Billett (Deep Seas Environmental Solutions), Pei-Yuan Qian (Hong Kong University) et J. Sarrazin (IFREMER). En tout, 25 articles devraient être publiés.

LIST OF ACRONYMS

ABMT	Area-Based Management Tools
AIFM	L'autorité Internationale des Fonds Marins
AINP	Areas In Need of Protection
APEI	Area of Particular Environmental Interest
CBD	Convention on Biological Diversity
CCZ	Clarion-Clipperton Zone
COMRA	China Ocean Mineral Resources Research and Development Association
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DSES	Deep Seas Environmental Solutions Ltd
DSM	Deep-Sea Mining
EBSA	Ecologically or Biologically Significant Marine Areas
ECS	Extended Continental Shelf
EEZ	Exclusive Economic Zones
EMV	Écosystèmes Marins Vulnérables
ERM	Environmental Resources Management Ltd
GIS	Geographic Information System
IFREMER	L'Institut Français de Recherche pour l'Exploitation de la Mer
IGO	Intergovernmental Organization
IMAR	Instituto do Mar
IMO	International Maritime Organisation
ISA	International Seabed Authority
LTC	Legal and Technical Commission
MAR	Mid-Atlantic Ridge
MGEL	Duke University Marine Geospatial Ecology
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	North East Atlantic Fisheries Commission
nMAR	northern Mid-Atlantic Ridge
OEMMR	Environmental Management and Mineral Resources
PMS	Polymetallic Sulphides
PROG	Partnership for Regional Ocean Governance
REMP	Regional Environmental Management Plan
S/A-Precaution	Sites/Areas in need of increased precaution
SEMPIA	Strategic Environmental Management Plan for the Atlantic Ocean
SINP	Sites In Need of Protection
SMS	Seafloor Massive Sulphides

SSC	Seascape Consultants Ltd
UN	United Nations
UNEP	United Nations Environment Programme
VME	Vulnerable Marine Ecosystems
ZEE	Zones Économiques Exclusives

1 OBJECTIVES OF THE PROJECT

This project works with the International Seabed Authority to facilitate the development of a Regional Environmental Management Plan (REMP) for the Area in the Atlantic Ocean. The objective of REMPs is to provide the relevant organs of the International Seabed Authority (ISA), as well as contractors and their sponsoring States, with a proactive area-based management tool to support informed decision-making that balances resource development with conservation (ISA document number ISBA/24/C/3).

Start date: 20 March 2018

Duration: 42 months

List of project participants

Name	Short Name	Position in project
Seascape Consultants Ltd, UK	SSC	Lead partner
Deep Seas Environmental Solutions Ltd, UK	DSES	Partner
Instituto do Mar (University of the Azores), Portugal	IMAR	Partner
Institute for Advanced Sustainability Studies, Germany	IASS	Partner
Duke University Marine Geospatial Ecology Lab, USA	MGEL	Subcontractor
Environmental Resources Management Ltd, UK	ERM	Subcontractor
Jose Angel Alvarez Perez, Brazil	AP	Subcontractor
Alexander Turra, Brazil	AT	Subcontractor

2 SUMMARY OF WORK DONE

2.1 List of deliverables and their submission date

Deliverable name	Submission date
D0.1 Kick-off meeting minutes	July 2018
D0.2 Inception report	February 2019
D0.3 First Interim report	March 2019
D0.4 Minutes of first Steering Committee meeting: Meeting date 10 July 2019	July 2019
D0.5 Minutes of second Steering Committee meeting	December 2019
D0.6 Second Interim report	May 2020
D0.7 Minutes of third Steering Committee meeting	October 2020
D0.8 Minutes of fourth Steering Committee meeting	July 2021
D0.9 Final report including steps towards developing a REMP in the Atlantic	September 2021
D0.10 Third Interim report New deliverable	February 2021
D1.1 Review of non-area-based environmental management measures	July 2019
D1.2 Contribution to ISA's Roadmap meeting 1 "Rules based management" Preparation of document, assistance in running the meeting and preparation of report from meeting in collaboration with the ISA	July 2019
D1.3 Update of the SEMPIA data report for the North Atlantic	February 2020
D1.4 Contribution to ISA's Roadmap meeting 2 on REMPs for sulphide areas (Indian Ocean and Atlantic) Preparation of document, assistance in running the meeting and preparation of report from meeting in collaboration with the ISA	April 2021
D1.5 Draft Regional Environmental Assessment	February 2020
D1.6 Interim transfer of data from the updated data report on the N. Atlantic plus the S. Atlantic data report to the ISA database	March 2021
D1.7. Proposal for draft REMP for nMAR **REPLACED by** **Publication of REA**	September 2021
D1.8 Contribution to ISA's Roadmap meeting 3 Developing a REMP for the N. Atlantic. Preparation of document, assistance in running the meeting and preparation of report from meeting in collaboration with the ISA	May 2021
D1.9 South Atlantic data report	January 2021
D1.10 "South Atlantic workshop on data availability and gap analysis" joint with ISA. Preparation of document, assistance in running the meeting and preparation of report from meeting in collaboration with the ISA **REPLACED by** **Final DG MARE Public Event on Project Results**	September 2021
D1.11 Final Submission of maps and other information to EMODnet	September 2021

D2.1 Stakeholder analysis of the North Atlantic	March 2021
D2.2 Review of stakeholder consultation approaches	March 2021
D2.3 Capacity building GIS training workshop to follow S. Atlantic workshop **REPLACED BY** **Special Issue of Frontiers in Marine Science**	September 2021
D3.1 Presentation at European meeting to promote the project	October 2019
D3.2 Contribution to a Special Issue on REMPs for DSM in an Open Access Journal	February 2021

2.2 Task 0: Project Management

2.2.1 Objectives

- Coordinate all project activities, with clear allocation of responsibilities for implementing tasks and subtasks;
- Ensure high-level quality control and timely delivery of results and deliverables;
- Work with the ISA to ensure the project achieves its objectives in line with ISA policy and procedures;
- Develop documentation and put in place procedures to ensure continuity of the products and services beyond the duration of the contract (Legacy Strategy).

