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REGIONAL WORKSHOP TO FACILITATE THE
DESCRIPTION OF ECOLOGICALLY OR
BIOLOGICALLY SIGNIFICANT MARINE AREAS
IN THE NORTH-EAST ATLANTIC OCEAN AND
TRAINING SESSION ON ECOLOGICALLY OR
BIOLOGICALLY SIGNIFICANT MARINE AREAS
Stockholm, 22-27 September 2019

COMPILATION OF SUBMISSIONS OF SCIENTIFIC INFORMATION TO DESCRIBE AREAS MEETING THE SCIENTIFIC CRITERIA FOR ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT MARINE AREAS (EBSAS) IN THE NORTH-EAST ATLANTIC OCEAN

Note by the Executive Secretary

1. The Executive Secretary is circulating herewith a compilation of scientific information in support of the Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas (EBSAs) in the North-East Atlantic Ocean.
2. This compilation was prepared drawing on submissions made by Parties, other Governments and relevant organizations in response to notification 2019-050 (ref. no. SCBD/SPS/SBG/AS/JA/JG/88146), dated 28 May 2019 (<https://www.cbd.int/doc/notifications/2019/ntf-2019-050-marine-ebsa-en.pdf>). Submissions were received from Denmark, Germany, Iceland, Portugal, Spain, BirdLife International, Conservation of Arctic Flora and Fauna, Global Ocean Biodiversity Initiative, Institute of Marine Research – University of Azores / ATLAS Project, IUCN Joint SSC/WCPA Marine Mammal Protected Areas Task Force, International Seabed Authority and International WWF-Centre for Marine Conservation. They are made available through hyperlinks in the tables below.
3. The present compilation consists of the following: (a) scientific information submitted using the EBSA template (compiled in Table 1); and (b) scientific information submitted in the form of scientific articles, reports or websites (compiled in Table 2), as inputs to the workshop discussion. It should be noted that, in preparing this compilation, neither the Secretariat of the Convention on Biological Diversity nor the technical support team commissioned by the Secretariat has validated the scientific information, addressed any information gaps, nor edited the content of the submissions. During the workshop, participants are expected to describe areas meeting the EBSA criteria in the North-East Atlantic Ocean, building on the relevant scientific information contained in the present compilation

Table 1. Scientific Information submitted in support of the workshop objectives using the EBSA template

Template No.	Short description of template
Template 1- Mainland Canyons Area (MCA)	<p>MCA (Mainland Canyons Area) EBSA is compounded by a total of 11 canyons, 4 seamounts and one archipelago, and this area includes one OSPAR Marine Protected Area, one Protected Area, one UNESCO Biosphere Reserve, one Natura 2000 Site of Community Interest and 5 Natura 2000 Special Protection Areas for wild birds. The EBSA is divided by 3 sections, North MCA (32786 km²), Center MCA (48048 km²) and South MCA (29099 km²). The structures in the EBSA are hotspots of marine life and in general they represent areas of an enhanced productivity, especially when compared with nearby areas. This EBSA has a total area of 109933 km² with identified structures depths ranging from 50m (head of Nazaré canyon) to ~5000m (bottom of Nazaré canyon). The area presents particular features which make it eligible as an EBSA when assessed against the EBSA scientific criteria. All structures included in the MCA EBSA fulfill four or more out of the seven EBSA scientific criteria. A total of 3411 species are listed to the area, with 776 specifically recorded for different EBSA structures. From the total of species recorded 11% are protected under international or regional law. The EBSA is totally under Portuguese national jurisdiction, with its structures located on territorial waters and on the Portuguese Economic Exclusive Zone (EEZ).</p>
Template 2 – Madeira – Tore	<p>Madeira-Tore EBSA includes a total of 17 seamounts. Seamounts are hotspots of marine life and in general they represent areas of an enhanced productivity, especially when compared with nearby abyssal areas. This EBSA has a total area of 197431 km² with depths ranging from 25m (top of Gettysburg seamount) to 4930m (bottom of Tore seamount). The area includes a proposed Site of Community Importance - Gorringe Bank and an OSPAR High Seas Marine Protected Area – Josephine seamount. All structures included in the Madeira-Tore EBSA fulfill four or more out of the seven EBSA scientific criteria. A total of 965 species are present in this EBSA of which 7% are protected under international or regional law.</p>
Template 3 – Meteor	<p>Meteor EBSA includes a total of 10 seamounts. The Seamounts are hotspots of marine life and in general they represent areas of an enhanced productivity, especially when compared with nearby abyssal areas. This EBSA has a total area of 134079 km² with depths ranging from 265m (top of Atlantis seamount) to 4800m (bottom of Great Meteor seamount). The area presents particular features which make it eligible as an EBSA when assessed against the EBSA scientific criteria. All structures included in the Meteor EBSA fulfill four or more out of the seven EBSA scientific criteria. The Meteor bank is one of the best explored in the world. A total of 437 species are present in this EBSA of which 3,9% are protected under international or regional law. The EBSA area is totally located under Portuguese national jurisdiction, with 9 of the 10 structures located on the extended continental shelf (seabed) and 1 (Pico Sul) is included on the Portuguese EEZ close to Azores.</p>
Template 4 – North of the	<p>NAA (North of the Azores Area) EBSA is compounded by a total of 7 seamounts and one hydrothermal vent, this area includes one OSPAR high-seas Marine Protected Area - Mid Atlantic Ridge North of Azores (MARNA). The structures</p>

Azores Area	<p>described and included are hotspots of marine life and in general they represent areas of an enhanced productivity, especially when compared with nearby abyssal areas. The Moytirra is the first known deep-sea hydrothermal vent field on the slow-spreading Mid-Atlantic Ridge North of the Azores, giving a high level of uniqueness to the NAA. This EBSA has a total area of 634515 km² with identified structures depths ranging from 660m (top of Sedlo seamount) to 3200m (bottom of Lukin-Lebedev seamount). The area presents particular features which make this area eligible as an EBSA when assessed against the EBSA scientific criteria. All structures included in the NAA EBSA fulfill four or more out of the seven EBSA scientific criteria. The Sedlo bank is recently and extensively studied. A total of 536 species are present in this EBSA of which 6% are protected under international or regional law. The EBSA area is totally located under Portuguese national jurisdiction, with 7 of the 8 structures located on the extended continental shelf (seabed) and 1 (Sedlo) on the Portuguese EEZ close to Azores.</p>
Template 5 – South of the Azores Area (SAA)	<p>SAA (South of the Azores Area) EBSA encompasses a total of 18 structures: 7 hydrothermal vents (Bubbylon, Ewan, Lucky Strike segment, Menez Gwen, Menez Hom, Rainbow, Saldanha), 5 structures less studied, inferred from water column profiles (North Oceanographer, South Lucky Strike, South Oceanographer, SOH1, SOH2) and 6 other structures: 4 segments (AMAR, FAMOUS, North FAMOUS, South AMAR) and 2 fractures (Hayes, Oceanographer). The EBSA area includes 3 OSPAR high-seas Marine Protected Area – segment Lucky Strike, Menez Gwen and Rainbow. The structures described and included are hotspots of marine life and in general they represent areas of an enhanced productivity, especially when compared with nearby abyssal areas. This EBSA has a total area of 98841 km² with identified structures depths ranging from the deepest 3460 m (inferred deep – South oceanographer), 2320 m (measured deep – Rainbow); to the shallowest 840 m (Menez Gwen). The hydrothermal temperatures range between 10° C (Menez Hom and Saldanha) to 362° C (Rainbow). The area presents particular features which make this area eligible as an EBSA when assessed against the EBSA scientific criteria. All structures registered in the SAA EBSA fulfill all of the seven EBSA scientific criteria. A total of 342 species are present in this EBSA. The area is totally located under Portuguese national jurisdiction, with 10 of the 18 structures located on the extended continental shelf (seabed) and 8 on the Portuguese EEZ close to Azores.</p>
Template 6 – Cantabrian Sea, Southern Bay of Biscay	<p>The Cantabrian Sea ecosystem includes the continental self and slope and the deep abyssal basin (5000 m water depth) located along the northern border of the Iberian Peninsula (Southern Bay of Biscay), from the Capbreton Canyon head to Estaca de Bares Cape, in the Galician coast. It is structurally a highly complex area, where the narrow continental shelf is deeply affected by the action of the tectonic compression, containing important geomorphological elements such as large submarine canyons and seamounts. The hydrology is also complex due to the interaction between waters formed in the Atlantic with water of Mediterranean origin. The EBSA proposal includes a diversity of benthic habitat that are considered as hotspots of biodiversity, spawning grounds for several fish species of commercial interest, soft bottoms essential for the biology of commercial benthic species, various habitats for endangered, threatened and declining species and it is also a seasonal migratory pathway for large migratory pelagic species and an important area for cetaceans.</p>