2.2.2 Subtask 0.1: Project coordination

An Inception meeting was held between EASME/CINEA, DGs MARE, Environment and GROW, together with the ISA on 19 February 2019. This meeting discussed a revised plan of work and in which the ISA would be more closely involved with the project progress. Agreement was reached on the way forward and a revised plan of work was put forward in the Inception Report (Deliverable D0.2). The Inception Report was circulated to all the project partners and subcontractors on 8 March 2019.

Project coordination involved a considerable amount of discussion between the coordinator and the secretariat of the ISA throughout the project life. This was necessary due to the realignment of the project objectives to work closely with the ISA, and because the project has progressed contemporaneously with the ISA developing its policy on REMPs. Thus, to be effective the project had to understand these developments and align its work to maximise effectiveness. Project partners were informed of any issues that affected their work.

The ISA was also developing its ideas in relation to REMPs during the life of the project and it released two documents: ISBA/25/C/4 "*Relationship between the draft regulations on exploitation of mineral resources in the Area and regional environmental management plans*", released in December 2018, and "*Guidance to facilitate the development of Regional Environmental Management Plans (REMPs)*" issued on 6 July 2019. Although not explicitly mentioned, these documents reflect some of the work being undertaken by the Atlantic REMP project. For example, the REMP guidance document describes Regional Environmental Assessment as an important aspect of REMPs – this had not been carried out for the Clarion Clipperton Zone management plan, which is currently the ISA's only existing REMP, but was an essential part of the Atlantic REMP work.

The project coordinator maintained regular contact with the project officers in DG MARE and EASME/CINEA, providing written and verbal updates of the progress including discussion of issues such as modifying the work in response to the Coronavirus crisis.

Regular contact has been maintained with the project partners and subcontractors especially during the writing of deliverables D1.1 and D1.5 and in the lead up to the Paris and Évora workshops.

2.2.3 Subtask 0.2: Quality control

The following reports were the key outputs issued by the project and subject to review:

- Deliverable D1.1 (Review of non-area-based environmental management measures) was reviewed by scientists within the project and by Dr Gordon Paterson (Natural History Museum, UK) – a biologist with a strong reputation in marine biology and who is a member of the ISA's Legal and Technical Commission. Available on ISA website www.isa.org.jm/files/files/documents/paris_meeting_report_for_webposting.pdf
- Deliverable D1.3 (North Atlantic Data Report): Discussions were held with our subcontractors at Duke University to ensure high quality of the data report. The document was reviewed by Seascape, the ISA secretariat and the expert scientists who participated in the Évora workshop. Available on the ISA website https://www.isa.org.jm/files/documents/data_report-feb2020-reduc.pdf
- Deliverable D1.5 (Regional Environmental Assessment of the Northern Mid-Atlantic Ridge) was reviewed by scientists in the project, and by external experts Prof. Cindy van Dover (Duke University) and Dr Gordon Paterson. It was also reviewed by the expert scientists who attended the Évora workshop. Available on the ISA website https://www.isa.org.jm/files/documents/rea-feb2020-reduc.pdf
- Deliverable D1.9 (the South Atlantic data report) was reviewed by project partners and sub-contractors.
- Deliverable D2.1 (Stakeholder Analysis of the North Atlantic) was reviewed by the ISA.

2.2.4 Subtask 0.3: Risk management

The project's Risk Register was produced at the beginning of the project and revised in the light of the modified work programme detailed in the Inception Report.

The plan of activities for REMP development issued by the ISA was on a shorter timescale than had been anticipated in the Inception Report. This put time pressure on the writing of the Regional Environmental Assessment document (Deliverable 1.5). This risk was identified and subcontracts put in place to bring in additional scientific expertise to write two sections of the report. One partner scientist could not make the Evora workshop for health reasons and a substitute was contracted to replace him.

The Coronavirus outbreak led to a number of adjustments in the project implementation plan:

- The St Petersburg meeting (Deliverable D1.8) did not take place as planned in summer 2020 and was replaced by an online meeting from 23 November - 4 December 2020.
- The capacity development meeting (initially Deliverable D2.3) could not take place. This was replaced by Prof. Weaver (Seascape) and Dr Billett (DSES) taking on the roles of editors of a special issue of Frontiers in Marine Science entitled

"*Understanding ocean ridges, a new frontier for science and development*" in which some new science related to the project is being published.

- The South Atlantic workshop on data availability and gap analysis (initially D1.10) could not take place and was replaced by a Final DG MARE Public Event on Project Results that took place on 20 September 2021.

All risks were therefore recognised and managed satisfactorily so as not to jeopardise the project.

Table 1. Risk register as of 20 September 2021

Risk	Impact	Chance of occurring	Mitigation strategy	Notes of changes	Status
Task 0 Management					
Inability to meet new tight deadlines as agreed with the ISA	Medium	Medium	The new deadline for developing a draft REMP is June 2020 and documents such as the REA (Deliverable D1.5) need to be produced by September 2019 - Month 18 as opposed to Month 24. A plan for this delivery has been produced and accepted by all authors concerned.	Added 18 March 2019 after feedback from ISA's LTC meeting. The REA document was produced on time for the new early deadline. Future deadlines are uncertain due to the Coronavirus crisis. The REA was produced on time and the key meeting was held in Nov 2020.	Closed
Loss of key staff member due to illness	High	High	This key member of the team was scheduled for major surgery that meant he was unlikely to complete his work on the REA document. The issue was acted upon quickly and a suitable replacement person was. A request was made to the EC for approval of his involvement and he was able to complete the REA text in time - a short time extension was agreed with the ISA for part of the biology chapter. The replacement found also participated at the Évora workshop.	The problem was identified in late October 2019. A replacement who could begin at short notice was identified. Issue resolved satisfactorily.	Closed
Task 1 Regional environmental management plan					
Lack of access to key data sets from contractors	Medium	Low	Work with the ISA secretariat to obtain relevant data sets from contractors. Engage with contractors, in cooperation with ISA, to explain to them the benefits of working together.	The ISA created an open database "DeepData" containing all environmental data from contractors.	Closed

Risk	Impact	Chance of occurring	Mitigation strategy	Notes of changes	Status
Delay in ISA processes leads to REMP not being approved during life of project	Medium	Medium	Extend the life of the project to allow for small delays (up to mid 2021). Provide legacy package for others to continue work beyond the life of the extended project.	Chance of occurring changed from Medium to Low on March 18th 2019 since ISA speeded up the process. Overtaken by Coronavirus crisis, which caused new delays - hence raised to medium. Extension of the project by 6 months enabled us to close this item.	Closed
Meeting 1 (Deliverable 1.2) does not reach a consensus	Medium	High	Polarised views between NGOs and some scientists *vs* contractors and some states need to be reconciled. We anticipate that full agreement may not be reached in this meeting and provision has been made to continue discussions in Meeting 2 (Deliverable D1.4).	Added 18 March 2019 after feedback from ISA's LTC meeting. Meeting successful and report approved by ISA secretariat.	Closed
Inability to produce REA report by deadline of 1st November 2019 as set by the ISA	High	High	The very much shortened deadline added pressure to the writing team and consequently a request was made to the EU on the 31July 2019 to add an additional author to write the physical oceanography chapter. A further author was added with agreement from the EU to cover for Dr T. Morato (see above).	The problem was identified in July 2019 and Dr A. Dale from the Scottish Association for Marine Science agreed to carry out the work. Prof. I. Priede covered for Dr Morato. Issue now concluded satisfactorily.	Closed
Inability to conduct REMP development workshops due to Coronavirus	High	High	The planned REMP workshop in St Petersburg in June 2020 cannot take place due to Coronavirus issues and is delayed indefinitely. This is completely out of our control and the only mitigation strategy available is to wait until the situation improves enough to allow unrestricted global travel unless the ISA Secretariat determine a different method to carry out this work. This may mean the progress of the project is delayed beyond the completion date of the contract.	Added 18 March 2020. We workined with the ISA Secretariat to identify other methods of working. Any decision will be delayed until at least June to assess the state of the global situation at that time. Virtual meeting held Nov/Dec 2020.	Closed

Risk	Impact	Chance of occurring	Mitigation strategy	Notes of changes	Status
Inability to conduct South Atlantic workshop on data availability and gap analysis due to Coronavirus	High	High	The planned workshop in September 2020 is unlikely to take place due to Coronavirus issues. As the situation clarifies later in the year we will assess whether the workshop can proceed or can be carried out by conference call.	Added 18 March 2020. Any decision will be delayed until at least September to assess the state of the global situation at that time. Deliverable replaced with Final DG MARE Public Event on Project Results.	Closed 30 July 2021
Task 2: Stakeholder engagement					
The capacity building workshop (Deliverable 2.3) is unlikely to take place due to the Coronavirus crisis	Medium	High	Discussions with the ISA secretariat to find alternative solutions such as providing a webinar to the ISA's Assembly members and Observers.	Added 28 February 2020 Replaced by work towards a Special Issue of Frontiers in Marine Science "*Understanding ocean ridges, a new frontier for science and development*".	Closed
Task 3 Ensure wide-ranging and effective communication and dissemination					
Stakeholder engagement does not achieve buy-in from all groups	Low	Medium	Prolonged and effective communication through the life of the project with clear explanations of the issues should satisfy most stakeholders.	Talks have been provided to international meetings and to the ISA's LTC and Council.	Closed

2.2.5 Subtask 0.4: Steering Committee

The project's Steering Committee was formed following the acceptance of the Inception Report in February 2019. However, since there were no significant reports produced during year 1 it was agreed during the Inception meeting that the first Steering Committee meeting would take place during the annual July 2019 session of the ISA. The first meeting took place on 10 July 2019 with the project coordinator and the ISA secretariat located in Kingston, Jamaica and members of the Commission and EASME/CINEA located in Brussels. This meeting reported on the success of the Paris meeting and the informal workshop to the LTC in Jamaica. Future plans for the project were discussed including planning for the Évora and Russia workshops. DG Mare also suggested the project could be presented to the Germany Partnership for Regional Ocean Governance (PROG) marine Regions Forum to be held in Berlin, Germany, 30 September – 2 October 2019. The coordinator agreed to this request.

The second Steering Committee meeting was held on by teleconference on 13 December 2019, two weeks after the Évora workshop. The meeting reported on the Évora workshop, planning for the Russia workshop and the possibility of a further workshop with the LTC in February 2020. The ISA secretariat stressed their appreciation of the REMP project in making the workshop a great success and especially the comprehensive REA document and the data report which were used as background documents.

The third Steering Committee meeting was held by teleconference on 7 October 2020. The meeting discussed rearrangement of some deliverables due to Covid, the publication of the REA as part of the ISA's Technical Series and the potential extension of the project. The ISA secretariat highlighted their appreciation of the REMP project, including the high quality of the scientific activities. The possibility of an extension to the project was discussed so that all deliverables could be completed and DG MARE confirmed that this would be possible.

The fourth steering committee meeting took place by teleconference on 16 June 2021. The ISA secretariat reported that the LTC co-chairs were very happy with the outcomes of the December workshop and the report had been presented to the LTC by the meeting co-chairs as a basis on which to develop a draft REMP. Further reorganisation of deliverables was discussed due to the continuing Covid disruptions.

2.2.6 Subtask 0.5: Reporting

All reports have been submitted to EASME/CINEA. Due to many changes in the timing of activities brought about by the inception report, the timetables of the ISA and the Coronavirus pandemic, the timings have not been in line with those originally planned. The REA report had to be completed earlier than anticipated to meet the timetable for the Évora meeting as set by the ISA. Due to Coronavirus, the South Atlantic workshop was repeatedly delayed and eventually replaced by the Final DG MARE Public Event on Project Results that took place on the last day of the project.

EASME/CINEA were kept updated on the timings of deliverables throughout the project.