Template 7 – Western Iberian Peninsula	The "Western Iberian Peninsula" includes the continental shelf along the Spanish (Galicia) coast, the Galicia Interior Basin (GIB) and the deep basin. The hydrology is also complex due to the interaction among the major Atlantic water masses that occur in the area. The EBSA proposal includes a diversity of benthic habitat that are considered as hotspots of biodiversity, spawning grounds for several fish species of commercial interest, soft bottoms essential for the biology of commercial benthic species, various habitats for endangered, threatened and declining species and it is also an important area for cetaceans.
Template 8 – Gulf of Cadiz	The Gulf of Cadiz is located in the eastern sector of the North Atlantic Ocean, to the southwest of the Iberian Peninsula. Its eastern boundary is the Strait of Gibraltar, western border of the Mediterranean Sea. It is structurally a highly complex area, containing important geomorphological elements such as large submarine canyons and seamounts. The hydrology is also complex due to the interaction between waters formed in the Atlantic with water of Mediterranean origin. The EBSA proposal includes a diversity of benthic habitat, both on soft and rocky bottoms, that are considered as hotspots of biodiversity, various habitats for endangered, threatened and declining species and it is also a seasonal migratory pathway for large migratory pelagic species and an important area for cetaceans.
Template 9 – Aveiro-Nazaré	The area is important for the Critically Endangered and OSPAR-listed Balearic Shearwater <i>Puffinus mauretanicus</i> , with estimates of up to 3,000 individuals using the site during their migration and winter period.
Template 10 – Varanger	An important breeding and staging area for seabirds and waterbirds in the region, with total numbers exceeding 187,000 individuals. An important staging ground for almost the entire Norwegian winter population of the Vulnerable and OSPAR listed threatened and/or declining species Steller's Eider <i>Polysticta stelleri</i> . Key species are the Vulnerable Lesser White-fronted Goose <i>Anser erythropus</i> , Long-tailed Duck <i>Clangula hyemalis</i> , Velvet Scoter <i>Melanitta fusca</i> , Black-legged Kittiwake <i>Rissa tridactyla</i> and Atlantic Puffin <i>Fratercula arctica</i> .
Template 11 – Cabo Raso	The area is important for the Critically Endangered and OSPAR-listed Balearic Shearwater <i>Puffinus mauretanicus</i> , with estimates of up to 4,300 individuals using the site. Regular gatherings are observed at this IBA, both during post-breeding dispersal movements and during the winter months. It is also the most important location for wintering of the Mediterranean Gull <i>Larus melanocephalus</i> on the European Atlantic coast and northern Africa (6,000 individuals). The site has been classified as an Important Bird and Biodiversity Area by BirdLife International. http://datazone.birdlife.org/site/factsheet/cabo-raso-iba-portugal . Cabo Raso stretches from the Paço de Arcos beach in Oeiras, along Cabo Raso and Cabo da Roca and up to Samarra beach, north of Magoito. The Site has a high volume of maritime traffic of various types because it is located at the entrance to Lisbon harbour. This highly productive IBA has an abundance of sediments and nutrients supplied by the river Tagus and is characterized by shallow depths, mostly under 100m, which is preferred by the Balearic Shearwater.
Template 12 – Inner Porsangerfjord	An important staging areas for seabirds and waterbirds in the region, with total numbers exceeding 33,000 individuals. An important staging ground for almost the entire Norwegian breeding population of the Vulnerable Lesser White-fronted Goose <i>Anser erythropus</i> . Key species are the Vulnerable Long-tailed Duck <i>Clangula hyemalis</i> and Velvet Scoter

	Melanitta fusca, and Near Threatened Red Knot Calidris canutus.
Template 13 – Graciosa	Graciosa contains the only breeding location of the Vulnerable and endemic Monteiro’s Storm-petrel Hydrobatas monteiroi and also contains breeding population of the Little Shearwater Puffinus lherminieri baroli – listed by OSPAR as a Threatened and/or Declining Species.
Template 14 – Nord- and Sør-Fugløy	An important seabird breeding site with total numbers exceeding 800,000 individuals. Globally significant numbers of the Vulnerable Atlantic Puffin Fratercula arctica and the Near Threatened Razorbill Alca torda are breeding at the site.
Template 15 – Desertas	The Desertas hold some of the most important colonies of seabirds in the Atlantic, with large populations of Procellariiforms, including the only population of Vulnerable Desertas Petrel Pterodroma deserta. It is also one of the most important areas for the reproduction of the Endangered monk-seal Monachus monachus in Europe.
Template 16 – The North-Atlantic Current and mid-Atlantic sub-polar frontal system	The North-Atlantic Current (NAC) dominates the ocean circulation of the North Atlantic. This is an area of intense mesoscale activity with near stationary eddies and numerous thermal fronts aligned in zonal bands. These fronts and eddies enhance primary production, and retain and concentrate secondary productivity both vertically and horizontally, and the combination of localised high intensity mixing in the eddies results in patchy but high surface productivity at fine scales (Vecchione et al. 2015). Seabird tracking data confirms this is an area of high productivity, with a high intensity of foraging activity in the area, suggesting that productivity cascades to higher trophic levels.
Template 17 - Trondheimsfjord and Froan	An important breeding and staging area for seabirds and waterbirds in the region, with total numbers exceeding 125,000 individuals. The site contains significant congregations of 12 species of seabirds and waterbirds throughout the year, including the Vulnerable Long-tailed Duck Clangula hyemalis and Velvet Scoter Melanitta fusca, as well as almost the entire Svalbard population of the Pink-footed Goose Anser brachyrhynchus.
Template 18 - North Mid-Atlantic Ridge	The North Mid-Atlantic Ridge (North MAR), is a linear feature of 7,700 km and an area of 4,4 million km ² (200 to 5,000 m depth). The North MAR contains 72 true seamounts, 9 major fracture zones, 64 known and inferred hydrothermal vent fields, and many canyons, guyots, rift valleys, and small ridges. The presence of the North MAR alters the water circulation creating regions of high productivity and enhanced biological biomass and diversity. It supports rich communities of vulnerable and fragile cold-water corals, sponge aggregations, and deep-water vulnerable fish. Additionally, hydrothermal vent fields and transform faults support unique fauna; many of which are endemic to the MAR. The level of human impacts is relatively low but concerns have arisen from the potential developments of deep-sea mining on the North MAR. Here, we present scientific information that suggest the North MAR meet the scientific criteria for being described as an EBSA.

<p>Template 19 – Tropic Seamount</p>	<p>The Tropic Seamount, located in an Area Beyond National Jurisdiction (ABNJ) in the subtropical North Atlantic, revealed numerous VMEs, including high-density octocoral gardens, <i>Solenosmilia variabilis</i> patch reefs, xenophyophores, crinoid fields and deep-sea sponge grounds. A recent study offered the first biological insight to ground-truth the occurrence of potential VMEs on Tropic Seamount, alongside predictive models to increase the spatial coverage beyond ROV and AUV surveys. Predicted habitat for the glass sponge <i>Poliopogon amadou</i>, a biogeographically restricted hexactinellid forming extensive near-monospecific grounds, was found to favour the deep seamount flanks within a very narrow oceanographic regime. This first visual and sampling survey on the area by the MarineE-Tech project found deposits of ferromanganese crusts at all depths. Therefore we present a case toward designating the Tropic Seamount as an Ecologically or Biologically Significant marine Area as a contribution to address biodiversity conservation in ABNJs.</p>
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Table 2. Other scientific information submitted in support of the workshop objectives

Party/org. of submitter	Author(s)/Title	Abstract/Contents of submission
Denmark	<p>Gogina L. M. et al. (2016) The Baltic Sea scale inventory of benthic faunal communities (. ICES Journal of Marine Science 73(4), 1196–1213. doi:10.1093/icesjms/fsv265.</p>	<p>This study provides an inventory of the recent benthic macrofaunal communities in the entire Baltic Sea. The analyses of soft-bottom benthic invertebrate community data based on over 7000 locations in the Baltic Sea suggested the existence of 10 major communities based on species abundances and 17 communities based on species biomasses, respectively. The low-saline northern Baltic, characterized by silty sediments, is dominated by <i>Monoporeia affinis</i>, <i>Marenzelleria</i> spp., and <i>Macoma balthica</i>. <i>Hydrobiidae</i>, <i>Pygospio elegans</i>, and <i>Cerastoderma glaucum</i> dominate the community in sandy habitats off the Estonian west coast and in the southeastern and southern Baltic Sea. Deep parts of the Gulf of Finland and central Baltic Sea often experience hypoxia, and when oxygen levels in these regions recover, <i>Bylgides sarsi</i> was the first species to colonize. The southwestern Baltic Sea, with high salinity, has higher macrofaunal diversity compared with the northern parts. (...) Our analysis provides a detailed baseline map of the distribution of benthic communities in the Baltic Sea to be used both in science and management.</p>
	<p>Jørgen L. S. Hansen Definitions of density-threshold of habitat forming infauna species: Examples from <i>Haploopsis tubicola</i> in the Kattegat and Belt Sea.</p>	<p>Historic background information on <i>Haploopsis tubicola</i> in the Kattegat and Belt Sea.</p>
	<p>Alf B. Josefson and Daniel J. Conley</p>	<p>With the aim of studying the influence of pelagic front primary production on</p>