2.2.7 Subtask 0.6: Working closely with the ISA to understand their requirements

This subtask was added during the production of the Inception Report when it became apparent that very close collaboration would be needed between the project and the ISA. Seascape attended a meeting in October 2018 at the offices of the ISA in Jamaica to finalise the workplan presented in the Inception Report. It was subsequently brought into line with the programme of work for REMPs that was being actively developed by the ISA. The Inception Report, complete with its revised programme of work, was submitted to EASME/CINEA on 31 January 2019.

Regular contact has been maintained between project leader Phil Weaver and Ms. Jihyun Lee (Director of the Office of Environmental Management and Mineral Resources (OEMMR) at ISA). A series of teleconferences and face-to-face meetings have taken place through the life of the project.

The ISA secretariat supported the Paris workshop and fully engaged with the project in designing the Évora workshop, which was led by the ISA and supported by the Atlantic REMP project. The ISA secretariat engaged with the design and content of the North Atlantic data report (D1.3) and the Regional Environmental Assessment document (D1.5). The secretariat invited the REMP project to host a one-day workshop for the Legal and Technical Commission during the ISA's 2019 annual session on 6 July 2019.

An account of the workshop discussions was presented to the Council of the ISA during a side-event on 15 July 2019 that attracted over 100 participants. Presentations were made by Ms Lee (ISA), Prof. Halpin (Duke University) and Prof. Weaver (Seascape) and brief presentations by LTC workshop chairs. This was followed by a useful discussion. Both the workshop and the side event were sponsored by the REMP project (i.e. this project).

The REMP project was closely involved with the ISA secretariat in the organisation of the Évora workshop. Two LTC members were appointed as co-chairs of the meeting by the ISA secretariat: P. Madureira (Portugal) and G. Paterson (UK). A number of conference calls we held between the ISA secretariat, some LTC members and partners in the REMP project (Weaver and Halpin) to plan the meeting.

Professor P. Weaver and Prof. P. Halpin were invited by the ISA secretariat to a meeting with the LTC with the title "*Informal Workshop on the Review and Development of Regional Environmental Management Plans in the Area: Results of CCZ Biodiversity Synthesis and Évora Workshops*". This took place in Kingston, Jamaica on 29 February 2020 and the meeting costs were covered by the Atlantic REMP project. The following Atlantic REMP presentations were made during the meeting, based on the three strands of the Evora workshop:

- Phil Weaver (Atlantic REMP Project): Scenario planning for adaptive management
- Pat Halpin (Duke University): Area-based management approaches
- Luciana Genio (ISA secretariat) & Skipton Wooley (CSIRO): Qualitative modelling for assessing cumulative impacts

The REMP project worked closely with the ISA Secretariat in the planning of the November 2020 workshop. This was due to take place in St Petersburg, Russian Federation on 15-19 June, 2020, but was postponed due to the Coronavirus crisis. Numerous conference calls were held during the year with the ISA Secretariat and with the workshop co-chairs (Dr Gordon Paterson and Dr Georgy Cherkashov, both members of the ISA's Legal and Technical Commission) to establish to establish the *modus operandi* of the meeting.

During the two-week long virtual workshop, Seascape was involved in daily pre- and post-workshop meetings with the ISA secretariat to ensure that the workshop progressed smoothly.

The ISA secretariat invited Seascape to be involved in their "Workshop for the development of a Regional Environmental Management Plan for the area of the Northwest Pacific" that took place on 26 October to 6 November 2020 with the intention that we could share our expertise gained in working on the North Atlantic REMP. We assisted the ISA by reviewing the draft Regional Environmental Assessment report written in preparation for the workshop and by being active participants in the workshop. This activity was outside of the contract specifications.

2.3 Task 1: Regional Environmental Management Plan and proposal of a representative network of APEIs

2.3.1 Objectives

- To assist the ISA in carrying out a Regional Environmental Assessment (REA) for the MAR;
- To assemble all relevant environmental data for the MAR and make this available in GIS format, to be shared through the ISA;
- To work with the ISA to develop a REMP for the MAR taking into account the development of APEIs and other management measures.

2.3.2 Subtask 1.1: To support the ISA in carrying out an REA for the MAR

The Regional Environmental Assessment (**Deliverable D1.5**) is an important document. It provides an aggregation and synthesis of existing information relating to the northern Mid-Atlantic Ridge, including geomorphology, physical characteristics, geology and biological communities, as well a description of the current mining areas, mining process and ecosystem features (regional biodiversity, temporal variability, trophic relationships, ecosystem functioning, connectivity, resilience and recovery). It also addressed cumulative impacts.

This report had to be completed on a shorter timescale than originally envisaged due to the ISA's timetable for REMP meetings. Because of this, and to ensure the highest quality, some of the work was subcontracted to key scientists outside of the project. Nine authors eventually contributed and over 700 publications were reviewed in its production, and the report was reviewed by a number of scientists and project partners.

The REA was used as the foundation for the scientific discussions on the development of the REMP at the Évora workshop. The document was warmly welcomed by the Évora workshop participants who were invited to submit comments so that the document could be updated. The update was completed on 10 February 2020, after which it was uploaded to the ISA's website (https://www.isa.org.jm/files/documents/rea-feb2020-reduc.pdf). The document has been widely acclaimed by scientists outside of the project as a thorough review of available relevant information necessary to provide the background to the REMP development and it should set a precedent for work toward REMPs in other areas.

At the time of the publication of this report, the REA is in the process of being published by the ISA as part of their technical series (ISA Technical Study No 28). The publication of this document and associated costs replaced initial Deliverable D1.7 (Proposal for draft REMP for nMAR), which we were not able to produce because ISA rules require such drafts to be produced by their Legal and Technical Commission.

The REA should be of value beyond the development of the REMP where it can be used to set the regional framework for contractor's Environmental Impact Assessments (EIAs) and for subsequent re-evaluations of the REMP. As such it should be regarded as a living document that will be updated from time to time as new information becomes available.