	(1997) Benthic response to a pelagic front, Marine Ecology Progress Series 1997. Vol. 147: 49-62.	the benthic system underneath, biomarkers of benthic organic matter constituents and macrofaunal abundance and biomass were measured on stations in a grid extending through the area of the Skagerrak-Kattegat pelagic plume front. Results indicate strong pelagic-benthic coupling near the front and in the area with a mixed water column and are consistent with the hypotheses that pelagic-benthic energy coupling is stronger in mixed areas compared to those which are stratified and that increased OM loading may increase subsurface dwelling and OM processing through benthic burrowing biomass.
	https://www.cbd.int/doc/c/65af/f4cd/06ace1d0c9ba56abe2502aaa/lanice-conchilega-positions-h255-en.pdf	Slide featuring maps indicating observations of <i>lanice conchilega</i> .
	Eelgrass potential	Map indicating eelgrass potential.
	Updated substrate maps from 2014-2017	Map indicating the location of substrates.
	Peter A. Staehr et al. 2019. Habitat Model of Eelgrass in Danish Coastal Waters: Development, Validation and Management Perspectives. Front. Mar. Sci. 6:175.	Nationwide study of eelgrass distribution in Danish coastal waters, including the Kattegat, the Danish straits and the Wadden Sea as well as estuaries, lagoons, bays and open stretches along the coastline. In total, more than 7000 km of coastline of shallow waters (<11 m depth) corresponding to 13125 km ² seafloor are included in this study.
Germany	Data from the Alfred Wegener Institute (AWI Germany)	Cruise tracks from multi-beam bathymetric surveys performed in the region from 1984 to 2018—available on request.
Iceland	Maps of grey seal and harbour seal “haul-outs“ on Icelandic shores (http://selalatur.ni.is/) & explanatory document, in Icelandic with English abstract (http://utgafa.ni.is/fjolrit/Fjolrit_56.pdf) Náttúrufræðistofnun Íslands 2018	Two species of seals live and breed in Icelandic waters and shores, the harbour seal (<i>Phoca vitulina</i>) and the grey seal (<i>Halichoerus grypus</i>), and a few other seal species visit Iceland, irregularly. This monograph provides a general overview of the seal haul-out locations around Iceland. Maps of the seal locations, and associated population counts, are accessible at the website of the Icelandic Institute of Natural History (www.ni.is).
	IUCN Red List species in Iceland, including marine animals (updated 2018). (https://www.ni.is/midlun/utgafa/valistar/spendyr/valisti-spendyra) – with Icelandic/English explanations (English: https://en.ni.is/node/27844)	The IINH Red List for Mammals of 2018 is the most recent inventory of threatened mammalian species in Iceland. Assessment is based on the IUCN Red List Categories and Criteria.

	<p>IUCN Red List of birds in Iceland, including seabirds (updated 2018) (https://www.ni.is/midlun/utgafa/valistar/fuglar/valisti-fugla, English: https://en.ni.is/node/27843) and maps of seabird nesting areas; (http://vistgerdakort.ni.is/) – with Icelandic/English explanations.</p>	<p>The IINH Red List for Birds of 2018 is the most recent inventory of threatened bird species in Iceland. Assessment of bird species is as per the IUCN Red List Categories and Criteria. All bird species that have been sighted in Iceland were examined. In accordance with the guidelines for application of IUCN Red List criteria at regional and national levels (Version 4.0), assessment was only carried out for those species that have either reproduced here for at least 10 consecutive years or are regular visitors. A total of 91 species were assessed, and 41 species are on the IINH’s 2018 Red List.</p>
	<p>International Council for the Exploration of the Sea. 2018. <i>Report of the ICES/NAFO Joint Working Group on Deep-water Ecology (WGDEC) 5–9 March 2018.</i> http://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2018/WGDEC/WGDEC_2018.pdf</p>	<p>The Working Group on Deep-water Ecology (WGDEC) met 5–9 March 2018 in Dartmouth, Nova Scotia, Canada to: provide new information on the distribution of vulnerable marine ecosystems (VMEs) in the North Atlantic.</p>
<p>Conservation of Arctic Flora and Fauna (CAFF)</p>	<p>CAFF. 2017. State of the Arctic Marine Biodiversity Report. Conservation of Arctic Flora and Fauna International Secretariat, Akureyri, Iceland. 978-9935-431-63-9</p> <ul style="list-style-type: none"> •Scientific report: https://caff.is/marine/marine-monitoring-publications/state-of-the-arctic-marine-biodiversity-report/431-state-of-the-arctic-marine-biodiversity-report-full-report •Policy report: https://caff.is/marine/marine-monitoring-publications/state-of-the-arctic-marine-biodiversity-report/416-state-of-the-arctic-marine-biodiversity-report-key-findings-and-advice-for-monit •Data and graphics generated for 	<p>This report is a synthesis of the state of knowledge about biodiversity in Arctic marine ecosystems, detectable changes, and important gaps in our ability to assess state and trends in biodiversity across six Focal Ecosystem Components (FECs). By compiling available information, the report provides an important first step to identify knowledge gaps in circumpolar biodiversity monitoring efforts. Current biodiversity monitoring is not sufficient to describe the status and trends for many of the FECs. The SAMBR builds on the Arctic Biodiversity Assessment and is an important first step towards better understanding and management of our living resources in the Arctic marine environment. It helps understand the limitations of what existing biodiversity monitoring is able to tell us about the Arctic environment and provides a path forward for improving knowledge. The SAMBR is a product of the Circumpolar Biodiversity Monitoring Program (CBMP) of the Arctic Council’s Conservation of Arctic Flora and Fauna (CAFF) Working Group.</p>

	<p>SAMBR: http://geo.abds.is/geonetwork/srv/eng/catalog.search#/search?resultType=details&from=1&to=100&sortBy=relevance&fast=index&content_type=json&cat=SAMBR&keyword=Key%20Findings •SAMBR website with associated information and reports etc.: https://arcticbiodiversity.is/marine</p>	
	<p>http://geo.abds.is/geonetwork/srv/eng/catalog.search#/search?resultType=details&fast=index&content_type=json&from=1&to=20&sortBy=relevance&any=EBSA</p>	<p>CAFF acted as the repository for the various data sets submitted to the CBD EBSA workshop for the Arctic Ocean in 2014.</p>
	<p>Arctic Biodiversity Data Service Geonetwork</p>	<p>The Arctic Biodiversity Data Service (ABDS) is the data-management framework for the Conservation of Arctic Flora and Fauna (CAFF), the biodiversity working group of the Arctic Council, and its programs and activities including the Circumpolar Biodiversity Monitoring Programme (CBMP). It is an online, interoperable data management system that serves as a focal point and common platform for all CAFF programs and projects as well as a dynamic source for up-to-date circumpolar Arctic biodiversity information and emerging trends.</p>
	<p>OBIS Arctic Node</p>	<p>CAFFs Arctic Biodiversity Data Service (ABDS) also operates as the Arctic NODE within OBIS.</p>
	<p>GBIF Arctic Node</p>	<p>CAFFs Arctic Biodiversity Data Service (ABDS) also operates as the Arctic NODE within GBIF.</p>
<p>EU Horizon 2020 ATLAS project</p>	<p>T. Oporto et al., 2012. Sedimentological and faunistic characterization of summits of mud volcanoes of the Spanish margin (Gulf of Cádiz), 7º Simpósio sobre a Margem Ibérica Atlântica – MIA 2012 16-20 de Dezembro de 2012, Lisboa, pp 131-136.</p>	<p style="text-align: center;">Gulf of Cadiz</p> <p>The Gulf of Cádiz displays a high biodiversity due to its complex oceanography, geological evolution, sediment and habitat heterogeneity and biogeographic context, among other reasons. In this area, emissions of hydrocarbon-rich fluids (mainly methane) cause the formation of sub-surface structures, such as mud volcanoes (300-3,000 m depth), pockmarks and carbonate mounds. Sedimentological and faunistic characterization of four mud volcanic summits located within the Spanish margin of the Gulf of Cádiz (Gazul, Anastasya, Pipoca and Tarsis) and 2 other areas in Anastasya mud volcano (flank and adjacent depression) was done using box-corer samples. In</p>

		<p>general, sediments are structureless and characterized by sandy-clay texture, although the depression of Anastasya and the summit of Pipoca are respectively characterized by mud and clay. The dominant species are typical for muddy bathyal bottoms such as the molluscs <i>Gibberula turgidula</i>, <i>Ledella messanensis</i>, <i>Alvania electa</i>, <i>Bittium watsoni</i> and <i>Kelliella miliaris</i>, annelids <i>Spiochaetopterus typicus</i> and <i>Euclymene</i> sp. or the sea-pen <i>Virgularia</i> cf <i>mirabilis</i>,. In Gazul mud volcano, the higher gravel content compared to other mud volcanoes and the presence of authigenic carbonates favour suspensivore species that are generally associated with gravel and hard bottoms, such as the coral <i>Madrepora oculata</i>, the annelid <i>Filograna implexa</i>, and the molluscs <i>Batharca philipiana</i>, <i>Alvania tomentosa</i> and <i>Alvania zylensis</i>. Typical cold seep fauna was represented by the annelid <i>Siboglinum</i> sp.1, the decapod <i>Calliax</i> sp. and the bivalves <i>Lucinoma asapheus</i> and <i>Solemya elarraichensis</i>, this chemosynthetic communities and deposit feeders displayed higher abundances and dominances in Anastasya, with a very low representation in Gazul.</p>
	<p>J. L. Rueda, 2012. Biodiversity and geodiversity in the mud volcano field of the Spanish margin (Gulf of Cádiz) <i>Biodiversidad y geodiversidad en el campo de volcanes de fango del margen Español (Golfo de Cádiz). 7º Simpósio sobre a Margem Ibérica Atlântica – MIA 2012 16-20 de Dezembro de 2012, Lisboa, pp 137-141.</i></p>	<p>Cold seeps and mud volcanoes represent heterogeneous seafloor structures that promote a wide variety of geological features, habitat types and associated biota. In Spanish waters of the Gulf of Cádiz, a total of 11 mud volcanoes have been found so far, containing more than 15 habitat types (according to EUNIS and LPRE) and around 850 species. Some of these species (~ 20 spp.) are included in local, national or international conservation lists of threatened species, others represent first records for this area and more than 50 are of commercial value. The biodiversity found in the mud volcano field of the Spanish margin of the Gulf of Cádiz is influenced by its biogeographical location (with Atlantic, Mediterranean, African, amphiatlantic and endemic species), its wide bathymetric range (from 300 to 1100 m depth), the singular biogeochemical and sedimentological characteristics of each mud volcano and the combination of different sampling methods targeting different faunistic components. According to the new directives (Habitats directive, Marine Strategy Framework directive) and the anthropogenic impacts occurring in the area (especially trawling fisheries), conservational measures should be carried out for a balanced and sustainable extraction of the natural resources and the conservation of the Spanish and European Natural heritage regarding these singular deep-sea ecosystems.</p>
	<p>Volcanes de Fango del Golfo de Cádiz. Áreas de estudio del proyecto LIFE+ INDEMARES. V. Díaz del Río, 2014.</p>	<p>The Gulf of Cadiz is located in the eastern sector of the North Atlantic Ocean, to the southwest of the Iberian Peninsula. Its eastern boundary is the Strait of Gibraltar, separating the gulf from the Mediterranean Sea. The area known as</p>

		<p>"the Gulf of Cadiz mud volcanoes" is located in the bathymetric range between 300 and 1,200 metres, placing it on the upper middle part of the continental slope and the southern Iberian continental margin.</p>
	<p>Multidisciplinary study of mud volcanoes and diapirs and their relationship to seepages and bottom currents in the Gulf of Cádiz continental slope (northeastern sector). D. Palomino et al., 2016. <i>Marine Geology</i> Volume 378, 1 August 2016, pp 196-212.</p>	<p>The seabed morphology, type of sediments, and dominant benthic species on eleven mud volcanoes and diapirs located on the northern sector of the Gulf of Cádiz continental slope have been studied. The morphological characteristics were grouped as: (i) fluid-escape-related features, (ii) bottom current features, (iii) mass movement features, (iv) tectonic features and (v) biogenic-related features. The dominant benthic species associated with fluid escape, hard substrates or soft bottoms, have also been mapped. A bottom current velocity analysis allowed, the morphological features to be correlated with the benthic habitats and the different sedimentary and oceanographic characteristics. The major factors controlling these features and the benthic habitats are mud flows and fluid-escape-related processes, as well as the interaction of deep water masses with the seafloor topography. Mud volcano eruptions give rise to mud flows and/or aqueous fluid seepage. These processes sustain chemosynthesis-based communities, closely associated with fluid seepage. Large depressions in the nearby area are influenced by collapse-related phenomena, where active fluid escape and the erosive effect of bottom currents have been identified. When the extrusion activity of the mud volcano is low and the seepage is diffuse, authigenic carbonates form within the edifice sediments. The bottom current sweeps the seafloor from the SE to the NW. When the velocity is moderate, sedimentary contourite processes take place on both sides of the edifices. At high velocities, the authigenic carbonates may be exhumed and colonised by species associated with hard substrates. Small carbonate mounds are found at the summits of some volcanoes and diapirs. Living corals have been found on the tops of the shallowest mud volcanoes, revealing different oceanographic conditions and strong bottom currents that favour the availability of nutrients and organic particles. The edifices affected by very high current velocities are located in the channels where erosive processes dominate.</p>
	<p>J.L. Rueda, 2016. From chemosynthesis-based communities to cold-water corals: Vulnerable deep-sea habitats of the Gulf of Cádiz (Mar Biodiv, 46:473–482).</p>	<p>The Gulf of Cádiz (GoC) represents an area of ecological importance within the northeastern Atlantic Ocean due to the presence of Mediterranean and Atlantic water masses, a heterogeneous seafloor and a biological confluence. Nevertheless, information on the presence of vulnerable deep-sea habitats is still very scarce and it is of importance for further habitat monitoring within the context of the Habitats and Marine Strategy Framework Directives and for improving conservation and resource extraction management. From 2010 to</p>

		<p>2012, fluid migration and emission related edifices (e.g., mud volcanoes, diapirs) from the Spanish continental margin of the GoC have been explored using a remotely operated vehicle (ROV; Liropus 2000) and an underwater camera sled (UCS; APHIA 2012) as well as several devices for collecting sediment and fauna. Different vulnerable deepsea habitats have been observed, including anoxic bottoms with bacterial mats, sea-pen communities, sponge aggregations, antipatharian and gorgonian communities and also cold-water coral banks. Some of these habitats are included in conservation lists of the habitat directive and in international conventions (OSPAR, RAC/SPA), however some of them are located in areas of the GoC that are exposed to intense trawling. The diversity of habitats detected in the Spanish continental margin of the GoC highlights the importance of seepage related edifices as inducers of seabed and habitat heterogeneity in deep-sea areas.</p>
	<p>L.V. Ramalho, C.M. López-Fé and J.L. Rueda, 2018. Three species of Reteporella (Bryozoa: Cheilostomata) in a diapiric and mud volcano field of the Gulf of Cádiz, with the description of Reteporella victori n. sp. Zootaxa 4375 (1): 090–104.</p>	<p>Diapirs and mud volcanoes (MVs) are formed by the migration and extrusion of fluids and mud to the seafloor, respectively. In the Gulf of Cádiz there are ca. 60 MVs and several diapirs with different environmental conditions and seepage activity. Previous studies, mainly on MVs, have demonstrated that the invertebrate fauna associated with these seafloor structures can be very diverse, including chemosymbiotic species, mostly mollusks and frenulate polychaetes, as well as vulnerable suspension feeders, such as cold-water corals and sponges, among others. Previous studies of the bryozoan fauna in this area have recorded species belonging to 28 families. One of these families is Phidoloporidae, which comprises 27 genera worldwide, including the common Rhynchozoon, Reteporellina, and Reteporella. In the present study, two species belonging to Reteporella are redescribed, and a new species is described from diapirs and MVs on the shelf and slope of the Gulf of Cádiz. The samples were collected during several oceanographic expeditions carried out by the Instituto Español de Oceanografía. This genus is well represented in the NE Atlantic Ocean and the Mediterranean Sea, and our study extends its occurrence on MVs and diapirs fields of the Gulf of Cádiz.</p>
	<p>F.M. Da Silva Morsoleto, 2009. Biodiversity of Cold-Water Coral Reefs in the Gulf of Cadiz (NE Atlantic). Universidade de Aveiro, Departamento de Biologia. Dissertação apresentada à Universidade de Aveiro</p>	<p>This work was carried out in different locations within the bathymetric range of 300-900m in the Spanish and Moroccan margins of the Gulf of Cadiz (NE Atlantic). This area is characterised by the occurrence of extensive carbonate provinces and mostly dead cold-water coral reefs. The main objectives were: i) to obtain information on the megafaunal biodiversity and human impact in the study area using digital images obtained during ROV (remote operated vehicle)</p>