2.3.3 Subtask 1.2: To assemble all relevant environmental data for the MAR and make this available to be shared through the ISA in GIS format

This subtask was led by our subcontractor, MGEL. A draft data report covering the North Atlantic was submitted to the ISA for their review at the beginning of November 2019 and after revision was made available to the Évora workshop participants. The concept of this report follows the format developed by the Convention on Biological Diversity (CBD) in their description of EBSAs (Ecologically or Biologically Significant Marine Areas), where the report

summarises a series of mappable data layers that can be displayed and overlain during the workshop to enable workshop participants to identify areas in need of attention. The MGEL team provided GIS support during the Évora workshop displaying maps and data layers as required. The Évora workshop participants were invited to review the data report and submit changes, and the update was completed on 7 February 2020, after which it was uploaded to the ISA's website (https://www.isa.org.jm/files/documents/data_report-feb2020-reduc.pdf) and submitted to EASME/CINEA as **Deliverable D1.3**.

The following data was provided to the ISA in September 2020 (**Deliverable D1.6**). Spatial data with information from the Évora workshop was submitted to ISA in August 2020, including datasets mapped in figures 2-6 from the Évora workshop report:

- Gridded habitat suitability models for cold water coral species
- Point locations of active and inferred vents from the InterRidge database and from experts at the Évora workshop
- Polygons of select fracture zones and surrounding areas created at the Évora workshop

The data report for the South Atlantic (**Deliverable D1.9**) covering the area of the Mid-Atlantic Ridge from the Equator to the northern end of the EEZ of Tristan da Cuna at around 34°S, excluding the EEZ of Ascension Island was completed in December 2020. This data report includes 130 maps of datasets and analyses pertaining to the southern Mid-Atlantic Ridge and surrounding ocean areas. This report may be used at a later date to aid the development of any REMP which the ISA chooses to define in this area. Due to the Coronavirus pandemic it was not possible to convene the South Atlantic workshop on data availability and gap analysis (**Deliverable D1.10**). This deliverable was replaced by the Final DG MARE Public Event on Project Results, which took place on the 20 September 2021. The session was an opportunity to showcase the main outcomes of the project and contributions to the ISA's REMP process, as well as the DG MARE-ISA partnership established through it. During the event the ISA Secretariat and Seascape described the process of REMP development, with Dr G. Paterson (LTC) describing the progress of the work through the LTC and its expected progress to an approved REMP sometime in 2022.

2.3.4 Subtask 1.3: Work with the ISA to develop building blocks for a REMP for the MAR taking into account development of APEIs and other management measures

And

2.3.5 Subtask 1.4: Working towards a draft REMP

The two subtasks became interwoven and were described as a single subtask in the second and third interim reports. They are also considered together here.

Seascape, DSES, IMAR and MGEL contributed to the ISA's workshop "*Developing a framework for Regional Environmental Management Plans (REMPs) for polymetallic sulphide deposits on mid-ocean ridges*" that took place in Szczecin, Poland on 26-29 June 2018. The concept of applying APEIs in east-west bands across the mid-Atlantic Ridge where no mining could take place was put forward in this meeting by MGEL. There were several objections from contractors and others that this would limit exploration and exploitation and did not follow the development process applied to the CCZ mining areas in the Pacific. The idea of creating a corridor through the APEIs along the ridge axis where the contract blocks are located was presented by Seascape. The whole of the ridge axis would then need to be managed by a rules-based management approach similar to other areas of offshore exploitation such as in the hydrocarbon industry. This concept was welcomed by some of the contractors but clearly needed more development.

Subsequent to the "Szczecin meeting", and with the approval of the ISA, ERM, SSC and DSES began work on a report to define the concept, describe areas where it has been applied successfully and indicate how it might be used in developing the North Atlantic REMP. The project expended considerable effort in identifying the management measures that are used in other offshore sectors. This was facilitated partly by our subcontractor ERM who had expertise in this field and through the development of **Deliverable D1.1** "*Review of non-area-based environmental management measures*", as well as being the focus of the Paris workshop. This deliverable summarised the application of a rule-based management approach in the following marine industries – offshore aggregates, high-seas fishing, shipping, waste management (The London Convention and the London Protocol) and the oil and gas sector. It concluded that a rules-based management approach to aspects of environmental management has been demonstrated to be effective and accepted by broad sectors of industry.

The Paris meeting (**Deliverable D1.2**) examined the application of a rules-based approach that could work in combination with a series of APEIs. In consultation with the ISA the title for this meeting was agreed as "*The application of rule-based management approaches to Regional Environmental Management Planning within the context of ISA for polymetallic massive sulphides deposits*". The meeting took place at the Maison des Océans in Paris on 28-30 May 2019 and was funded by the project. It provided a forum where different industries could compare management measures across their sectors and understand the environmental management needs of the ISA. Deliverable D1.1 was used as a background document for this meeting.

During the meeting it became apparent that APEIs, whilst providing a useful tool, were not the only measure that could be applied, and a combination of tools based on existing practice elsewhere might provide a more robust management system for consideration by the ISA. The Paris workshop examined "rules-based" measures that are common in other sectors and can give more flexibility to the contractor but put more responsibility on them to conduct thorough environmental reconnaissance work. This has advantages particularly in the deep sea where environmental information is sparse. This system would also require a robust system of monitoring and compliance that would need to be independent and overseen by the ISA's regulator.

What gradually became apparent was that a set of realistic mining scenarios were needed to identify all the potential pressures and their impacts so that a meaningful set of non-area based measures (e.g. rules-based measures) could be put forward. These were developed through discussions with the contractors in the North Atlantic where it became apparent that the greatest impacts would be experienced by faunas living on hard substrates and these substrates are common only along the axis of the Mid-Atlantic Ridge. Thus, the wide APEI mining exclusion zones as described in the paper by Dunn et al. 2018[1] would not have been useful on their own. The mining scenarios were gradually refined through discussions with many experts and presentations at the PROG Marine Regions Forum meeting in Berlin in October 2019 (**Deliverable D 3.1**), and the meeting on REMPs sponsored by the German Government in Hamburg in November 2019. In both cases the mining scenarios were presented, discussed and refined. The outcome of this work was that "Scenario planning for adaptive management" became one of the three topics for discussion at the ISA's Évora workshop.

The APEI approach was the second topic for discussion at the Évora workshop (**Deliverable D1.4**) under the term "application of area-based management tools". The APEI approach, including all the procedural steps to define APEIs and options of how they could be placed along the MAR, were presented in the paper by Dunn et al. (2018). This paper summarised the work carried out previously under the SEMPIA project. Following feedback from the LTC there

[1] Dunn et al. (2018) A strategy for the conservation of biodiversity on mid-ocean ridges from deep-sea mining. Scientific Advances, DOI:10.1126/sciadv.aar4313.

was pressure to reassess the design and positioning of the APEI boxes that could have restricted the ability to select mine sites, whilst not providing optimum conservation, particularly if other management measures were to be used in addition to APEIs. Conservation planning does in fact have options for small numbers of large conservation areas or larger numbers of smaller conservations areas and these options were explained to the LTC by Prof. Halpin (MGEL) during the REMP workshop held in Jamaica in July 2019.

The third topic for discussion at the Évora workshop was "qualitative modelling for assessing cumulative impacts". This topic was added following discussions at the Marine Regions Forum in Berlin, where it became apparent that the Australian Government had developed a third approach to managing its vast offshore areas based on qualitative modelling of cumulative impacts. Qualitative mathematical models represent a working hypothesis about how an ecosystem works. They should: a) identify important components and processes in the system; b) document assumptions about how these components and processes are related; c) identify the linkages between these components/processes and anthropogenic pressures; and d) identify knowledge gaps or other sources of uncertainty. This approach had some similarity to the scenario planning (rules-based) approach mentioned above. In theory, the mathematical models should be applicable to different oceans and exploitation strategies. Therefore, colleagues from CSIRO, Australia were invited to attend the Évora workshop to present this topic.

The Évora workshop thus became a challenging event with three distinct topics to be discussed. The philosophy was not for the topics to compete but for the results of each to be developed and forwarded to the subsequent meeting. The workshop drew heavily on the REA report (**D1.5**) and on presentation of data in GIS format (the data layers are summarised in the data report **D1.3**).

The ISA follows a strict process for developing REMPs in which it should be noted that only the LTC can make recommendations. The steps in the process and the supporting documents generated by the project are listed below:

- Background documents produced for the Évora science workshop. These included the Regional Environmental Assessment (**D1.5**), the data report (**D1.3**) and the report of the Paris workshop (**D1.2**);
- The Évora workshop and its report (**D1.4**) on science discussions, which fed into
- The November 2020 Russia workshop (**D1.8**) to identify spatial and non-spatial management measures for consideration in the development of the REMP and the report therefrom;
- Presentation of the relevant parts of the November 2020 Russia workshop report to the LTC for them to make recommendations to Council for the development of a REMP.

The November 2020 workshop (**D1.8**), known as the Russia workshop since it was originally planned to take place in St Petersburg, took the outcomes of the Évora science workshop and used them to identify spatial and non-spatial management measures for consideration in the development of the REMP. Two main categories were discussed, namely:

- Area-based management measures
- Non-area-based management measures

In the area-based discussion groups three approaches for the application of area-based management approaches (ABMTs) were discussed.

- **Sites in need of protection (SINP)** are fine-scale sites, where there is observation or evidence of vulnerable or sensitive species/ecosystems. They are described on an individual basis, using, within the context of ISA, the Food and Agriculture Organization's criteria for vulnerable marine ecosystems (VMEs). Identification of such

sites is intended to conserve specific ecosystems, habitats of species, and specific ecosystem features that are known or highly likely to be vulnerable to human activities (e.g. exploitation of mineral resources in the context of ISA). The Évora workshop described 11 active vent ecosystems as sites in need of protection, whose existence have been confirmed by direct observation. It was noted that additional SINPs could be described in the future, which could include cold-water corals or other vulnerable or sensitive species/ecosystems.

- **Areas in need of protection (AINP)** are large-scale areas with higher importance due to their uniqueness and/or biodiversity. In the Évora workshop, candidate areas were described using, in the context of ISA, the scientific criteria of CBD for ecologically or biologically significant marine areas (EBSAs). Three fracture zones were described as areas meeting the EBSA criteria and were put forward as candidates for Areas in Need of Protection.
- **Sites/Areas in need of increased precaution (S/A-Precaution)** are either fine-scale individual sites or large-scale areas that have been predicted to have features that may give the site/area conservation value. The predictions could be based on various methods, including indirect observation of natural plumes (e.g. inferred hydrothermal vents) and habitat modelling (e.g. cold-water octocorals).

In the non-area-based breakout groups discussion was guided by a series of questions considered at the regional scale and the scale of future contract areas for exploitation. The questions addressed: existing potential pressures (A), expected management outcomes (B), suggested management measures (C), key impact parameters and cumulative impact thresholds (D), and how information can be used by contractors and other actors (E). Through these discussions the main issues were identified, and specific management measures proposed. There was insufficient time or expertise within the meeting to suggest threshold levels and these will need to be developed later. It is possible that some of the cumulative impact modelling, discussed in Évora, could be used to help define some of the thresholds.

The complete report from the Russia workshop was submitted by the ISA secretariat to the LTC for their consideration at the May/June LTC session of the ISA. The outcome of this was the establishment of an LTC subgroup to consider the report further, and make recommendations on how to proceed, to the next session of the LTC which should be in February 2022.

The input of the project to the process going forward may be limited as the LTC meet in private and we are only allowed to the Council/Assembly meetings by invitation.

It may be that the ISA secretariat would like to hold an additional LTC workshop or for Seascape to present a side-event at the July 2022 sessions. This however, would be outside of the project duration.

2.4 Task 2: Stakeholder engagement

2.4.1 Objectives

- To assist the ISA in developing its knowledge of other stakeholders in the Atlantic Ocean and to train stakeholders from developing states in the use of spatial management techniques

2.4.2 Subtask 2.1 Providing the ISA with stakeholder information

This subtask was added to the Inception Report following discussion with the ISA. To facilitate this subtask, Rachel Boschen-Rose (Seascape) attended a 3-day training course on Good Practice Stakeholder Consultation, run by Dialogue Matters in Wye, UK on 3-5 July 2018.