	<p>para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Biologia Marinha.</p>	<p>dives, and ii) to characterise, in terms of abundance and biomass, the composition and structure of the benthic macroinvertebrate assemblages associated to the carbonate crust and coral reef habitats using sediment samples collected with a circular boxcore.</p>
	<p>L. Génio, 2008. New Record of “Bathymodiolus” Mauritanicus Cosel 2002 from the Gulf of Cadiz (NE Atlantic) Mud Volcanoes. Journal of Shellfish Research, Vol. 27, No. 1, 53–61.</p>	<p>The “Bathymodiolus” childressi group is the most geographically diverse assemblage of deep-sea mussel species. In this paper we consider several possible hypotheses to explain the present biogeographic distribution of the “B.” childressi species complex. Mussels were collected for the first time from mud volcanoes in the Gulf of Cadiz (NE Atlantic Ocean) during the training through research (TTR) 16 research expedition in 2006. Preliminary observations of the shell features indicate that they belong to the “B.” childressi species complex, which has been recognized as morphologically and genetically distinct from other Bathymodiolus species. Molecular analyses of two mitochondrial genes (COI-5 and ND4) were used to characterize the new mussel population from the Gulf of Cadiz (GOC) and to determine their phylogenetic relationships with other members of the “B.” childressi group. The results indicate that the GOC mussels are conspecific with “Bathymodiolus” mauritanicus Cosel (2002), described from West Africa margin, and support a previous hypothesis that “B.” mauritanicus is an amphiatlantic species.</p>
	<p>L. Génio1, 2013. The snails’ tale in deep-sea habitats in the Gulf of Cadiz (NE Atlantic).. Biogeosciences, 10, 5159–5170.</p>	<p>Bridging the Atlantic and Mediterranean continental margins, the South Iberian region has recently been the focus for geological and biological investigations. In this region, the Gulf of Cadiz (GoC) encompasses a great variety of deep-sea habitats that harbour highly diverse biological communities. In this study, we describe the composition of gastropod assemblages obtained from in situ colonization experiments and benthic sampling of deep-sea habitats in the GoC. Gastropod distributional patterns, such as bathymetric ranges, bathymetric turnover, affinity to substrate types and abundance-occupancy relationships, are analysed and interpreted in relation to their inferred dispersal capabilities and substrate availability. Overall, the GoC comprises a high diversity of gastropods (65 species), and distinct assemblages were found in typical sedimentary environments at mud volcanoes and in association with carbonate and coral samples or organic substrata. The number of taxa peaked at the Carbonate Province in the middle slope (600–1200m depth), a highly heterogeneous area with numerous mud volcanoes, carbonate mounds and corals. Darwin (1100 m) and Captain Arutyunov (1300 m) mud</p>

		<p>volcanoes harboured the most species-rich and abundant gastropod assemblages, respectively. Colonization experiments with organic substrata (wood and alfalfa grass) also yielded diverse and abundant gastropod assemblages. These organic inputs allowed the recruitment of local species but mainly of wood specialist taxa that were not previously known from the GoC. Our results suggest that the distribution of gastropod assemblages may be primarily determined by the occurrence of suitable habitats, probably due to the effect of the substrate type on the structural complexity of the habitat.</p>
	<p>A. Hilário, 2009. High diversity of frenulates (Polychaeta: Siboglinidae) in the Gulf of Cadiz mud volcanoes: A DNA taxonomy analysis. Deep-Sea Research I 57 (2010), pp 143–150.</p>	<p>Frenulates are the most poorly known members of the family Siboglinidae (Polychaeta:Canalipalpata). These thread-like worms occur in reducing marine sediments worldwide, but they are often overlooked in benthic samples or too poorly preserved for adequate taxonomic evaluations. We report on a remarkable diversity of frenulates that were recently sampled from 13 mud volcanoes (350–3902m deep) in the Gulf of Cadiz, off southern Iberia. Sampled with benthic coring devices, the bodies of these long tubicolous worms were often broken or incomplete, making them difficult to identify morphologically. Consequently, we employed DNA taxonomic methods to assess their diversity. Mitochondrial cytochrome-c-oxidase subunit 1 (COI) sequences distinguished 15 evolutionary lineages inhabiting the Gulf of Cadiz. Only four of the lineages could be assigned to currently recognized Atlantic species; the remaining 11 may be new to science. This remarkable diversity of frenulates in a small geographical region is unprecedented and is hypothesized to result from environmental heterogeneity associated with the bathymetric and geochemical settings of these mud volcanoes.</p>
	<p>R. León, 2010. Pockmarks, collapses and blind valleys in the Gulf of Cádiz. Geo-Mar Lett 30:231–247.</p>	<p>Herein we describe a suite of fluid escape depression features, including pockmarks and collapse structures, discovered in the Gulf of Cádiz (Spain) during several recent cruises. We also establish an evolutionary model for these depressions and discuss the generation of bottom undercurrent furrows from fluid-flow structures, considering the oceanographic and tectonic framework and gas expulsion mechanisms. We describe for the first time blind valleys, which we define as giant, elongated (3 to 10 km long), collapsed and complex fault-strike features comprising mega-collapses and mega-pockmarks, generated in gas-venting areas and not associated to the collapse of mud-volcano complexes. We detected the blind valleys above diapiric structures. The collapse processes associated to blind valleys result from fluid escape through migration pathways which, in turn, are created by distension due to diapiric activity or to later tectonic reactivation of these diapirs. The evolution of these</p>

		<p>blind valleys, and their present-day morphology as furrows, derives from progressive fluid migration as well as from interaction of Mediterranean Outflow Water with the seafloor.</p>
	<p>Pinheiro L.M. and Cunha M.R., 2010. Mud volcanism, gas hydrates and associated deep sea ecosystems in the Gulf of Cadiz.</p>	<p>Short description of mud volcanism, gas hydrates and associated deep sea ecosystems in the Gulf of Cadiz.</p>
	<p>C. F. Rodrigues, A. Hilario, and M. R. Cunha. 2012. Chemosymbiotic species from the Gulf of Cadiz (NE Atlantic): distribution, life styles and nutritional patterns. Biogeosciences Discuss., 9, 17347–17376.</p>	<p>Previous work in the mud volcanoes from the Gulf of Cadiz revealed a high number of chemosymbiotic species, namely bivalves and siboglinid polychaetes. In this study we give an overview of the distribution and life styles of those species in the Gulf of Cadiz, 5 determine the role of autotrophic symbionts in the nutrition of selected species using stable isotope analyses ($\delta^{13}C$, $\delta^{15}N$ and $\delta^{34}S$) and investigate the intra-specific variation of isotope signatures within and between study sites. Twenty siboglinid and nine bivalve chemosymbiotic species have been identified and were found living in fifteen mud volcanoes during our studies. Solemyids bivalves and tubeworms of the genus 10 Siboglinum are the most widespread, whereas other species were found in a single mud volcano (e.g. “Bathymodiolus” mauritanicus) or restricted to deeper mud volcanoes (e.g. Polybrachia sp., Lamellisabella denticulata). Species distribution suggests that different species may adjust their position within the sediment according to their particular needs and intensity and variability of the chemical substrata supply. Isotopic 15 values found for selected species are in accordance with values found in other studies, with thiotrophy as the dominant nutritional pathway, and with methanotrophy and mixotrophy emerging as secondary strategies. The heterogeneity in terms of nutrient sources (expressed in the high variance of nitrogen and sulphur values) and the ability to exploit different resources by the different species may explain the high diversity of 20 chemosymbiotic species found in the Gulf of Cadiz. This study increases the knowledge of the chemosymbiotic species in the Gulf of Cadiz, highlight the relevance of seep chemoautolithotrophic production in this area and provide a starting point for future trophic ecology studies.</p>
	<p>Seabed morphology and hydrocarbon seepage in the Gulf of Cadiz mud volcano area: Acoustic imagery, multibeam and ultra-high resolution</p>	<p>Extensive mud volcanism, mud diapirism and carbonate chimneys related to hydrocarbon-rich fluid venting are observed throughout the Spanish^Portuguese margin of the Gulf of Caodiz. All the mud volcanoes and diapirs addressed in this paper lie in the region of olistostrome/accretionary complex units which</p>

	<p>seismic data L. Somoza, Marine Geology 195 (2003) 153-176.</p>	<p>were emplaced in the Late Miocene in response to NW-directed convergence between the African and Eurasian plates. The study area was investigated by multibeam echo-sounder, high and ultra-high resolution seismic profiling, dredging and coring. The structures observed on multibeam bathymetry, at water depths between 500 and 1300 m, are dominated by elongate mud ridges, mud cones, mud volcanoes and crater-like collapse structures ranging in relief from 50 to 300 m and size from 0.8 to 2 km in diameter. The main morphotectonic features, named the Guadalquivir Diapiric Ridge (GDR) and the Cañiz Diapiric Ridge (CDR), are longitudinally shaped diapirs which trend NE^SW and consist of lower^middle Miocene plastic marly clays. The GDR field and the TASYO field, which consist of mud volcanoes and extensive fluid venting related to diapiric ridge development, are described in this paper. The GDR field is characterised by numerous, single, sub-circular mud volcanoes and mud cones. The single mud volcanoes are cone-shaped features with relatively gentle slopes of 3°^6°, consisting of several generations of mud breccia deposition with indications of gas-saturation, degassing structures and the presence of H₂S. The mud cones have asymmetric profiles with steep slopes of up to 25° and contain large surficial deposits of hydrocarbon-derived carbonate chimneys and slabs. The TASYO field is characterised by an extensive concentration of small, sub-circular depressions, oval and multi-cone mud volcanoes and large sediment slides. Mud volcanoes in this area are characterised by moderate slopes (8°^12°), have bathymetric relief ranging from 100 to 190 m and consist of sulphide-rich mud breccia, calcite chimneys, carbonate crusts and chemosynthetic fauna (Pogonophora tube worms). We propose that all these hydrocarbon seepage structures are related to lateral compressional stress generated at the front of the olistostromic/accretionary wedge. This stress results in the uplifting and squeezing plastic marly clay deposits. Additionally, the compressional stress at the toe of the olistostrome forms overpressurised compartments which provide avenues for hydrocarbonenriched fluids to migrate.</p>
	<p>Biodiversity of Cold Seep Ecosystems along the European Margins, Vanreusel A. et al., 2009, Oceanography, Volume 22, Number 1.</p>	<p>During the European Commission's Framework Six Programme, HERMES, we investigated three main areas along the European margin, each characterized by the presence of seep-related structures exhibiting different intensity of activity and biological diversity. These areas are: (1) the Nordic margin with the Håkon Mosby mud volcano and many pockmarks, (2) the Gulf of Cádiz, and (3) the eastern Mediterranean with its hundreds of mud volcanoes and brine pool structures. One of the main goals of the HERMES project was to unravel the</p>