Deliverable **D2.1** (*Stakeholder Analysis of the North Atlantic*) revealed that there are a large number of stakeholders in the North Atlantic, ranging from states and IGOs to those involved in exploitation, such as fisheries. Many NGOs have strong interests particularly regarding environmental protection. Organisations with an interest in deep-sea mining have sought observer status at the ISA. The list of observers includes 30 observer states, 32 UN and Intergovernmental Organizations; 30 Non-Governmental Organizations. An informal version of D2.1 was submitted to EASME/CINEA on 24 April 2020, followed by a revised version in March 2021.

Deliverable **D2.2** (*Review of stakeholder consultation approaches*) was submitted to CINEA in March 2021. It was subsequently revised to include more organisations and resubmitted in September 2021. The review reveals that there are very strong differences between the strategies of each organisation. UNEP has the most evolved strategy, engaging stakeholders at many levels and positively reaching out to many societal groups. UNEP is an implementing organisation which sets policy and carries it out as opposed to the CBD which is a facilitating organisation. The CBD's stakeholder strategy is based on that of its parent body UNEP with some differences, though as a facilitating organisation it does less work on the ground. The IMO is another large organisation, like the CBD and UNEP, and has a well-defined stakeholder strategy with a large number of active stakeholders (observers). The OSPAR Commission, and the two fisheries bodies NEAFC and NAFO are regional bodies and do not have such well-developed stakeholder strategies as the first three. In both NEAFC and NAFO the member states often carry out their own stakeholder engagements prior to the meetings and it is common practice for the state delegations to include industry representatives.

2.4.3 Subtask 2.2 Capacity Development

The capacity building workshop (initially **Deliverable D2.3**) has changed its form several times through the course of discussions between ISA, EC and Seascape. Prior to the pandemic, discussions had centred on whether this event would be better held as a sensitisation workshop in the margins of the ISA Assembly in July 2020, in order to inform ISA members about the REMP process and how it had proceeded. However, the Coronavirus crisis caused the in-person meeting to be cancelled and put pressure on the rest of the agenda preventing any further discussion of the sensitisation meeting.

During the Steering Committee meeting in October 2020 the possibility of holding this workshop under the umbrella of the UN Ocean Decade was discussed. However, discussion of REMPs was not included in the ISA's contribution to the UN Ocean Decade.

In July 2021 Seascape, CINEA and DG MARE reached agreement that this deliverable would be replaced by a Special Issue of Frontiers in Marine Science edited by P. Weaver (Seascape) and D. Billett (DSES). The project would support the publication costs for some of the papers in this publication. The topic of the special issue is "*Understanding Ocean Ridges, a New Frontier for Science and Development*" and it can be viewed at https://www.frontiersin.org/research-topics/21679/understanding-ocean-ridges-a-new-frontier-for-science-and-development .

This publication will contribute to capacity development by assembling a range of papers on the exploitation of mid-ocean ridges and making them publicly available in this open access journal. Each of the three contractors to the ISA in the North Atlantic has agreed to submit a paper, and the special issue will also feature a number of papers on the mid-ocean ridge of the Indian Ocean, which is another area where the ISA has issued contracts for polymetallic sulphide exploration.

The **Deliverable D 2.3** shows that as of September 2021 two papers were published, three were under review and twenty more were expected by the end of 2021 making a total of 25, which is a large number for such a special issue. These papers will add much new information on the North Atlantic ridge and other ridge systems worldwide. They reveal that there is a considerable amount of research in progress on ocean ridges which can only help to strengthen the development of REMPs. The special issue will form an important legacy of the project.

Outside the project, Seascape has used its expertise developed in the project to help the ISA. In August 2020 Seascape was asked by the ISA secretariat to help with the preparation of the Regional Environmental Assessment document for the NW Pacific workshop that would lead towards a REMP in that region. Seascape also took part in the NW Pacific REMP workshop that took place on 26 October to 5 November 2020. The objective of this engagement was to help transfer the knowledge and good practice that had been developed in the North Atlantic to other regions.

Seascape also participated in the "*Workshop on Marine Scientific Research in the Area: Establishing a collaborative platform to enhance biodiversity knowledge for environmental management in mid-ocean ridge ecosystems*" on 15-17 December 2020, sponsored by the ISA and China Ocean Mineral Resources Research and Development Association (COMRA). This activity was also outside of the contract specifications.

2.5 Task 3: Ensure wide-ranging and effective communication and dissemination

1.1.1 Objectives

- To ensure adequate, effective, transparent and clear communication of the activities and processes leading to the development of the REMP

Following suggestions from DG MARE a talk was presented at the Marine Regions Forum in Berlin on 2 October 2019. The title of the talk was "*Developing REMPs for polymetallic sulphide mining on ocean ridges*". The talk was well received and led to considerable interest from meeting participants. Conversations outside the formal sessions led to a discussion between the ISA Secretariat (J. Lee), CSIRO (P. Dunstan) and the REMP project (P. Weaver) during which we established that Australia had developed a new method of managing its offshore territory that could be very applicable to the North Atlantic. This led to the inclusion of this as one of the three topics in the Évora workshop.

The German Government, in collaboration with the Netherlands Government and Pew Charitable Trusts, funded the meeting "*Towards a standardised approach to Regional Environmental Management Plans in the Area*" that took place in Hamburg on 11-13 November 2019. P. Weaver (Seascape) presented a talk on "*Developing REMPs for polymetallic sulphide mining on ocean ridges – some of the main issues*" that outlined some of the main issues in developing REMPs for polymetallic sulphide areas on ocean ridges. The discussions during this meeting provided some very useful background regarding REMP development including criticism of the CCZ environmental management plan.

These two activities fulfilled **Deliverable D3.1**.

In fulfilment of **Deliverable D3.2** (*Contribution to a special issue on REMPs for DSM in an open access journal*) Boschen-Rose (Seascape) and Colaço (IMAR Univ. Azores) published a paper in Frontiers in Marine Science with the title "*Northern Mid-Atlantic Ridge Hydrothermal Habitats: A Systematic Review of Knowledge Status for Environmental Management*" (available at https://www.frontiersin.org/articles/10.3389/fmars.2021.657358/full). This paper updated the taxa list of benthic invertebrates associated with hydrothermally active habitats on the northern Mid-Atlantic Ridge; conducted a regional biogeographic analysis of hydrothermally active vent fields; undertook a comprehensive literature review to provide a

descriptive account of biological communities, and identified key knowledge gaps for these communities.