		<p>biodiversity associated with these seep-associated ecosystems, and to understand their driving forces and functions, using an integrated approach. Several multidisciplinary research cruises to these three areas provided evidence of high variability in ecosystem processes and associated biodiversity at different spatial scales, illustrating the “hotspot” nature of these deep water systems.</p>
Hatton Rockfall Plateau		
<p>EU Horizon 2020 ATLAS project and Global Ocean Biodiversity Initiative</p>	<p>ATLAS Deliverable 2.3: Community respiration rates, biogeochemical characteristics of organic matter and fauna at ATLAS Case Study Sites, Wolff, G. et al., 2019.</p>	<p>The overall aim of this deliverable is to further knowledge of the functioning of cold-water corals (CWCs), including reefs and octacorals as well as sponge ground ecosystems, by determining their overall contribution to the respiration and turnover of organic matter (OM) reaching the sea floor. Furthermore, baseline knowledge of the nature of the food supply that fuels the ecosystems is critical in knowing how they will respond to changing oceanic conditions and productivity.</p>
	<p>ATLAS Deliverable 2.4: Water mass properties, hydrodynamic controls and mechanisms of organic matter supply in ATLAS case study areas, Mohn, C. and van Oevelen, D. 2019.</p>	<p>Report of the in-situ hydrodynamics, abiotic variables, and suspended particles near the seafloor and sedimenting particles from bottom traps to identify organic matter transport pathways for different case-study sites and a qualitative comparison with output from the high-resolution hydrodynamic models during periods of strong and weak AMOC.</p>
	<p>ATLAS Deliverable 3.1 Good Environmental Status and Biodiversity Assessments, Borja, A., 2018.</p>	<p>This deliverable aims to explore how best to define Good Environmental Status (GES) for deep-sea habitats, to review progress with indicator development for the deep sea, and to explore how better to assess GES in the deep sea considering four of the eleven Descriptors included in the Marine Strategy Framework Directive (MSFD): D1 Biodiversity, D3 Commercial species, D6 Seafloor integrity and D10 Marine Litter.</p>
	<p>ATLAS Deliverable 3.2 Water masses controls on biodiversity and biogeography, Henry, L-A and Puerta, P. 2019.</p>	<p>The oceanographic and hydrographic conditions of the North Atlantic are predicted to dramatically change by this century’s end. The Atlantic Meridional Overturning Circulation (AMOC) is anticipated to slow, and many of the waters that currently bathe vulnerable marine ecosystems (VMEs) are predicted to be warmer, have reduced oxygen and food supply, and be more acidic. Among the many ways in which impacts of climate change on VMEs are being studied in ATLAS is the empirical approach, whereby effects of present day oceanographic variables are directly related to VME biodiversity through systematic review or statistical analyses. Deliverable 3.2 adopts this empirical approach: first, D3.2 reviews what is known about effects of oceanographic</p>

		<p>variables on VME biodiversity across the North Atlantic to derive a basin-scale synoptic view of key ocean controls on system biodiversity; second, D3.2 examines the statistical significance of these variables in selected regional ATLAS Case Studies covering several Exclusive Economic Zones (EEZs) and Areas Beyond National Jurisdiction (ABNJ).</p>
	<p>Morato, T., et al. 2019. Atlas Deliverable D3.3: Biodiversity, biogeography and GOODS classification system under current climate conditions and future IPCC scenarios.</p>	<p>In this deliverable, ATLAS used a combination of techniques, along with the best available information along with knowledge developments made by WP1 and WP2 and new data gathered by WP3 to improve the understanding of deep-sea the biodiversity and biogeographic patterns of sensitive deepwater ecosystems and deep-sea fish in the North Atlantic and forecast changes under IPCC 21st century scenarios of water mass structure and ocean currents.</p>
	<p>Combes, M. 2019. Deliverable 3.4 - Conservation Management Issues in ATLAS Basin-scale systematic conservation planning: identifying suitable networks for VMEs protection.</p>	<p>Based on the best available knowledge collated and produced in the framework of ATLAS, the objective of the present deliverable was to integrate all available data into a common analytical framework for systematic conservation planning at the scale of the North Atlantic.</p>
	<p>Appendix of the Atlas Deliverable 3.4</p>	<p>Appendices to the above deliverable.</p>
	<p>Bibliography for Hatton-Rockall plateau (Atlas project)</p>	<p>Bibliography for Hatton-Rockall plateau (Atlas project)</p>
	<p>Johnson, D.E., et al. 2019. Rockall and Hatton: Resolving a Super Wicked Marine Governance Problem in the High Seas of the Northeast Atlantic Ocean, Front. Mar. Sci. 6:69.</p>	<p>The Hatton-Rockall plateau in the northeast Atlantic Ocean has long been the subject of interest for fishers, prospectors, conservationists, managers, planners, and politicians. As a feature that straddles national and international waters, it is subject to a multitude of competing and confounding regulations, making the development of a holistic management plan for sustainable use fraught with difficulty. Here, the various stakeholders in the area are collated, together with the rules they have created or must abide by with respect to biodiversity assets, maritime resources, and governance frameworks. Blue Growth envisages optimal use of sea areas, including potential for additional commercial activities. Current research and stakeholder engagement efforts to achieve this integration are described, and the contribution of the EU-funded ATLAS project is analyzed. In particular, more precise, ground-truthed information has the potential to inform systematic conservation planning, providing the basis for sustainable development and improving adaptive management. By scrutinizing</p>

		and exposing all the elements in this example of a spatially managed area we show how the expectations of each stakeholder can be better managed.
	Neat, F., et al. (2018). Visual evidence of reduced seafloor conditions and indications of a cold-seep ecosystem from the Hatton–Rockall basin (NE Atlantic). Journal of the Marine Biological Association of the United Kingdom.	High definition video from a towed camera system was used to describe the deep sea benthic habitats within an elongate depression located at the western margin of Rockall Bank in the Hatton–Rockall Basin. At depths greater than 1190 m, an extensive area (10 km long by 1.5 km wide) of what appeared to be reduced sediments, bacterial mats and flocculent matter indicated possible cold seep habitat. Plumes of sediment rich fluid were observed alongside raised elongate features that gave topographic relief to the otherwise flat seafloor. In the deepest section of the depression (1215 m) dense flocculent matter was observed suspended in the water column, in places completely obscuring the seabed. Away from the bacterial mats, the habitat changed rapidly to sediments dominated by tube-dwelling polychaete worms and then to deep-sea sedimentary habitats more typical for the water depth (sponges and burrowing megafauna in areas of gentle slopes, and coral gardens on steeper slopes).
Hydrothermal Vents		
Global Biodiversity Initiative	List of active hydrothermal vents between 30n-and-55n-en.pdf	List of active hydrothermal vents between 30n and 55n
	Annotated Bibliography of North Atlantic Vents, CL Van Dover, Duke University	Annotated Bibliography of North Atlantic Vents
	Colaço, A. et al. (1998) Cah. Biol. Mar 39 (237-240).Ecology of the Menez Gwen hydrothermal vent field (Mid-Atlantic Ridge/Azores Triple Junction).	This article describes the ecology of the Menez Gwen hydrothermal vent field, located on the Mid-Atlantic Ridge. The fauna are described and compared with other shallow-water hydrothermal areas.
	Desbruyeres, D. et al. (2000) Hydrobiologia 440: 201–216. A review of the distribution of hydrothermal vent communities along the northern Mid-Atlantic Ridge: dispersal vs. environmental controls.	Vent sites on the MAR exhibit varied environmental conditions, resulting from depth variation of the axis and associated physical parameters, and different source rocks. In this paper, the geological setting and vent fluid composition of the fields are considered together with their community composition to tentatively ascertain the order of a hierarchy between dispersal and environmental control.
	Dubilier, N. 2010. Short Cruise Report, Meteor Cruise No. 82, Leg 3, 06.09. – 11.10.2010 Ponta Delgada (Portugal) – Las Palmas	The MenezMAR M82/3 cruise with the RV Meteor focused on the geology, chemistry, and biology of the Menez Gwen hydrothermal vent field at 37°N on the Mid-Atlantic Ridge (MAR). Menez Gwen was chosen as a key study site for interdisciplinary studies within the DFG Cluster of Excellence research on

	<p>(Spain)</p>	<p>hydrothermal vents at MARUM, Bremen (Research Area Geo-Biosphere Interactions). The goal of Meteor cruise M 82/3 was to gain a better understanding of the hydrothermal processes at the young Menez Gwen volcanic system.</p>
	<p>M. Klischies, M. et al. <i>Marine Geology</i> 412 (2019) 107–122. Geological mapping of the Menez Gwen segment at 37°50'N on the MidAtlantic Ridge: Implications for accretion mechanisms and associated hydrothermal activity at slow-spreading mid-ocean ridges</p>	<p>Slow-spreading mid-ocean ridges have the potential to form large seafloor massive sulphide (SMS) deposits. Current exploration for SMS deposits commonly targets associated active hydrothermal venting on the ridge axis, which makes the discovery of inactive vent sites and SMS deposits in the off-axis regions unlikely. Geological maps of the seafloor, which help understand the timing and location of SMS formation, usually focus on individual hydrothermal vent sites and their immediate surroundings, and are often too small to aid in SMS exploration. This study uses ship-based multibeam echosounder (MBES) data and a systematic classification scheme to produce a segment-scale geological map. (...)</p>
	<p>Konn, C. et al. (2015) <i>Astrobiology</i>, 15 (5), 381–399. The Production of Methane, Hydrogen, and Organic Compounds in Ultramafic-Hosted Hydrothermal Vents of the Mid-Atlantic Ridge</p>	<p>Both hydrogen and methane are consistently discharged in large quantities in hydrothermal fluids issued from ultramafic-hosted hydrothermal fields discovered along the Mid-Atlantic Ridge. Considering the vast number of these fields discovered or inferred, hydrothermal fluxes represent a significant input of H₂ and CH₄ to the ocean. Although there are lines of evidence of their abiogenic formation from stable C and H isotope results, laboratory experiments, and thermodynamic data, neither their origin nor the reaction pathways generating these gases have been fully constrained yet. Organic compounds detected in the fluids may also be derived from abiotic reactions. Although thermodynamics are favorable and extensive experimental work has been done on FischerTropsch-type reactions, for instance, nothing is clear yet about their origin and formation mechanism from actual data. Since chemolithotrophic microbial communities commonly colonize hydrothermal vents, biogenic and thermogenic processes are likely to contribute to the production of H₂, CH₄, and other organic compounds. There seems to be a consensus toward a mixed origin (both sources and processes) that is consistent with the ambiguous nature of the isotopic data. But the question that remains is, to what proportions? More systematic experiments as well as integrated geochemical approaches are needed to disentangle hydrothermal geochemistry. This understanding is of prime importance considering the implications of hydrothermal H₂, CH₄, and organic compounds for the ocean global budget, global cycles, and the origin of life.</p>

<p>Extraordinary hydrothermal vent discovery in the mid-Atlantic ocean (2018, June 22)</p>	<p>An international team of scientists has discovered a new hydrothermal field near the Gigante Seamount in the Azores, a rare finding they are very excited about. The team, including scientists from the EU Horizon 2020-funded project ATLAS, have been surveying the largely untouched seas of the Azores, an archipelago in the mid-Atlantic which harbours some of the most important deepsea ecosystems in the Atlantic Ocean.</p>
<p>Marcon, Y. Deep-Sea Research I 75 (2013) 93–109. Megafaunal distribution and assessment of total methane and sulfide consumption by mussel beds at Menez Gwen hydrothermal vent, based on geo-referenced photomosaics.</p>	<p>The Menez Gwen hydrothermal vents, located on the flanks of a small young volcanic structure in the axial valley of the Menez Gwen seamount, are the shallowest known vent systems on the Mid-Atlantic Ridge that host chemosynthetic communities. Although visited several times by research cruises, very few images have been published of the active sites, and their spatial dimensions and morphologies remain difficult to comprehend. We visited the vents on the eastern flank of the small Menez Gwen volcano during cruises with RV Poseidon (POS402, 2010) and RV Meteor (M82/3, 2010), and used new bathymetry and imagery data to provide first detailed information on the extents, surface morphologies, spatial patterns of the hydrothermal discharge and the distribution of dominant megafauna of five active sites. The investigated sites were mostly covered by soft sediments and abundant white precipitates, and bordered by basaltic pillows. The hydrothermally-influenced areas of the sites ranged from 59 to 200 m². Geo-referenced photomosaics and video data revealed that the symbiotic mussel <i>Bathymodiolus azoricus</i> was the dominant species and present at all sites. (...)</p>
<p>Meninia, E. and Van Dover, CL. (2019). Marine Policy 108. An atlas of protected hydrothermal vents.</p>	<p>Active hydrothermal vents are valued worldwide because of the importance of their biodiversity and their influence on scientific discovery and insight about life on Earth and elsewhere in the Universe. There exist at least 20 areas and area networks with conservation measures for deep-sea hydrothermal vents, established by 12 countries and three Regional Fisheries Management Organisations, in six oceanic regions. Area-based management tools (ABMT) implemented by these countries illustrate multiple categories and means of protection and management of these rare and vulnerable habitats. Some ABMTs only regulate bottom and deep-trawling fisheries activities, others manage additional activities such as mining, scientific research, and bioprospecting, while still others protect active hydrothermal vents through broad conservation interventions. This atlas summarizes the “who”, “what”, “when”, “where” of protected hydrothermal vents worldwide and underscores recognition of the importance of hydrothermal-vent ecosystems by coastal States.</p>
<p>Petersen, J.M. (2010) Environmental</p>	<p>The shrimp <i>Rimicaris exoculata</i> from hydrothermal vents on the Mid-Atlantic</p>

	<p>Microbiology 12(8), 2204–2218. Dual symbiosis of the vent shrimp <i>Rimicaris exoculata</i> with filamentous gamma- and epsilonproteobacteria at four Mid-Atlantic Ridge hydrothermal vent fields.</p>	<p>Ridge (MAR) harbours bacterial epibionts on specialized appendages and the inner surfaces of its gill chamber. Using comparative 16S rRNA sequence analysis and fluorescence in situ hybridization (FISH), we examined the <i>R. exoculata</i> epibiosis from four vents sites along the known distribution range of the shrimp on the MAR. Our results show that <i>R. exoculata</i> lives in symbiosis with two types of filamentous epibionts. One belongs to the Epsilonproteobacteria, and was previously identified as the dominant symbiont of <i>R. exoculata</i>. The second is a novel gammaproteobacterial symbiont that belongs to a clade consisting exclusively of sequences from epibiotic bacteria of hydrothermal vent animals, with the filamentous sulfur oxidizer <i>Leucothrix mucor</i> as the closest free-living relative. Both the epsilon- and the gammaproteobacterial symbionts dominated the <i>R. exoculata</i> epibiosis at all four MAR vent sites despite striking differences between vent fluid chemistry and distances between sites of up to 8500 km, indicating that the symbiosis is highly stable and specific. Phylogenetic analyses of two mitochondrial host genes showed little to no differences between hosts from the four vent sites. In contrast, there was significant spatial structuring of both the gamma- and the epsilonproteobacterial symbiont populations based on their 16S rRNA gene sequences that was correlated with geographic distance along the MAR. We hypothesize that biogeography and host–symbiont selectivity play a role in structuring the epibiosis of <i>R. exoculata</i>.</p>
	<p>Klischies, M. et al. (2019) <i>Marine Geology</i> 412 107–122. Geological mapping of the Menez Gwen segment at 37°50'N on the MidAtlantic Ridge: Implications for accretion mechanisms and associated hydrothermal activity at slow-spreading mid-ocean ridges.</p>	<p>This study uses ship-based multibeam echosounder (MBES) data and a systematic classification scheme to produce a segment-scale geological map. When combined with spreading rate, this allows us to not only reconstruct the segment's spreading history, but also reveals important processes that localize hydrothermal venting. Geological mapping around two known hydrothermal vent sites on the Menez Gwen segment at 37°50'N on the slow-spreading Mid-Atlantic Ridge showed that hydrothermal venting accompanies the tectonic break-up of a large, cooling magmatic body. Venting is focussed by faulting and resulting permeability changes. The large magmatic body is associated with an axial volcano that formed as a last stage of a period with intense magmatic accretion. Such magmatic accretion periods occur every 300 to 500 ka at the Menez Gwen segment, with increasing intensity over the past 3.5 Ma years. The most recent, most intense magmatic period appears to be a regional phenomenon, also affecting the neighbouring Lucky Strike and Rifted Hills segments. Understanding the accretional setting and the spatial and temporal constraints of hydrothermal venting enables us to develop criteria in MBES data</p>