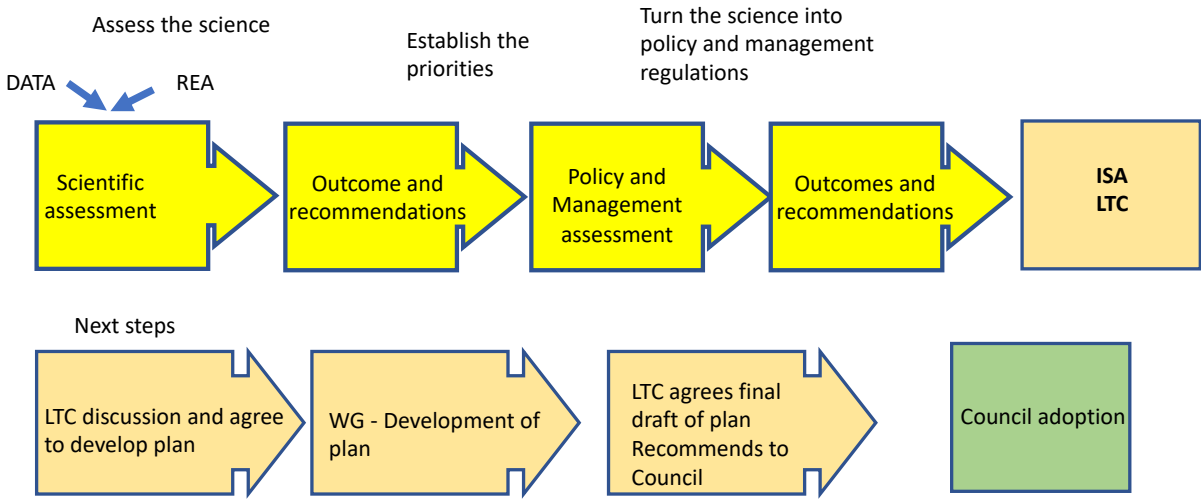
The REA document (**D1.5**) produced for the scientific review meeting in Évora in November 2020 has become a key document for development of the North Atlantic REMP and an important reference and model for those developing REMPs elsewhere. To ensure it will remain easily accessible we agreed that it would be published as part of the ISA's technical series. It will be prepared and published in spring 2021 with publication costs funded by the project. In July 2021 Seascape, CINEA and DG MARE reached agreement that the publication of the REA would replace **Deliverable D1.7** (originally *Proposal for draft REMP for nMAR*). This is because draft recommendations can only be produced by the ISA's formal bodies – in this case, the LTC.

3 FORWARD LOOK

The ISA secretariat provided the full report of the Russia workshop to the LTC in summer 2021, as a basis for their development of a draft REMP. This document contains a much more comprehensive set of ideas to develop the REMP than those which were adopted for the CCZ. It combines large area APEIs with discussions on identifying Sites in Need of Protection and suggestions of what these might be, such as active hydrothermal vent ecosystems, coral and sponge aggregations. Similar ecosystems are recognised by the fishery bodies NEAFC and NAFO as Vulnerable Marine Ecosystems (VMEs) and given protection from fishing impacts.

The LTC has appointed a working group to develop a draft REMP based on the Russia workshop report. This should be submitted to the LTC at their next meeting in February 2022 and, if agreed, it may progress to approval by the Council in July 2022. The steps in the process were outlined by Dr Paterson from the LTC in a presentation he made to DG Mare in October 2021 and his slide is reproduced below. The yellow boxes show where the REMP project was involved and the brown boxes show the steps to be taken by the LTC.

The above plan does not mention a period of public consultation which might be expected. At present there has been no mention of this by the ISA secretariat. The obvious time to hold such a consultation would be after the draft REMP is produced by the LTC in February 2021 and before it goes to Council in July 2022.



It should be noted that the Russia report left some open questions and these will need to be addressed in the REMP. These include:

1. **Development of threshold levels for identifying Sites In Need of Protection (VMEs)**. Each ecosystem or aggregation of species will only require protection is it is above a certain size e.g. how large an area of corals and of what density. These are defined for VMEs but the methods of verification are in some cases related to fishing practices e.g. tons of sponge per trawl length. The ISA will therefore need to set its own thresholds and provide information on how they should be identified.

2. **Development of threshold levels for impact of plumes on sites in need of protection (VMEs)**. Many organisms will be killed by plumes close to the mine site. Clearly, the plumes should not have such an impact on the Sites In Need of Protection. The tolerance levels of each organism in a SINP (or VME) will therefore need to be established and specified e.g. toxicity levels should be kept below "xx" at a distance of "yy" from the mine site

3. **Methods to monitor the contractors in real time to ensure they report any sites in need of protection (VMEs) during exploration**. Monitoring may be a big problem in the deep-sea due to its cost and the remoteness of the locations. This area needs a lot of attention in the eventual REMP and in the ISA's regulations in general. The ISA secretariat regarded this topic as beyond the scope of the Évora and Russia workshops acknowledging that it would be needed to be added later. Without effective real-time monitoring during exploration unscrupulous contractors could attempt to hide the fact that a SINP was located close to a mine site.

4. **Methods to monitor contractors to verify their plume models and the impacts of plumes during mining**. The content of the plumes in terms of particulate load and toxicity will be known by the contractor and should be reported as part of the Environmental Impact Assessment. The spread of the plume in the water column will be predicted by the contractor's plume model taking into account the rate of generation and local currents. The accuracy of the plume model will need to be independently verified to make sure SINPs in the far range are not being harmed.

5. **Methods and frequency to monitor Sites In Need of Protection (VMEs) to ensure there are no long-term effects e.g. from plumes**. It may be that organisms show little effect of the plumes in the short term (1-5 years for example). However continued exposure may eventually take its toll e.g. on preventing breeding activities. Thus monitoring needs to be carried out periodically to look for these effects.

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