	<p>Sarrazin, J. (2015) Biodiversity patterns, environmental drivers and indicator species on a high-temperature hydrothermal edifice, Mid-Atlantic Ridge, <i>Deep-Sea Research II</i> 121 (2015) 177–192.</p>	<p>to aid exploration for inactive SMS deposits.</p> <p>Knowledge on quantitative faunal distribution patterns of hydrothermal communities in slow-spreading vent fields is particularly scarce, despite the importance of these ridges in the global mid-ocean system. This study assessed the composition, abundance and diversity of 12 benthic faunal assemblages from various locations on the Eiffel Tower edifice (Lucky Strike vent field, Mid-Atlantic Ridge) and investigated the role of key environmental conditions (temperature, total dissolved iron (TdFe), sulfide (TdS), copper (TdCu) and pH) on the distribution of macro- and meiofaunal species at small spatial scales (0.1 m). (...) Our results also highlight very specific niche separation for copepod juveniles among the different hydrothermal microhabitats. Some sampling units showed unique faunal composition and increased beta diversity on the Eiffel Tower edifice. Contrary to what was expected, the highest beta diversity was not associated with a particular microhabitat type, but rather with location on the central part of the edifice where other structuring factors may predominate.</p>
	<p>Schmidt, C. 2008. Geochemical energy sources for microbial primary production in the environment of hydrothermal vent shrimps, <i>Marine Chemistry</i> 108, 18–31.</p>	<p>At deep-sea hydrothermal vents, dense invertebrate communities prevail along chemoclines where the relaxation of redox disequilibria sustains chemolithoautotrophic microbial CO₂-fixation. At the Mid-Atlantic Ridge, swarms of thousands of <i>Rimicaris exoculata</i> shrimps thus assemble along the turbulent mixing interface between the hydrothermal fluid and oxygenated seawater. It was suggested that this environment provides ideal conditions for growth to the abundant chemosynthetic microbial epiflora that colonizes the shrimps' branchial cavity. Sulfide has long been considered as the prime electron donor used by the epibionts but, the oxidation of iron has recently been hypothesized as an alternative pathway for the iron-rich Rainbow site. In order to examine the potential energy sources for microbial primary production within the swarms at Rainbow, the chemical conditions along the mixing gradient have been modeled from field data. This model provides a basis for the quantitative comparison of energy-budgets available for chemolithoautotrophic primary production based on different oxidative pathways (e.g.: oxidation of sulfide-iron II methane and hydrogen by oxygen). (...)</p>
	<p>Van Dover, C.L., 1996. Biology of the Lucky Strike hydrothermal field, <i>Deep-Sea Research I</i>, Vol. 43, No. 9, pp. 1509-1529.</p>	<p>Newly discovered hydrothermal vent communities at Lucky Strike on the Mid-Atlantic Ridge (37°18'N, 32°16'W) are comprised of an invertebrate fauna sufficiently different from known vent faunas of TAG and Snake Pit to consider Lucky Strike part of a new biogeographic province. The dominant component</p>

		<p>of the fauna is a new species of mussel, and the most unusual feature of the fauna is an echinoid echinoderm, <i>Echinus</i> sp. An abundance of small mussels (< 5 mm) indicates a recent recruitment event at Lucky Strike, and modal analysis of length-frequency data indicate a discontinuous recruitment process in space and time.</p>
	<p>Wheeler, A. J., et al. (2013), Moytirra: Discovery of the first known deep-sea hydrothermal vent field on the slow-spreading Mid-Atlantic Ridge north of the Azores, <i>Geochem. Geophys. Geosyst.</i>, 14, 4170–4184</p>	<p>Geological, biological, morphological, and hydrochemical data are presented for the newly discovered Moytirra vent field at 45° N. This is the only high temperature hydrothermal vent known between the Azores and Iceland, in the North Atlantic and is located on a slow to ultra-slow-spreading mid-ocean ridge uniquely situated on the 300 m high fault scarp of the eastern axial wall, 3.5 km from the axial volcanic ridge crest. Furthermore, the Moytirra vent field is, unusually for tectonically controlled hydrothermal vents systems, basalt hosted and perched midway up on the median valley wall and presumably heated by an off-axis magma chamber. The Moytirra vent field consists of an alignment of four sites of venting, three actively emitting “black smoke,” producing a complex of chimneys and beehive diffusers. The largest chimney is 18 m tall and vigorously venting. The vent fauna described here are the only ones documented for the North Atlantic (Azores to Reykjanes Ridge) and significantly expands our knowledge of North Atlantic biodiversity. The surfaces of the vent chimneys are occupied by aggregations of gastropods (<i>Peltoispira</i> sp.) and populations of alvinocaridid shrimp (<i>Mirocaris</i> sp. with <i>Rimicaris</i> sp. also present). Other fauna present include bythograeid crabs (<i>Segonzacia</i> sp.) and zoarcid fish (<i>Pachycara</i> sp.), but bathymodiolin mussels and actinostolid anemones were not observed in the vent field. The discovery of the Moytirra vent field therefore expands the known latitudinal distributions of several ventendemic genera in the north Atlantic, and reveals faunal affinities with vents south of the Azores rather than north of Iceland.</p>
<p>Tropic Seamount</p>		
<p>EU Horizon 2020 ATLAS project</p>	<p>Ramiro-Sánchez B, et al. (2019) Characterization and Mapping of a Deep-Sea Sponge Ground on the Tropic Seamount (Northeast Tropical Atlantic): Implications for Spatial Management in the High Seas. <i>Front. Mar. Sci.</i> 6:278.</p>	<p>Ferromanganese crusts occurring on seamounts are a potential resource for rare earth elements that are critical for low-carbon technologies. Seamounts, however, host vulnerable marine ecosystems (VMEs), which means that spatial management is needed to address potential conflicts between mineral extraction and the conservation of deep-sea biodiversity. Exploration of the Tropic Seamount, located in an Area Beyond National Jurisdiction (ABNJ) in the subtropical North Atlantic, revealed large amounts of rare earth elements, as well as numerous VMEs, including high-density octocoral gardens, <i>Solenosmilia variabilis</i> patch reefs, xenophyophores, crinoid fields and deep-</p>

		sea sponge grounds. This study focuses on the extensive monospecific grounds of the hexactinellid sponge <i>Poliopogon amadou</i> . (...)
	Berta Ramiro-Sánchez, J. et al. Which Seamount Ecosystems are Most Vulnerable to Plumes?	Slide presentation outlining core tasks for MarineE-tech and ATLAS projects.
International Seabed Authority	ISA Deep Seabed and Ocean Database (DeepData) https://data.isa.org.jm/isa/map/	This database, called “ISA Deep Seabed and Ocean Database” (DeepData) has been designed to serve as a spatial, internet-based data management system. Its main function is to host all deep seabed activities related data and in particular, data collected by the contractors on their exploration activities as well as any other relevant environmental and resources related data for the Area.
MMAFF	Summary Briefing on Marine Mammal Publications and Existing Conservation Areas Compiled by the IUCN Joint SSC/WCPA Marine Mammal Protected Areas Task Force	The Task Force has summarised the following information below which It considers to be relevant for informing the activities of the 2019 North-East Atlantic Ecologically or Biologically Significant Areas (EBSA) Workshop. This information being specific to large scale surveys and studies of marine mammal abundance, distribution and migration within the North-East Atlantic. Furthermore, the Task Force has highlighted existing areas labelled as identified for the conservation purposes of marine mammals within the North-East Atlantic, such as Marine Protected Areas (MPAs) and Priority Conservation Areas (PCAs) which may assist with the further identification or examination of wider EBSAs.
WWF	ICES WKEBSA Report - Report of the Workshop to Review and Advise on EBSA Proposed Areas (WKEBSA) – May 2013.	WKEBSA reviewed the ecological evidence supporting the ten proposed EBSAs from the OSPAR/NEAFC/CBD Workshop of September 2011, as presented in the proformas attached as Annexes to that Report. The review looked primarily at the references cited in the proformas, but often augmented those references with other publications and data sources. In nine of the ten proposed EBSAs, WKEBSA came to different conclusions than were contained in the OSPAR/NEAFC/CBC Workshop, with regard to the rankings on the CBD EBSA criteria.
	ICES advice - OSPAR/NEAFC special request on review of the results of the Joint OSPAR/NEAFC/CBD Workshop on Ecologically and Biologically Significant Areas (EBSAs) – June 2013; in particular	ICES reviewed the ecological evidence supporting the ten proposed ecologically and biologically significant areas (EBSAs) from the OSPAR/NEAFC/CBD Workshop of September 2011, as presented in the annexes to that report. The review applied standard ICES practices and used primarily the references cited in the relevant annexes, but augmented those references with other publications and data sources. In nine of the ten proposed

	<p>Annex 1.5.6.5.1. (revised EBSA template for the “The Arctic Ice habitat - multiyear ice, seasonal ice and marginal ice zone” contained therein</p>	<p>EBSAs, ICES came to different conclusions than were contained in the OSPAR/NEAFC/CBD Workshop report, with regard to the rankings of the Convention on Biological Diversity (CBD) EBSA criteria.</p>
	<p>“Meereisportal” (“sea-ice portal”) - administered by the Alfred-Wegener-Institut- Helmholtz-Zentrum für Polar- und Meeresforschung (AWI).</p>	<p>This data portal offers a variety of maps and underlying data (time series) with regards to sea-ice extent and thickness. Selected maps from https://www.meereisportal.de/en/ submitted.</p>
	<p>“Arctic mapping and data portal” - administered by WWF.</p>	<p>Arctic mapping and data portal</p>
